UPPER JEFFERSON RIVER TMDL PLANNING AREA: 2010 DISCHARGE MONITORING

Sampling and Analysis Plan

Prepared by:

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This document constitutes the Sampling and Analysis Plan (SAP) for continuous discharge assessment on selected streams in the Upper Jefferson River TMDL planning area (TPA). This SAP provides sampling and analysis guidance for a portion of the Upper Jefferson River TMDL Project (PP# MO8-TMDL-02) (DEQ, 2010).

1.0 INTRODUCTION AND BACKGROUND

The Upper Jefferson TPA is located in the Missouri River Watershed. The Jefferson River is a major tributary of the Missouri River. The Ruby, Big Hole and Beaverhead rivers converge to form the Jefferson River near the town Twin Bridges. The downstream extent of this TPA is near the town of Cardwell and the Jefferson River's confluence with Boulder River. The TMDL planning area includes portions of Broadwater, Silver Bow, and Madison counties.

Big Pipestone and Whitetail creeks are identified for various nutrient related impairments on Montana's 2008 impaired waters list (**Figure 1**). These two waters will be the focus of this sampling plan.

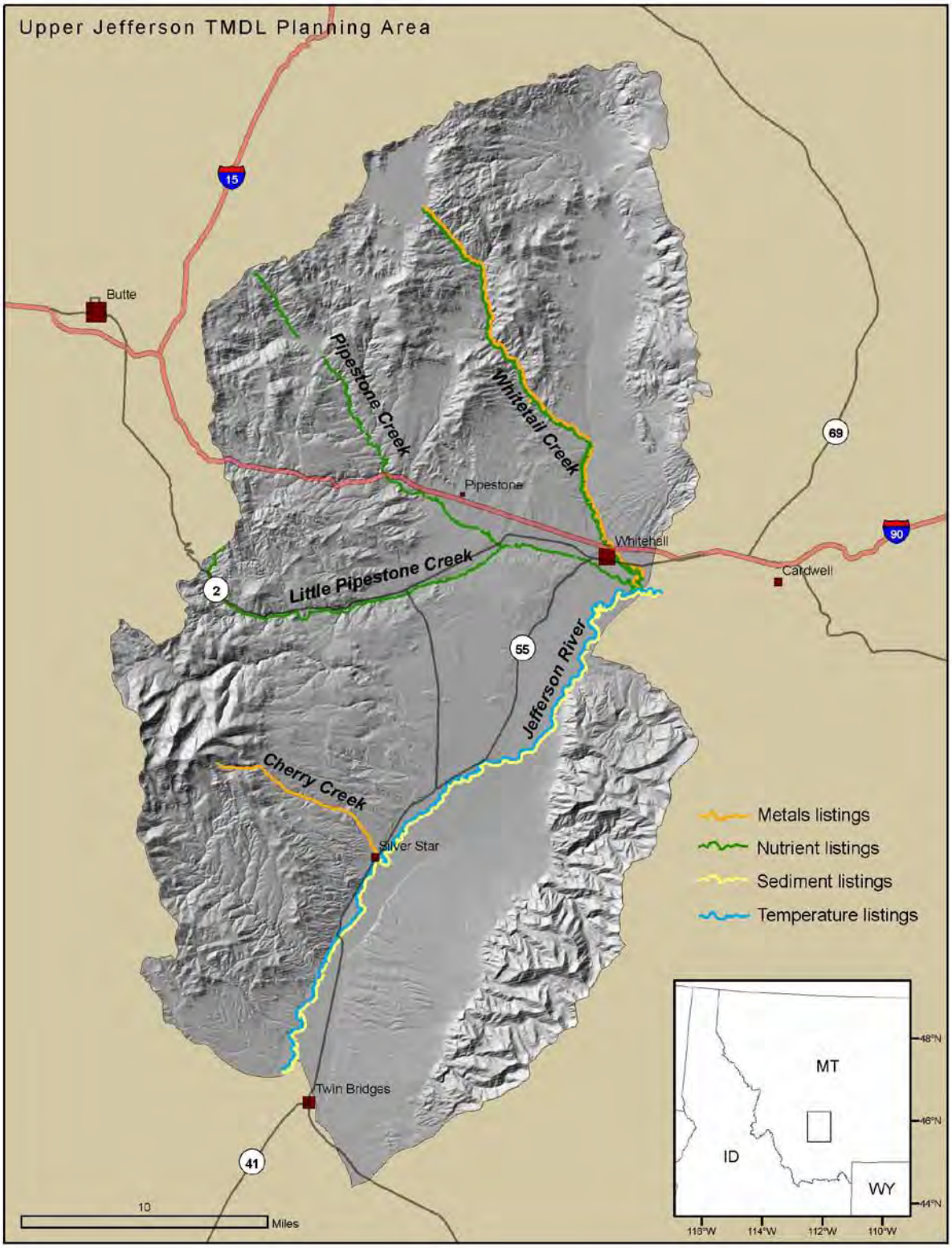

Figure 1. Metals, nutrient and other pollutant listings addressed by Upper Jefferson TMDL phase II

2.0 OBJECTIVES AND DESIGN

The objective of this sampling plan is to estimate summer low flow discharge at four sites which will be used for the following:

- Continuous stage monitoring, periodic discharge measurements, and an associated stage to discharge rating curve application will be used to provide an estimate of summer low flow discharge conditions which will provide hydrological input for a GWLF or similar model.
- Summer low flow conditions are the most critical timeframe for nutrient impacts upon beneficial uses.

2.1 Study Design

In order to meet the above objectives, stage conditions will be investigated in Whitetail and Pipestone Creeks near Whitehall, MT. Installation and operation of four stage recording devices (SRD) will be performed at each of the selected sample sites (**Figure 2**). Note that the lower end of both Whitetail and Big Pipestone stream segments are not depicted correctly in **Figure 2** or in Montana's Integrated Report. Below Whitehall's sewage lagoons Big Pipestone Creek flows northeast into Whitetail Creek. Whitetail Creek Flows into Jefferson Slough. Jefferson Slough flows into the Jefferson River near Cardwell. Stage recording will commence in the spring of 2010 and end prior to ice up conditions the same year. Sites are selected to assist in hydrologic calibration of a GWLF or similar water quality model. Monitoring locations are near watershed outlet locations, POTWs, or in locations where inter-basin water transfers will be assessed. Final monitoring locations will be established in the field for locations best suited for data collection, but considering overall objectives in which sites have been selected using aerial photos.

The proposed truetrack sampling sites are: 1) on the lower end of Jefferson Ditch where Jefferson River water enters Big Pipestone Creek's watershed, 2) just above SR55 on Big Pipestone Creek 3) near Big Pipestone Creek watershed outlet before it flows into Whitetail Creek, 4) on Whitetail Creek above the Big Pipestone confluence. Exact locations may shift in the field due to physical conditions of the channel or land access and will be noted in field forms. Also, instantaneous discharge will be measured in the ditch that empties into Big Pipestone Creek just below SR55.

A low certainty stage to discharge relationship is needed. This will entail gathering four to five discharge measures at various stage levels throughout the SRD deployment for each site. The WQPB's Monitoring and Assessment Section (WMAS) will measure one discharge measure at installation and one time at equipment retrieval. WQPB's Watershed Management Section will measure discharge two times total during July and September. A contractor for DEQ will monitor flow once during August, which is covered in another SAP.

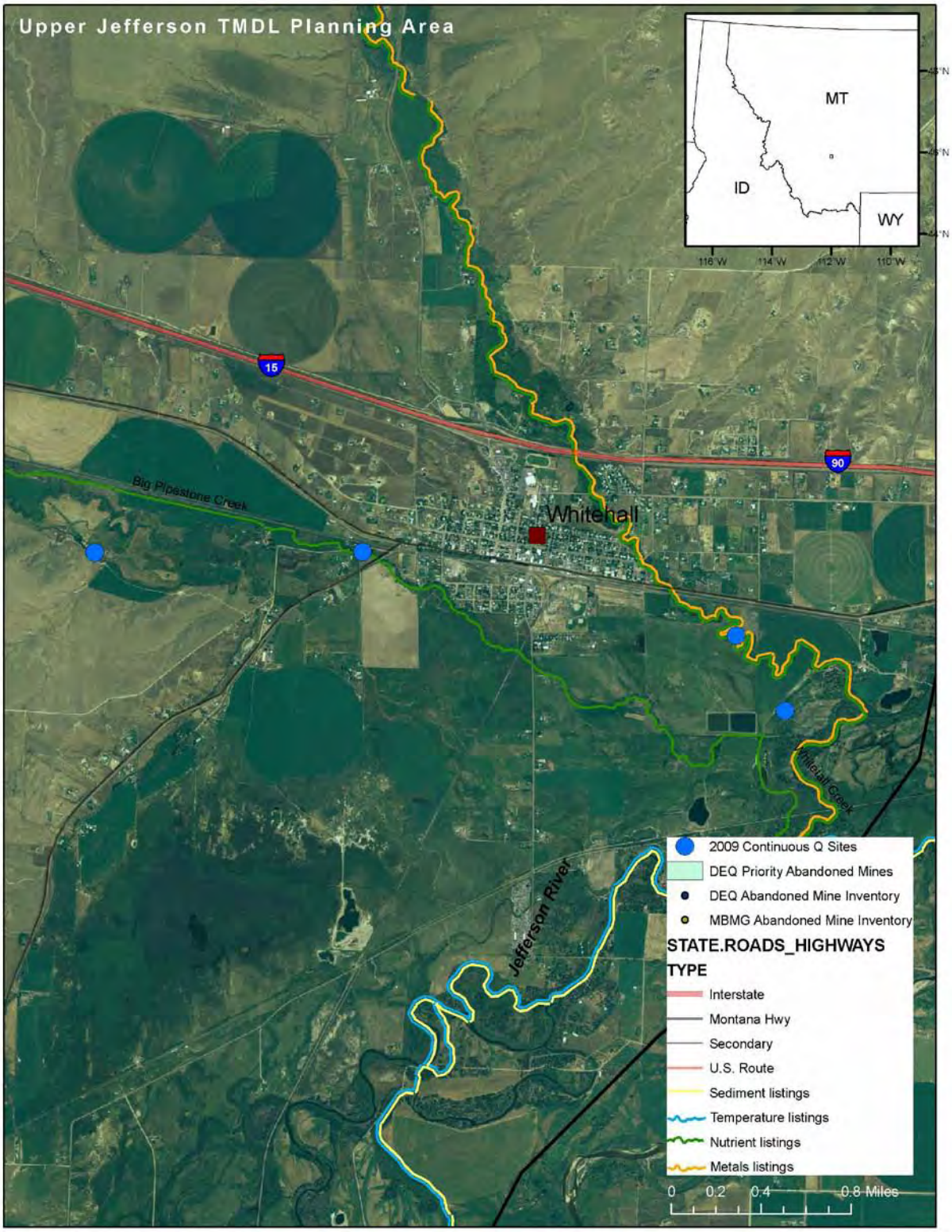

Figure 2. Proposed 2010 stage recording device monitoring sites.

3.0 FIELD SAMPLING METHODS

Manual stream discharge measurements will be collected at all sites using a *Marsh McBirney Flo-Mate 2000*™ current velocity meter in accordance with MDEQ's Field Procedures Manual (http://deq.mt.gov/wqinfo/QAProgram/PDF/SOP%20WQPBWQM-020.pdf) (DEQ, 2005a). Although it is not anticipated, additional precautions may be necessary to obtain discharge during high flow sampling. If high flow sampling necessitates the use of a float estimation method due to dangerous instream conditions, the following protocol should be used.

Find a reach of stream that is linear/straight, as well as uniform in width and depth; a glide is preferred. Estimate mean wetted width with rangefinder. Measure or pace off the distance twice the mean wetted width (in feet) along the bank and mark each end by driving a stake or piece of rebar into the ground at the high water line. Toss an orange or block of wood into the middle of the stream above the upstream marker of the measured reach. Begin timing when the object passes the upstream marker. Count (with a watch or stopwatch) the seconds it takes the orange to reach the downstream marker. The object must stay in the main current. If it does not, repeat the measurement. Complete three measurable floats in various parts of the channel. Record the data on the site visit form and the discharge form. For extreme low flow monitoring a small section of a twig can be used.

A WQPB generated draft SOP for Digital Stage Recorders (DEQ 2010) will be followed for physical installation procedures, calibration, exact site selection, further guidance on manual discharge measurements, stage to discharge curve assessment methodology, other data analysis, data storage and records management. In addition to the SOP, a site benchmark will be used because of the potential for aggredation or degradation. Each site's cross section will be monumented during installation and extraction.

Temperature data loggers will be deployed at each site by zip tying it onto the downstream side of the casing pipe for the Digital Stage Recorder, or attaching it to some other anchor in the channel near the casing pipe. Montana DEQ's Temperature Datalogger SOP guidance will be followed and is contained at the following link:
http://www.deq.state.mt.us/wqinfo/qaprogram/PDF/SOP%20WQPBWQM-006.pdf

A set of site forms will be completed for each site that includes the site coordinates, time, weather, and any other observations that may affect water stage in the area (e.g. beaver dams, cattle, or excessive macrophyte growth). The flow meters will be calibrated prior to use according to their respective operation manuals. The GPS coordinate system datum will be NAD 1983 State Plane Montana, in decimal degrees to at least the fourth decimal.

Pictures will be taken at each sampling location during the first sampling event in spring 2010 to document the general sample location. Pictures that document the sample site location do not need to be retaken for each sampling event, unless the sample location changes or an additional site is added. All pictures will be documented following the requirements in the bureaus photograph form.

4.0 QUALITY ASSURANCE MEASURES

This project will follow all QA/QC review procedures established in the WQPB "internal process". These procedures are described in Quality Assurance Project Plan (QAPP) Sampling and Water Quality Assessment of Streams and Rivers in Montana (DEQ, 2005b).

4.1 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 runoff from the whole watershed and interbasin transfers of water. Sampling sites were identified by both assessment of aerial images and field surveying.

Temporal representation:

Fine time periods are proposed for discrete discharge monitoring to temporally represent the potential for variable flows, which generally increase during spring runoff and summer storm events. Although understanding runoff volume is beneficial to the project, the summer low flow period is most important timeframe for this project.

4.2 Comparability

Comparability is the applicability of the project's data to the project's decision rule. The decision rule used for this project is to bolster the hydrologic understanding about the Whitetail and Big Pipestone watersheds. If this data provides more utility than current understanding of hydrology within these watersheds it will be used. If QA concerns about the discharge data collected under this SAP arise, they will be considered during data evaluation and model building.

4.3 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 as % = (No. Valid Data Points or Samples / Total # Data Points or Samples) x 100

The overall project goal is 90% completeness. Sites lost due to inaccessibility will reduce the total number of sites in the equation but not the completeness goal. Other potential influences upon completeness may be flood flows which may damage equipment and electronic equipment errors.

4.4 Sensitivity, Precision, Bias and Accuracy

Sensitivity is provided by the draft SOP for Digital Stage Recorders and MDEQ's Field Procedures Manual (http://deq.mt.gov/wqinfo/QAProgram/PDF/SOP%20WQPBWQM-020.pdf) (DEQ, 2005a). Sensitivity, precision, and accuracy of the TruTrack equipment and associated SOP for operation are acceptable for this project. Bias in stream stage data will be monitored using a fixed elevation of reference to ensure the stilling well remains a constant level and downstream

control point in the stream remains constant. Also, a independent, fixed staff gauge will be installed to assist in determining if any gauging bias (drift) occurs throughout the season.

5.0 DATA ANALYSIS, RECORD KEEPING, AND REPORTING REQUIREMENTS

5.1 QC Review and Documentation

This project will follow all QA/QC review procedures established in the WQPB "internal process". These procedures are described in Quality Assurance Project Plan (QAPP) Sampling and Water Quality Assessment of Streams and Rivers in Montana (DEQ, 2005b).

5.2 Record Keeping

Data generated during this project will be stored on field forms, in electronic files downloaded from the stage recording devices, summarized in electronic spreadsheets, and in eWQX. Site Visit forms will be properly completed for all samples. Written field notes, field forms, and digital photos will be processed by field staff following internal project QA/QC procedures.

6.0 SCHEDULE FOR COMPLETION

Stream gauging will occur between June, 2010 and early October, 2010 but no later than streams ice over.

7.0 PROJECT TEAM AND RESPONSIBILITIES

The WMAS will be responsible for equipment preparation, calibration, installation, maintenance, retrieval. The WMAS section will also be responsible for post processing data, initial data QA after downloading, and deriving a stage to discharge relationship. The WMAS is also responsible for instantaneous flow measurements at the time of installation and during equipment retrieval. The Watershed Management Section (WMS) or their Contractor will be responsible for monitoring instantaneous flow a total of three times during July through September, 2010 (EM08TMDL02SAP3). WMS will be responsible for contacting landowners and acquiring site access. Data QA review will be a shared duty between the water quality modeler from the Data Management Section and the TMDL project coordinator from the WMS.

8.0 REFERENCES

DEQ. Water Quality Planning Bureau, 2010. Standard Operating Procedure for Digital Stage Recorders.

DEQ. Water Quality Planning Bureau , 2009. Upper Jefferson River TPA Project Plan. DEQ-PPA Document: MO8-TMDL-02

DEQ. Water Quality Planning Bureau , 2005a. Field Procedures Manual for Water Quality Assessment Monitoring. Montana Dept. of Environmental Quality, WQPBWQM-020,

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DEQ. Water Quality Planning Bureau, 2005b. Quality Assurance Project Plan (QAPP) Sampling and Water Quality Assessment of Streams and Rivers in Montana, 2005. *Available at* http://www.deq.state.mt.us/wqinfo/QAProgram/WQPBQAP-02.pdf.