

## Fraser Flats River Habitat Project

### 2017 Final Annual Monitoring Report

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This 2017 annual monitoring report on Learning By Doing's (LBD's) Fraser Flats River Habitat Project establishes a record of the project and its effect on the riparian and aquatic habitat. While not required as part of its U.S. Army Corps of Engineers (Corps) Section 404 Permit for the project (NWP#27; Corps File No. SPK-2017-00179), LBD has voluntarily elected to create a temporary monitoring program, which will follow the measures in the *Monitoring at-a-Glance* table enclosed at the end of this report.

#### ***Program Objectives***

The objectives of the Fraser Flats River Habitat Project monitoring program include documentation of the following parameters:

- aquatic habitat features and substrate conditions
- benthic macroinvertebrate abundance and diversity
- trout population estimates and quality trout
- riparian woody habitat
- instream temperature monitoring

Construction of the project was completed in September 2017. This temporary monitoring program will be performed annually for at least 3 years post-project according to the program's guidelines finalized on October 20, 2017<sup>1</sup>.

#### ***Scope of 2017 Monitoring Program***

The scope of the 2017 monitoring program is to document and compare the 2017 conditions with the pre-construction (baseline) conditions of the project site.

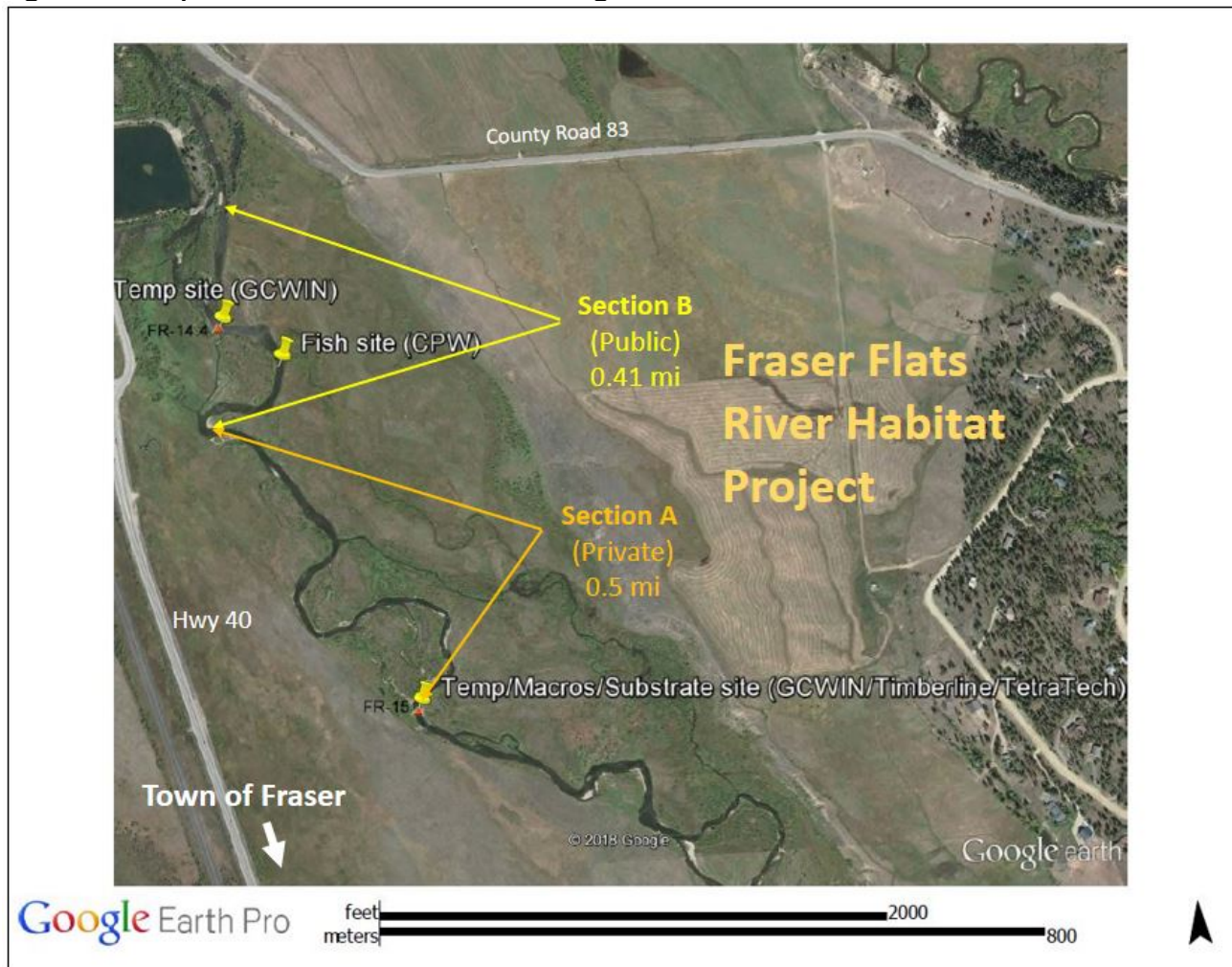
#### ***Monitoring Program Components***

The following provides a summary of the monitoring completed in 2017 and includes comparisons to available pre-project data. A map showing the locations of the sampling sites is provided as **Figure 1**.

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<sup>1</sup> LBD Monitoring Subcommittee, 2017. Fraser Flats River Habitat Project Monitoring Program Guidelines. Revised October 20, 2017 based on the August 16, 2016 monitoring plan.

Figure 1 - Map of 2017 Fraser Flats Monitoring Sites



## 1.0 Aquatic Habitat and Substrate Conditions

The data below will be used to document progress made with regards to *Project Goal #1 - An increase in aquatic habitat features and improved substrate conditions.*

### 1.1 Aquatic Habitat Features

The approach for monitoring aquatic habitat features includes pre- and post-construction photographs and inventory of the number of riffles and pools in the project reach. Pre- and post-construction photos of aquatic habitat features are provided in **Attachment 1**. Pre-project aquatic habitat features were inventoried based on field observations, photographs, and Google Earth images for the years 2016-2017. For the post-project inventory, Freestone Aquatics completed an as-built survey of the project reach in October 2017, immediately following the completion of construction. The as-built drawings were used to compare the existing and proposed site conditions detailed in the plan set. As it was designed and expected, the number of instream habitat features increased after construction of the project as compared to pre-project conditions.

For 2018, the Monitoring Subcommittee recommends LBD purchase a laser level to survey elevations of the constructed instream habitat features. These measurements could then be used for year-to-year comparisons of the quality of the instream habitat features. LBD will continue to monitor the aquatic habitat features in the project reach in 2018.

### 1.2 Summary

This table summarizes the number of 2016 (pre-project) and 2017 (post-project) aquatic habitat features inventoried in the project reach.

	2016 Pre-construction	2017 Post-construction
<b>Habitat Feature</b>		
Riffles	26	31
Pools	30	32
Constructed overhanging log habitat for fish shelter	0	2
<b>TOTAL</b>	<b>56</b>	<b>65</b>
Source: GoogleEarth 2018, Freestone Aquatics 2017a/b		

### 1.3 Substrate Conditions

Pebble counts (i.e. material sizes, presence of fines, and embeddedness) were sampled in the project reach by Tetra Tech in 2017, post-project. Tetra Tech's 2016 pebble count data for this site was used to document pre-project conditions.

In 2017, Tetra Tech observed small cobble (64-128 mm) as the dominant substrate size in the project reach with very coarse gravel (32-64 mm) as the second-most dominant sized substrate. Areas of sand and finer sediments (<2 mm) at the time of sampling were minimal to non-existent, proving to be well below the threshold of 27.5% identified by Policy 98-1 (CWQCC 2014) for preventing impacts to macroinvertebrate communities in Grand County (Sediment Region 1). Of the sites Tetra Tech sampled in 2017, substrate embeddedness was low and ranged from approximately 4% to 17%. The highest degree of embeddedness occurred on the Fraser River above County Road 83 at the Fraser Special Project (FrSpProj) site, which measured 17% embeddedness (Tetra Tech 2018). LBD will continue to monitor substrate conditions in the project reach in 2018.

### 1.4 Summary Table

This table summarizes the pebble count data for years 2016 (pre-project) and 2017 (post-project).

Site Name: FR-FrSpProj	2016 Pre-construction	2017 Post-construction
<b>Class size (mm)</b>		
0-2	1	4
2-4		
4-8		
8-16	1	1
16-32	2	1
32-64	18	25
64-128	46	57
128-256	29	13
256-512	3	2
512-1024		
1024-2048		
2048-4096		
<b>TOTAL</b>	<b>100</b>	<b>103</b>
<b>% Embedded</b>	<b>20</b>	<b>17</b>

Source: Tetra Tech 2018

## 2.0 Macroinvertebrates

The data below will be used to document progress made with regards to *Project Goal #2 - An increase in benthic macroinvertebrate abundance and diversity.*

### 2.1 Macroinvertebrate Sampling

Macroinvertebrate field sampling was performed by Timberline on September 18, 2017 (pre-project). In 2017, results for the FR-FrSpProj site (located at the upstream edge of the project reach) fell into the “gray zone” based on its Multimetric Index (MMI) score, but was designated as not impaired due to its low Hilsenoff Biotic Index (HBI) and high Shannon Diversity Index (SDI) scores (Tetra Tech 2018). In 2016, macroinvertebrate samples were collected by GCWIN (pre-project), and the MMI values for the FR-FrSpProj site were “impaired” based on HBI and SDI. The first year of post-project sampling of macroinvertebrates will occur in 2018, using MMI version 4.0. The pre-project MMI values were conducted using MMI version 3.0, so these scores will be calibrated in the future for ease of comparison of data across years. LBD will continue to monitor macroinvertebrates in the project reach in 2018.

### 2.2 Summary Table

This tables summaries the data on abundance and diversity of macroinvertebrates for years 2016 and 2017 (pre-project).

Site Name: FR-FrSpProj	2016 Pre-construction	2017 Pre-construction
Sample Type*	1	4
<b>Metric</b>		
MMI <sup>1</sup>	47.40	48.00
Aquatic Life Use Designation	Impaired	Attain
HBI <sup>2</sup>	4.99	4.69
Shannon <sup>3</sup>	1.82	3.49
<sup>1</sup> All scores are based on the MMI (v3) subsampling process <sup>2</sup> Hilsenoff Biotic Index <sup>3</sup> Shannon Diversity Index Source: Tetra Tech 2018		

No.	Sampling Device	Total Organisms Counted in Subsample
1	Hess Sampler	500
2	Kick Net	300
3	Hess Sampler	1500
4	Hess Sampler	Full count
*Adapted from Tetra Tech 2018		

### 3.0 Fish

The data below will be used to document progress made with regards to *Project Goal #3 - An increase in fish counts and quality trout.*

#### 3.1 CPW Electrofishing Survey

Colorado Parks and Wildlife (CPW) has an established electrofishing site in Section B (Grand County Water and Sanitation District #1 property) of the project reach (refer to **Figure 1**). This site was sampled by electrofishing surveys in 2007 and 2016, which provides two years of baseline data. An electrofishing survey was performed by CPW in October of 2017, post-project.

CPW will continue to monitor the project reach in 2018 with the goal of documenting changes in<sup>2</sup>:

- o biomass (pounds per surface acre of water),
- o density of trout greater than 14 inches, and
- o expected densities of sculpin.

*As shown in the table below, CPW observed that “prior to the habitat project, this site yielded the poorest estimates of any location...and among the lowest population estimates ever obtained in any location on the Fraser. We observed an immediate benefit after completion of the project, with greatly increased numbers of adult fish and a nearly four-fold increase in total trout biomass from 2016 to 2017” (CPW 2018).*

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<sup>2</sup> LBD Monitoring Subcommittee, 2017. Fraser Flats River Habitat Project Monitoring Program Guidelines. Revised October 20, 2017 based on the August 16, 2016 monitoring plan.

### 3.2 Summary Table

This table summarizes the fish survey results for fish biomass, density of trout greater than 14 inches, and number of sculpin for years 2007, 2016 (pre-project) and 2017 (post-project).

TABLE 4. Fish Data - Fraser Flats River Habitat Project			
Site Name: GCWSD#1 property	2007 Pre-construction	2016 Pre-construction	2017 Post-construction
<b>Brown trout</b>			
Biomass <sup>1</sup>	33	26	111
Fish > 14" per acre	3	6	33
Fish > 6" per mile	752	430	923
<b>Rainbow trout</b>			
Biomass <sup>1</sup>	9	6	16
Fish > 14" per acre	3	2	8
Fish > 6" per mile	53	35	70
<b>Brook trout</b>			
Biomass <sup>1</sup>	2	1	0
Fish > 6" per mile	44	9	0
<b>Total trout biomass<sup>1</sup></b>	44	33	127
<b>Total sculpin captured</b>	726	971	264
Source: CPW 2018			
<sup>1</sup> Pounds per surface acre			

### 4.0 Riparian Woody Habitat

The data below will be used to document progress made with regards to *Project Goal #4 - An increase in riparian woody habitat.*

#### 4.1 Riparian Woody Vegetation Survey

Pre-project photo points were established by Anna Drexler-Dreis to document canopy cover in 2016 and 2017. A map of the photo point locations is provided in **Attachment 2**. Pre- and post-construction photos of the riparian area are provided in **Attachment 3**. The canopy of willow and cottonwood stakes planted in the revegetated areas in May 2017 is expected to mature over time to provide bank stabilization and increased shade cover, which will benefit the river by helping to provide cool instream habitat.

During the summer of 2016, Ms. Drexler-Dreis established 13 photo points, took pre-project photos and identified the willows present on site. Post-planting, she conducted a stem count to see how many willow and cottonwood stems made it into the ground (**Table 5**). The actual number of willow stems varied from the expected number of willow stems for a variety of reasons: the area was too rocky to drive a metal stake into the ground, crew leaders expanded sections when

they fell short on other sections, groups of willows were already present in the sections, and two rows were planted instead of three rows due to steep hillsides.

Post peak runoff, on June 28, 2017, Ms. Drexler-Dreis took post-project photos to show change and determine success rate. While it is too early to determine success rate, most of the willow stems and cottonwoods had leafed out (see photos at end of post-project photos). In total, 2,575 trees were planted in the project reach.

The pre-project and post-project revegetation data will be evaluated in two ways: (i) spatially using aerial photographs (if available) and photos taken at the established photo points for year to year comparisons of the canopy re-establishment; and (ii) quantifying the number and condition of the willow and cottonwood plantings for year to year comparisons of the survival rate and health of the vegetation community. LBD will continue to monitor the riparian plantings in 2018.

#### 4.2 Summary Table

A table summarizing the 2017 plantings is shown below.

<b>TABLE 5. Riparian Planting Data - Fraser Flats River Habitat Project</b>		
	<b>Site No.*</b>	<b>2017 Number of Trees Planted</b>
<b>Private Section A</b>	1	117
	2	177
	3	89
	4	96
	6	37
	7	62
	8	160
	10 & 14	298
<b>Public Section B</b>	19	160
	20	66
	22	112
	23	154
	<b>TOTAL</b>	<b>2575</b>
	*This list is not consecutive: numbers 5, 9, 12, 16, 21 are not missing sites. Source: Drexler-Dreis (2017)	



## 5.0 Stream Temperature

### 5.1 Stream Temperature Data Collection

The purpose of this task is to compare instream temperatures with pre-project conditions with the goal of documenting changes in instream temperatures over time. GCWIN maintains temperature loggers at the upstream project boundary on Section A (Devil's Thumb Ranch property) and the lower project boundary on Section B (Grand County Water and Sanitation District #1 property) (**Figure 1**). LBD will continue to collect stream temperature data at these locations in 2018.

### 5.2 Summary

Graphs summarizing the 2013-2016 (pre-project) and 2017 (post-project) temperature data are provided in **Attachment 4**. As the data show, no exceedances have been recorded at the monitoring sites to date.

## Summary of Findings

In 2017, the following findings were noted in the project reach:

- Increased number of aquatic habitat features (riffles and pools) post-construction
- Small cobble and very coarse gravel were the predominant substrate types, with a low degree of embeddedness
- MMI values for macroinvertebrates were in attainment
- Four-fold increase in total trout biomass post-construction
- 2,575 trees planted
- No stream temperature exceedances

## **References**

Colorado Parks and Wildlife (CPW), 2018. Fraser River Fish Survey and Management Information. Prepared by Jon Ewert, Aquatic Biologist, Hot Sulphur Springs.

Drexler-Dreis, Anna. 2017. Fraser Flats River Habitat Project. Western State Colorado University. July 29, 2017.

Freestone Aquatics, 2017a. Fraser Flats Aquatic Habitat Restoration Project. Fraser River, near Fraser, Colorado. January 1, 2017.

Freestone Aquatics, 2017b. Fraser Flats Aquatic Habitat Restoration Project As-Built Set. Fraser River, near Fraser, Colorado. September 29, 2017.

GoogleEarth, 2018. "Grand County, Colorado." 39° 58' 54.11" N, 105° 49' 49.50 W. Accessed on June 28, 2018.

Tetra Tech, 2018. Final Draft Report, 2017 Monitoring Report, Grand County, Colorado. Prepared for Grand County, Colorado. May 10, 2018.

Monitoring At-A-Glance<sup>3</sup>

	Method	Agency	Frequency & duration	Sample Season	Site Location	Notes
<b>Benthic macro-invertebrates</b>	NAMC* protocol	Timberline Aquatics	annual for 3 years post construction	September of each year	1) New site in restoration area 2) County Road 83	Reach-based approach, 8 samples per site, composited, subsampled to 300. Metrics are calculated from these results.
<b>Fish count surveys</b>	electro-fishing	CPW	annual for 3 years post construction	September of each year	1) In restoration area 2) Fraser Safeway 3) Fraser, Kaibab Park in Granby	All trout species & sculpin will be totaled, and trout biomass (pounds per acre), fish >14" per surface acre, and >6" per mile will be reported.
<b>Riparian survey</b>	photos and woody stem counts	Trout Unlimited	every 3-5 years for 10 years.	First two years post construction	1) In restoration area	Include: percentage of woody canopy and riparian plant species, monumented photo points and photos.
<b>Substrate conditions</b>	pebble counts	Tetra Tech	annual for 3 years post construction	September of each year	1) New site in restoration area 2) County Road 83	Document bar material sizes, presence of fines and embeddedness.
<b>Aquatic habitat features</b>	photo points	LBD/CPW	annual for 3 years post construction	Low flow	To be determined	Pre- and post-construction monitoring using photographs and the inventory of # of riffles, runs, pools in project reach.
<b>Stream Temperature</b>	temperature loggers	GCWIN**	15-minute interval time-series; annual	Annually during ice off	1) Upstream project boundary 2) downstream project boundary	Measurable results as a result of the project are not anticipated because temperature depends upon several factors, and this is a relatively short, low gradient reach.

\*Bureau of Land Management/Utah State University National Aquatic Monitoring Center

\*\*Grand County Water Information Network

<sup>3</sup> This Monitoring At-A-Glance table is based on the 2016 Monitoring Plan guidelines developed by LBD. Some of the agency names and sampling methods may change, and if so, the Subcommittee will evaluate accordingly when comparing year to year data results of the program.