Walla Walla River RM 32.5 Floodplain Reconnection 30 Percent Basis of Design

Walla Walla County, Washington

for

Confederated Tribes of the Umatilla Indian Reservation

December 3, 2024

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GeoEngineers

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File No. 02698-037-00
December 3, 2024

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1.0 Project Background/Introduction

GeoEngineers, Inc. (GeoEngineers) has prepared this Basis of Design Report (report) for the Confederated Tribes of the Umatilla Indian Reservation (CTUIR) to describe and illustrate the Walla Walla River RM 32.5 Floodplain Reconnection Design Project (project). This is also intended for the CTUIR to submit to the Bonneville Power Administration (BPA) Restoration Review Team (RRT) for their review and to the Washington State Recreation and Conservation Office (RCO) Salmon Recovery Funding Board (SRFB) Review Panel. This report provides a summary of our findings pertaining to the existing conditions within the project reach and processes that shaped the stream. The evaluation and consideration of the site conditions provide the basis for the project design and an explanation of the design process, analyses and anticipated outcomes for the proposed enhancements. The preliminary (30 percent) design is included as Appendix A and described below. Additional background, technical data and contract documentation are provided below and in the attached appendices.

The project is located on the Walla Walla River in the vicinity of River Mile 32.5 and includes approximately 2,300 feet of the mainstem and its adjacent floodplains. The project area includes land owned by CTUIR along the right (north) bank and four privately owned parcels along the left (south) bank. The willing landowners have signed an agreement to complete this work and are in support of the project. CTUIR is sponsoring the project, which has an overall focus on improving instream habitat for Endangered Species Act (ESA) and non-ESA-listed native fish species.

1.1 NAME AND TITLES OF SPONSOR, FIRMS, AND INDIVIDUALS RESPONSIBLE FOR DESIGN

- **Project Sponsor:** Confederated Tribes of the Umatilla Indian Reservation (CTUIR)
- **Project Manager:** Ethan Green
- **Design Firm:** GeoEngineers, Inc. (GeoEngineers)
- **Engineer of Record:** Rebecca Miller, PE

1.2 PROJECT ELEMENTS THAT HAVE BEEN DESIGNED BY A LICENSED PROFESSIONAL ENGINEER

- Main channel and side channel grading
- Large woody material (LWM)

1.3 EXPLANATION AND BACKGROUND ON FISHERIES USE (BY LIFE STAGE - PERIOD) AND LIMITING FACTORS ADDRESSED BY PROJECT

Species of interest include juvenile and adult Mid-Columbia steelhead (*Oncorhynchus mykiss*), Spring Chinook Salmon (*Oncorhynchus tshawytscha*) and Bull Trout (*Salvelinus confluentus*). CTUIR's River Vision (Jones, et al. 2008) is the restoration framework, upon which the 30 percent design, and all subsequent designs, are based. Design objectives will be consistent with all five of the CTUIR's River Vision Touchstones:

- **Water Quality and Quantity.** Increase base flow through functional connection with the alluvial aquifer and decrease summer stream temperatures.
- **Geomorphology.** Restore natural form; sinuosity; complexity; geomorphic stability; enhance large wood and boulders to increase channel complexity; and improve sediment routing/dispersal.
- **Connectivity.** Increase lateral connection with the historic floodplain and vertical connection with the alluvial aquifer.
- **Riparian Vegetation.** Protect existing riparian vegetation and enhance vegetation to improve geomorphic function and water quality.
- **Aquatic Biota.** Increase the quality, quantity and diversity of habitat for resident and anadromous fish of all age classes.

1.4 PRIMARY PROJECT FEATURES INCLUDING CONSTRUCTED OR NATURAL ELEMENTS

The 30 percent preliminary design (Appendix A) contains restoration actions designed to achieve the objectives outlined in Table 1. The proposed restoration actions include:

1.4.1 Category of Action (2): River, Stream, Floodplain and Wetland Restoration

1.4.1.1 HIP IV CATEGORY 2A – IMPROVE SECONDARY CHANNEL AND FLOODPLAIN INTERACTIONS

This action includes selective grading to reconnect side channels, provide off channel habitat and increase geomorphic complexity. An upstream inlet connection for the right bank side channel will be restored and existing side channels along the left bank will be selectively graded to promote activation at bankfull flows. Redundant side channel connections will be made to promote a natural evolution of side channel location and function over time.

1.4.1.2 HIP IV CATEGORY 2B – SET-BACK OR REMOVAL OF EXISTING BERMS, DIKES AND LEVEES

This action includes partial removal of levees and bank armoring along the right bank within property owned by CTUIR and removal of bank armoring across several private parcels located on the left bank. These actions will restore floodplain connectivity and enhance water quality through improved riparian and hyporheic function. The areas of levee removal will be restored with native riparian plant species.

In addition, the proposed design expands riparian function and overbank connection through floodplain grading along the left bank floodplain. A portion of the land currently in agricultural production will be converted to floodplain and, to the extent practical, designed to be activated between the 1.01 at the 1.5-year recurrence interval events. The floodplain will include a network of high flow side channels to provide additional off-channel habitat complexity and provide storage and conveyance back to the main channel as high flows recede.

1.4.1.3 HIP IV CATEGORY 2D – INSTALL HABITAT-FORMING NATURAL MATERIAL INSTREAM STRUCTURES

This action includes the placement of LWM to add in-stream structure, habitat complexity, and encourage floodplain connection in tandem with the floodplain grading. LWM will be strategically placed throughout the floodplain and side channels to improve off-channel aquatic habitat. Placement of LWM within the main channel will promote inundation of the enhanced floodplain and side channels. Additional LWM will be placed in the channel to encourage sediment sorting and channel complexity.

1.4.1.4 HIP IV CATEGORY 2E – RIPARIAN VEGETATION PLANTING

This action includes native revegetation of disturbed areas on the floodplain. The project aims to increase the riparian buffer on both sides of the river with planting of native riparian species.

1.4.2 Category of Action (7): Irrigation and Water Delivery/Management Actions

1.4.2.1 HIP IV CATEGORY 7C –CONVERT INSTREAM DIVERSIONS TO GROUNDWATER WELLS FOR PRIMARY WATER SOURCE

This action includes consolidating multiple existing irrigation diversions and conversion to shallow aquifer well system. Converting the instream diversion to a groundwater source will remove infrastructure from the river and nearby floodplain and limit future disturbance to the riparian area.

Based on a review of area groundwater conditions, well logs for existing wells, and Ecology regulation of surface water and shallow alluvial groundwater in the Walla Walla Basin, it may be possible to replace the surface water diversions with a hydraulically connected groundwater diversion. Such a groundwater diversion, assuming feasible, would likely be a vertical well. A vertical well would likely be drilled with a casing advance system, to a total depth of approximately 100 to 140 feet (depending on location and water production encountered). The total number of wells would depend on the pumping rate and associated drawdown of a given well(s). It is our understanding that the water production target is approximately 1 cubic foot per second (cfs) (449 gallons per minute).

A subsurface investigation and hydrogeologic analysis will be completed in two phases as the design progresses to evaluate the feasibility of an alluvial aquifer in the project area to supply the water needs of the current surface water rights holders. The first phase will confirm the depth to water, thickness, and lithologic character of the alluvial aquifer (silty versus gravelly). The first phase results, if favorable, will be used to design the second phase which will focus on test well drilling to address aquifer hydraulics and evaluate additional production well placement and the need for new pumps and pipes (water distribution to replace the old system).

1.5 PERFORMANCE/SUSTAINABILITY CRITERIA FOR PROJECT ELEMENTS

Specific project goals aligned with each of the River Vision Touchstones are shown in Table 1. Restoration actions included in the design are intended to achieve the specific measurable objectives defined for each goal.

TABLE 1. WALLA WALLA RIVER RM 32.5 GOALS AND OBJECTIVES

RIVER VISION TOUCHSTONE	GOAL	OBJECTIVE
Water Quality and Quantity	Enhance water quality by improving riparian and hyporheic function.	Remove at least 500-feet of laterally-confining bank armoring.
Geomorphology	Increase geomorphic complexity by improving channel form and function and enhancing large wood density.	Increase large wood density to at least 1 piece of large wood per channel width.
Connectivity	Improve connectivity with the floodplain by removing laterally confining features and enhancing channel complexity.	Reconnect at least 10 acres of floodplain at the 1.5-year recurrence interval flow.
Riparian Vegetation	Increase riparian function with site-appropriate native vegetation.	Revegetate at least 5 acres with site-appropriate native floodplain vegetation.
Aquatic Biota	Increase locations suitable for summer and winter rearing of summer steelhead and spring Chinook and increase locations suitable for adult spawning of steelhead.	Increase suitable steelhead spawning habitat by at least 100 percent.
		Increase suitable steelhead summer rearing habitat by at least 100 percent.
		Increase suitable spring Chinook salmon and summer steelhead winter rearing habitat by at least 100 percent.

1.5.1 Assessment of Risk of Failure to Perform, Risk to Infrastructure, Potential Consequences and Compensating Analysis to Reduce Uncertainty

Performance of the design in meeting the objectives outlined in Table 1 will be evaluated throughout design development and will include hydraulic modeling of existing and proposed conditions to evaluate floodplain reconnection targets. Failure to meet design objectives would result in reduced habitat uplift compared to target conditions. However, the completed project would still result in increased habitat quality and quantity compared to existing conditions.

Risk to infrastructure for the project is low, as the surrounding land use is primarily agriculture, and infrastructure within the project reach is limited to power lines and irrigation pumps. The nearest downstream road crossing is McDonald Road, approximately 3 miles downstream of the project limits. Under current operations, the irrigation pumps are removed seasonally, further limiting infrastructure risks associated with the project during peak flows.

1.6 DISTURBANCE INCLUDING TIMING AND AREAL EXTENT AND POTENTIAL IMPACTS ASSOCIATED WITH IMPLEMENTATION OF EACH ELEMENT

Project construction is anticipated to occur in summer 2025 during an in-water work window established by regulatory agencies and is anticipated to be from July 15 through August 15 (U.S. Army Corps of Engineers 2010). Flow conditions during construction are anticipated to be low, and the majority of grading will occur outside of the wetted channel. In-water work will include the installation of LWM structures and grading to connect existing side channel inlets. In-water work will be isolated to the extent possible to reduce impacts from sediment to ESA-listed and resident fish species. The disturbance and grading limits are shown in Appendix A. CTUIR fisheries staff will provide fish salvage operations in isolated work areas following HIP guidance, as described in the conservation measures shown in the design drawings (Appendix A, Drawing no. 6.0 to 6.2). A sequencing and work isolation plan will be provided at 60 percent design submittal.

1.7 ALTERNATIVES ASSESSMENT AND SELECTION

Two alternatives were identified during the conceptual design (15 percent) phase based on project goals, objectives and the anticipated project elements described above. Both alternatives included selective grading to reconnect side channels and increase off channel habitat, removal of the levee material along the right-bank floodplain, conversion of agricultural land on the left-bank to riparian floodplain, placement of LWM throughout the main channel and side channels and riparian planting within disturbed areas. Alternative 1 included removal of the existing infrastructure associated with four surface water pump diversions from the river along the left bank. In Alternative 1, a shallow well connected to the alluvial aquifer would be installed outside the restored floodplain area to supply irrigation water. Alternative 2 retained all the project elements included in Alternative 1, but did not include construction of a shallow alluvial aquifer well. Instead, Alternative 2 would consolidate the four surface water diversions into one or two instream pumped diversions, thereby eliminating some—but not all—of the infrastructure in the river. In Alternative 2, the area converted from agricultural land to riparian floodplain would be reduced considerably on the south floodplain. CTUIR selected Alternative 1 as the preferred alternative because it results in the greatest amount of floodplain connectivity and removal of infrastructure from the river.

Following submittal of the conceptual design, GeoEngineers completed a desktop hydrogeologic analysis of the alluvial aquifer and will complete an exploratory borehole during 60 percent design development. As the design progresses there is the possibility that conversion of the surface water diversions into a shallow alluvial aquifer well is not feasible due to hydrogeologic conditions or regulatory constraints. In this scenario, Alternative 2 will become the preferred alternative that will be advanced in the 60 percent design, and grading extents within the south floodplain will be reduced to accommodate consolidation of irrigation infrastructure, including pumps and overhead power.

2.0 Resource Inventory and Evaluation/Site Characterization

2.1 PAST AND PRESENT IMPACTS ON CHANNEL, RIPARIAN AND FLOODPLAIN CONDITIONS

Habitat limiting factors through this reach are symptomatic of watershed-scale impacts that have been ongoing for more than a century. Upstream irrigation withdrawals have substantially reduced the low-flow volume. The reduced streamflow combined with riparian degradation and geomorphic simplification have resulted in elevated water temperatures that frequently exceed the thermal range tolerable to native salmonids. Within this reach, disconnected side channels and floodplains exacerbate thermal loading during summer months, which is inhospitable for salmonids and favors non-native predators. During cooler months, when water temperatures are suitable for salmonids, there is very little complex structure or off-channel areas that provide secure refugia. Consequently, minimally suitable habitat is only available in shallower channel margins where they are subjected to higher velocities and increased predation risk. Despite the poor existing habitat conditions throughout this reach, there is considerable potential for improvement owing to the areas of intact riparian vegetation and available lateral floodplain area. Selective removal of confining levees, moderate channel grading and installation of LWM will allow for riparian expansion and secure refugia areas for salmonids at their most vulnerable life stages. Additionally, consolidating irrigation infrastructure will reduce the likelihood of degrading channel modifications, potentially keep more water instream and reduce the risk of screen impingement.

2.2 INSTREAM FLOW MANAGEMENT AND CONSTRAINTS IN THE PROJECT REACH

There are multiple pumped surface water diversions located within the project reach, one located on the right (north) bank within a side channel and six within the main channel whose locations vary from year to year (Figure 2). The downstream most diversion on the right bank is located within a backwatered side channel that is periodically dredged to maintain water levels at the pump (Figure 3 and Figure 4). An access road follows this side channel and further disconnects the floodplain (Figure 5). Near the upstream limits of the side channel is a levee and bank armoring that disconnects the side channel from the main channel (Figure 6) and results in slow, stagnant water conditions that promote warmer water, algae growth, and provide habitat for non-native predators (Figure 2). Water is pumped from the diversion as far as two miles from the site, primarily between February and June. Powerlines supply electricity to the pump and the diversion includes a rotating drum screen. The pump is removed seasonally during high flows.

The remaining instream diversions within the project reach are smaller divisions for single water users, irrigating fields adjacent to and south of the Walla Walla River. Of these, four are being proposed for consolidation and service to properties located on the south floodplain. Three of the four diversions are located within 150 feet of one another, within the main channel and near the middle of the project reach (Figure 7). The fourth is located near the upstream project limits (Figure 9). The adjacent landowners install the diversion pipe and screens each season within the river. The pumps are located along a floodplain bench on the south edge of the river adjacent to overhead powerlines that lead to each pump (Figure 8). Bank armor consisting of concrete debris and riprap is sporadically spaced along the south floodplain (Figure 10). Collectively, ongoing maintenance of the instream diversions and associated infrastructure creates a continued disturbance to the riparian canopy, disrupting natural floodplain processes.

2.3 EXISTING GEOMORPHIC CONDITIONS AND CONSTRAINTS ON PHYSICAL PROCESSES

The project reach is situated along the Walla Walla River downstream of the Mill Creek confluence after flowing through a large alluvial fan that formed where the river leaves the Blue Mountains near Milton-Freewater. In the Walla Walla Valley, the river has cut down through layers of sediment that were deposited within the slackwater of glacial Lake Lewis; a large temporary lake that would form when waters from the Missoula Floods were slowed and backed up behind the Wallula Gap south of Pasco, Washington where the Walla Walla River flows into the Columbia River. While downcutting, the river reworked the slackwater sediments and formed a wide floodplain within the larger Walla Walla Valley.

Prior to anthropogenic influence, the channel moved across the wide valley floor but has since been relegated to a limited extent due to incision and agricultural practices implemented in the valley. The river downcut further within the historical pre-anthropogenic floodplain it formed. In the project area, the historical floodplain on either side of the river is only inundated during higher than 50-year recurrence interval floods. Since downcutting, the river has been forming a new inset floodplain associated with the current stream elevation between the high floodplain surfaces.

Placement of revetments along the active channel on both the north and south banks (Figure 15), possibly in the 1970's based on aerial photograph review, has constrained the channel. A levee separates floodplain and an irrigation intake from the channel along the right bank near the downstream end of the project reach. A second levee on the southern bank, just upstream of the project reach, is limiting migration in an area where several large meanders had previously been. Elsewhere, large rock or man-made materials such as broken slabs of concrete line the historical floodplain boundary on either side of the active channel. Up to approximately 40 percent of the channel may been revetted. The largest flood on record at the stream gage on the Walla Walla River near Touchet, WA (#14018500) was recorded in February of 1996. The 1996 ortho photo shows a lightly vegetated inset floodplain bottom, which implies recent sediment transport of the channel bed and floodplain materials. However, there did not appear to be any major lateral erosion beyond the active channel resulting from the flood. This suggests that, although the channel moves freely and often across the inset floodplain, it is not migrating into the historical floodplain. Erosion is active at a single meander along the right bank in the upstream section of the project reach, but it is still within the inset floodplain and not the historical floodplain.

Based on historical aerial photo review, the Walla Walla River in the project reach oscillates between a generally single thread with a few side channels to a more braided form. The average slope is less than 1 percent with only minor changes in local slopes that may slightly influence deposition and flow patterns in the pool-riffle system. Pools in the project reach are forced by large wood or failed riprap.

Near the project reach, the channel has lost sinuosity over time going from a value of 1.19 in 1952 (Figure 14) to a value of 1.06 in 2022 (Figure 15). Accompanied with the loss of sinuosity is an approximately 22 percent reduction in meander belt width. Prior to 1952, the channel, downstream of the project reach, appears to have been straightened as suggested by a linear feature approximately the width of the channel seen in the 1952 aerial photograph. This feature does not extend upstream into the project area, but the proximity suggests the channel within the project area could have been subject to anthropogenic manipulation as well. The straightened reach downstream may have instigated incision that propagated upstream through the project reach. By 1964 (Figure 14), the channel in the downstream portion of the project reach had straightened where a significant meander was cut off through avulsion along the back of the meander bar. By 1976 (Figure 15), the reach upstream of the project also appears straightened where two large meanders existed in 1964.

Although straightening a river usually causes or exacerbates incision, the ample sediment across the current floodplain bottom and within the river through the project reach may be countering those effects. The reach appears more like a response reach and could be experiencing aggradation with considerable sediment interchange as the stream shifts back and forth within the active channel/floodplain bottom. The sediment is temporarily stored as bars and on developing floodplains which is a vital process that shapes and maintains complex habitats. The river from the Mill Creek confluence down to the project reach has been straightened similar to the project reach but it is also somewhat entrenched, which typically provides a greater capacity to carry sediment. When a larger recurrence interval flood carrying sediment reaches the project area it is able to spread out and loses the capacity to carry the sediment further. Deposition is exacerbated by a reduction in stream flow primarily through irrigation withdrawal upstream. Less flow through the project reach further reduces the capacity and competency of the river to carry sediment.

2.4 EXISTING RIPARIAN CONDITION AND HISTORICAL RIPARIAN IMPACTS

Riparian and floodplain conditions at the site have been heavily impacted by historical agricultural practices, surface diversions, residential road development, bank armoring and flood control activities. The riparian canopy largely consists of black cottonwood (*Populus trichocarpa*), alder (*Alnus sp.*) and willow (*Salix sp.)* and is limited to the channel margins. The width of the overstory canopy varies between 20 and 300 feet along the left (south) bank and 0 to 110 feet along the right (north) bank. The left bank includes a vegetated buffer along the river that was previously enrolled in a Conservation Reserve Enhancement Program (CREP). Below this margin an inset floodplain runs the length of the project reach and is densely vegetated with reed canarygrass (*Phalaris arundinacea*). Channel bars are intermittently either bare or covered in reed canarygrass and other seasonally established vegetation. The lack of established riparian vegetation within bars and along the channel margins exacerbates thermal loading of the channel.

2.5 LATERAL CONNECTIVITY TO FLOODPLAIN AND HISTORICAL FLOODPLAIN IMPACTS

The right bank floodplain is disconnected from the mainstem due to historic disturbances and construction of a levee and additional revetments along the bank. A perimeter road following the diversion side channel further disconnects the mainstem from its historic floodplain. The left bank historical floodplain has similarly been modified by agricultural production, which currently extends to the edge of the riparian corridor. Bank armoring in the form of concrete and automotive debris sporadically lines the boundary of the historical and inset floodplains along the extent of the left bank.

2.6 TIDAL INFLUENCE IN PROJECT REACH AND INFLUENCE OF STRUCTURAL CONTROLS (DIKES OR GATES)

The project is not located within a tidally influenced setting.

3.0 Technical Data/Design Considerations and Analyses

3.1 INCORPORATION OF HIP SPECIFIC ACTIVITY CONSERVATION MEASURES FOR ALL INCLUDED PROJECT ELEMENTS

The Walla Walla RM 32.5 project includes HIP IV specific activity conservation measures associated with:

- Action Category 2: River, Stream, Floodplain and Wetland Restoration, including:
  - 2A – Improve Secondary Channel and Floodplain Interactions
  - 2B – Set-Back or Removal of Existing Berms, Dikes and Levees
  - 2D – Install Habitat-Forming Natural Material Instream Structures
  - 2E – Riparian Vegetation Planting
- Action Category of Action (7): Irrigation and Water Delivery /Management Actions, including:
  - 7C – Convert Instream Diversions to Groundwater Wells for Primary Water Source

HIP Conservation measures are included in Appendix A, Design Drawings. The plans include separate sheets outlining HIP conservation measures, which cover general conservation measures, fish protection, and water quality protection measures. Additional sheets detail project-specific measures for temporary erosion and sediment control, water management, and access and staging requirements.

3.2 SUMMARY OF SITE INFORMATION AND MEASUREMENTS (SURVEY, BED MATERIAL, ETC.) USED TO SUPPORT ASSESSMENT AND DESIGN

GeoEngineers completed a site reconnaissance on June 26, 2024 to document existing geomorphic and riparian conditions and identify areas for floodplain reconnection and habitat uplift. Field observations are included within Section 2.0 and Figures 3 to 13. The sections below describe the site information and measurements informing design.

3.2.1 Topographic Data

The site was surveyed by Resource Specialists, Inc. (RSI) in June 2024. RSI created an existing conditions surface of the project area by blending a detailed RTK GPS topo/bathymetric survey of the river with orthorectified point data collected via unmanned aerial system (UAS), along with 2021 LiDAR data provided by CTUIR. The resulting existing conditions surface provides a basis for planform and geometric measurements and existing terrain for use in grading and hydraulic modeling.

3.2.2 Bed Material

During the site reconnaissance we collected streambed gradation data across two riffles using Wolman pebble-count sampling methods. Material generally ranged from medium gravel to large cobbles with an average D_{50} of 1.6 inches (Table 2). We observed sand and silt on the floodplains but not commonly in the channel and no natural boulders were observed in the active channel.

TABLE 2. SUBSTRATE GRAIN-SIZE SUMMARY STATISTICS

GRAIN-SIZE STATISTIC	PEBBLE COUNT 1 (INCHES)	PEBBLE COUNT 2 (INCHES)	AVERAGE (INCHES)
D_{16}	1.1	0.9	1.0
D_{50}	1.8	1.4	1.6
D_{84}	2.8	2.2	2.5
D_{95}	3.5	3.1	3.3
D_{100}	10.1	5.0	7.6

3.2.3 Floodplain Connectivity

The existing meander belt is constrained by the numerous revetments observed along the inset floodplain–historical floodplain boundary (Figure 15). It has narrowed by more than 200 feet since 1952 and potentially 800 feet since the early 1900's according to USGS topographic maps of that time. Based on this, we extended several side channels south into the historical floodplain while utilizing a remnant of an old channel scroll on that historical floodplain as well as another side channel along the southern edge of the inset floodplain.

3.2.4 Side Channel Geometry

GeoEngineers used measurements of existing side channel geometry within and immediately downstream of the project area to inform proposed side channel design (Section 3.3.1). We used the RSI existing conditions surface in AutoDesk Civil3D to measure the geometry of existing side channels, including:

- A side channel located on the north floodplain that services an irrigation diversion
- A side channel located on the south floodplain that parallels the left bank
- A relic side located on the south floodplain within a wooded area near the upstream project limits
- Two side channels located on the south floodplain downstream of the project limits and within a wooded area

The surface and resulting measurements for the two side channels located outside of the project limits are based on 2021 LiDAR as that area was not included in the topo-bathymetric survey. We used the average of existing side channel geometry measurements to inform proposed side channel geometry, including average existing side channel toe width (19 feet), bank to bank width (40 feet), toe slopes (9 percent), and bank slopes (40 percent).

3.2.5 Hydrogeologic Characterization

GeoEngineers completed a desktop hydrogeologic analysis of the alluvial aquifer within the project area to support shallow aquifer well development. This summary is based on area well logs, information available from the Walla Walla Basin Watershed Council website, GSI (2007), and Cobb (2019).

3.2.5.1 STRATA HOSTING THE ALLUVIAL AQUIFER

The primary alluvial aquifer strata in the project area, from the surface downwards, are the:

- Quaternary fine unit, consisting of mixed soil/Touchet Beds ranging from 0 to 17 feet thick with an average thickness of 9 feet.
- Quaternary coarse unit, consisting of uncemented river deposited silt, sand, and basaltic gravel and Mio-Pliocene upper coarse unit, consisting of indurated river deposited silt, sand, and basaltic gravel. These gravelly strata, which also includes interbedded sand and mud, range from 70 to 121 feet thick with an average thickness of 92 feet.
- Mio-Pliocene fine unit consists of variously colored clay and silt with some interbedded sandy strata. The top of this unit ranges from approximately 86 to 135 feet below ground surface (bgs). It can be 300 feet or more thick in this area.

In the project area the productive alluvial aquifer is found predominantly in the two coarse units, the bottom of which is the top of the Mio-Pliocene fine unit.

3.2.5.2 ALLUVIAL AQUIFER CONDITIONS

Groundwater in the alluvial aquifer generally flows from east to west in the project area. Seasonally the water table west of the project area ranges from approximately 10 feet bgs in the winter to 6 feet bgs in the summer. East of the project area the water table ranges from 12 feet bgs in the winter to 7 feet bgs in the summer.

Groundwater production reported on the driller's logs in the project area indicate: (1) pumping rates ranging from 15 to 400 gpm, (2) pumping drawdown ranging from 4 to 84 feet, and (3) estimated specific capacity ranging from 0.4 to 5.0 gpm pumped per foot of drawdown (gpm/ft-dd). However, these reported pumping characteristics may be more representative of the small and relatively inefficient wells that characterize the area, and not fully representative of aquifer pumping capacity. Three of the larger diameter wells in the project area are reported to produce >100 gpm with one producing 400 gpm, which suggests productive aquifer conditions are present.

3.2.6 Subsurface Investigation

As the design progresses GeoEngineers will provide planning, coordinate drilling, field observation, and data analysis support before, during, and after the drilling of a sonic exploratory test boring on the south floodplain within the project area. The purpose of the exploratory boring is to assess subsurface physical conditions such as grain size, occurrence of muddy or cemented intervals that could potentially hinder groundwater pumping, occurrence of groundwater, and depth of the top of the Mio-Pliocene fine unit which forms the base of the shallow unconfined aquifer. Based on that assessment, GeoEngineers will provide a well construction recommendation for one or more groundwater production wells that could replace four current in-stream diversions for irrigation water supply located on the south floodplain.

3.3 DESIGN OF PROJECT ELEMENTS

3.3.1 Side Channel and Floodplain Grading - HIP IV Category 2a

Side channel development includes the creation of four side channel networks, described below. Side channel enhancement includes excavation to expose native substrate and does not include import of streambed materials or washing fines into the streambed. Reworking and selective placement of native streambed may occur at the side channel inlets and connection to the main channel if exposed materials are dissimilar in gradation to the adjacent main channel streambed. The proposed side channels are categorized into four distinct locations, as outlined below:

- **Side Channel 1 Network** is located along river right (north) bank and creates two new inlets (side channel 1 and side channel 1a) for an existing backwater side channel by removing a portion of an existing bank levee. This floodplain area is currently backwatered during summer flow conditions. The side channels are designed to be active at the August 50 percent exceedance flow with approximately 0.5 feet to 1.0 feet of water under proposed conditions. Grading of side channel 1 and 1a will also remove a portion of existing levee along the north bank.
- **Side Channel 2 Network** is located along the river left (south) bank and targets reconnecting existing low topographic features that function at higher flows but have become disconnected from the main channel at low flows. We designed the proposed side channel to be active at the August 50 percent exceedance flow with approximately 0.5 feet to 1.0 feet of water and is intended to provide habitat connectivity to existing vegetated areas along the left bank. Side channel 2 has a 20-foot-wide left bench to increase floodplain connectivity and hyporheic exchange. Grading of side channel 2 will also remove a large portion of existing levees and bank armoring along the south bank.
- **Side Channel 3 Network** consists of two side channels – side channel 3 and side channel 3a. Both are located along the river left (south) bank and target increasing floodplain connectivity and returning agricultural land to active floodplain. We designed the proposed side channels to be active between the April/May 50 percent exceedance flow and the 1.5-year event with approximately 0.5 feet to 1.0 feet of water under proposed conditions. Both side channels have 20-foot-wide benches on both sides of the channel to increase floodplain connectivity and hyporheic function. Side channel 3a is located closer to the main channel and therefore activates at lower flows.
- **Side Channel 4 Network** consists of three side channels – side channel 4, side channel 4a and side channel 4b. All three side channels are located along the river left (south) bank towards the upstream limits of the project and target increasing floodplain connectivity at higher flow events and reconnecting relic channel scrolls and areas with low topography. The proposed side channels are intended to be active at the 1.5-year event with approximately 0.5 feet to 1.0 feet of water under proposed conditions. Side channel 4 is located furthest south away from the main channel and side channel 4b is located closest to the main channel, with side channel 4a in between the two. Side channel 4 has a 20-foot-wide left bench to increase floodplain connectivity and hyporheic exchange, while side channels 4a and 4b are narrower to reduce impacts to surrounding riparian forest. Flow from all three side channels converges into side channel 3.

Large wood will be placed throughout the side channels. We anticipate side channels will primarily be used as nursery and juvenile rearing areas, so complexity and cover are important to provide refugia from high velocities and predator avoidance. Wood structures in the side channels will promote scour, create current breaks, and add diverse and secure hiding areas.

It is important to note that side channels are naturally transient. As such, channel avulsions and sediment deposition should be expected and could significantly change the size, shape, and flow over time.

3.3.2 Set-Back or Removal of Existing Berms, Dikes and Levees - HIP IV Category 2b

Portions of the existing levees and revetments along the river right (north bank) will be removed through grading of side channels 1 and 1a and additional selective grading on the north floodplain. We were selective in the removal of material in the river right floodplain due to concerns regarding cultural resources and removal of existing riparian vegetation. In addition to removal of river right levees through grading of side channels 1 and 1a, two additional levee breach areas are proposed – one through the middle of side channel 1 to increase floodplain activation at high flow events (1.5-year and higher) and one at the downstream limits of the project site to increase floodplain connectivity and to reduce the potential for fish stranding. Additionally, an existing dirt road extending nearly 200 feet north-south along the north bank will be removed and restored to the elevation of the surrounding floodplain, enhancing floodplain connectivity. This area is graded to provide positive drainage towards the main channel to reduce the potential for fish stranding. Cumulatively, grading on the north side of the project will remove nearly 400 linear feet of existing levees and revetments along the river right (north) bank.

Portions of the existing levees and revetments along the river left (south bank) will be removed through grading of side channel 2 and side channel 3. Cumulatively, grading on the south side of the project will remove approximately 1,000 linear feet of existing levees/revetments along the river left bank.

3.3.3 Install Habitat-Forming Natural Material Instream Structures – HIP IV Category 2d

Large wood will be incorporated in the main channel and side channels in the form of single and multi-log structures. Proposed wood structures located within the main channel are intended to add roughness and direct flows into side channels, encouraging floodplain activation at lower recurrence interval events. We placed the structures to interact with both low and high flow conditions, break up flow, create diverse flow paths, scour and add cover where existing secure cover is sparse. Structures within the side channels are smaller and include single logs and post-assisted log structures. The primary functions of side channel structures include adding roughness and complexity to off-channel habitat, increasing roughness and residence time of high flows on the floodplain and adding structure to retain organic matter transported through the system. Stabilizing large wood will incorporate a combination of methods including bank trenching and securing with logs to large piles (main channel) and smaller posts (side channel). Material used for these structures will be imported from offsite sources. Four types of LWM structures are proposed, including:

- **Apex Jams** are positioned in the main channel of the Walla Walla River in gravel bars and opposite of side channel inlet locations. These are the largest of the multi-log structures and will include 10 large rootwads to create a structure that extends across existing gravel bars. The structures span approximately 30 to 40 percent of the main channel and will be stabilized by embedding the cut ends of key members into the gravel bar and backfill within gravels and cobbles sourced from onsite excavations. The structures will be further reinforced with piles. These jams add significant roughness to the channel and direct flow towards the side channel inlets while providing complex fish habitat.
- **Flow Deflection Jams** are large, multi-log jams situated on the edge of the banks of the main channel and containing 8 large rootwads that extend into the low flow channel. They are stabilized by partially embedding the logs into the bank and securing between piles. We designed these structures to interact with all ranges of flow events and redirect flow to the opposite bank, with the purpose of increasing

hydraulic roughness, increasing habitat complexity, and accumulating additional woody material through time.

- **Side Channel Vertical Post Structures** are smaller multi-log structures located within the side channels. They will partially span the side channel and act to increase in-channel roughness and reduce velocities. The structure consists of 3 rootwads pinned by smaller vertical posts with clusters of posts, racking material and slash that function to increase hydraulic roughness, redirect flow, create diverse fish habitat, and accumulate organic material through time.
- **Side Channel Single Logs (with and without Rootwads)** are included throughout the side channels. The wood structures proposed within the side channels are primarily intended to promote scour and provide secure cover. The wood structures, combined with riparian restoration, will create a highly complex nursery/juvenile rearing habitat that allows fish to escape high-velocity mainstem flows and avoid predation. Floodplain woody material serves to increase roughness, which attenuates flow velocities and creates unique niche habitat for vegetation and wildlife.

Placement and configuration of LWM can vary and be field fit to maximize benefits, provided it is approved by the contracting officer and burial depths are adequate. Proposed locations of LWM target areas identified during the site reconnaissance that lacked instream structure and could be accessed from the bank with minimal disturbance to established riparian canopy. LWM placement also targets areas where other restoration actions would occur, including side channel and floodplain grading.

Rope is included in the design of Flow Deflection Jams and Apex Jams to provide additional stability in this high energy system during the first few years following structure installation when structures are the most vulnerable. We have selected a biodegradable material in place of chain so the material does not remain in the stream for years following the degradation of the original log structure.

3.3.4 Riparian Planting - HIP IV Category 2e

Riparian planting will occur throughout the project reach by CTUIR in the winter and spring following construction. Planting locations will focus on areas where there are gaps in the existing riparian canopy and areas disturbed during construction. Additionally, any and all shrubs excavated during construction will be salvaged to the extent practical and either replanted or buried throughout the excavated areas of the site. A planting plan will be developed at 60 Percent Design.

Herbaceous grass and forb species will be seeded throughout all areas disturbed during construction with native seed mixes that are readily available and appropriate for the site. Seeding will be conducted through broadcast hand seeding methods throughout both zones. Seeding may be accompanied by mulching (weed free straw) to reduce erosion, provide ground cover, and reduce the likelihood of invasive species encroachment. If seeding occurs the year after construction, it will be important to do it as early as practical, after high-flow events, and might require re-scarifying the seed bed again, as appropriate. Spot weed treatment may be required as a post-construction follow up to reduce the likelihood of invasive species encroachment.

3.3.5 Convert Instream Diversions to Groundwater Wells for Primary Water Source - HIP IV Category 7C

Additional detail on the proposed groundwater well will be provided at 60 Percent Design. The well will be located outside of the proposed side channel and floodplain grading on the south floodplain as approximately shown in planview in Appendix A. Details on well location and depth will be refined in future design phases.

3.4 SUMMARY OF HYDROLOGIC ANALYSES CONDUCTED, INCLUDING DATA SOURCES AND PERIOD OF RECORD INCLUDING A LIST OF DESIGN FLOW (Q) AND RETURN INTERVAL (RI) FOR EACH DESIGN ELEMENT

The Walla Walla River at the downstream limits of the project site drains approximately 429 square miles (United States Geological Survey 2019). The basin mean annual precipitation is 29.6 inches (United States (United States Geological Survey 2019).

3.4.1 Peak Flows

GeoEngineers estimated annual peak flows at the project site using Washington State Department of Ecology (Ecology) gauge data (Ecology 2024) and the 2002 Walla Walla County Federal Emergency Management Agency (FEMA) Flood Insurance Study (Federal Emergency Management Agency 2002). We also evaluated annual peak flows using the USGS gage on the Walla Walla River near Touchet and using USGS regional regression equations (Table 3).

The Ecology gage ID 32A100 is located on the Walla Walla River at river mile 32.8 at East Detour Road, approximately 0.6 miles upstream of the upstream project limits and includes 17 years of available data (Ecology 2024). We applied a Log Pearson Type 3 statistical distribution to the gauge data using the U.S. Army Corps of Engineers Hydrologic Engineering Center's Statistical Software Package (HEC-SSP) (United States Army Corps of Engineers 2022). To account for several small tributaries that flow into the Walla Walla River between the gauge location and the project site we used a basin transfer analysis to scale peak flows from the gauge to the project site. We scaled peak flows based on the relative sizes of the watershed drainage areas and estimated drainage areas using USGS StreamStats Version 4.20 (Mastin, et al. 2016). The drainage area of the Walla Walla River at the gage location is approximately 427.5 square miles and the drainage area at the downstream limits of the project site is approximately 429.0 square miles, resulting in slightly higher flow values at the project site compared with the gage location. Results of this analysis and comparison with flows calculated using other methods are shown in Table 3.

We evaluated how effective the Ecology gauge is at capturing high flow events by comparing annual peak flow data from the Ecology gauge with annual peak flow data from USGS gauge ID 14018500 on the Walla Walla River near Touchet, WA (United States Geological Survey 2024). The Ecology gauge appeared to consistently capture flood events around the 10-year event and below but did not appear to capture the exceptionally high flood events, such as the February 2020 flood, during which there is data gap in the Ecology gauge record. We also analyzed annual peak flows using the USGS gage ID 14018500, which has a period of record of 73 years and a drainage area of 1,657 square miles, using HEC-SSP and basin transfer analysis (United States Geological Survey 2024). We also compared our calculated peak flow rates with those reported in the FEMA Flood Insurance Study, which reports peak flows for the Walla Walla River upstream of the confluence of Dry Creek, just below the project site (Federal Emergency Management Agency 2002).

Peak flow rates calculated using the USGS gauge data were smaller than peak flow rates calculated using the Ecology gauge data for flows up to and including the 25-year event. For the 50-year and 100-year events, the USGS-calculated flows were higher than those derived from the Ecology gauge data. Both the

USGS and Ecology derived flows were much lower than the peak flows reported in the FEMA Flood Insurance Study (Federal Emergency Management Agency 2002). We selected peak flows derived from the Ecology gauge to inform the floodplain reconnection and side channel design for events ranging from the 1.5-year to the 10-year recurrence interval event. We selected the more conservative flow values reported in the FEMA Flood Insurance Study for the 50-year and 100-year events used in stability calculations and floodplain permitting (Table 3).

As an additional check, we used USGS regional regression equations to calculate peak flows for comparison with the basin transfer method. The project site is located within Regression Region 1 for the USGS regional regression equations method (Mastin, et al. 2016). Peak flow rates calculated using the USGS regional regression equations were generally smaller in value but within 15 percent of peak flow rates calculated using the Ecology gage (Table 3). Table 4 includes a summary of design flows used in the analysis.

TABLE 3. PEAK FLOW METHODS COMPARISON (DESIGN FLOWS USED IN THE ANALYSIS ARE IN BOLD)

RETURN PERIOD (YEARS)	BASIN TRANSFER USING ECOLOGY GAGE FLOW (CFS)	BASIN TRANSFER USING USGS GAGE FLOW (CFS)	FEMA FLOOD INSURANCE STUDY FLOW (CFS)	USGS REGIONAL REGRESSION EQUATIONS FLOW (CFS)
1.5-year	**2,552**	1,625	N/A	N/A
2-year	**3,263**	2,144	N/A	2,800
10-year	**6,680**	5,655	6,700	6,060
50-year	11,790	10,806	**13,500**	10,000
100-year	13,474	13,728	**18,000**	12,000

3.4.2 *Low Flows*

Additional flows evaluated include the August 50 percent exceedance flow to represent summer rearing conditions, the December 50 percent exceedance flow to represent winter rearing conditions and the April and May 50 percent exceedance flow to represent conditions during steelhead spawning. We used historic flow values from the Ecology gauge to compute seasonal low flows, as shown in Table 4 (Ecology 2024).

TABLE 4: SUMMARY OF DESIGN FLOWS

DESIGN FLOW	FLOW (CFS)	NOTES
August 50 percent exceedance[1]	41.1	Used to represent summer rearing conditions and to inform proposed side channel development.
December 50 percent exceedance[1]	250	Used to represent winter rearing conditions and to inform proposed side channel development.
April and May 50 percent exceedance[1]	445	Used to represent steelhead spawning conditions and to inform proposed side channel development.
1.5-year	2,552	Used to inform approximate bankfull conditions, proposed side channel development, and floodplain activation.
2-year	3,263	
10-year	6,680	
50-year[2]	13,500	
100-year[2]	18,000	Used for floodplain analysis.

Notes:

[1] August 50 percent exceedance is defined as the flow exceeded 50 percent of the time in August based on historic Ecology gage data. December and April/May 50 percent exceedance are calculated similarly.

[2] Flows published in the 2002 FEMA Flood Insurance Study were used for the 50-year and 100-year flow.

3.5 SUMMARY OF SEDIMENT SUPPLY AND TRANSPORT ANALYSES CONDUCTED, INCLUDING DATA SOURCES INCLUDING SEDIMENT SIZE GRADATION USED IN THE STREAMBED DESIGN

The proposed design does not include import of streambed sediment in the main channel or side channels. Therefore, sediment transport analyses were not warranted to inform design.

3.6 SUMMARY OF HYDRAULIC MODELING OR ANALYSES CONDUCTED AND OUTCOMES – IMPLICATIONS RELATIVE TO PROPOSED DESIGN

3.6.1 Hydraulic Model Development

GeoEngineers developed a two-dimensional hydraulic model of the project reach using the U.S. Army Corps of Engineers' Hydraulic Engineering Center River Analysis System (HEC-RAS) Version 6.6 computer program, a two-dimensional (2D) hydraulic numerical model (United States Army Corps of Engineers 2024).

Development of a two-dimensional hydraulic model requires the modeler to:

- Define the model domain (Section 3.6.1.1)
- Create or obtain a surface that is an accurate representation of the river system's topography including bathymetry (Section 3.6.1.2)

- Generate a mesh that accurately defines the surface for input into the model (Section 3.6.1.3)
- Generate a layer that defines the Manning's n roughness parameter (Section 3.6.1.4)
- Define the boundary conditions which describe how flow enters and exits the model's mesh (Section 3.6.1.5)
- Define model controls including simulation time and time step (Section 3.6.1.6)

We developed an existing (Section 3.6.2) and proposed (Section 3.6.3) conditions model for the site. The model development steps listed above are described in the sections below for both the existing and proposed conditions models.

3.6.1.1 MODEL DOMAIN

The model encompasses an approximately 3,250-foot reach of the Walla Walla River and floodplain through the project site. Laterally, the model spans roughly 4,000 feet. Figures B-1 and B-2 in Appendix B show the model domain.

3.6.1.2 MODEL ELEVATION SURFACE

HEC-RAS requires a topographic surface to represent bathymetric and overbank areas in the model. We obtained overbank and bathymetric survey data in the vicinity of the project from RSI that was collected in June 2024 and from Light Detection and Ranging (LiDAR) collected in 2021 and 2018. GeoEngineers developed the proposed conditions model elevation surface by modifying the existing 2D model elevation surface to reflect conditions described as the proposed project elements (Section 3.3).

3.6.1.3 MESH DEVELOPMENT

The mesh is the geometry input into the 2D model and is made up of elements with varying shapes. The edges of elements define key elevation information for the model. These elevations are extracted from the model surface. Development of the mesh requires creation of breaklines to align element edges with hydraulically relevant features such as the channel banks, side channels, and elevated features). Breaklines created during the development of the model surface were used to define these key features. Both the existing conditions and the proposed conditions model meshes cover approximately 290 acres and include more than 50,000 elements. Elements are spaced approximately 5 feet apart in the river channel and increase to up to 30 feet in the floodplain areas.

3.6.1.4 MODEL ROUGHNESS

Manning's n is a parameter used in the model to represent roughness of surfaces and are defined within HEC-RAS using coverages that define Manning's n value regions with polygons. Manning's n regions throughout the existing model domain include the main channel, gravel bars, existing side channels, floodplain (forest, agriculture, and grass areas), a dirt road, and structures such as houses and barns (Table 5). We delineated roughness regions using the survey basemap, aerial photography, and site visit photos. Existing and proposed conditions main channel Manning's n values are composite values based on combining tabular and quantitative guidance (Yochum 2018). We estimated floodplain Manning's n values using V.T. Chow's Open Channel Hydraulics Manning's reference table (Chow 1959). Manning's n regions throughout the proposed model domain include the same categories as the existing condition but with increased roughness to account for the placement of LWM. We accounted for LWM placed in the proposed side channels by increasing the composite roughness of the side channels (Addy and Wilkenson

2019, Yochum 2018). Due to their size and density of wood, we represented proposed Flow Deflection Jams and Apex Jams as discrete roughness regions within the proposed model main channel (Table 5). Manning's n extents are shown in Appendix B.

TABLE 5. EXISTING AND PROPOSED CONDITIONS MANNING'S N VALUES

CATEGORY	MANNING'S N VALUE
Main Channel	0.039
Gravel Bars	0.039
Existing Side Channels	0.039
Proposed Side Channels	0.042
Forest	0.09
Agriculture/Grass	0.035
Dirt Road	0.025
Buildings (houses, barns, etc.)	5
Proposed Main Channel Flow Deflection Jams and Apex Jams	0.2

3.6.1.5 BOUNDARY CONDITIONS AND STRUCTURES

HEC-RAS utilizes user-defined boundary conditions to define flow that enters and exits the model. Inflows are defined at the upstream boundary condition and normal depth water surface elevations are defined at the downstream boundary conditions. Inflow values include the flows identified from the hydrologic analysis (Section 3.4, Table 4). We calculated the normal depth water surface elevation for each simulated flow at the downstream boundary condition using the downstream average slope (0.004 feet/feet) and the composite Manning's n value from the HEC-RAS roughness coverage. We extended the inflow boundary conditions for flows above the 2-year event to account for flow entering the model domain on the floodplain and, similarly, included two additional downstream normal depth boundary conditions in the north and south overbank areas to account for flow exiting the model domain on the floodplain. We calculated these high flow overbank normal depth boundary conditions using the same downstream average slope (0.004 feet/feet) and the composite Manning's n value from the HEC-RAS roughness coverage.

Boundary conditions, roughness coverages, and model results extraction cross section locations for the existing and proposed conditions models are shown in Appendix B.

3.6.1.6 MODEL RUN CONTROLS

We ran all models using the HEC-RAS full momentum equation: Shallow Water Equations, Eulerian-Lagrangian Method (SWE-ELM), with the initial condition for all simulations set to dry. The simulation time was 4 hours to achieve steady state flows throughout the model. The time step was 0.5 seconds.

3.6.2 Existing Condition Model Results

Existing hydraulic model results include results for peak flows and low flows that are used to inform channel hydraulic and geomorphic trends, assess floodplain connectivity and side channel activation, and inform habitat analyses. Results from the hydraulic model are shown in detail in Appendix B. Locations at which we extracted results are also shown in Appendix B. We extracted results from sections that include both the main channel and the proposed side channels, allowing for a comparison of the flow in the side channels with the flow in the main channel, as follows:

- **Main Channel Upstream** cross section can be compared with **Side Channel 4** cross section
- **Main Channel Middle 1** cross section can be compared with **Side Channels 2, 3, 3a, 4, 4a, and 4b** cross sections
- **Main Channel Middle 2** cross section can be compared with **Side Channels 1 and 2** cross sections
- **Main Channel Downstream** cross section can be compared with **Side Channel 1** cross section

Low flow (August 50 percent exceedance) and 1.5-year channel hydraulics are reported at representative cross sections in the main channel (Table 6). Percent of flow in the existing and proposed side channel locations compared with percent of flow in the main channel at various flow conditions are shown in Table 7. Existing side channels do not become activated until the 1.5-year flow, and even then, they only account for a small percentage of flow. Although water is shown in side channel 1 under existing conditions, because there is no upstream inlet, water is stagnant and therefore accounts for 0 percent of total flow (Table 7). Under existing conditions, the vast majority of flow remains inside the main channel throughout the project reach, with 100 percent of flow remaining in the main channel up to the April May 50 percent exceedance flow, and with approximately 95 percent of flow remaining in the main channel at the 1.5-year event through the middle of the project reach, and 100 percent of flow remaining in the main channel towards the upstream and downstream project extents.

Inundation extents at the April and May 50 percent exceedance low flows and the 1.5-year, 10-year and 100-year peak flows are reported in Table 8.

TABLE 6. EXISTING HYDRAULIC MODEL RESULTS FOR LOW (AUGUST 50 PERCENT EXCEEDANCE) FLOW AND 1.5-YEAR FLOW

MAIN CHANNEL SECTION	LOW FLOW AUGUST 50 PERCENT EXCEEDANCE			1.5-YEAR		
	MAXIMUM DEPTH (FT)	MEAN VELOCITY (FT/S)	MEAN SHEAR STRESS (LB/FT^2)	MAXIMUM DEPTH (FT)	MEAN VELOCITY (FT/S)	MEAN SHEAR STRESS (LB/FT^2)
Main Channel Upstream	1.2	1.1	0.1	5.0	5.4	1.1
Main Channel Middle 1	1.3	1.1	0.1	5.2	5.4	0.7
Main Channel Middle 2	1.0	1.1	0.1	4.8	4.5	0.6
Main Channel Downstream	2.0	2.0	0.2	6.6	6.6	0.7

TABLE 7. EXISTING SIDE CHANNEL ACTIVATION COMPARED WITH PERCENT OF FLOW IN MAIN CHANNEL

SIDE CHANNEL OR MAIN CHANNEL SECTION	PERCENT OF TOTAL AUGUST FLOW	PERCENT OF TOTAL DECEMBER FLOW	PERCENT OF TOTAL APRIL/MAY FLOW	PERCENT OF TOTAL 1.5-YR FLOW
Side Channel 1 Combined	0.0%	0.0%	0.0%	0.0%
Side Channel 2	0.0%	0.0%	0.0%	1.1%
Side Channel 3	0.0%	0.0%	0.0%	0.0%
Side Channel 3a	0.0%	0.0%	0.0%	7.7%
Side Channel 4	0.0%	0.0%	0.0%	0.0%
Side Channel 4a	0.0%	0.0%	0.0%	0.0%
Side Channel 4b	0.0%	0.0%	0.0%	0.0%
Main Channel Upstream	100.0%	100.0%	100.0%	100.0%
Main Channel Middle 1	100.0%	100.0%	100.0%	98.9%
Main Channel Middle 2	100.0%	100.0%	100.0%	93.4%
Main Channel Downstream	100.0%	100.0%	100.0%	100.0%

TABLE 8. EXISTING INUNDATION EXTENTS

DESIGN FLOW	INUNDATED AREA (ACRES)
April and May 50% Exceedance	8.3
1.5-year	15.5
10-year	39.6
100-year	92.4

3.6.3 Proposed Condition Model Results

Proposed condition hydraulic model results include results for peak flows and low flows that are used to inform channel hydraulic and geomorphic trends, assess floodplain connectivity and side channel activation, and inform habitat analyses. Locations at which results were extracted below and detailed results from the hydraulic model are shown in Appendix B.

Low flow (August 50 percent exceedance) and 1.5-year channel hydraulics are reported at representative cross sections in the main channel (Table 9). Generally, maximum flow depths are similar between existing and proposed conditions with main channel depths decreasing slightly under proposed conditions downstream (maximum decrease of 0.1 feet at the August 50 percent exceedance and 0.4 feet at the 1.5-year event). This is due to increased side channel activation under proposed conditions. Average main channel velocity was similar between existing and proposed at the August 50 percent exceedance but lower under proposed conditions compared to existing at the 1.5-year event. These differences are also likely due to increased side channel activation and increased main channel roughness resulting from the LWM placement under proposed conditions. Main channel shear stress is lower under proposed conditions at both the low flow and 1.5-year events (Table 9).

Percent of flow in the existing and proposed side channel locations compared with percent of flow in the main channel at various flow conditions are shown in Table 10. Overall, proposed grading increased existing side channel (side channels 1 and 2) and proposed side channel activation considerably, particularly at the flow events at which the side channels were designed to activate. As discussed in Section 3.3.1, side channels 1 and 2 were designed to be active at the August 50 percent exceedance flow, and these side channels account for approximately 30 percent and 13 percent of August 50 percent exceedance flow, respectively. Through design iteration we observed that the flow rate into side channel 1 is extremely sensitive to side channel grading elevations and LWM discrete roughness regions, indicating the need for further sensitivity analysis and refinement of side channel activation which will be completed at 60 percent design.

Maximum depth in the newly graded portions of side channel 1 at the August 50 percent exceedance flow ranges from approximately 0.5 feet to 1 foot, meeting design targets. Depths increase in existing portions of side channel 1 near the irrigation diversion, where an existing pool will be maintained. Average maximum depth at the August 50 percent exceedance flow in the graded portions of side channel 2 is approximately

0.6 feet (with deeper depths observed in existing, ungraded, portions of side channel 2), which also meets the design targets.

We designed side channels 3 and 3a to be active between the April/May 50 percent exceedance flow and the 1.5-year event. Both side channels start to activate at the April/May 50 percent exceedance flow and collectively account for approximately 10 percent of flow at the 1.5-year event. Depths through side channel 3 range from 1.8 feet to 2.7 feet and depths through side channel 3a range from 2.4 feet to 2.8 feet at the 1.5-year event.

We designed side channel 4, 4a, and 4b to be active at the 1.5-year event and above. Note that the inlet for side channels 4 and 4a is located at the upstream project limits and grading is therefore limited by the project boundaries. These two side channels were designed to tie into an existing high flow channel that activates at the 1.5-year event, as shown in the Appendix B plan view figures. Side channel 4b ties into the main channel at the 1.5-year event. All three side channels start to activate at the 1.5-year event, although they collectively only account for approximately 1 percent of flow at this event. At higher flows, such as the 10-year event, they account for a much higher percentage of flow (16 percent of total 10-year flow, compared with only 1 percent under existing conditions). Overall, proposed side channel and floodplain grading increases floodplain and side channel activation considerably compared with proposed conditions. Depths through side channel 4 and 4a are approximately 0.4 feet at the 1.5-year event while depths through side channel 4b range from 1 foot to 1.4 feet at the 1.5-year event. The increase in depth in side channel 4b is a result of its closer proximity to the main channel.

As discussed in Section 3.4.2, the August and December 50 percent exceedance flows represent summer and winter rearing conditions, respectively, and the April and May 50 percent exceedance flow represents conditions during steelhead spawning. The proposed side channels provide off-channel rearing at varying degrees at all three of these flow events, with sufficient water depth, shade, and habitat complexity to support juvenile and adult salmon and steelhead at the necessary times of year. During the April and May 50 percent exceedance flow, steelhead spawning habitat will be available in the main channel, side channel 1 and side channel 2. Additionally, the proposed side channels increase low flow velocities, reducing the occurrence of stagnant water in the existing side channels, and provide velocity refugia at high flow events. Average velocity through side channels 1 and 2 ranges from approximately 1 foot per second (ft/s) to 4 ft/s at the modeled low flows (with the higher velocities at the April and May 50 percent exceedance) and from approximately 3 ft/s to 6 ft/s at the 1.5-year event. Average velocity through side channels 3, 3a, 4, 4a, and 4b ranges from approximately 1 ft/s to 3 ft/s at the 1.5-year event.

Inundation extents at the April and May 50 percent exceedance low flow and the 1.5-year, 10-year and 100-year peak flows are reported in Table 11. On average, an increase in inundated floodplain area of approximately 20 percent was observed between the existing and proposed conditions for the April/May 50 percent exceedance low flow and the 1.5-year and 2-year flows. The largest increase in innundated area occurred under the 1.5-year event; total innundated area increased by 3.9 acres, or approximately 25 percent. The majority of this increase occurred within the side channel grading footprint (Appendix A). The floodplain was previously inundated during the 10-year event, resulting in a smaller percent increase from existing conditions. Similarly, the floodplain was previously extensively innundated at the 100-year event (Table 11).

TABLE 9. PROPOSED HYDRAULIC MODEL RESULTS FOR AUGUST 50 PERCENT EXCEEDANCE FLOW AND 1.5-YEAR FLOW

MAIN CHANNEL SECTION	AUGUST 50 PERCENT EXCEEDANCE			1.5-YEAR FLOW		
	MAXIMUM DEPTH (FT)	MEAN VELOCITY (FT/S)	MEAN SHEAR STRESS (LB/FT^2)	MAXIMUM DEPTH (FT)	MEAN VELOCITY (FT/S)	MEAN SHEAR STRESS (LB/FT^2)
Main Channel Upstream	1.2	1.2	0.1	5.1	5.1	0.8
Main Channel Middle 1	1.4	1.2	0.0	5.2	5.1	0.4
Main Channel Middle 2	0.8	0.9	0.0	4.4	3.3	0.4
Main Channel Downstream	1.8	1.8	0.1	6.2	6.2	0.5

TABLE 10. PROPOSED SIDE CHANNEL ACTIVATION COMPARED WITH PERCENT OF FLOW IN MAIN CHANNEL

SIDE CHANNEL OR MAIN CHANNEL SECTION	PERCENT OF TOTAL AUGUST FLOW	PERCENT OF TOTAL DECEMBER FLOW	PERCENT OF TOTAL APRIL/MAY FLOW	PERCENT OF TOTAL 1.5-YR FLOW
Side Channel 1 Combined	31.3%	33.3%	31.9%	24.4%
Side Channel 2	13.3%	17.5%	19.9%	15.6%
Side Channel 3	0.0%	0.0%	0.0%	4.3%
Side Channel 3a	0.0%	0.0%	0.1%	6.1%
Side Channel 4	0.0%	0.0%	0.0%	0.1%
Side Channel 4a	0.0%	0.0%	0.0%	0.1%
Side Channel 4b	0.0%	0.0%	0.0%	1.0%
Main Channel Upstream	100.0%	100.0%	100.0%	98.9%
Main Channel Middle 1	86.7%	82.5%	80.0%	74.0%
Main Channel Middle 2	55.4%	49.2%	48.1%	58.7%
Main Channel Downstream	68.7%	66.7%	68.1%	75.6%

TABLE 11. PROPOSED INUNDATION EXTENTS

DESIGN FLOW	INUNDATED AREA (ACRES)	PERCENT INCREASE FROM EXISTING
April and May 50% Exceedance	9.9	19.4
1.5-year	19.4	24.8
10-year	42.1	6.5
100-year	92.1	-0.3

3.6.4 *Floodplain Analysis*

The project is located within a Federal Emergency Management Agency (FEMA) designated Special Flood Hazard Area, Zone A5, and does contain an effective base flood elevation (Federal Emergency Management Agency 2002). We evaluated changes to water surface elevation (WSE) throughout the project reach by comparing existing and proposed model results for the 100-year flow. We compared average 100-year WSE results at four cross sections throughout the project site at the upper, middle and lower project extents. Proposed condition model results show less than 0.2 feet of increase in WSE from existing to proposed 100-year average WSE. The 100-year flow inundation extents were similar between existing and proposed conditions; inundation extents increased in some locations under proposed conditions and decreased in other locations, but 100-year inundated area overall decreased from existing to proposed by 0.3 acres. Model output showing depth and velocities throughout the project reach are presented in Appendix B, Hydraulic Modeling Results.

3.7 STABILITY ANALYSES AND COMPUTATIONS FOR PROJECT ELEMENTS, AND COMPREHENSIVE PROJECT PLAN

Project elements that require stability analysis include the LWM structures. All multi-log structures will be designed to be stable against buoyancy and drag with a factor of safety equal to or greater than 1.5 at the 100-year event. Stability calculations and additional detail on LWM design will be included in the 60 percent design submittal.

3.8 DESCRIPTION OF HOW PRECEDING TECHNICAL ANALYSIS HAS BEEN INCORPORATED INTO AND INTEGRATED WITH THE CONSTRUCTION – CONTRACT DOCUMENTATION

GeoEngineers has used the preceding technical analysis to inform the locations of proposed project elements depicted in the design drawings (Appendix A). The approach has been iterative, starting with a resource inventory and evaluation/site characterization informing design concepts and channel grading, followed by a refinement of side channel locations and geometry informed by hydraulic modeling (Appendix B). A LWM stability analysis will be completed at the next design phase and used to inform LWM layout and burial depths shown in the design details.

3.9 FOR PROJECTS THAT ADDRESS PROFILE DISCONTINUITIES (GRADE STABILIZATION, SMALL DAM AND STRUCTURE REMOVALS): A LONGITUDINAL PROFILE OF THE STREAM CHANNEL THALWEG FOR 20 CHANNEL WIDTHS UPSTREAM AND DOWNSTREAM OF THE STRUCTURE SHALL BE USED TO DETERMINE THE POTENTIAL FOR CHANNEL DEGRADATION

This project does not address a profile discontinuity.

3.10 FOR PROJECTS THAT ADDRESS PROFILE DISCONTINUITIES (GRADE STABILIZATION, SMALL DAM AND STRUCTURE REMOVALS): A MINIMUM OF THREE CROSS-SECTIONS – ONE DOWNSTREAM OF THE STRUCTURE, ONE THROUGH THE RESERVOIR AREA UPSTREAM OF THE STRUCTURE, AND ONE UPSTREAM OF THE RESERVOIR AREA OUTSIDE OF THE INFLUENCE OF THE STRUCTURE) TO CHARACTERIZE THE CHANNEL MORPHOLOGY AND QUANTIFY THE STORED SEDIMENT

This project does not address a profile discontinuity.

4.0 Construction – Contract Documentation

4.1 INCORPORATION OF HIP GENERAL AND CONSTRUCTION CONSERVATION MEASURES

The Walla Walla RM 32.5 project includes HIP IV specific activity conservation measures associated with:

- Work area isolation and fish salvage
- Action Category 2: River, Stream, Floodplain and Wetland Restoration, including:
  - 2A – Improve Secondary Channel and Floodplain Interactions
  - 2B – Set-Back or Removal of Existing Berms, Dikes and Levees
  - 2D – Install Habitat-Forming Natural Material Instream Structures
  - 2E – Riparian Vegetation Planting
- Action Category of Action (7): Irrigation and Water Delivery /Management Actions, including:
  - 7C – Convert Instream Diversions to Groundwater Wells for Primary Water Source

The conservation measures are included in Appendix A in the 6-series drawings.

4.2 DESIGN – CONSTRUCTION PLAN SET INCLUDING BUT NOT LIMITED TO PLAN, PROFILE, SECTION AND DETAIL SHEETS THAT IDENTIFY ALL PROJECT ELEMENTS AND CONSTRUCTION ACTIVITIES OF SUFFICIENT DETAIL TO GOVERN COMPETENT EXECUTION OF PROJECT BIDDING AND IMPLEMENTATION

See attached, Appendix A, for project design drawings.

4.3 LIST OF ALL PROPOSED PROJECT MATERIALS AND QUANTITIES/COST ESTIMATE

Table 12 includes the proposed project materials and quantities to be imported to the site.

TABLE 12. PROJECT MATERIALS AND QUANTITIES

SPECIFICATION(S)	ITEM DESCRIPTION	UNITS	NO. OF UNITS
320	Clearing, Grubbing, Stockpile and Disposal	AC	2
245	Temporary Work Area Isolation (Side Channels and LWM)	EA	25
330	Excavation and on-site disposal - Floodplain and Side Channel Grading	CY	44260
1091	Place Excavated Material - Side Channel Inlets	CY	600
1093	LWM Structure - Apex Jam	EA	6
1093	LWM Structure - Flow Deflection Jam	EA	11
1093	LWM Structure - Side Channel Post Structures	EA	9
1093	LWM Structure - Side Channel Single Logs, with Rootwad	EA	59
1093	LWM Structure - Side Channel Single Logs, No Rootwad	EA	68
1040	Willow Trench	LF	2000
1040	Planting	AC	5
1030	Seeding	AC	17
1100	Well Construction	EA	1

GeoEngineers calculated construction quantities and applied unit costs based on recent project experiences, engineering judgment and published documentation. We included a summary of the anticipated construction costs in Appendix D. The total anticipated construction cost is $3,030,000 in 2024 dollars, including a 15 percent contingency.

4.4 DESCRIPTION OF BEST MANAGEMENT PRACTICES THAT WILL BE IMPLEMENTED AND IMPLEMENTATION RESOURCE PLANS INCLUDING:

4.4.1 Site Access Staging and Sequencing Plan

See attached, Appendix A, for site access and staging plan. Construction sequencing plan to be developed at 60 percent design.

4.4.2 Work Area Isolation and Dewatering Plan

Work area isolation and construction sequencing plan to be developed at 60 percent design. See attached, Appendix A, for work isolation structures.

4.4.3 Erosion and Pollution Control Plan

See attached, Appendix A, for erosion and pollution control plan and details.

4.4.4 Site Reclamation and Restoration Plan

Site reclamation and restoration plan, including revegetation to be developed at 60 percent design.

4.4.5 List Proposed Equipment and Fuels Management Plan

Proposed equipment may include low ground-pressure machinery to minimize soil compaction and disturbance. The primary equipment will consist of tracked excavators and loaders or tracked skid steers. Modifications to this equipment configuration may be suggested by the earthwork contractor selected to implement the project. Fuel storage and refueling activities will be carefully managed, with fuel tanks and equipment staged a minimum of 150 feet away from the stream. See attached, Appendix A, for HIP conservation measures related to fuel management.

4.5 CALENDAR SCHEDULE FOR CONSTRUCTION/IMPLEMENTATION PROCEDURES

Construction of in-stream components is anticipated to occur in summer 2025 during an in-water work window established by regulatory agencies and is anticipated to be from July 15 through August 15 (U.S. Army Corps of Engineers 2010).

4.6 SITE OR PROJECT SPECIFIC MONITORING TO SUPPORT POLLUTION PREVENTION AND/OR ABATEMENT

The project will follow the BPA Conservation Methods for pollution prevention and abatement as put forth in the two biological opinions issued by the United States Fish and Wildlife Service and the National Marine Fisheries Service on the effects of BPA's Habitat Improvement Program (National Marine Fisheries Service 2020, U.S. Fish and Wildlife Service 2020).

5.0 Monitoring and Adaptive Management Plan

Monitoring and Adaptive Management Plan will be compiled during 60 percent design.

5.1 INTRODUCTION

5.2 EXISTING MONITORING PROTOCOLS

5.3 PROJECT EFFECTIVENESS MONITORING PLAN

5.4 PROJECT REVIEW TEAM TRIGGERS

5.5 MONITORING FREQUENCY, TIMING, AND DURATION

5.6 MONITORING TECHNIQUE PROTOCOLS

5.7 DATA STORAGE AND ANALYSIS

5.8 MONITORING QUALITY ASSURANCE PLAN

6.0 Limitations

We have prepared this report for CTUIR for the Walla Walla River RM 32.5 Floodplain Reconnection project located near Walla Walla, Washington. CTUIR may distribute copies of this report to their agents and regulatory agencies as may be required for the project.

Within the limitations of scope, schedule and budget, our services have been executed in accordance with generally accepted practices in the field of stream and river habitat enhancement, stabilization and restoration design engineering in this area at the time this report was prepared. The conclusions, recommendations and opinions presented in this report are based on our professional knowledge, judgment and experience. No warranty, express or implied, applies to our services and this report.

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7.0 References

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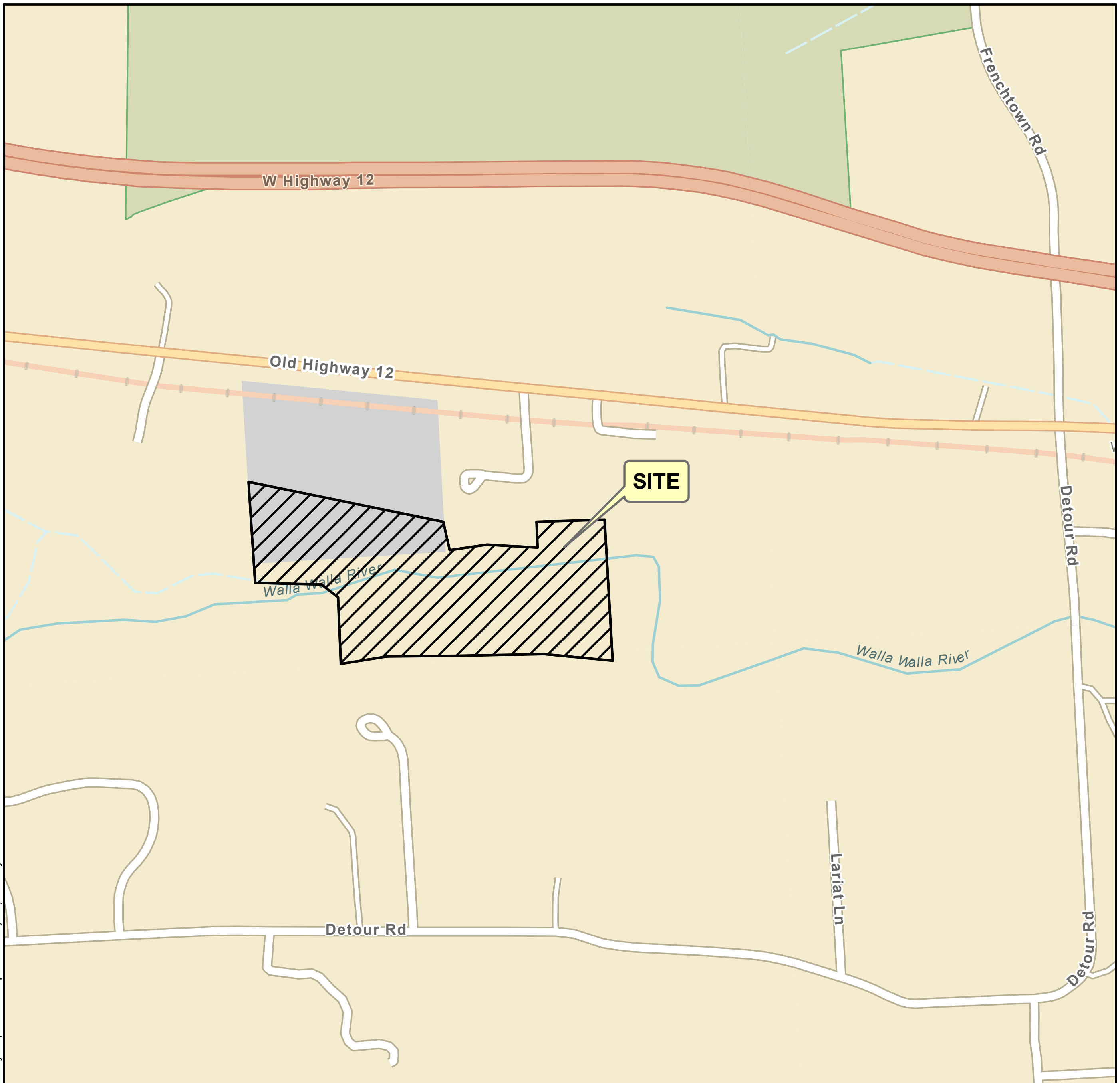
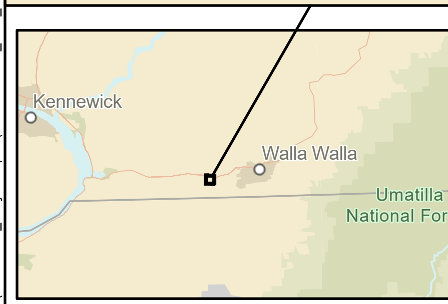
Figures





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Feet

Source(s):
- ESRI

Coordinate System: NAD 1983 UTM Zone 10N

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Vicinity Map	
Walla Walla RM 32.5 Floodplain Reconnection Walla Walla County, Washington	
GEOENGINEERS	**Figure 1**

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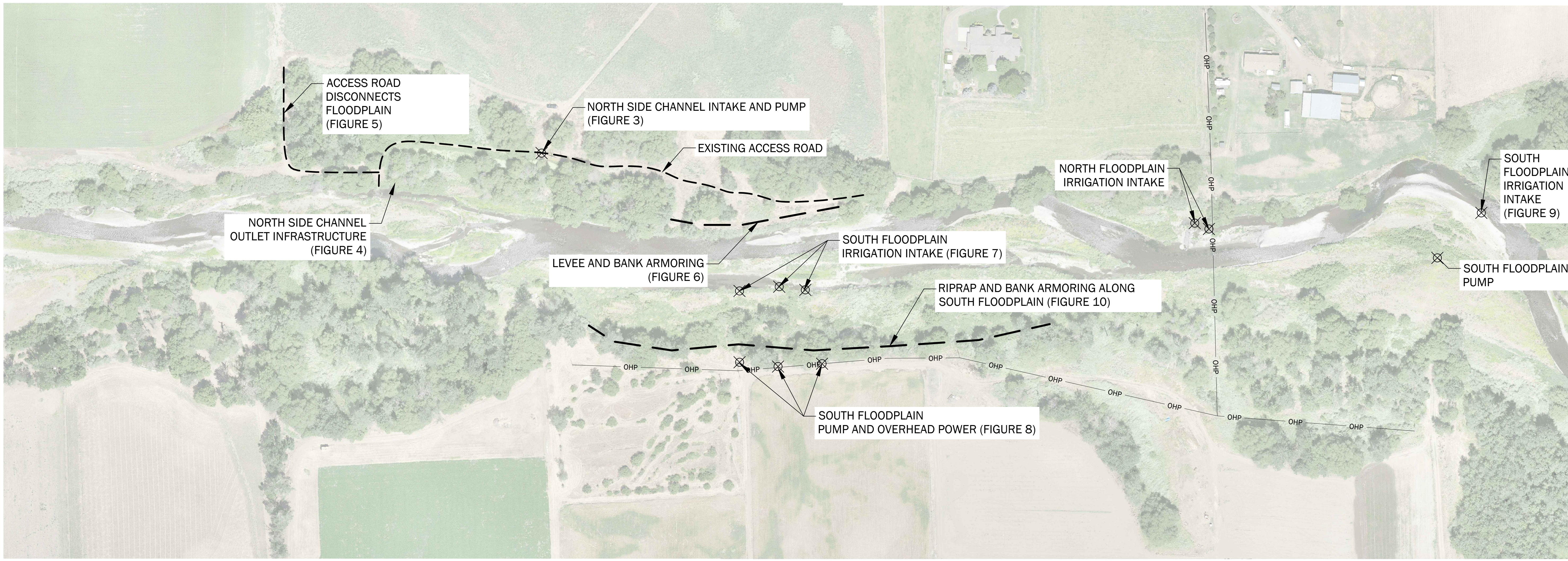

Source(s):
- Aerial from RSI collected June 2024

Coordinate System: WA State Plane, South Zone, NAD83, US Foot

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Legend

IRRIGATION INFRASTRUCTURE

OHP OVERHEAD POWER

ACCESS ROAD

LEVEE/BANK ARMORING

N

0 200

Feet

Existing Infrastructure

Walla Walla RM 32.5 Floodplain Reconnection
Walla Walla County, Washington

GEOENGINEERS

Figure 2

P:\2\2698037\CAD\00\Basis of Design Report\269803700_F02_Existing Infrastructure.dwg 2 Date Exported:9/17/2024 2:44 PM - by Becca H. Miller

Photograph 1. Irrigation Intake and Pump

Photograph 2. Existing Irrigation Infrastructure

Site Photographs – North Side Channel Irrigation Intake and Pump

Walla Walla RM 32.5 Floodplain Reconnection
Walla Walla County, Washington

GeoEngineers

Figure 3

02698-037-00 Date Exported: 11/15/2024

Photograph 3. Existing Structure at Side Channel Outlet

Photograph 4. Existing Structure at Side Channel Outlet

Site Photographs – North Side Channel Outlet

Walla Walla RM 32.5 Floodplain Reconnection
Walla Walla County, Washington

GeoEngineers

Figure 4

02698-037-00 Date Exported: 11/15/2024

Photograph 5. Berm and Road Adjacent to Existing Side Channel

Photograph 6. Access Road Disconnects Adjacent Floodplain

02698-037-00 Date Exported: 11/15/2024

Site Photographs – North Floodplain Access Road

Walla Walla RM 32.5 Floodplain Reconnection
Walla Walla County, Washington

GeoEngineers

Figure 5

Photograph 7. North Bank Levee

Photograph 8. North Bank Armoring

Site Photographs – North Side Channel Levee and Bank Armoring

Walla Walla RM 32.5 Floodplain Reconnection
Walla Walla County, Washington

GEOENGINEERS

Figure 6

02698-037-00 Date Exported: 11/15/2024

Photograph 9. Existing Irrigation Infrastructure

Photograph 10. Existing Irrigation Infrastructure

Site Photographs – South Floodplain Irrigation Infrastructure

Walla Walla RM 32.5 Floodplain Reconnection
Walla Walla County, Washington

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Figure 7

02698-037-00 Date Exported: 11/15/2024

Photograph 11. Existing Irrigation Infrastructure

Photograph 12. Existing Irrigation Infrastructure

Site Photographs – South Floodplain Irrigation Infrastructure

Walla Walla RM 32.5 Floodplain Reconnection
Walla Walla County, Washington

GEOENGINEERS

Figure 8

02698-037-00 Date Exported: 11/15/2024

Photograph 13. Existing Irrigation Diversion

Photograph 14. Existing Irrigation Diversion

Site Photographs – South Floodplain Irrigation Infrastructure

Walla Walla RM 32.5 Floodplain Reconnection
Walla Walla County, Washington

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Figure 9

02698-037-00 Date Exported: 11/15/2024

Photograph 15. South Floodplain Bank Armoring

Photograph 16. South Floodplain Bank Armoring

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Site Photographs – South Floodplain Bank Armoring

Walla Walla RM 32.5 Floodplain Reconnection
Walla Walla County, Washington

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Figure 10

02698-037-00 Date Exported: 11/15/2024

Photograph 17. North Bank Erosion

Photograph 18. North Bank Erosion

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Upstream Project Limits – Eroding Bend

Walla Walla RM 32.5 Floodplain Reconnection
Walla Walla County, Washington

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Figure 11

02698-037-00 Date Exported: 11/15/2024

Photograph 19. Walla Walla River

Photograph 20. Walla Walla River

Walla Walla – Main Channel

Walla Walla RM 32.5 Floodplain Reconnection
Walla Walla County, Washington

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Figure 12

Photograph 21. Walla Walla Bank Material

Photograph 22. Streambed Material

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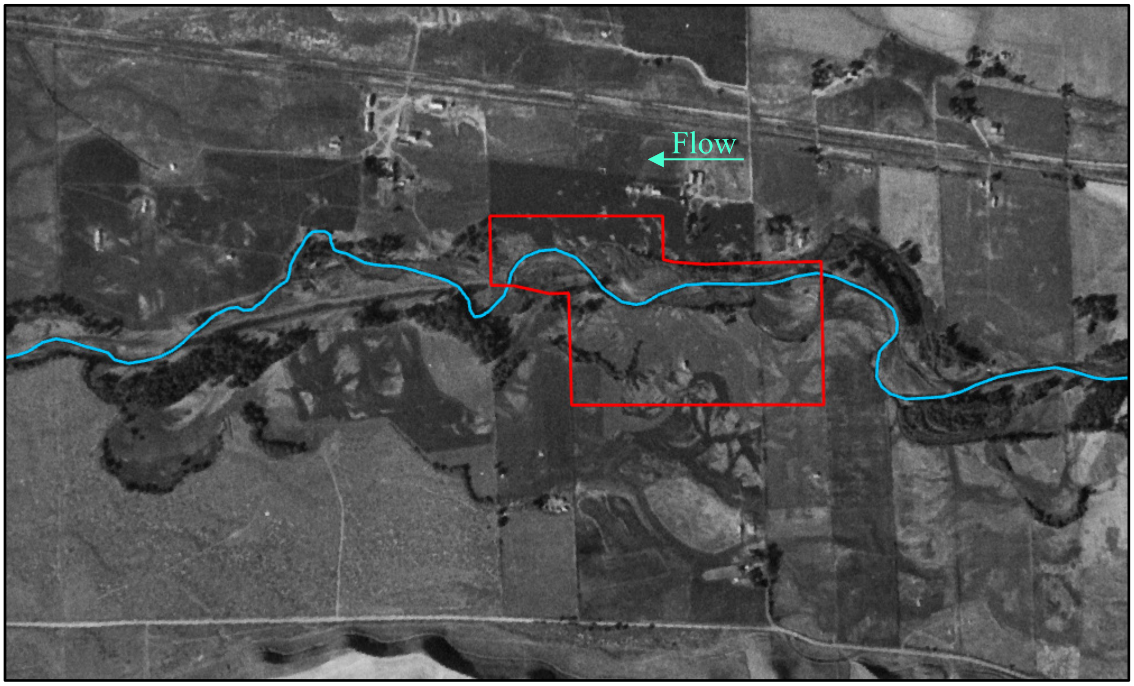
Walla Walla – Main Channel

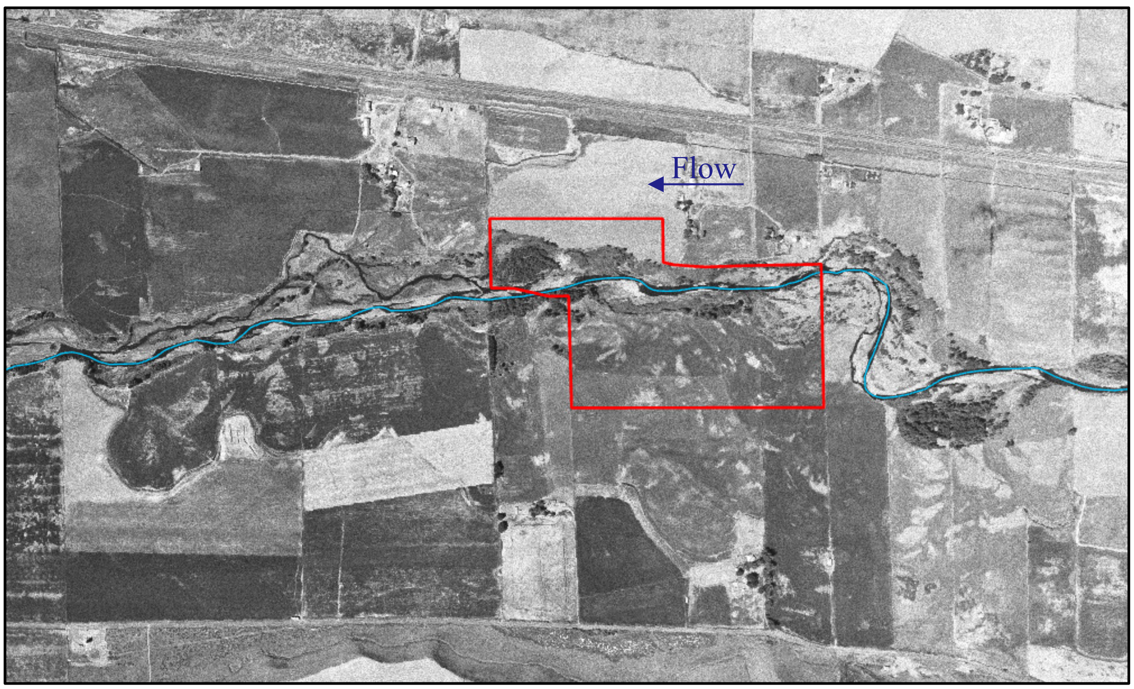
Walla Walla RM 32.5 Floodplain Reconnection
Walla Walla County, Washington

GEOENGINEERS

Figure 13



Photograph 23. 1952 Aerial photograph with 1952 river centerline in blue and approximate project area in red. Notice the linear feature downstream of the project area but wide meander belt still present.



Photograph 24. 1964 Aerial photograph with 1964 river centerline in blue and approximate project area in red. Notice straight channel with limited meander amplitudes downstream of project area roughly aligned with the linear feature in the 1952 aerial. Meanders at downstream end of the project area have been cut off and straightened.

Source:. 1952 and 1964 aerial photo from USGS

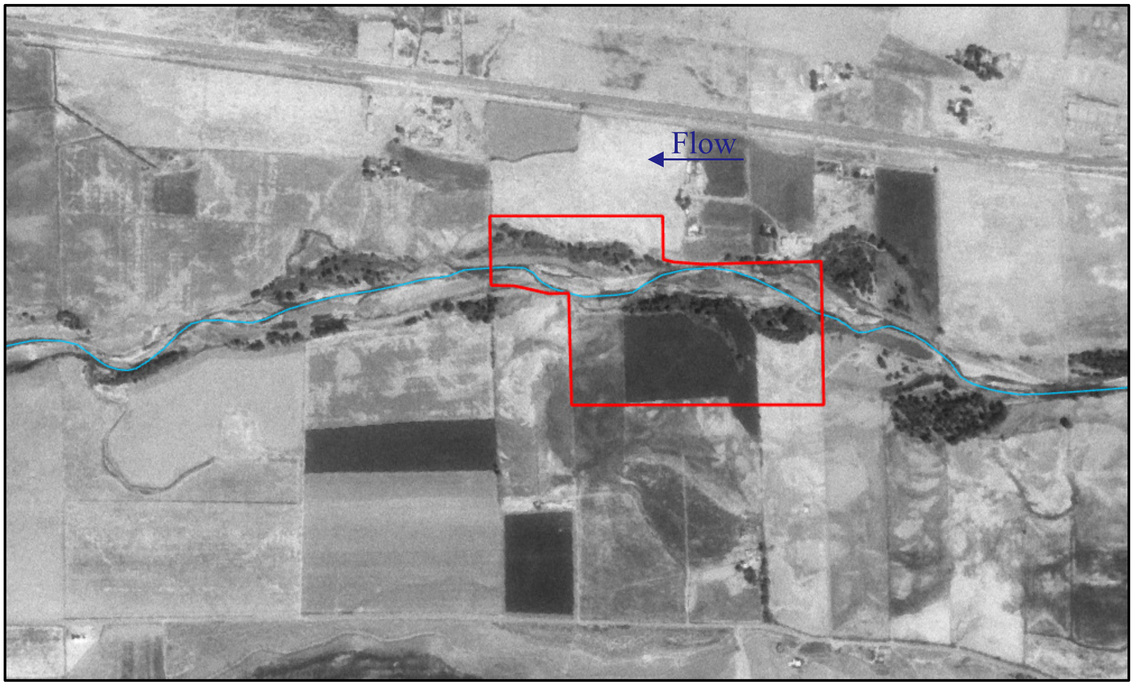
Walla Walla – Historical Aerial Photographs

Walla Walla RM 32.5 Floodplain Reconnection
Walla Walla County, Washington

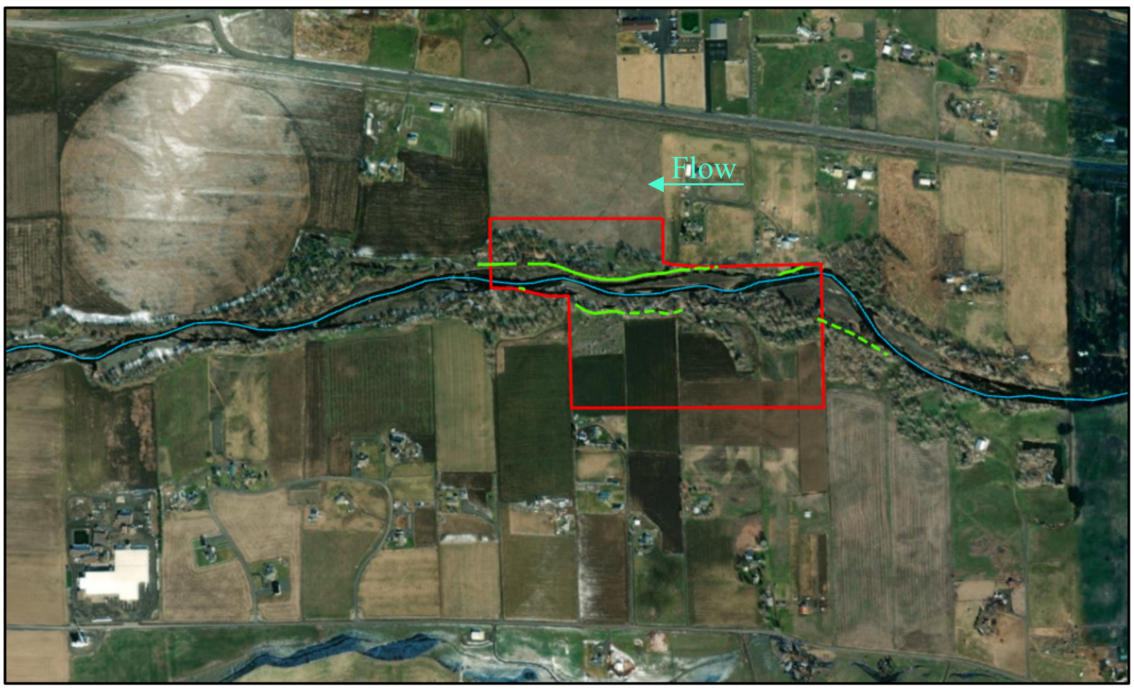
GeoEngineers

Figure 14

02698-037-00 Date Exported: 11/15/2024



Photograph 25. 1976 Aerial photograph with 1976 river centerline in blue and approximate project area in red. The two large meanders upstream of the project area in the 1964 aerial have been cut off and the river straightened.



Photograph 26. 2022 Aerial photograph with 2022 river centerline in blue, approximate project area in red, and revetments in green. Solid green are observed revetments, dashed are suspected.

Source:. 1976 aerial photo from USGS; 2022 aerial photo from ESRI Wayback World Imagery

Walla Walla – Historical Aerial Photographs

Walla Walla RM 32.5 Floodplain Reconnection
Walla Walla County, Washington

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Figure 15

02698-037-00 Date Exported: 11/15/2024

Appendices

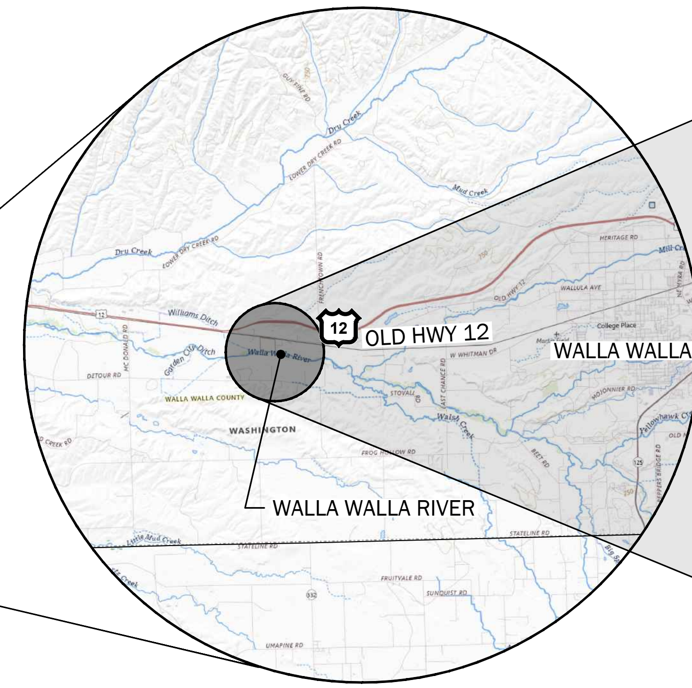
Appendix A

Walla Walla River RM 32.5 Floodplain Reconnection
30 Percent Design Drawings

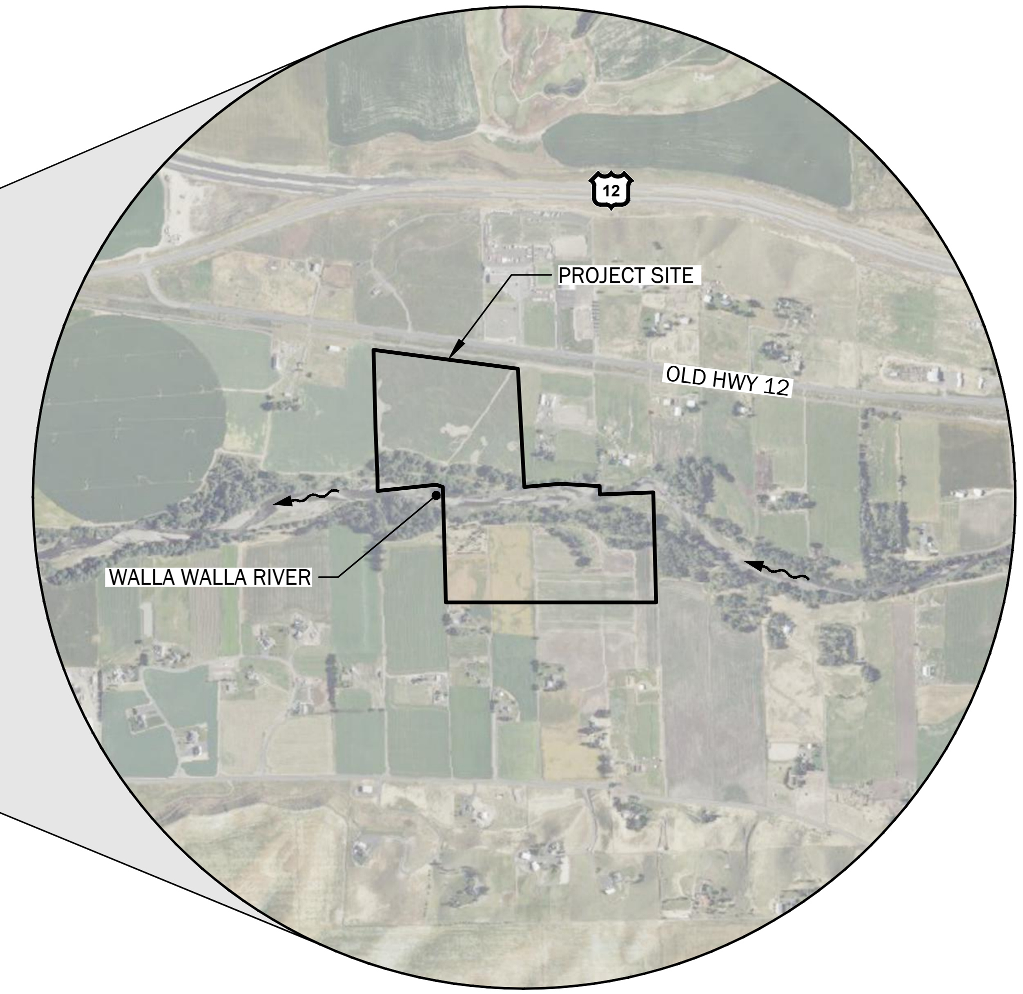
WALLA WALLA RM 32.5 FLOODPLAIN RECONNECTION 30% DESIGN

WALLA WALLA COUNTY, WASHINGTON

PROJECT LOCATION



NOT TO SCALE



NOT TO SCALE

THIS PROJECT WAS DESIGNED IN ACCORDANCE WITH THE BPA HABITAT IMPROVEMENT PROGRAM, PROGRAMMATIC BIOLOGICAL OPINION (HIP4)

ALL IN-WATER WORK TO BE COMPLETED DURING AN APPROVED IN-WATER WORK WINDOW, JULY 15 TO AUGUST 15.

Sheet Index

Sheet Number	Drawing Number	Sheet Title
1	1.0	Cover Sheet
2	1.1	General Construction Notes, Quantities and Project Vision
3	2.0	Existing Conditions Overview, Access and Staging
4	2.1	Temporary Erosion and Sediment Control Plan
5	2.2	Temporary Erosion and Sediment Control Details
6	2.3	Temporary Erosion and Sediment Control Details
7	3.0	Proposed Conditions Overview
8	3.1	Proposed Conditions Plan
9	3.2	Proposed Conditions Plan
10	3.3	Proposed Floodplain Sections

Sheet Index

Sheet Number	Drawing Number	Sheet Title
11	4.0	Side Channel 1 Grading
12	4.1	Side Channel 2 Grading
13	4.2	Side Channel 3 Grading
14	4.3	Side Channel 4 Grading
15	5.0	Typical Habitat Details
16	5.1	Typical Habitat Details
17	5.2	Typical Habitat Details
18	5.3	Typical Habitat Details
19	6.0	HIP IV - General Conservation Measures
20	6.1	HIP IV - General Conservation Measures
21	6.2	HIP IV - General Conservation Measures

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BECCA H. MILLER, PE
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PRELIMINARY

DRAFT SUBMITTAL - NOT FOR CONSTRUCTION

NO.	DATE	BY	ISSUE / DESCRIPTION

DESIGNED BY: BHM/KHR
DRAWN BY: KHR/SCY
APPROVED BY: JRS
REVISION NO.: ----
DATE: 12/2/24

GEOENGINEERS

PREPARED FOR:

WALLA WALLA RM 32.5 FLOODPLAIN RECONNECTION
WALLA WALLA COUNTY, WASHINGTON

COVER SHEET

DRAWING NUMBER: 1.0

SHEET: 1 OF 21

Plotted: 11/27/2024, 11:28 | bmiller P:\2\2698037\CAD\00\Floodplain and Habitat Restoration Design\v02_30_Percent\269803700_Sht 1_1.0 [Cover Sheet].dwg

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4. CTUIR IS ADVISED TO CONTACT AND TO OBTAIN THE NECESSARY PERMITS AND APPROVALS FROM ALL APPROPRIATE REGULATORY AGENCIES (LOCAL, STATE, AND FEDERAL) PRIOR TO CONSTRUCTION.
5. GEOMORPHIC CONDITIONS CAN CHANGE AND THESE DESIGNS ARE BASED ON CONDITIONS THAT EXISTED AT THE TIME THE DESIGN WAS PERFORMED. THE RESULTS OF THESE DESIGNS MAY BE AFFECTED BY THE PASSAGE OF TIME, BY MANMADE EVENTS SUCH AS CONSTRUCTION ON OR ADJACENT TO THE SITE, OR BY NATURAL EVENTS SUCH AS FLOODS, EARTHQUAKES, SLOPE INSTABILITY OR GROUNDWATER FLUCTUATIONS. ALWAYS CONTACT GEOENGINEERS BEFORE APPLYING THESE DESIGNS TO DETERMINE IF THEY REMAIN APPLICABLE.
6. ALL RIVERS, STREAMS, ROCKS AND FISH PASSAGE STRUCTURES ARE POTENTIALLY DANGEROUS. THESE PROPOSED STREAM IMPROVEMENTS ARE INTENDED TO ADDRESS FISH HABITAT. THESE STRUCTURES ARE INHERENTLY DANGEROUS TO PEOPLE IN OR AROUND THEM. CTUIR AND THE PROPERTY OWNER SHOULD ADDRESS SAFETY CONCERNS APPROPRIATELY.
7. POTENTIAL REGULATORY CHANGES TO FLOOD ELEVATIONS AND FLOOD EXTENTS RESULTING FROM THE PROPOSED ENHANCEMENTS ARE BEING ADDRESSED BY GEOENGINEERS AS PART OF THIS PROJECT.
8. IN GENERAL, THE PROPOSED ENHANCEMENTS ARE INTENDED TO RESULT IN MORE STABLE STREAMBEDS, BANKS AND FLOODPLAINS. HOWEVER, CHANNEL EROSION, CHANNEL MIGRATION AND/OR AVULSIONS CAN BE EXPECTED TO OCCUR OVER TIME. THESE CHANNEL PROCESSES ARE NATURAL AND APPROPRIATE FOR THESE STREAM SYSTEMS.
9. DESIGN SPECIFICS FOR STRUCTURES SHALL BE CONFIRMED AND/OR VERIFIED BY A QUALIFIED GEOENGINEERS STAFF MEMBER PRIOR TO OR DURING CONSTRUCTION AT EACH PROPOSED STRUCTURE LOCATION.
10. THESE FIGURES WERE ORIGINALLY PRODUCED IN COLOR.
11. BACKGROUND AERIAL FROM BING AND RSI 2024 SURVEY. TOPOGRAPHIC DATA FROM RSI SURVEY JUNE 2024, BLENDED WITH 2021 LIDAR.
12. PARCEL LINES PROVIDED BY CTUIR.

CONSTRUCTION NOTES:

1. ALL CONTRACTORS WORKING WITHIN THE PROJECT BOUNDARIES ARE RESPONSIBLE FOR COMPLIANCE WITH ALL APPLICABLE SAFETY LAWS. THE CONTRACTOR SHALL BE RESPONSIBLE FOR ALL BARRICADES, SAFETY DEVICES AND CONTROL OF TRAFFIC WITHIN AND AROUND THE CONSTRUCTION AREA.
2. ALL MATERIAL AND WORKMANSHIP FURNISHED ON OR FOR THE PROJECT MUST MEET THE MINIMUM REQUIREMENTS OF PROJECT PERMITS, APPROVING AGENCIES, SPECIFICATIONS AS SET FORTH HEREIN, OR WHICHEVER IS MORE RESTRICTIVE.
3. ALL FEDERAL, STATE AND LOCAL PERMITS SHALL BE OBTAINED BY THE CLIENT PRIOR TO CONSTRUCTION ACTIVITY COMMENCEMENT.
4. THE CONTRACTOR SHALL INSTALL AND MAINTAIN APPROPRIATE EROSION AND SEDIMENT CONTROL DEVICES THROUGHOUT THE WHOLE PROJECT SITE, INCLUDING THOSE ASSOCIATED WITH CONSTRUCTION ACCESS, STAGING AND STOCKPILE AREAS THROUGHOUT THE PROJECT'S CONSTRUCTION PERIOD. TEMPORARY CONSTRUCTION AND PERMANENT EROSION CONTROL MEASURES SHALL BE DESIGNED, CONSTRUCTED AND MAINTAINED IN ACCORDANCE WITH ALL APPLICABLE LOCAL, STATE AND FEDERAL REGULATIONS.
5. CONSTRUCTION ACTIVITY SHALL BE LIMITED TO THE CONSTRUCTION AREAS AND ACCESS ROUTES TO MINIMIZE DISTURBANCE OF THE EXISTING VEGETATION AND LANDSCAPE. ALL PUBLIC AND PRIVATE PROPERTY EITHER INSIDE OR OUTSIDE THE CONSTRUCTION LIMITS IMPACTED BY CONSTRUCTION SHALL BE RESTORED TO A CONDITION EQUAL TO OR BETTER THAN THAT WHICH EXISTED PRIOR TO THE CONSTRUCTION. NO CONSTRUCTION-RELATED MATERIALS, DEBRIS, GARBAGE, EQUIPMENT, FUEL, PROVISIONS OF ANY KIND SHALL REMAIN ON SITE AFTER CONSTRUCTION. NO STOCKPILES OR EXCAVATIONS ARE TO REMAIN AFTER CONSTRUCTION UNLESS AUTHORIZED BY THE LANDOWNER. THE SITE WILL BE GRADED TO APPEAR NATURAL AND CONFORM TO THE NATURAL TOPOGRAPHY.
6. CONSTRUCTION SHALL MINIMIZE DISTURBANCE TO, AND MAXIMIZE REUSE OF, EXISTING RIPARIAN VEGETATION TO REMAIN AND SALVAGE.
7. ONLY APPROPRIATE APPROVED NATIVE RIPARIAN VEGETATION SHALL BE USED FOR CUTTINGS AND TRANSPLANTING. VEGETATION CUTTING, TRANSPLANTING, PLANTING AND IRRIGATION SHALL BE MANAGED BY AN APPROPRIATE PROFESSIONAL.
8. CONSTRUCTION RECORDS AND AS-BUILT INFORMATION SHALL BE ACCURATELY RECORDED BY THE CONTRACTOR AND SUPPLIED TO THE OWNER AND GEOENGINEERS FOR REFERENCE AND MONITORING. SUBMITTAL OF RECORD INFORMATION IS A CONDITION OF FINAL ACCEPTANCE.
9. THIS DESIGN HAS BEEN PERFORMED AND THESE PLANS HAVE BEEN PREPARED WITH THE EXPRESS UNDERSTANDING THAT GEOENGINEERS WILL PROVIDE GUIDANCE TO THE CONTRACTOR DURING CONSTRUCTION.

VISION:
IMPROVE IN-STREAM HABITAT FOR ENDANGERED SPECIES ACT (ESA)-LISTED AND NON-ESA-LISTED NATIVE FISH SPECIES, WHILE BENEFITING NATURAL CHANNEL MORPHOLOGY AND IN-STREAM PROCESSESS.

PROJECT GOAL:
THE GOAL OF THE PROJECT IS TO ADDRESS THE PRIMARY LIMITING FACTORS IDENTIFIED FOR THE WALLA WALLA RIVER IN THE 2008 FISH ACCORDS, INCORPORATING THE PRIMARY TOUCHSTONES DESCRIBED IN THE 2008 UMATILLA RIVER VISION (JONES ET. AL., 2008) AND CONSISTENT WITH THE MID-COLUMBIA STEELHEAD RECOVERY PLAN (NOAA, 2009) AND THE WALLA WALLA SUBBASIN PLAN (NPCC, 2004).

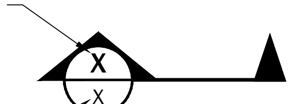
Item #	Specification(s)	Item Description	Units	No. of Units
1	280 & 290	Environmental Controls - Permit Compliance-Best Management Practices	LS	1
2	210	Mobilization and Demobilization	LS	1
3	320	Clearing, Grubbing, Stockpile and Disposal	AC	2
4	245	Temporary Work Area Isolation (Side Channels and LWM)	EA	21
5	330	Excavation and on-site disposal - Floodplain and Side Channel Grading	CY	44260
6	1091	Place Excavated Material - Side Channel Inlets	CY	600
7	1093	LWM Structure - Apex Jam	EA	6
8	1093	LWM Structure - Flow Deflection Jam	EA	11
9	1093	LWM Structure - Side Channel Post Structures	EA	9
10	1093	LWM Structure - Side Channel Single Logs, with Rootwad	EA	59
11	1093	LWM Structure - Side Channel Single Logs, No Rootwad	EA	68
12	1040	Willow Trench	LF	2000
13	1040	Planting	AC	5
14	1030	Seeding	AC	17
16	1100	Well Construction	LS	1

TYPE	DESCRIPTION	TOTAL
TYPE A	LARGE LOG WITH ROOTWAD - 18 TO 24-IN DBH. 35 TO 40 FT LONG	148
TYPE B	MEDIUM LOG WITH ROOTWAD - 12 TO 16-IN DBH. 25 TO 30 FT LONG	86
TYPE C	LARGE LOG NO ROOTWAD - 12 TO 16-IN DIA. 30 TO 35 FT LONG	90
PILE	15-IN AVG DIA. (MIN. 12-IN/MAX 18-IN) 15 FT LONG	108
VERTICAL POST	4 TO 6-IN AVG DIA. 8 FT LONG	108
LARGE RACKING LOG	8 TO 12-IN AVG DIA. 10 TO 15 FT LONG	411
SMALL RACKING LOG	4 TO 8-IN AVG. DIA. 6 TO 15 FT LONG	138
SLASH	LESS THAN 6-IN DIA. VARIABLE LENGTH	262
ROPE CONNECTION	MIN. 8,000LB BREAKING STRENGTH	148

SURVEY DATUM:

HORIZONTAL DATUM: NAD83 WASHINGTON STATE PLANE, SOUTH ZONE, US FOOT.

VERTICAL DATUM: NORTH AMERICAN VERTICAL DATUM 1988 (US FEET).



REBECCA H. MILLER
STATE OF WASHINGTON
56754
REGISTERED
PROFESSIONAL ENGINEER
PRELIMINARY

DRAFT SUBMITTAL - NOT FOR CONSTRUCTION

NO.	DATE	BY	ISSUE / DESCRIPTION

DESIGNED BY:	BHM/KHR
DRAWN BY:	KHR/SCY
APPROVED BY:	JRS
REVISION NO.:	----
DATE:	12/2/24

GEOENGINEERS

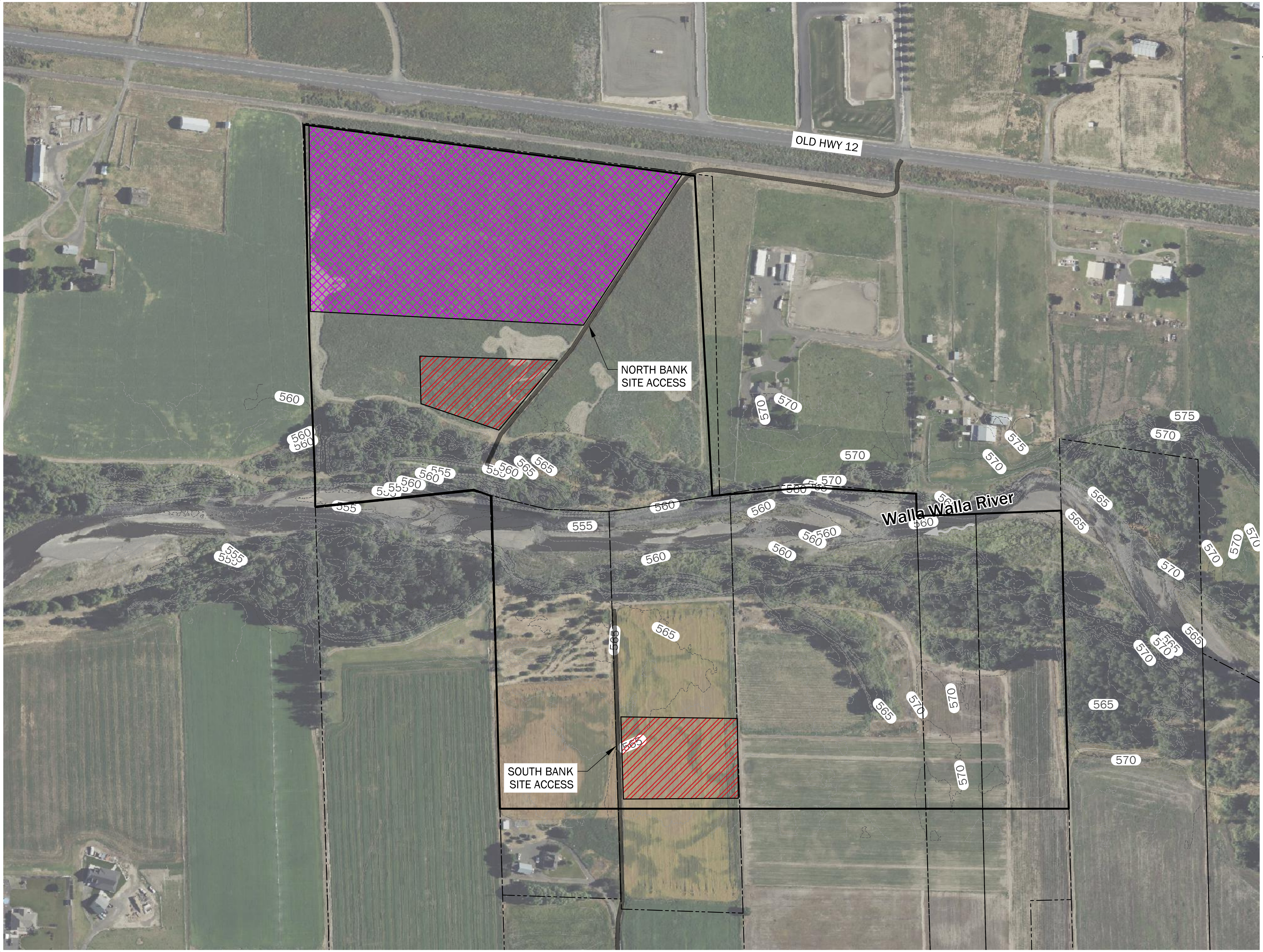
PREPARED FOR:

WALLA WALLA RM 32.5 FLOODPLAIN RECONNECTION
WALLA WALLA COUNTY, WASHINGTON

GENERAL CONSTRUCTION NOTES, QUANTITIES AND PROJECT VISION

DRAWING NUMBER:
1.1
SHEET: 2 OF 21

Plotted: 11/27/2024, 11:28 | bmiller P:\2\2698037\CAD\00\Floodplain and Habitat Restoration Design\v02_30_Percent\269803700_Sht 2_1.1 [General Construction Notes].dwg



LEGEND (EXISTING)

- EXISTING MAJOR (5-FT) CONTOUR LINE
- EXISTING MINOR (1-FT) CONTOUR LINE
- PROJECT SITE BOUNDARY
- FLOW DIRECTION
- PARCEL BOUNDARY

LEGEND (PROPOSED)

- TEMPORARY CONSTRUCTION ACCESS
- TEMPORARY CONSTRUCTION STAGING
- PERMANENT STOCKPILING LOCATION

NOTES:

1. NORTH SITE ACCESS FROM OLD HIGHWAY 12 AND SOUTH SITE ACCESS FROM DETOUR ROAD. TEMPORARY ACCESS ROUTES SHALL MINIMIZE DISTURBANCE TO NATIVE VEGETATION AND THE PRIVATE PROPERTY. PRIVATE ROADS AND DRIVEWAYS MUST BE CLEAR OF ALL CONSTRUCTION DEBRIS AT ALL TIMES AND SHALL NOT DISRUPT PROPERTIES OWNER'S ACCESS FOR DAILY OPERATIONS. ROADS SHALL BE RESTORED TO THE EXISTING CONDITIONS OR BETTER PRIOR TO COMPLETION OF THE PROJECT.
2. ESTABLISH GRADING AND STOCKPILE LOCATIONS AS SHOWN. STAGING AREAS FOR EQUIPMENT AND FUELING SHALL BE A MINIMUM OF 150 FEET FROM ANY NATURAL WATER BODY OR WETLAND. INSTALL PERIMETER SEDIMENT CONTROLS PER DRAWING 2.1 AND 2.2.
3. GRADE PERMANENT STOCKPILE AREA TO APPEAR NATURAL AND GRADUALLY TRANSITION INTO THE SURROUNDING GRADE. FILL HEIGHT SHALL NOT EXCEED 3.0 FEET. SEED FOLLOWING CONSTRUCTION. STOCKPILE AREA SHALL NOT INCLUDE LARGE ROCK. LARGE ROCK SHALL BE HAULED OFF-SITE FOR DISPOSAL.
4. ALL IN-WATER WORK TO BE COMPLETED DURING AN APPROVED IN-WATER WORK WINDOW, JULY 15 TO AUGUST 15.
5. REFER TO DRAWINGS 6.0 TO 6.2 FOR HIP GENERAL CONSERVATION MEASURES APPLICABLE TO ALL ACTIONS.

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GRAPHIC SCALE IN FEET

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APPROVED BY: JRS
REVISION NO.: ---
DATE: 12/2/24

GEOENGINEERS

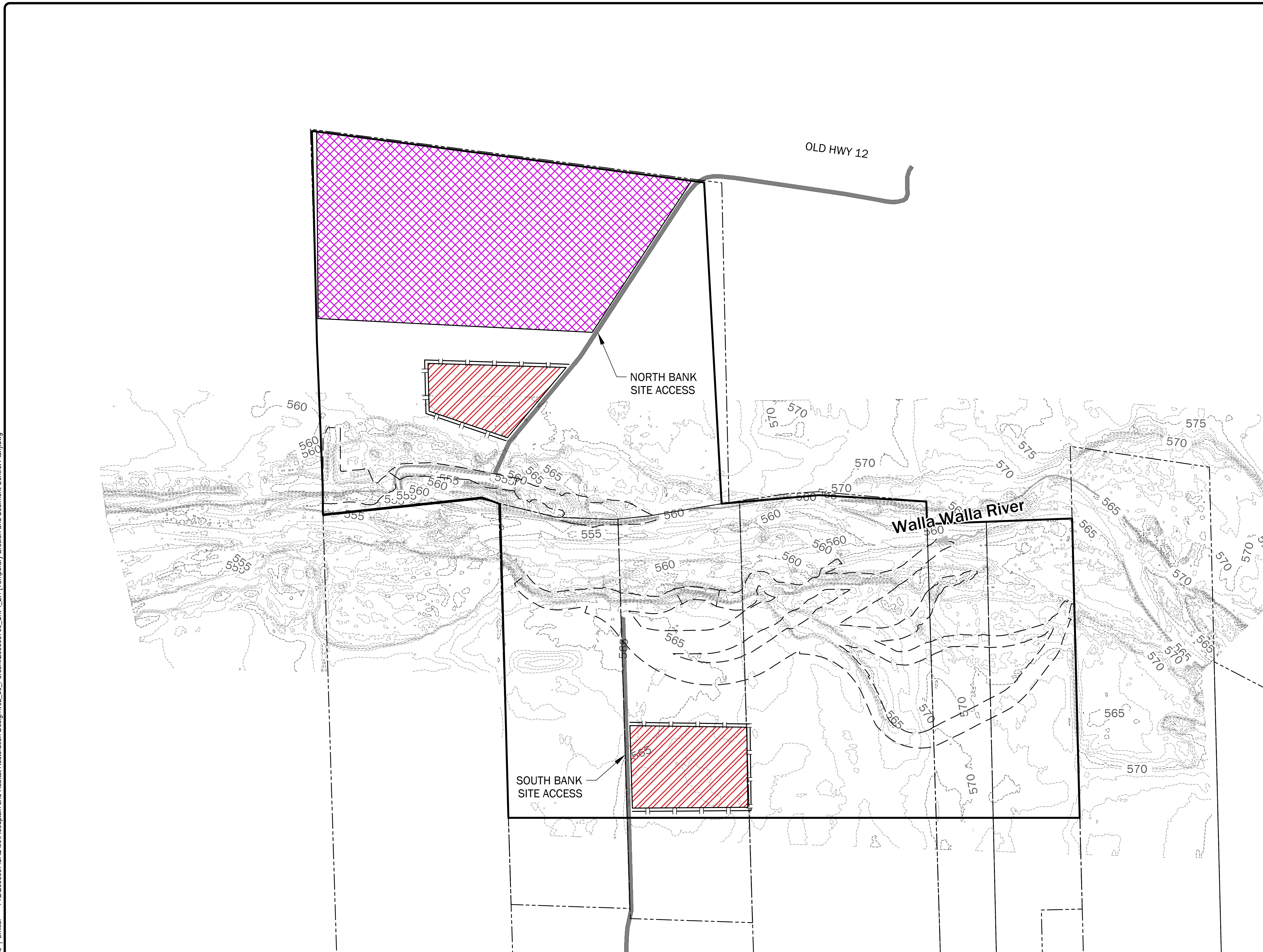
PREPARED FOR:

WALLA WALLA RM 32.5 FLOODPLAIN RECONNECTION
WALLA WALLA COUNTY, WASHINGTON

EXISTING CONDITIONS OVERVIEW, ACCESS AND STAGING

DRAWING NUMBER:
2.0
SHEET: 3 OF 21

Plotted: 11/27/2024, 11:29 | bmiller P:\2\2698037\CAD\00\Floodplain and Habitat Restoration Design\v02_30_Percent\269803700_Sht 3_2.0 [Existing Conditions Overview].dwg



LEGEND (EXISTING)

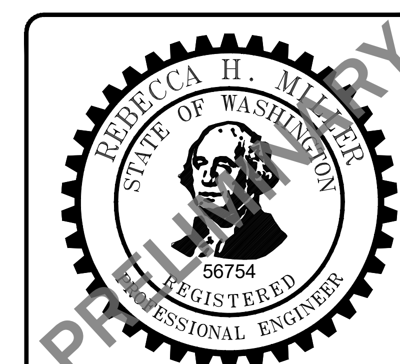
- EXISTING MAJOR (5-FT) CONTOUR LINE
- EXISTING MINOR (1-FT) CONTOUR LINE
- PROJECT SITE BOUNDARY
- FLOW DIRECTION
- PARCEL BOUNDARY

LEGEND (PROPOSED)

- TEMPORARY CONSTRUCTION ACCESS
- TEMPORARY CONSTRUCTION STAGING
- PERMANENT STOCKPILING LOCATION
- LIMITS OF GRADING
- SILT FENCE

NOTES:

1. REFER TO DRAWINGS 6.0 TO 6.2 FOR HIP GENERAL CONSERVATION MEASURES APPLICABLE TO ALL ACTIONS.
2. THE CONSTRUCTION, MAINTENANCE, REPLACEMENT, AND UPGRADING OF THE EROSION AND SEDIMENT CONTROL (ESC) STRUCTURES IS THE RESPONSIBILITY OF THE LEAD ESC CONTRACTOR UNTIL ALL CONSTRUCTION IS COMPLETE AND APPROVED.
3. ESC FACILITIES SHOWN ON THIS SHEET ARE THE MINIMUM REQUIREMENTS FOR ANTICIPATED SITE CONDITIONS. DURING THE CONSTRUCTION PERIOD, THESE ESC FACILITIES SHALL BE UPGRADED AS NEEDED FOR UNEXPECTED STORM EVENTS TO ENSURE THAT WATER MEETS WASHINGTON STATE WATER QUALITY STANDARDS.
4. THE ESC FACILITIES SHALL BE INSPECTED BY THE CONTRACTOR DAILY AND MAINTAINED AS NECESSARY TO ENSURE THEIR PROPER PERFORMANCE THROUGHOUT THE DURATION OF CONSTRUCTION. ANY DAMAGE SHALL BE REPAIRED IMMEDIATELY.



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APPROVED BY:	JRS
REVISION NO.:	---
DATE:	12/2/24

GEOENGINEERS

PREPARED FOR:

WALLA WALLA RM 32.5 FLOODPLAIN RECONNECTION
WALLA WALLA COUNTY, WASHINGTON

TEMPORARY EROSION AND SEDIMENT CONTROL PLAN

DRAWING NUMBER:

2.1

SHEET: 4 OF 21

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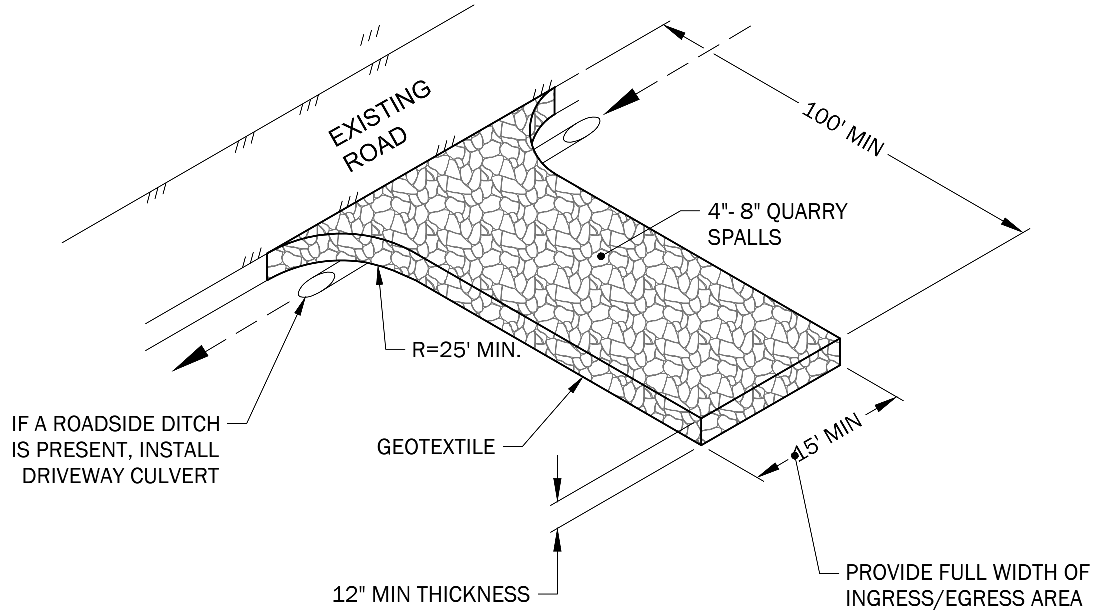
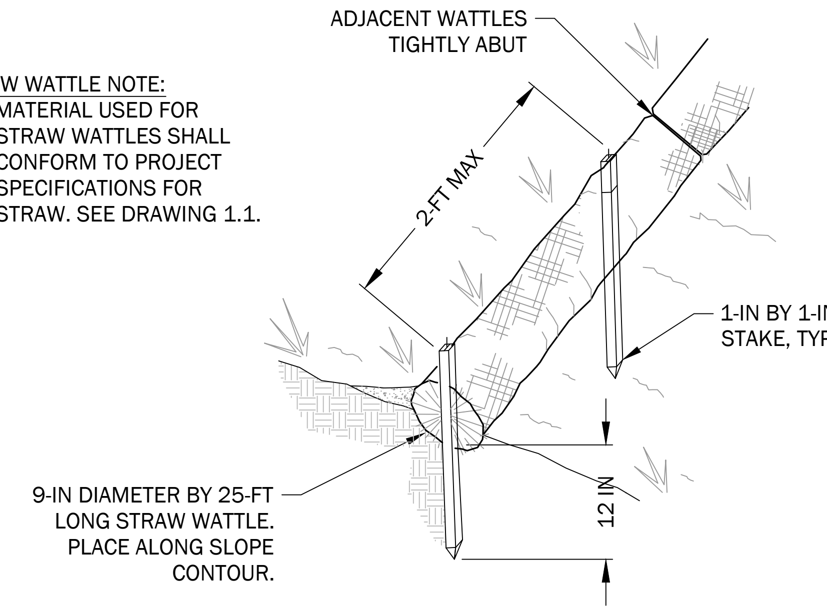


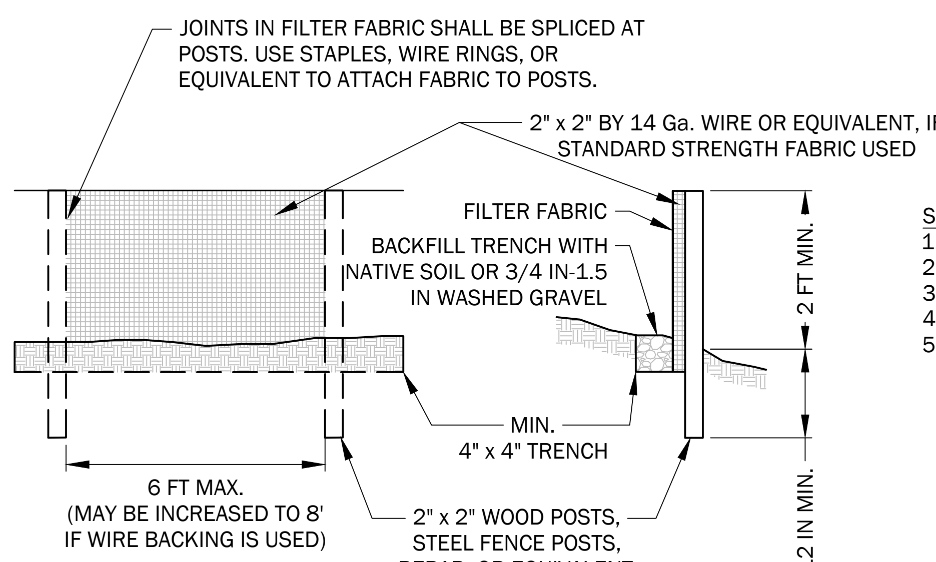
STABILIZED CONSTRUCTION ENTRANCE DETAIL 1 / 2.2
SCALE: NOT TO SCALE

STABILIZED CONSTRUCTION ENTRANCE NOTES:
1. THE ENTRANCE SHALL BE MAINTAINED IN A CONDITION THAT WILL PREVENT TRACKING OR FLOWING OF SEDIMENT ONTO PUBLIC RIGHT-OF-WAYS. THIS MAY REQUIRE TOP DRESSING, REPAIR AND/OR CLEAN OUT OF ANY MEASURES USED TO TRAP SEDIMENT.
2. WHEN NECESSARY, WHEELS SHALL BE CLEANED PRIOR TO ENTRANCE ONTO PUBLIC RIGHT-OF- WAY.
3. WHEN WASHING IS REQUIRED, IT SHALL BE DONE ON AN AREA STABILIZED WITH CRUSHED STONE THAT DRAINS INTO AN APPROVED SEDIMENT TRAP OR SEDIMENT BASIN.
4. WHERE RUNOFF CONTAINING SEDIMENT LADEN WATER IS LEAVING THE SITE VIA THE CONSTRUCTION ENTRANCE, OTHER MEASURES SHALL BE IMPLEMENTED TO DIVERT RUNOFF THROUGH AN APPROVED FILTERING SYSTEM.

STRAW WATTLE NOTE:
1. MATERIAL USED FOR STRAW WATTLES SHALL CONFORM TO PROJECT SPECIFICATIONS FOR STRAW. SEE DRAWING 1.1.



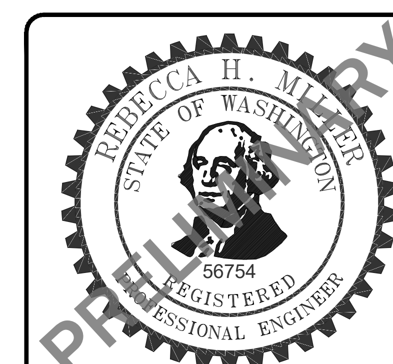
STRAW WATTLE 2 / 2.2
SCALE: NOT TO SCALE



NOTE:
1. FILTER FABRIC FENCES SHALL BE INSTALLED ALONG CONTOUR WHENEVER POSSIBLE.

SEDIMENT FENCE DETAIL 3 / 2.2
SCALE: NOT TO SCALE

SEDIMENT FENCE NOTES:
1. SEDIMENT FENCE TO HAVE STITCHED LOOPS AROUND 2" x 2" POSTS.
2. BURY BOTTOM OF FILTER FABRIC 6" VERTICALLY BELOW FINISHED GRADE.
3. 3'MINx2"x 2" FIR, PINE OR STEEL FENCE POSTS.
4. POSTS TO BE INSTALLED ON UPHILL SIDE OF SLOPE.
5. COMPACT BOTH SIDES OF FILTER FABRIC TRENCH.



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DATE:	12/2/24

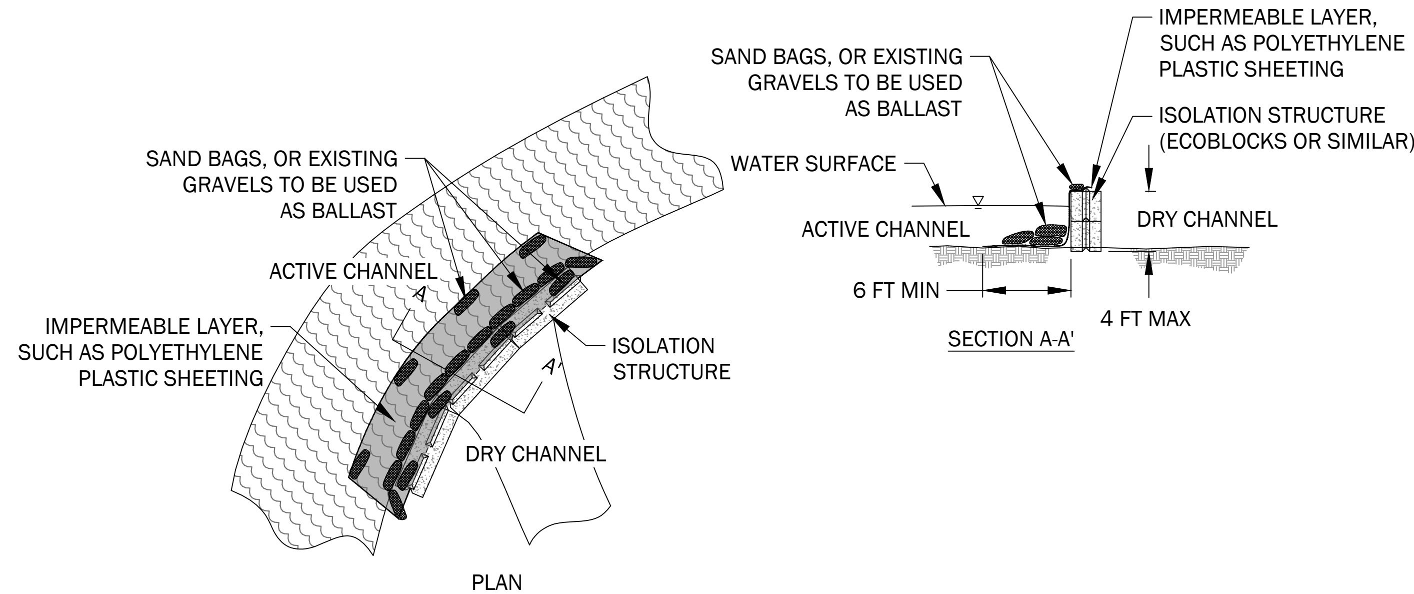
GEOENGINEERS

PREPARED FOR:

WALLA WALLA RM 32.5 FLOODPLAIN RECONNECTION
WALLA WALLA COUNTY, WASHINGTON

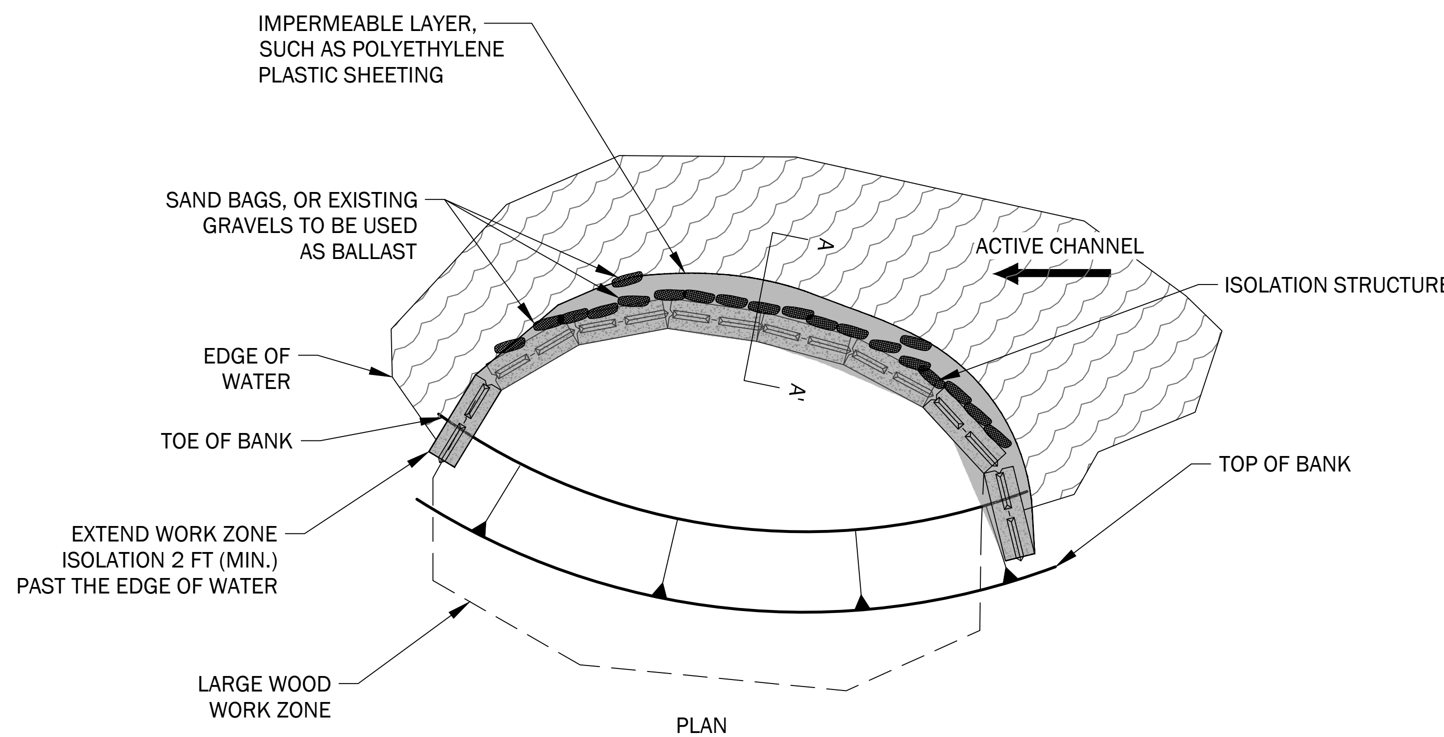
TEMPORARY EROSION AND SEDIMENT CONTROL DETAILS

DRAWING NUMBER: 2.2
SHEET: 5 OF 21



SIDE CHANNEL WORK ZONE ISOLATION STRUCTURE 1 / 2.3

SCALE: NOT TO SCALE



LARGE WOOD WORK ZONE ISOLATION STRUCTURE 2 / 2.3

SCALE: NOT TO SCALE

REBECCA H. MILLER
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GEOENGINEERS

PREPARED FOR:

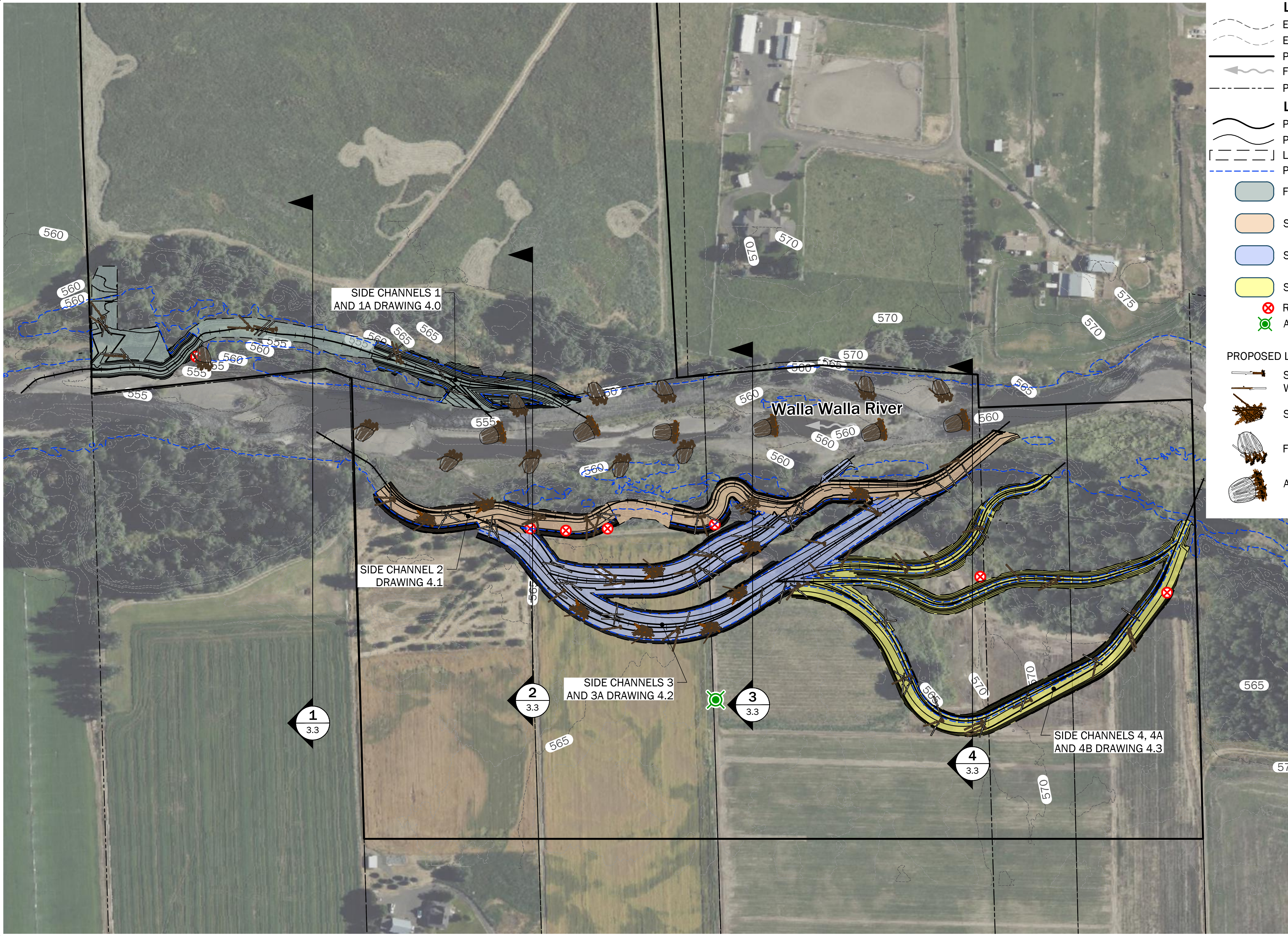
CONFEDERATED TRIBES OF THE UMATILLA INDIAN RESERVATION

WALLA WALLA RM 32.5 FLOODPLAIN RECONNECTION
WALLA WALLA COUNTY, WASHINGTON

TEMPORARY EROSION AND SEDIMENT CONTROL DETAILS

DRAWING NUMBER: 2.3

SHEET: 6 OF 21



LEGEND (EXISTING)

- EXISTING MAJOR (5-FT) CONTOUR LINE
- EXISTING MINOR (1-FT) CONTOUR LINE
- PROJECT SITE BOUNDARY
- FLOW DIRECTION
- PARCEL BOUNDARY

LEGEND (PROPOSED)

- PROPOSED MAJOR (5-FT) CONTOUR LINE
- PROPOSED MINOR (1-FT) CONTOUR LINE
- LIMITS OF GRADING
- PROPOSED 1.5-YEAR INUNDATION EXTENT
- FLOODPLAIN / SIDE CHANNEL 1 GRADING
- SIDE CHANNEL 2 GRADING
- SIDE CHANNEL 3 GRADING
- SIDE CHANNEL 4 GRADING
- REMOVE EXISTING INFRASTRUCTURE
- APPROXIMATE WELL LOCATION

PROPOSED LWM (LARGE WOODY MATERIAL)

- SIDE CHANNEL SINGLE LOG WITH AND WITHOUT ROOTWAD
- SIDE CHANNEL POST STRUCTURE
- FLOW DEFLECTION JAM
- APEX JAM

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REVISION NO.: ---
DATE: 12/2/24

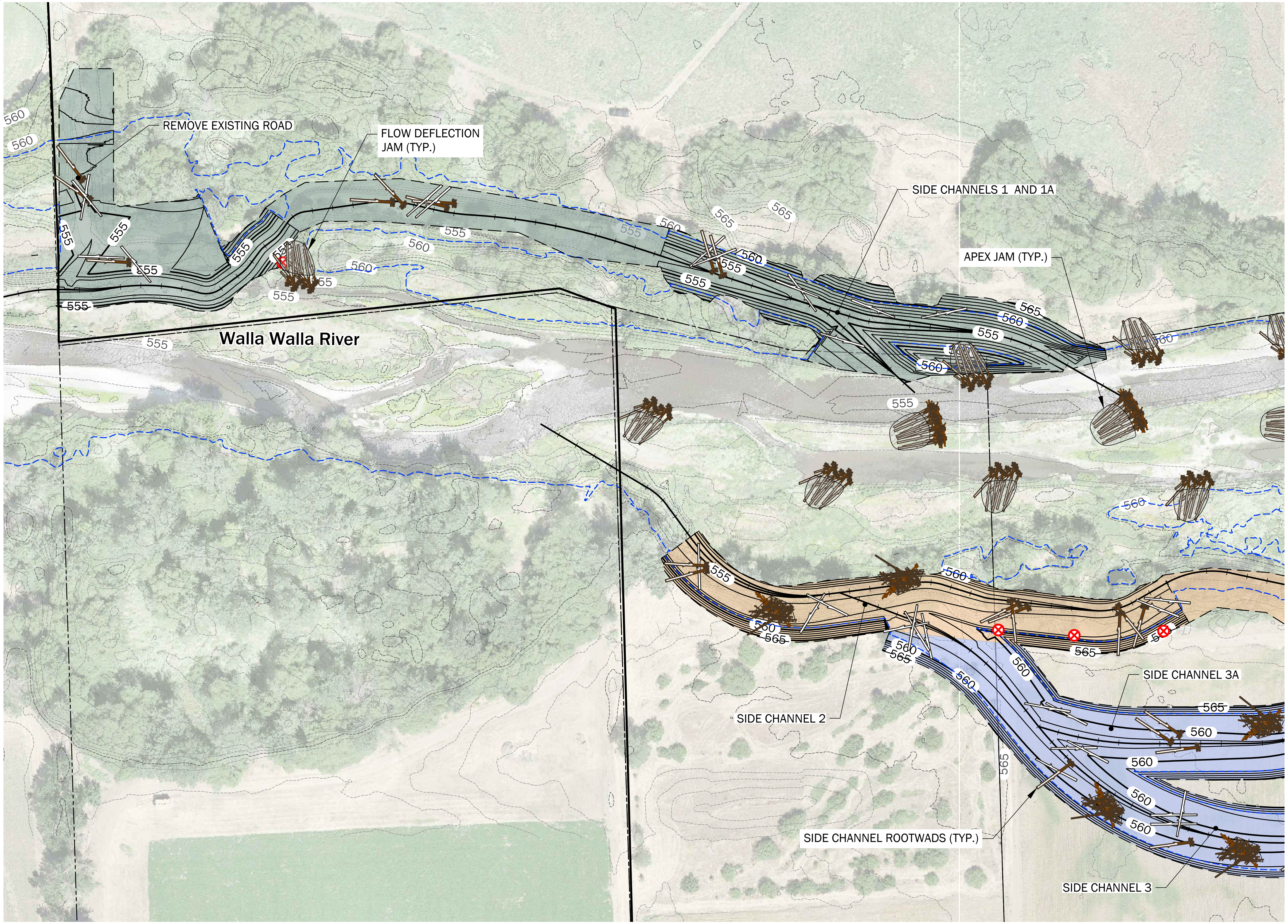
GEOENGINEERS

PREPARED FOR: CONFEDERATED TRIBES OF THE UMATILLA INDIAN RESERVATION

WALLA WALLA RM 32.5 FLOODPLAIN RECONNECTION
WALLA WALLA COUNTY, WASHINGTON

PROPOSED CONDITIONS OVERVIEW

DRAWING NUMBER: 3.0
SHEET: 7 OF 21



LEGEND (EXISTING)

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- EXISTING MINOR (1-FT) CONTOUR LINE
- PROJECT SITE BOUNDARY
- FLOW DIRECTION
- PARCEL BOUNDARY

LEGEND (PROPOSED)

- PROPOSED MAJOR (5-FT) CONTOUR LINE
- PROPOSED MINOR (1-FT) CONTOUR LINE
- LIMITS OF GRADING
- PROPOSED 1.5-YEAR INUNDATION EXTENT
- FLOODPLAIN / SIDE CHANNEL 1 GRADING
- SIDE CHANNEL 2 GRADING
- SIDE CHANNEL 3 GRADING
- REMOVE EXISTING INFRASTRUCTURE

PROPOSED LWM (LARGE WOODY MATERIAL)

- SIDE CHANNEL SINGLE LOG WITH AND WITHOUT ROOTWAD
- SIDE CHANNEL POST STRUCTURE
- FLOW DEFLECTION JAM
- APEX JAM

N

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GRAPHIC SCALE IN FEET

DRAFT SUBMITTAL - NOT FOR CONSTRUCTION

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GEOENGINEERS

PREPARED FOR:

WALLA WALLA RM 32.5 FLOODPLAIN RECONNECTION
WALLA WALLA COUNTY, WASHINGTON

PROPOSED CONDITIONS PLAN

DRAWING NUMBER: **3.1**
SHEET: 8 OF 21

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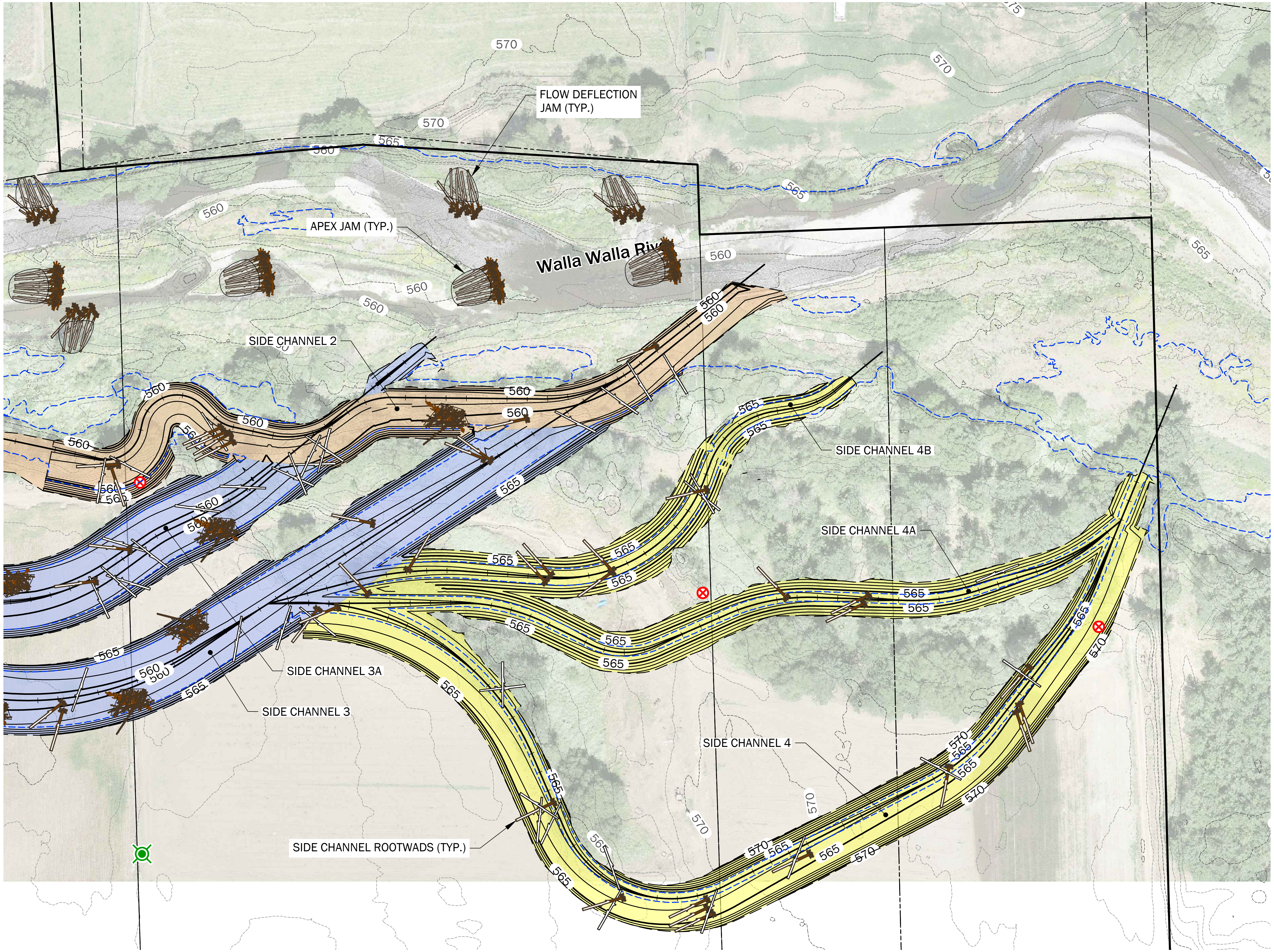

LEGEND (EXISTING)

- EXISTING MAJOR (5-FT) CONTOUR LINE
- EXISTING MINOR (1-FT) CONTOUR LINE
- PROJECT SITE BOUNDARY
- FLOW DIRECTION
- PARCEL BOUNDARY

LEGEND (PROPOSED)

- PROPOSED MAJOR (5-FT) CONTOUR LINE
- PROPOSED MINOR (1-FT) CONTOUR LINE
- LIMITS OF GRADING
- PROPOSED 1.5-YEAR INUNDATION EXTENT
- SIDE CHANNEL 2 GRADING
- SIDE CHANNEL 3 GRADING
- SIDE CHANNEL 4 GRADING
- REMOVE EXISTING INFRASTRUCTURE
- APPROXIMATE WELL LOCATION

PROPOSED LWM (LARGE WOODY MATERIAL)

- SIDE CHANNEL SINGLE LOG WITH AND WITHOUT ROOTWAD
- SIDE CHANNEL POST STRUCTURE
- FLOW DEFLECTION JAM
- APEX JAM

REBECCA H. MILLER
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DRAFT SUBMITTAL - NOT FOR CONSTRUCTION

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Plotted: 11/27/2024, 11:33 | bmiller

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DESIGNED BY:	BHM/KHR
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APPROVED BY:	JRS
REVISION NO.:	----
DATE:	12/2/24

GEOENGINEERS

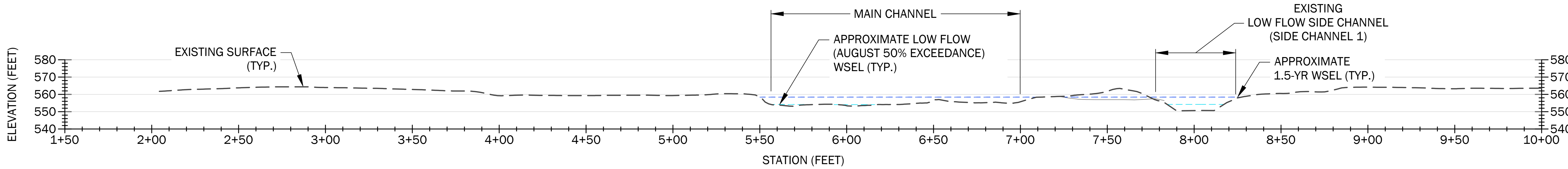
PREPARED FOR: CONFEDERATED TRIBES OF THE UMATILLA INDIAN RESERVATION

WALLA WALLA RM 32.5 FLOODPLAIN RECONNECTION
WALLA WALLA COUNTY, WASHINGTON

PROPOSED CONDITIONS PLAN

DRAWING NUMBER: 3.2

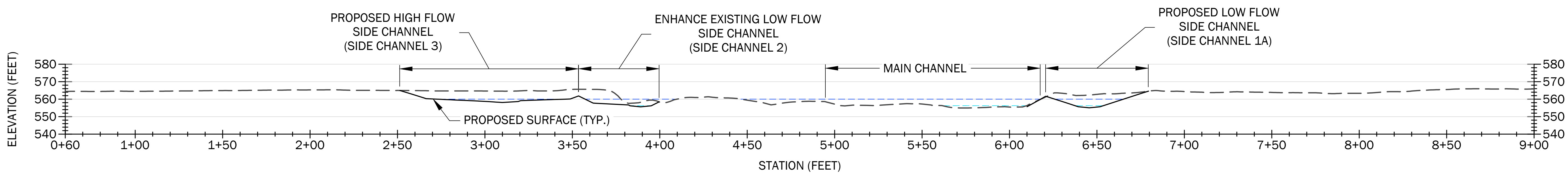
SHEET: 9 OF 21



DOWNSTREAM SECTION 1 / 3.0

SCALE: 1" = 30'

0 30 60 SCALE IN FEET



MIDDLE SECTION 2 / 3.0

SCALE: 1" = 30'

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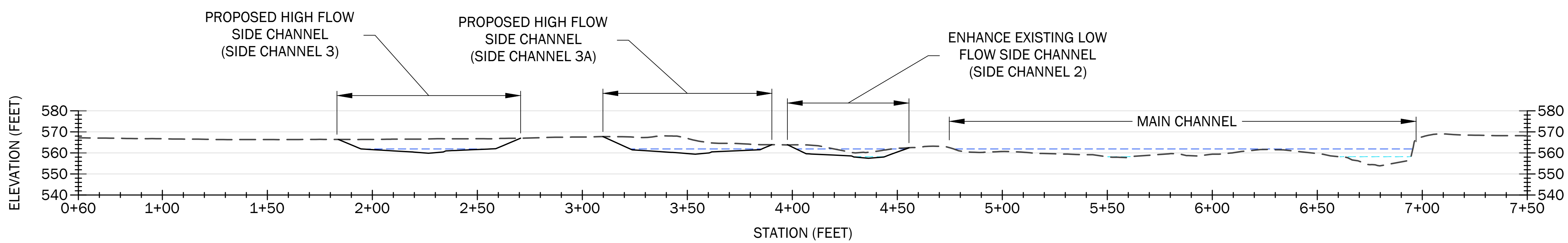

MIDDLE SECTION 3 / 3.0

SCALE: 1" = 30'

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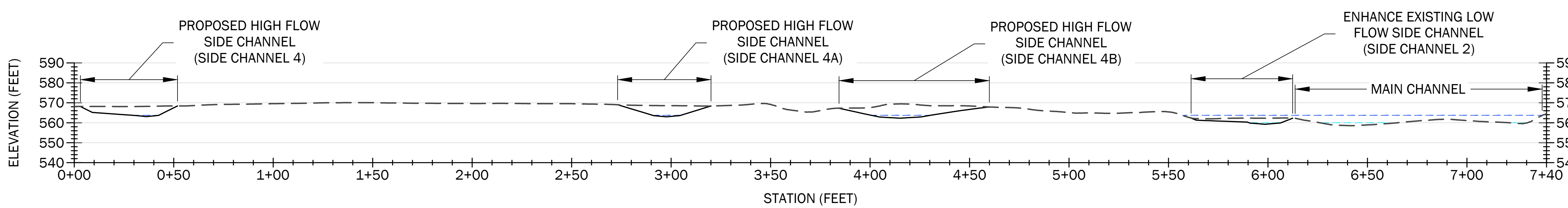

UPSTREAM SECTION 4 / 3.0

SCALE: 1" = 30'

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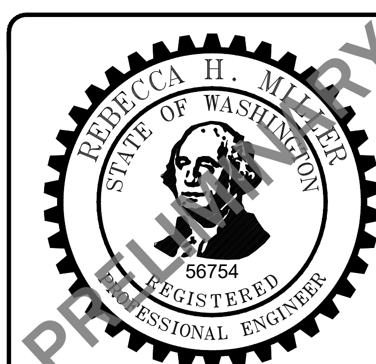


DRAFT SUBMITTAL - NOT FOR CONSTRUCTION

P:\2\2698037\CAD\00\Floodplain and Habitat Restoration Design\02_30_Percent\269803700_Sht 10_3.3 (Proposed Floodplain Sections).dwg

Plotted: 11/27/2024, 11:34 | bmiller

NO.	DATE	BY	ISSUE / DESCRIPTION

DESIGNED BY:	BHM/KHR
DRAWN BY:	KHR/SCY
APPROVED BY:	JRS
REVISION NO.:	----
DATE:	12/2/24

GEOENGINEERS

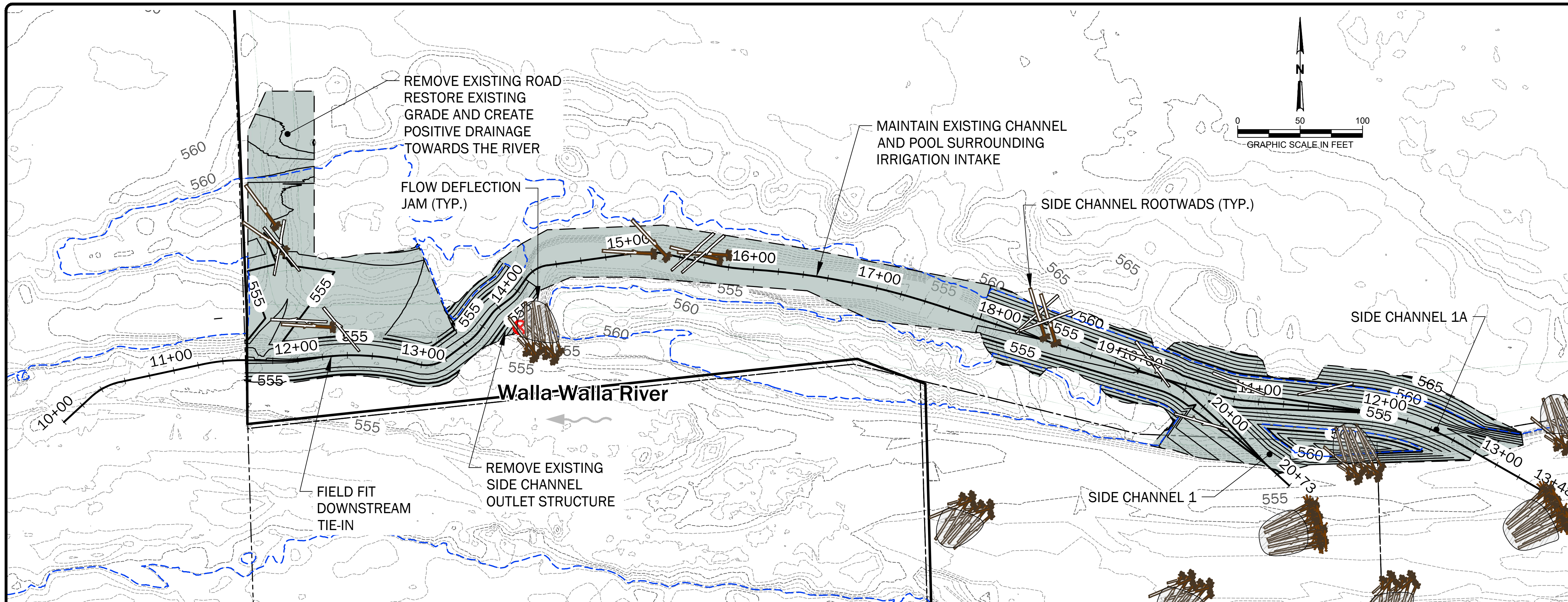
PREPARED FOR:

WALLA WALLA RM 32.5 FLOODPLAIN RECONNECTION
WALLA WALLA COUNTY, WASHINGTON

PROPOSED FLOODPLAIN SECTIONS

DRAWING NUMBER: **3.3**

SHEET: 10 OF 21



LEGEND (EXISTING)

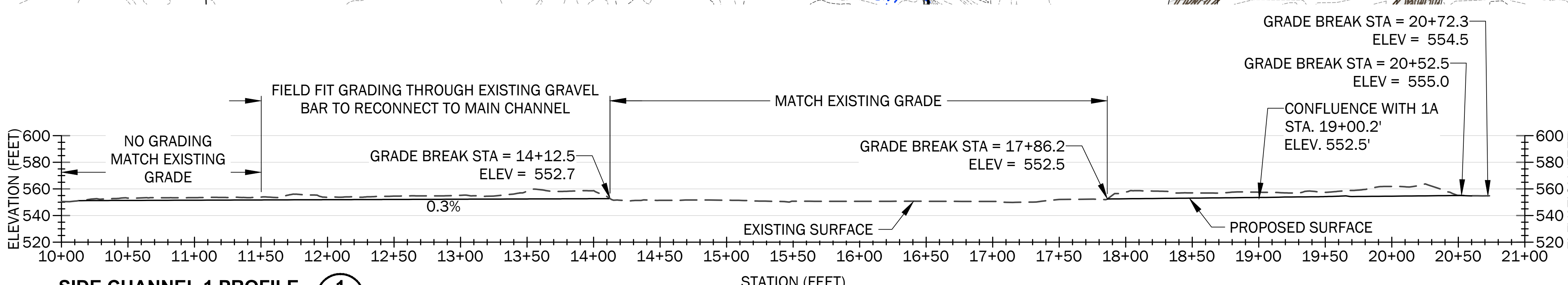
- EXISTING MAJOR (5-FT) CONTOUR LINE
- EXISTING MINOR (1-FT) CONTOUR LINE
- PROJECT SITE BOUNDARY
- FLOW DIRECTION
- PARCEL BOUNDARY

LEGEND (PROPOSED)

- PROPOSED MAJOR (5-FT) CONTOUR LINE
- PROPOSED MINOR (1-FT) CONTOUR LINE
- LIMITS OF GRADING
- PROPOSED 1.5-YEAR INUNDATION EXTENT
- FLOODPLAIN / SIDE CHANNEL 1 GRADING

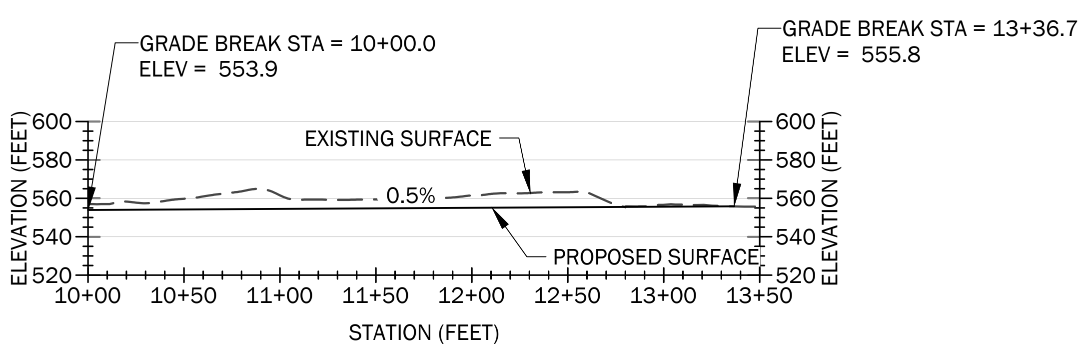
PROPOSED LWM (LARGE WOODY MATERIAL)

- SIDE CHANNEL SINGLE LOG WITH AND WITHOUT ROOTWAD
- SIDE CHANNEL POST STRUCTURE
- FLOW DEFLECTION JAM
- APEX JAM



SIDE CHANNEL 1 PROFILE (1 / 4.0)

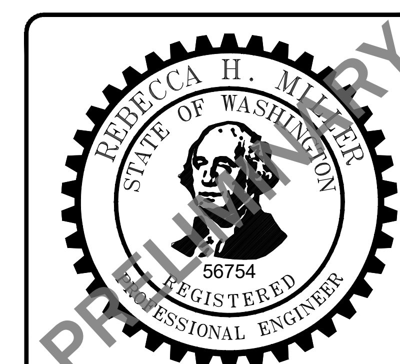
SCALE: 1" = 100'



SIDE CHANNEL 1A PROFILE (2 / 4.0)

SCALE: 1" = 100'

0 50 100
SCALE IN FEET



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NO.	DATE	BY	ISSUE / DESCRIPTION

DESIGNED BY:	BHM/KHR
DRAWN BY:	KHR/SCY
APPROVED BY:	JRS
REVISION NO.:	----
DATE:	12/2/24

GEOENGINEERS

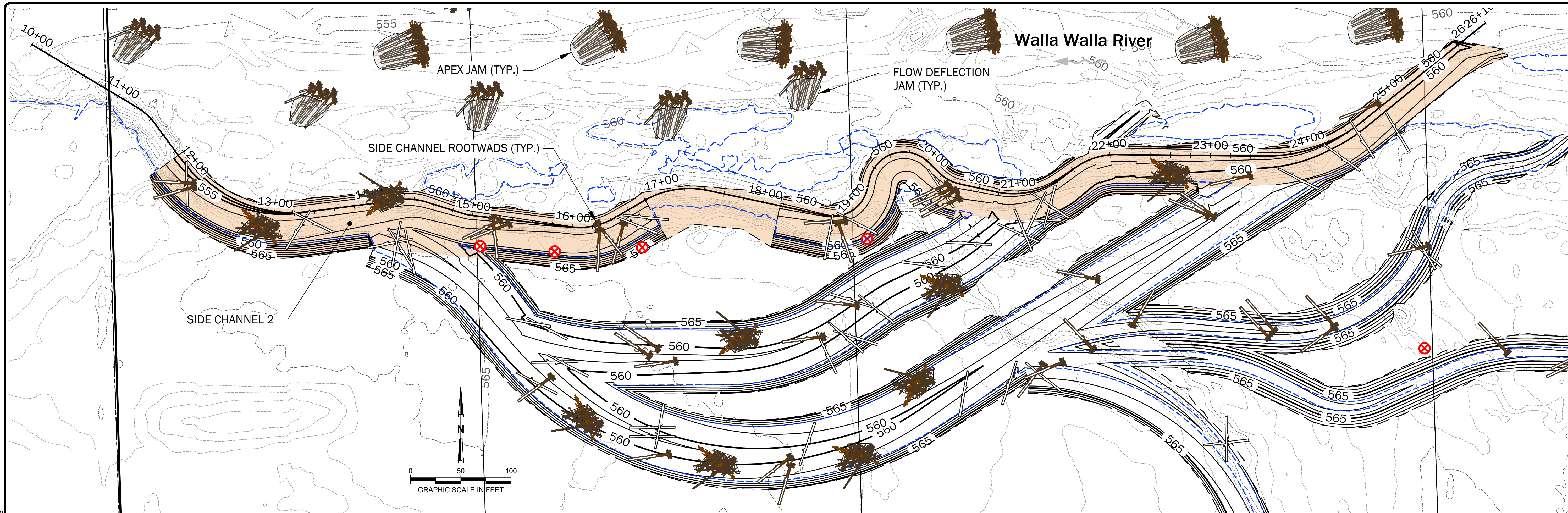
PREPARED FOR:

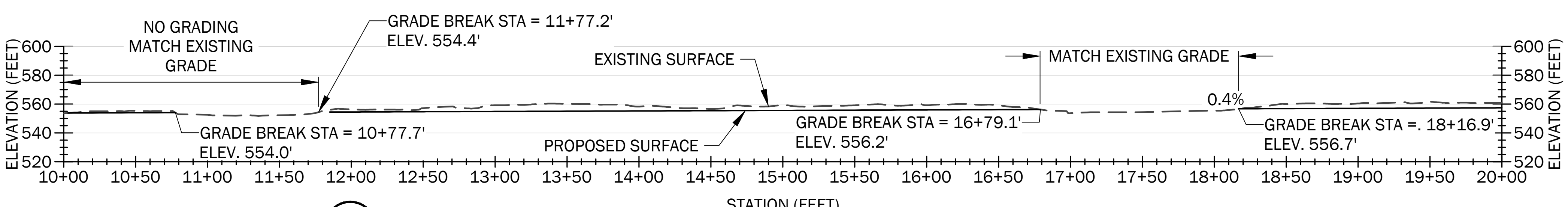
WALLA WALLA RM 32.5 FLOODPLAIN RECONNECTION
WALLA WALLA COUNTY, WASHINGTON

SIDE CHANNEL 1 GRADING

DRAWING NUMBER: 4.0

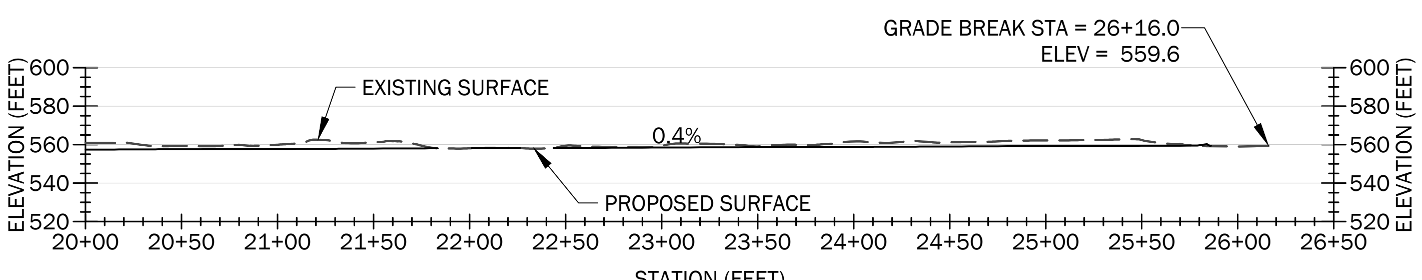
SHEET: 11 OF 21





SIDE CHANNEL 2 PROFILE 1 / 4.1

SCALE: 1" = 100'



SIDE CHANNEL 2 PROFILE 2 / 4.1

SCALE: 1" = 100'

0 50 100

SCALE IN FEET

LEGEND (EXISTING)

- EXISTING MAJOR (5-FT) CONTOUR LINE
- EXISTING MINOR (1-FT) CONTOUR LINE
- PROJECT SITE BOUNDARY
- FLOW DIRECTION
- PARCEL BOUNDARY

LEGEND (PROPOSED)

- PROPOSED MAJOR (5-FT) CONTOUR LINE
- PROPOSED MINOR (1-FT) CONTOUR LINE
- LIMITS OF GRADING
- PROPOSED 1.5-YEAR INUNDATION EXTENT
- SIDE CHANNEL 2 GRADING
- REMOVE EXISTING INFRASTRUCTURE

PROPOSED LWM (LARGE WOODY MATERIAL)

- SIDE CHANNEL SINGLE LOG WITH AND WITHOUT ROOTWAD
- SIDE CHANNEL POST STRUCTURE
- FLOW DEFLECTION JAM
- APEX JAM

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Plotted: 11/27/2024, 11:36 | bmiller P:\2\2698037\CAD\00\Floodplain and Habitat Restoration Design\02_30_Percent\269803700_Sht 12_4.1 [Side Channel 2 Grading].dwg

NO.	DATE	BY	ISSUE / DESCRIPTION

DESIGNED BY:	BHM/KHR
DRAWN BY:	KHR/SCY
APPROVED BY:	JRS
REVISION NO.:	----
DATE:	12/2/24

GEOENGINEERS

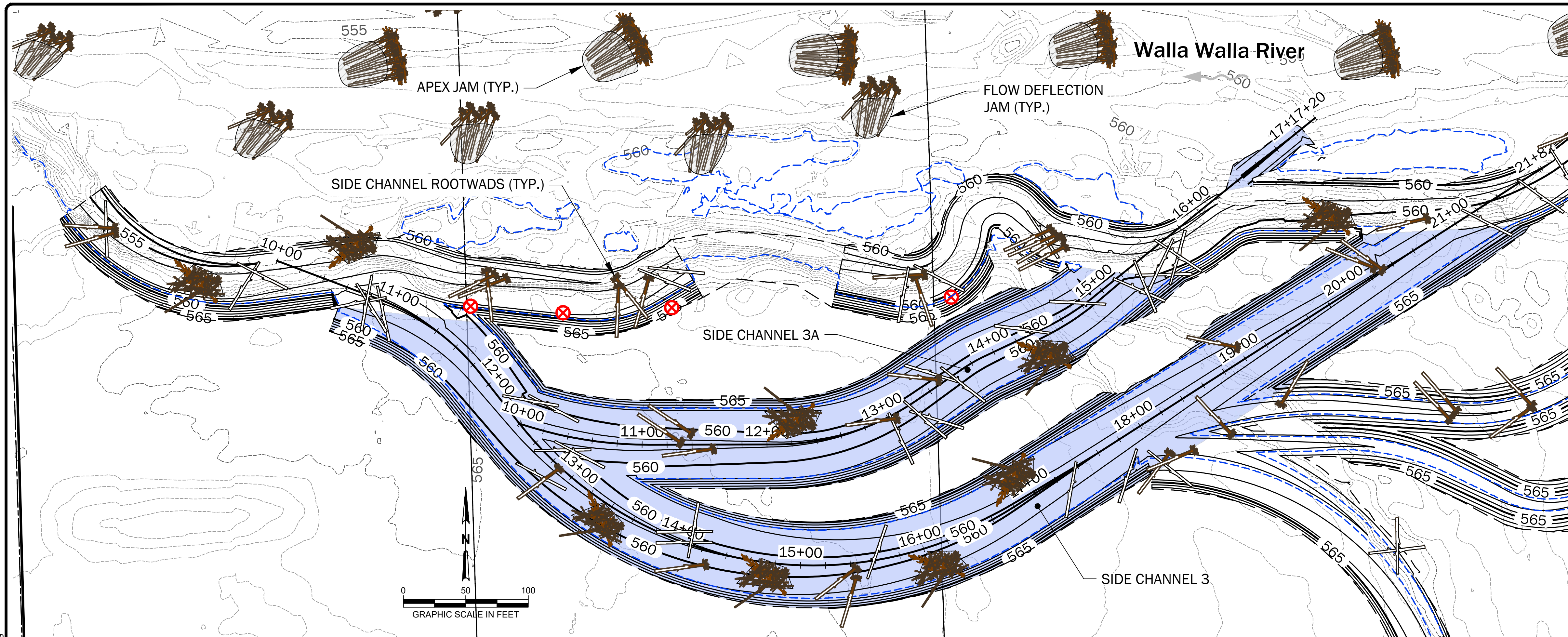
PREPARED FOR:

WALLA WALLA RM 32.5 FLOODPLAIN RECONNECTION
WALLA WALLA COUNTY, WASHINGTON

SIDE CHANNEL 2 GRADING

DRAWING NUMBER: **4.1**

SHEET: 12 OF 21



LEGEND (EXISTING)

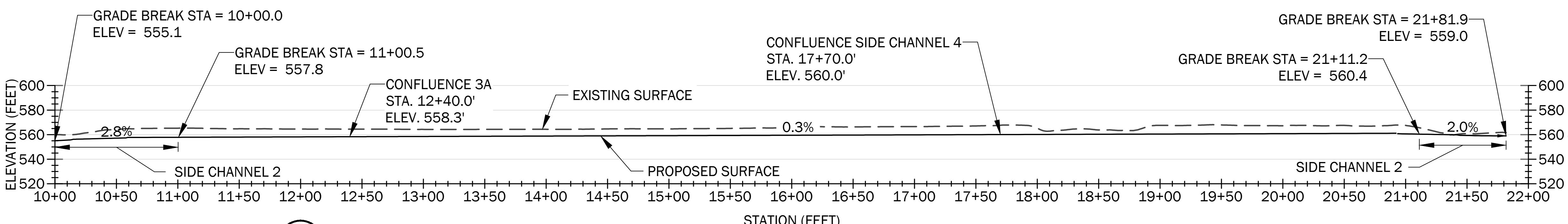
- EXISTING MAJOR (5-FT) CONTOUR LINE
- EXISTING MINOR (1-FT) CONTOUR LINE
- PROJECT SITE BOUNDARY
- FLOW DIRECTION
- PARCEL BOUNDARY

LEGEND (PROPOSED)

- PROPOSED MAJOR (5-FT) CONTOUR LINE
- PROPOSED MINOR (1-FT) CONTOUR LINE
- LIMITS OF GRADING
- PROPOSED 1.5-YEAR INUNDATION EXTENT
- SIDE CHANNEL 3 GRADING
- REMOVE EXISTING INFRASTRUCTURE

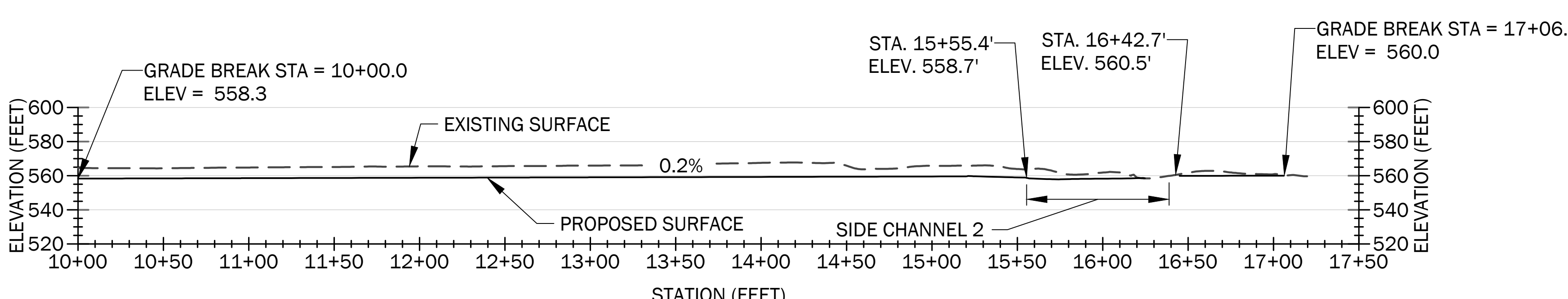
PROPOSED LWM (LARGE WOODY MATERIAL)

- SIDE CHANNEL SINGLE LOG WITH AND WITHOUT ROOTWAD
- SIDE CHANNEL POST STRUCTURE
- FLOW DEFLECTION JAM
- APEX JAM



SIDE CHANNEL 3 PROFILE 1 / 4.2

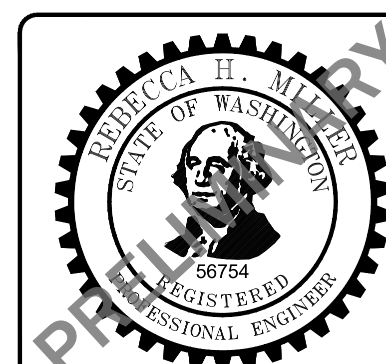
SCALE: 1" = 100'



SIDE CHANNEL 3A PROFILE 2 / 4.2

SCALE: 1" = 100'

0 50 100
SCALE IN FEET



DRAFT SUBMITTAL - NOT FOR CONSTRUCTION

Plotted: 11/27/2024, 11:37 | bmiller P:\2\26980037\CAD\00\Floodplain and Habitat Restoration Design\v02_30_Percent\269803700_Sht 13_4.2 [Side Channel 3 Grading].dwg

NO.	DATE	BY	ISSUE / DESCRIPTION

DESIGNED BY:	BHM/KHR
DRAWN BY:	KHR/SCY
APPROVED BY:	JRS
REVISION NO.:	----
DATE:	12/2/24

GEOENGINEERS

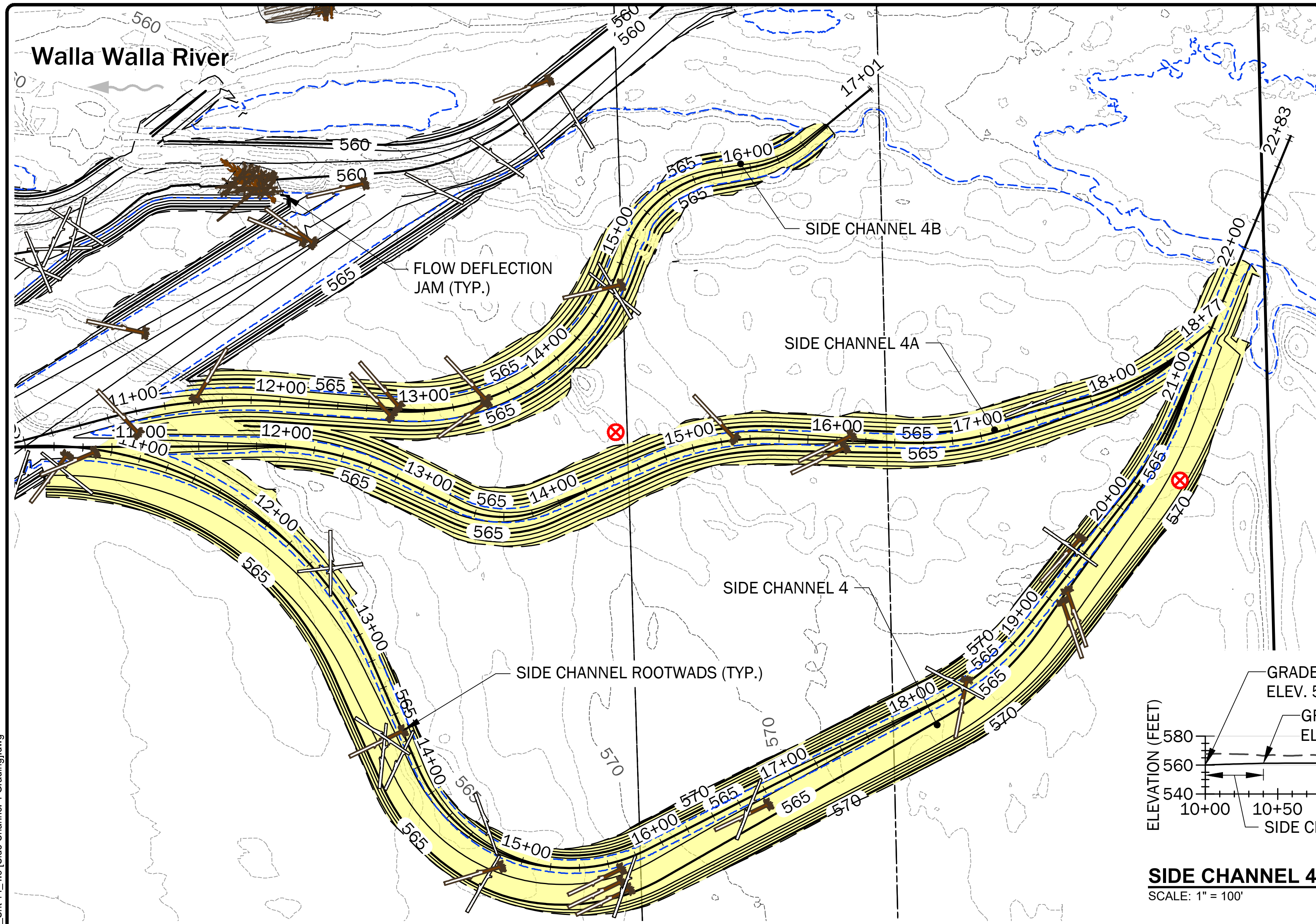
PREPARED FOR: CONFEDERATED TRIBES OF THE UMATILLA INDIAN RESERVATION

WALLA WALLA RM 32.5 FLOODPLAIN RECONNECTION
WALLA WALLA COUNTY, WASHINGTON

SIDE CHANNEL 3 GRADING

DRAWING NUMBER: **4.2**

SHEET: 13 OF 21



GRAPHIC SCALE IN FEET (0, 50, 100)

LEGEND (EXISTING)

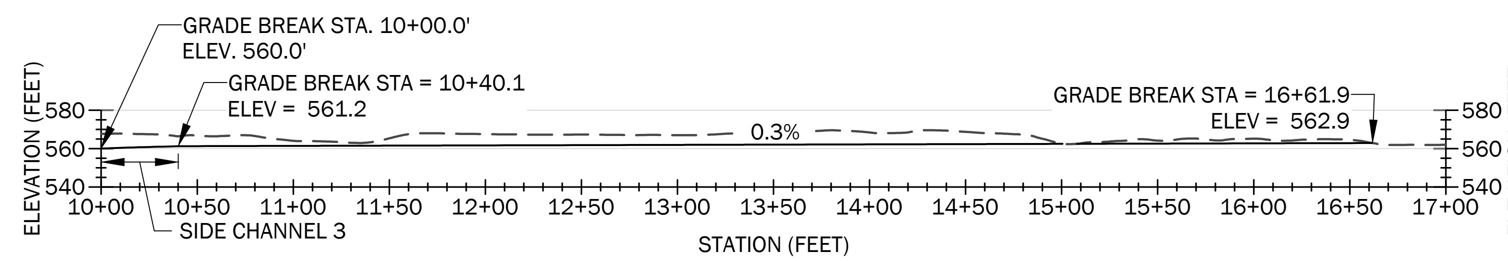
- EXISTING MAJOR (5-FT) CONTOUR LINE
- EXISTING MINOR (1-FT) CONTOUR LINE
- PROJECT SITE BOUNDARY
- FLOW DIRECTION
- PARCEL BOUNDARY

LEGEND (PROPOSED)

- PROPOSED MAJOR (5-FT) CONTOUR LINE
- PROPOSED MINOR (1-FT) CONTOUR LINE
- LIMITS OF GRADING
- PROPOSED 1.5-YEAR INUNDATION EXTENT
- SIDE CHANNEL 4 GRADING
- REMOVE EXISTING INFRASTRUCTURE

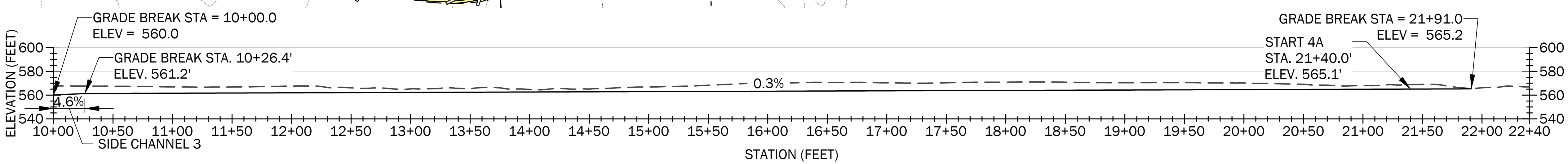
PROPOSED LWM (LARGE WOODY MATERIAL)

- SIDE CHANNEL SINGLE LOG WITH AND WITHOUT ROOTWAD
- SIDE CHANNEL POST STRUCTURE
- FLOW DEFLECTION JAM
- APEX JAM



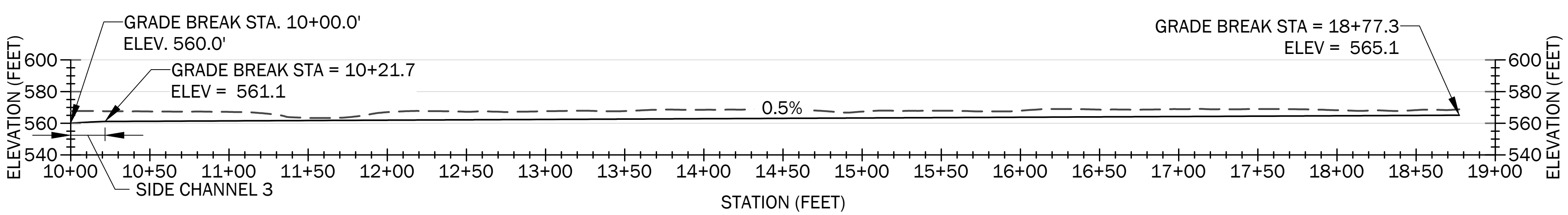
SIDE CHANNEL 4B PROFILE (3 / 4.3)

SCALE: 1" = 100'



SIDE CHANNEL 4 PROFILE (1 / 4.3)

SCALE: 1" = 100'



SIDE CHANNEL 4A PROFILE (2 / 4.3)

SCALE: 1" = 100'

SCALE IN FEET (0, 50, 100)

REBECCA H. MILLER — STATE OF WASHINGTON — 56754 — REGISTERED PROFESSIONAL ENGINEER

PRELIMINARY

DRAFT SUBMITTAL - NOT FOR CONSTRUCTION

NO.	DATE	BY	ISSUE / DESCRIPTION

DESIGNED BY:	BHM/KHR
DRAWN BY:	KHR/SCY
APPROVED BY:	JRS
REVISION NO.:	----
DATE:	12/2/24

GEOENGINEERS

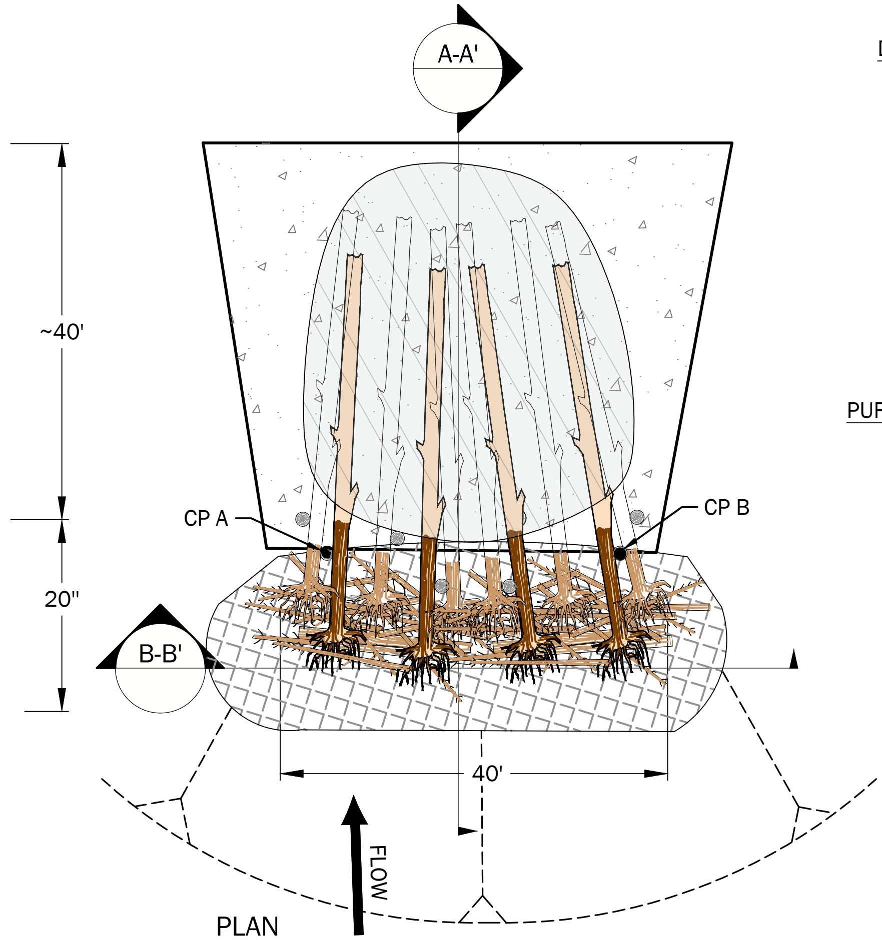
PREPARED FOR: Confederated Tribes of the Umatilla Indian Reservation

WALLA WALLA RM 32.5 FLOODPLAIN RECONNECTION
WALLA WALLA COUNTY, WASHINGTON

SIDE CHANNEL 4 GRADING

DRAWING NUMBER: 4.3
SHEET: 14 OF 21

P:\2\2698037\CAD\00\Floodplain and Habitat Restoration Design\02_30_Percent\269803700_Sht 14_4.3 [Side Channel 4 Grading].dwg
Plotted: 11/27/2024, 11:39 | bmiller

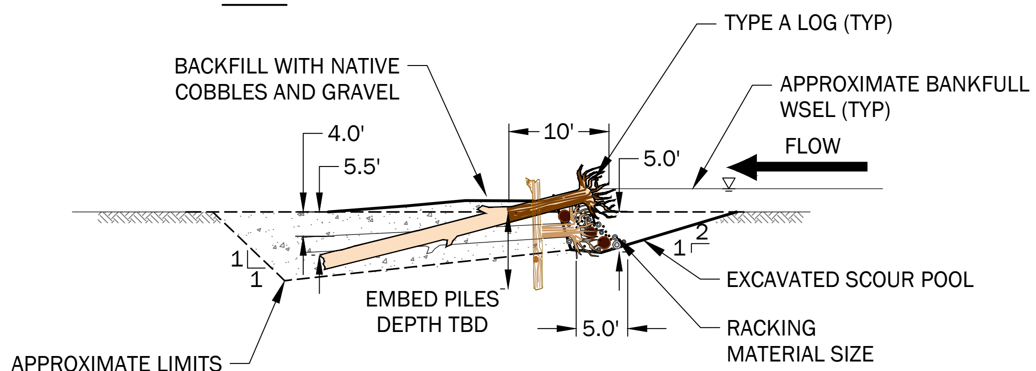


DESIGN SPECIFICS:

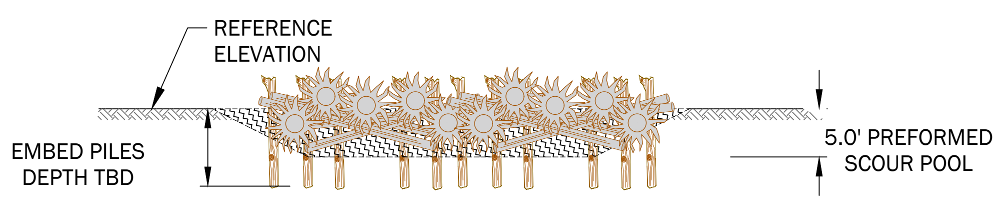
- THE DESIGN ENGINEER SHALL MAINTAIN THE ABILITY TO MAKE ADJUSTMENTS TO THE PROPOSED STRUCTURE IF SITE CONDITIONS WARRANT.
- SEE TABLE FOR MATERIAL SIZES AND QUANTITIES

PURPOSE:

- CREATES MID-STREAM GRAVEL BARS, PROMOTES SIDE CHANNEL FORMATION AND MAINTAINS SIDE CHANNEL INLETS.
- CREATES DIVERSE HABITAT AND GRAVEL CONDITIONS.



SECTION A-A'



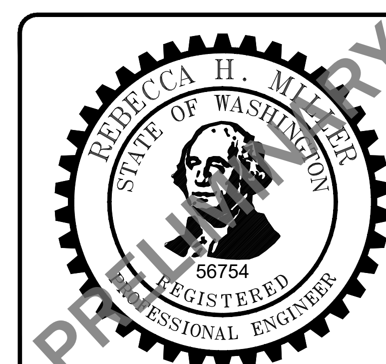
SECTION B-B'

APEX JAM

SCALE: NTS

-
-

STRUCTURE QUANTITIES					
LOG TYPE A - LARGE LOG WITH ROOTWAD	LARGE RACKING LOG	SMALL RACKING LOGS	PILE	SLASH MATERIAL (CY)	ROPE CONNECTIONS (EACH)
30' TO 35' LONG LOG WITH ROOTWAD, 18" TO 24" DBH	10' TO 15' LONG LOG, 8" TO 12" AVG. DIA.	6' TO 15' LONG LOG, 4" TO 8" AVG. DIA	15' LONG MIN., 15" AVG. DIA.		
10	8	24	12	20	10



NO.	DATE	BY	ISSUE / DESCRIPTION

DESIGNED BY: BHM/KHR
DRAWN BY: KHR/SCY
APPROVED BY: JRS
REVISION NO.: ----
DATE: 12/2/24

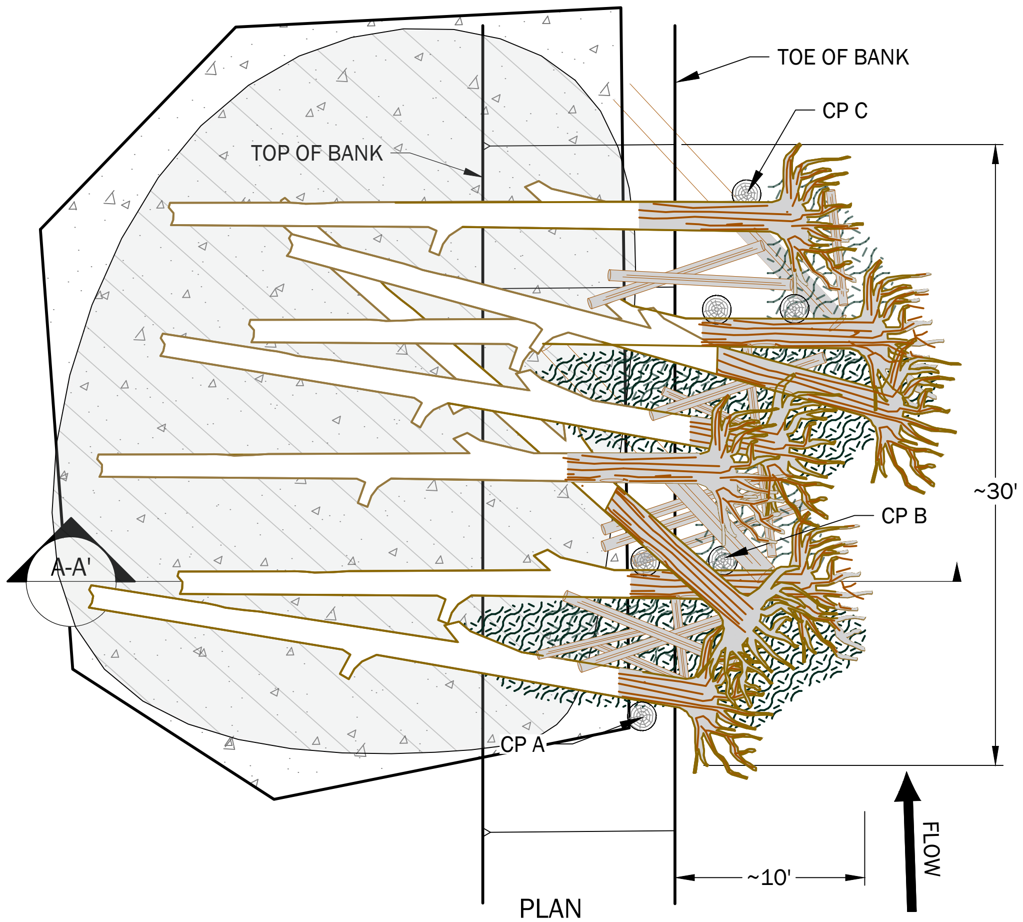
GEOENGINEERS

PREPARED FOR:

WALLA WALLA RM 32.5 FLOODPLAIN RECONNECTION
WALLA WALLA COUNTY, WASHINGTON

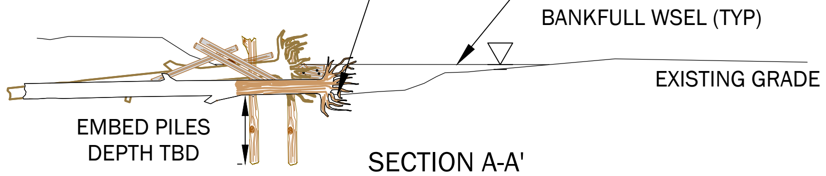
TYPICAL HABITAT DETAILS

DRAWING NUMBER:
5.0
SHEET: 15 OF 21



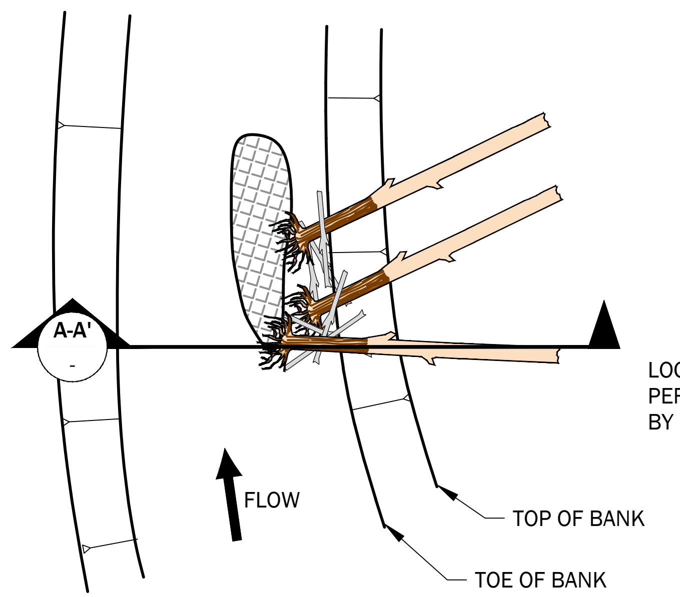
PURPOSE:
- PROVIDES INCREASED HYDRAULIC ROUGHNESS THROUGHOUT THE REACH.
- REDIRECTS FLOWS TO OPPOSITE BANK.
- OVER TIME ACCUMULATES ADDITIONAL LARGE WOOD MATERIAL.

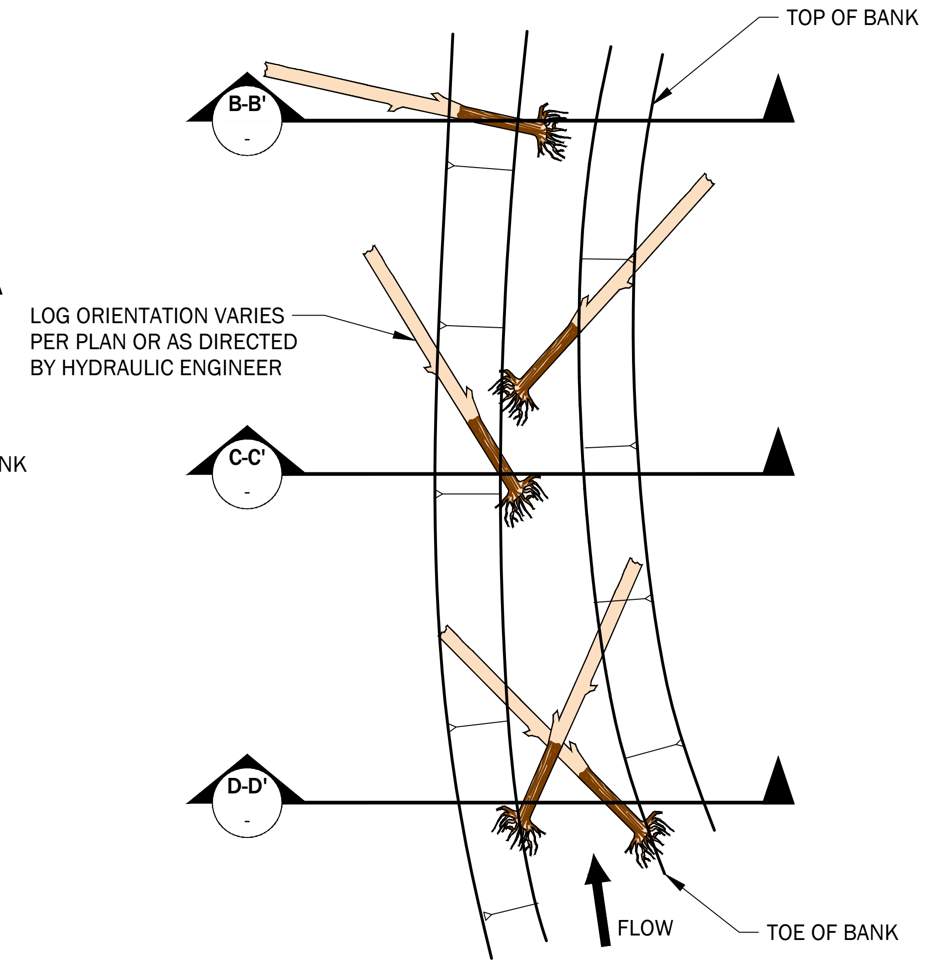
DESIGN SPECIFICS:
- THE DESIGN ENGINEER SHALL MAINTAIN THE ABILITY TO MAKE ADJUSTMENTS TO THE PROPOSED STRUCTURE IF SITE CONDITIONS WARRANT.
- SEE TABLE FOR MATERIAL SIZES AND QUANTITIES.



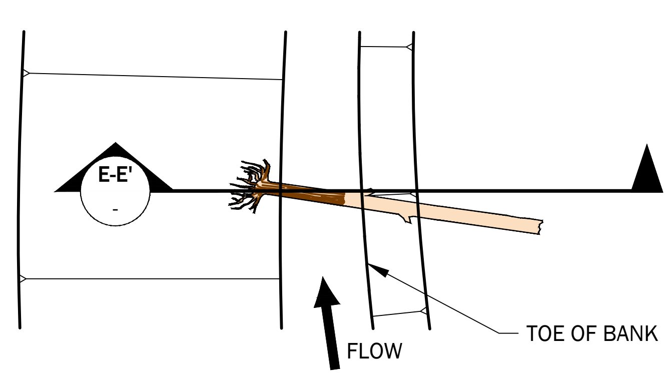
STRUCTURE QUANTITIES						
LOG TYPE A - LARGE LOG WITH ROOTWAD	LOG TYPE C - LARGE LOG - NO ROOTWAD	PILE	LARGE RACKING LOGS	SMALL RACKING LOGS	SLASH MATERIAL (CY)	ROPE CONNECTIONS (EACH)
35' TO 40' LONG LOG WITH ROOTWAD, 18" TO 24" DBH	30' TO 35' LONG LOG, 12" TO 16" AVG. DIA.	15' LONG MIN., 15" AVG. DIA.	10' TO 15' LONG LOG, 8" TO 12" AVG. DIA.	6' TO 15' LONG LOG, 4" TO 8" AVG. DIA		
8	2	6	12	12	8	8

FLOW DEFLECTION JAM -
SCALE: NTS -

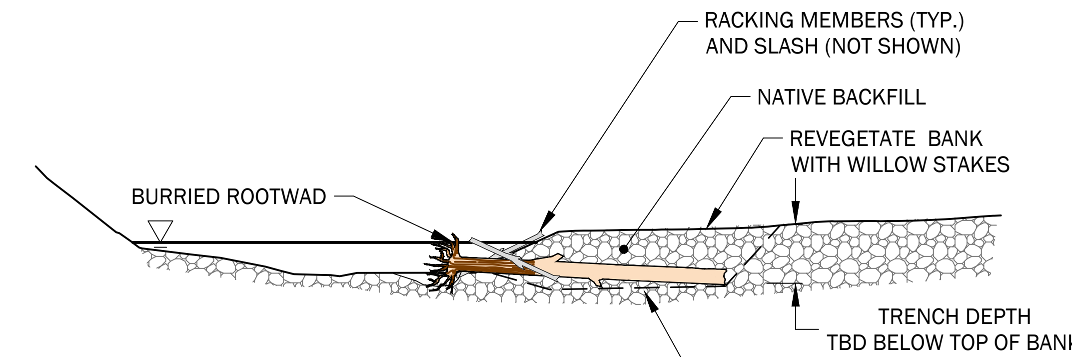




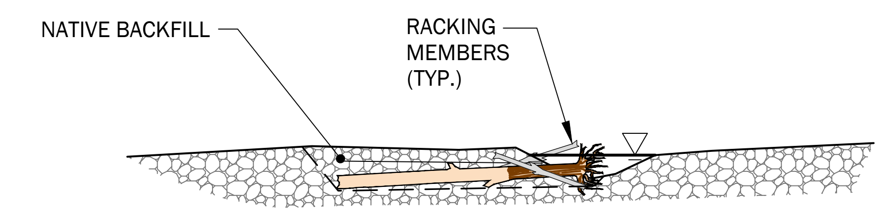
TYPICAL PLAN



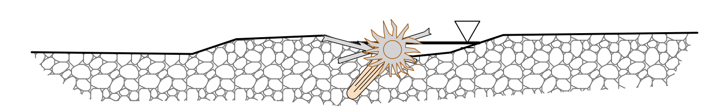
TYPICAL PLAN



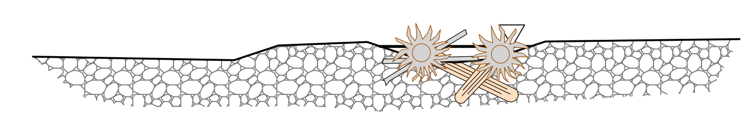
TYPICAL SECTION A-A' - SIDE CHANNEL



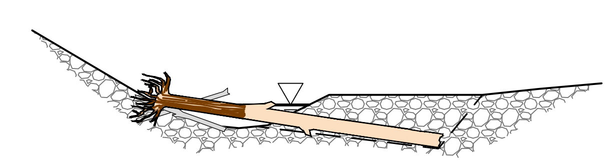
TYPICAL SECTION B-B' - SIDE CHANNEL



TYPICAL SECTION C-C' - SIDE CHANNEL



TYPICAL SECTION D-D' - SIDE CHANNEL



TYPICAL SECTION E-E'

PURPOSE:

- CREATES CHANNEL AND FLOODPLAIN ROUGHNESS.
- CREATES DIVERSE FISH HABITAT.

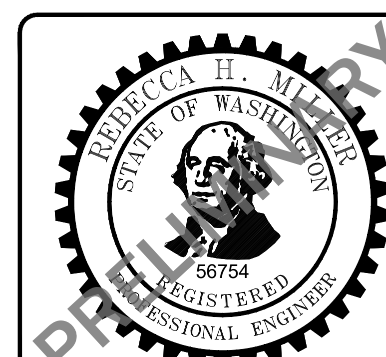
DESIGN SPECIFICS:

- WHOLE TREES CONTAIN BRANCHES IN ADDITION TO ROOTWADS. HANDLE WHOLE TREES WITH CARE TO MINIMIZE BREAKING OF BRANCHES.
- PLACEMENT SHALL LOOSELY FOLLOW PLANS. EXACT PLACEMENT WILL BE FIELD FIT AND SHALL BE APPROVED BY THE CONTRACTING OFFICER.
- PARTIALLY BURY TREE A MINIMUM OF $\frac{2}{3}$ TREE LENGTH
- EXCAVATE AS NECESSARY TO PLACE THE ROOTWADS AND WHOLE TREES.
- THE DESIGN ENGINEER SHALL MAINTAIN THE ABILITY TO MAKE ADJUSTMENTS TO THE PROPOSED STRUCTURE IF SITE CONDITIONS WARRANT.
- INSTALL RACKING LOGS AND SLASH DURING LOG PLACEMENT.

SIDE CHANNEL SINGLE LOG (WITH OR WITHOUT ROOTWAD) -

SCALE: NOT TO SCALE

-



DRAFT SUBMITTAL - NOT FOR CONSTRUCTION

P:\2\2698037\CAD\00\Floodplain and Habitat Restoration Design\02_30_Percent\269803700_Sht 17_5.2 [Typical Habitat Details].dwg

Plotted: 11/27/2024, 11:39 | bmiller

NO.	DATE	BY	ISSUE / DESCRIPTION

DESIGNED BY:	BHM/KHR
DRAWN BY:	KHR/SCY
APPROVED BY:	JRS
REVISION NO.:	----
DATE:	12/2/24

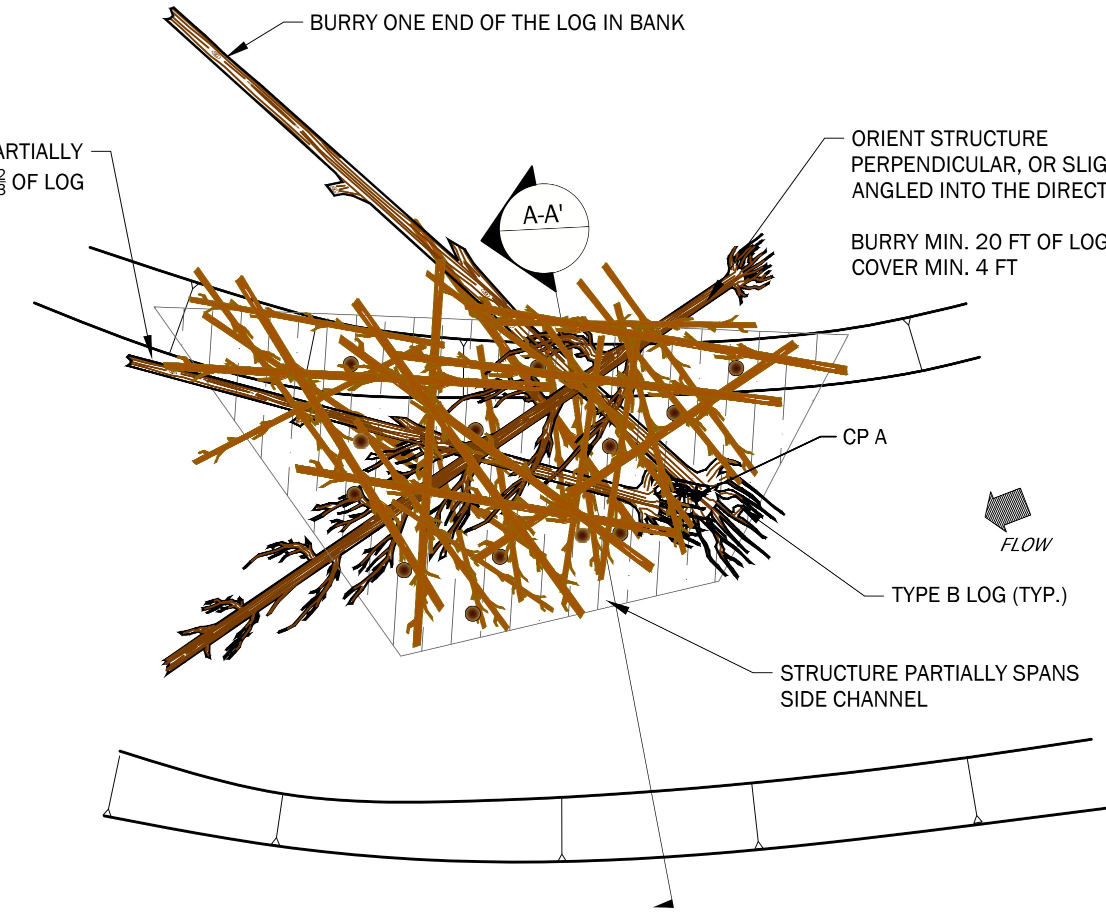
GEOENGINEERS

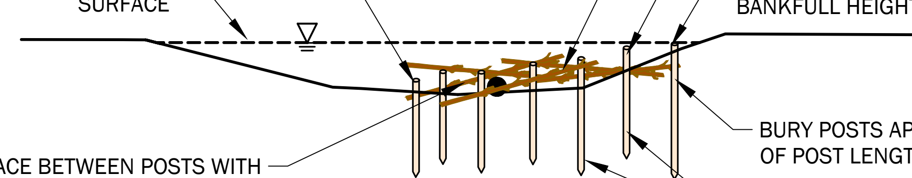
PREPARED FOR:

WALLA WALLA RM 32.5 FLOODPLAIN RECONNECTION
WALLA WALLA COUNTY, WASHINGTON

TYPICAL HABITAT DETAILS

DRAWING NUMBER:
5.2
SHEET: 17 OF 21





SECTION A-A'

PURPOSE:

- MIMICS FUNCTIONALITY OF FLOODPLAIN WOODY VEGETATION

USE IN SIDE CHANNEL TO CREATE BACKWATER CONDITIONS, INCREASE FLOODPLAIN INUNDATION AND RETENTION

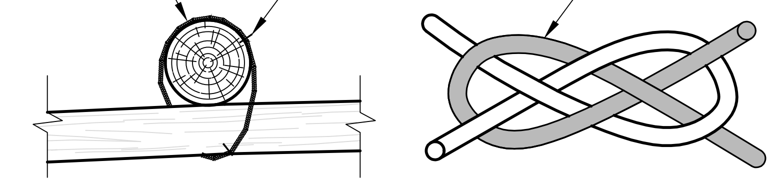
DESIGN SPECIFICS:

- USE 4 TO 6" DIAMETER POSTS, APPROXIMATELY 8' LONG AT 3' SPACING
- STAGGER POSTS SO THEY ARE NOT IN A STRAIGHT LINE
- DRIVE POSTS APPROXIMATELY 4' BELOW GROUND SURFACE
- WEAVE RACKING MATERIAL BETWEEN POSTS
- STRUCTURE SPANS 40-60% OF THE SIDE CHANNEL
- ADDITIONAL DEBRIS IS EXPECTED TO COLLECT OVER TIME
- PARTIALLY BURRY ALL KEY MEMBERS. REFER TO PLAN VIEW FOR MINIMUM COVER DEPTHS.

SIDE CHANNEL POST STRUCTURES -

SCALE: NTS -

STRUCTURE QUANTITIES				
LOG TYPE B - MEDIUM LOG WITH ROOTWAD	VERTICAL POSTS	LARGE RACKING LOGS	SMALL RACKING LOGS	SLASH MATERIAL (CY)
25' TO 30' LONG LOG WITH ROOTWAD, 12" TO 16" DBH	8' LONG MIN., 4 TO 6" AVG. DIA.	10' TO 15' LONG LOG, 8" TO 12" AVG. DIA.	6' TO 15' LONG LOG, 4" TO 8" AVG. DIA	
3	12	15	15	6

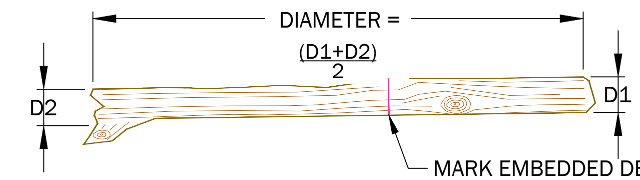


NOTES:

- ALL ROPE SHALL BE BIODEGRADABLE MANILA ROPE WITH A MINIMUM BREAKING STRENGTH GREATER THAN OR EQUAL TO 8,000 POUNDS.
- ROPE SHALL BE WRAPPED TWICE AROUND BOTH THE CONNECTING LOGS AND TIED WITH A CARRICK KNOT, OR SIMLIAR. ALL EXCESS SLACK SHALL BE REMOVED FROM THE ROPE PRIOR TO TYING AND BINDING.
- SECURE BOTH FREE-ENDS OF ROPE WITH A 1/2-INCH X 6-INCH (MIN.) STAPLE, A MINIMUM OF 12 INCHES FROM THE END. STAPLES SHALL BE DRIVEN INTO THE LOGS TO PREVENT ROPE FROM SLIPPING. ALL CONNECTING HARDWARE SHALL BE NON-GALVANIZED.
- ROPE LENGTH VARIES PER CONNECTION.

ROPE CONNECTION

SCALE: NTS



PILE NOTES:

- LOG DIAMETER IS THE AVERAGE OF THE DIAMETER MEASURED ON EITHER END OF THE LOG.
- LOG DIAMETER ON EITHER SIDE OF THE PILE MAY VARY BETWEEN 12 TO 18 INCHES.
- AVERAGE DIAMETER SHALL BE 15 INCHES.
- PILE LENGTH IS 15 FEET MINIMUM.
- PILE SHALL NOT EXTEND MORE THAN 2 FEET ABOVE THE TALLEST KEY MEMBER.
- PILES SHALL BE DRIVEN USING A VIBRATORY HEAD DRIVER. AN IMPACT HAMMER SHALL NOT BE USED.
- MARK MINIMUM EMBEDDED DEPTHS ON THE PILE PRIOR TO PLACEMENT.
- PILES SHALL BE DRIVEN TO MINIMUM DEPTHS SPECIFIED ON THE PLANS OR UNTIL REFUSAL. IF REFUSAL DEPTH IS LESS THAN MINIMUM DEPTH SPECIFIED ON THE PLANS COMPLETE A PULL TEST TO DEMONSTRATE PILE RESISTANCE IS EQUAL TO OR GREATER THAN 5,000 LB

PILES

SCALE: NTS

DRAFT SUBMITTAL - NOT FOR CONSTRUCTION

NO.	DATE	BY	ISSUE / DESCRIPTION

DESIGNED BY:	BHM/KHR
DRAWN BY:	KHR/SCY
APPROVED BY:	JRS
REVISION NO.:	----
DATE:	12/2/24

GEOENGINEERS

PREPARED FOR:

WALLA WALLA RM 32.5 FLOODPLAIN RECONNECTION
WALLA WALLA COUNTY, WASHINGTON

TYPICAL HABITAT DETAILS

DRAWING NUMBER: 5.3

SHEET: 18 OF 21

Plotted: 11/27/2024, 11:40 | bmiller P:\2\2698037\CAD\00\Floodplain and Habitat Restoration Design\02_30_Percent\2698037000_Sht 18_5.3 [Typical Habitat Details].dwg

HIP GENERAL CONSERVATION MEASURES APPLICABLE TO ALL ACTIONS

THE ACTIVITIES COVERED UNDER THE HIP ARE INTENDED TO PROTECT AND RESTORE FISH AND WILDLIFE HABITAT WITH LONG-TERM BENEFITS TO ESA-LISTED SPECIES. THE FOLLOWING GENERAL CONSERVATION MEASURES (DEVELOPED IN COORDINATION WITH USFWS AND NMFS) WILL BE APPLIED TO ALL ACTIONS OF THIS PROJECT.

PROJECT DESIGN AND SITE PREPARATION.

1. STATE AND FEDERAL PERMITS.

A. ALL APPLICABLE REGULATORY PERMITS AND OFFICIAL PROJECT AUTHORIZATIONS WILL BE OBTAINED BEFORE PROJECT IMPLEMENTATION.

B. THESE PERMITS AND AUTHORIZATIONS INCLUDE, BUT ARE NOT LIMITED TO, NATIONAL ENVIRONMENTAL POLICY ACT, NATIONAL HISTORIC PRESERVATION ACT, THE APPROPRIATE STATE AGENCY REMOVAL AND FILL PERMIT, USACE CLEAN WATER ACT (CWA) 404 PERMITS, CWA SECTION 401 WATER QUALITY CERTIFICATIONS, AND FEMA NO-RISE ANALYSES.

2. TIMING OF IN-WATER WORK.

A. APPROPRIATE STATE (OREGON DEPARTMENT OF FISH AND WILDLIFE (ODFW), WASHINGTON DEPARTMENT OF FISH AND WILDLIFE (WDFW), IDAHO DEPARTMENT OF FISH AND GAME (IDFG), AND MONTANA FISH WILDLIFE AND PARKS (MFWP)) GUIDELINES FOR TIMING OF IN-WATER WORK WINDOWS (IWW) WILL BE FOLLOWED.

B. CHANGES TO ESTABLISHED WORK WINDOWS WILL BE APPROVED BY REGIONAL STATE BIOLOGISTS AND BPA'S EC LEAD.

C. BULL TROUT. FOR AREAS WITH DESIGNATED IN-WATER WORK WINDOWS FOR BULL TROUT OR AREAS KNOWN TO HAVE BULL TROUT, PROJECT PROPONENTS WILL CONTACT THE APPROPRIATE USFWS FIELD OFFICE TO INSURE THAT ALL REASONABLE IMPLEMENTATION MEASURES ARE CONSIDERED AND AN APPROPRIATE IN-WATER WORK WINDOW IS BEING USED TO MINIMIZE PROJECT EFFECTS.

D. LAMPREY. WORKING IN STREAM OR RIVER CHANNELS THAT CONTAIN PACIFIC LAMPREY WILL BE AVOIDED FROM MARCH 1 TO JULY 1 FOR REACHES <5,000 FEET IN ELEVATION AND FROM MARCH 1 TO AUGUST 1 FOR REACHES >5,000 FEET. IF EITHER TIMEFRAME IS INCOMPATIBLE WITH OTHER OBJECTIVES, THE AREA WILL BE SURVEYED FOR NESTS AND LAMPREY PRESENCE, AND AVOIDED IF POSSIBLE. IF LAMPREYS ARE KNOWN TO EXIST, THE PROJECT SPONSOR WILL UTILIZE DEWATERING AND SALVAGE PROCEDURES (SEE FISH SALVAGE AND ELECTROFISHING SECTIONS) TO MINIMIZE ADVERSE EFFECTS.

E. THE IN-WATER WORK WINDOW WILL BE PROVIDED IN THE CONSTRUCTION PLANS.

3. CONTAMINANTS.

A. EXCAVATION OF MORE THAN 20 CUBIC YARDS WILL REQUIRE A SITE VISIT AND DOCUMENTED ASSESSMENT FOR POTENTIAL CONTAMINANT SOURCES. THE SITE ASSESSMENT WILL BE STORED WITH PROJECT FILES OR AS AN APPENDIX TO THE BASIS OF DESIGN REPORT.

B. THE SITE ASSESSMENT WILL SUMMARIZE:

1. THE SITE VISIT, CONDITION OF THE PROPERTY, AND IDENTIFICATION OF ANY AREAS USED FOR VARIOUS INDUSTRIAL PROCESSES;
2. AVAILABLE RECORDS, SUCH AS FORMER SITE USE, BUILDING PLANS, AND RECORDS OF ANY PRIOR CONTAMINATION EVENTS;
3. INTERVIEWS WITH KNOWLEDGEABLE PEOPLE, SUCH AS SITE OWNERS, OPERATORS, OCCUPANTS, NEIGHBORS, OR LOCAL GOVERNMENT OFFICIALS; AND
4. THE TYPE, QUANTITY, AND EXTENT OF ANY POTENTIAL CONTAMINATION SOURCES.

4. SITE LAYOUT AND FLAGGING.

A. CONSTRUCTION AREAS TO BE CLEARLY FLAGGED PRIOR TO CONSTRUCTION.

B. AREAS TO BE FLAGGED WILL INCLUDE:

1. SENSITIVE RESOURCE AREAS, SUCH AS AREAS BELOW ORDINARY HIGH WATER, SPAWNING AREAS, SPRINGS, AND WETLANDS;
2. EQUIPMENT ENTRY AND EXIT POINTS;
3. ROAD AND STREAM CROSSING ALIGNMENTS;
4. STAGING, STORAGE, AND STOCKPILE AREAS; AND
5. NO-SPRAY AREAS AND BUFFERS.

5. TEMPORARY ACCESS ROADS AND PATHS.

A. EXISTING ACCESS ROADS AND PATHS WILL BE PREFERENTIALLY USED WHENEVER REASONABLE, AND THE NUMBER AND LENGTH OF TEMPORARY ACCESS ROADS AND PATHS THROUGH RIPARIAN AREAS AND FLOODPLAINS WILL BE MINIMIZED.

B. VEHICLE USE AND HUMAN ACTIVITIES, INCLUDING WALKING, IN AREAS OCCUPIED BY TERRESTRIAL ESA-LISTED SPECIES WILL BE MINIMIZED.

C. TEMPORARY ACCESS ROADS AND PATHS WILL NOT BE BUILT ON SLOPES WHERE GRADE, SOIL, OR OTHER FEATURES SUGGEST A LIKELIHOOD OF EXCESSIVE EROSION OR FAILURE. IF SLOPES ARE STEEPER THAN 30%, THEN THE ROAD WILL BE DESIGNED BY A CIVIL ENGINEER WITH EXPERIENCE IN STEEP ROAD DESIGN.

D. THE REMOVAL OF RIPARIAN VEGETATION DURING CONSTRUCTION OF TEMPORARY ACCESS ROADS WILL BE MINIMIZED. WHEN TEMPORARY VEGETATION REMOVAL IS REQUIRED, VEGETATION WILL BE CUT AT GROUND LEVEL (NOT GRUBBED).

E. AT PROJECT COMPLETION, ALL TEMPORARY ACCESS ROADS AND PATHS WILL BE OBLITERATED, AND THE SOIL WILL BE STABILIZED AND REVEGETATED. ROAD AND PATH OBLITERATION REFERS TO THE MOST COMPREHENSIVE DEGREE OF DECOMMISSIONING AND INVOLVES DECOMPACTING THE SURFACE AND DITCH, PULLING THE FILL MATERIAL ONTO THE RUNNING SURFACE, AND RESHAPING TO MATCH THE ORIGINAL CONTOUR.

F. HELICOPTER FLIGHT PATTERNS WILL BE ESTABLISHED IN ADVANCE AND LOCATED TO AVOID TERRESTRIAL ESA-LISTED SPECIES AND THEIR OCCUPIED HABITAT DURING SENSITIVE LIFE STAGES.

6. TEMPORARY STREAM CROSSINGS.

A. EXISTING STREAM CROSSINGS OR BEDROCK WILL BE PREFERENTIALLY USED WHENEVER REASONABLE, AND THE NUMBER OF TEMPORARY STREAM CROSSINGS WILL BE MINIMIZED.

B. TEMPORARY BRIDGES AND CULVERTS WILL BE INSTALLED TO ALLOW FOR EQUIPMENT AND VEHICLE CROSSING OVER PERENNIAL STREAMS DURING CONSTRUCTION. TREATED WOOD SHALL NOT BE USED ON TEMPORARY BRIDGE CROSSINGS OR IN LOCATIONS IN CONTACT WITH OR DIRECTLY OVER WATER.

C. FOR PROJECTS THAT REQUIRE EQUIPMENT AND VEHICLES TO CROSS IN THE WET:

1. THE LOCATION AND NUMBER OF ALL WET CROSSINGS SHALL BE APPROVED BY THE BPA EC LEAD AND DOCUMENTED IN THE CONSTRUCTION PLANS;
2. VEHICLES AND MACHINERY SHALL CROSS STREAMS AT RIGHT ANGLES TO THE MAIN CHANNEL WHENEVER POSSIBLE;
3. NO STREAM CROSSINGS WILL OCCUR 300 FEET UPSTREAM OR 100 FEET DOWNSTREAM OF AN EXISTING REDD OR SPAWNING FISH; AND
4. AFTER PROJECT COMPLETION, TEMPORARY STREAM CROSSINGS WILL BE OBLITERATED AND BANKS RESTORED.

7. STAGING, STORAGE, AND STOCKPILE AREAS.

A. STAGING AREAS (USED FOR CONSTRUCTION EQUIPMENT STORAGE, VEHICLE STORAGE, FUELING, SERVICING, AND HAZARDOUS MATERIAL STORAGE) WILL BE 150 FEET OR MORE FROM ANY NATURAL WATER BODY OR WETLAND. STAGING AREAS CLOSER THAN 150 FEET WILL BE APPROVED BY THE EC LEAD.

B. NATURAL MATERIALS USED FOR IMPLEMENTATION OF AQUATIC RESTORATION, SUCH AS LARGE WOOD, GRAVEL, AND BOULDERS, MAY BE STAGED WITHIN 150 FEET IF CLEARLY INDICATED IN THE PLANS THAT AREA IS FOR NATURAL MATERIALS ONLY.

C. ANY LARGE WOOD, TOPSOIL, AND NATIVE CHANNEL MATERIAL DISPLACED BY CONSTRUCTION WILL BE STOCKPILED FOR USE DURING SITE RESTORATION AT A SPECIFICALLY IDENTIFIED AND FLAGGED AREA.

D. ANY MATERIAL NOT USED IN RESTORATION, AND NOT NATIVE TO THE FLOODPLAIN, WILL BE DISPOSED OF OUTSIDE THE 100-YEAR FLOODPLAIN.

8. EQUIPMENT.

A. MECHANIZED EQUIPMENT AND VEHICLES WILL 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).

B. EQUIPMENT WILL BE STORED, FUELED, AND MAINTAINED IN AN CLEARLY IDENTIFIED STAGING AREA THAT MEETS STAGING AREA CONSERVATION MEASURES.

C. EQUIPMENT WILL BE REFUELED IN A VEHICLE STAGING AREA 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).

D. BIODEGRADABLE LUBRICANTS AND FLUIDS WILL BE USED ON EQUIPMENT OPERATING IN AND ADJACENT TO THE STREAM CHANNEL AND LIVE WATER.

E. EQUIPMENT WILL BE INSPECTED DAILY FOR FLUID LEAKS BEFORE LEAVING THE VEHICLE STAGING AREA FOR OPERATION WITHIN 150 FEET OF ANY NATURAL WATER BODY OR WETLAND.

F. EQUIPMENT WILL BE THOROUGHLY CLEANED BEFORE OPERATION BELOW ORDINARY HIGH WATER, AND AS OFTEN AS NECESSARY DURING OPERATION, TO REMAIN GREASE FREE.

9. EROSION CONTROL.

A. TEMPORARY EROSION CONTROL MEASURES INCLUDE:

1. TEMPORARY EROSION CONTROLS WILL BE IN PLACE BEFORE ANY SIGNIFICANT ALTERATION OF THE ACTION SITE AND APPROPRIATELY INSTALLED DOWNSLOPE OF PROJECT ACTIVITY WITHIN THE RIPARIAN BUFFER AREA UNTIL SITE REHABILITATION IS COMPLETE;
2. IF THERE IS A POTENTIAL FOR ERODED SEDIMENT TO ENTER THE STREAM, SEDIMENT BARRIERS WILL BE INSTALLED AND MAINTAINED FOR THE DURATION OF PROJECT IMPLEMENTATION;
3. TEMPORARY EROSION CONTROL MEASURES MAY INCLUDE SEDGE MATS, FIBER WATTLES, SILT FENCES, JUTE MATTING, WOOD FIBER MULCH AND SOIL BINDER, OR GEOTEXTILES AND GEOSYNTHETIC FABRIC;
4. SOIL STABILIZATION UTILIZING WOOD FIBER MULCH AND TACKIFIER (HYDRO-APPLIED) MAY BE USED TO REDUCE EROSION OF BARE SOIL IF THE MATERIALS ARE NOXIOUS WEED FREE AND NONTOXIC TO AQUATIC AND TERRESTRIAL ANIMALS, SOIL MICROORGANISMS, AND VEGETATION;
5. SEDIMENT WILL BE REMOVED FROM EROSION CONTROLS ONCE IT HAS REACHED 1/3 OF THE EXPOSED HEIGHT OF THE CONTROL; AND
6. ONCE THE SITE IS STABILIZED AFTER CONSTRUCTION, TEMPORARY EROSION CONTROL MEASURES WILL BE REMOVED.

B. EMERGENCY EROSION CONTROLS. THE FOLLOWING MATERIALS FOR EMERGENCY EROSION CONTROL WILL BE AVAILABLE AT THE WORK SITE:

1. A SUPPLY OF SEDIMENT CONTROL MATERIALS; AND
2. AN OIL-ABSORBING FLOATING BOOM WHENEVER SURFACE WATER IS PRESENT.

10. DUST ABATEMENT.

A. THE PROJECT SPONSOR WILL DETERMINE THE APPROPRIATE DUST CONTROL MEASURES BY CONSIDERING SOIL TYPE, EQUIPMENT USAGE, PREVAILING WIND DIRECTION, AND THE EFFECTS CAUSED BY OTHER EROSION AND SEDIMENT CONTROL MEASURES.

B. WORK WILL BE SEQUENCED AND SCHEDULED TO REDUCE EXPOSED BARE SOIL SUBJECT TO WIND EROSION.

C. DUST-ABATEMENT ADDITIVES AND STABILIZATION CHEMICALS (TYPICALLY MAGNESIUM CHLORIDE, CALCIUM CHLORIDE SALTS, OR LIGNINSULFONATE) WILL NOT BE APPLIED WITHIN 25 FEET OF WATER OR A STREAM CHANNEL AND WILL BE APPLIED SO AS TO MINIMIZE THE LIKELIHOOD THAT THEY WILL ENTER STREAMS. APPLICATIONS OF LIGNINSULFONATE WILL BE LIMITED TO A MAXIMUM RATE OF 0.5 GALLONS PER SQUARE YARD OF ROAD SURFACE, ASSUMING MIXED 50:50 WITH WATER.

D. APPLICATION OF DUST ABATEMENT CHEMICALS WILL BE AVOIDED DURING OR JUST BEFORE WET WEATHER, AND AT STREAM CROSSINGS OR OTHER AREAS THAT COULD RESULT IN UNFILTERED DELIVERY OF THE DUST ABATEMENT MATERIALS TO A WATERBODY (TYPICALLY THESE WOULD BE AREAS WITHIN 25 FEET OF A WATERBODY OR STREAM CHANNEL; DISTANCES MAY BE GREATER WHERE VEGETATION IS SPARSE OR SLOPES ARE STEEP).

E. SPILL CONTAINMENT EQUIPMENT WILL BE AVAILABLE DURING APPLICATION OF DUST ABATEMENT CHEMICALS.

F. PETROLEUM-BASED PRODUCTS WILL NOT BE USED FOR DUST ABATEMENT.

REBECCA H. MILLER
STATE OF WASHINGTON
56754
REGISTERED
PROFESSIONAL ENGINEER
PRELIMINARY

DRAFT SUBMITTAL - NOT FOR CONSTRUCTION

NO.	DATE	BY	ISSUE / DESCRIPTION

DESIGNED BY:	BHM/KHR
DRAWN BY:	KHR/SCY
APPROVED BY:	JRS
REVISION NO.:	----
DATE:	12/2/24

GEOENGINEERS

PREPARED FOR:

CONFEDERATED TRIBES OF THE UMATILLA INDIAN RESERVATION

WALLA WALLA RM 32.5 FLOODPLAIN RECONNECTION
WALLA WALLA COUNTY, WASHINGTON

HIP IV - GENERAL CONSERVATION MEASURES

DRAWING NUMBER:
6.0
SHEET: 19 OF 21

PROJECT DESIGN AND SITE PREPARATION (CONTINUED).

11. SPILL PREVENTION, CONTROL, AND COUNTER MEASURES.

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

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

C. 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.

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

E. 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.

F. PUMPS USED ADJACENT TO WATER SHALL USE SPILL CONTAINMENT SYSTEMS.

12. INVASIVE SPECIES CONTROL.

A. 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.

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

C. WADING BOOTS WITH FELT SOLES ARE NOT TO BE USED DUE TO THEIR PROPENSITY FOR AIDING IN THE TRANSFER OF INVASIVE SPECIES UNLESS DECONTAMINATION PROCEDURES HAVE BEEN APPROVED BY THE EC LEAD.

WORK AREA ISOLATION AND FISH SALVAGE.

1. WORK AREA ISOLATION.

A. ANY WORK AREA WITHIN THE WETTED CHANNEL WILL BE ISOLATED FROM THE ACTIVE STREAM WHENEVER ESA-LISTED FISH ARE REASONABLY CERTAIN TO BE PRESENT, OR IF THE WORK AREA IS LESS THAN 300-FEET UPSTREAM FROM KNOWN SPAWNING HABITATS.

B. WORK AREA ISOLATION AND FISH SALVAGE ACTIVITIES WILL COMPLY WITH THE IN-WATER WORK WINDOW.

C. DESIGN PLANS WILL INCLUDE ALL ISOLATION ELEMENTS AND AREAS (COFFER DAMS, PUMPS, DISCHARGE AREAS, FISH SCREENS, FISH RELEASE AREAS, ETC.).

D. WORK AREA ISOLATION AND FISH CAPTURE ACTIVITIES WILL OCCUR DURING PERIODS OF THE COOLEST AIR AND WATER TEMPERATURES POSSIBLE, NORMALLY EARLY IN THE MORNING VERSUS LATE IN THE DAY, AND DURING CONDITIONS APPROPRIATE TO MINIMIZE STRESS AND DEATH OF SPECIES PRESENT.

2. FISH SALVAGE.

A. MONITORING AND RECORDING WILL TAKE PLACE FOR DURATION OF SALVAGE. THE SALVAGE REPORT WILL BE COMMUNICATED TO AGENCIES VIA THE PROJECT COMPLETION FORM (PCF).

B. SALVAGE ACTIVITIES SHOULD TAKE PLACE DURING CONDITIONS TO MINIMIZE STRESS TO FISH SPECIES, TYPICALLY PERIODS OF THE COOLEST AIR AND WATER TEMPERATURES WHICH OCCUR IN THE MORNING VERSUS LATE IN THE DAY.

C. SALVAGE OPERATIONS WILL FOLLOW THE ORDERING, METHODS, AND CONSERVATION MEASURES SPECIFIED BELOW:

1. SLOWLY REDUCE WATER FROM THE WORK AREA TO ALLOW SOME FISH TO LEAVE VOLITIONALLY.
2. BLOCK NETS WILL BE INSTALLED AT UPSTREAM AND DOWNSTREAM LOCATIONS AND MAINTAINED IN A SECURED POSITION TO EXCLUDE FISH FROM ENTERING THE PROJECT AREA.
3. BLOCK NETS WILL BE SECURED TO THE STREAM CHANNEL BED AND BANKS UNTIL FISH CAPTURE AND TRANSPORT ACTIVITIES ARE COMPLETE. BLOCK NETS MAY BE LEFT IN PLACE FOR THE DURATION OF THE PROJECT TO EXCLUDE FISH AS LONG AS PASSAGE REQUIREMENTS ARE MET.
4. NETS WILL BE MONITORED HOURLY DURING IN-STREAM DISTURBANCE.
5. IF BLOCK NETS REMAIN IN PLACE MORE THAN ONE DAY, THE NETS WILL BE MONITORED AT LEAST DAILY TO ENSURE THEY ARE SECURED AND FREE OF ORGANIC ACCUMULATION. IF BULL TROUT ARE PRESENT, NETS ARE TO BE CHECKED EVERY 4 HOURS FOR FISH IMPINGEMENT.
6. CAPTURE FISH THROUGH SEINING AND RELOCATE TO STREAMS.
7. WHILE DEWATERING, ANY REMAINING FISH WILL BE COLLECTED BY HAND OR DIP NETS.
8. SEINES WITH A MESH SIZE TO ENSURE CAPTURE OF THE RESIDING ESA-LISTED FISH WILL BE USED.
9. MINNOW TRAPS WILL BE LEFT IN PLACE OVERNIGHT AND USED IN CONJUNCTION WITH SEINING.
10. ELECTROFISH TO CAPTURE AND RELOCATED FISH NOT CAUGHT DURING SEINING PER ELECTROFISH CONSERVATION MEASURES.
11. CONTINUE TO SLOWLY DEWATER STREAM REACH.
12. COLLECT ANY REMAINING FISH IN COLD-WATER BUCKETS AND RELOCATED TO THE STREAM.
13. LIMIT THE TIME FISH ARE IN A TRANSPORT BUCKET.
14. MINIMIZE PREDATION BY TRANSPORTING COMPARABLE SIZES IN BUCKETS.
15. BUCKET WATER TO BE CHANGED EVERY 15 MINUTES OR AERATED.
16. BUCKETS WILL BE KEPT IN SHADED AREAS OR COVERED.
17. DEAD FISH WILL NOT BE STORED IN TRANSPORT BUCKETS, BUT WILL BE LEFT ON THE STREAM BANK TO AVOID MORTALITY COUNTING ERRORS.

D. SALVAGE GUIDELINES FOR BULL TROUT, LAMPREY, MUSSELS, AND NATIVE FISH.

1. CONDUCT SITE SURVEY TO ESTIMATE SALVAGE NUMBERS.
2. PRE-SELECT SITE(S) FOR RELEASE AND/OR MUSSEL BED RELOCATION.
3. SALVAGE OF BULL TROUT WILL NOT TAKE PLACE WHEN WATER TEMPERATURES EXCEED 15 DEGREES CELSIUS.
4. IF DRAWDOWN LESS THAN 48 HOURS, SALVAGE OF LAMPREY AND MUSSELS MAY NOT BE NECESSARY IF TEMPERATURES SUPPORT SURVIVAL IN SEDIMENTS.
5. SALVAGE MUSSELS BY HAND, LOCATING BY SNORKELING OR WADING.
6. SALVAGE LAMPREY BY ELECTROFISHING (SEE ELECTROFISHING FOR LARVAL LAMPREY SETTINGS AND LARVAL LAMPREY DRY SHOCKING SETTINGS).
7. SALVAGE BONY FISH AFTER LAMPREY WITH NETS OR ELECTROFISHING (SEE ELECTROFISHING FOR APPROPRIATE SETTINGS).
8. REGULARLY INSPECT DEWATERED SITE SINCE LAMPREY LIKELY TO EMERGE AFTER DEWATERING AND MUSSELS MAY BECOME VISIBLE.
9. MUSSELS MAY BE TRANSFERRED IN COOLERS.
10. MUSSELS WILL BE PLACED INDIVIDUALLY TO ENSURE ABILITY TO BURROW INTO NEW HABITAT.

3. ELECTROFISHING.

A. INITIAL SITE SURVEY AND INITIAL SETTINGS.

1. IDENTIFY SPAWNING ADULTS AND ACTIVE REDDS TO AVOID.
2. RECORD WATER TEMPERATURE. ELECTROFISHING WILL NOT OCCUR WHEN WATER TEMPERATURES ARE ABOVE 18 DEGREES CELSIUS.
3. IF POSSIBLE, A BLOCK NET WILL BE PLACED DOWNSTREAM AND CHECKED REGULARLY TO CAPTURE STUNNED FISH THAT DRIFT DOWNSTREAM.
4. INITIAL SETTINGS WILL BE 100 VOLTS, PULSE WIDTH OF 500 MICRO SECONDS, AND PULSE RATE OF 30 HERTZ.
5. RECORDS FOR CONDUCTIVITY, WATER TEMPERATURE, AIR TEMPERATURE, ELECTROFISHING SETTINGS, ELECTROFISHER MODEL, ELECTROFISHER CALIBRATION, FISH CONDITIONS, FISH MORTALITIES, AND TOTAL CAPTURE RATES WILL BE INCLUDED IN THE SALVAGE LOG BOOK.

B. ELECTROFISHING TECHNIQUE.

1. SAMPLING SHOULD BEGIN USING STRAIGHT DC. POWER WILL REMAIN ON UNTIL THE FISH IS NETTED WHEN USING STRAIGHT DC. GRADUALLY INCREASE VOLTAGE WHILE REMAINING BELOW MAXIMUM LEVELS.
2. MAXIMUM VOLTAGE WILL BE 1100 VOLTS WHEN CONDUCTIVITY IS <100 MILLISECONDS, 800 VOLTS WHEN CONDUCTIVITY IS BETWEEN 100 AND 300 MILLISECONDS, AND 400 VOLTS WHEN CONDUCTIVITY IS >300 MILLISECONDS.
3. IF FISH CAPTURE IS NOT SUCCESSFUL USING STRAIGHT DC, THE ELECTROFISHER WILL BE SET TO INITIAL VOLTAGE FOR PDC. VOLTAGE, PULSE WIDTH, AND PULSE FREQUENCY WILL BE GRADUALLY INCREASED WITHIN MAXIMUM VALUES UNTIL CAPTURE IS SUCCESSFUL.
4. MAXIMUM PULSE WIDTH IS 5 MILLISECONDS. MAXIMUM PULSE RATE IS 70 HERTZ
5. ELECTROFISHING WILL NOT OCCUR IN ONE AREA FOR AN EXTENDED PERIOD.
6. THE ANODE WILL NOT INTENTIONALLY COME INTO CONTACT WITH FISH. THE ZONE FOR POTENTIAL INJURY OF 0.5 M FROM THE ANODE WILL BE AVOIDED.
7. SETTINGS WILL BE LOWERED IN SHALLOWER WATER SINCE VOLTAGE GRADIENTS LIKELY TO INCREASE.
8. ELECTROFISHING WILL NOT OCCUR IN TURBID WATER WHERE VISIBILITY IS POOR (I.E. UNABLE TO SEE THE BED OF THE STREAM).
9. OPERATIONS WILL IMMEDIATELY STOP IF MORTALITY OR OBVIOUS FISH INJURY IS OBSERVED. ELECTROFISHING SETTINGS WILL BE REEVALUATED.

C. SAMPLE PROCESSING.

1. FISH SHALL BE SORTED BY SIZE TO AVOID PREDATION DURING CONTAINMENT.
2. SAMPLERS WILL REGULARLY CHECK CONDITIONS OF FISH HOLDING CONTAINERS, AIR PUMPS, WATER TRANSFERS, ETC.
3. FISH WILL BE OBSERVED FOR GENERAL CONDITIONS AND INJURIES
4. EACH FISH WILL BE COMPLETELY REVIVED BEFORE RELEASE. ESA-LISTED SPECIES WILL BE PRIORITIZED FOR SUCCESSFUL RELEASE.

D. BULL TROUT ELECTROFISHING.

1. ELECTROFISHING FOR BULL TROUT WILL ONLY OCCUR FROM MAY 1 TO JULY 31. NO ELECTROFISHING WILL OCCUR IN ANY BULL TROUT OCCUPIED HABITAT AFTER AUGUST 15. IN FMO HABITATS ELECTROFISHING MAY OCCUR ANY TIME.
2. ELECTROFISHING OF BULL TROUT WILL NOT OCCUR WHEN WATER TEMPERATURES EXCEED 15 DEGREES CELSIUS.

E. LARVAL LAMPREY ELECTROFISHING.

1. PERMISSION FROM EC LEAD WILL BE OBTAINED IF LARVAL LAMPREY ELECTROFISHER IS NOT ONE OF FOLLOWING PRE-APPROVED MODELS: ABP-2 "WISCONSIN", SMITH-ROOT LR-24, OR SMITH-ROOT APEX BACKPACK.
2. LARVAL LAMPREY SAMPLING WILL INCORPORATE 2-STAGE METHOD: "TICKLE" AND "STUN".
3. FIRST STAGE: USE 125 VOLT DC WITH A 25 PERCENT DUTY CYCLE APPLIED AT A SLOW RATE OF 3 PULSES PER SECOND. IF TEMPERATURES ARE BELOW 10 DEGREES CELSIUS, VOLTAGE MAY BE INCREASED GRADUALLY (NOT TO EXCEED 200 VOLTS). BURSTED PULSES (THREE SLOW AND ONE SKIPPED) RECOMMENDED TO INCREASE EMERGENCE.
4. SECOND STAGE (OPTIONAL FOR EXPERIENCED NETTERS): IMMEDIATELY AFTER LAMPREY EMERGE, USE A FAST PULSE SETTING OF 30 PULSES PER SECOND.
5. SE DIP NETS FOR VISIBLE LAMPREY. SIENES AND FINE MESH NET SWEEPS MAY BE USED IN POOR VISIBILITY.
6. SAMPLING WILL OCCUR SLOWLY (>60 SECONDS PER METER) STARTING AT UPSTREAM AND WORKING DOWNSTREAM.
7. MULTIPLE SWEEPS TO OCCUR WITH 15 MINUTES BETWEEN SWEEPS.
8. POST-DRAWDOWN "DRY-SHOCKING" WILL BE APPLIED IF LARVAL LAMPREY CONTINUE TO EMERGE. ANODES TO BE PLACED ONE METER APART TO SAMPLE ONE SQUARE METER AT A TIME FOR AT LEAST 60 SECONDS. FOR TEMPERATURES LESS THAN 10 DEGREES CELSIUS, MAXIMUM VOLTAGE MAY BE GRADUALLY INCREASED TO 400 VOLTS (DRY-SHOCKING ONLY).

REBECCA H. MILLER
STATE OF WASHINGTON
56754
REGISTERED PROFESSIONAL ENGINEER
PRELIMINARY

DRAFT SUBMITTAL - NOT FOR CONSTRUCTION

Plotted: 11/27/2024, 11:40 | bmiller P:\2\2698037\CAD\00\Floodplain and Habitat Restoration Design\02_30_Percent\269803700_Sht 20_6.1 [HIP IV - General Conservation Measures].dwg

NO.	DATE	BY	ISSUE / DESCRIPTION

DESIGNED BY:	BHM/KHR
DRAWN BY:	KHR/SCY
APPROVED BY:	JRS
REVISION NO.:	----
DATE:	12/2/24

GEOENGINEERS

PREPARED FOR:

CONFEDERATED TRIBES OF THE UMATILLA INDIAN RESERVATION

WALLA WALLA RM 32.5 FLOODPLAIN RECONNECTION
WALLA WALLA COUNTY, WASHINGTON

HIP IV - GENERAL CONSERVATION MEASURES

DRAWING NUMBER: 6.1

SHEET: 20 OF 21

WORK AREA ISOLATION AND FISH SALVAGE (CONTINUED).

4. DEWATERING.

A. DEWATERING WILL OCCUR AT A RATE SLOW ENOUGH TO ALLOW SPECIES TO NATURALLY MIGRATE OUT OF THE WORK AREA.

B. WHERE A GRAVITY FEED DIVERSION IS NOT POSSIBLE, A PUMP MAY BE USED. PUMPS WILL BE INSTALLED TO AVOID REPETIVE DEWATERING AND REWATERING.

C. WHEN FISH ARE PRESENT, PUMPS WILL BE SCREENED IN ACCORDANCE WITH NMFS FISH SCREEN CRITERIA. NMFS ENGINEERING REVIEW AND APPROVAL WILL BE OBTAINED FOR PUMPS EXCEEDING 3 CUBIC FEET PER SECOND.

D. DISSIPATION OF FLOW ENERGY AT THE BYPASS OUTFLOW WILL BE PROVIDED TO PREVENT DAMAGE TO THE STREAM CHANNEL AND RIPARIAN VEGETATION.

E. SEEPAGE WATER WILL BE PUMPED TO A TEMPORARY STORAGE AND TREATMENT SITE OF INTO UPLAND AREAS TO ALLOW WATER TO PERCOLATE THROUGH SOIL AND VEGETATION PRIOR TO REENTERING THE STREAM CHANNEL.

CONSTRUCTION AND POST CONSTRUCTION CONSERVATION MEASURES.

1. FISH PASSAGE.

A. FISH PASSAGE WILL BE PROVIDED FOR ADULT AND JUVENILE FISH LIKELY TO BE PRESENT DURING CONSTRUCTION UNLESS PASSAGE DID NOT EXIST BEFORE CONSTRUCTION, THE STREAM IS NATURALLY IMPASSABLE, OR PASSAGE WILL NEGATIVELY IMPACT ESA-LISTED SPECIES OR THEIR HABITAT.

B. FISH PASSAGE ALTERNATIVES WILL BE APPROVED BY THE BPA EC LEAD UNDER ADVISEMENT BY THE NMFS HABITAT BIOLOGIST.

2. CONSTRUCTION AND DISCHARGE WATER.

A. SURFACE WATER MAY BE DIVERTED TO MEET CONSTRUCTION NEEDS ONLY IF DEVELOPED SOURCES ARE UNAVAILABLE OR INADEQUATE.

B. DIVERSIONS WILL NOT EXCEED 10% OF THE AVAILABLE FLOW.

C. CONSTRUCTION DISCHARGE WATER WILL BE COLLECTED AND TREATED TO REMOVE DEBRIS, NUTRIENTS, SEDIMENT, PETROLEUM HYDROCARBONS, METALS, AND OTHER POLLUTANTS.

3. TIME AND EXTENT OF DISTURBANCE.

A. EARTHWORK REQUIRING IN-STREAM MECHANIZED EQUIPMENT (INCLUDING DRILLING, EXCAVATION, DREDGING, FILLING, AND COMPACTING) WILL BE COMPLETED AS QUICKLY AS POSSIBLE.

B. MECHANIZED EQUIPMENT WILL WORK FROM TOP OF BANK UNLESS WORK FROM ANOTHER LOCATION WILL RESULT IN LESS HABITAT DISTURBANCE (TURBIDITY, VEGETATION DISTURBANCE, ETC.).

4. CESSATION OF WORK.

A. PROJECT OPERATIONS WILL CEASE WHEN HIGH FLOW CONDITIONS MAY RESULT IN INUNDATION OF THE PROJECT AREA (FLOOD EFFORTS TO DECREASE DAMAGES TO NATURAL RESOURCES PERMITTED).

B. WATER QUALITY LEVELS EXCEEDED. SEE CWA SECTION 401 WATER QUALITY CERTIFICATION AND TURBIDITY MEASURES.

5. SITE RESTORATION.

A. DISTURBED AREAS, STREAM BANKS, SOILS, AND VEGETATION WILL BE CLEANED UP AND RESTORED TO IMPROVED OR PRE-PROJECT CONDITIONS.

B. PROJECT-RELATED WASTE WILL BE REMOVED.

C. TEMPORARY ACCESS ROADS AND STAGING WILL BE DECOMPACTED AND RESTORED. SOILS WILL BE LOOSENED IF NEEDED FOR REVEGETATION OR WATER INFILTRATION.

D. THE PROJECT SPONSOR WILL RETAIN THE RIGHT OF REASONABLE ACCESS TO THE SITE TO MONITOR AND MAINTAIN THE SITE OVER THE LIFE OF THE PROJECT.

6. REVEGETATION.

A. PLANTING AND SEEDING WILL OCCUR PRIOR TO OR AT THE BEGINNING OF THE FIRST GROWING SEASON AFTER CONSTRUCTION.

B. A MIX OF NATIVE SPECIES (INVASIVE SPECIES NOT ALLOWED) APPROPRIATE TO THE SITE WILL BE USED TO REESTABLISH VEGETATION, PROVIDE SHADE, AND REDUCE EROSION. REESTABLISHED VEGETATION SHOULD BE AT LEAST 70% OF PRE-PROJECT CONDITIONS WITHIN THREE YEARS.

C. VEGETATION SUCH AS WILLOWS, SEDGES, OR RUSH MATS WILL BE SALVAGED FROM DISTURBED OR ABANDONED AREAS TO BE REPLANTED.

D. SHORT-TERM STABILIZATION MEASURE MAY INCLUDE THE USE OF NON-NATIVE STERILE SEED MIX (WHEN NATIVE NOT AVAILABLE), WEED-FREE CERTIFIED STRAW, OR OTHER SIMILAR TECHNIQUES.

E. SURFACE FERTILIZER WILL NOT BE APPLIED WITHIN 50 FEET OF ANY STREAM, WATE BODY, OR WETLAND.

F. FENCING WILL BE INSTALLED AS NECESSARY TO PREVENT ACCESS TO REVEGETATED SITES BY LIVESTOCK OR UNAUTHORIZED PERSONS.

G. INVASIVE PLANTS WILL BE REMOVED OR CONTROLLED UNTIL NATIVE PLANT SPECIES ARE WELL ESTABLISHED (TYPICALLY THREE YEARS POST-CONSTRUCTION).

7. SITE ACCESS AND IMPLEMENTATION MONITORING.

A. THE PROJECT SPONSOR WILL PROVIDE CONSTRUCTION MONITORING DURING IMPLEMENTATION TO ENSURE ALL CONSERVATION MEASURES ARE ADEQUATELY FOLLOWED, EFFECTS TO LISTED SPECIES ARE NOT GREATER THAN PREDICTED, AND INCIDENTAL TAKE LIMITATIONS ARE NOT EXCEEDED.

B. THE PROJECT SPONSOR OR DESIGNATED REPRESENTATIVE WILL SUBMIT THE PROJECT COMPLETION FORM (PCF) WITHIN 30 DAYS OF PROJECT COMPLETION.

8. CWA SECTION 401 WATER QUALITY CERTIFICATION.

A. THE PROJECT SPONSOR OR DESIGNATED REPRESENTATIVE WILL COMPLETE AND RECORD WATER QUALITY OBSERVATIONS (SEE TURBIDITY MONITORING) TO ENSURE IN-WATER WORK IS NOT DEGRADING WATER QUALITY.

B. DURING CONSTRUCTION, WATER QUALITY PROVISIONS PROVIDED BY THE OREGON DEPARTMENT OF ENVIRONMENTAL QUALITY, WASHINGTON DEPARTMENT OF ECOLOGY, IDAHO DEPARTMENT OF ENVIRONMENTAL QUALITY WILL BE FOLLOWED.

STAGED REWATERING PLAN.

A. WHEN REINTRODUCING WATER TO DEWATERED AREAS AND NEWLY CONSTRUCTED CHANNELS, A STAGED REWATERING PLAN WILL BE APPLIED.

B. THE FOLLOWING WILL BE APPLIED TO ALL REWATERING EFFORTS. COMPLEX REWATERING EFFORTS MAY REQUIRE ADDITIONAL NOTES OR A DEDICATED SHEET IN THE CONSTRUCTION DETAILS.

1. TURBIDITY MONITORING PROTOCOL WILL BE APPLIED TO REWATERING EFFORTS.
2. PRE-WASH THE AREA BEFORE REWATERING. TURBID WASH WATER WILL BE DETAINED AND PUMPED TO THE FLOODPLAIN OR SEDIMENT CAPTURE AREAS RATHER THAN DISCHARGING TO FISH-BEARING STREAMS.
3. INSTALL SEINE NETS AT UPSTREAM END TO PREVENT FISH FROM MOVING DOWNSTREAM UNTIL 2/3 OF TOTAL FLOW IS RESTORED TO THE CHANNEL.
4. STARTING IN EARLY MORNING INTRODUCE 1/3 OF NEW CHANNEL FLOW OVER PERIOD OF 1-2 HOURS.
5. INTRODUCE SECOND THIRD OF FLOW OVER NEXT 1 TO 2 HOURS AND BEGIN FISH SALVAGE OF BYPASS CHANNEL IF FISH ARE PRESENT.
6. REMOVE UPSTREAM SEINE NETS ONCE 2/3 FLOW IN REWATERED CHANNEL AND DOWNSTREAM TURBIDITY IS WITHIN ACCEPTABLE RANGE (LESS THAN 40 NTU OR LESS THAN 10% BACKGROUND).
7. INTRODUCE FINAL THIRD OF FLOW ONCE FISH SALVAGE EFFORTS ARE COMPLETE AND DOWNSTREAM TURBIDITY VERIFIED TO BE WITHIN ACCEPTABLE RANGE.
8. INSTALL PLUG TO BLOCK FLOW INTO OLD CHANNEL OR BYPASS. REMOVE ANY REMAINING SEINE NETS.
9. IN LAMPREY SYSTEMS, LAMPREY SALVAGE AND DRY SHOCKING MAY BE NECESSARY.

TURBIDITY MONITORING.

A. RECORD THE READING, LOCATION, AND TIME FOR THE BACKGROUND READING APPROXIMATELY 100 FEET UPSTREAM OF THE PROJECT AREA USING A RECENTLY CALIBRATED TURBIDIMETER OR VIA VISUAL OBSERVATION (SEE THE HIP HANDBOOK TURBIDITY MONITORING SECTION FOR A VISUAL OBSERVATION KEY).

B. RECORD THE TURBIDITY READING, LOCATION, AND TIME AT THE MEASUREMENT COMPLIANCE LOCATION POINT.

1. 50 FEET DOWNSTREAM FOR STREAMS LESS THAN 30 FEET WIDE.
2. 100 FEET DOWNSTREAM FOR STREAMS BETWEEN 30 AND 100 FEET WIDE.
3. 200 FEET DOWNSTREAM FOR STREAMS GREATER THAN 100 FEET WIDE.
4. 300 FEET FROM THE DISCHARGE POINT OR NONPOINT SOURCE FOR LOCATIONS SUBJECT TO TIDAL OR COASTAL SCOUR.

C. TURBIDITY SHALL BE MEASURED (BACKGROUND LOCATION AND COMPLIANCE POINTS) EVERY 4 HOURS WHILE WORK IS BEING IMPLEMENTED.

D. IF THERE IS A VISIBLE DIFFERENCE BETWEEN A COMPLIANCE POINT AND THE BACKGROUND, THE EXCEEDANCE WILL BE NOTED IN THE PROJECT COMPLETION FORM (PCF). ADJUSTMENTS OR CORRECTIVE MEASURES WILL BE TAKEN IN ORDER TO REDUCE TURBIDITY.

E. IF EXCEEDANCES OCCUR FOR MORE THAN TWO CONSECUTIVE MONITORING INTERVALS (AFTER 8 HOURS), THE ACTIVITY WILL STOP UNTIL THE TURBIDITY LEVEL RETURNS TO BACKGROUND. THE BPA EC LEAD WILL BE NOTIFIED OF ALL EXCEEDANCES AND CORRECTIVE ACTIONS AT PROJECT COMPLETION.

F. IF TURBIDITY CONTROLS (COFFER DAMS, WADDLES, FENCING, ETC.) ARE DETERMINED INEFFECTIVE, CREWS WILL BE MOBILIZED TO MODIFY AS NECESSARY. OCCURRENCES WILL BE DOCUMENTED IN THE PROJECT COMPLETION FORM (PCF).

G. FINAL TURBIDITY READINGS, EXCEEDANCES, AND CONTROL FAILURES WILL BE SUBMITTED TO THE BPA EC LEAD USING THE PROJECT COMPLETION FORM (PCF).

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Plotted: 11/27/2024, 11:40 | bmiller P:\2\2698037\CAD\00\Floodplain and Habitat Restoration Design\v02_30_Percent\269803700_Sht 21_6.2 [HIP IV - General Conservation Measures].dwg

NO.	DATE	BY	ISSUE / DESCRIPTION

DESIGNED BY:	BHM/KHR
DRAWN BY:	KHR/SCY
APPROVED BY:	JRS
REVISION NO.:	----
DATE:	12/2/24

GEOENGINEERS

PREPARED FOR:

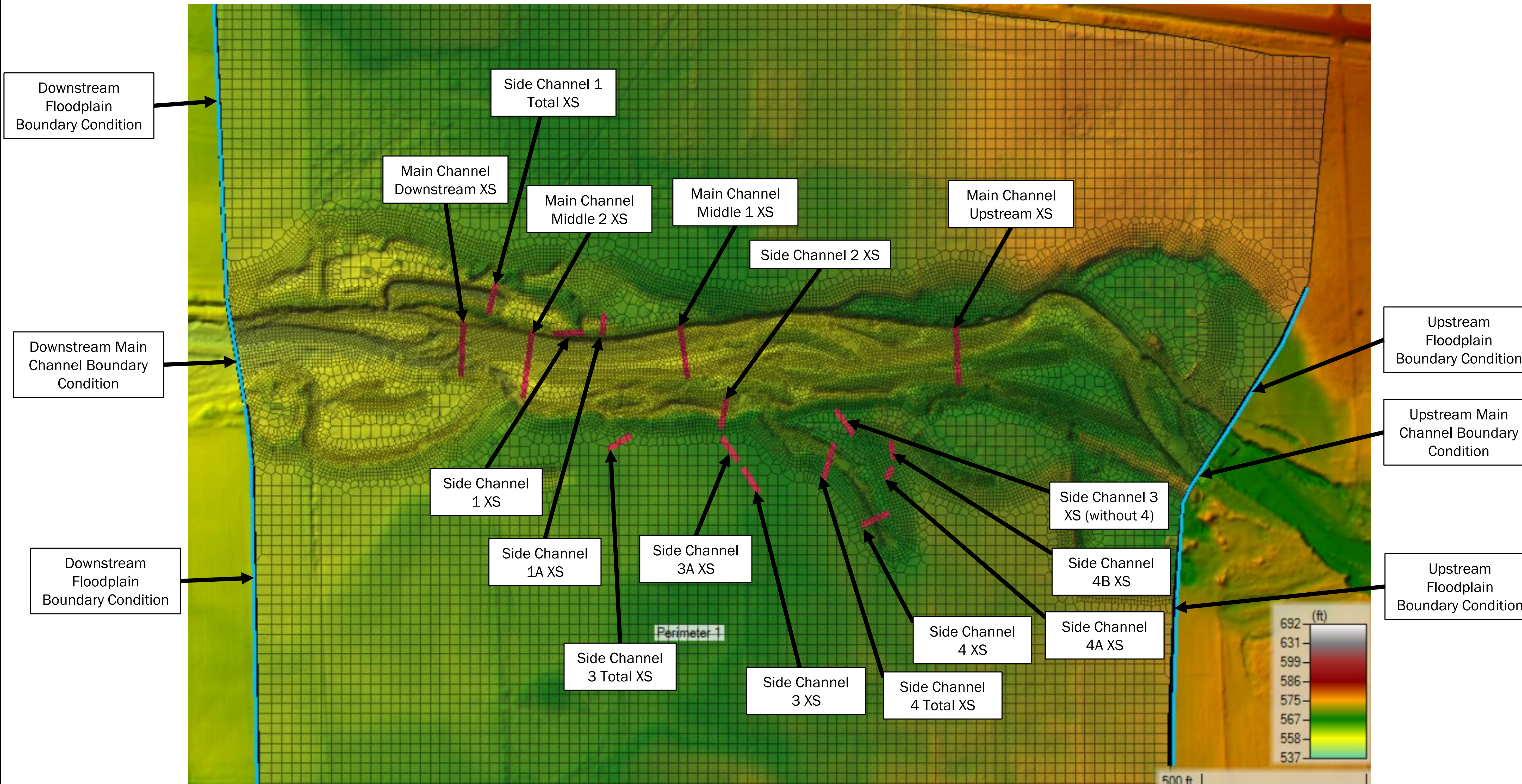
WALLA WALLA RM 32.5 FLOODPLAIN RECONNECTION
WALLA WALLA COUNTY, WASHINGTON

HIP IV - GENERAL CONSERVATION MEASURES

DRAWING NUMBER: 6.2

SHEET: 21 OF 21

Appendix B
Hydraulic Analysis



Notes:

1. The locations of all features shown are approximate.
2. This drawing is for information purposes. It is intended to assist in showing features discussed in an attached document. GeoEngineers, Inc. cannot guarantee the accuracy and content of electronic files. The master file is stored by GeoEngineers, Inc. and will serve as the official record of this communication.

Source(s): GeoEngineers, Inc., November 2024. Walla Walla RM 32.5 2-D unsteady HEC-RAS model. HEC-RAS 6.5

N

Not to Scale

Existing Conditions Model Overview: Mesh, Elevations, Boundary Conditions, Cross Sections

Walla Walla 32.5 Floodplain Reconnection
Walla Walla County, Washington

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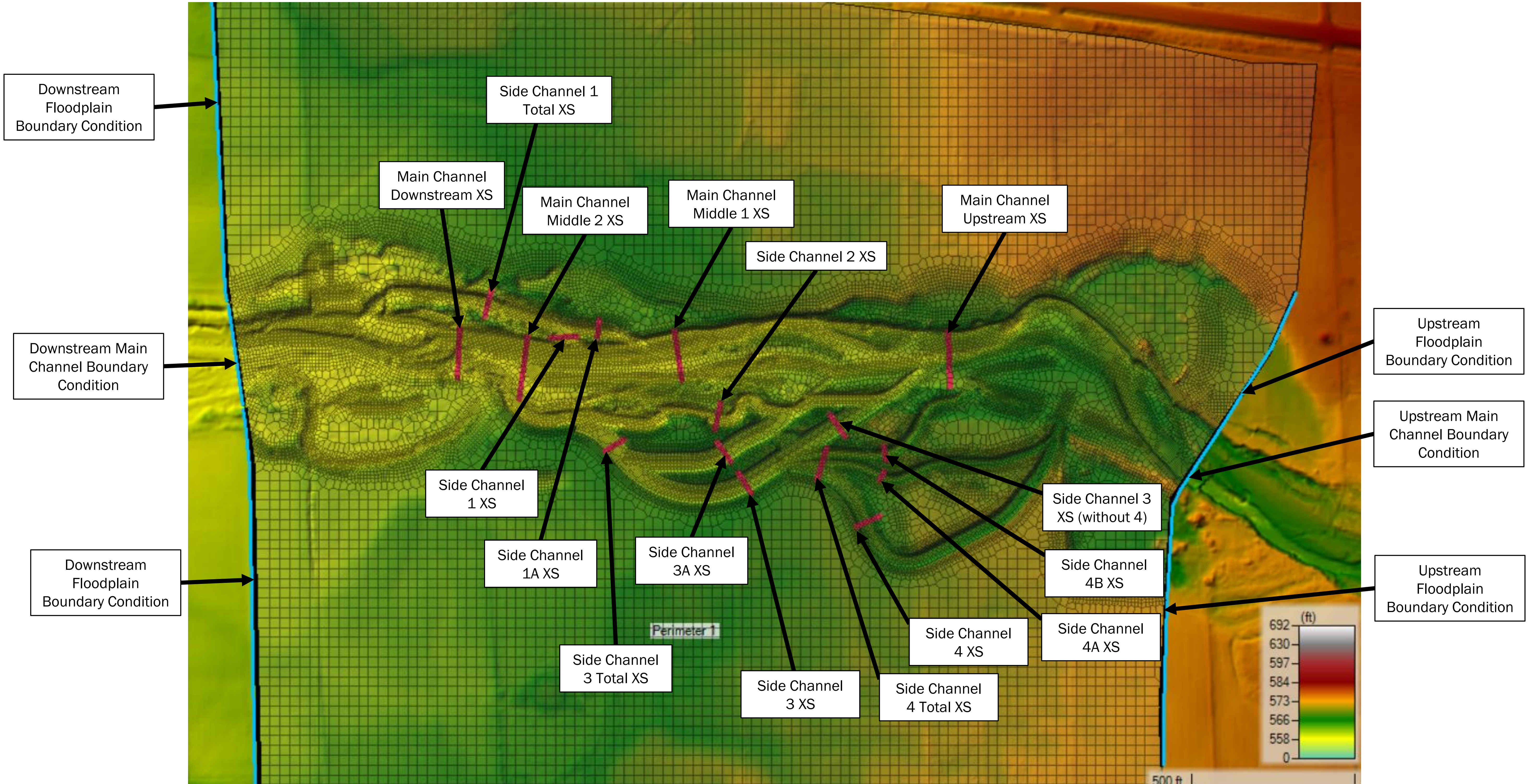
Figure B-1

002698-037-00 Date Exported: 11/13/2024



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Source(s): GeoEngineers, Inc., November 2024. Walla Walla RM 32.5 2-D unsteady HEC-RAS model. HEC-RAS 6.5

N
Not to Scale

Proposed Conditions Model Overview: Mesh, Elevations, Boundary Conditions, Cross Sections

Walla Walla 32.5 Floodplain Reconnection
Walla Walla County, Washington

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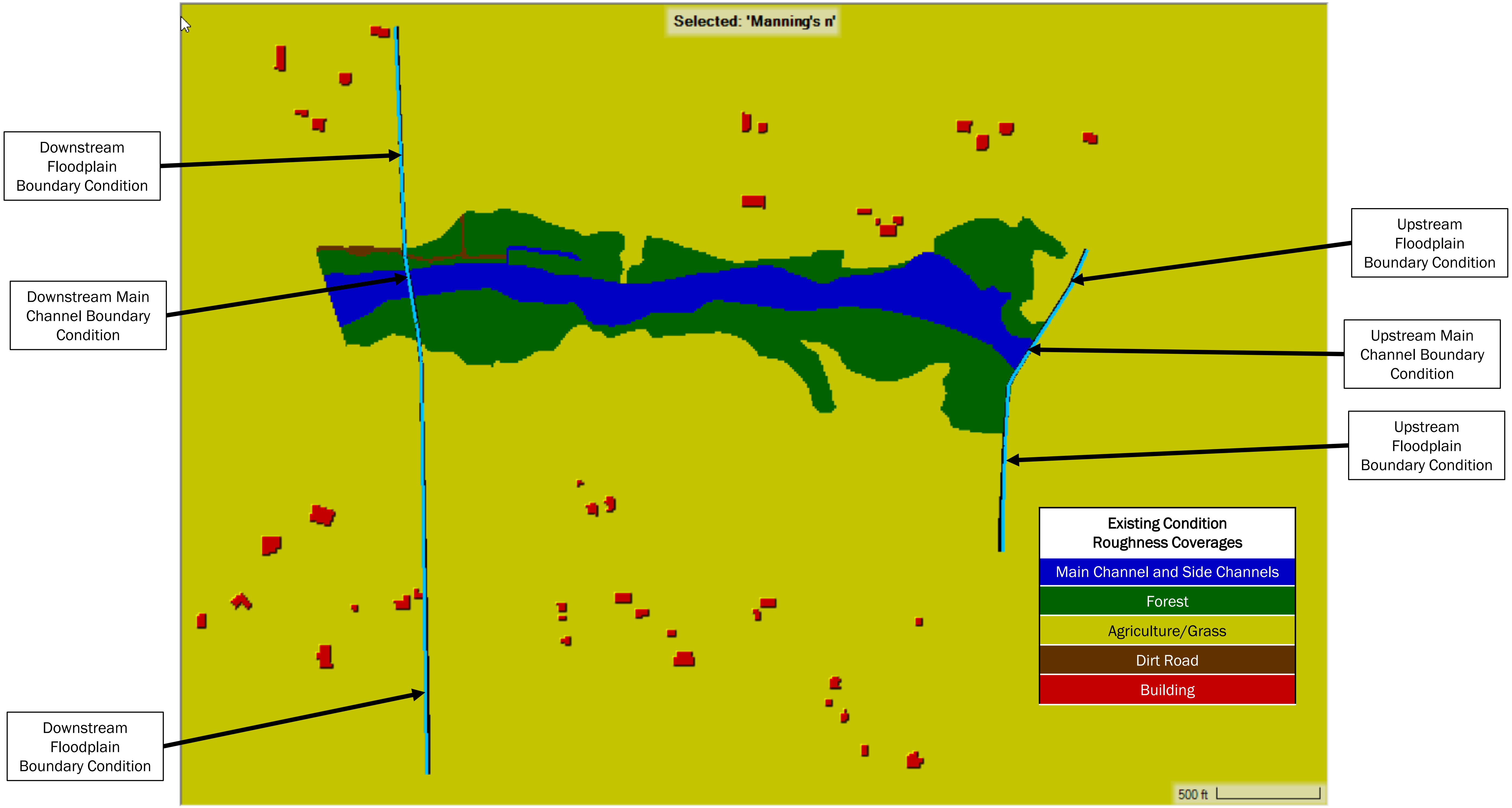
Figure B-2

002698-037-00 Date Exported: 11/13/2024



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Source(s): GeoEngineers, Inc., November 2024. Walla Walla RM 32.5 2-D unsteady HEC-RAS model. HEC-RAS 6.5

N
Not to Scale

Existing Conditions Model Overview: Manning's N and Boundary Conditions

Walla Walla 32.5 Floodplain Reconnection
Walla Walla County, Washington

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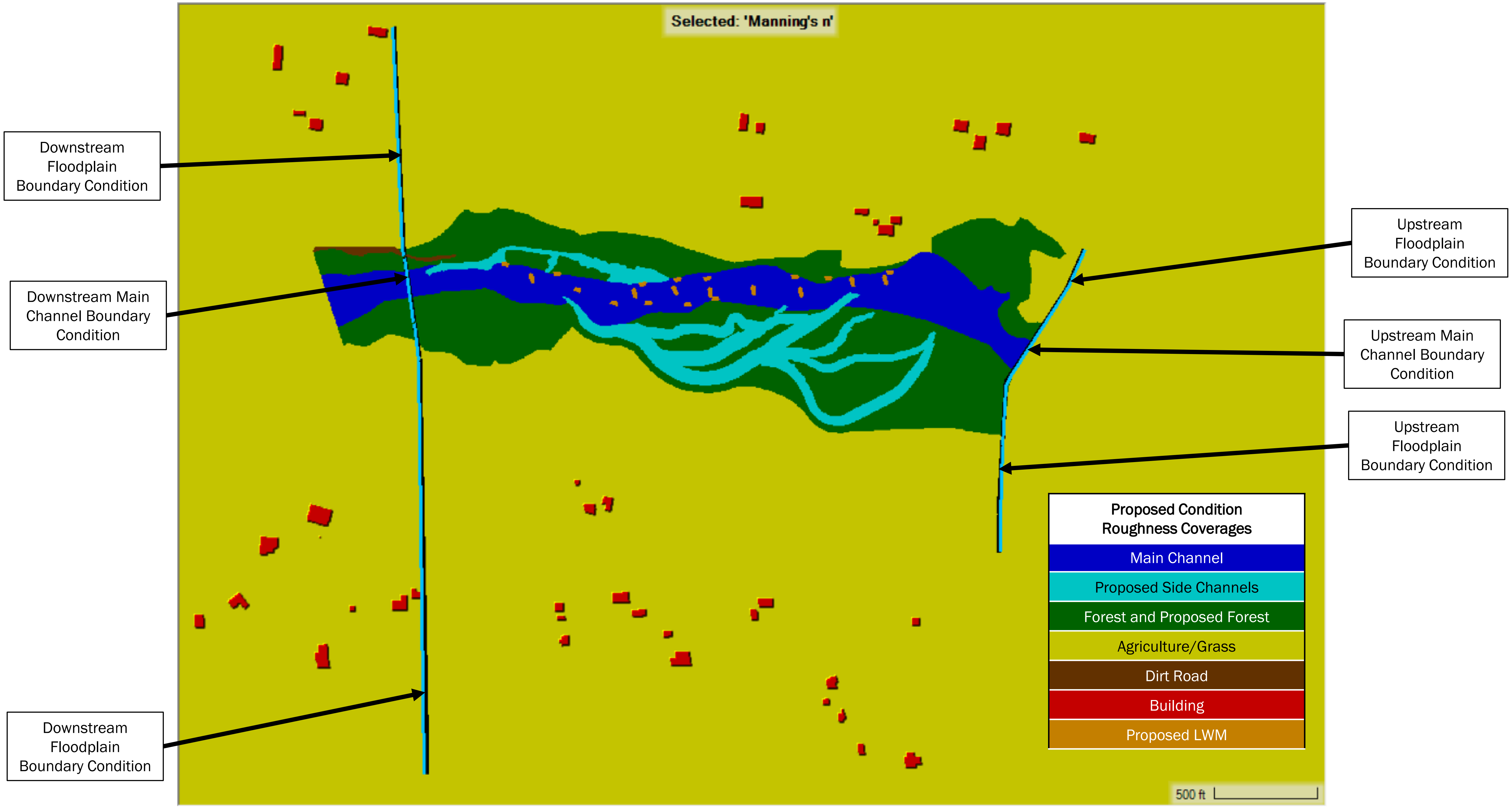
Figure B-3

002698-037-00 Date Exported: 11/13/2024



Notes:

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Source(s): GeoEngineers, Inc., November 2024. Walla Walla RM 32.5 2-D unsteady HEC-RAS model. HEC-RAS 6.5

N
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Proposed Conditions Model Overview: Manning's N and Boundary Conditions

Walla Walla 32.5 Floodplain Reconnection
Walla Walla County, Washington

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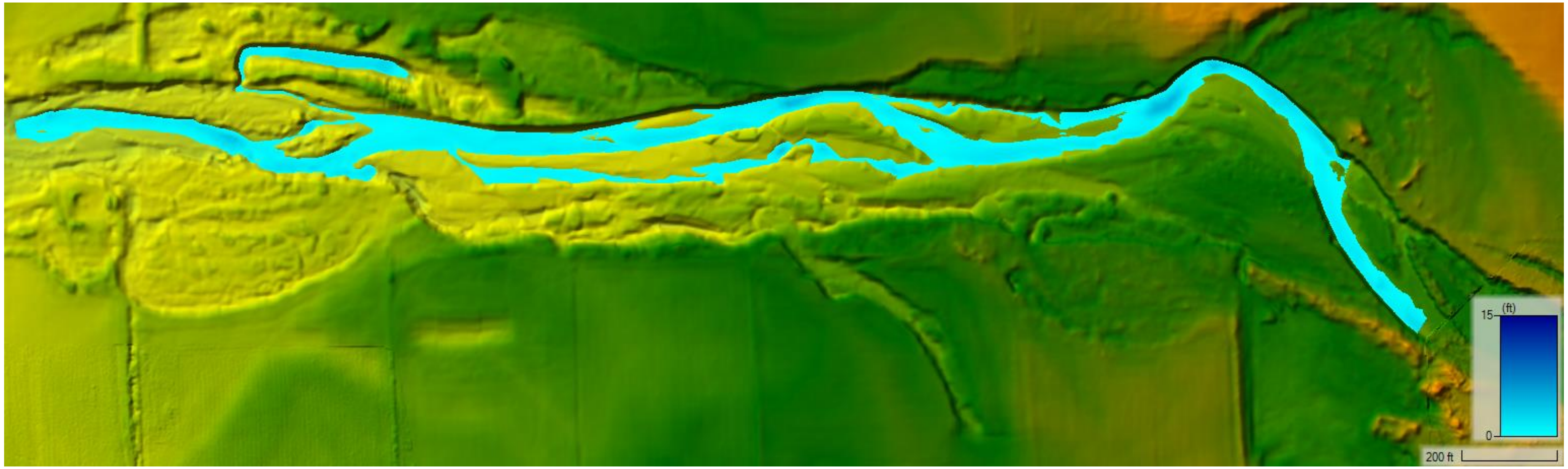
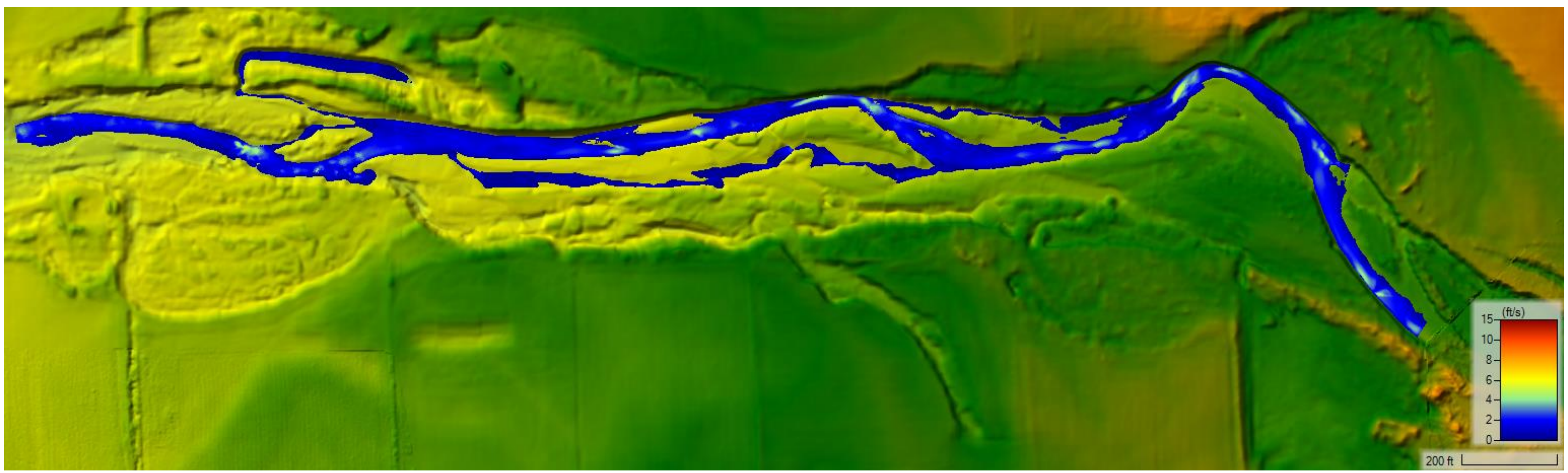
Figure B-4

002698-037-00 Date Exported: 11/13/2024





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Source(s): GeoEngineers, Inc., November 2024. Walla Walla RM 32.5 2-D unsteady HEC-RAS model. HEC-RAS 6.5

N
Not to Scale

Existing Conditions August 50 Percent Exceedance Depth and Velocity

Walla Walla 32.5 Floodplain Reconnection
Walla Walla County, Washington

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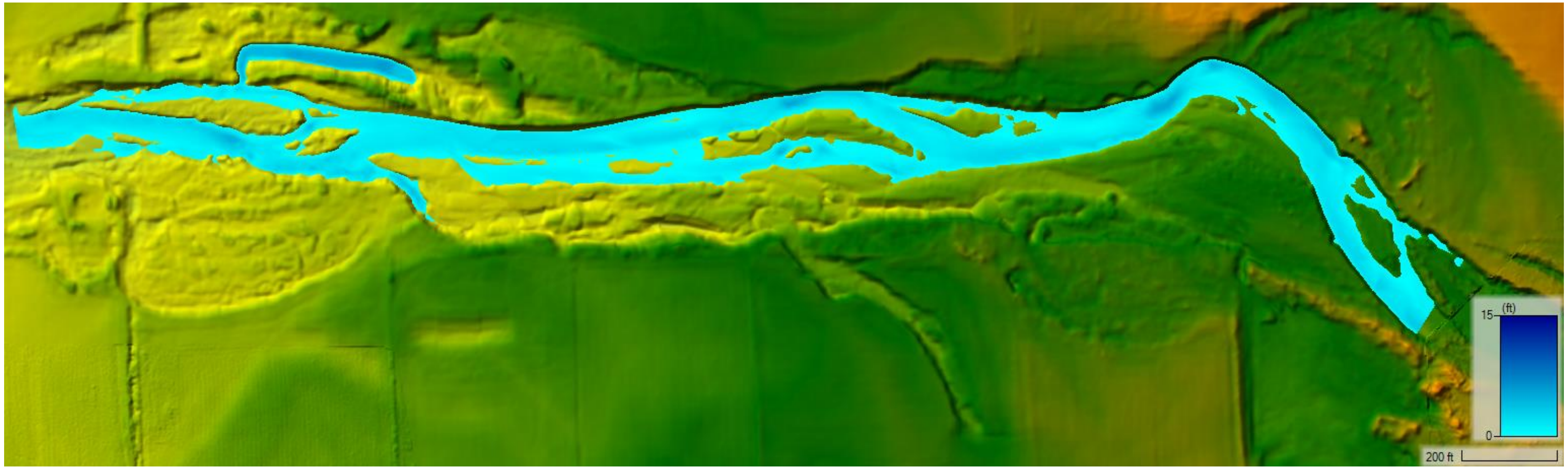
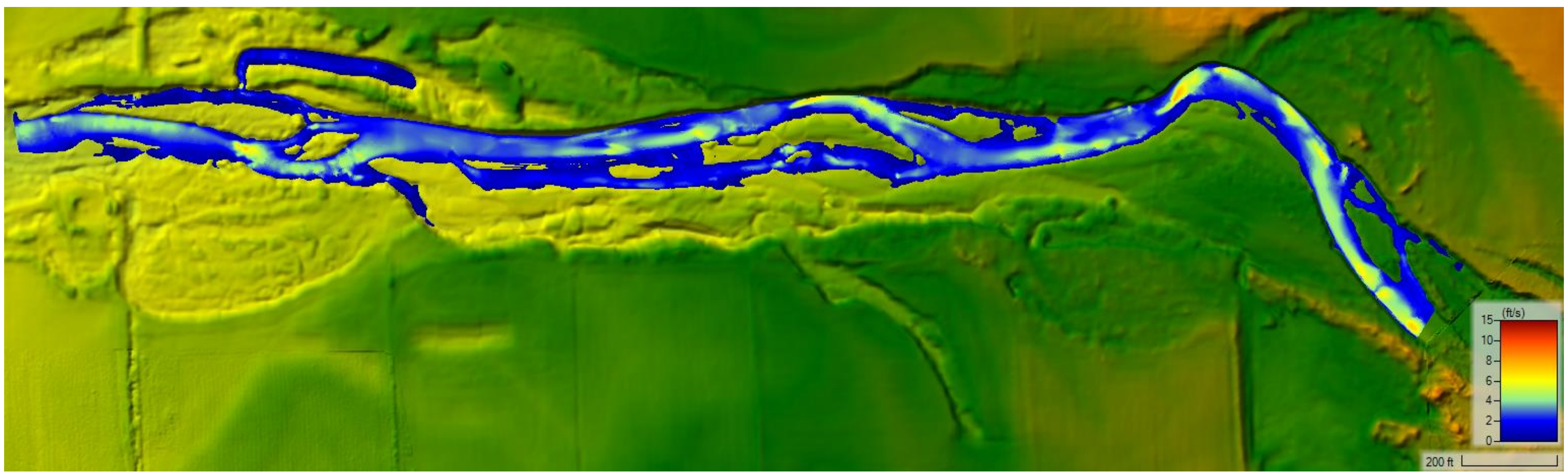
Figure B-5

002698-037-00 Date Exported: 11/13/2024





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Source(s): GeoEngineers, Inc., November 2024. Walla Walla RM 32.5 2-D unsteady HEC-RAS model. HEC-RAS 6.5

N
Not to Scale

Existing Conditions December 50 Percent Exceedance Depth and Velocity

Walla Walla 32.5 Floodplain Reconnection
Walla Walla County, Washington

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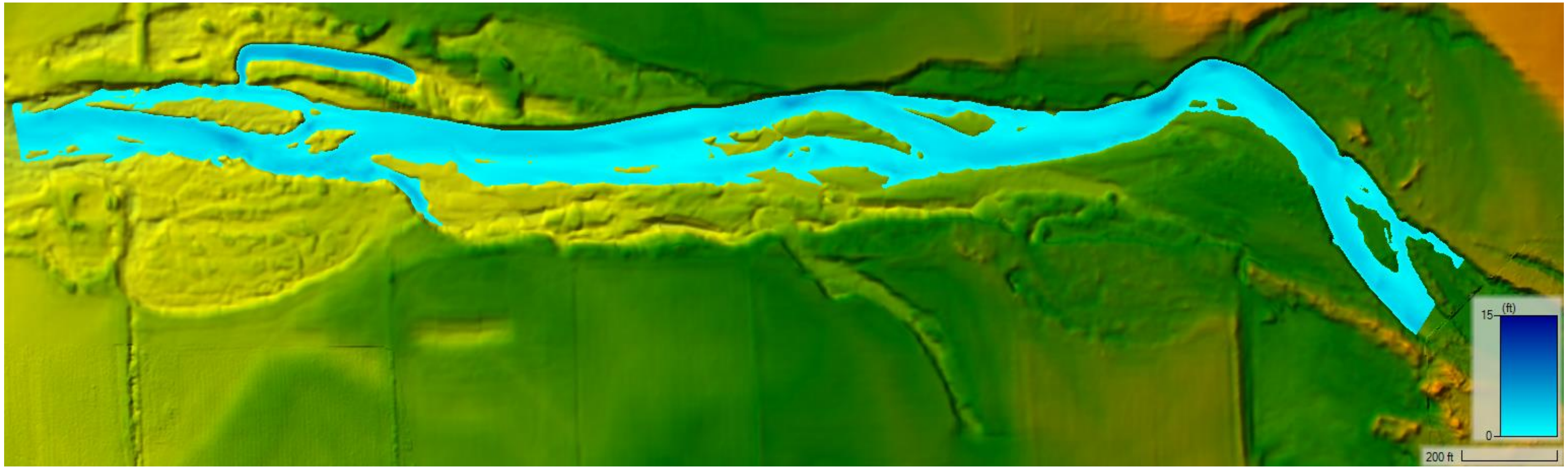
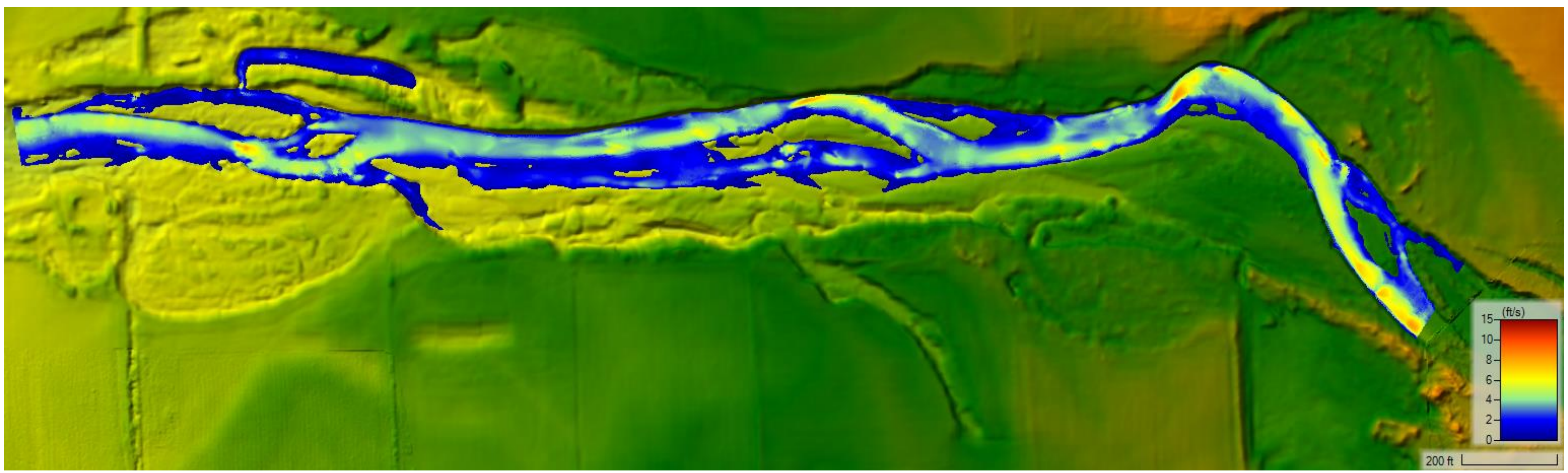
Figure B-6

002698-037-00 Date Exported: 11/13/2024





Notes:

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Source(s): GeoEngineers, Inc., November 2024. Walla Walla RM 32.5 2-D unsteady HEC-RAS model. HEC-RAS 6.5

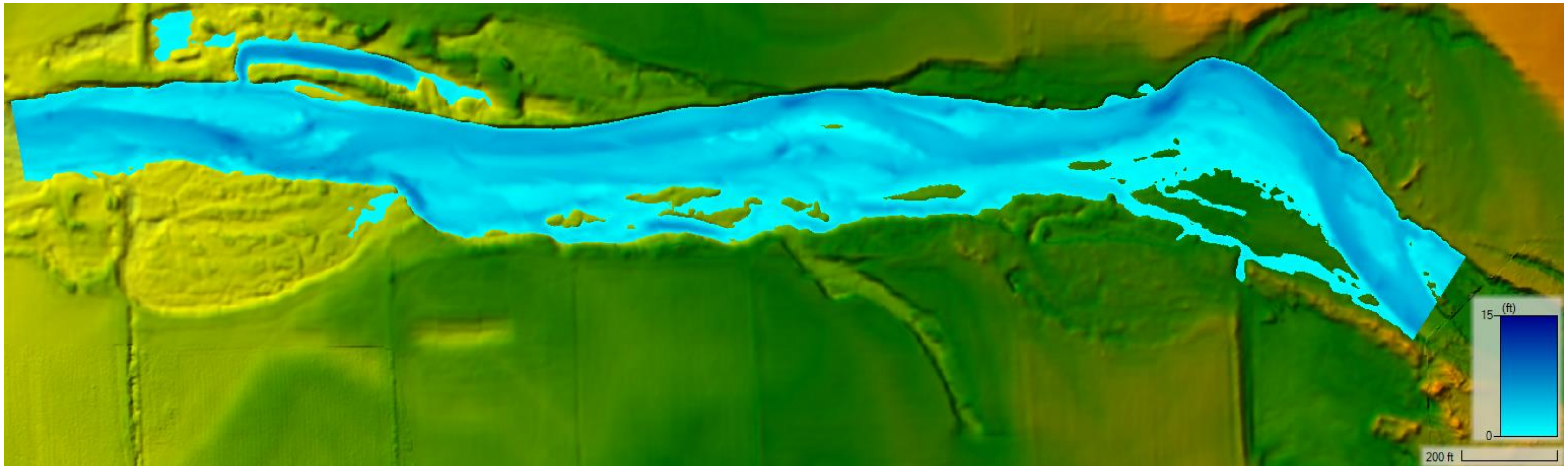
N
Not to Scale

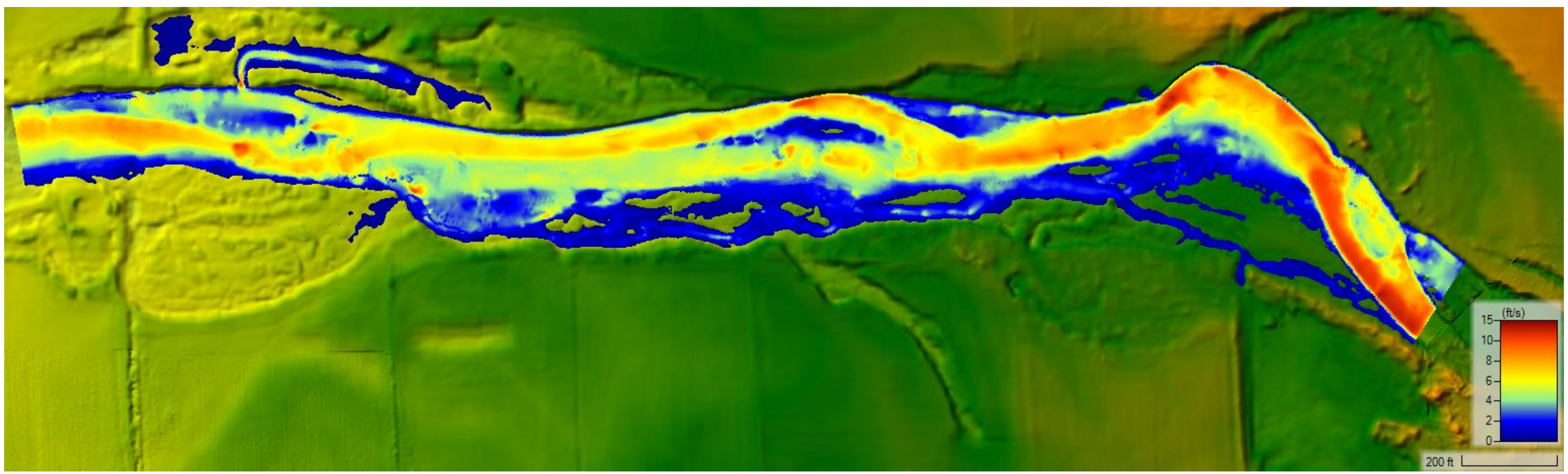
Existing Conditions April and May 50 Percent Exceedance Depth and Velocity

Walla Walla 32.5 Floodplain Reconnection
Walla Walla County, Washington

Figure B-7

002698-037-00 Date Exported: 11/13/2024





Notes:
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Source(s): GeoEngineers, Inc., November 2024. Walla Walla RM 32.5 2-D unsteady HEC-RAS model. HEC-RAS 6.5

22281-009-00 Date Exported: 06/24/2024
002598-037-00 Date Exported: 11/13/2024

N
Not to Scale

Existing Conditions 1.5-Year Depth and Velocity

Walla Walla 32.5 Floodplain Reconnection
Walla Walla County, Washington

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Figure B-8

Notes:
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Source(s): GeoEngineers, Inc., November 2024. Walla Walla RM 32.5 2-D unsteady HEC-RAS model. HEC-RAS 6.5

N
Not to Scale

Existing Conditions 10-Year Depth

Walla Walla 32.5 Floodplain Reconnection
Walla Walla County, Washington

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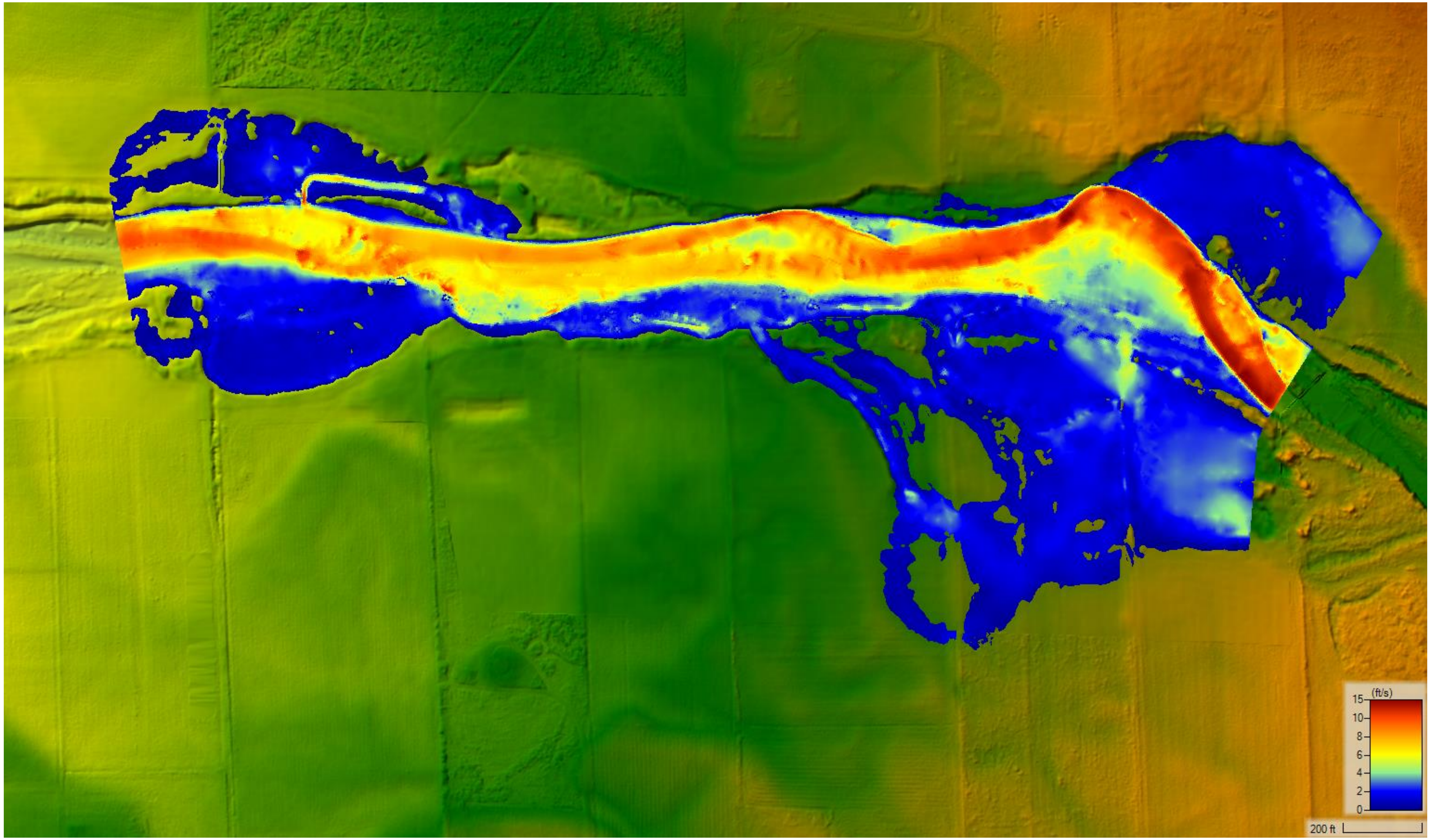
Figure B-9

002698-037-00 Date Exported: 11/13/2024



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002698-037-00 Date Exported: 11/13/2024

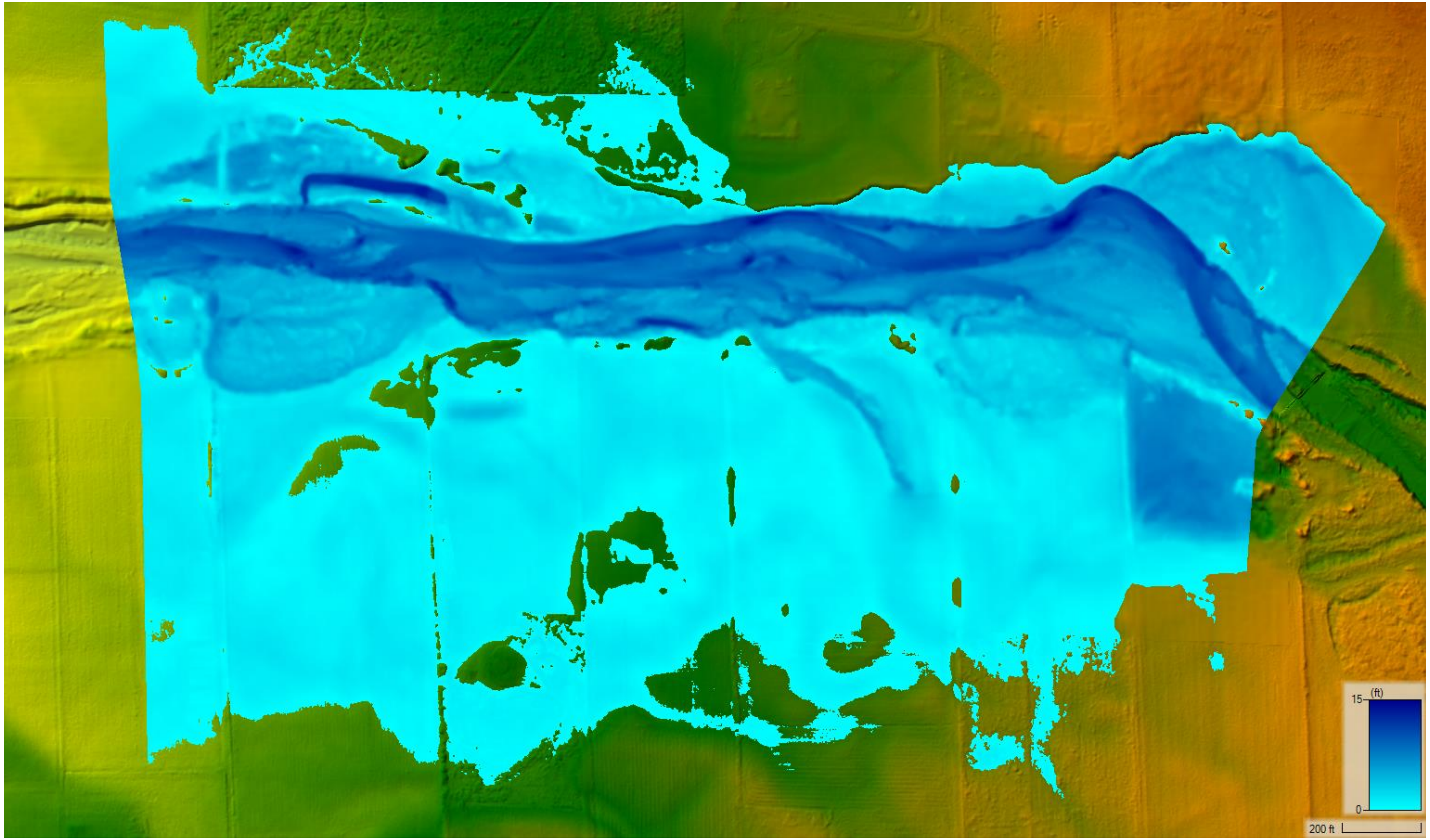
N
Not to Scale

Existing Conditions 10-Year Velocity

Walla Walla 32.5 Floodplain Reconnection
Walla Walla County, Washington

GeoEngineers

Figure B-10



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Not to Scale

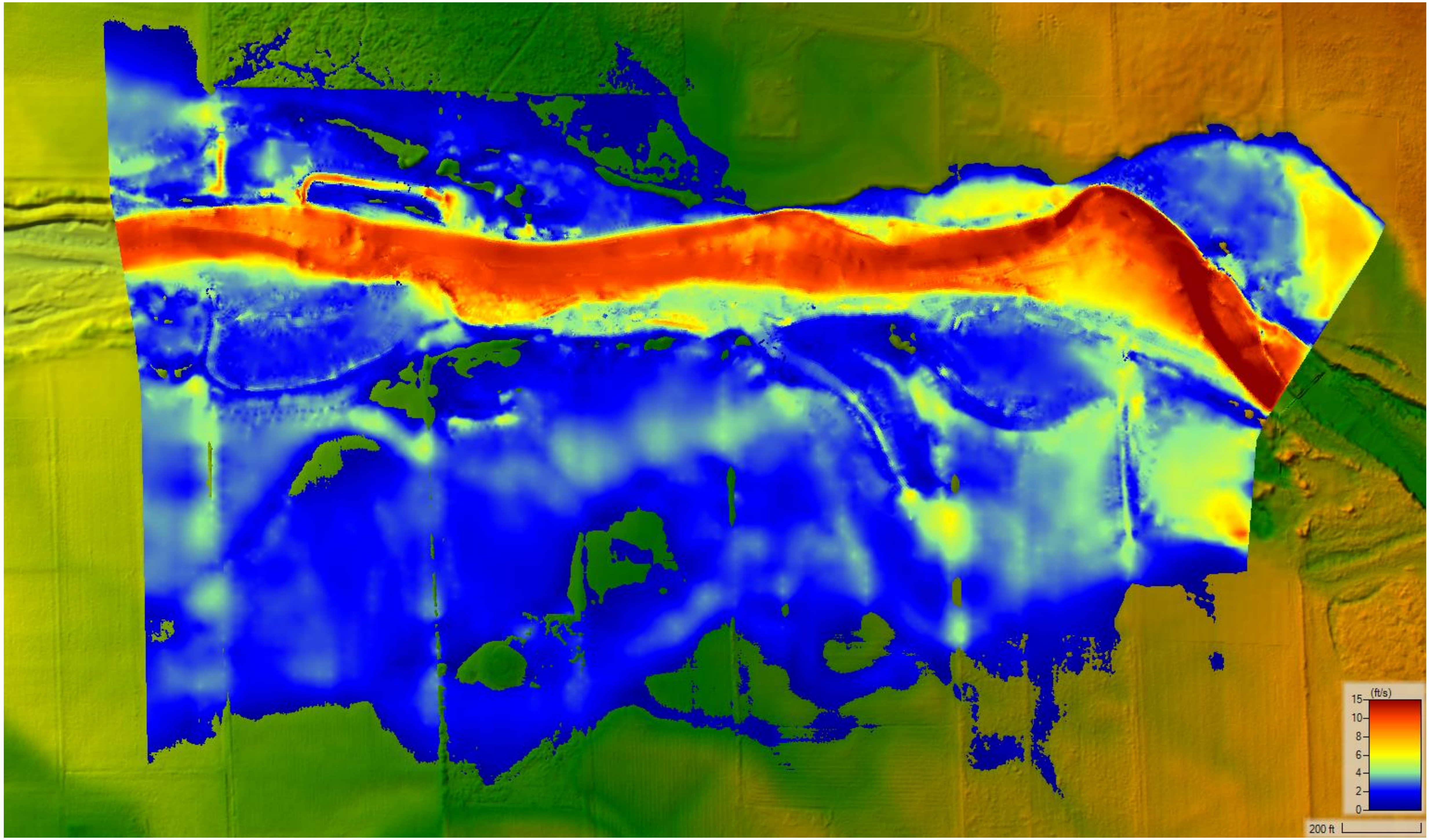
Existing Conditions 100-Year Depth

Walla Walla 32.5 Floodplain Reconnection
Walla Walla County, Washington

GEOENGINEERS

Figure B-11

002698-037-00 Date Exported: 11/13/2024



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N
Not to Scale

Existing Conditions 100-Year Velocity

Walla Walla 32.5 Floodplain Reconnection
Walla Walla County, Washington

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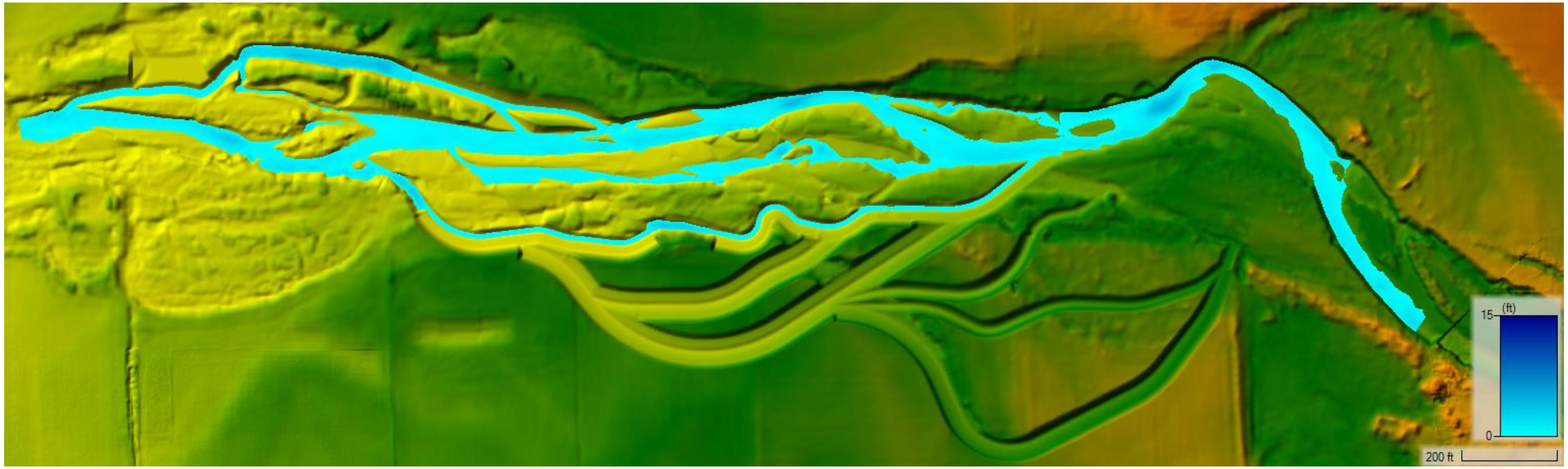
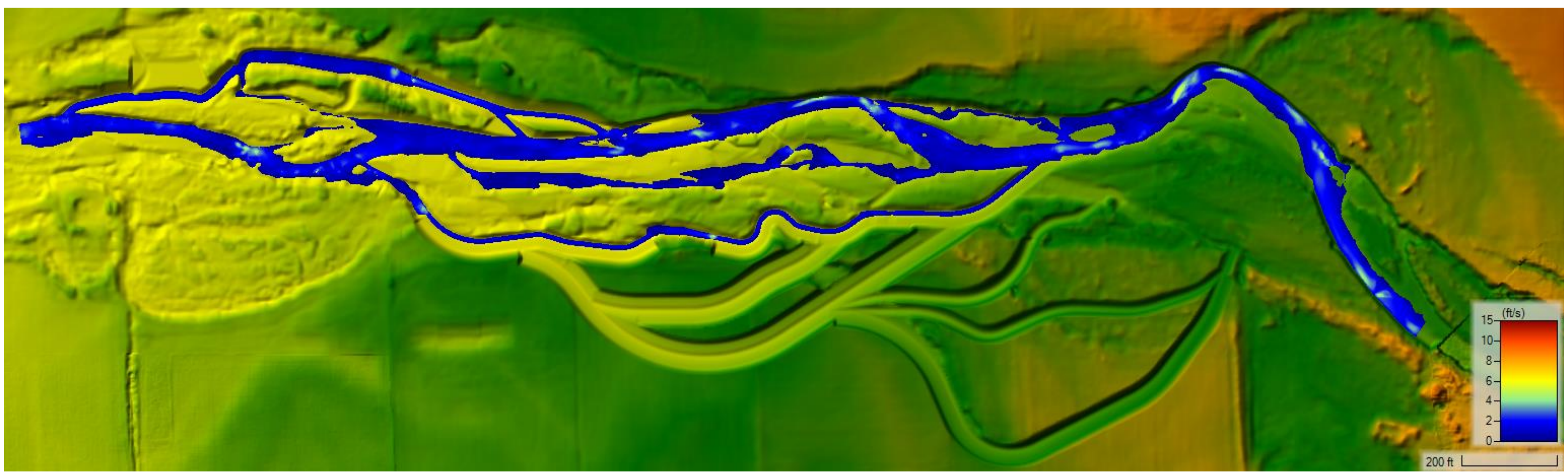
Figure B-12

002698-037-00 Date Exported: 11/13/2024





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Source(s): GeoEngineers, Inc., November 2024. Walla Walla RM 32.5 2-D unsteady HEC-RAS model. HEC-RAS 6.5

N
Not to Scale

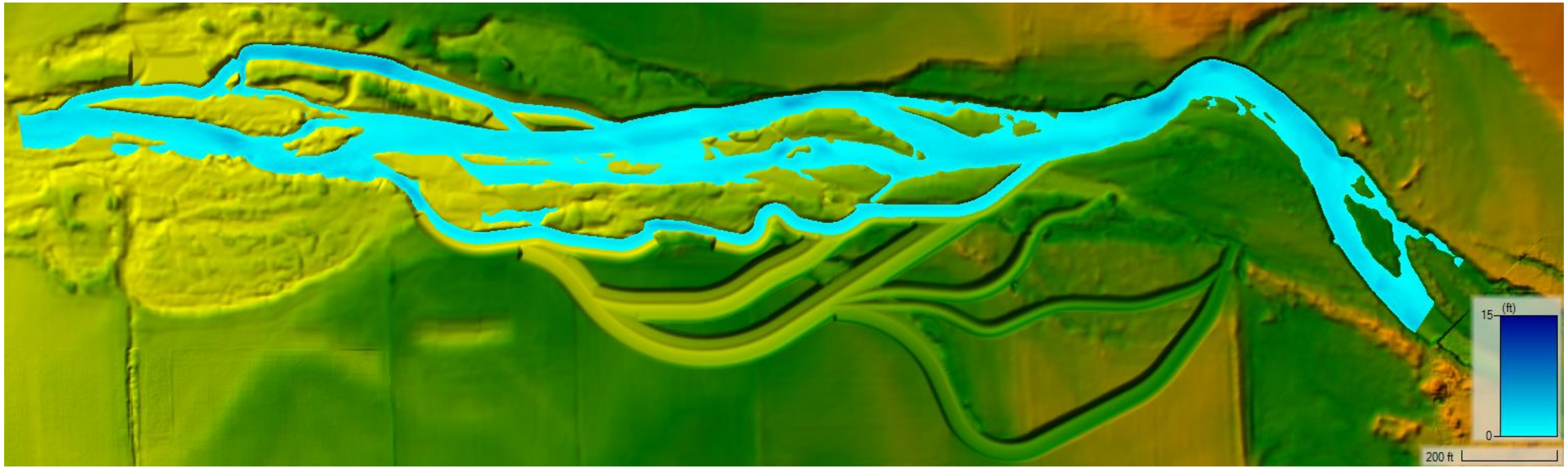
Proposed Conditions August 50 Percent Exceedance Depth and Velocity

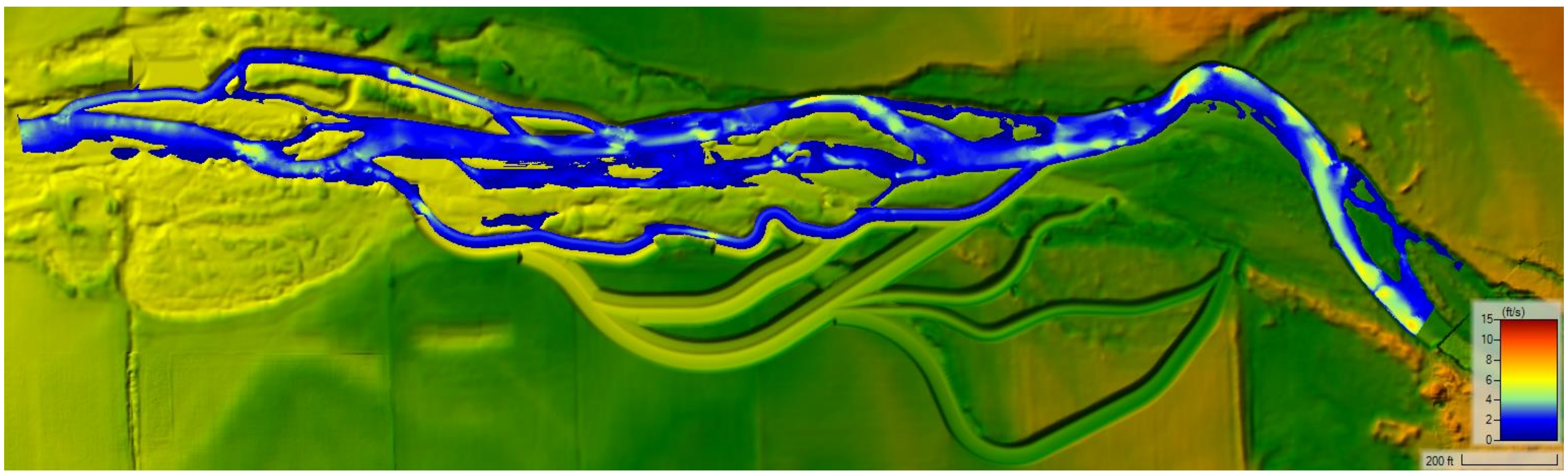
Walla Walla 32.5 Floodplain Reconnection
Walla Walla County, Washington

GEOENGINEERS

Figure B-13

002698-037-00 Date Exported: 11/13/2024





Notes:

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2. This drawing is for information purposes. It is intended to assist in showing features discussed in an attached document. GeoEngineers, Inc. cannot guarantee the accuracy and content of electronic files. The master file is stored by GeoEngineers, Inc. and will serve as the official record of this communication.

Source(s): GeoEngineers, Inc., November 2024. Walla Walla RM 32.5 2-D unsteady HEC-RAS model. HEC-RAS 6.5

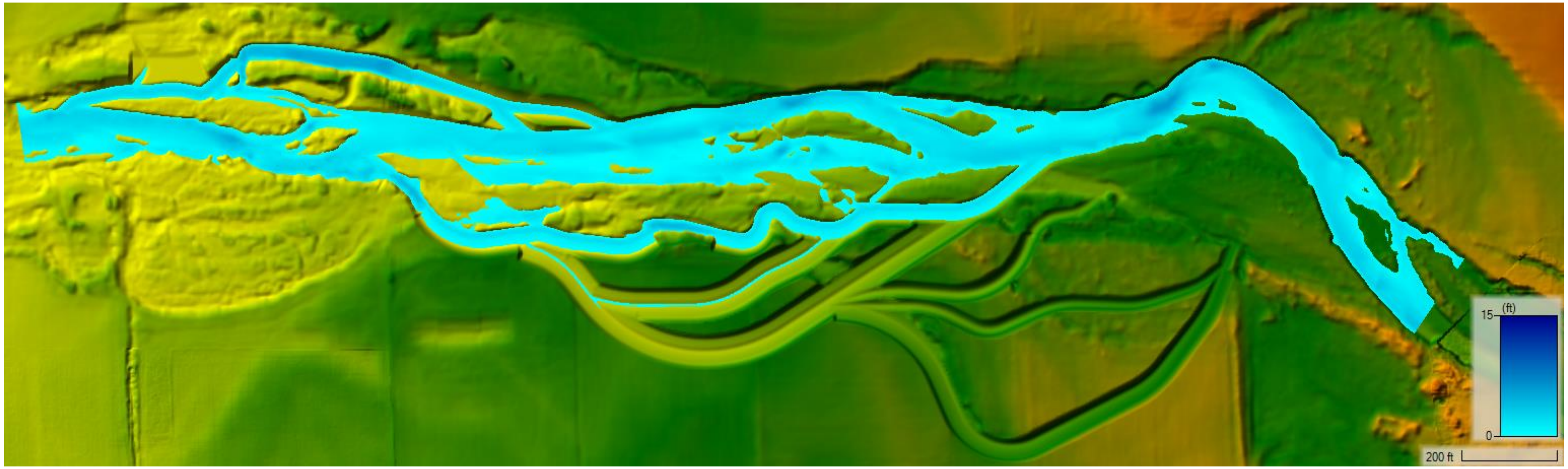
N
Not to Scale

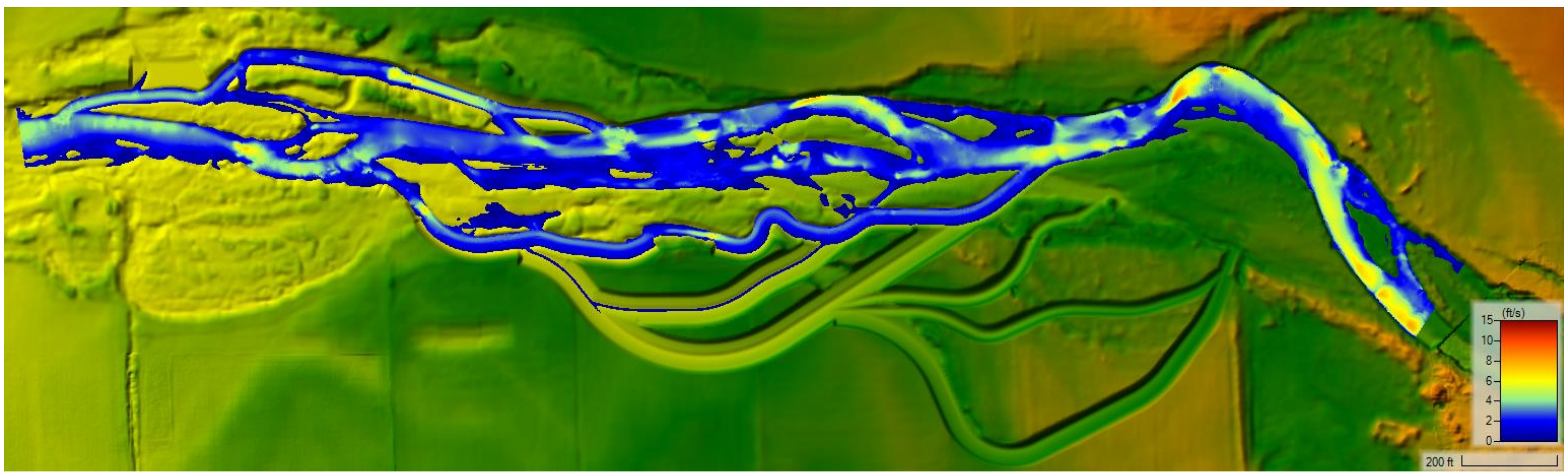
Proposed Conditions December 50 Percent Exceedance Depth and Velocity

Walla Walla 32.5 Floodplain Reconnection
Walla Walla County, Washington

GeoEngineers

Figure B-14





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Source(s): GeoEngineers, Inc., November 2024. Walla Walla RM 32.5 2-D unsteady HEC-RAS model. HEC-RAS 6.5

002698-037-00 Date Exported: 11/13/2024

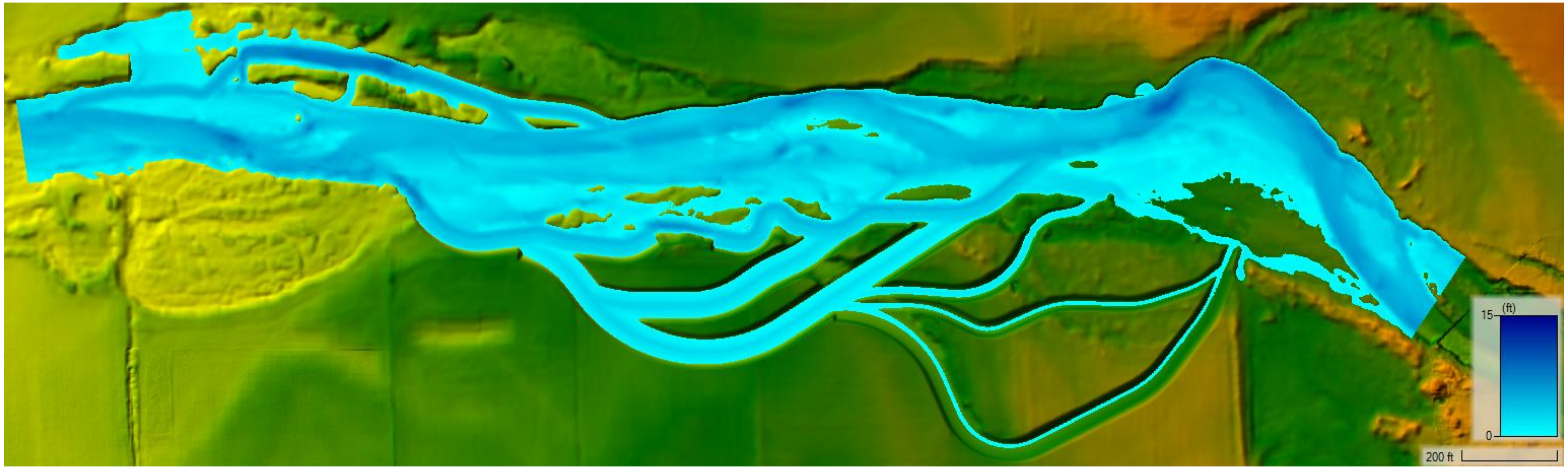
N
Not to Scale

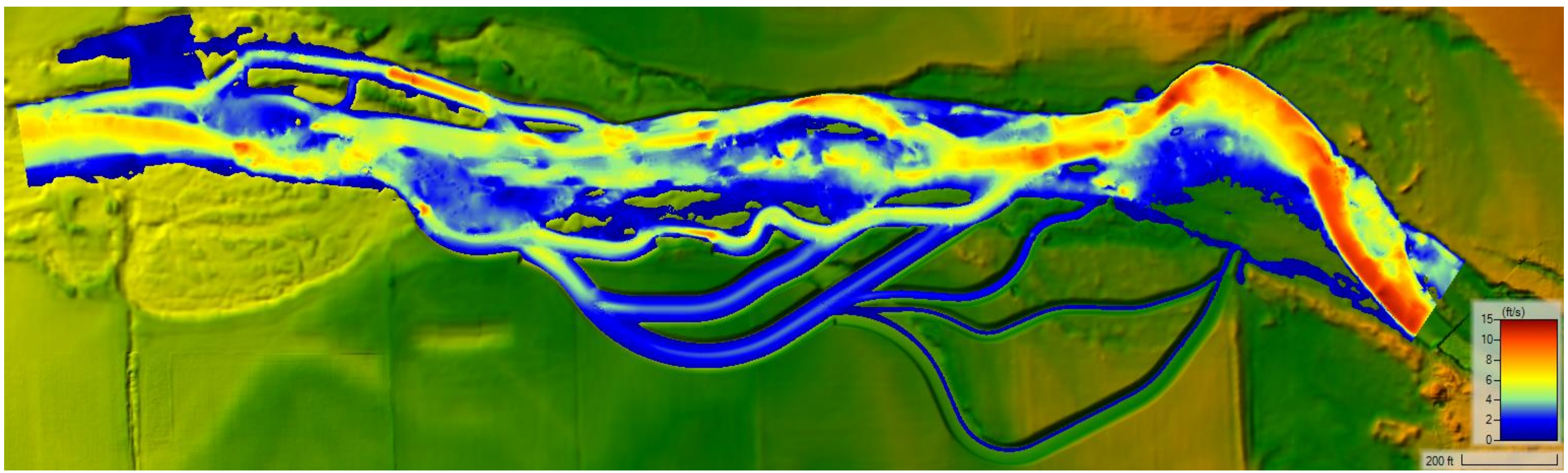
Proposed Conditions April and May 50 Percent Exceedance Depth and Velocity

Walla Walla 32.5 Floodplain Reconnection
Walla Walla County, Washington

GEOENGINEERS

Figure B-15





Notes:

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Source(s): GeoEngineers, Inc., November 2024. Walla Walla RM 32.5 2-D unsteady HEC-RAS model. HEC-RAS 6.5

N
Not to Scale

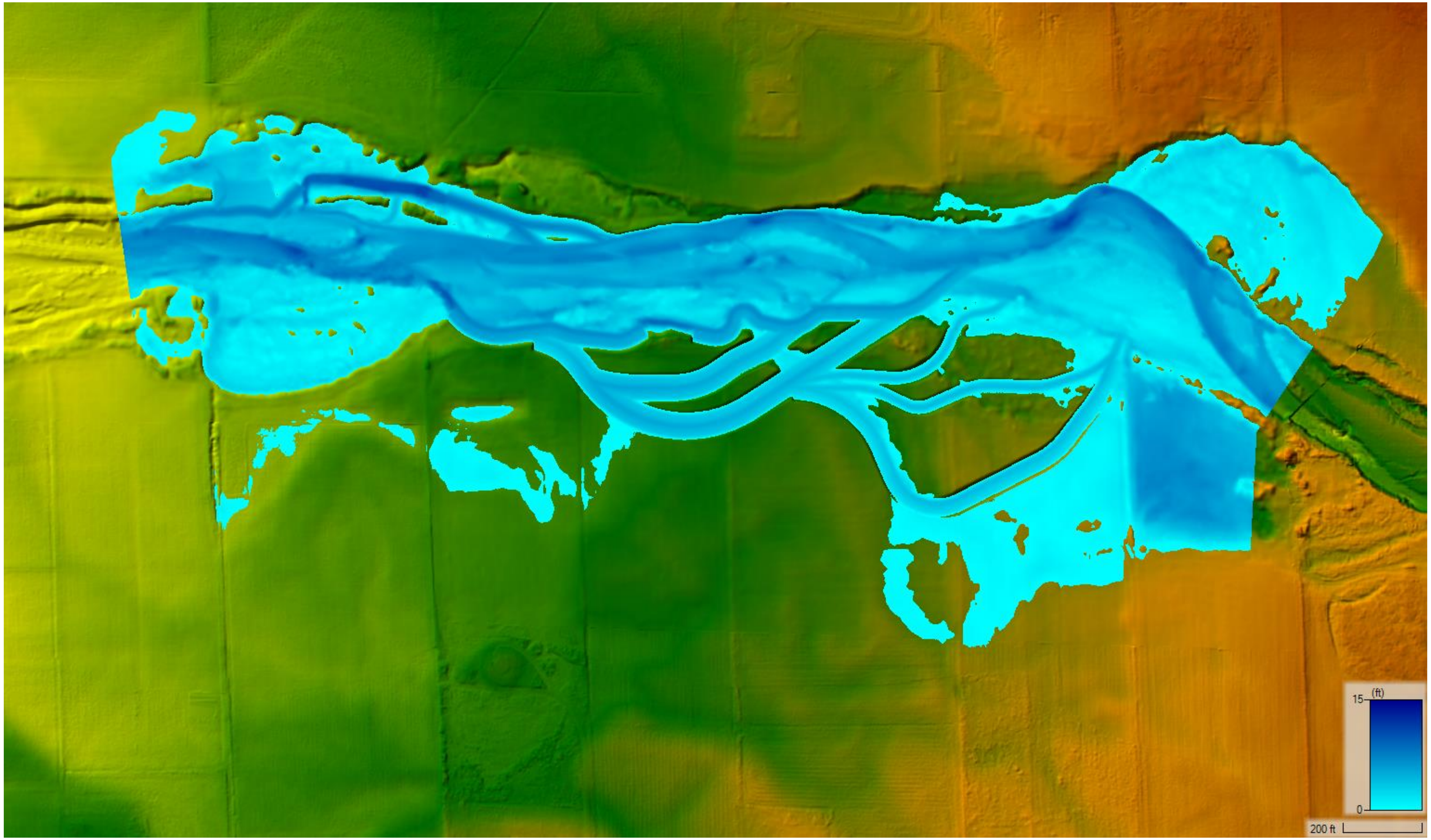
Proposed Conditions 1.5-Year Depth and Velocity

Walla Walla 32.5 Floodplain Reconnection
Walla Walla County, Washington

GEOENGINEERS

Figure B-16

002698-037-00 Date Exported: 11/13/2024



Notes:

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Source(s): GeoEngineers, Inc., November 2024. Walla Walla RM 32.5 2-D unsteady HEC-RAS model. HEC-RAS 6.5

002698-037-00 Date Exported: 11/13/2024

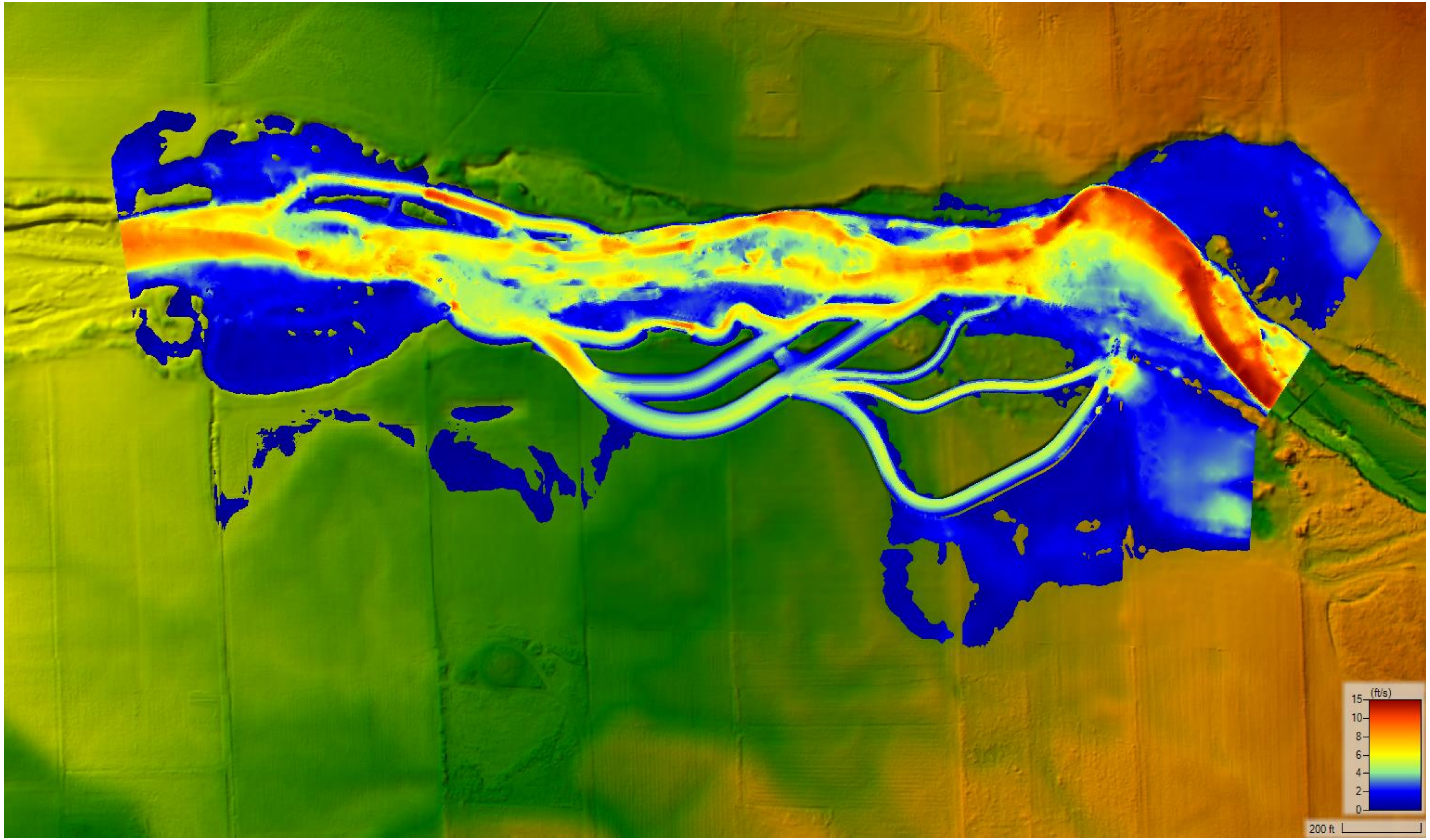
N
Not to Scale

Proposed Conditions 10-Year Depth

Walla Walla 32.5 Floodplain Reconnection
Walla Walla County, Washington

GEOENGINEERS

Figure B-17



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Source(s): GeoEngineers, Inc., November 2024. Walla Walla RM 32.5 2-D unsteady HEC-RAS model. HEC-RAS 6.5

N

Not to Scale

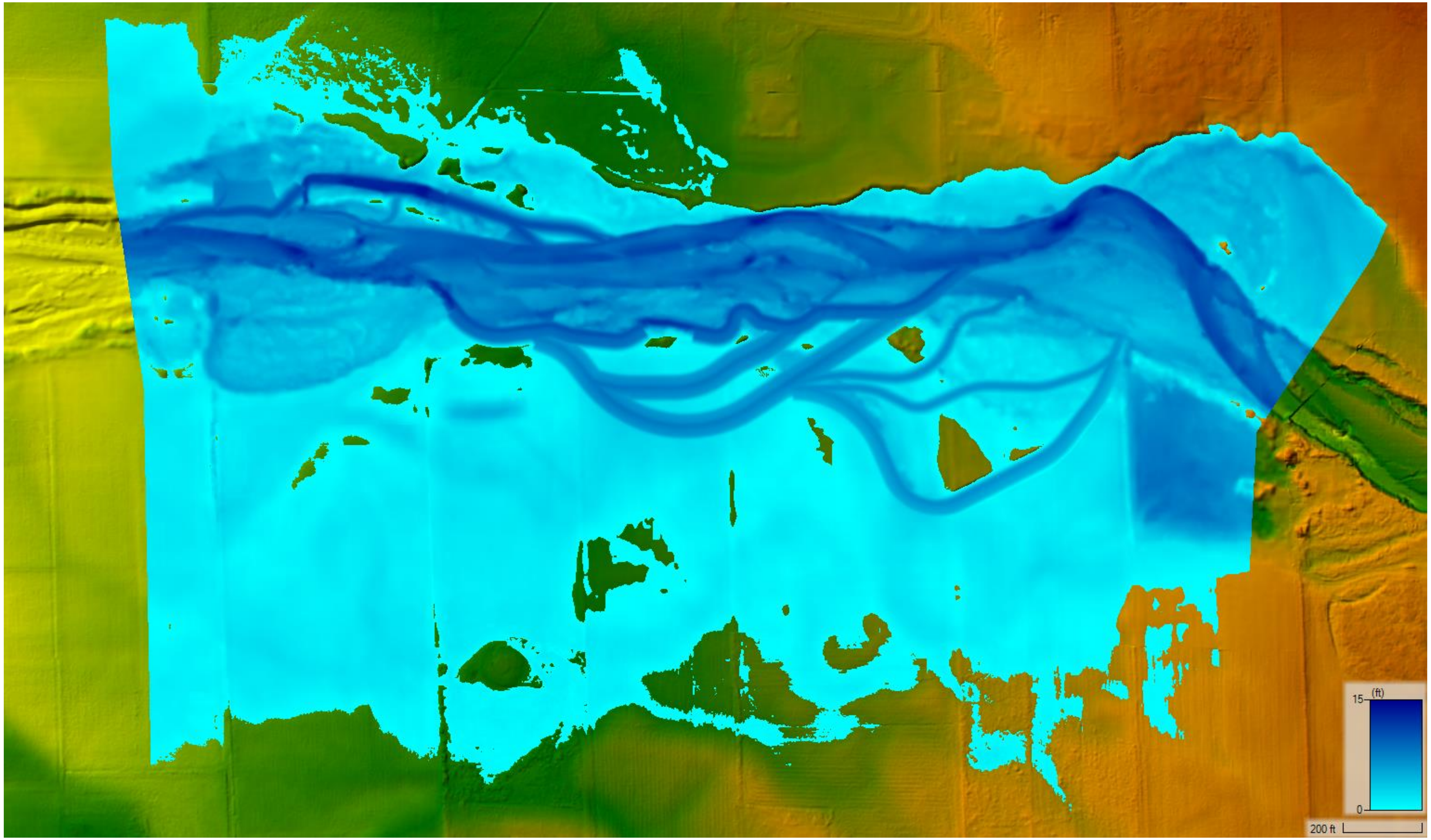
Proposed Conditions 10-Year Velocity

Walla Walla 32.5 Floodplain Reconnection
Walla Walla County, Washington

GEOENGINEERS

Figure B-18

002698-037-00 Date Exported: 11/13/2024



Notes:
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002698-037-00 Date Exported: 11/13/2024

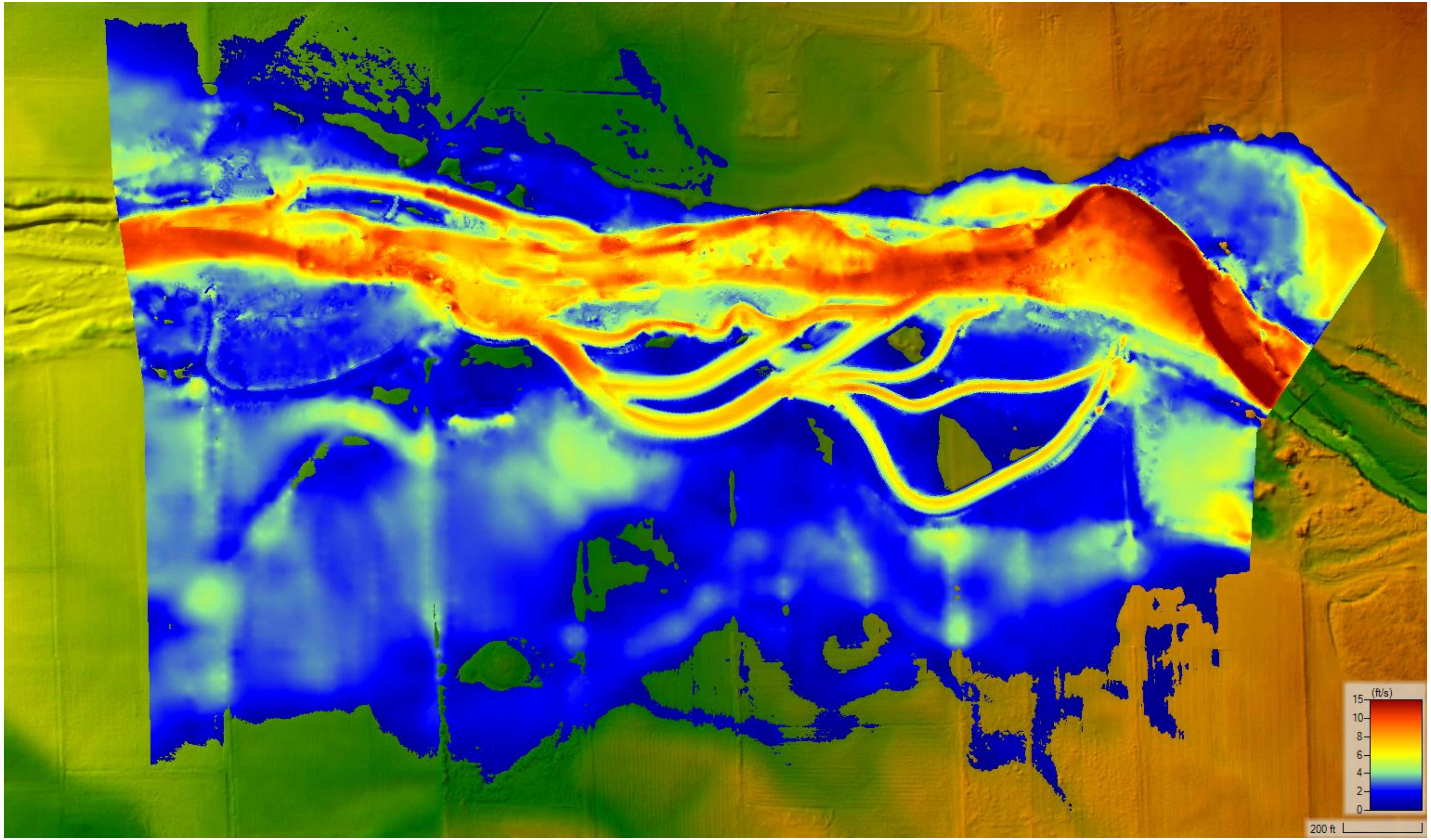
N
Not to Scale

Proposed Conditions 100-Year Depth

Walla Walla 32.5 Floodplain Reconnection
Walla Walla County, Washington

GEOENGINEERS

Figure B-19



Notes:
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002698-037-00 Date Exported: 11/13/2024

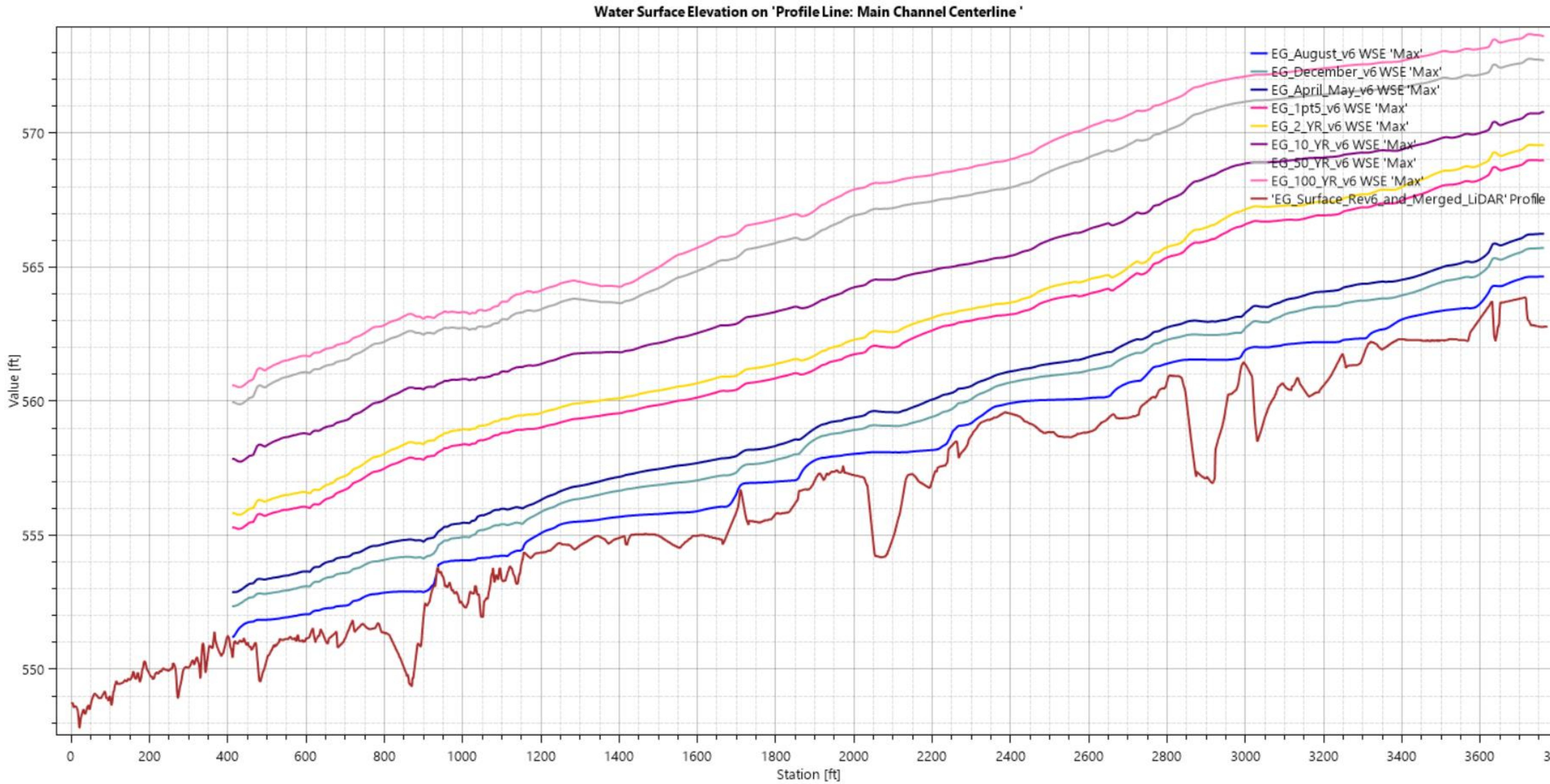
N
Not to Scale

Proposed Conditions 100-Year Velocity

Walla Walla 32.5 Floodplain Reconnection
Walla Walla County, Washington

GEOENGINEERS

Figure B-20



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2. This drawing is for information purposes. It is intended to assist in showing features discussed in an attached document. GeoEngineers, Inc. cannot guarantee the accuracy and content of electronic files. The master file is stored by GeoEngineers, Inc. and will serve as the official record of this communication.

Source(s): GeoEngineers, Inc., November 2024. Walla Walla RM 32.5 2-D unsteady HEC-RAS model. HEC-RAS 6.5

Not to Scale

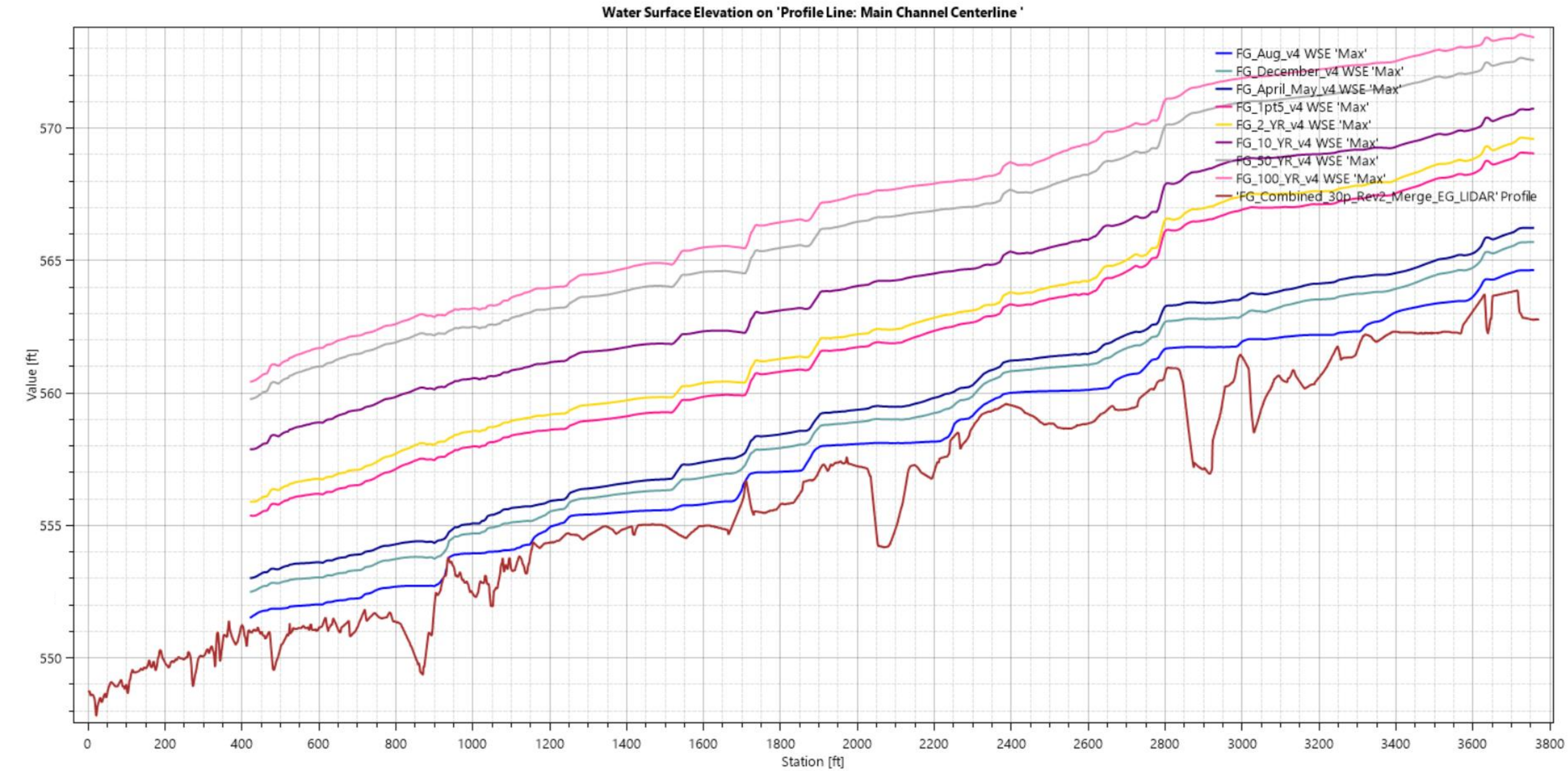
Existing Conditions Main Channel Profile View

Walla Walla 32.5 Floodplain Reconnection
Walla Walla County, Washington

GEOENGINEERS

Figure B-21

002698-037-00 Date Exported: 11/13/2024



Notes:

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Source(s): GeoEngineers, Inc., November 2024. Walla Walla RM 32.5 2-D unsteady HEC-RAS model. HEC-RAS 6.5

Not to Scale

Proposed Conditions Main Channel Profile View

Walla Walla 32.5 Floodplain Reconnection
Walla Walla County, Washington

GEOENGINEERS

Figure B-22

002698-037-00 Date Exported: 11/13/2024

Appendix C
Large Woody Material Design
(to be included at 60 Percent Design)

Appendix D
Cost Estimate

Construction Cost Workbook

Project:	Walla Walla RM 32.5	**Analyst:**	BHM/KHR
Project Number:	02698-037-00	**Latest Revision:**	11/26/24

Workbook Description

- This workbook contains spreadsheets that facilitate the analysis and/or design of this project.
- This spreadsheet lists the general project and workbook information that is consistent throughout the workbook.
- It also lists the titles of the spreadsheets contained in this workbook.
- This workbook is limited to the Construction Cost Estimate for modifications identified in the GeoEngineers Construction drawings and does **NOT** include the modifications proposed by others.
- This workbook is intended for use with ENGLISH UNITS.

Sheet Titles:

Construction Cost Workbook
Unit Costs
Bid Sheet
Summary of Restoration Costs

Unit Costs

Project:	Walla Walla RM 32.5	BHM/KHR
Project Number:	02698-037-00	11/26/2024

- This spreadsheet calculates the costs associated with site preparation. Unit costs include materials, labor, equipment, overhead and contractor profit.
- Reference used for "unit costs" include:
  (1) R.S. Means Heavy Construction Cost Data Manual, 2015 (Means)
  (2) Engineering Experience & Recent Similar Projects
  (3) Contractor or Supplier
- Additional adjustments are based on engineering judgement, experience and site-specific degree of difficulty.
- General mark-up percentages are also provided at the bottom.

Item #	Specification(s)	Item Description	Ref. ID	Units	Unit Cost ($)	Adjusted Unit Price ($)
1	280 & 290	Environmental Controls - Permit Compliance-Best Management Practices	2	LS	55,000.0	$ 55,000
2	210	Mobilization and Demobilization	2	LS	200,000.0	$ 200,000
3	320	Clearing, Grubbing, Stockpile and Disposal	2	AC	8,700.0	$ 8,700
4	245	Temporary Work Area Isolation (Side Channels and LWM)	2	EA	1,200.0	$ 1,200
5	330	Excavation and on-site disposal - Floodplain and Side Channel Grading	2	CY	22.0	$ 22
6	1091	Place Excavated Material - Side Channel Inlets	2	CY	12.0	$ 12
7	1093	LWM Structure - Apex Jam	2	EA	34,500.0	$ 34,500
8	1093	LWM Structure - Flow Deflection Jam	2	EA	28,500.0	$ 28,500
9	1093	LWM Structure - Side Channel Post Structures	2	EA	6,500.0	$ 6,500
10	1093	LWM Structure - Side Channel Single Logs, with Rootwad	2	EA	2,700.0	$ 2,700
11	1093	LWM Structure - Side Channel Single Logs, No Rootwad	2	EA	1,200.0	$ 1,200
12	1040	Willow Trench	2	LF	20.0	$ 20
13	1040	Planting	2	AC	12,000.0	$ 12,000
14	1030	Seeding	2	AC	3,500.0	$ 3,500
15	330	Contingency Grading	2	HR	225.0	$ 225
16	1100	Well Construction	2	LS	350,000.0	$ 350,000
3		CONTINGENCY (15%)		LS		

Bid Sheet

Project: Walla Walla RM 32.5
Project Number: 02698-037-00

Analyst: BHM/KHR
Latest Revision: 11/26/2024

- This spreadsheet summarizes the construction quantities for all preliminary construction bid items.

Item #	Specification(s)	Item Description	Units	Unit Cost	No. of Units	Total Cost ($)
1	280 & 290	Environmental Controls - Permit Compliance-Best Management Practices	LS		1	
2	210	Mobilization and Demobilization	LS		1	
3	320	Clearing, Grubbing, Stockpile and Disposal	AC		2	
4	245	Temporary Work Area Isolation (Side Channels and LWM)	EA		21	
5	330	Excavation and on-site disposal - Floodplain and Side Channel Grading	CY		44260	
6	1091	Place Excavated Material - Side Channel Inlets	CY		600	
7	1093	LWM Structure - Apex Jam	EA		6	
8	1093	LWM Structure - Flow Deflection Jam	EA		11	
9	1093	LWM Structure - Side Channel Post Structures	EA		9	
10	1093	LWM Structure - Side Channel Single Logs, with Rootwad	EA		59	
11	1093	LWM Structure - Side Channel Single Logs, No Rootwad	EA		68	
12	1040	Willow Trench	LF		2000	
13	1040	Planting	AC		5	
14	1030	Seeding	AC		17	
15	330	Contingency Grading	HR		20	
16	1100	Well Construction	LS		1	
		Final Construction Cost				

Summary of Restoration Costs

Project: Walla Walla RM 32.5 **Analyst:** BHM/KHR

Project No: 02698-037-00 **Latest Revision:** 11/26/2024

Summary of engineer's estimate of probable costs including construction survey staking and construction observation.

Summary Table						
Item #	**Specification(s)**	**Item Description**	**Units**	**Unit Cost ($)**	**No. of Units**	**Total Cost ($)**
1	280 & 290	Environmental Controls - Permit Compliance-Best Management Practices	LS	55000.00	1	$55,000
2	210	Mobilization and Demobilization	LS	200000.00	1	$200,000
3	320	Clearing, Grubbing, Stockpile and Disposal	AC	8700.00	2	$17,400
4	245	Temporary Work Area Isolation (Side Channels and LWM)	EA	1200.00	21	$25,200
5	330	Excavation and on-site disposal - Floodplain and Side Channel Grading	CY	22.00	44260	$973,720
6	1091	Place Excavated Material - Side Channel Inlets	CY	12.00	600	$7,200
7	1093	LWM Structure - Apex Jam	EA	34500.00	6	$207,000
8	1093	LWM Structure - Flow Deflection Jam	EA	28500.00	11	$313,500
9	1093	LWM Structure - Side Channel Post Structures	EA	6500.00	9	$58,500
10	1093	LWM Structure - Side Channel Single Logs, with Rootwad	EA	2700.00	59	$159,300
11	1093	LWM Structure - Side Channel Single Logs, No Rootwad	EA	1200.00	68	$81,600
12	1040	Willow Trench	LF	20.00	2000	$40,000
13	1040	Planting	AC	12000.00	5	$60,000
14	1030	Seeding	AC	3500.00	17	$59,500
15	330	Contingency Grading	HR	225.00	20	$4,500
16	1100	Well Construction	LS	350000.00	1	$350,000
SUBTOTAL CONSTRUCTION COST						$2,612,420
		CONTINGENCY (15%)	LS	15	1	$391,863
CONSTRUCTION COST						**$3,029,283**

Appendix E
Review Comment Tracking Forms

HIP Project Review
Comment Tracking

Project Information:

Project Name:	Walla Walla RM 32.5
Proposed Implementation:	July 2025
BPA Project #:	1996-046-01
Contract #:	Number
Sponsor:	CTUIR
Designer:	Geo Engineers
Area Lead:	Jenny Lord
COR/PM:	Victoria Bohlen

HIP Review Team:

HIP Program Lead:	Daniel A. Gambetta, ECF
BPA EC Lead:	~~Daniel A. Gambetta, ECF~~ Jacque Schei, ECF
BPA Technical Lead:	Mike Ward, P.E. EWL
NMFS Branch Chief:	Justin Yeager, NMFS, Columbia Basin Branch Chief
NMFS Biologist:	Colleen Fagan
NMFS Engineer:	Not Required
USFWS Field Office:	Julie Campbell, USFWS (Eastern WA) Spokane Field Office
USFWS Reviewer:	Nick Broderius

Documents Reviewed:

2024 Memorandum & 15% Design (May 30,2024)
Walla Walla River RM 32.5 - 15 Percent Basis of Design Report (July 11, 2024)

Activity Categories:	**Risk Level:**
2a - Improve Secondary Channel and Floodplain Connectivity	Medium
2b - Set-back or Removal of Berms, Dikes and Levees	High
2d - Install Habitat-Forming Instream Structures	High
2e - Riparian and Wetland Vegetation Planting	Low
7c - Convert from Instream Diversions to Groundwater Wells	Medium
Dropdown Menu	Dropdown Menu
Dropdown Menu	Dropdown Menu
Overall Project Risk	**High**

Review Timeline:	**Date Completed**
• Conceptual Review (typically 15%)	
o Site visit, if needed	Not Started
o Sponsor to submit conceptual design to EC Lead and COR	7/1/2024
o EC Lead to submit concept to HIP Review Team to initiate review	7/1/2024
o EC Lead to send design package to appropriate HIP Review members	9/17/2024
o EC Lead to compile comments and forward to Sponsor	Not Started
o Sponsor to provide responses to EC Lead	Not Started
o HIP Review Team and Sponsor to resolve “open” comments	Not Started
o EC Lead to notify Sponsor to proceed to preliminary design	Not Started
• Preliminary Design or Alternatives Analysis Review (typically 30%)	
o Sponsor to submit preliminary design to EC Lead and COR	Not Started
o EC Lead to submit design package to HIP Review Team	Not Started
o EC Lead to submit design to NMFS Engineer if applicable	Not Started
o NMFS Engineer approves project, if applicable	Not Started
o EC Lead to compile comments and forward to Sponsor	Not Started
o Sponsor to provide responses to EC Lead	Not Started
o HIP Review Team and Sponsor to resolve “open” comments	Not Started
o EC Lead to notify Sponsor to proceed with design	Not Started
• Permit Level Design Review (typically 60% to 80%)	
o Sponsor to submit design package to EC lead and COR	Not Started
o EC Lead to submit design package to HIP Review Team	Not Started
o EC Lead to compile comments and forward to Sponsor	Not Started
o Sponsor to provide responses to EC Lead	Not Started
o HIP Review Team and Sponsor to resolve “open” comments	Not Started
o EC Lead to notify Sponsor to proceed to final design	Not Started
• Final Design Package (100%)	
o Sponsor to submit final designs to EC Lead and COR	Not Started
o EC Lead and BPA Technical Lead to verify no critical changes	Not Started

Comments:

#	Reviewer (Org.)	Date	Document	Page/ Section	Comment		Response by (Org.)	Date	Response to Comment	Status (BPA to Update)
1	BPA	7/3/24	15% BDR		Thank you for the detailed 15% submittal. The project is currently designated “high risk” due to the proposed inundation area and the placement of apex jams in the mainstem. This risk category can be evaluated at future submittals as more information is provided.		GeoEngineers	10/28/2024	noted	For Information Only
2	BPA	7/3/24	15% BDR	3	Are all the levees being removed privately owned?		GeoEngineers	10/28/2024	Levee removal is occurring on the north (right-bank) floodplain on land owned by CTUIR. This information is added to section 1.4.1.2.	Open (Requirement)

#	Reviewer (Org.)	Date	Document	Page/ Section	Comment		Response by (Org.)	Date	Response to Comment	Status (BPA to Update)
3	BPA	7/3/24	15% BDR	12	How will water be directed into the uppermost side channel inlet? Aerial imagery shows the river is pulling hard to river-right. In addition, is this inlet at risk of plugging? Imagery shows heavy sedimentation along river-left. This question may be answered at the next submittal when modeling is provided.		GeoEngineers	10/28/2024	Side channel inlet locations have been modified in the 30% design based on existing conditions hydraulic modeling. Results of the hydraulic modeling including side channel activation and percentage of the total channel flow within each side channel are incorporated in the basis of design report, Section 3.5. The upstream-most side channels (Side Channel Network 4) are designed to be activated at higher flow events (1.5-year+) and side channel elevation are based on water surface elevations. We recognize that the Walla Walla River is a dynamic river with significant bedload transport capacity and that side channel activation may vary over time. To help mitigate the risk of disconnection the side channels are proposed to be graded to allow for flow continuity and transportation of accumulated sediments at high flows and multiple side channel inlets in the proposed condition are designed for redundancy.	To be Addressed at Next Review
4	BPA	7/3/24	15% BDR	12	How do the hydraulics of the uppermost side channel network work? These side channels turn 180 degrees from the inlet. Is something backwatering the channels or is there sheet-flow from the mainstem? This question may be answered at the next submittal when modeling is provided.		GeoEngineers	10/28/2024	As described in the above response, the side channel alignments have been updated in response to existing conditions hydraulic modeling. This information was not available at the 15% submittal. Hydraulic model results are included within the basis of design report, Section 3.5.	To be Addressed at Next Review

#	Reviewer (Org.)	Date	Document	Page/ Section	Comment		Response by (Org.)	Date	Response to Comment	Status (BPA to Update)
5	BPA	7/3/24	15% BDR	12	With the levees being removed on river-right, are there any concerns with the river avulsing through the property? Is this the property owned by the CTUIR? Is the LWD downstream of the removal being used for stability?		GeoEngineers	10/28/2024	The property on river-right where the levee is being partially removed is owned by CTUIR. Grading within this vicinity does not include full levee removal to avoid large disturbance to existing established riparian canopy and instead includes targeted grading to create an upstream side channel. Leaving the existing riparian canopy reduces the likelihood of the channel avulsing into this location. Proposed conditions hydraulic model results are shown in the 30% design and depict anticipated inundation extents at various flows. The LWM within this vicinity is placed opportunistically and to overlap with the disturbed grading areas and is intended to provide habitat. It is not intended for bank stability.	Open (Requirement)
6	BPA	7/3/24	15% BDR	12	What stability event will the apex jams in the mainstem be designed to? Are there any concerns about mobilization? As noted in the BDR, the Walla Walla River has had extreme flow events recently. This project reach has seen drastic changes to geomorphology just within the past few years (based on imagery)		GeoEngineers	10/28/2024	Apex Jam and other wood structures will be designed to the 100-year flow	Open (Requirement)
7	BPA	7/3/24	15% BDR	12	Are there any floodplain permit considerations for this project?		GeoEngineers	10/28/2024	Yes, we anticipate needing to complete a floodplain permitting as part of this project A comparison of pre- and post- project water surface elevations is included in the basis of design report, Section 3.5.	To be Addressed at Next Review

#	Reviewer (Org.)	Date	Document	Page/ Section	Comment		Response by (Org.)	Date	Response to Comment	Status (BPA to Update)
8	BPA	9/6/24	Plans	Cover	Please add the statement "This project was designed in accordance with the BPA Habitat Improvement Program, Programmatic Biological Opinion (HIP4)" on the Cover Sheet of the plans.		GeoEngineers	10/28/2024	Added to the cover page	To be Addressed at Next Review
9	BPA	9/6/24	Plans	Cover	The final project drawings shall be sealed by the Project Engineer.		GeoEngineers	10/28/2024	Noted	For Information Only
10	BPA	9/6/24	Plans		Please note the HIP activity categories listed above and the appropriate conservation measures outlined in the current HIP handbook. EC Lead will provide CAD sheets with HIP general conservation measures to be included in plan set.		GeoEngineers	10/28/2024	Noted We have included the CAD sheets within the 30% design plans.	For Information Only

#	Reviewer (Org.)	Date	Document	Page/ Section	Comment		Response by (Org.)	Date	Response to Comment	Status (BPA to Update)
11	BPA	9/6/24	BDR/Plans		As noted in your BDR, you will need to include details of the following in future designs as details develop: • Site access staging and sequencing (note: staging areas for equipment and fueling shall be 150 feet from any natural water body or wetland; areas for natural materials storage can be closer if needed) • Fuels management plan • Any sensitive resources in the project area • Work area isolation, dewatering, and fish salvage (if applicable) • Erosion, dust abatement, and pollution control • Site reclamation and restoration, including a detailed planting/replanting plan with native species identified • List of proposed equipment • In-water work dates (list actual dates) for the project area. Note: If the HIP general conservation measures cover the details of these plans, then you do not need to draft a separate plan and/or you can add additional details as needed to conservation measures sheets in the plan set.		GeoEngineers	10/28/2024	Noted and included as follows: Site access staging – Included in the 30% design plans Fuels management plan – included as part of the HIP general conservation measures Work area isolation, dewatering, and fish salvage - included as part of the HIP general conservation measures. Work area isolation and sequencing plan will be included as part of the 60% design submittal Erosion, dust abatement, and pollution control – included as part of the HIP general conservation measures. Erosion and sediment control plan and details are shown in the 30% design plans. Site reclamation and restoration, including a detailed planting/replanting plan with native species identified – revegetation plan will be included as part of the 60% design submittal. List of proposed equipment – included in the basis of design report. In-water work dates for the project area – included on the cover of the 30% design plans and in the basis of design report.	To be Addressed at Next Review
12										Dropdown Menu
13										Dropdown Menu

#	Reviewer (Org.)	Date	Document	Page/ Section	Comment		Response by (Org.)	Date	Response to Comment	Status (BPA to Update)
14										Dropdown Menu
15										Dropdown Menu
16										Dropdown Menu

Walla Walla RM 32.5 - SRFB Review Panel Comments Received on 15% Design

Response to comments/questions received August 7, 2024

RCO Comment	Response to Comment
The existing pumped irrigation diversion is described as located on the right bank floodplain, but the design set only shows irrigation infrastructure on the left bank of the river. Please show the location of irrigation infrastructure on the right bank of the river and how it interacts with the rip rap.	We have included a figure (Figure 2) that depicts the location of existing irrigation infrastructure and expanded our descriptions of how the existing infrastructure interacts with the channel in section 2.2.
Please explain how irrigation infrastructure is impacting channel morphology and how the proposed changes from the restoration project could affect channel conditions and fish habitat.	Additional decsription has been added to section 2.2 and includes how maintaing the existing infrstructure and instream diversions creates ongoing disturbance within the riparian coordior and and disrupts natural floodplain processes.
As the project design further develops, we would suggest adding additional apex jams in the mainstem upstream of cross-section 4 and downstream of cross-section 1 to provide greater channel complexity and habitat diversity in the reach.	Additional Apex Jams have been included in the design. We are limited by participating land owner proprtery boundaries in where Apex Jams can be placed, excluding the locations downstream of cross section 1 and upstream of cross section 4.
The apex jams shown in the concept cross-sections and typicals appear undersized for a river of this size. It is unlikely that the jams will rack/collect significant amounts of material in this reach, so they may need to be more robust to persist and provide long-term habitat benefits.	We have increased the size of Apex Jams and Flow Deflection Jams compared to the structures shown in the 15% design submittal.
As the design moves forward, the Review Panels encourages the project team to have at least one or two of the side channels be designed to accommodate flow at a higher frequency than the 1- to 1.5-year event. If the goal of the project is to "increase the quantity and quality of complex summer rearing habitat and off-channel floodplain winter rearing habitat available for juvenile summer steelhead and spring chinook," the side channels need to provide off-channel habitat for a sufficient duration to benefit both steelhead and chinook juveniles. The elevation of the side channel inlets/outlets should be designed to maximize the duration of flow within the side channels to benefit these two fish species, while working within the constraints of the system (e.g., not stranding fish, not splitting low flows, protecting agricultural needs, etc.).	Side channels will have redudundant inlets and will target various flows with the most upstream (SC Network 4) targeting higher flows (1.5yr+)
Add a more thorough depiction of all existing and proposed irrigation infrastructure, a horizontal collector was mentioned as an option but no discussion was provided about where it could be located or how it could affect design options; and scenarios on how the different irrigation options or lack thereof could limit or affect the proposed concept.	Addition detail on the groundwater well feasibility, next steps in design, and impacts on feasibility are included in section 1.7, 3.2.6 and 3.2.7

Appendix F

Report Limitations and Guidelines for Use

APPENDIX F

REPORT LIMITATIONS AND GUIDELINES FOR USE[1]

This appendix provides information to help you manage your risks with respect to the use of this report.

Read These Provisions Closely

Some clients, design professionals and contractors may not recognize that stream and river engineering analysis and design practices are less exact than other engineering and natural science disciplines. Such misunderstanding can create unrealistic expectations, sometimes leading to disappointments, claims and disputes. GeoEngineers, Inc. (GeoEngineers) includes these explanatory "limitations" provisions in our reports to help reduce such risks. Please confer with GeoEngineers if you are unclear how these "Report Limitations and Guidelines for Use" apply to your project or site.

Stream and River Design Engineering Services are Performed for Specific Purposes, Persons and Projects

We have prepared this report for the Confederated Tribes of the Umatilla Indian Reservation (CTUIR) for the Walla Walla River RM 32.5 Floodplain Reconnection project located near Walla Walla, Washington. The CTUIR may distribute copies of this report to their agents and regulatory agencies as may be required for the project. The information contained herein is not applicable to other sites or projects.

GeoEngineers structures its services to meet the specific needs of its clients. No party other than CTUIR may rely on the product of our services unless we agree to such reliance in advance and in writing. Within the limitations of the agreed scope of services for the Project(s), and its (their) schedule and budget, our services have been executed in accordance with our Agreement with the CTUIR signed April 9, 2024 and generally accepted practices in this area at the time this report was prepared. We do not authorize and will not be responsible for the use of this report for any purposes or projects other than those identified in the report.

A Stream or River Design Engineering Report is Based on a Unique Set of Project-Specific Factors

This report has been prepared for the Basis of Design for the Walla Walla River RM 32.5 Floodplain Reconnection project. GeoEngineers considered a number of unique, project-specific factors when establishing the scope of services for this project and report. Unless GeoEngineers specifically indicates otherwise, it is important not to rely on this report if it was:

- Not prepared for you,
- Not prepared for your project,
- Not prepared for the specific site, or
- Completed before project changes were made.

[1] Developed based on material provided by ASFE, Professional Firms Practicing in the Geosciences; www.asfe.org.

For example, changes that can affect the applicability of this report include those that affect:

- The function of the proposed design and/or structure;
- Elevation, configuration, location, orientation or weight of the proposed structures;
- Composition of the design team; or
- Project ownership.

If changes occur after the date of this report, GeoEngineers cannot be responsible for any consequences of such changes in relation to this report unless we have been given the opportunity to review our interpretations and recommendations in the context of such changes. Based on that review, we can provide written modifications or confirmation, as appropriate.

Conditions Can Change

This report is based on conditions that existed at the time the study/design was performed. The findings and conclusions of this report may be affected by the passage of time, by man-made events such as construction on or adjacent to the site, new information or technology that becomes available subsequent to the report date, or by natural events such as floods, earthquakes, slope instability, stream flow fluctuations or stream channel fluctuations. If more than a few months have passed since issuance of our report or work product, or if any of the described events may have occurred, please contact GeoEngineers before applying this report for its intended purpose so that we may evaluate whether changed conditions affect the continued reliability or applicability of our conclusions and recommendations.

Report Recommendations and Designs are Not Final

The recommendations included in this report are preliminary and should not be considered final. The designs depicted herein are approximate and are intended to express the overall design intent of the Project, and need to be adjusted in the field during construction in order to meet the specific-site conditions and intended function. GeoEngineers' recommendations can be finalized only by observing actual site-specific conditions revealed during construction.

We recommend that you allow sufficient monitoring and consultation by GeoEngineers during construction to confirm that the conditions encountered are consistent with those indicated in the report, to provide recommendations for design changes if the conditions revealed during the work differ from those anticipated and to evaluate whether construction activities are completed in accordance with our recommendations. GeoEngineers cannot assume responsibility for the recommendations in this report if we do not perform construction observation.

Report Could be Subject to Misinterpretation

Misinterpretation of this report by members of the design team or by contractors can result in costly problems. GeoEngineers can help reduce the risks of misinterpretation by conferring with appropriate members of the design team after submitting the report, reviewing pertinent elements of the design team's plans and specifications, participating in pre-bid and preconstruction conferences, and providing construction observation.

To help reduce the risk of problems, we recommend giving contractors the complete report, including these "Report Limitations and Guidelines for Use." When providing the report, you preface it with a clearly written letter of transmittal that:

- Advises contractors that the report was not prepared for purposes of bid development and that its accuracy is limited; and
- Encourages contractors to confer with GeoEngineers and/or to conduct additional study to obtain the specific types of information they need or prefer.

Hazards of Instream Habitat Structures

Instream habitat structures ("Structures") create potential hazards, including, but not limited to:

- Persons falling from the Structures and associated injury or death;
- Collisions of recreational users' and their watercraft with the Structures, and associated risk of injury, and damage of the watercraft;
- Mobilization of a portion or all of the Structures during high water flow conditions and related damage to downstream persons and property;
- Flooding;
- Erosion; and
- Channel avulsion.

In some cases, instream habitat structures are only intended to be temporary, providing temporary stabilization while stream/river processes stabilize. This gradual deterioration with age and vulnerability to major flood events make the risks with temporary Structures inherently greater with their increasing age.

GeoEngineers strongly recommends that the Client appropriately address safety concerns, including but not limited to warning construction workers of hazards associated with working in or near deep and fast moving water and on steep, slippery and unstable slopes. In addition, signs should be placed along the enhanced stream reaches in prominent locations to warn third parties, such as nearby residents and recreational users, of the potential hazards noted above.

Increased Flood Elevations and Wetland Expansion are Possible

The proposed stream enhancements may result in increased flood elevations and expansion of wetlands. These impacts are generally considered advantageous for aquatic and riparian habitat in the project locations of these stream systems, but the analysis, consideration and quantification of these impacts is beyond the scope of this report, unless expressly included within GeoEngineers' scope of services.

Channel Erosion and Migration are Possible

In general, river and stream enhancements result in more stable streambeds, banks and floodplains. In some cases, stream enhancement and channel stability includes reestablishing the natural balance of sediment erosion, distribution and deposition, which in some cases may induce channel meandering and migration. Therefore, channel erosion, channel migration and/or avulsions can occur over time.

Importance of Monitoring and Maintenance

In some instances, GeoEngineers may have purposely excluded piles, anchors, chains, cables, reinforcing bars, bolts and similar fasteners from structures with the intent of mimicking naturally-occurring instream structures. In other instances, GeoEngineers may have purposely included such fasteners, if considered appropriate. While GeoEngineers designs Structures to be relatively stable during flood events, some movement of these Structures is expected. We recommend that the Client implement appropriate monitoring and maintenance procedures to minimize potential adverse impacts at or near areas of concern, such as at downstream road, bridge and/or culvert crossings, including replacing, adjusting and removing damaged, malfunctioning or deteriorated components of Structures, particularly after a major storm event.

Contractors are Responsible for Site Safety on Their Own Construction Projects

Our recommendations are not intended to direct the contractor's procedures, means, methods, schedule or management of the work site. The contractor is solely responsible for job site safety and for managing construction operations to minimize risks to on-site personnel and adjacent properties.