Appendix F
Alternative Construction Method

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OWENS RIVER WATER TRAIL

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Introduction

The Owens River Water Trail (ORWT or project) would require clearing of aquatic vegetation (tules and cattail) and excavation of sediment along an approximately 6.3-mile section of the Lower Owens River to allow for recreational navigation. Maintenance of the project may also include periodic vegetation clearing and/or dredging beyond initial construction. The purpose of this memorandum is to describe an alternative scenario for construction and maintenance of the in-channel component of the ORWT to be considered by the County. Construction of the launch and take-out facilities are anticipated to use typical construction equipment, while construction of the navigable waterway will require specialized equipment and approaches. This memorandum documents two possible sets of equipment and methodologies that could achieve the objectives of the ORWT.

To inform our understanding of the environmental impacts of specialized construction equipment and construction approaches, ESA retained the services of a general contracting firm with experience in the Eastern Sierra and Owens River valley. Scott English of Northwest Biological Consultants (NBC) was retained to provide the following input:

1. Provide general comment on the proposed Project construction approach,
2. Describe and outline an alternative construction approach for consideration by the County (Alternative),
3. Provide specific examples of equipment suitable for use in the Project and Alternative, and
4. Provide planning level cost estimates for the Project and the Alternative.

Description of Project and Alternative Project Construction

The project is based on the Construction Plan (dated September 2016) prepared by the County that outlines a conceptual project design. In order to achieve the objective of a navigable water trail, emergent vegetation and occlusions must be removed from the channel. This work requires widening the navigable waterway to up to 15 feet by removal of emergent vegetation from within and adjacent to the river channel, removal of roots and tubers, and limited deepening of the river channel. ESA's description of the methods and equipment to implement the Project is based on knowledge of available construction equipment and methods that could be used to remove the emergent vegetation and occlusions, as well as the estimated response of the Owens River system in the project area based on our hydraulic modelling. ESA worked with NBC and the County to explore additional equipment possibilities and capabilities and develop an Alternative Project scenario that provides options for construction methods and equipment that also achieve the Project objective.

The Project and the Alternative Project construction approaches are summarized herein to facilitate comparisons between approaches.

- Project: Emergent vegetation and occlusions will be removed from the channel in a two-step process. First, amphibious mowing equipment will travel along the channel cutting/mowing emergent vegetation. Second, amphibious excavation equipment, located on the river banks, will remove occlusion and root masses. Excavated material will be placed on the shore and transported to spoils placement areas. Shore based spoils handling will likely utilize a non-amphibious excavator, a skid steer loader, and dump trucks (tracked and or wheeled). The spoils will be spread by a skid steer loader, to minimize impacts to local drainage patterns and to facilitate recovery of native vegetation. Excavation equipment will access the river banks either by travelling along or being transported on existing unpaved upland roads and ranch roads within the floodplain. The equipment will travel overland from the unpaved roads to the river banks.
- Alternative Project: Emergent vegetation, occlusions, and root masses will be removed in one step by amphibious excavators which will travel along the river banks. Spoils will be placed adjacent to the river channel and spread out to minimize impacts. Under this scenario, access would be directly from the river bank and would not require use of the existing unpaved roads. Maintenance vehicles for the amphibious excavators would utilize the unpaved roads, but overall, the use of unpaved roads would be less than that required under the Project described above.

Note: "Standard" or "typical" excavators do not have amphibious capabilities. In this document we use the term "standard" or excavator to mean non-amphibious excavators. Amphibious excavators exert low ground pressure and have specialized floatation pontoons which allow them to travel over mucky soils and float.

The following table summarizes the components associated with both the Project and Alternative Project scenarios.

Component	Project Scenario	Alternative Project Scenario
Channel Vegetation Removal Equipment	Amphibious mower	Amphibious excavator
Excavation Equipment	Amphibious excavator, excavator, tracked dump truck, off-road dump truck, and skid steer loader.	Amphibious excavator
Channel Vegetation Removal Method	Amphibious mowing equipment mows vegetation. Floating vegetation debris is gathered by hand and placed on the floodplain.	Emergent vegetation is removed concurrent with root excavation (vegetation would be picked up with roots/soil).
Root Excavation Method	Amphibious excavator	Amphibious excavator
Channel widening and deepening	Amphibious excavator	Amphibious excavator
Large Wood Debris Removal and Placement Method	Amphibious excavator	Amphibious excavator
Spoils Handling and Transport Method	Directly load spoils into dump truck (tracked or off road) from amphibious excavator, or mound spoils on floodplain for loading by floodplain-based excavator for transport to spoils area.	Place and spread spoils adjacent to river channel (on the floodplain) with amphibious excavator.
Spoils Placement Location	Distributed spoils placement areas as shown in **Figure 1.**	Place and spread spoils adjacent to river channel (on the floodplain) with amphibious excavator.

The following table provides the characteristics of the various pieces of equipment that would be used under the Project and the Alternative Project.

Equipment	Project Scenario	Alternative Project Scenario
Amphibious Mowing Equipment	X	
Amphibious Long Reach Excavator	X	X
Excavator	X	
Tracked Dump Truck	X	
Wheeled Dump Truck	X	
Tracked Skid Steer	X	

Alternative Project Construction Method

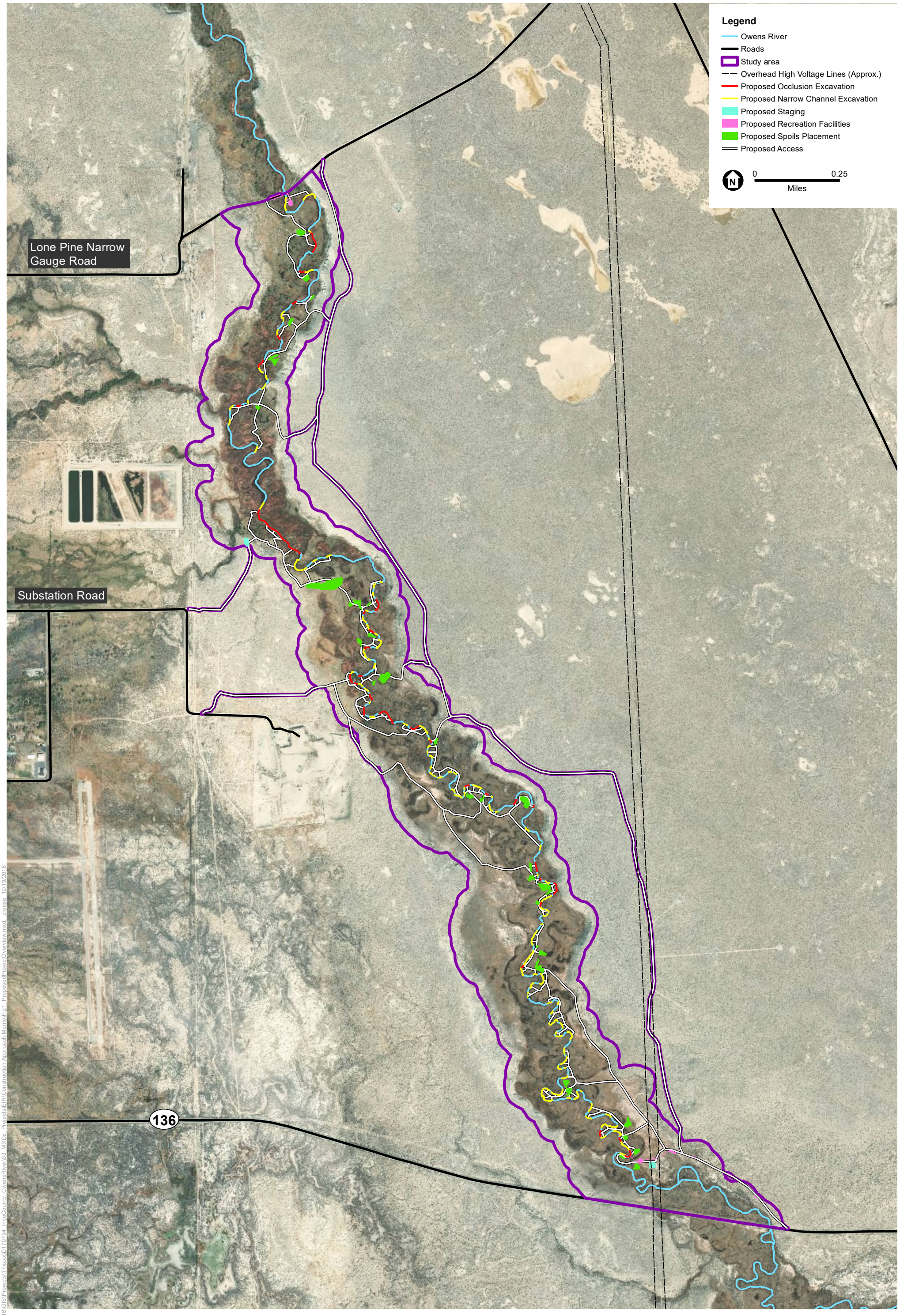
The approach to the Alternative Project minimizes equipment and equipment operations relative to the Project. Under the Alternative Project, construction would proceed from the upstream project limit to the downstream limit. This is for two reasons: first, existing occlusions and their reduction of stream flow would enhance passive filtration of sediments released by excavation; second, downstream occlusions act as vertical controls on water surface elevation. A primary difference between the Project and the Alternative Project is that the Alternative Project is a single step process: occlusions and emergent vegetation would be removed in a single step. This is different than the Project in which first, a machine travels down the river to mow emergent vegetation and then, occlusions would be excavated by an amphibious excavator travelling along the river bank. The Alternative Project does not include stockpiling of spoils; instead, spoils would be placed adjacent to the river. Spoils would be placed a minimum of 15' from the edge of water in order to utilize existing vegetation as filter strips to minimize movement of sediments. Placed spoils would be contoured to smoothly conform to adjacent existing grade and to minimize disturbance of existing flow paths. Placement of spoils adjacent to the river potentially creates additional surface for colonization by salt grass or native bunch grasses.

Under the Alternative Project, the amphibious excavator would proceed along the river until the end of day. At the completion of a work day the operator would drive the excavator along predetermined access routes to a location a minimum of 150 feet from the edge of water. This distance may be revised pending review by permitting agencies. All refueling and maintenance would occur a minimum of 150 feet from the edge of water. Access routes utilized under the Alternative Project approach would be the same as indicated for the Project.

Under the Alternative Project, the contractor may opt to have two or more pieces of machinery operating concurrently. This has the benefit of reducing project duration. Additionally, sediment impacts to the Owens River would be diminished from a temporal perspective (i.e., the period of increase turbidity as a result of excavation would be reduced).

The potential benefits of the Alternative Project relative to the Project may include but not be limited to the following:

- Air quality impacts could be less by minimizing travel on dirt or gravel roads; this would result in reduced need to for dust control.
- Greenhouse gas emissions could be less as a result of reduced number and types of equipment.
- Impacts to vegetation could be less as a result of reduced travel along access routes which traverse the floodplain.



Service Layer Credits: Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community, Inyo County

Owens River Water Trail

Figure 1
Proposed Project Overview

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Equipment Characteristics

The following table provides characteristics of the equipment included in the Project and Alternative Project as described above.

Equipment type	Amphibious Long Reach Excavator	Amphibious Long Reach Excavator	"Standard" Excavator	Tracked Dump Truck	Wheeled Dump Truck	Tracked Skid Steer Loader	Multi-functional Amphibious Machine
Equipment Example	REMU Big Float E 22	CAT 320 Marsh Buggy	CAT 320	Marooka MST 3000 VD	Volvo A25	CAT 299D2 XHP	Truxor DM 5045
Horsepower	Unknown	148	117	325	315	110	45
Dimensions	37' L (pontoons) x 18' W Track W: 4 ft.	30' L (pontoons) x 18' W Track W: 4 ft.	31' (transport L) x 9.8' (transport W)	20.2' L x 10.4' W Track width: 2.6 ft.	33.5' L x 9.6' W Tire width: 2.4 ft.	12.9' L x 6.3' W Track width: 1.3 ft.	15.4' L x 6.8' W Track width: Unknown
Capacity	1 CY dredging bucket, 29' reach	1 CY dredging bucket, 32.3' reach	1.56 CY bucket, 32.3' reach	7.25 CY	15.8 CY	Assume 78" dirt bucket, 1 CY	Front lifting weight: 550 lbs
Ground pressure	1.8 psi	1.5 psi	5.1 psi	4.8 psi (loaded)	24.1 psi (rear loaded)	5.3 psi	Unknown – Company claims nominal
Productivity	100-200 CY / day and 90-200 LF of channel / day	100-200 CY / day and 90-200 LF of channel / day	100-200 CY / day	1 machine = 64-128 CY / day	30 miles per hour	5.2 miles/hr	0-300 feet/hour; variable according to amount of vegetation cleared
Equipment Reference	1	2	3	4	5	6	7

Notes:
1 Assumes 40 hours per work week, for an 8-week duration (i.e., 40 days).
2 Assume 5,200 cubic yards of material excavated or removed from channel.
3 Assume 150 cubic yards excavated per day.
4 Information regarding REMU provided for reference; estimations based on CAT 320 Marsh Buggy
5 Excavator loading dump trucks would be limited by excavator productivity of amphibious excavator.

Equipment References

The following equipment references provide links to the pieces of equipment that would be used as listed in the table above.

1. https://www.remu.fi/product-series/big-float-e22
2. http://www.longreachhighreach.com/marshbuggy33.html
3. https://www.cat.com/en_US/products/new/equipment/excavators/medium-excavators/1000032602.html
4. http://www.morookacarriers.com/mst-3000vd.html
5. https://www.volvoce.com/global/en/product-archive/articulated-haulers/volvo/a25c-6x6/
6. https://www.cat.com/en_US/products/new/equipment/compact-track-and-multi-terrain-loaders/compact-track-loaders/1000002411.html

7. http://doroteamekaniska.se/en/truxor-dm-5000-2

Construction Activities: Project and Alternative Project

The following table provides a comparative summary of the Project and Alternative Project characteristics.

Activity	Project Scenario	Alternative Project Scenario
Overall construction schedule	Estimate 40 to 50 days for completion	Estimate 40 to 50 days for completion
Construction hours and work days per week	Estimate 8 hours per day, 5 days per week	Estimate 8 hours per day, 5 days per week
Number of construction workers for each construction activity/phase.	Two workers for the channel excavation (Equip. Operator and Grade checker/laborer) Two workers for the spoils removal phase (Equipment operators for Marooka & skid steer)	Two workers for the channel excavation (Equip. Operator and Grade checker/laborer)
Average distance construction workers would travel to the work site from their homes	Estimated RT travel from Lone Pine: 15 miles	Estimated RT travel from Lone Pine: 15 miles
Number of haul trucks on a maximum haul day and a typical average haul day	Estimate 150 -200 CY/day excavation; 1-2 two tracked trucks operating per day	N/A
Distance or location to where the haul trucks would deposit material	Estimate ¼ mile to 1 mile for dump locations; truck trips will vary depending on destinations; estimate for truck trips from each occlusion location to spoils placement area varies from 1 to 3 trips	N/A

Description of Project and Alternative Project Maintenance

Maintenance under the Project and the Alternative Project scenarios would be essentially the same. The table below presents the estimated frequency, duration, and days of effort for channel maintenance under the Project and the Alternative Project scenarios.

Year	Duration and frequency	Total days of effort
1 (post -construction)	2 weeks per event, 2 events per year	20
2 (maintenance)	2 weeks per event, 2 events per year	20
3 to 20 (maintenance)	1 week one time per year	5

Under the Project, annual maintenance would consist of hand or machine removal of emergent vegetation with the 15-foot-wide water trail corridor. Machine removal of emergent vegetation would consist of an amphibious equipment carrier (e.g., Truxor or similar) which would mow/masticate vegetation. Floating booms would be placed in the river channel to collect floating debris. Debris would be removed from the channel and placed on the floodplain in large piles (i.e., up to six feet). Based on observations by Inyo County staff, these piles quickly dewater, deflate, degrade to mulch, and are recolonized by saltgrass. Piles created in different years would be staggered in location as to not interfere with the progress of prior-year recolonization.

Under the Alternative Project scenario, annual maintenance would be similar in duration to maintenance under the Project but would differ in the method. Under the Alternative Project, maintenance would be done by hand with the support of a UTV to ferry supplies and provide winch assistance, or using a small CAT marsh buggy or

multifunctional amphibious machine (MAM) to cut and collect emergent vegetation. The CAT marsh buggy, or MAM, would move down the channel corridor and would remove emergent vegetation that might start to overgrow the channel. Spoils would be limited to vegetation only and would be placed along the banks of the channel set back a minimum of 15 feet from the water's edge. It is anticipated that two workers per day would perform the mechanical maintenance during the maintenance period and hand work would involve six to ten individuals working six to twelve work days per year.

NBC Construction Cost Estimate

The following cost estimates were provided by NBC for planning level analysis only. ESA has not performed cost estimation for ORWT project components.

Scenario	Estimated Occlusion Removal Cost (assuming a 40 day work schedule)
Project	$340,000
Alternative	$200,000 to $250,000

In depth estimation of probable costs associated with the occlusion removal (i.e., in-channel portion of the ORWT project) would likely include, but not be limited to:

- Mobilization/demobilization
  - Specialized equipment rental and transport (i.e., amphibious excavators).
  - Worker temporary housing and transport (if construction company is located outside of the region).
  - Establishment of access and staging routes, and repair at conclusion of project.
- Development and execution of a Stormwater Pollution Prevention Plan (SWPPP).
- Excavation costs (per cubic yard or lump sum).
- Large wood debris handling and placement.
- Post project erosion control and revegetation.

Appendix:
Photos of Equipment

Equipment for Owens River Water Trail – Typical Examples for Vegetation Removal and Excavation.

Amphibious Vegetation Management

Source: http://doroteamekaniska.se/en/truxor-dm-5000-2

Amphibious Excavator

Source: https://www.remu.fi/amphibious-excavator

Source: https://media.machines4u.com.au/machinery/8/147108/REMU-Big-Float-Amphibious-Excavator_4823489.l.jpg

Amphibious Long Reach Excavator

Source: http://www.longreachhighreach.com/marshbuggy33.html

Excavator

Source: https://www.cat.com/en_US/products/new/equipment/excavators/medium-excavators/1000032602.html

Tracked Dump Truck

Source: http://www.morookacarriers.com/mst-3000vd.html

Off-Road Dump Truck

Source: https://www.tradeearthmovers.com.au/reviews/1705/best-off-road-dump-trucks

Tracked Skid Steer Loader

Source: https://www.cat.com/en_US/products/new/equipment/compact-track-and-multi-terrain-loaders/compact-track-loaders/18484350.html