



US Army Corps  
of Engineers ®  
Seattle District

**BIOLOGICAL EVALUATION  
FOR INFORMAL ESA CONSULTATION**  
For: \_\_\_\_\_ (Corps Reference Number)  
Version: May 2012



**\*\* This form is for projects that have insignificant or discountable impacts on listed species. It contains all the information required for a biological evaluation, but in abbreviated form and with minimal instructions on how to fill it out. For more detailed instructions, a format for development of a biological assessment or biological evaluation can be found on the Seattle District Corps website ([www.nws.usace.army.mil](http://www.nws.usace.army.mil) – click on regulatory and then on endangered species, BA Template). You may also contact the Corps at 206-764-3495 for further information.**

**Drawings and Photographs - Drawings and photographs must be submitted.** Photographs must be submitted showing local area, shoreline conditions, existing overwater structures, and location of the proposed project. Drawings must include a vicinity map; plan, profile, and cross-section drawings of the proposed structures; and over- and in-water structures on adjacent properties. (For assistance with the preparation of the drawings, please refer to our *Drawing Checklist* located on our website at [www.nws.usace.army.mil](http://www.nws.usace.army.mil) Select Regulatory – Regulatory/Permits – Forms.) Submit the information to: U.S. Army Corps of Engineers, Regulatory Branch, P.O. Box 3755, Seattle, Washington 98124-3755.

**Date: March 25, 2020**

| <b>SECTION A - General Information</b>  |             |   |            |
|---|-------------|---|------------|
| <b>1. Applicant name:</b> Grays Harbor County Department of Public Works, Attention: Rob Wilson |             |   |            |
| Mailing address: 100 West Broadway, Suite 31, Montesano Washington, 98563                       |             |   |            |
| Work phone:<br>360-249-4222   | Home phone: | Email:<br>RWilson@co.grays-harbor.wa.us | Fax:       |
| <b>2. Joint-use applicant name (if applicable):</b>   |             |   |            |
| Mailing address:  |             |   |            |
| Work phone:   | Home phone: | Email:                                  | Fax:       |
| <b>3. Authorized agent name:</b>  |             |   |            |
| Mailing address:  |             |   |            |
| Work phone:   | Home phone: | Email:                                  | Fax:       |
| <b>4. Location where proposed work will occur</b>   |             |   |            |
| Address (street address, city, county):<br>110 Keys Road<br>Montesano, WA 98563                 |             |   |            |
| Location of joint-use property (street address, city, county):                                  |             |   |            |
| Waterbody: Satsop River   |             |   |            |
| ¼ Section: NW   | Section: 6  | Township: 17N                           | Range: 06W |
| Latitude: 46.982143   |             | Longitude: -123.482279                  |            |

## 5. Description of Work:

### **Include project drawings and site photographs.**

*Describe the proposed project in detail. Please describe any mitigation that is being proposed for impacts from your project. Attach a mitigation plan as an appendix, if appropriate.*

- Refer to Attachment A for Project Description
- Refer to Attachment B for Project Plan Sheets

### **For projects that include pile driving**

*If steel or concrete piles are being installed with an impact hammer pile driver, marbled murrelets may be adversely impacted. For installation of any type of pile with a vibratory pile driver, marine mammals may be adversely impacted. A monitoring plan may be required to ensure protection of these species.*

| <b>Please fill out the following: (obtain information from contractor)</b>                              |  |
|---|--|
| 5.1 Number of piles being <del>replaced</del> installed   | 422 piles will be installed (not replaced) as anchors to secure wood structures (i.e. Engineered Log Jams and setback revetments)<br>265 piles will be installed in-water.<br>157 piles will be installed out-of-water, within the floodplain  |
| 5.2 <del>Replacement</del> pile type:<br>(e.g.: ACZA-treated wood, steel, coating used on steel piles)  | Piles will be untreated wooden piling  |
| 5.3 <del>Replacement</del> pile size:<br>(e.g. 12-inch)   | Piling will be 16- to 24-inch diameter.  |
| 5.4 Installation method:<br>(e.g.: vibratory, impact hammer)  | Vibratory.<br><br><b>Note:</b> Vibratory or impact installation of wood, concrete, plastic, or other non-metal piles of any size is allowed. Impact installation of steel piles in marine waters is not covered under the programmatic and, in freshwater, is only covered programmatic for steel piles up to 10 inches. |
| 5.5 Anticipated dates, number of minutes and number of days vibratory pile driving                      | <u>240</u> minutes per day<br><u>31</u> number of days<br><br>Anticipated dates: August 1—August 31  |
| 5.6 For vibratory installation, will proofing be required? If so, how many pile strikes per pile?       | Yes _____ Number of pile strikes per pile _____<br>No <u> X </u>   |
| 5.7 For impact hammer installation, estimate the number of pile strikes required per pile:              | Not applicable.  |
| 5.8 For impact hammer installation or proofing, estimated number of pile strikes per day:               | Minutes per day _____<br>Number of days _____<br>Anticipated dates: _____  |
| 5.9 For impact hammer pile driving or proofing, sound attenuation measures:                             | Not applicable.  |
| 5.10 Anticipated dates, number of minutes and number of days of impact hammer pile driving or proofing: | Not applicable.  |
| 5.11 Describe substrate into which piling will be driven:   | Gravel, cobble and sand  |

## 6. Construction Techniques:

*Describe methods and timing of construction to be employed in building the project and any associated features. Identify actions that could affect listed / proposed species or designated / proposed critical habitat and describe in sufficient detail to allow an assessment of potential impacts. Consider actions such as vegetation removal, temporary or permanent elevations in noise level, channel modifications, hydrological or hydraulic alterations, access roads, power lines etc. Also discuss construction techniques associated with any interdependent or interrelated projects.*

*Address the following:*

### A. Construction sequencing and timing of each stage (duration and dates):

Construction mobilization will begin in early- to mid-June, with transport of equipment and woody material to the project site and establishing staging areas and construction access, as permissible. All construction activities that are performed prior to August 1 will be in upland areas, outside of the OHWL of the Satsop River and associated floodplain ponds and other aquatic features. In-water work will occur during the approved in-water work window of August 1—August 31. In-water work will consist of the following elements:

Complete temporary construction access, including temporary bridge and material staging area  
Excavate temporary bypass channel (1,250 ft. long x 50 ft. wide at toe, 60 ft. wide at top of bank)  
Install Type 1 Apex ELJs, Type 2 Apex ELJs, Type 1 Deflectors, and Timber Complexes.  
Install Floodplain Roughness and Type 1 and Type 2 Setback Levees.

Once the in-water work is completed, the project site will be cleaned up, all erosion and sediment control measures will be removed, and the project site will be returned to pre-project contours to the extent practicable. In total, the project will require the excavation of 33,256 cubic yards of material over 10.48 acres. Of this, 11,802 cubic yards will be excavated from the Satsop River, below the OHWM of the river. Material excavated from below the OHWM will be spread out over those areas where floodplain roughness elements will be installed, which will be dry during construction. This could raise the elevation in the areas around the floodplain roughness elements by 0.5 feet.

All areas of temporary upland and floodplain disturbance will be replanted with native grasses, shrubs and trees. The project related in-water work will be completed by August 31. Other project related upland work is expected to be completed by September 30.

### B. Site preparation:

Site prep will include establishing construction ingress-egress. Construction access will use existing primitive roads, reducing the extent of clearing required. Specific points and routes for construction ingress-egress will be delineated in the field with orange barrier fencing to avoid and minimize impacts to vegetation and other sensitive habitats. A temporary access route will be developed as well as an equipment staging and refueling area, located approximately 600 feet from the Satsop River. A material staging area will be located near the river, on a gravel bar.

### C. Equipment to be used:

The project will require the use of pick-up trucks, dump truck, backhoe, grader, trackhoe mounted vibratory pile driver, and hand-held power tools.

### D. Construction materials to be used:

Logs and woody racking material, concrete dolos, boulders, and anchoring cable to secure the structures.

- E. Work corridor:  
Work will occur in the lower 1.5 miles of the Satsop River, just upstream from the confluence with the Chehalis River.
- F. Staging areas and equipment wash outs:  
The staging and refueling area for equipment will be located in an upland area, just off Keys Road and approximately 600 feet from the Satsop River. Two material staging areas will be established down along the river, near the areas where the ELJs will be constructed. See Sheet 6 of 16 for locations of equipment/refueling and material staging areas.
- G. Stockpiling areas:  
See response above. Sheet 6 of 16 shows the locations of the material staging areas.
- H. Running of equipment during construction:  
Equipment will run 10-12 hours per day during the in-water work window of August 1—August 31, due to the compressed timeframe and the extent of work to be completed during this short window. Work in upland areas, gravel bars and the floodplain, that can be completed in the dry may occur before and/or after August 31, if necessary, to complete the project and ensure all in-water work is completed between August 1—August 31.
- I. Soil stabilization needs / techniques:  
Temporary Erosion and Sediment Control (TESC) measures will comply with all permit terms and conditions at a minimum. It will be the responsibility of the contractor to develop the TESC Plan and implement and maintain the appropriate measures during construction.
- J. Clean-up and re-vegetation:  
Post project, all construction related material will be removed from the project area and disposed of at an approved facility. Temporary construction ingress-egress will be regraded to original contours and site restoration will be implanted, including; plantings, installation of erosion control fabric as needed, seeding and mulching where necessary to return temporarily disturbed areas to pre-project conditions.
- K. Storm water controls / management:  
Not applicable.
- L. Source location of any fill used:  
Fill material will not be imported from off-site. All fill material will be sourced on-site from excavation of the temporary bypass channel and the pump outlet containment ponds.
- M. Location of any spoil disposal:  
Spoils will be used on-site. Spoils will consist of material from the active channel and adjacent floodplain and any spoils from the project will be returned to the active channel, gravel bars and adjacent floodplain as appropriate. No piles or other features will be created from disposal of spoils. Spoils will be incorporated into gravel bars and the floodplain to match existing contours as much as possible.

## 7. Action Area

*Please describe the action area. The action area means all areas to be affected directly (e.g., earth moving, vegetation removal, construction noise, placement of fill, release of environmental contaminants) and indirectly by the proposed action. (Example: as a direct effect, the action area for pile driving would include the area out to where the noise from the pile driving falls below the level of harm or disturbance for listed species. For vibratory hammer pile driving impacts to killer whales, this level is 120 dB. Action area will include any area where the underwater noise level may exceed 120 dB).*

The project is in a rural setting and will require the use of heavy machinery, including a tracked excavator, vibratory pile-driver and a dump truck along the active channel of the Satsop River. The Satsop River is forested along both banks, and the work will occur below the top of the river banks. This will reduce the extent terrestrial construction related noise can travel. Typical noise levels generated by this type of heavy equipment are around 90 A-weighted decibels (dBA) at 50 feet, decreasing to approximately 60-70 dBA at 3,000 feet. Ambient noise levels in a rural setting with a low-speed and high-speed arterial (i.e., Keys Road to the east and Hwy 101 to the north) are approximately 60-70 dBA at 50 feet from the roadway, decreasing to approximately and 43 dBA at 3,000 feet. Thus, construction noise levels are anticipated to be at ambient noise levels at a distance of 3,000 feet (0.57 mile) from the project site, based on the noise buffer provided by the vegetation and the river banks, the rural setting in which the project is located and the noise levels generated by project construction activities; thus, the action area associated with impacts from noise is delineated at 3,000 feet.

Temporary degradation to water quality associated with project construction is not anticipated to occur beyond 3,000 feet downstream of any project-related in-water work with the incorporation of appropriate BMPs to avoid or minimize temporary increases in turbidity associated with in-water work. The indirect effects of the project include the potential increase in production for salmonids within the Satsop River. The anticipated increase in production will have a temporal, beneficial impact to fish and other aquatic organisms, but will not affect the delineation of the project action area because conditions within the project reach will improve for fish locally over time but not over a known or measurable distance.

No interrelated or interdependent actions are anticipated as a result of the project. The construction activities required to complete the project were the basis of the determination that an action area of 3,000 feet is adequate for analysis of potential impacts to federally listed species. See Attachment C—Figure 1. Project Action Area

## 8. Species Information:

*Identify each listed or proposed species, including terrestrial species, as well as designated or proposed critical habitat in the action area. Please include information on which listed species use are expected to be found in the action area and the potential for them to be there during project activities.*

*To determine what listed or proposed species may occur in the action area, contact NOAA Fisheries at the address listed below and obtain a county list of federally listed/ designated and proposed species and critical habitat from the:*

U.S Fish and Wildlife Service at: [http://westernwashington.fws.gov/se/SE\\_List/Endangered\\_Species.asp](http://westernwashington.fws.gov/se/SE_List/Endangered_Species.asp)

National Marine Fisheries Service at:  
510 Desmond Dr., SE # 103  
Lacey, WA 98503  
(360) 753-9530  
<http://www.nwr.noaa.gov>

The following species are listed as of August 11, 2011

**Species covered, based on species list received from the USFWS iPac web site February 7, 2020: Refer to Attachment D—Species List from USFWS.**

**USFWS SPECIES**

**BIRDS**

Marbled murrelet

Northern spotted owl

Short-tailed albatross

Western snowy plover

Streaked horned lark

Yellow-billed cuckoo

**MAMMALS**

Canada lynx

Columbia white-tailed deer

Gray wolf (western WA)

Gray wolf (eastern WA)

Grizzly bear

Woodland caribou

Pygmy rabbit (Columbia Basin DPS)

Fisher

**INSECTS**

Oregon silverspot butterfly

**PLANTS**

Bradshaw's desert parsley

Marsh sandwort

Showy stickseed

Wenatchee Mtns. Checker-mallow

Golden paintbrush

Kincaid's lupine

Nelson's checker-mallow

Water howellia

Spalding's catchfly

Ute ladies'-tresses

**FISH**

Bull trout, Columbia River

Bull trout, coastal-Puget Sound

Dolly varden, coastal-Puget Sound

**NMFS SPECIES**

**FISH**

Chum, Columbia River

Chum, Hood Canal summer

Chinook, lower Columbia River

Chinook, upper Columbia River spring

Chinook, Puget Sound

Chinook, Snake River fall

Chinook, Snake River spring-summer

Chinook, upper Willamette River

Coho, lower Columbia River

Sockeye, Ozette Lake

Sockeye, Snake River

Steelhead, upper Columbia River

Steelhead, middle Columbia River

Steelhead, lower Columbia River

Steelhead, Snake River

Steelhead, upper Willamette River

Steelhead, Puget Sound

Sturgeon, Green (southern DPS)

Eulachon, Pacific (southern DPS)

Bocaccio (Georgia Basin DPS)

Rockfish, canary (Georgia Basin DPS)

Rockfish, yelloweye (Georgia Basin DPS)

**MARINE MAMMALS**

Humpback whale

Blue whale

Fin whale

Sei whale

Sperm whale

Southern resident killer whale

Steller sea lion

**REPTILES-AMPHIBIANS**

Leatherback sea turtle

Loggerhead sea turtle

Green sea turtle

Olive Ridley sea turtle

**9. Existing Environmental Conditions:**

*Describe existing environmental conditions for the following:*

*A. Shoreline riparian vegetation and habitat features*

Riparian vegetation is primarily young deciduous forest dominated by red alder (*Alnus rubra*) with a dense shrub understory of mixed native and invasive species such as giant knotweed (*Fallopia sachalinensis*), Himalayan blackberry (*Rubus armeniacus*), and reed canarygrass (*Phalaris arundinacea*).

Riparian vegetation is primarily established within the adjacent floodplain and channel migration zone or potential avulsion areas. Those areas beyond the active channel migration zone have sparse riparian vegetation such as deciduous trees, but are mostly agricultural fields beyond the river's active channel migration zone.

- B. *Aquatic substrate and vegetation (include information on the amount and type of eelgrass or macroalgae present at the site)*  
 No aquatic vegetation is present in the project area. Substrate consists of gravel and cobble within the active channel and high-flow channels, as well as fine sediments such as sand and mud in remnant side-channels.
- C. *Surrounding land/water uses*  
 The surrounding land use is primarily agricultural. The project setting is rural.
- D. *Level of development*  
 The level of development in the project action area is relatively low, with family farms and single-family residential homes.
- E. *Water quality*  
 The Department of Ecology lists this segment of the Satsop River as a Category 1 water, meaning it meets the state water quality standards.  
  
 The Satsop River upstream of the Hwy 101 Bridge is a Category 5 water, listed for dissolved oxygen.  
  
 The Chehalis River downstream of the project area, is also a Category 5 water, listed for Polychlorinated Biphenyls (PCBs) and Mercury.
- F. *Describe use of the action area by listed salmonid fish species.*  
 Bull trout presence in the project action area is assumed based on documented historic presence. Bull trout have not been observed in the Satsop River in some time and the USFWS indicates that they have likely been extirpated from the system, however WDFW indicates that bull trout have been documented in the Satsop River. Bull trout historically occurred in the Satsop River and the Satsop River is designated as critical habitat for bull trout.
- G. *Is the project located within designated / proposed bull trout or Pacific salmon critical habitat? If so, please address the proposed projects' potential direct and indirect effect to primary constituent elements (Critical habitat templates can be found on the Corps website at: <http://www.nws.usace.army.mil/Missions/CivilWorks/Regulatory/PermitGuidebook/EndangeredSpecies.aspx>, select Forms, Tools and References; Forms and Templates; Critical Habitat Assessment Forms.*  
 The project area is located within designated critical habitat for bull trout. The project will not have any potential direct or indirect effects on the following primary constituent elements; Water Temperature, Substrate Quality, Hydrology, Groundwater Connectivity, or Food Base.  
  
 The project could have direct or indirect impacts on the following primary constituent elements;  
  
**Complexity.** Complex stream channels are required by bull trout, with features such as woody debris, side channels, pools, and undercut banks to provide a variety of depths, velocities, and instream structures. The project will result in increased complexity within the project area, by installing instream structure in the form of Engineered Log Jams and other in-stream structures. These structures will develop pools and provide cover in the lower Satsop River that could benefit bull trout that may use this area of the Satsop River.

**Migratory Corridors.** Migratory corridors must have minimal physical, biological, or water quality impediments between spawning, rearing, overwintering, and foraging habitats, including intermittent or seasonal barriers induced by high water temperatures or low flows.

The project will not result in any impediments to migratory corridors, but may in fact improve migratory corridors by provide increased habitat complexity in the lower Satsop River; providing cover and reducing bank erosion.

Water Quantity and Quality. Bull trout require permanent water of sufficient quantity and quality such that normal reproduction, growth, and survival are not limited.

The project will not alter water quantity. Short-term, localized impacts to water quality are likely to occur from project related in-water work. This direct impact to water quality will occur during the approved in-water work window, will be temporary and not result in a permanent change in water quality.

- H. *Describe use of the action area by other listed fish species (green sturgeon, eulachon, bocaccio, canary rockfish and yelloweye rockfish).*

Not applicable. No other listed fish species are anticipated to occur in the project action area.

- I. *Is the project located within designated/proposed critical habitat for any of the species listed below? If so please address the proposed projects' potential direct and indirect effect to primary constituent elements. Please see the NOAA-Fisheries and US Fish and Wildlife websites ([www.nwr.noaa.gov](http://www.nwr.noaa.gov) and [www.fws.gov/pacific](http://www.fws.gov/pacific) respectively) for further information.*

|                                       |                             |
|---------------------------------------|-----------------------------|
| <i>Southern resident killer whale</i> | <i>Marbled murrelet</i>     |
| <i>Northern spotted owl</i>           | <i>Western snowy plover</i> |
| <i>Green sturgeon</i>                 | <i>Eulachon</i>             |

Not applicable.

- J. *Describe use of action area by marbled murrelets. How far to the nearest marbled murrelet nest site or critical habitat? Some information is available on the Fish and Wildlife Service website: <http://ecos.fws.gov/speciesProfile/profile/speciesProfile.action?spcode=B08C>.*

The action area may be used as a migratory corridor for marbled murrelets traveling between the Pacific Ocean and nest sites located in the Satsop or Chehalis River watershed. The nearest designated critical habitat is approximately ten miles to the east along the Chehalis River and 22 miles to the north along the Satsop River, in Olympic National Park.

- K. *Describe use of action area by the spotted owl. How far to the nearest spotted owl nest site or critical habitat? Some information is available on the Fish and Wildlife Service website: <http://ecos.fws.gov/speciesProfile/profile/speciesProfile.action?spcode=B08B>.*

Northern spotted owls are not expected to occur in the project action area due to lack of suitable habitat. Designated critical habitat is located approximately 22 miles to the north, in Olympic National Park.

- L. **For marine areas only:** Describe use of action area by Southern Resident killer whales. How often have they been seen in the area and during what months of the year? For information on noise

impacts on killer whales and other marine mammals, please see the National Marine Fisheries website: <http://www.nwr.noaa.gov/Marine-Mammals/MM-consults.cfm>.

Not applicable

M. **For marine areas and Columbia River:** How far is the nearest Steller sea lion haul out site from the action area? Describe their use of the action area. See the National Marine Fisheries website: <http://www.nwr.noaa.gov/Marine-Mammals/MM-consults.cfm> for information on the Steller sea lion and location of their haul out sites.

Not applicable.

N. **For marine areas only: Forage Fish Habitat** – only complete this section if the project is in tidal waters.

Not applicable.

Check box if Washington Department of Fish and Wildlife (WDFW) documented habitat is present. Go to the WDFW website for this information: <http://wdfw.wa.gov/fish/forage/forage.htm>, then search for each species under the link to Biology, then the link to Documented Spawning Grounds (if available, please attach a copy of the Hydraulic Project Approval from WDFW):

**Surf Smelt:**                       **Pacific Herring:**                       **Sand Lance:**

Check box if the proposed action will occur in potentially suitable forage fish spawning habitat:

**Surf Smelt:**                       **Pacific Herring:**                       **Sand Lance:**

If no boxes are checked, please explain why site is not suitable as forage fish spawning habitat.

Please describe the type of substrate and elevation and presence of aquatic vegetation at the project area. For example:

At +10 to +5 feet above MLLW, there is no aquatic vegetation, the substrate consists of large cobbles. At +5 to +1 foot above MLLW, there is eelgrass and the substrate consists of fine sand.

Not applicable.

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**10. Effects Analysis**

*Describe the direct and indirect effects of the action on the proposed and listed species as well as designated and proposed critical habitat within the action area. Consider the impact to both individuals and the population. Discuss the short-term, construction-related, impacts as well as the long-term and permanent effects.*

**Direct Impacts:**

**Underwater Noise from Vibratory Pile Driving**

The primary impact mechanism to bull trout is exposure to elevated underwater noise levels associated with vibratory pile driving activities necessary to install 422 untreated wooden piling for the various structures (265 piling to be installed in-water and 157 piling to be installed in-the-dry). Piling sizes will be 16 inches. For this analysis, it is assumed all piling installed in-water will be 16-inch wooden piling.

The noise produced during vibratory pile driving of 16-inch wooden piling was obtained from data presented in the Caltrans Pile Driving Compendium (Caltrans 2015). The recorded noise levels for installing 16-inch wooden piling with a vibratory pile driver are presented in Table 1, below. Additionally, the distance to thresholds for injury and behavioral effects are also shown in Table 1.

**Table 1. Underwater Noise- Distance to Injury and Disturbance Thresholds for Bull Trout**

| Effect                   | Fish size | USFWS/NMFS Thresholds                              | Recorded dB (measured at 10 m) | Distance to Threshold (m) |
|--------------------------|-----------|--|--------------------------------|---------------------------|
| Onset of physical injury | N/A       | 206 dB <sub>peak</sub> (re: 1 μPa)                 | 176 peak                       | n/a                       |
|                          | ≥ 2 g     | 187 dB <sub>SEL</sub> (re: 1μPa <sup>2</sup> •sec) | 165 SEL                        | n/a                       |
|                          | < 2 g     | 183 dB <sub>SEL</sub> (re: 1μPa <sup>2</sup> •sec) | 165 SEL                        | n/a                       |
| Behavioral effects       | N/A       | 150 dB <sub>RMS</sub> (re: 1 μPa)                  | 170 RMS                        | 215                       |

In general, bull trout within 215 meters of in-water vibratory pile driving activities would be subject to underwater noise levels exceeding the onset of behavioral effects. In-water vibratory pile driving is not anticipated to produce underwater noise levels that would result in physical injury to bull trout.

The approved in-water work window for the Satsop River is August 1—August 31 for WDFW and July 1—August 31 for the Corps of Engineers. All in-water work will be completed during the in-water work window specified in the permits, adhering to the most restrictive permit conditions.

**Turbidity**

Increases in sedimentation and turbidity have been shown to affect salmonid physiology, behavior, and habitat. Physiological effects of turbidity on salmonids include stressors that can affect the physical health of salmonids. Effects that have been studied in salmonids include gill trauma, blood sugar levels, and osmoregulatory function. Behavioral effects include changes associated with increases in turbidity, such as avoidance, as well as changes in foraging ability, response to predation risk, and reduced territoriality (Meehan 1991). Effects to salmonid habitat include changes to spawning and rearing habitat (Bash et al. 2001).

Sedimentation and erosion associated with project construction could potentially affect fish and fish habitat. Ground-disturbing construction activities could potentially degrade aquatic habitat through erosion and subsequent sediment transport and delivery to streams. Short-term pulses of suspended sediments have been shown to cause gill trauma in salmonids (Bash et al. 2001). Deposition of excessive fine sediment on the stream substrate could eliminate habitat for aquatic insects; reduce density, biomass, number, and diversity of aquatic insects and vegetation; reduce the permeability of spawning gravel; and block the interchange of surface and subsurface waters. Increases in fine sediments in low-velocity stream reaches could also cover suitable spawning gravel. Other potential effects include channel braiding, increased width/depth ratios, increased incidence and severity of bank erosion, reduced pool volume and frequency, and increased subsurface flow. Such changes could result in a reduction in the quality and quantity of spawning and rearing habitat (Meehan 1991).

The project will incorporate BMPs to avoid or minimize sediment inputs to the river during construction, as well as minimize potential increases in turbidity associated with in-water activities. The project will not introduce fine sediments to the system that would affect spawning areas, further increase substrate embeddedness, or degrade existing channel conditions.

Turbidity will increase during construction but is not expected to increase to a level that could cause injury to fish that may be present within the action area, such as causing gill trauma or negatively affecting blood sugar levels or osmoregulatory function. Turbidity levels may temporarily affect the behavior of fish, causing such behavioral changes as avoidance of project activities, or turbidity levels may temporarily affect juvenile foraging success and response to potential predation.

Construction will not occur across the entire channel at any given time but will occur from a stationary point, then progress as work is completed. The sediment plume created by construction activities will be relatively concentrated at the position within the channel where the work is occurring (i.e., left bank, right bank, center of channel), thereby providing a portion of the stream where fish are able to avoid the sediment plume to some extent. Additionally, the plume will dissipate as it moves downstream.

Adhering to the approved in-water work window will ensure that in-water activities occur when the life history stages of federally listed fish species that are best able to avoid increased turbidity are present and impacts to incubating eggs or alevins are minimized to the greatest extent practicable, should these life history stages occur in the project area.

### **Channel Modifications**

Channel modifications will occur as a result of the ELJs and timber complex installed as part of the project, increasing habitat complexity for salmonids and benefit both juveniles and adults by providing overhead cover and deep-water habitat, which provides rearing and holding areas for fish.

The increased habitat complexity will be maintained by the hydraulic conditions created by the various wood structures. The timber complex will reduce streambank erosion by reducing the hydraulic force exerted on the bank. Timber complex ELJs will also provide bank protection as well as push the thalweg away from the toe of the streambank, while also providing overhead cover for juvenile salmonids. The Apex ELJs will create scour pools within the active channel, creating deep water habitat and providing overhead cover. The project will greatly increase habitat complexity within the lower Satsop River, providing log jams in a segment of the system that has relatively low woody material in the active channel. Overall, the project related channel modifications will increase productivity within the lower Satsop River.

### **Fish Removal and Exclusion**

Fish removal and exclusion will adhere to the WSDOT fish removal and exclusion protocols. Bull trout have likely been extirpated from the Satsop River, according to the USFWS; although WDFW indicates that bull trout have been documented in the Satsop River. Bull trout historically did occur in the Satsop River. Overall, the likelihood of encountering bull trout during the fish removal and exclusion effort is unlikely.

Fish exclusion and removal efforts will be completed with a beach seine. The beach seine will be deployed from shore and spread waterward to effectively isolate the in-water work area without the need to capture or handle fish.

### **Temporary Impacts to Riparian Vegetation**

Riparian vegetation directly influences the quality of salmonid habitat, affecting cover, food, instream habitat complexity, streambank stability, and temperature regulation. LWD recruited from streamside trees provides instream cover and habitat complexity, an essential component of fish habitat. Riparian vegetation also provides shade and an insulating canopy that moderates water temperatures in both summer and winter. Riparian vegetation provides a filter that reduces the transport of fine sediment to the stream, and the roots provide streambank stability and cover for rearing fish (Meehan 1991).

Riparian vegetation influences the food chain of a stream, providing organic detritus and terrestrial insects. Riparian vegetation also controls aquatic productivity dependent on solar radiation (Meehan 1991). Because of the numerous ways riparian vegetation influences the stream ecosystem, the effects of altering riparian vegetation are highly variable, ranging from increased sedimentation and stream temperatures to decreased food production and habitat complexity.

A relatively small amount of riparian vegetation will be removed as part of the project, and to the extent practicable, every effort will be made to preserve riparian vegetation. The project includes the restoration and enhancement of habitat to improve conditions for salmonids, which also includes restoration of riparian habitat.

During construction, approximately 4.96 acres (216,058 square feet) of buffer vegetation will be temporarily impacted along the left bank. All buffer areas temporarily impacted will be replanted post-construction. The temporal loss of approximately 4.96 acres of buffer vegetation is expected to have a negligible impact to the aquatic and terrestrial environment and species. The vegetation to be removed would not affect the overall shading of the river, the allochthonous inputs, streambank stability, and overhead cover along the stream margins. Nor would it have a measurable effect on the overall suitability of the riparian forest area for species such as yellow-billed cuckoo, since existing primitive roads would be used to provide construction access, reducing the extent of clearing required for project construction.

#### ***Indirect Impacts:***

The project will modify the character of the lower Satsop River by increasing habitat complexity, forming pool habitat over time, increasing overhead and in-stream cover, and increasing streambank stability.

The project has been designed to result in indirect effects beneficial to salmonids within the lower Satsop River, with the overall objective of stabilizing stream banks and reducing bank erosion while improving in-stream habitat conditions.

### **11. Conservation measures:**

*Conservation measures are measures that would reduce or eliminate adverse impacts of the proposed activity (examples: work done during the recommended work window (to avoid times when species are most likely to be in the area), silt curtain, erosion control best management practices, percent grating on a pier to reduce shading impacts).*

**Proposed work window:** In-water work will occur August 1—August 31. Work outside of the active channel, and not in-water will occur as needed and allowed in permits obtained for the project. It is anticipated that work in upland areas may begin in July and be completed in September.

**Other conservation measures:**

The following conservation measures and Best Management Practices (BMPs) are incorporated as part of the project to avoid or minimize potential impacts to federally listed species within the project action area.

- Work within the active channel will be completed during the approved in-water work window (August 1—August 31).
- All material used to construct in-stream structures shall be clean of mud, dirt, and other material that could temporarily degrade water quality within the project action area.
- Clearing limits will be marked with flagging wherever clearing is proposed in or adjacent to the Satsop River.
- Construction equipment will be limited to the minimum access and construction footprint required for the construction the project.
- The contractor shall be responsible for preparing a detailed Spill Prevention Control and Countermeasures (SPCC) Plan, which will identify all the contingencies in the event of an accidental spill of any hazardous material.
- Equipment will be refueled in a designated area, with absorbent pads in place and spill containment equipment present to reduce the potential for contaminants to reach the water should any sort of accidental spill or leakage occur.
- All heavy equipment will be inspected prior to operating each day during project construction. All heavy equipment shall be deemed clean and free of external oil, fuel, or other potential pollutants prior to operating and performing construction activities, particularly in-water work.
- Hydraulic fluid in all heavy machinery operating in water will be replaced with vegetable oil.
- Refueling of all heavy machinery will occur at least 150 feet from the Satsop River or other sensitive areas (i.e., wetlands).
- A hazardous material spill kit will be on-site, and a hazardous material boom will be set up immediately downstream of the work site in case of a spill when vehicles are working near the active channel.
- The contractor will designate at least one employee as the Erosion and Spill Control Lead (ESCL). The ESCL will be responsible for installing and monitoring erosion control measures and maintaining spill containment and control equipment. The ESCL will also be responsible for ensuring compliance with all local, state, and federal erosion and sediment control requirements. Moreover, the ESCL will be responsible for inspecting all temporary

erosion and sediment control measures on a regular basis, as well as maintaining and repairing such measures and ensuring their continued performance.

## 12. Determination of Effect:

*Provide a summary of impacts concluding with statement(s) of effect, by species. Even projects that are intended to benefit the species might have short-term adverse impacts and those must be addressed. Only the following determinations are valid for listed species or designated critical habitat:*

**No effect.** Literally no effect. No probability of any effect. The action is determined to have ‘no effect’ if there are no proposed or listed salmon and no proposed or designated critical habitat in the action area or downstream from it. This effects determination is the responsibility of the action agency to make and does not require NMFS review.

**May Affect, Not Likely to Adversely Affect (NLAA)** – Insignificant, discountable, or beneficial effects. The effect level is determined to be ‘may affect, not likely to adversely affect’ if the proposed action does not have the potential to hinder attainment of relevant properly functioning indicators and has a negligible (extremely low) probability of taking proposed or listed salmon or resulting in the destruction or adverse modification of their habitat. An insignificant effect relates to the size of the impact and should never reach the scale where take occurs. A ‘discountable effect’ is defined as being so extremely unlikely to occur that a reasonable person cannot detect, measure, or evaluate it. This level of effect requires informal consultation, which consists of NMFS and/or USFWS concurrence with the action agency’s determination.

**May Affect, Likely to Adversely Affect (LAA)** This form is not appropriate for use with a project that is LAA listed species. Please see the Biological Assessment (BA) template on the Corps website:

[http://www.nws.usace.army.mil/PublicMenu/Menu.cfm?sitename=REG&pagename=mainpage\\_ESA](http://www.nws.usace.army.mil/PublicMenu/Menu.cfm?sitename=REG&pagename=mainpage_ESA)

### **Bull Trout**

The information and analysis presented in this Abbreviated BE was the basis of the finding that the project warrants an effect determination of **May Affect, Not Likely to Adversely Affect** for bull trout.

A determination of **May Affect** is warranted based on the following rationale:

- Bull trout have likely been extirpated from the Satsop River, according to the USFWS; although WDFW indicates that bull trout have been documented in the Satsop River. Bull trout historically did occur in the Satsop River and are not currently precluded from the Satsop River; thus, they could occur during project construction.
- The project will require in-water work and will modify habitat conditions for bull trout.

A determination of **Not Likely to Adversely Affect** is warranted based on the following rationale:

- Bull trout spawning has not been documented within the project action area; however, various life history stages may occur throughout the year.
- The project will modify habitat conditions within the project action area. The modifications will be positive over the long term, they will require relatively extensive in-water work and work in the adjacent floodplain and gravel bars.
- The in-water work will occur during the approved in-water work window of August 1—August 31, minimizing the number of bull trout and life history stages that may be present within the project action area during construction.

- Increases in turbidity will be of a short duration, and bull trout that may occur within the project action area will be able to avoid areas with increased turbidity.
- The project will stabilize the streambanks in a manner that also improves in-stream habitat conditions for salmonids, including bull trout. The project will increase in-stream and overhead cover, stabilize eroding streambanks, and increase habitat complexity.

### **Fisher (Proposed Threatened)**

The project **will not jeopardize the continued existence** of fisher of the West Coast DPS. Fisher are opportunistic predators that hunt exclusively in forested habitats. They prefer late-successional coniferous or mixed forests that contain key habitat and structural components including relatively large diameter trees, high canopy closure, large trees with cavities and large down wood. The project action area does not provide suitable habitat.

Should fisher be listed as threatened before project construction is completed, the project would have **No Effect** on fisher of the West Coast DPS.

### **Marbled Murrelet**

As mentioned above, the action area may be used as a migratory corridor for marbled murrelets traveling between the Pacific Ocean and nest sites located in the Satsop or Chehalis River watershed. The nearest designated critical habitat is approximately ten miles to the east along the Chehalis River and 22 miles to the north along the Satsop River, in Olympic National Park.

The project will not affect documented nest sites or designated critical habitat, and will not affect foraging activities or alter migratory patterns or corridors. Therefore, the project will have **No Effect** on marbled murrelets.

### **Streaked Horned-Lark**

Streaked horned-larks use a wide range of habitats, including open prairie and agricultural fields, which are present in the project action area. Thus, it is possible that streaked horned-larks could occur in the project action area and thus the project warrants a determination of **May Affect, Not Likely to Adversely Affect** for streaked horned-lark.

A determination of **May Affect** is warranted based on the following rationale:

- Suitable habitat is present within the project action area.
- The project action area is within the expected range of streaked horned-lark.

A determination of **Not Likely to Adversely Affect** is warranted based on the following rationale:

- The project will not result in any destruction or modification of potentially suitable habitat for the streaked horned-lark.
- Streaked horned-larks may be affected by construction related noise, resulting in behavioral response or disturbance.

### **Yellow-billed Cuckoo**

Yellow-billed cuckoo's nest in deciduous habitats with clearings and dense shrubby vegetation, especially those near rivers, streams and wetlands (Hughes 2015 in WDFW 2017). However, the last confirmed record of cuckoos nesting in Washington occurred in Seattle in 1923. A yellow-billed cuckoo was sighted in Grays Harbor County in 1996. However, it is unlikely, cuckoos could occur in the project action area and thus the project warrants a determination of **May Affect, Not Likely to Adversely Affect** for streaked horned-lark.

A determination of **May Affect** is warranted based on the following rationale:

- Suitable habitat is present within the project action area.
- The project action area is within the historic range of yellow-billed cuckoos.

A determination of **Not Likely to Adversely Affect** is warranted based on the following rationale:

- Yellow-billed cuckoos have not been observed in Grays Harbor County in over 24 years.
- Were cuckoos to occur in the project action area, noise generated by construction could affect them, resulting in behavioral response or disturbance.
- The project will temporarily remove 4.96 acres (216,058 square feet) of buffer vegetation. These areas will be replanted upon completion of construction activities and will not result in any long-term modification or loss of habitat.

### **13. EFH Analysis**

*Essential Fish Habitat (EFH) is broadly defined by the Act (now called the Magnuson-Stevens Act or the Sustainable Fisheries Act) to include “those waters and substrate necessary to fish for spawning, breeding, feeding, or growth to maturity”. This language is interpreted or described in the 1997 Interim Final Rule [62 Fed. Reg. 66551, Section 600.10 Definitions] -- Waters include aquatic areas and their associated physical, chemical, and biological properties that are used by fish and may include historic areas if appropriate; substrate includes sediment, hard bottom, structures underlying the waters, and associated biological communities; necessary means the habitat required to support a sustainable fishery and the managed species’ contribution to a healthy ecosystem; and “spawning, breeding, feeding, or growth to maturity” covers a species’ full life cycle.*

*Additional guidance for EFH analyses can be found at the NOAA Fisheries web site under the Sustainable Fisheries Division.*

#### **A. Description of the Proposed Action** (may refer to BA project description)

See Attachment A, Project Description and Attachment B, Project Plan Sheets.

#### **B. Addresses EFH for Appropriate Fisheries Management Plans (FMP)**

The Pacific Salmon Fishery Management Plan covers EFH for Chinook salmon, coho salmon and Puget Sound Pink Salmon. Only EFH for Chinook salmon and coho salmon occurs in the project action area.

#### **C. Effects of the Proposed Action**

##### **i. Effects on EFH (groundfish, coastal pelagic, and salmon EFH should be discussed separately)**

The impacts to Pacific salmon (Chinook salmon and coho salmon) EFH are similar to those impacts described above for bull trout designated critical habitat.

##### **ii. Effects on Managed Species (unless effects to an individual species are unique, it is not necessary to discuss adverse effects on a species-by species basis)**

The effects on Chinook salmon and coho salmon would be similar to those described above for bull trout.

##### **iii. Effects on Associated Species, Including Prey Species**

Major prey species for juvenile Chinook salmon and coho salmon includes aquatic macroinvertebrates. The project is not anticipated to have a measurable impact on macroinvertebrates. Short-term impacts could occur from in-water construction activities, but long term the project would likely improve conditions for macroinvertebrates by increasing habitat complexity, and types of substrate available (i.e., specific areas of wood, sand, gravel and cobble).

##### **iv. Cumulative Effects**

No cumulative effects associated with this project have been identified.

#### **D. Proposed Conservation Measures**

Conservation measures are included for all activities associated with the construction of the project. Conservation measures will maintain existing habitat conditions, including EFH, in the action area. See Section 11 of the Abbreviated BE, above, for list of proposed conservation measures.

#### **E. Conclusions by EFH (taking into account proposed conservation measures)**

In accordance with the EFH requirements of the Magnuson-Stevens Fishery Conservation and Management Act, it has been determined that the project will have **no adverse impact to EFH** utilized by Pacific salmon species.

#### **14. References:**

*Include any studies or papers that support statements made in this form (example: reference the source for the listed species that are covered).*

Bash, J., C. Berman, and S. Bolton. 2001. *Effects of Turbidity and Suspended Solids on Salmonids*. Center for Streamside Studies, College of Forest Resources. University of Washington. In press for Washington State Department of Transportation. Seattle, WA.

Caltrans (California Department of Transportation). 2015. Technical guidance for assessment and mitigation of the hydroacoustic effects of pile driving on fish. Prepared by Caltrans Division of Environmental Analysis, Report No. CTHWANP-RT-306.01.01. Sacramento, CA.

Meehan, W. R. (ed.). 1991. *Influences of Forest and Rangeland Management on Salmonid Fishes and Their Habitats*. Special publication 19. American Fisheries Society. Bethesda, MD.

#### **15. Appendices:**

*As needed include mitigation, revegetation plans, monitoring plans, results of studies, water quality information, etc.*

- Attachment A—Project Description
- Attachment B—Project Plan Sheets
- Attachment C—Project Action Area
- Attachment D—Species List from USFWS

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# Attachment A

Project Description



# PROJECT DESCRIPTION

## Project Area

The project area is located approximately 1.5 miles north of the confluence of the Satsop River with the Chehalis River, approximately 1.5 miles south of the community of Satsop Washington and within Water Resources Inventory Area (WRIA) 22, the Lower Chehalis Watershed. The project area is specifically located near the center of Section 6 in Township 17N, Range 6W.

The Satsop River and its eroding streambanks are located along the western edge of the project area. The river flows south with significant meanders at approximately RM 1.5 and 0.5. Four large ponds formed from past mining of the floodplain for gravels in the 1970s-1980s are located between the meanders and surrounded by young floodplain forest. The Port of Grays Harbor's well is located near the center of the RM 0.5 portion of the project area. Keys Road forms the eastern edge of the project area; adjacent land uses east of the road are rural residential and agricultural (primarily pasture).

The project area lies in a unique geomorphic setting which can help explain its active rates of channel migration. The Satsop River leaves its own valley and enters the Chehalis River valley directly downstream from Highway 12. Here, it forms a region of elevated land that surrounds the Satsop River and extends above the Chehalis River floodplain. Bank stratigraphy indicates that the underlying material is highly erodible silt which was likely deposited by floods from both river basins. Because the "confluence ridge" lies within the over-widened Chehalis River Valley<sup>1</sup>, there are no hillslopes to constrain the river's lateral migration, and thus, the Satsop River moves through the valley with few resistant features.

Topography of the project area is relatively flat with higher cut banks along the western bank of the river outside of the project area and an area of higher elevation sidecast along the northern edge of the ponds. Vegetation is primarily young deciduous forest dominated by red alder (*Alnus rubra*) with a dense shrub understory of mixed native and invasive species such as giant knotweed (*Fallopia sachalinensis*), Himalayan blackberry (*Rubus armeniacus*), and reed canarygrass (*Phalaris arundinacea*).

## Project Background

Prior to European Settlement, resistance to erosion on the landscape was likely provided by old-growth conifer forests and the stable logjams that they created. Logjams and patches of mature forest would have provided stability to the river channel banks (logjams by deflecting flow, roughening and strengthening banks and trees through their extensive root systems). The mature trees were also a source of the "key pieces" of large wood essential for forming stable logjams and creating an important ecosystem function referred to as the "floodplain large wood cycle" in which

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<sup>1</sup> The Chehalis River was one of the main drainage paths of the Puget Lobe of the Cordilleran Ice Sheet at the end of the last ice age. As the ice sheet melted, large quantities of water, ice, and rock were transported through the modern-day Chehalis River Valley into the ocean. During these flood waves, the valley was scoured and widened with forces much greater than the modern-day river can exert. Because of this, the valley is wider than it would have been, had it only been subject to erosion from the river alone. (First discussed in Bretz, J.H. 1913. *Glaciation of the Puget Sound Region*. Washington Geological Survey Bulletin No. 8).

stable logjams create stable areas where trees can mature within areas of frequent channel migration.

Today however, the resistance provided by the old-growth forest and stable logjams is no longer present on the landscape and the system is lacking natural material that can provide erosional resistance. The only features that are resisting lateral migration within the project area are man-made structures, such as roads and revetments. These features do not react dynamically to the river in a manner that slows erosion (such as a tree falling in and forming a stable log jam), rather they act as static features that direct the river.

Channel migration in the project area is driven by lateral migration of meander bends and channel avulsions, or cutoffs. It is these processes that establish the river's "meander belt" where meander bends expand in both directions around a central axis until they are cutoff by a channel avulsion when the slope of the bend gets too low. The lower meander between RM 0.0 and RM 1.0 experienced this expansion/cutoff process between ~1990 until November 2018. Prior to 2006, the meander sequence eroded outward from a central axis in both eastward and westward directions. However, when the eastern portion of the sequence met resistance with riprap protecting the Port's well, the bend between RM 0.2 and RM 0.6 began migrating towards itself from both ends because the stream's energy could no longer move eastward. The bends continued to migrate closer towards each other, until they eventually cutoff in a neck cutoff avulsion at RM 0.4 on November 27, 2018.

The current issues with the river are the result of confining the river and concentrating its power in locations where the river hasn't been in thousands of years. The system is now concentrating stream power resulting in increased erosion rates, loss of riparian vegetation, and loss of aquatic habitat. Since the avulsion, the primary flow path is now to the west, along the avulsion route. The cutoff shifted the central axis of the meander belt towards the west where it is likely to remain until the river expands in both directions and another bend eventually cuts off.

Because of this, both right bank outer bends are likely to migrate into existing farmland. The avulsed channel's proximity to landowner residences and the highly erodible soils have placed homes and valuable farmland in imminent danger. River discharge at the time of the avulsion coincided approximately with a 2-year peak flow recurrence event.

Prior to the avulsion, the river's primary route was through the meander bends which convey flow past the Port of Grays Harbor potable water well and adjacent to Keys Road. Although these meander bends are now secondary flow paths, they are engaged multiple times every year at relatively low flows and are experiencing rapid bank erosion which endangers Keys Road and the Port's well.

## **Proposed Project**

The goals of the proposed bank stabilization project are to distribute stream power across the floodplain, creating a system with dynamic equilibrium that supports riparian vegetation, aquatic habitat, and a restored historic channel migration zone. To achieve this goal, the proposed project focuses on stabilizing the floodplain, stabilizing river flow paths, and reducing rates of erosion along the lower approximately 2 miles of the Satsop River.

The proposed project will use ecologically sensitive solutions consistent with habitat restoration projects in the basin. Specifically, the proposed project would construct two timber revetments on the floodplain to protect Keys Road and to ultimately support full removal of revetments along the left bank adjacent to the upstream most structures to be constructed (Figure 1). The proposed

project also includes construction of a temporary bypass channel and 42 engineered log jams (ELJs) in the river, and 320 feet of timber complex along its banks to further reduce erosion of opposite bank agricultural lands by improving floodplain connectivity and helping distribute stream power across the floodplain and reducing main channel velocities.

The setback revetments will be installed within the floodplain of the Satsop River, but will be installed in-the-dry, and not in-water. Similarly, the Floodplain Roughness Structures will be installed on a gravel bar and are anticipated to be in-the-dry during installation, and not in-water. The other ELJ structures will be installed in-water. All the structures will be installed using a vibratory pile driver. Table 1 provides information on the number of piling. Piling sizes will range from 16 inches to 24 inches in diameter. For this analysis, it is assumed that all piling will be 24-inch, untreated wooden piling.

**Table 1. Total Number of 24-inch Untreated Wooden Piling to be Driven with Vibratory Pile Driver**

| Structure   | No of Piles/Structure | No of Structures | Total No of Piles |
|---|-----------------------|------------------|-------------------|
| Type 1 Apex ELJ <sup>1</sup>                        | 16                    | 7                | 112               |
| Type 2 Apex ELJ <sup>1</sup>                        | 9                     | 1                | 9                 |
| Type 1 Deflector <sup>1</sup>                       | 14                    | 9                | 126               |
| Floodplain Roughness <sup>2</sup>                   | 7                     | 7                | 49                |
| Timber Complex <sup>1</sup>                         | 6                     | 5                | 30                |
| Type 1 Setback Levee <sup>2</sup>                   | 8                     | 6                | 48                |
| Type 2 Setback Levee <sup>2</sup>                   | 5                     | 12               | 60                |
| <b>TOTAL No of PILES</b>                            |                       |                  | <b>434</b>        |
| <b>Total No of Piles to be installed In-Water</b>   |                       |                  | <b>277</b>        |
| <b>Total No of Piles to be installed In-the-Dry</b> |                       |                  | <b>157</b>        |

<sup>1</sup> Piles to be driven in-water

<sup>2</sup> Piles to be driven in floodplain, not in-water

In-water structures will require fish removal and exclusion. Fish removal and exclusion will adhere to the WSDOT protocols.

Post-project conditions are anticipated to reduce erosion and channel migration rates near the two meanders that currently threaten Keys Road and the Port of Grays Harbor well. Post-project instream conditions are anticipated to include higher quality habitat for aquatic species around the installed ELJ structures. These structures are designed to create habitat by:

- Scouring pools;
- Sorting sediment for spawning;
- Providing velocity refuge; and
- Supporting production of allochthonous organic matter in the ELJs which supports benthic macroinvertebrate productivity and thus provides food-web support to aquatic species.

Once the system is allowed to return to, and distribute its energy across its historic floodplain, a less intensive approach to improve habitat functions and further reduce bank erosion will be more feasible.



# Attachment B

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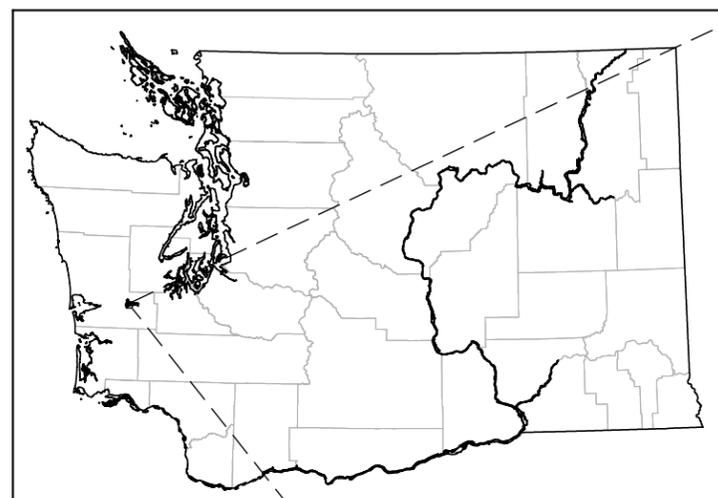
Project Plan Sheets



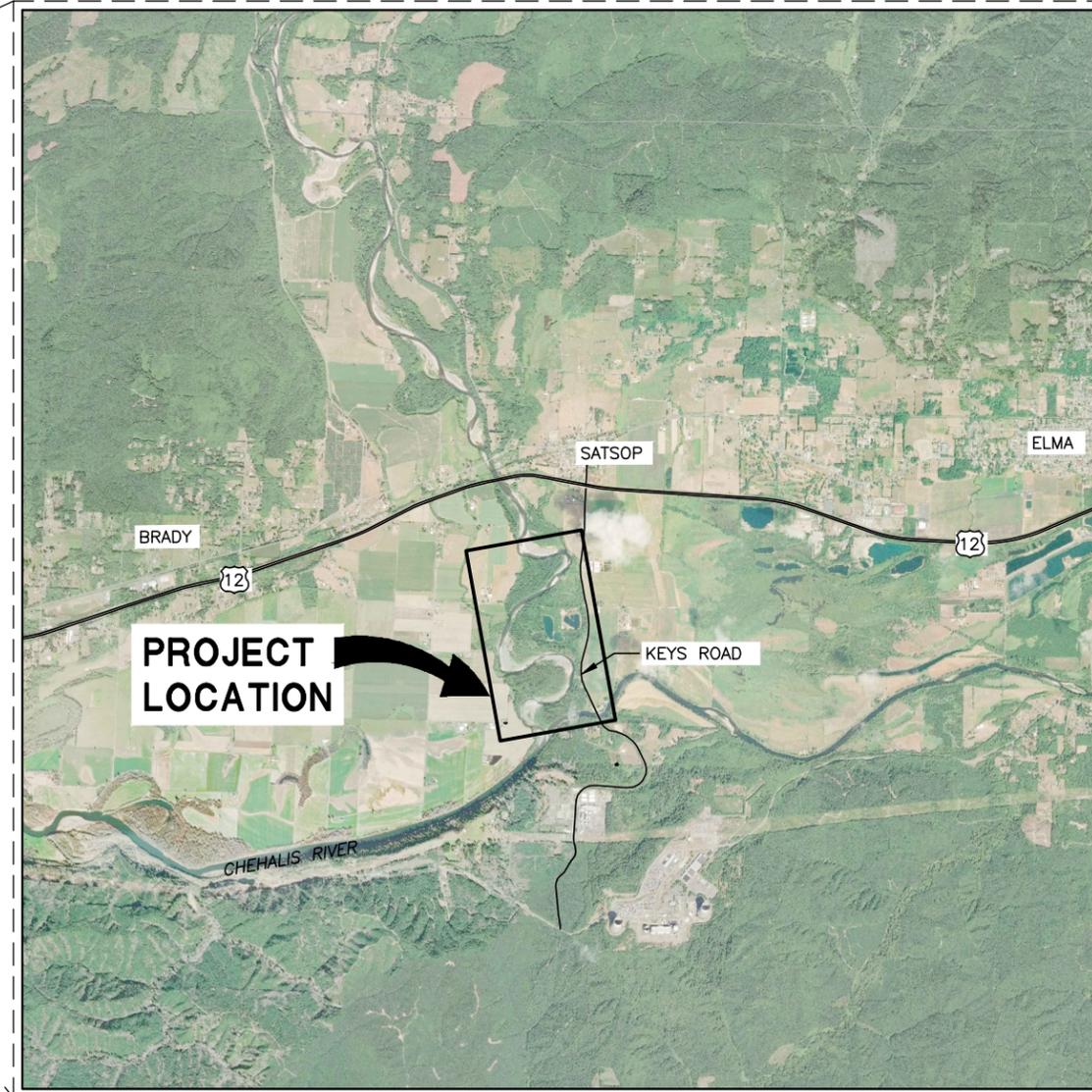
# KEYS ROAD FLOOD PROTECTION

## PHASE I PRELIMINARY DESIGN

### GRAYS HARBOR COUNTY



**WASHINGTON STATE**  
SCALE: 1" = 50 MILES



**PROJECT LOCATION MAP**  
SCALE: 1" = 1 MILE

| SHEET LIST TABLE |                                     |
|------------------|-------------------------------------|
| Sheet Number     | Sheet Title                         |
| 1                | COVER SHEET                         |
| 2                | GENERAL NOTES                       |
| 3                | LEGEND                              |
| 4                | EXISTING CONDITIONS                 |
| 5                | PROPOSED CONDITIONS                 |
| 6                | SETBACK REVETMENT ELJ SCHEDULE      |
| 7                | ACCESS AND STAGING                  |
| 8                | CONSTRUCTION SEQUENCING AND TESC    |
| 9                | TYPE 1 APEX ELJ DETAILS             |
| 10               | TYPE 2 APEX ELJ DETAILS             |
| 11               | TYPE 1 DEFLECTOR ELJ DETAILS        |
| 12               | FLOODPLAIN ROUGHNESS ELJ DETAILS    |
| 13               | TIMBER COMPLEX PLAN                 |
| 14               | TYPE 1 SETBACK REVETMENT            |
| 15               | TYPE 2 SETBACK REVETMENT            |
| 16               | RELIEF CHANNEL PROFILE AND SECTIONS |
| 17               | CONSTRUCTION DETAILS                |

**CONTACT INFORMATION**

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**GRAYS HARBOR COUNTY**  
DEPARTMENT OF PUBLIC WORKS  
110 WEST BROADWAY, SUITE 31  
MONTESANO, WA 98563  
(360) 249-4222

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IF THIS BAR DOES NOT MEASURE 1" THEN DRAWING IS NOT PLOTTED TO ORIGINAL SCALE.



| NAME OR INITIALS AND DATE | GEOGRAPHIC INFORMATION  |
|---------------------------|-------------------------|
| DESIGNED RLE, MS          | LATITUDE 46°58'55.71"N  |
| CHECKED RLE               | LONGITUDE 123°28'56.2"W |
| DRAWN MS, GM              | TN/SC/RG T17N/S6/R6W    |
| CHECKED RLE               | DATE 2/14/2019          |

**KEYS ROAD FLOOD PROTECTION**

**COVER SHEET**

1  
SHEET 1 OF 17

Mar 26, 2020 PHASE I PRELIMINARY DESIGN 60% NOT FOR CONSTRUCTION

**GENERAL NOTES**

1. THESE PLANS HAVE BEEN PREPARED FOR THE EXCLUSIVE USE OF GRAYS HARBOR COUNTY, HEREAFTER REFERRED TO AS "OWNER" AND "CONTRACTOR" AND THEIR AUTHORIZED AGENTS.
2. NATURAL SYSTEMS DESIGN HEREAFTER REFERRED TO AS "ENGINEER" IS RESPONSIBLE FOR THE PREPARATION OF THESE ORIGINAL PLANS AND ASSOCIATED SPECIFICATIONS; AND WILL NOT BE RESPONSIBLE FOR, OR LIABLE FOR, UNAUTHORIZED CHANGE, OR USE, OF THESE PLANS WHICH INCLUDES ALTERATION, DELETION, OR EDITING OF THIS DOCUMENT WITHOUT EXPLICIT WRITTEN PERMISSION FROM THE ENGINEER. ANY OTHER UNAUTHORIZED USE OF THIS DOCUMENT IS PROHIBITED.
3. MINOR MODIFICATIONS ARE EXPECTED TO SUIT JOB SITE DIMENSIONS OR CONDITIONS. SUCH MODIFICATIONS SHALL BE INCLUDED AS PART OF THE WORK. THE OWNER, ENGINEER AND APPROPRIATE REGULATORY AGENCIES SHALL BE NOTIFIED OF ANY OWNER-AUTHORIZED CHANGE RESULTING IN MORE THAN A 10% DESIGN CHANGE OF PROPOSED FOOTPRINT OR THAT SIGNIFICANTLY AFFECTS THE INTENDED BENEFIT OR FUNCTION OF A PROJECT ELEMENT.
4. THE LOCATION OF ALL FEATURES SHOWN IS APPROXIMATE.
5. THE CONTRACTOR AGREES TO ASSUME SOLE AND COMPLETE RESPONSIBILITY FOR JOB SITE CONDITIONS DURING THE COURSE OF CONSTRUCTION OF THIS PROJECT, INCLUDING SAFETY OF ALL PERSONS AND PROPERTY; AND FURTHER AGREES THAT THIS REQUIREMENT SHALL APPLY CONTINUOUSLY AND NOT BE LIMITED TO NORMAL WORKING HOURS IN ACCORDANCE WITH THE PROVISIONS OUTLINED BY THE PROJECT CONTRACT AND SPECIFICATIONS.
6. ALL IMPROVEMENTS SHALL BE ACCOMPLISHED UNDER THE APPROVAL, INSPECTION, AND TO THE SATISFACTION OF THE OWNER. IMPROVEMENT CONSTRUCTION SHALL COMPLY WITH THESE PLANS AND THE WASHINGTON STATE DEPARTMENT OF TRANSPORTATION (WASHDOT) STANDARD PLANS FOR CONSTRUCTION OF ROAD, BRIDGE, AND MUNICIPAL CONSTRUCTION, CURRENT EDITION UNLESS NOTED OTHERWISE. ALL REFERENCES TO THE "STANDARD SPECIFICATIONS" SHALL MEAN THE WASHINGTON STATE DEPARTMENT OF TRANSPORTATION (WASHDOT) STANDARD SPECIFICATIONS FOR CONSTRUCTION OF LOCAL STREETS AND ROADS, CURRENT EDITION. CONSTRUCTION NOT SPECIFIED ON THESE PLANS SHALL CONFORM TO THE REQUIREMENTS OF THE STANDARD SPECIFICATIONS. THE CONTRACTOR IS OBLIGATED TO BE FAMILIAR WITH APPLICABLE SECTIONS OF THE STANDARD SPECIFICATIONS NOT DISCUSSED IN THE GENERAL NOTES. THE CONTRACT SPECIAL PROVISIONS SHALL SUPERSEDE THOSE OF THE STANDARD SPECIFICATIONS WHERE DISCREPANCIES OCCUR.
7. IT IS THE RESPONSIBILITY OF THE CONTRACTOR AND SUBCONTRACTOR(S) TO EXAMINE THE PROJECT SITE PRIOR TO THE OPENING OF BID PROPOSALS. THE CONTRACTOR SHALL BECOME FAMILIAR WITH THE CONDITIONS UNDER WHICH THE WORK IS TO BE PERFORMED, SUCH AS THE NATURE AND LOCATION OF THE WORK; AND THE GENERAL AND LOCAL CONDITIONS, PARTICULARLY THOSE AFFECTING THE AVAILABILITY OF TRANSPORTATION, THE DISPOSAL, HANDLING, AND STORAGE OF MATERIALS, AVAILABILITY OF LABOR, WATER, ELECTRICITY, ROADS, THE UNCERTAINTIES OF WEATHER, THE CONDITIONS OF THE GROUND, SURFACE AND SUBSURFACE MATERIALS, GROUNDWATER, THE EQUIPMENT AND FACILITIES NEEDED FOR AND DURING THE PERFORMANCE OF THE WORK, AND THE COSTS THEREOF. ANY FAILURE BY THE CONTRACTOR AND SUBCONTRACTOR(S) TO ACQUAINT THEMSELVES WITH ALL THE AVAILABLE INFORMATION WILL NOT RELIEVE THE CONTRACTOR AND SUBCONTRACTOR(S) FROM RESPONSIBILITY FOR PROPERLY ESTIMATING THE DIFFICULTY AND COST OF SUCCESSFULLY PERFORMING THE WORK.
8. THE CONTRACTOR IS RESPONSIBLE FOR REVIEWING THE CONTRACT DOCUMENTS AND FOR ALL SUBMITTALS REQUIRED TO THE OWNER FOR REVIEW AND ACCEPTANCE.

**PERMIT NOTES**

1. EVERY REASONABLE EFFORT SHALL BE MADE TO CONDUCT THE ACTIVITIES SHOWN IN THESE PLANS, IN A MANNER THAT MINIMIZES THE ADVERSE IMPACT ON WATER QUALITY, FISH AND WILDLIFE, AND THE NATURAL ENVIRONMENT.
2. ALL WORK WILL BE IN COMPLIANCE WITH PERMIT CONDITIONS ISSUED BY PERTINENT REGULATORY AGENCIES. IT IS THE CONTRACTOR'S RESPONSIBILITY TO HAVE COPIES OF ALL PERMITS ON THE JOB SITE, UNDERSTAND AND COMPLY WITH ALL PERMIT CONDITIONS.
3. ALL WORK THAT DISTURBS THE SUBSTRATE, BANK, OR SHORE OF A WATERS OF THE STATE THAT CONTAINS FISH LIFE SHALL BE CONDUCTED ONLY DURING THE WORK PERIOD FOR THAT WATERBODY AS ALLOWED BY RELEVANT HYDRAULIC WORK PERMITS. THOSE PORTIONS OF THE PROJECT WORK THAT OCCUR OUTSIDE OR ABOVE THE ORDINARY HIGH WATER MARK (ABOVE THE USACE JURISDICTIONAL LINE) ARE NOT SUBJECT TO THE WORK PERIODS DESCRIBED ABOVE UNLESS SPECIFIED IN THE RELEVANT PERMITS.
4. ALL ACTIVITIES THAT INVOLVE WORK ADJACENT TO, OR WITHIN THE WETTED CHANNEL SHALL, AT ALL TIMES, REMAIN CONSISTENT WITH ALL APPLICABLE WATER QUALITY STANDARDS; EFFLUENT LIMITATION; AND STANDARDS OF PERFORMANCE, PROHIBITIONS, PRETREATMENT STANDARDS, AND MANAGEMENT PRACTICES ESTABLISHED PURSUANT TO THE CLEAN WATER ACT OR PURSUANT TO APPLICABLE STATE AND LOCAL LAW.
5. IF AT ANY TIME, AS A RESULT OF PROJECT ACTIVITIES, FISH ARE OBSERVED IN DISTRESS, A FISH KILL OCCURS, OR WATER QUALITY PROBLEMS DEVELOP (INCLUDING EQUIPMENT LEAKS OR SPILLS), OPERATIONS SHALL CEASE AND THE OWNER SHALL BE NOTIFIED IMMEDIATELY.
6. IF, DURING CONSTRUCTION, ARCHAEOLOGICAL REMAINS ARE ENCOUNTERED, CONSTRUCTION IN

THE VICINITY SHALL BE HALTED, AND THE STATE OFFICE OF HISTORIC PRESERVATION AND THE OWNER SHALL BE NOTIFIED IMMEDIATELY.

**SURVEY NOTES**

1. UNLESS NOTED OTHERWISE ON THE PLANS, THE CONTRACTOR SHALL BE RESPONSIBLE FOR THE PROTECTION OF ALL EXISTING SURVEY MONUMENTS AND OTHER SURVEY MARKERS DURING CONSTRUCTION.
2. THE CONTRACTOR SHALL MAINTAIN A SET OF PLANS ON THE JOB SHOWING "AS-CONSTRUCTED" CHANGES MADE TO DATE. UPON COMPLETION OF THE PROJECT, THE CONTRACTOR SHALL SUPPLY TO OWNER A SET OF PLANS, MARKED UP TO THE SATISFACTION OF THE OWNER, REFLECTING THE AS-CONSTRUCTED MODIFICATIONS.
3. ELEVATIONS SHOWN ON THE PLANS FOR PIPE INVERTS, TOPS OF BANKS, THALWEG, GRADE CONTROLS, ETC., ARE BASED UPON THE TOPOGRAPHIC INFORMATION SHOWN ON THE PLANS. THE CONTRACTOR SHALL VERIFY ALL NECESSARY SURFACE ELEVATIONS IN THE FIELD AND NOTIFY THE OWNER OF ANY DISCREPANCIES, WHICH MIGHT AFFECT PROPER OPERATION OF THE NEW FACILITIES BEFORE BREAKING GROUND AND PRIOR TO FACILITY INSTALLATION. THE OWNER SHALL BE CONTACTED IN THE EVENT ELEVATIONS ARE INCORRECT SO THAT THE PROPER ADJUSTMENTS CAN BE MADE BY ENGINEER PRIOR TO THE INSTALLATION OF THE FACILITIES, AS SET FORTH IN THE SPECIAL PROVISIONS.
4. LIDAR FOR THIS PROJECT WAS PROVIDED BY ANCHOR QEA AND WAS COLLECTED AS PART OF THE CHEHALIS BASIN LIDAR ACQUISITION AND IS REPRESENTATIVE OF 2017 CONDITIONS. THE VERTICAL DATUM IS NAVD88 GEOID12B. THE HORIZONTAL DATUM IS NAD83 (2011) WASHINGTON STATE PLANE SOUTH, US SURVEY FEET.

**EROSION, SEDIMENT CONTROL AND WATER MANAGEMENT NOTES**

1. THE CONTRACTOR SHALL BE RESPONSIBLE FOR IMPLEMENTING ALL TEMPORARY EROSION CONTROL MEASURES. THE EROSION CONTROL MEASURES SHALL BE IN ACCORDANCE WITH ALL FEDERAL, STATE, AND LOCAL REQUIREMENTS. THE CONTRACTOR SHALL BE RESPONSIBLE FOR THE MAINTENANCE AND PERFORMANCE OF THE TEMPORARY EROSION CONTROL MEASURES THROUGHOUT THE DURATION OF THE PROJECT.
2. A SEDIMENT AND EROSION CONTROL PLAN WILL BE DEVELOPED BY THE CONTRACTOR AND SUBMITTED FOR APPROVAL BY OWNER AND/OR THE ENGINEER BEFORE ANY CONSTRUCTION MAY BEGIN. THE SEDIMENT AND EROSION CONTROL PLAN WILL IDENTIFY BEST MANAGEMENT PRACTICES TO ENSURE THAT THE TRANSPORT OF SEDIMENT TO SURFACE WATERS, DRAINAGE SYSTEMS, AND ADJACENT PROPERTIES IS MINIMIZED.
3. ACTIVITIES SHALL BE DESIGNED AND CONSTRUCTED TO AVOID AND MINIMIZE ADVERSE IMPACTS TO WATERS OF THE UNITED STATES TO THE MAXIMUM EXTENT PRACTICAL THROUGH THE USE OF PRACTICAL ALTERNATIVES. ALTERNATIVES THAT SHALL BE CONSIDERED INCLUDE THOSE THAT MINIMIZE THE NUMBER AND EXTENT OF IN-WATER WORK AND EQUIPMENT CROSSINGS OF WETTED CHANNELS.
4. AT NO TIME SHALL SEDIMENT-LADEN WATER BE DISCHARGED OR PUMPED DIRECTLY INTO THE SUBJECT RIVER, STREAM, OR WETLAND. WATER SHALL BE DISCHARGED IN ACCORDANCE WITH REQUIREMENTS SET FORTH IN THE PROJECT PERMITS AND / OR SPECIFICATIONS.
5. IF HIGH WATER LEVEL CONDITIONS THAT CAUSE SILTATION OR EROSION ARE ENCOUNTERED DURING CONSTRUCTION, WORK SHALL STOP UNTIL THE WATER LEVEL SUBSIDES.
6. PERMIT CONDITIONS CONTAIN SPECIFIC REQUIREMENTS FOR THE CONTROL OF EROSION AND TURBIDITY FROM PROJECT OPERATIONS. TURBIDITY WILL BE MONITORED ON A FREQUENT BASIS BY THE PROJECT MANAGEMENT AND INSPECTION STAFF ON-SITE. TURBIDITY AMOUNTS IN EXCESS OF THE PERMITTED CONCENTRATIONS AND/OR DURATIONS WILL CAUSE WORK TO BE STOPPED UNTIL IMPROVED PRACTICES ARE IN EFFECT AND THE PROBLEMS CONTROLLED. THE CONTRACTOR IS COMPLETELY RESPONSIBLE FOR ANY PROJECT DELAYS THAT OCCUR BY NATURE OF THIS FAILURE TO ADEQUATELY CONTAIN SEDIMENT ON-SITE.
7. CONTRACTOR SHALL LIMIT MACHINERY MOVEMENT TO CONSTRUCTION AREAS DEFINED ON SITE PLAN OR IDENTIFIED AS ACCEPTABLE BY THE ENGINEER OR OWNER.
8. ALL EXTERNAL GREASE AND OIL SHALL BE PRESSURE-WASHED OFF THE EQUIPMENT PRIOR TO TRANSPORT TO THE SITE.
9. ALL EQUIPMENT OPERATING BELOW OHWM SHALL UTILIZE READILY BIODEGRADABLE VEGETABLE-BASED HYDRAULIC FLUIDS.
10. THE CONTRACTOR IS RESPONSIBLE TO ENSURE THAT NO PETROLEUM PRODUCTS, HYDRAULIC FLUID, SEDIMENTS, SEDIMENT-LADEN WATER, CHEMICALS, OR ANY OTHER TOXIC OR DELETERIOUS MATERIALS ARE ALLOWED TO ENTER OR LEACH INTO THE SUBJECT RIVER, STREAM, OR WETLAND.
11. THE CONTRACTOR SHALL HAVE AN EMERGENCY SPILL KIT ONSITE AT ALL TIMES.
12. NO TREES OR WETLAND VEGETATION SHALL BE REMOVED UNLESS THEY ARE SHOWN AND NOTED TO BE REMOVED ON THE PLANS OR AS DIRECTLY SPECIFIED ON-SITE BY THE PROJECT MANAGEMENT STAFF. ALL TREES CONFLICTING WITH GRADING SHALL BE REMOVED. NO GRADING SHALL TAKE PLACE WITHIN THE DRIP LINE OF TREES NOT TO BE REMOVED UNLESS OTHERWISE APPROVED.

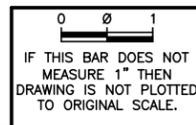
13. FOLLOWING CONSTRUCTION, SITE RESTORATION WILL INCLUDE ESTABLISHING LONG-TERM EROSION PROTECTION MEASURES. THESE MEASURES WILL INCLUDE PLANTINGS, EROSION CONTROL FABRIC, SEED, AND MULCH. EQUIPMENT AND EXCESS SUPPLIES WILL BE REMOVED AND THE WORK AREA WILL BE CLEANED. MAINTENANCE ACTIVITIES FOR THE NEWLY CONSTRUCTED RESTORATION PROJECTS ARE ANTICIPATED TO OCCUR PERIODICALLY.

**CONSTRUCTION NOTES**

1. CONTRACT DOCUMENTS REFER TO THESE PLANS.
2. CONTRACTOR SHALL FURNISH ALL MATERIALS, EQUIPMENT, AND LABOR NECESSARY TO COMPLETE ALL WORK AS INDICATED IN THE CONTRACT DOCUMENTS.
3. CONSTRUCTION HOURS SHALL BE WEEKDAYS BETWEEN 7:00 A.M. AND 6:30 P.M. UNLESS PRIOR APPROVAL IS RECEIVED FROM THE OWNER.
4. ANY DISCREPANCIES ARE TO BE BROUGHT TO THE ATTENTION OF THE OWNER PRIOR TO PROCEEDING WITH THE WORK.
5. THE CONTRACTOR SHALL INSTALL ALL EQUIPMENT AND MATERIALS IN ACCORDANCE WITH MANUFACTURER'S RECOMMENDATIONS UNLESS SPECIFICALLY INDICATED OTHERWISE BY THE OWNER OR WHERE LOCAL CODES OR REGULATIONS TAKE PRECEDENCE.
6. ALL WORK PERFORMED AND MATERIALS INSTALLED SHALL BE IN STRICT ACCORDANCE WITH ALL APPLICABLE CODES, REGULATIONS, AND ORDINANCES.
7. THE CONTRACTOR SHALL SUPERVISE AND DIRECT THE WORK USING THE BEST SKILLS AND ATTENTION. THE CONTRACTOR SHALL BE SOLELY RESPONSIBLE FOR ALL CONSTRUCTION MEANS, METHODS, TECHNIQUES, SEQUENCES, AND PROCEDURES AND FOR COORDINATING ALL PORTIONS OF THE WORK UNDER THIS CONTRACT.
8. THE CONTRACTOR SHALL MAKE ALL NECESSARY PROVISIONS TO PROTECT EXISTING IMPROVEMENTS, ROADWAY, DRAINAGE WAYS, PRIVATE BRIDGE, CULVERTS, AND VEGETATION UNTIL SUCH ITEMS ARE TO BE DISTURBED OR REMOVED AS INDICATED ON THE CONTRACT DOCUMENTS.
9. THE CONTRACTOR SHALL KEEP THE JOB SITE CLEAN AND HAZARD FREE. CONTRACTOR SHALL DISPOSE OF ALL DIRT, DEBRIS, AND RUBBISH FOR THE DURATION OF THE WORK. UPON COMPLETION OF WORK, CONTRACTOR SHALL REMOVE ALL MATERIAL AND EQUIPMENT NOT SPECIFIED AS REMAINING ON THE PROPERTY.
10. NOTES AND DETAILS ON THE PLANS SHALL TAKE PRECEDENCE OVER GENERAL NOTES HEREIN.
11. DIMENSIONS CALLOUTS SHALL TAKE PRECEDENCE OVER SCALES SHOWN ON THE PLANS.
12. THE PLANS REPRESENT THE FINISHED STRUCTURE. THEY DO NOT INDICATE THE METHOD OF ALL CONSTRUCTION. THE CONTRACTOR SHALL PROVIDE ALL MEASURES NECESSARY TO PROTECT THE STRUCTURES, WORKS, AND THE PUBLIC DURING CONSTRUCTION.
13. MATERIAL SHALL NOT BE STORED OUTSIDE OF IDENTIFIED STAGING AREAS. THE CONTRACTOR SHALL USE ONLY DESIGNATED SPECIFIC SITES FOR STORAGE OF EQUIPMENT AND MATERIALS AS SHOWN ON THESE PLANS. THE CONTRACTOR SHALL BE RESPONSIBLE FOR THE SECURITY OF ALL EQUIPMENT AND MATERIALS.

| GENERAL QUANTITIES |  |          |       |
|--------------------|--|----------|-------|
| ITEM #             | DESCRIPTION                              | QUANTITY | UNITS |
| 1                  | EROSION/WATER POLLUTION CONTROL MEASURES | 1        | LS    |
| 2                  | ACCESS AND STAGING                       | 1        | LS    |
| 3                  | SITE ISOLATION                           | 1        | LS    |
| 4                  | TYPE 1 APEX ELJ                          | 7        | EA    |
| 5                  | TYPE 2 APEX ELJ                          | 1        | EA    |
| 6                  | TYPE 1 DEFLECTOR ELJ                     | 9        | EA    |
| 7                  | TYPE 1 FLOODPLAIN ROUGHNESS ELJ          | 7        | EA    |
| 8                  | TIMBER COMPLEX UNIT ELJ                  | 5        | EA    |
| 9                  | TYPE 1 SETBACK REVETMETN ELJ             | 6        | EA    |
| 10                 | TYPE 2 SETBACK REVETMETN ELJ             | 12       | EA    |
| 11                 | EXCAVATION OF TEMPORARY RELIEF CHANNEL   | 10,000   | CY    |
| 12                 | RACKING LOGS                             | 5,550    | EA    |
| 13                 | SLASH                                    | 3,740    | CY    |

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| NAME OR INITIALS AND DATE |         | GEOGRAPHIC INFORMATION |               |
|---------------------------|---------|------------------------|---------------|
| DESIGNED                  | RLE, MS | LATITUDE               | 46°58'55.71"N |
| CHECKED                   | RLE     | LONGITUDE              | 123°28'56.2"W |
| DRAWN                     | MS, GM  | TN/SC/RG               | T17N/S6/R6W   |
| CHECKED                   | RLE     | DATE                   | 2/14/2019     |

**KEYS ROAD FLOOD PROTECTION**

**GENERAL NOTES**

**2**  
SHEET **2** OF **17**

**Mar 26, 2020 PHASE I PRELIMINARY DESIGN 60% NOT FOR CONSTRUCTION**

**GENERAL LEGEND**

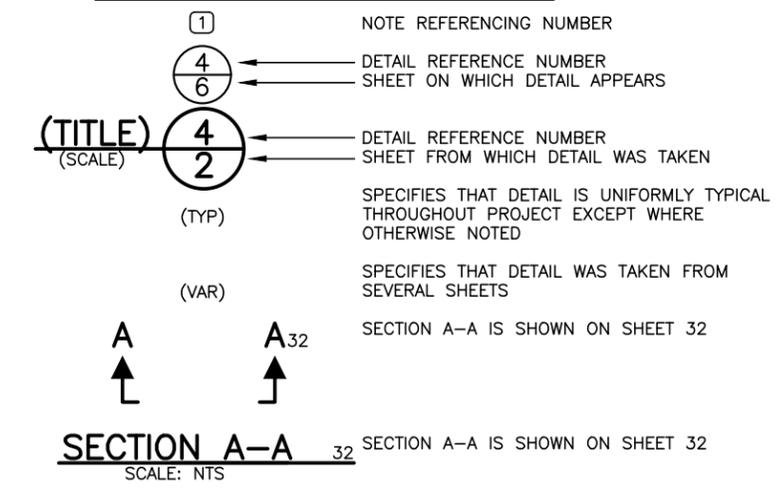
- PROPERTY LINE
- GAS LINE
- RIGHT OF WAY LINE
- EXISTING ROAD
- ACCESS ROAD
- CLEARING LIMIT
- GRADING LIMIT
- EXCAVATION LIMIT
- EXISTING MAJOR CONTOUR
- EXISTING MINOR CONTOUR
- PROPOSED MAJOR CONTOUR
- PROPOSED MINOR CONTOUR
- EXISTING FLOW
- EXISTING OHWM
- PROPOSED OHWM
- 2-YEAR FLOOD BOUNDARY
- 100-YEAR FLOOD BOUNDARY
- EXISTING WETLAND
- PROPOSED WETLAND
- EXISTING WATER
- PROPOSED WATER
- EXISTING FENCE
- CONTROL POINT LOCATION
- DEMOLITION/REMOVAL AREA

- ENGINEERED LOGJAM (ELJ) TYPE 1 APEX
- ENGINEERED LOGJAM (ELJ) TYPE 2 APEX
- ENGINEERED LOGJAM (ELJ) TYPE 1 DEFLECTOR
- ENGINEERED LOGJAM (ELJ) FLOODPLAIN ROUGHNESS
- ENGINEERED LOGJAM (ELJ) TYPE 1 SETBACK REVETMENT
- ENGINEERED LOGJAM (ELJ) TYPE 2 SETBACK REVETMENT
- ENGINEERED LOGJAM (ELJ) TIMBER COMPLEX UNIT

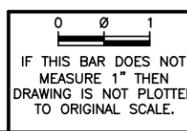
**TEMPORARY EROSION CONTROL LEGEND**

- SILT BOOM
- BLOCK NETS
- SILT FENCE
- STRAW WATTLE
- DEWATERING LINE DISCHARGE
- PROPOSED STAGING AREA
- BULK BAG COFFERDAM
- TEMPORARY ACCESS ROAD
- TEMPORARY ACCESS BRIDGE
- PUMP DISCHARGE OUTLET
- DEWATERING PUMP

**DETAIL AND SECTION REFERENCING**



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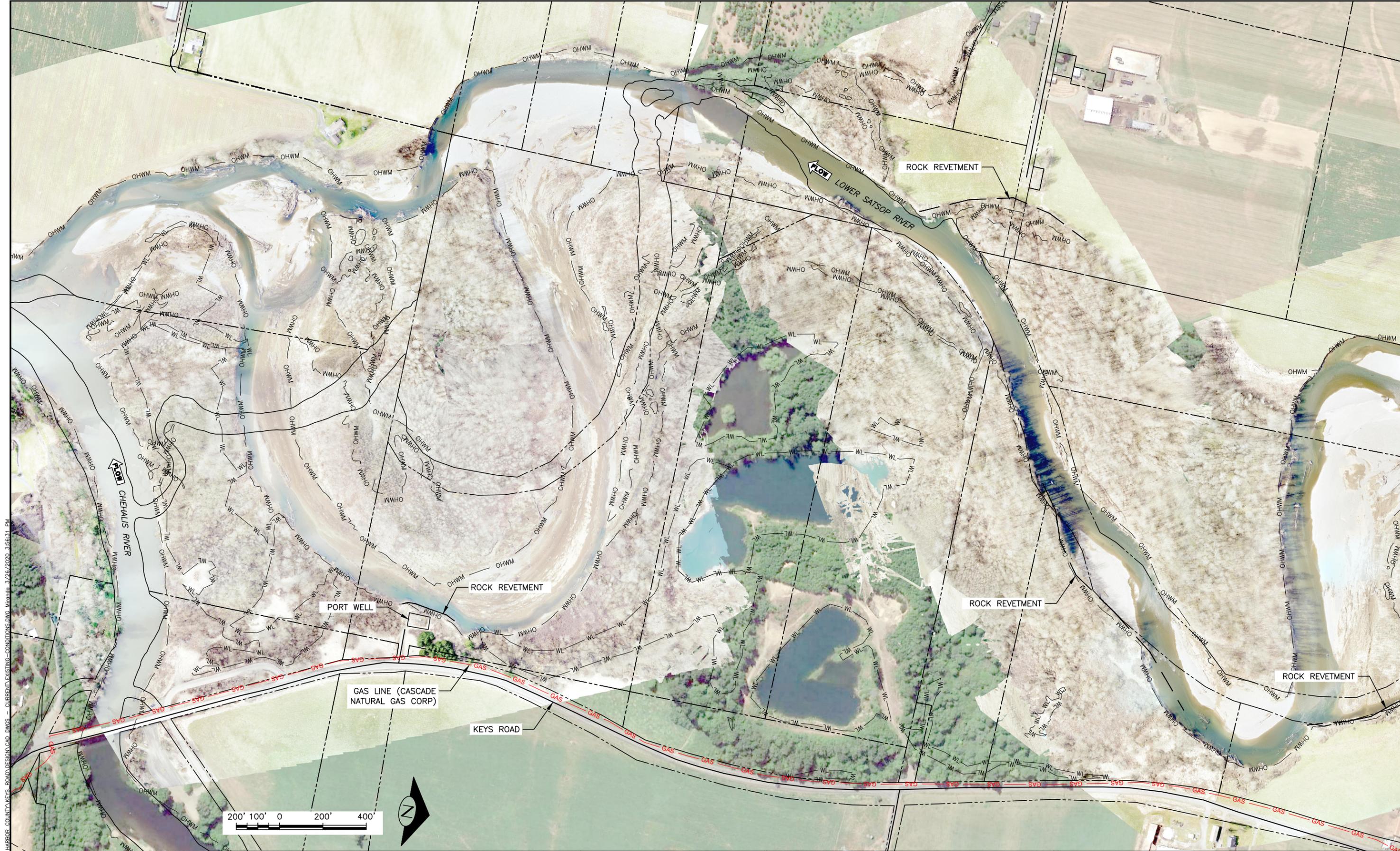


| NAME OR INITIALS AND DATE |         | GEOGRAPHIC INFORMATION |               |
|---------------------------|---------|------------------------|---------------|
| DESIGNED                  | RLE, MS | LATITUDE               | 46°58'55.71"N |
| CHECKED                   | RLE     | LONGITUDE              | 123°28'56.2"W |
| DRAWN                     | MS, GM  | TN/SC/RG               | T17N/S6/R6W   |
| CHECKED                   | RLE     | DATE                   | 2/14/2019     |

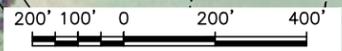
**KEYS ROAD FLOOD PROTECTION**

**LEGEND**

Mar 26, 2020 PHASE I PRELIMINARY DESIGN 60% NOT FOR CONSTRUCTION



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 MEASURE 1" THEN  
 DRAWING IS NOT PLOTTED  
 TO ORIGINAL SCALE.



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| NAME OR INITIALS AND DATE | DESIGNED | RLE, MS |
| CHECKED                   | RLE      |         |
| DRAWN                     | MS, GM   |         |
| CHECKED                   | RLE      |         |

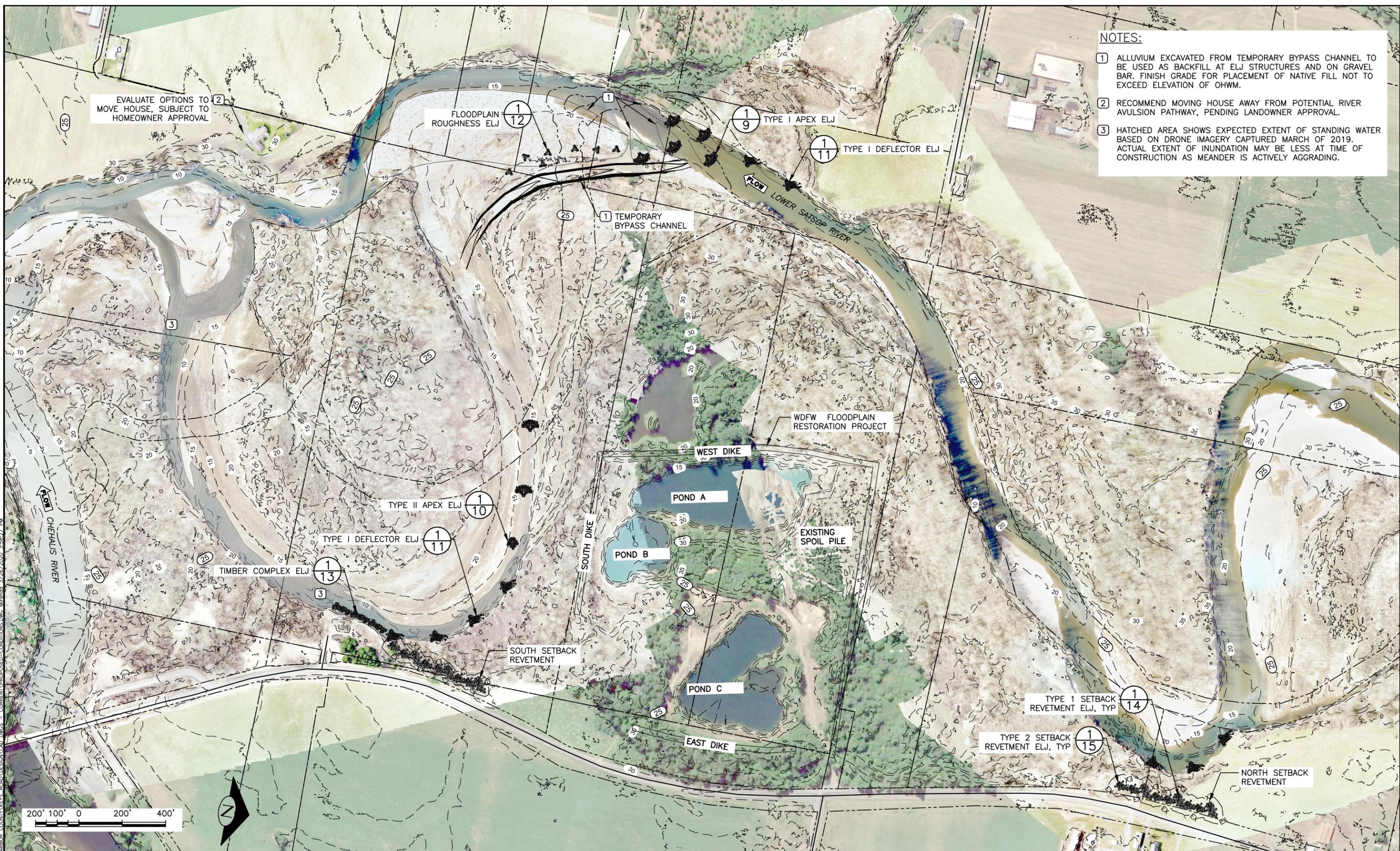
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| GEOGRAPHIC INFORMATION | LATITUDE  | 46°58'55.71"N |
|                        | LONGITUDE | 123°28'56.2"W |
|                        | TN/SC/RG  | T17N/S6/R6W   |
|                        | DATE      | 2/14/2019     |

### KEYS ROAD FLOOD PROTECTION

EXISTING CONDITIONS

Mar 26, 2020 PHASE I PRELIMINARY DESIGN 60% NOT FOR CONSTRUCTION

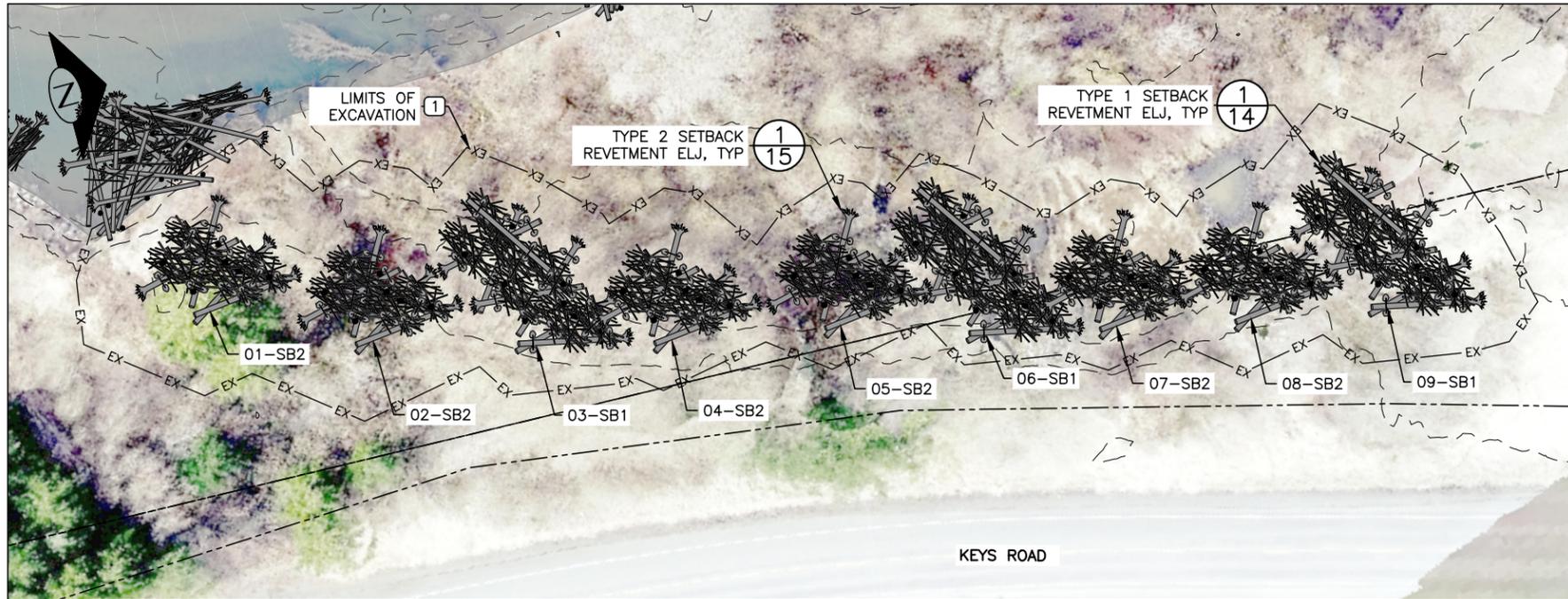
- NOTES:**
- ① ALLUVIUM EXCAVATED FROM TEMPORARY BYPASS CHANNEL TO BE USED AS BACKFILL AT ELJ STRUCTURES AND ON GRAVEL BAR. FINISH GRADE FOR PLACEMENT OF NATIVE FILL NOT TO EXCEED ELEVATION OF OHWM.
  - ② RECOMMEND MOVING HOUSE AWAY FROM POTENTIAL RIVER AVULSION PATHWAY, PENDING LANDOWNER APPROVAL.
  - ③ HATCHED AREA SHOWS EXPECTED EXTENT OF STANDING WATER BASED ON DRONE IMAGERY CAPTURED MARCH OF 2019. ACTUAL EXTENT OF INUNDATION MAY BE LESS AT TIME OF CONSTRUCTION AS MEANDER IS ACTIVELY AGGRADING.



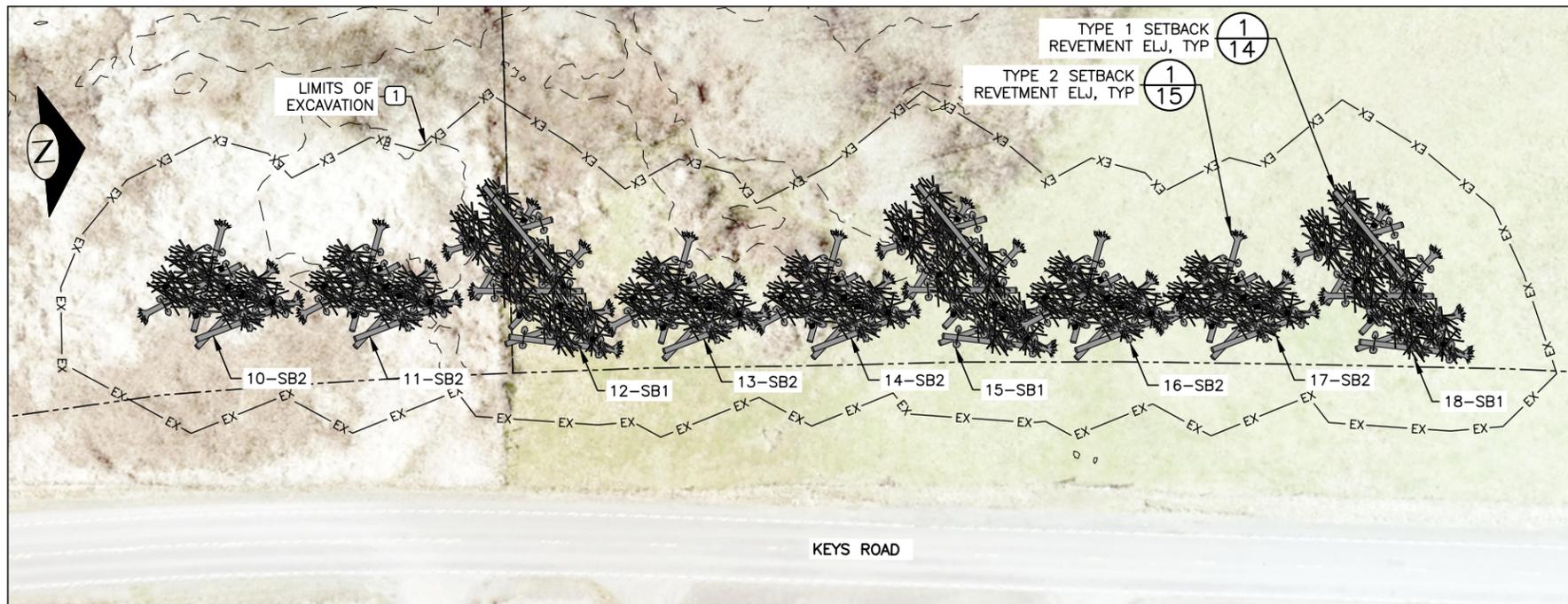
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|---|--|--|---|--|-----------------------------------|-----------------|
| <p>IF THIS BAR DOES NOT MEASURE 1" THEN DRAWING IS NOT PLOTTED TO ORIGINAL SCALE.</p> |  | NAME OR INITIALS AND DATE                                      | GEOGRAPHIC INFORMATION  | <p><b>KEYS ROAD FLOOD PROTECTION</b></p> | <p><b>PROPOSED CONDITIONS</b></p> | <p><b>5</b></p> |
|   |  | DESIGNED RLE, MS<br>CHECKED RLE<br>DRAWN MS, GM<br>CHECKED RLE | LATITUDE 46°58'55.71"N<br>LONGITUDE 123°28'56.2"W<br>TN/SC/RG T17N/S6/R6W<br>DATE 2/14/2019 |  |                                   |                 |



**SOUTH SETBACK REVETMENT**  
SCALE: 1:30



**NORTH SETBACK REVETMENT**  
SCALE: 1:30

| ELJ STRUCTURE SCHEDULE |                               |                        |                       |                      |
|------------------------|-------------------------------|------------------------|-----------------------|----------------------|
| ELJ ID                 | EXISTING GRADE ELEVATION (FT) | ELJ BED ELEVATION (FT) | EXCAVATION DEPTH (FT) | EXCAVATION QTY. (CY) |
| 01-SB2                 | 25.9                          | 11                     | 15                    | 1,805                |
| 02-SB2                 | 26.0                          | 12                     | 14                    | 1,675                |
| 03-SB1                 | 20.0                          | 12                     | 8                     | 945                  |
| 04-SB2                 | 19.2                          | 12                     | 7                     | 540                  |
| 05-SB2                 | 17.9                          | 12                     | 6                     | 435                  |
| 06-SB1                 | 16.1                          | 12                     | 4                     | 366                  |
| 07-SB2                 | 18.0                          | 12                     | 6                     | 403                  |
| 08-SB2                 | 19.9                          | 12                     | 8                     | 649                  |
| 09-SB1                 | 21.3                          | 12                     | 9                     | 1,273                |
| 10-SB2                 | 34.0                          | 16                     | 18                    | 2,438                |
| 11-SB2                 | 34.0                          | 16                     | 18                    | 2,381                |
| 12-SB1                 | 32.0                          | 16                     | 16                    | 2,705                |
| 13-SB2                 | 32.0                          | 16                     | 16                    | 1,950                |
| 14-SB2                 | 30.0                          | 16                     | 14                    | 1,536                |
| 15-SB1                 | 32.0                          | 16                     | 16                    | 2,713                |
| 16-SB2                 | 32.0                          | 16                     | 16                    | 1,870                |
| 17-SB2                 | 32.0                          | 16                     | 16                    | 1,945                |
| 18-SB1                 | 32.0                          | 16                     | 16                    | 3,397                |

**NOTES:**

- 1 EXCAVATION LIMITS WERE DETERMINED FOLLOWING OSHA GUIDANCE FOR OPEN PIT WITHOUT SHORING AT 1.5:1 SIDE SLOPES.
2. EXCAVATION QUANTITIES HAVE BEEN CALCULATED AS BANK CUBIC YARDS USING 2017 LIDAR TOPOGRAPHY, EXCAVATION DEPTHS SHOWN IN THE STRUCTURE SCHEDULE, AND OSHA GUIDANCE FOR 1.5:1 SIDE SLOPES.

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**Natural Systems Design**

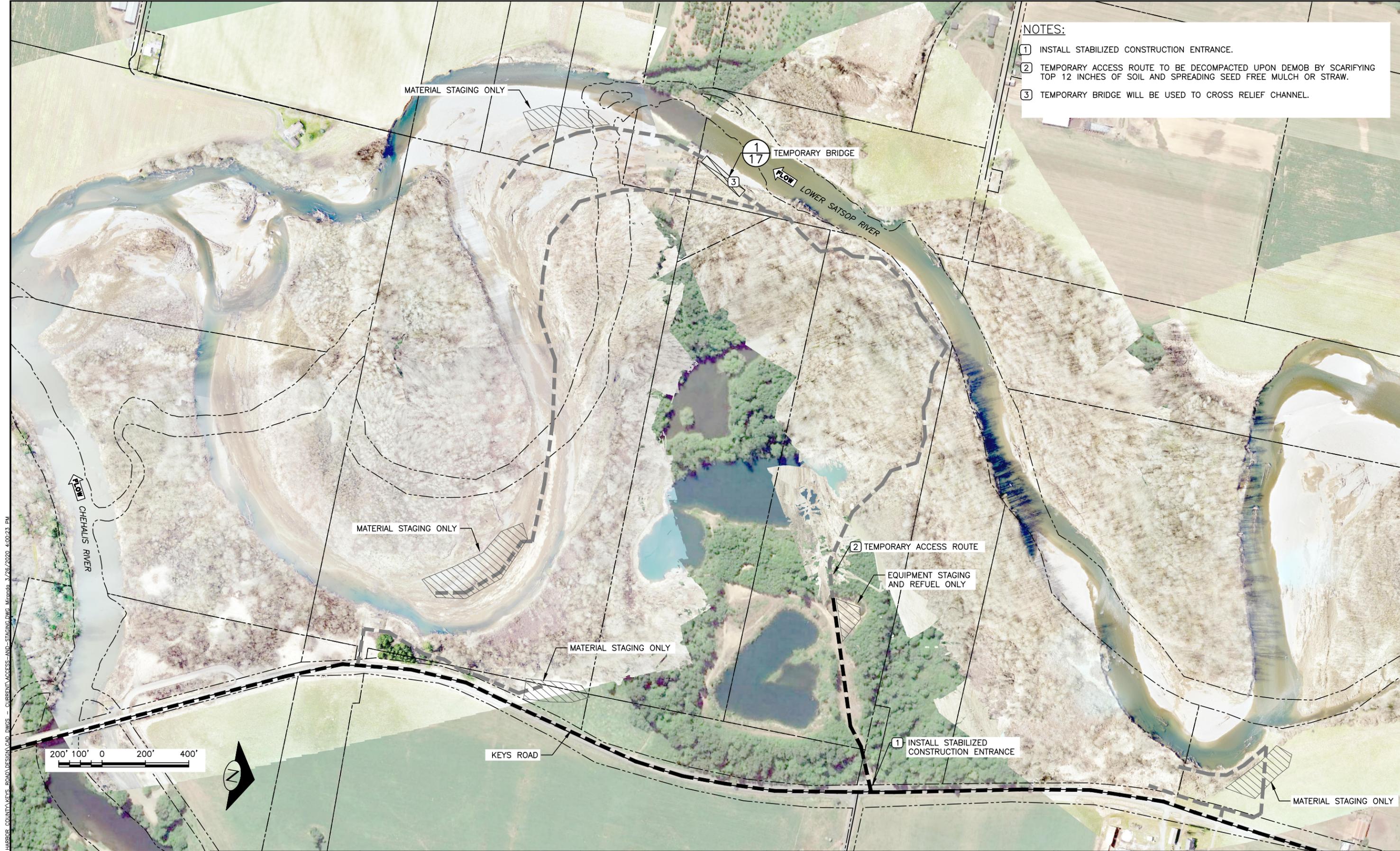
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|---------------------------|-------------------------|
| NAME OR INITIALS AND DATE | GEOGRAPHIC INFORMATION  |
| DESIGNED RLE, MS          | LATITUDE 46°58'55.71"N  |
| CHECKED RLE               | LONGITUDE 123°28'56.2"W |
| DRAWN MS, GM              | TN/SC/RG T17N/S6/R6W    |
| CHECKED RLE               | DATE 2/14/2019          |

**KEYS ROAD FLOOD PROTECTION**

**SETBACK REVETMENT ELJ SCHEDULE**

**6**  
SHEET 6 OF 17

Mar 26, 2020 PHASE I PRELIMINARY DESIGN 60% NOT FOR CONSTRUCTION



- NOTES:
- ① INSTALL STABILIZED CONSTRUCTION ENTRANCE.
  - ② TEMPORARY ACCESS ROUTE TO BE DECOMPACTED UPON DEMOB BY SCARIFYING TOP 12 INCHES OF SOIL AND SPREADING SEED FREE MULCH OR STRAW.
  - ③ TEMPORARY BRIDGE WILL BE USED TO CROSS RELIEF CHANNEL.

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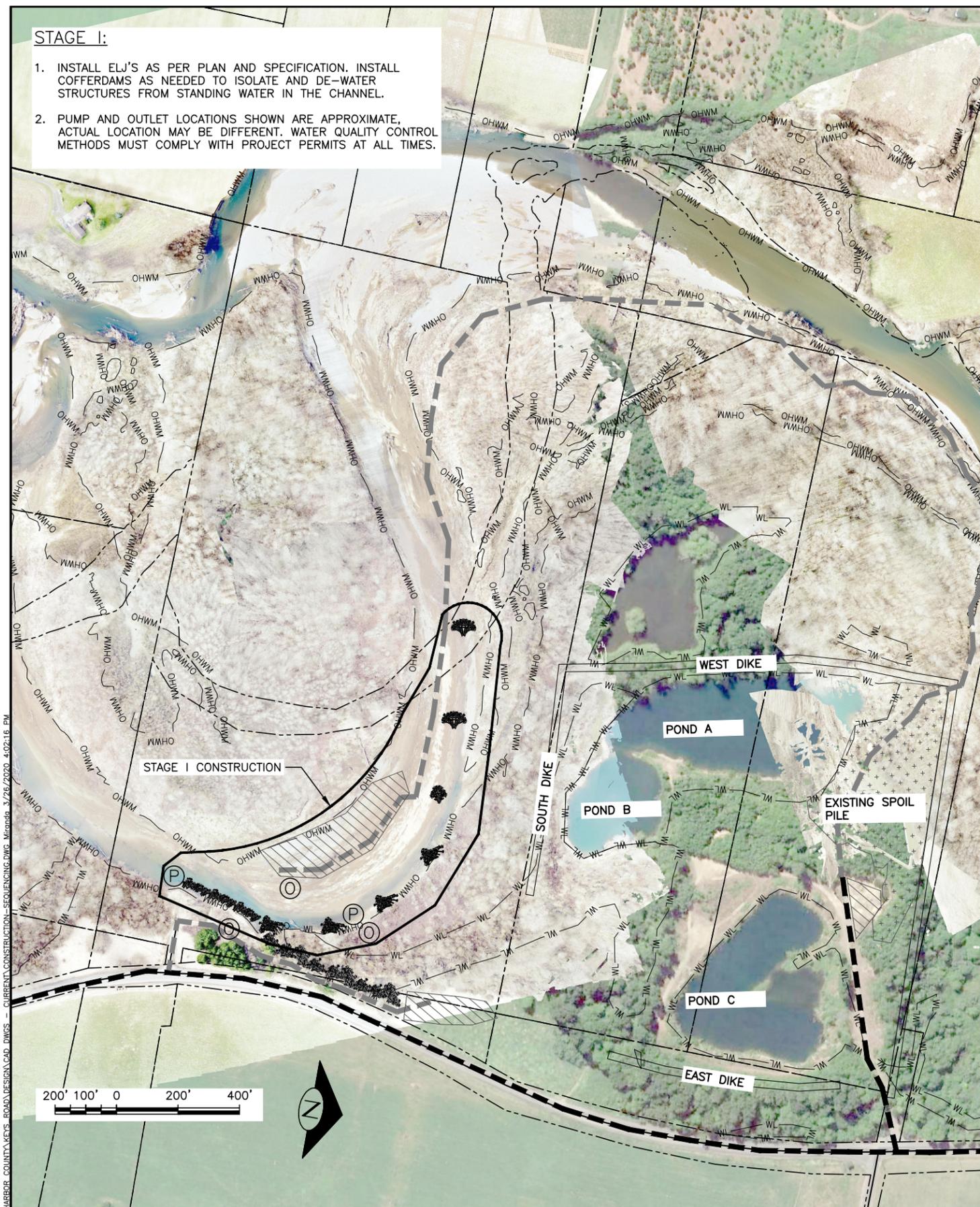
Mar 26, 2020 PHASE I PRELIMINARY DESIGN 60% NOT FOR CONSTRUCTION



| <br>IF THIS BAR DOES NOT MEASURE 1" THEN DRAWING IS NOT PLOTTED TO ORIGINAL SCALE. | <br>1854                |  | <table border="1" style="width: 100%; border-collapse: collapse;"> <tr> <th style="text-align: left;">NAME OR INITIALS AND DATE</th> <th style="text-align: left;">GEOGRAPHIC INFORMATION</th> </tr> <tr> <td>DESIGNED RLE, MS</td> <td>LATITUDE 46°58'55.71"N</td> </tr> <tr> <td>CHECKED RLE</td> <td>LONGITUDE 123°28'56.2"W</td> </tr> <tr> <td>DRAWN MS, GM</td> <td>TN/SC/RG T17N/S6/R6W</td> </tr> <tr> <td>CHECKED RLE</td> <td>DATE 2/14/2019</td> </tr> </table> | NAME OR INITIALS AND DATE | GEOGRAPHIC INFORMATION | DESIGNED RLE, MS | LATITUDE 46°58'55.71"N | CHECKED RLE | LONGITUDE 123°28'56.2"W | DRAWN MS, GM | TN/SC/RG T17N/S6/R6W | CHECKED RLE | DATE 2/14/2019 | <h2 style="margin: 0;">KEYS ROAD FLOOD PROTECTION</h2> | <h2 style="margin: 0;">ACCESS AND STAGING</h2> | <h1 style="margin: 0;">7</h1> <p style="font-size: small;">SHEET 7 OF 17</p> |
|--|-------------------------|--|--|---------------------------|------------------------|------------------|------------------------|-------------|-------------------------|--------------|----------------------|-------------|----------------|--|--|--|
| NAME OR INITIALS AND DATE  | GEOGRAPHIC INFORMATION  |  |  |                           |                        |                  |                        |             |                         |              |                      |             |                |  |  |  |
| DESIGNED RLE, MS   | LATITUDE 46°58'55.71"N  |  |  |                           |                        |                  |                        |             |                         |              |                      |             |                |  |  |  |
| CHECKED RLE  | LONGITUDE 123°28'56.2"W |  |  |                           |                        |                  |                        |             |                         |              |                      |             |                |  |  |  |
| DRAWN MS, GM   | TN/SC/RG T17N/S6/R6W    |  |  |                           |                        |                  |                        |             |                         |              |                      |             |                |  |  |  |
| CHECKED RLE  | DATE 2/14/2019          |  |  |                           |                        |                  |                        |             |                         |              |                      |             |                |  |  |  |

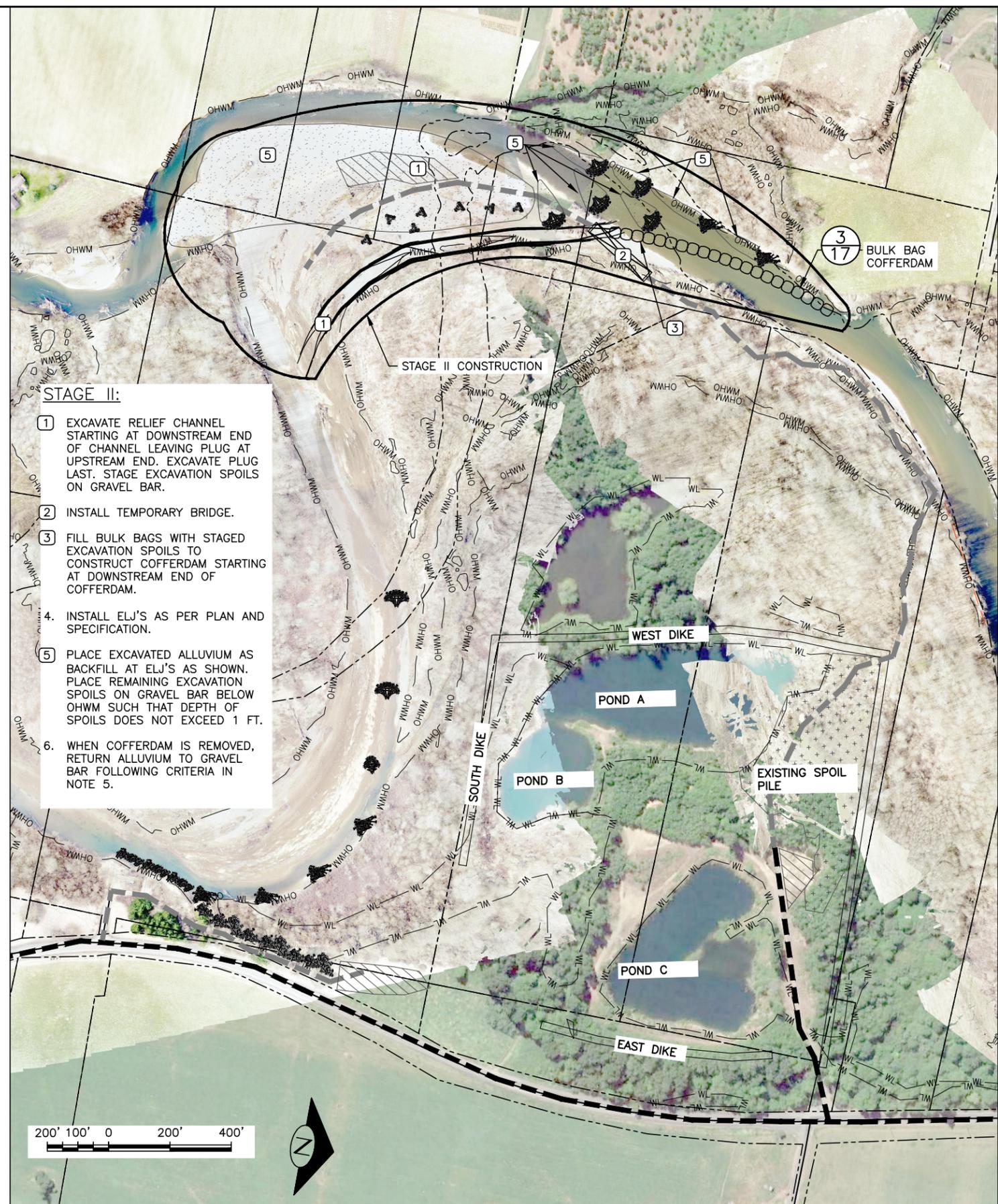
**STAGE I:**

1. INSTALL ELJ'S AS PER PLAN AND SPECIFICATION. INSTALL COFFERDAMS AS NEEDED TO ISOLATE AND DE-WATER STRUCTURES FROM STANDING WATER IN THE CHANNEL.
2. PUMP AND OUTLET LOCATIONS SHOWN ARE APPROXIMATE, ACTUAL LOCATION MAY BE DIFFERENT. WATER QUALITY CONTROL METHODS MUST COMPLY WITH PROJECT PERMITS AT ALL TIMES.



**STAGE II:**

- 1 EXCAVATE RELIEF CHANNEL STARTING AT DOWNSTREAM END OF CHANNEL LEAVING PLUG AT UPSTREAM END. EXCAVATE PLUG LAST. STAGE EXCAVATION SPOILS ON GRAVEL BAR.
- 2 INSTALL TEMPORARY BRIDGE.
- 3 FILL BULK BAGS WITH STAGED EXCAVATION SPOILS TO CONSTRUCT COFFERDAM STARTING AT DOWNSTREAM END OF COFFERDAM.
4. INSTALL ELJ'S AS PER PLAN AND SPECIFICATION.
- 5 PLACE EXCAVATED ALLUVIUM AS BACKFILL AT ELJ'S AS SHOWN. PLACE REMAINING EXCAVATION SPOILS ON GRAVEL BAR BELOW OHWM SUCH THAT DEPTH OF SPOILS DOES NOT EXCEED 1 FT.
6. WHEN COFFERDAM IS REMOVED, RETURN ALLUVIUM TO GRAVEL BAR FOLLOWING CRITERIA IN NOTE 5.



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Mar 26, 2020 PHASE I PRELIMINARY DESIGN 60% NOT FOR CONSTRUCTION

0 1  
IF THIS BAR DOES NOT MEASURE 1" THEN DRAWING IS NOT PLOTTED TO ORIGINAL SCALE.



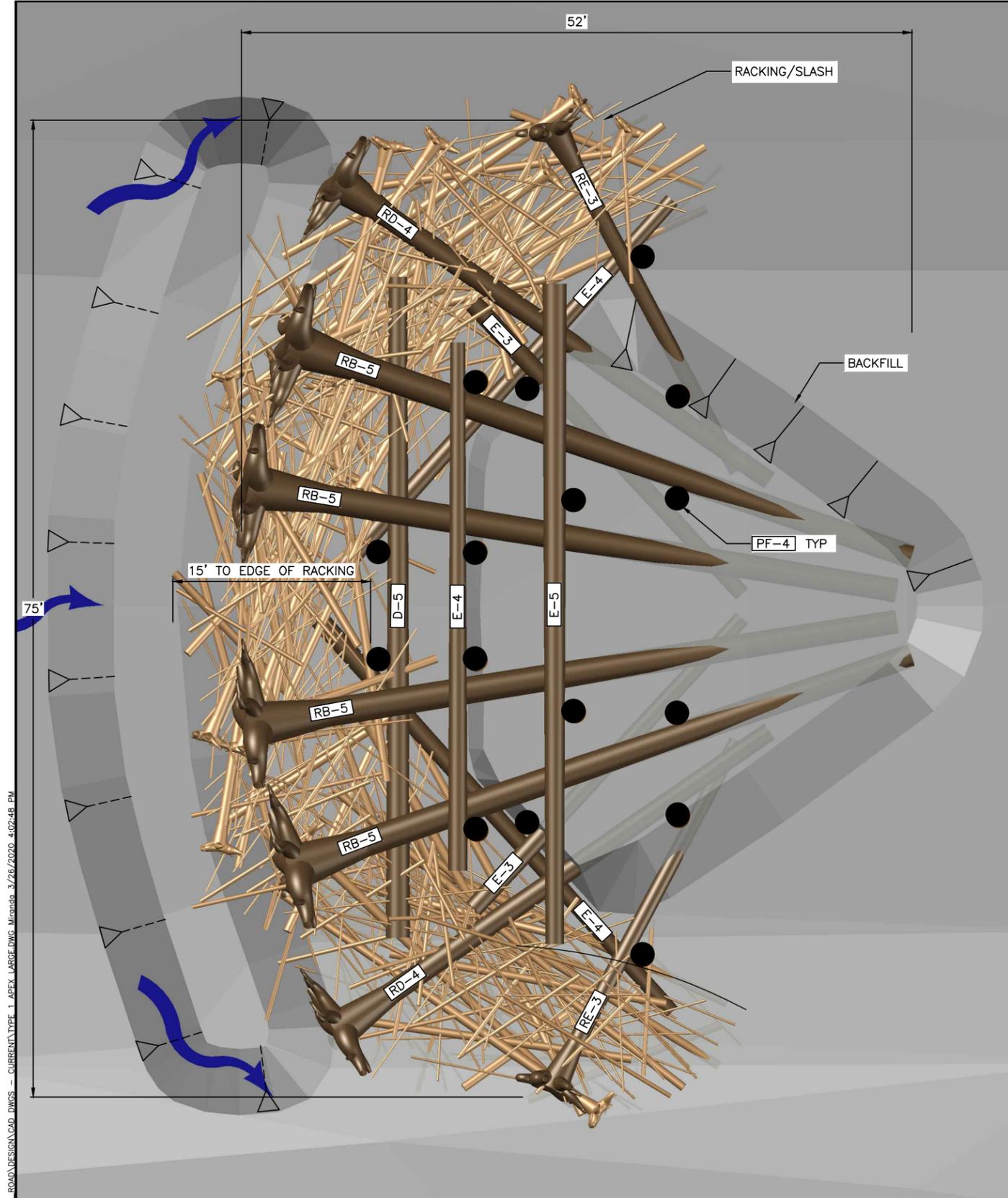
NAME OR INITIALS AND DATE  
DESIGNED RLE, MS  
CHECKED RLE  
DRAWN MS, GM  
CHECKED RLE

GEOGRAPHIC INFORMATION  
LATITUDE 46°58'55.71"N  
LONGITUDE 123°28'56.2"W  
TN/SC/RG T17N/S6/R6W  
DATE 2/14/2019

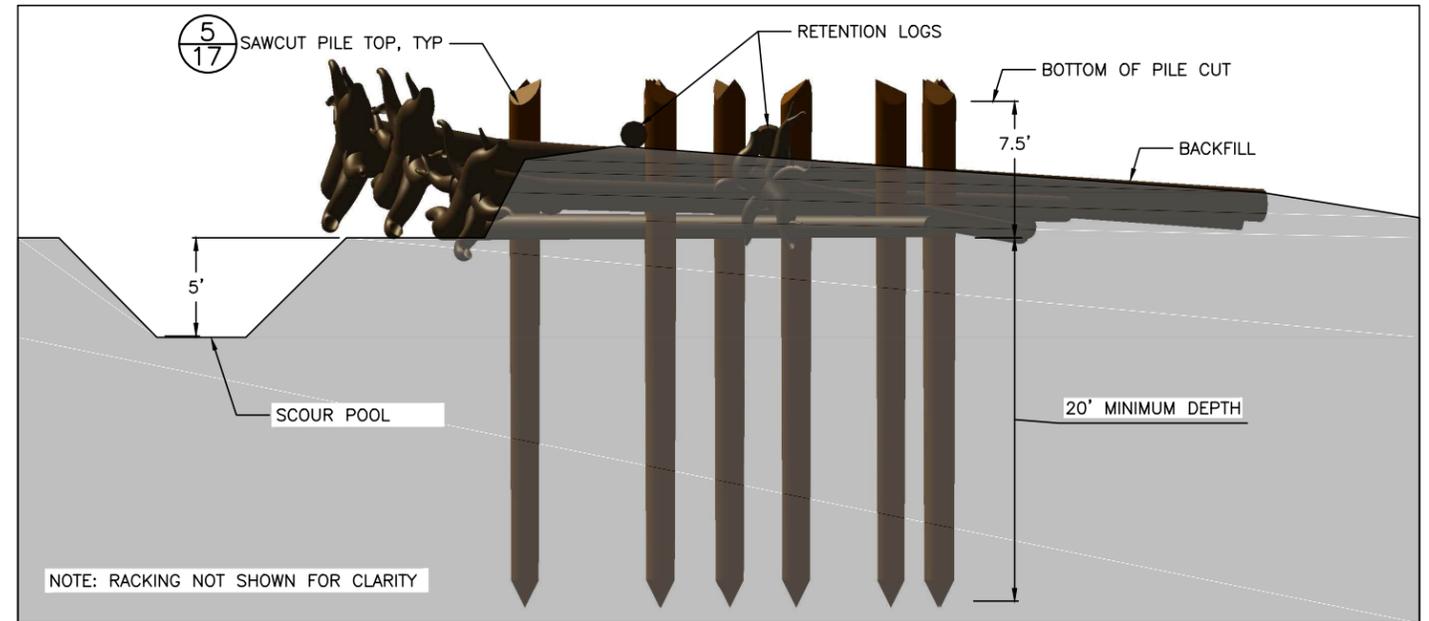
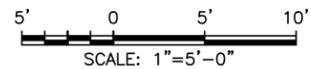
KEYS ROAD FLOOD PROTECTION

CONSTRUCTION SEQUENCING AND TESC

8  
SHEET 8 OF 17

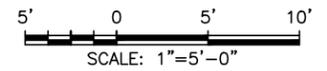


**TYPE 1 APEX ELJ PLAN**  
SCALE: 1" = 5'



**TYPE 1 APEX ELJ PROFILE**

SCALE: 1" = 5'



**NOTES:**

1. ALL LOGS SHALL BE DOUGLAS FIR, OR WESTERN RED CEDAR.
2. ALL PILES SHALL BE ROUND, UNTREATED TIMBER PILES AND SHALL BE DOUGLAS FIR. PILES SHALL BE FREE FROM DEFECTS, CRACKS, AND SPLITTING AT THE TIME OF DRIVING.
3. LOGS WITH ROOTWADS SHALL HAVE A DIAMETER AS SHOWN MEASURED AT DBH, DEFINED AS 4.5 FEET ABOVE GROUND WHEN TREE WAS STANDING.
4. THE CONTRACTOR SHALL PLACE LOGS AS ILLUSTRATED ON THIS SHEET UNLESS DIRECTED OTHERWISE BY THE CONTRACTING OFFICER.
5. SOIL EXCAVATED DURING CONSTRUCTION SHALL BE REPLACED TO ORIGINAL GROUND FOLLOWING PLACEMENT OF ALL LOGS.
6. THE LOCATIONS SHOWN IN THE PLANS ARE APPROXIMATE AND MAY BE ADJUSTED IN THE FIELD BY THE CONTRACTING OFFICER.
7. RACKING LOGS SHALL CONSIST OF TREES WITH BRANCHES HAVING A BASE DIAMETER OF 6-12 INCHES AND A LENGTH OF 20-40 FT. RACKING MATERIAL SHALL OCCUR WITH EACH LAYER TO ENSURE THAT RACKING MATERIAL EXTENDS THROUGH THE STRUCTURE AND IS PINNED BY SUBSEQUENT LAYERS. SLASH MATERIAL SHALL CONSIST OF LIMBS AND BRANCHES AND A BASE DIAMETER BETWEEN 1 AND 3 INCHES. SLASH MATERIAL SHALL BE PLACED AS DIRECTED BY THE CONTRACTING OFFICER. QUANTITY OF RACKING LOGS AND SLASH MATERIAL PER STRUCTURE ARE SHOWN IN LOG SCHEDULE. RACKING AND SLASH MATERIAL SHALL BE DOUGLAS FIR, PONDEROSA PINE, WESTERN RED CEDAR, OR WESTERN LARCH TREES.
8. RETENTION LOGS TO BE INSTALLED TO HOLD RACKING MATERIAL IN PLACE AT THE DIRECTION OF THE CONTRACTING OFFICER.
9. CONNECT LOGS WITH WRAPPED CHAIN CONNECTION WHERE INDICATED ON THE DRAWINGS. SEE DETAILS.
10. AT LOCATIONS WHERE SITE CONDITIONS ALLOW (IN DRY OR LIMITED DEWATERING), SCOUR POOL TO BE EXCAVATED. EXCAVATED ALLUVIUM TO BE PLACED BEHIND THE STRUCTURE AS DIRECTED BY THE CONTRACTING OFFICER. EXTENTS AND LOCATION OF THE SCOUR POOL IS APPROXIMATE AND TO BE ADJUSTED IN THE FIELD BY THE CONTRACTING OFFICER.
11. EXISTING WOODY MATERIAL AT THE STRUCTURE CONSTRUCTION SITE SHALL BE MOVED OR PROTECTED FROM CONSTRUCTION ACTIVITIES AND THEN INCORPORATED INTO THE STRUCTURE AS DIRECTED BY THE CONTRACTING OFFICER.

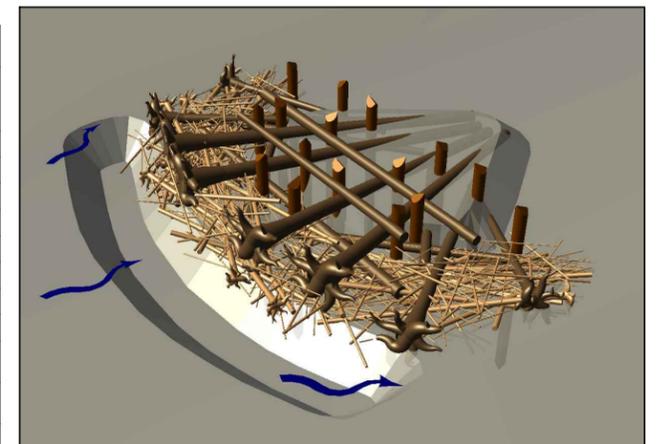
**TYPE 1 APEX ELJ LOG SCHEDULE**

| LOG ID   | DIA* (INCHES) | LENGTH ** (FEET) | ROOTWAD (Y/N) | QUANTITY PER STRUCTURE | NOTES               |
|----------|---------------|------------------|---------------|------------------------|---------------------|
| RB-5     | 20-24         | 50               | Y             | 4                      |                     |
| RD-4     | 18-20         | 40               | Y             | 2                      |                     |
| RE-3     | 14-18         | 30               | Y             | 2                      |                     |
| D-5      | 18-20         | 50               | N             | 1                      |                     |
| E-3      | 15-18         | 30               | N             | 2                      |                     |
| E-4      | 15-18         | 40               | N             | 3                      |                     |
| E-5      | 15-18         | 50               | N             | 1                      |                     |
| PF-4 *** | 16            | 40               | N             | 16                     |                     |
| RACKING  | 6-12          | 20-40            | N             | 150                    | TREES WITH BRANCHES |
| SLASH    | 1-3           |                  |               | 50 CY                  | LIMBS AND BRANCHES  |

\* MINIMUM DIAMETER AT BREAST HEIGHT (1" PER 10' MAXIMUM TAPER)

\*\* TOTAL LENGTH INCLUDING ROOTWAD

\*\*\* TURNED PILES - DIA (IN) IS BUTT DIAMETER



**TYPE 1 APEX ELJ PERSPECTIVE**  
NOT TO SCALE

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IF THIS BAR DOES NOT MEASURE 1" THEN DRAWING IS NOT PLOTTED TO ORIGINAL SCALE.



|                           |         |
|---------------------------|---------|
| NAME OR INITIALS AND DATE |         |
| DESIGNED                  | RLE, MS |
| CHECKED                   | RLE     |
| DRAWN                     | MS, GM  |
| CHECKED                   | RLE     |

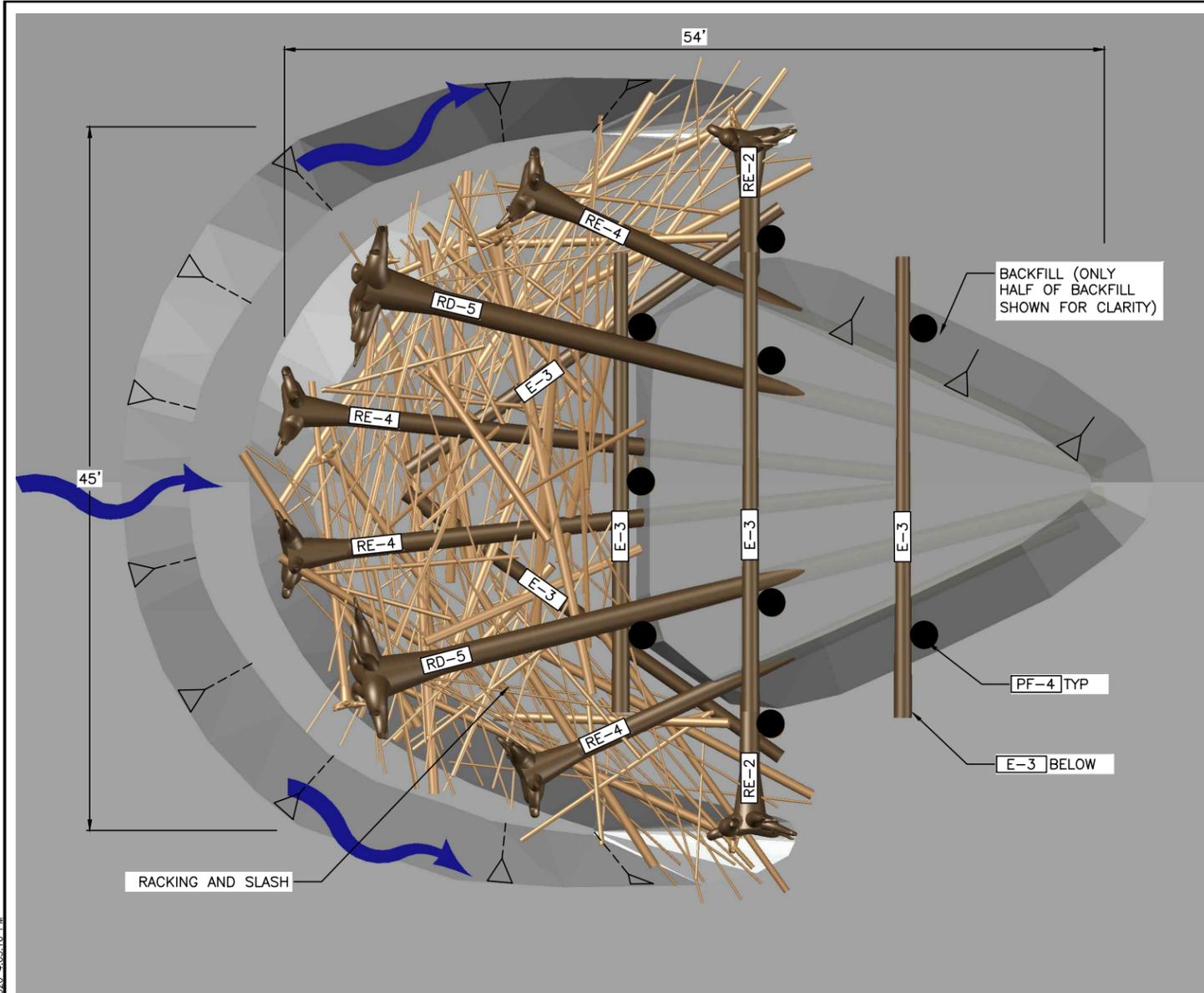
|                        |               |
|------------------------|---------------|
| GEOGRAPHIC INFORMATION |               |
| LATITUDE               | 46°58'55.71"N |
| LONGITUDE              | 123°28'56.2"W |
| TN/SC/RG               | T17N/S6/R6W   |
| DATE                   | 2/14/2019     |

**KEYS ROAD FLOOD PROTECTION**

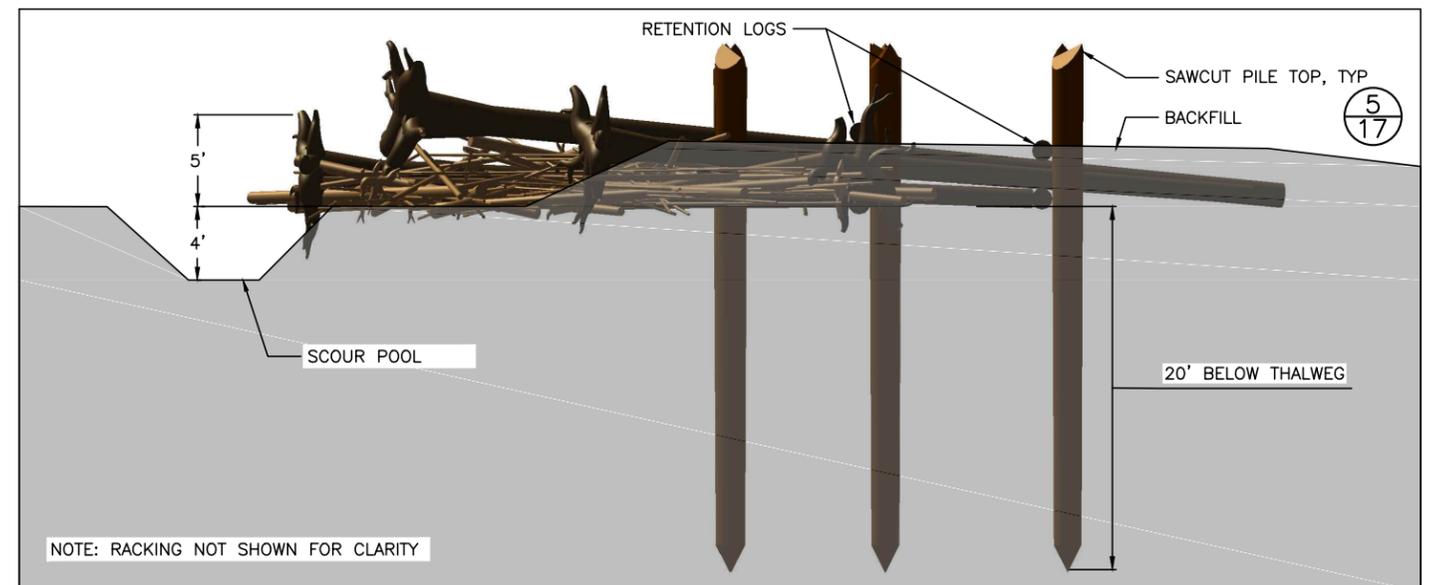
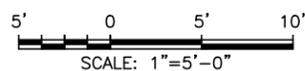
**TYPE 1 APEX ELJ DETAILS**

**9**  
SHEET **9** OF **17**

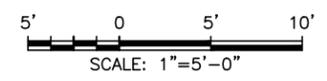
Mar 26, 2020 PHASE I PRELIMINARY DESIGN 60% NOT FOR CONSTRUCTION



**TYPE 2 APEX ELJ PLAN**  
SCALE: 1" = 5'



**TYPE 2 APEX ELJ PROFILE**  
SCALE: 1" = 5'



**NOTES:**

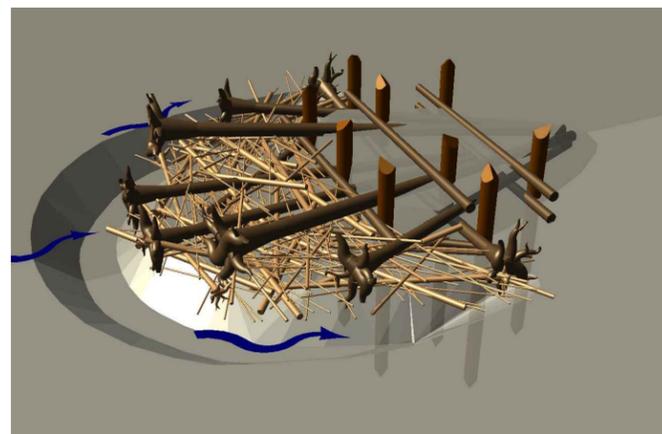
- ALL LOGS SHALL BE DOUGLAS FIR OR WESTERN RED CEDAR.
- ALL PILES SHALL BE ROUND, UNTREATED TIMBER PILES AND SHALL BE DOUGLAS FIR. PILES SHALL BE FREE FROM DEFECTS, CRACKS, AND SPLITTING AT THE TIME OF DRIVING.
- LOGS WITH ROOTWADS SHALL HAVE A DIAMETER AS SHOWN MEASURED AT DBH, DEFINED AS 4.5 FEET ABOVE GROUND WHEN TREE WAS STANDING.
- THE CONTRACTOR SHALL PLACE LOGS AS ILLUSTRATED ON THIS SHEET UNLESS DIRECTED OTHERWISE BY THE CONTRACTING OFFICER.
- SOIL EXCAVATED DURING CONSTRUCTION SHALL BE REPLACED TO ORIGINAL GROUND FOLLOWING PLACEMENT OF ALL LOGS.
- THE LOCATIONS SHOWN IN THE PLANS ARE APPROXIMATE AND MAY BE ADJUSTED IN THE FIELD BY THE CONTRACTING OFFICER.
- THE LOCATION SHOWN ON THE SHEET IS APPROXIMATE AND MAY BE ADJUSTED IN THE FIELD BY THE CONTRACTING OFFICER.
- RACKING LOGS SHALL CONSIST OF TREES WITH BRANCHES HAVING A BASE DIAMETER OF 6-12 INCHES AND A LENGTH OF 20-40 FT. RACKING MATERIAL SHALL OCCUR WITH EACH LAYER TO ENSURE THAT RACKING MATERIAL EXTENDS THROUGH THE STRUCTURE AND IS PINNED BY SUBSEQUENT LAYERS. SLASH MATERIAL SHALL CONSIST OF LIMBS AND BRANCHES AND A BASE DIAMETER BETWEEN 1 AND 3 INCHES. SLASH MATERIAL SHALL BE PLACED AS DIRECTED BY THE CONTRACTING OFFICER. QUANTITY OF RACKING LOGS AND SLASH MATERIAL PER STRUCTURE ARE SHOWN IN LOG SCHEDULE. RACKING AND SLASH MATERIAL SHALL BE DOUGLAS FIR, PONDEROSA PINE, WESTERN RED CEDAR, OR WESTERN LARCH TREES.
- RETENTION LOGS TO BE INSTALLED TO HOLD RACKING MATERIAL IN PLACE AT THE DIRECTION OF THE CONTRACTING OFFICER.
- CONNECT LOGS WITH WRAPPED CHAIN CONNECTION WHERE INDICATED ON THE DRAWINGS. SEE DETAILS.
- AT LOCATIONS WHERE SITE CONDITIONS ALLOW (IN DRY OR LIMITED DEWATERING), SCOUR POOL TO BE EXCAVATED. EXCAVATED ALLUVIUM TO BE PLACED BEHIND THE STRUCTURE AS DIRECTED BY THE CONTRACTING OFFICER. EXTENTS AND LOCATION OF THE SCOUR POOL IS APPROXIMATE AND TO BE ADJUSTED IN THE FIELD BY THE CONTRACTING OFFICER.
- EXISTING WOODY MATERIAL AT THE STRUCTURE CONSTRUCTION SITE SHALL BE MOVED OR PROTECTED FROM CONSTRUCTION ACTIVITIES AND THEN INCORPORATED INTO THE STRUCTURE AS DIRECTED BY THE CONTRACTING OFFICER.

**TYPE 2 APEX ELJ LOG SCHEDULE**

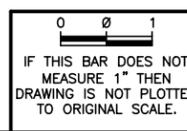
| LOG ID   | DIA* (INCHES) | LENGTH ** (FEET) | ROOTWAD (Y/N) | QUANTITY PER STRUCTURE | NOTES               |
|----------|---------------|------------------|---------------|------------------------|---------------------|
| RD-5     | 18-22         | 50               | Y             | 2                      |                     |
| RE-4     | 14-18         | 40               | Y             | 4                      |                     |
| RE-2     | 14-18         | 20               | Y             | 2                      |                     |
| E-3      | 15-18         | 30               | N             | 6                      |                     |
| PF-4 *** | 16            | 40               | N             | 9                      |                     |
| RACKING  | 6-12          | 20-40            | N             | 100                    | TREES WITH BRANCHES |
| SLASH    | 1-3           | -                | -             | 30 CY                  | LIMBS AND BRANCHES  |

\* MINIMUM DIAMETER AT BREAST HEIGHT (1" PER 10' MAXIMUM TAPER)  
 \*\* TOTAL LENGTH INCLUDING ROOTWAD  
 \*\*\* TURNED PILES - DIA (IN) IS BUTT DIAMETER

**TYPE 2 APEX ELJ PERSPECTIVE**  
NOT TO SCALE



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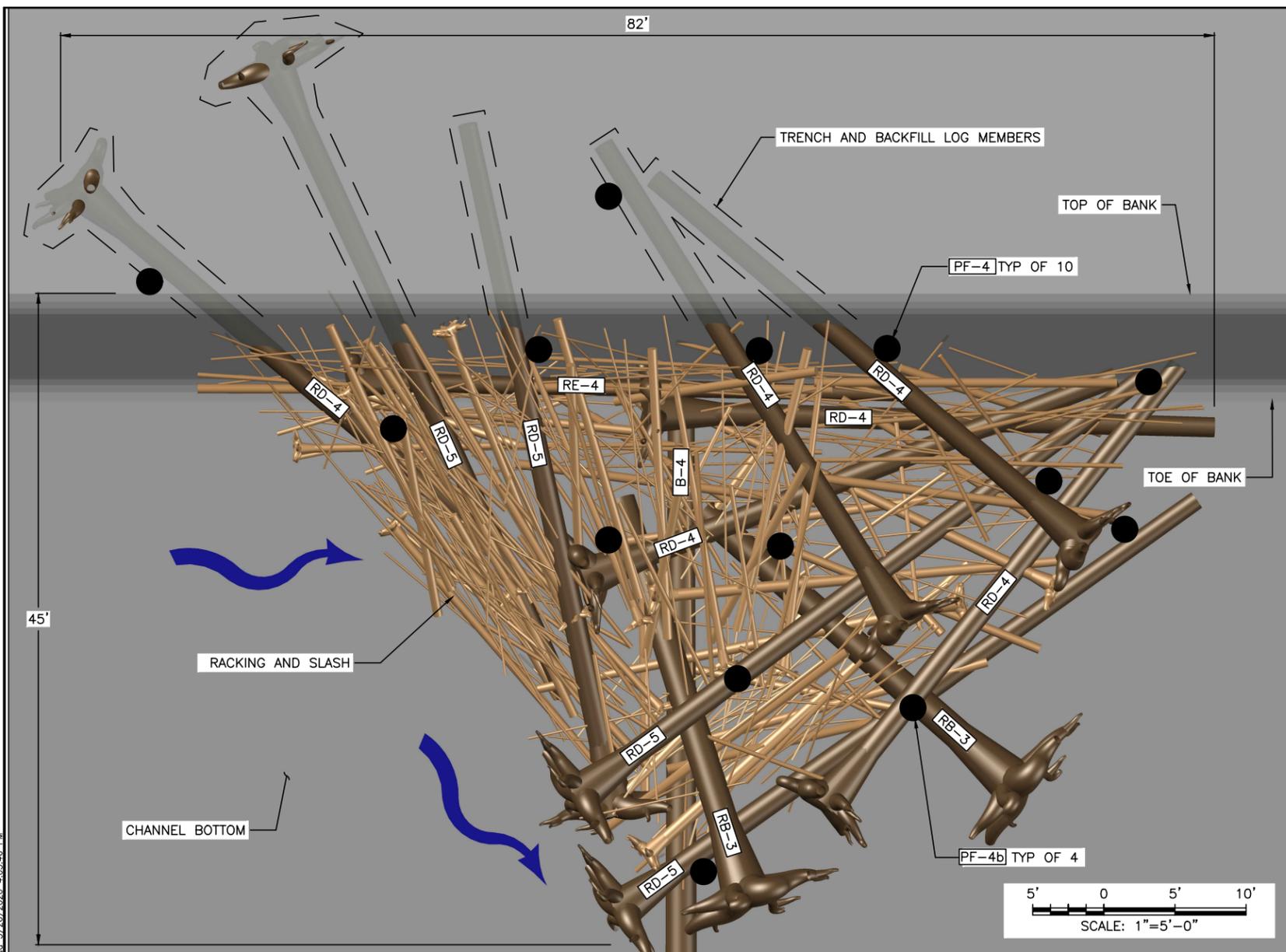


|                           |                         |
|---------------------------|-------------------------|
| NAME OR INITIALS AND DATE | GEOGRAPHIC INFORMATION  |
| DESIGNED RLE, MS          | LATITUDE 46°58'55.71"N  |
| CHECKED RLE               | LONGITUDE 123°28'56.2"W |
| DRAWN MS, GM              | TN/SC/RG T17N/S6/R6W    |
| CHECKED RLE               | DATE 2/14/2019          |

**KEYS ROAD FLOOD PROTECTION**

**TYPE 2 APEX ELJ DETAILS**

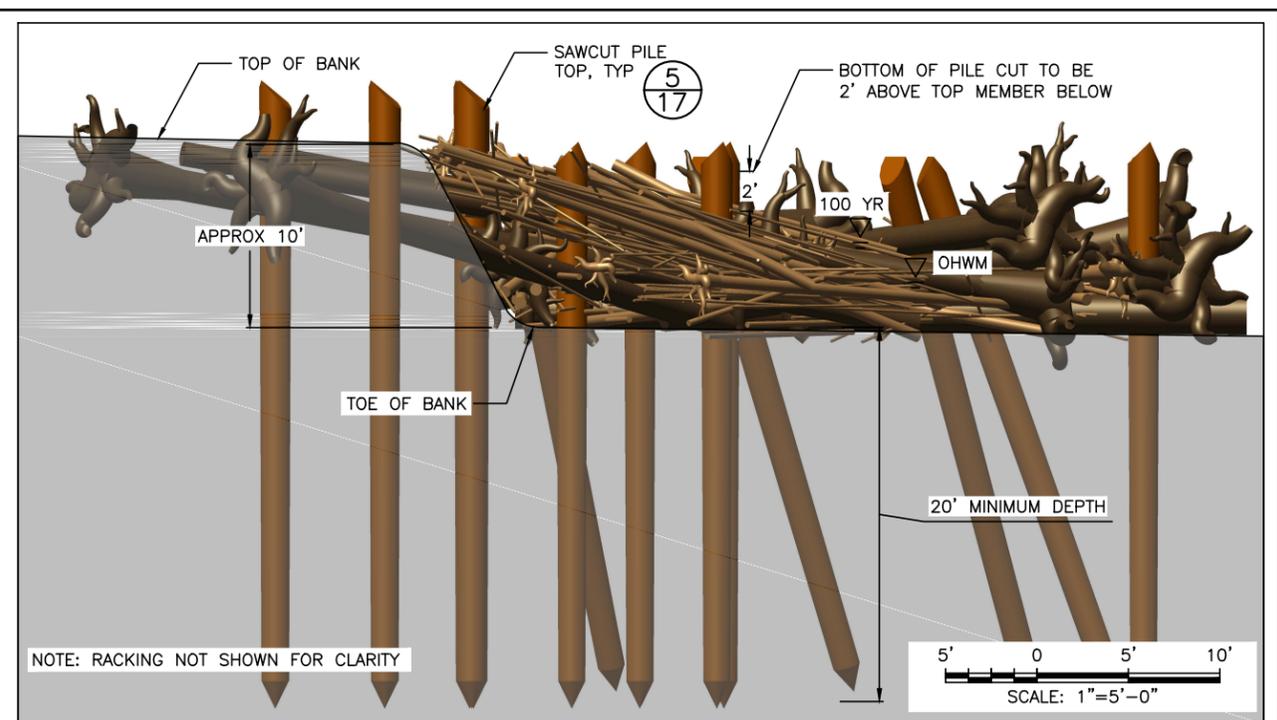
Mar 26, 2020 PHASE I PRELIMINARY DESIGN 60% NOT FOR CONSTRUCTION



**TYPE 1 DEFLECTOR ELJ PLAN**  
SCALE: 1" = 5'

| TYPE 1 DEFLECTOR ELJ LOG SCHEDULE |               |                  |               |                        |  |
|-----------------------------------|---------------|------------------|---------------|------------------------|--|
| LOG ID                            | DIA* (INCHES) | LENGTH ** (FEET) | ROOTWAD (Y/N) | QUANTITY PER STRUCTURE | NOTES  |
| RB-3                              | 22-26         | 30               | Y             | 2                      |  |
| RD-5                              | 18-22         | 50               | Y             | 4                      |  |
| RD-4                              | 18-22         | 40               | Y             | 6                      |  |
| RE-4                              | 14-18         | 40               | Y             | 1                      |  |
| B-4                               | 22-26         | 40               | N             | 1                      |  |
| PF-4 ***                          | 16            | 40               | N             | 10                     |  |
| PF-4b ***                         | 16            | 40               | N             | 4                      | INSTALL PILE AT 15 TO 20 DEGREES FROM VERTICAL |
| RACKING                           | 6-12          | 20-40            | N             | 120                    | TREES WITH BRANCHES                            |
| SLASH                             | 1-3           | -                | -             | 40 CY                  | LIMBS AND BRANCHES                             |

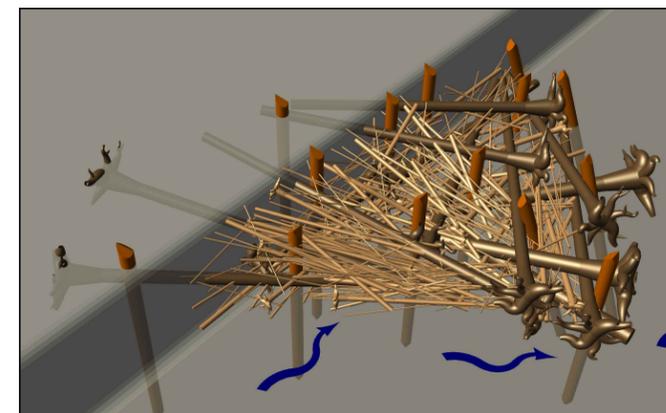
\* MINIMUM DIAMETER AT BREAST HEIGHT (1" PER 10' MAXIMUM TAPER)  
 \*\* TOTAL LENGTH INCLUDING ROOTWAD  
 \*\*\* TURNED PILES - DIA (IN) IS BUTT DIAMETER



**TYPE 1 DEFLECTOR ELJ PROFILE**  
SCALE: 1" = 5'

**NOTES:**

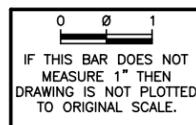
- ALL LOGS SHALL BE DOUGLAS FIR OR WESTERN RED CEDAR.
- ALL PILES SHALL BE ROUND, UNTREATED TIMBER PILES AND SHALL BE DOUGLAS FIR. PILES SHALL BE FREE FROM DEFECTS, CRACKS, AND SPLITTING AT THE TIME OF DRIVING.
- LOGS WITH ROOTWADS SHALL HAVE A DIAMETER AS SHOWN MEASURED AT DBH, DEFINED AS 4.5 FEET ABOVE GROUND WHEN TREE WAS STANDING.
- THE CONTRACTOR SHALL PLACE LOGS AS ILLUSTRATED ON THIS SHEET UNLESS DIRECTED OTHERWISE BY THE CONTRACTING OFFICER.
- SOIL EXCAVATED DURING CONSTRUCTION SHALL BE REPLACED TO ORIGINAL GROUND FOLLOWING PLACEMENT OF ALL LOGS.
- THE LOCATIONS SHOWN ON THE PLANS ARE APPROXIMATE AND MAY BE ADJUSTED IN THE FIELD BY THE CONTRACTING OFFICER.
- RACKING LOGS SHALL CONSIST OF TREES WITH BRANCHES HAVING A BASE DIAMETER OF 6-12 INCHES AND A LENGTH OF 20-40 FT. RACKING MATERIAL SHALL OCCUR WITH EACH LAYER TO ENSURE THAT RACKING MATERIAL EXTENDS THROUGH THE STRUCTURE AND IS PINNED BY SUBSEQUENT LAYERS. SLASH MATERIAL SHALL CONSIST OF LIMBS AND BRANCHES AND A BASE DIAMETER BETWEEN 1 AND 3 INCHES. SLASH MATERIAL SHALL BE PLACED AS DIRECTED BY THE CONTRACTING OFFICER. QUANTITY OF RACKING LOGS AND SLASH MATERIAL PER STRUCTURE ARE SHOWN IN LOG SCHEDULE. RACKING AND SLASH MATERIAL SHALL BE DOUGLAS FIR, PONDEROSA PINE, WESTERN RED CEDAR, OR WESTERN LARCH TREES.
- RETENTION LOGS TO BE INSTALLED TO HOLD RACKING MATERIAL IN PLACE AT THE DIRECTION OF THE CONTRACTING OFFICER.
- PILES TO BE DRIVEN WITH EXCAVATOR MOUNTED VIBRATORY EQUIPMENT. PILES TO BE DRIVEN IN A BATTER (NON-VERTICAL) CONFIGURATION AS DIRECTED BY THE CONTRACTING OFFICER.
- CONNECT LOGS WITH WRAPPED CHAIN CONNECTION WHERE INDICATED ON THE DRAWINGS.
- AT LOCATIONS WHERE SITE CONDITIONS ALLOW (IN DRY OR LIMITED DEWATERING), SCOUR POOL TO BE EXCAVATED. EXCAVATED ALLUVIUM TO BE PLACED BEHIND THE STRUCTURE AS DIRECTED BY THE CONTRACTING OFFICER. EXTENTS AND LOCATION OF THE SCOUR POOL IS APPROXIMATE AND TO BE ADJUSTED IN THE FIELD BY THE CONTRACTING OFFICER.
- EXISTING WOODY MATERIAL AT THE STRUCTURE CONSTRUCTION SITE SHALL BE MOVED OR PROTECTED FROM CONSTRUCTION ACTIVITIES AND THEN INCORPORATED INTO THE STRUCTURE AS DIRECTED BY THE CONTRACTING OFFICER.



**TYPE 1 DEFLECTOR ELJ PERSPECTIVE**  
NOT TO SCALE

N:\PROJECTS\KEYS ROAD DESIGN\CAD\DWGS - CURRENT\TYPE 1 DEFLECTOR - LARGE.DWG, Mfr: 04/17/2020, 4:03:46 PM

Mar 26, 2020 PHASE I PRELIMINARY DESIGN 60% NOT FOR CONSTRUCTION

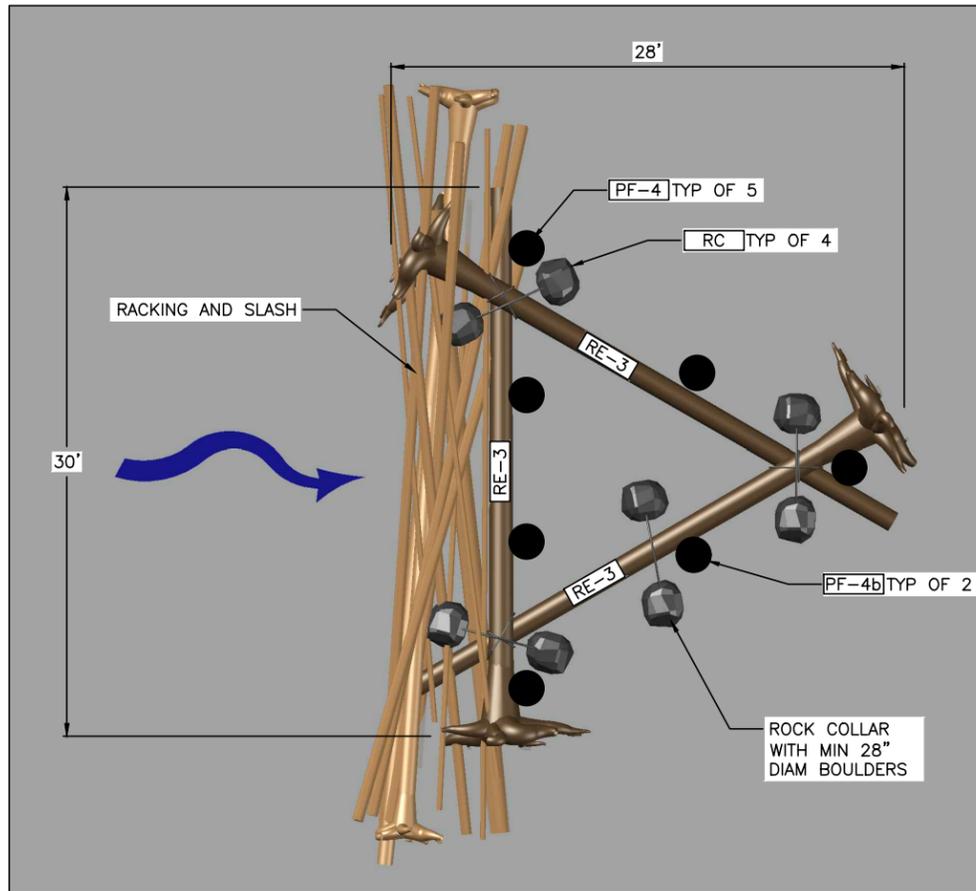


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| CHECKED RLE               | LONGITUDE 123°28'56.2"W |
| DRAWN MS, GM              | TN/SC/RG T17N/S6/R6W    |
| CHECKED RLE               | DATE 2/14/2019          |

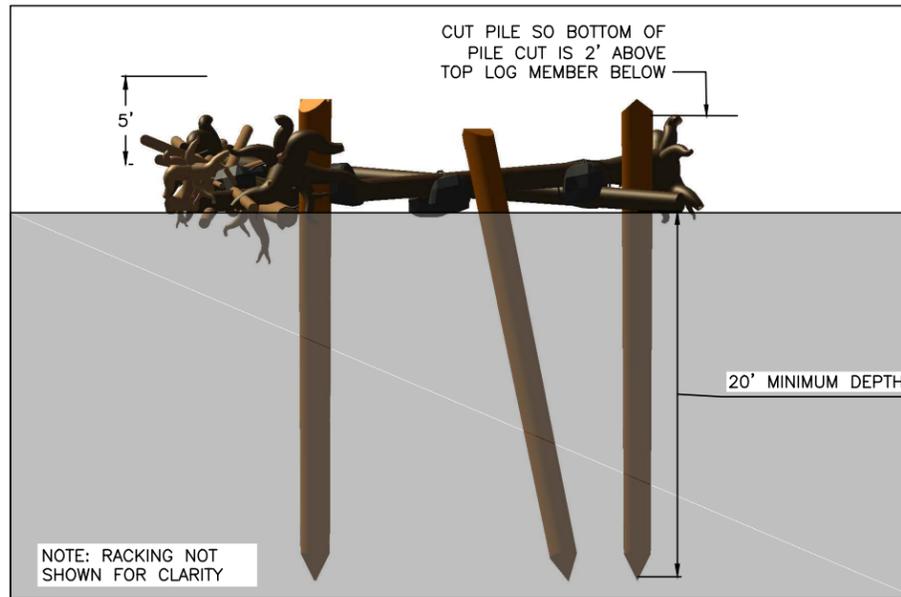
**KEYS ROAD FLOOD PROTECTION**

**TYPE 1 DEFLECTOR ELJ DETAILS**

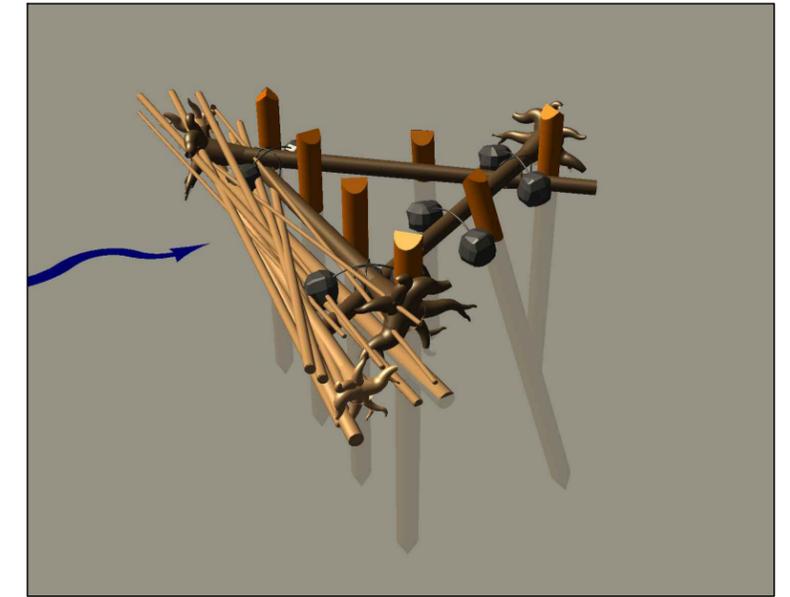
11  
SHEET 11 OF 17



**FLOODPLAIN ROUGHNESS PLAN**  
SCALE: 1" = 5'



**FLOODPLAIN ROUGHNESS ELJ PROFILE**  
SCALE: 1" = 5'



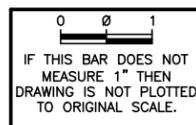
**FLOODPLAIN ROUGHNESS ELJ PERSPECTIVE**  
NOT TO SCALE

**NOTES:**

1. ALL LOGS SHALL BE DOUGLAS FIR OR WESTERN RED CEDAR.
2. ALL PILES SHALL BE ROUND, UNTREATED TIMBER PILES AND SHALL BE DOUGLAS FIR. PILES SHALL BE FREE FROM DEFECTS, CRACKS, AND SPLITTING AT THE TIME OF DRIVING.
3. LOGS WITH ROOTWADS SHALL HAVE A DIAMETER AS SHOWN MEASURED AT DBH, DEFINED AS 4.5 FEET ABOVE GROUND WHEN TREE WAS STANDING.
4. THE CONTRACTOR SHALL PLACE LOGS AS ILLUSTRATED ON THIS SHEET UNLESS DIRECTED OTHERWISE BY THE CONTRACTING OFFICER.
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7. RACKING LOGS SHALL CONSIST OF TREES WITH BRANCHES HAVING A BASE DIAMETER OF 6-12 INCHES AND A LENGTH OF 20-40 FT. RACKING MATERIAL SHALL OCCUR WITH EACH LAYER TO ENSURE THAT RACKING MATERIAL EXTENDS THROUGH THE STRUCTURE AND IS PINNED BY SUBSEQUENT LAYERS. SLASH MATERIAL SHALL CONSIST OF LIMBS AND BRANCHES AND A BASE DIAMETER BETWEEN 1 AND 3 INCHES. SLASH MATERIAL SHALL BE PLACED AS DIRECTED BY THE CONTRACTING OFFICER. QUANTITY OF RACKING LOGS AND SLASH MATERIAL PER STRUCTURE ARE SHOWN IN LOG SCHEDULE. RACKING AND SLASH MATERIAL SHALL BE DOUGLAS FIR, PONDEROSA PINE, WESTERN RED CEDAR, OR WESTERN LARCH TREES.
8. RETENTION LOGS TO BE INSTALLED TO HOLD RACKING MATERIAL IN PLACE AT THE DIRECTION OF THE CONTRACTING OFFICER.
9. PILES TO BE DRIVEN WITH EXCAVATOR MOUNTED VIBRATORY EQUIPMENT. PILES TO BE DRIVEN IN A BATTER (NON-VERTICAL) CONFIGURATION AS DIRECTED BY THE CONTRACTING OFFICER. EXISTING WOODY MATERIAL AT THE STRUCTURE CONSTRUCTION SITE SHALL BE MOVED OR PROTECTED FROM CONSTRUCTION ACTIVITIES AND THEN INCORPORATED INTO THE STRUCTURE AS DIRECTED BY THE CONTRACTING OFFICER.
10. TRIANGLE FRAME UNITS SHALL BE PINNED AT LOG INTERSECTIONS.

| FLOODPLAIN ROUGHNESS ELJ LOG SCHEDULE                          |               |                  |               |                        |                                   |
|--|---------------|------------------|---------------|------------------------|-----------------------------------|
| LOG ID   | DIA* (INCHES) | LENGTH ** (FEET) | ROOTWAD (Y/N) | QUANTITY PER STRUCTURE | NOTES                             |
| RF-3   | 14-18         | 30               | Y             | 3                      |                                   |
| PF-4 ***   | 16            | 40               | N             | 5                      |                                   |
| PF-4b ***  | 16            | 40               | N             | 2                      |                                   |
| RC   | -             | -                | -             | 4                      | ROCK COLLAR WITH 28"DIAM BOULDERS |
| RACKING  | 6-12          | 20-40            | Y/N           | 12                     | TREES WITH BRANCHES               |
| SLASH  | 1-3           | -                | -             | 5 CY                   | LIMBS AND BRANCHES                |
| * MINIMUM DIAMETER AT BREAST HEIGHT (1" PER 10' MAXIMUM TAPER) |               |                  |               |                        |                                   |
| ** TOTAL LENGTH INCLUDING ROOTWAD                              |               |                  |               |                        |                                   |
| *** TURNED PILES - DIA (IN) IS BUTT DIAMETER                   |               |                  |               |                        |                                   |

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|                           |                         |
|---------------------------|-------------------------|
| NAME OR INITIALS AND DATE | GEOGRAPHIC INFORMATION  |
| DESIGNED RLE, MS          | LATITUDE 46°58'55.71"N  |
| CHECKED RLE               | LONGITUDE 123°28'56.2"W |
| DRAWN MS, GM              | TN/SC/RG T17N/S6/R6W    |
| CHECKED RLE               | DATE 2/14/2019          |

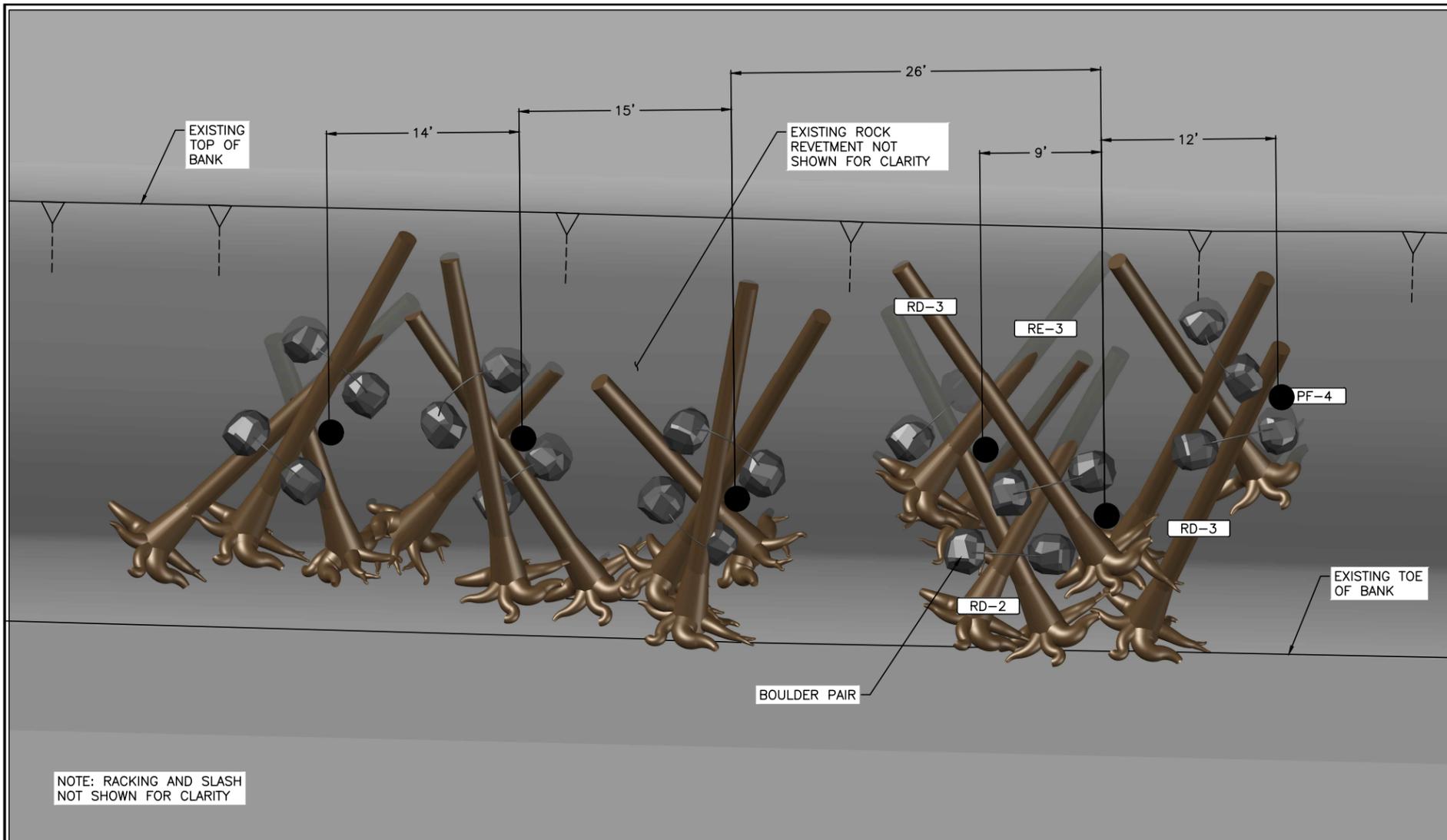
**KEYS ROAD FLOOD PROTECTION**

**FLOODPLAIN ROUGHNESS ELJ DETAILS**

12  
SHEET 12 OF 17

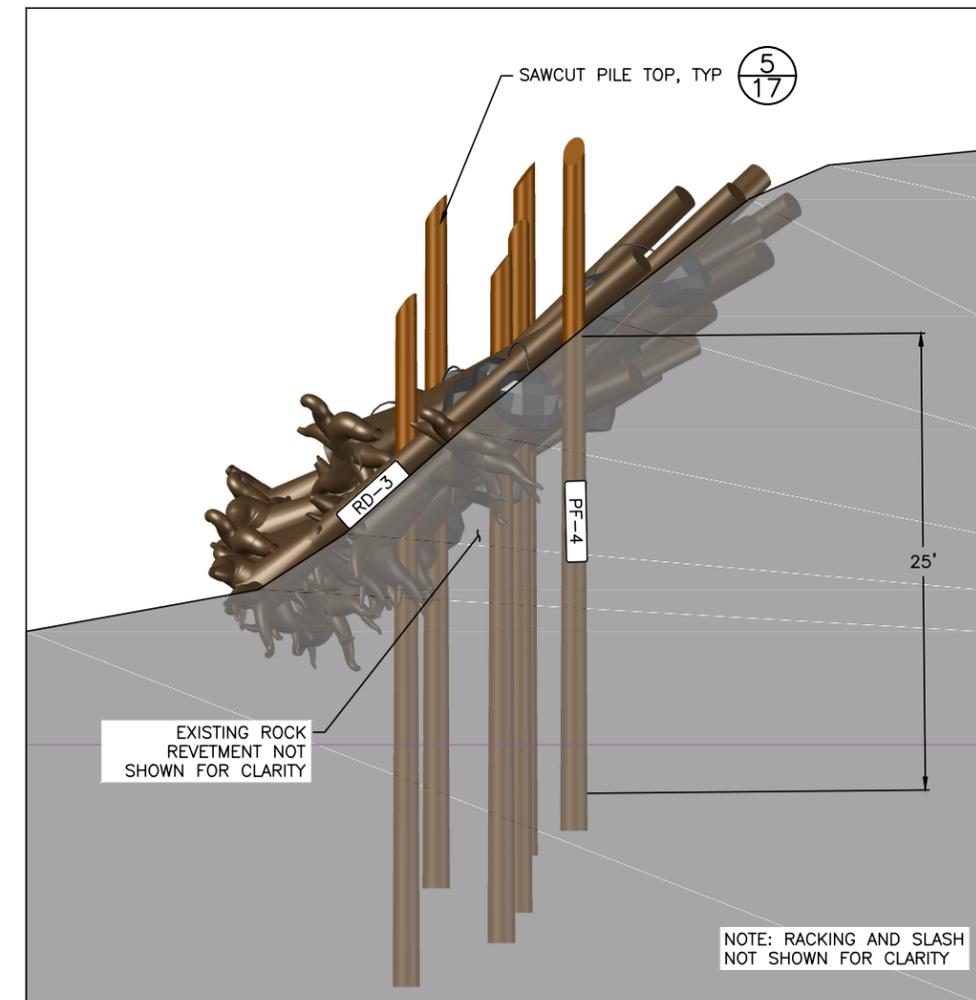
Mar 26, 2020 PHASE I PRELIMINARY DESIGN 60% NOT FOR CONSTRUCTION

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**TIMBER COMPLEX UNIT PLAN**

SCALE: 1"=5'



**TIMBER COMPLEX PERSPECTIVE**

SCALE: 1"=5'

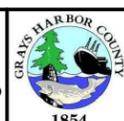
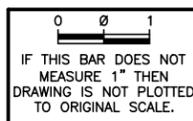
5' 0 5' 10'  
SCALE: 1"=5'-0"

| TIMBER COMPLEX ELJ LOG SCHEDULE |               |                  |               |                        |                                    |
|---------------------------------|---------------|------------------|---------------|------------------------|------------------------------------|
| LOG ID                          | DIA* (INCHES) | LENGTH ** (FEET) | ROOTWAD (Y/N) | QUANTITY PER STRUCTURE | NOTES                              |
| RD-3                            | 18-22         | 40               | Y             | 4                      |                                    |
| RD-2                            | 18-22         | 40               | Y             | 10                     |                                    |
| RE-3                            | 14-18         | 30               | Y             | 3                      |                                    |
| PF-3 ***                        | 16            | 25               | N             | 10                     |                                    |
| RC                              | -             | -                | -             | 11                     | ROCK COLLAR WITH 28" DIAM BOULDERS |
| RACKING                         | 6-12          | 20-40            | N             | 160                    | TREES WITH BRANCHES                |
| SLASH                           | N/A           | N/A              | N             | 150 CY                 | LIMBS AND BRANCHES                 |

\* MINIMUM DIAMETER AT BREAST HEIGHT (1" PER 10' MAXIMUM TAPER)  
 \*\* TOTAL LENGTH INCLUDING ROOTWAD  
 \*\*\* TURNED PILES - DIA (IN) IS BUTT DIAMETER

**NOTES:**

- ALL LOGS SHALL BE DOUGLAS FIR OR WESTERN RED CEDAR.
- ALL PILES SHALL BE ROUND, UNTREATED TIMBER PILES AND SHALL BE DOUGLAS FIR. PILES SHALL BE FREE FROM DEFECTS, CRACKS, AND SPLITTING AT THE TIME OF DRIVING.
- LOGS WITH ROOTWADS SHALL HAVE A DIAMETER AS SHOWN MEASURED AT DBH, DEFINED AS 4.5 FEET ABOVE GROUND WHEN TREE WAS STANDING.
- THE CONTRACTOR SHALL PLACE LOGS AS ILLUSTRATED ON THIS SHEET UNLESS DIRECTED OTHERWISE BY THE CONTRACTING OFFICER.
- SOIL EXCAVATED DURING CONSTRUCTION SHALL BE REPLACED TO ORIGINAL GROUND FOLLOWING PLACEMENT OF ALL LOGS.
- THE LOCATIONS SHOWN ON THE PLANS ARE APPROXIMATE AND MAY BE ADJUSTED IN THE FIELD BY THE CONTRACTING OFFICER.
- RACKING LOGS SHALL CONSIST OF TREES WITH BRANCHES HAVING A BASE DIAMETER OF 6-12 INCHES AND A LENGTH OF 20-40 FT. RACKING MATERIAL SHALL OCCUR WITH EACH LAYER TO ENSURE THAT RACKING MATERIAL EXTENDS THROUGH THE STRUCTURE AND IS PINNED BY SUBSEQUENT LAYERS. SLASH MATERIAL SHALL CONSIST OF LIMBS AND BRANCHES AND A BASE DIAMETER BETWEEN 1 AND 3 INCHES. SLASH MATERIAL SHALL BE PLACED AS DIRECTED BY THE CONTRACTING OFFICER. QUANTITY OF RACKING LOGS AND SLASH MATERIAL PER STRUCTURE ARE SHOWN IN LOG SCHEDULE. RACKING AND SLASH MATERIAL SHALL BE DOUGLAS FIR, PONDEROSA PINE, WESTERN RED CEDAR, OR WESTERN LARCH TREES.
- RETENTION LOGS TO BE INSTALLED TO HOLD RACKING MATERIAL IN PLACE AT THE DIRECTION OF THE CONTRACTING OFFICER.
- PILES TO BE DRIVEN WITH EXCAVATOR MOUNTED VIBRATORY EQUIPMENT.
- TIMBER COMPLEX CONSTRUCTION SITE CURRENTLY HAS ROCK REVETMENT ALONG THE BANK. EXISTING ROCK MATERIAL SHALL BE MOVED SO THAT PILES MAY BE DRIVEN INTO THE BED. ROCK THAT MEETS SIZE SPECIFICATIONS SHOULD BE SALVAGED TO CONSTRUCT ROCK COLLARS.



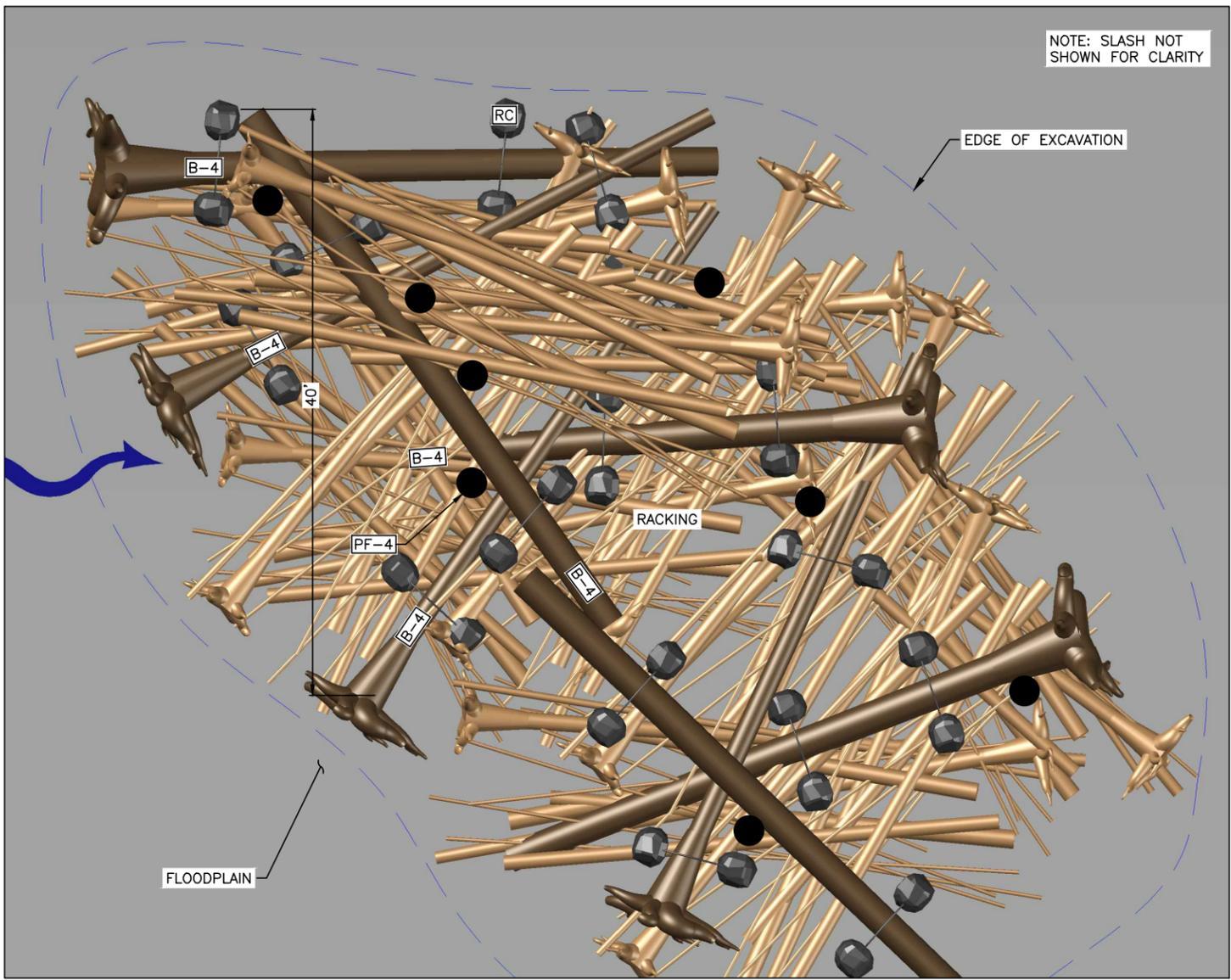
| NAME OR INITIALS AND DATE |         | GEOGRAPHIC INFORMATION |               |
|---------------------------|---------|------------------------|---------------|
| DESIGNED                  | RLE, MS | LATITUDE               | 46°58'55.71"N |
| CHECKED                   | RLE     | LONGITUDE              | 123°28'56.2"W |
| DRAWN                     | MS, GM  | TN/SC/RG               | T17N/S6/R6W   |
| CHECKED                   | RLE     | DATE                   | 2/14/2019     |

**KEYS ROAD FLOOD PROTECTION**

**TIMBER COMPLEX**

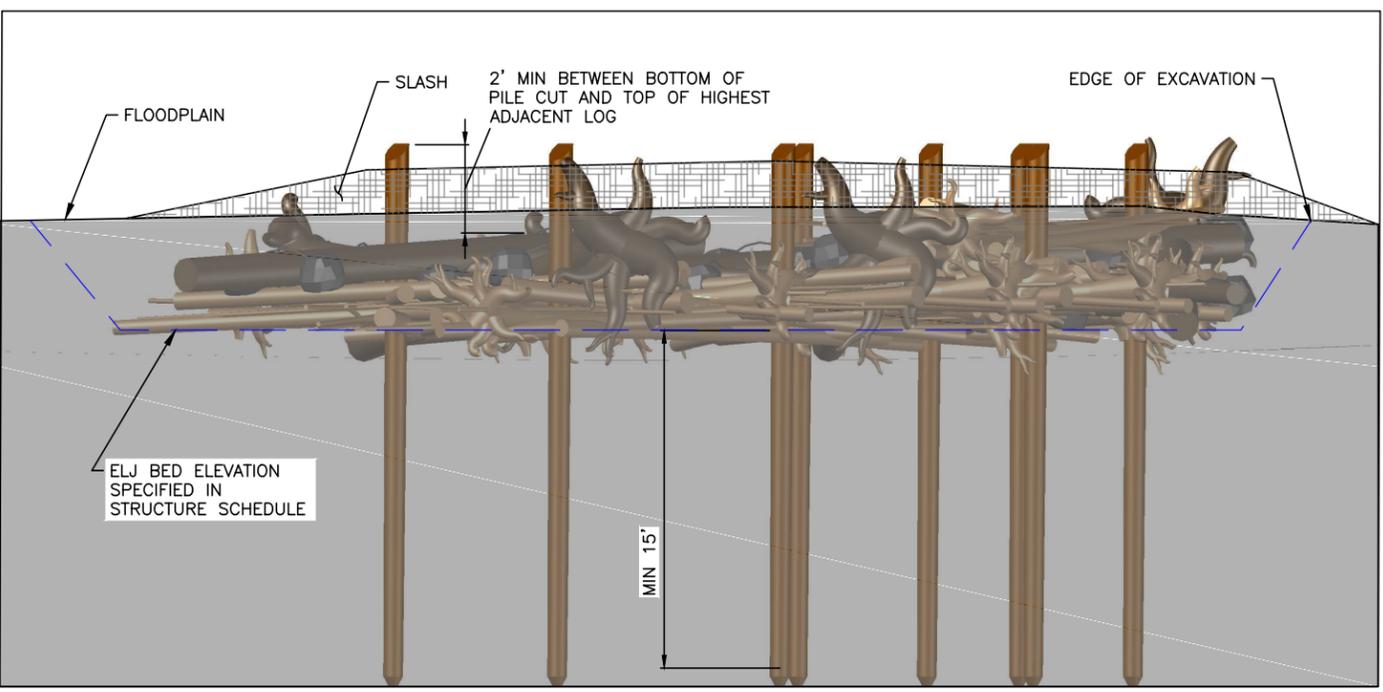
**13**  
SHEET 13 OF 17

Mar 26, 2020 PHASE I PRELIMINARY DESIGN 60% NOT FOR CONSTRUCTION



**TYPE 1 SETBACK REVETMENT PLAN**

SCALE: 1" = 5'

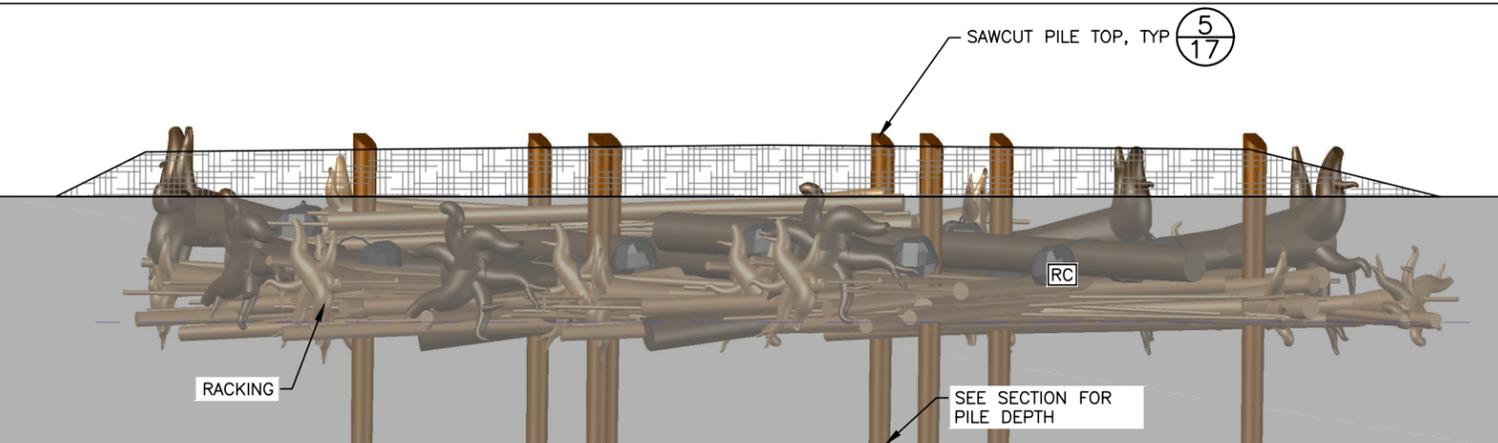


**TYPE 1 SETBACK REVETMENT ELJ SECTION**

SCALE: NTS

**NOTES:**

1. EXCAVATION SPOILS SHALL BE STAGED WITHIN THE WORK AREA AND OUTSIDE FLOWING WATER. SPOILS SHALL BE STOCKPILED TO ALLOW LOG LAYER PLACEMENT AND CONSTRUCTION ACCESS.
2. BACKFILL EXTENTS VARY AND TO BE CONSTRUCTED WITH NATIVE ALLUVIUM FROM EXCAVATION SPOILS.
3. FINAL REVETMENT HEIGHT TO BE ACHIEVED AS SPECIFIED REGARDLESS OF ACTUAL LOG DIAMETERS USED OR STACKING ARRANGEMENT.
4. ALL LARGE WOOD DIMENSIONS DO NOT INCLUDE BARK THICKNESS.
5. COVER TOP OF BACKFILL AREA AND BASE OF STRUCTURES WITH LOOSE WOOD DEBRIS AND CHIPS. MIX 6 INCHES OF LOOSE WOOD INTO UPPER 2 FT ON BACKFILL
6. THE LOCATIONS SHOWN ON THE PLANS ARE APPROXIMATE AND MAY BE ADJUSTED IN THE FIELD BY THE CONTRACTING OFFICER.
6. RACKING AND SLASH PLACEMENT SHALL OCCUR ACCORDING TO LAYERING PLAN. RACKING AND SLASH QUANTITIES ARE SHOWN IN THE LOG SCHEDULE.
7. THE CONTRACTOR SHALL FIELD VERIFY WITH THE ENGINEER ALL PILE LOCATIONS, LENGTHS, WIDTHS AND ELEVATIONS PRIOR TO EXCAVATION, ASSEMBLY AND INSTALLATION OF EACH STRUCTURE.
8. LOCATIONS FOR ALL STRUCTURE PLACEMENTS WILL BE STAKED IN FIELD BY THE ENGINEER PRIOR TO START OF CONSTRUCTION AT EACH SITE.
9. EXCAVATION LIMITS SHALL BE FIELD VERIFIED BY THE ENGINEER PRIOR TO EXCAVATION COMMENCING AND PLACEMENT OF ANY LARGE WOOD.
10. WOOD PLACEMENT IN EACH REVETMENT LAYER SHALL BE FIELD VERIFIED BY ENGINEER PRIOR TO BACKFILLING.



**TYPE 1 SETBACK REVETMENT ELJ SIDE PROFILE**

SCALE: 1" = 5'

| TYPE 1 SETBACK REVETMENT ELJ LOG SCHEDULE |               |                  |               |                        |                                    |
|---|---------------|------------------|---------------|------------------------|------------------------------------|
| LOG ID                                    | DIA* (INCHES) | LENGTH ** (FEET) | ROOTWAD (Y/N) | QUANTITY PER STRUCTURE | NOTES                              |
| B-3                                       | 22-26         | 30               | N             | 5                      |                                    |
| PC-4 ***                                  | 16            | 40               | N             | 8                      |                                    |
| RC  | -             | -                | -             | 16                     | ROCK COLLAR WITH 36" DIAM BOULDERS |
| RACKING                                   | 6-12          | 20-40            | N             | 160                    | TREES WITH BRANCHES                |
| SLASH                                     | N/A           | N/A              | N             | 150 CY                 | LIMBS AND BRANCHES                 |

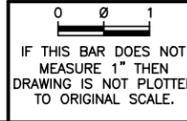
\* MINIMUM DIAMETER AT BREAST HEIGHT (1" PER 10' MAXIMUM TAPER)  
 \*\* TOTAL LENGTH INCLUDING ROOTWAD  
 \*\*\* TURNED PILES - DIA (IN) IS BUTT DIAMETER

**TYPE 1 SETBACK REVETMENT DETAILS**

SCALE: AS NOTED

1/14

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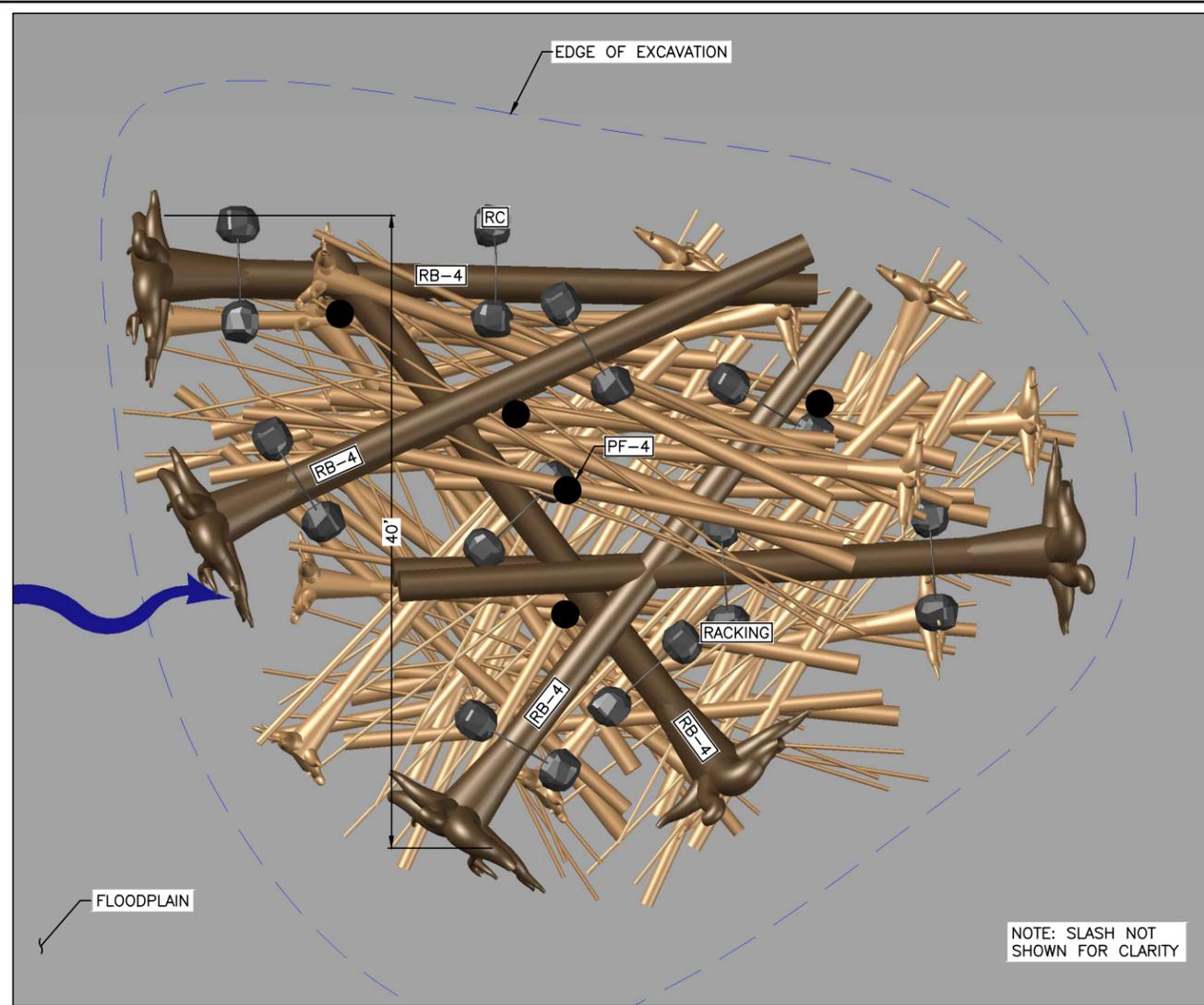
|                           |                         |
|---------------------------|-------------------------|
| NAME OR INITIALS AND DATE | GEOGRAPHIC INFORMATION  |
| DESIGNED RLE, MS          | LATITUDE 46°58'55.71"N  |
| CHECKED RLE               | LONGITUDE 123°28'56.2"W |
| DRAWN MS, GM              | TN/SC/RG T17N/S6/R6W    |
| CHECKED RLE               | DATE 2/14/2019          |

**KEYS ROAD FLOOD PROTECTION**

**TYPE 1 SETBACK REVETMENT**

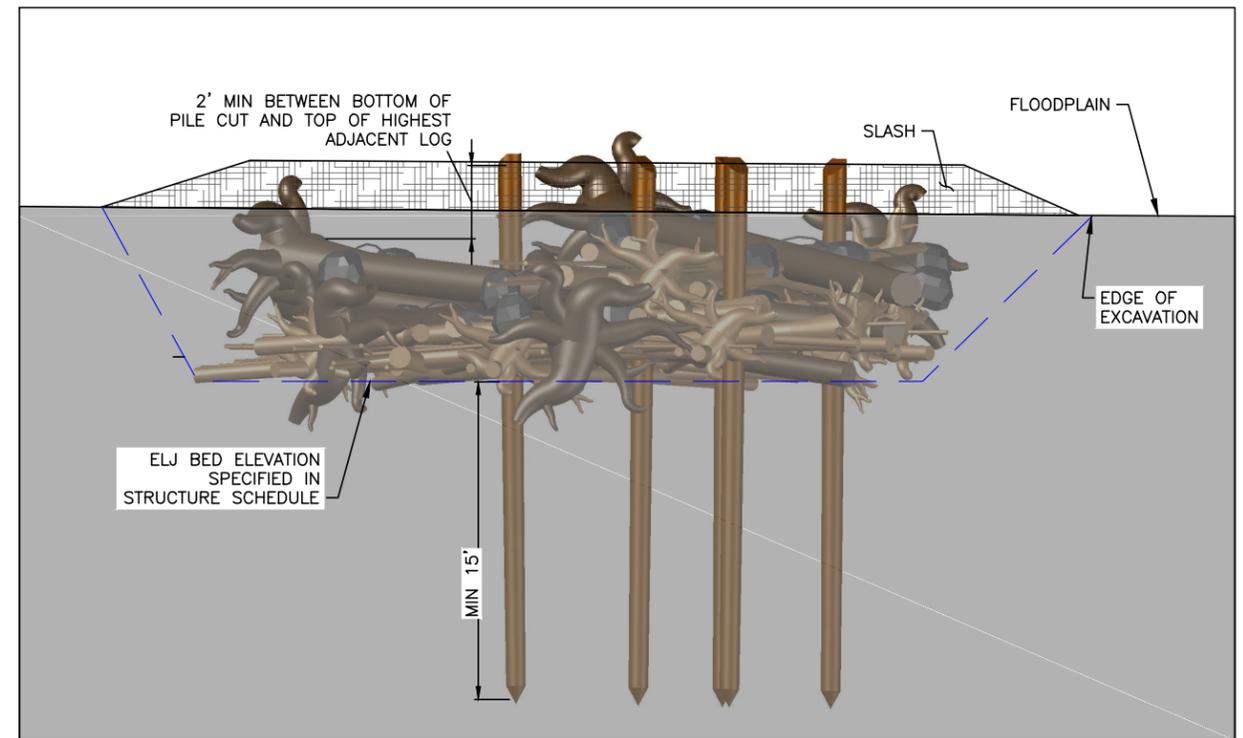
14  
SHEET 14 OF 17

Mar 26, 2020 PHASE I PRELIMINARY DESIGN 60% NOT FOR CONSTRUCTION



**TYPE 2 SETBACK REVETMENT PLAN**

SCALE: 1" = 5'

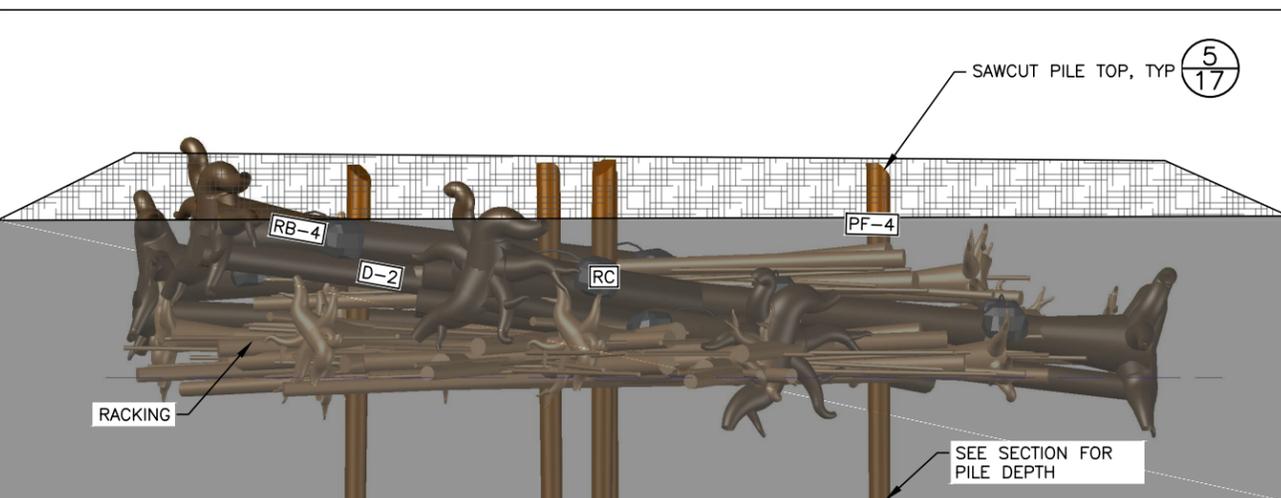


**TYPE 2 SETBACK REVETMENT ELJ SECTION**

SCALE: NTS

**NOTES:**

- EXCAVATION SPOILS SHALL BE STAGED WITHIN THE WORK AREA AND OUTSIDE FLOWING WATER. SPOILS SHALL BE STOCKPILED TO ALLOW LOG LAYER PLACEMENT AND CONSTRUCTION ACCESS.
- BACKFILL EXTENTS VARY AND TO BE CONSTRUCTED WITH NATIVE ALLUVIUM FROM EXCAVATION SPOILS.
- FINAL REVETMENT HEIGHT TO BE ACHIEVED AS SPECIFIED REGARDLESS OF ACTUAL LOG DIAMETERS USED OR STACKING ARRANGEMENT.
- ALL LARGE WOOD DIMENSIONS DO NOT INCLUDE BARK THICKNESS.
- COVER TOP OF BACKFILL AREA AND BASE OF STRUCTURES WITH LOOSE WOOD DEBRIS AND CHIPS. MIX 6 INCHES OF LOOSE WOOD INTO UPPER 2 FT ON BACKFILL.
- THE LOCATIONS SHOWN ON THE PLANS ARE APPROXIMATE AND MAY BE ADJUSTED IN THE FIELD BY THE CONTRACTING OFFICER.
- RACKING AND SLASH PLACEMENT SHALL OCCUR ACCORDING TO LAYERING PLAN. RACKING AND SLASH QUANTITIES ARE SHOWN IN THE LOG SCHEDULE.
- THE CONTRACTOR SHALL FIELD VERIFY WITH THE ENGINEER ALL PILE LOCATIONS, LENGTHS, WIDTHS AND ELEVATIONS PRIOR TO EXCAVATION, ASSEMBLY AND INSTALLATION OF EACH STRUCTURE.
- LOCATIONS FOR ALL STRUCTURE PLACEMENTS WILL BE STAKED IN FIELD BY THE ENGINEER PRIOR TO START OF CONSTRUCTION AT EACH SITE.
- EXCAVATION LIMITS SHALL BE FIELD VERIFIED BY THE ENGINEER PRIOR TO EXCAVATION COMMENCING AND PLACEMENT OF ANY LARGE WOOD.
- WOOD PLACEMENT IN EACH REVETMENT LAYER SHALL BE FIELD VERIFIED BY ENGINEER PRIOR TO BACKFILLING.



**TYPE 2 SETBACK REVETMENT ELJ SIDE PROFILE**

SCALE: 1" = 5'

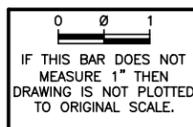
| TYPE 2 SETBACK REVETMENT ELJ LOG SCHEDULE                      |               |                  |               |                        |                                    |
|--|---------------|------------------|---------------|------------------------|------------------------------------|
| LOG ID   | DIA* (INCHES) | LENGTH ** (FEET) | ROOTWAD (Y/N) | QUANTITY PER STRUCTURE | NOTES                              |
| B-3  | 22-26         | 30               | N             | 5                      |                                    |
| PF-4   | 16            | 40               | N             | 5                      |                                    |
| RC   | -             | -                | -             | 10                     | ROCK COLLAR WITH 36" DIAM BOULDERS |
| RACKING  | 6-12          | 20-40            | N             | 100                    | TREES WITH BRANCHES                |
| SLASH  | N/A           | N/A              | N             | 100 CY                 | LIMBS AND BRANCHES                 |
| * MINIMUM DIAMETER AT BREAST HEIGHT (1" PER 10' MAXIMUM TAPER) |               |                  |               |                        |                                    |
| ** TOTAL LENGTH INCLUDING ROOTWAD                              |               |                  |               |                        |                                    |
| *** TURNED PILES - DIA (IN) IS BUTT DIAMETER                   |               |                  |               |                        |                                    |

**TYPE 2 SETBACK REVETMENT DETAILS**

SCALE: AS NOTED

1/15

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|                           |                         |
|---------------------------|-------------------------|
| NAME OR INITIALS AND DATE | GEOGRAPHIC INFORMATION  |
| DESIGNED RLE, MS          | LATITUDE 46°58'55.71"N  |
| CHECKED RLE               | LONGITUDE 123°28'56.2"W |
| DRAWN MS, GM              | TN/SC/RG T17N/S6/R6W    |
| CHECKED RLE               | DATE 2/14/2019          |

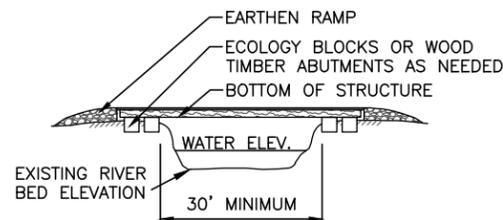
**KEYS ROAD FLOOD PROTECTION**

**TYPE 2 SETBACK REVETMENT**

15  
SHEET 15 OF 17

Mar 26, 2020 PHASE I PRELIMINARY DESIGN 60% NOT FOR CONSTRUCTION

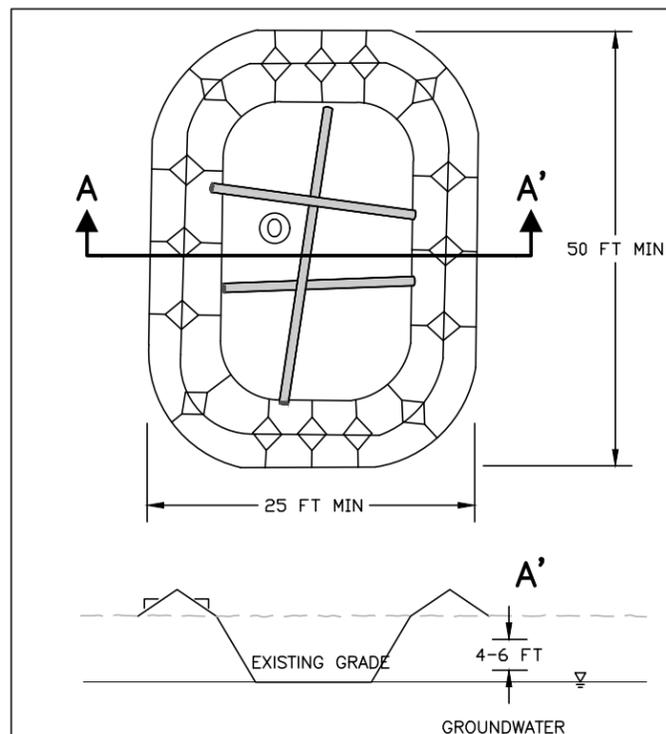




**NOTES:**

1. CONTRACTOR TO DESIGN TEMPORARY BRIDGE.
2. BRIDGE SHALL BE LOCATED SUCH THAT ONLY ONE SPAN IS USED TO ELIMINATE IMPACTS TO SUBSTRATE OF CHANNEL.
3. END OF BRIDGE SHALL BEAR ON HIGH BANKS WITH SUFFICIENT BEARING CAPACITY TO PREVENT SLOUGHING OR COLLAPSE OF SIDE CHANNEL BANKS.
4. CONCRETE ECOLOGY BLOCKS OR WOOD ABUTMENTS MAY BE USED TO SUPPORT ENDS OF TEMPORARY BRIDGE AS NEEDED.
5. BRIDGES MAY BE CONSTRUCTED FROM LOGS, RAIL CAR BEDS OR APPROVED EQUAL AND DECKED WITH STEEL SHEET, WOOD LAGGING OR APPROVED EQUAL.

**TEMPORARY BRIDGE DETAILS** (1/17)  
NOT TO SCALE

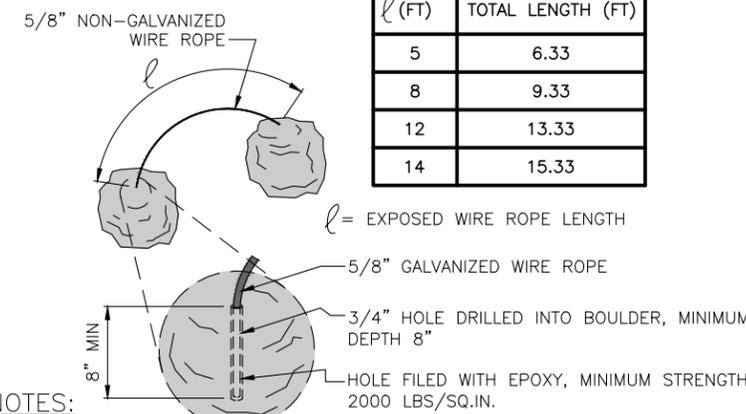


**NOTES:**

1. CONTAINMENT POND LOCATION TO BE DETERMINED BY CONTRACTOR.
2. POND WALLS WILL BE CONSTRUCTED FROM ONSITE NATIVE MATERIAL.
3. POND WILL BE ISOLATED FROM FLOWING WATERS.
4. CONTRACTOR SHALL MAINTAIN POND TO REDUCE RISK OF POND FAILURE.
5. FOLLOWING USE, MATERIALS SHALL BE RETURNED TO GRAVEL BAR AND SPREAD EVENLY.
6. PUMP OUTLET SECURED TO CROSS LOGS.



**PUMP OUTLET CONTAINMENT POND DETAILS** (2/17)  
SCALE: NTS

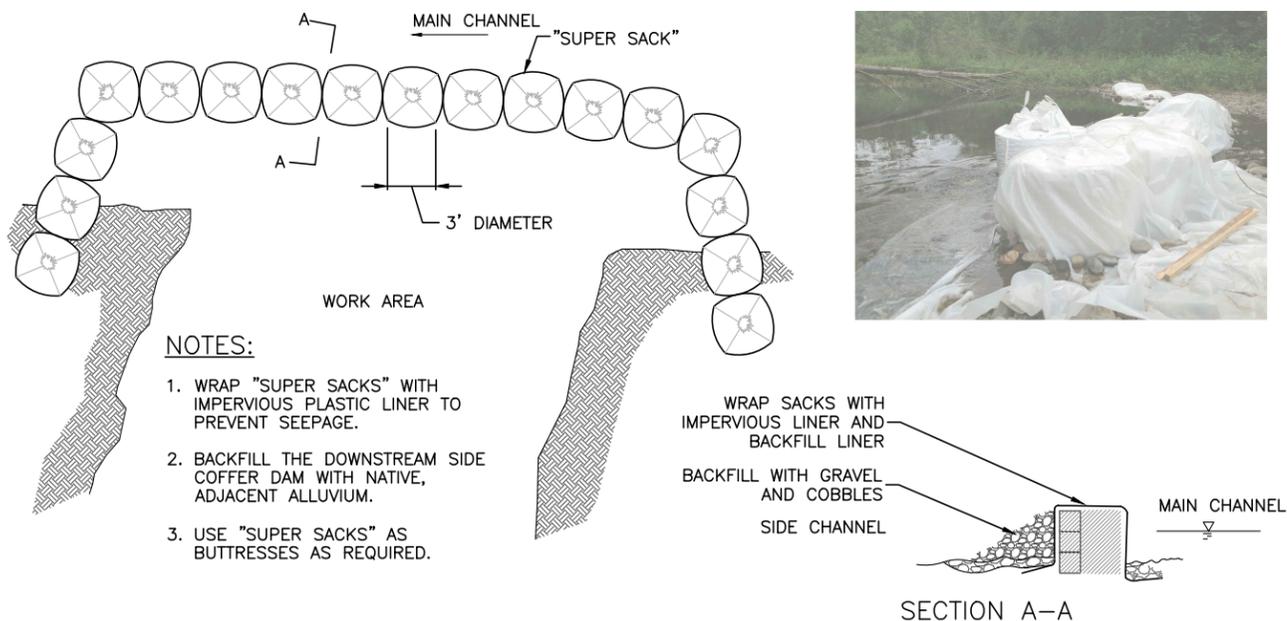


| ℓ (FT) | TOTAL LENGTH (FT) |
|--------|-------------------|
| 5      | 6.33              |
| 8      | 9.33              |
| 12     | 13.33             |
| 14     | 15.33             |

**NOTES:**

1. SEE ELJ STRUCTURE DETAIL FOR MINIMUM AVERAGE BOULDER DIAMETER TO BE USED PER STRUCTURE TYPE.
2. FOLLOWING EPOXY CURE, EACH ROCK COLLAR SHALL BE TESTED TO ENSURE PROPER BONDING.
3. THE DRILL HOLES MUST BE THOROUGHLY CLEANED OF ALL ROCK POWDER AND DRIED. THE RESIN WILL NOT PROPERLY ADHERE TO THE ROCK IF THE HOLE IS INADEQUATELY CLEANED OR IS WET. CLEANING IS DONE BY POURING WATER INTO THE HOLE WHILE PLUNGING IT WITH A CIRCULAR NYLON BRUSH. THE HOLE IS CLEAN WHEN THE WATER PLUNGES OUT CLEAR AND FREE OF SEDIMENT. ALLOWING 24 HOURS FOR DRILL HOLES TO DRY AFTER CLEANING IS USUALLY SUFFICIENT.
4. THE CABLE MUST BE CUT CLEANLY SO THAT THE END CAN BE INSERTED INTO THE TIGHT FITTING ROCK HOLE.
5. THE CABLE SURFACE TO BE BONDED SHOULD BE FREE OF DIRT AND GREASE. HOT DIP GALVANIZED CABLE IS RECOMMENDED.
6. THE HOLE MUST BE SUFFICIENTLY FILLED WITH RESIN SO THAT WHEN THE CABLE IS INSERTED, A SMALL AMOUNT OF RESIN WILL BE DISPLACED OUT OF THE TOP OF THE HOLE. ONCE THE CABLE IS INSERTED IN THE HOLE, IT SHOULD NOT BE DISTURBED UNTIL THE RESIN HAS CURED.
7. FOLLOW RESIN MANUFACTURING RECOMMENDATIONS FOR USE.

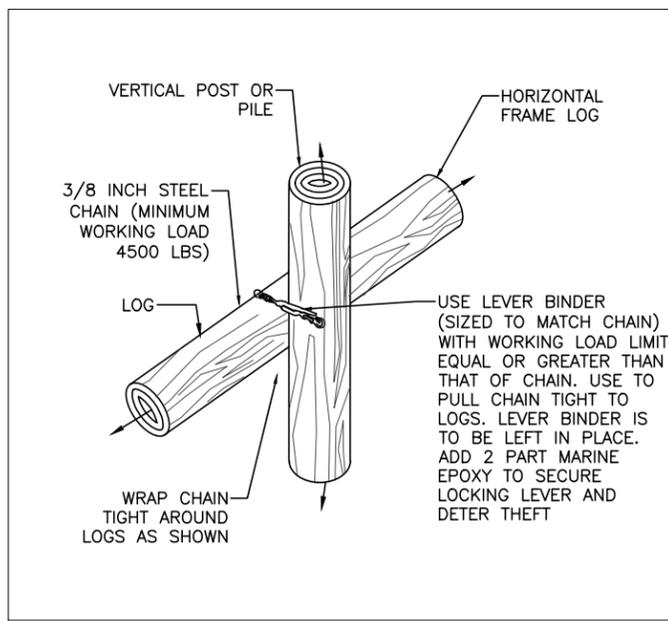
**ROCK COLLAR DETAIL** (6/17)  
NOT TO SCALE



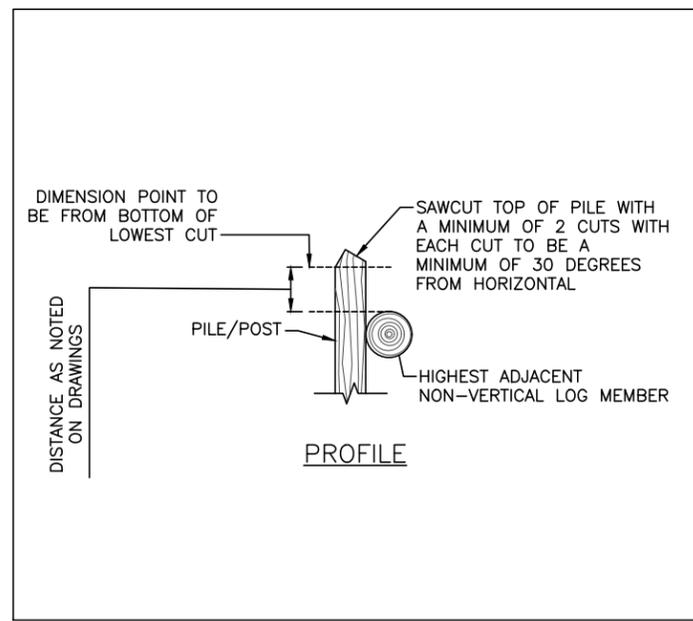
**NOTES:**

1. WRAP "SUPER SACKS" WITH IMPERVIOUS PLASTIC LINER TO PREVENT SEEPAGE.
2. BACKFILL THE DOWNSTREAM SIDE COFFER DAM WITH NATIVE, ADJACENT ALLUVIUM.
3. USE "SUPER SACKS" AS BUTTRESSES AS REQUIRED.

**COFFERDAM DETAILS** (3/17)  
NOT TO SCALE

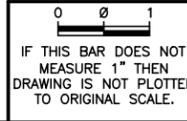


**CHAIN LASHING DETAIL** (4/17)  
NOT TO SCALE



**SAWCUT POST TOP DETAIL** (5/17)  
NOT TO SCALE

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|                           |                         |
|---------------------------|-------------------------|
| NAME OR INITIALS AND DATE | GEOGRAPHIC INFORMATION  |
| DESIGNED RLE, MS          | LATITUDE 46°58'55.71"N  |
| CHECKED RLE               | LONGITUDE 123°28'56.2"W |
| DRAWN MS, GM              | TN/SC/RG T17N/S6/R6W    |
| CHECKED RLE               | DATE 2/14/2019          |

**KEYS ROAD FLOOD PROTECTION**

**CONSTRUCTION DETAILS**

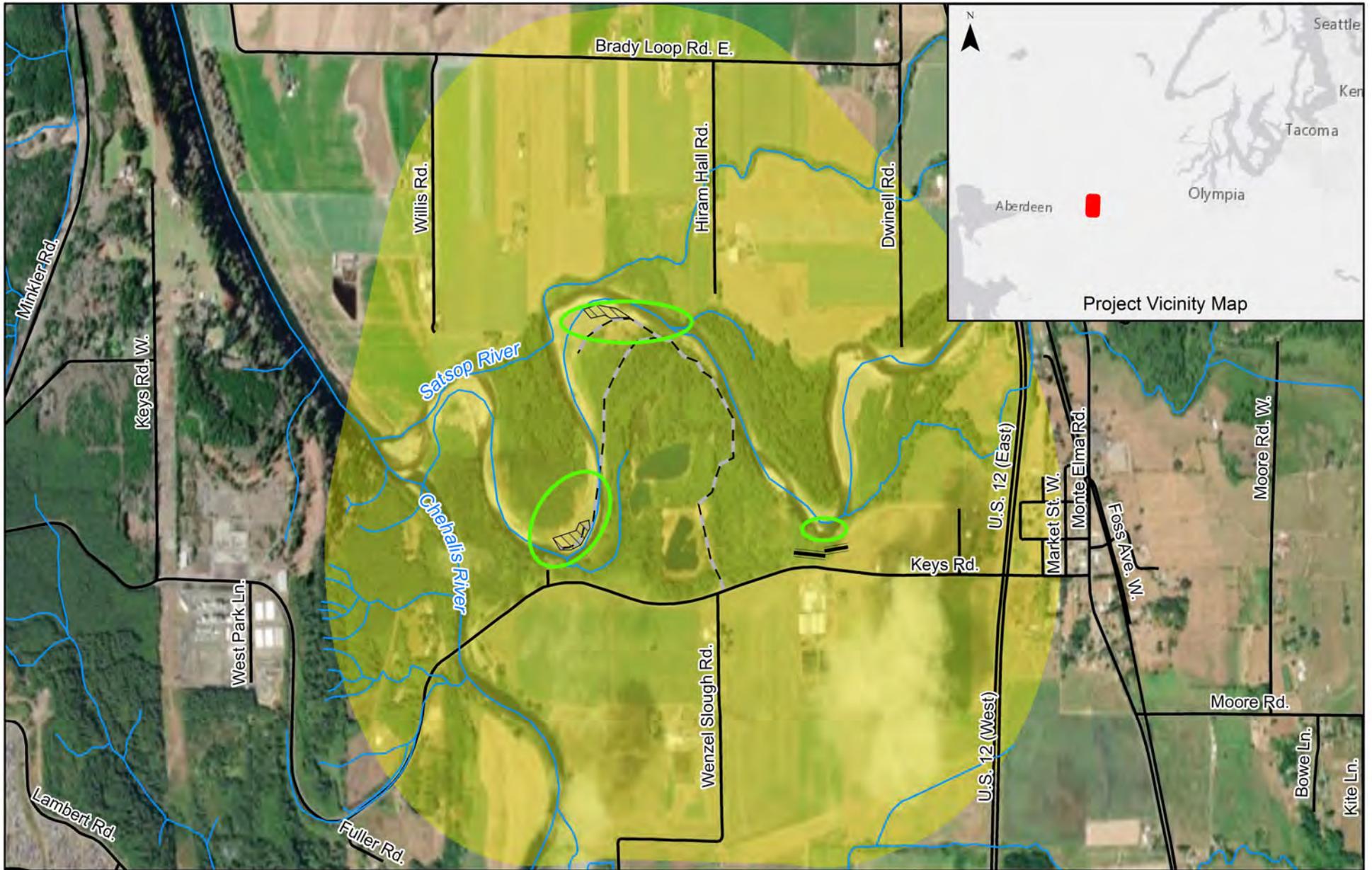
Mar 26, 2020 PHASE I PRELIMINARY DESIGN 60% NOT FOR CONSTRUCTION

## Attachment C

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Figure 1. Project Action Area





**CONFLUENCE**  
ENVIRONMENTAL COMPANY

0 550 1,100 2,200 Feet

0 120 240 480 Meters

North arrow pointing up.

|              |                             |
|--------------|-----------------------------|
| River/Stream | Material Staging Area       |
| Road         | Access Road                 |
|              | Setback Revetment           |
|              | Action Area                 |
|              | Engineered Log Jam Location |

**Figure 1. Project Action Area**



## Attachment D

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Species List from USFWS





## 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:

February 07, 2020

Consultation Code: 01EWF00-2020-SLI-0560

Event Code: 01EWF00-2020-E-01149

Project Name: Keys Road Bank Stabilization Project

Subject: List of threatened and endangered species that may occur in your proposed project location, and/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](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](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](http://www.nwr.noaa.gov/protected_species/species_list/species_lists.html)

Attachment(s):

- Official Species List
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## 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

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## Project Summary

Consultation Code: 01EWF00-2020-SLI-0560

Event Code: 01EWF00-2020-E-01149

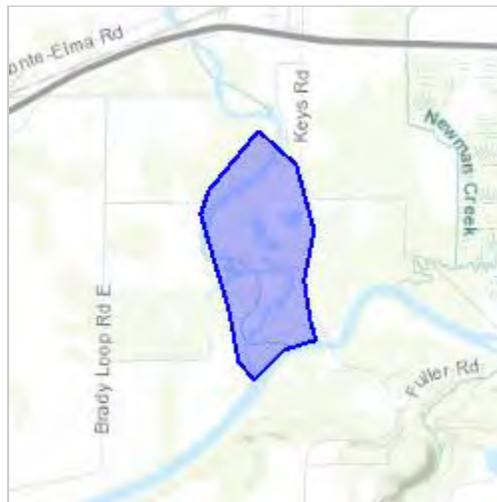
Project Name: Keys Road Bank Stabilization Project

Project Type: STREAM / WATERBODY / CANALS / LEVEES / DIKES

Project Description: Installation of several Engineered Log Jams and wood debris revetments in the lower 1.5 miles of the Satsop River to reduce bank erosion and loss of private property in a way to provides improved habitat conditions for fish.

Project Location:

Approximate location of the project can be viewed in Google Maps: <https://www.google.com/maps/place/46.984561377080624N123.48582619560646W>



Counties: Grays Harbor, WA

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## Endangered Species Act Species

There is a total of 5 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<sup>1</sup>, 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.

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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.

### Mammals

| NAME  | STATUS                 |
|---|------------------------|
| Fisher <i>Pekania pennanti</i><br>Population: West coast DPS<br>No critical habitat has been designated for this species.<br>Species profile: <a href="https://ecos.fws.gov/ecp/species/3651">https://ecos.fws.gov/ecp/species/3651</a> | Proposed<br>Threatened |

### Birds

| NAME   | STATUS     |
|--|------------|
| Marbled Murrelet <i>Brachyramphus marmoratus</i><br>Population: U.S.A. (CA, OR, WA)<br>There is <b>final</b> critical habitat for this species. Your location is outside the critical habitat.<br>Species profile: <a href="https://ecos.fws.gov/ecp/species/4467">https://ecos.fws.gov/ecp/species/4467</a> | Threatened |
| Streaked Horned Lark <i>Eremophila alpestris strigata</i><br>There is <b>final</b> critical habitat for this species. Your location is outside the critical habitat.<br>Species profile: <a href="https://ecos.fws.gov/ecp/species/7268">https://ecos.fws.gov/ecp/species/7268</a>                           | Threatened |
| Yellow-billed Cuckoo <i>Coccyzus americanus</i><br>Population: Western U.S. DPS<br>There is <b>proposed</b> critical habitat for this species. Your location is outside the critical habitat.<br>Species profile: <a href="https://ecos.fws.gov/ecp/species/3911">https://ecos.fws.gov/ecp/species/3911</a>  | Threatened |

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## Fishes

| NAME  | STATUS            |
|---|-------------------|
| <b>Bull Trout <i>Salvelinus confluentus</i></b><br>Population: U.S.A., conterminous, lower 48 states<br>There is <b>final</b> critical habitat for this species. Your location overlaps the critical habitat.<br>Species profile: <a href="https://ecos.fws.gov/ecp/species/8212">https://ecos.fws.gov/ecp/species/8212</a> | <b>Threatened</b> |

## Critical habitats

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

| NAME   | STATUS       |
|--|--------------|
| <b>Bull Trout <i>Salvelinus confluentus</i></b><br><a href="https://ecos.fws.gov/ecp/species/8212#crithab">https://ecos.fws.gov/ecp/species/8212#crithab</a> | <b>Final</b> |

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