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# UPPER GALLATIN RIVER TMDL PLANNING AREA SEDIMENT MONITORING

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## *Sampling and Analysis Plan*

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And

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## TABLE OF CONTENTS

<b>1.0 Introduction.....</b>	<b>1</b>
<b>2.0 Objectives and Design.....</b>	<b>2</b>
<b>3.0 Field Sampling Methods.....</b>	<b>3</b>
<b>4.0 Quality Assurance and Quality Control Requirements .....</b>	<b>3</b>
<b>5.0 Data Analysis, Record Keeping, and Reporting Requirements .....</b>	<b>8</b>
<b>6.0 Schedule for Completion .....</b>	<b>8</b>
<b>7.0 Project Team and Responsibilities .....</b>	<b>8</b>
<b>8.0 References .....</b>	<b>9</b>

### LIST OF TABLES

Table 2-1      Aerial Assessment Reach Stratification Spatial Representation

### LIST OF FIGURES

Figure 2-1      West Fork Gallatin River Watershed

## 1.0 Introduction and Background

The Upper Gallatin River TMDL Planning Area (TPA) is located in southwestern Montana, encompassing an area of 756 square miles (483,840 acres) in Gallatin and Madison counties. The Gallatin River begins in the Northwest corner of Yellowstone National Park and flows in a northerly direction to its confluence with the Jefferson and Madison rivers near Three Forks, Montana, where the Missouri River begins. The Upper Gallatin River watershed is included in the 4th code HUC 10020008, which is defined as the entire Gallatin River watershed. This Sampling and Analysis Plan addresses potential sediment impairments to streams in the West Fork Gallatin River watershed, which is a sub-watershed within the Upper Gallatin River TPA. The West Fork Gallatin River watershed encompasses 80 square miles (51,350 acres) and drains Lone Mountain (elevation 11,166 feet) and the Big Sky area. The West Fork Gallatin River watershed is 5<sup>th</sup> code HUC 100200080.

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. The field methods conducted under this SAP are intended to assist DEQ in evaluating the impairment status of tributary streams in the West Fork Gallatin River watershed of the Upper Gallatin River TPA and for developing TMDLs where necessary.

In the West Fork Gallatin River watershed, the Middle Fork West Fork Gallatin River, South Fork West Fork Gallatin River and the West Fork Gallatin River are listed as impaired due to sediment on the 2006 303(d) List. Streams identified in this sampling strategy include Beehive Creek, Middle Fork West Fork Gallatin River, Muddy Creek, North Fork West Fork Gallatin River, South Fork West Fork Gallatin River and West Fork Gallatin River (**Figure 1-1**). Smaller tributaries of these streams may also be assessed for supporting information.

## 2.0 Objectives and Design

The objective of this sampling plan is to collect sediment and stream habitat data that will be used for the following:

- Verification of sediments impairment conditions on 303(d) listed tributaries in the West Fork Gallatin River watershed of the Upper Gallatin River TMDL Planning Area
- Quantification of sediment loads associated with specific land use categories in the West Fork Gallatin River watershed of the Upper Gallatin River TMDL Planning Area to assist in TMDL sediment load allocations

### *Study Design*

In order to meet the above objectives, substrate character and stream habitat conditions will be determined by extensive water quality sampling in the listed tributaries within the West Fork Gallatin River watershed of the Upper Gallatin River TPA. Longitudinal surveys that include pebble counts, grid toss, cross sections, pool data collection, riparian greenline surveys, and eroding bank information will be performed at each of the selected sample sites during the late summer/early fall of 2007.

Following procedures described in the DRAFT document *Watershed Stratification Methodology for TMDL Sediment and Habitat Investigations* (MT DEQ 2008), listed stream reaches within the West Fork Gallatin River watershed of the Upper Gallatin River TPA were stratified by ecoregion, stream order, valley gradient, and channel confinement, as described in *Upper Gallatin TMDL Planning Area Aerial Assessment Reach Stratification* (PBS&J 2008). Additional stratification was performed through the use of aerial photography in order to identify distinct riparian conditions and to note areas of apparent local impacts.

### *Selection of Candidate Assessment Reaches*

Candidate assessment reaches were selected in relatively low-gradient portions of the study streams to facilitate the evaluation of sediment loading impacts. Other considerations in selecting candidate assessment reaches included representativeness of the candidate reaches to other reaches of the same slope, order, confinement and ecoregion, as well as ease of access.

Within each candidate assessment reach, survey reaches ranging from 500, 1000, or 2000 feet will be established based on bankfull width of the stream during the field assessment. Refer to the DRAFT *Longitudinal Field Methods for the Assessment of TMDL Sediment and Habitat Impairments* (MT DEQ 2007) for additional details.

### Sampling Sites

Twenty-one sediment sampling sites spatially distributed throughout the study tributaries in the West Fork Gallatin River watershed were selected for inclusion in this project. Sampling sites were chosen to include streams where data will assist with impairment determinations, as well as represent the range of landscape characteristics and land use/land cover influences existing in the

watershed. Sampling sites were identified by both assessment of aerial images and field surveying to capture the variability in land use and watershed characteristics potentially contributing to sediment impairment issues in streams including: stream order, valley confinement and slope, ecoregion, and land use/land cover (e.g. known mined areas, forest, grass, riparian area, geology, and soils).

The following streams are proposed for sediment and habitat sampling in the West Fork Gallatin River watershed (**Figure 2-1**) (reach locations are in parenthesis):

- Beehive Creek (12-01, 15-01)
- Middle Fork West Fork Gallatin River (2-01, 4-01, 8-01, 9-01)
- Muddy Creek (5-02, 5-03, 8-01, 8-02)
- North Fork West Fork Gallatin River (10-01)
- South Fork West Fork Gallatin River (16-02, 17-02, 18-01, 22-01, 28-01, 29-04)
- West Fork Gallatin River (1-02, 1-04, 2-01, 3-03)

In addition to these twenty-one sites, at least three streambank erosion assessments will be performed on first and second order tributary streams which comprise much of the West Fork Gallatin River watershed. Tributary streams may include First Yellow Mule, Second Yellow Mule, Third Yellow Mule, “Stony” and “Moose Tracks” creeks. *Note that “ ” indicates stream names assigned to un-named streams for the purposes of this assessment.*

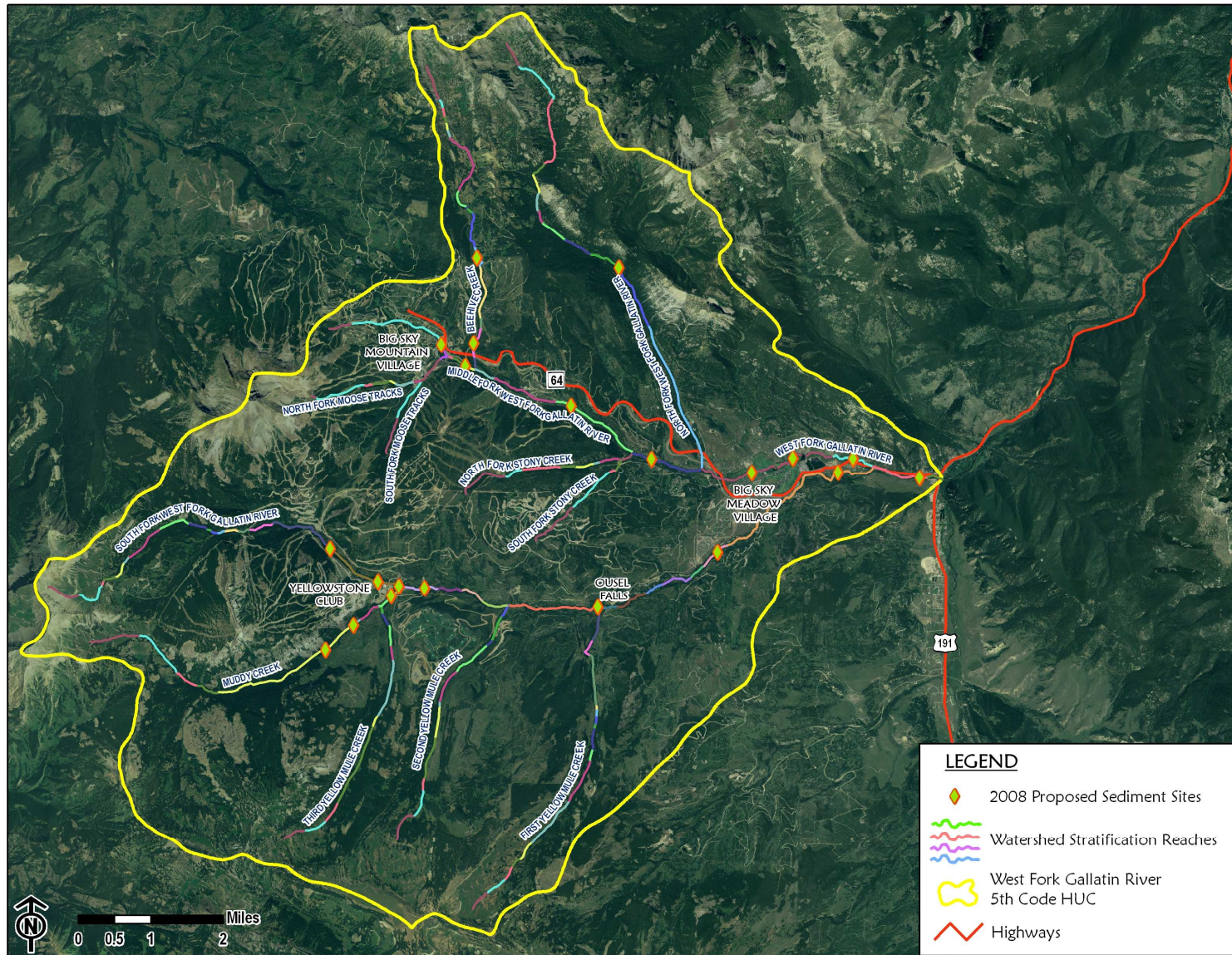
### **3.0 Field Sampling Methods**

All monitoring and data collection will be done in accordance with the approach described in *DRAFT Longitudinal Field Methods for the Assessment of TMDL Sediment and Habitat Impairments* (MT DEQ 2007) and *MDEQ’s Field Procedures Manual* (MT DEQ 2005). Because the approach for assessment of TMDL sediment and habitat impairments is currently in draft form, there may be some slight changes to the procedure. Any alterations will be determined by the DEQ TMDL project officer and will be discussed with all field crew members before field work begins. At the discretion of the DEQ project officer, only a portion of the method may be employed at some sites to avoid duplication of previous data collection efforts or to collect limited, targeted information to assist with sediment load calculations.

### **4.0 Quality Assurance and Quality Control Requirements**

Data Quality Objectives (DQOs) are the quantitative and qualitative criteria established for a sampling design in order to meet the project’s objectives. Data Quality Indicators (DQIs) are quantitative criteria established for the data acquired within this design to assure it is of sufficient quality for its intended use.

Figure 2-1. West Fork Gallatin River Watershed



# DQOs

## *Representativeness*

Representativeness refers to the extent to which measurements represent an environmental condition in time and space. This is a judgmental sampling design using the following rationale:

### Spatial representation:

Sampling sites were chosen to represent the influence of landscape characteristics and land use/land cover existing in the watershed on stream substrate character, stream morphology and habitat conditions. Sampling sites were identified by both assessment of aerial images and field surveying to capture the variability in land use and landscape characteristics potentially contributing to sediment impairment issues in streams including: stream order, valley confinement, slope, ecoregion, and land use/land cover (e.g. known mined areas, forest, grass, riparian area, geology, and soils) (Table 2-1, see PBS&J 2008).

**Table 2-1. Aerial Assessment Reach Stratification Spatial Representation.**

Reach Type	Number of Reaches	Number of Reaches to be Assessed
MR-0-3-U	12	4
MR-0-4-U	4	1
MR-2-1-U	2	1
MR-2-2-U	6	5
MR-2-3-C	2	0
MR-2-3-U	9	4
MR-4-1-C	10	1
MR-4-1-U	39	2
MR-4-2-C	2	0
MR-4-2-U	18	3
MR-4-3-C	2	0
MR-10-1-C	12	0
MR-10-1-U	36	0
MR-10-2-U	2	0

Reach types of primary interest highlighted in yellow.

### Temporal representation

This study is designed to document a stream’s geometry, riparian condition, and substrate characteristics. It uses bankfull width and depth for many of its measures, which is based upon a 1.2 – 2.0 year return cycle.

### ***Comparability***

Comparability is the applicability of the project's data to the project's decision rule. The decision rules used for this project will be determined based on reference data for sediment and habitat conditions based upon regional data, internal data (no/limited human impact), and literature values.

### ***Completeness***

Completeness is a measure of the amount of data prescribed for assessment activities and the usable data actually collected, expressed as a percentage. Completeness is determined after the evaluation of the project's DQIs.

#### Example:

There are approximately 21 sites planned with 5 individual study 'cells' per site for a total of 105 results. The overall project goal is 85% completeness. Sites lost due to inaccessibility will reduce the total number of sites in the equation above but not the completeness goal. If any listed stream has less than 50% of its planned sites sampled due to accessibility issues, the project conclusions will note this fact and account for the increased uncertainty in the TMDLs margin of safety.

## **DQIs**

### ***Precision***

Precision refers to the degree of agreement among repeated measurements of the same characteristic. DEQ has tested the reproducibility of the measurements employed in this design and found that the precision of repeat measurements is sufficient relative the total variance from cell to cell. The greatest source of result variance comes from the heterogeneity of a study site (due to natural/human disturbance variability) rather than systematic and random error of individual measurements. Therefore, DEQ feels that precision of measurements is controlled satisfactorily through training and adherence to the sampling protocols described in *DRAFT Longitudinal Field Methods for the Assessment of TMDL Sediment and Habitat Impairments* (MT DEQ 2007)

### ***Sensitivity***

Sensitivity refers to the limit of a measurement to reliably detect a characteristic of a sample. Similar to precision, the sensitivity of measurements was tested during method development. No modification to the measurement increments or units specified in *DRAFT Longitudinal Field Methods for the Assessment of TMDL Sediment and Habitat Impairments* (MT DEQ 2007) are allowed without consent from the DEQ TMDL Project Officer.

### ***Bias***

Bias is directional error from the true value. In this context, it is an extension of the representativeness concept applied to an individual sample. Bias can occur either during site selection or measurement.

The criteria for site selection in this study, as described in *DRAFT A Watershed Stratification Approach in TMDL Sediment and Habitat Impairment Verification* (MT DEQ 2008) is designed to reduce bias and identify sites that are representative of the natural (physical) influences of sediment loading, transport, and deposition in contrast to sites with non-natural (anthropogenic) influence. Because the stratification of a watershed is so key to controlling bias in the resulting data, all decisions made during the stratification process will be overseen by the DEQ TMDL Project Officer.

## **5.0 Data Analysis, Record Keeping, and Report Requirements**

A review of field data will be conducted following receipt of the field data package. All data collected as part of this SAP will be evaluated against the methods cited in Section 4.0. Data qualifiers may be assigned to data that does not appear to have followed these processes.

Following is a summary of the data qualifier codes that may be used

J - The associated numerical value is an extreme outlier to the dataset but the process appears to have been followed based on the supporting data and field notes. The use of a “J” qualifier allows the TMDL project officer to consider whether the value should be used outright, with caution, or censured from the dataset.

R – The associated numerical value is an extreme outlier to the dataset and the process appears NOT to have been followed based on the supporting data and field notes. The data are unusable; resampling and/or reanalysis are necessary if completeness goal is not met due to this data being rejected.

### **Summary of Data Quality**

A summary discussion of data quality will be prepared following review of field documentation and data. The data quality analysis will summarize the QA/QC information from the field event, audit information, corrective actions taken (if any), and the overall results of sampling activities with respect to compliance with the provisions of this SAP. The primary focus of the data quality analysis will be an estimate of the effects that any deviations from approved procedures may have on the project objectives or data uses.

Data generated during this project will be stored on field forms and in electronic spreadsheets and summary reports. Written field notes and forms will be processed by DEQ staff following QA/QC procedures to screen for data entry errors. All approved data will be input into an electronic spreadsheet format for future analysis purposes.

## **6.0 Schedule for Completion**

Sampling is scheduled for the summer of 2008.

## **7.0 Project Team Responsibilities**

Banning Starr – DEQ Project Officer  
Mark Bostrom – DEQ Quality Assurance Officer  
Jeff Dunn – PBS&J Lead Scientist

## 8.0 References

- MT DEQ 2007. Longitudinal Field Methods for the Assessment of TMDL Sediment and Habitat Impairments. Montana Dept. of Environmental Quality. June 2007.
- MT DEQ 2008. Watershed Stratification Methodology for TMDL Sediment and Habitat Investigations. Montana Dept. of Environmental Quality. April 2008.
- MT DEQ 2005. Water Quality Planning Bureau Field Procedures Manual for Water Quality Assessment Monitoring. Montana Dept. of Environmental Quality, WQPBWQM-020, revision 2. April 21, 2005. *Available at*  
<http://www.deq.state.mt.us/wqinfo/QAProgram/SOP%20WQPBWQM-020.pdf>
- PBS&J 2008. Upper Gallatin TMDL Planning Area Aerial Assessment Reach Stratification. Prepared by PBS&J, Bozeman, Montana. Prepared for Blue Water Task Force, Inc., Big Sky, Montana, and Montana Dept. of Environmental Quality, Helena, Montana.