East-West Corridor Project

Biological Assessment

Yakima County, Washington

Prepared for:

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Acronyms

BA	Biological Assessment
BGS	Below Ground Surface
BMP	Best Management Practices
CY	Cubic Yard(s)
dB(A)	A-Weighted Decibels
DBH	Diameter at Breast Height
DPS	Distinct Population Segment
EFH	Essential Fish Habitat
ELJ	Engineered Logjam
ESA	Endangered Species Act
ESPA	Endangered Species Preservation Act
ESU	Evolutionary Significant Unit
FHWA	Federal Highway Administration
GULD	General Use Level Designation
HRM	Highway Runoff Manual
HUC	Hydrologic Unit Code
I-82	Interstate 82
LWD	Large Woody Debris
LOS	Level of Service
MOT	Maintenance of Traffic
MSA	Magnuson-Stevens Fishery Conservation and Management Act
NEPA	National Environmental Policy Act
NMFS	National Marine Fisheries Service
NTU	Nephelometric Turbidity Units
OHW	Ordinary High-Water
OHWM	Ordinary High-Water Mark
PBF	Physical and Biological Features
PCB	Polychlorinated Biphenyl
PCE	Primary Constituent Element
PFMC	Pacific Fisheries Management Council
PGIS	Pollutant Generating Impervious Surface
RD	Regional Development
RID	Roza Irrigation District
RM	River Mile
ROW	Right-of-Way
SPCC	Spill Prevention, Control, and Countermeasures
SPL	Sound Pressure Level
TCE	Temporary Construction Easement
SWPPP	Stormwater Pollution Prevention Plan
TESC	Temporary Erosion and Sediment Control
USACE	United States Army Corps of Engineers
USDNR	United States Department of Natural Resources
UGA	Urban Growth Area
USGS	United States Geologic Survey
USFWS	United States Fish and Wildlife Service

WDFW	Washington Department of Fish and Wildlife
WRIA	Water Resource Inventory Area
WSDNR	Washington State Department of Natural Resources
WSDOE	Washington State Department of Ecology
WSDOT	Washington State Department of Transportation

Executive Summary

Yakima County will construct the East-West Corridor in Yakima County, WA. The proposed project will require a Federal Highway Administration (FHWA) approval to cross Interstate 82 (I-82) and may receive FHWA funding administered through the Washington State Department of Transportation (WSDOT) at some point in the future. FHWA is the lead Federal action agency for this project. Also, the proposed project mitigation site in the Yakima River floodplain occurs on Bureau of Reclamation land, creating an additional Federal nexus. The project will also require a Section 404 of the Clean Water Act permit, adding the U.S. Army Corps of Engineers as a Federal action agency.

The Biological Assessment supports compliance with section 7(c) of the Endangered Species Act (ESA) and section 305(b)(4) of the Magnuson-Stevens Fishery Conservation and Management Act (MSA).

The project proposes the construction of a transportation corridor from the intersection of North 1st Street and East H Street in the City of Yakima to the eastern terminus at the Roza Canal Wasteway #2 in the Terrace Heights neighborhood. This corridor is part of a larger transportation corridor that will eventually connect Fruitvale Boulevard in western Yakima to 57th Street in Terrace Heights. The East-West Corridor will involve the construction of two bridges: a combined vehicular and a pedestrian bridge over the Yakima River, and a combined pedestrian and vehicular bridge over the Roza Canal Wasteway #2. In addition to roadway and bridge construction, the proposed project will involve improvements to I-82 including new overpass bridges over the East-West Corridor. This project will also involve restoration and levee work along the Yakima River floodplain including removal of a portion of the Y-6 (Marsh Road) levee south of the proposed bridge managed by Yakima County. Floodplain mitigation work conducted as part of this project would be consistent with the work currently being done with Yakima County's Yakima River Gap to Gap Ecosystem Restoration Project. The purpose of this mitigation work is to encourage river flow towards the area of the floodplain with conservation status rather than its current path that flows against the west bank levee, provide cover for juvenile salmonids in areas that currently have poor cover, and to encourage the establishment of cottonwood stands further upland in the floodplain. This proposed project is located within Sections 7, 17, 18, 20, and 29 of Township 13N and Range 19E.

Currently the existing Yakima Avenue/Terrace Heights Drive route provides the only direct connection between the City of Yakima and the neighborhood of Terrace Heights. Current and projected population growth in Terrace Heights is expected to result in increasing congestion and delays along this route. The proposed East-West Corridor will consist of a 5-lane roadway that will improve vehicular and pedestrian access between Yakima and Terrace Heights. This new corridor is necessary as right-of-way (ROW) constraints along the existing Yakima Avenue/Terrace Heights Drive route prevent widening of the existing roadway.

In-water work will be required for the placement/removal of a maximum of 57 steel pipe piles for the construction/deconstruction of a temporary work bridge and the oscillator, and the placement/ removal of three 16-foot diameter casings for construction of the Yakima River bridge. All in-water work will be conducted during the in-water work window (July 15 to

February 1) agreed upon by the Washington Department of Fish and Wildlife (WDFW), United States Fish and Wildlife Service (USFWS) and the National Marine Fisheries Service (NMFS). Work outside the wetted channel may occur outside this period. Construction will be completed in phases and is anticipated to start in the summer of 2023. It will take 5 years for completion by the end of 2028.

Temporary substrate loss from steel pipe piles and casings will amount to 700 square feet (SF) and permanent substrate loss due to placement of one in-water pier will equal approximately 85 SF.

The proposed project will permanently displace 3.3 acres of riparian vegetation. It is anticipated that 50 trees greater than 12 inches diameter at breast height (DBH) will be removed, the majority will be associated with the floodplain restoration work. Felled trees greater than 8 inches DBH will be used as large woody debris (LWD) within the wetted channel of the Yakima River where possible and all disturbed areas will be revegetated with appropriate native plant species. 6.9 acres planting within the riparian areas of the Yakima River will provide mitigation for any disturbed riparian vegetation.

Under existing conditions, more than 85 percent of PGIS is untreated. The project will create 10.15 acres of new PGIS. All new PGIS will receive treatment and more than 75 percent of existing PGIS will treated following project construction. 5.01 acres of PGIS will receive basic treatment and will be discharged to the Yakima River via an existing outfall. An additional 10.39 acres will receive enhanced treatment using infiltration methods. Treatment will be provided in accordance with the Washington State Department of Ecology (WSDOE) Stormwater Management Manual for Eastern Washington.

The USFWS and the NMFS indicated that listed fish species and designated critical habitat occur in the project area. The installation/removal of piles and casings may produce a temporary increase in sedimentation and/or turbidity levels and pile driving activities may result in increased sound pressure levels which injure fish. Removal of trees in close proximity to the Yakima River along with other riparian vegetation loss could result in a temporal loss of refugia and LWD recruitment. The construction of the bridge and work bridge will result in permanent and temporary impacts to river substrate. The new pier and floodplain mitigation within the Yakima River may affect channel morphology and the pier will create a permanent obstacle for migration through the project area.

There is no suitable habitat nor have there been any documented occurrences of any federally listed terrestrial species within or adjacent to the project area.

Conservation measures such as erosion control best management practices (BMPs), containments structures (such as outer casings for placement of drilled shafts and a confined bubble curtain to limit increased sound pressure during impact pile driving activities), a Spill Prevention Control and Countermeasures (SPCC) Plan, a Stormwater Pollution Prevention Plan (SWPPP), and a designated in-water work window will be incorporated into the project in order to minimize and/or avoid project impacts.

Summary of project effects on species protected under the ESA

Species and Critical Habitat	Federal Status	Status in Action Area	Effect Determination
Yellow-billed Cuckoo Western U.S. DPS (*Coccyzus americanus*)	Threatened	Potentially Present	"May affect, not likely to adversely affect"
Bull Trout U.S.A., conterminous, lower 48 states (*Salvelinus confluentus)*	Threatened	Present	"May affect, likely to adversely affect"
Bull Trout Critical Habitat	Designated	Present	"May affect, likely to adversely affect
Steelhead Trout Middle Columbia River DPS (*Oncorhynchus tshawytscha*)	Threatened	Present	"May affect, likely to adversely affect"
Steelhead Trout Middle Columbia River DPS Critical Habitat	Designated	Present	"May affect, likely to adversely affect"
EFH of Pacific Salmonids		Present	"May adversely affect"

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Chapter 1. Project Overview

1.1. Federal Nexus

The proposed project will require a Federal Highway Administration (FHWA) approval to cross Interstate 82 (I-82) and may receive FHWA funding administered through the Washington State Department of Transportation (WSDOT) at some point in the future. FHWA is the lead Federal action agency for this project. Also, the proposed project mitigation site in the Yakima River floodplain occurs on Bureau of Reclamation land, creating an additional Federal nexus. The project will also require a Section 404 of the Clean Water Act permit, adding the U.S. Army Corps of Engineers as a Federal action agency.

The Biological Assessment (BA) supports compliance with section 7(c) of the Endangered Species Act (ESA) and section 305(b)(4) of the Magnuson-Stevens Fishery Conservation and Management Act (MSA). Appendix A of this BA addresses EFH as protected under the MSA as amended in 2007 and regulated by the NMFS (NMFS 2007).

1.2. Project Description

1.2.1. Existing Conditions

The area at the western terminus of the proposed construction, west of I-82, is within the Boise Cascade Mill Redevelopment Area and is zoned as Regional Development. This area was a part of a lumber mill from 1903 to 2006, with log ponds remaining until the 1960's. It currently consists of 225 acres of cleared land for redevelopment of mixed use, commercial, and light industrial purposes (City of Yakima 2018). There are several private residences and commercial businesses along the proposed route within the community of Terrace Heights, east of I-82. However, the majority of the project area is undeveloped land. Existing impervious areas within the proposed project area include portions of E H Street, Hartford Road, and N 15th Street as well as several driveways.

The proposed project area is characterized by the Yakima River and its associated floodplain immediately east of I-82. The Yakima River separates the City of Yakima from Terrace Heights. It runs generally north to south through the proposed project area. The southern portion of the project area east of the river is comprised of lowlands while the northern portion rises abruptly through a series of terraces to form the Yakima Ridge. Beginning at the southern end of the project area and heading north, the first terrace encountered is the Rest Haven Bench which is occupied by Rest Haven Road and its adjacent residential properties. The next terrace heading north is completely occupied by the Selah-Moxee Canal. The third terrace is occupied entirely by the Roza Canal, the main canal for the Roza Irrigation District (RID). The Roza Canal Wasteway #2 runs generally north-south through the proposed project area. See Figure 1. Vicinity Map.

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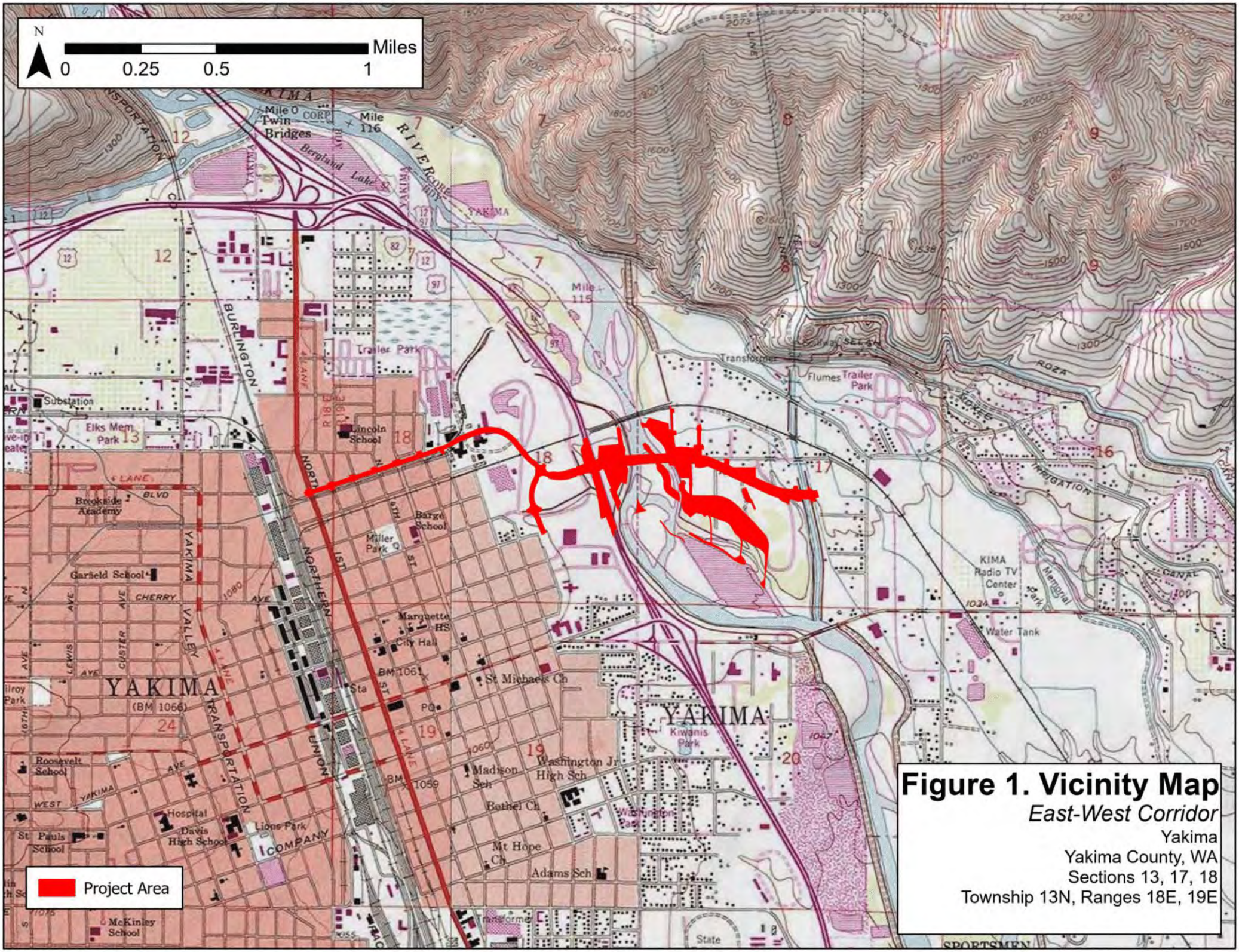
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Project Area
YAKIMA
YAKIMA
Figure 1. Vicinity Map
East-West Corridor
Yakima
Yakima County, WA
Sections 13, 17, 18
Township 13N, Ranges 18E, 19E

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1.2.2. Purpose and Need

The purpose of the proposed project is to reduce congestion and connect the growing neighborhood of Terrace Heights to the City of Yakima (as stated in the Purpose & Need for this project, dated March 22, 2022):

- Provide an alternative Yakima River crossing for east-west travel between the City of Yakima and Terrace Heights.
- Increase mobility, by decreasing travel delay, and relieving traffic congestion at the I-82/Yakima Avenue Interchange and on Terrace Heights Drive and Yakima Avenue.
- Construct the local road corridor which would allow for the consideration of construction of the recommended alternative for an interchange with I-82 identified in the WSDOT I-82/Yakima Avenue/Terrace Heights Drive IJR.
- Provide bicycle and pedestrian facilities including a connection to the Yakima Greenway Trail.
- Serve the existing approved transportation and land use planning along the roadway corridor as documented in the Yakima Valley Conference of Governments (YVCOG) 2020-2045 Metropolitan and Regional Transportation Plan.

The needs for the project include the following (as stated in the Purpose & Need for this project, dated March 22, 2022):

- *Congested Corridor* –The current road network cannot support the growth anticipated in the area under the current comprehensive plan. The Terrace Heights neighborhood lies just to the east of the City of Yakima. The neighborhood, an unincorporated part of Yakima County, has grown considerably over the last five decades, with its population increasing fivefold in the 30 years between 1970 and 2000, to a 2019 total of 8,507. Redevelopment of the Boise Cascade Mill Site consistent with the planned land use in the current City of Yakima Comprehensive Plan is also anticipated to increase traffic demand within the City of Yakima.

  The level of service (LOS) on the Yakima Avenue/Terrace Heights Drive corridor has been getting steadily worse and by 2035 it is expected to have multiple turning movements operating at LOS E or F. LOS is a letter grade corresponding to the amount of congestion a road has when completed to a standard. LOS A is the best or the least congested grade. LOS F indicates failure because the demand for a road is more than its capacity.

  The current LOS along the Yakima Avenue/Terrace Heights Drive corridor has triggered Yakima County's concurrency requirements, which limits new development permits along the corridor. In order to relax the restrictions, the County must either increase the capacity of the existing corridor or divert sufficient traffic volume onto another route. Right-of-way constraints along the existing Yakima Avenue/Terrace Heights Drive route prevent widening of the existing roadway. The future LOS at the Yakima Avenue interchange is also anticipated to cause back-ups onto the I-82 mainline.

- *Emergency Response* – The Yakima River poses a natural barrier to travel between Yakima and Terrace Heights. Historically, east-west traffic in the project vicinity has had only one option to travel between these two locations: the Yakima Avenue/Terrace Heights Drive corridor. A new corridor is needed to provide an alternative redundant route to Terrace Heights during any future closures of the Terrace Heights Bridge as well as an additional route for emergency services.

- *Lack of pedestrian and bicycle connectivity* – Access to the Greenway Trail is limited as it travels between I-82 and the Yakima River. The existing East H Street corridor does not include sidewalks or bike lanes and there is no access for pedestrians to the Greenway Trail from the surrounding residential neighborhood.

1.2.3. Proposed Conditions

Proposed Project
Yakima County is proposing to construct an East-West Corridor in the City of Yakima and unincorporated Yakima County, Washington from North 1st Street and East H Street on the west side of Interstate 82 (I-82) in the City of Yakima to the eastern terminus on the east side of the Roza Canal Wasteway #2 in the community of Terrace Heights. This corridor will connect with Yakima County's Phase 1 of Cascade Mill Parkway (construction already completed) which will continue to Butterfield Road and North Keys Road. The project would include construction of three separate streets:

- **East H Street** –The existing road would be extended to the east from the current terminus at North 7th Street where it would connect to Bravo Company Boulevard as the road turns to the south. The existing portion from North 1st Street to North 7th Street would be widened. A new signal would be installed at the intersection with North 1st Street.

- **Bravo Company Boulevard** – An extension of Bravo Company Boulevard connecting to East H Street would be constructed which would turn south and connect to the current terminus near Fair Avenue. A roundabout intersection with Cascade Mill Parkway would be constructed along with one additional roundabout intersection to connect to an existing access road to the adjacent properties.

- **Cascade Mill Parkway** –Cascade Mill Parkway would connect to Bravo Company Boulevard at a roundabout intersection and then continue east beneath I-82 and across the Yakima River and Roza Canal Wasteway #2.

The East-West Corridor project will involve improvements to existing roadways, including transforming East H Street from a residential street to a free-flowing arterial between North 1st Street and North 7th Street; the building of new connections and roundabouts; non-motorized facilities including bike lanes, sidewalks, Americans with Disabilities Act (ADA) ramps, crosswalks, and a shared-use path that will connect to the Yakima Greenway Trail; and construction of four bridges: two to carry I-82 over the proposed roadway, one over the Yakima River, and one over the Roza Canal Wasteway #2. This project will also involve restoration and levee work along the Yakima River floodplain including removal of a portion of the Y-6 (Marsh

Road) levee south of the proposed bridge managed by Yakima County. Floodplain mitigation work conducted as part of this project would be consistent with the work currently being done with Yakima County's Yakima River Gap to Gap Ecosystem Restoration Project. The purpose of this mitigation work is to encourage river flow towards the area of the floodplain with conservation status rather than its current path that flows against the west bank levee, provide cover for juvenile salmonids in areas that currently have poor cover, and to encourage the establishment of cottonwood stands further upland in the floodplain.

In total, four bridges are being proposed with approximate span lengths and descriptions listed below:

- I-82 bridge eastbound and westbound bridges
    - 113 feet long (span preliminary and subject to Washington State Department of Transportation (WSDOT) approval)
    - Two single-span bridges, one for each direction of traffic
    - Superstructure type to be determined and approved by WSDOT
    - To be constructed in stages to minimize traffic disruptions on I-82
- Yakima River pedestrian and vehicular bridge
    - 866 feet, 6 inches long, approximately, between ends of abutments
    - 4 spans
        - Two 187-foot, 3-inch spans
        - Two 246-foot spans
    - Constructed with spliced precast concrete girders
    - 3 intermediate piers each with 6-foot diameter columns supported on individual 10-foot diameter drilled shafts
    - Temporary work bridge with finger piers to construct foundation, substructure, temporary shoring towers and placing girders and constructing superstructure.
- Roza Canal Wasteway #2 pedestrian and vehicular bridge
    - 129 feet long
    - Single-span
    - Constructed with precast prestressed concrete girders

One of the piers for the proposed permanent bridge over the Yakima River will need to be drilled below the Ordinary High-Water Mark (OHWM) of the river while others will be drilled within the limits of the 100-year floodplain. Multiple bridge designs were considered to minimize impacts to the Yakima River. A superspan bridge which would have avoided the in-water pier was discussed but Yakima County believes this type of bridge would exceed their capacity for maintenance. The pier location in the channel was chosen due to maximum span length of the spliced concrete girders and the need to avoid the levee on the west bank of the river.

The in-water bridge pier is near the center of the current constricted river channel, but this will be altered in the future by the proposed mitigation which will distribute water more evenly across the historic floodplain. The pier is not likely to remain in the center of the channel after construction of the new channels and floodplain grading. There will be no rise in the 100-year or 500-year floodplain due to bridge construction (Shannon & Wilson 2019). The proposed pier locations and roadway alignment will have the least environmental impact of any of the analyzed alternatives. See Figure 2. Project Area and Figure 3. Project Elements.

1.3. Project Area and Setting

The proposed project is located between N 1st Street in the City of Yakima and the east bank of the Roza Canal Wasteway #2 Terrace Heights neighborhood where it meets the under-construction Phase 1 of the East-West Corridor (Figure 1 and Figure 2).

The Yakima River flows from north to south through the project area, at approximately river mile (RM) 114.2. The river continues south and then east before outletting into the Columbia River at RM 335.2 (Karp et al. 2005). The project area is located within the legal geographic area of Sections 17 and 18 of Township 13 North and Range 19 East as well as Section 13 of Township 13 North and Range 18 East. It is within Water Resource Inventory Area (WRIA) 37: Lower Yakima River/Hydrologic Unit Code (HUC) 170300030206.

The Roza Canal Wasteway #2 flows through the project area near the eastern terminus of the proposed East-West Corridor. It runs north-south, roughly perpendicular to the proposed single span bridge over the Canal.

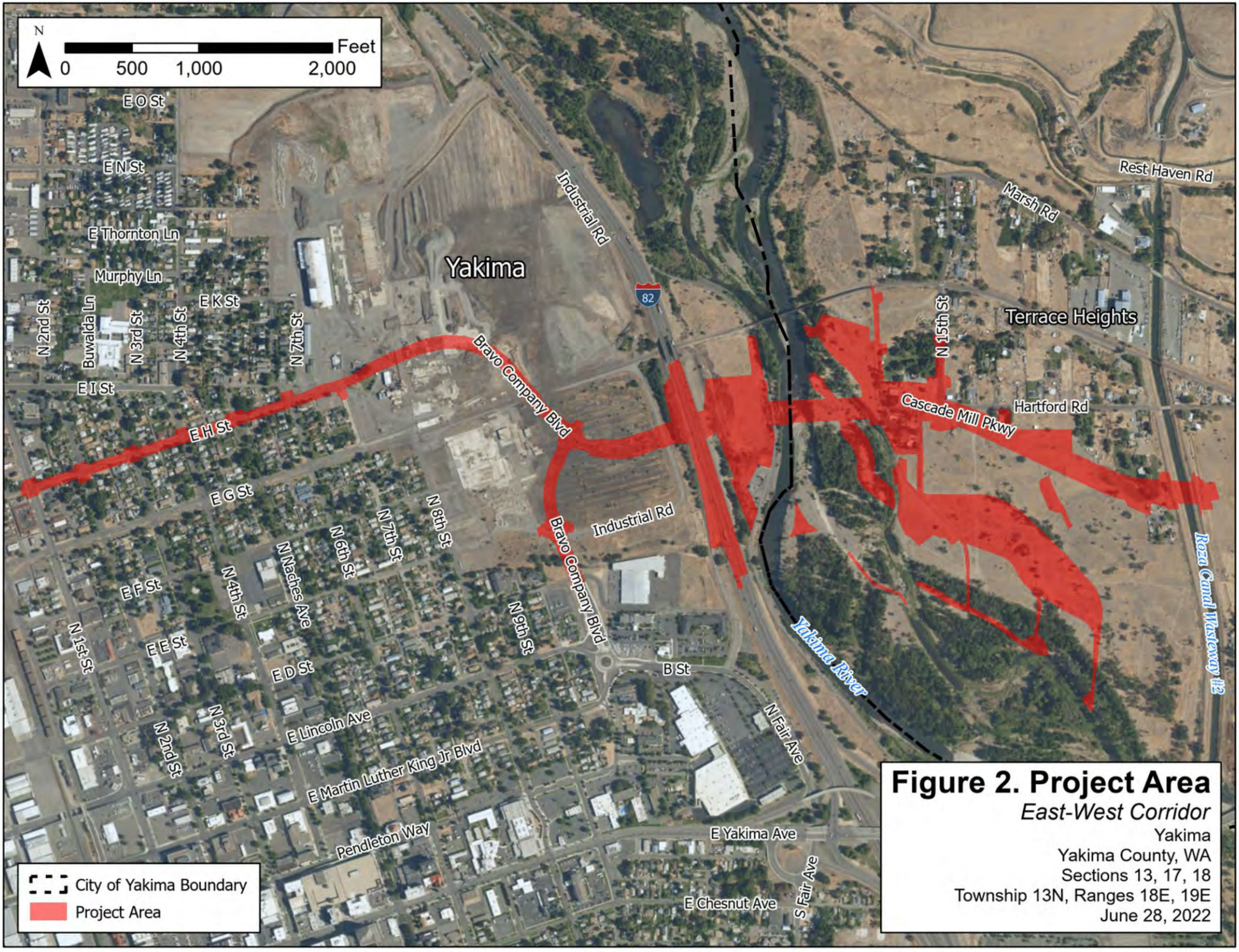

Figure 2. Project Area

East-West Corridor

Yakima
Yakima County, WA
Sections 13, 17, 18
Township 13N, Ranges 18E, 19E
June 28, 2022

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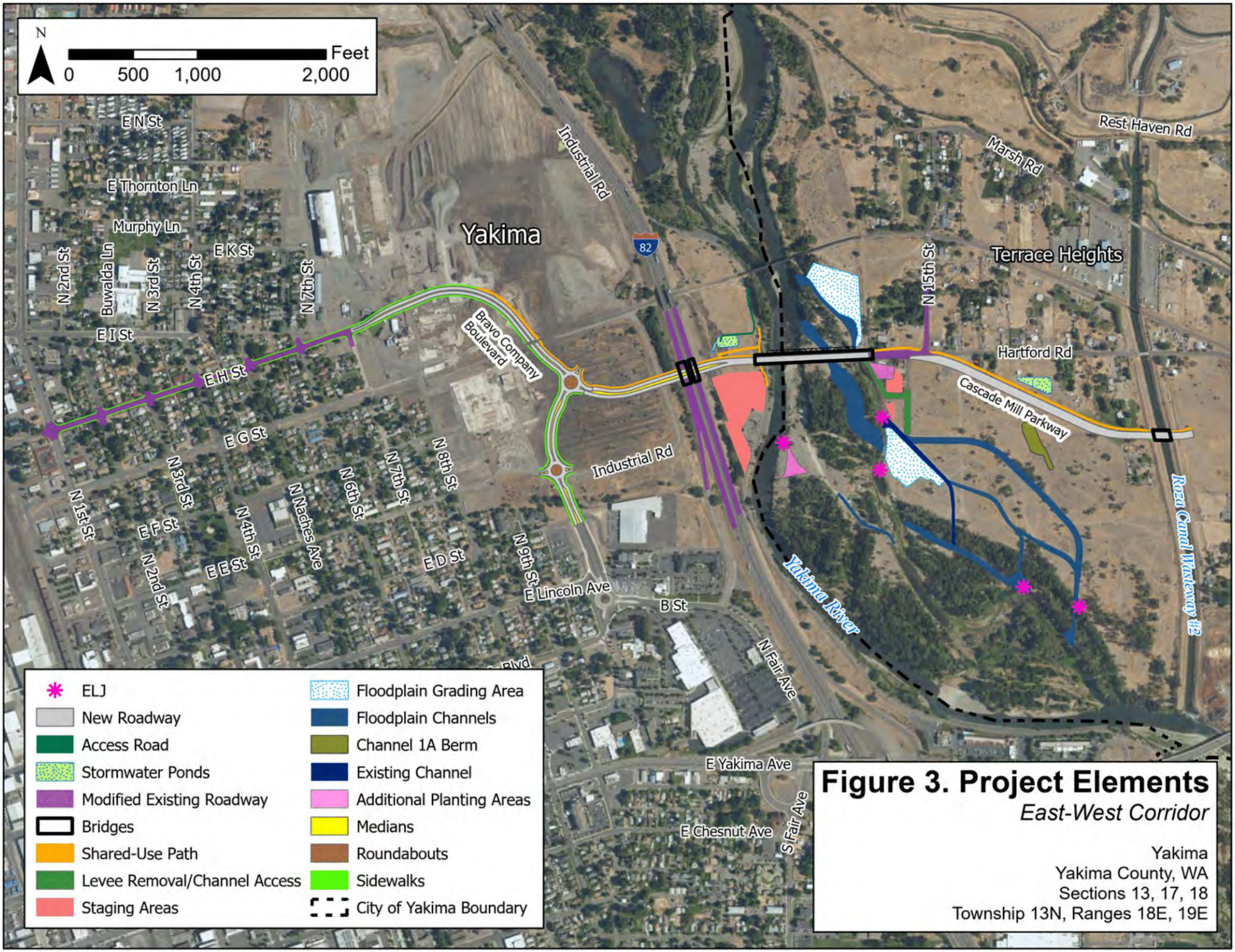

Figure 3. Project Elements

East-West Corridor

Yakima
Yakima County, WA
Sections 13, 17, 18
Township 13N, Ranges 18E, 19E

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Chapter 2. Project Details

2.1. Construction Summary

Construction is anticipated to begin in the summer of 2023 and last 5 years. Phase 1 was permitted separately, and construction has been completed. Construction will be completed in phases[1] (Figure 4):

- Phase 2 (Roza Canal Wasteway #2 bridge to N 15th Street and floodplain mitigation work): summer 2023 to fall 2024
- Phase 3 (Yakima River bridge to westernmost roundabout on Bravo Company Boulevard and I-82 work): 2024 to 2027
- Phase 4 (Bravo Company Boulevard and H Street): 2027 to 2028

Construction activities will consist of the following:

- Clearing;
- Constructing temporary work bridge across the Yakima River;
- Constructing finger piers, reaction piles, and temporary shoring towers;
- Installing drilled shafts for Yakima River bridge;
- Placing columns, abutments, caps, and concrete girders for the construction of new bridge;
- Laying base, paving, and striping for roadway regrade;
- Installing signage;
- Floodplain mitigation; and
- Re-vegetating disturbed areas post-construction.

2.2. Project Timeline and Sequencing

Construction of the project will occur in eight primary stages. The anticipated general work on this project is as follows, however, some stages may be completed simultaneously. Each stage has been deconstructed into its primary components in the following sections. See Table 1 for detailed Yakima River bridge construction timing and salmonid usage in the Yakima River.

<u>Site Preparation (all phases)</u>

1. Contractor Mobilization
2. Construction survey and stake out
3. Locate utilities
4. Temporary erosion control
5. Clearing and grubbing
6. Construction staging
7. Relocate utilities

[1] Phase 1 which has already been completed was permitted separately. It is only shown here to give this project context. This document does not discuss impacts from Phase 1.

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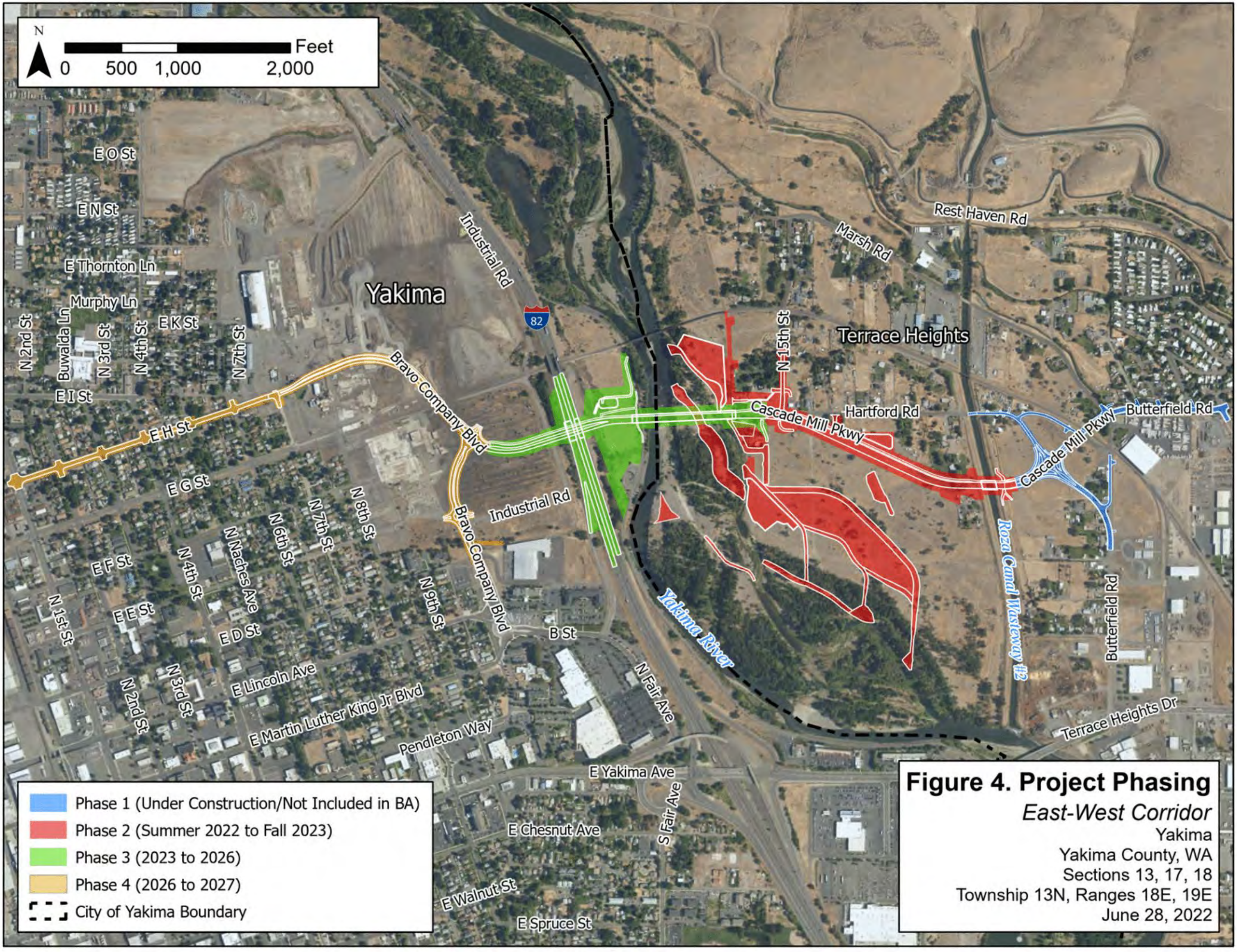

Figure 4. Project Phasing

East-West Corridor

Yakima
Yakima County, WA
Sections 13, 17, 18
Township 13N, Ranges 18E, 19E
June 28, 2022

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Table 1. Summary of bridge construction activities and listed species activities

MONTH	January	February	March	April	May	June	July	August	September	October	November	December
In-Water Work Window (3 seasons)*												
2023												
In-water impact pile driving												
Mobilization												
Site preparation and staging												
Test pile for work bridge (outside OHW)												
Construct work bridge												
Construct finger piers and support piles												
Bridge construction												
Construct girders												
Construct shafts												
Construct columns												
Construct caps												
Construct abutments												
2024												
Bridge construction												
Construct abutments												
Cure abutments												
Erect girders												
Construct diaphragms												
Cure diaphragms												
Post tension												
Construct deck												
Construct barriers												
Remove finger piers and support piles												
2025												
Remove work bridge												
Listed species activity periods[2]												
Bull trout upstream migration												
Bull trout staging												
Bull trout spawning												
Bull trout incubation												
Bull trout rearing												
Bull trout smolt downstream migration												
Steelhead trout upstream migration												
Steelhead trout kelt outmigration												
Steelhead trout spawning												
Steelhead trout incubation												
Steelhead trout rearing												
Steelhead trout smolt downstream migration												

*In-water vibratory and impact pile driving will both occur from July 15 to October 1. Only vibratory pile driving will occur after October 1, until February 1. No in-water impact pile driving will occur after October 1.

In-water work
Over-water work
Upland work

[2] Data taken from (Conley et al. 2009; Homel and Budy 2008; Mizell and Anderson 2015; Reiss et al. 2012; USFWS 2014)

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In-Water Work (Phase 3)

1. Construction of the temporary work bridge (to be done in 1st in-water work window)
    a. Test piles (may be done prior to work window, outside OHW)
    b. Install temporary work bridge piles and work bridge deck
    c. Install finger piers and reaction piles adjacent to work bridge
    d. Install temporary casing for pier shaft
2. Construction of Yakima River bridge
    a. Construct intermediate piers 2, 3, and 4
    b. Remove temporary casing for intermediate pier 2
    c. Construct pier caps
    d. Construct temporary support towers for bridge girders
3. Removal of the temporary work bridge
    a. Remove finger piers and reaction piles for temporary casings (2nd in-water work window)
    b. Remove bridge deck for finger piers (2nd in-water work window)
    c. Proceed with and complete remainder of over-water work activities
    d. Remove temporary support towers for bridge girders, cutting piles below mudline if removal is not possible (3rd in-water work window)
    e. Remove remaining work bridge piles and deck (3rd in-water work window)

Over-Water and Adjacent Work (Phases 2 and 3)

1. Construction of Yakima River bridge (Phase 3)
    a. Construct bridge abutments (piers 1 and 5)
    b. Erect bridge girders
    c. Install utilities as required
    d. Install stormwater collections system
    e. Form and pour bridge decks
    f. Form and pour curbing and traffic barriers
    g. Install streetlights and bridge railings
    h. Construct roadway embankment

1. Construction of Roza Canal Wasteway #2 Bridge (Phase 2)
    a. Construct bridge abutments
    b. Erect bridge girders
    c. Install utilities as required
    d. Install stormwater collections system
    e. Form and pour bridge deck
    f. Form and pour curbing, sidewalks, and traffic barrier
    g. Install streetlights and bridge railing
    h. Construct roadway embankment

General Construction (All Phases)

1. Construction of I-82 Bridges (Phase 3)
    a. Drive soldier piles in I-82 using staggered lane closures
    b. Construct temporary bridge supports adjacent to I-82 lanes
    c. Complete single-span bridges adjacent to eastbound/westbound I-82 lanes

d. Temporarily close eastbound I-82, excavate roadway, and complete soldier pile walls with permanent ground anchors
e. Place precast bridge abutment, slide eastbound bridge into final location
f. Place precast approach slabs, restore paving, re-open lanes
g. Temporarily close westbound I-82, excavate roadway, and complete soldier pile walls with ground anchors
h. Place precast bridge abutment, slide eastbound bridge into final location
i. Place precast approach slabs, restore paving, re-open lanes
j. Remove temporary bridge supports

1. Roadway Construction (All Phases)
   a. Construct roadway embankments
   b. Install utilities and stormwater collections system
   c. Install concrete curbing and sidewalks
   d. Grade roadway to final grade and set bridge approach slabs
   e. Pave roadway and install pavement markings
   f. Install streetlights and signs
   g. Install landscaping and permanent erosion control
   h. Remove temporary erosion control

Floodplain Mitigation (Phase 2)
1. Grade floodplain grading areas
2. Excavate out channels and grade channel banks
3. Excavate at ELJ locations
4. Install timber piles
5. Place wood in layers with racking, slash, and logjams
6. Stinger in cottonwoods
7. Plant native riparian vegetation live stakes

2.3. Detailed Construction Procedures

2.3.1. Site Preparation

Site preparation will occur for all phases of this project.

Mobilization

A key task in mobilization is for the contractor to submit a debris containment plan prior to the start of construction. The plan will describe how the contractor will contain debris and prevent it from entering the Yakima River. It is assumed that at a minimum the contractor will erect a catchment below both the work bridge and the proposed new superstructure of the Yakima River bridge to catch all debris.

Surveying for Clearing and Grubbing

Clearing limits will be surveyed, staked, and marked with high visibility fence prior to the start of construction.

Temporary Erosion Control
A Temporary Erosion and Sediment Control (TESC) plan and a Stormwater Pollution Prevention Plan (SWPPP) will be approved and implemented prior to any earth disturbing activities. Some erosion could occur during construction due to clearing, grubbing, and excavation activities, however best management practices (BMPs) such as erosion control blankets and seeding will be used to stabilize these areas and prevent soil erosion. To prevent sediment from entering the Yakima River, silt fences, straw bales (certified weed free), and/or catch basin liners will be installed prior to any earthmoving activities. Impacts are not expected to exceed the water quality standard set forth in the 401 water quality certification from the Washington State Department of Ecology (WSDOE).

Construction Access and Staging
Access to the river will not be necessary during construction of this project, as all work will be performed from the temporary work bridge. County owned parcel 19131841002, located west of the bridge; county owned parcels 19131732420, 19131732409, 19131732408, 19131732411, and 19131731408 located east of the river; and the Hartford Road ROW, may be used as a staging, stockpiling, and equipment wash-out area during construction. See Figure 3 for staging area locations. All equipment wash-out water debris will be contained and disposed of off-site at an approved disposal site.

Relocating Utilities
Existing overhead power and communications utilities will be relocated within the right-of-way (ROW) along H Street and Hartford Road to accommodate roadway construction.

2.3.2. In-Water Work

In-water work will occur during Phase 3 and will be required for:

- The placement and removal of steel pipe piles for the construction/deconstruction of temporary work bridge over the Yakima River finger piers and reaction piles;
- The placement of steel piles for the temporary shoring towers, and cutting of piles below mudline if removal is not possible;
- The placement of a confined bubble curtain around any piles that may impact driven in greater than 2 feet of water; and
- The installation of temporary casing for the placement of drilled shafts.

Additional work below the OHWM to be done during dry conditions in Phase 2 includes:

- Backchannel grading and excavation; and
- ELJ installation.

All in-water work will be conducted during the agreed-upon WDFW in-water work window (July 15 to February 1).

The project will require the placement of piles below the OHWM. All steel pipe piles will be installed with a vibratory and impact driver. Timber piles will be made of untreated Douglas fir (*Pseudotsuga menziesii*) or cedar trunks and installed with a vibratory pile driver. The following table shows pile counts below and above the OHWM.

Table 2. Piles anticipated to be installed and extracted

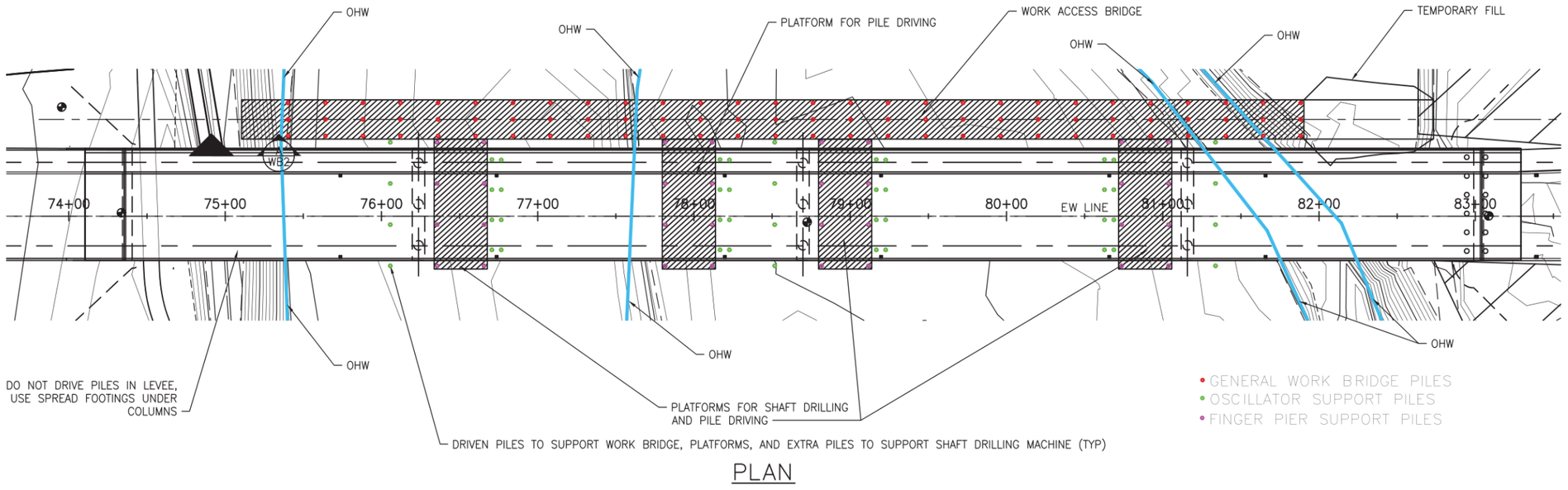
Pile Type	General Work Bridge Piles (beneath work bridge)		Finger Pier Support Piles		Oscillator Support Piles		ELJ Piles		Total	
	Total	Below OHWM	Total	Below OHWM	Total	Below OHWM	Total	Below OHWM	Total	Below OHWM
24-Inch Pipe Pile	84	36	32	8	44	13	-	-	160	57
30-Inch Timber Pile	-	-	-	-	-	-	15	14	15	14

At the time of steel pipe pile driving, the water depth will range from 2 to 8 feet. As substrate in the river is dominated by dense gravels at a depth up to 20 feet below the surface of the streambed, it is anticipated that 24-inch support piles will be driven to a depth of 20 feet with a vibratory hammer and driven the remaining 50 feet with an impact hammer for a total depth of 70 feet below the streambed. Approximately 2,650 impact strikes are anticipated to be required per pile based on geotechnical analysis completed by Shannon and Wilson. Prior to the in-water work window, a test pile will be installed outside of OHW to confirm substrate conditions and adjust the pile strikes per pile. It is anticipated that each pile should take 1.5 hours[3] to place, with 30 minutes of vibratory driving and 1 hour of impact driving. To minimize impacts to aquatic organisms, no more than 7,950 pile strikes will be allowed within the wetted channel in a given day, approximately three piles per day. With 57 total piles driven inside the wetted area, 19 days of pile-driving time are anticipated to be required to complete this task with this pile strike limit. Additional days maybe required if the Contractor has lower production days. More than three piles may be placed if fewer strikes per pile are required. See Figure 3 for ELJ locations and 5.1 for steel pipe pile locations pile locations.

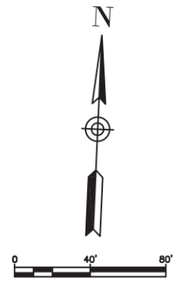
Within the wetted channel, vibratory pile driving is anticipated to occur for 28.5 hours over a period of 19 days in the first year of construction (anticipated to be 2023). Impact pile driving is anticipated to occur for 57 hours over a period of 19 days within the wetted channel in 2023. Finger pier and support piles will be removed in the second year of Phase 3 and the work bridge piles will be removed in the final year of Phase 3. All in-water pile driving/extraction will occur within the approved in-water work window (July 15 to February 1). Should any pile break during extraction, or not be able to be removed for some other reason, they will be cut below the mudline.

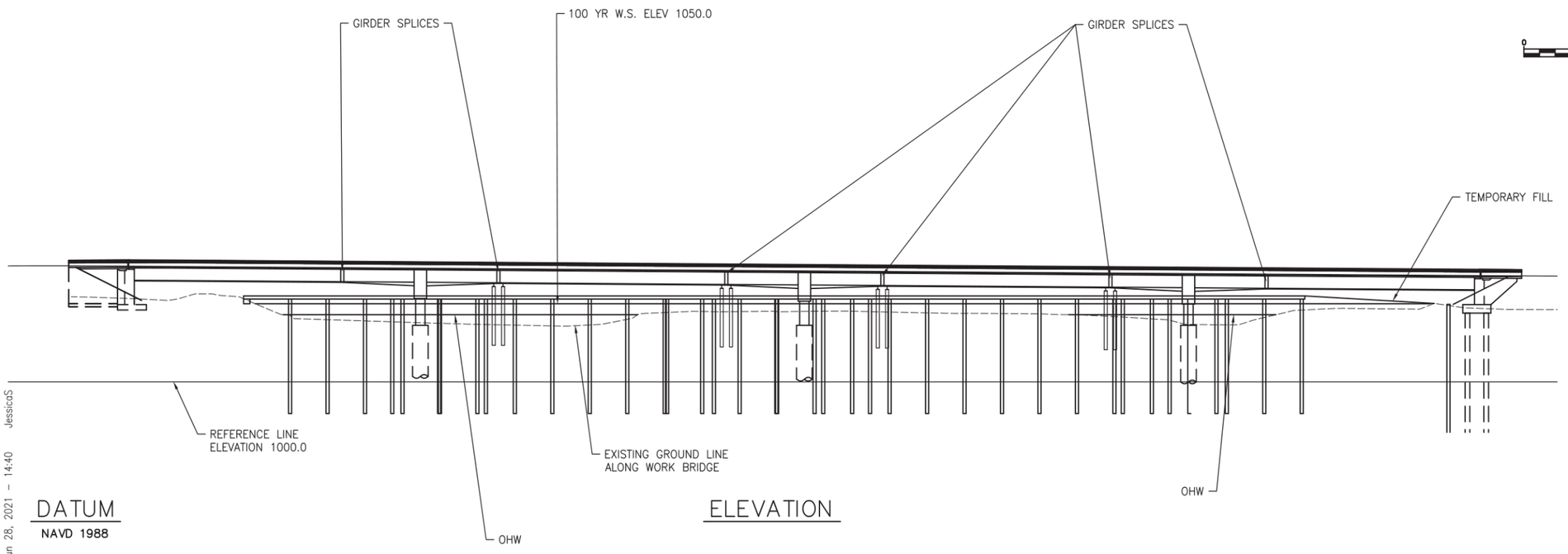
The 14 timber piles installed will all be installed below the OHWM with a vibratory pile driver. However, these piles will be installed in the late summer or early fall to be outside of the wetted channel. Because installation will be done in dry conditions, no sound or turbidity impacts to the Yakima River are anticipated. They are permanent along with the entire ELJ, so habitat impacts will be discussed in Chapter 6 of this document.

[3] Note that the 1.5 hours per pile reflect the amount of time required to drive a pile and that breaks may occur between hammer drops; therefore, while impact activities will be required for no more than 1.5 cumulative hours per pile it may take multiple hours or even days to place a single pile.



PLAN





DATUM
NAVD 1988

ELEVATION

Plotted: Jun 28, 2021 - 14:40 JessicaS

SARGENT

DO NOT SCALE REDUCED SHEETS

YAKIMA COUNTY

CASCADE MILL CORRIDOR PROJECT PHASE 3

CRP#

PREPARED UNDER THE DIRECTION OF:

MONTE JAY SMITH
STATE OF WASHINGTON
22378
STRUCTURAL ENGINEER
PROFESSIONAL ENGINEER

PRELIMINARY

DATE:

PROJECT ENGINEER:
M J SMITH

DRAWN:	CHECKED BY:
M. SMITH	–

REVISION:

FNAME: Yakima River Bridge 5-20-21.dwg

Temporary Work Bridge Plan and Profile

Figure 5.1

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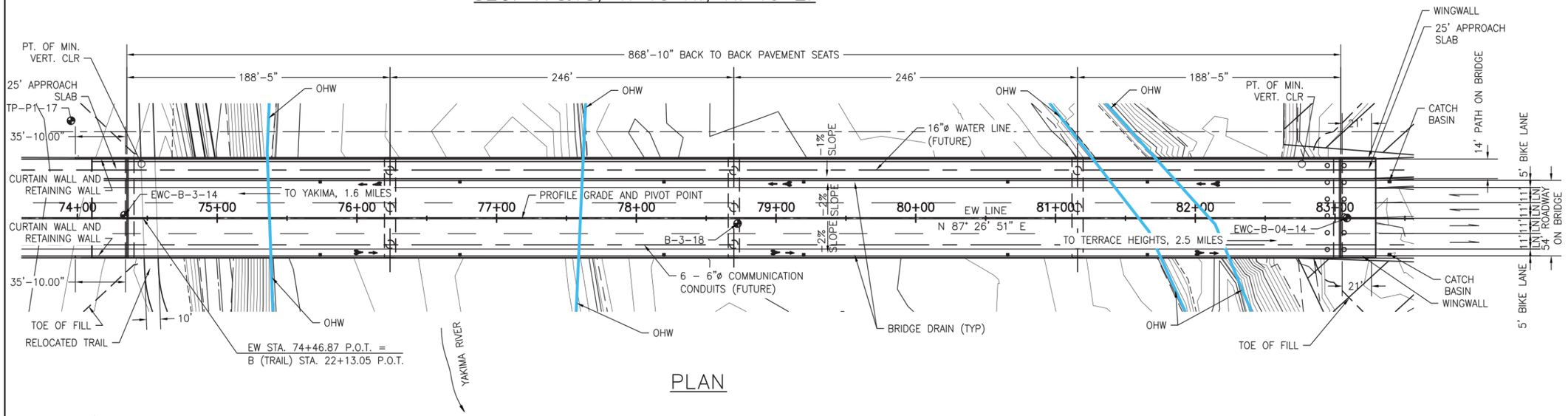
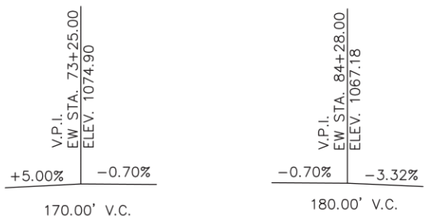
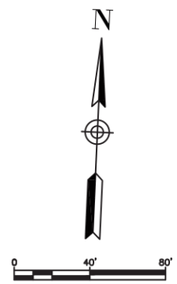
SEC. 17&18, T. 13 N., R. 19 E.

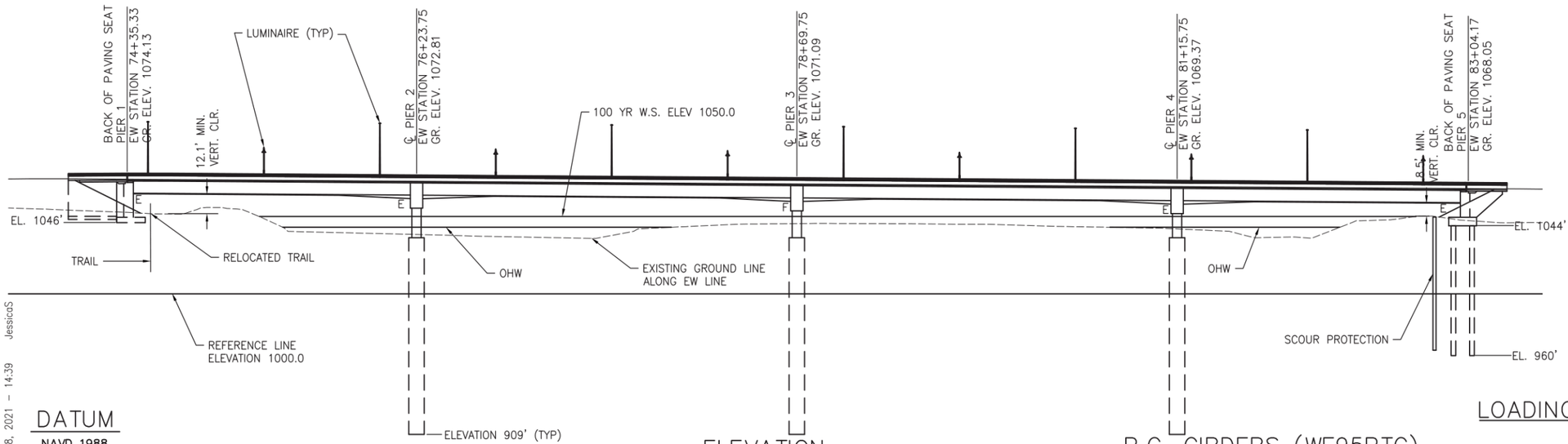


PLAN



EW PROFILE GRADE





ELEVATION

DATUM
NAVD 1988

GRADE ELEVATIONS SHOWN ARE FINISH GRADES ALONG EW LINE AND ARE EQUAL TO THE PROFILE GRADE.

LOADING: HL-93

P.C. GIRDERS (WF95PTG) CONTINUOUS FOR LIVE LOAD. DECK CAST AFTER POSTTENSIONING.

DO NOT SCALE REDUCED SHEETS

SARGENT

Plotted: Jun 28, 2021 - 14:39 JessicaS

YAKIMA COUNTY

CASCADE MILL CORRIDOR PROJECT PHASE 3

CRP#

PREPARED UNDER THE DIRECTION OF:

MONTE JAY SMITH
STATE OF WASHINGTON
22378
STRUCTURAL ENGINEER
PROFESSIONAL ENGINEER

PRELIMINARY

DATE:

PROJECT ENGINEER: M J SMITH

DRAWN: M. SMITH | CHECKED BY: -

REVISION:

FNAME: Yakima River Bridge 5-20-21.dwg

Yakima River Bridge Plan & Profile

Figure 5.2

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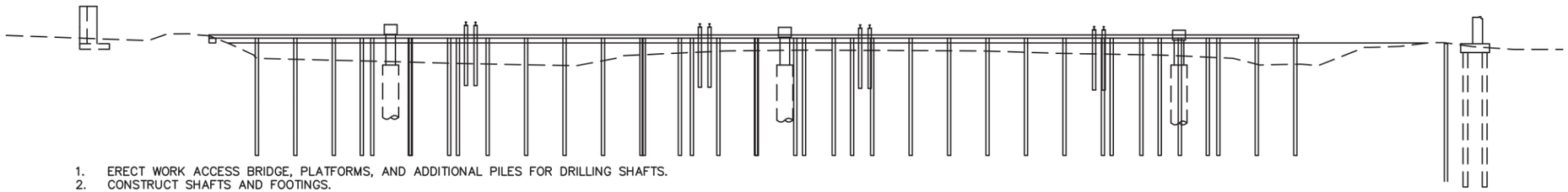
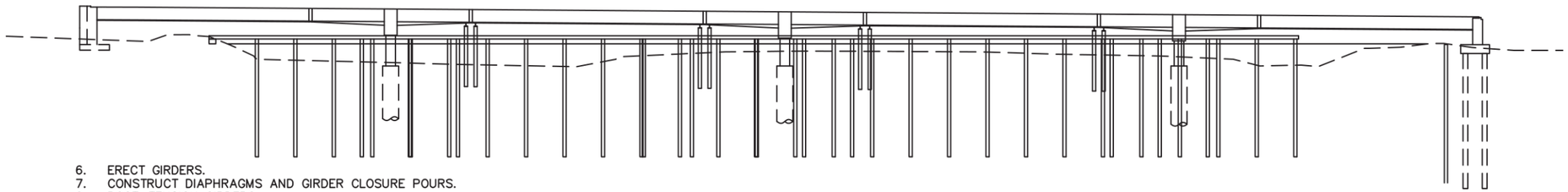
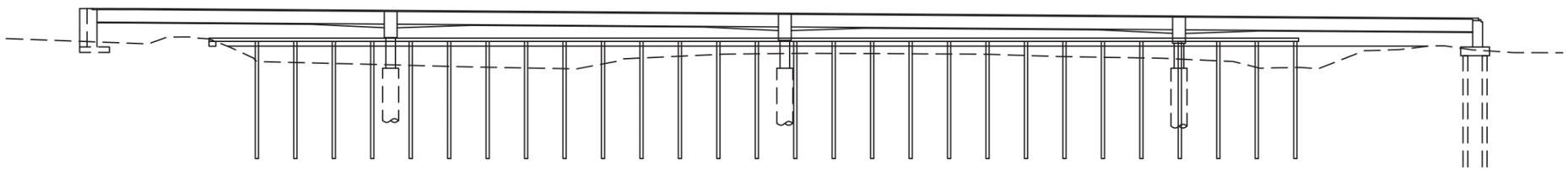


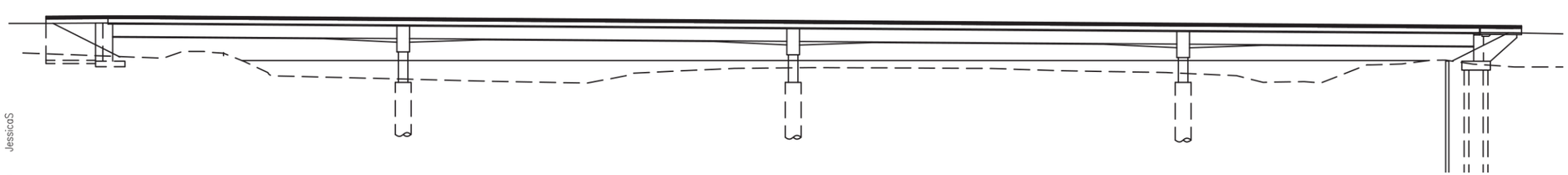
1. ERECT WORK ACCESS BRIDGE, PLATFORMS, AND ADDITIONAL PILES FOR DRILLING SHAFTS.
2. CONSTRUCT SHAFTS AND FOOTINGS.
3. CONSTRUCT ABUTMENT WALLS AND COLUMNS.
4. CONSTRUCT PIER CAPS.
5. CURE CONCRETE UNTIL IT HAS DESIGN STRENGTH.



6. ERECT GIRDERS.
7. CONSTRUCT DIAPHRAGMS AND GIRDER CLOSURE POURS.
8. POST–TENSION GIRDERS.



9. SUPPORTS FOR CLOSURE POURS MAY BE REMOVED.
10. PLATFORMS AND THEIR PILES MAY BE REMOVED, LEAVE WORK ACCESS BRIDGE.
11. CAST ABUTMENT BACKWALLS.
12. CONSTRUCT DECK.



13. REMOVE WORK ACCESS BRIDGE.
14. FINISH CONSTRUCTING ABUTMENTS.
15. CONSTRUCT APPROACH FILLS.
16. CONSTRUCT BRIDGE BARRIERS.

ELEVATION

Plotted: Jun 28, 2021 - 14:40 JessicaS

SARGENT

DO NOT SCALE REDUCED SHEETS

YAKIMA COUNTY

CASCADE MILL CORRIDOR PROJECT PHASE 3

CRP#

PREPARED UNDER THE DIRECTION OF:

PRELIMINARY

MONTE JAY SMITH
STATE OF WASHINGTON
22378
STRUCTURAL ENGINEER
PROFESSIONAL ENGINEER

DATE:

PROJECT ENGINEER:
M J SMITH

DRAWN:	CHECKED BY:
M. SMITH	–

REVISION:

FNAME: Yakima River Bridge 5–20–21.dwg

Bridge Construction Sequence

Figure 5.3

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Installation of the Temporary Work Bridge and Support Piles

The temporary work bridge will be constructed upstream, over the Yakima River, and will extend across the entire river in order to facilitate construction of new bridge from both ends. The work bridge will be constructed to clear the certified levee on the west bank.

The temporary work bridge adjacent to the new Yakima River bridge will measure 680 feet long and 25 feet wide. Bridge construction will also require the construction of four finger piers off the work bridge that will each measure approximately 83 feet long and 34 feet wide. The finger piers will be used to stage the shaft oscillator machine that will install 16-foot diameter casings to construct the in-water pier (Pier 2) of the new bridge and place the temporary falsework. The work bridge will be supported in a series of pile bents constructed from 24-inch diameter steel pipe. 84 general work bridge piles and 32 finger pier piles will be driven for the work bridge, with 36 general work bridge and 8 finger pier piles being waterward of the OHWM (Table 2, Figure 5.1). Construction of the temporary work bridge will require use of a vibratory and impact hammer to drive piles. After post-tensioning is complete, the girders can support the dead load of the bridge without the need for the temporary shoring towers which may then be removed.

The remaining piles will be driven to support the oscillator. 44, 24-inch diameter steel pipe piles will be driven adjacent to the proposed piers of the Yakima River bridge and the finger piers of the temporary work bridge to support the oscillator. 13 of these will be waterward of the OHWM.

In order to minimize impacts to aquatic species from underwater vibration a confined bubble curtain will be placed around any pile to be impact pile driven in greater than 2 feet of water.

After piles have been driven, the contractor will install lateral bracing/stringers. Steel beams and timber lagging will be installed for the bridge deck. The bridge will be built section-by-section until reaching its design length. The stringers of the temporary bridge will be constructed a minimum of 3 feet above the 5-year flood elevation. The contractor will be required to remove any large woody debris (LWD) that may become trapped on the stringers and place it downstream of the work bridge. If it becomes necessary, stringers will be removed in order to allow passage of debris.

Construction of the temporary work bridge will require the use of a vibratory pile driver, cranes, forklifts, power tools, and hand tools. A diesel impact hammer along with a confined bubble curtain will be used during pile driving operations. Only the piles being driven for the work bridge will be in the water. See Table 1 for construction sequencing. See Figures 3 and 5 for temporary work bridge details and sequencing.

Construction of the Proposed Bridge Over the Yakima River

Construction of the proposed bridges will require the use of large diameter oscillating or rotating drilling equipment, cranes, forklifts, cement trucks, pump trucks, power tools, and hand tools.

Construction of the new bridge over the Yakima River will take place from the temporary work bridge that will span the entire river channel of the Yakima River upstream of the proposed bridge. Construction will take place in three stages: 1) installation of the drilled shafts, columns,

caps, and abutments; 2) placement of precast concrete girders; and 3) construction of the bridge deck, sidewalks, pathways, and barriers.

Shafts for the piers and abutments, will be constructed from steel-reinforced cast-in-place concrete and will be drilled to an approximate depth of 120 feet below ground surface (BGS) Two of the intermediate piers are anticipated to be constructed on gravel bars. Work will take place during the WDFW in-water work window (July 15 to February 1), during which time the gravel bar is not anticipated to be within the wetted channel.

The three intermediate piers for the Yakima River bridge will each consist of columns placed atop 10-foot diameter drilled shafts. The abutments (Piers 1 and 5) will be cantilever-seat types placed upon a pile cap with three 10-foot diameter drilled shafts. The intermediate piers will be accessed from the temporary work bridge and finger piers. Prior to installation of the drilled shafts below the OWHM for Pier 2, 16-foot diameter casings will be installed below the riverbed with an oscillator. A total of three, 16-foot diameter casings will be installed below OHW. Casings will be lowered slowly to allow for fish to escape the work area. These casings will extend from above the water line to a few feet below the ground line to act as a cofferdam; excluding fish and preventing concrete from contaminating the river during the installation of drilled shafts. A biologist will be on-site prior to installation of the casing to monitor for fish presence within the area. Once a casing has been installed and fish exclusion has been confirmed construction will proceed.

A 10-foot diameter casing will be advanced for each drilled shaft within the previously installed casing, and the material inside the casing will be removed using a watertight clamshell bucket. Turbid water within the casing will be cleaned to prevent contamination of the concrete. A steel-reinforcing cage will be installed in the casing and the casing will be filled with concrete. Water displaced as the concrete is poured will be pumped to a baker tank to settle out. Once particulates have settled to 25 Nephelometric Turbidity Units (NTU), water will be pumped to an upland area over 300 feet from any sensitive areas to ensure filtration occurs prior to entering a waterbody or will be removed from the project area and disposed of at a commercial site.

Once drilled shafts have cured and the columns have been installed at the intermediate piers, a cap beam will be cast on the columns to allow for seating of the bridge girders. The abutment walls and pier caps will support future placement of the girders and bridge superstructure. After constructing the columns, the casings will be oscillated out of the earth with a possibility of a portion of the drilled shaft casing remaining in place at the top of the shaft. Reaction piles for the temporary work bridge will be removed this time. See Table 1 for construction sequencing. See Figures 3 and 5 for bridge details and sequencing.

Removal of Temporary Work Bridge

Removal of the temporary work bridge will require the use of vibrating pile driver, cranes, forklifts, power tools, and hand tools.

Once the proposed bridge's girders have been erected and deck placed, the temporary work bridge will be removed in the opposite order of how it was installed. As piles are removed with vibratory action, it is anticipated that the space that they vacate will naturally be filled with

native soils and streambed material due to liquefaction. If, at any time during pile extraction, a pile breaks off below the existing ground surface or mudline, the remaining pile will be left in place.

Upon splicing of the girders, the temporary shoring towers and piles can be removed to below the mudline. However, due to limited clearances, it is not expected that the piles can be fully removed. See Table 1 for construction sequencing. See Figures 3 and 5 for temporary work bridge details and sequencing.

2.3.3. Over-Water Work

Over-water work will occur during Phases 2 and 3.

Bridges over the Yakima River and Roza Canal Wasteway #2

Construction of bridges over the Yakima River and Roza Canal Wasteway #2 will require the use of cranes, forklifts, cement trucks, pump trucks, power tools, and hand tools.

Construction of the new bridge crossing the Yakima River will take place from the temporary work bridge that will span the Yakima River upstream of the planned new bridge. The bridge will be constructed with spliced precast concrete girders which will be placed onto the bridge piers and spliced at temporary tower locations. The bridge will have a minimum 13-foot vertical clearance over the OHWM of the Yakima River and a minimum 6.7-foot clearance over the 100-year flood elevation. Construction will take place in three stages: 1) installation of piles, columns, caps, and abutments; 2) placement of bridge girders; and 3) construction of the bridge deck. See Figures 3 for bridge location.

Construction of the new Roza Canal Wasteway #2 bridge will take place by accessing the construction site from each end of the new bridge. The proposed bridge will include a 129-foot-long single span bridge constructed of standard prestressed concrete girders for motorized vehicle traffic and non-motorized users. Construction of the Roza Canal Wasteway #2 bridge will take place in the following three stages: 1) placement of abutments; 2) placement of bridge girders; and 3) construction of the bridge deck. See Figures 3 and 4 for bridge details.

A medium to very dense bearing layer of sand and gravel exists near the ground surface of the abutments. Foundation construction will involve the installation of spread footings; approximately 15 feet outside of the 100-year floodplain and over 30 feet landward of OHW. The abutments will be scour protected for flows up to the 500-year flood. Scour protection will be located landward of the OHWM and will be limited to the limits of the project area. The abutments and wingwalls will support the girders and superstructure. The bridge will be comprised of precast, prestressed concrete girders across its width. Once the girders are in place, a cast-in-place concrete deck will be formed on top of the girders with a plywood formwork. Specifications for construction of the project will require that the formwork for the concrete deck contain the concrete to prevent it from entering the canal.

2.3.4. General Construction

Construction of the Proposed I-82 Bridges
Construction of the I-82 bridges will occur in Phase 3. Construction of the bridges in-line with I-82 will require the use of cranes, forklifts, excavators, cement trucks, pump trucks, power tools, and hand tools. The proposed bridges will be approximately 113 feet in length, and 61 feet in width for the westbound bridge and 42 feet in width for the eastbound bridge. Both bridges will consist of a single. The roadway widths will match existing I-82 geometry with 2-lanes in each direction, plus the off-ramp for Fair Avenue. The bridge detailing will accommodate a future widening or the addition of collector-distributor ramp bridges by WSDOT in the future.

These bridges will be constructed with prestressed concrete girders, with the construction occurring in the following general sequence: 1) Level existing median ditch and construct temporary pavement in the median to support future maintenance of traffic (MOT) shifts, 2) shift northbound traffic west – to the median, 3) construct east side of new northbound bridge, 4) move northbound traffic east – to the new bridge deck, 5) shift southbound traffic and Fair Avenue off-ramp traffic to the median, 6) construct west side of southbound bridge and additional pavement (shoulder widening) to match new bridge, 7) move southbound traffic, including off-ramp traffic west to the new southbound bridge deck, 8) complete construction of bridges in the median, 9) reinstate median section in the mainline, 10) remove all temporary pavement as needed, and 11) reinstate permanent barriers in the corridor.

Precast abutments will be on spread footings and will be supported on soldier pile walls. The new Cascade Mill Parkway will be excavated, built, and paved once the bridges are in place. See Figure 3 for bridge locations.

Roadway Grading
Roadway grading will occur during all phases of this project. Borrow material will be placed and compacted at the roadway approaches in order to build the embankments up to the elevations of the proposed bridges. All such borrow material will be placed outside the 100-year floodplains.

Once the embankments are constructed to the subgrade elevations, placements and compaction of base coarse will be followed by asphalt paving. Once the roadways are constructed, they will be striped, and the bridges/roadways will be reopened to traffic. See Figure 3 for roadway details.

Installation of Stormwater Infiltration Galleries
Stormwater infiltration galleries will be installed during Phases 2 and 3. The project proposes the installation of stormwater infiltration galleries and stormwater ponds adjacent to the new roadway and on either side of the new Yakima River bridge. Existing impervious surface within the project site is 8.09 acres of pollutant generating impervious surface (PGIS). Under existing conditions, more than 85 percent of PGIS is untreated. 10.15 acres of new PGIS will be created by the project and upon completion, a total of 18.24 acres of PGIS will exist.

Floodplain Mitigation

Floodplain mitigation will occur during Phase 2. Floodplain mitigation for this project will be in the form of floodplain grading including levee removal, backchannel construction, and ELJ installation. Mitigation work conducted as part of this project will be consistent with the work currently being done with Yakima County's Yakima River Gap to Gap Ecosystem Restoration Project. Historically, this section of the Yakima River has been generally forced into a single channel due to levee construction. United States Bureau of Reclamation parcels have been selected as locations for this work. Sections of the floodplain south of the project area are currently in conservation status with the Bureau of Reclamation. The purpose of this mitigation work is to encourage river flow towards the area of the floodplain with conservation status rather than its current path that flows against the leveed west bank, provide cover for juvenile salmonids in areas that currently have poor cover, and to encourage the establishment of cottonwood stands further upland in the floodplain. While the past few years' spring flows have allowed for improved cottonwood establishment and retention within the project reach, large cobble deposits particularly from the 1996 flood have reduced the river's ability to move through side channels and thus reduced cottonwood retention in areas that have become permanent upland. The proposed mitigation work will improve the river's ability to move through side channels thus expanding the area of viable cottonwood establishment and retention.

Proposed floodplain grading will occur north and south of the proposed Yakima River bridge along the eastern bank of the Yakima River (Figures 6, 7.1, and 7.2). The southern floodplain grading area was the site of a previous landfill, so prior to any grading, landfill debris will be excavated and transported to the appropriate disposal facility. BMPs will be in place to make sure potentially hazardous debris and sediment do not enter the Yakima River. The northernmost floodplain grading area will require 2 to 4 feet of excavation and will be graded to meet the edge of the adjacent proposed backchannel. The southernmost floodplain grading area will be graded to meet the existing OHWM elevation. Floodplain grading areas, as well as an area downstream of the island where the bridge will cross, will also have cottonwoods stingered into place and LWD placed along the bank. Stingering cottonwoods involves using a backhoe attachment called a stinger to drive cottonwood poles into the ground. Surrounding the stingered cottonwoods in both the north and south floodplain grading areas will be planted with coyote willow (*Salix exigua*), bitterbrush (*Purshia tridentata*), and native grasses (Figure 8). The floodplain grading areas will be graded to provide a more natural floodplain and maintain the no-rise from the proposed bridge construction. Graders, dozers, excavators, front-end loaders, dump trucks, and a backhoe equipped with a stinger will be used to complete this work.

A total of five backchannels are proposed for this project. Channel 1 will run along the eastern bank of the Yakima River from just south of the BNSF Railroad bridge to just north of the bridge. Channel 1A will run from an existing constructed backchannel adjacent to the southernmost floodplain grading area and connect to the Yakima River along the eastern bank upstream of the Roza Canal Wasteway #2 connection. Channel 2 will run from the existing backchannel downstream of Channel 1A's connection and will exit to the Yakima River upstream of Channel 1A's connection. Channel 2A will connect Channel 2 to Channel 1A. Channel 3 is proposed on the island the Yakima River bridge will cross. This island is made up of mostly larger cobbles deposited from the previously mentioned 1996 flood. The creation of a channel on this island will help establish cottonwoods on the island and is also the key channel in

activating side channels further downstream. The existing channel will exit to Channel 4 which will run parallel with the eastern bank of the Yakima River and exit at the same outlet as Channel 2. Channel 5 will be entirely below the OHWM, in an area that is not always inundated, downstream of the island the bridge will cross (See Figures 6, 7.1, and 7.2 for channel locations). Generally, channel widths will vary between 15 and 30 feet, with the exception of the island channel which will be between 60 and 120 feet. Backchannel banks will have a 1:1 slope, and the bottom of the channels will have a 5% slope with the southwestern side lower (Figure 9).

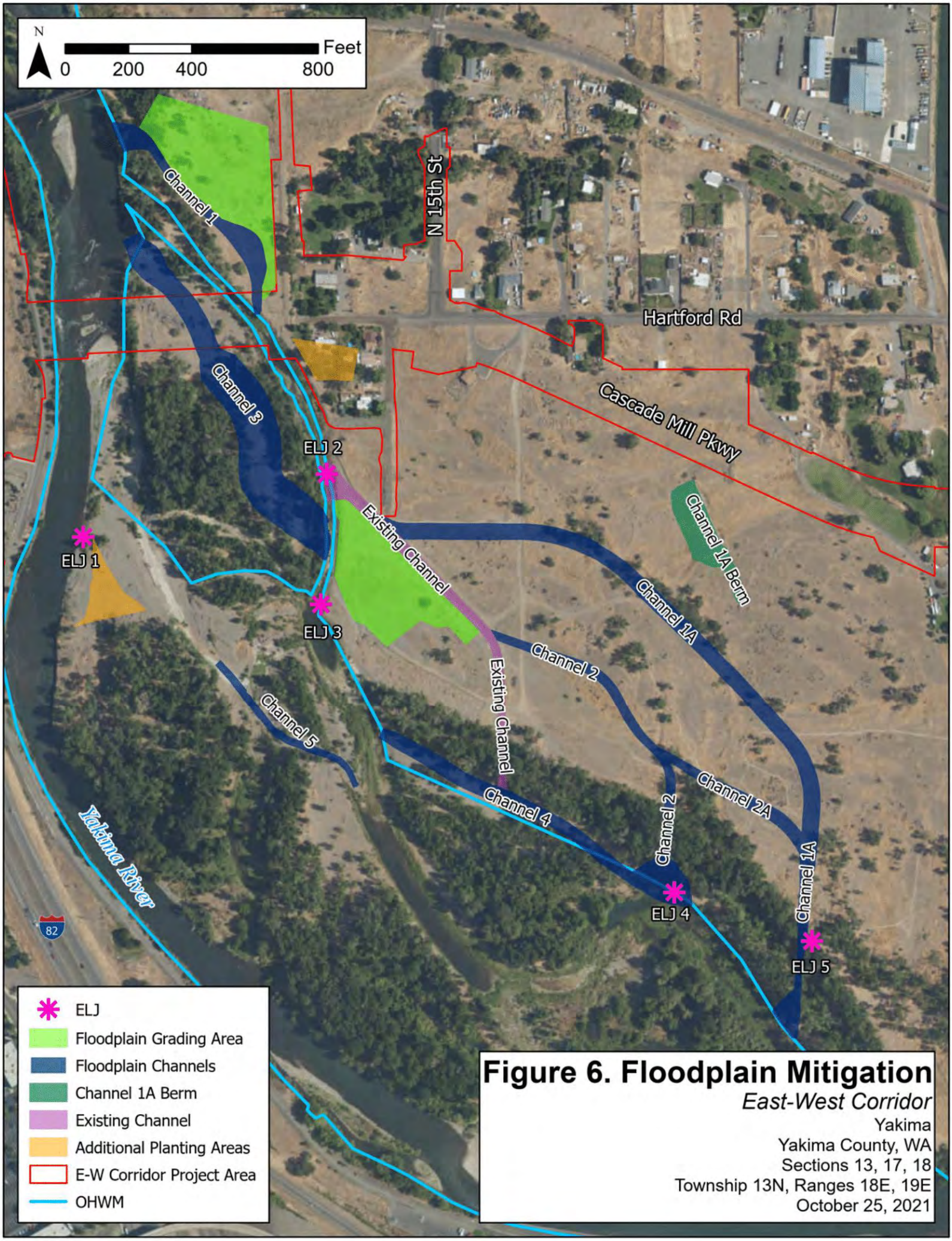

Figure 6. Floodplain Mitigation

East-West Corridor

Yakima
Yakima County, WA
Sections 13, 17, 18
Township 13N, Ranges 18E, 19E
October 25, 2021

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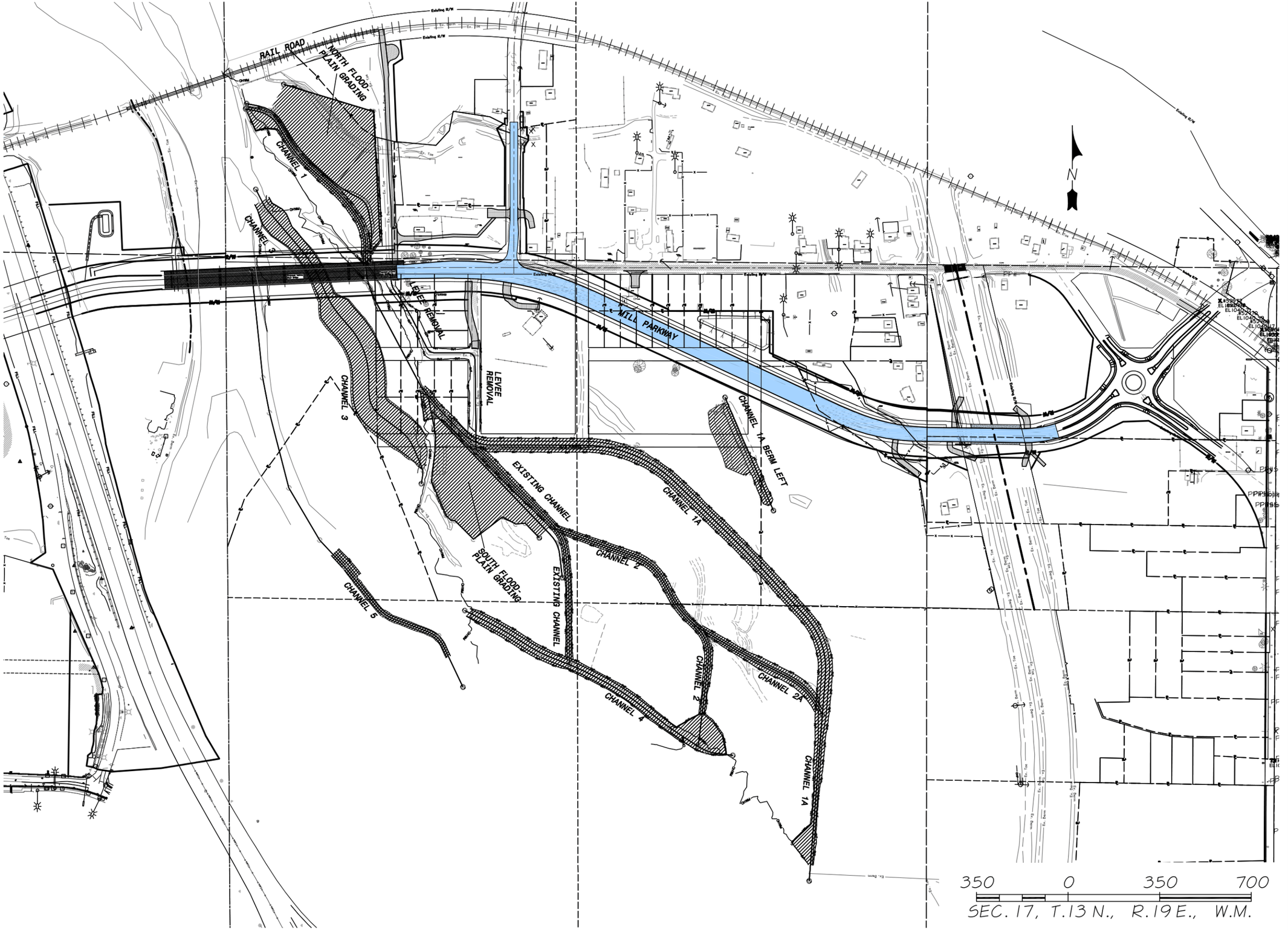

YAKIMA COUNTY

MILL PARKWAY PHASE 2A & 3A IMPROVEMENT

PROJECT MITIGATION

PROJECT NO.

RC3446-2A & RC3446-3A

PREPARED UNDER THE DIRECTION OF:

30% REVIEW PLANS

COUNTY ENGINEER

DATE:

PROJECT ENGINEER:
JOEL FREUNDENTHAL

DRAWN:	CHECKED BY:
BEN MAHONY	KIM PFAFF

REVISION:

Floodplain Mitigation Plan Sheet

Figure. 7.1

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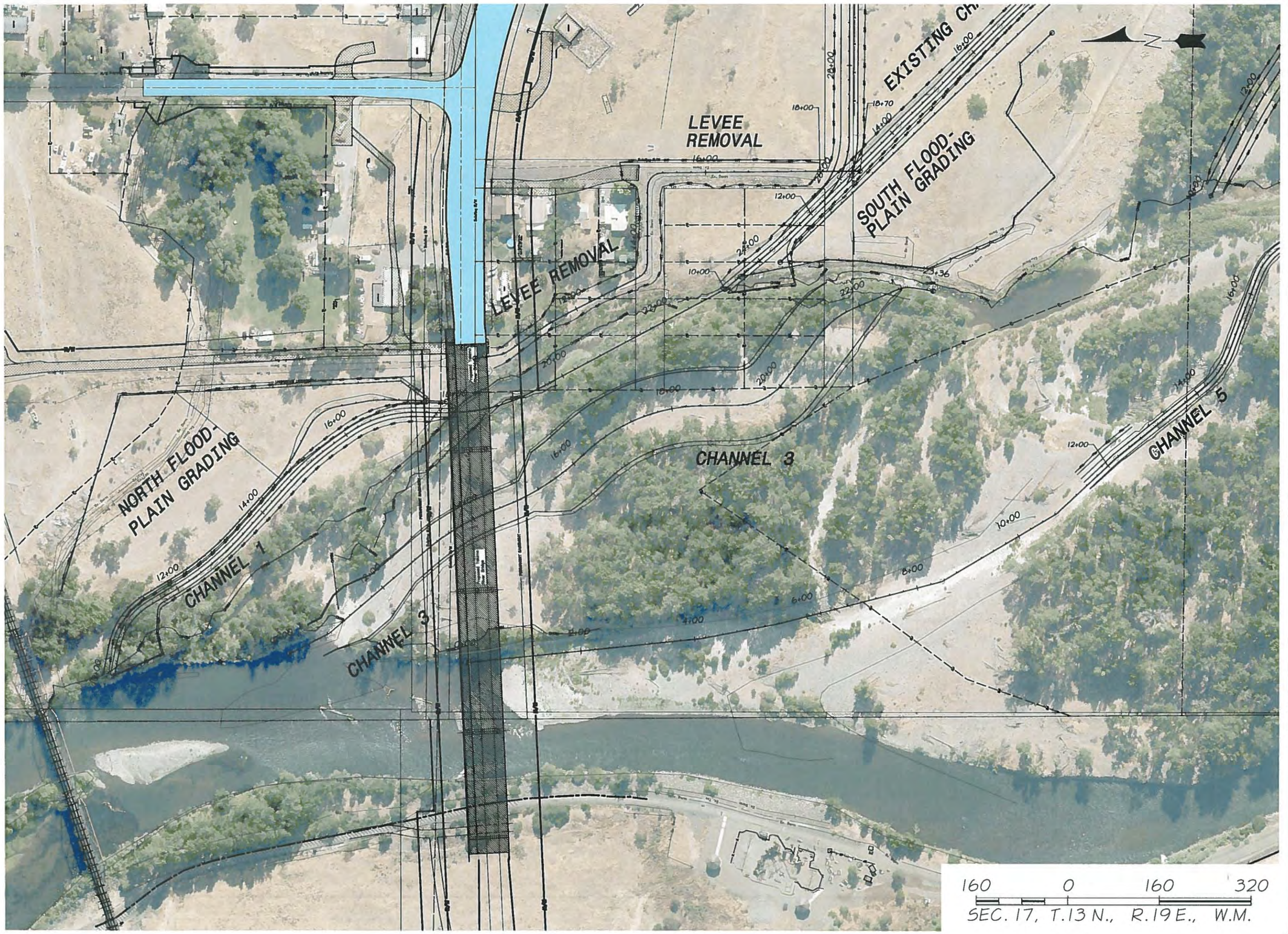

YAKIMA COUNTY

MILL PARKWAY
PHASE 2A & 3A
IMPROVEMENT

PROJECT MITIGATION
PROJECT NO.
RC3446-2A & RC3446-3A

PREPARED UNDER
THE DIRECTION OF:

30% REVIEW PLANS

COUNTY ENGINEER
DATE:

PROJECT ENGINEER:
JOEL FREUNDENTHAL

DRAWN:	CHECKED BY:
BEN MAHONY	KIM PFAFF

REVISION:

Floodplain Mitigation Plan North Detail

Figure. 7.2

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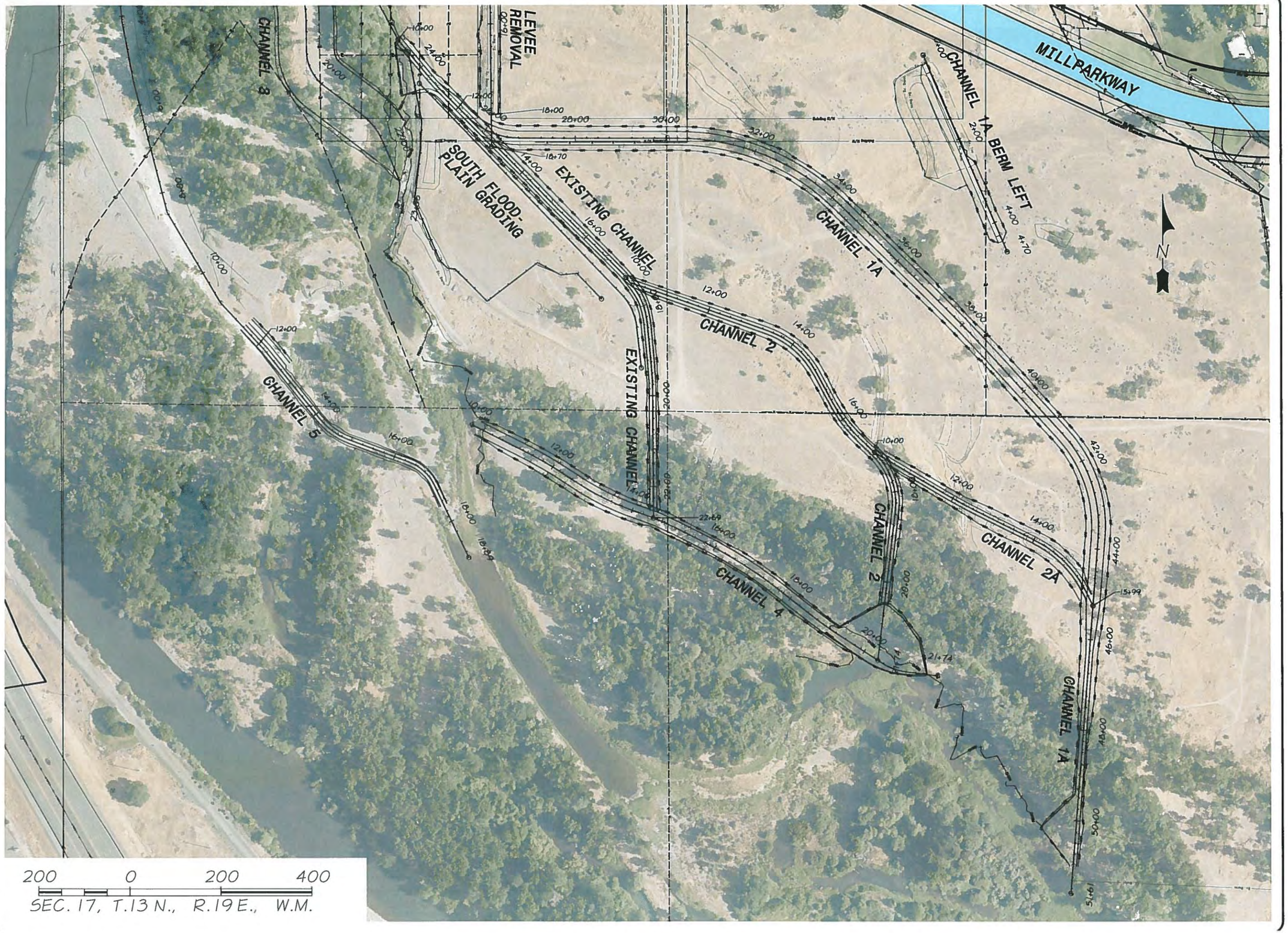

YAKIMA COUNTY

MILL PARKWAY
PHASE 2A & 3A
IMPROVEMENT

PROJECT MITIGATION
PROJECT NO.
RC3446-2A & RC3446-3A

PREPARED UNDER
THE DIRECTION OF:

30% REVIEW PLANS

COUNTY ENGINEER
DATE:

PROJECT ENGINEER: JOEL FREUNDENTHAL	
DRAWN: BEN MAHONY	CHECKED BY: KIM PFAFF
REVISIONS:	

Floodplain Mitigation Plan South Detail

Figure. 7.3

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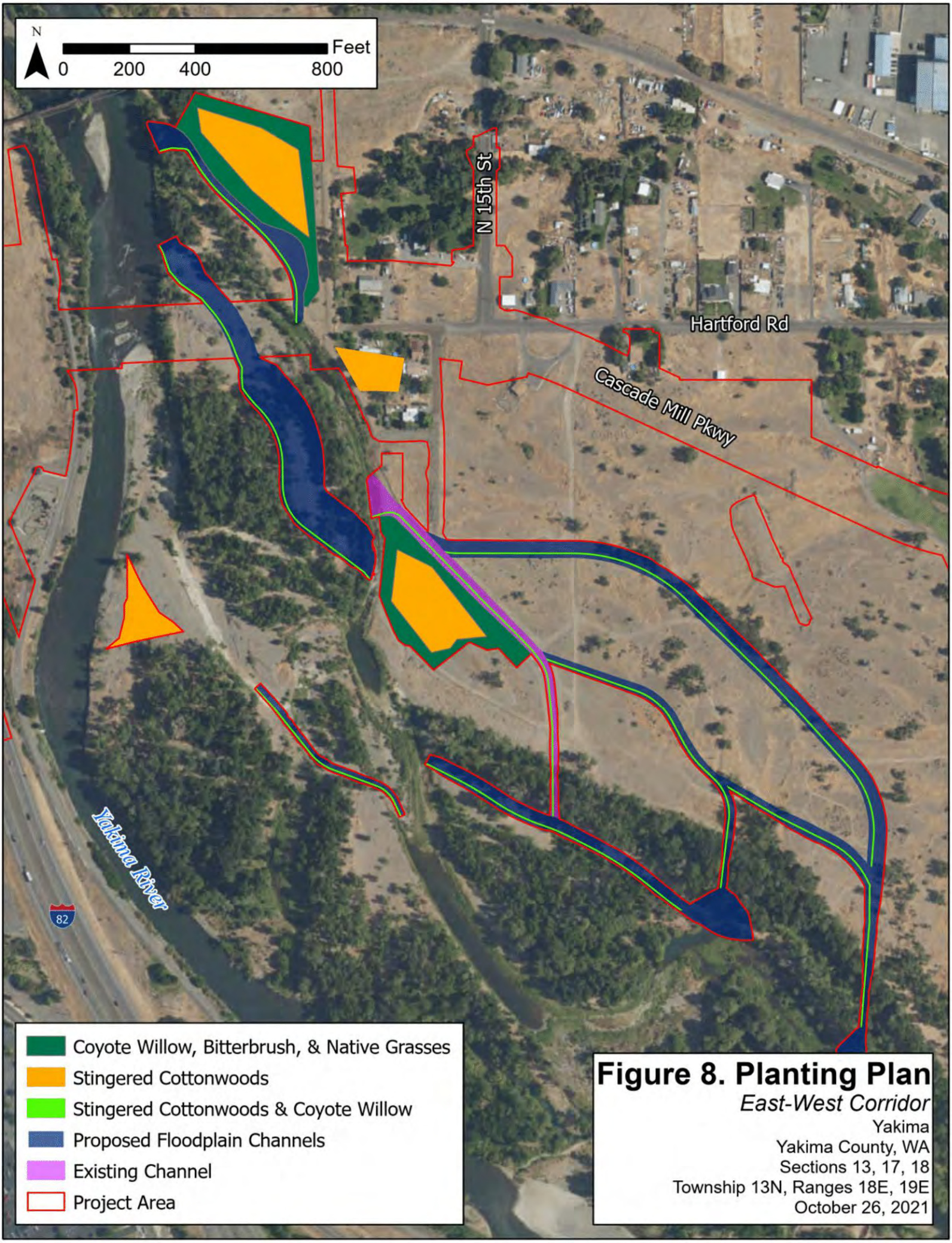

Figure 8. Planting Plan

East-West Corridor

Yakima
Yakima County, WA
Sections 13, 17, 18
Township 13N, Ranges 18E, 19E
October 26, 2021

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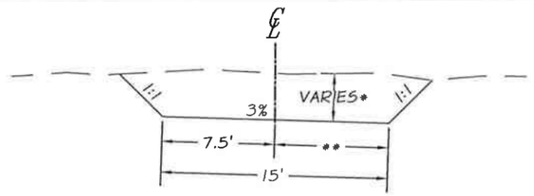
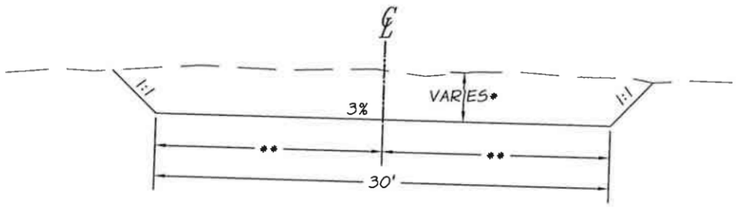
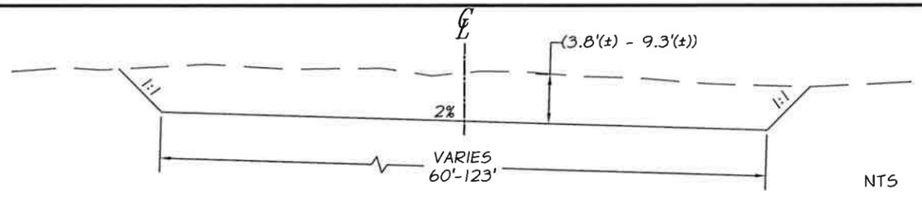


NTS



NTS



NTS

CHANNEL 1:

BOP STA 10+00 TO STA 10+85:	*DEPTH: 6.2'(±) - 6.8'(±)
STA 10+00 TO STA 11+65:	**WIDTH RT.: 7.5'(±) - 75'(±)
STA 17+50 TO EOP STA 18+03:	*DEPTH: 5.3'(±) - 9.0'(±)

CHANNEL 1A:

STA 46+25 TO STA 49+37:	*DEPTH: 1.6'(±) - 12.1'(±)
STA 49+37 TO EOP STA 51+00:	**WIDTH RT.: 7.5'(±) - 72.0'(±)
STA 49+37 TO EOP STA 51+00:	*DEPTH: 4.5'(±) - 8.1'(±)

CHANNEL 2:

BOP STA 10+00 TO EOP STA 20+52:	*DEPTH: 4.5'(±) - 9.4'(±)

CHANNEL 2A:

BOP STA 10+15 TO EOP STA 16+00:	*DEPTH: 6.2'(±) - 15.1'(±)

CHANNEL 5:

BOP STA 11+50 TO EOP STA 17+60:	*DEPTH: 2.5'(±) - 6.6'(±)

EXISTING CHANNEL:

STA 17+30 TO EOP STA 22+53:	*DEPTH: 1.8'(±) - 6.8'(±)

CHANNEL 1A:

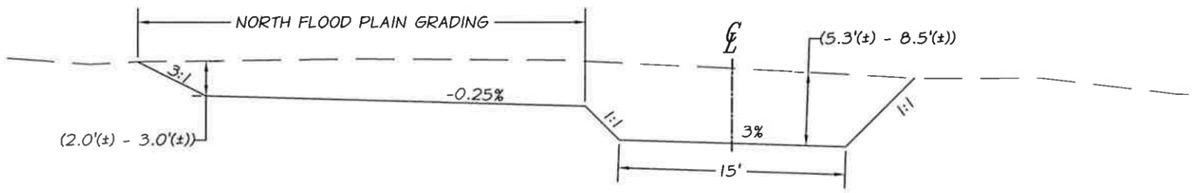
BOP STA 25+93 TO STA 46+25:	*DEPTH: 8.6'(±) - 15.3'(±)
STA 45+25 TO STA 46+25:	**WIDTH LT. & RT.: 7.5'(±) - 15.0'(±)

CHANNEL 4:

BOP STA 10+15 TO EOP STA 21+50:	*DEPTH: 1.4'(±) - 10.5'(±)
STA 19+25 TO EOP STA 21+50:	**WIDTH LT.: 15.0'(±) - 114.5'(±), RT.: 15.0'(±)

CHANNEL 3:

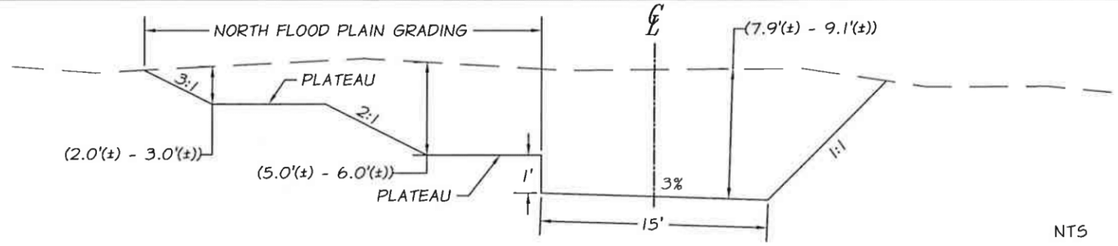
BOP STA 10+50 TO EOP STA 22+80:



NTS

CHANNEL 1:

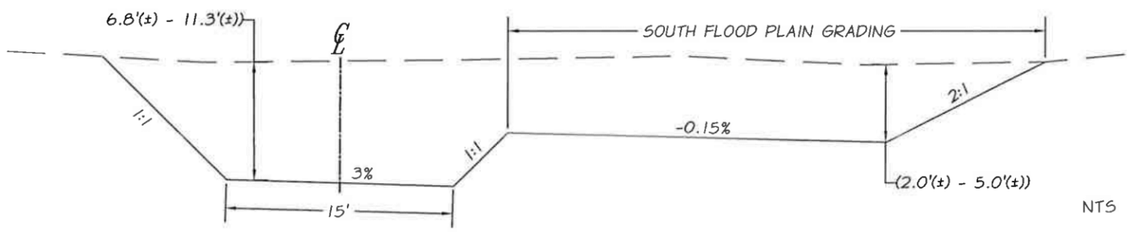
STA. 10+85 TO STA 14+50:



NTS

CHANNEL 1:

STA. 14+50 TO STA 17+50:



NTS

EXISTING CHANNEL:

BOP STA 10+00 TO STA 17+30:

YAKIMA COUNTY

Figure 9.

PREPARED UNDER THE DIRECTION OF:

30% REVIEW PLANS

COUNTY ENGINEER
DATE:

PROJECT ENGINEER:
JOEL FREUNDENTHAL

DRAWN:	CHECKED BY:
BEN MAHONY	KIM PFAFF

REVISION:

MITIGATION TYPICAL SECTIONS

Q:\Civil 3D projects\EW Corridor\Phase 2\Production environmental mitigation\3446_Production 2_Impact_channel sections.dwg, Layout1, 12/2/2021 9:14:15 AM

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The general depth of channels will be less than 5 feet BGS with the exception of Channel 1 which will have a depth of 8 feet BGS. Proposed channels have sections below the OHWM. The Yakima River level fluctuates significantly throughout the year with general low levels in the late summer and fall (USGS 2021). The proposed channel locations have been selected because they are in areas that are not always inundated. Channel sections below the OHWM will be constructed while they are dry to reduce impacts to fish by avoiding sedimentation and fish handling. Due to the general dry conditions in Yakima, cottonwoods will be stingered and coyote willows will be planted within backchannel trenches on the south side only (Figure 8). This will allow them to be partially shaded from the opposite bank to retain water. Dozers, excavators, front-end loaders, and dump trucks will be used to complete this work.

A total of 5 ELJs will be constructed for this project. ELJ 1 will be located southwest of the island the bridge will cross at the upstream corner of the proposed stingered cottonwood area. ELJ 2 will be located at the upstream connection of the existing backchannel to the Yakima River. ELJ 3 will be located downstream of the island the bridge will cross along the eastern bank. ELJ 4 will be located just downstream of Channel 2's connection with the Yakima River along the eastern bank. ELJ 5 will be located in Channel 1A just upstream of its downstream connection with the Yakima River (See Figure 6 ELJ locations). As the Yakima River shifts flow path with flood events, the final locations of these ELJs may change. These ELJs will be partially or completely below the OHWM, but as with the proposed backchannels, they are located in areas that go dry in the late summer and fall. Proposed construction will occur when the section is dry. Each ELJ will also have an excavated pool to provide additional habitat complexity requiring 600 cubic yards (CY) of excavation each. Each ELJ will have key member logs and racking material will be woven between buried wooden piles to prevent significant lateral movement. All logs used will have rootwads left intact, and key member logs will be buried 6 feet BGS or below the mudline. The key member logs and piles will be lashed together with cable and steel clamps to ballast the key member logs against buoyant forces. 5/8-inch galvanized steel cables will be tensioned to a minimum of 20,000 pounds with at least 5 wraps. Cables will be secured with 4-inch staples and cable clamps. Felled trees from the project will be kept intact and lashed onto ELJs and additional racking material will be placed on the upstream end of each ELJ. The first layer of racking material will contain the most live plants and roots, with larger logs secured on top, salvaged live material will also be placed below the key member logs prior to installation. This along with excavated native alluvium that will be placed on the finished ELJs will provide ballast and will facilitate vegetation growth. Each ELJ will also have cottonwoods stingered in adjacent to the ELJs. ELJ 1 will require the greatest erosion protection. This ELJ will be secured with 11, 24-inch diameter timber piles. The remaining ELJs will require one, 30-inch diameter timber pile (See Figure 10.1 and 10.2 for ELJ plan sheets). Each ELJ will be 30 feet by 30 feet, however ELJs 4 and 5 will experience the lowest velocity and will have the most additional felled trees added which may expand their footprint slightly. Limited vegetation clearing will be necessary to install ELJs. ELJs 1, 2, and 3 are in areas lacking in significant riparian vegetation so access to their locations will not require clearing. ELJ 4 can be accessed at an old levee location that is still cleared. ELJ 5 may require some clearing, but this will likely be done prior to the channel grading. A crane, excavator, vibratory pile driver, backhoe with stinger attachment, and hand tools will also be used to install the proposed ELJ.

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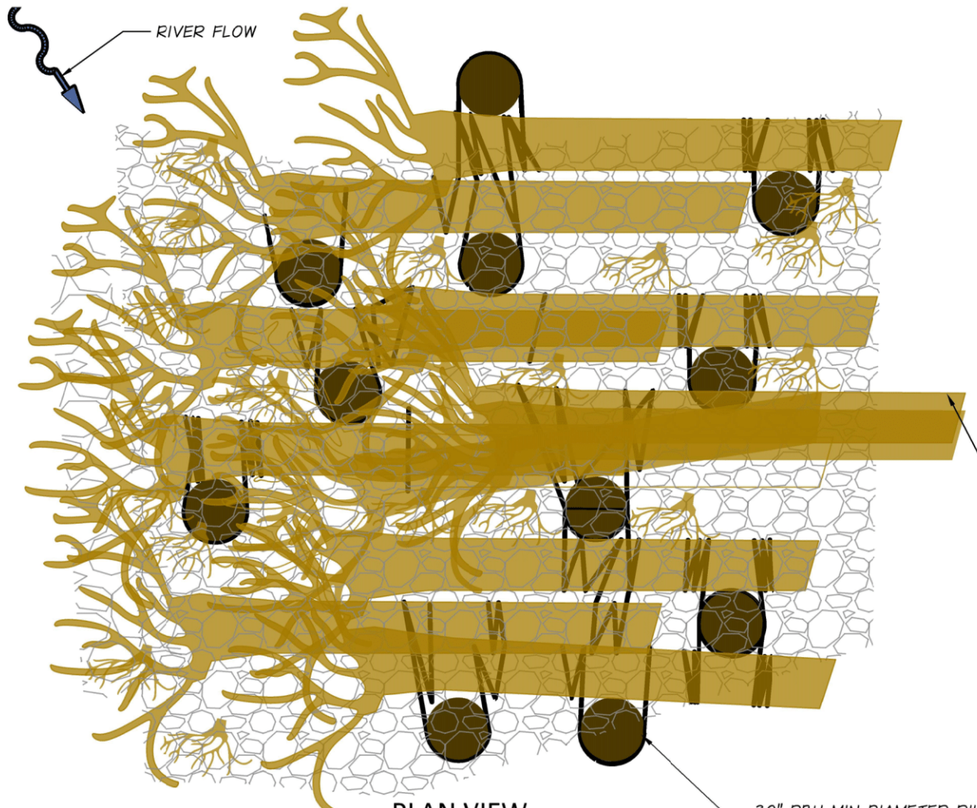
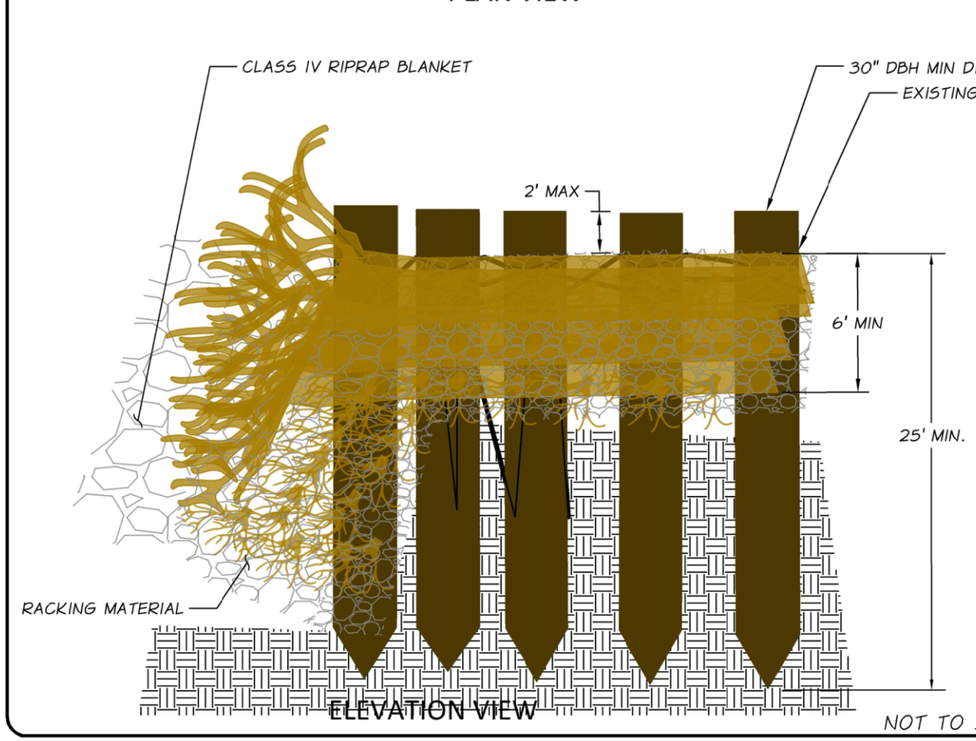
LARGE ROOTWAD JAM



PLAN VIEW



ELEVATION VIEW

NOT TO SCALE

NOTES:

1. THE ENTIRE STRUCTURE SHALL BE BURIED WITH NATIVE MATERIAL AND OTHER SALVAGED LIVE ROOT PLANTS BETWEEN LOGS.
2. BOTTOMS OF TREES SHALL BE BURIED 6' MIN. BELOW EXISTING GROUND WITH SALVAGED LIVE ROOTS AND SHRUBS BENEATH THEM.
3. ANCHORING CABLE SHALL BE 20,000 LB. CABLE WITH AT LEAST 5 WRAPS AROUND LOGS AND PILES HELD IN PLACE WITH 4" STAPLES AND CABLE CLAMPS
4. TRIM PILES TO 2' ABOVE LOGS AFTER CONSTRUCTION THEN STUFF WITH VEGETATION AND BURY

YAKIMA COUNTY

MILL PARKWAY PHASE 3A IMPROVEMENT PROJECT
MITIGATION

PROJECT NO. 3446-3A

PREPARED UNDER THE DIRECTION OF:

PRELIMINARY

COUNTY ENGINEER
DATE:

PROJECT ENGINEER:
JOEL FREUDENTHAL

DRAWN:	CHECKED BY:
A. LEONARD	KIM PFAFF

REVISION:

ELJ 1 Plan & Profile

Figure 10.1

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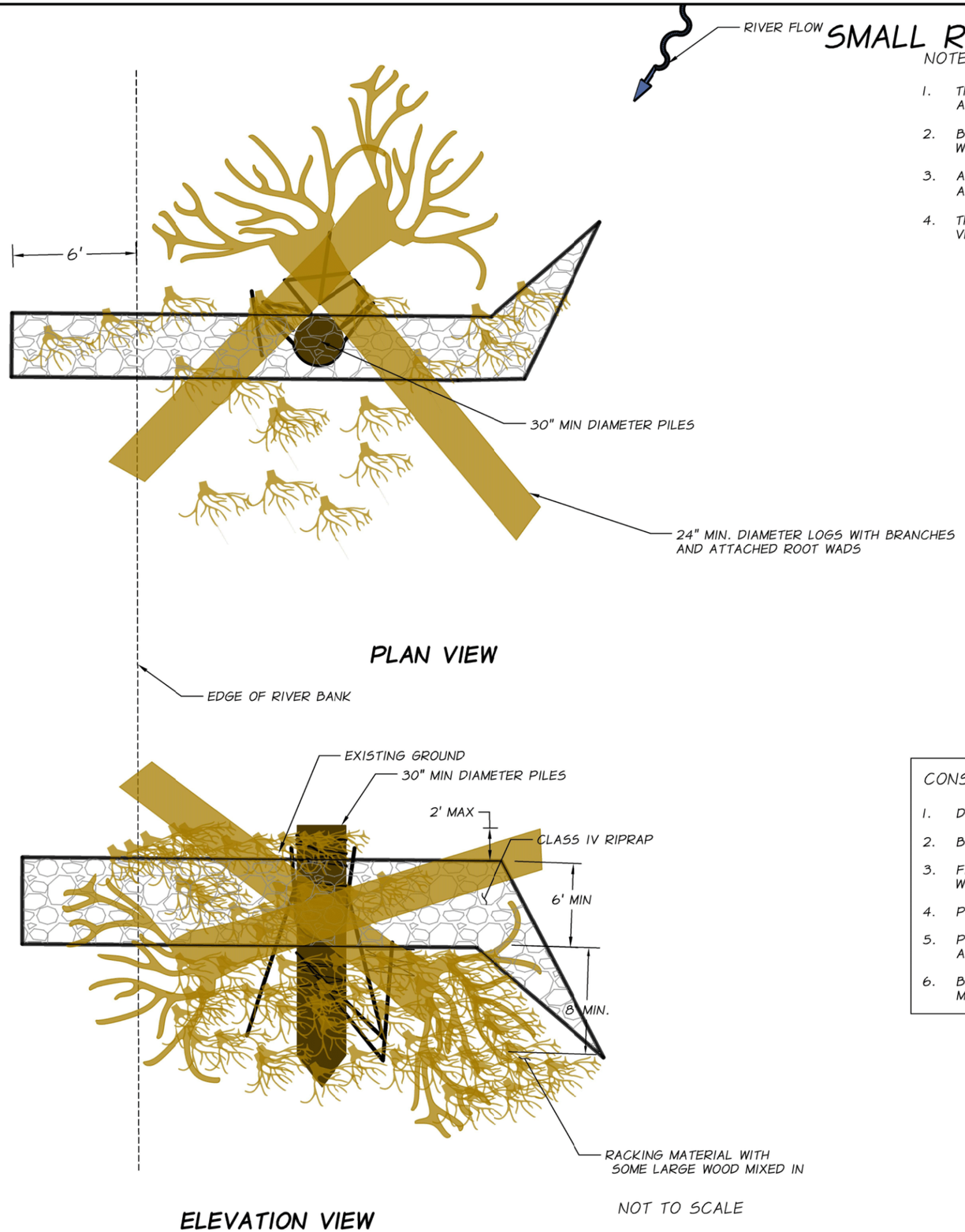
SMALL ROOTWAD JAM



NOTES:

1. THE ENTIRE STRUCTURE SHALL BE BURIED WITH NATIVE MATERIAL AND OTHER SALVAGED LIVE ROOT PLANTS BETWEEN LOGS.
2. BOTTOMS OF TREES SHALL BE BURIED 6' MIN. BELOW EXISTING GROUND WITH SALVAGED LIVE ROOTS AND SHRUBS BENEATH THEM.
3. ANCHORING CABLE SHALL BE 20,000 LB. CABLE WITH AT LEAST 5 WRAPS AROUND LOGS AND PILES HELD IN PLACE WITH 4" STAPLES AND CABLE CLAMPS
4. TRIM PILES TO 2' ABOVE LOGS AFTER CONSTRUCTION THEN STUFF WITH VEGETATION AND BURY

CONSTRUCTION SEQUENCE NOTES:

1. DIG TRENCH FOR RIPRAP GROIN.
2. BURY/ DRIVE PILE, ATTACH PILE CABLES TO PILE.
3. FILL TRENCH WITH CLASS IV RIPRAP, KEYING INTO BANK WITH A MIXTURE OF RIPRAP AND NATIVE MATERIAL.
4. PLACE RACKING MATERIAL IN FRONT OF PILE AND GROIN.
5. PLACE LOGS WITH ROOTWADS, COMPRESSING RACKING MATERIAL, AND LASHING WITH CABLE TO PILE AND TO EACH OTHER.
6. BURY THE STRUCTURE, LEAVING ROOTWADS AND RACKING MATERIAL EXPOSE TO THE UPSTREAM SIDE.

NOT TO SCALE

YAKIMA COUNTY

MILL PARKWAY PHASE 3A IMPROVEMENT PROJECT
MITIGATION

PROJECT NO. 3446-3A

PREPARED UNDER THE DIRECTION OF:

PRELIMINARY

COUNTY ENGINEER
DATE:

PROJECT ENGINEER:
JOEL FREUDENTHAL

DRAWN:	CHECKED BY:
A. LEONARD	KIM PFAFF

REVISION:

ELJ 2-5 Plan & Profile

Figure 10.2

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2.3.5. Post-Project Site Restoration

Post-project site restoration will be done with each phase and will be completed by the end of Phase 4. The proposed project will require the temporary clearing of approximately 0.3 acres of riparian vegetation during bridge construction. Permanent clearing of approximately 3.2 acres of riparian vegetation will occur, the majority of which is necessary for floodplain restoration work. Once construction is completed, temporarily impacted areas will be replanted with native vegetation as appropriate.

The project also proposes to remove 50 trees greater than 12 inches DBH. These trees are primarily black cottonwood (*Populus balsamifera*). To minimize this impact, a planting plan covering 6.9 acres has been proposed along the proposed floodplain mitigation as discussed in Section 2.3.4. (Figure 8). Planted trees will be monitored for 5 years to ensure 80% survivability. The trunks (30-foot sections, ≥12-inch diameter) of trees to be removed will be placed along the banks of the Yakima River within the project area (½ below and ½ above the OHWM).

2.4. Water Quality

Project water quality treatment will be consistent with the WSDOE Stormwater Management Manual for Eastern Washington (WSDOE 2019). Under existing conditions, more than 85 percent of PGIS is untreated. A total of 3.98 acres of existing PGIS for I-82 have the potential to reach the Yakima River, 2.89 acres of which are currently untreated. 10.15 acres of new PGIS will be created by the project and upon completion, a total of 18.24 acres of PGIS will exist within the project area.

All new PGIS will receive treatment and more than 75 percent of existing PGIS will treated following project construction. 5.01 acres of PGIS will receive basic treatment and will be discharged to the Yakima River via an existing outfall. An additional 10.39 acres will receive enhanced treatment using infiltration methods. All 16.49 acres receiving treatment will also be flow controlled. 1.75 acres of existing PGIS composed of private driveways in Phase 3 will remain untreated.

The project proposes the installation of infiltration trenches parallel to the proposed roadway and 2 ponds north of the proposed roadway. The total impervious surface at the end of the project will be 25.65 acres. The net increase in impervious surface will be 17.56 acres. The proposed project will have a total of 20 runoff basins. (See Appendix B for Basin Maps and Stormwater Facility Plans).

Table 3. Impervious surface acreage and proposed treatment within the project area

	PGIS		Non-PGIS		Total Impervious Surface
	Treated	Untreated	Treated	Untreated	
Existing Conditions	1.09	7.00	0	0	8.09
Proposed	16.49	1.75	7.41	0	25.65
Net Change	15.4	-5.25	7.41	0	17.56

Project Phases 2 and 3 will consist of 6 drainage basins. Basin 1 will drain west into the City of Yakima's Bravo Company Boulevard (Phase 4) where runoff will be incorporated into their flow control and water quality treatment facilities. The remaining basins (Basins 2 through 6) will utilize some form of infiltration which will provide Enhanced Treatment.

Basin 2 includes the I-82 improvements located north of Cascade Mill Parkway. Due to the high average daily traffic (ADT), I-82 requires oil treatment. A coalescing plate oil-water separator will treat runoff prior to converging with the rest of Basin 2 runoff. The I-82 basin located south of Cascade Mill Parkway (Basin 6) is isolated from the rest of the project basins and will continue to flow into I-82's conveyance and treatment facility. There will be no expansion of impervious surface for the I-82 work.

Basins 2 and 3 will flow into proposed biofiltration swales, providing basic treatment, before entering infiltration ponds which will be placed on the north side of the proposed roadway, one on either side of the Yakima River. The pond west of the Yakima River will be a 23-foot by 65-foot rectangle with a depth of 1.9-feet. The pond on the east side of the river will be 75-foot by 40-foot rectangle with a depth of 1.3-feet.

The biofiltration swales will feature a bioretention soil mix. Research in the last decade has shown that a bioretention soil mix consisting of 60% sand or mineral aggregate and 40% compost is effective in lowering concentrations and decreasing toxicity of harmful pollutants in runoff. Research by Dr. Jennifer McIntyre showed that stormwater passing through the Department of Ecology standard 60:40 bioretention soil mix prevented pre-spawn mortality in coho salmon that was observed when coho salmon were exposed to untreated stormwater (McIntyre et al. 2015). More recently, the discovery of the extremely harmful effects of 6PPD-quinone has triggered significant funding towards researching this pollutant. Initial lab testing conducted by McIntyre and Dr. Ed Kolodjiez indicates that bioretention media appears to remove 6PPD-quinone to below detection levels (McIntyre & Kolodjiez 2021). The bioretention soil mix used will meet Department of Ecology standards (WSDOE 2019).

The two easternmost basins at the Roza Canal Wasteway #2 crossing (Basins 4 & 5) will flow east toward Yakima County's Phase 1 of the project (construction already completed). Stormwater runoff will be collected prior to entering Phase 1 and retained using infiltration trenches located north and south of Cascade Mill Parkway. Infiltration trenches will be 6 feet wide and 4 feet deep.

Phase 4 of the project includes 14 total basins. 10 of these basins, all located on East H Street, will be conveyed to a dynamic separator for pretreatment and then conveyed to a subsurface infiltration facility. The remaining 4 basins (Bravo Company Boulevard) will be treated using a General Use Level Designation (GULD) basic treatment bio-filtration vault before following to an existing outfall to the Yakima River. WSDOE insists that no stormwater infiltration be allowed for Bravo Company Boulevard due to concerns that the stormwater could flow into the adjacent landfill and transport contaminants.

All basins are designed to contain waterflow during the 10-year 24-hour storm; and all ponds, and infiltration trenches are designed to have a greater capacity than would be necessary for the

10-year, 24-hour storm. Down-facing elbows in each catch basin are designed to catch oil as a form of oil control. In basins where infiltration ponds are used to control flow, basic water quality treatment will be provided for total suspended solids removal. For the other basins using gravel infiltration trenches, a manhole will be provided before the infiltration trench with pre-settling. Stormwater being piped to the Yakima River will be treated using the bio-infiltration vault at flows up to the 25-year storm event. Higher flows will bypass the treatment system. The basins that flow to this outfall amount to 8.48 acres and include 5.01 acres of PGIS.

2.5. Minimization Measures

The following recommendations have been made in order to minimize project impacts on listed species.

2.5.1. Site and Equipment Preparation

- A Spill Prevention, Control, and Countermeasures (SPCC) plan; SWPPP; and TESC plan will be approved and implemented prior to commencement of construction. Elements of these plans are outlined in the previous section.
- A confined bubble curtain will be placed around any pile impact driven in > 2 feet of water. Hydroacoustic monitoring will be conduced per the WSDOT monitoring template.
- Trucks transporting the dredged material must be adequately sealed to prevent spillage.

2.5.2. Erosion Control and Water Quality

Prior to construction, a TESC plan and a SWPPP will be implemented to prevent erosion and control sediments and the discharge of petroleum products from the work area. These plans will require the following actions:

- Erosion control BMPs will be installed before any earthmoving activities take place and will be maintained throughout construction in order to prevent sedimentation from entering the Yakima River, as per the Section 402 permit for this project. BMPs will include:
    - Catch basin filter inlet protection
    - Stabilized construction entrances
    - Silt fences
    - Straw wattles (certified weed free)
    - Protection of infiltration facilities from over compaction from heavy equipment
- Containment devices (chain-link fence covered in filter fabric) will be placed under the temporary work bridge, past the drip line, to catch debris generated from the work on the deck and girders.
- All equipment shall be checked daily for leaks and any necessary repairs made prior to the commencement of work.
- Care will be taken to ensure that the equipment handling the material does not allow material to spill into the water.
- Water displaced as the concrete is poured for the installation of drilled shafts will be pumped to a baker tank to settle out.
- Once particulates have settled to 25 NTU, the washout water from casings will be pumped to an upland area over 300 feet away from any sensitive areas to ensure filtration occurs prior to entering a waterbody or will be disposed of at a commercial site.
- Waters collected from the zone of isolation will be discharged to an upland area over 300 feet from any sensitive areas to ensure infiltration/dispersal will occur.
- Preceding pile extraction, a turbidity sleeve will be placed around any/all in-water piles.
- Piles will be pulled up slowly to minimize turbidity impacts.

- To ensure compliance with these standards outlined in WSDOE's Section 401 permit, qualified personnel will be on-site monitoring turbidity during the installation/removal of temporary pilings.
- Refueling operations will be conducted at least 50 feet from any open water body in accordance with the WSDOE Section 401 water quality certification.

Due to aforementioned actions, no impacts to water quality are anticipated to exceed the water quality standards set forth in the latest Water Quality Standards of Surface Waters of the State of Washington and/or the Section 401 permit issued by WSDOE.

2.5.3. Construction Methods and Timing

- All in-water work will take place within the designated in-water work period (July 15 to February 1).
- In-water vibratory and impact pile driving will happen from July 15 to October 1. In-water work will continue from October 1 through February 1, but it will only be vibratory pile driving; no impact pile driving will occur after October 1.
- A vibratory hammer will be used to drive piles to a depth of 20 feet below the riverbed in order to minimize possible increases in Sound Pressure Levels (SPLs).
- In-water vibratory pile driving is anticipated to occur for 28.5 hours over a period of 19 days, and in-water impact pile driving is anticipated to occur for 57 hours over a period of 19 days within the period of proposed in-water work window of the first work season (July 15 to February 1).
- An underwater camera will be lowered into the caisson to ensure no fish are within the casing. Any fish observed will be allowed to escape prior to installation of drilled shafts.
- If at any time during pile extraction, a pile breaks off below the existing ground elevation the remaining pile will be left in place, as no equipment will operate below the OHWM.
- The trunks (30-foot sections, ≥12-inches in diameter) of trees to be removed will be placed along the banks of the Yakima River within the project action area (½ below and ½ above the OHWM).
- Once construction is completed temporarily impacted areas will be replanted with native vegetation as appropriate.
- Mitigation for wetland impacts will be undertaken in accordance with the United States Army Corps of Engineers (USACE) guidance.
- During removal of material from within the casings, precautions will be taken to make sure the equipment handling the dredged material does not allow material to spill into the water.
- No more than 7,950 impact pile strikes will be allowed within the wetted channel, in a given day.
- To ensure compliance with the NMFS underwater SPL threshold, a biologist will be on site monitoring underwater SPLs during all impact pile driving activities.
- All waste materials will be fully contained, and disposed of offsite in accordance with federal, state, and local laws.

Chapter 3. Federally Listed Species and Designated Critical Habitat

3.1. Species List

Both the USFWS and NMFS listed species that are potentially present within Yakima County and/or the Yakima River and connecting waterbodies are summarized in Tables 2 and 3. The official species list from the USFWS for the project area, received October 27, 2021, is referenced for this assessment (USFWS 2021) (Appendix D). The NMFS list was last updated October 31, 2012 (NMFS 2016) (Appendix D).

Table 3. Terrestrial species and critical habitat listed by USFWS as potentially present in the project action area

Common Name	**Scientific Name**	**Federal Status**
Gray Wolf (Western DPS)	*Canis lupus*	Proposed Endangered
Yellow-Billed Cuckoo (Western U.S. DPS)	*Coccyzus americanus*	Threatened

Table 4. Aquatic species and critical habitat listed by USFWS and NMFS as potentially present in the Yakima River

Common Name	**Scientific Name**	**Federal Status**
Bull Trout (U.S.A., conterminous, lower 48 states)	*Salvelinus confluentus*	Threatened
Bull Trout Critical Habitat (U.S.A., conterminous, lower 48 states)		Designated
Steelhead Trout (Middle Columbia River DPS)	*Oncorhynchus mykiss*	Threatened
Steelhead Trout Critical Habitat (Middle Columbia River DPS)		Designated

3.2. Occurrence of Species in Action Area

The following sections discuss the federally listed species that according to the USFWS and the NMFS lists may be present within the project action area. Each listed species is discussed, and information is included to determine the presence or absence of that particular species**.** For more information see Appendix C. Detailed Listed Species Information.

3.2.1. Western DPS of Gray Wolf

(USFWS: Proposed Endangered)

Subspecies of the gray wolf (*Canis lupus*) were listed as early 1967 under the Endangered Species Preservation Act of 1966 (ESPA) and as a whole species as endangered in the United States in 1978 (32 FR 4001; 43 FR 9607; Ward 2020). In 2000, USFWS proposed to reclassify gray wolves into four Distinct Population Segments (DPSs) including the Western DPS (Ward 2020). The final rule on this was published on April 1, 2003 and included reclassifying the Western DPS from endangered to threatened, however district courts in Vermont and Oregon vacated the rule (68 FR 15804; Ward 2020). The gray wolf in the lower 48 United States and Mexico, except for the Mexican wolf (*C. l. baileyi*), was delisted on November 3, 2020 with the rule going into effect on January 4, 2021 (85 FR 69778; Ward 2020). As of December 8, 2020, USFWS identifies the Western DPS of gray wolf as proposed endangered (USFWS 2021).

Gray wolves are habitat generalists that can inhabit a wide range of ecosystems. Packs occupy territories between 200 and 500 square miles. They are generally found in mountainous or forested areas with abundant year-round prey, low road density, low numbers of domestic livestock, low agricultural use, and few people. Within Washington State, suitable habitat potentially occurs everywhere except the Columbia Basin and Puget Trough lowlands (USFWS 2012b). Because the project is within the Columbia Basin and has a high road and development density, this project will not jeopardize the continued existence of the gray wolf. However, if the gray wolf is listed prior to the completion of the project, a provisional effect determination is provided. The disturbed nature of the project action area does not provide suitable habitat for the gray wolf. Therefore, the project will have no effect on the gray wolf and thus will not be discussed further.

3.2.2. Western U.S. DPS of Yellow-billed Cuckoo

(USFWS: Threatened)

The Western U.S. DPS of the yellow-billed cuckoo (*Coccyzus americanus*) was listed as threatened on October 3, 2014 and critical habitat was proposed on August 15, 2014 (79 FR 59992; 79 FR 48548). There is no critical habitat for the yellow-billed cuckoo located within Washington State (79 FR 48548). The yellow-billed cuckoo has been extirpated from Washington and they have not been confirmed to breed in Washington since the 1930s (Halterman et al. 2015; Wiles and Kalasz 2017). Despite this, there have been 14 documented sightings since 1990. The majority of these have been east of the Cascades but none have occurred in Yakima County (Wiles and Kalasz 2017). While breeding has not been documented in Washington since the 1930s, the possibility of breeding occurring cannot be ruled out. Yellow-billed cuckoos are riparian obligates that breed within stands of mature riparian willows and cottonwoods greater than 50 acres (Halterman et al. 2015; Wiles and Kalasz 2017). There is potentially suitable breeding habitat within the project action area in Yakima Sportsman State Park south of the project area. Riparian habitat along the Yakima River is however fragmented. Despite no recent documented occurrences of yellow-billed cuckoo within the project vicinity, there is suitable habitat within the project area, so the effects of the project on this species will be analyzed in the Chapter 6 Effects Analysis and Chapter 7 Conclusions.

3.2.3. U.S.A., Conterminous, Lower 48 States Population of Bull Trout

(USFWS: Threatened)

The U.S.A, conterminous, lower 48 states population of bull trout (*Salvelinus confluentus*) was federally listed as a threatened species on June 10, 1998 (63 FR 31647). The species list obtained from the USFWS as well as data from WDFW indicates that bull trout are present in Yakima County (USFWS 2021; WDFW 2021a; b) (Appendix C). Bull trout are known to both spawn and rear in the Yakima Basin. Historically, bull trout occurred throughout the Yakima River Basin, but they are now fractured into isolated populations. This fragmentation of habitat impedes bull trout migration and has resulted in distribution being restricted to the lower Yakima River watershed (Matthews et al. 2002).

Bull trout require cold temperatures, abundant cover in the form of large wood, undercut banks and boulders, clean substrate for spawning, interstitial spaces large enough to conceal juvenile bull trout, migratory corridors with minimal physical, biological, or water quality impediments, and stable channels (Shellberg 2002, 70 FR 56212). The Yakima River, within the action area, is a moderate to slow moving river with limited cover, a lack of LWD, high summer temperatures, and a lack of undercut banks and boulders a lack of sufficient spawning substrate. Usable spawning substrate is present within the action area, but bull trout have not been documented spawning within the action area.

Bull trout require water temperatures below 59°F (Wydoski and Whitney 2003). At the time of in-water work, temperatures directly downstream of the aquatic portion of the action area are known to range between 34 and 68°F with an average of 51ºF during the in-water work window (USGS 2018). Water temperatures taken at the project site in August of 2014 ranged from 73°-75°F.

Water samples taken at the mouth of the Naches River (2 miles upstream) resulted in the lower section of the Naches River being listed by WSDOE as a Category 5 water[4] for temperature and pH. The Yakima River 1 mile downstream from the bridge crossing is listed as a Category 5 water for pH, Category 2 for temperature, and Category 1 for ammonia and fecal coliform bacteria. A section of the Yakima River 0.6 miles downstream is listed as Category 2 for pH and Category 1 for fecal coliform. All these river sections are also listed as impaired on the WSDOE 303d list (WSDOE 2016). Poor water and habitat quality create undesirable spawning and rearing habitat for bull trout within the project action area. However, bull trout have been documented migrating through the action area so, the effects of the project on this species will be analyzed in the Chapter 6 Effects Analysis and Chapter 7 Conclusions.

[4] Category 5 waters are polluted waters that require a total maximum daily load (TMDL). Placement in this category means that Ecology has data showing that the water quality standards have been violated for one or more pollutants, and there is no TMDL or pollution control plan. TMDLs are required for the water bodies in this category.

3.2.4. Middle Columbia River DPS of Steelhead Trout

(NMFS: Threatened)

The Middle Columbia River DPS of steelhead trout (*Oncorhynchus mykiss*) was federally listed as a threatened species on January 5, 2006 (71 FR 834). The species list obtained from NMFS, as well as data from the WDFW, indicate that steelhead trout may be present within the action area (NMFS 2016; WDFW 2017a; b; c; 2021a; b). Juvenile steelhead will possibly be present within the action area during the in-water work window (Conley et al. 2009). All Yakima Basin steelhead trout are classified as summer steelhead trout (Conley et al. 2009; WDFW 2021b).

Steelhead trout prefer rivers and tributaries with moderate water velocities and medium to coarse gravel substrate for spawning. The Yakima River, within the action area, is a moderate to slow moving river with limited cover, a lack of LWD, high summer temperatures, and a lack of undercut banks and boulders. Usable spawning substrate is present within the action area, but steelhead trout have not been documented spawning within the action area. No spawning or rearing habitat exists within the aquatic portion of the action area; however, steelhead may be present in potential holding pools, which provide minimal thermal refugia, at the time of in-water work and are known to migrate through the area at other times of the year (Conley et al. 2009). Thus, the effects of the project on this species will be analyzed in the Chapter 6 Effects Analysis and Chapter 7 Conclusions.

3.3. Designated Critical Habitat

Critical habitat is a specific geographic area(s) that contains features essential for the conservation of a threatened or endangered species and that may require special management and protection. Critical habitat may include an area that is not currently occupied by the species but that will be needed for its recovery (USFWS 2017c).

3.3.1. Critical Habitat for Bull Trout

Critical habitat for the U.S.A., conterminous lower 48 states population of bull trout was designated on September 26, 2005 and was revised on October 18, 2010 (70 FR 56212; 75 FR 63898). The project reach of the Yakima River is within the limits of designated bull trout critical habitat (USFWS 2017b; USFWS 2021).

There are nine listed Primary Constituent Elements (PCEs) for bull trout critical habitat. While still referred to as PCEs in the Federal Register, WSDOT now refers to these as physical and biological features (PBFs), so this document will refer to them as PBFs as well (WSDOT 2020). The PCEs determined essential to the conservation of bull trout are (75 FR 63898):

(1) Springs, seeps, groundwater sources and subsurface water connectivity (hyporheic flows) to contribute to water quality and quantity and provide thermal refugia.

This PBF is present in the Yakima River within the project vicinity both up and downstream of the project area. There is sufficient subsurface flow and surface water quantity. Springs and seeps are not present. Groundwater levels adjacent to the Yakima River within the action area range between 0 and 20 feet BGS (Vaccaro et al. 2009). During the summer, the temperature of

the Yakima River has been documented at above 59°F, which is believed to limit bull trout distribution (USFWS 2012a; USGS 2018). Subsurface flow may provide some thermal refugia, but the lacking riparian corridor provides little shade. While the Yakima River is not 303(d) listed for any parameter within the project reach, it is 303(d) listed for pH approximately 1 mile downstream. The Naches River at its confluence with the Yakima River, 2 miles upstream, is 303(d) listed for temperature and pH (WSDOE 2016).

(2) Migration habitats with minimal physical, biological, or water quality impediments between spawning, rearing, overwintering, and freshwater and marine foraging habitats, including but not limited to permanent, partial, intermittent, or seasonal barriers.

The main channel of the Yakima River is free of physical impediments and is not 303(d) listed for water quality. The closest bridge directly upstream from the project area utilizes an island for its single pier in the channel. The Terrace Heights Drive bridge approximately 1 mile downstream does the same. Water temperature is the only biological impediment within the project reach that does not meet the requirements of this PBF, but it is a seasonal impediment occurring during the summer months. As stated above, recorded water temperature during the summer has been documented exceeding 59°F, which is believed to limit bull trout distribution (USFWS 2012a; USGS 2018). Regarding the in-water work window, water temperature will be a biological impediment from July through September, when temperatures consistently exceed 60°F, but will not be an impediment from October to February (USGS 2018). The Yakima River within the project reach is not documented to have any bull trout spawning or rearing habitat, just fish passage (WDFW 2021b). Access to upstream spawning and rearing habitat has been limited due to dams like the Roza Dam. The Roza Dam (RM 128) is not an impassible dam, however no bull trout were documented passing the Roza Dam fish ladder in 2018 (DART 2019). Dams built at many of the lake outlets in the Yakima River basin have fragmented populations as well (Matthews et al. 2002). This project will place a new permanent obstacle into the channel through the installation of Pier 2 and barriers like this are present both up and downstream of the project. This PBF is present within the action area because bull trout have been documented migrating through the action area (WDFW 2021b).

(3) An abundant food base, including terrestrial organisms of riparian origin, aquatic macroinvertebrates, and forage fish.

Little is known about foraging opportunities within the project reach of the Yakima River, but it is assumed this PBF is present. Juvenile bull trout tend to feed on insects and transition to feeding on small fish as they grow (USFWS 2012a). Altered flow regimes caused by dams creating low winter flows and high summer flows reduce foraging efficiency and prey availability (Reiss et al. 2012).

(4) Complex river, stream, lake, reservoir, and marine shoreline aquatic environments, and processes that establish and maintain these aquatic environments, with features such as large wood, side channels, pools, undercut banks and unembedded substrates, to provide a variety of depths, gradients, velocities, and structure.

Within the project reach, there is one side channel and minimal presence of LWD. Side channels are present directly upstream and downstream of the bridge crossing. Undercut banks are not present within the project reach of the Yakima River. Upstream and downstream of the proposed bridge, there are side channels accompanying the main channel. Some of these channels stay inundated throughout the year. Substrate at the WSDOE Yakima River station 37A205 at Nob Hill (3 miles downstream of the bridge) is made up of boulders and cobbles (WSDOE 2018). Urban development and levee construction have reduced riparian habitat, river complexity, and floodplain (YBFWRB 2004). This PBF is present.

(5) Water temperatures ranging from 2 to 15 °C (36 to 59 °F), with adequate thermal refugia available for temperatures that exceed the upper end of this range. Specific temperatures within this range will depend on bull trout life-history stage and form; geography; elevation; diurnal and seasonal variation; shading, such as that provided by riparian habitat; streamflow; and local groundwater influence.

This PBF is not met during the summer and early fall (September) within the project reach. Water temperature regularly exceeds 59°F during the summer and early fall (USGS 2018). For the rest of the year this PBF is met.

(6) In spawning and rearing areas, substrate of sufficient amount, size, and composition to ensure success of egg and embryo overwinter survival, fry emergence, and young-of-the-year and juvenile survival. A minimal amount of fine sediment, generally ranging in size from silt to coarse sand, embedded in larger substrates, is characteristic of these conditions. The size and amounts of fine sediment suitable to bull trout will likely vary from system to system.

There is usable spawning substrate for bull trout within the project reach. However, bull trout have not been documented spawning within the project reach (WDFW 2018b). Bull trout that migrate through the Yakima River are known to spawn in Naches River tributaries and upper Yakima River lakes and tributaries (Matthews et al. 2002).

(7) A natural hydrograph, including peak, high, low, and base flows within historic and seasonal ranges or, if flows are controlled, minimal flow departure from a natural hydrograph.

This PBF is not met in the Yakima River. Numerous irrigation diversion dams have severely altered the natural hydrograph of the Yakima River (Matthews et al. 2002; Mizell and Anderson 2015).

(8) Sufficient water quality and quantity such that normal reproduction, growth, and survival are not inhibited.

There is sufficient sub-surface flow and surface water quantity within the project area. However, the Yakima River water temperature regularly exceeds 59°F, the upper preferred temperature threshold for bull trout (USGS 2018). Thus, thermal refugia for this PBF is not met during the summer months or September. Thermal refugia for this PBF is met during the rest of the in-water work window (October to February). Water quality is met for this PBF within the project reach.

However, it is not met 1 mile downstream or 1.95 miles upstream, where the Yakima River is 303(d) listed for pH, and temperature and pH respectively (WSDOE 2016).

(9) Sufficiently low levels of occurrence of nonnnative predatory (e.g., lake trout, walleye, northern pike, smallmouth bass); interbreeding (e.g., brook trout); or competing (e.g., brown trout) species that, if present, are adequately temporally and spatially isolated from bull trout.

This PBF is not met within the Yakima River basin. Numerous nonnative species have been introduced into the Yakima River basin including brook trout, lake trout, brown trout, bass, catfish, bluegill, sunfish, and crappie. Nonnative species are no longer stocked in the main stem of the Yakima River, but many nonnative populations have established themselves in the basin (Matthews et al. 2002). Genetic sampling conducted in the lower reached of Rattlesnake Creek and in the Naches River found no evidence of bull trout hybridization with brook trout (Reiss et al. 2012).

3.3.2 Critical Habitat for Steelhead Trout

Critical habitat for the Middle Columbia River steelhead trout Evolutionary Significant Unit (ESU) was designated on September 2, 2005 (70 FR 52630). The project reach of the Yakima River is within the limits of designated steelhead trout critical habitat (USFWS 2017b; 2019).

There are six listed PBFs (PCEs) for steelhead trout critical habitat. The PBFs determined essential to the conservation of steelhead trout are (70 FR 52630):

(1) *Freshwater spawning sites with water quantity and quality conditions and substrate supporting spawning, incubation, and larval development.*

Substrate suitable for spawning is present in the project action area, but steelhead trout have not been documented spawning this far downstream (WDFW 2021b). Furthermore, the water quality is suitable for spawning, but the river is downwelling in the action area so it is not a place where steelhead would generally spawn. High levels of suspended sediment pass through the action area and temperatures during the beginning of the in-water work window will likely be at the maximum if not above preferred steelhead spawning and incubation temperature (Reese and Harvey 2001; WSDOE 2018). This PBF is not present during the summer months, but when water temperatures drop it is present.

(2) *Freshwater rearing sites with water quantity and floodplain connectivity to form and maintain physical habitat conditions and support juvenile growth and mobility; water quality and forage supporting juvenile development; and natural cover such as shade, submerged and overhanging large wood, log jams and beaver dams, aquatic vegetation, large rocks and boulders, side channels, and undercut banks.*

Freshwater rearing sites within the action area are poor. There are side channels within the action area, but generally due to the channelization of the river for dams, levees, and transportation infrastructure streambank conditions and side channels are poor in the lower Yakima River (Conley et al. 2009). Riparian vegetation and LWD within the action area are also limited. The

action area also has no documented rearing steelhead trout (WDFW 2021b). This PBF is not present within the action area.

(3) *Freshwater migration corridors free of obstruction with water quantity and quality conditions and natural cover such as submerged and overhanging large wood, aquatic vegetation, large rocks and boulders, side channels, and undercut banks supporting juvenile and adult mobility and survival.*

The action area is a documented steelhead migration corridor (WDFW 2021b). The conditions of this corridor are poor, however. As mentioned previously, temperatures reach peak steelhead preferred temperatures during the summer and there are high levels of suspended sediment present in the lower Yakima River (Reese and Harvey 2001; WSDOE 2018). LWD and other cover is also lacking generally due to the development of the Yakima River valley. This project will place a new permanent obstacle into the channel through the installation of Pier 2 and barriers like this are present both up and downstream of the project. This PBF is present.

(4) *Estuarine areas free of obstruction with water quality, water quantity and salinity conditions supporting juvenile and adult physiological transitions between fresh-and saltwater; natural cover such as submerged and overhanging large wood, aquatic vegetation, large rocks and boulders, and side channels, and juvenile and adult forage, including aquatic invertebrates and fishes, supporting growth and maturation.*

This PBF does not exist within the project area.

(5) *Nearshore marine areas free of obstruction with water quality and quantity conditions and forage, including aquatic invertebrates and fishes, supporting growth and maturation; and natural cover such as submerged and overhanging large wood, aquatic vegetation, large rocks and boulders, and side channels.*

This PBF does not exist within the project area.

(6) *Offshore marine areas with water quality conditions and forage, including aquatic invertebrates and fishes, supporting growth and maturation.*

This PBF does not exist within the project area.

Chapter 4. Environmental Baseline

4.1. Terrestrial Resources / Habitat

4.1.1. Topography

The project area is located within the Lower Yakima Sub-basin of the Columbia Plateau. Within the Lower Yakima Subbasin, stream channels have incised narrow canyons into the basalt and other bedrock. The proposed project area is located within the existing floodplain, remnant floodplain, and associated terraces of the Yakima River. The topography is typical of an area of alluvial origin. There are several successive terraces heading north from the river. Each of these terraces is characterized by a flat layer of cobbles, gravels, small pebbles, and silt that point to their origin within the remnant floodplain of the Yakima River. Soil types in the project area are dominated by Weirman gravelly fine sandy loam, Weirman fine sandy loam, and Weirman sandy loam. Small amounts of Esquatzel silt loam and Yakima silt loam are also present within the project area (USDA 2018).

4.1.2. Land Use

Existing land use along the proposed project corridor is mostly undeveloped land. West of I-82 is the Boise Cascade Mill Redevelopment Area which is zoned as Regional Development. This area used to be part of a logging mill complex, but it is currently undeveloped and unvegetated land. There is also a railroad line owned by BNSF railway that is operated by the Columbia Basin Railroad. The proposed roadway will cross the railroad with an at-grade crossing within the Boise Cascade Mill Redevelopment Area. Directly east of I-82 and west of the Yakima River is the Yakima Greenway Trail which is a multi-use trail providing recreational opportunities along the Yakima River. Configuration of the proposed bridge takes into account the preservation of this greenway.

The areas directly adjacent to the Yakima are undeveloped with some areas zoned for potential suburban development. The majority of the project area east of I-82 is zoned Suburban Residential with some Light Industrial at the eastern terminus (Yakima County 2019). There are several private residences and commercial businesses along the proposed route within the community of Terrace Heights, east of I-82. However, the proposed alignment will impact mostly vacant, undeveloped land with little to no vegetation.

4.1.3. Vegetation

The East-West Corridor Project area is located within the Big Sagebrush-Bluebunch Wheatgrass (*Artemisia Tridentata-Agropyron spicatum*) zone of the Shrub-Steppe major vegetation area (Franklin and Dyrness 1973).

Vegetation within the project area consists of shrub-steppe vegetation and forested riparian vegetation, as well as native and non-native self-recruiting invasive species. The forested area includes black cottonwoods (*Populus balsamifera*), willows (*Salix spp.*), red-osier dogwoods (*Cornus sericea*), and reed canarygrass (*Phalaris arundinacea*). Along the edge of this zone is dominated by willows, roses (*Rosa spp.*), and weedy invasive species. The upland areas were

dominated by noxious weeds including tall tumblemustard (*Sisymbrium altissimum*), small tumbleweed mustard (*Sisymbrium loeselii*), hoary cress (*Lepidium draba*), pepperweed (*Lepidium latifolium*), Canada thistle (*Cirsium arvense*), and cheat grass (*Bromus tectorum*). Many weedy invasive plants were also found along the river islands within the project area.

4.2. Water Resources

4.2.1. Hydrology

The Yakima River is the main source of hydrology for the project area with a drainage area of approximately 6,155 square miles (USBR 2011). The Yakima River flows in a southeasterly direction through the project area, outletting into the Columbia River approximately 114 miles to the southeast.

With less than eight inches of precipitation a year, the natural climate of the area is desert conditions. Over 50% of the water flowing to the lower basin from the Naches River and upper Yakima River is diverted for irrigation and hydropower generation during the irrigation season (Yakima County 2007).

4.2.2. Wetlands

The National Wetlands Inventory identifies areas of temporarily flooded palustrine forested wetland along both banks of the Yakima River as well as an area of temporarily flooded palustrine forested unconsolidated shore within the project area (USFWS 2018). Wetland delineation in the area of the project was conducted during October through December of 2015, February through March of 2016, September through October of 2016, and January of 2019 (Widener & Associates 2019). Three wetlands were found to be in or adjacent to the project area. The proposed bridge over the Yakima River will run through two delineated wetlands. Roadway will also run through a wetland adjacent to I-82. A wetland mitigation plan will be developed prior to construction in accordance with federal, state, county, and local regulations.

4.2.3. NMFS/USFWS Combined Pathways and Indicators Matrix

The NMFS and the USFWS developed a Pathways and Indicators Matrix which is further discussed in Appendix E. USFWS requires that projects that may affect bull trout and/or bull trout critical utilize the USFWS Pathways and Indicators Matrix to analyze habitat condition and the effects of the proposed action on habitat conditions. The NMFS Pathways and Indicators Matrix is no longer required but is useful if a project may impact NMFS listed species (WSDOT 2020). Table 3 displays a summary of the baseline aquatic conditions of the Lower Yakima River and anticipated changes due to the proposed project.

Table 5. NMFS pathway and indicator matrix for the Yakima River within the action area

PATHWAYS: INDICATORS	ENVIRONMENTAL BASELINE			EFFECTS OF THE ACTIONS		
	Properly Functioning	At Risk	Not Properly Functioning	Restore / Enhance	Maintain	Degrade
Water Quality:						
Temperature			X		X	
Sediment/Turbidity		X			X long-term	X short-term
Chemical Contaminants & Nutrients		X			X	
Habitat Access:						
Physical Barriers	X					X
Habitat Elements:						
Substrate	X				X	
Large Woody Debris			X	X long-term		X short-term
Pool Frequency			X		X	
Off-channel Habitat		X		X		
Refugia		X		X long-term		X short-term
Channel Condition & Dynamics:						
Width : Depth Ratio			X		X	
Streambank Conditions			X		X long-term	X short-term
Floodplain Connectivity		X		X		
Flow Hydrology:						
Peak/Base Flows			X		X	
Drainage Network Increase		X			X	
Watershed Conditions:						
Road Density & Location		X				X
Disturbance History			X		X	
Riparian Reserves		X		X long-term		X short-term

Table 6. USFWS pathway and indicator matrix for the Yakima River within the action area

PATHWAYS: INDICATORS	ENVIRONMENTAL BASELINE			EFFECTS OF THE ACTIONS		
	Functioning Appropriately	Functioning At Risk	Functioning At Unacceptable Risk	Restore/ Enhance	Maintain	Degrade
Subpopulation Characteristics:						
Subpopulation Size			X		X	
Growth & Survival		X			X	
Life History Diversity & Isolation			X		X	
Persistence & Genetic Integrity			X		X	
Water Quality:						
Temperature			X		X	
Sediment/Turbidity		X			X long-term	X short-term
Chemical Contaminants & Nutrients		X			X	
Habitat Access:						
Physical Barriers	X					X
Habitat Elements:						
Substrate	X				X	
Large Woody Debris			X	X long-term		X short-term
Pool Frequency			X		X	
Off-channel Habitat		X		X		
Refugia		X		X long-term		X short-term
Channel Condition & Dynamics:						
Width : Depth Ratio			X		X	
Streambank Conditions			X		X long-term	X short-term
Floodplain Connectivity		X		X		
Flow Hydrology:						
Peak/Base Flows			X		X	
Drainage Network Increase		X			X	
Watershed Conditions:						
Road Density & Location		X				X
Disturbance History			X		X	
Riparian Reserves		X		X long-term		X short-term
Disturbance Regime		X			X	
Integration of Species & Habitat Conditions			X		X	

Chapter 5. Project Action Area

5.1. Limits of an Action Area

The action area includes all areas to be affected directly or indirectly by the federal action and not merely the immediate area involved in the action (51 FR 19926). The limits of the action area are based upon the geographic extent (in both aquatic and terrestrial environments) of the physical, chemical, and biological effects resulting from the proposed action, including direct and indirect effects, as well as effects of interrelated and interdependent activities (WSDOT 2020).

Stormwater due to untreated runoff will have impacts well downstream of the project due to chemicals which persist downstream. These effects are expected to determine the downstream limits of the action area.

The project will require the placement of up to 160, 24-inch steel pipe piles, 57 of which will be waterward of the OHWM, utilizing both a vibratory and diesel impact pile driver for the construction of a temporary work bridge. All steel pipe piles will be driven to a depth of 20 feet BGS or below the riverbed with a vibratory hammer. 24-inch support piles will require an impact hammer to drive them the remaining 50 feet for a total depth of 70 feet. As a result of the proposed impact pile driving activities, noise will be the farthest-reaching construction impact.

Therefore, noise was used to determine the terrestrial portions of the action area and upstream limits of the aquatic portion of the action area. Stormwater impacts determine the downstream limits of the aquatic portion of the action area.

5.1.1. Zone of Terrestrial Impacts

SPLs created from East-West Corridor construction noise are anticipated to reach 109 A-weighted decibels (dB(A)) through the laws of decibel addition (WSDOT 2020). Construction noise may potentially affect terrestrial wildlife. East-West Corridor construction noise will become indistinguishable from ambient levels of 55 dB(A), at a distance of 1.4 miles or 7,227 feet from the project area (7,389 acres). See Appendix F for noise calculations and Figure 11 for the Action Area.

5.1.2. Zone of Aquatic Impacts

The project will require in-water work, consisting of the placement/removal of up to 160, 24-inch steel pipe piles, 57 of which will be waterward of the OHWM, utilizing both a vibratory and diesel impact pile driver for the construction/deconstruction of the temporary work bridge and oscillator support; the placement of five ELJs which includes driving a total of eleven 23-inch timber piles with a vibratory pile driver; and the placement/removal of three 16-foot diameter casings for construction of the bridge over the Yakima River. Additionally, the proposed side channels have sections below the OHWM, however these sections will be completed during the Yakima River's low flow as to not increase sedimentation.

The installation/removal of piles and/or casings may produce a temporary increase in sedimentation and/or turbidity levels, and pile driving activities may result in increased SPLs. These activities could potentially impact listed species by frightening fish away from the area, temporarily increasing localized competition for resources. The sections of the proposed floodplain channels below the OHWM will permanently alter those sections of the Yakima River.

Sedimentation/turbidity impacts are not expected to exceed the water quality standards set forth in the WSDOE Section 401 water quality certification. The extent of possible impacts will be limited to the area 300 feet downstream of the Yakima River Bridge and temporary work bridge.

The use of a diesel impact hammer for the installation of 57, 24-inch steel pipe piles was determined to be the loudest noise generator within the Yakima River. As sound levels are estimated at 210 dB_{PEAK} or 189 dB_{RMS}[5] 10 meters from a pile during impact pile driving activities, the use of a confined bubble curtain will be required during all impact pile driving activities[6] (WSDOT 2020). Previous sound monitoring for pile driving in the Yakima River recorded that SPLs through the use of a bubble curtain are approximately 2.5 dB (Widener & Associates 2016). The bubble curtain will be built as per the NMFS and USFWS Impact Pile Driving Sound Attenuation Specifications (Appendix G).

The practical spreading loss model was used to determine where underwater SPLs created from both impact and vibratory pile driving construction will become indistinguishable from ambient levels of 140 dB_{RMS} (WSDOT 2020). Using this model, it was determined that impact pile driving construction noise with a bubble curtain will become indistinguishable 7.9 miles or 41,303 feet from the proposed pile driving. As land masses are known to hinder the forward movement of elevated SPLs within water, only those areas within line of sight of the proposed temporary pilings were included within the aquatic portion of the action area. Island and OHWM limits are from the November 2019 Wetland Delineation Report for this project (Widener & Associates 2019). OHWM limits outside of the wetland study area are from United States Geologic Survey (USGS) data. Therefore, because of the islands present and sinuosity of the Yakima River, the impact pile driving construction noise will become indistinguishable 0.7 miles or 3,816 feet upstream and 0.4 miles or 2,238 feet downstream of the proposed pile driving (55.6

[5] The RMS level is the square root of the energy divided by the impulse duration. This level is the mean square pressure level of the pulse. It is used by NOAA Fisheries to describe disturbance-related effects to aquatic organisms from underwater impulse-type noises

[6] As previously mentioned, piles to be impact driven in less than 2 feet of water will not require the use of a bubble curtain as water depth would be too low for the bubble curtain to operate effectively.

acres of the Yakima River). Vibratory pile driving construction noise will also become indistinguishable at the same distances. Refer to Appendix F for information on how ambient levels and distances to attenuation were derived.

Since the area of potential behavioral modifications in fish due to impact pile driving activities is the largest area of potential impact in the river during construction, 0.7 miles or 3,816 feet upstream and 0.4 miles or 2,238 feet downstream of the proposed pile driving will define the upstream limits of the aquatic portion of the action area. Additionally, 0.7 acres where the proposed backchannels and ELJs are below the OHWM will also be included in the aquatic portion of the action area (Figure 11). In total 56.3 acres of the Yakima River are within the action area due to these impacts. Refer to Appendix F for information on how ambient levels and distances to attenuation were derived.

Stormwater impacts following project completion will result in the release of untreated runoff during high flow events which will impact the Yakima River well downstream of the project. These limits are anticipated to extend beyond the limits of construction impacts from turbidity and noise from pile driving and will define the downstream limits of the aquatic portion of the action area.

5.2. Defining an Action Area

The action area encompasses all areas that could potentially be affected directly or indirectly by the proposed project and is not limited to the actual construction area (project area); therefore, the action area for this project will include all areas within 0.7 miles or 3,816 feet upstream of the proposed bridge, the distance downstream is defined by the impact created by stormwater runoff which current guidance defines as the confluence of the Yakima River with the Columbia River.

0.4 miles or 2,238 feet downstream of the proposed pile driving as well as backchannel sections and ELJs below the OHWM (0.7 acres), and the area within a 1.4 mile or 7,227-foot radius of the proposed bridge as noise is the furthest reaching effect from the project site (Figure 11).

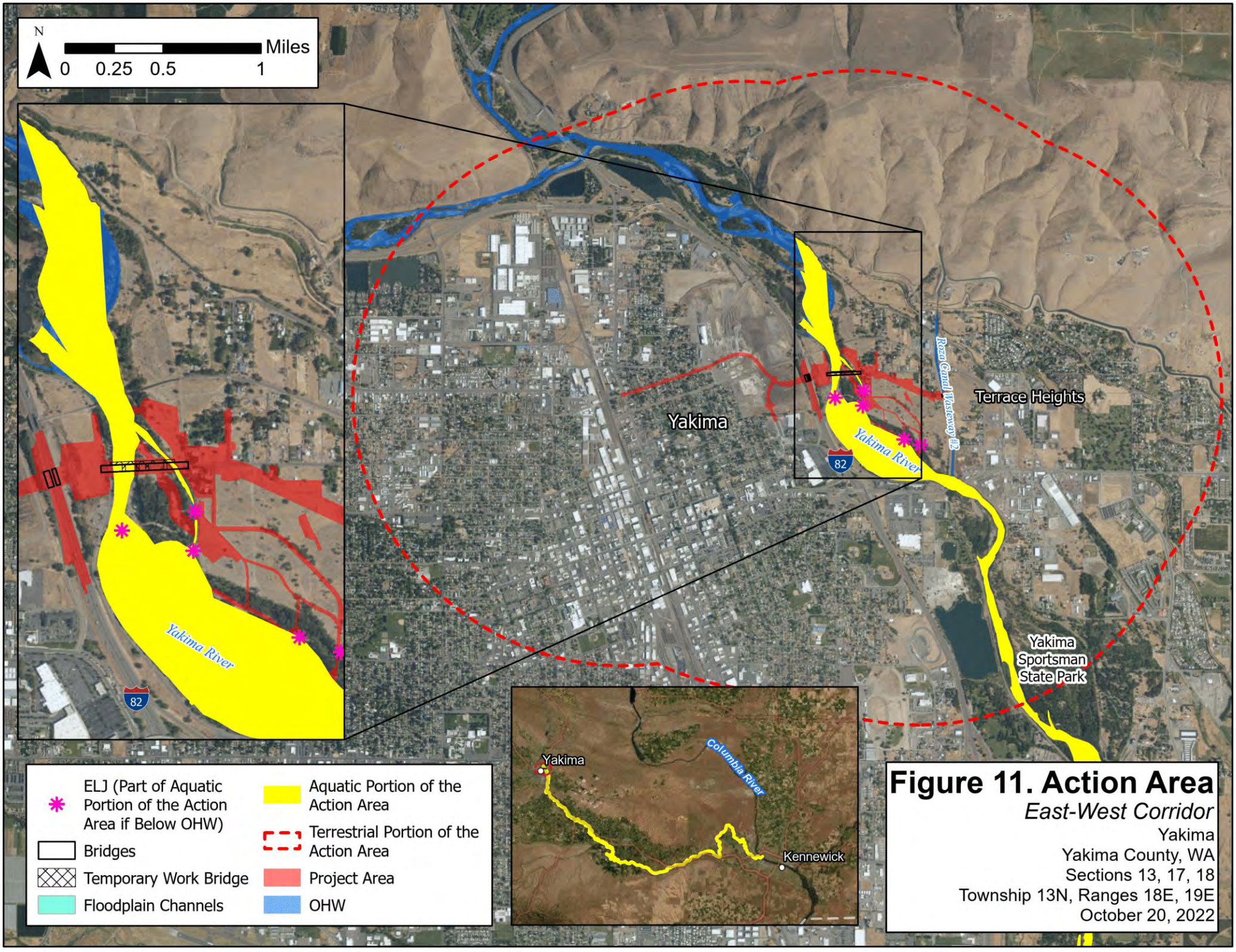

Figure 11. Action Area

East-West Corridor

Yakima
Yakima County, WA
Sections 13, 17, 18
Township 13N, Ranges 18E, 19E
October 20, 2022

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Chapter 6. Effects Analysis

6.1. Direct Effects

6.1.1. Underwater Vibrations

Impact pile driving of steel pilings can produce intense sound pressure waves that can injure and kill fish. The injuries caused by such pressure waves are known as barotraumas, and include hemorrhage and rupture of internal organs, including the swimbladder, lung (lunged fish), and kidneys in fish, and damage to the auditory system. Death can be instantaneous, occur within minutes after exposure, or occur several days later. Fish with swimbladders (which include trout) are sensitive to underwater impulsive sounds (sounds with a sharp sound pressure peak occurring in a short interval of time) (WSDOT 2020).

Sound pressure levels above 150 dB_{RMS} have been noted to cause temporary behavioral changes such as darting/startling or other behavior associated with stress. While studies have shown little to no physical damage to aquatic animals for peak SPLs below 190 dB_{PEAK}, much uncertainty exists as to the level of adverse effects to fish exposed to sound between 180 and 190 dB_{PEAK} due to species-specific variables (WSDOT 2020).

The NMFS spreadsheet was used to calculate the threshold distances within which fish will be affected. A 205 dB_{PEAK}, 186 dB_{RMS}, and 204 SEL dB sound level estimated 10 meters from a pile during impact pile driving with a diesel impact hammer for 24-inch steel pipe piles is utilized for the calculation (WSDOT 2020). According to the results generated from this spreadsheet, if 7,950 impact pile strikes (approximately three piles) were driven unmitigated in the same day increased underwater vibrations may cause physical injury to any fish within 0.8 miles or 4,459 feet of a pile being driven with an impact hammer and behavioral modification may result in fish within 2.5 miles of the proposed bridge. Refer to Appendix F.

To minimize impacts to fish only 7,950 impact pile strikes will be allowed in one day and a confined bubble curtain will be used at all times. With this minimization measure in place, physical injuries resulting from increased underwater vibrations due to impact pile driving activities may occur to fish within 3,062 feet or 0.6 miles of a pile (Figure 12). Increased underwater vibrations may result in behavioral changes to fish within 1.7 miles or 8,899 feet of pile driving.

The line-of-sight rule is also used when determining the extent of project related noise as noise may only propagate to the extent of an area that is within line of sight. Therefore, due to the sinuosity of the river and islands, potential behavior modification of fish will be limited to within approximately 0.7 miles or 3,816 feet upstream and 0.4 miles or 2,238 feet downstream of the proposed pile driving (75.5 acres) (Figure 12). Impact pile driving may physically injure fish within 0.4 miles or 2,238 feet downstream and 0.6 miles or 3,038 feet upstream (51.5 acres) of pile driving activities. Impact pile driving activities will occur for 57 hours over a period of 19 days within the WDFW approved in-water work window (July 15 to February 1). See Table 1 for work sequencing and fish use in the Yakima River.

In addition to elevated SPLs resulting from impact pile driving activities SPLs will also be elevated during vibratory pile driving activities. During vibratory pile driving activities, increased underwater vibrations may result in behavioral changes to fish within the same distance as stated for behavioral impacts from impact pile driving. Due to slow rise time, vibratory pile driving is not expected to cause injury but may result in behavioral changes to fish. Vibratory pile driving activities are anticipated to occur for 28.5 hours over 19 days. See Table 1 for work sequencing and fish use in the Yakima River.

6.1.2. Water Quality

Short-term impacts to water quality may occur as a result of an increase in sedimentation/ turbidity due to in-water work; this impact is not expected to exceed the water quality standards set forth in the 401 Water Quality Certification from WSDOE. Additional short-term sedimentation/turbidity is expected to occur during the first floods which result in water flow in the new side channels. This is anticipated to be minimal due to the gravel material in the channel and the stabilization of the lowest portions of the channel with cottonwood and willow stingers. The amount of fine erodible material in the channels is expected to be limited.

Within the aquatic portion of the action area, sedimentation and turbidity may occur for up to 300 feet downstream and may impact wildlife by reducing in-water visibility, clogging fish's gills, and disturbing aquatic insects and vegetation (Figure 12). See Table 1 for in-water work sequencing and fish use in the Yakima River.

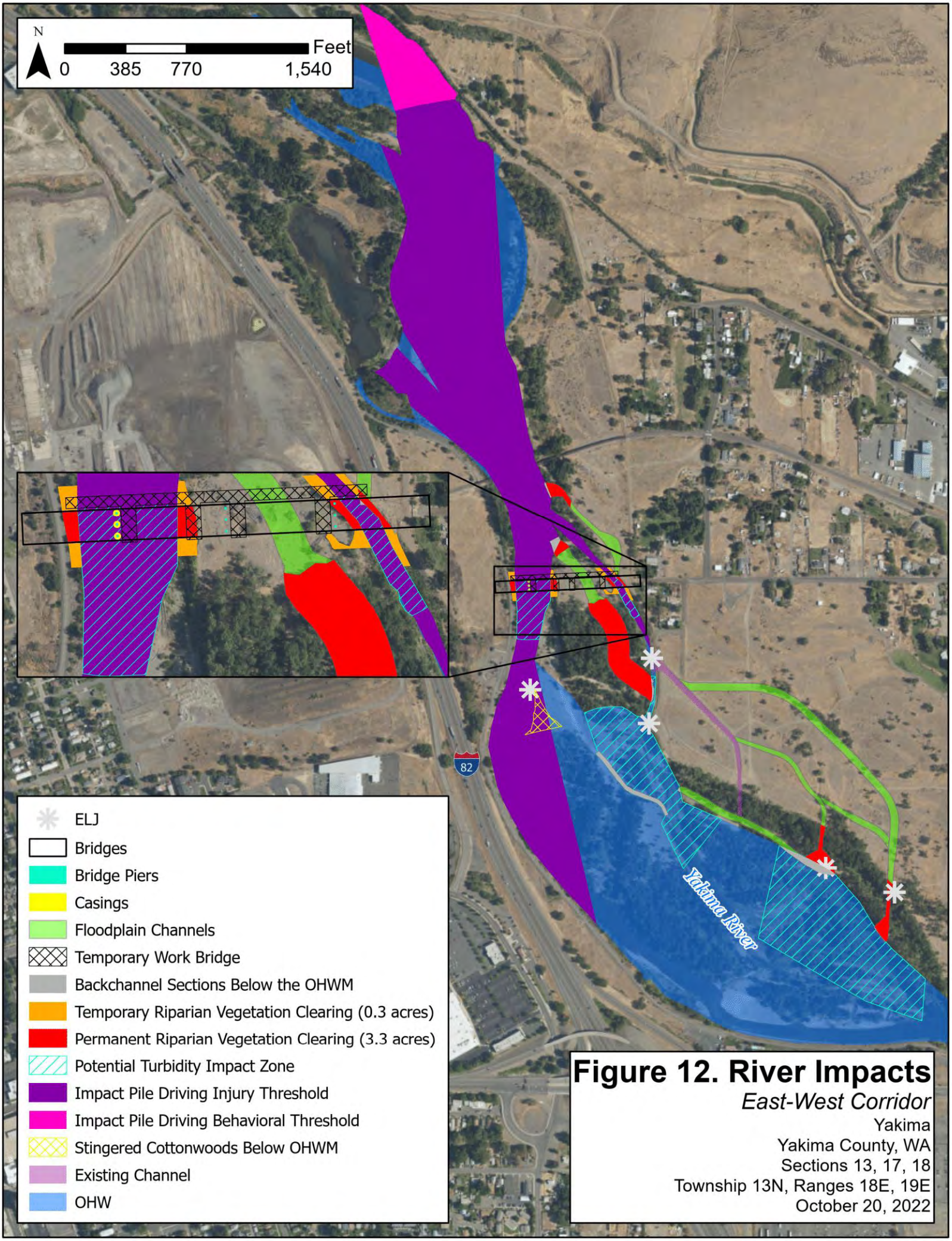

Figure 12. River Impacts

East-West Corridor

Yakima
Yakima County, WA
Sections 13, 17, 18
Township 13N, Ranges 18E, 19E
October 20, 2022

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6.1.3. Vegetation Removal

Prior to construction activities clearing limits for vegetation removal will be staked and/or flagged. BMPs such as silt fencing, erosion control blankets, mulching, matting, seeding, and minimizing the amount of excavation at any given time will be used in order to control erosion. During construction, these areas will be stabilized to prevent soil erosion. Construction of the bridge and floodplain mitigation will require the removal of 50 trees greater than 12 inches DBH. These trees are almost entirely black cottonwood and approximately 45 are within the floodplain mitigation. Backchannel construction and roadway construction will cause the permanent removal of 145,258 SF (3.3 acres) of riparian vegetation. 137,019 SF (3.1 acres) of that will be for channel construction (Figure 12; Table 8). Cottonwoods will be stingered and coyote willows will be planted in these channels so it is anticipated that the planting and channel construction will be an improvement to the baseline (Figure 8; Table 9). 13,400 SF (0.3 acres) of temporary riparian vegetation will occur with replanting occurring upon completion of Phase 3 (Figure 12; Table 8).

Table 7. Riparian vegetation removal

Temporary Riparian Vegetation Loss (to be replanted upon project completion)		**Permanent Vegetation Loss (to be mitigated)**	
Project Element	**Area (acres)**	**Project Element**	**Area (acres)**
Staging/work area for Yakima River bridge and roadway	0.3	Yakima River bridge	0.2
		Backchannels	3.1
Total	0.3	**Total**	3.3

Table 8. Planting plan quantities

Planting Plot	**Area (acres)**
Coyote willow, bitterbrush, & native grasses	2.6
Stingered cottonwood & coyote willow	1.0
Stingered cottonwood	3.3
Total	6.9

Removal of trees in close proximity to the Yakima River will result in a temporal decrease in refugia and LWD recruitment. Riparian vegetation loss could result in a temporal loss of refugia within the aquatic portion of the action area. In order to minimize these impacts the trunks of these trees (30-foot sections, ≥12-inches in diameter) will be placed along the banks of the Yakima River within the riparian portion of the project area, above the OHWM. The loss of trees may also result in a temporal loss of organic inputs within the aquatic portion of the action area. Therefore, a planting plan has been developed to minimize this impact and increase the organic inputs the area receives in the future (Figure 8; Table 9). The planting plan proposes 6.9 acres of native riparian vegetation including stingered cottonwoods, coyote willows, bitterbrush, and native grasses. The planting plan will be submitted to the USACE for approval. The planting plan more than doubles the vegetation lost, so it is anticipated that when plants mature this will be an improvement on the baseline.

6.1.4. Shading

The project proposes to construct a bridge where there is currently open space. The construction of an over-water structure can result in fewer food sources and result in disruption to salmonid behavior, affecting predation rate (Carrasquero 2001).

The proposed bridge will have a clearance of 16 feet above the OHWM at its highest section on the west side of the river. This side will allow for more diffusion and refraction around the bridge than a lower structure.

The lowest portions of the bridge along the eastern bank could possibly create more shading, however, this impact is thought to be insignificant as this area is generally in the dry (being inundated only when the river reaches OHWM) and when inundated affects less than 1 percent of the habitat in the aquatic portion of the action area.

6.1.5. Substrate

Temporary substrate loss as a result due to the placement of 24-inch steel pipe piles will amount to 180 SF. Temporary substrate loss due to the placement of three 16-foot diameter casings around Pier 2 will amount to 520 SF. Total temporary substrate loss from piles and casings will be 700 SF. Permanent substrate loss due to placement of 1 pier with 3, 6-foot diameter columns below the OHWM will equal approximately 85 SF. The 10-foot drilled shafts will be below the mudline upon completion so no additional permanent substrate loss will occur as a result of the drilled shafts. Backchannel construction will include 3,460 CY of dredge and 371 CY of fill over 32,924 SF of substrate below OHWM. Additionally, ELJs installed below the existing OHWM will cover 3,600 SF of substrate and require 2,400 CY of dredge for excavated pools. Upon completion, these channels and ELJs will provide improved salmonid habitat quality by providing cover for juvenile salmonids in areas that currently have poor cover and encouraging the establishment of cottonwood stands further upland in the floodplain. Yakima River substrate within the project area is boulder/cobble. See Figure 12, Table 10, and Table 11 for substrate impacts, and Table 1 for in-water work sequencing and fish use in the Yakima River.

Table 9. Temporary and permanent substrate loss

Temporary Substrate Loss		**Permanent Substate Loss**	
Project Element	**Area (SF)**	**Project Element**	**Area (SF)**
Steel Pipe Piles	180	Bridge Pier	85
Casings	520		
Total	**700**	**Total**	**85**

Table 10. Substrate impacts from constructed backchannels and ELJs

Project Element	**Impact Area (SF)**	**Fill (CY)**	**Dredge (CY)**
Backchannels	32,924	371	3,460
ELJs	3,600	0	2,400
Total	36,524	371	5,860

6.1.6. Channel Modifications

The bridge proposed over the Yakima River will require the placement of piers in the floodway of the Yakima River and will impact 255 SF of area within the 100-year floodplain. The project proposes to add 153,930 CY of fill and excavate 433 CY of native materials within the 100-year floodplain. Floodplain mitigation work will occur on 719,184 SF of existing floodplain and will include 124,539 CY of cut and 1,141 CY of fill. Bridge construction paired with floodplain mitigation will have no rise in 100-year flood levels with the excavation of flood conveyance channels within the floodplain.

The project will create one new obstacle in the channel with the installation of Pier 2. This pier will create a small change in flow patterns within the channel, though this is expected to be insignificant due to the reduction of backwater effects created by the narrow channel that exists in this location currently. It is possible that another pier in the 100-year floodplain may eventually be within the river channel in the future as floodplain develops following the construction of new channels though the floodplain modelling completed does not currently show this occurring.

Floodplain grading and backchannel construction will create a more natural floodplain connectivity, while also providing habitat for salmonids when inundated. These mitigation elements may impact potential holding/overwintering habitat within the existing channel as they are intended to destabilize the downstream channel and encourage it to move away from the west bank levee. The bottom of the new backchannels are constructed at the 2-year flood elevation and floodplain modelling completed with this mitigation does not show the current channel being abandoned for the new channels. The channels will reduce flood velocities, reduce constrictions and channel incision occurring through the project area, increase sediment availability, create additional holding/overwintering habitat, and distribute floodwaters more evenly across the floodplain.

Trees will be planted along the proposed channels to provide shading and eventual LWD recruitment. Overall, the modifications are expected to reduce flood hazards and improve habitat for fish and wildlife. These modifications are consistent with the work currently being done with Yakima County’s Yakima River Gap to Gap Ecosystem Restoration Project.

6.1.7. Artificial Lighting

Artificial lighting may impact outmigration of juvenile salmonids. No artificial lighting over the Yakima River is proposed during construction as all bridge work will occur during daylight hours. Lighting on the proposed Yakima Bridge may produce an illuminance of 2.15 lux to very small areas of the Yakima River south of the bridge (SCJ Alliance 2021). Many studies have been conducted on the effects of artificial light on juvenile salmonids. Research suggests that the increase in the number of cones as the eye of juvenile fish grows larger leads to greater sensitivity and improved resolution of an image. Times for cones and pigments to fully adapt to light or dark conditions in most salmonids are between 10 and 20 minutes, depending on species and life stage. Therefore, small fish generally avoid bright artificial lights near 400 lux as they cannot distinguish images. Juvenile salmonids have also been observed showing attraction to dimmer artificial light down to 0.25 lux. There are many factors that may determine salmonid response to artificial light including: genetic makeup (species and subspecies), life stage, season, time of day, light levels, presence of predators, distance to cover, temperature, group size, noise regime, and current (Mueller and Simmons 2008). Most studies of juvenile salmonids were of Chinook, coho, sockeye, and chum salmon and did not include bull trout or steelhead trout. Based on the lux levels anticipated, outmigrating juvenile salmonids may congregate around lit areas temporarily instead of continuing their migration but this effect is anticipated to be insignificant. The lighting plan has been designed to meet Yakima County lighting standards while minimizing light spilling onto the river. Effects were minimized by eliminating overhead luminaires on the south side of the road for the bridge length and placing them between the road and shared use path, using pedestrian level lighting where feasible, as well as barriers on the bridge which block light.

6.2. Delayed Consequences

6.2.1. Land Use

The following questions stated in Chapter 10: Delayed Consequences of the WSDOT Biological Assessment Preparation Advanced Training Manual for Transportation Projects, Version January 2020 are listed below to determine land use indirect effects for this project (WSDOT 2020).

Step 1- Will the project create a new facility (e.g., new road, new interchange etc.)? *If the answer to this question is yes, go to Step 3.*

Yes, the project will create a new roadway facility.

Step 3 – Determine if the transportation project has a causal relationship to a land use change by answering the following questions:

A) Is there a building moratorium in place that is contingent on the proposed road improvements?

No current building moratoriums are in place contingent on the proposed road improvements.

B) Are there any land use changes tied by permit condition to the proposed project?

No land use changes are tied by permit condition to the proposed project. See Figures 13 and 14 for comprehensive plan zoning designations within the project vicinity (City of Yakima 2017; Yakima County 2017).

C) Do the project's National Environmental Policy Act (NEPA) documents identify other actions or land use changes caused by or resulting from the project that are reasonably certain to occur?

No other actions or land use changes are caused by or result from the project.

D) Do development plans include scenarios for the planning area where land use differs based on a "build" and "no build" outcome related to the proposed project?

No

E) Is there land use change that is likely to occur at a different rate as a result of the project?

Yes, development in the Terrace Heights neighborhood along the Terrace Heights Drive corridor may occur at an increased rate as a result of the project due to the reduced traffic created by the diversion of traffic to the new route. Constraints created by Yakima County's traffic concurrency requirements will be eased.

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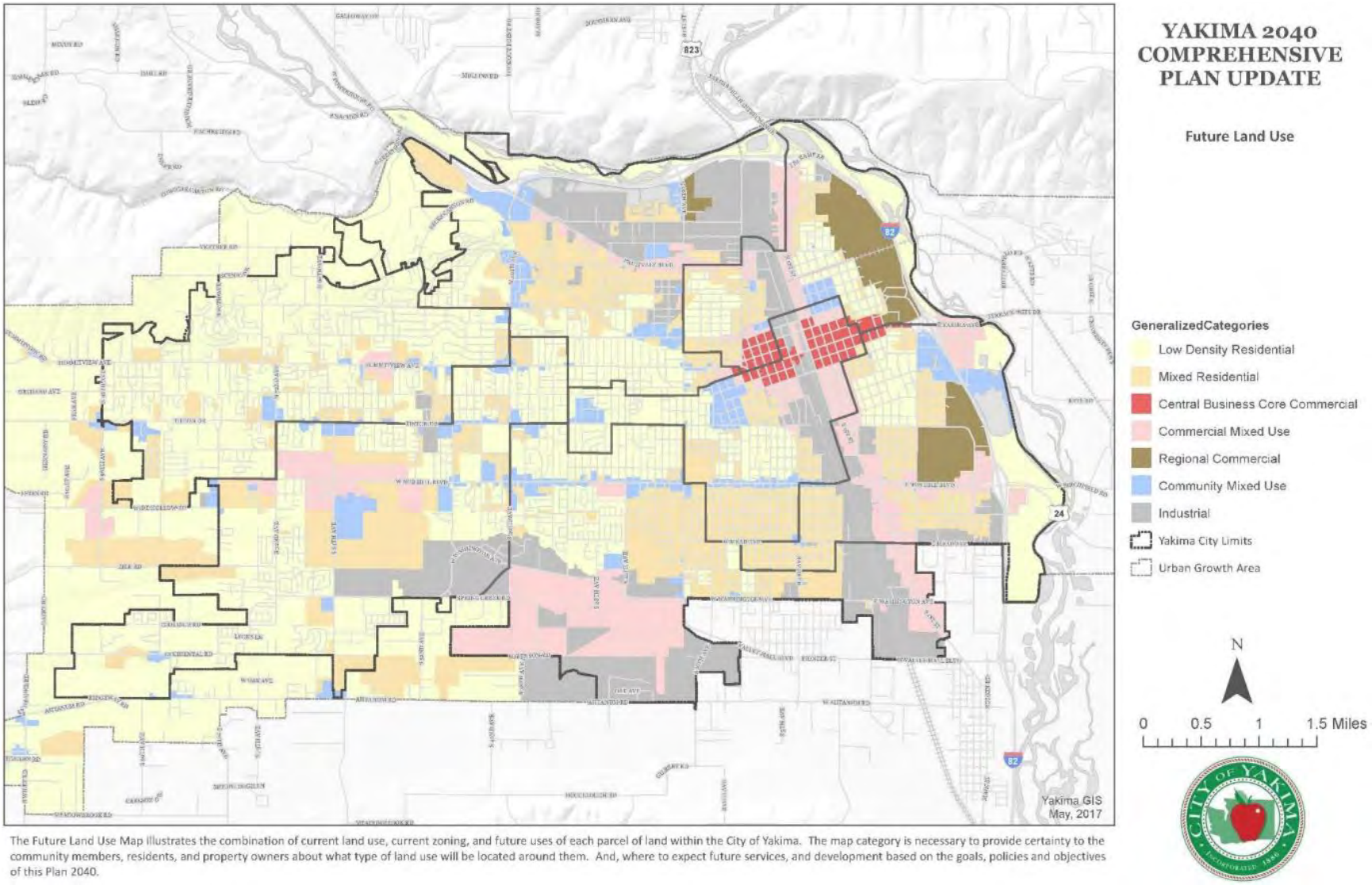

Figure 13. City of Yakima Future Land Use
(Retrieved from We Are Yakima Comprehensive Plan 2040 (City of Yakima 2017)).

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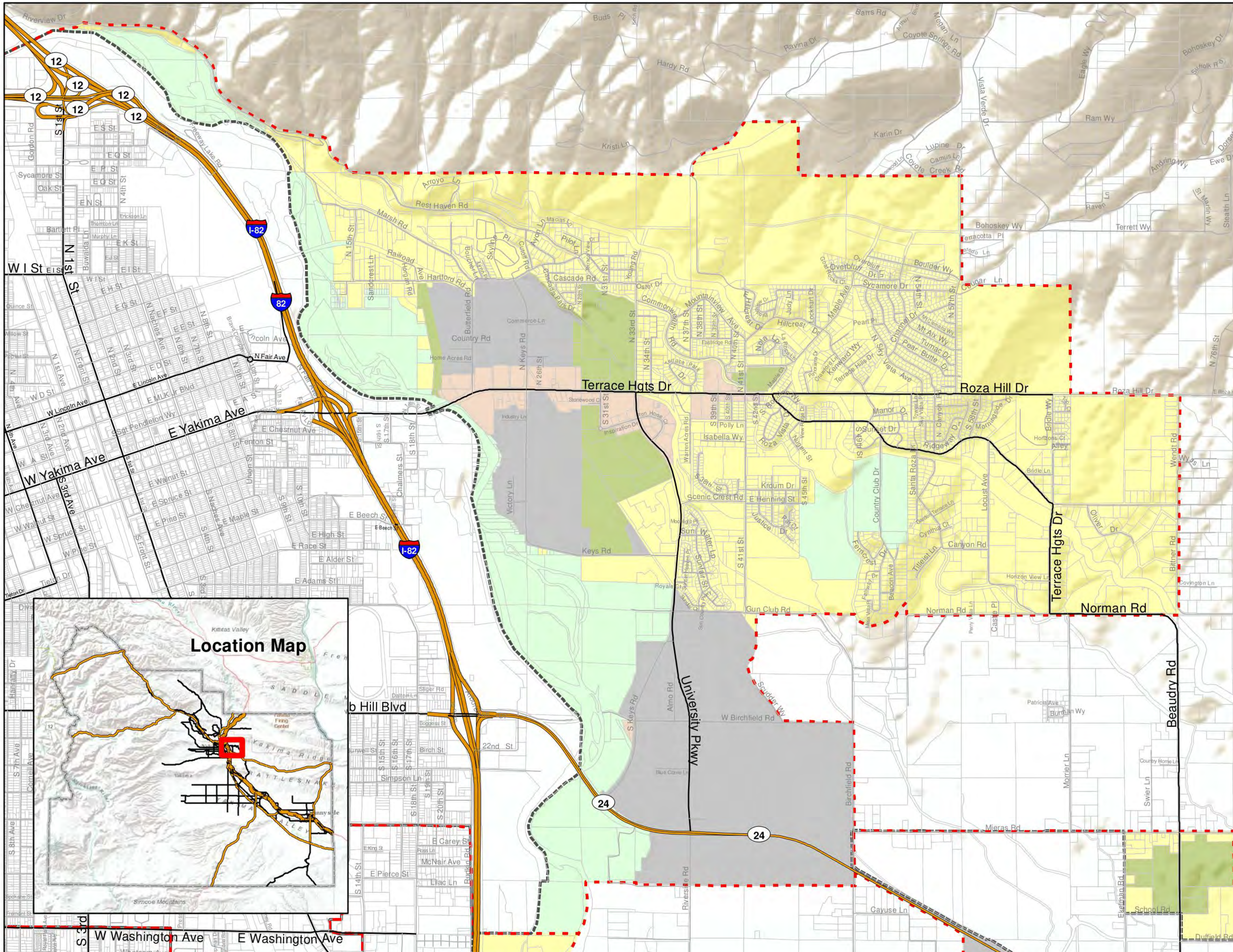

Land Use Element

HORIZON 2040

YAKIMA COUNTY

Map 5.8.4.1-13
Future Land Use
Yakima UGA
Terrace Heights Area

- Urban Growth Area
- City Limits
- Yakima County Boundary
- Taxlots
- Urban Residential
- Urban Commercial
- Urban Industrial
- Urban Public
- Urban Parks and Open Space
- Urban Tribal

0 0.25 0.5 1
Miles

March 2017

Yakima County GIS

Yakimap.com

Parcel Lot lines are for visual display only. Do not use for legal purposes.

Document Path: R:\disk_5\projects\county\planning\LongRangePlanning\WorkOrderPlan2040\Figures\Map5_8_4_1_13TerraceHeightsUGA_040517.mxd

Date: 4/6/2017

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The zone of influence[7] created by the project does not expand the action area. Traffic impacts are anticipated to occur which may create minor changes in the speed of adjacent development, however, these will occur within the action area as previously described. The proposed project will result in increased traffic along the existing H Street Corridor as well as creating new roadway in areas that are undeveloped. It will also reduce traffic along the Yakima Avenue/ Terrace Heights Drive corridor. Land use development compliant with the comprehensive plan may occur faster in the Terrace Heights neighborhood compared to the "no build" conditions.

Future developments along the new East-West corridor alignment should have no adverse effects to listed species as the area adjacent to the Yakima River and the new road corridor is unlikely to develop in the foreseeable future. This is because undeveloped land adjacent to the project within the Terrace Heights neighborhood is either owned by the United States Bureau of Reclamation, Yakima County, or Washington State for the purpose of preserving and/or restoring the floodplain and riparian habitat (Yakima County 2019). Stormwater from other developments east of the project limits in Terrace Heights is anticipated to utilize infiltration for treatment due to the existing county requirements and lack of available conveyance to the Yakima River.

The current level of service (LOS) along the Yakima Avenue/Terrace Heights Drive corridor has triggered Yakima County's concurrency requirements, which require public facilities are sufficient to support the planned development without decreasing levels of service below the minimum standards (Yakima County 2017). Should the County not act on this in the next 20 years, development in the Terrace Heights neighborhood could be slowed. This would limit development in an area that experienced a 33.3% population growth between 2000 and 2010 and is anticipated to grow in population by 20.43% in the next 10 years (pers. comm. Brett Sheffield). The County must either increase the capacity of the existing corridor or divert sufficient traffic volume onto another route. The construction of the East-West corridor will allow for traffic diversion necessary to avoid a slowing of development.

Future I-82 interchange improvements are planned which could include a new connection to Cascade Mill Parkway. These improvements will address traffic congestion on Yakima Avenue/Terrace Heights Drive. This project will allow for the consideration of the recommended alternative for the interchange with I-82 identified in the WSDOT I-82/Yakima Avenue/Terrace Heights Drive Interchange Justification Report. The East-West corridor is compatible with the potential improvements; however, the I-82 interchange will require its own NEPA process and alternative analysis to determine the final design and if it will connect to Cascade Mill Parkway.

While the I-82 interchange improvements may connect to the East-West corridor, the current project will improve mobility from Terrace Heights and provide reductions in congestion along the Yakima Avenue/Terrace Heights Drive corridor, even if there are no changes to the current interstate access. The interchange improvements will also have its own Section 7 of the ESA consultations. It is anticipated that the interchange will have no adverse impacts to listed species as it will not impact the Yakima River, or its riparian corridor and stormwater will be infiltrated.

[7] The zone of influence is defined by the area in which changes in traffic patterns due to the proposed action which may potentially result in a change in land use. The zone of influence may; therefore be affected by indirect effects associated with future development as a result increased stormwater from impervious surfaces or vegetation removal associated with future projects.

As stated previously, developments adjacent to the project on the east side of the river are not anticipated as the projected is surrounded by United States Bureau of Reclamation, Yakima County, and Washington State land (Yakima County 2019).

Development of the Boise Cascade Mill site have been discussed in conjunction with this project as remediation for the contaminated site is required for both this project and any future developments there. The potential Boise Cascade Mill site development is not directly connected to this project as its development is more reliant on the construction of the potential I-82 interchange. As such, its potential construction is not a delayed consequence and will be discussed in Section 6.4. Cumulative Impacts.

6.2.2. Predator/Prey Relationships

Predation
Artificial lighting may potentially impact fish. Research suggests that the increase in the number of cones as the eye of juvenile fish grows larger leads to greater sensitivity and improved resolution of an image. Times for cones and pigments to fully adapt to light or dark conditions in most salmonids are between 10 and 20 minutes, depending on species and life stage. Therefore, small fish generally avoid bright artificial lights as they cannot distinguish images. Juvenile fish have also been observed showing attraction to dimmer artificial light. There are many factors that may determine salmonid response to artificial light including: genetic makeup (species and subspecies), life stage, season, time of day, light levels, presence of predators, distance to cover, temperature, group size, noise regime, and current (Mueller and Simmons 2008). Most studies of juvenile salmonids were of Chinook, Coho, sockeye, and chum salmon and did not include bull trout or steelhead trout. Juvenile fish may either actively avoid lit areas or congregate towards them depending on the factors stated above. Both behavioral actions may lead to increased predation.

Invertebrates
The removal of riparian vegetation within the aquatic portion of the action area may result in a reduction of insects that fall in the river and are eaten by fish. Tree plantings will mitigate this over time.

6.2.3. Water Quality

Roads generate a broad range and large load of pollutants that accumulate and run off impervious surfaces into stormwater. Vehicle wear and emissions are primary sources of metallic particles (particularly copper and chromium); microplastics, persistent bio-accumulating toxicants (PBTs); and polycyclic aromatic hydrocarbons (PAHs), nickel, and zinc. Pollutants in stormwater can be transported far from the point of delivery either dissolved in solution, attached to suspended sediments, or through bioaccumulation.

Roadway stormwater has been found to include numerous chemicals that are toxic to salmonids, invertebrates which juvenile salmonids prey upon, and other fish species (McIntyre et al. 2015; 2017; Young et al. 2017). Juvenile salmonids have displayed negative impacts from exposure to untreated stormwater including impacts to the growth of salmonids and their sensory systems such as the lateral line system (Young et al. 2017). Untreated stormwater has also been found to cause premature death in adult salmonids returning to urban watersheds to spawn (McIntyre et al. 2017).

The project will result in additional roadway stormwater reaching the Yakima River from existing conditions. A total of 5.01 acres of proposed PGIS will flow to an existing outfall following treatment. During extreme weather events exceeding the 25-year storm, excess stormwater from Bravo Company Boulevard will bypass the proposed biofiltration system enroute to the outfall to the Yakima River. It is anticipated that contaminants will be diluted in a weather event exceeding the capacity of the system as contaminants would be washed off the road from the beginning of the storm event, and water will only begin to bypass when it exceeds the system capacity. Much of the accumulated roadway contaminants will have gone through the

system by the time flows exceed the capacity, and even with exceedance of the capacity, some water will still enter the biofiltration system. While these conditions will likely minimize the quantity, contamination from untreated stormwater may still enter the Yakima River and adversely affect listed species. The stormwater management system is designed to remain extremely effective even during exceedance level storms when there is the potential for untreated discharge to reach the river. The remaining project areas will all be infiltrated so no other project stormwater will reach the Yakima River.

Most of the existing project site is currently undeveloped so stormwater infiltrates into the soil. None of the existing PGIS within the project area have treatment or conveyance systems in place. Stormwater sheetflows off the pavement into adjacent vegetation where it infiltrates. Stormwater on the Boise Cascade Mill site currently infiltrates through contaminated soil into contaminated groundwater. The proposed project will have stormwater conveyance and treatment facilities for all new PGIS and non-PGIS. No new outfalls are proposed, and flow control will be implemented in all stormwater facilities including the conveyance system to the existing Yakima River outfall. Stormwater from Bravo Company Boulevard will no longer infiltrate into contaminated soil and groundwater and will instead be treated through a bioscape. See Appendix B for stormwater basin maps and treatment facilities.

Even following treatment, several types of pollutants can still be found in stormwater. A large fraction of the total cumulative toxic load present in stormwater runoff (treated or untreated) is often bound or complexed with, or carried by sediments (Grant et al. 2003). PAHs are petroleum-based contaminants from sources such as vehicle emissions, plastics including tire wear particles, improper motor oil disposal, leaks, and asphalt sealants. PBTs in stormwater include several types of chemicals such as persistent organochlorine pollutants (POPs), polychlorinated biphenyls (PCBs), polybrominated diphenyl ethers (PBDEs). These chemicals are from sources such as pesticides, flame retardants, lubricants, inks and dyes, and packaging. Metals such as copper and zinc originate from various sources including brake pads, vehicle exhaust, motor oil, lubricants, and tires. Microplastics include tire tread particles, agricultural runoff, construction, and electronics.

One of the compounds deposited by tire tread particles is 6PPD and its abiotic transformation product 6PPD-quinone. The Federal Highway Administration and WSDOT acknowledge the emerging research related to urban runoff mortality syndrome (URMS) caused by 6PPD-quinone (Tian et al. 2021). Research indicates that adult and juvenile coho salmon are particularly vulnerable to lethal effects of exposure to this chemical. We are closely tracking efforts to gather critical additional information on this topic, such as 6PPD-quinone's fate and transport in the environment and the extent potential sublethal and behavioral effects on coho and other salmonids. Currently, what is known about 6PPD-quinone is it is a ubiquitous chemical in tires that is introduced to streams in road runoff. Effective treatment occurs from applying biofiltration techniques using compost. Initial lab testing conducted by McIntyre and Kolodjiez indicates that bioretention media containing a mix of 60% mineral aggregate and 40% compost appears to remove 6PPD-quinone below detection levels (McIntyre & Kolodjiez 2021). A report released in June 2022 by WSDOE analyzed BMP effectiveness for stormwater treatment of tire contaminants. The report states that a basic biofiltration swale has a "High" potential treatment rating of flow and treatment BMPs (WSDOE 2022). Therefore, we expect the biofiltration

swales with the 60:40 bioretention soil mix implemented in this project will effectively reduce the amount and toxicity of 6PPD-quinone in runoff in the area. Department of Ecology will receive funding in the 2021-2023 biennium to begin working with WSDOT, University of Washington-Tacoma, and Washington State University-Puyallup to 1) identify priority areas affected by 6PPD or other related chemicals toxic to aquatic life from roads and transportation infrastructure, 2) identify best management practices for reducing toxicity, 3) develop a standard method for the laboratory measurement of 6PPD-quinone and related chemicals, and 4) submit a report to the legislature by November 1, 2022.

Yakima County and the City of Yakima are managing stormwater impacts in accordance with regulatory requirements and using approved best management practices. This includes constructing treatment facilities for new and existing pavement and performing ongoing maintenance of those facilities to remove contaminants before they reach nearby waterbodies and to help ensure they work as intended. FHWA and WSDOT are conducting and supporting stormwater research. We understand this is a source of pollution generated on the transportation system, however, current information is insufficient to evaluate impacts at the project level. The FHWA is also coordinating with the Environmental Protection Agency as they work on source control with the tire industry.

Despite treating stormwater runoff using preferred treatment BMPs, pollutants are known to remain in treated stormwater which can be harmful to listed species. The fate and transport of many pollutants, including 6PPD-quinone, are not known or poorly understood. In addition, some untreated discharges are expected over the life of the project during extreme weather events. Although improvements are expected over current conditions, the project will still expose listed salmonids to runoff that may be harmful.

6.3. Interrelated and Interdependent Actions

Twenty trees will be planted to minimize possible impacts resulting from riparian vegetation removal for the proposed project. The planting plan will be submitted to the USACE for approval. Planted trees will be monitored for 5 years to ensure 80 percent survivability.

6.4. Cumulative Effects

Cumulative effects are those effects of future state, local, or private (not federal) activities that are reasonably certain to occur within the action area of the proposed project.

While no specific plans have been made, it is anticipated that the Boise Cascade Mill site will be developed in the future. While the East-West Corridor will provide a direct route from the Terrace Heights neighborhood through this area, it is the potential I-82 interchange that will bring in sufficient people to potentially justify the expense of the development. The East-West corridor is proposed to cut directly through the Boise Cascade Mill site. The roadway will access this area but does not increase access to the surrounding parcels. The project will maintain exiting access to the surrounding properties through two roundabout intersections on Bravo Company Boulevard. The extensive cleanup necessary is anticipated to be cost prohibitive for redevelopment until improved freeway access is provided.

The City of Yakima has discussed the possibility of developments such as an auto mall, general retail, light industry, an office park, and education facilities (City of Yakima 2017; 2019). While the East-West corridor will provide access to these proposed developments, they are separate proposals, and the East-West corridor's purpose is connecting the City of Yakima and Terrace Heights regardless of any proposed developments. The proposed development is included in the City of Yakima's comprehensive plan and will comply with current zoning and comprehensive planning designations. The zoning designation for the mill site is Regional Development (RD), and the comprehensive plan designation is Regional Commercial (City of Yakima 2017; 2018) (Figure 13).

The potential development of the Boise Cascade Mill site will likely require extensive cleanup of site due to the site's historic use and its status on WSDOE's Confirmed and Suspected Contaminated Sites List (CSCSL) (WSDOE 2021b). The Boise Cascade mill operated as a sawmill and lumber manufacturer from the early 1900s until 2006. During that time there were numerous spills and accumulation of toxic materials with few cleanup efforts (Barr 2019). Currently, the site has confirmed soil contamination from benzene, halogenated solvents, metals, diesel, gasoline, other petroleum products, and polycyclic aromatic hydrocarbons; confirmed groundwater contamination from halogenated solvents and metals; and suspected soil contamination from polychlorinated biphenyls (PCBs) (WSDOE 2021a). Groundwater at the mill site has been measured between 5 and 20 feet BGS and flows towards the Yakima River (Barr 2019). Currently there is nothing stopping harmful contaminants in the groundwater from seeping into the Yakima River and harming listed salmonids. Additionally, the shallow groundwater levels pose a risk of contaminated soil seeping into the soil and eventually into the Yakima River. A complete cleanup of this site would eliminate a source of toxins to the aquatic portion of the action area that has been present for over 100 years and be an overall improvement to the Yakima River habitat for listed salmonids. Besides the beneficial cleanup to the Boise Cascade Mill Site, a development is not anticipated to adversely impact listed species. I-82 runs between the mill site and the Yakima River, so no impacts to river habitat are anticipated. It is anticipated that the site will infiltrate all on-site stormwater as well, so no stormwater impacts to listed species are anticipated.

Chapter 7. Conclusions

7.1. Potential Effects to Listed Species

Potential impacts to listed species are discussed below. A summary of listed species activities along with construction activities is shown in Table 7.

7.1.1. Western U.S. DPS of Yellow-billed Cuckoo

The project "**may affect**" the Western U.S. DPS of yellow-billed cuckoo for the following reasons:

- Potentially suitable nesting habitat exists within the project action area.
- 50 trees greater than 12 inches DBH will be removed from the Yakima River riparian area.
- The project will include construction noise up to 109 dBA.

The project "**is not likely to adversely affect**" yellow-billed cuckoo for the following reasons:

- Yellow-billed cuckoo are functionally extirpated from Washington State.
- There have been no confirmed breeding pairs of yellow-billed cuckoo since the 1930s.
- There have been no confirmed sightings of yellow-billed cuckoo in Yakima County.
- While there is will be riparian trees removed within the project area, it is not anticipated to be suitable nesting habitat due to the sparse, fragmented forested habitat.

7.1.2. U.S.A., Conterminous, Lower 48 States Population of Bull Trout

The project "**may affect**" the U.S.A., conterminous, lower 48 states population of bull trout for the following reasons:

- Bull trout are known to forage within and migrate through the aquatic portion of the action area, though this is less likely during the in-water work window due to high water temperatures.
- Construction of the temporary work bridge and placement of the oscillator will require the installation/removal of 57 steel pipe piles below OHW.
    - Impact pile driving activities will cause injurious sound pressure levels which may result in physical injury and/or behavioral modification to fish during pile installation and removal which is anticipated to occur for an estimated 57 hours for up to 19 days.
    - Vibratory pile driving activities will create sound pressure levels which may result in behavioral modification to fish for approximately 28.5 hours over the span of 19 days.
    - The vibratory installation/removal of temporary piles may produce a temporary increase in sedimentation and/or turbidity levels.
- Increases in sedimentation/turbidity may result during the placement/removal of casings and side channel connections. Sedimentation and turbidity may impact wildlife by reducing in-water visibility, clogging fish's gills, and disturbing aquatic insects and vegetation.

- 3.3 acres of riparian vegetation will be permanently cleared for this project, however 3.1 acres of that will be converted to side channel habitat. 0.3 acres of riparian vegetation will be temporarily cleared and replanted upon completion. This may result in a temporal loss of organic inputs within the aquatic portion of the action area.
- Removal of trees may also result in a temporal decrease in refugia and LWD recruitment.
- The construction of a bridge in a new location will create shading impacts that may result in fewer food sources and available refuges from predators.
- 85 SF of substrate will be permanently impacted below the OHWM by the construction of Pier 2. The new pier within the Yakima River will create a permanent obstacle for migration through the project area.
- Approximately 700 SF of substrate will be temporarily impacted by the placement of steel pipe piles and casings below the OHWM.
- 57,874 SF floodplain work will occur below the existing OHWM.
- Artificial lighting created by the project may result in increased predation to juvenile fish.
- There will be a net increase of 10.15 acres of PGIS in the project area.

The project "**is likely to adversely affect**" bull trout for the following reasons:

- There is the possibility of bull trout migration through the action area during the in-water work window.
- Impact pile driving activities may result in peak SPLs above 190 dB(A) potentially injuring fish.
- During 25-year storms, untreated stormwater may enter the Yakima River which is known to harm and even kill salmonids.
- Possible changes in current flow patterns within the channel and erodibility of the channel created by the new side channels and bridge pier within OHW may affect potential holding/overwintering habitat.

7.1.3. Middle Columbia River Steelhead Trout DPS

The project "**may affect**" the Middle Columbia River DPS of steelhead trout for the following reasons:

- Steelhead trout are known to forage within and migrate through the aquatic portion of the action area.
- Construction of the temporary work bridge and placement of the oscillator will require the installation/removal of 57 steel pipe piles below OHW.
    - Impact pile driving activities will cause injurious sound pressure levels which may result in physical injury and/or behavioral modification to fish during pile installation and removal which is anticipated to occur for an estimated 57 hours for up to 19 days.
    - Vibratory pile driving activities will create sound pressure levels which may result in behavioral modification to fish for approximately 28.5 hours over the span of 19 days.
    - The vibratory installation/removal of temporary piles may produce a temporary increase in sedimentation and/or turbidity levels.

- Increases in sedimentation/turbidity may result during the placement/removal of casings and side channel connections. Sedimentation may impact wildlife by reducing in-water visibility, clogging fish's gills, and disturbing aquatic insects and vegetation.
- 3.3 acres of riparian vegetation will be permanently cleared for this project, however 3.1 acres of that will be converted to side channel habitat. 0.3 acres of riparian vegetation will be temporarily cleared and replanted upon completion. This may result in a temporal loss of organic inputs within the aquatic portion of the action area.
- Removal of trees may also result in a temporal decrease in refugia and LWD recruitment.
- The construction of a bridge in a new location will create shading impacts that may result in fewer food sources and available refuges from predators.
- 85 SF of substrate will be permanently impacted below the OHWM by the construction of Pier 2. The new pier within the Yakima River will create a permanent obstacle for migration through the project area.
- Approximately 700 SF of substrate will be temporarily impacted by the placement of steel pipe piles and casings below the OHWM.
- 57,874 SF floodplain work will occur below the existing OHWM.
- Artificial lighting created by the project may result in increased predation to juvenile fish.
- There will be a net increase of 10.15 acres of PGIS in the project area.

The project "**is likely to adversely affect**" steelhead trout for the following reasons:

- There is the possibility of steelhead trout migration through the action area during the in-water work window, and fish may be present in holding pools.
- Impact pile driving activities may result in peak SPLs above 190 dB(A) potentially injuring fish.
- Possible changes in current flow patterns within the channel and erodibility of the channel created by the new side channels and bridge pier within OHW may affect potential holding/overwintering habitat.
- During 25-year storms, untreated stormwater may enter the Yakima River which is known to harm and even kill salmonids.

7.2. Analysis of Effects to Critical Habitat Primary Constituent Elements

NMFS defines critical habitat as areas that contain PBFs (PCEs) required by a species. PBFs are those physical and biological features of a landscape that a species needs to survive.

7.2.1. Designated Critical Habitat for the U.S.A., Conterminous, Lower 48 States Population of Bull Trout

The following discussion addresses the nine essential PBFs for designated bull trout critical habitat and the associated assessment for each element.

- *Springs, seeps, groundwater sources, and subsurface water connectivity to contribute to water quality and quality and provide thermal refugia:*

  No such features are located within the aquatic portion of the action area; therefore, none will be affected by the proposed project activities.

- *Migratory habitats with minimal physical, biological, or water quality impediments between spawning, rearing, overwintering, and freshwater and marine foraging habitats, including but not limited to permanent, partial, intermittent, or seasonal barriers.*

  The project proposes to install three piers, for the bridge over the Yakima River, within the river which may affect channel morphology. Only one of these piers will be below the OHWM while the other two will be above the OHWM on a gravel bar. This pier will create an obstacle in the channel. Floodplain mitigation will also alter flow patterns by reducing velocities, reduce constrictions and channel incision, increase sediment availability, and distribute floodwaters more evenly across the floodplain. Possible changes in current flow patterns within the channel and erodibility of the channel 'may impact' potential holding/overwintering habitat.

- *An abundant food base, including terrestrial organisms of riparian origin, aquatic macroinvertebrates, and forage fish.*

  The proposed project 'may impact' food sources within the aquatic portion of the action area.

- *Complex river, stream, lake, reservoir, and marine shoreline aquatic environments and processes that establish and maintain these aquatic environmental, with features such as large wood, side channels, pools, undercut banks, and unembedded substrates, to provide a variety of depths, gradients, velocities, and structure.*

  The project 'may impact' natural cover such as submerged and overhanging large wood as well as substrate within the aquatic portion of the action area. The placement of piers may result in loss of substrate and effect channel morphology.

- *Water temperatures ranging from 2 to 15°C (36 to 59°F), with adequate thermal refugia available for temperatures that exceed the upper end of this range. Specific temperatures in this range will depend on bull trout life-history stage and form; geography; elevation; diurnal and seasonal variation; shading; such as that provided by riparian habitat; streamflow; and local groundwater influence.*

  The proposed project 'may impact' temperatures within the aquatic portion of the action area due to alterations to riparian vegetation.

- *In spawning and rearing areas, substrate of sufficient amount, size, and composition to ensure success of egg and embryo overwinter survival, fry emergence, and young-of-the-year and juvenile survival. A minimal amount of fine sediment, generally ranging in size from silt to coarse sand, embedded in larger substrates, is characteristic of these conditions. The size and amounts of fine sediment suitable to bull trout will vary from system to system.*

  Spawning and rearing habitat is present within the action area, however bull trout are not documented spawning or rearing in this section of the Yakima River so this project will not affect spawning or rearing areas.

- *A natural hydrograph, including peak, high, low, and base flows within historical and seasonal ranges or, if flows are controlled, they minimize departures from a natural hydrograph.*

  The proposed project is not anticipated to affect the natural hydrograph within the aquatic portion of the action area.

- *Sufficient water quality and quantity such that normal reproduction, growth, and survival are not inhibited.*

  Possible impacts to water quality during construction are temporary and are not anticipated to impact bull trout critical habitat as any increases in sedimentation/turbidity will dissipate within the aquatic portion of the action area prior the dispersion of the thermal barrier. Despite treating stormwater runoff using preferred treatment BMPs, some untreated discharges are expected over the life of the project during extreme weather events. Although improvements are expected over current conditions, the project would reduce water quality due to this runoff that may be harmful.

- *Sufficiently low levels of occurrence of nonnative predatory (e.g., lake trout, walleye, northern pike, smallmouth bass); interbreeding (e.g. brook trout); or competing (e.g. brown trout) species that, if present, are adequately temporally and spatially isolated from bull trout.*

  The proposed project is not anticipated to affect the occurrence of nonnative predatory, interbreeding or competing species within the aquatic portion of the action area.

The Yakima River is designated critical habitat for the U.S.A., conterminous, lower 48 States population of bull trout. The project will require some in-water work. The in-water work area is not within, nor does it directly abut any bull trout spawning or rearing habitat; however, it does include migration habitat.

The project "**may affect**" listed critical habitat for the U.S.A., conterminous, lower 48 states population of bull trout for the following reasons:

- 3.3 acres of riparian vegetation will be permanently cleared for this project, however 3.1 acres of that will be converted to side channel habitat. 0.3 acres of riparian vegetation will be temporarily cleared and replanted upon completion. In order to minimize these impacts felled trees will be placed along the banks of the Yakima River and twenty trees will be planted on the northeast bank downstream of the bridge.
- Shading impacts may result in fewer food sources and available refuges from predators particularly on the eastern bank. However, this impact is thought to be insignificant as this area is generally in the dry (being inundated only when the river reaches OHWM) and when inundated affects less than 1 percent of the habitat in the aquatic portion of the action area.
- 57,874 SF floodplain work will occur below the existing OHWM but will ultimately improve habitat quality within the action area.
- The placement of one pier below OHWM and 2 piers on a gravel bar within the Yakima River as well as floodplain mitigation may affect channel morphology. While possible changes in current flow patterns within the river and erodibility of the channel may affect the channel bottom the aquatic portion of the action area is used only as a migration corridor so affects are anticipated to be insignificant.
- There will be a net increase of 7.94 acres of impervious surface in the project area.

The project "**is likely to adversely affect**" listed critical habitat for the U.S.A., conterminous, lower 48 States population of bull trout for the following reasons:

- Removal of riparian vegetation may result in a temporal loss of organic inputs within the aquatic portion of the action area. Removal of trees will result in a temporal decrease in refugia and LWD recruitment.
- During 25-year storms, untreated stormwater may enter the Yakima River which is known to harm and even kill salmonids.
- The proposed project will temporarily impact 700 SF of substrate for the placement of steel pipe piles and casings and permanently impact 85 SF square feet of substrate for the in-water pier for the proposed Yakima River bridge.

7.2.2. Designated Critical Habitat for the DPS of Middle Columbia River Steelhead Trout

The following discussion addresses the six essential PBFs (PCEs) for steelhead trout critical habitat and the associated assessment for each element.

- *Freshwater spawning sites with water quantity and quality conditions and substrate supporting spawning, incubation, and larval development.*

  No spawning habitat is located within the aquatic portion of the action area; therefore, none will be affected by the proposed project activities.

- *Freshwater rearing sites with water quantity and floodplain connectivity to form and maintain physical habitat conditions and support juvenile growth and mobility; water quality and forage supporting juvenile development; and natural cover such as shade, submerged and overhanging large wood, log jams and beaver dams, aquatic vegetation, large rocks and boulders, side channels, and undercut banks.*

  No rearing habitat is located within the aquatic portion of the action area; therefore, none will be affected by the proposed project activities.

- *Freshwater migration corridors free of obstruction with water quantity and quality conditions and natural cover such as submerged and overhanging large wood, aquatic vegetation, large rocks and boulders, side channels, and undercut banks supporting juvenile and adult mobility and survival.*

  The project 'may impact' water quality/quantity and natural cover such as submerged and overhanging large wood for steelhead trout. The placement of piers and floodplain mitigation may affect channel morphology. The pier may result in loss of substrate.

  Despite treating stormwater runoff using preferred treatment BMPs, some untreated discharges are expected over the life of the project during extreme weather events.

  Although improvements are expected over current conditions, the project would reduce water quality due to this runoff that may be harmful.

- The final three PBFs pertain to *offshore, nearshore and estuarine habitat* which does not exist in the project action area.

The Yakima River is designated as critical habitat for the Middle Columbia River DPS of steelhead trout. The project will require some in-water work. The in-water work area is not within, nor does it directly abut any steelhead spawning or rearing habitat; however, it does include migration habitat.

The project "**may affect**" listed critical habitat for the Middle Columbia River DPS of steelhead trout for the following reasons:

- 3.3 acres of riparian vegetation will be permanently cleared for this project, however 3.1 acres of that will be converted to side channel habitat. 0.3 acres of riparian vegetation will be temporarily cleared and replanted upon completion. In order to minimize these impacts felled trees will be placed along the banks of the Yakima River and twenty trees will be planted on the northeast bank downstream of the bridge.
- Shading impacts may result in fewer food sources and available refuges from predators particularly on the eastern bank. However, this impact is thought to be insignificant as this area is generally in the dry (being inundated only when the river reaches OHWM) and when inundated affects less than 1 percent of the habitat in the aquatic portion of the action area.
- 57,874 SF floodplain work will occur below the existing OHWM but will ultimately improve habitat quality within the action area.
- The placement of one pier below OHWM and 2 piers on a gravel bar within the Yakima River as well as floodplain mitigation may affect channel morphology. While possible changes in current flow patterns within the river and erodibility of the channel may affect the channel bottom
- The installation/removal of pilings may temporarily increase the levels of sedimentation/turbidity from the bridge to the area 300 feet downstream.

The project "**is likely to adversely affect**" listed critical habitat for the DPS of Middle Columbia River steelhead trout for the following reasons:

- Removal of riparian vegetation may result in a temporal loss of organic inputs within the aquatic portion of the action area. Removal of trees will result in a temporal decrease in refugia and LWD recruitment.
- During 25-year storms, untreated stormwater may enter the Yakima River which is known to harm and even kill salmonids.
- The proposed project will temporarily impact 700 SF of substrate for the placement of steel pipe piles and casings and permanently impact 85 SF square feet of substrate for the in-water pier for the proposed Yakima River bridge.
- Possible changes in current flow patterns within the channel and erodibility of the channel created by the new side channels and bridge pier within OHW may affect potential holding/overwintering habitat.

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Appendix A. Essential Fish Habitat

East-West Corridor Project

Assessment of Effects on Essential Fish Habitat for Coho and Chinook Salmon: as protected under the Magnuson-Stevens Fishery Conservation and Management Act (as amended 2007)

Lower Yakima River - Yakima County, Washington State

The Magnuson-Stevens Fishery Conservation and Management Act (MSA) includes a mandate that NMFS must identify essential fish habitat (EFH) for federally managed marine fishes, and federal agencies must consult with NMFS on all activities, or proposed activities, authorized, funded, or undertaken by the agency that may adversely affect EFH (NMFS 2007). The Pacific Fisheries Management Council (PFMC) has designated EFH for the Pacific salmon fishery in this tributary of the Columbia River (PFMC 2014).

The Pacific salmon management unit within the Lower Yakima River includes Chinook (*Oncorhynchus tshawytscha*), and Coho salmon (*Oncorhynchus kisutch).* Salmon need freshwater habitat that includes cool, clean water of appropriate water depth and flows, upland and riparian vegetation to stabilize soil and provide shade, clean gravel for spawning and egg-rearing, large woody debris to provide resting and hiding places, adequate food, and pool-riffle complexes (King County 2000).

Spawning Chinook salmon prefer waters 20 to 30 inches in depth, with water velocities of over 3-ft per second, gravels 1 to 4 inches in diameter and temperatures ranging from 42°F to 60.8°F. Rearing Chinook salmon prefer waters less than 4 feet deep with temperatures ranging from 53°F to 73°F. During the spring, juvenile fish primarily concentrate in backwater areas such as side channels and in the main channel at the edges of the channel where velocities are lower. During the winter, the fish move to deeper water in the main channel and shelter in the interstitial spaces in the substrate of the channel bed. Side channels provide important places for both rearing and refuge during flood events (King County 2000).

Spawning Coho salmon prefer waters 4 to 8 inches in depth, with water velocities of less than 1-ft per second, gravels 0.5 to 5.5 inches in diameter with < 30 percent fines and temperatures ranging from 42°F to 56°F (Reeves et al. 1989; Mills et al. 2004). Rearing Chinook salmon prefer waters greater than 30 inches deep with water velocities of less than 1-ft per second, and temperatures ranging from 45°F to 68°F (Reeves et al. 1989).

WDFW lists the aquatic portion of the action area as being documented spawning habitat for Fall Chinook and documented rearing habitat for Spring Chinook. Coho are only documented as using the aquatic portion of the action area for migration (WDFW 2018). Fall Chinook migrate upstream to spawning grounds mid-October through late November and out-migrate April though late June. Spring Chinook migrate upstream to spawning grounds March through late May. Emergence and downstream migration to as far as Prosser (over 65 miles downstream of the aquatic portion of the action area) occurs March through mid-June. Few juveniles are found below the Naches River in the summer. Spring Chinook rear upstream of Prosser throughout the

summer with a second migration occurring in late October. At this time juveniles move into the aquatic portion of the action area to overwinter. Outmigration occurs March through late June of the following year (Lichatowich and Mobrand 1995). There is a possibility that rearing Chinook salmon could occur within the aquatic action area during the time of in-water work (July 15 to February 1).

Coho salmon spawning habitat exists 5 miles upstream of the aquatic portion of the action area in several tributaries of the Naches River (WDFW 2018). The aquatic portion of the action area is only utilized for migration by Coho salmon. Coho salmon migrate upstream to spawning grounds October through November, spawn in November and December, rear in freshwater for 1 year, and migrate downstream April through June (Hubble et al. 2004). There is a possibility that migrating Coho salmon could occur within the aquatic action area during the time of in-water work (July 15 to February 1).

Essential fish habitat for the Pacific salmon fishery is present in the aquatic portion of the action area. Conservation measures will be in place such as: implementation of erosion control best management practices, a Spill Prevention Control and Countermeasures Plan, and a Stormwater Pollution Prevention Plan. 3.3 acres of riparian vegetation will be permanently cleared for this project, however 3.1 acres of that will be converted to side channel habitat. 0.3 acres of riparian vegetation will be temporarily cleared and replanted upon completion. In order to minimize these impacts felled trees will be placed along the banks of the Yakima River and twenty trees will be planted on the northeast bank downstream of the bridge. The removal of this vegetation may result in a temporary decrease in large woody debris (LWD) recruitment. This vegetation loss could also result in a temporary loss of refugia within the aquatic portion of the action area. In order to minimize these impacts, felled trees will be placed along the banks of the Yakima River and twenty trees will be planted on the northeastern bank downstream of the bridge. The loss of trees may also result in a temporary loss of organic inputs within the aquatic portion of the action area. However, the twenty planted trees will not only minimize this impact but also increase organic inputs the area receives in the future.

The project will temporarily impact 700 square feet (SF) of substrate for the placement of piles and casings and permanently impact 85 square feet of substrate for the placement of one pier below the OHWM for the Yakima River bridge. The installation of drilled shafts within the river and the floodplain mitigation may affect channel morphology. Possible changes in current flow patterns created within the channel and erodibility of the channel may affect potential overwintering habitat. 57,874 SF floodplain work will occur below the existing OHWM, but this work will ultimately improve habitat quality.

During 25-year or greater storm events, untreated stormwater may enter the Yakima River. Untreated stormwater has been known to harm and even kill salmonids.

While any impacts to EFH are likely to be minimal the project **“may adversely affect”** freshwater EFH for the Pacific Salmon Fishery.

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Appendix B. Stormwater Treatment Plans

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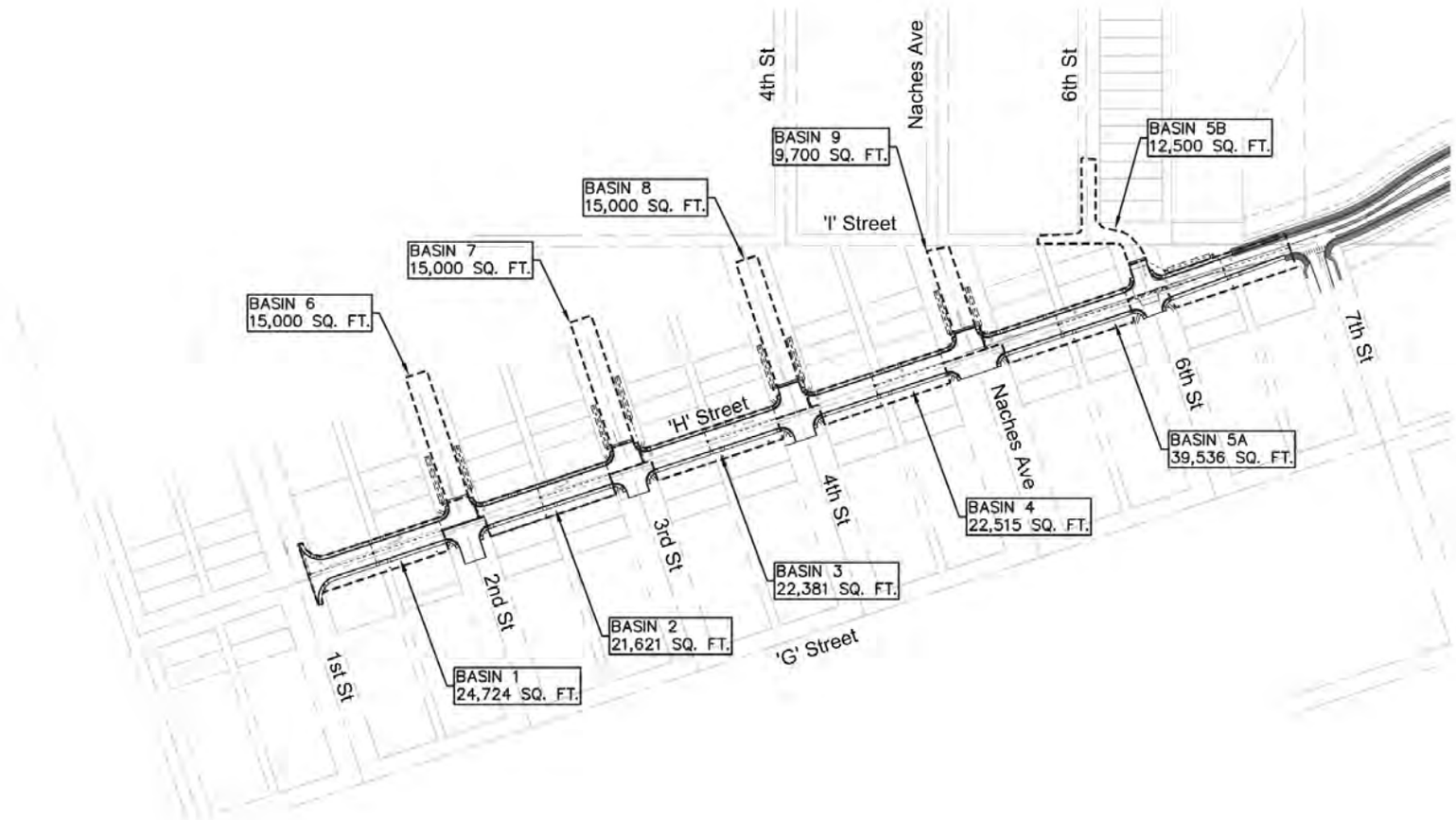

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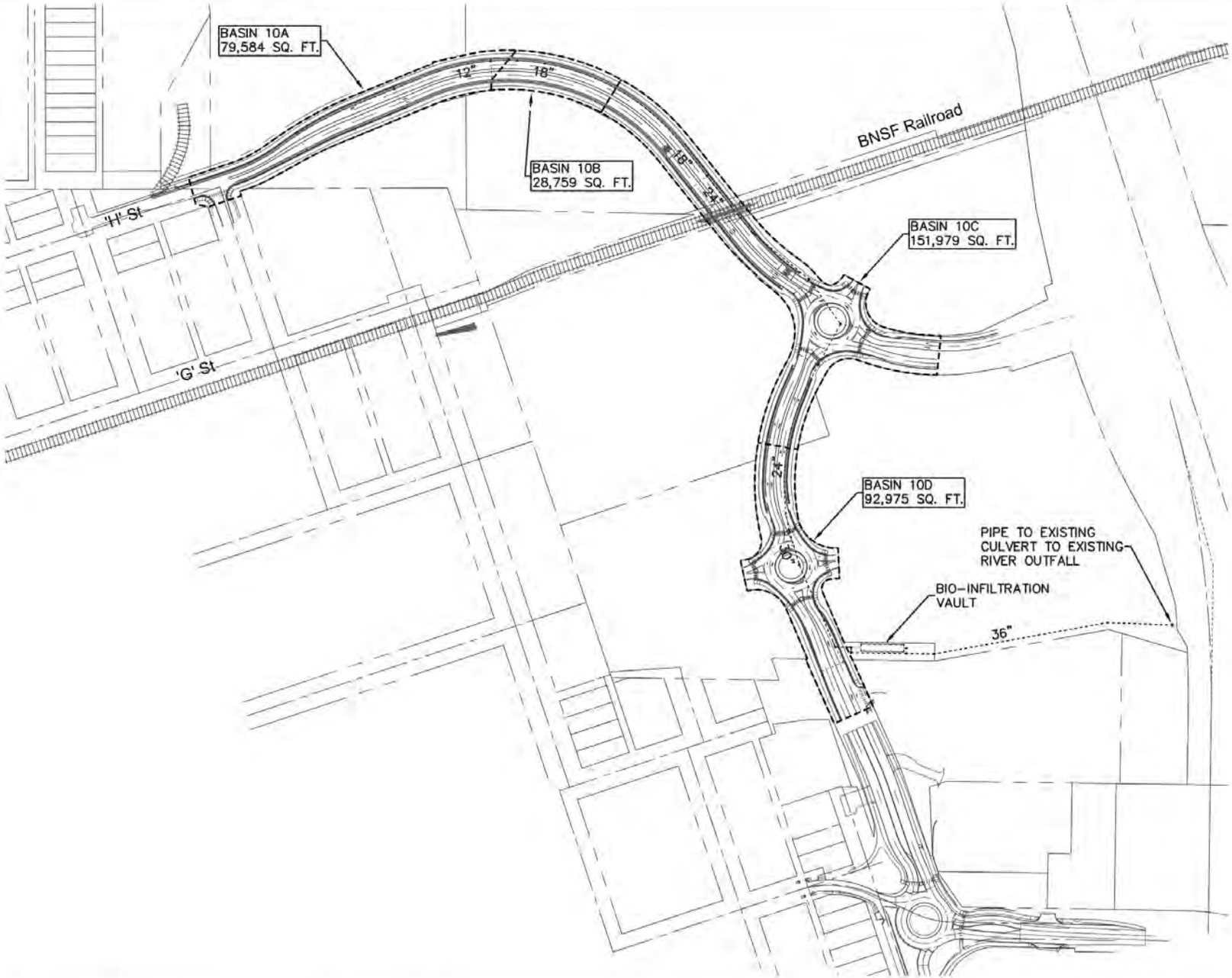
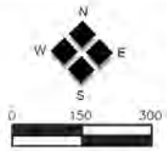
REVISION	DATE

JOB NUMBER: 11105	DATE: 5-17-22
FILE NAMES:	
DRAWING:	drainage-map.dwg
PLAN:	11105.dwg
DESIGNED BY:	TDA
ENTERED BY:	AJH

EAST H STREET (PHASE 4)
DRAINAGE BASIN MAP





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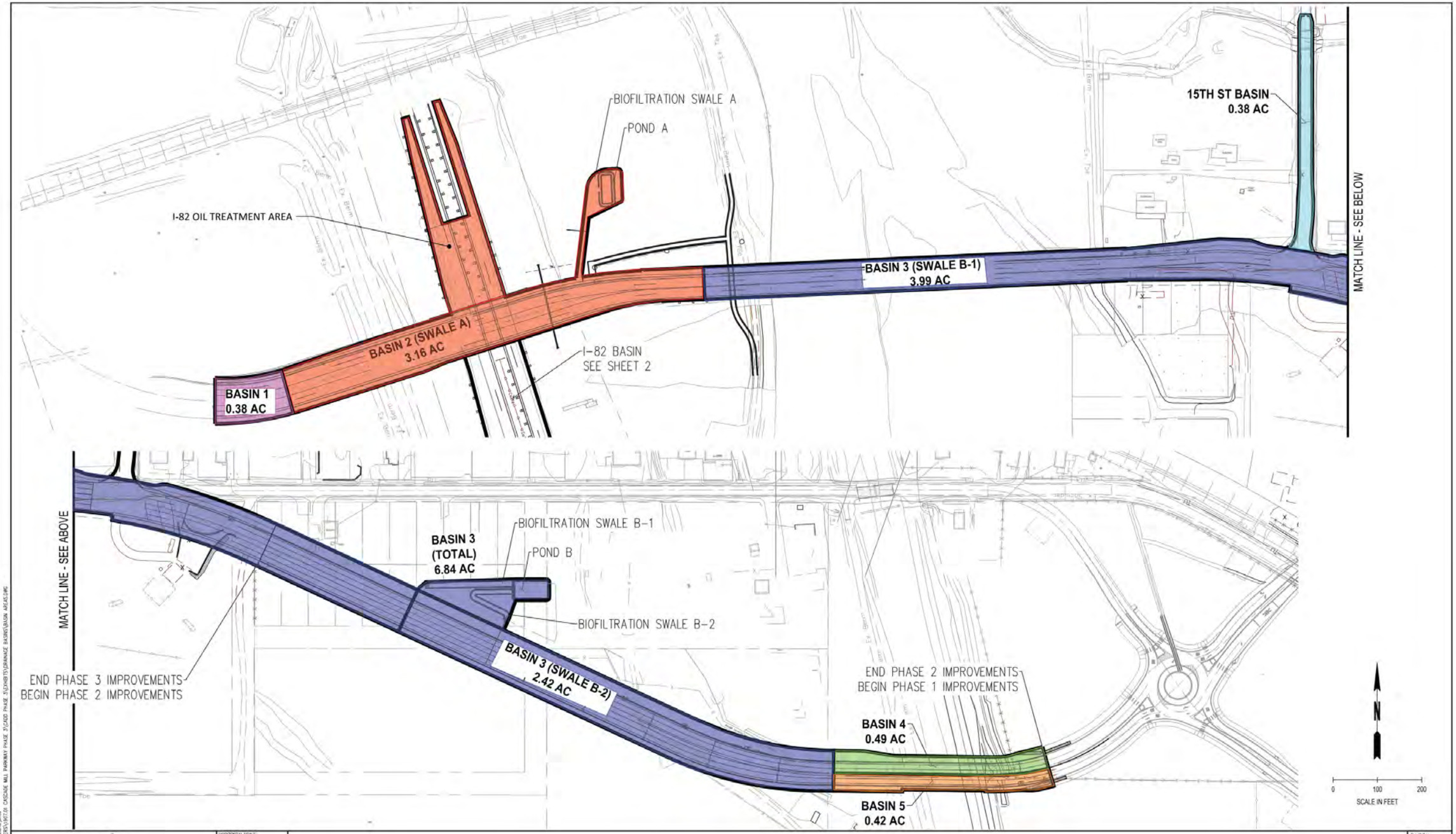
REVISION	DATE

JOB NUMBER: 11062	DATE: 5-17-22
FILE NAMES:	
DRAWING:	Drainage Map Alt.dwg
PLAN:	/Widmer
DESIGNED BY:	TOA
ENTERED BY:	AJH

BRAVO COMPANY BOULEVARD (PHASE 4)
DRAINAGE BASIN MAP



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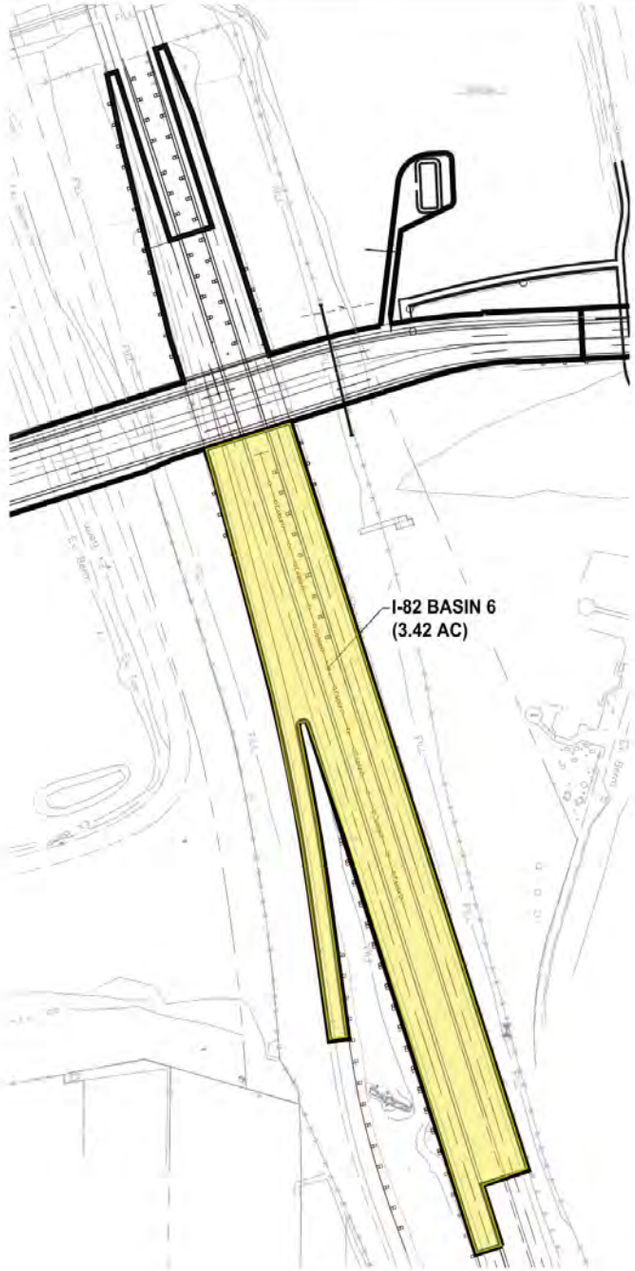
25 N WENATCHEE AVE., SUITE 238, WENATCHEE, WA 98801
P: 509.886.3265 F: 360.352.1509
SCJALLIANCE.COM

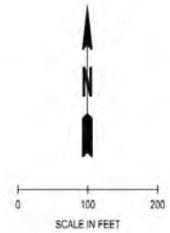
HORIZONTAL SCALE:	1"=100'
DATE:	APRIL 2022
JOB No.:	1907.01
DRAWING FILE No.:	xxxxxxxx.dwg

PHASE 2 & 3
DRAINAGE BASIN MAP

EXHIBIT No:
FIG. 3-1

SHEET No:
1 OF 2





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HORIZONTAL SCALE:	1"=100'
DATE:	APRIL 2022
JOB No:	1907.01
DRAWING FILE No:	xxxxxxxx.dwg

I-82 (PHASE 3)
DRAINAGE BASIN MAP

EXHIBIT No:	FIG. 3-2
SHEET No:	2 OF 2

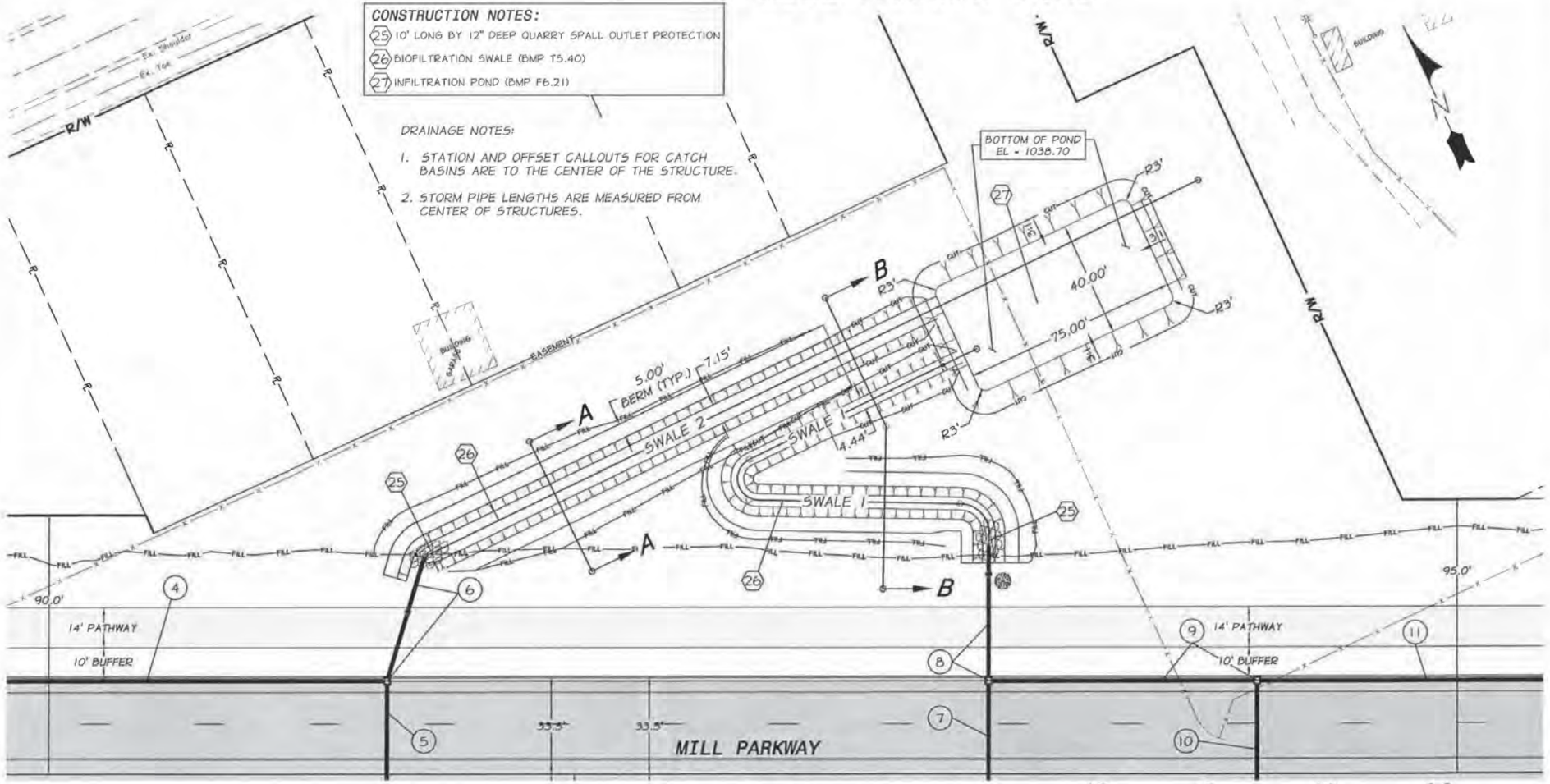
MILL PARKWAY POND

CONSTRUCTION NOTES:

25. 10' LONG BY 12" DEEP QUARRY SPALL OUTLET PROTECTION
26. BIOFILTRATION SWALE (BMP T5.40)
27. INFILTRATION POND (BMP F6.21)

DRAINAGE NOTES:

1. STATION AND OFFSET CALLOUTS FOR CATCH BASINS ARE TO THE CENTER OF THE STRUCTURE.
2. STORM PIPE LENGTHS ARE MEASURED FROM CENTER OF STRUCTURES.



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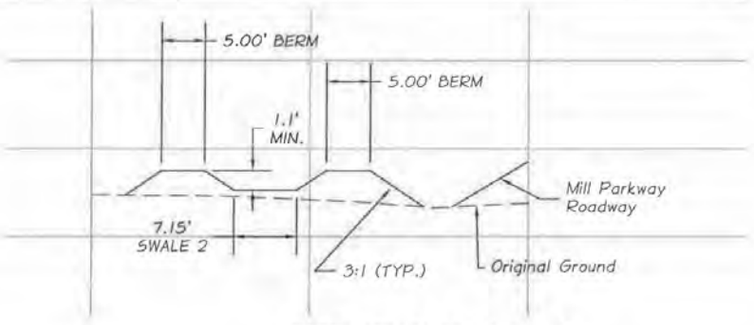
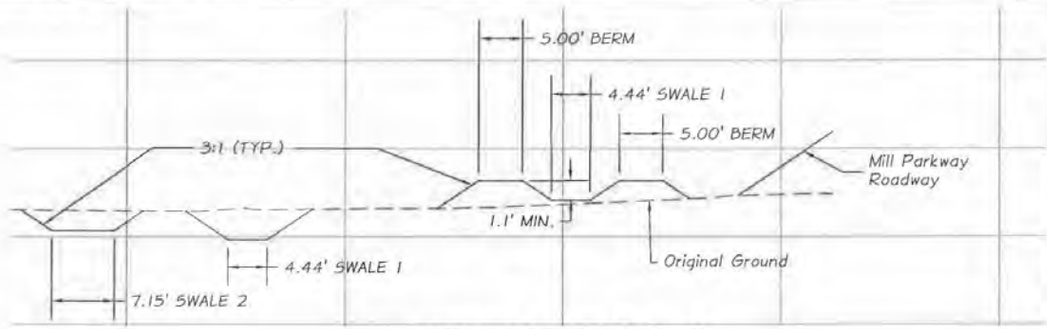


TYP. SECTION A–A

NTS



TYP. SECTION B–B

NTS

YAKIMA COUNTY

MILL PARKWAY PHASE 2 IMPROVEMENT PROJECT

PROJECT NO. 3446-2

PREPARED UNDER THE DIRECTION OF:

60% REVIEW PLANS

COUNTY ENGINEER
DATE:

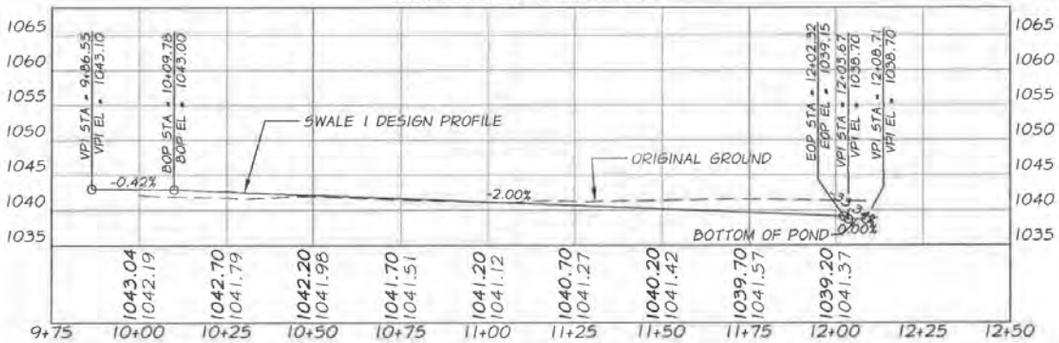
PROJECT ENGINEER:
KIM PFAFF

DRAWN:	CHECKED BY:
J. MATTHEWS	BRETT SHEFFIELD

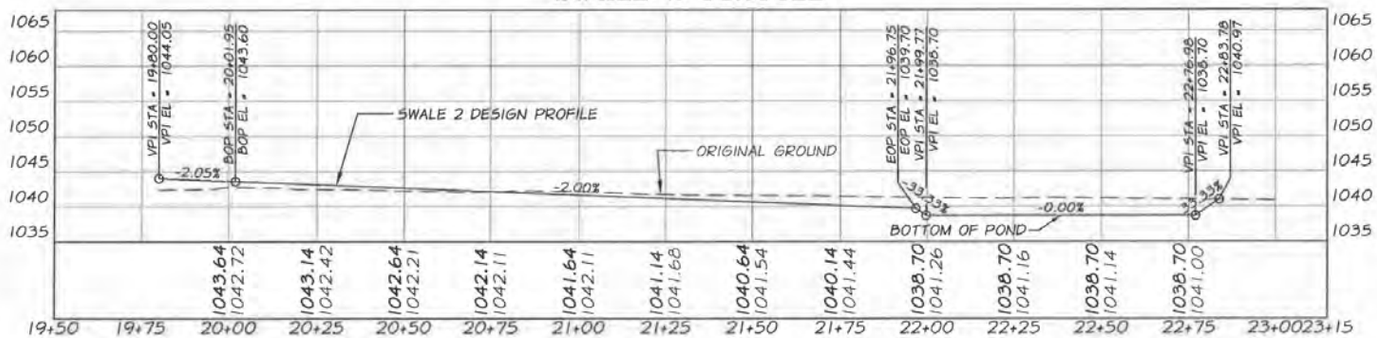
REVISION:

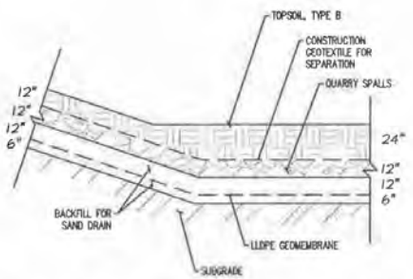
Phase 2 Infiltration Pond Plan & Profile

SWALE 1 PROFILE



SWALE 2 PROFILE





POND SIDE SLOPE & BOTTOM SECTION DETAIL

NTS

YAKIMA COUNTY

MILL PARKWAY PHASE 2 IMPROVEMENT PROJECT

PROJECT NO. 3446-2

PREPARED UNDER THE DIRECTION OF:

60% REVIEW PLANS

COUNTY ENGINEER
DATE:

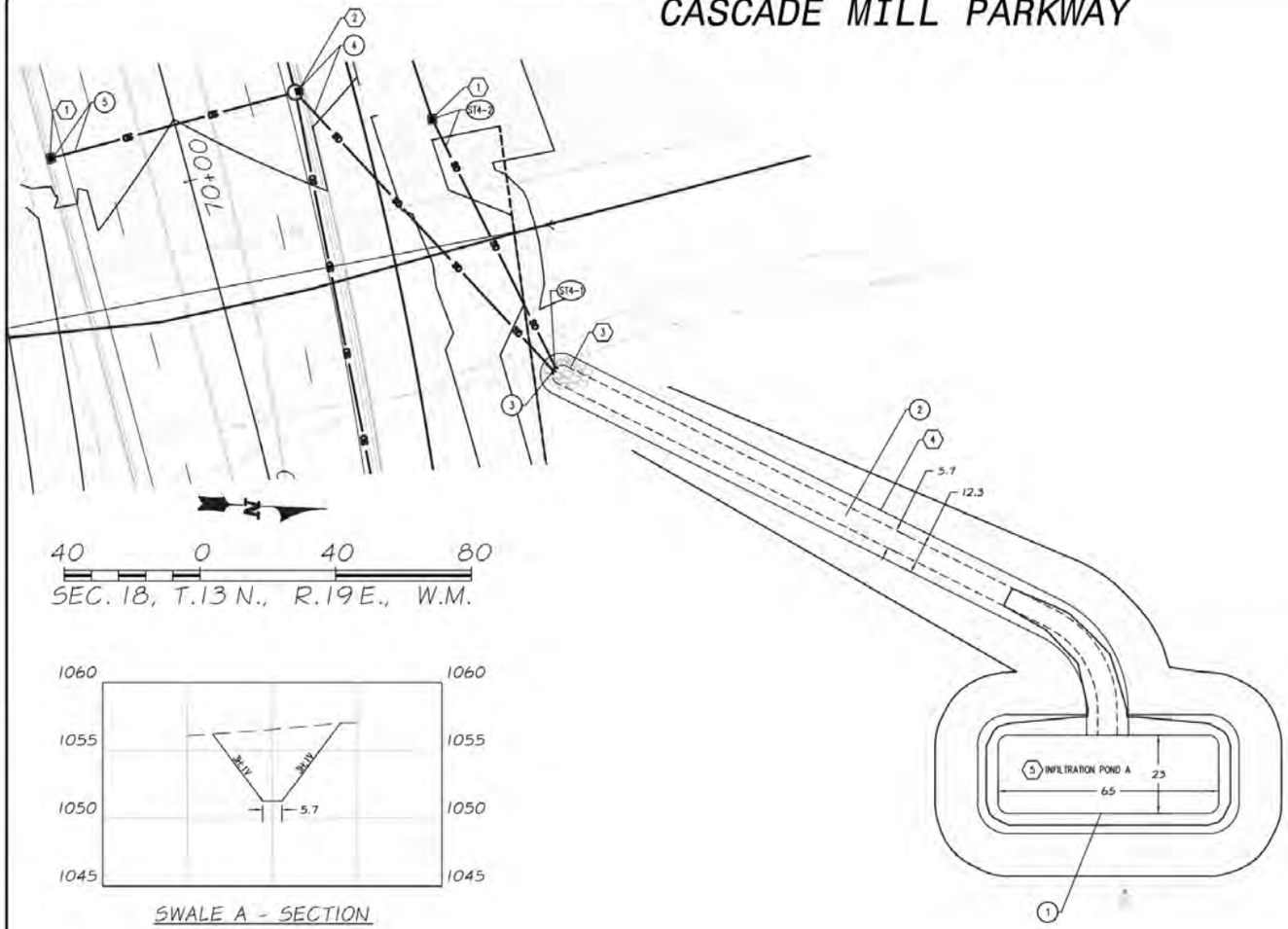
PROJECT ENGINEER:
KIM PFAFF

DRAWN:	CHECKED BY:
J. MATTHEWS	BRETT SHEFFIELD

REVISION:

Phase 2 Swale Profile

CASCADE MILL PARKWAY

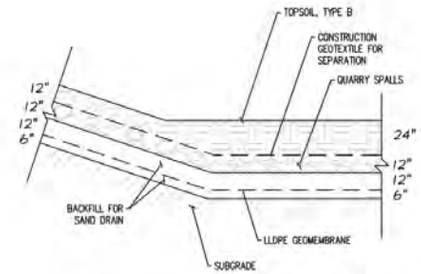


CONSTRUCTION NOTES

1. CATCH BASIN TYPE 1 PER YAKIMA COUNTY STANDARD PLAN D-1.
2. CATCH BASIN TYPE 2 PER YAKIMA COUNTY STANDARD PLAN D-2.
3. 10' LONG BY 12" DEEP QUARRY SPALL OUTLET PROTECTION.
4. BIOFILTRATION SWALE (BMP T5.40).
5. INFILTRATION POND (BMP F6.21).
6. CONNECT TRENCH DRAIN FROM BRIDGE, SEE LOCHNER SHEET XXX.

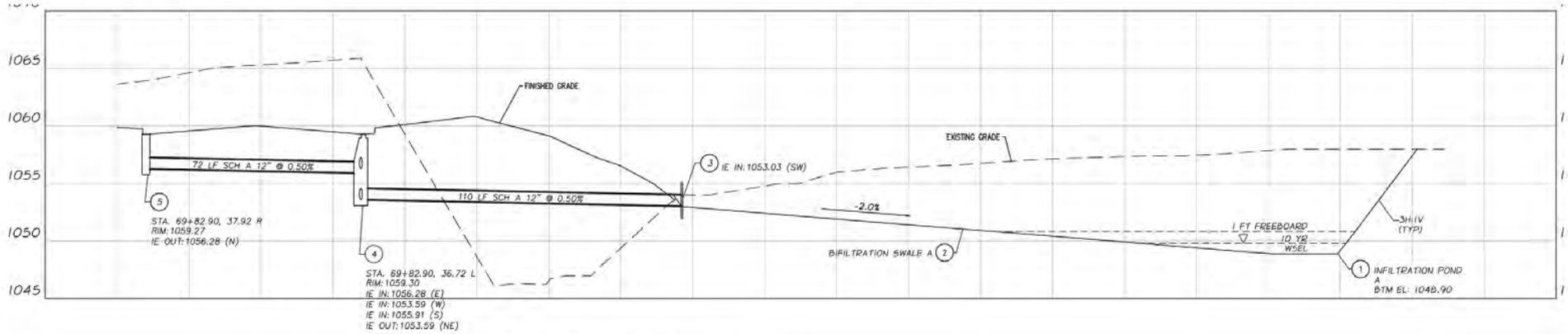
DRAINAGE NOTES:

1. STATION AND OFFSET CALLOUTS FOR CATCH BASINS ARE TO THE CENTER OF THE STRUCTURE.
2. STORM PIPE LENGTHS ARE MEASURED FROM CENTER OF STRUCTURES.



POND SIDE SLOPE & BOTTOM SECTION DETAIL

SWALE A - SECTION



69+82 CROSSING & SWALE A

YAKIMA COUNTY

MILL PARKWAY PHASE 3 IMPROVEMENT PROJECT

PREPARED UNDER THE DIRECTION OF:

60% REVIEW PLANS

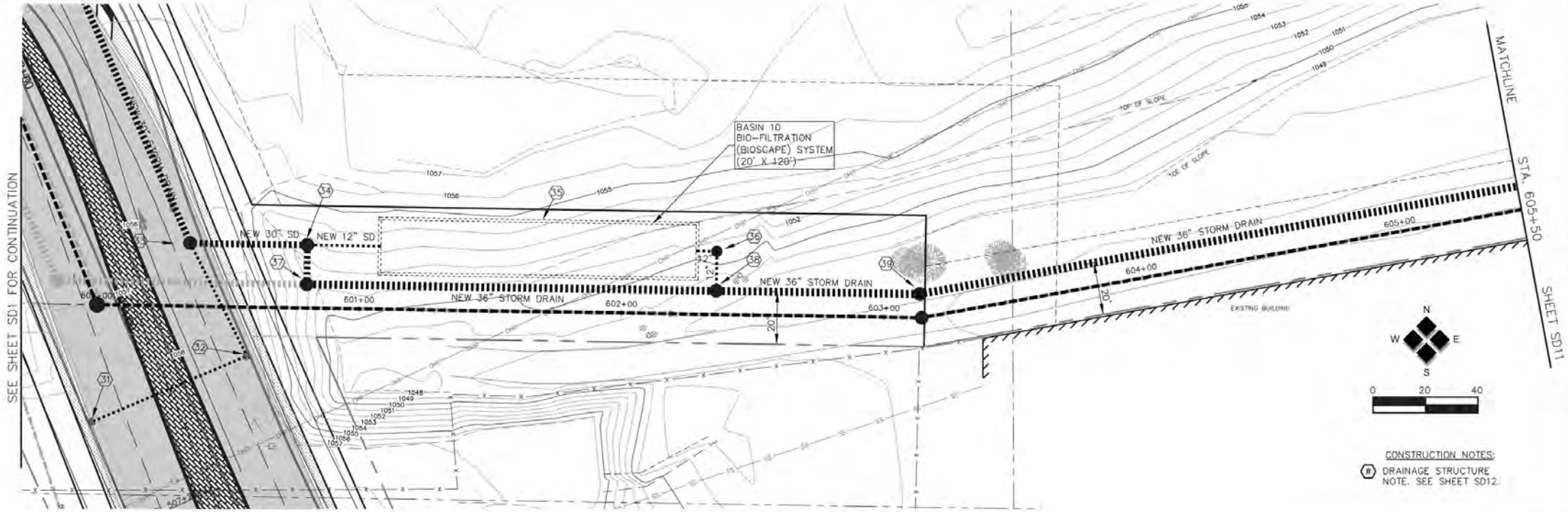
COUNTY ENGINEER
DATE:

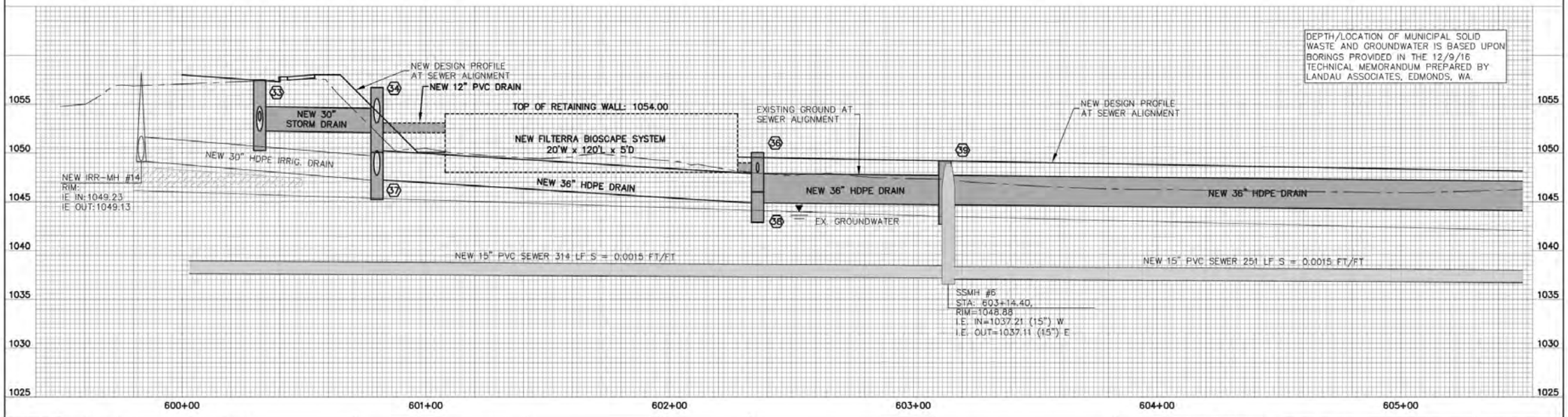
PROJECT ENGINEER:
D JONES

DRAWN:	CHECKED BY:
G MEHALL	D IRELAND

REVISION:

Phase 3 Pond & Swale Plan & profile





NO.	DATE	BY	APPR.	REVISIONS

APPROVED FOR CONSTRUCTION

ENGINEERING MANAGER DATE

PROJECT MANAGER DATE

PROJECT ENGINEER DATE

DESIGNED BY DATE

DRAWN BY DATE

CHECKED BY DATE

APPROVED BY DATE

FILENAME: sheets-drainage.dwg

PRELIMINARY
NOT FOR CONSTRUCTION

LOCHNER

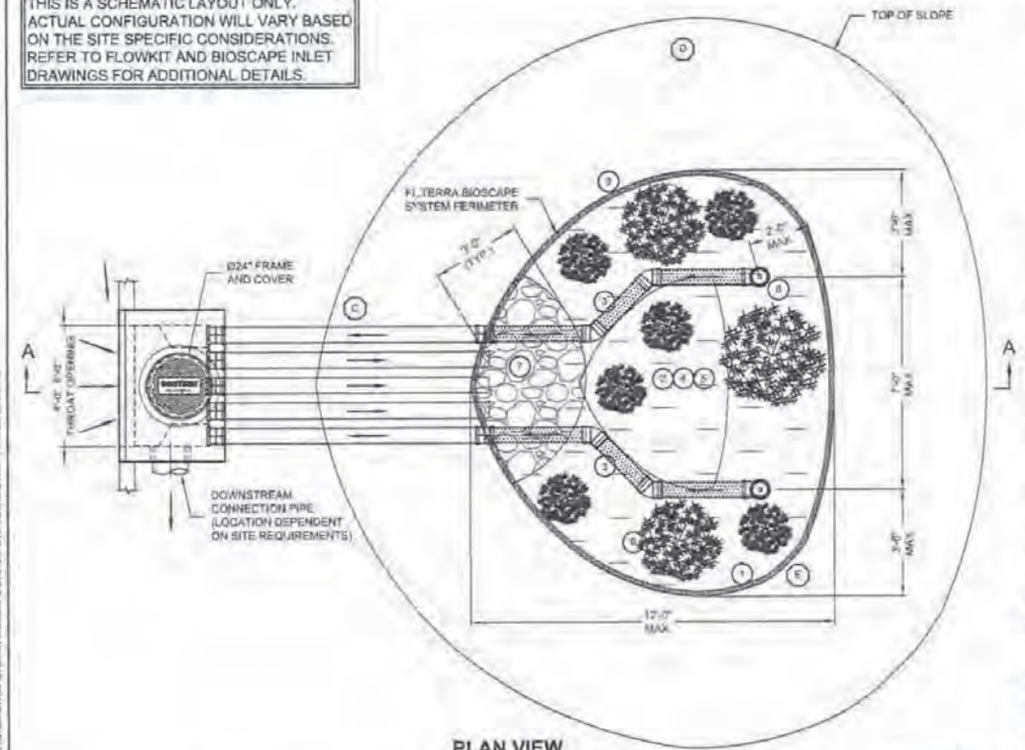
HLA Engineering and Land Surveying, Inc.

Bravo Company Boulevard (Phase 4) Bioscape Plan & Profile

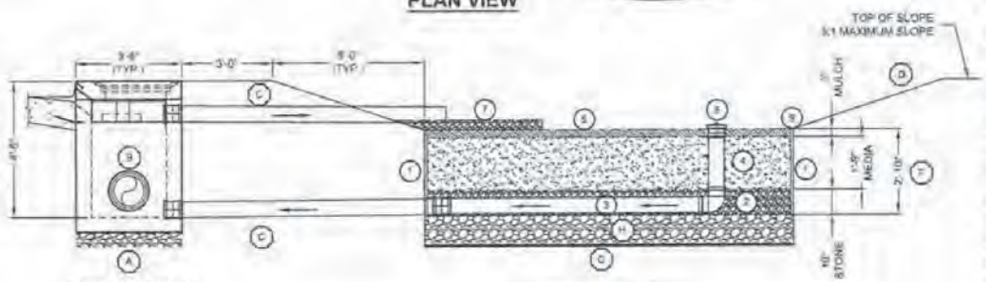
DRAWING NUMBER

SHT -*- OF -*-

THIS IS A SCHEMATIC LAYOUT ONLY. ACTUAL CONFIGURATION WILL VARY BASED ON THE SITE SPECIFIC CONSIDERATIONS. REFER TO FLOWKIT AND BIOSCAPE INLET DRAWINGS FOR ADDITIONAL DETAILS.



PLAN VIEW



BIOSCAPE INLET STRUCTURE

FILTERRA BIOSCAPE SYSTEM

SECTION A-A VIEW

BILL OF MATERIALS		
COUNT	DESCRIPTION	INSTALLED BY
XX	FILTERRA SURFACE AREA (SF)	CONTECH
XX	MULCH VOLUME (CY)	CONTECH
21	FILTERRA MEDIA DEPTH (IN)	CONTECH
XX	FILTERRA MEDIA VOLUME (CY)	CONTECH
X	1/2" Ø4 ROUND AGGREGATE UNDERDRAIN STONE (CY)	CONTECH
X	EROSION CONTROL (LF)	CONTECH
X	FILTERRA FLOWKIT	CONTECH

PLANTING SCHEDULE	
QUANTITY	FILTERRA BIOSCAPE SYSTEM PLANT PALETTE

GENERAL NOTES

1. CONTRACTOR SHALL CONTACT CONTECH TO COORDINATE DELIVERY AND INSTALLATION OF FILTERRA BIOSCAPE SYSTEM. CONTRACTOR SHALL COMPLETE ITEMS IN THE LIST OF CONTRACTOR INSTALLATION RESPONSIBILITIES LISTED ON THIS DETAIL BEFORE CONTECH'S REPRESENTATIVE COMPLETES/ACTIVATES THE FILTERRA BIOSCAPE SYSTEM
2. PERFORM FILTERRA BIOSCAPE SYSTEM EXCAVATION ONLY AFTER ALL THE CONTRIBUTING DRAINAGE AREAS ARE PERMANENTLY STABILIZED. DO NOT CONSTRUCT FILTERRA BIOSCAPE SYSTEM IN AN AREA PREVIOUSLY USED AS EROSION AND SEDIMENT CONTROL FACILITIES. DO NOT STOCKPILE MATERIALS NOR STORE EQUIPMENT IN THIS AREA
3. USE METHODS OF EXCAVATION THAT MINIMIZE COMPACTION OF THE UNDERLYING SOIL UNLESS THE SYSTEM IS TO BE LINED
4. CONTRACTOR SHALL COORDINATE WITH CONTECH BEFORE THE FILTERRA BIOSCAPE SYSTEM IS EXCAVATED TO MINIMIZE TIME BETWEEN EXCAVATION AND COMPLETION OF THE FILTERRA BIOSCAPE SYSTEM. ANY STANDING WATER THAT ACCUMULATES IN THE EXCAVATED AREA MUST BE REMOVED BY THE CONTRACTOR BEFORE CONTECH CAN COMPLETE THE FILTERRA BIOSCAPE SYSTEM. ANY ADDITIONAL EXCAVATION WILL BE THE RESPONSIBILITY OF THE CONTRACTOR
5. CONTRACTOR SHALL PROVIDE ACCESS TO THE EXCAVATED AREA(S) FOR CONTECH TO UTILIZE DURING THE COMPLETION OF THE FILTERRA BIOSCAPE SYSTEM(S). ACCESS SHALL NOT PROHIBIT LIGHT DUTY EQUIPMENT THAT MAY BE USED TO INSTALL THE COMPONENTS (STONE, MEDIA, ETC). THE CONTRACTOR SHALL BE RESPONSIBLE FOR ANY RE-STABILIZATION THAT MAY BE REQUIRED AFTER THE FILTERRA BIOSCAPE SYSTEM INSTALLATION/ACTIVATION
6. CONTECH AND/OR ITS REPRESENTATIVES SHALL BE RESPONSIBLE FOR THE LIST ENTITLED CONTECH INSTALLATION RESPONSIBILITIES

CONTRACTOR INSTALLATION RESPONSIBILITIES AS DENOTED BY (X) ON THIS DETAIL

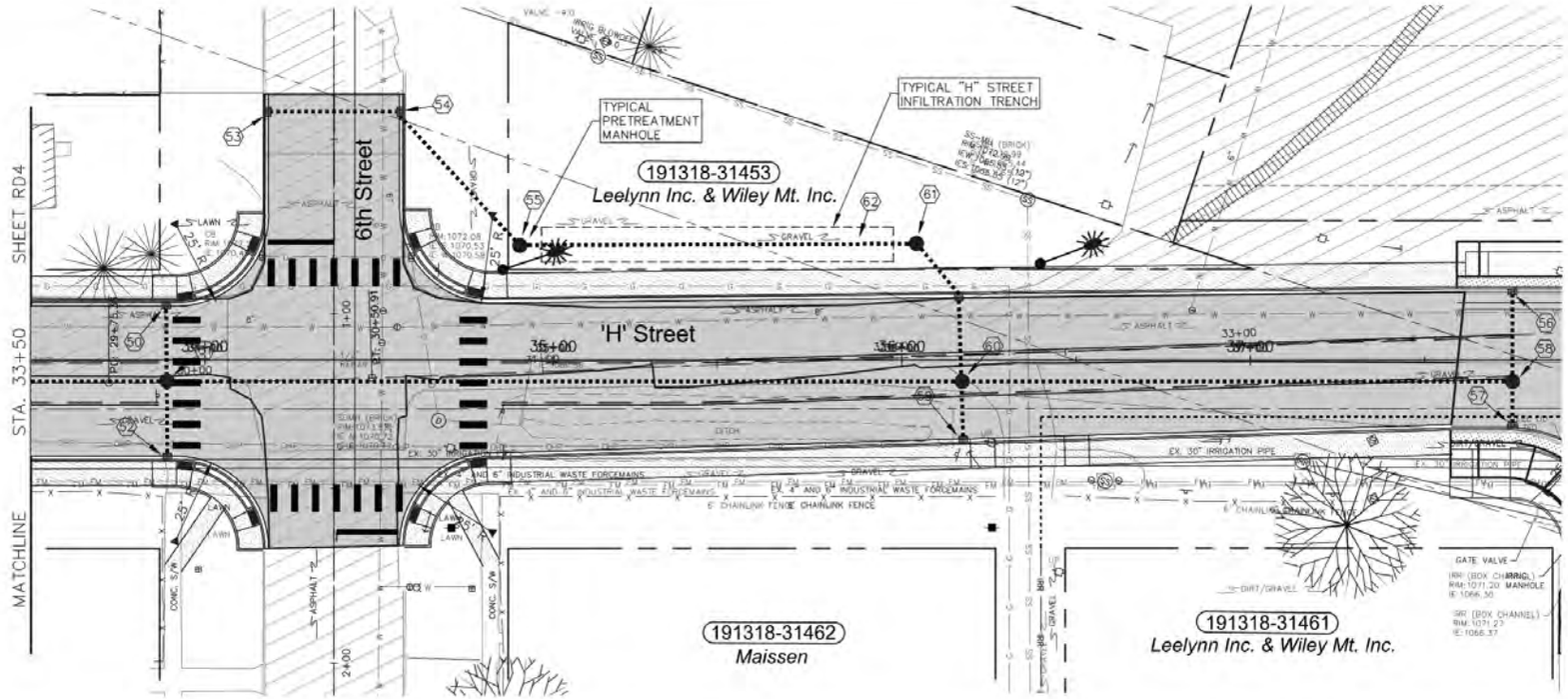
- (A) CONTRACTOR SHALL PLACE BIOSCAPE INLET STRUCTURE (IF APPLICABLE) ON 6 INCHES OF BEDDING STONE THAT HAS BEEN PLACED ON COMPACTED SUBGRADE. THE SUBGRADE SHALL BE COMPACTED TO 95% OF MAXIMUM DENSITY OR AS OTHERWISE SPECIFIED BY THE ENGINEER. ANY UNSUITABLE MATERIAL SHALL BE REPLACED AS APPROVED BY THE SITE ENGINEER
- (B) CONTRACTOR SHALL PROVIDE AND INSTALL PIPING FOR DOWNSTREAM CONNECTION IN THE BIOSCAPE INLET STRUCTURE OPENING PROVIDED, PER PLANS AND SPECIFICATIONS
- (C) CONTRACTOR SHALL PROVIDE 6" SDR 35 PVC INLET AND OUTLET PIPES TO CONNECT BIOSCAPE INLET STRUCTURE TO FILTERRA BIOSCAPE SYSTEM PERIMETER. 6" SDR 35 COUPLERS ARE PROVIDED IN THE INLET STRUCTURE AT THE PROPER ELEVATIONS. PIPES SHALL BE INSTALLED TO PROMOTE POSITIVE FLOW TO (UPPER PIPES) AND FROM (LOWER PIPES) THE FILTERRA BIOSCAPE SYSTEM
- (D) CONTRACTOR TO PROVIDE SHOULDER ACCORDING TO DIMENSION AND SLOPE SHOWN ON PLANS. SLOPE FROM SHOULDER TO FILTERRA BIOSCAPE SYSTEM SURFACE PERIMETER SHALL NOT EXCEED 3:1. SOD IS REQUIRED TO STABILIZE SIDE SLOPES
- (E) CONTRACTOR TO EXCAVATE MEDIA AREA CORRESPONDING TO THE SIZE OF THE FILTERRA BIOSCAPE SYSTEM SURFACE AREA AS SHOWN ON DETAIL AND ON PLAN SHEETS
- (F) CONTRACTOR SHALL EXCAVATE VERTICALLY FROM BOTTOM OF UNDERDRAIN STONE, OR DRAINAGE STONE, IF REQUIRED, TO ELEVATION OF MULCH AS SHOWN ON THIS DETAIL
- (G) CONTRACTOR TO PROVIDE IMPERMEABLE LINER/GEOTEXTILE FOR BOTTOM IF REQUIRED PER THE PLANS
- (H) CONTRACTOR TO PROVIDE AND INSTALL ANY ADDITIONAL DRAINAGE STONE BELOW THE FILTERRA BIOSCAPE SYSTEM AS CALLED OUT ON THE PLANS

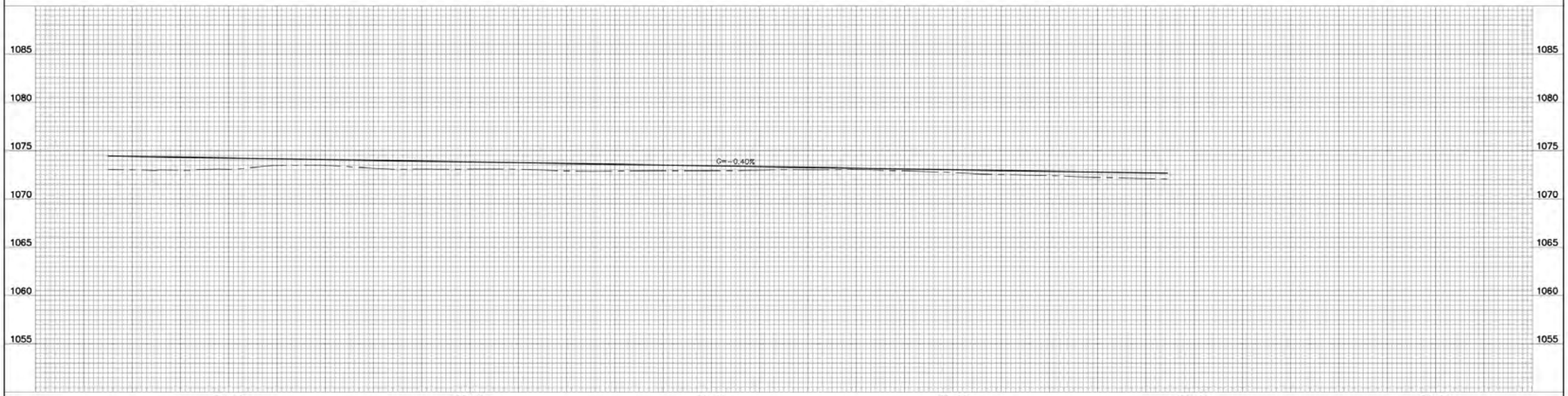
CONTECH INSTALLATION RESPONSIBILITIES AS DENOTED BY (#) ON THIS DETAIL

1. GEOTEXTILE FABRIC ALONG THE PERIMETER OF THE FILTERRA BIOSCAPE SYSTEM EXCAVATION
2. 10" OF UNDERDRAIN STONE - 2" UNDER THE PIPING, 6" AROUND THE PIPING AND 2" ABOVE THE PIPING
3. 6" UNDERDRAIN PIPING UNLESS OTHERWISE APPROVED BY CONTECH, ASSOCIATED PIPING AND FITTINGS/ELBOWS TO CONNECT TO THE PIPING/FITTING(S) THAT IS PROVIDED BY CONTRACTOR (SEE CONTRACTOR INSTALLATION RESPONSIBILITIES THIS DETAIL)
4. 21" ENGINEERED MEDIA
5. 3" DOUBLESHREDDED HARDWOOD MULCH OVER ENTIRE FILTERRA BIOSCAPE SYSTEM SURFACE AREA
6. PLANTINGS AS INDICATED IN TABLE ON THIS DETAIL
7. RIPRAP APRON AS DESIGNED AND INDICATED ON THIS DETAIL
8. CLEANOUT ADAPTER, PLUG AND PIPING
9. ADDITIONAL EROSION CONTROL AROUND THE FILTERRA BIOSCAPE SYSTEM

CONTECH ENGINEERED SOLUTIONS LLC
www.ContechES.com
9025 Centre Pointe Dr., Suite 400, West Chester, OH 45069
800-338-1122 513-645-7000 513-645-7993 FAX

Bravo Company Boulevard (Phase 4) Bioscape Detail





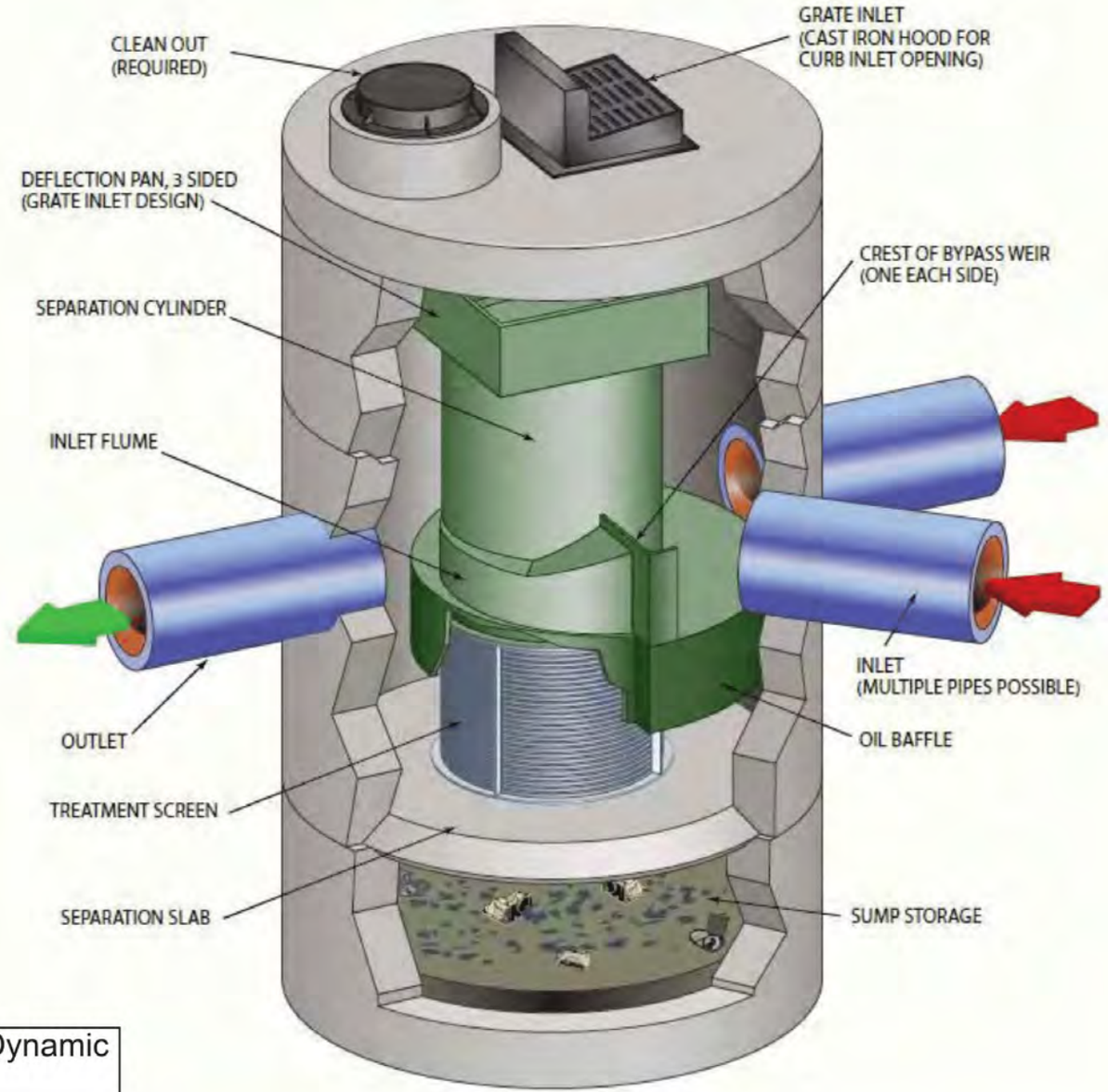
HLA
Engineering and Land Surveying, Inc.
2803 River Road
Yakima, WA 98902
509.966.7000
Fax 509.965.3800
www.hlacivil.com

PRELIMINARY
SUBJECT TO REVISION

REVISION	DATE

JOB NUMBER: 11062	DATE: 10-21-21
FILE NAMES:	
DRAWING:	Sheets.dwg
PLAN:	11105.dwg
PROFILE:	11105.dwg
DESIGNED BY:	TDA
ENTERED BY:	AJH

Typical H Street (Phase 4) Infiltration Trench Plan & Profile



Typical H Street (Phase 4) Dynamic Separator Detail

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Appendix C. Detailed Listed Species Information

Bull Trout (*Salvelinus confluentus*)
Bull trout (*Salvelinus confluentus*) were once found in about 60 percent of the Columbia River Basin, but today, they occur in less than half of their historic range, with scattered populations in portions of Oregon, Washington, Nevada, Idaho and Montana. In the Klamath River Basin, bull trout occur in 21 percent of their historic range. They no longer exist in California (Wydoski and Whitney 2003).

Bull trout are seldom found in waters where temperatures are warmer than 59ºF (USFWS 2010). Besides very cold water, bull trout require stable stream channels, clean spawning gravel, complex and diverse cover, and unblocked migration routes. Small bull trout eat terrestrial and aquatic insects but shift to being primarily piscivorous, preying on other fish as they grow larger. Bull trout evolved with whitefish, sculpins and other salmonids and use all of them as food sources. In the Willamette Basin, juvenile Chinook salmon are an important food source for bull trout (Wydoski and Whitney 2003).

Adult bull trout are usually small but can grow to 36 inches in length and weigh up to 32 pounds. Bull trout reach sexual maturity at between four and seven years of age and are known to live as long as 12 years. They spawn in the fall after temperatures drop below 48ºF, in streams with abundant cold, unpolluted water, clean gravel and cobble substrate, and gentle stream slopes. Many spawning areas are associated with cold water springs or areas where stream flow is influenced by groundwater. Bull trout eggs require a long incubation period compared to other salmon and trout, hatching in late winter or early spring. Fry may remain in the stream gravels for up to three weeks before emerging (Wydoski and Whitney 2003).

Steelhead Trout (*Oncorhynchus mykiss*)
Steelhead (*Oncorhynchus mykiss*), the anadromous form of rainbow trout, commence life in streams and migrate to seawater as smolts. Most steelhead in Washington become smolts at Age 2. Out-migration occurs during April through June, with a peak about mid-April. Most maturing steelhead ascend spawning streams from December to February (winter-run). In some streams there is a smaller summer-run in August and September (Wydoski and Whitney 2003).

Columbia River basin steelhead are most abundant in the Snake River but can be found in the Yakima River as well (Wydoski and Whitney 2003). Steelhead generally prefer fast water in small-to-large main stem rivers, and medium-to-large tributaries. In streams with steep gradient and large substrate, they spawn between these steep areas, where the water is flatter, and the substrate is small enough to dig into. The steeper areas make excellent rearing habitat for the juveniles (WDFW 1999). Many steelhead do not die after spawning, unlike the pattern in Pacific salmon species.

Steelhead trout are capable of surviving in a wide range of temperature conditions from 32 to 80°F but prefer water less than 70°F, containing high amount of dissolved oxygen, at least 7 parts per million (ppm). They aggressively defend feeding territories in streams where typical forage consists of drift organisms and aquatic vegetation (Reese and Harvey 2001). Juvenile steelhead trout feed primarily on foods that are drifting on the surface, in the water column, or

along the bottom of streams or lakes including aquatic insects, amphipods, aquatic worms, and fish eggs. Occasionally they eat small fish. Steelhead trout may feed at any time throughout a 24-hour period but usually feed most actively around dusk (NatureServe Explorer 2009).

Yellow-Billed Cuckoo (*Coccyzus americanus*)

The yellow-billed cuckoo (*Coccyzus americanus*) is a medium-sized bird, approximately 12 inches in length, with a slightly downward curved bill with yellow coloring on the bottom (78 FR 61622). It is likely that the bird has been extirpated as a breeder from Washington with only the possibility of a vestigial breeding population. Despite this, there have been 14 documented sightings in Washington since 1990. While the majority of these sightings have occurred east of the Cascades, no sightings have occurred in Yakima County. Dating back to 1834 when sightings began to be recorded, no sightings have occurred in Yakima County (Wiles and Kalasz 2017).

Yellow-billed cuckoos historically migrated back to the Pacific Northwest around May and return to their wintering grounds in September. These birds breed within large riparian habitats comprised of a cottonwood and willow forested overstory and dense understory foliage. Yellow-billed cuckoos are most likely to breed in patches of willow-cottonwood riparian habitat greater than 50 acres in size (78 FR 61622). Nesting usually results in two to five eggs with a breeding cycle of 17 days, from egg laying to fledgling. Yellow billed cuckoo eats large insects and sometimes small frogs and lizards. Breeding is timed to take advantage of the emergence of cicadas and tent caterpillars (78 FR 61622).

Gray Wolf (*Canis lupus*)

The gray wolf (*Canis lupus*) is a keystone predator canid (USFWS 2017; ITIS 2017). Historically, gray wolves were common throughout Washington State, as they are generalists that can thrive in many habitats. Starting in the early 1820s, with the establishment of the Hudson's Bay Company, their pelts were highly sought after and led to their population decline. Today the majority of gray wolf sightings in Washington occur in the North Cascades. Gray wolves live in packs and can occupy large territories between 200 and 500 square miles (USFWS 2011; 2017).

Gray wolves can live up to 13 years. They reach sexual maturity at age 2 and can reproduce yearly until they are around 10 years old. Litters generally have around 5 pups and are born in April in dens, abandoned beaver lodges, hollow trees, and shallow rock caves (USFWS 2011; 2017).

References

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Appendix D. USFWS and NMFS Species Lists

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United States Department of the Interior

FISH AND WILDLIFE SERVICE
Washington Fish And Wildlife Office
510 Desmond Drive Se, Suite 102
Lacey, WA 98503-1263
Phone: (360) 753-9440 Fax: (360) 753-9405
http://www.fws.gov/wafwo/

In Reply Refer To: October 27, 2021
Consultation Code: 01EWFW00-2021-SLI-0891
Event Code: 01EWFW00-2022-E-00320
Project Name: East-West Corridor

Subject: Updated list of threatened and endangered species that may occur in your proposed project location or may be affected by your proposed project

To Whom It May Concern:

The enclosed species list identifies threatened, endangered, and proposed species, designated and proposed critical habitat, and candidate species that may occur within the boundary of your proposed project and/or may be affected by your proposed project. The species list fulfills the requirements of the U.S. Fish and Wildlife Service (Service) under section 7(c) of the Endangered Species Act (Act) of 1973, as amended (16 U.S.C. 1531 et seq.).

New information based on updated surveys, changes in the abundance and distribution of species, changed habitat conditions, or other factors could change this list. The species list is currently compiled at the county level. Additional information is available from the Washington Department of Fish and Wildlife, Priority Habitats and Species website: http://wdfw.wa.gov/mapping/phs/ or at our office website: http://www.fws.gov/wafwo/species_new.html. Please note that under 50 CFR 402.12(e) of the regulations implementing section 7 of the Act, the accuracy of this species list should be verified after 90 days. This verification can be completed formally or informally as desired. The Service recommends that verification be completed by visiting the ECOS-IPaC website at regular intervals during project planning and implementation for updates to species lists and information. An updated list may be requested through the ECOS-IPaC system by completing the same process used to receive the enclosed list.

The purpose of the Act is to provide a means whereby threatened and endangered species and the ecosystems upon which they depend may be conserved. Under sections 7(a)(1) and 7(a)(2) of the Act and its implementing regulations (50 CFR 402 et seq.), Federal agencies are required to utilize their authorities to carry out programs for the conservation of threatened and endangered species and to determine whether projects may affect threatened and endangered species and/or designated critical habitat.

A Biological Assessment is required for construction projects (or other undertakings having similar physical impacts) that are major Federal actions significantly affecting the quality of the human environment as defined in the National Environmental Policy Act (42 U.S.C. 4332(2)(c)). For projects other than major construction activities, the Service suggests that a biological evaluation similar to a Biological Assessment be prepared to determine whether or not the project may affect listed or proposed species and/or designated or proposed critical habitat. Recommended contents of a Biological Assessment are described at 50 CFR 402.12.

If a Federal agency determines, based on the Biological Assessment or biological evaluation, that listed species and/or designated critical habitat may be affected by the proposed project, the agency is required to consult with the Service pursuant to 50 CFR 402. In addition, the Service recommends that candidate species, proposed species, and proposed critical habitat be addressed within the consultation. More information on the regulations and procedures for section 7 consultation, including the role of permit or license applicants, can be found in the "Endangered Species Consultation Handbook" at:
http://www.fws.gov/endangered/esa-library/pdf/TOC-GLOS.PDF

Please be aware that bald and golden eagles are protected under the Bald and Golden Eagle Protection Act (16 U.S.C. 668 et seq.). You may visit our website at http://www.fws.gov/pacific/eagle/for information on disturbance or take of the species and information on how to get a permit and what current guidelines and regulations are. Some projects affecting these species may require development of an eagle conservation plan: (http://www.fws.gov/windenergy/eagle_guidance.html). Additionally, wind energy projects should follow the wind energy guidelines (http://www.fws.gov/windenergy/) for minimizing impacts to migratory birds and bats.

Also be aware that all marine mammals are protected under the Marine Mammal Protection Act (MMPA). The MMPA prohibits, with certain exceptions, the "take" of marine mammals in U.S. waters and by U.S. citizens on the high seas. The importation of marine mammals and marine mammal products into the U.S. is also prohibited. More information can be found on the MMPA website: http://www.nmfs.noaa.gov/pr/laws/mmpa/.

We appreciate your concern for threatened and endangered species. The Service encourages Federal agencies to include conservation of threatened and endangered species into their project planning to further the purposes of the Act. Please include the Consultation Tracking Number in the header of this letter with any request for consultation or correspondence about your project that you submit to our office.

Related website:
National Marine Fisheries Service: http://www.nwr.noaa.gov/protected_species/species_list/species_lists.html

Attachment(s):

- Official Species List

Official Species List

This list is provided pursuant to Section 7 of the Endangered Species Act, and fulfills the requirement for Federal agencies to "request of the Secretary of the Interior information whether any species which is listed or proposed to be listed may be present in the area of a proposed action".

This species list is provided by:

Washington Fish And Wildlife Office
510 Desmond Drive Se, Suite 102
Lacey, WA 98503-1263
(360) 753-9440

Project Summary

Consultation Code: 01EWFW00-2021-SLI-0891
Event Code: Some(01EWFW00-2022-E-00320)
Project Name: East-West Corridor
Project Type: TRANSPORTATION
Project Description: The project proposes to create a new transportation corridor between the City of Yakima and the community of Terrace Heights. Upon project completion, the completed section of the East-West corridor will consist of a 5-lane roadway with two vehicular travel lanes in both directions, a center turn lane, sidewalks, a shared-use path curbing, gutters, and illumination. The project proposes the construction of four bridges: two carrying Interstate 82 (I-82) over the proposed corridor, one over the Yakima River, and one over Roza Canal Wasteway #2. Additional work will include floodplain mitigation in the form of floodplain grading, backchannel construction, and riparian vegetation planting.

Project Location:

Approximate location of the project can be viewed in Google Maps: https://www.google.com/maps/@46.6124364,-120.47865159242548,14z

Counties: Yakima County, Washington

Endangered Species Act Species

There is a total of 3 threatened, endangered, or candidate species on this species list.

Species on this list should be considered in an effects analysis for your project and could include species that exist in another geographic area. For example, certain fish may appear on the species list because a project could affect downstream species.

IPaC does not display listed species or critical habitats under the sole jurisdiction of NOAA Fisheries[1], as USFWS does not have the authority to speak on behalf of NOAA and the Department of Commerce.

See the "Critical habitats" section below for those critical habitats that lie wholly or partially within your project area under this office's jurisdiction. Please contact the designated FWS office if you have questions.

---

1. NOAA Fisheries, also known as the National Marine Fisheries Service (NMFS), is an office of the National Oceanic and Atmospheric Administration within the Department of Commerce.

Birds

NAME	STATUS
Yellow-billed Cuckoo *Coccyzus americanus* Population: Western U.S. DPS There is **final** critical habitat for this species. The location of the critical habitat is not available. Species profile: https://ecos.fws.gov/ecp/species/3911	Threatened

Fishes

NAME	STATUS
Bull Trout *Salvelinus confluentus* Population: U.S.A., conterminous, lower 48 states There is **final** critical habitat for this species. Your location overlaps the critical habitat. Species profile: https://ecos.fws.gov/ecp/species/8212	Threatened

Insects

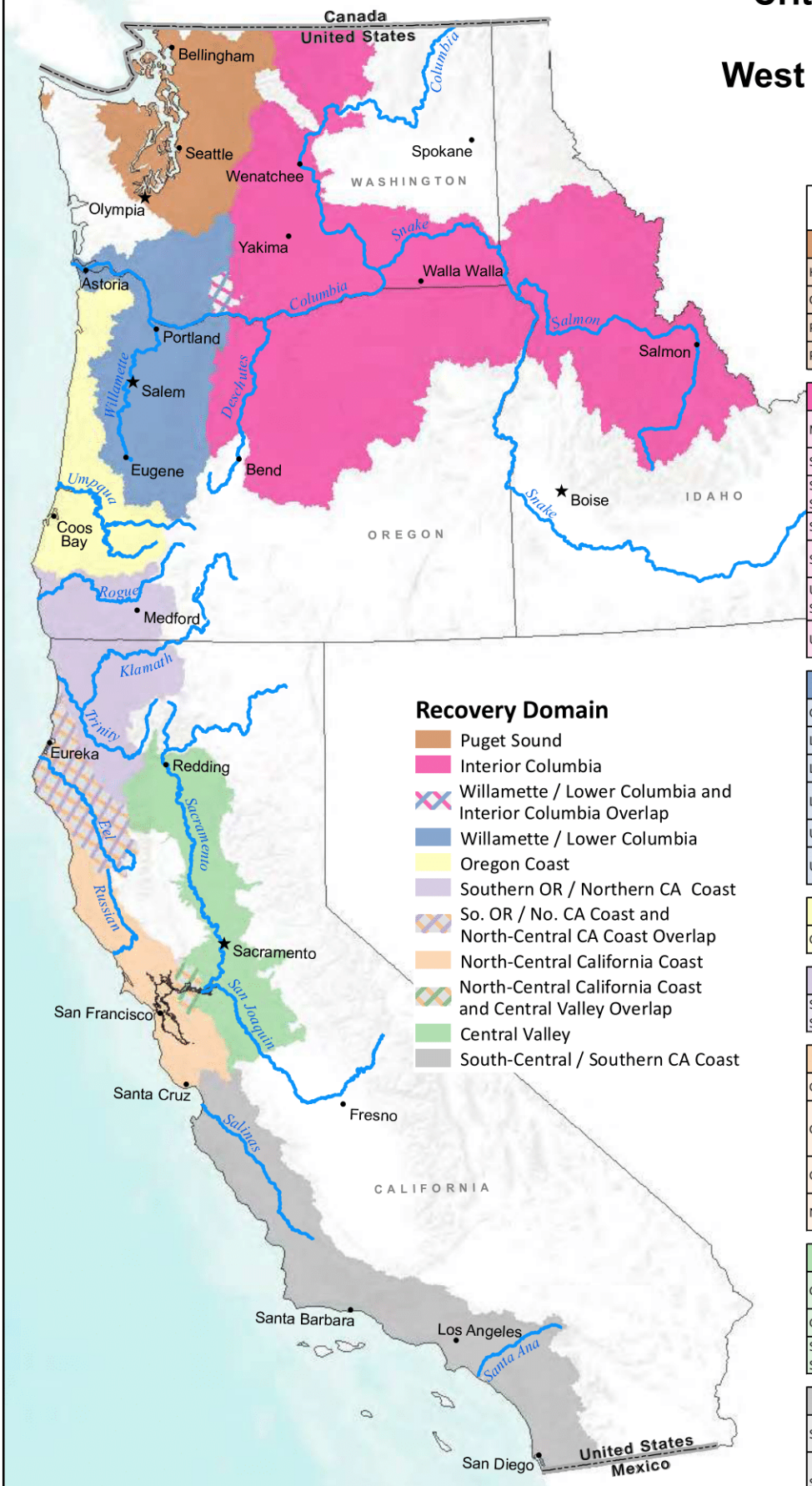
NAME	STATUS
Monarch Butterfly *Danaus plexippus* No critical habitat has been designated for this species. Species profile: https://ecos.fws.gov/ecp/species/9743	Candidate

Critical habitats

There is 1 critical habitat wholly or partially within your project area under this office's jurisdiction.

NAME	STATUS
Bull Trout *Salvelinus confluentus* https://ecos.fws.gov/ecp/species/8212#crithab	Final

Status of ESA Listings & Critical Habitat Designations for West Coast Salmon & Steelhead



Updated July 2016

Evolutionarily Significant Unit / Distinct Population Segment	ESA Status	Date of ESA Listing	Date of CH Designation
Puget Sound Recovery Domain			
Hood Canal Summer-run Chum Salmon	T	3/25/1999	9/2/2005
Ozette Lake Sockeye Salmon	T	3/25/1999	9/2/2005
Puget Sound Chinook Salmon	T	3/24/1999	9/2/2005
Puget Sound Steelhead	T	5/11/2007	2/24/2016
Interior Columbia Recovery Domain			
Middle Columbia River Steelhead	T	3/25/1999 1/5/2006	9/2/2005
Snake River Fall-run Chinook Salmon	T	4/22/1992	12/28/1993
Snake River Spring / Summer-run Chinook Salmon	T	4/22/1992	10/25/1999
Snake River Sockeye Salmon	E	11/20/1991	12/28/1993
Snake River Steelhead	T	8/18/1997 1/5/2006	9/2/2005
Upper Columbia River Spring-run Chinook Salmon	E	3/24/1999	9/2/2005
Upper Columbia River Steelhead	T	8/18/1997 1/5/2006	9/2/2005
Willamette / Lower Columbia Recovery Domain			
Columbia River Chum Salmon	T	3/25/1999	9/2/2005
Lower Columbia River Chinook Salmon	T	3/24/1999	9/2/2005
Lower Columbia River Coho Salmon	T	6/28/2005	2/24/2016
Lower Columbia River Steelhead	T	3/19/1998 1/5/2006	9/2/2005
Upper Willamette River Chinook Salmon	T	3/24/1999	9/2/2005
Upper Willamette River Steelhead	T	3/25/1999 1/5/2006	9/2/2005
Oregon Coast Recovery Domain			
Oregon Coast Coho Salmon	T	2/11/2008	2/11/2008
Southern Oregon / Northern California Coast Recovery Domain			
Southern OR / Northern CA Coasts Coho Salmon	T	5/6/1997	5/5/1999
North-Central California Coast Recovery Domain			
California Coastal Chinook Salmon	T	9/16/1999	9/2/2005
Central California Coast Coho Salmon	E	10/31/1996 (T) 6/28/2005 (E) 4/2/2012 (RE)	5/5/1999
Central California Coast Steelhead	T	8/18/1997 1/5/2006	9/2/2005
Northern California Steelhead	T	6/7/2000 1/5/2006	9/2/2005
Central Valley Recovery Domain			
California Central Valley Steelhead	T	3/19/1998 1/5/2006	9/2/2005
Central Valley Spring-run Chinook Salmon	T	9/16/1999	9/2/2005
Sacramento River Winter-run Chinook Salmon	E	11/5/1990 (T) 1/4/1994 (E)	6/16/1993
South-Central / Southern California Coast Recovery Domain			
South-Central California Coast Steelhead	T	8/18/1997 1/5/2006	9/2/2005
Southern California Steelhead	E	8/18/1997 5/1/2002 (RE) 1/5/2006	9/2/2005

ESA = Endangered Species Act, CH = Critical Habitat, RE = Range Extension
E = Endangered, T = Threatened,

Critical Habitat Rules Cited

- 2/24/2016 (81 FR 9252) Final Critical Habitat Designation for Puget Sound Steelhead and Lower Columbia River Coho Salmon
- 2/11/2008 (73 FR 7816) Final Critical Habitat Designation for Oregon Coast Coho Salmon
- 9/2/2005 (70 FR 52630) Final Critical Habitat Designation for 12 ESU's of Salmon and Steelhead in WA, OR, and ID
- 9/2/2005 (70 FR 52488) Final Critical Habitat Designation for 7 ESU's of Salmon and Steelhead in CA
- 10/25/1999 (64 FR 57399) Revised Critical Habitat Designation for Snake River Spring/Summer-run Chinook Salmon
- 5/5/1999 (64 FR 24049) Final Critical Habitat Designation for Central CA Coast and Southern OR/Northern CA Coast Coho Salmon
- 12/28/1993 (58 FR 68543) Final Critical Habitat Designation for Snake River Chinook and Sockeye Salmon
- 6/16/1993 (58 FR 33212) Final Critical Habitat Designation for Sacramento River Winter-run Chinook Salmon

ESA Listing Rules Cited

- 4/2/2012 (77 FR 19552) Final Range Extension for Endangered Central California Coast Coho Salmon
- 2/11/2008 (73 FR 7816) Final ESA Listing for Oregon Coast Coho Salmon
- 5/11/2007 (72 FR 26722) Final ESA Listing for Puget Sound Steelhead
- 1/5/2006 (71 FR 5248) Final Listing Determinations for 10 Distinct Population Segments of West Coast Steelhead
- 6/28/2005 (70 FR 37160) Final ESA Listing for 16 ESU's of West Coast Salmon
- 5/1/2002 (67 FR 21586) Range Extension for Endangered Steelhead in Southern California
- 6/7/2000 (65 FR 36074) Final ESA Listing for Northern California Steelhead
- 9/16/1999 (64 FR 50394) Final ESA Listing for Two Chinook Salmon ESUs in California
- 3/25/1999 (64 FR 14508) Final ESA Listing for Hood River Canal Summer-run and Columbia River Chum Salmon
- 3/25/1999 (64 FR 14517) Final ESA Listing for Middle Columbia River and Upper Willamette River Steelhead
- 3/25/1999 (64 FR 14528) Final ESA Listing for Ozette Lake Sockeye Salmon
- 3/24/1999 (64 FR 14308) Final ESA Listing for 4 ESU's of Chinook Salmon
- 3/19/1998 (63 FR 13347) Final ESA Listing for Lower Columbia River and Central Valley Steelhead
- 8/18/1997 (62 FR 43937) Final ESA Listing for 5 ESU's of Steelhead
- 5/6/1997 (62 FR 24588) Final ESA Listing for Southern Oregon / Northern California Coast Coho Salmon
- 10/31/1996 (61 FR 56138) Final ESA Listing for Central California Coast Coho Salmon
- 1/4/1994 (59 FR 222) Final ESA Listing for Sacramento River Winter-run Chinook Salmon
- 4/22/1992 (57 FR 14653) Final ESA Listing for Snake River Spring/summer-run and Snake River Fall Chinook Salmon
- 11/20/1991 (56 FR 58619) Final ESA Listing for Snake River Sockeye Salmon
- 11/5/1990 (55 FR 46515) Final ESA Listing for Sacramento River Winter-run Chinook Salmon

Appendix E. Pathways and Indicators Matrix Parameters

Subpopulation Characteristics

Subpopulation Size

Subpopulation size for bull trout in the lower Yakima River is "functioning at unacceptable risk." From 1983 until February 17, 2019, no bull trout have been counted at the closest downstream dams to the project area: Prosser Dam (river mile (RM) 46) (DART 2019a). A total of 18 bull trout have been counted at the closets upstream dam, Roza Dam (RM 128) between 1950 and February 17, 2019 (DART 2019b). The proposed project will maintain baseline conditions as the chance of bull trout take during in-water work is extremely low due to the fact that there is no documented spawning or rearing within the action area, there is limited documentation of bull trout presence within the lower Yakima River, and summer water temperatures have been documented to regularly exceed 15ºC (59ºF) which is the temperature that is considered to limit bull trout presence (Matthews et al. 2002; USGS 2018).

Growth & Survival

Growth and survival for Bull trout in the lower Yakima River is "functioning at risk." Since 2015, no bull trout have been counted at Roza Dam, and the greatest number of bull trout counted at Roza Dam in a single year was 5 bull trout in 2012 (DART 2019b). The proposed project will maintain baseline conditions as the chance of bull trout take during in-water work is extremely low due to the fact that there is no documented spawning or rearing within the action area, there is limited documentation of bull trout presence within the lower Yakima River, and summer water temperatures have been documented to regularly exceed 15ºC (59ºF) which is the temperature that is considered to limit bull trout presence (Matthews et al. 2002; USGS 2018).

Life History Diversity & Isolation

Life history diversity and isolation for bull trout in the lower Yakima River are "functioning at unacceptable risk." Dams, many lacking fish passage, on the Yakima River and its tributaries has left bull trout populations fragmented (Matthews et al. 2002; USBR 2011). The proposed project will maintain baseline conditions as there will be no effect on the diversity of life history strategies within the Yakima River subpopulation, and the project will not result in additional isolation mechanisms within the river system.

Persistence & Genetic Integrity

Persistence and genetic integrity are "functioning at unacceptable risk." As stated in the above sections, bull trout presence in the lower Yakima River is extremely low and dams have reduced population connectivity (Matthews et al. 2002; USBR 2011; DART 2019a; 2019b). In addition, there is the potential for hybridization with introduced brook trout (*Salvelinus fontinalis*) and lake trout (*Salvelinus namaycush*) which both have documented presence in the Yakima River and its tributaries (Fredenberg et al. 2005). The proposed project will maintain baseline conditions as it will have no effect on connectivity between subpopulations or the potential for hybridization within the river system.

Water Quality

Temperature

Water temperatures measured in the Yakima River are "not properly functioning" and "functioning at unacceptable risk" due to lack of adequate cover both within and adjacent to the aquatic portion of the action area. Temperature data recorded at United States Geological Survey (USGS) Surface Water Station #12500450 shows max water temperature in the area range from 56-71°F (13-22°C) in July, August, and September in 2016 (USGS 2018). This does not meet state temperature standards and exceeds the bull trout preferred temperature (Matthews et al. 2002; USFWS 2008). While 0.6 acres of riparian vegetation will be permanently removed as a part of this project the project proposes to plant new trees downstream of the proposed bridge along the northeastern bank and along the proposed back channels. Over the long term these trees will offset the loss of vegetative cover; therefore, the proposed project is expected to maintain water temperatures.

Sediment/Turbidity

The Washington State Department of Ecology (WSDOE) Water Quality Index (WQI) scores for suspended solids and turbidity were moderate concern at water quality monitoring station 37A205 at Nob Hill (WSDOE 2018). Based on this, the Yakima River within the action area is classified as "at risk" and "functioning at risk." Over the short-term sedimentation and turbidity may increase during the installation/removal of piles; however, this impact is not expected to exceed the water quality standards set forth in the 401 permit from WSDOE. The proposed project is expected to maintain baseline conditions over the long term.

Chemical Contaminants/Nutrients

Based on the data provided by the WSDOE, the levels of chemical contaminants/nutrients within the action area is classified as "at risk" and "functioning at risk." WSDOE data from water quality monitoring station 37A205 at Nob Hill shows both phosphorus and persulfate nitrogen levels were classified as a "moderate concern" for 2016 through WSDOE's WQI (WSDOE 2018). The project is expected to maintain the existing levels of chemical contaminants/nutrients in the river.

Habitat Access

Physical Barriers

There are currently no physical man-made barriers below the OHWM within the project area, thus the action area is classified as "properly functioning" and "functioning appropriately." The train bridge north of the proposed bridges over the Yakima River has two intermediate pier that sit on an island above OHW. The project proposes constructing a bridge with one pier waterward of the OHWM. Because of this, the proposed project will degrade the action area.

Habitat Elements

Substrate

Substrate within the aquatic portion of the action area is determined to be "properly functioning" and "functioning appropriately." Substrate is judged to well mixed boulder/cobble at the WSDOE water quality monitoring station 37A205 at Nob Hill (WSDOE 2018). The proposed project will temporarily impact 700 square feet of substrate for the placement of pilings and casings during construction of the Yakima River bridge. It will also permanently impact 85 square feet of substrate for the installation of drilled shafts for the in-water pier. Additional areas below OHW will be temporarily impacted during construction of the new channel and ELJ, however this work will be constructed in the dry and will maintain its habitat value after construction. Additional substrate will be available during portions of the year in the new backchannels. Because of this, the proposed project is expected to maintain baseline conditions.

Large Woody Debris

Large woody debris (LWD) within the action area is considered to be "not properly functioning" and fewer than 20 pieces of woody debris were observed within the aquatic portion of the action area. This is due to the lack of intact riparian vegetation along the banks of the river. 64 acres of riparian vegetation be permanently removed from the project area possible resulting in a decrease in LWD recruitment. The project proposes to minimize this disturbance by planting new trees downstream of the proposed bridge along the northeastern bank and along the proposed back channels as well as the placement of an engineered logjam; therefore, the proposed project is expected to enhance the baseline condition in the long-term. The planting plan for these trees will be submitted to the United States Army Corps of Engineers (USACE) for approval.

Pool Frequency

Pool frequency in the Yakima River is rated "not properly functioning" and functioning at unacceptable risk." Bank erosion and channelizing of the river for dams, levees, and transportation infrastructure has reduced habitat complexity within the river (Berg et al. 2001; Conley et al. 2009). The project is expected to maintain baseline conditions.

Off-channel Habitat

Within the project area there are several side channels. Some have sufficient cover from the riparian corridor, but the riparian corridor within the action area is degraded in several areas. In general, the lower Yakima River is lacking in off-channel habitat due to diking and dam construction (Berg et al. 2001; Conley et al. 2009) Because of this, the Yakima River within the action area is classified as "at risk" and "functioning at risk" for off-channel habitat. The proposed bridge over the Yakima River will cross one side channel, but the riparian corridor at the section of the channel is degraded. Creation of backchannels for this project will improve restore/enhance the project area slightly.

Refugia

Segments of the aquatic portion of the action area are within a forested/scrub-shrub riparian corridor providing adequate canopy cover to the Yakima River. In general, in the lower Yakima River, refugia has been significantly reduced due to diking and other developments (Berg et al.

2001; Conley et al. 2009). Refugia within the project area is determined to be "at risk" and "functioning at risk" because sections of the riparian corridor within the project area are degraded. The project proposes the removal 0.6 acres of riparian vegetation will be permanently removed as a part of this project, however the project proposes to plant new trees downstream of the proposed bridge along the northeastern bank and along the proposed back channels. Over the long-term the project is expected to enhance the amount of refugia in the area.

Channel Condition and Dynamics

Width : Depth Ratio

Width : depth ratio within the action area is "not properly functioning" and "functioning at unacceptable risk. The width : depth ratio of the lower Yakima River is large due to developments degrading the channel morphology and streambank conditions for developments (Berg et al. 2001). The proposed project will maintain baseline conditions.

Streambank Condition

Due to the channelization of the river for dams, levees, and transportation infrastructure streambank conditions are "not properly functioning" and "functioning at unacceptable risk" (Berg et al. 2001; Conley et al. 2009). The proposed project will remove 0.6 acres of riparian vegetation will be permanently removed as a part of this project, however the project proposes to plant new trees downstream of the proposed bridge along the northeastern bank and along the proposed back channels providing natural erosion control and improving channel stability. The project is expected to maintain streambank conditions in the long-term.

Floodplain Connectivity

Within the project vicinity there are several off-channel areas including wetlands and ponds that are frequently hydrologically linked to the main channel. Some side channels stay connected to the main channel for the majority of the year (Widener & Associates 2019). The Yakima Greenway acts as a barrier blocking off access from the main channel to some off-channel areas. Because of this, the area is determined to be "at risk" and "functioning at risk" for floodplain connectivity. The proposed project involves work within the 100-year floodplain, but a hydraulics and floodplain study for the project concluded that the project meets a No-Rise condition (Shannon & Wilson 2019). The proposed floodplain grading as well as the creation of backchannels will restore/enhance current conditions.

Flow/Hydrology

Peak/Base Flows

Over the past three years, the river discharge, as measured at USGS station 12500450 above Ahtanum Creek at Union Gap, has been above the 50-year average (USGS 2018). Dams constructed on the Yakima River have also affected the natural hydrology (Berg et al. 2001; Conley et al. 2009; USBR 2011) Because of this, the peak/base flows for this area are classified as "not properly functioning" and "functioning at unacceptable risk." The proposed project will maintain current conditions.

Drainage Network Increase
The Yakima River has a drainage area of 6,150 square miles (3,936,000 acres) (USBR 2011). While the project proposes to increase impervious surface within the project area from 3.9 to 17.4 acres, this increase will be insignificant within the drainage network. Therefore, the project will maintain the drainage network at an "at risk" and "functioning at risk" condition.

Watershed Conditions

Road Density/Location
The road density within the Yakima River Basin is calculated to be approximately 2 - 3 miles of road per square mile of watershed and is therefore classified as "at risk" and "functioning at risk" (USFWS 2005). The project will degrade the current road density at the watershed scale slightly.

Disturbance History
Disturbance history for the Yakima River within the action area is "not properly functioning" and "functioning at unacceptable risk." The City of Yakima was incorporated in 1883, but developments along the Yakima River in the project vicinity had been built prior to that (City of Yakima 2019). Dams, dikes, channelization, and other developments on or adjacent to the Yakima River have impacted the natural state of the lower Yakima River (Berg et al. 2001; Conley et al. 2009). The proposed project will maintain the baseline conditions.

Riparian Reserves
Riparian reserves within the action area are "at risk" and "functioning at risk." Vegetated riparian corridors and side channels exist within the project area but transition quickly to upland developments. In general, in the lower Yakima River, riparian reserves have been significantly reduced due to diking and other developments (Berg et al. 2001; Conley et al. 2009). The proposed project will remove 0.6 acres of riparian vegetation will be permanently removed as a part of this project, however the project proposes to plant new trees downstream of the proposed bridge along the northeastern bank and along the proposed back channels improving riparian reserves. The project is expected to improve the baseline condition as a result of this mitigation.

Disturbance Regime
Disturbance regime within the action area is "functioning at risk." Due to the dams on the Yakima River, it lacks a natural hydrograph. Much of the area is also highly disturbed due to developments. High-quality habitat within the action area is virtually non-existent. The proposed project will maintain the baseline conditions.

Integration of Species & Habitat Conditions
Integration of species and habitat conditions for bull trout in the lower Yakima River is "functioning at unacceptable risk." Bull trout numbers in the lower Yakima River are low (DART 2019a; 2019b). Dams and high summer temperatures have also reduced habitat connectivity for bull trout (Matthews et al. 2002; USBR 2011; USGS 2018). The proposed project will maintain the baseline conditions.

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Appendix F: Noise Analysis

Noise Calculations:

The following calculations and values are based on information and guidance from Chapter 7: Noise Impact Assessment in the Biological Assessment Preparation Advanced Training Manual for Transportation Projects, Version August 2020; prepared by the Washington State Department of Transportation (WSDOT); available online at: https://www.wsdot.wa.gov/sites/default/files/2018/01/18/Env-FW-BA_ManualCH07.pdf.

Terrestrial Noise Attenuation:
For terrestrial animals, sound is measures in dB(A), or A-weighted. This deemphasizes the upper and lower portions of the frequency spectrum, while emphasizing the middle portion of the spectrum (where humans have the greatest sensitivity).

Construction Noise: 109 dB(A)
The following is a list of equipment that will be used for general project work and the maximum noise level that each can produce at 50 feet: backhoe (84 dB(A)), cement truck (82 dB(A)), concrete saw (85 dB(A)), crane (79 dB(A)), dump truck (91 dB(A)), excavator (87 dB(A)), forklift (88 dB(A)), front end loader (81 dB(A)), impact pile driver (105 dB(A)), oscillator (70 dB(A)), power tools (dB(A)), pump truck (89 dB(A)), and vibratory pile driver (105 dB(A)). Using the law of decibel addition for the three loudest pieces of equipment, construction noise generated at the project location could be up to 109 dB(A) (WSDOT 2020).

Traffic noise: 75 dB(A)
Interstate 82 (I-82) is a 4-lane interstate highway with a speed limit of 60 mph and an ADT of 45,000. Line source, soft site: -4.5 dB(A) (WSDOT 2020).

Ambient Noise: 55 dB(A)
There are approximately 2,800 people per square mile within a 1-mile radius of the proposed project area. The Yakima River and Roza Canal Wasteway #2 also contribute to the ambient noise of the project area.

Terrestrial Noise Attenuation:
For construction, noise from a dump truck, impact pile driver, and vibratory pile driver use will be the farthest reaching. Following the laws of decibel addition for these three loudest pieces of equipment, 109 dB(A) will be the total loudest noise level at any given time.

Ambient noise is estimated at 55 dB(A). The equation for attenuation distance is:
$D = D_0 * 10^{((\text{Construction Noise} - \text{Background Noise in dBA})/\alpha))}$, where D_0 = distance original sound levels were measured (commonly 50 feet) and α = is 25 for "soft" site, point source.

$$D = D_0 * 10^{((\text{Construction Noise- Ambient Noise in dBA})/\alpha))}$$
$$D = 50 * 10^{((109-55)/25)}$$
$$D = 50 * 10^{(54/25)}$$
$$D = 50 * 10^{(2.16)}$$

$D = 50 * 144.54$
$D = 7{,}227.2$

Therefore, at approximately 7,227 feet or 1.37 miles from the project site, peak noise from construction activities will attenuate to the background.

Traffic noise is estimated at 75 dB(A) near I-82. The equation for attenuation distance is $D = D_0 * 10^{((\text{Traffic Noise} - \text{Ambient Noise in dBA})/\alpha))}$, where D_0 = distance original sound levels were measured (commonly 50 feet) and α = is 15 for "soft" site, line source.

$D = D_0 * 10^{((\text{Traffic Noise- Ambient Noise in dBA})/\alpha))}$
$D = 50 * 10^{((75-55)/15)}$
$D = 50 * 10^{(20/15)}$
$D = 50 * 10^{(1.33)}$
$D = 50 * 21.54$
$D = 1{,}077.2$

Therefore, at approximately 1,077 feet or 0.20 miles from the I-82, traffic noise will attenuate to the background traffic noise level. This attenuation distance is less than construction noise attenuating to background noise so approximately 1.37 miles from the project area is the estimated attenuation distance for terrestrial project noise. This distance for noise attenuation is used to determine the Action Area in Chapter 5.

Aquatic Noise:
Underwater noise is most commonly measured as instantaneous peak sound pressure level dB_{PEAK} or as the Root Mean Square dB_{RMS} pressure level during an impulse. The peak pressure is the instantaneous maximum overpressure or underpressure observed during each pulse and can be presented in Pascals (Pa) or SPL in decibels (dB) referenced to a pressure of 1 micropascal (dB re: 1 µPa). The RMS level is the square root of the energy divided by the impulse duration. This level is the mean square pressure level of the pulse. It is used by NOAA Fisheries to describe disturbance-related effects to aquatic organisms from underwater impulse-type noises. When evaluating potential injury impacts to fish, peak sound pressure (dB_{PEAK}) is often used (WSDOT 2020).

A third unit of measurement - Sound Exposure Level (SEL) is often used as a metric for acoustic events and is often used as an indication of the energy dose. SEL is calculated by summing the cumulative pressure squared (p^2), integrating over time, and normalizing to 1 second. This metric accounts for both negative and positive pressures because p^2 is positive for both and both are treated equally in the cumulative sum of p^2. The units for SEL are dB re: 1 μPa^2 sec (WSDOT 2020).

Aquatic Construction Noise from Impact Pile Driving: 205 dB_{PEAK}, 186 dB_{RMS}
A 205 dB_{PEAK}, 186 dB_{RMS}, and 204 SEL dB sound level is estimated 10 meters from a pile during impact pile driving with a diesel impact hammer for 24-inch steel pipe piles (WSDOT 2020).

Aquatic Construction Noise from Vibratory Pile Driving: 166 dB_{RMS}
A 162 dB_{RMS} and 165 SEL dB sound level is estimated 10 meters from a pile during vibratory pile driving 24-inch steel pipe piles (WSDOT 2020).

Ambient Aquatic Noise: 140dB_{RMS}
A 140dB_{RMS} ambient sound level is estimated within the Yakima River (WSDOT 2020).
Noise Reduction Factors:
Shallow Water (0-8 feet deep)

Practical Spreading Loss Model
The Practical Spreading Loss Model is used to determine the extent of project-related underwater noise.

$$TL = 15Log(R1/R2)$$

R1 is the distance where noise attenuates to ambient levels and/or disturbance/injury threshold levels
R2 is the distance from the source of the initial sound measurement
TL is the amount of spreading loss or the difference between the source sound level and the ambient sound level at some distance
The distance to where the source sound level attenuates to background noise may be calculated by rearranging the terms.

$$R1 = R2*10^{(TL/15)}$$

This formula can then be used to determine where construction noise will attenuate to background noise.

Impact Pile Driving 24-Inch Steel Pipe Piles (210 dB_{PEAK}, 189 dB_{RMS})

$$R1 = R2*10^{(TL/15)}$$
$$R1 = 10*10^{((189-140)/15)}$$
$$R1 = 10*10^{(3.27)}$$
$$R1 = 10*1,847.8$$
$$R1 = 18,478 \text{ meters}$$
60,625 feet or 11.5 miles

Noise from unmitigated impact pile driving 24-inch steel pipe piles will therefore reach ambient levels 11.5 miles or 60,625 feet from unmitigated impact pile driving activities.

The disturbance threshold for fish is estimated to be approximately 150 dB_{RMS}

$$R1 = R2*10^{(TL/15)}$$
$$R1 = 10*10^{((189-150)/15)}$$
$$R1 = 10*10^{(2.6)}$$
$$R1 = 10*398.11$$
$$R1 = 3,981.1 \text{ meters}$$
13,061 feet or 2.47 miles

Disturbance to fish may occur up to 2.5 miles or 13,061 feet with unmitigated impact pile driving of 24-inch steel pipe piles.

Utilization of a bubble curtain has been shown to reduce underwater noise during pile driving activities. A previous project on the Yakima River approximately 23 miles downstream had an approximately 2.5 dB reduction with bubble curtain use, so we will use this reduction in our calculations (Widener & Associates 2016).

$R1 = R2*10^{(TL/15)}$
$R1 = 10*10^{((186.5-140)/15)}$
$R1 = 10*10^{(3.1)}$
$R1 = 10*1,258.9$
$R1 = 12,589$ meters
41,303 feet or 7.82 miles

Mitigated impact pile driving of 24-inch steel pipe piles noise will therefore reach ambient levels 7.8 miles or 41,303 feet from impact pile driving activities mitigated with a bubble curtain.

The disturbance threshold for fish is estimated to be approximately 150 dB_{RMS}

$R1 = R2*10^{(TL/15)}$
$R1 = 10*10^{((186.5-150)/15)}$
$R1 = 10*10^{(2.43)}$
$R1 = 10*271.23$
$R1 = 2,712.3$ meters
8,898.5 feet or 1.68 miles

Disturbance to fish may occur up to 1.7 miles or 8,898.5 feet during impact pile driving of 24-inch steel pipe piles mitigated with a bubble curtain.

Vibratory Pile Driving 24-Inch Steel Pipe Piles (166 dB_{RMS})

$R1 = R2*10^{(TL/15)}$
$R1 = 10*10^{((166-140)/15)}$
$R1 = 10*10^{(1.73)}$
$R1 = 10*54.12$
$R1 = 541.2$ meters
1,775 feet or 0.34 miles

Vibratory pile driving of 24-inch steel pipe pile noise will therefore reach ambient levels 0.3 miles or 1,775 feet from vibratory pile driving activities.

The disturbance threshold for fish is estimated to be approximately 150 dB_{RMS}

$R1 = R2*10^{(TL/15)}$
$R1 = 10*10^{((166-150)/15)}$

$R1 = 10*10^{(1.067)}$
$R1 = 10*11.66$
$R1 = 116.6$ meters
382.5 feet or 0.072 miles

Disturbance to fish may occur up to 0.07 miles or 383 feet from vibratory pile driving of 24-inch steel pipe piles.

Underwater noise attenuation calculations assume a clear line-of site. The Yakima River has islands and turns both up and downstream of the project area. Due to these islands and the sinuosity of the Yakima River, SPLs from pile driving are expected to attenuate to background noise levels 3,816 feet (0.72 miles) upstream of pile driving and 2,238 feet (0.42 miles) downstream of pile driving.

Injury Thresholds
Elevated SPLs from impact pile driving are calculated using the NOAA Fisheries calculator, a spreadsheet developed by NOAA Fisheries, to assess the potential effect to fish resulting from elevated SPLs caused by impact pile driving, available online at: https://www.wsdot.wa.gov/environment/technical/fish-wildlife/policies-and-procedures/esa-ba/noise.

Estimated SPLs are taken from Table 7-14 in the Chapter 7: Noise Impact Assessment in the Biological Assessment Preparation Advanced Training Manual for Transportation Projects, Version August 2020.

	Acoustic Metric			
	Peak	SEL	RMS	Effective Quiet
Measured single strike level (dB)	**210**	**182**	**189**	**150**
Distance (m)	**10**	**10**	**10**	

Estimated number of strikes	**7950**

Cumulative SEL at measured distance
221

	Distance (m) to threshold			
	Onset of Physical Injury			Behavior
	Peak	Cumulative SEL dB**		RMS
	dB	Fish ≥ 2 g	Fish < 2 g	dB
Transmission loss constant (15 if unknown)	206	187	183	150
15	**18**	**1359**	**1359**	**3981**

According to this calculator if all 3, 24-inch piles are driven on the same day without a bubble curtain fish may incur physical injury within 1,359 meters or 0.8 miles and will be disturbed within 3,981 meters or 2.5 miles of the proposed steel pipe pile driving.

In order to minimize impacts to fish due to elevated SPLs a bubble curtain will be used at all times. A bubble curtain has been observed reducing sound levels by approximately 2.5 dB on a previous project in the Yakima River (Widener & Associates 2016).

	Acoustic Metric			
	Peak	SEL	RMS	Effective Quiet
Measured single strike level (dB)	**207.5**	**179.5**	**186.5**	**150**
Distance (m)	**10**	**10**	**10**	

Estimated number of strikes	**7920**

Cumulative SEL at measured distance
218

	Distance (m) to threshold			
	Onset of Physical Injury			Behavior
	Peak	Cumulative SEL dB**		RMS
	dB	Fish ≥ 2 g	Fish < 2 g	dB
Transmission loss constant (15 if unknown)	206	187	183	150
15	**13**	**926**	**926**	**2712**

According to the calculator if these minimization measures are taken fish may only incur physical injury within 926 meters or 0.6 miles and may be disturbed within 2,712 meters or 1.7 miles of pile driving.

As stated previously, land masses are known to hinder the forward movement of elevated SPLs within water, only those areas within line of sight of the proposed pile driving will experience elevated SPLs. Therefore, due to several islands and the sinuosity of the Yakima River, all sound impacts to fish will be within 3,816 feet (0.72 miles) upstream of pile driving and 2,238 feet (0.42 miles) downstream of pile driving.

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Appendix G. NMFS and USFWS, Western Washington Fish and Wildlife Office Impact Pile Driving Sound Attenuation Specification

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National Marine Fisheries Service (NMFS) and U.S. Fish and Wildlife Service (USFWS), Western Washington Fish and Wildlife Office
Impact Pile Driving Sound Attenuation Specification
Revised: October 31, 2006

INTRODUCTION

Air bubbles can reduce sound pressure levels (SPLs) at some frequencies by as much as 30 dB (Gisiner et al. 1998). Bubble curtains are essentially perforated pipes or hoses, surrounding the pile being driven, that produce bubbles when air is pumped through the perforations. Bubble curtains can also reduce particle velocity levels (MacGillivray and Racca 2005).

Bubble curtain designs are highly variable, but can generally be grouped in two categories: unconfined and confined. Unconfined systems are simply a frame which allows for transmission of air bubbles around a pile being driven. Confined systems add a sleeve around the pile to contain the bubbles. The sleeve can consist of fabric, hard plastic, or a larger pile (casing). Spacing of the bubble manifolds, air pressure, tidal currents, and water depth are all factors influencing effectiveness. Improper installation or operation can decrease bubble curtain effectiveness (Pommerenck 2006; Visconty 2004).

Reyff et al. (2002) evaluated the effectiveness of a confined system which used a foam-filled casing and bubble curtain. The casing was 3.8 meters in diameter with the interior coated with 2.54 centimeter closed cell foam. The casing surrounded the pile being driven, and contained the bubble flow. This system dramatically reduced both peak pressure and rms levels. Peak pressure was reduced by 23 to 24 dB and rms levels were reduced by 22 to 28 dB.

A confined bubble curtain used in driving 24 inch octagonal concrete piles at the Port of Benicia in San Francisco Bay, California, attenuated SPLs between 20 and 30 dB (Rodkin, 2003). At the Benicia Martinez Bridge project in California, the project proponents used a casing that was either dewatered, or included an air bubble system. Both techniques yielded substantial reductions in SPLs. The sleeve with an air bubble curtain reduced peak SPLs by up to 34 dB, which the authors note, equates to a 99 percent reduction in the overall energy of the impulse (Reyff et al, 2002). A confined bubble curtain used in driving 30 inch steel piles at a Washington State Ferries facility in Eagle Harbor, Washington, attenuated SPLs by an average of 9.1 dB (MacGillivary and Racca, 2005).

During impact installation of steel piles in an embayment on the Columbia River an unconfined bubble curtain built using a design by Longmuir and Lively (2001) achieved a maximum reduction of 17 dB, although the results were variable (Laughlin 2006). Unconfined bubble curtains used in driving very large steel piles for bridges in San Francisco Bay, California, have attenuated SPLs by as much as 20 dB (Abbott and Reyff 2004). An unconfined bubble curtain used during installation of 24 inch steel piles in the

City of Vancouver, British Columbia, reduced SPLs by 17 dB (Longmuir and Lively, 2001). At Friday Harbor, Washington, the Washington State Ferries monitored steel pile driving with and without a bubble curtain (Visconty 2004). Initially, the bubble curtain was improperly installed and no sound attenuation was observed. The bubble curtain was not placed firmly on the bottom; therefore, unattenuated sound escaped under the bubble curtain. After the bubble curtain was modified by adding weight and a canvas skirt to conform to the bottom contour of Puget Sound, the sound was reduced by up to 12 dB, with an average of 9 dB reduction. Vagle (2003) reported reductions of between 18 dB and 30 dB when using a properly designed bubble curtain.

In Washington, the effectiveness of both unconfined and confined systems has been variable and below that of other locations. This may be attributable to an incomplete understanding of design, deployment, and performance, and/or to site specific parameters such as substrate and driving depth. With a common set of design and performance specifications, variability should be minimized and limited to site specificity.

Unconfined Bubble Curtain Specifications:

1. General - An unconfined bubble curtain is composed of an air compressor(s), supply lines to deliver the air, distribution manifolds or headers, perforated aeration pipe, and a frame. The frame facilitates transport and placement of the system, keeps the aeration pipes stable, and provides ballast to counteract the buoyancy of the aeration pipes in operation.

2. The aeration pipe system shall consist of multiple layers of perforated pipe rings, stacked vertically in accordance with the following:

Water Depth (m)	No. of Layers
0 to less than 5	2
5 to less than 10	4
10 to less than 15	7
15 to less than 20	10
20 to less than 25	13

3. The pipes in all layers shall be arranged in a geometric pattern which shall allow for the pile being driven to be completely enclosed by bubbles for the full depth of the water column and with a radial dimension such that the rings are no more than 0.5 meters from the outside surface of the pile.

4. The lowest layer of perforated aeration pipe shall be designed to ensure contact with the substrate without burial and shall accommodate sloped conditions.

5. Air holes shall be 1.6 mm (1/16-inch) in diameter and shall be spaced approximately 20 mm (3/4 inch) apart. Air holes with this size and spacing shall be placed in four adjacent rows along the pipe to provide uniform bubble flux.

6. The system shall provide a bubble flux of 3.0 cubic meters per minute per linear meter of pipe in each layer (32.91 cubic feet per minute per linear foot of pipe in each layer). The total volume of air per layer is the product of the bubble flux and the circumference of the ring:

   $V_t = 3.0\ m^3/min/m$ * Circum of the aeration ring in m

   or

   $V_t = 32.91\ ft^3/min/ft$ * Circum of the aeration ring in ft

7. Meters shall be provided as follows:

   a. Pressure meters shall be installed at all inlets to aeration pipelines and at points of lowest pressure in each branch of the aeration pipeline.

   b. Flow meters shall be installed in the main line at each compressor and at each branch of the aeration pipelines at each inlet. In applications where the feed line from the compressor is continuous from the compressor to the aeration pipe inlet the flow meter at the compressor can be eliminated.

   c. Flow meters shall be installed according to the manufactures recommendation based on either laminar flow or non-laminar flow.

Performance: In Washington, unconfined bubble curtains have achieved a maximum of 17 dB attenuation and more typically range between 9 to 12 dB. Should hydroacoustic monitoring reveal that an unconfined bubble curtain is not achieving (to be determined based on site and project specific considerations), the NMFS and/or USFWS staff person on the project should be contacted immediately regarding modifications to the proposed action. Should attenuation rates continue at less than (to be determined based on site and project specific considerations), re-initiation of consultation may be necessary.

Confined Bubble Curtain Specifications:

1. General - A confined bubble curtain is composed of an air compressor(s), supply lines to deliver the air, distribution manifolds or headers, perforated aeration pipe(s), and a means of confining the bubbles.

   a. The confinement (e.g. fabric, plastic or metal sleeve, or equivalent) shall extend from the substrate to a sufficient elevation above the maximum water level expected during pile installation such that when the air delivery system is adjusted properly, the bubble curtain does not act as a water pump (i.e., little or no water should be pumped out of the top of the confinement system).

b. The confinement shall contain resilient pile guides that prevent the pile and the confinement from coming into contact with each other and do not transmit vibrations to the confinement sleeve and into the water column (e.g. rubber spacers, air filled cushions).

2. In water less than 15 meters deep, the system shall have a single aeration ring at the substrate level. In waters greater than 15 meters deep, the system shall have at least two rings, one at the substrate level and the other at mid-depth.

3. The lowest layer of perforated aeration pipe shall be designed to ensure contact with the substrate without sinking into the substrate and shall accommodate for sloped conditions.

4. Air holes shall be 1.6 mm (1/16-inch) in diameter and shall be spaced approximately 20 mm (3/4 inch) apart. Air holes with this size and spacing shall be placed in four adjacent rows along the pipe to provide uniform bubble flux.

8. The system shall provide a bubble flux of 3.0 cubic meters per minute per linear meter of pipe in each layer (32.91 cubic feet per minute per linear foot of pipe in each layer). The total volume of air per layer is the product of the bubble flux and the circumference of the ring:

$V_t = 3.0\ m^3/min/m$ * Circ of the aeration ring in m

or

$V_t = 32.91\ ft^3/min/ft$ * Circ of the aeration ring in ft

5. Meters shall be provided as follows:

a. Pressure meters shall be installed at all inlets to aeration pipelines and at points of lowest pressure in each branch of the aeration pipeline.

b. Flow meters shall be installed in the main line at each compressor and at each branch of the aeration pipelines at each inlet. In applications where the feed line from the compressor is continuous from the compressor to the aeration pipe inlet the flow meter at the compressor can be eliminated.

c. Flow meters shall be installed according to the manufactures recommendation based on either laminar flow or non-laminar flow.

Performance: In Washington, few projects have used confined bubble curtains so there is a lack of data. Based on performance in other locations, the effectiveness of a confined system could range from 9 dB to 30 dB. Should hydroacoustic monitoring reveal that a confined bubble curtain is not achieving (to be determined based on site and project specific considerations), the NMFS and/or USFWS staff person on the project should be

contacted immediately regarding modifications to the proposed action. Should attenuation rates continue at less than (to be determined based on site and project specific considerations), re-initiation of consultation may be necessary.

Terms and Conditions:

1. A bubble curtain meeting the above design specifications and performance requirements shall be used for all impact pile driving.

2. The bubble curtain design specifications shall be submitted to NMFS and/or the USFWS a minimum of 60 days prior to impact pile driving. The specification shall include, but not be limited to, details regarding hole size, hole spacing, hammer type and energy level, and air supply configuration and level. For confined systems the specification shall include details of the sleeve size, length, and guide system.

3. A hydroacoustic monitoring plan shall be submitted to NMFS and/or the USFWS for approval a minimum of 60 days prior to impact pile driving. The hydroacoustic monitoring plan must be prepared and implemented by someone with proven expertise in the field of underwater acoustics and data collection and shall include the name and qualifications of the biologist to be present during impact pile driving.

4. The contractor shall perform a performance test of the bubble curtain, prior to any impact pile driving, in order to confirm the calculated pressures and flow rates at each manifold ring. The contractor shall submit an inspection/performance report to NMFS and/or USFWS within 72 hours following the performance test.

5. Impact pile driving shall not take place between one hour after sunset and one hour before sunrise. (Note: Implementation of this condition will depend on site specific considerations)

6. A qualified biologist shall be present during all impact pile driving operations to observe and report any indications of dead, injured or distressed fishes, including direct observations of these fishes or increases in bird foraging activity.

7. If a barge is used to house the pile-driver, it shall be isolated from the noise-producing operations. This isolation shall be such that noise from the pile driving operation is not transmitted through the barge to the water column.

8. FHWA shall document the effectiveness of the bubble curtain through hydroacoustic monitoring of a minimum of five piles, as early in the project as possible. Factors to consider in identifying the piles to be monitored include, but are not limited to: bathymetry of project site, total number of piles to be driven, sizes of piles, and distance from shore. Peak and rms SPLs, and sound exposure levels (SEL), with and without a bubble curtain, shall be monitored at a distance of 10 meters from each pile at mid-water depth.

9. If the hydroacoustic monitoring indicates that the SPLs will exceed the extent of take exempted in the Biological Opinion(s), the FHWA shall contact NMFS and/or the USFWS within 24 hours. The FHWA shall consult with the Service(s) regarding modifications to the proposed action in an effort to reduce the SPLs below the limits of take and continue hydroacoustic monitoring.

10. FHWA shall submit a monitoring report to the consulting biologist(s) at NMFS and/or the USFWS within 60 days of completing hydroacoustic monitoring. The report shall include the following information:

    a. size and type of piles;
    b. a detailed description of the bubble curtain, including the design specifications identified above;
    c. the impact hammer force used to drive the piles;
    d. a description of the monitoring equipment;
    e. the distance between hydrophone and pile;
    f. the depth of the hydrophone;
    g. the distance from the pile to the wetted perimeter;
    h. the depth of water the pile was driven;
    i. the depth into the substrate the pile was driven;
    j. the physical characteristics of the bottom substrate into which the piles were driven; and
    k. the results of the hydroacoustic monitoring, including the frequency spectrum, peak and rms SPLs, and single-strike and cumulative SEL with and without the bubble curtain. The report must also include the ranges and means for peak, rms and SELs for each pile.

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