Entiat River – Stormy A Habitat Enhancement Project

60% Design Report

SUBMITTED TO
Yakama Nation Fisheries

December 4, 2018

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1. Introduction

1.1 OVERVIEW

This report presents preliminary designs for aquatic habitat enhancement within the Stormy A reach of the Entiat River in Chelan County, WA (Figure 1). This report includes support and rationale for the 60% draft design, which will be refined over the next several months as the project is moved forward to final design.

The purpose of this project is to enhance habitat for Endangered Species Act (ESA) listed Chinook Salmon (*Oncorhynchus tshawytscha*) and steelhead (*Oncorhynchus mykiss).* Property within the project area is owned by the US Forest Service and Chelan Douglas Land Trust. The project area includes approximately 1.9 miles of the mainstem Entiat River, including floodplains on both sides of the river. Several historical meander scars are located on these surfaces and provide an opportunity to increase off-channel habitat area. The proposed project includes creating high flow side channels, a perennial side channel, and placing large wood structures throughout the project reach.

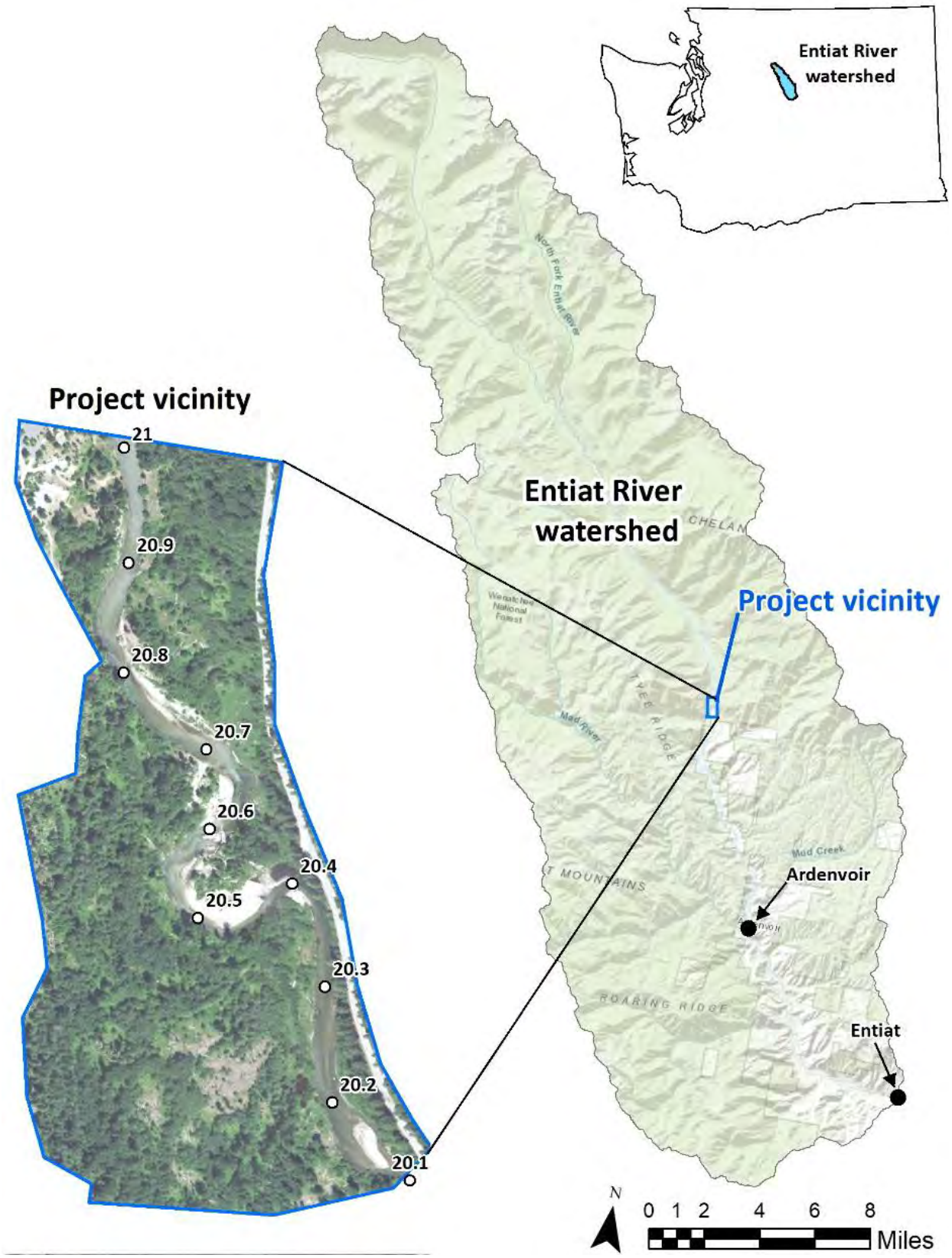

Figure 1. Entiat Stormy A project area locator map.

1.2 GOALS AND OBJECTIVES

1.2.1 Regional habitat objectives and priorities

Regional objectives for salmonid habitat protection and restoration in the Upper Columbia Region have been evaluated and summarized in the document *A Biological Strategy to Protect and Restore Salmonid Habitat in the Upper Columbia Region* (2014) by the Upper Columbia Salmon Recovery Board (UCSRB) Regional Technical Team (RTT). This Biological Strategy is part of the Upper Columbia Spring Chinook Salmon and Steelhead Recovery Plan (UCSRB 2007) and recommends region-wide biological considerations and approaches for salmonid habitat restoration and protection actions. The RTT guides the development and evaluation of salmonid recovery projects within the Upper Columbia Region.

The Biological Strategy has identified four assessment units within the major watersheds of the Entiat River. The Stormy A project area falls within the Middle Entiat (Stillwaters Reach), which is considered the highest priority for restoration. It is also designated as the highest priority (Tier 1) for protection (UCRTT 2017). The following ecological concerns for the Middle Entiat have been identified and ranked by the RTT in priority order as follows:

1. Channel structure and form (bed and channel form)
2. Peripheral and transitional habitat (side channels and wetland connections)
3. Channel structure and form (instream structural complexity)
4. Riparian condition (riparian conditions and large wood recruitment)
5. Food (altered primary productivity or prey species composition and diversity)
6. Sediment conditions (increased sediment quantity)
7. Injury or mortality (mechanical injury)
8. Habitat quantity (anthropogenic barriers)
9. Water quantity
10. Water quality

1.2.2 Stormy reach assessment

The Bureau of Reclamation published an update to their assessment of the Stormy Reach in 2013, which identifies historical impairments and desired future conditions of the reach (USBOR 2013). Target conditions for the reach include:

- Increase side channels and split flow conditions
- Provide hard points using LWM in the channel and floodplain
- Increase bank structure

- Do not limit channel migration, avulsion, and side channel
- Improve riparian vegetation

2. Site Conditions and Analysis

2.1 HYDROLOGY

The Entiat River watershed upstream of the project area is approximately 187 square miles in area. Mean annual precipitation in the basin is 48.2 inches (USGS 2018). The Entiat River has a snowmelt-driven hydrograph with glacier-fed low flows in late summer and peak stream flows occurring during snow melt in spring and early summer. Runoff timing and extent are affected by ambient air temperatures, snowpack mass, and the distribution of the season's snowpack. A peak flow USGS gaging station operated on the Entiat River near Ardenvoir from 1958 to 2018 (USGS #12452800). Baseflow occurs from late September through late February.

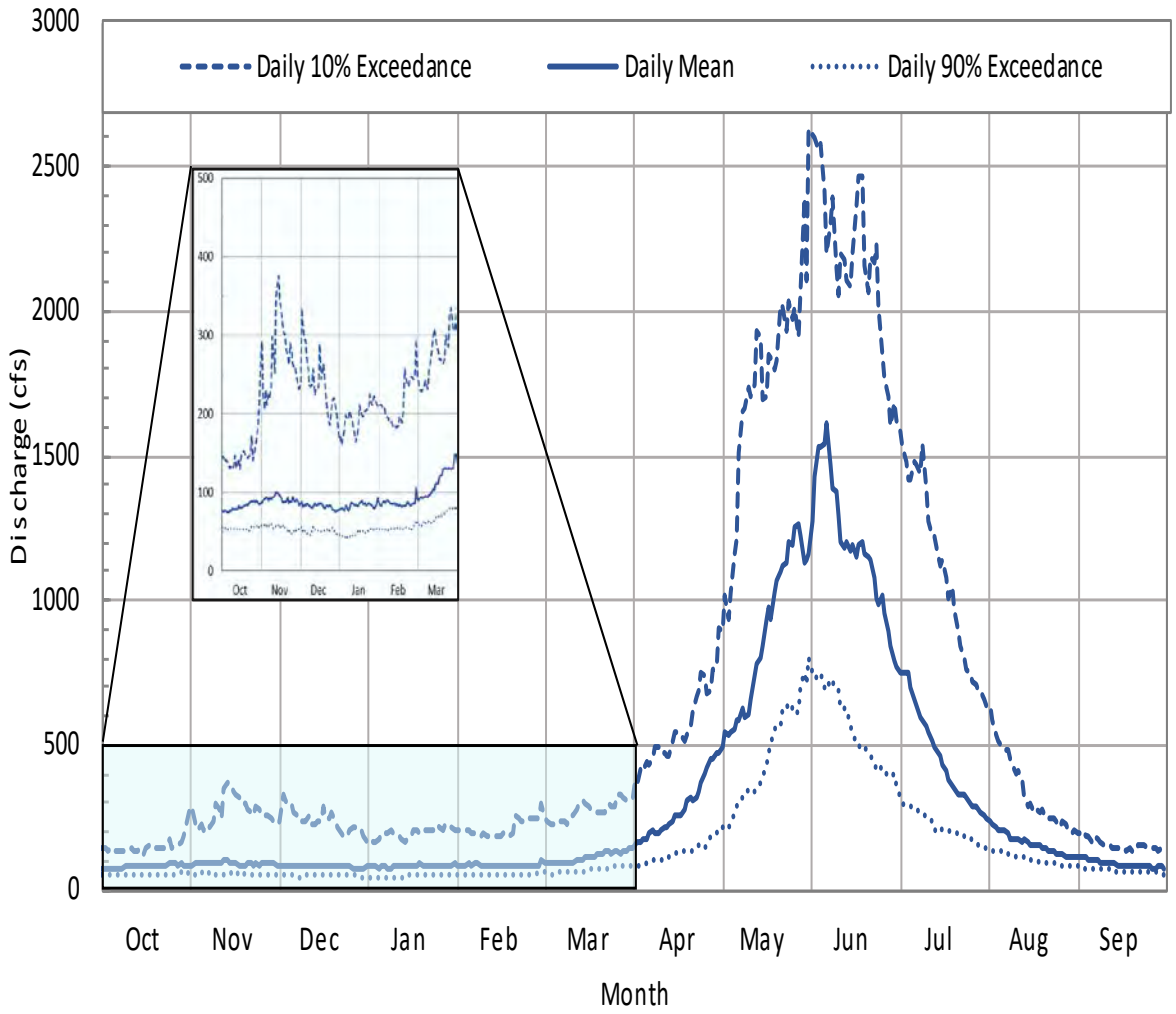

Figure 2. Daily mean, 10%, and 90% exceedances with low-flow expanded from October through March. Data derived from USGS gage #12452800.

Recurrence interval flows were calculated and used in the hydraulic model to evaluate flood flows and their potential effect on nearby structures. A Log Pearson Type III analysis is a statistical technique for fitting frequency distribution data to help predict flood flows. In order to estimate recurrence interval flows, a Log Pearson Type III distribution was applied to peak flow gauge data from the USGS gage on the Entiat River at Ardenvoir. The gauge recurrence interval flow values were then corrected based on a delineated basin-area ratio, since the project area is upstream and has a relatively smaller contributing watershed area compared to the gaged basin area.

Table 1. Flood recurrence flows for the Entiat River at the project area.

Recurrence Interval (years)	Discharge at project area (cfs)
2	2,640
5	3,610
10	4,240
25	5,040
50	5,630
100	6,220

2.2 GEOMORPHOLOGY

2.2.1 Overview

The project area is located within the "Stillwaters" reach of the Entiat River, which is characterized by a relatively sinuous, low gradient, and unconfined channel with an active floodplain. Channel scars visible in the floodplain and historical aerial images suggest that the channel has historically followed a highly sinuous path, utilizing the entire valley bottom throughout most of the project area (Figure 4). Historically, large log jams and old growth logs would have formed stable hard-points in the channel and along the banks, promoting split flow conditions, while alcoves and side channels may have formed preferentially along the valley wall where high flows concentrated and caused scouring (USBOR 2013).

Figure 3. Natural log accumulation within the project area comprised of one key piece and several smaller logs.

The Entiat River within the reach is currently characterized as a single threaded meandering channel with relatively few side channels. Historical logging and wildfires in the valley have reduced the abundance of old growth trees relative to historical conditions. This has reduced the size of wood recruited into the river channel, leading to smaller and less stable log jams within the channel.

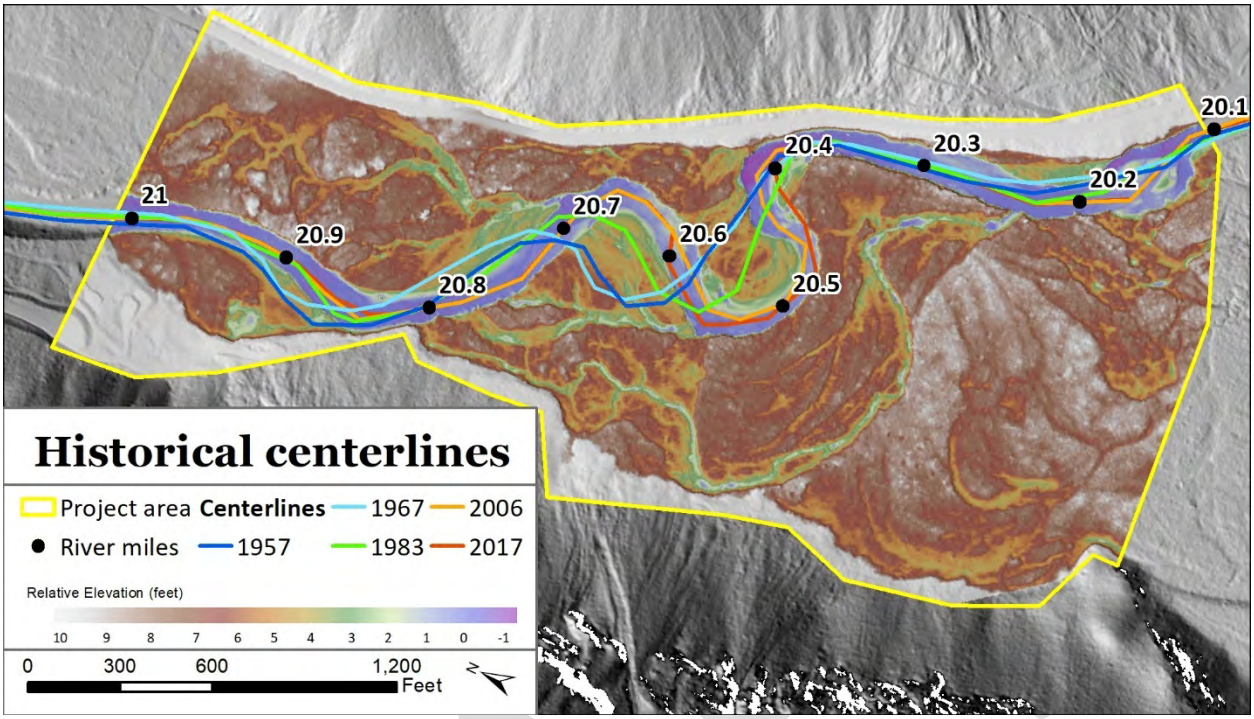

Figure 4. Relative elevation map of the project area with historical channel centerlines from 1957 to 2017.

2.2.2 Subsurface investigation

Yakama Nation, Inter-Fluve and Wildlands completed four soil pits at the Stormy A site on July 25, 2018. These field investigations were completed to gather data on subsurface substrate composition and groundwater dynamics to inform project design. Pits were dug 5 to 8 feet below ground, and a PVC piezometer fitted with a water level logger was installed in each pit. Data from water level loggers will be included in future project design development as more data are available and after piezometer elevations are surveyed in the spring of 2019. A detailed description of each test pit is included as an attachment. The following is a brief summary of the test pit results.

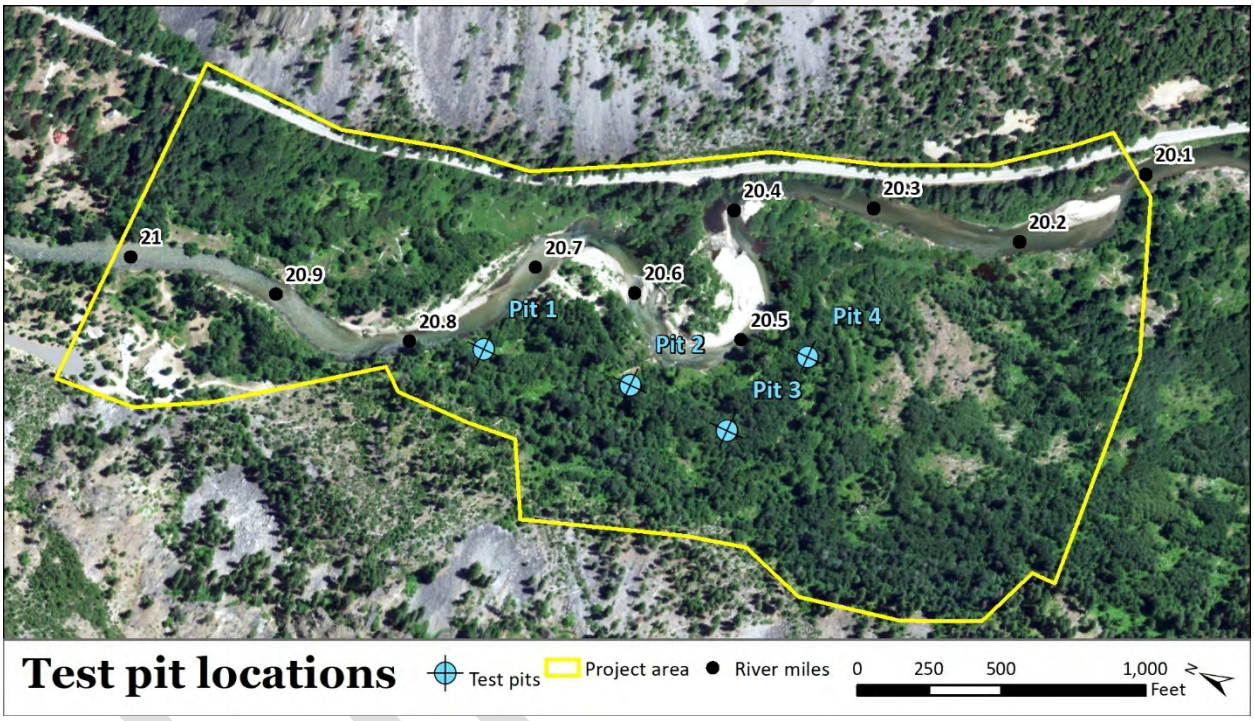

Figure 5. Location of test pits within the project area.

Test pits were all dug in the river right floodplain in the approximate alignment of a proposed side channel. A topsoil/humus layer (0.5 ft thick) was encountered at the ground level, and floodplain silty sands were found from 3.5 to 5.0 feet below ground. Coarse alluvium was located under the silty sand, and extended to the pit bottom. Alluvium was characterized as 4 to 6 inches minus cobble and gravel with some sand. Groundwater was encountered from 3.5 to 5.0 feet below ground. All soil pits appear to indicate that side channel excavations will encounter gravel/cobble at depths that are at or above the proposed side channel bed.

2.3 FISH USE AND HABITAT CONDITIONS

The project area provides migrating, spawning and rearing habitat for endangered Upper Columbia Spring Chinook salmon, and threatened Upper Columbia steelhead. Redd surveys have identified redds within the project are from 2003 to 2017 (Figure 7).

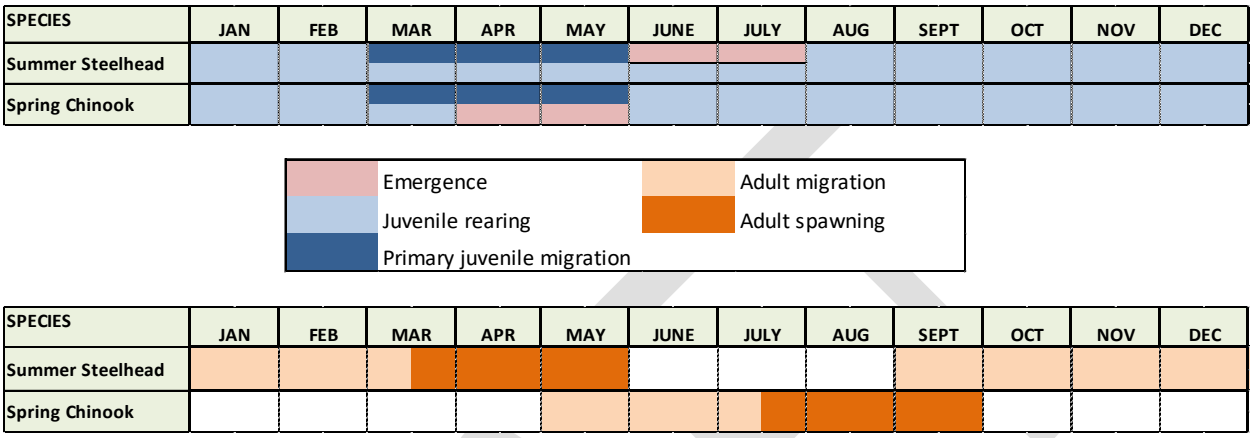

Figure 6. Life history timing of summer steelhead and spring Chinook salmon within the project area.

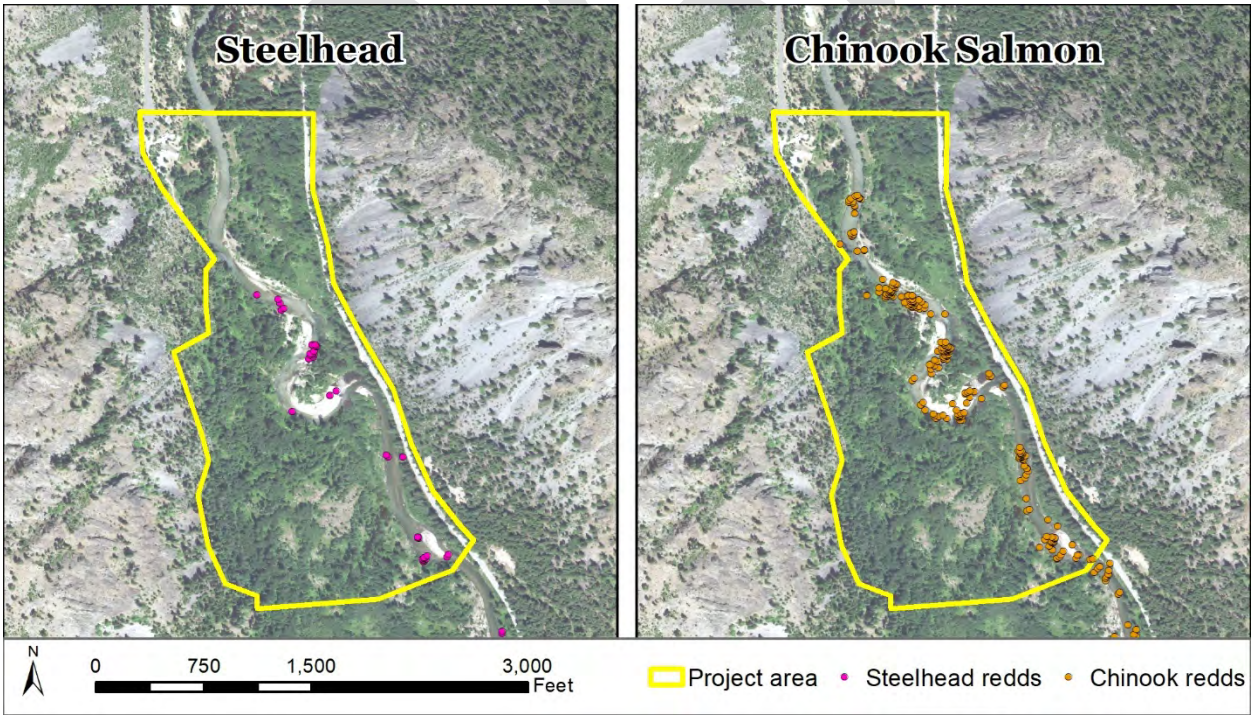

Figure 7. Steelhead and Chinook redds within the project area from 2005 to 2017 (steelhead) and 2003 to 2017 (Chinook) (UCSRB 2018).

2.3.1 Steelhead

Adult steelhead enter the Entiat basin from August through the following April, holding in deep pools with overhead cover. Spawning begins in very late March, peaks in mid to late-April, and lasts through May. Egg survival is highly sensitive to intra-gravel flow and temperature (NWPCC 2004) and is particularly sensitive to siltation earlier in the incubation period (Healy 1991). Fry emerge from the redds 6-10 weeks after spawning (Peven 2004).

Age-0 juveniles spend their first year primarily in shallow riffle habitats, feeding on invertebrates and utilizing overhanging riparian vegetation and undercut banks for cover (Moyle et al. 2002, US Fish and Wildlife Service 1995). Age-0 steelhead use slower, shallower water than Chinook Salmon, preferring small boulder and large cobble substrate (Hillman et al. 1989). Older juveniles prefer faster moving water including deep pools and runs over cobble and boulder substrate (US Fish and Wildlife Service 1995). Juveniles outmigrate between ages one and three, though some hold over and display a resident life history form. Smolts begin migrating downstream from natal areas in March (NWPCC 2004).

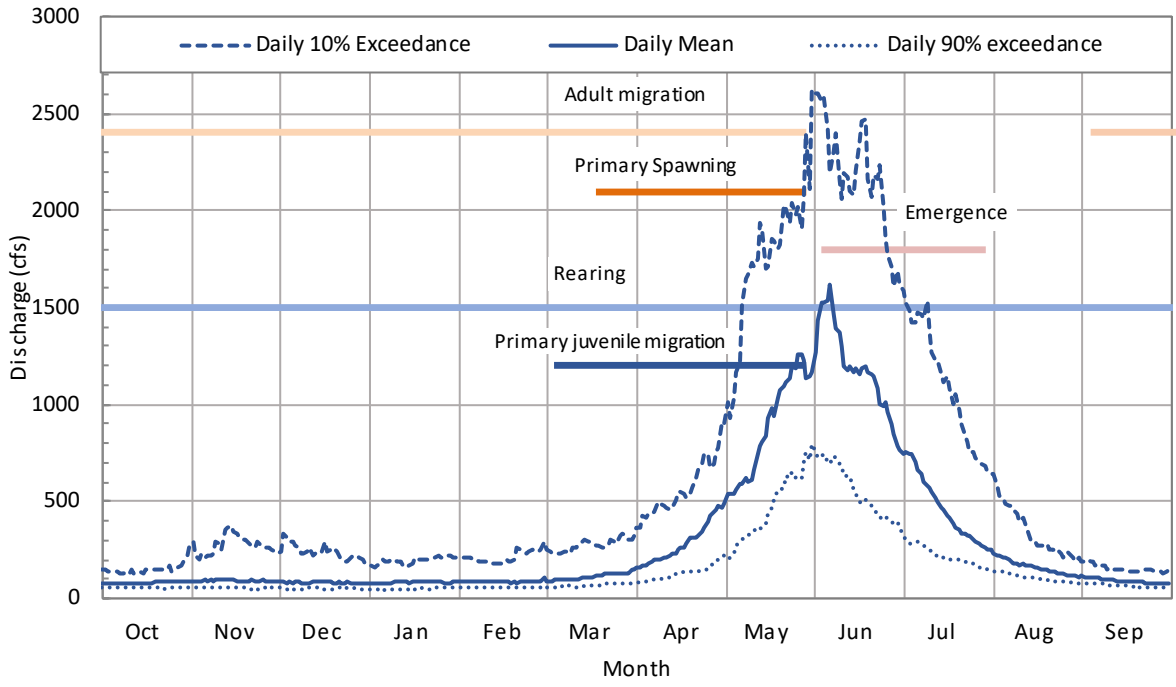

Figure 8. Steelhead life history timing and hydrology at the project site

2.3.2 Spring Chinook

Adult spring Chinook enter the Entiat basin in May, holding in deep pools under overhead cover in the Entiat River. Spawning occurrs from very late July through September with a peak in mid to late August. Spawning typically begins when temperatures drop below 16°C (NWPCC 2004). Eggs are very sensitive to changes in oxygen levels and percolation, both of

which are affected by sediment deposition and siltation in the redd (Healy 1991, Peven 200). Fry emerge in the spring, which coincides with the rising hydrograph, forcing juveniles to seek out backwater or margin areas with lower velocities, dense cover, and abundant food (Quinn 2005). Fry are extremely vulnerable when they emerge, because their swimming ability is poor and flows are high. Near-shore areas with eddies, large wood, undercut tree roots, and other cover are very important for post-emergent fry (Hillman et al. 1989, Healy 1991). Age-1 parr utilize deeper pools with resting cover in mainstem habitats more than post-emergent individuals (Figure 9). Spring Chinook express a stream-type life history where they rear for 1 year in freshwater before outmigrating as yearlings. Out-migration typically begins in March (NWPCC 2004).

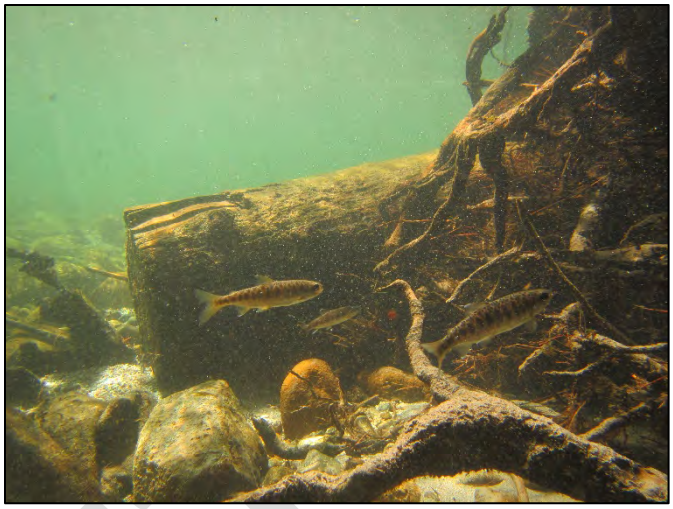

Figure 9. Chinook Salmon parr resting behind a constructed log jam in the Entiat River mainstem between feeding forays.

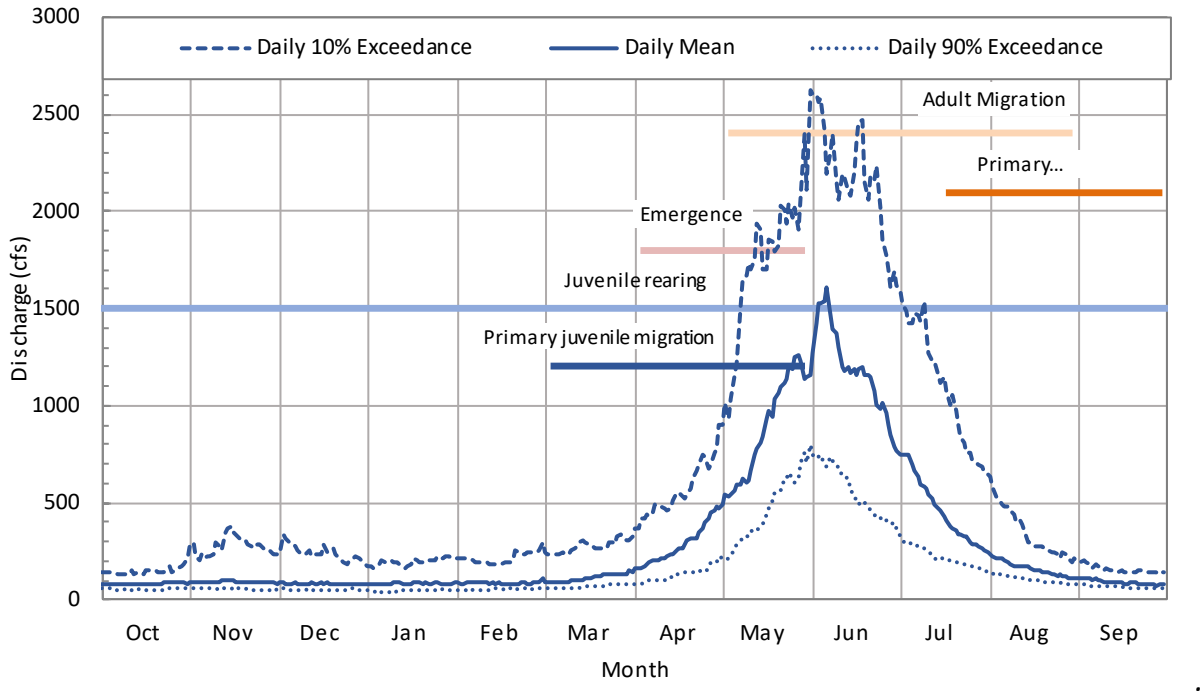

Figure 10. Spring Chinook life history timing and hydrology at the project site.

2.4 SITE SURVEY AND DATA COLLECTION

Topographic and bathymetric data were collected from April 23-25, 2018 using real time kinetic (RTK) GPS and total station survey equipment. The data collection focused on capturing topographic points in floodplain areas to inform preliminary design and side channel alignment. Temporary control points were placed throughout the project site for future reference.

To translate the survey data to known horizontal and vertical datum, static data at the rtkGPS base station were collected and adjusted using the National Geodetic Survey's Online Positioning User Service. The surveyed data are referenced to the Washington State Plane North coordinate system with vertical datum of NAVD88.

2.5 HYDRAULIC MODELING

A two-dimensional (2D) hydraulic model was developed in the U.S. Army Corps of Engineers HEC-RAS 5.0.5 software (USACE 2016), which can compute hydraulic properties related to the physical processes governing water flow through natural rivers and other channels. Both existing and proposed conditions models were developed to assess the current and proposed channel/floodplain dynamics, as well as assess the overall impacts of a wide range of flows on the existing landscape with and without the proposed design improvements.

The model terrain was created by combining LiDAR data (Quantum Spatial 2016) with topography and bathymetry obtained through the surveys completed in April 2018 by Inter-Fluve. The proposed conditions model terrain was constructed by merging design grading and features with the existing model terrain.

The model domain extends from approximately 2,000 feet upstream of the project reach to approximately 1,200 feet downstream of the project reach. The computational mesh consists of grid cells ranging from 15-20 feet, with the smallest grid cells utilized to provide higher resolution results at key design locations. Breaklines were added along topographic high points, to align cell faces along high ground and appropriately represent the underlying terrain.

A spatially varying hydraulic roughness layer was developed to represent the impacts of land cover and bed forms on the hydraulic properties of flow throughout the computational domain. Land cover was classified with respect to characteristics that relate to hydraulic roughness, and corresponding Manning's n coefficients were assigned to the classifications. Manning's n values ranged from 0.02 for road surfaces to 0.15 for large wood material, with a river channel coefficient of 0.03 and floodplain coefficients ranging from 0.04 to 0.065.

Boundary conditions representing inflow/outflow from the model domain consisted of an input flow hydrograph at the upstream end and normal depth at the downstream end. A synthetic "stepped" hydrograph that contains gradual rising limbs between discharges of interest (i.e., 100-year flow) was used as the input hydrograph to simulate steady-state flow conditions. The

discharges of interest remain unchanged for long enough to allow the model to reach a steady-state, before rising to the next step (Figure 11). It's worth noting that allowing the model to reach a steady state during large flood events provides conservative flooding results, as floodplain storage throughout the model domain must reach capacity to reach steady-state conditions. The receding limb of a typical flood hydrograph is not represented when using this methodology.

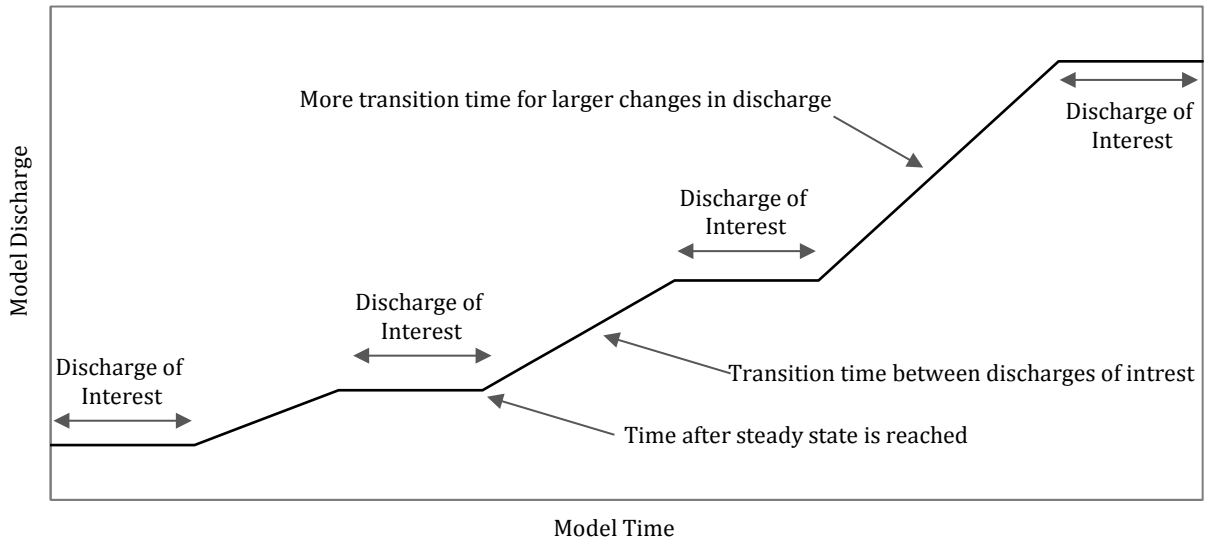

Figure 11: Demonstrative "stepped" flow input hydrograph

The downstream boundary condition (flow out of the model domain) was set as normal depth, with an assumed friction slope of 0.01 ft/ft, which was approximated from the topographic slope at the downstream end of the reach. The boundary condition points were placed as far as possible away from the project area to dampen the effects of any uncertainties associated with the boundary specifications and assumptions.

3. Preliminary Design Criteria

A suite of preliminary design criteria has been developed Inter-Fluve based on conversations with Yakama Nation and based on prior experience with other projects with similar objectives. These design criteria have helped to guide the development of the draft designs. Design criteria serve three primary purposes: 1) to clearly document and communicate specific project objectives and constraints, 2) to help inform and guide the design process so that objectives are met, and 3) provide a basis for future performance monitoring. The design criteria may continue to be refined in future design phases. The design criteria are divided into 4 categories: habitat, geomorphology/hydrology, engineering and risk, and construction impacts.

3.1 HABITAT

- Increase in-stream and floodplain habitat quality and quantity for juvenile steelhead and Chinook salmon rearing at a range of flows
- Design habitat elements that have a low risk of creating fish passage barriers
- Promote natural habitat forming processes to the maximum extent practicable
- Increase floodplain inundation extent and frequency

3.2 GEOMORPHOLOGY/HYDROLOGY

- Design channels and floodplains that are consistent with current and projected hydrologic and geomorphic regimes, including those affected by beaver activity
- Promote dynamic, habitat-forming processes
- Maintain sediment transport continuity to maximize design life and reduce sediment in-filling
- Promote sediment sorting

3.3 ENGINEERING AND RISK

- Do not increase flooding or erosion risk to Entiat River Road
- Provide adequate ballasting of placed logs to withstand high flows that overtop the structures (i.e. compensate for buoyancy)

3.4 CONSTRUCTION IMPACTS

- Minimize impacts to existing wetland habitat and mature vegetation

4. Project Design

Previously discussed site conditions, analyses, and design criteria were used to inform the preliminary design discussed below. Design details may evolve in future design phases based on stakeholder feedback and the availability of new information. The proposed project includes creating high flow side channels in the river left floodplain at the upstream end of the site, constructing a perennial side channel on river right, and placing large wood structures throughout the site.

4.1 RIVER LEFT: FLOODPLAIN ENHANCEMENT CHANNEL

4.1.1 Description and Benefits

High flow (i.e. seasonal) channels are relatively low areas of conveyance in the floodplain with an upstream surface-water connection to the mainstem only at high flow. The downstream portion of these high flow channels remains connected via backwater to the active channel at low flow, creating habitat that has very little or no current (i.e. alcove). Habitat structure and cover provided by logs, aquatic vegetation and overhanging vegetation make these areas attractive to young fish, who use these areas to search for food, to rest and to avoid predators. During winter periods, these backwater areas will continue to have quiet water with occasional flows moving through them. These areas also serve to accumulate nutrients, making them ideal places to support diverse emergent and wetland vegetation.

4.1.2 Application

A high flow side channel is proposed with inlet adjacent to the upstream-most perennial side channel. The high flow side channel inlet will be constructed at approximately 2.3 feet higher than the adjacent perennial channel. This area will be designed to create conditions suitable for wetland vegetation, and could provide high water refuge habitat for aquatic species. Topographic roughness or channel complexity is proposed for the surface of this feature (described more in Section 4.4). To achieve this, the enhancement channel surface will be over-excavated by 1 foot, backfilled with 1 foot of salvaged top soil, and seeded and mulched to encourage native vegetation.

4.1.3 Considerations

Excavation of this feature will impact minimal surface area of existing wetland, and create 0.49 acres of additional wetland. Additional wetland creation opportunities exist along the proposed perennial side channel.

4.2 RIVER RIGHT: PERENNIAL SIDE CHANNEL

4.2.1 Description and Benefits

A perennial side channel connects with the mainstem at both ends during high and low flows. The inlet is wetted throughout the year, and the stream flow is therefore split between the two channels. Side channels provide additional stream margin, which in combination with pools and woody debris, make these areas attractive to Chinook salmon and steelhead. Fish use these areas to search for food, to rest and to avoid predators. Construction of these areas includes excavation to form the channel and pools, placement of logs, and management of the surrounding vegetation.

4.2.2 Application

Two inlets to the perennial side channel are proposed, both located at the upstream extent of the project area. The perennial side channel is 2,200 feet in length, and is situated within existing floodplain scars for a portion of its length. Alignments were selected to minimize impacts to mature vegetation and work with the existing downstream side channel. Channel geometry of the side channel inlets, were designed to capture < 20% of flow at a 2-year flood recurrence interval. Log structures are designed at the side channel inlets to control flow and hold grade. Log placements and structures are proposed throughout the side channel length for added channel complexity and diversity, similar to Figure 11. Pools and riffles are graded into the side channel to provide stability and increase habitat and geomorphic complexity.

Figure 12: Example of off-channel habitat with large wood placements | Clackamas River, Clackamas County, OR

4.2.1 Considerations

Excavation of this feature will impact approximately 0.4 acres of existing wetland. The risk of main channel capture will be addressed through roughness features and large wood structure placements.

4.3 LOG STRUCTURES

4.3.1 Description and Benefits

Log placements include a variety of different enhancement types. The different log structure types, and their purpose/benefits are described in Table 2.

4.3.2 Application

Log placements will be stabilized through a range of techniques to discourage mobility along the project reach. Large wood structures and placement types are described in detail in Table 2. Wood will be stabilized using burial or through installation of vertical timber plies driven into the ground. Slash will be incorporated in wood structures for added complexity. Typical sections and details are included on the drawings, though it will be necessary to conform these typical approaches to the specifics of each installation location in real time during construction.

Table 2. Matrix of design considerations of LWM structures proposed in the designs.

Type	Location	Purpose/Application	Structural/Physical Characteristics	Site Specifics
Side Channel Inlet Log Structure	Main Channel	Large accumulations of LWD to create immobile channel margin elements that force channel redirection into side channel inlet. Designed to help maintain interface between main channel and lateral habitats, ensuring <20% of main channel flow is captured to prevent avulsion along overbank alignments.	Layered installation of 20 +/- logs and logs with rootwads spaced around vertical snags. Ballasted with vertical snags, boulders and backfill; includes one whole tree with rootwad and log piles for added resilience.	Two structures will be placed at the flow inlets of the side channel; Pools will be excavated at structure locations during construction using a fit-in-the-field approach; Spoils will be placed to create riffle and bar features local to the structures.
Buried Bank Structure	Main Channel	Banks (and sometimes bed) of side channel inlet defined by LWD, utilized to constrain inlet and discourage degradation of banks / bed in the area of the side channel inlet. Can be tied into an adjacent apex logjam.	Installed with rootwad elements primarily facing flow to discourage bank erosion. Ballasted with vertical snags and boulders. Smaller structures consist of 6-9 logs and large structure consists of 19 logs.	Smaller structures will be placed at bank margins periodically throughout the constructed side channel and at outer bends of the mainstem. One large structure will be constructed at the outlet of Dill Creek.
Side Channel Habitat Wood	Side Channel and Dill Creek Margins	Small to moderate accumulation of partially-submerged LWM placed along margins of side channels that project into habitat to create cover and habitat diversity; These placements are not expected to have a strong influence on channel flow direction or hydraulics, such as scour.	Installed with elements generally normal to the bank and which partially encroach the channel. Ballasted with vertical snags and boulders. Small placements consist of 4- 8 logs; large structure will consist of approximately 18 logs.	Six structures will be placed along Dill Creek where it enters the floodplain enhancement channel; approximately eight structures will be placed along the margins of the constructed side channel. One large structure will be placed at the most acute bend of the side channel.
Floodplain LWD	Floodplain/Overbanks	Small accumulations of LWM to create overbank roughness, slow floodwaters, and stabilize floodplain along overbank flow paths.	Generally horizontally oriented LWM spaced around and braced against vertical snags, oriented normal to overbank flow paths. Ballasted with vertical snags and boulders.	These placements will range in size and configuration, but will generally consist of slash and logs with and without rootwads. They are placed within the meander neck cut-off path to provide hydraulic roughness that would be expected from wood accumulations in this area.

Bar Apex Structure	Main Channel; Side Channel Inlet	Simulates a mature log structure that naturally would form at the upstream end of an island, or help anchor a point on the stream bed and allow an island to develop behind it. This installation type is utilized in locations where it is desired to create and/or maintain a split-flow condition.	Generally horizontally oriented LWM spaced around and braced against vertical snags, oriented generally parallel to flow in the main channels, and encroaching on the active channel. Ballasted with vertical snags and boulders. These structures consist of approximately 8 logs with rootwads and slash material.	Four structures will be placed at the downstream extent of the project area at the apex of existing bars, islands and depositional features to enhance those features.

4.3.3 Considerations

Localized impacts to flood water elevations have been considered on a case-by-case basis, and the size of habitat wood structures has been modified accordingly. Structures have been designed to minimize the potential for displacement during high flows according to location-specific risk assessments. Consideration of the mobility and longevity of placed wood has been carefully assessed and incorporated into the projected design life of the project.

4.4 FLOODPLAIN COMPLEXITY

4.4.1 Description and Benefits

Floodplain wetlands evolve within river systems to accommodate high flows, slow floodwaters, and provide refuge habitat for aquatic species. Encouragement of the natural processes that form these features can be accomplished through mimicking the roughness of a pre-human-disturbance floodplain and lowering surfaces to become inundated at more frequent flows. Enhanced and reconnected floodplain surfaces will:

- Increase residence time of floodwaters
- Encourage sediment and nutrient cycling
- Reduce high flow velocities
- Provide nutrient-enriched floodwater that returns to the channel
- Improve plant root access to the water table during periods of low precipitation in the summer months

4.4.2 Application

Floodplain complexity has been incorporated into this project as the addition of topographic complexity (or microtopography), floodplain roughness wood placement and native plantings in areas activated at 2-year recurrence interval or greater flows. These floodplain enhancement measures will provide numerous benefits to the main channel of and constructed side channels to the Entiat River, as well as balance any potential impacts to wetlands within the project area. This design element will recreate conditions identified elsewhere at the site that promote and sustain wetland and riparian growth.

4.4.1 Considerations

Floodplain enhancement through the placement of roughness features has been proposed only in areas and at scales that satisfy no-rise conditions. Additional wetland creation and floodplain enhancement opportunities exist along southern tributaries to the proposed perennial side channel.

5. Project Construction Considerations

The nature of land use and infrastructure constraints in the Stormy A Reach present logistical challenges for constructing the enhancements, discussed below.

5.1 RIGHT-OF-WAY CONSIDERATIONS

For purposes of determining limits for right-of-way determinations, in areas where off-channel enhancement is planned, it is recommended to include the full width of the channel corridor in order to anticipate potential future channel adjustments. For isolated log structures and enhancements, a margin of 50 feet upstream and downstream and 20 feet on each side of the planned enhancements is recommended. It should be noted that the locations of enhancement features may be adjusted to fit field conditions at the time of construction, thus flexibility in determining final right-of-way boundaries is recommended so this can be accommodated within necessary protocol.

5.2 ACCESS AND STAGING

Access and staging will be from Entiat River Road.

5.1 EARTHWORK

Earthwork volumes may vary dependent on wetland mitigation requirements. Excavated material will be placed on site, potentially on USFS land.

5.2 TIMING AND DURATION OF CONSTRUCTION

There is a two-week window for construction of projects that may influence fish use and health. The anticipated total duration of construction will require utilization of the entire in-water work period, and any available extension or shoulder periods on either end of the in-water work period that may be used to complete upland work. This may also require the phasing of construction over multiple years or the use of multiple contractors to maximize working hours.

5.3 STREAM DIVERSION AND DEWATERING

Best management practices will be employed to ensure construction conditions remain dry and nuisance sedimentation is limited to the extent feasible.

5.4 FISH SCREENING AND RESCUE

Stream diversions are not anticipated to be required for construction of Stormy A projects. Therefore, fish relocation efforts are anticipated primarily with installation of coffer dams, and other temporary control of water provisions which obscure a portion of the main channel or other habitats where fish may reside.

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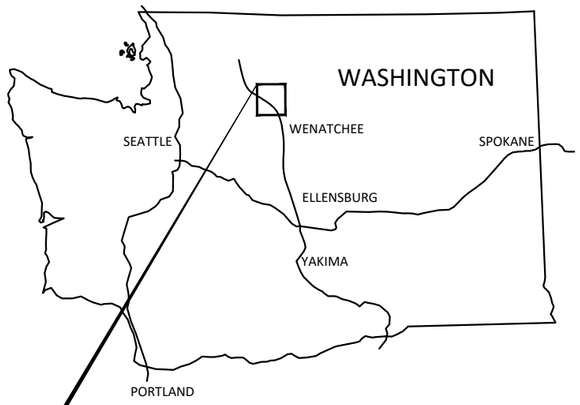
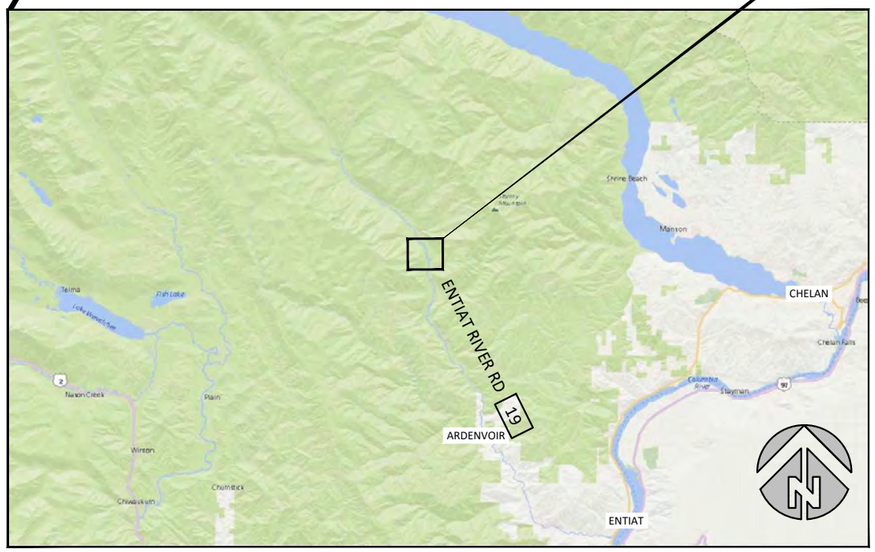
ENTIAT RIVER - STORMY A

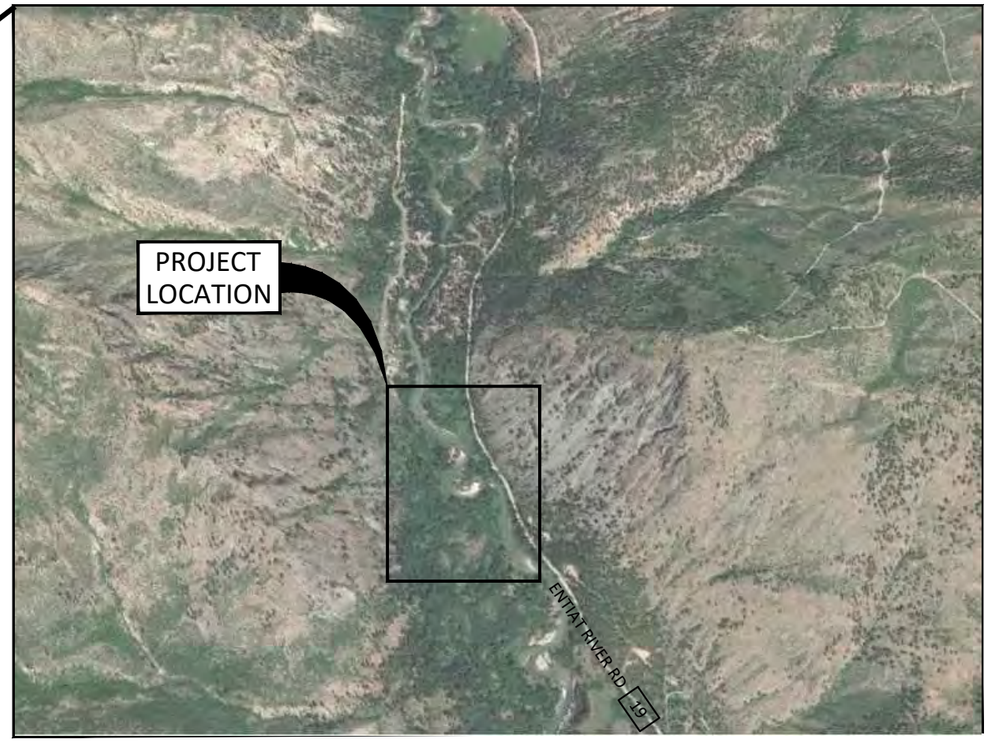
STREAM & FLOODPLAIN ENHANCEMENTS

60% DESIGN





VICINITY MAP
NOT TO SCALE



SITE MAP
NOT TO SCALE

COORDINATES:
LATITUDE: 47.84958
LONGITUDE: 120.42064

SECTION 14, TOWNSHIP 27N, RANGE 19E

WATERBODY: ENTIAT RIVER
TRIBUTARY OF: COLUMBIA RIVER

YAKAMA NATION FISHERIES
1885 S. WENATCHEE AVE.
WENATCHEE, WA. 98801

Sheets

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DRAWN	DESIGNED	CHECKED
MM, GS	MM	DM
APPROVED	DATE	PROJECT
GJ	12/31/18	----

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TITLE SHEET

SHEET 1 OF 24

IT IS STRONGLY SUGGESTED THAT THE CONTRACTOR ATTEND A PRE-BID SITE MEETING.

THE CONTRACTOR SHALL ATTEND A PRE-CONSTRUCTION MEETING WITH THE OWNER AND OWNER'S REPRESENTATIVE PRIOR TO BEGINNING CONSTRUCTION.

ALL WORK SHALL CONFORM TO THE CURRENT EDITIONS OF STANDARD PLANS AND SPECIFICATIONS OF THE WASHINGTON STATE DEPARTMENT OF TRANSPORTATION (WSDOT), AND LOCAL STANDARDS UNLESS INDICATED OTHERWISE BY THE CONTRACT DOCUMENTS. IN CASE OF A CONFLICT BETWEEN THE REGULATORY STANDARDS OR SPECIFICATIONS, THE MORE STRINGENT SHALL PREVAIL.

IN CASE OF DISCREPANCY, BETWEEN NOTES, LOCAL REGULATIONS, OR OTHER CONTRACT DOCUMENTATION, CONTRACTOR SHALL OBTAIN CLARIFICATION/DIRECTION FROM OWNER.

EXISTING DATA

TOPOGRAPHIC SURVEY IS REFERENCED TO NAD83 WASHINGTON STATE PLANE, NORTH ZONE US FEET NAVD 88.

PROPERTY BOUNDARIES PROVIDED BY CHELAN COUNTY.

WETLAND BOUNDARIES DISPLAYED IN THIS SET ARE THE RESULT OF A WETLAND ASSESSMENT PERFORMED BY XXXX. IN XXX 20XX.

THE ORDINARY HIGH WATER (OHW) AND APPROXIMATE LOW WATER LINES DISPLAYED IN THE DESIGN PACKAGE WERE DELINEATED BY INTER-FLUVE, AND ARE BASED UPON ANALYSIS, MODELING AND BEST PROFESSIONAL JUDGEMENT.

HYDRAULIC MODELING BY INTER-FLUVE USING USACE HEC-RAS (5.2.0). MODEL CALIBRATED USING SURVEYED WATER SURFACE ELEVATIONS AND EXISTING HIGH WATER MARKS.

SOILS

ENTIAT RIVER ALLUVIUM (GRAVEL/SAND) AND FLOODPLAIN SOILS (SILT/SAND).

UTILITIES

THE CONTRACTOR SHALL BE SOLELY RESPONSIBLE FOR HAVING UTILITIES LOCATED PRIOR TO CONSTRUCTION ACTIVITIES.

THE CONTRACTOR SHALL IMMEDIATELY CONTACT THE AFFECTED UTILITY SERVICE TO REPORT ANY DAMAGED OR DESTROYED UTILITIES. THE CONTRACTOR SHALL PROVIDE EQUIPMENT OR LABOR TO AID THE AFFECTED UTILITY SERVICE IN REPAIRING DAMAGED OR DESTROYED UTILITIES AT NO COST TO THE OWNER.

WDFW IN-WATER WORK PERIODS

WORK SHALL OCCUR DURING THE PERMITTED IN-WATER WORK PERIOD AS STATED IN THE HYDRAULIC PROJECT APPROVAL.

FISH RESCUE

ALL FISH RESCUE EFFORTS SHALL BE SUPERVISED BY A QUALIFIED FISHERIES/AQUATIC BIOLOGIST EXPERIENCED WITH THE COLLECTION AND HANDLING OF SALMONID FISHES FROM CONSTRUCTION SITES.

ALL FISH TRAPPED IN RESIDUAL POOLS WITHIN THE PROJECT AREA SHALL BE CAREFULLY COLLECTED BY SEINE AND/OR DIP NETS AND PLACED IN CLEAN TRANSFER CONTAINERS WITH ADEQUATE VOLUME OF WATER AND HELD WITHIN NO LONGER THAN 10 MINUTES.

CAPTURED FISHES SHALL BE IMMEDIATELY RELEASED INTO THE RIVER.

CULTURAL RESOURCES

IF ANY ARCHAEOLOGICAL RESOURCES AND/OR ARTIFACTS ARE ENCOUNTERED DURING CONSTRUCTION ALL CONSTRUCTION ACTIVITY SHALL IMMEDIATELY CEASE AND THE OWNER SHALL BE CONTACTED.

TREE SALVAGE

ALL SAPLING AND TREES TO BE REMOVED SHALL BE APPROVED AND CLEARLY MARKED BY THE OWNER'S REPRESENTATIVE.

ALL REMOVED VEGETATION SHALL BE INCORPORATED INTO HABITAT STRUCTURES AS DIRECTED BY THE OWNER'S REPRESENTATIVE. IF EXCESS MATERIAL NEEDS DISPOSAL OUTSIDE OF CHANNEL WORK, IT SHALL BE DISTRIBUTED ON THE FLOODPLAIN AS DIRECTED BY THE OWNER'S REPRESENTATIVE.

ALL TREES REMOVED WITHIN CLEARING LIMITS SHALL BE REMOVED WHOLE WITH ROOTS INTACT AND UTILIZED IN THE SIDE CHANNEL CONSTRUCTION OR IN MAINSTEM WORK AS DIRECTED BY OWNER'S REPRESENTATIVE.

REMOVE SOIL FROM ROOTS OF SALVAGED TREES BEFORE PLACEMENT IN THE WATERWAY.

LIVE TREES

ALL TREES NOT MARKED FOR REMOVAL SHALL BE PRESERVED AND UNDISTURBED. CONSTRUCTION ACTIVITY SHALL NOT DEBARK OR DAMAGE LIVE TREES.

KEEP OUT OF DRIP LINE OF ALL PRESERVED EXISTING TREES.

IMPORTED LOGS

LOGS WILL BE PROVIDED BY THE OWNER. CARE SHALL BE EXERCISED TO PRESERVE ROOTS.

PLANTINGS

PLANTS SHALL BE INSTALLED DURING LOG STRUCTURE CONSTRUCTION AS DIRECTED BY THE OWNER. OWNER SUPPLIED PLANTS WILL BE AVAILABLE AT THE YNF OFFICE. IT SHALL BE THE RESPONSIBILITY OF THE CONTRACTOR TO STORE PLANTS IN SHADE AND WATER THEM THREE TIMES DAILY ONCE THEY ARE ON THE PROJECT SITE UNTIL THEY ARE INSTALLED.

CONSTRUCTION ACCESS

THE CONTRACTOR IS ADVISED THAT ACCESS TO THE SITE WILL BE BY RURAL ROADS OF LIMITED WIDTH.

THE CONTRACTOR IS SOLELY RESPONSIBLE FOR OBTAINING ANY REQUIRED TRAFFIC CONTROL OR ACCESS PERMITS, AND PROVIDING REQUIRED TRAFFIC CONTROL MEASURES INCLUDING, BUT NOT LIMITED TO, SIGNAGE AND FLAGGERS.

THE CONTRACTOR SHALL BE RESPONSIBLE FOR ADHERING TO THE CONSERVATION MEASURES DETAILED IN THE FOREST SERVICE ROAD USE PERMIT.

ALL EQUIPMENT, MATERIALS AND PERSONNEL SHALL REMAIN WITHIN THE LIMITS OF DISTURBANCE.

THE CONTRACTOR SHALL KEEP THE WORK AREAS IN A NEAT AND CLEAN CONDITION FREE OF DEBRIS AND LITTER FOR THE DURATION OF THE PROJECT.

TEMPORARY ACCESS ROUTES IN AREAS PRONE TO INUNDATION DURING THE IN-WATER WORK WINDOW SHALL BE DECOMMISSIONED BEFORE THE END OF THE IN-WATER WORK WINDOW.

WHEN TEMPORARY VEGETATION REMOVAL IS REQUIRED FOR SITE ACCESS, VEGETATION SHALL BE CUT TO GROUND LEVEL (NOT GRUBBED).

CONSTRUCTION STAKING

THE OWNER OR DESIGNATED REPRESENTATIVE WILL INSTALL STAKES AND OR FLAGGING TO DELINEATE WETLANDS, EQUIPMENT ENTRY AND EXIT POINTS, STAGING AND STOCKPILE AREAS, AND PROJECT LIMITS. THE OWNER WILL INSTALL GRADE STAKES, AND ELEVATION CONTROL POINTS. THE CONTRACTOR SHALL BE RESPOSIBLE FOR REPLACING DAMAGED OR MISSING STAKES.

CONTRACTOR SHALL MEET WITH THE OWNER AND OWNER'S REPRESENTATIVE TO DEFINE AND MARK LIMITS OF DISTURBANCE PRIOR TO MOBILIZATION OF EQUIPMENT OR MATERIALS ONTO THE SITE.

SOME FIELD ADJUSTMENTS TO THE LINES AND GRADES ARE TO BE EXPECTED. LOCATION, ALIGNMENT, AND ELEVATION OF LOGS AND LOGS WITH ROOTWADS ARE SUBJECT TO ADJUSTMENT BASED ON FIELD CONDITIONS, AND MATERIAL SIZE.

STAGING, STORAGE, AND STOCKPILE AREAS

NATURAL MATERIALS USED FOR IMPLEMENTATION OF AQUATIC RESTORATION, SUCH AS LARGE WOOD, SLASH, PLANTINGS, GRAVEL, AND TOPSOIL MAY BE STAGED WITHIN THE 100-YEAR FLOODPLAIN AT STOCKPILE AREAS SHOWN IN PLANS. CONSTRUCTION EQUIPMENT STORAGE, VEHICLE STORAGE, FUELING, SERVICING, AND HAZARDOUS MATERIAL STORAGE SHALL BE 150 FEET OR MORE FROM ANY NATURAL WATER BODY OR WETLAND, OR ON AN ADJACENT ESTABLISHED ROAD AREA. INSTALL, MONITOR, AND MAINTAIN BEST MANAGEMENT PRACTICES (BMPS) TO PREVENT OR INTERCEPT CONTAMINANTS FROM ENTERING STREAM OR FLOODPLAIN.

EXCAVATED MATERIALS SHALL BE STOCKPILED NEATLY IN AN APPROVED LOCATION WITHIN THE STOCKPILE AREA.

ANY MATERIAL NOT USED IN RESTORATION, AND NOT NATIVE TO THE FLOODPLAIN, SHALL BE REMOVED TO A LOCATION OUTSIDE OF THE 100-YEAR FLOODPLAIN FOR DISPOSAL.

EQUIPMENT

MECHANIZED EQUIPMENT AND VEHICLES SHALL BE SELECTED, OPERATED, AND MAINTAINED IN A MANNER THAT MINIMIZES ADVERSE EFFECTS ON THE ENVIRONMENT (E.G., MINIMALLY-SIZED, LOW PRESSURE TIRES; MINIMAL HARD-TURN PATHS FOR TRACKED VEHICLES; TEMPORARY MATS OR PLATES WITHIN WET AREAS OR ON SENSITIVE SOILS). ALL VEHICLES AND OTHER MECHANIZED EQUIPMENT SHALL BE:

- STORED, FUELED, AND MAINTAINED IN A VEHICLE STAGING AREA PLACED 150 FEET OR MORE FROM ANY NATURAL WATER BODY OR WETLAND OR ON AN ADJACENT, ESTABLISHED ROAD AREA
- REFUELED IN A VEHICLE STAGING AREA PLACED 150 FEET OR MORE FROM A NATURAL WATERBODY OR WETLAND, OR IN AN ISOLATED HARD ZONE, SUCH AS A PAVED PARKING LOT OR ADJACENT, ESTABLISHED ROAD (THIS MEASURE APPLIES ONLY TO GAS-POWERED EQUIPMENT WITH TANKS LARGER THAN 5 GALLONS)
- BIODEGRADABLE LUBRICANTS AND FLUIDS SHALL BE USED IN EQUIPMENT OPERATING IN AND ADJACENT TO THE STREAM CHANNEL AND LIVE WATER.
- INSPECTED DAILY FOR FLUID LEAKS BEFORE LEAVING THE VEHICLE STAGING AREA FOR OPERATION WITHIN 150 FEET OF ANY NATURAL WATER BODY OR WETLAND
- THOROUGHLY CLEANED BEFORE OPERATION BELOW ORDINARY HIGH WATER, AND AS OFTEN AS NECESSARY DURING OPERATION, TO REMAIN GREASE FREE.

ABBREVIATIONS

APPROX	APPROXIMATE
CY	CUBIC YARDS
°	DEGREES
DIA or Ø	DIAMETER
DBH	DIAMETER AT BREAST HEIGHT
EA	EACH
EL or ELEV	ELEVATION
ESC	EROSION AND SEDIMENT CONTROL
EXIST	EXISTING
FT or '	FEET
FTR	FULLY THREADED ROD
HORIZ	HORIZONTAL
IN or "	INCH
INV	INVERT
LWM	LARGE WOODY MATERIAL
MAX	MAXIMUM
MIN	MINIMUM
OHW	ORDINARY HIGH WATER
%	PERCENT
RMx	RIVER MILE x
STA	STATION
TBD	TO BE DETERMINED
TYP	TYPICAL
VERT	VERTICAL
WSE	WATER SURFACE ELEVATION
YR	YEAR

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NOTES & LEGEND

SHEET
2 OF 24

EROSION CONTROL

CONTRACTOR SHALL BE SOLELY RESPONSIBLE AT OWN EXPENSE FOR PROVIDING AND MAINTAINING ALL NECESSARY EROSION CONTROL FACILITIES TO COMPLY WITH APPLICABLE EROSION CONTROL REGULATIONS AND TO MAINTAIN CLEAN ACCESS ROUTES.

EROSION/SEDIMENTATION CONTROL (ESC) PLAN

THE EROSION AND SEDIMENT CONTROL (ESC) PLAN PROVIDED IS FOR INFORMATIONAL PURPOSES ONLY, THE CONTRACTOR SHALL BE SOLELY RESPONSIBLE FOR PROVIDING EROSION CONTROL MEASURES TO COMPLY WITH APPLICABLE REGULATIONS.

THE RECOMMENDATIONS FOR AN ESC PLAN INCLUDED HEREIN WILL PROVIDE GUIDELINES FOR THE CONTRACTOR TO DEVELOP AND IMPLEMENT AN ESC PLAN. THE CONTRACTOR'S ESC PLAN SHALL BE SUBMITTED TO THE OWNER PRIOR TO MOBILIZATION.

A. THE IMPLEMENTATION OF AN ESC PLAN AND THE CONSTRUCTION, MAINTENANCE, REPLACEMENT, AND UPGRADING OF THESE ESC FACILITIES IS THE RESPONSIBILITY OF THE CONTRACTOR UNTIL ALL CONSTRUCTION IS COMPLETED AND APPROVED AND VEGETATION / LANDSCAPING IS ESTABLISHED.

B. THE BOUNDARIES OF THE CLEARING LIMITS SHOWN ON THIS PLAN SHALL BE CLEARLY FLAGGED IN THE FIELD PRIOR TO CONSTRUCTION. DURING THE CONSTRUCTION PERIOD, NO DISTURBANCE BEYOND THE FLAGGED CLEARING LIMITS SHALL BE PERMITTED. THE FLAGGING SHALL BE MAINTAINED BY THE CONTRACTOR FOR THE DURATION OF CONSTRUCTION.

ESC FACILITIES AS APPROXIMATELY SHOWN ON THIS PLAN ARE TO BE CONSTRUCTED PRIOR TO CLEARING AND GRADING ACTIVITIES, AND IN SUCH A MANNER AS TO ENSURE THAT SEDIMENT AND SEDIMENT LADEN WATER DO NOT ENTER THE DRAINAGE SYSTEM.

STABILIZE SOILS AND PROTECT SLOPES

FROM MAY 1 THROUGH SEPTEMBER 30, ALL EXPOSED SOILS SHALL BE PROTECTED FROM EROSION BY MULCHING, PLASTIC SHEETING, HYDROSEED COVERING, OR OTHER APPROVED MEASURES WITHIN THREE DAYS OF GRADING. FROM OCTOBER 1 THROUGH APRIL 30, ALL EXPOSED SOILS MUST BE PROTECTED WITHIN 2 DAYS OF GRADING. SOILS SHALL BE STABILIZED BEFORE A WORK SHUTDOWN, HOLIDAY OR WEEKEND IF NEEDED BASED ON THE WEATHER FORECAST. SOIL STOCKPILES MUST BE STABILIZED AND PROTECTED WITH SEDIMENT TRAPPING MEASURES. MULCH AS SOON AS PRACTICAL ALL DISTURBED AREAS NOT INDICATED IN THE CONTRACT DOCUMENTS FOR OTHER PERMANENT STABILIZATION MEASURES. HAY, STRAW, AND MULCH USED ON SITE MUST BE 99.9% WEED-FREE.

DESIGN, CONSTRUCT, AND PHASE CUT AND FILL SLOPES IN A MANNER THAT WILL MINIMIZE EROSION. REDUCE SLOPE VELOCITIES ON DISTURBED SLOPES BY PROVIDING TEMPORARY BARRIERS. STORMWATER FROM OFF SITE SHOULD BE HANDLED SEPARATELY FROM STORMWATER GENERATED ON SITE.

AFTER FINAL SITE STABILIZATION

ALL TEMPORARY EROSION AND SEDIMENTATION CONTROL MEASURES SHALL BE REMOVED WITHIN 30 DAYS AFTER FINAL SITE STABILIZATION IS ACHIEVED OR AFTER THE TEMPORARY BMPS ARE NO LONGER NEEDED. TRAPPED SEDIMENT SHALL BE REMOVED FROM THE SITE OR INCORPORATED INTO FINISHED GRADING. DISTURBED SOIL AREAS RESULTING FROM REMOVAL SHALL BE PERMANENTLY STABILIZED.

DUST CONTROL

THE CONTRACTOR SHALL CONTROL DUST FOR THE DURATION OF THE PROJECT. CONTROL MEASURES SHALL BE IN ACCORDANCE WITH APPLICABLE REGULATIONS.

INVASIVE SPECIES CONTROL

THE FOLLOWING MEASURES WILL BE FOLLOWED TO AVOID INTRODUCTION OF INVASIVE PLANTS AND NOXIOUS WEEDS INTO PROJECT AREAS:

PRIOR TO ENTERING THE SITE, ALL VEHICLES AND EQUIPMENT WILL BE POWER WASHED, ALLOWED TO FULLY DRY, AND INSPECTED TO MAKE SURE NO PLANTS, SOIL, OR OTHER ORGANIC MATERIAL ADHERES TO THE SURFACE.

WATERCRAFT, WADERS, BOOTS, AND ANY OTHER GEAR TO BE USED IN OR NEAR WATER WILL BE INSPECTED FOR AQUATIC INVASIVE SPECIES.

WADING BOOTS WITH FELT SOLES ARE NOT TO BE USED DUE TO THEIR PROPENSITY FOR AIDING IN THE TRANSFER OF INVASIVE SPECIES.

CONSTRUCTION DEWATERING

CONTRACTOR SHALL PERFORM CONSTRUCTION DEWATERING IN SUCH A MANNER AS TO AVOID THE RELEASE OF TURBID OR SEDIMENT-LADEN WATER IN ORDER TO PREVENT CONTAMINATION OR INCREASE TURBIDITY OF SURFACE WATERS. EXCAVATION OF DEWATERING SUMPS BEYOND LIMITS SHOWN SHALL BE AT NO ADDITIONAL COST. SEDIMENT LADEN WATER MAY BE PUMPED TO AN UPLAND DISCHARGE LOCATION AND ALLOWED TO SHEET FLOW THROUGH EXISTING VEGETATION BEFORE INFILTRATING INTO THE GROUND. IF THIS METHOD IS NOT SUFFICIENT TO PREVENT RETURN OF TURBID WATER TO SURFACE WATERS OR SENSITIVE FLOODPLAIN AREAS, A 'DIRT-BAG' OR SEDIMENT RETENTION STRUCTURE MAY BE REQUIRED AS NECESSARY TO COMPLY WITH LAWS AND PERMIT REQUIREMENTS AT NO ADDITIONAL COST.

CONTRACTOR SHALL PROVIDE, OPERATE, AND MAINTAIN NUMBER AND SIZE OF PUMPS AS NECESSARY TO ACHIEVE DEWATERING NEEDS. AT A MINIMUM, CONTRACTOR SHALL PROVIDE A 6" DRI-PRIME DIESEL POWERED PUMP AND A PORTABLE 2" PUMP. ADDITIONAL PUMPS AND OF DIFFERENT CAPACITIES MAY BE REQUIRED AT CONTRACTOR'S EXPENSE.

OWNER OR OWNER'S REPRESENTATIVE SHALL APPROVE DEWATERING DISCHARGE LOCATION PRIOR TO IMPLEMENTATION.

A. THE ESC FACILITIES SHOWN ON THIS PLAN ARE THE MINIMUM REQUIREMENTS FOR ANTICIPATED SITE CONDITIONS. DURING THE CONSTRUCTION PERIOD, THESE ESC FACILITIES SHALL BE UPGRADED AS NEEDED AT NO ADDITIONAL COST FOR UNEXPECTED STORM EVENTS AND TO ENSURE THAT SEDIMENT AND SEDIMENT-LADEN WATER DO NOT LEAVE THE SITE.

B. THE ESC FACILITIES SHALL BE INSPECTED DAILY BY THE CONTRACTOR AND MAINTAINED AS NECESSARY TO ENSURE THEIR CONTINUED FUNCTIONING.

C. THE ESC FACILITIES ON INACTIVE SITES SHALL BE INSPECTED AND MAINTAINED A MINIMUM OF ONCE A MONTH OR WITHIN THE 24 HOURS FOLLOWING A STORM EVENT.

D. STABILIZED CONSTRUCTION ENTRANCES AND ADDITIONAL MEASURES MAY BE REQUIRED AND SHALL BE MAINTAINED FOR THE DURATION OF THE PROJECT.

SPILL PREVENTION, CONTROL, AND COUNTER MEASURES

THE USE OF MECHANIZED MACHINERY INCREASES THE RISK FOR ACCIDENTAL SPILLS OF FUEL, LUBRICANTS, HYDRAULIC FLUID, OR OTHER CONTAMINANTS INTO THE RIPARIAN ZONE OR DIRECTLY INTO THE WATER. THE PROJECT SPONSOR WILL ADHERE TO THE FOLLOWING MEASURES:

A DESCRIPTION OF HAZARDOUS MATERIALS THAT WILL BE USED, INCLUDING INVENTORY, STORAGE, AND HANDLING PROCEDURES WILL BE AVAILABLE ON-SITE.

WRITTEN PROCEDURES FOR NOTIFYING ENVIRONMENTAL RESPONSE AGENCIES WILL BE POSTED AT THE WORK SITE.

SPILL CONTAINMENT KITS (INCLUDING INSTRUCTIONS FOR CLEANUP AND DISPOSAL) ADEQUATE FOR THE TYPES AND QUANTITY OF HAZARDOUS MATERIALS USED AT THE SITE WILL BE AVAILABLE AT THE WORK SITE.

WORKERS WILL BE TRAINED IN SPILL CONTAINMENT PROCEDURES AND WILL BE INFORMED OF THE LOCATION OF SPILL CONTAINMENT KITS.

ANY WASTE LIQUIDS GENERATED AT THE STAGING AREAS WILL BE TEMPORARILY STORED UNDER AN IMPERVIOUS COVER, SUCH AS A TARPAULIN, UNTIL THEY CAN BE PROPERLY TRANSPORTED TO AND DISPOSED OF AT A FACILITY THAT IS APPROVED FOR RECEIPT OF HAZARDOUS MATERIALS.

VEGETABLE BASED HYDRAULIC FLUIDS (BIODEGRADABLE OIL) WILL BE USED IN ANY VEHICLE THAT WILL BE OPERATED NEAR THE WATER.

INSPECTION AND MAINTENANCE

ALL ESC FACILITIES SHALL BE INSPECTED, MAINTAINED, AND REPAIRED AS NEEDED TO ASSURE CONTINUED PERFORMANCE OF THEIR INTENDED FUNCTION. ALL ESC FACILITIES SHALL BE INSPECTED DAILY AND WITHIN 24 HOURS AFTER ANY STORM EVENT GREATER THAN 0.5 INCHES OF RAIN PER 24 HOUR PERIOD AND AFTER EVENTS EXCEEDING 2 HOURS DURATION.

CONTRACTOR'S ESC RECORD

WEEKLY REPORTS SUMMARIZING THE SCOPE OF INSPECTIONS, THE PERSONNEL CONDUCTING THE INSPECTION, THE DATE(S) OF THE INSPECTION, MAJOR OBSERVATIONS RELATING TO THE IMPLEMENTATION OF THE CONTRACTOR'S EROSION AND SEDIMENT CONTROL PLAN, AND ACTIONS TAKEN AS A RESULT OF THESE INSPECTIONS SHALL BE PREPARED AND RETAINED ON SITE BY THE CONTRACTOR. IN ADDITION, A RECORD OF THE FOLLOWING DATES SHALL BE INCLUDED IN THE REPORTS:

1. WHEN MAJOR GRADING ACTIVITIES OCCUR,
2. DATES OF RAINFALL EVENTS EITHER EXCEEDING 2 HOURS DURATION OR MORE THAN 0.5 INCHES/24 HOURS,
3. WHEN CONSTRUCTION ACTIVITIES TEMPORARILY OR PERMANENTLY CEASE ON SITE, OR ON A PORTION OF THE SITE,
4. WHEN STABILIZATION MEASURES ARE INITIATED FOR PORTIONS OF THE SITE.

ESC RECORDS SHALL BE MADE AVAILABLE TO THE OWNER AND OWNER'S REPRESENTATIVE ON REQUEST AND SHALL BE PROVIDED FOR REVIEW AND APPROVAL PRIOR TO APPLICATION FOR PAYMENT.

NO.	BY	DATE	REVISION DESCRIPTION

MM, GS	MM	DM
DRAWN	DESIGNED	CHECKED
GJ	12/31/18	----
APPROVED	DATE	PROJECT

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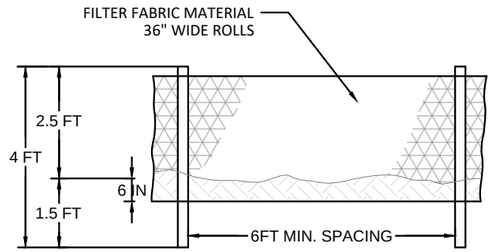
EROSION CONTROL PLAN

SHEET
3 OF 24



FRONT VIEW
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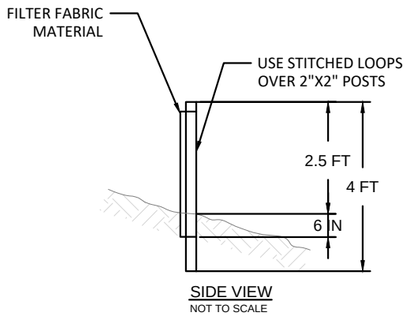
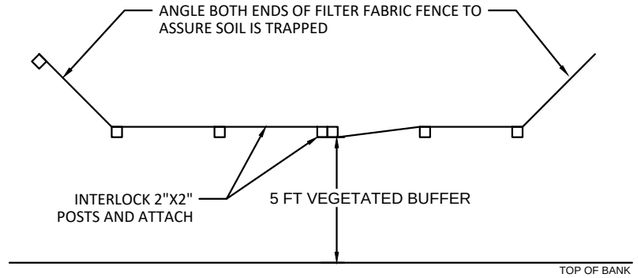


SIDE VIEW
NOT TO SCALE



PLAN VIEW
NOT TO SCALE

1/4 TYPICAL DETAIL
SILT FENCE
NOT TO SCALE

SILT FENCE NOTES

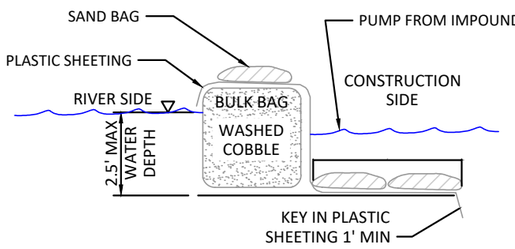
1.THE FILTER FABRIC SHALL BE PURCHASED IN A CONTINUOUS ROLL CUT TO THE LENGTH OF THE BARRIER TO AVOID USE OF JOINTS. WHEN JOINTS ARE NECESSARY, FILTER CLOTH SHALL BE SPLICED TOGETHER ONLY AT A SUPPORT POST, WITH A MINIMUM 6 INCH OVERLAP, AND BOTH ENDS SECURELY FASTENED TO THE POST. ALTERNATIVELY, OVERLAP AND INTERLOCK TWO POSTS WITH ATTACHED FABRIC AS APPROVED BY THE OWNER'S REPRESENTATIVE.

2.THE SILT FENCE IS TO BE INSTALLED AT LOCATIONS SHOWN ON THE PLAN ALONG THE DOWNHILL PERIMETER OF DISTURBED AREAS. THE FENCE POST SHALL BE SPACED A MAXIMUM OF 6 FEET APART AND DRIVEN SECURELY INTO THE GROUND A MINIMUM OF 24 INCHES APART.

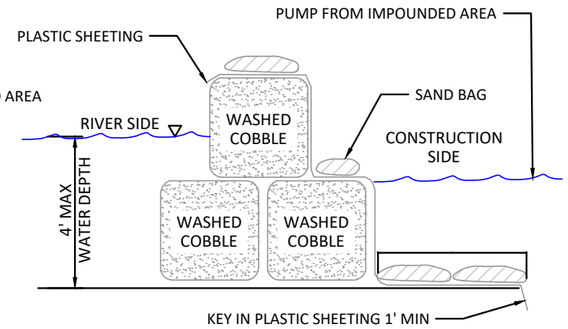
3. THE FILTER FABRIC SHALL HAVE A MINIMUM VERTICAL BURIAL OF 6 INCHES. ALL EXCAVATED MATERIAL FROM SILT FENCE INSTALLATION SHALL BE BACK-FILLED AND COMPACTED ALONG THE ENTIRE DISTURBED AREA.

4. STANDARD OR HEAVY DUTY SILT FENCE SHALL HAVE MANUFACTURED STITCHED LOOPS FOR 2 INCHES X 2 INCHES POST INSTALLATION.

5. SILT FENCES SHALL BE REMOVED WHEN THEY HAVE SERVED THEIR USEFUL PURPOSE, BUT NOT BEFORE THE UPSLOPE AREA HAS BEEN PERMANENTLY PROTECTED AND STABILIZED, OR AS DIRECTED BY THE OWNER'S REPRESENTATIVE.



TEMPORARY COFFER DAM SECTION
NOT TO SCALE



COFFER DAM SECTION IN WATER DEPTHS GREATER THAN 2.5'
NOT TO SCALE

2/4 TYPICAL DETAIL
BULK BAG COFFER DAM
NOT TO SCALE

BULK BAG NOTES:

1. BULK BAG COFFERDAM SHALL BE CONSTRUCTED OF SEVERAL UNITS OF BULK BAGS FILLED WITH WASHED GRAVEL, AND ABUTTED SIDE BY SIDE TO CREATE A ROW THAT ISOLATES THE CONSTRUCTION SITE.
2. IF WATER DEPTH EXCEEDS 85% OF THE BULK BAG HEIGHT, AN ADDITIONAL TOP ROW OF BULK BAGS SHALL BE INSTALLED, SUPPORTED BY TWO BOTTOM ROWS OF BULK BAGS. BULK BAG COFFERDAM SHALL BE SEALED BY COVERING THE COFFERDAM WITH PLASTIC SHEETING HELD IN PLACE BY STANDARD SANDBAGS PLACED IN ROWS ON TOP OF COFFERDAM, AND AT TOE OF COFFERDAM.
3. THE PLASTIC SHEETING SHALL BE DRAPED ALONG THE CHANNEL BOTTOM ON BOTH SIDES OF THE COFFERDAM WITH OUTWARD EDGE OF SHEETING MINIMUM 4-FEET FROM TOE OF COFFERDAM. THE DRAPED PORTION OF PLASTIC SHEETING SHALL BE PINNED TO THE CHANNEL BED BY MINIMUM TWO ROWS OF STANDARD SANDBAGS.
4. THE CONSTRUCTION SIDE EDGE OF PLASTIC SHEETING SHALL BE TOED INTO THE CHANNEL BED MINIMUM 1-FT. TOEING IN THE OUTWARD EDGE OF PLASTIC SHEETING SHALL OCCUR AFTER THE COFFERDAM IS CLOSED TO PREVENT TURBIDITY RELEASE TO THE WATERWAY.
5. THE TERMINAL ENDS OF BULK BAG COFFERDAM, WHERE IT CONNECTS TO CHANNEL BANK OR HIGH GROUND, SHALL BE SEALED WITH PLASTIC SHEETING AND STANDARD SANDBAGS.
6. BULK BAGS SHALL BE CUBE-SHAPED POLYPROPYLENE WOVEN FABRIC BAGS WITH FULLY OPEN TOP, FLAT BOTTOM, FOUR LOOPS, MINIMUM 2-TON WEIGHT CAPACITY, MINIMUM 5:1 SAFETY FACTOR.
7. PLASTIC SHEETING SHALL BE MINIMUM 6-MIL THICKNESS. ROLL LENGTH SHALL BE LONG ENOUGH TO ENSURE THAT ENTIRE LENGTH OF COFFERDAM WILL BE COVERED WITHOUT A SEAM. MINIMUM 12-FT WIDE ROLL SHALL BE USED FOR SINGLE LAYER BULK BAG COFFERDAM. MINIMUM 16-FT WIDE ROLL SHALL BE USED FOR 2-LAYER STACKED BULK BAG COFFERDAM.
8. BULK BAG COFFERDAM SHALL BE COMPLETELY REMOVED AFTER CONSTRUCTION IS COMPLETED AND TURBIDITY HAS BEEN REMOVED.
9. MEASUREMENT AND PAYMENT FOR BULK BAG COFFERDAM, SAND BAGS, PLASTIC SHEETING, WASHED GRAVEL PLACEMENT, MAINTENANCE AND REMOVAL OF ALL MATERIALS SHALL BE INCIDENTAL TO THE LUMP SUM ALL INCLUSIVE COST FOR DIVERSION AND DEWATERING.
10. ALTERNATE COFFERDAM MATERIALS AND CONFIGURATIONS MAY BE ALLOWED BUT SHALL NOT BE IMPLEMENTED WITHOUT REVIEW AND APPROVAL BY THE OWNER'S REPRESENTATIVE. CONTRACTOR SHALL PROVIDE SHOP DRAWINGS AND/OR VENDOR CUT SHEETS FOR SUBSTITUTIONS.

NO.	BY	DATE	REVISION DESCRIPTION

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MM, GS	MM	DM
APPROVED	DATE	PROJECT
GJ	12/31/18	----

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EROSION CONTROL DETAILS

SHEET
4 OF 24

ENTIAT RIVER RD

19

BAR APEX LOG STRUCTURES (SHEET 20)

BANK LOG STRUCTURES (SHEET 18)

FLOODPLAIN ROUGHNESS (SHEET 19)

FUELING AND STAGING AREA AT ROADSIDE

MAIN STOCKPILE AREA

LOG PLACEMENTS IN DILL CREEK (SHEET 17)

DILL CREEK

TEMPORARY BRIDGE (SHEETS 23-24)

ENTIAT RIVER

FLOODPLAIN ENHANCEMENT 0.49 WETLAND CREATION (SHEET 13)

BAR APEX LOG STRUCTURE AT SIDE CHANNEL INLET (SHEET 10)

FLOW

WEST SIDE CHANNEL (SHEETS 6-8)
- PERENNIAL FLOW
- 19% OF 2-YR FLOOD

EAST SIDE CHANNEL (SHEET 13)

BAR APEX LOG STRUCTURE AT INLET (SHEET 16)

0.49 AC WETLAND CREATION (OPTIONAL)

POTENTIAL ON-SITE FILL AREA (SHEET 12)

LEGEND

- PROPERTY LINE
- EXISTING GROUND CONTOUR (1 FT)
- PROPOSED GROUND CONTOUR (1 FT)
- OHW ORDINARY HIGH WATER
- EXISTING WETLAND
- WETLAND IMPACT (TOTAL = 0.43 AC)
- POTENTIAL WETLAND CREATION
- POTENTIAL FILL AREA
- STAGING AREA
- ACCESS ROUTE
- PROPOSED LOG STRUCTURE (numbered)
- TP TEST PIT

0 200 400

SCALE IN FEET

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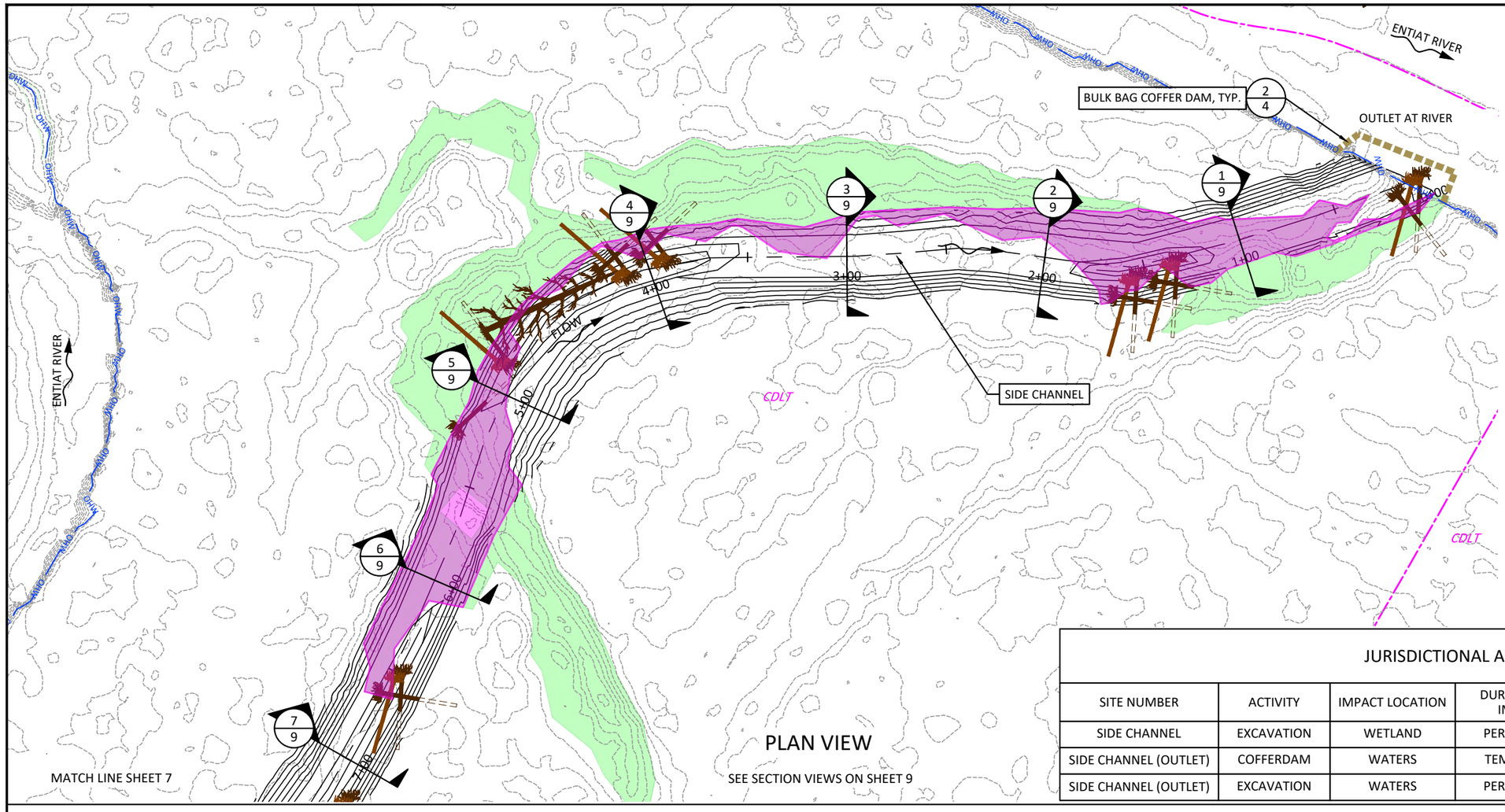
SITE OVERVIEW

SHEET 5 OF 24



LEGEND

- PROPERTY LINE
- EXISTING GROUND CONTOUR (1 FT)
- PROPOSED GROUND CONTOUR (1 FT)
- OHW — ORDINARY HIGH WATER
- TEMPORARY COFFERDAM
- EXISTING WETLAND
- WETLAND IMPACT
- PROPOSED LOG STRUCTURE (TYP)

0 — 60 — 120

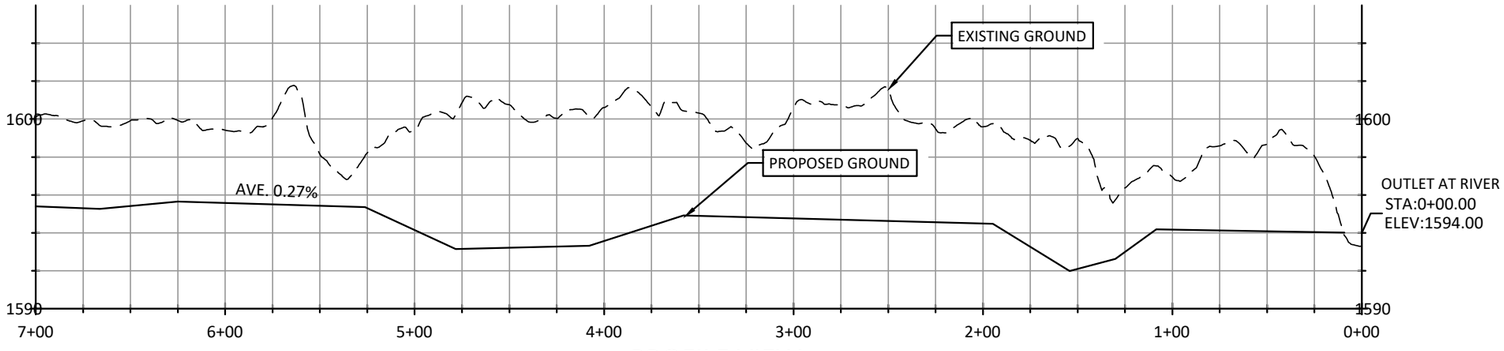
SCALE IN FEET

LOG NOTES

1. LOG LOCATIONS, SIZE, AND ALIGNMENTS DEPICTED HERE ARE TYPICAL. SOME ADJUSTMENTS IN THE FIELD MAY OCCUR BASED ON ACTUAL MATERIALS.
2. REMOVED SHRUBS AND SMALL WOODY DEBRIS GENERATED FROM SITE CLEARING SHALL BE INCORPORATED INTO LOG STRUCTURES AS SLASH. INSTALL SLASH LOOSELY BETWEEN LOGS.
3. SEE SIDE CHANNEL LOGS TYPICAL DETAILS (SHEET 11).

JURISDICTIONAL AREA IMPACTS

SITE NUMBER	ACTIVITY	IMPACT LOCATION	DURATION OF IMPACT	VOLUME OF MATERIAL PLACED OR REMOVAL	AREA OF IMPACT
SIDE CHANNEL	EXCAVATION	WETLAND	PERMANENT	1,405 CY REMOVAL	0.33 ACRES
SIDE CHANNEL (OUTLET)	COFFERDAM	WATERS	TEMPORARY	N/A	83 FT, 90 SY
SIDE CHANNEL (OUTLET)	EXCAVATION	WATERS	PERMANENT	17 CY REMOVAL	13 SY



PROFILE VIEW

NO.	BY	DATE	REVISION DESCRIPTION

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DRAWN	DESIGNED	CHECKED
GJ	12/31/18	----
APPROVED	DATE	PROJECT

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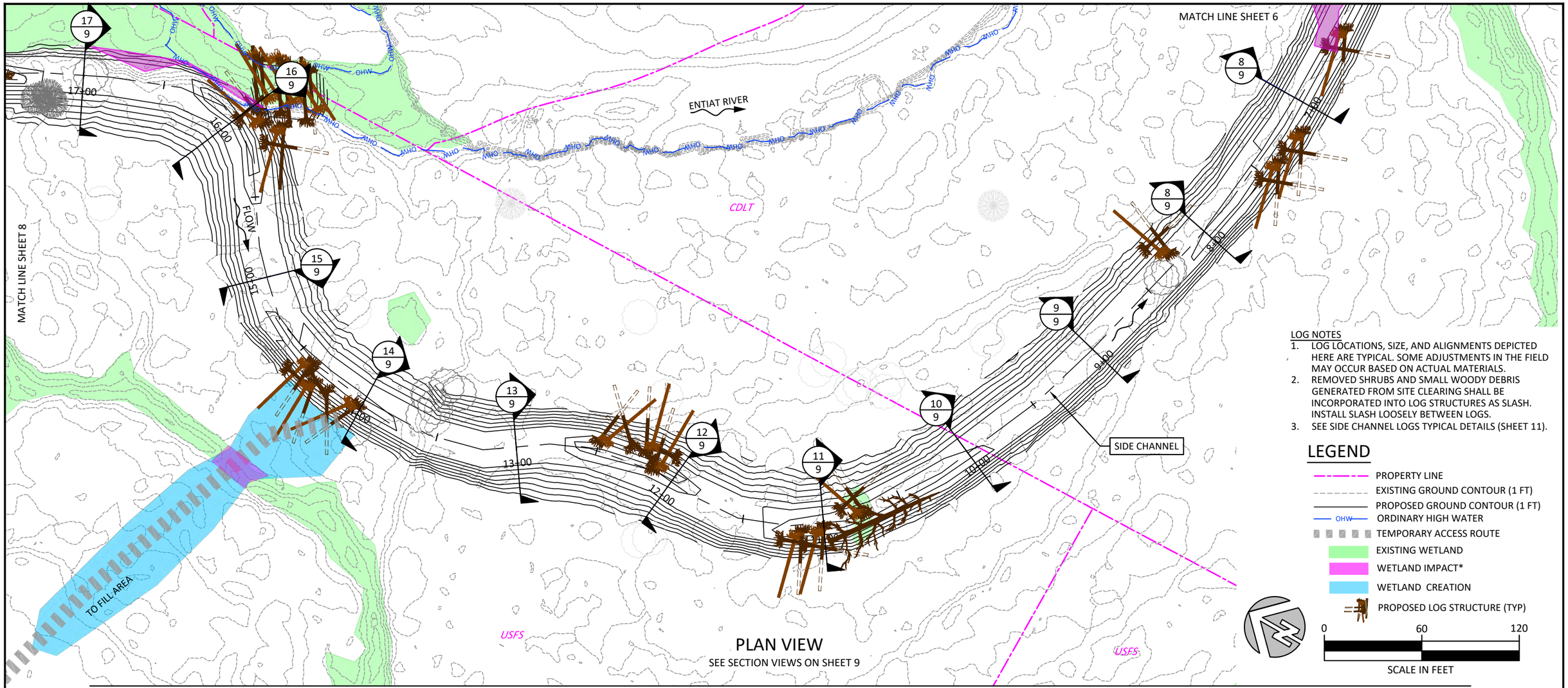
WEST SIDE-CHANNEL
0+00 TO 0+700

SHEET
6 OF 24



PLAN VIEW

SEE SECTION VIEWS ON SHEET 9

LOG NOTES

1. LOG LOCATIONS, SIZE, AND ALIGNMENTS DEPICTED HERE ARE TYPICAL. SOME ADJUSTMENTS IN THE FIELD MAY OCCUR BASED ON ACTUAL MATERIALS.
2. REMOVED SHRUBS AND SMALL WOODY DEBRIS GENERATED FROM SITE CLEARING SHALL BE INCORPORATED INTO LOG STRUCTURES AS SLASH. INSTALL SLASH LOOSELY BETWEEN LOGS.
3. SEE SIDE CHANNEL LOGS TYPICAL DETAILS (SHEET 11).

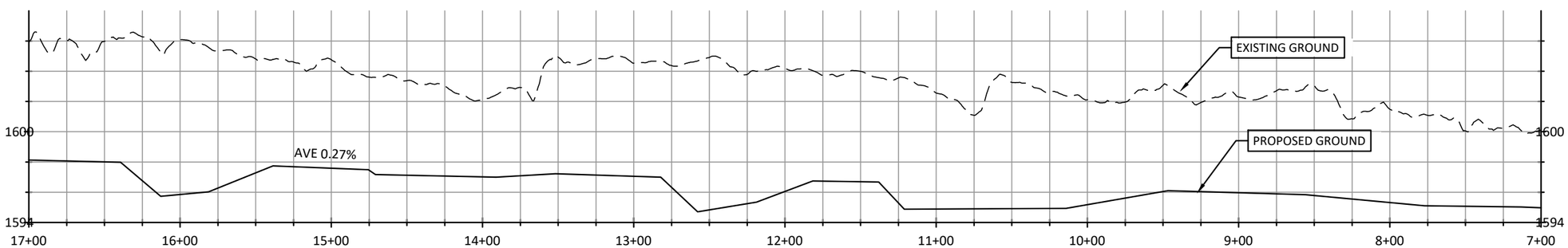
LEGEND

- PROPERTY LINE
- EXISTING GROUND CONTOUR (1 FT)
- PROPOSED GROUND CONTOUR (1 FT)
- OHW — ORDINARY HIGH WATER
- TEMPORARY ACCESS ROUTE
- EXISTING WETLAND
- WETLAND IMPACT*
- WETLAND CREATION
- PROPOSED LOG STRUCTURE (TYP)

0 60 120

SCALE IN FEET

* WETLAND IMPACT DECLARED ON SHEET 6



PROFILE VIEW

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DRAWN	DESIGNED	CHECKED
GJ	12/31/18	----
APPROVED	DATE	PROJECT

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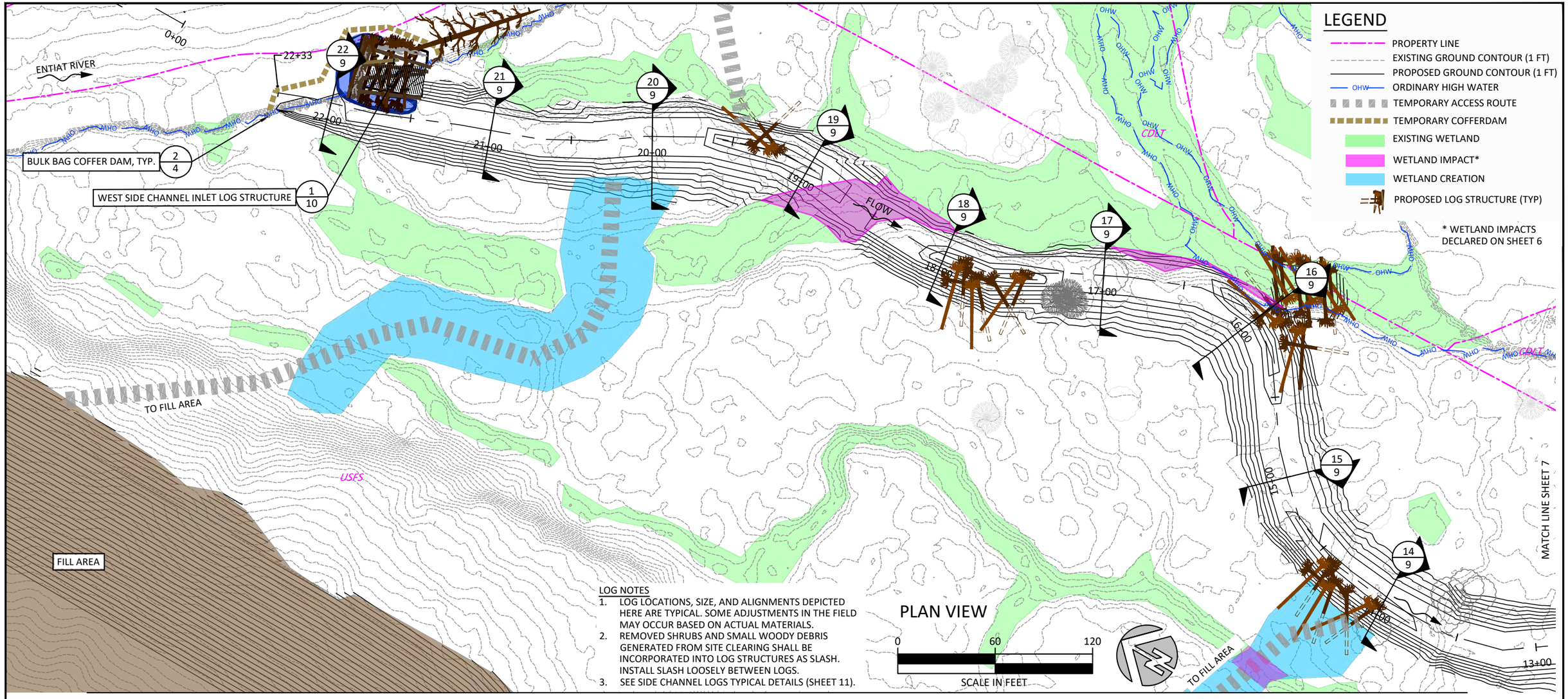
WEST SIDE-CHANNEL
7+00 TO 17+00

SHEET 7 OF 24



LOG NOTES

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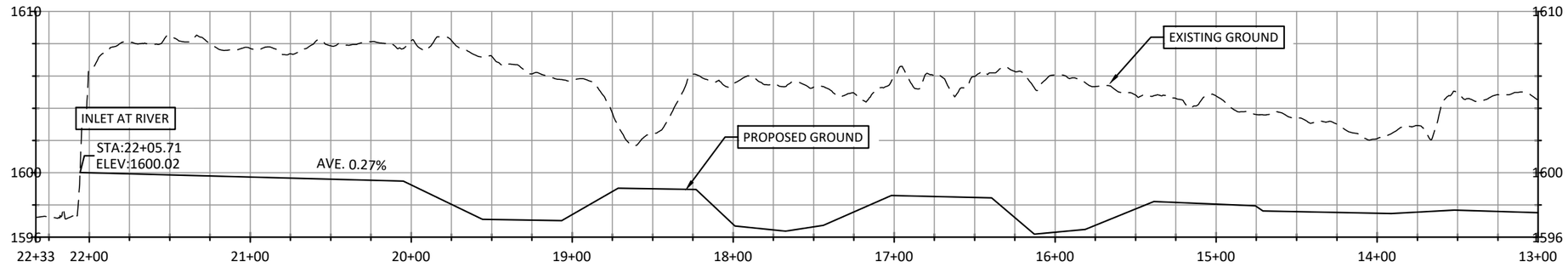
3. SEE SIDE CHANNEL LOGS TYPICAL DETAILS (SHEET 11).

PLAN VIEW

0 60 120

SCALE IN FEET



PROFILE VIEW

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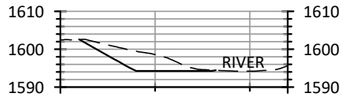
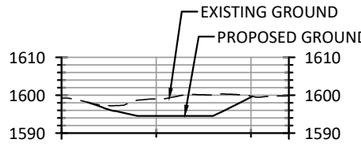
WEST SIDE-CHANNEL
17+00 TO 22+33

SHEET
8 OF 24

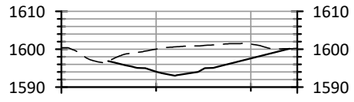


1/9 STA: 1+00



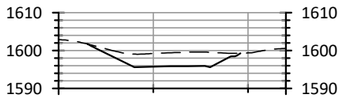
2/9 STA: 2+00

3/9 STA: 3+00



4/9 STA: 4+00

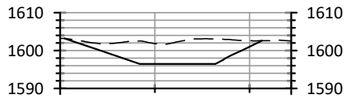
5/9 STA: 5+00



6/9 STA: 6+00

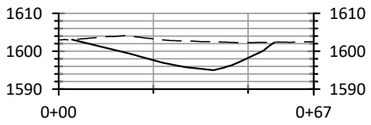
7/9 STA: 7+00

8/9 STA: 8+00



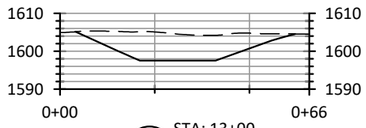
9/9 STA: 9+00

10/9 STA: 10+00

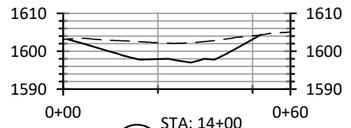


11/9 STA: 11+00

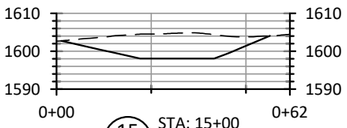
12/9 STA: 12+00



13/9 STA: 13+00

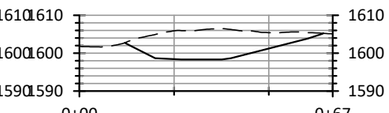


14/9 STA: 14+00



15/9 STA: 15+00

16/9 STA: 16+00

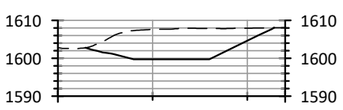


17/9 STA: 17+00

18/9 STA: 18+00

19/9 STA: 19+00

20/9 STA: 20+00



21/9 STA: 21+00

22/9 STA: 22+00

SECTION VIEWS ARE
LOOKING DOWNSTREAM

NO.	BY	DATE	REVISION DESCRIPTION

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MM, GS	MM	DM
APPROVED	**DATE**	**PROJECT**
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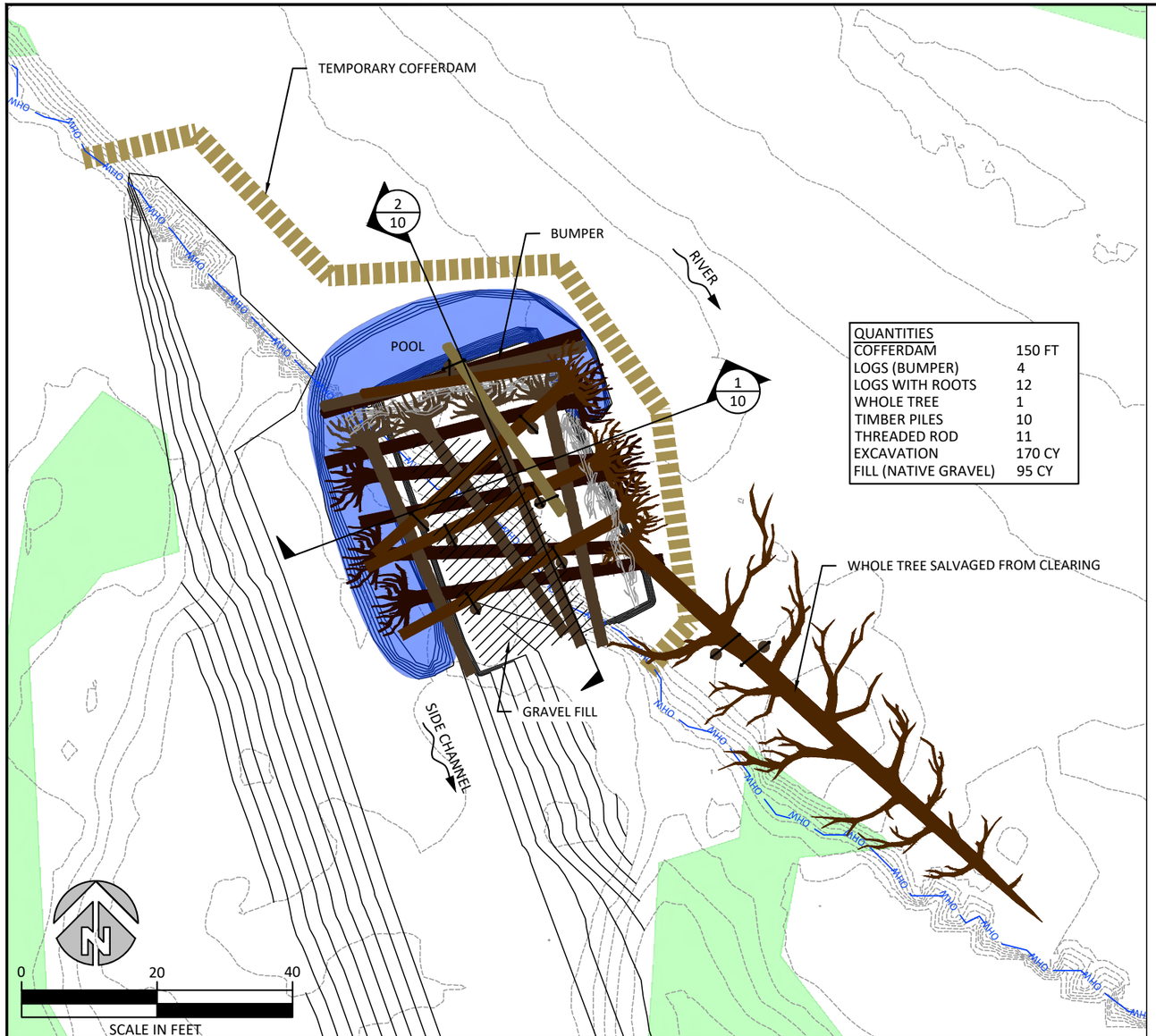
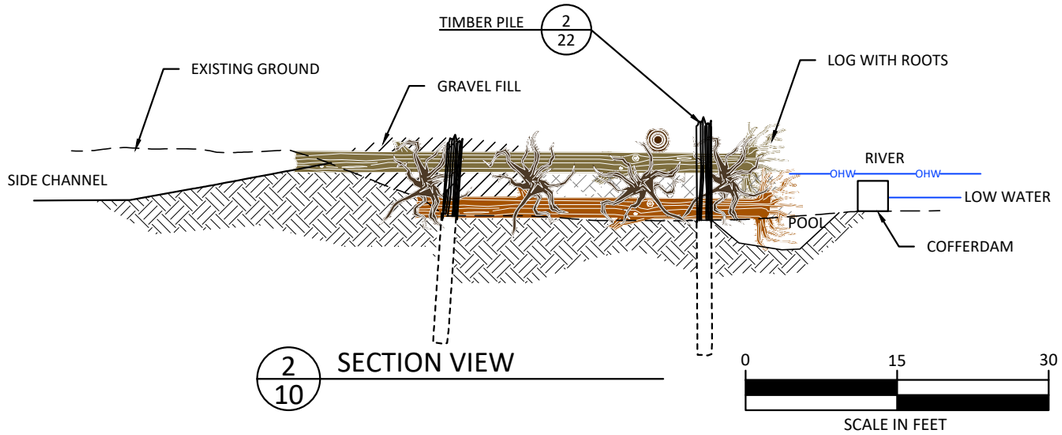
WEST SIDE-CHANNEL
SECTION VIEWS

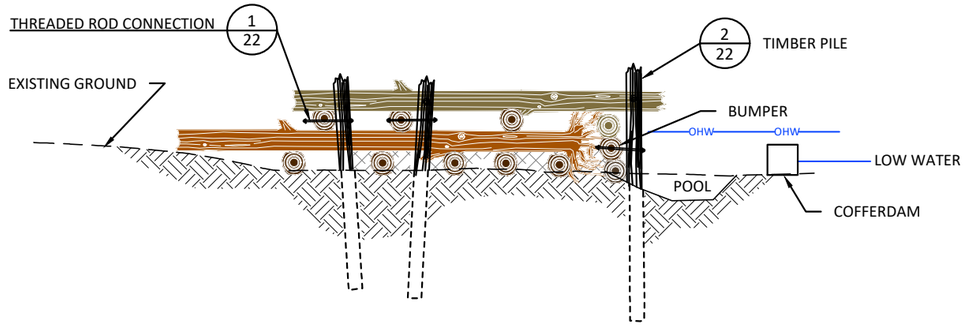
SHEET
9 OF 24



1/10 PLAN VIEW
WEST SIDE-CHANNEL INLET LOG STRUCTURE



2/10 SECTION VIEW



3/10 SECTION VIEW

JURISDICTIONAL AREA IMPACTS

SITE NUMBER	ACTIVITY	IMPACT LOCATION	DURATION OF IMPACT	VOLUME OF MATERIAL PLACED OR REMOVAL	AREA (SY) OF IMPACT
11	COFFERDAM	WATER	TEMPORARY	N/A	230 SY, 150 FT
11	EXCAVATION	WATER	PERMENANT	62 CY REMOVED	46
11	LARGE WOOD	WATER	PERMENANT	24 CY PLACED	40
11	FLL	WATER	PERMENANT	46 CY PLACED	26

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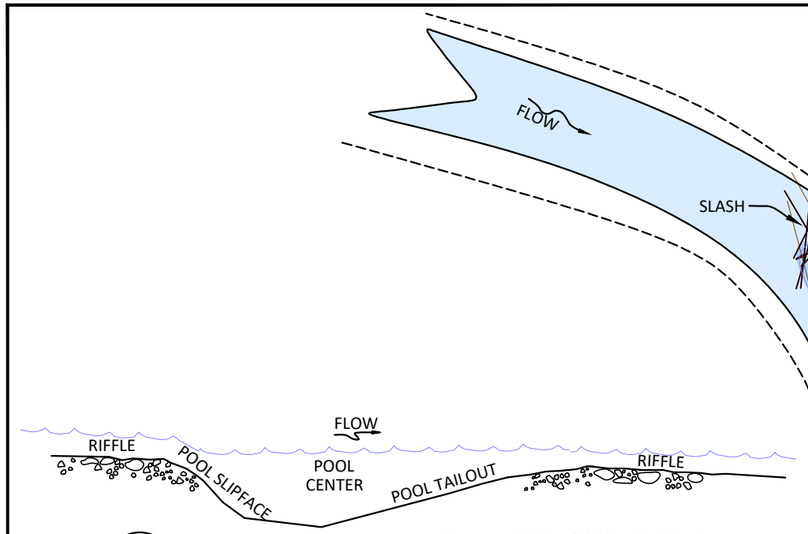
WEST SIDE-CHANNEL INLET
LOG STRUCTURE

SHEET
10 OF 24



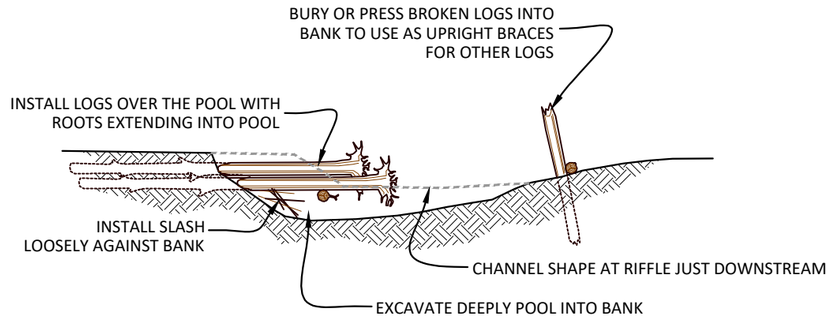
2/11 PROFILE VIEW - TYPICAL POOL AND RIFFLE

NOT TO SCALE

NOTES:

1. TREES AND SHRUBS WITHIN CLEARING LIMITS SHALL BE SALVAGED AND REUSED AS LOGS AND SLASH IN HABITAT STRUCTURES. TO THE EXTENT PRACTICABLE, PRESERVE BRANCHES AND ROOTS ON TREES REMOVED DURING CLEARING AND GRUBBING.

2. WOOD STRUCTURES SHALL BE STABILIZED. STABILIZATION METHODS INCLUDE PARTIAL BURIAL, BRACING AGAINST STANDING TREES, OR TIMBER PILES.



3/11 SECTION VIEW - TYPICAL POOL AND LWD

NOT TO SCALE

* SITES CAN BE SEEN IN PLAN VIEW ON SHEETS 6 THROUGH 8

1/11 PLAN VIEW- TYPICAL SIDE CHANNEL LARGE WOOD CONFIGURATIONS

NOT TO SCALE

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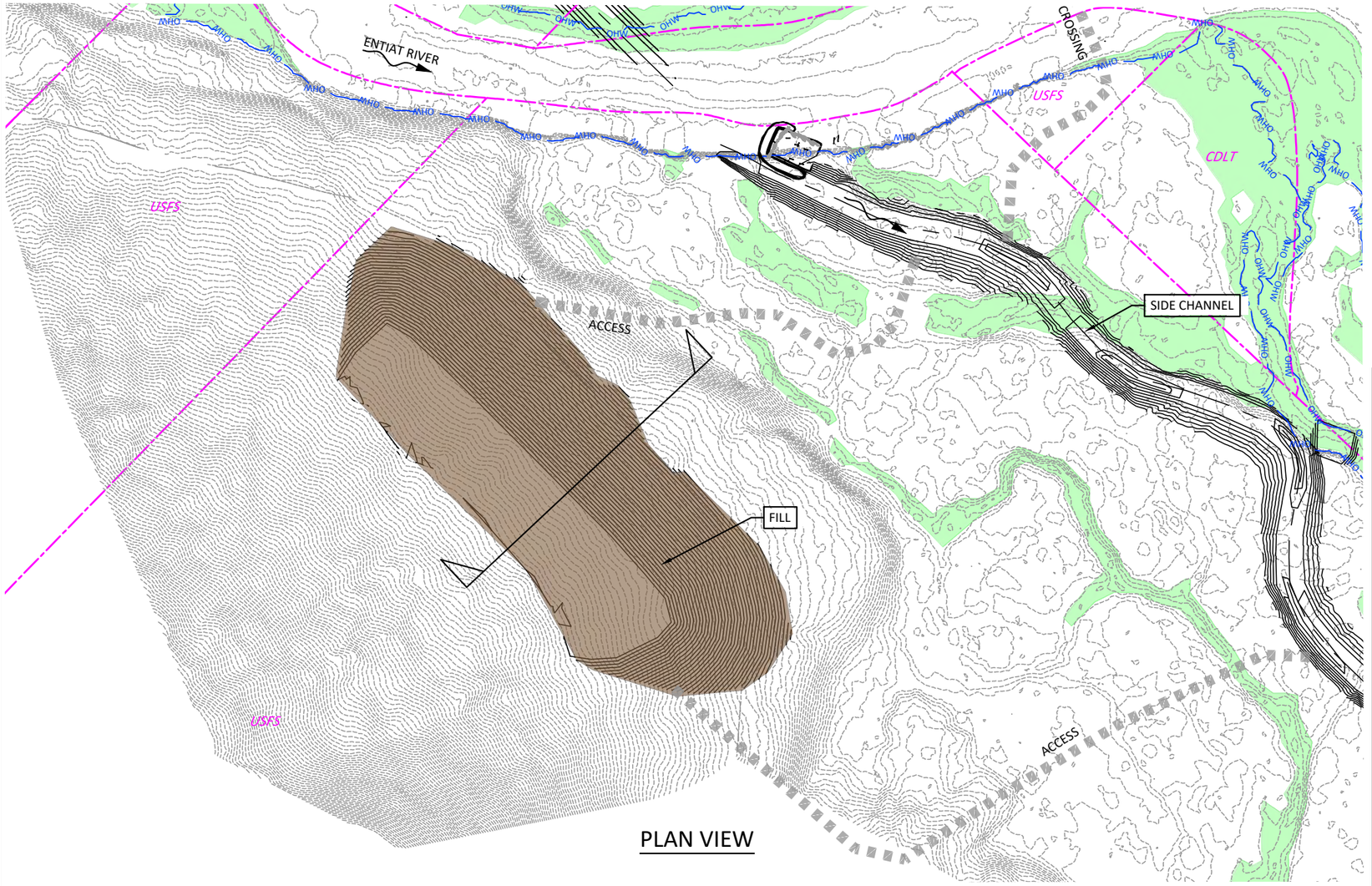
TYPICAL DETAILS
SIDE CHANNEL LOGS

SHEET
11 OF 24



PLAN VIEW

LEGEND

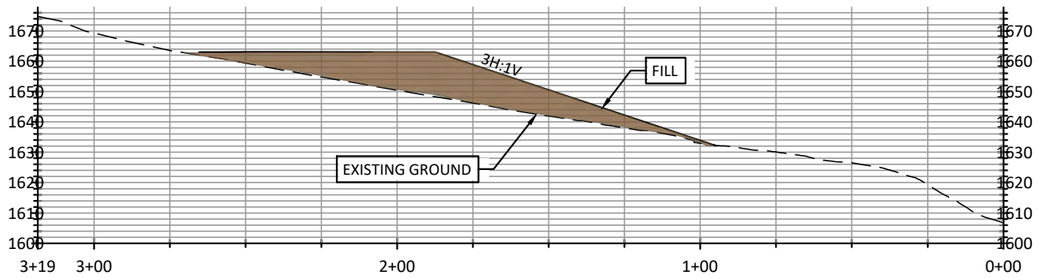
- PROPERTY LINE
- EXISTING GROUND CONTOUR (1 FT)
- PROPOSED GROUND CONTOUR (1 FT)
- TEMPORARY ACCESS ROUTE
- OHW ORDINARY HIGH WATER
- EXISTING WETLAND
- FILL AREA

0 120 240

SCALE IN FEET

THIS SCHEME SHOWS A BALANCE OF PROJECT EARTHWORK ASSUMING:
WEST SIDE-CHANNEL CUT = 17,000 CY
EAST SIDE-CHANNEL = 6,000 CY
FILL = 23,000 CY

OTHER CONFIGURATIONS ARE POSSIBLE.
EARTHWORK VOLUMES DEPENDENT ON WETLAND MITIGATION REQUIREMENTS, TBD.



SECTION VIEW

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FILL AREA
GRADING PLAN

SHEET
12 OF 24

JURISDICTIONAL AREA IMPACTS

SITE NUMBER	ACTIVITY	IMPACT LOCATION	DURATION OF IMPACT	VOLUME OF MATERIAL PLACED OR REMOVAL	AREA OF IMPACT
SIDE CHANNEL	EXCAVATION	WETLAND	PERMANENT	200 CY REMOVAL	0.06 ACRES
HIGH FLOW CHANNEL	EXCAVATION	WETLAND	PERMANENT	6 CY REMOVAL	0.01 ACRES
SIDE CHANNEL (INLET)	COFFERDAM	WATERS	TEMPORARY	N/A	150 FT, 200 SY
SIDE CHANNEL (OUTLET)	COFFERDAM	WATERS	TEMPORARY	N/A	100 FT, 125 SY

ENTIAT RIVER RD 19

MAIN STAGING & STOCKPILE AREA

DILL CREEK

USFS

HELLER EDWIN

SAMSON IVAN & CHARMAIN HECHANOVA

DILL CREEK SMALL LOG STRUCTURES 2/17

RIVERBANK LOG STRUCTURE 4/17

HIGH FLOW CHANNEL & WETLAND CREATION
- OVEREXCAVATE 1' BELOW FINAL GRADE AND BACKFILL WITH 12" SALVAGED TOP SOIL. APPLY SEED AND STRAW MULCH ONCE COMPLETED.

BULK BAG COFFER DAM, TYP. 2/22

FLOW

SIDE CHANNEL

TEMPORARY COFFERDAM 2/22

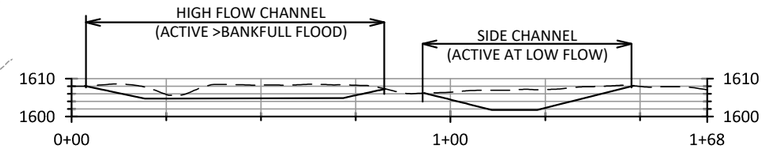
EAST SIDE-CHANNEL INLET LOG STRUCTURE 1/16

TEMPORARY COFFERDAM 2/22

WEST SIDE-CHANNEL INLET LOG STRUCTURE 1/10

ENTIAT RIVER

LOG NOTES
1. LOG LOCATIONS, SIZE, AND ALIGNMENTS DEPICTED HERE ARE TYPICAL. SOME ADJUSTMENTS IN THE FIELD MAY OCCUR BASED ON ACTUAL MATERIALS.
2. REMOVED SHRUBS AND SMALL WOODY DEBRIS GENERATED FROM SITE CLEARING SHALL BE INCORPORATED INTO LOG STRUCTURES AS SLASH. INSTALL SLASH LOOSELY BETWEEN LOGS. SEE DETAILS (SHEET 11).



TYPICAL CROSS SECTION

LEGEND

- PROPERTY LINE
- EXISTING GROUND CONTOUR (1 FT)
- PROPOSED GROUND CONTOUR (1 FT)
- ORDINARY HIGH WATER
- TEMPORARY COFFERDAM
- EXISTING WETLAND
- WETLAND IMPACT (TOTAL = 0.43 AC)
- POTENTIAL WETLAND ENHANCEMENT
- STAGING AREA
- ACCESS ROUTE
- PROPOSED LOG STRUCTURE (VARIES)

0 60 120
SCALE IN FEET

NO.	BY	DATE	REVISION DESCRIPTION

MM, GS	MM	DM
DRAWN	DESIGNED	CHECKED
GJ	12/31/18	----
APPROVED	DATE	PROJECT

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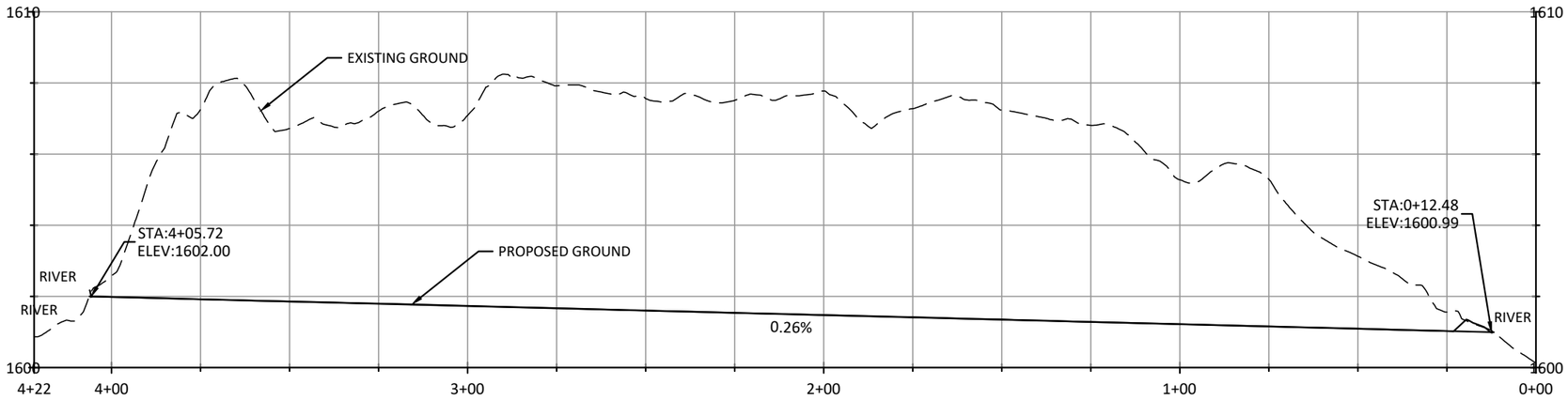
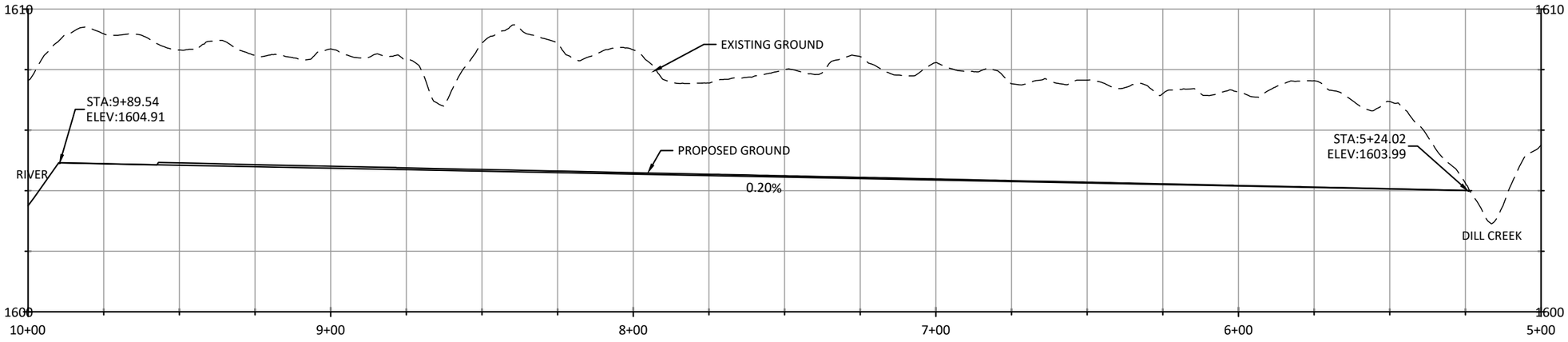
EAST SIDE-CHANNEL
PLAN VIEW

SHEET
13 OF 24



PROFILE VIEW - EAST SIDE CHANNEL



PROFILE VIEW - HIGH FLOW CHANNEL

NO.	BY	DATE	REVISION DESCRIPTION

DRAWN	DESIGNED	CHECKED
MM, GS	MM	DM
APPROVED	DATE	PROJECT
GJ	12/31/18	----

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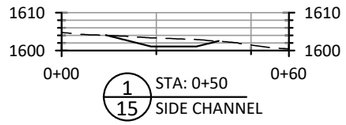
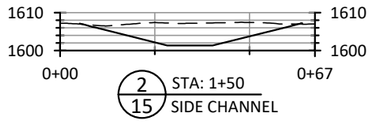
EAST SIDE-CHANNEL
PROFILE VIEWS

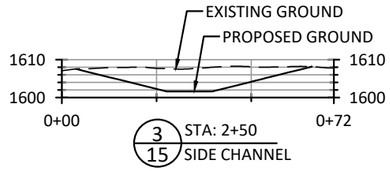
SHEET
14 OF 24



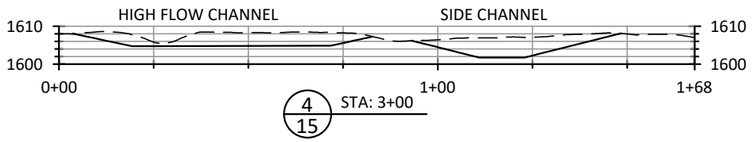
1
15
STA: 0+50
SIDE CHANNEL



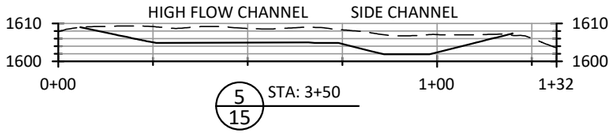
2
15
STA: 1+50
SIDE CHANNEL



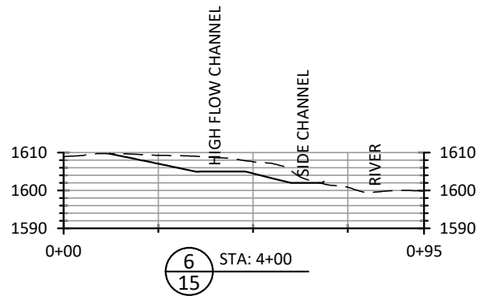
3
15
STA: 2+50
SIDE CHANNEL



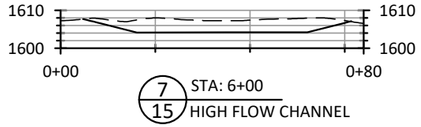
4
15
STA: 3+00



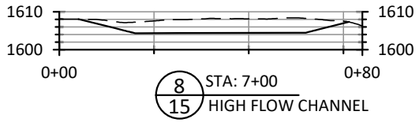
5
15
STA: 3+50



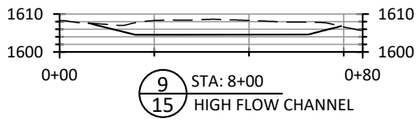
6
15
STA: 4+00



7
15
STA: 6+00
HIGH FLOW CHANNEL



8
15
STA: 7+00
HIGH FLOW CHANNEL



9
15
STA: 8+00
HIGH FLOW CHANNEL

SECTION VIEWS ARE
LOOKING DOWNSTREAM

NO.	BY	DATE	REVISION DESCRIPTION

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GJ	12/31/18	----
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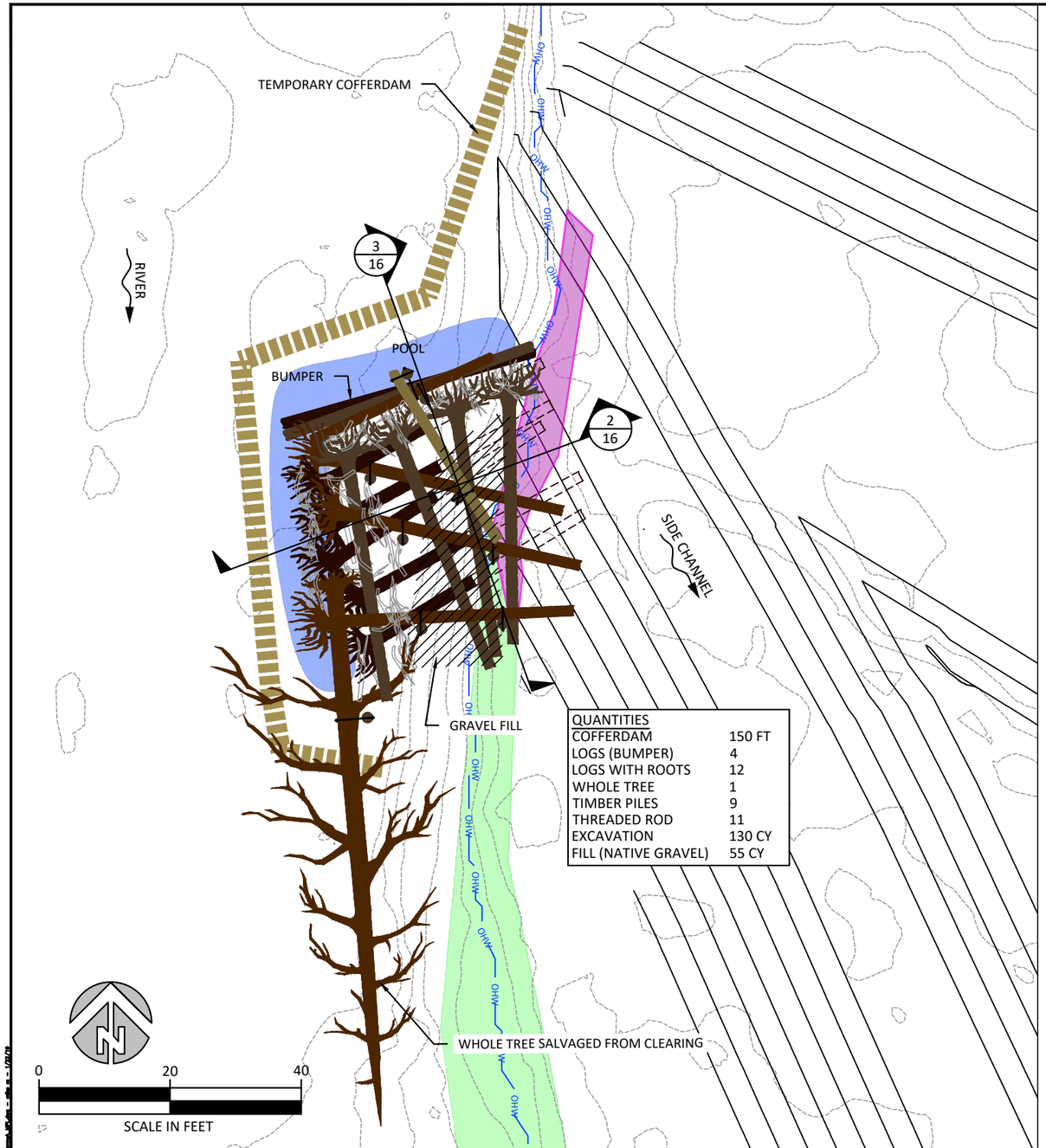
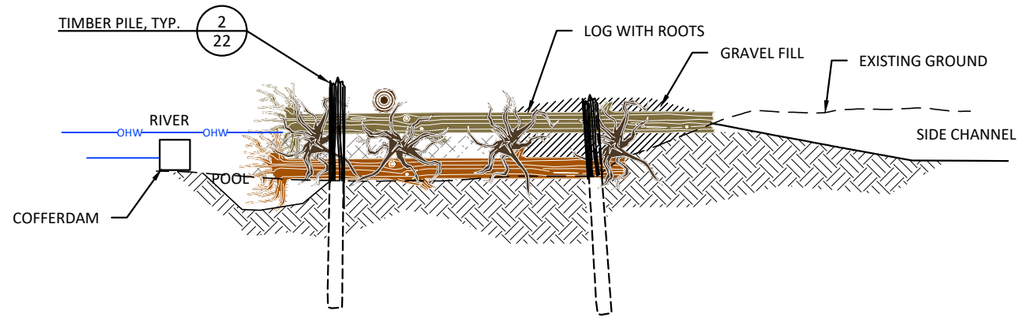
EAST SIDE-CHANNEL
CROSS SECTIONS

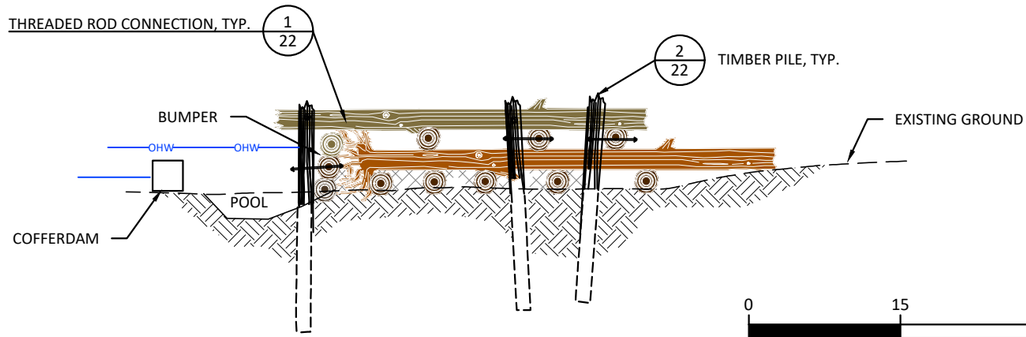
SHEET
15 OF 24



1/16 PLAN VIEW
EAST SIDE-CHANNEL INLET LOG STRUCTURE



2/16 SECTION VIEW



3/16 SECTION VIEW

JURISDICTIONAL AREA IMPACTS					
SITE NUMBER	ACTIVITY	IMPACT LOCATION	DURATION OF IMPACT	VOLUME OF MATERIAL PLACED OR REMOVAL	AREA (SY) OF IMPACT
1	COFFERDAM	WATER	TEMPORARY	N/A	200 SY, 150 FT
1	EXCAVATION	WATER	PERMENANT	62 CY REMOVED	110
1	LARGE WOOD PLACEMENT	WATER	PERMENANT	31 CY PLACED	54
1	FLL	WATER	PERMENANT	50 CY PLACED	40

WETLAND IMPACT DECLARED ON SIDE CHANNEL GRADING PLAN, SHEET 13

NO.	BY	DATE	REVISION DESCRIPTION

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DRAWN	DESIGNED	CHECKED
GJ	12/31/18	----
APPROVED	DATE	PROJECT

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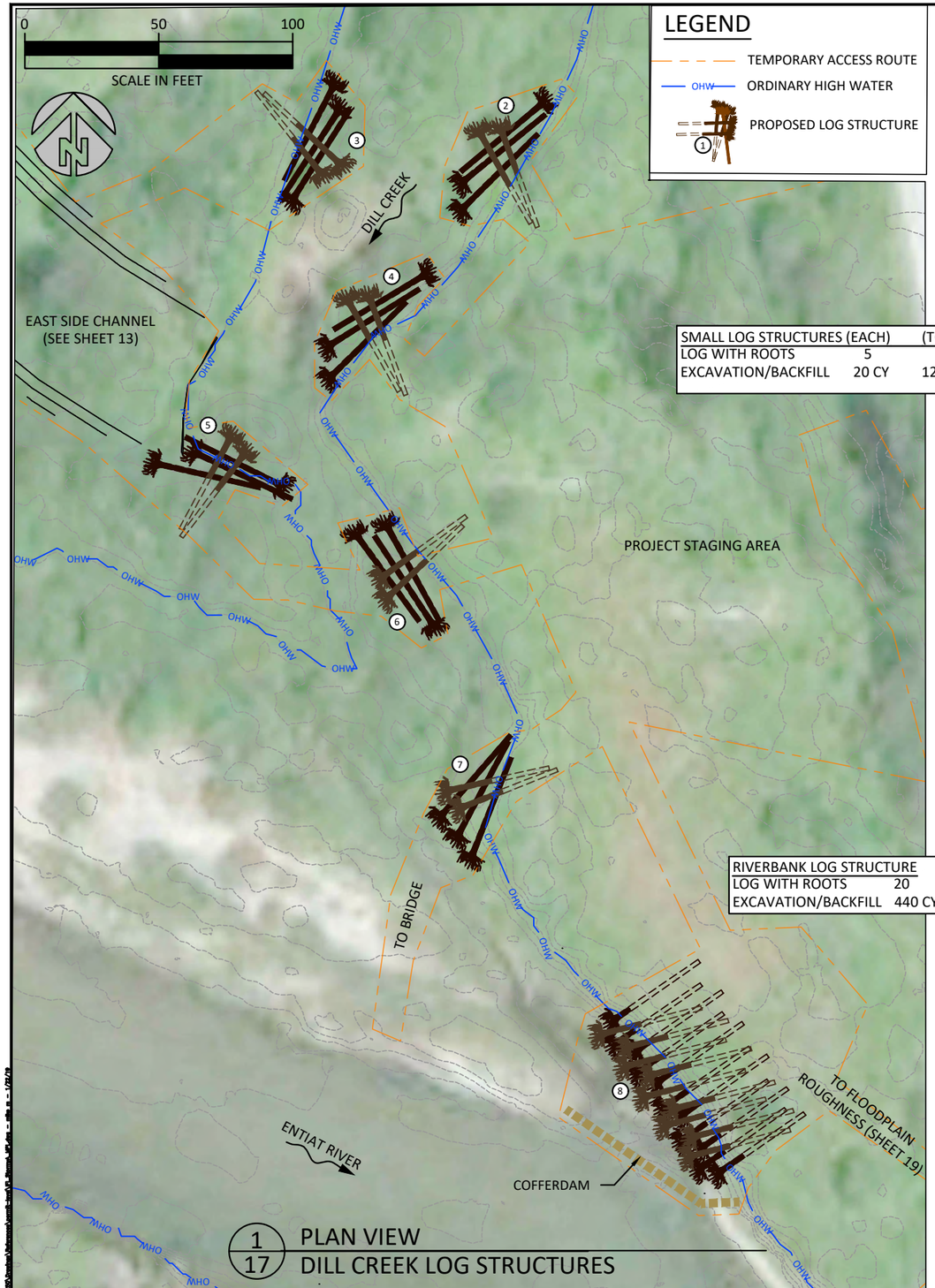
EAST SIDE-CHANNEL
INLET LOG STRUCTURE

SHEET
16 OF 24



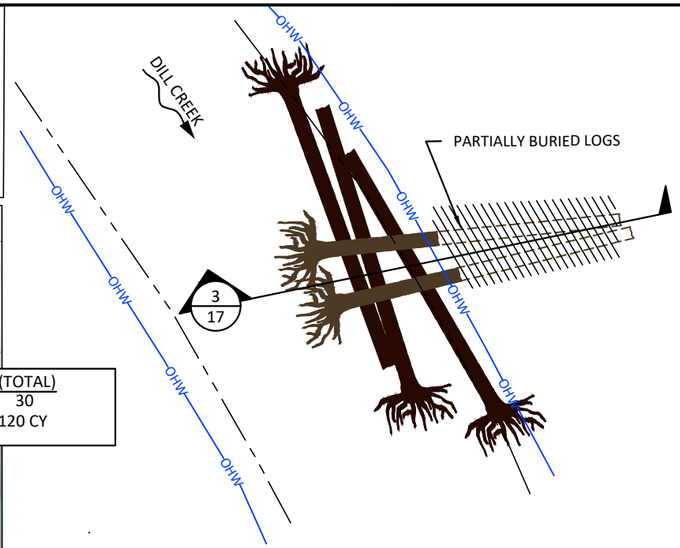
LEGEND

- TEMPORARY ACCESS ROUTE
- OHW — ORDINARY HIGH WATER
- PROPOSED LOG STRUCTURE

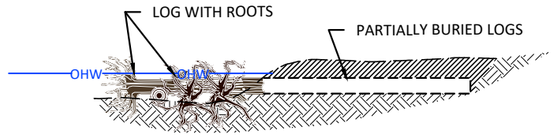
SMALL LOG STRUCTURES (EACH)		(TOTAL)
LOG WITH ROOTS	5	30
EXCAVATION/BACKFILL	20 CY	120 CY

RIVERBANK LOG STRUCTURE	
LOG WITH ROOTS	20
EXCAVATION/BACKFILL	440 CY

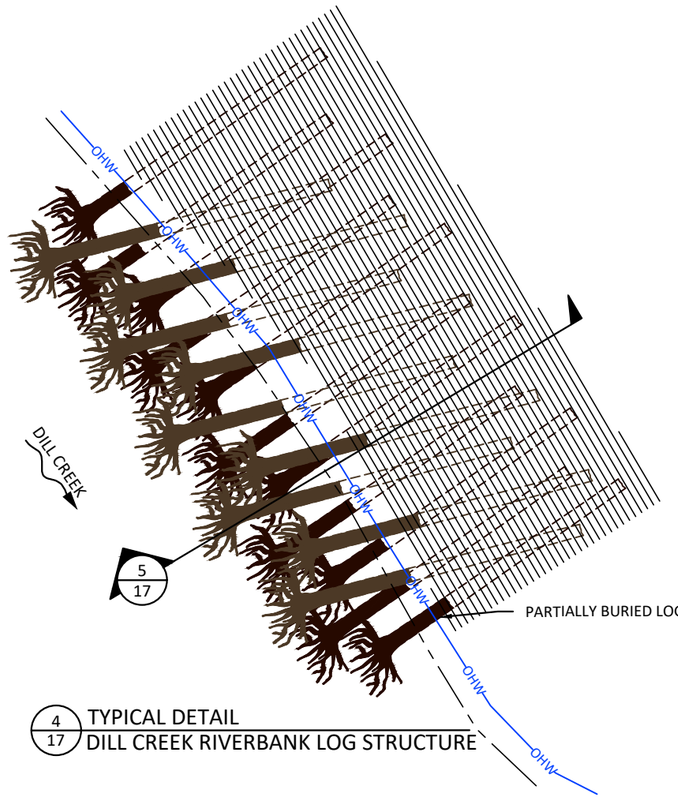
1/17 PLAN VIEW
DILL CREEK LOG STRUCTURES



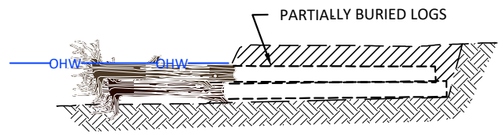
2/17 TYPICAL DETAIL
DILL CREEK SMALL LOG STRUCTURE



3/17 SECTION VIEW
DILL CREEK SMALL LOG STRUCTURE



4/17 TYPICAL DETAIL
DILL CREEK RIVERBANK LOG STRUCTURE



5/17 SECTION VIEW
DILL CREEK RIVERBANK LOG STRUCTURE

JURISDICTIONAL AREA IMPACTS

SITE NUMBER	ACTIVITY	IMPACT LOCATION	DURATION OF IMPACT	VOLUME OF MATERIAL PLACED (CY)	LENGTH OR AREA OF IMPACT
2	WOOD	WATERS	PERMENANT	8	240 SY
3	WOOD	WATERS	PERMENANT	8	240 SY
4	WOOD	WATERS	PERMENANT	8	240 SY
5	WOOD	WATERS	PERMENANT	8	240 SY
6	WOOD	WETLANDS	PERMENANT	8	240 SY
7	WOOD	WATERS	PERMENANT	8	240 SY
8	COFFERDAM	WATERS	TEMPORARY	N/A	75 FT
8	WOOD	WATERS	PERMENANT	7	33 SY

WETLAND AREAS ARE BELOW ORDINARY HIGH WATER

0 20 40
SCALE IN FEET

NO.	BY	DATE	REVISION DESCRIPTION

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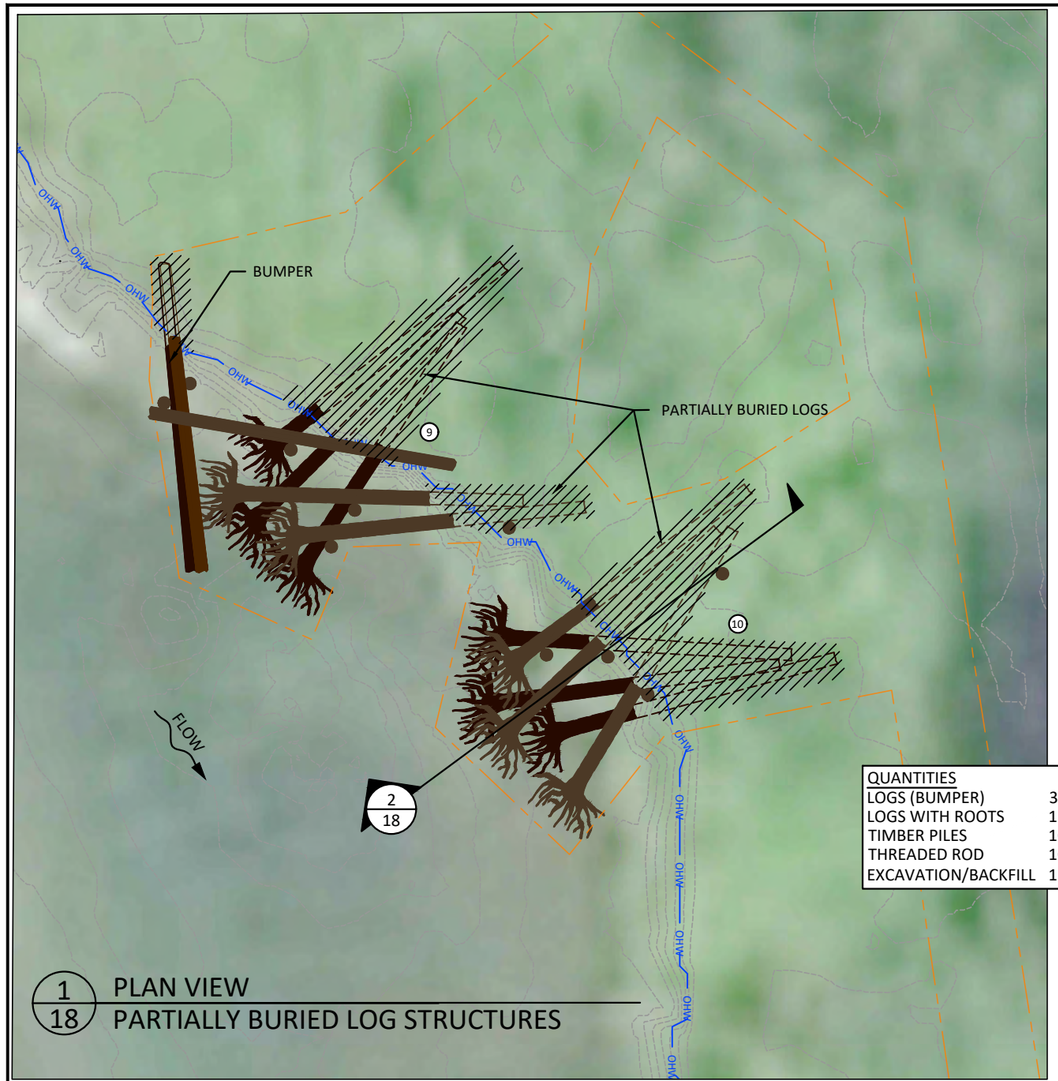
DILL CREEK LOG STRUCTURES

SHEET 17 OF 24



1 / 18 PLAN VIEW
PARTIALLY BURIED LOG STRUCTURES

QUANTITIES

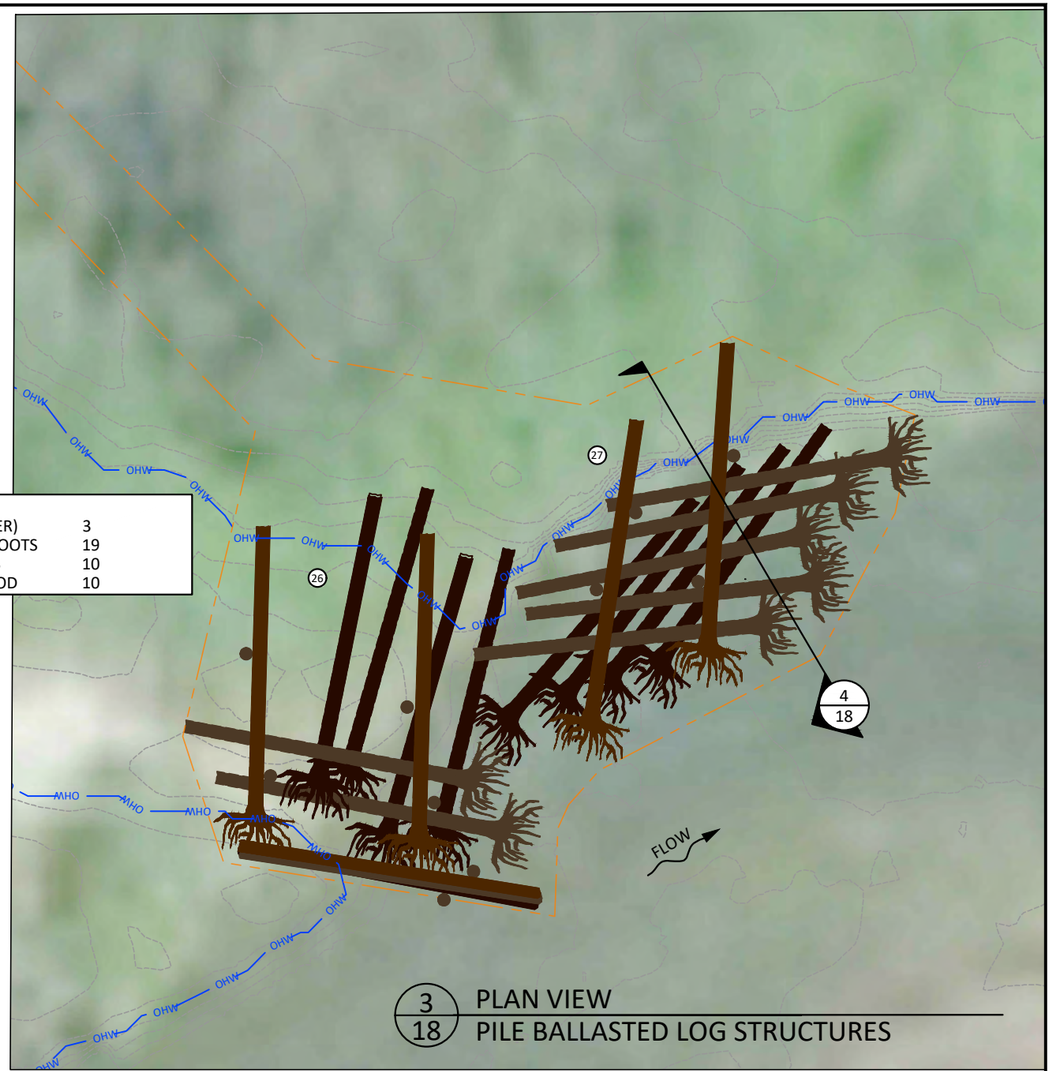
LOGS (BUMPER)	3
LOGS WITH ROOTS	12
TIMBER PILES	10
THREADED ROD	10
EXCAVATION/BACKFILL	110 CY

LEGEND

- TEMPORARY ACCESS ROUTE
- OHW — ORDINARY HIGH WATER
- PROPOSED LOG STRUCTURE (1)

0 20 40

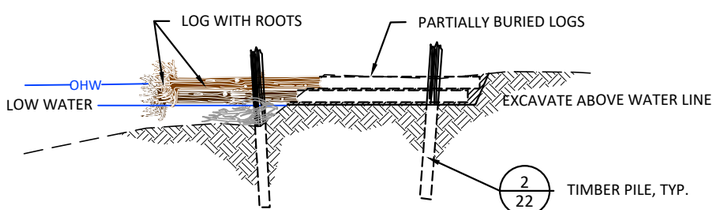
SCALE IN FEET



QUANTITIES

LOGS (BUMPER)	3
LOGS WITH ROOTS	19
TIMBER PILES	10
THREADED ROD	10

3 / 18 PLAN VIEW
PILE BALLASTED LOG STRUCTURES



2 / 18 SECTION VIEW
PARTIALLY BURIED LOG STRUCTURE

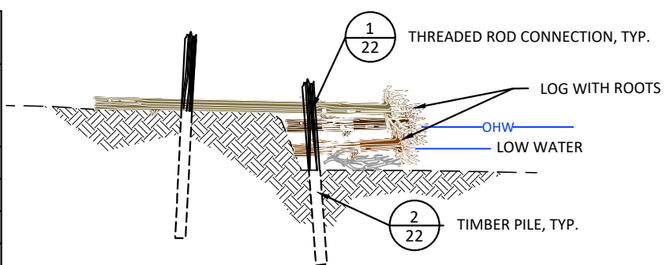
0 20 40

SCALE IN FEET

JURISDICTIONAL AREA IMPACTS

SITE NUMBER	ACTIVITY	IMPACT LOCATION	DURATION OF IMPACT	VOLUME OF MATERIAL PLACED (CY)	AREA OF IMPACT (SY)
9	WOOD	WATERS	PERMENANT	10	17
10	WOOD	WATERS	PERMENANT	7	7
26	WOOD	WATERS	PERMENANT	22	15
27	WOOD	WATERS	PERMENANT	23	8

WETLAND AREAS ARE BELOW ORDINARY HIGH WATER



4 / 18 SECTION VIEW
PILE BALLASTED LOG STRUCTURE

NO.	BY	DATE	REVISION DESCRIPTION

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APPROVED	DATE	PROJECT
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RIVERBANK LOG STRUCTURES

SHEET
18 OF 24

ENTIAT RIVER RD 19

USFS

COLT

RIVERBANK LOG STRUCTURES (SHEET 18)

FLOW

LOGS INSTALLED ON FLOODPLAIN, STABILIZED BY TIMBER PILES

ENTIAT RIVER

CDLT

LEGEND

- PROPERTY LINE
- EXISTING GROUND CONTOUR (1 FT)
- PROPOSED GROUND CONTOUR (1 FT)
- OHW — ORDINARY HIGH WATER
- EXISTING WETLAND
- ACCESS ROUTE
- PROPOSED LOG STRUCTURE (VARIES)
- TEMPORARY COFFERDAM

0 200 400

SCALE IN FEET

LOG NOTES

1. LOG LOCATIONS, SIZE, AND ALIGNMENTS DEPICTED HERE ARE TYPICAL. SOME ADJUSTMENTS IN THE FIELD MAY OCCUR BASED ON ACTUAL MATERIALS.
2. SHURBS AND SLASH GENERATED FROM SITE ACCESS SHALL BE INCORPORATED INTO THE STRUCTURES AS SLASH. INSTALL SLASH LOOSELY BETWEEN LOGS NEAR THE WATERWARD EDGE OF THE STRUCTURE. DO NOT BURY SLASH.
3. VARY THE APPEARANCE OF TIMBER PILES BY INSTALLING THEM AT ANGLES AND WITH DIFFERENT TOP HEIGHTS. BREAK OR ROUGHEN THE TOP OF PILES FOR A NATURAL APPEARANCE. PILES SHALL BE INSTALLED BY VIBRATORY DRIVER. PILE DEPTH SHALL BE MINIMUM 14'. FINAL DEPTH TO BE DETERMINED BY PULLOUT TEST RESULTS.

JURISDICTIONAL AREA IMPACTS

SITE NUMBER	ACTIVITY	IMPACT LOCATION	DURATION OF IMPACT	VOLUME OF MATERIAL PLACED (CY)	AREA OF IMPACT (SY)
24 & 25	WOOD	WATERS	PERMENANT	10	820

WETLAND AREAS ARE BELOW ORDINARY HIGH WATER

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APPROVED	DATE	PROJECT

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FLOODPLAIN ROUGHNESS

SHEET 19 OF 24

ENTIAT RIVER RD 19

CDLT

ENTIAT RIVER

28

29

30

31

BARPEX LOG STRUCTURE 1/21

WEST SIDE-CHANNEL

PLAN VIEW

0 60 120

SCALE IN FEET

LEGEND

- PROPERTY LINE
- EXISTING GROUND CONTOUR (1 FT)
- PROPOSED GROUND CONTOUR (1 FT)
- OHW — ORDINARY HIGH WATER
- EXISTING WETLAND
- STAGING AREA
- ACCESS ROUTE
- PROPOSED LOG STRUCTURE (VARIES)

LOG NOTES

1. LOG LOCATIONS, SIZE, AND ALIGNMENTS DEPICTED HERE ARE TYPICAL. SOME ADJUSTMENTS IN THE FIELD MAY OCCUR BASED ON ACTUAL MATERIALS.
2. SHRUBS AND SLASH GENERATED FROM SITE ACCESS SHALL BE INCORPORATED INTO THE STRUCTURES AS SLASH. INSTALL SLASH LOOSELY BETWEEN LOGS NEAR THE WATERWARD EDGE OF THE STRUCTURE. DO NOT BURY SLASH.
3. VARY THE APPEARANCE OF TIMBER PILES BY INSTALLING THEM AT ANGLES AND WITH DIFFERENT TOP HEIGHTS. BREAK OR ROUGHEN THE TOP OF PILES FOR A NATURAL APPEARANCE. PILES SHALL BE INSTALLED BY VIBRATORY DRIVER. PILE DEPTH SHALL BE MINIMUM 14'. FINAL DEPTH TO BE DETERMINED BY PULLOUT TEST RESULTS.

JURISDICTIONAL AREA IMPACTS

SITE NUMBER	ACTIVITY	IMPACT LOCATION	DURATION OF IMPACT	VOLUME OF MATERIAL PLACED OR REMOVAL	AREA (SY) OF IMPACT
28	LARGE WOOD PLACEMENT	WATERS	PERMANENT	20 CY PLACED	73
29	LARGE WOOD PLACEMENT	WATERS	PERMANENT	20 CY PLACED	73
30	LARGE WOOD PLACEMENT	WATERS	PERMANENT	20 CY PLACED	73
31	LARGE WOOD PLACEMENT	WATERS	PERMANENT	20 CY PLACED	73

WETLAND AREAS ARE BELOW ORDINARY HIGH WATER

NO.	BY	DATE	REVISION DESCRIPTION

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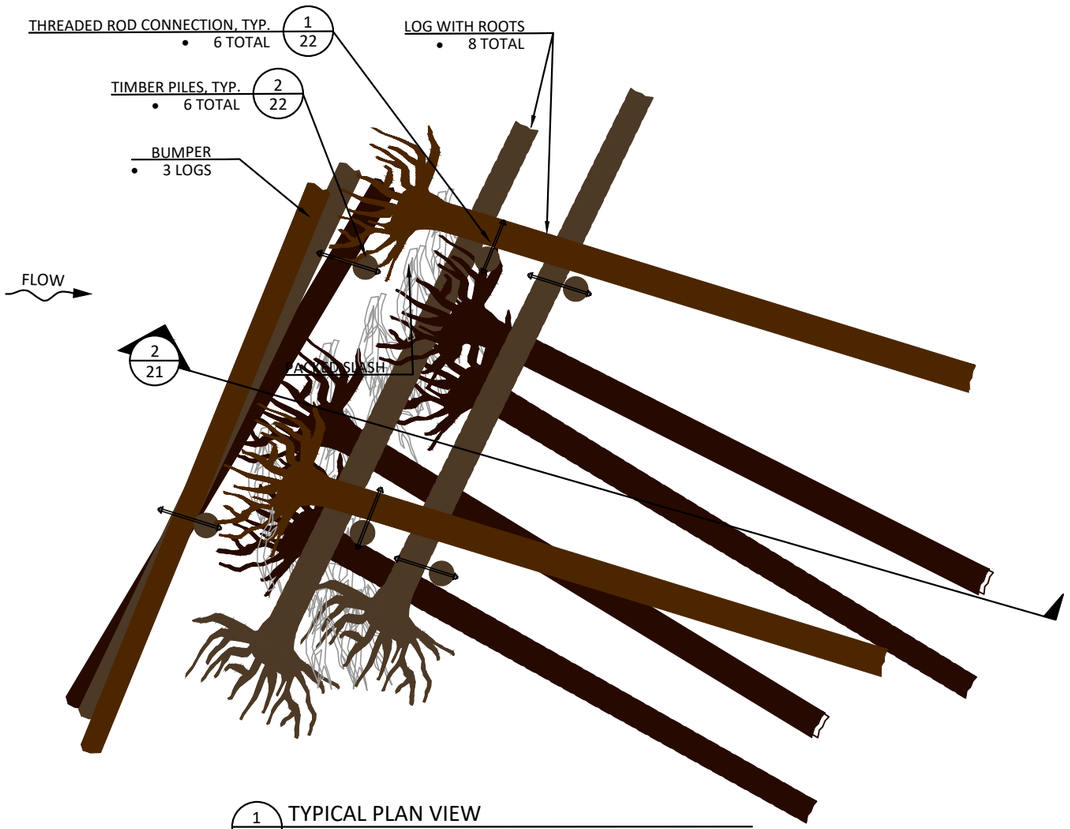
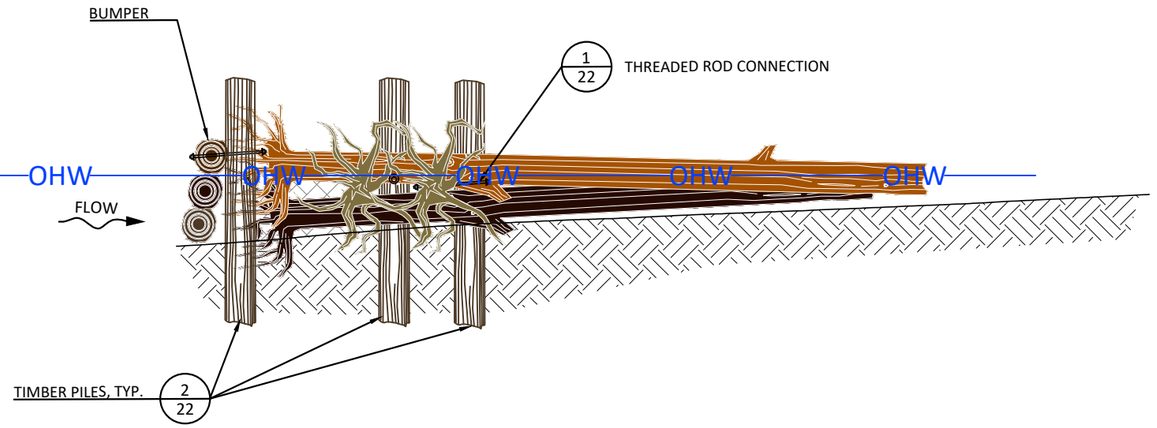
BAR APEX LOG STRUCTURES (DOWNSTREAM)

SHEET 20 OF 24



1/21 TYPICAL PLAN VIEW
BAR APEX LOG STRUCTURE



2/21 TYPICAL SECTION VIEW
BAR APEX LOG STRUCTURE

NO.	BY	DATE	REVISION DESCRIPTION

DRAWN	DESIGNED	CHECKED
MM, GS	MM	DM
APPROVED	DATE	PROJECT
GJ	12/31/18	----

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BAR APEX LOG STRUCTURE
DETAILS

SHEET
21 OF 24

NOTES:

GENERAL

1. ALL CHANNEL WORK TO BE COMPLETED PER ONSITE DIRECTION OF ENGINEER.

RIGGING

1. RIGGING FOR PILE TESTING SHALL CONFORM TO THE TENSION SCALE MANUFACTURER'S RECOMMENDATIONS.

2. CHOKERS, CABLES AND AND SHACKLES SHALL HAVE MINIMUM WORKING LOAD RATING OF 12 TONS. FITTINGS SHALL BE SIZED ACCORDINGLY.

TESTING

1. TESTING OF PILES SHALL BE PERFORMED IN THE PRESENCE OF THE ENGINEER. UP TO FOUR LOAD TESTS SHALL BE APPLIED TO EACH TESTED PILE. EACH OF THE FOUR LOAD TESTS SHALL BE APPLIED TO THE PILE WITH A DIFFERENT INSTALLED DEPTH.

2. EACH PILE TEST SHALL HAVE UPWARD LOAD GRADUALLY INCREASED AND AS CLOSELY ALIGNED TO AXIS OF PILE AS POSSIBLE. RECORD THE PILE DIAMETER, EMBEDMENT DEPTH AND MAXIMUM FORCE REQUIRED TO MOVE THE PILE VERTICALLY APPROXIMATELY 1 INCH. THEN DRIVE THE PILE TO A NEW DEPTH TO BE DETERMINED BY THE CONTRACTOR'S ENGINEER IN CONSULTATION WITH THE ENGINEER. APPLY NEW LOAD AND RECORD MAX FORCE THAT CAUSES THE PILE TO MOVE VERTICALLY 1 INCH. REPEAT FOR THIRD AND FOURTH TEST.

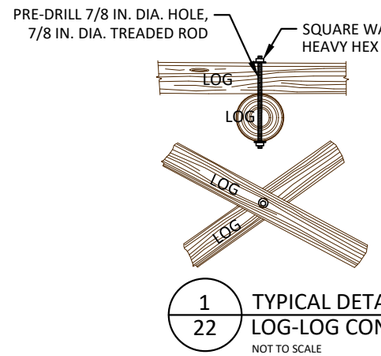
3. PROOF TESTS SHALL BE MADE AT UP TO FOUR EMBEDMENT DEPTHS FOR EACH PILE. DEPTHS SHALL BE DETERMINED IN THE FIELD. AS A GUIDELINE, TEST EMBEDMENT DEPTHS MAY INCLUDE 8 FT, 10 FT, 12 FT, AND 14 FT. TESTS AT 12 FT AND 14 FT WILL ONLY BE REQUIRED IF PILES MUST BE DRIVEN DEEPER THAN 10 FT TO ACHIEVE TARGET PULLOUT RESISTANCE. SEE NOTE BELOW.

4. EXCAVATOR CONDUCTING PULL OUT LOADING SHALL BE POSITIONED NO CLOSER THAN EMBEDMENT DEPTH OF PILE, IF POSSIBLE. IF A CLOSER POSITIONING IS REQUIRED, EXCAVATOR SHALL BE NO CLOSER THAN THAT REQUIRED TO GENERATE DESIRED LOADING WITH DISTANCE FROM PILE NOTED IN THE TEST RECORD. LIMIT COMPRESSIVE LOADING OF THE TRACKS ON THE GROUND BY DRIVING THE EXCAVATOR ONTO LOGS LAID ON THE GROUND TO DISTRIBUTE THE WEIGHT OVER A LARGER AREA.

5. PULL OUT RESISTANCE READING SHALL BE COMPARED AGAINST EXCAVATOR MAX LIFT OFFSET TABLE.

6. UP TO 10% OF PRODUCTION PILINGS SHALL BE PROOF TESTED. IF RESULTS VARY MORE THAN 50% THEN IT SHOULD BE ANTICIPATED THAT UP TO 25% OF THE PRODUCTION PILINGS SHALL BE PROOF TESTED.

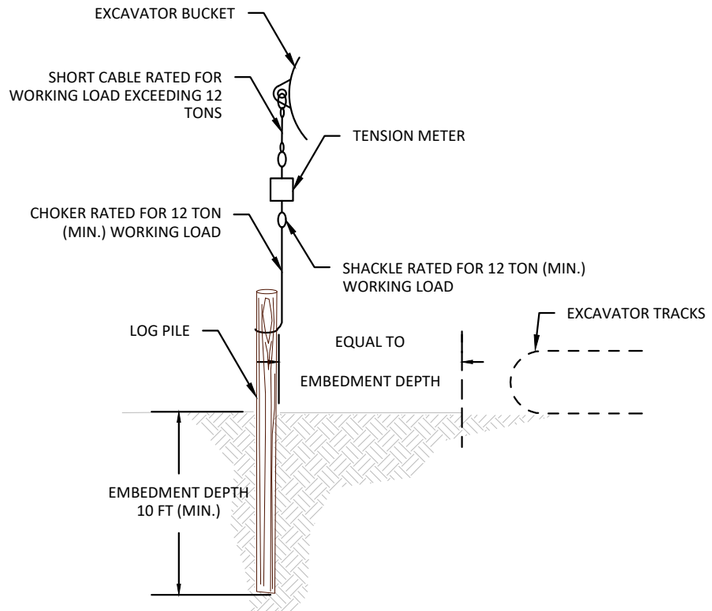
7. PILE EMBEDMENT DEPTH SPECIFIED IN THESE DRAWINGS MAY BE INCREASED, AT NO ADDITIONAL COST, PENDING COMPARISON OF PULL OUT TEST RESULTS TO AN ASSUMED RAW PULLOUT RESISTANCE OF 15,000 POUNDS. IF TESTING REVEALS FIELD PULLOUT RESISTANCE VALUES THAT ARE LESS THAN THE ASSUMED VALUES, PILES MAY BE REQUIRED TO BE DRIVEN UP TO 5 FT DEEPER THAN INDICATED. ENGINEER WILL DETERMINE WHETHER THE NUMBER OF PILES MAY BE REDUCED IF TESTING YIELDS VALUES THAT EXCEED ASSUMED VALUES, BASED ON EVALUATION OF VERTICAL PULLOUT AND LATERAL BRACING OBJECTIVES AT EACH LOCATION.



1/22 TYPICAL DETAIL
LOG-LOG CONNECTIONS
NOT TO SCALE

BOLTED CONNECTION NOTES

PIN LOGS TO LOGS
1. DRILL 7/8" DIA HOLE THROUGH LOGS.
2. INSERT 7/8" DIA THREADED ROD.
3. INSTALL STEEL PLATES AND HEAVY HEX NUTS. SECURE NUTS BY CHISELING THREADS OR MUSHROOMING EXPOSED ENDS OF ROD.
4. FILE OR GRIND OFF SHARP EDGES



2/22 TYPICAL DETAIL
LOG PULL OUT TEST
NOT TO SCALE

NO.	BY	DATE	REVISION DESCRIPTION

MM, GS	MM	DM
DRAWN	DESIGNED	CHECKED
GJ	12/31/18	----
APPROVED	DATE	PROJECT

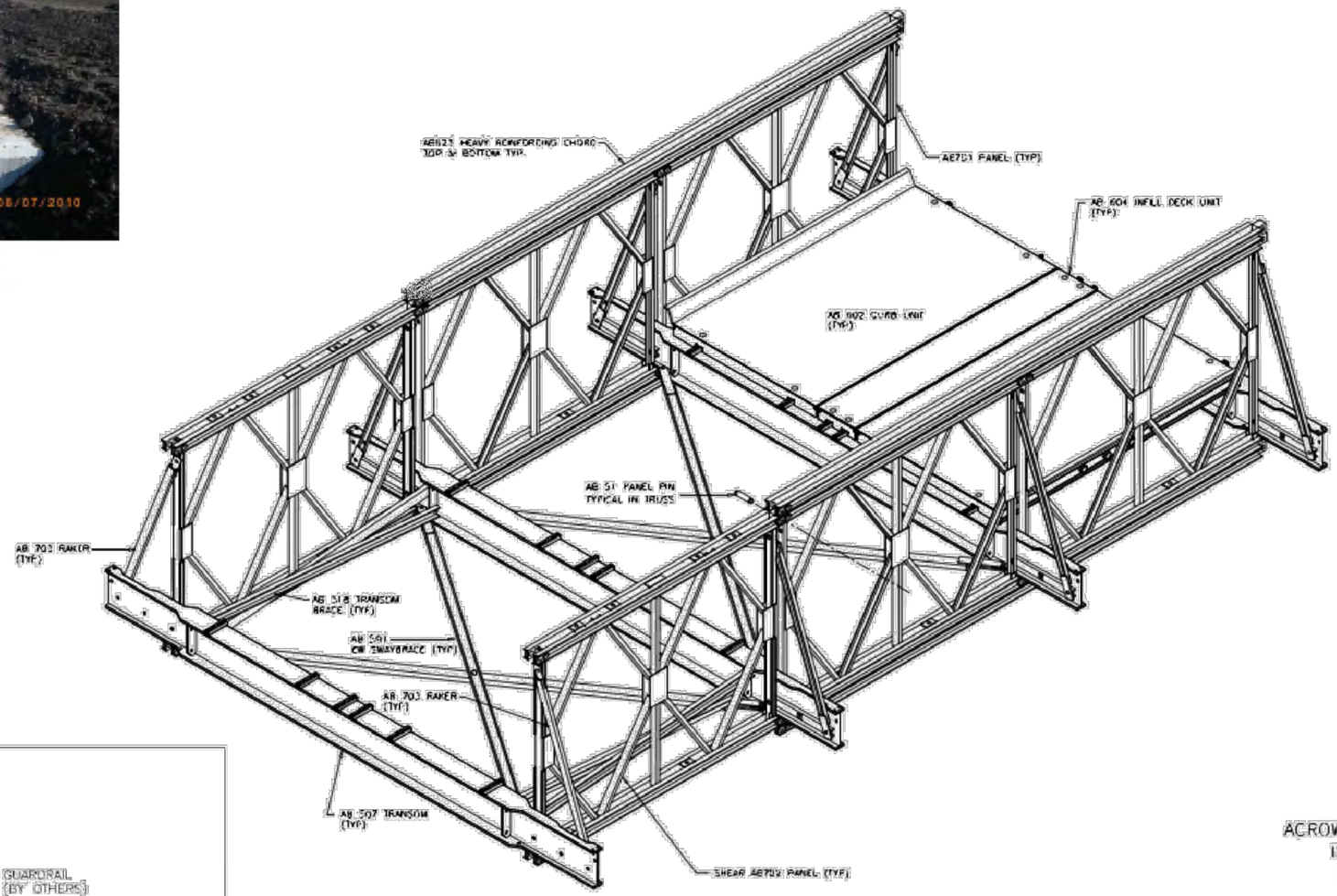
ENTIAT RIVER - STORMY A
STREAM & FLOODPLAIN ENHANCEMENTS
60% DESIGN

inter·fluve
501 Portway Avenue, Suite 101
Hood River, OR 97031
541.386.9003
www.interfluve.com

TIMBER PILE DETAILS

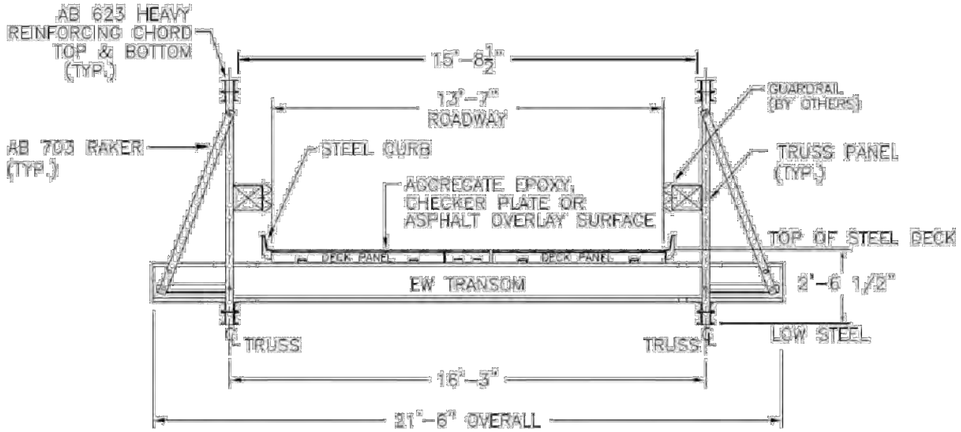
SHEET
22 OF 24

TYPICAL ABUTMENTS



ISOMETRIC VIEW OF FEMALE END OF BRIDGE

ACROW 700XS PANEL BRIDGE
ISOMETRIC VIEW OF
SSRH EW BRIDGE



EXTRA WIDE BRIDGE

ACROW BRIDGE
Building Bridges, Connecting People
Acrow Bridge, 101 New Road, Parsippany, NJ 07054

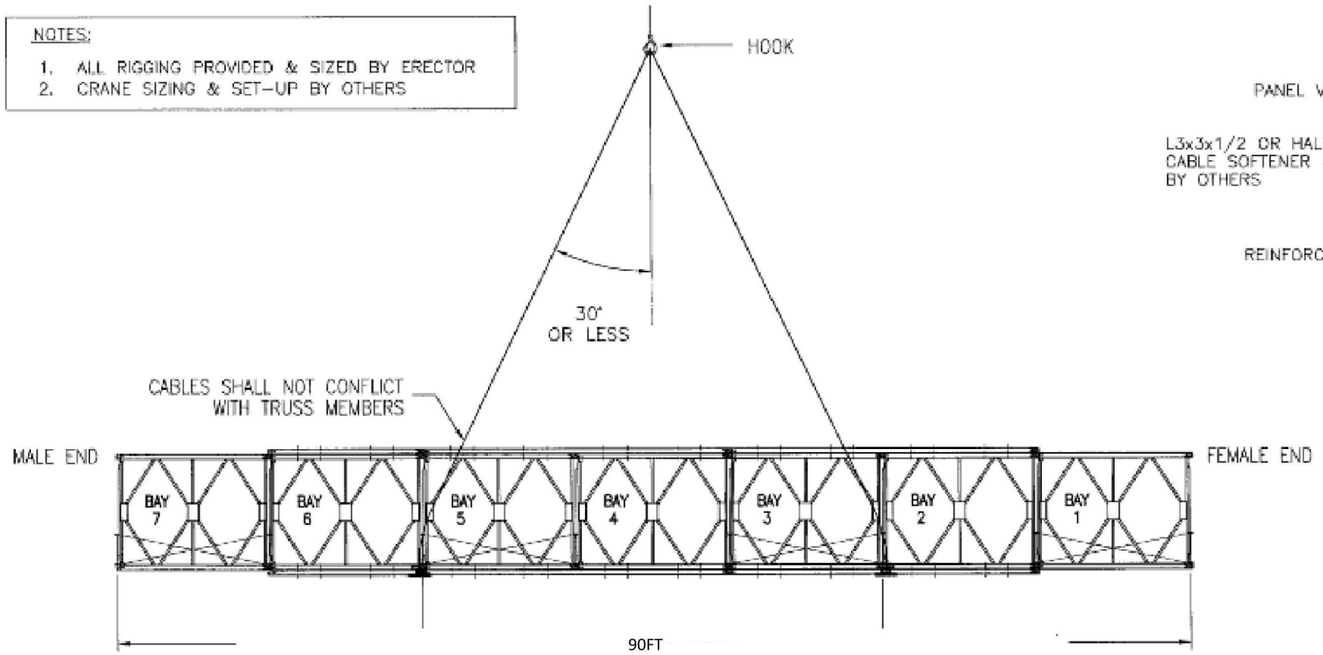
ACROW 700XS BRIDGE
EXTRA WIDE SSRH
CROSS SECTION

DRAWN BY:	RJ	DATE: MAY 22, 2013	CONTRACT NO:
CHECKED BY:	SP	SCALE: AS NOTED	
APPROVED BY:	SP		DRAWING NO: / REV:
			SHT 3 OF 3

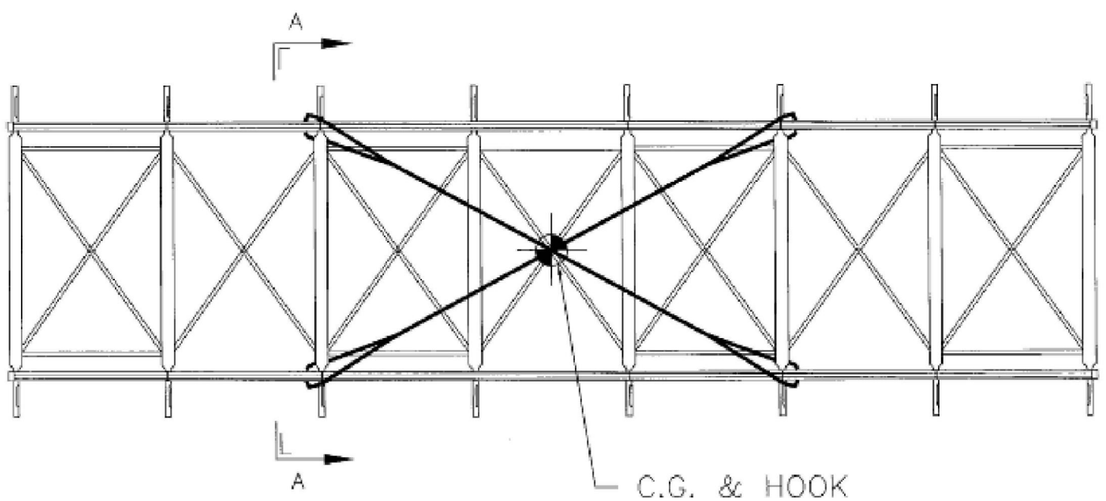
NOTES:
H-20 LOADING
MIN DECK ELEVATION = 2159FT

NOTES:

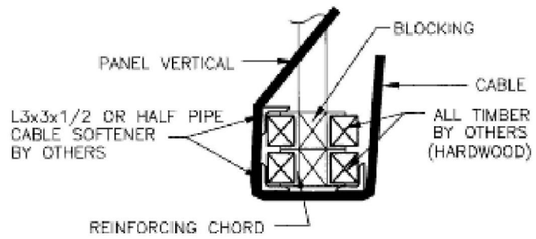
1. ALL RIGGING PROVIDED & SIZED BY ERECTOR
2. CRANE SIZING & SET-UP BY OTHERS



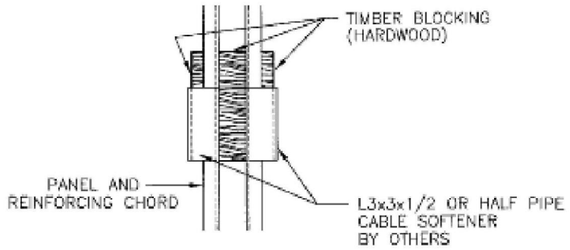
ELEVATION



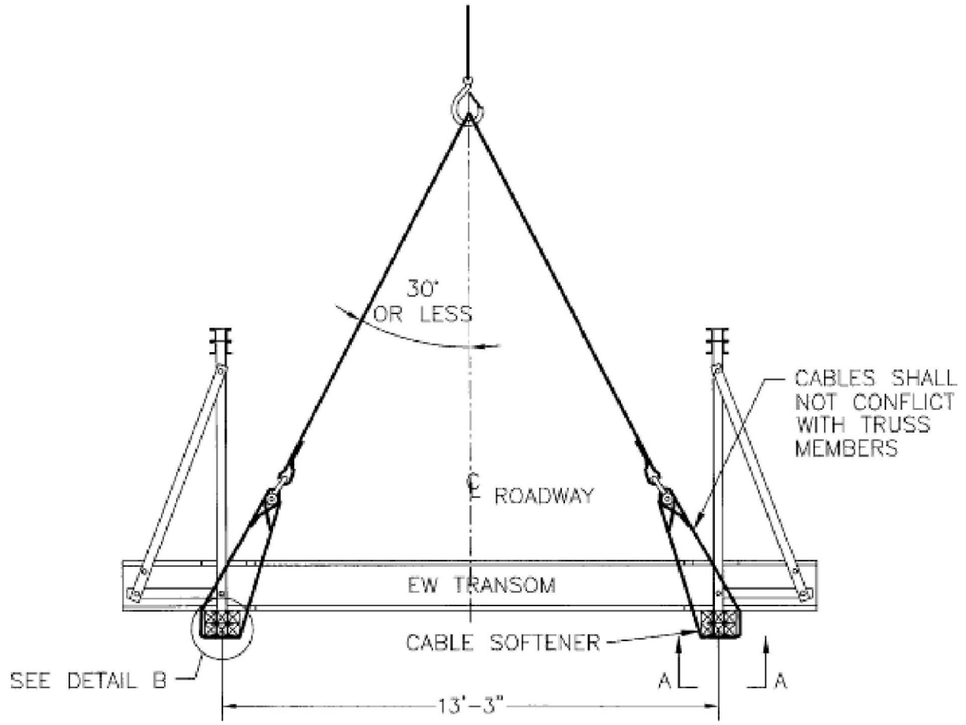
PLAN



DETAIL B



SECTION A-A



CROSS SECTION A-A

APPROXIMATE WEIGHT WITHOUT DECK = 25 KIPS (12.5 TONS)

APPROXIMATE WEIGHT WITH DECK = 48 KIPS (24 TONS)

REV.	DATE	DESCRIPTION	BY	APPR.

SEAL

ACROW BRIDGE

Building Bridges. Connecting People.

Acrow Corporation of America
181 New Road, Parsippany, NJ 07054

ACROW PANEL 700XS BRIDGE
LIFTING/ RIGGING PLAN
70FT x SCW SSR BRIDGE
BOND SPRING RD. BRIDGE 399 REPLACEMENT
GRANT COUNTY, DPW
WENATCHEE, WASHINGTON

DRAWN BY	RM	DATE MAY 29, 2015	CONTRACT NO.
CHECKED BY	TW	SCALE: AS SHOWN	
APPROVED BY	SP		

WEST COMPANY CONSTRUCTION
AIRWAY HEIGHTS, WA

DRAWING NO. AB1741-LP

REV.

SHT 1 OF 1

Tech Memo

To: Chris Clemons, Yakama Nation UCHRP

Authors: Michael McAllister, P.E.

Date: August, 2018

Re: Entiat River, Stormy A – Soil Pits

1. Introduction

Yakama Nation, Inter-Fluve and Wildlands completed four soil pits at the Stormy A site on July 25, 2018. These field investigations were completed to inform design for side channel stability and groundwater levels. As a relative measure of stream flow, the USGS gage at Ardenvoir reported a flow of 230 cfs along the Entiat River for the day of testing (http://waterdata.usgs.gov/nwis/uv?12452800).

Four test pits were dug by Wildlands with a rubber tracked Takeuchi TB290 excavator at the Tillicum Fan site at locations shown on the Figure in the Appendix. Pits were dug to 5 to 8 feet of depth below ground (BG). A four-inch diameter PVC piezometer was installed in each pit (Photo 1).

Photo 1. PVC pipe for piezometer

2. Soil pits

The following sections summarize the findings of the four exploratory pits. Test pit location map, soil profile figures and photos are included in the Appendix.

2.1. PIT 1

Soil Pit 1 was excavated to 8 ft BG. Water was encountered at 6.5 ft depth. As shown on the soil profile graphic in the attachments, soils from 0 to 0.5 ft BG is sod; 0.5 to 4 ft BG is sandy loam; 4 to 8 ft BG is 3 inch minus alluvium. The soil profile graphic includes photos of the pit and alluvial material.

2.2. PIT 2

Soil Pit 2 was excavated to 7 ft BG. Water was encountered at 5 ft depth. As shown on the soil profile graphic in the attachments, soils from 0 to 0.5 ft BG is sod; 0.5 to 5 ft BG is sandy loam; and 5 to 7 ft BG is 4 inch minus alluvial material. The soil profile graphic includes photos of the pit and alluvial material.

2.3. PIT 3

Soil Pit 3 was excavated to 5 ft BG. Water was encountered at 4.5 ft depth. As shown on the soil profile graphic in the attachments, soils from 0 to 0.5 ft BG is sod; 0.5 to 3.5 ft BG is sandy loam; and 3.5 to 5 ft BG is 3 inch minus alluvial material. The soil profile graphic includes photos of the pit and alluvial material.

2.4. PIT 4

Soil Pit 4 was excavated to 6 ft BG. Water was encountered at 4 ft BG. As shown on the soil profile graphic in the attachments, soils from 0 to 0.5 ft BG is sod; 0.5 to 4 ft BG is sandy loam; and 4 to 6 ft BG is 6 inch minus alluvial material. The soil profile graphic includes photos of the pit and alluvial material.

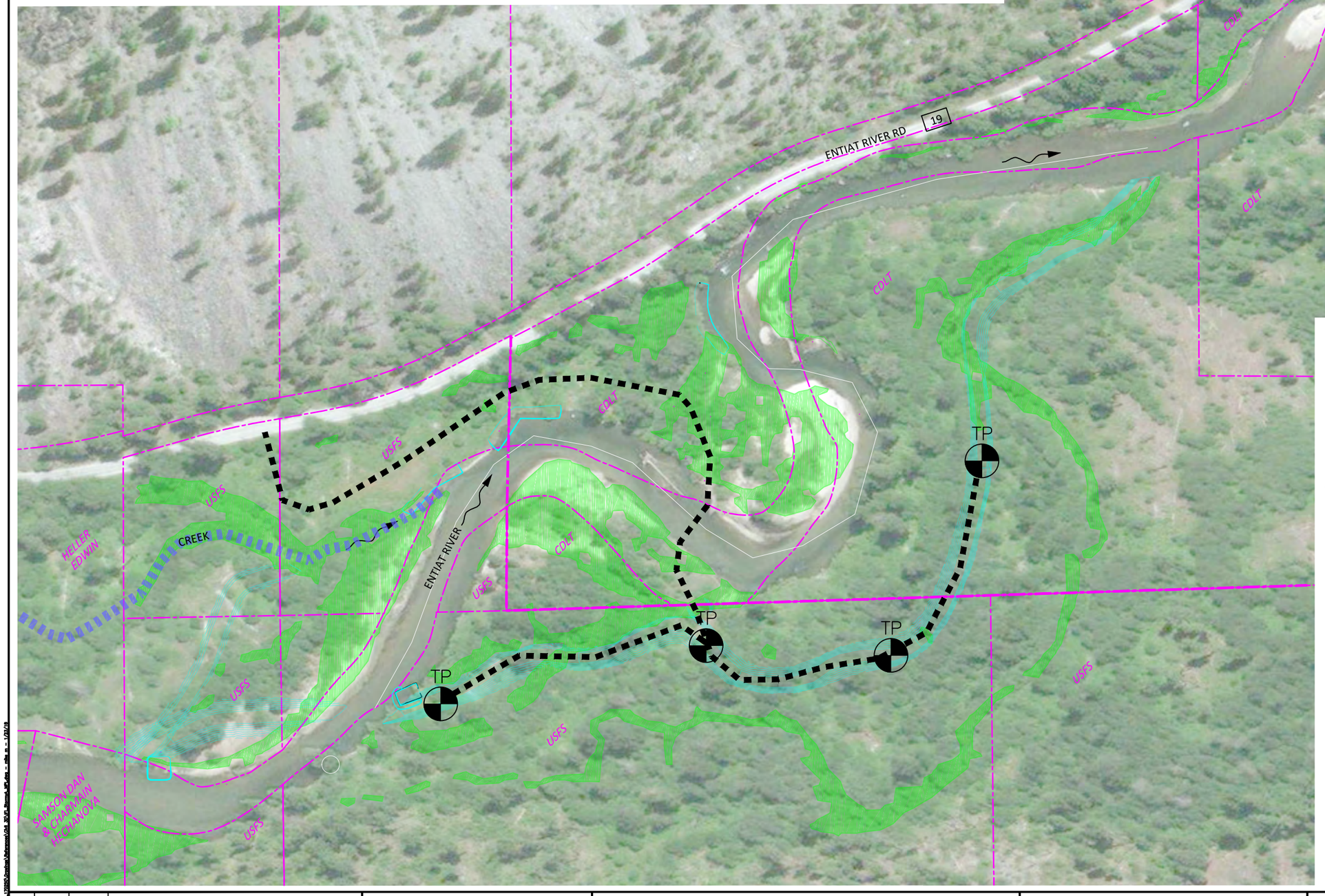
All soil pits appear to indicate that side channel excavations will encounter gravel/cobble at depths that are at or above the proposed side channel bed. Piezometers will be surveyed during spring 2019 to more accurately compare monitored groundwater levels to the design elevations.

Appendix

- Test pit site location map
- Soils profiles and photos

ENTIAT RIVER - STORMY A

TEST PIT LOCATIONS



LEGEND

- PROPERTY LINE
- EXISTING WETLAND
- PROPOSED GROUND CONTOUR (1 FT)
- TP — TEST PIT LOCATION AND APPROXIMATE ACCESS ROUTE

0 200 400

SCALE IN FEET

NO.	BY	DATE	REVISION DESCRIPTION

DRAWN	DESIGNED	CHECKED
MM	MM	DM
APPROVED	DATE	PROJECT
GJ	01/15/18	

ENTIAT RIVER
STORMY A
STREAM & FLOODPLAIN ENHANCEMENTS

inter·fluve
501 Portway Avenue, Suite 101
Hood River, OR 97031
541.386.9003
www.interfluve.com

TEST PITS

SHEET 2 OF 2

STORMY A - PIT 1

DEPTH, FT	SYMBOL	DESCRIPTION	DEPTH, FT	NOTES
0'				
		SOD	0.5'	
		SILTY SAND	4'	
5'		4" MINUS ALLUVIUM (SANDY)		WATER AT 6.5' DEPTH
10'				

PIT

EXCAVATED MATERIAL

STORMY A - PIT 2

DEPTH, FT	SYMBOL	DESCRIPTION	DEPTH, FT	NOTES
0'		SOD	0.5'	
		SILTY SAND	5'	WATER AT 5' DEPTH
5'		4" MINUS ALLUVIUM		
10'				

PIT

STORMY A - PIT 3

DEPTH, FT	SYMBOL	DESCRIPTION	DEPTH, FT	NOTES
0'		SOD	0.5'	
		SILTY SAND	3.5'	
5'		4" MINUS ALLUVIUM (SANDY)		WATER AT 4.5' DEPTH
10'				

PIT

EXCAVATED MATERIAL

STORMY A - PIT 4

DEPTH, FT	SYMBOL	DESCRIPTION	DEPTH, FT	NOTES
0'		SOD	0.5'	
		SILTY SAND	4'	WATER AT 4' DEPTH
5'		6" MINUS ALLUVIUM		
10'				

PIT

EXCAVATED MATERIAL