MONTANA DEPARTMENT OF TRANSPORTATION
WETLAND MITIGATION MONITORING REPORT: YEAR 2007

DH Ranch
Edgar, Montana

Prepared for:

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

Prepared by:

POST, BUCKLEY, SCHUH, AND JERNIGAN
801 North Last Chance Gulch, Suite 101
Helena, MT 59601-3360

December 2007

PBS&J Project No: B43088.00 - 0516

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1.0 INTRODUCTION

This report presents the results of the first year (2007) of wetland monitoring at the DH Ranch wetland mitigation project. This mitigation site was constructed during the spring of 2007 in the eastern portion of the Upper Yellowstone River watershed (Watershed #13). Approximately 17.4 acres of wetland credit at this site is to be provided to the Montana Department of Transportation (MDT) through a credit purchase agreement. It is anticipated that this site will compensate for wetland impacts resulting from MDT highway and bridge reconstruction projects in the watershed. The DH Ranch mitigation site was constructed on private property owned by Mr. George Duke. The goal of the project is to create wetland hydrology at the site, and thereby ultimately provide up to 23 acres of palustrine emergent and scrub-shrub wetland within the confines of the site. Prior to construction, approximately 0.38 acre of palustrine emergent and scrub-shrub wetland had been incidentally created along irrigation ditches traversing the site.

The site occurs at an elevation of approximately 3,430 feet above mean sea level and is located approximately three miles northeast of Edgar, MT in Carbon County on the eastern floodplain of the Clark Fork of the Yellowstone River. It can be found on the Silesia, MT U.S. Geologic Survey 7.5 minute topographic quadrangle in the SE ¼ of Section 1, Township 4 South, Range 23 East (**Figure 1**). Approximate universal transverse mercator (UTM) coordinates for the central portion of the site are (Zone 12N) 5,041,967 Northing, 669,792 Easting.

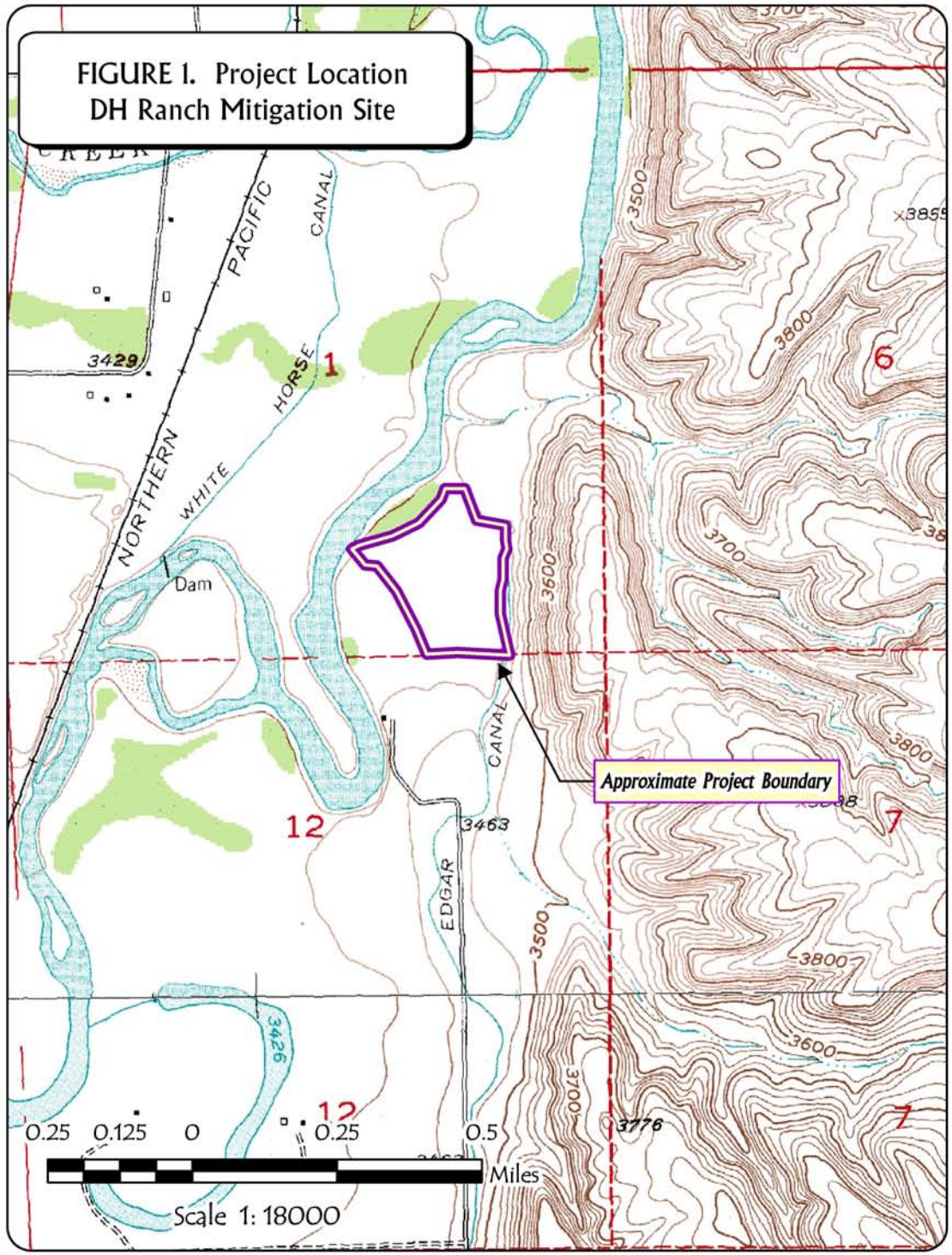
The approximate site boundary is illustrated on **Figure 2** (**Appendix A**) and on the plan sheet in **Appendix D**. The project is a wetland creation project and includes a series of wetland cells supplied primarily by irrigation return flow, with some minimal contributions from precipitation. Monitoring occurs on the site in mid-summer when all wetland data are collected. Wetland crediting ratios for the site are 1:1 for wetland creation areas and 4:1 for riparian buffers.

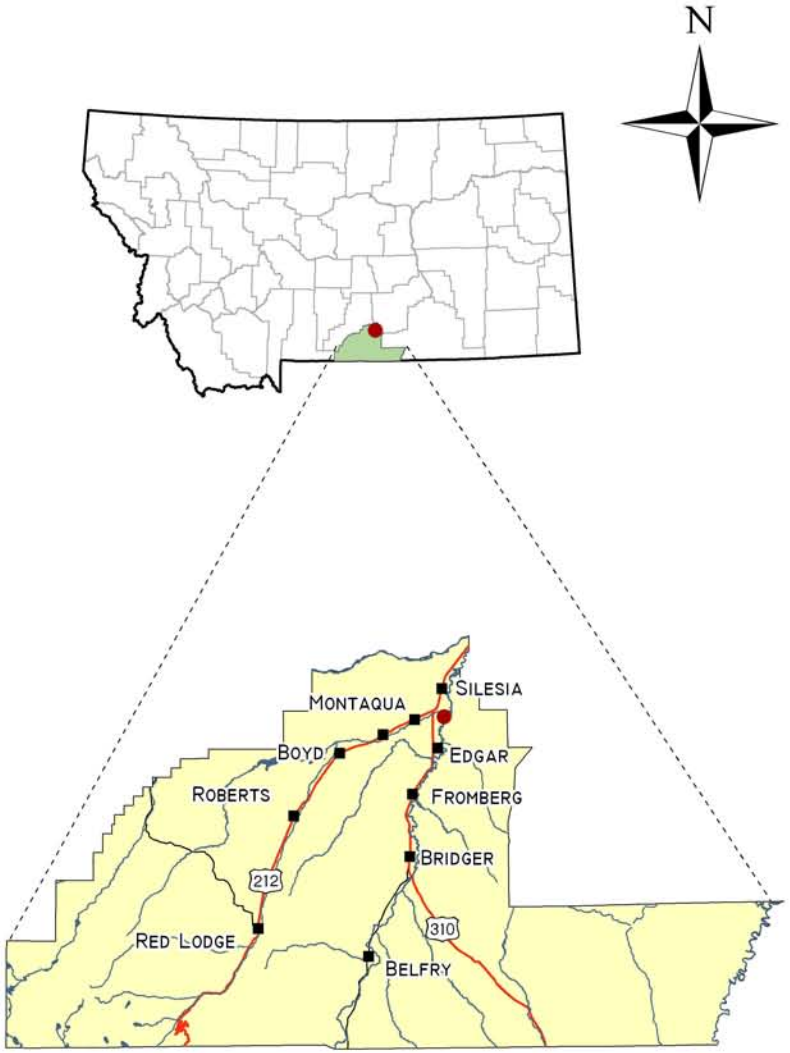
2.0 METHODS

2.1 Monitoring Dates and Activities

A reconnaissance site visit was performed with MDT on August 16, 2007 and the site was monitored on September 7, 2007 (mid-season visit). Habitat mapping was performed on October 8, 2007. The mid-season visit was conducted to document vegetation, soil, and hydrologic conditions used to map jurisdictional wetlands. The majority of the 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; macroinvertebrate sampling; functional assessment; and survival of planted woody vegetation.

FIGURE 1. Project Location
DH Ranch Mitigation Site





PROJECT #: B43088.00 0516
DATE: September 2007
LOCATION: DH Ranch
PROJECT MANAGER: R. McEldowney
DRAWN BY: MSA

PBS&J
801 N. Last Chance Gulch, Ste. 101 Helena, MT 59601

2.2 Hydrology

Hydrologic indicators were evaluated during the mid-season visit. Wetland hydrology indicators were recorded using procedures outlined in the Corps of Engineers (COE) Wetlands Delineation Manual (Environmental Laboratory 1987) and hydrology data were recorded on COE Routine Wetland Delineation Data Forms (**Appendix B**). 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.

All additional hydrologic data were recorded on the mitigation site monitoring form (**Appendix B**). 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.

2.3 Vegetation

General dominant species-based vegetation community types (e.g., *Scirpus acutus/Mixed graminoids*) were delineated on an aerial photograph during the October 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**).

A 10-foot wide belt transect was established **(Figure 2** in **Appendix A)**. Within the transect belt percent cover was estimated for each vegetative species for each 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%).

The purpose of the transect is to evaluate changes over time, especially the establishment and increase of hydrophytic vegetation. The transect location was marked on the aerial photo and all data recorded on the mitigation site monitoring form. Transect endpoint locations were recorded with a global positioning system (GPS) unit. Metal fence posts were utilized to physically mark the transect ends. Photos of the transect were taken from both ends during the mid-season visit. A comprehensive plant species list for the site was compiled.

Several woody species were planted at this mitigation site. Observers recorded the number of dead individuals for each species observed.

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 were 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 2003).

2.5 Wetland Delineation

A wetland delineation of the mitigation site was conducted during the 2007 mid-season visit according to the 1987 COE of Engineers Wetland Delineation Manual. Wetland and upland areas within the monitoring area were investigated for the presence of wetland hydrology, hydrophytic vegetation and hydric soils. The indicator status of vegetation was derived from the National List of Plant Species that occur in Wetlands: Northwest (Region 9) (Reed 1988).

The information was recorded on COE Routine Wetland Delineation Data Forms (**Appendix B**). The wetland/upland boundary was delineated with a resource grade global positioning system (GPS). The wetland/upland boundary in combination with the wetland/open water habitat boundary was used to calculate the wetland area that has developed within the monitoring area.

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 monitoring is compared to this 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 mid-season visit, bird observations were recorded incidental to other monitoring activities. Observations were categorized by species, activity code, and general habitat association (**Appendix B**).

2.8 Macroinvertebrates

One macroinvertebrate sample was collected during the mid-season site visit. Macroinvertebrate sampling procedures and analysis are included in **Appendix F**. The approximate location of this sample point, within emergent marsh habitat in the southeast portion of the site, is shown on **Figure 2** in **Appendix A**. The sample was preserved as outlined in the sampling procedure and sent to a laboratory for analysis.

2.9 Functional Assessment

Functional assessment forms were completed for the site within the monitoring area using the 1999 MDT Montana Wetland Assessment Method (Berglund 1999). Field data necessary for this assessment were collected during the mid-season site visit. The remainder of the functional assessment was completed in the office.

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, macroinvertebrate sampling location, and the vegetation transect (**Appendix C**). Each photograph point location was recorded with a GPS. The approximate location of photo points is shown on **Figure 2** in **Appendix A**. All photographs were taken using a digital camera, with no optical zoom used. A description and compass bearing for each photograph was recorded on the wetland monitoring form.

2.11 GPS Data

During the 2007 monitoring season, data were collected with a resource grade Magellan Mobile Mapper unit at the vegetation transect beginning and ending locations, at all photograph locations, wetland sample points, and at aerial photograph reference points. Procedures used for GPS mapping and aerial photography referencing are included in **Appendix E.**

2.12 Maintenance Needs

Where encountered, current or potential future problems were documented and conveyed to MDT.

3.0 RESULTS

3.1 Hydrology

Irrigation return flow is the primary source of water at the DH Ranch mitigation site. Irrigation return flows enter the south end of the site and are diverted to inundate/saturate the majority of the site. An outfall structure is located in the northeastern corner of the site.

The NRCS estimates that the growing season in Joliet, MT, extends from May 5th through September 29th, and is approximately 147 days long (NRCS 2002). Therefore, wetland hydrology requirements are met if the site remains saturated to the soil surface for a minimum of seven consecutive days (5 percent of the growing season). The closest active weather station to the wetland monitoring area is Bridger, MT station #241101. According to the Western Regional Climate Center (WRCC) (2007), mean annual precipitation at this station is approximately 11.49 inches; with the majority of precipitation occurring in April, May, June, and September and October. The precipitation total through October 2007 at the Bridger weather station was 9.08 inches (WRCC 2007). As an example of evapotranspiration in the area, the evapotranspiration rate (Penman equation) during the 2005 growing season (May – Sept) is estimated to have been approximately 35.59 inches at the South Bridger, Montana remote automated weather station (RAWS) (BLM-RAWS 2007); more than three times the yearly precipitation rate.

Inundation was present to various extents at all wetland cells within the monitoring area during the mid-season visit. Open water areas are shown on **Figure 3** (**Appendix A**). Water depths

ranged from 0 to roughly 1.5 feet, with an average depth of approximately 0.25 foot. No groundwater monitoring wells were observed.

3.2 Vegetation

Vegetation species identified on the site are presented in **Table 1** and on the **Monitoring Form** (**Appendix B**). Construction of the site was completed in July 2007 and much of the site has not revegetated from the herbicide treatment and construction impacts. A total of six main community types were documented at the site, with the Disturbed community type being divided into two subtypes – wetland and upland. Five of these community types are vegetated wetland community types. These wetland community types were identified and mapped (**Figure 3** in **Appendix A**) as: *Scirpus acutus*/Mixed graminoids (Bulrush), *Typha latifolia*/Mixed graminoids (Cattail), *Scirpus maritimus*/Mixed graminoids (Alkali Bulrush), *Salix amygdaloides*, Disturbed – wetland, Disturbed – upland, and Open Water. Dominant species within each of these communities are listed on the **Monitoring Forms** (**Appendix B**).

The bulrush and cattail community types occur as pockets throughout the site in slightly deeper, more permanently flooded areas. The alkali bulrush community type occurs in the southeast portion of the mitigation area. Disturbed-wetland areas were just becoming established in 2007 and are dominated by a variety of annuals such as barnyard grass (*Echinochloa muricata*) and perennials. In terms of water regime and depth, these disturbed-wetland areas are similar to the alkali bulrush habitat type and may develop into that type of marsh over time. Open water areas vary in depth, but appear to be relatively shallow and will likely develop into bulrush and cattail marshes over the next several years.

Disturbed-upland communities differ from disturbed-wetland communities by having a distinctly different water regime and a prevalence of facultative, facultative-upland, and upland plant species. Without intervention these areas are not expected to develop into wetlands.

Vegetation community data were recorded from a 10-foot wide belt transect (**Monitoring Forms** in **Appendix B**) and summarized in **Table 2**. In this first year of monitoring, vegetation is in a state of transition. If a similar hydrologic regime is perpetuated in future years as was observed on the site in 2007, it is expected that the total number of plant species will decrease, number of upland species will decrease, and total vegetative cover will increase. **Charts 1** and **2** show the results of the transect monitoring graphically.

A total of 320 woody plantings were found onsite. Observed mortality of planted woody vegetation species is summarized below in **Table 3**. As of September 7, 2007, the overall survival rate is estimated at 80 percent, with a total of 64 individuals observed to be dead. The most commonly planted species was silver buffaloberry (*Shepherdia argentea*), but the species with the highest level of survival was four-wing saltbush (*Atriplex canescens*).

Table 1: ***2007 vegetation species list for the DH Ranch Wetland Mitigation Site.***

Scientific Name	1988 Region 9 (Northwest) Wetland Indicator Status	Scientific Name	1988 Region 9 (Northwest) Wetland Indicator Status
Achillea millefolium	FACU	*Phalaris arundinaceae*	FACW
Alopecurus arundinaceus	NI	*Plantago major*	FAC+
Ambrosia trifida	FAC	*Poa pratensis*	FACU+
Ambrosia sp.	--	*Polygonum sp.*	FACW
Artemesia cana	FAC	*Populus deltoides*	FAC
Asclepias sp.	--	*Potentilla anserina*	OBL
Asparagus officinalis	FACU	*Purple aster*	??
Atriplex canescens (planted)	UPL	*Rhus trilobata* (planted)	NI
Bromus inermis	--	*Rosa woodsii*	FACU
Bromus tectorum	--	*Rumex crispus*	FACW
Capsella bursa-pastoris	FAC-	*Salix amygdaloides*	FACW
Carex sp.	(FACW)	*Salix exigua (planted)*	OBL
Chenopodium album	FAC	*Salix sp.*	(FACW)
Chrysothamnus nauseosus	--	*Sarcobatus vermiculatus*	FACU+
Cirsium arvense	FACU+	*Scirpus acutus*	OBL
Convolvulus arvensis	--	*Scirpus maritimus*	OBL
Cynoglossum officinale	--	*Scirpus microcarpus*	OBL
Distichlis spicata	FACW	*Scirpus pungens*	OBL
Echinochloa muricata	FACW	*Shepherdia argentea* (planted)	--
Elaeagnus angustifolia	FAC	*Sisymbrium altissimum*	FACU-
Eleocharis palustris	OBL	*Solanum sp.*	--
Elymus trachycaulus	FAC	*Sporobolus airoides*	FAC-
Festuca pratensis	FACU+	*Symphoricarpos albus*	FACU
Grindelia squarrosa	FACU	*Taraxacum officinale*	FACU
Hordeum jubatum	FAC+	*Thlaspi arvense*	NI
Juncus balticus	OBL	*Tragopogon dubius*	--
Juncus bufonius	FACW+	*Trifolium pratense*	FACU
Juncus effusus	FACW+	*Trifolium repens*	FACU+
Kochia scoparia	FAC	*Typha angustifolia*	OBL
Lactuca serriola	FACU	*Typha latifolia*	OBL
Lepidium perfoliatum	FACU+	*Verbascum thapsus*	--
Medicago sativa	--	*Verbena bracteata*	FACU+
Melilotus sp.	FACU	*Veronica sp.*	(FACW-OBL)

Table 2: ***2007 vegetation transect data summary.***

Monitoring Year	2007
Transect Length (feet)	645
# Vegetation Community Transitions along Transect	9
# Vegetation Communities along Transect	3
# Hydrophytic Vegetation Communities along Transect	2
Total Vegetative Species	39
Total Hydrophytic Species	20
Total Upland Species	19
Estimated % Total Vegetative Cover	50
% Transect Length Comprised of Hydrophytic Vegetation Communities	88.4
% Transect Length Comprised of Upland Vegetation Communities	11.6
% Transect Length Comprised of Unvegetated Open Water	0
% Transect Length Comprised of Bare Substrate	0

Table 3: ***2007 observed mortality of planted woody species for the DH Ranch Wetland Mitigation Site.***

Species	Living	Dead
Rhus trilobata	88	15
Shepherdia argentea	125	47
Atriplex canescens	39	1
Unidentified	4	1
Total Planted	**256**	**64**

Chart 1: ***Transect map showing vegetation types from the start of transect (0 feet) to the end of transect (645 feet) for 2007.***

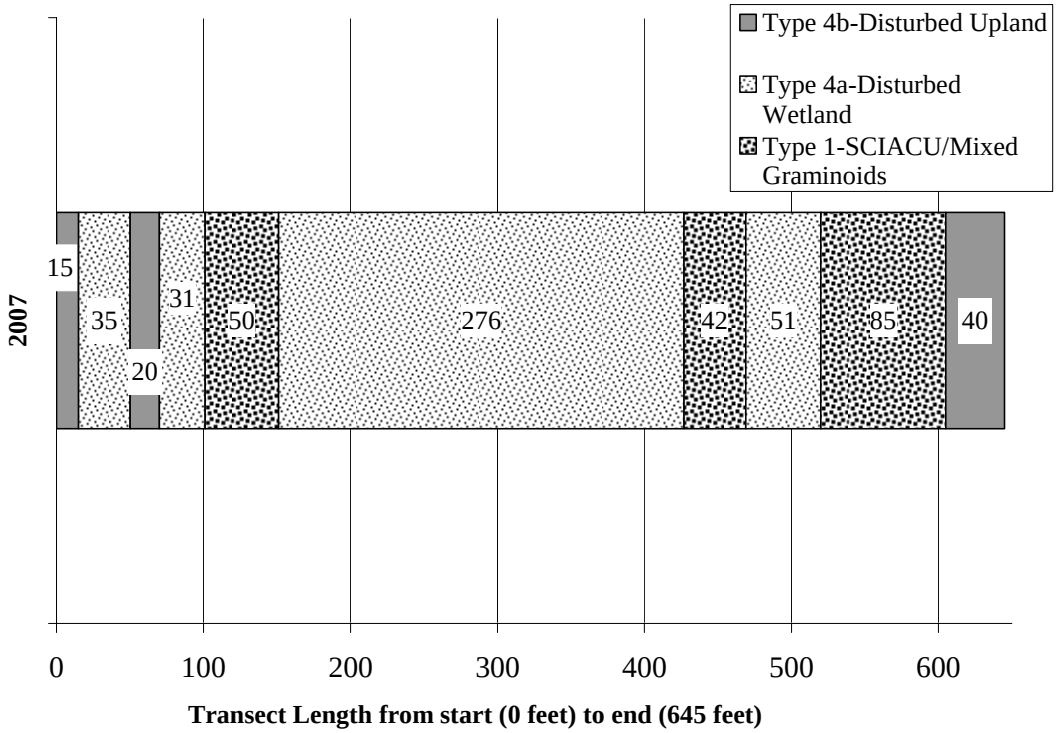
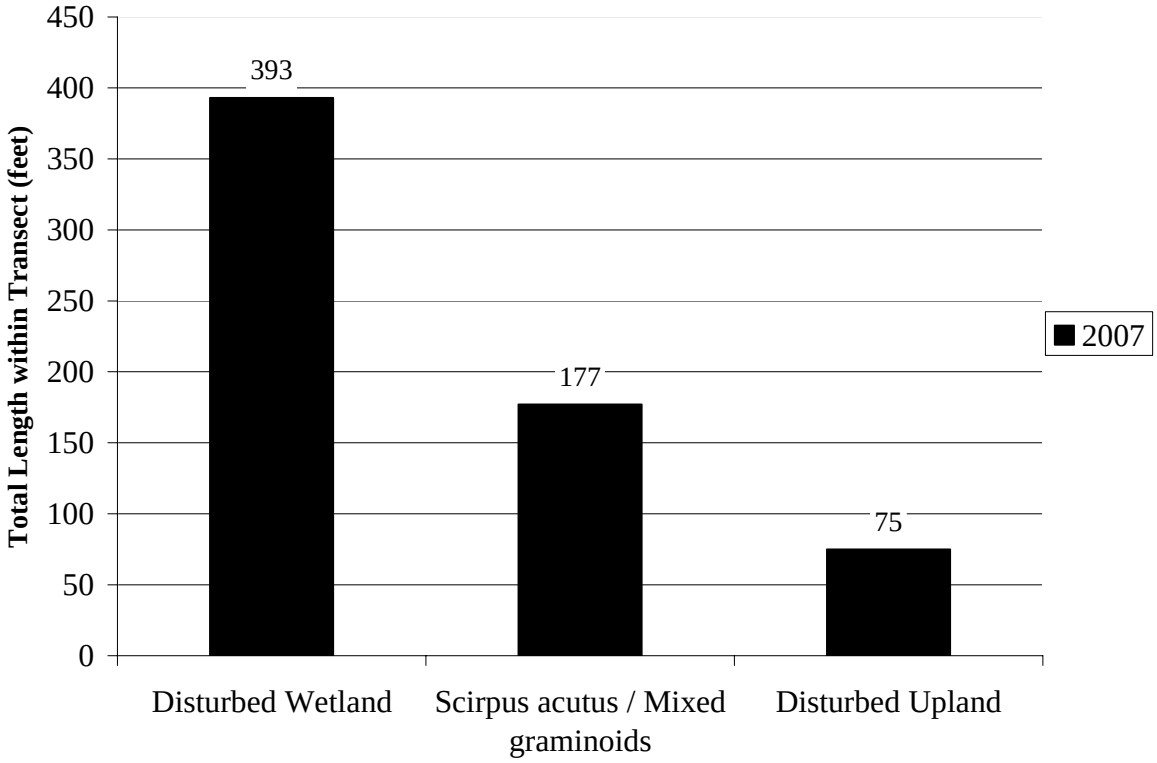


Chart 2: ***Length of vegetation communities within Transect 1 for 2007.***



3.3 Soils

Since the site was excavated and graded in spring/early summer 2007, soils are highly disturbed throughout the site. Soils sampled in wetland areas were inundated and comprised of silty clay. The matrix color was 2.5YR 3/1 and contained distinct mottles (5YR 3/4) and a sulfidic odor.

3.4 Wetland Delineation

Delineated wetland boundaries are illustrated on **Figure 3** (**Appendix A**). Completed COE Wetland Delineation Forms are included in **Appendix B**. Soils, vegetation, and hydrology were discussed in preceding sections. Total aquatic habitat on the site in 2007 was 16.70 acres (**Figure 3** in **Appendix A**). Wetlands comprised 11.31 acres of the 16.70-acre total.

Open water comprised 5.39 acres of the 16.70-acre total. Shallow open water habitat observed in 2007 is expected to continue to become vegetated with emergent hydrophytic species over time. Credits that have developed to date are discussed below in **Section 3.10**.

3.5 Wildlife

Though only constructed in 2007, the wetland complex created on the site provides habitat for several wildlife and bird species. Four mammal, one reptile, two amphibian, and 16 bird species were observed at the site during 2007 monitoring (**Table 4**). The habitat value of the site is

expected to increase as vegetation continues to establish and diversify. Shorebirds were prevalent during site monitoring, likely due to the large amount of bare ground.

Table 4: ***Fish and wildlife species observed at the DH Ranch Wetland Mitigation Site in 2007.***

AMPHIBIAN	
Northern leopard Frog (*Rana pipiens*) Woodhouse's toad (*Bufo woodhousii*)	
REPTILE	
Plains garter snake (*Thamnophis radix*)	
BIRD	
American White Pelican (*Pelecanus erythrorhynchos*) American Goldfinch (*Carduelis tristis*) American Robin (*Turdus migratorius*) Canada Goose (*Branta canadensis*) Common Snipe (*Gallinago gallinago*) Eastern Kingbird (*Tyranus tyranus*) Golden Eagle (*Aquila chrysaetos*) Grasshopper Sparrow (*Ammodramus savannarum*)	Greater Yellowlegs (*Tringa melanoleuca*) Killdeer (*Charadrius vociferous*) Lesser Yellowlegs (*Tringa flavipes*) Mourning Dove (*Zenaida macroura*) Sandhill Crane (*Grus canadensis*) Solitary Sandpiper (*Tringa solitaria*) Spotted Sandpiper (*Actitis macularia*) Wild Turkey (*Meleagris gallopavo*)
MAMMAL	
Deer (*Odocoileus sp.*) Cottontail (*Sylvilagus sp.*) Raccoon *(Procyon lotor)* Black-tailed prairie dog (*Cynomys ludovicianus*) Black bear (*Ursus americanus*) (observed by landowner)	

3.6 Macroinvertebrates

Macroinvertebrates were sampled at the northeast corner of the site (**Figure 2** in **Appendix A**). This results are typical of a newly constructed mitigation site. Sampling results are provided in **Appendix F** and were summarized by Rhithron Associates in the italicized section below (Bollman 2007).

> *Invertebrates were abundant at this site, but diversity was low. Snails (*Physa *sp. and* Stagnicola *sp.) were the dominant taxa, accounting for 64% of collected animals. Periodic drying at this site cannot be ruled out. Habitats may be underdeveloped or monotonous. Very warm water temperatures (about 20.0ºC) are suggested by the assemblage supported here. The bioassessment score of 40% indicates poor biotic conditions.*

3.7 Functional Assessment

Completed functional assessment forms are presented in **Appendix B** and are summarized in **Table 5**. For comparative purposes, the functional assessment results for baseline conditions prepared by Oasis Environmental in 2005 are also included in **Table 5**.

The created wetlands at DH Ranch were ranked as Category II wetlands in 2007 as compared to Category III in 2005. Functions that increased substantially over 2005 baseline conditions include general wildlife habitat, short and long term surface water storage, sediment/nutrient/toxicant removal, and production export. The pre-project site provided about 1.596 functional units within the monitoring area, and the post-project site currently provides about 73.5 functional units, for a conservative gain of roughly 71 functional units.

3.8 Photographs

Representative photographs taken from photo-points and transect ends are provided in **Appendix C**.

3.9 Maintenance Needs/Recommendations

Several breaches in berms were identified during the reconnaissance site visit, but were repaired prior to site monitoring in September. No other specific maintenance issues were identified, however, it may be worthwhile to adjust the distribution of water on the site in order to maximize the available acreage.

In the mitigation design report (ADC 2006), the berm areas are indicated to be riparian scrub-shrub areas. These areas were bare ground and had not been planted with riparian shrubs when the site was monitored, though some cottonwood seedlings had established. It is likely that these seedlings will grow taller in subsequent years, however they occur in a single line near the bases of the berms. If these berm areas are to be counted for credit in future years it is likely that the upper portions of the berms will need to be planted with shrubby riparian species.

Table 5: ***Summary of baseline and 2007 wetland function/value ratings and functional points[1] at the DH Ranch Wetland Mitigation Site.***

Function and Value Parameters from the 1999 MDT Montana Wetland Assessment Method[1]	2005 Baseline Assessment	2007
Listed/Proposed T&E Species Habitat	Low (0.0)	Low (0.0)
MNHP Species Habitat	Low (0.1)	Low (0.1)
General Wildlife Habitat	Mod (0.5)	High (0.9)
General Fish/Aquatic Habitat	NA	NA
Flood Attenuation	NA	NA
Short and Long Term Surface Water Storage	Low (0.3)	High (1.0)
Sediment, Nutrient, Toxicant Removal	NA	Mod (0.7)
Sediment/Shoreline Stabilization	High (0.9)	Low (0.3)
Production Export/Food Chain Support	Mod (0.5)	High (0.9)
Groundwater Discharge/Recharge	NA	Low (0.1)
Uniqueness	Mod (0.4)	Low (0.3)
Recreation/Education Potential	Low (0.1)	Low (0.1)
Actual Points/Possible Points	2.8/8	4.4/10
% of Possible Score Achieved	35	44
Overall Category	III	II
Total Acreage of Assessed Aquatic Habitat within AA Boundaries	**0.570**	**16.70**
Functional Units (acreage x actual points)	**1.596**	**73.50**
Net Acreage Gain	NA	**16.13**
Net Functional Unit Gain	NA	**71.90**

[1] See completed MDT functional assessment forms in **Appendix B** for further detail.

According to the mitigation design report, groundwater monitoring wells will be installed in each credit area to verify the hydrology of the site. No monitoring wells were observed during the mid-season visit.

3.10 Current Credit Summary

The wetland mitigation design for the DH Ranch indicated that a maximum of 21.1 acres of wetland, 1.7 acres of shrub dominated riparian islands and 0.8 acre of riparian buffer could be generated by the site (ADC 2006). **Tables 6** and **7** summarize the acreages and credits created as of the first year of wetland monitoring.

Success criteria for all created wetland areas will be based on the following criteria:

1. Sites will develop hydrophytic vegetation, wetland hydrology, and hydric soils as outlined in the COE 1987 wetlands delineation manual.
2. Ocular coverage of desirable herbaceous wetland plant species will be at least 80 percent. No species may comprise more than 25 percent of a vegetated layer. Non-preferred species will comprise a maximum of 10 percent of any given wetland area.
3. Soil saturation will be present for at least 12.5 percent of the growing season (18 days). A monitoring well will be installed in each credit area to verify this.
4. Woody planting zones (berms) will have a minimum of 1,000 stems/acre

Table 6: ***Summary of open water and wetland acreages at the DH Ranch Wetland Mitigation Site for 2005 and 2007.***

Period	Open Water (acre)	Wetland (acre)	Total Aquatic Habitat (acre)
2005 (pre-mitigation creation)	0.00	0.57	0.57
2007 -Monitoring Year 1 (post-construction)	5.39	11.31	16.70

The COE will determine which crediting ratios are applicable to the site. However, using the credit ratios listed, **Table 7** summarizes compensatory mitigation credits developed to date at DH Ranch. No groundwater monitoring wells have been installed on the site, and therefore the success criteria for hydrology cannot be completely confirmed. However, wetland hydrology was assumed based on typical field indicators, and credits were tentatively assigned to wetland creation areas. Standing water was observed in open water areas, and so credits were also assigned for those areas.

Credits for the upland buffer were not assigned in 2007 because the area is generally unvegetated, though many woody shrub species had been planted. The wetland mitigation design report (ADC 2006) also includes a credit category for shrubby riparian islands that would be located on the water diversion berms. These berms were essentially unvegetated, and so no credits were calculated for them this year. Based on this information and assumed credit ratios for wetlands, open water, and upland buffer, approximately 13.57 acres of credit, or 78% of the 17.4-acre MDT credit purchase goal, are currently available at the DH Ranch mitigation site (**Table 7**). Credits for wetland creation and upland buffer areas may be negotiated between the COE and MDT at their discretion.

Table 7: ***2007 mitigation credit summary for the DH Ranch Wetland Mitigation Site.***

Credit Category	Acre	Assumed Credit Ratio[a]	Credit [a]
Emergent wetland creation	11.31	1:1	11.31[c]
Open water	5.39	Up to 20% of wetland area	2.26
Upland buffer[b]	0.80	4:1	0.00[c]
TOTAL	**17.50**		**13.57**

[a] The Corps of Engineers is the regulatory authority and will determine the actual mitigation ratios.
[b] The upland/riparian buffer acreage was derived from the ADC (2006) report.
[c] All success criteria have not been met. Credits for these areas may be negotiated between MDT and the COE.

The pre-project site provided about 1.596 functional units within the monitoring area, and the post-project site currently provides about 73.5 functional units, for a conservative gain of roughly 71 functional units.

4.0 REFERENCES

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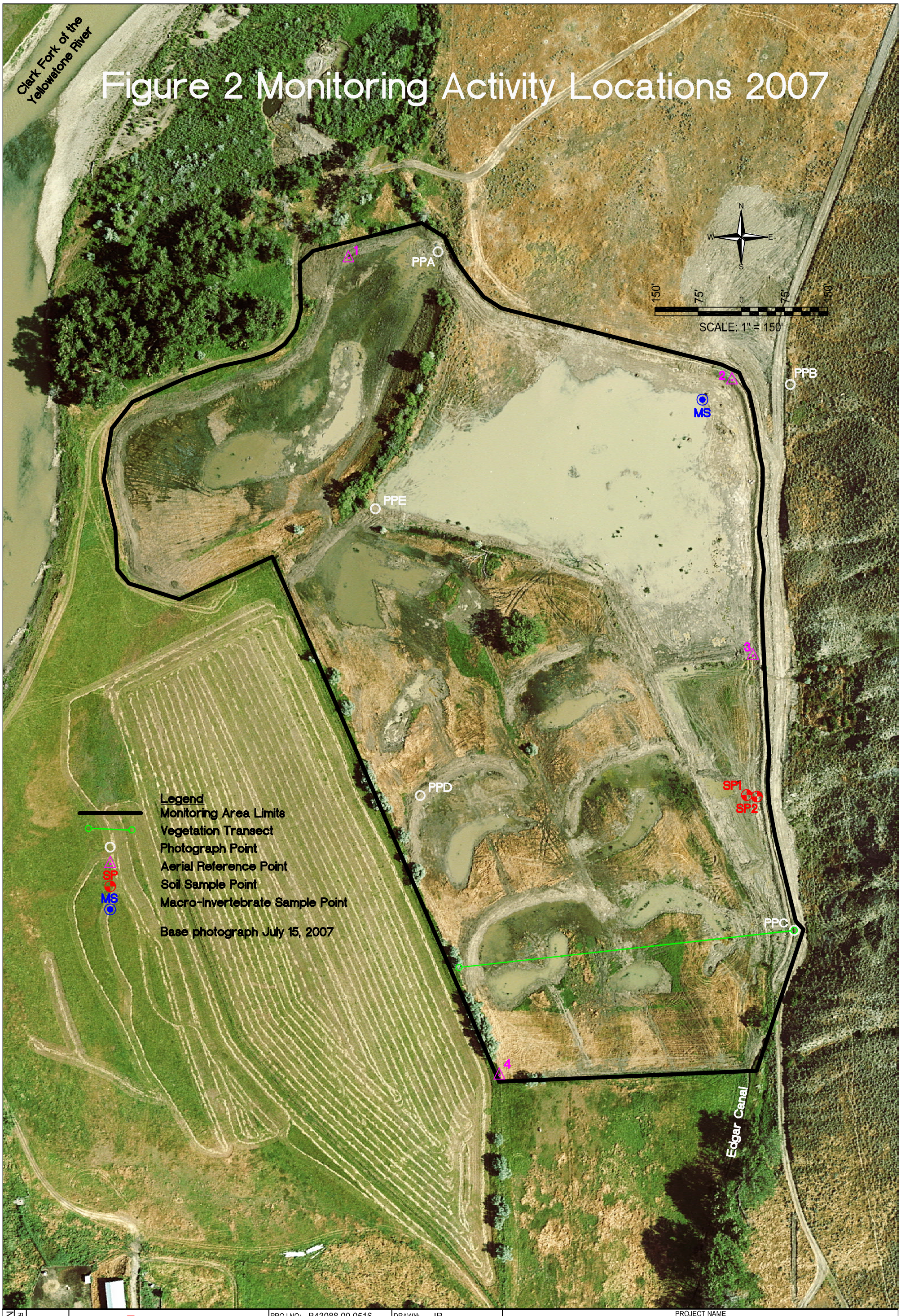
Appendix A

FIGURES 2 & 3

MDT Wetland Mitigation Monitoring
DH Ranch
Edgar, Montana

Figure 2 Monitoring Activity Locations 2007



REV - Nov/13/2007	FIGURE 2 OF	PBSJ 3810 Valley Commons Drive Suite 4 Bozeman, MT 59718	PROJECT NAME: MDT DH RANCH WETLAND MITIGATION
		PROJ NO: B43088.00 0516 / DRAWN: JR	
		LOCATION: EDGAR, MT / PROJ MGR: J. BERGLUND	
		SCALE: NOTED / CHECKED: RM / APPVD: JB	DRAWING TITLE: MONITORING ACTIVITY LOCATIONS 2007
		FILE NAME: 2007 BASE.dwg	

Figure 3 Mapped Site Features 2007

Clark Fork of the Yellowstone River

N
W E
S

150' 75' 0 75' 150'

SCALE: 1" = 150'

Legend

- Monitoring Area Limits
- Wetland Boundary
- Open Water
- Vegetation Community Boundary

Base photograph July 15, 2007

Wetland Area:

Gross Wetland	16.70 acres
Open Water Area	5.39 acres
Net Wetland	11.31 acres

Vegetation Types

1. Scirpus acutus/Mixed graminoids
2. Typha latifolia/Mixed graminoids
3. Scirpus maritimus/Mixed graminoids
4a. Disturbed - wetland
4b. Disturbed - upland
5. Open water
6. Salix amygdaloides

Edgar Canal

REV - Nov/13/2007	FIGURE 3 OF	PBSJ 3810 Valley Commons Drive Suite 4 Bozeman, MT 59718	PROJ NO: B43088.00 0516 | DRAWN: JR LOCATION: EDGAR, MT | PROJ MGR: J. BERGLUND SCALE: NOTED | CHECKED: RM | APPVD: JB FILE NAME: 2007 BASE.dwg

PROJECT NAME
MDT DH RANCH WETLAND MITIGATION

DRAWING TITLE
MAPPED SITE FEATURES 2007

Appendix B

2007 WETLAND MITIGATION SITE MONITORING FORMS
2007 COE WETLAND DELINEATION FORMS
2007 FUNCTIONAL ASSESSMENT FORMS

MDT Wetland Mitigation Monitoring
DH Ranch
Edgar, Montana

PBS&J / MDT WETLAND MITIGATION SITE MONITORING FORM

Project Name: **DH Ranch** Project Number: _____
Assessment Date: **September 7, 2007** Person(s) conducting the assessment: **McEldowney**
Location: **Edgar, MT** MDT District: **Billings** Milepost: _____
Legal Description: T **4S** R **23E** Section **1**
Weather Conditions: **Clear, 70 deg F, calm** Time of Day: **8 am - 6 pm**
Initial Evaluation Date: **September 7, 2007** Monitoring Year: **1** # Visits in Year: **1**
Size of evaluation area: **23 acres** Land use surrounding wetland: **Natural, agricultural**

HYDROLOGY

Surface Water Source: **Irrigation return flow**
Inundation: **Present** Average Depth: **0.25 feet** Range of Depths: **0 - 1.5 ft**
Percent of assessment area under inundation: **85%**
Depth at emergent vegetation-open water boundary: **1 foot**
If assessment area is not inundated then are the soils saturated within 12 inches of surface: _
Other evidence of hydrology on the site (ex. – drift lines, erosion, stained vegetation, etc.):
Cottonwood seedling lines, drift lines

Groundwater Monitoring Wells: **Absent**
Record depth of water below ground surface (in feet):

Well Number	Depth	Well Number	Depth	Well Number	Depth

Additional Activities Checklist:
☒ Map emergent vegetation-open water boundary on aerial photograph.
☒ Observe extent of surface water during each site visit and look for evidence of past surface water elevations (drift lines, erosion, vegetation staining, etc.)
☒ Use GPS to survey groundwater monitoring well locations, if present.

COMMENTS / PROBLEMS:
No groundwater wells observed onsite.

VEGETATION COMMUNITIES

Community Number: **1** Community Title (main spp): **Scirpus acutus/Mixed graminoids**

Dominant Species	% Cover	Dominant Species	% Cover
Scirpus acutus	3 = 11-20%	Polygonum sp.	+ = < 1%
Typha latifolia	2 = 6-10%	Echinochloa muricata	1 = 1-5%
Scirpus maritimus	1 = 1-5%		
Eleocharis palustris	+ = < 1%		
Juncus effusus	+ = < 1%		
Hordeum jubatum	+ = < 1%		

Comments / Problems: **Contains a significant component of open water.**

Community Number: **2** Community Title (main spp): **Typha latifolia/Mixed graminoids**

Dominant Species	% Cover	Dominant Species	% Cover
Typha latifolia	3 = 11-20%		
Scirpus acutus	1 = 1-5%		
Scirpus maritimus	1 = 1-5%		
Scirpus pungens	1 = 1-5%		

Comments / Problems: _____

Community Number: **3** Community Title (main spp): **Scirpus maritimus/Mixed graminoids**

Dominant Species	% Cover	Dominant Species	% Cover
Scirpus maritimus	5 = > 50%		
Hordeum jubatum	1 = 1-5%		
Echinochloa muricata	+ = < 1%		
Sporoblus airoides (?)	1 = 1-5%		
Distichlis spicata	1 = 1-5%		

Comments / Problems: _____

Community Number: **4** Community Title (main spp): **Disturbed**

Dominant Species	% Cover	Dominant Species	% Cover
Kochia scoparia	1 = 1-5%	Rumex crispus	1 = 1-5%
Hordeum jubatum	2 = 6-10%	Echinochloa muricata	2 = 6-10%
Scirpus pungens	+ = < 1%	Chenopodium sp.	1 = 1-5%
Populus deltoides	1 = 1-5%	Juncus balticus	+ = < 1%
Convovulus arvensis	1 = 1-5%	Plantago major	+ = < 1%
Cirsium arvense	+ = < 1%	Taraxacum officinale	

Comments / Problems: **Contains a wide variety of species. Additional species include Trifolium alba, Trifolium pratense, Eleocharis palustris, Bromus inermis, Veronica sp., Purple aster, Typha angustifolia, Phalaris arundinaeae, Verbascum thapsus, and Festuca pratensis.**

VEGETATION COMMUNITIES (continued)

Community Number: **5** Community Title (main spp): **Open water**

Dominant Species	% Cover	Dominant Species	% Cover
SCIACU	+ = < 1%		

Comments / Problems: _____

Community Number: **6** Community Title (main spp): **Salix amygdaloides**

Dominant Species	% Cover	Dominant Species	% Cover
Salix amygdaloides	5 = > 50%		
Populus deltoides	1 = 1-5%		

Comments / Problems: _____

Community Number: ___ Community Title (main spp): _____

Dominant Species	% Cover	Dominant Species	% Cover

Comments / Problems: _____

Community Number: ___ Community Title (main spp): _____

Dominant Species	% Cover	Dominant Species	% Cover

Comments / Problems: _____

VEGETATION COMMUNITIES (continued)

Community Number: ___ Community Title (main spp): _____

Dominant Species	% Cover	Dominant Species	% Cover

Comments / Problems: _____

Community Number: ___ Community Title (main spp): _____

Dominant Species	% Cover	Dominant Species	% Cover

Comments / Problems: _____

Community Number: ___ Community Title (main spp): _____

Dominant Species	% Cover	Dominant Species	% Cover

Comments / Problems: _____

Community Number: ___ Community Title (main spp): _____

Dominant Species	% Cover	Dominant Species	% Cover

Comments / Problems: _____

Additional Activities Checklist:

☐ Record and map vegetative communities on aerial photograph.

COMPREHENSIVE VEGETATION LIST

Plant Species	Vegetation Community Number (s)	Plant Species	Vegetation Community Number (s)
Achillea millefolium	4	*Phalaris arundinaceae*	4
Alopecurus arundinaceus	4	*Plantago major*	4
Ambrosia trifida	4	*Polygonum sp.*	1,5
Ambrosia sp.	4	*Populus deltoides*	4,6
Artemesia cana	4	*Potentilla anserina*	4
Asclepias sp.	4	*Rhus trilobata* (planted)	4
Asparagus officinalis	4	*Rosa woodsii*	4
Atriplex canescens (planted)	4	*Rumex crispus*	4
Bromus inermis	4	*Salix amygdaloides*	4,6
Bromus tectorum	4	*Salix exigua (planted)*	4
Capsella bursa-pastoris	4	*Sarcobatus vermiculatus*	4
Chenopodium album	4	*Scirpus acutus*	1,2,5
Chrysothamnus nauseosus	4	*Scirpus maritimus*	1,2,3,4
Cirsium arvense	4	*Scirpus microcarpus*	1,2,3
Convolvulus arvensis	4	*Scirpus pungens*	1,2,3
Cynoglossum officinale	4	*Shepherdia argentea* (planted)	4
Distichlis spicata	3,4	*Sisymbrium altissimum*	4
Echinochloa muricata	4	*Solanum sp.*	4
Elaeagnus angustifolia	4	*Sporobolus airoides*	3
Eleocharis palustris	1,2,3,4,5	*Symphoricarpos albus*	4
Elymus trachycaulus	4	*Taraxacum officinale*	4
Festuca pratensis	4	*Thlaspi arvense*	4
Grindelia squarrosa	4	*Tragopogon dubius*	4
Hordeum jubatum	4	*Trifolium pratense*	4
Juncus balticus	4	*Trifolium repens*	4
Juncus bufonius	4	*Typha angustifolia*	1,2
Juncus effusus	1,2,3	*Typha latifolia*	1,2,5
Kochia scoparia	4	*Verbascum thapsus*	4
Lactuca serriola	4	*Verbena bracteata*	4
Lepidium perfoliatum	4		
Medicago sativa	4		
Melilotus sp.	4		

Comments / Problems: _____

PLANTED WOODY VEGETATION SURVIVAL

Plant Species	Number Originally Planted	Number Observed	Mortality Causes
Rhus trilobata	103	88	Unknown, could be water availability, related to planting dates, or transplanting shock
Shepherdia argentea	172	125	Unknown, could be water availability, related to planting dates, or transplanting shock
Atriplex canescens	40	39	Unknown, could be water availability, related to planting dates, or transplanting shock
Unidentified	4	1	Unknown, could be water availability, related to planting dates, or transplanting shock

Comments / Problems: _____

WILDLIFE

Birds

Were man-made nesting structures installed? **No**
If yes, type of structure: _____ How many? _____
Are the nesting structures being used? **NA**
Do the nesting structures need repairs? _____

Mammals and Herptiles

Mammal and Herptile Species	Number Observed	Indirect Indication of Use			
		Tracks	Scat	Burrows	Other
Raccoon		☒	☐	☐	
Deer		☒	☐	☐	
Cottontail rabbit	1	☐	☐	☐	
Leopard frog	5	☐	☐	☐	
Woodhouse's toad	15	☐	☐	☐	
American bullfrog		☐	☐	☐	Auditory
Black-tailed prairie dog	3	☒	☐	☐	
Plains garter snake	1	☐	☐	☐	

Additional Activities Checklist:
NA Macroinvertebrate Sampling (if required)

Comments / Problems: _____

PHOTOGRAPHS

Using a camera with a 50mm lens and color film take photographs of the following permanent reference points listed in the check list below. Record the direction of the photograph using a compass. When at the site for the first time, establish a permanent reference point by setting a ½ inch rebar or fencepost extending 2-3 feet above ground. Survey the location with a resource grade GPS and mark the location on the aerial photograph.

Photograph Checklist:

- ☒ One photograph for each of the four cardinal directions surrounding the wetland.
- ☒ At least one photograph showing upland use surrounding the wetland. If more than one upland exists then take additional photographs.
- ☒ At least one photograph showing the buffer surrounding the wetland.
- ☒ One photograph from each end of the vegetation transect, showing the transect.

Location	Photograph Frame #	Photograph Description	Compass Reading (°)
Photopoint A	1	Lower marsh - cottonwood in center of photo.	188
Photopoint A	2	Lower marsh - Russian olive in center of photo	207
Photopoint A	3	Central portion of lower marsh	221
Photopoint A	4	West edge of lower marsh, berm	256
Photopoint B	1	Looking south along road.	179
Photopoint B	2	Lk across SE end of upper open water area	203
Photopoint B	3	Lk across main portion of open water area	238
Photopoint B	4	Lk along N end of open water area	264
Photopoint C	1	Lk at SE end of project area	212
Photopoint C	2	Lk toward house at S end of project area	239
Photopoint C	3	Lk toward river at south end of project area	272
Photopoint C	4	Lk diagonally across site toward NW corner	304
Photopoint C	5	Lk northward along road	334
Photopoint D	1	Lk toward NW corner of site.	337
Photopoint D	2	Lk toward N end of site.	354
Photopoint D	3	Lk toward NE corner of site.	42
Photopoint D	4	Lk along berm at E side of site.	75
Photopoint D	5	Lk E across open water area.	104
Photopoint D	6	Lk SE toward SE corner of site.	142
Photopoint D	7	Lk S along the SW side of the site.	165
Photopoint E	1	Lk N along vegetated berm at N end.	36
Photopoint E	2	Lk toward NE corner of site.	66
Photopoint E	3	Lk E along berm.	97
Photopoint E	4	Lk toward SE corner of site.	153
Photopoint E	5	Lk toward W side of site across open water area.	182
Photopoint E	6	Lk along berm toward W side of site.	221
Transect 1	1	Lk E	80
Transect 1	2	Lk W	260
Macro 1	1	Lk SE at macroinvertebrate sample location	

Comments / Problems: **None**

GPS SURVEYING

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

GPS Checklist:

- ☒ Jurisdictional wetland boundary.
- ☒ 4-6 landmarks that are recognizable on the aerial photograph.
- ☒ Start and End points of vegetation transect(s).
- ☒ Photograph reference points.
- ☐ Groundwater monitoring well locations.

Comments / Problems: _____

WETLAND DELINEATION

(attach COE delineation forms)

At each site conduct these checklist items:

- ☒ Delineate wetlands according to the 1987 Army COE manual.
- ☒ Delineate wetland – upland boundary onto aerial photograph.
- **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 any completed abbreviated field forms, if used)

Comments / Problems: _____

MAINTENANCE

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

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

Comments / Problems: **Dike breaches observed during recon visit were repaired prior to mid-season monitoring.**

MDT WETLAND MONITORING – VEGETATION TRANSECT

Site: **DH Ranch** Date: **September 7, 2007** Examiner: **McEldowney**
Transect Number: **1** Approximate Transect Length: **645 feet** Compass Direction from Start: **260˚** Note: **E to W**

Vegetation Type A: **DISTURBED-UPLAND**	
Length of transect in this type: 15 feet	
Plant Species	**Cover**
KOCSCO	+ = < 1%
HORJUB	1 = 1-5%
JUNBAL	1 = 1-5%
SHEARG (PLANTED)	+ = < 1%
Unk. Forb	1 = 1-5%
Total Vegetative Cover:	10%

Vegetation Type B: **DISTURBED - WETLAND**	
Length of transect in this type: 35 feet	
Plant Species	**Cover**
SCIACU	2 = 6-10%
SCIPUN	1 = 1-5%
SCIMAR	1 = 1-5%
ELEPAL	+ = < 1%
KOCSCO	+ = < 1%
Total Vegetative Cover:	25%

Vegetation Type C: **DISTURBED-UPLAND (DIKE)**	
Length of transect in this type: 20 feet	
Plant Species	**Cover**
MELOFF	+ = < 1%
KOCSCO	1 = 1-5%
FESPRA	+ = < 1%
SCIPUN	+ = < 1%
POPDEL	1 = 1-5%
HORJUB	+ = < 1%
CIRARV	+ = < 1%
TYPLAT	+ = < 1%
CONARV	+ = < 1%
Total Vegetative Cover:	10%

Vegetation Type D: **DISTURBED - WETLAND**	
Length of transect in this type: 17 feet	
Plant Species	**Cover**
HORJUB	5 = > 50%
RUMCRI	+ = < 1%
ECHMUR	+ = < 1%
CHENOPODIUM SP.	+ = < 1%
FESPRA	1 = 1-5%
PLAMAJ	+ = < 1%
Total Vegetative Cover:	70%

MDT WETLAND MONITORING – VEGETATION TRANSECT

Site: **DH Ranch** Date: **September 7, 2007** Examiner: **McEldowney**
Transect Number: **1** Approximate Transect Length: **645 feet** Compass Direction from Start: **260˚** Note: **E to W**

Vegetation Type E: **DISTURBED-WETLAND**	
Length of transect in this type: 14 feet	
Plant Species	**Cover**
KOCSCO	1 = 1-5%
Total Vegetative Cover:	5%

Vegetation Type F: **SCIACU/MIXED GRAMINOIDS**	
Length of transect in this type: 50 feet	
Plant Species	**Cover**
SCIACU	2 = 6-10%
ECHMUR	1 = 1-5%
KOCSCO	1 = 1-5%
ELEPAL	+ = < 1%
POLYGONUM SP.	+ = < 1%
CAREX SP.	1 = 1-5%
VERONICA SP.	+ = < 1%
SCIMAR	1 = 1-5%
HORJUB	+ = < 1%
JUNEFF	+ = < 1%
TYPANG	+ = < 1%
Total Vegetative Cover:	17%

Vegetation Type G: **DISTURBED-WETLAND**	
Length of transect in this type: 17 feet	
Plant Species	**Cover**
KOCSCO	+ = < 1%
DEAD FESPRA = 4 (21 - 50%)	
Total Vegetative Cover:	1%

Vegetation Type H: **DISTURBED - WETLAND**	
Length of transect in this type: 222 feet	
Plant Species	**Cover**
FESPRA	3 = 11-20%
BROINE	3 = 11-20%
ECHMUR	2 = 6-10%
ELEPAL	1 = 1-5%
TAROFF	1 = 1-5%
THLARV	+ = < 1%
CHEALB	1 = 1-5%
HORJUB	1 = 1-5%
TRIREP	1 = 1-5%
TRIPRA, VERONICA SP., PURPLE ASTER	+ = < 1%
POPDEL (SEEDLINGS), TYPANG, CIRARV	+ = < 1%
SALIX SP., CONARV, PHAARU, VERTHA	+ = < 1%
Total Vegetative Cover:	55%

MDT WETLAND MONITORING – VEGETATION TRANSECT

Site: **DH Ranch** Date: **September 7, 2007** Examiner: **McEldowney**
Transect Number: **1** Approximate Transect Length: **645 feet** Compass Direction from Start: **260˚** Note: **E to W**

Vegetation Type I: **DISTURBED - WETLAND**	
Length of transect in this type: 37 feet	
Plant Species	**Cover**
BROTEC	3 = 11-20%
LEPPER	4 = 21-50%
CHEALB	1 = 1-5%
TAROFF	4 = 21-50%
ALOARU	+ = < 1%
CIRARV	+ = < 1%
LATSER	+ = < 1%
SISALT	2 = 6-10%
TRADUB	+ = < 1%
TRIREP	1 = 1-5%
Total Vegetative Cover:	95%

Vegetation Type J: **SCIACU/MIXED GRAMINOIDS**	
Length of transect in this type: 42 feet	
Plant Species	**Cover**
SCIACU	1 = 1-5%
ELEPAL	1 = 1-5%
TYPANG	+ = < 1%
Total Vegetative Cover:	7%

Vegetation Type K: **DISTURBED - WETLAND**	
Length of transect in this type: 51 feet	
Plant Species	**Cover**
TRIREP	4 = 21-50%
POPDEL	1 = 1-5%
TYPANG	+ = < 1%
KOCSCO	1 = 1-5%
CIRARV	+ = < 1%
POAPRA	+ = < 1%
TAROFF	2 = 6-10%
HORJUB	+ = < 1%
CHEALB	+ = < 1%
RUMCRI	+ = < 1%
VERTHA	+ = < 1%
Total Vegetative Cover:	50%

Vegetation Type L: **SCIACU/MIXED GRAMINOIDS**	
Length of transect in this type: 85 feet	
Plant Species	**Cover**
ELEPAL	1 = 1-5%
TYPLAT	1 = 1-5%
POPDEL (SEEDLINGS)	+ = < 1%
Total Vegetative Cover:	8%

MDT WETLAND MONITORING – VEGETATION TRANSECT

Site: **DH Ranch** Date: **September 7, 2007** Examiner: **McEldowney**
Transect Number: **1** Approximate Transect Length: **645 feet** Compass Direction from Start: **260˚** Note: **E to W**

Vegetation Type M: **DISTURBED-UPLAND**	
Length of transect in this type: 40 feet	
Plant Species	**Cover**
CONARV	2 = 6-10%
BROINE	1 = 1-5%
CIRARV	+ = < 1%
POPDEL (SEEDLINGS)	+ = < 1%
Total Vegetative Cover:	10%

Vegetation Type N:	
Length of transect in this type: feet	
Plant Species	**Cover**
Total Vegetative Cover:	%

Vegetation Type O:	
Length of transect in this type: feet	
Plant Species	**Cover**
Total Vegetative Cover:	%

Vegetation Type P:	
Length of transect in this type: feet	
Plant Species	**Cover**
Total Vegetative Cover:	%

MDT WETLAND MONITORING – VEGETATION TRANSECT

Cover Estimate		**Indicator Class**	**Source**
+ = < 1%	3 = 11-10%	+ = Obligate	P = Planted
1 = 1-5%	4 = 21-50%	- = Facultative/Wet	V = Volunteer
2 = 6-10%	5 = > 50%	0 = Facultative	

Percent of perimeter 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 foot depth (in open water), or at the point where water depths or saturation are maximized. Mark this location with another metal fencepost.

Estimate cover within a 10 foot 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.

Comments: _____

BIRD SURVEY – FIELD DATA SHEET

Site: **DH Ranch** Date: **8/16/07** and **9/7/07**
Survey Time: **8 am** to **5 pm**

Bird Species	#	Behavior	Habitat	Bird Species	#	Behavior	Habitat
Sandhill Cranes	3	F	MA UP				
Canada Geese	20	FO					
Killdeer	2	F	MF				
American Pelican	9	FO					
Mourning Dove	3	F	UP				
Common Snipe	20	F	MA UP				
Greater Yellowlegs	4	F	MF				
American Robin	1	F	UP				
Golden Eagle	1	FO					
American Goldfinch	1	F	SS				
Eastern Kingbird	1	F	UP				
Grasshopper Sparrow	1	F	UP				
Solitary Sandpiper	3	F	MF				
Turkey	4	F	UP				
Spotted Sandpiper	1	F	MF				
Lesser Yellowlegs	2	F	MF				

BEHAVIOR CODES
BP = One of a breeding pair
BD = Breeding display
F = Foraging
FO = Flyover
L = Loafing
N = Nesting

HABITAT CODES
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 shore

Weather: **8/16/07 - sunny, 90 deg F, light breeze**
9/7/07 - Calm, partly cloudy, 55 deg F

Notes: _____

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

Project / Site: **DH Ranch MDT Mitigation Site** Applicant / Owner: **MDT/George Duke** Investigator: **PBS&J (RRM)**	Date: **September 9, 2007** County: **Carbon** State: **MT**

Do Normal Circumstances exist on the site? **Yes** Is the site significantly disturbed (Atypical Situation)? **Yes** Is the area a potential Problem Area? **No** (If needed, explain on reverse side)	Community ID: _____ Transect ID: _____ Plot ID: **SP1**

VEGETATION

Dominant Species	Stratum	Indicator	Dominant Species	Stratum	Indicator
1. *Scirpus maritimus*	Herb	OBL	11.		
2. *Sporobolus airoides*	Herb	FAC-	12.		
3. *Hordeum jubatum*	Herb	FAC+	13.		
4.			14.		
5.			15.		
6.			16.		
7.			17.		
8.			18.		
9.			19.		
10.			20.		

Percent of Dominant Species that are OBL, FACW, or FAC (excluding FAC-): **2** / **3** = **67%**	FAC Neutral: **1** / **3** = **33%**

Remarks: **Recently constructed wetland mitigation site that is dominated by alkali bulrush.**

HYDROLOGY

Yes Recorded Data (Describe in Remarks): **N/A** Stream, Lake, or Tide Gauge **Yes** Aerial Photographs **N/A** Other **No** No Recorded Data	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 Wetland Secondary Indicators (2 or more required): **YES** Oxidized Root Channels in Upper 12 inches **NO** Water-Stained Leaves **NO** Local Soil Survey Data **NO** FAC-Neutral Test **NO** Other (Explain in Remarks)
Field Observations: Depth of Surface Water = **1** (in.) Depth to Free Water in Pit = **0** (in.) Depth to Saturated Soil = **0** (in.)	

Remarks: **Sit eis inundated.**

SOILS

Map Unit Name (Series and Phase): **Heldt silty clay loam, saline, 0- 6% slopes**
Map Symbol: **Hw** Drainage Class: **Well** Mapped Hydric Inclusion? **No**
Taxonomy (Subgroup): _____ Field Observations confirm Mapped Type? **Yes**

Profile Description

Depth (inches)	Horizon	Matrix Color (Munsell Moist)	Mottle Color(s) (Munsell Moist)	Mottle Abundance/Contrast	Texture, Concretions, Structure, etc.
12	A	2.5 YR 3/1	5 YR 3/4 /	Common Distinct	Silty Clay
		/	/ /	N/A N/A	
		/	/ /	N/A N/A	
		/	/ /	N/A N/A	
		/	/ /	N/A N/A	

Hydric Soil Indicators:

- **NO** Histosol
- **NO** Histic Epipedon
- **YES** 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: **Soil has a sulfidic odor, low chroma, and mottling.**

WETLAND DETERMINATION

Hydrophytic Vegetation Present? **YES**
Wetland Hydrology Present? **YES**
Hydric Soils Present? **YES**

Is this Sampling Point within a Wetland? **YES**

Remarks: **The site has been recently disturbed - to create wetlands for wetland mitigation. Palustrine emergent wetland. Site is dominated by alkali bulrush, is inundated and has low chroma soils, mottling, and a sulfidic odor.**

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

Project / Site: **DH Ranch MDT Mitigation Site** Applicant / Owner: **MDT/George Duke** Investigator: **PBS&J (RRM)**	Date: **September 7, 2007** County: **Carbon** State: **MT**

Do Normal Circumstances exist on the site? **Yes** Is the site significantly disturbed (Atypical Situation)? **Yes** Is the area a potential Problem Area? **No** (If needed, explain on reverse side)	Community ID: _____ Transect ID: _____ Plot ID: **SP2**

VEGETATION

Dominant Species	Stratum	Indicator	Dominant Species	Stratum	Indicator
1. *Kochia scoparia*	Herb	FAC	6.		
2. *Sarcobatus vermiculatus (seedlings)*	Herb	FACU+	7.		
3.			8.		
4.			9.		
5.			10.		

Percent of Dominant Species that are OBL, FACW, or FAC (excluding FAC-): **1** / **2** = **50**%	FAC Neutral: **0** / **2** = **0**%

Remarks: **Recently constructed wetland mitigation site. This sample point is located approximately 10 ft east of sample point 1 and was disturbed during construction of the site. Bare ground is prevalent.**

HYDROLOGY

Yes Recorded Data (Describe in Remarks):
N/A Stream, Lake, or Tide Gauge
Yes Aerial Photographs
N/A Other

No No Recorded Data

Field Observations:

Depth of Surface Water **N/A** ____ (in.)

Depth to Free Water in Pit **N/A** ____ (in.)

Depth to Saturated Soil **N/A** ____ (in.)

Wetland Hydrology Indicators
Primary Indicators:
NO Inundated
NO Saturated in Upper 12 Inches
NO Water Marks
NO Drift Lines
NO Sediment Deposits
NO Drainage Patterns in Wetland
Secondary Indicators (2 or more required):
YES Oxidized Root Channels in Upper 12 inches
NO Water-Stained Leaves
NO Local Soil Survey Data
NO FAC-Neutral Test
NO Other (Explain in Remarks)

Remarks: **Despite having mottles in the soil (e.g., oxidized rhizospheres) there is no compelling evidence of wetland hydrology. This sample point is just and inch or two higher in elevation than sample point 1 which was inundated. This area may eventually develop wetland hydrology.**

SOILS

Map Unit Name (Series and Phase): **Heldt silty clay loam, saline, 0- 6% slopes**
Map Symbol: **Hw** Drainage Class: **Well** Mapped Hydric Inclusion? **No**
Taxonomy (Subgroup): _____ Field Observations confirm Mapped Type? **Yes**

Profile Description

Depth (inches)	Horizon	Matrix Color (Munsell Moist)	Mottle Color(s) (Munsell Moist)	Mottle Abundance/Contrast	Texture, Concretions, Structure, etc.
12	A	2.5 YR 3/1	5 YR 3/4 /	Many Distinct	Silty Clay
		/ 	/ /	N/A N/A	
		/ 	/ /	N/A N/A	
		/ 	/ /	N/A N/A	
		/ 	/ /	N/A N/A	

Hydric Soil Indicators:

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

Remarks:

WETLAND DETERMINATION

Hydrophytic Vegetation Present? **NO** Wetland Hydrology Present? **NO** Hydric Soils Present? **YES**	Is this Sampling Point within a Wetland? **NO**

Remarks: **Site was disturbed during the construction of the mitigation site. However, despite being within 10 feet of sample point 1, which was also a disturbed but has all three wetland parameters, the site does not exhibit hydrophytic vegetation or have compelling evidence of wetland hydrology, and therefore is considered to be an upland. As the mitigation site develops this area may evolve into a wetland, but it is not there yet.**

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

1. Project Name: DH Ranch **2. Project #:** _____ **Control #:** _____

3. Evaluation Date: 9/7/2007 **4. Evaluator(s):** PBS&J (RRM) **5. Wetland / Site #(s):** DH Ranch

6. Wetland Location(s) i. T: 4 S **R:** 23 E **S:** 1 **T:** __ N **R:** __ E **S:** _____

ii. Approx. Stationing / Mileposts: _____

iii. Watershed: 13 - Upper Yellowstone **GPS Reference No. (if applies):** 45.51067 N 108.82617

Other Location Information: Approx. 3 miles NE of Edgar, MT. HUC=10070006 Clark's Fork Yellowstone River

7. A. Evaluating Agency PBS&J

8. Wetland Size (total acres): 11.31 (visually estimated)
(measured, e.g. GPS)

B. Purpose of Evaluation:

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

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

Comments: _____

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	Unconsolidated Bottom	Semipermanently Flooded	Excavated/Impounded	40
Depression	Palustrine	---	Emergent Wetland	Seasonally Flooded	Excavated/Impounded	58
Depression	Palustrine	---	Scrub-Shrub Wetland	Seasonally Flooded	Excavated/Impounded	2
---	---	---	---	---	---	

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

Comments: Open water areas are expected to develop into aquatic bed or emergent vegetation, but due to how recently it was constructed aquatic vegetation has not established.

11. ESTIMATED RELATIVE ABUNDANCE (of similarly classified sites within the same Major Montana Watershed Basin)
Abundant **Comments:** Bulrush and cattail marshes.

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.) Site is a recently constructed (2007) mitigation site.

ii. Prominent weedy, alien, & introduced species: Some Canada thistle.

iii. Briefly describe AA and surrounding land use / habitat: Recently constructed marsh wetland on a terrace of the Clarks Fork Yellowstone River floodplain. Surrounding area on the west, north, and south sides are grazed and/or hayed. A ranch road at the base of a steep slope was recently improved along the east side.

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: PEM, expect PAB in subsequent years.

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	_____
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 & Rating	---	---	---	---	---	---	0 (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	_____
Secondary habitat **(list species)**	☐ D ☐ S	_____
Incidental habitat **(list species)**	☐ D ☒ S	Bald eagle, peregrine falcon
No usable habitat	☐ D ☐ S	_____

ii. 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 & Rating	---	---	---	---	---	.1 (L)	---

If documented, list the source (e.g., observations, records, etc.)**:** Bald eagle observed flying over the site. Suitable peregrine falcon habitat likely occurs on bluffs overlooking the Clark's Fork Yellowstone River.

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 the AA attribute 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: Use 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	--	--	--	--
Moderate	.9 (H)	--	--	--
Low	--	--	--	--

Comments: Wildlife use may increase substantially in subsequent years as this wetland complex becomes more well-established, and becomes more well-known to local and migrating animal 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 or 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 determine the quality rating of exceptional (E), high (H), moderate (M), or low (L).

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 arrive at 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: _____

14E. FLOOD ATTENUATION ☒ **NA** (proceed to 14F)

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

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**	--	--	--	--	--	--	--	--	--
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:** _____

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, then 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.
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 **≥ 5 out of 10 years**	1 (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 the 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**	--	--	.7 (M)	--	--	--	--	--
AA contains **unrestricted outlet**	--	--	--	--	--	--	--	--

Comments: Irrigation return flow is the main source of water. It is assumed that this water is relatively high in salts.

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

Applies only if AA occurs on or within the banks of 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, then 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
≥ 65 %	--	--	--
35-64 %	--	--	--
< 35 %	.3 (L)	--	--

Comments: Due to its recent construction shoreline vegetation is non-existent in many areas. The largest open water areas are in the NE and NW portions of the site.

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	--	--	.9H	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
S/I	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
T/E/A	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--

Comments: _____

14J. GROUNDWATER DISCHARGE / RECHARGE (DR) (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 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	--
No Discharge/Recharge indicators present	0.1 (L)
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)	--	--	--	--	--	--	--	--	.3L
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 (0.1) 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: _____

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	0.00	1	
B. MT Natural Heritage Program Species Habitat	low	0.10	1	
C. General Wildlife Habitat	high	0.90	1	
D. General Fish/Aquatic Habitat	N/A		--	
E. Flood Attenuation	N/A		--	
F. Short and Long Term Surface Water Storage	high	1.00	1	
G. Sediment/Nutrient/Toxicant Removal	moderate	0.70	1	
H. Sediment/Shoreline Stabilization	low	0.30	1	
I. Production Export/Food Chain Support	high	0.90	1	
J. Groundwater Discharge/Recharge	low	0.10	1	
K. Uniqueness	low	0.30	1	
L. Recreation/Education Potential	low	0.10	1	
	Total:	**4.40**	**10.00**	
		Percent of Total Possible Points:	**44%** (Actual / Possible) x 100 [rd to nearest whole #]	

Category I Wetland: (Must satisfy **one** of the following criteria. If not satisfied, 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, return 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

2007 REPRESENTATIVE PHOTOGRAPHS

MDT Wetland Mitigation Monitoring
DH Ranch
Edgar, Montana

DH RANCH WETLAND MITIGATION SITE 2007

Photo Point A – *Photo 1* **Location:** North Side
Compass bearing: 188 degrees

Photo Point A – *Photo 2* **Location:** North Side
Compass bearing: 207 degrees

Photo Point A – *Photo 3* **Location:** North Side
Compass bearing: 221 degrees

Photo Point A – *Photo 4* **Location:** North
Compass bearing: 256 degrees

Photo Point B – *Photo1* **Location:** Northeast corner
Compass bearing: 179 degrees

Photo Point B – *Photo 2* **Location:** Northeast corner
Compass bearing: 203 degrees

DH RANCH WETLAND MITIGATION SITE 2007

Photo Point B – *Photo3* **Location:** Northeast corner
Compass bearing: 238 degrees

Photo Point B – *Photo 4* **Location:** Northeast corner
Compass bearing: 264 degrees

Photo Point C – *Photo 1* **Location:** Southwest corner
Compass bearing: 212 degrees

Photo Point C – *Photo 2* **Location:** Southwest corner
Compass bearing: 239 degrees

Photo Point C – *Photo 3* **Location:** Southwest corner
Compass bearing: 272 degrees

Photo Point C – *Photo 4* **Location:** Southwest corner
Compass bearing: 304 degrees

DH RANCH WETLAND MITIGATION SITE 2007

Photo Point C – *Photo 5* **Location:** Southwest corner
Compass bearing: 334 degrees

Photo Point D – *Photo 1* **Location:** West side
Compass bearing: 42 degrees

Photo Point D – *Photo 2* **Location:** West side
Compass bearing: 75 degrees

Photo Point D – *Photo 3* **Location:** West side
Compass bearing: 104 degrees

Photo Point D – *Photo 4* **Location:** West side
Compass bearing: 142 degrees

Photo Point D – *Photo 5* **Location:** West side
Compass bearing: 165 degrees

DH RANCH WETLAND MITIGATION SITE 2007

Photo Point D – *Photo 6* **Location:** West side
Compass bearing: 337 degrees

Photo Point D – *Photo 7* **Location:** West side
Compass bearing: 354 degrees

Photo Point E – *Photo 1* **Location:** Central area
Compass bearing: 36 degrees

Photo Point E – *Photo 2* **Location:** Central area
Compass bearing: 66 degrees

Photo Point E – *Photo 3* **Location:** Central area
Compass bearing: 97 degrees

Photo Point E – *Photo 4* **Location:** Central area
Compass bearing: 153 degrees

Photo Point E – *Photo 5* **Location:** Central area
Compass bearing: 182 degrees

Photo Point E – *Photo 6* **Location:** Central area
Compass bearing: 221 degrees

Transect 1 – *Photo 1* Looking west from east end.
Compass bearing: 260 degrees

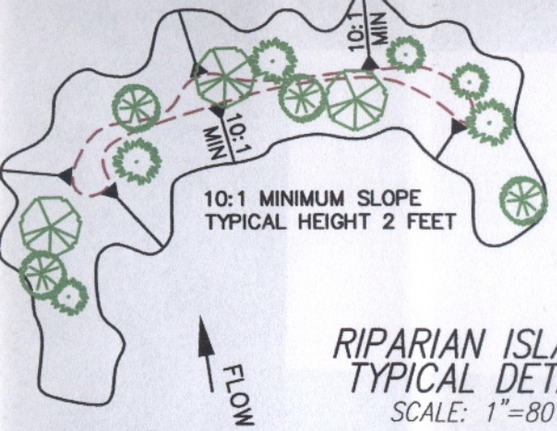
Transect 1 – *Photo 2* Looking east from west end.
Compass bearing: 80 degrees

Macro invertebrate sampling location in NE corner of site.

Appendix D

PLAN SHEET

MDT Wetland Mitigation Monitoring
DH Ranch
Edgar, Montana



RIPARIAN ISLAND TYPICAL DETAIL

SCALE: 1"=80'

REVEGETATION ZONES (23.45 ac.)

WETLAND PEM	15.90 ac.
WETLAND PEM DEPRESSION	*2.25 ac.
WETLAND SALINE PEM	6.75 ac.
RIPARIAN ISLAND SCRUB-SHRUB	*1.65 ac.
RIPARIAN BUFFER SCRUB-SHRUB SALINE	0.80 ac.

* SUB AREAS OF WETLAND PEM

RANCH ACCESS ROAD IMPROVED TO ACT AS LOW HEAD IMPOUNDMENT AND CONTINUED RANCH ACCESS

PROJECT BOUNDARY

BUFFER SWALE NARROWS BECOMES OVERFLOW DRAINAGE DITCH

INTERCEPTOR DITCH

INTERCEPTOR DITCH

NORTH

0 50 150 300

REVEGETATION PLAN

SCALE: 1"=150'

NOTES:

1> AERIAL PHOTO BACKGROUND – MDT Flight on 6/17/2005

2> FINISHED DESIGN CONTOUR INTERVAL = 1 foot

REVEGETATION PLAN & PROPOSED GRADING

DRAWING NO. FIGURE 5

REVISION

DH RANCH & Montana Department of Transportation

WETLAND MITIGATION PROJECT

Sec 1 TAN R23E CARBON COUNTY, MT

DHDESIGN.dwg

SCALE: AS NOTED

PROJECT NO. 251A

DRAWN bz

CHECK --

DATE 10/05/05

REV NO.	REVISION DESCRIPTION	BY	REVISION DATE

ADC SERVICES INC.
water resource consulting
Phone 406.222.7600 – Fax 406.222.7677

Appendix E

GPS PROTOCOL

MDT Wetland Mitigation Monitoring
DH Ranch
Edgar, Montana

GPS MAPPING AND AERIAL PHOTO REFERENCING PROCEDURE

From 2001 through 2006, PBS&J mapped the vegetation community boundaries, photograph points, and other sampling locations in the field using the resource-grade Trimble GEO III GPS (Global Positioning System) unit. The data were collected with a minimum of three positions per feature using Course/Acquisition code. The collected data were then transferred to a personal computer (PC) and differentially corrected to the nearest operating Community Base Station. The corrected data were then exported to ACAD drawings in Montana State Plain Coordinates NAD 83 international feet.

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

In 2007, some sites continued to be mapped using the Trimble GEO III GPS unit while most sites were mapped using the resource-grade Magellan MobileMapper Office GPS unit. The Magellan GPS unit has a comparable accuracy level to the Trimble Geo III unit.

Each year, MDT photographs each mitigation site from the air. These aerial photographs are not geo-referenced, but serve as a visual aid to map wetland development and vegetation communities, and to show approximate locations for various monitoring activities (i.e. photograph points, transects, or macroinvertebrate sampling). Reference points that are observable on the aerial photo (i.e. road, stream channel, or fence) were also marked with the GPS unit in order to better position the aerial photograph. This positioning did not remove any of the distortion inherent to all photos. All mapped features and community boundaries were reviewed by the wetland biologist, to increase the figure's accuracy.

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
DH Ranch
Edgar, Montana

AQUATIC INVERTEBRATE SAMPLING PROTOCOL

Equipment List

- D-frame sampling net with 1 mm mesh.
- 1-liter, wide-mouth, plastic sample jars provided by Rhithron Associates, Inc. (Quart sized, wide-mouthed canning jars can be substituted.)
- 95% ethanol (alternatively isopropyl alcohol).
- Pre-printed sample labels (printed on rite-in-the-rain paper); two labels per sample.
- Pencil.
- Clear packaging tape.
- 3-5 gallon plastic pail.
- Large tea strainer or framed screen.
- Cooler with ice for storing sample.

Site Selection

Select a site that is accessible with hip waders or rubber boots. If the substrate is too soft, place a wide board down to walk on. Choose a site that is representative of the overall condition of the wetland. Annual sampling should occur at the same site within the wetland.

Sampling Procedure

Wetland invertebrates (macroinvertebrates) inhabit the substrate, the water column, the stems and leaves of aquatic vegetation, and the water surface. At the given location, each habitat type is sampled and combined into a single 1-liter sample jar. Pre-cautions are made to minimize disturbing the sample site in order to maximize the number of animals collected.

Fill the pail with approximately 1 gallon of wetland water. Ideally, sample the water column from near-shore outward to a depth of 3 feet. Sample the water column using a long sweep of the net, keeping the net at about half the depth of the water. Sample the water surface with a long sweep of the net. Aquatic vegetation is sampled by pulling the net beneath the water surface, for at least a meter in distance. The substrate is sampled by pulling the net along the bottom, bumping it against the substrate several times as you pull. Be sure to place some muck, mud, and/or vegetation into the jar. After sampling a habitat, rinse the net in the bucket and look for insects, crustaceans, and other aquatic invertebrates. It is not necessary to sample habitats in any specific order, but all habitats, if present, are to be sampled. Habitats can be sampled more than once.

Fill about 1 cup of ethanol into the sample jar. Sieve the contents of the bucket through the straining device and pour or carefully scrape the contents of the strainer into the sample jar. Top off the jar with enough ethanol to cover all the material and leave as little headroom as possible. Alternatively, sampled materials can be lifted out of the net and put directly into the jar. Be sure to include some muck, mud, and/or vegetation into the jar. Each macroinvertebrate sampling site should have only one sampling jar.

Using pencil, complete two labels with the required information: project name, project number, date, collector's name, and habitats sampled. Do not complete the label with ink as it will dissolve in ethanol. For wetlands with at least two macroinvertebrate sampling sites, number the site consecutively followed by the total number of sites (e.g. Sample 2 of 3 sites). Place one label into the jar and seal the jar. Dry the jar off, if necessary, and tape the second label to the outside of the jar.

Photograph each macroinvertebrate sampling site.

Sample Handling/Delivery

In the field, keep sample jars cool by placing in a cooler with a small amount of ice.
Deliver samples to the PBS&J office in Missoula, where they will be inventoried and delivered to Rhithron Associates, Inc.

MDT Mitigated Wetland Monitoring Project: Aquatic Invertebrate Monitoring
Summary 2001 – 2007

Prepared for Post, Buckley, Schuh, and Jernigan (PBS&J)
Prepared by W.Bollman, Rhithron Associates, Inc.

INTRODUCTION

Aquatic invertebrate assemblages were collected at a number of mitigated wetlands throughout Montana. This report summarizes data generated from seven years of collection. Over all years of sampling, a total of 182 invertebrate samples were collected. Table 1 lists the currently monitored sites at which aquatic invertebrates were collected in 2007, and summarizes the sampling history of each.

METHODS

Sample processing

Aquatic invertebrate samples were collected at mitigated wetland sites in the summer months of 2001, 2002, 2003, 2004, 2005, 2006 and 2007 by personnel of PBS&J. Sampling procedures utilized were based on the protocols developed by the Montana Department of Environmental Quality (MT DEQ) for wetland sampling. Sampling consisted of D-frame net sweeps through emergent vegetation (when present), the water column, and over the water surface, and included disturbing and scraping substrates at each sampled site. These sample components were composited and preserved in ethanol at each wetland site. Samples were delivered to Rhithron Associates, Inc. for processing, taxonomic determinations, and data analysis.

Standard sorting protocols were applied to achieve representative subsamples of a minimum of 100 organisms. Caton sub-sampling devices (Caton 1991), divided into 30 grids, each approximately 5 cm by 6 cm, were used. Grid contents were examined under stereoscopic microscopes using 10x-30x magnification. All aquatic invertebrates from each selected grid were sorted from the substrate, and placed in 95% ethanol for subsequent identification. Grid selection, examination, and sorting continued until at least 100 organisms were sorted. A large/rare search was conducted to collect any taxa not found in the subsampling procedure.

Organisms were individually examined using 10x – 80x stereoscopic dissecting scopes (Leica S8E and S6E) and identified to the lowest practical taxonomic levels using appropriate published taxonomic references. Identification, counts, life stages, and information about the condition of specimens were recorded on bench sheets. To obtain accuracy in richness measures, organisms that could not be identified to the target level specified in MDEQ protocols were designated as “not unique” if other specimens from the same group could be taken to target levels. Organisms designated as “unique” were those that could be definitively distinguished from other organisms in the sample. Identified organisms were preserved in 95% ethanol in labeled vials, and archived at the Rhithron laboratory. Midges were morphotyped using 10x – 80x stereoscopic dissecting microscopes (Leica S8E and S6E) and representative specimens were slide mounted and examined at 200x – 1000x magnification using an Olympus BX 51 compound microscope. Slide mounted organisms were also archived at the Rhithron laboratory.

Quality assurance systems

Quality control procedures for initial sample processing and subsampling involved checking sorting efficiency. These checks were conducted on 96% of the samples by independent observers who microscopically re-examined 20% of sorted substrate from each sample. All organisms that were missed were counted and this number was added to the total number obtained in the original sort. Sorting efficiency was evaluated by applying the following calculation:

$$SE = \frac{n_1}{n_{1+2}} \times 100$$

where: SE is the sorting efficiency, expressed as a percentage, n_1 is the total number of specimens in the first sort, and n_{1+2} is the total number of specimens in the first and second sorts combined.

Quality control procedures for taxonomic determinations of invertebrates involved checking accuracy, precision and enumeration. At least 10% of samples are targeted for quality assurance procedures. For this project, three samples were randomly selected and all organisms re-identified and counted by an independent taxonomist. Taxa lists and enumerations were compared by calculating a Bray-Curtis similarity statistic (Bray and Curtis 1957) for each

selected sample. Routinely, discrepancies between the original identifications and the QC identifications are discussed among the taxonomists, and necessary rectifications to the data are made. Discrepancies that cannot be rectified by discussions are routinely sent out to taxonomic specialists for identification. However, taxonomic certainty for identifications in this project was high, and no external verifications were necessary.

Assessment

The method employed to assess these wetlands is based on an index incorporating 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 the 12 metrics were developed specifically for this project, since mitigated wetlands were not included in original criteria development.

Scoring criteria for wetland metrics were developed by generally following the tactic used by Stribling et al. (1995). Boxplots were generated using a statistical software package (Statistica™), and distributions, median values, ranges, and quartiles for each metric were examined. For the wetland sites, "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, which is expressed as a percentage of the maximum possible score (60). Total bioassessment scores were classified according to a similar process, using the ranges and distributions of total scores for all sites studied in all years. Data from a total of 167 samples were used to develop criteria.

Several sites in this study supported aquatic fauna characteristic of lotic habitats rather than lentic wetland habitats; these sites were excluded from mitigated wetland scoring criteria development, and were evaluated with a metric battery specific to flowing water habitats. In 2007, the lotic sites were Camp Creek (2 sites), Cloud Ranch stream, Kleinschmidt stream, Jack Creek, and Woodson Creek-Ringling stream. Invertebrate assemblages at these sites were generally characteristic of montane or foothill stream conditions and were assessed using the tested metric battery developed for montane streams of Western Montana (Bollman 1998).

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. However, the nature of the action needed is not determined solely by the index score or impairment classification, 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 since our understanding of the interrelationships of natural environmental factors and anthropogenic disturbances is tentative. Thus, the further interpretive remarks accompanying the raw taxonomic and metric data in this summary are offered cautiously. Year-to-year comparisons depend on an assumption that specific sites were revisited in each year, and that equivalent sampling methods were utilized at each site revisit.

Bioassessment metrics - wetlands

An index based on the performance of 12 metrics was constructed, as described above. Table 2 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; many 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.

Summary metric values and scores for the 2007 samples are given in Tables 4a-4c and 5.

In 2007, thermal preference of the invertebrate assemblages was calculated when possible, using the tool developed by Brandt 2001.

Bioassessment metrics – lotic habitats

For sites supporting rheophilic invertebrate assemblages, bioassessment was based on a metric battery and scoring criteria developed for montane regions of Montana (MVFP index: Bollman 1998). The six metrics constituting the bioassessment index used for MVFP sites in this study were selected because, both individually and as an integrated metric battery, they are robust at distinguishing impaired sites from relatively unimpaired sites (Bollman 1998). They have been demonstrated to be more variable with anthropogenic disturbance than with natural environmental gradients (Bollman 1998). Each of the six metrics, and their expected responses to various stressors is described below.

1. Ephemeroptera (mayfly) taxa richness. The number of mayfly taxa declines as water quality diminishes. Impairments to water quality which have been demonstrated to adversely affect the ability of mayflies to flourish include elevated water temperatures, heavy metal contamination, increased turbidity, low or high pH, elevated specific conductance and toxic chemicals. Few mayfly species are able to tolerate certain disturbances to instream habitat, such as excessive sediment deposition.
2. Plecoptera (stonefly) taxa richness. Stoneflies are particularly susceptible to impairments that affect a stream on a reach-level scale, such as loss of riparian canopy, streambank instability, channelization, and alteration of morphological features such as pool frequency and function, riffle development and sinuosity. Just as all benthic organisms, they are also susceptible to smaller scale habitat loss, such as by sediment deposition, loss of interstitial spaces between substrate particles, or unstable substrate.
3. Trichoptera (caddisfly) taxa richness. Caddisfly taxa richness has been shown to decline when sediment deposition affects habitat. In addition, the presence of certain case-building caddisflies can indicate good retention of woody debris and lack of scouring flow conditions.
4. Number of sensitive taxa. Sensitive taxa are generally the first to disappear as anthropogenic disturbances increase. The list of sensitive taxa used here includes organisms sensitive to a wide range of disturbances, including warmer water temperatures, organic or nutrient pollution, toxic pollution, sediment deposition, substrate instability and others. Unimpaired streams of western Montana typically support at least four sensitive taxa (Bollman 1998).
5. Percent filter feeders. Filter-feeding organisms are a diverse group; they capture small particles of organic matter, or organically enriched sediment material, from the water column by means of a variety of adaptations, such as silken nets or hairy appendages. In forested montane streams, filterers are expected to occur in insignificant numbers. Their abundance increases when canopy cover is lost and when water temperatures increase and the accompanying growth of filamentous algae occurs. Some filtering organisms, specifically the Arctopsychid caddisflies (*Arctopsyche* spp. and *Parapsyche* spp.) build silken nets with large mesh sizes that capture small organisms such as chironomids and early-instar mayflies. Here they are considered predators, and, in this study, their abundance does not contribute to the percent filter feeders metric.
6. Percent tolerant taxa. Tolerant taxa are ubiquitous in stream sites, but when disturbance increases, their abundance increases proportionately. The list of taxa used here includes organisms tolerant of a wide range of disturbances, including warmer water temperatures, organic or nutrient pollution, toxic pollution, sediment deposition, substrate instability and others.

Table 1. Montana Department of Transportation Mitigated Wetlands Monitoring Project sites: sampling history. Only those sites monitored in 2007 are included. An asterisk (*) indicates lotic sites.

Site Identifier	2001	2002	2003	2004	2005	2006	2007
Roundup	+	+	+	+	+	+	+
Ridgeway	+	+	+	+	+	+	+
Hoskins Landing MS-1		+	+	+	+		+
Hoskins Landing MS-2							+
Peterson Ranch pond 1		+	+	+	+	+	+
Peterson Ranch pond 2		+		+	+	+	+
Peterson Ranch pond 4		+	+	+	+	+	+
Peterson Ranch pond 5		+	+	+	+	+	+
Camp Creek MS-1*		+	+	+	+	+	+
Camp Creek MS-2*						+	+
Kleinschmidt		+	+	+	+	+	+
Kleinschmidt – stream*			+	+	+	+	+
Cloud Ranch Pond				+	+		+
Cloud Ranch Stream*				+			+
Jack Creek – pond				+	+		+
Jack Creek – McKee*							+
Norem				+	+	+	+
Rock Creek Ranch					+	+	+
Wagner Marsh					+	+	+
Alkali Lake 1						+	+
Charley Creek							+
Woodson pond MI 1							+
Woodson stream MI 2*							+
Little Muddy Creek							+
Selkirk Ranch							+
DH Ranch							+

Table 2. Aquatic invertebrate metrics employed for wetland (lentic) invertebrate assemblages in the MDT mitigated wetlands study, 2001 – 2007.

Metric	Metric calculation	Expected response to degradation or impairment
Total taxa	Count of unique taxa identified to lowest recommended taxonomic level	Decrease
POET	Count of unique Plecoptera, Trichoptera, Ephemeroptera, and Odonata taxa identified to lowest recommended taxonomic level	Decrease
Chironomidae taxa	Count of unique midge taxa identified to lowest recommended taxonomic level	Decrease
Crustacea taxa + Mollusca taxa	Count of 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 by that taxon's modified Hilsenhoff Biotic Index (tolerance) 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

RESULTS

(Note: Individual site discussions were removed from this report by PBS&J and are included in the macroinvertebrate section of individual project monitoring reports. Summary tables for lentic (4a – 4c) and lotic (5) sites and project specific taxa listings and metrics reports are provided on the following pages.)

Quality Assurance

Table 3 gives the results of quality assurance procedures for sample sorting efficiency (SE) and Bray-Curtis similarity statistics for comparisons of taxonomic determinations and enumeration. Sorting efficiency averaged 97.54% for the project, and taxonomic similarity averaged 97.44%.

Table 3. Results of quality control procedures for subsampling and taxonomic and enumeration similarity.

Site name	SE	Bray-Curtis similarity
Roundup	100.00%	
Ridgeway	100.00%	
Hoskins Landing MS-1	100.00%	
Hoskins Landing MS-2	93.40%	
Peterson Ranch pond 1	100.0%	95.38%
Peterson Ranch pond 2	96.64%	
Peterson Ranch pond 4	91.66%	
Peterson Ranch pond 5	96.64%	
Camp Creek MS-1	100.00%	
Camp Creek MS-2	100.00%	96.94%
Kleinschmidt – pond	100.00%	
Kleinschmidt – stream	99.10%	
Cloud Ranch Pond	95.65%	
Cloud Ranch Stream	91.61%	
Jack Creek – pond	n.a.	
Jack Creek - McKee	96.49%	
Norem	100.00%	100.00%
Rock Creek Ranch	100.00%	
Wagner Marsh	100.00%	
Alkali Lake 1	98.04%	
Charley Creek	100.00%	
Woodson pond	91.37%	
Woodson stream	100.00%	
Little Muddy Creek	92.31%	
Selkirk Ranch	95.56%	
DH Ranch	100.00%	

Table 4a. Metric values and scores for wetland (lentic) sites in the MDT mitigated wetland study – 2007 sampling.

	ROUNDUP	RIDGEWAY	HOSKINS LANDING MS-1	HOSKINS LANDING MS-2	PETERSON RANCH 1	PETERSON RANCH 2	PETERSON RANCH 4	PETERSON RANCH 5
Total taxa	7	13	18	21	17	18	26	18
POET	0	2	3	5	2	0	6	4
Chironomidae taxa	5	5	2	8	8	12	12	6
Crustacea + Mollusca	1	2	5	4	4	5	4	4
% Chironomidae	7.62%	30.00%	18.75%	52.68%	36.45%	51.79%	42.59%	14.78%
Orthocladiinae/Chir	0.38	0.17	0.00	0.03	0.08	0.16	0.09	0.12
%Amphipoda	0.00%	10.00%	0.00%	0.00%	0.93%	0.00%	21.30%	1.74%
%Crustacea + %Mollusca	89.52%	15.00%	26.79%	8.04%	10.28%	43.75%	28.70%	37.39%
HBI	8.02	7.11	7.23	6.55	7.42	7.76	6.53	7.23
%Dominant taxon	89.52%	30.00%	17.86%	35.71%	39.25%	23.21%	17.59%	30.43%
%Collector-Gatherers	92.38%	70.00%	78.57%	82.14%	49.53%	71.43%	38.89%	26.96%
%Filterers	0.00%	0.00%	0.89%	6.25%	9.35%	3.57%	1.85%	5.22%
Total taxa	1	1	3	5	3	3	5	3
POET	1	1	3	5	1	1	5	5
Chironomidae taxa	3	3	1	5	5	5	3	3
Crustacea + Mollusca	1	1	3	3	3	3	1	3
% Chironomidae	5	3	3	1	3	1	1	5
Orthocladiinae/Chir	3	1	1	1	1	1	3	1
%Amphipoda	5	3	5	5	5	5	5	5
%Crustacea + %Mollusca	1	5	5	5	5	3	5	3
HBI	1	3	3	5	3	1	5	3
%Dominant taxon	1	5	5	3	3	5	1	5
%Collector-Gatherers	5	3	3	5	3	3	3	1
%Filterers	3	3	3	1	1	3	5	3
Total score	**30**	**32**	**38**	**44**	**36**	**34**	**42**	**40**
Percent of maximum score	**50.00%**	**53.33%**	**63.33%**	**73.33%**	**60.00%**	**56.67%**	**70.00%**	**66.67%**
Impairment classification	**poor**	**sub-optimal**	**optimal**	**optimal**	**sub-optimal**	**sub-optimal**	**optimal**	**optimal**

Table 4b. Metric values and scores for wetland (lentic) sites in the MDT mitigated wetland study – 2007 sampling.

	KLEIN-SCHMIDT POND	CLOUD RANCH POND	JACK CREEK POND	NOREM	ROCK CREEK RANCH	WAGNER MARSH	ALKALI LAKE 1	CHARLEY CREEK
Total taxa	25	13	9	6	18	11	9	13
POET	5	2	0	1	2	2	0	0
Chironomidae taxa	8	11	5	2	4	4	2	3
Crustacea + Mollusca	8	1	4	1	4	0	2	3
% Chironomidae	18.63%	81.54%	92.79%	31.58%	4.76%	11.39%	1.96%	27.17%
Orthocladiinae/Chir	0.53	0.38	0.03	0.00	0.60	0.44	0.50	0.68
%Amphipoda	10.78%	3.08%	0.00%	0.00%	17.14%	0.00%	0.00%	22.83%
%Crustacea + %Mollusca	36.27%	3.08%	7.21%	21.05%	23.81%	0.00%	61.76%	53.26%
HBI	7.35	7.22	9.73	6.63	6.33	7.28	8.07	6.88
%Dominant taxon	13.73%	18.46%	62.16%	26.32%	29.52%	45.57%	60.78%	29.35%
%Collector-Gatherers	53.92%	84.62%	70.27%	57.89%	29.52%	15.19%	70.59%	32.61%
%Filterers	11.76%	9.23%	0.90%	0.00%	0.95%	0.00%	0.00%	0.00%
Total taxa	5	1	1	1	3	1	1	1
POET	5	1	1	1	1	1	1	1
Chironomidae taxa	5	5	3	1	3	3	1	3
Crustacea + Mollusca	5	1	3	1	3	1	1	1
% Chironomidae	3	1	1	3	5	5	5	3
Orthocladiinae/Chir	5	3	1	1	5	3	5	5
%Amphipoda	3	5	5	5	3	5	5	3
%Crustacea + %Mollusca	3	5	5	5	5	5	3	3
HBI	3	3	1	5	5	3	1	5
%Dominant taxon	5	5	1	5	5	3	1	5
%Collector-Gatherers	3	5	3	3	1	1	3	1
%Filterers	1	1	3	3	3	3	3	3
Total score	**46**	**36**	**28**	**34**	**42**	**34**	**30**	**34**
Percent of maximum score	**76.67%**	**60.00%**	**46.67%**	**56.67%**	**70.00%**	**56.67%**	**50.00%**	**56.67%**
Impairment classification	**optimal**	**sub-optimal**	**poor**	**sub-optimal**	**poor**	**sub-optimal**	**poor**	**sub-optimal**

Table 4c. Metric values and scores for wetland (lentic) sites in the MDT mitigated wetland study – 2007 sampling.

	WOODSON POND	LITTLE MUDDY CREEK	SELKIRK RANCH	DH RANCH
Total taxa	12	2	16	8
POET	0	0	2	1
Chironomidae taxa	9	0	8	4
Crustacea + Mollusca	1	1	2	2
% Chironomidae	85.71%	0.00%	77.27%	27.50%
Orthocladiinae/Chir	0.32	0.00	0.61	0.00
%Amphipoda	0.00%	0.00%	0.00%	0.00%
%Crustacea + %Mollusca	2.86%	75.00%	8.18%	64.17%
HBI	9.34	8.50	7.82	7.38
%Dominant taxon	33.33%	75.00%	46.36%	39.17%
%Collector-Gatherers	55.24%	75.00%	32.73%	27.50%
%Filterers	0.00%	0.00%	8.18%	17.50%
Total taxa	1	1	3	1
POET	1	1	1	1
Chironomidae taxa	5	1	5	3
Crustacea + Mollusca	1	1	1	1
% Chironomidae	1	5	1	3
Orthocladiinae/Chir	3	1	5	1
%Amphipoda	5	5	5	5
%Crustacea + %Mollusca	5	1	5	1
HBI	1	1	1	3
%Dominant taxon	5	1	3	3
%Collector-Gatherers	3	3	1	1
%Filterers	3	3	1	1
Total score	**34**	**24**	**32**	**24**
Percent of maximum score	**56.67%**	**40.00%**	**53.33%**	**40.00%**
Impairment classification	**sub-optimal**	**poor**	**sub-optimal**	**poor**

Table 5. Metric values and scores for stream (lotic) sites in the MDT mitigated wetland study – 2007 sampling.

	CAMP CREEK MS-1	CAMP CREEK MS-2	KLEIN-SCHMIDT STREAM	CLOUD RANCH STREAM	JACK CREEK - MCKEE	WOODSON STREAM
E Richness	6	6	0	2	1	1
P Richness	0	0	0	2	0	0
T Richness	4	6	2	4	4	0
Pollution Sensitive Richness	3	4	0	1	0	0
Filterer Percent	4.85%	5.56%	7.14%	3.57%	2.83%	16.67%
Pollution Tolerant Percent	32.04%	34.26%	9.82%	14.29%	58.49%	8.33%
E Richness	3	3	0	1	0	0
P Richness	0	0	0	2	0	0
T Richness	2	3	1	2	2	0
Pollution Sensitive Richness	2	3	0	1	0	0
Filterer Percent	3	2	2	3	3	1
Pollution Tolerant Percent	1	1	2	1	0	2
Total score	**11**	**12**	**5**	**10**	**5**	**3**
Percent of maximum score	**61.11%**	**66.67%**	**27.78%**	**55.56%**	**27.78%**	**16.67%**
Impairment classification	**slight**	**slight**	**moderate**	**slight**	**moderate**	**severe**

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Taxa Listing

Project ID: MDT07PBSJ
RAI No.: MDT07PBSJ026

RAI No.: MDT07PBSJ026 **Sta. Name:** DH Ranch
Client ID:
Date Coll.: 9/7/2007 **No. Jars:** 1 **STORET ID:**

Taxonomic Name	Count	PRA	Unique	Stage	Qualifier	BI	Function
Non-Insect							
Lymnaeidae							
Stagnicola sp.	30	25.00%	Yes	Unknown		6	SC
Physidae							
Physa sp.	47	39.17%	Yes	Unknown		8	SC
Odonata							
Coenagrionidae							
Coenagrionidae	1	0.83%	Yes	Larva	Early Instar	7	PR
Heteroptera							
Corixidae							
Corixidae	8	6.67%	Yes	Larva		10	PH
Diptera							
Dolichopodidae							
Dolichopodidae	1	0.83%	Yes	Larva		4	PR
Chironomidae							
Chironomidae							
Chironomidae	10	8.33%	No	Pupa		10	CG
Cladotanytarsus sp.	1	0.83%	Yes	Larva		7	CG
Cryptotendipes sp.	1	0.83%	Yes	Larva		6	CG
Tanytarsus sp.	21	17.50%	Yes	Larva		6	CF
Sample Count	**120**						

Metrics Report

Project ID: MDT07PBSJ
RAI No.: MDT07PBSJ026
Sta. Name: DH Ranch
Client ID:
STORET ID:
Coll. Date: 9/7/2007

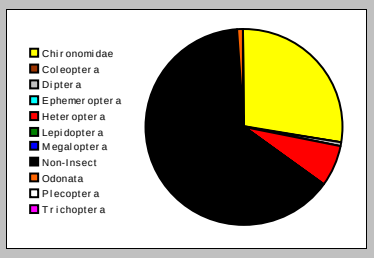
Abundance Measures

Sample Count: 120
Sample Abundance: 2,400.00 5.00% of sample used

Coll. Procedure:
Sample Notes:

Taxonomic Composition

Category	R	A	PRA
Non-Insect	2	77	64.17%
Odonata	1	1	0.83%
Ephemeroptera			
Plecoptera			
Heteroptera	1	8	6.67%
Megaloptera			
Trichoptera			
Lepidoptera			
Coleoptera			
Diptera	1	1	0.83%
Chironomidae	3	33	27.50%

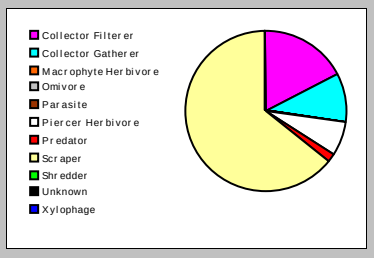


Dominant Taxa

Category	A	PRA
Physa	47	39.17%
Stagnicola	30	25.00%
Tanytarsus	21	17.50%
Chironomidae	10	8.33%
Corixidae	8	6.67%
Dolichopodidae	1	0.83%
Cryptotendipes	1	0.83%
Coenagrionidae	1	0.83%
Cladotanytarsus	1	0.83%

Functional Composition

Category	R	A	PRA
Predator	2	2	1.67%
Parasite			
Collector Gatherer	2	12	10.00%
Collector Filterer	1	21	17.50%
Macrophyte Herbivore			
Piercer Herbivore	1	8	6.67%
Xylophage			
Scraper	2	77	64.17%
Shredder			
Omivore			
Unknown			



Metric Values and Scores

Metric	Value	BIBI	MTP	MTV	MTM
Composition					
Taxa Richness	8	1	0		0
Non-Insect Percent	64.17%				
E Richness	0	1		0	
P Richness	0	1		0	
T Richness	0	1		0	
EPT Richness	0		0		0
EPT Percent	0.00%		0		0
Oligochaeta+Hirudinea Percent					
Baetidae/Ephemeroptera	0.000				
Hydropsychidae/Trichoptera	0.000				
Dominance					
Dominant Taxon Percent	39.17%		2		1
Dominant Taxa (2) Percent	64.17%				
Dominant Taxa (3) Percent	81.67%	1			
Dominant Taxa (10) Percent	100.00%				
Diversity					
Shannon H (loge)	1.395				
Shannon H (log2)	2.013		1		
Margalef D	1.489				
Simpson D	0.293				
Evenness	0.158				
Function					
Predator Richness	2		0		
Predator Percent	1.67%	1			
Filterer Richness	1				
Filterer Percent	17.50%			1	
Collector Percent	27.50%		3		3
Scraper+Shredder Percent	64.17%		3		3
Scraper/Filterer	3.667				
Scraper/Scraper+Filterer	0.786				
Habit					
Burrower Richness	0				
Burrower Percent	0.00%				
Swimmer Richness	1				
Swimmer Percent	6.67%				
Clinger Richness	1	1			
Clinger Percent	17.50%				
Characteristics					
Cold Stenotherm Richness	0				
Cold Stenotherm Percent	0.00%				
Hemoglobin Bearer Richness	1				
Hemoglobin Bearer Percent	0.83%				
Air Breather Richness	1				
Air Breather Percent	0.83%				
Voltinism					
Univoltine Richness	5				
Semivoltine Richness	0	1			
Multivoltine Percent	27.50%		3		
Tolerance					
Sediment Tolerant Richness	1				
Sediment Tolerant Percent	25.00%				
Sediment Sensitive Richness	0				
Sediment Sensitive Percent	0.00%				
Metals Tolerance Index	3.274				
Pollution Sensitive Richness	0	1		0	
Pollution Tolerant Percent	67.50%	1		0	
Hilsenhoff Biotic Index	7.383		0		0
Intolerant Percent	0.00%				
Supertolerant Percent	54.17%				
CTQa	108.000				

Bioassessment Indices

BioIndex	Description	Score	Pct	Rating
BIBI	B-IBI (Karr et al.)	10	20.00%	
MTP	Montana DEQ Plains (Bukantis 1998)	12	40.00%	Moderate
MTV	Montana Revised Valleys/Foothills (Bollman 1998)	1	5.56%	Severe
MTM	Montana DEQ Mountains (Bukantis 1998)	7	33.33%	Moderate