Environmental Assessment

M-I, LLC Upper Rim Plan of Operations (WYW-165980) and Right of Way (WYW-165779); Update to WDEQ Permit 278C for Bentonite Mining

Location: *6th P.M., T. 54 N., R. 92 W., Sections 27, 28, 29, 34, 35*
6th P.M., T. 53 N., R. 92 W., Sections 2, 3
Applicant/Address: *M-I, P.O. Box 832, Greybull, Wyoming 82426*

Wind River/Bighorn Basin District, Cody Field Office, Wyoming

U.S. DEPARTMENT OF THE INTERIOR BUREAU OF LAND MANAGEMENT
NATIONAL SYSTEM OF PUBLIC LANDS

May 2012

The Bureau of Land Management is responsible for stewardship of our public lands. The BLM is committed to manage, protect and improve these lands in a manner to serve the needs of the American people. Management is based upon the principles of multiple use and sustained yield of our nation's resources within a framework of environmental responsibility and scientific technology. These resources include recreation, rangelands, timber, minerals, watershed, fish and wildlife habitat, wilderness, air and scenic quality, as well as scientific and cultural values.

BLM/WY/PL-12/024+1430

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1.0 INTRODUCTION

1.1 BACKGROUND

The Bureau of Land Management Cody Field Office (BLM-CYFO) has received a combined application for (1) a Plan of Operations and (2) a Right-of-Way for bentonite mining from M-I Swaco, A Schlumberger Company (M-I), seeking approval to expand their mining operations northeast of Greybull, WY. A portion of the proposed new disturbance falls under the regulations at 43 CFR 3809 (Surface Management), and the majority falls under the regulations at 43 CFR 2800 (Rights-of-way). The application is hereafter referred to in this document as the **"Upper Rim Plan/ROW"**, with essentially two Proposed Actions, herein analyzed as one. For clarification purposes, the two Proposed Actions are referred to frequently throughout this document as the "Proposed Action" or the "Plan/ROW".

This Plan/ROW would cover or add:

(1) A total of ~43.4 acres new of disturbance on federal surface/federal minerals administered under 43 CFR 3809; and

(2) A total of ~431.1 acres of new disturbance within a BLM Stock driveway on federal surface/M-I patented minerals, as a Right-of-Way, administered under 43 CFR 2800.

This adds up to an approximate total of 474.5 acres of either already existing or proposed new surface disturbance on public lands. Of these acres, several have already been disturbed, which is explained below. In addition, and outside BLMs jurisdiction, M-I proposes to disturb an additional 190.7 acres of land with private surface/minerals (M-I patented lands). Mining on those acres would be authorized through the Wyoming Department of Environmental Quality – Land Quality Division (WDEQ-LQD) only.

1.2 PURPOSE AND NEED

The purpose of this Plan/ROW (the Proposed Action) is to allow M-I to mine bentonite on its unpatented mining claims under the 3809 regulations on specific lands, and to mine bentonite on split estate lands within the Stock Driveway, where the bentonite was patented to M-I or its predecessors, but the surface was retained by the BLM for stock driving purposes. Mining on unpatented claims with federally-administered surface and mineral estates is regulated under the Surface Management regulations at 43 CFR 3809. Mining on split estate lands (federal surface/M-I patented minerals) has been determined by the Solicitor's Office (Solicitor Mark S. Watt, November 8, 2007) to be authorized under the regulations governing rights of way (43 CFR 2800).

The need for this project is established by the BLM's responsibility to the rights of entry and use under the Mining Laws (1872), as amended; the requirements in the regulations at 43 CFR 3809 to review the submitted Plan of Operations to ensure prevention of unnecessary or undue degradation, and to ensure proper reclamation bonding for each year of mining disturbance. Portions of this submittal also fall under the purview of the regulations governing rights-of-way on split estate – BLM surface/private mineral.

Decision(s) to be Made

The Authorized Officer (AO), in this case the BLM-Cody Field Manager, must determine whether or not the Proposed Action(s), (Alternative I) with attached stipulations, mitigation and monitoring measures, or the No Action Alternative (Alternative II) could result in significant impact to the human environment. If not, this determination would be documented in a "Finding of No Significant Impact" (FONSI) as a part of the Environmental Assessment (EA). If impacts are determined to be significant, preparation of an acceptable Environmental Impact Statement would be necessary, prior to Plan and Right of Way approval.

(1) Approve the Plan of Operations and Right-of-Way (Plan/ROW) as submitted by M-I, with any needed additional stipulations, mitigation and monitoring measures as determined by BLM during review;

(2) Disapprove/withhold approval of the Plan of Operations and Right-of-Way because they would result in unnecessary or undue degradation of the public lands, and BLM would not be able to arrive at a Finding of No Significant Impact (FONSI) at the level of an EA.

1.3 ISSUES IDENTIFIED DURING SCOPING

Internal scoping relative to the Proposed Action (Plan/ROW) was conducted by a BLM CYFO interdisciplinary team during October 2009 and, as the legal description of the Plan was finalized, concluded in January 2012. Several joint BLM, WDEQ-LQD, and M-I field outings have been made to the general Upper Rim area over the past 3 years. Internal scoping resulted primarily with the following BLM specialist concerns:

- Air quality could be affected by dust and exhaust generated by burning fossil fuels associated with bentonite mining.
- Bentonite mining could increase sedimentation into surface water including wetlands, riparian areas, floodplains, and aquatic habitats.
- Disturbance caused by bentonite mining could affect drainages within and near the proposed mine area, which may or may not be jurisdictional waters of the United States.
- Area soils took thousands of years to develop and would be disturbed by the proposed mining.
- Revegetating areas disturbed by mining would be difficult due to changes in post-mining soil characteristics, the area's dry climate, and the presence of invasive weeds.
- Invasive weed species could spread through the proposed mining process.
- Active or inactive raptor nests, if present in the area, as well as nesting success, could be affected by proposed mining disturbance.
- Disturbance caused by the proposed mining could affect habitat for sage grouse, prairie dogs, mountain plovers and migratory birds.
- Bentonite mining would generally affect and fragment wildlife habitat in the proposed mining area.
- Bentonite mining could disturb buried cultural sites.
- Bentonite mining would increase the number of roads into the proposed mining area, which could increase human disturbance to cultural and wildlife resources.
- The proposed mining would cause a short-term (5-10 year) loss of forage for livestock and wildlife.

1.4 RELATIONSHIP TO STATUTES, REGULATIONS, POLICIES, PLANS OR OTHER ENVIRONMENTAL ANALYSES

This Plan/ROW has been reviewed to determine if it conforms with the approved Cody Resource Management Plan (RMP)/Land Use Plan relative to locatable minerals and realty actions, as required by 43 CFR 1610.5. The Cody RMP provides that, "*Except for specific areas identified as closed, the planning area is open to staking of mining claims and operation of the mining laws for locatable minerals*," (pg. 21, Record of Decision (ROD)/RMP). The area proposed for new mining under this Plan/ROW has not been withdrawn from mineral entry, and is therefore open to mining claim location, and subsequent mineral development, after proper review and approval. The Proposed Action is in conformance with the Cody RMP ROD, signed November 8, 1990.

The BLM is required under the mining laws, and the surface management regulations at 43 CFR 3809, to review Plans of Operation for compliance with the regulations, and to ensure the mining plan will not cause unnecessary and undue degradation to the public lands as defined in 43 CFR 3809.5. The No Action Alternative (Alternative II) could only be selected should the proposed Plan/ROW result in unnecessary and undue degradation of the public lands.

"Mining laws" means the Lode Law of July 26, 1866, as amended (14 Stat. 251); the Placer Law of July 9, 1870, as amended (16 Stat. 217); and the Mining Law of May 10, 1872, as amended (17 Stat. 91); as well as all laws supplementing and amending those laws, including the Building Stone Act of August 4, 1892, as amended (27 Stat. 348); the Saline Placer Act of January 31, 1901 (31 Stat. 745); the Surface Resources Act of 1955 (30 U.S.C. 611–614); and the Federal Land Policy and Management Act of 1976 (43 U.S.C. 1701 *et seq.*).

RMP Maintenance: On April 17, 2007, Wyoming BLM Instruction Memorandum (IM) No. WY-2007-018 was issued, entitled "Resource Management Plan (RMP) Maintenance Action: Incorporation of the Bureau of Land Management's (BLM) Programmatic Biological Evaluation (BE) for the mountain plover (*Charadrius montanus*) and the United States Fish and Wildlife Service (USFWS) Inter-agency Coordination Memorandum into Field Office (FO) Resource Management Plans (RMPs) by Maintenance Action". This IM conveyed the FWS Memorandum on mountain plover conservation measures, as well as the BLM Wyoming Programmatic Biological Evaluation of the mountain plover, and applies to the existing Cody ROD dated November 1990. This EA takes this IM into account, and a copy of the IM is attached in **Appendix A** for reference.

State Statutes and the WDEQ-LQD/BLM Memorandum of Agreement (MOU): The WDEQ-LQD administers and enforces all state statutes and regulations on land disturbances dealing with mining and reclamation within Wyoming, including on federal lands. The WDEQ-LQD's authority derives from the Wyoming Environmental Quality Act and the LQD Non-Coal regulations which are related to Article 4 of the Wyoming Environmental Quality Act (W.S. 35-11-401 through 437).WDEQ-LQD has the authority to require permitting and licensing of all operator actions of surface mines, and works in conjunction with the BLM under a Memorandum of Understanding (2003) for mines proposed on federal lands. Each mine/permit area is required by statute and regulation to be covered by a reclamation bond, in the event the operator is unable to fulfill reclamation requirements. M-I. is covered by such a bond, which is reviewed annually by the WDEQ-LQD and BLM to ensure it is adequate.

US Army Corp of Engineers (USACE) Requirements: If implementation of the Proposed Action would result in the placement of fill or dredge material in a pond, wet meadow, stream channel, or any other water feature, M-I would coordinate with the U.S. Army Corps of Engineers (COE) to determine if the feature is a "jurisdictional" wetland or a "Water of the U.S.", and whether the Clean Water Act (CWA) Section 404 Permit would be needed. The WDEQ-Water Quality Division (WQD) is responsible for administering Section 401 of the CWA in the State of Wyoming. According to Federal and State law, activities that would result in surface disturbance in excess of 1-acre, require a Storm Water Discharge Permit (SWDP), and associated Storm Water Pollution Prevention Plan (SWPPP) from the State of Wyoming. The mining plan analyzed in this EA propose to disturb more than one acre, and therefore the project proponent (M-I) has coordinated with the WDEQ-WQD to obtain the necessary SWDP(s) and associated SWPPP(s).

2.0 PROPOSED ACTION AND ALTERNATIVES

2.1. Alternative I – Proposed Action

The Proposed Action would be to approve (1) the Upper Rim Plan of Operations as submitted with stipulations, mitigation and monitoring measures as stated by M-I and WDEQ-LQD, and required by the BLM; and to approve (2) the Right-of-Way Grant for the Upper Rim area under Section V of the Federal Land Policy and Management Act (FLPMA) that authorizes bentonite mining, including active mine areas and access/haul roads for a period of up to 30 years for the legal descriptions provided in this EA.

(1) Operator Information (as per 43 CFR 3809.401(b)(1)):
The operator for the Proposed Action is **M-I, L.L.C, P.O. Box 832, Greybull, WY 82426**.

(2) Description of operations (as per 43 CFR 3809.401(b)(2)):

Below is a detailed description of the proposed mining operations being analyzed in this EA. This Plan/ROW would add:

(a) A total of 43.4 acres of new disturbance on federal surface/federal minerals administered under the regulations at 43 CFR 3809; and

(b) A total of 431.1 acres of new disturbance within a BLM Stock driveway on federal surface/M-I patented minerals as a Right-of-Way administered under the regulations at 43 CFR 2800.

This adds up to an approximate total of 474.5 acres of either already existing, or proposed new disturbance, on public lands.

The proposed Upper Rim mining area would be developed in six distinct mine series identified as **Arney, Davis, Leonard, Bonney, Howe and Upper Rim (Maps 1a and 1b).** Generally, these areas lie along the gently sloping western flank of Beaver Rim, among extensive previously developed M-I mining areas in portions of Sections 27, 28, 34 and 35, T.54 N, R. 92 W., and Sections 2 and 3, T. 53 N., R. 92 W. MAP 1 illustrates the general location of the area, haul road access, stockpile areas and the approximate planned sequencing for these phases. Numbers attached to each mining area indicate general sequencing and directions for pit development which are also summarized below. **Tables 1 and 2** summarize proposed Upper Rim Pit Areas, legal descriptions for each mine series, and newly proposed haul road(s), and **Table 3** (taken from Appendix A of the Plan/ROW application), provides specific disturbance acreages proposed by and associated with this Plan/ROW. Bentonite mining activity proposed in this Plan/ROW would target the "Beaver" bentonite bed, which lies beneath the erosion-resistant surface of the Peay Sandstone Member of the Cretaceous Frontier Formation.

Material Management - Mining/Backfilling/Recontouring: Bentonite mining usually initiates at the outcrop and progresses down dip to some economical depth or to a point where the seam disappears. Mining under the proposed Plan/ROW would generally be conducted using the castback/highwall reduction method. **Figure 1** (below), shows a model of the cast back system. In this process, topsoil and subsoil are first separately salvaged in areas of planned disturbance, and then stockpiled in an area free of contaminants, including bentonite and overburden. Overburden from the first open pit (phase 1) of a sequence is usually piled and contoured adjacent to the first cut or open hole (sometimes referred to as an "out-of-pit spoil pile" or OOPS). The bentonite seam is exposed, cleaned, blasted if necessary, and mined using various types of heavy equipment. Once the bentonite is removed from phase 1, overburden from the next open pit of the sequence (phase 2) is pushed or "cast back" into the open hole of phase 1. Thus, reclamation takes place concurrently with mining. After backfilling, the pit is recontoured, topsoiled, and seeded by the company. This process repeats itself until the end of the pit sequence is reached. Economical mining depths are determined by stripping ratios and equipment cost.

Sufficient volumes of topsoil and suitable cover material must be preserved to cover the final sequence recontour of a mine series. M-I would salvage and stockpile all suitable reclamation materials from the first two to four cuts of a mine series, to be used as cover for the final cuts. Several areas have been designated to accept overburden from the first cuts of each series. Where this material can be located away from areas of future mining, it would be contoured into permanent out-of-pit spoil sites. Where this material must be placed on lands subject to future mining, stockpiles would be temporary, and blended back into the backfill of the advancing pit series. In all cases, permanent out-of-pit spoil piles and mine backfill slopes would be contoured to slopes not exceeding 4(h):1(v), and that conform to surrounding topography.

Each series would require up to four initial cuts to develop the space necessary to fully engage in cast-back mining. When this space is available, all overburden, suitable cover, and topsoil will be live placed from the current cut back to a previous cut. Typically, the cast back cut is the third cut back from the active cut, if the backfill area is not used for drying bentonite.

If the backfill is used for drying, direct cast back may be extended to a four or five cut spread. ***Regardless, the amount of separation between the active and cast-back cuts is limited by M-I's reclamation concurrency commitment.***

It is anticipated that mining of all pits and reclamation of associated disturbances would be completed through seeding within 15-20 years of commencement. All topsoil and subsoil would be salvaged and stored using Best Management Practices (BMPs) to preserve biological integrity. Reclamation success ultimately leading to bond release by WDEQ, along with BLM consensus, could possibly take up to fifteen years or longer, depending on many factors. Companies are generally eligible for bond release five years after reclamation is complete.

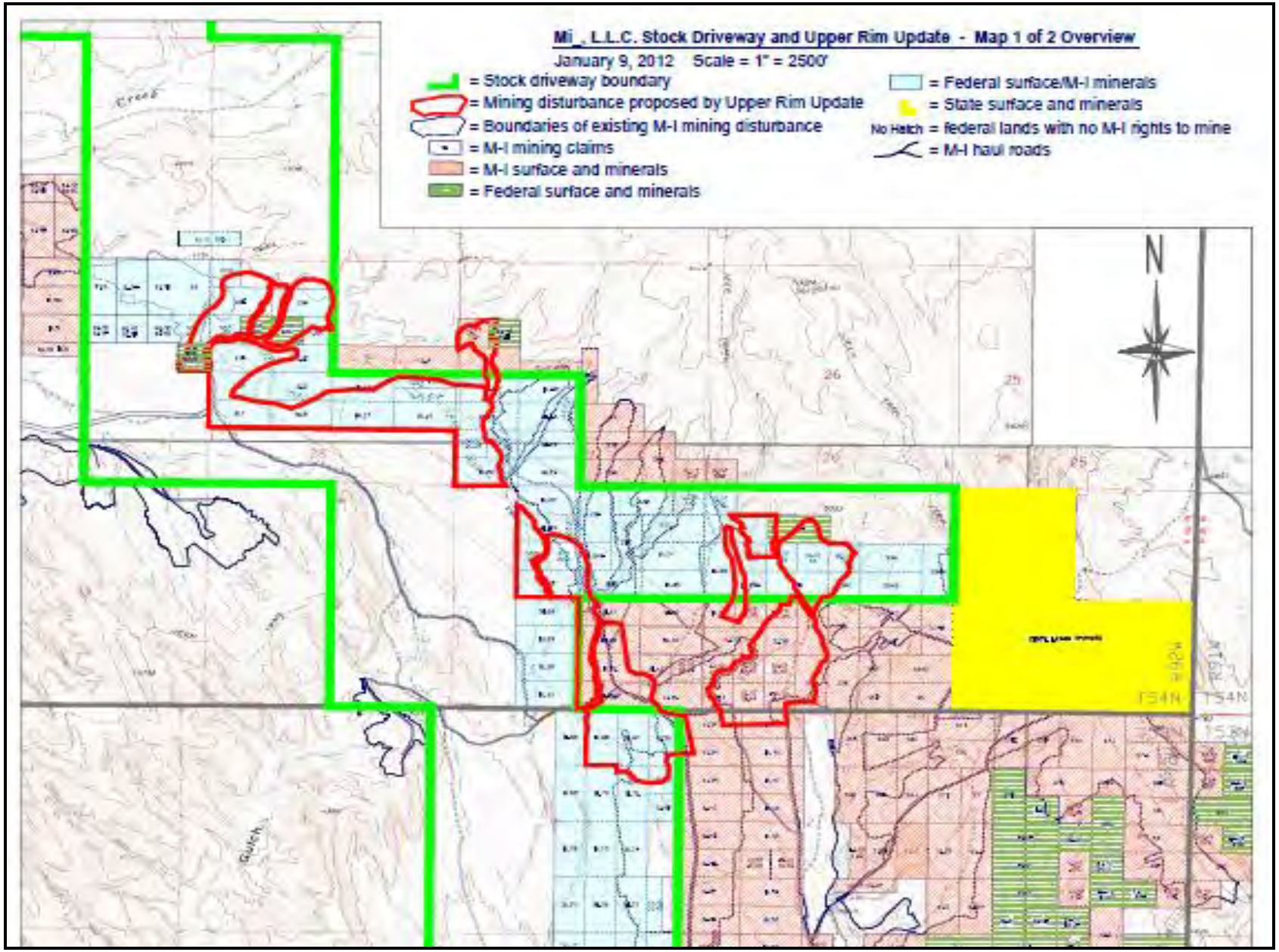
Table 1. From Upper Rim Plan/ROW Upper Rim Plan/ROW Areas and Legal Descriptions

Upper Rim Pit Areas	Township, Range and Section Legal Descriptions	
Upper Rim	T54N R92W	NW¼ & NE¼ Section 35
Howe	T54N R92W	SW¼ Section 35
Arney	T54N R92W	NW¼ Section 28; NE¼ Section 29
Davis	T54N R92W	S½ Section 28; SW¼ Section 27
Leonard	T54N R92W	NW¼ Section 34
Bonney	T54N R92W T53N R92W	SE¼ Section 34 NE¼ Section 3
Hinckley II	T54N R92W	W2W2 Section 35
North Esther	T54N R92W	NW¼ Section 35
Tanner II	T54N R92W	W2W2 Section 27

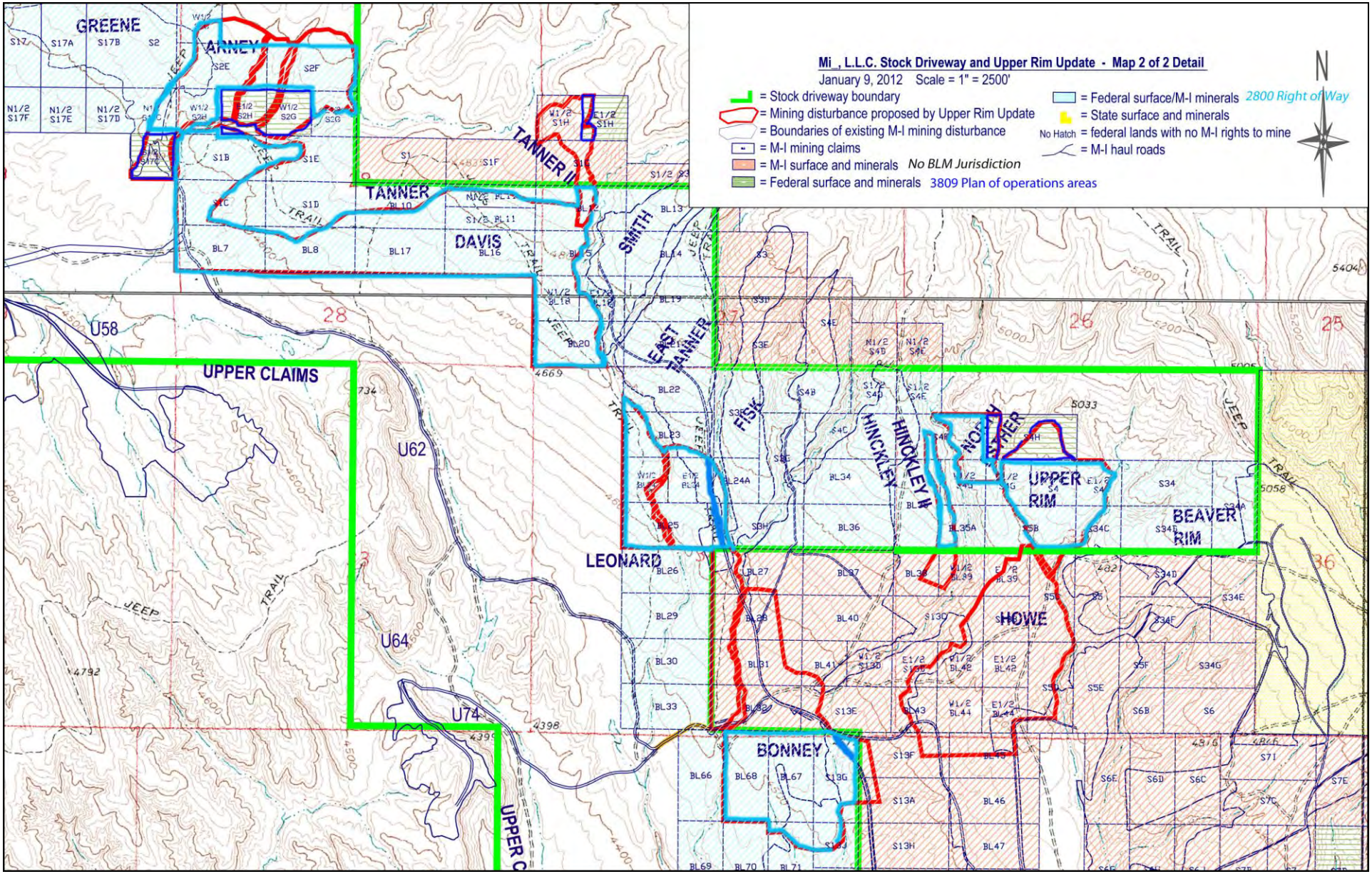
Recontouring and Seeding: After backfilling, the area would be recontoured to match as much as possible the original topographic contours. Recontoured overburden would then be prepared to receive the salvaged subsoil and topsoil. Once sub- and topsoils are spread and prepared, the disturbed area would be seeded as per the terms of the approved reclamation plan.

Haul Roads: Access to these pits would be provided primarily by existing bonded and permitted M-I haul roads. Several small connector haul roads are contained within mine disturbances. These are considered as portions of the affected mine areas and are not considered separately. Exact positions of these roads are too transitory to predict, as they will be periodically relocated to accommodate on-going mining and reclamation. All other haul roads/access roads required for activities proposed are either currently permitted or would be extended within proposed pit disturbance areas. Culverts would be set at a 2% slope or set on the bottom of the channel based on BLM Manual Section 9113. Roads and culverts on public lands would be constructed according to BLM specifications, including a crown and ditch drainage, with strategically placed water exit ditches to prevent pooling on roads.

Hydrologic Diversions and Culverts: Temporary hydrologic diversions and culverts would comply with WYDEQ-LQD Noncoal rules, Chapter 3, Section 2(e)(ii)(F) to allow passage of peak runoff from a 2 year, 6 hour precipitation event in a non-erosive manner. Permanent diversions would comply with WDEQ-LQD Noncoal rules, Chapter 3, Section 2(e)(iv), in that they would have sufficient capacity for peak runoff from a 100 year, 6 hour precipitation event. If necessary, sediment control fabric fences would be installed at discharge points into natural channels. These structures would be moved periodically to accommodate active mining.



Map 1a. M-I's Upper Rim Plan of Operations and Right-of-Way areas (outlined in red); as provided by M-I Lands shown in blue are split estate lands within the BLM Stock Driveway; Lands with pink hatching are M-I patented lands, and lands with green hatches are BLM surface/BLM minerals (3809) lands.



Map 1b. M-I's Upper Rim Plan of Operations (dark blue outlines) and Right-of-Way areas (light blue outlines); as provided by M-I. Lands with blue hatching are split estate lands (2800 ROW lands) within the BLM Stock Driveway; Lands with pink hatching are M-I patented lands, and lands with green hatches are BLM surface/BLM minerals (3809) lands.

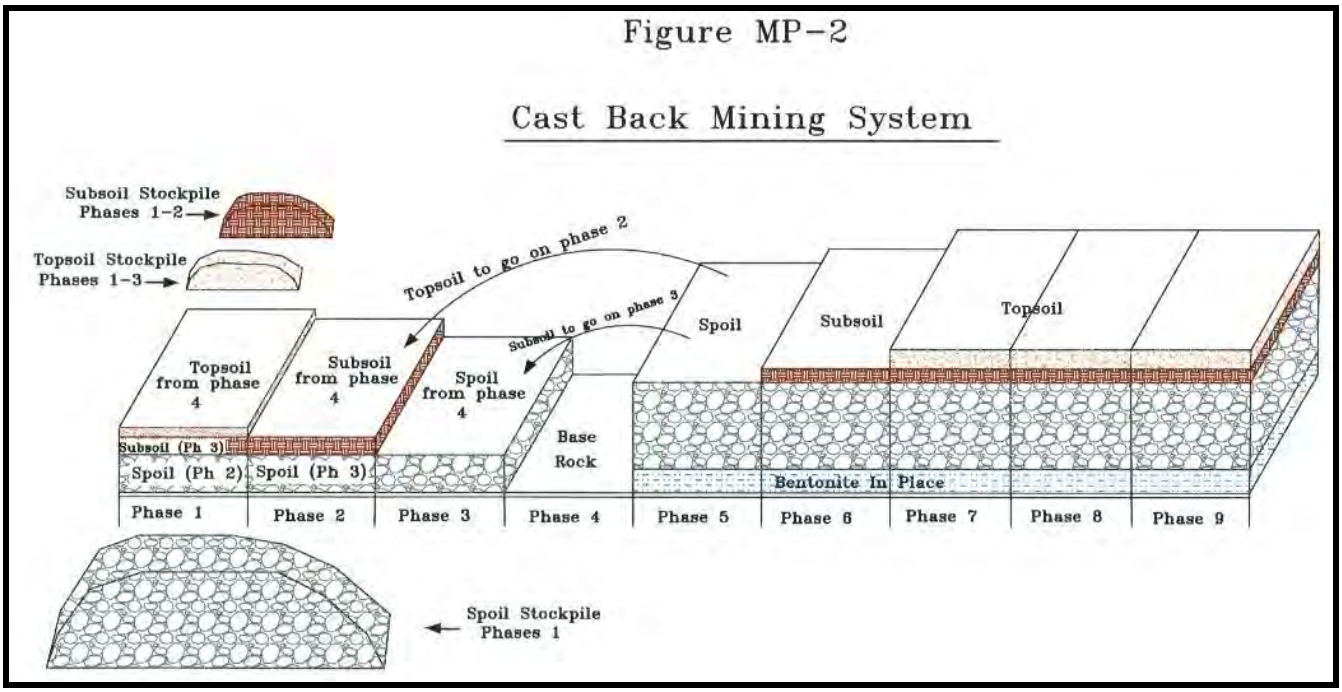


Figure 1. Theoretical schematic of a cast back bentonite mining sequence (*this schematic assumes horizontal bedding and fairly uniform overburden thicknesses).*

Table 2. Upper Rim Plan/ROW Proposed Pit Disturbance Acreages

PIT SERIES	**Pit Land Status and Acres** (*Numbers adjusted to match latest maps & claims table provided below)			
	Private/Patented Land	**Federal Surface/Private Mineral (ROW)**	**Federal Surface/ Federal Mineral (Plan)**	**Total acreage by pit area**
Upper Rim	*1.5*	***44.3***	***0 (see North Esther)***	*45.8*
Howe	*102.7*	***0.3***	***0***	*103.0*
Bonney	*44.7*	***65.7***	***0***	*110.4*
Leonard	*21.3*	***51.5***	***0***	*72.8*
Davis	*6.5*	***142.6***	***0***	*149.1*
Arney	*0*	***101.7***	***31.5****	*133.2**
Tanner II	*9.8*	***2.6***	***1.9****	*14.3**
Hinckley II	*4.2*	***7.2***	***0***	*11.4*
North Esther	*0*	***15.2***	***10****	*25.2**
TOTALS	***190.7***	***431.1***	***43.4****	***665.2****

More detailed information is provided in ***Appendix B.***

Table 3.

APPENDIX A: Tabulation of Ownership and Proposed Disturbance

NOTE: Highlight colors correspond with Map C/E.2

Addendum A.1: M-I, L.L.C. Unpatented Claims (Federal Surface/Federal Minerals)

Claim Name	WMC No.	Legal Description	Proposed New Disturbance Acres	Proposed Re-Disturbance Acres	Bond Release Acres Affected	Native Acres (NOT affected)	Reclaimed Acres (NOT affected)	Total Acres
E1/2 Sinkhole 2C	288815	NENWNW, 28, 54/92	4.5			5.5		10
E1/2 Sinkhole 1H	Pending	NESWNW, 27, 54/92	1.9			8.1		
Sinkhole 2B	288814	N2NENW, 28, 54/92	4.1			16.1		20.2
S1/2 Sinkhole 17C	288818	SESENE, 29, 54/92	4.3	3		0.8	1.9	10
E1/2 Sinkhole 2H	N/A	NESWNW, 28, 54/92	7.2			2.4		9.6
W1/2 Sinkhole 2G	N/A	NWSENW, 28, 54/92	8.4			1.6		10
Sinkhole 4H	N/A	S2NENW, 35, 54/92	10			10.3		20.3
Sub-Totals:			40.4	3	0	44.8	1.9	80.1

Addendum A.2: Split Estate Lands (Federal Surface/M-I, L.L.C. Minerals)

Claim Name	WMC No.	Legal Description	Proposed New Disturbance Acres	Proposed Re-Disturbance Acres	Bond Release Acres Affected	Native Acres (NOT affected)	Reclaimed Acres (NOT affected)	Total Acres
W1/2 Sinkhole 2C	N/A	NWNWNW, 28, 54/92	2.4	1		6.2	1.4	11
Sinkhole 2	N/A	N2NENE, 29, 54/92		0.2		20		
Sinkhole 2E	N/A	S2NWNW, 28, 54/92	12.3	4.6	2.6	0.7	2.6	22.8
Sinkhole 2F	N/A	S2NENW, 28, 54/92	18.1			2.1		20.2
N1/2 Sinkhole 17C	N/A	NESENE, 29, 54/92	2	2.5		0.3	7.3	12.1
W1/2 Sinkhole 2H	N/A	NWSWNW, 28, 54/92	8	0.6		1.4		10
E1/2 Sinkhole 2G	N/A	NESENW, 28, 54/92	3.5			6.2		9.7
Sinkhole 1B	N/A	S2SWNW, 28, 54/92	18.6			0.6	0.8	20
Sinkhole 1E	N/A	S2SENW, 28, 54/92	3.1			4.9	11.9	19.9
Sinkhole 1C	N/A	N2NWSW, 28, 54/92	4.9	5.1			9.8	19.8
Sinkhole 1D	N/A	N2NESW, 28, 54/92		1.4			18.7	20.1
Blue 7	N/A	S2NWSW, 28, 54/92	11.9	7.7			0.5	20.1
Blue 8	N/A	S2NESW, 28, 54/92	9.3	8.4			2.3	20
Blue 10	N/A	N2NWSE, 28, 54/92	1.3	8.4			10.3	20
Blue 17	N/A	S2NWSE, 28, 54/92	19.6	0.4				20
S1/2 Blue 11	N/A	S2N2NESE, 28, 54/92	6.3	3.7				10
Blue 16	N/A	S2NESE, 28, 54/92	19.9					19.9
Blue 12	N/A	N2NWSW, 27, 54/92	3.2	5.3		5.5	6.2	20.2

Table 3 continued

Addendum A.2 (Continued): Split Estate Lands (Federal Surface/M-I, L.L.C. Minerals)								
Claim Name	WMC No.	Legal Description	Proposed New Disturbance Acres	Proposed Re-Disturbance Acres	Bond Release Acres Affected	Native Acres (NOT affected)	Reclaimed Acres (NOT affected)	Total Acres
Blue 15	N/A	S2NWSW, 27, 54/92	9.9	0.1		3.5	6.7	20.2
Blue 18	N/A	N2SWSW, 27, 54/92	12			3.7	4.5	20.2
Blue 20	N/A	S2SWSW, 27, 54/92	14.8			2.3	3	20.1
Blue 22	N/A	N2NENW, 34, 52/94	1.2			2.1	16.7	20
Blue 23	N/A	S2NENW, 32, 54/92	4.9	0.4		3.9	8.6	17.8
W1/2 Blue 24	N/A	NWSENW, 34, 54/92	9.1			1.1		10.2
E1/2 Blue 24	N/A	NESENW, 34, 54/92	5.4	3.9			0.8	10.1
Blue 24A	N/A	NWSWNE, 34, 54/92	1.4	0.3		1.3	8.4	11.4
Blue 25	N/A	S2SENW, 34, 54/92	17.2	1.8		1.1		20.1
Sinkhole 3H	N/A	S2SWNE, 34, 54/92	0.9	2.3		5.9	11.1	20.2
Blue 68	N/A	E2NWNE, 3, 53/92	20			0.2		20.2
Blue 67	N/A	W2NENE, 3, 53/92	16.1		4			20.1
Sinkhole 13G	N/A	E2NENE, 3, 53/92	5.6	0.5	11.8		1.5	19.4
Blue 71	N/A	W2SEN3, 3, 53/92	0.8		3.2	1.5	16.1	21.6
Sinkhole 13J	N/A	NESENE, 3, 53/92			3.8		6.3	10.1
Sinkhole 4F	N/A	S2NWNW, 35, 54/92	9.5			6.2	4.6	20.3
Blue 35	N/A	W2SWNW, 35, 54/92	1.8			18.2	0.1	20.1
Blue 35A	N/A	SESWNW, 35, 54/92	3.2			6.9		10.1
W1/2 Sinkhole 4G	N/A	NESWNW, 35, 54/92	3.9			6.2		10.1
E1/2 Sinkhole 4G	N/A	NWSENW, 35, 54/92	7			3.1		10.1
W1/2 Sinkhole 4	N/A	NESENW, 35, 54/92	10.1					10.1
E1/2 Sinkhole 4	N/A	NWSWNE, 35, 54/92	6.9			3.2		10.1
Sinkhole 5B	N/A	S2SENW, 35, 54/92	11.3			8.8		20.1
Sinkhole 34C	N/A	SWSWNE, 35, 54/92	3.1			7		10.1
Sub-Totals:			320.5	58.6	25.4	134.1	160.2	678.6

Table 3 continued.

Addendum A.3: Private Surface/Private Minerals (M-I, L.L.C.)								
Claim Name	WMC No.	Legal Description	Proposed New Disturbance Acres	Proposed Re-Disturbance Acres	Bond Release Acres Affected	Native Acres (NOT affected)	Reclaimed Acres (NOT affected)	Total Acres
N1/2 Blue 11	N/A	N2N2NESE, 28, 54/92		6.4			3.5	9.9
W1/2 Sinkhole 1H	N/A	NWSWNW, 27, 54/92	7.1	0.6		2.1	0.3	10.1
Sinkhole 1G	N/A	S2SWNW, 27, 54/92	2.8	0.9		8.2	8.2	20.1
Blue 27	N/A	N2NWSE, 34, 54/92	3.7	2.9		1.6	13.4	21.6
Blue 28	N/A	S2NWSE, 34, 54/92	7.1	6.6		0.7	4.3	18.7
Blue 31	N/A	N2SWSE, 34, 54/92	10	5		0.8	4.4	20.2
Blue 41	N/A	NWSESE, 34, 54/92	0.1	1.3		1.7	8.6	11.7
Blue 32	N/A	S2SWSE, 34, 54/92	15.5	2.9		1.7		20.1
Addendum A.3 (Continued): Private Surface/Private Minerals (M-I, L.L.C.)								
Claim Name	WMC No.	Legal Description	Proposed New Disturbance Acres	Proposed Re-Disturbance Acres	Bond Release Acres Affected	Native Acres (NOT affected)	Reclaimed Acres (NOT affected)	Total Acres
Sinkhole 13E	N/A	S2SESE, 34, 54/92	2.4	2.4	0.2	0.3	14.9	20.2
Sinkhole 13F	N/A	N2NWNW, 2, 53/92	1.3	4.4			14.5	20.2
Blue 45	N/A	N2NENW, 2, 53/92	5	2			13.1	20.1
Sinkhole 13	N/A	S2NWNW, 2, 53/92		0.4	1.8		18	20.2
Blue 38	N/A	NWNWSW, 35, 54/92	1.8					1.8
W1/2 Blue 39	N/A	NENWSW, 35, 54/92	2.6			7.6		10.2
E1/2 Blue 39	N/A	NWNESW, 35, 54/92	6.8			3.4		10.2
Sinkhole 5C	N/A	E2NESW, 35, 54/92	13.9			4.9	1.5	20.3
Sinkhole 13C	N/A	S2NWSW, 35, 54/92	2.6	0.7		11.9	5.2	20.4
Sinkhole 13B	N/A	SWNESW, 35, 54/92	10.1					10.1
E1/2 Sinkhole 13D	N/A	NWSWSW, 35, 54/92	1.4	1.4		7.4		10.2
W1/2 Blue 42	N/A	NESWSW, 35, 54/92	7.8	1.5			0.9	10.2
E1/2 Blue 42	N/A	NWSESW, 35, 54/92	10.1					10.1
Sinkhole 5D	N/A	E2SESW, 35, 54/92	10.4		1.4		8.5	20.3
Blue 43	N/A	NWSESW, 35, 54/92	4	3.3			3.6	10.9
W1/2 Blue 44	N/A	SESWSW, 35, 54/92	10.1					10.1
E1/2 Blue 44	N/A	SWSESW, 35, 54/92	6.4	1.7	1.2		0.9	10.2
Sub-Totals:			143	44.4	4.6	52.3	123.8	368.1
			Proposed New Disturbance Acres	Proposed Re-Disturbance Acres	Bond Release Acres Affected	Native Acres (NOT affected)	Reclaimed Acres (NOT affected)	Total Acres
TOTALS:			503.9	106	30	231.2	285.9	1126.8

(3) <u>Reclamation Plan (as per 43 CFR 3809.401(b)(3):</u> (General Reclamation Plan from M-I, LLC's Master Permit, and specific to the Upper Rim area) The detailed reclamation plan for the Upper Rim area is provided below.

<u>Slope restoration:</u> Generally, all post-mining slopes would be designed and reconstructed to blend with adjacent native and previously reclaimed areas. M-I strives to keep slopes within angles where they can be safely ripped along the contour with a farm tractor. Draws would be reconstructed within these slopes, consistent in size and position to existing native features both above and below the reclamation. These draws are critical for the management of down slope drainage and for the aesthetic transition between disturbed lands and the adjacent native landscape.

<u>Drainage restoration:</u> Ephemeral drainages would be replaced at a density consistent with the pre-mine landscape, or as appropriate to the desired post-mine topography. Reclaimed channels are divided into two basic classifications: (1) Designed, and (2) Non-designed. Design drainages are generally described as major ephemeral drainages and are often delineated on USGS 7.5 minute quadrangles. Non-designed drainages would be reconstructed as winding swales with a concave profile and a gradient that approximates pre-mine conditions. These small pre-mine channels may empty onto flat areas with no definable outlet. In most instances, only a portion of these channels are mined through, resulting in the need to establish a stable transition between the native and reclaimed channel. Channel reconstruction would be accomplished by using scrapers, which results in an average channel bottom width of 12 feet. To promote long term stability, M-I would create a channel transition zone to allow the reclaimed channel to gradually taper into the native channel. Reclaimed channels are designed to be stable for an event with a return period between two and five years and have sufficient capacity to carry the flow associated with the 100-year, 6-hour event.

<u>Wetland restoration:</u> Any man-made wetlands to be disturbed would be excavated and reconstructed in a planned position elsewhere within the same drainage in the approved mine disturbance boundary. The reconstructed wetland subsurface would consist of a contoured basin similar in size and profile to the original feature, and lined with clay to hold water. Wetland soils would be excavated from the original feature, and placed live within the reconstructed basin. (*Note: Natural wetland features and their water source (s), ground water or contributing areas, would not be disturbed*).

<u>Replacement of Topsoil, Subsoil, and Suitable Material</u> All contoured overburden, and any bentonitic spoil, would be covered (capped) with a minimum of two (2) feet of clean overburden or chemically suitable material, to include the depth of additional topsoil. "Clean overburden", although not chemically suitable as a topsoil replacement, is material not contaminated with bentonite. This material will be used for cover in mine areas where no chemically suitable material was present. Suitable material is chemically suitable as a topsoil replacement. This material may be spread as a sub-cover beneath topsoil, as final cover on slopes and drainages where topsoil stability is threatened, or as a topsoil replacement where topsoil reserves are insufficient.

<u>Subsoil:</u> Subsoil, if characterization and salvage is required by the specific mine plan, will be spread on top of suitable cover material, or clean overburden if suitable cover is not available. M-I will determine the best placement of this subsoil to include the option of either spreading it as a topsoil substitute on areas where topsoil volumes are inadequate, or to use the subsoil as a base in those areas targeted for topsoil coverage.

<u>Topsoil and Surface Rock:</u> M-I recognizes that a small topsoil reserve, spread thinly (less than 4 inches) to uniformly cover the reclamation is not conducive to revegetation. M-I's primary goal is to stretch its soil reserve by creating a mixture of deeper soil pockets favorable for some plants, and non-topsoiled areas that are capable of supporting other species. M-I's secondary goal is to create a mosaic of growing mediums with a resulting vegetation diversity that is more resistant to cyclic drought and weather patterns, and more accommodating to targeted wildlife species, than is homogenous cover.

Topsoil, where possible, will be spread live (directly from a preceding pit), and replaced to a minimum depth of 6-8 inches, concentrating on areas most conducive to harvesting moisture (low spots, swales, lee sides of rocks and slopes, north slopes, along drainages). High angle slopes and the tops of knobs and ridges, will be covered

with rock, clean overburden, subsoil, or suitable material (depending on pre-mine availability of materials and revegetation goals). Topsoiled surfaces, or surfaces in final cover, will be left as rough as possible and ripped along the contour.

M-I would utilize surface rock as a reclamation component, a condition which is similar to what exists in the pre-mine environment at many locations. Surface rock encourages a vegetative mosaic by selectively harvesting water, creates windbreaks, and provides a growing medium that favors the reestablishment of certain shrub species. Where practical and available, placement of large rock and rocky overburden on slopes and the tops of ridges and knobs aids in the control of water and wind erosion within these areas. The addition of surface rock also helps stretch topsoil volumes when topsoil reserves are limited.

Postmine Sediment and Erosion Control Slope contouring and surface corrugation is effective in containing erosion and providing for water infiltration. For drainages, sediment and erosion control structures will be constructed as prescribed by the Master Permit (Mine Plan), and as necessary to prevent accelerated erosion within the drainage, or head-ward erosion and sedimentation onto native or reclaimed land.

Reclamation Schedule Live cast back of materials will begin as soon as adequate room for reclamation develops behind the active pit. Per WDEQ-LQD Noncoal Rules and Regulations Chapter 13, Section 3 (a)(vi), for lands permitted prior to August 31, 1981, reclamation will be initiated within two years and completed within four years of the date that the land was affected (on areas where field drying is to take place, reclamation will begin within three years, and completed within five years, of the date that the land is affected). Access and haul roads would be reclaimed, with culverts removed, as they are abandoned. Should a suspension of mining or reclamation activity for more than two years be anticipated, the specific mine area will be placed on an interim stability schedule as per M-Is "Master Mine Plan: Monitoring and Compliance/Interim Stabilization Plan" (2006). Reasons for suspension include changing market conditions or the scheduled delay of an area that will be subject to re-disturbance at a later stage of pit advancement.

Seeding: Seeding of recontoured mine areas would occur between October 15 and April 15 of the year. M-I may reserve the right to deviate from the pre-mine plant community locations, tailoring seed mixes with BLM and WDEQ concurrence, to accommodate post-mine conditions. Conditions that may influence application decisions include topography, soil depth, availability of topsoil or other suitable soil, soil quality, and climatic cycles. All areas that have been topsoiled or that have been covered with a final cover of either subsoil or suitable overburden would be seeded, as well as areas intentionally left rocky such as ridges and slopes. The decision to seed or not to seed areas characterized pre-mine, would be based on the availability of chemically suitable cover/plant growth medium. If sufficient subsoil or suitable overburden is available to cover formerly barren areas, they will be seeded. If suitable cover material is not available, M-I will leave a similar (to pre-mine barren conditions) acreage of ground not seeded, with the exception to give consideration to the application of select species to topographic depressions.

All seed will be broadcast with either an ATV-mounted, or hand held, broadcast seeder. Following seeding, the surface may be lightly harrowed to encourage some soil-covering of the seed. Seed will not be covered to a depth greater than 1", with a preferred depth of 0.25" to 0.5".

Reseeding Areas: Previously seeded areas that have not demonstrated satisfactory revegetation will be considered for reseeding. If an evaluation suggests the need, M-I will consider and implement soil amendments, additional topsoil placement or surface modification, weed management or a change in the seed mix or application methods. *Deviations in the seed mix, soil amendments or major surface modifications, will involve consultation with the WDEQ-LQD, and on federal lands, with the BLM Cody Field Office prior to making the changes*. The reseeded areas will be spot-ripped or harrowed before seeding, with possible light harrowing to follow.

Approved seed mixes*: Whenever possible, shrub seeds originating from Wyoming high desert shrub lands or adapted habitats will be used, with preference given local vendors. These mixes and their applications were cooperatively developed by representatives from MI, Wind River Seed, Shell Valley Consulting, the WDEQ-

LQD, and the BLM. Big Sagebrush has been historically difficult to establish; it requires deeper soil and is benefited by locations that encourage moisture collection. It is inhibited by competition from more aggressive plants. Sagebrush will be seeded separately from the seed mix. Ideal sagebrush locations will be surveyed, with this information stored digitally (Computer Aided Drafting or CAD format), by year, to be used for the tracking of success/failure of the seeding.

Greasewood has not been approved for BLM lands, thus, this species would be excluded when seeding BLM lands. Seed such as Winterfat, whose properties impede the mechanical distribution of the general seed mix will not be added to the mix; instead, this would be seeded separately. It may take several years to begin to see the effectiveness of the mixes and their applications. M-I will monitor success of individual species, and experiment with both substitutions in the mixes and alterations in their applications. This ongoing tracking and experimentation is an attempt to identify combinations that will best demonstrate success within cyclic climatic conditions, noxious weed invasions, and soil conditions altered by mining. Agency-approved deviations to any of the approved seed mixes or applications will be detailed in the Annual Report to the State and BLM. ***The proposed M-I Upper Rim Area Seed Mix* is provided in Appendix G of this EA.***

(4) <u>Monitoring Plan (as per 43 CFR 3809.401 (b)(4)):</u> The following monitoring plan components are proposed below:

Storm Water and Spill (pollution) Prevention Plan: M-I's SWPPP (Greybull mill site) was submitted in June 1998 and re-authorized on August 30, 2002. The plan was amended on October 15, 2004 to include the mine site, and subsequently revised on November 8, 2005. It includes protocols for spill and runoff prevention, emergency response and notification, training and monitoring.

Monitoring programs: The mine permitting process requires the collection of baseline data, conducted under WDEQ-LQD approved methodologies, of all environmental and cultural aspects of the proposed disturbance. Special issues, as defined by the baseline data, may suggest the need for additional monitoring efforts. These special requirements are documented in the Mine and Reclamation plans, with compliance oversight provided by routine agency mine inspections, internal audits by M-I personnel, and subsequent reporting in each year's Annual Report. All active mining and reclamation areas will be inspected monthly, by qualified M-I personnel. Additional inspections will be triggered by unusual weather events or any mine-site accidents.

Wildlife monitoring and protection: According to a February 2, 2004, United States Department of the Interior Fish and Wildlife (USFWS) letter (reference: ES-61411/BFF/WY7746), all areas within Permit 278C have been block-cleared from black-footed ferret habitat consideration. (*However, surveys should still be conducted so that prairie dog towns can be avoided when possible)*. Prior to opening any new pit or area, M-I personnel will inspect the site for presence of raptors, sage grouse (specifically leks, nesting, and brood rearing), Migratory Birds, to include sage sparrow, lark bunting, mountain plover, and horned lark, and Threatened & Endangered (T&E) species.

In the action of performing these surveys, USFWS observation guidelines would be used. Should any evidence of these species be observed, mining activity would be suspended until the Wyoming Game and Fish Department (WGFD) and/or the WDEQ-LQD have been contacted and approval to continue mining has been secured. M-I personnel would record the number and locations of pronghorn and mule deer noted in the Upper Rim area. All known raptor nests in the proposed mine area would be monitored for activity starting in February and continue through the nesting season to July 15th. Migratory bird and Mountain Plover nest searches would be conducted prior to any initial surface disturbing activities during the dates April 10 to July 15.

Additional Monitoring Efforts: M-I would utilize contractors to conduct the mining and reclamation operations. The M-I mining supervisor would work with the contractor's field supervisors to ensure that mining would be being conducted in a lawful and environmentally responsible manner, as well as supervise and direct pit reclamation. Monitoring of field operations and contact with contractor's field supervisors would occur on an almost daily basis. M-I monitors all its reclaimed lands post closure for off-site sedimentation, erosion and

seeding failures. Off-site sedimentation would be controlled by installation of straw bale or fabric check dams into affected drainages. Unacceptable erosion would be repaired at the first available opportunity. Past repair has been accomplished by reconstructing the drainage and lining it with erosion control fabric, rock, or installation of rock gabions. Finally, seeding would be monitored on a regular basis. If M-I finds vegetation establishment inadequate after three to five growing seasons, M-I would determine the reason for failure and mitigate the problem, (while consulting with WDEQ-LQD and BLM-CYFO).

(5) Interim Management Plan (as per 43 CFR 3809.401(b)(5)):

Interim stabilization plan (for suspended operations): Should market conditions dictate suspension of mining in any portion of the Plan/ROW area, all pit highwalls, drainages, overburden areas, and points of potential runoff will be stabilized and monitored as per the site specific and Master Reclamation Plan (2006-2010). M-I would subsequently place the area on its interim stability schedule as reported in the Annual Report: Compliance Appendix, submitted to the WDEQ and BLM each year, to include a plan and timetable for remediation. M-I would monitor, on a quarterly basis, any area of suspended mine operations.

2.2 Alternative II – No Action

Under the No Action alternative, the BLM would not approve the Upper Rim Plan/ROW if it determined that it would cause unnecessary or undue degradation (as per federal regulations at 43 CFR 3809.5). M-I's proposed new mining in the Upper Rim area would not be approved, no new mining would occur, and mining that has taken place on split estate would have to be permitted under a different authorization.

3.0 AFFECTED ENVIRONMENT AND ENVIRONMENTAL CONSEQUENCES OF THE PROPOSED ACTION AND NO ACTION ALTERNATIVES WITH PROPOSED STIPULATIONS AND MITIGATION MEASURES

Introduction

This chapter presents site specific information by alternative, on the potentially affected environment (i.e., the physical, biological, social, and economic values and resources) that could be effected by the Proposed Action and No Action alternatives, as well as the potential environmental effects/consequences of the alternatives, as identified during scoping with the BLMs Interdisciplinary Team. **Stipulations (strict requirements based in law or regulation), and Mitigation/Monitoring measures (defined below), either proposed by M-I, or those that would be required by BLM should the Proposed Action be approved, are provided in each section in red.** Resource issues or concerns, which were considered during this analysis, which may (or may not) be affected by the Proposed Action are presented in **Table 4** (below).

Under the CEQ NEPA regulations, (40 CFR 1508.8), "Effects" are defined as:

(a) **Direct effects/impacts -** are caused by the action and occur at the same time and place (These types of effects were discussed above in Sections 4.1 through 4.10).

(b) **Indirect effects/impacts -** are caused by the action and are later in time or farther removed in distance, but are still reasonably foreseeable. Indirect effects may include growth inducing effects and other effects related to induced changes in the pattern of land use, population density or growth rate, and related effects on air and water and other natural systems, including ecosystems.

Table 4.		
Resource, Issue, and/or Concern	**May Affect**	**No Affect**
Air Quality	**X**	
Cultural Resources and Native American Religious Concerns		**X (but analyzed)**
Water (Surface and Ground)/Floodplains	**X**	
Wetlands/Riparian/Aquatic Resources	**X**	
Geology/Minerals	**X**	
Paleontological Resources	**X**	
Soils	**X**	
Vegetation	**X**	
Invasive, Non-native Plant Species	**X**	
Wildlife/Migratory Birds/Raptors	**X**	
Threatened & Endangered Species/T&E Habitat		**X (but analyzed)**
BLM Sensitive Species	**X**	
Livestock Grazing and Range Management	**X**	
Socioeconomics	**X**	
Lands with Wilderness Characteristics		**X**
Recreation, Visual Resource Management, Caves and Karst		**X**

As described in 43 CFR 1508.20**,** "Mitigation" includes:

(a) Avoiding the impact altogether by not taking a certain action or parts of an action.
(b) Minimizing impacts by limiting the degree or magnitude of the action and its implementation.
(c) Rectifying the impact by repairing, rehabilitating, or restoring the affected environment.
(d) Reducing or eliminating the impact over time by preservation and maintenance operations during the life of the action.
(e) Compensating for the impact by replacing or providing substitute resources or environments.

3.1 Climate and Air Quality

3.1.1 Affected Environment

The climate of the area is typical of upland desert regions of the inter-mountain west. Based on 1971-2000 Climate Normals, as cumulated by the Wyoming State Climatologist, the annual mean temperature is 45.5 degrees for Basin, WY; 44.6 degrees for Greybull, WY; 44.5 degrees for Lovell, WY; and 43.9 degrees for Shell, WY. The annual mean precipitation, for the same communities, is 6.77" for Basin, WY, 7.54" for Greybull, WY, 6.74" for Lovell, WY, and 10.25" for Shell, WY.

No site-specific air quality data are available from the Upper Rim Plan area; however, air quality in the area is generally considered to be good (meets national and state standards). The air-shed within the Upper Rim Plan area is classified as in the Cody RMP as Class II, which allows concentrations of some air pollutants to increase to accommodate regional economic development.

Being located in an industrialized area, the primary air-borne pollutant in the M-I Upper Rim area is Particulate Matter (PM) in the form of fugitive dust (uncontrolled wind-carried particulates) generated from natural and human sources, primarily bentonite mining in this area. Total suspended particulate matter (TSP) is the only contaminant for which long-term data are available (BLM, 1988) - the long-term mean for TSP at Lovell, WY is 32 micrograms per cubic meter. Particulate matter includes dust, soot and other tiny bits of solid materials that are released into and move around in the air. Particulates are produced by many sources, including burning of gasoline and diesel fuels, incineration of garbage, mixing and application of fertilizers and pesticides, road

construction, industrial processes such as steel making, mining operations, oil and gas fields, agricultural and forest burning, and operation of fireplaces and woodstoves. Emission levels in northwest Wyoming are much lower than levels in other highly developed and industrialized areas.

Other air quality contaminants present and related to fuel combustion associated with mining, include hydrogen sulfide (H_2S), sulfur dioxide (SO_2), nitrogen oxide (NO_2), carbon dioxide (CO_2), and vaporous hydrocarbons. Visibility in the region is typically very good (>70 miles) and fine particulates (PM) are generally considered to be the main source of visibility degradation. ***Additional air quality and climate data and information pertinent to this application can be found in Appendix C.***

3.1.2 Environmental Consequences of the Proposed Action Alternative I

As a result of increased surface disturbance, air quality of the local area would be moderately impacted for the life of the Plan/ROW. Soil and overburden stripping, blasting, bentonite removal and hauling would result in temporary increases in the amount of particulate matter, fugitive dust, and fossil fuel combustion-related air pollution. Haul trucks would increase amounts of air-borne dust until roads were reclaimed, or were no longer used as haul roads. An increase in the amount of combustion-related by-products released by operation of heavy equipment and hauling would rise and dissipate into the atmosphere. This combustion-related effect on air quality may not be able to be mitigated during mining operations.

The temporary loss of vegetation and disturbance of the soils would result in a somewhat lowered capacity for natural carbon sequestration by plants. The Air Quality Standard #6 (Air Quality) for Healthy Rangelands in Wyoming could fail if the BLM or WDEQ determined that air quality associated with the proposed mining activity was impaired. If air quality was impaired, and mining found to be the cause, BMP's to mitigate this impact would need to be implemented.

- ***Mitigation****: If approved, dust suppression measures would be required of M-I in order to control fugitive dust emissions. These measures would include application of dust suppression water to the mine/work area and haul roads, using water trucks as needed, during mining and hauling activities.*

3.1.3 Environmental Consequences of the No Action Alternative II

There would be no additional direct or indirect effects on air quality in the Upper Rim area under this Alternative, because the proposed Plan/ROW would not be reviewed/approved. Additional particulate matter and other contaminants as a result of exhaust would not be released into the air by equipment or haul trucks.

3.2 Cultural Resources and Native American Religious Concerns

3.2.1 Affected Environment

A series of five (5) Class III cultural resource inventories meeting the requirements of the Wyoming State Historic Preservation Office (WYSHPO) Format, Guidelines, and Standards for Reports for the proposed mining area were conducted by Terra Alta Archaeology (Allan Burns, Archaeologist) of Cody, Wyoming. The inventories consisted of the Stock Driveway Mining Areas (020-2007-153), the Smith/East Tanner Mine Extensions (020-2008-012), the Fisk and Tanner Mine Extensions (020-2008-148), the Tanner II Mine Extension (020-2011-010), and the Upper Rim Mining Area (020-2012-078). As a result of the multiple inventories, eleven (11) newly recorded cultural resource sites were identified. The sites are characterized as prehistoric lithic scatters, FCR scatters and open camps. None of the sites meet the eligibility criteria for inclusion on the National Register of Historic Places.

As per the Wyoming State Protocol between the BLM State Director and the WYSHPO, the Upper Rim undertaking (Plan/ROW) received a "No Effect" determination of effect. Through the multiple inventories no additional investigations or mitigations are anticipated. However, if cultural resources are noted during mining operations, M-I will follow all commitments as indicated in the Master Permit: Appendix D3/Archaeological and Paleontological Resources, and adhere to all stipulations required by the BLM Cody Field Office (Appendix G).

The area in question contains no known areas or locations of religious or cultural concerns to Native American. If sites are noted during mining operations associated with these properties, M-I will follow all commitments as indicated in the Master Permit: Appendix D3/Archaeological and Paleontological Resources, and adhere to all stipulations required by the BLM Cody Field Office (Appendix G).

3.2.2 Environmental Consequences of the Proposed Action Alternative I

Potential impacts from the Proposed Action could include discovery of unanticipated, buried, cultural materials that were not located via surficial inspection. The previously recorded, not-eligible sites received a "no effect" determination. Any unknown cultural resources that exist in the proposed mining area that were not detected by the Class III cultural survey would be reported to the BLM, if found by M-I as required in the Cultural Resources Stipulations found in Appendix G.

Improvement of haul roads could facilitate access to and within the project area, thereby increasing potential for additional unauthorized surface collection and looting. If any areas or locations of traditional gathering areas, or religious or cultural concern to Native Americans would be subsequently identified or become known through the Native American notification or consultation process, they would be considered during the implementation phase. The BLM would take no action that would adversely affect these areas or locations without consultation with the appropriate Native Americans.

- ***Stipulations*** *to protect cultural resources and Native American interests would be attached to any approval document should this Plan/ROW be approved by BLM.(See Appendix G)*

3.2.3 Environmental Consequences of the No Action Alternative II

Under this alternative there would be no additional impacts on Cultural Resources as surface disturbance under the proposed Upper Rim Plan/ROW would not be approved. No impacts to Native American Religious concerns would occur under the No Action alternative, as the BLM would take no action that would affect these areas/locations without consultation with the appropriate Native Americans.

3.3 Water Resources: Surface, Ground, Wetland, Riparian Areas, and Aquatic Resources

3.3.1 Affected Environment

Surface Water Resources: Watersheds within the Plan/ROW area are typical of low elevation arid west, as they support sparse vegetation and contain topography shaped by fluvial erosion. The watersheds range in size from 96.2 to 700 acres. The highest watershed elevation is 5,647 feet. The average slope of the watersheds is 7.6%. The predominant aspect of the watersheds is to the southwest.

Eight watersheds and two sub-watersheds are mapped within the Plan/ROW areas. The watersheds have well defined stream channels, and streams emerging from all watersheds with the Plan/ROW area are ephemeral. Four of these watersheds flow into Bear Creek, which flows into the Big Horn River. Bear Creek is an intermittent stream, most of the year, although it has taken ephemeral characteristics in late summer due to the drought occurring in the Big Horn Basin since 1998-1999. Six other watersheds flow into Porter Gulch which flows into Shell Creek, which in turn flows into the Big Horn River. Porter Gulch is an ephemeral stream until it enters private land, where it picks up subsurface irrigation waste water and begins to flow perennially.

Relative to water quality, M-I personnel have not collected surface water quality and suspended sediment data for any of the watersheds affected by the proposed mining area. Suspended sediment naturally discharges from all watersheds surveyed in this report. Depending on the amount of water flowing, the length of time flow occurs and conditions of vegetation and soil on the watershed, turbidity of flow, size of material moving downstream and total amount of sediment discharged vary from storm to storm, and year to year. In proportion to suspended sediment, dissolved components flowing down streams of the area is relatively minor. This area is a major contributor of suspended sediment in the Shell Creek watershed, however there has been no attempt to quantify the rate or volume of sediment flowing from Porter Gulch.

Groundwater Resources: The proposed Plan/ROW would have little to no effect on any shallow aquifer in the area as no saturated confined or unconfined aquifers are present within proposed mining depths. Important confined (artesian) aquifers that produce large amounts of high quality water lie at least 2,000 feet below the surface, and would not be affected by the Proposed Action. These include the Tensleep Sandstone, Madison Limestone, Big Horn Dolomite and Flathead Sandstone. Cretaceous formations proposed to be mined include the Frontier Formation, Mowry and Thermopolis shales. During exploration drilling no water was found above beds of bentonite. Thus no effects on the shallower or deeper confined aquifers are anticipated as a result of the Proposed Action.

Wetlands/Riparian/Aquatic Resources: None of the investigated wetland sites associated with the Proposed Action meet the criteria for classification as "jurisdictional", as per the joint guidance memorandum from the Environmental Protection Agency (EPA) and U. S. Army Corp of Engineers (USACE) (2007). None of these sites support streams flowing at least three months out of the year. Sites with standing water do not have connectivity to perennial streams. However, several of the investigated sites have wetland characteristics; sites B-1, B-2 and B-3 have all resulted from topographic alterations associated with past mining activity.

The proposed mine expansion area is situated within areas that drain into Bear Creek and Porter Gulch. Riparian-wetland vegetation, dominated by Plains and narrowleaf cottonwood, coyote willow, Baltic rush, and wild licorice occur at the points where drainage from some of the proposed mine expansion area enters Bear Creek. Salt cedar and Russian olive are also present. Porter Gulch supports a few widely scattered riparian plants with salt cedar (considered a noxious weed) being quite common. Bear Creek eventually drains into the Bighorn River, and Porter Gulch is a tributary of Shell Creek. Both these receiving waters support aquatic life including several species of game fish. ***More information on these resources is presented in Appendix D.***

3.3.2 Environmental Consequences of the Proposed Action Alternative I

Surface Water Resources: The Proposed Action could impact surface water/quality, primarily suspended sediment values, if sediment was allowed to leave the mine areas and flow into live waters. During the proposed mining process, natural drainage patterns would temporarily be disrupted, altering drainages and increasing overland flow. Run-off from proposed mining areas could transport excess sediment and water with a higher level of acidity into watersheds than was previously present in the system.

Fabric fences, berms or certified weed-free straw bale check dams would be installed at discharge points into natural channels, which would be moved periodically to accommodate active mining. Through drainage would be required to be reestablished during final reclamation. Channel design for both temporary and permanent diversions would match pre-mine channel gradients and cross-sectional shapes and dimensions. After reclamation, drainage would temporarily be affected until vegetation has recovered to pre-mine conditions.

- ***Mitigation**: Larger ephemeral channels (those having drainage basins greater than 5 acres) would be temporarily directed by M-I around open pits during active mining stages, and straw bale sediment barriers would be utilized as sedimentation control measures.*

Groundwater Resources: The Proposed Action would have little to no impact on groundwater resources. It is not likely that ground water would be directly affected through infiltration in the pits, it is more likely to evaporate than to infiltrate due to the presence of fine-grained impermeable clays and shales in pit bases. Mine pits would be dug an average of 15 feet deep, and the nearest static water well (located 2 miles away) depth is 40 feet deep. If runoff increases, there would also be less water infiltration into the soil.

Wetlands/Riparian areas/Aquatic resources: Coordination and compliance with WDEQ-Water Quality Division (WDEQ-WQD) requirements, as well as those of other U.S. Army Corp of Engineers would reduce impacts to aquatic resources. Wetland riparian areas and down gradient aquatic resources could be affected by the Proposed Action if not properly mitigated. If drainages are modified, water (ground and surface) might not flow into wetlands as it previously did. Portions of upstream watersheds associated with B-1 and B-2 would be altered during active mining and reclamation. Impacts are not anticipated in either case because B-1 is not a wetland and B-2's inlet channel gradients and flow patterns will be reduced and consolidated during Bonney reclamation. The upstream watershed for B-3 will not be altered.

Sites A-1, A-2, A-3, H-2, H-3 and H-4 will not be physically impacted, nor will their upstream watersheds be altered by activity included with this proposal. Of the investigated sites, only H-1 would be directly affected by proposed mining activity, and it does not possess wetland characteristics. Wetland H-3 should not be impacted as it is located upstream of proposed mining. Wetland H-4 has been partially impacted by previous mining activities and the majority of these affected lands have been reclaimed. The proposed "Upper Rim" portion of the entire Plan/ROW area involves approximately 46 acres or roughly 10% of the contributing basin area. Given the irregular frequency of flows, removal of 10% of the contributing drainage area should not significantly affect the functionality of this wetland area. Wetlands B-2 and B-3 were created as a result of activities related to past mining activity and did not exist pre-mine. ***Additional data and information on hydrology and wetland/riparian resources in the Upper Rim area is provided in Appendix D.***

- ***Mitigation**: If future mine plan modifications indicate waters of the U.S. or wetland disturbances other than those indicated would be necessary, all disturbance would be contingent on jurisdictional determination by the U.S. Army Corp of Engineers.*
- ***Mitigation:** BLM would also have input into any potential disturbance to riparian-wetland-aquatic resources in addition to USACE involvement per Executive Order 11990/EO 11988 and BLM policy.*

3.3.3 Environmental Consequences of the No Action Alternative II

There would be no effect on surface water, ground water, or riparian or other aquatic resources because the proposed Upper Rim Plan/ROW would not be approved. This alternative would result in no additional effects on wetlands, riparian areas, or other aquatic resources, because the proposed Upper Rim Plan/ROW would not be approved.

3.4 Geology/Mineral Resources

3.4.1 Affected Environment

Information on stratigraphy, structure, overburden characteristics, and mineral resources in the area is provided below. M-I's propose Plan/ROW area is representative of the semi-arid, dissected, upland topography of the Big Horn Mountain foreland adjacent to Shell Creek in the north Big Horn Basin.

Geologic Structure – Bighorn Basin and Upper Rim Area

The Bighorn Basin is bounded by the Bighorn Mountains to the east, the Owl Creek Mountains to the south, and the Absaroka Mountains to the west. The Bighorns and the Owl Creeks are a result of the Laramide Orogeny that occurred from the end of the Cretaceous Period through the beginning of the Tertiary Period. The various

anticlines and synclines found in the Bighorn Basin formed during the Laramide Orogeny, a mountain-building event that took place during Late Cretaceous to Eocene time approximately 80 to 40 million years ago (mya).

Alternating beds of incompetent and resistant sedimentary rocks, structurally affected by low-angle folding, have been carved by cyclic runoff into a pattern of broad bedding plane surfaces with steep scarp slopes and deeply incised drainages. The Laramide Orogeny, a regional mountain-building episode that began during the late Cretaceous period, initiated the ending of the Western Interior Sea, and the structural development of the modern Big Horn Mountains. This orogenic episode caused a discontinuous series of incidental folds and faults along the perimeter of the basin, which are responsible for the variable dip angles, and thus the variable outcrop patterns, of bentonite beds targeted by M-I for bentonite production.

In the Bighorn Basin, commercial bentonite is limited to middle-lower Cretaceous strata, identified as the Thermopolis, Mowry, and Frontier Formations. These bentonite-bearing strata are generally composed of sodium bentonite beds of varying thicknesses, interbedded with gray, marine shales and claystones which were deposited in the Cretaceous Interior Seaway around 100 million years ago. The Upper Rim Plan of Operations proposes to mine various bentonite beds in the Thermopolis Shale, Mowry Shale, and Frontier Formation.

Stratigraphy – Upper Rim Area

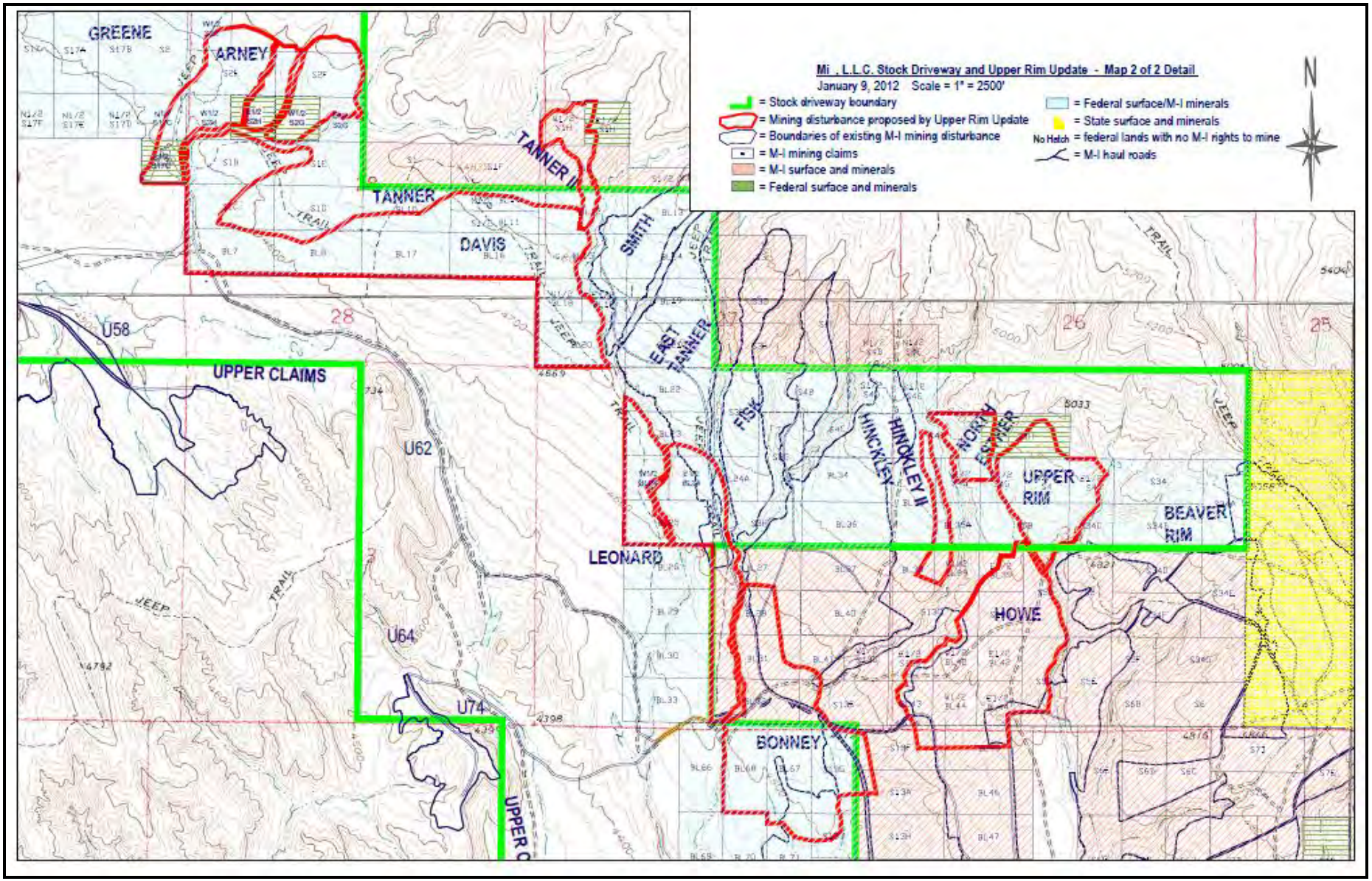
The stratigraphic column for the area (**Figure 3**) is comprised of a sequence of marine beds that were deposited during Cretaceous time during several advances of the Cretaceous Western Interior Seaway. The Thermopolis Shale forms the bottom of this sequence, followed by, in ascending order, the Muddy Sandstone Member, Shell Creek Shale Member, the Mowry Shale, and the Frontier Formation.

Lithologic Description of Strata (in descending order younger to older)

Frontier Formation: The Frontier consists of sandstones, siltstones, mudstones, claystones, and shale. Bentonitic clays are prevalent throughout, with three beds commercially produced by MI; these are, in ascending order, the Beaver, the Flat, and the Upper beds. A prominent, massive sandstone, known as the Peay Sandstone, separates the Flat and Beaver beds. This resistant sandstone generally upholds the erosional surface of the land in areas where only the Beaver Bed is available for mining. The traditional focus of M-I's bentonite mining activity has been with the Beaver and Flat beds, with minor activity in the Upper Bed. As reserves of this priority product experience decline, a corresponding increase in emphasis will be placed on deeper extensions of these Frontier deposits, and on the Mowry and Thermopolis shales.

Mowry Shale: As per geology section of the submitted Plan of Operations, this formation is typified by gray siliceous shales, sandstones, sandy shales, mudstones and claystones. The siliceous shales are characterized by silver-gray weathering features, zones containing numerous fish scale fossils, and a "walking on broken glass" texture. Several bentonite beds are found in the Mowry Shale to include, from top to bottom, the "A" or "Upper" bed, "B" or "Commercial" bed, "10th" bed, "9th" bed, "Canadian" bed, "D" bed, and the "E" bed. The "A" bed is often referenced as the "double bed", as it typically presents a shale seam in the middle of the deposit. The "10th" bed has a thick, hard cap, as does both the roof and floor of the Canadian and the floor of the "A". The Canadian bed, from one location to the next, displays a great deal of variability in thickness. The E bed presents a diagnostic silver weathering feature, and is associated with the bottom of the formation.

Thermopolis Shale: This lower Member is composed dark shales underlying the Muddy Sandstone Member. These shales consists of alternating layers of dark gray shales, mudstones, and claystones, with scattered lenses of dark, ferruginous concretions. These shales also include several bentonite beds and transient bentonite stringers. The Shell Creek Member presents two commercial bentonite beds, with regional variance in thickness: the "Rusty" bed positioned near the top of the formation, and the "3rd" bed positioned lower in the column. The "Rusty" bed is a varicolored clay, that has proven to be a desired clay by the industry.



Map 2. Detailed topographic map of the proposed Upper Rim Plan of Operations/Right-of-Way (areas outlined in red & labeled) provided by M-I

Overburden Characteristics (Site Specific)
Overburden samples were collected using a truck mounted rotary drill, with a 4" auger bit, at 5-foot intervals or to the top of the bentonite bed. They were then submitted to Inter-Mountain Laboratories, Inc. in Sheridan, Wyoming for analyses. Suitability ratings are used to evaluate backfill suitability criteria during reclamation. Laboratory overburden analyses indicates:

1. **Arney & Davis** pit areas have no unsuitable overburden material at depths less than 31 feet, although some layers are marginal.
2. **Howe & Upper** Rim pit areas have unsuitable material to 11 feet. Overburden layers are then suitable or marginal to 26 feet (approximate depth of bentonite bed).
3. **Bonney** pit area has suitable & marginal overburden material to 34 feet.
4. **Leonard** pit area has unsuitable material at the surface to 10 feet and then suitable or marginal layers to 41.5 feet (approximate depth of bentonite bed). Layers between 16.5 feet and 35 feet were suitable.
5. **North Esther** pit area has unsuitable overburden near the surface to 5 feet (limit of drilling)
6. **Hinckley II** pit area has marginal overburden to 20 feet (approximate depth of bentonite bed).
7. **Tanner II** pit area has unsuitable overburden near the surface to 1.5 feet (limit of drilling).

Mineral Resources
Bentonite is the only locatable mineral found in this area. No commercially valuable mineral materials such as sand and gravel, decorative stone or flagstone are located in the proposed Upper Rim mine area. No oil and gas leases are known to be located within this area. Neither do any solid leasable minerals such as coal or trona occur in the area.

3.4.2 Environmental Consequences of the Proposed Action Alternative I

Under the Proposed Action, commercial quantities of bentonite would be removed from beds in the Cretaceous Thermopolis and Mowry Formations. Mining would disrupt the natural stratigraphic order of beds within the open pit areas, and disturb overburden, as well as top and subsoil profiles, as described in the Mine Plan. No other locateable mineral resources would be affected by the Proposed Action.

Overburden layers that test as marginal or suitable as plant growth medium may be considered for separate salvage on a pit-specific basis with a goal of providing sufficient volume of suitable plant growth medium (combined topsoil, subsoil and good/marginal quality overburden) to cover unsuitable material with at least 2 feet of buffer material during final reclamation. During site characterization, overburden associated with each bed was sampled by M-I and Intermountain Laboratories in five-foot increments to the contact with the top of the bentonite. Samples of overburden in the proposed area were tested for several parameters including pH, percent saturation, conductivity, calcium, magnesium, sodium, sodium absorption ratio (SAR), and acid-base potential (ABP). The data indicated that the overburden had a variety of conditions, including elevated SAR levels, high acidic conditions, high ABP, and high salinity.

Overburden sampling characterizes soils and rock units below the surface to determine if their exposure to potential ground or surface water would adversely affect the environment and whether the overburden may be suitable soil for plants. Overburden considered adverse to ground or surface water and plants would generally be managed to minimize its impact to the environment and potential rooting zones.
This would include entombing unsuitable material above groundwater zones and well below the surface to prevent any wicking or capillary draw. Drill hole samples taken by M-I while collecting baseline data, determined that groundwater was not present to the depth of mining therefore would not be a major concern.

The Proposed Action would have minimal impact on the limited saleable mineral resource located on public lands proposed to be mined, as no commercially important deposits of sand and gravel, decorative rock, flagstone, or other saleable materials are known in the area. No active oil and gas leases or leasable minerals are present in the proposed Plan/ROW area, but future access to leasable mineral resources would not be impacted due to the Proposed Action.

3.4.3 Environmental Consequences of the No Action Alternative II

There would be no effect on the geology or minerals of the area under this alternative, because the proposed Upper Rim Plan mining would not be approved.

3.5 Paleontological Resources

3.5.1 Affected Environment

BLM uses a classification system known as the "Potential Fossil Yield Classification" (PFYC) during site specific analysis of a Proposed Action, to determine the potential for vertebrate or scientifically significant fossil resources to be found there. The Upper Rim area has been rated as a **PFYC=3a**, meaning there is moderate potential for such fossils. The geologic formations in the area are dominated by the Frontier Formation, and the underlying Mowry and Thermopolis shales, representing ancient sedimentation in the Cretaceous Interior Seaway that covered most of Wyoming at the time. Marine and flying reptiles, as well as various types of fish, lived in this seaway. Multiple types of invertebrates also occupied these ancient environments. The Cretaceous Mowry Shale is known for its abundance of fossil fish scales in certain units. The Muddy Sandstone Member of the Thermopolis Shale also yields vertebrate fossils such as teeth and occasional chunks or chips of fossil bone. The Muddy Sandstone Member of the Thermopolis Shale is located stratigraphically below any of the bentonite units proposed for mining.

3.5.2 Environmental Consequences of the Proposed Action Alternative I

Paleontological resources in the proposed mining area may be affected under the Proposed Action, which would involve mining in the Frontier Formation, which has been rated by BLM-CYFO with a PFYC=3a, meaning that vertebrate fossils may occasionally be found, though they are not found with great frequency. Standard paleontological stipulations (Appendix G) would be applied to approval of the Proposed Action in order to protect any paleontological resources that might be found during mining.

- ***Stipulations**: If vertebrate or scientifically significant fossil materials are discovered, M-I would be required to immediately suspend all operations that might further disturb such materials, and contact the BLMs Authorized Officer (Cody Field Manager) so the fossil resource could be investigated and assessed. Significant scientifically valuable fossil resources would be removed from the area prior to resumption of mining. Stipulations to protect paleontological resources would be attached to any plan of operations approval letter.*

3.5.3 Environmental Consequences of the No Action Alternative II

There would be no effect on paleontological resources under this alternative, because the proposed Upper Rim Plan/ROW would not be approved.

3.6 Soils

3.6.1 Affected Environment

Soil surveys were conducted on areas proposed to be mined, and on areas proposed for the haul road right-of-way. Soil series used were based on field observations and laboratory results. Soils were tested for pH, electrical conductivity (EC), saturation percent, calcium, magnesium, sodium, the sodium adsorption ration (SAR), and texture. The area is dominated by shallow soils formed in residuum, colluvium, and slopewash of shale and sandstone, and from alluvium in drainages. The soils are generally well to moderately-well drained. Most of the soils contain a suite of neutral salts, such as the sulfates, carbonates, and chlorides of sodium and calcium. In addition, some have a considerable amount of exchangeable sodium, and with the salts they are classified as saline-sodic soils. Alluvial soils are generally deep (>40") and have coarse to loamy textures. Soils derived from sedimentary rocks have a clay texture and are generally very shallow (<10") or shallow (<20"). Many of the soils in the proposed mining area contain a thin surface layer that is marginally suitable as topsoil. Subsoils, however, are generally unsuitable due to high exchangeable sodium (high SAR) and some have a high amount of salts that are more soluble than gypsum (high EC). Most of the unsuitable subsoils with a high SAR are saline-sodic, which means they contain appreciable quantities of neutral salts and enough sodium ions to affect most plants.

Excess sodium indirectly affects plant growth through deterioration of soil structure. This breakdown of soil structure could result in restricted water movement, aeration, root elongation and seeding emergence and development. High level of salt in the soil also increases the hold that the soil has on water, which limits the vegetation that can occupy the site to only those that can extract the water they need to survive. It also affects ability of many plant species to extract nutrients. Soils with higher SAR tend to support saline-tolerant vegetation, such as those found in Gardner's saltbush communities. ***Additional soils data and information pertinent to this application can be found in Appendix E.***

3.6.2 Environmental Consequences of the Proposed Action Alternative I

Soils in the project area would be affected by mining. Because of the harsh environment and the bentonitic parent material, site specific soils took thousands of years to develop,. By disturbing these soils, a complex ecosystem would be disrupted. Some of the integrity of the soil could be preserved by properly separating and storing suitable topsoil from subsoil, overburden, and especially from bentonite and "ash" stockpiles. If topsoil would be exposed to bentonite or "ash" materials, it would become contaminated and no longer able to support life.

WDEQ-LQD requires all soil stockpiles be separated from all other materials by a buffer zone of at least one bulldozer width to prevent contamination. Organisms living in the topsoil would have a relatively short lifespan when soil is stockpiled, due to the disturbance of normal processes including the following: lack of oxygen, lack of new organic material, lack of water, and the increase in depth to surface. Topsoil must be redistributed within a few months of being stockpiled in order for the soil to maintain a functioning ecosystem. These microorganisms help to reduce water and wind erosion, hold water in the soil, and prevent weed establishment. The cast back mining system is designed to quickly reclaim disturbed areas so topsoil remains viable and would more easily support re-vegetation efforts. Live-spreading is currently the best method for reclamation because topsoil that is removed from an open pit is immediately placed on the area that has already been mined, backfilled and recontoured. This preserves many of the topsoil's important biological and physical qualities.

The loss of topsoil biological viability, as a result of stripping and stockpiling, would increase as the length of stockpiling time increases (loss could occur rapidly at first and then gradually taper off), depth of stockpile, and having no or little deeply-rooted plant growth. Impacts of the Proposed Action to soils would require mitigation (required by both BLM and LQD), as per the terms of any approved mining and reclamation plan(s) and as presented in the Upper Rim Plan/ROW application.

- ***Mitigation****: M-I would use live-spreading of topsoil whenever possible and would try to stockpile topsoil for as short of a time as possible before re-spreading it. M-I would seed its longer-term topsoil stockpiles to prevent weed growth, reduce erosion, and maintain the soil's biological integrity. Associated disturbance relative to proposed mining would be kept to a minimum in order to prevent unnecessary and undue disturbance of native soil profiles. The areas would be seeded in a timely manner to promote speedy plant growth and further reduce erosion. Until successful reclamation of the soil occurs, the disturbed areas would have reduced soil stability and could fail Standard #1 (Soils) for Healthy Rangelands in Wyoming. M-I could conduct soil analysis of stockpiles prior to re-spreading them to determine need for amendments and the kinds amounts needed to assist in reclamation.*

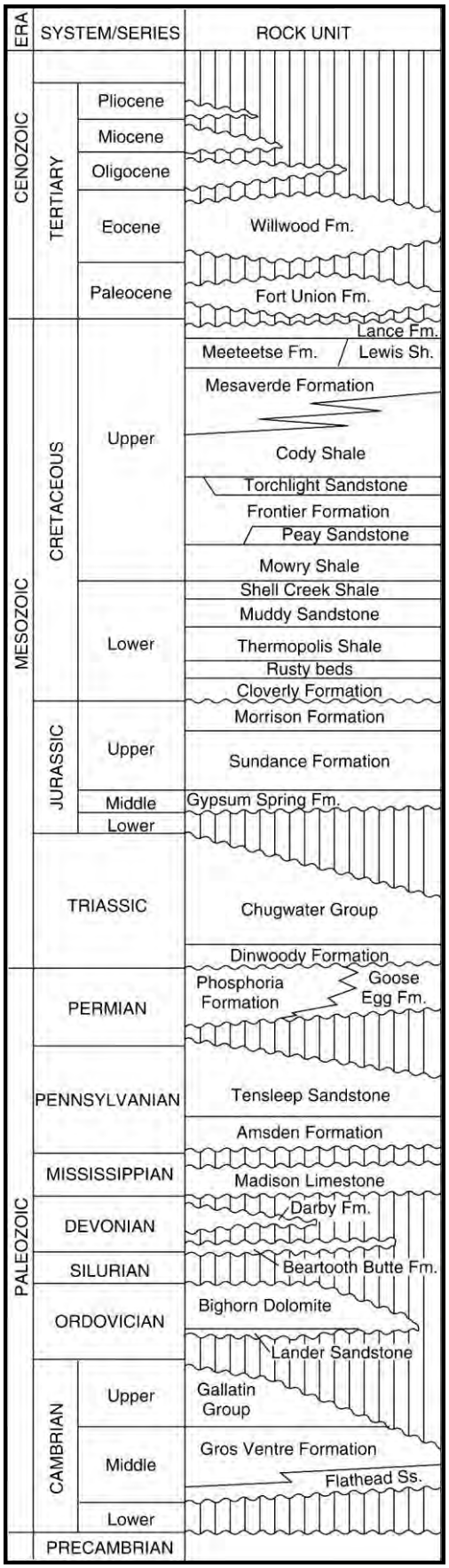


Figure 3. Stratigraphic Column of the Bighorn Basin and Upper Rim area
Source: Wyoming Geological Association (1989)

3.6.3 Environmental Consequences of the No Action Alternative II

There would be no effect on soils under this alternative because the proposed Upper Rim Plan/ROW would not be approved, and soils would not be disturbed.

3.7 Vegetation

3.7.1 Affected Environment

The majority of land within the proposed mining area lies within the 5-9" precipitation zone for the Bighorn Basin, and in a Very Shallow (50%) – Gravelly (25%) range vegetation site. The following vegetation map units were identified and mapped in the Upper Rim Plan/ROW area:

1) Gardner's Saltbush/Frontier North Gardner Saltbush: Occurs on shallow, salt-affected clay to clay loam soils in all geologic formations associated with the proposed mine area. Occasionally, this unit is associated with bentonitic shale outcrops and, in some areas, littered with small to medium-sized stones. Terrain is variable, ranging from 0 to 30 percent on mixed aspects or slope.

2) Mixed Shrub Complex (MSC): Occurs across all geologic formations associated with the proposed mine/ROW, and contains a variety of soils, topographic aspects and slopes. Vegetation dominance within this unit ranges dramatically reflecting that diversity. In general, this unit is dominated by three large shrub species: Wyoming big sagebrush, rubber rabbitbrush, and greasewood, all of which occur either alone or in various combinations of abundance and dominance throughout the unit.

2a) MSC Drainage: The area associated with the proposed mining is bisected by several deep channels that contain a variety of mixed shrub communities. Most of these drains would not be affected, but some would be. Some areas, mostly in the Thermopolis Shale, contain drainages dominated by greasewood, with occasional Wyoming big sagebrush occurrence.

2b) MSC Mowry: The Mowry Shale contains a regular pattern of mixed shrub occurrence generally on the northwest slope. Soil quality, based on geologic influence, change dramatically over short distances on this formation. This results in mixed shrub communities of differing species abundance over a short distance. Generally, shrub communities of the Peay sandstone are dominated by big sagebrush.

*2c) MSC Frontier: O*ccurs on the northwest end of the proposed mine area in the Frontier Formation and is influenced by the Peay sandstone. In this area, the Peay sandstone dips at a relatively gentle slope, and soils are deeper than on other, steeper dipping areas of the formation. The unit is dominated by Wyoming big sagebrush and greasewood, with rabbitbrush and Gardner's saltbush occurring in smaller numbers.

3) Barren Outcrop Complex: Mostly devoid of vegetation with small intermittent inclusions of black seepweed and Gardner's saltbush occurring throughout. Occasional crosscutting drainages bisect the bare outcrop supporting small areas of increased vegetation. Soils tend to be mostly saline and sodic-affected clay, though areas of barren rock outcrops are also included within this unit. Slopes range between 0 and 40 percent with varied aspects.

*4) Mowry Complex: C*omposed of the following three previously described units: Gardner's saltbush (20%), MSC (50%), and barren outcrop (30%).

*5) Frontier North MSC/Gardner Saltbush Complex: C*omposed of two previously described units, the Gardner's Saltbush/Frontier North Gardner Saltbush unit (65%) and the MSC Frontier unit (35%). This complex is intermixed throughout this unit lies east of the Frontier North Gardner Saltbush unit on the Frontier Formation. The MSC Frontier occurs mainly in the swales where there is more accumulation of moisture from rain and snow events. The Wyoming big sagebrush has receded during the recent drought period leaving dead sagebrush along the fringe of the swales and drainages.

6) Hoary Aster/ Annual Sunflower: Occurs mainly on the Thermopolis Shale in the center of the proposed mine area. Hoary aster and annual sunflower (*Helianthus annuus*) co-dominate this unit, with Eastern lomatium (*Lomatium orientale*) also abundant. Gardner's saltbush occurs on a limited basis, mostly near the ecocline of the Gardner's saltbush unit that is near the slope of the Thermopolis Shale.

7) Shadscale Saltbush/ Winterfat: Occurs at the northwest portion of the area on a Mowry Shale bench. Shadscale saltbush and winterfat co-dominate the unit. Rabbit buckwheat (*Eriogonum brevicaule*) is another common woody shrub-type species of this unit. Wyoming big sagebrush and fourwing saltbush also occur at a much reduced rate. Soils of this unit range from sandy loam to sandy clay loam and contain a great deal of gravel and cobbles, especially along the edges of the bench. Vegetation abundance decreases along the edges of the unit where surface rock abundance is high. Slopes are gentle at between 1% and 3%, to steep, with varied aspects.

Additional site specific vegetation data and information pertinent to this application can be found in Appendix F.

3.7.2 Environmental Consequences of the Proposed Action Alternative I

Vegetation would be directly affected by the approval of the Proposed Action. Native vegetation in all areas to be mined would be removed, along with the suitable topsoil that has established over time. After mining and recontouring an area, subsoils and topsoils would be placed back on the surface. If the cast back mining proceeds along in a timely manner, some of the soil biota and other microorganisms associated with healthy, living soil would still be alive to help the newly planted seeds reestablish. If the topsoil was left sitting in a stockpile for more than a few months, the likelihood that there would be any life left in the soil would be much lower, thus decreasing the ability of the soil to support plant life. The success of the vegetation reclamation depends largely on the timeliness and cleanliness of the topsoil replacement process. Also, future topsoil quality and quantity depends on the establishment of vegetation.

Clearing many acres of land at a time leaves areas open to invasive weed species that establish quickly and flourish in disturbed areas. Speedy revegetation with native plants would be necessary to prevent a non-native weed invasion. Due to the areas low precipitation (five to nine inches of mostly rain) and the very shallow, saline soils of bentonite areas, revegetation in the area is often a slow process taking anywhere from two to twenty years or more. Any islands of native vegetation that would be left in the mined area would aid in the spread of native plants throughout the disturbance. Also, if topsoil would be replaced quickly, viable native seeds could sometimes still be present to reestablish themselves in the reclaimed areas.

The vegetation native to the proposed mining area is adapted to the local climate, soils, native herbivory, and other unique ecological variables and it has, in most instances, the best chance for returning disturbed areas to the desired state (see standard 3 below). If reclamation is not properly conducted, a different type of plant community could eventually replace the native one. Often, even successful reclamation will result in a change from the existing native plant community that occupied the site prior to being disturbed for decades. Until vegetation on disturbed sites consist of plant communities appropriate to the site, which are resilient, diverse, and once again able to recover from disturbances, they would fail Standards #3 (Upland Vegetation) and #4 (Wildlife) for Healthy Rangelands of Wyoming.

Impacts of the Proposed Action to vegetation would require mitigation (required by both BLM and DEQ-LQD), as per the terms of the Upper Rim mining and reclamation plan, discussed above under Section 2.1, and any accompanying mitigation measures. According to M-I's proposed reclamation plan, a vegetative community dominated by native shrubs and grasses would be reestablished over time.

- ***Mitigation (M-I proposed and BLM required)****: Mitigation measures would include the use of proper BLM approved seed mixtures (Appendix G) and seeding application rates, to help reestablish vegetation over time to pre-mine or better conditions. All seed used on public lands will be certified to be cheatgrass seed and noxious weed seed-free by a Wyoming State approved seed testing laboratory and will conform to BLM seed policy IM No. 2006-073; any hay or straw used for check-dam construction or mulching will also be certified to be cheatgrass and noxious weed seed-free.*

- *Some reclaimed areas may need to be fenced to exclude livestock from grazing too heavily on newly-germinated or established seedlings in these areas. Additional revegetation goals include site stabilization, erosion control, and restoration of visual aesthetics.*

3.7.3 Environmental Consequences of the No Action Alternative II

There would be no additional effect on vegetation under Alternative I, because the proposed Upper Rim Plan/ROW would not be approved.

3.8 Invasive, Non-native Plant Species

3.8.1 Affected Environment

Though there are invasive weed species present, including cheatgrass, halogeton, salt cedar, and other non-natives, native plants are the dominant species in the proposed Upper Rim mining area. Weeds are most common in disturbed areas.

3.8.2 Environmental Consequences of the Proposed Action Alternative I

Invasive and non-native plant species in the area would most likely increase under the Proposed Action. To expose the bentonite layers, topsoil would be scraped and stockpiled, and all vegetation would be removed from that disturbed area as well. It would be less likely that invasive weed species would enter or return to the area if seeding could be completed quickly to establish desirable vegetation. If the reclamation seeding did not reestablish in a reasonable time frame, annual, invasive and/or non-native weed species could be more likely to spread throughout the disturbed areas. Seeding of topsoil stockpiles, which would be a required mitigation measure for this Plan, would decrease the potential for weeds to spread to and contaminate topsoil. Some weed species that commonly establish in post-mining areas are as follows: cheatgrass (*Bromus tectorum*), halogeton (*Halogeton glomeratus*), kochia (*Kochia scoparia*), and Russian thistle (*Salsola kali)*. Halogeton pulls salt to the surface, creating a saline environment few native plants can survive. If cheatgrass comes in, as it frequently does in this general area, it could form a monoculture, outcompeting native species, reducing species diversity, decreasing sagebrush establishment, and creating a volatile fuel source for fires. The use of unfiltered/untreated surface water to suppress dust on haul roads, etc. has the potential to spread invasive, non-native plants including state listed noxious weed species.

In order to decrease the spread of noxious weeds on public lands, M-I, would inventory all areas and access routes for the presence of weeds. M-I personnel would be trained to identify weeds and would conduct on-going monitoring of weeds. M-I would be responsible for managing all noxious and undesirable invading plant species in the reclaimed areas, including cheat grass, Russian olive, and tamarisk, until revegetation activities would be determined to be successful, and the bond would be released for a given area.

The following is a list of Wyoming State Listed Noxious Weeds that would need to be controlled should they begin to grow on the Upper Rim area lands during mining and/or reclamation. Cheatgrass would also need to be controlled in the proposed project area that would be disturbed under this Plan, should it begin to grow in mined or reclaimed areas.

1) Field bindweed (*Convolvulus arvensis* L.)
2) Canada thistle (*Cirsium arvense* L.)
3) Leafy spurge (*Euphorbia esula L.*)
4) Perennial sowthistle (*Sonchus arvensis L.*)
5) Quackgrass (*Agropyron repens (L.) Beauv.*)
6) Hoary cress (*Cardaria draba & pubescens*)
7) Perennial pepperweed (*Lepidium latifolium L.*)
8) Ox-eye daisy (*Chrysanthemum leucanthemum L.)*
9) Skeletonleaf bursage (*Franseria discolor Nutt.*)
10) Russian knapweed (*Centaurea repens L.*)
11) Yellow toadflax (*Linaria vulgaris L.*)
12) Dalmation toadflax (*Linaria dalmatica (L.) Mill.*)
13) Scotch thistle (*Onopordum acanthium L.*)
14) Musk thistle (*Carduus nutans* L.)
15) Common burdock (*Arctium minus* (Hill) Bernh.)
16) Plumeless thistle (*Carduus acanthoides L.*)
17) Dyers woad (*Isatis tinctoria L.*)
18) Houndstongue (*Cynoglossum officinale L.*)
19) Spotted knapweed (*Centaurea maculosa Lam.*)
20) Diffuse knapweed (*Centaurea diffusa Lam.*)
21) Purple loosestrife (*Lythrum salicaria L.*)
22) Saltcedar (*Tamarix spp.*)
23) Common St. Johnswort (*Hypericum perforatum*)
24) Common Tansy (*Tanacetum vulgare*)
25) Russian olive (*Elaeagnus angustifolia L.*)

- ***Stipulations:*** *If noxious or invasive weeds are present, the BLM and/or the Big Horn County Weed and Pest Department would be consulted by the operator/holder for control and eradication methods. A Pesticide Use Proposal (PUP) and written approval from the BLM Authorized Officer for the use of herbicides would be obtained prior to the use of herbicides on public land. M-I will also need to follow the* ***BLM seed policy IM No. 2006-073*** *(Appendix H), which would help prevent weed spreading and infestations.*

- ***Stipulations and Mitigation:*** *Weeds would be controlled/eradicated by use of BLM approved methods and herbicides, and their management would be the sole responsibility of M-I.*

- ***Stipulations and Mitigation:*** *Where weed infestations are noted on Federal lands associated with this Plan, all vehicle access will be limited to only necessary routes and would be controlled to minimize travel in the infested area until weed removal would be accomplished. Vegetation would be reestablished and weed-free seeds and hay for mulch would be used in the proposed mining area. Cleaning vehicles, equipment, and materials before they enter public land would help reduce the spread of invasive, non-native plant species.*

3.8.3 Environmental Consequences of the No Action Alternative II

There would be no new effects as a result of an increase in invasive and non-native species under Alternative I, because the proposed Upper Rim Plan/ROW would not be approved, and no additional disturbance would occur.

3.9 Wildlife/Migratory Birds/Raptors

3.9.1 Affected Environment

A variety of wildlife species were observed within the Upper Rim Plan/ROW study area. These observations, combined with the information referenced above, enabled evaluations of area use by wildlife. The following sections discuss specific species of concern including game animals, birds, reptiles and amphibians.

Game Species

Mule Deer: The Upper Rim Plan/ROW area lies within the North Big Horn Deer Herd Unit (Hunt Area No. 321) and Wyoming Game and Fish Department (WGFD) Hunt Area 52. Mule deer use was consistently noted within the study area during November, January and March surveys. These individuals were observed browsing on sagebrush shrublands located upslope and up to ½ mile east of the proposed mining areas.

Elk: The area includes the North Big Horn Elk Herd Unit (No. 321) and WGFD hunt area 40, which lies on the west slope of the Big Horn Mountains between U.S. Highway 14A and U.S. Highway 14. No elk were observed within this study area during surveys, although they do occur in the region and may be occasional winter visitors.

Pronghorn: As indicated in WGFD correspondence, the Upper Rim Plan/ROW area includes both yearlong and crucial winter habitat for Pronghorn Herd Unit No. 202 (Big Horn). It also includes WGFD Pronghorn hunt area 79, which was closed for the 2006 hunting season because of low population numbers.

Raptors/Migratory Birds:

The study area provides habitat for a number of migratory and non-migratory bird species. The U.S. Fish and Wildlife Service (USFWS) and the Wyoming Bird Conservation Plan (WBCP) prioritize management concerns for Wyoming migratory bird species by listing species of concern in two levels. Level I Species (Conservation Action) are defined as those clearly needing conservation action. Level II species (Monitoring) are defined as those for which monitoring is the action and focus.

Level I Species observed in the study area include:

Brewer's Sparrow	*(Spizella breweri),*
Burrowing Owl	*(Athene cunicularia),*
Sage Grouse	(*Centrocercus urophasianus*)
Short-Eared Owl	(*Asio flammeus*)
Ferruginous Hawk	(*Buteo regalis)*
Bald Eagle	(*Halianaeetus leucocephalus*)
Swainson's Hawk	(*Buteo swainsoni)*

Level II Species (Monitoring) observed in the study area include:

Lark bunting	(*Calomospiza melanocorys*)
Loggerhead Shrike	(*Lanius ludovicianus*)

Sage Thrasher (*Oreoscoptes montanus*), Grasshopper Sparrow (*Ammodramus savannarum*), Vesper Sparrow (*Pooecetes gramineus*), Lark Sparrow (*Chondestes grammacus*) and Merlin (*Falco columbarius*) are also listed as Level II Species that have been seen in the region but not in the study area.
Other raptors found within the survey area include Red-Tailed Hawk (*Buteo jamaicensis*), Golden Eagle (*Aquila chrysaetos*), Northern Harrier (*Circus cyaneus*), Long-Eared Owl (*Asio otus*), Prairie Falcon (*Falco mexicanus*) and American Kestrel (*Falco sparverius*).

A golden eagle nest was noted in the SW¼SW¼ Section 26, T. 54 N., R. 92 W., but was not observed to be active during the 2007, 2009 or 2010 field seasons.

Sage Grouse: Sage grouse are now considered to be "Candidate Species" by the U.S. Fish and Wildlife Service (USFWS). Candidate species are plants and animals for which the U.S. Fish and Wildlife Service (FWS) has sufficient information on their biological status and threats to propose them as endangered or threatened under the Endangered Species Act (ESA), but for which development of a proposed listing regulation is precluded by other higher priority listing activities (as per http://www.fws.gov/endangered/esa-library/pdf/candidate_species.pdf). Sage grouse sometimes use the area in the winter season. Sage grouse use has been observed within the Plan/ROW area - birds were flushed during the January, 2007 survey near the proposed Bonney Pit area. *The area is not located in a known Sage Grouse Core area (WGFD - version 3 of the WGFD core area boundary determination).*

Reptiles and Amphibians: An unidentified frog species was noted from vocalizations at two pond areas associated with reclaimed bentonite pits in the SW¼NE¼ Section 34, T. 54 N., R. 92 W., and NE¼NE¼ Section 3, T. 53 N., R. 92 W., during vegetation survey work in late June and early July, 2007.

3.9.2 Environmental Consequences of the Proposed Action Alternative I

Approval of the Proposed Action would generally affect wildlife that live near or move through the proposed mining area. It may also affect flora and fauna that use aquatic environments within and downstream of the proposed mining area. Movement through the area would become difficult as pits appear and disappear in places animals may have used to travel. Larger wildlife species, such as mule deer, pronghorn, and coyotes, would have to adapt and change their movement patterns to avoid the proposed mining area. Large areas of suitable habitat exist on public lands surrounding the mining areas to which game animals can move; big game populations would be affected by fragmentation and disruption from mining activities. The habitat would become less suitable for pronghorn and mule deer.

Smaller animals such as badgers, rabbits, rodents, and reptiles whose home range is much smaller would be directly affected by the mining. Displaced animals would have to try to move to a new area, which may already be fully occupied, resulting in stress, extra competition, and probable mortality. An unknown number of these small animals would be lost during the mining either directly by machinery or indirectly through habitat loss; their numbers would probably not rise to current levels again until the disturbed area would be fully reclaimed to pre-mine conditions. Their returned presence in the reclaimed area would help increase the aeration and permeability of the soil and improve the overall health of the soils and vegetation.

If the Proposed Action were approved, wildlife would likely avoid the area until reclamation would be successful. If the vegetative community was changed post-mining, wildlife species using the area would change as well. The change in vegetative community from pre-mine conditions to post-mine conditions may result in a shift to plant species not specifically adapted to the local site, and would provide different and lesser quality of habitat across all acres affected. If wetlands (moist habitats) are mined through, a loss of habitat for amphibians (see note above) and other species would result. Habitat lost as a result of mining through such areas may be restored if their reconstruction, as laid out in the proposed action, is successful. Some amphibians, i.e., spadefoot toads, bury themselves in the soil around moist areas and remain dormant for considerable periods of time. Mining through or near moist areas has the potential to directly impact these and possibly other native fauna. Plant and animal species that use moist habitats located down-gradient from the proposed mine expansion areas may be impacted by modified flow, sediment, and chemical regimes.

Mitigation:

- ***Mule Deer****: M-I would address concerns related to winter mule deer use of this habitat by focusing enhanced reclamation efforts on sagebrush reestablishment as previously referenced (Reclamation Plan).*

- ***Pronghorn****: M-I would address concerns related to pronghorn use of the Upper Rim area by focusing enhanced reclamation efforts on sagebrush reestablishment as discussed in the Reclamation Plan.*

- ***Raptors****: A golden eagle nest in Section 26, T. 54 N., R. 92 W., was not observed to be active during the 2007, 2009 or 2010 field seasons. M-I would follow proposed survey and buffer protocols outlined by the USFWS. These include conducting at least three surveys during nest-initiation periods from early March through early June and maintaining a disturbance-free zone around active golden eagle nests of at least 0.75 miles during the nesting season (February 1 to August 15). M-I would be required to notify the BLM and the USFWS if any nesting raptors are spotted; After an effects analysis with the BLM and USFWS, further mitigation and actions may be required which may include mining activities be halted until the young have fledged, as "take" under the Bald and Golden Eagle Protection Act is considered to be illegal should it occur.*

- ***Sage Grouse****: M-I's mitigation efforts would focus on protection of nesting and brood-rearing sage grouse by conducting pre-disturbance ground surveys within immediate areas to be affected, if initial ground disturbing activities occur during nesting or brood-rearing periods (March 15 through July 15). If nests or broods are noted, operations will be voluntarily delayed or temporarily relocated until grouse use was completed or moved. Additional mitigation efforts will focus on enhanced efforts to restore sagebrush during reclamation as described in the Reclamation Plan.*

- ***Sage Grouse****: On Feb. 10, 2012, the BLM Wyoming State Office issued* ***Instruction Memorandum WY-2012-019 entitled "Greater Sage-Grouse Habitat Management Policy on Wyoming Bureau of Land Management (BLM) Administered Public Lands Including the Federal Mineral Estate****". Though mining activities regulated on federal surface/federal mineral estate may not be affected by this new sage grouse IM, mining activities carried out under the Right-of-way regulations (43 CFR 2800) are so affected. Therefore, any mitigation for sage grouse as spelled out in this IM required on split estate lands (discretionary actions) under the Proposed Action may be subject to terms of this IM. As stated in the IM, "…determinations that do not apply the measures located in this policy IM may be necessary where BLM is required to comply with other non-discretionary statutes and regulations (i.e., valid existing rights, oil and gas "drainage", etc.)."*

- *The following narrative was taken from pages 18-19 of the Wyoming Instruction Memorandm WY-2012-019* ***(pertinent portions to this review are highlighted in bold)****:*

Locatable Mineral Activities (applies to actions under 43 CFR 3809 only):

- ***Notices or Plans of Operation, or modifications thereto, submitted following the issuance of this guidance:*** *As part of the 15 day completeness review of notices [or modifications thereto] and 30 day completeness review of plans of operations [or modifications thereto], the proposed project area(s) where exploration, development, mining, access and reclamation would take place should be reviewed for overlap of sage-grouse core areas in the corporate GIS database.* ***If there is overlap, the BLM AO may notify the operator of ways that they may minimize impacts to core area habitats and request the operator to amend its notice or plan to include such measures. The request to amend the submitted notice or plan of operations must make clear that the operator's compliance is not mandatory and that including such measures is not a requirement for completeness of either the notice or a plan of operations, nor is it a condition of acceptance of the notice or approval of the plan of operations.***

- *OTHER MIGRATORY BIRDS: M-I would conduct nest searches in migratory bird habitat prior to, and during ground disturbing activities between April 10th and July 15th. If nesting migratory birds would be found, clearing of new ground for mining would be halted until the BLM and the USFWS were consulted for further action. Through this monitoring, no migratory birds would be harmed during the mining process. Because M-I agrees to implement mitigation measures, this Plan would not cause "take" of migratory birds, which is prohibited by the Migratory Bird Treaty Act.*

- *M-I proposes to address impacts to nesting bird species, including mountain plover, by conducting ground surveys within the immediate areas to be affected. These surveys would be conducted not more than five days prior to disturbance by heavy equipment if initial ground disturbing activity occurs during nesting or brood-rearing periods (April 10 through July 15). If bird nests/broods would be noted, operations would be delayed until the WDEQ-LQD and USFWS have been consulted or operations temporarily moved to suitable locations.*

- *The prairie dog town would be avoided when possible to reduce impacts to the white-tailed prairie dog, which is a BLM Sensitive Species.*

3.9.3 Environmental Consequences of the No Action Alternative II

There would be no additional environmental consequences on wildlife/raptors/migratory birds under this alternative, because the proposed Upper Rim Plan/ROW would not be approved, due to a potential to cause U&U. Wildlife use of the area would continue at current levels because the additional disturbance and habitat loss would not occur.

3.10 Threatened & Endangered Species/ BLM Sensitive Species

3.10.1 Affected Environment

Black-footed ferret activity is associated with both black-tailed and white-tailed prairie dog colonies. According to the February 2, 2004 USFWS letter , all areas within M-I's WDEQ-LQD Mining Permit 278C (a much larger area than that being analyzed in this EA) have been block-cleared from black-footed ferret habitat consideration, thus removing prairie dog town size as a consideration for possible presence of black-footed ferrets. No prairie dog colonies were observed within the Upper Rim study area.

Bald eagles winter in the region and may pass through during migration, especially along both the Big Horn River corridor (which lies several miles west of these proposed mining areas) and the Shell Creek corridor (which lies several miles south). No bald eagles were seen hunting or traveling through the Upper Rim Plan/ROW area during M-I monitoring surveys, nor were any active nests located or indicated by contact with wildlife agencies.

UNITED STATES FISH AND WILDLIFE SERVICE (USFWS) RESPONSES TO PROPOSED PROJECT:

The USFWS responses to M-I's requests for information addressed potential impacts to Federally-listed species, specifically black-footed ferrets (*Mustela nigripes*) and Ute ladies'-tresses (*Spiranthes diluvialis*), a white, perennial orchid. The bald eagle (*Haliaeetus leucocephalus*) was removed from Federal Listing in July 2007, during the period between these two USFWS responses although it is still protected by other Federal Law. Other specific USFWS concerns related to Migratory Bird Species of Management Concern in Wyoming, **Mountain plover** (*Charadrius montanus*), Greater sage-grouse (*Centrocercus urophasianus*) and prairie dog complexes all of which are discussed below.

WYOMING GAME AND FISH DEPARTMENT (WGFD) RESPONSES TO PROPOSED PROJECT:

Terrestrial Considerations. The WGFD response letters address terrestrial considerations related to potential impacts on sage grouse, pronghorn (*Antilocapra americana*) and other species dependent on affected sagebrush habitat. WGFD indicate that the Upper Rim area supports an important remaining community of dense sagebrush/mixed-brush habitat that has been otherwise strongly impacted in the Porter Gulch drainage by past bentonite mining activity, and that pronghorn and sage grouse populations in the area rely heavily on this habitat. The WGFD also indicates the Upper Rim Plan/ROW area is yearlong habitat for mule deer and may include peregrine falcons, bald eagles, prairie dogs, burrowing owls, mountain plovers and ferruginous hawks.

In addition, the second WGFD response letter (February 2010), indicates that much of the Upper Rim Area lies within a sage grouse "Core Area" initially delineated with the August 2008 Governor's Executive Order issued by then Governor Freudenthal. Subsequently the entire Upper Rim Plan/ROW Area was removed from core area delineation with the Governor's Executive Order of August 18, 2010. Therefore core area stipulations accompanying that Order will not apply to these Lands. M-I would still address WGFD and BLM concerns by focusing enhanced reclamation efforts on sagebrush reestablishment as indicated in the proposed Reclamation Plan.

Aquatic Considerations. The WGFD response letters also commented on potential aquatic considerations related to this action. While the January 2007 WGFD responses found "no aquatic concerns pertaining to this mining activity" and recommends best management practices for erosion and sediment control, WGFD correspondence dated February 3, 2010 suggests possible impacts to a "Green Ribbon trout stream". This assessment seems to have arisen from confusion related to identifying the correct location ("Bear River" vs. "Bear Creek") and was clarified in later correspondence dated February 12, 2010 and, finally, February 24, 2010. M-I agrees to comply with recommendations listed under Aquatic Considerations in the later correspondence, specifically to implement best management practices for erosion and sediment control, to promptly revegetate disturbed areas, and to stage equipment servicing and fueling areas at least 150 feet from streams and riparian areas. These commitments have also been added to text in the Reclamation Plan.

***Note**: Bear Creek as discussed in this EA supports Yellowstone cutthroat trout (YCT) in the first five (5) stream miles off Forest, most of which is on BLM. The WGFD's Aquatic Database lists "Bear Creek" as a GREEN RIBBON FISHERY. Green Ribbon Fisheries support up to 50 pounds of trout per stream mile, and provide recreational fishing opportunities for the local population. The presence of Yellowstone cutthroat trout (a WY BLM Sensitive Species) in this stream elevates its importance/priority for BLM management. Fortunately, the proposed action would only impact those reaches of Bear Creek downstream from the section of stream that supports cold water fish/YCT.*

3.10.2 Environmental Consequences of the Proposed Action Alternative I

THREATENED & ENDANGERED SPECIES: No Threatened or Endangered plant or animal species (gray wolf, lynx, grizzly bear, black-footed ferret and Ute ladies'-tresses) or Candidate species (yellow-billed cuckoo and sage-grouse) are known to exist in the area and therefore would not be affected by the Proposed Action.
There is potential for Ute ladies'-tresses to be in the area, although no population has ever been observed in the Bighorn Basin. The proposed mining would not occur in riparian areas, specifically wet floodplains that are

commonly inundated, where these plants grow, thus making the potential these plants being present extremely low. There would be no effect on any listed or candidate plant species.

BLM SENSITIVE SPECIES: The Proposed Action would temporarily affect wildlife habitat, and may cause fragmentation and wildlife avoidance of larger habitat areas for several BLM Sensitive species, including the following species: mountain plover, sage sparrow, Brewer's sparrow, sage thrasher, loggerhead shrike, white-tailed prairie dog, sage-grouse, and northern leopard frogs.

The Proposed Action may temporarily affect mountain plover habitat until reclamation of the mined area would be complete. Full reclamation of area habitat would take periods of one or more decades. Mountain plovers, which were recently proposed to be listed on the Threatened and Endangered Species List, are now not considered proposed, but are still considered to be a BLM Sensitive Species and are protected under the Migratory Bird Treaty Act (MBTA), 16 U.S.C. 703.

- ***Mitigation****: In conformance with USFWS suggestions, M-I would conduct nest searches in mountain plover habitat prior to, and during ground disturbing activities between April 10th and July 10th. If nesting mountain plovers are found, mining operations would halt until BLM and USFWS were consulted for further action. Through this monitoring, no mountain plovers or migratory birds would be knowingly harmed during the proposed mining process.*

Sage Grouse (Candidate species) may be present in the area and its habitat would be negatively affected by road and mining activities as a result of vegetation removal and habitat fragmentation taking place until reclamation was successful. This could lead to future sage grouse declines in local populations. Core and non-core leks are located north and west of the area of the Proposed Action. A former lek in the area known as the Porter Gulch lek is no longer active, most likely as a result of nearby mining activities. The Proposed Action could further degrade, fragment and disrupt sage grouse habitat causing further declines in local populations. Mitigation measures would help lessen the severity of disruption, but would not fully account for habitat quality and quantity effects until reclamation was successful, which can take up to thirty years or more.

The Proposed Action may impact the watershed, affecting northern leopard frogs if present downstream of the area by modifying flow and/or sediment regimes or changing the water chemistry. Habitat fragmentation would also take place in the Upper Rim Plan/ROW area. Haul road traffic would also be increased in the area. Additional weeds, disturbance, human activity, changes in water quality, modified hydrologic and sediment regimes, and habitat destruction may have negative impacts on BLM Sensitive species in the area.

- ***Mitigation****: See the above narrative regarding sage grouse mitigation.*

3.10.3 Environmental Consequences of the No Action Alternative II

There are no known Threatened or Endangered species located in the proposed mining area thus this alternative would have no effect on such species. Also, BLM Sensitive Species, such as the mountain plover, would not lose any habitat or potential suitable habitat should this Alternative be selected, as no additional surface disturbance would take place.

3.11 Livestock Grazing and Range Management

3.11.1 Affected Environment

The Upper Rim Plan/ROW area is included within the Lost #01532 and the Clay Pits #01505 Allotments. The Lost Allotment encompasses 6,350 acres and contains 106 AUMs available for livestock grazing.
The Clay Pits Allotment encompasses 5,944 acres and contains 64 AUMs available for livestock grazing. Both allotments are operating within a three pasture rest rotational grazing strategy. During a three year grazing cycle, each allotment receives livestock use only once in the critical growing season (April/May/June), and the other two years are one year fall use and one year total rest from livestock grazing.

3.11.2 Environmental Consequences of the Proposed Action Alternative I

The Proposed Action would temporarily but directly affect rangelands in the proposed mining areas by resulting in a loss of vegetation in the areas mined. BLM calculated that long term loss of forage and ground cover on about 449 acres as proposed, equates to approximately 75 tons of vegetation lost per year to grazing, until recovery of vegetation takes place on those acres. ***This equates to approximately 40 AUMs per year of grazing value lost each year; 400 AUMs would be lost over a ten year period, and approximately 800 AUMs over a 20 year period***. As cast back mining takes place in stages, the areas disturbed first would be the furthest along in the reclamation process.

Reclamation could be successful if proper topsoil handling and drought do not make it exceptionally difficult for seedlings to germinate and grow. Once reseeding was successful, depending on moisture etc., vegetation could be reestablished enough to provide forage for wildlife and livestock use.

Reclaimed mine areas are occasionally fenced out of grazing allotments to facilitate reestablishment of vegetation. Generally, cattle are rarely prevented from grazing on reclaimed lands where seeds are trying to germinate and establish. This can be detrimental to both grazing and the mine reclamation effort. Grazing before plants have become well established stresses seedlings and makes it very difficult for them to survive, spread, or create healthy rangeland. Grazing during the early stages of revegetation can lead to an increase of weed growth; native seeds in the seed mix are more desirable to cattle and are quickly grazed off, leaving the barren area open to possible establishment by weeds. M-I may install temporary fences around seeded areas that are in locations used heavily by cattle, in order to give seedlings a chance to establish. M-I would be responsible for installation, maintenance, and removal of these reclamation fences.

- ***Mitigation****: M-I would be responsible for successful reseeding (see Appendix G for seed mix) and weed management, and held accountable for the reseeding by WDEQ-LQD and the BLM until an acceptable vegetative community has established. M-I would work with the BLM-CYFO to maintain and/or replace the allotment boundary fence that runs through the Plan/ROW area during and before completing the mining process.*

3.11.3 Environmental Consequences of the No Action Alternative II

There would be no effect on livestock, grazing, or range because the proposed Upper Rim Plan/ROW would not be approved. Cattle grazing in the area would not decrease and the forage would not change to post-mining vegetation species.

3.12 Socioeconomics

3.12.1 Affected Environment

The Proposed Action area is located in Big Horn County, Wyoming. The closest community is the town of Greybull, WY, located southwest of the proposed Upper Rim Plan/Row area. In 2008, the estimated population of Big Horn County was 11,322 people. Communities in Big Horn County include Basin (the county seat), Burlington, Byron, Cowley, Deaver, Emblem, Frannie, Greybull, Hyattville, Kane, Lovell, Manderson, and Otto. Big Horn County covers 3,137 square miles and has a population density of 3.7 people per square mile. In the last three decades of the 1900s, its population grew by 8 percent. Since 2000, its population dropped by 1.2 percent. The area has a strong agricultural economy, which includes farming (corn, sugar beets, alfalfa, barley, beans, hay) and ranching (cattle, sheep, horses).

In July 2009, Greybull's population was 1,774 people, and the estimated median annual income was about $54,000. (Source: http://www.city-data.com/city/Greybull-Wyoming.html). Data from the State of Wyoming Economic Analysis Division (WEAD) indicate that Mining* accounted for 16% of the jobs, and 15% of the personal income in Big Horn County. This statistic indicates that employment in the mining sector is higher-paying than the county average.

In 2009, mining employment provided an average wage per job of $34,290.00 (WEAD 2011). The depression of the U.S. economy in 2009 severely reduced the mining workforce, as can be seen in these numbers, though

mining activity has begun to increase since the beginning of 2010. In 2009, approximately 589 people were employed directly by the mining industry in the county according to the Wyoming Economic Analysis Division and their website at http://eadiv.state.wy.us/. M-I has approximately 127 employees working at the Greybull mine and mill (Source: http://www.slb.com/services/miswaco/services/hdd/bentonite/plant_operations.aspx). M-I employs their own equipment operators for the vast majority of their mining, and also contracts with various Big Horn County service companies to conduct mining activities when needed. These service companies provide heavy equipment and labor to strip and salvage soil and overburden, expose, mine and haul the clay, and conduct reclamation and seeding.

This area is also used for recreational purposes, such as hunting, hiking, rock hounding, and off-highway vehicles, as well as for other values such as driving for pleasure in an aesthetically pleasing environment, finding solitude, and wildlife viewing. The Bighorn Basin has an active tourism industry from people visiting Yellowstone National Park and the Bighorn Canyon Recreation Area, among other attractions. The scenery along the way to these areas adds to the enjoyment of both visitors and local residents. Livestock grazing has been, and continues to be, a major resource-use activity on BLM-administered public lands in the Cody Field Office and around the proposed mining areas analyzed in this EA. Grazing has occurred in the proposed mining area for over 100 years.

***Mining:** The Mining sector comprises establishments that extract naturally occurring mineral solids, such as coal and ores; liquid minerals, such as crude petroleum; and gases, such as natural gas. The term mining is used in the broad sense to include quarrying, well operations, beneficiating (e.g. crushing, screening, washing, and flotation), and other preparation customarily performed at the mine site, or as a part of mining activity. The sector distinguishes two basic activities: mine operation and mining support activities. Operation includes establishments operating mines, quarries, or oil and gas wells on their own account or for others on a contract or fee basis. Support activities include establishments that perform exploration and/or other mining services on a contract or fee basis.

3.12.2 Environmental Consequences of the Proposed Action Alternative I

Under the Proposed Action, the proposed Upper Rim Plan/ROW would be approved and additional bentonite mining would proceed. The proposed mining area would be a job site for M-I workers in future years. AUMs available for livestock grazing would be temporarily reduced, as bentonite mining would remove available forage until reclamation was considered successfully completed. The grazing allotments would temporarily lose hundreds of AUMs over time, prior to successful reclamation. The Proposed Action would temporarily disturb some limited recreational uses in the area. The mine could temporarily affect the immediate view from area roads for those appreciating local scenery until reclamation is successful. The proposed disturbance would not be visible from any paved roads such as state highways or paved county roads. New disturbance from mining would disturb additional wildlife habitat, which would temporarily affect hunting and wildlife watching opportunities until the reclaimed land is restored to suitable wildlife habitat again.

3.12.3 Environmental Consequences of the No Action Alternative II

There would be an affect to M-I and its employees if the No Action alternative was selected as M-I would not have access to all of the bentonite resources needed; and if this bentonite could not be mined, some workers could lose their jobs at some level. The supply of bentonite may be reduced, potentially causing a rise in the price of bentonite products, affecting those who use them. No impact to livestock grazing would occur as a result of choosing this alternative. Some recreation activities, such as hunting, wildlife viewing, and driving for pleasure, that are included in the area would not be affected.

3.13 Residual Impacts

3.13.1 Alternative I: Proposed Action

The following are potential residual impacts that could occur as a result of the Proposed Action:

1) Though recontouring and reseeding of the land would follow proposed mining, the landscape may not look exactly as it did prior to mining. Topography could vary somewhat, reclaimed road beds may be present, drainages could be altered, and vegetation types may be modified.

2) Reseeding would be required as part of the Proposed Action, but seeded species may not all reestablish. Residual effects on vegetation would occur until native species were reestablished. Soil characteristics could also residually change. The mined area could take decades after reclamation efforts to achieve vegetative production and species diversity comparable to pre-mine conditions. It may take longer than 10 years to get bond release based on current methods, and pre-mine vegetative diversity and productivity may not be achievable as long as 30 to 50 years after initial disturbance. Also, the disturbed area could be affected by various weed species – some of which cannot be eradicated from an area once they establish and could be present in the reseeded areas for many years, i.e., cheatgrass. Changes in vegetation would also affect surface water, soil stability and health, wildlife habitat quality and grazing.

3) The Proposed Action would involve the removal and then replacement of topsoil on the mined areas. This handling of topsoil would cause residual effects, as the biota within the soil and the soil's structure and chemistry would be modified during the process. Also, some of the soil would be lost to erosion during the proposed mining process. It may take decades before the soils would be able to function as they did before the area was mined and support a vegetative community. Changes in topsoil quality would have a residual effect on vegetation, surface water and related resources, wildlife habitat and grazing.

4) The Proposed Action could cause residual effects to wildlife populations, including those of local migratory birds and BLM Sensitive Species. If seeded species do not reestablish, wildlife may not be able to use the area as they did prior to mining. Habitat fragmentation is most likely the largest potential residual effect, and could continue to occur throughout the general area.

5) The Proposed Action may have residual effects on the amount of permitted livestock grazing if vegetation does not reestablish after reclamation. Invasive weed species could also overtake and displace desirable forage species. If this happens, the number of AUMs in the allotments included in the proposed mining would likely be reduced for years until desirable vegetation reestablishes. This situation could also result in a failure of range land health standards #1, 3, and 4 (listed below from the following website: http://www.blm.gov/wy/st/en/programs/grazing/standards_and_guidelines/standards.html).

Standard #1 Within the potential of the ecological site (soil type, landform, climate, and geology), soils are stable and allow for water infiltration to provide for optimal plant growth and minimal surface runoff. This Means That: The hydrologic cycle will be supported by providing for water capture, storage, and sustained release. Adequate energy flow and nutrient cycling through the system will be achieved as optimal plant growth occurs. Plant communities are highly varied within Wyoming. Indicators May Include But Are Not Limited To:

- Water infiltration rates
- Soil compaction
- Erosion (rills, gullies, pedestals, capping)
- Soil micro-organisms
- Vegetative cover (gully bottoms and slopes)
- Bare ground and litter

Standard #3 Upland vegetation on each ecological site consists of plant communities appropriate to the site which are resilient, diverse, and able to recover from natural and human disturbance. This Means That: In order to maintain desirable conditions and/or recover from disturbance within acceptable timeframes, plant communities must have the components present to support the nutrient cycle and adequate energy flow. Plants depend on nutrients in the soil and energy derived from sunlight. Nutrients stored in the soil are used over and over by plants, animals, and microorganisms. The amount of nutrients available and the speed with which they cycle among plants, animals, and the soil are fundamental components of rangeland health. The amount, timing, and distribution of energy captured through photosynthesis are fundamental to the function of rangeland ecosystems. Indicators May Include But Are Not Limited To:

- Vegetative cover
- Plant composition and diversity (species, age class, structure, successional stages, desired plant community, etc.)
- Bare ground and litter
- Erosion (rills, gullies, pedestals, capping)
- Water infiltration rates
-

Standard #4 Rangelands are capable of sustaining viable populations and a diversity of native plant and animal species appropriate to the habitat. Habitats that support or could support threatened, endangered, species of special concern, or sensitive species will be maintained or enhanced. This Means That: The management of Wyoming rangelands will achieve or maintain adequate habitat conditions that support diverse plant and animal species. These may include listed threatened or endangered species (U.S. Fish and Wildlife-designated), species of special concern (BLM-designated), and other sensitive species (State of Wyoming- designated). The intent of this standard is to allow the listed species to recover and be delisted. Indicators May Include But Are Not Limited To:

- Noxious weeds
- Species diversity
- Age class distribution
- All indicators associated with the upland and riparian standards
- Population trends
- Habitat fragmentation

6) The Proposed Action would not result in any unavoidable residual impacts to cultural resources, unless such resources were located during mining or road construction and *not* reported to the BLM authorized officer. The Cultural Resource Stipulations provided would mitigate this residual impact. Improvement of haul roads could facilitate access to and within the project area, thereby increasing the potential for additional unauthorized surface collection and looting.

7) Removal of the bentonite resource under the Proposed Action would constitute an unavoidable long term, post-mining, irreversible and irretrievable (residual) impact on the locateable bentonite resource, but the economic gains would offset this potential impact.

3.13.2 Alternative II: No Action

There would be no residual impacts under the No Action Alternative, as the proposed mining and road disturbance would not be approved; there would be no new disturbance or impact on the land.

3.14 Cumulative Impacts Analysis

This Environmental Assessment has attempted to combine the results of internal scoping, describing the Affected Environment, determining the Environmental Consequences, proposed Stipulations, Mitigation and Monitoring Measures should Alternative I be selected, as well as a Cumulative Effects Analysis (CEA), as per CEQ guidelines. The geographic area analyzed for this CEA includes a relatively large area that spans approximately 3 miles in each direction around the Upper Rim Plan/ROW area (see Maps 3, 4, and 5, below).

Cumulative impacts are discussed in the Cody RMP, Environmental Impact Statement, and ROD, (1990). Typical activities are described in that document and are incorporated by reference into this environmental analysis. Cumulative impacts are those that would result from the incremental impacts of the Proposed Action or Alternative I, when added to other past, present and reasonably foreseeable future actions regardless of what agency (Federal or non-Federal) or person undertakes such other actions (40 CFR 1508.7). Cumulative impacts can result from individually minor, but collectively significant actions taking place over a period of time. These reasonably foreseeable future actions refer to future action projections, or estimates, of what is likely to take place when a given Proposed Action is implemented. They are not part of the Proposed Action, but are projections being made so that future impacts, cumulative and otherwise, can be estimated as required by NEPA.

Using the CEQ (1997) report as a guide, several principles of CEA are applicable to this analysis and Proposed Action. In particular, item #6 states "*Cumulative effects may result from the accumulation of similar effects or the synergistic interaction of different effects. Repeated actions may cause effects to build up through simple addition (more and more of the same type of effect), and the same or different actions may produce effects that interact to produce cumulative effects greater than the sum of the effects*".

CEQ (1997) lists 8 examples of cumulative effects:

(1) Time crowding effects	(Frequent and repetitive effects on an environmental system);
(2) Time lags	(Delayed effects);
(3) Space crowding effects	(High spatial density of effects on an environmental system);
(4) Cross-boundary effects	(Effects occur away from the source);
(5) Fragmentation	(Change in a landscape pattern);
(6) Compounding effects	(Effects arising from multiple sources or pathways);
(7) Indirect effects	(Secondary effects); and
(8) Triggers and thresholds	(Fundamental chances in system behavior or structure).

It also lists 4 types of cumulative effects:

(1) **Type 1 Single Action-Additive**: Repeated "additive" effects from a single proposed Project;
(2) **Type 2 Single Action-Interactive**: Stressors from a single source that interact with receiving biota to have an interactive (non-linear) effect;
(3) **Type 3 Multiple Actions-Additive**: Effects arising from multiple sources (projects, point sources or general effects associated with development) that affect environmental resources additively;
(4) **Type 4 Multiple Actions-Interactive**: Effects arising from multiple sources that affect environmental resources in an interactive (i.e., countervailing or synergistic) fashion.

Cumulative effects from the Proposed Action are herein classified as Type 1 effects (single-action additive) as well as Type 3 effects (multiple actions-additive) as per CEQ (1997). This type of effect is the result of repeated "additive" effects from a single proposed project(s).

PAST, PRESENT, REASONABLY FORESEEABLE FUTURE ACTIONS, AND INCREMENTAL EFFECTS

Past, present and reasonably foreseeable future actions in the general Cumulative Effects Analysis Area, are bentonite mining and livestock grazing. Therefore, these two major activities are discussed below as the primary land uses under analysis. The area also sustains recreational activities such as hunting, off-highway vehicle use, and other activities, but these land uses are not considered among the primary surface-disturbing land uses, and therefore, are not discussed below. The general analysis area selected for the Cumulative Effects Analysis (CEA) includes an area of approximately 9 miles in diameter, 63.6 square miles, or 40,704 acres out radially from the area of the Proposed Action (Maps 3, 4, and 5). This approach of generally delineating a CEA area has been accepted by the BLM field office management for the past 4 years as part of BLM's cumulative effects analyses. CEA area delineation may be more be in the future, for example, it may use more of a watershed-based analysis area, or analysis areas based on sage grouse habitat, however, at this time, the approach described above is being used.

Past Actions:

BENTONITE MINING: There are currently four companies mining bentonite in the Cody Field Office, and within the cumulative effects analysis area, including M-I Swaco, Bentonite Performance Minerals (BPM), American Colloid Company (ACC), and M-I, Inc. (Several hundred acres have also been disturbed by gypsum mining on the west side of the Bighorn River by G-P Gypsum nearby). Approximately 21,000 acres have been directly affected by bentonite mining in the Cody Field Office since it began in the 1960s. Approximately 13,020 acres (62%) of the 21,000 acres have been reclaimed and reseeded, leaving the balance (7,980 acres or 38%), as either active mining areas, areas that have been mined but pending reclamation, or as areas proposed for new mining. About 16% of all areas that have been disturbed by bentonite mining have been released from bond in the field office. Reclamation success has not kept pace with mining disturbance.

LIVESTOCK GRAZING: Livestock grazing has been, and continues to be, a major resource-use activity on BLM-administered public lands in the Cody Field Office. Grazing has occurred for over 100 years by cattle and sheep. It is difficult to quantify the actual direct and indirect impact that livestock grazing has had on the landscape, because grazing occurred prior to BLM quantifying pre-grazing conditions. Improper grazing practices in general can have long-term effects on vegetation, including reduced species diversity, altered

species composition, altered vegetative structure, altered abiotic processes (e.g., mean fire return interval), loss of topsoil, and increased invasibility of sagebrush communities (Crawford et al. 2004; Miller and Eddleman 2000). In the 1980's, 1990's and 2000's, management of livestock grazing was changed in all relevant allotments, including use of rotational grazing strategies, reductions in authorized use, and utilization limits for key plant species were implemented. These management changes have provided for adequate plant recovery time and leave ample residual vegetation following livestock grazing for watershed protection and wildlife habitat needs. Reclaimed areas can be impacted by livestock grazing if livestock are not fenced out of such areas. The effects of grazing can change from year to year depending upon how heavily the vegetation is grazed in relation to that year's vegetative forage produced. Annual forage produced varies depending on precipitation, and effects from previous years of grazing.

OIL AND GAS WELLS: Approximately ten (10) oil and gas wells have been drilled within the CEA area; according to the Wyoming Oil and Gas Conservation Commission, all of these have since been plugged and abandoned as non-producing wells.

Present Actions:

BENTONITE MINING: M-I Swaco has currently affected or is planning to affect a total of 6,000 acres of land, of which, about 4,300 acres (~ 65%) are reseeded and reclaimed and about 30% of that are bond released. Of the reclaimed acres, about 1,600 are recontoured, "topsoiled", and possess a native vegetative community sufficient enough to be bond released by the Wyoming Department of Environmental Quality (WDEQ). Bentonite mining disturbs dozens of new acres of land in the area each year. Since reclamation is attempted to be concurrent with mining, companies try to reclaim as they progress.

LIVESTOCK GRAZING: Within the CEA area analyzed in this EA (Maps 3, 4, and 5), are several active grazing allotments. The Upper Rim Plan/ROW area is located within the Lost, Clay Pits, North Shell Group, Bear Creek and Lower Bear Creek allotments, which would temporarily lose a total of about 0-40 AUMs per year, depending on how much new disturbance took place under the Proposed Action, and until post mining reclamation was successful. Since reclamation of the mine areas occurs concurrently with mining, some AUMs are restored for grazing use, however as new land is disturbed, those AUMs are temporarily lost. The present kind and number of livestock and the number of days/seasons they graze are expected to continue. The effects of grazing can change from year to year depending upon how heavily the vegetation is grazed in relation to that year's vegetative forage produced. Annual forage produced varies depending on precipitation, and effects from previous years of grazing.

Reasonably Foreseeable Future Actions:

BENTONITE MINING: Bentonite has become a very important locatable mineral, being used for kitty litter, drilling mud to lubricate oilfield drilling equipment, as a binding agent for taconite iron pellets, as well as for crayons, medicines, food thickeners, and cosmetics to name a few. Sodium-bentonite deposits in Wyoming make up about 70% of the world's known supply, suggesting that bentonite mining will continue well into the future in Wyoming and the Bighorn Basin. It is currently economical to remove up to 50 to 80 feet of overburden to extract the bentonite. The BLM estimates another 9,000 to 10,000 acres of bentonite mining related disturbances will be proposed by bentonite mining companies in the Cody Field Office area in the reasonably foreseeable future. This Plan/ROW would add a total of 665.2 acres of new surface disturbance on federal lands as shown in the table below which breaks out the disturbance by land status.

LIVESTOCK GRAZING: Livestock grazing on public lands has been occurring for over 100 years in the Bighorn Basin. The present kind and number of livestock and the number of days/seasons they graze is expected to continue in the future, provided reclamation is successful. If successful reclamation is not achieved, livestock grazing would be expected to decline in the future. Proposed Upper Rim pit disturbance areas are provided here once more for reference.

PIT SERIES	Pit Land Status and Acres (*Numbers adjusted to match latest maps & claims table provided below)			
	Private/Patented Land	Federal Surface/Private Mineral (ROW)	Federal Surface/ Federal Mineral (Plan)	Total acreage by pit area
Upper Rim	*1.5*	***44.3***	***0 (see North Esther)***	*45.8*
Howe	*102.7*	***0.3***	***0***	*103.0*
Bonney	*44.7*	***65.7***	***0***	*110.4*
Leonard	*21.3*	***51.5***	***0***	*72.8*
Davis	*6.5*	***142.6***	***0***	*149.1*
Arney	*0*	***101.7***	***31.5****	*133.2**
Tanner II	*9.8*	***2.6***	***1.9****	*14.3**
Hinckley II	*4.2*	***7.2***	***0***	*11.4*
North Esther	*0*	***15.2***	***10****	*25.2**
TOTALS *More detailed information is provided in **Appendix B.***	***190.7***	***431.1***	***43.4****	***665.2****

Incremental effect of each Alternative

Alternative I – Proposed Action (with required Stipulations, Mitigation and Monitoring Measures)

Upper Rim Plan of Operations CEA Area - Incremental Impact of the Proposed Action

The BLM Cody Field Office staff conducted a general cumulative effects analysis (CEA) for the Proposed Action under this EA, using GIS overlays and field inspections. The general analysis area selected for the CEA includes an area roughly 23,040 acres in size, and roughly 3 miles out radially from the area of the Proposed Action (Maps 3, 4, and 5). Within this CEA area, approximately 2,700 acres have already been disturbed by bentonite mining (~12.0% of the total area); and approximately another ~1000 acres are planned for new mining (4.3% of the total area) over the next 15-20 years. The Proposed Action incrementally adds 665.2 acres of mining disturbance within the analysis area, or 2.9% of the total CEA area. Several maps were generated using ArcMap9 GIS software, to overlay existing and known projected land uses, known wildlife/T&E/BLM Sensitive species habitats and nesting sites, and general vegetation communities, along with past, current and proposed bentonite mining and other land uses, in the area northeast of Greybull, WY. These maps are provided below as CEA Maps 3, 4 and 5.

Generally about 16% of the amount of land mined for bentonite in the entire field office has been successfully reclaimed (released from bond) since bentonite mining began in the 1960's. Approximately 84% of the land disturbed by bentonite mining is either "reclaimed" but not released from bond because it doesn't yet meet reclamation bond release standards, in active mining status, or in proposed mining status. The bentonite companies continue to post larger and larger reclamation bonds each year in order to continue to mine, which is all that is required by the regulations. The BLM and the WDEQ-LQD will not release bonds until the reclamation meets, ideally, pre-mine or better conditions (~90% of original perennial cover is sometimes used as a reclamation standard).

Effects of Mining on Livestock Grazing/Range Management

Until the land is reclaimed, bentonite mining incrementally reduces the amount of vegetation, wildlife habitat, and livestock forage. This can incrementally affect ranching families economically. In the area of the Proposed Action, bentonite mining has encroached on some ranch operations, in some cases increasing problems with use of existing range improvements, costing extra time and money to maintain range improvements, and gathering

up livestock for various reasons that are associated with mining activities (i.e., gates left open, fences down, cattle guards filled with dirt from haul trucks, cattle traveling long distances on haul roads and into unauthorized areas, etc.). Surface mining in areas where public (and private) resources have been expended to improve watershed function, wildlife habitat, and other public resources can result in a reduction in progress that has been achieved through these efforts. Presently in this CEA there are approximately ~2,700 acres disturbed by mining, equating to some financial and operational losses to the permittees that graze livestock within the CEA area. With the addition of ~1,000 more acres of planned bentonite mining (449 acres from the proposed mining), approximately 4.3% of the CEA area would be disturbed by bentonite mining within the next 15 years. Past, present, and future actions may cause more allotments to fail Rangeland Standard #1, 3, and 4.

Effects of Mining on Wildlife

Native wildlife habitat is either lost directly, or diminished in quality through fragmentation, until post-mine reclamation is successful. Species such as sage grouse and mountain plover are most affected by these incremental mining actions, and have been listed as BLM Candidate and Sensitive species which now require conservation actions to stop further decline or possible placement on the Threatened and Endangered species list, especially in the case of the grouse. The incremental effect of the Proposed Action, in addition to past and present disturbances, may further fragment and reduce population size and connectivity.

Effects of Mining on Soil, Water, Riparian-Wetland Areas, and Aquatic Habitats

Surface disturbance due to mining and access/haul roads can affect local hydrology, sediment and flow regimes, and water chemistry, which can in turn cause impacts to water, riparian-wetland areas, aquatic habitats and the species that use them. Disturbance of the soil profile would to some extent affect biological and physical viability. If not successfully reclaimed in a reasonable time frame, soil and water-related impacts can incrementally accrue within the CEA boundary. (Water-related impacts can accrue down-gradient from the CEA boundary).

Cumulative Effects Analysis Summary

Under the Proposed Action, the incremental amount of new disturbance per year by M-I would be about **44 acres per year, anticipated over the 15-year life of the mine**. The Proposed Action would add a total of 665.2 acres of new mining disturbance within the CEA area over 15 years, representing about 2.9% of the total CEA area (which is approximately 23,040 acres). This type of mining typically takes place concurrently with reclamation, during use of the cast back method of material handling. Based on the affected environment, and on known environmental consequences of the Proposed Action; the CEA indicates that the incremental effects of the Proposed Action, coupled with other existing and planned land uses on wildlife habitats/species, vegetation, and soils, can be mitigated or reduced over time, by implementing the stipulations, mitigation and monitoring measures that would be required by M-I, BLM and WDEQ-LQD as outlined in the Mine and Reclamation Plans, should these be approved by the regulatory agencies. *This statement assumes reasonable and proper on-the-ground implementation of same by M-I Swaco.*

Biannual compliance inspections conducted jointly with M-I, WDEQ-LQD and BLM would ensure compliance with these measures, as well as provide corrective actions should they ever be necessary in order to prevent non-compliant actions on the State permit area, as well as unnecessary or undue degradation taking place on the public lands. *This statement and summary is applicable to those lands regulated under the Surface Management regulations (43 CFR 3809) and the Regulations under 43 CFR 2800 that govern rights-of-way under the Federal Land Management Policy Act (FLPMA).*

Alternative II – No Action Alternative

Alternative I would not add to the incremental effects that already exist in the area because the proposed bentonite mining would not take place.

4.0 List of Preparers:

Author – BLM Cody Field Office

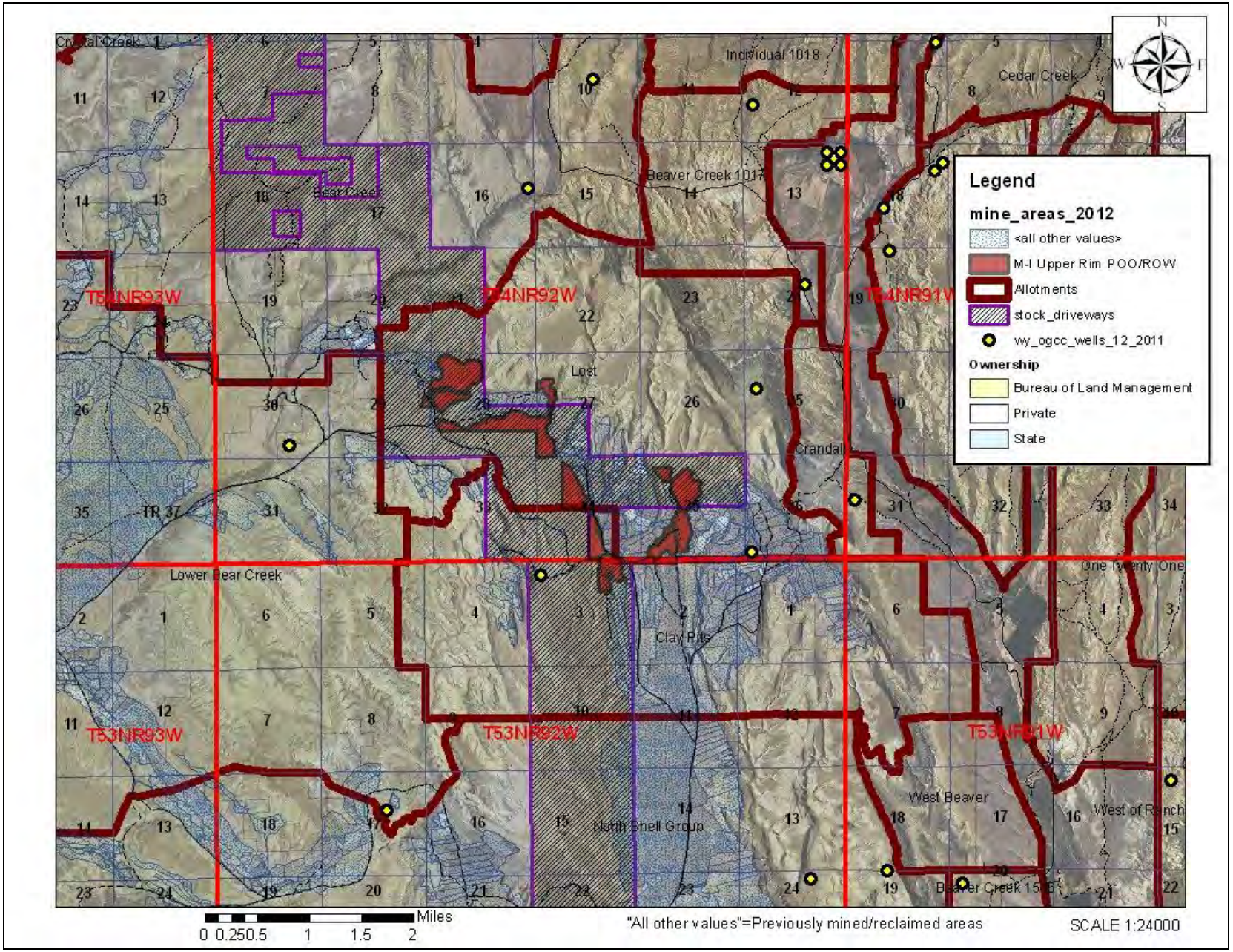
Gretchen L. Hurley	Geologist – (Geology, Paleontology, Mineral Resources)

Interdisciplinary Team – BLM Cody Field Office Reviewers

Kierson Crume	Cultural Resources & Native American Consultation
Destin Harrell	Wildlife, Migratory Birds, Special Status Species, T&E Species
Duane Feick & Cara Blank	Realty and Rights-of-Way
Shirley Bye-Jech	Recreation
Jerry Jech	Hydrology, Soils, Air Quality, Riparian & Aquatic Resources
Jack Mononi	Rangeland Management and Vegetation
Mike Wengert	Weeds/Invasive, Non-native Plant Species
Ann Perkins	NEPA Coordination/Editing

Consultation (Agencies)

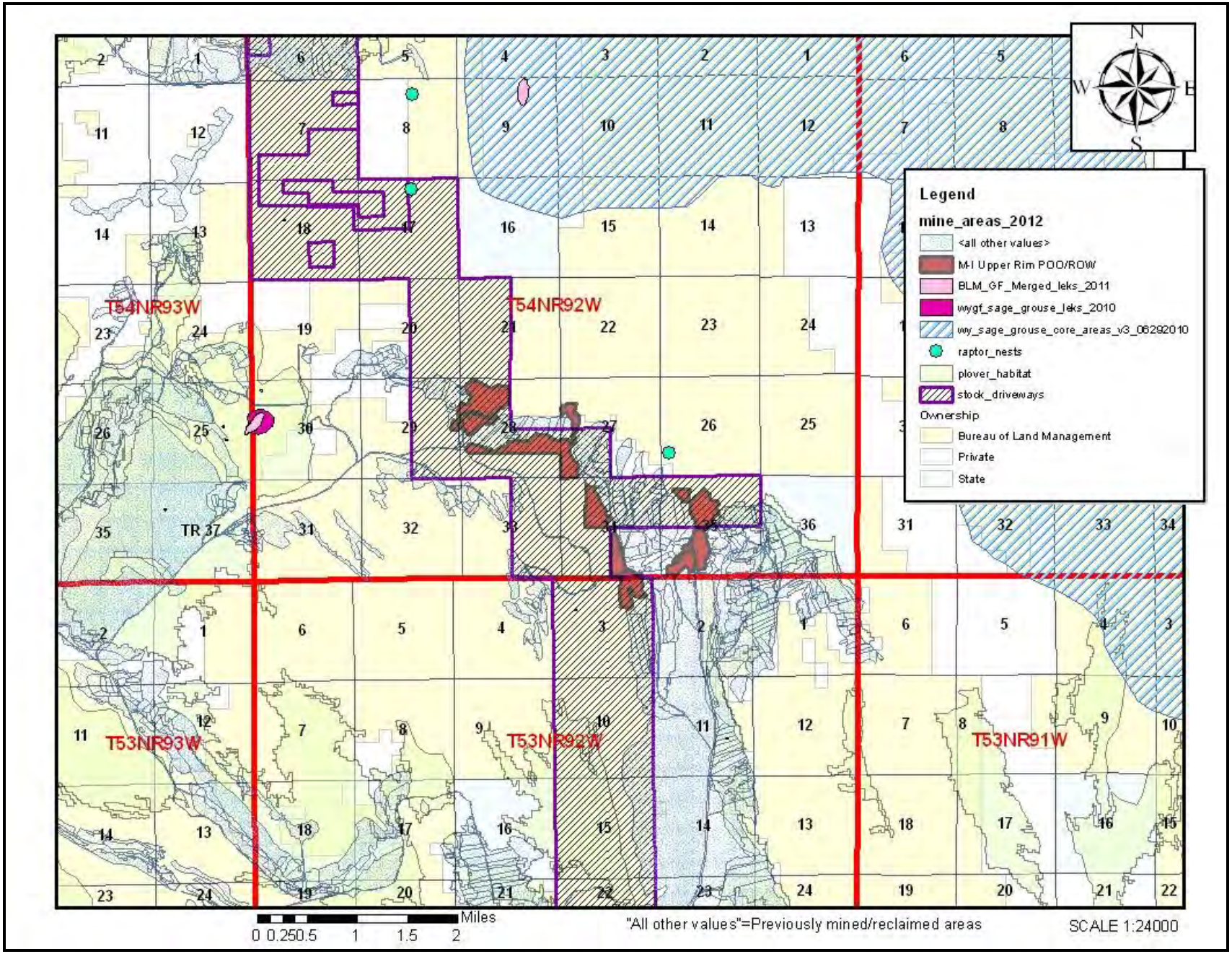
Wyoming Department of Environmental Quality – Land Quality Division
U.S. Fish and Wildlife Service
Wyoming Game and Fish Department
United States Army Corp of Engineers



Map 3. Land uses (existing and proposed) within the Upper Rim Plan Cumulative Effects Analysis Area

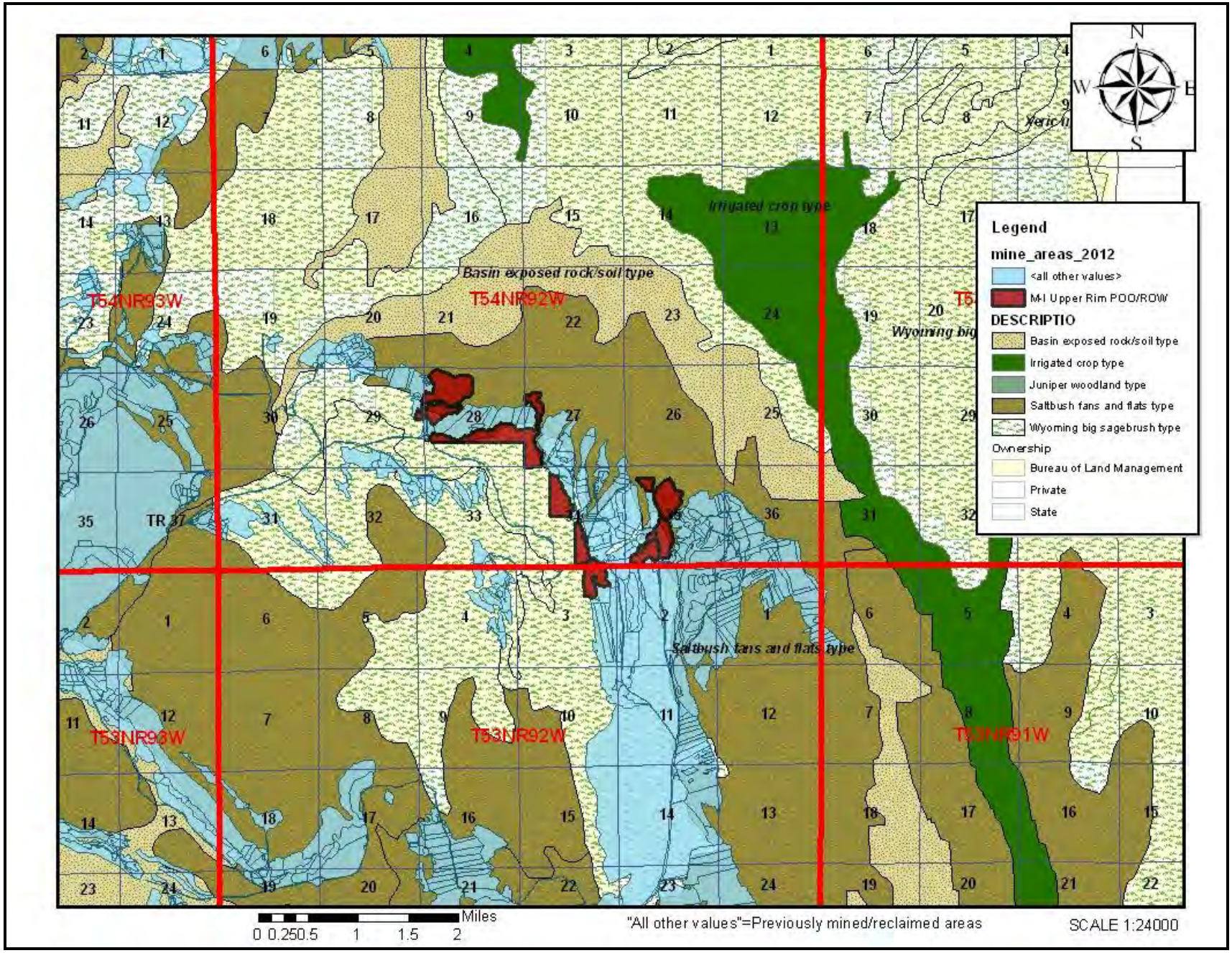
Livestock grazing, bentonite mining (present and reasonably foreseeable future) were analyzed.

No warranty is made by the BLM for use of this data for purposes not intended by the BLM



Map 4. Raptor nest sites (known), Mountain Plover Habitat, and Sage-grouse Key Areas in the Upper Rim Plan Cumulative Effects Analysis Area

No warranty is made by the BLM for use of this data for purposes not intended by the BLM



Map 5. Vegetation Types within the Upper Rim Plan of Operations Cumulative Effects Analysis Area

No warranty is made by the BLM for use of this data for purposes not intended by the BLM

5.0 References

BLM Cody Field Office, 2011-2012; Geographical Information Systems Data and other digital or hardcopy resource data

M-I Swaco, 2006 - 2010 "Master Mine Plan: Monitoring and Compliance/Interim Stabilization Plan".

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6.0 APPENDICES

Appendix A. RMP Maintenance Action regarding Mountain Plover IM-2007-018

United States Department of the Interior
BUREAU OF LAND MANAGEMENT
Wyoming State Office
P.O. Box 1828
Cheyenne, Wyoming 82003-1828

TAKE PRIDE IN AMERICA

In Reply Refer To:
6840 (930) P

April 17, 2007

Instruction Memorandum No. WY-2007-018
Expires: 9/30/08

To: Field Managers

From: Associate State Director

Subject: *Resource Management Plan (RMP) Maintenance Action:* Incorporation of the Bureau of Land Management's (BLM) Programmatic Biological Evaluation (BE) for the Mountain Plover (*Charadrius montanus*) and the United States Fish and Wildlife Service (FWS) Inter-agency Coordination Memorandum into Field Office (FO) Resource Management Plans (RMPs) by Maintenance Action

The attached document transmits the FWS inter-agency coordination memorandum based on a review of potential activities and conservation measures described under all current Wyoming BLM RMPs (except the Snake River RMP) and the Wyoming statewide Programmatic mountain plover BE, and the potential effects of these activities on the mountain plover in accordance with BLM's 6840 manual. The FWS reviewed all of BLM's activity specific determinations and was in agreement with our proactive analysis and proactive conservation measures, which should serve to better protect this species from further decline.

The Wyoming BLM Statewide Programmatic BE for the mountain plover and the inter-agency coordination memorandum covering the FWS review can be found on the on the internet at www.blm.gov/wy/st/en/programs/Wildlife/mtn-plover.html.

The preliminary determination is that this action is an RMP *Maintenance Action* as defined in 43 CFR 1610.5-4. All Wyoming BLM FOs should review their existing RMPs, the programmatic BE, and the FWS inter-agency coordination memorandum. If you agree with this determination, please maintain the official hard copy of your RMP within 30 days of the date of this Instruction Memorandum (IM). Please also maintain the web-based copy of your RMP during the same timeframe. If you believe this action may require an RMP amendment, please contact Ken Peacock, Wyoming State Office, at (307) 775-6329.

If you have further questions regarding this IM, please contact Jeff Carroll at (307) 775-6090.

/s/Donald A. Simpson

2 Attachments:
1. Fish and Wildlife Service Memorandum (ES-61411/W.02/WY07FA0290) (24 pp.)
2. BLM Wyoming Programmatic Biological Evaluation of the Mountain Plover (9 March 2007) (110 pp.)

Appendix B. Specific Mine and Reclamation Plan Information for the Upper Rim Plan of Operations/Right-of-Way/Plan/ROW

The following mine plan descriptions are specific to each proposed mine series under this Proposed Action. These areas are outlined in Figures 1 and 2 above.

MINE PLAN (PLAN OF OPERATIONS/RIGHT-OR-WAY): UPPER RIM PLAN/ROW

ARNEY SERIES

Within Arney, mining will occur in 6 distinct series, beginning with series A-1 in the southwest corner of the proposed disturbance and preceding sequentially upslope in numerous phases as illustrated on Mine Plan Map 1. The estimated 30,000 cubic yards of overburden from cut A1-1 will be permanently placed on the 4.2 acre site designated as storage site A1. This material added to the A1 storage site will cause an approximate 4.5' average elevation gain.

Series A2, A3, and A4 lie immediately to the east of A1. The overburden from the first cut in each of these three series will be hauled back, in part, to the final cuts of the previous series. Excess overburden, meaning material that cannot be blended into the topographic expression of these previous cuts, will be carried out ahead to be blended into the backfill of successive cuts. Topsoil and suitable cover materials, from the initial cuts of the A1 through A4 series, will be temporarily stockpiled at locations as illustrated in Map 1. Two adjacent previously reclaimed areas will be re-disturbed by operations; a former stockpile and staging area located along the current haul road immediately south of the A6 series, and the east side of the Greene mine reclamation which will be affected along the west margin of the A1 series.

The two ephemeral drainages that separate Series A2 and A3, and Series A3 and A4, will be crossed with haul roads to access the next series. Culvert sizing for Crossings 4 and 5 is described in Addendum B and the results shown in the table on page MP-5. These two drainages will not be disturbed, other than where breached to accept road crossings and culverts (refer to Mine Plan Map 1). The final contour of reclaimed slopes adjacent to these channels will not exceed the angle of the adjacent native slopes. Mining in series A1 through A4 will affect several minor drainages that have developed, naturally, to channel runoff from the platforms. During backfill operations, M-I will ensure that numerous low-gradient, swale-like features are retained to aide in the distribution of this runoff. Straw bale check dams and course rock/rocky overburden will be installed, as necessary, to control sedimentation and potential erosion.

Series A5 and A6 lie immediately south of the A2, A3, and A4 series across a significant ephemeral drainage. The above referenced ephemeral drainage will not be affected by mining. Access to the A5 and A6 mine series will be provided from the south using currently permitted haul roads. The overburden from cuts A5-1 and A5-2, along with overburden from the Davis D-1 cut, will combine for a total of 150,000 cubic yards to be spread on the 9.2 acre D/A5 permanent overburden storage site as referenced on Map 1. This additional material will result in an average elevation rise of approximately 11 feet to the storage site, which will blend well into the topographic rises of the Arney A6 and Davis pit series areas. The A5/D1 overburden storage site will also be utilized as a bentonite stockpile and drying area for the Arney and Davis mine series. Locations have been illustrated in Map-1 for temporary stockpile sites for the topsoil and suitable cover material from the initial cuts of the A-5 and A-6 series. The overburden from the initial A6 series cut will be cast back onto the final cuts of the A5 series prior to covering the A5 series with suitable cover material and topsoil.

BONNEY SERIES

Bonney mining will occur in three distinct series, B1, B2, and B3. B2 and B3 are located on opposite sides of a significant ephemeral tributary of Porter Gulch illustrated on Mine Plan Map 2. Mining will be initiated along the eastern edges of each series and will proceed westward. Initial mining, and overburden and soils stockpiling, at B1 will re-disturb former mine lands including 28 acres of land released of bond liability by the WDEQ in 2003. The east half of B2 will re-disturb reclaimed, but not bond released, mine lands.

Approximately 160,000 cubic yards of overburden from cut B1-1 will be permanently placed on the 7.8 acre site designated as storage site B1. This material will cause an approximate 13' average elevation gain. Topsoil and suitable

cover materials, from the initial cuts of the B1 series, will be temporarily stockpiled at a location illustrated in Map 1. This material will be preserved as cover for the final B3 series cuts.

Approximately 60,000 cubic yards of the overburden from the B2-1 cut will be hauled back to the final cut of the B1 series prior to covering the B1 series with suitable material and topsoil. The remaining 165,000 cubic yards of the B2-1 overburden will be permanently placed on the 7.7 acre site designated as storage site B2. This material will cause an approximate 14' average elevation gain. Topsoil and suitable cover materials, from the initial B2 cuts, will be hauled back as cover for the final B1 cuts plus any short term mine access roads. The overburden and cover materials from the B3-1 cut will likewise be hauled back as backfill and cover for the final B2 cut plus any short term mine access roads.

The ephemeral drainage that separates Series B2 and B3 will be crossed by way of the existing haul road crossing. This drainage will not be otherwise disturbed.

DAVIS SERIES

Davis mining will occur as one advancing series that advances from west to east. Access will be provided by a spur road off of M-I's permitted haul road to the southwest of the mine area. This spur will cross previously mined and reclaimed land, and will not affect any major drainages. A band approximately 150 feet wide of previously reclaimed lands along the south margin of the old Tanner mine will be re-affected for the entire length of the Davis series.

The estimated 100,000 cubic yards of overburden from cut D-1 will be permanently placed on the D/A5 permanent overburden storage site. Two locations have been illustrated in Map 1 for temporary storage of topsoil and suitable cover materials to be used later to reclaim the final pits plus any short term mine access roads plus the main trunk access road. Due to the existence of Rocky Mountain Juniper, which have established on the rocky platform of this mine area, the Reclamation Plan commits M-I to salvaging large surface rock and subsequently returning this rock to the reclaimed land surface. This will be accomplished by dozing this rock to the margins of an active cut, and then later dozing it back onto the contoured backfill once the backfill has been covered with suitable material.

Several shallow, insignificant drainages will be affected by mining. During backfill operations, M-I will ensure that numerous low-gradient, swale-like features are retained to aide in the distribution of surface runoff. These reconstructed features will be located to tie into any native drainages that intersect with the down slope border of the mine. Reclaimed drainages will be constructed in coarse rock/rocky overburden and straw bale check dams will be installed, as necessary, to control sedimentation and potential erosion. Any constructed ACM's will be removed once the series is revegetated and stabilized.

HINCKLEY II SERIES

The Hinckley II series captures a strip of land that was inadvertently left out of the Hinckley mine series as referenced to the 1999 Plan/ROW. As this strip will be mined concurrently with lands approved by the 1999 Plan/ROW, no reclaimed lands will be disturbed. This extension will progress from south to north, terminating at the bentonite outcrop. Overburden from cut HI-1 will be cast back into the preceding pit, and topsoil and suitable cover from the first couple of cuts will be hauled ahead to the temporary stockpile location illustrated in Map 2.

HOWE SERIES

Howe mining will occur in two series, H1 and H2, as based on the depth of bentonite. In all likelihood, M-I will mine the shallower H1 series before mining H2. All mining will progress from south to north. Mining along the east and west sides, along with temporary overburden stockpiling along the southern ends of the two series, will re-disturb former mine lands including 5.6 acres of land released of bond liability by the WDEQ. H2 will re-disturb reclaimed, but not bond released, mine lands.

Overburden from both the H1 and H2 series will be temporarily stockpiled at the south end of the series at the site illustrated on Map 2, and then later redistributed over the first cuts. The purpose of temporary, as opposed to permanent, storage of this overburden is to not apply additional cover to lands that may be considered for mining at a later date. This 7.6 acre site will accommodate either the 165,000 cubic yards of overburden anticipated from the H2-1 cut, or the 30,000 cubic yards from the H1-1 cut. Topsoil and suitable cover materials, from the initial cuts of the either

series, will be temporarily stockpiled on locations illustrated in Map 2 to be later used to cover the final H1 and H2 series cuts.

LEONARD SERIES

Leonard mining will occur in two distinct series, L1 and L2. These series are located on opposite sides of a significant ephemeral tributary of Porter Gulch illustrated on Mine Plan Maps 1 and 2. Mining will be initiated along the eastern edges of both series and will proceed westward. Initial mining at L1 will re-disturb an area that was formerly used as a stockpile and staging area, and not mined, during an earlier era of mining. The east side of the Leonard disturbance will border, but not disturb, the channel of the drainage that separates Leonard from the Fisk mine area to the east.

Approximately 170,000 cubic yards of overburden, which represents one half of the total overburden, from cut L1-1 will be permanently placed on the 5.9 acre site designated as storage site L1. This material will cause an approximate 18' average elevation gain. The other one half of the L1-1 overburden will be redistributed over the backfill of the first several cuts of the series. This blending of backfill will create a smooth topographic transition from the adjacent reclaimed lands through the Leonard series.

Topsoil and suitable cover materials, from the initial cuts of the L1 series, will be temporarily stockpiled at a location illustrated in Map 1. This material will be preserved as cover for the final L2 series cuts plus any short term mine access roads. The overburden from the L2-1 cut will be hauled back to the final cut of the L1 series prior to covering the L1 series with suitable material and topsoil.

The ephemeral drainage that separates Series L1 and L2 will be crossed by way of a culvert as described in Addendum and the table on page MP-5. This drainage will not be disturbed other than where breached to accept the road crossing.

NORTH ESTER SERIES

The North Ester series captures a strip of land that was inadvertently left out of the Esther mine series as referenced to the 1999 Plan/ROW. No reclaimed lands will be re-affected by this project. North Ester mining will occur as one series, and will be developed as an extension of already approved mining, at Esther, immediately to the south. This extension will progress from south to north, terminating at the bentonite outcrop. Due to the shallow depth of the clay there will be negligible overburden volumes to manage. Overburden from cut NS-1 will be cast back into the preceding pit, and topsoil and suitable cover will be hauled ahead to the temporary stockpile location illustrated in Map 2.

TANNER II SERIES

Tanner II mining will occur as one series, and will progress from south to north, terminating at the bentonite outcrop. This series is an outcrop recovery operation, and due to the shallow depth of the clay there will be negligible overburden volumes to manage. A narrow strip of reclaimed lands, along the western edge of the series, will be re-affected by this project. Overburden, topsoil, and suitable cover material from cut T-1 will be temporarily stockpiled at locations as illustrated in Map 2.

UPPER RIM SERIES

Upper Rim mining will occur as one series. The ephemeral drainage that separates Upper Rim from North Esther, to the west, and Howe, to the south, will be crossed in two locations by way of culverts as described in Addendum and the table on page MP-5. This drainage will not be disturbed other than where breached to accept the road crossing.

Mining will be initiated along the southern boundary of the series and proceed northward to the outcrop of the bentonite bed. Should the Upper Rim series be developed before the Howe series, the approximately 50,000 cubic yards of overburden stripped from the first three cuts of Howe will be temporarily stockpiled at the north end of the Howe H1 series as designated in Map 2. This material will later be blended back onto the first several cuts of the Upper Rim series. Should the Howe series be developed before Upper Rim, then this overburden from will be cast back onto the final Howe cuts. Topsoil and suitable cover material from the first Upper Rim cuts will be temporarily stockpiled at locations as illustrated on Map 2 to be used later to reclaim the final cuts plus any short term mine access roads.

RECLAMATION PLAN: UPPER RIM PLAN/ROW

Generalized Reclamation Plan (methods and procedures)
Refer to ***Master Permit 278C, Reclamation Plan***, for the generalized reclamation plan. The following sections are presented in the Master Permit volume and are available upon request
:

A.	***Postmine Land Use***
B.	***Equipment***
C.	***Postmine Surface Reconstruction***
D.	***Placement of Topsoil, Subsoil, and Suitable Material***
E.	***Postmine Sediment and Erosion Control***
F.	***Reclamation Schedule***
G.	***Special Soil Reconstruction Procedures, Soil Amendments, or Planting Methods***
H.	***Seeding***
I.	***Protection of Reclaimed and Native Areas***
J.	***Weed Control Program***
K.	***Methods for the Evaluation of Reclamation Success***
L.	***Reclamation Performance Bond Estimate***
Addendum A:	***Currently Approved Seed Mixes and Species Evaluation***

Reclamation Issues Specific to Upper Rim Plan/ROW Series

BRIEF DESCRIPTION GEOLOGIC SETTING, OVERBURDEN AND TOPSOIL
Mining within the Upper Rim Plan/ROW area will target the "Beaver" bentonite bed which lies beneath the erosion-resistant surface of Peay Sandstone belonging to the Frontier Geologic Formation. The Upper Rim Plan/ROW area will be developed in several distinct mine series identified as Arney, Davis, Leonard, Bonney, Howe, Upper Rim, Tanner II, Hinckley II, and North Esther. Refer to Mine Plan Maps 1 and 2 (Addendum MP.A) for the locations of these proposed mine series. These series lie along the gently sloping western flank of Beaver Rim among extensive previously developed M-I mining activity in portions of sections 27, 28, 29, 34, and 35 of T.54N, R.92W and section 2 and 3 of T.53N, R.92W. Mine Plan Maps 1 and 2 illustrate haul road access, stockpile areas and the approximate planned sequencing for these phases. Overburden depths vary between 0 and 40 feet along the dip of the mineral bed from outcrop to highwall. Availability of suitable overburden for capping postmine overburden during backfill activities will be identified using chemical criteria outlined by LQD Guideline #1 (Appendix D5, Geology. Addendum D5.A, Tables D5.A1 & D5.A2). A minimum of 24" of total suitable cover, to include both suitable material and topsoil, will adequately buffer the seeded vegetation from the underlying unsuitable bentonitic spoil. Average anticipated depths of replaced topsoil/subsoil are indicated in Appendix D-7, Soils; Table D7.2.

HABITAT RESTORATION PLAN

Sage brush vegetation communities
It is recognized that the Upper Rim Area includes lands with important wildlife habitat that revolves around Basin Big Sagebrush (*Artemisia tridentate* var. *tridentata*). Thus, M-I will prioritize the reestablishment of sage lands within the postmine condition. Specific to re-establishment of Basin Big Sagebrush, MI may choose to the experiment with other known of not-yet developed full-shrub sagebrush species that could be accepted as either a substitute or an addition to Basin Big Sagebrush.

M-I commits to selective seeding a *sagebrush mix* on one acre per every 20 acres of disturbed land that was identified, pre-mine, as Mixed Desert Shrub (MDS). To maximize success potential, every attempt will be made to select seeding areas that have a reduced exposure to the wind and have the potential to trap moisture. Prior to seeding the *sagebrush mix,* M-I will either avoid the target areas with the general MDS replacement mix or will seed all areas with the MDS replacement mix and then chemically treat the areas after the immediate growing season and prior to seeding the *sagebrush mix.* While the latter technique would put the sage seeding a year behind the general seeding, it may be a

preferable alternative for seeding smaller plots where there is concern of broadcast seed drift from the MDS replacement mix. In addition to sagebrush seed, the *sagebrush mix* would consist of select forbs, shrubs, and grasses that would be less likely to out-compete the sagebrush. The presence of no-sagebrush species in the *sagebrush mix* not only enhances the habitat value of the mix, but also provides weed and erosion control in the form of ground cover.

Examples of non-Big Sagebrush species added to the *sagebrush mix* include: (1) other full shrubs (fourwing saltbush and spiny hopsage), (2) sub-shrubs (shadscale, winterfat, fringed sage, prairie sage, and dragon sagewort), (3) grasses (bluebunch wheatgrass, bottlebrush squirreltail, Indian ricegrass, prairie sand reed, sandberg bluegrass, needle and thread grass, prairie june grass), and (4) forbs (sweet vetch, globemallow, bee plant, evening primrose, basin daisy, purple prairie clover, waxleaf penstemon, and phlox).

In cases where the plot-seeding of sagebrush does not result in visible sagebrush germination and persistence, other application techniques will be utilized to mitigate the lack of response. These mitigation measures may utilize one or more of several promising techniques, including (1) reseeding with Zeba® treated seed, (2) irrigated bare root transplants, (3) water enhancing products [Rainbird® gel packs or Zeba® granular application(s)], (4) supplemental watering efforts, (5) soil amendments, or (6) any other technique identified by research or practice as a likely means to increase sagebrush establishment success.

Specific to the bond release process, M-I and the WDEQ/LQD agree that these "Sagebrush Enhancement Areas" are not to be evaluated independently of the parent MDS vegetation community type. Rather, the enhancement areas will be lumped in with the other MDS community for purposes of quantitative vegetative sampling. The Bond Release submittal request will include a map that illustrates the location of the "Sagebrush Enhancement Area(s)". Bond release will be granted provided that perennial vegetative cover of the entire bond release community type is equal or greater than its native counterpart. However, M-I understands that it is important to establish which techniques and species provide the best chance for reclamation success and, thus, will provide a qualitative evaluation of the "Sagebrush Enhancement Area" reclamation success.

Juniper vegetation communities

Proposed mining within the Davis and Arney mine series are projected to affect 16.3 acres of the Rock Outcrop/Juniper plant community which supports a pre-mine average of 14.6 juniper trees/acre. M-I, LLC will utilize bare-rootstock transplants planted at a density of approximately 20 transplants/acre in order to achieve a plant survival equal to or better than 14.6 juniper trees/acre. This translates, should the entire community be affected, to a post-transplant survival target of 25 juniper trees at Arney and 215 juniper trees at Davis. These juniper transplants will be planted in numerous "pods" located relative to concentrations of the surface sandstone set into the reclaimed surface. M-I's approved MDS seed mix will be applied to the remaining topsoiled areas of the reclaimed surface.

M-I, LLC habitat restoration will include efforts to maximize salvage of useable sandstone material from pre-mine areas dominated by sandy soils with intermittent surface exposures of outcropping sandstone outcrops (e.g. the Rock Outcrop/Juniper plant community). In these areas, initial topsoil salvage will be accomplished by skimming surface soils and pockets as best as possible with scrappers to expose underlying sandstone parent material. To the degree possible, exposed sandstone will then be ripped using bulldozers with the recovered materials being dozed into "rubble" stockpiles along the edges of active mining areas. This "rubble" will be strategically replaced upon reclaimed surfaces to blend with topsoiled areas to mimic the pre-mine surface conditions as much as possible.

RECLAMATION RESPONSIBILITY BY PLANT COMMUNITY

Table RP-1 indicates projected reclamation seeding acreages by pit area and seed mixture (and targeted reclamation plant communities). Seven acres of pre-mine landscape determined to be barren outcrop (vegetation map units OC and RC-40%) will be considered as allowable barren acreage within postmine reclaimed areas.

ADDITIONAL RECLAMATION COMMITMENTS

In order to address concerns indicated by the Wyoming Game and Fish Department related to potential impacts on aquatic habitat, M-I agrees to comply WGF recommendations to implement best management practices for erosion and

sediment control, to promptly revegetate disturbed areas, and to stage equipment servicing and fueling areas at least 150 feet from streams and riparian areas.

Table RP-1. Projected Acreages for Application of Reclamation Seed Mixtures.

Seed Mix and Pre-mine Map Units	PLAN/ROW PIT AREAS (in acres)									GRAND TOTALS
	Arney	Bonney	Davis	Hinckley II	Howe	Leonard	North Esther	Tanner II	Upper Rim	
Mix 1: SDS, Rec-B, Rec-BR, & RC-30%	72.9	47.5	43.5	0	18.8	11.2	1.68	5.77	17.7	**219.05**
Mix 2: MDS1, MDS2, J/RO, RC-30%	43.1	62.9	105.6	11.4	84.2	61	11.28	7.27	27.1	**413.85**
OC & RC-40%	1.6	0	0	0	0	0.6	2.24	1.56	1	**7**
TOTAL	**117.6**	**110.4**	**149.1**	**11.4**	**103**	**72.8**	**15.2**	**14.6**	**45.8**	**639.9**

SEED MIXTURES REFERENCED IN THIS TABLE ARE TAKEN FROM THE PERMIT 278C MASTER PERMIT:

(1) SALT DESERT SHRUB MIX (BLM), AND

(2) MIXED DESERT SHRUB MIX (BLM) WITH ADDITIONAL APPLICATIONS OF WINTERFAT AND BIG SAGEBRUSH.

MIXTURE 1 TARGETS ESTABLISHMENT OF SALT DESERT SHRUB PLANT COMMUNITIES (PRIMARILY DOMINATED BY GARDNER SALTBUSH AND PERENNIAL GRASSES); MIXTURE 2 TARGETS ESTABLISHMENT OF MIXED DESERT SHRUB PLANT COMMUNITIES (PRIMARILY DOMINATED BY WYOMING BIG SAGEBRUSH, OTHER NATIVE SHRUBS AND PERENNIAL GRASSES). THE OC/RC-40% AREA INDICATES ALLOWABLE BARREN AREAS WITHIN RECLAMATION COMMUNITIES IN THESE PIT AREAS.

Upper Rim Reclamation Performance Bond Estimate

RECLAMATION PERFORMANCE BOND ESTIMATE (estimate for first year of operation)

Cost Justification (Revised 2010): Overburden/Topsoil ($.852/cu.yd.) Contouring ($58.69/acre) Seeding ($250/acre) Retainer ($300/acre)

		SPECIFIC MINE AREAS:			
RECLAMATION REQUIRED	**CURRENT OR PROJECTED STATUS (Map Symbol)**	**Arney**	**Howe**	**Hinckley II**	**Column Totals**
BACKFILL	**OPEN PIT ACRES (OP)**	2.00	6.00	9.00	**17.0**
	Ft. Ovbdn.	12.00	11.00	8.00	
	Ovbdn.Cu.Yd.	38720.00	106480.00	116160.00	
	Backfill Cost	$32,989	$90,721	$98,968	**$222,679**
CONTOUR	**OVERBURDEN ACRES (OB)**	4.30	5.70	3.90	**13.9**
	Tot. Ovrbdn. Acres	6.30	11.70	12.90	
	Contour Cost	$370	$687	$757	**$1,814**
COVER (subsoil or suitable material)	**CONTOURED ACRES (CN)**	0.00	0.00	0.00	**0.0**
	Tot. Contour Acres	6.30	11.70	12.90	
	Cover Depth	2.00	2.00	2.00	
	Cover Cu.Yds.	20328.00	37752.00	41624.00	
	Cover Cost	$17,319	$32,165	$35,464	**$84,948**
TOPSOIL or FINAL COVER	**SUITABLE COVER (SU)**	2.50	5.10	2.20	**9.8**
	Tot. Acres to Topsoil or Final Cover	8.80	16.80	15.10	
	Topsoil Depth	0.80	0.80	0.50	
	Topsoil Cu.Yds.	11357.87	21683.20	12180.67	
	Topsoil Cost	$9,677	$18,474	$10,378	**$38,529**
SEEDING	**TOPSOILED ACRES (TS)**	0.40	0.90	0.60	**1.9**
NONE	**FINAL COVER ACRES (FC)**	0.00	0.00	0.00	**0.0**
	Tot. Acres to Seed	9.20	17.70	15.70	
	Seeding Cost	$2,300	$4,425	$3,925	**$10,650**
NONE	**ACRES RECLAIMED**	9.20	17.70	15.70	**42.6**
	Revegetation Retainer Cost	$2,760	$5,310	$4,710	**$12,780**
Total Proposed Bond:					
Total Acreage Affected:		9.2	17.7	15.7	**42.6**
Projected Bond:		**$65,416**	**$151,781**	**$154,202**	**$371,399**

Appendix C – Climate and Air Quality Data/Information

As per data submitted by M-I, the Upper Rim POO/ROW area lies within an 8-10 inch precipitation zone, and a 23-25 inch evapotranspiration zone. The median annual temperature of the area is approximately 44° F, with winter temperatures commonly dipping below zero, and high summer temperatures in excess of 100° F.

CLIMATE: Climate of the area is typical of cold desert regions of the inter-mountain west. The Upper Rim Plan of Operations area falls under normal conditions, in a 5 to 9 inch precipitation zone. However, the entire Bighorn Basin has been experiencing a severe drought since 1999 with precipitation rates generally much lower than average (NCDC, 2011). Outside of drought conditions, climate in this area was typical of cold desert regions of the inter-mountain west, with long, cold winters; hot, dry summers and moderate to high winds.

Average maximum temperatures for the Alkali area are during the months of June, July and August as expected, and average minimum temperatures are during the months of December, January and February. Between 1897 and 2010, the mean average annual high temperature in the area was 59.0°F, and the mean average annual low temperature is 30.1°F (See Table 6 below). Average total precipitation for the area is 6.66 inches/year with most of this precipitation falling during the months of May and June. This area has average annual precipitation of 5 to 9 inches, approximately 80% of which falls between April and October. The remainder falls during the months of December through February in the form of snow and/or rain. The growing season for cool season species is approximately April 15 to June 30.

The following table provides a summary of climatic data for the Greybull, Wyoming area from 1897 to 2010 as provided by M-I:

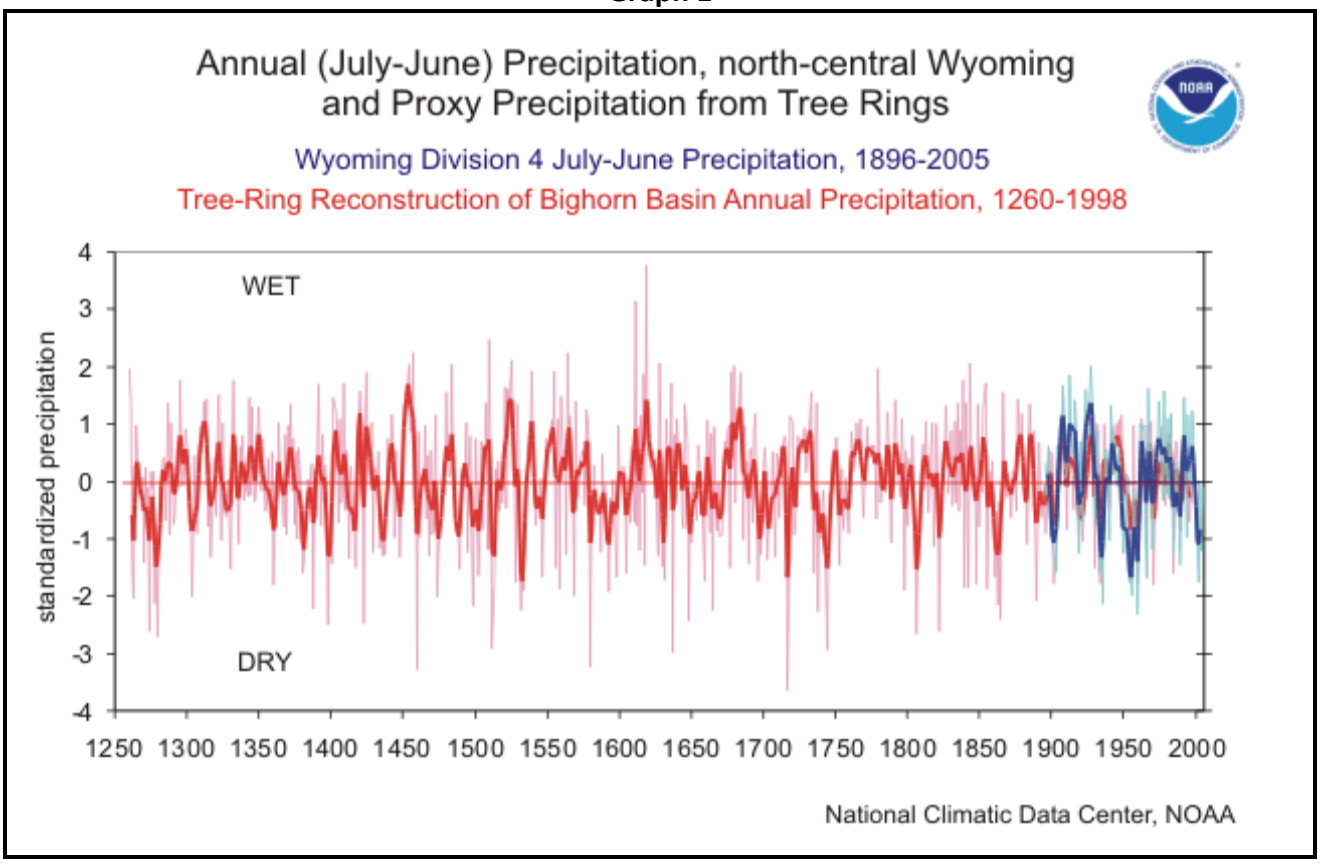
GREYBULL AREA CLIMATE AVERAGES (Source: M-I LLC data and records)

YEAR	TOT PRECIP (in.)	AV MAX TEMP (°F)	AV MIN TEMP (°F)	AV MEAN TEMP (°F)	AV DEW PT (°F)	TOTAL GROWING DEGREE DAYS	AV WIND SPEED (mph)	AV BAR. PRES.
2000	3.21	57	31	43	29	85	6	30.02
2001	4.2	61	33	47	28	127	6	30
2002	5.11	58	32	45	27	110	7	30.02
2003	3.48	60	33	46	27	115	7	29.99
2004	3.35	60	33	46	28	98	7	30
2005	7.25	60	33	47	28	102	7	29.99
2006	4.48	62	34	48	27	117	7	29.99
2007	5.33	61	34	47	29	125	6	29.99
2008	5.89	58	31	45	26	98	6	29.99
2009	5.15	58	31	44	27	98	6	30.01
2010	6.93	59	33	46	28	103	6	29.96
2011	8.64	58	33	45	28	110	6	29.97

A National Climatic Data Center (NCDC) is located in Lovell, Wyoming. Graph 1 below shows the average annual (July-June) precipitation, 1896-2005, for Wyoming Division 4 (5-year annual values in light blue, 5-year weighted average in dark blue). *"Several severe multi-year drought events can be seen in this record: around 1900; the mid-1930s Dust Bowl; the 1950s; and the last six years (1999-2005), all of which have been below the long-term average."* Also shown on Graph 1 below is a 739-year tree-ring reconstruction (1260-1998) of Bighorn Basin annual precipitation (annual values in light red; 5-year smoothed values in dark red).

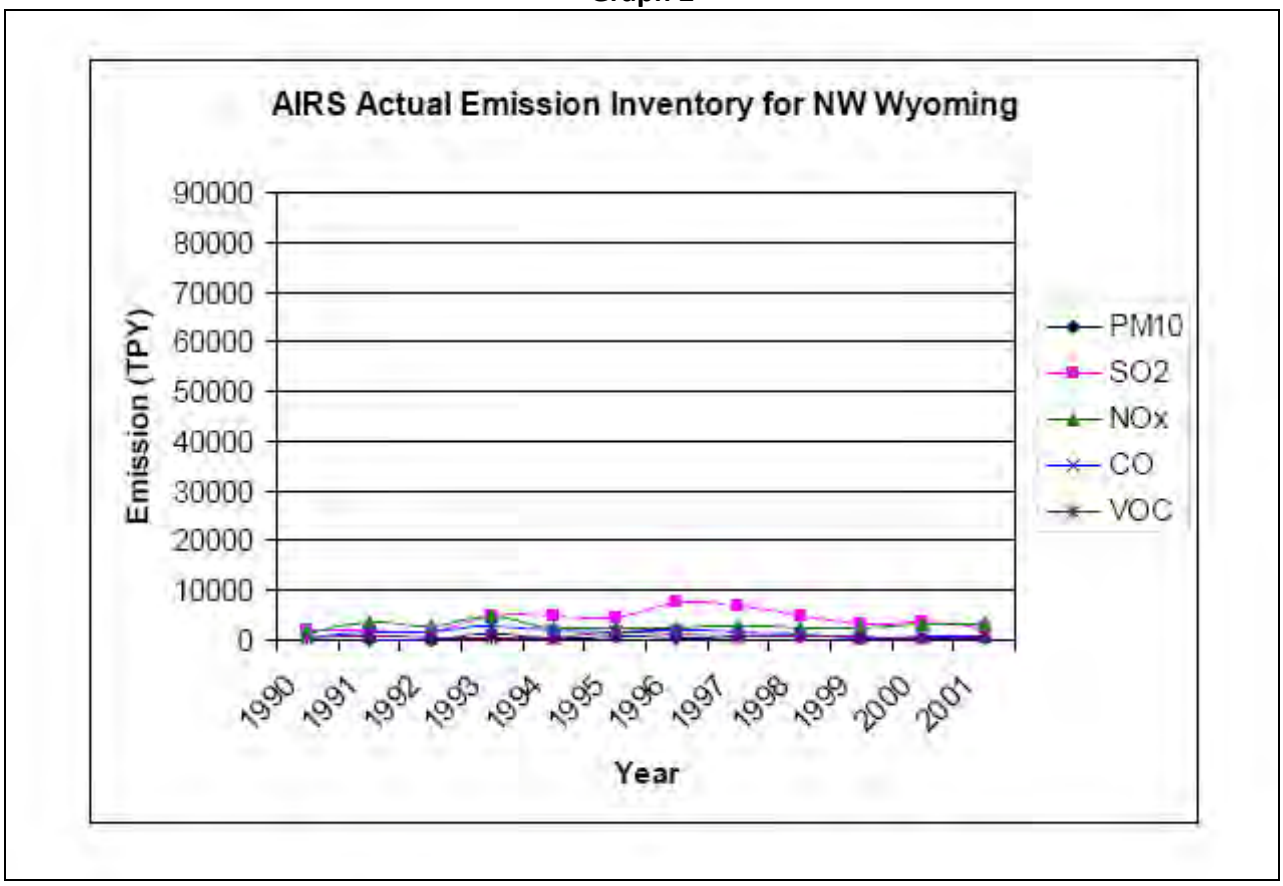
As per NCDC: "…*this reconstruction is based on four long tree-ring chronologies (one Douglas-fir, three limber pine) from the Bighorn Basin, and was calibrated on an instrumental precipitation record (1907-1996) averaged from five long-term weather stations in the Bighorn Basin, four of which are within Wyoming Division 4: Buffalo Bill Dam, WY; Lovell, WY; Powell Field Station, WY; Worland, WY; and Bridger, MT. The reconstruction was calibrated on a 13-month "annual" period (June-June), but it correlates well with the Wyoming Division 4 annual (July-June) precipitation." "Over their common period (1896-1996) the correlation is 0.602, indicating a high degree of shared variance. The precipitation units shown are standardized for comparison; negative values indicate below-average precipitation, and positive values indicate above-average precipitation."*

Graph 1



AIR QUALITY: Graph 2 below (1990-2001) is provided in Appendix G, Emissions Data Assessment of the WDEQ Air Quality Division report entitled "2003 Review Report on Wyoming Long Term Strategy for Visibility Protection in Class I Areas". This report provides some general baseline data on air quality in northwest Wyoming. Emissions shown on the graph are particulate matter 10 (PM10), sulfur dioxide, carbon dioxide, nitrogen oxides, and volatile organic compounds. Most of these emissions are due to industry and the use of vehicles and equipment. PM10 is particulate matter with an aerodynamic diameter of up to 10 micrometers (about 1/7 the diameter of a single human hair). Particulate matter includes dust, soot and other tiny bits of solid materials that are released into and move around in the air. Particulates are produced by many sources, including burning of diesel fuels by trucks and buses, incineration of garbage, mixing and application of fertilizers and pesticides, road construction, industrial processes such as steel making, mining operations, agricultural and forest burning, and operation of fireplaces and woodstoves. Emission levels in northwest Wyoming are much lower than levels in highly developed and industrialized areas.

Graph 2


AIRS Actual Emission Inventory for NW Wyoming
Emission (TPY)
90000
80000
70000
60000
50000
40000
30000
20000
10000
0
1990
1991
1992
1993
1994
1995
1996
1997
1998
1999
2000
2001
Year
PM10
SO2
NOx
CO
VOC

Appendix D – Hydrological and Wetlands/Riparian Data & Information

The following information was provided by M-I and their consultant in the Plan/ROW application. The goal of M-I is to mine the Upper Rim/Plan/ROW area, while minimizing impacts to the physical and biological landscape.

Surface Water Eight watersheds and two sub-watersheds were mapped within the areas of disturbance in the Upper Rim Plan/ROW Area. The watersheds have well defined stream channels and watershed boundaries Streams emerging from all watersheds with the Plan/ROW area are ephemeral. Watersheds BC1, BC1a, BC1b and BC2 flow into Bear Creek, approximately 2.5 miles below the Plan/ROW area and Bear Creek flows into the Big Horn River approximately 15.8 miles below the confluence. Bear Creek is an intermittent stream, most of the year, although it has taken ephemeral characteristics in late summer due to the drought occurring in the Big Horn Basin since 1998. Watersheds PG1, PG2, PG3, PG4, PG5 and PG6 flow into Porter Gulch, and the channel flowing from watershed PG2 is the main stem of Porter Gulch. Porter Gulch flows into Shell Creek approximately 7.5 miles below the Plan/ROW area. Shell Cheek flows into the Big Horn River approximately 11 miles downstream. Porter Gulch is an ephemeral stream until it enters private land, where it picks up subsurface irrigation waste water and begins to flow perennially.

Watersheds were mapped from the highest point, along the hydrologic divide, to the lowest point influenced by the proposed mining, including haul roads, pits and staging areas. Each watershed was mapped using base maps prepared by the All Topo Program, which contains the 7.5 minute topography maps for the state of Wyoming, and aerial photos provided by the University of Wyoming Geospatial Database. Autodesk Map 2008 was employed to delineate watershed parameters on the base maps. Parameters measured and described on each watershed and stream were slope, main stem channel length, overland flow length, elevation change, sinuosity, length of channel planned for disturbance and flow type.

Watersheds within the Plan/ROW area are typical of low elevation arid west, as they support sparse vegetation and contain topography shaped by fluvial erosion. The watersheds range in size from 96.2 acres (PG6), up to 700 acres (PG2). The highest watershed elevation is 5,647 feet (PG3). The average slope of the watersheds is 7.6%. The predominant aspect of the watersheds is southwest.

Surface Water Quality Flow events of ephemeral drainages in arid and semi-arid regions usually occur many times annually. Channel substrate is a poorly sorted cobble, gravel, sand and silt. M-I has not specifically collected surface water quality and suspended sediment data for any of the watersheds affected by the mining area. Suspended sediment naturally discharges from all watersheds surveyed in this report. Depending on the amount of water flowing, the length of time flow occurs and conditions of vegetation and soil on the watershed, turbidity of flow, size of material moving downstream and total amount of sediment discharged vary from storm to storm and year to year. Constituents in ephemeral streams of the area are composed of dissolved salts and suspended sediment. The area contributes suspended sediment to the Shell Creek watershed, the quantity of sediment flowing from Porter Gulch has not been obtained.

Groundwater and Aquifer Properties Paleozoic aquifers that can produce large amounts of high quality water lie at least 2,000 feet below the Upper Rim mining surface. These include the middle Pennsylvanian Ten Sleep Sandstone, Mississippian Madison Limestone, Ordovician Big Horn Dolomite and Cambrian Flathead Sandstone. More likely to be affected by bentonite mining would be shallow or perched aquifers found in younger Cretaceous strata. Cretaceous formations that would be mined through include the Frontier Formation, and the Mowry and Thermopolis Shales. During exploration drilling no water was found above beds of bentonite. Wells completed in the Mowry Shale yield less that 5 gal/min while most of the Thermopolis shale is not an aquifer. Generally, groundwater in the area is only suitable for short term livestock watering. Any disturbance in the Upper Rim area should generally have no effect on any shallow (unconfined) aquifers, and no effect on deep confined aquifers.

Wetlands/Riparian/Aquatic Resources None of the investigated sites associated with this Proposed Action (either wetland or non-wetland) meet the criteria for classification as jurisdictional as discussed in the joint guidance memorandum from the EPA and US ACE (2007). None of these sites support streams flowing at least three months out of the year and/or sites with standing water do not have connectivity to perennial streams. However, several of the

investigated sites have wetland characteristics as summarized in Table D10.1. Sites B-1, B-2 and B-3 all resulted from topographic alterations associated with past mining activity. Although none of these sites will be directly affected by proposed activity, portions of upstream watersheds associated with B-1 and B-2 will be altered during active mining and reclamation. Impacts are not anticipated in either case because B-1 is not a wetland and B-2's inlet channel gradients and flow patterns will be reduced and consolidated during Bonney reclamation. The upstream watershed for B-3 will not be altered. Sites A-1, A-2, A-3, H-2, H-3 and H-4 will not be physically impacted, nor will their upstream watersheds be altered by activity included with this proposal. Site H-1 is not a wetland; it does not possess hydric soil or vegetation characteristics, nor does it have wetland hydrologic characteristics.

Potential wetland areas (both NWI listed and field located sites) are summarized in Table D10.1. Locations, Cowardin Classifications (Cowardin, 1979), and field verified wetland status are given for each. The application binder includes Wetland Map D10.1 which illustrates NWI listed sites. Wetland maps D10.2 and D10.3 illustrate locations of these and additional field investigated sites relative to proposed disturbance activities. Representative aspect photographs of each investigated site are included in Addendum D10.A.

Of the investigated sites, only H-1 will be directly affected by proposed mining activity and it does not possess wetland characteristics. All other identified sites will not be directly affected by disturbance activity proposed with this submission. Wetland H-3 should not be impacted at all because it is located upstream of proposed mining. The wetland H-4 watershed has been partially impacted by previous mining activities and the majority of these affected lands reclaimed. The proposed Upper Rim Mine Area involves approximately 46 acres or roughly 10% of the contributing basin area. Given the irregular frequency of flows, removal of 10% of the contributing drainage area should not significantly affect the functionality of this wetland area. Wetlands B-2 and B-3 were created as a result of activities related to past mining activity and did not exist pre-mine. Therefore, M-I believes it retains no obligation to mitigate any potential impacts. If future mine plan modifications indicate wetland disturbances other than those indicated will be necessary, all disturbance will be contingent on jurisdictional determination by the U.S. ACE.

According to the National Wetlands Inventory Map, there are approximately ten wetland features located within one-half mile from the proposed mining area. Of these wetlands, none lie within the area proposed for mining. Three of these wetlands are temporarily flooded riverine beds, two of which flow northwest directly to the Bighorn River, four are man-made reservoirs, one is a palustrine, temporarily flooded area, and two are potential wetlands identified by M-I personnel. About half of these wetlands lie downstream from the proposed mining. Two of the temporarily flooded riverine beds are unnamed drainages below the proposed mining that support riparian-wetland vegetation. One of these channels may be jurisdictional waters of the United States according to the U.S. Army Corps of Engineers. The unnamed drainages at the southeast end of the proposed mine area run into Upper Rim, which also may be a jurisdictional water of the United States. These drainages flow into the Bighorn River, which has a well-developed riparian and wetland area along its banks and supports a diverse assemblage of aquatic and semi-aquatic flora and fauna including game and non-game fish, mammals, birds, reptiles, amphibians, and invertebrates.

Table D10.1. Site Designations, NWI Designations, Cowardin Classifications, Locations and Status of Investigated Potential Wetlands.

(NWI designations taken from Devils Kitchen and Bear Creek Ranch Quad Maps).

UPPER RIM and HOWE Pit Areas

Wetland Site	NWI Designation (if given)	Cowardin Classification (if given)	LOCATION	WETLAND CHARACTERISTICS
Site H-1	PUSCh	Palustrine, Unconsolidated Shore, Seasonally flooded/Well Drained, Diked/Impounded	sesw sec. 35 T54NR92W	no
Site H-2*	PABFh	Palustrine, Aquatic Bed, Semi-permanently Flooded, Diked/Impounded	swne sec. 35 T54NR92W	no
Site H-3*	PABFh	Palustrine, Aquatic Bed, Semi-permanently Flooded, Diked/Impounded	swne sec. 35 T54NR92W	yes
Site H-4*	PUSCh	Palustrine, Unconsolidated Shore, Seasonally flooded/Well Drained, Diked/Impounded	sesw sec. 35 T54NR92W	yes

*either will not be disturbed or not a wetland/no acreage calculated

ARNEY and DAVIS Pit Areas

Wetland Site	NWI Designation (if given)	Cowardin Classification (if given)	LOCATION	WETLAND CHARACTERISTICS
Site A-1*	None recorded	None recorded	swnw sec. 28 T54NR92W	no
Site A-2*	None recorded	None recorded	senw sec. 28 T54NR92W	no
Site A-3*	None recorded	None recorded	senw sec. 28 T54NR92W	no

*Will not be disturbed/no acreage calculated.

LEONARD and BONNEY Pit Areas (COMMENT FROM BLM - LARGE DRAINAGES IN THESE AREAS WILL BE AVOIDED)

Wetland Site	NWI Designation (if given)	Cowardin Classification (if given)	LOCATION	WETLAND CHARACTERISTICS
Site B-1*	None recorded	None recorded	sene sec. 3 T53NR92W	no
Site B-2*	PUSCh	Palustrine, Unconsolidated Shore, Seasonally flooded/Well Drained, Diked/Impounded	nene sec. 3 T53NR92W	yes
Site B-3*	PUSCh	Palustrine, Unconsolidated Shore, Seasonally flooded/Well Drained, Diked/Impounded	swne sec. 34 T54NR92W	yes

*either will not be disturbed or not a wetland/no acreage calculated

Table D6.1 Watershed parameters at the Upper Rim Update Area of the 278C Permit, MI L.L.C., Greybull, Wyoming

Watershed Name	Watershed Area (ac)	Watershed Length (ft)	Watershed Elevation Change (ft)	Watershed Slope (%)	Mainstem Channel Length (ft)	Channel Elevation Change (ft)	Mean Channel Slope (%)	Distance Overland Flow (ft)	Overland Elevation Change (ft)	SCS Curve Number
BC1	682.3	10739	930	8.7	14843	840	5.7	350	90	80
BC1a	243.5	6919	730	10.6	9071	640	7.1	350	90	75
BC1b	226.0	6450	510	7.9	6899	470	6.8	1210	150	75
BC2	273.1	4328	240	5.5	4651	120	2.6	663	110	80
PG1	404.4	6874	560	8.1	5095	260	5.1	3191	300	80
PG2	700.3	15088	1129	7.5	20057	850	4.2	1148	397	80
PG3	661.8	14300	1010	7.1	17365	910	5.2	991	115	80
PG4	624.7	16672	1177	7.1	21743	1090	5.0	518	90	80
PG5	490.4	9850	785	8.0	10641	700	6.6	738	120	80
PG6	96.2	4139	240	5.8	1650	46	2.8	3152	220	83

Table D-6.2 Stream morphology parameters at the Upper Rim Update Area of the 278C Permit, MI L.L.C., Greybull, WY

Stream Name	Total Stream Length (ft)		Sinuosity	Flow Type	Lenth of Stream Planned for Disturbance (ft)		Type of Disturbance	Mean Slope in Disturbance Area	Sinuosity in Disturbance Area
BC1	21743	‡&†	1.45	Ephemeral	270	●	Road		
BC1a	9071	‡&†	1.40	Ephemeral	0		-	-	-
BC1b	6899	†	1.43	Ephemeral	0		-	-	-
BC2	4651	†	1.31	Ephemeral	0		-	-	-
PG1	5095	†	1.21	Ephemeral	0		-	-	-
PG2	20057	†	1.40	Ephemeral	120	●	Road		
PG3	30920	‡&†	1.30	Ephemeral	0		-	-	-
PG4	21743	‡&†	1.34	Ephemeral	1472	‡	Surface Mine	3%	1.11
PG5	14158	†	1.16	Ephemeral	120	●	Road		
PG6	0	-	1.01	Ephemeral	-	-	-	-	-

† Measured from 2000 aerial photos

‡ GPS Surveys of the stream

● Estimated Road Foot Print

Table D-6.3 Watershed Discharge Estimates for the Upper Rim Update Area of the 278C Permit, MI L.L.C., Greybull, Wyoming							
Watershed Name	Time of Concentration	Signature Storm	Signature Flow (cfs)	Flow Volume (acft)	Signature Storm	Signature Flow (cfs)	Flow Volume (acft)
BC1	1.02	2 yr/24hr (1.1 in)	16.26	6.60	2 yr/6hr (0.8 in)	6.88	1.83
BC1	1.02	5 yr/24hr (1.5 in)	54.27	16.25	5 yr/6hr (1.0 in)	14.64	4.74
BC1	1.02	10yr/24hr (1.9 in)	108.44	28.57	10yr/6hr (1.3 in)	32.60	11.03
BC1	1.02	25 yr/24hr (2.4 in)	190.50	46.65	25 yr/6hr (1.5 in)	50.50	16.25
BC1	1.02	50 yr/24hr (2.5 in)	208.61	50.54	50 yr/6hr (1.8 in)	83.72	25.29
BC1	1.02	100 yr/24hr (2.8 in)	265.12	62.66	100 yr/6hr (1.9 in)	96.26	28.57
BC1a	0.57	2 yr/24hr (1.1 in)	1.67	1.01	2 yr/6hr (0.8 in)	0.80	0.10
BC1a	0.57	5 yr/24hr (1.5 in)	11.48	3.38	5 yr/6hr (1.0 in)	2.87	0.61
BC1a	0.57	10yr/24hr (1.9 in)	30.86	6.76	10yr/6hr (1.3 in)	6.93	2.05
BC1a	0.57	25 yr/24hr (2.4 in)	63.24	12.03	25 yr/6hr (1.5 in)	11.22	3.38
BC1a	0.57	50 yr/24hr (2.5 in)	70.54	13.20	50 yr/6hr (1.8 in)	19.84	5.84
BC1a	0.57	100 yr/24hr (2.8 in)	93.72	16.89	100 yr/6hr (1.9 in)	23.91	6.76
BC1b	0.56	2 yr/24hr (1.1 in)	1.55	0.94	2 yr/6hr (0.8 in)	0.75	0.10
BC1b	0.56	5 yr/24hr (1.5 in)	10.78	3.14	5 yr/6hr (1.0 in)	2.67	0.57
BC1b	0.56	10yr/24hr (1.9 in)	28.87	6.27	10yr/6hr (1.3 in)	6.43	1.90
BC1b	0.56	25 yr/24hr (2.4 in)	58.96	11.17	25 yr/6hr (1.5 in)	10.44	3.14
BC1b	0.56	50 yr/24hr (2.5 in)	65.74	12.25	50 yr/6hr (1.8 in)	18.47	5.42
BC1b	0.56	100 yr/24hr (2.8 in)	87.47	15.68	100 yr/6hr (1.9 in)	22.28	6.27
BC2	0.52	2 yr/24hr (1.1 in)	8.95	2.64	2 yr/6hr (0.8 in)	3.10	0.73
BC2	0.52	5 yr/24hr (1.5 in)	31.58	6.50	5 yr/6hr (1.0 in)	6.38	1.90
BC2	0.52	10yr/24hr (1.9 in)	63.40	11.44	10yr/6hr (1.3 in)	15.19	4.41
BC2	0.52	25 yr/24hr (2.4 in)	112.13	18.67	25 yr/6hr (1.5 in)	24.85	6.50
BC2	0.52	50 yr/24hr (2.5 in)	122.65	20.23	50 yr/6hr (1.8 in)	44.85	10.12
BC2	0.52	100 yr/24hr (2.8 in)	155.44	25.08	100 yr/6hr (1.9 in)	52.32	11.44
PG1	0.77	2 yr/24hr (1.1 in)	11.07	3.91	2 yr/6hr (0.8 in)	4.37	1.08
PG1	0.77	5 yr/24hr (1.5 in)	38.03	9.63	5 yr/6hr (1.0 in)	8.96	2.81
PG1	0.77	10yr/24hr (1.9 in)	76.73	16.94	10yr/6hr (1.3 in)	20.43	6.54
PG1	0.77	25 yr/24hr (2.4 in)	135.00	27.65	25 yr/6hr (1.5 in)	32.21	9.63
PG1	0.77	50 yr/24hr (2.5 in)	147.59	29.96	50 yr/6hr (1.8 in)	55.33	14.99
PG1	0.77	100 yr/24hr (2.8 in)	186.82	37.14	100 yr/6hr (1.9 in)	64.42	16.94
PG2	1.62	2 yr/24hr (1.1 in)	13.16	6.78	2 yr/6hr (0.8 in)	6.04	1.88
PG2	1.62	5 yr/24hr (1.5 in)	41.27	16.67	5 yr/6hr (1.0 in)	13.39	4.86
PG2	1.62	10yr/24hr (1.9 in)	81.62	29.33	10yr/6hr (1.3 in)	29.83	11.32
PG2	1.62	25 yr/24hr (2.4 in)	143.85	47.88	25 yr/6hr (1.5 in)	44.95	16.67
PG2	1.62	50 yr/24hr (2.5 in)	157.48	51.87	50 yr/6hr (1.8 in)	72.33	25.95
PG2	1.62	100 yr/24hr (2.8 in)	200.04	64.32	100 yr/6hr (1.9 in)	82.59	29.33

Tables D-6.1, D-6.2 and D-6.3 were sourced from the Upper Rim application materials submitted by M-I

Table D-6.3 Watershed Discharge Estimates for the Upper Rim Update Area of the 278C Permit, MI L.L.C., Greybull, Wyoming

Watershed Name	Time of Concentration	Signature Storm	Signature Flow (cfs)	Flow Volume (acft)	Signature Storm	Signature Flow (cfs)	Flow Volume (acft)
PG3	1.32	2 yr/24hr (1.1 in)	13.87	6.40	2 yr/6hr (0.8 in)	6.13	1.77
PG3	1.32	5 yr/24hr (1.5 in)	44.53	15.76	5 yr/6hr (1.0 in)	13.38	4.60
PG3	1.32	10yr/24hr (1.9 in)	88.70	27.72	10yr/6hr (1.3 in)	29.77	10.70
PG3	1.32	25 yr/24hr (2.4 in)	156.34	45.25	25 yr/6hr (1.5 in)	45.41	15.76
PG3	1.32	50 yr/24hr (2.5 in)	171.17	49.02	50 yr/6hr (1.8 in)	74.07	24.53
PG3	1.32	100 yr/24hr (2.8 in)	217.47	60.78	100 yr/6hr (1.9 in)	84.87	27.72
PG4	1.59	2 yr/24hr (1.1 in)	11.87	6.05	2 yr/6hr (0.8 in)	5.43	1.67
PG4	1.59	5 yr/24hr (1.5 in)	37.31	14.87	5 yr/6hr (1.0 in)	12.02	4.34
PG4	1.59	10yr/24hr (1.9 in)	74.00	26.16	10yr/6hr (1.3 in)	26.78	10.10
PG4	1.59	25 yr/24hr (2.4 in)	130.79	42.71	25 yr/6hr (1.5 in)	40.43	14.87
PG4	1.59	50 yr/24hr (2.5 in)	143.13	46.27	50 yr/6hr (1.8 in)	65.11	23.15
PG4	1.59	100 yr/24hr (2.8 in)	181.65	57.37	100 yr/6hr (1.9 in)	74.35	26.16
PG5	0.73	2 yr/24hr (1.1 in)	13.75	4.75	2 yr/6hr (0.8 in)	5.36	1.31
PG5	0.73	5 yr/24hr (1.5 in)	47.88	11.68	5 yr/6hr (1.0 in)	10.94	3.41
PG5	0.73	10yr/24hr (1.9 in)	95.89	20.54	10yr/6hr (1.3 in)	25.16	7.93
PG5	0.73	25 yr/24hr (2.4 in)	167.85	33.53	25 yr/6hr (1.5 in)	39.65	11.68
PG5	0.73	50 yr/24hr (2.5 in)	183.38	36.33	50 yr/6hr (1.8 in)	68.77	18.17
PG5	0.73	100 yr/24hr (2.8 in)	232.41	45.04	100 yr/6hr (1.9 in)	80.16	20.54
PG6	0.63	2 yr/24hr (1.1 in)	5.55	1.40	2 yr/6hr (0.8 in)	1.66	0.50
PG6	0.63	5 yr/24hr (1.5 in)	15.12	3.04	5 yr/6hr (1.0 in)	3.45	1.06
PG6	0.63	10yr/24hr (1.9 in)	27.23	5.03	10yr/6hr (1.3 in)	8.00	2.16
PG6	0.63	25 yr/24hr (2.4 in)	44.47	7.86	25 yr/6hr (1.5 in)	12.40	3.04
PG6	0.63	50 yr/24hr (2.5 in)	48.13	8.46	50 yr/6hr (1.8 in)	20.21	4.51
PG6	0.63	100 yr/24hr (2.8 in)	59.37	10.32	100 yr/6hr (1.9 in)	23.15	5.03

The combined peak discharge from the most common storm event (two year/six hour) from the Porter Gulch watersheds is insignificantly low, but the combined discharge from the ten year/six hour storm event is 140.42 ft^3/second from the mined area into Porter Gulch tributaries. A 100 year storm from these same watersheds will discharge nearly 410 ft^3/second and fill a reservoir of over 125 acre feet. The combined flow in the ten year/six hour storm in watersheds B1 and B2 is estimated at 47.79 ft^3/second and the 100 year storm event will produce 148.58 ft^3/second. Compared with the Greybull River, Shell Creek and the Shoshone River under similar storm events, flow in Porter Gulch and the tributaries of Bear Creek watersheds is relatively minor.

Appendix E – Soils Data and Information (Site Specific)

Upper Rim Plan/ROW Areas; Soil Series and Map Unit Descriptions

Descriptions for soil series and their associated soil map units found on the proposed pit areas within the Upper Rim Plan/ROW area are given below and in Table D7.2.

Chipeta Soils

Minor inclusions in Map Units 5, 6, 13, 18, 22, 46, 141.

Sampled Chipeta profile: UR8

The Chipeta series consists of very shallow and shallow, well drained, slowly permeable soils that formed in alkaline marine shale residuum that contains gypsum. Chipeta soils are on upland pediments and hills. Depth to paralithic or lithic shale contact ranges from 5 to 20 inches. Both salinity and sodicity range from mild to strong. Slopes range up to 20 percent. As noted above, Chipeta soils occur as minor inclusions in other map units throughout the Upper Rim Plan/ROW area. They are intermittent on steep slopes (>20 percent) and transitional from barren or nearly barren outcrops of bentonite, shale, or rock to better developed soils. Characteristically, the particle size control section has between 35 and 50 percent clay. Recommended topsoil and subsoil salvage depths for Chipeta soils are 6 inches and 6 inches or lithic contact, respectively.

Mudray Soils

Map Unit 46; Also as minor inclusions in Map Units 6, 18, 22, & 141;

Sampled Mudray profiles: UR1, UR7, UR9, UR11, DN5, DN11, DN12, DN20, TW3, TW4, TW6, TW12, TW15, TS6, HSW1, HSW14, HSW39.

The Mudray series consists of moderately well drained, shallow or very shallow soils formed in slopewash alluvium weathered from sodic shale and interbedded fine grained sandstone. Within the Upper Rim Plan/ROW area, Mudray soils are found on gently sloping backslopes and transitional areas grading to bentonite outcrops. Slopes range between 2 and 15 %. Depth to bedrock ranges from 6 to 18 inches. These soils are typically calcareous throughout, although shallow surfaces of some pedons have been leached. Particle size control sections range from 29 to 44 percent clay. Soft shale and sandstone fragments range from 0 to 15 percent throughout the whole soil. Characteristically, both topsoil and subsoil of this series (to 18 inches) are often unsuitably sodic (SAR >15%). However, to ensure utilization of a soil medium that supports native plant communities in the pre-mine condition, recommended topsoil and subsoil salvage depths for Mudray soils are 6 inches and 0 inches, respectively.

Oceanet Soils

Map Units 23; 223. Also as minor inclusions in Map Units 22, 30.

Sampled Oceanet profiles: TS4, HSW15, HSW24, HSW27, HSW29, HSW30, HSW49

Oceanet soils are well-drained, shallow or very shallow from soft, calcareous sandstone. They formed in residuum and local alluvium weathered from the underlying bedrock. Within the Upper Rim Plan/ROW area, these soils are found on gently rolling backslopes, hillslopes and summits; mainly within the Davis, Leonard and Bonney proposed pit areas. Slopes grade from simple to complex and range up to 20 percent. Depth to bedrock or paralithic contact varies from 7 to 48 inches. Recommended topsoil and subsoil salvage depths for Oceanet soils are 6 and 20 inches (or lithic/paralithic contact), respectively.

Persayo Soils

Map Units 13 & 141; Also as minor inclusions in Map Units 6, 18, 22, 46.

Sampled Persayo profiles: UR5, UR12, UR13, DN18, DN19, TW5, TW7, TW8, TW14, TS8, HSW16, HSW32.

Persayo soils are shallow and well drained on hills, toeslopes and backslopes. They formed in thin sediments weathered from underlying soft sedimentary bedrock. The C horizons contain visible calcium carbonate and gypsum which are characteristic of the parent sediments rather than pedogenic. Slopes vary from 10 to 20 percent. Chipeta, Sayles and other shallow soils occur as <20% inclusions within map unit 24. Within the Plan/ROW area, paralithic contact ranges from 6 to 32 inches. Recommended topsoil and subsoil salvage depths for Persayo soils are 6 inches and 12 inches (or paralithic contact), respectively.

Upper Rim Plan/ROW. Soil Series, List of Representative Pedons and Taxonomic Classification

Soil Series	Representative Pedons*	Family Classification
Chipeta	UR8	Clayey, mixed, active, calcareous, mesic, shallow Typic Torriorthents
Mudray	UR1, UR7, UR9, UR11, DN5, DN11, DN12, DN20, TW3, TW4, TW6, TW12, TW15, TS6, HSW1, HSW14, HSW39	Clayey, smectitic, mesic, shallow Typic Natrargids
Oceanet	TS4, HSW15, HSW24, HSW27, HSW29, HSW30, HSW49	Loamy, mixed, superactive, calcareous, mesic, shallow Typic Torriorthents
Persayo	UR5, UR12, UR13, DN18, DN19, TW5, TW7, TW8, TW14, TS8, HSW16, HSW32	Loamy, mixed, active, calcareous, mesic, shallow Typic Torriorthents
Saddle	DN4, DN21, TW1, TS1, HSW18, HSW20, HSW21, HSW25, HSW35, HSW40	Fine-loamy, mixed, superactive, mesic Typic Haplargids
Saddle taxadjuncts (shallow, clay content or sodic)	UR14, HSW10, HSW19, HSW23, HSW26, HSW28, HSW33, HSW36, HSW41, HSW47	Fine-loamy, mixed, superactive, mesic Typic Haplargids
Sayles	TW9, TS9	Fine, smectitic, nonacid, mesic Typic Torriorthents
Travessilla	UR2, UR3, DN1, DN3, TW2, TS2, TS3, TS7, TS10, HSW9	Loamy, mixed, superactive, calcareous, mesic Lithic Ustic Torriorthents
Youngston	UR16, HSW6	Coarse-loamy, mixed, superactive, calcareous, mesic Typic Torrifluvent
Reclaimed Soil	HSW2, HSW5, HSW17	disturbed soils, not classified

*Some named pedons were sampled as inclusions within other map units. Locations are illustrated on Soil Maps D7-1a & b in the application binder.

Upper Rim Plan/ROW Areas. Soil Map Unit Descriptions and Recommended Salvage Depths

Map Unit	*Description*	*Range of Suitable Soil*	*Topsoil Salvage (inches)*	*Subsoil Salvage (inches)*
5	**Cliffs and Steep Outcrops, >50% slopes;<10% Chipeta**	0-6 inches	0”(4-6 inches in shallow soil areas)	
6	**Ravine Complex; rock & barren outcrops (60%); channel & flood plain with Youngston taxadjunct & other Fluvents (20%); steep slopes, deep erosional features (<20% shallow soils-Chipeta, Persayo, Mudray); Range=0-24”.**		0”/0”outcrops 6”/24” Youngston 4-6”/6” shallow soils	
13	**Persayo-Chipeta Complex; <20% slopes; 10% Saddle and rock outcrop inclusions**	6-18 inches	6”	12” or lithic contact
18	**Sayles;2-20% slopes; 10% OC & 15% inclusions other shallow soils**	0-6 inches	6”	0
19	**Mixed Alluvium, Youngston taxadjunct and other Fluvents; 0-8% slopes**	12-48 inches	6”	42”
22	**Travessilla; <20% rock outcrop, <30% Saddle & Oceanet, <10% Persayo, Chipeta, Mudray**	0-48 inches	6”	6” or hard lithic contact 24” in Saddle/Oceanet
223	**Travessilla/Oceanet/Rock Outcrop Complex**	0-48 inches”	6”	6” or hard lithic contact 20” in Oceanet
23	**Oceanet; <20% sandstone rock outcrop & Travessilla**	8-48 inches	6”	20” or hard lithic contact
30	**Saddle;<15% Travessilla/Oceanet; <10% rock outcrop**	12-32 inches	6”	24”
30	**Saddle taxadjunct (increased clay content, shallow <20” or sodic);<15% Travessilla**	0-24 inches	6”	12”
46	**Mudray; 2-15% slopes, <15% other shallow soils**	0-10 inches	6”	0”
141	**Persayo (75%)/Mudray (15%) Complex; 2-20% slopes; RO, OC and other shallow soil inclusions <10%**	See previously described component soil recommendations		
772	**Previously Disturbed Lands-Reclaimed Soil**	0-6 inches	6”	0”
OC	**Barren clay and shale outcrops**	0	0”	0”

Saddle and Saddle taxadjunct Soils

Map Unit 30; Also as minor inclusions in Map Units 13, 22, 223, 23.

Sampled Saddle profiles: DN4, DN21, TW1, TS1, HSW18, HSW20, HSW21, HSW25, HSW35, HSW40. Sampled Saddle taxadjunct profiles: UR14, HSW10, HSW19, HSW23, HSW26, HSW28, HSW33, HSW36, HSW41, HSW47.

Saddle soils are well drained and moderately deep to soft bedrock. They formed in residuum and slopewash alluvium derived dominantly from interbedded sandstone and sandy shale. Within the Upper Rim Plan/ROW area, these soils are on gentle backslopes and ridge crests associated with relatively small intermittent drainages. Eolian impacts influence the coarse textures found in surface horizons of these map units. Slopes are <20 percent. Depth to continuous horizons of carbonate accumulation ranges from 6 to 14 inches. Depth to lithic or paralithic contact ranges from 8 to 32 inches. Taxadjunct pedons have increased clay content in the particle size control section (approaching 40% or greater), have lithic/paralithic contact at <20" or are sodic at shallow depths. Recommended topsoil and subsoil salvage depths for Saddle soils are 6 and 24 inches (or lithic/paralithic contact), respectively. Recommended topsoil and subsoil salvage depths for Saddle taxadjunct soils are 6 and 12 inches (or lithic/paralithic contact), respectively.

Sayles Soils

Map Unit 18; Also as minor inclusions in Map Units 5, 6, 13, 46, 141.

Sampled Sayles profiles: TW9, TS9.

Sayles soils formed in thick, noncalcareous, gypsiferous materials weathered from dark gray, gypsiferous shale. Accumulation of visible secondary calcium sulfate is not continuous in these soils. This soil is limited in extent within the Upper Rim Plan/ROW area, occupying several small isolated pockets associated with transitions from relatively deep or coarse-textured soils to shallow, sodic, fine-textured soils associated with shale and bentonite outcrops. Slopes range from 2 to 20 percent. Profile TW9 is sodic at 8 inches. Recommended topsoil and subsoil salvage depths are 6 and 0 inches, respectively.

Travessilla Soils

Map Units 22 and 223; Also as inclusions in Map Units 23 & 30.

Sampled Travessilla profiles: UR2, UR3, DN1, DN3, TW2, TS2, TS3, TS7, TS10, HSW9.

Travessilla soils are very shallow to shallow and well drained. They formed in calcareous eolian sediments and residuum weathered from sandstone with inter-bedded shale. Within the Upper Rim Plan/ROW areas, Travessilla soils occupy gently sloping ridge backslopes and crests and are often associated with sandstone outcrops. Intermittent inclusions of Saddle and Oceanet soils (<30%) and Rock Outcrop (<20%) are common. Occasional Mudray inclusions (<5%) also occur. Slopes are <20 percent and hard lithic contact ranges from 3 to 20 inches. Textures of surface horizons are sandy loams and loamy sand. Laboratory analyses of Travessilla soil from this Plan/ROW indicates consistently suitable topsoil material to Lithic contact. Therefore, recommended topsoil and subsoil salvage depths are 6 inches and 6 inches or hard lithic contact, respectively.

Youngston Soils

Included in Complex descriptions for Map Units 6 and 19.

Sampled Youngston profiles: UR16, HSW6.

Youngston soils are very deep, well drained soils formed in stratified alluvium from mixed sources. Within the Plan/ROW area, they occur as narrow bands on recent alluvial terraces associated with ephemeral drainages. Slopes are 0 to 6 percent. These soils are calcareous throughout. Youngston soils are locally associated with other Fluvents along the lengths of these drainages. Strata are quite variable with very fine sandy loam, silt loam, silty clay loam, and sandy clay loam the most common. Coarse fragment content is also variable, both linearly and between horizons. Salinity and sodicity also vary. Proposed disturbances within this map unit are limited. Recommended topsoil and subsoil salvage depths are 6 inches and 42 inches or paralithic contact, respectively.

Reclaimed Soil (Previously Disturbed Lands)

Map Unit 772.

Sampled Reclaimed Soil profiles: HSW2, HSW5, HSW17

This map unit designates portions of several distinct reclaimed pit areas that will be re-affected by mining proposed with this application. It represents various reclamation efforts which have created variable soil replacement depths and qualities. Saline-sodic characteristics and high clay content are common conditions in the underlying spoil. Therefore recommended topsoil salvage depth is 6 inches in areas supporting vegetation regrowth. Subsoil salvage depth will be variable (0-6 inches) and include material between topsoil and underlying spoil material. Bond calculations will assume averages of 6 inches/0 inches of topsoil/subsoil, respectively.

Appendix F – Vegetation Data and Information (Site Specific)

D 8.4 Vegetation Map Unit Descriptions

Affected plant communities were delineated into several vegetation map units: Mixed Desert Shrub 1 (MDS1), Mixed Desert Shrub 2 (MDS2), Salt Desert Shrub (SDS), Juniper/Rock Outcrop (J/RO), Outcrop (OC), Ravine Complex (RC), Riparian Desert Shrub (RDS), Reclaimed lands with current reclamation bonds (Rec-B) and Reclaimed lands with bonds released (Rec-BR). Four map units were sampled during the 2007 field season (MDS1, MDS2, SDS, and J/RO). Data used to represent the Rec-B and Rec-BR map units were collected during the 2006 field season for the adjacent Porter Amendment to Mine Permit 278C. Other map units were not sampled: OC-barren with no vegetation; RC-a complex of map units that were summarized separately or barren; RDS-will not be affected. Total proposed affected acreages by vegetation map unit are listed by pit area in Table D8-2.

Proposed Affected Pit Acreages by Vegetation Map Unit and Area.

MAP UNIT	PLAN/ROW PIT AREAS (in acres)									GRAND TOTALS
	Arney	Bonney	Davis	Hinckley II	Howe	Leonard	North Esther	Tanner II	Upper Rim	
SDS	56.9	0	1.8	0.0	2.4	0.0	0.0	3.9	17.7	**82.7**
MDS1	21.0	28.5	39.4	1.9	84.2	11.7	9.6	6.1	27.1	**229.5**
MDS2	20.4	34.4	51.6	9.5	0.0	49.3	0.0	0.0	0.0	**165.2**
Rec-B	16.0	47.5	41.7	0.0	10.0	11.2	0.0	0.7	0.0	**127.1**
Rec-BR	0.0	0	0.0	0.0	6.4	0.0	0.0	0.0	0.0	**6.4**
J/RO	1.7	0	14.6	0.0	0.0	0.0	0.0	0.0	0.0	**16.3**
RC	0.0	0	0.0	0.0	0.0	0.0	5.6	3.9	0.0	**9.5**
OC	1.6	0	0.0	0.0	0.0	0.6	0.0	0.0	1.0	**3.2**
TOTAL	**117.6**	**110.4**	**149.1**	**11.4**	**103.0**	**72.8**	**15.2**	**14.6**	**45.8**	**639.9**

Summaries of cover estimates by life-form/cover type, shrub density, calculated sample adequacy and number of sampled transects are given in Tabular format for the four sampled map units (Tables D8-3 to D8-6). Summaries by individual plant species (absolute cover, relative cover and shrub density) for each map unit are also presented (Addendum D8.C, Vegetation transect data summaries). Transect and photograph locations are illustrated on Vegetation Maps D8.1 and D8.2 (Addendum D8.A). Addendum D8.D includes comprehensive plant species list by map unit. Addendum D8.E includes vegetation data field sheets from each map unit.

D8.4.1 Mixed Desert Shrub 1 (MDS1)

This map unit occurs throughout the Plan/ROW area in upland drainages, escarpments and hills with relatively shallow and/or rocky soils. Inclusions of other vegetation types occur variously throughout and are difficult to separate from the dominant map unit. Inclusions encountered in the MDS1 type were 15%-30% SDS, 20% RO and 15% OC. Average cover (absolute) transect data indicates the MDS1 type averaged 7% annual grass, 1% perennial grass, 3.1% annual forbs, 2.2 % perennial forbs, 2.5% sub-shrubs, 10.6% shrubs, 0.3% biological crust, 18.6% rock, 20.2% litter, and 34.4% bare ground. Total vegetation cover (absolute) is 26.5% and total cover (absolute) is 65.6%. Relative vegetative cover data shows 26.6% annual grass, 4% perennial grass, 11.7 % annual forbs, 8.3% perennial forbs, 9.5% sub-shrubs and 39.9% shrubs. Shrubs and annual grasses are primary components of this map unit. Big sagebrush dominates the overstory with approximately 9.2% cover while cheatgrass (*Bromus tectorum*) is dominant in the understory (approximately 7% cover). Shrub density data indicates 1,827 live and 1,297 dead shrubs/acre, respectively. Comparatively, this map unit has the highest diversity of perennial grass species (7).

D8.4.2 Mixed Desert Shrub 2 (MDS2)

This map unit occurs on sandstone escarpments and backslopes throughout the Plan/ROW area. Soils are predominantly sandy. Approximately 40% of this map unit is comprised of RO inclusions (compared to 20% within MDS1). Other inclusions (OC and SDS) are insignificant. It also has more green rabbitbrush, spiny hopsage, a more diverse perennial forb component and significantly less Gardner saltbush than MDS1. Average cover (absolute) transect data indicates the MDS2 type averaged 5.7% annual grass, 0.5% perennial grass, 2.5% annual forbs, 2.5% perennial forbs, 0.4% sub-shrub, 11.6% shrub, 1.2% biological crust, 7.0% rock, 23.5% litter, and 44.7% bare ground. Total vegetation cover (absolute) is 23.7% and total cover (absolute) is 55.4%. Relative vegetative cover data shows 23.8% annual grass, 3.0% perennial grass, 10.3% annual forbs, 10.8% perennial forbs, 3.4% sub-shrubs and 48.7% shrubs. Shrubs and annual grasses are primary components. Big sagebrush and green rabbitbrush dominate the overstory with 6.5% and 2.7% average cover (absolute), respectively. Cheatgrass is the primary understory component with 5.7% average cover (absolute).

Typically this map unit also supports a large spiny hopsage component. Shrub density data indicates 2,760 live and 799 dead shrubs/acre, respectively. This map unit supports a relatively high diversity of both perennial (7 species) and annual forbs.

D8.4.3 Salt Desert Shrub (SDS)

This map unit occurs on relatively level topography with fine-textured and sometimes sodic or saline-sodic soils. Inclusions of other map units occur intermittently throughout the SDS type and are difficult to separate from the dominant map unit. Inclusions are <30% MDS1 and <10% OC, respectively. Average cover (absolute) transect data indicates the SDS type averaged 4.8% annual grass, 0.2% perennial grass, 2.9% annual forbs, 1.6% perennial forbs, 7.4% sub-shrub, 2.6% shrub, 0.2% biological crust, 24.3% rock, 10.6% litter and 45.5% bare ground. Total vegetation cover (absolute) is 19.6% and total cover (absolute) is 54.5%. Relative vegetation cover data shows 24.5% annual grass, 1.2% perennial grass, 14.7 % annual forbs, 8.4% perennial forbs, 38% sub-shrubs and 13.1% shrubs. Sub-shrubs and annual grasses comprise the majority of vegetation cover with Gardner saltbush averaging 7.3% absolute cover and cheatgrass averaging 4.8%. Shrub density data indicates 523 live and 400 dead shrubs/acre, respectively. Lower shrub density values are common in SDS plant communities because Gardner saltbush dominates. This map unit had a high diversity of annual forbs (11 species) and a very high percent of bare ground.

D8.4.4 Juniper/ Rock Outcrop (J/RO)

This map unit occurs on terrain varying from nearly flat to steep sandstone outcrops. Rocky mountain juniper (*Juniperus scopulorum*) is the most visible vegetative component. This map unit type is generally limited in distribution and size within the Bighorn Basin compared to previously listed plant communities (MDS1, MDS2 and SDS). Average cover (absolute) transect data indicates the J/RO type averaged 0.2% annual grass, 0.2% perennial grass, 2.4% annual forb, 2.1% perennial forbs, 0.3% sub-shrubs, 8.4% shrubs, 4.4% tree, 0.2% biological crust, 39.8% rock, 13.0% litter and 29.1% bare ground. Total vegetation cover (absolute) is 17.9% and total cover (absolute) is 70.9%. Relative vegetation cover data shows 0.9% annual grass, 0.9 perennial grass, 13.6% annual forbs, 11.6% perennial forbs, 1.8% sub-shrubs, 46.7% shrubs and 24.3% tree. Shrub density data indicates 1290 live and 442 dead shrubs/acre, respectively. This plant community was sampled within the Plan/ROW area for the *1999 Plan/ROW to Permit 278C* and was also included in the *Upper Claims Plan/ROW to Permit 278C* of June 15, 2006. Previously collected data indicates average tree density (rocky mountain juniper) to be 14.8 trees/acre. This map unit supports a diverse mixture of native shrub species (7). Two of these species [shortspine horsebrush (*Tetradymia spinosa*) and skunkbush sumac (*Rhus trilobata*) were not observed on other Upper Rim map units.

D8.4.5 Outcrops (OC)

This map unit designates barren and nearly barren shale, clay, or bentonite outcrops that are intermittent throughout the Upper Rim Plan/ROW area. No transects were sampled because of the lack of vegetation cover.

D8.4.6 Reclaimed—Bond Release (Rec-BR)

This map unit occurs on previously reclaimed mine land within the area to be affected by the proposed Howe pit. Topography and aspect are variable. Soils vary in depth and quality according to placement during reclamation efforts. Occasional small barren or nearly barren areas are intermittent throughout. Dominant plant species include Gardner saltbush (23.1% relative cover) and Russian wildrye (*Elymus junceus*) (22.6% relative cover). Because M-I has been released from reclamation bonding obligations on these lands, it is assumed that their current status represents the reclamation standard for evaluating success after new disturbances associated with the current proposal. Transect data were collected on this map unit during the 2006 growing season for immediately adjacent mining proposed with the Porter Amendment/Plan/ROW to Permit 278C. These data indicate an average of 6.4% surface rock, 20.9% litter, 20.1% vegetation cover, and 52.6% bare ground. Dominant life-forms are perennial grass (35.8% relative cover) and sub-shrubs (23.2% relative cover). Shrub and sub-shrub density averaged 2,815 individuals/acre (2,278 for Gardner saltbush). Annual forbs provided 11.3% and annual grass provided 19.5% of relative vegetation cover in this map unit. A complete species list is included with Addendum D8.D. Transect data (2006) indicates total vegetation cover averaged 20.1% and total **perennial** vegetation cover averaged 13.9%.

D8.4.7 Reclaimed—Currently Bonded (Rec-B)

This map unit designates lands mined and reclaimed subsequent to enactment of the Wyoming Environmental Quality Act of 1973. M-I currently carries reclamation bonding liability on all these lands. Their reclamation success standards are established in previously approved mine permits related to Wyoming Mine Permit 278C. Five representative line cover transects from this map unit were sampled and analyzed (2006) on lands included in the Porter Amendment which lies adjacent to and south of the Upper Rim Plan/ROW. Soils, aspect, and topographic slopes are variable. This map unit averaged 14.0% surface rock, 32.0% litter, 14.0% vegetation cover, and 40.0% bare ground. Shrub and sub-shrub density averaged 292 individuals/acre (65 for Gardner saltbush). Annual forbs provided 17.1% and annual grasses provided 77.1% of relative vegetation cover in this map unit. A complete list of all species and shrub densities is included in Addendum D8.E. Transect data indicates total vegetation cover averaged 14.0% and total **perennial** vegetation cover averaged 0.8%.

D8.4.8 Riparian Desert Shrub (RDS)

This map unit occupies a relatively narrow corridor paralleling the drainage separating upland portions of the proposed Arney pit area. It will not be affected by activity associated with this proposal. Intermittent sections of this drainage are influenced by various naturally occurring saline seeps. These wet areas generally have relatively thin deposits of alluvial and colluvial saline-sodic soils. The increased moisture content of these soils supports a shrub community dominated by greasewood, rubber rabbitbrush, green rabbitbrush and salt cedar (*Tamarix chinensis*). The drainage gradient is very gentle (0-1%) with a northwesterly aspect. The drainage channel is scoured by active intermittent flows associated with storm run-off events and is generally not vegetated. Dry portions of this drainage support a shrub community dominated by big sagebrush and green rabbitbrush.

D8.4.9 Ravine Complex (RC)

This map unit occupies steep-sided ravines in the North Esther, Tanner II and Arney Plan/ROW areas. It is comprised primarily of three previously described map units: barren outcrops (40%), Salt Desert Shrub (30%) and Mixed Desert Shrub 1 (30%).

D8.5 Federally Threatened Species

Correspondence with the USFWS indicated a concern for Ute ladies'-tresses (*Spiranthes diluvialis*) a perennial, terrestrial orchid that occurs in alluvial substrates of riparian areas, gravel bars, old oxbows, and moist to wet meadows (Wildlife Addendum D9.A). No potential habitat for this Federally Threatened species was found within the Upper Rim Plan/ROW area and no orchids were observed during August 2007 wetland designation surveys. No impacts are anticipated on this species from the proposed activity.

D8.6 Vegetation Control and Extended Reference Areas

A previously established vegetation control area located in the SENW section 28 T54N R92W will be disturbed by the proposed mining activity associated with the Arney pit area. This control area was to be utilized as the comparison standard for adequate reclamation of adjacent lands disturbed by bentonite mining in the 1980's. M-I has replaced this control area with several extended reference areas (ERA's) as illustrated in maps D8.1 and D8.2. These ERA's will provide reference criteria, for eventual bond release comparison, for the following vegetation community types: MDS1, MDS2, J/RO, and SDS.

D8.7 Noxious Weeds and Selenium Indicator Plants

Wyoming State Designated Noxious Weeds-Salt cedar (*Tamarix chinensis*) is the only Wyoming State Designated Noxious Weed observed within the Upper Rim study area. It is very limited in extent, appearing only within a few natural seeps that occur intermittently along ephemeral channels and in minor extents of poorly drained reclaimed mine land. This species requires periods of saturated soil to germinate and establish. Upper Rim mine plans do not include recreation of conditions suitable for salt cedar to establish and spread.

Restricted Noxious (Designated) Weeds-Tansy mustard (*Descurainia pinnata*) is the only Restricted Noxious weed observed within the study area. It appears in the sample data from all four sampled native plant communities providing 0.3%, 1.0%, 0.4% and 1.5% aerial cover respectively in the MDS1, MDS2, SDS and JU/RO map units. It is a minor component of the study area plant communities. Proper reclamation with aggressive perennial grasses will limit its ability to spread in the postmine landscape.

Selenium Indicator Plant Species-No selenium indicator plant species were noted within the Upper Rim Plan/ROW study area.

D8.8 Summary

Plant communities within this Plan/ROW area are typical of the Bighorn Basin northeast of Greybull, WY. Gardner saltbush and Wyoming Big sage are primary plant species within vegetated areas, and cheatgrass is very common as an understory component. Significant barren areas occur intermittently throughout the study area. These are usually very high in clay (often bentonitic) and exhibit saline and sodic chemistry which precludes establishment of vegetative cover.

Appendix G. Stipulations, Mitigation and Monitoring Measures for Alternative I

STIPULATIONS

Required stipulations that would be applied to any approval of the Proposed Action are presented below. These were also discussed above in Chapter 3. The best mitigation for the proposed Plan/ROW was included in the Proposed Action and described above. (Note: The Authorized Officer as referred to below is the Field Manager of the BLM Cody Field Office)

CULTURAL RESOURCES PROTECTION STIPULATIONS

Cultural Resources, Standard Stipulation: The operator/holder of this authorization shall immediately bring any objects or resources of cultural value discovered as a result of operations under this authorization to the attention of the authorized officer. The holder shall suspend all activities in the vicinity of such a discovery until notified to proceed by the authorized officer.

Cultural Resources, Standard Stipulation The operator/holder is responsible for informing all persons associated with this project that they may be subject to prosecution for knowingly damaging, altering, excavating or removing any archaeological, historical, or vertebrate fossil objects or site. If archaeological, historical, Native American, or vertebrate fossil materials are discovered, the operator/holder is to suspend all operations that further disturb such materials and immediately contact the Authorized Officer. Operations are not to resume until written authorization to proceed is issued by the Authorized Officer (AO).

The Authorized Officer will evaluate, or will have evaluated, such discoveries not later than five working days after being notified, and will determine what action shall be taken with respect to such discoveries. The decision as to the appropriate measures to mitigate adverse effects to significant cultural or paleontological resources will be made by the authorized officer after consulting with the holder.

The operator/holder is responsible for the cost of any investigations necessary for the evaluation, and any mitigation measures required by the Authorized Officer. The AO will provide technical and procedural guidelines for the conduct of evaluation and mitigation. Upon verification from the AO that the required evaluation and/or mitigation has been completed, the operator will be allowed to resume operations.

Cultural Resources Mining Stipulations (compatible with the current 43 CFR 3809 regulations)
The operator/holder is responsible for informing all persons associated with this project that they may be subject to prosecution for knowingly disturbing, altering, injuring, excavating, removing or destroying any historical or archaeological site, structure, building, or object on Federal lands.

The operator/holder shall immediately bring to the attention of the Authorized Officer any cultural resources that might be altered or destroyed on Federal lands by his/her operations. If archaeological, historical, or Native American resources are discovered, the operator is to suspend all operations that further disturb such materials and immediately contact the Authorized Officer. Any such discovery shall be left intact until the operator is told to proceed by the Authorized Officer.

The Authorized Officer shall evaluate the discoveries brought to his/her attention, take action to protect or remove the resource, and allow operations to proceed within 10 working days after notification to the Authorized Officer of such discovery. The decision as to the appropriate measures to mitigate adverse effects to cultural or paleontological resources shall be made by the Authorized Officer after consulting with the operator/holder.

Before a Plan of Operations is approved, the operator/holder is responsible for the cost of any investigations necessary, and any mitigation measures required by the Authorized Officer. The Authorized Officer would provide technical and procedural guidelines for the conduct of the required evaluation and mitigation. After the Plan of Operations is

approved, or where a Plan of Operations is not involved, the Federal Government (BLM) shall have the responsibility and bear the cost of investigations and salvage of any cultural (and paleontological) values discovered by the operator.

Human Remains

If human remains are discovered or suspected the operator shall suspend operations immediately, physically guard the area, and notify BLM immediately.

Special Stipulations

None.

PALEONTOLOGICAL RESOURCES STIPULATIONS

Paleontological Resources Stipulations:

1. **Collecting:** The project operator is responsible for informing all persons associated with this project including employees, contractors and subcontractors under their direction that they shall be subject to prosecution for damaging, altering, excavating or removing any vertebrate fossils or other scientifically significant paleontological resources from the project area. Collection of vertebrate fossils (bones, teeth, turtle shells) or other scientifically significant paleontological resources is prohibited without a permit. Unlawful removal, damage, or vandalism of paleontological resources will be prosecuted by federal law enforcement personnel.

2. **Discovery:** If vertebrate or other scientifically significant paleontological resources (fossils) are discovered on BLM-administered land during operations, the Operator shall suspend operations that could disturb the materials, stabilize and protect the site, and immediately contact the BLM Cody Field Office Manager (Authorized Officer). The Authorized Officer would arrange for evaluation of the find within an agreed timeframe and determine the need for any mitigation actions that may be necessary.

Any mitigation would be developed in consultation with the Operator, who may be responsible for the cost of site evaluation and mitigation of project effects to the site. If the operator can avoid disturbing a discovered site, there is no need to suspend operations; however, the discovery shall be immediately brought to the attention of the Authorized Officer.

3. **Avoidance:** All vertebrate or scientifically significant paleontological resources found as a result of the project/action will be avoided during operations. Avoidance in this case means "No action or disturbance within a distance of at least 50 feet of the outer edge of the paleontological locality".

MITIGATION AND MONITORING MEASURES

As described in 43 CFR 1508.20**,** "Mitigation" includes:

(a) Avoiding the impact altogether by not taking a certain action or parts of an action.
(b) Minimizing impacts by limiting the degree or magnitude of the action and its implementation.
(c) Rectifying the impact by repairing, rehabilitating, or restoring the affected environment.
(d) Reducing or eliminating the impact over time by preservation and maintenance operations during the life of the action.
(e) Compensating for the impact by replacing or providing substitute resources or environments.

Air Quality

- **To control fugitive dust emissions generated by haul trucks, roads and mine/work areas will be kept watered using a truck equipped with a spray bar or other BLM-approved method. If blasting would be necessary, M-I will notify the BLM in advance, and fly rock and other particles would be required to be kept to a minimum.**

Water Quality and Riparian-Wetland Area Management

- **Larger ephemeral channels (those having drainage basins greater than 5 acres) will be temporarily directed by M-I around open pits during active mining stages and straw bale sediment barriers will be utilized as sedimentation control measures.**

- **If future mine plan modifications indicate waters of the U.S. or wetland disturbances other than those indicated would be necessary, all disturbance will be contingent on jurisdictional determination by the U.S. Army Corp of Engineers. BLM will also have input into any potential disturbance to riparian-wetland-aquatic resources in addition to USACE involvement per EO 11990/EO 11988 and BLM policy.**

- **If mining results in the placement of fill or dredge material in a pond, wet meadow, stream channel, or any other water feature, M-I will coordinate with the U.S. Army Corps of Engineers (COE) to determine if the feature is a "jurisdictional" wetland or a "Water of the U.S." and whether a Clean Water Act (CWA) Section 404 Permit would be needed. M-I will obtain authorization from the Department of the Army prior to disturbance of waters of the United States. M-I will also maintain their Storm Water Discharge Permit (SWDP) and associated Storm Water Pollution Prevention Plan (SWPPP) with the WDEQ-WQD, per Section 401 of the CWA in the State of Wyoming. According to Federal and State law, activities that will result in surface disturbance in excess of 1-acre, require a SWDP and a SWPPP.**

- **Modification of the hydrology of riparian and wetland areas, including jurisdictional waters of the United States will be avoided whenever possible. Where hydrology is modified, through drainage will be required to be reestablished during final reclamation. Channel design for both temporary and permanent diversions will match pre-mine channel gradients and cross-sectional shapes and dimensions. In order to control sediment and runoff under the Proposed Action, fabric fences or certified weed-free straw bale check dams will be installed at discharge points into natural channels. Berms will be installed around pits and haul roads.**

Reclamation Seed Mix

- **The amount of seed applied to public land will be calculated on a Pure Live Seed (PLS) basis. Pounds of PLS equals the pounds of seed divided by the ratio of pure live seed in the mix; the result will always be less than 1.0. All seed applied on BLM administered public lands must comply with the current BLM seed policy in IM-2006-073 (see Appendix C). Also per IM-2006-073, *Copies of the seed lab test results, including purity and germination (viability) rate, must be forwarded to the appropriate BLM office prior to seed application. If the seed does not meet the BLM and State/Federal standard for noxious weed seed content or other crop seed allowances, it shall not be applied to public land.* Seed will be planted in the fall or early winter (occasionally in early spring) as soon as possible after topsoiling. All seed will be certified to be cheatgrass and noxious weed seed-free per current BLM Seed Policy. If M-I decides to try mulching, they must first contact the BLM for proper mulching techniques on Federal land and approval. Use of all species depends on seed availability in the year of seeding; changes to the seed mix are acceptable with prior authorization from the BLM.**

PLS is derived by multiplying purity by germination (example: 0.95 purity x 0.95 germination = 0.9 PLS). Thus, to have two pounds PLS of Indian Ricegrass in the mix, divide "two" by the PLS ratio, which will always increase the quantity needed (example: if you want 2 lbs PLS seed of a given plant species divide 2 by the PLS ratio, 0.9, in this example = 2.2 lbs bulk seed is needed to obtain 2 lbs of PLS). PLS determinations must be made for each plant species in a specific mix. Seed would be stored properly to preserve its viability and would be used within three months of the most recent viability test. Seed that has been stored longer than three months beyond the last viability test would be tested for viability again and the bulk pounds/acre rates would be adjusted to reflect any new PLS values before being applied to public land.

- ***Reclamation Seed Mix:* Within 3-5 years following the mining of bentonite, the Upper Rim Plan pits will be recontoured, deep ripped, and seeded using the following PLS (pure live seed) mix:**

M-I SEED MIXES (Revised 1/18/06)

All mixes will be broadcast, not drilled.---Broadcasting will be followed by surface dragging/harrowing in order to encourage some soil cover on top of the seed.---Greasewood is NOT approved for BLM lands; therefore, Greasewood will be pulled from the mix when seeding BLM lands. This will result in a 1-pound reduction of total PLS pounds/acre/mix on BLM lands.---Forb species and rates may be revised based on the availability of current, and newly developed, species.

SALT DESERT SHRUB MIX

	LBS PLS/Acre	# Seeds/Lb	# Seeds/Sq. Ft
Gardner Saltbush	9	111,500	23.04
Indian Ricegrass Rimrock	3	141,000	9.71
Russian Wildrye Bozoisky (NN)	3	175,000	12.05
Bottlebrush Squirreltail	4.5	192,000	19.83
Total:	**19.5**		**64.63**

Greasewood will be packaged separately from the Salt Desert Shrub Mix, but will be blended into the mix when seeding private and state land, and **excluded when seeding BLM land**:

	LBS PLS/Acre	# Seeds/Lb.	# Seeds/ Sq. Ft
Greasewood, Black	1.5	210,000	7.23
Total:	**1.5**		**7.23**

MIXED DESERT SHRUB MIX

	LBS PLS/Acre	# Seeds/Lb.	# Seeds/Sq. Ft
Fourwing Saltbush Sl Natrona	2	52,000	2.39
Shadscale	1	64,900	1.49
Gardner Saltbush	3	111,500	7.68
Indian Ricegrass Rimrock	2	141,000	6.47
Greasewood, Black	1	210,000	4.82
Russian Wildrye Bozoisky (NN)	2	175,000	8.03
Bottlebrush Squirreltail	2	192,000	8.82
Rubber Rabbitbrush	1	400,000	9.18
Alkali Sacaton	0.25	1,758,000	10.09
Sandberg Bluegrass	0.5	925,000	10.62
Globemallow (*Sphaeralcea spp.*)	0.25	500,000	2.87
Rocky Mountain beeplant (*Cleome serrulata*)	3	65,000	4.48
Sunflower Annual Wild (*Helianthus annuus)*	3	58,000	3.99
Total:	**21 PLS/acre**		**80.93**

Each of the following species will be packaged separately.--- Big Sagebrush and Winterfat will be seeded along with, but separately from, the Mixed Desert Shrub mix. Areas targeted for Big Sagebrush and Winterfat seeding will be selected based on favorable moisture, aspect, and soil conditions.---Greasewood will be blended into the Mixed Desert Shrub mix when seeding private and state land, and excluded when seeding BLM land:

	LBS PLS/Acre	# Seeds/Lb.	# Seeds/Sq. Ft
Big Sagebrush, Wyoming	1	2,500,000	57.39
Winterfat Sl Artillery	1	56,700	1.30
Greasewood, Black	1.5	210,000	7.23
Total:	**3.5**		**65.92**

- **This mixture will be supplemented with <u>Wyoming big sagebrush</u> (*Artemisia tridentata*) at a rate of 1 to 2 pounds per acre in targeted areas of greater moisture potential (i.e. drainages and depressions) and higher quality soil; <u>basin wildrye</u> (*Elymus cinereus*) broadcast onto swales and reconstructed drainages, and other**

low-lying areas at a rate of 0.5 to 2 pounds per acres, and fringed sagewort (*Artemisia frigid*) at a rate of 0.5 to 1.0 pounds per acre. This seed mix will be doubled if broadcast seeding is used. Monitoring of past reclamation successes and failures could influence seed mixture composition and surface preparation techniques. *Prior to any seed mix revisions, M-I will contact the BLM for approval of the proposed changes.*

- **M-I will use live-spreading of topsoil whenever possible, and will stockpile topsoil for the least amount of time before re-spreading it. M-I will seed its longer-term topsoil stockpiles to prevent weed growth, reduce erosion, and maintain the soil's biological integrity. Associated disturbance relative to proposed mining would be kept to a minimum in order to prevent unnecessary and undue disturbance of native soil profiles. Disturbed areas will be seeded in a timely manner to promote speedy plant growth and further reduce erosion.**

- **M-I may conduct soil analysis of stockpiles prior to re-spreading them to determine need for amendments and the types needed to assist in reclamation**

- **All seed used on public lands will be certified cheatgrass-free and noxious weed- free by a Wyoming State approved seed testing laboratory and technician testing and would conform to BLM seed policy IM No. 2006-073; any hay or straw used for check-dam construction or mulching would also be certified to be cheatgrass and noxious weed-free.**

- **Some reclaimed areas may need to be fenced to exclude livestock from grazing too heavily on newly-germinated or established seedlings in these areas.**

Reclamation and Visual Aesthetics

- **Reclamation will be concurrent with mining as much as possible. After mining, disturbed areas under this Plan/ROW will be contoured to blend in with the adjacent land, and reseeded to support similar vegetation. Proper topsoil and subsoil salvage is essential to ensure successful reclamation.**

- **Use of mine pit areas for bentonite drying will be kept to a minimum so mine pits can be backfilled, recontoured and reseeded in a timely manner. Unnecessary and undue degradation of native soils and vegetation will not be allowed to occur as a result of bentonite mining under this Plan or ROW.**

- **Within 3-5 years following completion of mining, disturbed areas will be recontoured to match the surrounding topography, reestablish drainages, and minimize erosion. The entire disturbed area with the exception of the main haul roads will be topsoiled and seeded using the seed mixes provided previously in this document.**

- **Topsoil stockpiles that are not live spread in a timely fashion will be seeded in the fall or spring following placement.**

Livestock Grazing Management

- **M-I will work with the BLM-CYFO to upkeep the allotment boundary fence between the Himes Group and Crystal Creek grazing allotments. A temporary fence or fence realignment will be constructed along the allotment boundary where the proposed mining would disturb the existing fence.**

- **A cattleguard or gated bypass will be used along the southeastern haul road where it would pass through the allotment boundary fence.**

Sensitive Wildlife Species and Migratory Birds

In conformance with the USFWS and BLM requirements to not cause "take" on protected species under the Migratory Bird Treaty Act, which is illegal, M-I will conduct nest searches for migratory birds between April 10th and July 15th.

Mining will stop if nesting migratory birds are detected, until the migratory birds have fledged and can leave the nesting area. Nest searches will also be conducted for nesting mountain plover in nesting habitat prior to and during ground disturbing activities between April 10th and July 15th. Mountain plover are migratory birds and a BLM Sensitive Species, are rare and in need of conservation. If nesting mountain plovers are found, mining operations will halt until the chicks have fledged and are able to leave the nesting area. Prairie dog towns will be avoided. Proper management of water within the mined areas would minimize potential impacts to northern leopard frogs present downstream.

Raptor Nesting Sites

- **M-I will follow proposed survey and buffer protocols outlined by the USFWS. These include conducting at least three surveys during nest-initiation periods from early March through early June and maintaining a disturbance-free zone around active golden eagle nests of at least 0.75 miles during the nesting season (February 1 to August 15). M-I will notify the BLM and the USFWS if any nesting raptors are spotted. After an effects analysis is conducted with the BLM and USFWS, further mitigation may be required which may include halting mining activities until the young have fledged.**

- **In conformance with the USFWS consultation and BLM requirements to not "take" protected species under the Migratory Bird Treaty Act, and the Bald and Golden Eagle Protection Act, on the ground surveys will be conducted prior to any surface disturbing activities to ensure no active raptor nests would be disturbed. M-I personnel agree to mitigate potential impacts to raptors and raptor nesting sites by monitoring any nearby raptor nests in the spring of the year to determine species and activity status. The BLM and the USFWS will be notified if nest sites are discovered during mining activities; any active nest site will be evaluated for appropriate mitigation measures and buffer distance based on circumstances including: raptor species, nesting stage, activity, topography, and disturbance type. Generally, the Cody Field Office RMP states a ¾ mile buffer (or closer visual horizon) seasonal restriction, which could be applied depending on circumstances, from February 1st through July 31st for raptors and three zones of buffer restrictions for bald eagles. Results of monitoring will be reported and provided to the BLM and the USFWS.**

Sage Grouse (Candidate Species)

- **(The WGFD has indicated a concern for sage grouse populations within the greater region bounded by Highway 14A on the north, Shell Creek on the south, Sheep Mountain on the west and the Big Horn Mountains on the east which includes the Upper Rim Plan/ROW area. Specific concerns have been expressed for impacts to sagebrush habitat from bentonite mining activity in this region.)**

- **M-I's mitigation efforts will focus on protection of nesting and brood-rearing sage grouse by conducting pre-disturbance ground surveys within immediate areas to be affected, if initial ground disturbing activities occur during nesting or brood-rearing periods (March 15 through July 15). If nests or broods are noted, operations will be voluntarily delayed or temporarily relocated until grouse use was completed or moved. Additional mitigation efforts will focus on enhanced efforts to restore sagebrush during reclamation as described in the Reclamation Plan.**

- **Sage Grouse: On Feb. 10, 2012, the BLM Wyoming State Office issued Instruction Memorandum WY-2012-019 entitled "Greater Sage-Grouse Habitat Management Policy on Wyoming Bureau of Land Management (BLM) Administered Public Lands Including the Federal Mineral Estate". Though mining activities regulated under 43 CFR 3809 on federal surface/federal mineral estate may not be affected by this new sage grouse IM, *mining activities carried out under the Right-of-way regulations (43 CFR 2800) are so affected.* Therefore, any mitigation for sage grouse as spelled out in this IM required on split estate lands (discretionary actions) under the Proposed Action may be subject to terms of this IM. As stated in the IM, "…determinations that do not apply the measures located in this policy IM may be necessary where BLM is required to comply with other non-discretionary statutes and regulations (i.e., valid existing rights, oil and gas "drainage", etc.)."**

- **The following narrative was taken from pages 18-19 of the 2012 IM (pertinent portions to this review are highlighted in bold):**

> **Locatable Mineral Activities (43 CFR 3809)**:
> ***Notices or Plans of Operation, or modifications thereto, submitted following the issuance of this guidance:*** *As part of the 15 day completeness review of notices [or modifications thereto] and 30 day completeness review of plans of operations [or modifications thereto], the proposed project area(s) where exploration, development, mining, access and reclamation would take place should be reviewed for overlap of sage-grouse core areas in the corporate GIS database.* ***If there is overlap, the BLM AO may notify the operator of ways that they may minimize impacts to core area habitats and request the operator to amend its notice or plan to include such measures. The request to amend the submitted notice or plan of operations must make clear that the operator's compliance is not mandatory and that including such measures is not a requirement for completeness of either the notice or a plan of operations, nor is it a condition of acceptance of the notice or approval of the plan of operations.***

Other Migratory Birds:

- **M-I will conduct nest searches in migratory bird habitat prior to and during surface-disturbing activities between April 10th and July 15th. These surveys will be conducted not more than five days prior to disturbance by heavy equipment if initial ground disturbing activity occurs during nesting or brood-rearing periods (April 10 through July 15). If nesting migratory birds would be found, clearing of new ground for mining will halt until the BLM, WDEQ and USFWS are consulted for further action or operations temporarily moved to suitable locations. Through this monitoring, no migratory birds will be harmed/"taken" during the mining process. Because M-I agrees to implement mitigation measures, this Plan/ROW would not cause "take" of migratory birds, which is prohibited by the Migratory Bird Treaty Act.**

- **In conformance with USFWS suggestions, M-I will conduct nest searches in mountain plover habitat prior to, and during ground disturbing activities between April 10th and July 15th. If nesting mountain plovers are found, mining operations will halt temporarily until BLM and USFWS were consulted. Through this monitoring, no mountain plovers or migratory birds will be harmed during the mining process.**

Other Wildlife:

- **Mule Deer: M-I will address concerns related to winter mule deer use of this habitat by focusing enhanced reclamation efforts on sagebrush reestablishment as previously referenced (Reclamation Plan).**

- **Pronghorn: M-I will address concerns related to pronghorn use of the Upper Rim area by focusing enhanced reclamation efforts on sagebrush reestablishment as discussed in the Reclamation Plan.**

- **Prairie dog towns will be avoided when possible to reduce impacts to the white-tailed prairie dog, a BLM Sensitive Species.**

Noxious or Invasive Weeds

- **M-I will be responsible for preventing and managing all noxious and undesirable invading plant species in disturbed areas including, but not limited to, cheatgrass, Russian olive, and tamarisk, until the revegetation activities have been determined to be successful, and the bond has been released for a given area. If noxious or invasive weeds are encountered, the BLM and the Big Horn County Weed and Pest will be consulted by the operator for control and eradication methods. Written approval of the Pesticide Use Proposal (PUP) submitted by M-I Inc., from the BLM Authorized Officer must be obtained prior to usage of herbicides on public land. M-I would also need to follow the BLM seed policy IM No. 2006-073 (Appendix H), which would help prevent weed spreading and infestations.**

- **Newly arriving equipment will be cleaned/washed of plant material off-site prior to arriving at the Upper Rim Plan area.**

- **Certified noxious weed-free and cheatgrass-free seed will be used to seed the area during reclamation.**

- **Weeds will be controlled/eradicated by use of BLM approved methods and herbicides, and their management will be the sole responsibility of M-I.**

- **Where weed infestations are noted on Federal lands associated with this Plan, all vehicle access will be limited to necessary routes only and will be controlled to minimize travel in the infested area until weed removal would be accomplished. Vegetation will be reestablished and weed-free seeds and hay for mulch will be used in the proposed mining area. Cleaning vehicles, equipment, and materials before they enter public land will reduce the spread of invasive, non-native plant species.**

Roads

- **All new roads will be constructed, and existing roads will be upgraded, according to BLM Manual Section 9113. Exceptions to this must be approved in writing by the BLM Authorized Officer.**

Appendix H. BLM seed policy in IM-2006-073

UNITED STATES DEPARTMENT OF THE INTERIOR
BUREAU OF LAND MANAGEMENT
WASHINGTON, D.C. 20240
January 20, 2006

In Reply Refer To:
1745 (220) P

EMS TRANSMISSION 01/27/2006
Instruction Memorandum No. 2006-073
Expires: 09/30/2007

To: All Field Officials

From: Director

Subject: Weed-Free Seed Use on Lands Administered by the Bureau of Land Management

Program Area: All programs which place seed, or approve the placement of seed on public lands.
Purpose: This Instruction Memorandum (IM) describes Bureau of Land Management (BLM) policy for the quality of seed purchased by BLM for use on public lands.

Background: The BLM Manual Section 1745 (1992) establishes policy and guidance for transplantation, augmentation, and reestablishment of habitat on public land utilizing native, and when necessary, introduced plant species. This action will comply with all Federal and State regulations, restrictions, and requirements governing the release and distribution of non-native exotic plants, including weed seeds.

BLM's Partners Against Weeds – An Action Plan for the Bureau of Land Management, January 1996, outlines BLM's plan to prevent and control the spread of noxious and invasive weeds on BLM lands. In addition, the 1999 Executive Order No. 13112 on Invasive Species states that each Federal agency shall not authorize, fund, or carry out actions that are likely to cause or promote the introduction or spread of invasive species in the United States.

The BLM obtains/purchases native or introduced plant seed, from seed producers and collectors for stabilization, rehabilitation, or restoration of public land. Prior to BLM accepting seed from any source, all seed must be tested for noxious weed seed at official state seed analysis labs. Noxious weed seed is not allowed in certified seed according to individual State's Department of Agriculture seed law and the Federal Seed Act. It has been acceptable for the seed lot (excluding species on the State and Federal noxious weed seed list) to contain from 0.5 percent to 2.0 percent of other "weed" seed depending on the State. "Other weed seed" is defined as any non-noxious weed seed, such as cheatgrass (downy brome) or Russian thistle, in the State(s) of concern. When purchased, all seed must also be of certified quality or source-identified.

Policy/Action: All Field Offices are required to use seed on public lands that contain no noxious weed seed and meets certified seed quality. All seed to be applied on public land must have a valid seed test, within one year of the acceptance date, from a seed analysis lab by a registered seed analyst (Association of Official Seed Analysts). The seed lab results shall show no more than 0.5 percent by weight of other weed seeds; and the seed lot shall contain no noxious, prohibited, or restricted weed seeds according to State seed laws in the respective State(s). The seed procured for use on public land will meet the Federal Seed Act criteria. Seed may contain up to 2.0 percent of "other crop seed" by weight which includes the seed of other agronomic crops and native plants; however, a lower percent of other crop seed is recommended. Copies of the seed lab test results, including purity and germination (viability) rate, must be forwarded to the appropriate BLM office prior to seed application. If the seed does not meet the BLM and State/Federal standard for noxious weed seed content or other crop seed allowances, it shall not be applied to public land. All seed test results must be retained in the seeding project file.

The BLM State contracts for seed may be more restrictive with "other weed seeds" of concern as deemed necessary.

All donated seed or seed used for "mitigation or restoration" by contractors per a reclamation plan must meet BLM's noxious weed seed policy prior to use on public lands.

An exemption will be allowed for small reclamation projects, less than 20 acres or not to exceed 200 pounds of seed, which have an approved BLM reclamation or rehabilitation plan or permit. The seed will be accepted if accompanied by an official seed analysis report that provides documentation to show no noxious weed seed per State(s) weed law and no more than 0.5% other weed seeds. For this exception, any one of three seed test documents will be accepted:

1. A certified "blue" tag or tags.
2. An independent seed lab test.
3. A seed lab analysis supplied by a vendor either by seed lot or by seed mix.

Straw or mulches applied as part of seeding, stabilization, rehabilitation, or restoration projects on public lands must be certified to be weed seed-free.

Timeframe: Effective immediately.
Budget Impact: Approximately 80% of the seed used on public lands is purchased during a National Seed Buy (three times a year average) via a national seed contract. Under this contract, the seed must be tested prior to acceptance and payment. Therefore, there will be no new costs associated with the National Seed Buy. For offices and programs not currently testing their seed for noxious weeds or are approving project proponents to apply seed on public land without first testing for noxious weeds there will be a slight increase in the cost of seeding treatments. A typical seed test costs between $120-220 per lot for purity, germination, and noxious weed seed analysis.
Manual/Handbook Sections Affected: None.
Coordination: Coordination for this IM has been with WO-200, WO-220, WO-230, WO-270, WO-310, ID-930, BC-660.
Contact: If you have any questions on policy, please contact Jack Hamby, National ES&R Program Lead, at (202) 452-7747 or via email at Jack_Hamby@blm.gov. Questions pertaining to seed test, viability, seed lot tags, or weed seeds should be directed to Scott M. Lambert, National Seed Coordinator, Idaho State Office, at (208) 373-3894 or by e-mail Scott_Lambert@blm.gov.

Signed by:
Lawrence E. Benna
Acting, Director

Authenticated by:
Robert M. Williams
Policy and Records Group,WO-560
_____

Appendix I. BLM Sage Grouse IM-2012-019

(applicable portions provided here)

United States Department of the Interior

BUREAU OF LAND MANAGEMENT
Wyoming State Office
P.O. Box 1828
Cheyenne, Wyoming 82009-1828

IN REPLY REFER TO:
6840 (930) P

February 10, 2012

EMS TRANSMISSION: 02/15/2012
Instruction Memorandum No. WY-2012-019
Expires: 9/30/2013

To: District Managers and Deputy State Directors

From: State Director

Subject: Greater Sage-Grouse Habitat Management Policy on Wyoming Bureau of Land Management (BLM) Administered Public Lands Including the Federal Mineral Estate

Program Area: All programs

Purpose: This Instruction Memorandum (IM) provides guidance to Bureau of Land Management Wyoming (BLM WY) Field Offices (FOs) regarding management consideration of Greater Sage-Grouse habitats for proposed activities until resource management planning updates are completed. This guidance is in place of direction provided in Washington Office (WO) IM No. 2012-043 concerning interim management policies and procedures for Greater Sage-Grouse. Specifically, this IM addresses all BLM WY programs and provides all necessary interim program direction consistent with WO IM No. 2012-043. Where planning efforts to update and incorporate this guidance are not yet completed, the BLM WY State Office will conduct periodic review of the implementation of measures and directives contained in this IM to determine their applicability and effectiveness and make changes as necessary. This IM replaces IM No. WY-2010-012 and IM No.WY-2010-013 (USDI BLM 2010a, USDI BLM 2010b). This IM also acknowledges that Wyoming BLM will be meeting the intent of WO IM-No. 2012-044, BLM National Greater Sage Grouse Land Use Planning Strategy.

Policy Statement 4: Project Locations and Analyses

BLM WY regularly conducts wildlife habitat evaluations in response to applications and proposed activities in coordination with an interdisciplinary team. Evaluations involve a review of baseline data from office-based sources including, but not limited to, aerial photography, satellite imagery and sage-grouse demographic data which may refer to activities which pose potential threats to sage-grouse habitat. Evaluations typically include field visits to identify where impacts can be reduced by protecting seasonal habitats, especially leks, nesting, early brood-rearing, and WCAs. During these habitat evaluations, other vegetation communities not generally used by sage-grouse can be identified as potential sites in which to relocate certain projects with proposed surface disturbance or disruptive activity. In order to claim that the overall relocation results in having no substantive impacts on sage-grouse, the "patch" of non-habitat would need to be quite large and activities would have to be further than 0.6mi from the edge of suitable habitat. This same principle would apply in the case of timing restrictions/limitations. In any case, relocation into least sensitive habitats or vegetation types would still be appropriate. Sage-grouse habitat indicators that may be useful to consider when identifying conservation measures may include existing disturbance, habitat availability, patch size, currently approved or proposed fragmentation of existing habitats, patch connectivity, patch dynamics (*i.e.,* seral stages of vegetation), habitat edge characteristics and corridors potentially used for seasonal migration. The interdisciplinary team will consider and weigh potential impacts on other resources, such as cultural resources, soils and water to determine siting within the least environmentally sensitive area. In all cases, direct, indirect and cumulative impacts of proposed action on sage-grouse, other wildlife and all other impacted resources must be described regardless of distance from the project or whether inside or outside sage-grouse core areas.

Locatable Mineral Activities:
Existing Notices and Approved Plans of Operations under 43 CFR 3809: For projects that overlap core areas, operators may be requested to submit modifications to the accepted notice or approved plan of operations so that the operations minimally impact core area habitats. The AO may convey to the operator suggested conservation measures, based upon the notice or plan level operations and the geographic area of those operations [also called the project area which is defined in CFR 3809.5]. These suggested conservation measures include measures that support the overall goals and objectives of the core population area strategy, though measures listed for evaluation in Policy Statement 2 of this IM may not be reasonable or applicable to the BLM's determination of whether the proposed operations will cause unnecessary or undue degradation under 43 CFR 3809.5. The request containing the suggested conservation measures must make clear that the operator's compliance is not mandatory.

Notices or Plans of Operation, or modifications thereto, submitted following the issuance of this guidance: As part of the 15 day completeness review of notices [or modifications thereto] and 30 day completeness review of plans of operations [or modifications thereto], the proposed project area(s) where exploration, development, mining, access and reclamation would take place should be reviewed for overlap of sage-grouse core areas in the corporate GIS database. If there is overlap, the BLM AO may notify the operator of ways that they may minimize impacts to core area habitats and request the operator to amend its notice or plan to include such measures. The request to amend the submitted notice or plan of operations must make clear that the operator's

compliance is not mandatory and that including such measures is not a requirement for completeness of either the notice or a plan of operations, nor is it a condition of acceptance of the notice or approval of the plan of operations.

Timeframe: Effective immediately.

Budget Impact: There may be a significant effect on budgets.

Background:

In March 2010, the FWS published its finding on the petition for the Greater Sage-Grouse to be listed as Threatened or Endangered. The finding was that the species is "warranted, but precluded." The inadequacy of regulatory mechanisms was identified as one of the major factors in the FWS's finding on Greater Sage-Grouse. The FWS has identified the principal regulatory mechanism for the BLM as protective measures embedded in land use plans. The BLM is identifying sage-grouse conservation measures for consideration through the planning process, with a target decision date of September 2014. The goal of the overall planning effort is to conserve and manage habitats necessary to sustain Greater Sage-Grouse populations and reduce the likelihood of listing under the Endangered Species Act.

In July 2011, the BLM announced the National Greater Sage-Grouse Planning Strategy which provides a framework for establishing adequate regulatory mechanisms (conservation measures) in applicable BLM LUPs throughout the range of the Greater Sage-Grouse. BLM WY will be working to incorporate the Wyoming Core Strategy into LUPs throughout the State and this IM will assist in preserving decision space that may be needed in the selection of potential alternatives.

Manual or Handbook Sections Affected: No manual or handbook sections are affected.

Coordination: This IM was coordinated among the BLM Washington D.C. Directorate, WY BLM Field Offices, other BLM State Offices, the Wyoming Office of Governor Mead and the Wyoming Game and Fish Department.

Contacts: Chris Keefe, Wildlife Biologist, 307-775-6101, and Buddy Green, Deputy State Director for Resources Policy and Management, 307-775-6113.

Signed By:	Authenticated By:
Donald A. Simpson	Sherry Dixon
State Director	Secretary

9 Attachments:

1 – Wyoming Sage-Grouse Definitions (4 pp)
2 – Seasonal Sage-grouse Habitat Component Descriptions (2 pp)
3 – Wyoming Core Areas Map ver. 3 (1 p)
4 – Coordination with Wyoming Game and Fish - Diagram (1 p)
5 – DDCT Process Manual (31 pp)
6 – Wyoming Game and Fish Department Protocols for Treating Sagebrush to be Consistent with Wyoming Executive Order 2011-5; Greater Sage-Grouse Core Area Protection (5 pp)
7 – BLM Wyoming Sage-Grouse Fluid Mineral Lease Screen (1 p)
8 – Management of Livestock Grazing in Sage-Grouse Habitats on Lands Administered by the Bureau of Land Management in Wyoming (4 pp)
9 – References (3 pp)

Distribution

Director (230), Room 204, LS	1 (w/o atchs)
CF	1(w/atchs)