# Attachment A – Analysis of Base Parameter Data and Erosion Inventory Data for Sediment TMDL Development Within the Flint Creek TPA

# ANALYSIS OF BASE PARAMETER DATA AND EROSION INVENTORY DATA FOR SEDIMENT TMDL DEVELOPMENT WITHIN THE FLINT CREEK TPA

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February 2010

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## 1.0 INTRODUCTION

The Flint Creek TMDL Planning Area (TPA) encompasses an area of approximately 500 square miles in southwestern Montana (**Figure 1-1**), and lies almost entirely in Granite County with a small portion in Deer Lodge County. The Flint Creek watershed originates in the Flint Creek Mountains to the east, the Pintlar Mountains to the south, and the Sapphire and John Long Mountains to the west. Flint Creek drains from Georgetown Lake and bisects two large agricultural valleys, the Philipsburg Valley and the Drummond Valley, which are separated by a narrow bedrock canyon. Flow in upper Flint Creek is primarily controlled by the outlet structure at Georgetown Lake, and flow is seasonally augmented from a trans-basin diversion in the East Fork of Rock Creek. Approximately 2,200 residents reside within the Flint Creek TPA, with Philipsburg (pop. 911) and Drummond (pop. 315) as the largest towns. Other population centers include Maxville and Hall. Land ownership in the Flint Creek TPA is primarily private and U.S. Forest Service (Beaverhead-Deer Lodge National Forest), with a small amount of land managed by Bureau of Land Management (BLM) and the State of Montana. Private lands are located predominantly in the lower elevation areas where wide, low-gradient valleys are conducive to agriculture and development.

Today, the economy of the Flint Creek watershed is dominated by agriculture and tourism supported through the areas rich recreational opportunities, although historically the Flint Creek watershed has also seen extensive mining activity, and forested lands were harvested for timber. Many roads were built in conjunction with these activities. Currently, forest lands in the Flint Creek TPA are used for recreational purposes as well as some resource extraction. Most of the historic road system is maintained to some degree to supply access for recreation, resource extraction and fire suppression. Other roads are either decommissioned or left in place. Private lands are predominantly agricultural and rural, with some residential areas. Several tracts of land that were historically grazed or farmed are now subdivided into smaller parcels and have been developed into residential units.

Under Montana law, an impaired water body is defined as a water body for which sufficient and credible data indicates non-compliance with applicable water quality standards (MCA 75-5-103). Section 303 of the Federal Clean Water Act requires states to submit a list of impaired water bodies or stream segments to the U.S. Environmental Protection Agency (EPA) every two years. Prior to 2004, this list was referred to as the "303(d) list", but is now named the "Integrated Report". The Montana Water Quality Act further directs states to develop TMDLs for all water bodies appearing on the 303(d) list as impaired or threatened by "pollutants" (MCA 75-5-703). If sufficient credible data exists to support the sediment impairment determinations for the 1996 listed streams, then sediment TMDLs will be developed. If sufficient data does not exist, then data will be collected to confirm or deny the 1996 listings and TMDLs will be developed for all streams determined to be impaired.

In 2009, Montana Department of Environmental Quality (DEQ) initiated an effort to collect data to support the development of sediment TMDLs for streams within the Flint Creek TPA. The data collection effort involved assessing sediment and habitat conditions within the Flint Creek watershed, as these conditions influence aquatic life beneficial uses. The data collection effort included stream stratification, sampling design, ground surveys, and sediment and habitat analyses, and is intended to assist DEQ in evaluating the impairment status of tributary streams in the Flint Creek TPA and for developing TMDLs where necessary.

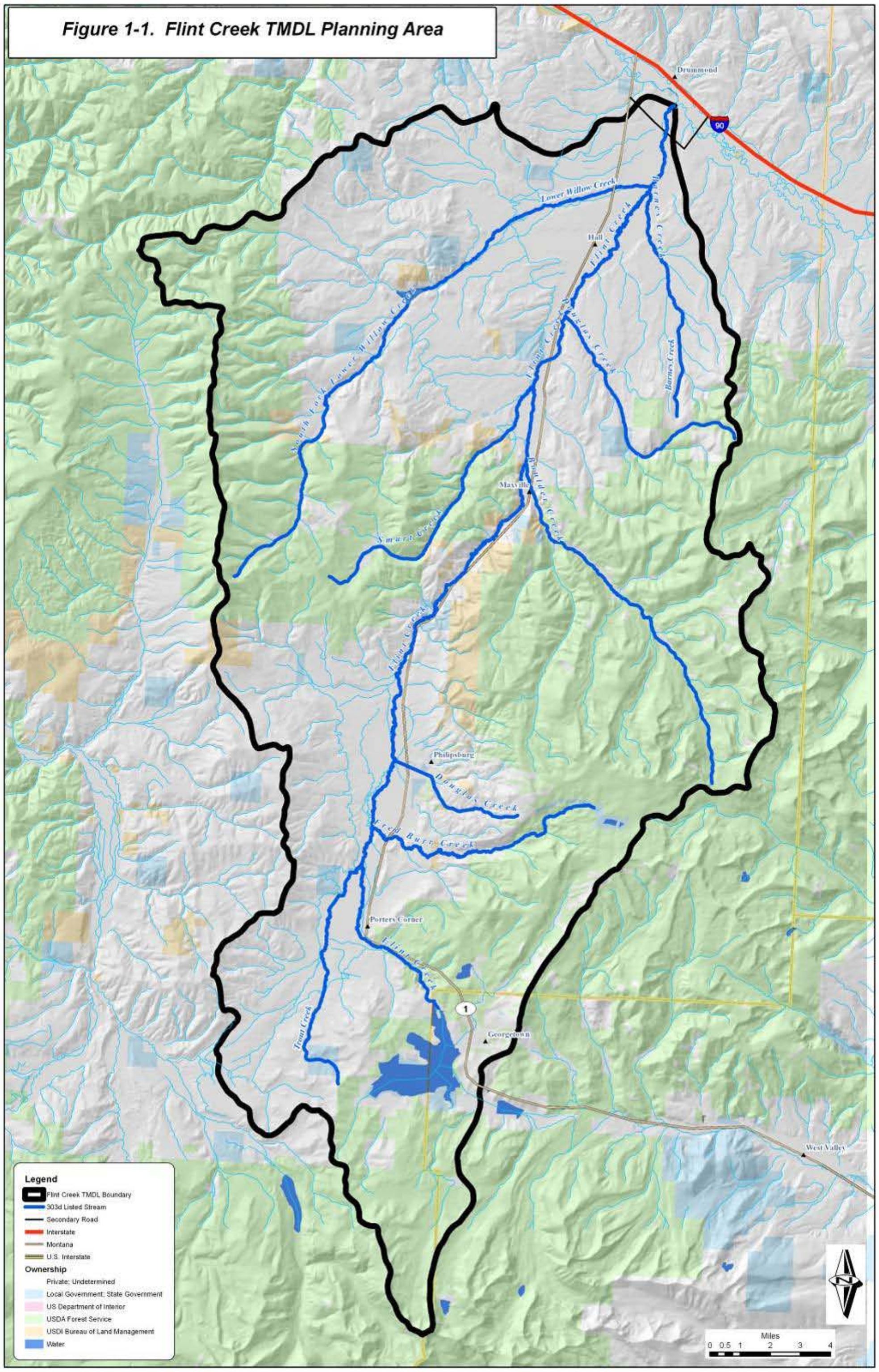


**Figure 1-1. Flint Creek TMDL Planning Area.**

A total of nine streams in the Flint Creek TPA were included for sediment and habitat assessment: Barnes Creek, Boulder Creek, Douglas Creek North (near Hall), Douglas Creek South (near Philipsburg), Flint Creek, Fred Burr Creek, Flint Creek, Lower Willow Creek, Smart Creek, and Trout Creek. Flint Creek, Smart Creek, Douglas Creek South and Barnes Creek appear on Montana's 2008 Integrated Report for sediment impairment.

A stream stratification process was completed on listed stream segments and is intended to develop water body characterizations that can be applied across watersheds, accounting for localized ecological and hydrologic variations. The stratification enables comparison between observed and expected values for various sediment and habitat parameters, and helps quantify the effects of anthropogenic influences. Stratification for streams in the Flint Creek TPA began by dividing the water bodies into reaches and sub-reaches based on aerial photo interpretation of stream characteristics, landscape conditions, and land-use factors. This preliminary work was completed in summer 2009.

Following the initial primary reach stratification, representative reaches were chosen by DEQ for data collection. A two-day sampling reach reconnaissance was conducted on August 11 and 12, 2009, and field personnel completed full site surveys from September 8-18, 2009. Field personnel visited the selected reaches and recorded bank erosion sites, vegetation, and channel characteristics data. Data were later compiled and analyzed resulting in full descriptions of sediment and habitat conditions for all of the surveyed reaches and the ability to extrapolate to non-surveyed reaches.

# 2.0 Aerial Assessment Reach Stratification

## 2.1 Methods

An aerial assessment of streams in the Flint Creek TPA was conducted by Montana DEQ using geographic information systems (GIS) software and 2005 color aerial imagery. Relevant geographic data layers were acquired from the U.S. Geological Survey (USGS), the U.S. Environmental Protection Agency (USEPA) and the Montana State National Resource Information System (NRIS) database. Layers include the following data sets.

- Ecoregion (USEPA)
- Scanned and Rectified Topographic Maps, 1:24,000 and 1:100,000 (USGS)
- National Hydrography Dataset Lakes and Streams (USGS)
- 2005 National Aerial Image Program (NAIP – NRIS)

GIS data layers were used to stratify streams into primary reaches based on stream characteristics, landscape and land-use factors. The stream reach stratification methodology applied in this study is described in *Watershed Stratification Methodology for TMDL Sediment and Habitat Investigations* (DEQ 2008a). The reach stratification methodology involves delineating a water body stream segment into stream reaches and sub-reaches. This process was completed for the following stream segments in the Flint Creek TPA: Barnes Creek, Boulder Creek, Douglas Creek North (near Hall), Douglas Creek South (near Philipsburg), Flint Creek, Fred Burr Creek, Lower Willow Creek, Smart Creek, Trout Creek, and Princeton Gulch.

## 2.2 Stream Reaches

Water body segments are delineated by a water use class designated by the State of Montana, e.g. A-1, B-3, C-3 (Administrative Rules of Montana Title 17 Chapter 30, Sub-Chapter 6). Although a water body segment is the smallest unit for which an impairment determination is made, the stratification approach described in this document initially stratifies individual water body segments into discrete assessment reaches that are delineated by landscape controls such as Ecoregion, Strahler stream order, valley gradient, and valley confinement. The reason for this stratification is that the inherent differences in landscape controls between stream reaches often prevents a direct comparison from being made between the physical attributes of one stream reach to another. By initially stratifying water body segments into stream reaches having similar landscape controls, it is feasible to make comparisons between similar reaches in regards to observed versus expected channel morphology. Likewise, when land use is used as an additional stratification (e.g. grazed vs. non-grazed sub-reaches), sediment and habitat parameters for impaired stream reaches can be more readily compared to reference reaches that meet the same geomorphic stratification criteria.

The aerial photograph reach stratification methodology involves dividing a stream segment into distinct reaches based on four primary watershed characteristics, including Ecoregion, valley gradient, Strahler stream order, and valley confinement. Once stream reaches have been classified by the four watershed characteristics, reaches are further divided based on the surrounding vegetation and land-use characteristics as observed in the color aerial imagery using GIS. The result is a series of stream reaches and sub-reaches delineated by landscape and land-use factors. Stream reaches with similar landscape factors can then be compared based on the character of surrounding land-use practices.

For ease of labeling, each listed stream in the assessment was assigned an abbreviation based on the stream name. These labels were use in the individual stream reach classification. **Table 2-1** shows the abbreviations developed for each water body.

**Table 2-1. Water body naming key.**

| Water Body | Label Abbreviation |
|---|---|
| Barnes Creek | BARN |
| Boulder Creek | BOUL |
| Douglas Creek (North) | DOUN |
| Douglas Creek (South) | DOUS |
| Flint Creek | FLIN |
| Fred Burr Creek | FRED |
| Lower Willow Creek | LOWI |
| Smart Creek | SMAR |
| Trout Creek | TROU |

## 2.3 Reach Types

Individual stream reaches were delineated by reach type based on four watershed characteristics. For the purposes of this report, a "reach type" is defined as a unique combination of Ecoregion, valley gradient, Strahler stream order, and valley confinement, and is designated using the following naming convention based on the reach type identifiers provided in **Table 2-2**:

*Level III Ecoregion – Valley Gradient – Strahler Stream Order – Confinement*

**Table 2-2. Reach type identifiers.**

| Watershed Characteristic | Stratification Category | Reach Type Identifier |
|---|---|---|
| Level III Ecoregion | Middle Rockies | MR |
| Valley Gradient | 0-2% | 0 |
| | 2-4% | 2 |
| | 4-10% | 4 |
| | > 10% | 10 |
| Strahler Stream Order | first order | 1 |
| | second order | 2 |
| | third order | 3 |
| | fourth order | 4 |
| | fifth order | 5 |

**Table 2-2. Reach type identifiers.**

| Watershed Characteristic | Stratification Category | Reach Type Identifier |
|---|---|---|
| Confinement | confined | C |
| | unconfined | U |

The Flint Creek TPA exists solely within the Middle Rockies Level III Ecoregion (Ecoregion 17), which includes three Level IV Ecoregions within the Flint Creek TPA, including the Flint Creek-Anaconda Mountains (17am), the Deer Lodge-Philipsburg-Avon Grassy Intermontane Hills and Valleys (17ak), and a portion of the Sapphire Mountains (17x). Present reach type combinations for the Flint Creek TPA are provided in **Table 2-3**, including the number of sites monitored of each reach type. Overall, 24 monitoring sites were selected for field evaluation.

**Table 2-3. Stratified reach types within the Flint Creek TPA.**

| Level III Ecoregion | Valley Gradient | Strahler Stream Order | Confine-ment | Reach Type | Number of Reaches | Number of Monitoring Sites |
|---|---|---|---|---|---|---|
| Middle Rockies | <2% | 1 | C | MR-0-1-C | 1 | |
| | | | U | MR-0-1-U | 8 | |
| | | 2 | C | MR-0-2-C | 2 | |
| | | | U | MR-0-2-U | 50 | 5 |
| | | 3 | U | MR-0-3-U | 98 | 6 |
| | | 4 | U | MR-0-4-U | 121 | 5 |
| | | 5 | U | MR-0-5-U | 11 | 1 |
| | 2-4% | 1 | U | MR-2-1-U | 15 | |
| | | 2 | C | MR-2-2-C | 20 | |
| | | | U | MR-2-2-U | 74 | 4 |
| | | 3 | U | MR-2-3-U | 43 | 2 |
| | | 4 | U | MR-2-4-U | 13 | 1 |
| | 4-10% | 1 | C | MR-4-1-C | 20 | |
| | | | U | MR-4-1-U | 31 | |
| | | 2 | C | MR-4-2-C | 16 | |
| | | | U | MR-4-2-U | 40 | |
| | | 3 | U | MR-4-3-U | 8 | |
| | | 4 | U | MR-4-4-U | 2 | |
| | >10% | 1 | C | MR-10-1-C | 24 | |
| | | | U | MR-10-1-U | 14 | |
| | | 2 | C | MR-10-2-C | 6 | |
| | | | U | MR-10-2-U | 14 | |
| | | | | **Totals:** | **631** | **24** |

**Table 2-4** shows the assessed water bodies and monitored reaches included within each reach type. A map of monitoring site locations is provided as **Attachment A**.

**Table 2-4. Monitoring sites in assessed reach types.**

| Reach Type | Water body | Monitoring Sites |
|---|---|---|
| MR-0-2-U | Douglas Creek (North), Fred Burr Creek, Smart Creek | DOUN 08-02, FRED 29-02, SMAR 21-01, SMAR 18-01-1, SMAR 18-01-2 |
| MR-0-3-U | Barnes Creek, Boulder Creek, Flint Creek, Trout Creek | BARN 11-01, BARN 13-01, BARN 13-03, BOUL 21-02, FLIN 09-02, TROU 09-03 |
| MR-0-4-U | Flint Creek, Lower Willow Creek | FLIN 11-01, FLIN 11-04, FLIN 18-02, FLIN 18-05, LOWI 02-05 |
| MR-0-5-U | Flint Creek | FLIN 19-01 |
| MR-2-2-U | Douglas Creek (North), Douglas Creek (South), Flint Creek, Smart Creek | DOUN 07-01, DOUS 19-02, FLIN 06-01, SMAR 13-01 |
| MR-2-3-U | Boulder Creek | BOUL 16-01, TROU 10-01 |
| MR-2-4-U | Flint Creek | FLIN 17-01 |

# 3.0 SEDIMENT AND HABITAT DATASET REVIEW

## 3.1 Field Methodology

The following sections describe the field methodologies employed during the stream assessments. The methods follow standard DEQ protocols for sediment and habitat assessment as presented in the document *Longitudinal Field Methodology for the Assessment of TMDL Sediment and Habitat Impairments* (DEQ 2008b). For most survey sites, a minimum of 5 team members were present, which were always divided into 3 teams, referred to as the “Greenline”, “Longitudinal Profile” or “Long-Pro”, and “Cross-Section” teams in this section. The teams worked independently moving upstream through the survey site and in a pre-established order to facilitate accurate data collection and to create the least possible in-stream disturbance. All field data were collected on DEQ standard forms for sediment and habitat assessments, and are summarized and provided in tabular format in **Attachment B**.

### 3.1.1 Survey Site Delineation

Stream survey sites were delineated beginning at riffle crests at the downstream ends of reaches. Survey sites were measured upstream at pre-determined lengths based on the bankfull width at the selected downstream riffle. Survey lengths of 500 ft were used for bankfull widths less than 10 ft; survey lengths of 1,000 ft were used for bankfull widths between 10 ft and 50 ft; and survey lengths of 1,500 ft were used for bankfull widths greater than 60 ft. Each survey site was divided into 5 equally sized study cells. For each site, the field team leader identified the appropriate downstream riffle crest to begin a reach. Where no riffles were present or the stream was dry, the field team leader identified the appropriate starting point. The GPS location of the downstream and upstream ends of the survey site was recorded on the **Sediment and Habitat Assessment Site Information Form**. Digital photographs were taken at both upstream and downstream ends of the survey site, looking both upstream and downstream. Photo numbers and a brief description were recorded in the **Photo Log**, which is included in **Attachment C**.

### 3.1.2 Field Determination of Bankfull

All members of the field crew participated in determining the bankfull elevation prior to breaking into their respective teams. Indicators that were used to estimate the bankfull channel elevation included scour lines, changes in vegetation types, tops of point bars, changes in slope, changes in particle size and distribution, stained rocks and inundation features. Multiple locations and indicators were examined, and bankfull elevation estimates and their corresponding indicators were recorded in the **Bankfull Elevation and Slope Assessment Field Form** by the field team leader. Final determination of the appropriate bankfull elevation was determined by the team leader, and informed by the team experience and notes from the field form.

### 3.1.3 Channel Cross-Sections

The “Cross-Section team” was composed of two members of the assessment crew, who also performed pebble counts, riffle stability index, and riffle grid tosses. Channel cross-section surveys were performed at the first riffle in each cell moving upstream using a line level and a measuring rod. Channel surveys were recorded in the **Channel Cross-section Field Form**. Cross-sections were surveyed in each cell containing a riffle. In the case that riffles were present in only 1 or 2 cells, but those cells contained multiple riffles, additional cross-sections were performed at the most downstream unmeasured riffle, such that a minimum of three cross-sections were surveyed. If only 1 or 2 riffles were present in the entire reach, all riffle cross-sections were surveyed.

To begin each survey, the Cross-Section team placed a bank pin at the pre-determined bankfull elevation (using bankfull indicators as guides) on the right and left banks. A measuring tape was strung perpendicular to the stream channel at the most well-defined portion of the riffle and tied to the bank pins. Where mid-channel bars or other features were present which prevented a clean line across the channel, the protocol provided in the field methodology document was followed (DEQ 2008b). Bankfull depth measurements were collected to a tenth of a foot across the channel at regular intervals depending on channel width. The thalweg depth was recorded at the deepest point of the channel independent of the regularly spaced intervals. From the recorded data, the following information was calculated for each cross-section:

**Bankfull channel width** = with of the channel measured at bankfull height

**Cross-sectional area** = the sum of the calculated areas from each measured cross-section cell, this value is estimated in the field and later calculated in a spreadsheet

**Mean bankfull depth** = cross-section area/bankfull channel width, this value is estimated in the field and later calculated in a spreadsheet

**Width/depth ratio** = bankfull width / mean bankfull depth

**Entrenchment ratio** = floodprone width / bankfull width.

The floodprone depth was determined by doubling the maximum channel depth. The floodprone width was then determined by stringing a tape from the bankfull channel margin on both right and left banks until the tape (pulled tight and flat) touched ground at the floodprone elevation. The total floodprone width was calculated by adding the bankfull channel width to the distances on either end of the channel to the floodprone elevation. When dense vegetation or other features prevented a direct line of tape from being strung, best professional judgment was used to determine the floodprone width. GPS coordinates for each cross-section were recorded. Photos were taken upstream and downstream of the cross section from the middle of the channel. A photo was also taken across the channel, showing the tape across the stream.

### 3.1.4 Channel Bed Morphology

A variety of channel bed morphology features were measured and recorded by the "Long-Pro" team, which usually consisted of two team members, and included the field team leader. The length of the survey site occupied by pools and riffles was identified and recorded in the **Pools, Riffles and Large Woody Debris Field Form.** Beginning from the downstream end of the survey site, the upstream and downstream stations of dominant riffle and pool stream features were recorded. Features were considered dominant when occupying over 50% of the stream width for riffles and 33% for pools. Pools and riffles were measured from the downstream to upstream end of each feature. Runs and glides were not recorded in the field form. Stream features were identified using standard methods (DEQ 2008b).

### 3.1.4.1 Residual Pool Depth

At all pools encountered, a residual pool depth measurement was determined. Backwater pools were not measured. Measured pools were recorded at each station (distance in feet) of occurrence beginning at the downstream end (station 0) of the survey site. The depth of the pool tail crest at its deepest point was measured. The maximum depth of each pool was also recorded. The max pool depth minus the pool tail crest depth provides the residual pool depth. In the case of dry channels, readings were taken from channel bed surface to bankfull height. No pool tail crest depth was recorded for dammed pools (see **Section 3.1.4.2**).

### 3.1.4.2 Pool Habitat Quality

Qualitative assessments of each pool feature were undertaken and recorded in the **Pools, Riffles and Large Woody Debris Field Form** as follows:

1. Pool types were determined to be either Scour (S) or Dammed (D).
2. Pool size was estimated relative to bankfull channel width was recorded as Small (S), Medium (M), or Large (L). Small pools were defined as <1/3 of the bankfull channel width; medium pools were >1/3 and <2/3 of the bankfull channel with; and large pools were determined to be those >2/3 of the bankfull channel width or >20 feet wide.
3. Pool formative features were recorded as lateral scour (LS), plunge (P), boulder (B), or woody debris (W).
4. The primary pool cover type was recorded using the following codes:
   V = Overhanging Vegetation
   D = Depth
   U = Undercut
   B = Boulder
   W = Woody Debris
   N = No apparent cover
5. When undercut banks were present, their depths were measured to a tenth of a foot by inserting a measuring rod horizontally into the undercut bank.

### 3.1.4.3 Fine Sediment in Depositional Spawning Areas

A measurement of the percent of fine sediment in depositional spawning areas was taken using the grid toss method at the first and second scour pool of each cell. Grid toss readings were focused in those gravels that appeared to be suitable or potentially suitable for trout spawning. Measurements were taken within the "arc" just upstream of the pool tail crest, following the methodology in *Longitudinal Field Methodology for the Assessment of TMDL Sediment and Habitat Impairments* (DEQ 2008b). Three measurements were taken across the channel with specific attention given to measurements in gravels determined to be of appropriate size for salmonid spawning. The presence of spawning gravels was recorded as Yes (Y), No (N) or Unknown (?) at each pool location.

#### 3.1.4.4 Fine Sediment in Riffles

Measurements of fine sediment in riffles were recorded by the Cross-Section team using the same grid toss method as used in pools (**Section 3.1.4.3**). Grid tosses were performed approximately within the right, middle, and left third of the riffle. Grid tosses were performed in the same general location but before the pebble counts (**Section 3.1.4.6**) to avoid disturbances to fine sediments. These measurements were recorded in the **Riffle Pebble Count Field Form.**

#### 3.1.4.5 Woody Debris Quantification

The amount of large woody debris (LWD) was recorded by the Long-Pro team along the entire assessment reach in the **Pools, Riffles and Large Woody Debris Field Form**. Large pieces of woody debris located within the bankfull channel and which were relatively stable as to influence the channel form were counted as either single, aggregate or willow bunch. Further description of these categories is provided in *Longitudinal Field Methodology for the Assessment of TMDL Sediment and Habitat Impairments* (DEQ 2008b).

#### 3.1.4.6 Riffle Pebble Count

A Wolman pebble count (Wolman 1954) was performed by the Cross-Section team at the first riffle encountered in cells 1, 3 and 5 as the team progressed upstream. These data were recorded in the **Riffle Pebble Count Field Form**. Particle sizes were measured along their intermediate length axis (*b-axis*) and results were grouped into size categories. The team progressed from bankfull edge to bankfull edge using the "heel to toe" method, measuring particle size at the tip of the boot at each step. More specific details of the pebble count methodology can be found in the field methods document (DEQ 2008b).

#### 3.1.4.7 Riffle Stability Index

In stream reaches that had well developed point bars downstream of riffles, a riffle stability index (RSI) was performed to determine the average size of the largest recently deposited particles, and to calculate an RSI which evaluates riffle particle stability (Kappesser 2002). For stream reaches in which well developed gravel bars were present, a RSI was determined by first measuring the intermediate axis (*b-axis*) of 15 of the largest recently deposited particles on a depositional bar. This information was recorded in the **Riffle Pebble Count Field Form**. During post-field data processing, the arithmetic mean of the largest recently deposited particles is calculated. This value is then compared to the cumulative particle size distribution of an adjacent riffle, as determined by the Wolman pebble count. The RSI is reported as the cumulative percentile of the particle size classes that are smaller than the arithmetic mean of the largest recently deposited particles. The RSI value generally represents the percent of mobile particles within the riffle that is adjacent to the sampled bar.

### 3.1.5 Riparian Greenline Assessment

After the entire survey station length was measured by the "Greenline" team member, an assessment of riparian vegetation cover was performed. The reach was walked by the

"Greenline" team member who noted the general vegetation community type of the groundcover, understory and overstory on both banks. Vegetation types were recorded at 10-foot intervals and were entered in the **Riparian Greenline Field Form**.

The *ground cover* vegetation (<1.5 feet tall) was described using the following categories:

**W** = Wetland vegetation, such as sedges and rushes
**G** = Grasses or forbs, rose, snowberry (vegetation lacking binding root structure)
**B** = Bare/disturbed ground
**R** = Rock, when a large cobble or bolder is encountered
**RR** = Riprap

The *understory* (1.5 to 15 feet tall) and *overstory* (>15 feet tall) vegetation was described using the following categories:

**C** = Coniferous
**D** = Deciduous, riparian shrubs and trees with sufficient rooting mass and depth to provide protection to the streambanks
**M** = mixed coniferous and deciduous

At 50-foot intervals, riparian buffer width was estimated for both banks by evaluating the belt of riparian vegetation buffering the stream from adjacent land uses. Upon conclusion of the Greenline measurements, the total numbers of each type of vegetation were tallied.

### 3.1.6 Streambank Erosion Assessment

An assessment of all actively/visually eroding and slowly eroding/undercut/vegetated streambanks was conducted along each survey site. This assessment consisted of the Bank Erosion Hazard Index (BEHI) and Near Bank Stress (NBS) estimation which are used to quantify sediment loads from bank erosion. All streambank measurements were recorded in the **Streambank Erosion Field Form** and **Additional Streambank Erosion Measurements Form.** Further information related to the streambank erosion assessment methodology and results is included in **Sections 4.2** and **4.3**.

### 3.1.7 Water Surface Slope

Where possible, water surface slope measurements were estimated and recorded in the **Elevation & Water Surface Slope Field Form**. Two crew members, usually part of the Cross-Section team, stood distant from each other within direct line-of-sight at the water's surface between two similar stream features, and estimated slope with a clinometer.

### 3.1.8 Field Notes

At the completion of data collection at each survey site, field notes were collected by the field team leader with inputs from the entire field team. The following four categories contributed to field notes, which served to provide an overall context for the condition of the stream channel relative to surrounding and historical uses:

- Description of human impacts and their severity;

- Description of stream channel conditions;
- Description of streambank erosion conditions; and
- Description of riparian vegetation conditions.

### 3.1.9 Quality Assurance/Quality Control

Quality assurance and quality control (QA/QC) was achieved through strict adherence to the project's Sampling and Analysis Plan (WET 2009). During each stream assessment, the field team leader and most experienced crew members led the separate teams. Equipment checks were done each morning and field maps were reviewed with drivers before approaching field sites. Field forms were distributed and double-checked before teams left the vehicles to the survey sites. At the conclusion of each stream assessment, all field forms were reviewed for completeness and accuracy. Any questions that arose from field teams were brought to the attention of the field team leader until resolved to the leader's satisfaction.

Despite the best efforts to adhere to the project's Sampling and Analysis Plan (SAP), some deviations did occur while in the field and during data processing. Additionally, parameters used for sediment loading calculations were adjusted during data processing and following review of field photos to better represent actual field conditions. These adjustments and any deviations from the SAP are described in the Quality Assurance/Quality Control Review provided in **Attachment D**.

## 3.2 Sampling Parameter Descriptions and Summaries by Reach Type

The following sections provide definitions of sampling parameters that were measured at each reach, and basic statistical summaries of data for each parameter organized by reach type. Parameters described in this section include bankfull channel width, width/depth ratio, entrenchment ratio, percent understory shrub cover, percent bare/disturbed ground, riffle pebble count data (% <2 mm and <6 mm, D50), riffle grid toss data (% <6 mm), riffle stability index (RSI), mean pool depth, pool frequency, pool grid toss data (% <6 mm), and large woody debris (LWD) frequency. Data for each individual measurement site were used in the statistical analysis (i.e. data from each of the individual cross sections in one assessment reach were used), and then sample reaches and water bodies were grouped into reach types as shown in **Table 2-3**.

Data provided for each parameter include statistical box plots and data tables organized by each reach type and for the total planning area. The box plots and data tables provide the minimum and maximum observed values, and the $25^{th}$ (Q1), $50^{th}$ (median), and $75^{th}$ (Q3) percentile values. The statistics tables also provide the number of reaches sampled and the number of data cases available for each parameter. Parameters with a limited number of cases (N<4) will appear as a single line on the box plots.

### 3.2.1 Bankfull Channel Width

Bankfull is a concept used by hydrologists to define a regularly occurring, channel-forming high flow. One of the first generally accepted definitions of bankfull was provided by Dunne and Leopold (1978):

> *"The bankfull stage corresponds to the discharge at which channel maintenance is the most effective, that is, the discharge at which moving sediment, forming or removing bars, forming or changing bends and meanders, and generally doing work that results in the average morphologic characteristics of channels."*

Bankfull channel width is measured at each surveyed cross-section as the width of the channel at bankfull height. In general, bankfull channel width will increase with stream order, although over-widened streams may have an artificially high channel width.

The measured bankfull channel widths are presented in **Figure 3-1** by reach type, and summary statistics are provided in **Table 3-1**. All surveyed cross sections are included in the data generated for each reach type**.**

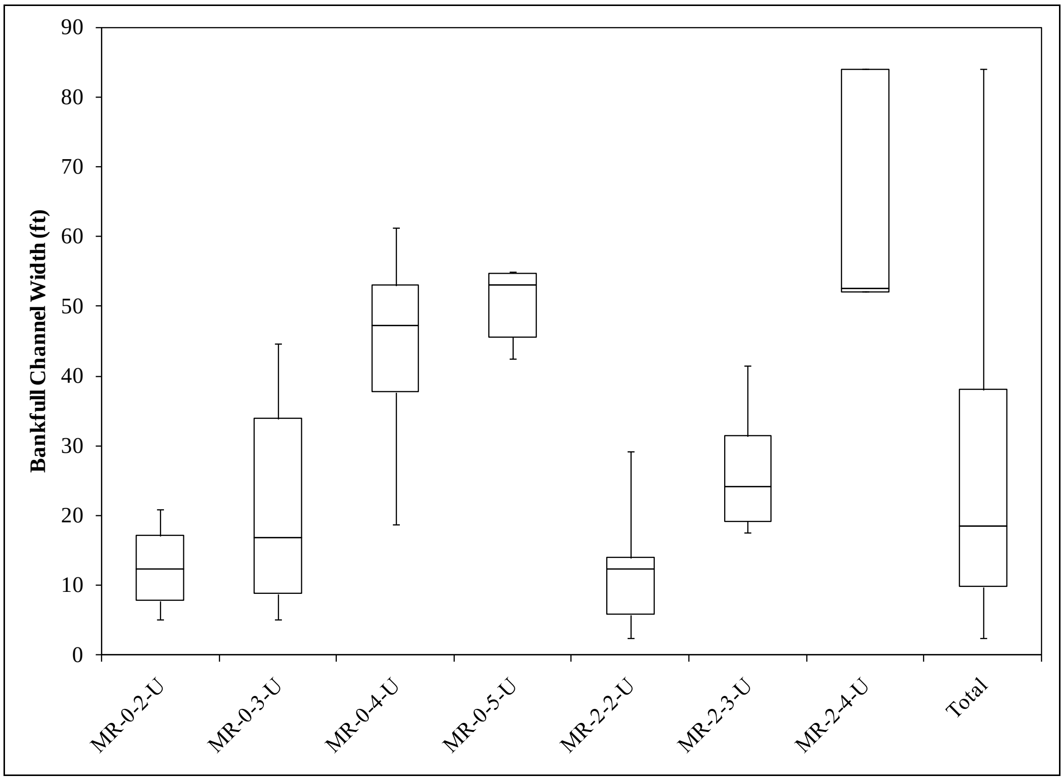


**Figure 3-1. Bankfull channel width by reach type.**

**Table 3-1. Summary statistics of bankfull channel width by reach type.**

| Reach Type | Reaches | Count | Minimum | Q1 | Median | Q3 | Maximum |
|---|---|---|---|---|---|---|---|
| MR-0-2-U | 5 | 24 | 5.1 | 7.9 | 12.3 | 17.1 | 20.9 |
| MR-0-3-U | 6 | 30 | 5.2 | 8.8 | 16.8 | 33.9 | 44.7 |
| MR-0-4-U | 5 | 21 | 18.8 | 37.7 | 47.2 | 53.1 | 61.3 |
| MR-0-5-U | 1 | 5 | 42.5 | 45.6 | 53.1 | 54.8 | 55.0 |
| MR-2-2-U | 4 | 19 | 2.5 | 5.8 | 12.3 | 14.0 | 29.2 |
| MR-2-3-U | 2 | 10 | 17.6 | 19.2 | 24.2 | 31.4 | 41.5 |

| Table 3-1. Summary statistics of bankfull channel width by reach type. | | | | | | | |
|---|---|---|---|---|---|---|---|
| **Reach Type** | **Reaches** | **Count** | **Minimum** | **Q1** | **Median** | **Q3** | **Maximum** |
| MR-2-4-U | 1 | 3 | 52.1 | 52.1 | 52.6 | 84.0 | 84.0 |
| Total | 24 | 112 | 2.5 | 9.9 | 18.5 | 38.1 | 84.0 |

## 3.2.2 Width/Depth Ratio

The stream channel width/depth ratio is defined as the channel width at bankfull height divided by the mean bankfull depth (Rosgen 1996). The channel width/depth ratio is one of several standard measurements used to classify stream channels, making it a useful variable for comparing conditions on reaches within the same stream type. A comparison of observed and expected width/depth ratio is a useful indicator of channel over-widening and aggradation, which are often linked to excess streambank erosion or acute or chronic erosion from sources upstream of the study reach. Channels that are over-widened often are associated with excess sediment deposition and streambank erosion, contain shallower, warmer water, and provide fewer deepwater habitat refugia for fish.

The measured width/depth ratios are presented in **Figure 3-2** by reach type, and summary statistics are provided in **Table 3-2**. All surveyed cross sections are included in the data generated for each reach type**.**

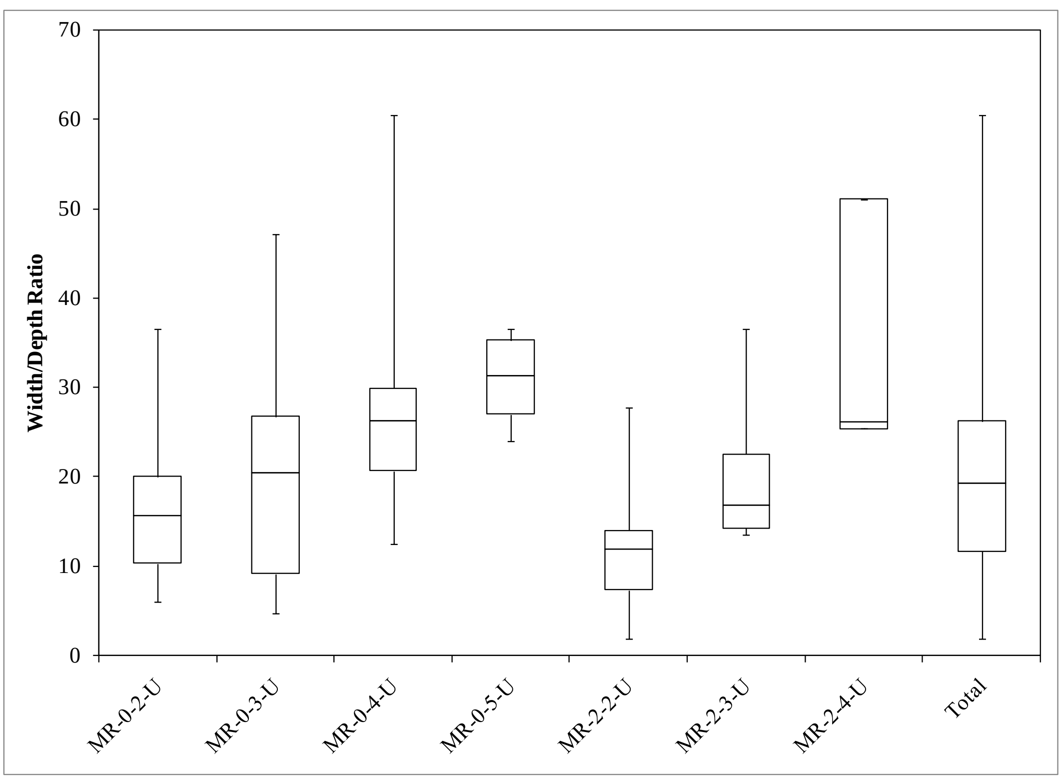


**Figure 3-2. Width/depth ratio by reach type.**

**Table 3-2. Summary statistics of width/depth ratio by reach type.**

| Reach Type | Reaches | Count | Minimum | Q1 | Median | Q3 | Maximum |
|---|---|---|---|---|---|---|---|
| MR-0-2-U | 5 | 24 | 6.0 | 10.3 | 15.7 | 20.0 | 36.6 |
| MR-0-3-U | 6 | 30 | 4.8 | 9.2 | 20.5 | 26.7 | 47.1 |
| MR-0-4-U | 5 | 21 | 12.6 | 20.7 | 26.3 | 29.9 | 60.5 |
| MR-0-5-U | 1 | 5 | 24.0 | 27.1 | 31.3 | 35.3 | 36.6 |
| MR-2-2-U | 4 | 19 | 2.0 | 7.4 | 12.0 | 14.0 | 27.8 |
| MR-2-3-U | 2 | 10 | 13.5 | 14.3 | 16.9 | 22.6 | 36.6 |
| MR-2-4-U | 1 | 3 | 25.4 | 25.4 | 26.1 | 51.1 | 51.1 |
| Total | 24 | 112 | 2.0 | 11.7 | 19.3 | 26.3 | 60.5 |

## 3.2.3 Entrenchment Ratio

Stream entrenchment ratio is equal to the floodprone width divided by the bankfull width (Rosgen 1996). Entrenchment ratio is used to help determine if a stream shows departure from its natural stream type. It is an indicator of stream incision, and therefore indicates how easily a stream can access its floodplain. Streams are often incised due to detrimental land management or may be naturally incised due to landscape characteristics. A stream that is overly entrenched generally is more prone to streambank erosion due to greater energy exerted on the banks during flood events. Greater scouring energy in incised channels results in higher sediment loads derived from eroding banks. If the stream is not actively degrading (down-cutting), the sources of human caused incision may be historical in nature and may not currently be present, although sediment loading may continue to occur. The entrenchment ratio is an important measure of channel condition as it relates to sediment loading and habitat condition, due to the long-lasting impacts of incision and the large potential for sediment loading in incised channels.

The entrenchment ratios by reach type are presented in **Figure 3-3**, and summary statistics are provided in **Table 3-3**. All surveyed cross sections are included in the statistics generated within each reach type**.**

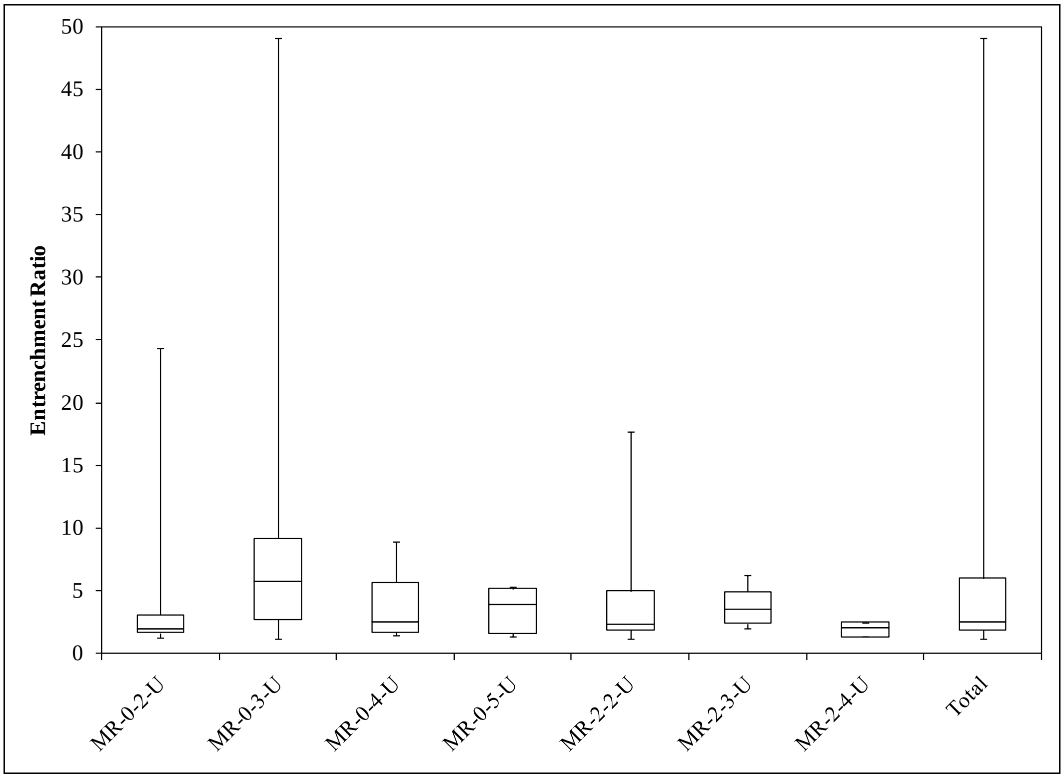


**Figure 3-3. Entrenchment ratio by reach type.**

**Table 3-3. Summary statistics of entrenchment ratio by reach type.**

| Reach Type | Reaches | Count | Minimum | Q1 | Median | Q3 | Maximum |
|---|---|---|---|---|---|---|---|
| MR-0-2-U | 5 | 24 | 1.2 | 1.7 | 2.0 | 3.1 | 24.3 |
| MR-0-3-U | 6 | 30 | 1.2 | 2.7 | 5.8 | 9.2 | 49.1 |
| MR-0-4-U | 5 | 21 | 1.4 | 1.7 | 2.6 | 5.7 | 8.9 |
| MR-0-5-U | 1 | 5 | 1.3 | 1.6 | 3.9 | 5.2 | 5.3 |
| MR-2-2-U | 4 | 19 | 1.2 | 1.9 | 2.3 | 5.0 | 17.7 |
| MR-2-3-U | 2 | 10 | 2.0 | 2.4 | 3.6 | 5.0 | 6.2 |
| MR-2-4-U | 1 | 3 | 1.4 | 1.4 | 2.1 | 2.5 | 2.5 |
| Total | 24 | 112 | 1.2 | 1.9 | 2.6 | 6.0 | 49.1 |

### 3.2.4 Riffle Pebble Count: Substrate Fines (% <2 mm)

Clean stream bottom substrates are essential for optimum habitat for many fish and aquatic insect communities. The most obvious forms of degradation occur when critical habitat components such as spawning gravels (Chapman and McLeod 1987) and cobble surfaces are physically covered by fines, thereby decreasing inter-gravel oxygen and reducing or eliminating the quality and quantity of habitat for fish, macroinvertebrates and algae (Lisle 1989, Waters 1995). Chapman and Mcleod found that size of bed material is inversely related to habitat suitability for fish and macroinvertebrates and that excess sediment decreased both density and diversity of aquatic insects. Specific aspects of sediment-invertebrate relationships may be described as follows: 1) invertebrate abundance is correlated with substrate particle size; 2) fine sediment reduces the abundance of original populations by reducing interstitial habitat normally available in large-particle substrate (gravel, cobbles); and 3) species type, species richness, and diversity all change as particle size of substrate changes from large (gravel, cobbles) to small (sand, silt, clay) (Waters 1995).

The percent of fine sediment in a stream channel provides a measure of the siltation occurring in a river system and is an indicator of stream channel condition. Although it is difficult to correlate percent surface fines with sediment loading directly, the Clean Water Act allows "other applicable measures" for the development of TMDL water quality restoration plans. Percent surface fines have been used successfully in other TMDLs in western Montana addressing sediment related to stream bottom deposits, siltation, and aquatic life uses. Surface fine sediment measured in the Wolman pebble count is one indicator of aquatic habitat condition and can indicate excessive sediment loading. The Wolman pebble count method provides a survey of the particle distribution of the entire channel width, allowing investigators to calculate a percentage of the surface substrate (as frequency of occurrence) composed of fine sediment.

In addition to being a direct measure of impairment to the aquatic macroinvertebrate community, riffle percent surface fines can be used as an indicator of possible impairment condition to cold water fish since the elevated riffle surface fines are likely an indicator of elevated subsurface fines within spawning gravels.

The pebble count measurements for particles <2 mm by reach type are presented in **Figure 3-4**, and summary statistics are provided in **Table 3-4**.

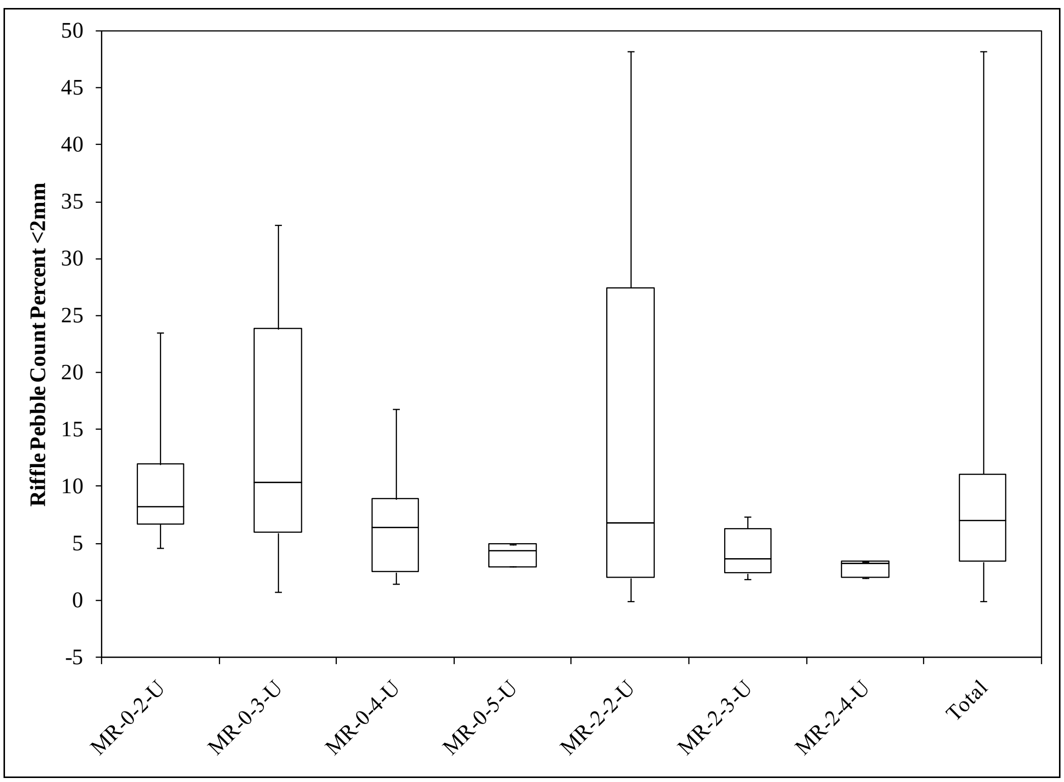


**Figure 3-4. Riffle pebble count (% <2 mm) by reach type.**

**Table 3-4. Summary statistics of riffle pebble count (% <2 mm) by reach type.**

| Reach Type | Reaches | Count | Minimum | Q1 | Median | Q3 | Maximum |
|---|---|---|---|---|---|---|---|
| MR-0-2-U | 5 | 15 | 4.6 | 6.7 | 8.3 | 12.0 | 23.5 |
| MR-0-3-U | 6 | 18 | 0.8 | 6.0 | 10.4 | 23.9 | 33.0 |
| MR-0-4-U | 5 | 14 | 1.5 | 2.5 | 6.4 | 8.9 | 16.8 |
| MR-0-5-U | 1 | 3 | 3.0 | 3.0 | 4.4 | 5.0 | 5.0 |
| MR-2-2-U | 4 | 12 | 0.0 | 2.0 | 6.8 | 27.5 | 48.2 |
| MR-2-3-U | 2 | 6 | 1.9 | 2.4 | 3.7 | 6.3 | 7.3 |
| MR-2-4-U | 1 | 3 | 2.0 | 2.0 | 3.3 | 3.4 | 3.4 |
| Total | 24 | 71 | 0.0 | 3.4 | 7.0 | 11.1 | 48.2 |

### 3.2.5 Riffle Pebble Count: Substrate Fines (% <6 mm)

As with surface fine sediment smaller than 2 mm diameter, an accumulation of surface fine sediment less than 6 mm diameter may also indicate excess sedimentation and has the potential to negatively impact the spawning success of cold water fish. The size distribution of substrate material in the streambed is also indicative of habitat quality for salmonid spawning and incubation. Excess surface fine substrate may have detrimental impacts on aquatic habitat by cementing spawning gravels, thus reducing their accessibility, preventing flushing of toxins in egg beds, reducing oxygen and nutrient delivery to eggs and embryos, and impairing emergence of fry (Meehan 1991). Weaver and Fraley (1991) observed a significant inverse relationship between the percentage of material less than 6.35 mm and the emergence success of westslope cutthroat trout and bull trout.

The pebble count measurements for sediment fines (% <6 mm) by reach type are presented below in **Figure 3-5** and summary statistics are provided in **Table 3-5**.

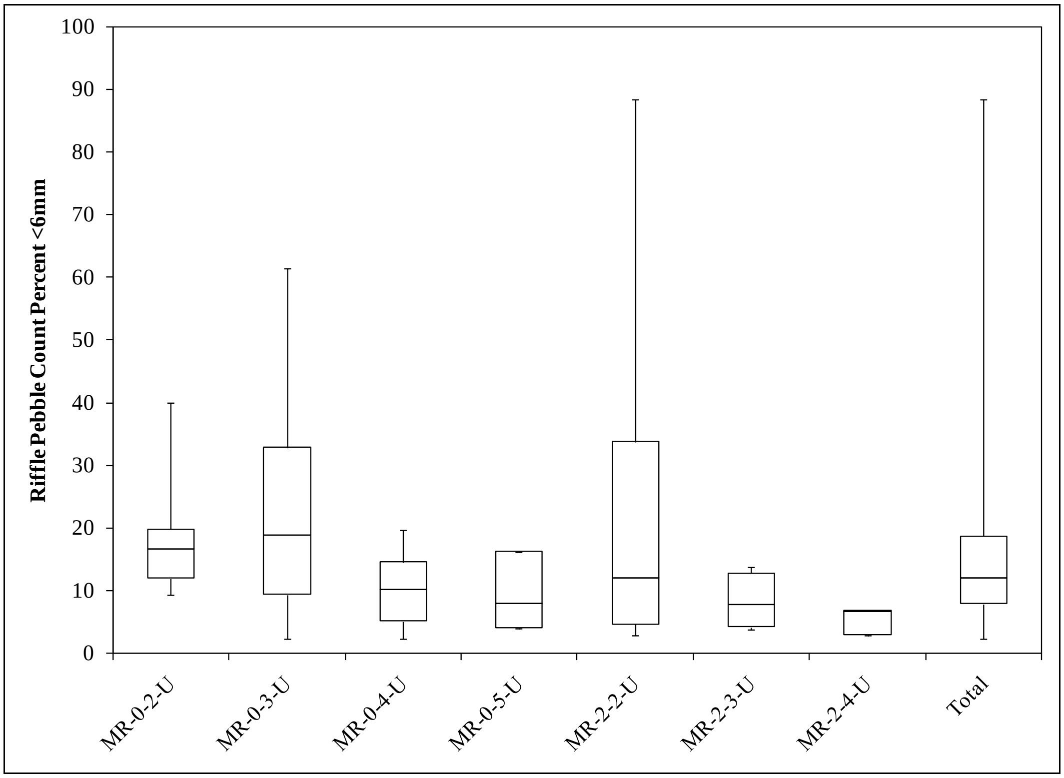


**Figure 3-5. Riffle pebble count (% <6 mm) by reach type.**

**Table 3-5. Summary statistics of riffle pebble count (% <6 mm) by reach type.**

| Reach Type | Reaches | Count | Minimum | Q1 | Median | Q3 | Maximum |
|---|---|---|---|---|---|---|---|
| MR-0-2-U | 5 | 15 | 9.3 | 11.9 | 16.7 | 19.8 | 40.0 |
| MR-0-3-U | 6 | 18 | 2.3 | 9.4 | 18.8 | 32.9 | 61.5 |
| MR-0-4-U | 5 | 14 | 2.3 | 5.1 | 10.2 | 14.5 | 19.7 |
| MR-0-5-U | 1 | 3 | 4.0 | 4.0 | 7.9 | 16.3 | 16.3 |
| MR-2-2-U | 4 | 12 | 2.9 | 4.7 | 12.0 | 33.8 | 88.4 |
| MR-2-3-U | 2 | 6 | 3.9 | 4.2 | 7.8 | 12.8 | 13.8 |
| MR-2-4-U | 1 | 3 | 3.0 | 3.0 | 6.6 | 6.9 | 6.9 |
| Total | 24 | 71 | 2.3 | 7.9 | 11.9 | 18.8 | 88.4 |

## 3.2.6 Riffle Pebble Count: D50

The D50 represents the median (50$^{th}$ percentile) particle size of a riffle as determined by the Wolman pebble count. This value can be used to evaluate the suitability of a riffle as spawning gravel for salmonids. Kondolf and Wolman (1993) state that the appropriate size of spawning gravels varies based on stream size and fish species, since larger fish are capable of moving larger particles. In general, appropriate sized spawning gravels should be less than approximately 40 mm for salmonids.

Results of the riffle pebble count D50 are presented below by reach type in **Figure 3-6** and summary statistics are provided in **Table 3-6**.

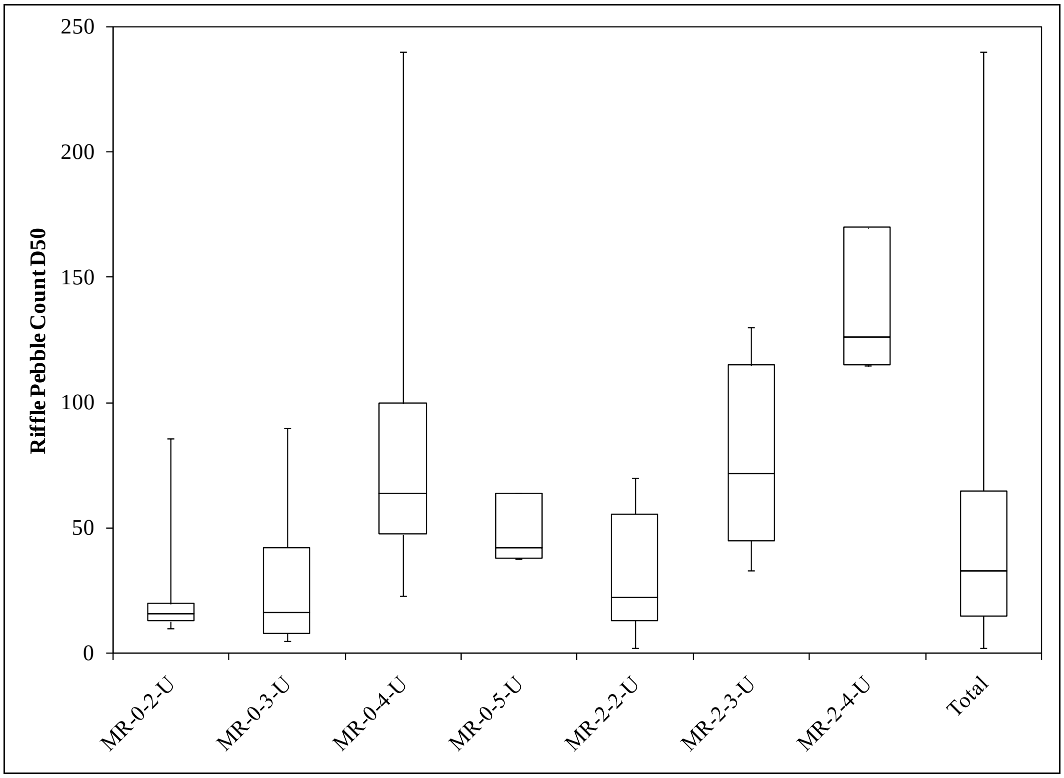


**Figure 3-6. Riffle pebble count D50 (mm) by reach type.**

**Table 3-6. Summary statistics of riffle pebble count D50 (mm) by reach type.**

| Reach Type | Reaches | Count | Minimum | Q1 | Median | Q3 | Maximum |
|---|---|---|---|---|---|---|---|
| MR-0-2-U | 5 | 15 | 10 | 13 | 16 | 20 | 86 |
| MR-0-3-U | 6 | 18 | 5 | 8 | 17 | 42 | 90 |
| MR-0-4-U | 5 | 14 | 23 | 48 | 64 | 100 | 240 |
| MR-0-5-U | 1 | 3 | 38 | 38 | 42 | 64 | 64 |
| MR-2-2-U | 4 | 12 | 2 | 13 | 23 | 56 | 70 |
| MR-2-3-U | 2 | 6 | 33 | 45 | 72 | 115 | 130 |
| MR-2-4-U | 1 | 3 | 115 | 115 | 126 | 170 | 170 |
| Total | 24 | 71 | 2 | 15 | 33 | 65 | 240 |

### 3.2.7 Riffle Stability Index

The riffle stability index (RSI) is used to evaluate riffle particle mobility in an area receiving excessive sediment input (Kappesser 2002). The mobile fraction in a riffle is estimated by comparing the particle sizes in the riffle to the arithmetic mean of the largest mobile particles on an adjacent depositional bar. Riffle particles of the size class smaller than the largest particles on a depositional bar are interpreted as mobile, and the RSI value represents the percent of mobile particles within a riffle. Riffles that have received excessive sediment from upstream eroding banks have a higher percent of mobile particles than riffles in equilibrium. The following breaks are provided as general guidelines for interpreting RSI values:

| **RSI Value** | **Description** |
|---|---|
| < 40 | High bedrock component to riffle (very stabile system) or channel has been scoured |
| 40 – 70 | Stream is in dynamic equilibrium – good channel and watershed stability |
| 70 – 85 | Riffle is somewhat loaded with excessive sediment |
| > 85 | Riffle is loaded with excessive sediment |

Limited RSI data were collected during this field effort due to the frequency of poorly developed point bars downstream of riffles and actively eroding banks. The riffle stability index results for all reaches are provided below in **Table 3-7**.

**Table 3-7. Riffle stability index results for all reaches.**

| Reach ID | Cell | Reach Type | Arithmetic Mean (cm) | Riffle Stability Index |
|---|---|---|---|---|
| FLIN 19-01 | 1 | MR-0-5-U | 84 | 37 |
| FRED 29-02 | 1 | MR-0-2-U | 123 | 71 |
| FRED 29-02 | 3 | MR-0-2-U | 121 | 70 |
| SMAR 13-01 | 2 | MR-2-2-U | 48 | 88 |

### 3.2.8 Riffle Grid Toss: Substrate Fines (% <6 mm)

The wire grid toss is a standard procedure frequently used in aquatic habitat assessment to approximate the percent fine material in a stream. The grid toss measurement does not cover the entire channel width as in the Wolman pebble count, but rather provides a more focused measurement of surface fines in a subsample of the cross-section.

The riffle grid toss results for sediment fines (% <6 mm) are presented below in **Figure 3-7** and summary statistics are provided in **Table 3-8**.

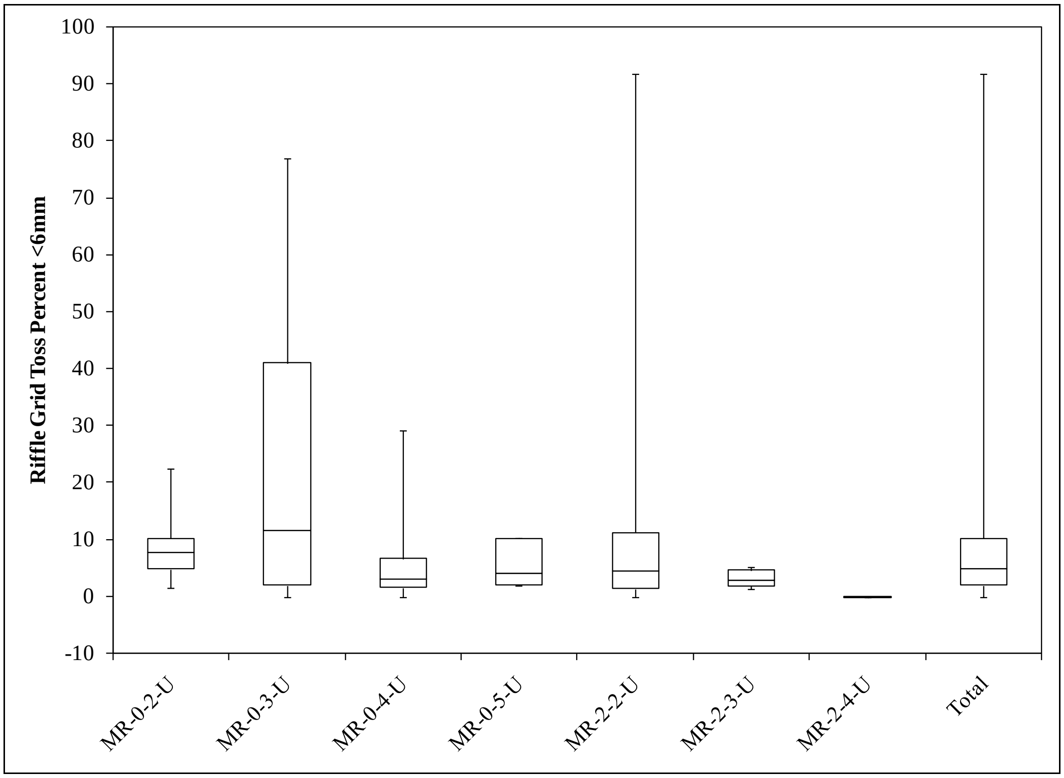


**Figure 3-7. Riffle grid toss (% <6 mm) by reach type.**

**Table 3-8. Summary statistics of riffle grid toss (% <6 mm) by reach type.**

| Reach Type | Reaches | Count | Minimum | Q1 | Median | Q3 | Maximum |
|---|---|---|---|---|---|---|---|
| MR-0-2-U | 5 | 15 | 1.5 | 4.8 | 7.7 | 10.2 | 22.5 |
| MR-0-3-U | 6 | 18 | 0.0 | 2.0 | 11.6 | 41.0 | 76.9 |
| MR-0-4-U | 5 | 14 | 0.0 | 1.5 | 3.0 | 6.6 | 29.3 |
| MR-0-5-U | 1 | 3 | 2.0 | 2.0 | 4.1 | 10.2 | 10.2 |
| MR-2-2-U | 4 | 12 | 0.0 | 1.4 | 4.4 | 11.2 | 91.8 |
| MR-2-3-U | 2 | 6 | 1.4 | 1.9 | 2.7 | 4.6 | 5.1 |
| MR-2-4-U | 1 | 3 | 0.0 | | 0.0 | | 0.0 |
| Total | 24 | 71 | 0.0 | 2.0 | 4.8 | 10.2 | 91.8 |

### 3.2.9 Pool Grid Toss within Depositional Spawning Areas: Sediment Fines (% <6 mm)

Grid toss measurements in depositional spawning areas provide a measure of fine sediment accumulation in potential spawning sites. Excess surface fines may have detrimental impacts on aquatic habitat by cementing spawning gravels, thus reducing their accessibility, preventing flushing of toxins in egg beds, reducing oxygen and nutrient delivery to eggs and embryos, and impairing emergence of fry (Meehan 1991). Weaver and Fraley (1991) observed a significant inverse relationship between the percentage of material less than 6.35mm and the emergence success of westslope cutthroat trout and bull trout.

Grid toss results for sediment fines (% <6 mm) found within depositional spawning areas are provided below in **Figure 3-8** and summary statistics are provided in **Table 3-9**. The data presented represents only pool tails that were identified as having the appropriate sized gravels to support spawning. There were three assessed reaches (BARN 11-01, FRED 29-02, and DOUS 19-02) where spawning gravels did not exist.

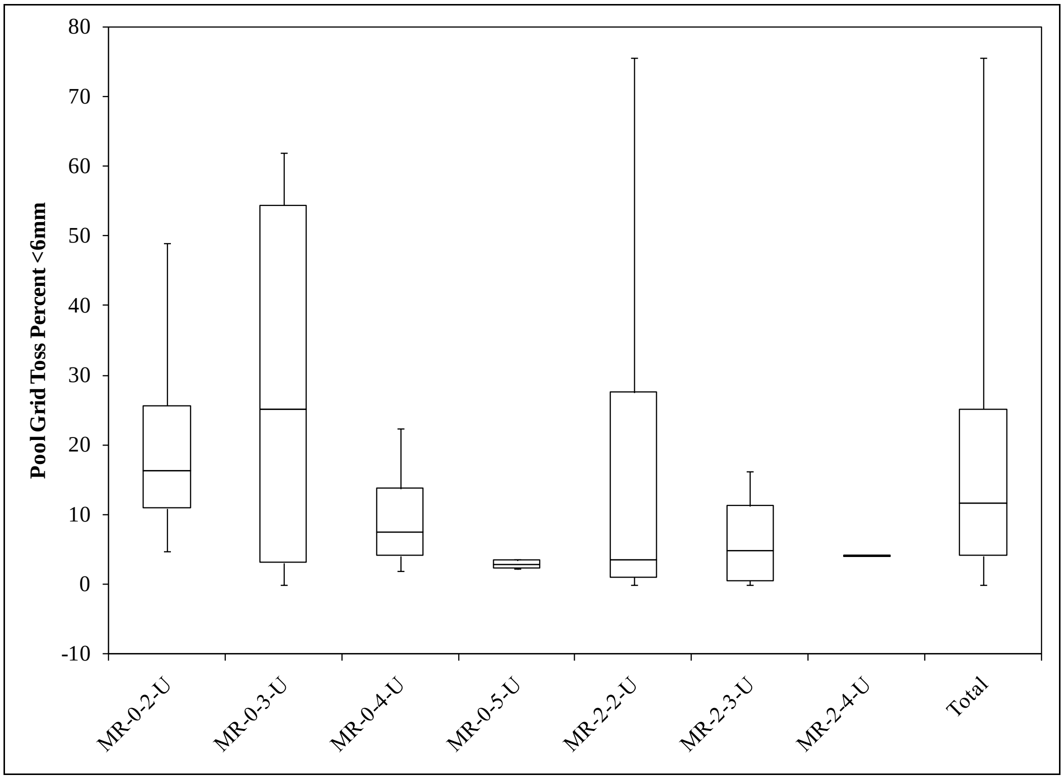


**Figure 3-8. Pool grid toss (% <6 mm) by reach type.**

**Table 3-9 Summary statistics of pool grid toss (% <6 mm) by reach type.**

| Reach Type | Reaches | Count | Minimum | Q1 | Median | Q3 | Maximum |
|---|---|---|---|---|---|---|---|
| MR-0-2-U | 4 | 38 | 4.8 | 10.9 | 16.3 | 25.7 | 49.0 |
| MR-0-3-U | 5 | 16 | 0.0 | 3.1 | 25.2 | 54.4 | 61.9 |
| MR-0-4-U | 5 | 9 | 1.9 | 4.1 | 7.5 | 13.8 | 22.5 |
| MR-0-5-U | 1 | 4 | 2.2 | 2.3 | 2.8 | 3.4 | 3.6 |
| MR-2-2-U | 3 | 17 | 0.0 | 1.1 | 3.4 | 27.6 | 75.5 |
| MR-2-3-U | 2 | 6 | 0.0 | 0.5 | 4.8 | 11.2 | 16.3 |
| MR-2-4-U | 1 | 1 | 4.1 | | 4.1 | | 4.1 |
| Total | 21 | 91 | 0.0 | 4.1 | 11.6 | 25.2 | 75.5 |

### 3.2.10 Pool Residual Depth

Residual pool depth, defined as the difference between pool maximum depth and crest depth, is a discharge-independent measure of pool depth and an indicator of the quality of pool habitat. Deep pools are important resting and hiding habitat for fish, and provide refugia during temperature extremes and high flow periods. Pool residual depth is also an indirect measurement of sediment inputs to listed streams. An increase in sediment loading would be expected to cause pools to fill, thus decreasing residual pool depth over time.

Data are presented below in **Figure 3-9** and **Table 3-10**. Note that the data presented represents the mean residual pool depth for each reach, so some reach types have only one data point. Residual pool depths were not calculated for dammed pools.

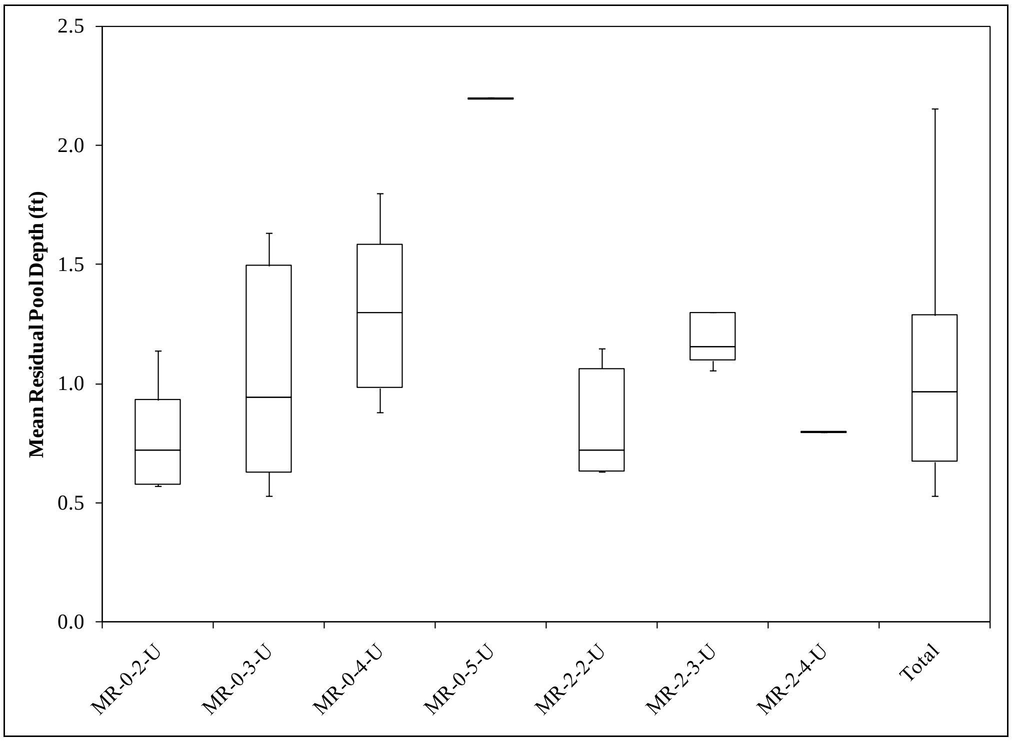


**Figure 3-9. Residual pool depth (ft) by reach type.**

**Table 3-10. Summary statistics of residual pool depth (ft) by reach type.**

| Reach Type | Reaches | Count | Minimum | Q1 | Median | Q3 | Maximum |
|---|---|---|---|---|---|---|---|
| MR-0-2-U | 5 | 5 | 0.6 | 0.6 | 0.7 | 0.9 | 1.1 |
| MR-0-3-U | 6 | 6 | 0.5 | 0.6 | 0.9 | 1.5 | 1.6 |
| MR-0-4-U | 5 | 5 | 0.9 | 1.0 | 1.3 | 1.6 | 1.8 |
| MR-0-5-U | 1 | 1 | 2.2 | | 2.2 | | 2.2 |
| MR-2-2-U | 4 | 4 | 0.6 | 0.6 | 0.7 | 1.1 | 1.2 |
| MR-2-3-U | 2 | 2 | 1.1 | | 1.2 | | 1.3 |
| MR-2-4-U | 1 | 1 | 0.8 | | 0.8 | | 0.8 |
| Total | 24 | 24 | 0.5 | 0.7 | 1.0 | 1.3 | 2.2 |

### 3.2.11 Pool Frequency

Pool frequency is a measure of the availability of pools within a reach to provide rearing habitat, cover, and refugia for salmonids. Pool frequency is related to channel complexity, availability of stable obstacles, and sediment supply. Excessive erosion and sediment deposition can reduce pool frequency by filling in smaller pools. Pool frequency can also be affected adversely by riparian habitat degradation resulting in a reduced supply of large woody debris or scouring from stable root masses in streambanks.

The pool frequencies per 1,000 ft for each reach type are presented in below **Figure 3-10** and summary statistics are provided in **Table 3-11**. As with residual pool depth, some reach types are represented by only a single value.

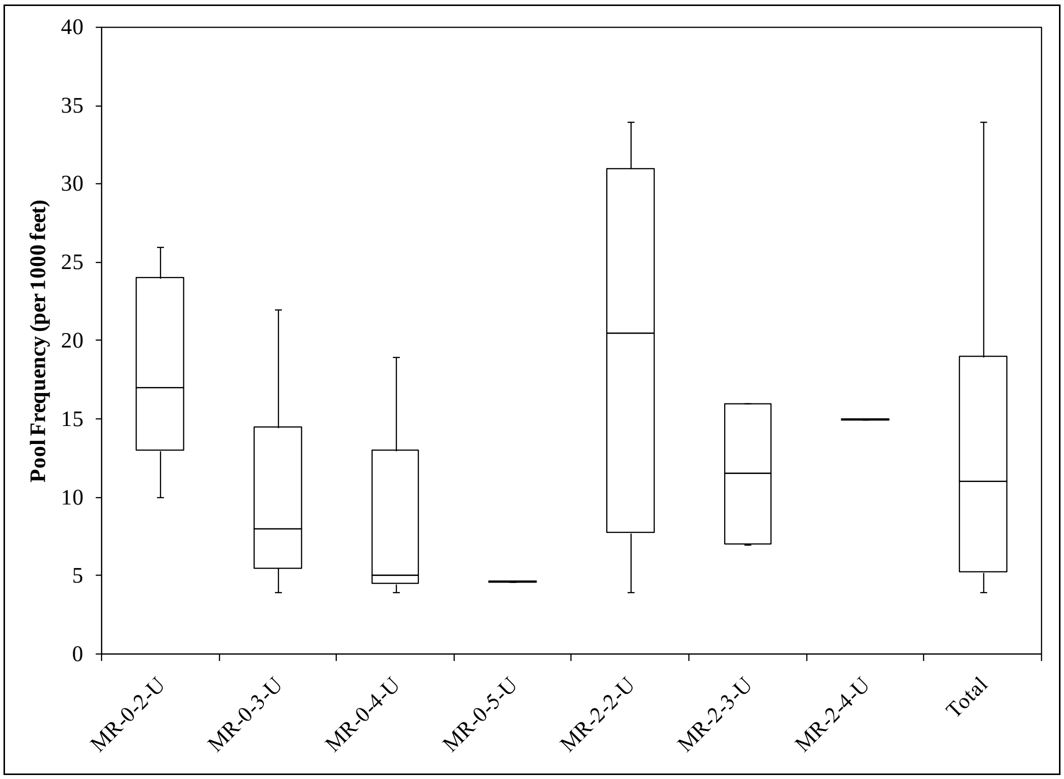


**Figure 3-10. Pool frequency (per 1,000 ft) by reach type.**

**Table 3-11. Summary statistics of pool frequency by reach type.**

| Reach Type | Reaches | Count | Minimum | Q1 | Median | Q3 | Maximum |
|---|---|---|---|---|---|---|---|
| MR-0-2-U | 5 | 5 | 10.0 | 13.0 | 17.0 | 24.0 | 26.0 |
| MR-0-3-U | 6 | 6 | 4.0 | 5.5 | 8.0 | 14.5 | 22.0 |
| MR-0-4-U | 5 | 5 | 4.0 | 4.5 | 5.0 | 13.0 | 19.0 |
| MR-0-5-U | 1 | 1 | 4.7 | | 4.7 | | 4.7 |
| MR-2-2-U | 4 | 4 | 4.0 | 7.8 | 20.5 | 31.0 | 34.0 |

| Table 3-11. Summary statistics of pool frequency by reach type. | | | | | | | |
|---|---|---|---|---|---|---|---|
| **Reach Type** | **Reaches** | **Count** | **Minimum** | **Q1** | **Median** | **Q3** | **Maximum** |
| MR-2-3-U | 2 | 2 | 7.0 | | 11.5 | | 16.0 |
| MR-2-4-U | 1 | 1 | 15.0 | | 15.0 | | 15.0 |
| Total | 24 | 24 | 4.0 | 5.3 | 11.0 | 19.0 | 34.0 |

### 3.2.12 Large Woody Debris Frequency

Large woody debris (LWD) is a critical component of salmonid habitat, providing stream complexity, pool habitat, cover, and long-term nutrient inputs. LWD also constitutes a primary influence on stream function, including sediment and organic material transport, channel form, bar formation and stabilization, and flow dynamics (Bilby and Ward 1989). LWD frequency can be measured and compared to reference reaches or literature values to determine if more or less LWD is present than would be expected under reference conditions. Too little or too much LWD may indicate riparian habitat impairment or upstream influences on habitat quality.

Target values for LWD span a broad range of values, even for streams of similar size. A guideline value of approximately 150 pieces of LWD per mile, or approximately 28 pieces of LWD per 1000 feet, represents an average of target values from other studies. Results for LWD should be interpreted with caution, as the guideline value for this parameter is tied to a high degree of variability due to land use, vegetative community and soils, among other factors.

The LWD frequencies for each reach type are provided below in **Figure 3-11** and summary statistics are provided in **Table 3-12**.

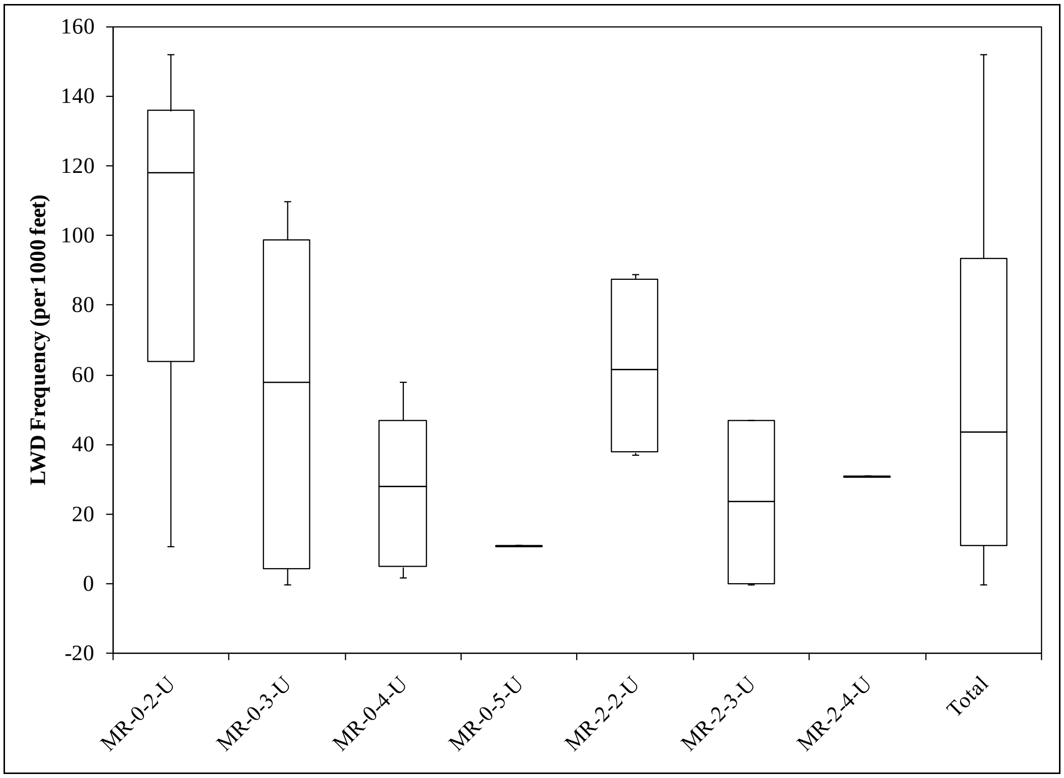


**Figure 3-11. LWD frequency (per 1,000 ft) by reach type.**

**Table 3-12. Summary statistics of LWD frequency by reach type.**

| Reach Type | Reaches | Count | Minimum | Q1 | Median | Q3 | Maximum |
|---|---|---|---|---|---|---|---|
| MR-0-2-U | 5 | 5 | 11.0 | 64.0 | 118.0 | 136.0 | 152.0 |
| MR-0-3-U | 6 | 6 | 0.0 | 4.5 | 58.0 | 98.8 | 110.0 |
| MR-0-4-U | 5 | 5 | 2.0 | 5.0 | 28.0 | 47.0 | 58.0 |
| MR-0-5-U | 1 | 1 | 11.1 | | 11.1 | | 11.1 |
| MR-2-2-U | 4 | 4 | 37.0 | 37.8 | 61.5 | 87.5 | 89.0 |
| MR-2-3-U | 2 | 2 | 0.0 | | 23.5 | | 47.0 |
| MR-2-4-U | 1 | 1 | 31.0 | | 31.0 | | 31.0 |
| Total | 24 | 24 | 0.0 | 11.0 | 43.5 | 93.5 | 152.0 |

## 3.2.13 Greenline Inventory: Percent Understory Shrub Cover

Riparian shrub cover is an important factor on streambank stability. Removal of riparian shrub cover can dramatically increase streambank erosion and increase channel width/depth ratios. Shrubs stabilize streambanks by holding soil and armoring lower banks with their roots, and reduce scouring energy of water by slowing flows with their branches. Good riparian shrub cover is also important for fish habitat. Riparian shrubs provide shade which reduce solar inputs and help maintain cooler water temperatures. The dense network of fibrous roots of riparian shrubs allows streambanks to remain intact while water scours the lowest portion of streambanks, creating important fish habitat in the form of overhanging banks and lateral scour pools.

Overhanging branches of riparian shrubs provide important cover for aquatic species. In addition, riparian shrubs provide critical inputs of food for fish and other aquatic life. Terrestrial insects falling from riparian shrubs provide one main food source for fish. Organic inputs from shrubs, such as leaves and small twigs, provide food for aquatic macroinvertebrates, which are also an important food source for fish.

The Greenline understory shrub cover percentages by reach type are presented in **Figure 3-12**. The summary data are also presented in **Table 3-13**.

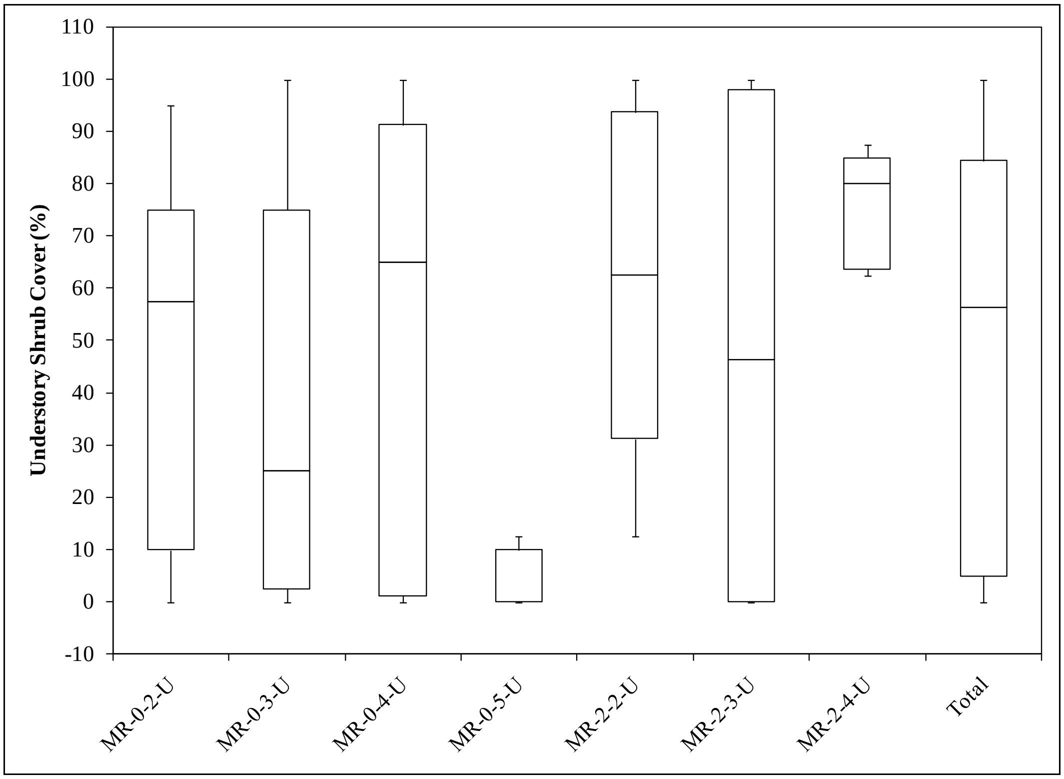


**Figure 3-12. Greenline understory shrub cover (%) by reach type.**

**Table 3-13. Summary statistics of understory shrub cover (%) by reach type.**

| Reach Type | Reaches | Count | Minimum | Q1 | Median | Q3 | Maximum |
|---|---|---|---|---|---|---|---|
| MR-0-2-U | 5 | 25.0 | 0.0 | 10.0 | 57.5 | 75.0 | 95.0 |
| MR-0-3-U | 6 | 30.0 | 0.0 | 2.5 | 25.0 | 75.0 | 100.0 |
| MR-0-4-U | 5 | 25.0 | 0.0 | 1.3 | 65.0 | 91.3 | 100.0 |
| MR-0-5-U | 1 | 5.0 | 0.0 | 0.0 | 0.0 | 10.0 | 12.5 |
| MR-2-2-U | 4 | 20.0 | 12.5 | 31.3 | 62.5 | 93.8 | 100.0 |
| MR-2-3-U | 2 | 10.0 | 0.0 | 0.0 | 46.3 | 98.1 | 100.0 |
| MR-2-4-U | 1 | 5.0 | 62.5 | 63.8 | 80.0 | 85.0 | 87.5 |
| Total | 24 | 120.0 | 0.0 | 5.0 | 56.3 | 84.4 | 100.0 |

### 3.2.14 Greenline Inventory: Percent Bare/Disturbed Ground

Percent bare ground is an important indicator of erosion potential, as well as an indicator of land management influences on riparian habitat. Bare ground was noted in the Greenline inventory in cases where recent ground disturbance was observed, leaving bare soil exposed. Bare ground is often caused by trampling from livestock or wildlife, fallen trees, recent bank failure, new sediment deposits from overland or overbank flow, or severe disturbance in the riparian area, such as past mining, road-building, or fire. Ground cover on streambanks is important to prevent sediment recruitment to stream channels. Sediment can wash in from unprotected areas due to snowmelt, storm runoff, or flooding. Bare areas are also much more susceptible to erosion from hoof shear. Most stream reaches have a small amount of naturally-occurring bare ground. As conditions are highly variable, this measurement is most useful when compared to reference values from best available conditions within the study area or literature values.

Results of the Greenline survey for percent bare/disturbed ground are provided by reach type below in **Figure 3-13**, and tabular data are presented in **Table 3-14**.

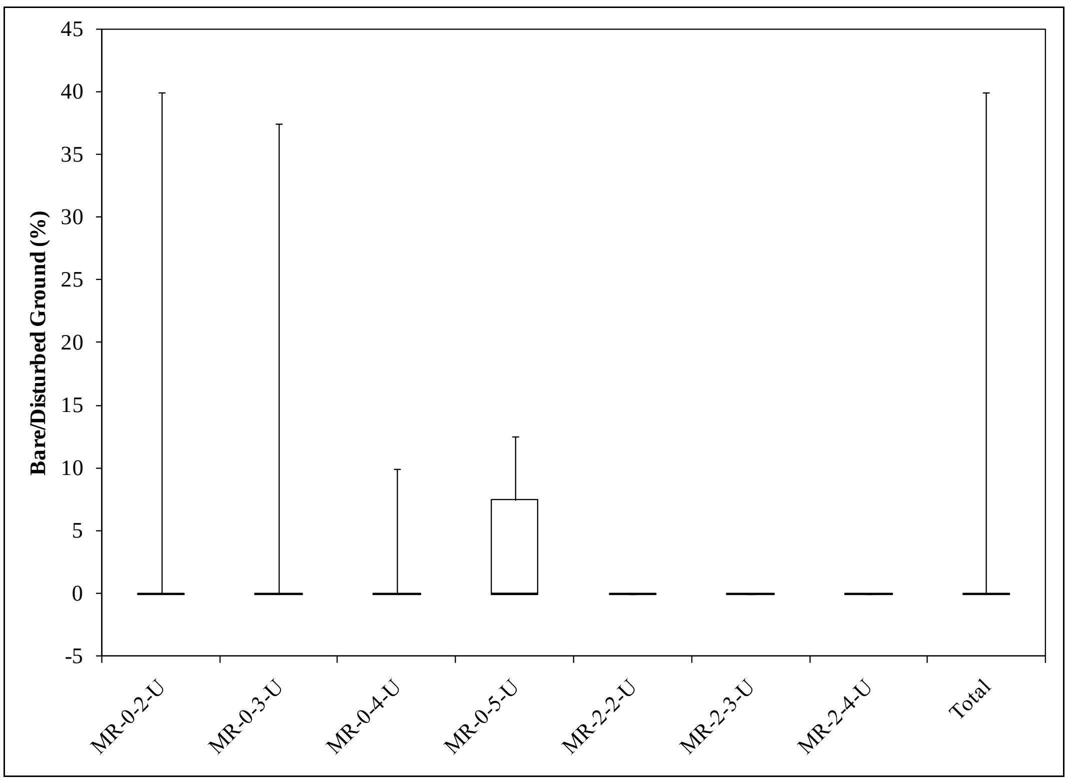


**Figure 3-13. Greenline bare/disturbed ground (%) by reach type.**

**Table 3-14. Summary statistics of bare/disturbed ground (%) by reach type.**

| Reach Type | Reaches | Count | Minimum | Q1 | Median | Q3 | Maximum |
|---|---|---|---|---|---|---|---|
| MR-0-2-U | 5 | 25 | 0.0 | 0.0 | 0.0 | 0.0 | 40.0 |
| MR-0-3-U | 6 | 30 | 0.0 | 0.0 | 0.0 | 0.0 | 37.5 |
| MR-0-4-U | 5 | 25 | 0.0 | 0.0 | 0.0 | 0.0 | 10.0 |

**Table 3-14. Summary statistics of bare/disturbed ground (%) by reach type.**

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| MR-0-5-U | 1 | 5 | 0.0 | 0.0 | 0.0 | 7.5 | 12.5 |
| MR-2-2-U | 4 | 20 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| MR-2-3-U | 2 | 10 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| MR-2-4-U | 1 | 5 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| Total | 24 | 120 | 0.0 | 0.0 | 0.0 | 0.0 | 40.0 |

## 3.3 Assessment Reach Field Descriptions

The following sections provide brief descriptions of each sampled reach. Descriptions are provided for human impacts, stream channel conditions, and riparian vegetation conditions. Stream bank erosion conditions are provided with sediment loading results in **Section 4.6**. Assessment reaches are organized by water body and reach location starting at the upstream end and moving downstream.

### 3.3.1 Barnes Creek

**BARN 11-01**
*Description of human impacts and their severity:*
Site has heavy grazing impacts with significant hoof shear and hummocking. Banks in some areas are completely trampled. Turbid water exists throughout sample reach. Site is in very poor condition.

*Description of stream channel conditions:*
This reach is a C4/C5 type channel with small gravels and coarse sand, moderate sinuosity, and channel slope of 1.5 to 2%. The uppermost cell has a low width/depth ratio resembling an E4 type channel, but the potential stream type for this reach is C4. Site has poorly developed features, and riffles are difficult to discern. Site has minimal pool development, no spawning gravels, heavy fine sediment, and split channels in places. Several seeps and springs were noted along entire reach.

*Description of streambank erosion conditions:*
Streambanks are heavily impacted by grazing, including extensive hummocking. Banks have minimal vegetation, especially in upper two cells. A fenceline exists near station 250. Banks are in better condition downstream of the fenceline. A few old irrigation structures exist in reach.

*Description of riparian vegetation conditions:*
Lower cells (1-3) have a mix of grass and woody vegetation, including alder, chokecherry, willow, timothy, brome, fescue, and burdock. Upper cells (4-5) have minimal grass, some woody vegetation (although sparse), and significant bare ground from hoof shear.

**BARN 13-01**

*Description of human impacts and their severity:*
Site has moderate to heavy grazing impacts with significant hummocking and grazed riparian vegetation, however, overall impacts to streams are not as significant as upper Barnes Creek. This site is a good candidate for riparian fencing.

*Description of stream channel conditions:*
Stream is a highly sinuous E4 type channel, although significant fines make it close to E5. Stream has many undercut banks, and pools predominantly occur on outside meander bends with undercuts. Riffles are short and poorly developed, and runs are long and deep.

*Description of streambank erosion conditions:*
Reach has minimal natural bank erosion, and most streambank erosion is from hoof shear. Soils are composed of fine clays that create vertical and undercut banks that have some active erosion, although most banks were slowly eroding.

*Description of riparian vegetation conditions:*
Riparian vegetation is predominantly grasses and sedges with minimal woody species. Some willow exist that help stabilize banks, although most have been grazed.

**BARN 13-03**

*Description of human impacts and their severity:*
Site is adjacent to alfalfa hay field, which has been mowed approximately 50 feet from stream on river left. Field is not mowed on river right. There is no evidence of current grazing. A culvert exists at the road crossing immediately upstream of the sampled reach, which creates some impacts in cell 5.

*Description of stream channel conditions:*
The potential Rosgen stream type for this reach is likely E4, but because of entrenchment portions of this reach resemble types B4c and G4c. Stream is slightly entrenched in most of reach, and very entrenched in cell 2. Stream has poorly developed riffle and pool habitat. Woody debris is common and has impacted channel form. Some transverse bars are evident in upper cells (4 and 5).

*Description of streambank erosion conditions:*
Stream channel is generally stable with minimal streambank erosion, which is primarily caused by woody debris. Consistent slowly eroding banks were noted. Soils are hard packed clay with low erosion potential.

*Description of riparian vegetation conditions:*
Lots of woody debris exists throughout reach (mostly willow). Upper cells are grass only, but other cells are mix of woody species and grass. Adjacent field has been mowed for hay on river left, but an approximate 50’ buffer exists between stream and field with tall grass.

### 3.3.2 Boulder Creek

**BOUL 16-01**

*Description of human impacts and their severity:*
This site contains no immediately noticeable human impacts. Several camp sites exist on the lower portion of the reach, and a small foot trail parallels the stream; however, these activities appear to have minimal impact on the stream reach. Lower end of reach has a bridge and road crossing with some localized over-widening of the stream channel. As a whole, reach appears to be a B channel in near reference condition.

*Description of stream channel conditions:*
This site has moderate entrenchment, high slope (3-4%), and large cobble substrate. The estimated Rosgen stream type for this reach is B3, although areas with a larger floodplain resemble a C3b channel type. Stream is a step-pool, riffle-run complex with pools formed by boulders and some large woody debris. Pools are primarily pocket pools of moderate habitat quality, although a few deep, large plunge pools do exist. Channel has low sinuosity and stream velocities are relatively fast throughout the reach.

*Description of streambank erosion conditions:*
Stream banks are very well armored with heavy cobble and boulders acting as natural rip-rap. Few areas of slowly eroding natural banks were noted, typically at the base of large coniferous trees near the streambank edge. Root structure and cobbles hold together undercut banks where bank erosion was noted.

*Description of riparian vegetation conditions:*
Site was heavily forested with a well developed understory and canopy, and a mix of age classes throughout. Riparian grasses and small woody vegetation were also abundant along banks, including raspberry bushes, sedges, and various forbs. Overstory canopy was mostly Douglas fir.

**BOUL 21-02**

*Description of human impacts and their severity:*
A paved road exists approximately 20-200 feet from the right side of the stream, and a large primitive campsite and parking area exist in the center of the reach. A power line also cuts through the reach, and there is some evidence of wood cutting. Historic mining activity existed upstream, but not immediately within the reach. The road is encroaching the stream in lower portion of reach and is causing aggradation, braiding, and over-widening in places.

*Description of stream channel conditions:*
The potential stream type for this reach is likely B3, although much of the stream has a high width/depth ratio and has access to its floodplain, so most areas resemble a C3 type channel. Road encroachment in the lower reach causes aggradation which has lowered the slope through this reach. Stream reach is riffle/run dominated with large substrate and very few fines. Most pools are large lateral scour pools and small pocket pools behind boulders. Only one pool with spawning gravels exists within the reach.

*Description of streambank erosion conditions:*
Reach has only slowly eroding banks with primarily natural sources of erosion. Some banks are armored with heavy cobbles, while others are undercut with fine sediment supporting bank. Some human influences from the campsite and road encroachment were noted.

*Description of riparian vegetation conditions:*
Overall, riparian vegetation is in good condition with tall canopy of fir, thick understory, and many grasses and forbs on banks. Vegetation has been cleared in power line right of way and near campsite.

### 3.3.3 Douglas Creek (North)

**DOUN 07-01**
*Description of human impacts and their severity:*
Reach has historically experienced significant flow alteration due to reservoirs upstream and downstream of reach. An old road parallels the stream approximately 100 feet away on river left, while the existing road parallels the stream approximately 150 feet away. Extensive grazing exists throughout reach with hoof shear and hummocking in many places. Mines have existed in upper watershed and possibly near stream reach, although no obvious mining impacts were noted.

*Description of stream channel conditions:*
The stream channel through this site is nearly straight with slopes of 2.5 to 3%. The potential Rosgen stream type for this reach is B4. Site has many cattle crossings, and substrate is somewhat embedded with fines. Woody debris creates diverse pool habitat, although pools are commonly shallow and have many fine materials in pools and tail-outs. Very few good spawning gravels exist. Log jams downstream of site create large pools. Riffles are poorly developed.

*Description of streambank erosion conditions:*
Site has many cattle crossings and is heavily trampled, creating many eroding banks. Three main bank types exist, including slowly eroding natural banks, actively eroding sloped banks, and actively eroding vertical banks. Some natural erosion exists, but most streambank erosion is attributed to cattle and riparian grazing.

*Description of riparian vegetation conditions:*
Site has thick canopy and understory, but grasses are grazed to almost nothing. Some bare ground exists due to hoof shear and over-grazing. Riparian vegetation is primarily willow, alder, and juniper with some fir in the canopy and many weeds, including toadflax, knapweed, mullein and thistle.

**DOUN 08-02**
*Description of human impacts and their severity:*
Site has extensive cattle grazing with hoof shear and hummocking present in all areas. Numerous livestock crossings exist throughout the reach. Stream flow has historically been altered by reservoirs above and below the site. An old railroad bed confines the stream on river right in the

two lowest cells, and a road exists approximately 100’ away on river left. A culvert exists just downstream of the study site. Local area and upper watershed have historically been mined for phosphate and other minerals, but no direct evidence of mining on site.

*Description of stream channel conditions:*
This reach has moderate sinuosity, small gravel substrate, and channel slope of approximately 1.5%. The potential stream type for this reach is C4. Stream has many fines in all pool tails. Large substrate is embedded except at active cattle crossings. Stream channel is over-widened at cattle crossings, and entrenched through much of the reach. Stream is confined by railroad bed on river right in downstream portion of the site. Channel has lots of woody debris and several dammed pools.

*Description of streambank erosion conditions:*
Site has many active eroding banks with two primary types, including tall steep banks, and low angle hoof-trodden banks. Almost all streambank erosion is due to cattle grazing, including hoof shear on banks and grazing of riparian vegetation. Some erosion may also be attributed to historic flow alteration. Streambanks are composed of fine substrate, but no riparian grasses exist to stabilize banks.

*Description of riparian vegetation conditions:*
Riparian grasses are severely grazed on all banks. Understory is fairly dense, with alder, rose and chokecherry. Noxious weeds were present throughout the study area, including mullein, thistle and knapweed.

### 3.3.4 Douglas Creek (South)

**DOUS 19-02**
*Description of human impacts and their severity:*
This reach has been dramatically altered by channelization. River right is confined by an abandoned railroad bed or dirt road, while river left has residential yards and fenced hayfields within 10’ of the stream channel. The top of the reach is cut short 50’ by a culvert at a road crossing, and at the bottom of the reach the stream is almost completely diverted through a hay field. Stream is channelized or confined to a culvert for the remainder of its course to Flint Creek. Some willows dot the banks, but most streamside vegetation has been removed and currently only grasses exist on the banks. Channel is completely full of sandy sediment, which is likely sourced from roads and historic mining operations in the upper watershed. Some urban trash is also accumulating in the stream channel.

*Description of stream channel conditions:*
The stream channel in this reach is straight and narrow with low width/depth ratios and a channel slope of 2 to 2.5%. The potential stream type for this reach is E4, but the existing channel has hardly any sinuosity and resembles a G4 type channel in places. Channel is entrenched throughout the reach with varying levels of severity. Some small pools exist where woody debris has lodged and created plunge pools or scoured the banks. Substrate is dominated by fines throughout the reach. Any large substrate that does exist is deeply embedded.

*Description of streambank erosion conditions:*
Hard pack clay soil and good grassy vegetation keeps streambanks relatively stable. Site has alternating undercut and near vertical banks throughout the reach, but minimal sediment production is expected from this site.

*Description of riparian vegetation conditions:*
Site has good grassy vegetation along riparian corridor and some interspersed alder and willow, although little to no mature woody vegetation. No woody vegetation occurs outside of approximately 5' from the stream channel.

### 3.3.5 Flint Creek

**FLIN 06-01**
*Description of human impacts and their severity:*
The most immediate and obvious human impact on this site is from the dam just upstream at Georgetown Lake. Flow releases from the dam have created an unnatural flow regime that has resulted in anomalies in channel form and function. Site is also parallel to a popular campground with a road that continues past the monitoring site. The road confines the stream on river left, especially in the upper cells, and a berm appears to have been constructed to limit flooding of the road and campground during high water. The highway also runs parallel to the stream on river right, but it is elevated and quite distant from the stream. Below the sample site, remnants of old buildings and structures remain in and near the stream channel. The culvert at the USGS gauging station appears to create aggradation and braiding downstream of the study site.

*Description of stream channel conditions:*
Stream channel is confined in upper portion of site with low width/depth ratio and fast flows. Channel is wider in lower reaches, and splits in places forming mid-channel bars and islands. Stream presently is Rosgen type C3b channel with access to its floodplain in most places; however, should likely be type B3 channel. Some pools are formed by large woody debris. Channel is mostly composed of large cobble substrate, although fines and gravels occur in pockets of slow water.

*Description of streambank erosion conditions:*
River left has sections of old fill with loose gravel and cobbles that are actively eroding at high flows. Adjacent road certainly influences streambank erosion in many places, and non-normal flow releases from upstream dam may also contribute. Banks on river right are primarily slowly eroding and well protected by cobble and strong root matrix.

*Description of riparian vegetation conditions:*
Reach has a mix of grasses and weeds. Some mid-story woody vegetation (willow) exists, along with a mature coniferous overstory. Vegetation has established good root network in most places; however, river left adjacent to the road is dominated by weak rooted weeds and non-native species.

**FLIN 09-02**

*Description of human impacts and their severity:*
A number of human influences influence the stream in this reach. Riparian grazing has occurred in the area as evidenced by invasive weeds, few grasses, and little woody vegetation throughout the site. Some tall cottonwoods remain. A bridge occurs just upstream of the study area and may influence some channel features in the top of cell 5. Cattle grazing occurs just below the sample reach, and a flowing irrigation ditch exists in cell 1. A dirt road parallels the stream on river left, and several residences exist in the area. A barn or equipment shed exists below cell 1, and a gravel yard operates within the floodplain on river right. Flow alteration from Georgetown Lake may also influence sediment delivery and channel form in this reach.

*Description of stream channel conditions:*
Stream channel is moderately sloped (~1.5%) throughout reach with mostly long runs and intermixed riffles. The existing and potential stream type for this reach is C4. Few quality pools exist, although some deep holding water occurs at bends and around large wood debris (although rare). Only one pool contained potential spawning gravels. Substrate is mostly large gravels with some embeddedness. Patches of algae were present in some areas.

*Description of streambank erosion conditions:*
Some streambank erosion occurs at outside bends or constricted sections of stream channel. Erosion is largely influenced by lack of good riparian vegetation. Large cobbles provide some surface protection in some areas. Banks are generally low profile and contributing moderate to low amounts of sediment where erosion occurs.

*Description of riparian vegetation conditions:*
Bank vegetation is primarily composed of non-native grasses and weeds, which also dominate the floodplain. Very little mid-story vegetation exists, and sparse cottonwoods provide some overstory.

**FLIN 11-01**

*Description of human impacts and their severity:*
Flint Creek is confined by both the highway and railroad just upstream of this site. Stream channel is confined by railroad on river left within the study reach, with the railroad entering the existing stream channel in one location. Adjacent landowner says ice scour is common during periods of thaw in winter and spring. Site has evidence of historic grazing, although presently riparian grazing is very minimal. A power line crosses through the reach, and the highway is several hundred feet away on river right.

*Description of stream channel conditions:*
The stream channel in this reach has a high sinuosity and low channel slope similar to a Rosgen E4 type channel, but most cross-sections have high width/depth ratios that are more similar to a C4 type channel. Site has poor riffle development with long lateral scour pools on outside meander bends. Substrate is somewhat embedded. Stream channel appears relatively unstable with evidence of old and recent oxbow cutoffs. Site has almost no large woody debris and has clay substrate on banks.

*Description of streambank erosion conditions:*
Site has many eroding banks, including primarily long actively eroding banks on outside meander bends, and some slowly eroding banks on inside undercuts. Bank substrate is mostly composed of fine material with no obvious stratification, and shallow grass roots with low root density.

*Description of riparian vegetation conditions:*
Banks have primarily grasses, sedges and few forbs. Site has no understory or overstory, and few weeds on the floodplain (primarily thistle).

**FLIN 11-04**
*Description of human impacts and their severity:*
Stream is adjacent to railroad on river right, which creates some encroachment in places, although the effects of the railroad appear to be minimal. A few residences also occur on river right, although they are distant from the study reach. Mining activity exists in the area, although there are no obvious effects on site.

*Description of stream channel conditions:*
Site is a steep (2.5% slope), boulder-dominated C3b type channel with few well-developed pools, although many small step pools. Site has minimal wood within the channel, but a log jam in cell 5 creates overwidening, and a log pool exists in cell 3. Pool tails have few fines due to the high stream velocity, and also have few spawning-sized gravels.

*Description of streambank erosion conditions:*
Site has minimal streambank erosion with only slowly eroding banks and natural erosion sources. Banks are well armored with large cobble, good vegetation cover and deep roots.

*Description of riparian vegetation conditions:*
Overall, riparian area has good diversity. Banks have tall grasses and woody shrubs, and overstory has mature Ponderosa pine, Douglas fir and cottonwood. Knapweed and toadflax occurs on railroad bed but not in riparian areas.

**FLIN 17-01**
*Description of human impacts and their severity:*
No human impacts were noted within stream channel, although agricultural land (hay fields and livestock grazing) exists approximately 50 to 100’ away on both sides of stream. An irrigation return exists just downstream of the study reach, and several ditches were noted in the area. Study reach has riparian fencing on both sides of stream.

*Description of stream channel conditions:*
Stream channel is boulder/cobble dominated with slopes of 3-4%. Channel is predominantly Rosgen type C3b or B3, but is downcutting and entrenched in cell 2 resembling type F3b channel.  Riffle features dominate throughout the study reach. Pools are infrequent and small,

commonly forming behind large boulders. Most pools have no tail feature. Site has good wood recruitment from cottonwoods. Groundwater seepage was noted along both banks just above bankfull elevation.

*Description of streambank erosion conditions:*
No actively eroding banks were noted in this reach, only several small slowly eroding banks. Streambanks are primarily composed of boulders and cobbles and cobbles which help armor the banks.

*Description of riparian vegetation conditions:*
Site has good riparian condition with multiple grasses (timothy, fescue), alder understory, and a mature cottonwood overstory. The left bank has a narrow riparian buffer adjoining agricultural land, but riparian vegetation is in good condition. Some historic beaver activity is noted.

**FLIN 18-02**
*Description of human impacts and their severity:*
Site is adjacent to agricultural land (hay fields) on river right with narrow riparian buffer. Grazing impacts are minor. An irrigation ditch contributes return flow in the upper end of the reach on the right bank. Some rip-rap has been placed on right bank of cell 3.

*Description of stream channel conditions:*
Stream channel is a moderately entrenched B3c type channel with channel slope of 1.5 to 2%. Reach is riffle dominated with minimal pools, all of which are formed by boulders or woody debris. Some debris dams occur within the reach.

*Description of streambank erosion conditions:*
Site has very minimal streambank erosion, with only slowly eroding, well armored banks with dense root mass. Erosion sources are mostly natural, although agriculture land on right bank has some influence. Banks are mostly large gravels and cobbles with minimal fines. Rip-rap in cell 3 appears to be stable.

*Description of riparian vegetation conditions:*
Riparian vegetation is in good condition with good mix of grasses and shrubs, including alder, willow, chokecherry, wild rose, and buffalo berry. Lower cells have conifers on left bank, but overstory is sparse on the right bank.

**FLIN 18-05**
*Description of human impacts and their severity:*
Site is adjacent to agriculture land, but has riparian fencing throughout the reach. Site may have historically been grazed, but has recovered well. Two irrigation returns occur within the reach. Overall, human impacts are minimal.

*Description of stream channel conditions:*
Stream varies between C3 and B3c type channel based on entrenchment, but its potential stream type is likely B3c. Substrate is predominantly gravel and cobble with some embeddedness in areas. Site has good riffle development. Minimal spawning gravels were noted.

*Description of streambank erosion conditions:*
Most eroding banks were slowly eroding undercut banks protected with woody debris. Most banks have cobble substrate, although one was composed of fine substrate that may be from an old beaver dam. Most erosion sources are natural, but historic grazing and agricultural practices have some contribution.

*Description of riparian vegetation conditions:*
Site has good riparian vegetation due to riparian fencing. Right bank has more deciduous trees than left bank, primarily willow and cottonwood. The left bank has less diversity and a smaller buffer (~10') with mostly grass and willow, although many cottonwoods exist in lower part of reach where riparian buffer is wider.

**FLIN 19-01**
*Description of human impacts and their severity:*
Reach has riparian fencing on river left with approximately 10-100' of riparian buffer, although there is evidence of historic grazing on river left. River right is unfenced hay and pasture land with little evidence of riparian grazing.

*Description of stream channel conditions:*
Site has decent pool habitat, but not much woody debris. Channel may be over-widened in places, but appears to be recovering. Reach has good riffle development with some point bars. Substrate is mainly large gravel and small cobble, and substrate is not embedded as it was in upstream reaches. This reach is predominantly a C4 type channel, although cells 4 and 5 resemble B4c and F4 channel types, respectively, due to entrenchment.

*Description of streambank erosion conditions:*
This reach has long stretches of actively eroding banks on meander bends, and few slowly eroding streambanks. Banks have good protection from cobbles, but some areas have little riparian vegetation to help stabilize banks. Some past hoof shear is evident in places. One area has approximately 80-100' of rip-rap, with a fence falling into the stream channel.

*Description of riparian vegetation conditions:*
Site has mostly grasses and sedges on both banks. This reach is not heavily grazed, although one cattle crossing occurs in lower reach. River left is fenced with 10-100' riparian buffer, including many cottonwoods. River right is a hay field that has no riparian buffer. Some knapweed was noticed in places.

### 3.3.6 Fred Burr Creek

**FRED 29-02**
*Description of human impacts and their severity:*
Stream channel has been routed between highway and pasture/hay field in the upper 2 cells. Irrigation withdrawal above the reach also diverts some water through the hay field. The confinement of the road and hay field has probably resulted in the biggest impact toward streambank erosion through this reach. Lower cells may have historically been grazed, but currently have good riparian condition with tall, dense grasses and mid-sized woody shrubs.

*Description of stream channel conditions:*
The stream channel in this reach has become entrenched and is down-cutting due to unnatural confinement. Stream is primarily slow moving with low slope sections interrupted by occasional drops in elevation, resulting in short step-pool systems. Large woody debris is also forming dams and split channels and rerouting the stream in several areas. Site is mostly cobble dominated, but lots of fines and sandy material occurs in pools and slow water. Upper cells are armored with cobble, but lower cells appear much less stable. The potential Rosgen stream type for this reach is likely C4, but because of entrenchment it currently resembles a F4 or B4c/B3c channel type.

*Description of streambank erosion conditions:*
Lots of streambank erosion occurs in lower cells as stream channel is migrating around log jams and other obstructions. Cell 5 is mostly well armored with little erosion. Site has both slow and actively eroding streambanks. Slowly eroding banks are composed of fine substrate, while actively eroding banks typically have more sand or cobble. Site has plenty of woody debris and riparian vegetation, but unstable nature of channel is creating increased erosion. An extreme rain and runoff event this summer may have destabilized the channel since there is evidence of high scour lines and recent flood inundation.

*Description of riparian vegetation conditions:*
Upper cells (4-5) have some cottonwood and willow with assorted grasses, wetland species, and a few invasive weeds. The lower cells have dense grasses and woody vegetation (willow) with mature and diverse age classes, suggesting good riparian condition above is transitioning into more mature and complex riparian condition in the lower cells. Upper cells had a number of mid-age deciduous trees which were cut at ~6’ level leaving only the trunks. Some beaver activity was noticed on older tree trunks in the upper cells.

### 3.3.7 Lower Willow Creek

**LOWI 02-05**
*Description of human impacts and their severity:*
This reach has recently been grazed and has evidence of historic grazing impacts, including several cattle crossings within the reach. Some bank modification and rip-rap exists which has altered stream channel and immediate floodplain. The stream is controlled by a reservoir, and has an extensive network of irrigation ditches upstream. Immediately upstream of the reach is a highway and railroad bridge crossing. The upper watershed has historically been mined upstream

of the reservoir, although no immediate mining impacts are evident in this reach. Site is also influenced by an abnormally large population of domestic cats.

*Description of stream channel conditions:*
Stream channel is riffle/run dominated C3 channel with low sinuosity, cobble substrate and little spawning habitat. Aquatic vegetation has covered whatever potential spawning habitat does exist. Stream channel slope is approximately 1.5%.

*Description of streambank erosion conditions:*
Site has relatively little streambank erosion, but where it is occurring it is generally actively eroding slumping banks where channel is moving laterally. Banks are not stabilized by woody vegetation, only short grasses and weeds. Causes of erosion are largely due to grazing, flow alteration, and modifications made to stream channel.

*Description of riparian vegetation conditions:*
Site has little woody vegetation and is dominated by short grasses and weeds. A few alder and cottonwoods exist, but understory and canopy vegetation is almost non-existent.

### 3.3.8 Smart Creek

**SMAR 13-01**
*Description of human impacts and their severity:*
A road parallels the stream for much of the reach, although road impacts appear minor. Cattle grazing is obvious throughout the reach with hoof prints, fresh cow manure, and animal trails along the stream and throughout the riparian area. Invasive weeds are present throughout the reach, and a campsite exists in cell 1. Upper watershed has historically seen mining and logging activity.

*Description of stream channel conditions:*
This reach is a Rosgen B4 channel type with moderate entrenchment, small gravel substrate, and channel slopes of 2-2.5%. Cell 2 has a low width/depth ratio and channel form more similar to an F4b type channel, and has a large conifer that has fallen into the stream. Reach appears to be downcutting. Channel has long riffles, small pools, some point bar development, and good spawning gravel. The best pool habitat is formed by sloughed vegetation and woody debris in the channel.

*Description of streambank erosion conditions:*
Site has many tall eroding banks. Soil composition is primarily fines with stratified layer of gravel and small cobble that is highly erosive. Eroding streambanks have limited protection with poor vegetation holding banks together, and basically no root mass or length.

*Description of riparian vegetation conditions:*
This reach has very limited good quality woody vegetation throughout the riparian corridor. Some conifers and woody shrubs exist; however, vegetation is dominated by invasive weeds and some grasses. Improvements to riparian vegetation in this reach would be very beneficial to reducing sediment loads in this stream.

**SMAR 18-01-1**

*Description of human impacts and their severity:*
This is a 500’ unfenced reach, and is paired with the fenced 500’ reach immediately upstream (SMAR 18-01-2). This reach is extensively grazed with lots of hummocking and hoof shear. Stream channel is over-widened in many places. A dirt road exists within 150’ of stream, and portions of forest have been cleared to accommodate a power line. An old mine exists on river left above the road and the upper watershed has historically been mined, but there is no direct evidence of mining influences within the reach.

*Description of stream channel conditions:*
This reach is a Rosgen C4b type channel that is over-widened in places and also shows evidence of aggradation (especially in cell 3). Channel slopes are approximately 2%. Potential stream type is likely B4. Reach has poorly developed pools. Pools tails were trampled by cattle and had some spawning gravels, but most pool tails also had a significant percentage of fines. Larger substrate is not overly embedded and shows signs of trampling. Some woody debris exists in stream channel, but it is mostly poor quality and provides little habitat.

*Description of streambank erosion conditions:*
Streambank erosion is fairly limited and all noticeable erosion is caused by hoof shear and cattle grazing. Some banks have been grazed to nothing. Bank substrate is mostly fine clay. Eroding banks are short and low angle from trampling, but don’t contribute much sediment due to amount of fine materials.

*Description of riparian vegetation conditions:*
Banks are grazed very short. Some grasses and sedges are established on slumped banks. Some weeds occur throughout the riparian area, including thistle, knapweed and mullein. Understory is mostly alder, and sparse conifers exist on river right.

**SMAR 18-01-2**

*Description of human impacts and their severity:*
This is a 500’ reach with riparian fencing, and was paired with the unfenced 500’ reach immediately downstream (SMAR 18-01-1). Site has some evidence of past grazing, although effects are minor. A dirt road exists parallel to the stream, approximately 100-150’ away on river left. Old mines exist in the area and the upper watershed, although none occur within the sample reach. A power line crosses the bottom of the reach.

*Description of stream channel conditions:*
Site is a Rosgen B4 channel type with small gravel substrate and channel slope of 1.5 to 2%; however, some cross sections have low width/depth ratios resembling an E4b channel type. Reach has well developed pools and riffles and good spawning gravels, although pools are somewhat shallow. A log jam has created an aggraded area in the upper cell, and a new channel is forming on river left. The log jam creates a significant drop of approximately 4’ in elevation. Substrate size is consistent throughout the reach except in upper cell where aggradation has occurred and fine materials are accumulating.

*Description of streambank erosion conditions:*
Site has only four eroding streambanks with 100% natural sources of erosion. Banks are well vegetated and appear to have minimal sediment contribution to the stream.

*Description of riparian vegetation conditions:*
Site has good diversity of riparian vegetation with functional woody debris in the stream channel, a mix of grasses and sedges on banks, and both conifers and deciduous species in the understory and canopy. Some weeds do occur including thistle and mullein.

**SMAR 21-01**

*Description of human impacts and their severity:*
This site has a headgate at the top of the reach, and appears to be affected by irrigation practices. Reach also has evidence of past or rotational grazing, but is not currently being grazed. Sheep and llama are grazing pasture downstream of reach. A pivot line runs through the reach and crosses the creek with numerous small bridges to accommodate the pivot wheels. A dirt road is parallel to the stream but distant (~500’ away).

*Description of stream channel conditions:*
Stream channel has downcut and is now entrenched with slumping banks. Sedges are well established on the slumped banks. The potential Rosgen stream type for this reach is likely E4, but because of entrenchment some areas resemble F4 or G4c stream types. The reach has small gravels and a channel slope of 1.5 to 2%. Site has poor riffle and pool development, and resembles a step-pool type system in places. The headgate at the upper end of the reach may cause some overwidening, and woody debris in the upper reach also causes some backwater effects. Substrate is fairly consistent throughout the reach, and is not embedded.

*Description of streambank erosion conditions:*
Site has many eroding streambanks, most of which are slumped banks covered with sedges and tall steep banks behind the slumping areas. Changes in stream energy from irrigation practices are likely responsible for altering channel form which has contributed to current streambank erosion. There is no evidence of hoof shear, but site is periodically grazed by sheep. Landowner says some ice scour does occur during periods of thaw, but there was little direct evidence of ice scour at time of sampling.

*Description of riparian vegetation conditions:*
Site has dense grass on banks (timothy and fescue) which was previously grazed. Slumped areas are covered with dense sedges. A few weedy species were noted, including mullein, thistle and knapweed. Sparse aspen and old willows exist in the upper portion of the reach below the headgate. Site is fenced on both sides approximately 100-150’ from the stream.

### 3.3.9 Trout Creek

**TROU 09-03**

*Description of human impacts and their severity:*

This stream receives flow augmentation from a trans-basin diversion to supplement irrigation in the Flint Creek valley. As a consequence, the stream channel within this reach appears to be nearly twice the size that would be expected based on regional curve information. Some cultivated agriculture fields exist upstream, and the upper watershed has historically been logged. This reach may have historically been grazed, although there is little direct evidence. Some aquatic vegetation and algae occur on the stream bottom, which suggests possible impairment from nutrients, temperature or shading. A highway crosses the stream just downstream of the study area.

*Description of stream channel conditions:*

The stream in this reach is a highly sinuous, low slope E4 type channel, although some areas are overwidened and have a high width/depth ratio resembling a C4 type channel. The potential stream type for this reach is E4. The stream becomes anastamosed and even more sinuous downstream of the study area. The channel is riffle/run dominated. The runs on outside bends were deep and fast and typically had no defined pool crest, although the few pools that were noted occurred on outside bends. Site has good spawning gravel. One pool had embedded fines, but most riffle and pool substrate was not embedded.

*Description of streambank erosion conditions:*

This site has low to moderate streambank erosion, typically occurring on outside meander bends where vegetation is dominated by weedy species and root density is poor. As a whole, channel and bank stability appears to be quite good in this reach. The channel is very sinuous and is migrating across the valley, so a few slowly eroding banks could be expected with this channel type.

*Description of riparian vegetation conditions:*

Riparian vegetation is dominated by wetland species at bank edge. There is no understory or overstory within this reach. Some knapweed exists which contributes to poor bank stability and streambank erosion.

**TROU 10-01**

*Description of human impacts and their severity:*

This site is not far downstream from TROU 09-03, and similar impacts from flow-augmentation apply to this reach. Effects of irrigation withdrawal are evident at this site, since cross-sectional areas in this reach were lower than the study reach upstream. Irrigation sprinkler systems border the reach on both sides, and several seeps and springs were noticed in the lower cells of the reach. There are no obvious signs of riparian grazing, although the site may have been historically been grazed. This reach has noticeably more algae and aquatic vegetation than the reach upstream.

*Description of stream channel conditions:*
This reach is a C4 channel type with fairly high sinuosity, medium to large gravel substrate, and channel slope of 1 to 1.5%. Some sections of stream have a low/width ratio and resemble E4 channel type, although the potential type for this reach is C4. The stream is a riffle/run type system with relatively fast flows as seen upstream. This reach has fewer areas with appropriately sized spawning gravels, and substrate is generally larger and more embedded than above.

*Description of streambank erosion conditions:*
Only two eroding streambanks were noted in this reach. The eroding streambanks were near-vertical banks on outside meander bends with very fine clay composition. The erosion on these banks was attributed to irrigation and riparian grazing. The areas with weak bank structure are a result of non-native encroachment typical of grazed areas, although there is little direct evidence of grazing on site.

*Description of riparian vegetation conditions:*
Riparian vegetation in this reach is dominated by deeply-rooted grasses and sedges. Some weedy species do occur, including knapweed and thistle, although weeds are not as prolific in this reach as they were in TROU 09-03.

## 3.4 Sampling Parameter Summaries by Individual Reach

The following **Figures 3-13** to **3-21** display statistical boxplots of stream channel and riparian zone parameters that were measured in each of the monitored sites. Individual reaches are also grouped by reach type and displayed below the reach names on each boxplot.

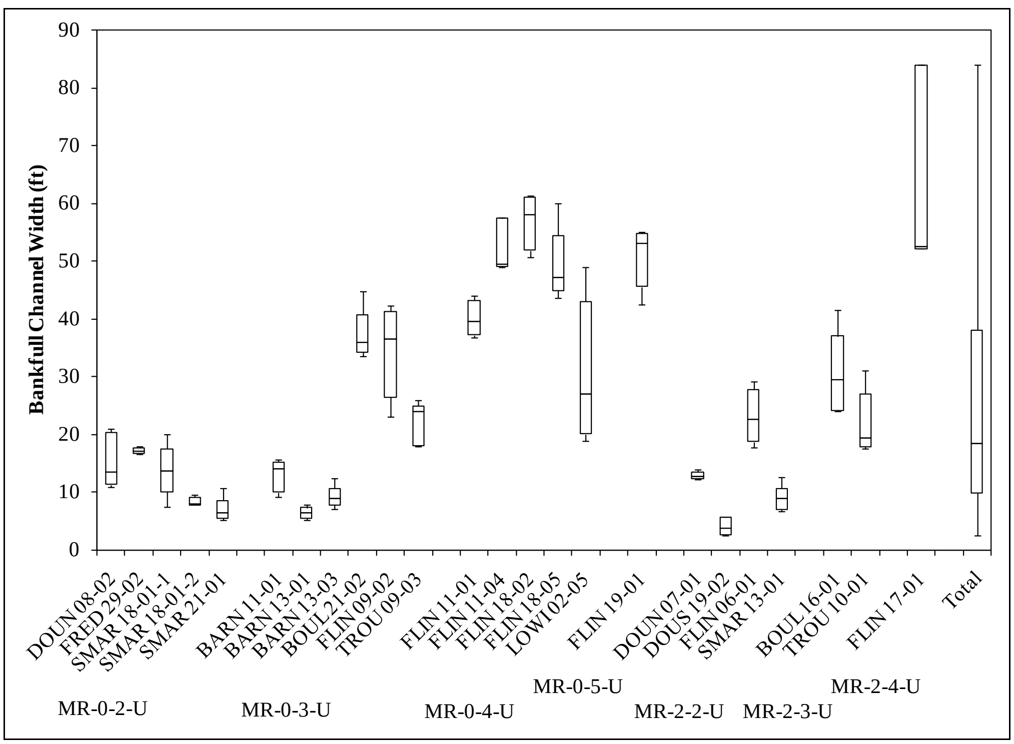


**Figure 3-13. Bankfull channel width by reach.**

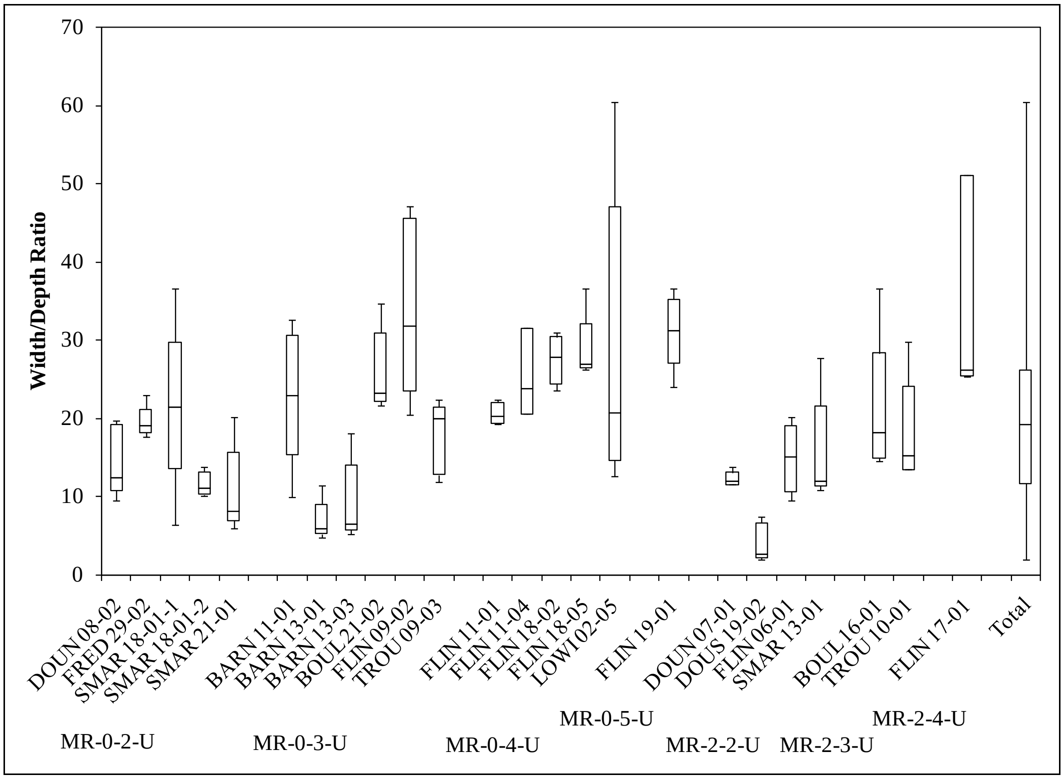


**Figure 3-14. Width/depth ratio by reach.**

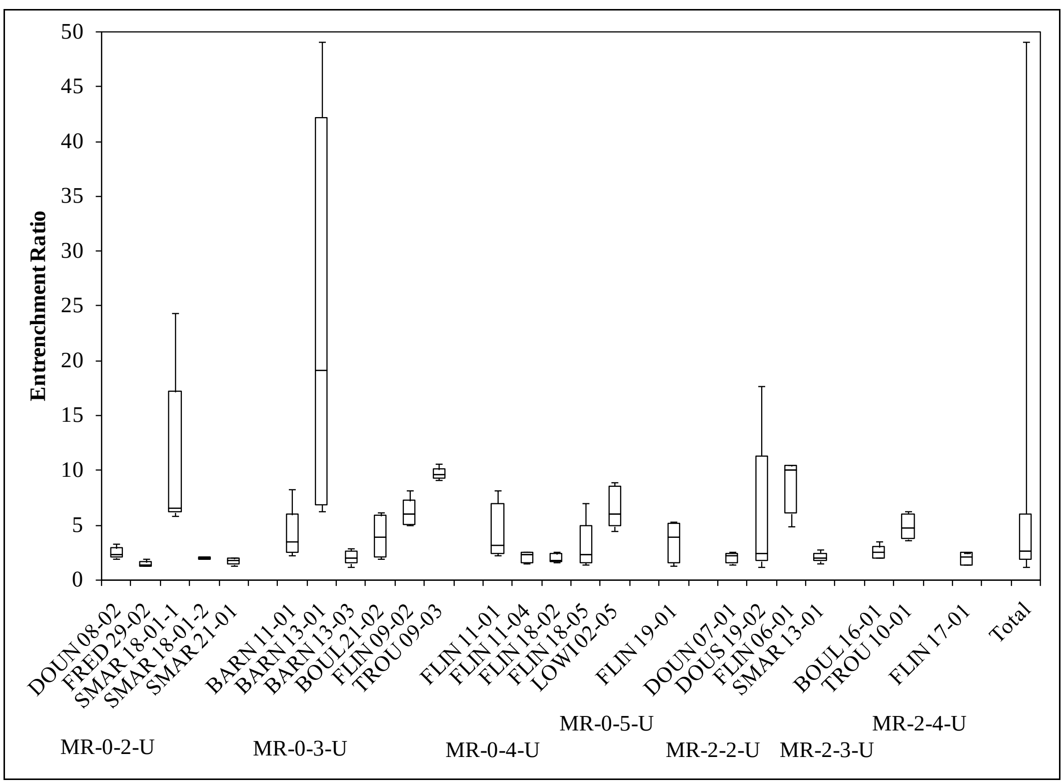


**Figure 3-15. Entrenchment ratio by reach.**

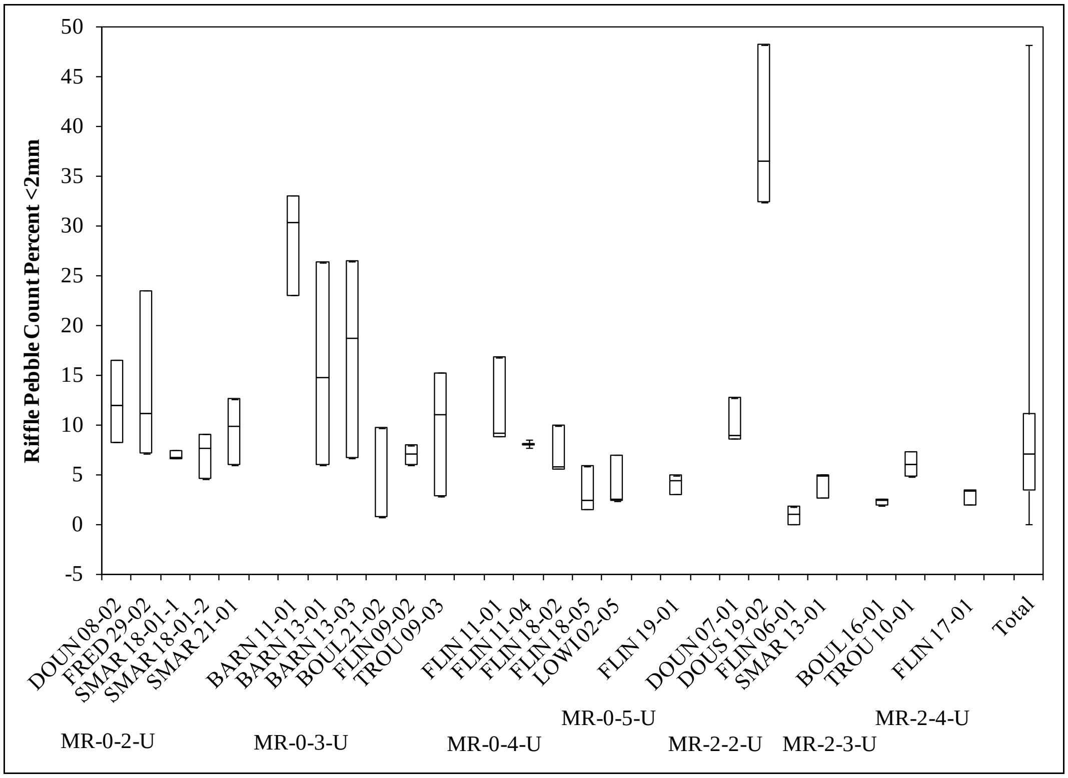


**Figure 3-16. Riffle pebble count (% <2 mm) by reach.**

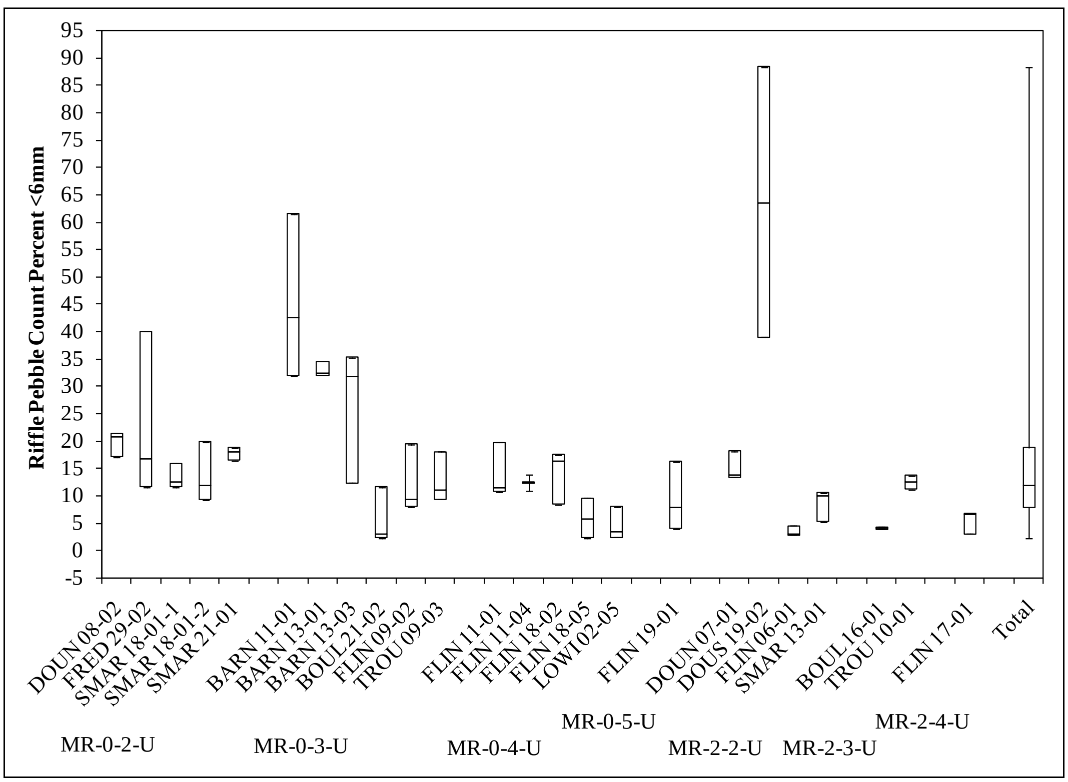


**Figure 3-17. Riffle pebble count (% <6 mm) by reach.**

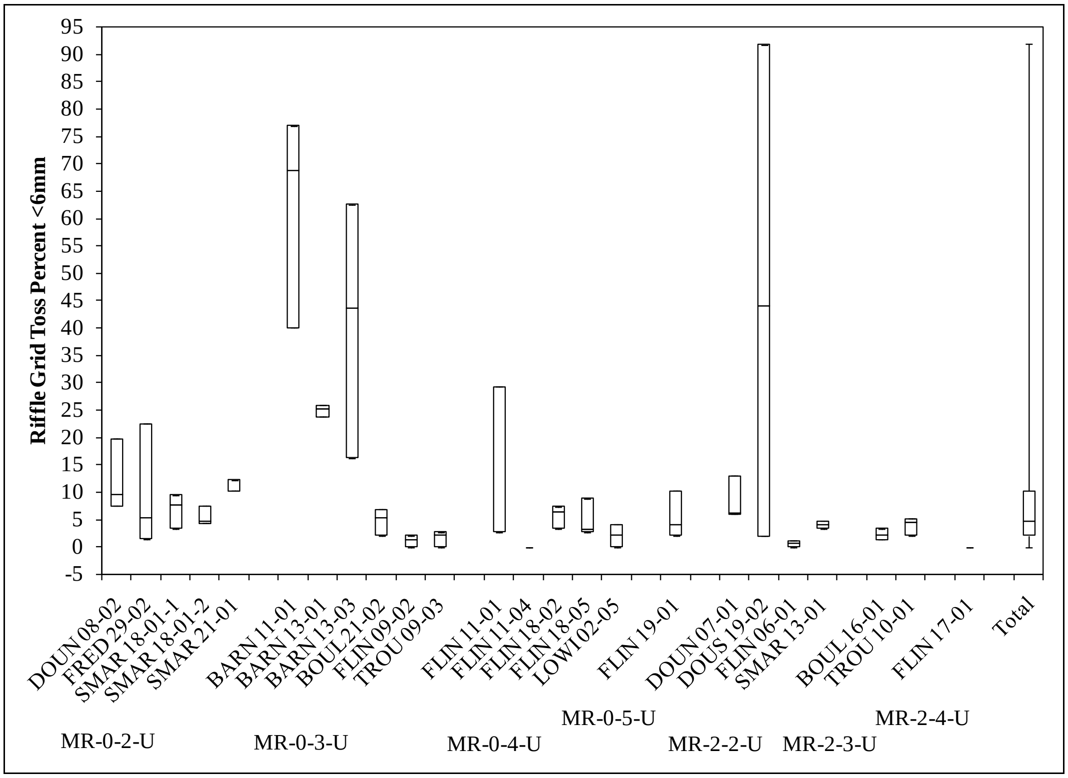


**Figure 3-18. Riffle grid toss (% <6 mm) by reach.**

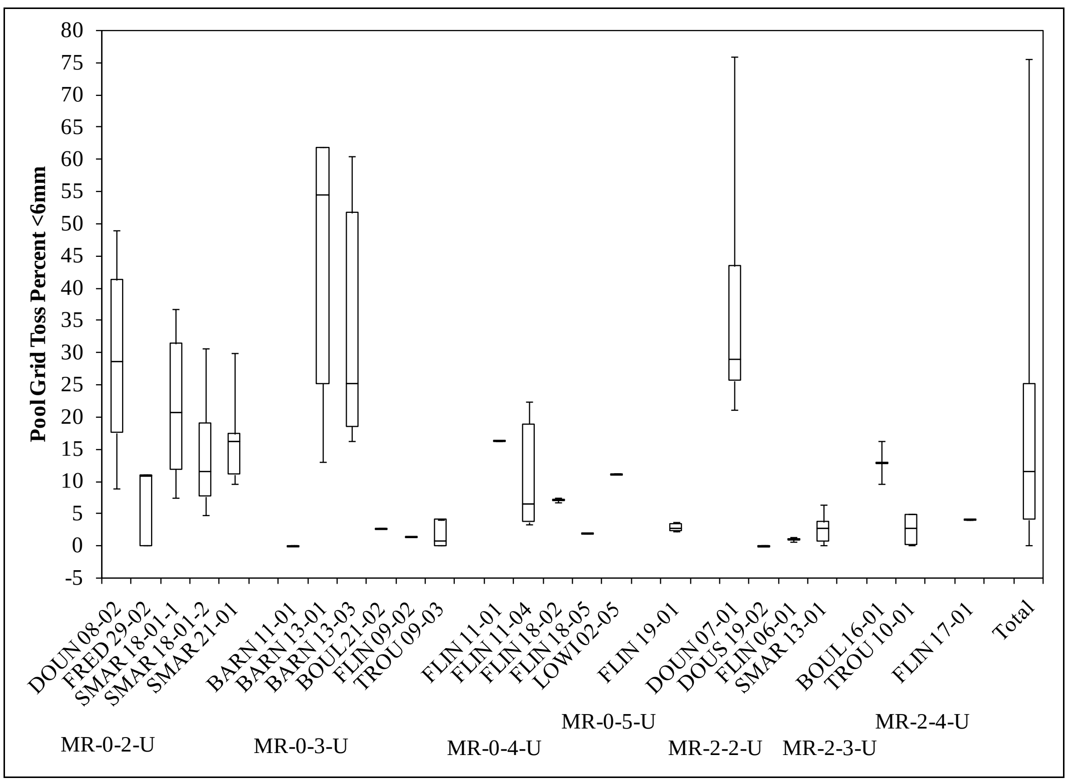


**Figure 3-19. Pool grid toss (% <6 mm) by reach.**

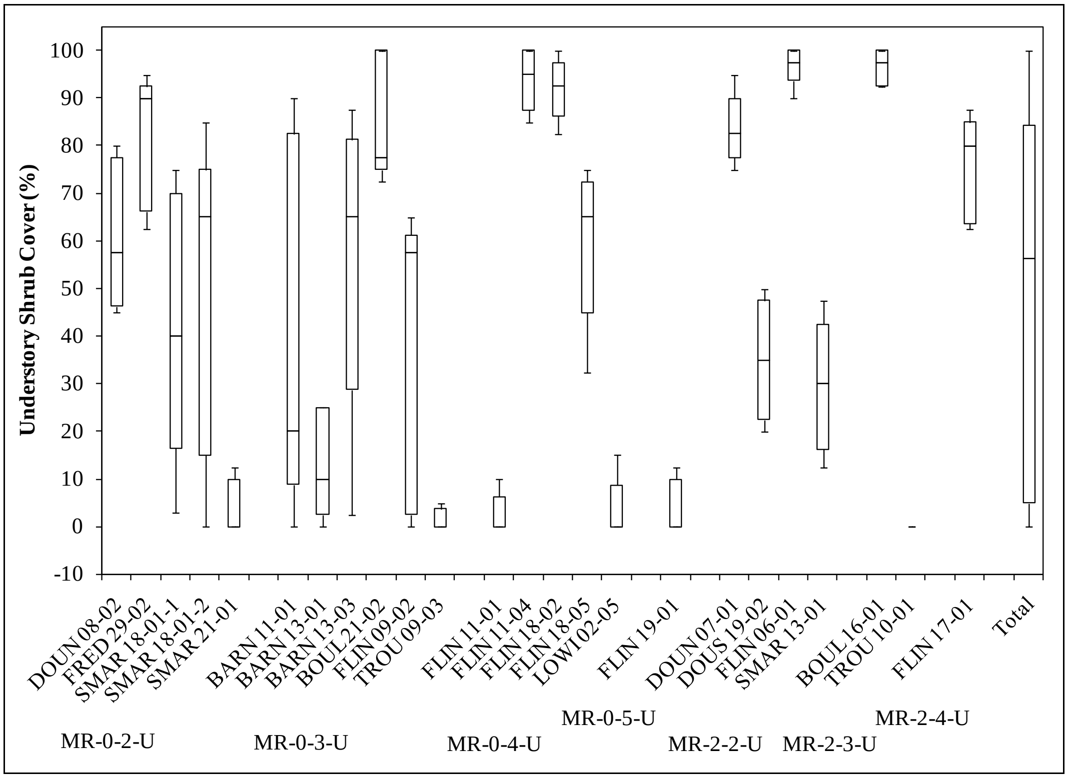


**Figure 3-20. Greenline understory shrub cover (%) by reach.**

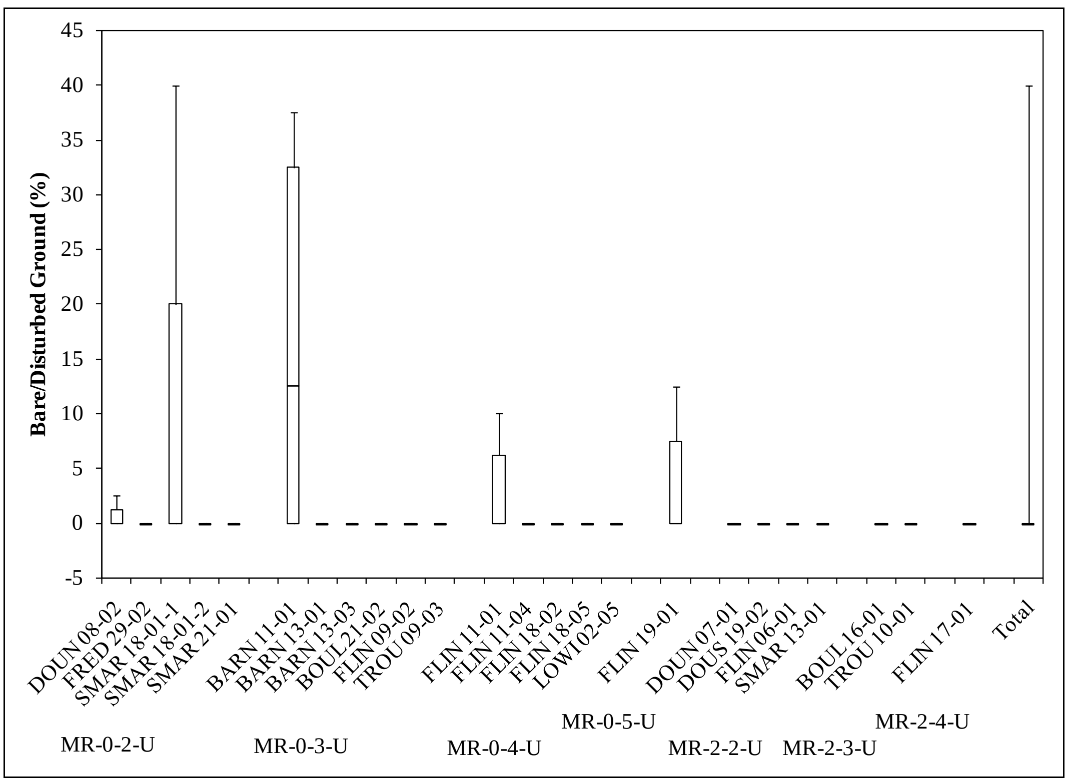


**Figure 3-21. Greenline bare/disturbed ground (%) by reach.**

# 4.0 Streambank Erosion Source Assessment

For each monitoring reach assessed during the study, measurements were collected to calculate the Bank Erosion Hazard Index (BEHI) and Near Bank Stress (NBS) in accordance with guidelines provided in *Watershed Assessment of River Stability and Sediment Supply* (Rosgen 2006). These measurements were used in conjunction with streambank length and erosion source notes to determine sediment loads per 1,000 feet within each surveyed reach.

For sites within the Flint Creek TPA, eroding banks were identified as "actively eroding" or "slowly eroding". Eroding bank sites within each reach were evaluated based on the variability of streambank conditions within the reach. The banks selected for evaluation provide a representative sample of conditions throughout the reach, and banks which are similar to the evaluated banks are measured and recorded as "additional banks". At each eroding bank, photos were taken from locations perpendicular and upstream/downstream of the streambank. Photos were labeled according to the streambank site and position of the photograph.

## 4.1 Field Measurements and Loading Calculations

### 4.1.1 Field Measurements

Within each sampled reach, eroding streambanks were identified by the field team and supporting measurements were recorded for the following metrics:

- Bank condition (includes actively eroding or slowly eroding/undercut/vegetated banks)
- Bank height
- Bankfull height
- Root depth
- Root density
- Bank angle
- Surface protection
- Material adjustments
- Bankfull mean depth
- Near bank maximum depth
- Stationing
- Mean height
- Bank composition (size classes)
- Hoof shear presence
- Sources of streambank instability (%): transportation, grazing, cropland, irrigation, natural, urban, railroad

### 4.1.2 Determination of BEHI Scores

To determine the BEHI score for each eroding bank, the following parameters are used:

- Bank height/bankfull height

- Root depth/bank height
- Weighted root density (root density * root depth/bank height)
- Bank angle
- Surface protection

These five bank erosion parameters are used to determine a numerical BEHI index score that ranks erosion potential from very low to extreme based on relationships provided by Rosgen (2006) (**Table 4-1**).

**Table 4-1. BEHI score and rating system for individual parameters.**

| Parameter | | Very Low | Low | Moderate | High | Very High | Extreme |
|---|---|---|---|---|---|---|---|
| Bank Height Ratio | Value | 1.0 – 1.1 | 1.11 – 1.19 | 1.2 – 1.5 | 1.6 – 2.0 | 2.1 – 2.8 | > 2.8 |
| | Index | 1.0 – 1.9 | 2.0 – 3.9 | 4.0 – 5.9 | 6.0 – 7.9 | 8.0 – 9.0 | 10 |
| Root Depth Ratio | Value | 1.0 – 0.9 | 0.89 – 0.5 | 0.49 – 0.3 | 0.29 – 0.15 | 0.14 – 0.05 | <0.05 |
| | Index | 1.0 – 1.9 | 2.0 – 3.9 | 4.0 – 5.9 | 6.0 – 7.9 | 8.0 – 9.0 | 10 |
| Weighted Root Density | Value | 100 – 80 | 79 – 55 | 54 – 30 | 29 – 15 | 14 – 5 | <5 |
| | Index | 1.0 – 1.9 | 2.0 – 3.9 | 4.0 – 5.9 | 6.0 – 7.9 | 8.0 – 9.0 | 10 |
| Bank Angle | Value | 0 – 20 | 21 – 60 | 61 – 80 | 81 – 90 | 91 – 119 | >119 |
| | Index | 1.0 – 1.9 | 2.0 – 3.9 | 4.0 – 5.9 | 6.0 – 7.9 | 8.0 – 9.0 | 10 |
| Surface Protection | Value | 100 – 80 | 79 – 55 | 54 – 30 | 29 – 15 | 14 – 10 | <10 |
| | Index | 1.0 – 1.9 | 2.0 – 3.9 | 4.0 – 5.9 | 6.0 – 7.9 | 8.0 – 9.0 | 10 |

After obtaining the BEHI index score for each individual parameter, the index scores are summed to produce a total BEHI score. Bank material factors are then considered, and total BEHI scores may be adjusted up or down. Banks comprised of bedrock, boulders, or cobble have very low erosion potential, and total BEHI scores for banks composed of these materials may be adjusted down by up to 10 points. Banks composed of cobble and/or gravel with a high fraction of sand have increased erosion potential, and total BEHI scores may be adjusted up by 5 to 10 points depending on the amount of sand present and whether the sandy material is exposed to erosion. Stratified banks containing layers of unstable material also have greater erosion potential, and total BEHI scores may be adjusted up by 5 to 10 points if stratified banks are present. After all material adjustments are made to the total BEHI score, the erosion potential is ranked from very low to extreme based on the scale provided below (**Table 4-2**). Photos of example streambanks with each BEHI rating are provided in **Attachment D**.

**Table 4-2. Total BEHI score and rating system.**

| Rating | Very Low | Low | Moderate | High | Very High | Extreme |
|---|---|---|---|---|---|---|
| Score | 5 - 9.5 | 10 - 19.5 | 20 - 29.5 | 30 - 39.5 | 40 - 45 | 46 - 50 |

## 4.1.3 Near Bank Stress (NBS) Determination

To calculate Near Bank Stress (NBS) for each eroding bank, the following relationship is used:

NBS = Near Bank Maximum Bankfull Depth (ft) / Bankfull Mean Depth (ft)

As with the BEHI scores, the resulting NBS values correspond to a categorical rating that ranks the erosion potential from very low to extreme (**Table 4-3)**. If appropriate measurements are not recorded for NBS determination, the NBS rating is estimated in the field or from photos using best professional judgment.

**Table 4-3. Near bank stress (NBS) rating system.**

| NBS Value | Rating |
|---|---|
| < 1.0 | very low |
| 1.0 - 1.5 | low |
| 1.51 - 1.8 | moderate |
| 1.81 - 2.5 | high |
| 2.51 - 3.0 | very high |
| > 3.0 | extreme |

## 4.1.4 Retreat Rate

Once respective BEHI and NBS ratings are found for each eroding bank, the ratings are used to derive the average retreat rate of each streambank based on empirical relationships derived by Rosgen (2006). The average retreat rates (ft/yr) based on BEHI and NBS ratings are provided below in **Table 4-4**.

**Table 4-4. Streambank retreat rate (ft/yr) based on BEHI and NBS rating.**

| | Near Bank Stress | | | | | |
|---|---|---|---|---|---|---|
| BEHI | Very Low | Low | Moderate | High | Very High | Extreme |
| Very Low | NA | NA | NA | NA | NA | NA |
| Low | 0.02 | 0.04 | 0.07 | 0.16 | 0.32 | 0.67 |
| Moderate | 0.09 | 0.15 | 0.25 | 0.42 | 0.70 | 1.16 |
| High-Very High | 0.17 | 0.25 | 0.38 | 0.58 | 0.87 | 1.32 |
| Extreme | 0.16 | 0.42 | 1.07 | 2.75 | 7.03 | 17.97 |

## 4.1.5 Sediment Loading Calculation

Once retreat rate is determined from the BEHI and NBS ratings, the dimensions of the eroding stream bank are used to find the total mass eroding from each bank per year. The total mass eroded from each streambank is calculated using the following equation:

*mass eroded (tons/yr) = bank length (ft) * bank height (ft) * retreat rate (ft/yr) * material density (tons/ft$^3$)*

The sediment load from each streambank is filtered into two bank erosion type categories including actively eroding banks or slowly eroding/undercut/vegetated banks. The total loads for each bank erosion type and for the entire reach are then calculated in tons of sediment per year per 1000 feet of reach.

## 4.2 Sediment Loading Results by Assessment Reach

The following sections provide sediment loading results for each sampled stream. One data table is included for each stream which includes data from each reach summarizing bank erosion and sediment loading for each bank erosion type (active or slowly eroding) and for the total reach. Information provided includes the number of eroding banks identified, the mean BEHI rating for each erosion type, the percent of reach that has eroding streambanks, the percent contribution from each erosion source present, and the sediment load per 1000 feet. The percentage of reach with eroding streambanks was calculated by summing the total footage of eroding banks (active and slow) and dividing the total by the total bank footage in the reach, including both right and left banks (i.e., a 1000' reach has 2000' of bank). Identified sources of streambank erosion within the Flint Creek TPA included transportation, riparian grazing, irrigation, natural sources, or those classified as "other". Additional sources such as cropland, mining and silviculture were evaluated but not identified at any sample locations; however, these sources may contribute to streambank erosion in other parts of the watershed.

### 4.2.1 Sediment Loading Results for Barnes Creek

#### 4.2.1.1 BARN 11-01

Eroding banks are generally similar throughout the reach with major pugging and hummocking. Three bank types were identified in this reach including near vertical banks in downcutting straight sections, exposed banks on outside meander bends, and the primary type included low angle banks that were trodden down by cattle. Typical eroding streambank conditions are depicted for this reach in **Figure 4-1** and sediment loading results are provided in **Table 4-5**.

**Figure 4-1. Typical eroding streambank conditions in Barnes Creek Reach 11-01.**

### 4.2.1.2 BARN 13-01

Three primary bank types were identified in this reach, including near vertical banks on meander bends, banks that were trodden by cattle, and one low angle bank at a cattle crossing. Typical eroding streambank conditions are depicted in **Figure 4-2** and sediment loading results are provided in **Table 4-5**.

**Figure 4-2. Typical eroding streambank conditions in Barnes Creek Reach 13-01.**

### 4.2.1.3 BARN 13-03

Three primary bank types were identified in this reach, including two actively eroding types and a heavily vegetated slowly eroding bank type. Most streambank erosion was associated with large woody debris. Bank composition was primarily fines which create a stable bank. Typical eroding streambank conditions are depicted in **Figure 4-3** and sediment loading results are provided in **Table 4-5**.

**Figure 4-3. Typical eroding streambank conditions in Barnes Creek Reach 13-03.**

**Table 4-5. Sediment loading results for Barnes Creek.**

| Reach ID | Erosion Type | Number of Banks | Mean BEHI Rating | Percent Eroding Bank | Loading Source (%) | | | | | Sediment Load per 1000' (Tons/Year) |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | Transpor-tation | Riparian Grazing | Irrigation | Natural | Other | |
| BARN 11-01 | Active | 12 | moderate | 16.9 | 0.0 | 95.9 | 0.6 | 3.5 | 0.0 | 8.4 |
| | Slow | 1 | high | 0.3 | 0.0 | 100.0 | 0.0 | 0.0 | 0.0 | 0.2 |
| | Total | 13 | moderate | 17.2 | 0.0 | 96.0 | 0.6 | 3.4 | 0.0 | 8.6 |
| BARN 13-01 | Active | 5 | moderate | 3.5 | 0.0 | 81.2 | 0.0 | 18.8 | 0.0 | 1.8 |
| | Slow | 5 | moderate | 2.2 | 0.0 | 77.3 | 0.0 | 22.7 | 0.0 | 0.7 |
| | Total | 10 | moderate | 5.7 | 0.0 | 80.1 | 0.0 | 19.9 | 0.0 | 2.6 |
| BARN 13-03 | Active | 6 | high | 3.2 | 0.0 | 0.0 | 10.0 | 90.0 | 0.0 | 4.0 |
| | Slow | 2 | high | 1.8 | 0.0 | 0.0 | 7.1 | 92.9 | 0.0 | 2.5 |
| | Total | 8 | high | 5.0 | 0.0 | 0.0 | 8.9 | 91.1 | 0.0 | 6.5 |

## 4.2.2 Sediment Loading Results for Boulder Creek

### 4.2.2.1 BOUL 16-01

Only three slowly eroding banks were identified in this reach. Banks are well armored with large cobbles and boulders, and erosion sources are 100% natural. Eroding banks typically occur at base of large conifers. Typical eroding streambank conditions are depicted for this reach in **Figure 4-4** and sediment loading results are provided in **Table 4-6**.

**Figure 4-4. Typical eroding streambank conditions in Boulder Creek Reach 16-01.**

### 4.2.2.2 BOUL 21-02

Nine slowly eroding banks were noted in this reach. Some were well armored with large cobbles and boulders. Many eroding banks are undercut, but banks are held in place by fine materials or root wads. Typical eroding streambank conditions are depicted for this reach in **Figure 4-5** and sediment loading results are provided in **Table 4-6**.

**Figure 4-5. Typical eroding streambank conditions in Boulder Creek Reach 21-02.**

**Table 4-6. Sediment loading results for Boulder Creek.**

| Reach ID | Erosion Type | Number of Banks | Mean BEHI Rating | Percent Eroding Bank | Loading Source (%) | | | | | Sediment Load per 1000' (Tons/Year) |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | Transpor-tation | Riparian Grazing | Irrigation | Natural | Other | |
| BOUL 16-01 | Active | 0 | | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| | Slow | 3 | low | 4.2 | 0.0 | 0.0 | 0.0 | 100.0 | 0.0 | 0.4 |
| | Total | 3 | low | 4.2 | 0.0 | 0.0 | 0.0 | 100.0 | 0.0 | 0.4 |
| BOUL 21-02 | Active | 0 | | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| | Slow | 9 | high | 11.2 | 5.0 | 4.0 | 0.0 | 91.0 | 0.0 | 10.3 |
| | Total | 9 | high | 11.2 | 5.0 | 4.0 | 0.0 | 91.0 | 0.0 | 10.3 |

## 4.2.3 Sediment Loading Results for Douglas Creek (North)

### 4.2.3.1 DOUN 07-01

This site has 18 total eroding banks and 3 primary bank types, including slowly eroding banks that are near vertical and held together with vegetation or clay, heavily trampled low angle banks with pugging and hummocking, and one trampled bank on an outside bend. Typical eroding streambank conditions are depicted for this reach in **Figure 4-6** and sediment loading results are provided in **Table 4-7**.

**Figure 4-6. Typical eroding streambank conditions in Douglas Creek (North) Reach 07-01.**

### 4.2.3.2 DOUN 08-02

This site has 15 eroding streambanks and 2 primary bank types, including tall moderately-angled actively eroding banks, and short near-vertical banks typically occurring in slower water. Typical eroding streambank conditions are depicted for this reach in **Figure 4-7** and sediment loading results are provided in **Table 4-7**.

**Figure 4-7. Typical eroding streambank conditions in Douglas Creek (North) Reach 08-02.**

**Table 4-7. Sediment loading results for Douglas Creek (North).**

| Reach ID | Erosion Type | Number of Banks | Mean BEHI Rating | Percent Eroding Bank | Loading Source (%) | | | | | Sediment Load per 1000' (Tons/Year) |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | Transpor-tation | Riparian Grazing | Irrigation | Natural | Other | |
| DOUN 07-01 | Active | 11 | high | 8.2 | 0.0 | 90.5 | 0.0 | 9.5 | 0.0 | 4.3 |
| | Slow | 7 | high | 4.5 | 0.0 | 39.9 | 0.0 | 60.1 | 0.0 | 8.8 |
| | Total | 18 | high | 12.7 | 0.0 | 56.4 | 0.0 | 43.6 | 0.0 | 13.1 |
| DOUN 08-02 | Active | 8 | high | 9.3 | 0.0 | 87.6 | 0.0 | 12.4 | 0.0 | 19.2 |
| | Slow | 7 | moderate | 6.9 | 0.0 | 83.6 | 0.0 | 16.4 | 0.0 | 4.1 |
| | Total | 15 | high | 16.2 | 0.0 | 86.9 | 0.0 | 13.1 | 0.0 | 23.3 |

### 4.2.4 Sediment Loading Results for Douglas Creek (South)

#### 4.2.4.1 DOUS 19-02

One 500' reach was evaluated on Douglas Creek (South). This reach is straight and channelized, and much of the reach is alternating between near vertical and undercut slowly eroding banks; however, bank composition is primarily fine material. Typical eroding streambank conditions are depicted in **Figure 4-8** and sediment loading results are provided in **Table 4-8**.

**Figure 4-8. Typical eroding streambank conditions in Douglas Creek (South) Reach 19-02.**

**Table 4-8. Sediment loading results for Douglas Creek (South).**

| Reach ID | Erosion Type | Number of Banks | Mean BEHI Rating | Percent Eroding Bank | Loading Source (%) | | | | | Sediment Load per 1000' (Tons/Year) |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | Transpor-tation | Riparian Grazing | Irrigation | Natural | Other | |
| DOUS 19-02 | Active | 0 | | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| | Slow | 20 | high | 30.4 | 50.0 | 0.0 | 50.0 | 0.0 | 0.0 | 16.1 |
| | Total | 20 | high | 30.4 | 50.0 | 0.0 | 50.0 | 0.0 | 0.0 | 16.1 |

### 4.2.5 Sediment Loading Results for Flint Creek

#### 4.2.5.1 FLIN 06-02

This reach recorded 7 eroding streambanks and 2 primary bank types, including actively eroding banks with low root density and exposed cobble soil, and slowly eroding banks (sometimes undercut) in forested areas with high root density and fine substrate. Typical eroding streambank conditions are depicted in **Figure 4-9** and sediment loading results are provided in **Table 4-9**.

**Figure 4-9. Typical eroding streambank conditions in Flint Creek Reach 06-02.**

#### 4.2.5.2 FLIN 09-02

This reach has 7 eroding banks and 3 primary eroding bank types, including actively eroding undercut banks with some cobble, actively eroding banks that are sloped or near vertical with fine bank material, and slowly eroding banks on outside meander bends with good protection from cobbles. Typical eroding streambank conditions are depicted in **Figure 4-10** and sediment loading results are provided in **Table 4-9**.

**Figure 4-10. Typical eroding streambank conditions in Flint Creek Reach 09-02.**

#### 4.2.5.3 FLIN 11-01

This reach has 9 long actively eroding streambanks and 3 primary bank types, including tall undercut banks primarily occurring on outside bends, tall sloped banks, and one very tall long bank that is undercutting an abandoned railroad bed. Typical eroding streambank conditions are depicted in **Figure 4-11** and sediment loading results are provided in **Table 4-9**.

**Figure 4-11. Typical eroding streambank conditions in Flint Creek Reach 11-01.**

## 4.2.5.3 FLIN 11-04

This site has very minimal streambank erosion with only two slowly eroding banks that are protected by cobble and dense roots. Typical eroding streambank conditions are depicted in **Figure 4-12** and sediment loading results are provided in **Table 4-9**.

**Figure 4-12. Typical eroding streambank conditions in Flint Creek Reach 11-04.**

## 4.2.5.4 FLIN 17-01

This reach has 8 slowly eroding banks and 2 primary bank types. One bank type is slightly undercut with cobble armor, and occurs in small areas throughout the reach where the bank is influenced by high stream velocities. The other bank type includes sloped banks downstream of inside bends that are also heavily protected by cobble. Typical eroding streambank conditions are depicted in **Figure 4-13** and sediment loading results are provided in **Table 4-9**.

**Figure 4-13. Typical eroding streambank conditions in Flint Creek Reach 17-01.**

## 4.2.5.5 FLIN 18-02

This reach has five slowly eroding banks of the same bank type. These banks are very stable, heavily armored, well vegetated, and have a dense root mass. Typical eroding streambank conditions are depicted in **Figure 4-14** and sediment loading results are provided in **Table 4-9**.

**Figure 4-14. Typical eroding streambank conditions in Flint Creek Reach 18-02.**

## 4.2.5.6 FLIN 18-05

This reach has 7 eroding banks and 3 bank types, although most are slowly eroding undercut banks protected by woody debris. Most banks have cobble substrate, although one is composed of fine material and may occur in an area previously dammed by beavers. Typical eroding streambank conditions are depicted in **Figure 4-15** and sediment loading results are provided in **Table 4-9**.

**Figure 4-15. Typical eroding streambank conditions in Flint Creek Reach 18-05.**

## 4.2.5.7 FLIN 19-01

This reach has 7 eroding banks and 4 primary banks types including slowly eroding low angle banks with cobble, actively eroding near vertical banks with little vegetation, actively eroding near vertical banks with cobble, and actively eroding banks with rip-rap and concrete slabs for protection. Typical eroding streambank conditions are depicted in **Figure 4-16** and sediment loading results are provided in **Table 4-9**.

**Figure 4-16. Typical eroding streambank conditions in Flint Creek Reach 19-01.**

**Table 4-9. Sediment loading results for Flint Creek.**

| Reach ID | Erosion Type | Number of Banks | Mean BEHI Rating | Percent Eroding Bank | Loading Source (%) | | | | | Sediment Load per 1000' (Tons/Year) |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | Transpor-tation | Riparian Grazing | Irrigation | Natural | Other | |
| FLIN 06-01 | Active | 3 | very high | 6.6 | 0.0 | 0.0 | 70.0 | 1.1 | 28.9 | 6.7 |
| | Slow | 4 | moderate | 5.1 | 0.0 | 0.0 | 70.0 | 10.0 | 20.0 | 4.9 |
| | Total | 7 | high | 11.7 | 0.0 | 0.0 | 70.0 | 4.8 | 25.2 | 11.6 |
| FLIN 09-02 | Active | 5 | high | 5.1 | 0.0 | 80.0 | 0.0 | 20.0 | 0.0 | 3.2 |
| | Slow | 2 | high | 1.0 | 0.0 | 63.3 | 0.0 | 36.7 | 0.0 | 0.7 |
| | Total | 7 | high | 6.1 | 0.0 | 77.1 | 0.0 | 22.9 | 0.0 | 3.9 |
| FLIN 11-01 | Active | 6 | high | 29.9 | 19.6 | 38.1 | 0.0 | 42.3 | 0.0 | 71.4 |
| | Slow | 3 | high | 6.0 | 13.5 | 20.0 | 0.0 | 66.5 | 0.0 | 7.4 |
| | Total | 9 | high | 35.8 | 19.0 | 36.4 | 0.0 | 44.6 | 0.0 | 78.8 |
| FLIN 11-04 | Active | 0 | | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| | Slow | 2 | low | 3.4 | 0.0 | 0.0 | 0.0 | 100.0 | 0.0 | 1.4 |
| | Total | 2 | low | 3.4 | 0.0 | 0.0 | 0.0 | 100.0 | 0.0 | 1.4 |
| FLIN 17-01 | Active | 0 | | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| | Slow | 8 | low | 10.0 | 0.0 | 0.0 | 20.0 | 80.0 | 0.0 | 0.8 |
| | Total | 8 | low | 10.0 | 0.0 | 0.0 | 20.0 | 80.0 | 0.0 | 0.8 |
| FLIN 18-02 | Active | 0 | | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| | Slow | 5 | low | 7.8 | 0.0 | 0.0 | 0.0 | 100.0 | 0.0 | 0.5 |
| | Total | 5 | low | 7.8 | 0.0 | 0.0 | 0.0 | 100.0 | 0.0 | 0.5 |
| FLIN 18-05 | Active | 4 | high | 4.3 | 0.0 | 0.0 | 0.0 | 80.0 | 20.0 | 2.8 |
| | Slow | 3 | low | 6.6 | 0.0 | 0.0 | 0.0 | 84.0 | 16.0 | 2.5 |
| | Total | 7 | moderate | 10.9 | 0.0 | 0.0 | 0.0 | 81.9 | 18.1 | 5.3 |
| FLIN 19-01 | Active | 6 | moderate | 19.0 | 0.0 | 86.3 | 0.0 | 13.7 | 0.0 | 23.6 |
| | Slow | 2 | moderate | 1.5 | 0.0 | 46.1 | 0.0 | 42.3 | 11.6 | 0.4 |
| | Total | 8 | moderate | 20.5 | 0.0 | 85.6 | 0.0 | 14.2 | 0.2 | 23.9 |

## 4.2.6 Sediment Loading Results for Fred Burr Creek

### 4.2.6.1 FRED 29-02

This reach has 12 eroding streambanks and 4 primary bank types, including slowly eroding near vertical banks, slowly eroding undercut banks, actively eroding tall banks with some vegetation, and tall actively eroding banks with mixed substrate and poor root density. Typical eroding streambank conditions are shown in **Figure 4-17** and sediment loading results are provided in **Table 4-10**.

**Figure 4-17. Typical eroding streambank conditions in Fred Burr Creek Reach 29-02.**

**Table 4-10. Sediment loading results for Fred Burr Creek.**

| Reach ID | Erosion Type | Number of Banks | Mean BEHI Rating | Percent Eroding Bank | Loading Source (%) | | | | | Sediment Load per 1000' (Tons/Year) |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | Transpor-tation | Riparian Grazing | Irrigation | Natural | Other | |
| FRED 29-02 | Active | 3 | high | 5.5 | 27.8 | 0.0 | 0.0 | 72.2 | 0.0 | 11.7 |
| | Slow | 9 | high | 10.4 | 54.0 | 0.0 | 0.0 | 46.0 | 0.0 | 16.9 |
| | Total | 12 | high | 15.9 | 43.3 | 0.0 | 0.0 | 56.7 | 0.0 | 28.6 |

## 4.2.7 Sediment Loading Results for Lower Willow Creek

### 4.2.7.1 LOWI 02-05

This reach has 6 eroding banks and 3 bank types, including short slowly eroding banks that are near vertical, undercut actively eroding banks, and tall actively eroding banks. All banks have some protection from cobble substrate. Typical eroding streambank conditions are depicted in **Figure 4-18** and sediment loading results are provided in **Table 4-11**.

**Figure 4-18. Typical eroding streambank conditions in Lower Willow Creek Reach 02-05.**

**Table 4-11. Sediment loading results for Lower Willow Creek.**

| Reach ID | Erosion Type | Number of Banks | Mean BEHI Rating | Percent Eroding Bank | Loading Source (%) | | | | | Sediment Load per 1000' (Tons/Year) |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | Transpor-tation | Riparian Grazing | Irrigation | Natural | Other | |
| LOWI 02-05 | Active | 4 | moderate | 6.3 | 0.0 | 43.1 | 32.3 | 24.6 | 0.0 | 3.4 |
| | Slow | 2 | moderate | 2.9 | 0.0 | 59.3 | 40.7 | 0.0 | 0.0 | 0.5 |
| | Total | 6 | moderate | 9.1 | 0.0 | 45.3 | 33.4 | 21.3 | 0.0 | 3.9 |

## 4.2.8 Sediment Loading Results for Smart Creek

### 4.2.8.1 SMAR 13-01

This reach has 10 actively eroding streambanks and 4 primary bank types, including banks with fine substrate and little vegetative cover, banks with fine substrate and some surface cover, stratified banks on outside meander bends, and a tall eroding bank under a tree. Eroding banks in this reach are quite tall for the size of the stream with little vegetative cover, low root density, and stratification of bank substrate. Typical eroding streambank conditions are depicted in **Figure 4-19** and sediment loading results are provided in **Table 4-12**.

**Figure 4-19. Typical eroding streambank conditions in Smart Creek Reach 13-01.**

### 4.2.8.2 SMAR 18-01-1

This reach is the unfenced section paired with fenced reach SMAR 18-01-2 upstream. This reach has 7 eroding banks and 2 bank types including slowly eroding low angle grassy banks that have been exposed to hoof shear, and actively eroding banks similar to those above but occurring on outside meander bends. Typical eroding streambank conditions are shown in **Figure 4-20** and sediment loading results are provided in **Table 4-12**.

**Figure 4-20. Typical eroding streambank conditions in Smart Creek Reach 18-01-1.**

## 4.2.8.3 SMAR 18-01-2

This reach has riparian fencing and is paired with unfenced reach SMAR 18-01-1 downstream. Only four eroding banks were recorded in this reach, including both active and slowly eroding types with good surface protection. Typical eroding streambank conditions are depicted in **Figure 4-21** and sediment loading results are provided in **Table 4-12**.

**Figure 4-21. Typical eroding streambank conditions in Smart Creek Reach 18-01-2.**

## 4.2.8.4 SMAR 21-01

This reach has 12 eroding streambanks and 3 primary bank types, including actively eroding banks with moderate angle and fine substrate, actively eroding undercut banks with gravel and cobble substrate, and slowly eroding undercut banks occurring on outside bends where banks have previously slumped. Typical eroding streambank conditions are depicted in **Figure 4-22** and sediment loading results are provided in **Table 4-12**.

**Figure 4-22. Typical eroding streambank conditions in Smart Creek Reach 21-01.**

**Table 4-12. Sediment loading results for Smart Creek.**

| Reach ID | Erosion Type | Number of Banks | Mean BEHI Rating | Percent Eroding Bank | Loading Source (%) | | | | | Sediment Load per 1000' (Tons/Year) |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | Transpor-tation | Riparian Grazing | Irrigation | Natural | Other | |
| SMAR 13-01 | Active | 10 | very high | 10.7 | 20.9 | 50.0 | 0.0 | 29.1 | 0.0 | 40.8 |
| | Slow | 0 | | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| | Total | 10 | very high | 10.7 | 20.9 | 50.0 | 0.0 | 29.1 | 0.0 | 40.8 |
| SMAR 18-01-1 | Active | 5 | moderate | 6.8 | 0.0 | 100.0 | 0.0 | 0.0 | 0.0 | 2.6 |
| | Slow | 2 | high | 2.7 | 0.0 | 100.0 | 0.0 | 0.0 | 0.0 | 2.3 |
| | Total | 7 | moderate | 9.5 | 0.0 | 100.0 | 0.0 | 0.0 | 0.0 | 4.9 |
| SMAR 18-01-2 | Active | 2 | high | 2.6 | 0.0 | 0.0 | 0.0 | 100.0 | 0.0 | 2.7 |
| | Slow | 2 | moderate | 1.4 | 0.0 | 0.0 | 0.0 | 100.0 | 0.0 | 0.6 |
| | Total | 4 | moderate | 4.0 | 0.0 | 0.0 | 0.0 | 100.0 | 0.0 | 3.3 |
| SMAR 21-01 | Active | 10 | high | 8.9 | 0.0 | 50.0 | 50.0 | 0.0 | 0.0 | 28.6 |
| | Slow | 2 | very high | 0.9 | 0.0 | 50.0 | 50.0 | 0.0 | 0.0 | 0.8 |
| | Total | 12 | high | 9.8 | 0.0 | 50.0 | 50.0 | 0.0 | 0.0 | 29.4 |

### 4.2.9 Sediment Loading Results for Trout Creek

#### 4.2.9.1 TROU 09-03

This reach is highly sinuous and has 10 eroding banks and 2 primary bank types, including slowly eroding undercut or near vertical banks that are well vegetated, and similar banks that have less vegetative protection that typically occur on outside meander bends with invasive plant species. Typical eroding streambank conditions are depicted in **Figure 4-23** and sediment loading results are provided in **Table 4-13**.

**Figure 4-23. Typical eroding streambank conditions in Trout Creek Reach 09-03.**

## 4.2.9.2 TROU 10-01

This reach has only two eroding streambanks which are actively eroding, near vertical, and have little surface protection. Typical eroding streambank conditions are depicted in **Figure 4-24** and sediment loading results are provided in **Table 4-13**.

**Figure 4-24. Typical eroding streambank conditions in Trout Creek Reach 10-01.**

**Table 4-13. Sediment loading results for Trout Creek.**

| Reach ID | Erosion Type | Number of Banks | Mean BEHI Rating | Percent Eroding Bank | Loading Source (%) | | | | | Sediment Load per 1000' (Tons/Year) |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | Transpor-tation | Riparian Grazing | Irrigation | Natural | Other | |
| TROU 09-03 | Active | 5 | high | 5.4 | 0.0 | 81.5 | 0.0 | 18.5 | 0.0 | 3.9 |
| | Slow | 5 | high | 3.0 | 0.0 | 16.0 | 0.0 | 84.0 | 0.0 | 2.3 |
| | Total | 10 | high | 8.4 | 0.0 | 57.6 | 0.0 | 42.4 | 0.0 | 6.2 |
| TROU 10-01 | Active | 2 | high | 4.0 | 0.0 | 70.0 | 30.0 | 0.0 | 0.0 | 7.6 |
| | Slow | 0 | | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| | Total | 2 | high | 4.0 | 0.0 | 70.0 | 30.0 | 0.0 | 0.0 | 7.6 |

## 4.3 Sediment Loading Results by Reach Type

The following sections provide sediment loading results organized by reach type. Data provided includes sediment load per 1000 feet for each bank type (active, slow and total) and the dominant influence (anthropogenic or natural). If <75% of the bank erosion-influenced load was attributed to natural sources, the load is considered to be anthropogenically influenced.

### 4.3.1 Sediment Loading Results for Reach Type MR-0-2-U

Five sites were sampled of reach type MR-0-2-U. This reach type is in the Middle Rockies Ecoregion, has low valley slope (<2%), and includes 2$^{nd}$ order streams within unconfined valleys. Loading results are provided below in **Table 4-14**.

**Table 4-14. Sediment loading results for reach type MR-0-2-U.**

| Reach ID | Sediment Load per 1000 ft (tons/year) | | | Dominant Influence | |
|---|---|---|---|---|---|
| | Active | Slow | Total | Anthropogenic | Natural |
| DOUN 08-02 | 19.2 | 4.1 | 23.3 | X | |
| FRED 29-02 | 11.7 | 16.9 | 28.6 | X | |
| SMAR 18-01-1 | 2.6 | 2.3 | 4.9 | X | |
| SMAR 18-01-2 | 2.7 | 0.6 | 3.3 | | X |
| SMAR 21-01 | 28.6 | 0.8 | 29.4 | X | |
| Reach Type Average | 13.0 | 4.9 | 17.9 | 21.5 | 3.3 |

### 4.3.2 Sediment Loading Results for Reach Type MR-0-3-U

Six reaches were sampled of reach type MR-0-3-U. This reach type is in the Middle Rockies Ecoregion, has low valley slope (<2%), and includes 3$^{rd}$ order streams within unconfined valleys. Loading results are provided below in **Table 4-15**.

**Table 4-15. Sediment loading results for reach type MR-0-3-U.**

| Reach ID | Sediment Load per 1000 ft (tons/year) | | | Dominant Influence | |
|---|---|---|---|---|---|
| | Active | Slow | Total | Anthropogenic | Natural |
| BARN 11-01 | 8.4 | 0.2 | 8.6 | X | |
| BARN 13-01 | 1.8 | 0.7 | 2.6 | X | |
| BARN 13-03 | 4.0 | 2.5 | 6.5 | | X |
| BOUL 21-02 | 0.0 | 10.3 | 10.3 | | X |
| FLIN 09-02 | 3.2 | 0.7 | 3.9 | X | |
| TROU 09-03 | 3.9 | 2.3 | 6.2 | X | |
| Reach Type Average | 2.6 | 3.3 | 5.9 | 5.3 | 8.4 |

### 4.3.3 Sediment Loading Results for Reach Type MR-0-4-U

Five reaches were sampled of reach type MR-0-4-U, primarily on Flint Creek. This reach type is in the Middle Rockies Ecoregion, has low valley slope (<2%), and includes 4th order streams within unconfined valley types. Loading results are provided below in **Table 4-16**.

**Table 4-16. Sediment loading results for reach type MR-0-4-U.**

| Reach ID | Sediment Load per 1000 ft (tons/year) | | | Dominant Influence | |
|---|---|---|---|---|---|
| | Active | Slow | Total | Anthropogenic | Natural |
| FLIN 11-01 | 71.4 | 7.4 | 78.8 | X | |
| FLIN 11-04 | 0.0 | 1.4 | 1.4 | | X |
| FLIN 18-02 | 0.0 | 0.5 | 0.5 | | X |
| FLIN 18-05 | 2.8 | 2.5 | 5.3 | | X |
| LOWI 02-05 | 3.4 | 0.5 | 3.9 | X | |
| Reach Type Average | 15.5 | 2.5 | 18.0 | 41.3 | 2.4 |

### 4.3.4 Sediment Loading Results for Reach Type MR-0-5-U

One site was sampled of reach type MR-0-5-U. This reach type is in the Middle Rockies Ecoregion, has low valley slope (<2%), and includes 5th order streams within unconfined valleys. Loading results are provided below in **Table 4-17**.

**Table 4-17. Sediment loading results for reach type MR-0-5-U.**

| Reach ID | Sediment Load per 1000 ft (tons/year) | | | Dominant Influence | |
|---|---|---|---|---|---|
| | Active | Slow | Total | Anthropogenic | Natural |
| FLIN 19-01 | 23.6 | 0.4 | 23.9 | X | |
| Reach Type Average | 23.6 | 0.4 | 23.9 | 23.9 | NA |

### 4.3.5 Sediment Loading Results for Reach Type MR-2-2-U

Four sites were sampled of reach type MR-2-2-U. This reach type is in the Middle Rockies Ecoregion, has moderate valley slope (2-4%), and includes 2nd order streams within unconfined valley types. Loading results are provided below in **Table 4-18**.

**Table 4-18. Sediment loading results for reach type MR-2-2-U.**

| Reach ID | Sediment Load per 1000 ft (tons/year) | | | Dominant Influence | |
|---|---|---|---|---|---|
| | Active | Slow | Total | Anthropogenic | Natural |
| DOUN 07-01 | 4.3 | 8.8 | 13.1 | X | |
| DOUS 19-02 | 0.0 | 16.1 | 16.1 | X | |
| FLIN 06-01 | 6.7 | 4.9 | 11.6 | X | |

**Table 4-18. Sediment loading results for reach type MR-2-2-U.**

| Reach ID | Sediment Load per 1000 ft (tons/year) | | | Dominant Influence | |
|---|---|---|---|---|---|
| | Active | Slow | Total | Anthropogenic | Natural |
| SMAR 13-01 | 40.8 | 0.0 | 40.8 | X | |
| Reach Type Average | 12.9 | 7.5 | 20.4 | 20.4 | NA |

## 4.3.6 Sediment Loading Results for Reach Type MR-2-3-U

Two sites were sampled of reach type MR-2-3-U. This reach type is in the Middle Rockies Ecoregion, has moderate valley slope (2-4%), and includes 3$^{rd}$ order streams within unconfined valley types. Loading results are provided below in **Table 4-19**.

**Table 4-19. Sediment loading results for reach type MR-2-3-U.**

| Reach ID | Sediment Load per 1000 ft (tons/year) | | | Dominant Influence | |
|---|---|---|---|---|---|
| | Active | Slow | Total | Anthropogenic | Natural |
| BOUL 16-01 | 0.0 | 0.4 | 0.4 | | X |
| TROU 10-01 | 7.6 | 0.0 | 7.6 | X | |
| Reach Type Average | 3.8 | 0.2 | 4.0 | 7.6 | 0.4 |

## 4.3.7 Sediment Loading Results for Reach Type MR-2-4-U

One reach was sampled of reach type MR-2-4-U. This reach type is in the Middle Rockies Ecoregion, has moderate valley slope (2-4%), and includes 4$^{th}$ order streams within unconfined valley types. Loading results are provided below in **Table 4-20**.

**Table 4-20. Sediment loading results for reach type MR-2-4-U.**

| Reach ID | Sediment Load per 1000 ft (tons/year) | | | Dominant Influence | |
|---|---|---|---|---|---|
| | Active | Slow | Total | Anthropogenic | Natural |
| FLIN 17-01 | 0.0 | 0.8 | 0.8 | | X |
| Reach Type Average | 0.0 | 0.8 | 0.8 | NA | 0.8 |

### 4.3.8 Summarized Loading Results for All Reaches

**Table 4-21. Summarized BEHI sediment loads for all reaches.**

| Erosion Source | Sediment Load per 1000 Feet | | |
|---|---|---|---|
| | Active | Slow | Total |
| Predominantly Anthropogenic Average Load | 14.8 | 4.1 | 18.9 |
| Predominantly Natural Average Load | 1.2 | 2.4 | 3.6 |
| Total Average Load | 10.3 | 3.5 | 13.8 |

## 5.0 References

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# ATTACHMENT A – Flint Creek Monitoring Site Location Map

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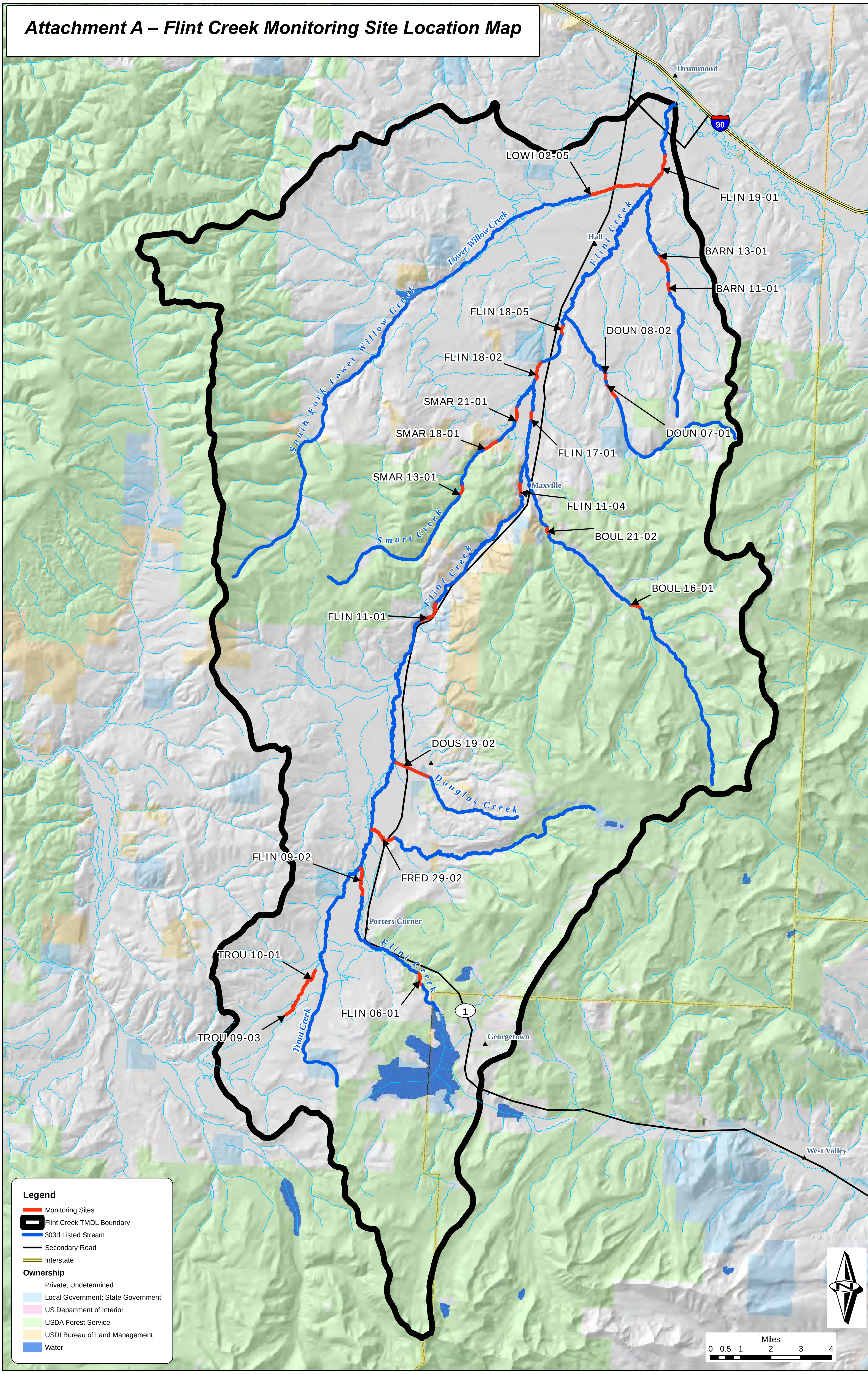

# ATTACHMENT B – Field Data Sheets

| Aerial Stratification Data | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Stream | Reach | Reach ID | Primary Ecoregion | Secondary Ecoregion | Strahler Stream Order | Confinement | Gradient | Reach Type | Break Trigger | Break Trigger Comments | Dominant Land Use | Left Bank Vegetation | Right Bank Vegetation | Length (feet) |
| Barnes Creek | 11-1 | BARN 11-01 | 17ak | 17am | 3 | U | <2 | MR-0-3-U | stream order | ag land | confined livestock | shrubs | shrubs | 1845 |
| Barnes Creek | 13-1 | BARN 13-01 | 17ak | 17am | 3 | U | <2 | MR-0-3-U | gradient | | rural residence | grass | grass | 3884 |
| Barnes Creek | 13-3 | BARN 13-03 | 17ak | 17am | 3 | U | <2 | MR-0-3-U | rip veg/land use | ag land | hay | grass | grass | 8179 |
| Boulder Creek | 16-1 | BOUL 16-01 | 17am | | 3 | U | 2-<4 | MR-2-3-U | gradient | | forest | mature coniferous | mature coniferous | 2489 |
| Boulder Creek | 21-2 | BOUL 21-02 | 17am | | 3 | U | <2 | MR-0-3-U | land use | residential start | rural residence | mature coniferous | mature coniferous | 1328 |
| Douglas Creek (north) | 7-1 | DOUN 07-01 | 17ak | 17am | 2 | U | 2-<4 | MR-2-2-U | gradient | | range | shrubs | shrubs | 3018 |
| Douglas Creek (north) | 8-2 | DOUN 08-02 | 17ak | 17am | 2 | U | <2 | MR-0-2-U | land use | irrigation | range | bare | bare | 1245 |
| Douglas Creek (south) | 19-2 | DOUS 19-02 | 17ak | 17am | 2 | U | 2-<4 | MR-2-2-U | land use | ditch begins | urban | bare | bare | 6618 |
| Flint Creek | 6-1 | FLIN 06-01 | 17am | | 2 | U | 2-<4 | MR-2-2-U | gradient | | rural residence | shrubs | mature coniferous | 2435 |
| Flint Creek | 9-2 | FLIN 09-02 | 17ak | 17am | 3 | U | <2 | MR-0-3-U | land use | ag land | hay | grass | grass | 5986 |
| Flint Creek | 11-1 | FLIN 11-01 | 17am | 17ak-17am | 4 | U | <2 | MR-0-4-U | ecoregion | | hay | grass | grass | 6486 |
| Flint Creek | 11-4 | FLIN 11-04 | 17am | 17ak-17am | 4 | U | <2 | MR-0-4-U | ecoregion | | mine | bare | mature coniferous | 2280 |
| Flint Creek | 17-1 | FLIN 17-01 | 17ak | 17am-17ak-17am | 4 | U | 2-<4 | MR-2-4-U | gradient | | hay | shrubs | shrubs | 1715 |
| Flint Creek | 18-2 | FLIN 18-02 | 17ak | 17am-17ak-17am | 4 | U | <2 | MR-0-4-U | land use | cropland | hay | shrubs | shrubs | 3677 |
| Flint Creek | 18-5 | FLIN 18-05 | 17ak | 17am-17ak-17am | 4 | U | <2 | MR-0-4-U | land use | begin ranch | rural residence | grass | shrubs | 1642 |
| Flint Creek | 19-1 | FLIN 19-01 | 17ak | 17am-17ak-17am | 5 | U | <2 | MR-0-5-U | stream order | | hay | grass | grass | 7032 |
| Fred Burr Creek | 29-2 | FRED 29-02 | 17ak | 17am | 2 | U | <2 | MR-0-2-U | rip veg/land use | ranch ends | hay | grass | grass | 6195 |
| Lower Willow Creek | 2-5 | LOWI 02-05 | 17ak | 17x | 4 | U | <2 | MR-0-4-U | riparian veg | | hay | grass | grass | 11417 |
| Smart Creek | 13-1 | SMAR 13-01 | 17am | 17x | 2 | U | 2-<4 | MR-2-2-U | confinement | | forest | mature coniferous | mature coniferous | 1864 |
| Smart Creek | 18-1 | SMAR 18-01-1 | 17ak | 17am-17x | 2 | U | <2 | MR-0-2-U | gradient | | forest | shrubs | mature coniferous | 2741 |
| Smart Creek | 18-1 | SMAR 18-01-2 | 17ak | 17am-17x | 2 | U | <2 | MR-0-2-U | gradient | | forest | shrubs | mature coniferous | 2741 |
| Smart Creek | 21-2 | SMAR 21-02 | 17ak | 17am-17x | 2 | U | <2 | MR-0-2-U | land use | end crop land | hay | grass | grass | 5352 |
| Trout Creek | 9-3 | TROU 09-03 | 17ak | 17am | 3 | U | <2 | MR-0-3-U | land use | irrigation | range | grass | grass | 8924 |
| Trout Creek | 10-1 | TROU 10-01 | 17ak | 17am | 3 | U | 2-<4 | MR-2-3-U | gradient | | hay | grass | grass | 2021 |

| Site Information | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Stream | Reach ID | Date | Reach Type | Existing Stream Type | Estimated Potential Stream Type | Downstream End Latitude | Downstream End Longitude | Upstream End Latitude | Upstream End Longitude | Site Length (Feet) | Field Slope (Percent) | Calculated Sinuosity |
| Barnes Creek | BARN 11-01 | 09/08/09 | MR-0-3-U | C4 | C4 | 46.56731 | -113.14476 | 46.56527 | -113.14401 | 1000 | 1.8 | 1.3 |
| Barnes Creek | BARN 13-01 | 09/09/09 | MR-0-3-U | E4 | E4 | 46.57840 | -113.14911 | 46.57780 | -113.14722 | 1000 | 1.5 | 1.9 |
| Barnes Creek | BARN 13-03 | 09/08/09 | MR-0-3-U | B4c | E4 | 46.59338 | -113.16063 | 46.59129 | -113.16000 | 1000 | 1.0 | 1.3 |
| Boulder Creek | BOUL 16-01 | 09/15/09 | MR-2-3-U | C3b | B3 | 46.41268 | -113.15819 | 46.41204 | -113.15488 | 1000 | 3.5 | 1.2 |
| Boulder Creek | BOUL 21-02 | 09/15/09 | MR-0-3-U | C3 | B3 | 46.44856 | -113.22076 | 46.44657 | -113.22074 | 1000 | 1.6 | 1.4 |
| Douglas Creek (north) | DOUN 07-01 | 09/11/09 | MR-2-2-U | B4 | B4 | 46.51684 | -113.18282 | 46.51361 | -113.17968 | 1000 | 2.8 | 1.0 |
| Douglas Creek (north) | DOUN 08-02 | 09/14/09 | MR-0-2-U | C4 | C4 | 46.52017 | -113.18610 | 46.51849 | -113.18466 | 1000 | 1.5 | 1.4 |
| Douglas Creek (south) | DOUS 19-02 | 09/16/09 | MR-2-2-U | E4 | E4 | 46.32859 | -113.30053 | 46.32802 | -113.29893 | 500 | 2.2 | 1.1 |
| Flint Creek | FLIN 06-01 | 09/16/09 | MR-2-2-U | C3b | B3 | 46.23042 | -113.29404 | 46.22783 | -113.29433 | 1000 | 2.3 | 1.1 |
| Flint Creek | FLIN 09-02 | 09/16/09 | MR-0-3-U | C4 | C4 | 46.26886 | -113.33697 | 46.26654 | -113.33646 | 1000 | 1.5 | 1.2 |
| Flint Creek | FLIN 11-01 | 09/14/09 | MR-0-4-U | C4 | C4 | 46.40148 | -113.30263 | 46.40034 | -113.30396 | 1000 | 1.0 | 1.9 |
| Flint Creek | FLIN 11-04 | 09/14/09 | MR-0-4-U | C3b | C3b | 46.46990 | -113.23986 | 46.46761 | -113.24050 | 1000 | 2.5 | 1.2 |
| Flint Creek | FLIN 17-01 | 09/11/09 | MR-2-4-U | C3b | C3b | 46.50417 | -113.23433 | 46.50194 | -113.23571 | 1000 | 3.2 | 1.1 |
| Flint Creek | FLIN 18-02 | 09/11/09 | MR-0-4-U | B3c | B3c | 46.52206 | -113.23361 | 46.51980 | -113.23251 | 1000 | 1.6 | 1.2 |
| Flint Creek | FLIN 18-05 | 09/09/09 | MR-0-4-U | C3 | B3c | 46.54589 | -113.21600 | 46.54367 | -113.21794 | 1000 | 1.1 | 1.1 |
| Flint Creek | FLIN 19-01 | 09/09/09 | MR-0-5-U | C4 | C4 | 46.62829 | -113.15137 | 46.62461 | -113.15215 | 1500 | 1.1 | 1.1 |
| Fred Burr Creek | FRED 29-02 | 09/16/09 | MR-0-2-U | F4 | C4 | 46.29488 | -113.31992 | 46.29553 | -113.31689 | 1000 | 1.4 | 1.3 |
| Lower Willow Creek | LOWI 02-05 | 09/15/09 | MR-0-4-U | C3 | C3 | 46.61448 | -113.17083 | 46.61391 | -113.17430 | 1000 | 1.5 | 1.1 |
| Smart Creek | SMAR 13-01 | 09/10/09 | MR-2-2-U | B4 | B4 | 46.46451 | -113.27998 | 46.46271 | -113.28158 | 1000 | 2.1 | 1.3 |
| Smart Creek | SMAR 18-01-1 | 09/10/09 | MR-0-2-U | C4b | B4 | 46.48538 | -113.26367 | 46.48472 | -113.26499 | 500 | 2.0 | 1.2 |
| Smart Creek | SMAR 18-01-2 | 09/10/09 | MR-0-2-U | B4 | B4 | 46.48484 | -113.26503 | 46.48421 | -113.26663 | 500 | 1.7 | 1.1 |
| Smart Creek | SMAR 21-01 | 09/10/09 | MR-0-2-U | F4 | E4 | 46.50000 | -113.24517 | 46.49809 | -113.24619 | 1000 | 1.6 | 1.3 |
| Trout Creek | TROU 09-03 | 09/17/09 | MR-0-3-U | E4 | E4 | 46.21495 | -113.37883 | 46.21347 | -113.38013 | 1000 | 1.1 | 1.6 |
| Trout Creek | TROU 10-01 | 09/17/09 | MR-2-3-U | C4 | C4 | 46.22948 | -113.36731 | 46.22765 | -113.36763 | 1000 | 1.3 | 1.5 |

**Channel Cross Section Data**

| Reach ID | Date | Reach Type | Cell | Latitude | Longitude | Feature | Bankfull Channel Width | Cross-Sectional Area | Bankfull Mean Depth | Width / Depth Ratio | Maximum Depth | Floodprone Width | Entrenchment Ratio |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| BARN 11-01 | 09/08/09 | MR-0-3-U | 1 | 46.56734 | -113.14473 | riffle | 14.8 | 7.6 | 0.5 | 28.7 | 1.2 | 32.8 | 2.2 |
| BARN 11-01 | 09/08/09 | MR-0-3-U | 2 | 46.56600 | -113.14462 | riffle | 15.6 | 7.5 | 0.5 | 32.6 | 1.3 | 53.6 | 3.4 |
| BARN 11-01 | 09/08/09 | MR-0-3-U | 3 | 46.56607 | -113.14449 | riffle | 14.0 | 8.5 | 0.6 | 23.0 | 1.3 | 40.0 | 2.9 |
| BARN 11-01 | 09/08/09 | MR-0-3-U | 4 | 46.56611 | -113.14430 | riffle | 10.8 | 5.6 | 0.5 | 20.8 | 1.0 | 88.8 | 8.2 |
| BARN 11-01 | 09/08/09 | MR-0-3-U | 5 | 46.56539 | -113.14423 | riffle | 9.2 | 8.5 | 0.9 | 9.9 | 1.1 | 34.2 | 3.7 |
| BARN 13-01 | 09/09/09 | MR-0-3-U | 1 | 46.57839 | -113.14915 | riffle | 6.9 | 8.3 | 1.2 | 5.8 | 1.5 | 131.9 | 19.1 |
| BARN 13-01 | 09/09/09 | MR-0-3-U | 2 | 46.57819 | -113.14894 | riffle | 5.2 | 5.7 | 1.1 | 4.8 | 1.7 | 255.2 | 49.1 |
| BARN 13-01 | 09/09/09 | MR-0-3-U | 3 | 46.57833 | -113.14811 | riffle | 6.0 | 5.3 | 0.9 | 6.8 | 1.8 | 212.0 | 35.3 |
| BARN 13-01 | 09/09/09 | MR-0-3-U | 4 | 46.57786 | -113.14764 | riffle | 6.5 | 7.1 | 1.1 | 6.0 | 1.6 | 40.5 | 6.2 |
| BARN 13-01 | 09/09/09 | MR-0-3-U | 5 | 46.57786 | -113.14727 | riffle | 7.8 | 5.4 | 0.7 | 11.4 | 1.7 | 58.8 | 7.5 |
| BARN 13-03 | 09/08/09 | MR-0-3-U | 1 | 46.59336 | -113.16065 | riffle | 8.9 | 12.2 | 1.4 | 6.5 | 2.0 | 25.9 | 2.9 |
| BARN 13-03 | 09/08/09 | MR-0-3-U | 2 | 46.59263 | -113.16093 | riffle | 7.0 | 9.5 | 1.4 | 5.1 | 1.9 | 8.5 | 1.2 |
| BARN 13-03 | 09/08/09 | MR-0-3-U | 3 | 46.59232 | -113.16074 | riffle | 8.5 | 7.1 | 0.8 | 10.1 | 1.7 | 17.0 | 2.0 |
| BARN 13-03 | 09/08/09 | MR-0-3-U | 4 | 46.59194 | -113.16041 | riffle | 8.9 | 12.1 | 1.4 | 6.6 | 2.0 | 15.9 | 1.8 |
| BARN 13-03 | 09/08/09 | MR-0-3-U | 5 | 46.59148 | -113.16008 | riffle | 12.4 | 8.5 | 0.7 | 18.1 | 1.4 | 29.4 | 2.4 |
| BOUL 16-01 | 09/15/09 | MR-2-3-U | 1 | 46.41269 | -113.15826 | riffle | 29.5 | 43.2 | 1.5 | 20.1 | 2.4 | 74.5 | 2.5 |
| BOUL 16-01 | 09/15/09 | MR-2-3-U | 2 | 46.41241 | -113.15708 | riffle | 24.0 | 39.7 | 1.7 | 14.5 | 2.3 | 48.0 | 2.0 |
| BOUL 16-01 | 09/15/09 | MR-2-3-U | 3 | 46.41276 | -113.15600 | riffle | 24.3 | 38.1 | 1.6 | 15.5 | 2.2 | 48.3 | 2.0 |
| BOUL 16-01 | 09/15/09 | MR-2-3-U | 4 | 46.41253 | -113.15585 | riffle | 32.6 | 58.3 | 1.8 | 18.2 | 2.3 | 112.6 | 3.5 |
| BOUL 16-01 | 09/15/09 | MR-2-3-U | 5 | 46.41220 | -113.15987 | riffle | 41.5 | 47.1 | 1.1 | 36.6 | 2.1 | 106.5 | 2.6 |
| BOUL 21-02 | 09/15/09 | MR-0-3-U | 1 | 46.44841 | -113.22076 | riffle | 36.9 | 58.5 | 1.6 | 23.3 | 2.4 | 69.9 | 1.9 |
| BOUL 21-02 | 09/15/09 | MR-0-3-U | 2 | 46.44796 | -113.22054 | riffle | 44.7 | 57.7 | 1.3 | 34.6 | 1.7 | 104.7 | 2.3 |
| BOUL 21-02 | 09/15/09 | MR-0-3-U | 3 | 46.44754 | -113.22009 | riffle | 36.0 | 47.5 | 1.3 | 27.3 | 2.5 | 140.0 | 3.9 |
| BOUL 21-02 | 09/15/09 | MR-0-3-U | 4 | 46.44706 | -113.22075 | riffle | 33.5 | 51.9 | 1.5 | 21.6 | 2.2 | 186.5 | 5.6 |
| BOUL 21-02 | 09/15/09 | MR-0-3-U | 5 | 46.44654 | -113.22079 | riffle | 35.0 | 53.7 | 1.5 | 22.8 | 2.2 | 215.0 | 6.1 |
| DOUN 07-01 | 09/11/09 | MR-2-2-U | 1 | 46.51570 | -113.18127 | riffle | 12.8 | 14.1 | 1.1 | 11.6 | 1.5 | 32.8 | 2.6 |
| DOUN 07-01 | 09/11/09 | MR-2-2-U | 2 | 46.51505 | -113.18091 | riffle | 14.0 | 14.1 | 1.0 | 13.9 | 1.8 | 23.0 | 1.6 |
| DOUN 07-01 | 09/11/09 | MR-2-2-U | 3 | 46.51470 | -113.18072 | riffle | 12.3 | 12.6 | 1.0 | 12.0 | 1.3 | 26.3 | 2.1 |
| DOUN 07-01 | 09/11/09 | MR-2-2-U | 4 | 46.51411 | -113.18022 | riffle | 12.4 | 13.3 | 1.1 | 11.5 | 1.3 | 17.4 | 1.4 |
| DOUN 07-01 | 09/11/09 | MR-2-2-U | 5 | 46.51386 | -113.18011 | riffle | 13.0 | 13.7 | 1.1 | 12.4 | 1.4 | 29.0 | 2.2 |
| DOUN 08-02 | 09/14/09 | MR-0-2-U | 1 | 46.52011 | -113.18613 | riffle | 20.9 | 23.3 | 1.1 | 18.8 | 1.7 | 48.9 | 2.3 |
| DOUN 08-02 | 09/14/09 | MR-0-2-U | 2 | 46.51990 | -113.18544 | riffle | 10.9 | 12.5 | 1.1 | 9.5 | 1.7 | 20.9 | 1.9 |
| DOUN 08-02 | 09/14/09 | MR-0-2-U | 3 | 46.51977 | -113.18478 | riffle | 20.0 | 20.3 | 1.0 | 19.7 | 1.5 | 50.0 | 2.5 |
| DOUN 08-02 | 09/14/09 | MR-0-2-U | 4 | 46.51925 | -113.18446 | riffle | 13.5 | 14.6 | 1.1 | 12.4 | 1.7 | 29.5 | 2.2 |
| DOUN 08-02 | 09/14/09 | MR-0-2-U | 5 | 46.51855 | -113.18473 | riffle | 11.8 | 11.5 | 1.0 | 12.1 | 2.1 | 39.3 | 3.3 |
| DOUS 19-02 | 09/16/09 | MR-2-2-U | 1 | 46.32858 | -113.30047 | riffle | 3.0 | 3.6 | 1.2 | 2.5 | 1.4 | 53.0 | 17.7 |
| DOUS 19-02 | 09/16/09 | MR-2-2-U | 2 | 46.32846 | -113.30004 | riffle | 5.8 | 5.6 | 1.0 | 6.0 | 1.4 | 6.8 | 1.2 |
| DOUS 19-02 | 09/16/09 | MR-2-2-U | 3 | 46.32827 | -113.29931 | riffle | 3.8 | 5.4 | 1.4 | 2.7 | 1.7 | 8.8 | 2.3 |
| DOUS 19-02 | 09/16/09 | MR-2-2-U | 4 | 46.32816 | -113.29924 | riffle | 5.8 | 4.6 | 0.8 | 7.4 | 1.7 | 13.8 | 2.4 |
| DOUS 19-02 | 09/16/09 | MR-2-2-U | 5 | 46.32809 | -113.29910 | riffle | 2.5 | 3.2 | 1.3 | 2.0 | 1.5 | 12.5 | 5.0 |
| FLIN 06-01 | 09/16/09 | MR-2-2-U | 1 | 46.23037 | -113.29398 | riffle | 17.8 | 33.2 | 1.9 | 9.6 | 2.5 | 172.8 | 9.7 |
| FLIN 06-01 | 09/16/09 | MR-2-2-U | 2 | 46.22964 | -113.29397 | riffle | 23.8 | 34.7 | 1.5 | 16.3 | 2.3 | 248.8 | 10.5 |
| FLIN 06-01 | 09/16/09 | MR-2-2-U | 3 | 46.22927 | -113.29392 | riffle | 21.6 | 33.3 | 1.5 | 14.0 | 2.3 | 104.6 | 4.8 |
| FLIN 06-01 | 09/16/09 | MR-2-2-U | 4 | 46.22874 | -113.29396 | riffle | 29.2 | 42.4 | 1.5 | 20.1 | 2.3 | 299.2 | 10.2 |
| FLIN 09-02 | 09/16/09 | MR-0-3-U | 1 | 46.26858 | -113.33695 | riffle | 42.2 | 37.8 | 0.9 | 47.1 | 1.9 | 252.2 | 6.0 |
| FLIN 09-02 | 09/16/09 | MR-0-3-U | 2 | 46.26808 | -113.33704 | riffle | 23.0 | 25.9 | 1.1 | 20.4 | 2.0 | 188.0 | 8.2 |
| FLIN 09-02 | 09/16/09 | MR-0-3-U | 3 | 46.26783 | -113.33727 | riffle | 36.6 | 42.1 | 1.2 | 31.8 | 1.9 | 188.6 | 5.2 |
| FLIN 09-02 | 09/16/09 | MR-0-3-U | 4 | 46.26730 | -113.33716 | riffle | 30.0 | 33.9 | 1.1 | 26.5 | 1.7 | 189.0 | 6.3 |
| FLIN 09-02 | 09/16/09 | MR-0-3-U | 5 | 46.26689 | -113.33681 | riffle | 40.5 | 37.1 | 0.9 | 44.2 | 1.8 | 200.5 | 5.0 |
| FLIN 11-01 | 09/14/09 | MR-0-4-U | 1 | 46.40149 | -113.30267 | riffle | 38.4 | 66.0 | 1.7 | 22.3 | 2.7 | 313.4 | 8.2 |
| FLIN 11-01 | 09/14/09 | MR-0-4-U | 2 | 46.40145 | -113.30346 | riffle | 40.7 | 85.7 | 2.1 | 19.3 | 2.7 | 115.7 | 2.8 |
| FLIN 11-01 | 09/14/09 | MR-0-4-U | 3 | 46.40105 | -113.30309 | riffle | 36.8 | 70.1 | 1.9 | 19.3 | 2.4 | 82.8 | 2.3 |
| FLIN 11-01 | 09/14/09 | MR-0-4-U | 5 | 46.40041 | -113.30389 | riffle | 44.0 | 91.3 | 2.1 | 21.2 | 2.6 | 149.0 | 3.4 |
| FLIN 11-04 | 09/14/09 | MR-0-4-U | 1 | 46.46981 | -113.23981 | riffle | 49.5 | 119.3 | 2.4 | 20.5 | 4.0 | 125.5 | 2.5 |
| FLIN 11-04 | 09/14/09 | MR-0-4-U | 2 | 46.46929 | -113.23988 | riffle | 57.5 | 104.7 | 1.8 | 31.6 | 3.2 | 87.5 | 1.5 |
| FLIN 11-04 | 09/14/09 | MR-0-4-U | 3 | 46.46866 | -113.24037 | riffle | 49.0 | 100.7 | 2.1 | 23.8 | 3.4 | 111.0 | 2.3 |
| FLIN 17-01 | 09/11/09 | MR-2-4-U | 1 | 46.50414 | -113.23422 | riffle | 52.1 | 103.9 | 2.0 | 26.1 | 3.1 | 130.1 | 2.5 |
| FLIN 17-01 | 09/11/09 | MR-2-4-U | 2 | 46.50354 | -113.23512 | riffle | 84.0 | 138.2 | 1.6 | 51.1 | 2.7 | 114.0 | 1.4 |
| FLIN 17-01 | 09/11/09 | MR-2-4-U | 5 | 46.50232 | -113.23582 | riffle | 52.6 | 108.9 | 2.1 | 25.4 | 3.3 | 109.6 | 2.1 |
| FLIN 18-02 | 09/11/09 | MR-0-4-U | 1 | 46.52201 | -113.23360 | riffle | 60.6 | 118.5 | 2.0 | 31.0 | 3.0 | 96.6 | 1.6 |
| FLIN 18-02 | 09/11/09 | MR-0-4-U | 3 | 46.52100 | -113.23338 | riffle | 61.3 | 130.3 | 2.1 | 28.8 | 2.8 | 156.3 | 2.5 |
| FLIN 18-02 | 09/11/09 | MR-0-4-U | 4 | 46.52058 | -113.23278 | riffle | 55.4 | 114.0 | 2.1 | 26.9 | 2.8 | 93.4 | 1.7 |
| FLIN 18-02 | 09/11/09 | MR-0-4-U | 5 | 46.52004 | -113.23255 | riffle | 50.7 | 109.1 | 2.2 | 23.6 | 2.7 | 88.7 | 1.7 |
| FLIN 18-05 | 09/09/09 | MR-0-4-U | 1 | 46.54572 | -113.21595 | riffle | 60.0 | 98.4 | 1.6 | 36.6 | 2.6 | 180.0 | 3.0 |
| FLIN 18-05 | 09/09/09 | MR-0-4-U | 2 | 46.54515 | -113.21636 | riffle | 46.2 | 80.2 | 1.7 | 26.6 | 2.4 | 66.2 | 1.4 |
| FLIN 18-05 | 09/09/09 | MR-0-4-U | 3 | 46.54465 | -113.21709 | riffle | 49.0 | 86.7 | 1.8 | 27.7 | 2.4 | 112.0 | 2.3 |
| FLIN 18-05 | 09/09/09 | MR-0-4-U | 4 | 46.54406 | -113.21742 | riffle | 47.2 | 82.6 | 1.8 | 27.0 | 2.5 | 80.2 | 1.7 |
| FLIN 18-05 | 09/09/09 | MR-0-4-U | 5 | 46.54364 | -113.21788 | riffle | 43.6 | 72.3 | 1.7 | 26.3 | 2.4 | 303.6 | 7.0 |

| Channel Cross Section Data | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Reach ID | Date | Reach Type | Cell | Latitude | Longitude | Feature | Bankfull Channel Width | Cross-Sectional Area | Bankfull Mean Depth | Width / Depth Ratio | Maximum Depth | Floodprone Width | Entrenchment Ratio |
| FLIN 19-01 | 09/09/09 | MR-0-5-U | 1 | 46.62816 | -113.15131 | riffle | 54.6 | 87.6 | 1.6 | 34.0 | 2.0 | 290.6 | 5.3 |
| FLIN 19-01 | 09/09/09 | MR-0-5-U | 2 | 46.62698 | -113.15106 | riffle | 55.0 | 96.8 | 1.8 | 31.3 | 2.5 | 276.0 | 5.0 |
| FLIN 19-01 | 09/09/09 | MR-0-5-U | 3 | 46.62601 | -113.15095 | riffle | 48.7 | 78.7 | 1.6 | 30.1 | 2.4 | 188.7 | 3.9 |
| FLIN 19-01 | 09/09/09 | MR-0-5-U | 4 | 46.62514 | 113.15154 | riffle | 42.5 | 75.4 | 1.8 | 24.0 | 2.7 | 79.5 | 1.9 |
| FLIN 19-01 | 09/09/09 | MR-0-5-U | 5 | 46.62477 | -113.15192 | riffle | 53.1 | 77.1 | 1.5 | 36.6 | 2.2 | 70.6 | 1.3 |
| FRED 29-02 | 09/16/09 | MR-0-2-U | 1 | 46.29480 | -113.31979 | riffle | 18.0 | 16.8 | 0.9 | 19.3 | 1.2 | 23.2 | 1.3 |
| FRED 29-02 | 09/16/09 | MR-0-2-U | 2 | 46.29482 | -113.31919 | riffle | 17.5 | 16.1 | 0.9 | 19.0 | 1.3 | 32.7 | 1.9 |
| FRED 29-02 | 09/16/09 | MR-0-2-U | 3 | 46.29502 | -113.31826 | riffle | 16.5 | 11.9 | 0.7 | 23.0 | 1.4 | 21.0 | 1.3 |
| FRED 29-02 | 09/16/09 | MR-0-2-U | 4 | 46.29516 | -113.31755 | riffle | 17.2 | 16.8 | 1.0 | 17.7 | 1.3 | 22.2 | 1.3 |
| FRED 29-02 | 09/16/09 | MR-0-2-U | 5 | 46.29543 | -113.31713 | riffle | 16.8 | 15.1 | 0.9 | 18.7 | 1.4 | 24.2 | 1.4 |
| LOWI 02-05 | 09/15/09 | MR-0-4-U | 1 | 46.61455 | -113.17088 | riffle | 21.4 | 27.3 | 1.3 | 16.8 | 1.9 | 191.4 | 8.9 |
| LOWI 02-05 | 09/15/09 | MR-0-4-U | 2 | 46.61412 | -113.17213 | riffle | 27.0 | 35.1 | 1.3 | 20.8 | 2.1 | 162.0 | 6.0 |
| LOWI 02-05 | 09/15/09 | MR-0-4-U | 3 | 46.61399 | -113.17240 | riffle | 18.8 | 28.1 | 1.5 | 12.6 | 2.2 | 153.8 | 8.2 |
| LOWI 02-05 | 09/15/09 | MR-0-4-U | 4 | 46.61397 | -113.17320 | riffle | 49.0 | 39.7 | 0.8 | 60.5 | 1.6 | 219.0 | 4.5 |
| LOWI 02-05 | 09/15/09 | MR-0-4-U | 5 | 46.61404 | -113.17370 | riffle | 37.0 | 40.5 | 1.1 | 33.8 | 1.9 | 199.0 | 5.4 |
| SMAR 13-01 | 09/10/09 | MR-2-2-U | 1 | 46.46448 | -113.27997 | riffle | 12.5 | 5.6 | 0.5 | 27.8 | 0.9 | 24.0 | 1.9 |
| SMAR 13-01 | 09/10/09 | MR-2-2-U | 2 | 46.46391 | -113.28060 | riffle | 7.6 | 4.8 | 0.6 | 12.0 | 0.9 | 11.6 | 1.5 |
| SMAR 13-01 | 09/10/09 | MR-2-2-U | 3 | 46.46344 | -113.28075 | riffle | 9.0 | 5.2 | 0.6 | 15.5 | 0.9 | 17.0 | 1.9 |
| SMAR 13-01 | 09/10/09 | MR-2-2-U | 4 | 46.46305 | -113.28107 | riffle | 9.0 | 6.8 | 0.8 | 12.0 | 1.3 | 19.0 | 2.1 |
| SMAR 13-01 | 09/10/09 | MR-2-2-U | 5 | 46.46278 | -113.28162 | riffle | 6.6 | 4.0 | 0.6 | 10.8 | 0.9 | 18.0 | 2.7 |
| SMAR 18-01-1 | 09/10/09 | MR-0-2-U | 1 | 46.48533 | -113.26371 | riffle | 12.7 | 7.1 | 0.6 | 22.9 | 1.2 | 82.7 | 6.5 |
| SMAR 18-01-1 | 09/10/09 | MR-0-2-U | 2 | 46.48513 | -113.26399 | riffle | 13.7 | 9.0 | 0.7 | 20.8 | 1.3 | 88.7 | 6.5 |
| SMAR 18-01-1 | 09/10/09 | MR-0-2-U | 3 | 46.48488 | -113.26447 | riffle | 20.0 | 10.9 | 0.5 | 36.6 | 1.1 | 117.0 | 5.9 |
| SMAR 18-01-1 | 09/10/09 | MR-0-2-U | 4 | 46.48498 | -113.26456 | riffle | 7.5 | 8.8 | 1.2 | 6.4 | 1.5 | 182.5 | 24.3 |
| SMAR 18-01-1 | 09/10/09 | MR-0-2-U | 5 | 46.48487 | -113.26489 | riffle | 15.0 | 10.5 | 0.7 | 21.4 | 1.0 | 150.0 | 10.0 |
| SMAR 18-01-2 | 09/10/09 | MR-0-2-U | 1 | 46.48479 | -113.26529 | riffle | 7.8 | 6.0 | 0.8 | 10.1 | 1.1 | 15.8 | 2.0 |
| SMAR 18-01-2 | 09/10/09 | MR-0-2-U | 2 | 46.48469 | -113.26555 | riffle | 9.6 | 6.7 | 0.7 | 13.8 | 1.2 | 18.1 | 1.9 |
| SMAR 18-01-2 | 09/10/09 | MR-0-2-U | 3 | 46.48466 | -113.26584 | riffle | 8.0 | 5.6 | 0.7 | 11.4 | 1.1 | 16.5 | 2.1 |
| SMAR 18-01-2 | 09/10/09 | MR-0-2-U | 4 | 46.48450 | -113.26596 | riffle | 8.0 | 5.9 | 0.7 | 10.8 | 1.1 | 15.0 | 1.9 |
| SMAR 21-01 | 09/10/09 | MR-0-2-U | 1 | 46.49998 | -113.24517 | riffle | 6.5 | 3.7 | 0.6 | 11.4 | 1.4 | 12.5 | 1.9 |
| SMAR 21-01 | 09/10/09 | MR-0-2-U | 2 | 46.49923 | -113.24541 | riffle | 6.5 | 5.2 | 0.8 | 8.2 | 1.4 | 10.5 | 1.6 |
| SMAR 21-01 | 09/10/09 | MR-0-2-U | 3 | 46.49877 | -113.24541 | riffle | 6.0 | 4.6 | 0.8 | 7.9 | 1.3 | 10.5 | 1.8 |
| SMAR 21-01 | 09/10/09 | MR-0-2-U | 4 | 46.49839 | -113.24567 | riffle | 5.1 | 4.3 | 0.8 | 6.0 | 1.3 | 10.1 | 2.0 |
| SMAR 21-01 | 09/10/09 | MR-0-2-U | 5 | 46.49813 | -113.24606 | riffle | 10.6 | 5.6 | 0.5 | 20.1 | 1.0 | 13.1 | 1.2 |
| TROU 09-03 | 09/17/09 | MR-0-3-U | 1 | 46.21471 | -113.37885 | riffle | 24.0 | 28.8 | 1.2 | 20.0 | 1.7 | 219.0 | 9.1 |
| TROU 09-03 | 09/17/09 | MR-0-3-U | 2 | 46.21432 | -113.37905 | riffle | 26.0 | 30.2 | 1.2 | 22.4 | 1.7 | 246.0 | 9.5 |
| TROU 09-03 | 09/17/09 | MR-0-3-U | 3 | 46.21404 | -113.37909 | riffle | 24.0 | 28.1 | 1.2 | 20.5 | 1.9 | 254.0 | 10.6 |
| TROU 09-03 | 09/17/09 | MR-0-3-U | 4 | 46.21359 | -113.37934 | riffle | 18.0 | 27.3 | 1.5 | 11.9 | 1.8 | 172.0 | 9.6 |
| TROU 09-03 | 09/17/09 | MR-0-3-U | 5 | 46.21354 | -113.37979 | riffle | 18.0 | 23.6 | 1.3 | 13.7 | 1.7 | 173.0 | 9.6 |
| TROU 10-01 | 09/17/09 | MR-2-3-U | 1 | 46.22899 | -113.36753 | riffle | 18.2 | 21.8 | 1.2 | 15.2 | 1.9 | 113.2 | 6.2 |
| TROU 10-01 | 09/17/09 | MR-2-3-U | 2 | 46.22890 | -113.36768 | riffle | 31.0 | 32.2 | 1.0 | 29.8 | 1.6 | 113.0 | 3.6 |
| TROU 10-01 | 09/17/09 | MR-2-3-U | 3 | 46.22858 | -113.36716 | riffle | 17.6 | 22.8 | 1.3 | 13.6 | 1.5 | 101.6 | 5.8 |
| TROU 10-01 | 09/17/09 | MR-2-3-U | 4 | 46.22828 | -113.36725 | riffle | 19.5 | 28.2 | 1.4 | 13.5 | 1.9 | 74.5 | 3.8 |
| TROU 10-01 | 09/17/09 | MR-2-3-U | 5 | 46.22773 | -113.36740 | riffle | 23.0 | 28.5 | 1.2 | 18.5 | 1.9 | 108.0 | 4.7 |

| Riffle Substrate Data | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| Reach ID | Date | Reach Type | Cell | Riffle Pebble Count D50 | Riffle Pebble Count Percent <2mm | Riffle Pebble Count Percent <6mm | Riffle Grid Toss Percent <6mm | Riffle Stability Index |
| BARN 11-01 | 09/08/09 | MR-0-3-U | 1 | 5 | 30 | 61 | 69 | |
| BARN 11-01 | 09/08/09 | MR-0-3-U | 3 | 7 | 33 | 42 | 40 | |
| BARN 11-01 | 09/08/09 | MR-0-3-U | 5 | 8 | 23 | 32 | 77 | |
| BARN 13-01 | 09/09/09 | MR-0-3-U | 1 | 7 | 6 | 32 | 25 | |
| BARN 13-01 | 09/09/09 | MR-0-3-U | 3 | 10 | 15 | 32 | 24 | |
| BARN 13-01 | 09/09/09 | MR-0-3-U | 5 | 10 | 26 | 35 | 26 | |
| BARN 13-03 | 09/08/09 | MR-0-3-U | 1 | 9 | 26 | 35 | 63 | |
| BARN 13-03 | 09/08/09 | MR-0-3-U | 3 | 11 | 7 | 12 | 16 | |
| BARN 13-03 | 09/08/09 | MR-0-3-U | 5 | 8 | 19 | 32 | 44 | |
| BOUL 16-01 | 09/15/09 | MR-2-3-U | 1 | 90 | 2 | 4 | 1 | |
| BOUL 16-01 | 09/15/09 | MR-2-3-U | 3 | 110 | 3 | 4 | 2 | |
| BOUL 16-01 | 09/15/09 | MR-2-3-U | 5 | 130 | 3 | 4 | 3 | |
| BOUL 21-02 | 09/15/09 | MR-0-3-U | 1 | 55 | 10 | 12 | 7 | |
| BOUL 21-02 | 09/15/09 | MR-0-3-U | 3 | 90 | 1 | 3 | 2 | |
| BOUL 21-02 | 09/15/09 | MR-0-3-U | 5 | 80 | 1 | 2 | 5 | |
| DOUN 07-01 | 09/11/09 | MR-2-2-U | 1 | 26 | 13 | 18 | 6 | |
| DOUN 07-01 | 09/11/09 | MR-2-2-U | 3 | 21 | 9 | 13 | 13 | |
| DOUN 07-01 | 09/11/09 | MR-2-2-U | 5 | 28 | 9 | 14 | 6 | |
| DOUN 08-02 | 09/14/09 | MR-0-2-U | 1 | 15 | 17 | 21 | 20 | |
| DOUN 08-02 | 09/14/09 | MR-0-2-U | 3 | 17 | 8 | 21 | 7 | |
| DOUN 08-02 | 09/14/09 | MR-0-2-U | 5 | 20 | 12 | 17 | 10 | |
| DOUS 19-02 | 09/16/09 | MR-2-2-U | 1 | 4 | 37 | 63 | 44 | |
| DOUS 19-02 | 09/16/09 | MR-2-2-U | 4 | 2 | 48 | 88 | 92 | |
| DOUS 19-02 | 09/16/09 | MR-2-2-U | 5 | 11 | 32 | 39 | 2 | |
| FLIN 06-01 | 09/16/09 | MR-2-2-U | 1 | 65 | 0 | 3 | 0 | |
| FLIN 06-01 | 09/16/09 | MR-2-2-U | 3 | 70 | 2 | 5 | 1 | |
| FLIN 06-01 | 09/16/09 | MR-2-2-U | 4 | 65 | 1 | 3 | 1 | |
| FLIN 09-02 | 09/16/09 | MR-0-3-U | 1 | 23 | 8 | 19 | 2 | |
| FLIN 09-02 | 09/16/09 | MR-0-3-U | 3 | 38 | 7 | 9 | 1 | |
| FLIN 09-02 | 09/16/09 | MR-0-3-U | 5 | 55 | 6 | 8 | 0 | |
| FLIN 11-01 | 09/14/09 | MR-0-4-U | 1 | 40 | 9 | 11 | 3 | |
| FLIN 11-01 | 09/14/09 | MR-0-4-U | 3 | 38 | 9 | 11 | 3 | |
| FLIN 11-01 | 09/14/09 | MR-0-4-U | 5 | 23 | 17 | 20 | 29 | |
| FLIN 11-04 | 09/14/09 | MR-0-4-U | 1 | 240 | 8 | 14 | 0 | |
| FLIN 11-04 | 09/14/09 | MR-0-4-U | 3 | 88 | 8 | 11 | 0 | |
| FLIN 17-01 | 09/11/09 | MR-2-4-U | 1 | 170 | 2 | 3 | 0 | |
| FLIN 17-01 | 09/11/09 | MR-2-4-U | 3 | 126 | 3 | 7 | | |
| FLIN 17-01 | 09/11/09 | MR-2-4-U | 5 | 115 | 3 | 7 | | |
| FLIN 18-02 | 09/11/09 | MR-0-4-U | 1 | 115 | 6 | 8 | 6 | |
| FLIN 18-02 | 09/11/09 | MR-0-4-U | 3 | 59 | 6 | 18 | 3 | |
| FLIN 18-02 | 09/11/09 | MR-0-4-U | 5 | 68 | 10 | 16 | 7 | |
| FLIN 18-05 | 09/09/09 | MR-0-4-U | 1 | 64 | 2 | 2 | 9 | |
| FLIN 18-05 | 09/09/09 | MR-0-4-U | 3 | 98 | 6 | 10 | 3 | |
| FLIN 18-05 | 09/09/09 | MR-0-4-U | 5 | 105 | 2 | 6 | 3 | |
| FLIN 19-01 | 09/09/09 | MR-0-5-U | 1 | 38 | 3 | 4 | 2 | 37 |
| FLIN 19-01 | 09/09/09 | MR-0-5-U | 3 | 64 | 4 | 8 | 4 | |
| FLIN 19-01 | 09/09/09 | MR-0-5-U | 5 | 42 | 5 | 16 | 10 | |

| Riffle Substrate Data | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **Reach ID** | **Date** | **Reach Type** | **Cell** | **Riffle Pebble Count D50** | **Riffle Pebble Count Percent <2mm** | **Riffle Pebble Count Percent <6mm** | **Riffle Grid Toss Percent <6mm** | **Riffle Stability Index** |
| FRED 29-02 | 09/16/09 | MR-0-2-U | 1 | 63 | 7 | 12 | 1 | 71 |
| FRED 29-02 | 09/16/09 | MR-0-2-U | 3 | 50 | 23 | 40 | 22 | 70 |
| FRED 29-02 | 09/16/09 | MR-0-2-U | 5 | 86 | 11 | 17 | 5 | |
| LOWI 02-05 | 09/15/09 | MR-0-4-U | 1 | 64 | 2 | 2 | 4 | |
| LOWI 02-05 | 09/15/09 | MR-0-4-U | 3 | 64 | 3 | 3 | 2 | |
| LOWI 02-05 | 09/15/09 | MR-0-4-U | 5 | 50 | 7 | 8 | 0 | |
| SMAR 13-01 | 09/10/09 | MR-2-2-U | 1 | 20 | 3 | 5 | 5 | 88 |
| SMAR 13-01 | 09/10/09 | MR-2-2-U | 3 | 24 | 5 | 10 | 3 | |
| SMAR 13-01 | 09/10/09 | MR-2-2-U | 5 | 20 | 5 | 11 | 4 | |
| SMAR 18-01-1 | 09/10/09 | MR-0-2-U | 1 | 12 | 7 | 16 | 10 | |
| SMAR 18-01-1 | 09/10/09 | MR-0-2-U | 3 | 12 | 7 | 13 | 3 | |
| SMAR 18-01-1 | 09/10/09 | MR-0-2-U | 5 | 15 | 7 | 12 | 8 | |
| SMAR 18-01-2 | 09/10/09 | MR-0-2-U | 1 | 16 | 8 | 9 | 4 | |
| SMAR 18-01-2 | 09/10/09 | MR-0-2-U | 3 | 16 | 5 | 12 | 7 | |
| SMAR 18-01-2 | 09/10/09 | MR-0-2-U | 5 | 10 | 9 | 20 | 5 | |
| SMAR 21-01 | 09/10/09 | MR-0-2-U | 1 | 15 | 13 | 17 | 10 | |
| SMAR 21-01 | 09/10/09 | MR-0-2-U | 3 | 18 | 6 | 18 | 10 | |
| SMAR 21-01 | 09/10/09 | MR-0-2-U | 5 | 13 | 10 | 19 | 12 | |
| TROU 09-03 | 09/17/09 | MR-0-3-U | 1 | 27 | 3 | 9 | 2 | |
| TROU 09-03 | 09/17/09 | MR-0-3-U | 3 | 30 | 11 | 11 | 3 | |
| TROU 09-03 | 09/17/09 | MR-0-3-U | 5 | 22 | 15 | 18 | 0 | |
| TROU 10-01 | 09/17/09 | MR-2-3-U | 1 | 49 | 5 | 13 | 2 | |
| TROU 10-01 | 09/17/09 | MR-2-3-U | 3 | 53 | 6 | 11 | 4 | |
| TROU 10-01 | 09/17/09 | MR-2-3-U | 5 | 33 | 7 | 14 | 5 | |

| Pool and Large Woody Debris Data | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Reach ID | Date | Reach Type | Cell | Mean Residual Pool Depth | Number of Pools per 1000 Feet | Number of Individual Pieces of LWD per 1000 Feet | Number of LWD Aggregates per 1000 Feet | Total Number of LWD per 1000 Feet | Number of Pools per 500 Feet | Number of Individual Pieces of LWD per 500 Feet | Number of LWD Aggregates per 500 Feet | Total Number of LWD per 500 Feet | Number of Pools per 1500 Feet | Number of Individual Pieces of LWD per 1500 Feet | Number of LWD Aggregates per 1500 Feet | Total Number of LWD per 1500 Feet |
| BARN 11-01 | 09/08/09 | MR-0-3-U | 1-5 | 0.53 | 9 | 50 | 8 | 110 | | | | | | | | |
| BARN 13-01 | 09/09/09 | MR-0-3-U | 1-5 | 0.70 | 22 | 4 | 0 | 6 | | | | | | | | |
| BARN 13-03 | 09/08/09 | MR-0-3-U | 1-5 | 0.66 | 12 | 27 | 5 | 95 | | | | | | | | |
| BOUL 16-01 | 09/15/09 | MR-2-3-U | 1-5 | 1.06 | 16 | 22 | 6 | 47 | | | | | | | | |
| BOUL 21-02 | 09/15/09 | MR-0-3-U | 1-5 | 1.18 | 7 | 22 | 8 | 63 | | | | | | | | |
| DOUN 07-01 | 09/11/09 | MR-2-2-U | 1-5 | 0.81 | 22 | 37 | 12 | 89 | | | | | | | | |
| DOUN 08-02 | 09/14/09 | MR-0-2-U | 1-5 | 0.73 | 16 | 44 | 14 | 118 | | | | | | | | |
| DOUS 19-02 | 09/16/09 | MR-2-2-U | 1-5 | 0.63 | 34 | 0 | 2 | 40 | 17 | 0 | 1 | 20 | | | | |
| FLIN 06-01 | 09/16/09 | MR-2-2-U | 1-5 | 1.15 | 4 | 21 | 2 | 83 | | | | | | | | |
| FLIN 09-02 | 09/16/09 | MR-0-3-U | 1-5 | 1.63 | 6 | 32 | 5 | 53 | | | | | | | | |
| FLIN 11-01 | 09/14/09 | MR-0-4-U | 1-5 | 1.38 | 4 | 2 | 0 | 2 | | | | | | | | |
| FLIN 11-04 | 09/14/09 | MR-0-4-U | 1-5 | 1.08 | 19 | 16 | 3 | 28 | | | | | | | | |
| FLIN 17-01 | 09/11/09 | MR-2-4-U | 1-5 | 0.80 | 15 | 26 | 2 | 31 | | | | | | | | |
| FLIN 18-02 | 09/11/09 | MR-0-4-U | 1-5 | 1.80 | 7 | 14 | 10 | 58 | | | | | | | | |
| FLIN 18-05 | 09/09/09 | MR-0-4-U | 1-5 | 1.30 | 5 | 14 | 6 | 36 | | | | | | | | |
| FLIN 19-01 | 09/09/09 | MR-0-5-U | 1-5 | 2.16 | 5 | 9 | 1 | 11 | | | | | 7 | 13 | 2 | 17 |
| FRED 29-02 | 09/16/09 | MR-0-2-U | 1-5 | 1.14 | 10 | 21 | 13 | 117 | | | | | | | | |
| LOWI 02-05 | 09/15/09 | MR-0-4-U | 1-5 | 0.88 | 5 | 1 | 2 | 8 | | | | | | | | |
| SMAR 13-01 | 09/10/09 | MR-2-2-U | 1-5 | 0.64 | 19 | 19 | 3 | 37 | | | | | | | | |
| SMAR 18-01-1 | 09/10/09 | MR-0-2-U | 1-5 | 0.72 | 22 | 40 | 4 | 120 | 11 | 20 | 2 | 60 | | | | |
| SMAR 18-01-2 | 09/10/09 | MR-0-2-U | 1-5 | 0.57 | 26 | 50 | 4 | 152 | 13 | 25 | 2 | 76 | | | | |
| SMAR 21-01 | 09/10/09 | MR-0-2-U | 1-5 | 0.59 | 17 | 4 | 2 | 11 | | | | | | | | |
| TROU 09-03 | 09/17/09 | MR-0-3-U | 1-5 | 1.45 | 4 | 0 | 0 | 0 | | | | | | | | |
| TROU 10-01 | 09/17/09 | MR-2-3-U | 1-5 | 1.25 | 7 | 0 | 0 | 0 | | | | | | | | |

| Fine Sediment in Pool Tail-outs | | | | | |
|---|---|---|---|---|---|
| Reach ID | Date | Reach Type | Cell | Pool Grid Toss Percent <6mm | Spawning Gravels Present (Y or ?) |
| BARN 13-01 | 09/09/09 | MR-0-3-U | 1 | 52 | Y |
| BARN 13-01 | 09/09/09 | MR-0-3-U | 1 | 54 | Y |
| BARN 13-01 | 09/09/09 | MR-0-3-U | 1 | 54 | Y |
| BARN 13-01 | 09/09/09 | MR-0-3-U | 2 | 13 | Y |
| BARN 13-01 | 09/09/09 | MR-0-3-U | 2 | 25 | Y |
| BARN 13-01 | 09/09/09 | MR-0-3-U | 4 | 62 | Y |
| BARN 13-01 | 09/09/09 | MR-0-3-U | 4 | 62 | Y |
| BARN 13-03 | 09/08/09 | MR-0-3-U | 1 | 25 | Y |
| BARN 13-03 | 09/08/09 | MR-0-3-U | 2 | 25 | Y |
| BARN 13-03 | 09/08/09 | MR-0-3-U | 4 | 61 | Y |
| BARN 13-03 | 09/08/09 | MR-0-3-U | 5 | 16 | Y |
| BOUL 16-01 | 09/15/09 | MR-2-3-U | 1 | 10 | Y |
| BOUL 16-01 | 09/15/09 | MR-2-3-U | 3 | 16 | Y |
| BOUL 21-02 | 09/15/09 | MR-0-3-U | 2 | 3 | Y |
| DOUN 07-01 | 09/11/09 | MR-2-2-U | 1 | 33 | Y |
| DOUN 07-01 | 09/11/09 | MR-2-2-U | 2 | 27 | Y |
| DOUN 07-01 | 09/11/09 | MR-2-2-U | 3 | 30 | Y |
| DOUN 07-01 | 09/11/09 | MR-2-2-U | 3 | 28 | Y |
| DOUN 07-01 | 09/11/09 | MR-2-2-U | 4 | 21 | Y |
| DOUN 07-01 | 09/11/09 | MR-2-2-U | 5 | 76 | ? |
| DOUN 08-02 | 09/14/09 | MR-0-2-U | 1 | 24 | Y |
| DOUN 08-02 | 09/14/09 | MR-0-2-U | 1 | 49 | Y |
| DOUN 08-02 | 09/14/09 | MR-0-2-U | 3 | 33 | Y |
| DOUN 08-02 | 09/14/09 | MR-0-2-U | 4 | 20 | Y |
| DOUN 08-02 | 09/14/09 | MR-0-2-U | 5 | 9 | Y |
| DOUN 08-02 | 09/14/09 | MR-0-2-U | 5 | 39 | Y |
| FLIN 06-01 | 09/16/09 | MR-2-2-U | 1 | 1 | Y |
| FLIN 06-01 | 09/16/09 | MR-2-2-U | 5 | 1 | Y |
| FLIN 09-02 | 09/16/09 | MR-0-3-U | 3 | 1 | Y |
| FLIN 11-01 | 09/14/09 | MR-0-4-U | 5 | 16 | Y |
| FLIN 11-04 | 09/14/09 | MR-0-4-U | 3 | 22 | Y |
| FLIN 11-04 | 09/14/09 | MR-0-4-U | 4 | 8 | Y |
| FLIN 11-04 | 09/14/09 | MR-0-4-U | 4 | 5 | Y |
| FLIN 11-04 | 09/14/09 | MR-0-4-U | 5 | 3 | Y |
| FLIN 17-01 | 09/11/09 | MR-2-4-U | 1 | 4 | Y |
| FLIN 18-02 | 09/11/09 | MR-0-4-U | 4 | 7 | Y |
| FLIN 18-02 | 09/11/09 | MR-0-4-U | 5 | 7 | Y |
| FLIN 18-05 | 09/09/09 | MR-0-4-U | 4 | 2 | Y |
| FLIN 19-01 | 09/09/09 | MR-0-5-U | 1 | 3 | Y |
| FLIN 19-01 | 09/09/09 | MR-0-5-U | 2 | 4 | ? |
| FLIN 19-01 | 09/09/09 | MR-0-5-U | 2 | 2 | Y |
| FLIN 19-01 | 09/09/09 | MR-0-5-U | 3 | 3 | Y |
| LOWI 02-05 | 09/15/09 | MR-0-4-U | 4 | 11 | Y |
| SMAR 13-01 | 09/10/09 | MR-2-2-U | 1 | 3 | Y |
| SMAR 13-01 | 09/10/09 | MR-2-2-U | 2 | 3 | Y |
| SMAR 13-01 | 09/10/09 | MR-2-2-U | 2 | 1 | Y |

no data for BARN 11-01
no data for FRED 29-02
no data for DOUS 19-02

| Fine Sediment in Pool Tail-outs | | | | | |
|---|---|---|---|---|---|
| Reach ID | Date | Reach Type | Cell | Pool Grid Toss Percent <6mm | Spawning Gravels Present (Y or ?) |
| SMAR 13-01 | 09/10/09 | MR-2-2-U | 2 | 6 | Y |
| SMAR 13-01 | 09/10/09 | MR-2-2-U | 3 | 0 | Y |
| SMAR 13-01 | 09/10/09 | MR-2-2-U | 3 | 2 | Y |
| SMAR 13-01 | 09/10/09 | MR-2-2-U | 3 | 1 | Y |
| SMAR 13-01 | 09/10/09 | MR-2-2-U | 3 | 4 | Y |
| SMAR 13-01 | 09/10/09 | MR-2-2-U | 3 | 3 | Y |
| SMAR 18-01-1 | 09/10/09 | MR-0-2-U | 1 | 7 | Y |
| SMAR 18-01-1 | 09/10/09 | MR-0-2-U | 1 | 16 | Y |
| SMAR 18-01-1 | 09/10/09 | MR-0-2-U | 2 | 11 | Y |
| SMAR 18-01-1 | 09/10/09 | MR-0-2-U | 2 | 12 | Y |
| SMAR 18-01-1 | 09/10/09 | MR-0-2-U | 2 | 37 | Y |
| SMAR 18-01-1 | 09/10/09 | MR-0-2-U | 3 | 33 | Y |
| SMAR 18-01-1 | 09/10/09 | MR-0-2-U | 3 | 26 | Y |
| SMAR 18-01-1 | 09/10/09 | MR-0-2-U | 4 | 15 | Y |
| SMAR 18-01-1 | 09/10/09 | MR-0-2-U | 4 | 26 | Y |
| SMAR 18-01-1 | 09/10/09 | MR-0-2-U | 5 | 31 | Y |
| SMAR 18-01-2 | 09/10/09 | MR-0-2-U | 1 | 31 | Y |
| SMAR 18-01-2 | 09/10/09 | MR-0-2-U | 1 | 9 | Y |
| SMAR 18-01-2 | 09/10/09 | MR-0-2-U | 2 | 7 | Y |
| SMAR 18-01-2 | 09/10/09 | MR-0-2-U | 3 | 8 | Y |
| SMAR 18-01-2 | 09/10/09 | MR-0-2-U | 3 | 16 | Y |
| SMAR 18-01-2 | 09/10/09 | MR-0-2-U | 4 | 12 | Y |
| SMAR 18-01-2 | 09/10/09 | MR-0-2-U | 4 | 19 | Y |
| SMAR 18-01-2 | 09/10/09 | MR-0-2-U | 5 | 12 | Y |
| SMAR 18-01-2 | 09/10/09 | MR-0-2-U | 5 | 5 | Y |
| SMAR 18-01-2 | 09/10/09 | MR-0-2-U | 5 | 19 | Y |
| SMAR 21-01 | 09/10/09 | MR-0-2-U | 1 | 16 | Y |
| SMAR 21-01 | 09/10/09 | MR-0-2-U | 1 | 18 | Y |
| SMAR 21-01 | 09/10/09 | MR-0-2-U | 1 | 17 | Y |
| SMAR 21-01 | 09/10/09 | MR-0-2-U | 1 | 12 | Y |
| SMAR 21-01 | 09/10/09 | MR-0-2-U | 3 | 16 | Y |
| SMAR 21-01 | 09/10/09 | MR-0-2-U | 3 | 10 | Y |
| SMAR 21-01 | 09/10/09 | MR-0-2-U | 3 | 24 | Y |
| SMAR 21-01 | 09/10/09 | MR-0-2-U | 4 | 12 | Y |
| SMAR 21-01 | 09/10/09 | MR-0-2-U | 4 | 16 | Y |
| SMAR 21-01 | 09/10/09 | MR-0-2-U | 4 | 11 | Y |
| SMAR 21-01 | 09/10/09 | MR-0-2-U | 4 | 10 | Y |
| SMAR 21-01 | 09/10/09 | MR-0-2-U | 5 | 30 | Y |
| TROU 09-03 | 09/17/09 | MR-0-3-U | 1 | 0 | Y |
| TROU 09-03 | 09/17/09 | MR-0-3-U | 2 | 4 | Y |
| TROU 09-03 | 09/17/09 | MR-0-3-U | 4 | 1 | Y |
| TROU 10-01 | 09/17/09 | MR-2-3-U | 1 | 5 | Y |
| TROU 10-01 | 09/17/09 | MR-2-3-U | 2 | 0 | Y |
| TROU 10-01 | 09/17/09 | MR-2-3-U | 5 | 1 | Y |
| TROU 10-01 | 09/17/09 | MR-2-3-U | 5 | 5 | Y |

| Riparian Greenline Data | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Reach ID | Date | Reach Type | Cell | Percent Understory Shrub Cover | Percent Bare/Disturbed Ground | Percent Riprap | Percent Overstory Canopy Cover | Right Bank Mean Riparian Zone Width | Left Bank Mean Riparian Zone Width |
| BARN 11-01 | 09/08/09 | MR-0-3-U | 1 | 90 | 0 | 0 | 63 | 34 | 43 |
| BARN 11-01 | 09/08/09 | MR-0-3-U | 2 | 75 | 0 | 0 | 43 | 68 | 29 |
| BARN 11-01 | 09/08/09 | MR-0-3-U | 3 | 18 | 13 | 0 | 43 | 1 | 1 |
| BARN 11-01 | 09/08/09 | MR-0-3-U | 4 | 0 | 28 | 0 | 18 | 0 | 0 |
| BARN 11-01 | 09/08/09 | MR-0-3-U | 5 | 20 | 38 | 0 | 23 | 0 | 0 |
| BARN 13-01 | 09/09/09 | MR-0-3-U | 1 | 25 | 0 | 0 | 0 | 1 | 1 |
| BARN 13-01 | 09/09/09 | MR-0-3-U | 2 | 0 | 0 | 0 | 0 | 0 | 0 |
| BARN 13-01 | 09/09/09 | MR-0-3-U | 3 | 10 | 0 | 0 | 0 | 0 | 0 |
| BARN 13-01 | 09/09/09 | MR-0-3-U | 4 | 25 | 0 | 0 | 0 | 0 | 0 |
| BARN 13-01 | 09/09/09 | MR-0-3-U | 5 | 5 | 0 | 0 | 0 | 0 | 0 |
| BARN 13-03 | 09/08/09 | MR-0-3-U | 1 | 75 | 0 | 0 | 58 | 45 | 14 |
| BARN 13-03 | 09/08/09 | MR-0-3-U | 2 | 88 | 0 | 0 | 25 | 63 | 18 |
| BARN 13-03 | 09/08/09 | MR-0-3-U | 3 | 55 | 0 | 0 | 55 | 125 | 45 |
| BARN 13-03 | 09/08/09 | MR-0-3-U | 4 | 65 | 0 | 0 | 60 | 126 | 40 |
| BARN 13-03 | 09/08/09 | MR-0-3-U | 5 | 3 | 0 | 0 | 0 | 88 | 43 |
| BOUL 16-01 | 09/15/09 | MR-2-3-U | 1 | 100 | 0 | 0 | 13 | 135 | 73 |
| BOUL 16-01 | 09/15/09 | MR-2-3-U | 2 | 93 | 0 | 0 | 53 | 200 | 125 |
| BOUL 16-01 | 09/15/09 | MR-2-3-U | 3 | 98 | 0 | 0 | 60 | 200 | 163 |
| BOUL 16-01 | 09/15/09 | MR-2-3-U | 4 | 93 | 0 | 0 | 83 | 200 | 200 |
| BOUL 16-01 | 09/15/09 | MR-2-3-U | 5 | 100 | 0 | 0 | 45 | 200 | 200 |
| BOUL 21-02 | 09/15/09 | MR-0-3-U | 1 | 100 | 0 | 0 | 23 | 94 | 200 |
| BOUL 21-02 | 09/15/09 | MR-0-3-U | 2 | 73 | 0 | 0 | 48 | 125 | 200 |
| BOUL 21-02 | 09/15/09 | MR-0-3-U | 3 | 78 | 0 | 0 | 30 | 100 | 200 |
| BOUL 21-02 | 09/15/09 | MR-0-3-U | 4 | 78 | 0 | 0 | 78 | 150 | 200 |
| BOUL 21-02 | 09/15/09 | MR-0-3-U | 5 | 100 | 0 | 0 | 38 | 150 | 200 |
| DOUN 07-01 | 09/11/09 | MR-2-2-U | 1 | 75 | 0 | 0 | 23 | 0 | 0 |
| DOUN 07-01 | 09/11/09 | MR-2-2-U | 2 | 80 | 0 | 0 | 10 | 3 | 3 |
| DOUN 07-01 | 09/11/09 | MR-2-2-U | 3 | 95 | 0 | 0 | 10 | 0 | 0 |
| DOUN 07-01 | 09/11/09 | MR-2-2-U | 4 | 83 | 0 | 0 | 3 | 0 | 0 |
| DOUN 07-01 | 09/11/09 | MR-2-2-U | 5 | 85 | 0 | 0 | 18 | 0 | 0 |
| DOUN 08-02 | 09/14/09 | MR-0-2-U | 1 | 45 | 3 | 0 | 0 | 3 | 0 |
| DOUN 08-02 | 09/14/09 | MR-0-2-U | 2 | 80 | 0 | 0 | 3 | 8 | 1 |
| DOUN 08-02 | 09/14/09 | MR-0-2-U | 3 | 48 | 0 | 0 | 3 | 1 | 3 |
| DOUN 08-02 | 09/14/09 | MR-0-2-U | 4 | 58 | 0 | 0 | 3 | 4 | 6 |
| DOUN 08-02 | 09/14/09 | MR-0-2-U | 5 | 75 | 0 | 0 | 15 | 8 | 3 |
| DOUS 19-02 | 09/16/09 | MR-2-2-U | 1 | 35 | 0 | 0 | 0 | 0 | 5 |
| DOUS 19-02 | 09/16/09 | MR-2-2-U | 2 | 20 | 0 | 0 | 0 | 3 | 3 |
| DOUS 19-02 | 09/16/09 | MR-2-2-U | 3 | 45 | 0 | 0 | 0 | 0 | 5 |
| DOUS 19-02 | 09/16/09 | MR-2-2-U | 4 | 50 | 0 | 0 | 35 | 3 | 5 |
| DOUS 19-02 | 09/16/09 | MR-2-2-U | 5 | 25 | 0 | 0 | 0 | 0 | 5 |
| FLIN 06-01 | 09/16/09 | MR-2-2-U | 1 | 100 | 0 | 0 | 18 | 163 | 150 |
| FLIN 06-01 | 09/16/09 | MR-2-2-U | 2 | 90 | 0 | 0 | 20 | 200 | 125 |
| FLIN 06-01 | 09/16/09 | MR-2-2-U | 3 | 100 | 0 | 0 | 38 | 200 | 100 |
| FLIN 06-01 | 09/16/09 | MR-2-2-U | 4 | 98 | 0 | 0 | 23 | 200 | 79 |
| FLIN 06-01 | 09/16/09 | MR-2-2-U | 5 | 98 | 0 | 0 | 55 | 200 | 71 |
| FLIN 09-02 | 09/16/09 | MR-0-3-U | 1 | 0 | 0 | 0 | 0 | 0 | 0 |
| FLIN 09-02 | 09/16/09 | MR-0-3-U | 2 | 5 | 0 | 0 | 5 | 5 | 0 |
| FLIN 09-02 | 09/16/09 | MR-0-3-U | 3 | 58 | 0 | 0 | 53 | 14 | 1 |
| FLIN 09-02 | 09/16/09 | MR-0-3-U | 4 | 65 | 0 | 0 | 43 | 0 | 0 |
| FLIN 09-02 | 09/16/09 | MR-0-3-U | 5 | 58 | 0 | 0 | 40 | 0 | 6 |
| FLIN 11-01 | 09/14/09 | MR-0-4-U | 1 | 0 | 0 | 0 | 0 | 0 | 0 |
| FLIN 11-01 | 09/14/09 | MR-0-4-U | 2 | 10 | 3 | 0 | 0 | 0 | 0 |
| FLIN 11-01 | 09/14/09 | MR-0-4-U | 3 | 3 | 10 | 0 | 0 | 0 | 0 |
| FLIN 11-01 | 09/14/09 | MR-0-4-U | 4 | 0 | 0 | 0 | 0 | 0 | 0 |
| FLIN 11-01 | 09/14/09 | MR-0-4-U | 5 | 0 | 0 | 0 | 0 | 3 | 0 |
| FLIN 11-04 | 09/14/09 | MR-0-4-U | 1 | 100 | 0 | 0 | 13 | 94 | 74 |
| FLIN 11-04 | 09/14/09 | MR-0-4-U | 2 | 90 | 0 | 0 | 13 | 88 | 103 |
| FLIN 11-04 | 09/14/09 | MR-0-4-U | 3 | 85 | 0 | 0 | 18 | 188 | 69 |
| FLIN 11-04 | 09/14/09 | MR-0-4-U | 4 | 95 | 0 | 0 | 23 | 200 | 36 |
| FLIN 11-04 | 09/14/09 | MR-0-4-U | 5 | 100 | 0 | 0 | 38 | 200 | 66 |

| Riparian Greenline Data | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Reach ID | Date | Reach Type | Cell | Percent Understory Shrub Cover | Percent Bare/Disturbed Ground | Percent Riprap | Percent Overstory Canopy Cover | Right Bank Mean Riparian Zone Width | Left Bank Mean Riparian Zone Width |
| FLIN 17-01 | 09/11/09 | MR-2-4-U | 1 | 63 | 0 | 0 | 55 | 78 | 74 |
| FLIN 17-01 | 09/11/09 | MR-2-4-U | 2 | 65 | 0 | 0 | 93 | 105 | 66 |
| FLIN 17-01 | 09/11/09 | MR-2-4-U | 3 | 88 | 0 | 0 | 35 | 133 | 30 |
| FLIN 17-01 | 09/11/09 | MR-2-4-U | 4 | 83 | 0 | 0 | 40 | 150 | 40 |
| FLIN 17-01 | 09/11/09 | MR-2-4-U | 5 | 80 | 0 | 0 | 88 | 96 | 124 |
| FLIN 18-02 | 09/11/09 | MR-0-4-U | 1 | 95 | 0 | 0 | 10 | 14 | 40 |
| FLIN 18-02 | 09/11/09 | MR-0-4-U | 2 | 93 | 0 | 0 | 5 | 11 | 61 |
| FLIN 18-02 | 09/11/09 | MR-0-4-U | 3 | 90 | 0 | 0 | 0 | 11 | 200 |
| FLIN 18-02 | 09/11/09 | MR-0-4-U | 4 | 100 | 0 | 0 | 3 | 14 | 200 |
| FLIN 18-02 | 09/11/09 | MR-0-4-U | 5 | 83 | 0 | 0 | 0 | 14 | 200 |
| FLIN 18-05 | 09/09/09 | MR-0-4-U | 1 | 70 | 0 | 0 | 25 | 79 | 96 |
| FLIN 18-05 | 09/09/09 | MR-0-4-U | 2 | 33 | 0 | 0 | 0 | 88 | 49 |
| FLIN 18-05 | 09/09/09 | MR-0-4-U | 3 | 65 | 0 | 0 | 8 | 123 | 34 |
| FLIN 18-05 | 09/09/09 | MR-0-4-U | 4 | 58 | 0 | 0 | 0 | 88 | 29 |
| FLIN 18-05 | 09/09/09 | MR-0-4-U | 5 | 75 | 0 | 0 | 63 | 88 | 26 |
| FLIN 19-01 | 09/09/09 | MR-0-5-U | 1 | 13 | 0 | 0 | 55 | 0 | 0 |
| FLIN 19-01 | 09/09/09 | MR-0-5-U | 2 | 8 | 0 | 0 | 10 | 0 | 0 |
| FLIN 19-01 | 09/09/09 | MR-0-5-U | 3 | 0 | 0 | 10 | 8 | 0 | 0 |
| FLIN 19-01 | 09/09/09 | MR-0-5-U | 4 | 0 | 13 | 0 | 15 | 0 | 0 |
| FLIN 19-01 | 09/09/09 | MR-0-5-U | 5 | 0 | 3 | 0 | 0 | 0 | 0 |
| FRED 29-02 | 09/16/09 | MR-0-2-U | 1 | 95 | 0 | 0 | 0 | 150 | 200 |
| FRED 29-02 | 09/16/09 | MR-0-2-U | 2 | 70 | 0 | 0 | 28 | 70 | 106 |
| FRED 29-02 | 09/16/09 | MR-0-2-U | 3 | 63 | 0 | 0 | 5 | 81 | 88 |
| FRED 29-02 | 09/16/09 | MR-0-2-U | 4 | 90 | 0 | 0 | 3 | 33 | 18 |
| FRED 29-02 | 09/16/09 | MR-0-2-U | 5 | 90 | 0 | 0 | 35 | 13 | 0 |
| LOWI 02-05 | 09/15/09 | MR-0-4-U | 1 | 0 | 0 | 0 | 0 | 0 | 0 |
| LOWI 02-05 | 09/15/09 | MR-0-4-U | 2 | 15 | 0 | 0 | 0 | 0 | 0 |
| LOWI 02-05 | 09/15/09 | MR-0-4-U | 3 | 0 | 0 | 0 | 5 | 0 | 0 |
| LOWI 02-05 | 09/15/09 | MR-0-4-U | 4 | 3 | 0 | 0 | 0 | 0 | 0 |
| LOWI 02-05 | 09/15/09 | MR-0-4-U | 5 | 0 | 0 | 0 | 0 | 0 | 0 |
| SMAR 13-01 | 09/10/09 | MR-2-2-U | 1 | 38 | 0 | 0 | 5 | 19 | 0 |
| SMAR 13-01 | 09/10/09 | MR-2-2-U | 2 | 20 | 0 | 0 | 8 | 5 | 5 |
| SMAR 13-01 | 09/10/09 | MR-2-2-U | 3 | 30 | 0 | 0 | 5 | 26 | 0 |
| SMAR 13-01 | 09/10/09 | MR-2-2-U | 4 | 48 | 0 | 0 | 13 | 63 | 0 |
| SMAR 13-01 | 09/10/09 | MR-2-2-U | 5 | 13 | 0 | 0 | 5 | 200 | 13 |
| SMAR 18-01-1 | 09/10/09 | MR-0-2-U | 1 | 75 | 0 | 0 | 0 | 0 | 0 |
| SMAR 18-01-1 | 09/10/09 | MR-0-2-U | 2 | 65 | 0 | 0 | 0 | 0 | 0 |
| SMAR 18-01-1 | 09/10/09 | MR-0-2-U | 3 | 30 | 0 | 0 | 0 | 0 | 0 |
| SMAR 18-01-1 | 09/10/09 | MR-0-2-U | 4 | 3 | 0 | 0 | 0 | 0 | 0 |
| SMAR 18-01-1 | 09/10/09 | MR-0-2-U | 5 | 40 | 40 | 0 | 0 | 0 | 0 |
| SMAR 18-01-2 | 09/10/09 | MR-0-2-U | 1 | 0 | 0 | 0 | 0 | 200 | 93 |
| SMAR 18-01-2 | 09/10/09 | MR-0-2-U | 2 | 65 | 0 | 0 | 0 | 200 | 100 |
| SMAR 18-01-2 | 09/10/09 | MR-0-2-U | 3 | 85 | 0 | 0 | 0 | 200 | 175 |
| SMAR 18-01-2 | 09/10/09 | MR-0-2-U | 4 | 30 | 0 | 0 | 0 | 200 | 163 |
| SMAR 18-01-2 | 09/10/09 | MR-0-2-U | 5 | 65 | 0 | 0 | 0 | 200 | 163 |
| SMAR 21-01 | 09/10/09 | MR-0-2-U | 1 | 0 | 0 | 0 | 0 | 0 | 0 |
| SMAR 21-01 | 09/10/09 | MR-0-2-U | 2 | 0 | 0 | 0 | 0 | 0 | 0 |
| SMAR 21-01 | 09/10/09 | MR-0-2-U | 3 | 0 | 0 | 0 | 0 | 0 | 0 |
| SMAR 21-01 | 09/10/09 | MR-0-2-U | 4 | 8 | 0 | 0 | 10 | 0 | 0 |
| SMAR 21-01 | 09/10/09 | MR-0-2-U | 5 | 13 | 0 | 0 | 38 | 0 | 0 |
| TROU 09-03 | 09/17/09 | MR-0-3-U | 1 | 3 | 0 | 0 | 0 | 0 | 0 |
| TROU 09-03 | 09/17/09 | MR-0-3-U | 2 | 0 | 0 | 0 | 0 | 0 | 0 |
| TROU 09-03 | 09/17/09 | MR-0-3-U | 3 | 0 | 0 | 0 | 0 | 0 | 0 |
| TROU 09-03 | 09/17/09 | MR-0-3-U | 4 | 5 | 0 | 0 | 0 | 0 | 0 |
| TROU 09-03 | 09/17/09 | MR-0-3-U | 5 | 0 | 0 | 0 | 0 | 0 | 0 |
| TROU 10-01 | 09/17/09 | MR-2-3-U | 1 | 0 | 0 | 0 | 0 | 0 | 0 |
| TROU 10-01 | 09/17/09 | MR-2-3-U | 2 | 0 | 0 | 0 | 0 | 0 | 0 |
| TROU 10-01 | 09/17/09 | MR-2-3-U | 3 | 0 | 0 | 0 | 0 | 0 | 0 |
| TROU 10-01 | 09/17/09 | MR-2-3-U | 4 | 0 | 0 | 0 | 0 | 0 | 0 |
| TROU 10-01 | 09/17/09 | MR-2-3-U | 5 | 0 | 0 | 0 | 0 | 0 | 0 |

**Streambank Erosion Data**

| Reach ID | Date | Reach Type | Erosion Rate | Number of Banks | Mean BEHI Score | Mean Rating | Length of Eroding Bank (Feet) | Percent of Reach with Eroding Bank | Reach Sediment Load (Tons/Year) | Total Sediment Load per 1000 Feet (Tons/Year) | Reach Transporation Load (Tons/Year) | Transporation Load (Percent) | Reach Riparian Grazing Load (Tons/Year) | Riparian Grazing Load (Percent) | Reach Cropland Load (Tons/Year) | Cropland Load (Percent) | Reach Mining Load (Tons/Year) | Mining Load (Percent) | Reach Silviculture Load (Tons/Year) | Silviculture Load (Percent) | Reach Irrigation Load (Tons/Year) | Irrigation Load (Percent) | Reach Natural Load (Tons/Year) | Natural Load (Percent) | Reach "Other" Load (Tons/Year) | "Other" Load (Percent) | Coarse Gravel >6mm Load (Tons/Year) | Coarse Gravel >6mm (Percent) | Fine Gravel 6-2mm Load (Tons/Year) | Fine Gravel 6-2mm (Percent) | Sand/Clay <2mm Load (Tons/Year) | Sand/Clay <2mm (Percent) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| BARN 11-01 | 09/08/09 | MR-0-3-U | Active | 12 | 29.0 | moderate | 338 | 16.9 | 8.4 | 8.4 | 0.0 | 0.0 | 8.0 | 95.9 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.1 | 0.6 | 0.3 | 3.5 | 0.0 | 0.0 | 0.0 | 0.0 | 0.8 | 10.0 | 7.5 | 90.0 |
| BARN 11-01 | 09/08/09 | MR-0-3-U | Slow | 1 | 36.3 | high | 6 | 0.3 | 0.2 | 0.2 | 0.0 | 0.0 | 0.2 | 100.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 10.0 | 0.2 | 90.0 |
| BARN 11-01 | 09/08/09 | MR-0-3-U | Total | 13 | 29.5 | moderate | 344 | 17.2 | 8.6 | 8.6 | 0.0 | 0.0 | 8.2 | 96.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.1 | 0.6 | 0.3 | 3.4 | 0.0 | 0.0 | 0.0 | 0.0 | 0.9 | 10.0 | 7.7 | 90.0 |
| BARN 13-01 | 09/09/09 | MR-0-3-U | Active | 5 | 26.7 | moderate | 70 | 3.5 | 1.8 | 1.8 | 0.0 | 0.0 | 1.5 | 81.2 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.3 | 18.8 | 0.0 | 0.0 | 0.0 | 0.0 | 0.2 | 10.0 | 1.7 | 90.0 |
| BARN 13-01 | 09/09/09 | MR-0-3-U | Slow | 5 | 25.7 | moderate | 43 | 2.2 | 0.7 | 0.7 | 0.0 | 0.0 | 0.6 | 77.3 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.2 | 22.7 | 0.0 | 0.0 | 0.0 | 0.0 | 0.1 | 10.0 | 0.7 | 90.0 |
| BARN 13-01 | 09/09/09 | MR-0-3-U | Total | 10 | 26.2 | moderate | 113 | 5.7 | 2.6 | 2.6 | 0.0 | 0.0 | 2.1 | 80.1 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.5 | 19.9 | 0.0 | 0.0 | 0.0 | 0.0 | 0.3 | 10.0 | 2.3 | 90.0 |
| BARN 13-03 | 09/08/09 | MR-0-3-U | Active | 6 | 31.7 | high | 64 | 3.2 | 4.0 | 4.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.4 | 10.0 | 3.6 | 90.0 | 0.0 | 0.0 | 0.4 | 10.0 | 0.4 | 10.0 | 3.2 | 80.0 |
| BARN 13-03 | 09/08/09 | MR-0-3-U | Slow | 2 | 35.9 | high | 35 | 1.8 | 2.5 | 2.5 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.2 | 7.1 | 2.3 | 92.9 | 0.0 | 0.0 | 0.3 | 10.0 | 0.3 | 10.0 | 2.0 | 80.0 |
| BARN 13-03 | 09/08/09 | MR-0-3-U | Total | 8 | 32.7 | high | 99 | 5.0 | 6.5 | 6.5 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.6 | 8.9 | 5.9 | 91.1 | 0.0 | 0.0 | 0.6 | 10.0 | 0.6 | 10.0 | 5.2 | 80.0 |
| BOUL 16-01 | 09/15/09 | MR-2-3-U | Active | 0 | | | 0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| BOUL 16-01 | 09/15/09 | MR-2-3-U | Slow | 3 | 18.6 | low | 84 | 4.2 | 0.4 | 0.4 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.4 | 100.0 | 0.0 | 0.0 | 0.2 | 66.9 | 0.0 | 10.0 | 0.1 | 23.1 |
| BOUL 16-01 | 09/15/09 | MR-2-3-U | Total | 3 | 18.6 | low | 84 | 4.2 | 0.4 | 0.4 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.4 | 100.0 | 0.0 | 0.0 | 0.2 | 66.9 | 0.0 | 10.0 | 0.1 | 23.1 |
| BOUL 21-02 | 09/15/09 | MR-0-3-U | Active | 0 | | | 0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| BOUL 21-02 | 09/15/09 | MR-0-3-U | Slow | 9 | 32.7 | high | 223 | 11.2 | 10.3 | 10.3 | 0.5 | 5.0 | 0.4 | 4.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 9.4 | 91.0 | 0.0 | 0.0 | 2.2 | 21.1 | 1.2 | 12.0 | 6.9 | 66.9 |
| BOUL 21-02 | 09/15/09 | MR-0-3-U | Total | 9 | 32.7 | high | 223 | 11.2 | 10.3 | 10.3 | 0.5 | 5.0 | 0.4 | 4.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 9.4 | 91.0 | 0.0 | 0.0 | 2.2 | 21.1 | 1.2 | 12.0 | 6.9 | 66.9 |
| DOUN 07-01 | 09/11/09 | MR-2-2-U | Active | 11 | 31.8 | high | 164 | 8.2 | 4.3 | 4.3 | 0.0 | 0.0 | 3.9 | 90.5 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.4 | 9.5 | 0.0 | 0.0 | 0.1 | 2.4 | 0.4 | 10.0 | 3.7 | 87.6 |
| DOUN 07-01 | 09/11/09 | MR-2-2-U | Slow | 7 | 33.7 | high | 90 | 4.5 | 8.8 | 8.8 | 0.0 | 0.0 | 3.5 | 39.9 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 5.3 | 60.1 | 0.0 | 0.0 | 0.0 | 0.0 | 0.9 | 10.0 | 8.0 | 90.0 |
| DOUN 07-01 | 09/11/09 | MR-2-2-U | Total | 18 | 32.5 | high | 254 | 12.7 | 13.1 | 13.1 | 0.0 | 0.0 | 7.4 | 56.4 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 5.7 | 43.6 | 0.0 | 0.0 | 0.1 | 0.8 | 1.3 | 10.0 | 11.7 | 89.2 |
| DOUN 08-02 | 09/14/09 | MR-0-2-U | Active | 8 | 34.4 | high | 186 | 9.3 | 19.2 | 19.2 | 0.0 | 0.0 | 16.8 | 87.6 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 2.4 | 12.4 | 0.0 | 0.0 | 0.0 | 0.0 | 1.9 | 10.0 | 17.3 | 90.0 |
| DOUN 08-02 | 09/14/09 | MR-0-2-U | Slow | 7 | 29.5 | moderate | 137 | 6.9 | 4.1 | 4.1 | 0.0 | 0.0 | 3.4 | 83.6 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.7 | 16.4 | 0.0 | 0.0 | 0.4 | 10.0 | 0.4 | 10.0 | 3.3 | 80.0 |
| DOUN 08-02 | 09/14/09 | MR-0-2-U | Total | 15 | 32.1 | high | 323 | 16.2 | 23.3 | 23.3 | 0.0 | 0.0 | 20.2 | 86.9 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 3.1 | 13.1 | 0.0 | 0.0 | 0.4 | 1.8 | 2.3 | 10.0 | 20.6 | 88.2 |
| DOUS 19-02 | 09/16/09 | MR-2-2-U | Active | 0 | | | 0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| DOUS 19-02 | 09/16/09 | MR-2-2-U | Slow | 20 | 31.6 | high | 314 | 31.4 | 8.0 | 16.1 | 4.0 | 50.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 4.0 | 50.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.8 | 10.0 | 7.2 | 90.0 |
| DOUS 19-02 | 09/16/09 | MR-2-2-U | Total | 20 | 31.6 | high | 314 | 31.4 | 8.0 | 16.1 | 4.0 | 50.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 4.0 | 50.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.8 | 10.0 | 7.2 | 90.0 |
| FLIN 06-01 | 09/16/09 | MR-2-2-U | Active | 3 | 42.1 | very high | 132 | 6.6 | 6.7 | 6.7 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 4.7 | 70.0 | 0.1 | 1.1 | 1.9 | 28.9 | 2.7 | 40.0 | 2.0 | 30.0 | 2.0 | 30.0 |
| FLIN 06-01 | 09/16/09 | MR-2-2-U | Slow | 4 | 25.4 | moderate | 101 | 5.1 | 4.9 | 4.9 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 3.4 | 70.0 | 0.5 | 10.0 | 1.0 | 20.0 | 1.0 | 20.0 | 0.5 | 10.0 | 3.4 | 70.0 |
| FLIN 06-01 | 09/16/09 | MR-2-2-U | Total | 7 | 32.6 | high | 233 | 11.7 | 11.6 | 11.6 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 8.1 | 70.0 | 0.6 | 4.8 | 2.9 | 25.2 | 3.7 | 31.6 | 2.5 | 21.6 | 5.4 | 46.9 |
| FLIN 09-02 | 09/16/09 | MR-0-3-U | Active | 5 | 33.2 | high | 101 | 5.1 | 3.2 | 3.2 | 0.0 | 0.0 | 2.5 | 80.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.6 | 20.0 | 0.0 | 0.0 | 0.9 | 29.0 | 0.3 | 10.0 | 1.9 | 61.0 |
| FLIN 09-02 | 09/16/09 | MR-0-3-U | Slow | 2 | 31.3 | high | 20 | 1.0 | 0.7 | 0.7 | 0.0 | 0.0 | 0.4 | 63.3 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.2 | 36.7 | 0.0 | 0.0 | 0.3 | 40.0 | 0.1 | 10.0 | 0.3 | 50.0 |
| FLIN 09-02 | 09/16/09 | MR-0-3-U | Total | 7 | 32.7 | high | 121 | 6.1 | 3.9 | 3.9 | 0.0 | 0.0 | 3.0 | 77.1 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.9 | 22.9 | 0.0 | 0.0 | 1.2 | 30.9 | 0.4 | 10.0 | 2.3 | 59.1 |
| FLIN 11-01 | 09/14/09 | MR-0-4-U | Active | 6 | 37.0 | high | 597 | 29.9 | 71.4 | 71.4 | 14.0 | 19.6 | 27.2 | 38.1 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 30.2 | 42.3 | 0.0 | 0.0 | 16.5 | 23.0 | 7.9 | 11.1 | 47.0 | 65.9 |
| FLIN 11-01 | 09/14/09 | MR-0-4-U | Slow | 3 | 33.5 | high | 119 | 6.0 | 7.4 | 7.4 | 1.0 | 13.5 | 1.5 | 20.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 4.9 | 66.5 | 0.0 | 0.0 | 0.0 | 0.0 | 0.7 | 10.0 | 6.7 | 90.0 |
| FLIN 11-01 | 09/14/09 | MR-0-4-U | Total | 9 | 35.8 | high | 716 | 35.8 | 78.8 | 78.8 | 15.0 | 19.0 | 28.7 | 36.4 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 35.1 | 44.6 | 0.0 | 0.0 | 16.5 | 20.9 | 8.6 | 11.0 | 53.7 | 68.2 |
| FLIN 11-04 | 09/14/09 | MR-0-4-U | Active | 0 | | | 0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| FLIN 11-04 | 09/14/09 | MR-0-4-U | Slow | 2 | 17.1 | low | 67 | 3.4 | 1.4 | 1.4 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 1.4 | 100.0 | 0.0 | 0.0 | 1.0 | 70.0 | 0.1 | 10.0 | 0.3 | 20.0 |
| FLIN 11-04 | 09/14/09 | MR-0-4-U | Total | 2 | 17.1 | low | 67 | 3.4 | 1.4 | 1.4 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 1.4 | 100.0 | 0.0 | 0.0 | 1.0 | 70.0 | 0.1 | 10.0 | 0.3 | 20.0 |
| FLIN 17-01 | 09/11/09 | MR-2-4-U | Active | 0 | | | 0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| FLIN 17-01 | 09/11/09 | MR-2-4-U | Slow | 8 | 11.7 | low | 200 | 10.0 | 0.8 | 0.8 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.2 | 20.0 | 0.6 | 80.0 | 0.0 | 0.0 | 0.6 | 74.5 | 0.1 | 12.7 | 0.1 | 12.7 |
| FLIN 17-01 | 09/11/09 | MR-2-4-U | Total | 8 | 11.7 | low | 200 | 10.0 | 0.8 | 0.8 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.2 | 20.0 | 0.6 | 80.0 | 0.0 | 0.0 | 0.6 | 74.5 | 0.1 | 12.7 | 0.1 | 12.7 |
| FLIN 18-02 | 09/11/09 | MR-0-4-U | Active | 0 | | | 0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| FLIN 18-02 | 09/11/09 | MR-0-4-U | Slow | 5 | 15.0 | low | 156 | 7.8 | 0.5 | 0.5 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.5 | 100.0 | 0.0 | 0.0 | 0.4 | 70.0 | 0.1 | 10.0 | 0.1 | 20.0 |
| FLIN 18-02 | 09/11/09 | MR-0-4-U | Total | 5 | 15.0 | low | 156 | 7.8 | 0.5 | 0.5 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.5 | 100.0 | 0.0 | 0.0 | 0.4 | 70.0 | 0.1 | 10.0 | 0.1 | 20.0 |
| FLIN 18-05 | 09/09/09 | MR-0-4-U | Active | 4 | 32.0 | high | 86 | 4.3 | 2.8 | 2.8 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 2.2 | 80.0 | 0.6 | 20.0 | 0.6 | 21.9 | 0.6 | 19.7 | 1.6 | 58.5 |
| FLIN 18-05 | 09/09/09 | MR-0-4-U | Slow | 3 | 18.7 | low | 132 | 6.6 | 2.5 | 2.5 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 2.1 | 84.0 | 0.4 | 16.0 | 1.8 | 70.0 | 0.3 | 10.0 | 0.5 | 20.0 |
| FLIN 18-05 | 09/09/09 | MR-0-4-U | Total | 7 | 26.3 | moderate | 218 | 10.9 | 5.3 | 5.3 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 4.4 | 81.9 | 1.0 | 18.1 | 2.4 | 44.7 | 0.8 | 15.1 | 2.1 | 40.2 |
| FLIN 19-01 | 09/09/09 | MR-0-5-U | Active | 6 | 26.3 | moderate | 569 | 19.0 | 35.3 | 23.6 | 0.0 | 0.0 | 30.5 | 86.3 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 4.9 | 13.7 | 0.0 | 0.0 | 11.1 | 31.3 | 7.1 | 20.0 | 17.2 | 48.7 |
| FLIN 19-01 | 09/09/09 | MR-0-5-U | Slow | 2 | 20.9 | moderate | 46 | 1.5 | 0.6 | 0.4 | 0.0 | 0.0 | 0.3 | 46.1 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.2 | 42.3 | 0.1 | 11.6 | 0.2 | 30.0 | 0.1 | 20.0 | 0.3 | 50.0 |
| FLIN 19-01 | 09/09/09 | MR-0-5-U | Total | 8 | 24.9 | moderate | 615 | 20.5 | 35.9 | 23.9 | 0.0 | 0.0 | 30.7 | 85.6 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 5.1 | 14.2 | 0.1 | 0.2 | 11.2 | 31.3 | 7.2 | 20.0 | 17.5 | 48.7 |
| FRED 29-02 | 09/16/09 | MR-0-2-U | Active | 3 | 38.0 | high | 110 | 5.5 | 11.7 | 11.7 | 3.2 | 27.8 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 8.4 | 72.2 | 0.0 | 0.0 | 0.9 | 7.7 | 1.2 | 10.0 | 9.6 | 82.3 |
| FRED 29-02 | 09/16/09 | MR-0-2-U | Slow | 9 | 35.2 | high | 208 | 10.4 | 16.9 | 16.9 | 9.1 | 54.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 7.8 | 46.0 | 0.0 | 0.0 | 4.3 | 25.4 | 0.9 | 5.5 | 11.7 | 69.1 |
| FRED 29-02 | 09/16/09 | MR-0-2-U | Total | 12 | 35.9 | high | 318 | 15.9 | 28.6 | 28.6 | 12.4 | 43.3 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 16.2 | 56.7 | 0.0 | 0.0 | 5.2 | 18.2 | 2.1 | 7.3 | 21.3 | 74.5 |
| LOWI 02-05 | 09/15/09 | MR-0-4-U | Active | 4 | 26.0 | moderate | 125 | 6.3 | 3.4 | 3.4 | 0.0 | 0.0 | 1.4 | 43.1 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 1.1 | 32.3 | 0.8 | 24.6 | 0.0 | 0.0 | 1.6 | 48.4 | 0.6 | 18.4 | 1.1 | 33.2 |
| LOWI 02-05 | 09/15/09 | MR-0-4-U | Slow | 2 | 22.8 | moderate | 57 | 2.9 | 0.5 | 0.5 | 0.0 | 0.0 | 0.3 | 59.3 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.2 | 40.7 | 0.0 | 0.0 | 0.0 | 0.0 | 0.1 | 20.0 | 0.1 | 20.0 | 0.3 | 60.0 |
| LOWI 02-05 | 09/15/09 | MR-0-4-U | Total | 6 | 25.0 | moderate | 182 | 9.1 | 3.9 | 3.9 | 0.0 | 0.0 | 1.8 | 45.3 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 1.3 | 33.4 | 0.8 | 21.3 | 0.0 | 0.0 | 1.7 | 44.7 | 0.7 | 18.6 | 1.4 | 36.7 |
| SMAR 13-01 | 09/10/09 | MR-2-2-U | Active | 10 | 43.3 | very high | 213 | 10.7 | 40.8 | 40.8 | 8.5 | 20.9 | 20.4 | 50.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 11.9 | 29.1 | 0.0 | 0.0 | 3.1 | 7.6 | 13.7 | 33.5 | 24.1 | 59.0 |
| SMAR 13-01 | 09/10/09 | MR-2-2-U | Slow | 0 | | | 0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| SMAR 13-01 | 09/10/09 | MR-2-2-U | Total | 10 | 43.3 | very high | 213 | 10.7 | 40.8 | 40.8 | 8.5 | 20.9 | 20.4 | 50.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 11.9 | 29.1 | 0.0 | 0.0 | 3.1 | 7.6 | 13.7 | 33.5 | 24.1 | 59.0 |
| SMAR 18-01-1 | 09/10/09 | MR-0-2-U | Active | 5 | 25.7 | moderate | 68 | 6.8 | 1.3 | 2.6 | 0.0 | 0.0 | 1.3 | 100.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.4 | 30.0 | 0.1 | 10.0 | 0.8 | 60.0 |
| SMAR 18-01-1 | 09/10/09 | MR-0-2-U | Slow | 2 | 32.3 | high | 27 | 2.7 | 1.1 | 2.3 | 0.0 | 0.0 | 1.1 | 100.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 1.1 | 100.0 |
| SMAR 18-01-1 | 09/10/09 | MR-0-2-U | Total | 7 | 27.6 | moderate | 95 | 9.5 | 2.4 | 4.9 | 0.0 | 0.0 | 2.4 | 100.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.4 | 16.1 | 0.1 | 5.4 | 1.9 | 78.6 |
| SMAR 18-01-2 | 09/10/09 | MR-0-2-U | Active | 2 | 30.1 | high | 26 | 2.6 | 1.4 | 2.7 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 1.4 | 100.0 | 0.0 | 0.0 | 0.4 | 26.5 | 0.1 | 10.0 | 0.9 | 63.5 |
| SMAR 18-01-2 | 09/10/09 | MR-0-2-U | Slow | 2 | 23.3 | moderate | 14 | 1.4 | 0.3 | 0.6 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.3 | 100.0 | 0.0 | 0.0 | 0.1 | 20.0 | 0.1 | 20.0 | 0.2 | 60.0 |
| SMAR 18-01-2 | 09/10/09 | MR-0-2-U | Total | 4 | 26.7 | moderate | 40 | 4.0 | 1.6 | 3.3 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 1.6 | 100.0 | 0.0 | 0.0 | 0.4 | 25.4 | 0.2 | 11.7 | 1.0 | 62.9 |
| SMAR 21-01 | 09/10/09 | MR-0-2-U | Active | 10 | 35.9 | high | 177 | 8.9 | 28.6 | 28.6 | 0.0 | 0.0 | 14.3 | 50.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 14.3 | 50.0 | 0.0 | 0.0 | 0.0 | 0.0 | 6.1 | 21.2 | 3.0 | 10.6 | 19.5 | 68.2 |
| SMAR 21-01 | 09/10/09 | MR-0-2-U | Slow | 2 | 41.0 | very high | 18 | 0.9 | 0.8 | 0.8 | 0.0 | 0.0 | 0.4 | 50.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.4 | 50.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.1 | 10.0 | 0.2 | 20.0 | 0.5 | 70.0 |
| SMAR 21-01 | 09/10/09 | MR-0-2-U | Total | 12 | 36.7 | high | 195 | 9.8 | 29.4 | 29.4 | 0.0 | 0.0 | 14.7 | 50.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 14.7 | 50.0 | 0.0 | 0.0 | 0.0 | 0.0 | 6.1 | 20.9 | 3.2 | 10.8 | 20.1 | 68.3 |
| TROU 09-03 | 09/17/09 | MR-0-3-U | Active | 5 | 39.2 | high | 108 | 5.4 | 3.9 | 3.9 | 0.0 | 0.0 | 3.2 | 81.5 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.7 | 18.5 | 0.0 | 0.0 | 0.4 | 10.0 | 0.0 | 0.0 | 3.5 | 90.0 |
| TROU 09-03 | 09/17/09 | MR-0-3-U | Slow | 5 | 32.3 | high | 59 | 3.0 | 2.3 | 2.3 | 0.0 | 0.0 | 0.4 | 16.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 1.9 | 84.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 2.3 | 100.0 |
| TROU 09-03 | 09/17/09 | MR-0-3-U | Total | 10 | 35.7 | high | 167 | 8.4 | 6.2 | 6.2 | 0.0 | 0.0 | 3.6 | 57.6 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 2.6 | 42.4 | 0.0 | 0.0 | 0.4 | 6.4 | 0.0 | 0.0 | 5.8 | 93.6 |
| TROU 10-01 | 09/17/09 | MR-2-3-U | Active | 2 | 39.8 | high | 79 | 4.0 | 7.6 | 7.6 | 0.0 | 0.0 | 5.3 | 70.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 2.3 | 30.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.2 | 2.0 | 0.1 | 1.0 | 7.3 | 97.0 |
| TROU 10-01 | 09/17/09 | MR-2-3-U | Slow | 0 | | | 0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| TROU 10-01 | 09/17/09 | MR-2-3-U | Total | 2 | 39.8 | high | 79 | 4.0 | 7.6 | 7.6 | 0.0 | 0.0 | 5.3 | 70.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 2.3 | 30.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.2 | 2.0 | 0.1 | 1.0 | 7.3 | 97.0 |

# ATTACHMENT C – Photo Log

**Table C-1. Photo log.**

| Stream | Reach ID | Date | Camera | Photo # | Description |
|---|---|---|---|---|---|
| Barnes Creek | BARN 13-03 | 9/8/2009 | BEHI1 | 132 | bank 1 |
| Barnes Creek | BARN 13-03 | 9/8/2009 | BEHI1 | 133 | bank 1 u/s |
| Barnes Creek | BARN 13-03 | 9/8/2009 | BEHI1 | 134 | bank 2 |
| Barnes Creek | BARN 13-03 | 9/8/2009 | BEHI1 | 135 | bank 2 d/s |
| Barnes Creek | BARN 13-03 | 9/8/2009 | BEHI1 | 136 | bank 3 |
| Barnes Creek | BARN 13-03 | 9/8/2009 | BEHI1 | 137 | bank 3 u/s |
| Barnes Creek | BARN 13-03 | 9/8/2009 | BEHI1 | 138 | bank 4 |
| Barnes Creek | BARN 13-03 | 9/8/2009 | BEHI1 | 139 | bank 4 u/s |
| Barnes Creek | BARN 13-03 | 9/8/2009 | BEHI1 | 140 | bank 5 |
| Barnes Creek | BARN 13-03 | 9/8/2009 | BEHI1 | 141 | bank 5 d/s |
| Barnes Creek | BARN 13-03 | 9/8/2009 | BEHI1 | 142 | bank 6 |
| Barnes Creek | BARN 13-03 | 9/8/2009 | BEHI1 | 143 | bank 6 d/s |
| Barnes Creek | BARN 13-03 | 9/8/2009 | BEHI1 | 144 | bank 7 |
| Barnes Creek | BARN 13-03 | 9/8/2009 | BEHI1 | 145 | bank 7 d/s |
| Barnes Creek | BARN 11-01 | 9/8/2009 | BEHI1 | 148 | bank 1 |
| Barnes Creek | BARN 11-01 | 9/8/2009 | BEHI1 | 149 | bank 1 d/s |
| Barnes Creek | BARN 11-01 | 9/8/2009 | BEHI1 | 150 | bank 2 |
| Barnes Creek | BARN 11-01 | 9/8/2009 | BEHI1 | 151 | bank 2 u/s |
| Barnes Creek | BARN 11-01 | 9/8/2009 | BEHI1 | 152 | bank 3 |
| Barnes Creek | BARN 11-01 | 9/8/2009 | BEHI1 | 153 | bank 3 u/s |
| Barnes Creek | BARN 11-01 | 9/8/2009 | BEHI1 | 154 | bank 4 |
| Barnes Creek | BARN 11-01 | 9/8/2009 | BEHI1 | 155 | bank 4 d/s |
| Barnes Creek | BARN 11-01 | 9/8/2009 | BEHI1 | 156 | bank 5 |
| Barnes Creek | BARN 11-01 | 9/8/2009 | BEHI1 | 157 | bank 5 d/s |
| Barnes Creek | BARN 11-01 | 9/8/2009 | BEHI1 | 158 | bank 6 |
| Barnes Creek | BARN 11-01 | 9/8/2009 | BEHI1 | 159 | bank 6 d/s |
| Barnes Creek | BARN 11-01 | 9/8/2009 | BEHI1 | 160 | bank 7 |
| Barnes Creek | BARN 11-01 | 9/8/2009 | BEHI1 | 161 | bank 7 u/s |
| Barnes Creek | BARN 11-01 | 9/8/2009 | BEHI1 | 162 | bank 8 |
| Barnes Creek | BARN 11-01 | 9/8/2009 | BEHI1 | 163 | bank 8 u/s |
| Barnes Creek | BARN 11-01 | 9/8/2009 | BEHI1 | 164 | cell 5 u/s view |
| Barnes Creek | BARN 11-01 | 9/8/2009 | BEHI1 | 165 | bank 9 |
| Barnes Creek | BARN 11-01 | 9/8/2009 | BEHI1 | 166 | bank 9 u/s |
| Barnes Creek | BARN 11-01 | 9/8/2009 | BEHI1 | 167 | bank 10 |
| Barnes Creek | BARN 11-01 | 9/8/2009 | BEHI1 | 168 | bank 10 u/s |
| Barnes Creek | BARN 11-01 | 9/8/2009 | BEHI1 | 169 | bank 11 |
| Barnes Creek | BARN 11-01 | 9/8/2009 | BEHI1 | 170 | bank 12 d/s |
| Barnes Creek | BARN 11-01 | 9/8/2009 | BEHI1 | 171 | bank 12 |
| Barnes Creek | BARN 11-01 | 9/8/2009 | BEHI1 | 172 | bank 13 d/s |
| Barnes Creek | BARN 11-01 | 9/8/2009 | BEHI1 | 173 | bank 13 |
| Barnes Creek | BARN 11-01 | 9/8/2009 | BEHI1 | 174 | bank 13 d/s |
| Barnes Creek | BARN 13-01 | 9/9/2009 | BEHI1 | 175 | bank 1 |
| Barnes Creek | BARN 13-01 | 9/9/2009 | BEHI1 | 176 | bank 1 d/s |
| Barnes Creek | BARN 13-01 | 9/9/2009 | BEHI1 | 177 | bank 2 |
| Barnes Creek | BARN 13-01 | 9/9/2009 | BEHI1 | 178 | bank 2 u/s |
| Barnes Creek | BARN 13-01 | 9/9/2009 | BEHI1 | 179 | bank 3 |

**Table C-1. Photo log.**

| Stream | Reach ID | Date | Camera | Photo # | Description |
|---|---|---|---|---|---|
| Barnes Creek | BARN 13-01 | 9/9/2009 | BEHI1 | 180 | bank 3 u/s |
| Barnes Creek | BARN 13-01 | 9/9/2009 | BEHI1 | 181 | bank 4 |
| Barnes Creek | BARN 13-01 | 9/9/2009 | BEHI1 | 182 | bank 4 d/s |
| Barnes Creek | BARN 13-01 | 9/9/2009 | BEHI1 | 183 | bank 4 |
| Barnes Creek | BARN 13-01 | 9/9/2009 | BEHI1 | 184 | bank 5 |
| Barnes Creek | BARN 13-01 | 9/9/2009 | BEHI1 | 185 | bank 5 d/s |
| Barnes Creek | BARN 13-01 | 9/9/2009 | BEHI1 | 186 | bank 6 |
| Barnes Creek | BARN 13-01 | 9/9/2009 | BEHI1 | 187 | bank 6 d/s |
| Barnes Creek | BARN 13-01 | 9/9/2009 | BEHI1 | 188 | bank 8 |
| Barnes Creek | BARN 13-01 | 9/9/2009 | BEHI1 | 189 | bank 8 u/s |
| Barnes Creek | BARN 13-01 | 9/9/2009 | BEHI1 | 190 | bank 9 |
| Barnes Creek | BARN 13-01 | 9/9/2009 | BEHI1 | 191 | bank 9 u/s |
| Barnes Creek | BARN 13-01 | 9/9/2009 | BEHI1 | 192 | bank 10 |
| Barnes Creek | BARN 13-01 | 9/9/2009 | BEHI1 | 193 | bank 10 u/s |
| Flint Creek | FLIN 18-05 | 9/9/2009 | BEHI1 | 194 | bank 1 |
| Flint Creek | FLIN 18-05 | 9/9/2009 | BEHI1 | 195 | bank 1 d/s |
| Flint Creek | FLIN 18-05 | 9/9/2009 | BEHI1 | 196 | bank 2 |
| Flint Creek | FLIN 18-05 | 9/9/2009 | BEHI1 | 197 | bank 2 d/s |
| Flint Creek | FLIN 18-05 | 9/9/2009 | BEHI1 | 198 | bank 3 |
| Flint Creek | FLIN 18-05 | 9/9/2009 | BEHI1 | 199 | bank 3 d/s |
| Flint Creek | FLIN 18-05 | 9/9/2009 | BEHI1 | 200 | bank 4 |
| Flint Creek | FLIN 18-05 | 9/9/2009 | BEHI1 | 201 | bank 4 d/s |
| Flint Creek | FLIN 18-05 | 9/9/2009 | BEHI1 | 202 | bank 5 |
| Flint Creek | FLIN 18-05 | 9/9/2009 | BEHI1 | 203 | bank 5 d/s |
| Flint Creek | FLIN 18-05 | 9/9/2009 | BEHI1 | 204 | bank 6 |
| Flint Creek | FLIN 18-05 | 9/9/2009 | BEHI1 | 205 | bank 6 d/s |
| Flint Creek | FLIN 18-05 | 9/9/2009 | BEHI1 | 206 | bank 7 |
| Flint Creek | FLIN 18-05 | 9/9/2009 | BEHI1 | 207 | bank 7 d/s |
| Flint Creek | FLIN 19-01 | 9/9/2009 | BEHI1 | 208 | bank 1 |
| Flint Creek | FLIN 19-01 | 9/9/2009 | BEHI1 | 209 | bank 1 d/s |
| Flint Creek | FLIN 19-01 | 9/9/2009 | BEHI1 | 210 | bank 2 |
| Flint Creek | FLIN 19-01 | 9/9/2009 | BEHI1 | 211 | bank 2 d/s |
| Flint Creek | FLIN 19-01 | 9/9/2009 | BEHI1 | 212 | bank 3 |
| Flint Creek | FLIN 19-01 | 9/9/2009 | BEHI1 | 213 | bank 3 d/s |
| Flint Creek | FLIN 19-01 | 9/9/2009 | BEHI1 | 214 | bank 4 |
| Flint Creek | FLIN 19-01 | 9/9/2009 | BEHI1 | 215 | bank 4 d/s |
| Flint Creek | FLIN 19-01 | 9/9/2009 | BEHI1 | 216 | bank 5 |
| Flint Creek | FLIN 19-01 | 9/9/2009 | BEHI1 | 217 | bank 5 d/s |
| Flint Creek | FLIN 19-01 | 9/9/2009 | BEHI1 | 218 | bank 6 |
| Flint Creek | FLIN 19-01 | 9/9/2009 | BEHI1 | 219 | bank 6 d/s |
| Flint Creek | FLIN 19-01 | 9/9/2009 | BEHI1 | 220 | bank 7 |
| Flint Creek | FLIN 19-01 | 9/9/2009 | BEHI1 | 221 | bank 7 d/s |
| Flint Creek | FLIN 19-01 | 9/9/2009 | BEHI1 | 222 | bank 8 |
| Flint Creek | FLIN 19-01 | 9/9/2009 | BEHI1 | 223 | bank 8 d/s |
| Smart Creek | SMAR 13-01 | 9/10/2009 | BEHI1 | 224 | bank 1 |
| Smart Creek | SMAR 13-01 | 9/10/2009 | BEHI1 | 225 | bank 1 d/s |

**Table C-1. Photo log.**

| Stream | Reach ID | Date | Camera | Photo # | Description |
|---|---|---|---|---|---|
| Smart Creek | SMAR 13-01 | 9/10/2009 | BEHI1 | 226 | bank 2 |
| Smart Creek | SMAR 13-01 | 9/10/2009 | BEHI1 | 227 | bank 2 d/s |
| Smart Creek | SMAR 13-01 | 9/10/2009 | BEHI1 | 228 | bank 3 |
| Smart Creek | SMAR 13-01 | 9/10/2009 | BEHI1 | 229 | bank 3 d/s |
| Smart Creek | SMAR 13-01 | 9/10/2009 | BEHI1 | 230 | bank 4 |
| Smart Creek | SMAR 13-01 | 9/10/2009 | BEHI1 | 231 | bank 4 d/s |
| Smart Creek | SMAR 13-01 | 9/10/2009 | BEHI1 | 232 | bank 5 |
| Smart Creek | SMAR 13-01 | 9/10/2009 | BEHI1 | 233 | bank 5 d/s |
| Smart Creek | SMAR 13-01 | 9/10/2009 | BEHI1 | 234 | bank 6 |
| Smart Creek | SMAR 13-01 | 9/10/2009 | BEHI1 | 235 | bank 6 d/s |
| Smart Creek | SMAR 13-01 | 9/10/2009 | BEHI1 | 236 | bank 7 |
| Smart Creek | SMAR 13-01 | 9/10/2009 | BEHI1 | 237 | bank 7 d/s |
| Smart Creek | SMAR 13-01 | 9/10/2009 | BEHI1 | 238 | bank 8 |
| Smart Creek | SMAR 13-01 | 9/10/2009 | BEHI1 | 239 | bank 8 d/s |
| Smart Creek | SMAR 13-01 | 9/10/2009 | BEHI1 | 240 | bank 9 |
| Smart Creek | SMAR 13-01 | 9/10/2009 | BEHI1 | 241 | bank 9 d/s |
| Smart Creek | SMAR 13-01 | 9/10/2009 | BEHI1 | 242 | bank 10 |
| Smart Creek | SMAR 13-01 | 9/10/2009 | BEHI1 | 243 | bank 10 d/s |
| Smart Creek | SMAR 18-01-01 | 9/10/2009 | BEHI1 | 244 | bank 1 |
| Smart Creek | SMAR 18-01-01 | 9/10/2009 | BEHI1 | 245 | bank 1 d/s |
| Smart Creek | SMAR 18-01-01 | 9/10/2009 | BEHI1 | 246 | bank 2 |
| Smart Creek | SMAR 18-01-01 | 9/10/2009 | BEHI1 | 247 | bank 2 d/s |
| Smart Creek | SMAR 18-01-01 | 9/10/2009 | BEHI1 | 248 | bank 3 |
| Smart Creek | SMAR 18-01-01 | 9/10/2009 | BEHI1 | 249 | bank 3 d/s |
| Smart Creek | SMAR 18-01-01 | 9/10/2009 | BEHI1 | 250 | bank 4 |
| Smart Creek | SMAR 18-01-01 | 9/10/2009 | BEHI1 | 251 | bank 4 d/s |
| Smart Creek | SMAR 18-01-01 | 9/10/2009 | BEHI1 | 252 | bank 5 |
| Smart Creek | SMAR 18-01-01 | 9/10/2009 | BEHI1 | 253 | bank 5 d/s |
| Smart Creek | SMAR 18-01-01 | 9/10/2009 | BEHI1 | 254 | bank 6 |
| Smart Creek | SMAR 18-01-01 | 9/10/2009 | BEHI1 | 255 | bank 6 d/s |
| Smart Creek | SMAR 18-01-01 | 9/10/2009 | BEHI1 | 256 | bank 7 |
| Smart Creek | SMAR 18-01-01 | 9/10/2009 | BEHI1 | 257 | bank 7 u/s |
| Smart Creek | SMAR 18-01-02 | 9/10/2009 | BEHI1 | 258 | bank 1 |
| Smart Creek | SMAR 18-01-02 | 9/10/2009 | BEHI1 | 259 | bank 1 d/s |
| Smart Creek | SMAR 18-01-02 | 9/10/2009 | BEHI1 | 260 | bank 2 |
| Smart Creek | SMAR 18-01-02 | 9/10/2009 | BEHI1 | 261 | bank 2 d/s |
| Smart Creek | SMAR 18-01-02 | 9/10/2009 | BEHI1 | 262 | bank 3 |
| Smart Creek | SMAR 18-01-02 | 9/10/2009 | BEHI1 | 263 | bank 3 d/s |
| Smart Creek | SMAR 18-01-02 | 9/10/2009 | BEHI1 | 264 | bank 4 |
| Smart Creek | SMAR 18-01-02 | 9/10/2009 | BEHI1 | 265 | bank 4 d/s |
| Smart Creek | SMAR 18-01-02 | 9/10/2009 | BEHI1 | 266 | log jam and sediment at 411' |
| Smart Creek | SMAR 18-01-02 | 9/10/2009 | BEHI1 | 267 | log jam and sediment at 411' |
| Smart Creek | SMAR 18-01-02 | 9/10/2009 | BEHI1 | 268 | log jam and sediment at 411' |
| Smart Creek | SMAR 18-01-02 | 9/10/2009 | BEHI1 | 269 | log jam and sediment at 411' |
| Smart Creek | SMAR 21-01 | 9/10/2009 | BEHI1 | 270 | bank 1 |
| Smart Creek | SMAR 21-01 | 9/10/2009 | BEHI1 | 271 | bank 1 d/s |

**Table C-1. Photo log.**

| Stream | Reach ID | Date | Camera | Photo # | Description |
|---|---|---|---|---|---|
| Smart Creek | SMAR 21-01 | 9/10/2009 | BEHI1 | 272 | bank 2 |
| Smart Creek | SMAR 21-01 | 9/10/2009 | BEHI1 | 273 | bank 2 d/s |
| Smart Creek | SMAR 21-01 | 9/10/2009 | BEHI1 | 274 | bank 3 |
| Smart Creek | SMAR 21-01 | 9/10/2009 | BEHI1 | 275 | bank 3 d/s |
| Smart Creek | SMAR 21-01 | 9/10/2009 | BEHI1 | 276 | bank 4 |
| Smart Creek | SMAR 21-01 | 9/10/2009 | BEHI1 | 277 | bank 4 d/s |
| Smart Creek | SMAR 21-01 | 9/10/2009 | BEHI1 | 278 | bank 5 |
| Smart Creek | SMAR 21-01 | 9/10/2009 | BEHI1 | 279 | bank 5 d/s |
| Smart Creek | SMAR 21-01 | 9/10/2009 | BEHI1 | 280 | bank 6 |
| Smart Creek | SMAR 21-01 | 9/10/2009 | BEHI1 | 281 | bank 6 d/s |
| Smart Creek | SMAR 21-01 | 9/10/2009 | BEHI1 | 282 | bank 7 |
| Smart Creek | SMAR 21-01 | 9/10/2009 | BEHI1 | 283 | bank 7 d/s |
| Smart Creek | SMAR 21-01 | 9/10/2009 | BEHI1 | 284 | bank 8 |
| Smart Creek | SMAR 21-01 | 9/10/2009 | BEHI1 | 285 | bank 8 d/s |
| Smart Creek | SMAR 21-01 | 9/10/2009 | BEHI1 | 286 | bank 9 |
| Smart Creek | SMAR 21-01 | 9/10/2009 | BEHI1 | 287 | bank 9 d/s |
| Smart Creek | SMAR 21-01 | 9/10/2009 | BEHI1 | 288 | bank 10 |
| Smart Creek | SMAR 21-01 | 9/10/2009 | BEHI1 | 289 | bank 10 d/s |
| Smart Creek | SMAR 21-01 | 9/10/2009 | BEHI1 | 290 | bank 11 |
| Smart Creek | SMAR 21-01 | 9/10/2009 | BEHI1 | 291 | bank 11 d/s |
| Smart Creek | SMAR 21-01 | 9/10/2009 | BEHI1 | 292 | bank 12 |
| Smart Creek | SMAR 21-01 | 9/10/2009 | BEHI1 | 293 | bank 12 d/s |
| Flint Creek | FLIN 17-01 | 9/11/2009 | BEHI1 | 294 | bank 1 |
| Flint Creek | FLIN 17-01 | 9/11/2009 | BEHI1 | 295 | bank 1 d/s |
| Flint Creek | FLIN 17-01 | 9/11/2009 | BEHI1 | 296 | bank 3 |
| Flint Creek | FLIN 17-01 | 9/11/2009 | BEHI1 | 297 | bank 4 |
| Flint Creek | FLIN 17-01 | 9/11/2009 | BEHI1 | 298 | bank 5 |
| Flint Creek | FLIN 17-01 | 9/11/2009 | BEHI1 | 299 | bank 5 |
| Flint Creek | FLIN 17-01 | 9/11/2009 | BEHI1 | 300 | bank 6 |
| Flint Creek | FLIN 17-01 | 9/11/2009 | BEHI1 | 301 | bank 6 d/s |
| Flint Creek | FLIN 17-01 | 9/11/2009 | BEHI1 | 302 | bank 7 |
| Flint Creek | FLIN 17-01 | 9/11/2009 | BEHI1 | 303 | bank 8 |
| Flint Creek | FLIN 17-01 | 9/11/2009 | BEHI1 | 304 | bank 8 d/s |
| Flint Creek | FLIN 18-02 | 9/11/2009 | BEHI1 | 305 | bank 1 |
| Flint Creek | FLIN 18-02 | 9/11/2009 | BEHI1 | 306 | bank 1 d/s |
| Flint Creek | FLIN 18-02 | 9/11/2009 | BEHI1 | 307 | bank 2 u/s |
| Flint Creek | FLIN 18-02 | 9/11/2009 | BEHI1 | 308 | bank 2 |
| Flint Creek | FLIN 18-02 | 9/11/2009 | BEHI1 | 309 | bank 3 |
| Flint Creek | FLIN 18-02 | 9/11/2009 | BEHI1 | 310 | bank 3 d/s |
| Flint Creek | FLIN 18-02 | 9/11/2009 | BEHI1 | 311 | bank 4 |
| Flint Creek | FLIN 18-02 | 9/11/2009 | BEHI1 | 312 | bank 4 d/s |
| Flint Creek | FLIN 18-02 | 9/11/2009 | BEHI1 | 313 | bank 5 |
| Flint Creek | FLIN 18-02 | 9/11/2009 | BEHI1 | 314 | bank 5 d/s |
| Douglas Creek (north) | DOUN 07-01 | 9/11/2009 | BEHI1 | 315 | bank 1 |
| Douglas Creek (north) | DOUN 07-01 | 9/11/2009 | BEHI1 | 316 | bank 1 d/s |
| Douglas Creek (north) | DOUN 07-01 | 9/11/2009 | BEHI1 | 317 | bank 2 |

**Table C-1. Photo log.**

| Stream | Reach ID | Date | Camera | Photo # | Description |
|---|---|---|---|---|---|
| Douglas Creek (north) | DOUN 07-01 | 9/11/2009 | BEHI1 | 318 | bank 2 d/s |
| Douglas Creek (north) | DOUN 07-01 | 9/11/2009 | BEHI1 | 319 | bank 2 d/s second shot |
| Douglas Creek (north) | DOUN 07-01 | 9/11/2009 | BEHI1 | 320 | bank 3 |
| Douglas Creek (north) | DOUN 07-01 | 9/11/2009 | BEHI1 | 321 | bank 3 d/s |
| Douglas Creek (north) | DOUN 07-01 | 9/11/2009 | BEHI1 | 322 | bank 4 |
| Douglas Creek (north) | DOUN 07-01 | 9/11/2009 | BEHI1 | 323 | bank 4 d/s |
| Douglas Creek (north) | DOUN 07-01 | 9/11/2009 | BEHI1 | 324 | bank 5 |
| Douglas Creek (north) | DOUN 07-01 | 9/11/2009 | BEHI1 | 325 | bank 5 u/s |
| Douglas Creek (north) | DOUN 07-01 | 9/11/2009 | BEHI1 | 326 | bank 7 |
| Douglas Creek (north) | DOUN 07-01 | 9/11/2009 | BEHI1 | 327 | bank 7 d/s |
| Douglas Creek (north) | DOUN 07-01 | 9/11/2009 | BEHI1 | 328 | bank 8 |
| Douglas Creek (north) | DOUN 07-01 | 9/11/2009 | BEHI1 | 329 | bank 8 d/s |
| Douglas Creek (north) | DOUN 07-01 | 9/11/2009 | BEHI1 | 330 | bank 9 |
| Douglas Creek (north) | DOUN 07-01 | 9/11/2009 | BEHI1 | 331 | bank 9 d/s |
| Douglas Creek (north) | DOUN 07-01 | 9/11/2009 | BEHI1 | 332 | bank 10 |
| Douglas Creek (north) | DOUN 07-01 | 9/11/2009 | BEHI1 | 333 | bank 10 d/s |
| Douglas Creek (north) | DOUN 07-01 | 9/11/2009 | BEHI1 | 334 | bank 11 |
| Douglas Creek (north) | DOUN 07-01 | 9/11/2009 | BEHI1 | 335 | bank 11 d/s |
| Douglas Creek (north) | DOUN 07-01 | 9/11/2009 | BEHI1 | 336 | bank 12 |
| Douglas Creek (north) | DOUN 07-01 | 9/11/2009 | BEHI1 | 337 | bank 12 d/s |
| Douglas Creek (north) | DOUN 07-01 | 9/11/2009 | BEHI1 | 338 | bank 13 |
| Douglas Creek (north) | DOUN 07-01 | 9/11/2009 | BEHI1 | 339 | bank 13 d/s |
| Douglas Creek (north) | DOUN 07-01 | 9/11/2009 | BEHI1 | 340 | bank 14 |
| Douglas Creek (north) | DOUN 07-01 | 9/11/2009 | BEHI1 | 341 | bank 14 d/s |
| Douglas Creek (north) | DOUN 07-01 | 9/11/2009 | BEHI1 | 342 | bank 15 |
| Douglas Creek (north) | DOUN 07-01 | 9/11/2009 | BEHI1 | 343 | bank 15 d/s |
| Douglas Creek (north) | DOUN 07-01 | 9/11/2009 | BEHI1 | 344 | bank 16 |
| Douglas Creek (north) | DOUN 07-01 | 9/11/2009 | BEHI1 | 345 | bank 16 d/s |
| Douglas Creek (north) | DOUN 07-01 | 9/11/2009 | BEHI1 | 346 | bank 17 |
| Douglas Creek (north) | DOUN 07-01 | 9/11/2009 | BEHI1 | 347 | bank 17 d/s |
| Douglas Creek (north) | DOUN 07-01 | 9/11/2009 | BEHI1 | 348 | bank 18 |
| Douglas Creek (north) | DOUN 07-01 | 9/11/2009 | BEHI1 | 349 | bank 18 d/s |
| Douglas Creek (north) | DOUN 08-02 | 9/14/2009 | BEHI1 | 350 | bank 1 |
| Douglas Creek (north) | DOUN 08-02 | 9/14/2009 | BEHI1 | 351 | bank 1 d/s |
| Douglas Creek (north) | DOUN 08-02 | 9/14/2009 | BEHI1 | 352 | bank 2 |
| Douglas Creek (north) | DOUN 08-02 | 9/14/2009 | BEHI1 | 353 | bank 2 d/s |
| Douglas Creek (north) | DOUN 08-02 | 9/14/2009 | BEHI1 | 354 | bank 3 |
| Douglas Creek (north) | DOUN 08-02 | 9/14/2009 | BEHI1 | 355 | bank 3 d/s |
| Douglas Creek (north) | DOUN 08-02 | 9/14/2009 | BEHI1 | 356 | bank 4 |
| Douglas Creek (north) | DOUN 08-02 | 9/14/2009 | BEHI1 | 357 | bank 4 u/s |
| Douglas Creek (north) | DOUN 08-02 | 9/14/2009 | BEHI1 | 358 | bank 5 |
| Douglas Creek (north) | DOUN 08-02 | 9/14/2009 | BEHI1 | 359 | bank 5 d/s |
| Douglas Creek (north) | DOUN 08-02 | 9/14/2009 | BEHI1 | 360 | bank 6 |
| Douglas Creek (north) | DOUN 08-02 | 9/14/2009 | BEHI1 | 361 | bank 6 u/s |
| Douglas Creek (north) | DOUN 08-02 | 9/14/2009 | BEHI1 | 362 | bank 7 |
| Douglas Creek (north) | DOUN 08-02 | 9/14/2009 | BEHI1 | 363 | bank 7 u/s |

**Table C-1. Photo log.**

| Stream | Reach ID | Date | Camera | Photo # | Description |
|---|---|---|---|---|---|
| Douglas Creek (north) | DOUN 08-02 | 9/14/2009 | BEHI1 | 364 | bank 8 |
| Douglas Creek (north) | DOUN 08-02 | 9/14/2009 | BEHI1 | 365 | bank 8 u/s |
| Douglas Creek (north) | DOUN 08-02 | 9/14/2009 | BEHI1 | 366 | bank 9 |
| Douglas Creek (north) | DOUN 08-02 | 9/14/2009 | BEHI1 | 367 | bank 9 d/s |
| Douglas Creek (north) | DOUN 08-02 | 9/14/2009 | BEHI1 | 368 | bank 10 |
| Douglas Creek (north) | DOUN 08-02 | 9/14/2009 | BEHI1 | 369 | bank 10 u/s |
| Douglas Creek (north) | DOUN 08-02 | 9/14/2009 | BEHI1 | 370 | bank 11 |
| Douglas Creek (north) | DOUN 08-02 | 9/14/2009 | BEHI1 | 371 | bank 11 d/s |
| Douglas Creek (north) | DOUN 08-02 | 9/14/2009 | BEHI1 | 372 | bank 12 |
| Douglas Creek (north) | DOUN 08-02 | 9/14/2009 | BEHI1 | 373 | bank 12 d/s |
| Douglas Creek (north) | DOUN 08-02 | 9/14/2009 | BEHI1 | 374 | bank 13 |
| Douglas Creek (north) | DOUN 08-02 | 9/14/2009 | BEHI1 | 375 | bank 13 d/s |
| Douglas Creek (north) | DOUN 08-02 | 9/14/2009 | BEHI1 | 376 | bank 14 |
| Douglas Creek (north) | DOUN 08-02 | 9/14/2009 | BEHI1 | 377 | bank 14 d/s |
| Douglas Creek (north) | DOUN 08-02 | 9/14/2009 | BEHI1 | 378 | bank 15 |
| Douglas Creek (north) | DOUN 08-02 | 9/14/2009 | BEHI1 | 379 | bank 15 d/s |
| Flint Creek | FLIN 11-04 | 9/14/2009 | BEHI1 | 380 | bank 1 |
| Flint Creek | FLIN 11-04 | 9/14/2009 | BEHI1 | 381 | bank 1 u/s |
| Flint Creek | FLIN 11-04 | 9/14/2009 | BEHI1 | 382 | bank 2 |
| Flint Creek | FLIN 11-04 | 9/14/2009 | BEHI1 | 383 | bank 2 d/s |
| Flint Creek | FLIN 11-01 | 9/14/2009 | BEHI1 | 384 | bank 1 |
| Flint Creek | FLIN 11-01 | 9/14/2009 | BEHI1 | 385 | bank 1 d/s |
| Flint Creek | FLIN 11-01 | 9/14/2009 | BEHI1 | 386 | bank 2 |
| Flint Creek | FLIN 11-01 | 9/14/2009 | BEHI1 | 387 | bank 2 d/s |
| Flint Creek | FLIN 11-01 | 9/14/2009 | BEHI1 | 388 | bank 3 |
| Flint Creek | FLIN 11-01 | 9/14/2009 | BEHI1 | 389 | bank 3 d/s |
| Flint Creek | FLIN 11-01 | 9/14/2009 | BEHI1 | 390 | bank 4 |
| Flint Creek | FLIN 11-01 | 9/14/2009 | BEHI1 | 391 | bank 4 d/s |
| Flint Creek | FLIN 11-01 | 9/14/2009 | BEHI1 | 392 | bank 5 |
| Flint Creek | FLIN 11-01 | 9/14/2009 | BEHI1 | 393 | bank 5 d/s |
| Flint Creek | FLIN 11-01 | 9/14/2009 | BEHI1 | 394 | bank 5 u/s |
| Flint Creek | FLIN 11-01 | 9/14/2009 | BEHI1 | 395 | bank 5 |
| Flint Creek | FLIN 11-01 | 9/14/2009 | BEHI1 | 396 | bank 6 |
| Flint Creek | FLIN 11-01 | 9/14/2009 | BEHI1 | 397 | bank 6 d/s |
| Flint Creek | FLIN 11-01 | 9/14/2009 | BEHI1 | 398 | bank 7 u/s |
| Flint Creek | FLIN 11-01 | 9/14/2009 | BEHI1 | 399 | bank 7 |
| Flint Creek | FLIN 11-01 | 9/14/2009 | BEHI1 | 400 | bank 8 |
| Flint Creek | FLIN 11-01 | 9/14/2009 | BEHI1 | 401 | bank 8 d/s |
| Flint Creek | FLIN 11-01 | 9/14/2009 | BEHI1 | 402 | bank 9 |
| Flint Creek | FLIN 11-01 | 9/14/2009 | BEHI1 | 403 | bank 9 d/s |
| Lower Willow Creek | LOWI 02-05 | 9/15/2009 | BEHI1 | 404 | bank 1 |
| Lower Willow Creek | LOWI 02-05 | 9/15/2009 | BEHI1 | 405 | bank 1 u/s |
| Lower Willow Creek | LOWI 02-05 | 9/15/2009 | BEHI1 | 406 | bank 2 |
| Lower Willow Creek | LOWI 02-05 | 9/15/2009 | BEHI1 | 407 | bank 2 u/s |
| Lower Willow Creek | LOWI 02-05 | 9/15/2009 | BEHI1 | 408 | bank 3 |
| Lower Willow Creek | LOWI 02-05 | 9/15/2009 | BEHI1 | 409 | bank 3 u/s |

**Table C-1. Photo log.**

| Stream | Reach ID | Date | Camera | Photo # | Description |
|---|---|---|---|---|---|
| Lower Willow Creek | LOWI 02-05 | 9/15/2009 | BEHI1 | 410 | bank 4 |
| Lower Willow Creek | LOWI 02-05 | 9/15/2009 | BEHI1 | 411 | bank 4 u/s |
| Lower Willow Creek | LOWI 02-05 | 9/15/2009 | BEHI1 | 412 | bank 5 |
| Lower Willow Creek | LOWI 02-05 | 9/15/2009 | BEHI1 | 413 | bank 5 u/s |
| Lower Willow Creek | LOWI 02-05 | 9/15/2009 | BEHI1 | 414 | bank 6 |
| Lower Willow Creek | LOWI 02-05 | 9/15/2009 | BEHI1 | 415 | bank 6 d/s |
| Boulder Creek | BOUL 21-02 | 9/15/2009 | BEHI1 | 416 | bank 1 |
| Boulder Creek | BOUL 21-02 | 9/15/2009 | BEHI1 | 417 | bank 1 d/s |
| Boulder Creek | BOUL 21-02 | 9/15/2009 | BEHI1 | 418 | bank 2 |
| Boulder Creek | BOUL 21-02 | 9/15/2009 | BEHI1 | 419 | bank 2 d/s |
| Boulder Creek | BOUL 21-02 | 9/15/2009 | BEHI1 | 420 | bank 3 |
| Boulder Creek | BOUL 21-02 | 9/15/2009 | BEHI1 | 421 | bank 3 d/s |
| Boulder Creek | BOUL 21-02 | 9/15/2009 | BEHI1 | 422 | bank 4 |
| Boulder Creek | BOUL 21-02 | 9/15/2009 | BEHI1 | 423 | bank 4 d/s |
| Boulder Creek | BOUL 21-02 | 9/15/2009 | BEHI1 | 424 | bank 5 |
| Boulder Creek | BOUL 21-02 | 9/15/2009 | BEHI1 | 425 | bank 5 d/s |
| Boulder Creek | BOUL 21-02 | 9/15/2009 | BEHI1 | 426 | bank 6 |
| Boulder Creek | BOUL 21-02 | 9/15/2009 | BEHI1 | 427 | bank 6 d/s |
| Boulder Creek | BOUL 21-02 | 9/15/2009 | BEHI1 | 428 | bank 7 |
| Boulder Creek | BOUL 21-02 | 9/15/2009 | BEHI1 | 429 | bank 7 d/s |
| Boulder Creek | BOUL 21-02 | 9/15/2009 | BEHI1 | 430 | bank 7 u/s |
| Boulder Creek | BOUL 21-02 | 9/15/2009 | BEHI1 | 431 | bank 8 |
| Boulder Creek | BOUL 21-02 | 9/15/2009 | BEHI1 | 432 | bank 8 d/s |
| Boulder Creek | BOUL 21-02 | 9/15/2009 | BEHI1 | 433 | bank 9 |
| Boulder Creek | BOUL 21-02 | 9/15/2009 | BEHI1 | 434 | bank 9 d/s |
| Boulder Creek | BOUL 16-01 | 9/15/2009 | BEHI1 | 435 | bank 1 |
| Boulder Creek | BOUL 16-01 | 9/15/2009 | BEHI1 | 436 | bank 1 u/s |
| Boulder Creek | BOUL 16-01 | 9/15/2009 | BEHI1 | 437 | bank 2 |
| Boulder Creek | BOUL 16-01 | 9/15/2009 | BEHI1 | 438 | bank 2 u/s |
| Boulder Creek | BOUL 16-01 | 9/15/2009 | BEHI1 | 439 | bank 3 |
| Boulder Creek | BOUL 16-01 | 9/15/2009 | BEHI1 | 440 | bank 3 u/s |
| Flint Creek | FLIN 09-02 | 9/16/2009 | BEHI1 | 441 | bank 1 |
| Flint Creek | FLIN 09-02 | 9/16/2009 | BEHI1 | 442 | bank 1 d/s |
| Flint Creek | FLIN 09-02 | 9/16/2009 | BEHI1 | 443 | bank 2 |
| Flint Creek | FLIN 09-02 | 9/16/2009 | BEHI1 | 444 | bank 2 d/s |
| Flint Creek | FLIN 09-02 | 9/16/2009 | BEHI1 | 445 | bank 3 |
| Flint Creek | FLIN 09-02 | 9/16/2009 | BEHI1 | 446 | bank 3 d/s |
| Flint Creek | FLIN 09-02 | 9/16/2009 | BEHI1 | 447 | bank 4 |
| Flint Creek | FLIN 09-02 | 9/16/2009 | BEHI1 | 448 | bank 4 d/s |
| Flint Creek | FLIN 09-02 | 9/16/2009 | BEHI1 | 449 | bank 4 d/s |
| Flint Creek | FLIN 09-02 | 9/16/2009 | BEHI1 | 450 | bank 5 |
| Flint Creek | FLIN 09-02 | 9/16/2009 | BEHI1 | 451 | bank 5 d/s |
| Flint Creek | FLIN 09-02 | 9/16/2009 | BEHI1 | 452 | bank 6 |
| Flint Creek | FLIN 09-02 | 9/16/2009 | BEHI1 | 453 | bank 6 d/s |
| Flint Creek | FLIN 09-02 | 9/16/2009 | BEHI1 | 454 | bank 7 |
| Flint Creek | FLIN 09-02 | 9/16/2009 | BEHI1 | 455 | bank 7 d/s |

**Table C-1. Photo log.**

| Stream | Reach ID | Date | Camera | Photo # | Description |
|---|---|---|---|---|---|
| Fred Burr Creek | FRED 29-02 | 9/16/2009 | BEHI1 | 456 | bank 1 |
| Fred Burr Creek | FRED 29-02 | 9/16/2009 | BEHI1 | 457 | bank 1 d/s |
| Fred Burr Creek | FRED 29-02 | 9/16/2009 | BEHI1 | 458 | bank 2 |
| Fred Burr Creek | FRED 29-02 | 9/16/2009 | BEHI1 | 459 | bank 2 d/s |
| Fred Burr Creek | FRED 29-02 | 9/16/2009 | BEHI1 | 460 | bank 3 |
| Fred Burr Creek | FRED 29-02 | 9/16/2009 | BEHI1 | 461 | bank 3 d/s |
| Fred Burr Creek | FRED 29-02 | 9/16/2009 | BEHI1 | 462 | bank 4 |
| Fred Burr Creek | FRED 29-02 | 9/16/2009 | BEHI1 | 463 | bank 4 d/s |
| Fred Burr Creek | FRED 29-02 | 9/16/2009 | BEHI1 | 464 | bank 5 |
| Fred Burr Creek | FRED 29-02 | 9/16/2009 | BEHI1 | 465 | bank 5 u/s |
| Fred Burr Creek | FRED 29-02 | 9/16/2009 | BEHI1 | 466 | bank 6 |
| Fred Burr Creek | FRED 29-02 | 9/16/2009 | BEHI1 | 467 | bank 6 d/s |
| Fred Burr Creek | FRED 29-02 | 9/16/2009 | BEHI1 | 468 | bank 7 |
| Fred Burr Creek | FRED 29-02 | 9/16/2009 | BEHI1 | 469 | bank 7 d/s |
| Fred Burr Creek | FRED 29-02 | 9/16/2009 | BEHI1 | 470 | bank 8 |
| Fred Burr Creek | FRED 29-02 | 9/16/2009 | BEHI1 | 471 | bank 8 d/s |
| Fred Burr Creek | FRED 29-02 | 9/16/2009 | BEHI1 | 472 | bank 9 |
| Fred Burr Creek | FRED 29-02 | 9/16/2009 | BEHI1 | 473 | bank 9 d/s |
| Fred Burr Creek | FRED 29-02 | 9/16/2009 | BEHI1 | 474 | bank 10 |
| Fred Burr Creek | FRED 29-02 | 9/16/2009 | BEHI1 | 475 | bank 10 d/s |
| Fred Burr Creek | FRED 29-02 | 9/16/2009 | BEHI1 | 476 | bank 11 |
| Fred Burr Creek | FRED 29-02 | 9/16/2009 | BEHI1 | 477 | bank 11 d/s |
| Fred Burr Creek | FRED 29-02 | 9/16/2009 | BEHI1 | 478 | bank 12 |
| Fred Burr Creek | FRED 29-02 | 9/16/2009 | BEHI1 | 479 | bank 12 d/s |
| Douglas Creek (south) | DOUS 09-02 | 9/16/2009 | BEHI1 | 480 | bank 1 |
| Douglas Creek (south) | DOUS 09-02 | 9/16/2009 | BEHI1 | 481 | bank 1 d/s |
| Douglas Creek (south) | DOUS 09-02 | 9/16/2009 | BEHI1 | 482 | bank 2 |
| Douglas Creek (south) | DOUS 09-02 | 9/16/2009 | BEHI1 | 483 | bank 2 d/s |
| Flint Creek | FLIN 06-01 | 9/16/2009 | BEHI1 | 484 | bank 1 |
| Flint Creek | FLIN 06-01 | 9/16/2009 | BEHI1 | 485 | bank 1 d/s |
| Flint Creek | FLIN 06-01 | 9/16/2009 | BEHI1 | 486 | bank 2 |
| Flint Creek | FLIN 06-01 | 9/16/2009 | BEHI1 | 487 | bank 2 d/s |
| Flint Creek | FLIN 06-01 | 9/16/2009 | BEHI1 | 488 | bank 3 |
| Flint Creek | FLIN 06-01 | 9/16/2009 | BEHI1 | 489 | bank 3 d/s |
| Flint Creek | FLIN 06-01 | 9/16/2009 | BEHI1 | 490 | bank 4 |
| Flint Creek | FLIN 06-01 | 9/16/2009 | BEHI1 | 491 | bank 4 d/s |
| Flint Creek | FLIN 06-01 | 9/16/2009 | BEHI1 | 492 | bank 5 |
| Flint Creek | FLIN 06-01 | 9/16/2009 | BEHI1 | 493 | bank 5 d/s |
| Flint Creek | FLIN 06-01 | 9/16/2009 | BEHI1 | 494 | bank 6 |
| Flint Creek | FLIN 06-01 | 9/16/2009 | BEHI1 | 495 | bank 6 d/s |
| Flint Creek | FLIN 06-01 | 9/16/2009 | BEHI1 | 496 | bank 7 |
| Flint Creek | FLIN 06-01 | 9/16/2009 | BEHI1 | 497 | bank 7 d/s |
| Trout Creek | TROU 09-03 | 9/17/2009 | BEHI2 | 1 | bank 1 |
| Trout Creek | TROU 09-03 | 9/17/2009 | BEHI2 | 2 | bank 1 d/s |
| Trout Creek | TROU 09-03 | 9/17/2009 | BEHI2 | 3 | bank 1 close-up |
| Trout Creek | TROU 09-03 | 9/17/2009 | BEHI2 | 4 | bank 2 |

**Table C-1. Photo log.**

| Stream | Reach ID | Date | Camera | Photo # | Description |
|---|---|---|---|---|---|
| Trout Creek | TROU 09-03 | 9/17/2009 | BEHI2 | 5 | bank 2 d/s |
| Trout Creek | TROU 09-03 | 9/17/2009 | BEHI2 | 6 | bank 3 |
| Trout Creek | TROU 09-03 | 9/17/2009 | BEHI2 | 7 | bank 3 d/s |
| Trout Creek | TROU 09-03 | 9/17/2009 | BEHI2 | 8 | bank 4 |
| Trout Creek | TROU 09-03 | 9/17/2009 | BEHI2 | 9 | bank 4 d/s |
| Trout Creek | TROU 09-03 | 9/17/2009 | BEHI2 | 10 | bank 5 |
| Trout Creek | TROU 09-03 | 9/17/2009 | BEHI2 | 11 | bank 5 d/s |
| Trout Creek | TROU 09-03 | 9/17/2009 | BEHI2 | 12 | bank 6 |
| Trout Creek | TROU 09-03 | 9/17/2009 | BEHI2 | 13 | bank 6 d/s |
| Trout Creek | TROU 09-03 | 9/17/2009 | BEHI2 | 14 | bank 7 |
| Trout Creek | TROU 09-03 | 9/17/2009 | BEHI2 | 15 | bank 7 d/s |
| Trout Creek | TROU 09-03 | 9/17/2009 | BEHI2 | 16 | bank 8 |
| Trout Creek | TROU 09-03 | 9/17/2009 | BEHI2 | 17 | bank 8 d/s |
| Trout Creek | TROU 10-01 | 9/17/2009 | BEHI2 | 22 | bank 1 |
| Trout Creek | TROU 10-01 | 9/17/2009 | BEHI2 | 23 | bank 1 d/s |
| Trout Creek | TROU 10-01 | 9/17/2009 | BEHI2 | 24 | bank 2 |
| Trout Creek | TROU 10-01 | 9/17/2009 | BEHI2 | 25 | bank 2 d/s |
| Barnes Creek | BARN 13-03 | 9/8/2009 | XS1 | 2365 | reach bottom, u/s view |
| Barnes Creek | BARN 13-03 | 9/8/2009 | XS1 | 2366 | reach bottom, d/s view |
| Barnes Creek | BARN 13-03 | 9/8/2009 | XS1 | 2367 | xs1 from rb |
| Barnes Creek | BARN 13-03 | 9/8/2009 | XS1 | 2368 | xs1 u/s view |
| Barnes Creek | BARN 13-03 | 9/8/2009 | XS1 | 2369 | xs2 from lb |
| Barnes Creek | BARN 13-03 | 9/8/2009 | XS1 | 2370 | xs2 u/s view |
| Barnes Creek | BARN 13-03 | 9/8/2009 | XS1 | 2371 | xs3 from lb |
| Barnes Creek | BARN 13-03 | 9/8/2009 | XS1 | 2372 | xs3 u/s view |
| Barnes Creek | BARN 13-03 | 9/8/2009 | XS1 | 2373 | xs4 from rb |
| Barnes Creek | BARN 13-03 | 9/8/2009 | XS1 | 2374 | xs4 u/s view |
| Barnes Creek | BARN 13-03 | 9/8/2009 | XS1 | 2375 | xs5 from rb |
| Barnes Creek | BARN 13-03 | 9/8/2009 | XS1 | 2376 | xs5 u/s view |
| Barnes Creek | BARN 13-03 | 9/8/2009 | XS1 | 2377 | reach top, u/s view |
| Barnes Creek | BARN 13-03 | 9/8/2009 | XS1 | 2378 | reach top, d/s view |
| Barnes Creek | BARN 11-01 | 9/8/2009 | XS1 | 2379 | reach bottom, d/s view |
| Barnes Creek | BARN 11-01 | 9/8/2009 | XS1 | 2380 | reach bottom, u/s view |
| Barnes Creek | BARN 11-01 | 9/8/2009 | XS1 | 2381 | xs1 from lb |
| Barnes Creek | BARN 11-01 | 9/8/2009 | XS1 | 2382 | xs1 u/s view |
| Barnes Creek | BARN 11-01 | 9/8/2009 | XS1 | 2383 | xs2 from lb |
| Barnes Creek | BARN 11-01 | 9/8/2009 | XS1 | 2384 | xs2 u/s view |
| Barnes Creek | BARN 11-01 | 9/8/2009 | XS1 | 2385 | xs3 from rb |
| Barnes Creek | BARN 11-01 | 9/8/2009 | XS1 | 2386 | xs3 u/s view |
| Barnes Creek | BARN 11-01 | 9/8/2009 | XS1 | 2387 | xs4 from rb |
| Barnes Creek | BARN 11-01 | 9/8/2009 | XS1 | 2388 | xs4 u/s view |
| Barnes Creek | BARN 11-01 | 9/8/2009 | XS1 | 2389 | reach top, u/s view |
| Barnes Creek | BARN 11-01 | 9/8/2009 | XS1 | 2390 | reach top, d/s view |
| Barnes Creek | BARN 11-01 | 9/8/2009 | XS1 | 2391 | xs5 from rb |
| Barnes Creek | BARN 11-01 | 9/8/2009 | XS1 | 2392 | xs5 u/s view |
| Barnes Creek | BARN 13-01 | 9/9/2009 | XS1 | 2393 | reach bottom, u/s view |

**Table C-1. Photo log.**

| Stream | Reach ID | Date | Camera | Photo # | Description |
|---|---|---|---|---|---|
| Barnes Creek | BARN 13-01 | 9/9/2009 | XS1 | 2394 | reach bottom, d/s view |
| Barnes Creek | BARN 13-01 | 9/9/2009 | XS1 | 2395 | xs1 from lb |
| Barnes Creek | BARN 13-01 | 9/9/2009 | XS1 | 2396 | xs1 u/s view |
| Barnes Creek | BARN 13-01 | 9/9/2009 | XS1 | 2397 | xs2 from rb |
| Barnes Creek | BARN 13-01 | 9/9/2009 | XS1 | 2398 | xs2 u/s view |
| Barnes Creek | BARN 13-01 | 9/9/2009 | XS1 | 2399 | xs3 from rb |
| Barnes Creek | BARN 13-01 | 9/9/2009 | XS1 | 2400 | xs3 u/s view |
| Barnes Creek | BARN 13-01 | 9/9/2009 | XS1 | 2401 | xs4 from lb |
| Barnes Creek | BARN 13-01 | 9/9/2009 | XS1 | 2402 | xs4 u/s view |
| Barnes Creek | BARN 13-01 | 9/9/2009 | XS1 | 2403 | xs5 from lb |
| Barnes Creek | BARN 13-01 | 9/9/2009 | XS1 | 2404 | xs5 u/s view |
| Barnes Creek | BARN 13-01 | 9/9/2009 | XS1 | 2405 | reach top, u/s view |
| Barnes Creek | BARN 13-01 | 9/9/2009 | XS1 | 2406 | reach top, d/s view |
| Flint Creek | FLIN 18-05 | 9/9/2009 | XS1 | 2407 | reach bottom, d/s view |
| Flint Creek | FLIN 18-05 | 9/9/2009 | XS1 | 2408 | reach bottom, u/s view |
| Flint Creek | FLIN 18-05 | 9/9/2009 | XS1 | 2409 | xs1 from rb |
| Flint Creek | FLIN 18-05 | 9/9/2009 | XS1 | 2410 | xs1 u/s view |
| Flint Creek | FLIN 18-05 | 9/9/2009 | XS1 | 2411 | xs2 from rb |
| Flint Creek | FLIN 18-05 | 9/9/2009 | XS1 | 2412 | xs2 u/s view |
| Flint Creek | FLIN 18-05 | 9/9/2009 | XS1 | 2413 | xs3 from lb |
| Flint Creek | FLIN 18-05 | 9/9/2009 | XS1 | 2414 | xs3 u/s view |
| Flint Creek | FLIN 18-05 | 9/9/2009 | XS1 | 2415 | xs4 from rb |
| Flint Creek | FLIN 18-05 | 9/9/2009 | XS1 | 2416 | xs4 d/s view |
| Flint Creek | FLIN 18-05 | 9/9/2009 | XS1 | 2417 | reach top, u/s view |
| Flint Creek | FLIN 18-05 | 9/9/2009 | XS1 | 2418 | reach top, d/s view |
| Flint Creek | FLIN 18-05 | 9/9/2009 | XS1 | 2419 | xs5 from rb |
| Flint Creek | FLIN 18-05 | 9/9/2009 | XS1 | 2420 | xs5 u/s view |
| Flint Creek | FLIN 19-01 | 9/9/2009 | XS1 | 2421 | reach bottom, d/s view |
| Flint Creek | FLIN 19-01 | 9/9/2009 | XS1 | 2422 | reach bottom, u/s view |
| Flint Creek | FLIN 19-01 | 9/9/2009 | XS1 | 2423 | xs1 from rb |
| Flint Creek | FLIN 19-01 | 9/9/2009 | XS1 | 2424 | xs1 u/s view |
| Flint Creek | FLIN 19-01 | 9/9/2009 | XS1 | 2425 | xs2 from rb |
| Flint Creek | FLIN 19-01 | 9/9/2009 | XS1 | 2426 | xs2 u/s view |
| Flint Creek | FLIN 19-01 | 9/9/2009 | XS1 | 2427 | xs3 from rb |
| Flint Creek | FLIN 19-01 | 9/9/2009 | XS1 | 2428 | xs3 u/s view |
| Flint Creek | FLIN 19-01 | 9/9/2009 | XS1 | 2429 | xs4 from rb |
| Flint Creek | FLIN 19-01 | 9/9/2009 | XS1 | 2430 | xs4 u/s view |
| Flint Creek | FLIN 19-01 | 9/9/2009 | XS1 | 2431 | xs5 from rb |
| Flint Creek | FLIN 19-01 | 9/9/2009 | XS1 | 2432 | xs5 u/s view |
| Flint Creek | FLIN 19-01 | 9/9/2009 | XS1 | 2433 | reach top, u/s view |
| Flint Creek | FLIN 19-01 | 9/9/2009 | XS1 | 2434 | reach top, d/s view |
| Smart Creek | SMAR 13-01 | 9/10/2009 | XS1 | 2435 | reach bottom, u/s view |
| Smart Creek | SMAR 13-01 | 9/10/2009 | XS1 | 2436 | reach bottom, d/s view |
| Smart Creek | SMAR 13-01 | 9/10/2009 | XS1 | 2437 | xs1 from lb |
| Smart Creek | SMAR 13-01 | 9/10/2009 | XS1 | 2438 | xs1 u/s view |
| Smart Creek | SMAR 13-01 | 9/10/2009 | XS1 | 2439 | xs2 from lb |

**Table C-1. Photo log.**

| Stream | Reach ID | Date | Camera | Photo # | Description |
|---|---|---|---|---|---|
| Smart Creek | SMAR 13-01 | 9/10/2009 | XS1 | 2440 | xs2 u/s view |
| Smart Creek | SMAR 13-01 | 9/10/2009 | XS1 | 2441 | xs3 u/s view |
| Smart Creek | SMAR 13-01 | 9/10/2009 | XS1 | 2442 | xs3 u/s view |
| Smart Creek | SMAR 13-01 | 9/10/2009 | XS1 | 2443 | xs3 from lb |
| Smart Creek | SMAR 13-01 | 9/10/2009 | XS1 | 2444 | xs4 from lb |
| Smart Creek | SMAR 13-01 | 9/10/2009 | XS1 | 2445 | xs4 u/s view |
| Smart Creek | SMAR 13-01 | 9/10/2009 | XS1 | 2446 | reach top, u/s view |
| Smart Creek | SMAR 13-01 | 9/10/2009 | XS1 | 2447 | reach top, d/s view |
| Smart Creek | SMAR 13-01 | 9/10/2009 | XS1 | 2448 | xs5 from lb |
| Smart Creek | SMAR 13-01 | 9/10/2009 | XS1 | 2449 | xs5 u/s view |
| Smart Creek | SMAR 18-01-01 | 9/10/2009 | XS1 | 2450 | reach bottom, d/s view |
| Smart Creek | SMAR 18-01-01 | 9/10/2009 | XS1 | 2451 | reach bottom, u/s view |
| Smart Creek | SMAR 18-01-01 | 9/10/2009 | XS1 | 2452 | xs1 from rb |
| Smart Creek | SMAR 18-01-01 | 9/10/2009 | XS1 | 2453 | xs1 u/s view |
| Smart Creek | SMAR 18-01-01 | 9/10/2009 | XS1 | 2454 | xs2 from lb |
| Smart Creek | SMAR 18-01-01 | 9/10/2009 | XS1 | 2455 | xs2 u/s view |
| Smart Creek | SMAR 18-01-01 | 9/10/2009 | XS1 | 2456 | xs3 from lb |
| Smart Creek | SMAR 18-01-01 | 9/10/2009 | XS1 | 2457 | xs3 u/s view |
| Smart Creek | SMAR 18-01-01 | 9/10/2009 | XS1 | 2458 | xs4 from lb |
| Smart Creek | SMAR 18-01-01 | 9/10/2009 | XS1 | 2459 | xs4 u/s view |
| Smart Creek | SMAR 18-01-01 | 9/10/2009 | XS1 | 2460 | xs5 from lb |
| Smart Creek | SMAR 18-01-01 | 9/10/2009 | XS1 | 2461 | xs5 u/s view |
| Smart Creek | SMAR 18-01-01 | 9/10/2009 | XS1 | 2462 | reach top, u/s view |
| Smart Creek | SMAR 18-01-01 | 9/10/2009 | XS1 | 2463 | reach top, d/s view |
| Smart Creek | SMAR 18-01-02 | 9/10/2009 | XS1 | 2464 | reach bottom, d/s view |
| Smart Creek | SMAR 18-01-02 | 9/10/2009 | XS1 | 2465 | reach bottom, u/s view |
| Smart Creek | SMAR 18-01-02 | 9/10/2009 | XS1 | 2466 | xs1 from lb |
| Smart Creek | SMAR 18-01-02 | 9/10/2009 | XS1 | 2467 | xs1 u/s view |
| Smart Creek | SMAR 18-01-02 | 9/10/2009 | XS1 | 2468 | xs2 from lb |
| Smart Creek | SMAR 18-01-02 | 9/10/2009 | XS1 | 2469 | xs2 u/s view |
| Smart Creek | SMAR 18-01-02 | 9/10/2009 | XS1 | 2470 | xs3 from lb |
| Smart Creek | SMAR 18-01-02 | 9/10/2009 | XS1 | 2471 | xs3 d/s view |
| Smart Creek | SMAR 18-01-02 | 9/10/2009 | XS1 | 2472 | xs4 from lb |
| Smart Creek | SMAR 18-01-02 | 9/10/2009 | XS1 | 2473 | xs4 u/s view |
| Smart Creek | SMAR 18-01-02 | 9/10/2009 | XS1 | 2474 | xs5 from rb |
| Smart Creek | SMAR 18-01-02 | 9/10/2009 | XS1 | 2475 | xs5 u/s view |
| Smart Creek | SMAR 18-01-02 | 9/10/2009 | XS1 | 2476 | reach top, u/s view |
| Smart Creek | SMAR 18-01-02 | 9/10/2009 | XS1 | 2477 | reach top, d/s view |
| Smart Creek | SMAR 21-01 | 9/10/2009 | XS1 | 2478 | reach bottom, d/s view |
| Smart Creek | SMAR 21-01 | 9/10/2009 | XS1 | 2479 | reach bottom, u/s view |
| Smart Creek | SMAR 21-01 | 9/10/2009 | XS1 | 2480 | xs1 from lb |
| Smart Creek | SMAR 21-01 | 9/10/2009 | XS1 | 2481 | xs1 u/s view |
| Smart Creek | SMAR 21-01 | 9/10/2009 | XS1 | 2482 | xs2 from rb |
| Smart Creek | SMAR 21-01 | 9/10/2009 | XS1 | 2483 | xs2 u/s view |
| Smart Creek | SMAR 21-01 | 9/10/2009 | XS1 | 2484 | xs3 from rb |
| Smart Creek | SMAR 21-01 | 9/10/2009 | XS1 | 2485 | xs3 u/s view |

**Table C-1. Photo log.**

| Stream | Reach ID | Date | Camera | Photo # | Description |
|---|---|---|---|---|---|
| Smart Creek | SMAR 21-01 | 9/10/2009 | XS1 | 2486 | xs4 from rb |
| Smart Creek | SMAR 21-01 | 9/10/2009 | XS1 | 2487 | xs4 u/s view |
| Smart Creek | SMAR 21-01 | 9/10/2009 | XS1 | 2488 | reach top, u/s view |
| Smart Creek | SMAR 21-01 | 9/10/2009 | XS1 | 2489 | reach top, d/s view |
| Smart Creek | SMAR 21-01 | 9/10/2009 | XS1 | 2490 | xs5 from rb |
| Smart Creek | SMAR 21-01 | 9/10/2009 | XS1 | 2491 | xs5 u/s view |
| Flint Creek | FLIN 17-01 | 9/11/2009 | XS1 | 2492 | reach bottom, u/s view (old) |
| Flint Creek | FLIN 17-01 | 9/11/2009 | XS1 | 2493 | reach bottom, d/s view (old) |
| Flint Creek | FLIN 17-01 | 9/11/2009 | XS1 | 2494 | reach bottom, u/s view (new) |
| Flint Creek | FLIN 17-01 | 9/11/2009 | XS1 | 2495 | reach bottom, d/s view (new) |
| Flint Creek | FLIN 17-01 | 9/11/2009 | XS1 | 2496 | xs1 from lb |
| Flint Creek | FLIN 17-01 | 9/11/2009 | XS1 | 2497 | xs1 u/s view |
| Flint Creek | FLIN 17-01 | 9/11/2009 | XS1 | 2498 | xs2 from lb |
| Flint Creek | FLIN 17-01 | 9/11/2009 | XS1 | 2499 | xs2 d/s view |
| Flint Creek | FLIN 17-01 | 9/11/2009 | XS1 | 2500 | reach top, u/s view |
| Flint Creek | FLIN 17-01 | 9/11/2009 | XS1 | 2501 | reach top, d/s view |
| Flint Creek | FLIN 17-01 | 9/11/2009 | XS1 | 2502 | xs5 from lb |
| Flint Creek | FLIN 17-01 | 9/11/2009 | XS1 | 2503 | xs5 u/s view |
| Flint Creek | FLIN 18-02 | 9/11/2009 | XS1 | 2504 | reach bottom, u/s view |
| Flint Creek | FLIN 18-02 | 9/11/2009 | XS1 | 2505 | reach bottom, d/s view |
| Flint Creek | FLIN 18-02 | 9/11/2009 | XS1 | 2506 | xs1 u/s view |
| Flint Creek | FLIN 18-02 | 9/11/2009 | XS1 | 2507 | xs1 from lb |
| Flint Creek | FLIN 18-02 | 9/11/2009 | XS1 | 2508 | xs3 from lb |
| Flint Creek | FLIN 18-02 | 9/11/2009 | XS1 | 2509 | xs3 u/s view |
| Flint Creek | FLIN 18-02 | 9/11/2009 | XS1 | 2510 | xs4 from lb |
| Flint Creek | FLIN 18-02 | 9/11/2009 | XS1 | 2511 | xs4 u/s view |
| Flint Creek | FLIN 18-02 | 9/11/2009 | XS1 | 2512 | xs5 from lb |
| Flint Creek | FLIN 18-02 | 9/11/2009 | XS1 | 2513 | xs5 u/s view |
| Flint Creek | FLIN 18-02 | 9/11/2009 | XS1 | 2514 | irrigation return |
| Flint Creek | FLIN 18-02 | 9/11/2009 | XS1 | 2515 | reach top, u/s view |
| Flint Creek | FLIN 18-02 | 9/11/2009 | XS1 | 2516 | reach top, d/s view |
| Douglas Creek (north) | DOUN 07-01 | 9/11/2009 | XS1 | 2519 | reach bottom, u/s view |
| Douglas Creek (north) | DOUN 07-01 | 9/11/2009 | XS1 | 2520 | reach bottom, d/s view |
| Douglas Creek (north) | DOUN 07-01 | 9/11/2009 | XS1 | 2521 | xs1 from lb |
| Douglas Creek (north) | DOUN 07-01 | 9/11/2009 | XS1 | 2522 | xs1 u/s view |
| Douglas Creek (north) | DOUN 07-01 | 9/11/2009 | XS1 | 2523 | xs2 from rb |
| Douglas Creek (north) | DOUN 07-01 | 9/11/2009 | XS1 | 2524 | xs2 d/s view |
| Douglas Creek (north) | DOUN 07-01 | 9/11/2009 | XS1 | 2525 | xs3 from lb |
| Douglas Creek (north) | DOUN 07-01 | 9/11/2009 | XS1 | 2526 | xs3 d/s view |
| Douglas Creek (north) | DOUN 07-01 | 9/11/2009 | XS1 | 2527 | xs4 from rb |
| Douglas Creek (north) | DOUN 07-01 | 9/11/2009 | XS1 | 2528 | xs4 u/s view |
| Douglas Creek (north) | DOUN 07-01 | 9/11/2009 | XS1 | 2529 | reach top, u/s view |
| Douglas Creek (north) | DOUN 07-01 | 9/11/2009 | XS1 | 2530 | reach top, d/s view |
| Douglas Creek (north) | DOUN 07-01 | 9/11/2009 | XS1 | 2531 | xs5 from lb |
| Douglas Creek (north) | DOUN 07-01 | 9/11/2009 | XS1 | 2532 | xs5 u/s view |
| Douglas Creek (north) | DOUN 08-02 | 9/14/2009 | XS1 | 2533 | reach bottom, u/s view |

**Table C-1. Photo log.**

| Stream | Reach ID | Date | Camera | Photo # | Description |
|---|---|---|---|---|---|
| Douglas Creek (north) | DOUN 08-02 | 9/14/2009 | XS1 | 2534 | reach bottom, d/s view |
| Douglas Creek (north) | DOUN 08-02 | 9/14/2009 | XS1 | 2535 | xs1 from lb |
| Douglas Creek (north) | DOUN 08-02 | 9/14/2009 | XS1 | 2536 | xs1 u/s view |
| Douglas Creek (north) | DOUN 08-02 | 9/14/2009 | XS1 | 2537 | xs2 from lb |
| Douglas Creek (north) | DOUN 08-02 | 9/14/2009 | XS1 | 2538 | xs2 u/s view |
| Douglas Creek (north) | DOUN 08-02 | 9/14/2009 | XS1 | 2539 | xs3 from lb |
| Douglas Creek (north) | DOUN 08-02 | 9/14/2009 | XS1 | 2540 | xs3 d/s view |
| Douglas Creek (north) | DOUN 08-02 | 9/14/2009 | XS1 | 2541 | xs4 from rb |
| Douglas Creek (north) | DOUN 08-02 | 9/14/2009 | XS1 | 2542 | xs4 u/s view |
| Douglas Creek (north) | DOUN 08-02 | 9/14/2009 | XS1 | 2543 | xs5 from lb |
| Douglas Creek (north) | DOUN 08-02 | 9/14/2009 | XS1 | 2544 | xs5 d/s view |
| Douglas Creek (north) | DOUN 08-02 | 9/14/2009 | XS1 | 2545 | reach top, u/s view |
| Douglas Creek (north) | DOUN 08-02 | 9/14/2009 | XS1 | 2546 | reach top, d/s view |
| Flint Creek | FLIN 11-04 | 9/14/2009 | XS1 | 2547 | reach bottom, u/s view |
| Flint Creek | FLIN 11-04 | 9/14/2009 | XS1 | 2548 | reach bottom, d/s view |
| Flint Creek | FLIN 11-04 | 9/14/2009 | XS1 | 2549 | xs1 from rb |
| Flint Creek | FLIN 11-04 | 9/14/2009 | XS1 | 2550 | xs1 u/s view |
| Flint Creek | FLIN 11-04 | 9/14/2009 | XS1 | 2551 | xs2 from rb |
| Flint Creek | FLIN 11-04 | 9/14/2009 | XS1 | 2552 | xs2 u/s view |
| Flint Creek | FLIN 11-04 | 9/14/2009 | XS1 | 2553 | xs3 from rb |
| Flint Creek | FLIN 11-04 | 9/14/2009 | XS1 | 2554 | xs3 u/s view |
| Flint Creek | FLIN 11-04 | 9/14/2009 | XS1 | 2555 | reach top, u/s view |
| Flint Creek | FLIN 11-04 | 9/14/2009 | XS1 | 2556 | reach top, d/s view |
| Flint Creek | FLIN 11-01 | 9/14/2009 | XS1 | 2557 | reach bottom, u/s view |
| Flint Creek | FLIN 11-01 | 9/14/2009 | XS1 | 2558 | reach bottom, d/s view |
| Flint Creek | FLIN 11-01 | 9/14/2009 | XS1 | 2559 | xs1 from rb |
| Flint Creek | FLIN 11-01 | 9/14/2009 | XS1 | 2560 | xs1 u/s view |
| Flint Creek | FLIN 11-01 | 9/14/2009 | XS1 | 2561 | xs2 from rb |
| Flint Creek | FLIN 11-01 | 9/14/2009 | XS1 | 2562 | xs2 u/s view |
| Flint Creek | FLIN 11-01 | 9/14/2009 | XS1 | 2563 | xs3 from rb |
| Flint Creek | FLIN 11-01 | 9/14/2009 | XS1 | 2564 | xs3 u/s view |
| Flint Creek | FLIN 11-01 | 9/14/2009 | XS1 | 2565 | xs5 from rb |
| Flint Creek | FLIN 11-01 | 9/14/2009 | XS1 | 2566 | xs5 u/s view |
| Flint Creek | FLIN 11-01 | 9/14/2009 | XS1 | 2567 | reach top, u/s view |
| Flint Creek | FLIN 11-01 | 9/14/2009 | XS1 | 2568 | reach top, d/s view |
| Lower Willow Creek | LOWI 02-05 | 9/15/2009 | XS1 | 2569 | reach bottom, u/s view |
| Lower Willow Creek | LOWI 02-05 | 9/15/2009 | XS1 | 2570 | reach bottom, d/s view |
| Lower Willow Creek | LOWI 02-05 | 9/15/2009 | XS1 | 2571 | xs1 from lb |
| Lower Willow Creek | LOWI 02-05 | 9/15/2009 | XS1 | 2572 | xs1 u/s view |
| Lower Willow Creek | LOWI 02-05 | 9/15/2009 | XS1 | 2573 | xs2 from rb |
| Lower Willow Creek | LOWI 02-05 | 9/15/2009 | XS1 | 2574 | xs2 u/s view |
| Lower Willow Creek | LOWI 02-05 | 9/15/2009 | XS1 | 2575 | xs3 from rb |
| Lower Willow Creek | LOWI 02-05 | 9/15/2009 | XS1 | 2576 | xs3 u/s view |
| Lower Willow Creek | LOWI 02-05 | 9/15/2009 | XS1 | 2577 | xs4 from rb |
| Lower Willow Creek | LOWI 02-05 | 9/15/2009 | XS1 | 2578 | xs4 u/s view |
| Lower Willow Creek | LOWI 02-05 | 9/15/2009 | XS1 | 2579 | reach top, u/s view |

**Table C-1. Photo log.**

| Stream | Reach ID | Date | Camera | Photo # | Description |
|---|---|---|---|---|---|
| Lower Willow Creek | LOWI 02-05 | 9/15/2009 | XS1 | 2580 | reach top, d/s view |
| Lower Willow Creek | LOWI 02-05 | 9/15/2009 | XS1 | 2581 | xs5 from rb |
| Lower Willow Creek | LOWI 02-05 | 9/15/2009 | XS1 | 2582 | xs5 u/s view |
| Boulder Creek | BOUL 21-02 | 9/15/2009 | XS1 | 2583 | reach bottom, d/s view |
| Boulder Creek | BOUL 21-02 | 9/15/2009 | XS1 | 2584 | reach bottom, u/s view |
| Boulder Creek | BOUL 21-02 | 9/15/2009 | XS1 | 2585 | xs1 from lb |
| Boulder Creek | BOUL 21-02 | 9/15/2009 | XS1 | 2586 | xs1 u/s view |
| Boulder Creek | BOUL 21-02 | 9/15/2009 | XS1 | 2587 | xs2 main channel from lb |
| Boulder Creek | BOUL 21-02 | 9/15/2009 | XS1 | 2588 | xs2 main channel u/s view |
| Boulder Creek | BOUL 21-02 | 9/15/2009 | XS1 | 2589 | xs2 side channel from rb |
| Boulder Creek | BOUL 21-02 | 9/15/2009 | XS1 | 2590 | xs2 side channel u/s view |
| Boulder Creek | BOUL 21-02 | 9/15/2009 | XS1 | 2591 | xs3 from lb |
| Boulder Creek | BOUL 21-02 | 9/15/2009 | XS1 | 2592 | xs3 u/s view |
| Boulder Creek | BOUL 21-02 | 9/15/2009 | XS1 | 2593 | xs4 from rb |
| Boulder Creek | BOUL 21-02 | 9/15/2009 | XS1 | 2594 | xs4 u/s view |
| Boulder Creek | BOUL 21-02 | 9/15/2009 | XS1 | 2595 | reach top, u/s view |
| Boulder Creek | BOUL 21-02 | 9/15/2009 | XS1 | 2596 | reach top, d/s view |
| Boulder Creek | BOUL 21-02 | 9/15/2009 | XS1 | 2597 | xs5 from rb |
| Boulder Creek | BOUL 21-02 | 9/15/2009 | XS1 | 2598 | xs5 u/s view |
| Boulder Creek | BOUL 16-01 | 9/15/2009 | XS1 | 2599 | reach bottom, u/s view |
| Boulder Creek | BOUL 16-01 | 9/15/2009 | XS1 | 2600 | reach bottom, d/s view |
| Boulder Creek | BOUL 16-01 | 9/15/2009 | XS1 | 2601 | xs1 from rb |
| Boulder Creek | BOUL 16-01 | 9/15/2009 | XS1 | 2602 | xs1 u/s view |
| Boulder Creek | BOUL 16-01 | 9/15/2009 | XS1 | 2603 | xs2 from lb |
| Boulder Creek | BOUL 16-01 | 9/15/2009 | XS1 | 2604 | xs2 u/s view |
| Boulder Creek | BOUL 16-01 | 9/15/2009 | XS1 | 2605 | xs3 u/s view |
| Boulder Creek | BOUL 16-01 | 9/15/2009 | XS1 | 2606 | xs3 from lb |
| Boulder Creek | BOUL 16-01 | 9/15/2009 | XS1 | 2607 | xs4 from lb |
| Boulder Creek | BOUL 16-01 | 9/15/2009 | XS1 | 2608 | xs4 u/s view |
| Boulder Creek | BOUL 16-01 | 9/15/2009 | XS1 | 2609 | reach top, u/s view |
| Boulder Creek | BOUL 16-01 | 9/15/2009 | XS1 | 2610 | reach top, d/s view |
| Flint Creek | FLIN 09-02 | 9/16/2009 | XS1 | 2613 | reach bottom, u/s view |
| Flint Creek | FLIN 09-02 | 9/16/2009 | XS1 | 2614 | reach bottom, d/s view |
| Flint Creek | FLIN 09-02 | 9/16/2009 | XS1 | 2615 | xs1 from rb |
| Flint Creek | FLIN 09-02 | 9/16/2009 | XS1 | 2616 | xs1 d/s view |
| Flint Creek | FLIN 09-02 | 9/16/2009 | XS1 | 2617 | xs2 from rb |
| Flint Creek | FLIN 09-02 | 9/16/2009 | XS1 | 2618 | xs2 u/s view |
| Flint Creek | FLIN 09-02 | 9/16/2009 | XS1 | 2619 | xs3 from rb |
| Flint Creek | FLIN 09-02 | 9/16/2009 | XS1 | 2620 | xs3 u/s view |
| Flint Creek | FLIN 09-02 | 9/16/2009 | XS1 | 2621 | xs4 from lb |
| Flint Creek | FLIN 09-02 | 9/16/2009 | XS1 | 2622 | xs4 d/s view |
| Flint Creek | FLIN 09-02 | 9/16/2009 | XS1 | 2623 | xs5 from lb |
| Flint Creek | FLIN 09-02 | 9/16/2009 | XS1 | 2624 | xs5 u/s view |
| Flint Creek | FLIN 09-02 | 9/16/2009 | XS1 | 2625 | reach top, u/s view |
| Flint Creek | FLIN 09-02 | 9/16/2009 | XS1 | 2626 | reach top, d/s view |
| Fred Burr Creek | FRED 29-02 | 9/16/2009 | XS2 | 45 | reach bottom, u/s view |

**Table C-1. Photo log.**

| Stream | Reach ID | Date | Camera | Photo # | Description |
|---|---|---|---|---|---|
| Fred Burr Creek | FRED 29-02 | 9/16/2009 | XS2 | 46 | reach bottom, d/s view |
| Fred Burr Creek | FRED 29-02 | 9/16/2009 | XS2 | 47 | xs1 from rb |
| Fred Burr Creek | FRED 29-02 | 9/16/2009 | XS2 | 48 | xs1 u/s view |
| Fred Burr Creek | FRED 29-02 | 9/16/2009 | XS2 | 49 | xs2 from rb |
| Fred Burr Creek | FRED 29-02 | 9/16/2009 | XS2 | 50 | xs2 u/s view |
| Fred Burr Creek | FRED 29-02 | 9/16/2009 | XS2 | 51 | xs3 from rb |
| Fred Burr Creek | FRED 29-02 | 9/16/2009 | XS2 | 52 | xs3 u/s view |
| Fred Burr Creek | FRED 29-02 | 9/16/2009 | XS2 | 53 | xs4 from rb |
| Fred Burr Creek | FRED 29-02 | 9/16/2009 | XS2 | 54 | xs4 u/s view |
| Fred Burr Creek | FRED 29-02 | 9/16/2009 | XS2 | 55 | xs5 from rb |
| Fred Burr Creek | FRED 29-02 | 9/16/2009 | XS2 | 56 | xs5 u/s view |
| Fred Burr Creek | FRED 29-02 | 9/16/2009 | XS2 | 57 | reach top, u/s view |
| Fred Burr Creek | FRED 29-02 | 9/16/2009 | XS2 | 58 | reach top, d/s view |
| Douglas Creek (south) | DOUS 09-02 | 9/16/2009 | XS2 | 59 | reach bottom, u/s view |
| Douglas Creek (south) | DOUS 09-02 | 9/16/2009 | XS2 | 60 | reach bottom, d/s view |
| Douglas Creek (south) | DOUS 09-02 | 9/16/2009 | XS2 | 61 | xs1 from rb |
| Douglas Creek (south) | DOUS 09-02 | 9/16/2009 | XS2 | 62 | xs1 u/s view |
| Douglas Creek (south) | DOUS 09-02 | 9/16/2009 | XS2 | 63 | xs2 from rb |
| Douglas Creek (south) | DOUS 09-02 | 9/16/2009 | XS2 | 64 | xs2 u/s view |
| Douglas Creek (south) | DOUS 09-02 | 9/16/2009 | XS2 | 65 | xs3 from rb |
| Douglas Creek (south) | DOUS 09-02 | 9/16/2009 | XS2 | 66 | xs3 u/s view |
| Douglas Creek (south) | DOUS 09-02 | 9/16/2009 | XS2 | 67 | xs4 from rb |
| Douglas Creek (south) | DOUS 09-02 | 9/16/2009 | XS2 | 68 | xs4 u/s view |
| Douglas Creek (south) | DOUS 09-02 | 9/16/2009 | XS2 | 69 | xs5 from rb |
| Douglas Creek (south) | DOUS 09-02 | 9/16/2009 | XS2 | 70 | xs5 u/s view |
| Douglas Creek (south) | DOUS 09-02 | 9/16/2009 | XS2 | 71 | reach top, u/s view |
| Douglas Creek (south) | DOUS 09-02 | 9/16/2009 | XS2 | 72 | reach top, d/s view |
| Flint Creek | FLIN 06-01 | 9/16/2009 | XS2 | 73 | reach bottom, u/s view |
| Flint Creek | FLIN 06-01 | 9/16/2009 | XS2 | 74 | reach bottom, d/s view |
| Flint Creek | FLIN 06-01 | 9/16/2009 | XS2 | 75 | xs1 from rb |
| Flint Creek | FLIN 06-01 | 9/16/2009 | XS2 | 76 | xs1 u/s view |
| Flint Creek | FLIN 06-01 | 9/16/2009 | XS2 | 77 | xs2 from rb |
| Flint Creek | FLIN 06-01 | 9/16/2009 | XS2 | 78 | xs2 d/s view |
| Flint Creek | FLIN 06-01 | 9/16/2009 | XS2 | 79 | xs3 from rb |
| Flint Creek | FLIN 06-01 | 9/16/2009 | XS2 | 80 | xs3 u/s view |
| Flint Creek | FLIN 06-01 | 9/16/2009 | XS2 | 81 | xs4 from rb |
| Flint Creek | FLIN 06-01 | 9/16/2009 | XS2 | 82 | xs4 d/s view |
| Flint Creek | FLIN 06-01 | 9/16/2009 | XS2 | 83 | reach top, u/s view |
| Flint Creek | FLIN 06-01 | 9/16/2009 | XS2 | 84 | reach top, d/s view |
| Trout Creek | TROU 09-03 | 9/17/2009 | XS2 | 85 | reach bottom, d/s view |
| Trout Creek | TROU 09-03 | 9/17/2009 | XS2 | 86 | reach bottom, u/s view |
| Trout Creek | TROU 09-03 | 9/17/2009 | XS2 | 87 | xs1 from lb |
| Trout Creek | TROU 09-03 | 9/17/2009 | XS2 | 88 | xs1 d/s view |
| Trout Creek | TROU 09-03 | 9/17/2009 | XS2 | 89 | xs2 from lb |
| Trout Creek | TROU 09-03 | 9/17/2009 | XS2 | 90 | xs2 d/s view |
| Trout Creek | TROU 09-03 | 9/17/2009 | XS2 | 91 | xs3 from lb |

**Table C-1. Photo log.**

| Stream | Reach ID | Date | Camera | Photo # | Description |
|---|---|---|---|---|---|
| Trout Creek | TROU 09-03 | 9/17/2009 | XS2 | 92 | xs3 d/s view |
| Trout Creek | TROU 09-03 | 9/17/2009 | XS2 | 93 | xs4 from lb |
| Trout Creek | TROU 09-03 | 9/17/2009 | XS2 | 94 | xs4 d/s view |
| Trout Creek | TROU 09-03 | 9/17/2009 | XS2 | 95 | xs5 from lb |
| Trout Creek | TROU 09-03 | 9/17/2009 | XS2 | 96 | xs5 d/s view |
| Trout Creek | TROU 09-03 | 9/17/2009 | XS2 | 97 | reach top, u/s view |
| Trout Creek | TROU 09-03 | 9/17/2009 | XS2 | 98 | reach top, d/s view |
| Trout Creek | TROU 10-01 | 9/17/2009 | XS2 | 99 | reach bottom, d/s view |
| Trout Creek | TROU 10-01 | 9/17/2009 | XS2 | 100 | reach bottom, u/s view |
| Trout Creek | TROU 10-01 | 9/17/2009 | XS2 | 101 | xs1 from lb |
| Trout Creek | TROU 10-01 | 9/17/2009 | XS2 | 102 | xs1 d/s view |
| Trout Creek | TROU 10-01 | 9/17/2009 | XS2 | 103 | xs2 from rb |
| Trout Creek | TROU 10-01 | 9/17/2009 | XS2 | 104 | xs2 d/s view |
| Trout Creek | TROU 10-01 | 9/17/2009 | XS2 | 105 | xs3 from rb |
| Trout Creek | TROU 10-01 | 9/17/2009 | XS2 | 106 | xs3 u/s view |
| Trout Creek | TROU 10-01 | 9/17/2009 | XS2 | 107 | xs4 from rb |
| Trout Creek | TROU 10-01 | 9/17/2009 | XS2 | 108 | xs4 d/s view |
| Trout Creek | TROU 10-01 | 9/17/2009 | XS2 | 109 | xs5 from lb |
| Trout Creek | TROU 10-01 | 9/17/2009 | XS2 | 110 | xs5 u/s view |
| Trout Creek | TROU 10-01 | 9/17/2009 | XS2 | 111 | reach top, u/s view |
| Trout Creek | TROU 10-01 | 9/17/2009 | XS2 | 112 | reach top, d/s view |

# ATTACHMENT D – Quality Assurance/Quality Control Review

### General Description of Field Activities

Sediment and habitat monitoring was conducted in the Flint Creek TMDL Planning Area in the summer of 2009. Two separate field visits were conducted as part of this assessment. On August 11-12, 2009, a field reconnaissance crew consisting of Jim Bond (DEQ), John Babcock and Josh Vincent (Water & Environmental Technologies) conducted site visits of potential field assessment sites which were previously identified using aerial photography and GIS. Sites were inspected for their sampling feasibility and ability to gain access to private property. On September 8-18, 2009, a sediment and habitat field crew consisting of Jim Bond, Steve Cook, and Christina Staten (DEQ), and Josh Vincent, John Trudnowski, John Babcock, and Ty DeBoo (Water & Environmental Technologies) conducted field assessments on 24 stream reaches according to the Sampling and Analysis Plan prepared for this project.

### Field Variance from SAP

During the field assessments, all primary sites identified during field reconnaissance were evaluated with the exception of sites BARN 12-01, DOUS 14-01, and SMAR 17-01. Secondary site BARN 11-01 was evaluated instead of BARN 12-01 to provide greater spatial coverage of Barnes Creek. Access to private land could not be gained for DOUS 14-01 nor for any suitable alternative sites. SMAR 17-01 was not evaluated; instead, SMAR 18-01 was divided into two 500’ paired reaches (SMAR 18-01-1 and SMAR 18-01-2) to evaluate differences between fenced and unfenced sections within a similar landscape.

### Data Adjustments

The following table provides adjustments made to the field data during data entry and analysis. During the field component of this project, several parameters were erroneously omitted from the data entry forms, and in these cases, field values were later estimated from photos.

**Table D-1. Data adjustments.**

| Reach | Location | Parameter | Original Value | Adjusted Value | Rationale |
|---|---|---|---|---|---|
| BARN 13-01 | Bank 2 | bank height | not included | 2.0’ | estimated from photos |
| DOUN 08-02 | Cell 3, Pool 4 | maximum depth | not included | 1.0’ | estimated from photos |
| DOUN 08-02 | Station 650 | riparian buffer width | not included | 0’ | estimated from photos |
| FLIN 09-02 | Cell 5 | floodprone distance | not included | 10’ on LB 150’ on RB | estimated from photos |
| FLIN 18-02 | Cell 4 | RB floodprone distance | not included | 20’ | estimated from photos |
| SMAR 13-01 | Cell 3, Pool 6 | pool length | not included | 6’ | estimated from photos |