

Quality Assurance Project Plan/Sample & Analysis Plan
Malheur River Basin TMDL Nutrient Water Quality Study
for TMDL Development - 2006

A1. Title and Approval Sheet

Project Manager Signature:

John Dadoly

Signature/Date

Laboratory Monitoring Coordinator/Data Manager

Larry Marxer

Signature/Date

Project QA Officer:

Chris Redman

Signature/Date

Laboratory Analytical Officer:

Raeann Haynes

Signature/Date

WSA Manager:

Rick Hafele

Signature/Date



A2. Table of Contents

| | | |
|--|---|----|
| A1. | Title and Approval Sheet..... | 1 |
| A2. | Table of Contents | 2 |
| A3. | Plan Distribution List | 3 |
| Table 1 | Distribution List | 3 |
| A4. | Project Description..... | 3 |
| | A4.1 Introduction..... | 3 |
| | A4.2 Background..... | 3 |
| | A4.3 Geographic Area..... | 3 |
| | A4.4 TMDL Schedule..... | 4 |
| | A4.5 Significant Issues..... | 4 |
| | A4.6 Geographic Area..... | 5 |
| | A4.7 Beneficial Uses..... | 6 |
| | A4.8 Existing Surface Water Quality Data..... | 6 |
| Table A4.8 | Water Quality Limited Streams..... | 7 |
| | A4.9 Monitoring Network Design..... | 9 |
| Table A4.9 | Site Locations..... | 9 |
| A5. | Parameters and Frequency..... | 10 |
| Table A5-1 | Sample Locations, Schedule, Parameters and Frequency for Intensive Surveys..... | 11 |
| Table A5-2 | Continuous Temperature Monitoring Sites..... | 12 |
| Table A5-3 | Biomonitoring Site Locations..... | 12 |
| Table A5-3a | Biomonitoring Site Parameter List | 13 |
| A6. | Quality Objectives and Criteria..... | 13 |
| Table A6 | Data Quality Criteria | 13 |
| A7. | Documentation and Records | 16 |
| B1. | Sampling Methods..... | 17 |
| Table B1 | Sample Preservation Methods and Holding Times | 17 |
| B2 | Sample Handling and Custody Procedures..... | 18 |
| B3 | Analytical Methods..... | 18 |
| B4 | Quality Control..... | 18 |
| B5 | Instrument/Equipment Testing, Inspection, and Maintenance..... | 18 |
| B6 | Instrument Calibration and Frequency..... | 18 |
| B7. | Inspection/Acceptance of Supplies and Consumables..... | 19 |
| B8. | Non-direct Measurements..... | 19 |
| B9. | Data Management..... | 19 |
| C1. | Assessment and Response Actions..... | 20 |
| C2. | Reports to Management | 20 |
| D1. | Data Review, Verification and Validation..... | 21 |
| D2. | Verification and Validation Methods..... | 21 |
| D3. | Reconciliation with User Requirements..... | 21 |
| Appendix A. | | 22 |
| Appendix B-Field Data Forms..... | | 22 |
| Appendix C-Addendums to Original Plan..... | | 22 |



A3. Plan Distribution List:

Table No. 1

| Name: | Project Title/Responsibility | Telephone Number |
|---------------|-------------------------------------|-------------------------|
| John Dadoly | DEQ Regional TMDL Coordinator | 1-541-278-4616 |
| Larry Marxer | DEQ Project Manager/Field Crew Lead | 1-541-229-5983 Ext. 274 |
| Rick Hafele | DEQ Watershed Assessment Manager | 1-541-229-5349 |
| RaeAnn Haynes | DEQ Inorganic Lab Manager | 1-503-229-5983 Ext. 227 |
| Chris Redman | DEQ Laboratory QA Officer | 1-503-229-5983 Ext. 254 |
| Gene Foster | DEQ Organic Lab Manager | 1-503-229-5983 Ext. |
| Bob McCoy | DEQ Sample Tracker | 1-503-229-5983 Ext. 238 |
| | | |

A4. PROJECT DESCRIPTION

A4.1 Introduction

This Quality Assurance Project Plan describes the field work and laboratory analytical work that will be performed by staff from the Oregon Department of Environmental Quality (ODEQ) Laboratory in Portland, OR and Regional Office in Pendleton to conduct a water quality study in the Upper Malheur River Basin between May 2006 and December 2006. DEQ is conducting this study to fulfill the requirements for TMDL development for the Malheur Basin.

A4.2 Background

The Malheur River is one of eighteen major river basins in Oregon. The Malheur Basin is located in eastern Oregon and is bordered to the north by the Powder River Basin, to the south by the Owyhee River Basin, and to the west by the Malheur Lake Basin. The mainstem Malheur River is 190 miles long, fourth longest within the state boundaries of Oregon. The drainage area of the basin covers 5072 square miles and includes 8000 miles of surface water streams. The Malheur River empties into the Snake River at river mile 368.5 in the area referred to as the Upstream Snake River segment of the Snake River-Hell's Canyon TMDL study reach.

Rivers and streams in the Malheur Basin have been placed on the current 303(d) list of water quality limited water bodies due to a variety of pollution-related problems including bacteria, chlorophyll, low dissolved oxygen, and high water temperatures. Federal law requires individual states to manage water bodies that appear on the 303(d) list to meet the state water quality standards. ODEQ has started the scoping process for the Total Maximum Daily Loads (TMDLs) for pollutants entering the Malheur River and its tributaries.

A4.3 Geographic Area

The TMDL process for the Malheur Basin will cover all streams within the Malheur River (17050116) and Middle Snake-Payette (17050115) USGS 4th field HUC watersheds. The Malheur Basin is divided into the Lower Malheur, Upper Malheur, Willow Creek, and Bully Creek sub-basins. Major Bureau of Reclamation water storage reservoirs are located on the Upper Malheur mainstem (Warm Springs), North Fork Malheur (Beulah), and Bully Creek (Bully). Smaller reservoirs are located on Willow Creek and the South Fork Malheur. The reservoirs provide water for an extensive irrigation system in the Lower Malheur, Bully and Willow sub-basins. Irrigation of crops also occurs on a smaller scale above the reservoirs.



A4.4 TMDL Schedule

The TMDL scoping process started in November 2005 and will continue through Spring 2006. Sampling activities aimed at providing data for TMDL development will occur during the Spring, Summer, and Fall of 2006. TMDL development will occur in 2007 with a target completion date of December 2007.

A4.5 Significant Issues

The Lower Malheur Sub-basin contains the Malheur Groundwater Management Area (GWMA) which was established by DEQ in 1989 to address elevated nitrate concentrations in groundwater. The TMDL process will be coordinated with DEQ and local activities conducted in the Malheur GWMA.

The TMDL for the Snake River-Hells Canyon reach was completed in July 2003. It includes load allocations for phosphorus, sediment, and water temperature for the Malheur River and point sources with the Middle Snake-Payette watershed. These allocations will be incorporated into the Malheur TMDL.

Snake River TMDL Requirements for Malheur River and Middle Snake-Payette Basins

The TMDL for the Snake River-Hells Canyon reach was completed in July 2003. It includes load allocations for phosphorus, sediment, and water temperature for the Malheur River and point sources with the Middle Snake-Payette watershed. These allocations will be incorporated into the Malheur TMDL.

Phosphorus: The Snake River-Hells Canyon Reach TMDL assigned a total phosphorus load of 61 kg/day for the Malheur River (87% reduction from 461 kg/day). Based on average flow levels, this equates to a total phosphorus concentration of 0.07 mg/l at the mouth of the Malheur River. The goal of this reduction is to reduce algae growth and improve dissolved oxygen conditions in the Snake River. It was assumed that data would be collected during the development of the Malheur TMDL that would allow for accurate assessments of the naturally occurring phosphorus loading so that anthropogenic loads could be identified and distributed to point and non-point sources within the Malheur Basin.

Waste load allocations were also assigned for phosphorus point sources located in the Middle Snake-Payette Basin. These sources discharge directly to the Snake River. Point sources in Oregon include: City of Nyssa, Amalgamated Sugar, Heinz Frozen Foods, and City of Ontario (does not discharge during the critical Summer period). No significant point sources of phosphorus or other nutrients which discharge directly to the Malheur River have been identified.

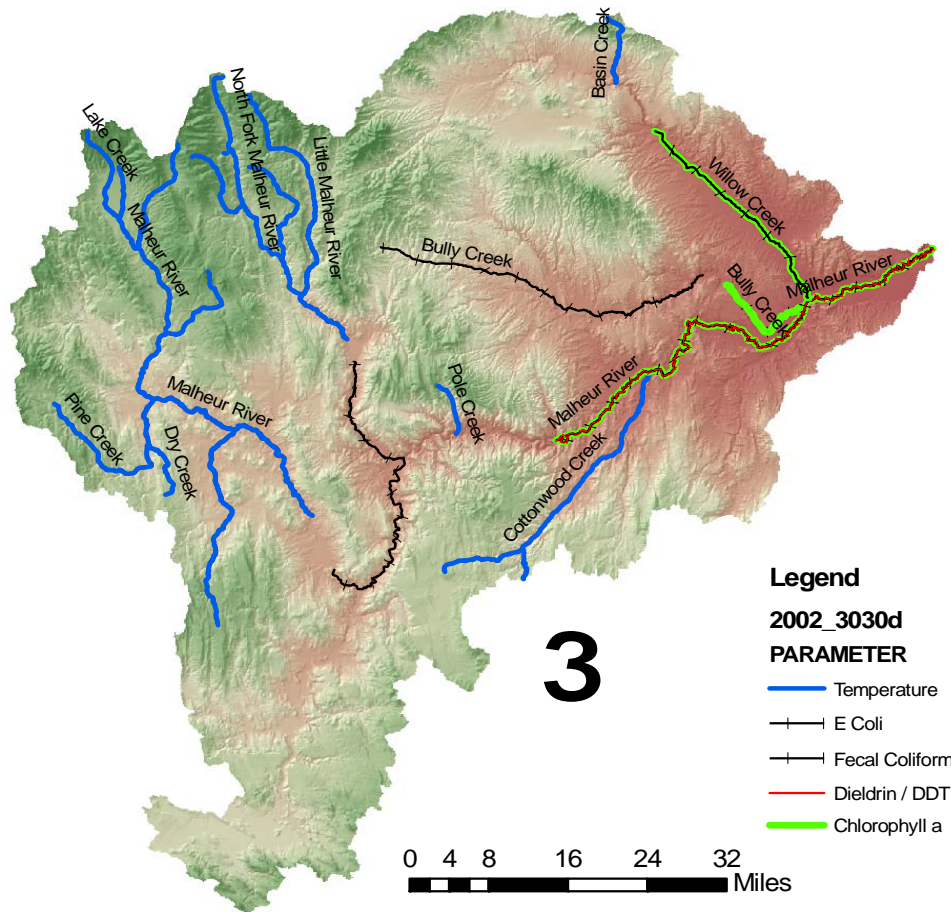
Sediment: Tributaries of the Snake River were assigned a TSS concentration of no more than 50 mg/l as a monthly average. This equates to a sediment load for Malheur River of 46,735 kg/day (current load estimated at 92,870 kg/day). It is assumed that measures taken to limit the loading of nutrients such as phosphorus will also help to reduce overall sediment loading.

Temperature: The Malheur River and other tributaries of the Snake River in the Snake River-Hells Canyon (SR-HC) TMDL reach were each assigned a total anthropogenic temperature load allocation of less than 0.14 degrees C. This load applies at the inflow to the SR-HC reach during periods when the site potential temperature in the Snake River is greater than 17.8 degrees C.



A4.6 Geographic Area

The TMDL process for the Malheur Basin will cover all streams within the Malheur River (17050116) and Middle Snake-Payette (17050115) USGS 4th field HUC watersheds. The Malheur Basin is divided into the Lower Malheur, Upper Malheur, Willow Creek, and Bully Creek sub-basins. Major Bureau of Reclamation water storage reservoirs are located on the Upper Malheur mainstem (Warm Springs), North Fork Malheur (Beulah), and Bully Creek (Bully). Smaller reservoirs are located on Willow Creek and the South Fork Malheur. The reservoirs provide water for an extensive irrigation system in the Lower Malheur, Bully and Willow sub-basins. Irrigation of crops also occurs on a smaller scale above the reservoirs.



Beneficial Uses

The beneficial uses of surface water in the Malheur River Basin as listed in ORS 340-41-0201:

- Public Domestic Water Supply
- Private Domestic Water Supply
- Industrial Water Supply
- Irrigation
- Livestock Watering
- Fish and Aquatic Life
- Wildlife and Hunting
- Fishing
- Boating
- Water Contact Recreation
- Aesthetic Quality

Fish/aquatic life is considered one of the most sensitive beneficial uses in the basin. The fish use designation for the lower 65 miles of the Malheur River, along with the lower portions of Willow and Bully Creeks is Cool Water Species (no salmonid use). The headwaters of the mainstem Malheur River, North Fork Malheur River, and Little Malheur River are designated either Bull Trout Spawning and Rearing or Core Cold-Water Habitat. The remainder of streams in the basin are designated Redband or Lahontan Cutthroat Trout Habitat.

Existing Surface Water Quality Data

DEQ currently maintains four ambient water quality stations in the Malheur Basin. They are located near the mouth of the Malheur in Ontario, at the mouths of Willow Creek and Bully Creek near Vale (RM 20), and in Little Valley (RM 50). Data from these sites has been collected over many years and includes a wide range of analytes including nutrients, bacteria, total suspended solids, pH, and chlorophyll. These data form the basis for many of the 303(d) listings in the Lower Malheur. DDT and dieldrin listings are based on sampling performed in the Lower Malheur by the USGS in 1990.

Based on concerns regarding natural and anthropogenic phosphorus loading in the Malheur Basin, the Malheur Experiment station evaluated data from sampling conducted by the Malheur Watershed Council (WSC) and Malheur Soil and Water Conservation District (SWCD). The sampling was conducted over a wide area of the basin between 1997 and 2001. Analyses included nutrients and general water quality criteria.

In 2003 and 2004, DEQ teamed with BLM and conducted further sampling throughout the Malheur Basin with the intent of determining source areas and background nutrient loading sources. Samples were analyzed from approximately 25 locations.

EPA's STORET database includes data from surface water samples collected at approximately 80 locations in the Malheur Basin by the United States Bureau of Reclamation (USBR), Malheur WSC, and Malheur SWCD. Samples collected by the WSC and SWCD were analyzed by the USBR laboratory. The data sets at many of the sites span 3-5 years of monthly or bimonthly sampling between 1999 and 2005. Sample locations include the USBR reservoirs (Bully, Beulah, and Warm Springs), the Malheur River and tributaries, irrigation canals, and newly constructed water treatment systems such as constructed wetlands.

The USBR also maintains continuous flow and temperature monitoring stations above and below Beulah Reservoir (approx. RM 18 and RM 23) on the North Fork Malheur, above and below Warm Springs Reservoir (approx. RM 122 and 142) on the Upper Malheur, and near the mouth of the Malheur in Ontario. A USBR flow gauge is also located at the Nevada diversion Dam near Vale (approx. RM 20), and a USGS flow gauge is located on the Snake River near Nyssa (approx. RM 392).



Continuous temperature monitoring data from streams in the Upper Malheur Sub-basin and a few streams in the Lower Malheur and Willow creek Sub-basins has been collected by the Burns-Paiute Tribe, ODF&W, BLM and USFS. These data were the basis for temperature 303(d) listings. The BLM also has low-level aerial photography and Proper Functioning Condition (PFC) stream survey data. DEQ will request similar data from USFS if available.

The 303(d) listings for bacteria, chlorophyll, and toxics (DDT and dieldrin) are found in the Lower Malheur and its major tributaries, Bully Creek and Willow Creek. Temperature listings occur on the mainstem Malheur and tributaries above Warm Springs Reservoir, the North Fork Malheur and tributaries above Beulah Reservoir, Cottonwood Creek and Pole Creek (tributaries of the Lower Malheur River) and Basin Creek tributary of Willow Creek. The Malheur River is listed for low dissolved oxygen throughout its length (RM 0-186.1).

In general, the existing data from EPA STORET and DEQ LASAR databases support the 303(d) listings. These data indicate that moderate nutrient and bacteria loading starts in the upper Malheur River, above Warm Springs and Beulah Reservoirs. Significant increases in bacteria, phosphorus, nitrite/nitrate, and chlorophyll occur in the lower river below Bully and Willow Creeks. Similar dramatically increasing patterns of bacteria and nutrient loading occur in Bully Creek below Bully reservoir and Willow Creek below Malheur Reservoir. The existing data also indicate low DO conditions in Summer from the mouth of the Malheur River as far upstream as Drewsey (approx. RM 142).

Table A4.8 Water Quality Limited Streams

Lower Malheur Subbasin

| Record ID | Waterbody Name | River Mile | Parameter | Season | List Date | Listing Status |
|----------------------|------------------|------------|-------------|-----------------------|-----------|----------------|
| 2465 | Alder Creek | 0 to 4.1 | Temperature | Summer | 1998 | 303(d) List |
| 2464 | Cottonwood Creek | 0 to 35.3 | Temperature | Summer | 1998 | 303(d) List |
| 2231 | Pole Creek | 0 to 6.3 | Temperature | Summer | 1998 | 303(d) List |
| 9098 | Willow Creek | 0 to 0.2 | E Coli | October 1 - May 31 | 2002 | 303(d) List |
| 9097 | Willow Creek | 0 to 0.2 | E Coli | June 1 - September 30 | 2002 | 303(d) List |

Upper Malheur Subbasin

| Record ID | Waterbody Name | River Mile | Parameter | Season | List Date | Listing Status |
|----------------------|--------------------------|--------------|----------------|---------------|-----------|----------------|
| 2193 | Bear Creek | 0 to 14.7 | Temperature | Summer | 1998 | 303(d) List |
| 2194 | Big Creek | 0 to 6.1 | Temperature | Summer | 1998 | 303(d) List |
| 2196 | Bluebucket Creek | 0 to 12.1 | Temperature | Summer | 1998 | 303(d) List |
| 2201 | Crane Creek | 0 to 1.1 | Temperature | Summer | 1998 | 303(d) List |
| 2444 | Dry Creek | 0 to 8.3 | Temperature | Summer | 1998 | 303(d) List |
| 2204 | Elk Creek | 0 to 1 | Temperature | Summer | 1998 | 303(d) List |
| 2206 | Lake Creek | 0 to 11.9 | Temperature | Summer | 1998 | 303(d) List |
| 2202 | Little Crane Creek | 0 to 9.3 | Temperature | Summer | 1998 | 303(d) List |
| 2208 | Little Malheur River | 0 to 28.5 | Temperature | Summer | 1998 | 303(d) List |
| 2210 | North Fork Malheur River | 20.8 to 43.1 | Temperature | Summer | 1998 | 303(d) List |
| 2211 | North Fork Malheur River | 43.1 to 59.3 | Temperature | Summer | 1998 | 303(d) List |
| 2251 | North Fork Malheur River | 0 to 18 | Fecal Coliform | Spring/Summer | 1998 | 303(d) List |
| 2217 | Pine Creek | 0 to 24.7 | Temperature | Summer | 1998 | 303(d) List |
| 2220 | Stinkingwater Creek | 0 to 27.8 | Temperature | Summer | 1998 | 303(d) List |
| 2222 | Summit Creek | 0 to 14.2 | Temperature | Summer | 1998 | 303(d) List |

Willow Creek Subbasin

| Record ID | Waterbody Name | River Mile | Parameter | Season | List Date | Listing Status |
|----------------------|----------------|------------|----------------|--------------------|-----------|----------------|
| 9174 | Basin Creek | 0 to 8.7 | Temperature | Summer | 2002 | 303(d) List |
| 9175 | Basin Creek | 0 to 8.7 | Temperature | March 1 - June 30 | 2002 | 303(d) List |
| 2267 | Willow Creek | 0 to 27.4 | Chlorophyll a | Summer | 1998 | 303(d) List |
| 2434 | Willow Creek | 0 to 27.4 | Fecal Coliform | Winter/Spring/Fall | 1998 | 303(d) List |
| 2254 | Willow Creek | 0 to 27.4 | Fecal Coliform | Summer | 1998 | 303(d) List |



Bully Creek Subbasin

| Record ID | Waterbody Name | River Mile | Parameter | Season | List Date | Listing Status |
|----------------------|----------------|--------------|----------------|-------------|-----------|----------------|
| 2252 | Bully Creek | 0 to 12.8 | Fecal Coliform | Summer | 1998 | 303(d) List |
| 2253 | Bully Creek | 15.9 to 57.1 | Fecal Coliform | Summer/Fall | 1998 | 303(d) List |
| 2438 | Bully Creek | 0 to 12.8 | Chlorophyll a | Summer | 1998 | 303(d) List |

Malheur River

| Record ID | Waterbody Name | Sub-Basin | River Mile | Parameter | Season | List Date | Listing Status |
|----------------------|----------------|--------------------|----------------|----------------|--------------------|-----------|----------------|
| 2190 | Malheur River | -CROSSES SUBBASINS | 126.8 to 162.3 | Temperature | Summer | 1998 | 303(d) List |
| 2191 | Malheur River | -CROSSES SUBBASINS | 162.3 to 185.9 | Temperature | Summer | 1998 | 303(d) List |
| 2249 | Malheur River | -CROSSES SUBBASINS | 0 to 67 | Fecal Coliform | Winter/Spring/Fall | 1998 | 303(d) List |
| 2250 | Malheur River | -CROSSES SUBBASINS | 93.4 to 119.9 | Fecal Coliform | Summer | 1998 | 303(d) List |
| 2265 | Malheur River | -CROSSES SUBBASINS | 0 to 67 | Chlorophyll a | Summer | 1998 | 303(d) List |
| 2375 | Malheur River | -CROSSES SUBBASINS | 0 to 67 | Dieldrin | Year Around | 1998 | 303(d) List |
| 2440 | Malheur River | -CROSSES SUBBASINS | 0 to 67 | DDT | Year Around | 1998 | 303(d) List |
| 2431 | Malheur River | -CROSSES SUBBASINS | 0 to 67 | Fecal Coliform | Summer | 1998 | 303(d) List |

Federal law requires individual states to manage water bodies that appear on the 303(d) list to meet the state water quality standards. ODEQ has started the scoping process for the Total Maximum Daily Loads (TMDLs) for pollutants entering the Malheur River and its tributaries.



A4.9 Monitoring Network Design

Proposed Monitoring/Modeling Strategy

Eutrophication Parameters: Three synoptic surveys are proposed for May, August and October. Major focus will include mainstem Malheur and major tributaries downstream of reservoirs and Willow Creek below Malheur Reservoir. Sample sites will include up to 12 hydro labs and approximately 31 grab sample sites. Field monitoring work will include standard field and water quality lab parameters including: chlorophyll a, TOC, BOD, TSS, alkalinity, nutrients, and flow. Bacteria analyses would be conducted at datasonde sites. Data will be used to build a QUAL2K model for the critical eutrophication period and load duration curves for bacteria.

Pesticides: Chlorinated Pesticide analyses will be conducted at a subset of the water quality sampling sites. Water and sediment will be analyzed in order to determine the validity of the DDT/Dieldrin listing and measure the geographical extent of possible sources.

Table A4.9 Site Locations

| Lasar# | Site Name | Riv. Mile | Elevation | Latitude | Longitude |
|--------|---|-----------|-----------|----------|-----------|
| 10407 | Malheur River @ Mouth | 0 | 2135' | 44.05675 | 116.9722 |
| 33261 | Malheur Riv. d/s Irrig. Pump opp. Ontario WWTP ponds | 2 | 2140' | 44.04512 | 117.01044 |
| 10408 | Malheur River @ Halliday Rd. | 14 | 2200' | 44.00022 | 117.14136 |
| 33260 | Malheur R. u/s of Willow Cr. near Vale WWTP | 20 | 2220' | 43.98706 | 117.22958 |
| 10727 | Malheur River at Hope | 35 | 2281' | 43.9394 | 117.3658 |
| 11480 | Malheur River @ Little Valley | 50 | 2400' | 43.91033 | 117.50758 |
| 11044 | Malheur River @ Harper | 57 | 2510' | 43.85439 | 117.60372 |
| 33175 | Malheur River @ Namorf | 67 | 2640' | 43.7786 | 117.7415 |
| 33176 | Malheur River @ Jones Ranch | 83 | 2800' | 43.8011 | 117.9304 |
| 33177 | Malheur River @ Juntura, OR | 100 | 2945' | 43.7094 | 118.093 |
| 31431 | Malheur Riv. @ Riverside d/s of So. Fork Malheur R. | 120 | 3300' | 43.5532 | 118.16385 |
| 33178 | So. Fork Malheur River @ mouth (Riverside) | 120 | 3300' | 43.5509 | 118.1674 |
| 33179 | Malheur River d/s of Warm Springs Res. @ dam | 122 | 3310' | 43.5776 | 118.2109 |
| 11047 | Malheur River @ Hwy. 20 near Drewsey, OR | 140 | 3490' | 43.78378 | 118.33178 |
| 33181 | Cottonwood Creek @ mouth | 0.75 | 3000' | 43.8712 | 117.5624 |
| 33182 | North Fork Malheur River near mouth | 1 | 2960' | 43.7552 | 118.028 |
| 33223 | A-Irrigation Drain | 2 | 2168' | 44.0395 | 116.9952 |
| 33224 | B-Irrigation Drain | 4 | 2188 | 44.0321 | 117.0253 |
| 33225 | 6 th Ave. Irrigation Drain | 6 | 2400' | 44.0690 | 117.2853 |
| 33184 | Bully Creek @ mouth | 0 | 2220' | 43.9746 | 117.2396 |
| 33262 | Bully Creek @ Graham Blvd. | 11 | 2400' | 43.983 | 117.36398 |
| 33186 | Bully Creek u/s of Reservoir | 18 | 2520' | 44.0263 | 117.4548 |
| 30448 | Bully Creek u/s of No. Fork Bully Creek | 46 | 3450' | 44.0477 | 117.8826 |
| 30449 | Indian Creek u/s of confluence w/Bully Creek | 0 | 3050' | 43.9849 | 117.7473 |
| 30446 | Clover Creek u/s of Buckbrush Creek W | 5 | 3050' | 44.027 | 117.7269 |
| 10728 | Willow Creek @ RR Crossing, Vale, OR | 0 | 2220' | 43.9881 | 117.22917 |
| 33266 | Willow Creek @ Diversion Weir just N. of Jamieson, OR | 20 | 2487 | 44.18784 | 117.43603 |
| 30435 | Willow Cr. u/s of Basin Cr. S. of Huntington Junction | 36 | 3150' | 44.3459 | 117.6033 |
| 33188 | Willow Creek @ Hwy.26 Indian Gulch Bridge | 48 | 3420' | 44.3773 | 117.7633 |
| 33189 | South Fork Willow Creek @ Hwy. 26 | 1 | 3760' | 44.3246 | 117.9451 |
| 33190 | Middle Fork Willow Creek @ Hwy. 26 Bridge | 4 | 3940' | 44.3245 | 118.0014 |

A5. Parameters and Frequency:

Summer & Fall Intensive Surveys:

The intensive water quality surveys in May, August and October in the Malheur Basin will include approximately 31 sites (See Table A4.9 above). The water quality monitoring will include continuous diurnal data collection, instantaneous grab sample ambient data collection and flow measurements (when possible). The field work will be conducted by water quality staff from the DEQ Laboratory and Pendleton Regional Office.

The continuous diurnal data collection will be accomplished using YSI brand datasondes for monitoring water temperature, pH, specific conductance and dissolved oxygen. Up to 12 datasondes will be deployed at selected sites throughout the study area. They will be deployed on Monday afternoon of each survey week, and will be left in the field typically until Friday morning of each week. Field staff will conduct daily field audits at each datasonde site which will consist of collecting independent field measurements for water temperature, pH, specific conductance and dissolved oxygen.

The instantaneous grab ambient data will be collected throughout the Malheur River Basin by two-person field teams. Field staff will collect ambient grab samples one time during each intensive survey. Study parameters will include nutrients (nitrogen and phosphorus), BOD, alkalinity, solids, chlorophyll-a, TOC, bacteria and flow. Field measurements for water temperature, pH, specific conductance, dissolved oxygen and turbidity will be measured at the same time the water samples are collected. Water samples will be shipped to the DEQ Laboratory at the end of each sampling day via Greyhound Bus or other suitable transportation method.

DEQ staff will collect the flow measurements using a Marsh-McBirney Model 2000 Flowmate flow meter, or comparable equipment at sites indicated in Tables A5-1 below. Flows with a question mark next to them may or not be able to be made depending on depth of the water. Flow measurements will likely be collected on Thursday of the sampling week, in conjunction with audits and retrieval of the datasondes.

Note: See Table A5.1 next page.



Table A5-1: Sample Locations, Schedule, Parameters and Frequency for Intensive Surveys

| LASAR | Site Name | Sample Type | Field | Basic | Nutr. | BOD | Chlor. A | E. coli | Pesticides | Metals | Flow |
|-------|---|-------------|-------|-------|-------|-----|----------|---------|------------|--------|------|
| | Team No. 1 | | | | | | | | | | |
| 10407 | Malheur River @ Mouth | Grab | X | X | X | X | X | X | X | X | * |
| 33261 | Malheur Riv. d/s Irrig. Pump opp. WWTP ponds | Grab Cont. | X | X | X | X | X | X | X | X | |
| 10408 | Malheur River @ Halliday Rd.. | Grab | X | X | X | X | X | X | | X | |
| 33260 | Malheur R. u/s Willow Cr. near Vale WWTP | Grab Cont. | X | X | X | X | X | X | X | X | |
| 10727 | Malheur River @ Hope | Grab | X | X | X | X | X | X | | X | |
| 11480 | Malheur River @ Little Valley | Grab Cont. | X | X | X | X | X | X | | X | |
| 11044 | Malheur River @ Harper | Grab | X | X | X | X | X | X | | X | |
| 33175 | Malheur River @ Namorf | Grab Cont. | X | X | X | X | X | X | | X | |
| 33176 | Malheur River @ Jones Ranch | Grab Cont. | X | X | X | X | X | X | | X | |
| 33177 | Malheur River @ Juntura, OR | Grab Cont. | X | X | X | X | X | X | X | X | |
| 31431 | Malheur Riv. @ Riverside d/s of So. Fork Malheur R. | Grab Cont. | X | X | X | X | X | X | | X | |
| 33178 | So. Fork Malheur River @ mouth (Riverside) | Grab | X | X | X | X | X | X | | X | |
| 33179 | Malheur River d/s of Warm Springs Res. @ dam | Grab | X | X | X | X | X | X | | X | * |
| 11047 | Malheur River @ Hwy. 20 near Drewsey, OR | Grab | X | X | X | X | X | X | | X | * |
| 33181 | Cottonwood Creek @ mouth | Grab | X | X | X | X | X | X | | X | |
| 33182 | North Fork Malheur River near mouth | Grab | X | X | X | X | X | X | | X | |
| 33223 | A-Drain Irrigation Return | Grab | X | X | X | X | X | X | | X | |
| 33224 | B-Drain Irrigation Return | Grab | X | X | X | X | X | X | | X | X |
| 33225 | 6 th Ave. Irrigation Drain | Grab | X | X | X | X | X | X | | X | |
| 33184 | Bully Creek @ mouth | Grab Cont. | X | X | X | X | X | X | X | X | X |
| 33262 | Bully Cr at Graham Blvd. | Grab Cont. | X | X | X | X | X | X | | X | |
| 33186 | Bully Creek u/s of Reservoir | Grab | X | X | X | X | X | X | | X | |
| 30448 | Bully Creek u/s of No. Fork Bully Creek | Grab | X | X | X | X | X | X | | X | |
| 30449 | Indian Creek u/s of confluence w/Bully Creek | Grab | X | X | X | X | X | X | | X | |
| 30446 | Clover Creek u/s of Buckbrush Creek W | Grab | X | X | X | X | X | X | | X | |
| 10728 | Willow Cr. at RR Xng., Vale, OR | Grab Cont. | X | X | X | X | X | X | X | X | X |
| 33266 | Willow Creek @ Diversn. Weir N. of Jamieson, OR | Grab Cont. | X | X | X | X | X | X | | X | |
| 30435 | Willow Cr. u/s of Basin Cr. S. of Huntington Junc. | Grab Cont. | X | X | X | X | X | X | | X | |
| 33188 | Willow Creek @ Hwy.26 Indian Gulch Bridge | Grab | X | X | X | X | X | X | | X | |



| | | | | | | | | | | |
|-------|---|------|---|---|---|---|---|---|---|---|
| 33189 | South Fork Willow Creek @ Hwy. 26 | Grab | X | X | X | X | X | X | X | |
| 33190 | Middle Fork Willow Creek @ Hwy. 26 Bridge | Grab | X | X | X | X | X | X | | X |

Temperature: Continuous temperature monitoring in the mainstem Malheur River is proposed for up to 10 new locations and three existing USBR temperature monitoring stations. Temperature data from this group of sites will allow possible heatsource temperature modeling of the Upper Malheur River mainstem. Site-specific shad modeling is proposed for the mainstem below Warm Springs Reservoir and the entire North Fork Malheur River. Development of generic shade curves is proposed on other listed and non-listed perennial streams. Biomonitoring data will be used to provide insight on natural temperature conditions and other possible limiting factors using reference data.

Table A5.2 Continuous Temperature Monitoring Sites

| Lasar# | Site Name | Riv. Mile | Elevation | Latitude | Longitude | Vemco # |
|--------|--|-----------|-----------|----------|-----------|---------|
| 33228 | Malheur River @ Hog Flat | 179 | 4568 | 44.0312 | 118.5275 | 5927 |
| 33526 | Malheur River @ Dunten Ranch | 150 | 4193 | 43.8276 | 118.4530 | 9426 |
| 11047 | Malheur River @ Hwy 20 near Drewsey | 142 | 3490 | 43.7844 | 118.3305 | 5925 |
| 33229 | Malheur River @ Warm Springs Dam @ Gage Stn. | 122 | 3308 | 43.5746 | 118.2086 | 5972 |

Biomonitoring: Biomonitoring activities will include the collection of aquatic insects from at least 30 randomly selected sites across the entire basin. Basic chemical and stream habitat data (See Table A5.3) will also be collected at each site, and some sites may overlap with the eutrophication study sites. Diversity and abundance of aquatic insects will be used as a measure of overall stream health that will be statistically representative of the entire basin, and will serve as a baseline that will allow future measurement of the success of attempts to improve water quality and aquatic habitat. Biomonitoring data can also be used to identify what are the limiting factors for improvements stream health, and may be able to give insight on natural condition temperature range based on reference sites (minimally disturbed stream) in the Blue Mountains and Great Basin. It is hoped that the use of biomonitoring data will allow less focus on numeric standards and more focus on actual restoration and protection of aquatic ecosystems.

Table A5.3 Biomonitoring Site Locations

| LASAR | Site Name: | Riv. Mile | Elevation | Latitude | Longitude |
|-------|--|-----------|-----------|------------|------------|
| 33677 | Cottonwood Creek trib. Near Bully Cr. Rd. | 0.25 | 3400 | 117.573326 | 44.0238075 |
| 33681 | Malheur River near Vale WWTP | 20 | 2220 | 117.21409 | 44.9911 |
| 33691 | Malheur River d/s of Riverside, OR | 118 | 3550 | 118.149475 | 44.5537605 |
| 33808 | Malheur River d/s of China Creek | 76 | 2800 | 117.817726 | 44.7780075 |
| 33809 | Malheur River at RM 62.6 (d/s of Namorf) | 66 | 2600 | 117.717453 | 44.7867241 |
| 33810 | Malheur River at RM 62.2 (d/s of Namorf) | 65 | 2580 | 117.709953 | 44.786438 |
| 33694 | Wolf Creek MF (Malheur) | 1 | 4300 | 118.70792 | 44.03974 |
| 33697 | Lower Pine Creek at Pine Creek Rd. | 5 | 3920 | 118.57919 | 44.78241 |
| 33699 | Muddy Creek (Malheur) | 3 | 3960 | 118.64565 | 44.87305 |
| 33706 | Calamity Creek near USFS Rd. 1580 | 4 | 4430 | 118.771370 | 44.9802246 |
| 33708 | Little Malheur River d/s of Camp Creek | 19.5 | 4800 | 118.26264 | 44.24347 |
| 33715 | N.F. Malheur River d/s of Crane Creek | 42 | 4800 | 118.348793 | 44.1421394 |
| 33716 | N.F. Malheur River north of USFS Rd. 16 | 52.5 | 5040 | 118.394813 | 44.270443 |
| 33722 | S.F. Malheur River near Ott Ranch | 12 | 3400 | 118.23683 | 44.43827 |
| 33725 | S.F. Malheur River near Venator | 19 | 3600 | 118.286415 | 44.3904915 |
| 33727 | S.F. Malheur River d/s of Ott Ranch Bridge | 13 | 3400 | 118.256569 | 44.4419365 |
| 33730 | Mud Creek near Vale main canal | 3 | 2590 | 117.42579 | 44.12998 |
| 33734 | S.F. Willow Creek off Rose Cr. Rd. | 2 | 3800 | 117.9559 | 44.30531 |



| | | | | | | |
|-------|---|------|------|------------|------------|--|
| 33739 | Willow Creek d/s of Boswell Spring | 37 | 3200 | 117.616776 | 44.335518 | |
| 33740 | Willow Creek d/s of Crow Creek | 33 | 3000 | 117.570511 | 44.3181114 | |
| 33741 | Willow Creek u/s of Miller Creek | 50 | 3600 | 117.808235 | 44.373989 | |
| 33807 | Willow Creek d/s of Basin Creek | 34 | 3200 | 117.600738 | 44.3360329 | |
| 33806 | Willow Creek trib. Near Thompson Spring | 0.25 | 3120 | 117.592949 | 44.3326416 | |
| 30444 | Basin Creek u/s of confluence w/ Willow Creek | 0.1 | 3200 | 117.60573 | 44.34921 | |

Table A5.3a Biomonitoring Site Parameter List

| Field Chemistry | Laboratory Chemistry | Physical Habitat |
|----------------------|-----------------------------------|------------------------------|
| Dissolved Oxygen | Total Organic Carbon | Physical Habitat |
| pH | NO ₂ + NO ₃ | Solar Pathfinder |
| Specific Conductance | TKN | Stream Width |
| Water Temperature | Ammonia | Riparian Habitat Description |
| | Total Phosphorus | Tree Heights |
| | Ortho-Phosphorus | Flow (where possible) |

A6. Quality Objectives and Criteria

Water samples collected for laboratory analysis will take following standard DEQ protocol and analyzed as described in the DEQ Laboratory Field Sample Reference Guide, 1998, Rev.6.0 and the DEQ Laboratory Quality Assurance Manual, 1999. Table A7 below list the analytical methods and performance measures specific to this project

Table A7: Data Quality Criteria¹

| Parameter | Method Ref. | Detection Limit | Reporting Limit | Accuracy ² | Precision |
|----------------------------------|--|-------------------------------------|-----------------|---|---------------------------|
| Temperature | 170.1 (R2) | 1°C | 1°C | ≤ ± 0.5°C (Thermometer Accuracy checked with NIST standards) | ≤ ± 1.5°C |
| pH | 150.1 (R2) | (equipment specific) | 0-14 S.U. | ≤ ± 0.2 S.U. (Calibrated pH electrode) | ≤ ± 0.3 S.U. |
| Specific Conductivity (@ 25°C) | 120.1 (R2) | 1 µmhos/cm | 1 µmhos/cm | ≤ ± 7% of standard value (Meter with temp correction to 25°C) | ≤ ± 10% |
| Dissolved Oxygen | 4500-O C (R1) | (cannot be determined) ³ | 0.1 mg/L | ≤ ± 0.2 mgL ⁻¹ (Winkler titration or calibrated Oxygen meter) | ≤ ± 0.3 mgL ⁻¹ |
| Alkalinity | 2320 B (R1) | 0.124 mg/L as CaCO ₃ | 1 | ±10-15% | ± 20% |
| Turbidity | SM2130B (R1) | | 1 NTU | ±5% of Std. Value | ±5% of Std. Value |
| BOD | 5210B (ODEQ Modified BOD ₅) ⁴ (R1) | 0.1 mg/L | 0.1 mg/L | ±10-15% | ± 20% |
| Ammonia | 4500-NH3 G (R1) | 0.01 mg/L as N | 0.02 mg/L as N | ±10-15% | ± 20% |
| NO ₂ -NO ₃ | 4500-NO3 F, (R1) | 0.0019 mg/L as N | 0.005 mg/L as | ±10-15% | ± 20% |

¹ Field variables and their respective precision and accuracy are outlined at <http://www.deq.state.or.us/lab/qa/DEQ04-LAB-0003-GD.pdf>. Data to be used for TMDL purposes shall meet, at a minimum, "Grade B" level data. Table A7 outlines "Grade A" field parameter accuracies and precisions

² Accuracy of analytical methods will vary based upon calibration and equipment employed

³ MDL cannot be determined because it is not possible to prepare DO standards of known concentration

⁴ ODEQ BOD "stream" methodology available upon request; ODEQ Document Control #DEQ03-LAB-0016-SOP.pdf



| | | | | | |
|------------------------|---------------------------------|-----------------|-----------------|---------------|--------------|
| | 353.2 (R2) | | N | | |
| TKN | 351.2, (R2) 4500-Norg D (R1) | 0.1 mg/L as N | 0.2 mg/L as N | ±10-15% | ± 20% |
| Total PO ₄ | 4500-P E (R1) | 0.001 mg/L as P | 0.01 mg/L as P | ±10-15% | ± 20% |
| Ortho-PO ₄ | 4500-P E (R1) | 0.001mg/L as P | 0.005 mg/L as P | ±10-15% | ± 20% |
| Chlorophyll a | 10200-H (R1) | 0.1 µg/L | 0.1 µg/L | ±10-15% | ± 20% |
| Carbon, total organic | SM5220D (R1) | 0.2mg/L | 1 mg/L | 0.2 mg/L | +/- 0.1 mg/l |
| TS | SM2540D (R1) | 0.35 mg/L | 1 mg/L | ±10-15% | ± 20% |
| TSS | SM2540D (R1) | 0.35 mg/L | 1 mg/L | ±10-15% | ± 20% |
| Cations & Anions | 200.7 (R2) | 0.029 mg/L | 0.10 mg/L | ±10-15% | ± 20% |
| <u>E. coli</u> | SM9223B(R1) | | <1 | 0.6 log diff. | NA |
| Chlorinated Pesticides | 608(R2) | | 0.0001 mg/L | | |

References: R1: Standard Methods for the Examination of Water and Wastewater, 19th Edition, APHA, AWWA, WPCF, 1995.
R2: Methods for Chemical Analysis of Water and Wastes, EPA-600/4-79-020, Revised 3/83.

Representativeness: Samples will be collected at or near the center of the stream channel where the water is well mixed and representative of the ambient conditions

Comparability: Coordination with other agencies is emphasized to ensure that data are comparable.

Completeness: It is anticipated that samples will be collected from all sites unless unanticipated weather-related events or safety issues prevent sampling¹. Field variables and their respective precision and accuracy are outlined at <http://www.deq.state.or.us/lab/qa/DEQ04-LAB-0003-GD.pdf>. Data to be used for TMDL purposes shall meet, at a minimum, "Grade B" level data. Table A7 outlines "Grade A" field parameter accuracies and precisions

For all data and information collected and analyzed by field staff, all quality assurance/quality control procedures outlined in the DEQ Laboratory Quality Assurance Manual (1999) and the DEQ Laboratory Watershed Assessment Section Mode of Operations Manual (MOMs) (2004) will be followed. Specific QA Objectives for this project are:

- Collect a sufficient number of field audits, sample duplicates and field blanks to evaluate the potential for contamination from sampling equipment and techniques.
- Analyze a sufficient number of QC Standards, blanks and duplicate samples in the Laboratory environment to effectively evaluate results against numerical QA goals established for precision and accuracy.
- Implement sampling techniques in such a manner that the analytical results are representative of the media and conditions being sampled.

The following Data Quality Objectives describe the quality of the data required to satisfy the goals and objectives of this Project is assessed by the following QA/QC parameters:

- Precision
- Accuracy
- Representativeness
- Comparability
- Completeness

Refer to DEQ's Quality Assurance Manual for DQO definitions.

Precision

Precision is a measure of the scatter of the data when more than one measurement is made on the same sample. Scatter is commonly attributed to sampling activities and/or chemical analysis. For duplicate measurements,



Document: DEQ06-LAB-0022-QAPP
Section: **Watershed Assessment**

Revision No. 8
Date 9/20/2010
Page 14 of 23

precision can be expressed as the relative percent difference. Duplicate analyses for organics are performed to confirm reportable concentrations detected in the sample. Field duplicates will be run at a frequency of one per 10 sets of samples.

Precision requirements for this project are defined in Paragraph 6.2.1, Section 6, DEQ Laboratory Quality Assurance Manual, (1999). Specific precision requirements for the field equipment (conductivity/salinity & turbidity meters, etc.) are defined in the Data Quality Matrix in Chapter 4, “Data Quality” of the Oregon Plan for Salmon and Watersheds Water Quality Monitoring Guidebook, (2001).

Accuracy

Accuracy is a measure of the error between reported test results and the true sample concentration. Inasmuch as true sample concentrations are not known, a priori, accuracy is usually inferred from recovery data as determined by sample spiking. Spiked samples will be run on a 10% frequency or one per 10 sets of samples; whichever is greater. For those analyses where sample spiking cannot be performed, e.g. turbidity, QC reference standards will be analyzed to determine accuracy.

Accuracy requirements for this project are defined in Section 6.2.2 of the DEQ Laboratory Quality Assurance Manual, (1999). Specific accuracy requirements for the field equipment (conductivity/salinity & turbidity meters, etc.) are defined in the Data Quality Matrix in Chapter 4, “Data Quality” of the Oregon Plan for Salmon and Watersheds Water Quality Monitoring Guidebook, (2001).

Representativeness

Representativeness is a measure of how closely the measured results of the matrix sampled reflect the actual site conditions. Sampling procedures are designed so that results are representative of the matrix being sampled. Sample handling protocols for storage, preservation and transportation have been developed to preserve the representativeness of the collected samples. Proper documentation will establish that protocols have been followed and sample identification and integrity assured.

Transfer blanks, transport blanks and field duplicates at a frequency of one per 10 sets of samples and matrix type, will be used to assess field and transport contamination and method variation. Laboratory method blanks will be run on a daily run basis.

Representativeness requirements for this project are defined in Section VII “Sample Collection” of the DEQ Field Sampling Reference Guide, (1998); and Paragraph 6.2.3 of Section 6, DEQ Laboratory Quality Assurance Manual, (1999)

Comparability

The objective of this parameter is to assure that data developed during the investigation are either directly comparable, or comparable with defined limitations, to literature data or other applicable criteria. Comparability of the data will be maintained by using EPA-defined procedures.

Comparability requirements for this project are defined in Paragraph 6.2.4 of Section 6, DEQ Laboratory Quality Assurance Manual (1998).

Completeness

Completeness is a measure of the amount of valid data obtained from the analytical measurement system compared to the amount that was expected to be obtained. It is defined as the total number of samples taken for which valid analytical data are obtained divided by the total number.



A7. Documentation and Records

As outlined in the DEQ Laboratory Field Sampling Reference Guide, (1998) DEQ field staff will prepare field data sheets (DEQ's standard *Analysis Request Forms*) prior to the field sampling events that will be submitted to the Lab with the samples. Information to be recorded on the field data sheets includes: Project name, date and time of sampling events, water body name, major basin name, general weather conditions, names of field staff, time of each sample or field measurement, LASAR station ID number, DEQ equipment ID numbers. All metadata and field data will be entered into the DEQ Laboratory LASAR database.

Field Notebook:

A bound field notebook will be maintained by DEQ field staff to provide a daily record of significant events, observations, and measurements during field investigations. This record should include water level data, field measurements, personnel, weather observations, including temperature, and cloud cover; and physical conditions. All entries in the field notebooks should be signed and dated. The field notebooks will be kept as a permanent record.

Corrections To Documentation:

All original data recorded in field notebooks, chain of custody records, and other forms will be written in waterproof ink. None of these documents will be destroyed or thrown away, even if they are illegible or contain inaccuracies that require a replacement document. If an error is made on a document assigned to one individual, that individual will make corrections by crossing a single line through the error, entering the correct information and initialing the correction.



B1. Sampling Methods

Sampling will be accomplished using the standard DEQ protocol described in the DEQ Laboratory Field Sampling Reference Guide (1998), Revision 6.0, and the ODEQ Laboratory Section Watershed Assessment Section Methods of Operations Manual (MOMs), 2001. Specific sample preservation methods and holding times are listed in Table B2 below.

Table B1: Sample Preservation Methods and Holding Times

| Method | Method Number | Holding Time | Container | Sample Preservation |
|----------------------------------|--------------------|----------------------------------|--------------------|--|
| Ammonia | 4500-NH3 G | 28 days | R-500ml poly | preserved with H ₂ SO ₄ (12 drops), <4°C |
| NO ₂ -NO ₃ | 4500-NO3 F, 353.2 | 28 days | R-500ml poly | preserved with H ₂ SO ₄ (12 drops), <4°C |
| TKN | 351.2, 4500-Norg D | 28 days | R-500ml poly | preserved with H ₂ SO ₄ (12 drops), <4°C |
| Total PO ₄ | 4500-P E | 28 days | R-500ml poly | preserved with H ₂ SO ₄ (12 drops), <4°C |
| Ortho-PO ₄ | 4500-P E | 48 hours | DP-250 ml poly | (filtered sample) <4°C |
| Temperature | 170.1 | NA | Field | NA |
| pH | 150.1 | Immediate (24 hours) | Field | NA |
| Dissolved Oxygen | 4500-O C | Analyze immediately ⁵ | Field | NA |
| Specific Conductivity (@ 25°C) | 120.1 | 28 days | Field | NA |
| Turbidity | SM2130 B | 48 hours | Field | NA |
| Alkalinity | 2320 B | 14 days | P-1000ml Poly | NA |
| Chlorophyll a and Pheophytin | 10200-H | 28 days | Glass Fiber Filter | Avoid exposure to light; freeze with dry ice, and keep frozen until analysis |
| TOC | SM5130B | 28 days | R-500ml poly | preserved with H ₂ SO ₄ (12 drops), <4°C |
| COD | SM5220D | 28 days | R-500ml poly | preserved with H ₂ SO ₄ (12 drops), <4°C |
| TSS | SM2540D | 7 days | P-1000ml Poly | <4°C |
| TS | SM2540B | 7 days | P-1000ml Poly | <4°C |
| Cations & Anions | 220.7 | | DM-250 ml Poly | 25 drops of Nitric Acid. Refrigerate to <4°C |
| E. coli | SM9223B | 36 Hrs | Amber Bact | <4°C |
| Chlorinated Pesticides | 608 | 7 Days | 1000ml Amber glass | <4°C |

⁶ Winkler allows stabilization and holding time for 8 hours until titration

B2. Sample Handling and Custody Procedures

Samples for laboratory analysis will be preserved as identified in **DEQ Laboratory Field Sampling Reference Guide** (1998), Rev. 6, and held on ice and/or refrigerated at <4°C until analysis can begin.

Sample collectors will also follow proper chain of custody procedures outlined in the Watershed Assessment Mode of Operations Manual (MOMs) which is available on the DEQ Laboratory website at, <http://www.deq.state.or.us/lab/qa/DEQ03-LAB-0036-SOP.pdf> and the ODEQ Quality Management Plan located at <http://www.deq.state.or.us/about/QualityManagement/DEQ03-LAB-0006-QMP.pdf>. Data collection forms used for each sample event will be signed and dated by each data collector.

YSI brand datasondes will be deployed in the field by DEQ staff and retrieved at the end of the monitoring period by DEQ staff. After the datasondes have been retrieved, they will be transported to the DEQ Laboratory where the data will be downloaded. All continuous data will be processed according to standard DEQ Quality Assurance protocols and data management procedures.

If and when Vemco brand temperature loggers are used for this project, they will be deployed in the field by DEQ staff and retrieved at the end of the monitoring season by DEQ staff. Water and/or air temperature data will be collected at hourly intervals. After loggers have been retrieved, they will be forwarded to WSA staff at the DEQ Laboratory for Quality Assurance and data management procedures.

B3. Analytical Methods

All parameters will be measured using the protocols previously listed in Tables A7 & B1 above. Field analytical methods can be found in the Watershed Assessment Mode of Operations Manual MOMs which is available on the DEQ Laboratory website at, <http://www.deq.state.or.us/lab/qa/DEQ03-LAB-0036-SOP.pdf>.

B4. Quality Control

For all field surveys conducted for this project, duplicate quality assurance (QA) samples will be collected at a minimum of 10% of the total number of monitoring sites, or at least one duplicate per sample event.

B5. Instrument/Equipment Testing, Inspection, and Maintenance

Routine inspection and preventative maintenance of field and laboratory equipment and facilities will be done according to the protocols outlined in the following documents:

- DEQ Laboratory Watershed Assessment Section Mode of Operations Manual (2001).
- DEQ Laboratory Quality Assurance Manual (1999)
- DEQ Laboratory Field Sampling Reference Guide (1998)

B6. Instrument Calibration and Frequency

Routine calibration and accuracy testing of field and laboratory equipment will be done according to the protocols outlined in the following documents:

- DEQ Laboratory Watershed Assessment Section Mode of Operations Manual (2001).
- DEQ Laboratory Quality Assurance Manual (1999)
- DEQ Laboratory Field Sampling Reference Guide (1998)



Field instruments and meters (Vemco temperature loggers, YSI Datasondes) will be calibrated prior to the start of field work. pH meters will be calibrated with pH 7.0 and 10 standard buffers, and checked for accuracy with 7.0, 10.0, 4.0 and LIS buffers. Conductivity meters will be tested for accuracy against 147(+/-) and 1350 (+/-) uhmos /cm standard solutions. Instruments that do not fall with established performance limits will be removed from use until proper maintenance /repair has been done. All calibration and field checks will be recorded in the respective instrument notebooks.

B7. Inspection/Acceptance of Supplies and Consumables

Separate field data sheets will be maintained for each sampling event. Information recorded on data sheets is to include: Project name, data and time of sampling events, water body name, basin name, LASAR numbers, general weather conditions, and names of field staff, time of each sample or measurement, results and equipment ID numbers. Quality assurance staff reviews data sheets for all continuous, field and laboratory data. All data are entered into the DEQ Laboratory Analytical Storage And Retrieval (LASAR) database.

B8. Non-direct Measurements

Historical flow information and historical E. coli data will be collected and compiled for use of ODEQ modeling staff. No additional acceptance criteria will be required for this data and will not be further qualified by DEQ staff.

B9. Data Management

Data management will be provided through the ODEQ LIMS and LASAR databases. C1. Assessment and Response Actions

Surveillance and data management will be performed as required to ensure the data being collected will meet the needs of the project. Information collected during this project is intended to meet the needs of section A 7.1. Success criteria include sufficient flow and E. coli analysis to address the modeling approach also outlined in section A 7.1.

All results of the individual assessments will be compiled and managed by the Data Manager.

Response actions will be developed as data becomes available. Any stop work orders or change in project scope will come from the Basin Coordinator. Corrective actions will be documented as addendums to this QAPP/SAP.



C1. Assessment and Response Actions

Surveillance and data management will be performed as required to ensure that the data being collected will meet the needs of the project. Information collected during this project is intended to meet the needs of Section A 7.1. Success criteria include sufficient flow and E. coli analysis to address the modeling approach (To be determined).

C2. Reports to Management

Reports will include the data results and QA/QC assessments. No additional reporting to management is planned at this time.

A summary biomonitoring report following the Oregon Plan format will be written.



D1. Data Review, Verification and Validation

The Project Officer, the QA Officer and the Data Manager will determine if the data collected meets the QA Plan objectives will review all data resulting from this project as data becomes available. Decisions to accept, qualify or reject data will be made by the Project Manager/Basin Coordinator, QA Officer and Data Manager.

D2. Verification and Validation Methods

As required by the project QA Program, duplicate data loggers will be deployed at a rate of 1 duplicate per 10 loggers deployed. Any data or sample values outside of the expected range for the parameter being measured will be rechecked for validity in the field by the field team, and if necessary, the field team will re-sample. Data that continue to be outside expected values will be further investigated to determine the cause, using alternate methodology, if available. Additional sampling may be used to verify or refute outliers collected during the prescribed sample events.

Once the data has been entered in the project database and into LASAR, the Data Manager will print a paper copy of the data and proofread it against the original field data sheets. Errors in data entry will be corrected at that time. Outliers and inconsistencies will be flagged for further review or be discarded. Data quality problems will be discussed as they occur and in the final report to data users.

D3. Reconciliation with User Requirements

As soon as possible after each sampling event, calculations and determinations for precision, completeness, and accuracy will be made and corrective action implemented if needed. If data quality indicators do not meet the project's specifications, data may be discarded and re-sampling may occur. The cause of the failure will be evaluated. If the cause is found to be equipment failure, calibration and/or maintenance techniques will be reassessed and improved. If the problem is found to be sampling team error, team members will be retrained. Any limitations on data use will be detailed in both interim and final reports, and other documentation as needed. If failure to meet project specifications is found to be unrelated to equipment, methods, or sample error, specifications may be revised for the next sampling season. Revisions will be submitted to the QA section of the DEQ Laboratory for review and/or approval.



Appendix A

Appendix B-Field Data Forms

The Filed Data Sheet associated with this Sampling and Analysis Plan will be supplied by DEQ Lab staff.

Appendix C-Addendums to Original Plan

1. 11/3/05: Revisions and corrections to Tables A6, A6-2 and A
2. 7/20/2006: Revisions to Tables A4.9 (Pg. 9) and A5.1 (Pg.11).
3. 10/09/06: Revisions to: Document No. (Title Pg.); Table of Contents (Page 2); Table A4.9 (Page 9); Table A5-1 (Pg. 11); Table A5.2 (Pg. 12); Table A5.3 (Pg. 12); Table A7 (Pg. 13); Table B1 (Pg. 17)

Temperature Monitoring of Malheur River and North Fork Malheur River, 2007

Addendum to: Quality Assurance Project/Sample and Analysis Plan, Malheur River Basin TMDL Nutrient Water Quality Study for TMDL Development – 2006 Document DEQ06-LAB-0022-QAPP

The collection of additional continuous temperature data in the Malheur River and North Fork Malheur River below the Warm Springs and Agency Valley dams has been recommended, based on the analysis of previous temperature monitoring data by DEQ Watershed Management staff. These data would be used to evaluate the temperature conditions in the Malheur River and North Fork Malheur for comparison to DEQ temperature standards and to support possible future temperature modeling efforts. There are no temperature data available for the reaches extending from the dams down to the lower end of the area designated as Redband Trout habitat (RM 65).

Continuous temperature monitoring is proposed at the six locations shown in Table 1. Flow measurements will be collected at locations other than the Warm Springs and Agency Valley dams which have permanent flow gauges, during Vemco installation, removal, and auditing, if flow conditions allow access to the river.

| Lasar # | Site Name | River Mile | Elevation | Latitude | Longitude | Vemco # |
|---------|---|------------|-----------|----------|-----------|---------|
| 33229 | Malheur River d/s Warm Springs Reservoir | 122 | 3310 | 43.5776 | 118.2109 | 4489E |
| 33177 | Malheur River @ Juntura | 100 | 2945 | 43.7094 | 118.0930 | 4485E |
| 33176 | Malheur River @ Jones Ranch | 83 | 2800 | 43.8011 | 117.9304 | 4486E |
| 33175 | Malheur River @ Namorf | 67 | 2640 | 43.7786 | 117.7415 | 4482E |
| 34258 | N. F. Malheur River @ Agency Valley Dam | 18 | 3394 | 43.9075 | 118.1530 | 4481E |
| 34259 | N.F. Malheur River @ Chukar Park | 9 | 3198 | 43.8020 | 118.1544 | 4487E |