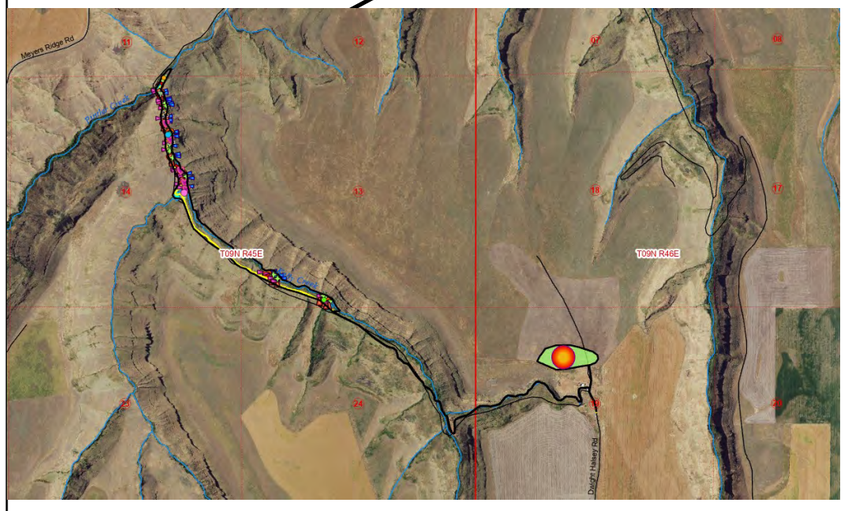
In water work window

July 15th to September 30th



LOCATION MAP

NOT TO SCALE

This project was designed to comply with Bonneville Program Administration's Habitat Improvement Program (HIP) Programmatic Biological Opinion for Compliance with Section 7 of the Endangered Species Act. Activity Category: 2D, 2E

KELLY CREEK PROJECT AREA 45

FISH HABITAT RESTORATION

80% DESIGN LEVEL

Friday, December 15th, 2023

SHEET INDEX

GENERAL NOTES

1. The Contractor will comply with the Terms & Conditions from Bonneville Power Administration's HIP IV Biological Opinion that requires the utmost care is taken when construction activity is taking place in or near the waterway.
2. The contractor is responsible for procuring and complying with all permits and easements including all federal, state, county, and local permits.
3. Excavation, trenching, shoring, and shielding shall be the responsibility of the contractor performing the work, these drawings are not intended to provide means or methods of construction.
4. All existing conditions are to be verified in the field prior to construction and any adjustments to the drawings shall be made as directed by ACCD staff.
5. Excavation shall meet the requirements of OSHA 29 CFR Part 1926, Subpart P, Excavations. Actual slopes shall not exceed the slopes as indicated on drawings.
6. Protect all trees and land areas marked for protection. Exercise care in areas not so marked to avoid unnecessary damage to natural vegetation.
7. Existing private improvements, which lie within the construction limits, unless otherwise noted will be removed by the owner thereof or abandoned in place.
8. The ACCD makes no representations as to the existence or non-existence of utilities. It is the responsibility of land owners or operators to comply with the Washington state provisions. Land owners or operators and contractors will be liable for any damage resulting from disruption of service caused by construction activities.
9. These drawings and the associated written specifications represent the construction documents. Any deviations from these drawings and associated specifications without written approval from ACCD may result in this project not meeting specifications and may affect the terms and conditions of the construction contract.
10. All construction activities are to be performed and completed within the permit specified in-water work window.
11. All excess materials and excavation to be placed at location identified by the project sponsor with coordination with the contractor.

12/15/2023
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Asotin County CONSERVATION DISTRICT

Kelly Creek Project Area 45

Asotin County, WA

Asotin County Conservation District

COVER SHEET

GENERAL NOTES TO CONTRACTOR

1.THE CONSTRUCTION SPECIFICATIONS AND MATERIAL SPECIFICATIONS DESCRIBE MINIMUM ACCEPTABLE QUALITY OF WORK AND MATERIALS FOR THE PROJECT. IF A CONFLICT ARISES BETWEEN THE DRAWINGS AND SPECIFICATIONS, THE SPECIFICATION GOVERNS THE WORK AND/OR MATERIAL. THE DRAWINGS ARE A VISUAL REPRESENTATION TO COMPLEMENT CONSTRUCTION AND MATERIAL SPECIFICATIONS. THE DRAWINGS INCLUDE LOCATION, PROFILES, SECTIONS, DETAILS AND NOTES NECESSARY TO DESCRIBE THE WORK. IF SITE CONDITIONS WARRANT CHANGES TO THE PLANS, THE PROJECT INSPECTOR RESERVES THE RIGHT TO DIRECT THE CONTRACTOR TO MAKE THESE MODIFICATIONS. NO CHANGES SHALL BE MADE TO THE DRAWINGS OR SPECIFICATIONS WITHOUT PRIOR WRITTEN APPROVAL OF THE PROJECT INSPECTOR.

2.IN THE EVENT THAT A PERMIT CONDITION CONFLICTS WITH THE DRAWINGS AND SPECIFICATIONS, THE ISSUE SHALL BE BROUGHT TO THE ATTENTION OF THE PROJECT INSPECTOR FOR CLARIFICATION PRIOR TO PROCEEDING WITH WORK.

3.THE PROJECT SHALL BE CONSTRUCTED ACCORDING TO THE PLAN SET. THE CONTRACTOR SHALL NOTIFY THE PROJECT INSPECTOR OF ANY CHANGES PRIOR TO IMPLEMENTATION. THE PROJECT INSPECTOR FOR THIS PROJECT SHALL BE THE ASOTIN COUNTY CONSERVATION DISTRICT (ACCD).

4. ACCD MAKES NO REPRESENTATION OF THE EXISTENCE OR NONEXISTENCE OF UTILITIES. CONTRACTOR IS RESPONSIBLE FOR CALLING THE WASHINGTON STATE UTILITY NOTIFICATION CENTER 811 AT LEAST TWO BUSINESS DAYS PRIOR TO DIGGING.

5. COSTS INCURRED DUE TO PROJECT DELAYS RESULTING FROM FAILURE OF THE CONTRACTOR TO MEET THE REQUIREMENTS OF THE GENERAL NOTES TO CONTRACTOR, SAFETY, CONTRACTOR QUALIFICATIONS, MATERIAL SPECIFICATIONS, EQUIPMENT SPECIFICATIONS, CONSTRUCTION SPECIFICATIONS, HIP PERMIT CONDITIONS AND PLAN SET SHALL BE THE EXPENSE OF THE CONTRACTOR.

6. CONSTRUCTION ACTIVITY TO BE SUPERVISED BY THE PROJECT INSPECTOR. STRUCTURE LAYOUT TO BE PROVIDED BY PROJECT INSPECTOR. SPECIAL ATTENTION SHALL BE TAKEN TO OPERATE EQUIPMENT IN A SAFE AND EFFICIENT MANNER WITH MINIMAL DISTURBANCE OUTSIDE OF GRADING LIMITS UNLESS OTHERWISE SPECIFIED. UTMOST CARE SHALL BE EMPLOYED TO ENSURE EXCAVATION AND CONSTRUCTION MATERIALS DO NOT ENTER RIVER OR INCREASE AMBIENT TURBIDITY LEVELS.

7. STRUCTURE SHALL BE CONSTRUCTED FROM PROVIDED LWD MATERIALS AND WILL BE MOVED TO FINAL LOCATION BY CONTRACTOR. LIMBS, BRANCHES, AND ROOT-WADS SHALL BE INTACT TO THE FULLEST EXTENT POSSIBLE AND CARE SHALL BE EMPLOYED BY THE CONTRACTOR WHEN HANDLING AND PLACING LWD. STRUCTURE MEMBERS SHALL CONFORM TO SPECIFICATIONS INDICATED ON PROJECT QUANTITIES AND PLANS.

8. REMOVAL OF TREES, BRUSH AND STRIPPING SHALL ONLY BE TO THE EXTENT NECESSARY TO DO THE WORK AND DONE IN A MANNER AS TO AVOID DAMAGE TO REMAINING TREES, OTHER VEGETATION, AND PROPERTY.

SAFETY

1.THE CONTRACTOR IS RESPONSIBLE FOR COMPLIANCE WITH ALL STATE AND LOCAL LAWS, ORDINANCES, CODES, AND/OR REGULATIONS APPLICABLE FOR THE PROJECT INSTALLATION. THE PROJECT INSPECTOR WILL DOCUMENT ANY SAFETY VIOLATIONS WITNESSED.

CONTRACTOR QUALIFICATIONS

1. IT IS PREFERRED THAT THE CONTRACTOR SHALL HAVE AT LEAST TWO (2) YEARS OF RIVER RESTORATION CONSTRUCTION EXPERIENCE AND SHALL HAVE COMPLETED AT LEAST FIVE (5) RIVER RESTORATION PROJECTS. SIMILAR EXPERIENCE WILL BE EVALUATED ON A CASE BY CASE SCENARIO.

2. IF THE CONTRACTOR CHOOSES TO DESIGNATE AN EMPLOYEE WITHOUT QUALIFIED STREAM RESTORATION EXPERIENCE, THE CONTRACTOR SHALL BE ON-SITE AT ALL TIMES WHEN THE EMPLOYEE IS PERFORMING RIVER RESTORATION WORK. FAILURE TO ABIDE BY THIS CONDITION WITHOUT PREVIOUS AGREEMENT WITH THE PROJECT INSPECTOR COULD BE GROUNDS FOR TERMINATION.

5. COPIES OF ALL PROJECT PERMITS SHALL BE POSTED ON-SITE IN A VISIBLE LOCATION. THE CONTRACTOR SHALL COMPLY WITH THE PROVISIONS OF THE PERMITS. THE CONTRACTOR SHALL NOTIFY THE CONSTRUCTION MANAGER OF ANY KNOWN CHANGES OR ACTIVITIES THAT COULD VIOLATE PERMIT REQUIREMENTS PRIOR TO IMPLEMENTATION.

EQUIPMENT SPECIFICATION

1. THE CONTRACTOR SHALL FURNISH ALL EQUIPMENT NECESSARY TO CONSTRUCT THE PROJECT IN A SAFE AND TIMELY FASHION. AT A MINIMUM, THE CONTRACTOR SHALL PROVIDE THE FOLLOWING EQUIPMENT FOR THIS PROJECT:

CHAINSAW - AT A MINIMUM, ONE CHAINSAW SHALL BE REQUIRED. THE CHAINSAW MUST BE CAPABLE OF COMPLETELY SAWING LOGS OF THE DIAMETER SPECIFIED IN THE MATERIAL SPECIFICATIONS.

POST POUNDER - AT A MINIMUM, ONE HAND OPERATED HYDRAULIC OR GAS POWERED POST POUNDER SHALL BE REQUIRED. POST POUNDER MUST BE CAPABLE OF POUNDING A 3”-4” WOOD POST.

ATV/UTV— AT A MINIMUM, ONE ATV OR UTV SHALL BE REQIUIRED FOR SITE ACCESS. WORK SITE IS ONLY ACCESSABLE BY A SMALL ROAD NOT SUITABLE FOR FULL SIZE VEHICLE ACCESS.

2. ALL EQUIPMENT SHALL BE WASHED PRIOR TO MOBILIZATION TO THE SITE TO MINIMIZE THE INTRODUCTION OF FOREIGN MATERIALS AND FLUIDS TO THE PROJECT SITE. ALL EQUIPMENT SHALL BE FREE OF OIL, HYDRAULIC FLUID, AND DIESEL FUEL LEAKS. TO PREVENT INVASION OF NOXIOUS WEEDS OR THE SPREAD OF WHIRLING DISEASE SPORES, ALL EQUIPMENT SHALL BE POWER WASHED OR CLEANED TO REMOVE MUD AND SOIL PRIOR TO MOBILIZATION INTO THE PROJECT AREA. IT WILL BE THE CONTRACTOR'S RESPONSIBILITY TO INSURE THAT ADEQUATE MEASURES HAVE BEEN TAKEN.

3. EQUIPMENT SHALL BE IN A WELL-MAINTAINED CONDITION TO MINIMIZE THE LIKELIHOOD OF A FLUID LEAK. IF A FLUID LEAK DOES OCCUR, THE PROJECT INSPECTOR SHALL BE NOTIFIED IMMEDIATELY, AND ALL WORK CEASED UNTIL THE LEAK HAS BEEN RECTIFIED. AT ALL TIMES DURING THE CONSTRUCTION PHASE, FLUID SPILL CONTAINMENT EQUIPMENT SHALL BE PRESENT ON-SITE AND READY FOR DEPLOYMENT SHOULD AN ACCIDENTAL SPILL OCCUR. PROJECT INSPECTOR RESERVES THE RIGHT TO REFUSE EQUIPMENT THAT DOES NOT MEET THE PREVIOUS CRITERIA.

5.THE CONTRACTOR SHALL MAINTAIN A COMPLETE TOOL SET WITH COMMONLY REPLACED PARTS (E.G. O-RINGS) TO MINIMIZE DOWNTIME IN THE EVENT OF EQUIPMENT MALFUNCTION. THE CONTRACTOR SHALL HAVE AN EMERGENCY SPILL KIT ON SITE DURING THE PROJECT.

MOBILIZATION SPECIFICATIONS

1.ALL MOBILIZATION AND DEMOBILIZATION WILL BE PERFORMED IN A SAFE AND ORDERLY MANNER WITH PARTICULAR CARE NOT TO DAMAGE EXISTING VEGETATION OR UNDUE DISTURBANCE TO THE INGRESS-EGRESS ROUTE.

2.THE CONTRACTOR IS RESPONSIBLE FOR DAMAGE INCURRED TO PROPERTY RESOURCES DURING MOBILIZATION AND DE-MOBILIZATION. VEGETATION THAT MAY BE CAUSE FOR CONCERN DURING MOBILIZATION SHALL BE IDENTIFIED BY THE CONTRACTOR AND FLAGGED BY THE PROJECT INSPECTOR AT THE TIME OF THE PROJECT “WALK THROUGH”.

3.INGRESS AND EGRESS ROUTES TO THE PROJECT SITE WILL BE IDENTIFIED DURING THE PROJECT “WALK THROUGH”.

4.UPON COMPLETION OF CONSTRUCTION AND DEMOBILIZATION ACTIVITIES THE CONTRACTOR SHALL PERFORM SITE RESTORATION. ORGANIC CONSTRUCTION DEBRIS SHALL BE PLACED AT THE DIRECTION OF THE PROJECT INSPECTOR ON SURFACES EXPOSED DURING CONSTRUCTION. SITE RESTORATION SHALL BE CERTIFIED COMPLETE IN WRITING BY THE PROJECT INSPECTOR UPON COMPLETION OF CONSTRUCTION ACTIVITIES.

CONSTRUCTION SPECIFICATIONS

1. CONSTRUCTION SHALL OCCUR IN ACCORDANCE WITH THE PLAN SET, CONSTRUCTION SPECIFICATIONS, EQUIPMENT SPECIFICATIONS, MATERIAL SPECIFICATIONS, REVEGETATION SPECIFICATIONS AND GENERAL SPECIFICATIONS.

2. IF REQUIRED, PRIOR TO CONSTRUCTION, CONSTRUCTION AREAS WILL BE STAKED OUT USING A SURVEY GRADE GLOBAL POSITIONING SYSTEM (GPS), TOTAL STATION, OR SURVEY LASER. THE PROJECT INSPECTOR SHALL STAKE THE LOCATIONS OF THE CONSTRUCTION ACCESS, STOCKPILE LOCATIONS, LIMITS OF DISTURBANCE, TEMPORARY DIVERSION CHANNELS, TEMPORARY CULVERTS, PROPOSED CHANNEL CENTERLINE, PROPOSED CHANNEL MARGINS, CHANNEL BED FEATURES, FLOODPLAIN EXTENTS, WETLANDS AND ALL STRUCTURES ACCORDING TO THE PLAN SET. AT A MINIMUM, STAKING OF FEATURES SHALL OCCUR EVERY 25 FEET ALONG THE ALIGNMENT. THE CONTRACTOR SHALL MINIMIZE DISTURBANCE TO GRADE STAKES. IF EXCESSIVE DISTURBANCE TO GRADE STAKES BY THE CONTRACTOR OCCURS, IT SHALL BE THE CONTRACTOR'S EXPENSE TO RE-STAKE THE PROJECT.

3. CONSTRUCTION ACCESS SHALL BE DETERMINED BY THE PROJECT INSPECTOR. CONSTRUCTION EQUIPMENT SHALL NOT CROSS PRIVATE LAND UNLESS PERMISSION IS OBTAINED FROM THE LANDOWNER. THE CONTRACTOR SHALL LEAVE ALL GATES, WHETHER OPEN OR CLOSED, AS FOUND.

4. STRAW BALES AND SILT FENCING SHALL BE AVAILABLE AND INSTALLED BY THE CONTRACTOR IF DEEMED NECESSARY BY THE PROJECT INSPECTOR. CONSTRUCTION FENCING (LIMITS OF DISTURBANCE) SHALL BE INSTALLED BY THE CONTRACTOR IF DEEMED NECESSARY BY THE PROJECT INSPECTOR.

5.THE CONTRACTOR SHALL REMOVE EXCESS MATERIALS AND EQUIPMENT FROM THE SITE. THE CONTRACTOR SHALL REGRADE DISTURBED AREAS AND CONSTRUCTION ACCESS ROADS TO THEIR ORIGINAL GRADES. THE CONTRACTOR SHALL TREAT COMPACTED SOIL AREAS INCLUDING ACCESS ROADS AND MATERIAL STOCKPILE AREAS. THE CONTRACTOR SHALL REMOVE SOIL FROM THE PROJECT SITE IF THE SOIL IS TAINTED WITH PETROLEUM-BASED FLUIDS.

MATERIALS SPECIFICATIONS

1. THE CONTRACTOR SHALL FURNISH ALL MATERIALS NECESSARY TO CONSTRUCT THE PROJECT UNLESS OTHER PROVISIONS HAVE BEEN AGREED UPON PRIOR TO CONSTRUCTION. THE CONTRACTOR SHALL DELIVER ALL MATERIALS TO THE DESIGNATED STOCKPILE LOCATIONS LABELED ON THE PLAN SET OR TO A LOCATION SPECIFIED BY THE PROJECT INSPECTOR. IF A MATERIAL SOURCE HAS BEEN PRE-DETERMINED, THE PROJECT INSPECTOR SHALL PROVIDE DIRECTIONS TO THE CONTRACTOR.

2. MATERIAL QUANTITIES, DIMENSIONS AND SIZES SHALL CONFORM TO THE NOTES AND SPECIFICATIONS PROVIDED ON THE PLAN SET OR ON THE MATERIALS LIST.

3. THE PROJECT INSPECTOR SHALL INSPECT AND APPROVE ALL MATERIALS PRIOR TO CONSTRUCTION. IF MATERIALS DO NOT MEET THE MINIMUM REQUIREMENTS SPECIFIED IN THE PLAN SET OR MATERIAL LIST, THE PROJECT INSPECTOR SHALL REJECT THE MATERIALS.

HIP GENERAL AQUATIC CONSERVATION MEASURES APPLICABLE TO ALL ACTIONS

THE ACTIVITIES COVERED UNDER THE HIP ARE INTENDED TO PROTECT AND RESTORE FISH AND WILDLIFE HABITAT WITH LONG-TERM BENEFITS TO ESA-LISTED SPECIES. TO MINIMIZE THESE SHORT-TERM ADVERSE EFFECTS AND MAKE THEM PREDICTABLE FOR THE PURPOSES OF PROGRAMMATIC ANALYSIS, BPA WILL INCLUDE IN ALL PROJECTS IMPLEMENTED UNDER THIS HIP PROPOSED ACTION THE FOLLOWING GENERAL CONSERVATION MEASURES (DEVELOPED IN COORDINATION WITH USFWS AND NMFS).

PROJECT DESIGN AND SITE PREPARATION.

1) STATE AND FEDERAL PERMITS. ALL APPLICABLE REGULATORY PERMITS AND OFFICIAL PROJECT AUTHORIZATIONS WILL BE OBTAINED BEFORE PROJECT IMPLEMENTATION. THESE PERMITS AND AUTHORIZATIONS INCLUDE, BUT ARE NOT LIMITED TO, NATIONAL ENVIRONMENTAL POLICY ACT, NATIONAL HISTORIC PRESERVATION ACT, AND THE APPROPRIATE STATE AGENCY REMOVAL AND FILL PERMIT, USACE CLEAN WATER ACT (CWA) 404 PERMITS, AND CWA SECTION 401 WATER QUALITY CERTIFICATIONS.

2) TIMING OF IN-WATER WORK. WASHINGTON DEPARTMENT OF FISH AND WILDLIFE (WDFW) GUIDELINES FOR TIMING OF IN-WATER WORK WINDOWS (IWW) WILL BE FOLLOWED. THE IN WATER WORK WINDOW FOR KELLY CREEK IS JULY 15TH TO SEPTEMBER 30TH.

A) BULL TROUT - WHILE UTILIZING THE APPROPRIATE STATE DESIGNATED IN-WATER WORK PERIOD WILL LESSEN THE RISK TO BULL TROUT, THIS ALONE MAY NOT BE SUFFICIENT TO ADEQUATELY PROTECT LOCAL BULL TROUT POPULATIONS. THIS IS ESPECIALLY TRUE IF WORK IS OCCURRING IN SPAWNING AND REARING AREAS BECAUSE EGGS, ALEVIN, AND FRY ARE IN THE SUBSTRATE OR CLOSELY ASSOCIATED HABITATS NEARLY YEAR ROUND. SOME AREAS MAY NOT HAVE DESIGNATED IN-WATER WORK WINDOWS FOR BULL TROUT OR IF THEY DO, THEY MAY CONFLICT WITH WORK WINDOWS FOR SALMON AND STEELHEAD. IF THIS IS THE CASE, OR IF PROPOSED WORK IS TO OCCUR WITHIN BULL TROUT SPAWNING AND REARING HABITATS, PROJECT PROPONENTS WILL CONTACT THE APPROPRIATE USFWS FIELD OFFICE TO INSURE THAT ALL REASONABLE IMPLEMENTATION MEASURES ARE CONSIDERED AND AN APPROPRIATE IN-WATER WORK WINDOW IS BEING USED TO MINIMIZE PROJECT EFFECTS.

B) LAMPREY - THE PROJECT SPONSOR AND/OR THEIR CONTRACTORS WILL AVOID WORKING IN STREAM OR RIVER CHANNELS THAT CONTAIN PACIFIC LAMPREY FROM MARCH 1 TO JULY 1 IN LOW TO MID ELEVATION REACHES (<5,000 FEET). IN HIGH ELEVATION REACHES (>5,000 FEET), THE PROJECT SPONSOR WILL AVOID WORKING IN STREAM OR RIVER CHANNELS FROM MARCH 1 TO AUGUST 1. IF EITHER TIMEFRAME IS INCOMPATIBLE WITH OTHER OBJECTIVES, THE AREA WILL BE SURVEYED FOR NESTS AND LAMPREY PRESENCE, AND AVOIDED IF POSSIBLE. IF LAMPREYS ARE KNOWN TO EXIST, THE PROJECT SPONSOR WILL UTILIZE DEWATERING AND SALVAGE PROCEDURES OUTLINED IN US FISH AND WILDLIFE SERVICE BEST MANAGEMENT PRACTICES TO MINIMIZE ADVERSE EFFECTS TO PACIFIC LAMPREY (2010).

C) EXCEPTIONS TO ODFW, WDFW, MFWP, OR IDFG IN-WATER WORK WINDOWS WILL BE REQUESTED THROUGH THE VARIANCE PROCESS (PAGE 2).

3) CONTAMINANTS. THE PROJECT SPONSOR WILL COMPLETE A SITE ASSESSMENT WITH THE FOLLOWING ELEMENTS TO IDENTIFY THE TYPE, QUANTITY, AND EXTENT OF ANY POTENTIAL CONTAMINATION FOR ANY ACTION THAT INVOLVES EXCAVATION OF MORE THAN 20 CUBIC YARDS OF MATERIAL:

A) A REVIEW OF AVAILABLE RECORDS, SUCH AS FORMER SITE USE, BUILDING PLANS, AND RECORDS OF ANY PRIOR CONTAMINATION EVENTS;

B) A SITE VISIT TO INSPECT THE AREAS USED FOR VARIOUS INDUSTRIAL PROCESSES AND THE CONDITION OF THE PROPERTY;

C) INTERVIEWS WITH KNOWLEDGEABLE PEOPLE, SUCH AS SITE OWNERS, OPERATORS, AND OCCUPANTS, NEIGHBORS, OR LOCAL GOVERNMENT OFFICIALS; AND

D) A SUMMARY, STORED WITH THE PROJECT FILE THAT INCLUDES AN ASSESSMENT OF THE LIKELIHOOD THAT CONTAMINANTS ARE PRESENT AT THE SITE, BASED ON ITEMS 4(A) THROUGH 4(C).

4) SITE LAYOUT AND FLAGGING. PRIOR TO CONSTRUCTION. THE ACTION AREA WILL BE CLEARLY FLAGGED TO IDENTIFY THE FOLLOWING:

A) SENSITIVE RESOURCE AREAS, SUCH AS AREAS BELOW ORDINARY HIGH WATER, SPAWNING AREAS, SPRINGS, AND WETLANDS;

B) EQUIPMENT ENTRY AND EXIT POINTS;

C) ROAD AND STREAM CROSSING ALIGNMENTS;

D) STAGING, STORAGE, AND STOCKPILE AREAS; AND

E) NO-SPRAY AREAS AND BUFFERS.

5) TEMPORARY ACCESS ROADS AND PATHS.

A) EXISTING ACCESS ROADS AND PATHS WILL BE PREFERENTIALLY USED WHENEVER REASONABLE, AND THE NUMBER AND LENGTH OF TEMPORARY ACCESS ROADS AND PATHS THROUGH RIPARIAN AREAS AND FLOODPLAINS WILL BE MINIMIZED TO LESSEN SOIL DISTURBANCE AND COMPACTION, AND IMPACTS TO VEGETATION.

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

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

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

E) TEMPORARY ROADS AND PATHS IN WET AREAS OR AREAS PRONE TO FLOODING WILL BE OBLITERATED BY THE END OF THE IN-WATER WORK WINDOW.

6) TEMPORARY STREAM CROSSINGS.

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

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

C) EQUIPMENT AND VEHICLES WILL CROSS THE STREAM IN THE WET ONLY WHERE:

I. THE STREAMBED IS BEDROCK; OR

II. MATS OR OFF-SITE LOGS ARE PLACED IN THE STREAM AND USED AS A CROSSING.

D) VEHICLES AND MACHINERY WILL CROSS STREAMS AT RIGHT ANGLES TO THE MAIN CHANNEL WHEREVER POSSIBLE.

E) THE LOCATION OF THE TEMPORARY CROSSING WILL AVOID AREAS THAT MAY INCREASE THE RISK OF CHANNEL RE-ROUTING OR AVULSION.

F) POTENTIAL SPAWNING HABITAT (I.E., POOL TAILOUTS) AND POOLS WILL BE AVOIDED TO THE MAXIMUM EXTENT POSSIBLE.

G) NO STREAM CROSSINGS WILL OCCUR AT ACTIVE SPAWNING SITES, WHEN HOLDING ADULT LISTED FISH ARE PRESENT, OR WHEN EGGS OR ALEVINS ARE IN THE GRAVEL. THE APPROPRIATE STATE FISH AND WILDLIFE AGENCY WILL BE CONTACTED FOR SPECIFIC TIMING INFORMATION.

H) AFTER PROJECT COMPLETION, TEMPORARY STREAM CROSSINGS WILL BE OBLITERATED AND THE STREAM CHANNEL AND BANKS RESTORED.

7) STAGING, STORAGE, AND STOCKPILE AREAS.

A) STAGING AREAS (USED FOR CONSTRUCTION EQUIPMENT STORAGE, VEHICLE STORAGE, FUELING, SERVICING, AND HAZARDOUS MATERIAL STORAGE) WILL BE 150 FEET OR MORE FROM ANY NATURAL WATER BODY OR WETLAND, OR ON AN ADJACENT, ESTABLISHED ROAD AREA IN A LOCATION AND MANNER THAT WILL PRECLUDE EROSION INTO OR CONTAMINATION OF THE STREAM OR FLOODPLAIN.

B) NATURAL MATERIALS USED FOR IMPLEMENTATION OF AQUATIC RESTORATION, SUCH AS LARGE WOOD, GRAVEL, AND BOULDERS, MAY BE STAGED WITHIN THE 100-YEAR FLOODPLAIN.

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

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

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

A) STORED, FUELED, AND MAINTAINED IN A VEHICLE STAGING AREA PLACED 150 FEET OR MORE FROM ANY NATURAL WATER BODY OR WETLAND OR ON AN ADJACENT, ESTABLISHED ROAD AREA;

B) REFUELED IN A VEHICLE STAGING AREA PLACED 150 FEET OR MORE FROM A NATURAL WATERBODY OR WETLAND, OR IN AN ISOLATED HARD ZONE, SUCH AS A PAVED PARKING LOT OR ADJACENT, ESTABLISHED ROAD (THIS MEASURE APPLIES ONLY TO GAS-POWERED EQUIPMENT WITH TANKS LARGER THAN 5 GALLONS);

C) BIODEGRADABLE LUBRICANTS AND FLUIDS SHALL BE USED ON EQUIPMENT OPERATING IN AND ADJACENT TO THE STREAM CHANNEL AND LIVE WATER.

D) INSPECTED DAILY FOR FLUID LEAKS BEFORE LEAVING THE VEHICLE STAGING AREA FOR OPERATION WITHIN 150 FEET OF ANY NATURAL WATER BODY OR WETLAND; AND

E) THOROUGHLY CLEANED BEFORE OPERATION BELOW ORDINARY HIGH WATER, AND AS OFTEN AS NECESSARY DURING OPERATION, TO REMAIN GREASE FREE.

9) EROSION CONTROL. EROSION CONTROL MEASURES WILL BE PREPARED AND CARRIED OUT, COMMENSURATE IN SCOPE WITH THE ACTION, THAT MAY INCLUDE THE FOLLOWING:

A) TEMPORARY EROSION CONTROLS.

I. TEMPORARY EROSION CONTROLS WILL BE IN PLACE BEFORE ANY SIGNIFICANT ALTERATION OF THE ACTION SITE AND APPROPRIATELY INSTALLED DOWNSLOPE OF PROJECT ACTIVITY WITHIN THE RIPARIAN BUFFER AREA UNTIL SITE REHABILITATION IS COMPLETE.

IV. SOIL STABILIZATION UTILIZING WOOD FIBER MULCH AND TACKIFIER (HYDRO-APPLIED) MAY BE USED TO REDUCE EROSION OF BARE SOIL IF THE MATERIALS ARE NOXIOUS WEED FREE AND NONTOXIC TO AQUATIC AND TERRESTRIAL ANIMALS, SOIL MICROORGANISMS, AND VEGETATION.

V. SEDIMENT WILL BE REMOVED FROM EROSION CONTROLS ONCE IT HAS REACHED 1/3 OF THE EXPOSED HEIGHT OF THE CONTROL.

VI. ONCE THE SITE IS STABILIZED AFTER CONSTRUCTION, TEMPORARY EROSION CONTROL MEASURES WILL BE REMOVED.

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

I. A SUPPLY OF SEDIMENT CONTROL MATERIALS; AND

II. AN OIL-ABSORBING FLOATING BOOM WHENEVER SURFACE WATER IS PRESENT.

10) DUST ABATEMENT. THE PROJECT SPONSOR WILL DETERMINE THE APPROPRIATE DUST CONTROL MEASURES BY CONSIDERING SOIL TYPE, EQUIPMENT USAGE, PREVAILING WIND DIRECTION, AND THE EFFECTS CAUSED BY OTHER EROSION AND SEDIMENT CONTROL MEASURES. IN ADDITION, THE FOLLOWING CRITERIA WILL BE FOLLOWED:

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

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

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

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

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

11) SPILL PREVENTION, CONTROL, AND COUNTER MEASURES. THE USE OF MECHANIZED MACHINERY INCREASES THE RISK FOR ACCIDENTAL SPILLS OF FUEL, LUBRICANTS, HYDRAULIC FLUID, OR OTHER CONTAMINANTS INTO THE RIPARIAN ZONE OR DIRECTLY INTO THE WATER. ADDITIONALLY, UNCURED CONCRETE AND FORM MATERIALS ADJACENT TO THE ACTIVE STREAM CHANNEL MAY RESULT IN ACCIDENTAL DISCHARGE INTO THE WATER. THESE CONTAMINANTS CAN DEGRADE HABITAT, AND INJURE OR KILL AQUATIC FOOD ORGANISMS AND ESA-LISTED SPECIES. THE PROJECT SPONSOR WILL ADHERE TO THE FOLLOWING MEASURES:

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

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

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

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

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

F) HYDROLIC POST POUNDER MAY BE REFILLED WITHIN 150 FT OF THE WATER IF THE ACCD CONSTRUCTION SPILL MAT POLICY IS FOLLOWED. THE POLICY CAN BE FOUND IN APPENDIX C OF THE BASIS OF DESIGN.

12) INVASIVE SPECIES CONTROL. THE FOLLOWING MEASURES WILL BE FOLLOWED TO AVOID INTRODUCTION OF INVASIVE PLANTS AND NOXIOUS WEEDS INTO PROJECT AREAS:

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

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

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

WORK AREA ISOLATION & FISH SALVAGE.

ANY WORK AREA WITHIN THE WETTED CHANNEL WILL BE ISOLATED FROM THE ACTIVE STREAM WHENEVER ESA-LISTED FISH ARE REASONABLY CERTAIN TO BE PRESENT, OR IF THE WORK AREA IS LESS THAN 300-FEET UP-STREAM FROM KNOWN SPAWNING HABITATS. WHEN WORK AREA ISOLATION IS REQUIRED, DESIGN PLANS WILL INCLUDE ALL ISOLATION ELEMENTS, FISH RELEASE AREAS, AND, WHEN A PUMP IS USED TO DEWATER THE ISOLATION AREA AND FISH ARE PRESENT, A FISH SCREEN THAT MEETS NMFS'S FISH SCREEN CRITERIA (NMFS 2011, OR MOST CURRENT). WORK AREA ISOLATION AND FISH CAPTURE ACTIVITIES WILL OCCUR DURING PERI-ODS OF THE COOLEST AIR AND WATER TEMPERATURES POSSIBLE, NORMALLY EARLY IN THE MORNING VERSUS LATE IN THE DAY, AND DURING CONDITIONS APPROPRIATE TO MINIMIZE STRESS AND DEATH OF SPECIES PRE-SENT.

- NATIONAL MARINE FISHERIES SERVICE. 2011. ANADROMOUS SALMONID PASSAGE FACILITY DESIGN. NORTH-WEST REGION. AVAILABLE ONLINE AT: HTTP://WWW.NWR.NOAA.GOV/SALMON-HYDROPOWER/FERC/UPLOAD/FISH-PASSAGE-DESIGN.PDF

- U.S. FISH AND WILDLIFE SERVICE. 2010. BEST MANAGEMENT PRACTICES TO MINIMIZE ADVERSE EFFECTS TO PACIFIC LAMPREY.

HTTP://WWW.FWS.GOV/PACIFIC/FISHERIES/SPHABCON/LAMPREY/PDF/BEST%20MANAGEMENT

%20PRACTICES%20FOR%20PACIFIC%20LAMPREY%20APRIL%202010%20VERSION.PDF

FOR SALVAGE OPERATIONS IN KNOWN BULL TROUT SPAWNING AND REARING HABITAT, ELECTROFISHING SHALL ONLY OCCUR FROM MAY 1 TO JULY 31. NO ELECTROFISHING WILL OCCUR IN ANY BULL TROUT OCCUPIED HABI-TAT AFTER AUGUST 15. BULL TROUT ARE VERY TEMPERATURE SENSITIVE AND GENERALLY SHOULD NOT BE ELECTROSHOCKED OR OTHERWISE HANDLED WHEN TEMPERATURES EXCEED 15 DEGREES CELSIUS. SALVAGE ACTIVITIES SHOULD TAKE PLACE DURING PERIODS OF THE COOLEST AIR AND WATER TEMPERATURES POSSIBLE, NORMALLY EARLY IN THE MORNING VERSUS LATE IN THE DAY, AND DURING CONDITIONS APPROPRIATE TO MINIMIZE STRESS TO FISH SPECIES PRESENT.

SALVAGE OPERATIONS WILL FOLLOW THE ORDERING, METHODOLOGIES, AND CONSERVATION MEASURES SPECI-FIED BELOW IN STEPS 1 THROUGH 6. STEPS 1 AND 2 WILL BE IMPLEMENTED FOR ALL PROJECTS WHERE WORK AREA ISOLATION IS NECESSARY ACCORDING TO CONDITIONS ABOVE. ELECTROFISHING (STEP 3) CAN BE IMPLE-MENTED TO ENSURE ALL FISH HAVE BEEN REMOVED FOLLOWING STEPS 1 AND 2, OR WHEN OTHER MEANS OF FISH CAPTURE MAY NOT BE FEASIBLE OR EFFECTIVE. DEWATERING AND REWATERING (STEPS 4 AND 5) WILL BE IMPLEMENTED UNLESS WETTED IN-STREAM WORK IS DEEMED TO BE MINIMALLY HARMFUL TO FISH, AND IS BENEFICIAL TO OTHER AQUATIC SPECIES. DEWATERING WILL NOT BE CONDUCTED IN AREAS KNOWN TO BE OCCUPIED BY LAMPREY, UNLESS LAMPREYS ARE SALVAGED USING GUIDANCE SET FORTH IN US FISH AND WILD-LIFE SERVICE (2010)3.

1) ISOLATE.

A) BLOCK NETS WILL BE INSTALLED AT UPSTREAM AND DOWNSTREAM LOCATIONS AND MAINTAINED IN A SE-CURED POSITION TO EXCLUDE FISH FROM ENTERING THE PROJECT AREA.

B) BLOCK NETS WILL BE SECURED TO THE STREAM CHANNEL BED AND BANKS UNTIL FISH CAPTURE AND TRANSPORT ACTIVITIES ARE COMPLETE. BLOCK NETS MAY BE LEFT IN PLACE FOR THE DURATION OF THE PRO-JECT TO EXCLUDE FISH.

C) IF BLOCK NETS REMAIN IN PLACE MORE THAN ONE DAY, THE NETS WILL BE MONITORED AT LEAST DAILY TO ENSURE THEY ARE SECURED TO THE BANKS AND FREE OF ORGANIC ACCUMULATION. IF THE PROJECT IS WITHIN BULL TROUT SPAWNING AND REARING HABITAT, THE BLOCK NETS MUST BE CHECKED EVERY FOUR HOURS FOR FISH IMPINGEMENT ON THE NET. LESS FREQUENT INTERVALS MUST BE APPROVED THROUGH A VARIANCE RE-QUEST.

D) NETS WILL BE MONITORED HOURLY ANYTIME THERE IS INSTREAM DISTURBANCE.

2) SALVAGE. AS DESCRIBED BELOW, FISH TRAPPED WITHIN THE ISOLATED WORK AREA WILL BE CAPTURED TO MINIMIZE THE RISK OF INJURY, THEN RELEASED AT A SAFE SITE:

A) REMOVE AS MANY FISH AS POSSIBLE PRIOR TO DEWATERING.

B) DURING DEWATERING, ANY REMAINING FISH WILL BE COLLECTED BY HAND OR DIP NETS.

C) SEINES WITH A MESH SIZE TO ENSURE CAPTURE OF THE RESIDING ESA-LISTED FISH WILL BE USED.

D) MINNOW TRAPS WILL BE LEFT IN PLACE OVERNIGHT AND USED IN CONJUNCTION WITH SEINING.

E) IF BUCKETS ARE USED TO TRANSPORT FISH:

I. THE TIME FISH ARE IN A TRANSPORT BUCKET WILL BE LIMITED, AND WILL BE

RELEASED AS QUICKLY AS POSSIBLE;

II. THE NUMBER OF FISH WITHIN A BUCKET WILL BE LIMITED BASED ON SIZE, AND FISH WILL BE OF RELATIVELY COMPARABLE SIZE TO MINIMIZE PREDATION;

III. AERATORS FOR BUCKETS WILL BE USED OR THE BUCKET WATER WILL BE FREQUENTLY CHANGED WITH COLD CLEAR WATER AT 15 MINUTE OR MORE FREQUENT INTERVALS.

IV. BUCKETS WILL BE KEPT IN SHADED AREAS OR WILL BE COVERED BY A CANOPY IN EXPOSED AREAS.

V. DEAD FISH WILL NOT BE STORED IN TRANSPORT BUCKETS, BUT WILL BE LEFT ON THE STREAM BANK TO AVOID MORTALITY COUNTING ERRORS.

F) AS RAPIDLY AS POSSIBLE (ESPECIALLY FOR TEMPERATURE-SENSITIVE BULL TROUT), FISH WILL BE RELEASED IN AN AREA THAT PROVIDES ADEQUATE COVER AND FLOW REFUGE. UPSTREAM RELEASE IS GENERALLY PRE-FERRED, BUT FISH RELEASED DOWNSTREAM WILL BE SUFFICIENTLY OUTSIDE OF THE INFLUENCE OF CONSTRUC-TION.

G) SALVAGE WILL BE SUPERVISED BY A QUALIFIED FISHERIES BIOLOGIST EXPERIENCED WITH WORK AREA ISOLA-TION AND COMPETENT TO ENSURE THE SAFE HANDLING OF ALL FISH.

3) ELECTROFISHING. ELECTROFISHING WILL BE USED ONLY AFTER OTHER SALVAGE METHODS HAVE BEEN EM-PLOYED OR WHEN OTHER MEANS OF FISH CAPTURE ARE DETERMINED TO NOT BE FEASIBLE OR EFFECTIVE. IF ELECTROFISHING WILL BE USED TO CAPTURE FISH FOR SALVAGE, THE SALVAGE OPERATION WILL BE LED BY AN EXPERIENCED FISHERIES BIOLOGIST AND THE FOLLOWING GUIDELINES WILL BE FOLLOWED:

A) THE NMFS'S ELECTROFISHING GUIDELINES (NMFS 2000).

B) ONLY DIRECT CURRENT (DC) OR PULSED DIRECT CURRENT (PDC) WILL BE USED AND CONDUCTIVITY MUST BE TESTED.

I. IF CONDUCTIVITY IS LESS THAN 100 MS, VOLTAGE RANGES FROM 900 TO 1100 WILL BE USED.

II. FOR CONDUCTIVITY RANGES BETWEEN 100 TO 300 MS, VOLTAGE RANGES WILL BE 500 TO 800.

III. FOR CONDUCTIVITY GREATER THAN 300 MS, VOLTAGE WILL BE LESS THAN 400.

C) ELECTROFISHING WILL BEGIN WITH A MINIMUM PULSE WIDTH AND RECOMMENDED VOLTAGE AND THEN GRADUALLY INCREASE TO THE POINT WHERE FISH ARE IMMOBILIZED.

D) THE ANODE WILL NOT INTENTIONALLY CONTACT FISH.

E) ELECTROFISHING SHALL NOT BE CONDUCTED WHEN THE WATER CONDITIONS ARE TURBID AND VISIBILITY IS POOR. THIS CONDITION MAY BE EXPERIENCED WHEN THE SAMPLER CANNOT SEE THE STREAM BOTTOM IN ONE FOOT OF WATER.

F) IF MORTALITY OR OBVIOUS INJURY (DEFINED AS DARK BANDS ON THE BODY, SPINAL DEFORMATIONS, DE-SCALING OF 25% OR MORE OF BODY, AND TORPIDITY OR INABILITY TO MAINTAIN UPRIGHT ATTITUDE AFTER SUFFICIENT RECOVERY TIME) OCCURS DURING ELECTROFISHING, OPERATIONS WILL BE IMMEDIATELY DISCON-TINUED, MACHINE SETTINGS, WATER TEMPERATURE AND CONDUCTIVITY CHECKED, AND PROCEDURES ADJUST-ED OR ELECTROFISHING POSTPONED TO REDUCE MORTALITY.

4) DEWATER. DEWATERING, WHEN NECESSARY, WILL BE CONDUCTED OVER A SUFFICIENT PERIOD OF TIME TO ALLOW SPECIES TO NATURALLY MIGRATE OUT OF THE WORK AREA AND WILL BE LIMITED TO THE SHORTEST LINEAR EXTENT PRACTICABLE.

A) DIVERSION AROUND THE CONSTRUCTION SITE MAY BE ACCOMPLISHED WITH A COFFER DAM AND A BY-PASS CULVERT OR PIPE, OR A LINED, NON-ERODIBLE DIVERSION DITCH. WHERE GRAVITY FEED IS NOT POSSIBLE, A PUMP MAY BE USED, BUT MUST BE OPERATED IN SUCH A WAY AS TO AVOID REPETITIVE DEWATERING AND REWATERING OF THE SITE. IMPOUNDMENT BEHIND THE COFFERDAM MUST OCCUR SLOWLY THROUGH THE TRANSITION, WHILE CONSTANT FLOW IS DELIVERED TO THE DOWNSTREAM REACHES.

B) ALL PUMPS WILL HAVE FISH SCREENS TO AVOID JUVENILE FISH IMPINGEMENT OR ENTRAINMENT, AND WILL BE OPERATED IN ACCORDANCE WITH NMFS'S CURRENT FISH SCREEN CRITERIA (NMFS 20114, OR MOST RECENT VERSION). IF THE PUMPING RATE EXCEEDS 3 CUBIC FEET SECOND (CFS), A NMFS HYDRO FISH PASSAGE REVIEW WILL BE NECESSARY.

C) DISSIPATION OF FLOW ENERGY AT THE BYPASS OUTFLOW WILL BE PROVIDED TO PREVENT DAMAGE TO RI-PARIAN VEGETATION OR STREAM CHANNEL.

D) SAFE REENTRY OF FISH INTO THE STREAM CHANNEL WILL BE PROVIDED, PREFERABLY INTO POOL HABITAT WITH COVER, IF THE DIVERSION ALLOWS FOR DOWNSTREAM FISH PASSAGE.

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

4 NATIONAL MARINE FISHERIES SERVICE. 2011. ANADROMOUS SALMONID PASSAGE FACILITY DESIGN. NORTH-WEST REGION. AVAILABLE ONLINE AT: HTTP://WWW.NWR.NOAA.GOV/SALMON-HYDROPOWER/FERC/UPLOAD/FISH-PASSAGE-DESIGN.PDF

5) SALVAGE NOTICE. MONITORING AND RECORDING OF FISH PRESENCE, HANDLING, AND MORTALITY MUST OCCUR DURING THE DURATION OF THE ISOLATION, SALVAGE, ELECTROFISHING, DEWATERING, AND REWA-TERING OPERATIONS. ONCE OPERATIONS ARE COMPLETED, A SALVAGE REPORT WILL DOCUMENT PROCE-DURES USED, ANY FISH INJURIES OR DEATHS (INCLUDING NUMBERS OF FISH AFFECTED), AND CAUSES OF ANY DEATHS.

CONSTRUCTION AND POST-CONSTRUCTION CONSERVATION MEASURES.

1) FISH PASSAGE. FISH PASSAGE WILL BE PROVIDED FOR ANY ADULT OR JUVENILE FISH LIKELY TO BE PRESENT IN THE ACTION AREA DURING CONSTRUCTION, UNLESS PASSAGE DID NOT EXIST BEFORE CONSTRUCTION OR THE STREAM IS NATURALLY IMPASSABLE AT THE TIME OF CONSTRUCTION. IF THE PROVISION OF TEMPORARY FISH PASSAGE DURING CONSTRUCTION WILL INCREASE NEGATIVE EFFECTS ON AQUATIC SPECIES OF INTEREST OR THEIR HABITAT, A VARIANCE CAN BE REQUESTED FROM THE NMFS BRANCH CHIEF AND THE FWS FIELD OFFICE SUPERVISOR. PERTINENT INFORMATION, SUCH AS THE SPECIES AFFECTED, LENGTH OF STREAM REACH AFFECTED, PROPOSED TIME FOR THE PASSAGE BARRIER, AND ALTERNATIVESCONSIDERED, WILL BE INCLUDED IN THE VARIANCE REQUEST.

2) CONSTRUCTION AND DISCHARGE WATER.

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

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

C) ALL CONSTRUCTION DISCHARGE WATER WILL BE COLLECTED AND TREATED USING THE BEST AVAILABLE TECHNOLOGY APPLICABLE TO SITE CONDITIONS.

D) TREATMENTS TO REMOVE DEBRIS, NUTRIENTS, SEDIMENT, PETROLEUM HYDROCARBONS, METALS AND OTHER POLLUTANTS LIKELY TO BE PRESENT WILL BE PROVIDED.

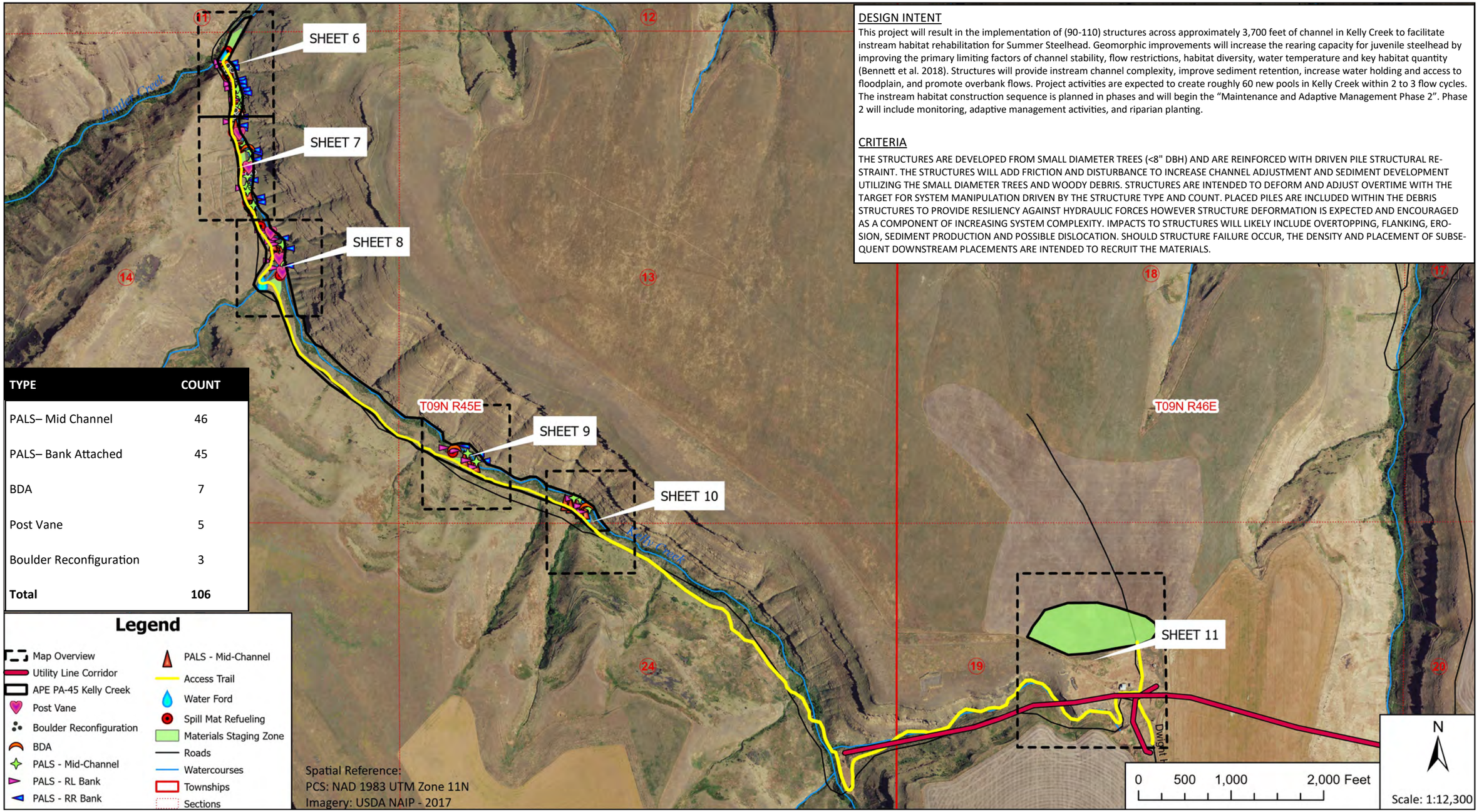
DESIGN INTENT

This project will result in the implementation of (90-110) structures across approximately 3,700 feet of channel in Kelly Creek to facilitate instream habitat rehabilitation for Summer Steelhead. Geomorphic improvements will increase the rearing capacity for juvenile steelhead by improving the primary limiting factors of channel stability, flow restrictions, habitat diversity, water temperature and key habitat quantity (Bennett et al. 2018). Structures will provide instream channel complexity, improve sediment retention, increase water holding and access to floodplain, and promote overbank flows. Project activities are expected to create roughly 60 new pools in Kelly Creek within 2 to 3 flow cycles. The instream habitat construction sequence is planned in phases and will begin the "Maintenance and Adaptive Management Phase 2". Phase 2 will include monitoring, adaptive management activities, and riparian planting.

CRITERIA

THE STRUCTURES ARE DEVELOPED FROM SMALL DIAMETER TREES (<8" DBH) AND ARE REINFORCED WITH DRIVEN PILE STRUCTURAL RESTRAINT. THE STRUCTURES WILL ADD FRICTION AND DISTURBANCE TO INCREASE CHANNEL ADJUSTMENT AND SEDIMENT DEVELOPMENT UTILIZING THE SMALL DIAMETER TREES AND WOODY DEBRIS. STRUCTURES ARE INTENDED TO DEFORM AND ADJUST OVERTIME WITH THE TARGET FOR SYSTEM MANIPULATION DRIVEN BY THE STRUCTURE TYPE AND COUNT. PLACED PILES ARE INCLUDED WITHIN THE DEBRIS STRUCTURES TO PROVIDE RESILIENCY AGAINST HYDRAULIC FORCES HOWEVER STRUCTURE DEFORMATION IS EXPECTED AND ENCOURAGED AS A COMPONENT OF INCREASING SYSTEM COMPLEXITY. IMPACTS TO STRUCTURES WILL LIKELY INCLUDE OVERTOPPING, FLANKING, EROSION, SEDIMENT PRODUCTION AND POSSIBLE DISLOCATION. SHOULD STRUCTURE FAILURE OCCUR, THE DENSITY AND PLACEMENT OF SUBSEQUENT DOWNSTREAM PLACEMENTS ARE INTENDED TO RECRUIT THE MATERIALS.

TYPE	COUNT
PALS– Mid Channel	46
PALS– Bank Attached	45
BDA	7
Post Vane	5
Boulder Reconfiguration	3
Total	**106**



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Asotin County Conservation District

Kelly Creek Project Area 45

Asotin County, WA

Asotin County Conservation District

PROJECT OVERVIEW & MAP INDEX

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Kelly Creek Project Area 45

Asotin County, WA

Asotin County Conservation District

Complex 1

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Kelly Creek Project Area 45

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Complex 2

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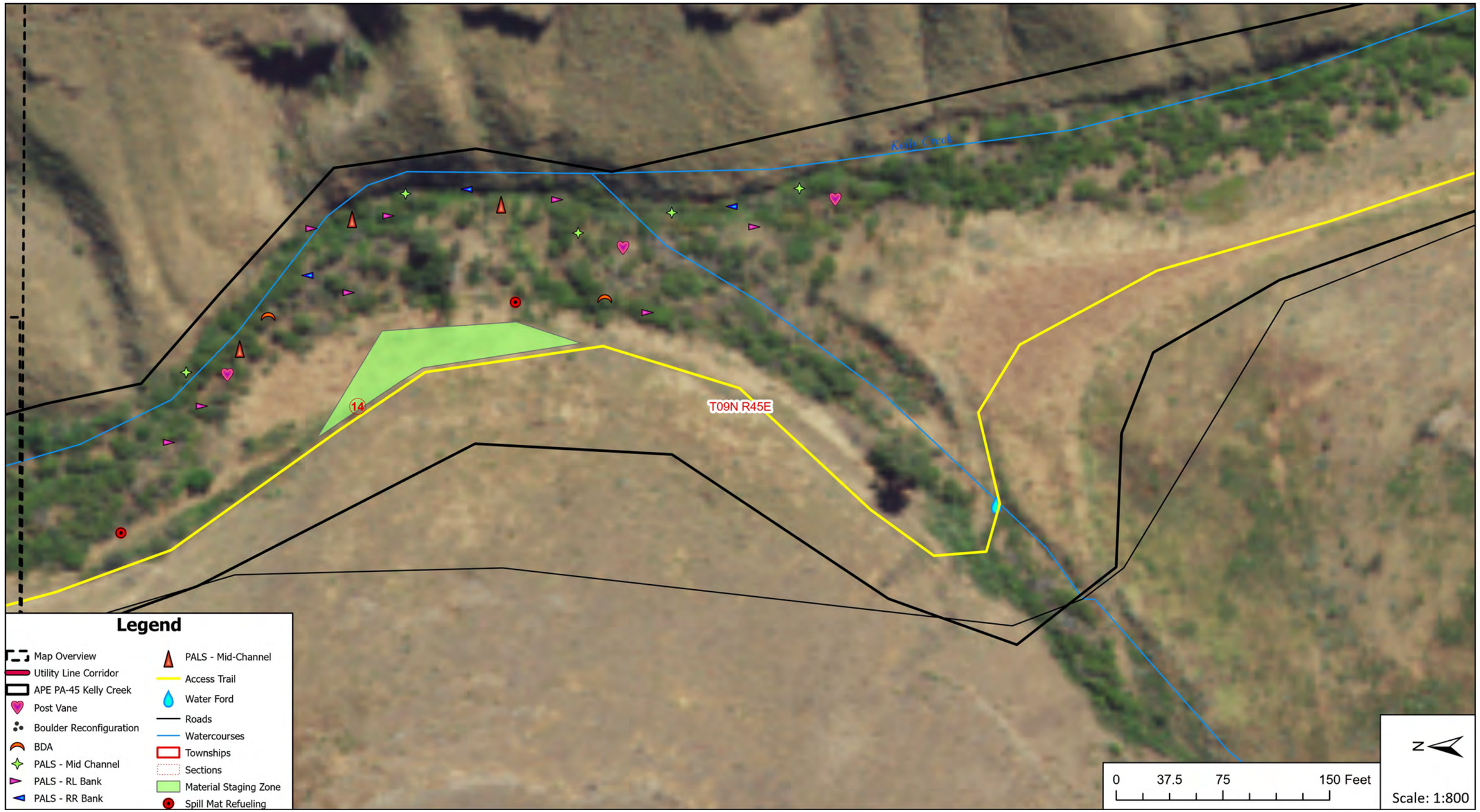
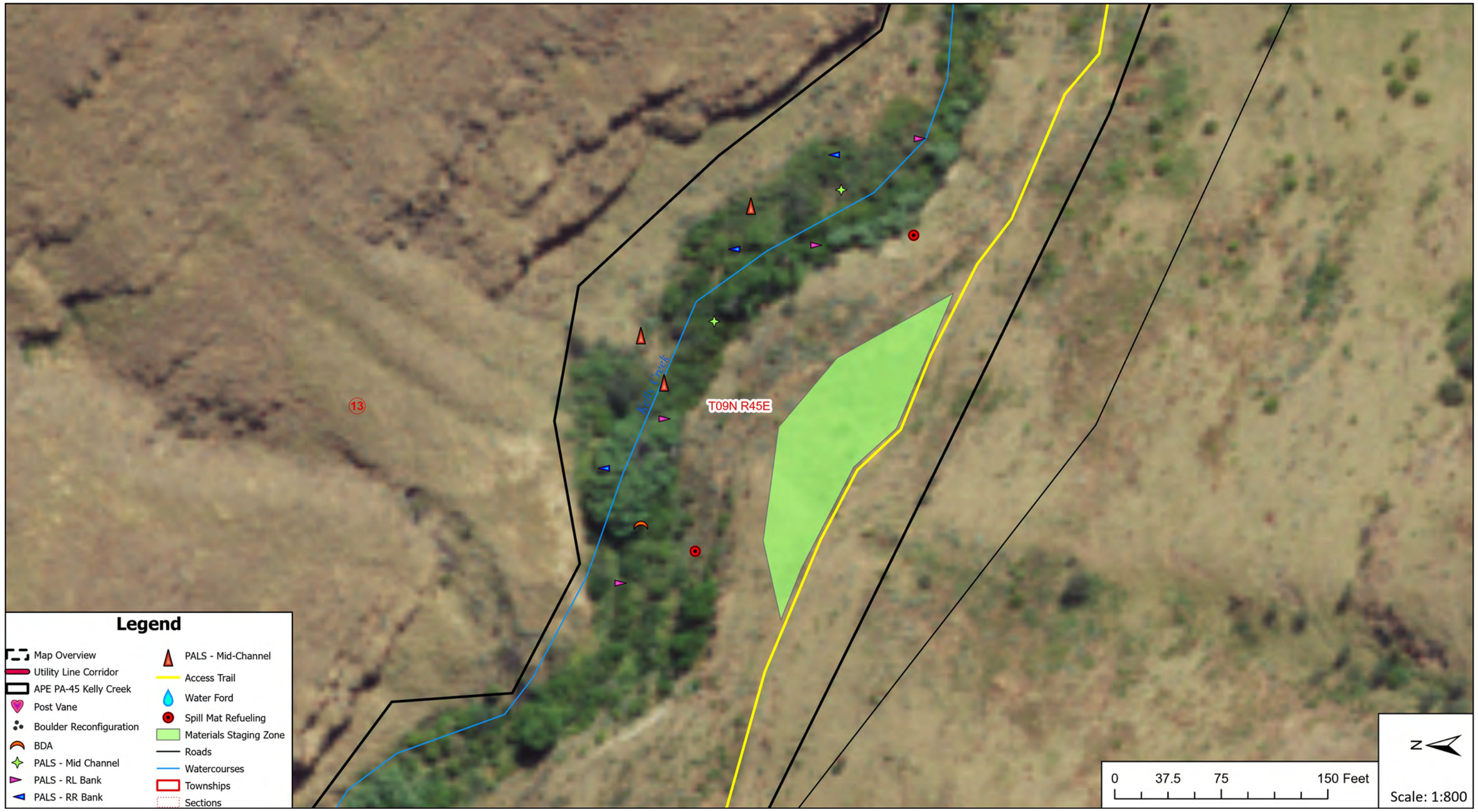


12/15/2023 Prepared By: Lacy Ausman-Ditto Brad Riehle Kodie Wight	Asotin County Conservation District	Kelly Creek Project Area 45 Asotin County, WA Asotin County Conservation District	Complex 3	Sheet 8 of 20



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Asotin County, WA

Asotin County Conservation District

Complex 4

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Complex 5

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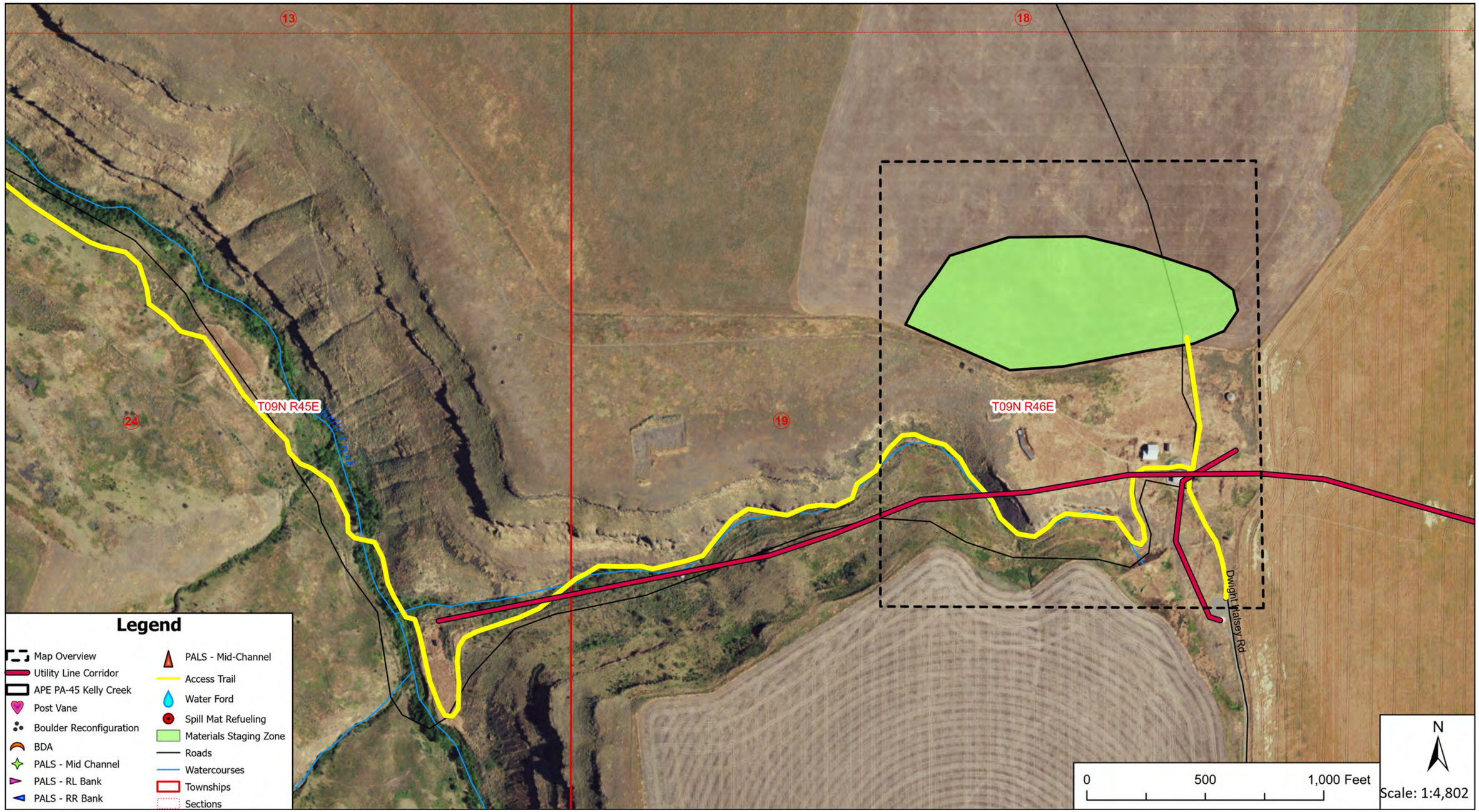

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Kelly Creek Project Area 45

Asotin County, WA

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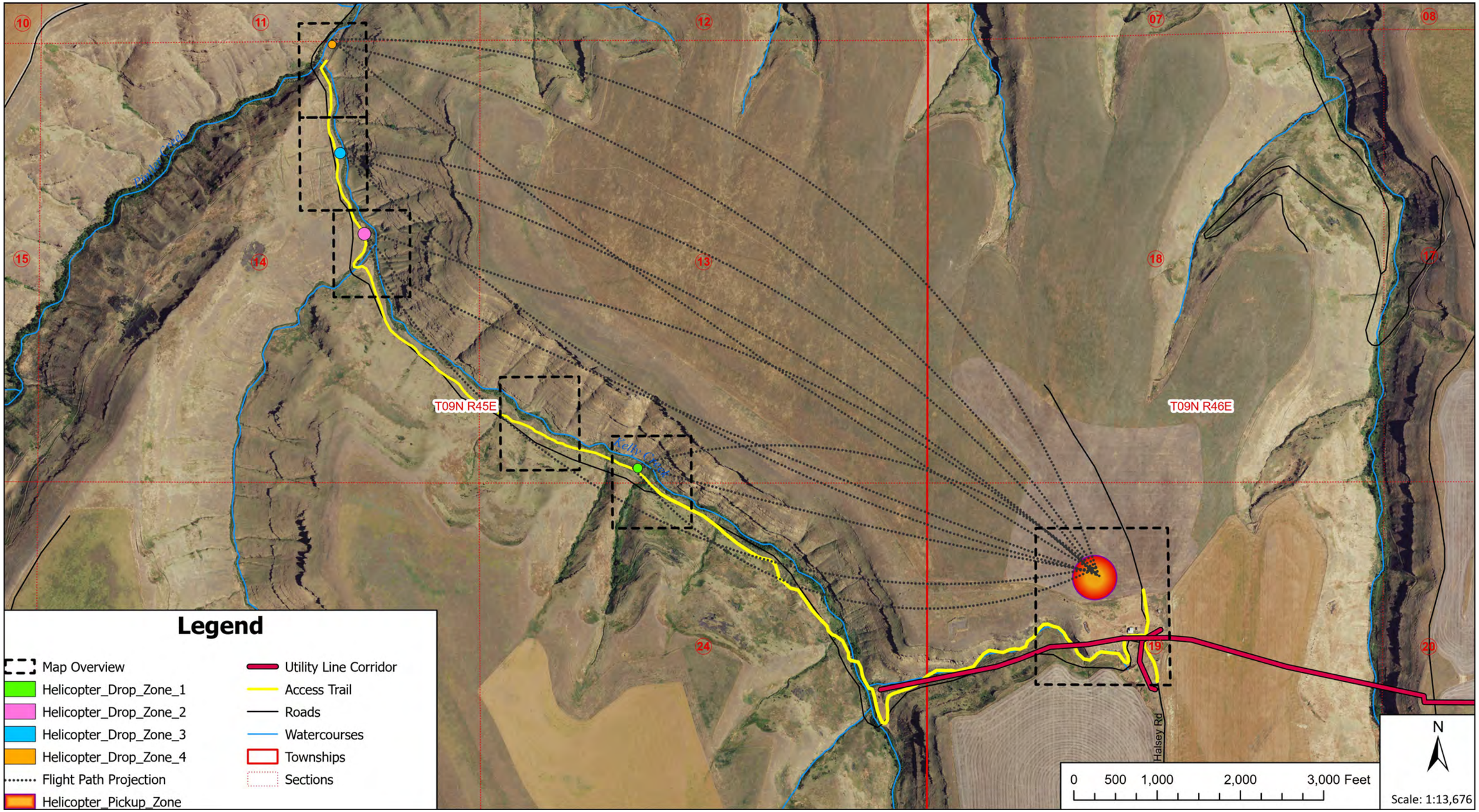
Staging Area



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Kelly Creek Project Area 45

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Helicopter Drops

Sheet
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WOOD POSTS

UNTREATED WOOD POSTS <4" DIAMETER SHARPENED AT ONE END FOR DRIVING INTO STREAMBED

BASE LOGS

- MINIMUM 6 INCHES DIAMETER
- MAXIMUM 8 INCHES DIAMETER
- MINIMUM 4 FEET IN LENGTH
- MAXIMUM 15 FEET IN LENGTH
- WITH OR WITHOUTH BRANCHES

SMALL LOGS

- MINIMUM 2 INCHES DIAMETER
- MAXIMUM 5
- INCHES DIAMETER
- MINIMUM 4 FEET IN LENGTH
- MAXIMUM 15 FEET IN LENGTH
- WITH OR WITHOUTH BRANCHES

SLASH

WOOD MATERIALS <2" DIAMETER WITH LEAVES AND BRANCHES INTACT.

ESTIMATED DREDGE/FILL

Activity (clear, dredge, fill, pile drive, etc.)	Waterbody name[1]	Impact location[2]	Duration of impact[3]	Amount of material (cubic yards) to be placed in or removed from waterbody	Area (sq. ft. or linear ft.) of waterbody directly affected
BDA: Dredging/Fill	Kelly Creek	Instream and adjacent floodplain	10 years	<3 CY. of materials including: sediment, gravel and small rocks will be incorporated into (7) separate BDA structures.	1,500 sq. ft.
Boulders: Dredging/Fill	Kelly Creek	Instream and adjacent floodplain	10 years	<2.4 CY, Boulders will be rearranged in stream into (3) boulder structures	<1,000 sq. ft.

APPROXIMATE WOOD MATERIALS QUANTITIES

	Wood Posts <4"	Base Logs	Small Logs	Slash
	EA	EA	EA	CY
PALS– Mid Channel	368	92	276	46
PALS– Bank Attached	360	90	270	45
BDA	84	28	56	21
Post Vane	50	0	0	0
Boulder Reconfiguration	0	0	0	0
Total	**862**	**210**	**602**	**112**

STRUCTURES

TYPE	COUNT
PALS– Mid Channel	46
PALS– Bank Attached	45
BDA	7
Post Vane	5
Boulder Reconfiguration	3
Total	**106**

LOCATION OF DREDGE/FILL

Beaver Dam Analogue (BDA) structures will be installed at the following GPS locations:
117.1309914°W 46.2641817°N <10 ft. length, 2 ft. height, <3 ft. width. (<0.25 CY fill material)
117.1305863°W 46.2627647°N <15 ft. length, 2 ft. height, <3 ft. width. (<0.25 CY fill material)
117.1301028°W 46.2616991°N <10 ft. length, 2 ft. height, <3 ft. width. (<0.25 CY fill material)
117.1289602°W 46.2590996°N <12 ft. length, 2 ft. height, <3 ft. width. (<0.25 CY fill material)
117.1289020°W 46.2584507°N <15 ft. length, 2 ft. height, <3 ft. width. (<0.25 CY fill material)
117.1212617°W 46.2528027°N <10 ft. length, 2 ft. height, <3 ft. width. (<0.25 CY fill material)
117.1156132°W 46.2510876°N <10 ft. length, 2 ft. height, <3 ft. width. (<0.25 CY fill material)

Boulder Reconfiguration structures will be installed at the following GPS locations (Upstream, beginning at Pintler Creek Confluence):
117.1309162°W 46.2640393°N
117.1305889°W 46.2627181°N
117.1300007°W 46.2610140°N

Restoration of Rare or Declining Natural Communities:

USDA United States Department of Agriculture
Natural Resources Conservation Service

Beaver Dam Analogues and Post-Assisted Log Structures for Low-Tech Stream Restoration

Conservation Practice 643 - Specification Sheet

Appendix A: Structure schematics and installation instructions. From Wheaton et al. 2019. Low-Tech Process-Based Restoration of Riverscapes: Pocket Field Guide. Utah State University Restoration Consortium. Logan, UT.

LOW-TECH STRUCTURE DEFINITIONS

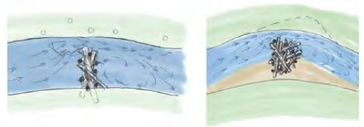
PALS
POST-ASSISTED LOG STRUCTURES

- PALS are handbuilt structures that mimic and promote the processes of **wood accumulation.**
- Woody material of various sizes pinned together with untreated wooden posts driven into the substrate.

BDAs
BEAVER DAM ANALOGUES

- BDAs are handbuilt structures that mimic and promote the processes of **beaver dam activity.**
- BDAs are a permeable, channel-spanning structure with a constant crest elevation, constructed with a mixture of woody debris and fill material to promote temporary ponding of water.

BANK-ATTACHED PALS

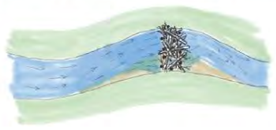


POSTLESS BDA

MID-CHANNEL PALS

POST-ASSISTED BDA

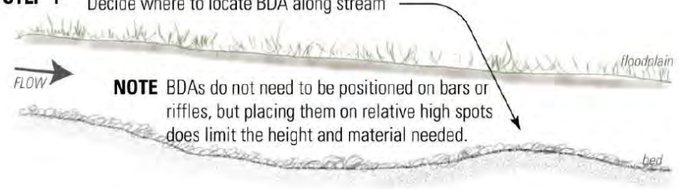
CHANNEL-SPANNING PALS



POST-LINE WICKER WEAVE

BEAVER DAM ANALOGUES

STEP 1 Decide where to locate BDA along stream

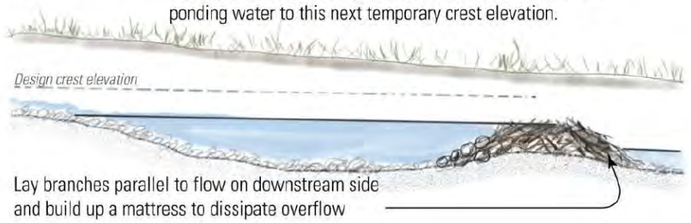


NOTE BDAs do not need to be positioned on bars or riffles, but placing them on relative high spots does limit the height and material needed.

STEP 2 Build up first layer only to just above existing water surface and make sure crest is level across bed and its pooling water upstream to this temporary crest elevation

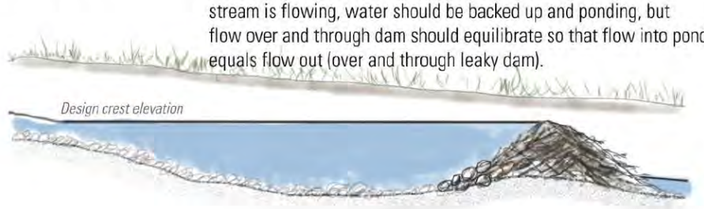
Use mud, bed material & turf sourced from backwater area combined with sticks of various sizes to build wide base. Make sure base is wide enough to accommodate designed height.

STEP(S) 3 Build up subsequent layer(s) in 6 to 12" lifts, packing well with mud, turf, leaves, needles, sediment and other material until ponding water to this next temporary crest elevation.



Lay branches parallel to flow on downstream side and build up a mattress to dissipate overflow

FINISHING STEP Bring dam up to desired design crest elevation. Make sure crest of dam is perfectly level (so no preferential flow or weir exists). If stream is flowing, water should be backed up and ponding, but flow over and through dam should equilibrate so that flow into pond equals flow out (over and through leaky dam).



HOW TO BUILD BDAs

1. Decide location of BDA dam crest orientation, configuration (e.g., straight or convex downstream), and crest elevation (use landscape flags if necessary). Position yourself with your eye-level at the proposed crest elevation of the dam (make sure it is < 5' in height). Look upstream to find where the pond will backwater to. Adjust crest elevation as necessary to achieve desired size of pond, inundation extent, and overflow patterns. If concerned about head drop (water surface elevation difference) over BDA, build a secondary BDA downstream with a crest elevation set to backwater into base of this BDA (and lessen head drop or elevation difference between water surface in pond and water surface downstream of BDA).
2. Build up first layer or course by widening base upstream and downstream of crest to flat height of 6 to 12" above existing water surface, and make sure it holds back water.
   - *a.* If larger key pieces (i.e., larger logs, cobble or small boulders) are locally abundant, these can be used to lay out the crest position across the channel. Optionally, they can be 'keyed' in by excavating a small trench (no need to be deeper than ~1/3 of the height of key piece diameter) and place key pieces in and pack with excavated material.
   - *b.* Lay out first layer of larger fill material, being careful not to go to higher than 6" to 12" above existing water surface. The first layer should be just high enough to backwater a flat water surface behind it.
   - *c.* Using mud, bed material & turf (typically sourced from backwater area of pond) as fine fill material to plug up leaks, combine with sticks and branches of various sizes to build a wide base. Make sure base is wide enough to accommodate anticipated dam height (most dams will have a 1.5:1 to 3:1 (horizontal : vertical) proportions.
   - *d.* Build up first layer only to top of key pieces from first layer. Make sure the crest is level across the channel and water is pooling to this temporary crest elevation.

continued >>

3. Build up subsequent layer(s) in 6" to 12" lifts, packing well with fine fill material until ponding water to its next temporary crest elevation.
4. Repeat step 3 as many times as necessary to build up to design crest elevation.
5. Work a overflow mattress (laying branches parallel to flow) into dam on downstream side and build to provide energy dissipation to overtopping flows.
6. If desired, and time permits, attempt to plug up BDA with mud and organic material (small sticks and turf) to flood pond to crest elevation. Optionally, you can leave this for maintenance by beaver or for infilling with leaves, woody debris and sediment.

A permeable, channel-spanning structure with a constant crest elevation constructed with a mixture of woody debris and fill material to mimic a natural beaver dam and create ponding of water. BDA'S will be installed in the stream bed by scouring the channel using hand-tools and buckets to build subsequent layers of substrate between 6"-12" into the BDA formation. Fine woody debris and additional sediment will be woven by hand between and on top of layers. BDA installations are "post-assisted," and 4-25 treated wooden posts will be inserted into the stream bed using a hand-held pneumatic post-pounder. Depth of disturbance will be variable depending on location of structure, design, and woody materials characteristics, usually less than 2 feet of sediment will be moved to form layers of BDA. Post-assisted BDA structures will cause ground disturbance of 2-3 feet (posts into stream bed).

Posts will be cut at <18" above the channel invert or at <1' drops, all posts will be cut horizontally to the same elevation. Equipment to be used includes chainsaws, hand-held pneumatic post-pounder, sledgehammers, handsaws, shovels, drills, and buckets. An ATV will be used for staging materials, equipment, and crew on site with access provided by a WDFW access trail adjacent to the stream.

Material for BDA structures will consist of assorted cobbles and sediments, will be sourced from the streambed and floodplain within 10 yards of the BDA location, will be excavated using hand tools, and placed by hand in the stream in a way which promotes ponding within low-flow channels in the floodplain. The structures will be varied in size based on their locations and beneficial effects, but the amount of fill used in all BDA structures will be less than 0.25 cubic yards per structure, (less than 3.0 cubic yards total for all structures), of woody debris, rocks, gravel and sediments, and will directly impact less than 1,500 sq. ft of the waterbody.

12/15/2023
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Asotin County CONSERVATION DISTRICT

Kelly Creek Project Area 45

Asotin County, WA

Asotin County Conservation District

PALS & BDAs

Design Specifications

NOTES

- The temptation is always to build up (in height) quickly without making sure each layer is holding back water well and is stable. A better dam results in building up to the design crest elevation slowly.
- Overall dam height is best not to exceed the height of the people constructing it.
- It is easier to build in systems that already have a perennial water source and flowing water, as you can see instantly how well your structure backs up water. It is possible to build in intermittent channels or areas you expect to receive water in the future, but you will not immediately mimic a beaver pond in such situations.
- Much of the 'strength' of the dam comes from the messy carbon fiber matrix you are building with a mix of size and type of materials combined. Similar to concrete, the cement by itself is not strong, but the aggregate and/or reinforcing rebar is what gives the structure its strength.
- Resist the temptation to overbuild the BDA.
- A BDA that 'breaches' or 'blows out', just like natural beaver dams do, is not a 'failure' if designed to accommodate such a response. Often, BDAs that blow out or breach provide improved and more complex habitat.
- If upstream fish passage is a concern, consider building features that make for flow variability that facilitate typical pathways through, over and around natural beaver dams. These can include ensuring overflow side channels that act as fish ladders, sloppier mattresses with micro pools, more branches in the mattress laid parallel to the flow, decreasing head drop for crest elevation of large dams, by building secondary dam(s) downstream that backwater up to base, leaving some porous pathways through dam for fish (and water) to get through.
- Design life: < 1 year (note actual life may last many years or even decades).

OPTIONS, CONSIDERATIONS & VARIATIONS

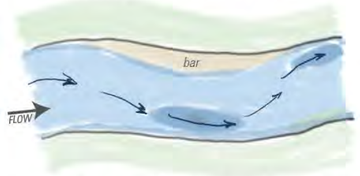
- For **Step 2a**, it is not necessary to build with larger key pieces. Often building with a mix of smaller woody material and fine fill material is stronger. If woody key pieces are used, consider limbing (cut off branches) on side in contact with bed.
- For **Step 2b**, if key pieces are limbed on the side that is in contact with bed, the branches removed from the other side can be used to help weave and wedge material in subsequent layers in. If this is done, make sure that limbs are trimmed at completion to design crest elevation.
- Just like natural beaver dams, there are a huge number of variations in the woody fill material and fine fill material. In some riverscapes that lack woody riparian vegetation, or nearby woody material, beaver build very strong beaver dams out of nothing more than fine fill material.

- If building a 'primary' dam (larger dam that tends to be deep enough to support an underwater entrance to a beaver lodge, consider backwater inundation extents relative to good bank-lodging opportunities (e.g., overhanging banks, vegetation and cover from predation).
- If building multiple dams (typically secondary) in series, the dams within a complex tend to be positioned (spacing downstream) and built to heights that support flatwater from the crest of the downstream dam all the way upstream to the base of the next dam upstream *(see page 22)*.

DAM CREST ORIENTATIONS

UNDAMMED REACH

At low flows, and in the absence of dams, flow paths within the bankfull channel follow the thalweg and are shunted by bars.

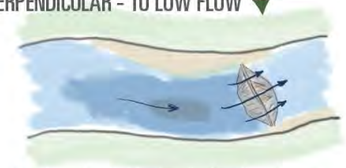


Since dams are built to a constant crest elevation, they essentially are a contour. Water flows perpendicular to the contour and over the dam crest, when the dam is maintained and/or intact.

PERPENDICULAR - STRAIGHT ✔

When dam crests span the bankfull channel, but are lower elevation than the adjacent floodplain, low flows are contained within the channel. Perpendicular orientations will back water up, and alter the flow paths to that of bankfull flows.

PERPENDICULAR - TO LOW FLOW ✔



Smaller dams that just backup the low-flow channels often have an orientation perpendicular to the low flow, but at an angle to the bankfull flow patterns.

CONVEX DOWNSTREAM ✔

Beaver dams are sometimes curved in a convex downstream orientation across the channel, which creates divergent flow paths over the dam. This flow pattern is effective at dissipating energy.

PERPENDICULAR-STRAIGHT ✔ ANGLED-STRAIGHT ✔

When dam crests are higher than bankfull and extend out onto floodplains,they can direct overflow onto those floodplains. However, a perpendicular, straight dam will direct most flow straight downstream. By contrast an angled dam will direct flow to one side of the channel (however the head drop tends to dissipate most of the flow energy).

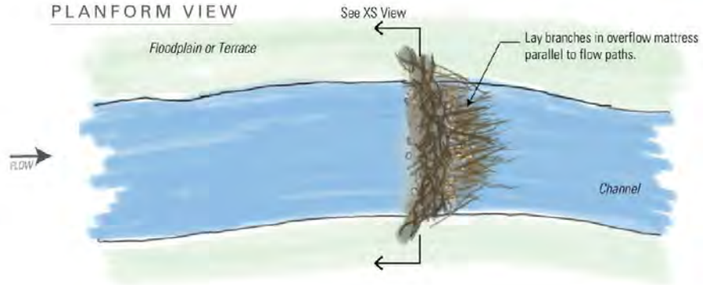
CONCAVE DOWNSTREAM ✖

Beavers rarely build dams like Hoover Dam (and Hoover was not designed to withstand spill over the top). Concave downstream crests concentrate flow at the base of the dam, scouring out a deep pool, but also potentially undermining the dam integrity.

POSTLESS BDA

- BDAs are built to initially mimic a natural beaver dam (i.e., backwater upstream, such that a pond is created), but most BDAs are intended to promote beaver dam activity at some point thereafter.
- Many of the benefits of natural beaver dams, come from their ephemeral nature, and whether dams are actively maintained, blown-out, breached, filled in and/or abandoned.
- Postless BDA design are inspired by how beavers build dams; without fence posts, a hydraulic post pounder or heavy equipment. Like natural beaver dams, the postless BDA is appropriate in areas that can already support beaver dams.

PLANFORM VIEW



CROSS SECTION VIEW

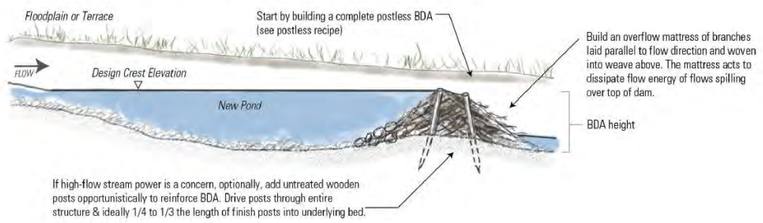
NOTE
The crest elevation is a critical consideration. In general, primary dams are taller than secondary dams, and usually wider (either extending onto bars, inset benches or floodplains, as to lower unit stream power). Secondary dams tend to just be tall enough to back-water up to the base of the next upstream dam. Secndary dams can be built higher to lower the head (elevation) drop of an upstream dam.

PROFILE VIEW

POST-ASSISTED BDA

- Posts can provide some temporary anchoring and stability to help with initial dam stability during high flows in systems with flashier flow regimes or that produce larger magnitude floods.
- For situations where additional support during high flows is deemed necessary, our suggested practice is to start out following the instructions to build a postless BDA, and then simply add posts as extra reinforcement after the fact.

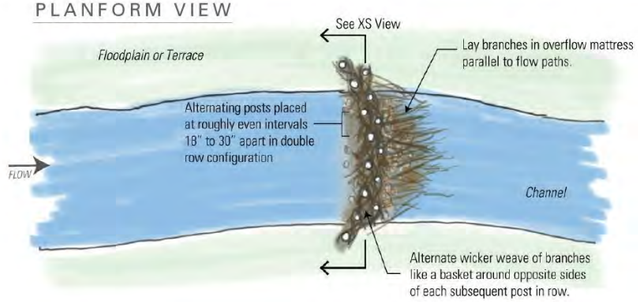
PROFILE VIEW WITH POSTS



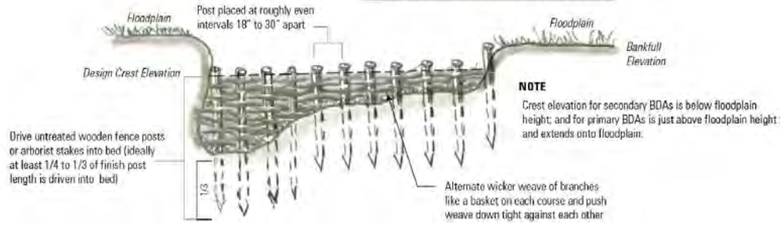
POST-LINE WICKER WEAVE

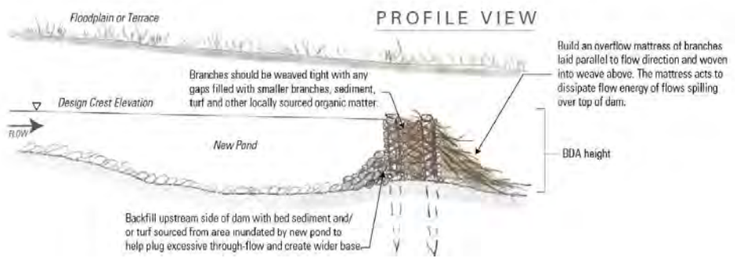
- BDAs can be constructed using post-line wicker weaves, to initially mimic beaver dam activity and later promote it.
- Posts used to layout a crestline, and long branches are woven between the posts to provide most of the structure.
- Post-line wicker weaves have been used for at least 150 years as instream structures, but have most often been used in check-dam or weir designs, which have higher crest elevations along the banks, and concentrate flow over the middle of the structure. By contrast, post-line wicker weave BDAs have a constant crest elevation as to not concentrate flow at any point.

PLANFORM VIEW



CROSS SECTION VIEW





POST-ASSISTED LOG STRUCTURES

HOW TO BUILD PALS

1. Decide location of PALS, configuration (e.g., orientation and type of PALS) as part of the design of a complex of structures (multiple structures working together).
2. Position larger logs on the base of the structure to make the general shape of structure.
3. Limb branches from one side of the logs so that much of the log comes in contact with the bed to increase interaction between the flow and the structure, even at low flows.
4. Pin large pieces in place with posts; drive posts at angles and downstream to help hold wood in place at high flows.
5. Add more logs, and pack and wedge smaller material to fill spaces in the structure.
6. Build up the structure to desired crest elevation, but crest elevation need not be uniform.

OPTIONS & CONSIDERATIONS

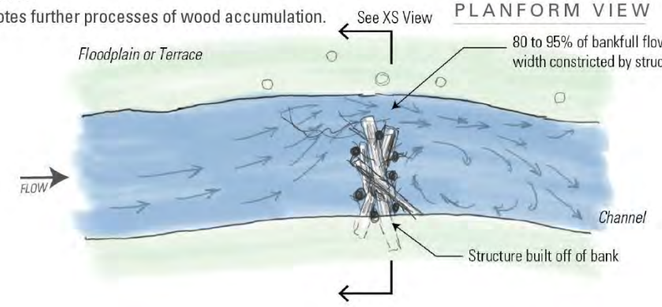
- Consider how much hydraulic purchase (interaction with flow) you want the structure to have and what flows (e.g., baseflows, typical floods, rare floods) it should engage with.
- Build PALS with irregular shapes and branches and small debris sticking out in multiple directions (i.e., make a mess).
- For PALS where flow over the top is anticipated, consider constructing a mattress of woody material on downstream side to dissipate pour over flow energy over-top of structure. Alternatively, if the intention is to encourage formation of a plunge pool, maybe build mattress incompletely, or not at all.
- When building bank-attached and channel-spanning PALS, extend the structures onto the floodplain by wedging structure material into existing vegetation, trunks, roots or boulders on the floodplain.Build bank-attached PALS with a broader base (streamwise) where the structure attaches to the bank, to better shunt flows to the opposite bank
- Locate bank-attached PALS across from hard features like boulders or roots to force a scour pool.
- Build a broad base (streamwise) for channel-spanning structures relative to channel width so that the structure is not narrow and "wall like". Use multiple lines of offset posts to build it wide.
- Build mid-channel PALS with large and wide logs perpendicular to the flow on the upstream end of the structure to act like a natural root wad.
- In general, the larger the structure relative to the channel width (i.e., constriction width), the larger effect it will have on hydraulics, and subsequently geomorphic change during high flows.
- Not all woody structures need to have posts (i.e., ALS – assisted log structures). Large cobble and boulders, or wedging key pieces between existing trees, roots, can all serve the 'temporary pinning' function of posts if available.

BANK-ATTACHED PALS

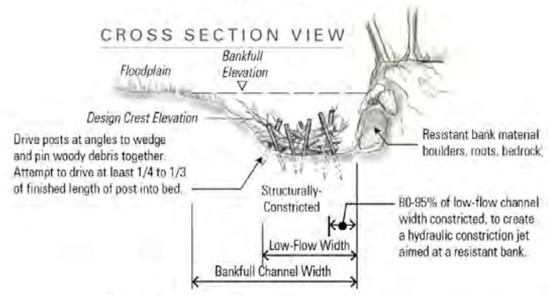
VARIATION 1: TO FORCE A CONSTRICTION JET

- Creates convergent jet of flow between bank- or margin-attached structure and a resistant feature (e.g., bedrock bank, roots, wood) on opposite bank.
- Forces more variable hydraulics, which typically create a backwater eddy upstream of the structure, a large eddy in the wake of the structure, and divergent flow paths where the jet weakens.
- Promotes structurally-forced pool, riffle growth at the divergent jet, and eddy bar formation in the eddies. Upstream deposition stabilizes and grows the structures.
- Promotes further processes of wood accumulation.

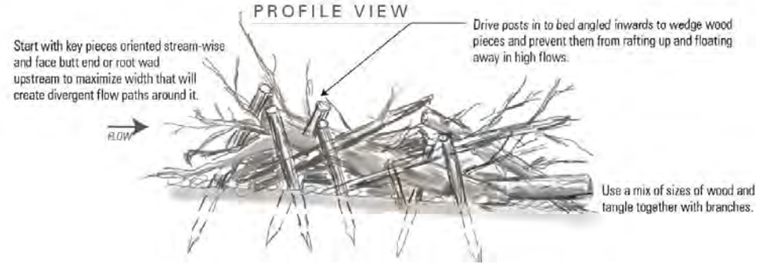
PLANFORM VIEW



CROSS SECTION VIEW



PROFILE VIEW

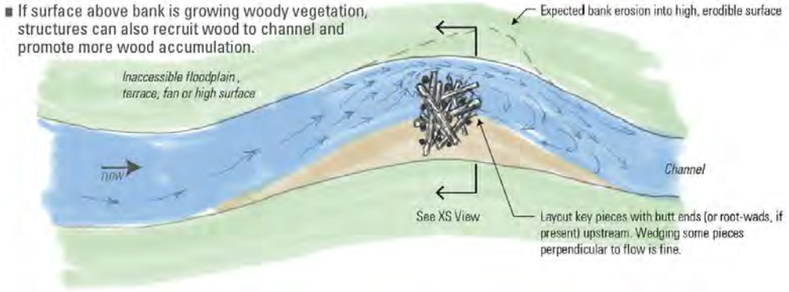


BANK-ATTACHED PALS:

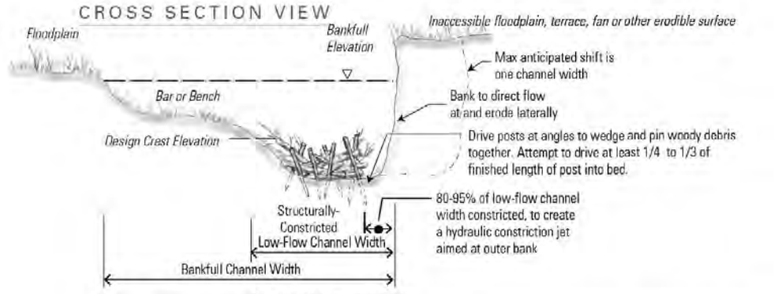
VARIATION 2: BANK BLASTER

- Accelerates lateral widening via bank erosion of an erodible bank opposite of the structure.
- Shunting of flow forces more variable hydraulics, which typically create a backwater eddy upstream of the structure, an eddy downstream of structure, and temporary jet aimed at opposite erodible bank.
- Leads to lateral shift of channel (no more than one channel width typically). Further lateral migration occurs if bar growth continues on inside bend, further natural woody debris accumulates on structure, or subsequent treatment is extended off structure.
- If surface above bank is growing woody vegetation, structures can also recruit wood to channel and promote more wood accumulation.

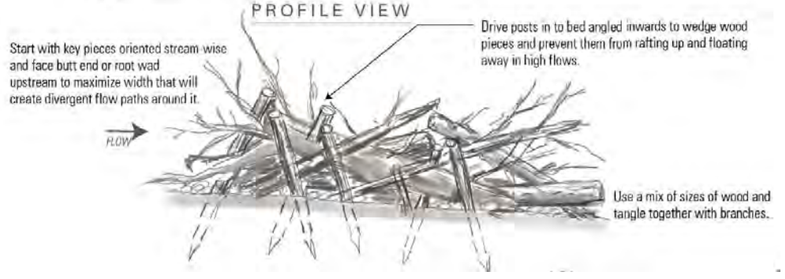
PLANFORM VIEW



CROSS SECTION VIEW



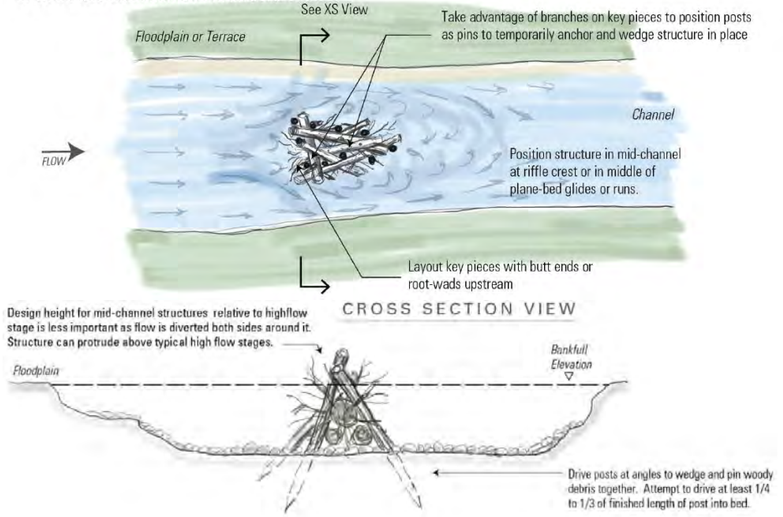
PROFILE VIEW



MID-CHANNEL PALS

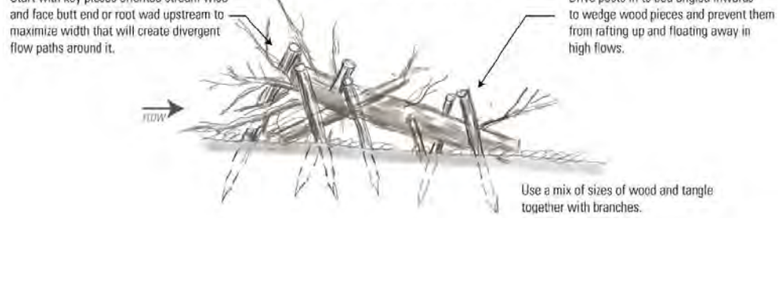
- Installed mid-channel to split flow around the structure.
- Forces more variable hydraulics, which creates an eddy downstream of structure.
- Can promote mid-channel bar development in place of planebed morphologies, encourage or promote diffluences, convert riffles into mid-channel bars and/or to dissipate flow energy.
- In larger channels, multiple mid-channel PALS can be used in close proximity and are often more effective than a single large structure.
- In all cases, the mid-channel PALS can promote the process of wood accumulation on the structure itself.

PLANFORM VIEW



CROSS SECTION VIEW

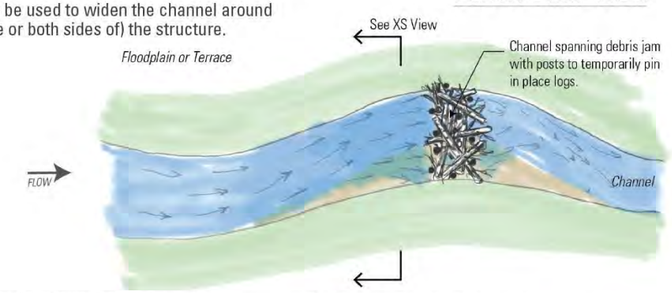
PROFILE VIEW



CHANNEL-SPANNING PALS

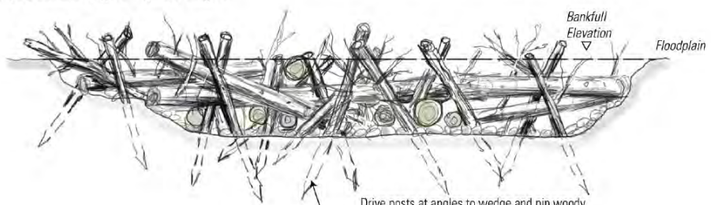
- Bank-attached on both sides, such that even at low-flow there is some hydraulic purchase across most of the channel, acting to back-water flow behind it. Unlike a beaver dam (with a uniform crest elevation), channel-spanning PALS can have a variable crest elevation and rougher finish, and are generally built with much greater porosity.
- Over time, increased water depth and decreased velocity upstream of PALS encourages more wood accumulation, organic accumulation and sediment deposition, all of which can act to stabilize the structure.
- If crest elevations are higher than adjacent floodplain(s), it can increase frequency of floodplain inundation, force new diffluences, and/or promote avulsions.
- Can be used to widen the channel around (one or both sides of) the structure.

PLANFORM VIEW



CROSS SECTION VIEW

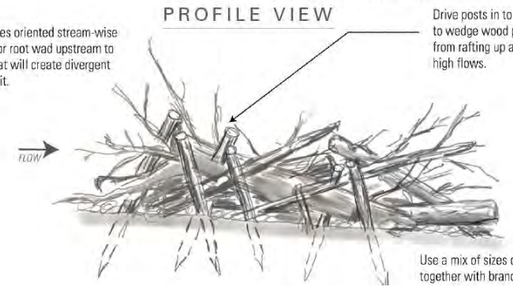
Design height for channel-spanning structures is important. If it is intended Structure can protrude above typical high flow stages.



PROFILE VIEW

Start with key pieces oriented stream-wise and face butt end or root wad upstream to maximize width that will create divergent flow paths around it.

Drive posts in to bed angled inwards to wedge wood pieces and prevent them from rafting up and floating away in high flows.



Use a mix of sizes of wood and tangle together with branches.

TOOLS TYPICALLY USED

- PPE (personal protective equipment): closed-toe work boots, full pants, gloves, hardhat, eye protection and ear protection; optionally: dry suit or waders
- Cutting tools: loppers; optionally: chainsaw, hand saw(s), and pruning shears – for sourcing, trimming and cutting to size woody fill material
- Digging tools: shovel(s); optionally: pick-axe and/or digging bars – for sourcing finer fill material
- Five-gallon buckets: for filling and moving finer fill material from source areas to BDA
- Cam straps (optional): helpful to bundle together branches for easier hauling

POST DRIVER OPTIONS

	Sledge Hammer	Post Driver Manual Powered	Hand Operated Gas Powered	Hand Operated Hydraulic Powered
				
Equipment Cost	$	$	$$	$$$
Operator Expertise	Unskilled	Unskilled	Moderate	Moderate
Ease of Deployment	Easy	Easy	Easy	Moderate
Max Diameter of Post	0.5 - 2"	0.5 to 2.5"	1" to 2.5"	1" to 4"
Effectiveness / Scalability	Low	Low	Moderate	High

POST OPTIONS

Posts are used to provide temporary stability or pins when building many low-tech restoration structures. There are many commercially-available post options (e.g., fence posts), but a premium price is charged for consistency, larger diameter, and straight poles (e.g., peeler cores and lodge pole). Smaller diameter (e.g., 2" to 3") posts and/or tree stakes (1.5" to 2" diameter) are cheaper, and often available from fuels reduction or non-commercially viable slash from timber harvest operations. Since posts are driven into substrate, they need to be pointed at tips. Pointing can be done by supplier or by an experienced chainsaw operator with four cuts.


Pre-tipped fence posts from untreated peeler cores or lodgepole pipe are easy to work with, but more expensive.


Avoid pressure treated so chemicals do not leach into stream.


Rough, limbed logs of variable diameter are fine and often cheaper

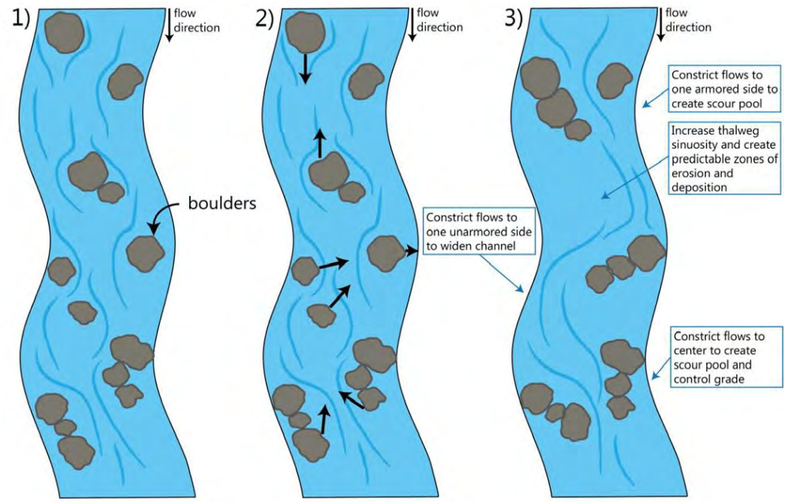

Manually pointed with chainsaw

A huge variety of wood species can be turned into posts. Wood with less commercial value and locally available makes sense!

Boulder Reconfiguration

Boulder reconfiguration is a simple, but labor intensive, method to increase instream channel complexity in high-gradient streams with large substrate. Large boulders in small streams are usually mobilized and naturally configured during large, rare, episodic flood events. Because these types of events are rare, boulders are often left in a random configuration that does not provide optimal hydraulic and geomorphic effects. As more large flood events occur, boulders continue to roll downstream and eventually form predictable configurations that have a greater impact on local hydraulics which lead to positive geomorphic changes. Rather than waiting for large flood events, the boulder reconfiguration method aims to move existing boulders a short distance to form configurations that are commonly observed in intact streams (e.g., ribs, clusters, gardens, berms). Boulders can be moved using a pry bar, come along, grip hoist, winch, or heavy machinery.

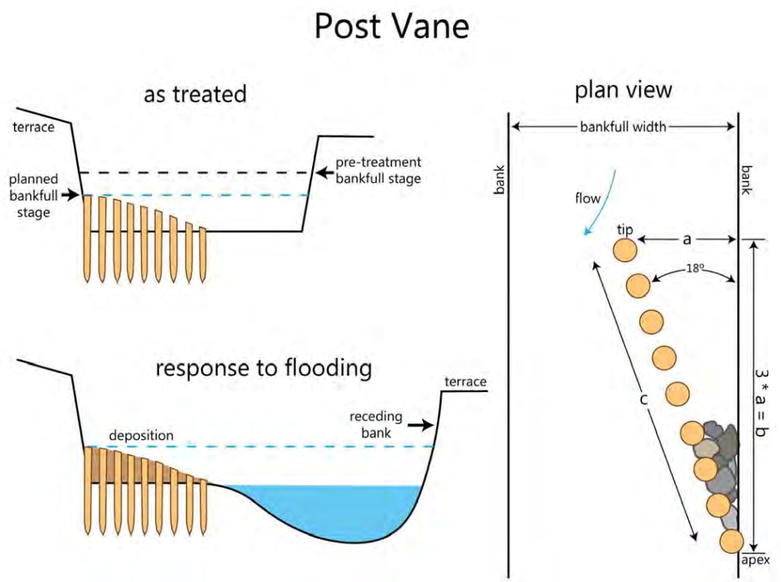
Boulder Reconfiguration



Typical schematic of boulder reconfiguration used to move boulders into formations that result in predictable hydraulic and geomorphic responses.

Post Vanes

Post vanes are similar to PALS, but do not incorporate wood. They are not meant to explicitly mimic a natural feature, rather they create roughness along the streambed to increase variability in the channel cross section. Most often, these are used to induce meandering in structurally starved streams. A line of non-treated wood fence posts is driven into the stream bed at an acute angle of approximately 18 from the stream bank. The height of the post closest to the bank is trimmed to the bankfull elevation that is expected following bank erosion and channel widening. Each subsequent post is trimmed linearly down to the most upstream post which should remain a few inches above the streambed. Cobble is placed at the apex (near the most downstream post) to increase stability and help capture bedload. During flood events, bedload is trapped within the triangle created between the posts and the bank. This increase in the streambed elevation forces flows towards the opposite bank. If the bank is erodible, the channel will widen near the structure, forcing a meander bend and pool. Post vanes should be built in sequence with structures on alternating banks to create a meander pattern.



Typical schematic of a post vane structure used to induce meandering in rocky, high energy streams (from Zeedyk et al. 2009).

ACCD Monitoring and Adaptive Management Plan

1. & 2. Introduction & Responsible Parties Involved

The following monitoring plan will be used by ACCD to assess the effectiveness of low-tech process-based restoration projects. Monitoring will take place for 5 years. Adaptive Management Plan is good for 5 years or until cultural survey has expired (whichever is sooner).

3. Assessment Protocols

	Element	Performance	Monitoring Method	Responsible
1	**Complex function**	Is the Complex achieving the predicted responses?	Annual assessment of complex function.	ACCD
2	**Structure Integrity & Function**	Is the structure intact and achieving the predicted responses?	Annual assessment of structure.	ACCD
3	**Harm to Infrastructure**	Structures should not cause harm to infrastructure.	Annual assessment of damage or potential damage to infrastructure.	ACCD
4	**Harm to riverscape function**	Mimic or promote desired processes.	Annual assessment of damage to riverscape processes.	ACCD
5	**Harm to fish passage**	Structures should maintain fish passage.	Annual assessment of structure function.	ACCD
6	**Increased benefits**	Structure working as intended, modifications will maintain or increase benefit.	Annual assessment of structure function.	ACCD

4. Adaptive Management Triggers

	Element	Triggers	Adaptive Management*
1	**Complex function**	Is the Complex contributing to improving watershed processes? (e.g., sediment sorting and transport, channel development, water routing, vegetation establishment/growth, etc.) If no, the adaptive management is triggered.	Improve existing structures (e.g., add wood, add posts) or build new structures to achieve desired response*.
2	**Structure Integrity & Function**	Is the structure intact and achieving the desired objective OR promoting another desired process? If no, adaptive management is triggered	Improve structure (add wood), relocate structure, or modify function by installing adjacent structures to produce a beneficial function.
3	**Harm to Infrastructure**	Is the structure causing harm to or at risk of causing harm to infrastructure? If yes, adaptive management is triggered.	Remove or modify structure to stop or avoid damage to infrastructure.
4	**Harm to riverscape function**	Is the structure causing harm to riverscape processes? If yes, adaptive management is triggered.	Remove or modify the structure to mimic or promote desired process. (add posts and/or woody debris to achieve desired function.)
5	**Harm to fish passage**	Do structures prevent the passage of fish during spawning season? If yes, adaptive management is triggered. This time frame may be extended as structures allow for year-round flow in streams that typically run dry in the summer.	Remove or modify the structure to allow for passage.
6	**Increased Benefits**	Is this structure functioning as intended? Would modifications to this structure increase or maintain process-based benefits?	Modify the structure to maintain or increase process-based benefits from existing structure (add posts and/or woody debris to achieve desired function.)

***The number of new structures per year will be limited to less than 15% of original design specifications; Modification to existing structures not to exceed 50% of original materials quantities per structure. Adaptive management plan addresses environmental compliance and depends on funding availability.**

5. Assessment Frequency, Timing, and Duration

ACCD will monitor the project annually for 5 years. Results and adaptive measures will be submitted to HIP review team (EC Lead, COR, and Tech Lead) to ensure proposed actions are compliant with original consultation. A PNF shall be submitted annually if any in-water work is to occur.

a. Refer to design report for current site conditions.

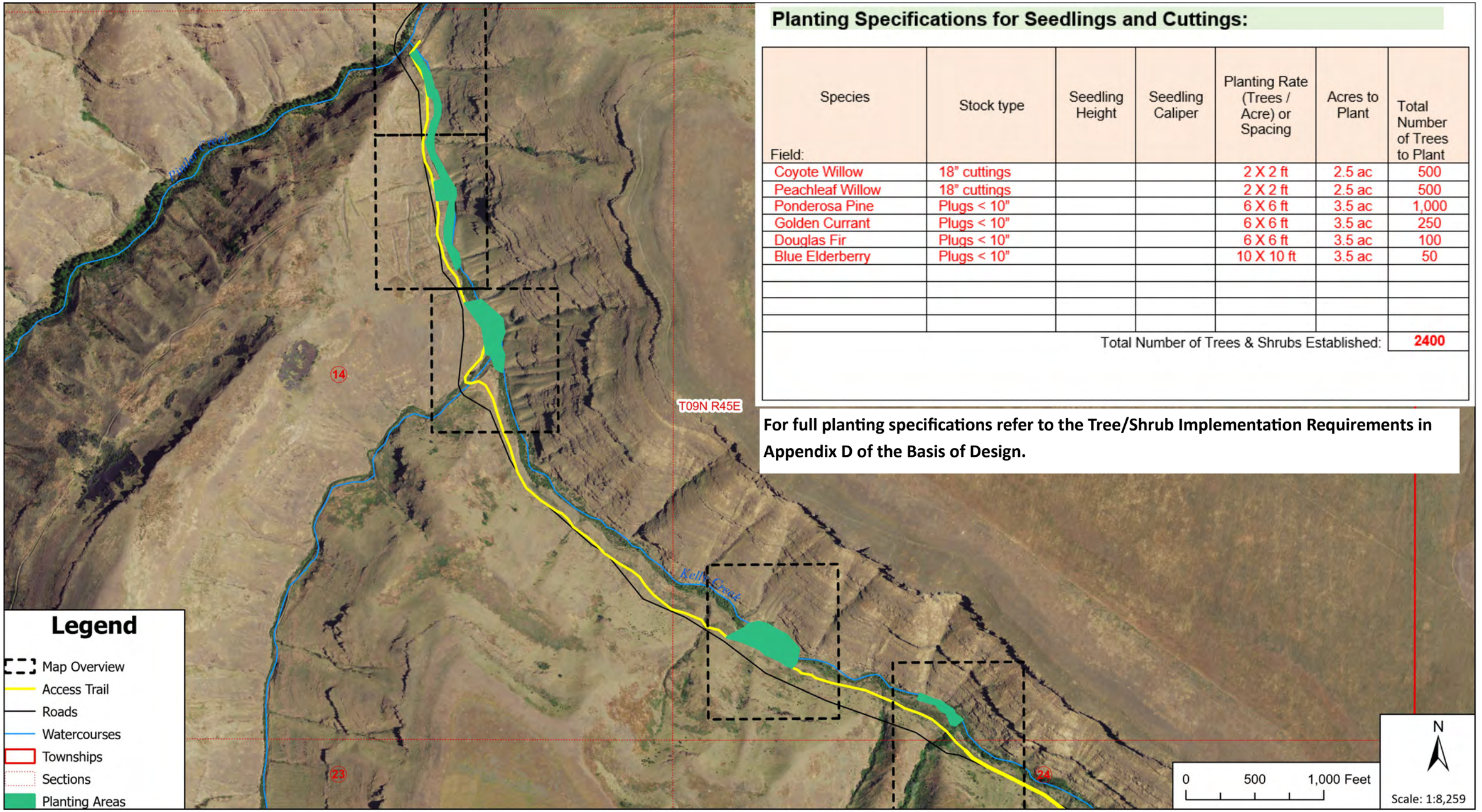
b. The as-built survey will be completed by the project consultant to determine that the design objectives were met. Any deviations from the final plan set will be recorded, rationale provided and circulated to the project stakeholders.

c. Photos of the site and structures look up and downstream for documentation during visual inspection post install.

d. Project site will be monitored to ensure that project actions do not negatively impact fish passage.

6 & 7. Data Storage and Quality Assurance Plan

All photos, field and survey data collected will be stored by ACCD or their contractor. ACCD will be responsible for ensuring that the monitoring plan is followed and that the field observer is adequately trained.



Planting Specifications for Seedlings and Cuttings:

Species Field:	Stock type	Seedling Height	Seedling Caliper	Planting Rate (Trees / Acre) or Spacing	Acres to Plant	Total Number of Trees to Plant
Coyote Willow	18" cuttings			2 X 2 ft	2.5 ac	500
Peachleaf Willow	18" cuttings			2 X 2 ft	2.5 ac	500
Ponderosa Pine	Plugs < 10"			6 X 6 ft	3.5 ac	1,000
Golden Currant	Plugs < 10"			6 X 6 ft	3.5 ac	250
Douglas Fir	Plugs < 10"			6 X 6 ft	3.5 ac	100
Blue Elderberry	Plugs < 10"			10 X 10 ft	3.5 ac	50
				Total Number of Trees & Shrubs Established:		**2400**

For full planting specifications refer to the Tree/Shrub Implementation Requirements in Appendix D of the Basis of Design.

12/15/2023
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Asotin County Conservation District

Kelly Creek Project Area 45

Asotin County, WA

Asotin County Conservation District

Tree/Shrub Establishment

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