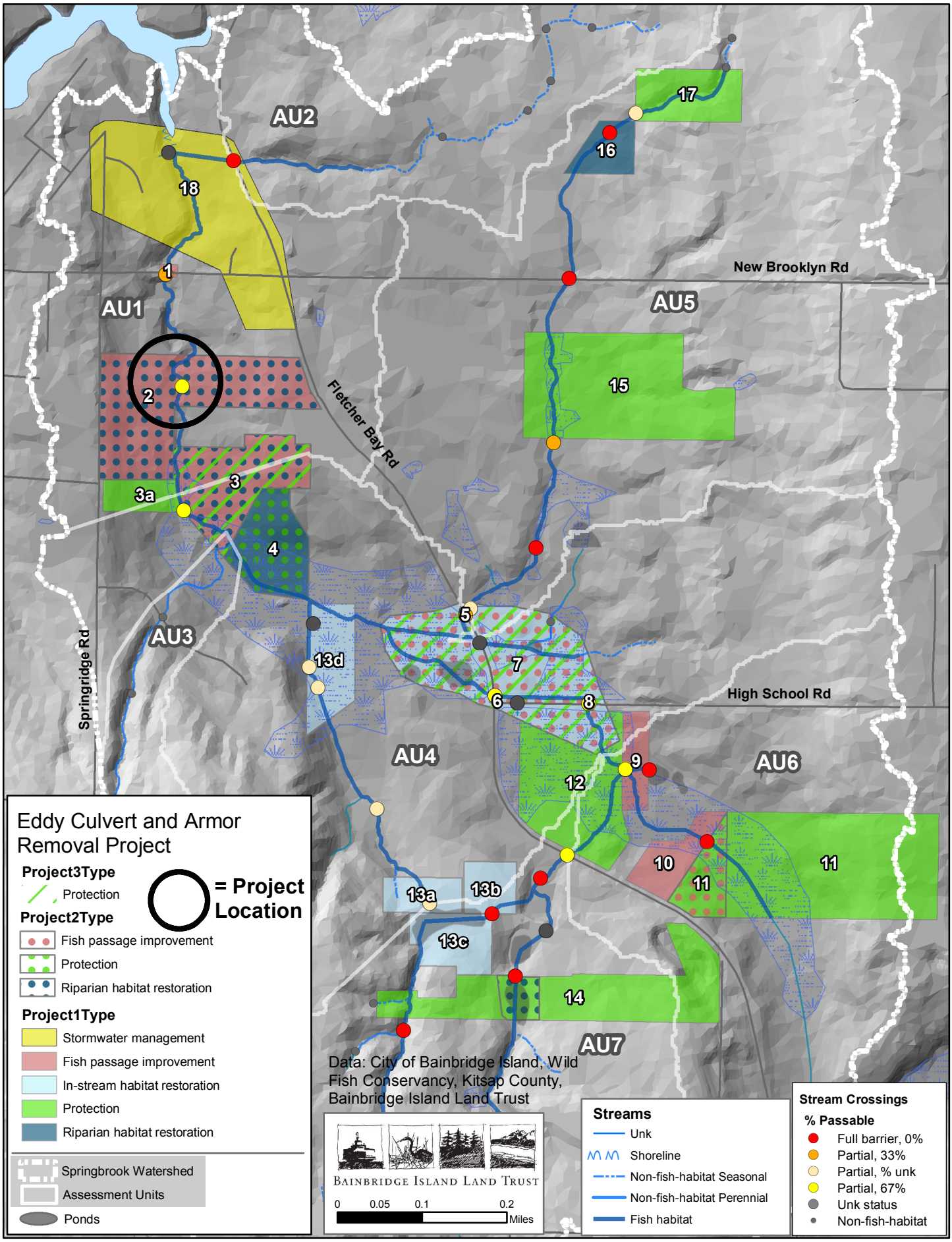
Appendix III Project 2

Eddy Culvert and Armor Removal, Bridge Replacement,

Stream Restoration Project

Conceptual Design


AU1
AU2
AU3
AU4
AU5
AU6
AU7
New Brooklyn Rd
High School Rd
Springridge Rd
Fletcher Bay Rd
1
2
3
3a
4
5
6
7
8
9
10
11
12
13a
13b
13c
13d
14
15
16
17
18
Eddy Culvert and Armor Removal Project
Project3Type
Protection
= Project Location
Project2Type
Fish passage improvement
Protection
Riparian habitat restoration
Project1Type
Stormwater management
Fish passage improvement
In-stream habitat restoration
Protection
Riparian habitat restoration
Springbrook Watershed
Assessment Units
Ponds
Data: City of Bainbridge Island, Wild Fish Conservancy, Kitsap County, Bainbridge Island Land Trust
Bainbridge Island Land Trust
0 0.05 0.1 0.2 Miles
Streams
Unk
Shoreline
Non-fish-habitat Seasonal
Non-fish-habitat Perennial
Fish habitat
Stream Crossings
% Passable
Full barrier, 0%
Partial, 33%
Partial, % unk
Partial, 67%
Unk status
Non-fish-habitat

Barbara Eddy Culvert and Armor Removal, Bridge Replacement, Stream Restoration

Site Description

At river mile 0.39 Springbrook Creek crosses a field access road on a 14.58 acre parcel belonging to Barbara Eddy. Above the crossing, Springbrook Creek runs through a forested valley with an average bankfull width of 9.5 ft. and the average gradient of 2%. 3.4 miles of fish habitat exist upstream from this crossing. The stream is carried beneath the field access road in a 4 ft. round corrugated steel pipe 40 ft. in length. WDFW has identified it as a 67% passable partial barrier culvert due to the fact that it is undersized and has a slope of 1.68% and has established a priority index (PI) of 19.86.Approximately 100 ft. downstream from the culvert there is a long section of riprap armament protecting a picnic area on the right bank. This armored section of channel is artificially narrow and has caused substantial scour of the unprotected left bank. The armored channel also lacks instream complexity forming a 70 ft. long continuous riffle with neither pools nor large woody debris. A foot bridge at the upper end of the right bank riprap has additional armor protecting its left bank foundation. Below the armored section of the channel, Springbrook Creek enters a lush forested valley with excellent pool-riffle habitat.

Specific Goals

The primary objective is to replace the undersized culvert with a crossing structure that improves fish passage and the transport of sediment and large woody debris. A secondary goal is to remove the downstream armoring from the right bank, increase instream habitat complexity, and widen this section of channel to reflect natural stream conditions. This project improves connectivity between the intact stream reaches adjacent to the existing undersized culvert.

Negative impacts from the undersized culvert and constrained stream (from the armor) are likely to exacerbate in the coming decades as a result of climate change impacts on hydrology (higher flows/storm events).

Design Development: Topographical and stream condition surveys were performed on site with the permission of the landowner by Wild Fish Conservancy. Conceptual drawings and project narrative were presented to the landowner for review and revised based on her feedback.

Option 1 (Sheet 2)

Option 1 replaces the undersized barrier culvert with a 40’ x 12’ bridge and regrades the channel under the newly installed bridge. This option also removes the riprap armoring on the downstream right bank as well as removing the foot bridge and its associated riprapped abutments. Once the armoring is removed from the downstream channel, the right stream bank should be pulled back to reflect natural stream conditions and the bank should be reconstructed using coir-wrap bioengineering techniques. Root wads gathered from alders removed during the bridge construction are to be installed downstream of the foot bridge in the section of channel

lacking instream complexity. The bioengineering will protect the stream bank until the planted vegetation takes root. All construction is to be done during the dry summer months. The following winter, during plant dormant season, the coir wrapped stream banks and the old picnic area are to be replanted with native vegetation. A new picnic area on the left bank of the stream is to be provided to replace the picnic area no longer accessible with the removal of the footbridge.

Pros

Replacing the undersized culvert with a bridge would benefit fish migration and restore stream migration and natural wood and sediment transport processes. A bridge will accommodate a larger range of flows and will require less long term maintenance. Removing the downstream footbridge and bank armoring, and widening the channel to reflect the natural stream would enhance fish habitat and reduce erosion and sedimentation associated with the exacerbated scouring of the left bank.

Cons

Installing a bridge is expensive. There is a large amount of fill that would need to be removed if a bridge was built.

Option 2 (Sheet 3)

Option 2 is similar to Option 1, but instead of removing the footbridge to the picnic area it is replaced with a longer footbridge with footings protected by bioengineering (coir lifts), not riprap, so that flows are not constricted at the structure. In Option 2, the new left bank picnic area is not constructed; instead, the existing right-bank picnic area is retained and partially vegetated.

Pros

Option 2 provides similar benefits as Option 1, with the addition of not requiring development of a new picnic area on the left bank. The landowner has a sentimental attachment to the existing right bank picnic area, which would be maintained in Option 2.

Cons

Under Option 2 there will be impacts associated with the replacement footbridge and coir lifts, although these will be less impactful to stream processes than the existing footbridge and armoring.

Option 3 (Sheet 4)

Option 3 is identical to Option 1, except a 14 ft wide arch culvert is proposed instead of a 40’ long steel bridge.

Pros

Option 3 provides benefits similar to those afforded by Option 1. A 14' arch culvert will likely be slightly less expensive to purchase and install compared to a 40' steel bridge.

Cons

A 14' wide arch culvert is more likely to constrict flows during large storm events , may require more maintenance, and will likely have a shorter life span, compared to a 40' steel bridge.

Selected Option

The project team and the landowner preferred the conceptual channel modifications described in Option 2 in order to restore fish passage, remove substantial bank armoring, and restore natural processes to the extent possible within this reach while also achieving landowner goals. The steel bridge is preferable to the arch culvert due to the bridge's ability to accommodate potentially higher flow patterns in the watershed anticipated in the coming decades as a result of climate change. The landowner deliberated the footbridge options at length and in the end decided she was more comfortable maintaining the picnic area in its present location, though without the hard rock armoring and with the addition of riparian vegetation. Replacing the existing footbridge with a longer one will remove the flow constriction and hydromodification associated with the current footbridge.

The project team rationale for recommending this project as the #2 project within the Springbrook Creek Watershed included: project's location low in the watershed, its adjacency to project #1 (Fletcher Bay Culvert/Weir Removal) and project #3 (Rekow Stream Restoration), improving the following limiting factors: fish passage, riparian habitat, sediment transport, instream complexity designed to support fish life stages (large wood transport and restoring stream to its historical profile and gradient and more pools and riffle), stream hydrology, and landowner willingness. Additionally, the project team focused on sequencing projects moving upstream from Fletcher Bay. This project is the second lowest barrier in the creek system, making it a priority to address in the near term order to provide access to 3.4 miles of upstream fish habitat.

Photo 1

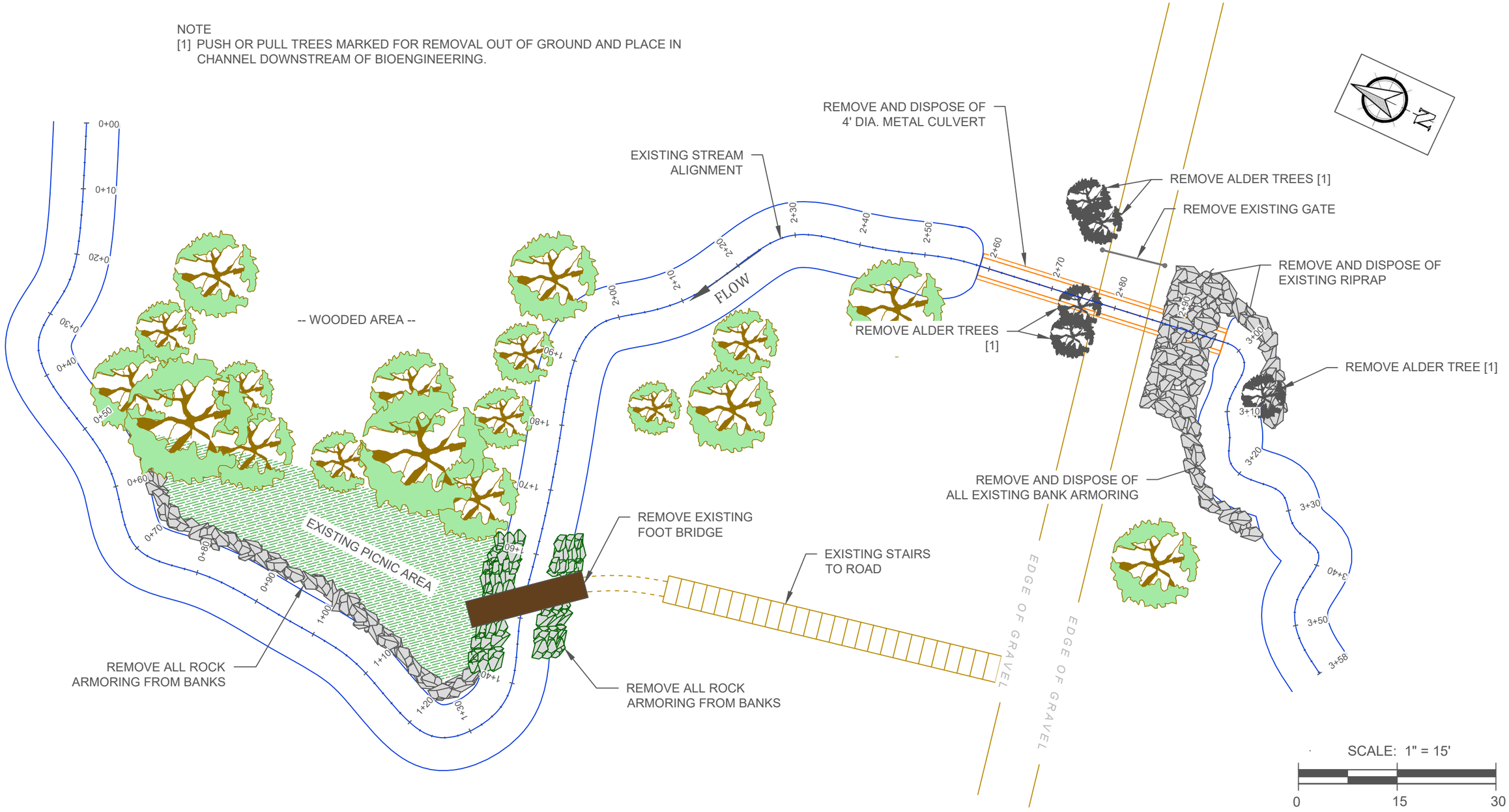
Photos of Project Area: **Photo 1**: Good conditions upstream of culvert existing with excellent spawning gravels. Bankfull width is 9.5 ft. and an average gradient of 2%. **Photo 2:** Undersized 4 foot round corrugated culvert, 67% passable, 1.68% gradient. **Photo 3:** Illustration of armor located approximately 100 feet below the culvert. To the left is the landowner's picnic area. **Photo 4:** Existing footbridge will be replaced with a longer version to allow the stream channel to expand and existing armor will be removed.

Photo 2

Photo 3

Photo 4

NOTE
[1] PUSH OR PULL TREES MARKED FOR REMOVAL OUT OF GROUND AND PLACE IN CHANNEL DOWNSTREAM OF BIOENGINEERING.



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Mod: 08/28/2018, 07:23 | Plotted: 08/28/2018, 07:28 | Layout: 4

DATE:	08-27-2018
DRAWN BY:	S. KROPP
DESIGNED BY:	A. STONKUS, P.E.
CHECKED BY:	
JOB NO. :	

Wild Fish Conservancy
15629 Main Street NE
Duvall, WA 98019
Phone: 425-788-1167

EXISTING CONDITIONS

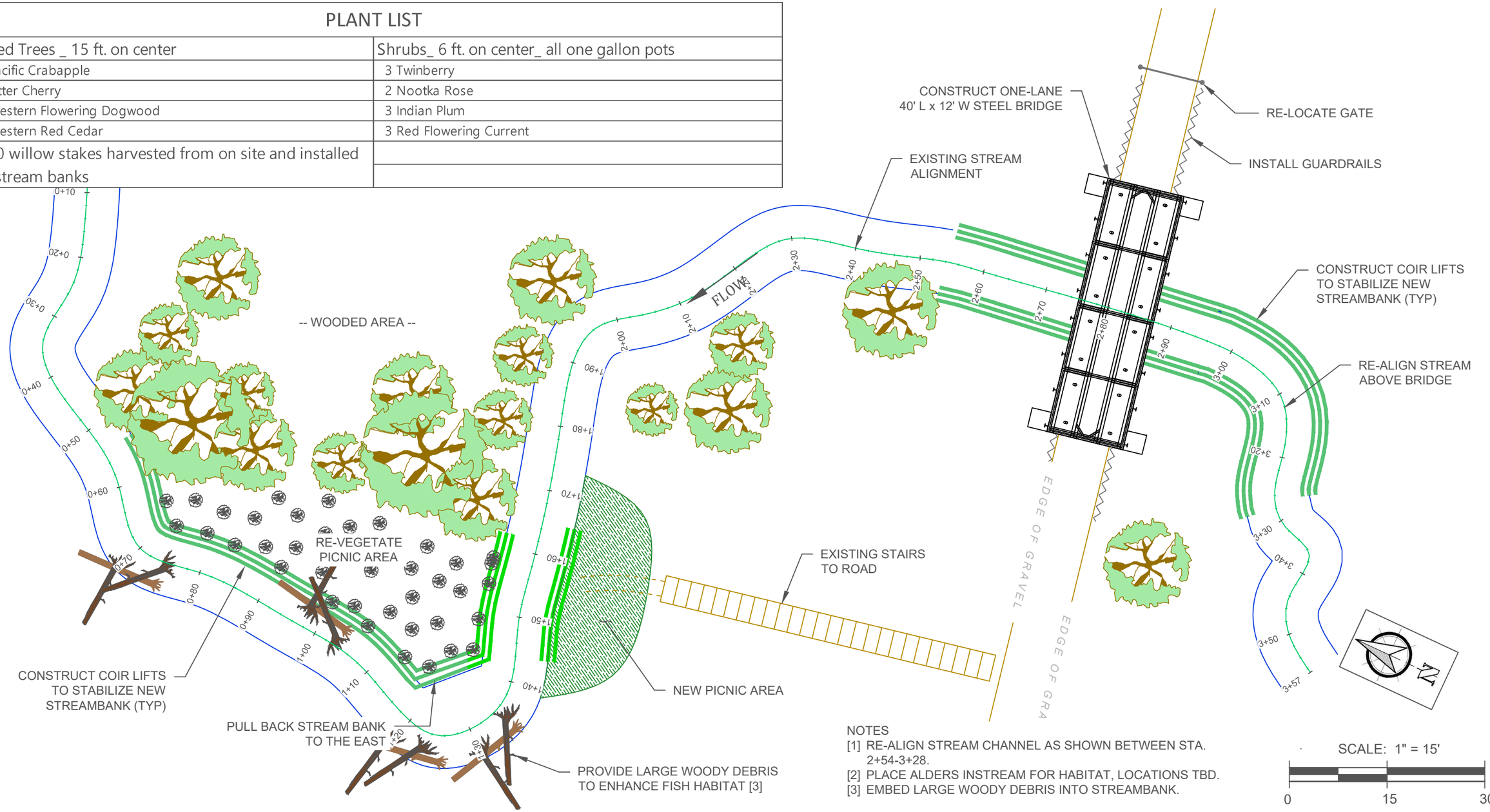
BARB EDDY CULVERT REPLACEMENT

BAINBRIDGE ISLAND, WA

REVISIONS	DATE

SHEET NO.
1
SHEET _____ of __XX__

PLANT LIST	
Potted Trees _ 15 ft. on center	Shrubs_ 6 ft. on center_ all one gallon pots
1 Pacific Crabapple	3 Twinberry
1 Bitter Cherry	2 Nootka Rose
1 Western Flowering Dogwood	3 Indian Plum
1 Western Red Cedar	3 Red Flowering Current
100 willow stakes harvested from on site and installed in stream banks	



NOTES
[1] RE-ALIGN STREAM CHANNEL AS SHOWN BETWEEN STA. 2+54-3+28.
[2] PLACE ALDERS INSTREAM FOR HABITAT, LOCATIONS TBD.
[3] EMBED LARGE WOODY DEBRIS INTO STREAMBANK.

SCALE: 1" = 15'

0 15 30

C:\Users\sjkrol\Documents\Work Files\01. PROJECTS - Active\20. Springbrook Creek\Barb Eddy\Design Drawings\02. Sheets\(4) Restoration Plan.dwg
Mod: 08/28/2018, 07:23 | Plotted: 08/28/2018, 07:29 | Layout: 4

DATE:	08-27-2018
DRAWN BY:	S. KROPP
DESIGNED BY:	A. STONKUS, P.E.
CHECKED BY:	
JOB NO. :	

Wild Fish Conservancy
15629 Main Street NE
Duvall, WA 98019
Phone: 425-788-1167

RESTORATION PLAN: OPTION 1

BARB EDDY CULVERT REPLACEMENT

BAINBRIDGE ISLAND, WA

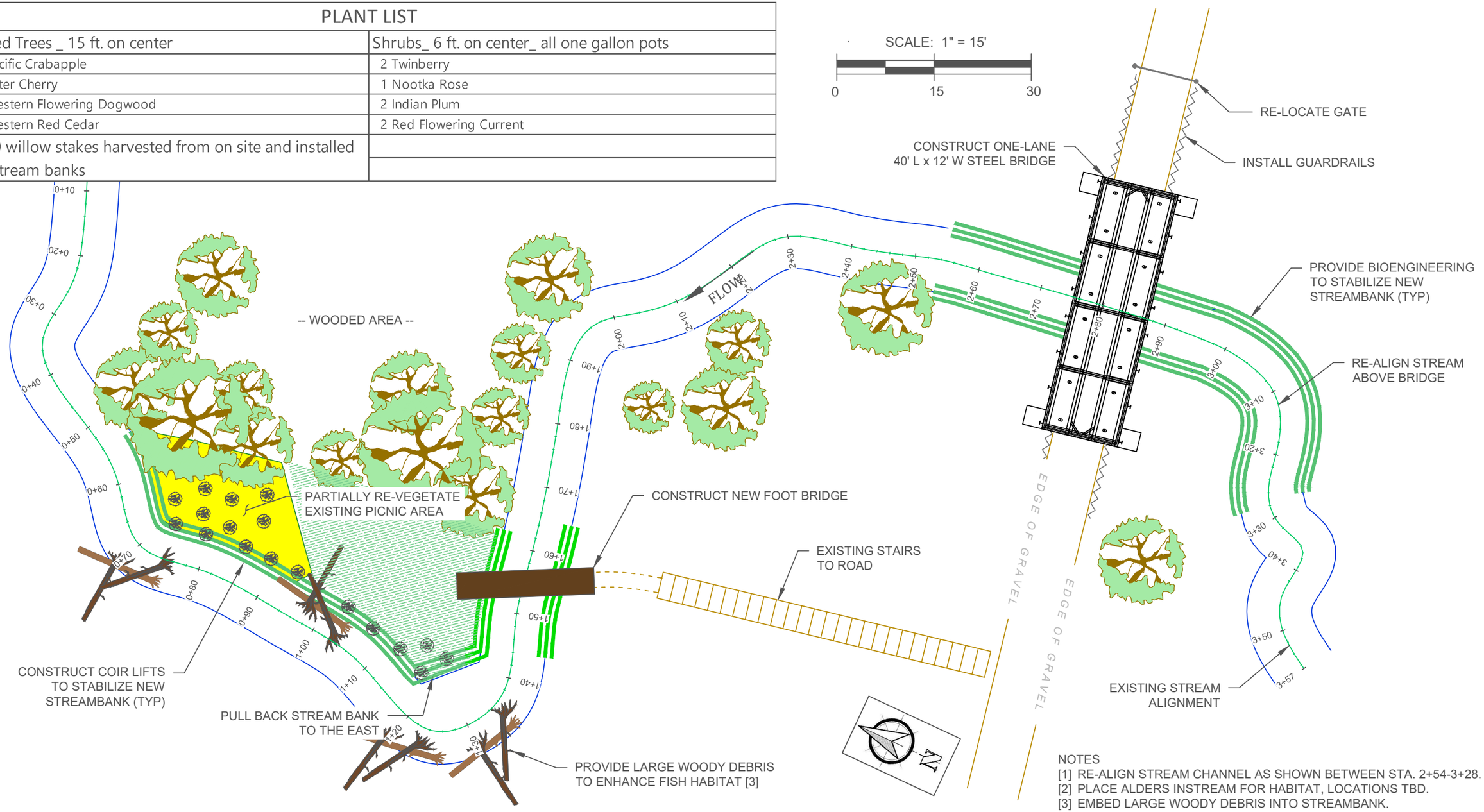
REVISIONS	DATE

SHEET NO.

2

SHEET _____ of XX

PLANT LIST	
Potted Trees _ 15 ft. on center	Shrubs_ 6 ft. on center_ all one gallon pots
1 Pacific Crabapple	2 Twinberry
1 Bitter Cherry	1 Nootka Rose
1 Western Flowering Dogwood	2 Indian Plum
1 Western Red Cedar	2 Red Flowering Current
100 willow stakes harvested from on site and installed in stream banks	



NOTES
[1] RE-ALIGN STREAM CHANNEL AS SHOWN BETWEEN STA. 2+54-3+28.
[2] PLACE ALDERS INSTREAM FOR HABITAT, LOCATIONS TBD.
[3] EMBED LARGE WOODY DEBRIS INTO STREAMBANK.

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Mod: 08/28/2018, 07:24 | Plotted: 08/28/2018, 07:29 | Layout: 4

DATE:	08-27-2018
DRAWN BY:	S. KROPP
DESIGNED BY:	A. STONKUS, P.E.
CHECKED BY:	
JOB NO. :	

Wild Fish Conservancy
15629 Main Street NE
Duvall, WA 98019
Phone: 425-788-1167

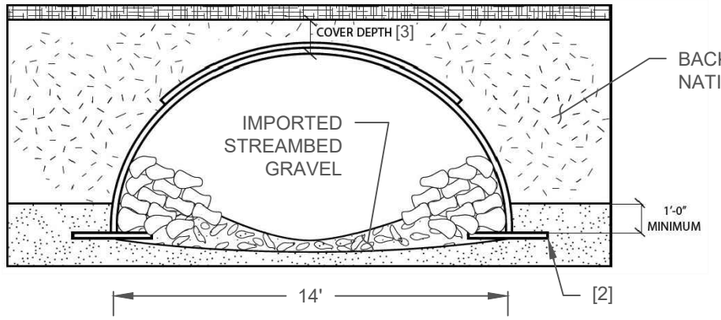
RESTORATION PLAN: OPTION 2

BARB EDDY CULVERT REPLACEMENT

BAINBRIDGE ISLAND, WA

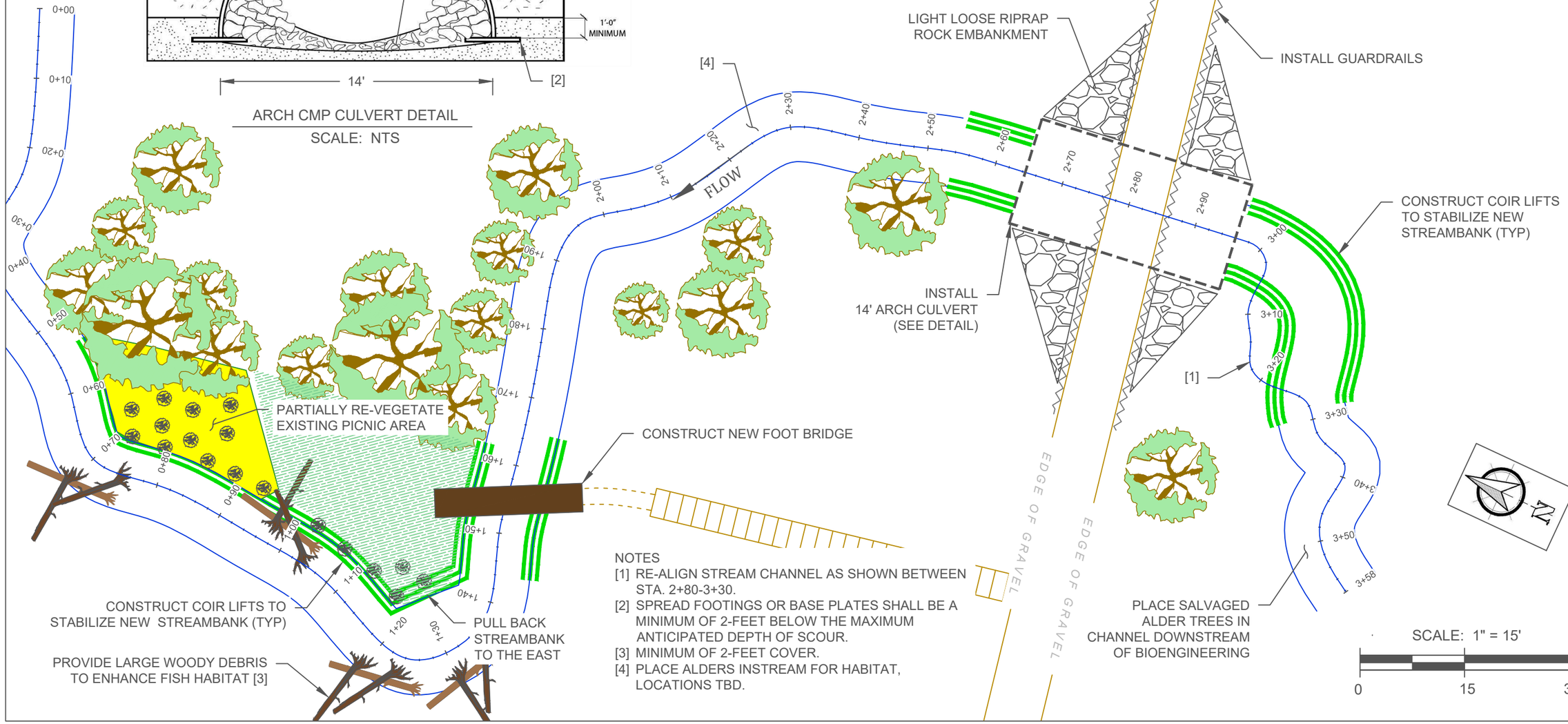
REVISIONS	DATE

SHEET NO.
3
SHEET ____ of XX



ARCH CMP CULVERT DETAIL

SCALE: NTS



NOTES

[1] RE-ALIGN STREAM CHANNEL AS SHOWN BETWEEN STA. 2+80-3+30.

[2] SPREAD FOOTINGS OR BASE PLATES SHALL BE A MINIMUM OF 2-FEET BELOW THE MAXIMUM ANTICIPATED DEPTH OF SCOUR.

[3] MINIMUM OF 2-FEET COVER.

[4] PLACE ALDERS INSTREAM FOR HABITAT, LOCATIONS TBD.

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Mod: 08/28/2018, 07:27 | Plotted: 08/28/2018, 07:29 | Layout: 2

DATE:	08-27-2018
DRAWN BY:	S. KROPP
DESIGNED BY:	A. STONKUS, P.E.
CHECKED BY:	
JOB NO. :	

Wild Fish Conservancy

15629 Main Street NE
Duvall, WA 98019
Phone: 425-788-1167

ARCH CULVERT OPTION

BARB EDDY CULVERT REPLACEMENT

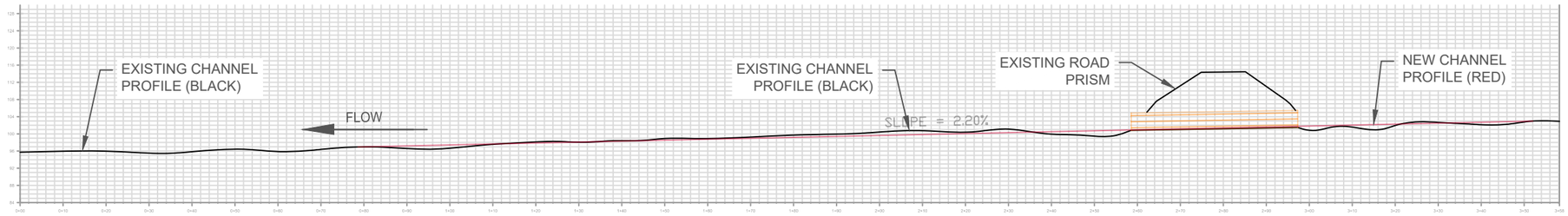
BAINBRIDGE ISLAND, WA

REVISIONS	DATE

SHEET NO.

4

SHEET _____ of XX



STREAM PROFILE

SCALE: 1H:1V

DATE:	**08-27-2018**
DRAWN BY:	**S. KROPP**
DESIGNED BY:	**A. STONKUS, P.E.**
CHECKED BY:	
JOB NO. :	

Wild Fish Conservancy
15629 Main Street NE
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STREAM PROFILE

BARB EDDY CULVERT REPLACEMENT

BAINBRIDGE ISLAND, WA

REVISIONS	DATE

SHEET NO.

5

SHEET _____ of XX

Wild Fish Conservancy
Cost Estimate Template

Revised 8/27/2018

Project Name: **Barb Eddy Option 2: Steel Bridge, replace footbridge**
Date: 08/27/18
Estimate By: SK. AS. JG
Stream: Springbrook Creek
Proposed Correction: Remove culvert and replace with steel bridge.
Restore stream channel and add LWD.

Description	Unit	Quantity	Cost	Amount	Sub Total	
Mobilization / Site Preparation						
Mobilize	L.S.	1	$12,000	$12,000		Assume 10% of construction costs. Mob, demob, surveying and staking.
Bypass	L.S.	1	$2,500.00	$2,500		
Access	L.S.	1	$0.00	$0		Provide temporary access and traffic control during construction.
Erosion Control	L.S.	1	$500.00	$500		
Utilities	L.S.	0	$0.00	$0		
MOBILIZATION SUB TOTAL					$15,000	
Excavation						
Excavation, Common	C.Y.	867	$15.00	$13,000		Includes floodplain, overbank and stream re-alignment excavations.
Excavation Disposal	C.Y.	667	$45.00	$30,000		Haul to an approved receiving site.
Rmv. & Disp. Culvert	L.S.	1	$3,500.00	$3,500		Remove and dispose of culvert
Rmv. & Disp. Riprap	Tons	300	$6.00	$1,800		Assume 1.2 tons per lineal foot of streambank.
Rmv. & Disp. Foot Bridge	L.S.	1	$500.00	$500		
EXCAVATION SUBTOTAL					$48,800	
Bridge Installations						
Purchase Bridge	L.S.	1	$42,000.00	$42,000		Includes bridge, abutments, and wing walls.
Install Bridge	L.S.	1	$6,000.00	$6,000		
Resurface Gravel Road	L.S.	1	$3,000.00	$3,000		
Purchase and install footbridge	L.S.	1	$12,000.00	$12,000		remove existing footbridge, purchase and install new bridge and assoc. armor.
BRIDGE INSTALLATIONS SUBTOTAL					$63,000	
Stream Channel and Bioengineering						
Excavation, Channel	C.Y.	68	$50.00	$3,407		
Streambed Material	C.Y.	36	$50.00	$1,778		Includes cost of materials and labor.
Large Woody Debris	Each	12	$700.00	$8,400		
Install Coir Wrap	L.F.	1120	$25.00	$28,000		Includes cost of all materials and labor.
Revegetation	Acres	0.4	$25,000.00	$10,000		Costs of invasive control, native plants, and installation included.
STREAM CHANNEL AND BIOENGINEERING SUBTOTAL					$51,585	
CONSTRUCTION TOTAL					$178,385	
Sales Tax	9.60%				$17,125	
Engineering	15%				$33,157.78	Includes final designs and construction oversight.
Topo Survey					$1,850	
Fish Exclusion					$2,000	
Project management					$6,000	
Indirect costs	25%				$31,996.30	
Permitting	5%				$6,399	
Contingency (construction)	20%				$35,677.04	
PROJECT TOTAL					$312,591	