GRANDE RONDE MODEL WATERSHED

Watershed Enhancement Project Proposal

1. **Project Name:** Lostine River/Tulley-Hill Fish Passage Improvement

2. **Applicant:** Nez Perce Tribe Department of Fisheries Resource Management, Watershed Division (NPT)

3. **Participating Landowner(s) and Agencies:**

Participant	Contact	Role	Address	Phone	Email
Nez Perce Tribe	Mitch Daniel	Project Manager	PO Box 909 500 N Main St Joseph, OR 97846	541-432-2506	mitchd@nezperce.org
Landowner	Woody Wolfe	Irrigator/ Land Owner	69405 Baker Rd. Wallowa, OR 97885	541-263-0802	woodywolfe@yahoo.com
Landowner	Perry Johnston	Land Owner	81703 E Highway 82 Wallowa, OR 97885	541-886-4365	N/A
GRMW	Coby Menton	GRMW Project Coordinator	1114 J Ave. La Grande, OR 97850	541-398-0151	rcoby@grmw.org
ODFW	Jeff Yanke	Technical	65495 Alder Slope Rd. Enterprise, OR 97828	541-426-3279	Jeff.Yanke@state.or.us

4. **Project Contact(s):**

Contact	Role	Address	Phone	Email
Mitch Daniel	Technical	PO Box 909 500 N Main St Joseph, OR 97846	541-432-2506	mitchd@nezperce.org
Heidi McRoberts	Administrative	28764 Salmon Lane Lapwai, ID 83540	208-621-3548	heidim@nezperce.org
Arlene Henry	Fiscal	PO Box 365 Lapwai, ID 83540	808-843-7317	arleneh@nezperce.org

5. **Project Location:**

Township, Section, Range: T1N, R43E, S29.
Lostine Watershed at Lostine River Mile 1.6.
Longitude, Latitude: -117.470017, 45.533144.
Hydrologic Unit Code: 1706010502.

6. Project Objectives:

Project Element	Specific Objectives	Measure for Evaluation
Grade Control Structures and Rock Ribs	Rock grade control structures used as a method to construct roughened channels are a proven way to restore fish passage where jump height and flow velocity exceed currently applied passage criteria. **Objective 1:** Restore fish passage at the Tulley-Hill diversion and fish ladder such that both State and Federal fish passage criteria are met as currently applied.	Bullets 1, 2 and 3 in the below monitoring plan.
Engineered Riffle with Sinuous Low Flow Channel	Engineered riffles with stream simulation materials provide hydraulic diversity throughout the project reach . Hydraulic diversity creates a condition in which all life stages of fish species can navigate up- and downstream as desired. **Objective 2:** Improve hydraulic complexity and sediment transport throughout the project reach.	Bullets 1, 2 and 5 in the below monitoring plan.
Large Woody Debris Structures	Large woody debris structures will provide resting locations for migrating adults and rearing habitat for juvenile fish. Tree bank logs will be implemented to increase bank stability as well as fish habitat. **Objective 3** Enhance stream habitat characteristics throughout the project reach.	Bullets 1, 2 and 3 in the below monitoring plan.

The Grande Ronde Subbasin Plan Supplement identifies the importance of this project in the following sections for the Lostine River:

1. 5.2.2.1, page 37, GRSBP. Provide connectivity between functioning habitats.
2. 5.2.4.1, page 38, GRSBP. Protect high quality habitat and protect and restore connectivity of functioning habitats.
3. Table 5.4, Wallowa – Lostine River, page 40, GRSBP. Priority attribute sediment (reduction)
4. Table 5.6, page 50, GRSBP. Grande Ronde Subbasin watersheds listed in order of potential impact to steelhead and spring Chinook populations (abundance and productivity) from comprehensive habitat restoration: Wallowa – Lostine is the highest ranked watershed.

The OWEB limiting factors document for the Lostine River in the Grande Ronde Basin rates Habitat Fragmentation/Connectivity/Fish Passage as no impact with a high confidence rating. Data for this assessment was taken from the Ecosystem Diagnosis and Treatment Database (Mobrand and Lestelle, 2004). However, adult Chinook tracking data from the Nez Perce Tribe (OWEB Project #'s 208-5076 & 210-5057) from 2008 to 2012 shows the Tulley-Hill fishway causes some delays in upstream movement of adult Chinook. This empirical data is confirmed by observation from Nez Perce Tribe fisheries biologists.

7. Project Description

Introduction

The Tulley-Hill ditch diversion on the Lostine River in Wallowa County, Oregon is a passage barrier to ESA Listed fish including Chinook salmon (Oncorhynchus tshawytscha), steelhead trout (Oncorhynchus mykiss), bull trout (Salvelinus confluentus), as well as several other aquatic species. The structure does not meet fish passage criteria as currently applied by ODFW and National Marine Fisheries Service - especially at low, late-season, summer flows. The proposed action will convert the existing structure to a roughened channel diversion and fishway restoring access to 29 miles of habitat upstream. Engineering and design for the project is substantiated by the success of similar projects including one recently constructed directly downstream at the City of Lostine diversion. Partners include the Grande Ronde Model Watershed, ODFW, and the Wolfe Ranch.

Existing condition

A total of 11 ditches appropriate water from the Lostine. Several, including Tulley-Hill, have been upgraded to engineered, permanent, fish-passable structures in the mid to late 1990's. Over time and after several fixes it is apparent that each of these installations has a short lifespan, tend to erode from the bottom up compromising structure integrity, and do not meet current fish passage standards as applied.

Located on the Lostine river just 1.6 miles upstream of its confluence with the Wallowa River, the ditch supplies 119 acres with adjudicated water rights established in 1879. It is used during the Wallowa Valley irrigation season, which starts on May 1st and ends on September 30th. An ODFW operated fish screen composed of two paddle wheel operated drums is located below the diversion and in the irrigation ditch.

This diversion site includes a series of steps including rock weirs at the bottom, leading up to two log weirs, the upper most providing the water elevation for the diversion headgate. The structures were installed in 1998 to provide fish passage through the thalweg of the stream through gaps between the logs. Since the installation, considerable scour pools have formed below each step of the weir.

This diversion structure is an upstream velocity barrier to all fish at high flow, juvenile upstream movement at low flows due to jump height, and adult Chinook at low flow during the spawning time of year, again due to jump height. The elevation difference between steps at low flows is greater than 12 inches, which exceeds fish passage criteria. The jump height barrier is exacerbated by dewatering in the later part of the irrigation season. There is also concern as the structure ages that extreme high water events brought on rain on snow events related to climate change could cause catastrophic failure at the diversion. Such an event has the potential to impede upstream migration to the detriment of an already imperiled stock of Chinook salmon and steelhead.

Fish native to the Lostine River include spring Chinook, summer steelhead, rainbow trout, and bull trout as well as other resident species. Design criteria to pass spring Chinook, bull trout, and steelhead are the most stringent and will be used for design purposes. Spring Chinook migrate through the Lostine system to their spawning areas between July and mid-September. Summer steelhead migrate to their spawning areas in late winter and spring. Bull trout are very sparse in the area and mainly forage during winter and early spring. However, bull trout use this reach as a migration corridor to access spawning areas in the upper Lostine River from June through September.

Specific Actions

Project Element	Proposed Action
Restoration Activity	
Mobilization	This action at the beginning of the project is when all equipment is transported to the project area. The staging area is prepared, raw material is delivered and the work site is prepared for construction.
Clearing and Grubbing Project site	For this project clearing and grubbing will be minimally required. As the majority of work will occur in the Lostine River channel riparian vegetation will not need to be removed, the irrigation ditch will be used as the work area water bypass, and an opening exists to return flow from the ditch back to the river channel below the project footprint. Equipment access to the river will need to be installed at approximately mid project. Access will be over an existing culvert in the irrigation ditch and down the riverbank to the project. In 2012 at the City of Lostine diversion we were able to preserve all riparian shrub and canopy vegetation and only minimally disturbed herbaceous vegetation at the work access point. Conditions are the same at the Tulley-Hill diversion. Where necessary, clearing and grubbing will be accomplished with an excavator and spoils will be transported with a dump truck.
Grade Control Structures (8)	Eight grade control structures will be installed in the project area. They will be built with large boulders, span the channel, and have a shallow V-shape pointing upstream. They have been sized to remain stable during expected high flow events. At project completion they will be subsurface features that will maintain channel invert elevation, concentrate expected low flows to the center of the channel, and meet jump height and flow velocity standards for fish passage. Grade control structures will be installed with an excavator and boulder material will be transported for installation with a dump truck.
Engineered Riffle Streambed Mix Large Scale Roughness Boulders (30)	One aspect to consider when working in rivers is sediment transport. Installing large-scale roughness features in the form of boulders will create a hydraulically diverse environment in which sediment transport is anticipated to be maintained. A 2.5 percent sloped engineered riffle complete with streambed simulation material will be used between the grade control structures. This will aid in natural sediment transport through the project reach. Seven pools will be constructed throughout the channel including one large plunge pool at the downstream end of the engineered riffle for increased habitat complexity. Installation will require a variety of equipment including a dump truck, dozer and excavator.
Large Woody Debris Structures Streambed Simulation Material	Eight log cross structures will be placed throughout the channel to provide increased habitat complexity within the engineered riffle. All LWD will be surface placed. Excavation will be required to embed LWD to provide increased structure stability during higher flood flows. Boulders may be placed on LWD to provide added stability.
Site Restoration	Site restoration is expected to be minimal but where necessary will include erosion control seeding of disturbed ground, planting riparian shrubs and trees, grading access routes to natural ground contour and stabilizing the staging area.
Water Control	Water control will be accomplished by diverting the Lostine River flow around the work area in the Tulley-Hill ditch. While the bulk of flow will be passed around the work area subsurface flow will continue to wet the work area. For this reason a sediment sump and 2 silt fences will be installed at the bottom of the work area. This action will help maintain low turbidity and reduce fine sedimentation during construction.

Project Management Activity	
Pre-Implementation	Pre-implementation activities include project coordination by the project manager including landowner and agency coordination, directing engineering support, acquiring funding, aligning environmental compliance requirements of the project, contracting, and reporting. This process can take one to two years depending on the complexity of the project. Specific deliverables include: Design and engineering with the deliverable of final approved design, removal/fill permits from both Oregon DSL and ACOE, ESA Section 7 Consultation, Cultural resources clearance from both Oregon SHPO and Tribes, and a public bidding and award for project construction.
Project Management	Project management is implemented by the project manager with assistance from engineering support. Activities include construction site visits, assessing change orders that may occur, and coordinating with the construction engineer. In-house personnel manage the fiscal aspects of the project including funds payable and receivable, managing grants and filing all aspects of the project.
Complete Final Design and Specification.	Winter 2016.
Apply for Additional Funding	GRMW will apply for OWEB funding in October of 2016. If awarded OWEB grant, funding available April 2017.
Acquire all Permits	Army Corp of Engineers 404 permit: Letter of Exemption in progress OR DSL: Removal/Fill Joint application in progress Consultation: HIP III programmatic in progress Cultural Resources: Survey Complete, Submitted to BPA All Environmental Compliance C complete Spring 2017
Advertise for Construction Bids and Select Contractor	Spring 2017 Contract will be awarded to lowest qualified bidder. Qualifications will be based on experience, insurance, bonding and responsiveness to bid solicitation.
Implement Restoration Project	Summer 2017. All construction work will be inspected by AP engineer for adherence to project design, appropriateness of materials, and quality of construction.
Final Construction and Close Out Project.	Fall 2017. Complete construction, site cleanup, demobilization and final project close out and payment. Upon final inspection a 1-year warranty period begins.

A scoring matrix was developed by the design engineer, Tetra Tech, to evaluate the proposed fish passage and habitat design alternatives. Each evaluation criterion in the matrix was assigned a numerical score representing its overall value for the project. The evaluation criteria, which were developed to align with the project goal and objectives, included instream habitat benefit (cover for fish), ability to address limiting factors (fish passage, degraded floodplain connectivity, degraded channel complexity, degraded riparian areas and LWD recruitment, etc.), scale (length of project, extent of floodplain work, longitudinal benefits, connectivity), social perception (landowner acceptance, agency approval), disturbance (construction footprint), landowner protection (influence of stream mechanics on landowner property), long-term maintenance, and cost benefit.

Based on scoring matrix results, along with costs estimates and NPT and stakeholder input, Alternative B – Engineered Riffle with Sinuous Low Flow was selected as the preferred alternative to achieve the project goals and objectives and was advanced to the preliminary (60 percent) design stage.

A map is provided in Attachment 1.

Benefits

The Nez Perce people's relationship with the landscape and the species that inhabit our aquatic ecosystems is well documented. The Tribe's Department of Fisheries Resource Management Watershed Division mission is to protect and restore aquatic ecosystems throughout Nez Perce Country, including Wallowa County and the Lostine River. This commitment has been recently renewed with staff living and working in this project area. The Tulley-Hill diversion fish passage project is an excellent opportunity to establish a strong working relationship with the Grande Ronde Model Watershed, cooperating agencies, the ditch companies and landowners. Working in cooperation with stakeholders for positive change from *all* perspectives will promote ongoing success.

In particular, this project would eliminate a seasonal fish passage barrier by replacing an aging and substandard fish ladder on the Lostine River in Wallowa County, Oregon. The existing diversion is a fish passage barrier to migrating and spawning adult Chinook salmon during the latter part of the summer when flows are at their lowest. Steelhead also inhabit the Lostine River and its tributaries and improving aquatic passage in the Lostine will improve conditions for all life stages of steelhead, specifically juvenile rearing allowing them to move upstream as stream temperatures warm in the summer months. The resulting restoration project will improve anadromous fish passage to 29 miles of the Lostine River upstream of the diversion structure and fish ladder.

Project Maintenance

Name of Person & Agency/Organization and Addresses	Telephone Number Email Address	What will be done and for how long?
Woody Wolfe, Primary Irrigator	541-263-0802 woodywolfe@yahoo.com	Irrigation ditch, headgate, and diversion maintenance. 10-years minimum.
Mitch Daniel, Nez Perce Tribe	541-432-2506 mitchd@nezperce.org	Implementation and status reporting as per terms in BPA contract. Adaptive management and maintenance of project as needed and as funds are available.
Coby Menton, GRMW	541.398.0151 rcoby@grmw.org	Implementation and status reporting as per terms in OWEB contract. Adaptive management and maintenance of project as needed and as funds are available.

Permits

Project Activity Requiring a Permit/License	Permit or License Name	Entity Issuing Permit or License
Modify diversion and fish ladder and install roughened channel	ACOE 404 permit (Exemption letter in progress)	Army Core of Engineers
Modify diversion and fish ladder and install roughened channel	Oregon DSL removal/fill permit	Oregon Department of State Lands
Modify diversion and fish ladder and install roughened channel	ESA Section 7 Consultation for Chinook Salmon and steelhead	National Marine Fisheries Service
Modify diversion and fish ladder and install roughened channel	ESA Section 7 Consultation for bulltrout	US Fish and Wildlife Service
All ground disturbing activities	Cultural Resources Consultation and Clearance	Oregon State Historic Preservation Office and Tribal Historic Preservation Offices (NPT and CTUIR)

Monitoring Plan

Bonneville Power Administration is implementing an effort in the Columbia River Basin to assess restoration action effectiveness. This monitoring effort known as AEM is intended to quantify habitat

restoration benefits for a multitude of habitat improvement actions. The Tulley-Hill project has been chosen as a monitoring site to help assess effectiveness of partial barrier projects. The monitoring protocol is CHaMP, developed using a combination of existing protocols, is repeatable and easily implemented by diverse field crews. For the Tulley-Hill project a modified BACI (before after control impact) program is being used, relies on longitudinal profiles, cross sections, and juvenile fish sampling above and below the project site. A control reach has been established above the project area and the CHaMP trained Nez Perce Tribe monitoring crew is implementing the protocol. The monitoring plan is as follows:

1. Channel cross sections have been installed in the action and control reaches to assess channel development over time. Cross section measurements will occur twice pre project and twice post project including both the action and control reaches. CHaMP's protocol.
2. Habitat conditions will be measured using longitudinal profile surveys (thalweg profile from top to bottom) in both the action and control reaches. The longitudinal profile measurements will occur twice pre project and twice post project including both the action and control reaches. CHaMP's protocol.
3. Juvenile fish populations will be sampled twice pre-project and twice post project in both the action and control reaches. CHaMP's protocol.
4. Annual redd surveys will be completed for Chinook as part of the annual Chinook salmon spawning survey on the Lostine River.
5. Baseline photo points have been established throughout the project area. Additional photo points will be established at each cross-section where photos will be replicated annually looking both up-stream and down-stream of the cross-sections.

As the CHaMP data becomes available it will be supplied to partners and funding sources in the completion and monitoring reports. A final write up with results and conclusions will be included in the final monitoring report.

Work Dates

Project Elements	Start Date	End Date	Description
Obtain 30% design	March, 2016	April, 2016	30% design and project clarity appropriate for construction funding applications.
Obtain final design	September 2016	October 2017	Final design complete with quantities and construction specification.
Permit Applications	Fall 2016	March 2017	ACOE and Oregon DSL removal/fill permits, Cultural Resources Clearance, and ESA Section 7 consultation documents.
Bid Solicitation	Spring of 2017.	Spring of 2017.	Solicit for construction contractor through public bid process, conduct site bid tour, and award contract to lowest qualified bidder.
Contracting	Variable depending on implementation year. Spring 2017.	Variable depending on implementation year. Spring 2017.	Finalize all necessary insurance, bonding, and contractual obligations between NPT and selected contractor.
Materials Acquisition and Mobilization	May 2017.	July 15, 2017.	Allow mobilization to project site for materials staging, prep work, and necessary out of stream work.
Construction	July 15, 2017.	August 15, 2017.	For this section of the Lostine River the in-water work window is from July 15 – August 15. Extensions are possible depending upon flow conditions and Chinook migration timing. For scheduling purposes this 30-day window is considered the time in-water work will occur.
Demobilization	August 15, 2017.	September 2017.	Final construction cleanup, grounds restoration, and demobilization.
Project Inspection/Post Project Implementation Review	September 1, 2017.	September 30, 2017.	Final project walk through and inspection engineer sign off. Prep final invoice, make payment, and release construction contractor.
Project Completion	October 1, 2012017.	November 30, 2017.	Project closeout, final accounting, and completion report.
Project Maintenance	October 1, 2017.	Indefinite	Cooperatively addressed by the Tulley-Hill Ditch Company, NPT, GRMW and ODFW as needed and funding is available.

8. Project Budget

Tulley Hill Fish Passage Project Budget

Totals automatically round to the nearest dollar

A	B	C	D	E	F	G
	Unit Number	**Unit Cost**	**OWEB Funds**	**BPA Funds**	**In-Kind Match**	**Total Costs**
	(e.g., # of hours)	(e.g., hourly rate)		-		(add columns D, E, F)
SALARIES, WAGES AND BENEFITS. List position titles, include only costs of employees charged to this grant.						
NPT Project Leader (pre-implementation)	80 hours	45		-	3,600	3,600
NPT Projec Leader (project management)	45 hours	45		-	2,025	2,025
NPT Restoration Spec. (pre-implementation)	20 hours	45		-	900	900
NPT Restoration Spec. (project management)	20 hours	45		-	900	900
NPT Office Manager	20 hours	45		-	900	900
NPT Grants Office and Signatures	10 hours	45		-	450	450
GRMW Project Coordinator (pre-implementation)	80 hours	45		-	3,600	3,600
GRMW Project Coordinator (project management)	45 hours	45		-	2,025	2,025
GRMW Executive Director (pre-implementation)	20 hours	45		-	900	900
GRMW Executive Director (project management)	20 hours	45		-	900	900
SUBTOTAL (1)			0	0	16,200	16,200

CONTRACTED SERVICES. Labor, supplies, and materials to be provided by *non-staff* for project implementation.						
Preperation				-		
Mobilization and Demobiliztion (10% of Project Cost)	1 Lump Sum	21962	21962	-		21,962
Clearing and Grubbing	0.5 Acres	800	400	-		400
Removal of Structure and Obstructions	1 Lump Sum	5000	5,000	-		5,000
Earthwork				-		
Excavation and Grade Control	75 Cubic Yards	8	600	-		600
Excavation - Plunge Pool	180 Cubic Yards	8	1,440	-		1,440
Excavation - Bypass Channel	2110 Cubic Yards	8	16,880	-		16,880
Grade Control Stuctures	112 Hours	180	20,160	-		20,160
Rock	480 Each	75	36,000	-		36,000
Riffle Boulder Placement	50 Hours	180	9,000	-		9,000
Rock	250 Each	20	5,000	-		5,000
Enginneered Riffle Streambed Mix	80 hours	180		47,630		47,630
Rock	866 Cubic Yards	55		14,400		14,400
Large Woody Debris Stuctures				0		0
Log Cross Type 1 and 2	7 Hours	180		1,260		
Logs	14 Each	300		4200		4,200
Log cross Type 2	1.5 Hours	180		270		270
Logs	3 Each	300		900		900
Tree bank Logs	3.5 Hours	180		630		630
Logs	7 Each	300		2,100		2,100
Erosion Control and Planting						
Fuel containment, Equuipment and mMaterial Storage, Haul Road Maintenance	1 Lump Sum	7500		7,500		7,500
Temporary Erosion and Sediment Control sSilt Fence, pumps, turbidity control))	1 Lump Sum	10000		10,000		10,000
Riparian Planting (natve seeds and hardwoods)	0.5 Acres	2500		1,250		1,250
Other Items						0
Stream Dewatering, Bypass and Coffer Dams	1 Lump Sum	30000		30,000		30,000
Project Cleanup & Repairs	2 Lump Sum	5000		5,000		5,000
Construction Engineering						
Construction Survey and Layout	20 hours	100	2,000			2,000
Construction Inspection	84 hours	100	8,400			8,400
Invoice Review	8 hours	100	800			800
Final Walk Through and Contractor Release	8 hours	100	800			800
Contingency	1 Lump Sum	50000	25,000	25000		50,000
SUBTOTAL (2)			153,442	150,140	0	302,322

TRAVEL. Mileage, per diem, lodging, etc. Must use current State of Oregon rates.						
NPT travel to project site (10 times at 36 miles)	360 miles	0.575		-	207	207
GRMW travel to project site (10 times at 30 miles)	300 miles	0.575		-	173	173
SUBTOTAL (3)			0	0	380	380
MATERIALS/SUPPLIES. Refers to items that are "used up" in the course of the project. Costs must be directly related to the implementation of this grant.						
				-		0
SUBTOTAL (4)			0	0	0	0
EQUIPMENT/SOFTWARE. List portable equipment costing **$300** or more per unit.						
				-		0
SUBTOTAL (5)			0	0	0	0
OTHER. Costs must be necessary and reasonable for successful completion of this grant.						
				-		0
SUBTOTAL (6)			0	0	0	0
[Add all subtotals, (1-6) above] CATEGORY TOTALS (7)			153,442	150,140	16,580	318,902
				-		
GRANT ADMINISTRATION.						
10% of Category Totals			15,344	-		
SUBTOTAL (8)			15,344	0	0	334,246
POST-GRANT.						
Completion Reports	40 Hrs	45		-	1,800	1,800
Monitoring Reports (2)	120 Hrs	45		-	5,400	5,400
SUBTOTAL (9)			0	0	7,200	7,200
RESTORATION BUDGET TOTAL **Totals automatically round to the nearest dollar**						
RESTORATION BUDGET TOTAL (10) [Add Category Totals (7), Subtotals (8) and (9)]			168,786	150,140	23,780	341,446

9. Attachments

1. **Maps: Location and Vicinity Maps for Tulley Hill Diversion**
2. **Photos: Tulley Hill Diversion in its current status**
3. **Design: Tetra Tech's 60% Design**

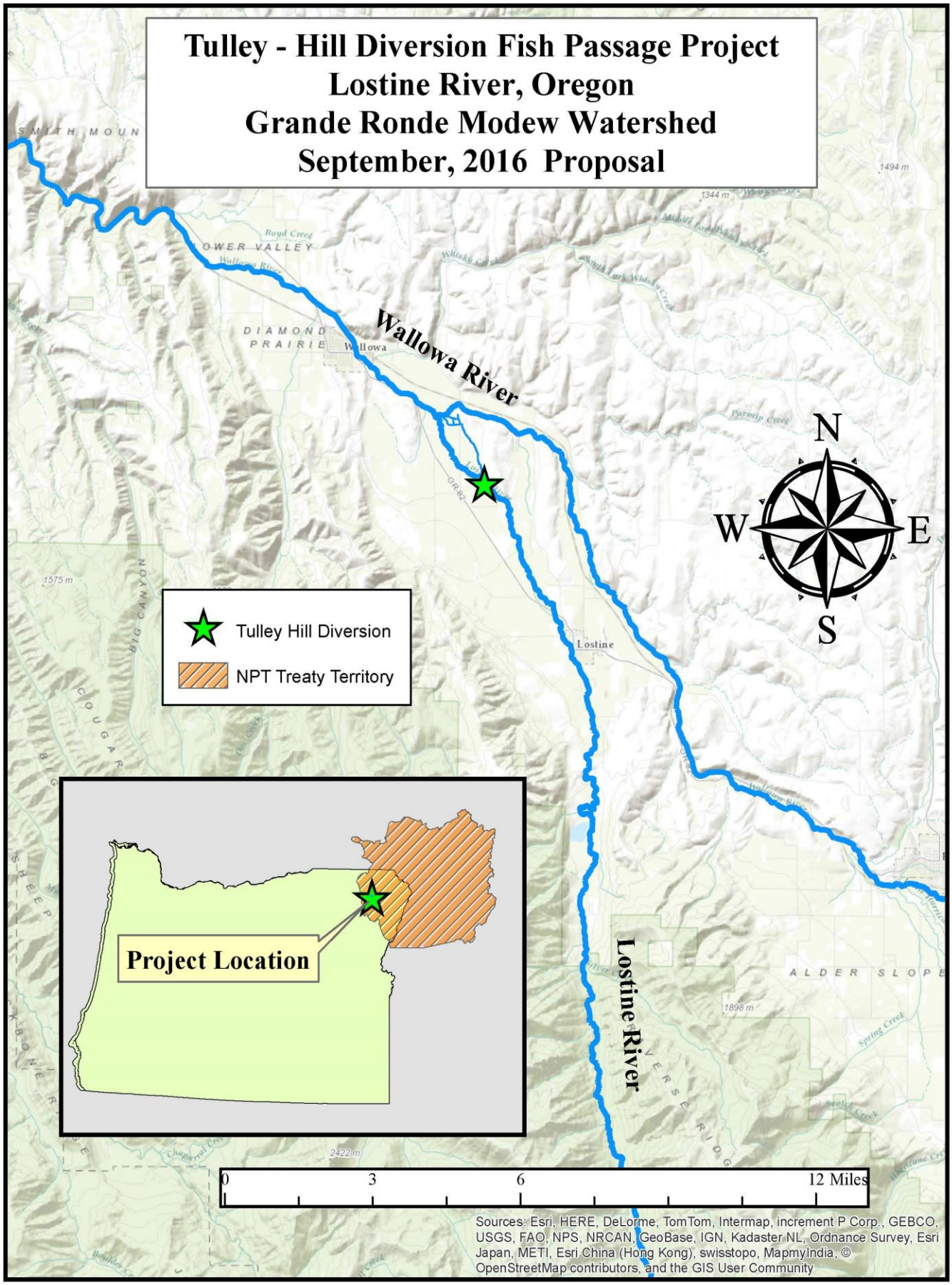
Tulley - Hill Diversion Fish Passage Project
Lostine River, Oregon
Grande Ronde Modew Watershed
September, 2016 Proposal
Wallowa River
Lostine River
Lostine
Wallowa
DIAMOND PRAIRIE
ALDER SLOPE
N
W
E
S
Tulley Hill Diversion
NPT Treaty Territory
Project Location
0
3
6
12 Miles
Sources: Esri, HERE, DeLorme, TomTom, Intermap, increment P Corp., GEBCO, USGS, FAO, NPS, NRCAN, GeoBase, IGN, Kadaster NL, Ordnance Survey, Esri Japan, METI, Esri China (Hong Kong), swisstopo, MapmyIndia, © OpenStreetMap contributors, and the GIS User Community

Photo 1: This photo was taken upstream of the second log weir just below the Tulley-Hill irrigation ditch diversion on the Lostine River, Wallowa County, OR. The photo was taken in late summer during low flow conditions on August 17, 2012. This is one of several rock and log weir structures that, at low flows, create jump height barriers to both upstream migrating juvenile fish, as well as adult Chinook migrating upstream to spawn.

Photo 1: This photo was taken during the late fall downstream of all three step structures, below the Tulley-Hill irrigation diversion. The three barriers featured here include one rock weir (furthest downstream) and two log weirs. Fish passage issues arise over these structures at various flows, functioning as velocity barriers during high flows and jump height barriers during low flows.