Lewis River Aquatic Fund Projects (SA 7.5.3.2)
Project Closeout Report

Project Title:	**Lewis River Hydroelectric Project** **Cedar Creek Reach 1A Restoration**
Project Approved By:	Aquatic Coordination Committee March 27, 2013
Original Project Sponsor:	Lower Columbia Fish Enhancement Group
Project Funding	Aquatic Coordination Committee - $53,000 + $12,931.00 (insurance expense) -
Project Description (work completed):	• Installed 150+ pieces of large wood in stream channel • Installed 15+ logjams • Installed 4 floodplain roughness logs • Excavated a 100' long alcove rearing channel • Re-directed perennial tributary to increase habitat function • Removed/ controlled 2 acres of invasive non-native vegetation • Installed 2,000 native trees and shrubs • Installed boater safety sign upstream of project site
Workforce: o **Personnel (by craft)** o **Contractors:**	• Bill Norris, P.E. Interfluve • Peter Barber, LCFEG Project Manager • Tony Meyer, LCFEG Project Oversight • Tammy Weisman, LCFEG Billing • Glen Saastad, LCFEG Crew Supervisor • WA DOC and Cowlitz County Offender crew labor • Kysar-Koistenen, contractor
Schedule Summary:	Planned Completion Date: October – December 2015 Actual Completion Date: October 2015
Problems Encountered:	• Permitting delayed construction, had to acquire extension of in water work window. Otherwise no problems encountered.
Things that went well:	• Piling were easy to install • Pool/ riffle sequences formed as desired • Fish responded as desired • High potential for 2nd phase to restore entire reach.
Work Not Completed:	• N/A; all tasks completed

Lessons Learned:

- Installing piling was easier than anticipated indicating un-embedded substrate conditions.
- A second phase of restoration is necessary to restore natural land forms and channel conditions in the project reach. Currently channel conditions are degraded by historical log drives, sediment deposition and remnants of a channel spanning concrete dam. The deposition of fine sediments on top of coarse sediments significantly reduces habitat function including ground water upwelling, formation of a braided multi-thread channel and native riparian plant succession.

*** Attachments (Photo Documentation):**

- See attached as-builts

*(<u>Per National Marine Fisheries Service's Biological Opinion for Relicensing of the Lewis River Hydroelectric Projects):</u>

Identify process or methodology the project will include and provide photo documentation of habitat conditions at the project site **before, during, and after** project completion.

a. Include general views and close-ups showing details of the project and project area, including pre- and post-construction.
b. Label each photo with date, time, project name, photographer's name, and documentation of the subject activity.

Lower Columbia Fish Enhancement Group
Project: Cedar Creek Reach 1A Habitat Restoration Project
Planting Plan
Updated: 10/2/2015

Background:

This project location acts as spawning grounds for chinook (Spring and Fall), coho, and steelhead and also hosts an established beaver population. By installing large woody debris (LWD) structures into the floodplain, we have increased the spawning capacity by creating refuge for adults in the scoured pools under the LWD structures and by re-establishing natural gravel migration patterns. Beaver also utilize the structures for protection from predators and to assist them in building dams. LCFEG has observed both of these activities at this site. By planting shrubby plant species, we can quickly increase the amount of cover for spawning and rearing salmonids as well as provide browse and structural material for beaver to forage on and build their dams.

Planting Approach:

LCFEG has planted about 2,000 native shrubs comprised of about 70% willow (*Salix spp*.), 20% red-osier dogwood (*Cornus stolonifera)*, and 5% Pacific ninebark (*Physocarpus capitatus)*. These shrubs were planted in larger pockets between the LWD structures along the creek bank and in a few smaller pockets closer to the toe of the southern slope. The larger pockets will provide cover for fish, forage and structure for beaver, and help stabilize the soft, sandy sediments along the banks of Cedar Creek. The smaller pockets will act as islands of established shrubby vegetation that beaver will have to seek out. These islands were strategically chosen based on soil conditions and likelihood of success.

Planting Plan Maps:

Figure 1: Aerial Image of site from 4/17/2015 showing LWD structures

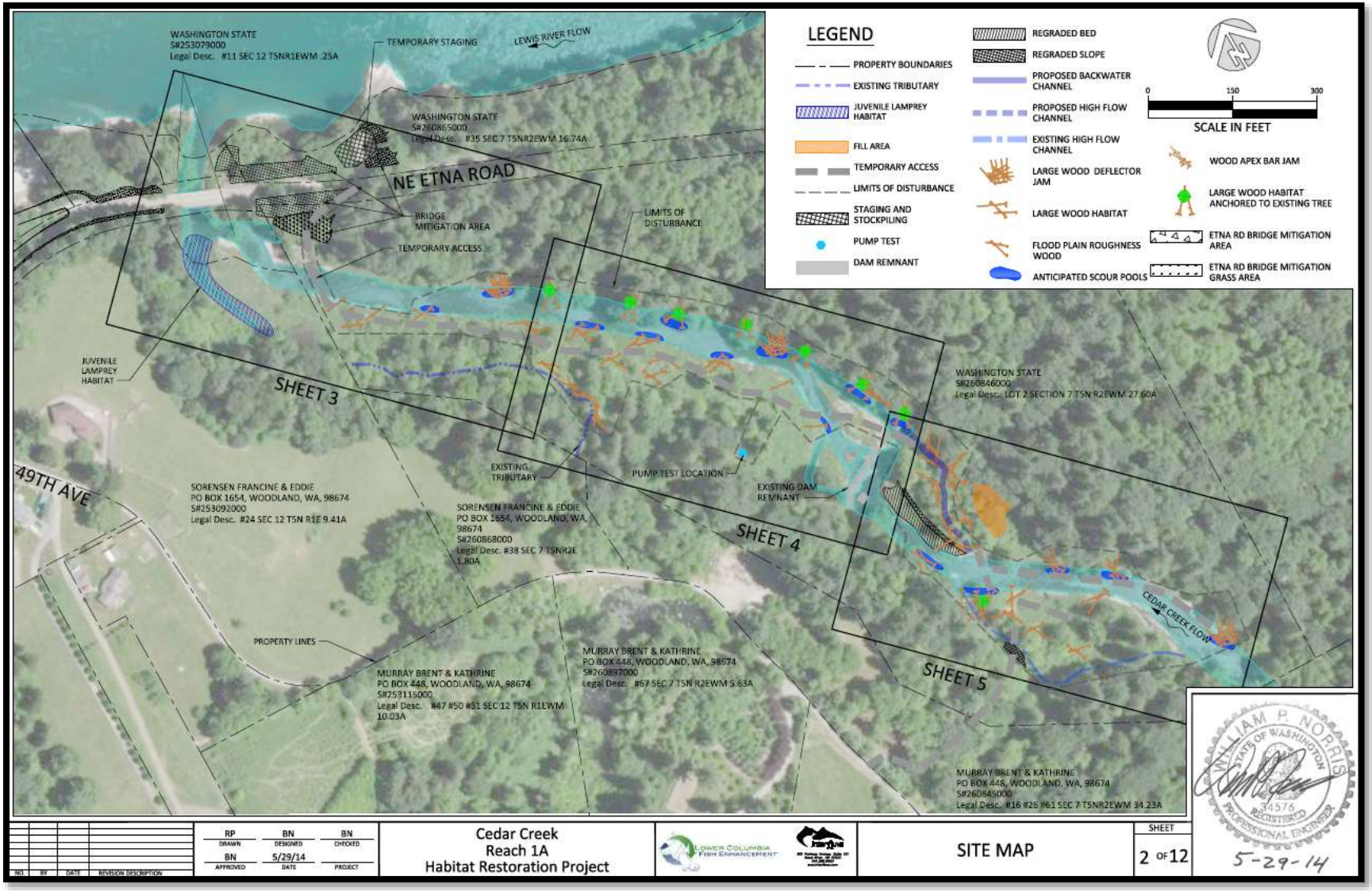


Figure 2: Design plans from engineer

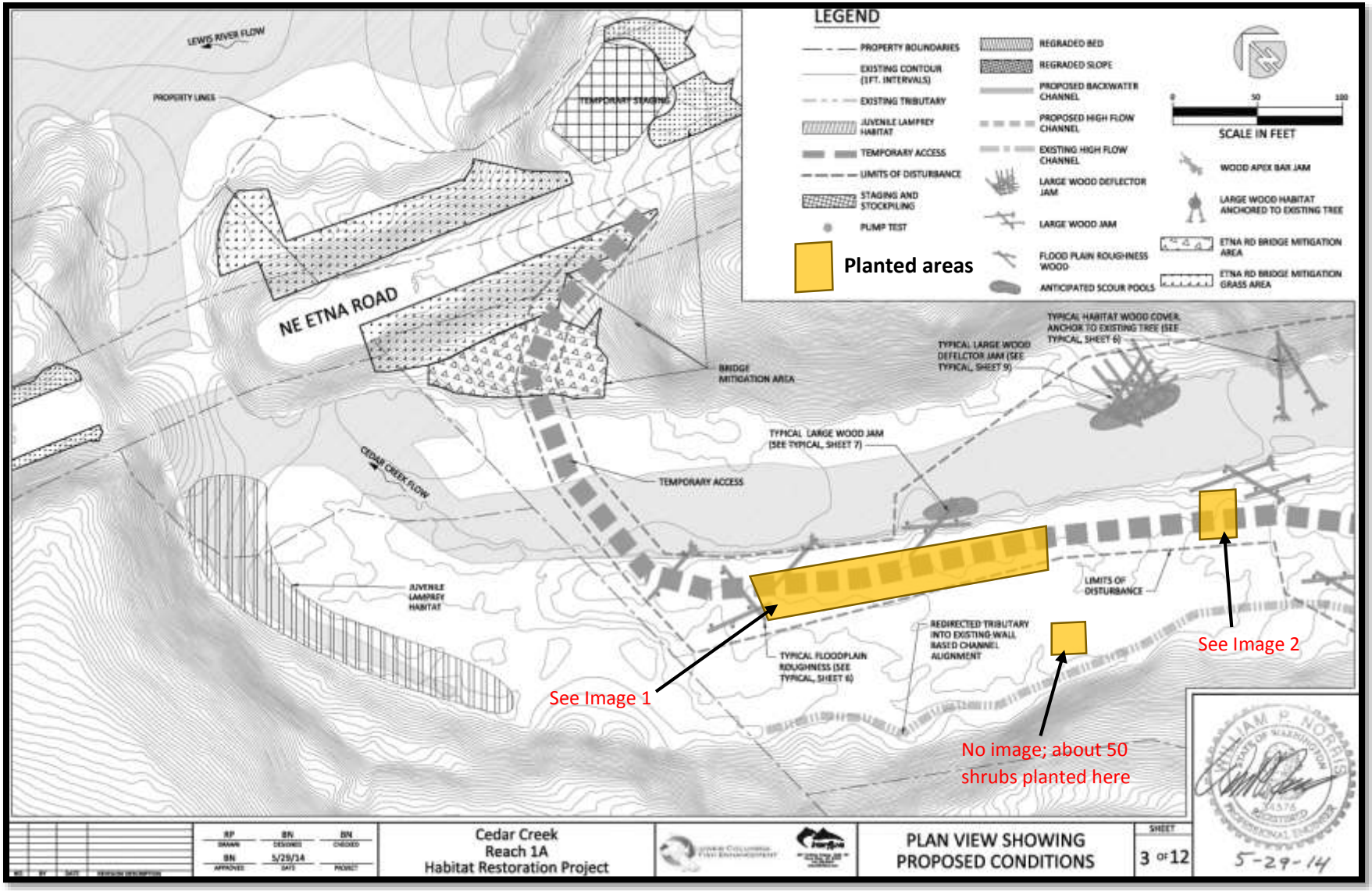


*Figure 3: Proposed LWD placement with **actual** planting areas*

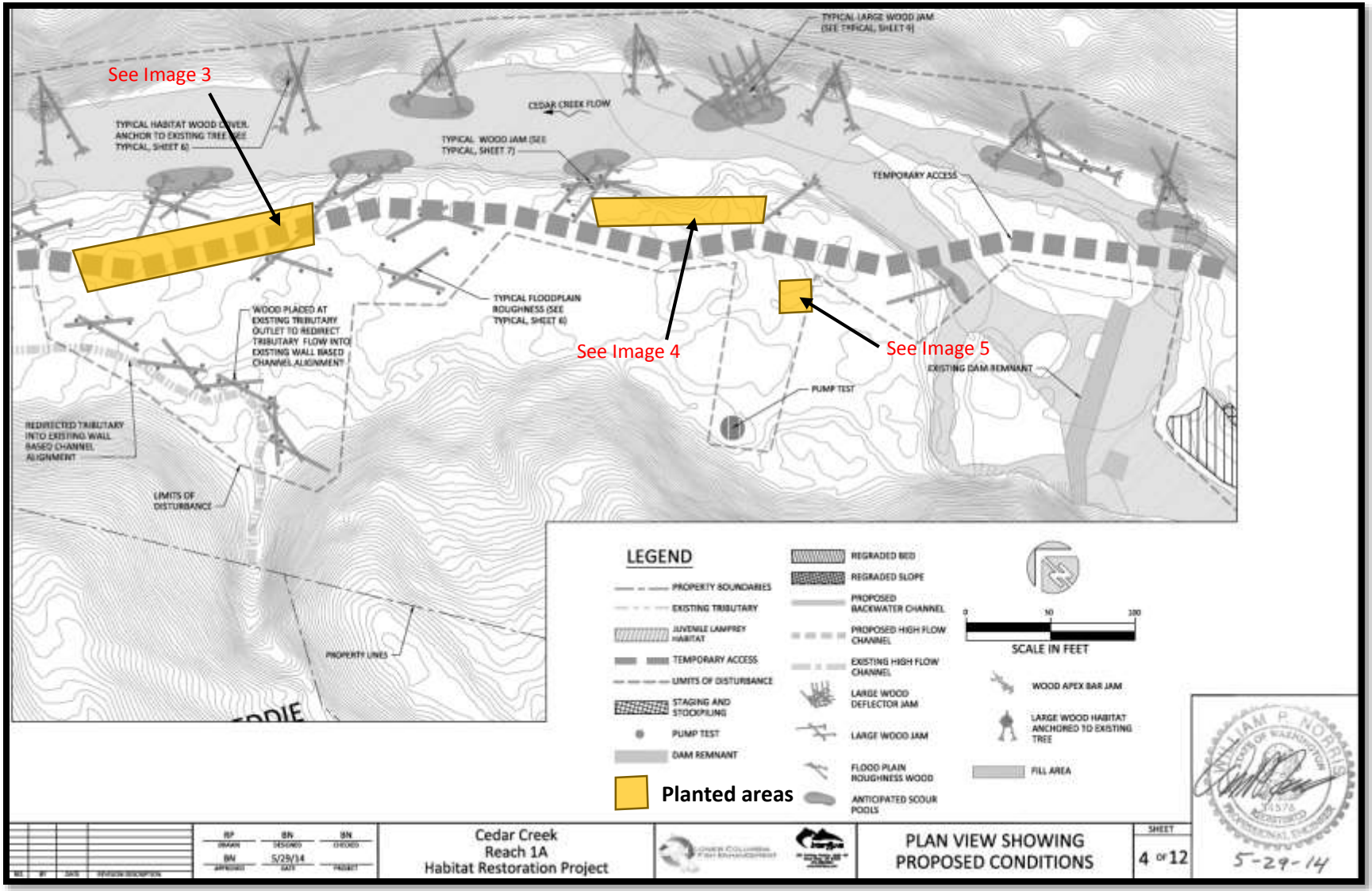


*Figure 4: Proposed LWD placement with **actual** planting areas*

Image 1: Furthest downstream planting area (~750 willow, dogwood, and ninebark)

Image 2: ~50 Red-Osier dogwood planted in the shade of an Alder

Image 3: ~750 shrubs including willow spp., dogwood, and ninebark

Image 4: ~350 shrubs comprised of willow spp., dogwood, and ninebark

Image 5: Small plot of about 50 shrubs including dogwood and willow

As-Built and ground photos for Lower Cedar Creek Restoration project 12-1170

This project is located on WDFW property, was funded by Salmon Recovery Funding Board, designed by Bill Norris, P.E. Interfluve and constructed by Kysar-Koistenen in late summer 2014. The project goal was to increase access between the mainstem NF Lewis and lower Cedar creek, and to increase spawning and rearing habitat for multiple salmonid species including spring and fall Chinook, coho, chum, cutthroat and steelhead. Pacific lamprey juveniles are present within the project area which excluded the lower portion of the site in order to protect their habitat. USFWS personnel reviewed the design prior to construction to insure construction would not impact the lamprey ammocetes or their habitat.

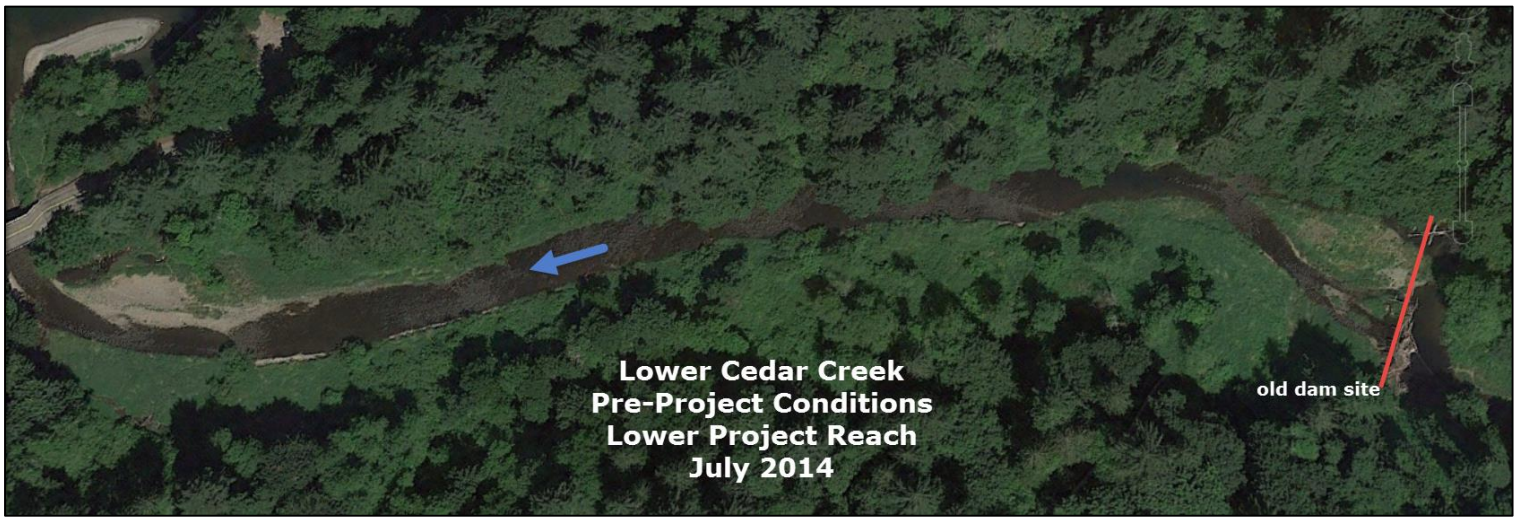
The design of the project entailed use of large wood to create a mosaic of structures placed on the stream bed, stream banks and floodplain. Construction over sight was completed by LCFEG project manager Peter Barber and Interfluve engineer Bill Norris. The project design included more elements than we had funds available to complete. The as-built shows which elements were constructed, which were not and a brief note explaining why changes occurred to the design. Changes to the design were approved by the project engineer during construction. A boater safety sign was installed several hundred yards upstream of the upper most structure to warn boaters of the wood structures obstructing the channel.

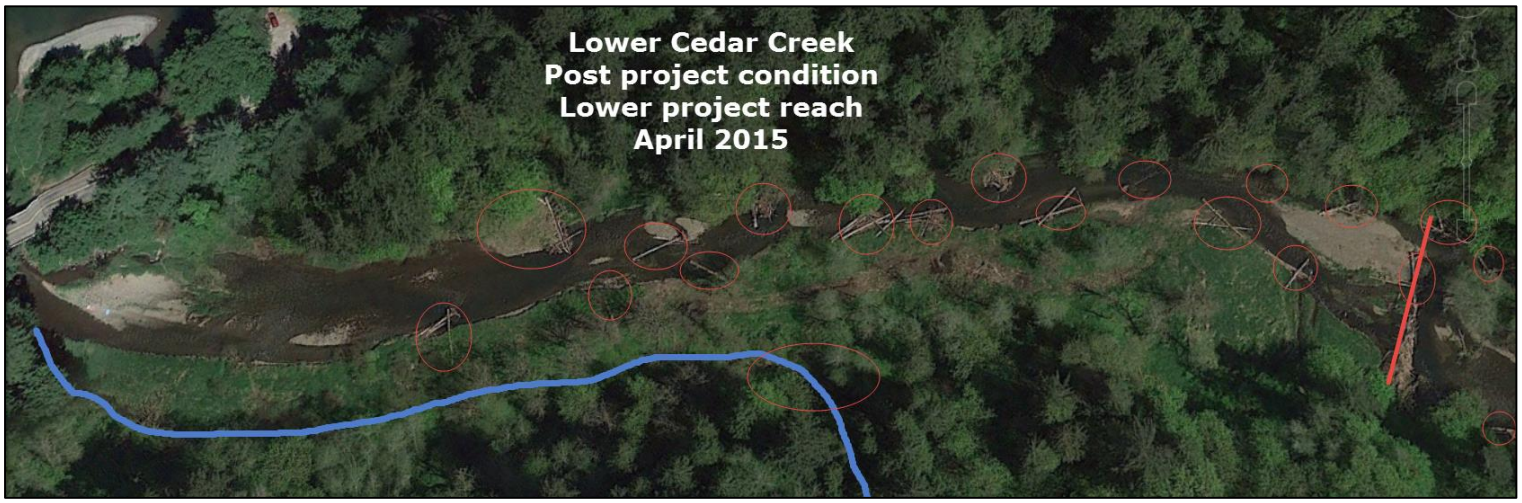
The project installed hundreds of pieces of wood resulting in significant sediment sorting in 2,200' of channel. New pools were scoured out and the coarse sediments created new bars all the way downstream to Lewis River. The structures also instigated significant lateral movement into the relic floodplain surface which was created as a result of a dam and fine sediments deposited during the log drive era. This floodplain terrace is perched above the water level approximately 6' and is vegetated in reed canary grass, Himalayan blackberry and Japanese knotweed along with patches of native alder, maple, cedar, willow and dogwood. LCFEG installed 2,000 native potted shrubs and trees on this terrace to re-vegetate areas disturbed by construction. See riparian as-built uploaded to PRISM.

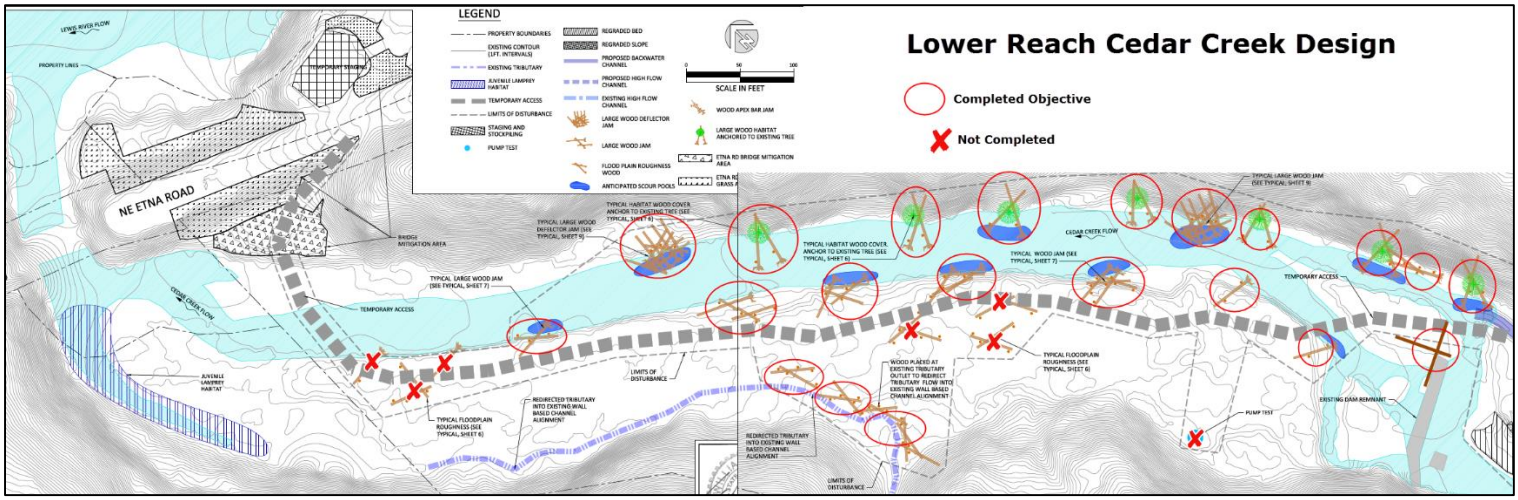
Lateral migration (erosion) has revealed a significant deposit of coarse gravels under the relic floodplain terrace which we believe should be exposed as they represent a much higher opportunity to improve salmon habitat. Additional wood structures could be installed to accelerate erosion of the fine sediments and over time create a braided channel network composed of deep pools and extensive spawning areas. This would potentially increase both chum and Chinook spawning success as well as steelhead, coho and cutthroat rearing success. In addition, removal of all or a portion of the relic concrete dam would also increase desirable erosion at the upstream end of the perched terrace and restore a more natural floodplain function.

In 2015, during the peak of the drought in mid-August, water conditions were extremely low and very warm. Despite these poor water conditions LCFEG staff was able to document extensive numbers of juvenile coho salmon using the new pools. Adult spring and fall Chinook and coho are spawning in the new gravel bars that have formed in response to new hydraulic conditions. We anticipate additional changes will occur over the next few years in response to changed hydraulic conditions in the project area. These changes should be purposely accelerated to instigate removal of the relic terrace and formation of a braided channel network that maximizes spawning and rearing habitat for use by multiple salmon and steelhead populations.

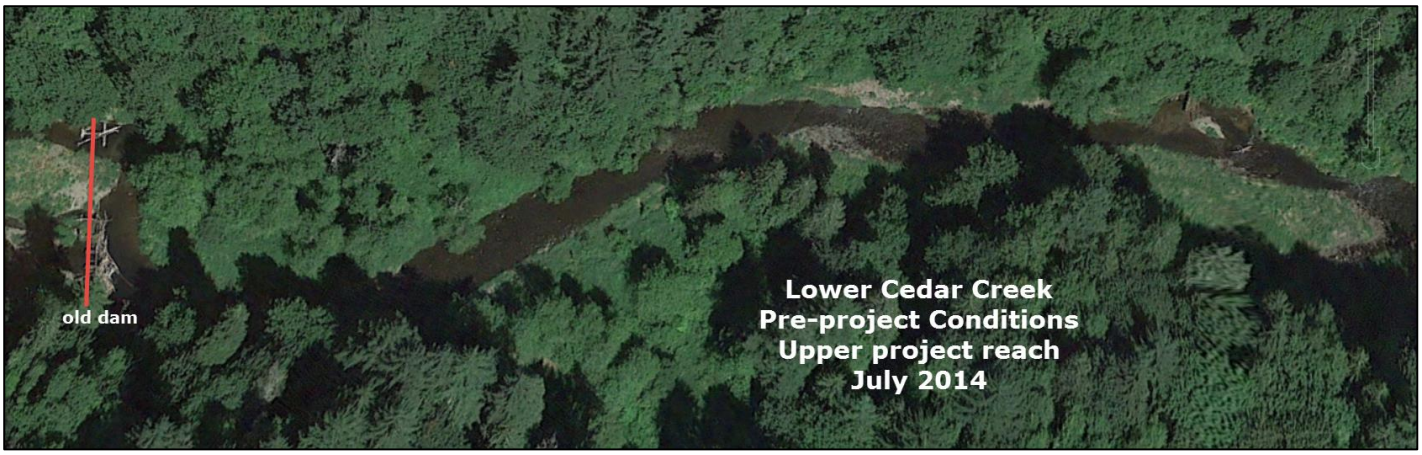
AS-BUILT

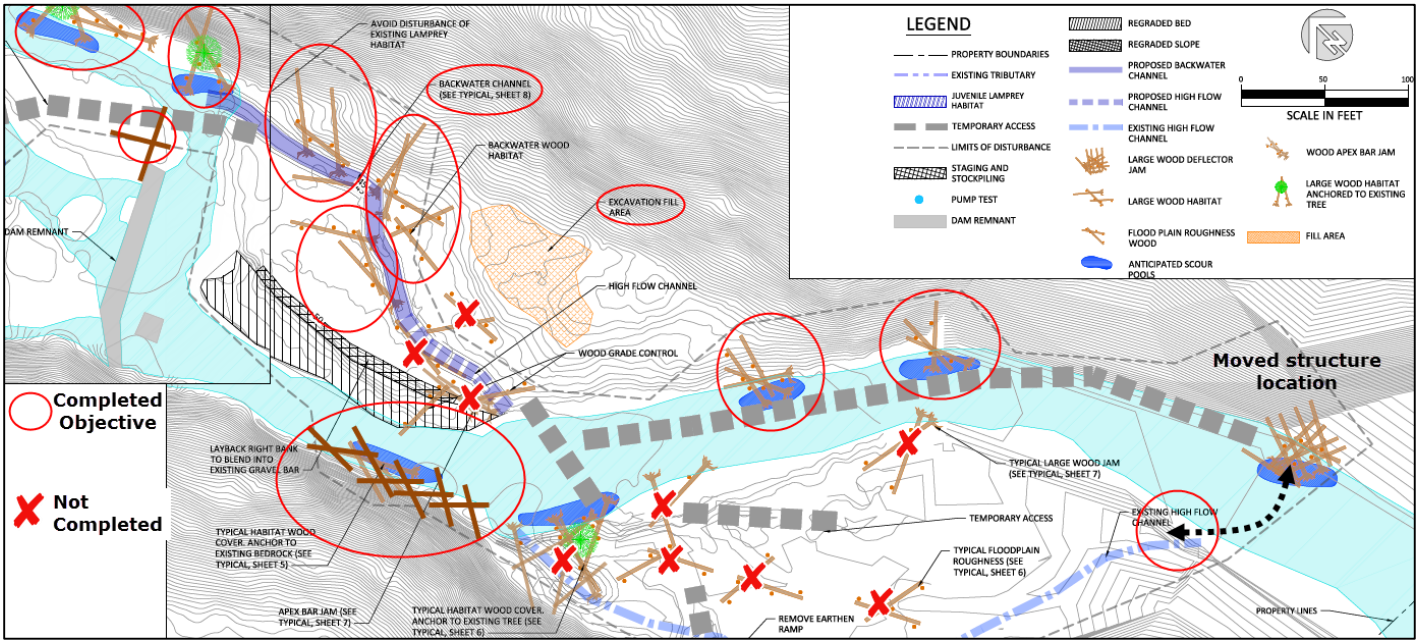






- Deleted floodplain roughness wood due to cost
- Added 1 log on end of dam to direct flow, added 1 root-wad to increase scour
- Deleted lower left bank structures due to concern with lamprey habitat
- Did not complete pump test due to cost, vegetation impact and low likelihood of future need





Lower Reach- Cedar Creek Design

- Deleted floodplain roughness logs due to cost and level of disturbance to floodplain
- Deleted 3 left bank instream structures due to cost & boater safety concerns
- Added logs to lower left bank structure and dam
- Added boater beware sign upstream of project

Pre Project Photos

Upper project site at OHW view u/s

Lower project area at OHW, view d/s

Pre & Post Project Photos

Note formation of new mid-channel bar

LWD significantly increased hydraulic complexity, note lateral channel expansion

Pre & Post Project view d/s

Summer 2014

Spring 2015

Excellent spawning and rearing habitat, diverse seasonal flow conditions

View downstream at OHW and OLW

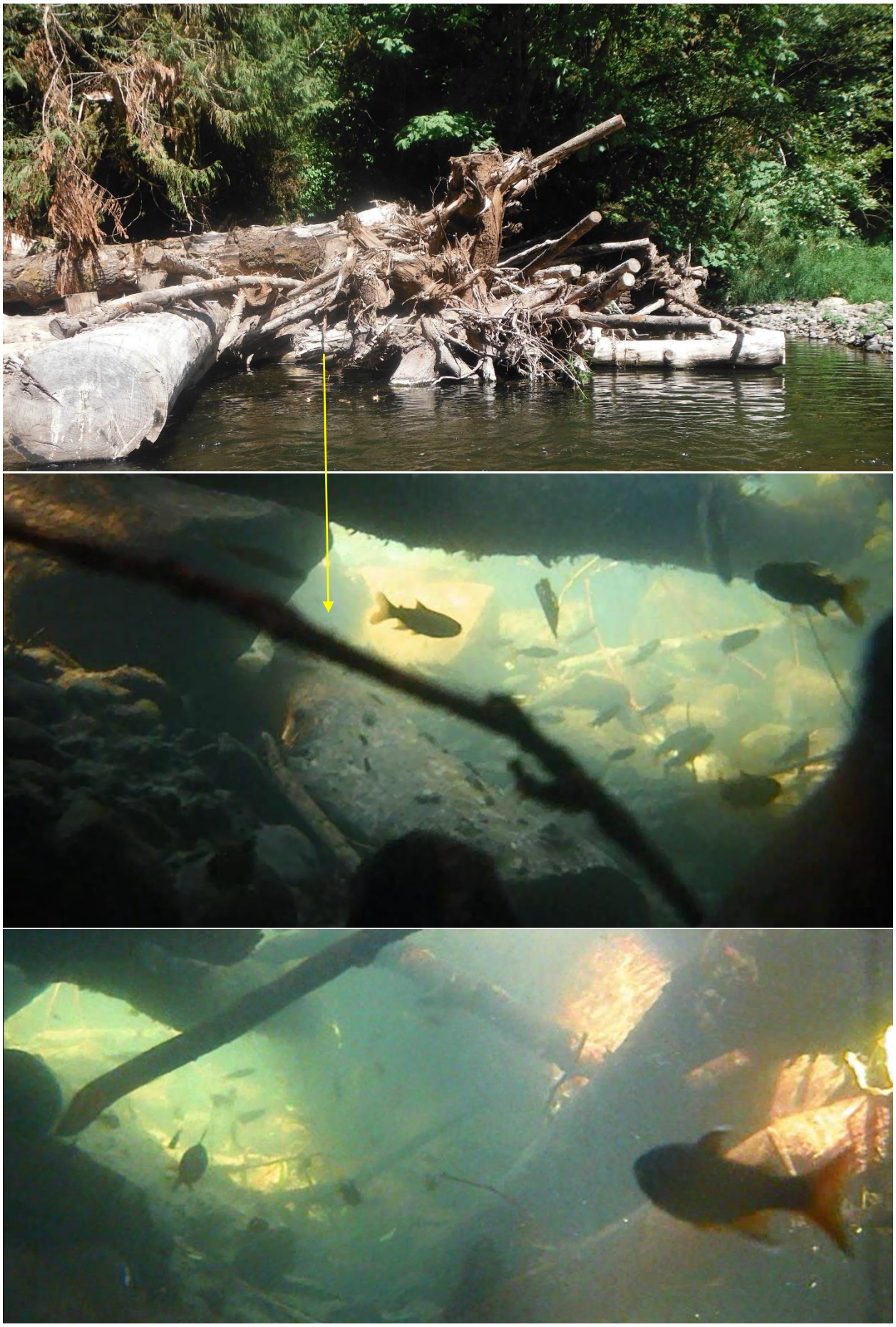
Alcove rearing pond contains juvenile salmon, lamprey and beaver

Checking post project pool depth

Fall Chinook and coho observed spawning on 10-19-2015

Spawned out Chinook

Spawning Chinook



Even with extreme (75F) warm water conditions in lower Cedar creek in 2015 we found large numbers of juvenile salmonids in the pools under the log jams. Water temperatures are lower in the pools due to heavy shade and hyporeic/ ground water upwelling.

Post-implementation Status Report
Little Creek Fish Habitat Restoration 2015

Partnership between Mount St. Helens Institute and USFS Gifford Pinchot National Forest

Prepared by: Abigail Groskopf, MSHI Science Education Director and Jacob Sleasman, MSHI Fisheries Lead

Reviewed by: Bryce Michaelis, South Zone Aquatic Technician, Gifford Pinchot National Forest

December 2015

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Project Summary

The Little Creek Fish Habitat Restoration Project resulted in the construction of 22 complex Large Woody Material (LWM) structures over 0.5 miles of stream. These LWM structures are designed to increase diversity in Little Creek, provide winter refuge from high flows and increase spawning habitat for Chinook salmon, coho salmon, and Steelhead trout.

Construction of the structures occurred during the summer of 2015. Approximately 300 trees with root wads were harvested from Forest Service land and flown to Little Creek. Trees were flown and stored at strategic locations to minimize soil erosion and to be in close proximity to structure areas. Trees were moved into place using a skidder and excavator and then 10-15 trees per structure were anchored using an excavator to bury one-half or more of the stem into streambanks with root wads projecting into the stream channel. In 2016 conifer saplings will be planted to provide future natural LWM and increase inner riparian shade. Areas around the stream will also be treated to remove noxious weeds.

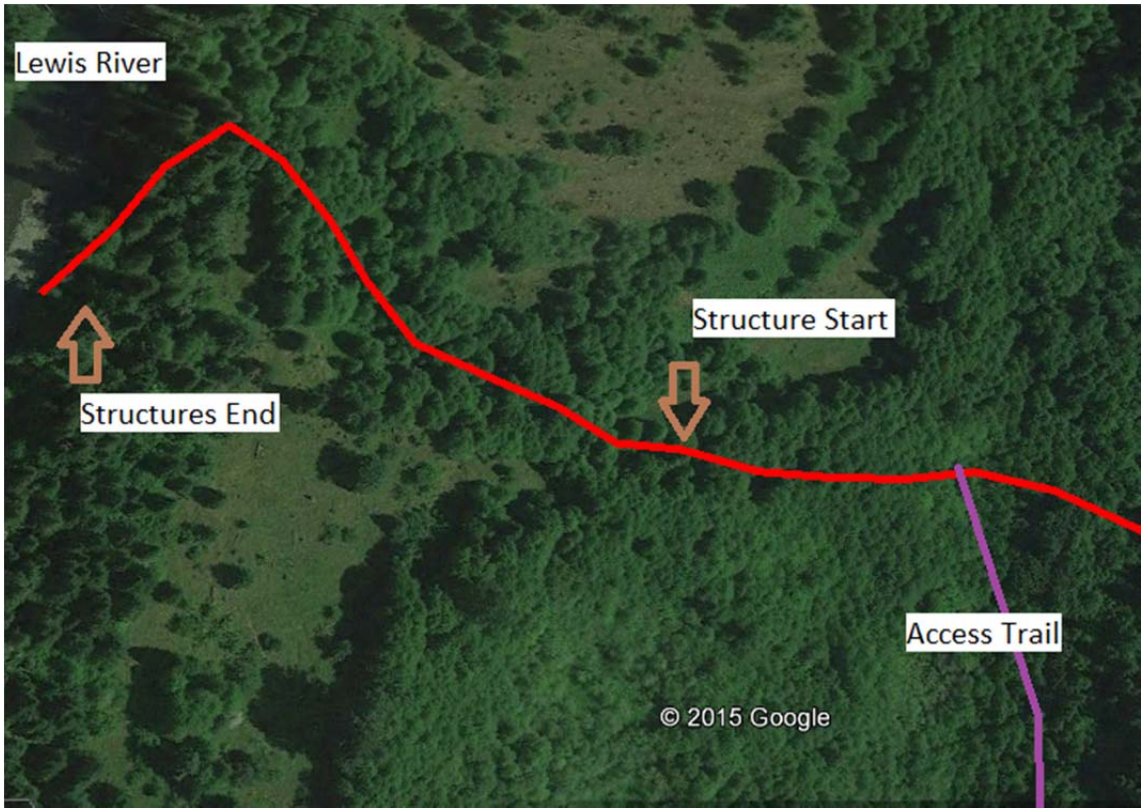
LWM being dropped by helicopter

This report summarizes the data collected in monitoring efforts. Longitudinal profiles, cross-section profiles, Wolman Pebble Counts are used to quantify changes in the stream channel. Photographs were also taken to visually monitor changes in the stream channel. Analysis and documentation of stream channel modifications is used to determine if the project goals outlined in the Lewis River Aquatic Coordination Committee (ACC) Project Proposal have been accomplished. Baseline monitoring of the project occurred in 2015 before and after project implementation. Post installation monitoring will occur in 2016.

Site Location and Description

Little Creek, located in the Gifford Pinchot National Forest, is located approximately 5.5 miles upstream of Swift Reservoir between Rush Creek and Big Creek. Access to the site is by parking at a decommissioned road to the east of the Rush Creek Bridge on FR 90. Little Creek is 0.5 miles down the decommissioned road.

Water flows year round in Little Creek and the stream channel varies between 15 to 30 feet in width. The stream channel braids in multiple locations. The section of Little Creek where the restoration project was implemented flows through a meadow and the riparian area is predominately alders with occasional conifers. There is a fish migration barrier upstream of the restoration project and downstream from FR 90.



1: Map of project area. Little Creek is identified by the red line.

Priorities and Goals

The Aquatic Coordination Committee has three priorities for restoration projects in the Lewis River Basin:

1. Benefit fish recovery throughout the North Fork Lewis River, with priority to federal ESA-listed species.
2. Support the reintroduction of anadromous fish throughout the basin.
3. Enhance fish habitat in the Lewis River Basin, with priority given to the North Fork Lewis River.

The three goals of this project to address these priorities include,

1. Improving habitat complexity and diversity in Little Creek using Large Woody Material
2. Providing refugia during winter flows for juvenile salmonids.
3. Providing increased spawning opportunities for adult salmonids.

The Mount St. Helens Institute monitored the structure in 2015 with support from the Forest Service and will conduct monitoring again in 2016 in order to determine if these goals have been meet.

Community Outreach

The Mount St. Helens Institute provides internships for undergraduate students studying fisheries science. Interns gain experience surveying and monitoring restoration projects. This experience is a stepping stone for a career in fisheries management. In addition, the Mount St. Helens Institute trains school age youth in watershed dynamics, monitoring and water quality analysis.

Monitoring Methodology

A baseline longitudinal profile was conducted prior to project implementation in 2015. Immediately following project installation, baseline cross-sectional surveys and pebble counts were conducted. In 2016 these measurements will be taken again to determine how the structures have changed stream morphology.

Cross-sections

To capture the effects of the LWM restoration structures a cross-section was established at key points within the structure. Only structures that were designed to alter geomorphology (pools, gravel-beds) were monitored with a cross section. A benchmark was placed on each side of the channel. Benchmarks are identified by either a nail in a tree or rebar in the ground. A measuring tape is then stretched across the channel and attached to each benchmark. A laser level is used to take height from ground measurements (elevation) along the tape (distance). For benchmarks in trees the height was taken at the end of the nail and the height from the ground to the nail was recorded in the notes.

Wolman Pebble Count

Each structure has an accompanying Wolman Pebble Count (WPC). Counts were taken upstream of each structure where gravel recruitment is expected. A gravel-o-meter was used to measure substrate that can be picked up. Larger substrate was measured with a ruler on the side of the gravel-o-meter. A minimum of 100 pieces of substrate were counted for each WPC.

Longitudinal Profile

A longitudinal profile was created for the entire stream channel. A longitudinal profile measures the elevation changes following the thalweg. The thalweg is the deepest continuing line in the stream channel. It is important to note that due to stream/thalweg meandering the longitudinal profile is not only a measure of distance and elevation, but also of sinuosity. From the longitudinal profile, pool depths and pool:riffle ratio can be assessed.

The benchmark for the longitudinal profile is a nail in a tree, located in a tree overhanging the stream at the upstream start of the project area. A laser level is used to take height off ground measurements. A range finder is used to measure the distance between each point. The creek channel is too long to be surveyed from one placement of the laser. When the laser had to be moved a height was taken before and after the laser move

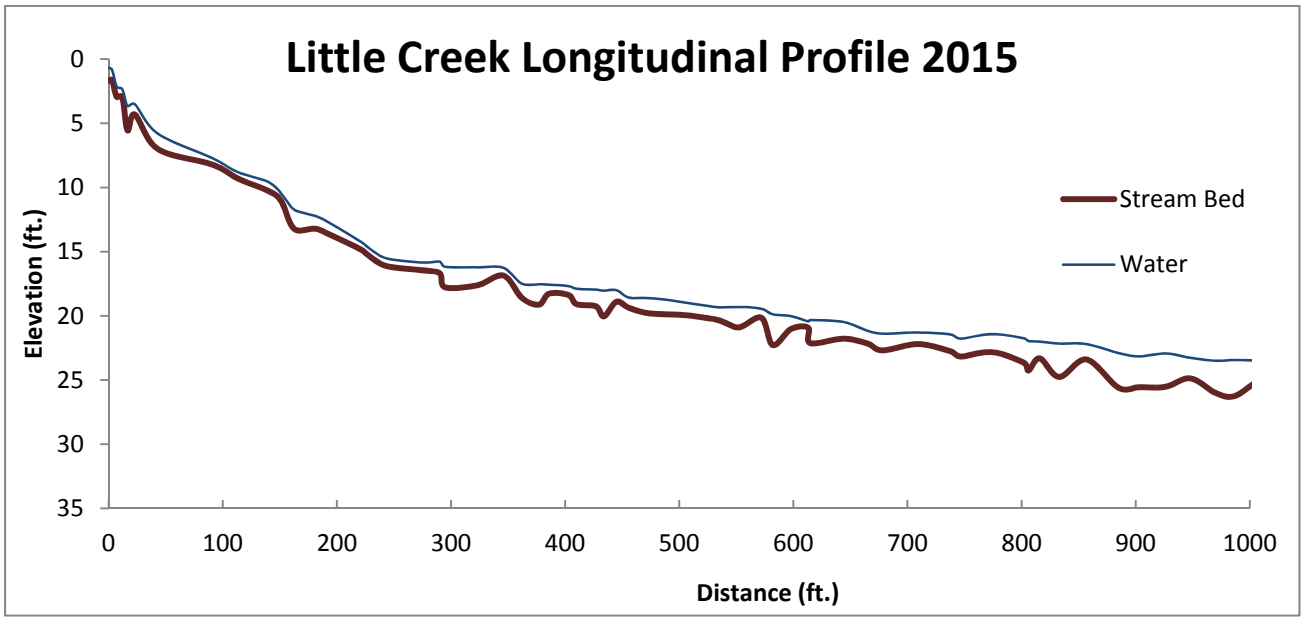
Photos

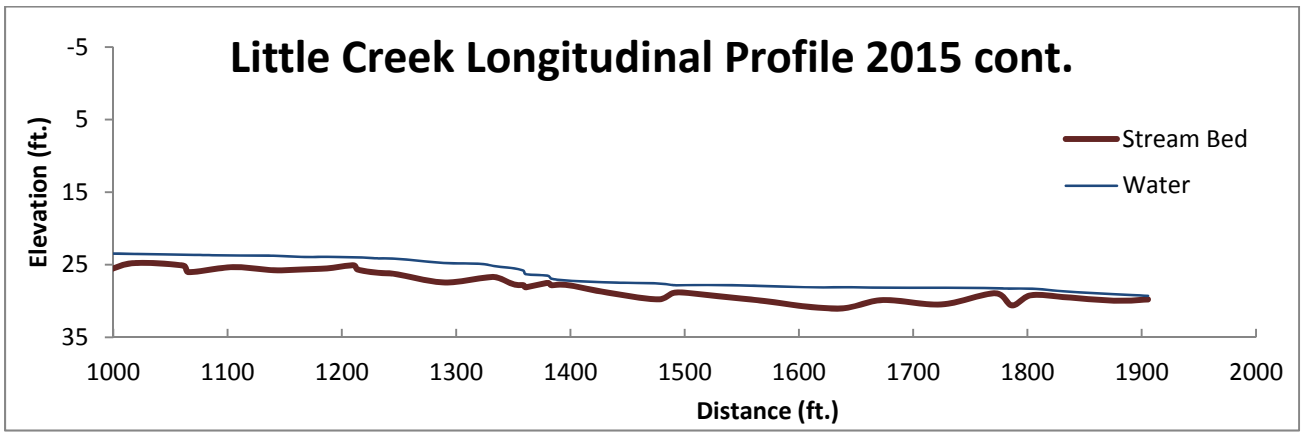
Photos were taken at all structures above the structure looking downstream, opposite the structure, and below the structure looking upstream.

Results and Analysis

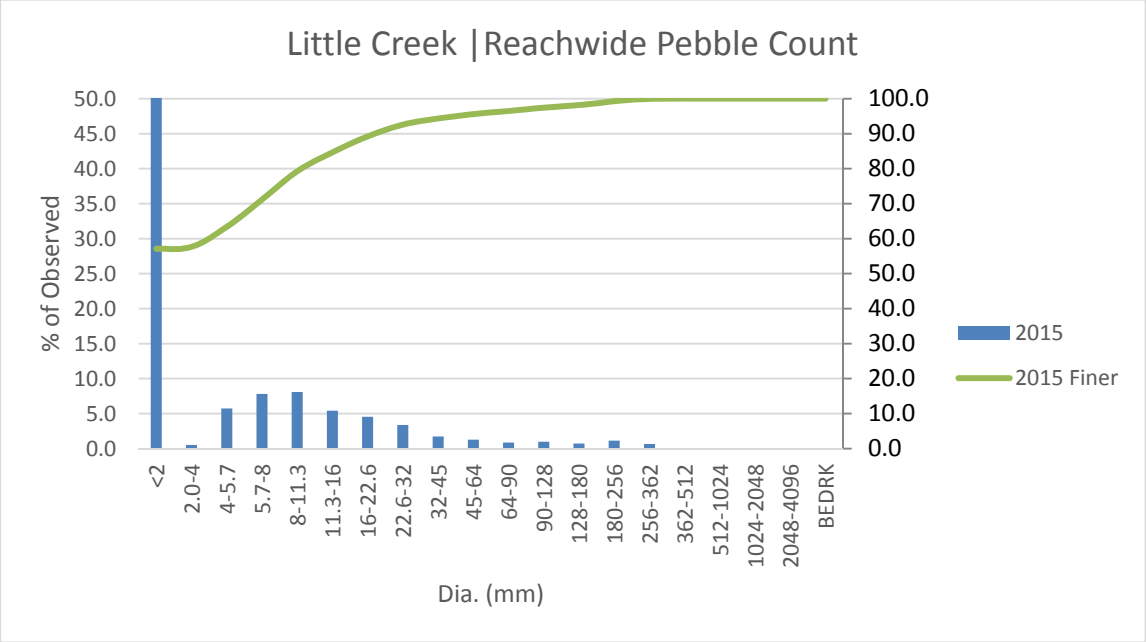
Analysis will be conducted following the 2016 monitoring season. The restoration reach-level longitudinal profile and substrate assessment are included below.

Longitudinal Profile





Pebble Counts



	2015	
ST	**D50**	**D84**
1	6	9
2	7	15
3	12	35
5	Fines	65
6	80	207
7	3	8
8	Fines	6
9	3	6
10	Fines	4
11	Fines	Fines
13	Fines	11
14	Fines	Fines
16	Fines	4
17	15	25
19	5	16
20	Fines	Fines
21	Fines	Fines
22	Fines	7
Reach-wide	Fines	13

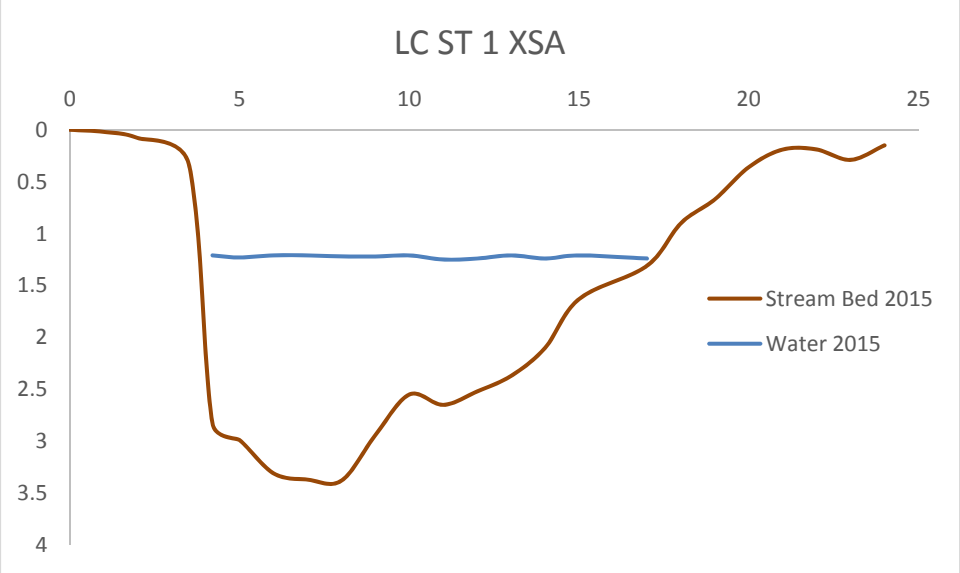
Conclusions

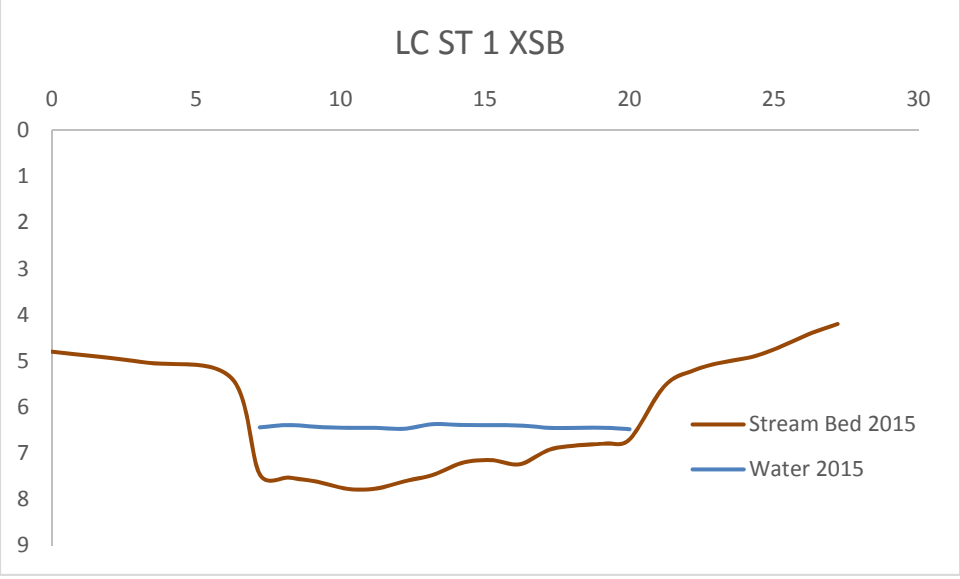
Conclusions on the project's three main goals will be included in the 2016 final report. The project goals are:

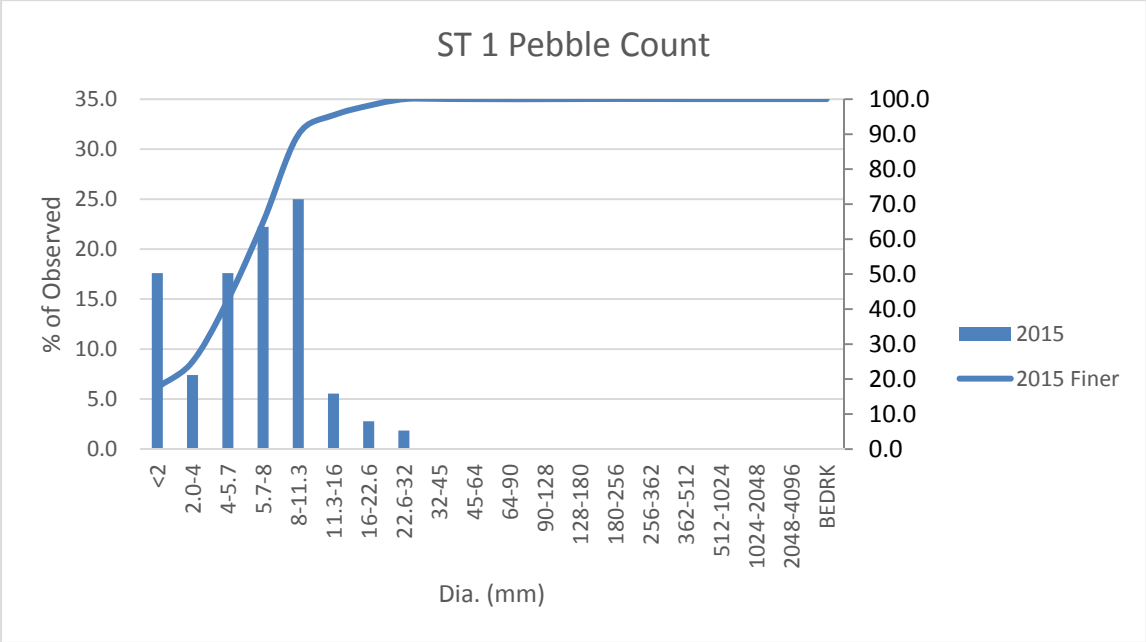
1. Improving habitat complexity and diversity in the creek channel using LWM
2. Provide refuge during winter flows for juvenile salmonids.
3. Providing increased spawning opportunities for adult salmonids.

Appendix A: Site level cross-sections and photo-documentation

Included for each complex structure are baseline cross-sectional graphs and well as post-installation photographs. Substrate graphs and additional site photos are available upon request. Photos of bank stabilization structures are available on request.



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% of Observed
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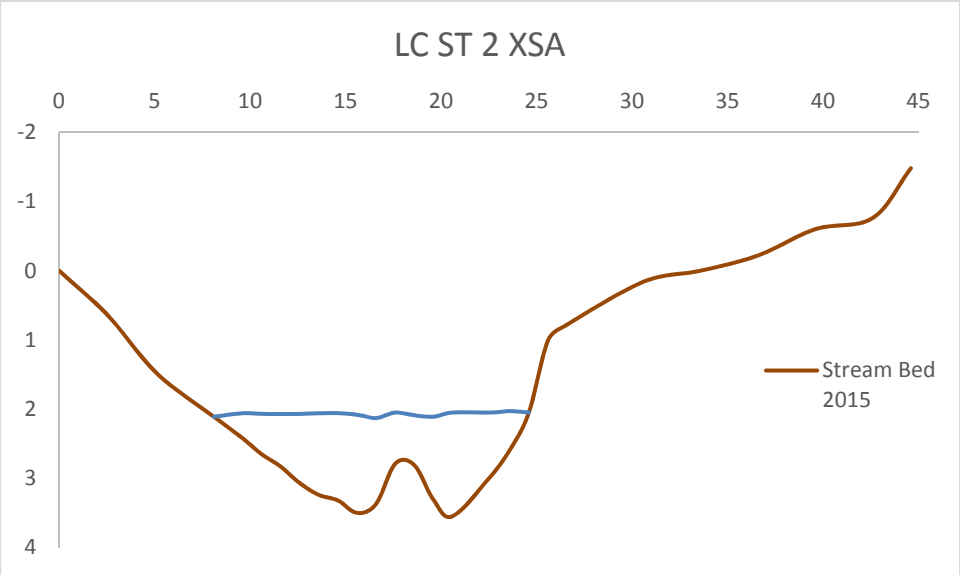
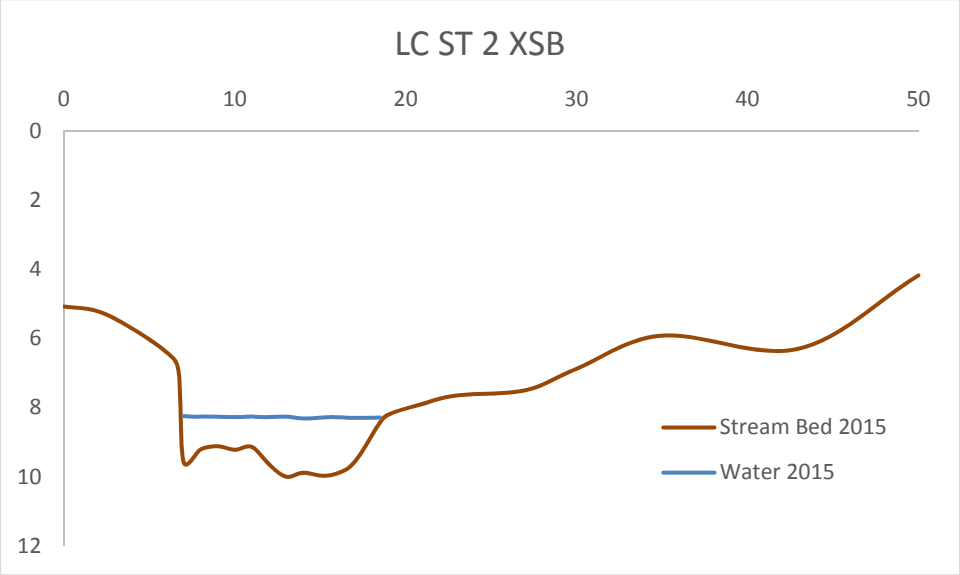
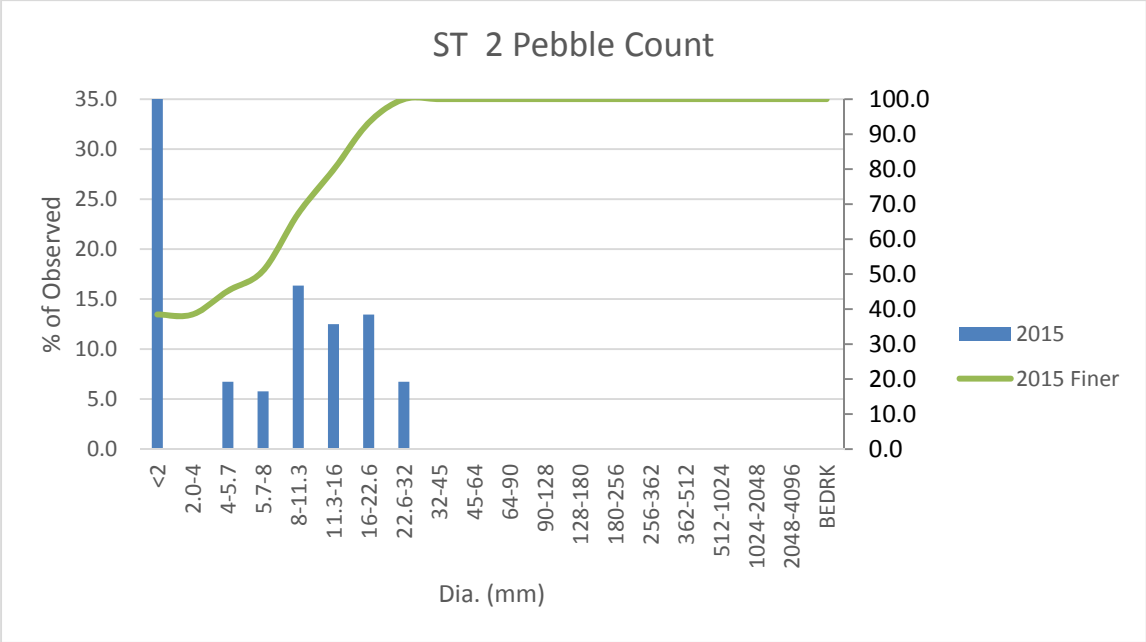
30.0
25.0
20.0
15.0
10.0
5.0
0.0
100.0
90.0
80.0
70.0
60.0
50.0
40.0
30.0
20.0
10.0
0.0
<2
2.0-4
4-5.7
5.7-8
8-11.3
11.3-16
16-22.6
22.6-32
32-45
45-64
64-90
90-128
128-180
180-256
256-362
362-512
512-1024
1024-2048
2048-4096
BEDRK
Dia. (mm)
2015
2015 Finer

St 1 2015


LC ST 2 XSA
0
5
10
15
20
25
30
35
40
45
-2
-1
0
1
2
3
4
Stream Bed 2015


LC ST 2 XSB
0
10
20
30
40
50
0
2
4
6
8
10
12
Stream Bed 2015
Water 2015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% of Observed
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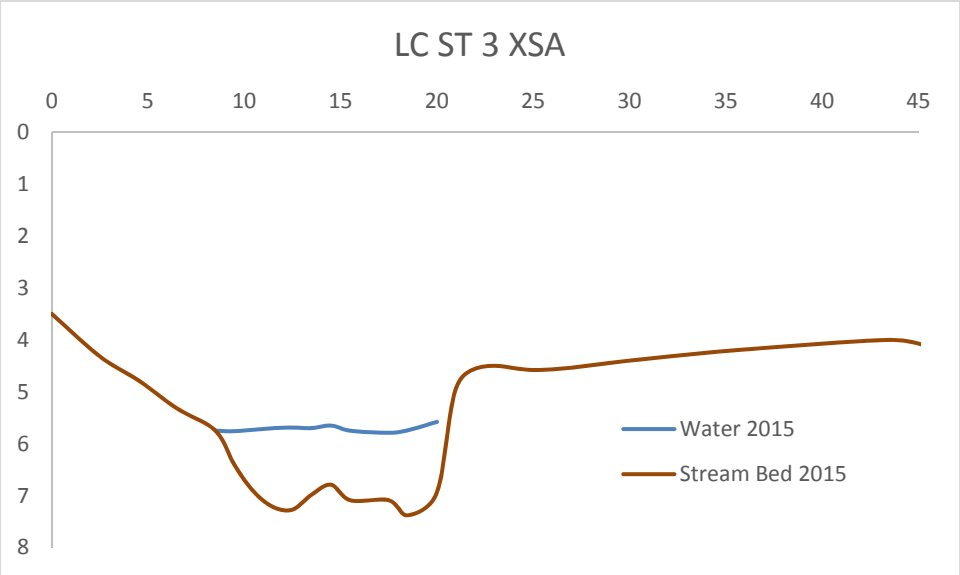
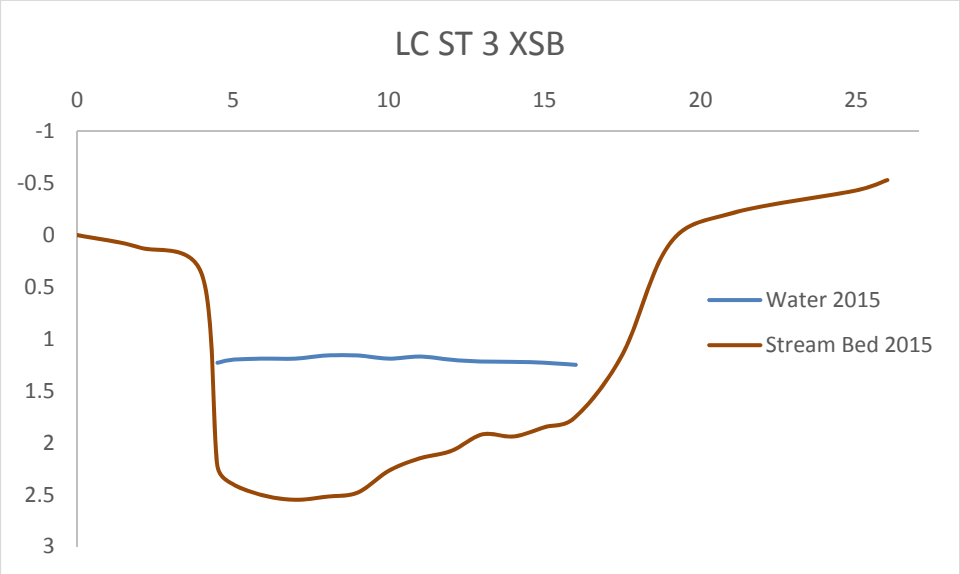
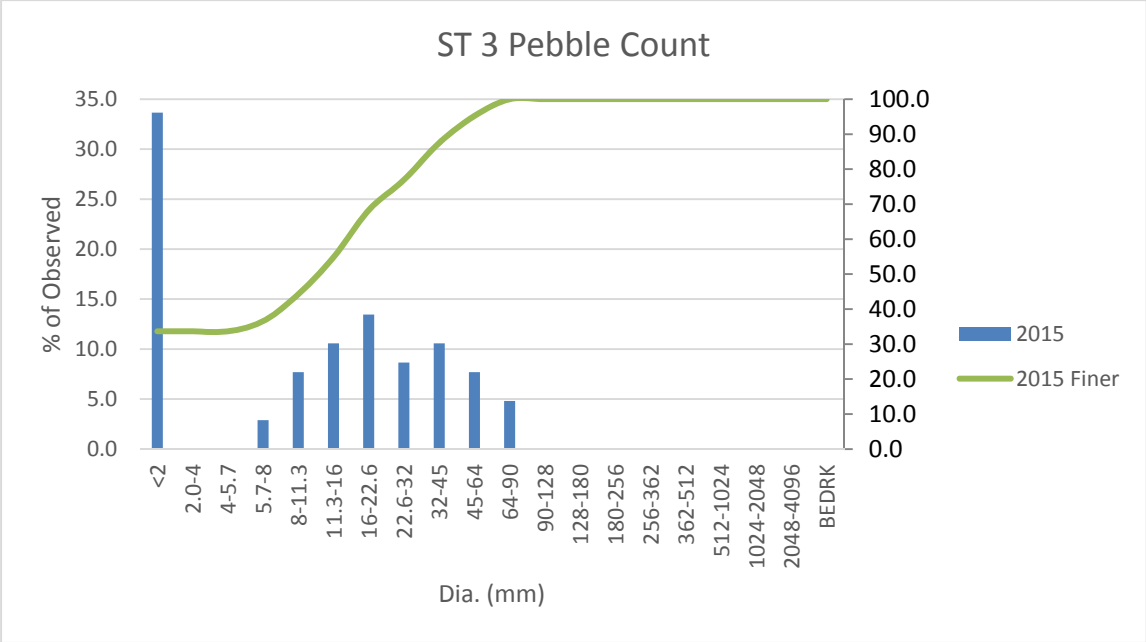
30.0
25.0
20.0
15.0
10.0
5.0
0.0
100.0
90.0
80.0
70.0
60.0
50.0
40.0
30.0
20.0
10.0
0.0
<2
2.0-4
4-5.7
5.7-8
8-11.3
11.3-16
16-22.6
22.6-32
32-45
45-64
64-90
90-128
128-180
180-256
256-362
362-512
512-1024
1024-2048
2048-4096
BEDRK
Dia. (mm)
2015
2015 Finer

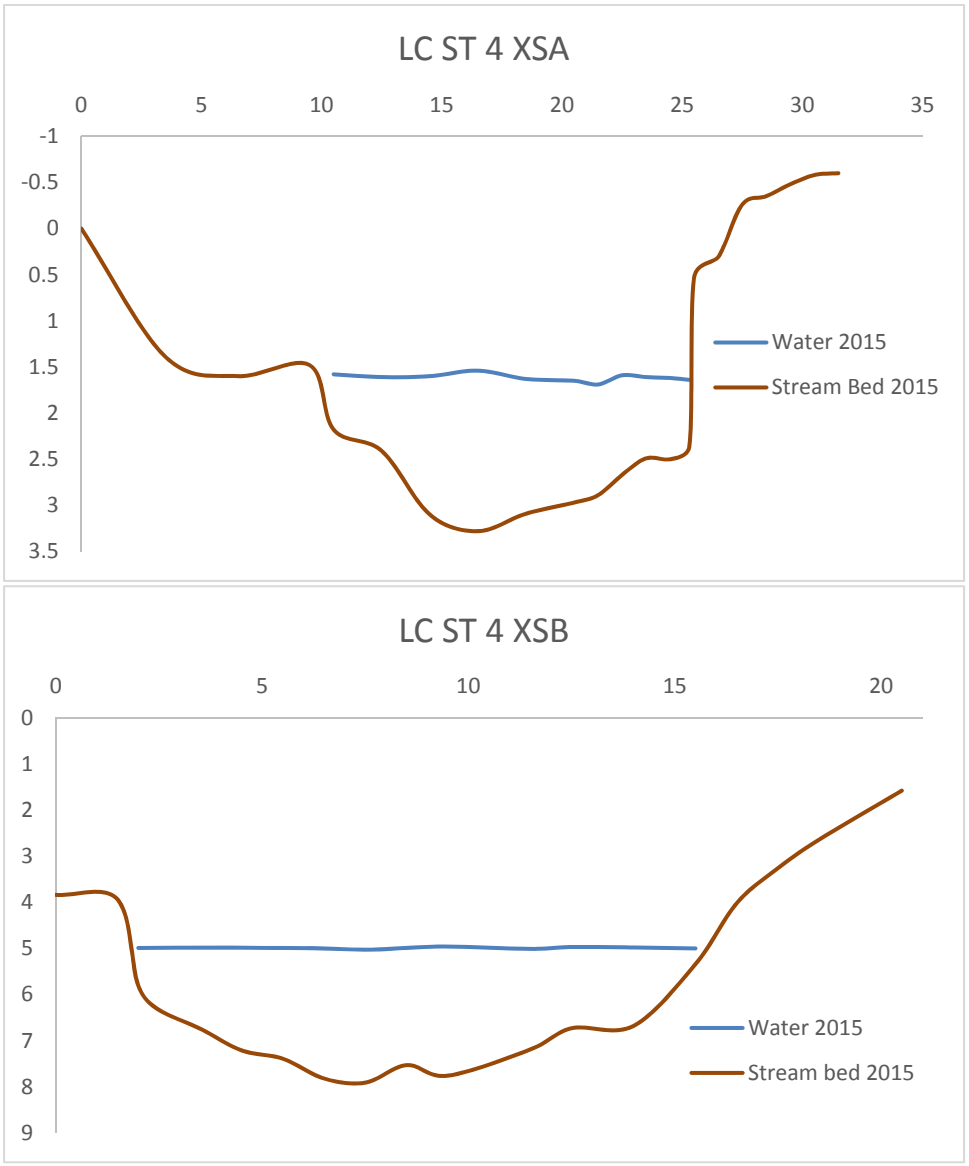
St 2 2015


LC ST 3 XSA
0
5
10
15
20
25
30
35
40
45
0
1
2
3
4
5
6
7
8
Water 2015
Stream Bed 2015


LC ST 3 XSB
0
5
10
15
20
25
-1
-0.5
0
0.5
1
1.5
2
2.5
3
Water 2015
Stream Bed 2015

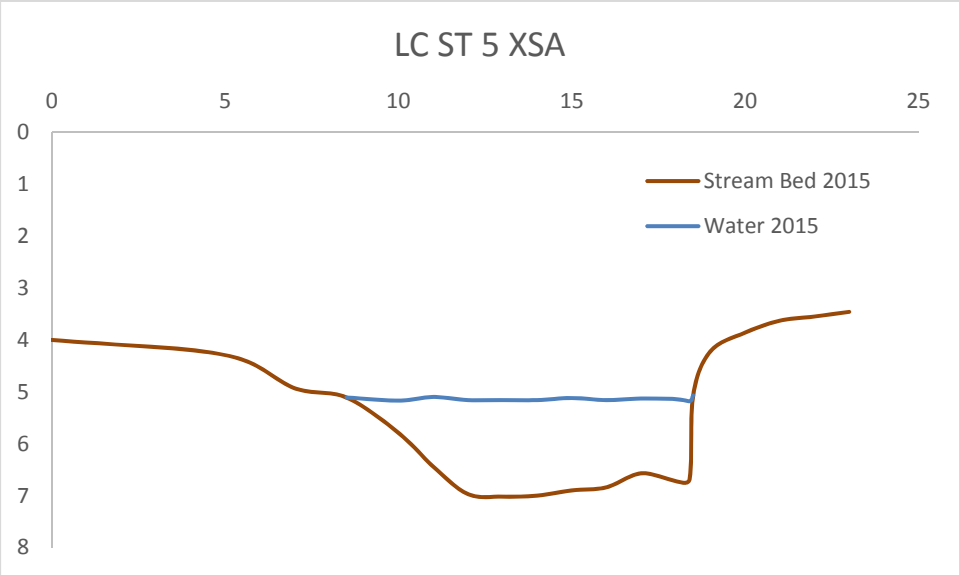

ST 3 Pebble Count
% of Observed
35.0
30.0
25.0
20.0
15.0
10.0
5.0
0.0
100.0
90.0
80.0
70.0
60.0
50.0
40.0
30.0
20.0
10.0
0.0
<2
2.0-4
4-5.7
5.7-8
8-11.3
11.3-16
16-22.6
22.6-32
32-45
45-64
64-90
90-128
128-180
180-256
256-362
362-512
512-1024
1024-2048
2048-4096
BEDRK
Dia. (mm)
2015
2015 Finer

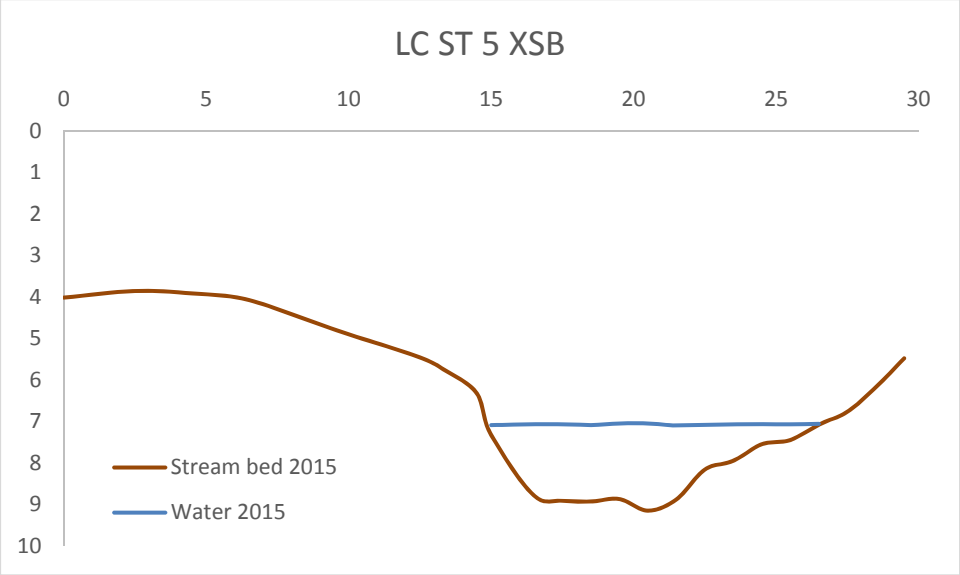
St 3 2015

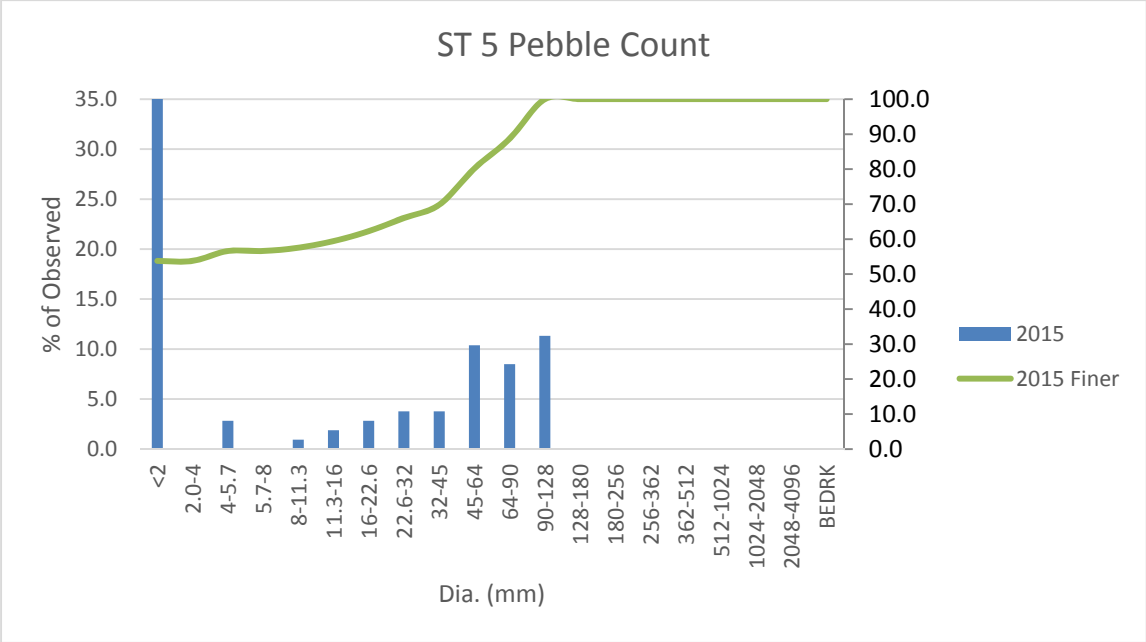


Water is too deep/swift for accurate pebble count

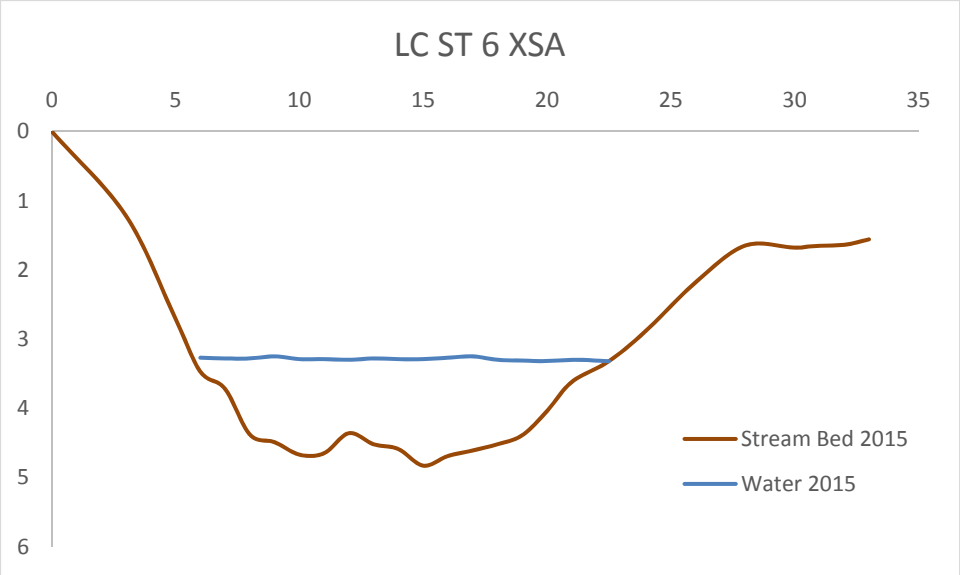
St 4 2015

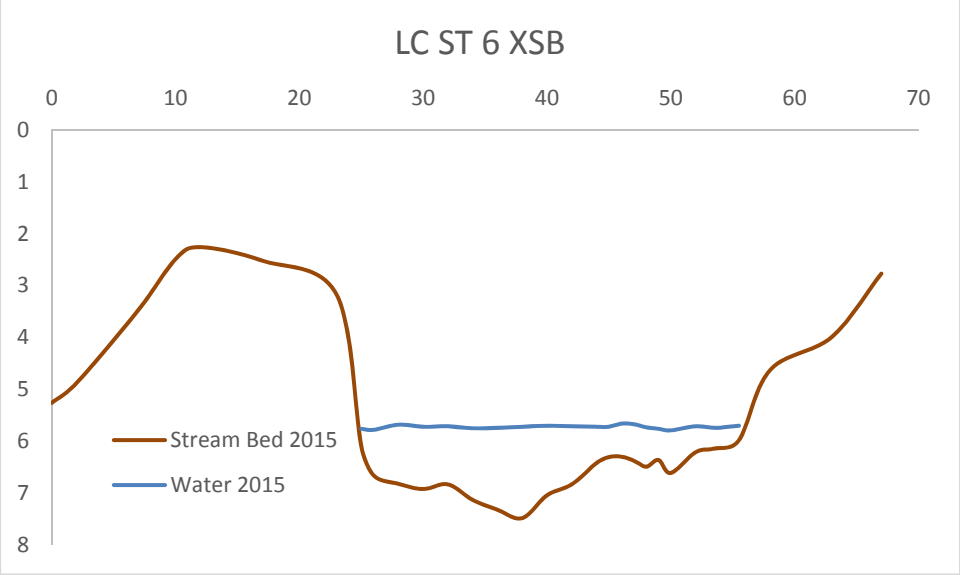

LC ST 5 XSA
0
5
10
15
20
25
0
1
2
3
4
5
6
7
8
Stream Bed 2015
Water 2015

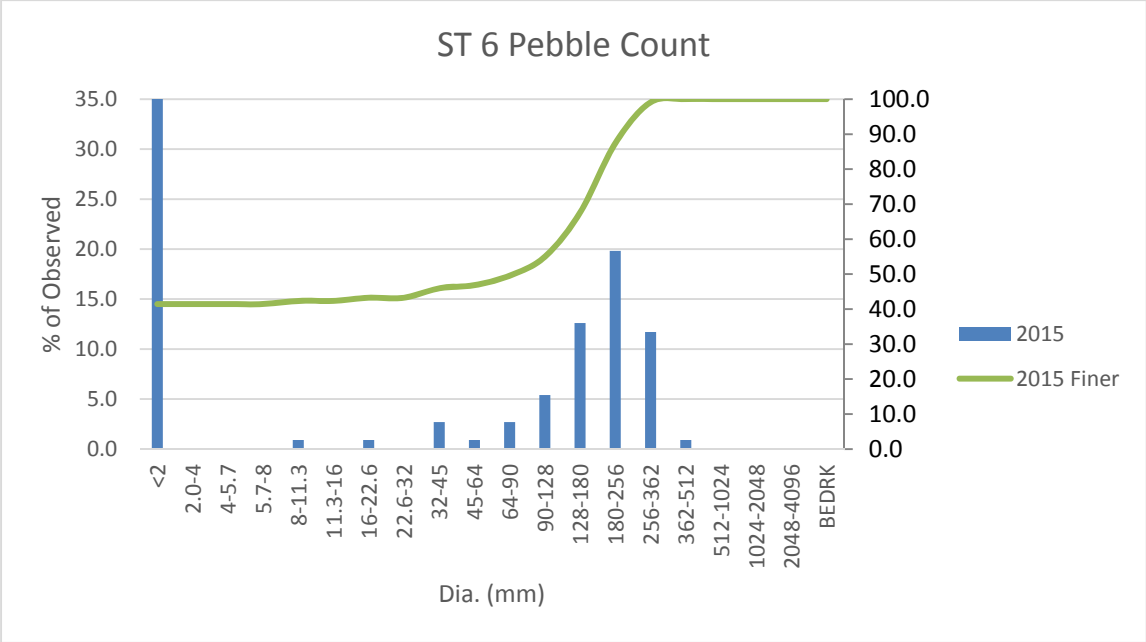

LC ST 5 XSB
0
5
10
15
20
25
30
0
1
2
3
4
5
6
7
8
9
10
Stream bed 2015
Water 2015


ST 5 Pebble Count
% of Observed
35.0
30.0
25.0
20.0
15.0
10.0
5.0
0.0
100.0
90.0
80.0
70.0
60.0
50.0
40.0
30.0
20.0
10.0
0.0
<2
2.0-4
4-5.7
5.7-8
8-11.3
11.3-16
16-22.6
22.6-32
32-45
45-64
64-90
90-128
128-180
180-256
256-362
362-512
512-1024
1024-2048
2048-4096
BEDRK
Dia. (mm)
2015
2015 Finer

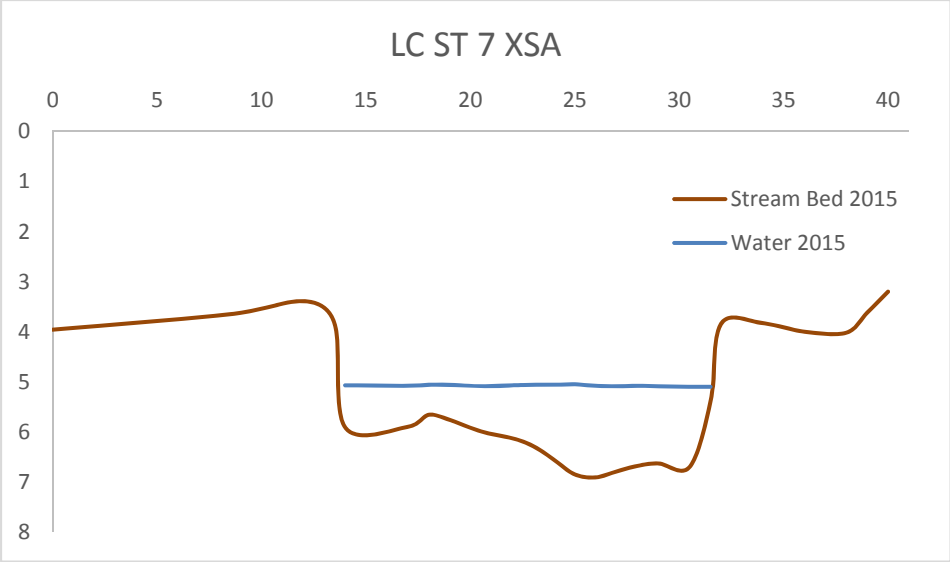
St 5 2015

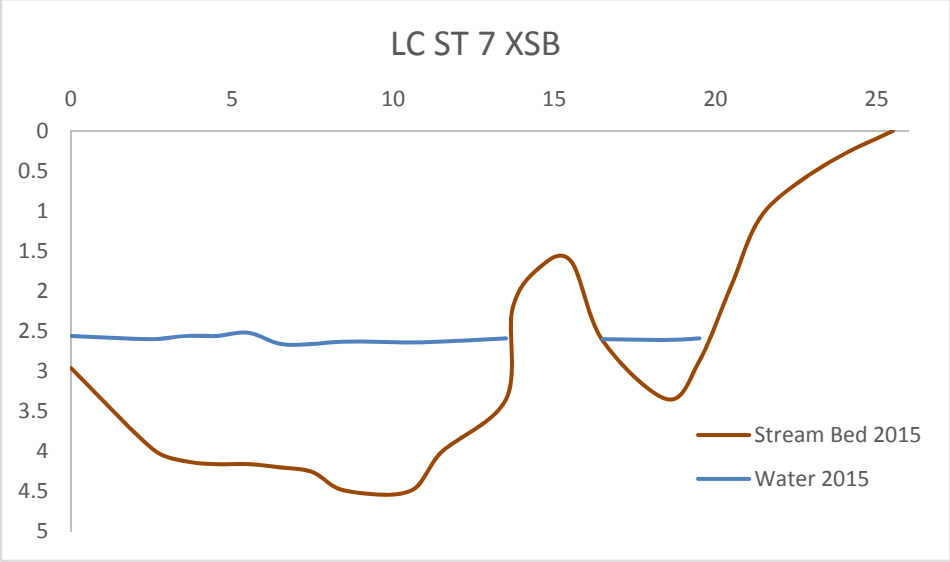

LC ST 6 XSA
0
5
10
15
20
25
30
35
0
1
2
3
4
5
6
Stream Bed 2015
Water 2015

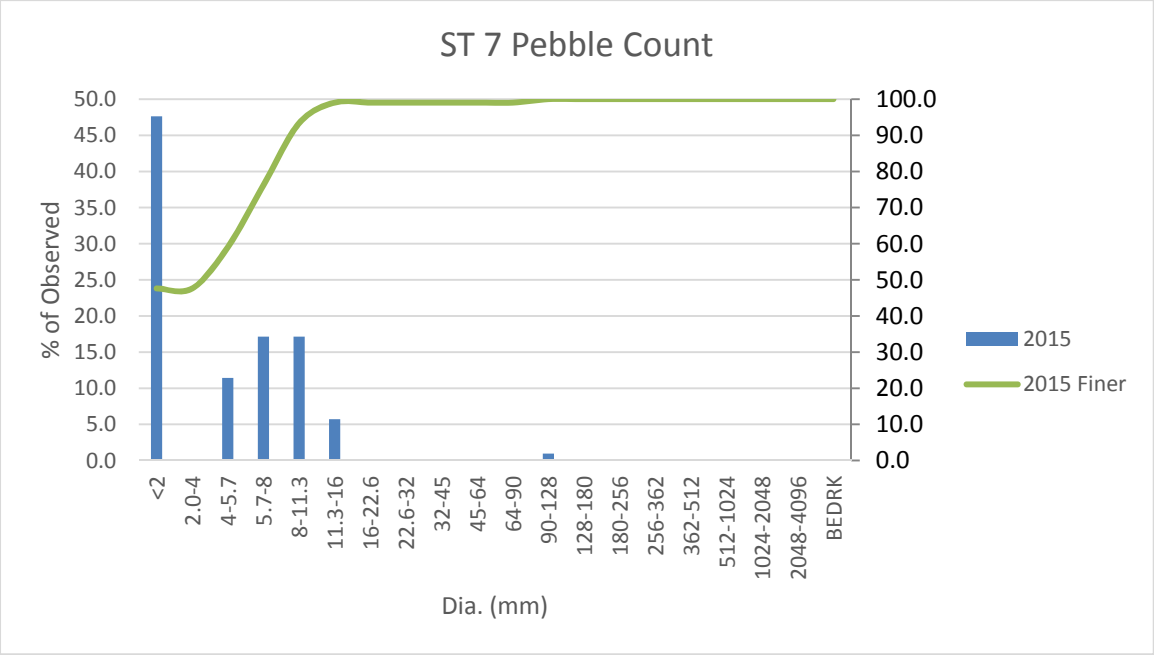

LC ST 6 XSB
0
10
20
30
40
50
60
70
0
1
2
3
4
5
6
7
8
Stream Bed 2015
Water 2015


ST 6 Pebble Count
% of Observed
35.0
30.0
25.0
20.0
15.0
10.0
5.0
0.0
100.0
90.0
80.0
70.0
60.0
50.0
40.0
30.0
20.0
10.0
0.0
<2
2.0-4
4-5.7
5.7-8
8-11.3
11.3-16
16-22.6
22.6-32
32-45
45-64
64-90
90-128
128-180
180-256
256-362
362-512
512-1024
1024-2048
2048-4096
BEDRK
Dia. (mm)
2015
2015 Finer

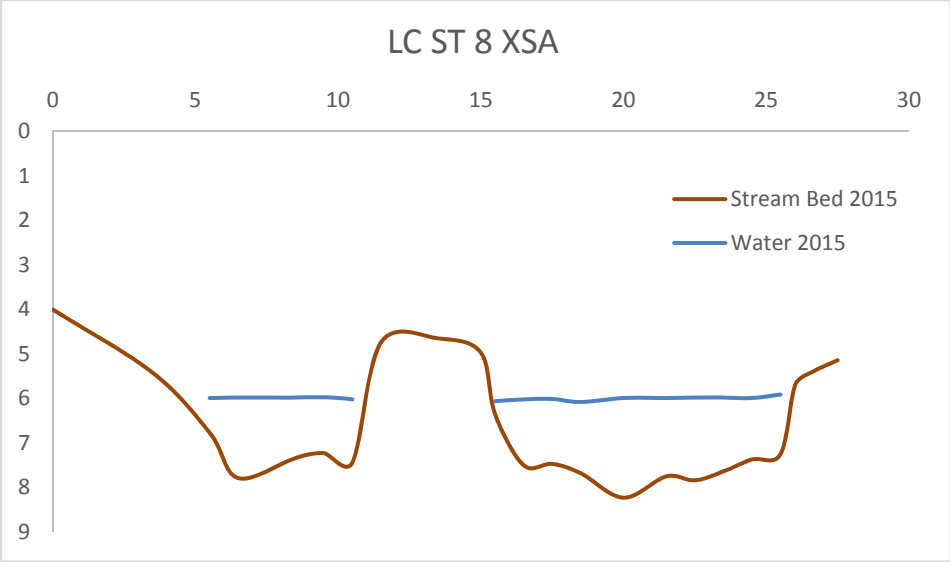
St 6 2015

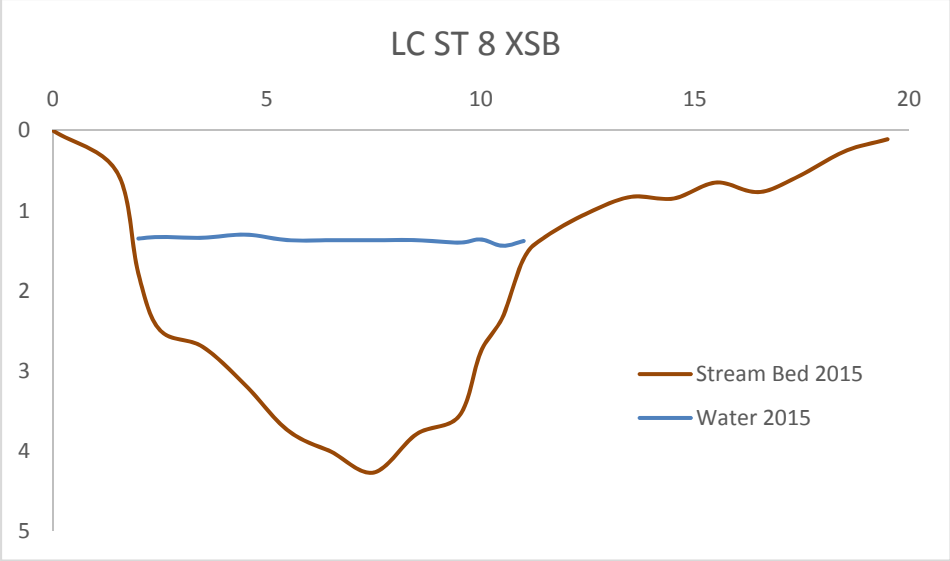

LC ST 7 XSA
0
5
10
15
20
25
30
35
40
0
1
2
3
4
5
6
7
8
Stream Bed 2015
Water 2015

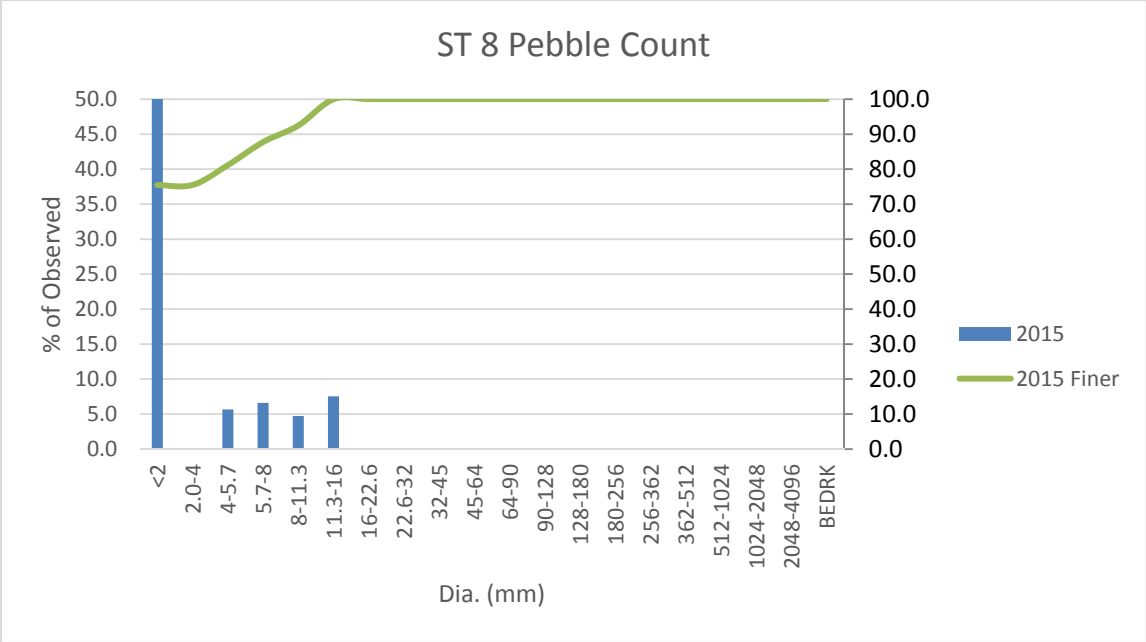

LC ST 7 XSB
0
5
10
15
20
25
0
0.5
1
1.5
2
2.5
3
3.5
4
4.5
5
Stream Bed 2015
Water 2015


ST 7 Pebble Count
% of Observed
50.0
45.0
40.0
35.0
30.0
25.0
20.0
15.0
10.0
5.0
0.0
100.0
90.0
80.0
70.0
60.0
50.0
40.0
30.0
20.0
10.0
0.0
<2
2.0-4
4-5.7
5.7-8
8-11.3
11.3-16
16-22.6
22.6-32
32-45
45-64
64-90
90-128
128-180
180-256
256-362
362-512
512-1024
1024-2048
2048-4096
BEDRK
Dia. (mm)
2015
2015 Finer

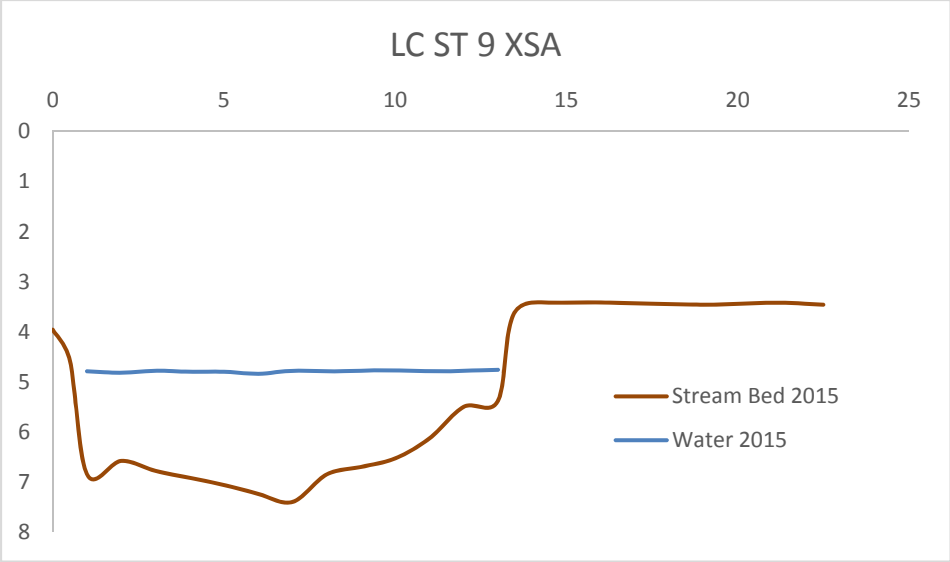
St 7 2015

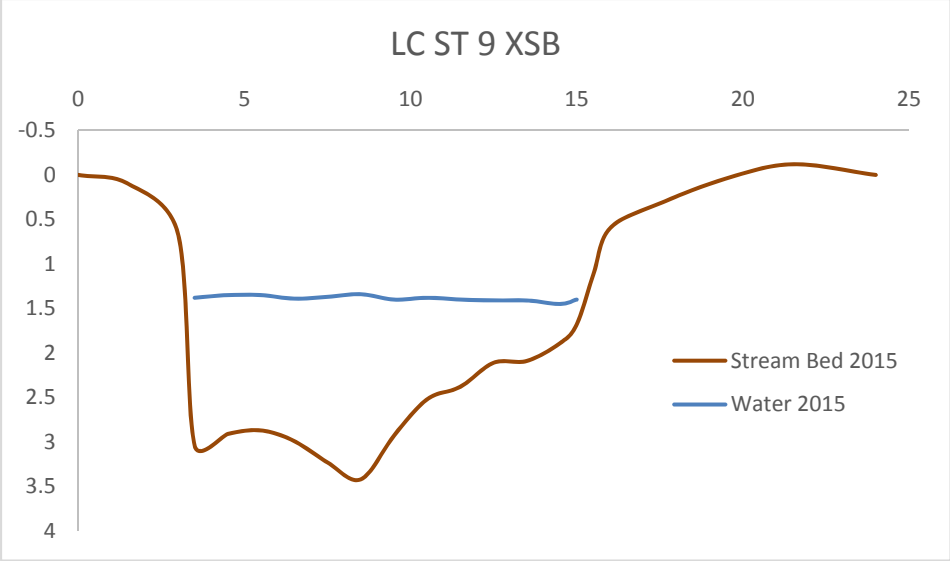

LC ST 8 XSA
0
5
10
15
20
25
30
0
1
2
3
4
5
6
7
8
9
Stream Bed 2015
Water 2015

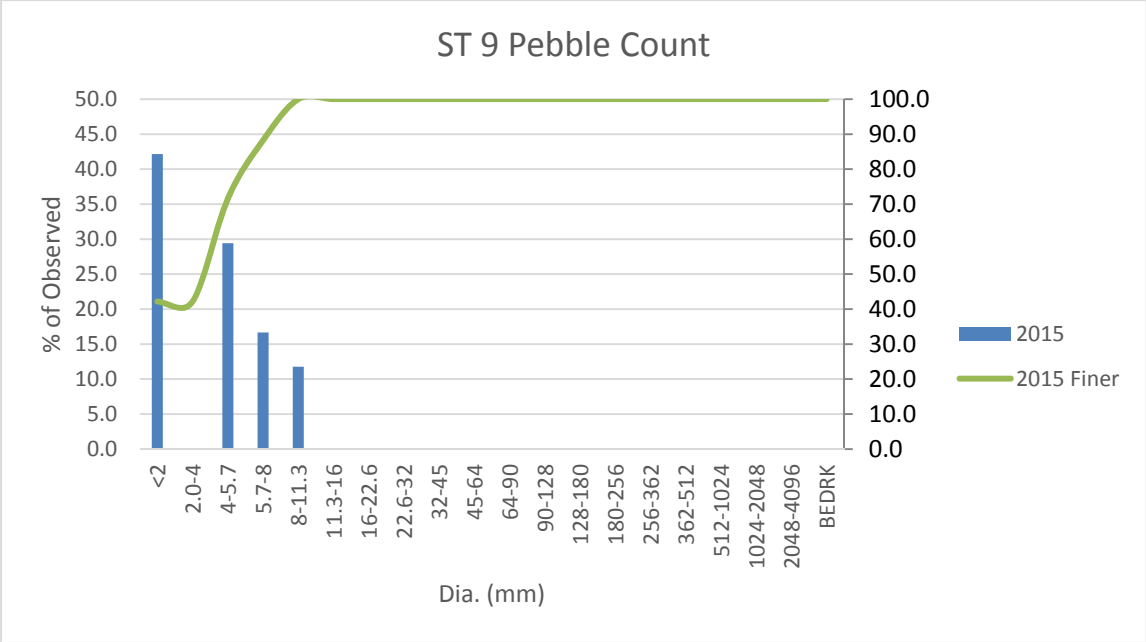

LC ST 8 XSB
0
5
10
15
20
0
1
2
3
4
5
Stream Bed 2015
Water 2015


ST 8 Pebble Count
% of Observed
50.0
45.0
40.0
35.0
30.0
25.0
20.0
15.0
10.0
5.0
0.0
100.0
90.0
80.0
70.0
60.0
50.0
40.0
30.0
20.0
10.0
0.0
<2
2.0-4
4-5.7
5.7-8
8-11.3
11.3-16
16-22.6
22.6-32
32-45
45-64
64-90
90-128
128-180
180-256
256-362
362-512
512-1024
1024-2048
2048-4096
BEDRK
Dia. (mm)
2015
2015 Finer

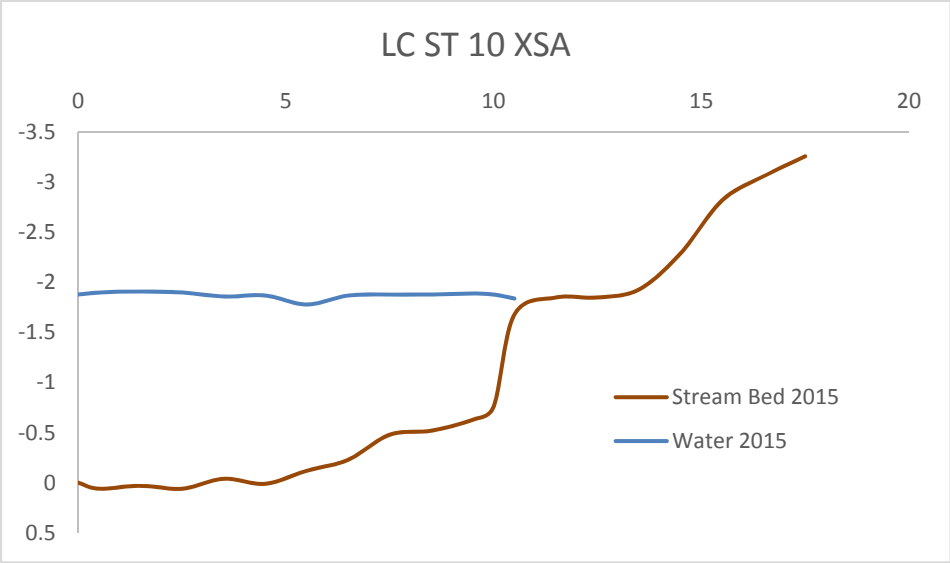
St 8 2015

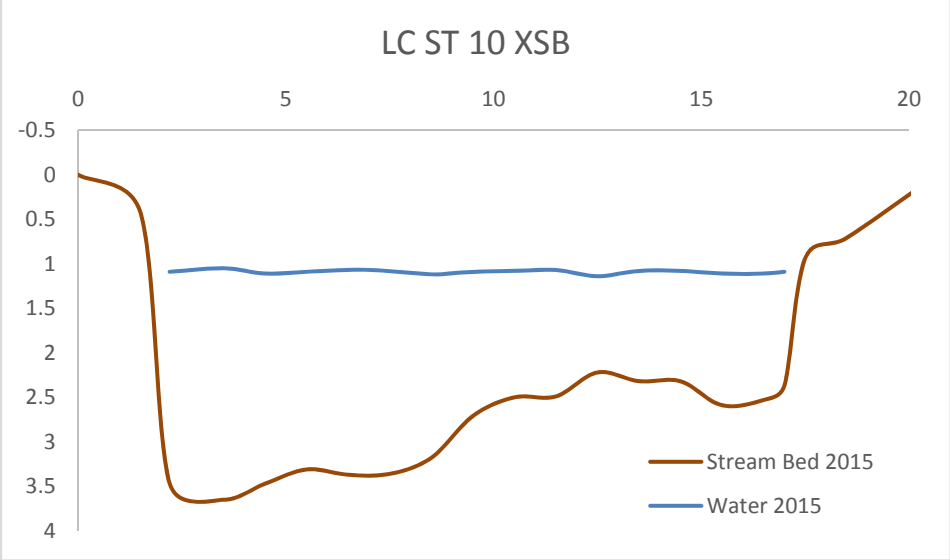

LC ST 9 XSA
0
5
10
15
20
25
0
1
2
3
4
5
6
7
8
Stream Bed 2015
Water 2015

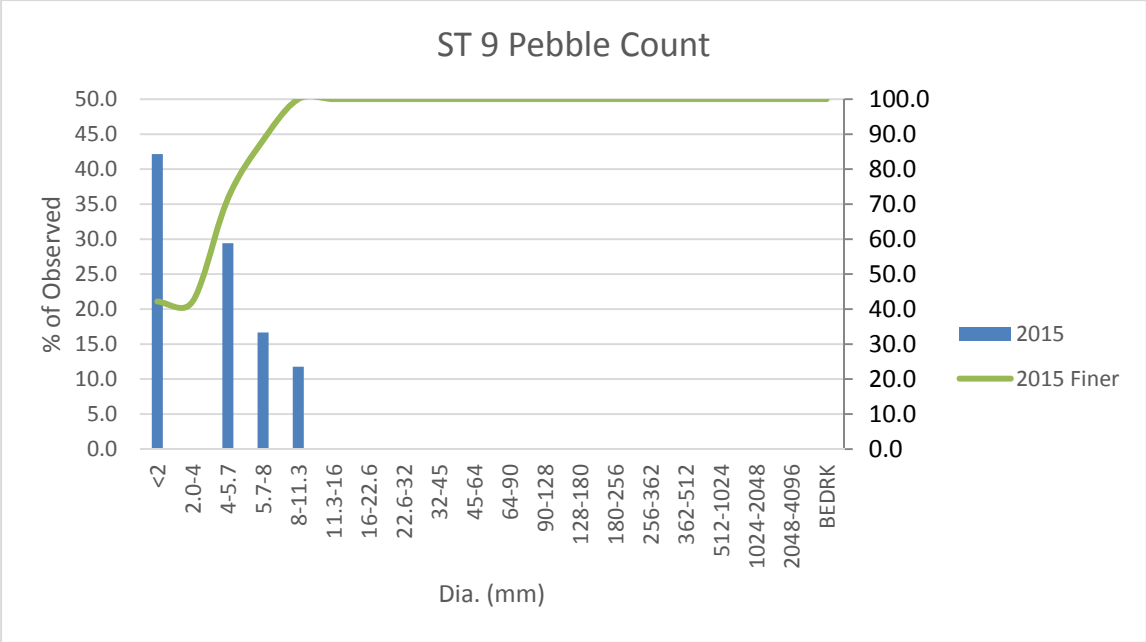

LC ST 9 XSB
0
5
10
15
20
25
-0.5
0
0.5
1
1.5
2
2.5
3
3.5
4
Stream Bed 2015
Water 2015


ST 9 Pebble Count
% of Observed
50.0
45.0
40.0
35.0
30.0
25.0
20.0
15.0
10.0
5.0
0.0
100.0
90.0
80.0
70.0
60.0
50.0
40.0
30.0
20.0
10.0
0.0
<2
2.0-4
4-5.7
5.7-8
8-11.3
11.3-16
16-22.6
22.6-32
32-45
45-64
64-90
90-128
128-180
180-256
256-362
362-512
512-1024
1024-2048
2048-4096
BEDRK
Dia. (mm)
2015
2015 Finer

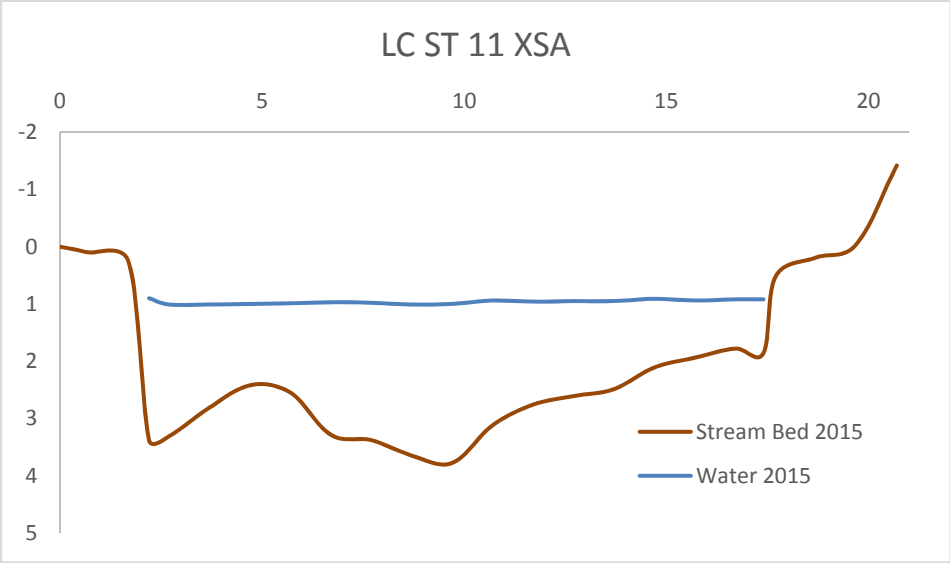
St 9 2015

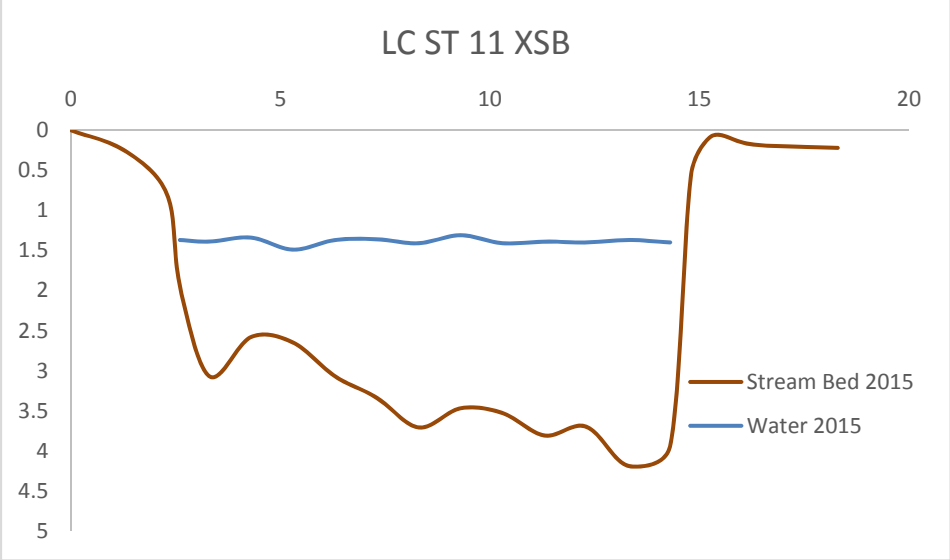

LC ST 10 XSA
0
5
10
15
20
-3.5
-3
-2.5
-2
-1.5
-1
-0.5
0
0.5
Stream Bed 2015
Water 2015

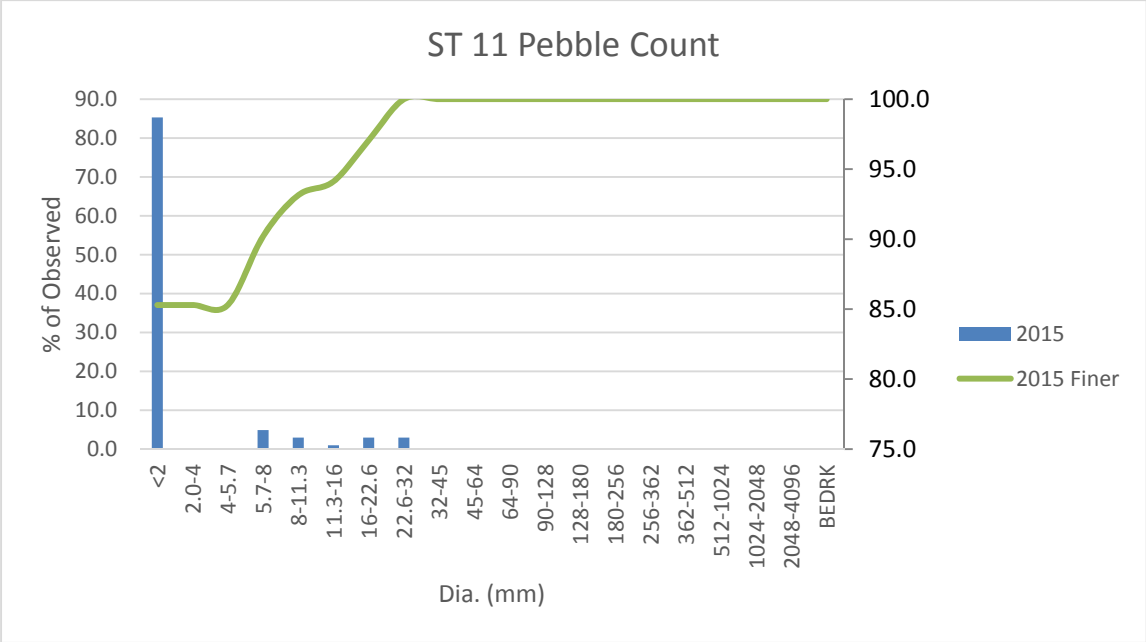

LC ST 10 XSB
0
5
10
15
20
-0.5
0
0.5
1
1.5
2
2.5
3
3.5
4
Stream Bed 2015
Water 2015


ST 9 Pebble Count
% of Observed
50.0
45.0
40.0
35.0
30.0
25.0
20.0
15.0
10.0
5.0
0.0
100.0
90.0
80.0
70.0
60.0
50.0
40.0
30.0
20.0
10.0
0.0
<2
2.0-4
4-5.7
5.7-8
8-11.3
11.3-16
16-22.6
22.6-32
32-45
45-64
64-90
90-128
128-180
180-256
256-362
362-512
512-1024
1024-2048
2048-4096
BEDRK
Dia. (mm)
2015
2015 Finer

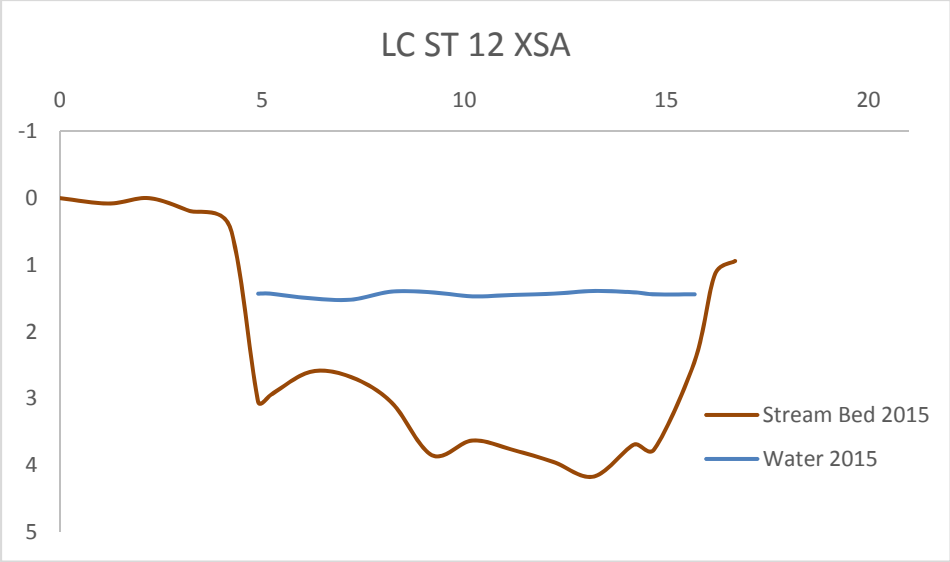
St 10 2015

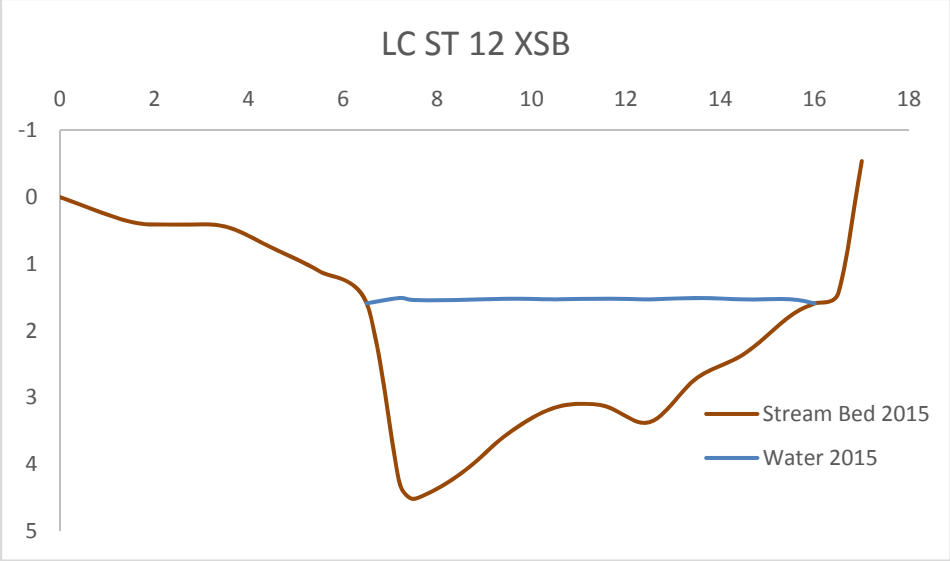

LC ST 11 XSA
0
5
10
15
20
-2
-1
0
1
2
3
4
5
Stream Bed 2015
Water 2015


LC ST 11 XSB
0
5
10
15
20
0
0.5
1
1.5
2
2.5
3
3.5
4
4.5
5
Stream Bed 2015
Water 2015


ST 11 Pebble Count
% of Observed
90.0
80.0
70.0
60.0
50.0
40.0
30.0
20.0
10.0
0.0
100.0
95.0
90.0
85.0
80.0
75.0
<2
2.0-4
4-5.7
5.7-8
8-11.3
11.3-16
16-22.6
22.6-32
32-45
45-64
64-90
90-128
128-180
180-256
256-362
362-512
512-1024
1024-2048
2048-4096
BEDRK
Dia. (mm)
2015
2015 Finer

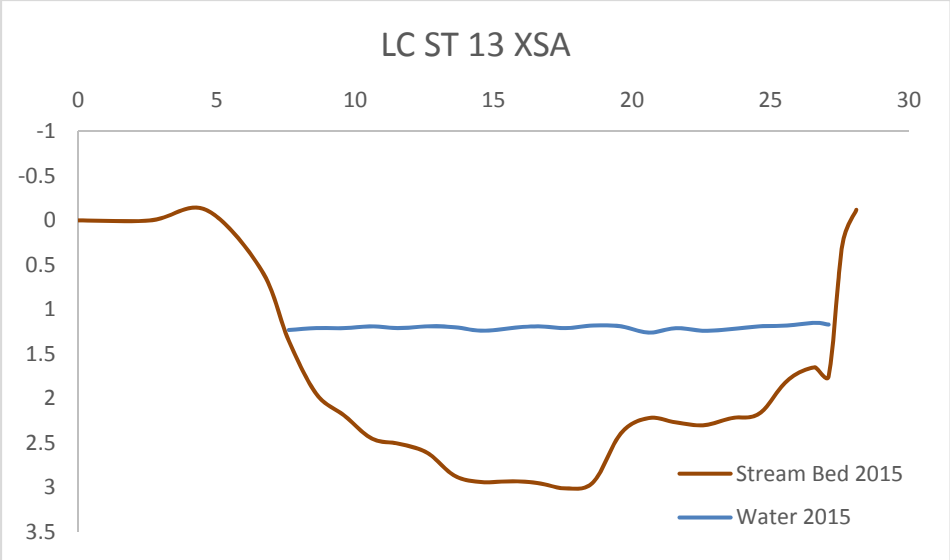
St 11 2015

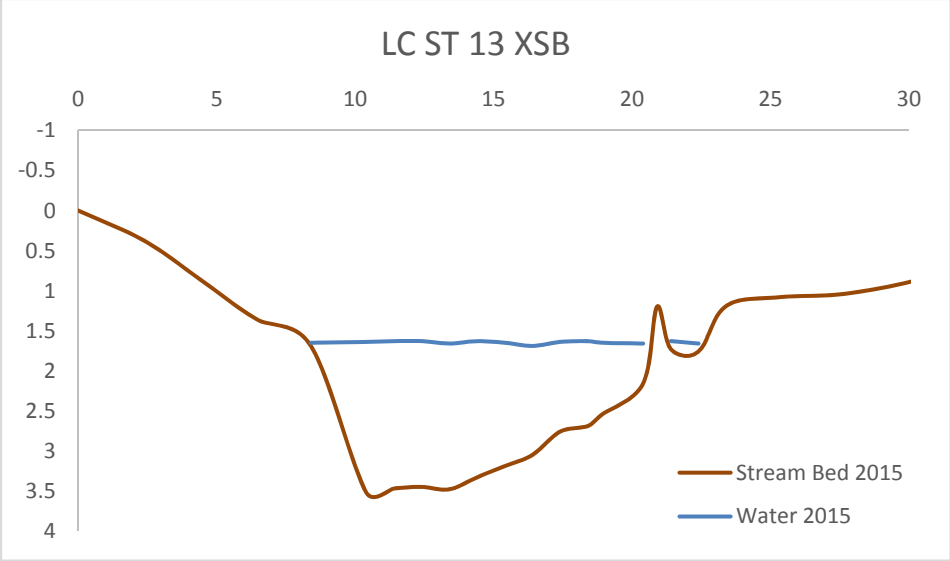


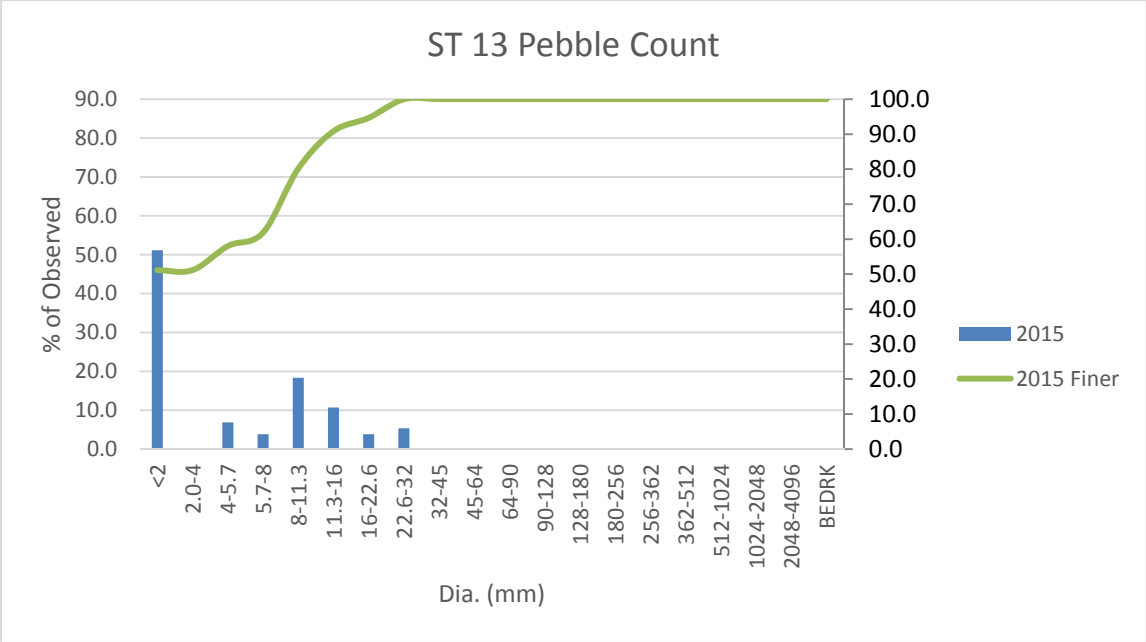


Water is too deep/swift for accurate pebble count

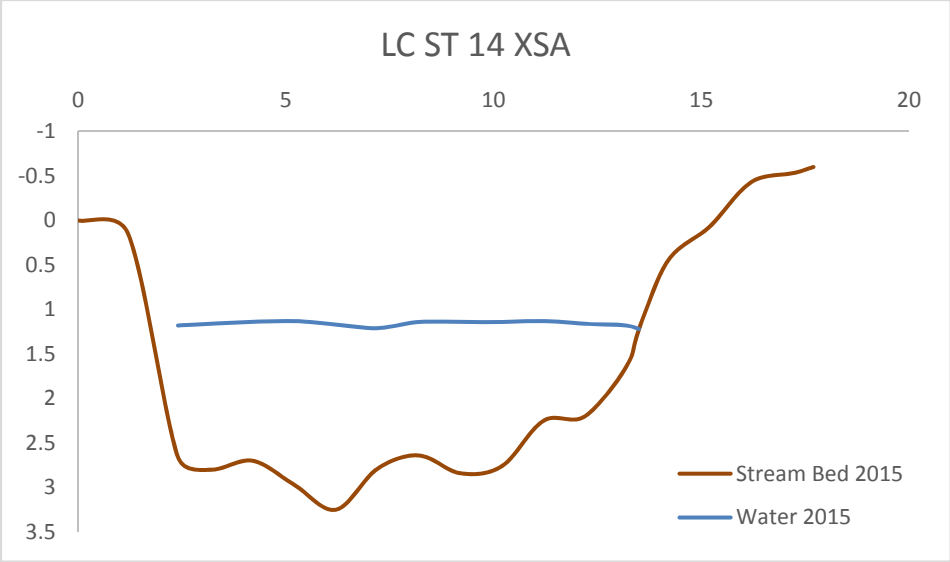
St 12 2015

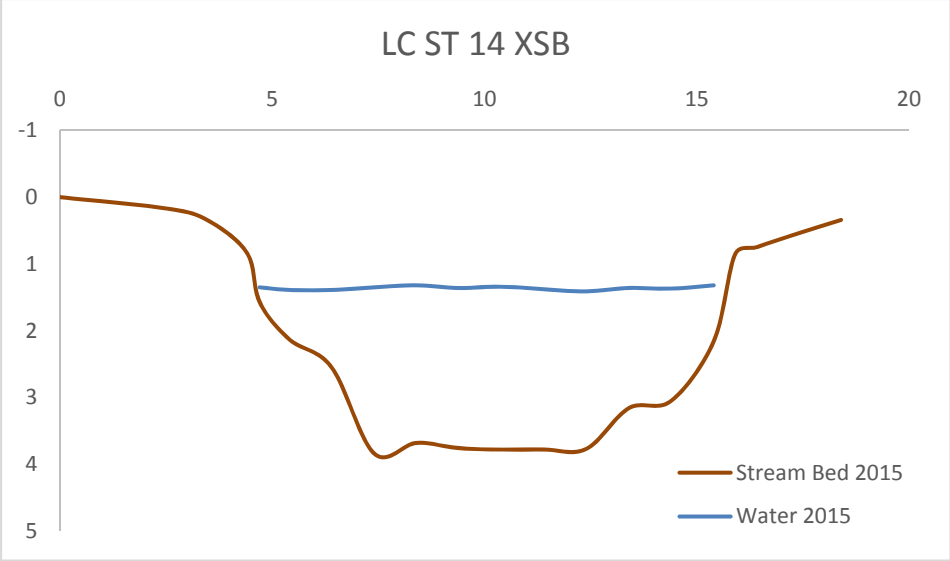

LC ST 13 XSA
0
5
10
15
20
25
30
-1
-0.5
0
0.5
1
1.5
2
2.5
3
3.5
Stream Bed 2015
Water 2015

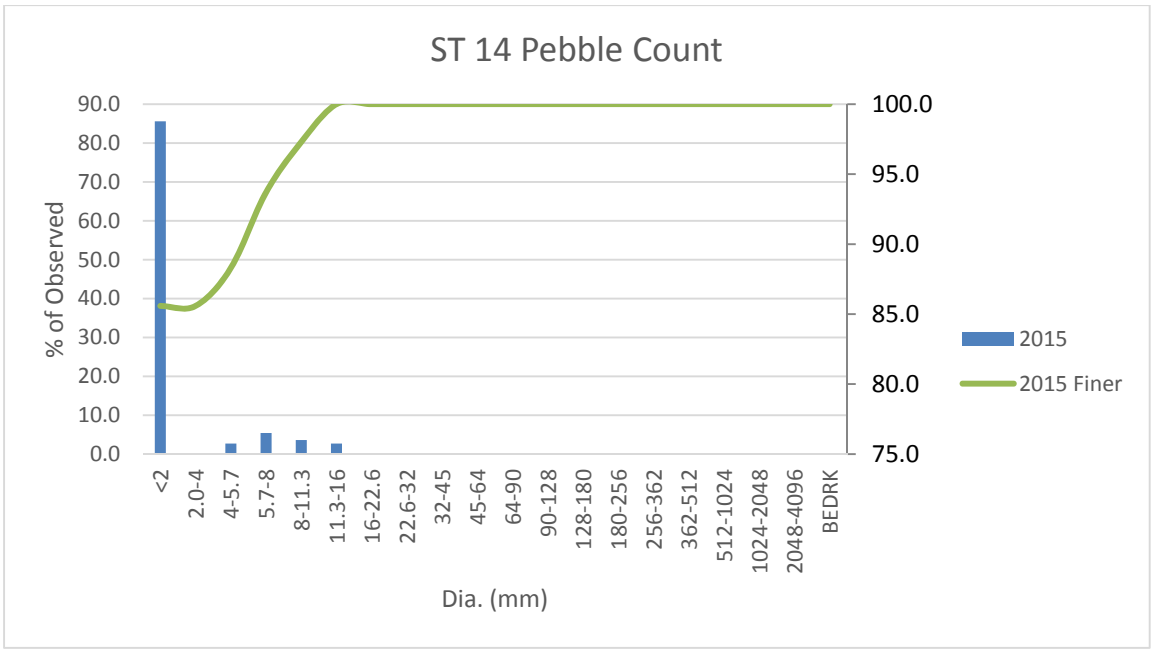

LC ST 13 XSB
0
5
10
15
20
25
30
-1
-0.5
0
0.5
1
1.5
2
2.5
3
3.5
4
Stream Bed 2015
Water 2015


ST 13 Pebble Count
% of Observed
90.0
80.0
70.0
60.0
50.0
40.0
30.0
20.0
10.0
0.0
100.0
90.0
80.0
70.0
60.0
50.0
40.0
30.0
20.0
10.0
0.0
<2
2.0-4
4-5.7
5.7-8
8-11.3
11.3-16
16-22.6
22.6-32
32-45
45-64
64-90
90-128
128-180
180-256
256-362
362-512
512-1024
1024-2048
2048-4096
BEDRK
Dia. (mm)
2015
2015 Finer

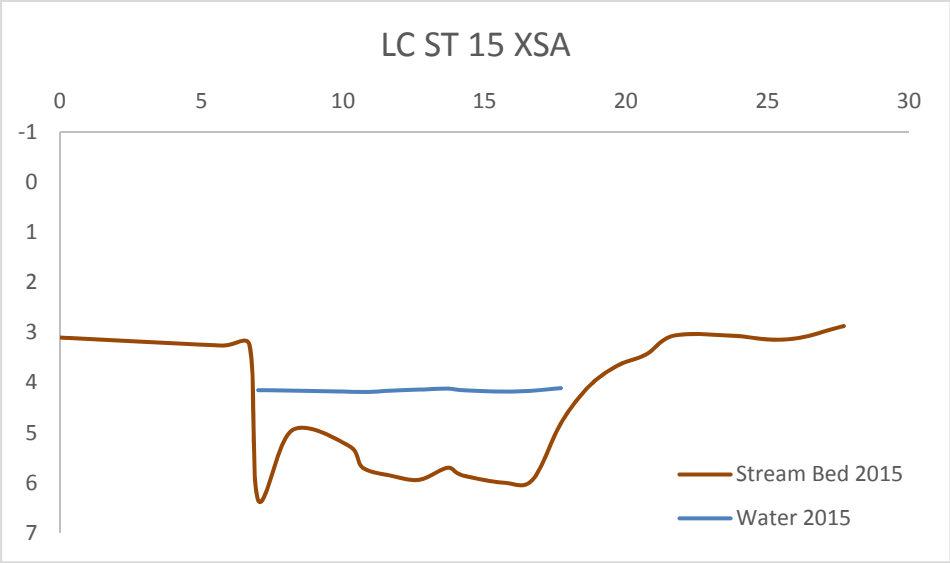
St 13 2015

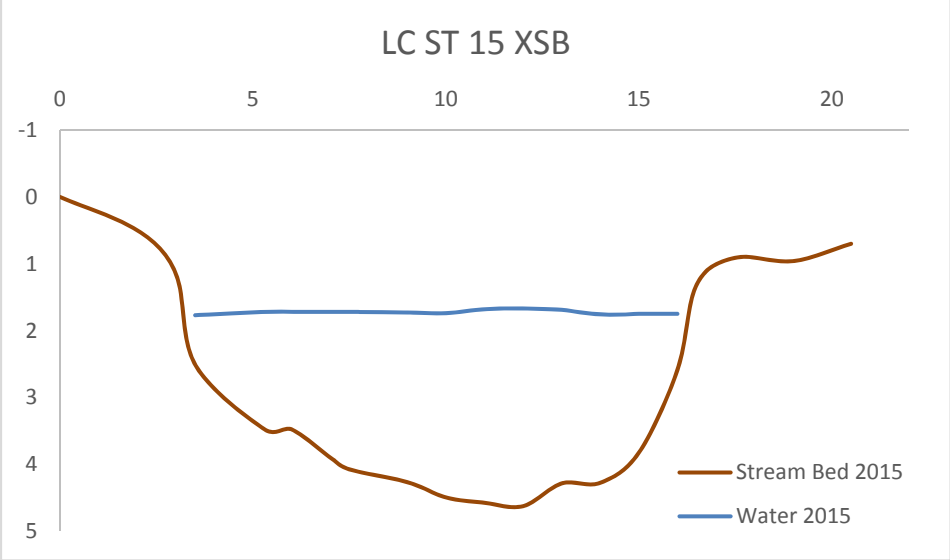

LC ST 14 XSA
0
5
10
15
20
-1
-0.5
0
0.5
1
1.5
2
2.5
3
3.5
Stream Bed 2015
Water 2015


LC ST 14 XSB
0
5
10
15
20
-1
0
1
2
3
4
5
Stream Bed 2015
Water 2015


ST 14 Pebble Count
% of Observed
90.0
80.0
70.0
60.0
50.0
40.0
30.0
20.0
10.0
0.0
100.0
95.0
90.0
85.0
80.0
75.0
<2
2.0-4
4-5.7
5.7-8
8-11.3
11.3-16
16-22.6
22.6-32
32-45
45-64
64-90
90-128
128-180
180-256
256-362
362-512
512-1024
1024-2048
2048-4096
BEDRK
Dia. (mm)
2015
2015 Finer

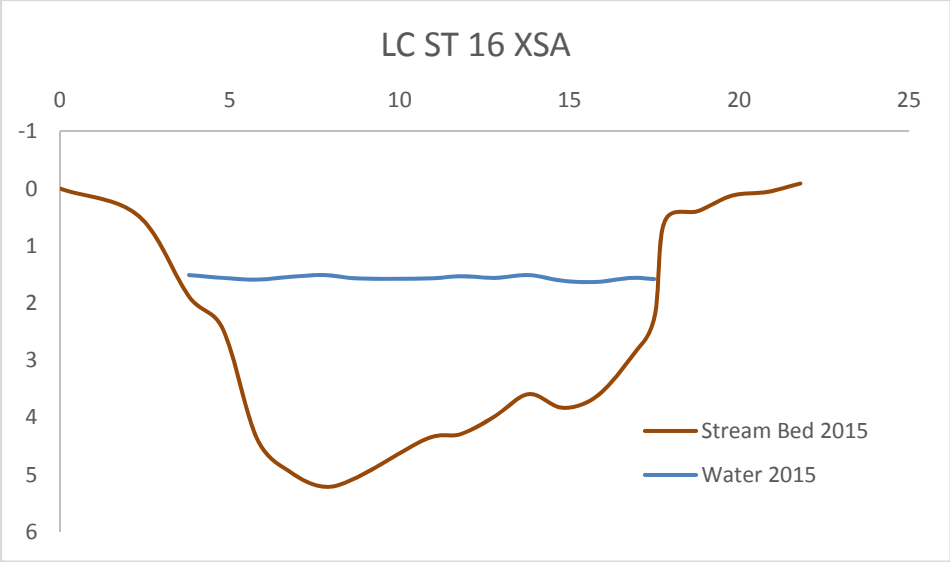
St 14 2015

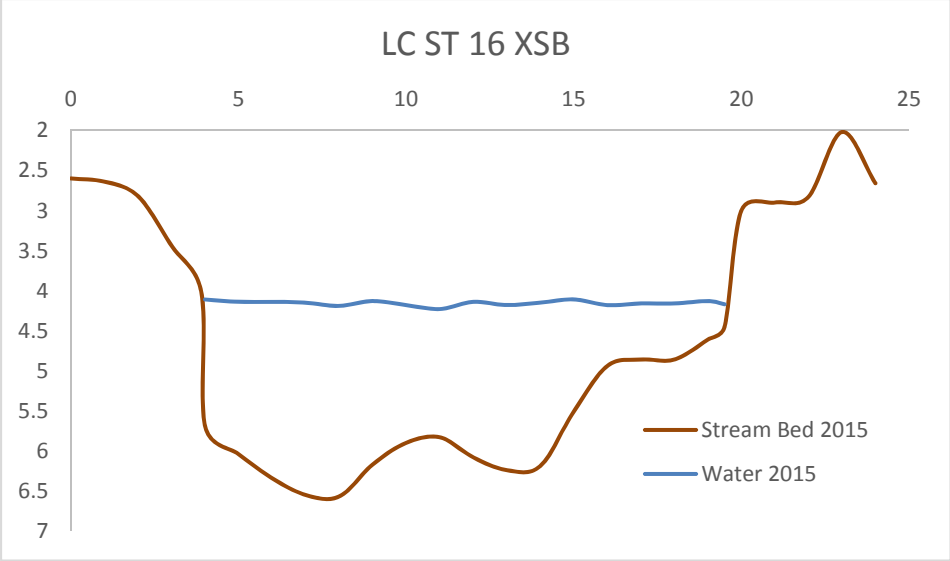


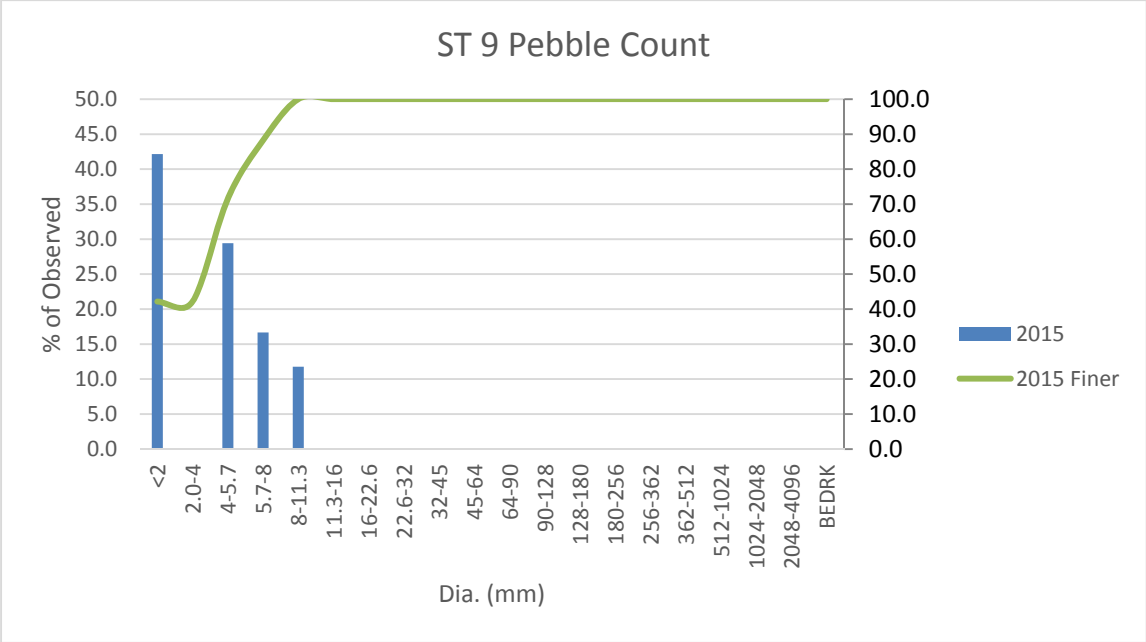


Water is too deep/swift for accurate pebble count

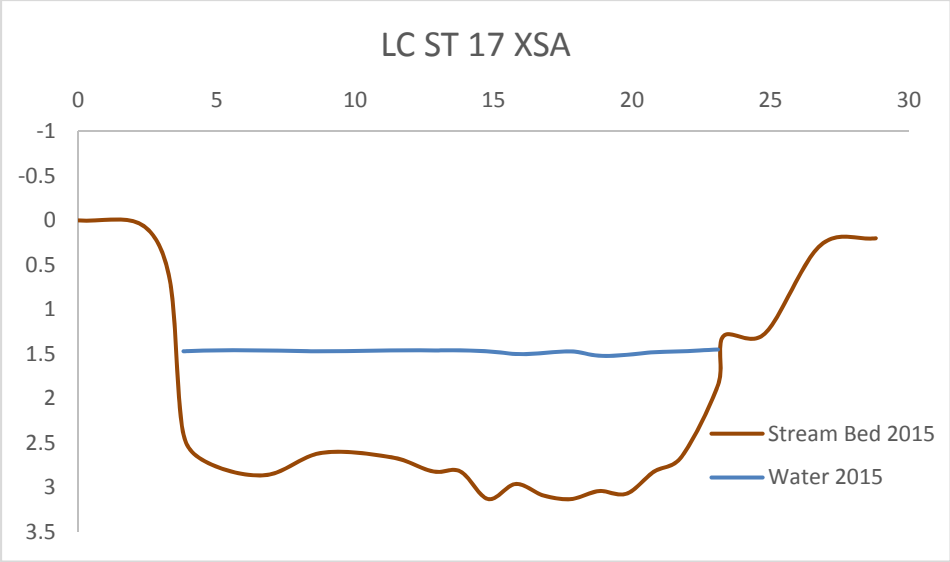
St 15 2015

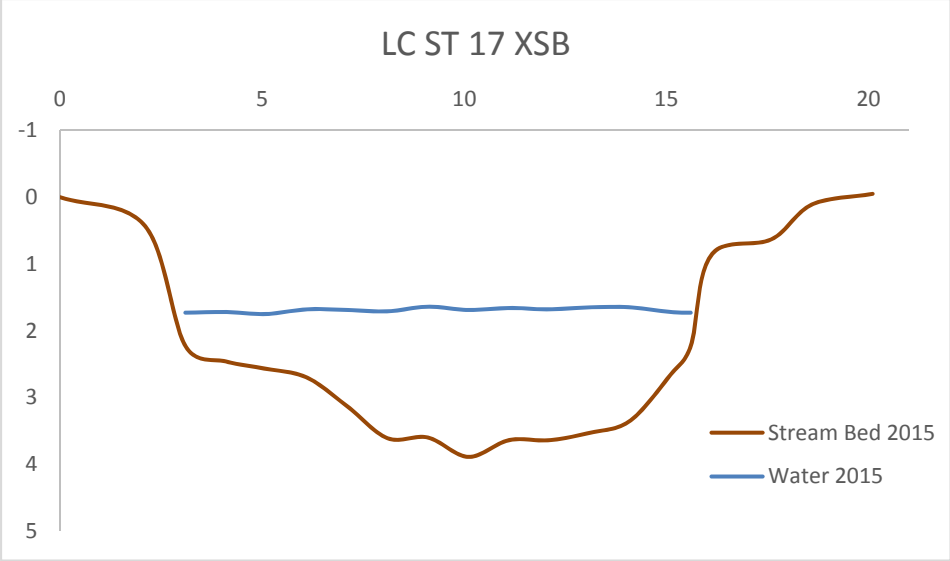

LC ST 16 XSA
0
5
10
15
20
25
-1
0
1
2
3
4
5
6
Stream Bed 2015
Water 2015

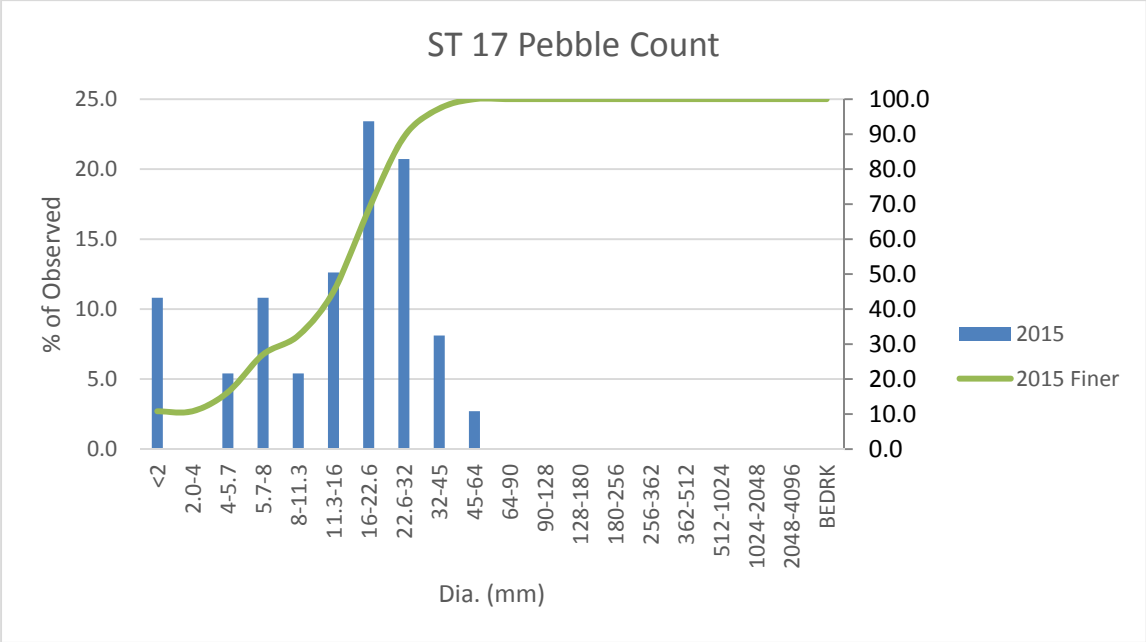

LC ST 16 XSB
0
5
10
15
20
25
2
2.5
3
3.5
4
4.5
5
5.5
6
6.5
7
Stream Bed 2015
Water 2015


ST 9 Pebble Count
% of Observed
50.0
45.0
40.0
35.0
30.0
25.0
20.0
15.0
10.0
5.0
0.0
100.0
90.0
80.0
70.0
60.0
50.0
40.0
30.0
20.0
10.0
0.0
<2
2.0-4
4-5.7
5.7-8
8-11.3
11.3-16
16-22.6
22.6-32
32-45
45-64
64-90
90-128
128-180
180-256
256-362
362-512
512-1024
1024-2048
2048-4096
BEDRK
Dia. (mm)
2015
2015 Finer

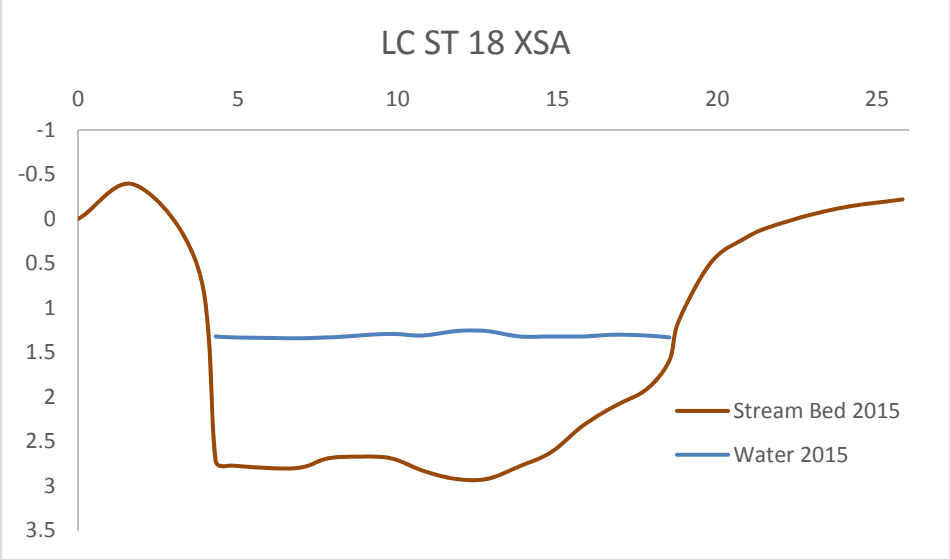
St 16 2015

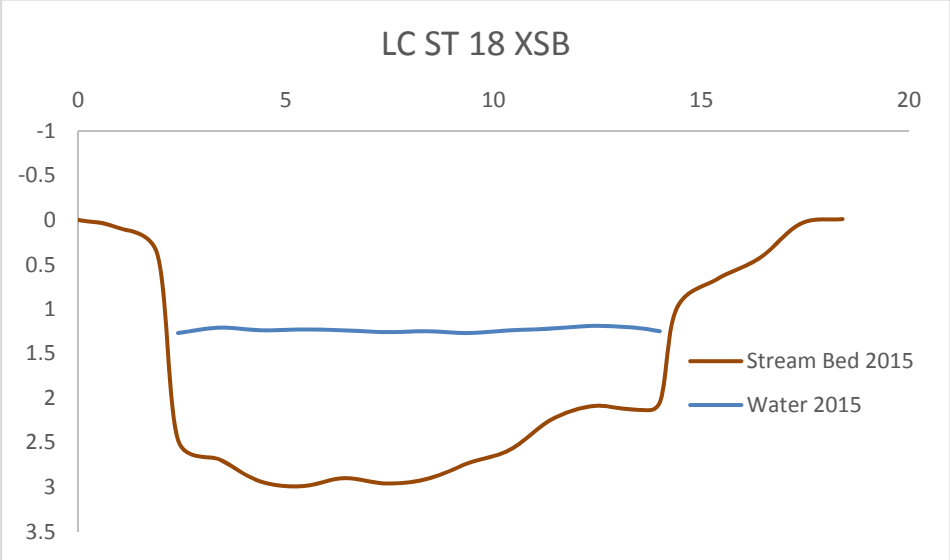

LC ST 17 XSA
0
5
10
15
20
25
30
-1
-0.5
0
0.5
1
1.5
2
2.5
3
3.5
Stream Bed 2015
Water 2015


LC ST 17 XSB
0
5
10
15
20
-1
0
1
2
3
4
5
Stream Bed 2015
Water 2015


ST 17 Pebble Count
% of Observed
25.0
20.0
15.0
10.0
5.0
0.0
100.0
90.0
80.0
70.0
60.0
50.0
40.0
30.0
20.0
10.0
0.0
<2
2.0-4
4-5.7
5.7-8
8-11.3
11.3-16
16-22.6
22.6-32
32-45
45-64
64-90
90-128
128-180
180-256
256-362
362-512
512-1024
1024-2048
2048-4096
BEDRK
Dia. (mm)
2015
2015 Finer

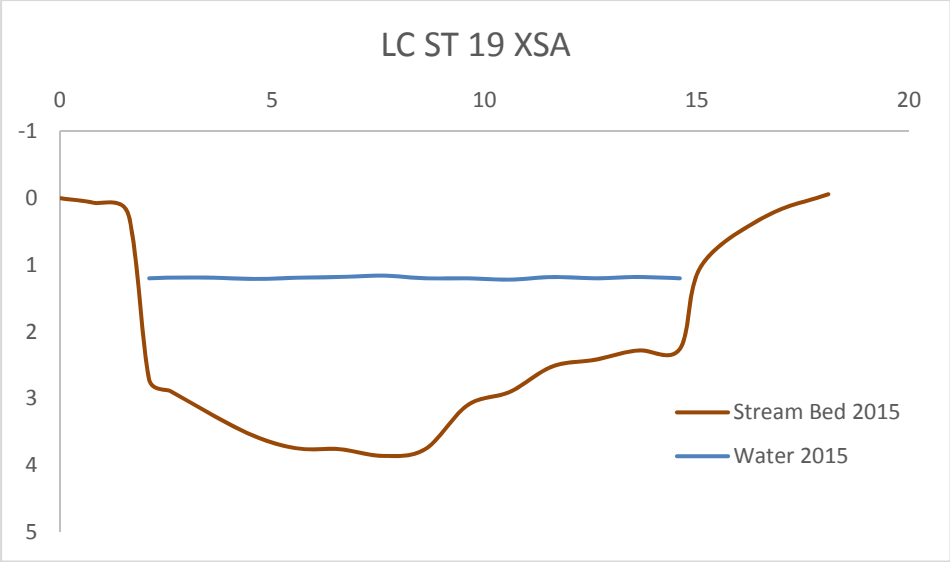
St 17 2015

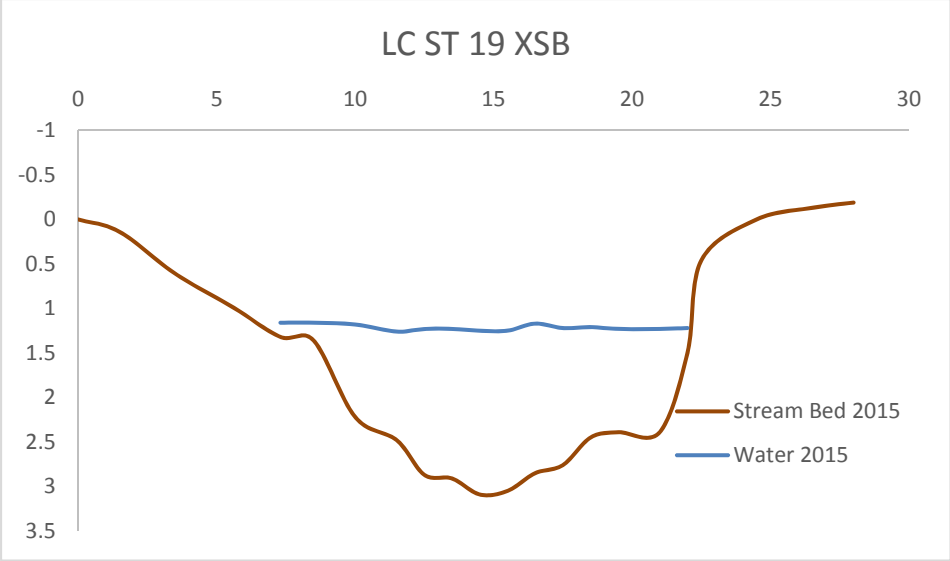


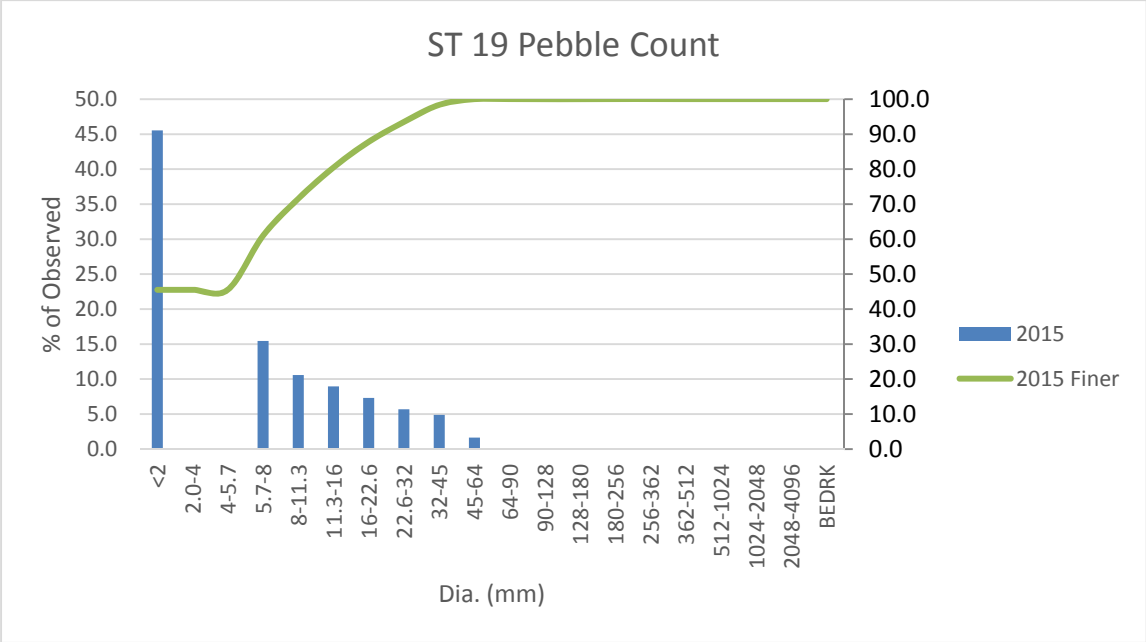


Water is too deep/swift for accurate pebble count

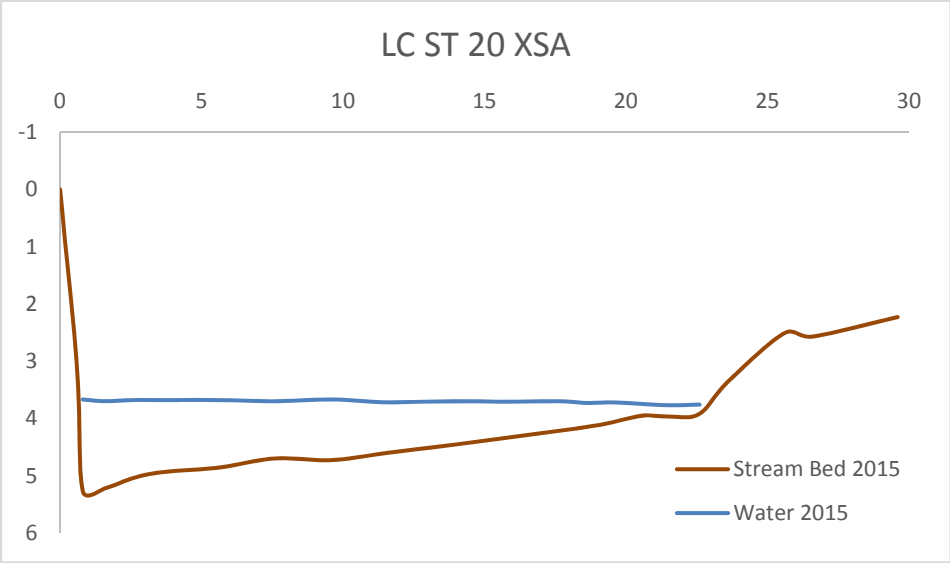
St 18 2015

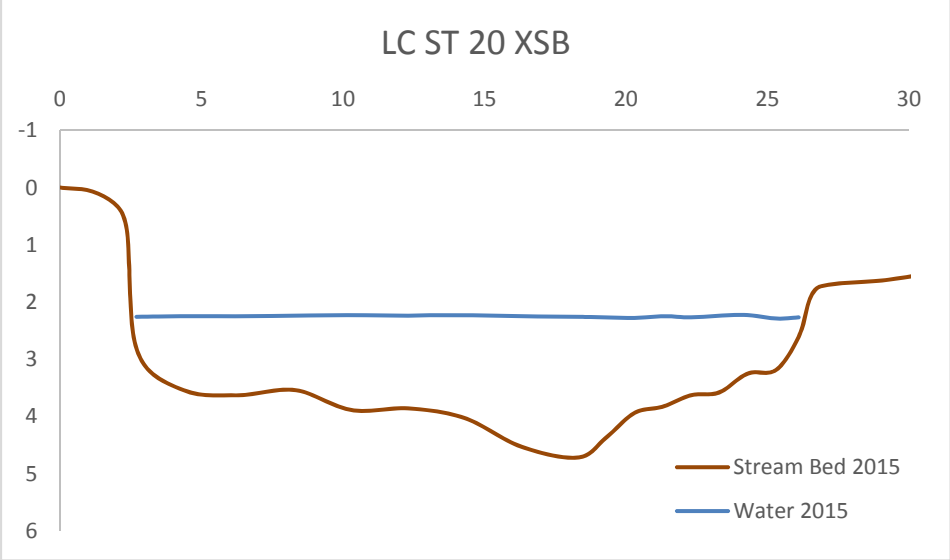

LC ST 19 XSA
0
5
10
15
20
-1
0
1
2
3
4
5
Stream Bed 2015
Water 2015

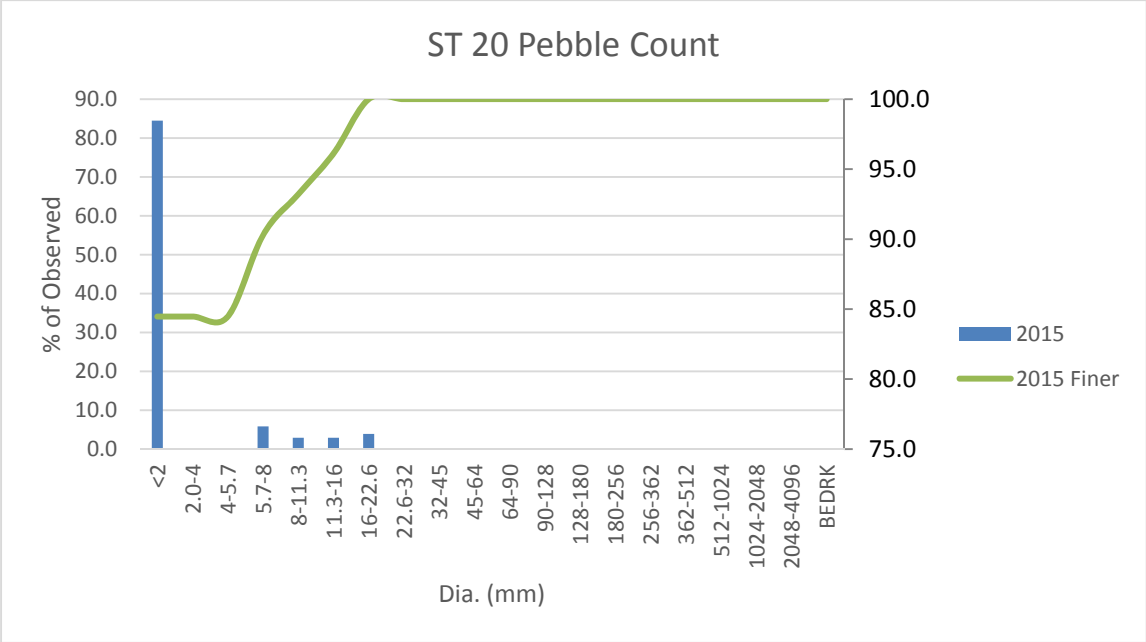

LC ST 19 XSB
0
5
10
15
20
25
30
-1
-0.5
0
0.5
1
1.5
2
2.5
3
3.5
Stream Bed 2015
Water 2015


ST 19 Pebble Count
% of Observed
50.0
45.0
40.0
35.0
30.0
25.0
20.0
15.0
10.0
5.0
0.0
100.0
90.0
80.0
70.0
60.0
50.0
40.0
30.0
20.0
10.0
0.0
<2
2.0-4
4-5.7
5.7-8
8-11.3
11.3-16
16-22.6
22.6-32
32-45
45-64
64-90
90-128
128-180
180-256
256-362
362-512
512-1024
1024-2048
2048-4096
BEDRK
Dia. (mm)
2015
2015 Finer

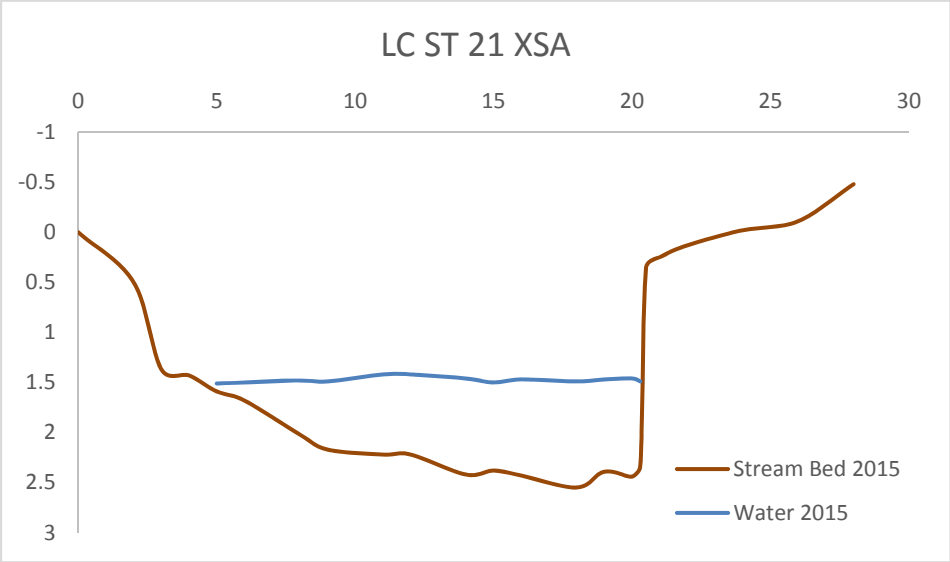
St 19 2015

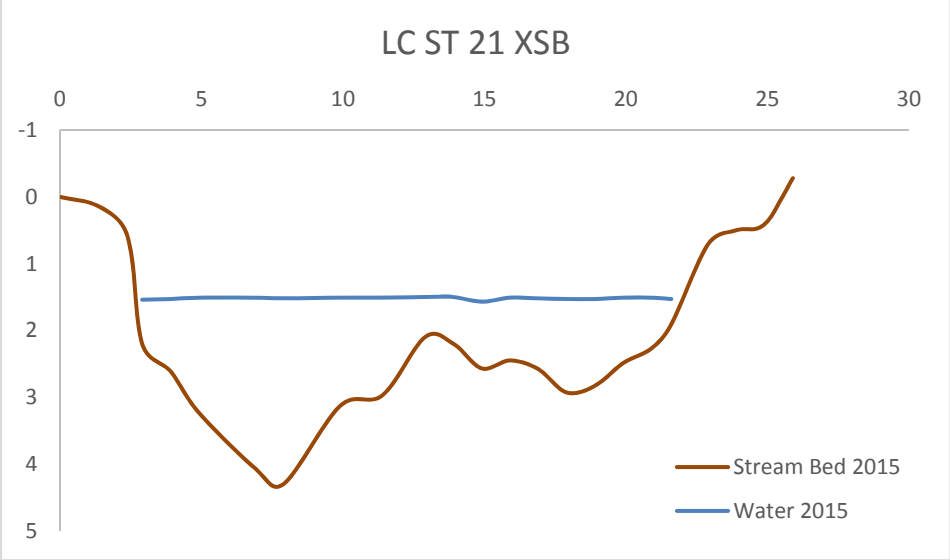

LC ST 20 XSA
0
5
10
15
20
25
30
-1
0
1
2
3
4
5
6
Stream Bed 2015
Water 2015

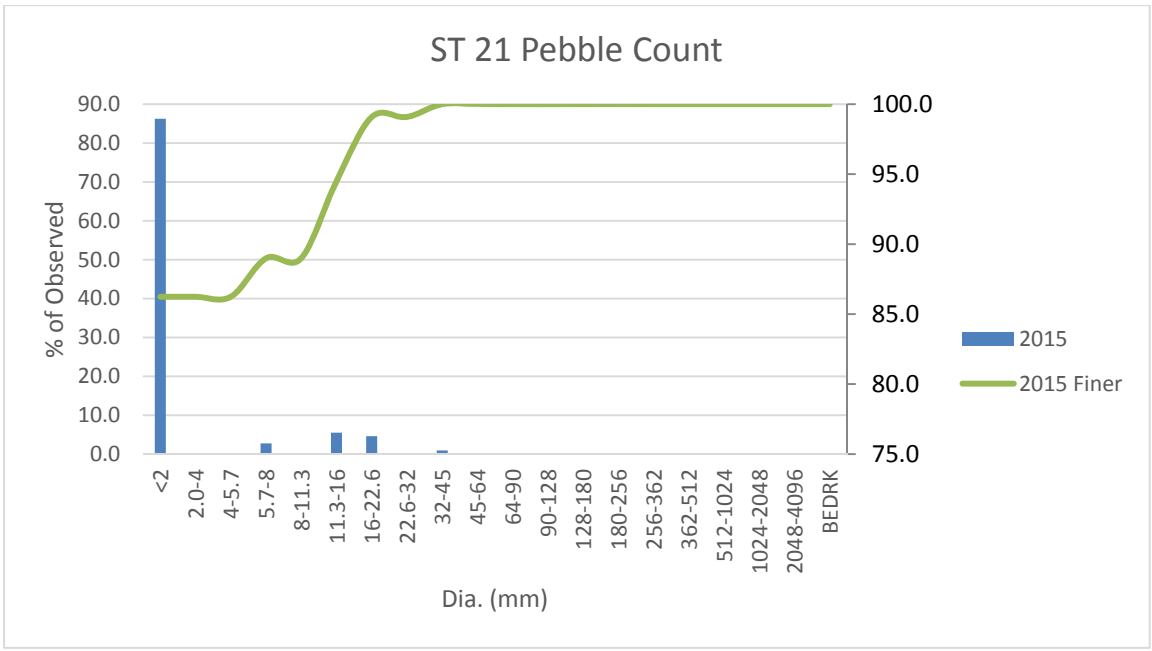

LC ST 20 XSB
0
5
10
15
20
25
30
-1
0
1
2
3
4
5
6
Stream Bed 2015
Water 2015


ST 20 Pebble Count
% of Observed
90.0
80.0
70.0
60.0
50.0
40.0
30.0
20.0
10.0
0.0
100.0
95.0
90.0
85.0
80.0
75.0
<2
2.0-4
4-5.7
5.7-8
8-11.3
11.3-16
16-22.6
22.6-32
32-45
45-64
64-90
90-128
128-180
180-256
256-362
362-512
512-1024
1024-2048
2048-4096
BEDRK
Dia. (mm)
2015
2015 Finer

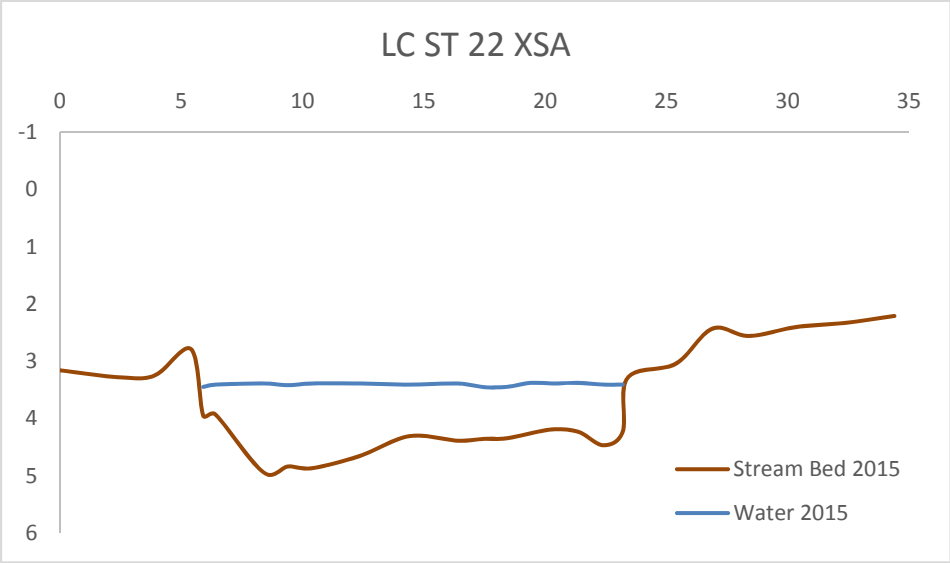
St 20 2015

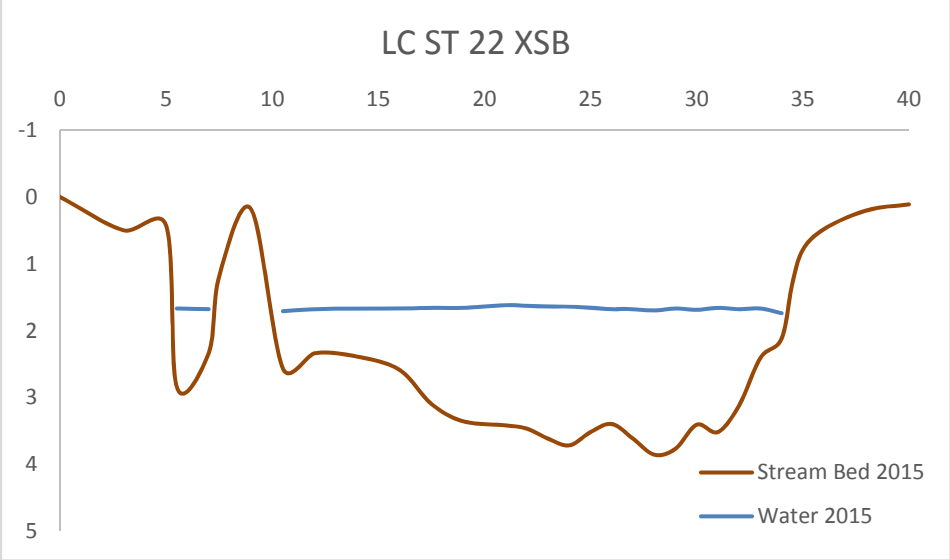

LC ST 21 XSA
0
5
10
15
20
25
30
-1
-0.5
0
0.5
1
1.5
2
2.5
3
Stream Bed 2015
Water 2015

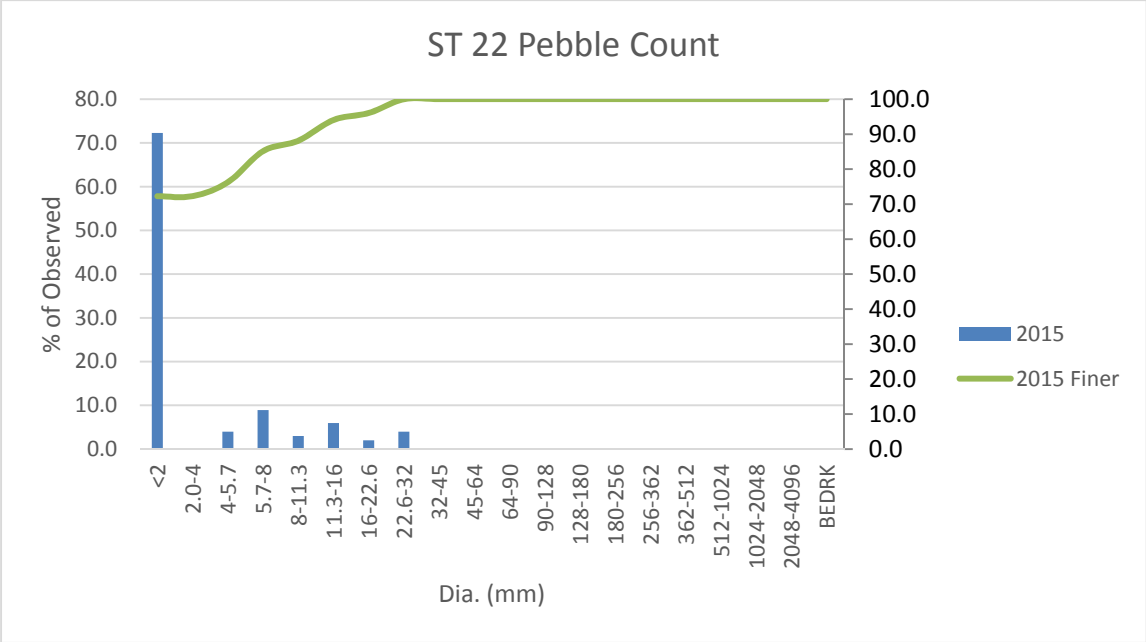

LC ST 21 XSB
0
5
10
15
20
25
30
-1
0
1
2
3
4
5
Stream Bed 2015
Water 2015


ST 21 Pebble Count
% of Observed
90.0
80.0
70.0
60.0
50.0
40.0
30.0
20.0
10.0
0.0
100.0
95.0
90.0
85.0
80.0
75.0
<2
2.0-4
4-5.7
5.7-8
8-11.3
11.3-16
16-22.6
22.6-32
32-45
45-64
64-90
90-128
128-180
180-256
256-362
362-512
512-1024
1024-2048
2048-4096
BEDRK
Dia. (mm)
2015
2015 Finer

St 21 2015


LC ST 22 XSA
0
5
10
15
20
25
30
35
-1
0
1
2
3
4
5
6
Stream Bed 2015
Water 2015


LC ST 22 XSB
0
5
10
15
20
25
30
35
40
-1
0
1
2
3
4
5
Stream Bed 2015
Water 2015


ST 22 Pebble Count
% of Observed
80.0
70.0
60.0
50.0
40.0
30.0
20.0
10.0
0.0
100.0
90.0
80.0
70.0
60.0
50.0
40.0
30.0
20.0
10.0
0.0
<2
2.0-4
4-5.7
5.7-8
8-11.3
11.3-16
16-22.6
22.6-32
32-45
45-64
64-90
90-128
128-180
180-256
256-362
362-512
512-1024
1024-2048
2048-4096
BEDRK
Dia. (mm)
2015
2015 Finer

St 22 2015