MONTANA DEPARTMENT OF TRANSPORTATION WETLAND MITIGATION MONITORING REPORT: YEAR 2003

Musgrave Lake
Zurich, Montana

Prepared for:

MONTANA DEPARTMENT OF TRANSPORTATION
2701 Prospect Ave
Helena, MT 59620-1001

Prepared by:

LAND & WATER CONSULTING, INC.
P.O. Box 8254
Missoula, MT 59807

March 2004

Project No: 130091.019

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1.0 INTRODUCTION

The Musgrave Lake wetland mitigation project was constructed in late 2000/early 2001 in Watershed 11 (Milk River). It is anticipated that this site will compensate for wetland impacts resulting from several proposed Montana Department of Transportation (MDT) highway and bridge reconstruction projects along the U.S. Highway 2 corridor between Havre and Harlem. Constructed on private land in the MDT Great Falls District, the mitigation site is located approximately four miles south of Zurich and the U.S. Highway 2 corridor within 0.25 mile of the Milk River in Blaine County (**Figure 1**). The goal of the project is to restore hydrology via construction of ditch plugs in natural drained wetland basins and historic oxbow sections, providing at least 27.2 acres of wetland credit within the confines of a 100-acre conservation easement. The agreement between the landowner and MDT specifies that approximately 27.2 acres of wetland credit will be developed.

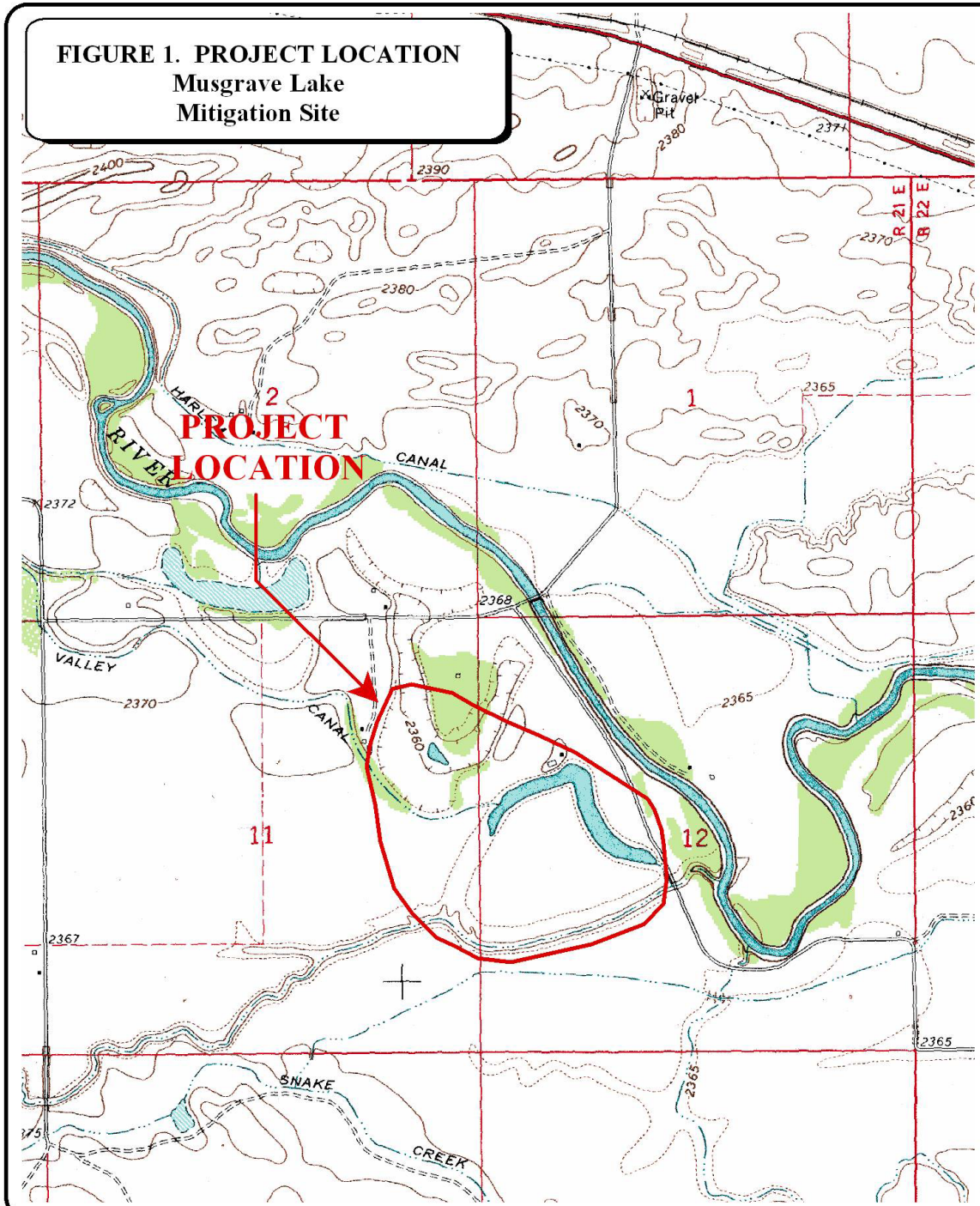
The approximate site boundary is illustrated on **Figure 2** (**Appendix A**), and the original conceptual layout is provided in **Appendix D**. The project is comprised of two "restoration" sites and two "enhancement" sites. Restoration Site 1 (RS1) occurs in a basin in the northwest corner of the mitigation area. Restoration Site 2 (RS2) occurs within a drained and farmed historic oxbow section of Musgrave Lake located along the south property boundary. Wetland hydrology in these areas is to be supplied by precipitation, surface runoff, and possibly groundwater, and is anticipated to result in maximum depths of 3-3.5 feet and 1-1.5 feet at RS1 and RS2, respectively.

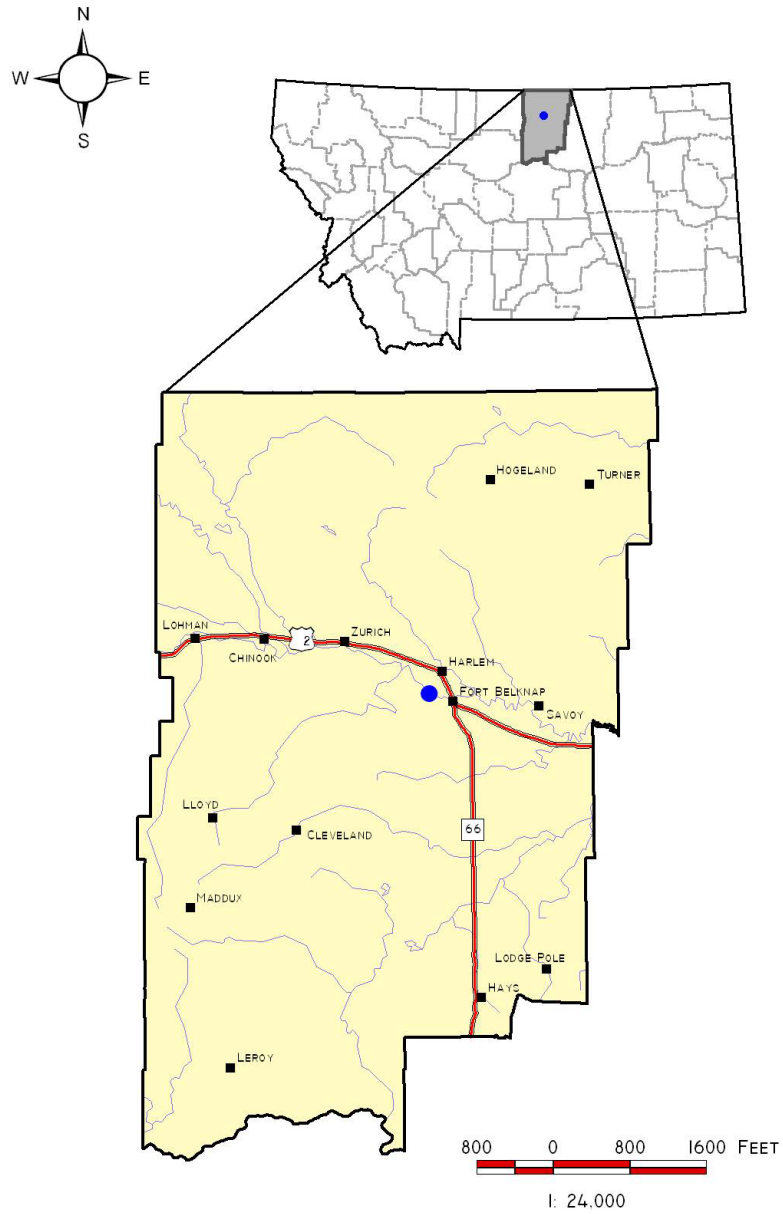
Approximately 4.6 acres of impaired, low-quality wetlands were delineated by MDT at RS1 prior to project implementation. However, given the restoration of hydrology, the Corps of Engineers (COE) has approved allocation of 1:1 credit at the two basins, inclusive of these existing impaired wetlands (1:1 ratio) (Urban pers. comm.). No pre-project wetlands were delineated by MDT at RS2. A target of 24.5 credit acres was established in these two basins by the landowner (Musgrave Lake Ranch LLC [MLR] 2001). An additional 0.75 acre of credit was proposed by the landowner and tentatively approved by the COE (2001) for maintenance of at least three acres of 75-foot wide upland buffer around all wetland and riparian areas (4:1 ratio).

The project further intends to enhance approximately four to five acres of Musgrave Lake an area referenced as Enhancement Site 1 (ES1) (**Figure 2, Appendix A**). Although currently wetland, Enhancement Site 1, the "middle" portion of Musgrave Lake, is separated from the lake's southern arm by an earthen dike and was impacted by a large drainage ditch, a perched culvert causing headcutting & associated sedimentation, and chronic overgrazing.

The project attempts to remedy these problems by relocating the water control structure, installing a larger culvert, and revising the grazing system. Grazing will be prohibited for five years, after which grazing prescriptions will follow a Natural Resources Conservation Service grazing management plan. Assuming that an appropriate increase in wetland functional condition is achieved, a ratio of 3:1 was tentatively approved by the COE.

FIGURE 1. PROJECT LOCATION
Musgrave Lake
Mitigation Site





PROJECT #: 130091.019
DATE: MAY 2001
LOCATION:
PROJECT MANAGER: B. DUTTON
DRAWN BY: B. NOECKER

LAND & WATER CONSULTING, INC.
1120 CEDAR PO BOX 8254 MISSOULA, MT 59807

The wetland credit breakdown proposed by the landowner (MLR 2001) and tentatively approved by the COE (2001), once performance standards are met, is as follows:

- Restoration Site 1: 13.6 acres, 1:1 ratio, 13.6 credits
- Restoration Site 2: 10.9 acres, 1:1 ratio, 10.9 credits
- Enhancement Sites 1 and 2: 11.2 acres, 3:1 ratio, 3.7 credits
- Upland Buffer: 3 acres, 4:1 ratio, 0.75 credits

Total Credits: 28.95 acres (*note: the agreement between the landowner and MDT specifies that approximately 27.2 acres of wetland credit will be developed; this is the minimum target for the project. Enhancement Site 2 has been dropped from the mitigation site*).

To achieve a 3:1 ratio for wetland enhancement, the COE has required that significant functional improvement be demonstrated (COE 2001). This will occur if the composite functional assessment score improves to within 10 percent of that achieved at the onsite reference wetland (**Figure 2**; see **Appendix C** for completed pre-project functional assessment forms). The COE (2001) further stated that "*enhancement of an existing wetland must show significant functional increase to qualify for any credit. Simply changing the character or type of an existing good wetland to a different type of equally good wetland may not qualify for credit.*" Other than these improvements to functional attributes, and a five-year monitoring term, no performance standards or success criteria were required by the COE or other agencies.

The site was first monitored in 2001. This report documents the results of 2002 monitoring efforts. The monitoring area is illustrated in **Figure 2** (**Appendix A**).

2.0 METHODS

2.1 Monitoring Dates and Activities

The site was visited on May 19th (spring) and July 29-30 (mid-season) 2003. The primary purpose of the spring visit was to conduct a bird/general wildlife reconnaissance. The mid-May period was selected for the spring visit because monitoring between mid-May and early June is likely to detect migrant as well as early nesting activities for a variety of avian species (Carlson pers. comm.), as well as maximizing the potential for amphibian detection. In Montana, most amphibian larval stages are present by early June (Werner pers. comm.).

The mid-season visit was conducted to document vegetation, soil, and hydrologic conditions used to map jurisdictional wetlands. All information contained on the Wetland Mitigation Site Monitoring Form (**Appendix B**) was collected at this time. Activities and information conducted/collected included: wetland delineation; wetland/open water boundary mapping; vegetation community mapping; vegetation transects; soils data; hydrology data; bird and general wildlife use; photograph points; macro-invertebrate sampling; functional assessment; and (non-engineering) examination of dike structures.

2.2 Hydrology

Hydrologic indicators were evaluated at the site during the mid-season visit. Approximate designed water depths are shown on the conceptual restoration plan in **Appendix D**. Wetland hydrology indicators were recorded using procedures outlined in the COE 1987 Wetland Delineation Manual (Environmental Laboratory 1987). Hydrology data were recorded on COE Routine Wetland Delineation Data Forms (**Appendix B**).

All additional hydrologic data were recorded on the mitigation site monitoring form (**Appendix B**). Where possible, the boundary between wetlands and open water (no rooted vegetation) aquatic habitats was mapped on the aerial photograph and an estimate of the average water depth at this boundary was recorded.

No groundwater monitoring wells were installed at the site. If located within 18 inches of the ground surface (soil pit depth for purposes of delineation), groundwater depths were documented on the routine wetland delineation data form at each data point.

2.3 Vegetation

General dominant species-based vegetation community types (e.g., *Typha latifolia/Scirpus acutus*) were delineated on an aerial photograph during the mid-season visit. Standardized community mapping was not employed as many of these systems are geared towards climax vegetation and may not reflect yearly changes. Estimated percent cover of the dominant species in each community type was listed on the site monitoring form (**Appendix B**).

Three 10-foot wide belt transects were sampled during the mid-season monitoring event to represent the range of current vegetation conditions. Transects were evaluated at RS 1, RS 2, and ES 1. Percent cover was estimated for each vegetative species for each successive vegetation community encountered within the "belt" using the following values: + (<1%); 1 (1-5%); 2 (6-10%); 3 (11-20%); 4 (21-50%); and 5 (>50%).

Approximate transect locations are depicted on **Figure 2** (**Appendix A**). The transects will be used to evaluate changes over time, especially the establishment and increase of hydrophytic vegetation. Transect locations were marked on the air photo and all data recorded on the mitigation site monitoring form. Photos along each transect were taken from both ends during the mid-season visit.

A comprehensive plant species list prepared for the site in 2001 was updated as new species were encountered. Woody species were not planted at this mitigation site. Consequently, no monitoring relative to the survival of such species was conducted.

2.4 Soils

Soils were evaluated during the mid-season visit according to hydric soils determination procedures outlined in the COE 1987 Wetland Delineation Manual. Soil data was recorded for each wetland determination point on the COE Routine Wetland Delineation Data Form (**Appendix B**). The most current terminology used by NRCS was used to describe hydric soils (USDA 1998).

2.5 Wetland Delineation

Wetland delineation was conducted during the mid-season visit according the 1987 COE Wetland Delineation Manual. The indicator status of vegetation was derived from the National List of Plant Species that Occur in Wetlands: Northwest Region 9 (Reed 1988). Wetland and upland areas within the monitoring area were investigated for the presence of wetland hydrology, hydrophytic vegetation and hydric soils. The information was recorded on COE Routine Wetland Delineation Data Forms (**Appendix B**). The wetland/upland boundary was modified on the aerial photo. The wetland/upland boundary in combination with the wetland/open water habitat boundary was used to calculate the wetland area developed at each impoundment.

2.6 Mammals, Reptiles, and Amphibians

Mammal, reptile, and amphibian species observations and other positive indicators of use, such as vocalizations, were recorded on the wetland monitoring form during each visit. Indirect use indicators, including tracks; scat; burrows; eggshells; skins; bones; etc., were also recorded. Observations were recorded as the observer traversed the site while conducting other required activities. Direct sampling methods, such as snap traps, live traps, and pitfall traps, were not implemented. A comprehensive list of observed species was compiled. Observations from past years will ultimately be compared with new data.

2.7 Birds

Bird observations were recorded during each visit. No formal census plots, spot mapping, point counts, or strip transects were conducted. During the spring visit, observations were recorded in compliance with the bird survey protocol in **Appendix E**. During the mid-season visit, bird observations were recorded incidental to other monitoring activities. During all visits, observations were categorized by species, activity code, and general habitat association (see field data forms in **Appendix B**). Observations from past years will be compared with new data.

2.8 Macroinvertebrates

A total of three macroinvertebrate samples, one each at RS1, RS2, and ES1, were collected during the mid-season site visit and data recorded on the wetland mitigation monitoring form. Macroinvertebrate sampling procedures are included in **Appendix F**. The approximate locations of these sample points are shown on **Figure 2**, **Appendix A**. Samples were preserved as outlined in the sampling procedure and sent to Rhithron Associates for analysis.

2.9 Functional Assessment

Functional assessment forms were completed at RS1, RS2, and ES1 using the 1999 MDT Montana Wetland Assessment Method. Field data necessary for this assessment were generally collected during each mid-season site visit. An abbreviated field data sheet for the 1999 MDT Montana Wetland Assessment Method was compiled to facilitate rapid collection of field information. The remainder of the functional assessment was completed in the office.

Pre-project functional assessments of the mitigation site and reference area were included in the 2001 monitoring report and are not provided in this document.

2.10 Photographs

Photographs were taken during the mid-season visit showing the current land use surrounding the site, the upland buffer, the monitored area, and the vegetation transects. The approximate location of photo points is shown on **Figure 2**, **Appendix A**. All photographs were taken using a 50 mm lens. A description and compass direction for each photograph was recorded on the wetland monitoring form.

2.11 GPS Data

During the 2003 monitoring season, no survey points were collected with a GPS unit as most site features were recorded during 2001. These included vegetation transect beginning and ending locations, all photograph locations and wetland boundaries. Wetland boundary changes observed in 2003 were documented by hand on a 2002 aerial photograph.

2.12 Maintenance Needs

Dike structures were examined during site visits for obvious signs of breaching, damage, or other problems. This did not constitute an engineering-level structural inspection, but rather a cursory examination. Current or future potential problems were documented.

3.0 RESULTS

3.1 Hydrology

Substantial inundation was observed at each of the three monitored sites. Water depths at open water/rooted vegetation interfaces ranged between approximately 20 inches and five feet, with an average of about three feet. Open water areas are shown on **Figure 3** (**Appendix A**). Specific recorded values for are provided on the attached data forms. According to the Western Regional Climate Center, mean monthly precipitation totals from January through July over the last 54 years total 8.6 inches for the Chinook station. During 2003, 8.5 inches of precipitation were recorded in Chinook between January and July. Thus, this year-three evaluation was apparently conducted during an average precipitation period.

RS1 was virtually 100 percent inundated, with an average depth of about two feet and a range of depths from two inches to an estimated four feet. Deepest areas were located in the center of the impoundment. A groundwater component appears to contribute to this site, possibly resulting from upslope irrigation ditch seepage.

RS2 was approximately 90 percent inundated, with an average depth of 6 inches and a depth range of one to five feet in inundated areas. A deep pool occurs where water enters the site through a culvert at the northwest end. The vast majority of this site east of the ditch/dike was inundated during spring and summer visits.

ES1 was virtually 100 percent inundated during spring and summer visits, with an average depth of 8 to 10 inches and a range of depths from 0 to 30 inches.

3.2 Vegetation

Vegetation species identified on the site are presented in **Table 1** and on the attached data form. Seven wetland community types were identified and mapped on the mitigation area (**Figure 3**, **Appendix A**) in 2003. These included Type 1: *Typha latifolia*/*Scirpus acutus*, Type 2: *Polygonum amphibium*, Type 3: *Salix exigua/Elaeagnus angustifolia*, Type 4: *Potamogeton*/*Myriophyllum*, Type 5: *Carex*, Type 7: *Populus deltoides* and Type 8: *Rumex crispus*. Type 8 was added in 2003 due to increased inundation at RS1 and RS2, which eliminated Type 6: *Hordeum jubatum*/*Rumex crispus*. Type 6 was replaced by Type 8 in 2003. Dominant species within each of these communities are listed on the attached data form (**Appendix B**).

Type 1 occurs commonly at RS1 and ES1. Type 2 occurs primarily in newly developing wetland areas of RS1 and RS2, and in 2003 was reduced to primarily *Polygonum amphibium* communities, with far less *Alopecurus pratensis* than observed in previous years. Consequently, this community type was revised from *Polygonum amphibium* / *Alopecurus pratensis* to simply *Polygonum amphibium* in 2003. Type 3 occurs in patches at RS1, ES1, and RS2. Type 4 occurs in the ditch segment of ES1. Type 5 occurs primarily at ES1. Type 7 occurs mainly along the south and east fringe of RS1 in newly-inundated areas formerly mapped as uplands. Type 8 occurs as a fringe around RS1 and in large sections of RS2.

Upland communities generally range from kochia (*Kochia scoparia*) and smooth brome (*Bromus inermis*)-dominated areas, to hayland dominated by alfalfa (*Medicago sativa*) and/or foxtail barley (*Hordeum jubatum*).

Vegetation transect results are detailed in the attached data form (**Appendix B**), and are summarized in the transect maps; **Tables 2**, **3 and 4**; and **Charts 1, 2, and 3** below.

Table 1: *2001-2003 Musgrave Lake Vegetation Species List*

Species[1]	Region 9 (Northwest) Wetland Indicator Status	Species[1]	Region 9 (Northwest) Wetland Indicator Status
Acer negundo	FAC+	*Lycopus americanus*	OBL
Agropyron intermedium	--	*Medicago sativa*	--
Agropyron repens	FACU	*Melilotus alba*	FACU
Agropyron smithii	FACU	*Myriophyllum spicatum*	OBL
Agrostis alba	FACW	*Phalaris arundinacea*	FACW
Alisma plantago-aquatica	OBL	*Phleum pretense*	FAC-
Alopecurus pratensis	FACW	*Plantago major*	FAC+
Apocynum androsaemifolium	--	*Poa bulbosa*	--
Arctium minus	--	*Poa pratensis*	FAC
Asclepias speciosa	FAC+	*Polygonum amphibium*	OBL
Asparagus officinalis	--	*Polygonum erectum*	FACW-
Beckmannia syzigachne	OBL	*Polygonum lapathifolium*	FACW
Bromus inermis	--	*Polygonum persicaria*	FACW
Carex lanuginosa	OBL	*Populus deltoides*	FAC
Carex praegracilis	FACW	*Potamogeton natans*	OBL
Carex stipata	OBL	*Potentilla anserine*	OBL
Carex utriculata	OBL	*Prunus virginiana*	FACU
Carex vesicaria	OBL	*Ranunculus occidentalis*	FAC
Carex vulpinoidea	OBL	*Rosa nutkana*	FAC-
Chenopodium album	FAC	*Rumex crispus*	FACW
Cicuta douglasii	OBL	*Sagittaria cuneata*	OBL
Cirsium arvense	FAC-	*Salix amygdaloides*	OBL
Cornus stolonifera	FACW	*Salix exigua*	OBL
Elaeagnus angustifolia	FAC	*Salix lutea*	OBL
Eleocharis acicularis	OBL	*Scirpus acutus*	OBL
Eleocharis palustris	OBL	*Scirpus americanus*	OBL
Festuca sp.	--	*Scirpus maritimus*	OBL
Glyceria grandis	OBL	*Scirpus validus*	OBL
Glycyrrhiza lepidota	FAC+	*Sium suave*	OBL
Helianthus annuus	FACU+	*Solidago canadensis*	FACU
Hordeum jubatum	FAC-	***Spartina pectinata***	OBL
Iva xanthifolia	FAC	*Sparganium eurycarpum*	OBL
Juncus effuses	FACW	*Symphoricarpos occidentalis*	--
Kochia scoparia	FAC	*Taraxacum officinale*	FACU
Lemna minor	OBL	*Typha latifolia*	OBL

[1] **Bolded** species indicate those documented in the analysis area for the first time in 2003.

Transect 1 (RS1) Maps for 2001, 2002, 2003

RS1 Start 2001	***Upland (45')***		***Type 2 (35')***	***Type 1 (110')***	***Type 2 (195')***			***Upland (115')***	**Total: 500'**	**RS1 End**
RS1 Start 2002	***T2 15'***	***Up 16'***	***T7 49'***	***T1 80'***	***Open water – transitional 120'***	***T2 20'***	***Open water – transitional 200'***		**Total: 500'**	**RS1 End**
RS1 Start 2003	***T2 15'***	***Up 16'***	***T7 49'***	***Open water – transitional 200'***		***T2 15'***	***Open water transitional 200'***	***T8 5'***	**Total: 500'**	**RS1 End**

Transect 2 (ES1) Maps for 2001, 2002, 2003

ES1 Start 2001	***Upland (18')***	***Type 5 (68')***		**Total: 86'**	**ES2 End**
ES1 Start 2002	***Upland (18')***	***Type 5 (68')***		**Total: 86'**	**ES2 End**
ES1 Start 2002	***Upland (15')***	***Type 5 (5')***	***Type 1 (66')***	**Total: 86'**	**ES2 End**

Transect 3 (RS2) Maps for 2001, 2002, 2003

RS2 Start 2001	***Upland (20')***	***Type 6 (80')***	***Upland (70')***		**Total: 170'**	**RS2 End**
RS2 Start 2002	***Upland (20')***	***Type 6 (80')***	***Upland (70')***		**Total: 170'**	**RS2 End**
RS2 Start 2003	***Upland (15')***	***Type 8 (75')***	***Type 2 (70')***	***Up (10)'***	**Total: 170'**	**RS2 End**

Table 2: *Transect 1 (RS1) Data Summary*

Monitoring Year	2001	2002	2003
Transect Length	500 feet	500 feet	500 feet
# Vegetation Community Transitions along Transect	4	6	6
# Vegetation Communities along Transect	3	4	4
# Hydrophytic Vegetation Communities along Transect	2	3	3
Total Vegetative Species	19	16	16
Total Hydrophytic Species	8	9	9
Total Upland Species	11	7	7
Estimated % Total Vegetative Cover	100%	25%	20%
% Transect Length Comprised of Hydrophytic Vegetation Communities	68%	33%	17%
% Transect Length Comprised of Upland Vegetation Communities	32%	3%	3%
% Transect Length Comprised of Unvegetated Open Water	0%	64%	80%
% Transect Length Comprised of Bare Substrate	0%	0%	0%

Table 3: *Transect 2 (ES1) Data Summary*

Monitoring Year	2001	2002	2003
Transect Length	86 feet	86 feet	86 feet
# Vegetation Community Transitions along Transect	1	1	2
# Vegetation Communities along Transect	2	2	3
# Hydrophytic Vegetation Communities along Transect	1	1	2
Total Vegetative Species	13	14	9
Total Hydrophytic Species	10	10	6
Total Upland Species	3	4	3
Estimated % Total Vegetative Cover	100%	100%	70%
% Transect Length Comprised of Hydrophytic Vegetation Communities	79%	79%	83%
% Transect Length Comprised of Upland Vegetation Communities	21%	21%	17%
% Transect Length Comprised of Unvegetated Open Water	0%	0%	0%
% Transect Length Comprised of Bare Substrate	0%	0%	0%

Table 4: *Transect 3 (RS2) Data Summary*

Monitoring Year	2001	2002	2003
Transect Length	170 feet	170 feet	170 feet
# Vegetation Community Transitions along Transect	2	2	3
# Vegetation Communities along Transect	2	2	3
# Hydrophytic Vegetation Communities along Transect	1	1	2
Total Vegetative Species	13	12	9
Total Hydrophytic Species	6	6	4
Total Upland Species	7	6	5
Estimated % Total Vegetative Cover	100%	100%	80%
% Transect Length Comprised of Hydrophytic Vegetation Communities	47%	47%	85%
% Transect Length Comprised of Upland Vegetation Communities	53%	53%	15%
% Transect Length Comprised of Unvegetated Open Water	0%	0%	0%
% Transect Length Comprised of Bare Substrate	0%	0%	0%

Chart 1: ***Length of Vegetation Communities along Transect 1***

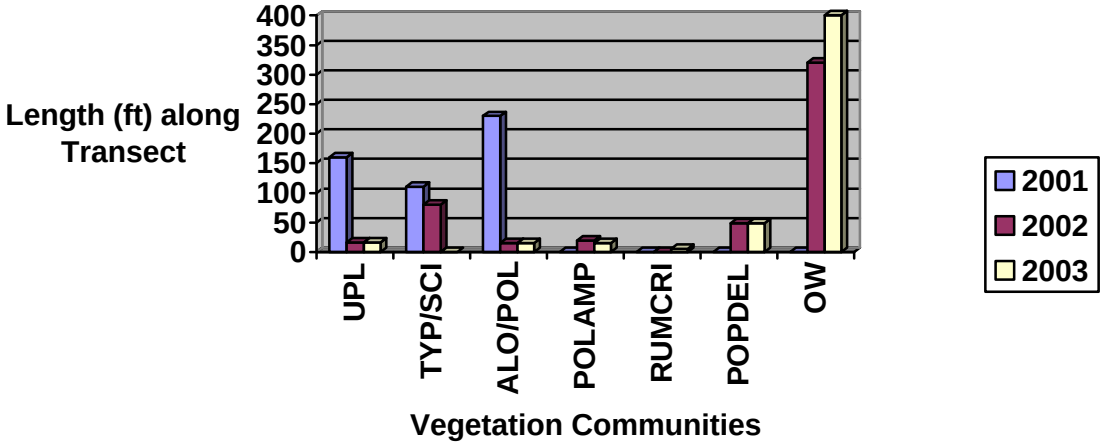


Chart 2: ***Length of Vegetation Communities along Transect 2***

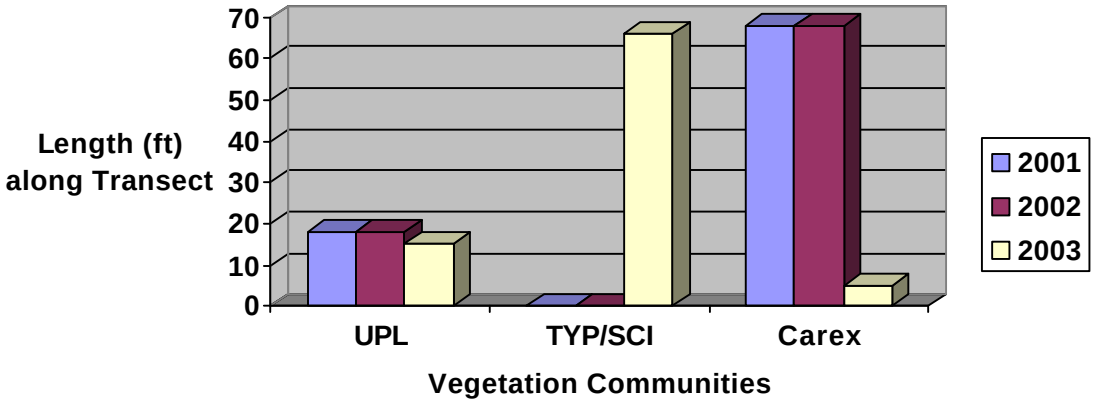
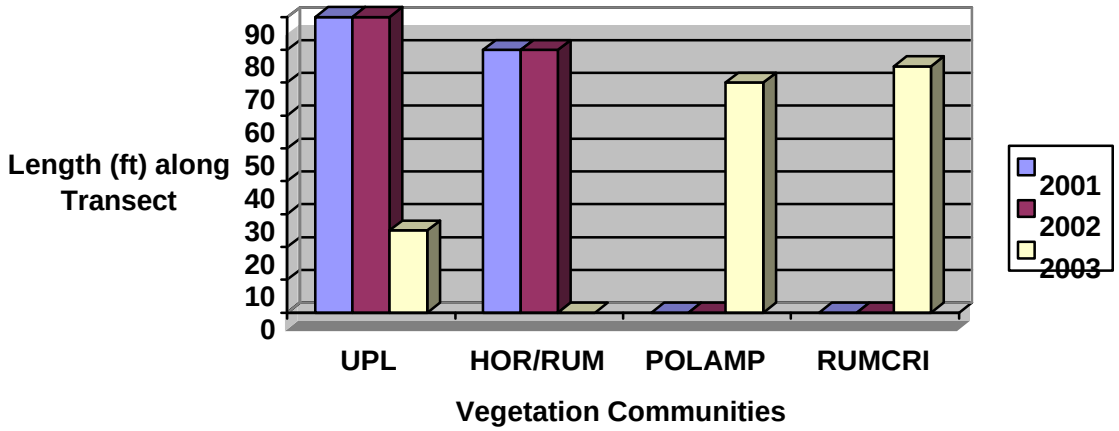


Chart 3: ***Length of Vegetation Communities along Transect 3***



3.3 Soils

According to the Blaine County soil survey (Soil Conservation Service 1986), soils at RS1 and the proposed enhancement areas are Typic Fluvaquents. These are somewhat poorly drained or poorly drained silty clays and silty clay loams that formed in alluvium in areas with seasonally high water tables, usually during the irrigation season. Typic Fluvaquents are not suited to cultivated crops, windbreaks, or most urban uses due to flooding and general wetness.

These characteristics were generally confirmed during monitoring. Soils sampled in wetland areas along the RS1 transect consistently were comprised of silty clays / clay loams with a matrix color of 2.5Y4/2 with mottles in the range of 2.5 Y 5/6 or 10YR 5/8, indicating a fluctuating water table. Soils along the ES 1 transect were comprised of clay loam with a matrix color of 10YR 4/1 and mottles at 10YR 4/6. Wetland soils were saturated or inundated at the time of the survey.

Soils at RS2 consist of Havre silty clay loam, saline. This is a well-drained soil formed in alluvium on flood plains and stream terraces. Permeability is moderately slow, and the available water capacity is moderate because of the effects of salts and sodium. According to the soil survey, this soil type is often subject to rare flooding. Soils were sampled at RS2 along the transect. Soils were comprised of silty clay loams with a matrix color of 10YR4/1 and distinct mottles of a 10YR4/6 color. Soils were inundated during the survey. Soils in this area have developed stronger hydric characteristics as the hydroperiod has increased.

3.4 Wetland Delineation

Delineated wetland boundaries are illustrated on **Figure 3**. Completed wetland delineation forms are included in **Appendix B**. Soils, vegetation, and hydrology are discussed in preceding sections. Delineation results are as follows:

RS1: 4.59 wetland acres impaired pre-existing, but currently "restored".
9.48 additional wetland and flooded "open water / transitional" areas.
Total of 14.07 acres of aquatic habitats delineated in 2003; a gain of 0.75 acre over 2002 totals.

RS2: 0 wetland acres pre-existing.
6.39 wetland acres "restored".
Total of 6.39 acres of wetlands delineated in 2003; a gain of 3.81 acres over 2002 totals due to dramatically increased inundation area.

ES1: 4.3 wetland acres pre-existing within delineation area (see below).
0.5 estimated (planimeter) additional pre-existing wetland acres within easement area north of ditch.
0.18 acre additional wetlands delineated in 2003.
Total of 4.98 wetland acres; increase of 0.18 acre from 2002.

Inclusive of open water/transitional areas at RS1, approximately 20.64 wetland/aquatic habitat acres have been "restored" on the mitigation site to date, an increase of 4.74 acres over 2002 totals.

In addition to wetland borders delineated during the 2003 mid-season visit, RS1 also contained approximate borders of pre-existing, impaired wetlands delineated by MDT that were referenced in the introduction to this report. Wetland fringes were noted developing below the RS1 dike in addition to pre-existing wetlands associated with the ditch, as well as along the south border of the impoundment in forested areas. "Open water/transitional" areas at RS1 consisted of recently flooded wetland and previously-mapped upland areas that were under from one to an estimated four feet of water during the mid-season visit. Rooted vegetation in these areas was not observable due to water depth/turbidity. These areas are expected to develop emergent or aquatic bed wetland vegetation over the next few years.

Approximately 3.81 wetland acres were gained at RS2 due to increased inundation.

Wetland borders of ES1 were delineated in 2001, although the north border of ES1 was drawn based on the approximate easement borders and is therefore "artificial". The north border of ES1 was drawn along the path of the ditch flowing into the site from the west, even though the actual wetland is contiguous to the north. Slight wetland expansion occurred along the south border of ES1 (along the dike) in 2003.

3.5 Wildlife

Wildlife species, or evidence of wildlife, observed on the site during 2001 and 2002 monitoring efforts are listed in **Table 5**. Specific evidence observed, as well as activity codes pertaining to birds, is provided on the completed monitoring form in **Appendix B**. Three mammal, two amphibian, and 43 bird species were noted using portions of the mitigation site during 2003 monitoring efforts. Several Blue-winged Teal (*Anas discors*) and Gadwall (*Anas strepera*) broods were observed at RS1 and RS2 during the July visit.

Of special interest were observations of northern leopard frogs (*Rana pipiens*) at each of the sites in 2001, at RS1 and RS2 in 2002, and at ES1 and RS2 in 2003. Leopard frogs are considered a "species of special concern" by the Montana Natural Heritage Program (MNHP) due largely to their apparent extirpation from the portion of their historic distribution west of the Continental Divide. This species has been assigned the rank of S1 (critically imperiled) west of the Divide and S3 (rare occurrence and/or restricted range and/or vulnerable to extinction) east of the Divide by the MNHP.

Table 5: ***Fish and Wildlife Species Observed on the Musgrave Lake Mitigation Site, 2001-2003***

FISH **Unidentified Minnow Species *(Hybognathus* sp.*)***	
AMPHIBIANS **Northern Leopard Frog (*Rana pipiens*)**	**Western Chorus Frog (*Pseudacris triseriata*)**
REPTILES Plains Garter Snake (*Thamnophis radix*)	
BIRDS American Coot (*Fulica americana*) **American Kestrel (*Falco sparverius*)** **American Robin (*Turdus migratorius*)** American White Pelican (*Pelecanus erythrorhynchos*) American Wigeon (*Anas Americana)* **Barn Swallow (*Hirundo rustica*)** Belted Kingfisher (*Ceryle alcyon)* Black-billed Magpie (*Pica pica*) Black-capped Chickadee (*Poecile atricapillus*) **Blue-winged Teal (*Anas discors*)** Bobolink (*Dolichonyx oryzivorus*) **Brewer's Blackbird (*Euphagus cyanocephalus*)** **Brown-headed Cowbird (*Molothrus ater*)** Bufflehead (*Bucephala albeola*) Bullock's Oriole (*Icterus bullockii*) **Canada Goose (*Branta canadensis*)** **Canvasback (*Aythya valisineria*)** **Cedar Waxwing (*Bombycilla cedrorum*)** Chipping Sparrow (*Spizella passerina*) **Clay-colored Sparrow (*Spizella pallida*)** Cliff Swallow (*Petrochelidon pyrrhonota*) Common Grackle (*Quiscalus quiscula*) Common Nighthawk (*Chordeiles minor)* **Common Snipe (*Gallinago gallinago*)** **Common Tern (*Sterna hirundo*)** **Common Yellowthroat (*Geothlypis trichas)*** **Double-crested Cormorant (*Phalacrocorax auritus*)** **Eastern Kingbird (*Tyrannus tyrannus*)** European Starling (*Sturnus vulgaris*) **Gadwall (*Anas strepera*)** Gray Catbird (*Dumetella carolinensis*) **Great Blue Heron (*Ardea herodias*)** Green-winged Teal (*Anas crecca*) **House Wren (*Troglodytes aedon*)** **Killdeer (*Charadrius vociferous*)** Least Flycatcher (*Empidonax minimus*) **Lesser Scaup (*Aythya affinis*)**	**Long-billed Dowitcher (*Limnodromus scolopaceus*)** **Mallard (*Anas platyrhynchos*)** Marbled Godwit (*Limosa fedoa*) **Marsh Wren (*Cistothorus palustris*)** **Mourning Dove (*Zenaida macroura*)** Northern Flicker (*Colaptes auratus*) **Northern Harrier (*Circus cyaneus*)** **Northern Pintail (*Anas acuta*)** **Northern Rough-winged Swallow (*Stelgidopteryx serripennis*)** **Northern Shoveler (*Anas clypeata*)** Orange-crowned Warbler (*Vermivora celata*) **Red-tailed Hawk (*Buteo jamaicensis)*** **Red-winged Blackbird (*Agelaius phoeniceus)*** **Ring-billed Gull (*Larus delawarensis*)** **Ring-necked Pheasant (*Phasianus colchicus*)** Rock Dove (*Columba livia*) Savannah Sparrow (*Passerculus sandwichensis*) Sharp-tailed Grouse (*Tympanuchus phasianellus*) Solitary Sandpiper (*Tringa solitaria*) Song Sparrow (*Melospiza melodia*) **Sora (*Porzana carolina*)** **Spotted Sandpiper (*Actitis macularia*)** **Tree Swallow (*Tachycineta bicolor*)** Upland Sandpiper (*Bartramia longicauda*) Warbling Vireo (*Vireo gilvus*) Western Meadowlark (*Sturnella neglecta*) **Western Sandpiper (*Calidris mauri*)** **Western Wood-pewee (*Contopus sordidulus*)** **Willet (*Catoptrophorus semipalmatus*)** **Willow Flycatcher (*Empidonax traillii*)** **Wilson's Phalarope (*Phalaropus tricolor*)** Wood Duck (*Aix sponsa*) **Yellow-rumped Warbler (*Dendroica coronata*)** **Yellow Warbler (*Dendroica petechia*)** **Yellow-headed Blackbird (*Xanthocephalus xanthocephalus*)**
MAMMALS American Badger (*Taxidea taxus*) **American Beaver (*Castor canadensis*)** Coyote (*Canis latrans*)	Long-tailed Weasel (*Mustela frenata*) **Raccoon (*Procyon lotor*)** Richardson's Ground Squirrel (*Spermophilus richardsonii*) **White-tailed Deer (*Odocoileus virginianus*)**
Bolded species were observed during 2003 monitoring. All other species were observed during one or more of the previous monitoring years, but not during 2003.	

3.6 Macroinvertebrates

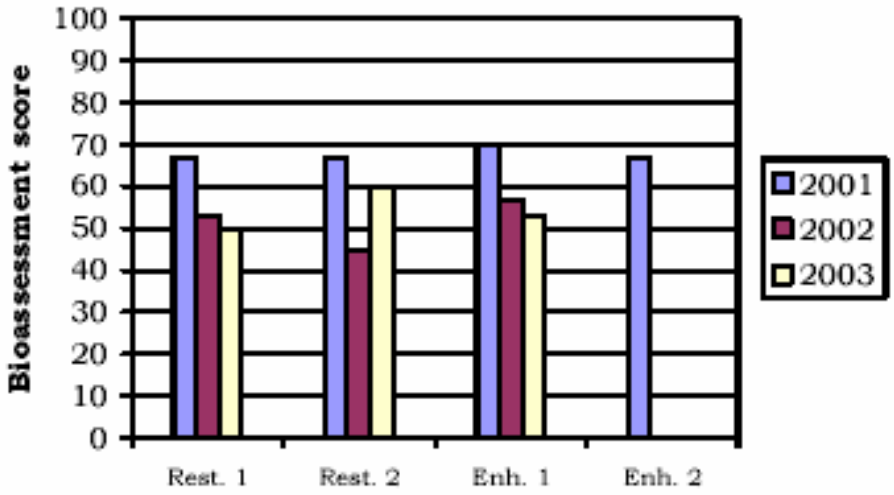
Macroinvertebrate sampling results are provided in **Appendix F** and are summarized below by Rhithron Associates (Bollman 2003). Bioassessment results are summarized in **Chart 4**.

RS1. Total bioassessment scores continue to decline at this site; biotic conditions rated poorly in 2003. However, improvements in taxa richness and in assemblage sensitivity suggest that neither habitat nor water quality were substantially worse than in 2002. Habitat diversity seems to have been good, since sediment dwellers, macrophyte-oriented organisms, and inhabitants of the water column all appear to have been well-represented. Scrapers dominated the functional composition of the assemblage, suggesting that macrophytes were abundant.

RS2. Here, an improvement in bioassessment score in 2003 over that of the previous year may have been due to differences in sampling between the 2 years. The depauperate sample of the earlier year contrasted sharply with that of both 2001 and 2003. Sub-optimal conditions were indicated, which is a decline from the optimal conditions suggested by scores in 2001. The site supported a unique fauna, compared to the other wetland sites in this study. Tubificid worms made up a large proportion of the assemblage; these hemoglobin-bearers may signal nutrient enrichment and hypoxic substrates. Leeches were unusually prolific and diverse, suggesting warm water temperatures. Habitats appear to have been diverse.

ES1. Taxa richness fell dramatically at this site since 2002. Scores suggest that biotic conditions were poor in 2003. Naiad worms were a large component of the assemblage at this site, suggesting that bacteria were abundant. Warm water temperatures and nutrient enrichment could account for this. The other dominant taxon were ceratopogonid gnats; as adults, these flies rely on blood meals. Abundance of larvae of blood-feeding insects may be a signal of poor water quality conditions, though this has not been adequately explored.

Chart 4: ***Bioassessment Scores for Musgrave Lake, 2001-2003***



3.7 Functional Assessment

Completed functional assessment forms are presented in **Appendix B**. Functional assessment results are summarized in **Table 6**. For comparative purposes, the functional assessment results for the reference wetland site and baseline conditions prepared by MDT and the landowner are also included in **Table 6**.

Ratings and scores improved in 2003 at RS1, RS2, and ES1 due to dramatically increased inundation (**Table 6**). Net functional unit gain nearly doubled at the mitigation site from 74.44 units in 2002 to 143.26 units in 2003. This was due to increased wetland area at RS1 and ES1, increased wildlife habitat scores at all sites, and documentation of northern leopard frog habitat at all three sites. All three sites rated as Category II wetlands in 2003.

Based on the baseline functional assessments conducted by MDT and the landowner, the site has experienced an apparent gain of about 125 functional units (acreage x functional points) at restoration sites RS1 and RS2, and 18.17 functional units at ES1. As stated in the 2001 report, some of this lift at ES1 may be due to differing approaches to completing the assessment form. No pre-project functional assessment was conducted at RS2 due to the absence of pre-project wetlands.

The composite score at ES1 (7.6 points) exceeded the composite score for the reference wetland (6.6 points) in 2003. This is partially due to the fact that some variables evaluated and scored for the enhancement site were not evaluated for the reference wetland, resulting in additional points assigned to the enhancement site. Appreciable functional gain occurred at ES1 in 2003. However, functional gain at the ES1 may ultimately need to be compared to the reference wetland in terms of percentage of possible score achieved, functional units, individual functions, or some combination. This should be worked out with the COE and the landowner so that gains can be accurately tracked over the monitoring period.

3.8 Photographs

Representative photographs taken from photo-points and transect ends are provided in **Appendix C**. **Figures 2 and 3** (**Appendix A**) are based on the 2003 aerial photograph; consequently, a separate 2003 aerial photograph is not included.

3.9 Maintenance Needs/Recommendations

All dikes were in good condition during the spring and mid-season visits, although the culvert between ES1 and RS2 had been removed between the May and July monitoring visits. This did not appear to affect the inundation extent at either ES1 or RS2. Lowering the water level slightly at RS1 may be necessary to prevent drowning of existing mature cottonwoods.

3.10 Current Credit Summary

Inclusive of open water/transitional areas at RS1, approximately 20.64 wetland/aquatic habitat acres have been "restored" on the mitigation site to date, an increase of 4.74 acres over 2002 totals.

Wetland fringes were continuing to develop below the RS1 northwest dike in addition to pre-existing wetlands associated with the ditch, as well as along the south border of the impoundment in forested areas. "Open water/transitional" areas at RS1 consist of recently flooded wetland and previously-mapped upland areas that were under from one to an estimated four feet of water during the mid-season visit. Rooted vegetation in these areas was not observable due to water depth/turbidity. These areas are expected to develop emergent or aquatic bed wetland vegetation over the next few years.

Approximately 3.81 wetland acres were gained at RS2 due to increased inundation. Slight wetland expansion (0.18 acre) occurred along the south border of ES1 (along the dike) in 2003.

Appreciable functional enhancement has been achieved across about 4.98 acres within the easement area at ES1, currently calculated at an approximate 18.17 functional unit "gain". An applied 1:3 credit ratio at ES1 would result in approximately 1.66 acres of credit. Also, it should be noted that the total wetland acreage within the easement area at the enhancement site appears to be approximately 6 acres short of the original 11-acre estimate, reducing the amount of credit available at this site.

Approximately 0.75 acre of credit is associated with the upland buffer surrounding wetlands. Consequently, the maximum assignable credit at this site (RS1, RS2, ES1, and upland buffer) as of 2003 is approximately 20.64 + 1.66 + 0.75 = 23.05 acres.

Table 6: ***Summary of 2003 Wetland Function/Value Ratings and Functional Points [1] at the Musgrave Lake Mitigation Project***

Function and Value Parameters From the 1999 MDT Montana Wetland Assessment Method	Wetland Numbers					
	Reference Wetland (Stutzman 1999)	Pre-Project RS1 (Stutzman 1999)[2]	Pre-Project ES1 (MDT 1999)	2003 RS1	2003 RS2	2003 ES1
Listed/Proposed T&E Species Habitat	Low (0.3)	Low (0.3)	Low (0.3)	Low (0.3)	Low (0.3)	Low (0.3)
MNHP Species Habitat	Mod (0.7)	Low (0.1)	Mod (0.7)	High (1.0)	High (1.0)	High (1.0)
General Wildlife Habitat	High (0.9)	Low (0.1)	Mod (0.7)	Exceptional (1.0)	High (0.8)	High (0.9)
General Fish/Aquatic Habitat	NA	NA	Low (0.3)	NA	Low (0.3)	Low (0.3)
Flood Attenuation	Mod (0.5)	Low (0.1)	Mod (0.5)	Mod (0.5)	Mod (0.5)	Mod (0.5)
Short and Long Term Surface Water Storage	High (1)	Low (0.2)	Low (0.3)	High (0.9)	Mod (0.6)	Mod (0.6)
Sediment, Nutrient, Toxicant Removal	Mod (0.7)	Mod (0.4)	Low (0.2)	NA	High (1.0)	High (1.0)
Sediment/Shoreline Stabilization	NA	NA	Low (0.2)	Low (0.2)	NA	Mod (0.6)
Production Export/ Food Chain Support	High (0.9)	Mod (0.5) [Low 0.2]	Mod (0.7)	High (0.9)	High (0.8)	High (0.8)
Groundwater Discharge/Recharge	High (1)	NA	NA	High (1.0)	High (1)	High (1)
Uniqueness	Low (0.3)	Low (0.2)	Low (0.1)	Mod (0.6)	Low (0.3)	Mod (0.5)
Recreation/Education Potential	Low (0.3)	Low (0.1)	Low (0.1)	Low (0.1)	Low (0.1)	Low (0.1)
Actual Points/Possible Points	6.6 / 10	2.0 / 9	4.1 / 11	6.5 / 10	6.7 / 11	7.6 / 12
% of Possible Score Achieved	66%	22%	37%	65%	61%	63%
Overall Category	II	III	III	II*	II*	II*
Total Acreage of Assessed Wetlands within Easement	6.5 ac (estimated)	4.59 ac	4.8 ac (ES1)	14.07 ac	6.39 ac	4.98 ac
Functional Units (acreage x actual points)	42.9 fu	9.18 fu	19.68 fu (ES1)	91.46 fu	42.81 fu	37.85 fu
Net Acreage Gain	NA	NA	NA	9.48 ac	6.39 ac	0.18
Net Functional Unit Gain	NA	NA	NA	82.28 fu	42.81 fu	18.17 fu
Total Functional Unit "Gain" over baseline	143.26 Total Functional Units; 125.09 at restoration wetlands; 18.17 at enhancement wetlands (ES1 only; ES2 could not be calculated)					

[1] See completed MDT functional assessment forms in Appendix B for further detail.
[2] Production Export rating was corrected based on size of vegetated component in the AA and shown in bold; this resulted in site rating as Category III.
* Did not achieve Category II rating based on functional points, but did achieve Category II rating based on score for MNHP species and/or general wildlife habitat.

4.0 REFERENCES

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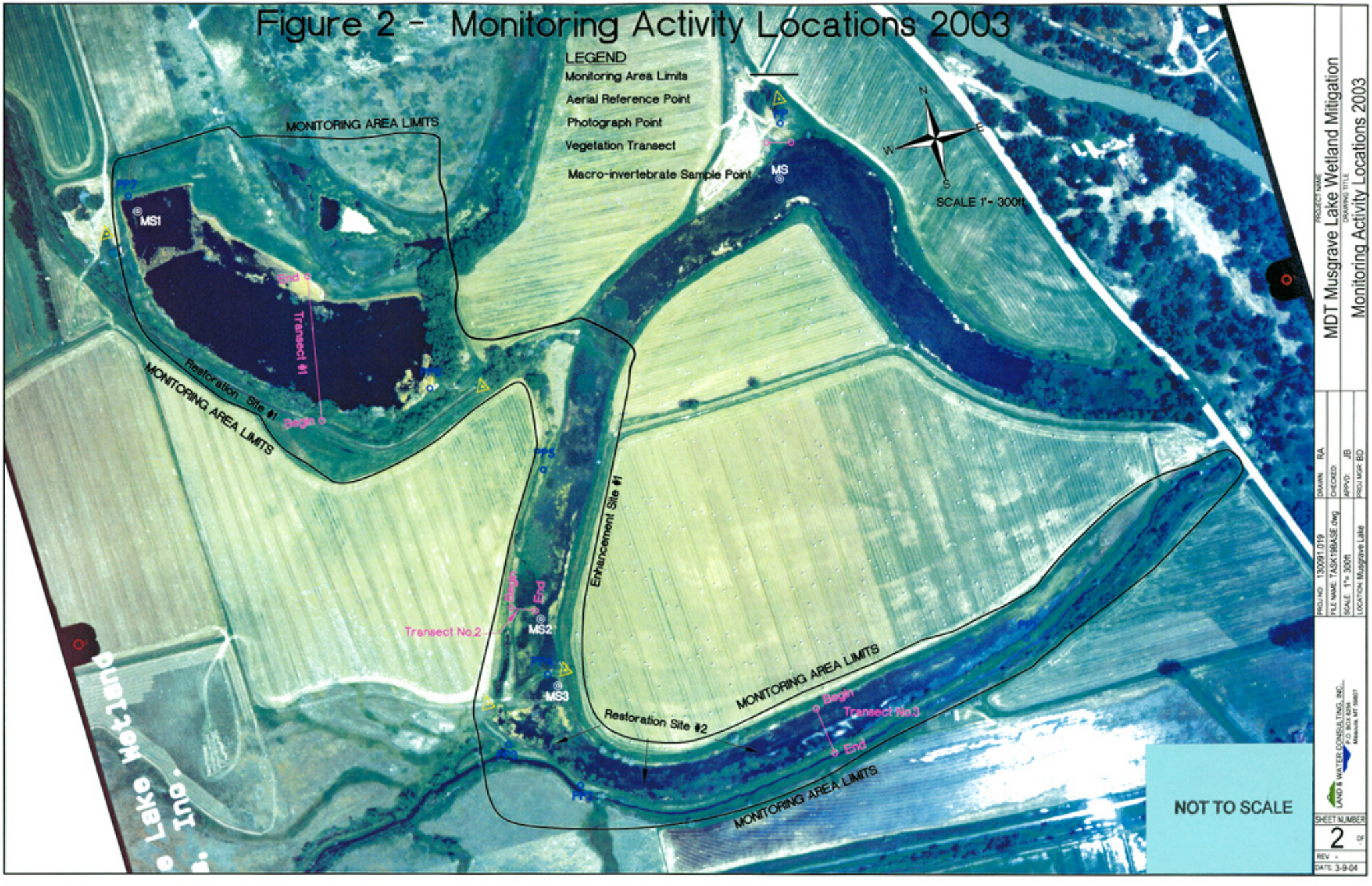
Appendix A

FIGURES 2 - 3

MDT Wetland Mitigation Monitoring
Musgrave Lake
Zurich, Montana

LAND & WATER

Figure 2 - Monitoring Activity Locations 2003



PROJECT NAME: MDT Musgrave Lake Wetland Mitigation
DRAWING TITLE: Monitoring Activity Locations 2003

PROJ NO: 130091.019 | DRAWN: RA
FILE NAME: TASK19BASE.dwg | CHECKED:
SCALE: 1" = 300ft | APPVD: JB
LOCATION: Musgrave Lake | PROJ MGR: BD

LAND & WATER CONSULTING, INC.
P.O. BOX 8254
Missoula, MT 59807

SHEET NUMBER: 2
REV: -
DATE: 3-9-04

Figure 3 - Mapped Site Features 2003

PROJECT NAME
MDT Musgrave Lake Wetland Mitigation
DRAWING TITLE
Mapped Site Features 2003

PROJ NO: 130091.019
FILE NAME: TASK19BASE.dwg
SCALE: 1"= 300ft
LOCATION: Musgrave Lake

DRAWN: RA
CHECKED:
APPVD: JB
PROJ MGR: BD

LAND & WATER CONSULTING, INC.
P.O. BOX 8254
Missoula, MT 59807

SHEET NUMBER
3

REV -
DATE: 3-09-04

Appendix B

COMPLETED 2003 WETLAND MITIGATION SITE MONITORING FORM
COMPLETED 2003 BIRD SURVEY FORMS
COMPLETED 2003 WETLAND DELINEATION FORMS
COMPLETED 2003 FUNCTIONAL ASSESSMENT FORMS

MDT Wetland Mitigation Monitoring
Musgrave Lake
Zurich, Montana

LAND & WATER

LWC / MDT WETLAND MITIGATION SITE MONITORING FORM

Project Name:__Musgrave Lake____ Project Number:_NH-STPX 3(33)_ Assessment Date:__7_/_30_/_03_
Location:S. of Zurich_____ MDT District:____Great Falls Milepost:_417_____
Legal description: T_32N R21E_ Section_11/12 Time of Day:0700-1200
Weather Conditions:__dry, sunny_____ Person(s) conducting the assessment: Berglund
Initial Evaluation Date:_5_/_15_/_01_ Visit #:__6___ Monitoring Year:_3_____
Size of evaluation area:_100___acres Land use surrounding wetland:____Hayland and pasture_

HYDROLOGY

Surface Water Source:_Irrigation water, ground water, surf. runoff / ppt._____
Inundation**:** Present__X_ Absent____ Average depths:_0-2ft Range of depths:_0_-__6_ft
Assessment area under inundation:__90%
Depth at emergent vegetation-open water boundary:_3__ft
If assessment area is not inundated are the soils saturated w/in 12" of surface**:** Yes_X__No_____
Other evidence of hydrology on site (drift lines, erosion, stained vegetation etc.): ___RS1, RS2, and ES1 are all nearly 100% inundated.

Groundwater
Monitoring wells: Present_____ Absent X
Record depth of water below ground surface

Well #	Depth	Well #	Depth	Well #	Depth

Additional Activities Checklist:
_X____Map emergent vegetation-open water boundary on air photo
_X____Observe extent of surface water during each site visit and look for evidence of past surface water elevations (drift lines, erosion, vegetation staining etc.)
_NA__GPS survey groundwater monitoring wells locations if present

COMMENTS/PROBLEMS: RS1: 100% inundated, ave. depth = 2 feet, range = 2" to 4'_____
RS2: 90% inundated, ave. depth = 1 ft, range = 6" to 5', pipe removed between ES1 and RS2, but now dammed by beaver activity. ES1: 95% inundated, ave. depth = 24", range = 6-30". ES2: 85% inundated, ave. depth = 1 ', range = 0-6 ft._____

VEGETATION COMMUNITIES

Community No.:_1__ Community Title (main species):_TYP LAT / SCI ACU_____

Dominant Species	% Cover	Dominant Species	% Cover
TYP LAT	>50	POL AMP	11-20
SCI ACU	21-50		
CAR LAN	21-50		
ELE PAL	6-10		
CAR VES	21-50		

COMMENTS/PROBLEMS: __Similar to 2001 and 2002._____

Community No.:__2_ Community Title (main species):_~~ALO PRA /~~ POL AMP_____

Dominant Species	% Cover	Dominant Species	% Cover
ALO PRA	1-5		
POL AMP	>50		
RUM CRI	1-5		
TYP LAT	1-5		
SCI ACU	1-5		

COMMENTS/PROBLEMS: ___POL AMP vastly dominated this community type in 2003; ALO PRA was removed from community type title due to current lack of dominance. _____

Community No.:__3_ Community Title (main species):_SALIX / ELA ANG_____

Dominant Species	% Cover	Dominant Species	% Cover
SAL EXI	>50	BRO INE	6-10
SAL LUT	21-50	SAL AMY	>50
ELA ANG	>50		
CAR LAN	21-50		
AGR ALB	11-20		

COMMENTS/PROBLEMS: ___Similar to 2002.

Additional Activities Checklist:
_X__Record and map vegetative communities on air photo

VEGETATION COMMUNITIES (continued)

Community No.:_4__ Community Title (main species):_POT / MYR_____

Dominant Species	% Cover	Dominant Species	% Cover
POT NAT	1-5		
MYR SPI	>50		
ELE ACI	6-10		
SAG CUN	6-10		
POTAMOGETON sp.	>50		

COMMENTS/PROBLEMS: __Similar to 2001 and 2002._____

Community No.:_5__ Community Title (main species):_CAREX_____

Dominant Species	% Cover	Dominant Species	% Cover
CAL VUL	21-50	ALO PRA	6-10
CAR UTR	21-50	AGR ALB	11-20
CAR VES	21-50	POL AMP	1-5
TYP LAT	6-10		
CAR LAN	21-50		

COMMENTS/PROBLEMS: ____Similar to 2001 and 2002, with POL AMP added in 2003._____

Community No.:__6_ Community Title (main species):_~~HOR JUB / RUM CRI~~_____

Dominant Species	% Cover	Dominant Species	% Cover
~~HOR JUB~~	~~21-50~~	~~CAR VES~~	6-10
~~RUM CRI~~	~~21-50~~	~~FES ARU~~	1-5
~~AGR REP~~	~~21-50~~		
~~POT ANS~~	~~1-5~~		

COMMENTS/PROBLEMS: __This community was gone in 2003, having been replaced by Community #8, *Rumex Crispus*.

VEGETATION COMMUNITIES (continued)

Community No.:_7__ Community Title (main species):_POP DEL_____

Dominant Species	% Cover	Dominant Species	% Cover
POP DEL	21-50	TYP LAT	11-20
ELA ANG	11-20		
SAL LUT	11-20		
SAL EXI	11-20		
IVA XAN	11-20		

COMMENTS/PROBLEMS: _New wetland community type in 2002 due to increased site inundation. Was upland in 2001. Wetland understory species appeared to germinate in 2002. Stayed consistent in 2003.

Community No.:_8__ Community Title (main species):__RUM CRI_____

Dominant Species	% Cover	Dominant Species	% Cover
RUM CRI	>50	TYP LAT	<1
AGR REP	21-50	SCI MAR	6-10
BEC SCH	11-20		
CAR VES	6-10		
POL AMP	6-10		

COMMENTS/PROBLEMS: __New community type in 2003. Replaced Type 6. Occurs around perimeter of RS1 and in portions of RS2.

Community No.:____ Community Title (main species):_____

Dominant Species	% Cover	Dominant Species	% Cover

COMMENTS/PROBLEMS: _____

COMPREHENSIVE VEGETATION LIST

Species	Vegetation Community Number(s)	Species	Vegetation Community Number(s)
Acer negundo	3	*Poa bulbosa*	7, upland
Agropyron intermedium	upland	*Poa pratensis*	2, upland
Agropyron repens	2,6, 8	*Polygonum amphibium*	1, 2, 5, 8
Agropyron smithii	upland	*Polygonum lapathifolium*	1,2
Agrostis alba	1,2,3,7	*Polygonum persicaria*	1,2
Alisma plantago-aquatica	1,4	*Populus deltoides*	7
Alopecurus pratensis	2,5	*Potamogeton natans*	4
Apocynum androsaemifolium	7, upland	*Potentilla anserina*	1,6
Arctium minus	3,7	*Prunus virginiana*	3, upland
Asclepias speciosa	5,7	*Ranunculus occidentalis*	1,4
Asparagus officinalis	upland	*Rosa nutkana*	3, upland
Beckmannia syzigachne	1,5, 8	*Rumex crispus*	1,5, 6, 8
Bromus inermis	3,7, upland	*Sagittaria cuneata*	1,4
Carex lanuginose	1,3,5	*Salix amygdaloides*	3
Carex praegracilis	5, upland	*Salix exigua*	3
Carex stipata	5	*Salix lutea*	3
Carex utriculata	1,5	*Scirpus acutus*	1
Carex vesicaria	1,5, 8	*Scirpus americanus*	1,6
Carex vulpinoides	5	*Scirpus maritimus*	1, 8
Chenopodium album	6, upland	*Scirpus validus*	1
Cicuta douglasii	1,3	*Sium suave*	1,4
Cirsium arvense	1,3	*Solidago canadensis*	1,3,7, upland
Convolvulus arvensis	upland	*Spartina pectinata*	5
Cornus stolonifera	3,7	*Sparganium eurycarpum*	1
Elaeagnus angustifolia	3,7	*Symphoricarpos occidentalis*	upland
Eleocharis acicularis	1,4	*Taraxacum officinale*	upland
Eleocharis palustris	1,2,4	*Typha latifolia*	1,4,7, 8
Festuca arundinacea	6		
Glyceria grandis	1,2		
Glycyrrhiza lepidota	2,7		
Helianthus annuus	upland		
Hordeum jubatum	6, upland		
Iva xanthifolia	7, upland		
Juncus effuses	1		
Kochia scoparia	upland		
Lemna minor	4		
Lycopus americanus	1,2,4		
Medicago sativa	upland		
Melilotus alba	upland		
Myriophyllum spicatum	4		
Phalaris arundinacea	1		
Phleum pratense	2, upland		

COMMENTS/PROBLEMS: ____Dense growth of Kochia on dikes at RS 1.

PLANTED WOODY VEGETATION SURVIVAL

Species	Number Originally Planted	Number Observed	Mortality Causes
NO WOODY SPECIES PLANTED			

COMMENTS/PROBLEMS: _____

WILDLIFE

BIRDS

(Attach Bird Survey Field Forms)

Were man made nesting structures installed? Yes____ No_X_Type:_____ How many?_____ Are the nesting structures being utilized? Yes____ No____ Do the nesting structures need repairs? Yes____ No____

MAMMALS AND HERPTILES

Species	Number Observed	Indirect indication of use			
		Tracks	Scat	Burrows	Other
White-tailed deer	6	yes	yes		
Badger	0			yes	
Raccoon	0	yes			+
Beaver	0				slide, dams
Northern leopard frog (ES1, RS2)	50+				
Western chorus frog (RS1, RS2, ES1)	100+				

Additional Activities Checklist:
_X___Macroinvertebrate sampling (if required)

COMMENTS/PROBLEMS: ___Substantial frog activity observed in 2003 at all sites.

PHOTOGRAPHS

Using a camera with a 50 mm lenses and color film take photographs of the following permanent reference points listed in the checklist below. Record the direction of the photograph using a compass. (The first time at each site establish a permanent reference point by setting a ½ inch rebar or fencepost extending 2-3' above ground, survey the location with a resource grade GPS and mark the location on the air photo.)
Checklist:

_X___ One photo for each of the 4 cardinal directions surrounding wetland
_X___ At least one photo showing upland use surrounding wetland – if more than one upland use exists, take additional photos
_X___ At least one photo showing buffer surrounding wetland
_X___ One photo from each end of vegetation transect showing transect

Location	Photo Frame #	Photograph Description	Compass Reading
A		SEE FIGURES AND PHOTO SHEETS	
B			
C			
D			
E			
F			
G			
H			

COMMENTS/PROBLEMS: _____

GPS SURVEYING

Using a resource grade GPS survey the items on the checklist below. Collect at least 3 location points with the GPS unit set at 5 second recording rate. Record file numbers fore site in designated GPS field notebook

Checklist:

_____ Jurisdictional wetland boundary
_____ 4-6 landmarks recognizable on the air photo
_____ Start and end points of vegetation transect(s)
_____ Photo reference points
_____ Groundwater monitoring well locations

COMMENTS/PROBLEMS: ___No GPS data collected in 2003; modifications made using high-quality 2002 aerial photograph during field visits.

WETLAND DELINEATION

(Attach Corps of Engineers delineation forms)

At each site conduct the items on the checklist below:
_X___Delineate wetlands according to the 1987 Army Corps manual.
_X___ Delineate wetland-upland boundary on the air photo
_NA__ Survey wetland-upland boundary with a resource grade GPS survey

COMMENTS/PROBLEMS: _____

FUNCTIONAL ASSESSMENT

(Complete and attach full MDT Montana Wetland Assessment Method field forms; also attach abbreviated field forms, if used)

COMMENTS/PROBLEMS: __ ES2 NOT SAMPLED (PER MDT INSTRUCTION).

MAINTENANCE

Were man-made nesting structures installed at this site? YES___ NO_X__
If yes, do they need to be repaired? YES____ NO____
If yes, describe problems below and indicate if any actions were taken to remedy the problems.

Were man-made structures build or installed to impound water or control water flow into or out of the wetland? YES_X__ NO____
If yes, are the structures working properly and in good working order? YES____ NO_X_
If no, describe the problems below.

COMMENTS/PROBLEMS: _ Flow was overtopping road/dike between ES1 and RS2 during May visit.

MDT WETLAND MONITORING – VEGETATION TRANSECT

Site: Musgrave Lake Date: 7/30/03 Examiner: Berglund Transect # RS1

Approx. transect length: 500 feet Compass Direction from Start (Upland):

Vegetation type A:	ALO PRA (Wetland comm. #2)	
Length of transect in this type:	15	feet
Species:		Cover:
ALO PRA		>50
APO AND		6-10
CAR LAN		1-5
PHL PRA		1-5
Upland in 2001		
Total Vegetative Cover:		100

Vegetation type B:	UPLAND	
Length of transect in this type:	16	feet
Species:		Cover:
BRO INE		6-10
PHL PRA		21-50
AGR REP		21-50
POA PRA		1-5
TAR OFF		1-5
SYM OCC		<1
APO AND		1-5
POL AMP		<1
Total Vegetative Cover:		100

Vegetation type C:	POP DEL (Wetland comm. #7)	
Length of transect in this type:	49	feet
Species:		Cover:
POP DEL (not rooted in transect)		21-50
POL AMP		11-20
TYP LAT		<1
Mapped as ALO PRA / POL LAP in 2001 – wet		
community extended to POP DEL in 2002 due to		
increased inundation – mapped as POP DEL		
in 2002 and 2003		
Total Vegetative Cover:		100

Vegetation type D:	Open Water – Transitional	
Length of transect in this type:	approx. 200	feet
Species:		Cover:
TYP LAT		<1
SCI ACU		<1
POL AMP		11-20
Estimated from photo – inaccessible due to flooding		
Total Vegetative Cover:		15-20%

MDT WETLAND MONITORING – VEGETATION TRANSECT (continued)

Site: Musgrave Lake Date: 7/30/03 Examiner: Berglund Transect # RS1 – cont.

Approx. transect length: 500 Compass Direction from Start (Upland):

Vegetation type E:	POL AMP (COMM. #2, w/ALO PRA flooded out)	
Length of transect in this type:	Approx. 15	feet

Species:	Cover:
POL AMP	>50
Estimated from aerial photo.	
Total Vegetative Cover:	80

Vegetation type F:	OPEN WATER – transitional	
Length of transect in this type:	approx. 200	feet

Species:	Cover:
POL AMP	1-5
Length estimated from photo due to flooding.	
Flooded to end of transect at fencepost.	
Total Vegetative Cover:	1-5

Vegetation type G:	RUM CRI (Wetland Comm. #8)	
Length of transect in this type:	5	feet

Species:	Cover:
RUM CRI	>50
BEC SCH	21-50
SCI MAR	11-20
BRO INE	6-10
	100
Total Vegetative Cover:	1-5

Vegetation type H:		
Length of transect in this type:		feet

Species:	Cover:
Total Vegetative Cover:	

MDT WETLAND MONITORING – VEGETATION TRANSECT

Site: Musgrave Lake Date: 7/30/03 Examiner: Berglund Transect # RS2

Approx. transect length: 170 ft Compass Direction from Start (Upland):

Vegetation type A:	UPLAND	
Length of transect in this type:	15	feet
Species:		Cover:
AGR REP		21-50
BRO INE		21-50
SYM OCC		11-20
ROS NUT		1-5
CIR ARV		6-10
GLY LEP		1-5
Similar to 2002.		
Total Vegetative Cover:		100

Vegetation type B:	RUM CRI (Wetland Comm. #8)	
Length of transect in this type:	75	feet
Species:		Cover:
RUM CRI		>50
AGR REP		21-50
POL AMP		6-10
TYP LAT		<1
Inundated 6-8”		
Total Vegetative Cover:		90

Vegetation type C:	POL AMP (Wetland Comm. #2)	
Length of transect in this type:	70	feet
Species:		Cover:
POL AMP		>50
RUM CRI		1-5
Inundated 6-8”. Was upland in 2002.		
Total Vegetative Cover:		60

Vegetation type D:	Upland	
Length of transect in this type:	10	feet
Species:		Cover:
SYM OCC		21-50
BRO INE		11-20
CIR ARV		11-20
Total Vegetative Cover:		100

MDT WETLAND MONITORING – VEGETATION TRANSECT

Site: Musgrave Lake Date: 7/30/03 Examiner: Berglund Transect # ES1

Approx. transect length: 86 ft Compass Direction from Start (Upland): 106 degrees

Vegetation type A:	UPLAND	
Length of transect in this type:	15	feet
Species:		Cover:
PRU VIR		1-5
MED SAT		1-5
BRO INE		21-50
POL LAP		11-20
IVA XAN		1-5
Total Vegetative Cover:		100

Vegetation type B:	CAREX (Wetland Comm. # 5)	
Length of transect in this type:	5	feet
Species:		Cover:
CAR LAN		>50
POL LAP		1-5
CAR VES		>50
BRO INE		<1
Fringe of flooded area (was 68'wide in 2002).		
Total Vegetative Cover:		100

Vegetation type C:	TYP LAT/SCI ACU (Wet. Comm. #1)	
Length of transect in this type:	66	feet
Species:		Cover:
TYP LAT		1-5
SCI ACU		21-50
POL LAP		1-5
Flooded to 2-foot depth.		
Total Vegetative Cover:		50

Vegetation type D:		
Length of transect in this type:		feet
Species:		Cover:
Total Vegetative Cover:		

LAND & WATER

MDT WETLAND MONITORING – VEGETATION TRANSECT (back of form)

Cover Estimate

+ = <1%
1 = 1-5%
2 = 6-10%
3 = 11-20%
4 = 21-50%
5 = >50%

Indicator Class:

+ = Obligate
- = Facultative/Wet
0 = Facultative

Source:

P = Planted
V = Volunteer

Percent of perimeter see below % developing wetland vegetation – excluding dam/berm structures.

Establish transects perpendicular to the shoreline (or saturated perimeter). The transect should begin in the upland area. Permanently mark this location with a standard metal fencepost. Extend the imaginary transect line towards the center of the wetland, ending at the 3 food depth (in open water), or at a point where water depths or saturation are maximized. Mark this location with another metal fencepost.

Estimate cover within a 10 ft wide "belt" along the transect length. At a minimum, establish a transect at the windward and leeward sides of the wetland. Remember that the purpose of this sampling is to monitor, not inventory, representative portions of the wetland site.

Notes:

All sites inundated and transitioning to wetland areas. Dramatic changes observed along RS2 transect, where upland reverted to wetland in
one growing season.
% perimeter developing wetland vegetation: RS1 – 100; ES1 – 100; RS2 – 90; ES2 unsampled in 2003.

3/01 rev

LAND & WATER

BIRD SURVEY – FIELD DATA SHEET

Page__1_of__1_
Date: 5/19/03

SITE: Musgrave Lake

Survey Time: 1030-1300

Bird Species	#	Behavior	Habitat	Bird Species	#	Behavior	Habitat
American Kestrel	1	F	UP	Sora	2	L	MA
American Robin	6	F	ALL	Yellow-Headed Blackbird	3	F	MA
House Wren	2	N	UP	Brown-Headed Cowbird	2	F	UP
Brewer's Blackbird	4	F	ALL	Double-Crested Cormorant	1	FO	OW
Canada Goose	6	F, BD	MA	Great Blue Heron	1	FO	MA
Red-Tailed Hawk	1	F	MA	Tree Swallow	2	F	SS
Clay-Colored Sparrow	5	F	UP				
Gadwall	2	L	OW				
Killdeer	30	F,N	MF				
Mallard	10	F,N	AB,OW				
Mourning Dove	20	F	UP, FO				
Western Wood Pewee	4	L	FO				
Northern Harrier	1	F	MA				
Northern Shoveler	8	F, BD	OW				
Wilson's Phalarope	20	F	OW				
Red-Winged Blackbird	50	F,N	MA				
Ring-Billed Gull	1	FO	MA				
Ring-Necked Pheasant	1	F	UP				
Willow Flycatcher	4	L	FO				
Common Snipe	10	F	MA				
Yellow-Rumped Warbler	3	F	FO				
Canvasback	1	F	OW				
Barn Swallow	10	F	MA				
Yellow Warbler	1	L	FO				
Northern Rough-Wing Swallow	5	F	OW,MA				
Common Yellowthroat	2	F	SS				
Common Tern	5	F	MA, OW				
Northern Pintail	1	F	OW				
Blue-Wing Teal	8	F, BD	MA, OW				
Long-Billed Dowitcher	4	F	MA				

Notes:
RS1 – 80% full & filling; RS2 – 100% full; ES1 – 95% full, overtopping road, ES2 – inundation extends
to east.
Numerous chorus frogs calling at all sites, deer tracks & scat, raccoon tracks, beaver activity at RS2
(slide over dike, dam in adjacent irrigation canal), minnows/tadpoles at RS2 – could not catch.
Dry, sunny, and windy conditions

Behavior: BP – one of a breeding pair; BD – breeding display; F – foraging; FO – flyover; L – loafing; N – nesting

Habitat: AB – aquatic bed; FO – forested; I – island; MA – marsh; MF – mud flat; OW – open water; SS – scrub/shrub; UP – upland buffer; WM – wet meadow, US – unconsolidated shoreline

BIRD SURVEY – FIELD DATA SHEET

Page__1_of__1_
Date: 7/30/03
Survey Time: 0730-1130

SITE: Musgrave Lake

Bird Species	#	Behavior	Habitat	Bird Species	#	Behavior	Habitat
American Robin	10	F	ALL				
Barn Swallow	20	F	OW				
Blue-Winged Teal	50+	Broods	MA				
Brewer's Blackbird	10	F	UP				
Cedar Waxwing	5	F	UP				
Common Snipe	10	N	MA				
Common Yellowthroat	2	F	SS				
Eastern Kingbird	10	F	UP				
Gadwall	30+	Broods	MA				
Great Blue Heron	2	F	MA				
Lesser Scaup	5	F	OW				
Marsh Wren	2	F	MA				
Mourning Dove	10	F	ALL				
Red-Winged Blackbird	5	N	MA				
Sora	2	F	MA				
Spotted Sandpiper	3	F	MA				
Tree Swallow	30	F	OW				
Western Sandpiper	2	F	MA				
Western Wood Pewee	2	F	FO				
Willet	5	F	MA				
Yellow-Headed Blackbird	5	N	MA				

Notes:
Beaver sign at RS-2, white-tailed deer observed @RS1 and ES1, numerous northern leopard frogs observed
at ES1, RS2.
Dry, sunny, and windy conditions

Behavior: BP – one of a breeding pair; BD – breeding display; F – foraging; FO – flyover; L – loafing; N – nesting

Habitat: AB – aquatic bed; FO – forested; I – island; MA – marsh; MF – mud flat; OW – open water; SS – scrub/shrub; UP – upland buffer; WM – wet meadow, US – unconsolidated shoreline

DATA FORM
ROUTINE WETLAND DETERMINATION
(1987 COE Wetlands Delineation Manual)

Project/Site: Musgrave Lake Mitigation Site	**Project No:** #4421	**Date:** 30-Jul-2003
Applicant/Owner: Montana Department of Transportation		**County:** Blaine
Investigators: Berglund		**State:** Montana
		Plot ID: 1

Do Normal Circumstances exist on the site?	(Yes) No	**Community ID:** Emergent
Is the site significantly disturbed (Atypical Situation:)?	Yes (No)	**Transect ID:** 1
Is the area a potential Problem Area? (If needed, explain on the reverse side)	Yes (No)	**Field Location:** RS-1, beginning of transect

VEGETATION (USFWS Region No. 9)

Dominant Plant Species(Latin/Common)	Stratum	Indicator	Plant Species(Latin/Common)	Stratum	Indicator
Alopecurus pratensis	Herb	FACW	*Phleum pratense*	Herb	FACU
Foxtail,Meadow			Timothy		
Apocynum androsaemifolium	Herb	NI	*Carex lanuginosa*	Herb	OBL
dogbane			Sedge,Wooly		

Percent of Dominant Species that are OBL, FACW or FAC: (excluding FAC-) 2/3 = 66.67%
FAC Neutral: 2/3 = 66.67%
Numeric Index: 7/3 = 2.33

Remarks:
ALO PRA vastly dominant.

HYDROLOGY

NO Recorded Data(Describe in Remarks):
- N/A Stream, Lake or Tide Gauge
- N/A Aerial Photographs
- N/A Other

YES No Recorded Data

Field Observations

Depth of Surface Water:	= 3 *(in.)*
Depth to Free Water in Pit:	N/A *(in.)*
Depth to Saturated Soil:	N/A *(in.)*

Wetland Hydrology Indicators

Primary Indicators
- YES Inundated
- YES Saturated in Upper 12 Inches
- NO Water Marks
- NO Drift Lines
- NO Sediment Deposits
- NO Drainage Patterns in Wetlands

Secondary Indicators
- NO Oxidized Root Channels in Upper 12 Inches
- NO Water-Stained Leaves
- NO Local Soil Survey Data
- YES FAC-Neutral Test
- NO Other(Explain in Remarks)

Remarks:
Much of site is inundated. Free water at top of pit.

DATA FORM
ROUTINE WETLAND DETERMINATION
(1987 COE Wetlands Delineation Manual)

Project/Site: Musgrave Lake Mitigation Site	**Project No:** #4421	**Date:** 30-Jul-2003
Applicant/Owner: Montana Department of Transportation		**County:** Blaine
Investigators: Berglund		**State:** Montana
		Plot ID: 1

SOILS

Map Unit Name (Series and Phase): Typic Fluvaquents, 0-2%
Map Symbol: 129 **Drainage Class:** PD **Mapped Hydric Inclusion?**
Taxonomy (Subgroup): Typic Fluvaquents **Field Observations Confirm Mapped Type?** (Yes) No
Profile Description

Depth (Inches)	Horizon	Matrix Color (Munsell Moist)	Mottle Color (Munsell Moist)	Mottle Abundance/Contrast	Texture, Concretions, Structure, etc
10	B	2.5Y4/2	2.5Y5/6	Common Distinct	Clay loam
10	B	2.5Y4/2	10YR5/8	Common Distinct	Silty clay

Hydric Soil Indicators:

- NO Histosol
- NO Histic Epipedon
- NO Sulfidic Odor
- NO Aquic Moisture Regime
- NO Reducing Conditions
- YES Gleyed or Low Chroma Colors
- NO Concretions
- NO High Organic Content in Surface Layer in Sandy Soils
- NO Organic Streaking in Sandy Soils
- NO Listed on Local Hydric Soils List
- NO Listed on National Hydric Soils List
- NO Other (Explain in Remarks)

Remarks:
Pit excavated at beginning of transect.

WETLAND DETERMINATION

Hydrophytic Vegetation Present?	(Yes) No	Is the Sampling Point within the Wetland? (Yes) No
Wetland Hydrology Present?	(Yes) No	
Hydric Soils Present?	(Yes) No	

Remarks:
Restoration Site 1; large developing marsh area. This plot taken at beginning of transect. Center of transect not accessible due to inundation.

DATA FORM
ROUTINE WETLAND DETERMINATION
(1987 COE Wetlands Delineation Manual)

Project/Site: Musgrave Lake Mitigation Site	Project No: #4421	**Date:** 30-Jul-2003
Applicant/Owner: Montana Department of Transportation		**County:** Blaine
Investigators: Berglund		**State:** Montana
		Plot ID: 2

Do Normal Circumstances exist on the site?	(Yes) No	**Community ID:** Emergent
Is the site significantly disturbed (Atypical Situation:)?	Yes (No)	**Transect ID:** 2
Is the area a potential Problem Area?	Yes (No)	**Field Location:**
(If needed, explain on the reverse side)		Center of Transect 2, ES1

VEGETATION (USFWS Region No. 9)

Dominant Plant Species(Latin/Common)	Stratum	Indicator	Plant Species(Latin/Common)	Stratum	Indicator
Scirpus acutus	Herb	OBL	*Typha latifolia*	Herb	OBL
Bulrush,Hard-Stem			Cattail,Broad-Leaf		
Polygonum amphibium	Herb	OBL			
Smartweed,Water					

Percent of Dominant Species that are OBL, FACW or FAC: (excluding FAC-) 3/3 = 100.00%

FAC Neutral: 3/3 = 100.00%

Numeric Index: 3/3 = 1.00

Remarks:

HYDROLOGY

YES Recorded Data(Describe in Remarks):
- NO Stream, Lake or Tide Gauge
- YES Aerial Photographs
- NO Other

NO No Recorded Data

Field Observations

Depth of Surface Water:	= 24 *(in.)*
Depth to Free Water in Pit:	N/A *(in.)*
Depth to Saturated Soil:	N/A *(in.)*

Wetland Hydrology Indicators
- Primary Indicators
  - YES Inundated
  - YES Saturated in Upper 12 Inches
  - NO Water Marks
  - NO Drift Lines
  - NO Sediment Deposits
  - YES Drainage Patterns in Wetlands
- Secondary Indicators
  - NO Oxidized Root Channels in Upper 12 Inches
  - NO Water-Stained Leaves
  - NO Local Soil Survey Data
  - YES FAC-Neutral Test
  - NO Other(Explain in Remarks)

Remarks:
Site inundated to about 2'-deep.

DATA FORM
ROUTINE WETLAND DETERMINATION
(1987 COE Wetlands Delineation Manual)

Project/Site: Musgrave Lake Mitigation Site	Project No: #4421	**Date:** 30-Jul-2003
Applicant/Owner: Montana Department of Transportation		**County:** Blaine
Investigators: Berglund		**State:** Montana
		Plot ID: 2

SOILS

Map Unit Name (Series and Phase): Typic Fluvaquents, 0-2%
Map Symbol: 129 **Drainage Class:** PD
Taxonomy (Subgroup): Typic Fluvaquents
Mapped Hydric Inclusion?
Field Observations Confirm Mapped Type? (Yes) No

Profile Description

Depth (inches)	Horizon	Matrix Color (Munsell Moist)	Mottle Color (Munsell Moist)	Mottle Abundance/Contrast	Texture, Concretions, Structure, etc
10	B	10YR3/1	10YR4/6	Common Distinct	Clay loam

Hydric Soil Indicators:
- NO Histosol
- NO Histic Epipedon
- NO Sulfidic Odor
- NO Aquic Moisture Regime
- NO Reducing Conditions
- YES Gleyed or Low Chroma Colors
- NO Concretions
- NO High Organic Content in Surface Layer in Sandy Soils
- NO Organic Streaking in Sandy Soils
- NO Listed on Local Hydric Soils List
- NO Listed on National Hydric Soils List
- NO Other (Explain in Remarks)

Remarks:

WETLAND DETERMINATION

Hydrophytic Vegetation Present?	(Yes) No	Is the Sampling Point within the Wetland? (Yes) No
Wetland Hydrology Present?	(Yes) No	
Hydric Soils Present?	(Yes) No	

Remarks:
Enhancement Site 1; plot in center of transect. Site inundated during survey.

LAND & WATER

DATA FORM
ROUTINE WETLAND DETERMINATION
(1987 COE Wetlands Delineation Manual)

Project/Site: Musgrave Lake Mitigation Site	Project No: #4421	**Date:** 30-Jul-2003
Applicant/Owner: Montana Department of Transportation		**County:** Blaine
Investigators: Berglund		**State:** Montana
		Plot ID: 3

Do Normal Circumstances exist on the site?	(Yes) No	**Community ID:** Emergent
Is the site significantly disturbed (Atypical Situation:)?	Yes (No)	**Transect ID:** 3
Is the area a potential Problem Area? (If needed, explain on the reverse side)	Yes (No)	**Field Location:** RS2 along transect

VEGETATION (USFWS Region No. 9)

Dominant Plant Species(Latin/Common)	Stratum	Indicator	Plant Species(Latin/Common)	Stratum	Indicator
Rumex crispus	Herb	FACW	*Polygonum amphibium*	Herb	OBL
Dock,Curly			Smartweed,Water		
Agropyron repens	Herb	FACU	*Typha latifolia*	Herb	OBL
Quackgrass			Cattail,Broad-Leaf		

Percent of Dominant Species that are OBL, FACW or FAC: (excluding FAC-) 3/4 = 75.00%

FAC Neutral: 3/4 = 75.00%
Numeric Index: 8/4 = 2.00

Remarks:
Shift to wetter species in 2003.

HYDROLOGY

NO Recorded Data(Describe in Remarks):
- N/A Stream, Lake or Tide Gauge
- N/A Aerial Photographs
- N/A Other

YES No Recorded Data

Field Observations

Depth of Surface Water:	= 6 *(in.)*
Depth to Free Water in Pit:	N/A *(in.)*
Depth to Saturated Soil:	N/A *(in.)*

Wetland Hydrology Indicators

Primary Indicators
- YES Inundated
- YES Saturated in Upper 12 Inches
- NO Water Marks
- NO Drift Lines
- NO Sediment Deposits
- YES Drainage Patterns in Wetlands

Secondary Indicators
- NO Oxidized Root Channels in Upper 12 Inches
- NO Water-Stained Leaves
- NO Local Soil Survey Data
- YES FAC-Neutral Test
- YES Other(Explain in Remarks)

Remarks:
Site inundated to 6". Much wetter than 2002.

DATA FORM
ROUTINE WETLAND DETERMINATION
(1987 COE Wetlands Delineation Manual)

Project/Site: Musgrave Lake Mitigation Site	Project No: #4421	**Date:** 30-Jul-2003
Applicant/Owner: Montana Department of Transportation		**County:** Blaine
Investigators: Berglund		**State:** Montana
		Plot ID: 3

SOILS

Map Unit Name (Series and Phase): Havre silty clay loam, saline
Map Symbol: 58 **Drainage Class:** WD
Taxonomy (Subgroup): Ustic Torrifluvents
Mapped Hydric Inclusion?
Field Observations Confirm Mapped Type? (Yes) No

Profile Description

Depth (Inches)	Horizon	Matrix Color (Munsell Moist)	Mottle Color (Munsell Moist)	Mottle Abundance/Contrast	Texture, Concretions, Structure, etc
10	B	10YR4/1	10YR4/6	Common Distinct	Silty clay loam

Hydric Soil Indicators:
- NO Histosol
- NO Histic Epipedon
- NO Sulfidic Odor
- NO Aquic Moisture Regime
- NO Reducing Conditions
- YES Gleyed or Low Chroma Colors
- NO Concretions
- NO High Organic Content in Surface Layer in Sandy Soils
- NO Organic Streaking in Sandy Soils
- NO Listed on Local Hydric Soils List
- NO Listed on National Hydric Soils List
- NO Other (Explain in Remarks)

Remarks:
Stronger indicators than observed in 2001 and 2002.

Hydrophytic Vegetation Present?	(Yes) No	Is the Sampling Point within the Wetland? (Yes) No
Wetland Hydrology Present?	(Yes) No	
Hydric Soils Present?	(Yes) No	

Remarks:
Restoration site 2, along transect. Site much wetter than observed in 2001 or 2002. Developing strong wetland characteristics.

MDT MONTANA WETLAND ASSESSMENT FORM (revised May 25, 1999)

1. Project Name: Musgrave Lake Mitigation Project **2. Project #:** 130091-019 **Control #:** NA

3. Evaluation Date: 7/30/2003 **4. Evaluator(s):** Berglund **5. Wetland / Site #(s):** ES-1

6. Wetland Location(s) i. T: 32 N **R:** 21 E **S:** 11, 12 **T:** __ N **R:** __ E **S:** _____

ii. Approx. Stationing / Mileposts: NA

iii. Watershed: 10050004 **GPS Reference No. (if applies):** NA

Other Location Information: Enhancement Site 1, center of easement, south of Zurich, south of Milk River, Blaine County.

7. A. Evaluating Agency MDT

B. Purpose of Evaluation:

- ☐ Wetlands potentially affected by MDT project
- ☐ Mitigation wetlands; pre-construction
- ☒ Mitigation wetlands; post-construction
- ☐ Other

8. Wetland Size (total acres): _____ (visually estimated)
4.98 (measured, e.g. GPS)

9. Assessment Area (total acres): _____ (visually estimated)
4.98 (measured, e.g. GPS)

Comments: Enhancement Site 1

10. CLASSIFICATION OF WETLAND AND AQUATIC HABITATS IN AA

HGM CLASS [1]	SYSTEM [2]	SUBSYSTEM [2]	CLASS [2]	WATER REGIME [2]	*MODIFIER* [2]	% OF AA
Riverine	Palustrine	None	Emergent Wetland	Seasonally Flooded	Impounded	85
Riverine	Palustrine	None	Scrub-Shrub Wetland	Seasonally Flooded	Impounded	10
Riverine	Palustrine	None	Aquatic Bed	Semipermanently Flooded	Impounded	5
---	---	---	---	---	---	

[1] = Smith et al. 1995. [2] = Cowardin et al. 1979.

Comments: _____

11. ESTIMATED RELATIVE ABUNDANCE (of similarly classified sites within the same Major Montana Watershed Basin)
Common **Comments:** _____

12. GENERAL CONDITION OF AA

i. Regarding Disturbance: (Use matrix below to select appropriate response.)

Conditions Within AA	Predominant Conditions Adjacent (within 500 Feet) To AA		
	Land managed in predominantly natural state; is not grazed, hayed, logged, or otherwise converted; does not contain roads or buildings.	Land not cultivated, but moderately grazed or hayed or selectively logged or has been subject to minor clearing; contains few roads or buildings.	Land cultivated or heavily grazed or logged; subject to substantial fill placement, grading, clearing, or hydrological alteration; high road or building density.
AA occurs and is managed in predominantly a natural state; is not grazed, hayed, logged, or otherwise converted; does not contain roads or occupied buildings.	---	---	moderate disturbance
AA not cultivated, but moderately grazed or hayed or selectively logged or has been subject to relatively minor clearing, or fill placement, or hydrological alteration; contains few roads or buildings.	---	---	---
AA cultivated or heavily grazed or logged; subject to relatively substantial fill placement, grading, clearing, or hydrological alteration; high road or building density.	---	---	---

Comments: (types of disturbance, intensity, season, etc.) Grazing and hayland occur adjacent to site.

ii. Prominent weedy, alien, & introduced species: CIR ARV, PHL PRA, KOC SCO

iii. Briefly describe AA and surrounding land use / habitat: Enhancement Site #1 in approximate center of site. Large, impounded marsh / oxbow area with partial SS component. Surrounding land use is agricultural.

13. STRUCTURAL DIVERSITY (Based on 'Class' column of #10 above.)

Number of 'Cowardin' Vegetated Classes Present in AA	≥3 Vegetated Classes or ≥ 2 if one class is forested	2 Vegetated Classes or 1 if forested	= 1 Vegetated Class
Select Rating	High	---	---

Comments: _____

LAND & WATER

14A. HABITAT FOR FEDERALLY LISTED OR PROPOSED THREATENED OR ENDANGERED PLANTS AND ANIMALS

i. AA is Documented (D) or Suspected (S) to contain (check box):

Primary or Critical habitat **(list species)**	☐ D ☐ S	_____
Secondary habitat **(list species)**	☐ D ☐ S	_____
Incidental habitat **(list species)**	☐ D ☒ S	Bald Eagle
No usable habitat	☐ D ☐ S	_____

ii. **Rating** (Based on the strongest habitat chosen in 14A(i) above, find the corresponding rating of High (H), Moderate (M), or Low (L) for this function.

Highest Habitat Level	doc/primary	sus/primary	doc/secondary	sus/secondary	doc/incidental	sus/incidental	none
Functional Point and Rating	---	---	---	---	---	.3 (L)	---

If documented, list the source (e.g., observations, records, etc.)**:** _____

14B. HABITAT FOR PLANTS AND ANIMALS RATED AS S1, S2, OR S3 BY THE MONTANA NATURAL HERITAGE PROGRAM.
Do not include species listed in 14A(i).

i. AA is Documented (D) or Suspected (S) to contain (check box):

Primary or Critical habitat **(list species)**	☒ D ☐ S	Northern Leopard Frog
Secondary habitat **(list species)**	☐ D ☐ S	_____
Incidental habitat **(list species)**	☐ D ☐ S	_____
No usable habitat	☐ D ☐ S	_____

iii. **Rating** (Based on the strongest habitat chosen in 14B(i) above, find the corresponding rating of High (H), Moderate (M), or Low (L) for this function.

Highest Habitat Level:	doc/primary	sus/primary	doc/secondary	sus/secondary	doc/incidental	sus/incidental	none
Functional Point and Rating	1 (H)	---	---	---	---	---	---

If documented, list the source (e.g., observations, records, etc.)**:** Numerous northern leopard frogs observed at ES2 in 2003 and habitat conditions continue to improve.

14C. General Wildlife Habitat Rating

i. **Evidence of overall wildlife use in the AA:** (Check either substantial, moderate, or low)

☒ **Substantial** (based on any of the following)
- ☒ observations of abundant wildlife #s or high species diversity (during any period)
- ☒ abundant wildlife sign such as scat, tracks, nest structures, game trails, etc.
- ☐ presence of extremely limiting habitat features not available in the surrounding area
- ☐ interviews with local biologists with knowledge of the AA

☐ **Low** (based on any of the following)
- ☐ few or no wildlife observations during peak use periods
- ☐ little to no wildlife sign
- ☐ sparse adjacent upland food sources
- ☐ interviews with local biologists with knowledge of AA

☐ **Moderate** (based on any of the following)
- ☐ observations of scattered wildlife groups or individuals or relatively few species during peak periods
- ☐ common occurrence of wildlife sign such as scat, tracks, nest structures, game trails, etc.
- ☐ adequate adjacent upland food sources
- ☐ interviews with local biologists with knowledge of the AA

ii. **Wildlife Habitat Features** (Working from top to bottom, select appropriate AA attributes to determine the exceptional (E), high (H), moderate (M), or low (L) rating. Structural diversity is from #13. For class cover to be considered evenly distributed, vegetated classes must be within 20% of each other in terms of their percent composition in the AA (see #10). Duration of Surface Water: P/P = permanent/perennial; S/I = seasonal/intermittent; T/E = temporary/ephemeral; A= absent.

Structural Diversity (from #13)	☒High								☐Moderate								☐Low			
Class Cover Distribution (all vegetated classes)	☐Even				☒Uneven				☐Even				☐Uneven				☐Even			
Duration of Surface Water in = 10% of AA	P/P	S/I	T/E	A	P/P	S/I	T/E	A	P/P	S/I	T/E	A	P/P	S/I	T/E	A	P/P	S/I	T/E	A
Low disturbance at AA (see #12)	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Moderate disturbance at AA (see #12)	--	--	--	--	--	H	--	--	--	--	--	--	--	--	--	--	--	--	--	--
High disturbance at AA (see #12)	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--

iii. **Rating** (Using 14C(i) and 14C(ii) above and the matrix below to arrive at the functional point and rating of exceptional (E), high (H), moderate (M), or low (L) for this function.)

Evidence of Wildlife Use from 14C(i)	**Wildlife Habitat Features Rating** from 14C(ii)			
	☐ Exceptional	☒ High	☐ Moderate	☐ Low
Substantial	--	.9 (H)	--	--
Moderate	--	--	--	--
Low	--	--	--	--

Comments: Numerous waterfowl, shorebirds, northern leopard frogs observed.

LAND & WATER

14D. GENERAL FISH/AQUATIC HABITAT RATING ☐ **NA** (proceed to 14E)

If the AA is not or was not historically used by fish due to lack of habitat, excessive gradient, then check the NA box above.

Assess if the AA is used by fish or the existing situation is "correctable" such that the AA could be used by fish [*e.g.* fish use is precluded by perched culvert or other barrier, etc.]. If fish use occurs in the AA but is not desired from a resource management perspective (*e.g.* fish use within an irrigation canal], then Habitat Quality [14D(i)] below should be marked as "Low", applied accordingly in 14D(ii) below, and noted in the comments.

i. **Habitat Quality** (Pick the appropriate AA attributes in matrix to pick the exceptional (E), high (H), moderate (M), or low (L) quality rating.

Duration of Surface Water in AA	☐ Permanent/Perennial			☒ Seasonal / Intermittent			☐ Temporary / Ephemeral		
Cover - % of waterbody in AA containing cover objects (*e.g.* submerged logs, large rocks & boulders, overhanging banks, floating-leaved vegetation)	>25%	10-25%	<10%	>25%	10-25%	<10%	>25%	10-25%	<10%
Shading - >75% of streambank or shoreline of AA contains riparian or wetland scrub-shrub or forested communities	--	--	--	--	--	M	--	--	--
Shading – 50 to 75% of streambank or shoreline of AA contains riparian or wetland scrub-shrub or forested communities.	--	--	--	--	--	--	--	--	--
Shading - < 50% of streambank or shoreline of AA contains riparian or wetland scrub-shrub or forested communities.	--	--	--	--	--	--	--	--	--

ii. **Modified Habitat Quality:** Is fish use of the AA precluded or significantly reduced by a culvert, dike, other man-made structure or activity **or** is the waterbody included on the 'MDEQ list of waterbodies in need of TMDL development' with 'Probable Impaired Uses' listed as cold or warm water fishery or aquatic life support**?**
☒ **Y** ☐ **N** If yes, reduce the rating from 14D(i) by one level and check the modified habitat quality rating: ☐ E ☐ H ☐ M ☒ L

iii. **Rating** (Use the conclusions from 14D(i) and 14D(ii) above and the matrix below to pick the functional point and rating of exceptional (E), high (H), moderate (M), or low (L).)

Types of Fish Known or Suspected Within AA	**Modified Habitat Quality** from 14D(ii)			
	☐ Exceptional	☐ High	☐ Moderate	☒ Low
Native game fish	--	--	--	--
Introduced game fish	--	--	--	--
Non-game fish	--	--	--	.3 (L)
No fish	--	--	--	--

Comments: Fish use is incidental at RS2 - minnows enter from Musgrave Lake and associated irrigation flow.

14E. FLOOD ATTENUATION ☐ **NA** (proceed to 14G)

Applies only to wetlands subject to flooding via in-channel or overbank flow.
If wetlands in AA do not flooded from in-channel or overbank flow, check NA above.

i. **Rating** (Working from top to bottom, mark the appropriate attributes to arrive at the functional point and rating of high (H), moderate (M), or low (L) for this function.)

Estimated wetland area in AA subject to periodic flooding	☐ ≥ 10 acres			☒ <10, >2 acres			☐ ≤2 acres		
% of flooded wetland classified as forested, scrub/shrub, or both	75%	25-75%	<25%	75%	25-75%	<25%	75%	25-75%	<25%
AA contains **no outlet or restricted outlet**	--	--	--	--	--	.5 (M)	--	--	--
AA contains **unrestricted outlet**	--	--	--	--	--	--	--	--	--

ii. **Are residences, businesses, or other features which may be significantly damaged by floods located within 0.5 miles downstream of the AA?** (check)
☐ **Y** ☒ **N** **Comments:** This function is somewhat "artificial", in that flooding ultimately occurs via an irrigation ditch. However, the ditch could be used to carry flood flows from the Milk River.

14F. SHORT AND LONG TERM SURFACE WATER STORAGE ☐ **NA** (proceed to 14G)

Applies to wetlands that flood or pond from overbank or in-channel flow, precipitation, upland surface flow, or groundwater flow.
If no wetlands in the AA are subject to flooding or ponding, check NA above.

i. Rating (Working from top to bottom, use the matrix below to arrive at the functional point and rating of high (H), moderate (M), or low (L) for this function.)
Abbreviations: P/P = permanent/perennial; S/I = seasonal/intermittent; T/E = temporary/ephemeral.

Estimated maximum acre feet of water contained in wetlands within the AA that are subject to periodic flooding or ponding.	☐ >5 acre feet			☒ <5, >1 acre feet			☐ ≤1 acre foot		
Duration of surface water at wetlands within the AA	P/P	S/I	T/E	P/P	S/I	T/E	P/P	S/I	T/E
Wetlands in AA flood or pond [3] **5 out of 10 years**	--	--	--	--	.6 (M)	--	--	--	--
Wetlands in AA flood or pond **< 5 out of 10 years**	--	--	--	--	--	--	--	--	--

Comments: _____

14G. SEDIMENT/NUTRIENT/TOXICANT RETENTION AND REMOVAL ☐ **NA** (proceed to 14H)

Applies to wetlands with potential to receive excess sediments, nutrients, or toxicants through influx of surface or ground water or direct input.
If no wetlands in the AA are subject to such input, check NA above.

i. **Rating** (Working from top to bottom, use the matrix below to arrive at the functional point and rating of high (H), moderate (M), or low (L) for this function.)

Sediment, Nutrient, and Toxicant Input Levels Within AA	AA receives or surrounding land use has potential to deliver low to moderate levels of sediments, nutrients, or compounds such that other functions are not substantially impaired. Minor sedimentation, sources of nutrients or toxicants, or signs of eutrophication present.				Waterbody on MDEQ list of waterbodies in need of TMDL development for "probable causes" related to sediment, nutrients, or toxicants **or** AA receives or surrounding land use has potential to deliver high levels of sediments, nutrients, or compounds such that other functions are substantially impaired. Major sedimentation, sources of nutrients or toxicants, or signs of eutrophication present.			
% cover of wetland vegetation in AA	☒ ≥ 70%		☐ < 70%		☐ ≥ 70%		☐ < 70%	
Evidence of flooding or ponding in AA	☒ Yes	☐ No	☐ Yes	☐ No	☐ Yes	☐ No	☐ Yes	☐ No
AA contains **no or restricted outlet**	1 (H)	--	--	--	--	--	--	--
AA contains **unrestricted outlet**	--	--	--	--	--	--	--	--

Comments: Treats adjacent agricultural runoff.

14H. SEDIMENT/SHORELINE STABILIZATION ☐ **NA** (proceed to 14I)

Applies only if AA occurs on or within the banks or a river, stream, or other natural or man-made drainage, or on the shoreline of a standing water body that is subject to wave action. If this does not apply, check NA above.

i. **Rating** (Working from top to bottom, use the matrix below to arrive at the functional point and rating exceptional (E), high (H), moderate (M), or low (L) for this function.

% Cover of wetland streambank or shoreline by species with deep, binding rootmasses.	***Duration of Surface Water Adjacent to Rooted Vegetation***		
	☐Permanent / Perennial	☒Seasonal / Intermittent	☐Temporary / Ephemeral
[3] **65 %**	--	--	--
35-64 %	--	.6 (M)	--
< 35 %	--	--	--

Comments: Few shrubs along actual water course.

14I. PRODUCTION EXPORT / FOOD CHAIN SUPPORT

i. **Rating** (Working from top to bottom, use the matrix below to arrive at the functional point and rating of high (H), moderate (M), or low (L) for this function. **A** = acreage of vegetated component in the AA. **B** = structural diversity rating from #13. **C** = Yes (Y) or No (N) as to whether or not the AA contains a surface or subsurface outlet; **P/P** = permanent/perennial; **S/I** = seasonal/intermittent; **T/E/A**= temporary/ephemeral/absent.

A	☐ Vegetated component >5 acres						☒ Vegetated component 1-5 acres						☐ Vegetated component <1 acre					
B	☐ High		☐ Moderate		☐ Low		☒ High		☐ Moderate		☐ Low		☐ High		☐ Moderate		☐ Low	
C	☐Y	☐N	☐Y	☐N	☐Y	☐N	☒Y	☐N	☐Y	☐N	☐Y	☐N	☐Y	☐N	☐Y	☐N	☐Y	☐N
P/P	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
S/I	--	--	--	--	--	--	.8H	--	--	--	--	--	--	--	--	--	--	--
T/E/A	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--

Comments: _____

14J. GROUNDWATER DISCHARGE/RECHARGE (D/R) (Check the indicators in i & ii below that apply to the AA)

i. ☐ **Discharge Indicators**

- ☐ Springs are known or observed.
- ☐ Vegetation growing during dormant season/drought.
- ☐ Wetland occurs at the toe of a natural slope.
- ☒ Seeps are present at the wetland edge.
- ☐ AA permanently flooded during drought periods.
- ☐ Wetland contains an outlet, but no inlet.
- ☐ Other _____

ii. ☐ **Recharge Indicators**

- ☐ Permeable substrate presents without underlying impeding layer.
- ☐ Wetland contains inlet but not outlet.
- ☐ Other _____

iii. **Rating:** Use the information from 14J(i) and 14j(ii) above and the table below to arrive at the functional point and rating of high (H) or low (L) for this function.

Criteria	Functional Point and Rating
AA has known Discharge/Recharge area or one or more indicators of D/R present	1 (H)
No Discharge/Recharge indicators present	--
Available Discharge/Recharge information inadequate to rate AA D/R potential	--

Comments: _____

14K. UNIQUENESS

i. Rating (Working from top to bottom, use the matrix below to arrive at the functional point and rating of high (H), moderate (M), or low (L) for this function.

Replacement Potential	AA contains fen, bog, warm springs or mature (>80 yr-old) forested wetland or plant association listed as "S1" by the MTNHP.			AA does not contain previously cited rare types and structural diversity (#13) is high or contains plant association listed as "S2" by the MTNHP.			AA does not contain previously cited rare types or associations and structural diversity (#13) is low-moderate.		
Estimated Relative Abundance from #11	☐rare	☐common	☐abundant	☐rare	☒common	☐abundant	☐rare	☐common	☐abundant
Low disturbance at AA (#12i)	--	--	--	--	--	--	--	--	--
Moderate disturbance at AA (#12i)	--	--	--	--	.5M	--	--	--	--
High disturbance at AA (#12i)	--	--	--	--	--	--	--	--	--

Comments: _____

14L. RECREATION / EDUCATION POTENTIAL

i. Is the AA a known recreational or educational site? ☐ **Yes (Rate** ☐ **High (1.0)**, then proceed to 14L(ii) only] ☒ **No** [Proceed to 14L(iii)]

ii. Check categories that apply to the AA: ☐ Educational / scientific study ☐ Consumptive rec. ☐ Non-consumptive rec. ☐ Other

iii. Based on the location, diversity, size, and other site attributes, is there a strong potential for recreational or educational use?

☐ **Yes** [Proceed to 14L (ii) and then 14L(iv).] ☒ **No** [Rate as low in 14L(iv)]

iv. Rating (Use the matrix below to arrive at the functional point and rating of high (H), moderate (M), or low (L) for this function.

Ownership	Disturbance at AA from #12(i)		
	☐ Low	☐ Moderate	☐ High
Public ownership	--	--	--
Private ownership	--	--	.1(L)

Comments: Private land with no access.

FUNCTION, VALUE SUMMARY, AND OVERALL RATING

Function and Value Variables	Rating	Actual Functional Points	Possible Functional Points	Functional Units (Actual Points x Estimated AA Acreage)
A. Listed/Proposed T&E Species Habitat	Low	0.30	1	
B. MT Natural Heritage Program Species Habitat	High	1.00	1	
C. General Wildlife Habitat	High	0.90	1	
D. General Fish/Aquatic Habitat	Low	0.30	1	
E. Flood Attenuation	Moderate	0.50	1	
F. Short and Long Term Surface Water Storage	Moderate	0.60	1	
G. Sediment/Nutrient/Toxicant Removal	High	1.00	1	
H. Sediment/Shoreline Stabilization	Moderate	0.60	1	
I. Production Export/Food Chain Support	High	0.80	1	
J. Groundwater Discharge/Recharge	High	1.00	1	
K. Uniqueness	Moderate	0.50	1	
L. Recreation/Education Potential	Low	0.10	1	
	Totals:	**7.60**	**12.00**	
	Percent of Total Possible Points:		**63%** (Actual / Possible) x 100 [rd to nearest whole #]	

Category I Wetland: (Must satisfy **one** of the following criteria. If not proceed to Category II.)
- ☐ Score of 1 functional point for Listed/Proposed Threatened or Endangered Species; **or**
- ☐ Score of 1 functional point for Uniqueness; **or**
- ☐ Score of 1 functional point for Flood Attenuation **and** answer to Question 14E(ii) is "yes"; **or**
- ☐ Percent of total Possible Points is > 80%.

Category II Wetland: (Criteria for Category I not satisfied **and** meets any **one** of the following Category II criteria. If not satisfied, proceed to Category IV.)
- ☒ Score of 1 functional point for Species Rated S1, S2, or S3 by the MT Natural Heritage Program; **or**
- ☒ Score of .9 or 1 functional point for General Wildlife Habitat; **or**
- ☐ Score of .9 or 1 functional point for General Fish/Aquatic Habitat; **or**
- ☐ "High" to "Exceptional" ratings for **both** General Wildlife Habitat **and** General Fish / Aquatic Habitat; **or**
- ☐ Score of .9 functional point for Uniqueness; **or**
- ☐ Percent of total possible points is > 65%.

☐ **Category III Wetland:** (Criteria for Categories I, II, or IV not satisfied.)

Category IV Wetland: (Criteria for Categories I or II are not satisfied **and** all of the following criteria are met; If not satisfied, proceed to Category III.)
- ☐ "Low" rating for Uniqueness; **and**
- ☐ "Low" rating for Production Export / Food Chain Support; **and**
- ☐ Percent of total possible points is < 30%.

OVERALL ANALYSIS AREA (AA) RATING: (Check appropriate category based on the criteria outlined above.)

☐ **I** ☒ **II** ☐ **III** ☐ **IV**

MDT MONTANA WETLAND ASSESSMENT FORM (revised May 25, 1999)

1. Project Name: Musgrave Lake Mitigation Project **2. Project #:** 130091-019 **Control #:** NA

3. Evaluation Date: 7/30/2003 **4. Evaluator(s):** Berglund **5. Wetland / Site #(s):** RS-1

6. Wetland Location(s) i. T: 32 N **R:** 21 E **S:** 11 **T:** __ N **R:** __ E **S:** _____

ii. Approx. Stationing / Mileposts: NA

iii. Watershed: 10050004 **GPS Reference No. (if applies):** NA

Other Location Information: Restoration Site 1, NW corner of easement, south of Zurich, south of Milk River, Blaine County.

7. A. Evaluating Agency MDT

B. Purpose of Evaluation:

- ☐ Wetlands potentially affected by MDT project
- ☐ Mitigation wetlands; pre-construction
- ☒ Mitigation wetlands; post-construction
- ☐ Other

8. Wetland Size (total acres): _____ (visually estimated)
14.07 (measured, e.g. GPS)

9. Assessment Area (total acres): _____ (visually estimated)
14.07 (measured, e.g. GPS)

Comments: Restoration Site 1

10. CLASSIFICATION OF WETLAND AND AQUATIC HABITATS IN AA

HGM CLASS [1]	SYSTEM [2]	SUBSYSTEM [2]	CLASS [2]	WATER REGIME [2]	*MODIFIER* [2]	% OF AA
Depression	Palustrine	None	Emergent Wetland	Seasonally Flooded	Impounded	10
Depression	Palustrine	None	Scrub-Shrub Wetland	Seasonally Flooded	Impounded	5
Depression	Palustrine	None	Forested Wetland	Seasonally Flooded	Impounded	5
Depression	Palustrine	None	Unconsolidated Bottom	Semipermanently Flooded	Impounded	80

[1] = Smith et al. 1995. [2] = Cowardin et al. 1979.

Comments: _____

11. ESTIMATED RELATIVE ABUNDANCE (of similarly classified sites within the same Major Montana Watershed Basin)
Common **Comments:** _____

12. GENERAL CONDITION OF AA

i. Regarding Disturbance: (Use matrix below to select appropriate response.)

Conditions Within AA	Predominant Conditions Adjacent (within 500 Feet) To AA		
	Land managed in predominantly natural state; is not grazed, hayed, logged, or otherwise converted; does not contain roads or buildings.	Land not cultivated, but moderately grazed or hayed or selectively logged or has been subject to minor clearing; contains few roads or buildings.	Land cultivated or heavily grazed or logged; subject to substantial fill placement, grading, clearing, or hydrological alteration; high road or building density.
AA occurs and is managed in predominantly a natural state; is not grazed, hayed, logged, or otherwise converted; does not contain roads or occupied buildings.	---	low disturbance	---
AA not cultivated, but moderately grazed or hayed or selectively logged or has been subject to relatively minor clearing, or fill placement, or hydrological alteration; contains few roads or buildings.	---	---	---
AA cultivated or heavily grazed or logged; subject to relatively substantial fill placement, grading, clearing, or hydrological alteration; high road or building density.	---	---	---

Comments: (types of disturbance, intensity, season, etc.) Grazing and hayland occur adjacent to site.

ii. Prominent weedy, alien, & introduced species: CIR ARV, PHA ARU, PHL PRA, KOC SCO

iii. Briefly describe AA and surrounding land use / habitat: Restoration Site #1 in NW corner of site. Large, impounded marsh / transitional open water area with partial SS and FO fringe. Surrounding land use is agricultural.

13. STRUCTURAL DIVERSITY (Based on 'Class' column of #10 above.)

Number of 'Cowardin' Vegetated Classes Present in AA	≥3 Vegetated Classes or ≥ 2 if one class is forested	2 Vegetated Classes or 1 if forested	= 1 Vegetated Class
Select Rating	High	---	---

Comments: _____

LAND & WATER

14A. HABITAT FOR FEDERALLY LISTED OR PROPOSED THREATENED OR ENDANGERED PLANTS AND ANIMALS

iv. AA is Documented (D) or Suspected (S) to contain (check box):

Primary or Critical habitat **(list species)**	☐ D ☐ S	_____
Secondary habitat **(list species)**	☐ D ☐ S	_____
Incidental habitat **(list species)**	☐ D ☒ S	Bald Eagle
No usable habitat	☐ D ☐ S	_____

v. **Rating** (Based on the strongest habitat chosen in 14A(i) above, find the corresponding rating of High (H), Moderate (M), or Low (L) for this function.

Highest Habitat Level	doc/primary	sus/primary	doc/secondary	sus/secondary	doc/incidental	sus/incidental	none
Functional Point and Rating	---	---	---	---	---	.3 (L)	---

If documented, list the source (e.g., observations, records, etc.)**:** _____

14B. HABITAT FOR PLANTS AND ANIMALS RATED AS S1, S2, OR S3 BY THE MONTANA NATURAL HERITAGE PROGRAM.
Do not include species listed in 14A(i).

ii. AA is Documented (D) or Suspected (S) to contain (check box):

Primary or Critical habitat **(list species)**	☒ D ☐ S	Northern Leopard Frog
Secondary habitat **(list species)**	☐ D ☐ S	_____
Incidental habitat **(list species)**	☐ D ☐ S	_____
No usable habitat	☐ D ☐ S	_____

vi. **Rating** (Based on the strongest habitat chosen in 14B(i) above, find the corresponding rating of High (H), Moderate (M), or Low (L) for this function.

Highest Habitat Level:	doc/primary	sus/primary	doc/secondary	sus/secondary	doc/incidental	sus/incidental	none
Functional Point and Rating	1 (H)	---	---	---	---	---	---

If documented, list the source (e.g., observations, records, etc.)**:** Northern leopard frogs observed at RS1 in 2001 and 2002; habitat conditions continue to improve. Not observed in 2003, but numerous chorus frogs observed - assumed that leopard frogs are still present and breeding.

14C. General Wildlife Habitat Rating

ii. **Evidence of overall wildlife use in the AA:** (Check either substantial, moderate, or low)

☒ **Substantial** (based on any of the following)
- ☒ observations of abundant wildlife #s or high species diversity (during any period)
- ☒ abundant wildlife sign such as scat, tracks, nest structures, game trails, etc.
- ☐ presence of extremely limiting habitat features not available in the surrounding area
- ☐ interviews with local biologists with knowledge of the AA

☐ **Low** (based on any of the following)
- ☐ few or no wildlife observations during peak use periods
- ☐ little to no wildlife sign
- ☐ sparse adjacent upland food sources
- ☐ interviews with local biologists with knowledge of AA

☐ **Moderate** (based on any of the following)
- ☐ observations of scattered wildlife groups or individuals or relatively few species during peak periods
- ☐ common occurrence of wildlife sign such as scat, tracks, nest structures, game trails, etc.
- ☐ adequate adjacent upland food sources
- ☐ interviews with local biologists with knowledge of the AA

ii. **Wildlife Habitat Features** (Working from top to bottom, select appropriate AA attributes to determine the exceptional (E), high (H), moderate (M), or low (L) rating. Structural diversity is from #13. For class cover to be considered evenly distributed, vegetated classes must be within 20% of each other in terms of their percent composition in the AA (see #10). Duration of Surface Water: P/P = permanent/perennial; S/I = seasonal/intermittent; T/E = temporary/ephemeral; A= absent.

Structural Diversity (from #13)	☒High								☐Moderate								☐Low			
Class Cover Distribution (all vegetated classes)	☒Even				☐Uneven				☐Even				☐Uneven				☐Even			
Duration of Surface Water in = 10% of AA	P/P	S/I	T/E	A	P/P	S/I	T/E	A	P/P	S/I	T/E	A	P/P	S/I	T/E	A	P/P	S/I	T/E	A
Low disturbance at AA (see #12)	--	E	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Moderate disturbance at AA (see #12)	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
High disturbance at AA (see #12)	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--

iii. **Rating** (Using 14C(i) and 14C(ii) above and the matrix below to arrive at the functional point and rating of exceptional (E), high (H), moderate (M), or low (L) for this function.)

Evidence of Wildlife Use from 14C(i)	**Wildlife Habitat Features Rating** from 14C(ii)			
	☒ Exceptional	☐ High	☐ Moderate	☐ Low
Substantial	1 (E)	--	--	--
Moderate	--	--	--	--
Low	--	--	--	--

Comments: Numerous waterfowl broods, shorebirds, western chorus frogs observed, as well as numerous additional bird species.

14D. GENERAL FISH/AQUATIC HABITAT RATING ☒ **NA** (proceed to 14E)

If the AA is not or was not historically used by fish due to lack of habitat, excessive gradient, then check the NA box above.

Assess if the AA is used by fish or the existing situation is "correctable" such that the AA could be used by fish [*e.g.* fish use is precluded by perched culvert or other barrier, etc.]. If fish use occurs in the AA but is not desired from a resource management perspective (*e.g.* fish use within an irrigation canal], then Habitat Quality [14D(i)] below should be marked as "Low", applied accordingly in 14D(ii) below, and noted in the comments.

i. **Habitat Quality** (Pick the appropriate AA attributes in matrix to pick the exceptional (E), high (H), moderate (M), or low (L) quality rating.

Duration of Surface Water in AA	☐ Permanent/Perennial			☐ Seasonal / Intermittent			☐ Temporary / Ephemeral		
Cover - % of waterbody in AA containing cover objects (*e.g.* submerged logs, large rocks & boulders, overhanging banks, floating-leaved vegetation)	>25%	10-25%	<10%	>25%	10-25%	<10%	>25%	10-25%	<10%
Shading - >75% of streambank or shoreline of AA contains riparian or wetland scrub-shrub or forested communities	--	--	--	--	--	--	--	--	--
Shading – 50 to 75% of streambank or shoreline of AA contains riparian or wetland scrub-shrub or forested communities.	--	--	--	--	--	--	--	--	--
Shading - < 50% of streambank or shoreline of AA contains riparian or wetland scrub-shrub or forested communities.	--	--	--	--	--	--	--	--	--

ii. **Modified Habitat Quality:** Is fish use of the AA precluded or significantly reduced by a culvert, dike, other man-made structure or activity **or** is the waterbody included on the 'MDEQ list of waterbodies in need of TMDL development' with 'Probable Impaired Uses' listed as cold or warm water fishery or aquatic life support**?**
☐ **Y** ☐ **N** If yes, reduce the rating from 14D(i) by one level and check the modified habitat quality rating: ☐ E ☐ H ☐ M ☐ L

iii. **Rating** (Use the conclusions from 14D(i) and 14D(ii) above and the matrix below to pick the functional point and rating of exceptional (E), high (H), moderate (M), or low (L).)

Types of Fish Known or Suspected Within AA	**Modified Habitat Quality** from 14D(ii)			
	☐ Exceptional	☐ High	☐ Moderate	☐ Low
Native game fish	--	--	--	--
Introduced game fish	--	--	--	--
Non-game fish	--	--	--	--
No fish	--	--	--	--

Comments: NA

14E. FLOOD ATTENUATION ☐ **NA** (proceed to 14G)

Applies only to wetlands subject to flooding via in-channel or overbank flow.
If wetlands in AA do not flooded from in-channel or overbank flow, check NA above.

i. **Rating** (Working from top to bottom, mark the appropriate attributes to arrive at the functional point and rating of high (H), moderate (M), or low (L) for this function.)

Estimated wetland area in AA subject to periodic flooding	☐ ≥ 10 acres			☒ <10, >2 acres			☐ ≤2 acres		
% of flooded wetland classified as forested, scrub/shrub, or both	75%	25-75%	<25%	75%	25-75%	<25%	75%	25-75%	<25%
AA contains **no outlet or restricted outlet**	--	--	--	--	--	.5 (M)	--	--	--
AA contains **unrestricted outlet**	--	--	--	--	--	--	--	--	--

ii. **Are residences, businesses, or other features which may be significantly damaged by floods located within 0.5 miles downstream of the AA?** (check)
☐**Y** ☒**N** **Comments:** This function is somewhat "artificial", in that flooding occurs via an irrigation ditch. However, the ditch could be used to carry flood flows from the Milk River.

14F. SHORT AND LONG TERM SURFACE WATER STORAGE ☐ **NA** (proceed to 14G)

Applies to wetlands that flood or pond from overbank or in-channel flow, precipitation, upland surface flow, or groundwater flow.
If no wetlands in the AA are subject to flooding or ponding, check NA above.

i. Rating (Working from top to bottom, use the matrix below to arrive at the functional point and rating of high (H), moderate (M), or low (L) for this function.)
Abbreviations: P/P = permanent/perennial; S/I = seasonal/intermittent; T/E = temporary/ephemeral.

Estimated maximum acre feet of water contained in wetlands within the AA that are subject to periodic flooding or ponding.	☒ >5 acre feet			☐ <5, >1 acre feet			☐ ≤1 acre foot		
Duration of surface water at wetlands within the AA	P/P	S/I	T/E	P/P	S/I	T/E	P/P	S/I	T/E
Wetlands in AA flood or pond [3] **5 out of 10 years**	--	.9 (H)	--	--	--	--	--	--	--
Wetlands in AA flood or pond **< 5 out of 10 years**	--	--	--	--	--	--	--	--	--

Comments: _____

14G. SEDIMENT/NUTRIENT/TOXICANT RETENTION AND REMOVAL ☒ **NA** (proceed to 14H)

Applies to wetlands with potential to receive excess sediments, nutrients, or toxicants through influx of surface or ground water or direct input.
If no wetlands in the AA are subject to such input, check NA above.

i. **Rating** (Working from top to bottom, use the matrix below to arrive at the functional point and rating of high (H), moderate (M), or low (L) for this function.)

Sediment, Nutrient, and Toxicant Input Levels Within AA	AA receives or surrounding land use has potential to deliver low to moderate levels of sediments, nutrients, or compounds such that other functions are not substantially impaired. Minor sedimentation, sources of nutrients or toxicants, or signs of eutrophication present.				Waterbody on MDEQ list of waterbodies in need of TMDL development for "probable causes" related to sediment, nutrients, or toxicants **or** AA receives or surrounding land use has potential to deliver high levels of sediments, nutrients, or compounds such that other functions are substantially impaired. Major sedimentation, sources of nutrients or toxicants, or signs of eutrophication present.			
% cover of wetland vegetation in AA	☐ ≥ 70%		☐ < 70%		☐ ≥ 70%		☐ < 70%	
Evidence of flooding or ponding in AA	☐ Yes	☐ No	☐ Yes	☐ No	☐ Yes	☐ No	☐ Yes	☐ No
AA contains **no or restricted outlet**	--	--	--	--	--	--	--	--
AA contains **unrestricted outlet**	--	--	--	--	--	--	--	--

Comments: _____

14H. SEDIMENT/SHORELINE STABILIZATION ☐ **NA** (proceed to 14I)

Applies only if AA occurs on or within the banks or a river, stream, or other natural or man-made drainage, or on the shoreline of a standing water body that is subject to wave action. If this does not apply, check NA above.

i. **Rating** (Working from top to bottom, use the matrix below to arrive at the functional point and rating exceptional (E), high (H), moderate (M), or low (L) for this function.

% Cover of wetland streambank or shoreline by species with deep, binding rootmasses.	***Duration of Surface Water Adjacent to Rooted Vegetation***		
	☐Permanent / Perennial	☒Seasonal / Intermittent	☐Temporary / Ephemeral
[3] **65 %**	--	--	--
35-64 %	--	--	--
< 35 %	--	.2 (L)	--

Comments: Wave action. Vegetation is developing along dikes.

14I. PRODUCTION EXPORT / FOOD CHAIN SUPPORT

i. **Rating** (Working from top to bottom, use the matrix below to arrive at the functional point and rating of high (H), moderate (M), or low (L) for this function. **A** = acreage of vegetated component in the AA. **B** = structural diversity rating from #13. **C** = Yes (Y) or No (N) as to whether or not the AA contains a surface or subsurface outlet; **P/P** = permanent/perennial; **S/I** = seasonal/intermittent; **T/E/A**= temporary/ephemeral/absent.

A	☒ Vegetated component >5 acres						☐ Vegetated component 1-5 acres						☐ Vegetated component <1 acre					
B	☒ High		☐ Moderate		☐ Low		☐ High		☐ Moderate		☐ Low		☐ High		☐ Moderate		☐ Low	
C	☒Y	☐N	☐Y	☐N	☐Y	☐N	☐Y	☐N	☐Y	☐N	☐Y	☐N	☐Y	☐N	☐Y	☐N	☐Y	☐N
P/P	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
S/I	.9H	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
T/E/A	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--

Comments: _____

14J. GROUNDWATER DISCHARGE/RECHARGE (D/R) (Check the indicators in i & ii below that apply to the AA)

i. ☐ **Discharge Indicators**

- ☐ Springs are known or observed.
- ☒ Vegetation growing during dormant season/drought.
- ☐ Wetland occurs at the toe of a natural slope.
- ☒ Seeps are present at the wetland edge.
- ☐ AA permanently flooded during drought periods.
- ☐ Wetland contains an outlet, but no inlet.
- ☐ Other _____

ii. ☐ **Recharge Indicators**

- ☐ Permeable substrate presents without underlying impeding layer.
- ☐ Wetland contains inlet but not outlet.
- ☐ Other _____

iii. **Rating:** Use the information from 14J(i) and 14j(ii) above and the table below to arrive at the functional point and rating of high (H) or low (L) for this function.

Criteria	Functional Point and Rating
AA has known Discharge/Recharge area or one or more indicators of D/R present	1 (H)
No Discharge/Recharge indicators present	--
Available Discharge/Recharge information inadequate to rate AA D/R potential	--

Comments: _____

14K. UNIQUENESS

i. Rating (Working from top to bottom, use the matrix below to arrive at the functional point and rating of high (H), moderate (M), or low (L) for this function.

Replacement Potential	AA contains fen, bog, warm springs or mature (>80 yr-old) forested wetland or plant association listed as "S1" by the MTNHP.			AA does not contain previously cited rare types and structural diversity (#13) is high or contains plant association listed as "S2" by the MTNHP.			AA does not contain previously cited rare types or associations and structural diversity (#13) is low-moderate.		
Estimated Relative Abundance from #11	☐rare	☐common	☐abundant	☐rare	☒common	☐abundant	☐rare	☐common	☐abundant
Low disturbance at AA (#12i)	--	--	--	--	.6M	--	--	--	--
Moderate disturbance at AA (#12i)	--	--	--	--	--	--	--	--	--
High disturbance at AA (#12i)	--	--	--	--	--	--	--	--	--

Comments: _____

14L. RECREATION / EDUCATION POTENTIAL

i. Is the AA a known recreational or educational site? ☐ **Yes (Rate** ☐ **High (1.0)**, then proceed to 14L(ii) only] ☒ **No** [Proceed to 14L(iii)]

ii. Check categories that apply to the AA: ☐ Educational / scientific study ☐ Consumptive rec. ☐ Non-consumptive rec. ☐ Other

iii. Based on the location, diversity, size, and other site attributes, is there a strong potential for recreational or educational use?

☐ **Yes** [Proceed to 14L (ii) and then 14L(iv).] ☒ **No** [Rate as low in 14L(iv)]

iv. Rating (Use the matrix below to arrive at the functional point and rating of high (H), moderate (M), or low (L) for this function.

Ownership	Disturbance at AA from #12(i)		
	☐ Low	☐ Moderate	☐ High
Public ownership	--	--	--
Private ownership	--	--	.1(L)

Comments: Private land with no access.

FUNCTION, VALUE SUMMARY, AND OVERALL RATING

Function and Value Variables	Rating	Actual Functional Points	Possible Functional Points	Functional Units (Actual Points x Estimated AA Acreage)
A. Listed/Proposed T&E Species Habitat	Low	0.30	1	
B. MT Natural Heritage Program Species Habitat	High	1.00	1	
C. General Wildlife Habitat	Except.	1.00	1	
D. General Fish/Aquatic Habitat	NA	0.00	--	
E. Flood Attenuation	Moderate	0.50	1	
F. Short and Long Term Surface Water Storage	High	0.90	1	
G. Sediment/Nutrient/Toxicant Removal	NA	0.00	--	
H. Sediment/Shoreline Stabilization	Low	0.20	1	
I. Production Export/Food Chain Support	High	0.90	1	
J. Groundwater Discharge/Recharge	High	1.00	1	
K. Uniqueness	Moderate	0.60	1	
L. Recreation/Education Potential	Low	0.10	1	
	Totals:	**6.50**	**10.00**	
	Percent of Total Possible Points:		**65%** (Actual / Possible) x 100 [rd to nearest whole #]	

Category I Wetland: (Must satisfy **one** of the following criteria. If not proceed to Category II.)
- ☐ Score of 1 functional point for Listed/Proposed Threatened or Endangered Species; **or**
- ☐ Score of 1 functional point for Uniqueness; **or**
- ☐ Score of 1 functional point for Flood Attenuation **and** answer to Question 14E(ii) is "yes"; **or**
- ☐ Percent of total Possible Points is > 80%.

Category II Wetland: (Criteria for Category I not satisfied **and** meets any **one** of the following Category II criteria. If not satisfied, proceed to Category IV.)
- ☒ Score of 1 functional point for Species Rated S1, S2, or S3 by the MT Natural Heritage Program; **or**
- ☒ Score of .9 or 1 functional point for General Wildlife Habitat; **or**
- ☐ Score of .9 or 1 functional point for General Fish/Aquatic Habitat; **or**
- ☐ "High" to "Exceptional" ratings for **both** General Wildlife Habitat **and** General Fish / Aquatic Habitat; **or**
- ☐ Score of .9 functional point for Uniqueness; **or**
- ☒ Percent of total possible points is > 65%.

☐ **Category III Wetland:** (Criteria for Categories I, II, or IV not satisfied.)

Category IV Wetland: (Criteria for Categories I or II are not satisfied **and** all of the following criteria are met; If not satisfied, proceed to Category III.)
- ☐ "Low" rating for Uniqueness; **and**
- ☐ "Low" rating for Production Export / Food Chain Support; **and**
- ☐ Percent of total possible points is < 30%.

OVERALL ANALYSIS AREA (AA) RATING: (Check appropriate category based on the criteria outlined above.)

☐ **I** ☒ **II** ☐ **III** ☐ **IV**

MDT MONTANA WETLAND ASSESSMENT FORM (revised May 25, 1999)

1. Project Name: Musgrave Lake Mitigation Project **2. Project #:** 130091-019 **Control #:** NA

3. Evaluation Date: 7/30/2003 **4. Evaluator(s):** Berglund **5. Wetland / Site #(s):** RS-2

6. Wetland Location(s) i. T: 32 N **R:** 21 E **S:** 11, 12 **T:** __ N **R:** __ E **S:** _____

ii. Approx. Stationing / Mileposts: NA

iii. Watershed: 10050004 **GPS Reference No. (if applies):** NA

Other Location Information: Restoration Site 2, SE corner of easement, south of Zurich, south of Milk River, Blaine County.

7. A. Evaluating Agency MDT

B. Purpose of Evaluation:

- ☐ Wetlands potentially affected by MDT project
- ☐ Mitigation wetlands; pre-construction
- ☒ Mitigation wetlands; post-construction
- ☐ Other

8. Wetland Size (total acres): _____ (visually estimated)
6.39 (measured, e.g. GPS)

9. Assessment Area (total acres): _____ (visually estimated)
6.39 (measured, e.g. GPS)

Comments: Restoration Site 2

10. CLASSIFICATION OF WETLAND AND AQUATIC HABITATS IN AA

HGM CLASS [1]	SYSTEM [2]	SUBSYSTEM [2]	CLASS [2]	WATER REGIME [2]	*MODIFIER* [2]	% OF AA
Depression	Palustrine	None	Emergent Wetland	Seasonally Flooded	Impounded	90
Depression	Palustrine	None	Scrub-Shrub Wetland	Seasonally Flooded	Impounded	10
---	---	---	---	---	---	
---	---	---	---	---	---	

[1] = Smith et al. 1995. [2] = Cowardin et al. 1979.

Comments: _____

11. ESTIMATED RELATIVE ABUNDANCE (of similarly classified sites within the same Major Montana Watershed Basin)
Common **Comments:** _____

12. GENERAL CONDITION OF AA

i. Regarding Disturbance: (Use matrix below to select appropriate response.)

	Predominant Conditions Adjacent (within 500 Feet) To AA		
Conditions Within AA	Land managed in predominantly natural state; is not grazed, hayed, logged, or otherwise converted; does not contain roads or buildings.	Land not cultivated, but moderately grazed or hayed or selectively logged or has been subject to minor clearing; contains few roads or buildings.	Land cultivated or heavily grazed or logged; subject to substantial fill placement, grading, clearing, or hydrological alteration; high road or building density.
AA occurs and is managed in predominantly a natural state; is not grazed, hayed, logged, or otherwise converted; does not contain roads or occupied buildings.	---	---	moderate disturbance
AA not cultivated, but moderately grazed or hayed or selectively logged or has been subject to relatively minor clearing, or fill placement, or hydrological alteration; contains few roads or buildings.	---	---	---
AA cultivated or heavily grazed or logged; subject to relatively substantial fill placement, grading, clearing, or hydrological alteration; high road or building density.	---	---	---

Comments: (types of disturbance, intensity, season, etc.) Grazing and hayland occur adjacent to site.

ii. Prominent weedy, alien, & introduced species: CIR ARV, PHL PRA, KOC SCO

iii. Briefly describe AA and surrounding land use / habitat: Restoration Site #2 in SE corner of site. Large, impounded marsh / oxbow area with partial SS component. Surrounding land use is agricultural.

13. STRUCTURAL DIVERSITY (Based on 'Class' column of #10 above.)

Number of 'Cowardin' Vegetated Classes Present in AA	≥3 Vegetated Classes or ≥ 2 if one class is forested	2 Vegetated Classes or 1 if forested	= 1 Vegetated Class
Select Rating	---	Moderate	---

Comments: _____

LAND & WATER

14A. HABITAT FOR FEDERALLY LISTED OR PROPOSED THREATENED OR ENDANGERED PLANTS AND ANIMALS

vii. AA is Documented (D) or Suspected (S) to contain (check box):

Primary or Critical habitat **(list species)**	☐ D	☐ S	_____
Secondary habitat **(list species)**	☐ D	☐ S	_____
Incidental habitat **(list species)**	☐ D	☒ S	Bald Eagle
No usable habitat	☐ D	☐ S	_____

viii. **Rating** (Based on the strongest habitat chosen in 14A(i) above, find the corresponding rating of High (H), Moderate (M), or Low (L) for this function.

Highest Habitat Level	doc/primary	sus/primary	doc/secondary	sus/secondary	doc/incidental	sus/incidental	none
Functional Point and Rating	---	---	---	---	---	.3 (L)	---

If documented, list the source (e.g., observations, records, etc.)**:** _____

14B. HABITAT FOR PLANTS AND ANIMALS RATED AS S1, S2, OR S3 BY THE MONTANA NATURAL HERITAGE PROGRAM.
Do not include species listed in 14A(i).

iii. AA is Documented (D) or Suspected (S) to contain (check box):

Primary or Critical habitat **(list species)**	☒ D	☐ S	Northern Leopard Frog
Secondary habitat **(list species)**	☐ D	☐ S	_____
Incidental habitat **(list species)**	☐ D	☐ S	_____
No usable habitat	☐ D	☐ S	_____

ix. **Rating** (Based on the strongest habitat chosen in 14B(i) above, find the corresponding rating of High (H), Moderate (M), or Low (L) for this function.

Highest Habitat Level:	doc/primary	sus/primary	doc/secondary	sus/secondary	doc/incidental	sus/incidental	none
Functional Point and Rating	1 (H)	---	---	---	---	---	---

If documented, list the source (e.g., observations, records, etc.)**:** Northern leopard frogs observed at RS2 in 2001, 2002, 2003 and habitat conditions continue to improve. Numerous leopard frogs observed in 2003.

14C. General Wildlife Habitat Rating

iii. **Evidence of overall wildlife use in the AA:** (Check either substantial, moderate, or low)

☒ **Substantial** (based on any of the following)
- ☒ observations of abundant wildlife #s or high species diversity (during any period)
- ☒ abundant wildlife sign such as scat, tracks, nest structures, game trails, etc.
- ☐ presence of extremely limiting habitat features not available in the surrounding area
- ☐ interviews with local biologists with knowledge of the AA

☐ **Low** (based on any of the following)
- ☐ few or no wildlife observations during peak use periods
- ☐ little to no wildlife sign
- ☐ sparse adjacent upland food sources
- ☐ interviews with local biologists with knowledge of AA

☐ **Moderate** (based on any of the following)
- ☐ observations of scattered wildlife groups or individuals or relatively few species during peak periods
- ☐ common occurrence of wildlife sign such as scat, tracks, nest structures, game trails, etc.
- ☐ adequate adjacent upland food sources
- ☐ interviews with local biologists with knowledge of the AA

ii. **Wildlife Habitat Features** (Working from top to bottom, select appropriate AA attributes to determine the exceptional (E), high (H), moderate (M), or low (L) rating. Structural diversity is from #13. For class cover to be considered evenly distributed, vegetated classes must be within 20% of each other in terms of their percent composition in the AA (see #10). Duration of Surface Water: P/P = permanent/perennial; S/I = seasonal/intermittent; T/E = temporary/ephemeral; A= absent.

Structural Diversity (from #13)	☐High								☒Moderate								☐Low			
Class Cover Distribution (all vegetated classes)	☐Even				☐Uneven				☐Even				☒Uneven				☐Even			
Duration of Surface Water in = 10% of AA	P/P	S/I	T/E	A	P/P	S/I	T/E	A	P/P	S/I	T/E	A	P/P	S/I	T/E	A	P/P	S/I	T/E	A
Low disturbance at AA (see #12)	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Moderate disturbance at AA (see #12)	--	--	--	--	--	--	--	--	--	--	--	--	--	M	--	--	--	--	--	--
High disturbance at AA (see #12)	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--

iii. **Rating** (Using 14C(i) and 14C(ii) above and the matrix below to arrive at the functional point and rating of exceptional (E), high (H), moderate (M), or low (L) for this function.)

Evidence of Wildlife Use from 14C(i)	**Wildlife Habitat Features Rating** from 14C(ii)			
	☐ Exceptional	☐ High	☒ Moderate	☐ Low
Substantial	--	--	.8 (H)	--
Moderate	--	--	--	--
Low	--	--	--	--

Comments: Numerous waterfowl, shorebirds, western chorus frogs, northern leopard frogs observed.

LAND & WATER

14D. GENERAL FISH/AQUATIC HABITAT RATING ☐ **NA** (proceed to 14E)

If the AA is not or was not historically used by fish due to lack of habitat, excessive gradient, then check the NA box above.
Assess if the AA is used by fish or the existing situation is "correctable" such that the AA could be used by fish [*e.g.* fish use is precluded by perched culvert or other barrier, etc.]. If fish use occurs in the AA but is not desired from a resource management perspective (*e.g.* fish use within an irrigation canal], then Habitat Quality [14D(i)] below should be marked as "Low", applied accordingly in 14D(ii) below, and noted in the comments.

i. **Habitat Quality** (Pick the appropriate AA attributes in matrix to pick the exceptional (E), high (H), moderate (M), or low (L) quality rating.

Duration of Surface Water in AA	☐ Permanent/Perennial			☒ Seasonal / Intermittent			☐ Temporary / Ephemeral		
Cover - % of waterbody in AA containing cover objects (*e.g.* submerged logs, large rocks & boulders, overhanging banks, floating-leaved vegetation)	>25%	10-25%	<10%	>25%	10-25%	<10%	>25%	10-25%	<10%
Shading - >75% of streambank or shoreline of AA contains riparian or wetland scrub-shrub or forested communities	--	--	--	--	--	M	--	--	--
Shading – 50 to 75% of streambank or shoreline of AA contains riparian or wetland scrub-shrub or forested communities.	--	--	--	--	--	--	--	--	--
Shading - < 50% of streambank or shoreline of AA contains riparian or wetland scrub-shrub or forested communities.	--	--	--	--	--	--	--	--	--

ii. **Modified Habitat Quality:** Is fish use of the AA precluded or significantly reduced by a culvert, dike, other man-made structure or activity **or** is the waterbody included on the 'MDEQ list of waterbodies in need of TMDL development' with 'Probable Impaired Uses' listed as cold or warm water fishery or aquatic life support**?**
☒ **Y** ☐ **N** If yes, reduce the rating from 14D(i) by one level and check the modified habitat quality rating: ☐ E ☐ H ☐ M ☒ L

iii. **Rating** (Use the conclusions from 14D(i) and 14D(ii) above and the matrix below to pick the functional point and rating of exceptional (E), high (H), moderate (M), or low (L).)

Types of Fish Known or Suspected Within AA	**Modified Habitat Quality** from 14D(ii)			
	☐ Exceptional	☐ High	☐ Moderate	☒ Low
Native game fish	--	--	--	--
Introduced game fish	--	--	--	--
Non-game fish	--	--	--	.3 (L)
No fish	--	--	--	--

Comments: Fish use is incidental at RS2 - minnows enter via culvert from Musgrave Lake and associated irrigation flow.

14E. FLOOD ATTENUATION ☐ **NA** (proceed to 14G)

Applies only to wetlands subject to flooding via in-channel or overbank flow.
If wetlands in AA do not flooded from in-channel or overbank flow, check NA above.

i. **Rating** (Working from top to bottom, mark the appropriate attributes to arrive at the functional point and rating of high (H), moderate (M), or low (L) for this function.)

Estimated wetland area in AA subject to periodic flooding	☐ ≥ 10 acres			☒ <10, >2 acres			☐ ≤2 acres		
% of flooded wetland classified as forested, scrub/shrub, or both	75%	25-75%	<25%	75%	25-75%	<25%	75%	25-75%	<25%
AA contains **no outlet or restricted outlet**	--	--	--	--	--	.5 (M)	--	--	--
AA contains **unrestricted outlet**	--	--	--	--	--	--	--	--	--

ii. **Are residences, businesses, or other features which may be significantly damaged by floods located within 0.5 miles downstream of the AA?** (check)
☐**Y** ☒**N** **Comments:** This function is somewhat "artificial", in that flooding ultimately occurs via an irrigation ditch. However, the ditch could be used to carry flood flows from the Milk River.

14F. SHORT AND LONG TERM SURFACE WATER STORAGE ☐ **NA** (proceed to 14G)

Applies to wetlands that flood or pond from overbank or in-channel flow, precipitation, upland surface flow, or groundwater flow.
If no wetlands in the AA are subject to flooding or ponding, check NA above.

i. Rating (Working from top to bottom, use the matrix below to arrive at the functional point and rating of high (H), moderate (M), or low (L) for this function.)
Abbreviations: P/P = permanent/perennial; S/I = seasonal/intermittent; T/E = temporary/ephemeral.

Estimated maximum acre feet of water contained in wetlands within the AA that are subject to periodic flooding or ponding.	☐ >5 acre feet			☒ <5, >1 acre feet			☐ ≤1 acre foot		
Duration of surface water at wetlands within the AA	P/P	S/I	T/E	P/P	S/I	T/E	P/P	S/I	T/E
Wetlands in AA flood or pond [3] **5 out of 10 years**	--	--	--	--	.6 (M)	--	--	--	--
Wetlands in AA flood or pond **< 5 out of 10 years**	--	--	--	--	--	--	--	--	--

Comments: _____

14G. SEDIMENT/NUTRIENT/TOXICANT RETENTION AND REMOVAL ☐ **NA** (proceed to 14H)

Applies to wetlands with potential to receive excess sediments, nutrients, or toxicants through influx of surface or ground water or direct input.
If no wetlands in the AA are subject to such input, check NA above.

i. **Rating** (Working from top to bottom, use the matrix below to arrive at the functional point and rating of high (H), moderate (M), or low (L) for this function.)

Sediment, Nutrient, and Toxicant Input Levels Within AA	AA receives or surrounding land use has potential to deliver low to moderate levels of sediments, nutrients, or compounds such that other functions are not substantially impaired. Minor sedimentation, sources of nutrients or toxicants, or signs of eutrophication present.				Waterbody on MDEQ list of waterbodies in need of TMDL development for "probable causes" related to sediment, nutrients, or toxicants **or** AA receives or surrounding land use has potential to deliver high levels of sediments, nutrients, or compounds such that other functions are substantially impaired. Major sedimentation, sources of nutrients or toxicants, or signs of eutrophication present.			
% cover of wetland vegetation in AA	☒ ≥ 70%		☐ < 70%		☐ ≥ 70%		☐ < 70%	
Evidence of flooding or ponding in AA	☒ Yes	☐ No	☐ Yes	☐ No	☐ Yes	☐ No	☐ Yes	☐ No
AA contains **no or restricted outlet**	1 (H)	--	--	--	--	--	--	--
AA contains **unrestricted outlet**	--	--	--	--	--	--	--	--

Comments: Treats adjacent agricultural runoff.

14H. SEDIMENT/SHORELINE STABILIZATION ☒ **NA** (proceed to 14I)

Applies only if AA occurs on or within the banks or a river, stream, or other natural or man-made drainage, or on the shoreline of a standing water body that is subject to wave action. If this does not apply, check NA above.

i. **Rating** (Working from top to bottom, use the matrix below to arrive at the functional point and rating exceptional (E), high (H), moderate (M), or low (L) for this function.

% Cover of wetland streambank or shoreline by species with deep, binding rootmasses.	***Duration of Surface Water Adjacent to Rooted Vegetation***		
	☐ Permanent / Perennial	☐ Seasonal / Intermittent	☐ Temporary / Ephemeral
[3] **65 %**	--	--	--
35-64 %	--	--	--
< 35 %	--	--	--

Comments: Nominal flow component - no wave action.

14I. PRODUCTION EXPORT / FOOD CHAIN SUPPORT

i. **Rating** (Working from top to bottom, use the matrix below to arrive at the functional point and rating of high (H), moderate (M), or low (L) for this function.
A = acreage of vegetated component in the AA. **B** = structural diversity rating from #13. **C** = Yes (Y) or No (N) as to whether or not the AA contains a surface or subsurface outlet; **P/P** = permanent/perennial; **S/I** = seasonal/intermittent; **T/E/A**= temporary/ephemeral/absent.

A	☒ Vegetated component >5 acres						☐ Vegetated component 1-5 acres						☐ Vegetated component <1 acre					
B	☐ High		☒ Moderate		☐ Low		☐ High		☐ Moderate		☐ Low		☐ High		☐ Moderate		☐ Low	
C	☐Y	☐N	☒Y	☐N	☐Y	☐N	☐Y	☐N	☐Y	☐N	☐Y	☐N	☐Y	☐N	☐Y	☐N	☐Y	☐N
P/P	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
S/I	--	--	.8H	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
T/E/A	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--

Comments: _____

14J. GROUNDWATER DISCHARGE/RECHARGE (D/R) (Check the indicators in i & ii below that apply to the AA)

i. ☐ **Discharge Indicators**
- ☒ Springs are known or observed.
- ☐ Vegetation growing during dormant season/drought.
- ☐ Wetland occurs at the toe of a natural slope.
- ☒ Seeps are present at the wetland edge.
- ☐ AA permanently flooded during drought periods.
- ☐ Wetland contains an outlet, but no inlet.
- ☐ Other _____

ii. ☐ **Recharge Indicators**
- ☐ Permeable substrate presents without underlying impeding layer.
- ☐ Wetland contains inlet but not outlet.
- ☐ Other _____

iii. **Rating:** Use the information from 14J(i) and 14j(ii) above and the table below to arrive at the functional point and rating of high (H) or low (L) for this function.

Criteria	Functional Point and Rating
AA has known Discharge/Recharge area or one or more indicators of D/R present	1 (H)
No Discharge/Recharge indicators present	--
Available Discharge/Recharge information inadequate to rate AA D/R potential	--

Comments: _____

14K. UNIQUENESS

i. Rating (Working from top to bottom, use the matrix below to arrive at the functional point and rating of high (H), moderate (M), or low (L) for this function.

Replacement Potential	AA contains fen, bog, warm springs or mature (>80 yr-old) forested wetland or plant association listed as "S1" by the MTNHP.			AA does not contain previously cited rare types and structural diversity (#13) is high or contains plant association listed as "S2" by the MTNHP.			AA does not contain previously cited rare types or associations and structural diversity (#13) is low-moderate.		
Estimated Relative Abundance from #11	☐rare	☐common	☐abundant	☐rare	☐common	☐abundant	☐rare	☒common	☐abundant
Low disturbance at AA (#12i)	--	--	--	--	--	--	--	--	--
Moderate disturbance at AA (#12i)	--	--	--	--	--	--	--	.3L	--
High disturbance at AA (#12i)	--	--	--	--	--	--	--	--	--

Comments: _____

14L. RECREATION / EDUCATION POTENTIAL

i. Is the AA a known recreational or educational site? ☐ **Yes (Rate ☐ High (1.0)**, then proceed to 14L(ii) only] ☒ **No** [Proceed to 14L(iii)]

ii. Check categories that apply to the AA: ☐ Educational / scientific study ☐ Consumptive rec. ☐ Non-consumptive rec. ☐ Other

iii. Based on the location, diversity, size, and other site attributes, is there a strong potential for recreational or educational use?

☐ **Yes** [Proceed to 14L (ii) and then 14L(iv).] ☒ **No** [Rate as low in 14L(iv)]

iv. Rating (Use the matrix below to arrive at the functional point and rating of high (H), moderate (M), or low (L) for this function.

Ownership	Disturbance at AA from #12(i)		
	☐ Low	☐ Moderate	☐ High
Public ownership	--	--	--
Private ownership	--	--	.1(L)

Comments: Private land with no access.

FUNCTION, VALUE SUMMARY, AND OVERALL RATING

Function and Value Variables	Rating	Actual Functional Points	Possible Functional Points	Functional Units (Actual Points x Estimated AA Acreage)
A. Listed/Proposed T&E Species Habitat	Low	0.30	1	
B. MT Natural Heritage Program Species Habitat	High	1.00	1	
C. General Wildlife Habitat	High	0.80	1	
D. General Fish/Aquatic Habitat	Low	0.30	1	
E. Flood Attenuation	Moderate	0.50	1	
F. Short and Long Term Surface Water Storage	Moderate	0.60	1	
G. Sediment/Nutrient/Toxicant Removal	High	1.00	1	
H. Sediment/Shoreline Stabilization	NA	0.00	--	
I. Production Export/Food Chain Support	High	0.80	1	
J. Groundwater Discharge/Recharge	High	1.00	1	
K. Uniqueness	Low	0.30	1	
L. Recreation/Education Potential	Low	0.10	1	
	Totals:	**6.70**	**11.00**	
	Percent of Total Possible Points:		**61%** (Actual / Possible) x 100 [rd to nearest whole #]	

Category I Wetland: (Must satisfy **one** of the following criteria. If not proceed to Category II.)
- ☐ Score of 1 functional point for Listed/Proposed Threatened or Endangered Species; **or**
- ☐ Score of 1 functional point for Uniqueness; **or**
- ☐ Score of 1 functional point for Flood Attenuation **and** answer to Question 14E(ii) is "yes"; **or**
- ☐ Percent of total Possible Points is > 80%.

Category II Wetland: (Criteria for Category I not satisfied **and** meets any **one** of the following Category II criteria. If not satisfied, proceed to Category IV.)
- ☒ Score of 1 functional point for Species Rated S1, S2, or S3 by the MT Natural Heritage Program; **or**
- ☐ Score of .9 or 1 functional point for General Wildlife Habitat; **or**
- ☐ Score of .9 or 1 functional point for General Fish/Aquatic Habitat; **or**
- ☐ "High" to "Exceptional" ratings for **both** General Wildlife Habitat **and** General Fish / Aquatic Habitat; **or**
- ☐ Score of .9 functional point for Uniqueness; **or**
- ☐ Percent of total possible points is > 65%.

☐ **Category III Wetland:** (Criteria for Categories I, II, or IV not satisfied.)

Category IV Wetland: (Criteria for Categories I or II are not satisfied **and** all of the following criteria are met; If not satisfied, proceed to Category III.)
- ☐ "Low" rating for Uniqueness; **and**
- ☐ "Low" rating for Production Export / Food Chain Support; **and**
- ☐ Percent of total possible points is < 30%.

OVERALL ANALYSIS AREA (AA) RATING: (Check appropriate category based on the criteria outlined above.)

☐ **I** ☒ **II** ☐ **III** ☐ **IV**

Appendix C

REPRESENTATIVE PHOTOGRAPHS

MDT Wetland Mitigation Monitoring
Musgrave Lake
Zurich, Montana

LAND & WATER

RS1, Transect 1 from Start, 10 degrees N/NE

RS1, Transect 1 from End, 192 degrees S/SW

ES1, Transect 2 from Start, 106 degrees E/SE

ES1, Transect 2 from End, 299 degrees W/NW

RS2, Transect 3 from Start, 167 degrees S/SE

RS2, Transect 3 from End, 354 degrees N/NW

RS2, Photo Point 1, 260 degrees W

RS2, Photo Point 2, 100 degrees E

RS2, Photo Point 3, 54 degrees NE

RS2, Photo Point 4, 19 degrees S

ES1, Photo Point 4, 15 degrees N

ES1, Photo Point 5, 123 degrees SE

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LAND & WATER

ES1, Photo Point 5, 290 degrees W/NW (adjacent upland)

RS1, Photo Point 6, 310 degrees NW

Blank

RS1, Photo Point 7, 143 degrees SE

Blank

Blank

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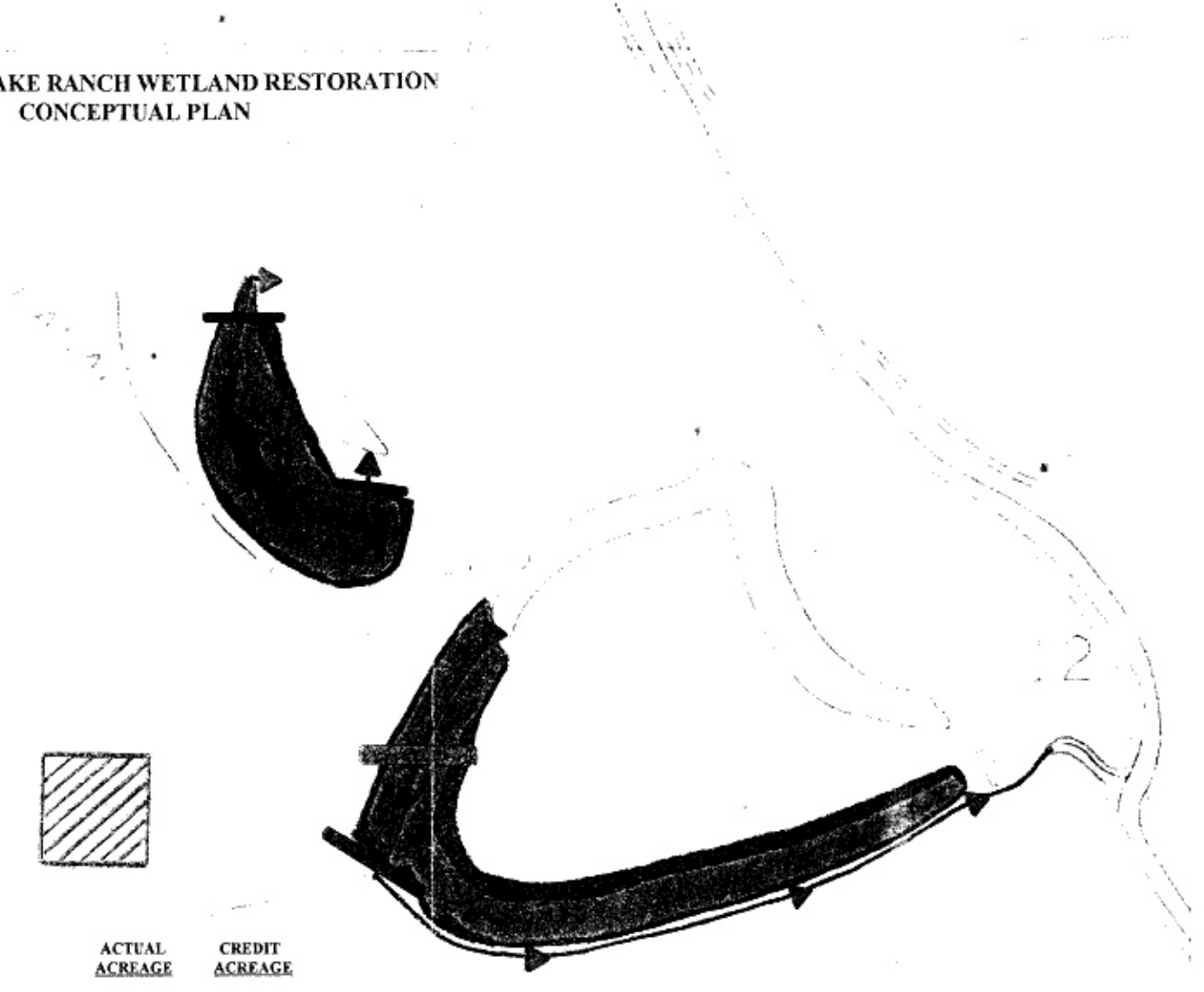
Appendix D

CONCEPTUAL SITE LAYOUT

MDT Wetland Mitigation Monitoring
Musgrave Lake
Zurich, Montana

LAND & WATER

MUSGRAVE LAKE RANCH WETLAND RESTORATION
CONCEPTUAL PLAN



SYMBOL	DESCRIPTION	ACTUAL ACREAGE	CREDIT ACREAGE
	Standing Water Depth from 0" to 24"	16.6 acres	15.2 acres
	Standing Water Depth from 24" to 42"	3.6 acres	3.6 acres
	Riparian and Upland Buffer	8.4 acres	8.4 acres
	Ditch Plug/Dike		27.2 acres
	Borrow Area and Road Fill (existing)		
	Existing Ditches		

Appendix E

BIRD SURVEY PROTOCOL
GPS PROTOCOL

MDT Wetland Mitigation Monitoring
Musgrave Lake
Zurich, Montana

LAND & WATER

BIRD SURVEY PROTOCOL

The following is an outline of the MDT Wetland Mitigation Site Monitoring Bird Survey Protocol. Though each site is vastly different, the bird survey data collection methods must be standardized to a certain degree to increase repeatability. An Area Search within a restricted time frame will be used to collect the following data: a bird species list, density, behavior, and habitat-type use. There will be some decisions that team members must make to fit the protocol to their particular site. Each of the following sections and the desired result describes the protocol established to reflect bird species use over time.

Species Use within the Mitigation Wetland: Survey Method

Result: To conduct a bird survey of the wetland mitigation site within a restricted period of time and the budget allotment.

Sites that can be circumambulated or walked throughout.

These types of sites will include ponds, enhanced historic river channels, wet meadows, and any area that can be surveyed from the entirety of its perimeter or walked throughout. If the wetland is not uncomfortably inundated, conduct several "meandering" transects through the site in an orderly fashion (record the number and approximate location/direction of the transects in the field notebook; they do not have to be formalized or staked). If a very small portion of the site cannot be crossed due to inundation, this method will also apply. Though the sizes of the site vary, each site will require surveying to the fullest extent possible within a set time limit. The optimum times to conduct the survey are in the morning hours. Conduct the survey from sunrise to no later than 11:00 AM. (Note: some sites may have to be surveyed in the late afternoon or evening due to time constraints or weather; if this is the case, record the time of day and include this information in your report discussion.) If the survey is completed before 11:00 AM and no additions are being made to the list, then the task is complete. The overall limiting factor regarding the number of hours that are spent conducting this survey is the number of budgeted hours; this determination must be made by site by each individual.

In many cases, binoculars will be the only instrument that is needed to identify and count the birds using the wetland. If the wetland includes deep water habitat that can not be assessed with binoculars, then a scope and tripod are necessary. If this is the case, establish as many lookout posts as necessary from key vantage points to collect the data. Depending on the size of the open water, more time may be spent viewing the mitigation area from these vantage points than is spent walking the peripheries of more shallow-water wetlands.

Sites that cannot be circumambulated.

These types of sites will include large-bodied waters, such as reservoirs, particularly those with deep water habitat (>6 ft) close to the shore and no wetland development in that area of the shoreline. If one area of the reservoir was graded in such a way to create or enhance the development of a wetland, then that will be the area in which the ambulatory bird survey is conducted. The team member must then determine the length of the shoreline that will be surveyed during each visit.

As stated above in the ambulatory site section, these large sites most likely will have to be surveyed from established vantage points.

Species Use within the Mitigation Wetland: Data Recording

Result: A complete list of bird species using the site, an estimate of bird densities and associated behaviors, and identification of habitat use.

1. Bird Species List

Record the bird species on the Bird Survey - Field Data Sheet using the appropriate 4-letter code of the common name. The coding uses the first two letters of the first two words of the birds' common name or if one name, the first four (4) letters. For example, mourning dove is coded MODO and mallard is MALL. If an unknown individual is observed, use the following protocol and define your abbreviation at the bottom of the field data sheet: unknown shorebird: UNSB; unknown brown bird (UNBR); unknown warbler (UNWA); unknown waterfowl (UNWF). For a flyover of a flock of unknown species, use a term that describes the birds' general characteristics and include the approximate flock size in parentheses; do not fill in the habitat column. For example, a flock of black, medium-sized birds could be coded: UNBB / FO (25). You may also note on the data sheet if that particular individual is using a constructed nest box.

2. Bird Density

In the office, sum the Bird Survey – Field Data Sheet data by species and by behavior. Record this data in the Bird Summary Table.

3. Bird Behavior

Bird behavior must be identified by what is known. When a species is simply observed, the behavior that it is immediately exhibiting is what is recorded. Only behaviors that have discreet descriptive terms should be used. The following terms are recommended: breeding pair individual (BP); foraging (F); flyover (FO); loafing (L; e.g. sleeping, roosting, floating with head tucked under wing are loafing behaviors); and, nesting (N). If more behaviors are observed that do have a specific descriptive word, use them and we will add it to the protocol; descriptive words or phrases such as "migrating" or "living on site" are unknown behaviors.

4. Bird Species Habitat Use

We are interested in what bird species are using which particular habitat within the mitigation wetlands. This data is easily collected by simply recording what habitat the species was initially observed. Use the following broad category habitat classifications: aquatic bed (AB - rooted floating, floating-leaved, or submergent vegetation); forested (FO); marsh (MA – cattail, bulrush, emergent vegetation, etc. with surface water); open water (OW – primarily unvegetated); scrub-shrub (SS); and upland buffer (UP); wet meadow (WM – sedges, rushes, grasses with little to no surface water). If other categories are observed onsite that are not suggested here, we will make a new category next year.

GPS Mapping and Aerial Photo Referencing Procedure

The wetland boundaries, photograph location points and sampling locations were field located with mapping grade Trimble Geo III GPS units. The data was collected with a minimum of three positions per feature using Course/Acquisition code. The collected data was then transferred to a PC and differentially corrected to the nearest operating Community Base Station. The corrected data was then exported to ACAD drawings in Montana State Plain Coordinates NAD 83 international feet.

The GPS positions collected and processed had a 68% accuracy of 7 feet except in isolated areas of Tasks .008 and .011, where it went to 12 feet. This is within the 1 to 5 meter range listed as the expected accuracy of the mapping grade Trimble GPS.

Aerial reference points were used to position the aerial photographs. This positioning did not remove the distortion inherent in all photos; this imagery is to be used as a visual aide only. The located wetland boundaries were given a final review by the wetland biologist and adjustments were made if necessary.

Any relationship of features located to easement or property lines are not to be construed from these figures. These relationships can only be determined with a survey by a licensed surveyor.

Appendix F

MACROINVERTEBRATE SAMPLING PROTOCOL AND DATA

MDT Wetland Mitigation Monitoring
Musgrave Lake
Zurich, Montana

LAND & WATER

AQUATIC INVERTEBRATE SAMPLING PROTOCOL

Equipment List

- D-frame sampling net with 1 mm mesh. Wildco is a good source of these.
- Spare net.
- 1-liter plastic sample jars, wide-mouth. VWR has these: catalog #36319-707.
- 95% ethanol: Northwest Scientific in Billings carries this.

All these other things are generally available at hardware or sporting goods stores. Make the labels on an ink jet printer preferably.

- hip waders.
- pre-printed sample labels (printed on Rite-in-the-Rain or other coated paper, two labels per sample).
- pencil.
- plastic pail (3 or 5 gallon).
- large tea strainer or framed screen.
- towel.
- tape for affixing label to jar.
- cooler with ice for sample storage.

Site Selection

Select the sampling site with these considerations in mind:

- Select a site accessible with hip waders. If substrates are too soft, lay a wide board down to walk on.
- Determine a location that is representative of the overall condition of the wetland.

Sampling

Wetland invertebrates inhabit the substrate, the water column, the stems and leaves of aquatic vegetation, and the water surface. Your goal is to sweep the collecting net through each of these habitat types, and then to combine the resulting samples into the 1-liter sample jar.

Dip out about a gallon of water into the pail. Pour about a cup of ethanol into the sample jar. Fill out the top half of the sample labels, using pencil, since ink will dissolve in the ethanol.

Ideally, you can sample a swath of water column from near-shore outward to a depth of approximately 3 feet with a long sweep of the net, keeping the net at about half the depth of the water throughout the sweep. Sweep the water surface as well. Pull the net through a vegetated area, beneath the water surface, for at least a meter of distance.

Sample the substrate by pulling the net along the bottom, bumping it against the substrate several times as you pull.

This step is optional, but it gives you a chance to see that you've collected some invertebrates. Rinse the net out into the bucket, and look for insects, crustaceans, etc. If necessary, repeat the sampling process in a nearby location, and add the net contents to the bucket. Remember to sample all four environments.

Sieve the contents of the bucket through the straining device and pour or carefully scrape the contents of the strainer into the sample jar.

If you skip the bucket-and-sieve steps, simply lift handfuls of material out of the sampling net into the jars. In either case, please include some muck or mud and some vegetation in the jar. Often, you will have collected a large amount of vegetable material. If this is the case, lift out handfuls of material from the sieve into the jar, until the jar is about half full. Please limit material you include in the sample, so that there is only a single jar for each sample.

Top off the sample jar with enough ethanol to cover all the material in the jar. Leave as little headroom as possible.

It is not necessary to sample habitats in any specified order. Keep in mind that disturbing the habitats prior to sampling will chase off the animals you are trying to capture.

Complete the sample labels. Place one label inside the sample jar and tape the other label securely to the outside of the jar. Dry the jar before attaching the outer label if necessary. In some situations, it may be necessary to collect more than one sample at a site. If you take multiple samples from the same site, clearly indicate this by using individual sample numbers, along with the total number of samples collected at the site (e.g. Sample #3 of 5 total samples).

Photograph the sampled site.

Sample Handling/Shipping

- In the field, keep collected samples cool by storing them in a cooler. Only a small amount of ice is necessary.
- Inventory all samples, preparing a list of all sites and enumerating all samples, before shipping or delivering to the laboratory.
- Deliver samples to Rhithron.

MDT WETLAND MITIGATION MONITORING PROJECT
Aquatic Invertebrate Monitoring
Summary 2001, 2002, 2003

METHODS

Among other monitoring activities, aquatic invertebrate assemblages were collected at a number of mitigation wetlands throughout Montana. This report summarizes data generated from three years of collection.

The method employed to assess these wetlands is based on constructing an index using a battery of 12 bioassessment metrics or attributes (**Table 1**) tested and recommended by Stribling et al. (1995) in a report to the Montana Department of Health and Environmental Science. In that study, it was determined that some of the metrics were of limited use in some geographic regions, and for some wetland types. Despite that finding, all 12 metrics are used in this evaluation of mitigated wetlands, since detailed geographic information and wetland classifications were unavailable.

Scoring criteria for metrics were developed by generally following the tactic used by Stribling et al. Boxplots were generated and distributions, ranges, and quartiles for each metric were examined. All sites were used except Camp Creek, which was sampled in 2002 and 2003. The fauna at that site was different from that of the other sites, and suggested montane stream conditions rather than wetland conditions. The Camp Creek site was assessed using the tested metric battery developed for montane streams of Western Montana (Bollman 1998). For the wetlands, "optimal" scores were generally those that fell above the 75th percentile (for those metrics that decrease in value in response to stress) or below the 25th percentile (for metrics that respond to stress by an increase in value) of all scores. Additional scoring ranges were established by bisecting the range below the 75th percentile for decreasing scores (or above the 25th percentile for increasing scores) into "sub-optimal" and "poor" assessment categories. A score of 5, 3, or 1 was assigned to optimal, sub-optimal, and poor metric performance, respectively. In this way, metric values were translated into normalized metric scores, and scores for all metrics were summed to produce a total bioassessment score. Total bioassessment scores were classified according to a similar process, using the ranges and distributions of total scores for all sites studied.

The purpose of constructing an index from biological attributes or metrics is to provide a means of integrating information to facilitate the determination of whether management action is needed. The nature of the action needed is not determined solely by the index score, however, but by consideration of an analysis of the component metrics, the taxonomic composition of the assemblages and other issues. The diagnostic functions of the metrics and taxonomic data need more study; our understanding of the interrelationships of natural environmental factors and anthropogenic disturbances are tentative. Thus, the further interpretive remarks accompanying the raw taxonomic and metric data are offered cautiously.

Sample Processing

Aquatic invertebrate samples were collected at mitigation wetland sites in the summer months of 2001, 2002, and 2003 by personnel of Wetlands West, Inc. and/or Land & Water Consulting, Inc. Sampling procedures utilized were based on the protocols developed by the Montana Department of Environmental Quality (MDEQ).

Sampling consisted of D-frame net sweeps through emergent vegetation (when present), the water column, over the water surface, and included disturbing and scraping substrates at each sampled sites. Samples were preserved in ethanol at each wetland site and subsequently delivered to Rhithron Associates, Inc. for processing, taxonomic determinations, and data analysis.

At Rhithron's laboratory, Caton subsamplers and stereomicroscopes with 10X magnification were used to randomly select a minimum of 200 organisms, when possible, from each sample. In some cases, the entire sample contained fewer than 200 organisms; in these cases, all organisms from the sample were taken. Taxa were identified in general accordance with the taxonomic resolution standards set out in the MDEQ Standard Operating Procedures for Sampling and Sample Analysis (Bukantis 1998). Ten percent of samples were re-identified by a second taxonomist

for quality assurance purposes. The identified samples have been archived at Rhithron's laboratory. Taxonomic data and organism counts were entered into an Excel 2000 spreadsheet, and metrics were calculated and scored using spreadsheet formulae.

Bioassessment Metrics

An index based on the performance of 12 metrics was constructed, as described above. **Table 1** lists those metrics, describes their calculation and the expected response of each to increased degradation or impairment of the wetland.

In addition to the summed scores of each metric and the associated impairment classification described above, each individual metric informs the bioassessment to some degree. The four richness metrics (Total taxa, POET, Chironomidae taxa, and Crustacea taxa + Mollusca taxa) can be interpreted to express habitat complexity as well as water quality. Complex, diverse habitats consist of variable substrates, emergent vegetation, variable water depths and other factors, and are potential features of long-established stable wetlands with minimal human disturbance. In the study conducted by Stribling et al. (1995), all four richness metrics were found to be significantly associated with water quality parameters including conductance, salinity, and total dissolved solids.

Four composition metrics (%Chironomidae, %Orthocladiinae of Chironomidae, %Crustacea + %Mollusca, and Amphipoda) measure the relative contributions of certain taxonomic groups that may have significant responses to habitat and/or water quality impacts. For example, amphipods have been demonstrated to increase in abundance in alkaline conditions. Short-lived, relatively mobile taxa such as chironomids dominate ephemeral environments; any are hemoglobin-bearers capable of tolerating de-oxygenated conditions.

Two tolerance metrics (the Hilsenhoff Biotic Index and %Dominant taxon) were included in the bioassessment battery. The HBI indicates the overall invertebrate assemblage tolerance to nutrient enrichment, warm water, and/or low dissolved oxygen conditions. The percent abundance of the dominant taxon has been demonstrated to be strongly associated with pH, conductance, salinity, total organic carbon, and total dissolved solids.

Two trophic measures (%Collector-gatherers and %Filterers) may be helpful in expressing functional integrity of the invertebrate assemblage, which can be impacted by poor water quality or habitat degradation. High proportions of filtering organisms suggest nutrient and/or organic enrichment, while abundant collectors suggest more positive functional conditions and well-developed wetland morphology. These organisms graze periphyton growing on stable surfaces such as macrophytes.

RESULTS

In 2001, 29 sites were sampled statewide. Nineteen of these sites were revisited in 2002, and 13 new sites were sampled. In 2003, 17 sites that had been visited in both 2001 and 2002 were re-sampled, and 11 sites sampled for the first time in 2001 were re-visited. In addition, 2 new sites were sampled. Thus, the 2003 database contains records for 90 sampling events at 44 unique sites. **Table 2** summarizes sites and sampling dates.

Metric scoring criteria were re-developed each year as new data was added. For 2003, 88 records were utilized. Because of the addition of data, scoring criteria changed for several metrics in 2003; thus, biotic condition classifications assigned in 2002 for some sites also changed. However, ranges of individual metrics, as well as median metric values remained remarkably consistent in each of the three years.

Table 1. Aquatic invertebrate metrics employed in the MTDT mitigation wetland monitoring study, 2001- 2003.

Metric	Metric Calculation	Expected Response to Degradation or Impairment
Total taxa	Count of unique taxa identified to lowest recommended taxonomic level	Decrease
POET	Count unique Plecoptera, Trichoptera, Ephemeroptera, and Odonata taxa identified to lowest recommended taxonomic level	Decrease
Chironomidae taxa	Count unique midge taxa identified to lowest recommended taxonomic level	Decrease
Crustacea taxa + Mollusca taxa	Count unique Crustacea taxa and Mollusca taxa identified to lowest recommended taxonomic level	Decrease
% Chironomidae	Percent abundance of midges in the subsample	Increase
Orthocladiinae/Chironomidae	Number of individual midges in the sub-family Orthocladiinae / total number of midges in the subsample.	Decrease
%Amphipoda	Percent abundance of amphipods in the subsample	Increase
%Crustacea + %Mollusca	Percent abundance of crustaceans in the subsample plus percent abundance of molluscs in the subsample	Increase
HBI	Relative abundance of each taxon multiplied times that taxon's modified Hilsenhoff Biotic Index value. These numbers are summed over all taxa in the subsample.	Increase
%Dominant taxon	Percent abundance of the most abundant taxon in the subsample	Increase
%Collector-Gatherers	Percent abundance of organisms in the collector-gatherer functional group	Decrease
%Filterers	Percent abundance of organisms in the filterer functional group	Increase

LITERATURE CITED

Bollman, W. 1998. Montana Valleys and Foothill Prairies Ecoregion. Master's Thesis. (M.S.) University of Montana. Missoula, Montana.

Bukantis, R. 1998. Rapid bioassessment macroinvertebrate protocols: Sampling and sample analysis SOP's. Working draft. Montana Department of Environmental Quality. Planning Prevention and Assistance Division. Helena, Montana.

Stribling, J.B., J. Lathrop-Davis, M.T. Barbour, J.S. White, and E.W. Leppo. 1995. Evaluation of environmental indicators for the wetlands of Montana: the multimetric approach using benthic macroinvertebrates. Report to the Montana Department of Health and Environmental Science. Helena, Montana.

Table 2. Sampled MDT Mitigation Sites by Year

2001	2002	2003
Beaverhead 1	Beaverhead 1	Beaverhead 1
Beaverhead 2	Beaverhead 2	
Beaverhead 3	Beaverhead 3	
Beaverhead 4	Beaverhead 4	Beaverhead 4
Beaverhead 5	Beaverhead 5	Beaverhead 5
Beaverhead 6	Beaverhead 6	Beaverhead 6
Big Sandy 1		
Big Sandy 2		
Big Sandy 3		
Big Sandy 4		
Johnson-Valier		
VIDA		
Cow Coulee	Cow Coulee	Cow Coulee
Fourchette - Puffin	Fourchette - Puffin	Fourchette - Puffin
Fourchette – Flashlight	Fourchette – Flashlight	Fourchette – Flashlight
Fourchette – Penguin	Fourchette – Penguin	Fourchette – Penguin
Fourchette – Albatross	Fourchette – Albatross	Fourchette – Albatross
Big Spring	Big Spring	Big Spring
Vince Ames		
Ryegate		
Lavinia		
Stillwater	Stillwater	Stillwater
Roundup	Roundup	Roundup
Wigeon	Wigeon	Wigeon
Ridgeway	Ridgeway	Ridgeway
Musgrave – Rest. 1	Musgrave – Rest. 1	Musgrave – Rest. 1
Musgrave – Rest. 2	Musgrave – Rest. 2	Musgrave – Rest. 2
Musgrave – Enh. 1	Musgrave – Enh. 1	Musgrave – Enh. 1
Musgrave – Enh. 2		
	Hoskins Landing	Hoskins Landing
	Peterson - 1	Peterson – 1
	Peterson – 2	
	Peterson – 4	Peterson – 4
	Peterson – 5	Peterson – 5
	Jack Johnson - main	Jack Johnson - main
	Jack Johnson - SW	Jack Johnson - SW
	Creston	Creston
	Lawrence Park	
	Perry Ranch	
	SF Smith River	SF Smith River
	Camp Creek	Camp Creek
	Kleinschmidt	Kleinschmidt – pond
		Kleinschmidt – stream
		Ringling - Galt

Aquatic Invertebrate Taxonomic Data

Site Name MUSGRAVE LAKE ES-1 **Date Collected** 7/30/2003

Order	Family	Taxon	Count	Percent	Unique	BI	FFG
Acarina	Acari	Copepoda	3	3.09%	Yes	8	CG
		Acari	1	1.03%	Yes	5	PR
Amphipoda	Talitridae	*Hyalella*	2	2.06%	Yes	8	CG
Diptera	Ceratopogonidae	Ceratopogoninae	48	49.48%	Yes	6	PR
Ephemeroptera	Caenidae	*Caenis*	1	1.03%	Yes	7	CG
Haplotaxida	Naididae	*Nais*	41	42.27%	Yes	8	CG
Odonata	Coenagrionidae	Coenagrionidae	1	1.03%	Yes	7	PR
Grand Total			**97**				

Aquatic Invertebrate Taxonomic Data

Site Name MUSGRAVE LAKE RS-1 **Date Collected** 7/30/2003

Order	Family	Taxon	Count	Percent	Unique	BI	FFG
Acarina							
	Acari						
		Acari	2	1.68%	Yes	5	PR
Basommatophora							
	Lymnaeidae						
		Lymnaeidae	1	0.84%	Yes	6	SC
	Physidae						
		Physidae	1	0.84%	Yes	8	SC
	Planorbidae						
		Gyraulus	52	43.70%	Yes	8	SC
Coleoptera							
	Dytiscidae						
		Agabus	1	0.84%	Yes	5	PR
		Graphoderus	1	0.84%	Yes	5	PR
		Liodessus	1	0.84%	Yes	5	PR
	Hydrophilidae						
		Enochrus	1	0.84%	Yes	5	CG
Diptera							
	Ceratopogonidae						
		Ceratopogoninae	19	15.97%	Yes	6	PR
	Chaoboridae						
		Chaoborus	28	23.53%	Yes	7	PR
	Chironomidae						
		Acricotopus	1	0.84%	Yes	10	CG
		Chironomus	2	1.68%	Yes	10	CG
		Dicrotendipes	2	1.68%	Yes	8	CG
		Endochironomus	1	0.84%	Yes	10	SH
		Parachironomus	1	0.84%	Yes	10	PR
	Ephydridae						
		Ephydridae	2	1.68%	Yes	6	CG
	Stratiomyidae						
		Odontomyia	1	0.84%	Yes	7	CG
Heteroptera							
	Notonectidae						
		Notonecta	1	0.84%	Yes	5	PR
Odonata							
	Coenagrionidae						
		Coenagrionidae	1	0.84%	Yes	7	PR
Grand Total			**119**				

Aquatic Invertebrate Taxonomic Data

Site Name MUSGRAVE LAKE RS-2 **Date Collected** 7/30/2003

Order	Family	Taxon	Count	Percent	Unique	BI	FFG
		Copepoda	4	2.29%	Yes	8	CG
Acarina							
	Acari						
		Acari	6	3.43%	Yes	5	PR
Amphipoda							
	Talitridae						
		Hyalella	45	25.71%	Yes	8	CG
Arhynchobdellida							
	Erpobdellidae						
		Erpobdella	1	0.57%	Yes	8	PR
Basommatophora							
	Planorbidae						
		Gyraulus	7	4.00%	Yes	8	SC
Coleoptera							
	Haliplidae						
		Haliplus	25	14.29%	Yes	5	PH
	Hydrophilidae						
		Berosus	1	0.57%	Yes	5	PR
Diplostraca							
		Cladocera	6	3.43%	Yes	8	CF
Diptera							
	Ceratopogonidae						
		Ceratopogoninae	14	8.00%	Yes	6	PR
	Chironomidae						
		Cricotopus (Cricotopus)	1	0.57%	Yes	7	SH
		Dicrotendipes	1	0.57%	Yes	8	CG
	Ephydridae						
		Ephydridae	1	0.57%	Yes	6	CG
Ephemeroptera							
	Caenidae						
		Caenis	4	2.29%	Yes	7	CG
Haplotaxida							
	Tubificidae						
		Tubificidae	33	18.86%	Yes	10	CG
Rhynchobdellida							
	Glossiphoniidae						
		Helobdella stagnalis	16	9.14%	Yes	10	PR
		Placobdella	10	5.71%	Yes	6	PR
Grand Total			**175**				

Aquatic Invertebrate Data Summary

Project ID: MDT03LW
STORET Station ID:
Station Name: MUSGRAVE LAKE ES-1

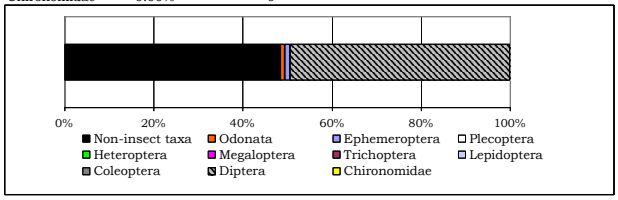
Activity ID:

Sample Date: 7/30/2003

Sample type	
SUBSAMPLE TOTAL ORGANISMS	97
Portion of sample used	10.00%
Estimated number in total sample	970
Sampling effort	
Time	
Distance	
Jabs	
Habitat type	
EPT abundance	1
Taxa richness	7
Number EPT taxa	1
Percent EPT	1.03%

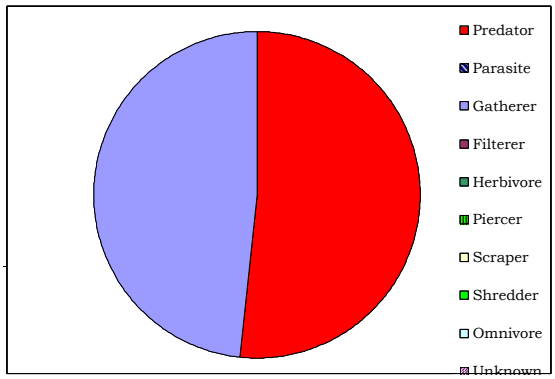
TAXONOMIC COMPOSITION

GROUP	PERCENT	#TAXA
Non-insect taxa	48.45%	4
Odonata	1.03%	1
Ephemeroptera	1.03%	1
Plecoptera	0.00%	0
Heteroptera	0.00%	0
Megaloptera	0.00%	0
Trichoptera	0.00%	0
Lepidoptera	0.00%	0
Coleoptera	0.00%	0
Diptera	49.48%	1
Chironomidae	0.00%	0



FUNCTIONAL COMPOSITION

GROUP	PERCENT	#TAXA
Predator	51.55%	3
Parasite	0.00%	0
Gatherer	48.45%	4
Filterer	0.00%	0
Herbivore	0.00%	0
Piercer	0.00%	0
Scraper	0.00%	0
Shredder	0.00%	0
Omnivore	0.00%	0
Unknown	0.00%	0



COMMUNITY TOLERANCES

Sediment tolerant taxa	0
Percent sediment tolerant	0.00%
Sediment sensitive taxa	0
Metals tolerance index (McGuire)	7.08
Cold stenotherm taxa	0
Percent cold stenotherms	0.00%

HABITUS MEASURES

Hemoglobin bearer richness	0
Percent hemoglobin bearers	0.00%
Air-breather richness	0
Percent air-breathers	0.00%
Burrower richness	1
Percent burrowers	49.48%
Swimmer richness	3
Percent swimmers	8.25%

DOMINANCE

TAXON	ABUNDANCE	PERCENT
Ceratopogoninae	48	49.48%
Nais	41	42.27%
Copepoda	3	3.09%
Hyalella	2	2.06%
Acari	1	1.03%
SUBTOTAL 5 DOMINANTS	95	97.94%
Coenagrionidae	1	1.03%
Caenis	1	1.03%
TOTAL DOMINANTS	97	100.00%

SAPROBITY

Hilsenhoff Biotic Index	7.00

DIVERSITY

Shannon H (loge)	1.00
Shannon H (log2)	0.69
Margalef D	1.31
Simpson D	0.42
Evenness	0.10

VOLTINISM

TYPE	# TAXA	PERCENT
Multivoltine	2	4.12%
Univoltine	5	95.88%
Semivoltine	0	0.00%

TAXA CHARACTERS

	#TAXA	PERCENT
Tolerant	2	2.06%
Intolerant	0	0.00%
Clinger	0	0.00%

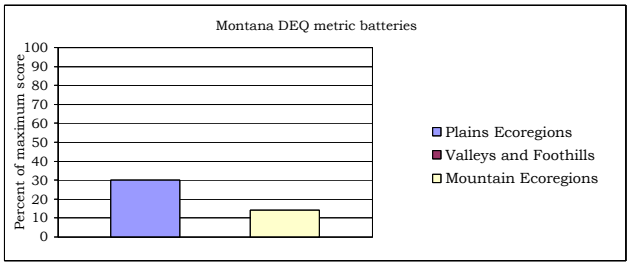
BIOASSESSMENT INDICES

B-IBI (Karr et al.)

METRIC	VALUE	SCORE	
Taxa richness	7	1	
E richness	1	1	
P richness	0	1	
T richness	0	1	
Long-lived	0	1	
Sensitive richness	0	1	
%tolerant	2.06%	5	
%predators	51.55%	3	
Clinger richness	0	1	
%dominance (3)	94.85%	1	
	TOTAL SCORE	16	32%

MONTANA DEQ METRICS (Bukantis 1998)

METRIC	VALUE	Plains Ecoregions	Valleys and Foothills	Mountain Ecoregions
Taxa richness	7	0	0	0
EPT richness	1	0	0	0
Biotic Index	7.00	1	0	0
%Dominant taxon	49.48%	1	1	0
%Collectors	48.45%	3	3	3
%EPT	1.03%	0	0	0
Shannon Diversity	0.69	0		
%Scrapers +Shredders	0.00%	0	0	0
Predator taxa	3	1		
%Multivoltine	4.12%	3		
%H of T	#DIV/0!		#DIV/0!	
TOTAL SCORES		9	#DIV/0!	3
PERCENT OF MAXIMUM		30.00	#DIV/0!	14.29
IMPAIRMENT CLASS		MODERATE	#DIV/0!	SEVERE



Montana Plains ecoregions metrics (Bramblett and Johnson)

Riffle		*Pool*	
EPT richness	1	E richness	1
Percent EPT	1.03%	T richness	0
Percent Oligochaetes and Leeches	42.27%	Percent EPT	1.03%
Percent 2 dominants	91.75%	Percent non-insect	48.45%
Filterer richness	0	Filterer richness	0
Percent intolerant	0.00%	Univoltine richness	5
Univoltine richness	5	Percent supertolerant	47.42%
Percent clingers	0.00%		
Swimmer richness	3		

Aquatic Invertebrate Data Summary

Project ID: MDT03LW
STORET Station ID:
Station Name: MUSGRAVE LAKE RS-1

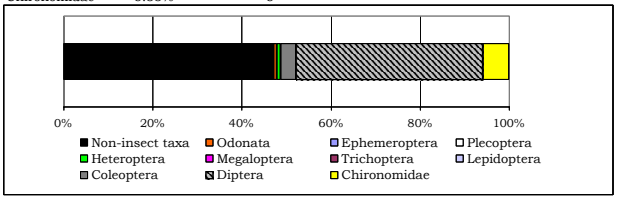
Activity ID:

Sample Date: 7/30/2003

Sample type	
SUBSAMPLE TOTAL ORGANISMS	119
Portion of sample used	10.00%
Estimated number in total sample	1190
Sampling effort	
Time	
Distance	
Jabs	
Habitat type	
EPT abundance	0
Taxa richness	19
Number EPT taxa	0
Percent EPT	0.00%

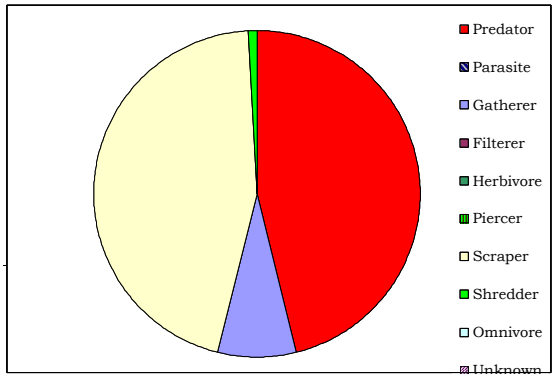
TAXONOMIC COMPOSITION

GROUP	PERCENT	#TAXA
Non-insect taxa	47.06%	4
Odonata	0.84%	1
Ephemeroptera	0.00%	0
Plecoptera	0.00%	0
Heteroptera	0.84%	1
Megaloptera	0.00%	0
Trichoptera	0.00%	0
Lepidoptera	0.00%	0
Coleoptera	3.36%	4
Diptera	42.02%	4
Chironomidae	5.88%	5



FUNCTIONAL COMPOSITION

GROUP	PERCENT	#TAXA
Predator	46.22%	9
Parasite	0.00%	0
Gatherer	7.56%	6
Filterer	0.00%	0
Herbivore	0.00%	0
Piercer	0.00%	0
Scraper	45.38%	3
Shredder	0.84%	1
Omnivore	0.00%	0
Unknown	0.00%	0



COMMUNITY TOLERANCES

Sediment tolerant taxa	2
Percent sediment tolerant	44.54%
Sediment sensitive taxa	0
Metals tolerance index (McGuire)	5.48
Cold stenotherm taxa	0
Percent cold stenotherms	0.00%

HABITUS MEASURES

Hemoglobin bearer richness	5
Percent hemoglobin bearers	48.74%
Air-breather richness	5
Percent air-breathers	4.20%
Burrower richness	4
Percent burrowers	20.17%
Swimmer richness	0
Percent swimmers	0.00%

DOMINANCE

TAXON	ABUNDANCE	PERCENT
Gyraulus	52	43.70%
Chaoborus	28	23.53%
Ceratopogoninae	19	15.97%
Acari	2	1.68%
Ephydridae	2	1.68%
SUBTOTAL 5 DOMINANTS	103	86.55%
Chironomus	2	1.68%
Dicrotendipes	2	1.68%
Lymnaeidae	1	0.84%
Physidae	1	0.84%
Coenagrionidae	1	0.84%
TOTAL DOMINANTS	110	92.44%

SAPROBITY

Hilsenhoff Biotic Index	7.00

DIVERSITY

Shannon H (loge)	2.14
Shannon H (log2)	1.49
Margalef D	3.76
Simpson D	0.27
Evenness	0.08

VOLTINISM

TYPE	# TAXA	PERCENT
Multivoltine	6	7.56%
Univoltine	9	89.08%
Semivoltine	3	2.52%

TAXA CHARACTERS

	#TAXA	PERCENT
Tolerant	8	51.26%
Intolerant	0	0.00%
Clinger	0	0.00%

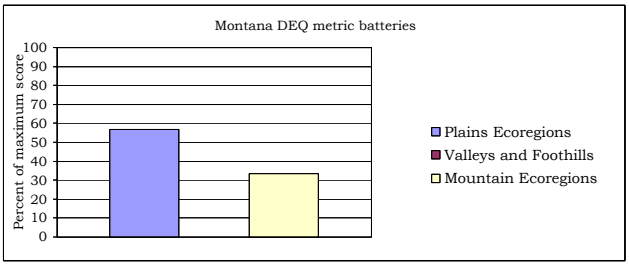
BIOASSESSMENT INDICES

B-IBI (Karr et al.)

METRIC	VALUE	SCORE
Taxa richness	19	1
E richness	0	1
P richness	0	1
T richness	0	1
Long-lived	3	3
Sensitive richness	0	1
%tolerant	51.26%	1
%predators	46.22%	3
Clinger richness	0	1
%dominance (3)	83.19%	1
	TOTAL SCORE	14 28%

MONTANA DEQ METRICS (Bukantis 1998)

METRIC	VALUE	Plains Ecoregions	Valleys and Foothills	Mountain Ecoregions
Taxa richness	19	2	1	1
EPT richness	0	0	0	0
Biotic Index	7.00	1	0	0
%Dominant taxon	43.70%	2	1	1
%Collectors	7.56%	3	3	3
%EPT	0.00%	0	0	0
Shannon Diversity	1.49	0		
%Scrapers +Shredders	46.22%	3	3	2
Predator taxa	9	3		
%Multivoltine	7.56%	3		
%H of T	#DIV/0!		#DIV/0!	
TOTAL SCORES		17	#DIV/0!	7
PERCENT OF MAXIMUM		56.67	#DIV/0!	33.33
IMPAIRMENT CLASS		SLIGHT	#DIV/0!	MODERATE



Montana Plains ecoregions metrics (Bramblett and Johnson)

Riffle		*Pool*	
EPT richness	0	E richness	0
Percent EPT	0.00%	T richness	0
Percent Oligochaetes and Leeches	0.00%	Percent EPT	0.00%
Percent 2 dominants	67.23%	Percent non-insect	47.06%
Filterer richness	0	Filterer richness	0
Percent intolerant	0.00%	Univoltine richness	9
Univoltine richness	9	Percent supertolerant	50.42%
Percent clingers	0.00%		
Swimmer richness	0		

Aquatic Invertebrate Data Summary

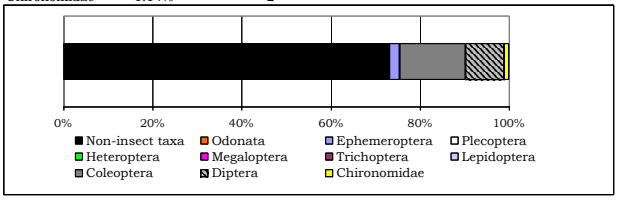
Project ID: MDT03LW
STORET Station ID:
Station Name: MUSGRAVE LAKE RS-2

Activity ID:
Sample Date: 7/30/2003

Sample type	
SUBSAMPLE TOTAL ORGANISMS	175
Portion of sample used	26.67%
Estimated number in total sample	656
Sampling effort	
Time	
Distance	
Jabs	
Habitat type	
EPT abundance	4
Taxa richness	16
Number EPT taxa	1
Percent EPT	2.29%

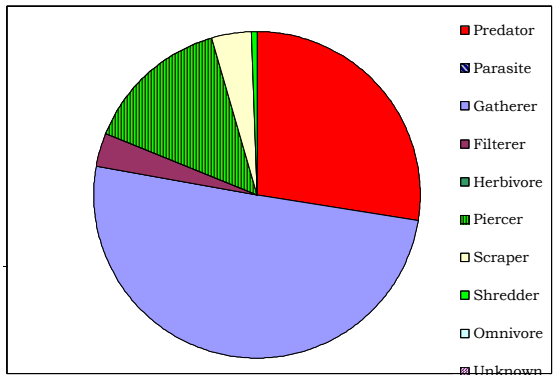
TAXONOMIC COMPOSITION

GROUP	PERCENT	#TAXA
Non-insect taxa	73.14%	9
Odonata	0.00%	0
Ephemeroptera	2.29%	1
Plecoptera	0.00%	0
Heteroptera	0.00%	0
Megaloptera	0.00%	0
Trichoptera	0.00%	0
Lepidoptera	0.00%	0
Coleoptera	14.86%	2
Diptera	8.57%	2
Chironomidae	1.14%	2



FUNCTIONAL COMPOSITION

GROUP	PERCENT	#TAXA
Predator	27.43%	6
Parasite	0.00%	0
Gatherer	50.29%	6
Filterer	3.43%	1
Herbivore	0.00%	0
Piercer	14.29%	1
Scraper	4.00%	1
Shredder	0.57%	1
Omnivore	0.00%	0
Unknown	0.00%	0



COMMUNITY TOLERANCES

Sediment tolerant taxa	2
Percent sediment tolerant	22.86%
Sediment sensitive taxa	0
Metals tolerance index (McGuire)	5.29
Cold stenotherm taxa	0
Percent cold stenotherms	0.00%

HABITUS MEASURES

Hemoglobin bearer richness	3
Percent hemoglobin bearers	23.43%
Air-breather richness	1
Percent air-breathers	0.57%
Burrower richness	2
Percent burrowers	8.57%
Swimmer richness	4
Percent swimmers	2.29%

DOMINANCE

TAXON	ABUNDANCE	PERCENT
Hyalella	45	25.71%
Tubificidae	33	18.86%
Haliplus	25	14.29%
Helobdella stagnalis	16	9.14%
Ceratopogoninae	14	8.00%
SUBTOTAL 5 DOMINANTS	133	76.00%
Placobdella	10	5.71%
Gyraulus	7	4.00%
Cladocera	6	3.43%
Acari	6	3.43%
Copepoda	4	2.29%
TOTAL DOMINANTS	166	94.86%

SAPROBITY

Hilsenhoff Biotic Index	7.19

DIVERSITY

Shannon H (loge)	3.05
Shannon H (log2)	2.12
Margalef D	2.90
Simpson D	0.14
Evenness	0.13

VOLTINISM

TYPE	# TAXA	PERCENT
Multivoltine	5	10.29%
Univoltine	9	74.86%
Semivoltine	2	14.86%

TAXA CHARACTERS

	#TAXA	PERCENT
Tolerant	7	49.71%
Intolerant	0	0.00%
Clinger	1	0.57%

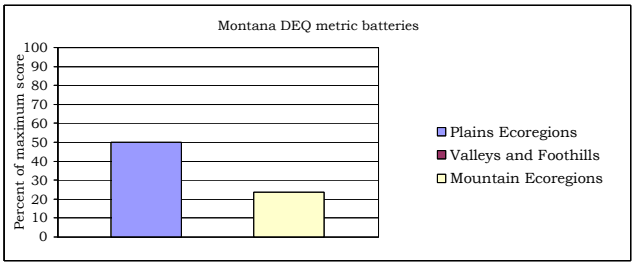
BIOASSESSMENT INDICES

B-IBI (Karr et al.)

METRIC	VALUE	SCORE	
Taxa richness	16	1	
E richness	1	1	
P richness	0	1	
T richness	0	1	
Long-lived	2	1	
Sensitive richness	0	1	
%tolerant	49.71%	3	
%predators	27.43%	3	
Clinger richness	1	1	
%dominance (3)	58.86%	3	
	TOTAL SCORE	16	32%

MONTANA DEQ METRICS (Bukantis 1998)

METRIC	VALUE	Plains Ecoregions	Valleys and Foothills	Mountain Ecoregions
Taxa richness	16	1	1	0
EPT richness	1	0	0	0
Biotic Index	7.19	0	0	0
%Dominant taxon	25.71%	3	3	2
%Collectors	53.71%	3	3	3
%EPT	2.29%	0	0	0
Shannon Diversity	2.12	1		
%Scrapers +Shredders	4.57%	1	0	0
Predator taxa	6	3		
%Multivoltine	10.29%	3		
%H of T	#DIV/0!		#DIV/0!	
TOTAL SCORES		15	#DIV/0!	5
PERCENT OF MAXIMUM		50.00	#DIV/0!	23.81
IMPAIRMENT CLASS		MODERATE	#DIV/0!	MODERATE



Montana Plains ecoregions metrics (Bramblett and Johnson)

Riffle		*Pool*	
EPT richness	1	E richness	1
Percent EPT	2.29%	T richness	0
Percent Oligochaetes and Leeches	34.29%	Percent EPT	2.29%
Percent 2 dominants	44.57%	Percent non-insect	73.14%
Filterer richness	1	Filterer richness	1
Percent intolerant	0.00%	Univoltine richness	9
Univoltine richness	9	Percent supertolerant	64.57%
Percent clingers	0.57%		
Swimmer richness	4		