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ADJUDICATION FILE
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Mountain Cement Company Exhibits
EQC Docket No. 13-407
LQD Permit No. 298C-A7; TFN 5 1/110
MCC-1

TFN 5 1/110
RECD OCT 15, 2012

NOTE: **DO NOT MODIFY THIS FORM.** Use typewriter or print neatly in blue ink. Submit two (2) copies one of which must be an original Form 1 as supplied by the Department of Environmental Quality, Land Quality Division.

STATE OF WYOMING
DEPARTMENT OF ENVIRONMENTAL QUALITY
LAND QUALITY DIVISION
APPLICATION
FOR
PERMIT TO MINE
OR
AMENDMENT TO A PERMIT TO MINE
OR
COAL PERMIT RENEWAL

COPY

1. (a) Name, telephone number, and mailing address of applicant:
MOUNTAIN CEMENT COMPANY
5 SAND CREEK RD, LARAMIE, WYO 82070

(b) If the applicant is a partnership, association or corporation, (circle one) the names and addresses of all managers, partners and executives directly responsible for operations in this State:

Name: DAVID CHALLACOMB Address: 5 SAND CREEK RD LARAMIE, WYO
Title: PRESIDENT Phone No. 1-307-745-2665

Name: _____ Address: _____
Title: _____ Phone No. _____

Name: _____ Address: _____
Title: _____ Phone No. _____

Name: _____ Address: _____
Title: _____ Phone No. _____

2. Name, address, and telephone number of the agent or person to whom any notice under the provisions of Wyoming Environmental Quality Act or Rules and Regulations adopted thereunder may be sent: ANDY MAC CLUGAGE, 5 SAND CREEK RD
LARAMIE, WYO 82070 1-307-745-2687

3. Attach the following information as part of the specific appendices:

(a) APPENDIX "A"

Names and addresses of surface and mineral owners of record within the proposed permit (amendment) area.

(b) APPENDIX "B"

(i) Names and last known addresses of the owners of record of the surface rights of the lands immediately adjacent to the proposed permit (amendment) area.

(ii) Names and last known addresses of any other persons within one-half (1/2) mile having a valid legal estate of record.

(iii) **For surface coal mining operations,** the names and last known addresses of coal ownership immediately adjacent to the proposed permit (amendment) area.

NOTE: Appendices "A" and "B" shall each be accompanied by maps showing the ownership locations required by the respective appendices. Mapping of (b)(ii) is not required.

(c) APPENDIX "C"

(i) All lands to be included in the proposed permit (amendment) area shall be tabulated by legal subdivision, section, township, range, county, and municipal corporation, if any, and the number of acres for each subdivision listed.

(ii) Lands which are to be part of the proposed permit (amendment) area, for which no right to mine is claimed shall be identified in item (c)(i) above as such and tabulated separately listing the number of acres for each legal subdivision.

(iii) Lands which are located within other permit areas shall be identified and a copy of the land use agreement with the other permittee shall be attached as part of this application.

(iv) An original United State Geological Survey topographic map, clearly outlining and identifying the lands to be within the proposed permit areas, shall be provided. Photo copies or other similar copies are not acceptable unless prior approval is obtained from the Land Quality Division.

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(d) APPENDIX "D"

A description of the land which shall include: historic and present land use; vegetative cover; annual rainfall; general directions and average velocities of the winds; indigenous wildlife; present surface water and the immediate drainage areas; valid water rights; nature and depth of the overburden, subsoil, topsoil; including a soils map; mineral seams, or other deposits; subsurface water(s) known to exist above the deepest projected depth of the mining operation.

(e) APPENDIX "E"

A map or maps with the boundary of the proposed permit (amendment) are clearly outlined and identified showing:

(i) The lands to be affected by the mining;

(ii) The drainage area within and surrounding the proposed permit (amendment) area;

(iii) The location and names, where known, of all roads, railroads, public or private rights-of-way and easements, utility lines, lakes, streams, creeks, springs, and other surface water courses, oil wells, gas wells, and water wells;

(iv) An outline of the probable limits of all areas previously disturbed or to be disturbed by underground or subsurface mining, whether active or inactive, on or immediately adjacent to the proposed permit (amendment) area;

(v) The names, last known addresses and boundary lines of the present surface landowners and occupants on the adjacent land to be affected;

(vi) The location, ownership, and uses of all buildings on, or on lands adjacent to, the land to be affected;

(vii) Information presented as part of APPENDIX "D" when necessary for clarification.

4. Mineral(s) to be mined: LIMESTONE
Mining method to be used: SURFACE MINING/QUARRY

5. Estimated dates of commencement and termination of the proposed operation:
Start: 2012 Terminate: 2163

6. The total number of acres in the proposed permit (amendment) area and an estimate of the total number of acres to be affected by the operation:

Permit Acres		Approved Acreage to Affect		Surface Ownership	
Original Permit	337	Original Permit	132	No. of Federal Acres	440
Approved Amendments	3076	Approved Amendments	548	No. of State Acres	760
This Application	4960.13	This Application	2770	No. of Private Acres	7173.13
Total Acres	8373.13	Total Acres	3450	Total Acres	8373.13

7. The name, if any, by which the permit (amendment) lands or any part thereof are known:
ETCHEPARE LIMESTONE QUARRY

8. The nearest town or city: LARAMIE WYO

9. A filing fee of $100.00 ($200.00 for amendments) plus $10.00 for each acre in the request permit (amendment) area. For any single permit (amendment) the maximum fee shall not exceed $2,000.00.

10. Plan or plans of the applicant, including maps for the proposed mining operation and the reclamation of all affected lands as required by W.S. §35-11-406(b) and Chapter 2, Sec. 2 of the Land Quality Rules and Regulations.

11. Each application **for coal mining operations** shall also contain:

(a) Additional information as required in Chapter 2, Section 2 of the Land Quality Division Coal Rules and Regulations;

(b) A certification that the applicant has a public liability insurance policy in force for the proposed mining and reclamation, as required by W.S. §35-11-406(a)(xiii) and Land Quality Division Coal Rules and Regulations Chapter 12, Section 2.;

(c) A listing of all notices of violations required by W.S. §35-11-406(a)(xiv).

12. The following obligations are incumbent upon the applicant upon approval of this application:

(a) The provisions of the permit are severable, and if any provision of the permit, or the application of any provision of the permit, to any circumstance, is held invalid, the application of such provision to other circumstances, and the remainder of the permit, shall not be affected thereby.

(b) The operator shall allow the Director, the Administrator and/or his authorized representatives, at reasonable times and upon presentation of appropriate credentials, to enter upon and have access to any and all lands covered by this permit and amendments thereto and to inspect and copy any records or documents, obtain or monitor any samples or sampling, for any activities associated with the operation and permit.

(c) The following shall also apply **for coal mining operations**:

(i) The operator shall conduct his operation in a manner which prevents violation of any other applicable State or Federal law.

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(ii) The operator shall take all possible steps to minimize any adverse impact to the environment or public health and safety resulting from noncompliance with his approved mining and reclamation plan and other terms and conditions of any permit or license, including monitoring to define the nature of the noncompliance and warning of any potentially dangerous condition.

(iii) The operator shall conduct all operations in accordance with his approved mining and reclamation plan and with any special conditions of the permit or license attached thereto.

(iv) All reclamation fees shall be paid as required by Title IV, P.L. 95-87, for coal produced under the permit for sale, transfer or use.

FINAL SWORN STATEMENT

State of Wyoming)
) ss
County of Albany)

I David Challacomb being duly sworn on my oath that I am the applicant (President or Vice President if the applicant is a corporation) for the foregoing permit (amendment); that I have read the said application and fully know the contents thereof; that all statements contained in the permit (amendment) application are true and correct to my best knowledge and belief; by execution of this statement I certify that Mountain Cement Co., applicant or entities controlled by or under common control with the applicant has the right and power by the legal estate owned to mine from the land for which this permit (amendment) is desired; that applicant or entities controlled by or under common control with the applicant has not forfeited, or is not involved in forfeiture proceedings for, a bond posted for reclamation purposes; and if a **surface coal mining application**, that applicant or entities controlled by or under common control with the applicant has paid the reclamation fees for this and all coal mining operations under the jurisdiction of P.L. 95-87 as required by Title IV of that law; and that applicant or entities controlled by or under common control with the applicant has not had any Federal or State coal mining permits suspended or revoked in the five years preceding the date of this application.

Dated this 14TH day of August, 2012.

(Corporate Seal)

Signature David Challacomb

Name DAVID CHALLACOMB
(Printed or typed)

Title President

The foregoing instrument was acknowledged before me by David Challacomb this 14th day of August, 2012.

Witness my hand and official seal.

Lynne Nachtman
(Notary Public or Secretary if a Corporation)

LYNNE NACHTMAN
(Name printed or typed)

(Notary Seal)

My Commission Expires: 04-27-16

LYNNE NACHTMAN- NOTARY PUBLIC
COUNTY OF ALBANY
STATE OF WYOMING
MY COMMISSION EXPIRES APRIL 27, 2016

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Temporary Filing No. 5/110

THE STATE OF WYOMING)
)ss
DEPARTMENT OF ENVIRONMENTAL QUALITY)

TEN B 1/110
OCT 15, 2012

This is to certify that I have examined the foregoing application and do hereby grant the same subject to the following limitations and conditions:

This permit/coal renewal/amendment grants only the right to affect the land described in Appendix "C" of the application.

Acceptance of the approved permit/coal renewal/amendment obligates the operator to abide by the standard conditions specified in Item No. 12. of this application form. Any condition and/or special condition attached to approval of this permit/coal renewal/amendment shall supersede and/or replace any conflicts with the original permit, amendments, coal renewals or any other revision.

Additional special conditions and limitations are as follows:

Approved: _____
Administrator
Land Quality Division
Department of Environmental Quality

Approved: _____
Director
Department of Environmental Quality

Effective Date: _____

Form 1
Rev. 6/00
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Initial AHM

Date 8/9/12

Permit No. 298C
Temporary Filing No. 5 Y110

TPM 5 1/110
OCT 15, 2012

Reclamation Bond

As of July 2012 the bond for the Etchepare Limestone Quarry was approximately $640,000. The bonding amount is revised yearly in the quarry's annual report. The current amount covers the cost of reclamation through March 2013. Prior to commencing the A8 mine sequence Mountain Cement will revise the bond estimate to reflect the disturbance of the first A8 mine sequence block. The bond will continue to be updated by Mountain Cement and reviewed by WDEQ/LQD annually, and reset accordingly.

Do not make corrections *to this form after printing. Forms bearing strikeouts, ink changes, etc will not be accepted.*

SURFACE LANDOWNER'S CONSENT

I, **David Challacomb, President, Mountain Land & Cattle Co.**, CERTIFY that I hold surface rights on the following lands on which **Mountain Cement Company** holds mineral estate rights:

E ½ NE ¼ Section 13	T.15 N. R.73W.
SW ¼ Section 7-portion south of Interstate 80	T.15 N. R.72W.
All Section 17 south of Interstate 80 except W ½ SW ¼	T.15 N. R.72W.
All Section 21	T.15 N. R.72W.
All Section 29	T.15 N. R.72W.
All Section 33 except portion conveyed to Williams Land & Livestock Co.	T.15 N. R.72W.

County of Albany.

I have examined the mining plans and reclamation plan prepared by **Mountain Cement Company** in compliance with the Wyoming ENVIRONMENTAL QUALITY ACT, and do hereby approve said plans, and give my consent to enter and carry out said mining and reclamation programs on said lands as proposed therein.

Dated this 20TH day of OCTOBER, 2010

Surface Land Owner (signature) David Challacomb

Printed or Typed Name DAVID CHALLACOMB

Witness 10/20/10 Date

LOD
OCT 22 2010
RECEIVED

Form 8
Rev. 10/99

5 1/110

Do not make corrections to this form after printing. Forms bearing strikeouts, ink changes, etc will not be accepted.

SURFACE LANDOWNER'S CONSENT

I, **David Challacomb, President, Mountain Land & Cattle Co.**, CERTIFY that I hold surface rights on the following lands on which **Mountain Cement Company** holds ½ **undivided** mineral estate rights:

SW¼ SW¼ Section 18	T.15 N. R.72W.
~~SE¼, SE¼ SW¼, SW¼ SW¼~~ Section 28	T.15 N. R.72W.

County of Albany.

I have examined the mining plans and reclamation plan prepared by **Mountain Cement Company** in compliance with the Wyoming ENVIRONMENTAL QUALITY ACT, and do hereby approve said plans, and give my consent to enter and carry out said mining and reclamation programs on said lands as proposed therein.

Dated this 22ND day of July, 2010

Surface Land Owner (signature) David G. Challacomb

Printed or Typed Name David G. Challacomb

Amy McGuyre 7/22/2010

Witness Date

TOD AUG 19 RECEIVED

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Rev. 10/99

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SURFACE LANDOWNER'S CONSENT

I, **David Challacomb, President, Mountain Land & Cattle Co.**, CERTIFY that I hold surface rights on the following lands on which **The U.S. Gov't Bureau of Land Management** holds mineral estate rights:

All Section 18 south of Interstate 80 except SW¼ SW¼	T.15 N. R.72W.
E½ Section 20	T.15 N. R.72W.
All Section 28 except NE¼ NE¼, NW¼ NE¼, NE¼ NW¼, ~~SW¼ SW¼, SE¼ SW¼, SE¼~~	T.15 N. R.72W.
All Section 32 except lands conveyed to the Williams Land & Livestock Co.	T.15 N. R.72W.

County of Albany.

I have examined the mining plans and reclamation plan prepared by **Mountain Cement Company** in compliance with the Wyoming ENVIRONMENTAL QUALITY ACT, and do hereby approve said plans, and give my consent to enter and carry out said mining and reclamation programs on said lands as proposed therein.

Dated this 22ND day of July, 2010

Surface Land Owner (signature) David G. Challacomb

Printed or Typed Name DAVID G. CHALLACOMB

Witness Date 7/22/2010

Form 8
Rev. 10/99

5/110

United States Department of the Interior

BUREAU OF LAND MANAGEMENT
Wyoming High Desert District
Rawlins Field Office
1300 North Third Street
P.O. Box 2407
Rawlins, Wyoming 82301-2407

DEC 19 2012

BLM LETTER 12/19/12

BLM

In Reply Refer To:
3800 (WYD03)

CERTIFEID MAIL NO. 7011 1570 0001 2933 8318
RETURN RECEIPT REQUESTED

Mr. Andy MacClugage
Mountain Cement Company
5 Sand Creek Road
Laramie, Wyoming 82070

Dear Mr. MacClugage:

On November 9, 2012, Mountain Cement Company submitted Mine Plan IX for review as a Plan of Operations, as required by the 43 CFR Surface Management Regulations for mining of limestone. This is for lands located in T. 15 N., R. 72 W., sections 7, 17, 18, 19, 20, 21, 28, 29, 30, 31, 32, 33; and T. 15 N., R. 73 W., sections 13, 24, 26, and 36, 6th P.M., Albany County, Wyoming.

Mark Newman, a Bureau of Land Management (BLM) Geologist, discussed the mine plan with you and reviewed the mine sequence section. The information provided indicates new disturbance on lands administered by the BLM will not occur for approximately 60 years. Establishment of a case file is not justified at this time. If changes are made to the mine plan that include mining activity on the BLM-Administered lands earlier than currently projected, a notice or plan must be submitted as required by the 43 CFR 3809 Surface Management Regulations.

If you have any questions, please contact Mark Newman, Geologist, at the address shown above, or telephone (307) 328-4248.

Sincerely,

DJ Carpenter

Dennis J. Carpenter
Field Manager

Insert behind the Last Surface owner Consent Form 8 in the Adjudication file

P.L. #23
Amended April 6, 2000

METALLIC AND NON-METALLIC ROCKS AND MINERALS

Mining Lease

THIS INDENTURE OF LEASE, entered into by and between the STATE OF WYOMING acting by and through its Board of Land Commissioners, party of the first part, hereinafter called lessor, and

Mountain Cement Company, party of the second part, hereinafter called the lessee.

Witnesseth:

Section 1 - PURPOSES. The lessor, in consideration of the rents and royalties to be paid and the covenants and agreements hereinafter contained and to be performed by the lessee, does hereby grant and lease to the lessee the exclusive right and privilege to prospect, mine, extract and remove from any lode, lead, vein or ledge, or any deposit, either lode or placer, and dispose of ~~*all metallic and non-metallic rocks and minerals, with the exception of coal, oil shale, bentonite, leonardite, oil and gas, sand and gravel, or rock crushed for aggregate~~, in or under the following described lands, to-wit:
*Limestone

640.00 All Section 36, Twp 15N, Rg 73W, 6th p.m

consisting of 640.00 acres, more or less, Albany county, together with the right to construct and maintain thereon all works, buildings, plants, waterways, roads, communication lines, power lines, tipples, hoists, or other structures and appurtenances necessary to the full enjoyment thereof, subject however, to the conditions hereinafter set forth;

Section 2 - TERM OF LEASE. This lease unless terminated at an earlier date as hereinafter provided, shall remain in force and effect for a term of
ten (10) years beginning on the 2nd day of October, 2004
and expiring on the 1st day of October, 2014.

Section 3. In consideration of the foregoing, the lessee covenants and agrees as follows:

A. BOND - When the lease becomes an operating lease or actual operations for the mineral are to be commenced, the bond shall be furnished in such reasonable amounts as the Director shall determine to be advisable in the premises. The operating bond shall preferably be a corporate surety bond, executed by the lessee, the surety being authorized to do business in the State of Wyoming. A cash bond may be furnished on consent of the Director if the lessee is unable to obtain a corporate surety bond. Form of bond will be furnished by the Director. The State will require two executed copies of the bond, therefore as many additional copies should be made as will be required by the lessee and the bonding company.

B. PAYMENTS - To make all payments accruing hereunder to the Office of State Lands and Investments 122 West 25th Street, Herschler Building, Cheyenne, Wyoming 82002-0600.

C. RENTALS - Prior to the discovery of commercial quantities of the leased mineral or minerals in the lands herein leased, to pay to the lessor in advance, beginning with the effective date hereof, an

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annual rental of ONE DOLLAR ($1.00) PER ACRE OR FRACTION THEREOF PER YEAR for the 1st through the 5th years inclusive and TWO DOLLARS ($2.00) PER ACRE OF FRACTION THEREOF PER YEAR for the 6th through 20th years inclusive, THREE DOLLARS ($3.00) PER ACRE OR FACTION THEREOF PER YEAR for the 21st through 30th years inclusive, and FOUR DOLLARS ($4.00) PER ACRE OR FARCTION THEREOF for any year beyond the 30th lease year; provided, however, that if the said lands are not on a commercial mining basis and so operated at the end of two (2) years from the date hereof, such rental may be increased at the option of the lessor, to such an amount as the lessor may decide to be fair and equitable. After the discovery of commercial quantities of said mineral or minerals in the lands herein leased to pay to the lessor in advance, beginning with the first day of the lease year succeeding the lease year in which commercial discovery was made, an annual rental of TWO DOLLARS ($2.00) PER ACRE OR FRACTION THEREOF PER YEAR through and including the 20th through 30th years, and FOUR DOLLARS ($4.00) PER ACRE THEREAFTER.

Annual rentals on all leases shall be payable in advance for the first year and each year thereafter. No notice of rental due shall be sent to the lessee. If the rental is not received in this office on or before the date it becomes due, Notice of Default will be sent to the lessee and a penalty of $1.00 per acre or fraction thereof, for late payment will be assessed.

The lessee is not legally obligated to pay either the rental or the penalty, but if the rental and penalty are not received in this office within thirty (30) days after the Notice of Default has been received by the lessee, the lease will terminate automatically by operation of law. Termination of the lease shall not relieve the lessee of any obligation incurred under the lease other than the obligation to pay rental or penalty. The lessee shall not be entitled to a credit on royalty due for any penalty paid for late payment of rental on an operating lease.

D. ROYALTY. Lessee shall pay to lessor:

(1) A royalty of five percent (5%) of the gross value of uranium bearing ore mined and removed from the said lands. Gross value of uranium ore removed from the leased lands shall be the fair market value of ore of like grade and quality for uranium contained therein prevailing in the area of the leased lands at the time of removal. Determination of uranium content for purposes of determining the gross value on which royalty shall be paid shall be made on a calendar monthly basis using a weighted arithmetic average of uranium content on all lots of ore mined and removed from the leased lands during said calendar month. The mineral content of all ore mined and removed from the leased premises shall be determined by lessee in accordance with standard sampling and analysis procedures. Lessor upon request to lessee and at lessor's expense shall have the right to have a representative present at the time samples are taken and, at lessor's request, shall be furnished a portion of all or any samples taken without cost to lessor.

(2) A royalty of one dollar ($1.00) per wet ton (2,000 pounds) on all merchantable sulphur mined, removed, and recovered from the leased lands. If the lessor elects to take its royalty in kind, the royalty shall be five percent (5%) of the merchantable sulphur mined, such sulphur to be good merchantable mine-run sulphur at the mine.

(3) A royalty of five percent (5%) of the quantity or gross value at the mine of all merchantable sodium, calcium carbonate, shortite, potassium, trona and associated mineral salts mined, revolved and recovered from the leased lands; provided, however, that the royalty so paid to lessor shall not be less than twenty-five cents

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(25¢) per ton of 2000 pounds.

(4) A royalty of five percent (5%) of the quantity or gross value at the mine of all merchantable phosphate mined, removed and recovered from the leased lands.

(5) Other unspecified Minerals - Unless a lower royalty is fixed by the Board, in order to allow the economic mining or development of a particular mineral deposit, royalty on all other minerals for which no royalty rate is specified shall be based on Adjusted Sales Value per ton as follows:

Adjusted Sales Value per Ton	Percentage Royalty
$ 00.00 to $ 50.00	5%
$ 50.01 to $100.00	7%
$100.01 to $150.00	9%
$150.01 and up	10%

(a) Determine the Gross Sales Value of all such minerals and/or mineral products from this lease sold during the past calendar month. Such sales value shall be based upon the actual sales value of marketable products as shown by sales receipts. If sales should occur within a company, then prices as published by the Engineering and Mining Journal in the "E" and "MJ" Markets section, or other mutually agreed upon prices shall prevail for determining Gross Sales Value. The Gross Sales Value shall then be divided by the tons of ore processed in that production of mineral and/or mineral products sold - to determine the Gross Sales Value per ton.

(b) Determine the Price Index Factor by dividing the Constant Price Index by the Current Price Index. Both prices indices shall be obtained from the Producer Price Index for all commodities, or its successor index, as published monthly by the United States Department of Labor, Bureau of Labor Statistics. The Constant Price Index shall be the index for the month and year of the lease and the Current Price Index shall be the index for that month for which royalty is being calculated.

(c) Determine the Adjusted Sales Value per ton by multiplying the Gross Sales Value per ton by the Price Index Factor.

(d) The amount of Production Royalty is then the product of the Royalty Rate expressed in decimals to five (5) places and the Gross Sales Value.

After a lease becomes an operating lease, the Board of Land Commissioners may reduce the royalty payable to the State as to all or any of the lands, formations, deposits, or resources covered by the lease, if it determines that such a reduction is necessary to allow the lessee to undertake operations or to continue to operate with a reasonable expectation that the operations will be profitable. Such a reduction in royalty payable to the State shall in all cases be conditioned upon the cancellation of all cost-free interests in excess of 5% and the reduction of all other cost-free interests in the same proportion as the State's royalty is reduced. The Board may also make other requirements as a condition to the reduction in royalty.

If any ore contains more than one of the minerals which are the subject of this paragraph, royalties shall be computed and paid separately under the appropriate rate as to and for each of such minerals, i.e. value of ore as to one mineral shall not be added to value as to another mineral in determining value for royalty purposes. The determination of such mineral content for purposes of determining

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the ore value per ton on which royalty shall be paid shall be made on a calendar monthly basis, using a weighted arithmetic average of said mineral content on all lots of ore mined and removed from the leased lands during said calendar month.

E. LESSOR MAY TAKE ROYALTY IN KIND. At any time and from time to time the lessor may at its option notify the lessee that lessor desires its royalty proceeds to be paid direct to it by the purchaser of the mineral or minerals and lessee agrees promptly upon receipt of such notice to make, execute and deliver in writing to lessor a royalty authorization deduction request on a form approved by lessor requiring the mineral purchaser to pay lessor's royalty direct to it.

F. MONTHLY PAYMENTS AND STATEMENTS. Unless a different time or method of payment is agreed to by the Board, lessee shall make payments in full on or before the twentieth (20th) day of the calendar month succeeding the month of production of all minerals mined and removed from the land; and to furnish sworn monthly statements therewith showing in tons or cubic yards the amount of all ore mined and removed; and such other pertinent information as may be requested of its lessees by the lessor. These statements are to be subject to verification by examination of the relevant books and records of the lessee.

G. WORKINGS.

(1) All mining operations and workings shall be conducted in such a manner so as to remove all commercial quantities of minerals so far as is economically possible in the deposits worked; that all shafts, inclines and tunnels shall be well timbered (when good mining practice requires timbering); that all underground timbering placed in the mines and necessary to the preservation of the property and safety of the workmen shall be kept in good condition and repair and at no time shall such timbering be removed unless all of the commercial quantities of ore has been removed or such removal will in no way or manner interfere with or prevent future mining operations in the land; that at the expiration of this lease, or earlier termination thereof, all underground timberings shall become the property of the lessor without compensation therefore to the lessee; that all parts or workings when the ore is not exhausted and for good reasons not being worked shall be kept free of water and debris; that underground workings will be protected against fire and flood, and creeps and squeezes will be checked without delay, and to leave such pillars as may be necessary to support the cover and protect the slopes, air courses, manways and hauling roads.

(2) That all open or strip-mining operations shall be conducted so as to remove all commercial quantities of minerals so far as is economically possible in the deposits worked; that all waste material mined and not removed from the premises shall, as mining progresses, be used to fill the pits and leveled unless consent of the lessor is otherwise obtained, so that at the expiration, surrender, or termination of the lease, the land will reasonably approximate its original configuration and with a minimum of permanent damage to the surface; that all roads and bridges built and necessary to the mining operations on the land shall, upon expiration, forfeiture or surrender of the said lease, become the property of the lessor.

H. MAPS AND REPORTS. Upon demand, to furnish the Office of State Lands and Investments, copies or blueprints of all maps of underground surveys of leased lands made or authorized by the lessee, including engineer's field notes, certified by the engineer who made such survey; and to make such other reports pertaining to the production and operations by the lessee as may be called for by the lessor.

Copies of all electrical, gamma-ray neutron, resistivity or other

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types of subsurface log reports obtained by or for lessee in conducting operation on the leased premises shall be submitted to the State Geologist as required by W.S. 36-6-102.

I. TAXES AND WAGES - FREEDOM OF PURCHASE. To pay, when due, all taxes lawfully assessed and levied under the laws of the State of Wyoming upon improvements and values produced from the land hereunder, or other rights, property or assets of the lessee; to accord all workmen and employees complete freedom of purchase, and to pay all wages due workmen and employees as required by law.

J. STATUTORY REQUIREMENTS AND REGULATIONS. To comply with all State statutory requirements and valid regulations thereunder.

K. ASSIGNMENT OF LEASE - MINING AGREEMENTS.

(1) Lessee may assign the entire lease with the written consent of lessor, but not any one or more of the minerals which this lease might include, except by assignment of the entire lease.

(2) Lessee shall submit a signed copy of any mining agreement entered into affecting the possessory title to any of the land hereby leased for approval by the lessor.

(3) All overriding royalties to be valid must have the approval of the Board and be noted on the executed lease. The Board reserves the exclusive right of disapproval of such overriding royalties when in its sole opinion they become excessive and hence are detrimental to the proper development of the leased lands.

L. DELIVER PREMISES IN CASE OF FORFEITURE. Subject to the provisions of Section 6 hereof, to deliver the leased lands with all permanent improvements thereon, in good order and condition, in case of forfeiture of this lease, but this shall not be construed to prevent the removal, alteration or renewal of equipment and improvements in the ordinary course of operations.

M. DILIGENCE IN DEVELOPMENT. This lease is granted with the express understanding that prospecting, mining and the recovery of the commercial quantities of minerals in the above described lands shall be pursued with diligence, and if at any time the lessor has reasonable belief that the operations are not being so conducted, it shall so notify lessee in writing, and if compliance is not promptly obtained and the delinquency fully satisfied, it may then, at the end of any lease year, declare this lease terminated. Any improvements that the lessee may have placed on the property shall be disposed of pursuant to Section 6 of this lease.

Section 4. GENERAL COVENANTS

A. Subject to the rules and regulations governing multiple use and development of sub-surface resources, the lessee shall have the right to enter upon, occupy and enjoy such surface areas of the described tract as are necessary for mining, and the construction of all buildings and other surface improvements incidental to the work contemplated by this lease.

The lessee shall fully protect the rights of any agricultural and grazing leases which have heretofore or may hereafter be granted by erecting cattle guards or gates and keeping closed gates in all fences in which openings are or may be made, and for protection of stock grazing thereon to fence or close all holes, pits, shafts, tunnels, or open cuts in which injury might be sustained, and shall not contaminate any living water upon the land so as to make it injurious to livestock.

Should the lessee or any person holding from, by or under the

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lessee, in any operation on said premises under this lease, destroy or injure any crop, building or other improvements of any tenant, lessee, purchaser or other person holding under the State, the lessee agrees to fully indemnify all such injured parties in such sum or sums as may be mutually agreed upon by the respective parties, or as may be fixed by appraisers appointed by each party. If agreement is impossible the Board of Land Commissioners may fix the amount of such indemnity after inspection and Hearing.

Mining operations shall not be conducted nearer than two hundred (200) feet from any productive oil or gas well without consent of the oil and gas lessee or operator. Lessee shall not disturb any existing road or roads now on said lands nor roads leading to or from any mine or well or well location without first providing adequate and suitable roads in lieu thereof. Lessee shall fully indemnify any other sub-surface lessee for any injury or damages resulting from negligent or unauthorized operations hereunder.

B. Relinquishment and Surrender or Forfeiture of this lease shall be in conformance to Section 13 (Relinquishment or Surrender) of the Rules and Regulations Governing the leasing of Metallic and Non-Metallic Rocks and Minerals adopted by the Board of Land Commissioners and the State Loan and Investment Board, effective January 3, 2000.

C. As to mine and personnel safety, all mining operations on these premises shall be subject to the supervision of any official or agency of the State of Wyoming having jurisdiction under the laws of such State.

D. During the proper hours and at all times during the continuance of this lease the lessor or its representatives shall be authorized to go through any of the shafts, openings or working on the premises, and to examine, inspect and survey the same and to make extracts of all books and weigh sheets which show in any way the output from the land.

E. It is expressly understood and agreed that the mining rights and privileges hereunder shall extend to *~~and include all metallic and non metallic rocks and minerals~~, and that no rights or privileges respecting coal oil and gas, oil shale, bentonite, leonardite, zeolite, sand and gravel, or rock crushed for aggregate are granted or intended to be granted by this lease. The lessee shall promptly notify the lessor of the discovery of any minerals upon the leased premises which can be produced in commercial quantities.
*Limestone

F. This lease is granted for the purposes as herein set forth only under such title as the State of Wyoming now holds in and to the minerals that may be found in or under the above described lands, and if it is subsequently divested of same, no liability shall be incurred by virtue of this lease for any loss or damage to the lessee; nor shall any claim for refund of rents or royalties theretofore paid be made by said lessee, its successors or assigns, or be allowed by lessor.

In the event the possession or occupancy of said leased premises is denied or contested, the lessor shall have the right, but not the obligation, and at lessor's election, to undertake to place said lessee in possession by process of law or otherwise, or to defend him in such occupancy.

Section 5. THE LESSOR EXPRESSLY RESERVES:

Disposition of Surface. The right to lease, grant rights-of-way across, sell or otherwise dispose of the surface of the land embraced within this lease and to lease, sell, or otherwise dispose of

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any sub-surface resource not covered by this lease, under existing laws or laws hereafter enacted, or in accordance with the rules of the Board of Land Commissioners insofar as the surface is not necessary for the use of the lessee in mining operations.

Section 6. APPRAISAL OF IMPROVEMENTS. Upon the expiration of this lease or earlier termination thereof pursuant to surrender of forfeiture, or if such land be leased to another other than the owner of the improvements thereon, the lessee agrees that the improvements shall be disposed of pursuant to Title 36, W.S. 1977 as to State and School Lands and Title 11, W.S. 1977 as to State Loan and Investment Board Lands. In the event that within ninety (90) days after the expiration of this lease, or earlier termination thereof pursuant to surrender or forfeiture there is no new lessee of said lands, or of the part thereof on which lessee has caused improvements to be made, then lessee may, within the sixty (60) day period next succeeding said ninety (90) days, cause to be removed from said lands any improvements theretofore made thereon by lessee, provided that lessee shall repair any damage to the land caused by such removal.

Section 7. FORFEITURE CLAUSE. in the event that the Board, after notice and hearing, shall determine that the lessee has procured this lease through fraud, misrepresentation or deceit, then and in that event this agreement, at the option of the lessor, shall cease and terminate and shall become ipso facto null and void and all improvements upon said land or premises under the terms of this lease shall forfeit to and become property of the State of Wyoming.

In the event that the lessee shall fail to make payments of rentals and royalties as herein provided, or make default in the performance or observance of any of the terms, covenants and stipulations hereof, or of the general regulations promulgated by the Board of Land Commissioners and in force on the date hereof, the lessor shall serve notice of such failure or default, either by personal service or by registered mail upon the lessee and if such failure or default continues for a period of thirty (30) days after the service of such notice, then and in that event the lessor may at its option, declare a forfeiture and cancel this lease, whereupon all rights and privileges except those granted in Section 6 hereof, obtained by the lessee hereunder shall terminate and cease and the lessor may re-enter and take possession of said premises or any part thereof, but these provisions shall not be construed to prevent the exercise by the lessor of any legal or equitable remedy which the lessor might otherwise have. A waiver of any particular cause of forfeiture or for the same cause occurring at any other time.

Section 8. HEIRS AND SUCCESSORS IN INTEREST. It is further agreed that each obligation hereunder shall extend to and be binding upon and every benefit hereof shall inure to the heirs, executors, administrators, successors of or assigns of the respective parties hereto.

Section 9. This lease is issued by virtue of and under the authority conferred by Title 36, W.S. 1977 as to the State and School Lands and Title 11, W.S. 1977 as to State Loan and Investment Board Lands and amendments thereto.

Section 10. Sovereign Immunity. The State of Wyoming and the lessor do not waive sovereign immunity by entering into this lease, and specifically retain immunity and all defenses available to them as sovereigns pursuant to Wyoming Statute § 1-39-104(a) and all other state laws.

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IN WITNESS WHEREOF, this lease has been executed by lessor and lessee effective on the day and year first above written.

LESSOR, STATE OF WYOMING, Acting by and through its BOARD OF LAND COMMISSIONERS AND STATE LOAN AND INVESTMENT BOARD

SEAL

By Lynne Boomgaarden
Director,
Office of State Lands and Investments

CORPORATE SEAL

LESSEE:

B. Baly

Board approved:
Examined by:

TFN 5 1/110
RECD OCT 15,2012

LEASE NO.: 0-40958

TYPE OF LEASE: Limestone

NAME OF LESSEE: Mountain Cement Company

ADDRESS: 5 Sand Creek Road
Laramie, WY 82070

EXPIRATION DATE OF LEASE: October 1, 2014

AMOUNT OF RENTAL: $1.00/ACRE 1-5 YEARS PRIOR TO DISCOVERY.

$2.00/ACRE 6-10 YEARS PRIOR TO DISCOVERY.

COUNTY: Albany

FUND: Common School

BOND

TFN 5 1/110
RECD OCT 15,2012

STATE
INVES
2004 OCT 13 AM 9 34

TFN 5 1/110
OCT 15,2012

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JUL 14 2005

APPENDIX AIX

Names and Addresses of last known owners of record of surface and mineral rights within in the permit boundary

Prepared by:
Andy MacClugage
Mountain Cement Company
5 Sand Creek Rd
Laramie, Wyo 82070

Introduction

This appendix contains information pertaining to the original permit area as well as lands through this amendment, the A8 Amendment.

In all parcels encompassed by this application, Mountain Cement possesses the right, through ownership, leases, agreements, and/or federal mining claims, to mine *cement and chemical grade limestone and other valuable mineral deposits,* **except** the mineral estate beneath Mountain Land & Cattle Company surface, where Mountain Cement has the right to mine, through ownership, *all limestone, limestone spalls, calcium carbonate rock, and other elements, minerals, and compounds contained or intermingled within the limestone, limestone spalls, calcium carbonate rock and associated quarry materials.* Additionally, pursuant to a lease with the State of Wyoming, Mountain Cement has the right to mine *limestone* from beneath the State of Wyoming surface estate.

The original permit area and successive amendments are shown on Map EIX-3.

TFN: .....
Approved: .....
Change No. .....

TFN 5 1/110
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Appendix AIX-A- Owners of Record of Surface Rights within the Permit Area

T15N, R72W, 6th P.M. Section 7

Name	Address	City	State	Zip Code
Mountain Land & Cattle Co.	5 Sand Creek Rd	Laramie	Wyo.	82070

T15N, R72W, 6th P.M. Section 17

Name	Address	City	State	Zip Code
Mountain Land & Cattle Co.	5 Sand Creek Rd	Laramie	Wyo.	82070
Mountain Cement Company	5 Sand Creek Rd	Laramie	Wyo.	82070

T15N, R72W, 6th P.M. Section 18

Name	Address	City	State	Zip Code
Mountain Land & Cattle Co.	5 Sand Creek Rd	Laramie	Wyo.	82070
Mountain Cement Company	5 Sand Creek Rd	Laramie	Wyo.	82070

T15N, R72W, 6th P.M. Section 19

Name	Address	City	State	Zip Code
Mountain Cement Co.	5 Sand Creek Rd	Laramie	Wyo.	82070

T15N, R72W, 6th P.M. Section 20

	Name	Address	City	State	Zip Code
W ½	Mountain Land & Cattle Co.	5 Sand Creek Rd	Laramie	Wyo.	82070
E ½	Bureau of Land Management	P.O. Box 670	Rawlins	Wyo.	82301

T15N, R72W, 6th P.M. Section 21

Name	Address	City	State	Zip Code
Mountain Land & Cattle Co.	5 Sand Creek Rd	Laramie	Wyo.	82070

T15N, R72W, 6th P.M. Section 28

Name	Address	City	State	Zip Code
Mountain Land & Cattle Co.	5 Sand Creek Rd	Laramie	Wyo.	82070
Laramie Plains Antenna & TV Association	PO Box 188	Laramie	Wyo.	82070
Bureau of Land Management	P.O. Box 670	Rawlins	Wyo.	82301

TFN: .....
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Change No. .....

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T15N, R72W, 6th P.M. Section 29

Name	Address	City	State	Zip Code
Mountain Land & Cattle Co.	5 Sand Creek Rd	Laramie	Wyo.	82070

T15N, R72W, 6th P.M. Section 30

Name	Address	City	State	Zip Code
Mountain Cement Company	5 Sand Creek Rd	Laramie	Wyo.	82070

T15N, R72W, 6th P.M. Section 31

Name	Address	City	State	Zip Code
Mountain Cement Company	5 Sand Creek Rd	Laramie	Wyo.	82070

T15N, R72W, 6th P.M. Section 32

Name	Address	City	State	Zip Code
Mountain Land & Cattle Co.	5 Sand Creek Rd	Laramie	Wyo.	82070

T15N, R72W, 6th P.M. Section 33

Name	Address	City	State	Zip Code
Mountain Land & Cattle Co.	5 Sand Creek Rd	Laramie	Wyo.	82070

T15N, R73W, 6th P.M. Section 13

Name	Address	City	State	Zip Code
Mountain Land & Cattle Co.	5 Sand Creek Rd	Laramie	Wyo.	82070
Mountain Cement Company	5 Sand Creek Rd	Laramie	Wyo.	82070
Avery, Cindy & Richard	3630 Howe Rd	Laramie	Wyo.	82070

T15N, R73W, 6th P.M. Section 24

Name	Address	City	State	Zip Code
Avery, Cindy & Richard	3630 Howe Rd	Laramie	Wyo.	82070

TFN: .....
Approved: .....
Change No. .....

TFN 5 1/110
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T15N, R73W, 6th P.M. Section 25

Name	Address	City	State	Zip Code
Mountain Cement Co.	5 Sand Creek Rd	Laramie	Wyo.	82070
Barnes, Donald & Yvonda	PO Box 608	Laramie	Wyo.	82073
Barthelmes, Craig P.	130 Antelope Ct.	Laramie	Wyo.	82070
Breyfogle, William	PO Box 22	Centennial	Wyo.	82055
Lane, Phillip A.	5051 Howe Lane	Laramie	Wyo.	82070
Hardy, Scott & Melissa	5200 Howe Lane	Laramie	Wyo.	82070
Steinkraus, Peter & Holly	5949 Howe Lane	Laramie	Wyo.	82070
Davis, Burton & Joann	PO Box 2194	Laramie	Wyo.	82073
Sailors, Erin M	PO Box 1024	Laramie	Wyo.	82070
Colter, Chris & Jenny (trust.)	1332 Grafton St	Laramie	Wyo	82070
Hoopes, Verdon & Debbie	1505 Palomino Dr	Laramie	Wyo.	82070

(listing includes individuals w/ Howe Lane/Permit Haulroad frontage)

T15N, R73W, 6th P.M. Section 26

Name	Address	City	State	Zip Code
State of Wyoming (OSL & I)	Herschler Bldg., 122 W. 25th	Cheyenne	Wyo.	82002
Mountain Cement Company	5 Sand Creek Rd	Laramie	Wyo.	82070
Avery, Cindy & Richard	3630 Howe Rd	Laramie	Wyo.	82070

T15N, R73W, 6th P.M. Section 36

Name	Address	City	State	Zip Code
State of Wyoming (OSL & I)	Herschler Bldg., 122 W. 25th St	Cheyenne	Wyo.	82002

TFN: .....
Approved: .....
Change No. .....

TFN 5 1/110
RECD OCT 15,2012

Appendix AIX-B- Owners of Record of Mineral Rights within the Permit Area

T15N, R72W, 6th P.M. Section 7

Name	Address	City	State	Zip Code
Mountain Cement Co.	5 Sand Creek Rd	Laramie	Wyo.	82070

T15N, R72W, 6th P.M. Section 17

Name	Address	City	State	Zip Code
Mountain Cement Company	5 Sand Creek Rd	Laramie	Wyo.	82070

T15N, R72W, 6th P.M. Section 18

Name	Address	City	State	Zip Code
Mountain Cement Company	5 Sand Creek Rd	Laramie	Wyo.	82070
Bureau of Land Management	P.O. Box 670	Rawlins	Wyo.	82301
½ Mountain Cement & ½ Piper	c/o Mountain Cement 5 Sand Creek Rd	Laramie	Wyo.	82070

T15N, R72W, 6th P.M. Section 19

Name	Address	City	State	Zip Code
Mountain Cement Co.	5 Sand Creek Rd	Laramie	Wyo.	82070

T15N, R72W, 6th P.M. Section 20

Name	Address	City	State	Zip Code
Bureau of Land Management	P.O. Box 670	Rawlins	Wyo.	82301

T15N, R72W, 6th P.M. Section 21

Name	Address	City	State	Zip Code
Mountain Cement Co.	5 Sand Creek Rd	Laramie	Wyo.	82070

T15N, R72W, 6th P.M. Section 28

Name	Address	City	State	Zip Code
Mountain Cement Company	5 Sand Creek Rd	Laramie	Wyo.	82070
Bureau of Land Management	P.O. Box 670	Rawlins	Wyo.	82301
½ Mountain Cement & ½ Piper	c/o Mountain Cement 5 Sand Creek Rd	Laramie	Wyo.	82070

TFN: .....
Approved: .....
Change No. .....

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T15N, R72W, 6th P.M. Section 29

Name	Address	City	State	Zip Code
Mountain Cement Company	5 Sand Creek Rd	Laramie	Wyo.	82070

T15N, R72W, 6th P.M. Section 30

Name	Address	City	State	Zip Code
Bureau of Land Management	P.O. Box 670	Rawlins	Wyo.	82301

T15N, R72W, 6th P.M. Section 31

Name	Address	City	State	Zip Code
Mountain Cement Company	5 Sand Creek Rd	Laramie	Wyo.	82070

T15N, R72W, 6th P.M. Section 32

Name	Address	City	State	Zip Code
Bureau of Land Management	P.O. Box 670	Rawlins	Wyo.	82301

T15N, R72W, 6th P.M. Section 33

Name	Address	City	State	Zip Code
Mountain Cement Co.	5 Sand Creek Rd	Laramie	Wyo.	82070

T15N, R73W, 6th P.M. Section 13

Name	Address	City	State	Zip Code
Mountain Cement Company	5 Sand Creek Rd	Laramie	Wyo.	82070

T15N, R73W, 6th P.M. Section 24

Name	Address	City	State	Zip Code
Avery, Cindy & Richard (Piper heir)	3630 Howe Rd	Laramie	Wyo.	82070
Mountain Cement Company	5 Sand Creek Rd	Laramie	Wyo.	82070
Bureau of Land Management	P.O. Box 670	Rawlins	Wyo.	82301

TFN: .....
Approved: .....
Change No. .....

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T15N, R73W, 6th P.M. Section 25

Name		Address	City	State	Zip Code
E ½	Union Pacific Land Resources	1717 Main Street, Suite 5900	Dallas	Texas	75201
Barnes, Donald & Yvonda		PO Box 608	Laramie	Wyo.	82073
Barthelmes, Craig P.		130 Antelope Ct.	Laramie	Wyo.	82070
Breyfogle, William		PO Box 22	Centennial	Wyo.	82055
Lane, Phillip A.		5051 Howe Lane	Laramie	Wyo.	82070
Hardy, Scott & Melissa		5200 Howe Lane	Laramie	Wyo.	82070
Davis, Burton & Joann		PO Box 2194	Laramie	Wyo.	82073
Hoopes, Verdon & Debbie		1505 Palomino Dr	Laramie	Wyo.	82070

T15N, R73W, 6th P.M. Section 26

Name	Address	City	State	Zip Code
State of Wyoming (OSL & I)	Herschler Bldg., 122 W. 25th	Cheyenne	Wyo.	82002
Avery, Cindy & Richard	3630 Howe Rd	Laramie	Wyo.	82070

T15N, R73W, 6th P.M. Section 36

Name	Address	City	State	Zip Code
State of Wyoming (OSL & I)	Herschler Bldg., 122 W. 25th St	Cheyenne	Wyo.	82002

Bureau of Land Management Minerals listed above are subject to Mountain Cement Company mining claims.

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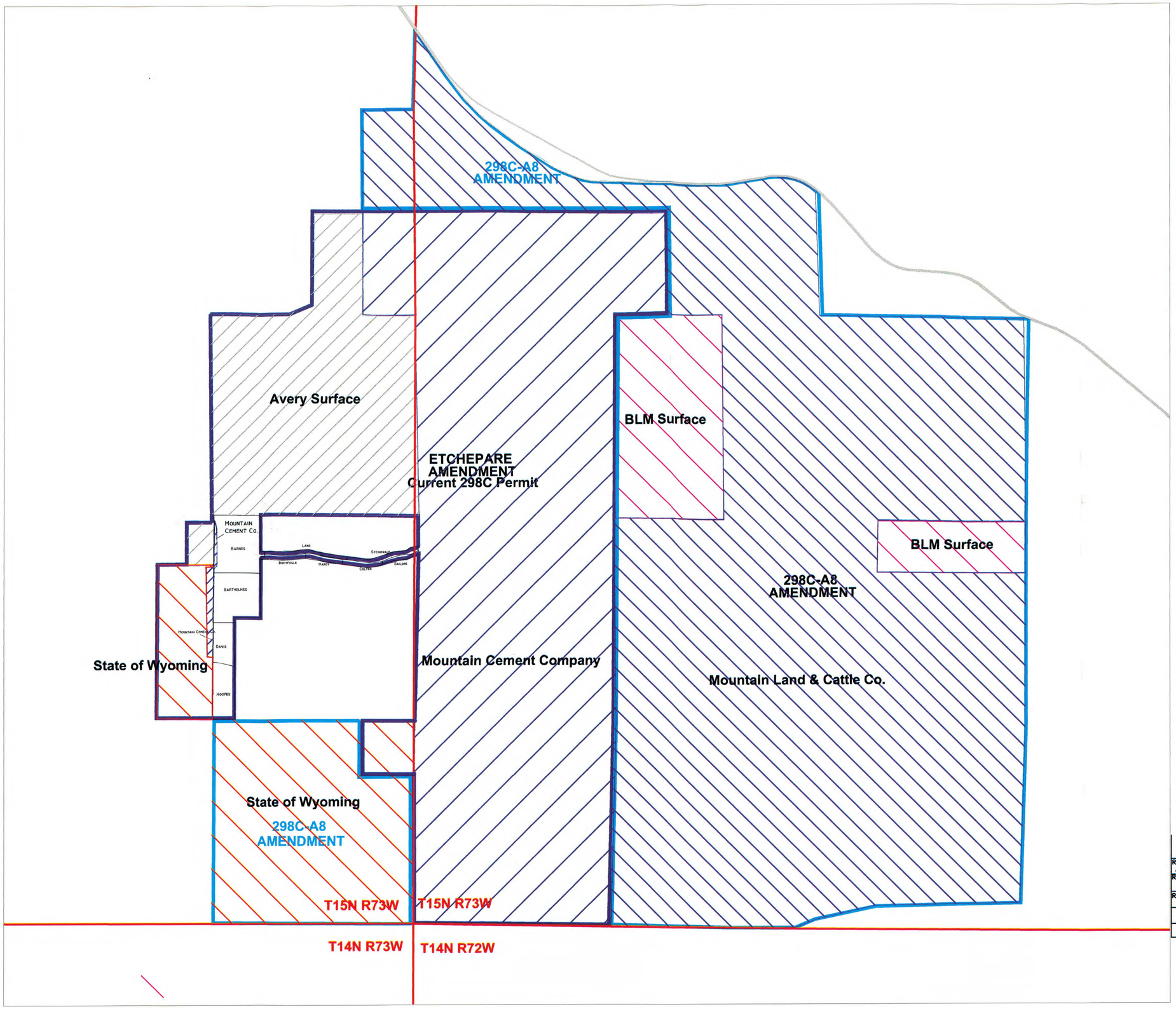

LEGEND

- Permit Boundary
- Proposed Permit Boundary
- Avery Surface
- BLM Surface
- Mountain Cement Surface
- Mountain Land & Cattle Co.
- State of Wyoming Surface
- Highway Interstate 80
- Steinkraus — Summit Estates Homeowner Surfaces

0 — 1,320 feet — 2,640 feet — 1 mile

N

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RECD MAR 07, 2013

Appendix AIX Map AIX-1

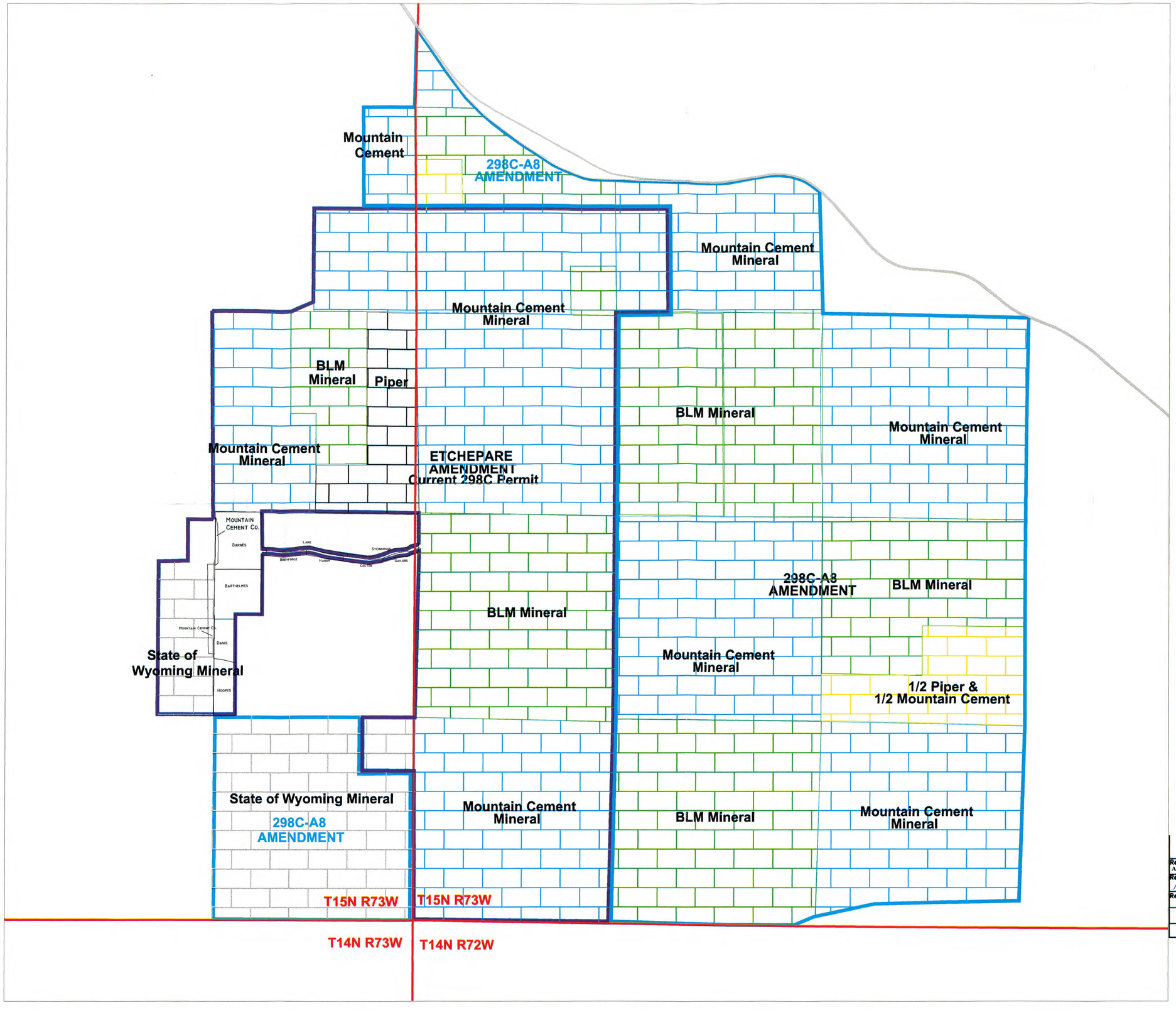
Surface Owners of Record within the Permit Area

Permit # 298C-A8

Etchepare Limestone Quarry

Revised By:	Date:	Mountain Cement Company	Design By:	Date:
AHM	10/10/12		AHM	10/26/2009
Revised By:	Date:		Drawn By:	Date:
AHM	2/10/13		AHM	10/26/2009
Revised By:	Date:		Checked By:	Date:

5 Sand Creek Rd.
Laramie, Wyo. 82070
(307) 745-2687



LEGEND

- Permit Boundary
- Proposed Permit Boundary
- BLM Mineral
- 1/2 Piper & 1/2 Mountain Cement Mineral
- Mountain Cement Mineral
- Piper Mineral
- Steinkraus — Summit Estates Surface Ownership
- Highway Interstate 80

T15NR73W Section 25 Mineral Ownership;
East half- Union Pacific Land Resources
West half- Union Pacific Land Resources minerals below 7300 feet. Minerals belong to the Surface Estate above 7300 feet.

0 — 1,320 feet — 2,640 feet — 1 mile

N

TFN 5 1/110
RECD MAR 07, 2013

Appendix AIX Map AIX-2

Mineral Owners of Record within the Permit Area

Permit # 298C-A8

Etchepare Limestone Quarry

Revised By: AHM Date: 10/10/12	Mountain Cement Company	Design By: AHM Date: 10/26/2009
Revised By: AHM Date: 2/10/13	5 Sand Creek Rd. Laramie, Wyo. 82070 (307) 745-2687	Drawn By: AHM Date: 10/26/2009
Revised By: Date:		Checked By: Date:

TFN 5 1/110
RECD OCT 15, 2012

APPENDIX BIX

Names and Addresses of last known owners of record of surface rights within ½ mile of permit boundary

Introduction

This appendix contains information pertaining to the original permit area as well as lands through this amendment, the A8 Amendment.

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Appendix BIX

T15N, R72W, 6th P.M.

Section	Last Name	First Names	c/o	Mailing Address	City	State	Zip
7	Heard	George E. & Anna Maria		P.O. Box 2228	Laramie	WY	82073
7	Etchepare Jr. Revocable Trust	Paul G.	Paul G. Etchepare Jr., Trustee	P.O. Box 1163	Laramie	WY	82073
7	Hansen	William L. & Nancy B.		6323 Grandview Drive	Laramie	WY	82070
7	Bienz	Thomas A. & Karen R.		1826 Beaufort	Laramie	WY	82072
7	Pilot Peak LLC			1960 US HWY 85	Cheyenne	WY	82009
8	JHD Ranch LLC			1960 US HWY 85	Cheyenne	WY	82009
9	Lodgepole Ranch LLC			1960 US HWY 85	Cheyenne	WY	82009
15	United States Forest Service		Laramie Ranger District	2468 Jackson St	Laramie	Wy	82070
16	State of Wyoming		Off. of State Lands & Investments	Herschler Building 3-W	Cheyenne	Wy	82002
17	Lodgepole Ranch LLC			1960 US HWY 85	Cheyenne	WY	82009
18	Warren Livestock, LLC			1961 US HWY 85	Cheyenne	WY	82009
22	United States Forest Service		Laramie Ranger District	2468 Jackson St	Laramie	Wy	82070
27	United States Forest Service		Laramie Ranger District	2468 Jackson St	Laramie	Wy	82070
34	United States Forest Service		Laramie Ranger District	2468 Jackson St	Laramie	Wy	82070
33	Mountain Land & Cattle Co.		Laramie Ranger District	2468 Jackson St	Laramie	Wy	82070
33	Ganfield	Roger A.		P.O. Box 850	Guernsey	WY	82214
33	DeJohn	Kenneth D.		3236 E Grand Ave H-188	Laramie	WY	82070

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33	DeJohn	Kenneth D.		3236 E Grand Ave H-188	Laramie	WY	82070

T14N, R72W, 6th P.M.

Section	Last Name	First Names	c/o	Mailing Address	City	State	Zip
3	Kline	Margaret		PO Box 785	Laramie	WY	82073
3	Adams	Mary P & John P	Mary P & John P	1204 Adams Ave	Rock Springs	WY	82901
3	Dzialak	Matthew		PO Box 430	Laramie	WY	82073
3	Schaaf	Joseph G & Eva M		PO Box 658	Laramie	WY	82073
3	DeVore	Michael A		PO Box 1148	Laramie	WY	82073
3	Maurer	Darren L & Emily J		PO Box 260034	Lakewood	CO	80226
4	Ganfield	Roger A.		P.O. Box 850	Guernsey	WY	82214
4	DeJohn	Kenneth D.		3236 E Grand Ave H-188	Laramie	WY	82070
4	Myers	Sandra A & John E.		P.O. Box 543	Laramie	WY	82073
4	Young	Maude E.		12545 Northlake Court	Fairfax	VA	22033
4	Pearson, Michael A.	Hemenover, William & Bottorff, Terry		1424 W. 31st Street	Cheyenne	WY	82001
4	Rollin	Robert Leon		2640 S Hubbard Rd	Lowellville	OH	44436
4	Johnson	Elliott E. & Elizabeth H.		P.O. Box 1655	Laramie	WY	82073
4	Rollin	Bernard E. & Linda M.		2101 E County Road 30	Fort Collins	CO	82525
4	Pajak	Mark W. & Nancy R.		1422 Bridger Rd	Laramie	WY	82070
5	Cotton Holdings, LLC			5520 Yellowstone Rd	Cheyenne	WY	82009
5	Cotton	Kathryn E. & Jean K.		2019 Carls Rd	Cheyenne	WY	82009
5	Cotton Holdings, LLC		Avenues Pet Clinic	5520 Yellowstone Rd	Cheyenne	WY	82009
5	DeJohn	Kenneth D.		3236 E Grand Ave H-188	Laramie	WY	82070
5	Cotton Holdings, LLC			5520 Yellowstone Rd	Cheyenne	WY	82009
5	Boysen Revocable Trust		Robert D. & Penny B. Boysen	P.O. Box 1691	Laramie	WY	82073
5	Hargraves	Garrie D. & Pamela E.		1402 Koster Rd	Cheyenne	WY	82009
5	Hargraves	Kent & Sandra		1064 S Davenport Dr.	Grantsville	UT	84029
5	Hargraves	Garrie D. & Pamela E.		1402 Koster Rd	Cheyenne	WY	82009
6	Cotton Holdings, LLC			5520 Yellowstone Rd	Cheyenne	WY	82009

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T15N, R73W, 6th P.M.

Section	Q-Q	Last Name	First Names	c/o	Mailing Address	City	State	Zip
35		Smallwood	Jason & Stacey		64 Paradise Valley Rd	Laramie	WY	82070
35		Brown	Shawn M., Gary & Mary F.		40 Paradise Valley Rd	Laramie	WY	82070
35		Brisendine	Michael R & Michelle		54 Paradise Valley Rd	Laramie	WY	82070
35		Clute	John A. & Sara D.		222 Mountain Air Drive	Laramie	WY	82070
35		Ullrich	John A & Tracy A		27 Laredo Dr	Laramie	WY	82070
35		Brown	Gary R. & Mary F.		9 Paradise Valley Rd	Laramie	WY	82070
35		Paintin	James A. & Jo Marie		14 Paradise Valley Rd	Laramie	WY	82070
35		Trotter	Richard L. & Diane H.		21 Trotter Ln.	Laramie	WY	82070
35		Rollin H. Abernethy Living Trust	Carolyn A. Abernethy Living Trust		12 Trotter Ln	Laramie	WY	82070
35		Reilly	William Alan		133 Mountain Air Dr	Laramie	WY	82070
35		Pawlowski	Clara M.		P.O. Box 1825	Laramie	WY	82070
35		Schutz	Marvin P & Mary Jo		7903 Powderhouse Rd	Cheyenne	WY	82009
35		Ibarra	Mario A. & Troy J.		118 Mountain Air Rd	Laramie	WY	82070
26		State of Wyoming			Herschler Bldg	Cheyenne	WY	82002
26		Avery	Richard & Cindy		3630 Howe Rd	Laramie	WY	82070
26	SENE, NESE	Mountain Cement Company		David Challacomb	5 Sand Creek Rd	Laramie	WY	82070
25		Watikus	Brian R.		P.O. Box 1411	Laramie	WY	82073
25		Barlow	William A. & Lynnette L.		64 Eagles Nest Lane	Laramie	WY	82070
25		Sandra B. Brome Living Trust	Sandra B. Brome		P.O. Box 2104	Laramie	WY	82073
25		Hoopes	Verdon & Debbie		1505 Palomino Dr	Laramie	WY	82070
25		Davis	Burton S. & Joann B.		P.O. Box 2194	Laramie	WY	82073
25		Uren	W. Richard & Mickey Ann		67 Eagle Nest Ln	Laramie	WY	82070
25		Carolyn B. Miller Living Trust	Richard H. Miller Living Trust		101 Eagle Nest Lane	Laramie	WY	82070
25		Sailors	Erin M.		5710 Howe Rd	Laramie	WY	82070
25		Colter	Chris & Jenny Revocable Trust		1332 Grafton	Laramie	WY	82070
25		Hardy	Scott & Melissa		5200 Howe Rd	Laramie	WY	82070
25		Breyfogle	William		P.O. Box 22	Centennial	WY	82055
25		Barnes	Donald J. & Yvonda D.		P.O. Box 608	Laramie	WY	82073
25		Barthelmes	Craig P. & Beyer, Edith A.		130 Jackalope Ct	Laramie	WY	82070

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25		Lane	Phillip A		5051 Howe Lane	Laramie	WY	82070
25		Steinkraus	Peter B. & Holly B.		5949 Howe Lane	Laramie	WY	82070
25	NWNW	Mountain Cement Company		David Challacomb	5 Sand Creek Rd	Laramie	WY	82070
24		Avery	Richard & Cindy		3630 Howe Rd	Laramie	WY	82070
23		Matthew Brown Revocable Trust			680 State Rd 344	Edgewood	NM	87015
23		Hughes	Harlan & Lois		30 Ramble A Rd	Laramie	WY	82070
23		Bonham	Peavy B. & Jennifer B.		4271 Howe Rd	Laramie	WY	82070
23		Prahl	Kevin L. & Joanne M.		4310 Howe Rd	Laramie	WY	82070
23		Kersting	James Patrick		4230 Howe Rd	Laramie	WY	82070
23		Pantier	Vincent M. & Marti S.		4100 Howe Rd	Laramie	WY	82070
23		Strom	Richard E.		P.O. Box 1513	Palmer Lake	CO	80133
23		Martin	Tom		4285 Soldier Springs Rd	Laramie	WY	82070
23		Helling	Ronert F. & Carolyn W.		P.O. Box 762	Laramie	WY	82073
23		Henschel	Howard L. & Nanette R.		3725 Howe Ln	Laramie	WY	82070
23		City of Laramie				Laramie	WY	82070
23		Williams	Paul A. & Judy L.		122 Satanka Road	Laramie	WY	82070
23		Gonzales	Ronert L. & Jane R.		105 Satanka Road	Laramie	WY	82070
23		Webb	Eric B & Kathleen L.		5720 Gap Rd	Laramie	WY	82070
23		Doyle	Mark W. & Lynnette A.		P.O. Box 2292	Laramie	WY	82070
23		Weibel	Torry & Julia		5602 Gap Rd	Laramie	WY	82070
14		City of Laramie			406 Invison	Laramie	WY	82070
14		Carson	Jay G. & Cinthy A.		3025 Pope Springs Rd	Laramie	WY	82070
14		Carson	Jay G. & Cinthy A.		3025 Pope Springs Rd	Laramie	WY	82070
14		Carson	Jay G. & Cinthy A.		3025 Pope Springs Rd	Laramie	WY	82070
13		Gapter	Douglas L. & Kelly D.		35 Targhee	Laramie	WY	82070
13		Walsh	Jerry B.		4820 Vista Dr	Laramie	WY	82070
13		Walsh	Jerry Travis & Aimee		4630 Vista Dr	Laramie	WY	82070
13		Walsh Children Trust		Walsh, Jerry Travis & Aimee	4630 Vista Dr	Laramie	WY	82070
13		Luhr	Suzanne C. & Wesley L.		603 S 12th	Laramie	WY	82070
13		Moore, Robert A.	Moldenhauer, Susan B.		4024 Pope Springs Rd	Laramie	WY	82070
13		Avery	Richard & Cindy		3630 Howe Rd	Laramie	WY	82070
13	NESE,	Mountain Cement Company		David Challacomb	5 Sand Creek Rd	Laramie	WY	82070

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13	SESE NESE, SESE	Nature Conservancy			258 Main St, Ste #200	Lander	WY	82520
13		Mountain Land & Cattle Company		David Challacomb	5 Sand Creek Rd	Laramie	WY	82070
13		Daie	Daniel & Kimberly		5146 Piper Rd	Laramie	WY	82070
13		Avery	Richard & Cindy		3630 Howe Rd	Laramie	WY	82070
13		Lazy JW Investment Company, LLC			4630 Vista Dr	Laramie	WY	82070
13		Dale	Daniel A. & Kimberly A. H.		5146 Piper Rd	Laramie	WY	82070
13		Sinner	Leonard A. Jr.		600 S 2nd St	Laramie	WY	82070
13		Swierczek	Clinton Andrew & Dennie Lynn		P.O. Box 2497	Laramie	WY	82070
13		Avery	Richard & Cindy		3630 Howe Rd	Laramie	WY	82070
13		Christensen	David J & Susan T		4388 Vista Dr	Laramie	WY	82070
12		Grand Avenue Corporation			1404 Grand Ave	Laramie	WY	82070
12		Grand Avenue Corporation			1404 Grand Ave	Laramie	WY	82070
12		Grand Avenue Corporation			1404 Grand Ave	Laramie	WY	82070
12		Grand Avenue Corporation			1404 Grand Ave	Laramie	WY	82070
12		Grand Avenue Corporation			1404 Grand Ave	Laramie	WY	82070
12		Grand Avenue Corporation			1404 Grand Ave	Laramie	WY	82070
12		Grand Avenue Corporation			1404 Grand Ave	Laramie	WY	82070
12		Grand Avenue Corporation			1404 Grand Ave	Laramie	WY	82070
12		Kaltenbach	C. Colin & Ruth H.		727 E Via Entrada	Tucson	AZ	85718
12		Constantinides	Christos T. & Janet C.		5110 Summit Dr	Laramie	WY	82070
12		Constantinides	Christos T. & Janet C.		5110 Summit Dr	Laramie	WY	82070
12		Constantinides	Christos T. & Janet C.		5110 Summit Dr	Laramie	WY	82070
12		Constantinides	Christos T. & Janet C.		5110 Summit Dr	Laramie	WY	82070
12		Constantinides	Christos T. & Janet C.		5110 Summit Dr	Laramie	WY	82070
12		Constantinides	Christos T. & Janet C.		5110 Summit Dr	Laramie	WY	82070
12		Castano	Matthew F. G		3630 Juniper	Laramie	WY	82070
12		Schroyer	Gordon L. & Julie M.		5300 Canyon Ranch Rd	Laramie	WY	82070
12		Herbert D. Pownall Revocable Trust	Pownall, Herbert D.		5000 Sunset Dr	Laramie	WY	82070
12		March	Jeffery J. & Cindy L.		3926 Canyon Court	Laramie	WY	82070
12		Aukerman	Ryan A.		1520 Boswell Ct	Laramie	WY	82070

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12	Jacobs	James J. & Carol A.		3542 Sage Drive	Laramie	WY	82070
12	Ainsworth	Scott & Penne		5710 E Skyline Dr	Laramie	WY	82070
12	Williams	Shannon Marie		3445 Evergreen	Laramie	WY	82070
12	Callaway Revocable Trust	Callaway, Wayne & Peggy		3401 Juniper Dr	Laramie	WY	82070
12	Callaway Revocable Trust	Callaway, Wayne & Peggy		3401 Juniper Dr	Laramie	WY	82070
12	Callaway Revocable Trust	Callaway, Wayne & Peggy		3401 Juniper Dr	Laramie	WY	82070
12	Callaway Revocable Trust	Callaway, Wayne & Peggy		3401 Juniper Dr	Laramie	WY	82070
12	Callaway Revocable Trust	Callaway, Wayne & Peggy		3401 Juniper Dr	Laramie	WY	82070
12	Callaway Revocable Trust	Callaway, Wayne & Peggy		3401 Juniper Dr	Laramie	WY	82070
12	Callaway Revocable Trust	Callaway, Wayne & Peggy		3401 Juniper Dr	Laramie	WY	82070
12	Callaway Revocable Trust	Callaway, Wayne & Peggy		3401 Juniper Dr	Laramie	WY	82070
12	Callaway Revocable Trust	Callaway, Wayne & Peggy		3401 Juniper Dr	Laramie	WY	82070
12	Walden	William E. & Mary S.		3428 Sage Dr	Laramie	WY	82070
12	Scherer	Robert L. II		P.O. Box 2060	Laramie	WY	82073
12	David E. Walrath Living Trust	Christel B. Walrath Living Trust		3429 Wyatt Ct	Laramie	WY	82070
12	Guice	Jimmy D. & Robyn A.		P.O. Box 310	Laramie	WY	82073
12	Olsen	Ronald H. & Anne T.		4848 Sage Dr	Laramie	WY	82070
12	Machalek, Richard S.	Barnes, Donna A.		4915 Sunset Dr	Laramie	WY	82070
12	Haefner	John A. & R. Renee		4825 Sunset Dr	Laramie	WY	82070
12	Fisher	James R.		3220 Sage Dr	Laramie	WY	82070
12	Knopp	Larry V. & Roxi A.		4919 Wyatt Ct	Laramie	WY	82070
12	Ferris	Thomas J. & Rebecca L.		3001 Sage Dr	Laramie	WY	82070
12	Novak	Lance		5306 Skyline Dr	Laramie	WY	82070
12	Lindahl	Peter M. & Joanne H.		5415 Meadow Lane	Laramie	WY	82070
12	Sundial Acres, Inc.		Malin, James	P.O. Box 1135	Hockessin	DE	19707
12	Higham	Jill		5315 Meadow	Laramie	WY	82070
12	Root	Margaret L.		3049 Sage Dr	Laramie	WY	82070
12	Johnson	James A. & Deanna S.		5203 Meadow Lane	Laramie	WY	82070
12	Jairell	Ronald E. & Barbara A.		5330 Meadow Lane	Laramie	WY	82070
12	Fry	Harry Keener Jr. & Lisa S.		4935 Valley View	Laramie	WY	82070
12	Hedley	Frank A. & Connie L.		3125 Sage Dr	Laramie	WY	82070
12	Wilkerson	Gary C. & Norma N.		5410 Meadow Lane	Laramie	WY	82070

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12	Moffett	Mark A. & Mary B. Ruskey-Moffett		5520 Skyline Dr	Laramie	WY	82070
12	Martin	William P		5530 Skyline Dr	Laramie	WY	82070
12	McLean	Howard Lee & Katherine		5301 Wabash Ave	Terre Haute	IN	47803
12	Wykert	Wade D.		5445 Valley View	Laramie	WY	82070
12	Sage Ramblings		Wade D. & Cony L. Wykert	5445 Valley View	Laramie	WY	82070
12	Mountain West Farm Bureau		Mutual Insurance Company	P.O. Box 1348	Laramie	WY	82073
12	Kerr	Greg & Dianna		15 Kerr	Laramie	WY	82070
12	Johnson	Ory Joe		3215 Sage	Laramie	WY	82070
12	Kite	Byra A. III		3333 Sage Dr	Laramie	WY	82070
12	Montgomery	Donald L. & Carol L.		3350 Mesquite Lane	Laramie	WY	82070
12	Rogers	Rodney D. & Mary N.		3320 Mesquite Lane	Laramie	WY	82070
12	Bressler	Wesley R. & Lurlene		3228 Mesquite Lane	Laramie	WY	82070
12	Schutterle	Robert J. & Kacee K.		1613 Hackney Dr	Laramie	WY	82070
12	Jauncey	William T & Marcia B	William T. Jauncey	3204 Mesquite Lane	Laramie	WY	82070
12	Buckner	Kim & Laura C.		5010 Valley View Rd	Laramie	WY	82070
12	Nichols	Alan W. & Andrea C. Devita		3213 Mesquite Lane	Laramie	WY	82070
12	Caithlin G. Grimes Revocable Trust	Grimes, Caithlin G. & Deirdre Odwyer		3317 Mesquite Lane	Laramie	WY	82070
12	Baltimore	Jeffrey A.		4848 Juniper Dr	Laramie	WY	82070
12	Arbour	Vincent P.		111 Ivinson	Laramie	WY	82070
12	Robbins	Craig D & Paula L		5148 Valley View Rd	Laramie	WY	82070
12	Rhodine	Brent N. & Karen E.		3203 Juniper Dr	Laramie	WY	82070
12	Scott	Walter D. & Suzanna L. Penningroth		3213 Juniper Dr	Laramie	WY	82070
12	Wechsler	Perry J.		4810 Ponderosa Lane	Laramie	WY	82070
12	Wechsler	Perry J.		4810 Ponderosa Lane	Laramie	WY	82070
12	Covell	James R.		3345 Juniper Dr	Laramie	WY	82070
12	Foulke	Thomas K.		4812 Ponderosa Lane	Laramie	WY	82070
12	Espinoza, Angela K. & Henry P.	Alyx Mauk		3204 Ponderosa Lane	Laramie	WY	82070
12	Monroe	Timothy Earl & Ruth		3203 Ponderosa Lane	Laramie	WY	82070
12	Bredehoft	Roger A. & Wendy E.		4803 Ponderosa Lane	Laramie	WY	82070
12	Frank	Alan & Cheri C.		3305 Ponderosa Lane	Laramie	WY	82070
12	Marshall	Kent G. & Janice J.		5505 Sunset Dr	Laramie	WY	82070
12	Marshall	Kent G. & Janice J.		5505 Sunset Dr	Laramie	WY	82070

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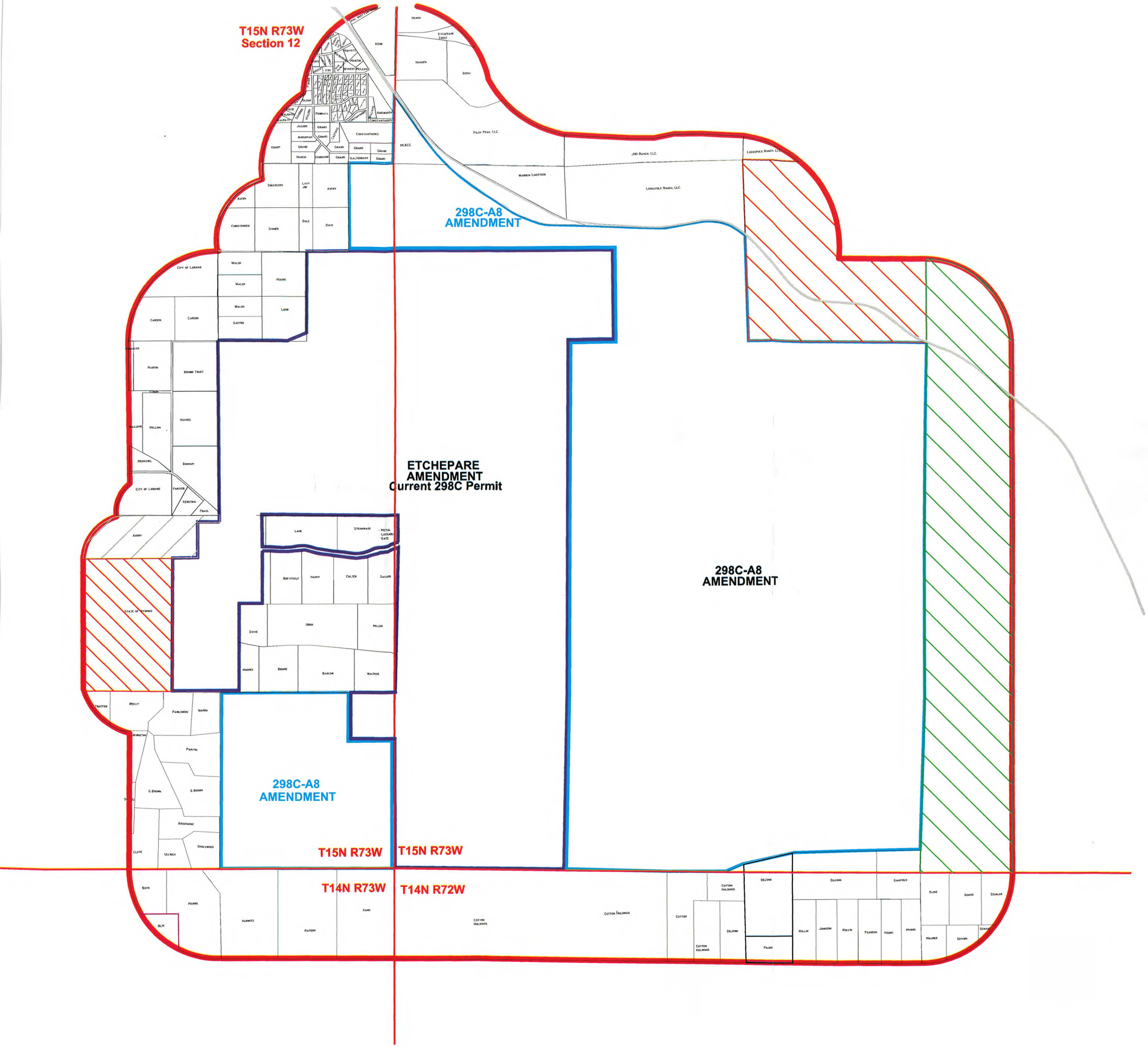
12	Reif	F. David & Ilona J.	3340 Aspen Lane	Laramie	WY	82070
12	Brian	Daniel P. & Debra L.	4808 Aspen Lane	Laramie	WY	82070
12	David G. Earnshaw Living Trust	Jean L. Earnshaw Living Trust	3220 Aspen Lane	Laramie	WY	82070
12	Richards	Mary	3202 Aspen Lane	Laramie	WY	82070
12	Wallen	David F.	3201 Aspen Lane	Laramie	WY	82070
12	O'Donnell	Gregory W. & Debra L.	P.O. Box 1021	Laramie	WY	82070
12	Rovani	Joseph R. Jr. & E. Margarita	5635 Sunset Dr	Laramie	WY	82070
12	Jenkins	Vicki & Mark Wheelis	2525 9th Ave West	Seattle	WA	98119
12	Petrie	Connie M. & James C.	4804 Evergreen Dr	Laramie	WY	82070
12	Paul	Margret M	3210 Evergreen Dr	Laramie	WY	82070

T14N, R73W, 6th P.M.

Section	Last Name	First Names	c/o	Mailing Address	City	State	Zip
1	Gaddis	Jenelle		182 Paradise Valley Rd	Laramie	WY	82070
1	Rapson	David J. & Shelley Fahnanstiel		170 Paradise Valley Rd	Laramie	WY	82070
1	Hurwitz	Caroline Elizabeth	Caroline Elizabeth Hurwitz Trust	809 Ord St	Laramie	WY	82070
1	Kuhn	Vicki S.		PO Box 2870	Cheyenne	WY	82003
2	Ronald Wayne Maars Trust	Glenna Louise Maars Trust		376 Gilmore Gulch	Laramie	WY	82070
2	Michael R. Boyd Living Trust		Michael R. & Cynthia S. Boyd	350 Gilmore Gulch	Laramie	WY	82070
2	Bureau of Land Management		Great Divide Resource Office	P.O. Box 670	Rawlins	WY	82301

* Surface ownership records within a ½ mile of proposed permit boundary obtained from the County Assessor's Office, revised summer 2012.



LEGEND

- Permit Boundary
- Proposed Permit Boundary
- Half Mile Boundary
- State of Wyoming Surface
- U.S. Forest Service Surface
- Highway Interstate 80

0 — 1,320 feet — 2,640 feet — 1 mile

N

TFN 5 1/110
RECD MAR 07, 2013

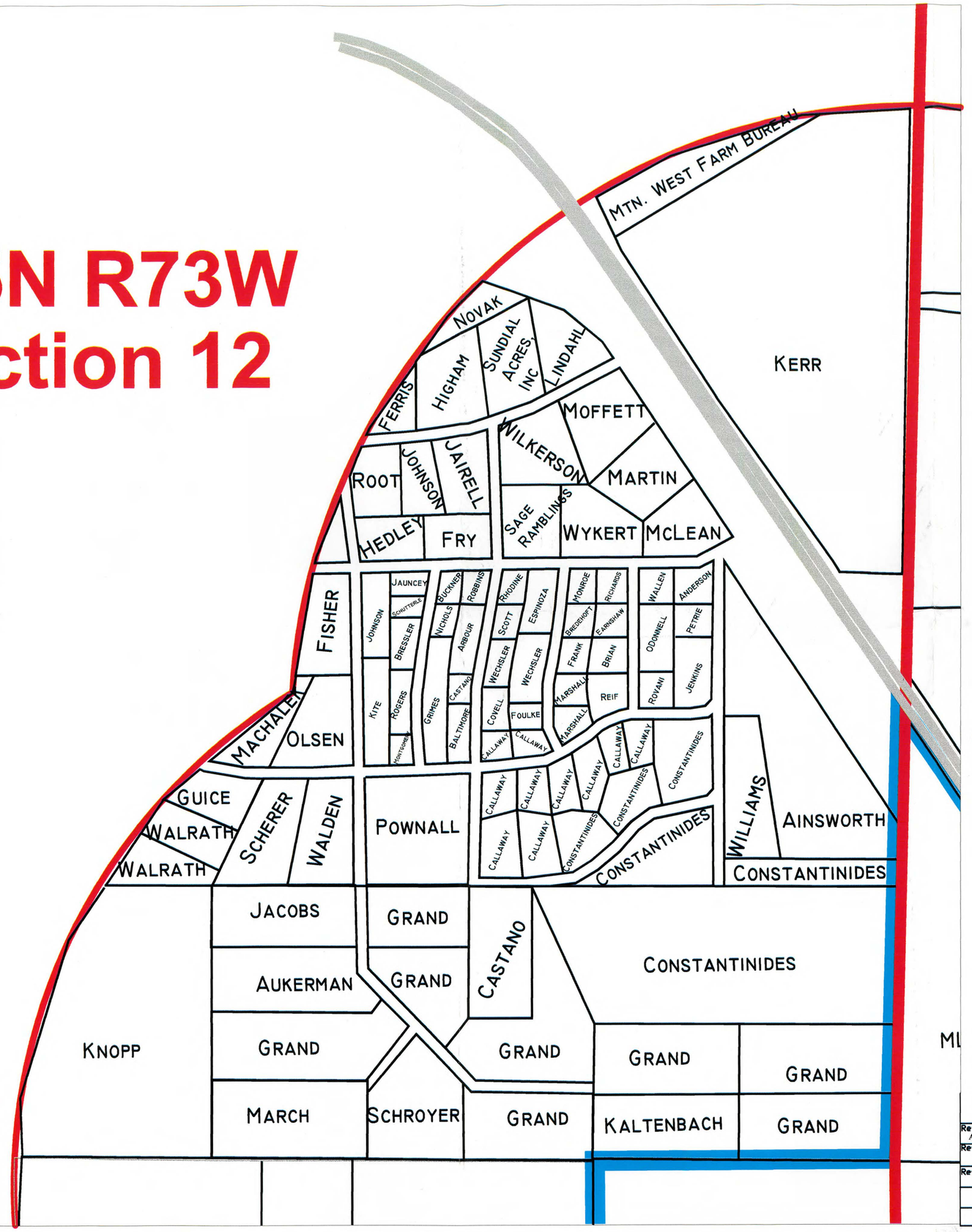
Appendix BIX Map B1

Surface Owners of Record Adjacent to the Permit Area

Permit # 298C-A8
Etchepare Limestone Quarry

Revised By:	Date:	Mountain Cement Company	Design By:	Date:
ADN	08/22/2012		AHM	08/22/2012
Revised By:	Date:	5 Sand Creek Rd. Laramie, Wyo. 82070 (307) 745-2687	Drawn By:	Date:
AHM	2/11/13		AHM	08/22/2012
Revised By:	Date:		Checked By:	Date:

T15N R73W
Section 12



LEGEND

- Proposed Permit Boundary
- Half Mile Boundary
- Highway Interstate 80

0 330 660 1,320 feet

N

TFN 5 1/110
RECD MAR 07, 2013

Appendix BIX Map B2

Surface Owners of Record Adjacent to the Permit Area
T15N R73W Section 12

Permit # 298C-A8
Etchepare Limestone Quarry

Revised By: AHM Date: 2/10/13	Mountain Cement Company 5 Sand Creek Rd. Laramie, Wyo. 82070 (307) 745-2687	Design By: AHM Date: 12/8/09
Revised By: Date:		Drawn By: AHM Date: 12/8/09
Revised By: Date:		Checked By: Date:

APPENDIX CIX

Tabulation of Lands

Mountain Cement Co.

Etchepare Limestone Quarry

Permit #298C-A8

Prepared By:
Mountain Cement Co
Laramie, Wyoming
June 2010

Introduction

This appendix contains information pertaining to the original permit area as well as lands through this amendment, the A8 Amendment. Areas that have been already been mined and reclaimed are tabulated in Appendix C-3, as Mountain Cement no longer has any right to mine on them.

TFN 5 1/110
RECD OCT 15, 2012

Do not make corrections to this form after printing. Forms bearing strikeouts, ink changes, etc will not be accepted.

APPENDIX "C"

Bearing and distance Description

This appendix "C" represents the location of lands by legal subdivision, section, township, range, county, and municipal corporation, if any, (W.S. §35-11-406,(a),(vi)) and the number of acres in each bearing and distance description. No mining activity may take place on land for which there is not in effect a valid mining permit (W.S. §35-11-405). To include additional lands within a permit area it is necessary to amend the permit (W.S. §35-11-406,(a),(xii)), so care should be taken to include all lands necessary to the mining operation as defined in W.S. §35-11-103,(e),(viii). Each description should state the acreage encompassed by the description and the total permit acreage should be stated. An original U.S.G.S. topographic map with the permit area clearly outlined should accompany each permit application.

Appendix C-1
298C-A8 Permit Area
Etchepare Quarry

T15N, R73W, 6th P.M.

Section	Quarter-Quarter	Acres
13	NENE, .SENE, NESE, SESE, SWSE, NWSE	240
24	ALL	640
25	W½SW¼SW¼, W½NW¼SW¼, SWNW, NWNW, Haulroad Easement	127
26	SESE, NESE, SENE, E½NE¼NE¼ minus northern 200'	137
36	ALL	640
	Total:	***1784 Acres***

T15N, R~~73~~72W, 6th P.M.

Section	Quarter-Quarter	Acres
7	Tracts in SWSW, NWSW, SESW	29.25
17	SWSW, NWSW, NESW, SESW, NWSE, SWSE, SESE, NESE, Tracts in SWNW, SENW, SWNE, SENE south of Interstate 80 Right-of-Way	395.73
18	ALL minus Tracts within and north of the I-80 Right-of-Way lying within the NENW, NWNE,NENE, SENE,SWNE	516.29
19	ALL	624.3
20	ALL	640
21	ALL	638.5
28	ALL	640
29	ALL	640
30	ALL	626.39
31	ALL	623.86
32	ALL minus Tracts in the SESE	638
33	ALL minus Tracts in SESE, SWSE, SESW, SWSW	576.81
	Total:	***6589.13Acres***

Sum: ***8373.13 Acres***

TFN 5 1/110
OCT 15, 2012

COUNTY of **Albany**
Municipal Corporation
Reviewed (compiled), DEQ/LQD_____
Date_____

Checked, DEQ/LQD _____
Date_____

Subtotal Above Acres 5021
Total Permit (Amendment) Acres 5021
Applicant Signature _____
Date _____
Permit No. **298C-A8**
TFN **5 1/110**
Page

TFN 5 1/110
RECD OCT 15, 2012

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APPENDIX "C"

Bearing and distance Description

This appendix "C" represents the location of lands by legal subdivision, section, township, range, county, and municipal corporation, if any, (W.S. §35-11-406,(a),(vi)) and the number of acres in each bearing and distance description. No mining activity may take place on land for which there is not 0in effect a valid mining permit (W.S. §35-11-405). To include additional lands within a permit area it is necessary to amend the permit (W.S. §35-11-406,(a),(xii)), so care should be taken to include all lands necessary to the mining operation as defined in W.S. §35-11-103,(e),(viii). Each description should state the acreage encompassed by the description and the total permit acreage should be stated. An original U.S.G.S. topographic map with the permit area clearly outlined should accompany each permit application.

Appendix C-2
298C-A8 Permit Area
Right-to-Mine Claim
Etchepare Expansion

T15N, R73W, 6th P.M.

Section	Quarter-Quarter	Acres
13	NENE, SENE	80
36	ALL minus the northern 200' of section (24.0 Acres)	616
	Total:	***696 Acres***

T15N, R72W, 6th P.M.

Section	Quarter-Quarter	Acres
7	Tracts in SWSW, NWSW, SESW	29.25
17	SWSW, NWSW, NESW, SESW, NWSE, SWSE, SESE, NESE, Tracts in SWNW, SENW, SWNE, SENE south of Interstate 80 Right-of-Way	395.73
18	SWSW	80
19	ALL	624.3
20	ALL minus NENW	600
21	ALL	638.5
28	ALL minus 1 acre Tract in the NESE (Laramie Plains TV)	639
29	ALL	640
30	ALL minus NWNW, SWNW, NWSW, SWSW	466.39
31	ALL	623.86
33	ALL minus Tracts in SESE, SWSE, SESW, SWSW	576.81

Total: ***5313.84 Acres***
Sum: ***6009.84 Acres***

COUNTY of **Albany**
Municipal Corporation
Reviewed (compiled), DEQ/LQD_____
Date_____

Checked, DEQ/LQD _____
Date_____

Subtotal Above Acres **4104**
Total Permit (Amendment) Acres **5021**
Applicant Signature _____
Date _____
Permit No. **298C-A8**
TFN 5 1/110
Page

Permit 298C-A8
Etchepare LS Quarry
Revised: May 3, 2012

TFN 5 1/110
Approved:_____

TFN 5 1/110
RECD OCT 15, 2012

TFN 5 1/110
RECD OCT 15,2012

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APPENDIX "C"

Bearing and distance Description

This appendix "C" represents the location of lands by legal subdivision, section, township, range, county, and municipal corporation, if any, (W.S. §35-11-406,(a),(vi)) and the number of acres in each bearing and distance description. No mining activity may take place on land for which there is not in effect a valid mining permit (W.S. §35-11-405). To include additional lands within a permit area it is necessary to amend the permit (W.S. §35-11-406,(a),(xii)), so care should be taken to include all lands necessary to the mining operation as defined in W.S. §35-11-103,(e),(viii). Each description should state the acreage encompassed by the description and the total permit acreage should be stated. An original U.S.G.S. topographic map with the permit area clearly outlined should accompany each permit application.

Appendix C-3
298C-A8 Permit Area
No Right-to-Mine Claim
Etchepare Expansion

T15N, R73W, 6th P.M.

Section	Quarter-Quarter	Acres
13	NESE, SESE, SWSE, NWSE	160
24	ALL- MINED & RECLAIMED/NO AGREEMENT	640
25	W½SW¼SW¼, W½NW¼SW¼, SWNW, NWNW, Haulroad Easement-MINED & RECLAIMED/NO AGREEMENT	127
26	SESE, NESE, SENE, E½NE¼NE¼ minus northern 200' - MINED & RECLAIMED/NO AGREEMENT	137
36	Northern 200' of section- BUFFER ZONE	24
	Total:	***1088 Acres***

T15N, R72W, 6th P.M.

Section	Quarter-Quarter	Acres
18	ALL minus SWSW	436.29
20	NENW	40
28	Laramie Plains Antenna 1 Acre in NESE	1
30	NWNW, SWSW, NWSW, SWSW	160
32	ALL	638
	Total:	***1275.29 Acres***
	Sum:	***2363.29 Acres***

COUNTY of **Albany**

Subtotal Above Acres **917**

Permit 298C-A8
Etchepare LS Quarry
Revised: May 2012

TFN 5 1/110
Approved:_____

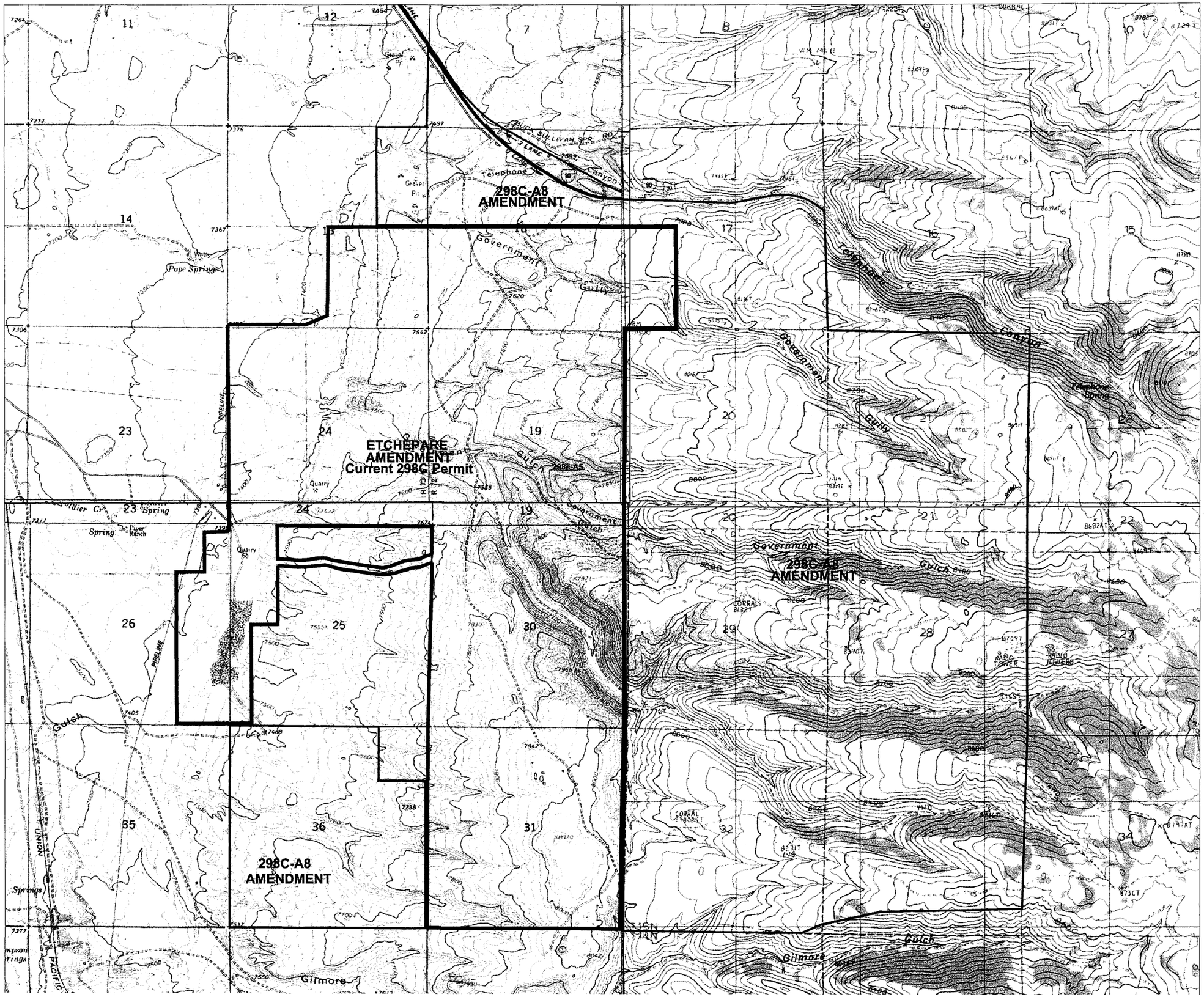
TFN 5 1/110
OCT 15, 2012

Municipal Corporation
Reviewed (compiled), DEQ/LQD_____
Date_____

Checked, DEQ/LQD _____
Date_____

Total Permit (Amendment) Acres **5021**
Applicant Signature _____
Date _____
Permit No. **298C-A8**
TFN 5 1/110
Page of

TFN 5 1/110
OCT 15, 2012



LEGEND

Proposed 298C-A8 Amendment Areas

Current 298C Permit Boundary

RECEIVED
APR 6 2010
WDEQ/LQD

N

5'/110

1/4 mile 1/2 mile 1 mile
1320 ft 2640 ft 5280 ft

Appendix CIX Map C1

Lands within Amendment Area

Permit # 298C-A8

Etchepare Limestone Quarry

Revised By: Date:	Mountain Cement Company 5 Sand Creek Rd. Laramie, Wyo. 82070 (307) 745-2687	Design By: AHM Date: 12/15/09	
Revised By: Date:		Drawn By: AHM Date: 12/15/09	
Revised By: Date:		Checked By: Date:	

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TFN 5 1/110
RECD AUG 4 2011

APPENDIX DIX1

LAND USE

Mountain Cement Company

Etchepare Limestone Quarry

Prepared by:

Mountain Cement Company
Laramie, Wyoming

TFN .....
Approved:_____

TFN 5 1/110
RECD OCT 15, 2012

February 2010

Adapted From:
Intermountain Resources
DVII1 Land Use
October 1995

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LAND USE
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MAPS

Map DIX1-1. Site Location
Map DIX1-2. Land Uses

APPENDIX DIX1

LAND USE

DIX1.0 Location

The Mountain Cement Company Etchepare Limestone Quarry site is located in Albany County in southeastern Wyoming about 5 miles southeast of Laramie, Wyoming off of Howe Road. The current permit area is located in Sections 17, 18, 19, 30, and 31 T15N R72W and Sections 13, 24, and 25 T15N R73W. The amendment area is 4960 acres located in Sections 7, 17, 18, 20, 21, 28, 29, 33, and 32 T15N R72W and Sections 13 and 36 T15N 73W. The mining areas are, for the most part, located on the east-west running ridge tops. There will be a total of approximately 145 acres disturbed for haulroad between current and proposed roads. Map DIX1-1 shows the exact location of the amendment and affected areas. The remainder of the amendment area is a buffer of undisturbed land surrounding the affected area. This buffer has been included to preclude

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RECD OCT 15,2012

developments which may impact the project.

DIX1.1 Regional Land Use

For decades, the primary land use in Albany County has been for agricultural purposes (approximately 1.7 million acres) which accounts for nearly all of the total private land use in the county. Rangeland makes up the largest portion of agricultural use with about 92 percent. Livestock production, primarily cattle, is the predominant use of the rangeland. Some areas are also used for sheep production. The remaining eight percent of the agricultural sector is comprised of cropland, improved pasture, woodlands, fallow and idle cropland. Hay constitutes the major cultivated crop in the county and is comprised mostly of irrigated fields producing native hay. Very little alfalfa hay is produced in the county.

DIX1.2 Land Use - Past & Present

Presently, the greater portion of the affected area exists as native rangeland represented by several vegetation/habitat types as discussed in Appendix DIX8. Photographs of the area are also provided in Appendix DIX8. The land use was, and continues to include joint uses by livestock grazing and wildlife habitat. Land uses in the vicinity of the amendment area include mining, transportation (Interstate 80), telecommunication lines and a housing development. These areas are shown on Map DIX1-2.

DIX1.2.1 Grazing Practices

The land occupied by the amendment area has been owned or operated by Warren Land and Livestock Company for over 20 years. Mountain Cement now owns the land where the amendment area lays. Mountain Cement Company has an agreement with Warren land and livestock to allow the continuation of their prior grazing practices. The area has been grazed by sheep during various periods in the past based on ranch operations. Currently the area is used as late spring-early fall pasture for ewes with lambs. All flocks of sheep are managed by herders. Stocking rates are generally light but vary with forage conditions and ranch objectives. Pronghorn antelope and a few mule deer also frequent the area for forage. The rangeland is generally in good condition.

DIX1.2.2 Mining

The adjacent areas to the west and south have a past and current history of mining by Mountain Cement Company and their predecessors. Limestone has been mined in those areas and used in the plant, located due south of Laramie, for the production of cement. Currently approved mining operations are shown on Map DIX1-1 in Sections 18, 19, 30, and 31 T15N R72W and Section 36 T15N R73W. A total of seven separate limestone quarry sites are shown on the map. Also shown on the map are the reclaimed Piper and Warren limestone quarries. Mining operations have occurred in the area for over 3O years. There are 4 additional quarry sites, 3 of which are in the amendment area, that have been operated in the past by WYDOT and others for highway and general construction, these are shown on the map in Sections 12 and 13 T15N R73W and Section 21 T15N R72W..

DIX1.2.3 Pipelines and Telecommunications Lines

No gas pipelines or water pipelines exist within one mile of the affected areas. Only one

commercial telecommunications line and several residential communication lines are located within one mile of the proposed quarries. None of the lines are located within the affected areas; however the commercial telecomm line does boundary the northern edge of the No. 6 pit. The operators will be contacted directly and/or through the "one call" system and advised of Mountain Cement Company's proposed operation. Blasting is the only concern of the operators and additional information will be sent to the concerned parties when quarries are operated near their lines. This information will included a map of the proposed affected area location and a copy of the blasting plan.

DIX1.2.4 Dwellings

Dwellings and other buildings are currently located in the residential areas shown on Map DIX1-1. There are several residential areas adjacent to or near the amendment area. Areas where homes will be closest to the affected areas are to the west and the south; to the west the residential areas include Summit Estates and housing on or near Howe Road. To the south the residential areas consist of homes located on or near Paradise Valley and Indian Springs Roads. To the north, the closest homes are located on Chinook Drive, Piper Road, and Sage Drive. Many of the lots to the south and west share a common property line with Mountain Cement Company. There are no dwellings immediately to the due north of the amendment area because it is grazing land for the Pilot Peak, J.H.D., and Lodgepole Ranches. There are no dwellings immediately to the east because it is U.S. Forest Service Property.

DIX1.2.5 Visual Impacts

The proposed affected areas are located along the west facing slope of the Laramie range.

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Portions of the operation may be visible to current and future home builders on the adjacent residential areas. Some of the quarries may also be visible from the city of Laramie, Highway 287 and Interstate 80. Currently existing quarries are actually closer in proximity and view of the highways, residential areas and the city of Laramie than most of the quarry sites proposed for this permit. Additional visual impacts from the proposed mine sites will be negligible since they are small and scattered. Though the sheer size of the amendment area is very large, the yearly disturbance visible will be minute in comparison to the Laramie Mountains on which the small pits will exist.

DIX1.3 Prime Farmland

Prime farmland does not exist on the area or in Albany County due to the relatively dry conditions and short growing season.

DIX1.4 Sources

- Intermountain Resources, 1995. Mountain Cement Co, Etchepare Mine Permit Application, Appendix DVII1 Land Use, 10/1995.

- Albany County, 1995. Albany County Courthouse, Records of the

TFN 5 1/110

County Clerks Office

- United States Department of Agriculture, Soil Conservation Service, 511 1/2 Ivinson Avenue, Laramie, Wyoming, Personal Communication

- Warren Land and Livestock Company, 1995. Personal Communications with Mr. John Etchepare.

- Wyoming Agricultural Statistics, Wyoming Crop and Livestock Reporting Service, Cheyenne, Wyoming 82003

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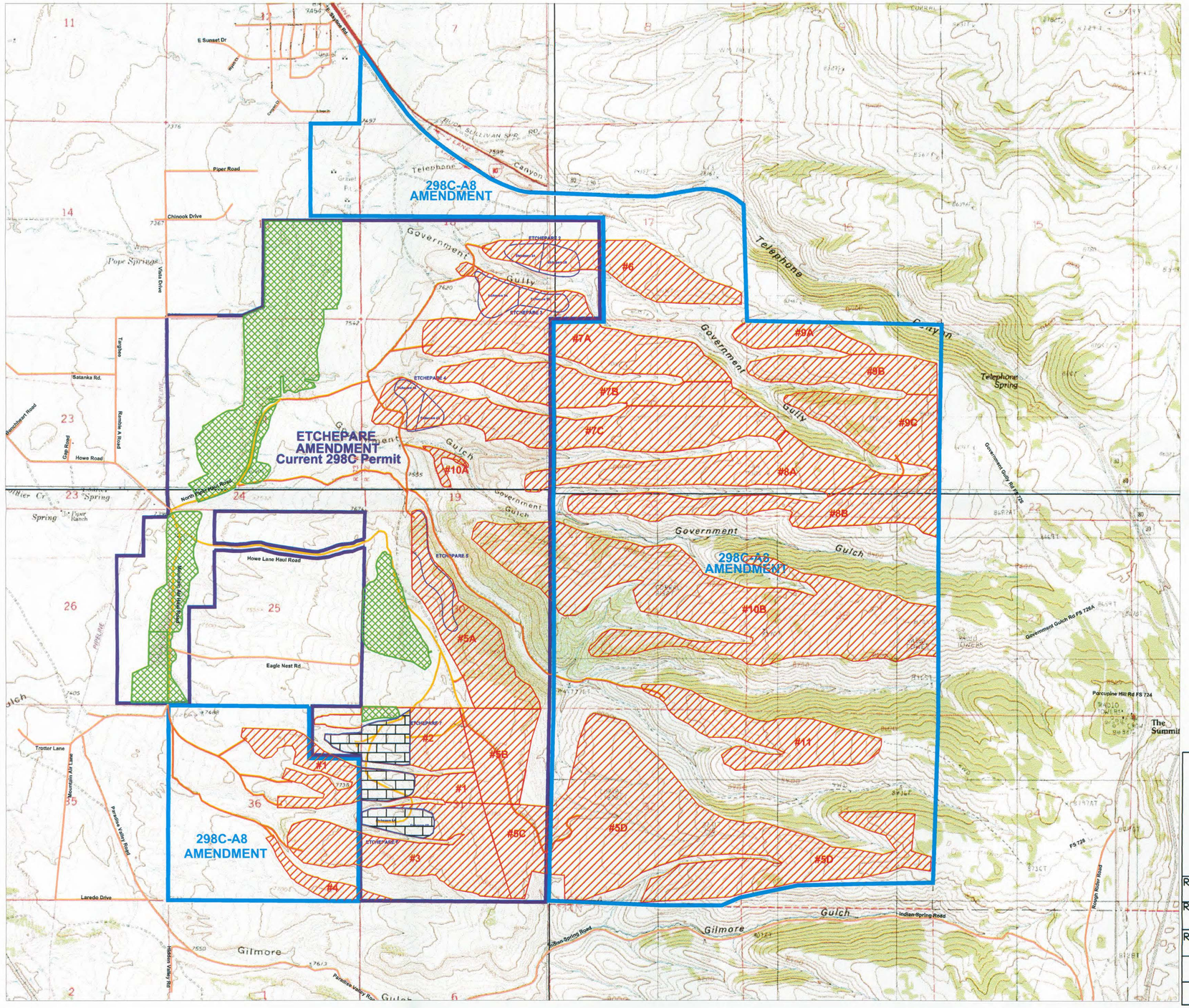


LEGEND

- Proposed 298C-A8 Amendment Areas
- Currently Approved 298C Permit Area
- #6 Proposed 298C-A8 Disturbance Areas
- Current Haul Roads
- Proposed 298C-A8 Haul Roads
- Current Residential Roads
- Current U.S. Forest Service Roads
- Previously Disturbed/Reclaimed Areas (North Piper, South Piper, Warren, Etchepare 7A)
- Currently Disturbed Areas (Etchepare 7B, 7C, 6A, 6B, Area C)
- Currently Approved Affected Areas (Etchepare & Area C Amendments)

N

0 — 1,320 feet — 2,640 feet — 1 mile

Land Use Map DIX1-1

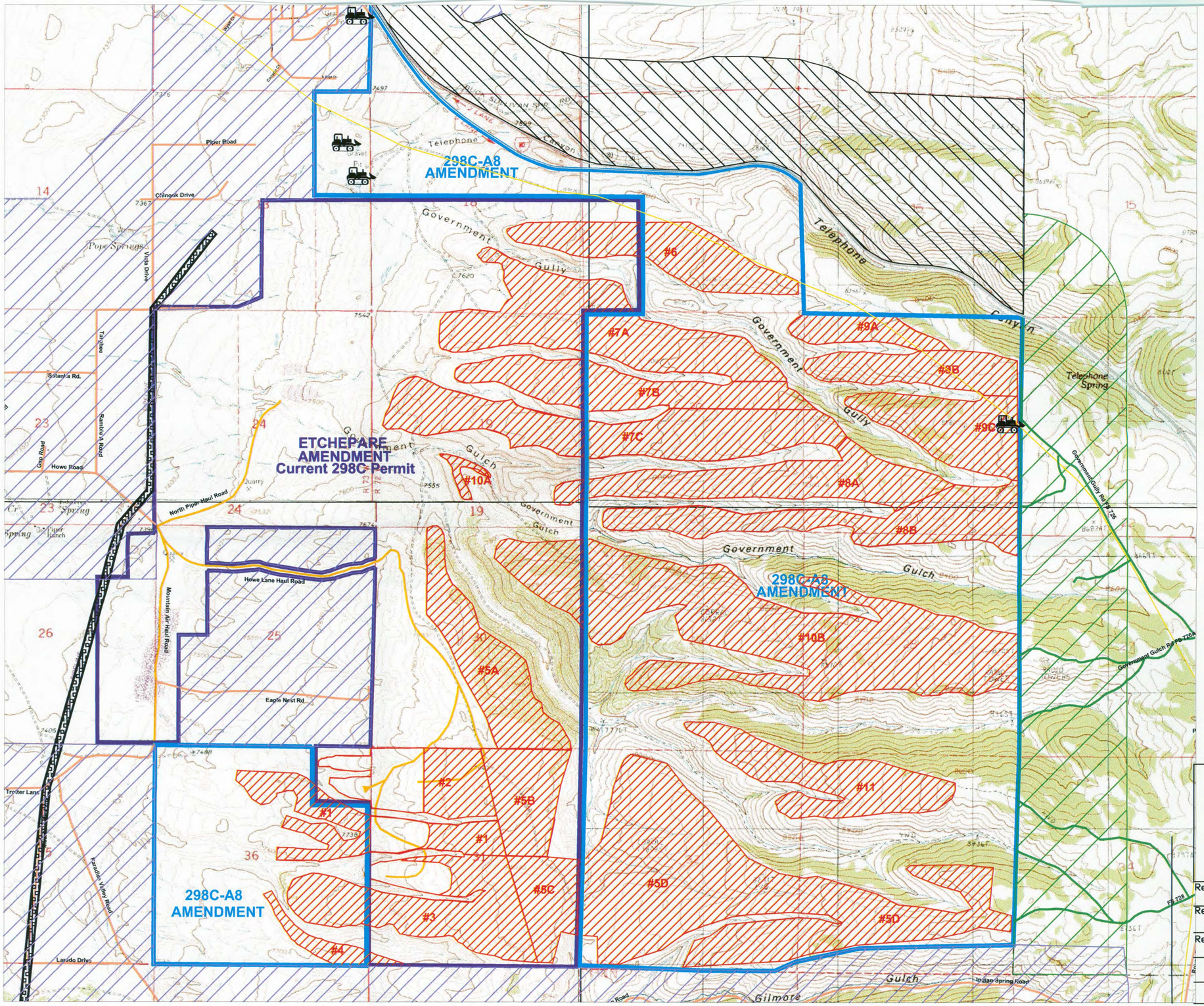
Site Map

Permit # 298C-A8

Etchepare Limestone Quarry

TFN 5 1/110
OCT 15, 2012

Revised By:	Date:		Design By:	Date:
AHM	10/10/12	Mountain Cement Company	AHM	2/23/10
Revised By:	Date:	5 Sand Creek Rd. Laramie, Wyo. 82070 (307) 745-2687	Drawn By: AHM	Date: 2/23/10
Revised By:	Date:		Checked By:	Date:



LEGEND

- Current Haul Roads
- Current Residential Roads
- Current U.S. Forest Service Roads
- Proposed 298C-A8 Amendment Areas
- Currently Approved 298C Permit Area
- #6 Proposed 298C-A8 Disturbance Areas
- Residential Areas near Amendment Area
- Grazing Areas near Amendment Area
- U.S. Forest Service (Public Use)
- Former mine sites (non-Mountain Cement)
- AT&T Fiberoptic Cable
- Pipeline Corridor
- U.S. Interstate Route 80

N

0 — 1,320 feet — 2,640 feet — 1 mile

Land Use Map DIX1-2

Land Uses

Permit # 298C-A8

TFN 5 1/110
OCT 15, 2012

Etchepare Limestone Quarry

Revised By:	Date:	Design By:	Date:
AHM	8/12/10	AHM	2/23/10
Revised By:	Date:	Drawn By: AHM	Date: 2/23/10
Revised By:	Date:	Checked By:	Date:

Mountain Cement Company
5 Sand Creek Rd.
Laramie, Wyo. 82070
(307) 745-2687

APPENDIX DIX2

BRIEF HISTORY

Mountain Cement Company

Etchepare Limestone Quarry

TFN 5 1/110
RECD OCT 15,2012

Prepared by:
Mountain Cement Company
Laramie, Wyoming
February 2010

Adapted From:
Intermountain Resources
Laramie, Wyoming
October, 1995

TFN 5 1/110
OCT 15, 2012

APPENDIX DIX2

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MAPS

No Maps

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APPENDIX DIX2

BRIEF HISTORY

DIX2.1 Location

The Etchepare limestone quarry is located in Albany County approximately 5 miles southeast of Laramie off of Howe road. The current permit area is located in Sections 17, 18, 19, 30, and 31 T15N R72W and Sections 13, 24, and 25 T15N R73W. The amendment area is 4960 acres located in Sections 7, 17, 18, 20, 21, 28, 29, 33, and 32 T15N R72W and Sections 13 and 36 T15N 73W; totaling approximately 8373 acres. The total permit area is bounded immediately to the north by Interstate 80 and immediately to the east by the U.S. Forest Service National Forest. The proposed amendment and affected areas are shown on Map DIX2-1.

DIX2.2 Pre-historic Inhabitants

The first inhabitants of North America, and direct ancestors of the American Indians, crossed the Bering Strait from Asia over 20,000 years ago. Archeological finds indicate human presence in Wyoming as long as 11,500 years ago. One site near Laramie, called the Jimmy Allen site, was excavated and date ancient people living there approximately 7,900 years ago.

Most of the inhabitants left the region approximately 6,000 years ago because

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climatic changes turned the area to desert. The climate improved about 4,500 years ago and people returned. Archeological artifacts have been studied which show that ancient people inhabited Wyoming from that time until the first white man visited the country.

DIX2.3 First White Visitors

The first white men visited Wyoming in the late 1700's and early 1800's. The first visitors were mainly explorers and were followed by traders and trappers. It has been estimated that during the 1830's there may have been two hundred fur traders in Wyoming at one time.

DIX2.4 Albany County History

The City of Laramie was originally established in 1868 and Albany County was formed later that year. This was the result of major activity on the Overland Trail (1862 - 1868) and construction of the Union Pacific Railroad through the area (1867 - 1868). The early economy of the area consisted of livestock, lumbering, and activities associated with the railroad.

Minerals were also important economically to the County in the late 1800's. Mining activities were related to gypsum, gold, coal, copper, natural soda, cement, and stone for building.

Since 1900 Albany County has observed economic and population trends relative to the region and nation as a whole. These have been triggered by the various wars, recessions,

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depressions, and energy booms and busts. Mining is limited primarily to hard rock quarries with limestone, gypsum, sandstone, and shale excavated for a local cement plant. Oil is produced in the northwest part of the county. Major industry is not present, however, the University of Wyoming helps to maintain a fairly stable economy.

DIX2.5 Project Location History

The proposed amendment and surrounding area is rangeland and has been used historically by wildlife and for grazing livestock. Quarries have also existed in the area for over 30 years. These quarries have primarily provided aggregate for highway construction and limestone for the cement plant. The historic Cheyenne Pass Trail crosses the amendment area through the northern portion of Section 20. This road was also known as the Lodgepole Creek Trail and was used in the mid to late 1800's and early 1900's. The trail was used to supply troops at Fort Sanders located immediately south of the current site of Laramie, carry ties for the construction of the railroad and for immigrants. This route was abandoned when the first road was constructed through telephone canyon in the early 1900's.

TFN 5 1/110
RECD OCT 15, 2012

DIX2.6 Sources

- Intermountain Resources, 1995. Mountain Cement Co, Etchepare Mine Permit Application, Appendix DVII2 Brief History, 10/1995.

- Albany County, 1995, The Albany County Records located in the
Albany County Courthouse.

- Bartlett, I. S., 1918, History of Wyoming S. J. Clarke
Publishing Company, Chicago, Il.

- Fisher, T.D., J.E. Harrel and J.E. Orpet. 1987. A Class III
Cultural Resource Survey of the Mountain Cement Company's 1987
Limestone Quarry Expansions, Albany County, Wyoming. Prepared
for Mountain Cement Company Project Number IMWY. 87-1,
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- Homsher, L. M., 1965, The History of Albany County, Wyoming to
1880, The Lusk Herald, Lusk, Wyoming.

-Larson, T. A., 1978, History of Wyoming 2nd Edition, University
of Nebraska Press.

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DIX3BB Paleontological Resource Inventory

Etchepare Limestone Quarry

Permit #298C-A8

Prepared By:

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August 2009

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DIX3B.1 Paleontological Overview

DIX3B.1.1 Introduction

The permit amendment area sits approximately 7 miles to the southeast of Laramie, Wyoming on the Casper formation. The Casper formation is sandstone and limestone units of late Pennsylvanian/early Permian age, approximately 299 million years old. The fossil assemblages in the area typify the invertebrate fauna that would have existed in a Pennsylvanian/Permian age shallow marine environment. These assemblages consist of mostly disarticulated crinoids, brachiopods, and mollusks as well as fusulinids, conodonts and trace fossils.

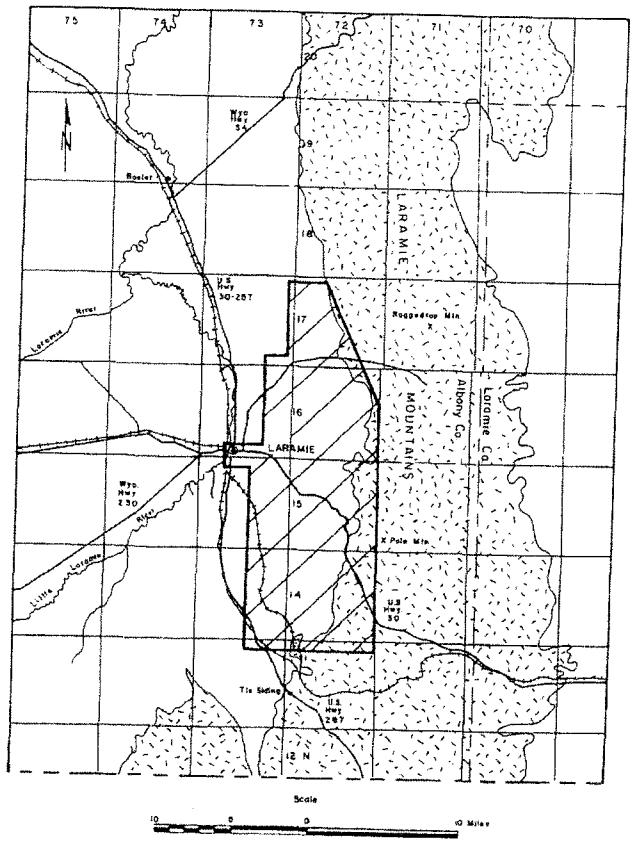

Figure 1: Map of Benniran's (1970) study area, taken from his Master of Science thesis.

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DIX3B.1.2 Faunal Overview

This fauna consists of at least 70 species from 46 genera with brachiopods and mollusks being the most abundant and diverse. Mollusks were represented by 35 species coming from 28 genera. Brachiopods were represented by 26 species coming from 12 genera. One species of trilobite is represented in the fauna. Fusulinids were represented with 3 species from 2 genera. Conondonts had 5 genera accounted for. The disarticulated crinoids only allow for identification to the Class level, which is Crinoidea.

DIX3B.1.3 Stratigraphy

The Casper formation consists of Pennsylvanian/Permian age strata that outcrop from Casper Mountain southward as the western flank of the Laramie Range into northern Colorado. The stratum consists of interbedded limestones, sandstones, and some shales. Near Laramie, Wyo. and the permit area the Casper formation is believed to be close to 700 feet thick; it is bounded at the top by the Satanka shale and at the bottom by the Sherman Granite and in some places, the strata of the Fountain formation.

Generally, it is accepted that the Casper formation is 10 limestone layers separated by sandstones. The thicknesses of these layers vary greatly, as do the lateral extents. These variations create great difficulty in correlating Casper strata from different locales; this also makes some generalizations necessary. The Casper is bound on the top and bottom by well-sorted, fine-grained sandstones, as are the sandstones between each of the Casper limestones. The sandstones vary in color, from pink to red to buff. The sandstones exhibit cross-bedding from small festoon-scale to large, bed-scale cross bedding. The sandstones are not only well-sorted, but grade upward into the immediately overlying limestone. This gradational contact exists between all of the Casper sandstones and their overlying limestone counterparts. This explains why the Casper limestones contain fine grained sand in their bases.

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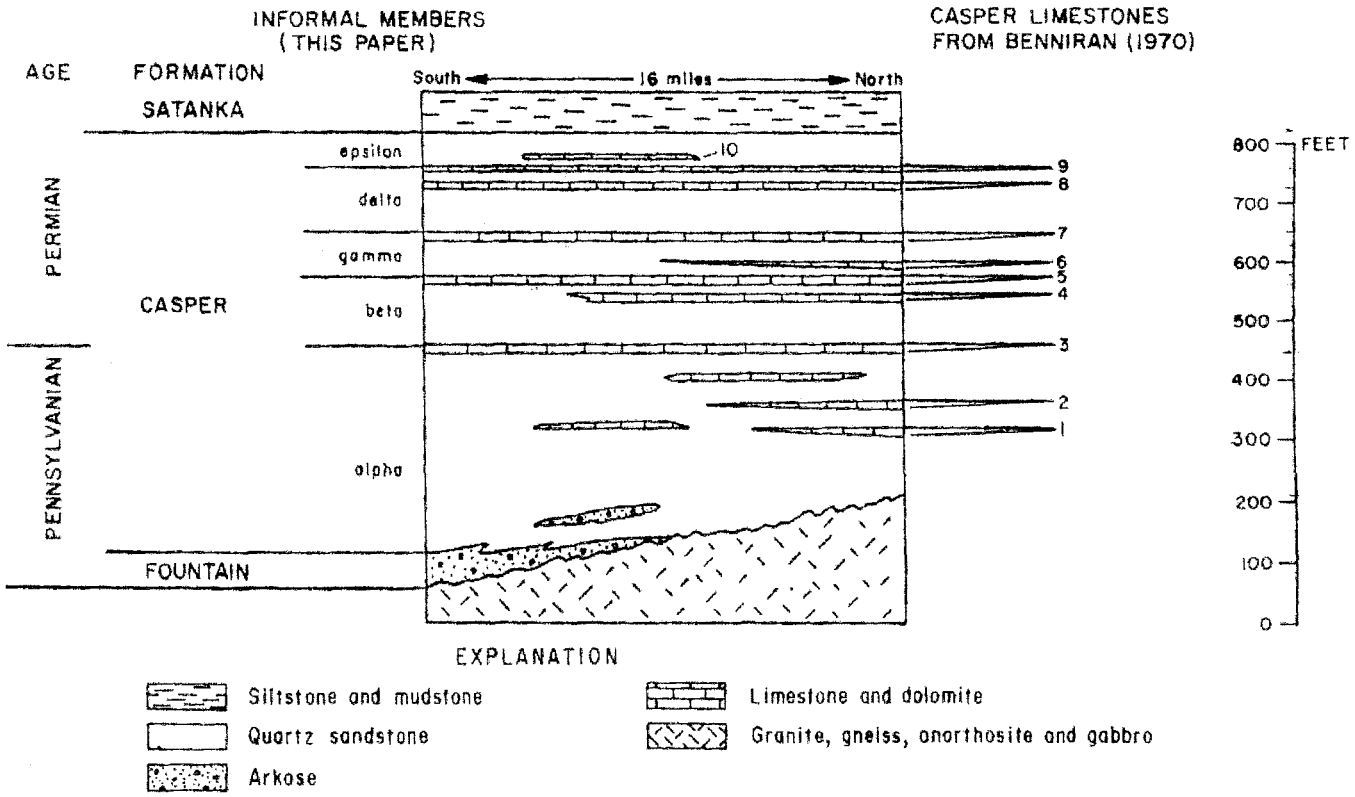

Figure 6. The relationship between informal members of the Casper Formation defined herein and the Casper limestones of Benniran (1970) in the vicinity of Laramie, Wyoming.

Figure 2. Casper formation stratigraphy showing Benniran and Lundy's Units, from Lundy's (1978) Master of Science thesis.

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The limestones are mostly purple or gray in color. Some of the members grade from purple to gray, and there is at least one limestone that is pink. The limestones are massively-bedded, microcrystalline and largely fossiliferous; several of the limestones are dolomitic. Unlike the contact between the sandstones and the overlying limestones, the contact between the limestone units and the overlying sandstone units are extremely sharp, as discussed by Benniran (1970). Miller et al. suggests three positions where sandstone units sit unconformably on limestone units. Benniran also suggests that the Pennsylvanian-Permian boundary is at the base of his limestone no.4, near the middle of the formation.

DIX3B.1.4 Paleoenvironment

It is widely accepted that the strata of the Casper formation were deposited in close proximity to a migrating shoreline approximately 300 million years ago. This fact is supported by the stratigraphic sequence as well as the fossil record contained therein. During the Pennsylvanian-Permian Ages Laramie and the amendment area sat in a transitional area between marine and non-marine environments. This area saw many sea level transgression- regression cycles. At times when the sea level was transgressing the immediate area would be gradually covered with a shallow sea, and as sea level regressed the area became super-tidal shoreline, well above sea level.

The ancient shoreline trended from the northwest to the south east, thus as sea level rose and dropped the shoreline would move west with a rise and move east with a drop. Along this shoreline there were protected lagoons and super-tidal flats where the dolomitic limestone was deposited. As sea level rose, these lagoons and flats would become shallow warm water pools that lacked currents and wave action. These areas were ideal for the precipitation of carbonates. They were also excellent habitats for brachipods, gastropods, and crinoids. The limestones precipitated here were wackestones composed of shell fragments. As the water got deeper in these areas, they became optimal for fusulinid fauna; the limestone precipitated here was wackestones with fusulinids.

As the shoreline regressed sea level dropped and the waters became agitated by wave action, and much of the lime mud was winnowed away. As wave action increased the shells of brachiopods and columns of crinoids became broken and disaggregated, producing a limestone

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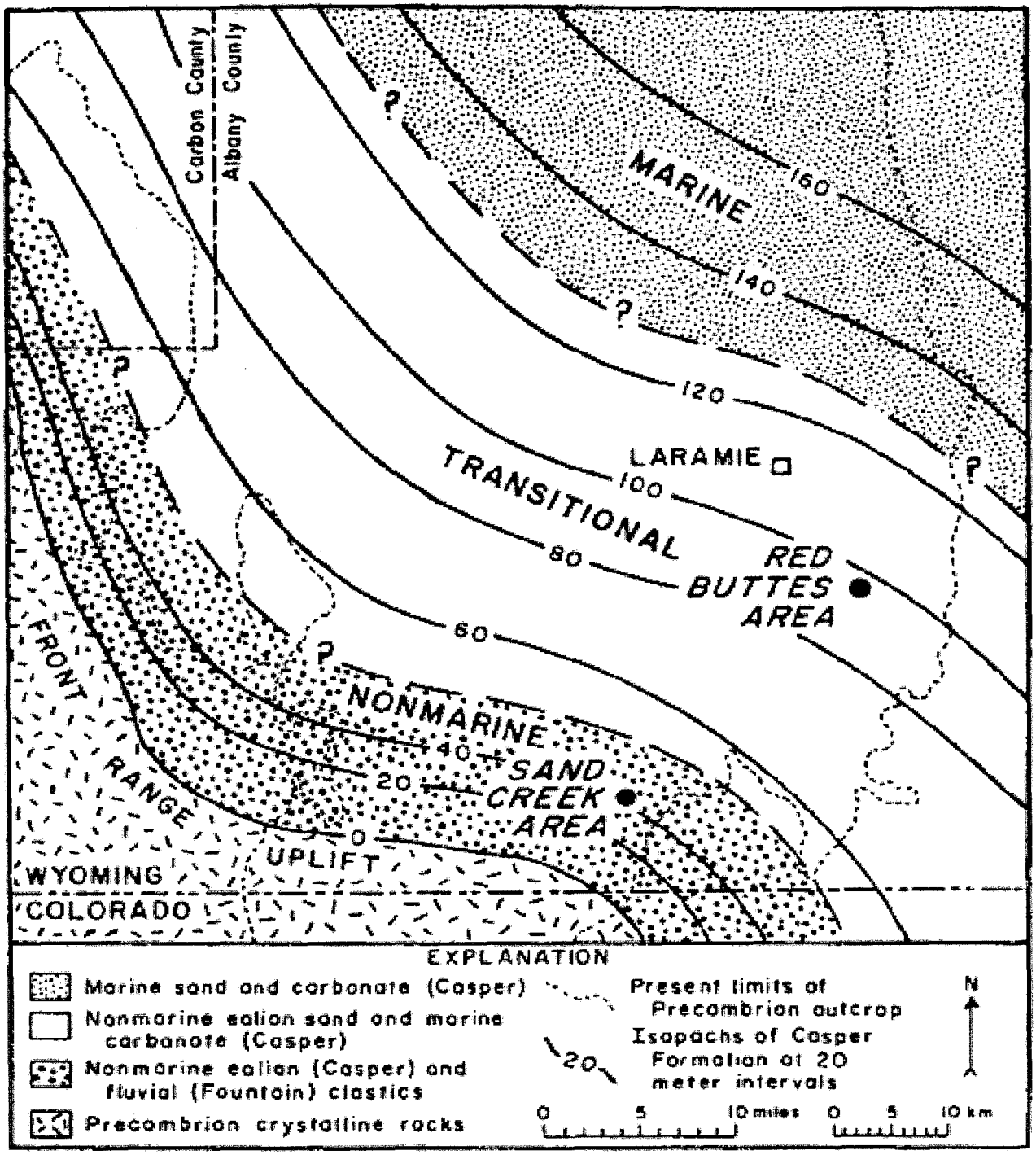

Figure 11. Generalized paleoenvironments and lithotopes in southernmost Laramie Basin at the beginning of Permian time.

Figure 3. Map showing paleoenvironment of Laramie Area (Streidtmann, 1974).

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consisting of shell fragments and coarser grained particles. As sea level withdrew farther the deposited carbonate ooze was subjected to wind and water erosion; this was the cause of the extremely sharp contacts and unconformities between the limestones and the overlying sandstones. At this point the deposition of terrigenous, siliclastic sediment would begin. The same wind that produced erosion carried sand with it. Eventually, the tidal zone would turn into a dune field as more and more sand blew in and was deposited from the west. These dunes are represented by the massive cross-bedded sandstones we see in the area today. Not only is the stratigraphic sequence representative of sea level transgression-regression cycles, but the fossil fauna contained therein serves to demonstrate that this region was definitely a transitional shoreline.

DIX3B.2 Paleontological Resources

DIX3B.2.1 Methods

The list of paleontological resources and their locations, geographically and stratigraphically, was collected through a literature search. Through the University of Wyoming and the Wyoming State Geological Survey, Mountain Cement was provided with 9 pieces of literature. From the University, Mountain Cement had two Master of Science theses on hand. Mr. Alan Ver Ploeg, Assistant Director of the Wyoming State Geological Survey, provided Mountain Cement with two United States Geological Survey Professional Papers, two papers from the Geological Society of America Bulletin, one Geological Survey of Wyoming bulletin, two articles from the Journal of Paleontology, and one stratigraphic column from an unknown author.

Theses:

Casper Formation Limestones, Southwestern Laramie Mountains, Albany County Wyoming by Mansour Benniran.

Purpose of Investigation

The three purposes of this investigation are: 1) preparation of a geologic map showing the distribution of limestones in the Casper formation along the southwestern flank of the Laramie Mountains; 2) description of the

limestones in regard to rock type and diagenetic history; 3) interpretation of the environments of deposition of the limestones.

Benniran also provides information about fossil findings within the Casper and their locations.

Hydrology and Geochemistry of the Casper Aquifer in the Vicinity of Laramie, Albany County Wyoming by Don A. Lundy

The purpose of this paper is to describe the chemical composition of ground water in and hydraulics of the Casper aquifer in the vicinity of Laramie, Wyoming.

Lundy also gives a good description of the overall geologic setting of the area, including petrology and stratigraphy of the Casper.

United States Geological Survey Professional Papers:

The Mississippian and Pennsylvanian (Carboniferous) Systems in the United States-Wyoming by David R. Lageson, Edwin K. Maughan, and William J. Sando

Abstract:

Lower Carboniferous strata of Wyoming (Mississippian to early middle Pennsylvanian) represent 2 marine depositional sequences separated by a period of epeirogenic uplift and erosion. The Mississippian part of the succession is a wedge that thickens northwestward from a zero edge in S.E. Wyoming; this wedge is disconformably overlain by predominantly thin-bedded terrigenous strata of the upper part of the succession. In W. Wyoming, the lower depositional sequence is represented by the Madison group, which includes the Mission Canyon and Lodgepole limestones. Throughout most of central Wyoming, the lower depositional sequence is represented by the Madison limestone, which includes 6 members, ranging from Kinderhookian to early Meramecian. In the Hartville uplift area of E. Wyoming, the lower depositional sequence is represented by the Guernsey formation, which consists of limestone and dolomitic limestone unconformably lying on Precambrian, Cambrian, and Ordovician rocks. Strata equivalent to the Madison limestone in the Black Hills include the Lower Mississippian Englewood formation (red and purple dolomite, limestone, and shale) and the Kinderhookian-to-Osagean Pahasapa limestone.

Pennsylvanian and Associated Rocks in Wyoming by William W. Mallory

A regional study of the extent, thickness, lithology, and stratigraphic relations of the Tensleep, Amsden, Casper, and Fountain Formations, with emphasis on origin, paleogeography, and paleotectonic implications.

Geological Society of America Bulletins:

Evidence for Eolian Origin of Cross-Stratification in Sandstone of the Casper Formation, Southernmost Laramie Basin, Wyoming by James R Steidtmann

Abstract:

The Casper Formation of Pennsylvanian and Permian age in the southernmost Laramie Basin contains large trough cross-stratification for which both eolian and subaqueous origins have been proposed. To determine which is the most reasonable interpretation of origin, information concerning depositional processes was obtained from a study of associated sedimentary structures and settling velocities of light and heavy minerals.

Two important characteristics of sandstone units in the Casper Formation strongly suggest an eolian origin: (1) The cross-stratified units typically contain low-crested, locally truncated ripple marks that nearly everywhere are oriented with their crests parallel to the dip of the cross-strata, and (2) there are evenly spaced lag grains along bedding surfaces.

Other characteristics of the sandstone units are compatible with an eolian environment, although their origin is more ambiguous. For example, low-dipping cross-strata, often cited as evidence against an eolian origin, are similar to the internal stratification of eolian dunes where moisture prohibits development of large avalanche faces. Moreover, large-scale contemporaneous deformation of sand, although commonly attributed to subaqueous gliding, probably requires more cohesion than would be present in saturated subaqueous sand. Moist eolian conditions may provide this cohesion. Finally, settling velocities of associated light and heavy minerals indicate deposition from eolian suspension. Therefore, I conclude that sandstone units in the Casper Formation of the southernmost Laramie Basin were deposited as a coastal dune field that bordered the ancestral Front Range uplift and migrated laterally in response to a fluctuating sea level.

The Paleozoic and Mesozoic of Central Wyoming by N.H. Darton

"It is the purpose of this memoir to present an outline of the results which throw light on the classification and general stratigraphy of formations from Cambrian to Cretaceous in age. Tertiary deposits exist throughout the area examined, but only passing attention was given to their features, and the various formations are not differentiated on the geologic map"

Geological Survey of Wyoming Bulletin:

Fusulinids of the Casper Formation of Wyoming by Horace D. Thomas, M.L. Thompson, and John W. Harrison

Abstract:

The Casper Formation, exposed around the margins of the Laramie Range, Wyoming, comprises an alternating succession of beds made up principally of cross-bedded sandstones and fossiliferous limestones. Fusulinid faunas indicate that the formation ranges from Middle Pennsylvanian (Desmoinesian) to Lower Permian

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(Wolfcampian) in age. The stratigraphy of the formation is discussed and the fusulinids, represented by four genera and sixteen species, six of which are new, are described. The Wolfcampian species are the first fusulinids of this age to be described from Wyoming.

Journal of Paleontology:

A Permian (Wolfcampian) Fauna of the Casper Formation of Southeastern Wyoming by Selmer L. Pederson

Pederson gives a overview of the Casper formation stratigraphy, and gives the systematic paleontology of the fauna collected from a specific bed near the middle of the Casper.

The Casper Formation and Its Cephalopod Fauna by A.K. Miller and H.D. Thomas

Abstract:

The general nature of the Casper formation of southeastern Wyoming is discussed in this paper, an attempt is made to explain its relationship to other Late Paleozoic formations of the same and nearby regions, and much of its fauna is illustrated and described in detail. The fossils treated systematically represent one species of fusulinids, nine species of cephalopods (all nautiloids), and one species of trilobites. It is concluded that the formation probably represents the major portion of the Pennsylvanian period.

Most of the specimens collected were from Gilmore Canyon, 8 miles southeast of Laramie, just outside the amendment area.

DIX3B.2.2 Paleontological Resources within Amendment Area

The paleontological resources of the Casper formation in the amendment area consist of invertebrates and trace fossils only. The Casper formation wasn't studied in depth until the early 20th century, and even then there were several different descriptions from several different geologists. There were differences in lithologic and stratigraphic descriptions; and because of those differences each geologist has their own particular way of describing locations within the formation. As a result of the discrepancies between geologists and the varied stratigraphy of the Casper formation, the locations of a portion of the fossils are estimated. Perhaps the best source for basic paleontological data was Benniran's thesis; this is largely because several geologists adapted his system for naming the limestones; one such geologist was Don Lundy, who grouped Benniran's limestones into 5 groups named Alpha through Epsilon. Mountain Cement adopted Benniran's and Lundy's nomenclature for use in mine planning.

The species list for paleontological resources within the amendment area for all of the Casper formation:

Brachiopoda (Brachiopods):
Chonetes sp. indet.
Composita sp.
Composita argentia
Composita ovata
Composita subtilita
Derbyia sp. *(a)*
Derbya aff. *D. multistriata* ©
Derbyia aff *D. ciscoensis (a)*
Dictyoclostus sp. ©
Dictyoclostus americanus
Dictyoclostus portlockianus ©
Juresania nebrascensis ©
Linoproductus sp. ©
Linoproductus americanus
Linoproductus prattenianus
Marginifera haydenensis
Meekella sp. *(a)*
Meekella attunuata (a)
Meekella striatocostata (a)
Neospirifer sp. ©
Neospirifer bakeri wyomingensis
Neospirifer cameratus
Neospirifer dunbari
Orthotetes sp.
Orthotichia sp. indet.
Wellerella sp. indet.

Mollusca (Mollusks):
Gastropoda (Gastropods):
Bellerophontoidae *(a)*
Bellerophon sp. ©
Bellerophon crassus
Euphemus carbonarius
Murchasonia aff. *M. terrebra*
Patellostium montfortiannum
Solenscus hallanus
Unidentified gastropods *(a)*
Planispiral gastropods *(a)*

Scaphopoda (Scaphopods):
Dentalium sublaeve
Plagioglypta sp.

Bivalvia (Bivalves):
Allorisma sp.
Aviculopecten 2 sp.

Bivalvia (con't):
Aviculopecten occidentalis®,
Deltopecten sp. ®
Edmondia gibbosa ®
Myalina sp.
Myalina permiana
Orthotichia sp. *(s)*
Parallelodon sp. ®
Pleurophorus sp. ©
Pseudomonotis hawni
Schizodus sp.
Schizodus wheeleri ©

Cephalopoda (Cephalopods):
Ammonite sp.
Coloceras sp. ®
Metacoceras sp. ©,
Metacoceras knighti (a)
Metacoceras. sulciferum©
Mooreoceras sp. ©
Nautilus sp.
Orthoceras sp.
Pseudorthoceras knoxense ©,
Solenochilus cf. *S. Brammeri* ©
Stenopoceras abundum ®
Tainoceras wyomingense (a)
Tainoceras occidentale

Trilobita (Trilobites):
Ameura "Phillipsia sp."

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Echinodermata (Echinoderms):
Crinoidea:
Crinoid columnals

Foraminifera (Forams, Fusulinids):
Kansanella
Schwagerina sp.©
Triticites notus (a)
Triticites ventricosus (a)
Wedekindellina

Conodonta (Conodonts):
Cavusgnathus
Hindeodella
Lingodella
Lonchodina aff. *mulleri*
Streptognathodus

Genus or Species with (a)-abundant, ©-common, ®-rare, (s)-scarce. Genus or species without a letter indicates that there was no mention of the abundance of that particular genus or species.

DIX3B.2.3 Paleoecology of Phyla and Classes:

Phylum Brachiopoda:

Brachiopods are exclusively benthic marine invertebrates, living primarily on the shallow shelf and in epicontinental platform seas as solitary animals. All are sessile filter feeders and are incapable of moving in search of food. A few are known from deep-water graptolitic shales, and it is possible that some of the tinniest articulates may have attached to floating substrate, but most lived in shallow, benthic habitats. A few species, such as the lingulides, can tolerate brackish salinities and burrow, but most articulate brachiopods clearly tolerate only normal marine salinities, and live on the bottom (epifaunal). Most brachiopods are incapable of burrowing because they do not have a large, fleshy mantle that can be extended into a tube-like siphon; this is the feature that allows some mollusks to burrow. Consequently, brachiopods must always stay near where the currents are strong enough to bring them fresh food and oxygen, and eliminate wastes (Prothero, 2004).

Phylum Mollusca:

Class Gastropoda:

The Class Gastropoda includes snails and slugs. Most gastropods have a single, usually spirally coiled shell into which the body can be withdrawn, but the shell is lost or reduced in some important groups. Gastropods are characterized by "torsion," a process that results in the rotation of the visceral mass and mantle on the foot. Many snails have an operculum, a horny plate that seals the opening when the snail's body is drawn into the shell. Gastropods have a muscular mantle foot which is used for "creeping" locomotion in most species. In some, it is modified for swimming or burrowing. Most gastropods have a well-developed head that includes eyes; 1-2 pairs of tentacles and a concentration of nervous tissue. Gastropod feeding habits are extremely varied, although most species make use of a radula, a ribbon-like string of tiny teeth, in some aspect of their feeding behavior. Some graze, some browse, some feed on plankton, some are scavengers or detritivores, and some are active carnivores. They were common to the shallow marine floor as well as land.

Class Scaphopoda:

Found in marine regions around the world, scaphopods are also known as tusk shells, owing to their tusk shape. They are known to live in waters from 10 meters deep to more than 4000 m. They live with their shell buried halfway in the sea floor, where they use their mantle foot to dig and their tentacles to catch prey. Scaphopods are selective deposit feeders, mainly feeding on microscopic organisms, particularly diatoms and foraminiferans.

Class Bivalvia:

Bivalves are known from every marine habitat; from the inter-tidal zone to the surf-zone to the deep ocean vents. This class includes mussels, clams, scallops, and oysters. Bivalves are called such because they enclose their bodies with in a hinged calcareous shell excreted by the mantle. As a class, they no longer have heads nor most sense organs, and their foot has been modified into an axe-like wedge for burrowing. Most bivalves are filter

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feeders who use there gills for filtration of food particles, some scrape detritus from the sea floor, and others still are carnivorous. Unlike brachiopods, bivalves are capable of movement. Some are epifaunal, meaning they live on top of the sediment by attaching themselves to the sediment or objects, or they just rest on the sediment. Others with a large foot are burrowers and live infaunally, meaning in the sediment. Others still are semi-infaunal and live half way submerged in the sediment. The species that live in the sediment often have large siphons for the intake and discharge of water.

Class Cephalopoda:

Cephalopods are the most active and intelligent mollusks. This class has modified their foot into a ring of tentacles around their mouth. They are found in every ocean. This class includes today's nautiloid cephalopods, shell-less squids, and octopuses. The members of this class have large sophisticated eyes, a parrot-like beak, and a relatively large brain. They also have their mantle cavity modified for jet propulsion backwards, some can also swim forwards using small fin like mantle extensions. All cephalopods are carnivorous, using their tentacles to capture prey and feed themselves. All cephalopods have 2 part beaks, used to bite captured prey. Only one shelled cephalopod remains, the Nautilus, the nautiloid cephalopod.

Phylum Arthropoda:

Class Trilobita:

Trilobites are the most commonly fossilized arthropods. These early arthropods were hard-shelled creatures with multiple body segments and jointed legs who roamed the sea floor. They make up the most diverse class of extinct organisms. It is thought that the majority of trilobites were bottom-dwellers, crawling on the sea floor, or within complex reefs, acting as roving predators on smaller invertebrates or as slow scavengers on organic debris. We know of planktonic, free-swimming, benthic (bottom-dwellers), burrowing, reef-dwelling, and even parasitic trilobites.

Phylum Echinodermata:

Class Crinoidea:

Crinoids are the only surviving stalked echinoderms; they are also known as "sea lilies". These suspension feeders used their fan-like arms to filter food out of the water column. They were the dominant group on the shallow sea floor. These organisms sat on top of a stalk that was rooted to the sea floor by a holdfast. Upon death, wave action and water energy disarticulated and reworked them; this is why it is most common to find the platelets (columnals) that the stalk was made of instead of complete specimens.

Phylum Sacromastigophora:

Class Granuleticulosa:

Order: Foraminiferida:

The Foraminifera are a large group of amoeboid protists with reticulating pseudopods, fine strands of cytoplasm that branch and merge to form a net. They typically produce a shell, which can have either one or multiple chambers, some becoming quite elaborate in structure. These shells are made of calcium carbonate ($CaCO_3$) or agglutinated sediment particles. More specifically, fusulinids, existed in shallow warm seas and filled a very important niche, as they were a key part of the food chain; they were opportunistic feeders who preyed on smaller micro-organisms and detritus and then went on to become food for larger organisms. They were such an abundant organism that in some places entire beds of limestone are made entirely of fusulinids.

Phylum Hemichordata:

Class Conodonta:

Conodonts are extinct chordates resembling eels, classified in the class Conodonta. For many years, they were known only from tooth-like microfossils now called conodont elements, found in isolation. They are believed to have had eyes, ears, fins, a dorsal fin, and segmented muscles. Not much is known of these organisms being that largely the only fossilized remains are conodont elements. They are also assumed to be predators that used their elements to hold and crush prey.

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DIX3B.3 Assessment of Paleontological Resources to be Impacted by Mining

DIX3B.3.1 Areas to be Impacted by Mining

Mountain Cement plans to mine at least one limestone member in all the pit areas designated in the mine plan and shown on Map MPIX-1; this member is the uppermost limestone, and in most places within the amendment area it makes up the surface of the ridge tops. In addition to mining the uppermost limestone, in certain places within the amendment area Mountain Cement will attempt to mine the second limestone member as well. Depending on where mining is taking place, Mountain Cement will be mining Benniran's limestone nos. 5, 7, and 8, as limestone no. 6 doesn't occur in the Laramie area.

DIX3B.3.2 Paleontological Content of Limestone Nos. 5, 7, and 8

Limestone no. 5 is the lowermost unit that Mountain Cement will mine. According to Benniran (1970) this unit contains ooids, crinoid columnals, and some trace fossils in the form of burrows. Also present in this member are Brachiopods; they are represented by *Jurensia nebrascensis,* and species from the *Linoproductus*, *Dictyoclostus,* and *Neospirifer* genera. Darton (1908) described the brachiopod *Neospirifer cameratus* in the lower limestone at the mouth of Gilmore Canyon. The unit described by Miller and Thomas (1936) that is correlated with Benniran's limestone no. 5 also contains the brachiopod *Meekella* sp. and the bivalve *Schizodus* cf. *S.wheeleri.* Thomas (1953) detailed the fusulinid *Schwagerina*, which is likely to occur in this unit. Other genera of fusulinids that are likely to occur are *Triticites, Kansanella,* and *Wedekindellina.* It is also possible that the scaphopod *Plagioglypta* sp. is present but no clear correlation was possible. Crinoid columnals and fusulinids are most likely also abundant, being that these organisms typified the Paleozoic seas.

Limestone no. 7 makes up the majority of the dip-slope of the western flank of the Laramie Range. This unit is very fossil rich. Benniran (1970) describes this member as containing abundant brachiopods *Derbyia* sp. and *Linoproductus* sp., including *Linoproductus*

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americanus. He also cites brachiopods *Composita argentia* and *Meekella* as abundant. He also identified a member of the trilobite genus *Ameura,* members of the bivalve genus *Myalina,* and conodonts *Lonchodina* aff. *mulleri, Cavusgnathus, Streptognathodus, Hindeonella, and Lingonodina.* Abundant unidentified Bellerophont and planispiral gastropods, ooids, and trace fossils occur throughout this unit. It is possible to correlate the *Stenopoceras* bed of Thomas and Miller (1936) to this limestone. They describe a rich fauna that includes brachiopods *Derbyia* aff. *D. multistriata,* and *Orthotichia* sp. indet., bivalves *Pseudomonotis hawni, Schizodus* sp., *and Myalina* sp., the mollusk *Dentalium sublaeve.* The most abundant and diverse organisms identified were the cephalopods. These include *Pseudorthoceras knoxense, Mooreoceras* sp., *Coloceras* sp., *Metacoceras* sp., *Metacoceras knighti, Metacoceras sulciferum, Tainoceras wyomingense, Stenopoceras abundum,* and *Solenochilus* cf. *S. brammeri.* Darton (1908) describes a brachiopod, *Orthotetes* sp., that was found in the uppermost limestone at the mouth of Gilmore Canyon. He also describes a unit that maybe the same as Benniran's limestone no. 7. In this unit he finds the bivalves *Myalina permiana, Schizodus meekanus, Aviculopecten occidentalis,* as well as two unidentified *Aviculopecten* species, an unidentified *Pleurophorus* sp., and an unidentified *Schizodus* species. He also identified several gastropods, including *Patellostium montfortiannum, Bellerophon crassus, Soleniscus hallanus, Murchisonia* aff. *M. terrebra,* and an unidentified *Euphemus* species. He also identified several cephalopod species that include *Tainoceras occidentale*, and several unidentified species of the genera *Nautilus, Orthoceras,* and an Ammonoid. Crinoid columnals and fusulinids are most likely also abundant, being that these organisms typified the Paleozoic seas.

Limestone no. 8 is also rich in fossil specimens. Benniran describes it as containing abundant brachiopods *Derbyia* aff. *D. ciscoensis,* and *Meekella attenuata*, as well as unidentified gastropods. This limestone correlates with the *Meekella* bed unit of Thomas and Miller (1936). They identified brachiopods *Derbyia* aff. *D. multistriata,* and *Meekella striatocostata.* They identified several genera and species of bivalve; these include *Schizodus wheeleri, Aviculopecten occidentalis, Edmondia gibbosa, Orthotichia sp., Pleurophorus sp., Deltopecten sp.,* and *Parallelodon sp.* They describe two gastropods: *Euphemus carbonarius* and *Bellerophon sp.* The cephalopods they identified were *Stenopoceras abundum* and a *Metacoceras* species.

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Crinoid columnals and fusulinids are most likely also abundant, being that these organisms typified the Paleozoic seas.

Though limestone no. 5, 7, and 8 are fossiliferous, limestones no.1 through no.4 are just as, if not more fossiliferous. Benniran's limestone no.4 is especially known as a key bed identified by several authors because of its abundant fusulinid, *Triticites ventricosus*. Other organisms fossilized within the *Triticites* bed are the brachipods *Linoproductus prattenianus, Neospirifer dunbari*, and an unidentified *Composita* species. Pederson (1954) identified nine brachiopods with in this bed; *Juresania nebrascensis, Marginifera haydenensis, Meekella attunuata, Dictyoclostus americanus, Composita subtilita, Composita ovata, Neospirifer bakeri wyomingensis, Chonetes* sp. indet, and *Wallerella* sp. indet. Benniran (1970) identifies the brachiopod *Derbyia* aff. *D. ciscoensis,* and the fusulinid *Triticites notus* in addition to the species listed above. He also identifies the conodonts *Streptognathodus, Cavusgnathus, Hindeodella,* and *Lonchodina* aff. *mulleri.* This member correlates to Thompson's (1953) *Schwagerina* unit. Also present in this member is the bivalve *Allorisma* sp. indet., and the trilobite *Ameura "phillipsia"* sp. Crinoid columnals and fusulinids are most likely also abundant, being that these organisms typified the Paleozoic seas.

DIX3B.3.3 Summary and Assessment of Paleontological Resources

The literature collected for use in this paleontology assessment consisted of Masters' theses from the University of Wyoming, articles from the Journal of Paleontology, professional papers from the United States Geological Survey, bulletins from the Wyoming Geological Survey, and bulletins from the Geological Society of America. This wide range of sources also spanned a wide range of years, the oldest article being from 1908 and the newest from 1979. The articles that discussed paleontology identified only invertebrates as the fauna. The invertebrate fauna of the Casper formation consists of representatives from six phyla; these being Brachiopoda, Mollusca, Arthropoda, Echinodermata, Sarcomastigophora, and Hemichordata. The fauna has representatives of 26 brachiopods, 8 gastropods, 2 scaphopods, 13 bivalves, 13 cephalopods, 1 trilobite, 1 crinoid, 5 fusulinids, and 5 conodonts.

None of the fauna that is known from the Casper formation should be considered significant. None of the genera or species found therein is unique; nor is the fauna itself unique.

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In fact, the fauna of the Casper formation is similar to the Lower Permian Luta and Fort Riley beds of Kansas in so much as they contain some of the same genera of brachiopods and cephalopods. Also, the Florena shale of Kansas contains some of the same genera of cephalopods, but the correlation with the Casper is not as strong. Another note for consideration is that the Paleozoic seas were known for their fusulinid content as well as their crinoid content; so any limestone deposited during that time is likely to have an extreme abundance of these organisms. The preservation of this fauna is nothing to be considered significant either; most of the fossils consist of molds, shells filled with calcite, some recrystallized, and shell/skeletal fragments. There is no original shell material present, nor is there any replacement by pyrite or anything of that sort. The Casper formation contains the typical fauna for typical limestone of that era, fossilized by common modes of preservation. The only significance the fossilized fauna has is that it is a main constituent of the limestone.

DIX3B.4 Closing

DIX3B.4.1 Responsible Party

This inventory was prepared by Andrew H. MacClugage, Geologist, of Mountain Cement Company, Laramie, Wyoming in August 2009. It was prepared in accordance with discussions held with WDEQ/LQD Lowell Spackman and Steve Ingle pertaining to the paleontology section of the Etchepare 298C-A8 Amendment.

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DIX3B.5 References

Benniran, M. M. 1970. Casper Formation Limestones, Southwestern Laramie Mountains, Albany County, Wyoming. Master's Thesis University of Wyoming. Laramie, Wyoming.

Burk, C.A. 1954. Faunas and Age of the Amsden Formation in Wyoming. *Journal of Paleontology.* 28(1)

Darton, N.H. Paleozoic and Mesozoic of Central Wyoming. 1908. *Bulletin of the Geological Society of America.*19:403-470, Plates. 21-30.

Lageson, D. R., Maughan, E. K., Sando, W. J. 1979. The Mississippian and Pennsylvanian (Carboniferous) Systems in the United States-Wyoming. *Geological Survey Professional Paper.* 1110-U. U.S. Government Printing Office. Washington.

Lundy, D. A. 1978. Hydrology and Geochemistry of the Casper Aquifer in the Vicinity of Laramie, Albany County, Wyoming. Master's Thesis University of Wyoming. Laramie, Wyoming.

Mallory, W. W. 1967. Pennsylvanian and Associated Rocks in Wyoming. Shorter Contributions to General Geology. *Geological Survey Professional Paper.* 554-G. U.S. Government Printing Office, Washington.

Miller, A.K., and Thomas, H.D. 1936. The Casper Formation of Wyoming and its Cephalopod Fauna. *Journal of Paleontology.* 10(8):715-738, Plates.96-99.

Pederson, S. L. 1954. A Permian (Wolfcampian) Fauna of the Casper Formation of Southeastern Wyoming. *Journal of Paleontology.*28(1).

Steidtmann, J. R. 1974. Evidence for Eolian Origin of Cross-Stratification in Sandstone of the Casper Formation, Southernmost Laramie Basin, Wyoming. *Geological Society of America Bulletin.* 85:1835-1842.

Thomas, H. D., Thompson, M.L., and Harrison, John W. 1953. Fusulinids of the Casper Formation of Wyoming. *Geological Survey of Wyoming Bulletin.* No. 46.

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DIX3B.6 Appendix A

Specimens

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EXPLANATION OF PLATE I

FIG. *1*—*Orthotetes?* sp. Unique specimen from Loc. $\frac{43106}{19B}$. ×1. U. Wyo. IT-187. (p. 9)

2–4, 11—*Composita subtilita* (Hall) var. *ovata* Mather. *2, 4*. Dorsal and lateral views showing shape and line of commissure. Loc. $\frac{3199}{19A}$. ×1. U. Wyo. IT-215. *3*. Anterior view showing line of commissure. Loc. $\frac{3199}{19A}$. ×1. U. Wyo. IT-216. *11*. Dorsal view showing shape of larger specimen. Loc. $\frac{43106}{19B}$. U. Wyo. IT-217. (p. 12)

5–7, 12—*Composita subtilita* (Hall) var. *subtilita*. *5*. Dorsal view showing general shape. Loc. $\frac{3199}{19A}$. ×1. U. Wyo. IT-211. *6, 7*. Anterior and lateral views showing shape, line of commissure, and lamellose growth lines. Loc. $\frac{3199}{19A}$. ×1. U. Wyo. IT-212. *12*. Same specimen. ×2. U. Wyo. IT-212. (p. 12)

8–10—*Composita subtilita* (Hall) var. *trinucleus* (Hall). *8*. Dorsal view showing shape. Loc. $\frac{3199}{19A}$. ×1. U. Wyo. IT-221. *9, 10*. Anterior and lateral views showing shape and line of commissure. Loc. $\frac{3199}{19A}$. ×1. U. Wyo. IT-222. (p. 13)

13, 14—*Lingulodiscina* sp. *13*. Dorsal view of immature specimen. Loc. $\frac{3099}{9B}$. ×2. U. Wyo. IT-184. *14*. Dorsal view of mature specimen. Loc. $\frac{3099}{9B}$. ×1. U. Wyo. IT-185. (p. 8)

15—*Cleiothyridina* sp. Dorsal view of exfoliated specimen showing shape and median septum. Loc. $\frac{43106}{19A}$. ×1. U. Wyo. IT-228. (p. 13)

16–22—*Spirifer opimus* Hall. *16*. Dorsal view showing arrangement of costae. Loc. $\frac{3199}{19A}$. ×1. U. Wyo. IT-202. *17, 18*. Ventral and dorsal views showing shape and arrangement of costae. Loc. $\frac{3199}{19A}$. ×1. U. Wyo. IT-204. *19*. Posterior view of steinkern showing dental lamellae and striated interareas. Loc. $\frac{3099}{LA}$. ×2. U. Wyo. IT-201. *20*. Postero-ventral, showing sulcus and costae on ventral beak. Loc. $\frac{3199}{19A}$. ×1. U. Wyo. IT-203. *21, 22*. Anterior and lateral views showing shape and line of commissure. Loc. $\frac{3199}{19A}$. ×1. U. Wyo. IT-205. (p. 11)

23–25—*Wellerella osagensis* (Swallow). Dorsal, anterior, and lateral views showing shape and prominent fold and sulcus. Loc. $\frac{3199}{19A}$. ×2. U. Wyo. IT-233. (p. 14)

26–28—*Marginifera muricatina* Dunbar & Condra. *26*. Posterior view of trail showing coarse costae and spine bases. Loc. $\frac{3099}{9A}$. ×1. U. Wyo. IT-197. *27, 28*. Posterior and dorsal views showing shape and ornamentation. Loc. $\frac{3099}{9A}$. ×1. U. Wyo. IT-198. (p. 10)

29, 30—*Dictyoclostus portlockianus* (Norwood & Pratten). *29*. Lateral view showing general shape. Loc. $\frac{43106}{19B}$. ×1. U. Wyo. IT-189. *30*. Anterior view showing ribbing and sulcus on trail. Loc. $\frac{43106}{19B}$. ×1. U. Wyo. IT-188. (p. 9)

31–34—*Eumetria sulcata* Burk, n. sp. Dorsal, ventral, anterior, and lateral views of holotype. Loc. $\frac{3199}{19A}$. ×1. U. Wyo. IT-231. (p. 14)

35—*Camerinella hoonensis* (Swallow). External impression of ventral valve, reverse-lighted, showing concentric rugae on umbo, and spine bases on cardinal extremities. Loc. $\frac{3099}{9A}$. ×2. U. Wyo. IT-195. (p. 10)

36, 37—*Linoproductus prattenianus* (Norwood in Norwood & Pratten). *36*. Lateral view showing shape and costae. Loc. $\frac{43106}{19B}$. ×1. U. Wyo. IT-192. *37*. View of ventral beak showing prominent wrinkled cardinal extremities. Loc. $\frac{43106}{19B}$. ×2. U. Wyo. IT-193. (p. 9)

38–40—*Allorisma terminale* Hall. *38*. Small specimen referred to this species with hesitation. Loc. $\frac{3099}{9A}$. ×2. U. Wyo. IT-237. *39*. Left valve. Loc. $\frac{43106}{19B}$. ×1. U. Wyo. IT-238. *40*. Right valve showing concentric ornamentation. Loc. $\frac{43106}{19B}$. ×1. U. Wyo. IT-239. (p. 14)

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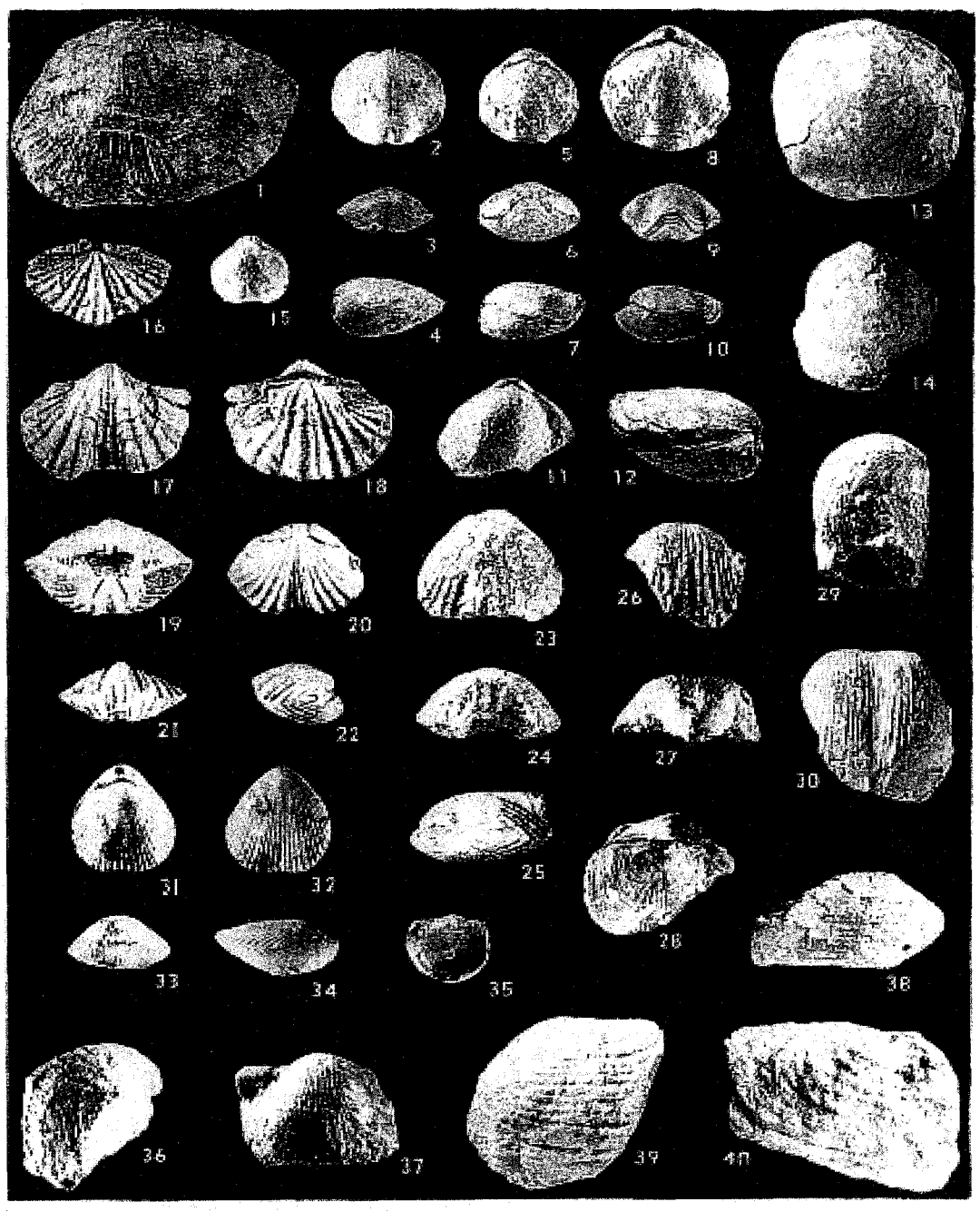
Explanation of Plate 1, Burk (1954), shown on following page.



Burk, Amsden fauna

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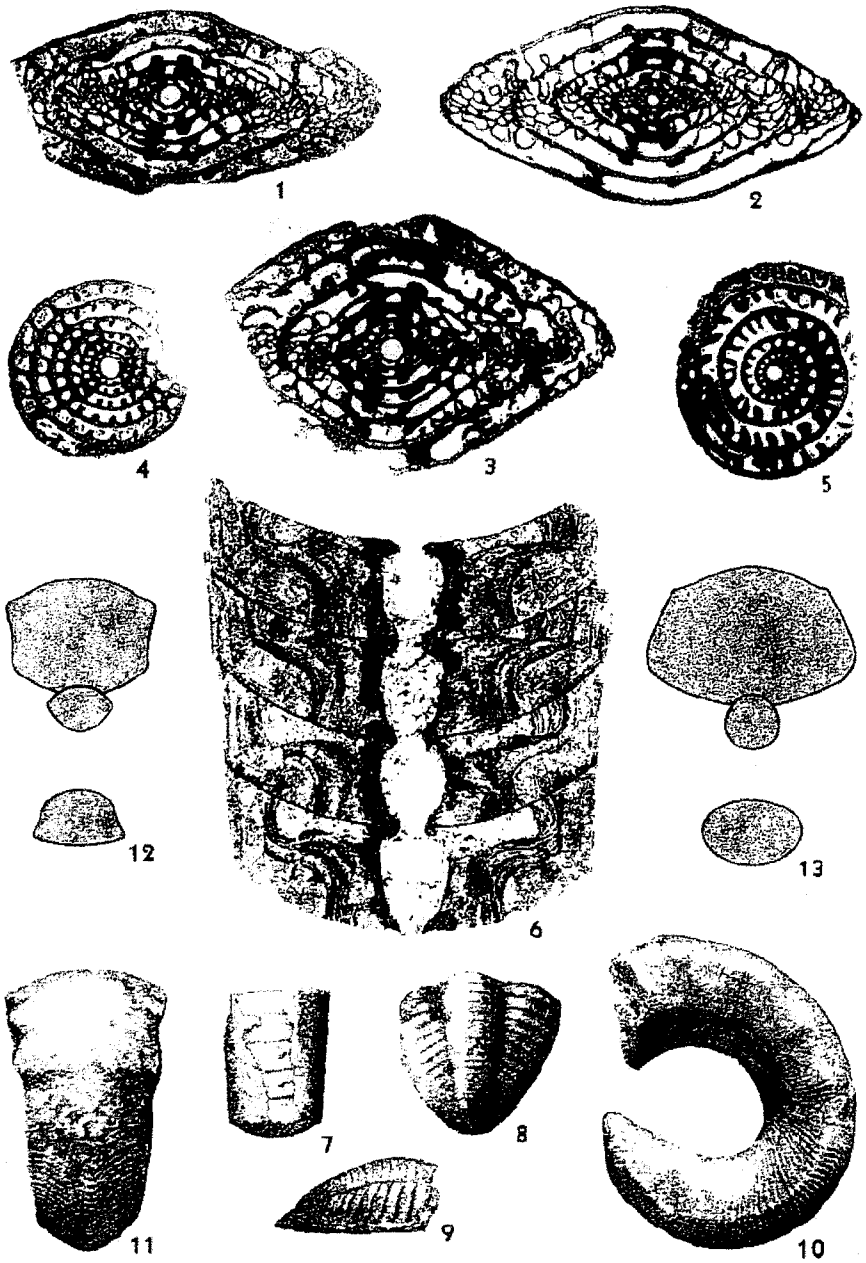
Explanation of Miller and Thomas's Plates:

Foraminifera:
Triticites ventricosus: Plate 96, Figures 1-5

Cephalopoda:
Pseudorthoceras knoxense: Plate 96, Figs. 6, 7
Mooreoceras sp.: Plate 97, Fig. 1
Coloceras sp.: Plate 98, Figs. 5, 6
Metacoceras knighti: Plate 97, Figs. 2, 3
Metacoceras sulciferum: Plate 97, Figs. 4, 5
Metacoceras sp.: Plate 96, Figs. 10-12
Tainoceras wyomingense: Plate 96, Fig 13; Plate 97, Fig. 6; Plate 98, Figs. 3, 4
Stenopoceras abundum: Plate 98, Figs. 7-10; Plate 99, Figs. 1, 2
Solenochilus cf. *S. brammeri*: Plate 98, Figs. 1, 2

Trilobita:
Ameura "phillipsia sp.": Plate 96, Fig. 8, 9



Miller and Thomas, Pennsylvanian Invertebrates

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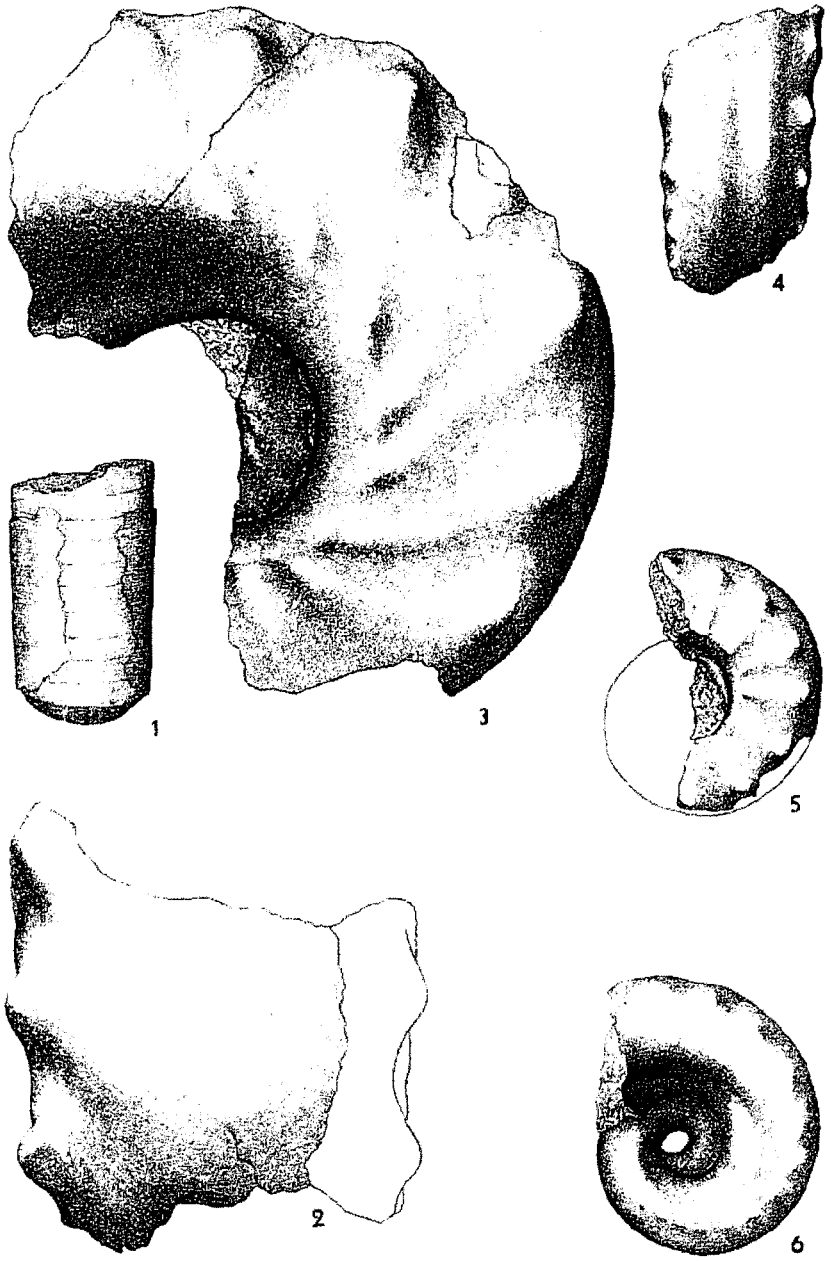

Miller and Thomas, Pennsylvanian Cephalopods

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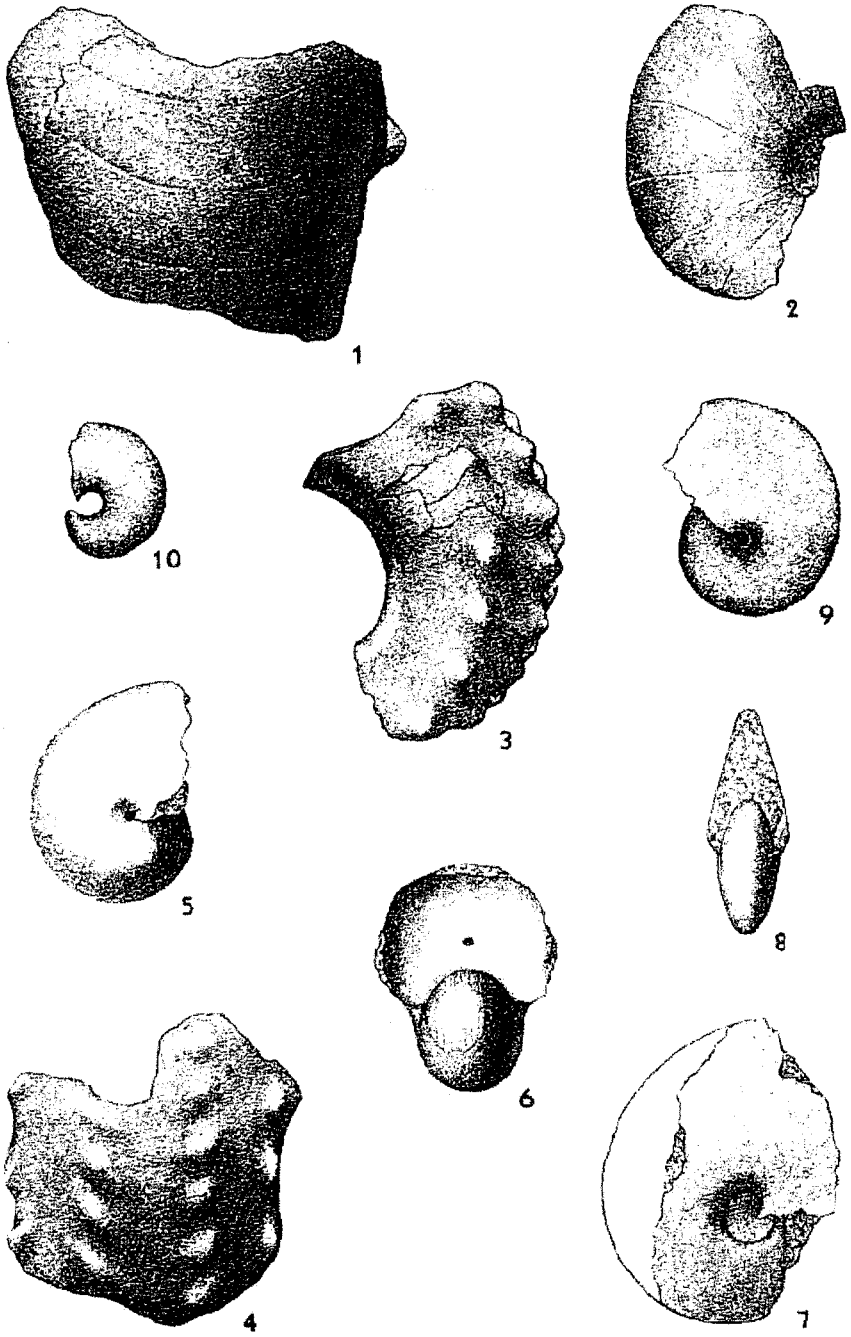

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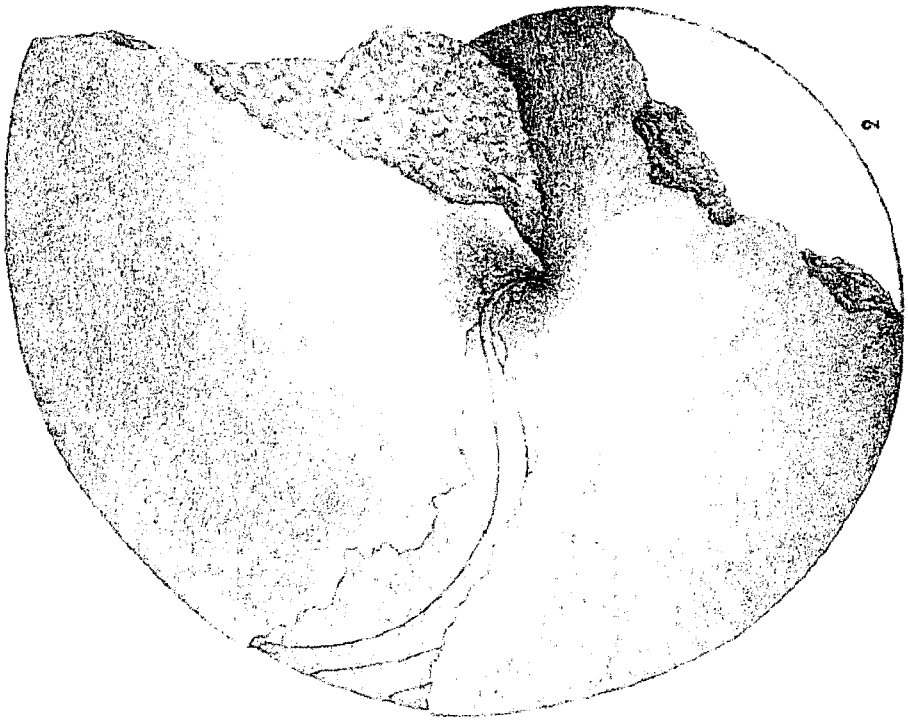

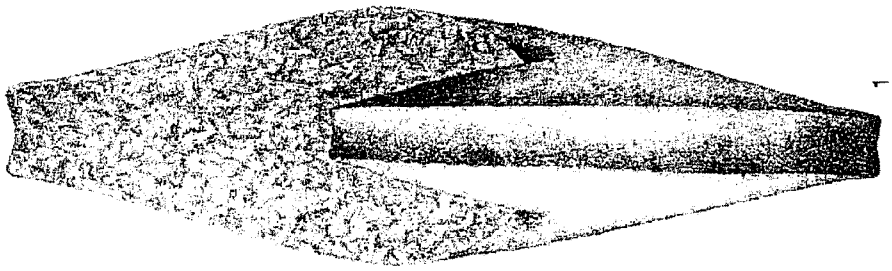

Miller and Thomas, Pennsylvanian Cephalopods

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APPENDIX DIX4

CLIMATOLOGY

Mountain Cement Company

Etchepare Limestone Quarry

Prepared by:
Mountain Cement Company
Laramie, Wyoming
February 2010

Adapted From:
Intermountain Resources
Appendix DVII4 Climatology
October, 1995

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APPENDIX DIX4

CLIMATOLOGY

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DIX4.3	Evaporation	DIX4-3
DIX4.4	Temperature Inversions	DIX4-4
DIX4.5	Wind	DIX4-4
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TABLES

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FIGURES

Figure DIX4-1. Wind Rose for 1993 Mountain Cement Meteorological Data DIX4-8

ATTACHMENT

Copy of Air Quality Permit No. CT-2033 for the Etchepare Quarry

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APPENDIX DV114

CLIMATOLOGY

DIX4.0 Introduction

Since the Mountain Cement Company Etchepare limestone quarry is approximately 5 miles southeast of Laramie, climatic data from the Laramie FAA-Airport station west of Laramie compiled by the National Oceanic and Atmospheric Administration (NOAA) would be representative of the climate at the amendment area.

Climatic conditions of southeastern Wyoming are generally location dependent with respect to elevation and proximity to mountain ranges. The amendment area lies on the high plains about 30 miles east of the Snowy Range Mountains at 7400 to 8600 feet elevation above mean sea level. The Snowy Range shields this location from eastward moving synoptic weather patterns so the climate in the area is dry. To the east and south the area is shielded by the Laramie Range and the Rockies of Northern Colorado, respectively. To the north the area is unprotected and is subsequently subjected to the movement of southerly trending arctic air masses from Canada. Because of the high frequency of clear skies and the relatively high elevation, the area experiences large diurnal temperature variations. The primary climatic influences in the area are cold dense air masses from the southwest and arctic masses from the north.

High winds are common to the area because it is at the southeastern end of the wind corridor. The most persistent winds are those from the west-southwest. The most dramatic are winds from the north which produce the well known "northerlies".

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DIX4.1 Temperature

Table DIX4-1 presents the climatic summary of data from the station at Laramie FAA Airport for the period of 1961 - 1990. The diurnal differences between daytime and nighttime temperatures average about 33°F in July and 24°F in January. The average annual temperature for Laramie is 40°F. July temperatures typically range from 48°F at night to 81°F during the day and average about 64°F. The highest temperature on record is 94°F having been attained in the months of June and August. January temperatures average about 20°F with maximum averages usually rising to 32°F and the minimum averaging 9°F. The lowest daily temperature on record is -50°F.

The average frost free period in Laramie is 93 days. The average date of the first fall frost is September 10 and the average date of the last spring frost is June 8.

DIX4.2 Precipitation

As shown in Table DIX4-1, Laramie, receives about 11 inches of precipitation each year. Less than half of this moisture is in the form of snow, with an average of 48 inches of snowfall each year. Table DIX4-1 also shows that May, June, July, and August are the four wettest months of the year. About 50 percent of the average annual precipitation occurs during these four months. The greatest monthly precipitation was in the month of July with 4 inches. September and October are the only two months that have gone without precipitation.

DIX4.3 Evaporation

As shown in Table DIX4-1 the May through September pan evaporation at Laramie averaged 48 inches. The coefficient usually used to convert pan evaporation to lake evaporation is O.7. This coefficient is applicable on an annual basis and can be used with relatively deep bodies of water. For shallow water bodies such as stock water ponds the coefficient has been found to be

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approximately O.9.

DIX4.4 Temperature Inversions

In the Laramie area inversions are for the most part, of quite short duration due primarily to topography and latitude. The topography is such that there is no collecting "valley" in which an inversion can persist and permit concentration of particulates in the atmosphere. Thus, air does not "stagnate" in this area. In these latitudes, the prevailing westerlies are strong and persistent unless the wave motion of the atmosphere blocks these westerlies. Definite atmospheric motion in the region is maintained from west to east.

DIX4.5 Wind

Wind speed in the Laramie area averages about 9 mph on an annual basis. The wind is somewhat stronger in the winter and early spring than in summer, and on the average is definitely stronger during the day than during the night. The predominant winds blow out of the west-southwest with the least recorded winds blowing out of the northeast. See Figure DIX4-1.

DIX4.6 Conclusions

The mine amendment area is located on the southeastern edge of the Laramie plains. The area is typified by a climate that is relatively cool, dry and windy. Limestone mining has occurred in the southeastern portion of the Laramie plains for an excess of 30 years with no impacts from climatic conditions. Impacts on this mining operation or the immediate environment by climate will be minimal. Work slowdowns may occur due to snow or rainstorms but these impacts would be short term. All runoff possibly carrying sediment will be prevented from leaving the mine site by construction of structures as discussed in the mine plan. Wind blown particles will be minimal due to the small size of area to be disturbed at any one time and the use of dust control measures. Past

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reclamation projects for mining, highways, pipelines and other disturbances have proven to be successful in the area hence climate will not affect revegetation of the site.

DIX4.7 Sources

Elliot, D. L., and W. R. Barchet, 1980. Wind Energy Resource Atlas, The Northwest Region. Report PNL 3195, WERA-1 VC-60, Pacific Northwest Laboratories, Richland, WA. 176 pp.

Martner, B. E., 1986. Wyoming Climate Atlas in cooperation with Wyoming Water Research Center University of Wyoming. University of Nebraska Press. 432 pp.

McVehil-Monnett Associates, Inc. 1997. Air Quality Modeling Analysis of Potential PM_{10} Impacts From the Etchepare LS Quarry. MMA Project No. 736-97.

U.S. Department of Commerce 1992. Daily Normals of Temperature, Precipitation and Heating and Cooling Degree Days 1961 - 1990. Wyoming, Laramie FAA AP, Climatography of the United States No. 84. NOAA Climate Data Center, Ashville N.C.

U.S. Department of Commerce. Monthly Station Normals of Temperature, Precipitation, and Heating and Cooling Degree Days 1961-1990. Wyoming. Climatography of the United States No. 81. NOAA Climate Data Center, Ashville N.C.

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Table DIX4-1.Climate Summary - Laramie, Wyoming FAA - Airport Station 5415, Elevation 7266, Period Spanned 1961-1990 (Temperature in °F and Precipitation in inches).

Temperature Normals (DEG F)

	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	ANN
Normal Max	31.9	34.8	40.5	50.7	61.5	72.9	80.4	77.9	68.3	56.6	42.0	33.3	54.2
Normal Min	8.0	10.7	16.4	24.1	33.0	41.7	47.8	45.7	37.1	27.4	17.0	9.9	26.6
Normal	20.0	22.8	28.5	37.4	47.3	57.3	64.1	61.8	52.8	42.0	29.5	21.7	40.4
Median	20.6	23.3	28.3	38.6	47.4	57.1	64.0	61.3	52.8	42.2	29.8	21.7	40.5

Precipitation Normals (Inches)

	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	ANN
Normal	.44	.45	.84	1.05	1.35	1.20	1.58	1.12	.94	.82	.64	.45	10.88
Median	.32	.30	.64	.88	1.11	.97	1.33	1.06	.76	.68	.51	.28	10.73

Evaporation

	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	ANN
Class A Pan Evaporation	-	-	-	-	8.96	10.23	11.02	9.73	7.65	-	-	-	-

Frost Period

	Spring Freeze		Autumn Freeze		Freeze Free Period		
	Mean	Last	Mean	Early	Mean	Max	Min
Light Frost 32	6-08	7-07	9-10	8-18	93	130	57
Moderate Freeze 28	5-23	6-14	9-22	8-19	122	147	87

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Severe 24	5-10	6-02	10-02	9-03	145	171	112

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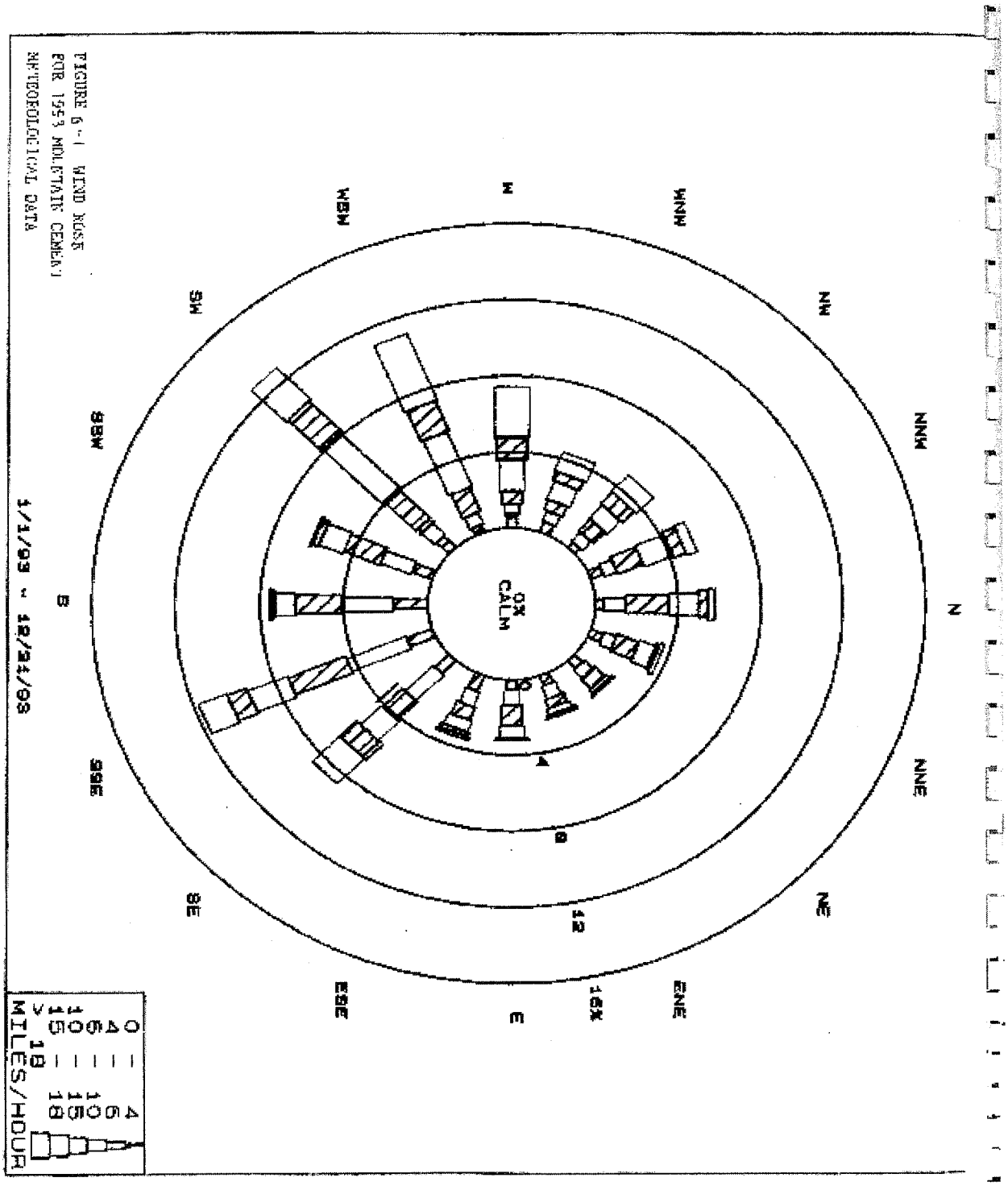
Figure DIX4-1- Wind Rose for 1993 Mountain Cement Meteorological Data



Permit 298C-A8
Etchepare LS Quarry
Submitted: April 2010

TFN ……..
Approved:_____

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APR 6 2010
WDEQ/LQD

The State
of Wyoming

Department of Environmental Quality

Jim Geringer, Governor

Herschler Building • 122 West 25th Street • Cheyenne, Wyoming 82002

ADMIN/OUTREACH	ABANDONED MINES	AIR QUALITY	INDUSTRIAL SITING	LAND QUALITY	SOLID & HAZ. WASTE	WATER QUALITY
(307) 777-7758	(307) 777-6145	(307) 777-7391	(307) 777-7369	(307) 777-7756	(307) 777-7752	(307) 777-7781
FAX 777-3610	FAX 777-6462	FAX 777-5616	FAX 777-6937	FAX 777-5864	FAX 777-5973	FAX 777-5973

October 19, 2000

Mr. Scott Nielson
Environmental Manager
Mountain Cement Company
5 Sand Creek Road
Laramie, WY 82070

Permit No. **CT-2033 (Corrected)**

Dear Mr. Nielson:

The Division of Air Quality of the Wyoming Department of Environmental Quality has completed final review of Mountain Cement Company application to construct a 750,000 ton per year (TPY) limestone quarry, known as the Etchepare Quarry, located in Sections 18, 19, 30, and 31, T15N, R72W, approximately 5 miles southeast of Highway 287 in Laramie, in Albany County, Wyoming.

Following this agency's proposed approval of the request as published July 27, 2000 and in accordance with Chapter 6, Section 2(m) of the Wyoming Air Quality Standards and Regulations, the public was afforded a 30-day period in which to submit comments concerning the proposed new source, and an opportunity for a public hearing. No comments have been received. Therefore, on the basis of the information provided to us, approval to construct a new limestone quarry as described in the application is hereby granted pursuant to Chapter 6, Section 2 of the regulations with the following conditions:

1. That authorized representatives of the Division of Air Quality be given permission to enter and inspect any property, premise or place on or at which an air pollution source is located or is being constructed or installed for the purpose of investigating actual or potential sources of air pollution, and for determining compliance or non-compliance with any rules, regulations, standards, permits or orders.

2. That all substantive commitments and descriptions set forth in the application for this permit, unless superseded by a specific condition of this permit, are incorporated herein by this reference and are enforceable as conditions of this permit.

3. That a permit to operate, in accordance with Chapter 6, Section 2(a)(iii) of the Wyoming Air Quality Standards and Regulations (WAQSR), is required after a 120-day startup period in order to operate this facility.

4. All notifications, reports and correspondence required by this permit shall be submitted to the Stationary Source Compliance Program Manager and the District Engineer, Air Quality Division, 122 West 25th Street, Cheyenne, WY 82002.

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File

5. That written notification of the anticipated date of initial startup, in accordance with Chapter 6, Section 2(i) of the WAQSR, is required 60 days prior to such date. Notification of the actual date of initial startup is required 15 days after startup.

6. That all unpaved haul routes (Howe Lane and Piper Quarry Haul Roads) scheduled to be utilized during the calendar year shall be treated with dust suppressant and water on a schedule sufficient to control fugitive dust from vehicular traffic and wind erosion. At a minimum, two (2) applications of dust suppressant shall be applied each calendar year.

7. That prior to removing material from the south half of Etchepare 5, and from Etchepare 6 and 7, Mountain Cement Company shall surface the 1.1 miles of the Howe Lane with a chip and seal or equivalent road surface to control fugitive dust emissions.

8. That crushing/screening equipment located at this site shall have a separate, valid air quality permit. Water sprays will be used during all hours of operation. All crushing/screening equipment operated at this site shall utilize water spray control measures at all belt transfer points, shaker screens, and discharge points of the primary and secondary crushers as necessary to limit visible emissions to twenty (20) percent opacity or applicable limits set by Wyoming Air Quality Standards and Regulations, Chapter 5, Section 2, Subpart OOO, as determined by 40 CFR Part 60, Appendix A, Method 9.

9. That access roads, work areas, exposed acreage and stockpiles shall be treated with water and/or chemical dust suppressants on a schedule sufficient to control fugitive dust from vehicular traffic and wind erosion.

It must be noted that this approval does not relieve you of your obligation to comply with all applicable county, state, and federal standards, regulations or ordinances. Special attention must be given to Chapter 6, Section 2 of the Wyoming Air Quality Standards and Regulations, which details the requirements for compliance with conditions 3 and 5. Any appeal of this permit as a final action of the Department must be made to the Environmental Quality Council within sixty (60) days of permit issuance per Section 16, Chapter I, General Rules of Practice and Procedure, Department of Environmental Quality.

If we may be of further assistance to you, please feel free to contact this office.

Sincerely,

Dan Olson
Administrator
Air Quality Division

Dennis Hemmer
Director
Dept. of Environmental Quality

cc: District 1 Engineer

DO/cs

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WDEQ/LQD

5/10

APPENDIX DIX5

TOPOGRAPHY, GEOLOGY AND OVERBURDEN ASSESSMENT

Mountain Cement Company

Etchepare Limestone Quarry

Permit #298C-A8

Prepared by

Mountain Cement Company
5 Sand Creek Rd.
Laramie, Wyo. 82070

August 2012

TFN 5 1/110
RECD OCT 15,2012

APPENDIX DIX5

TOPOGRAPHY, GEOLOGY AND OVERBURDEN ASSESSMENT

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DIX5.2 Topography	DIX5-2
DIX5.3 Geology	DIX5-3
DIX5.4 Overburden	DIX5-7
DIX5.5 Conclusions	DIX5-7
DIX5.6 Sources	DIX5-8

DIX7.7 FIGURES

Figures DIX5-1 -- DIX5-54: Geologic Cross Sections

Figures DIX5-55: Drill Hole Stratigraphic Columns from 2010 Exploration Work

MAPS

Map DIX5-1. Permit Area Location and Pre-Mine Topography

Maps DIX5-2 & DIX5-3. Geology of the Permit and Surrounding Area

Map DIX5-4. Cross-Section Locations

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APPENDIX DIX5

TOPOGRAPHY, GEOLOGY AND OVERBURDEN ASSESSMENT

DIX5.1 Introduction

The Etchepare Limestone permit area is located in Albany County, Wyoming, approximately 5 miles southeast of Laramie. Access is by way of Howe Road. The entire area to be mined consists of eleven contiguous and non-contiguous finger shaped pits ranging in size from 5 to 850 acres and totaling 3450 acres of mine disturbance. The haulroads affect approximately 150 acres of land. The entire permit area totals 8373.13 acres. As shown on Map DIX5-1, the affected areas are comprised primarily of gently sloping, west facing hillsides. Ephemeral drainages run west off the hillsides into one of three intermittent ephemeral drainages, Pope Springs Creek, Soldier Springs Creek or Simpson Springs Creek. Topographical relief is minor in the affected areas ranging from about 200 feet to more than 300 feet over the distance of 2 miles, in some pits. Topographic elevation across the entire permit area ranges from approximately 7560 feet in the Southwest corner to 8680 feet in the East.

DIX5.2 Topography

The topography of the permit area and adjacent areas is composed of gently rolling hills and deep, steep sloped canyons with limestone outcrops occurring throughout the area. Elevations range from a high of approximately 8680 feet on the eastern portion of the permit area boundary to a low of 7560 feet along the western boundary. Map DIX5-1 is an enlarged area of the Wyoming USGS topographic map that shows the proposed permit and affected areas. The majority of the affected area gently slopes at an average of 7.9 percent to the west.

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However, slopes immediately adjacent to the ephemeral drainages are much steeper and range from 10 to 50 percent. The elevation of the entire mined area will drop an average of 10 to 20 feet when the limestone is removed. Overall average post-mining topography will be similar to the observed pre-mining topography with small increases along the disturbance area boundaries and decreases adjacent to drainages. Ephemeral drainage channel geometry is described in more detail in Appendix DIX6.

DIX5.3 Geology

The proposed permit area is located on the southeast side of the Laramie Basin. The Laramie range, which lie immediately east of the City limits, was uplifted by compressional forces during the Laramide orogeny. This uplift resulted in general stratigraphic dips of approximately 2° - 5° to the west away from the Laramie Mountains and strike nearly north-south. The stratum that outcrops within the permit area is primarily limestone of the Casper Formation with dips closer to 2°. The uplift was not entirely uniform and faults and folds locally interrupt the dip regime (Lundy, 1978) It has also been noted that there is a wide variability in the stratum, especially in thicknesses thinning from North to South. Alluvial, colluvial, and eolian deposits are found along major ephemeral drainages and in other areas west of the permit area.

Map DIX5-2 is a geological map of the permit and affected area (adapted from Ver Ploeg, 1995). This map shows the local limestone units comprising the Casper Formation, and the effect of the fault running through the Etchepare amendment area. Subsurface geology is illustrated in 54 cross sections, in Figures DIX 5-1 through DIX5-54. The Casper formation is the stratum of interest for Mountain Cement and is comprised of marine and eolian sandstones, interbedded with marine limestone and minor amounts of shale. It is divided into five members, alpha-epsilon, and limestone comprises approximately 15% of the formation.

There will be several areas where Mountain Cement will wish to mine two limestone deposits within the Casper Formation simultaneously, primarily in the northern regions of the

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amendment area. Mountain Cement will attempt to do this only when certain conditions are present; those conditions being: when the quality of the second limestone is adequate, when the amount of interburden is not restrictive, and when that second limestone is not the same deposit or stratigraphically lower that the adjacent drainages are composed of, as this will prevent mining deeper than the drainage bottoms. As shown on Map DIX5-3, five of the ten limestone beds outcrop within and near the permit area.

Figure 3-2 in the Casper Aquifer Protection Plan presents a stratigraphic column in the vicinity of Laramie, including a description and approximate thicknesses of each layer within the Casper formation. Below are general descroptions based on Ver Ploeg (1995) and CAPP (2011) of the strata discussed above that are found on or adjacent to the permit area as shown on Map DIX5-2.

Alluvial Deposits (Quaternary)

Unconsolidated and poorly consolidated clay, silt, sand and gravel; mainly in floodplains and lowest stream terraces. Thickness 0 to 25 feet.

Wind-Blown Deposits(Quaternary)

Active/stabilized dunes made up of very fine to find grain sands.

Mixed Alluvium and Colluvium (Quaternary)

Sand, silt, clay and gravel deposited mainly along intermittent streams; includes slope wash and smaller alluvial fan deposits that coalesce with alluvium. Thickness approximately 0 to 20 feet.

Alluvial Fan Deposits (Quaternary)

Poorly sorted clay, silt, and gravel; crudely bedded to nonbedded. Appear to be active receiving sediments from intermittent streams flowing off of the Laramie Range. May have some debris flow component. Grade into terrace deposits toward west, approaching the Laramie River. Locally, grade into alluvium and colluvium. Thickness approximately 0 to 25 feet.

Older Alluvial Fan Deposits (Quaternary)

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Poorly sorted clay, silt, sand and gravel; crudely bedded to nonbedded with some debris flow component. Limestone cobbles are common. Currently inactive and dissected, often occurring as erosional remnants. Grade into older terrace deposits toward the west, in the northern part of the map area. Thickness 0 to 30 feet.

Satanka Shale (Permian)

Permian red beds with sandy shale interbedded with sandstone and siltstone layers. The overlying Satanka Sandstone ranges form absent to about 25 feet thick. Overburden characterization is better covered in Section DIX5.4. Satanka Shale is not present in the permit area.

Casper Formation (Permian and Pennsylvanian)

Brief Description: Buff to reddish, calcareous to quartzitic, very fine- to coarse-grained, well cemented subarkosic sandstone interbedded with buff to purplish-gray limestone and dolomite beds, usually micritic and locally fossiliferous. Sandstone often exhibits large-scale festoon cross-bedding, increasing toward the south. As many as 10 different limestone or dolomite beds, which are locally quarried for cement or gravel uses, have been identified in the Laramie area. Limestone comprises approximately 15 percent of the formation. The Casper formation is exposed on the western slope of the Laramie Range, including the permit area. It is informally subdivided from the bottom to the top into five members, designated alpha through epsilon, each of which consists of a sandstone layer bounded at the top by a regionally continuous limestone (Lundy,1978) The Casper Formation serves as the prime aquifer in the Laramie area. Intertongues with underlying Fountain Formation, which is less than 50 feet thick and does not crop out in the map area. Thickness 600 to 700 feet.

The Casper Formation unconformably overlies the Fountain Formation where it exists, or the Sherman Granite which acts as an effective lower confining layer. The low Satanka Shale provides an effective upper confining layer where it exists in sufficient thickness(CAPP, 2011). The Casper formation varies in thickness thinning from north to south with a total thickness ranging from 600 to 800 feet at the southern end of the Laramie Basin (Ver Ploeg, 1995). The Casper Formation is a buff to reddish, calcareous to quartzitic, very fine to coarse grained, well cemented to subarkosic sandstone interbedded with buff to purplish-gray limestone and dolomite beds, usually micritic and locally fossiliferous (Ver Ploeg, 1998). Sandstone accounts for approximately 85% of the unit, with limestone comprising the remaining lithology. The upper section of the Casper Formation consists of alternating layers of limestone and sandstone, where the 5 to 25 feet thick limestones separate generally fine-grained, well-sorted and well-cemented sandstones which are 12 to 60 feet thick (Burritt, 1962). The lower section of the Casper Formation consists of fine-grained shaley sandstones, siltstones and shales with interbedded limestones and is less permeable than the upper section. The Casper Formation has been divided into five members in

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ascending order, alpha, beta, gamma, delta and epsilon, with each member consisting of a thick sandstone unit separated by a laterally extensive limestone (Lundy, 1978). As many as ten different limestone or dolomite beds have been identified in the Laramie area and the limestone beds are numbered in stratigraphic sequence ascending from the top of the Laramie Mountains to the Laramie Plains. The primary stratum that outcrops within the permit area is the resistant limestone of the Casper Formation. The limestone beds dip gently to the west with an average thickness ranging from 2 to 20 feet over the permit area and are generally underlain by sandstone. Portions of the limestone are covered with overburden, sandstone and soil material, while the remaining areas are exposed cap rock. The Casper Formation has water bearing characteristics and supplies water to both wells and springs on the west flank of the Laramie Range. Sandstones in the Casper Formation have large permeabilities in comparison with regional geologic units. The Casper Aquifer has been studied extensively because it provides municipal water for the City of Laramie.
The Red Hills Fault, which runs roughly north-south through the Etchepare Amendment, is a right-lateral, oblique-slip fault that is down-thrown to the east. Several smaller faults with motions indicated on Maps DIX5-2 and DIX5-3 are associated with the Red Hills Fault, creating a fault zone that is referenced on several of the cross sections. The displacement along the fault is evident, indicated by the outcrop pattern along the trace of the fault, as well as lateral displacement of the Soldier Monocline.

Fountain Formation

The Fountain Formation is an irregularly distributed sedimentary unit that appears in thicknesses of up to 50 feet and then pinches out throughout the Laramie area (Lundy, 1978). The Fountain Formation is arkosic sandstone with small amounts of siltstone that unconformably overlies the Sherman Granite. In the Laramie area, the Fountain Formation is relatively thin and is often included with the overlying Casper Formation. Does not crop out in the map area.

Sherman Granite

Sherman Granite is a Precambrian basement rock that forms the core of the Laramie Range. It is resistant to erosion and is responsible for the topographic relief at the edges of the Laramie Basin and is predominantly exposed east of the Laramie Range. Sherman Granite is a crystalline igneous and metamorphic rock that consists primarily of granite with gneiss anorthosite and gabbro intrusions. The crystalline matrix is impermeable; however secondary permeability is imparted to the rock by fracturing and weathering. Groundwater movement within the Sherman Granite is typified by conduit flow. The Sherman Granite yields small amounts of water, maximum anticipated yield of approx 20 gallons per minute in fractured or weathered granite, to domestic wells but is not an aquifer suitable for high yield irrigation, commercial or municipal uses. In general, the regional hydraulic role of the Sherman Granite is a lower confining layer, aquitard or aquiclude, to the overlying Casper Formation, although

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there as not been a systematic study of the hydrogeology of the Sherman Granite to date (CAPP, 2011).

Based on a maximum depth of mining, the total volume of limestone resource for the proposed mining areas is calculated to be approximately 200 million tons. The average thickness of limestone ranges from 2 to approximately 20 feet depending on site. The amount of overburden present varies from site to site, ranging from none to depths of 25 feet. The overburden that does occur is primarily mixed limestone, sandstone and soil material and the limestone bed is generally underlain by sandstone.

Several faults have been identified along the western flank of the Laramie Range in the vicinity of this study area. As explained before, the uplift caused by the Laramide orogeny between 75 and 50 million years ago was not entirely uniform and faults and folds locally interrupt the dep regime. The oldest set of faults is the reverse faults and monoclines caused by the compression and uplift of the Laramie range, and then there are normal faults formed by extensional stress. In most cases, the faults and folds observed in the Casper Formation do not propagate vertically through the entire thickness of the overlying Satanka Shale, with some exceptions. CAPP (2011) The majority of proposed mining will occur to the east of the main trace of the Red Hills reverse fault, except the mining remaining to be done in Sections 31 and 36, which will occur west of the fault. Folding in the area predominantly occurs as east-west trending, west plunging anticlines and monoclines. The Red Hills Fault, Pilot Hill Monocline, Soldier Monocline and Simpson Springs Anticline all are in part located within the permit area. Limestone has been mined in this area for over 30 years and highly fractured limestone has never been documented during mining operations. Please see Appendix DIX6 for detailed information on faults and fractures.

As mentioned previously the limestone that will be mined is a surface layer ranging from 2 to 20 feet thick. Some sites may have minor amounts of topsoil or overburden on top of the limestone. The limestone that will be mined is generally uniform in nature with high enough calcium carbonate content and low enough silicates to be usable in cement production. Mining stops where the silica content, usually in the form of sand, has increased

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to the point the material is not suitable for cement production. The limestone grades to a mixture of sandstone and limestone at variable depths and is finally underlain by sandstone. Drilling has been conducted in several areas throughout the current permit. In 2008 and 2010 Mountain Cement drilled its own property, as well as Mountain Land & Cattle Company's property, to estimate and evaluate the depths of overburden and the uppermost limestone layer, as well as to estimate the thicknesses of the sandstone interburden and second limestone. Similarly, they also collected quality data for the top and second limestones. The interburden ranged between 15 and 40 feet in thickness. The drilling logs from the 2010 drilling campaign are attached as Figure DIX5-55.

DIX5.4 Overburden and Interburden

The amount of overburden encountered over limestone ranged from zero to 25 feet but is closer to zero on most areas to be mined. This material is generally soil and sandstone with a limited amount of limestone, which is unsuitable for use in the plant. However, the amount of overburden varies due to the vastness of the permit area. Past reclamation and revegetation success at various sites within the permit area using the overburden as backfill have demonstrated its suitability. Five overburden sampling locations were randomly selected across the amendment area: the samples have been analyzed for pH, conductivity, and Extractable Selenium. The interburden is primarily the sandstone members of the Casper Formation with red and black shales and siltstones occurring locally. The interburden will be used as fill when mining is complete.

Overburden Analysis Table

Overburden Sample #	**pH**	**Conductivity**(mmhos/cm)	**Extractable Selenium** (ppm)
1	8.3	0.4	<0.001
2	7.8	0.5	0.380
3	7.6	0.8	<0.001
4	8.0	0.4	0.500
5	8.5	0.6	<0.001

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RECD MAR 07, 2013

plan. This limestone will be mixed with the appropriate amounts of other raw materials in a process primarily for producing dry cement.

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DIX5.6 SOURCES

Benniran, M.M., 197O, Casper Formation limestone, southwestern Laramie Mountains, Albany County, Wyoming: M.S. Thesis, University of Wyoming, Laramie, 95 p., plate 1, map scale 1:24,000

Burritt, Edward Curtis, 1962, A ground water study of part of the southern Laramie Basin, Albany County, Wyoming; University of Wyoming Department of Geology and Geophysics, M.A. Thesis.

Casper Aquifer Protection Plan, 2011

Lowry, Marlin E., Rucker, Samuel J., IV, and Wahl, Kenneth L., 1973, Water resources of the Laramie, Shirley, Hanna Basins and adjacent areas, southeastern Wyoming; U.S. Geological Survey Hydrologic Investigations Atlas HA-471.

Lundy, D.A., 1978. Hydrology and Geochemistry of the Casper Aquifer in the Vicinity of Laramie, Albany County, Wyoming. Unpublished M.S. Thesis, University of Wyoming.

Ver Ploeg, Alan J., 1995, Preliminary Geologic maps of the Laramie and Red Buttes Quadrangles, Albany County, Wyoming. Wyoming State Geological Survey.

Ver Ploeg, Alan J., 2008, Geologic Map of the Laramie Quadrangle, Albany County, Wyo. Wyoming State Geological Survey.

Ver Ploeg, Alan J., 2007, Geologic Map of the Red Buttes Quadrangle, Albany County, Wyo. Wyoming State Geological Survey.

Ver Ploeg, Alan J., 2006, Preliminary Geologic Map of the Pilot Hill, Albany County, Wyo. Wyoming State Geological Survey.

Ver Ploeg, Alan J. and Boyd, Cynthia S., 2000, Preliminary Digital Geologic Map of the Laramie 30'x 60' Quadrangle, Albany and Laramie Counties, Southeastern Wyoming. Wyoming State Geological Survey.

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DIX5.7 FIGURES

Geologic Cross-Sections
Figures DIX5-1 Through DIX5-54

Drill Hole Stratigraphic Columns from 2010 Exploration Work
Figure DIX5-55

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Figure DIX5-55

Drill Hole Stratigraphic Columns from 2010 Exploration Work

Introduction:

The attached Stratigraphic Columns were generated from the Drill Hole Log data collected as the holes were drilled. The drilling operations took place in November 2010 and June 2011; at no point during the drilling was groundwater intersected.

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RECD AUG 4 ,2011

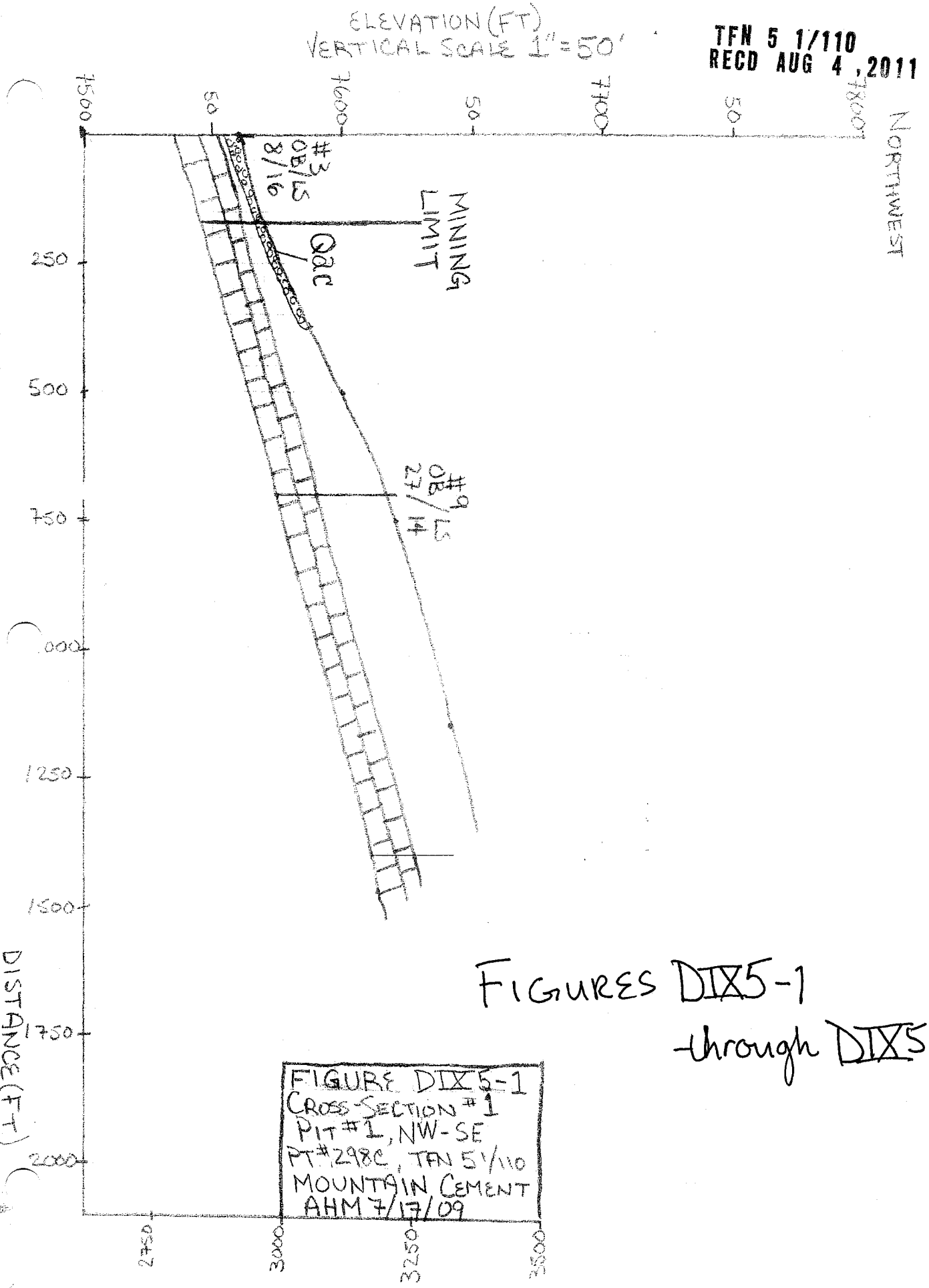


FIGURE DIX5-1
CROSS-SECTION #1
PIT #1, NW-SE
PT #298C, TFN 5 1/110
MOUNTAIN CEMENT
AHM 7/17/09

FIGURES DIX5-1
through DIX5-55

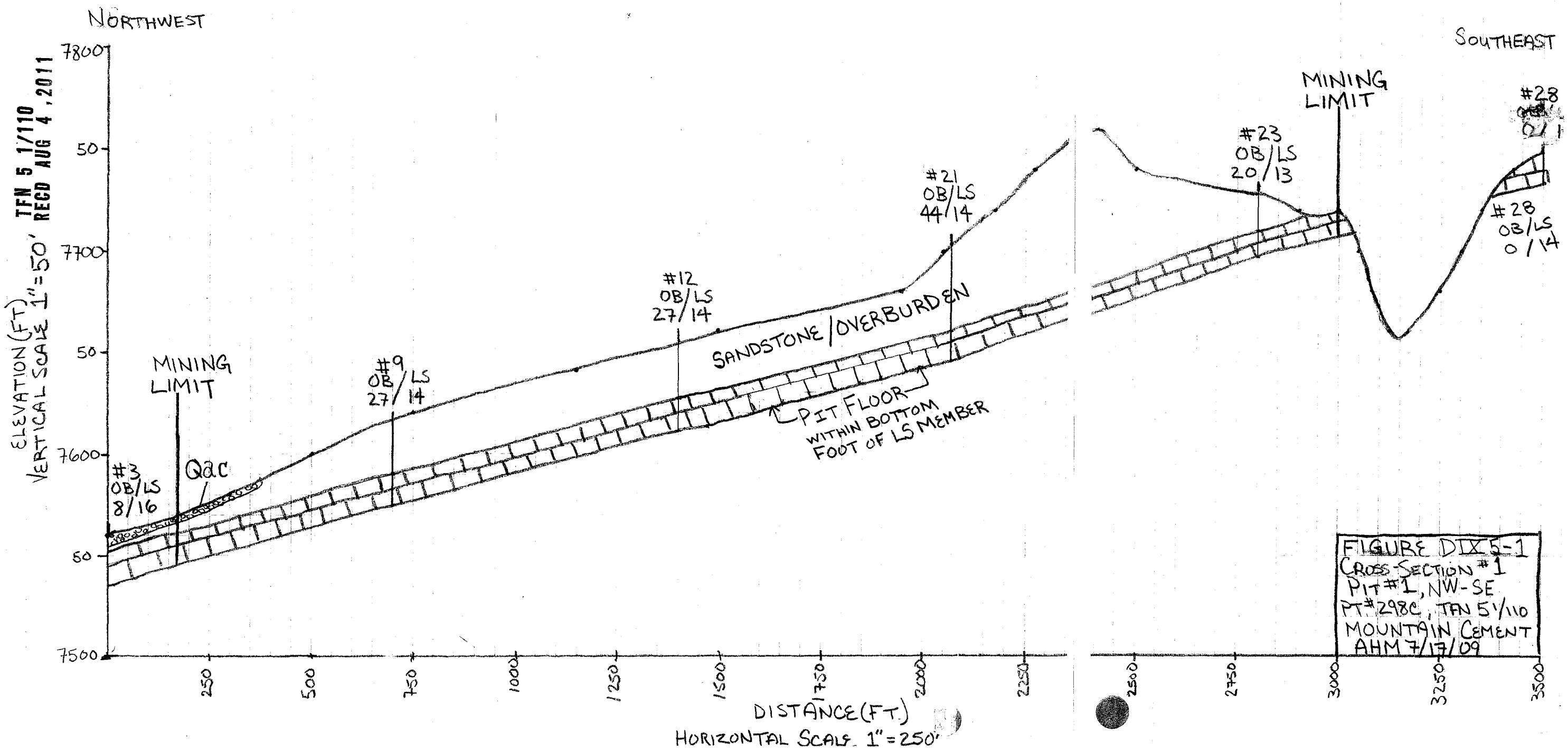
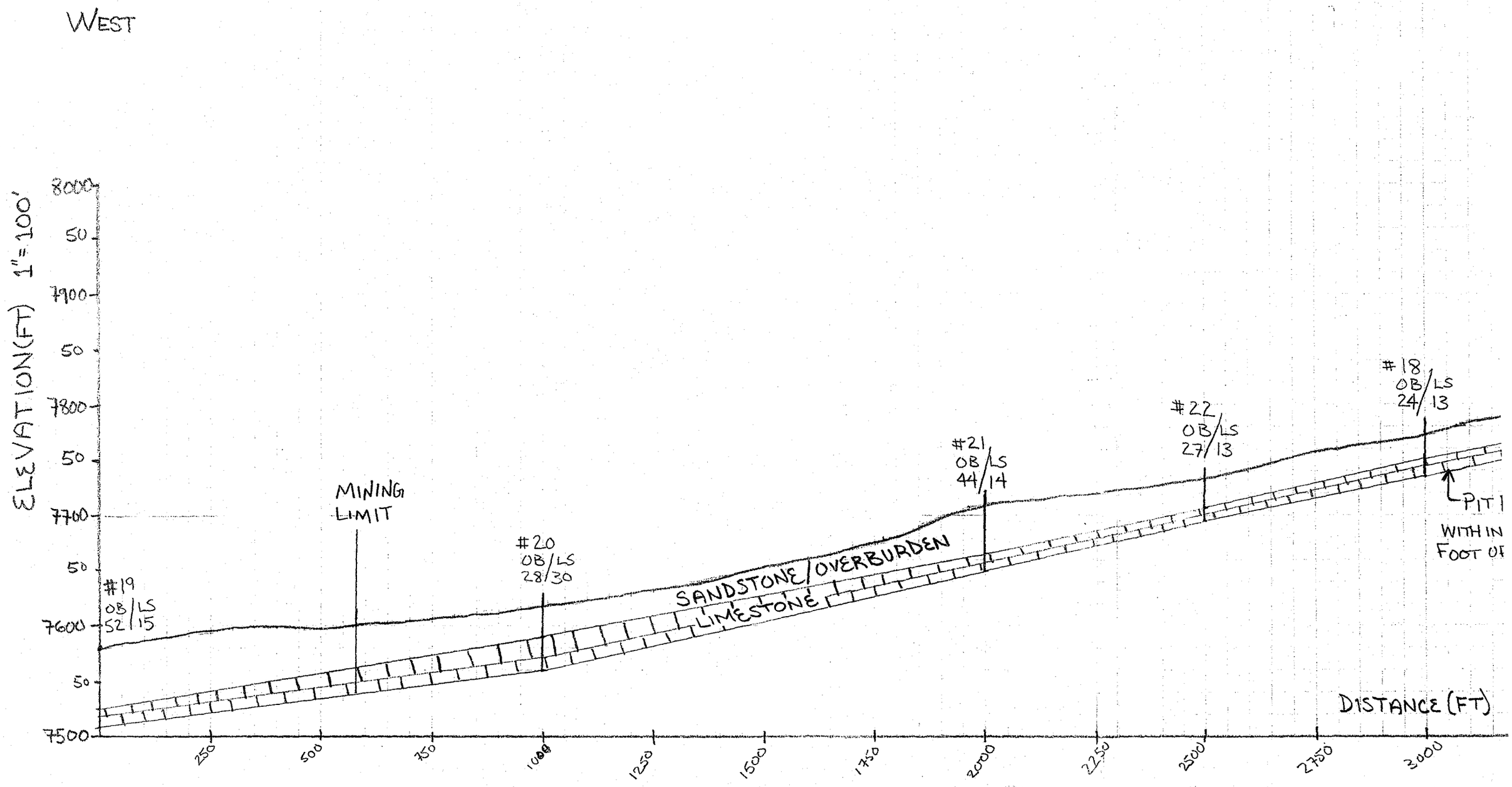


FIGURE DIX 5-1
CROSS-SECTION #1
PIT #1, NW-SE
PT #298C, TFN 5 1/110
MOUNTAIN CEMENT
AHM 7/17/09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ELEVATION(FT) 1"=100'
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50
7900
50
7800
50
7700
50
7600
50
7500
#19
OB/LS
52/15
MINING
LIMIT
#20
OB/LS
28/30
SANDSTONE/OVERBURDEN
LIMESTONE
#21
OB/LS
44/14
#22
OB/LS
27/13
#18
OB/LS
24/13
PIT 1
WITHIN
FOOT OF
DISTANCE (FT)
250
500
750
1000
1250
1500
1750
2000
2250
2500
2750
3000

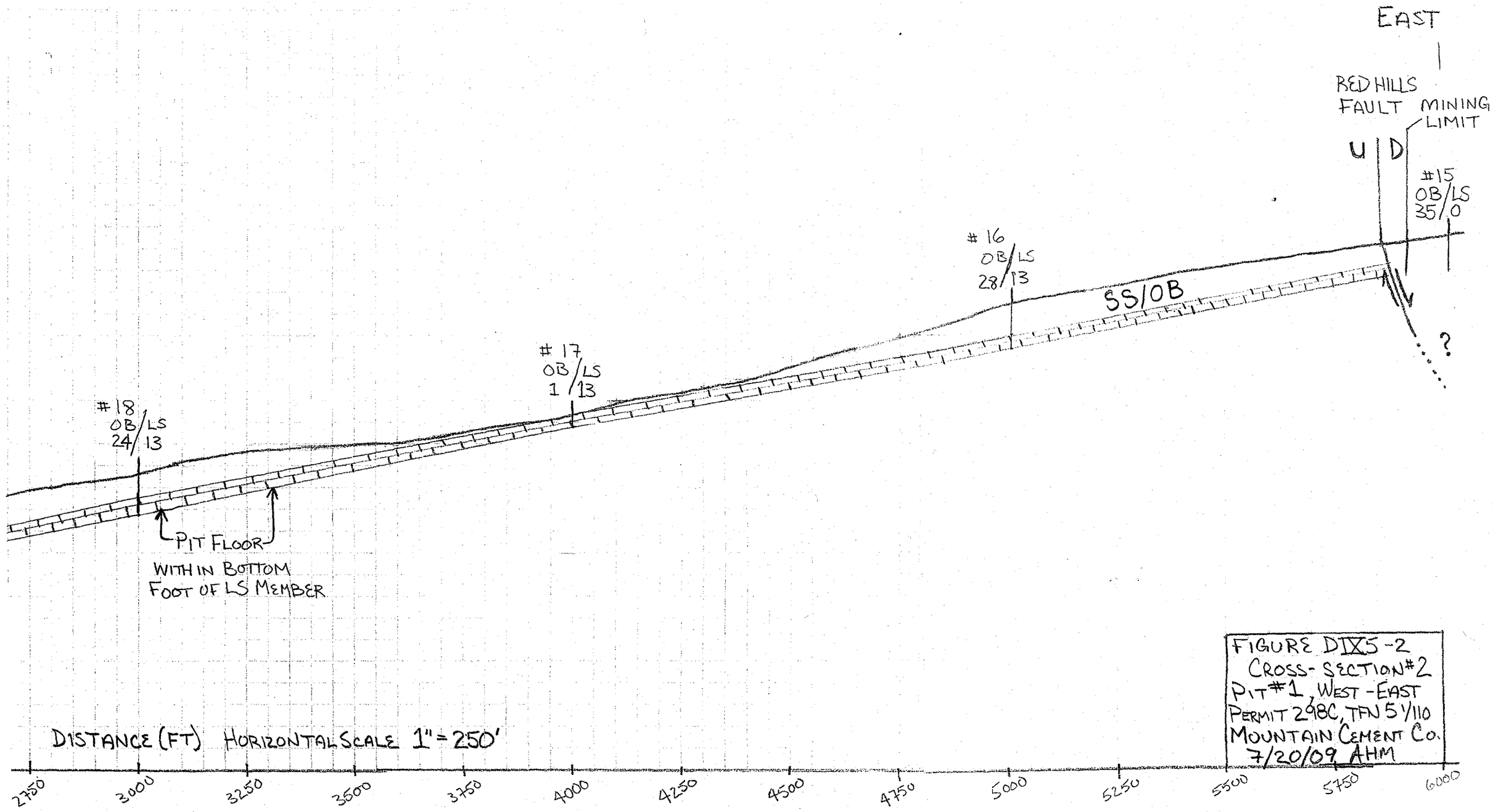


FIGURE DIX5-2
CROSS-SECTION #2
PIT #1, WEST-EAST
PERMIT 298C, TFN 5 1/110
MOUNTAIN CEMENT CO.
7/20/09 AHM

FN 5 1/110
RCD AUG 4, 2011

TFN 5 1/110
AUG 4, 2011

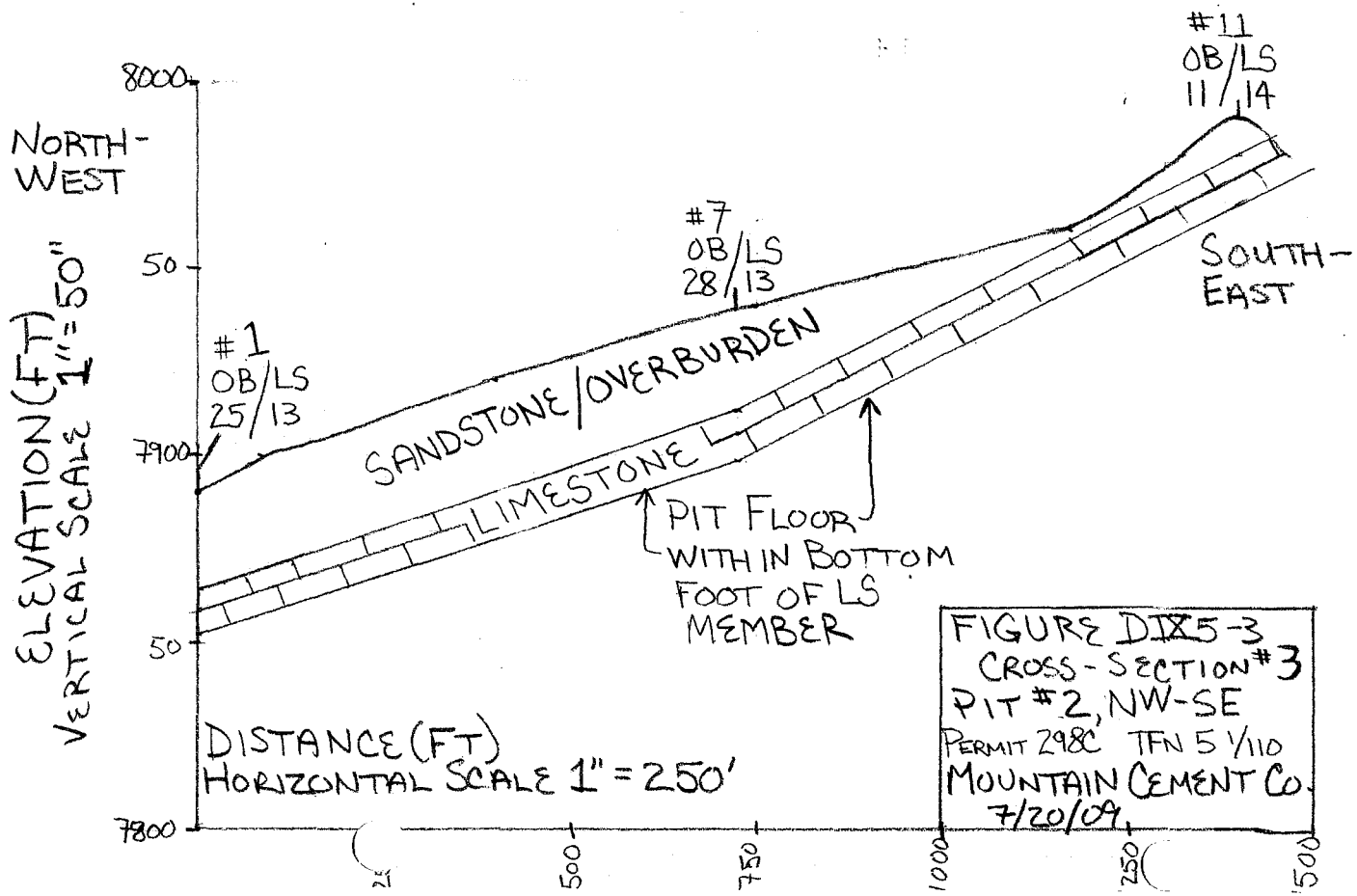


FIGURE DIX5-3
CROSS-SECTION #3
PIT #2, NW-SE
PERMIT 298C TFN 5 1/110
MOUNTAIN CEMENT CO.
7/20/09

TFN 5 1/110
AUG 4, 2011

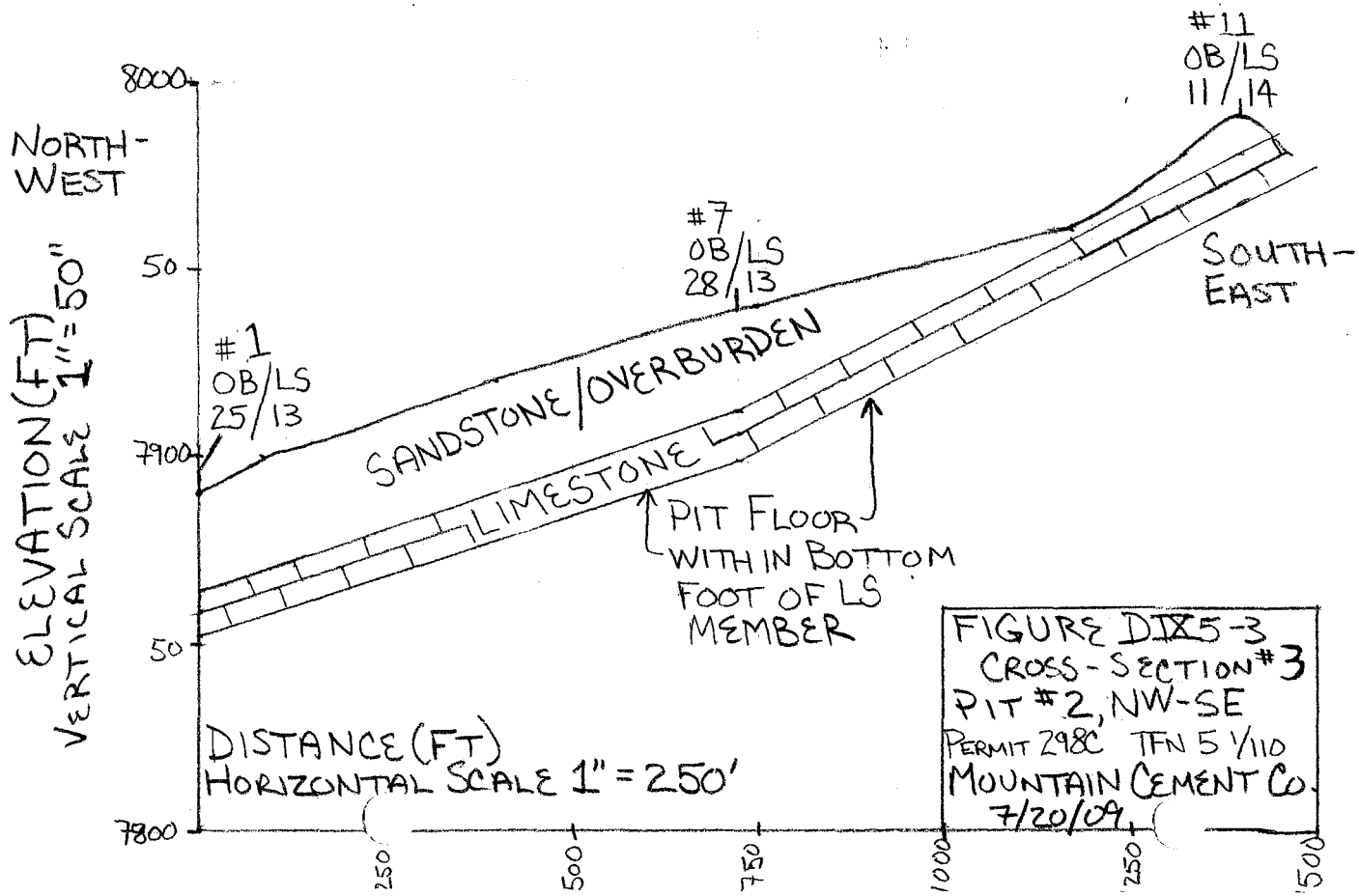


FIGURE DIX5-3
CROSS-SECTION #3
PIT #2, NW-SE
PERMIT 298C TFN 5 1/110
MOUNTAIN CEMENT CO.
7/20/09

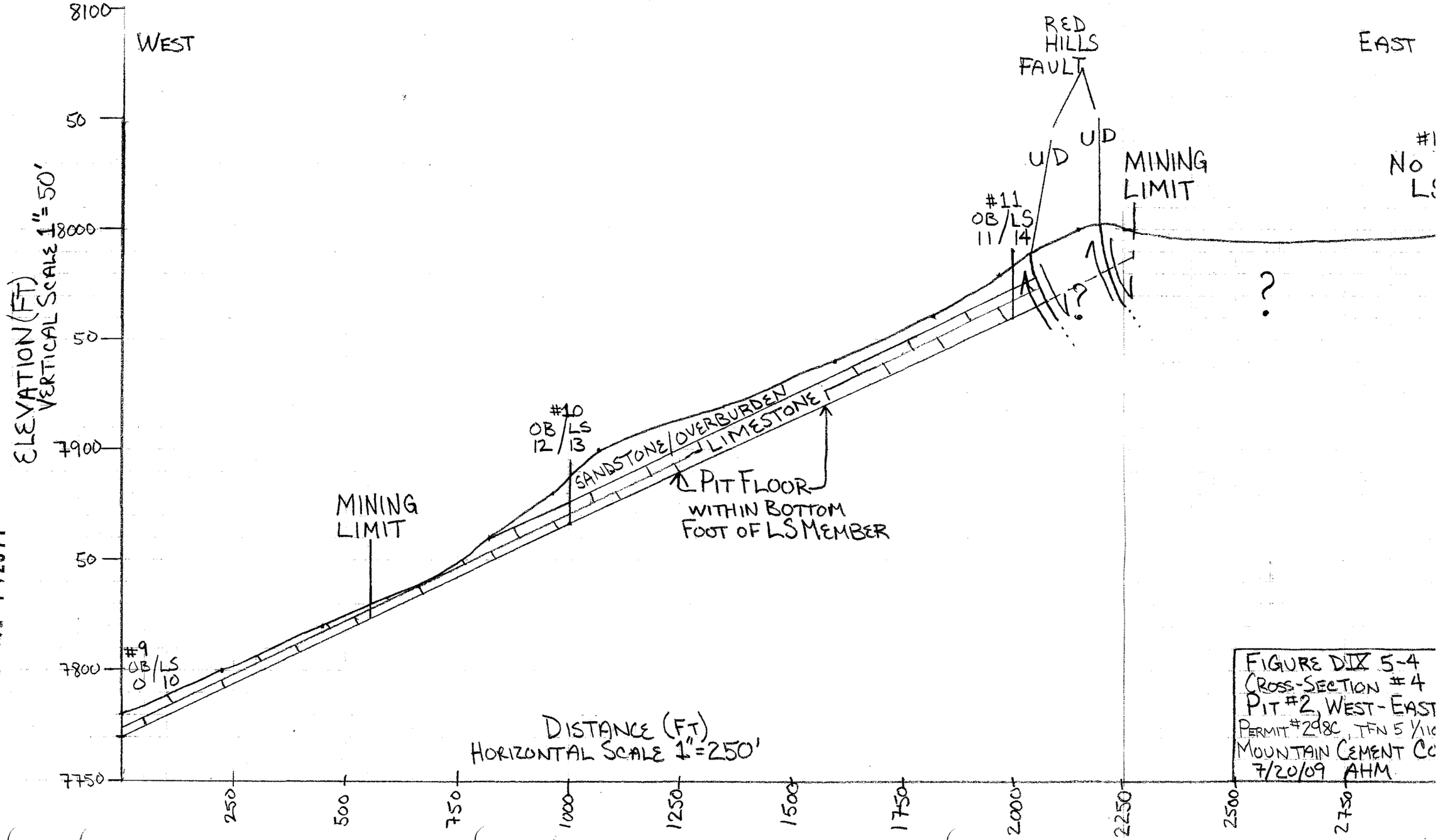


FIGURE DIX 5-4
CROSS-SECTION #4
PIT #2, WEST-EAST
PERMIT #298C, TFN 5 1/110
MOUNTAIN CEMENT CO
7/20/09 AHM

TFN 5 1/110
RECD AUG 4, 2011

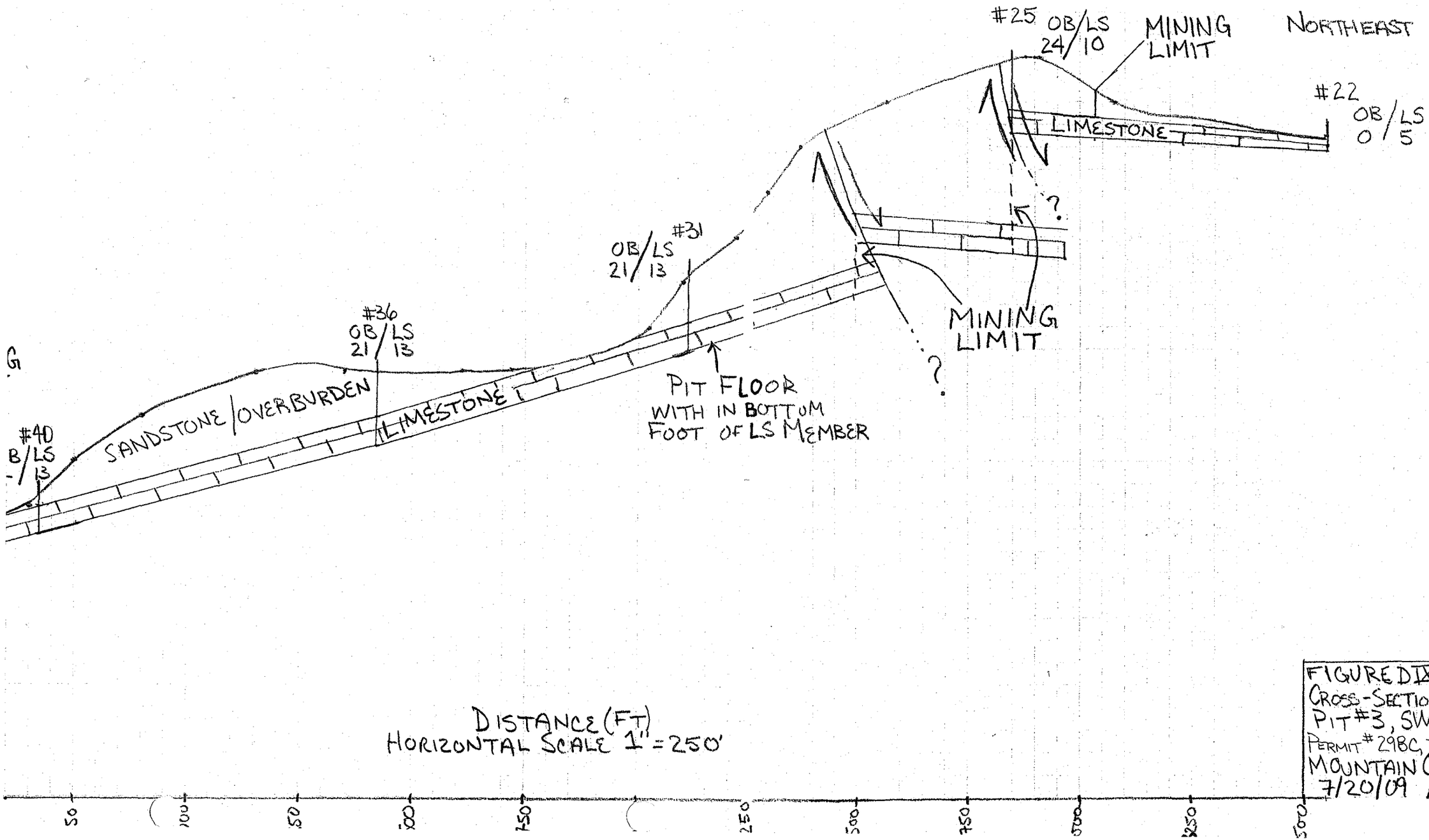
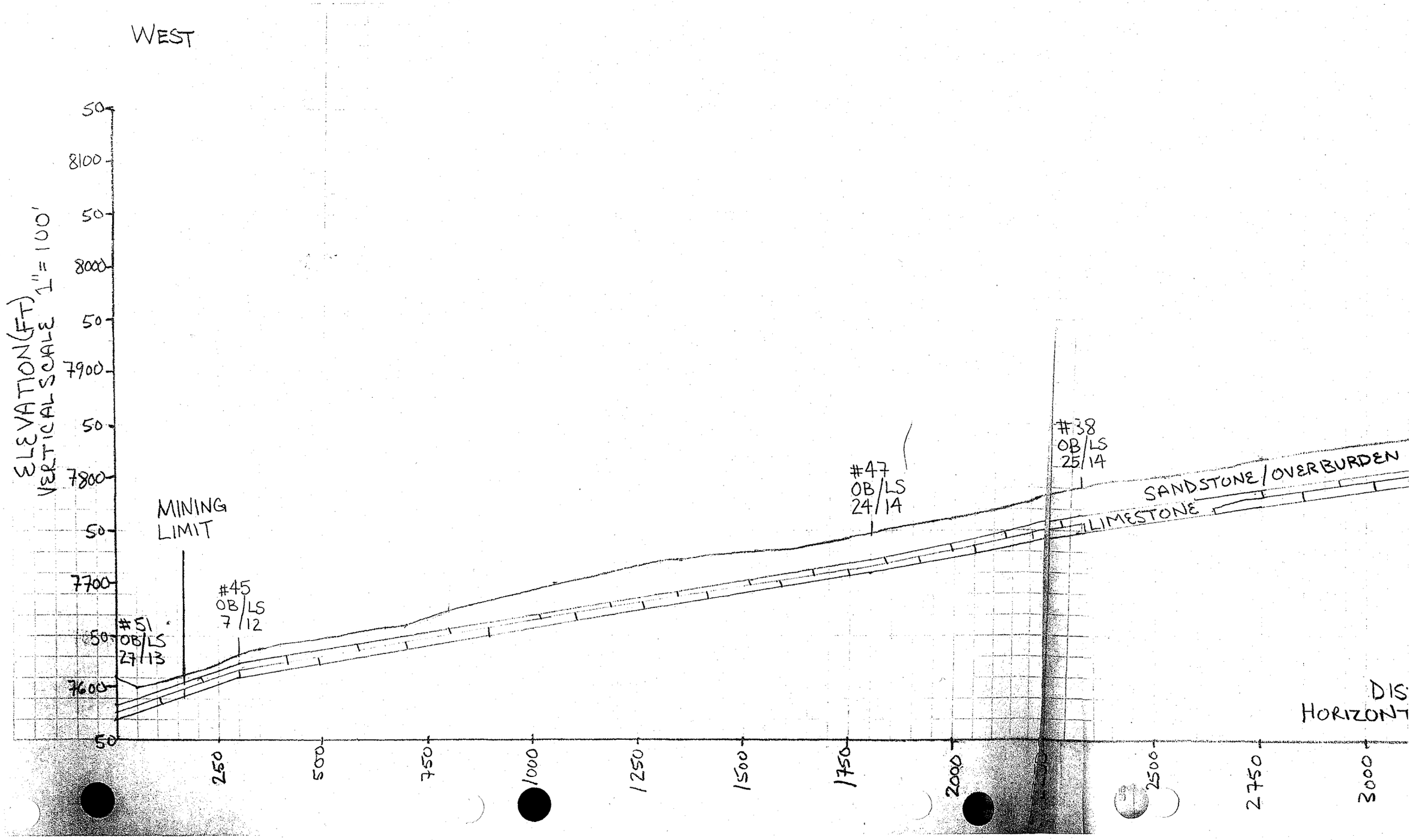


FIGURE DIX 5-5
CROSS-SECTION #5
PIT #3, SW-NE
PERMIT # 298C, TFN 5 1/110
MOUNTAIN CEMENT CO.
7/20/09 AHM


WEST
ELEVATION (FT)
VERTICAL SCALE 1" = 100'
50
8100
50
8000
50
7900
50
7800
50
7700
50
7600
50
MINING LIMIT
#51
OB/LS
27/13
#45
OB/LS
7/12
#47
OB/LS
24/14
#38
OB/LS
25/14
SANDSTONE/OVERBURDEN
LIMESTONE
DIS
HORIZONT
250
500
750
1000
1250
1500
1750
2000
2500
2750
3000

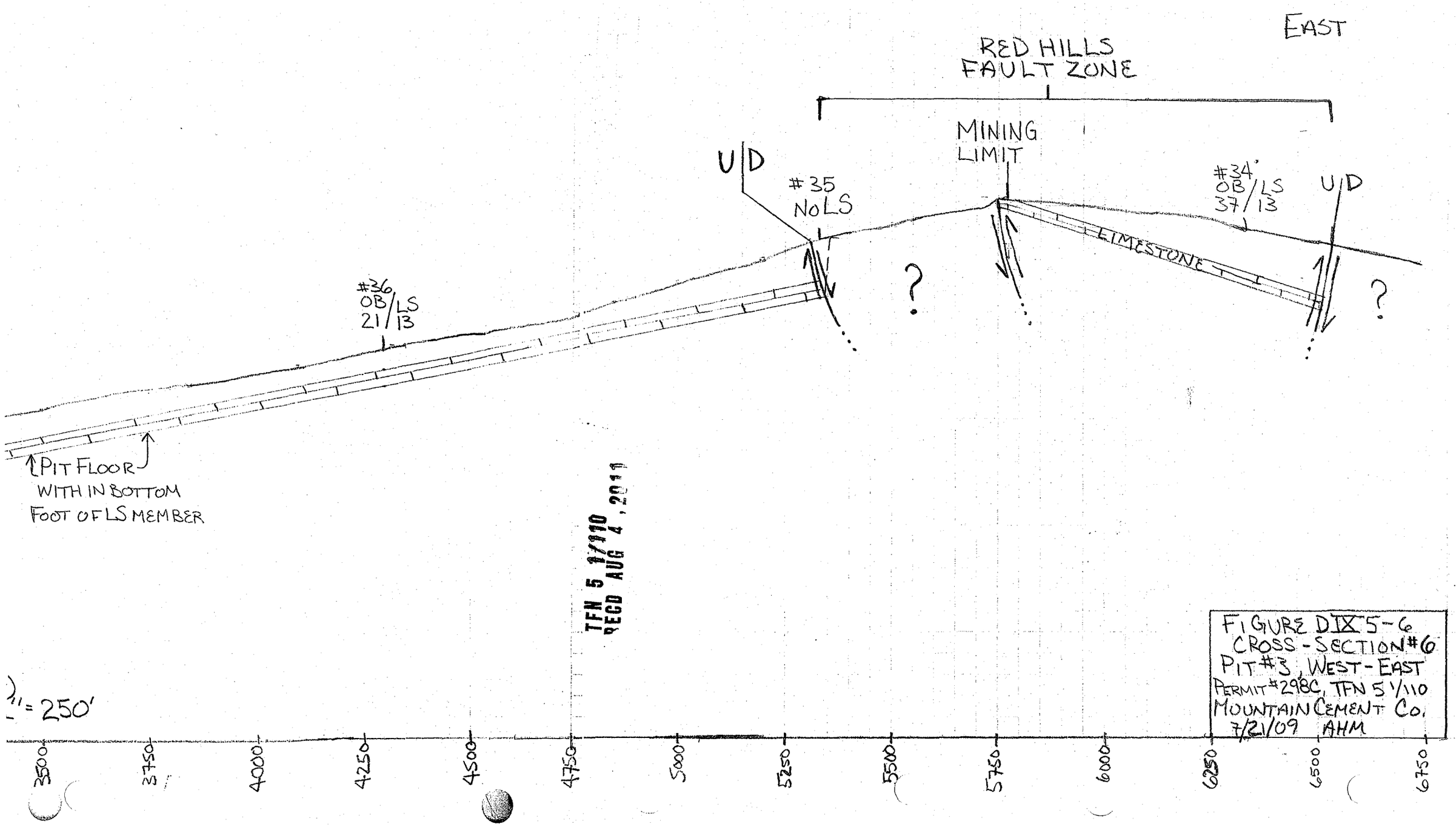


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FIGURE DIX 5-6
CROSS-SECTION #6
PIT #3, WEST-EAST
PERMIT #298C, TFN 5 1/110
MOUNTAIN CEMENT CO.
7/21/09 AHM

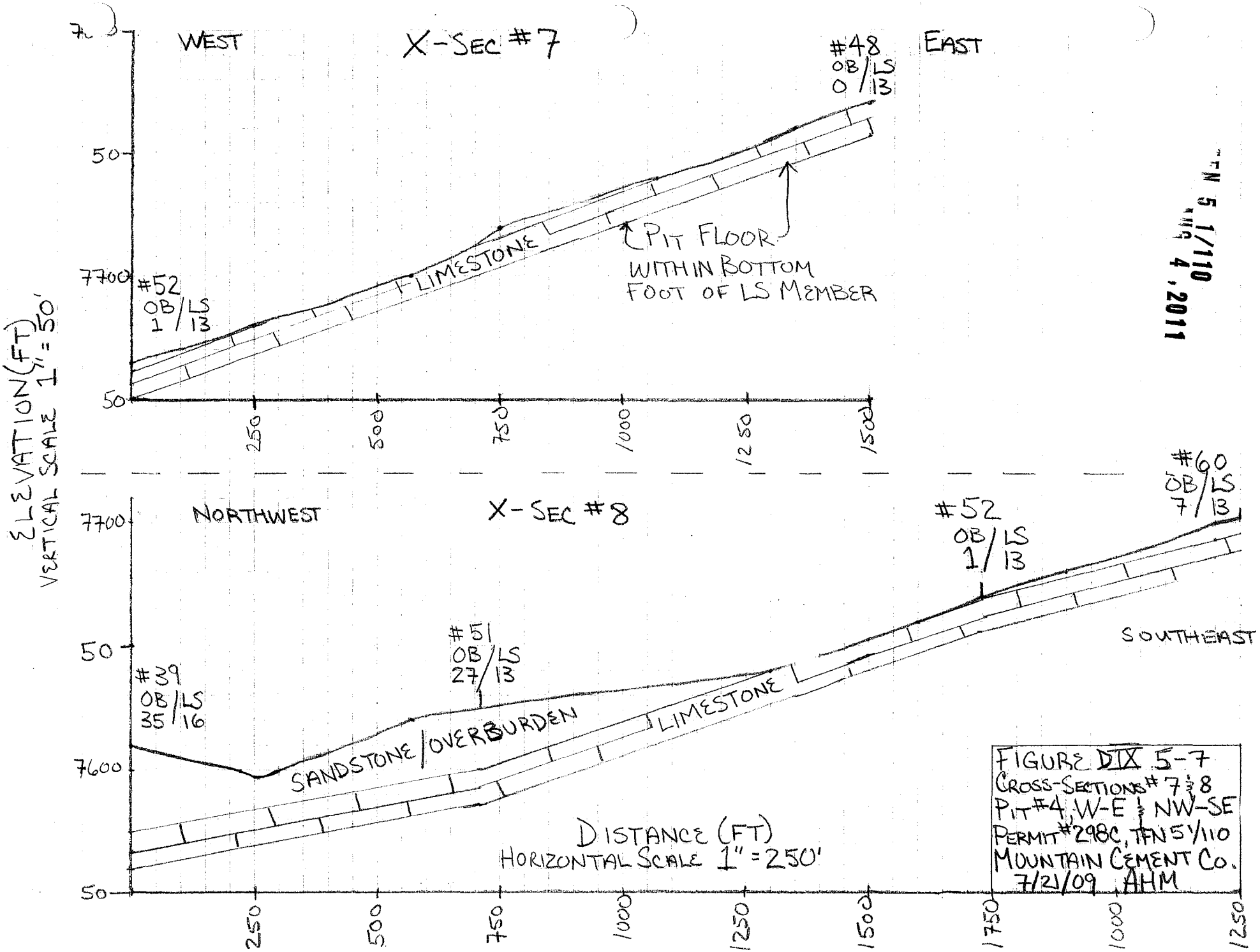

FIGURE DIX 5-7
CROSS-SECTIONS #7 & 8
PIT #4, W-E & NW-SE
PERMIT #298C, TFN 5 1/110
MOUNTAIN CEMENT CO.
7/21/09, AHM

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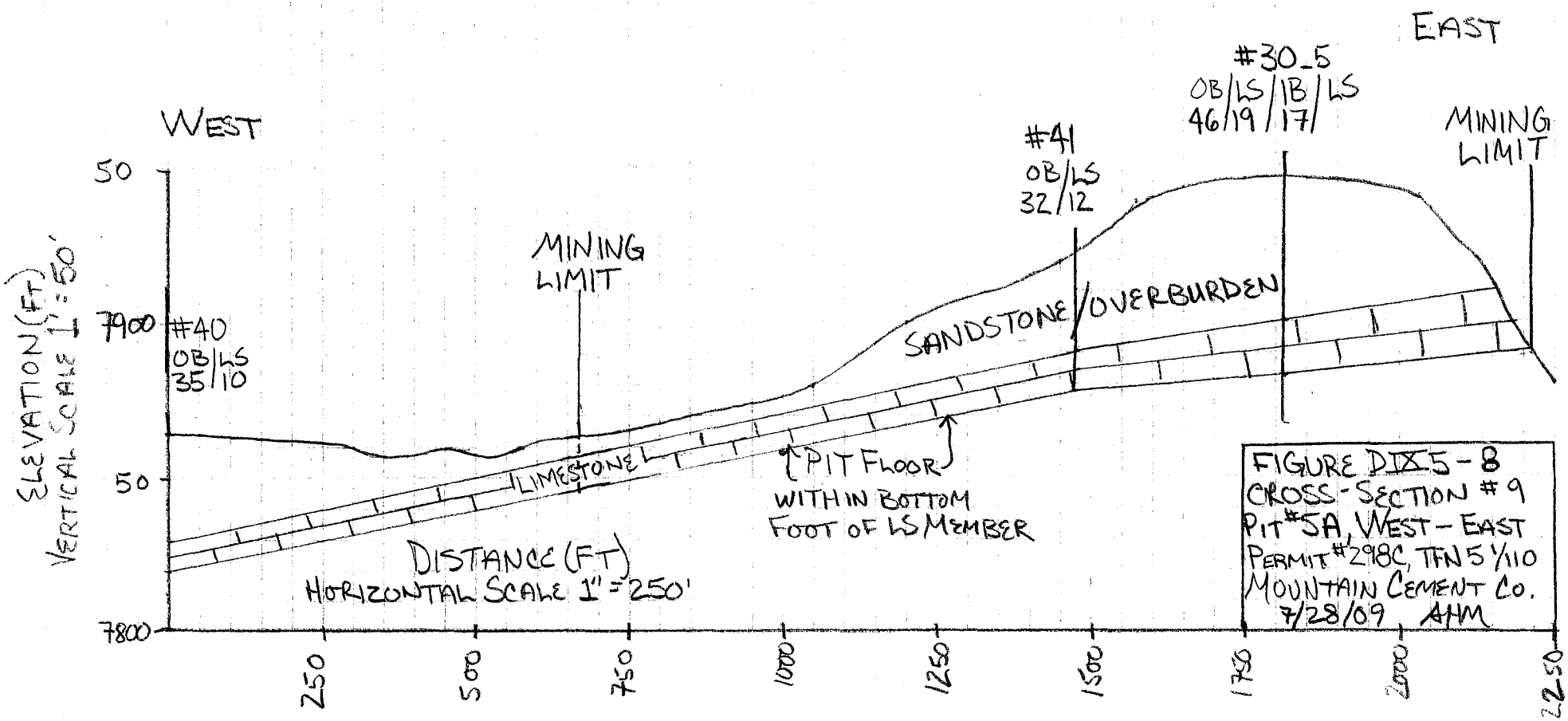
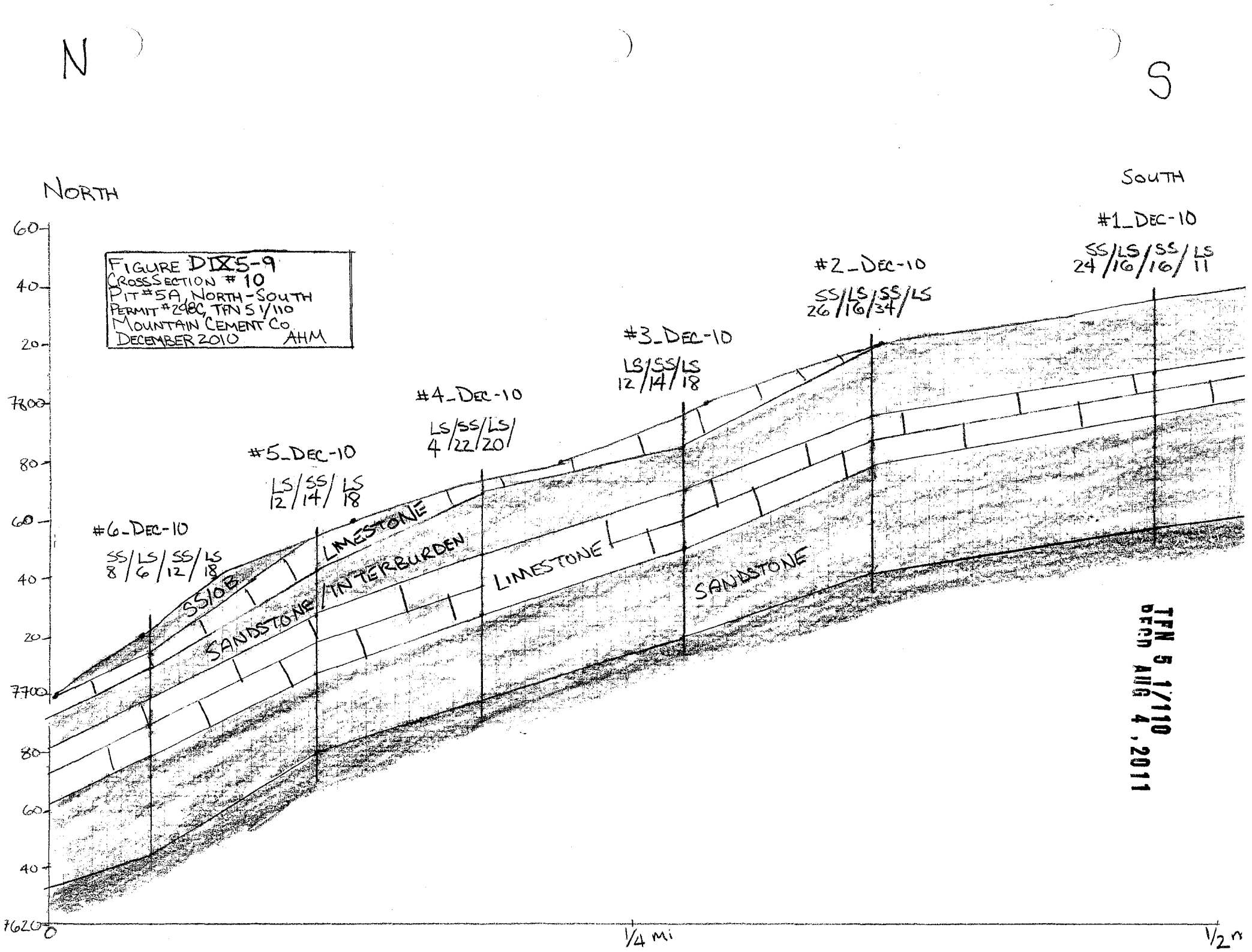


FIGURE DIX 5-8
CROSS-SECTION #9
PIT #5A, WEST-EAST
PERMIT #298C, TFN 5 1/110
MOUNTAIN CEMENT CO.
7/28/09 AHM



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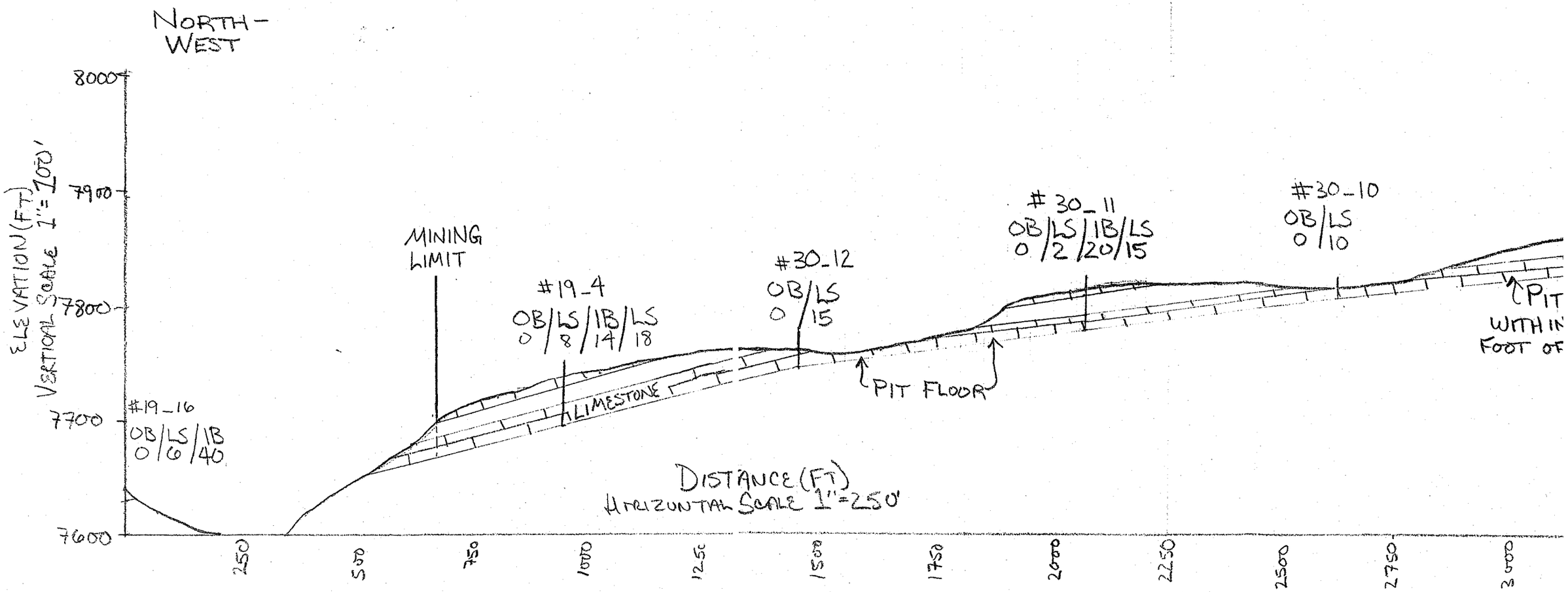
NORTH-WEST
8000
7900
7800
7700
7600
ELEVATION (FT)
VERTICAL SCALE 1" = 100'
MINING LIMIT
#19_16
OB/LS/IB
0/6/40
#19_4
OB/LS/IB/LS
0/8/14/18
LIMESTONE
#30_12
OB/LS
0/15
PIT FLOOR
#30_11
OB/LS/IB/LS
0/2/20/15
#30_10
OB/LS
0/10
PIT
WITHIN
FOOT OF
DISTANCE (FT)
HORIZONTAL SCALE 1" = 250'
250
500
750
1000
1250
1500
1750
2000
2250
2500
2750
3000

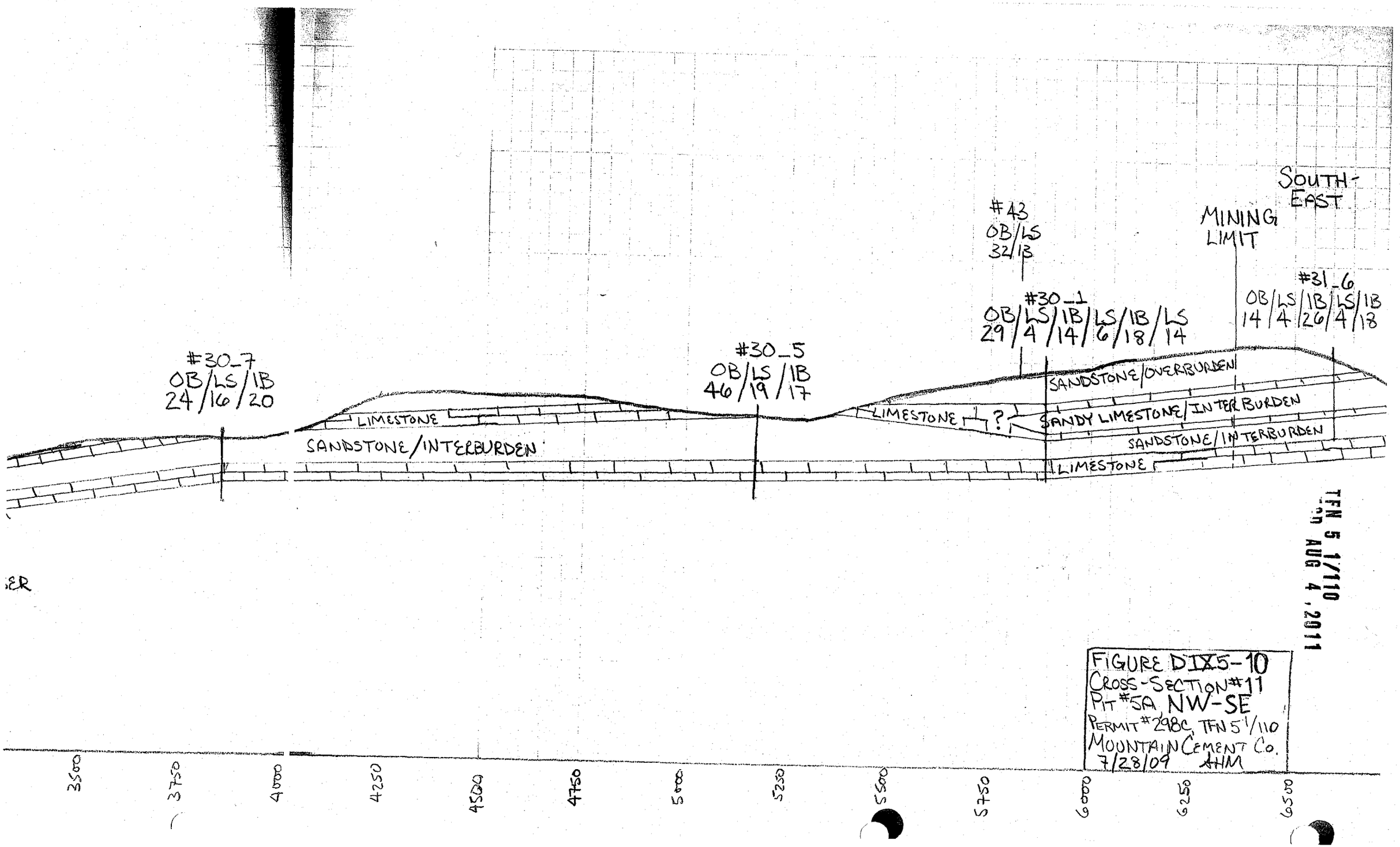

FIGURE DIX5-10
CROSS-SECTION #11
PIT #5A, NW-SE
PERMIT #298C, TFN 5 1/110
MOUNTAIN CEMENT CO.
7/28/09 AHM

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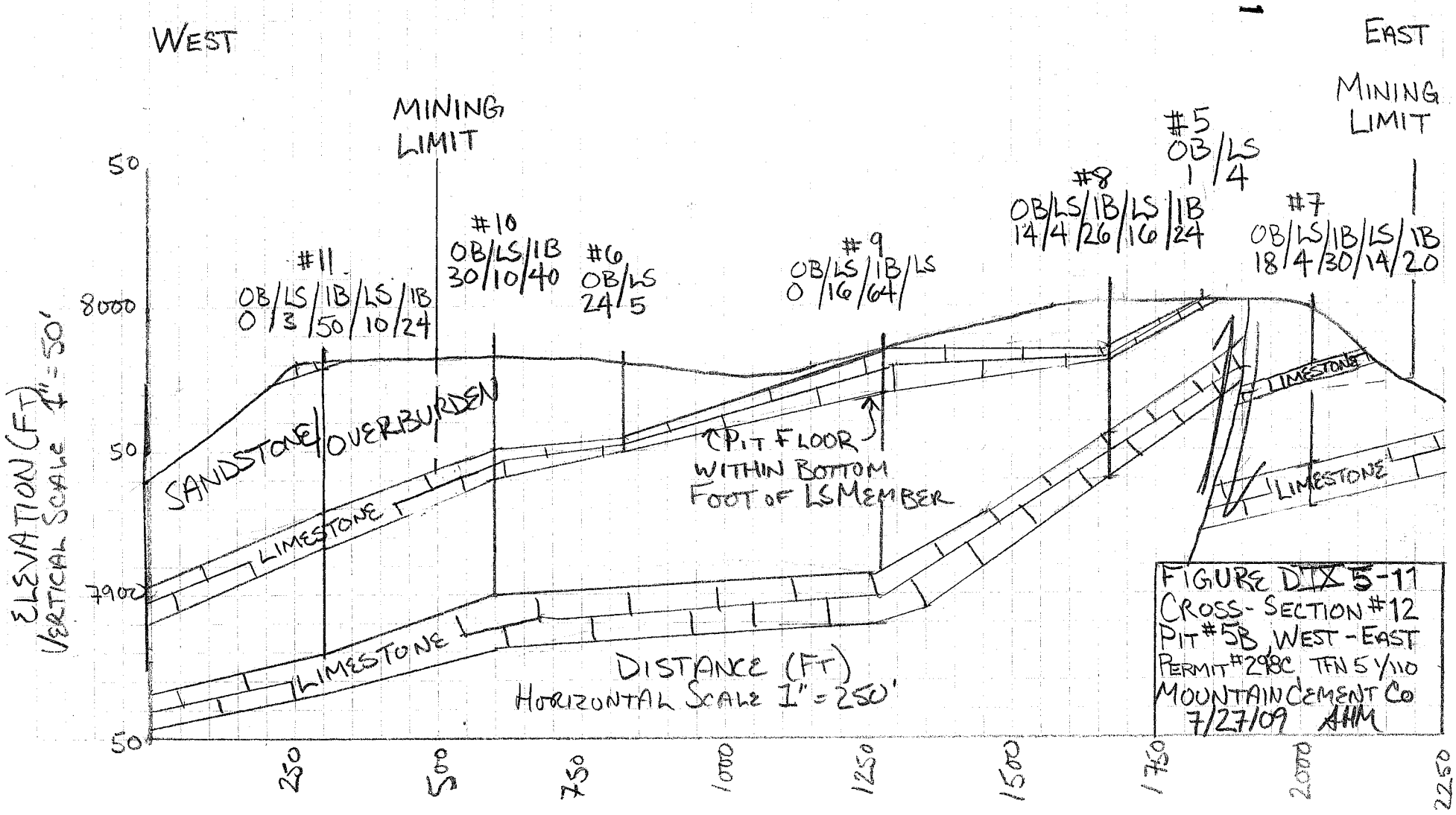

FIGURE ~~DIX~~ 5-11
CROSS-SECTION #12
PIT #5B, WEST-EAST
PERMIT #298C TFN 5 1/110
MOUNTAIN CEMENT CO
7/27/09 AHM

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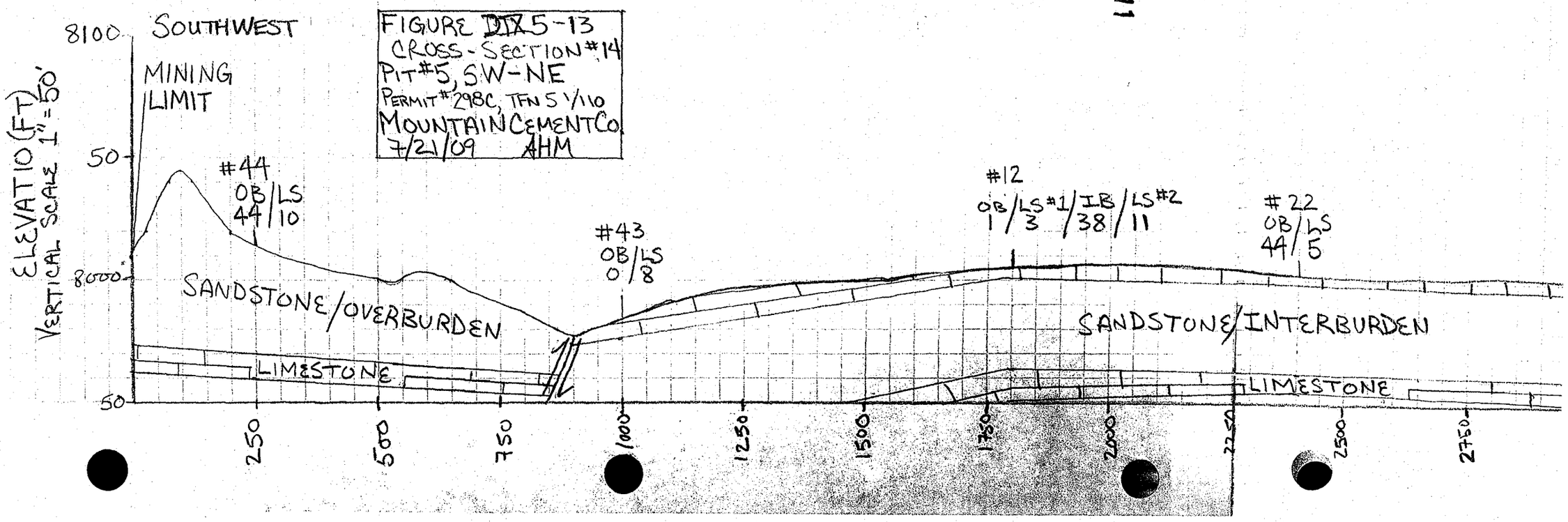
FIGURE ~~DIX~~ 5-13
CROSS-SECTION #14
PIT #5, SW-NE
PERMIT #298C, TFN 5 1/110
MOUNTAIN CEMENT CO.
7/21/09 AHM



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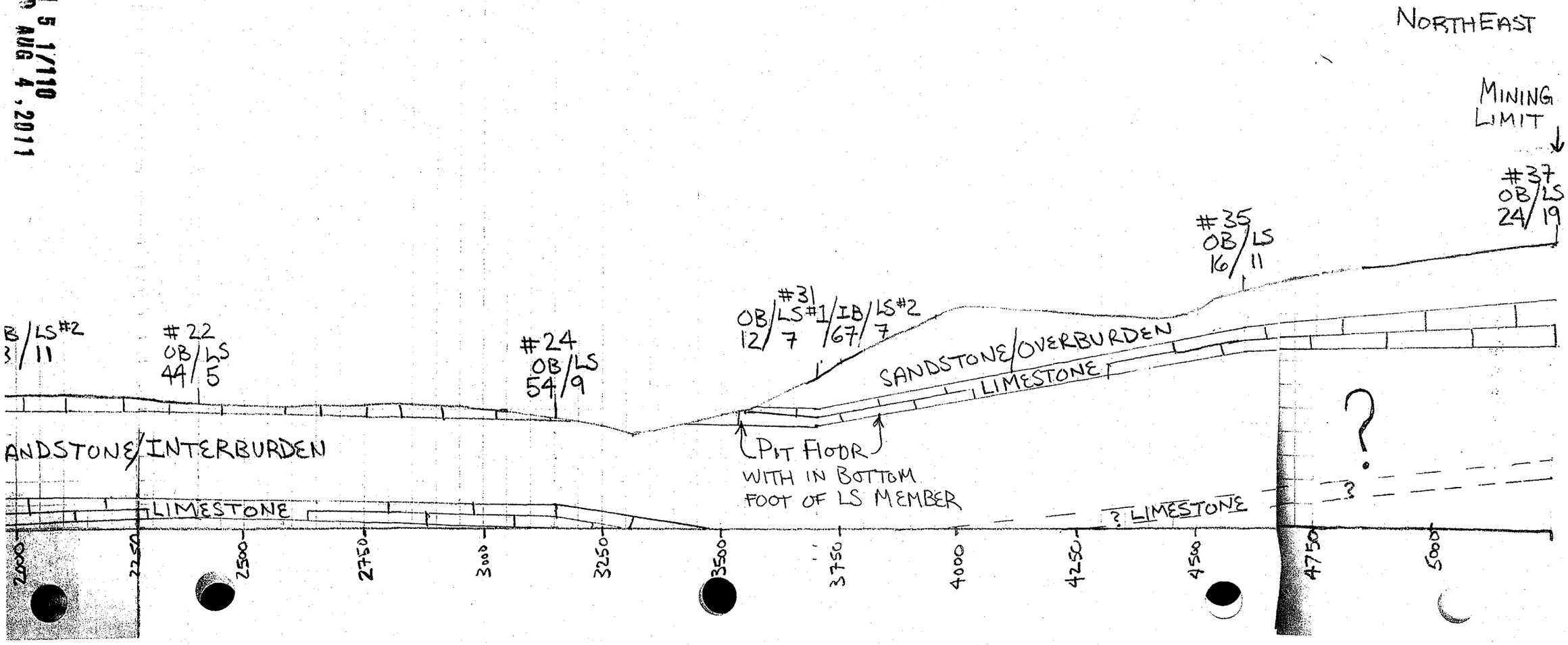
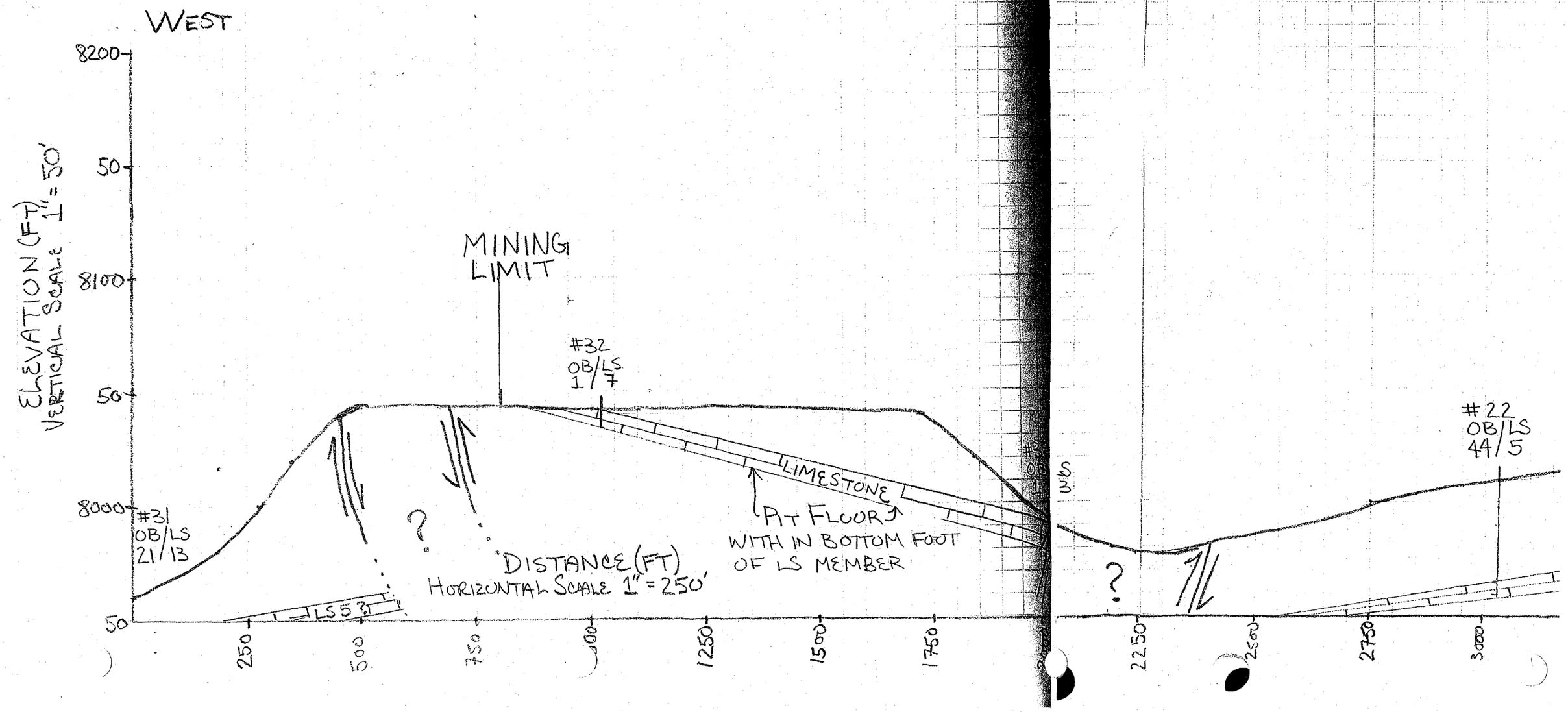



WEST
ELEVATION (FT)
VERTICAL SCALE 1" = 50'
8200
50
8100
50
8000
50
MINING LIMIT
#32
OB/LS
1/7
LIMESTONE
PIT FLOOR
WITH IN BOTTOM FOOT
OF LS MEMBER
#31
OB/LS
21/13
?
LS 5 ?
DISTANCE (FT)
HORIZONTAL SCALE 1" = 250'
250
500
750
1250
1500
1750
2250
2500
2750
3000
?
#22
OB/LS
44/5

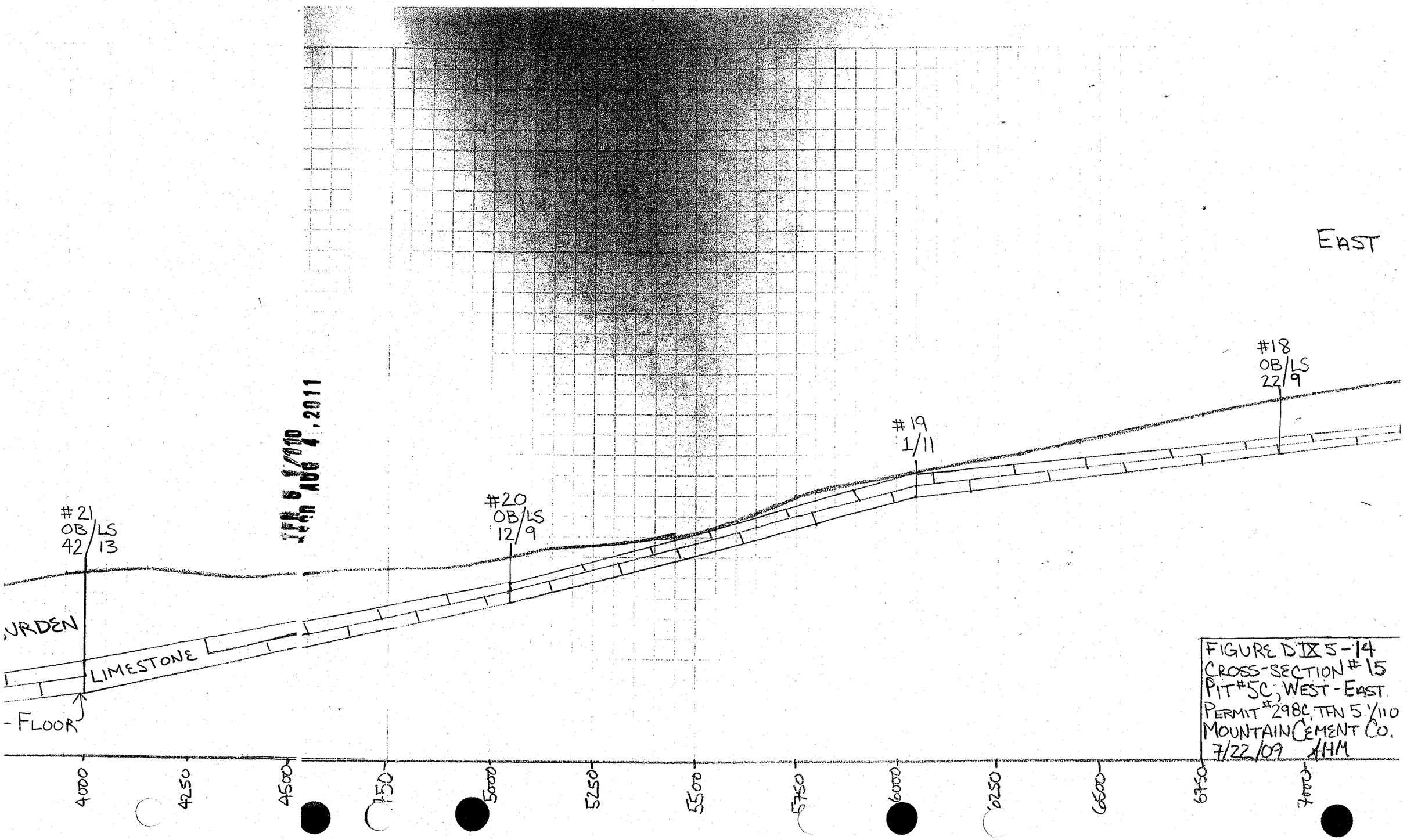


FIGURE DIX 5-14
CROSS-SECTION #15
PIT #5C, WEST-EAST
PERMIT #298C, TAN 5 1/110
MOUNTAIN CEMENT CO.
7/22/09 AHM

FEB 6 2011
AUG 4, 2011

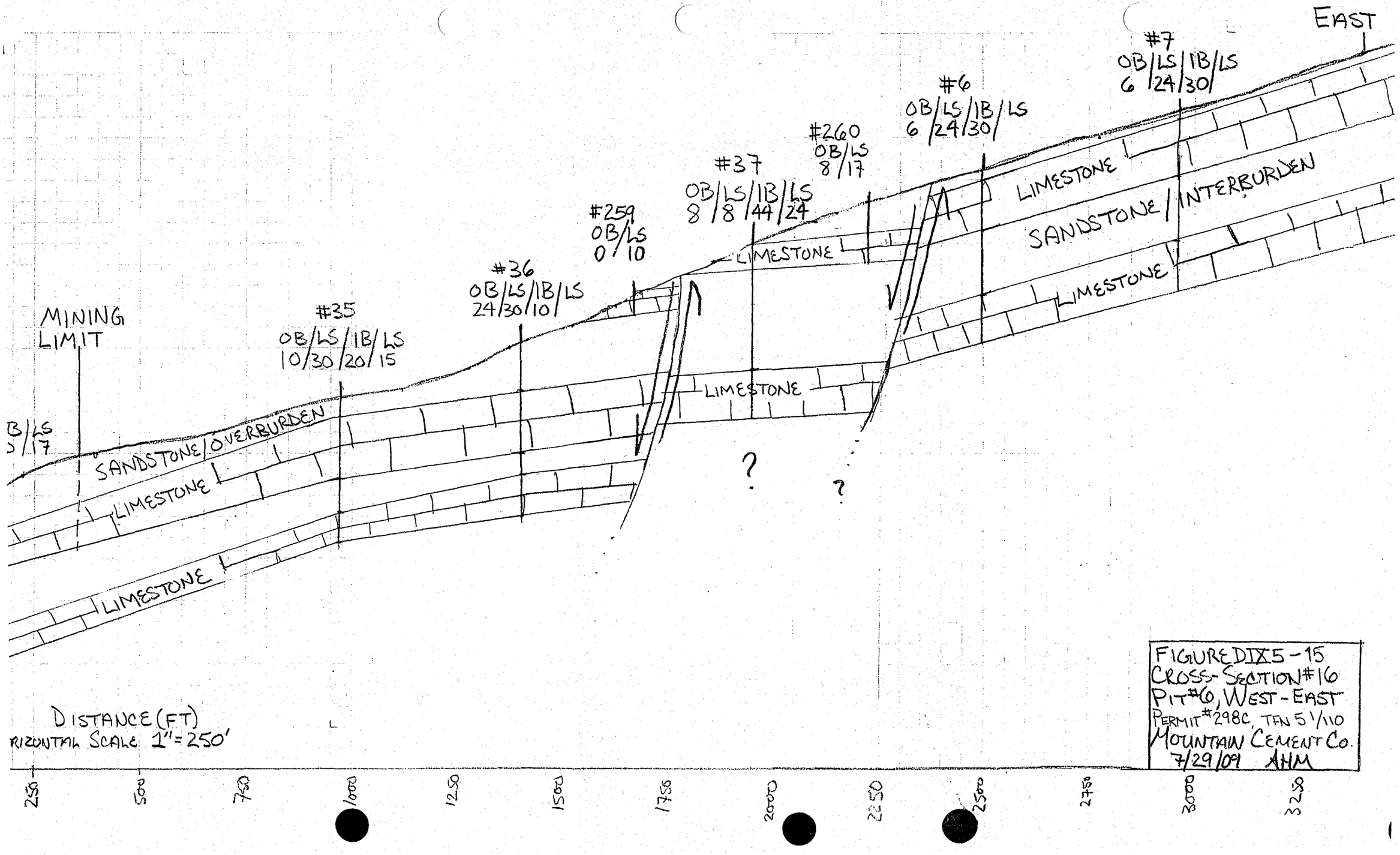


FIGURE DIX5-15
CROSS-SECTION #16
PIT #6, WEST-EAST
PERMIT #298C, TAN 51/110
MOUNTAIN CEMENT CO.
7/29/09 AHM

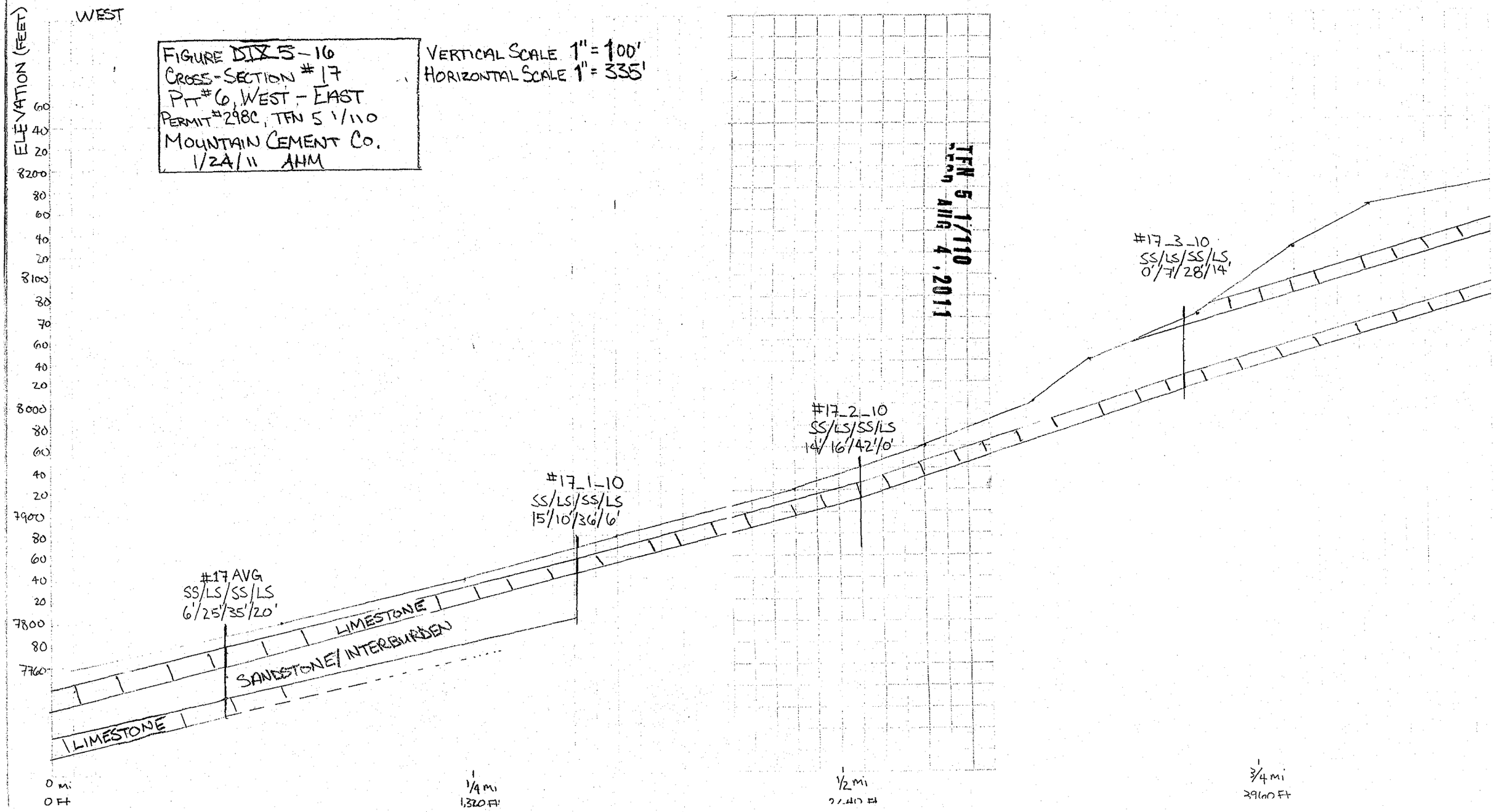
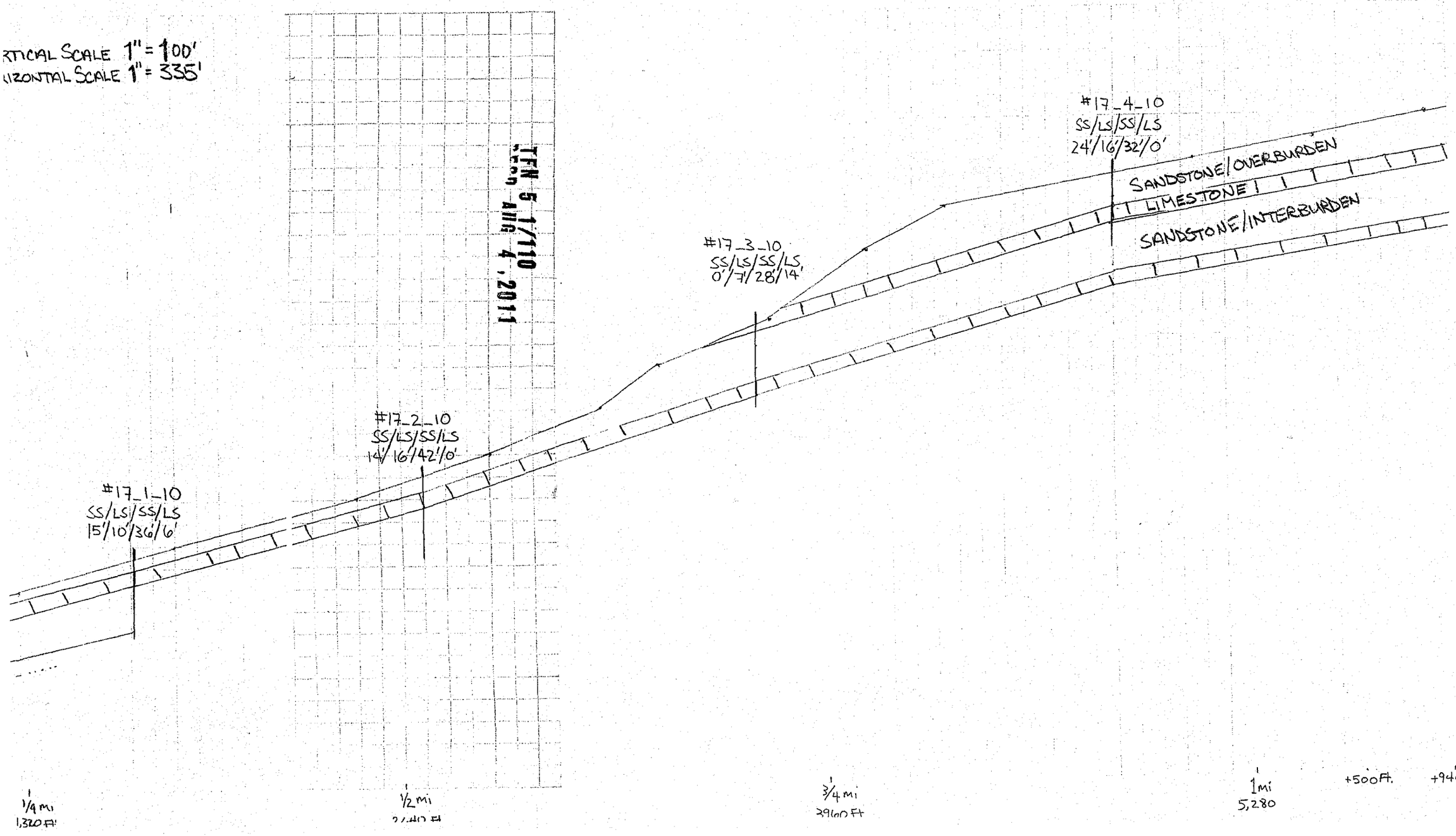


FIGURE DIX 5-16
CROSS-SECTION #17
PIT #6, WEST - EAST
PERMIT #298C, TFN 5 1/110
MOUNTAIN CEMENT CO.
1/24/11 AHM
VERTICAL SCALE 1" = 100'
HORIZONTAL SCALE 1" = 335'
WEST
ELEVATION (FEET)
60
40
20
8200
80
60
40
20
8100
80
70
60
40
20
8000
80
60
40
20
7900
80
60
40
20
7800
80
7760
#17 AVG
SS/LS/SS/LS
6'/25'/35'/20'
#17_1_10
SS/LS/SS/LS
15'/10'/36'/6'
#17_2_10
SS/LS/SS/LS
14'/16'/42'/0'
#17_3_10
SS/LS/SS/LS
0'/7'/28'/14'
LIMESTONE
SANDSTONE/INTERBURDEN
LIMESTONE
0 mi
0 FT
1/4 mi
1,320 FT
1/2 mi
3/4 mi
3960 FT
TFN 5 1/110
AUG 4, 2011

RTICAL SCALE 1" = 100'
IZONTAL SCALE 1" = 335'



TFN 5 1/110
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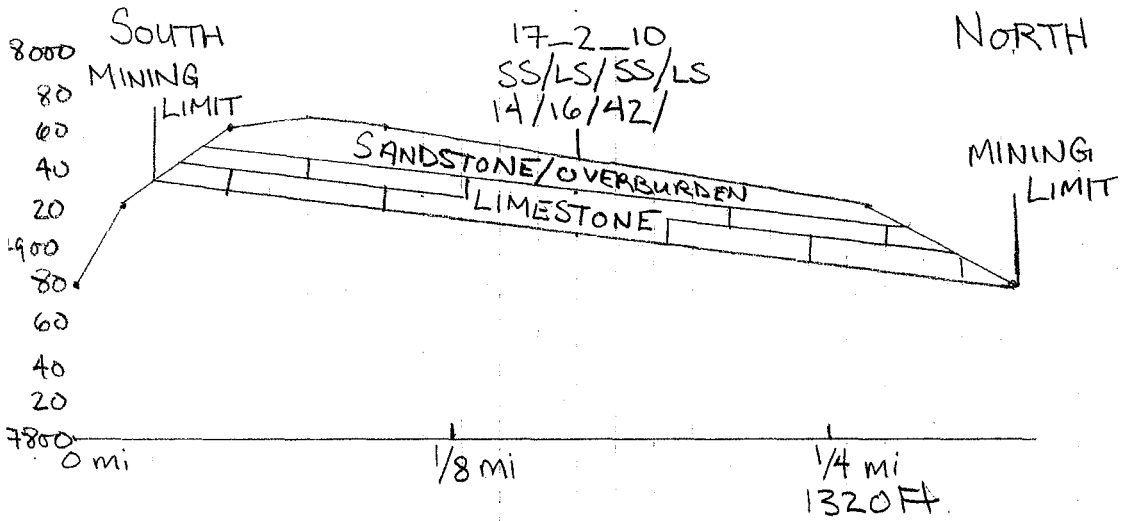

FIGURE DIX 5-18
CROSS-SECTION # 19
PIT # 6, SOUTH-NORTH
PERMIT # 298C TFN 5 1/110
MOUNTAIN CEMENT CO.
7/14/11 AHM

VERTICAL SCALE 1" = 100'
HORIZONTAL SCALE 1" = 335'

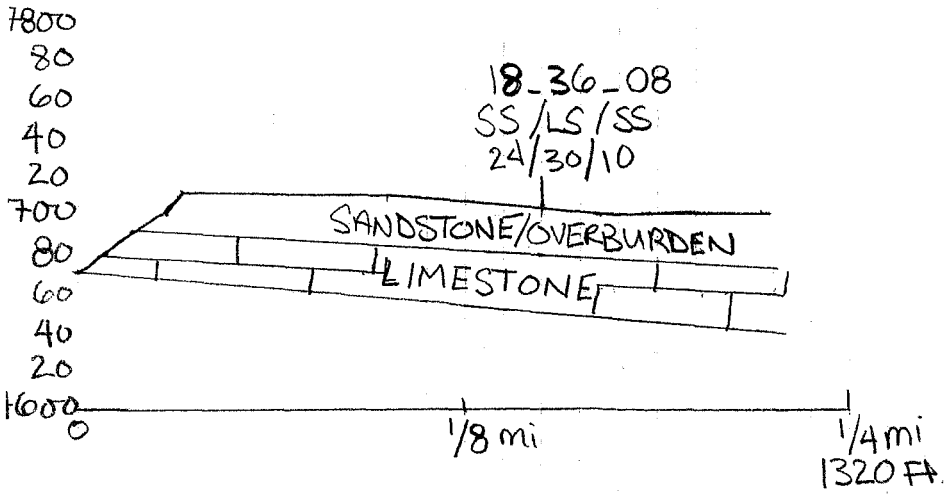

FIGURE DIX 5-17
CROSS-SECTION # 18
PIT # 6, SOUTH-NORTH
PERMIT # 298C TFN 5 1/110
MOUNTAIN CEMENT CO.
7/14/11 AHM

VERTICAL SCALE 1" = 100'
HORIZONTAL SCALE 1" = 330'

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TFN 5 1/110
AUG 4, 2011

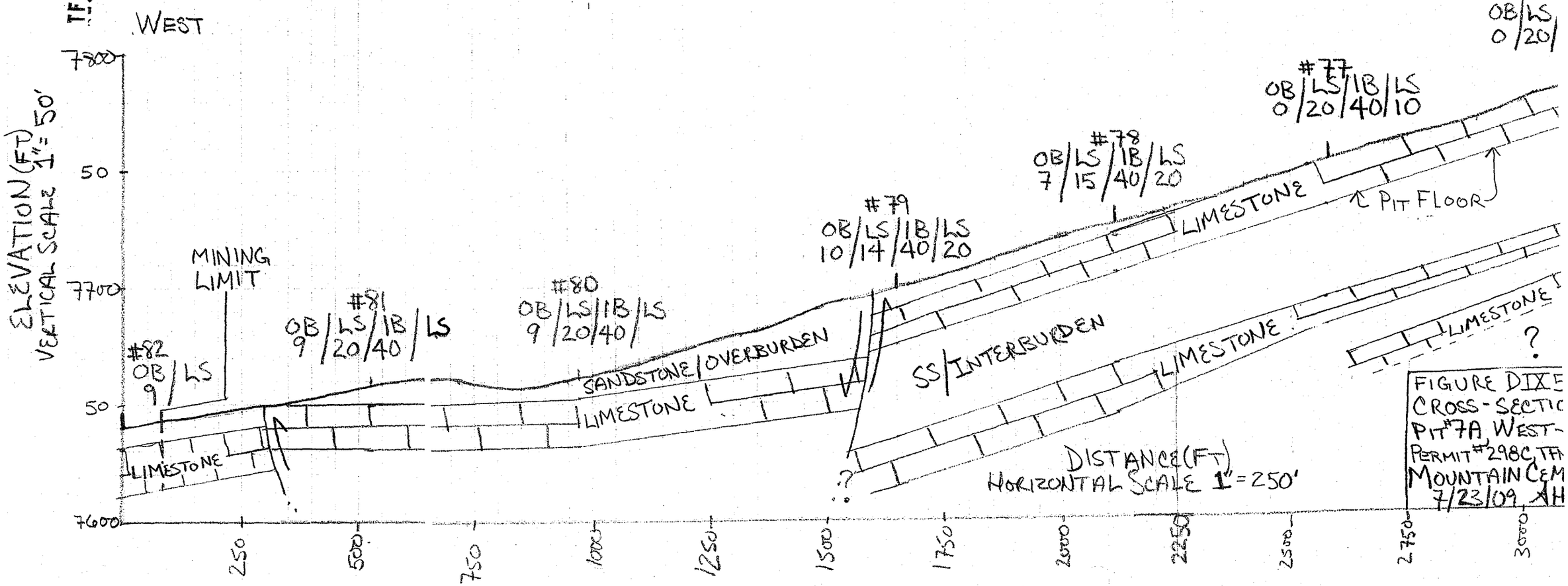

FIGURE DIXE
CROSS-SECTIO
PIT #7A, WEST-
PERMIT #298C, TH
MOUNTAIN CEM
7/23/09 AH

TN 5 1/110
AUG 4, 2011

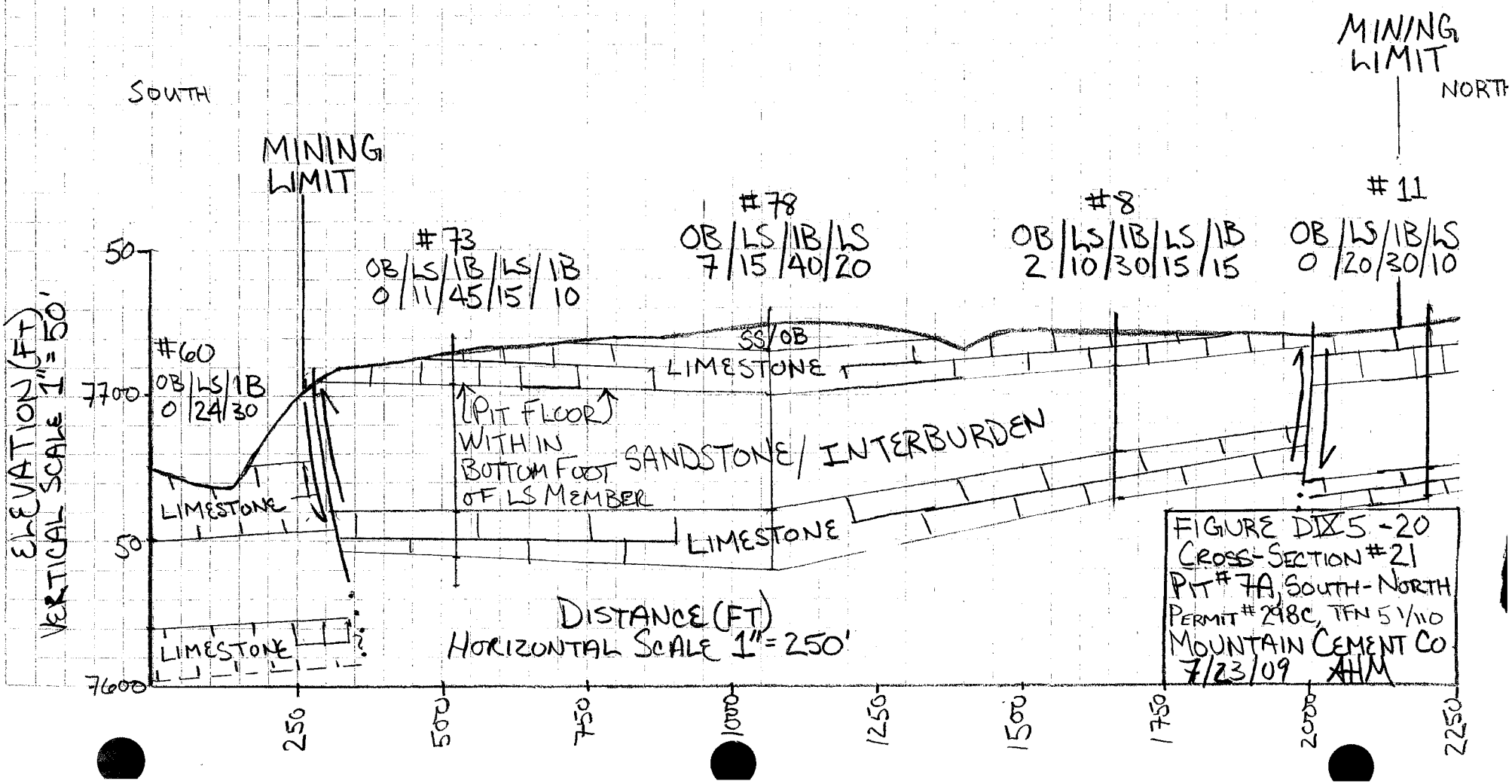

FIGURE DIX 5-20
CROSS-SECTION #21
PIT #7A, SOUTH-NORTH
PERMIT #298C, TFN 5 1/110
MOUNTAIN CEMENT CO
7/23/09 AHM

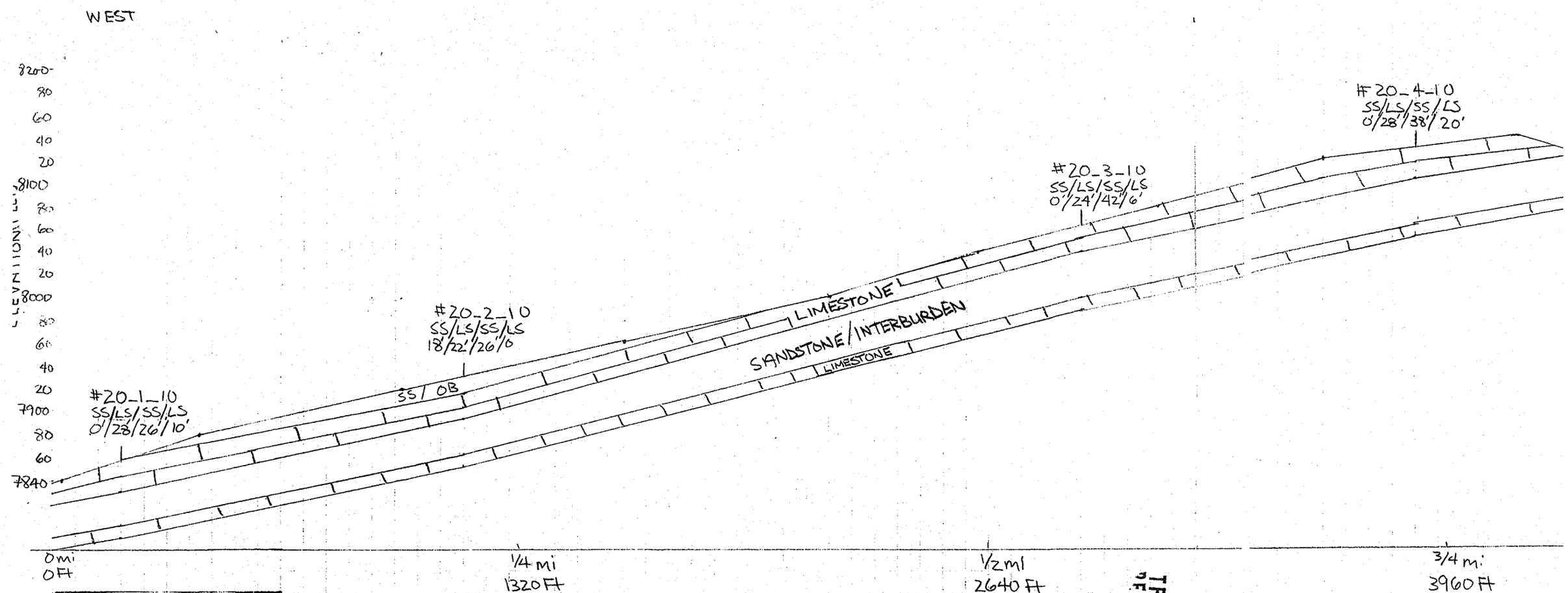

FIGURE DIX 5-21
CROSS-SECTION #22
PIT #7A, WEST-EAST
PERMIT #298C, TFN 5 1/110
MOUNTAIN CEMENT CO.
1/25/11 AHM

VERTICAL SCALE 1" = 100'
HORIZONTAL SCALE 1" = 360'

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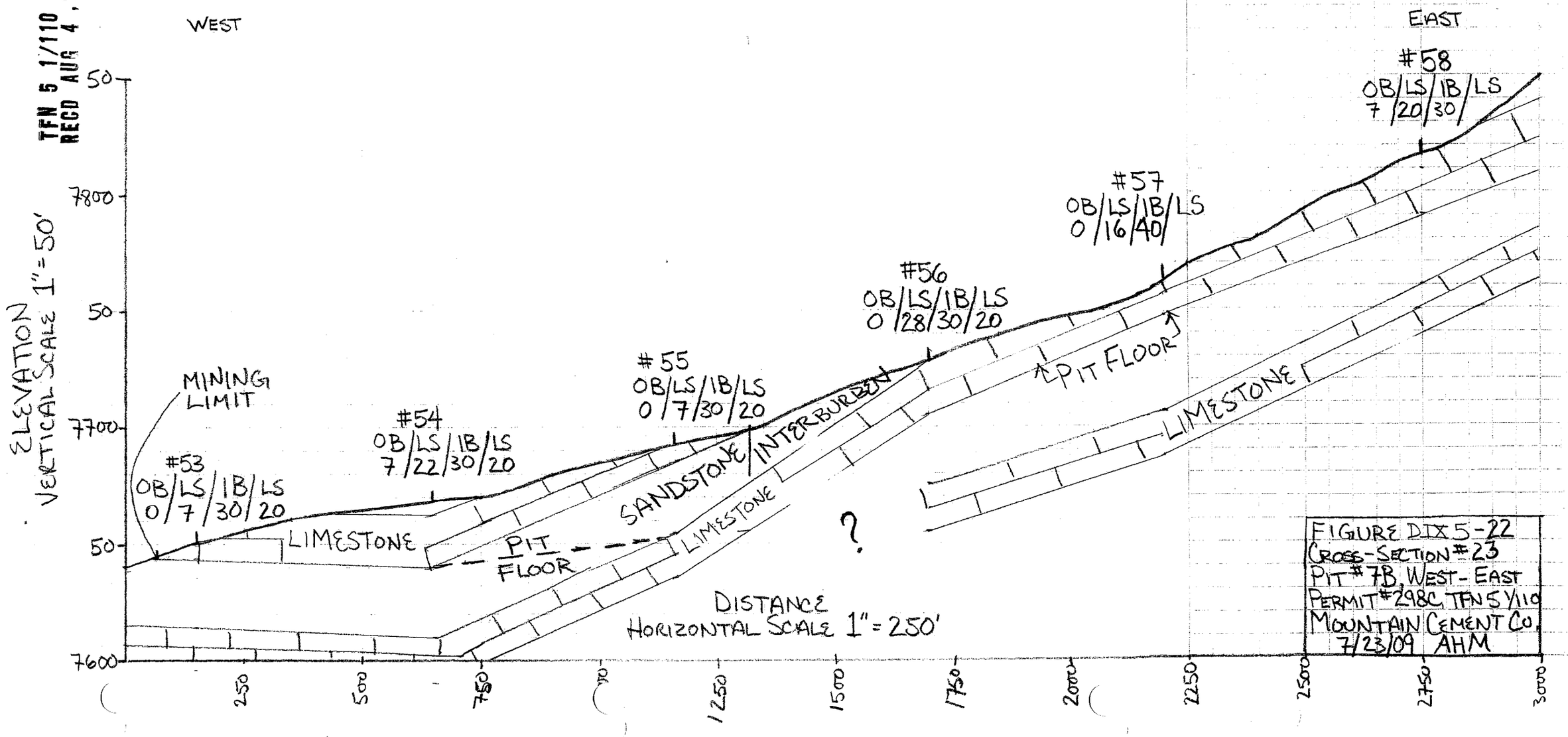
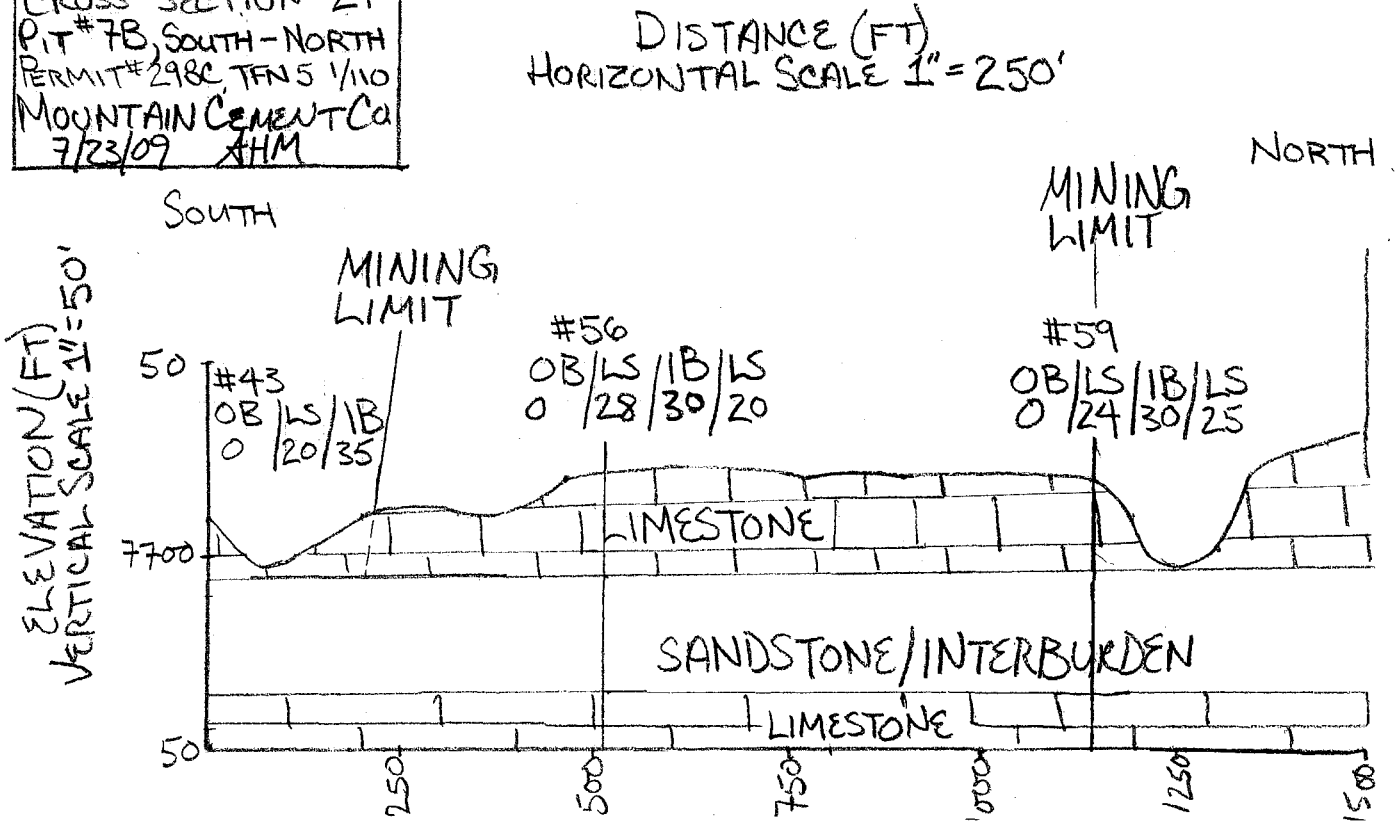


FIGURE DIX 5-22
CROSS-SECTION #23
PIT #7B, WEST-EAST
PERMIT #298C, TFN 5 1/110
MOUNTAIN CEMENT CO.
7/23/09 AHM

FIGURE DIX5 -23
CROSS-SECTION #24
PIT #7B, SOUTH-NORTH
PERMIT #298C, TFN 5 1/110
MOUNTAIN CEMENT Co
7/23/09 AHM



TFN 5 1/110
RECD AUG 4, 2011

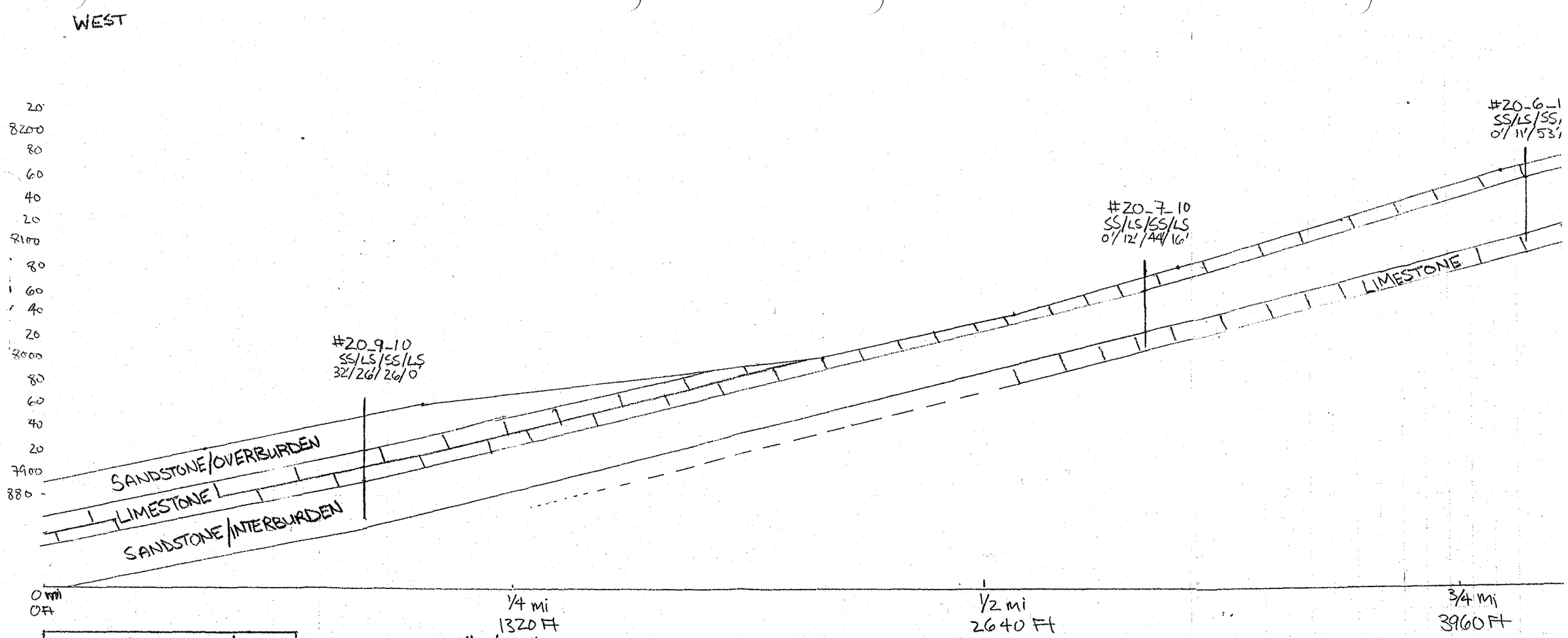
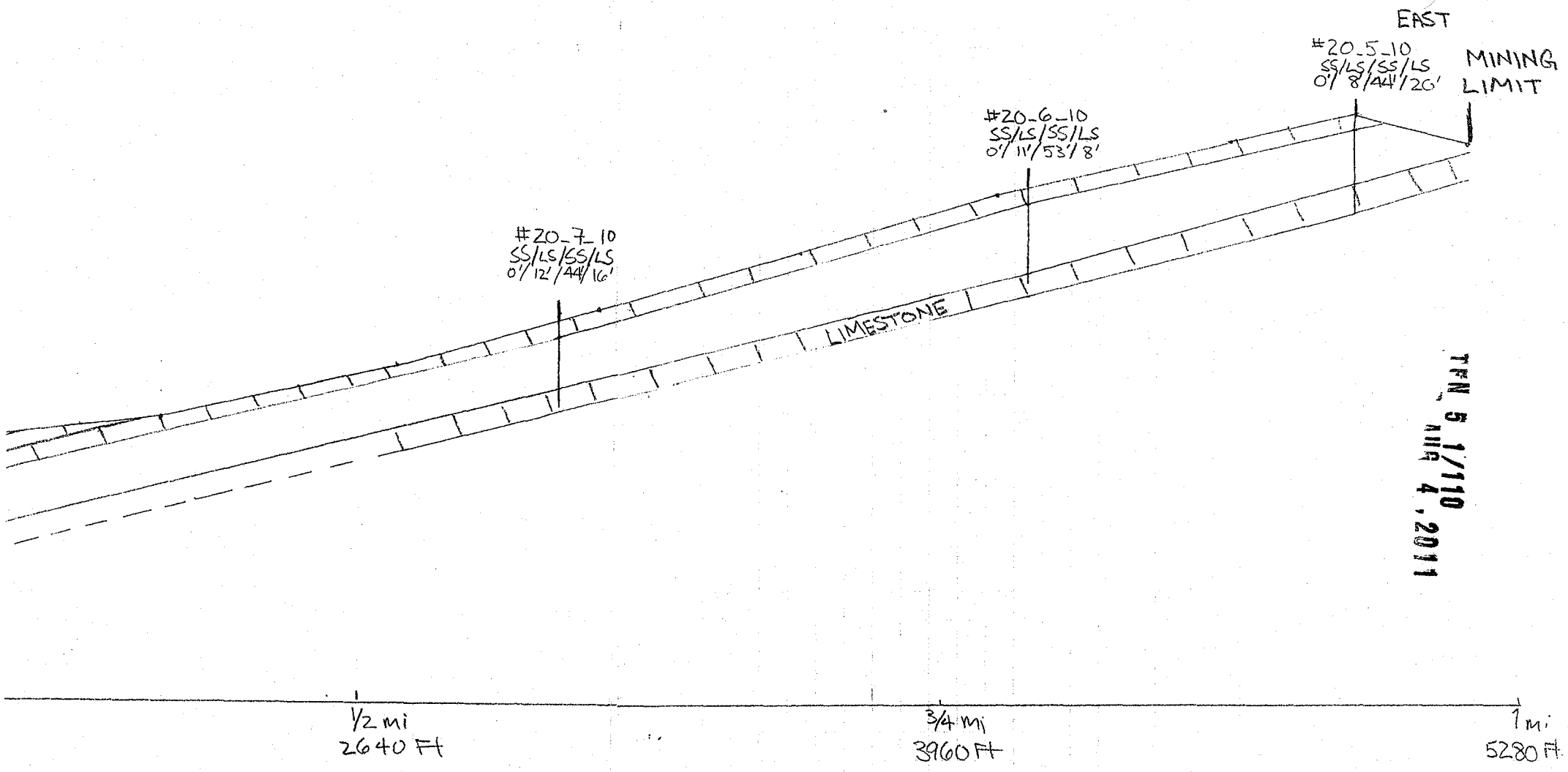


FIGURE DIX 5-24
CROSS-SECTION # 25
PIT # 7B, WEST-EAST
PERMIT # 298C, TFN 5 1/110
MOUNTAIN CEMENT CO.
1/25/11 AHM

VERTICAL SCALE 1" = 100'
HORIZONTAL SCALE 1" = 360'



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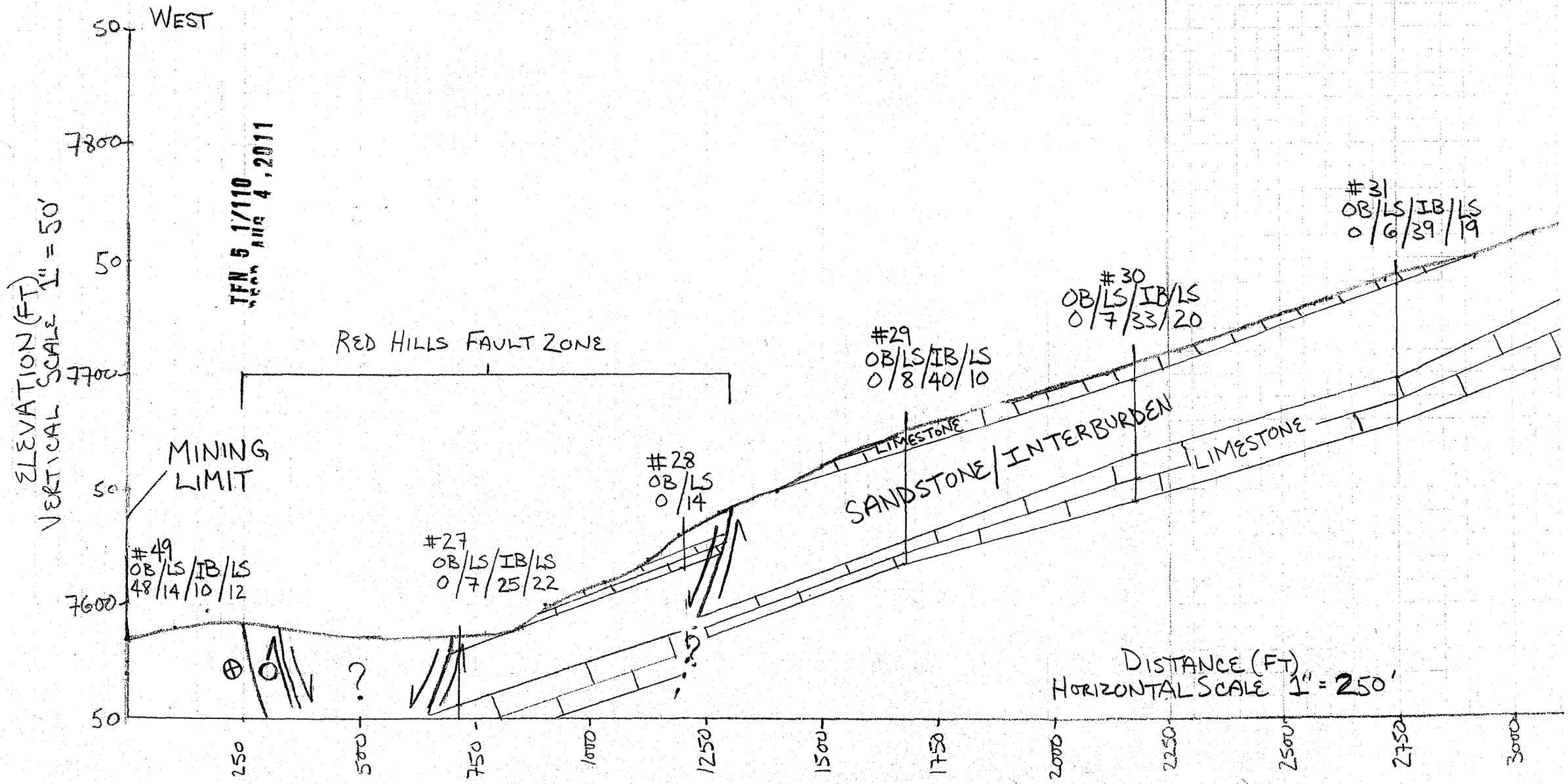
WEST
ELEVATION (FT)
VERTICAL SCALE 1" = 50'
50
7800
50
7700
50
7600
50
TFN 5 1/110
AUG 4, 2011
RED HILLS FAULT ZONE
MINING LIMIT
#49
OB/LS/IB/LS
48/14/10/12
#27
OB/LS/IB/LS
0/7/25/22
#28
OB/LS
0/14
#29
OB/LS/IB/LS
0/8/40/10
#30
OB/LS/IB/LS
0/7/33/20
#31
OB/LS/IB/LS
0/6/39/19
LIMESTONE
SANDSTONE/INTERBURDEN
LIMESTONE
DISTANCE (FT)
HORIZONTAL SCALE 1" = 250'
250
500
750
1000
1250
1500
1750
2000
2250
2500
2750
3000

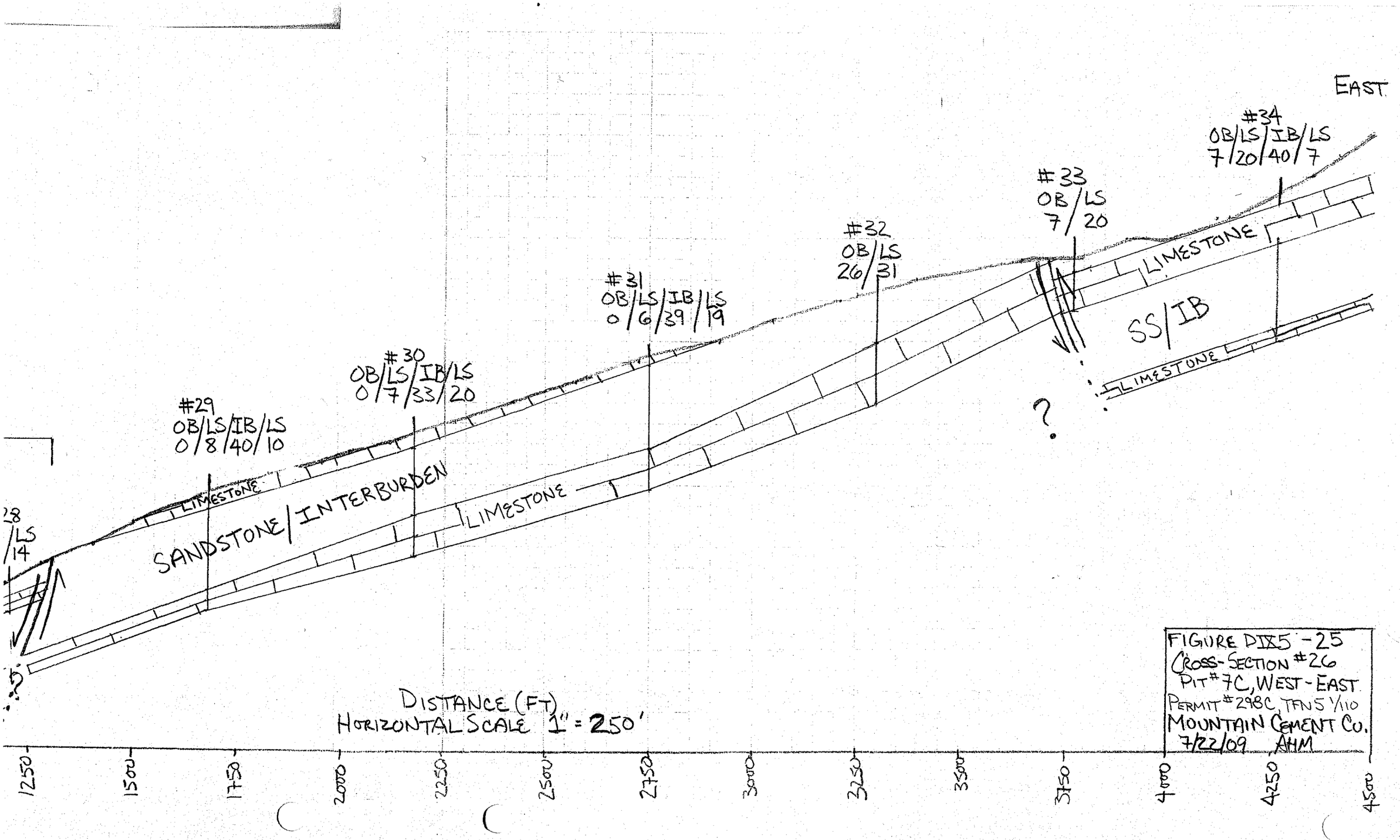

FIGURE DIX5 -25
CROSS-SECTION #26
PIT #7C, WEST-EAST
PERMIT #298C, TFN 5 1/10
MOUNTAIN CEMENT CO.
7/22/09 AHM

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REC'D ... 4, 2011

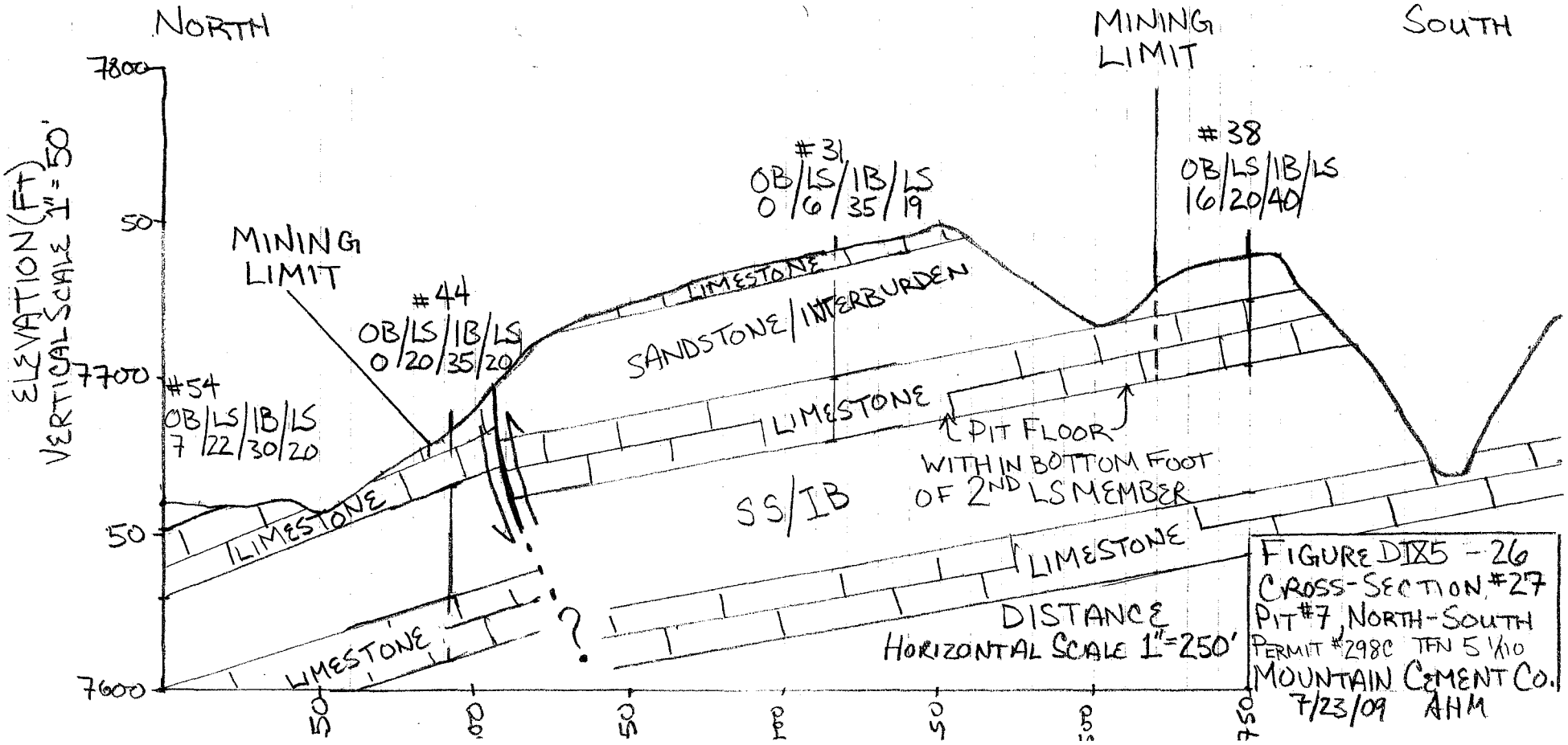
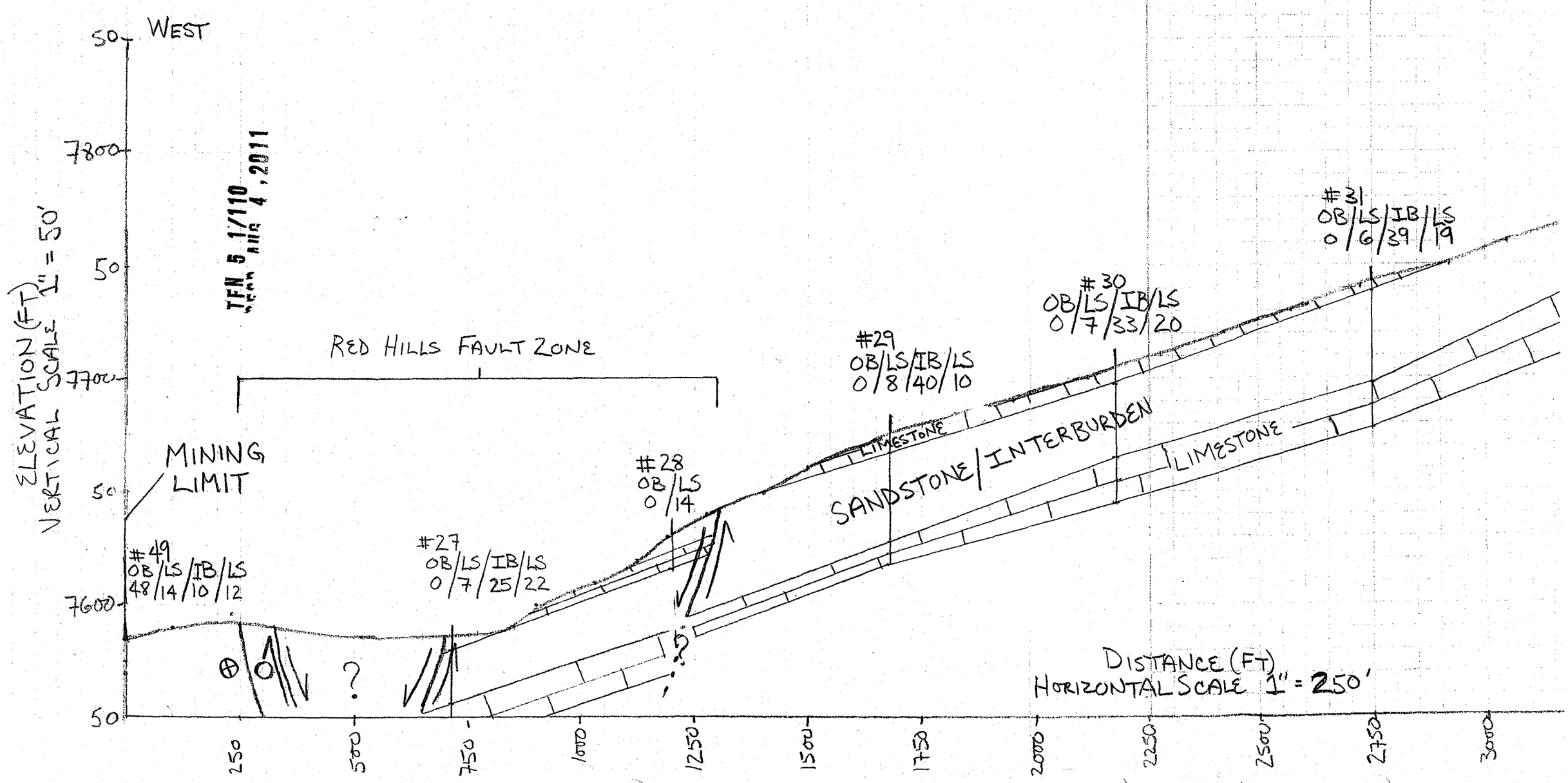


FIGURE DIX5 - 26
CROSS-SECTION #27
PIT #7, NORTH-SOUTH
PERMIT #298C TFN 5 1/10
MOUNTAIN CEMENT CO.
7/23/09 AHM


WEST
ELEVATION (FT)
VERTICAL SCALE 1" = 50'
50
7800
50
7700
50
7600
50
TFN 5 1/110
MAR 4, 2011
RED HILLS FAULT ZONE
MINING LIMIT
#49
OB/LS/IB/LS
48/14/10/12
#27
OB/LS/IB/LS
0/7/25/22
#28
OB/LS
0/14
#29
OB/LS/IB/LS
0/8/40/10
#30
OB/LS/IB/LS
0/7/33/20
#31
OB/LS/IB/LS
0/6/39/19
LIMESTONE
SANDSTONE/INTERBURDEN
LIMESTONE
?
?
DISTANCE (FT)
HORIZONTAL SCALE 1" = 250'
250
500
750
1000
1250
1500
1750
2000
2250
2500
2750
3000

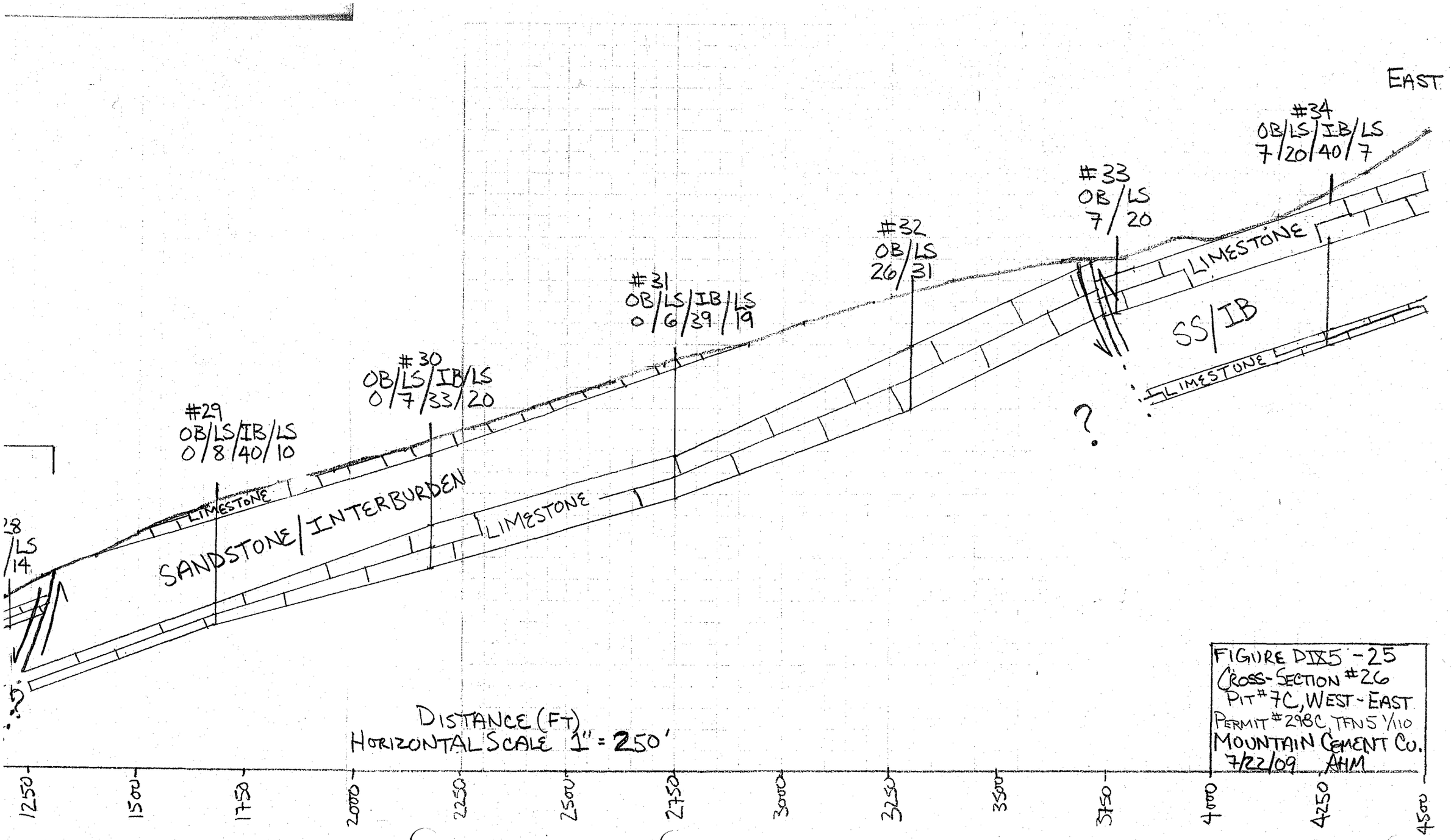


FIGURE DIX5-25
CROSS-SECTION #26
PIT #7C, WEST-EAST
PERMIT #298C, TFN 5 1/10
MOUNTAIN CEMENT CO.
7/22/09 AHM

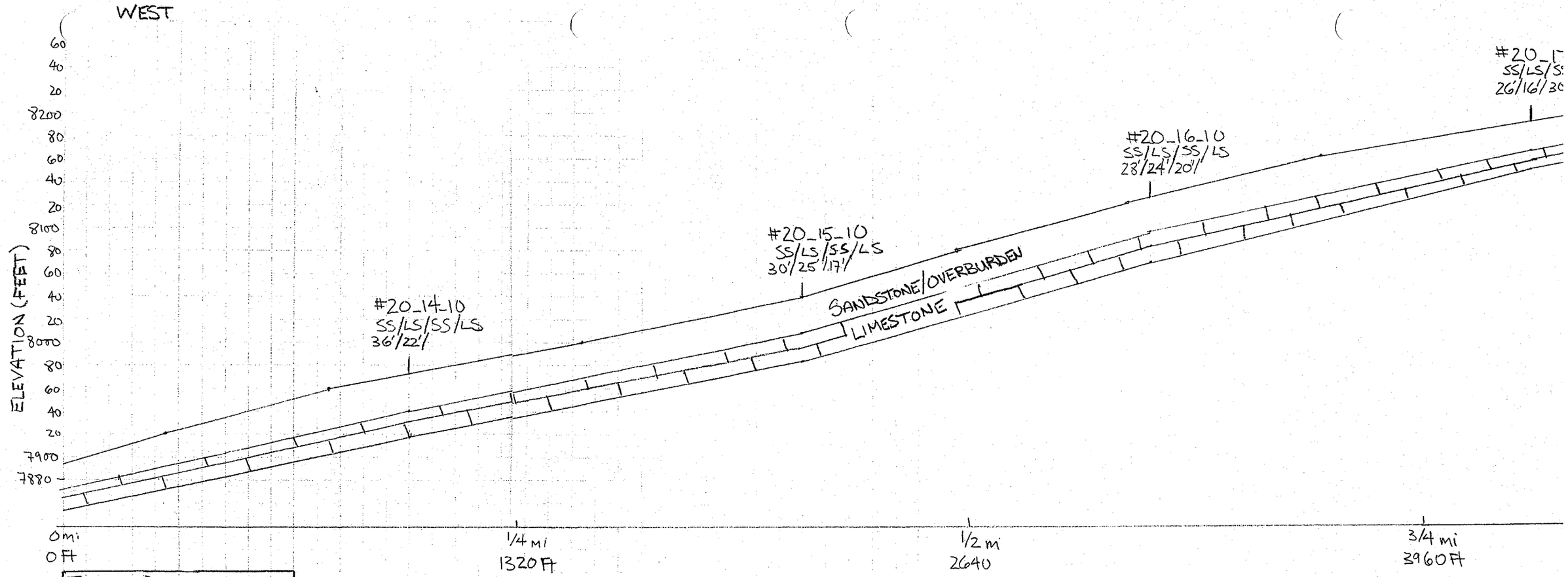
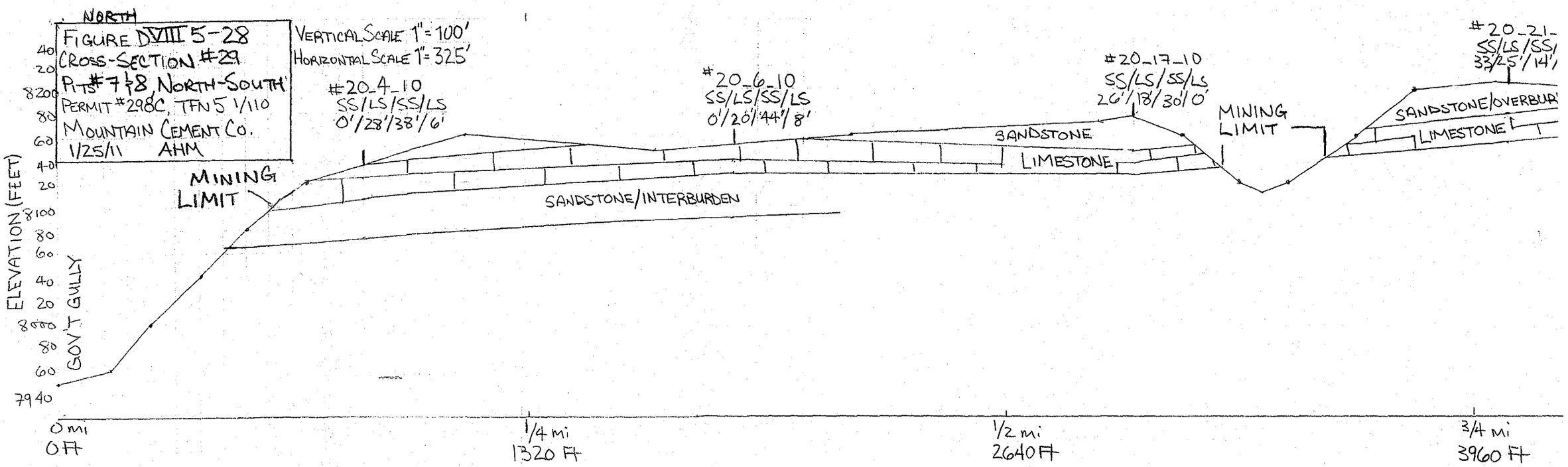
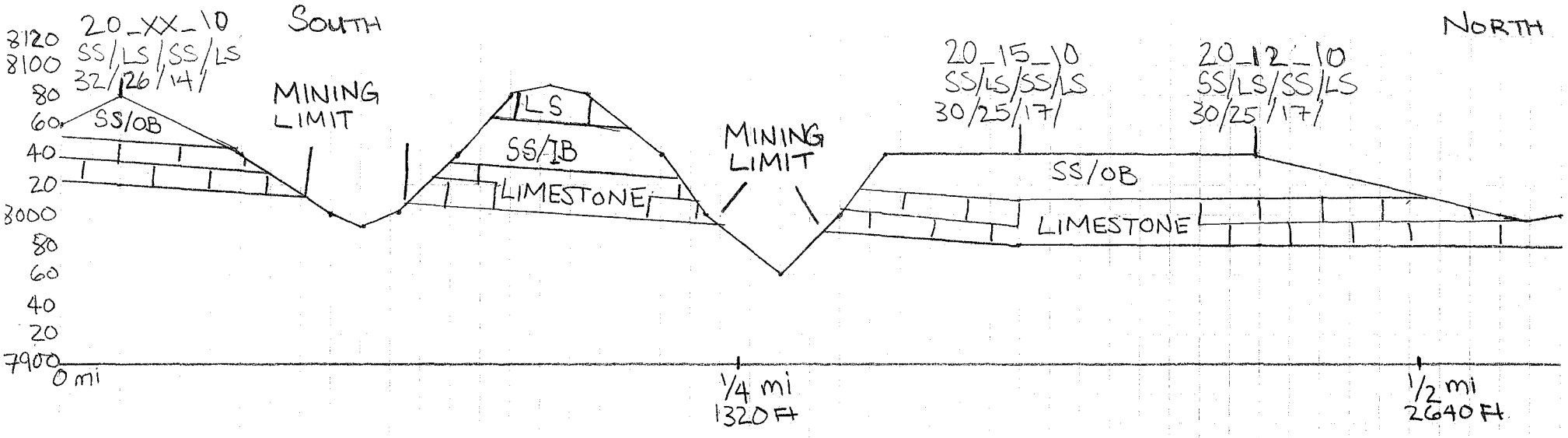


FIGURE DIX 5-27
CROSS-SECTION #28
PIT #7C, WEST - EAST
PERMIT #298C, TFN 5 1/110
MOUNTAIN CEMENT CO.
1/25/11 AHM

VERTICAL SCALE 1" = 100'
HORIZONTAL SCALE 1" = 385'


NORTH
FIGURE DVIII 5-28
CROSS-SECTION #29
PITS #7 & 8, NORTH-SOUTH
PERMIT #298C, TFN 5 1/110
MOUNTAIN CEMENT CO.
1/25/11 AHM
VERTICAL SCALE 1" = 100'
HORIZONTAL SCALE 1" = 325'
#20_4_10
SS/LS/SS/LS
0'/28'/38'/6'
#20_6_10
SS/LS/SS/LS
0'/20'/44'/8'
#20_17_10
SS/LS/SS/LS
26'/18'/30'/0'
#20_21_
SS/LS/SS/
33/25'/14'/
MINING LIMIT
MINING LIMIT
SANDSTONE
LIMESTONE
SANDSTONE/INTERBURDEN
SANDSTONE/OVERBUR
LIMESTONE
GOV'T GULLY
ELEVATION (FEET)
8200
8100
8000
7940
0 mi
0 FT
1/4 mi
1320 FT
1/2 mi
2640 FT
3/4 mi
3960 FT



VERTICAL SCALE 1" = 100'
HORIZONTAL SCALE 1" = 290'

FIGURE DIX 5-29
CROSS SECTION #30
PIT # 7 & 8, NORTH-SOUTH
PERMIT #298C, TFN 5 1/110
MOUNTAIN CEMENT CO
7/6/11 AHM

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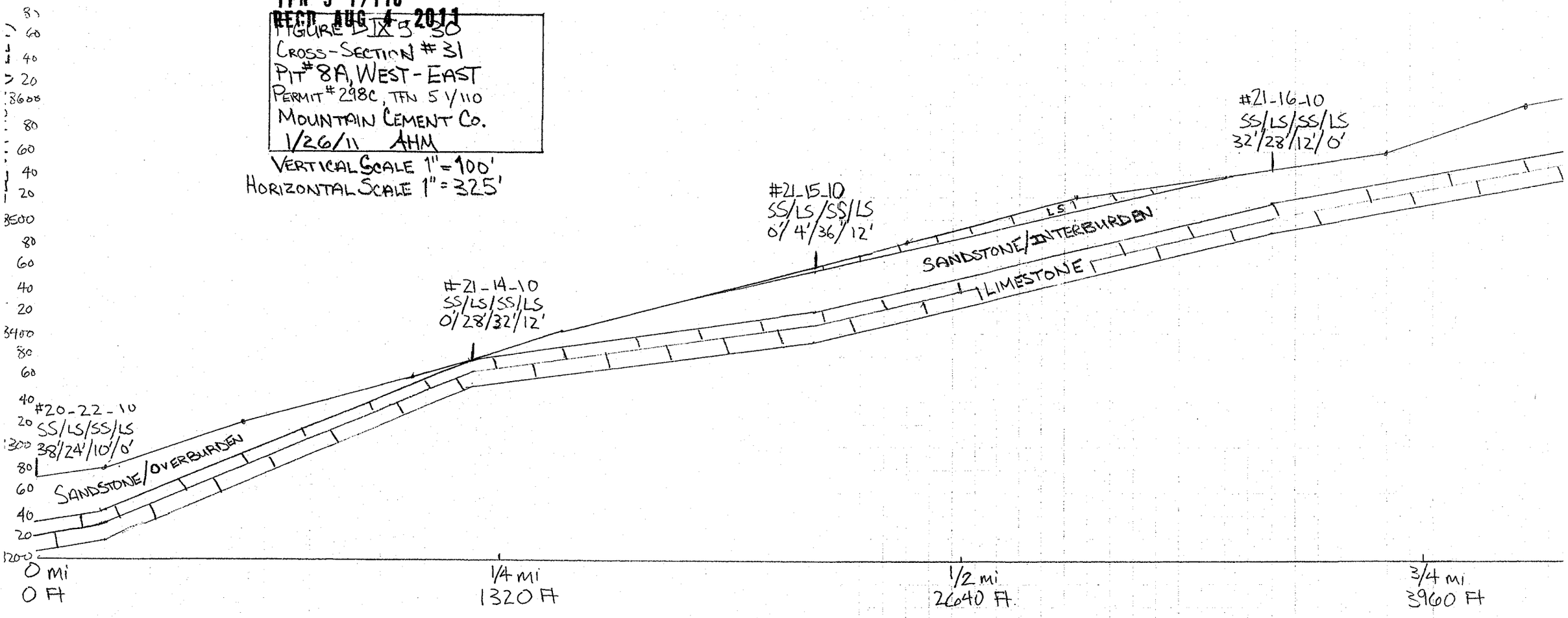
RECD AUG 4 2011

FIGURE DIX 5 30
CROSS-SECTION #31
PIT #8A, WEST-EAST
PERMIT #298C, TFN 5 1/110
MOUNTAIN CEMENT CO.
1/26/11 AHM

VERTICAL SCALE 1" = 100'
HORIZONTAL SCALE 1" = 325'



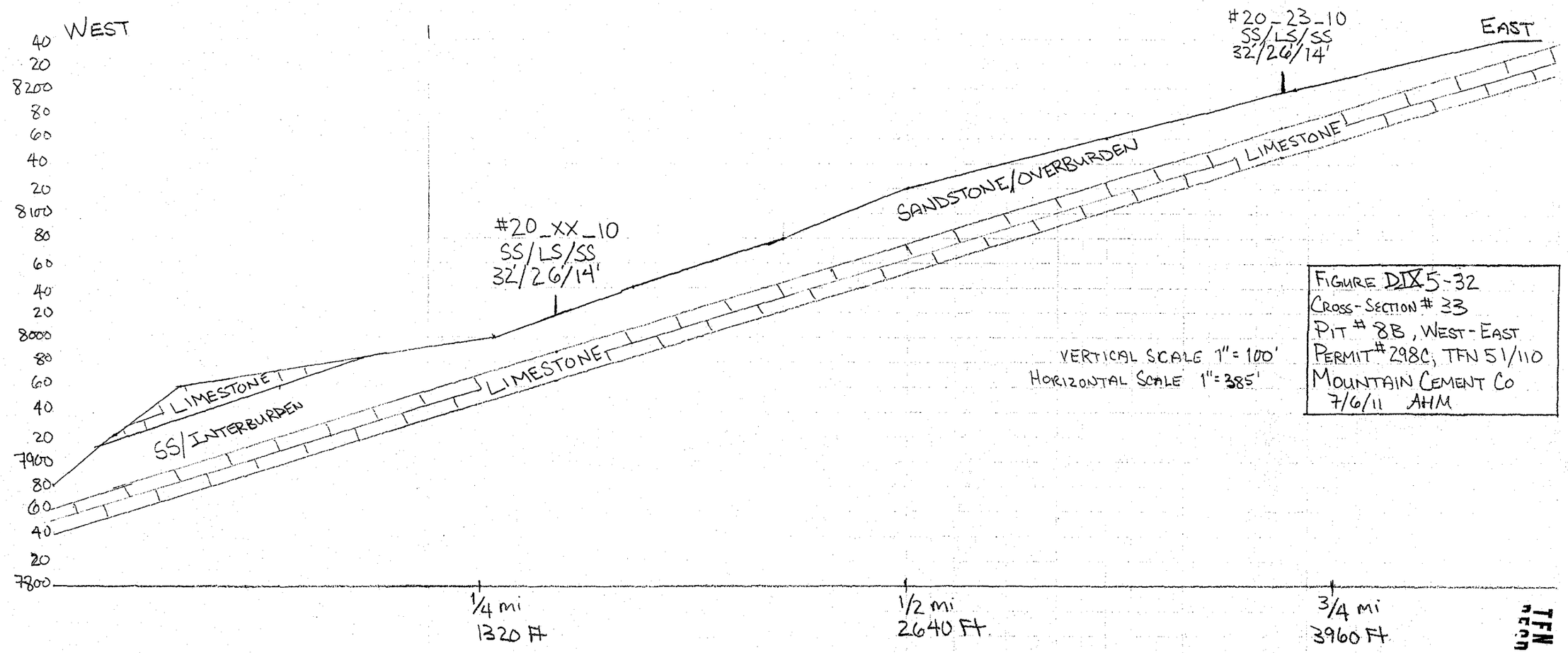
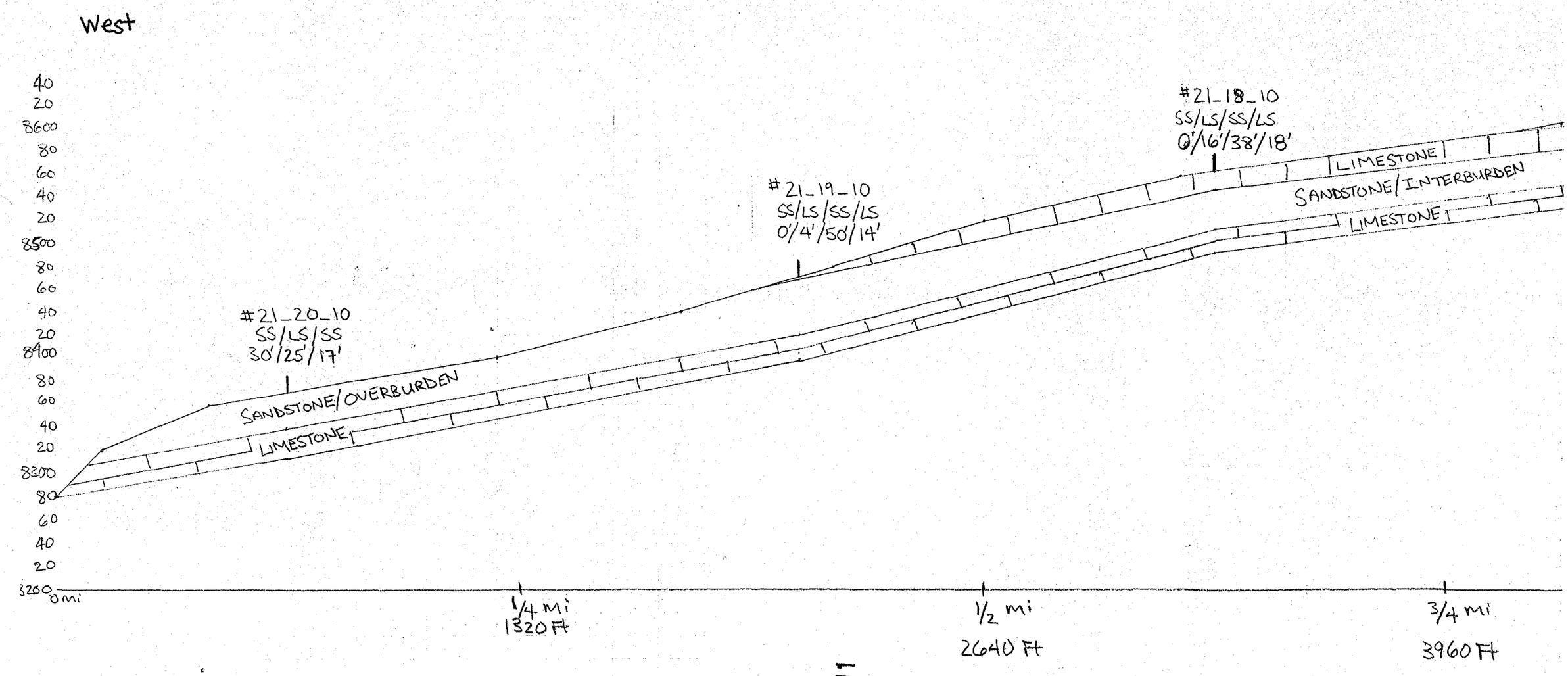


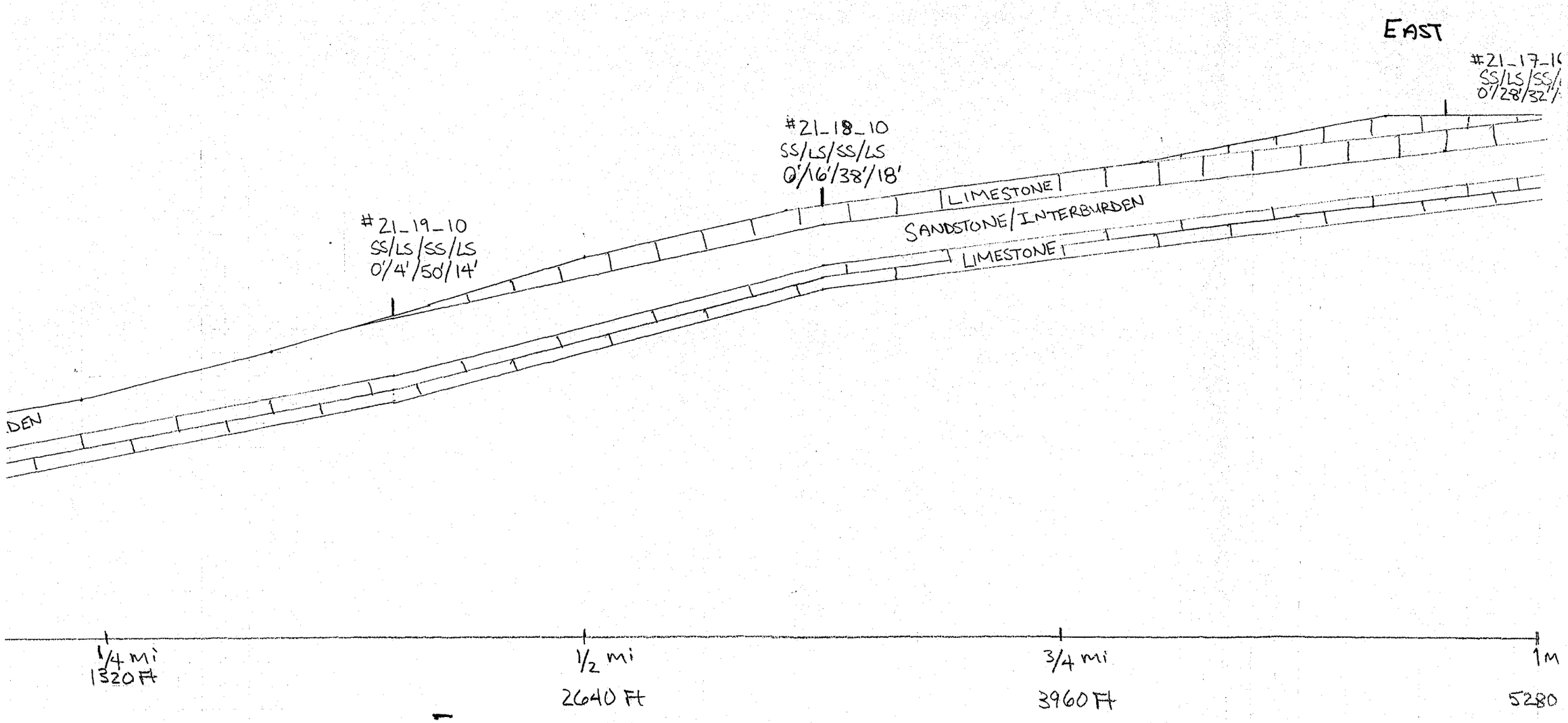
FIGURE DIX 5-32
CROSS-SECTION # 33
PIT # 8B, WEST-EAST
PERMIT # 298C; TFN 51/110
MOUNTAIN CEMENT CO
7/6/11 AHM

TFN 5 1/110
RECD AUG 4, 2011



TFN 5 1/110
RECD AUG 4, 2011

VERTICAL SC
HORIZONTAL SCALE



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RECD AUG 4, 2011

VERTICAL SCALE 1" = 100'
HORIZONTAL SCALE 1" = 325'

FIGURE ~~DIX~~ 5-33
CROSS-SECTION #34
PIT #8B, WEST-EAST
PERMIT #298C, TFN 5 1/110
MOUNTAIN CEMENT CO
7/7/11 AHM

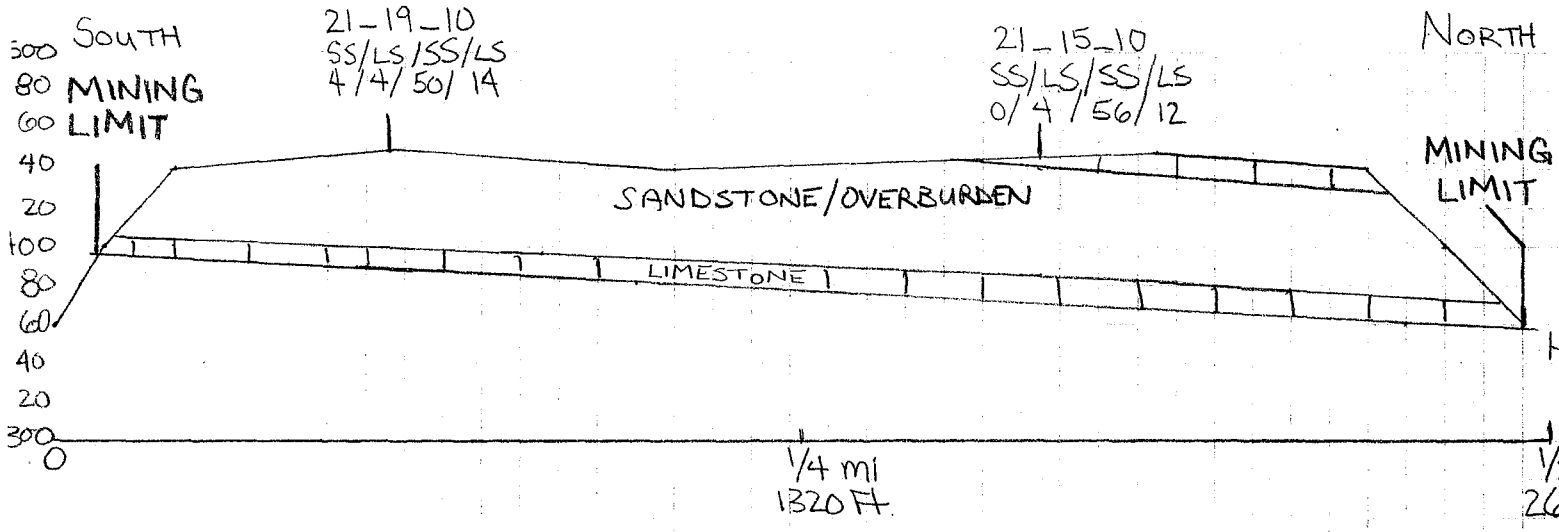

FIGURE DIX5-34
CROSS SECTION #35
PERMIT # 298C, TFN 5 1/110
PIT #8, SOUTH-NORTH
MOUNTAIN CEMENT CO.
7/12/11 AHM

VERTICAL SCALE 1" = 100'
HORIZONTAL SCALE 1" = 335'

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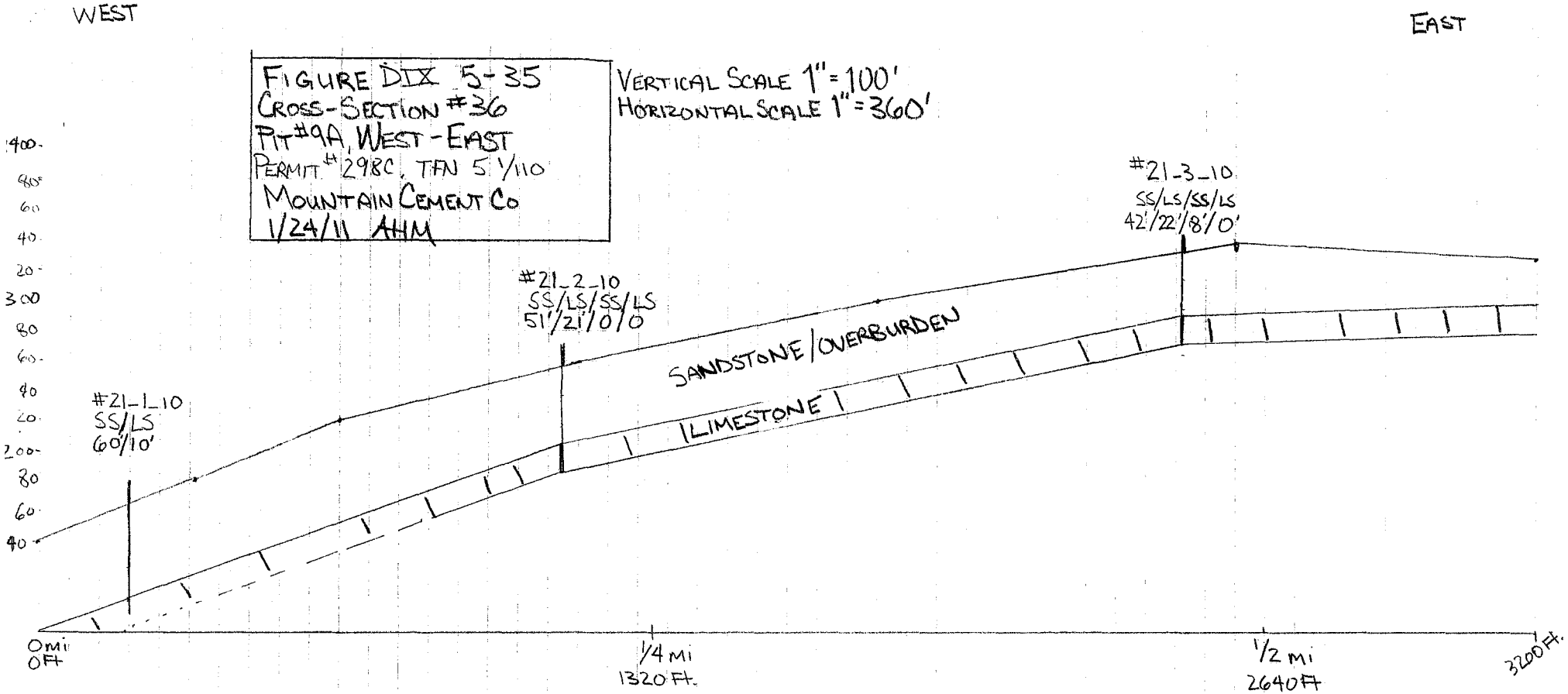
FIGURE DIX 5-35
CROSS-SECTION #36
PIT #9A, WEST-EAST
PERMIT #298C, TFN 5 1/110
MOUNTAIN CEMENT CO
1/24/11 AHM

VERTICAL SCALE 1" = 100'
HORIZONTAL SCALE 1" = 360'



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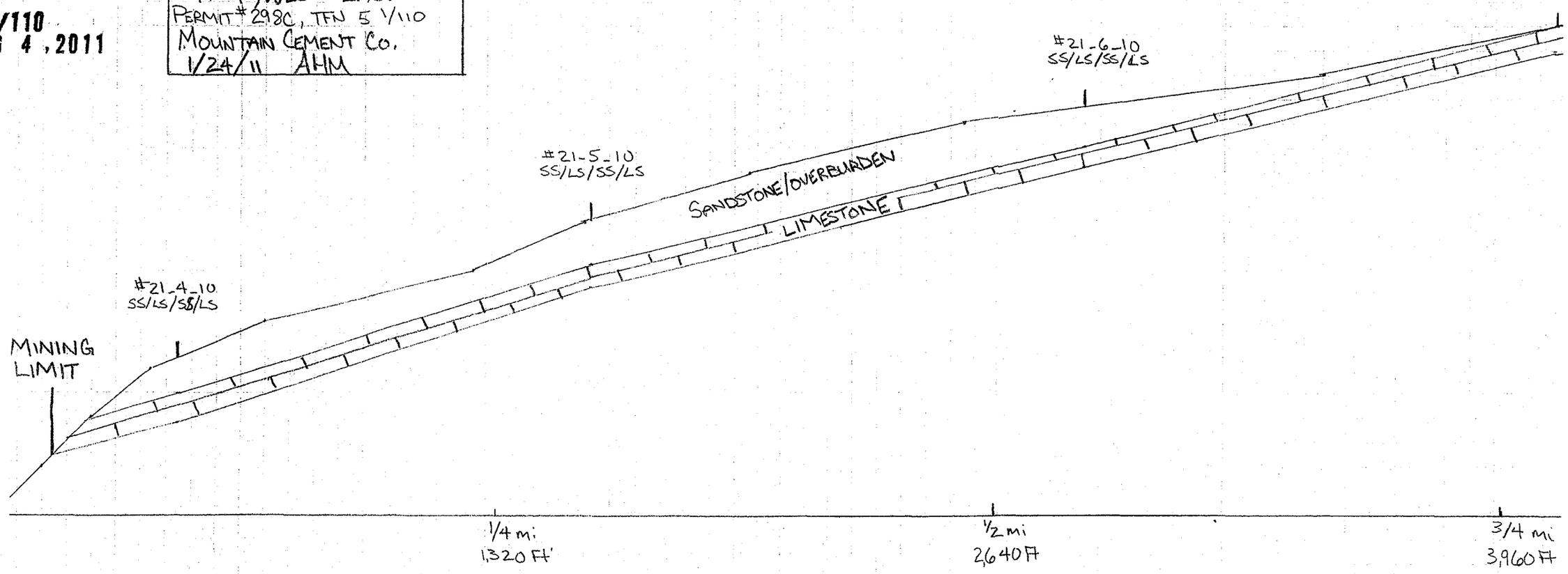
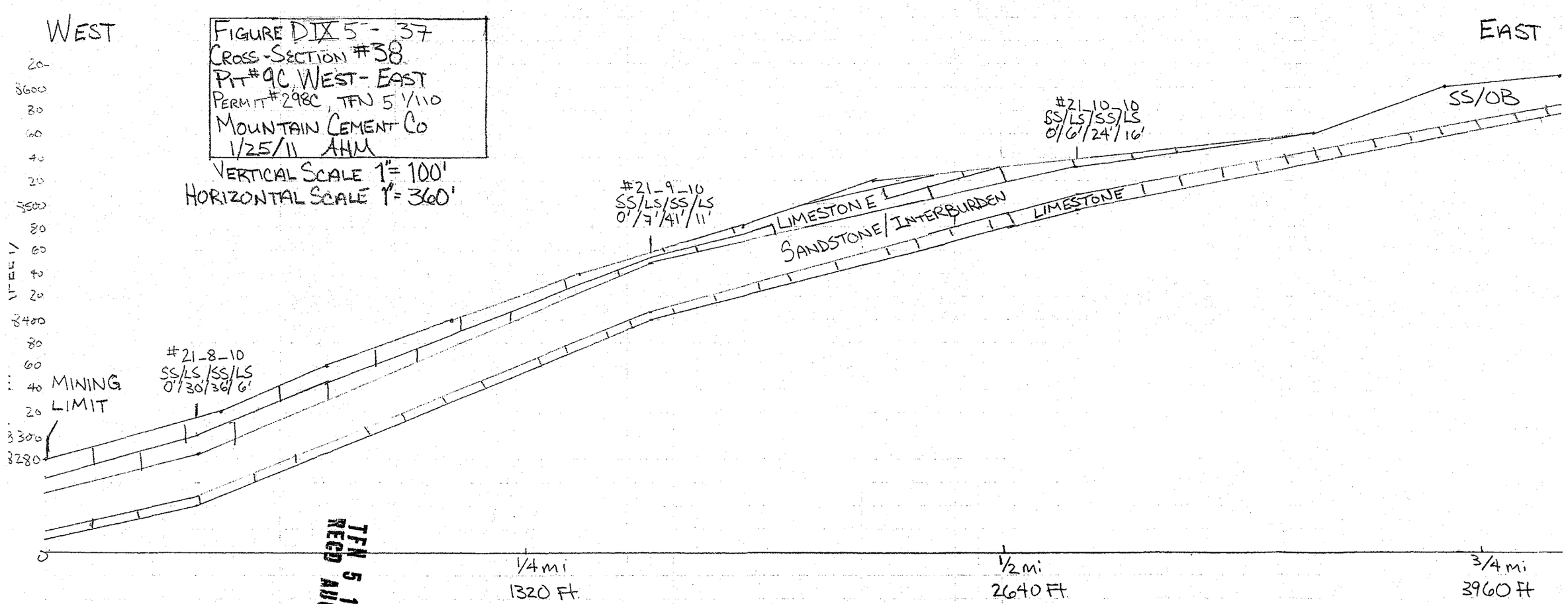
RECD AUG 4, 2011

FIGURE DIX 5-36
CROSS-SECTION # 37
PIT #9B, WEST - EAST
PERMIT # 298C, TFN 5 1/110
MOUNTAIN CEMENT CO.
1/24/11 AHM

VERTICAL SCALE 1" = 100'
HORIZONTAL SCALE 1" = 360'





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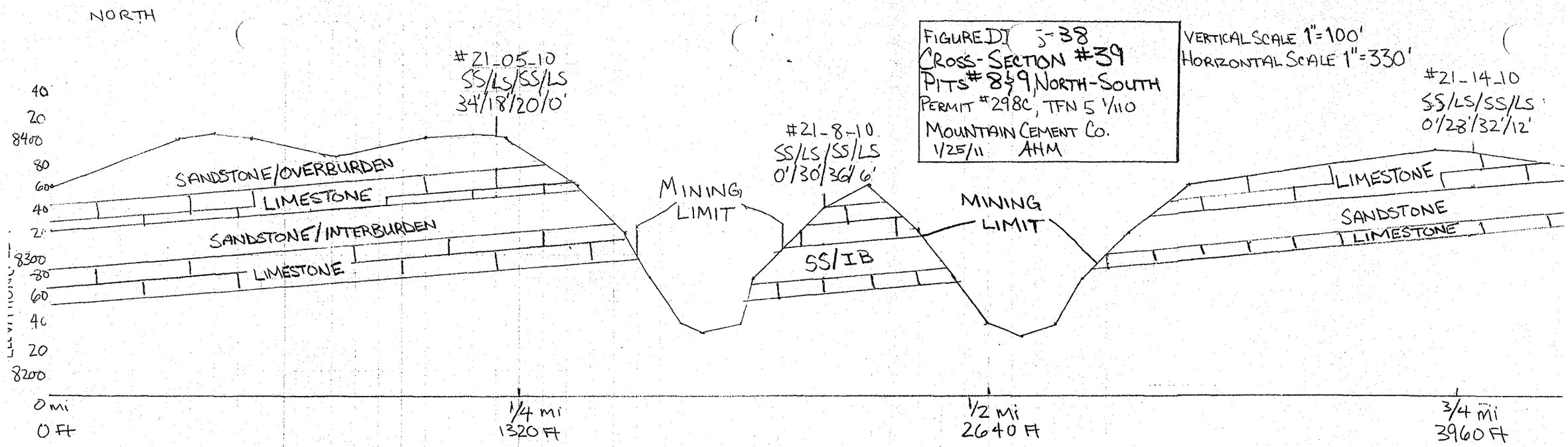

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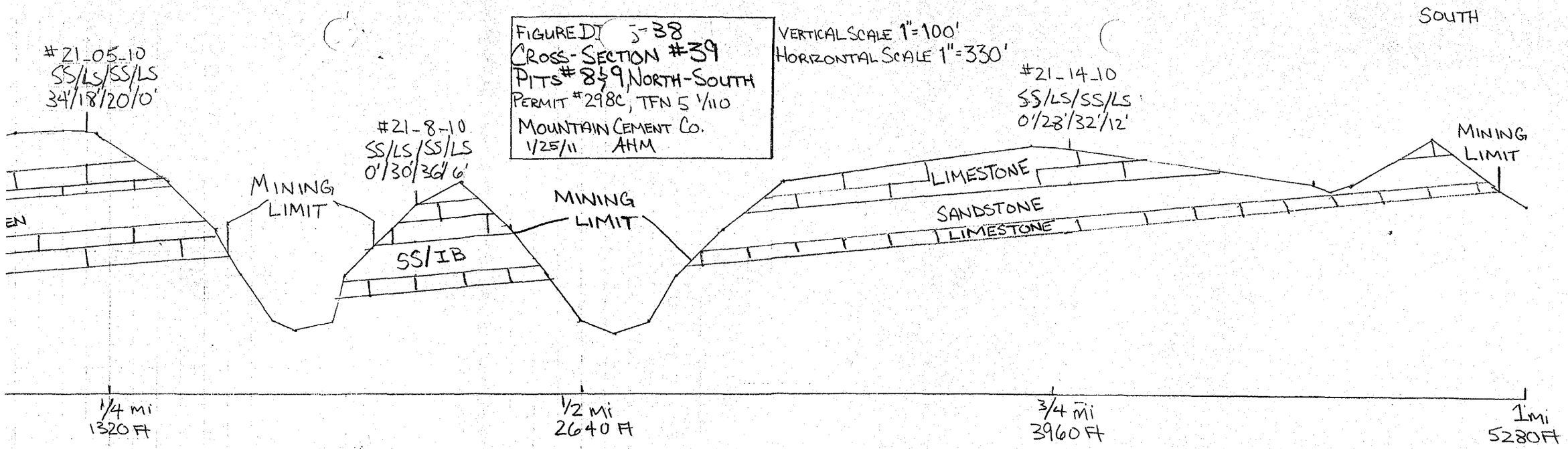
FIGURE D[illegible]-38
CROSS-SECTION #39
PITS #8&9, NORTH-SOUTH
PERMIT #298C, TFN 5 1/110
MOUNTAIN CEMENT CO.
1/25/11 AHM

VERTICAL SCALE 1"=100'
HORIZONTAL SCALE 1"=330'



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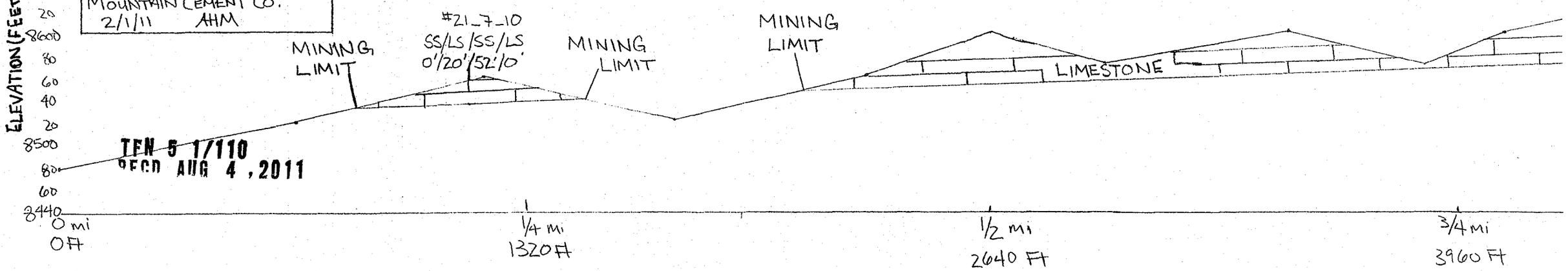
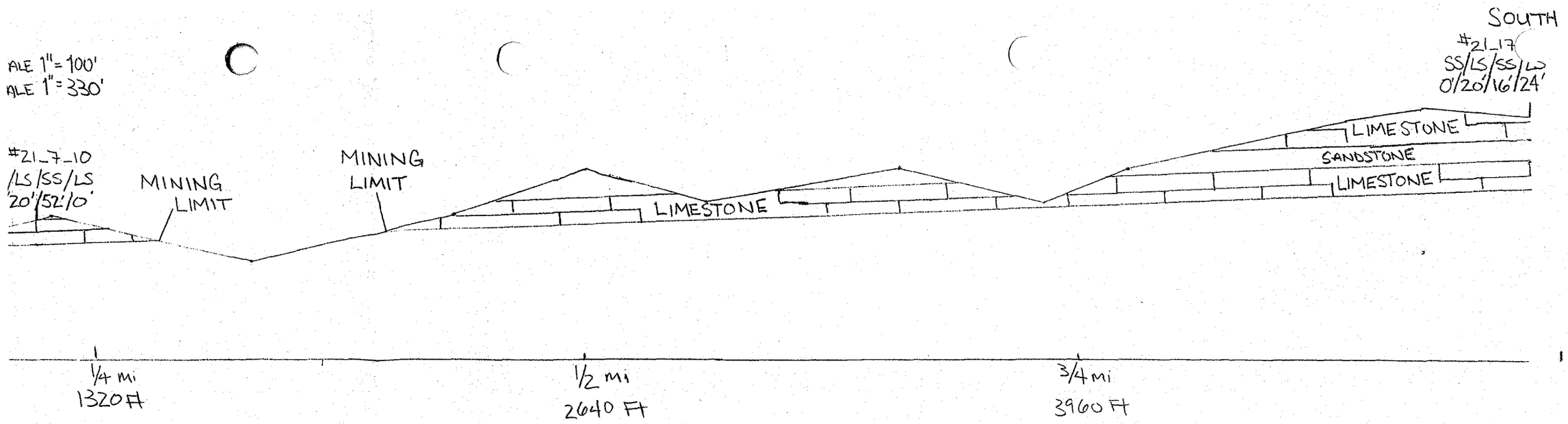
RECD AUG 4, 2011

FIGURE DIV 5-39
CROSS-SECTION #40
PIT #9 NORTH-SOUTH
PERMIT #298C, TFN 5 1/110
MOUNTAIN CEMENT CO.
2/1/11 AHM

VERTICAL SCALE 1" = 100'
HORIZONTAL SCALE 1" = 330'



TFN 5 1/110
RECD AUG 4, 2011


ALE 1" = 100'
ALE 1" = 330'
SOUTH
#21_17
SS/LS/SS/LS
0'/20'/16'/24'
#21_7_10
/LS/SS/LS
20'/52'/0'
MINING LIMIT
MINING LIMIT
LIMESTONE
LIMESTONE
SANDSTONE
LIMESTONE
1/4 mi
1320 Ft
1/2 mi
2640 Ft
3/4 mi
3960 Ft

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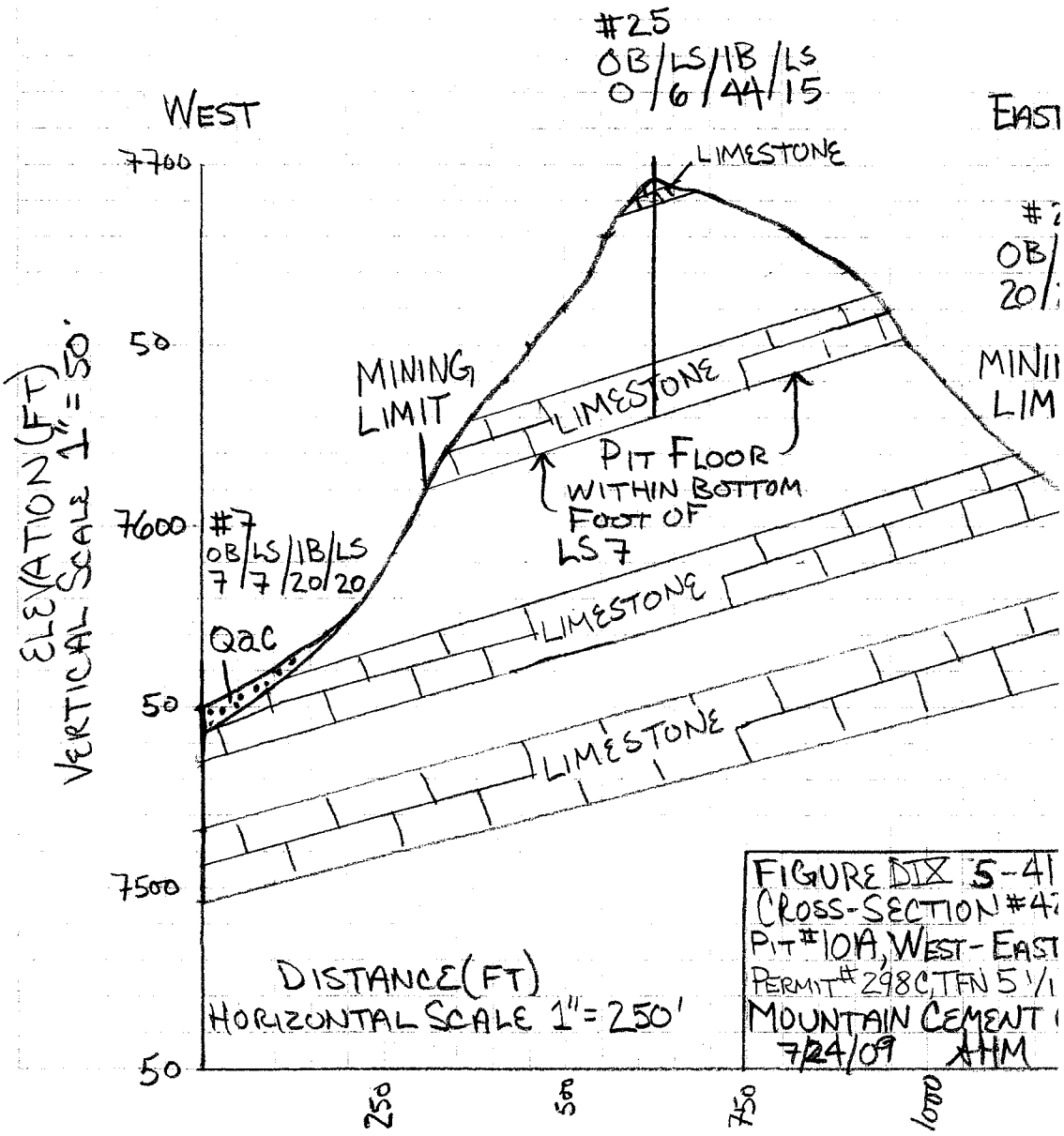
RECD AUG 4 , 2011



TFN 5 1/110
RECD AUG 4 ,2011

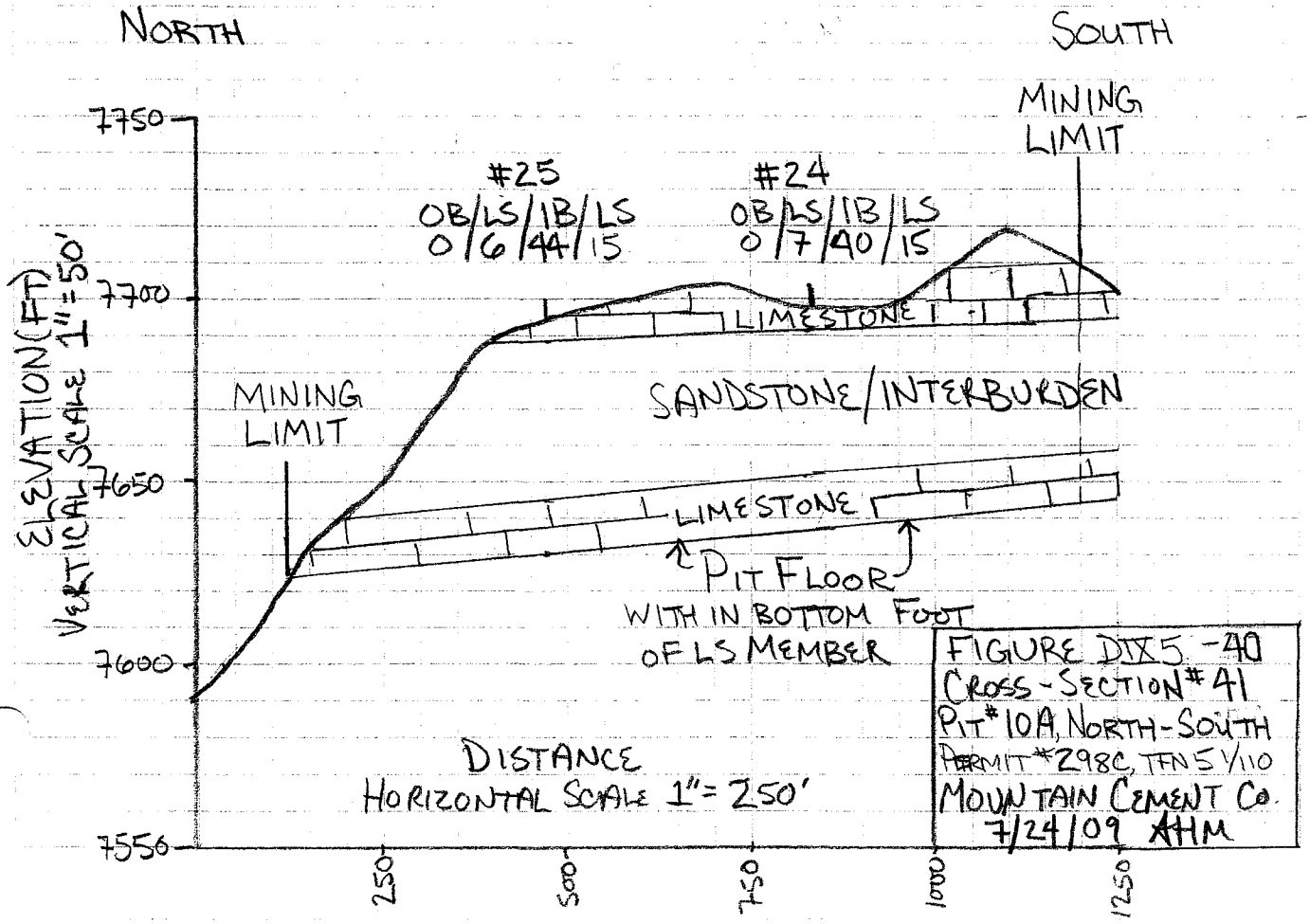


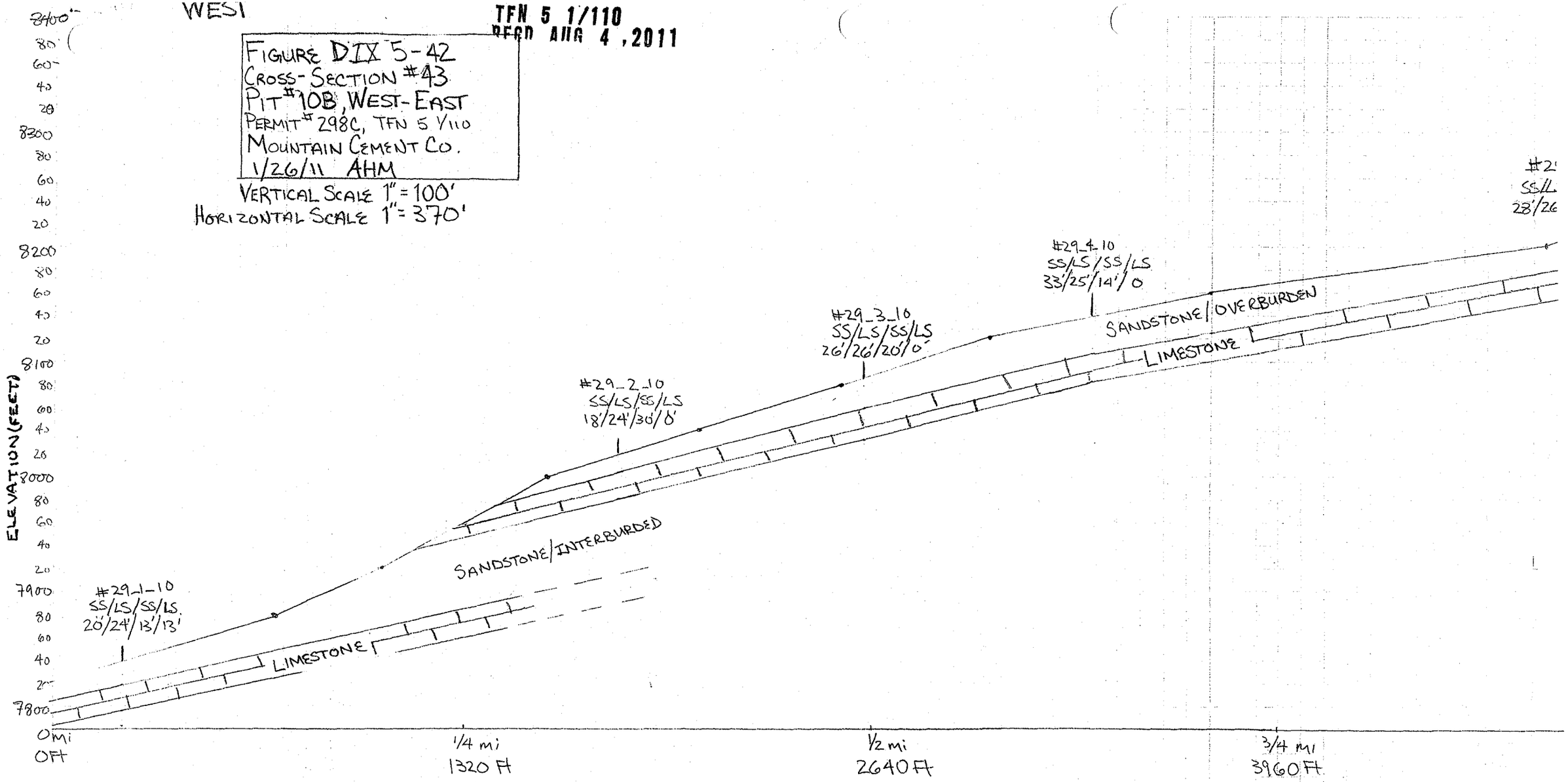
FIGURE DIX5 -40
CROSS-SECTION # 41
PIT # 10A, NORTH-SOUTH
PERMIT # 298C, TFN 5 1/110
MOUNTAIN CEMENT CO.
7/24/09 AHM

WEST

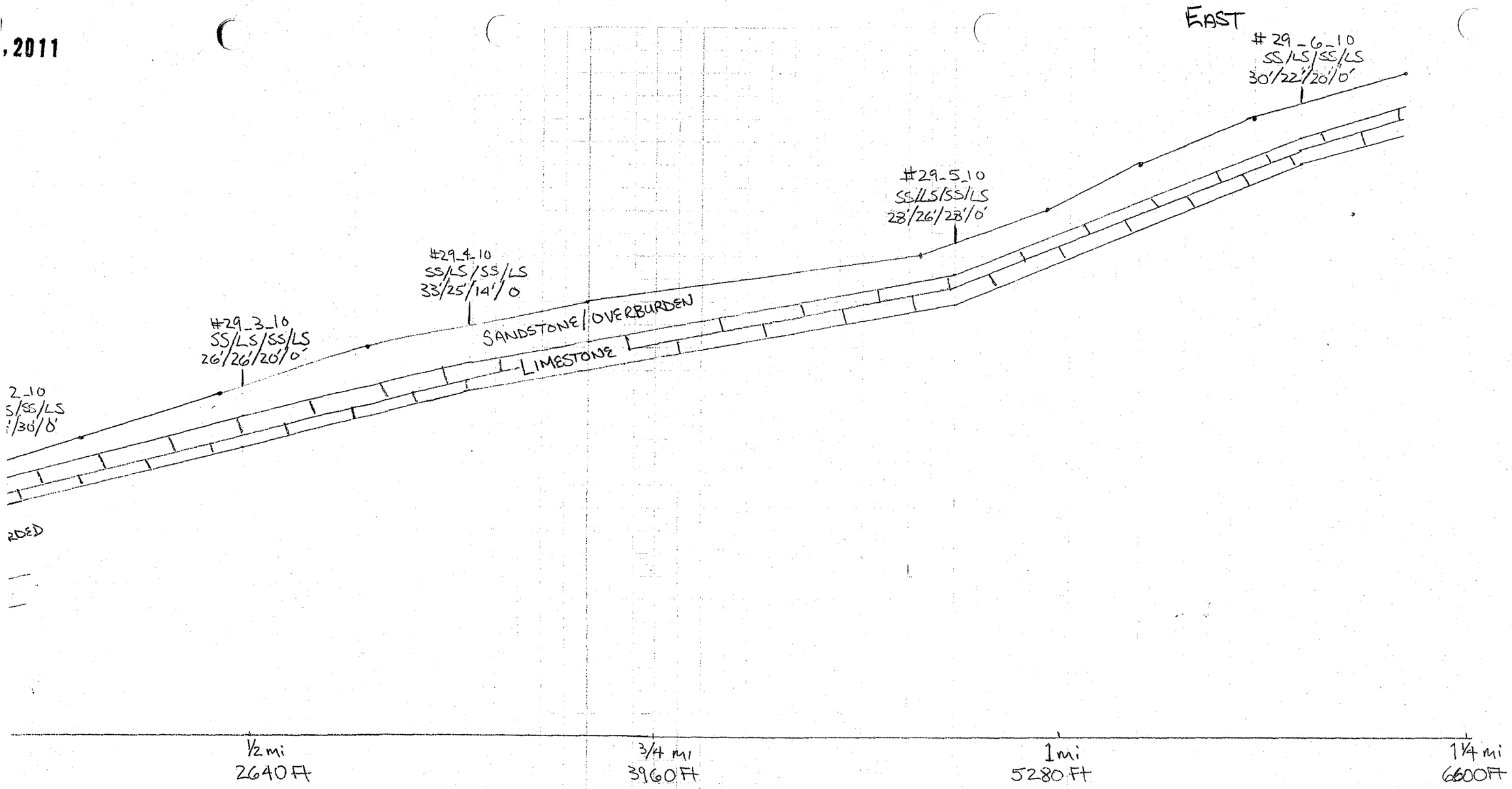
TFN 5 1/110
RECD AUG 4 ,2011

FIGURE DIX 5-42
CROSS-SECTION #43
PIT #10B, WEST-EAST
PERMIT # 298C, TFN 5 1/110
MOUNTAIN CEMENT CO.
1/26/11 AHM

VERTICAL SCALE 1" = 100'
HORIZONTAL SCALE 1" = 370'



,2011

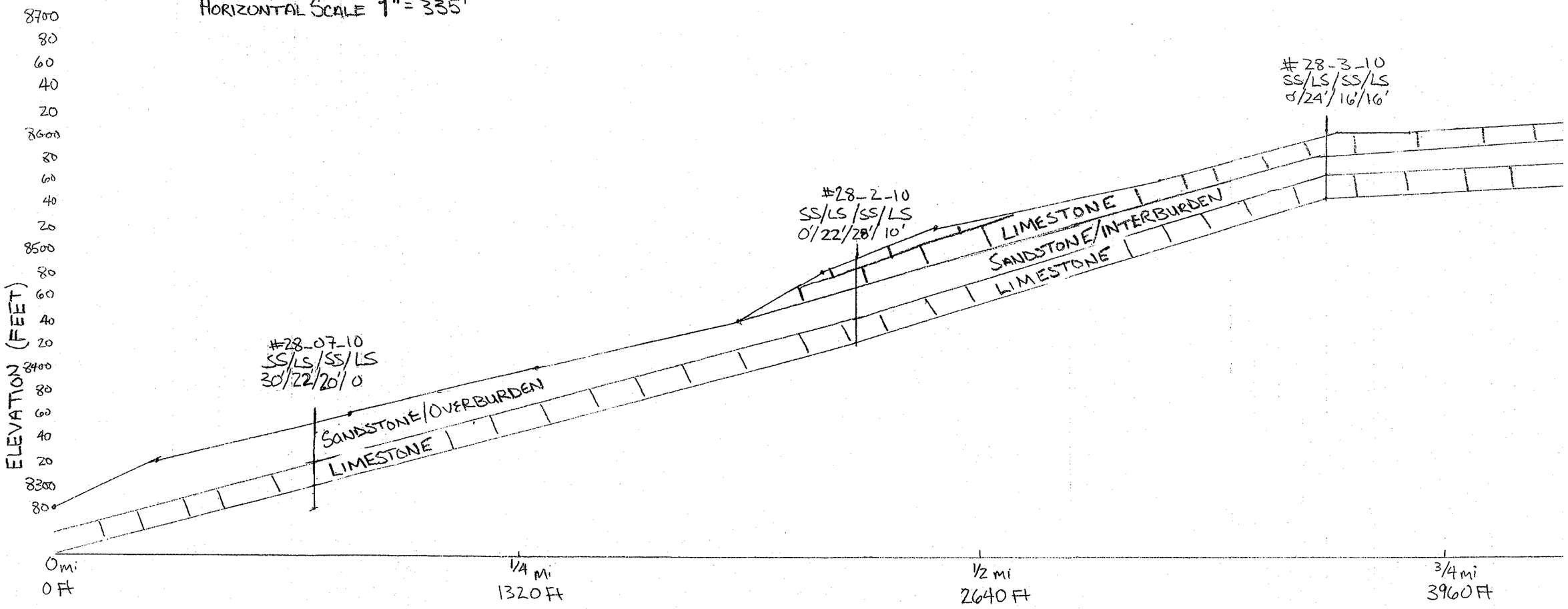

EAST
#29_6_10
SS/LS/SS/LS
30'/22'/20'/0'
#29_5_10
SS/LS/SS/LS
28'/26'/28'/0'
#29_4_10
SS/LS/SS/LS
33'/25'/14'/0
#29_3_10
SS/LS/SS/LS
26'/26'/20'/0'
2_10
S/SS/LS
'/30'/0'
SANDSTONE/OVERBURDEN
LIMESTONE
RDED
1/2 mi
2640 Ft
3/4 mi
3960 Ft
1 mi
5280 Ft
1 1/4 mi
6600 Ft

WEST

TFN 5 1/110
RECD AUG 4 ,2011

FIGURE DIX 5-44
CROSS-SECTION #45
PIT #10B WEST - EAST
PERMIT #298C, TFN 5 1/110
MOUNTAIN CEMENT CO.
1/26/11 AHM

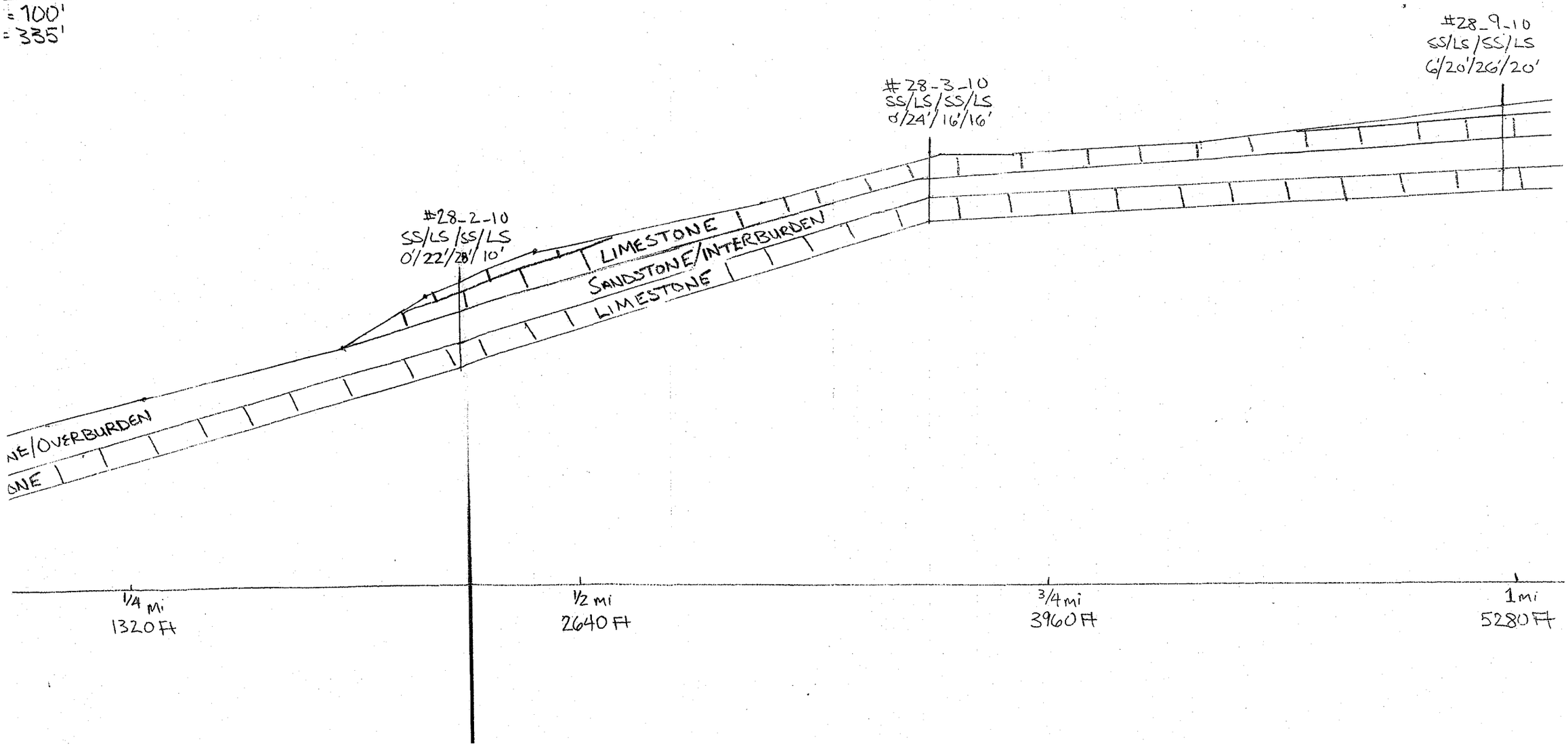
VERTICAL SCALE 1" = 100'
HORIZONTAL SCALE 1" = 335'

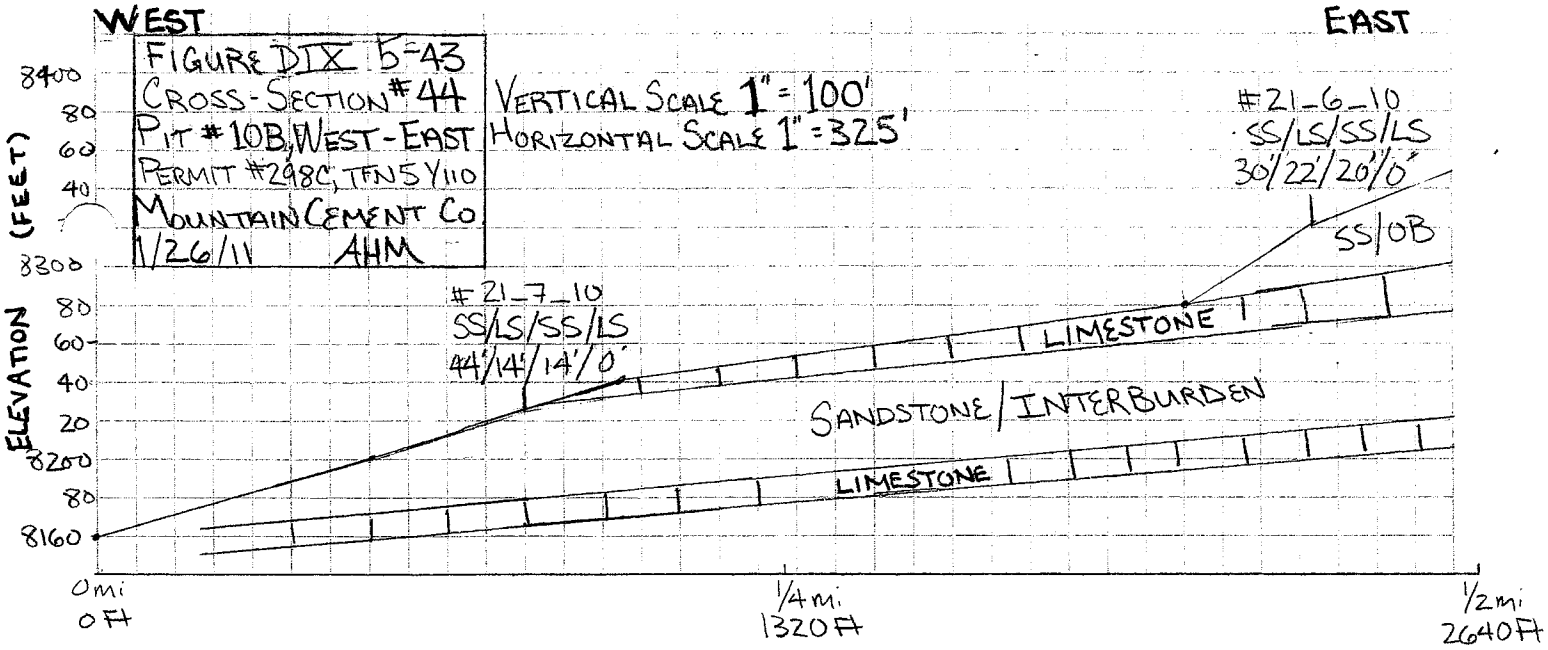


-44
5
EAST
S 1/110
T Co.

= 100'
= 335'

EAST





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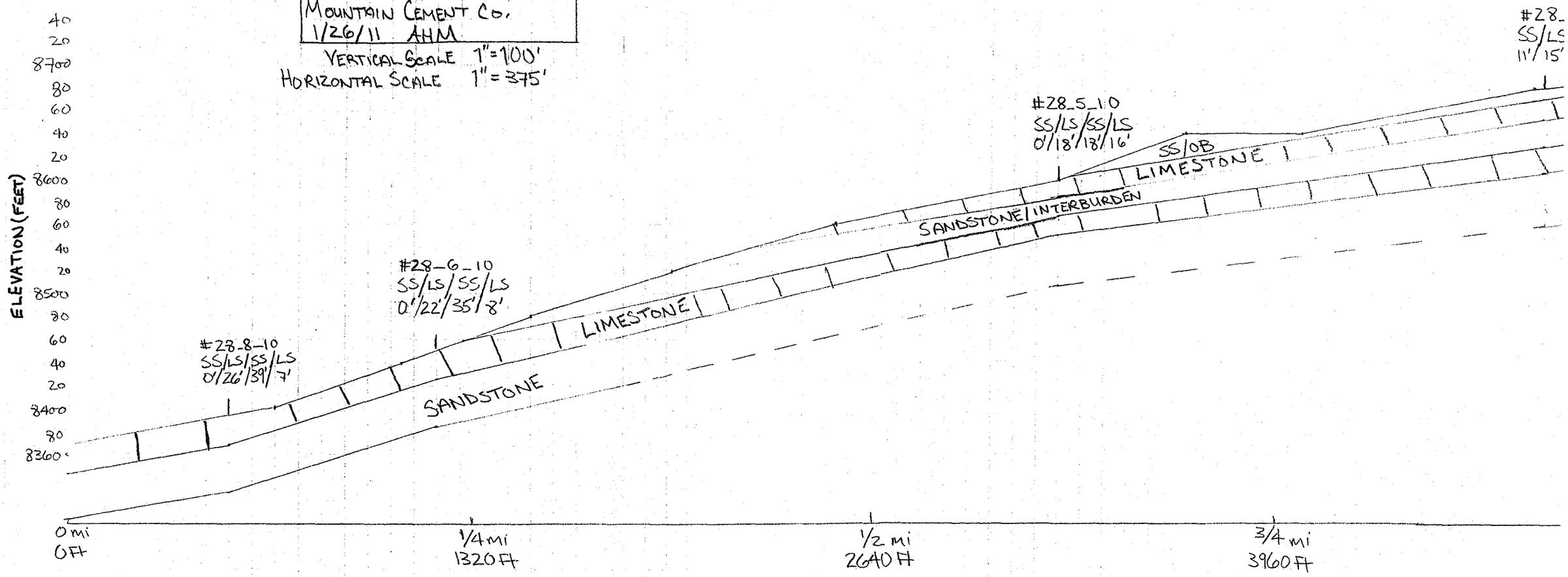
WEST

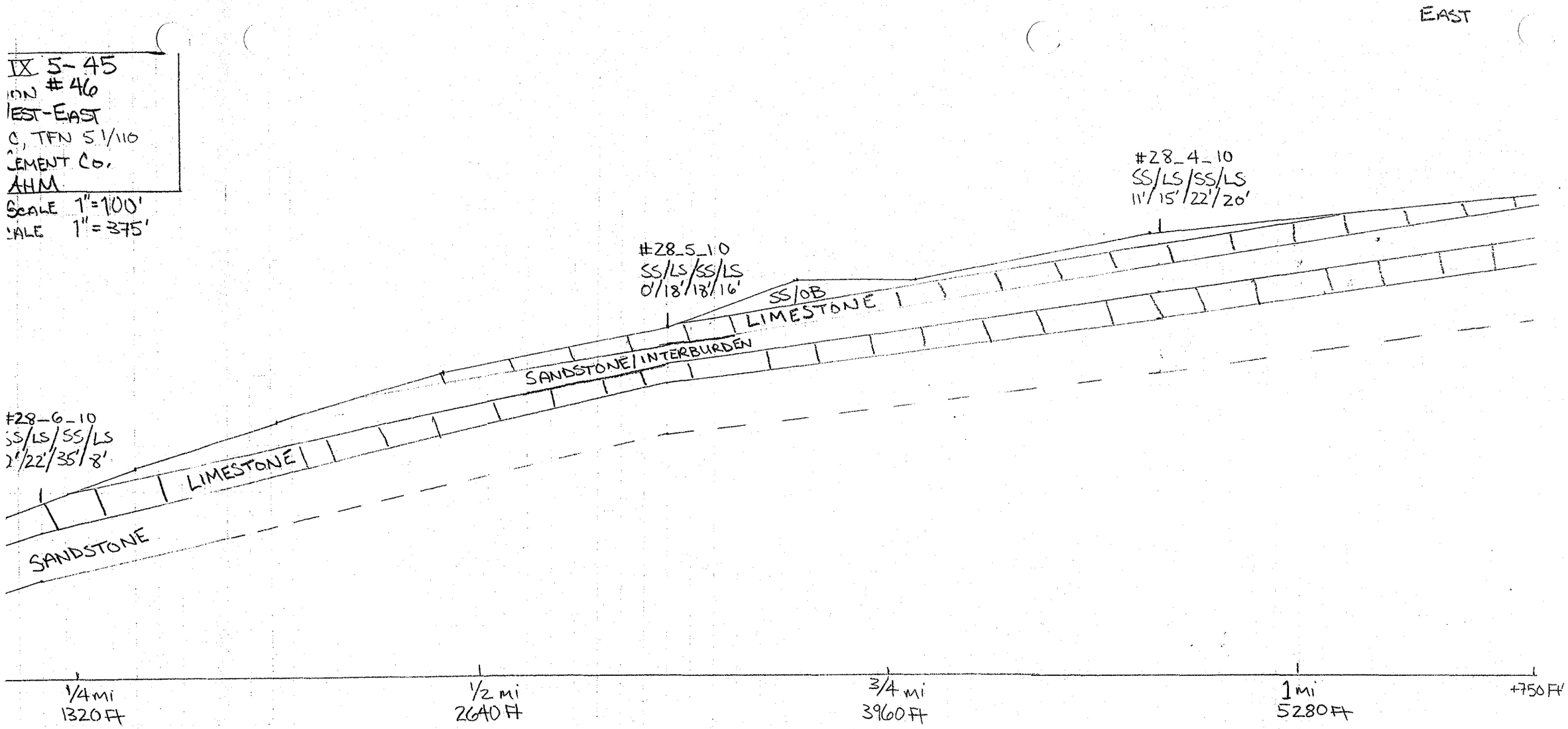
TFN 5 1/110
RECD AUG 4, 2011

FIGURE DIX 5-45
CROSS-SECTION #46
PIT #10B, WEST-EAST
PERMIT #298C, TFN 5 1/110
MOUNTAIN CEMENT CO.
1/26/11 AHM

VERTICAL SCALE 1" = 100'
HORIZONTAL SCALE 1" = 375'

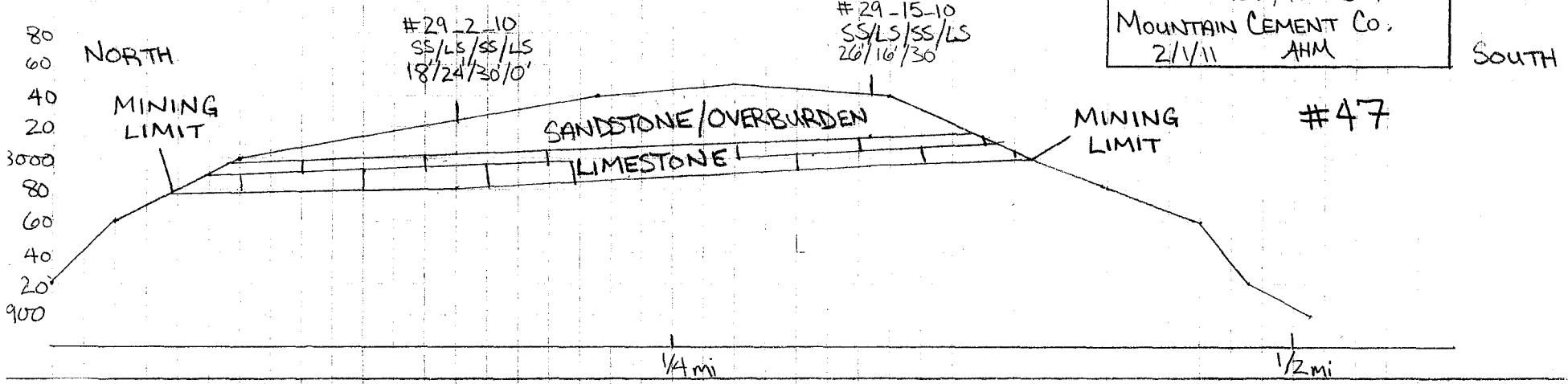


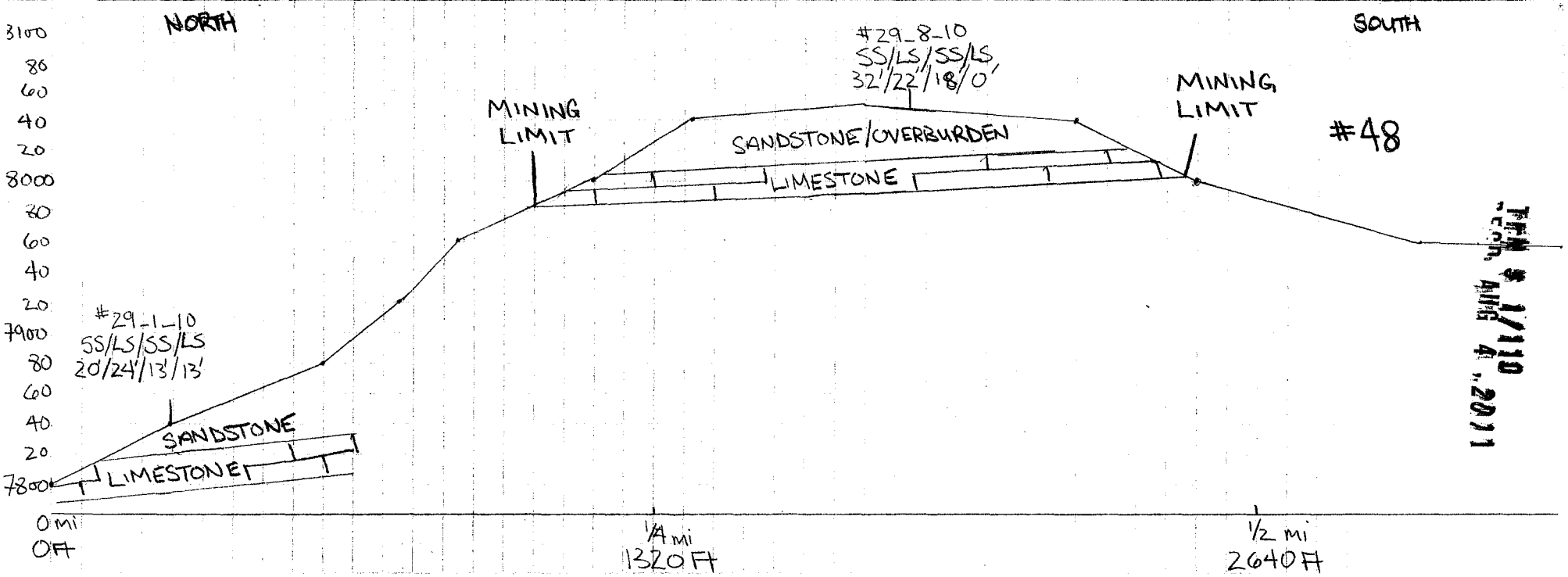
IX 5-45
ION #46
EST-EAST
C, TFN 51/110
CEMENT Co.
AHM
SCALE 1"=100'
CALE 1"=375'



VERTICAL SCALE 1" = 100'
HORIZONTAL SCALE 1" = 325'

FIGURE DIX 5-46
CROSS-SECTIONS #47 & 48
PIT #10B, NORTH-SOUTH
PERMIT #298C, TFN 5 1/110
MOUNTAIN CEMENT CO.
2/1/11 AHM





TFN 5 1/110
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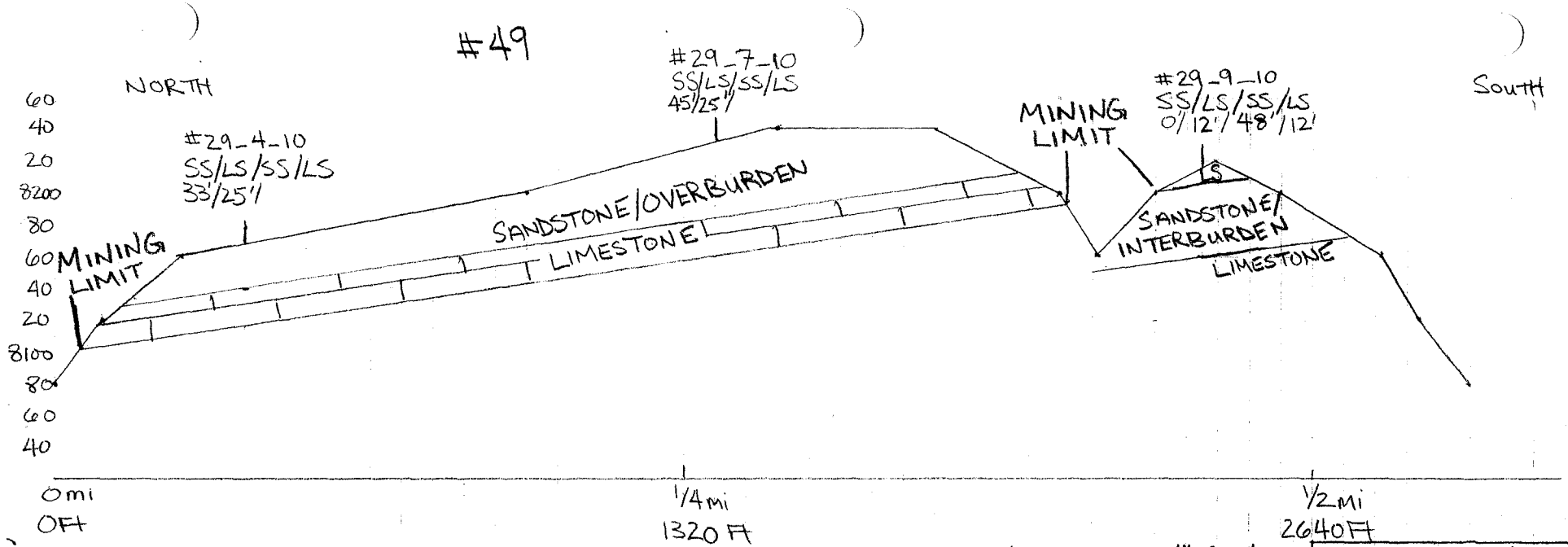
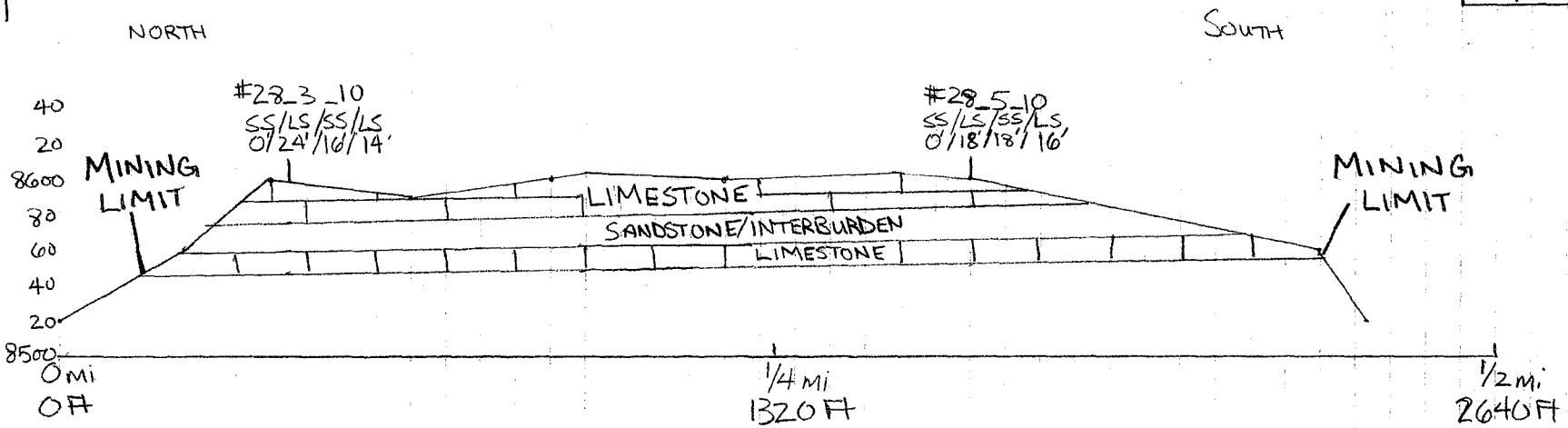


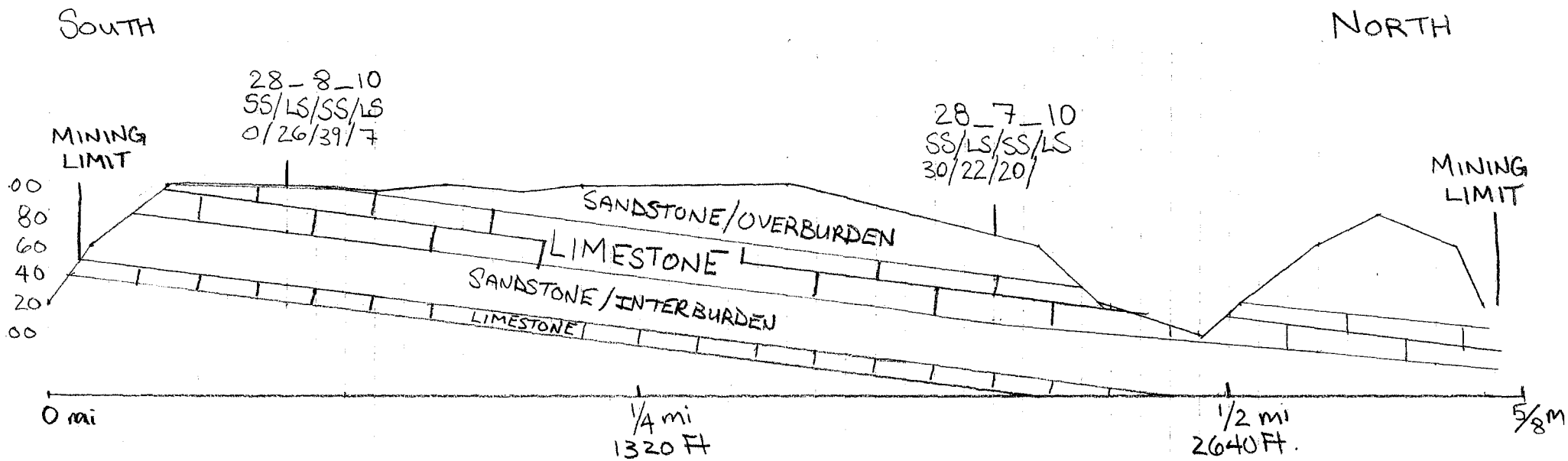
VERTICAL SCALE 1" = 100'
HORIZONTAL SCALE 1" = 325'

FIGURE DIX 5-47
CROSS-SECTIONS #49 & 50
PIT #10B, NORTH-SOUTH
PERMIT #298C, TFN 5 1/110
MOUNTAIN CEMENT CO
2/1/11 AHM



TFN 5 1/110
DFCD AUG 4, 2011

#50



VERTICAL SCALE 1" = 100'
HORIZONTAL SCALE 1" = 325'

FIGURE DIX 5-48
CROSS SECTION # 51
PIT # 10B, South-NORTH
PERMIT # 298C, TFN 5 1/110
MOUNTAIN CEMENT Co.
7/12/19 AHM

TFN 5 1/110
RECD AUG 4, 2011

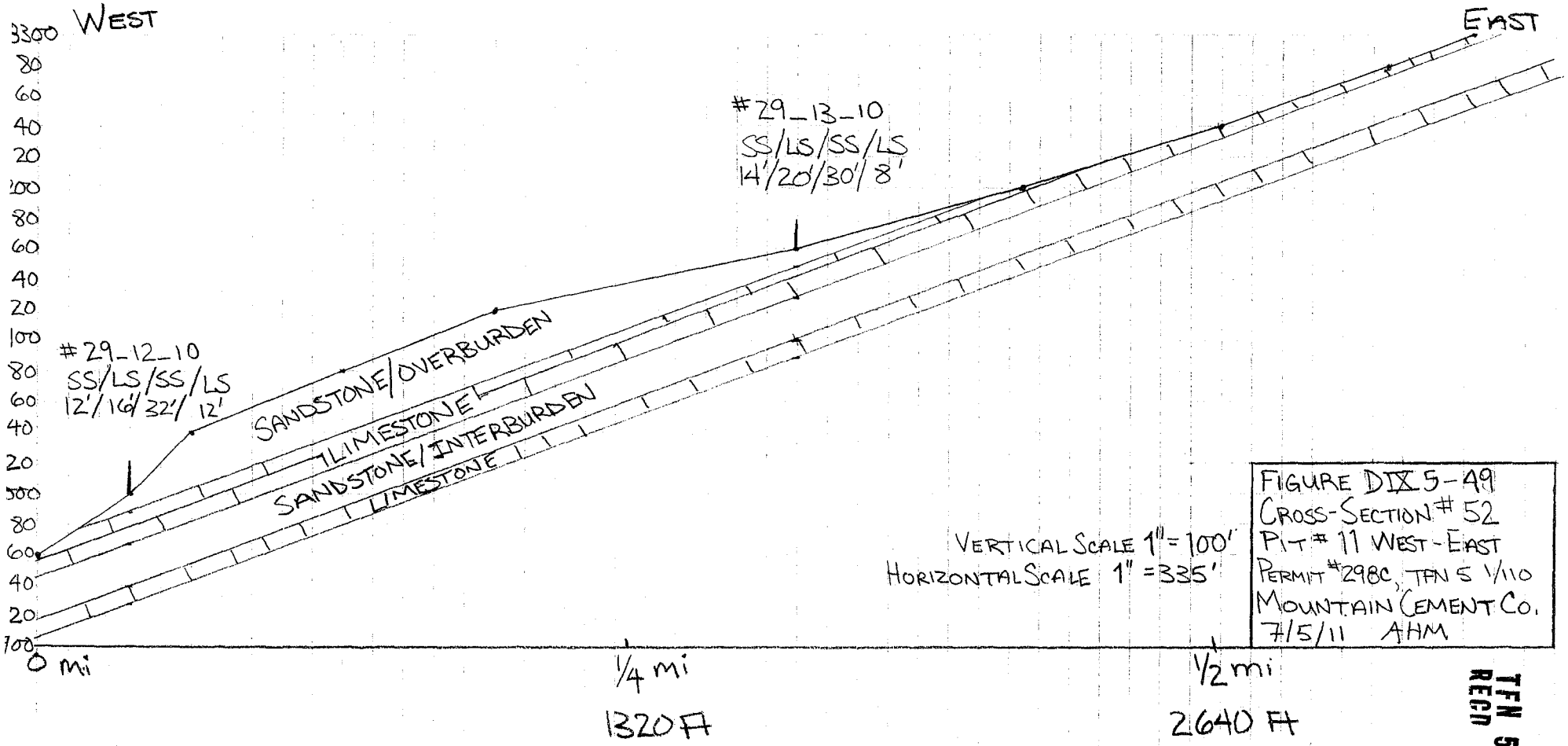
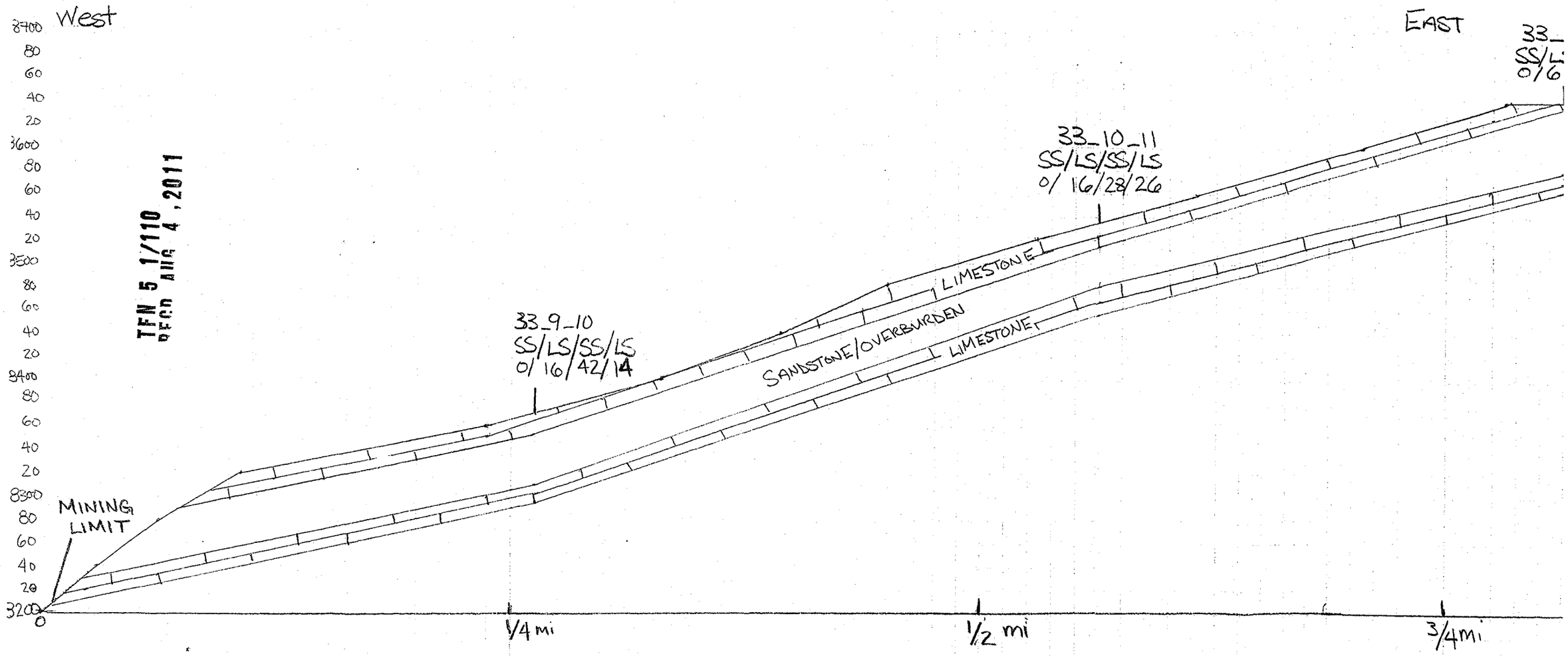


FIGURE DIX 5-49
CROSS-SECTION # 52
PIT # 11 WEST-EAST
PERMIT #298C, TFN 5 1/110
MOUNTAIN CEMENT CO.
7/5/11 AHM

TFN 5 1/110
RECD AUG 4, 2011

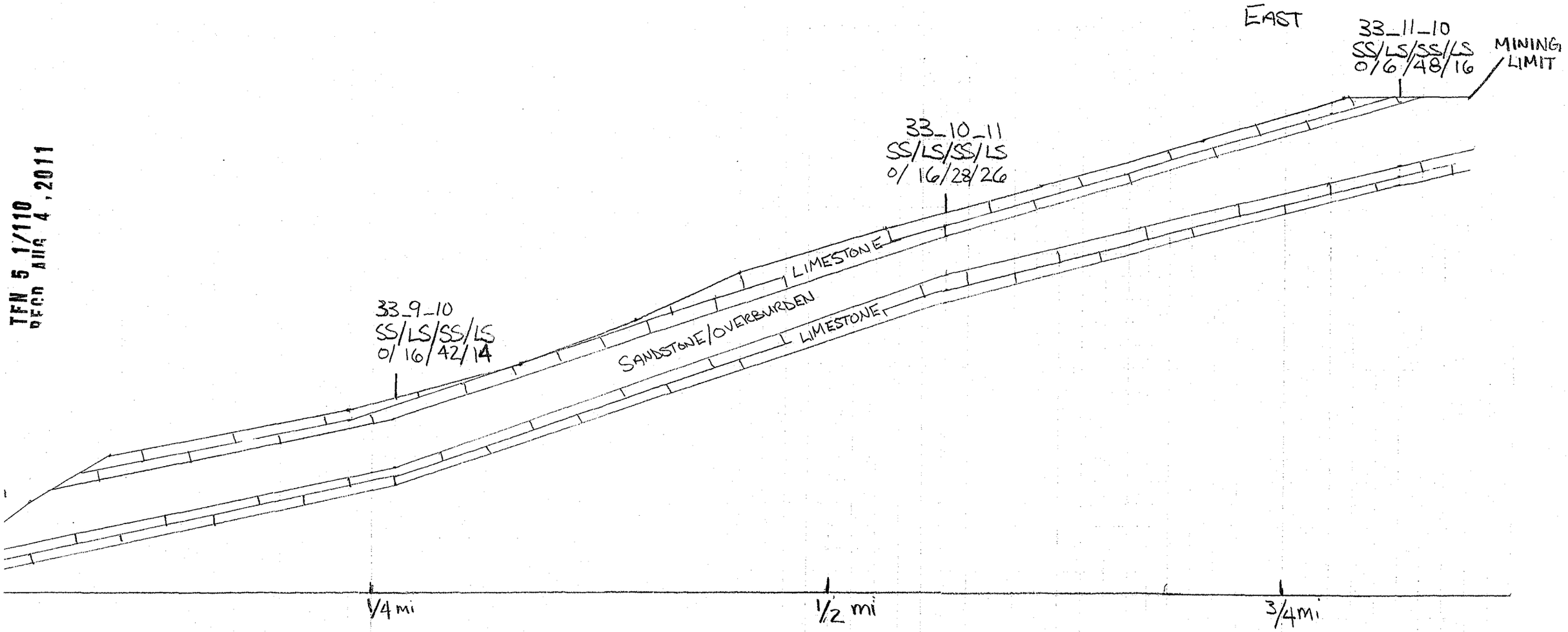


TFN 5 1/110
RECD AUG 4, 2011

VERTICAL SCALE 1" = 100'
HORIZONTAL SCALE 1" = 330'

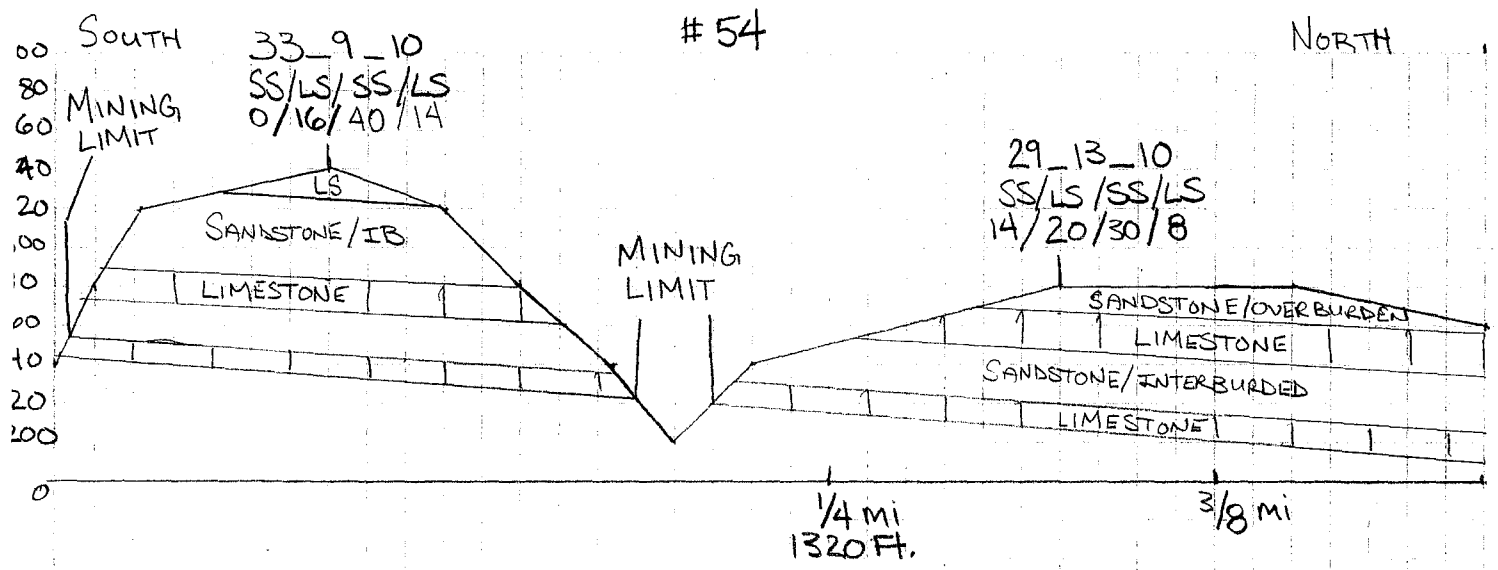
FIGURE DIX
CROSS-SECTI
PIT #11 WES
PERMIT #298C
MOUNTAIN C
7/13/11

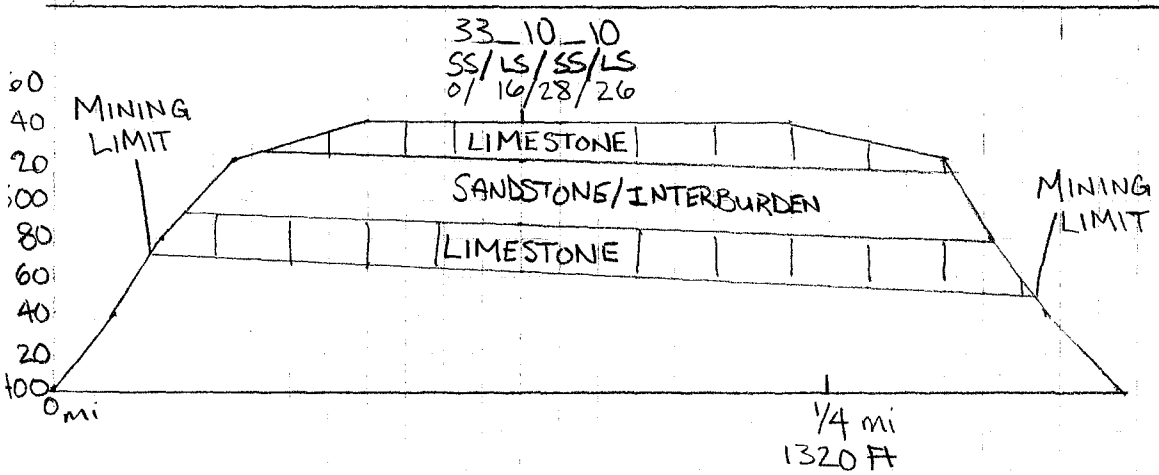
TFN 5 1/110
RECD AUG 4, 2011



VERTICAL SCALE 1" = 100'
HORIZONTAL SCALE 1" = 330'

FIGURE DIX 5-50
CROSS-SECTION # 53
PIT # 11, West-East
PERMIT # 298C, TFN 5 1/110
MOUNTAIN CEMENT CO.
7/13/11 AHM





#55

FIGURE DIX 5-51
CROSS SECTIONS #54 & 55
PIT #11, SOUTH-NORTH
PERMIT #298C, TFN 5 1/110
MOUNTAIN CEMENT CO.
7/13/11 AHM

VERTICAL SCALE 1" = 100'
HORIZONTAL SCALE 1" = 360'

TFN 5 1/110
AUG 4, 2011

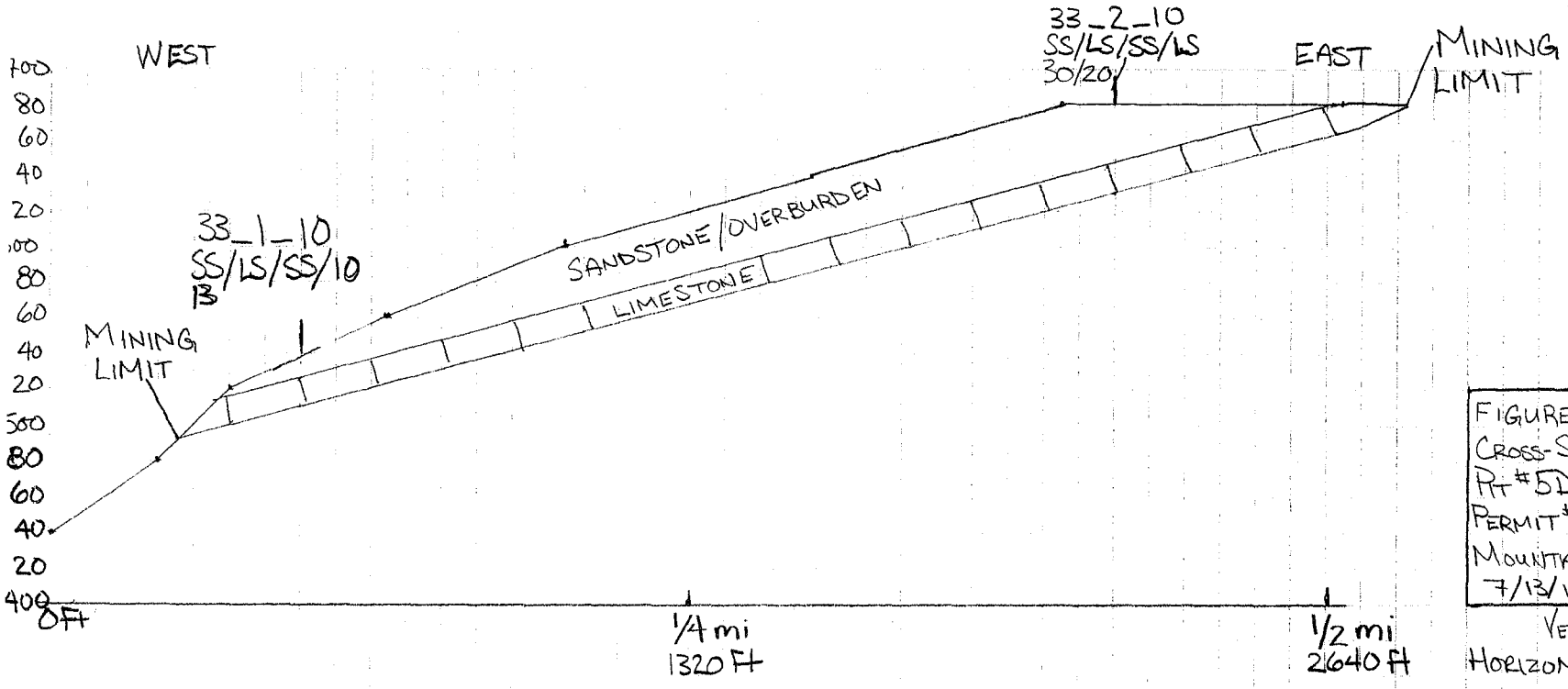
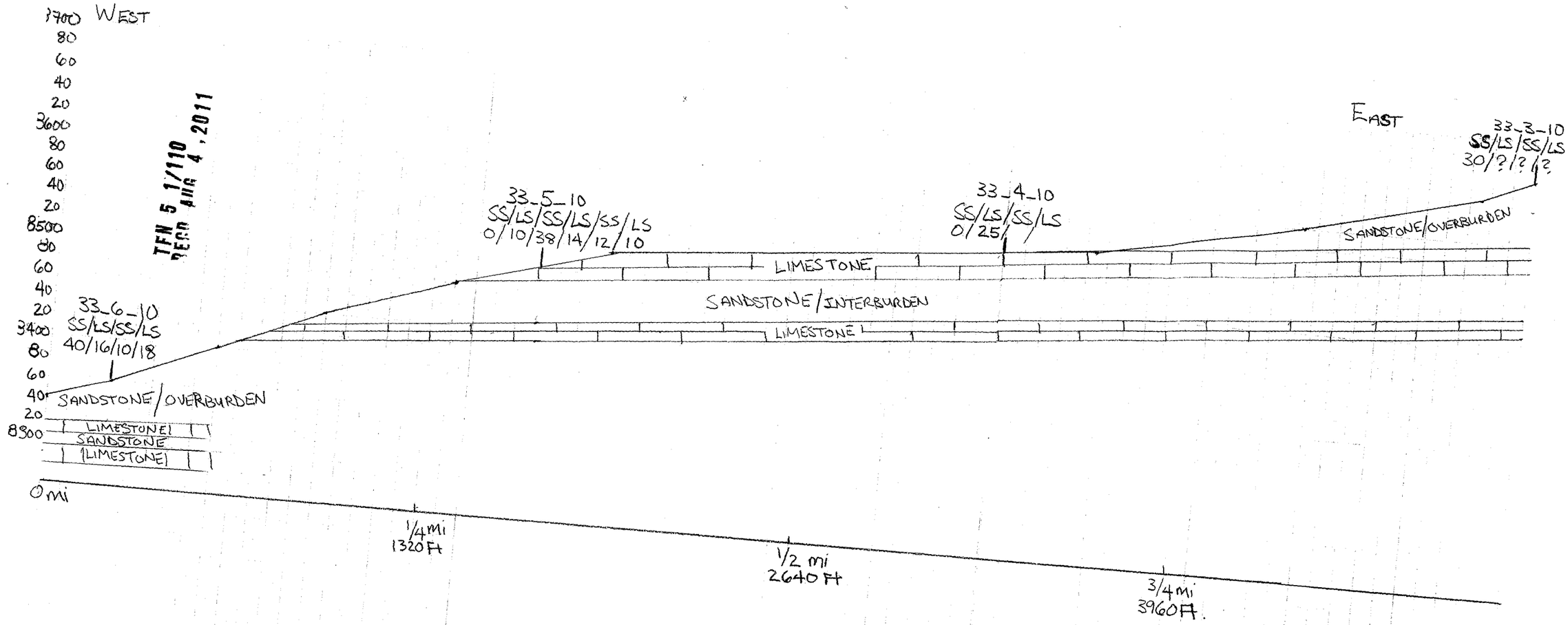


FIGURE DIX 5-52
CROSS-SECTION # 56
PIT #5D, WEST - EAST
PERMIT #298C, TFN 5 1/110
MOUNTAIN CEMENT CO.
7/13/11 AHM

VERTICAL SCALE 1" = 100'
HORIZONTAL SCALE 1" = 360'

TFN 5 1/110
RECD AUG 4, 2011



TFN 5 1/110
RECD AUG 4, 2011

FIGURE DIX 5-53
CROSS-SECTION # 57
PIT #5D, WEST - EAST
PERMIT #298C, TFN 5 1/110
MOUNTAIN CEMENT CO.
7/13/11 AHM

VERTICAL SCALE 1" = 100'
HORIZONTAL SCALE 1" = 360'

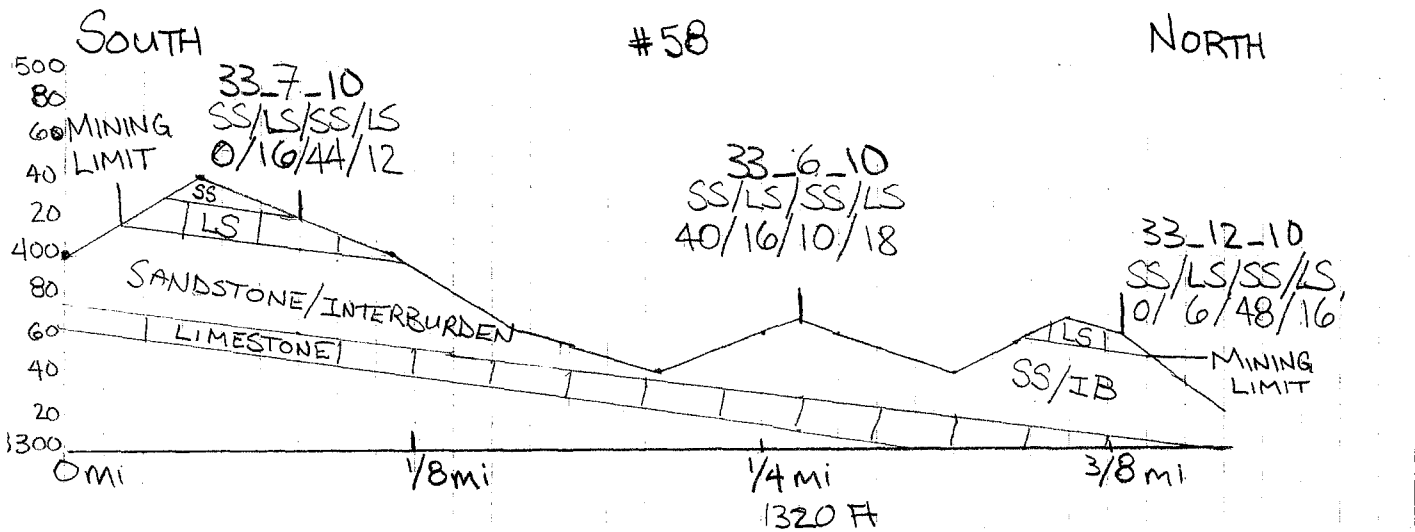
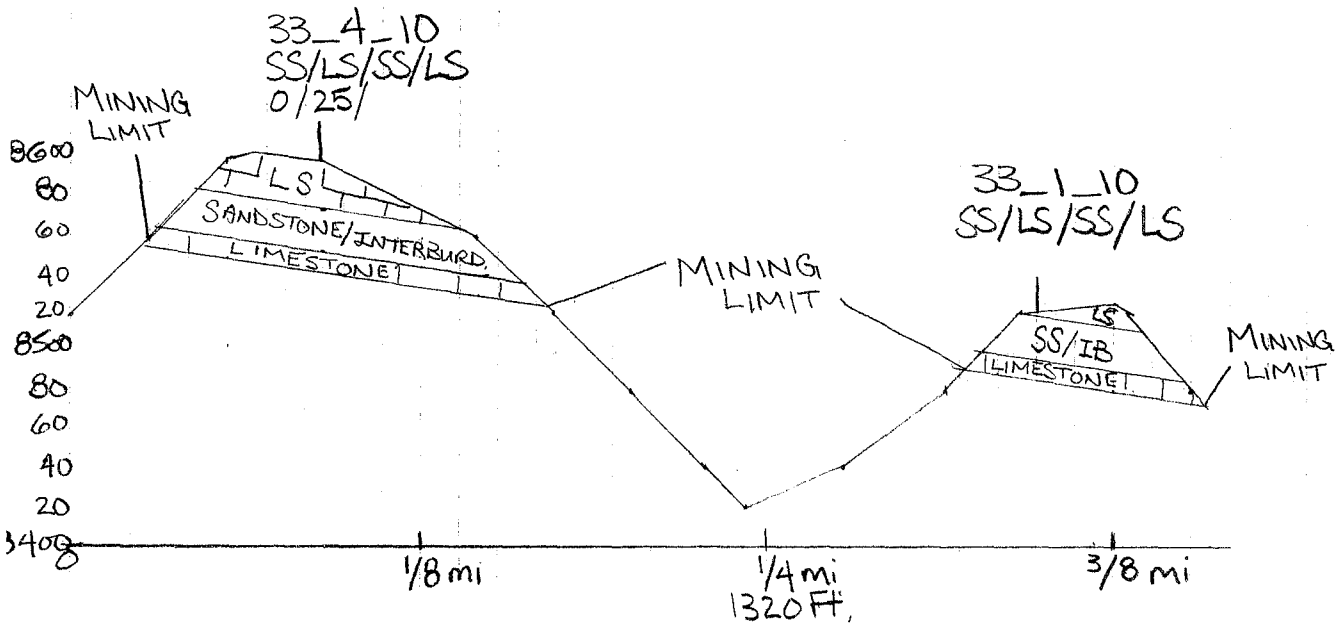


FIGURE DIX 5-54
CROSS-SECTIONS #58 & 59
PIT #5D, SOUTH-NORTH
PERMIT #298C, TFN 5 1/110
MOUNTAIN CEMENT CO
7/13/11 AHM

VERTICAL SCALE 1" = 100'
HORIZONTAL SCALE 1" = 360'



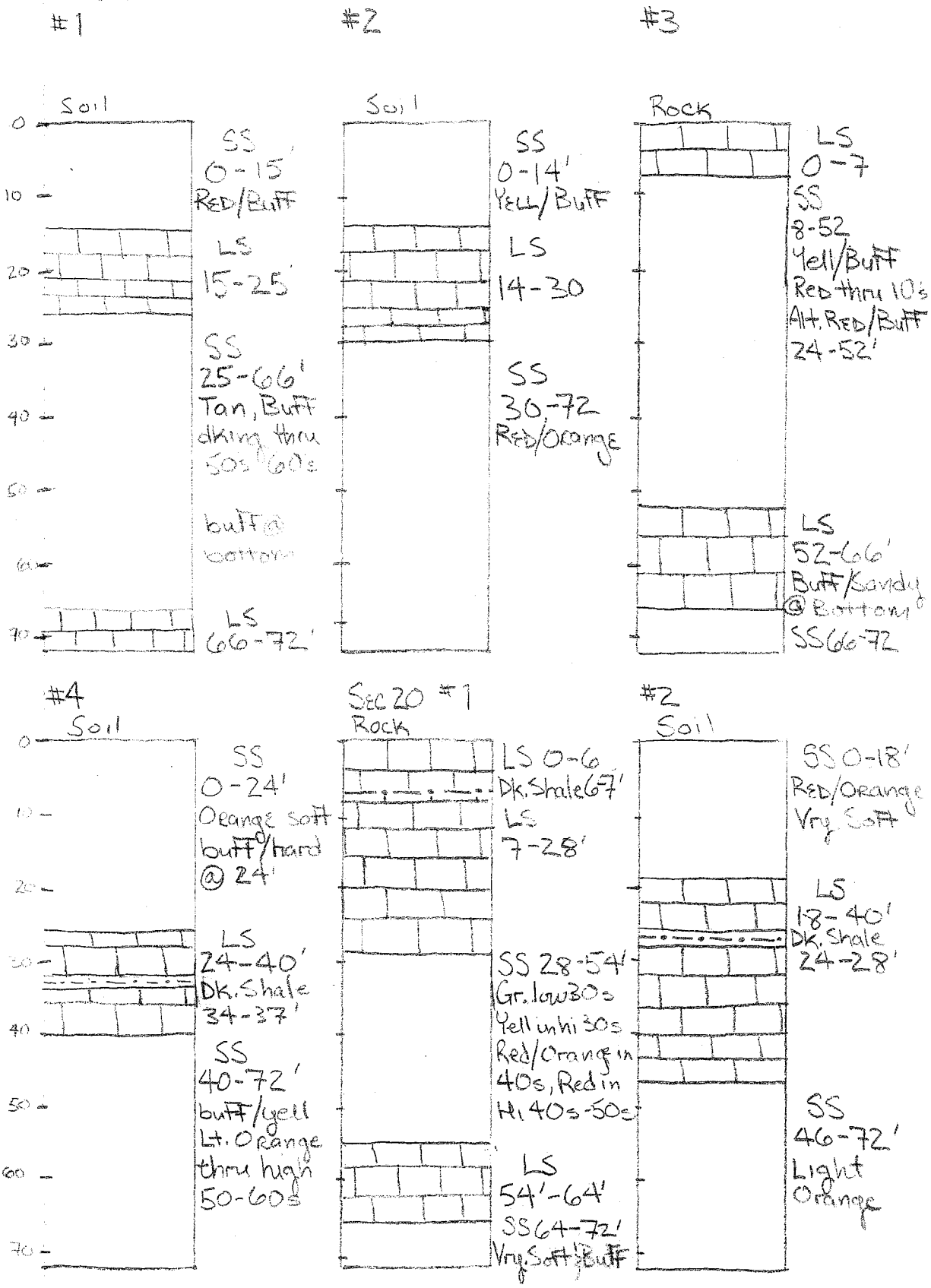
#59

TFN 5 1/110
RECD AUG 4, 2011

Stratigraphic Sections from 2010 Exploration (Pg 1)

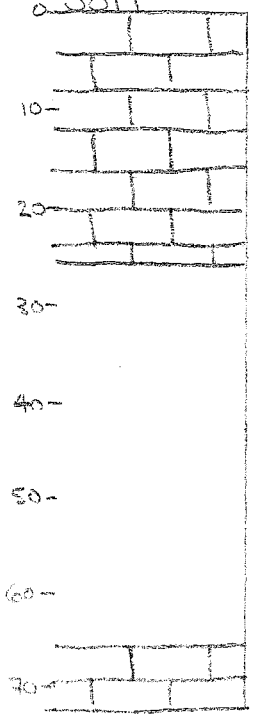
1/17/11

Sec 17



TFN 5 1/110
RECD AUG 4, 2011

#20-03-10
Soil

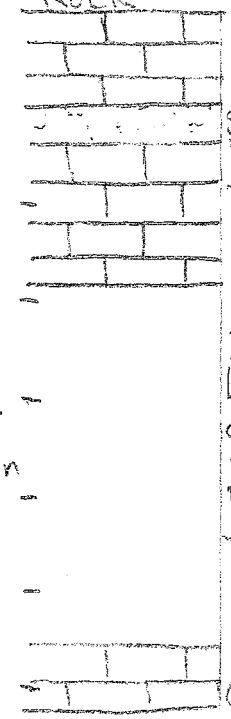


LS
0-24'

SS
24-66'
pink/buff
dk.ing down

LS
66-72'

#4
Rock



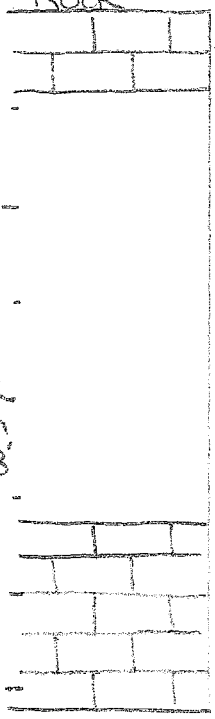
LS
0-28

SS 10-14'?
Pink?
Transitioning
near 24'
softening

SS
28-66'
Lt. red/pink
dk.ing down
soft near 48'
Red/Orange
thru 50's

LS
66-72 Hard

#5
Rock



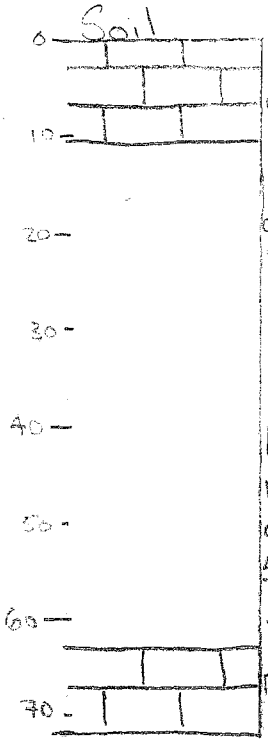
LS
0-8

SS
8-52

Orange
darkening
downward

LS
52-72'

#6
Soil



LS
0-11'

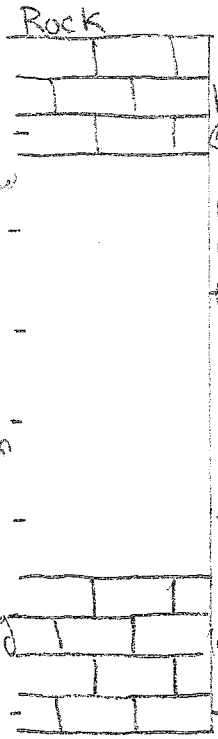
SS 11-64'
Buff/Yellow
dk.ing in 20's

Red in 30's

LS lenses in
mid 40's
dk. Red in
50's-60's

Transitioning
LS 64-72
Buff S.S.
@ 68'

#7
Rock



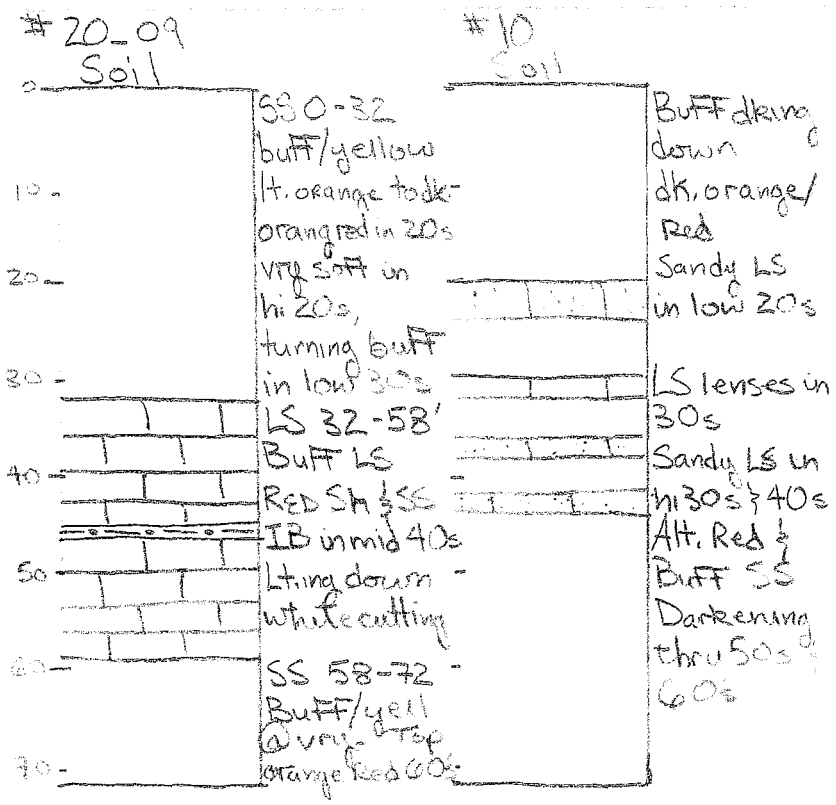
LS 0-12'
hard, sandy LS
@ 8'; buff, tiny
SS 12-56'
Red/Orange
homogeneous
thru 50's

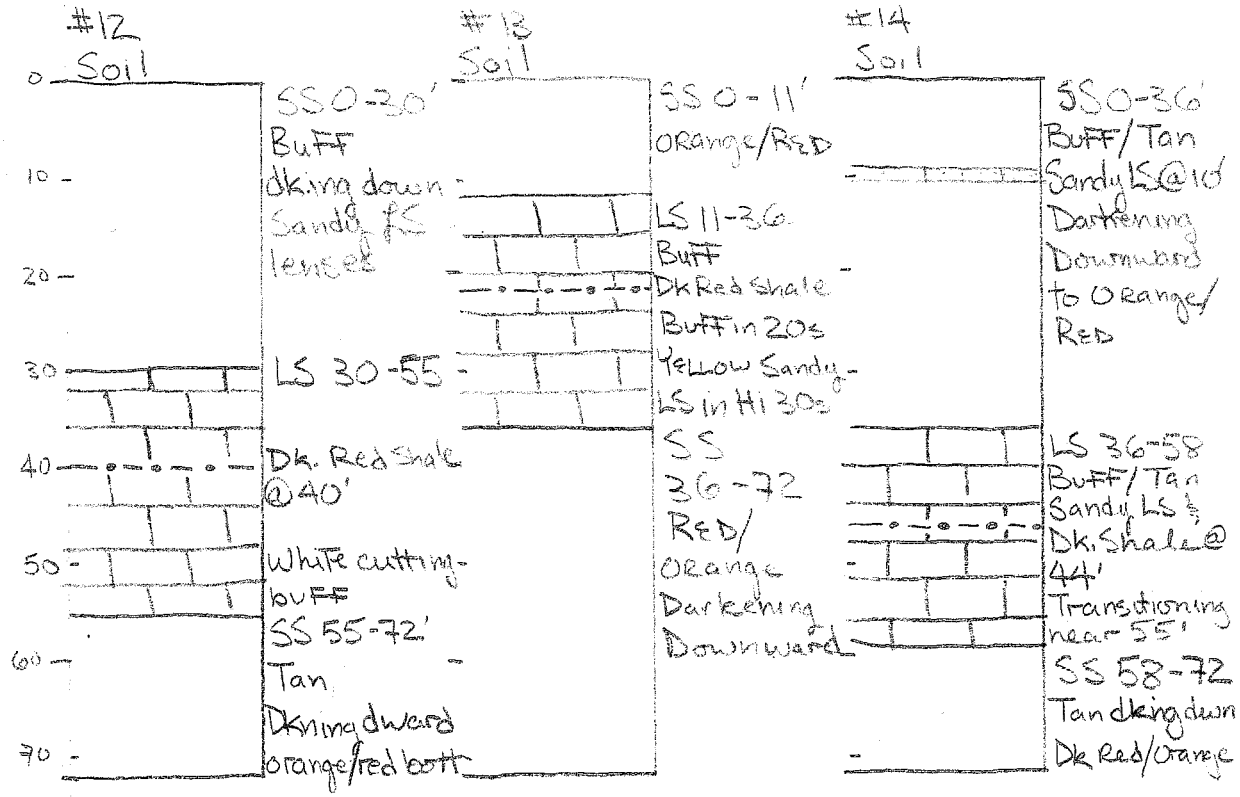
transitioning
Sandy LS'
LS 56-72
dark LS
Sandy Buff
thru 60's

#8

NOT
DRILLED

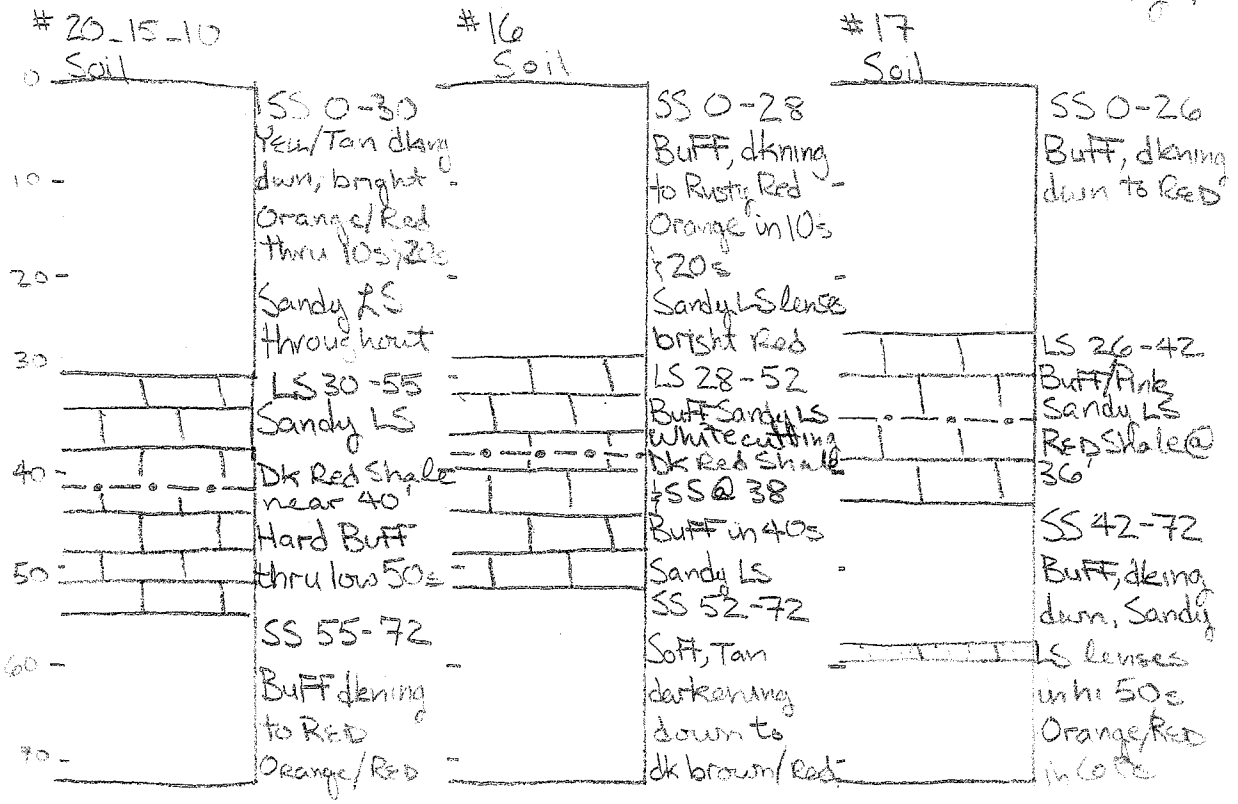
TFN 5 1/110
RECD AUG 4 ,2011

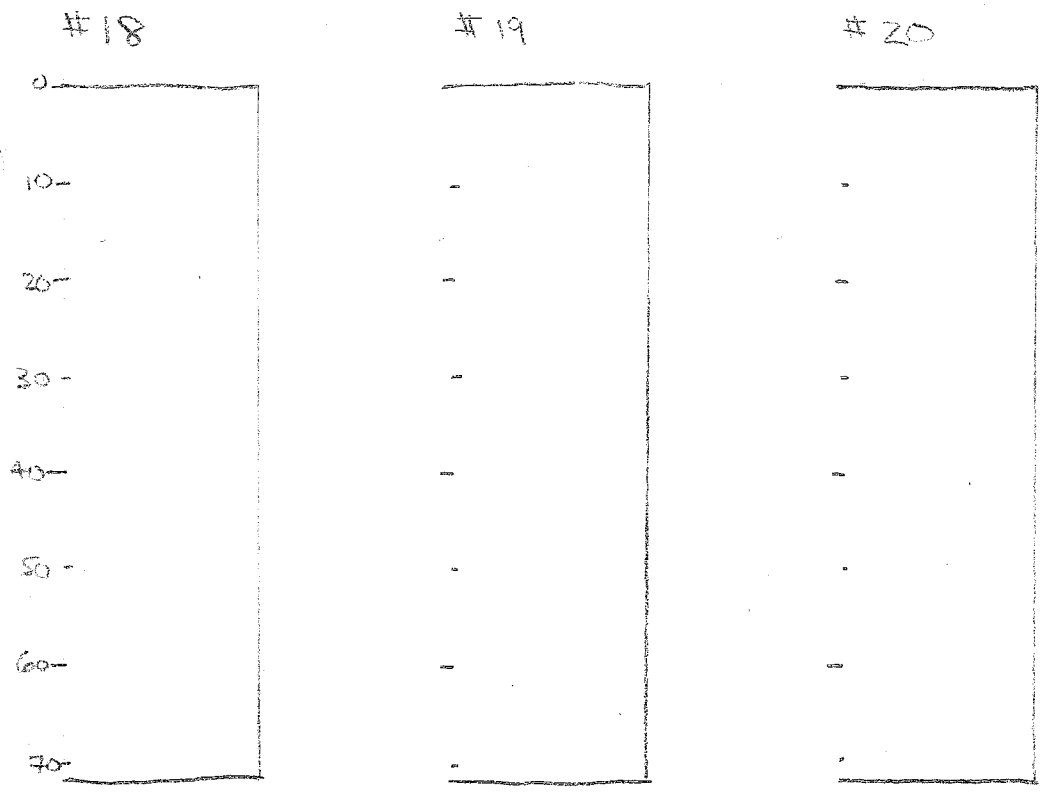




TFN 5 1/110
RECD AUG 4 ,2011

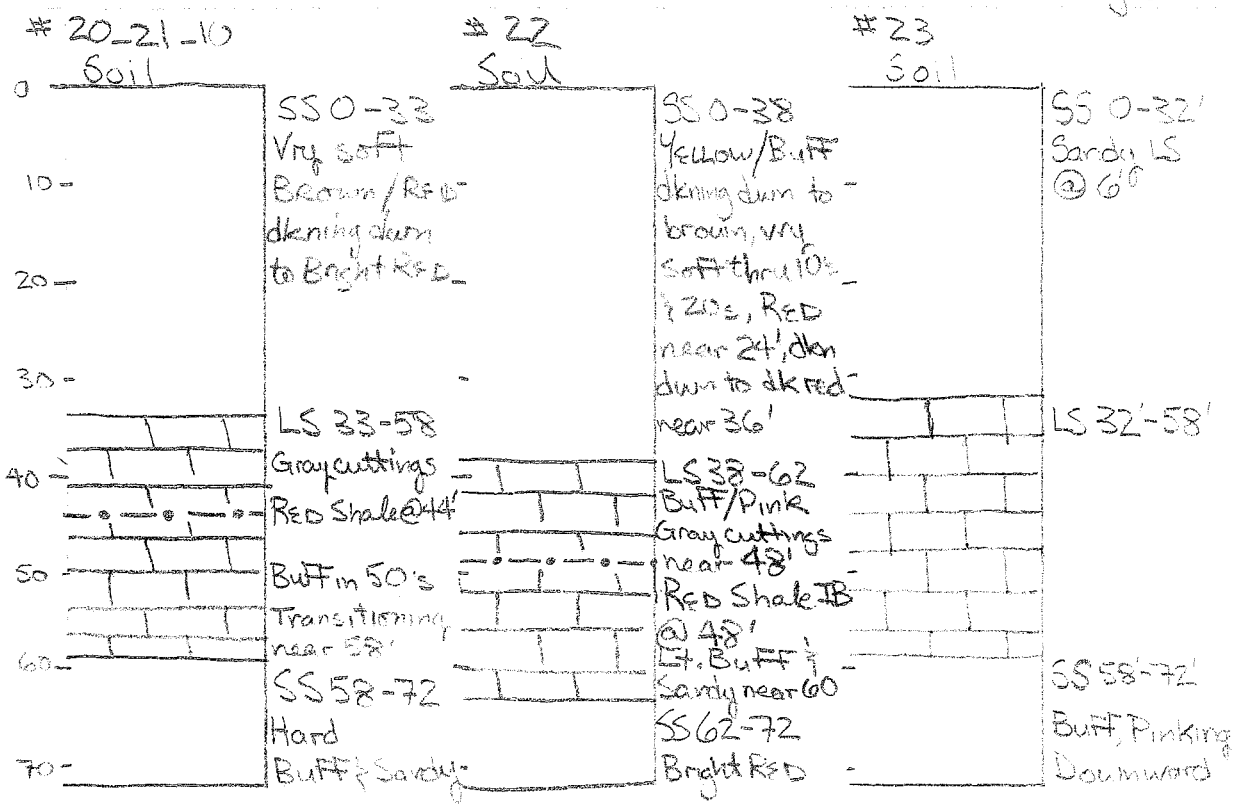
1/17/11
Pg 4





NOT DRILLED

TFN 5 1/110
FILED AUG 4, 2011

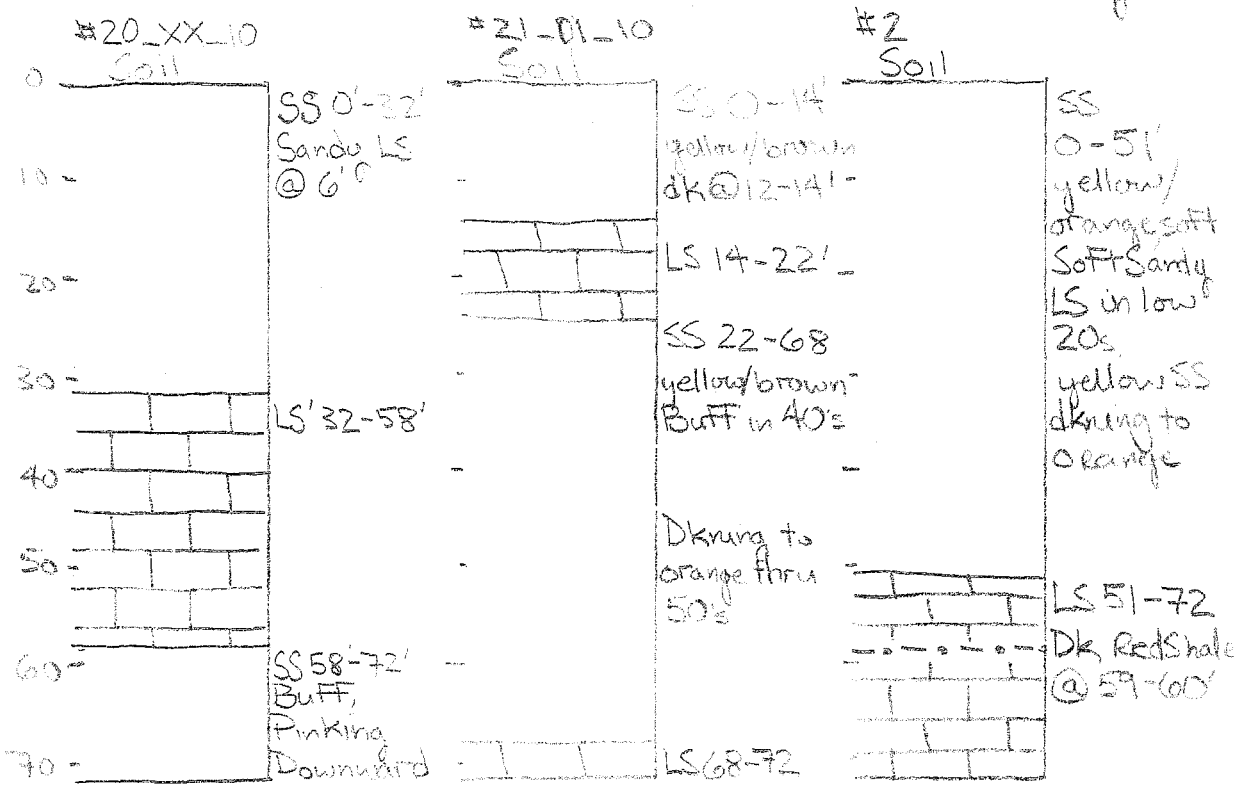


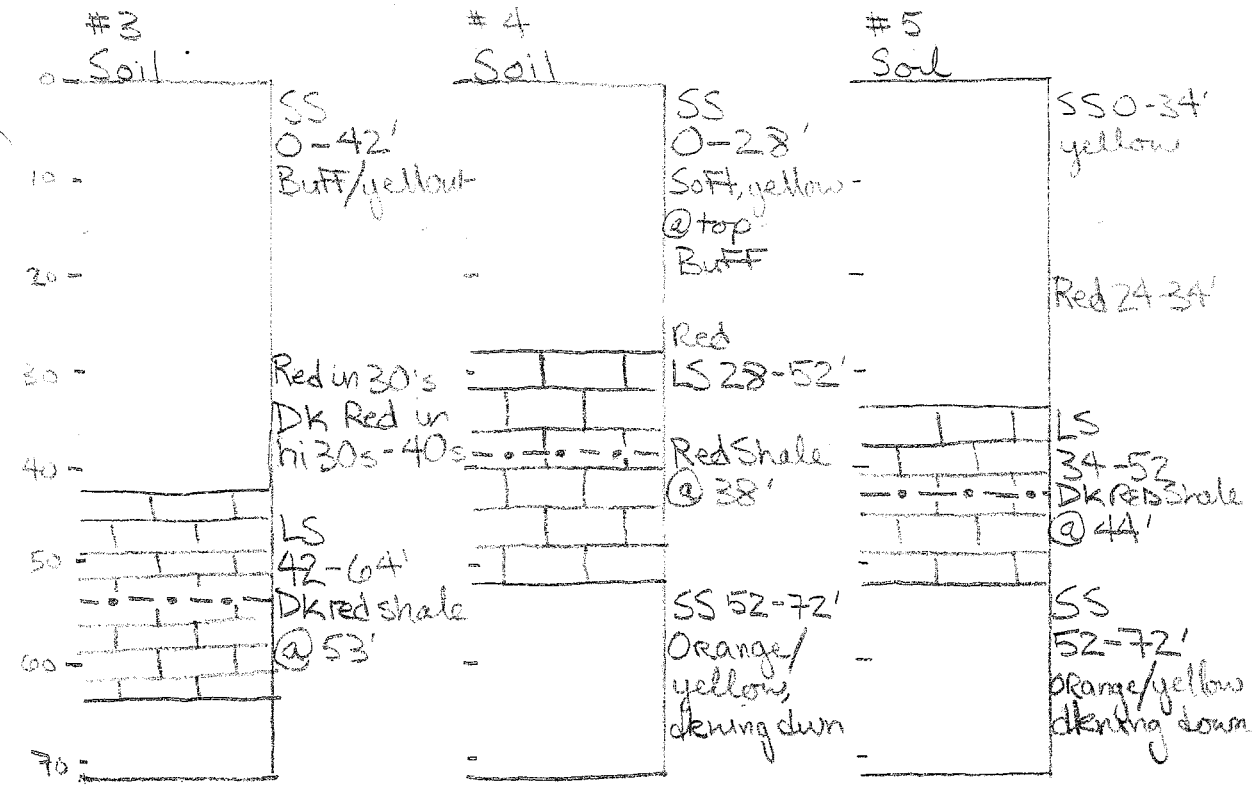
#24 #25 #26

NOT DRILLED

TFN 5 1/110
RECD AUG 4 ,2011

1/17/11
Pg 6





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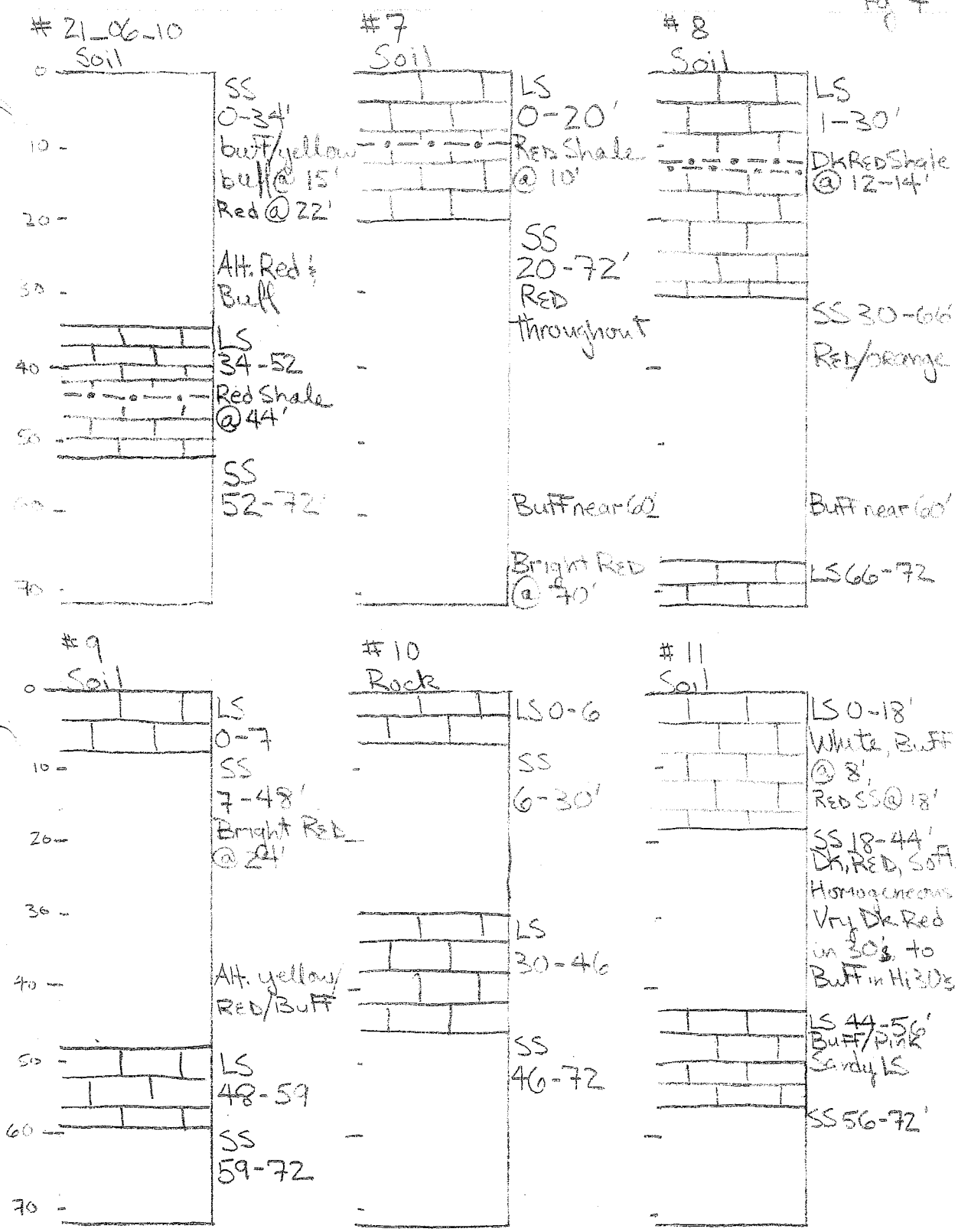
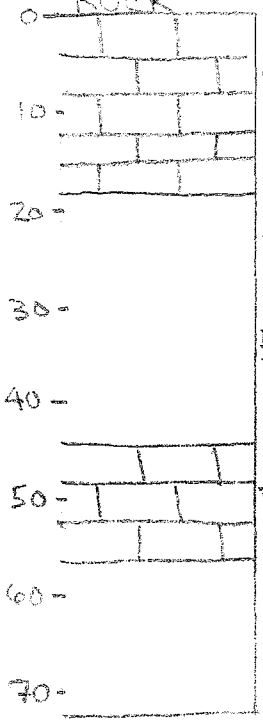
1/17/11
pg 7



TFN 5 1/110
RECD AUG 4, 2011

1/18/11
Pg 8

21-12-10
Rock



LS 0-18' Buff

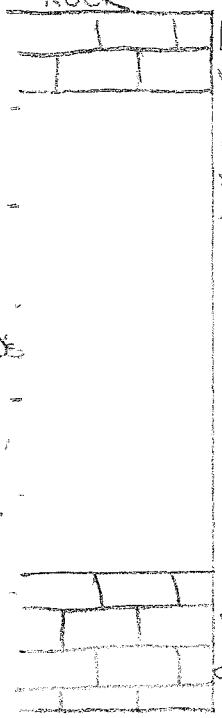
SS 18-44' Dk. Red, Soft

Buff in hi 30's

LS 44-56' Buff/Pink, Sandy LS

SS 56-72'

13
Rock

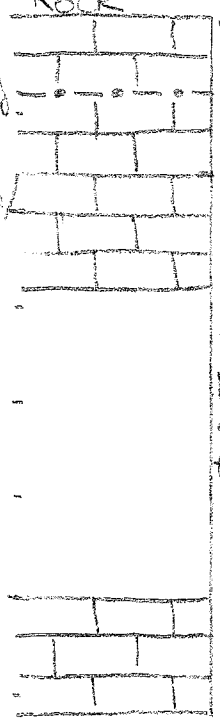


LS 2-8' wt/gy cutting

SS 8-58' Dk. Brown/Red

LS 58-72 Buff dk ring down

14
Rock

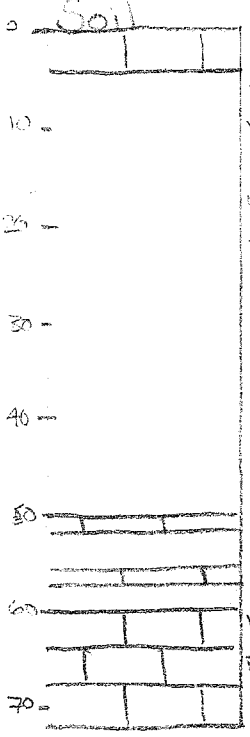


LS 0-28' Red Shale @ 8'

SS 28-60' buff @ top, Lt. Red thru 40's, Dk. Red thru 50's, Buff in hi 50's

LS 60-72'

21-15-10
Soil

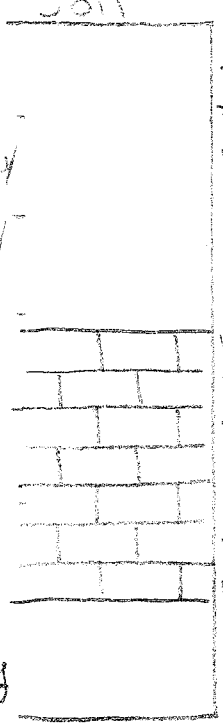


LS 0-4

SS 4-60 Vrg. Dk @ top, yellow/Buff thru 20, Orange/Red 20s 50s, LS lenses in 50's

LS 60-72 Buff/Sandy color

16
Soil



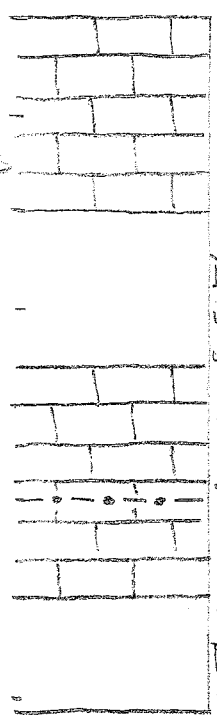
SS 0-32' Dk/Bright Red, Soft, homogeneous

LS 32-60 Buff

Transition in hi 60's

SS 60-72

17



SS 20-36 Dk. Red, buff in 20s, Dk @ 30' yellow/rusty

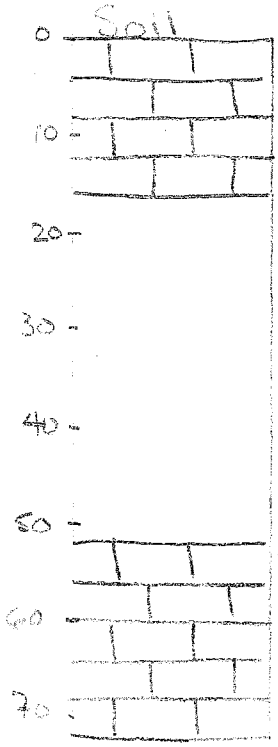
LS 36-60

Dk. Red Shale

SS 60-72 Dk. Red Shale throughout

1/110
4, 2011

21-18-10



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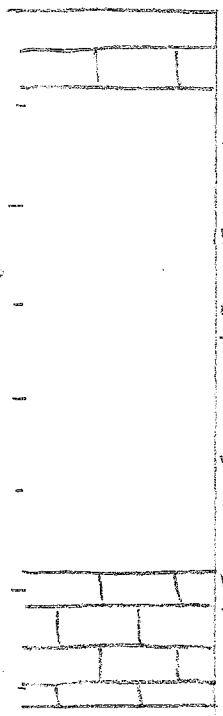

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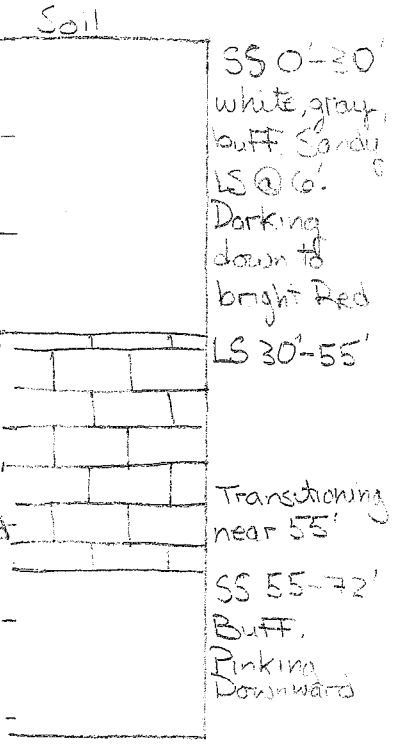
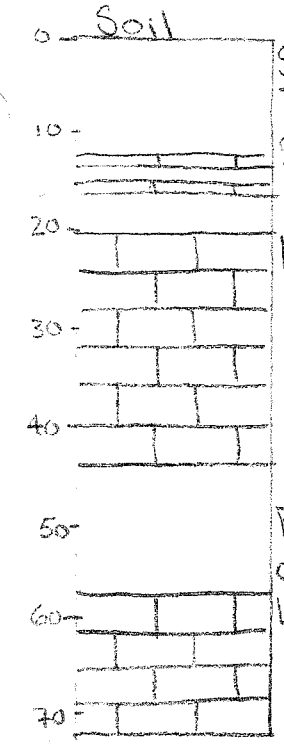


29-01-10



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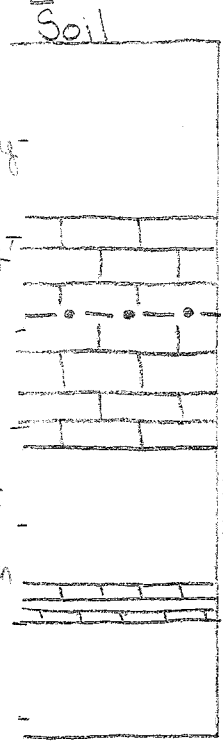

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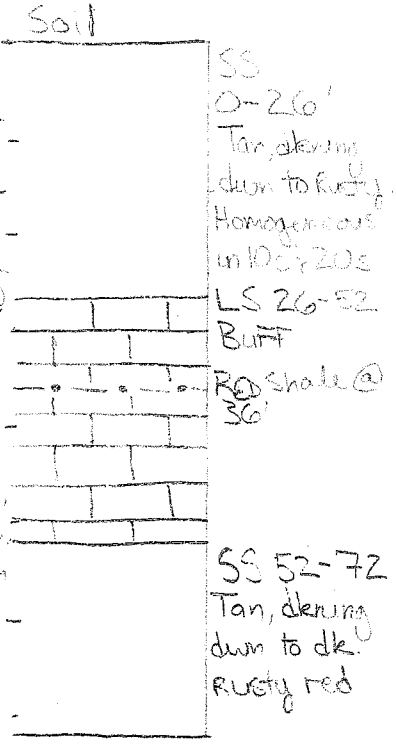
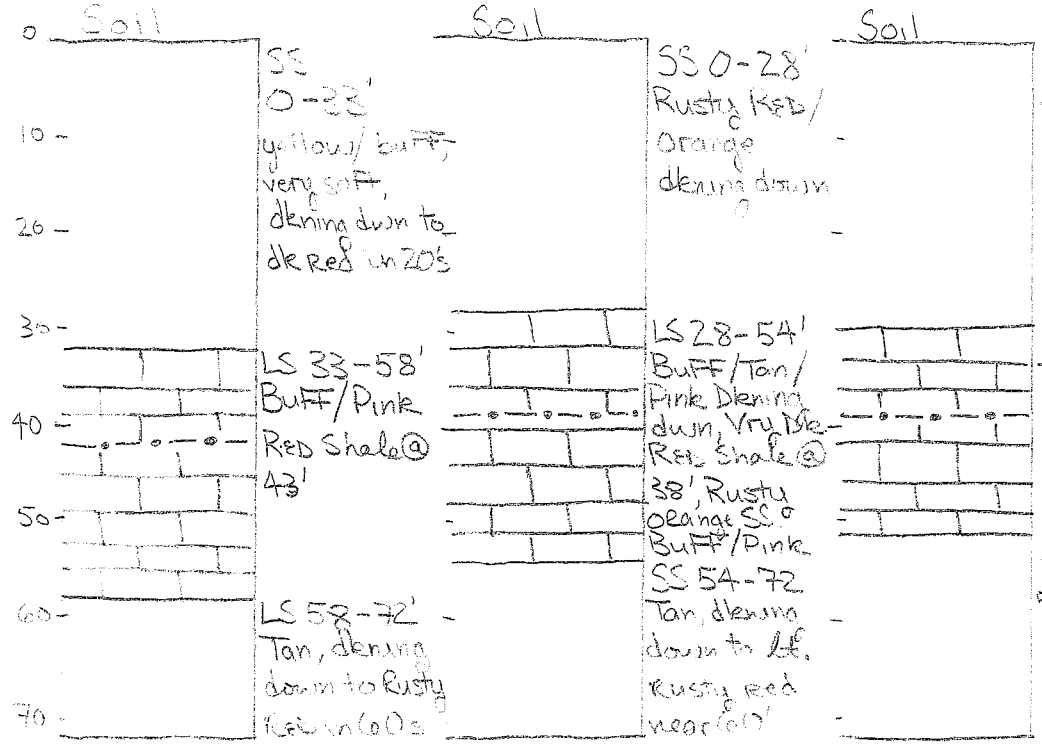


TFN 5 1/110
RECD AUG 4, 2011

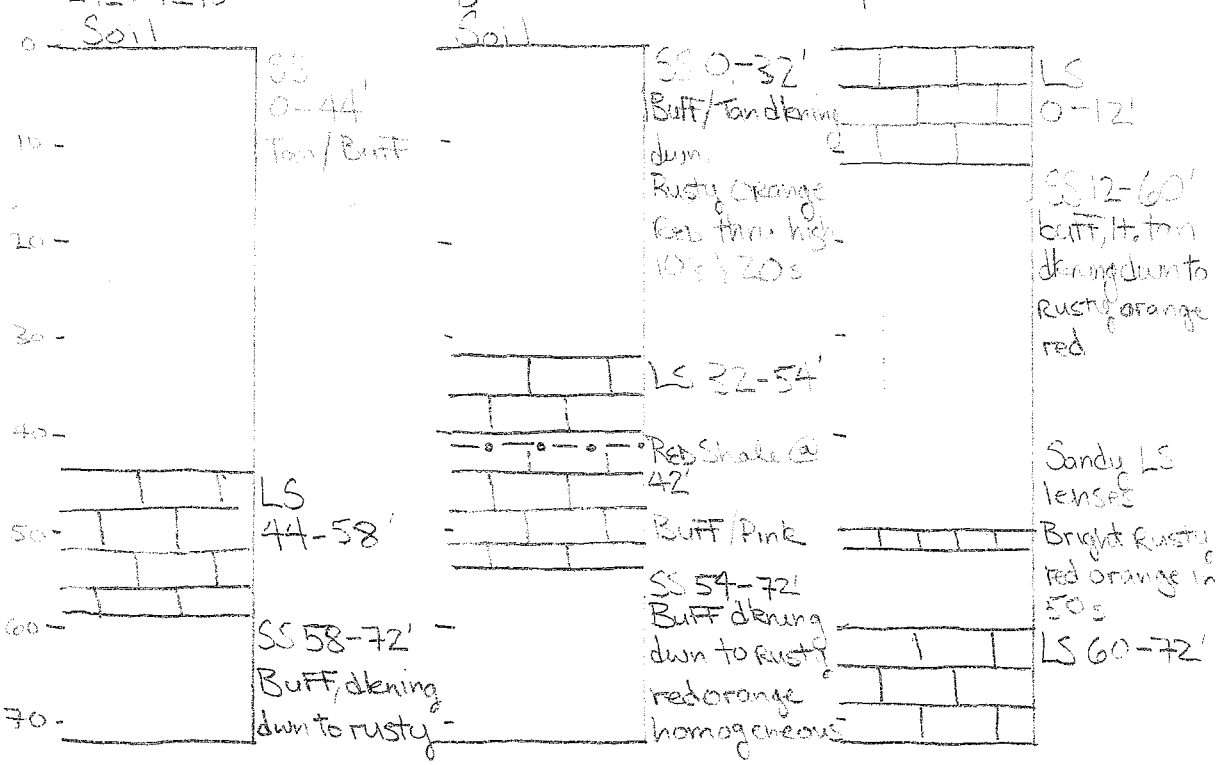
1/18/10

Fig 10

29-04-10



29-07-10

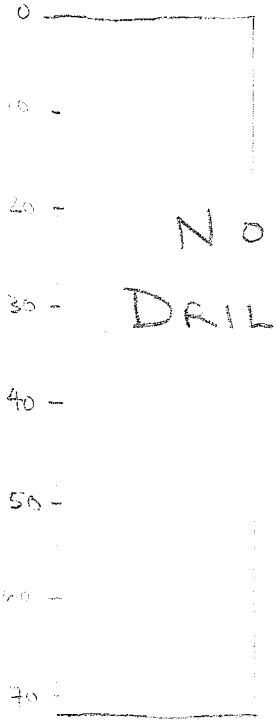


TFN 5 1/110
RECD AUG 4 ,2011

1/13/11

Pg 11

29-10-10



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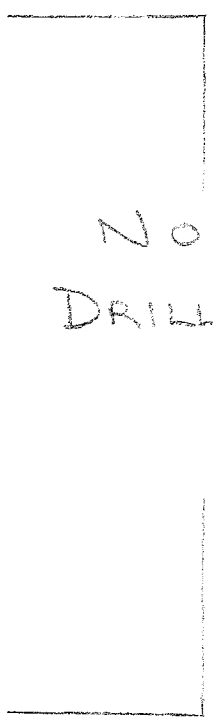
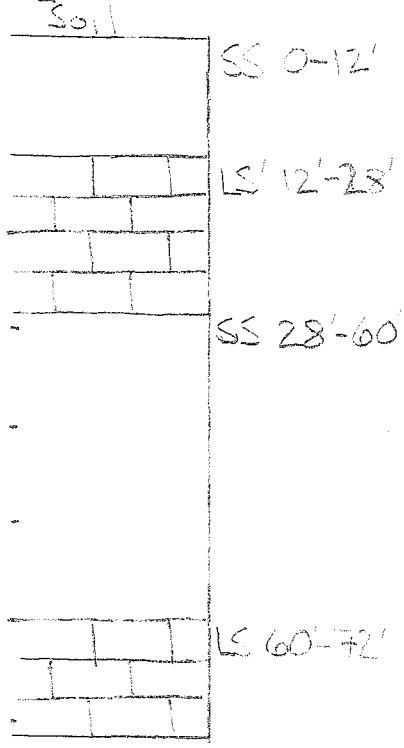
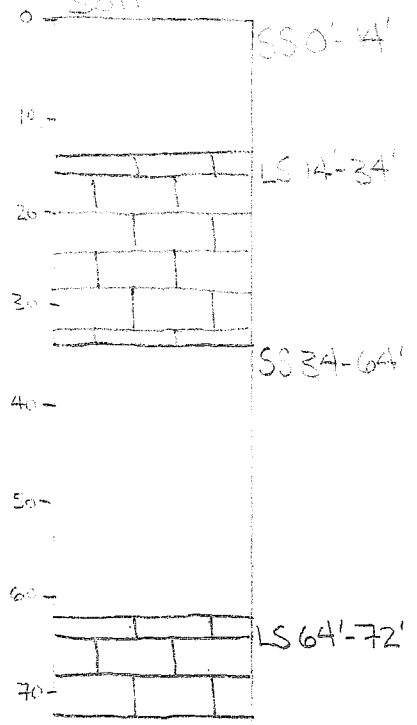


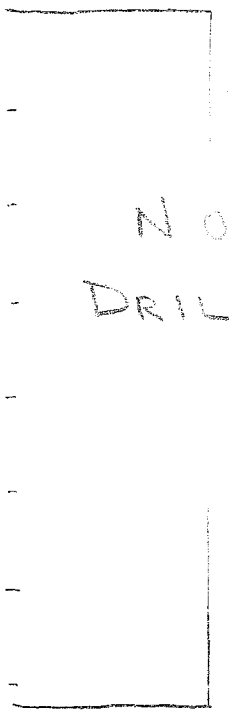
12 Soil



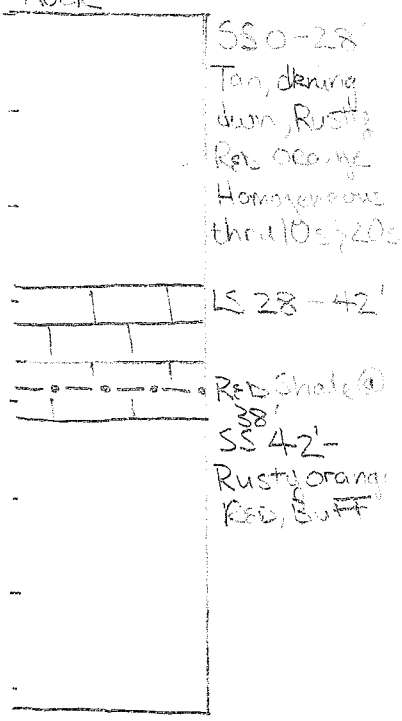
29-12-10 Soil



14



15 Rock



TFN 5 1/110
RECD AUG 4 ,2011

28_01_10

0
10
20
30
40
50
60
70

NOT DRILLED

2
Soil

LS 0-22'
Tan SS @ 8'
yellow near 18'
dkening down

SS 22-50'
Red, Red Shale
@ 24, Rusty
orange thru 44'.

Red Shale @
44', Ltning dn
near 50'

LS 50-60'
wt/gy cutting
Buff thru 58'

SS 60-72'
Dk. Red
LS lenses

3
Soil

LS 0-24'
wt. dkening to
buff, nice
gy cuttings
dkening to
Pink

SS 24-40'
Pink dkening to
Rusty Red, Buff
Pink in 30's

LS 40-54'
Hard, Buff,
Gray cuttings

SS 54-72'
Dk. Rusty Red
Red Shale in
low 60's,
rusty orange

28_04_10

0
10
20
30
40
50
60
70

5
Soil

SS 0-11'
Tan, dkening down

LS 11-26'
wt. cuttings @
top, buff/wt in
10s gy cuttings
thru 20's

SS 26-48'
vry, soft, buff,
dkening/ltning down
Red Shale @ 38'
Ltning down to
Buff Pink, dk
tan thru 40's

LS 48-68'
Buff, Sandy?
Lt. Tan dkening to
Pink, Buff @ 60'
Very soft @ 61'
Dk Rusty Red
shale in high 60's

5
Rock

LS 0-18'
wt/gr cuttings
turning buff

SS 18-36'
yellow/buff,
orange dkening
down to tan in 20's
LS lenses

LS 36-52
no cuttings

SS 52-72
no cuttings

6
Soil

LS 0-22'
Red Shale @ 8'
wt cuttings
buffing down

SS 22-58'
Rusty Red/orange
dkening down,
homogeneous,
soft thru 40's,
dkning thru high
50's

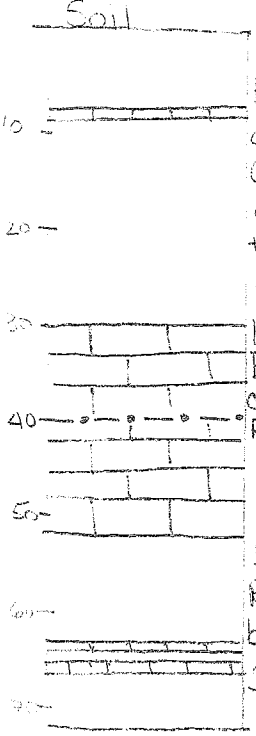
LS 58-66
Buff/Tan
dkening down

SS 66-72

TFN 5 1/110
RECD AUG 4, 2011

28_07_10

Soil



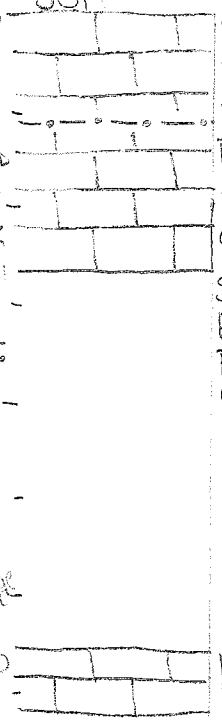
SS 0-30'
Brown/yellow, dkning down, LS @ 8', Rusty Red orange, vry soft thru 10s, vry dk Red dkning down

LS 30-52
Buff, Buff & wt. cuttings, Dk Red Shale @ 40'

SS 52-72'
Rusty Red Orange brightning down, Sandy LS in 60

8

Soil



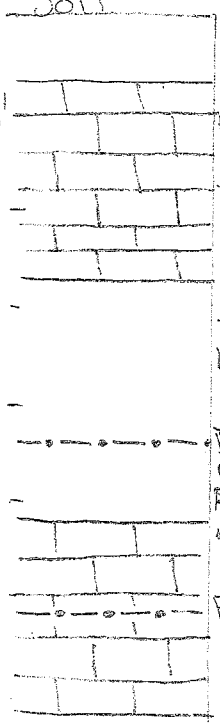
LS 0-26
Buff
Red Shale @ 11'
Pink Sandy LS in 10s, wt. cuttings.

SS 26-65
Bright Rusty Red Orange, dkning down

LS 65-72
Buff

9

Soil



SS 0-6
Buff

LS 6-26
Hard, dkning dn
Sandy LS
Dk tan/Pink

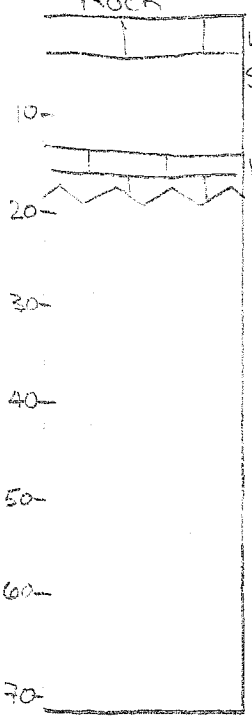
SS 26-52
Tan/Red
Lenses Sandy LS

Dk Red Shale @ 44'
Rusty Red

LS 52-72'
Buff
Red Shale @ 62'

33_01_10

Rock

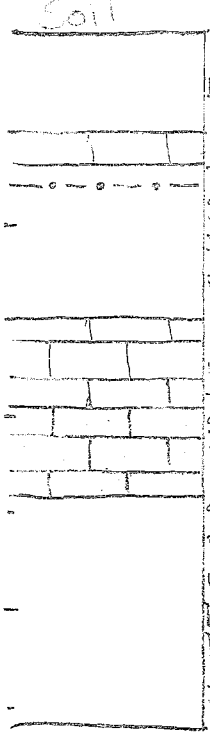


LS 0-2'
SS 2-13'
LS 13-?'

No Cuttings

2

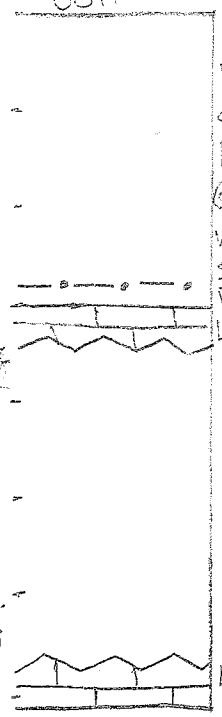
Soil



SS 0'-10'
Buff, vry soft
LS 10'-14'
Dk Shale
SS 14'-30'
Red, Brown Buffing down
LS 30'-38'
White cuttings turning Sandy
Sandy LS 38'-48'
SS 48'-72'
Bright Red, yellowing. Dk. near 58'. Bright Red & Soft near bottom

3

Soil



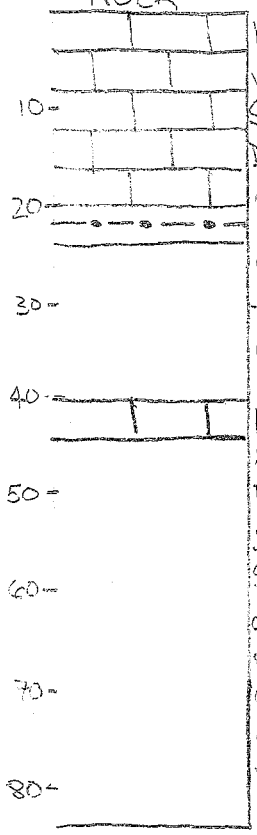
SS 0'-30'
Bright Red, gray near top. Dk Red, purple @ 12'. Sandy LS near 20'. Dk Shale Inter Bed
LS 30'-?'

No Cuttings

LS 70'-72'

TFN 5 1/110
RECD AUG 4, 2011

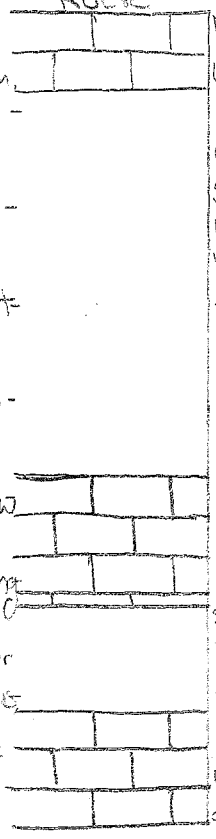
33_04_11
Rock



LS 0-25'
white, uniform
Sandy LS &
Dk shale IB
at 22'
SS 25'-40'
Sandy LS
turning bright
Red SS

LS 40'-44'
SS 44-84'
Buff to Yellow
SS/LS, hard
Sandy LS, dking
down, bright
rust color near
60', homogenous
dk red, Sandy
LS near 80'

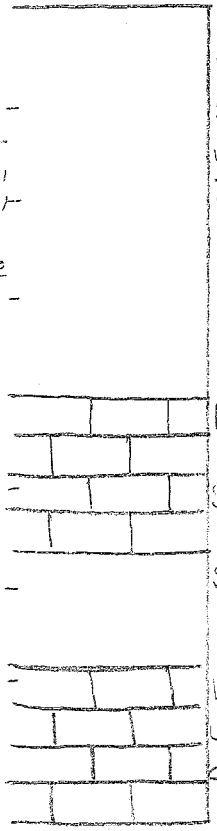
5
Rock



LS 0-10'
white
SS 10'-48'
Orange, Buff
Sandy LS @18',
homogenous,
bright orange
thru 20s.

LS 48-62'
buff & gray
cuttings
SS 62-74'
brown, red
redding down
LS 74'-84'
white & pink
gray cuttings

6
Soil

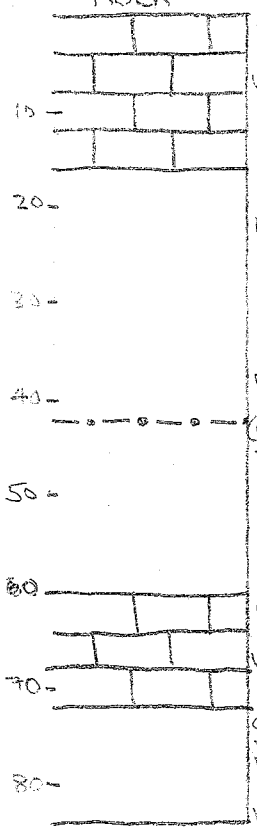


SS 0-40'
buff orange,
Sandy LS @18',
whitening @
24', Sandy
LS lenses @
36'

LS 40-56
bright white
Sandy LS
near 56'
SS 56'-66'

LS 66'-84'
white, biffing
down

7
Rock



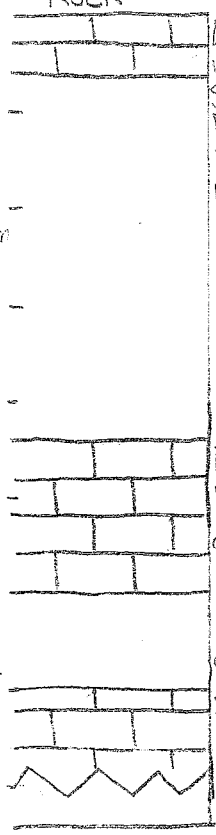
LS 0'-16'
white, hard

SS 16'-60'
buff, dking down

Rd Shale IB
@ 42'
Bright
orange

LS 60-72'
white, Sandy
near 70'
SS 72'-84'
Brown, LS
near 78'

8
Rock

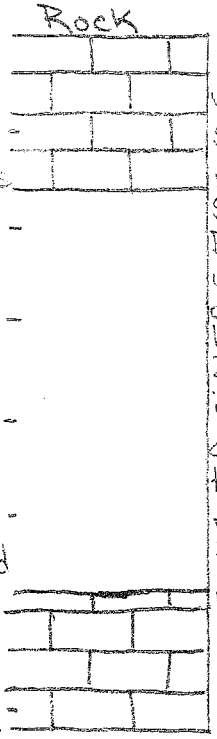


LS 0-6'
white
SS 6-44'
Red, pretty
homogeneous
biffing down

LS lenses
@ 44'
LS 44'-60'
buff, hard
dking downward

SS 60'-70'
dking down,
Sandy LS
LS 70'-80'
UNKNOWN
very soft

9
Rock



LS 0-16'
white
Sandy LS
near 12'
SS 16-58
Buff soft,
yellow, dking
down near 24'
hardening in
20s. Sandy LS
in 30s. Dking
at 36' to Red.
homogenous &
red thru 40s
& 50s

LS 58-72'

TFN 5 1/110
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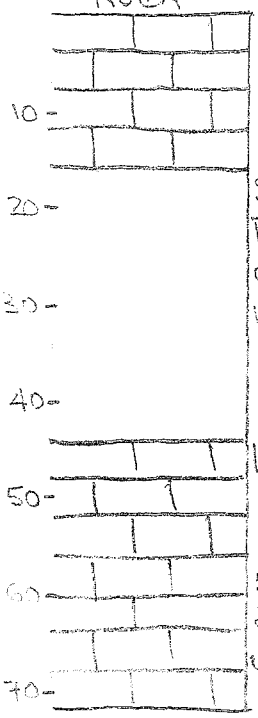
#33_10_10 Rock



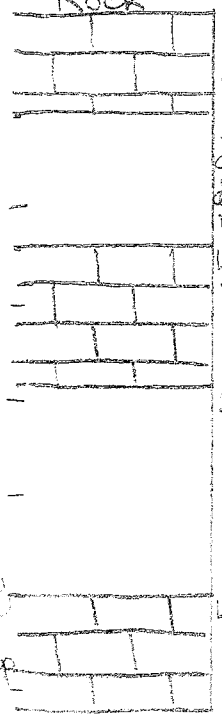
LS 0-10' white

SS 16-44' Buff D'king down, Red near 40

LS 44-70'

Sandy LS @ 56', oranging down, then whitening up again

#11 Rock



LS 0-10' white

SS 10-24' orange red'king down, Sandy LS Buff, Yellow

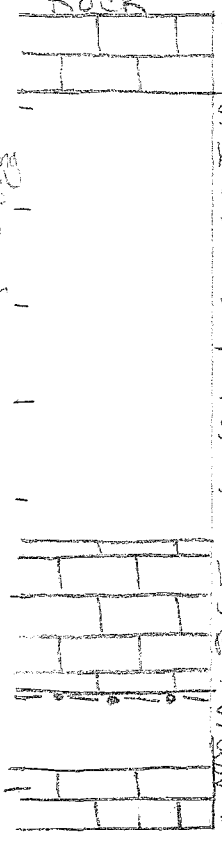
LS 24-38' very uniform

SS 38-60' buff

Sandy LS

LS 60-72'

#12 Rock



LS 0-6' white

SS 6-54' buff soft red then buffing near 30', alternating buff, red beds thru 30's, 40's lenses of Sandy LS in 40's

Dk Red near 48'

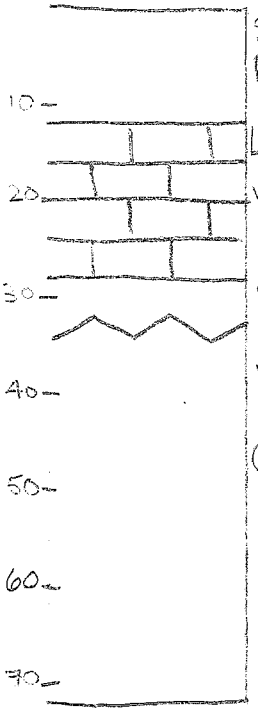
LS 54-70' white, turning pink

Dk Shale @ 70'

SS 70-78' orange, soft sandy LS

LS 78-84 pure white

#13 Soil



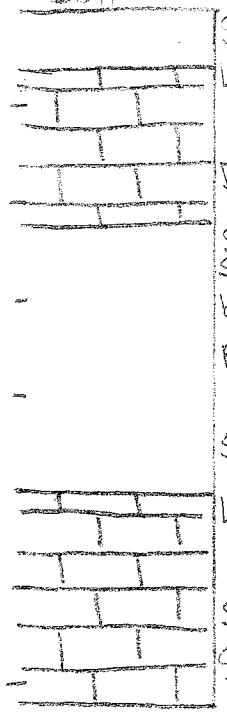
SS 0-13' light brown

LS 13-28' white

SS 28-?'

No Cuttings

#14 Soil



SS 0-6'

LS 6-22'

Buff, Sandy LS

SS 22-50' Sandy LS & SS. buff/yellow pinking down

Sandy LS @ 48'

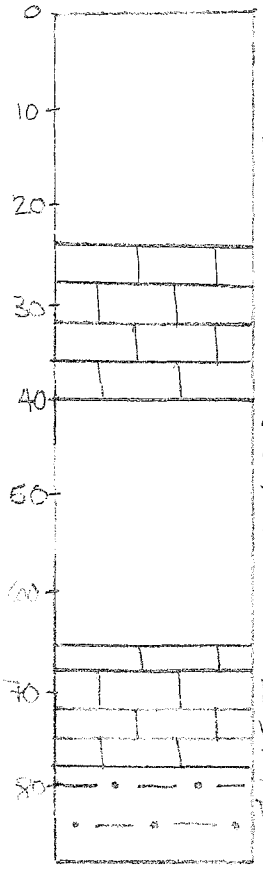
LS 50-72

Sandy orange near 70'

TEN 5 1/110
RECD AUG 4, 2011

DRILLING LOGS
E5 DRILLING

#1_DEC-10



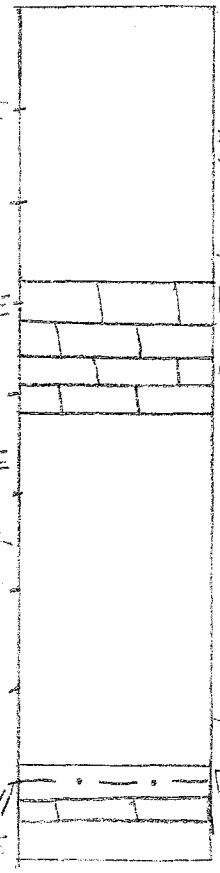
Soil
0'-24'
SANDSTONE
DARK RED

24'-40'
LIMESTONE

40'-66'
SANDSTONE
DARK RED,
BUFF NEAR
64', TRANS

66'-77
LIMESTONE
Whitening
Down
76'-84'
DK. SHALE W/
SANDSTONE

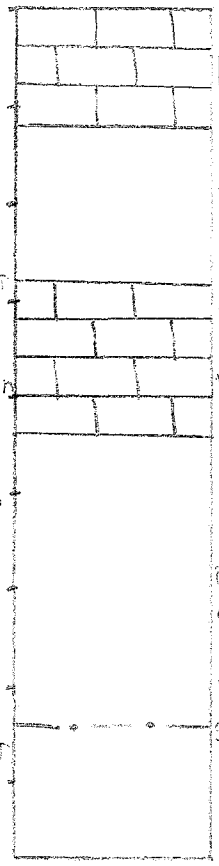
#2_DEC-10



Soil
0'-26'
SANDSTONE
Bright RED,
Darkening
down, BUFF
in 20's,
Transitioning
LIMESTONE
26'-42'
Whitening Down
SANDSTONE
42'-76'
BRIGHT RED

BUFF,
Transitioning
Dk. Shale w/
LS & SS
76'-88'

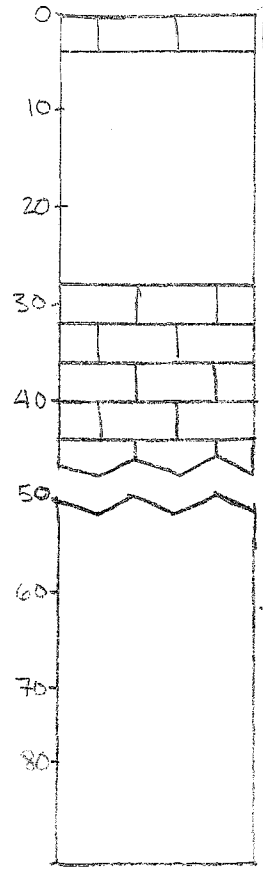
#3_DEC-10



Soil
LIMESTONE
0'-12'
SANDSTONE
12'-26'
Dk. RED, very
soft, Sandy
LS
LIMESTONE
26'-44'
whitening down

SANDSTONE
44'-88'
tan/lt. RED
darkening to
Orange Red in 50's,
Sandy LS in
hi 60's, Dk.
Shale in low
70's, Sandy
LS in mid 70's

#4_DEC-10

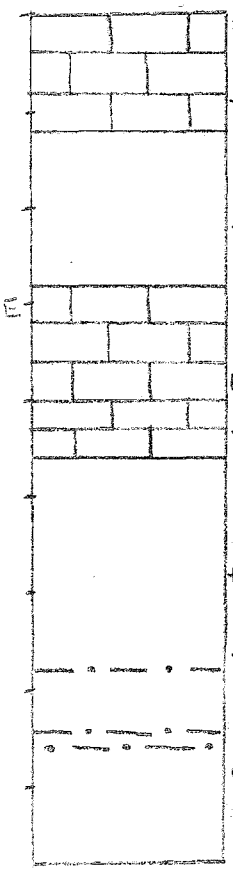


Soil
LIMESTONE
0'-4'
SANDSTONE
4'-26'

LIMESTONE
26'-46'

NOT
DRILLED

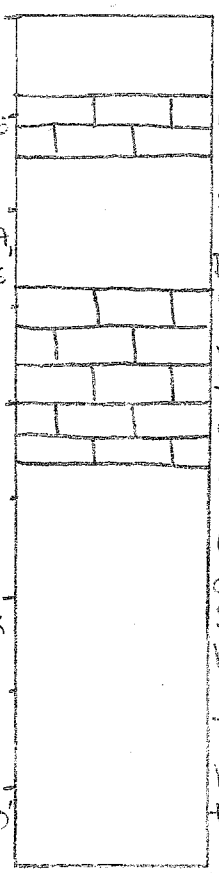
#5_DEC-10



Soil
LIMESTONE
0'-12'
Pink, whitens
down
SANDSTONE
12'-26'
Bright RED, soft,
Sandy LS Beds
LIMESTONE
26'-44'
White turning
pink near 42'

SANDSTONE
44'-88'
Sandy LS
thru hi 50's
dking down, dk
Shale in hi
60's, Bright
Red alter w/
dk shales,
Sandy LS @ 80'

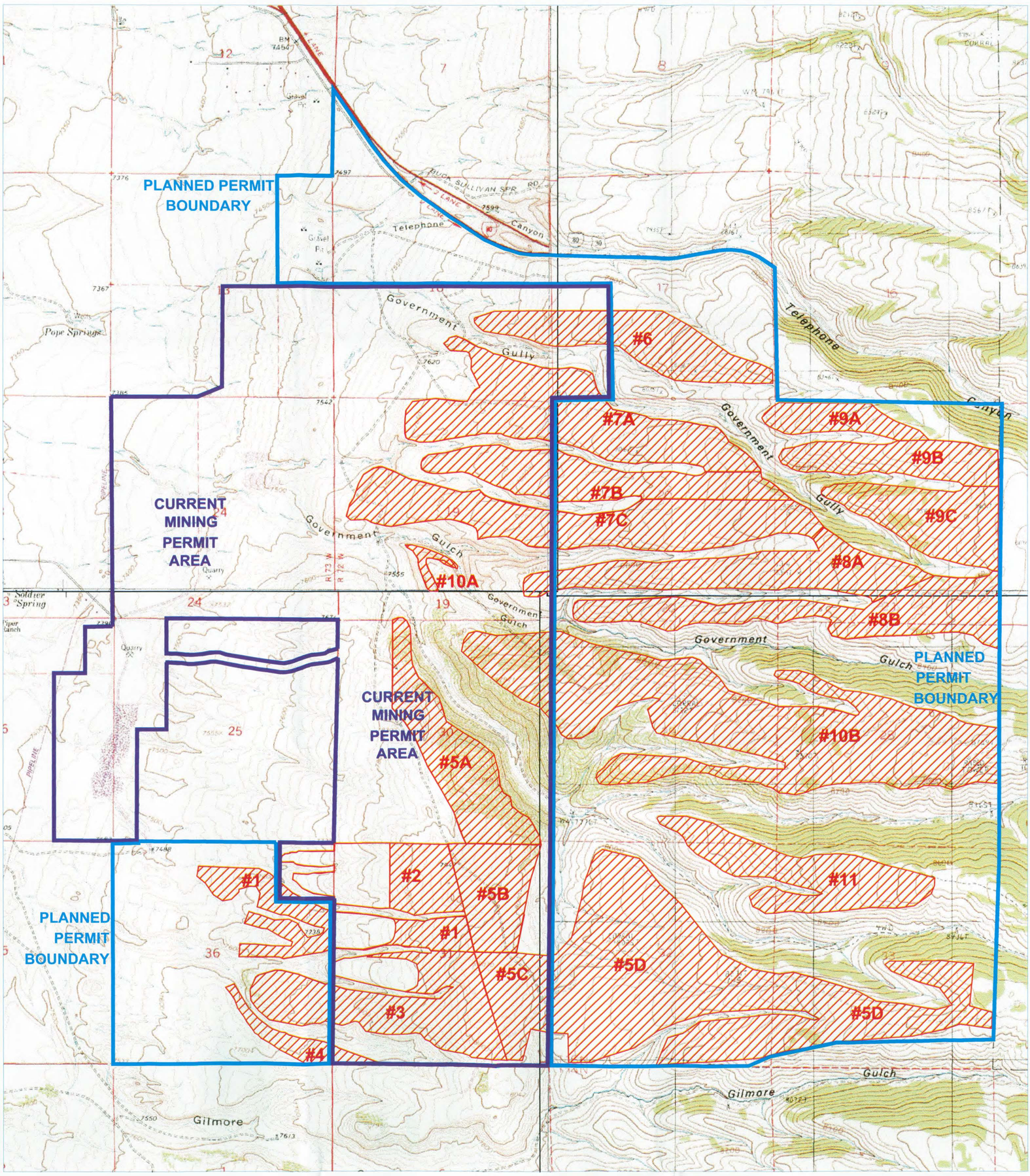
#6_DEC-10



Soil
SANDSTONE
0'-8' TAN
LIMESTONE
8'-14'
White
Sandstone
14'-26'
Bright Red to
Orange
LIMESTONE
White
transitioning
in low 40's

SANDSTONE
44'-88'
Orange Red,
dk @ 52',
Sandy LS in
hi 60's, RED
Sandy LS in
70's, Red
homogeneous
thru 88'

TFN 5 1/110
RECD AUG 4, 2011



Legend

Current Mining Permit Area

Planned Permit Boundary

298C-A8 Amendment Disturbance Areas

N

0 1400 ft

SCALE

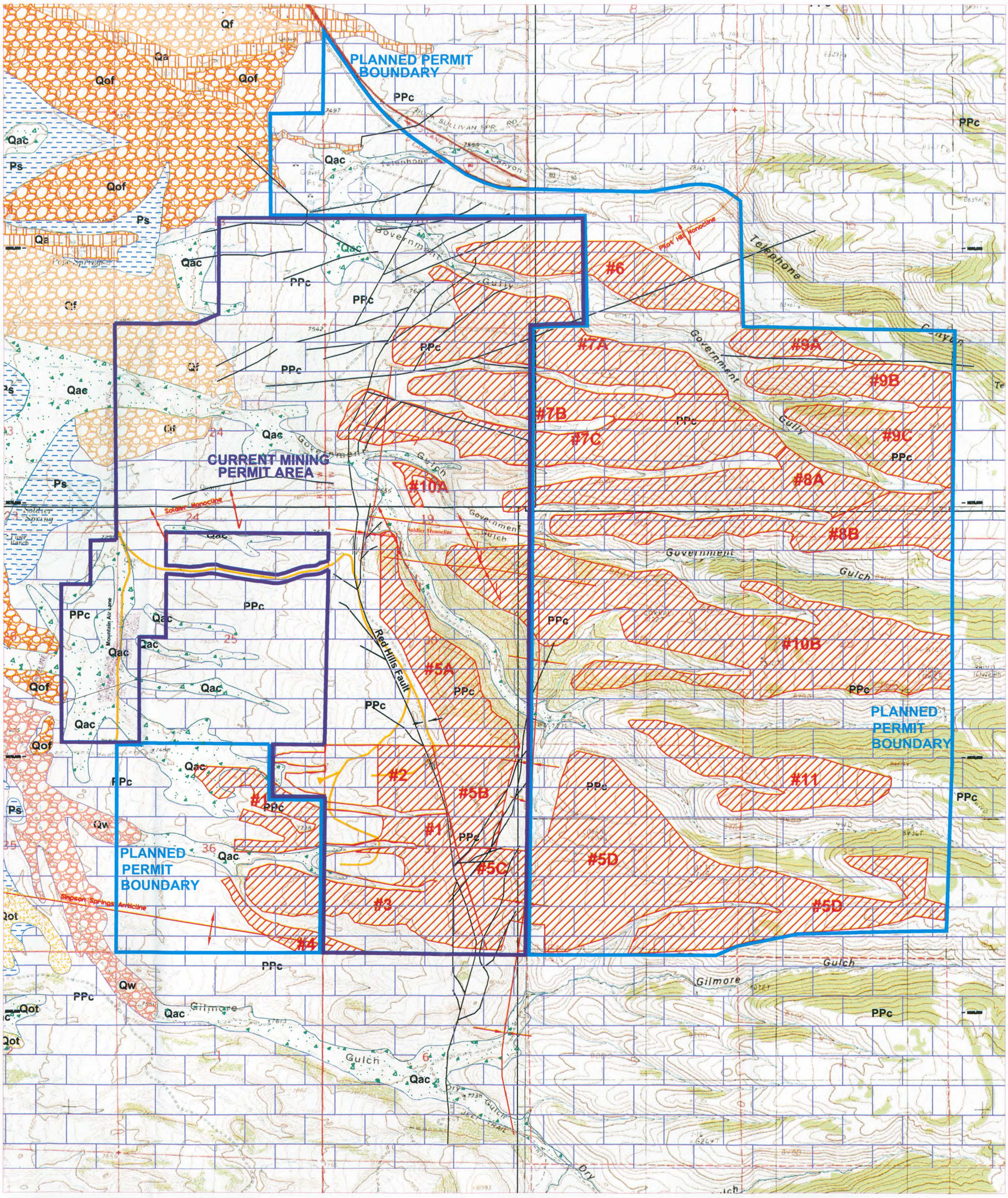
Map DIX5-1
Permit #298C-A8
Permit Area Location and Pre-Mine Topography

Mountain Cement Company
5 Sand Creek Road
Laramie, WY 82070

TFN 5 1/110
OCT 15, 2012

Laramie, Pilot Hill, Sherman Mtns West & Red Buttes, Wyo.
USGS Quad Map (Enhanced DRG)
Township 15N, Range 72W, Sections 17, 18, 19, 30, & 31
Albany County, Wyoming

Andy H. MacClugage
August 2012



Projection: Wyoming State Plane
East Zone
North American Datum 1983 (NAD83)
U. S. Feet

SCALE 1" = 1320'

CONTOUR INTERVAL 10', 20', & 40'

LEGEND

Qac-Mixed Alluvium and Colluvium
Quaternary strata - Sand, silt, clay, and gravel deposits along intermittent streams, 0 to 20 feet thick

Qa-Alluvial Deposits
Quaternary Strata - Unconsolidated and poorly consolidated clay, silt, sand, and gravel, thickness 0 to 25 feet

Qw-Windblown Deposits
Quaternary strata - Active/stabilized sand dunes made up of very fine to fine grained sand

Qf-Alluvial Fan Deposits
Quaternary strata - Poorly sorted clay, silt, and gravel: crudely bedded to nonbedded, sediment deposits, 0 to 25 feet thick

Qof-Older Alluvial Fan Deposits
Quaternary strata - Poorly sorted clay, silt, sand and gravel; crudely bedded to nonbedded, inactive, 0 to 30 feet thick

Qot-Older Terrace Deposits
Quaternary strata - Beds of coarse sand and gravel with occasional boulders and lenses of silt and clay. Erosional remnants ranging from 20 to 40 feet thick, above present stream flood plains.

Ps-Satanka Shale
Permian strata -Red siltstones, soft sandstones, thin limestone beds, local Gypsum beds, especially near top, fine grained sandstone with ripple marks common near base. 75 to 300 feet thick

PPcf-Casper and Fountain Formations undivided
Pennsylvanian and Permian Strata-combined thickness 600 to 800 feet.
Casper Formation- Permian and Upper and Middle Pennsylvanian strata- Buff to purplish, locally fossiliferous, limestones interbedded with festoon cross-bedded sandstones, dolostones, and siltstones. 600-700 feet.
Fountain Formation- Pennsylvanian strata- Maroon cross-bedded fine to coarse sandstones and conglomerates interbedded with thin limestones- upto 400 feet.

CURRENT PERMIT BOUNDARY

PLANNED PERMIT BOUNDARY (298C-A8 Amendment Area)

EXISTING HAULROADS

FAULTS

FAULTS WITH DIRECTION OF MOVEMENT

MONOCLINE WITH DIRECTION OF TREND

ANTICLINE WITH DIRECTION OF TREND

SYNCLINE WITH DIRECTION OF TREND

1/4 mile — 1/2 mile — 1 mile
1320 ft — 2640 ft

N

0 — 1320ft
SCALE

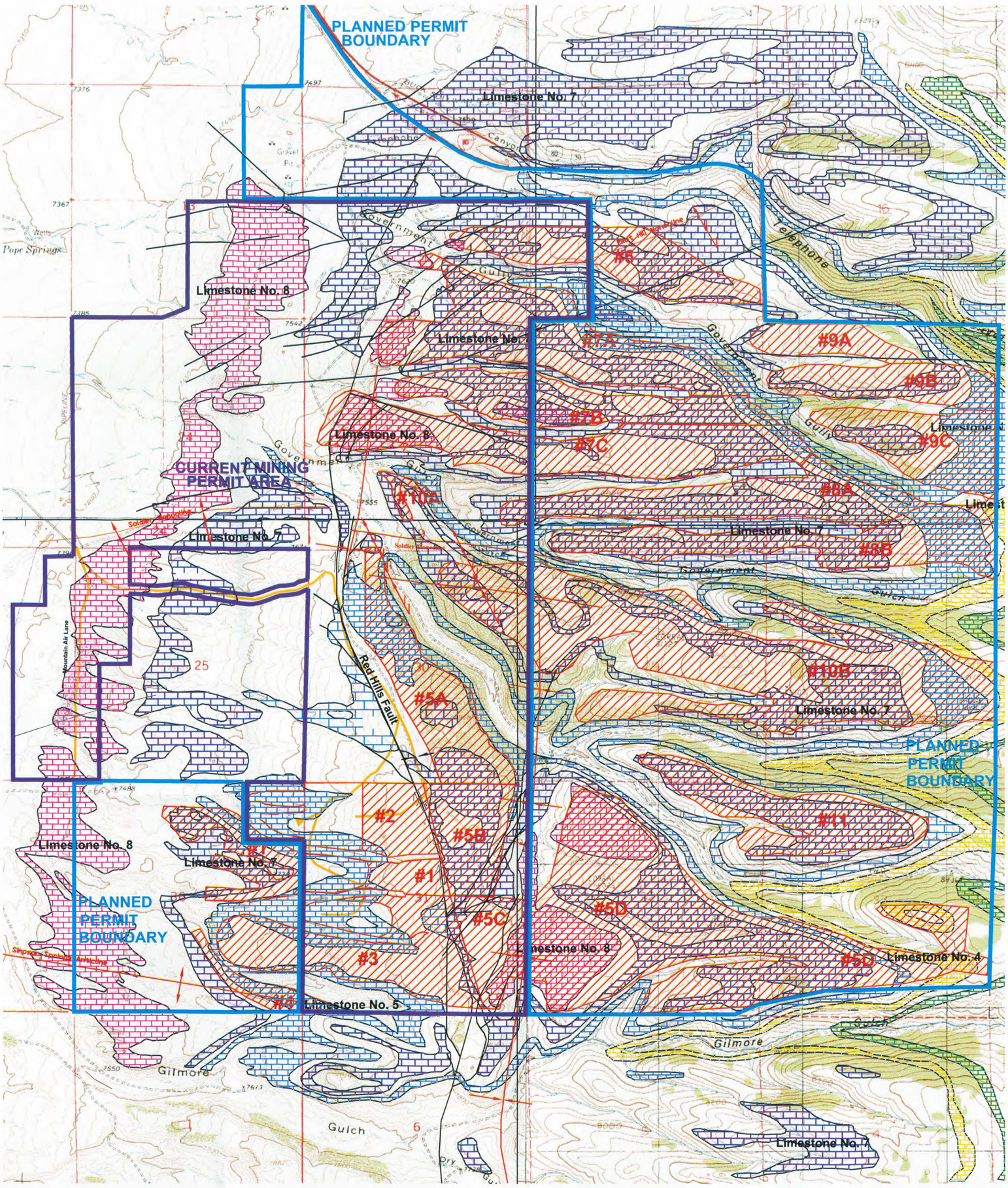
Map DIX5-2
Permit #298C-A8
Geology of the Amendment and Surrounding Area
Etchepare Quarries

Mountain Cement Company
5 Sand Creek Road
Laramie, WY 82070

TFN 5 1/110
OCT 15, 2012

Laramie, Pilot Hill, Sherman Mtns West & Red Buttes, Wyo.
USGS Quad Map (Enhanced DRG)
Township 15N, Range 72W, Sections 17, 18, 19, 30, & 31
Albany County, Wyoming

Andy H. MacClugage
August 2012



Legend

Limestone No. 3

Limestone No. 4

Limestone No. 5

Limestone No. 7

Limestone No. 8

CURRENT PERMIT BOUNDARY

PLANNED PERMIT BOUNDARY (298C-A8 Amendment Area)

EXISTING HAULROADS

PROPOSED QUARRY SITES

FAULTS WITH DIRECTION OF MOVEMENT U-UP/TOWARD D-DOWN/AWAY

FAULTS WITH DIRECTION OF MOVEMENT

MONOCLINE WITH DIRECTION OF TREND

ANTICLINE WITH DIRECTION OF TREND

SYNCLINE WITH DIRECTION OF TREND

The white areas between the hatched limestones within the permit area are sandstone overburden/interburden.

SCALE 1" = 1400'

CONTOUR INTERVAL 10', 20', & 40'

N

0 1400 ft

SCALE

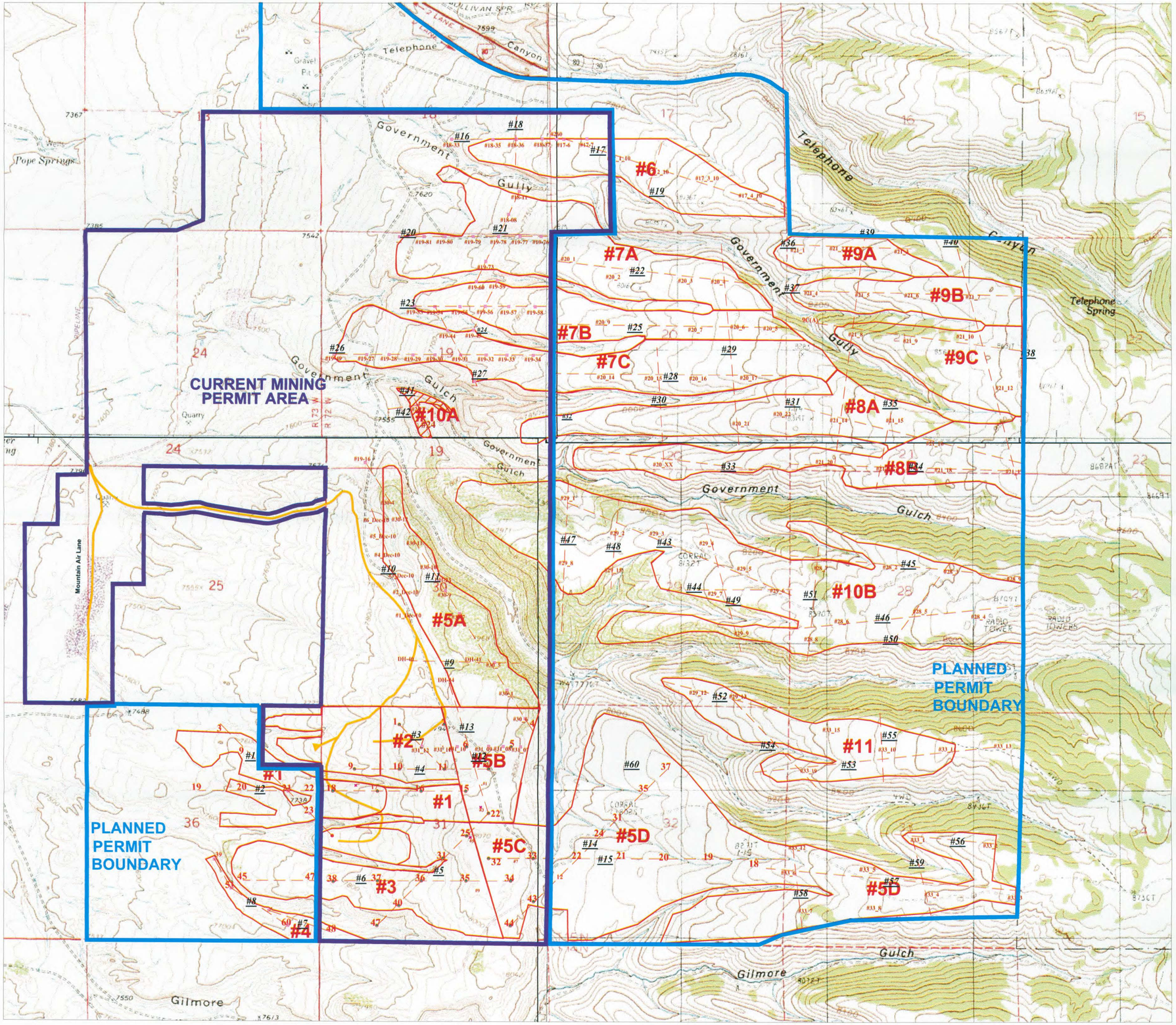
TFN 5 1/110
OCT 15, 2012

Map DIX5-3
Geology of the Casper Formation in the Permit Area
Permit #298C-A8
Etchepare Limestone Quarry

Mountain Cement Company
5 Sand Creek Road
Laramie, WY 82070

Laramie, Pilot Hill, Sherman Mtns West & Red Buttes, Wyo.
USGS Quad Map (Enhanced DRG)
Township 15N, Range 72W, Sections 17, 18, 19, 30, & 31
Albany County, Wyoming

Andy H. MacDagage
August 2012



LEGEND

CURRENT 298C PERMIT BOUNDARY

PROPOSED 298C-A8 AMENDMENT PERMIT BOUNDARY

#8B — 298C-A8 PROPOSED DISTRURBANCE AREAS

#24 — CROSS-SECTION LOCATION WITH NUMBER

DH-41 #21_20 — DRILL HOLES WITH NUMBER*

21 #4

*DRILL HOLE DATA WAS COLLECTED FROM SEVERAL CAMPAIGNS; DIFFERENT NUMBERING FORMAT FOR HOLES REPRESENTS DIFFERENT CAMPAIGNS

SCALE 1" = 1000'

CONTOUR INTERVAL 10', 20', & 40'

N

0 1600 ft

SCALE

TFN 5 1/110
OCT 15, 2012

Map DIX5-4
Cross Section Locations
Permit #298C-A8
Etchepare Limestone Quarry

Mountain Cement Company
5 Sand Creek Road
Laramie, WY 82070

Laramie, Pilot Hill, Sherman Mtns West & Red Buttes, Wyo.
USGS Quad Map (Enhanced DRG)
Township 15N, Range 72W, Sections 17, 18, 19, 30, & 31
Albany County, Wyoming

Andy H. MacClugage
August 2012

APPENDIX DIX6
HYDROLOGY

MOUNTAIN CEMENT COMPANY
ETCHEPARE QUARRY
PERMIT 298C-A8

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DIX6-1.0 INTRODUCTION

Appendix DIX6 Hydrology has been developed in conformance with Wyoming Department of Environmental Quality-Land Quality Division (LQD) Rules and Regulations; Chapter 2, Noncoal and Guideline 8, Hydrology. Appendix DIX6 Hydrology presents a discussion of the Surface Water, Groundwater, Water Rights, Mining Impacts on Hydrology and References associated with the Mountain Cement Company (MCC) Etchepare Limestone Quarry Permit 298C-A8.

DIX6-2.0 SURFACE WATER

Section DIX6-2 Surface Water, presents a discussion of Drainage Basin Description, Surface Runoff Flood Estimates, Surface Water Quality, Channel Geometry, Monitoring Program and Surface Water Summary associated with the MCC Etchepare Limestone Quarry Permit 298C-A8.

DIX6-2.1 DRAINAGE BASIN DESCRIPTION

The permit area is located on the southern end of the Laramie Range's western slope foothills and encompasses 8,375 acres of land. The southern end of the Laramie Basin lies to the west of the quarry site and the Laramie River flows about 6 miles to the northwest. The terrain and vegetation entails coniferous tree stands, sage brush parks, mountain mahogany covered hillsides, steep rocky drainages, and short-grass prairie. The permit area has a predominantly western aspect, and has been divided into 12 major watersheds (DA1-DA12), five of which contain numerous sub-watersheds. All drainage watersheds, channels, and pertinent hydrologic information are located and tabulated on Map DIX6-1.

A total of 50 stream channels exist within the permit area. Only two of these channels are named on USGS topographical maps; Government Gully and Government Gulch. Because of the arid climate and ephemeral nature of these streams, they are considered to be Class 3B by WDEQ Surface Water Quality Standards (2001). In general, these channels demonstrate very little lateral development. However, many of the channels consist of deep gullies and canyons, containing ledges, natural drops, and pools.

Government Gully is the only channel within the permit area that experiences perennial flow, which is caused by a spring (P80876W) that exists just off the channel. The spring is located within the NE¼NW¼ of Section 20, T15N R72W. Near the spring source, the water flow causes a marshy section of channel bottom that gradually dissipates and dries up within ½ mile downstream. Ultimately, water from each drainage discharges into the Laramie River, however, drainage areas take several different paths to reach the river. The drainages located in the southern and central portion of the permit area flow into Gilmore Gulch and Soldier Creek, respectively, which in turn flow to Harney Creek, then to the Laramie River. The northern drainages flow into the Laramie River just south of Interstate 80 via an unnamed channel.

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DIX6-2.2 Surface Runoff Flood Estimates

Appendix DIX4 Climatology discusses historical precipitation data for the Laramie region. Snow fall accumulates in the upper elevations of the watersheds and is slowly released into the drainages during spring runoff. The drainages within the permit area flow in response to rainfall and snowmelt, but typically remain dry throughout most of the year.

Peak flow runoff was calculated for the 2-yr, 10-yr, and 100-yr, 24-hr storms. Information from the National Oceanic and Atmospheric Administration (NOAA Atlas 2 Precipitation Frequency Data Center, 2009) for the location specific to the permit boundary provided precipitation values of 1.55 inches, 2.31 inches, and 3.40 inches, respectively.

Peak flow data for each drainage area was estimated with the hydrology/sedimentology program SEDCAD. SEDCAD utilizes the NRCS (SCS) Triangular Hydrograph Method for calculating peak runoff events. SEDCAD also enables the user to route storm flows through watershed/sub-watershed networks to give a more accurate estimation of flow. Soil data from the Natural Resources Conservation Service's (NRCS) Soil Survey (NRCS, 2009) were used to calculate an area weighted curve number encompassing the entire permit boundary. As described in Section DIX6-2.1, 12 major watersheds were identified within the permit boundary. Within those 12 major watersheds, 33 stream channels were used to develop the hydrologic network within SEDCAD. Map DIX6-1 provides peak flow results. Appendix DIX6-1 provides the SEDCAD design reports.

DIX6-2.3 Surface Water Quality

No water quality data exists within the permit boundary due to the ephemeral nature of the drainages and low volume discharge. Flow events in ephemeral drainages in arid and semi-arid regions usually have high concentrations of suspended sediment, but the sediment load is relatively small, especially on an annual basis. The substrate of the channels consists of poorly sorted cobble, gravel and sands, as well as exposed bedrock. MCC has not collected surface water quality data for any of the watersheds affected by the currently mined areas, as in-channel flows have not yet been observed to date.

DIX6-2.4 Channel Geometry

The ephemeral channels are well defined, single channels with steep banks. Rock outcrops and ledges are common within most of the channels running through the permit area, although some channels have portions with gradually sloping banks. As mining progresses, stream channels will be surveyed and monitored in accordance with the Monitoring Plan (see DIX6-2.5). MCC anticipates that the primary channels within the Etchepare permit area will be neither affected nor modified during mining activities.

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DIX6-2.5 Monitoring Program

MCC is committed to consultation with the WDEQ/LQD regarding baseline streamflow monitoring; especially in reference to when mining is scheduled to begin near Government Gully.

Based on the characterization of surface water flows in the permit area, monitoring would only be for ephemeral flow except for the lower portions of Government Gully.

DIX6-2.6 Surface Water Summary

Nearly all channels within the Etchepare permit area are well defined. However, most are not mature due to their low sinuosity and steep gradient, and lack regular flow. The channel morphology is most likely due to the abundance of bedrock on the surface and the low precipitation in the area. In response to occasional high intensity thunderstorms the channels may convey large amounts of runoff at near bankfull capacity, depending on the intensity and duration of the event.

DIX6-3.0 Groundwater

Section DIX6-3 Groundwater presents a discussion of the Hydrogeologic Setting, Aquifer Characteristics, Groundwater Quality, Groundwater Monitoring Program and Groundwater Summary associated with the MCC Etchepare Limestone Quarry Permit 298C-A8.

Appendix DIX5 contains a detailed description of the geology in the vicinity of the permit area.

DIX6-3.1 Hydrogeologic Setting

The permit area is located in the Laramie Basin which is open to the north, bounded to the east by the Laramie Range, to the south by the Front Range and to the west by the Medicine Bow Mountains. Topographical relief across the permit area ranges from gently rolling hills to steep sloped canyons, with approximate high and low elevations of 8,880 to 7,300 ft-msl, generally decreasing from east to west. In the vicinity of the permit area the Laramie Range trends north-south, drainages begin at the crest of the surrounding mountains and flow westward toward the center of the basin and eventually trend northward about 6 miles to the Laramie River.

The Laramie Basin is a 30-mile wide asymmetrical structural syncline that plunges to the north. The strata in the Laramie Basin range in age from the Precambrian igneous and metamorphic rocks that form the core of the Laramie Range and Medicine Bow Mountains to Quaternary alluvium. Strata on the east limb of the syncline dip gently west, between 2 and 5

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degrees, and generally strike north-south. Several faults and folds have been identified along the western flank of the Laramie Range in the vicinity of the permit area. Faults within the area are both reverse and normal. Folding in the area predominantly occurs as east-west trending, west plunging anticlines and monoclines. The Red Hills Fault, Pilot Hill Monocline, Soldier Monocline and Simpson Springs Anticline all are in part located within the permit area.

The lithologic sequence in the vicinity of the permit area includes Precambrian basement rock that is overlain by Pennsylvanian to Permian sedimentary rock. Unconsolidated Quaternary alluvial, colluvial and eolian deposits derived from shale, sandstone and limestone deposits occur in the streams and river bottoms along major drainages ranging in thickness up to 25 feet. Geologic exposures are of Pennsylvanian and early Permian age within the permit area. The outcroppings dip generally due west, away from the Laramie Mountains and toward the center of the basin, and strike north-south. Map DIX6-2 depicts the hydrogeologic setting of the permit area. For more details on Geology, please see Appendix DIX5.

DIX6-3.1.1 SHERMAN GRANITE

Sherman Granite is a Precambrian basement rock that forms the core of the Laramie Range. It is resistant to erosion and is responsible for the topographic relief at the edges of the Laramie Basin and is predominantly exposed east of the Laramie Range. Sherman Granite is a crystalline igneous and metamorphic rock that consists primarily of granite with gneiss anorthosite and gabbro intrusions. The crystalline matrix is impermeable; however, secondary permeability is imparted to the rock by fracturing and weathering. Groundwater movement within the Sherman Granite is typified by conduit flow. The Sherman Granite yields small amounts of water, less than 20 gallons per minute, to domestic wells but is not an aquifer suitable for high yield uses. In general, the regional hydraulic role of the Sherman Granite is a lower confining layer, aquitard or aquiclude, to the overlying Casper Formation, although there as not been a systematic study of the hydrogeology of the Sherman Granite to date (CAPP, 2011).

DIX6-3.1.2 FOUNTAIN FORMATION

The Fountain Formation is an irregularly distributed sedimentary unit that appears in thicknesses of up to 50 feet and then pinches out throughout the Laramie area (Lundy, 1978). The Fountain Formation is arkosic sandstone with small amounts of siltstone that unconformably overlies the Sherman Granite in some areas. In the Laramie area, the Fountain Formation is relatively thin and is often included with the overlying Casper Formation.

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DIX6-3.1.3 CASPER FORMATION

The Casper Formation unconformably overlies the Fountain Formation where it exists, or the Sherman Granite which acts as an effective lower confining layer. The overlying Satanka Shale provides an effective upper confining layer where it exists in sufficient thickness (CAPP, 2011). The Casper formation varies in thickness, thinning from north to south, with a total thickness ranging from 600 to 800 feet at the southern end of the Laramie Basin (Ver Ploeg, 1995). The Casper Formation is a buff to reddish, calcareous to quartzitic, very fine to coarse grained, well cemented to subarkosic sandstone interbedded with buff to purplish-gray limestone and dolomite beds, usually micritic and locally fossiliferous (Ver Ploeg, 1998). Sandstone accounts for approximately 85% of the unit, with limestone comprising the remaining lithology. The upper section of the Casper Formation consists of alternating layers of limestone and sandstone, where the 5 to 25 feet thick limestones separate generally fine-grained, well-sorted and well-cemented sandstones which are 12 to 60 feet thick (Burritt, 1962). The lower section of the Casper Formation consists of fine-grained shaley sandstones, siltstones and shales with interbedded limestones and is less permeable than the upper section. The Casper Formation has been divided into five members in ascending order, alpha, beta, gamma, delta and epsilon, with each member consisting of a thick sandstone unit separated by a laterally extensive limestone (Lundy, 1978). As many as ten different limestone or dolomite beds have been identified in the Laramie area and the limestone beds are numbered in stratigraphic sequence ascending from the top of the Laramie Mountains to the Laramie Plains. The primary stratum that outcrops within the permit area is the resistant limestone of the Casper Formation. The limestone beds dip gently to the west with an average thickness ranging from 2 to 20 feet over the permit area and are generally underlain by sandstone. Portions of the limestone are covered with sandstone and soil material, while the remaining areas are exposed resistant cap rock. The Casper Formation has water-bearing characteristics and supplies water to both wells and springs on the west flank of the Laramie Range. Sandstones in the Casper Formation have large permeabilities in comparison with regional geologic units. The Casper Aquifer has been studied extensively because it provides municipal water for the City of Laramie.

DIX6-3.1.4 SATANKA SHALE

Lower in the Laramie Basin, the Satanka Shale Formation unconformably lies directly above and regionally confines the Casper Formation, however, it is not present within the permit area.

DIX6-3.2 AQUIFER CHARACTERISTICS

The Casper Aquifer is the primary water-bearing hydrogeologic unit within the Laramie region as well as the permit area. Numerous studies and tests have been performed to determine the hydrologic properties of the Casper Aquifer; a compilation of those efforts is presented in Section DIX6-3.2.1.

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RECD MAR 07, 2013

DIX6-3.2.1 CASPER AQUIFER

The Casper Aquifer is comprised of two media types; porous sandstone and fractured sandstone and limestone. Flow within these materials includes both porous and conduit flow. Porous flow occurs within the unfractured, permeable sandstones and conduit flow occurs in the sandstones and limestones where the permeabilities have been enhanced by fractures and/or dissolution (CAPP 2011). The intergranular porosity of the rocks comprising the Casper Aquifer varies significantly. Reports differ as to the storage coefficients for the Casper Aquifer, which vary from confined to slightly leaky by Lundy (1978) to confined by a study by WWC in 1997. Specific permeability enhancements associated with all the faults and folds in the Casper Aquifer cannot be determined with certainty; some structures may enhance aquifer permeability while others may reduce permeability. Although the effects that each structure has on aquifer permeability are not known, it is important to recognize the hydraulic complexity imparted to the Casper Aquifer by geologic structures such as faults and folds. (CAPP 2011). Informal members, designated in descending order (epsilon, delta, gamma, beta, and alpha), comprise subaquifers within the Casper Aquifer. However, the confining ability of the limestones may be compromised where fractures from faults and folds have created hydraulic connection between the members (WWC, 1993 and 1997). For more information on geologic structures such as faults & folding, please see Appendix DIX5.

DIX6-3.2.1.1 AQUIFER PARAMETERS

Table DIX6-1 presents results of aquifer tests performed on the Casper Formation. The uppermost sandstone layer, the member epsilon, has the highest permeability and therefore is the highest water producing zone (Lundy, 1978). The delta and gamma sandstone members also have high permeability and, combined with the epsilon member, create the water bearing first 250 feet of the Casper Aquifer (Lundy, 1978). The fine-grained beta and alpha sandstones at the base of the Casper Formation possess a lower permeability (Lundy, 1978). Therefore, these two members are not typically considered to be water producing. The porosity of the well-cemented sandstones is approximately 22 percent while the porosity of the epsilon sandstone ranges from 15 to 30 percent (Lundy, 1978). The average porosity of the sandstones is 19 percent (Lundy, 1978). The hydraulic conductivity of the epsilon member ranges from 1.3 to 2.6 ft/day, transmissivity is 600 gpd/ft, and the hydraulic conductivity of the gamma member is approximately 1.5 ft/day, transmissivity is 600 gpd/ft (Lundy, 1978). The hydraulic conductivity of the aggregate members alpha through epsilon ranges from 0.21 to 0.32 ft/day, transmissivity is 900 to 1,390 gpd/ft, and of the aggregate members gamma through epsilon ranges from 0.11 to 0.13 ft/day, transmissivity is 315 to 375 gpd/ft (Lundy, 1978).

The hydraulic conductivity of the sandstone and limestone limits downward flow of water. The porous sandstone with limestone lenses of the Casper Formation has an estimated hydraulic conductivity of 0.8 ft/day (WWC, 1993). The hydraulic gradient is between 0.01 and 0.07 for this portion of the Casper Formation (WWC, 1993). The hydraulic properties of

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the Casper Aquifer are largely dependent on the presence or absence of an interconnected fracture network. The average bulk or fracture porosity within the Casper Formation is 0.02 percent (WWC, 1995). The hydraulic conductivity values range from 0.1 to 2.6 ft/day in unfractured sandstone, whereas larger hydraulic conductivity values ranging from 17 to 40 ft/day occur when the formation is fractured. The wells that are known to occur near or in folds or faults exhibit the greatest hydraulic conductivities. Typically, water wells completed in unfractured sandstone produce 10 to 100 gpm, whereas wells completed in fractures associated with faults and folds can produce over 1,500 gpm (WWC, 1997). Storage coefficients are variable and range from 0.001 to 0.006 and indicate confined to slightly leaky conditions (Lundy, 1978).

A rough range of groundwater velocities were calculated on Table DIX6-1. Two generalized gradients were utilized, one for the majority of the permit area and one for the valley area bottom west of the 7,400 ft-msl potentiometric contour shown on Map DIX6-2. The groundwater velocity in the permit area ranges from 18 to 475 ft/yr whereas the valley bottom ranges from 2 to 54 ft/yr.

DIX6-3.2.1.2 POTENTIOMETRIC SURFACE

Groundwater elevations were approximated in the vicinity of the permit area using water level data attained from the Wyoming State Engineers Office (SEO) Water Rights Database. Table DIX6-2 lists the well permits and water elevations used to approximate the potentiometric surface. The approximated potentiometric surface is shown on Map DIX6-2 and cross-sectional views are shown on Map DIX6-3. The lateral direction of groundwater flow in the Casper Aquifer is east to west, from the Laramie Range crest to the center of the Laramie Basin (Lundy, 1978 and Burritt, 1962). The horizontal hydraulic gradient in the Casper Aquifer is approximately 400 ft/mile (0.08 ft/ft) along the flank of the Laramie Range, and decreases to approximately 25 ft/mile (0.005 ft/ft) west of the contact between the Casper Formation and Satanka Shale (Huntoon and Lundy, 1979). The change in hydraulic gradient is attributed to a loss of water from the aquifer through springs and an increase in saturated thickness of the aquifer to the west. Within the permit area, based on the potentiometric surface shown on Map DIX6-2, the hydraulic gradient ranges from 0.01 ft/ft west of and in the western portion of the permit area, to 0.06 ft/ft eastward and through the proposed amendment area. Somewhat steeper gradients, up to approximately 0.08 ft/ft, occur in the northern portion of the area. The saturated portion of the aquifer is relatively thin at the crest of the Laramie Range and gradually thickens westward. The eastern portions of the Casper Aquifer throughout the recharge area are characterized by a combination of confined and unconfined conditions. Where exposed in the permit area, only the lower portion of the Casper Formation is saturated. Test holes bored by MCC through the surface limestone and into underlying sandstone detected no evidence of water. This indicates that the surface limestone layer does not act as an aquitard to saturated strata, and the sandstone below the limestone is not saturated with water. Where the Casper Aquifer lies underneath Satanka Shale, at the foot of the Laramie Range, and west of the permit area, the entire thickness of the Casper Formation is saturated, approximately 600 to 700 feet, and groundwater exists beneath shales and siltstones resulting in confined conditions (WWC, 1993).

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There are several points worth mentioning regarding the approximate potentiometric surface. A potentiometric surface can be defined throughout almost any saturated rock but such a surface does not signify an aquifer. Equipotential contour lines represent a line of equal energy potential. If one point is hydraulically connected to a second point, then groundwater will flow between those two points from the high energy state to the low energy state. The direction of flow would be perpendicular to the equipotential contour lines. The presence of an equipotential contour line between two points does not imply that groundwater flows between those two points. There has to be hydraulic connection before flow can occur. If the potentiometric surface elevation is greater than the ground surface or greater than the elevation of a well screen interval, there is potential for groundwater to flow on to the ground surface or into the well. However, there still needs to be hydraulic connection for flow to occur.

Topographical relief across the permit area includes steep sloped canyons. Cross-sections on Map DIX6-3 depict some of these canyon locations as areas in which the topography exceeds that of the approximate potentiometric surface elevation. If there were hydraulic connection in these locations then one would expect to see groundwater surfacing through a spring or seep. There is no spring at this point, illustrating possible errors in the approximate potentiometric surface or the lack of hydraulic connection at this point (e.g., confined or semiconfined groundwater). Wells having static water elevations significantly above the saturation zone result from holes penetrating an aquitard into a confined aquifer, in areas with a potentiometric surface lying above the saturated zone elevation.

Features in the approximate potentiometric surface contours, including irregular bends in equipotential contour lines are possibly due to the nature of the available data. Groundwater elevations were approximated from the SEO database. Some of the records used are decades older than others. The location of each well is reported on the SEO database to within one ¼, ¼ section. All of the wells are shown being located in the center of the applicable ¼, ¼ section. USGS topography elevation data was averaged over each ¼, ¼ section. The information recorded on the records (i.e., well depth, well log) and the type of drilling used is variable between well reports. All of these variables lead to inaccuracies in the approximated potentiometric surface.

The intent of the preceding discussion is to illustrate the uncertainty when inferring subsurface conditions and groundwater conditions. Installation of a groundwater monitoring network, per Section DIX6-3.4 and the Mine Plan, will provide data to confirm the potentiometric surface in the permit area.

DIX6-3.2.1.3 RECHARGE

The recharge area for the Casper Aquifer consists of the top and western slope of the Laramie Range, where the Casper Formation is exposed. The primary source of recharge is infiltration from rainfall and snow melt, which infiltrates into the exposed sandstones and fractures. The majority of recharge occurs between March and August through surface runoff and

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infiltration. The extent of the outcrop area determines the amount of recharge. The average east-west width of the Casper Formation outcrop along the west flank of the Laramie Range is 4 miles. Precipitation amounts vary with elevation, ranging from an annual average of 10.9 inches in the foothills around Laramie to approximately 14 inches at the higher elevations where the Casper Formation is exposed on the Laramie Range (Lundy, 1978). Assuming an annual precipitation of 12 inches on the range flank and that about 10 percent of the precipitation recharges the aquifer (Lundy, 1978), approximately 257 ac-ft/yr recharges the Casper Aquifer per mile of north-south outcrop. Recharge to the aquifer can be extremely variable on an annual and seasonal basis. An average spring recharge raises the potentiometric surface by approximately 1 ft (WWC, 1995). The recharge capacity and pattern of the Casper Aquifer is still not certain, due to its variation from year to year and ability for rapid recharge.

DIX6-3.2.1.4 DISCHARGE

Groundwater discharge results when the basin can not circulate all of the annual recharge. Discharge from the Casper Aquifer occurs primarily through topographically low areas along drainages where the Casper Formation is exposed and through springs. The primary springs are located along the western edge of the Casper Formation outcrop area at or near the Casper Formation and Satanka Shale contact, west of the permit area, and are associated with major faults and folds (WWC, 1993). The remaining groundwater discharges either through municipal and domestic water supply wells, upward vertical leakage or flows westward into the center of the Laramie Basin subsurface. The only spring known to exist within permit area, P80876W (in Government Gully, in the NE¼ NW¼ of Section 20, T15N R72W), likely occurs from fractures in the limestone that are hydraulically connected to lower, saturated strata.

DIX6-3.3 GROUNDWATER QUALITY

Groundwater quality of aquifers in the southeastern portion of the Laramie basin has been documented in numerous studies (Lundy, 1978 and Burritt, 1962). Table DIX6-3 presents water quality data for wells and springs sampled in the Casper, the Satanka and the Chugwater Formations. The data shows a distinct contrast between water quality of the Casper Formation and the Satanka Shale.

DIX6-3.3.1 CASPER AQUIFER

Throughout the Laramie area, groundwater from the Casper Aquifer is of high quality and potable. Water from the Casper Formation is typically dominated by bicarbonate, sulfate, and calcium ions, with a fairly neutral pH. Casper Aquifer groundwater can be classified as calcium-bicarbonate in the recharge area to a calcium/magnesium-bicarbonate type water downgradient (Lundy, 1978). Water chemistry of the Casper Aquifer is controlled by dissolution of calcite and dolomite in the aquifer matrix (Lundy, 1978).

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The Casper Aquifer has a fairly low concentration of dissolved solids. Total dissolved solids concentrations in the Laramie area range from 218 to 230 mg/L (WWC, 1995). The Casper Aquifer is hard with values ranging from 190 to 201 mg/L CaCO3 (WWC, 1995). Data analysis of water taken from several Casper Formation aquifer wells, provided by the Wyoming State Engineers Office, is presented in Table DIX6-4.

Additional groundwater quality data were collected in 1998 for the Etchepare Quarry Permit 298C-A5, and are presented in Table DIX6-5. The test results exhibit general consistency between the wells sampled. These results establish a baseline from which water quality can be monitored as mining progresses.

DIX6-3.4 Groundwater Monitoring Program

Currently, groundwater monitoring is performed quarterly for both static water level and water quality. All monitoring and sampling practices are performed in accordance with WDEQ/LQD regulation and guideline. The analyte suite has been established through past consultations with WDEQ/LQD to address potential types of impacts caused by mining. Groundwater monitoring results are listed on Table DIX6-6 and the well locations are depicted on Maps DIX6-2 and DIX6-4. Monitoring results are also included in the Annual Reports

Future groundwater monitoring program plans will be established through consultation with the WDEQ/LQD. This consultation will include determining the quantity and location of future monitoring wells, and may include changes to the analyte suite. This consultation will also consider current commitments for both baseline monitoring and monitoring as discussed in Section MPIX 4.8.9 of the Mine Plan.

DIX6-3.5 Casper Aquifer Protection Plan

The Casper Aquifer Protection Plan (CAPP) is an aquifer protection program implemented by the City of Laramie and Albany County. To date, the CAPP has been implemented by the City of Laramie. The primary purpose of the CAPP is to reduce the possibility of contaminating the Casper Aquifer which supplies the City of Laramie and Albany County residents with drinking water (WHPA, 2008). The permit area is located within Casper Aquifer Protection Area (CAPA) Zones 2 and 3. CAPA Zones 2 and 3 are designated as the Attenuation and Remedial Action Zones, respectively. The purpose of Zone 2 is to protect city supply wells from contact with pathogenic microorganisms and to allow for remediation or clean-up of a spill that may occur in the vicinity of the well. The purpose of Zone 3 is to protect the aquifer from contaminants that may migrate to city supply wells and to allow time for the remediation of the contaminant or replacement of the water resource. The CAPA zones are delineated based on hydrogeologic and vulnerability mapping. The CAPA is depicted on Maps DIX6-2 and DIX6-4.

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Limestone quarries are identified as a possible source of contamination in the CAPP within CAPA Zones 2 and 3. Primary contaminate concerns are fuel and blasting materials. The CAPP lists quarry operations within the CAPA as a low priority risk based on distance from wellhead, groundwater flow direction consideration and types of contaminants present. Furthermore, the CAPP states that long-term impacts of a quarry will be minimal (WHPA, 2008).

DIX6-3.6 GROUNDWATER SUMMARY

The Casper Formation is the exposed geologic formation within the permit area. The Casper Formation is composed of a sequence of interlayered sandstone and limestone, which, when saturated, comprises the Casper Aquifer. The Casper Aquifer is the primary water-bearing unit in the permit area. The Casper Aquifer is confined or semi-confined by impermeable limestone of the Casper Formation and Satanka Shale where present and unconfined where absent. Groundwater flow within the Casper Aquifer includes both porous and conduit flows. The Casper Aquifer recharge area consists of exposed sandstone of the Casper Formation which occurs within the permit area. Casper Formation groundwater quality in the permit area has a low concentration of total dissolved solids and is suitable for human consumption.

DIX6-4.0 WATER RIGHTS

The SEO Water Rights Database was utilized to search for both surface water and groundwater permits. Surface water rights within the permit boundary and the adjacent half-mile boundary are displayed on Map DIX6-4 and listed in Table DIX6-7. There are 33 surface water permits that exist within the permit boundary and 125 surface water permits that exist within one half-mile of the permit boundary.

Groundwater rights within the permit boundary and the adjacent 3 mile boundary are depicted on Map DIX6-4 and listed in Table DIX6-8. There are 26 groundwater permits that exist within the permit boundary and 701 groundwater permits that exist within 3 miles of the permit boundary. These water rights are used for municipal, industrial, stock and domestic uses.

DIX6-5.0 MINING IMPACTS ON HYDROLOGY

Information from this hydrologic investigation will be used to minimize the effect of the mining operation on the hydrologic regime and as a guide to measure the progress and performance of the restoration of the hydrologic regime after reclamation. Impacts of the mining operations to water resources will be minimal and of short duration.

Mining operations will have minimal impacts to surface water or any permitted water rights. The ephemeral streams below the mine sites will receive minimal discharge from the mine sites during mining, as runoff will be trapped by containment berms, and rock and hay bale

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check dams. Sediment will be trapped in these features as well. As the mine sites will be mined at varying time periods per the Mine Plan, effects of mining to downstream hydrologic systems will be minimized and cumulative impacts will in all probability be undetectable. Reestablishment of vegetation will return watershed discharge to premine levels. Soil losses at mined sites are anticipated to be similar to that occurring prior to mining, and will be minimized with sediment control and reclamation efforts.

Mining operations will have minimal impacts on groundwater. Mining is not anticipated to impact groundwater recharge, groundwater quality or any permitted water rights in the area. Due to the relatively near surface limestone extraction mining will not occur below any zones of saturation. MCC is committed to not mining below the groundwater surface. In addition, aquitards associated with any unconfined and confined aquifers will not be mined or impacted. Test holes bored into the surface limestone at each quarry site detected no evidence of water. Only the surface limestone will be affected at each quarry site, which is not part of any aquitard or aquifer. MCC is committed to not adversely impacting other groundwater users and to mitigating impacts if detected. Baseline and subsequent monitoring will be used to determine if groundwater impacts occur.

Except for emergencies, MCC maintains all equipment at shop facilities at the Laramie cement plant. Therefore washing, maintenance, oil changes, etc. will not take place on the site, eliminating potential impacts from spills related to those activities. No permanent fuel storage facilities are needed at the site (i.e., permanent fuel tanks). MCC has an area designated away from the mine site for parking and fueling mobile equipment; thereby eliminating the potential impacts to groundwater within the mine area from refueling and fuel storage. If a spill occurs, the MCC's Spill Prevention Control and Countermeasure Plan (SPCC) will be applied. Major spills and leaks would be mitigated immediately utilizing mobile equipment (i.e. backhoes, front-end loaders, haul tracks). Contaminated material would be transported off-site. The remote locations of equipment for maintenance and refueling and the commitment to the SPCC Plan will further minimize the potential for impacts to groundwater from fuel.

MCC will be in close contact with LQD prior to, throughout and during mining operations, including reporting of monitoring results and proposed mitigation activities, if needed. Quarry operations have been active in the area for at least 50 years, with no reported impacts to surface water and/or groundwater. No impacts to the water quantity or quality are foreseen, both during and following mining.

DIX6-6.0 REFERENCES

Albany County GIS Department, 2009.

Benniran, M.M., 1970, Casper Formation limestone, southwestern Laramie Mountains, Albany County, Wyoming: M.S. Thesis, University of Wyoming.

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Boos, C.M., 1940. Geological Survey of the Laramie Water Supply Area. Unpublished report of the Wyoming Geological Society to the City of Laramie.

Burritt, E.C., 1962. A Ground Water Study of Part of the Southern Laramie Basin, Albany County, Wyoming. M.S. Thesis, University of Wyoming.

Casper Aquifer Protection Plan (CAPP), 2011. BCC Approved CAPP 01.04.11

Chow, V.T., 1964. Handbook of Applied Hydrology, McGraw Hill Company.

Civil Software Design, 1998. SEDCAD4 for Windows.

Craig, G.S. and Rankl, J.G., 1978. Analysis of Runoff from Small Drainage Basins in Wyoming. USGS Water-Supply Paper 2056, Washington, DC.

Haan, C.T., and Barfield, B.J., 1979. Hydrology and Sedimentology of Surface Mined Lands, University of Kentucky.

Huntoon, P.W., and D.A Lundy, 1979. Fracture-Controlled Ground-Water Circulation and Well Siting in the Vicinity of Laramie, Wyoming. Ground Water, Volume 17, No. 5.

Laramie GIS Department, 2009.

Leopold, L.B., M.G. Wolman, and J.P. Miller. 1964. Fluvial Processes in Geomorphology, W.H. Freeman and Company.

Linsley, R.K. Jr., Kohler, M.A., Paulhus, J.L.H., 1975. Hydrology for Engineers, 2nd Edition, McGraw-Hill, Inc.

Love & Weitz, 1953.

Lowham, H.W., 1976. Techniques for Estimating Flow Characteristics of Wyoming Streams. USGS Water-Resources Investigations 76-112, Cheyenne, Wyoming.

Lowry, Marlin E., Rucher, Samuel J. IV, and Wahl, Kenneth L., 1973. Water Resources of the Laramie, Shirley, Hanna Basins and adjacent areas, Southeastern Wyoming: U.S. Geological Survey Hydrological Investigation Atlas HA-471, Cheyenne, Wyoming.

Lundy, D.A., 1978. Hydrology and Geochemistry of the Casper Aquifer in the Vicinity of Laramie, Albany County, Wyoming. Unpublished M.S. Thesis, University of Wyoming.

Miller, J.F., R. H. Frederick, and R.J. Tracey, 1973, Precipitation Atlas of the Western United States: U.S. Dept. of Commerce, NOAA Atlas No. 2, Wyoming.

TFN 5 1/110
RECD MAR 07, 2013

Morgan, A.M., 1947. Geology and groundwater in the Laramie area, Albany County, WY. U.S. Geological Survey, open-file report.

Nicoll, G.A., 1963. Geology of the Hutton Lake anticline area, Albany County, Wyoming.

NOAA, 2009. Hydrometeorological Design Studies Center - NOAA Atlas 2.

NRCS, 2009. Web Soil Survey-Albany County Area, Wyoming, http://websoilsurvey.nrcs.usda.gov

Piper, A.M., 1944. A graphic procedure in the geochemical interpretation of water analyses: Am. Geophys. Union Trans., V. 25.

Robinson, J.R., 1956. The Ground Water Resources of the Laramie Area, Albany County, Wyoming. Unpublished M.S. Thesis, University of Wyoming, 80 p.

Thompson, K. S., 1979. Prediction of Water Level Declines in the Casper Aquifer in the Vicinity of Laramie, WY. M.S. Thesis, University of Wyoming.

USDA, 2009. Digital NAIP Map of Albany County, WY.

USDA Natural Resources Conservation Service. 1988. Published Soil Survey of Albany County, Wyoming.

USGS EROS Data Center, Sioux Falls, SD. Topographic Data.

USGS, 1963, Photorevised 1978. Digital 7.5 Minute Quadrangle of Red Buttes, WY.

USGS, 1978, Photorevised 1978. Digital 7.5 Minute Quadrangle of Laramie, WY.

USGS, 1987. Digital 7.5 Minute Quadrangle of Pilot Hill, WY.

USGS, 1987. Digital 7.5 Minute Quadrangle of Sherman Mountains West, WY.

Ver Ploeg, Alan J., 1995, Preliminary Geologic maps of the Laramie and Red Buttes Quadrangles, Albany County, Wyoming. Wyoming State Geological Survey.

Ver Ploeg, Alan J., 2008, Geologic Map of the Laramie Quadrangle, Albany County, Wyo. Wyoming State Geological Survey.

Ver Ploeg, Alan J., 2007, Geologic Map of the Red Buttes Quadrangle, Albany County, Wyo. Wyoming State Geological Survey.

Ver Ploeg, Alan J., 2006, Preliminary Geologic Map of the Pilot Hill, Albany County, Wyo. Wyoming State Geological Survey.

TFN 5 1/110
RECD MAR 07, 2013

Ver Ploeg, Alan J. and Boyd, Cynthia S., 2000, Preliminary Digital Geologic Map of the Laramie 30'x 60' Quadrangle, Albany and Laramie Counties, Southeastern Wyoming. Wyoming State Geological Survey.

Western Water Consultants, 1993. Wellhead protection area delineation for Turner Well Field, Pope Well Field, Soldier Spring, and Simpson Springs. Western Water Consultants, Inc., Laramie, Wyoming.

Western Water Consultants, 1997. Hydrogeologic Investigation of LaPrele Park Project.

Western Water Consultants, 1997. Volume I: Testing and Evaluation of Production Test Wells, Spur Wellfield Project-Phase I.

Wittman Hydro Planning Associates (WHPA), 2008. Casper Aquifer Protection Plan.

Wyoming Department of Environmental Quality, Land Quality Division, 2005, Guideline No. 8 Hydrology.

Wyoming Department of Environmental Quality, Water Quality Division, 2001, Surface Water Standards.

Wyoming Geolibrary.

Wyoming State Engineers Office, September 2, 2009, Wyoming SEO Water Rights Database, http://seo.state.wy.us

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APPENDIX DIX6

TABLES

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Table DIX6-1. Casper Aquifer Parameters

Well Number(s)[a]	Location *Township-Range-Section* *USGS Numbering System*	Thickness of Producing Zone[b] (feet)	Producing Zone (inclusive)	Storage Coefficient	Transmissivity ($feet^2$/day)	Hydraulic Conductivity (feet/day)	Test Method	Groundwater Velocity Permit Area[c] (feet/year)	Groundwater Velocity Valley Bottom[d] (feet/year)
Wells completed in Casper sandstones with intergranular and limited joint permeability[e]									
CR3	16-73-16 cdd	50	epsilon	-----	130	2.6	Specific capacity	475	54
CR2	16-73-16 caa	60	epsilon	-----	80	1.3	Specific capacity	237	27
C16	16-73-29 bca	385	gamma-epsilon	-----	50	0.13	Van Everdingen solution	24	3
C16	16-73-29 bca	385	gamma-epsilon	-----	42	0.11	Specific capacity	20	2
C50	15-73-20 baa	580	alpha-epsilon	-----	130	0.22	Jacob solution	40	5
C50	15-73-20 baa	580	alpha-epsilon	-----	120	0.21	Specific capacity	38	4
C15	16-73-21 cbc	180	gamma-epsilon	-----	18	0.1	Jacob solution	18	2
C15	16-73-21 cbc	180	gamma-epsilon	-----	20	0.11	Specific capacity	20	2
C31	15-73-01 dba2	38	gamma	-----	57	1.5	Jacob solution	274	31
C48, C49	15-73-17 dcb, dbc	575	alpha-epsilon	-----	186	0.32	Closed contour	58	7
Wells completed in proximity of faults where rocks have significant joint and fracture permeability[f]									
C25	15-73-02 bab	650	alpha-epsilon	-----	11,000	17	Jacob solution		
C21, C24, C25	73-35 aaa, 15-73-02 aba, 15-73-02	650	alpha-epsilon	.001	18,000	28	Theis solution		
C25	15-73-02 bab	650	alpha-epsilon	-----	26,000	40	Specific capacity		
C24	15-73-02 aba	650	alpha-epsilon	-----	14,000	22	Specific capacity		
C46	15-73-14 dac2	700	alpha-epsilon	.006	18,000	26	Theis solution		
C46	15-73-14 dac2	700	alpha-epsilon	-----	23,000	33	Specific capacity		

Notes:

Data From Lundy, 1978

[a] C = Casper aquifer, comprised of the Casper and Fountain formations,
CR = Combined Casper aquifer and Satanka Shale

[b] Length of slotted casing or open hole in unfaulted zones; total thickness of Casper aquifer in faulted zones

[c] Hydraulic gradient of 0.07 ft/ft utilized

[d] Hydraulic gradient of 0.008 ft/ft utilized

[e] Intrinsic effective porosity value of 0.14 (14%) utilized (Lundy, 1978)

[f] Groundwater velocities are not calculated due to unknown porosities

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Table DIX6-2. Potentiometric Surface Groundwater Elevations

SEO Permit	Calculated Groundwater Elevation
P96838W	8620.00
P19563P, P148804W, P143437W	8587.11
P102500W, P133074W, P98779W	8622.21
P108817W	8555.00
P101402W	8535.00
P106854W	8445.00
P99826W	8426.00
P103296	8568.00
P115992W, P106426W	8372.09
P19569P, P19570P	8419.00
P147688W	8441.00
P102148W	8288.00
P111804W	8406.00
P121656W	8113.00
P19580P	8085.00
P19564P	7891.60
P19565P	7711.20
P152025W	7481.00
P149013W	7453.08
P38303W	7354.00
P5769W	7360.00
P38304W	7334.00
P5767W, P75328W	7348.41
P49103W, P72982W, P5768W	7354.00
P73055W	7242.00
P102243W	7325.00
P131638W	7257.00
P96994W	7387.00
P150325W, P92885W	7353.50
P98131W	7357.80
P106853W, P151006W, P98132W	7370.01
P8765P	7886.40
P2558W	8597.00
P106852W, P98131W	7361.50
P8769P	7495.10
P8770P	8023.80
P80876W	7915.00
P8767P	8327.30
P8772P	7747.29
P8766P	8364.40
P40266W	7309.00
P34766W	7292.00
P106649W, P63564W	7342.20
P63533W	7338.00
P63334W, P72966W, P77630W, P109498W, P83076W, P125275W, P94722W, P62398W	7333.50
P53955W	7345.00
P29196W, P46209W, P49224W, P49225W, P55632W, P59161W, P62980W, P62982W, P1050W	7338.44
P59577W	7305.00
P34315W,P34316W	7328.00
P46205W, P68130W, P61026W, P105200W, P63550W, P95787W, P5W, P65133W	7323.38
P72312W, P72684W, P76535W, P117430W, P5W, P73629W, P71912W, P63720W, P56897W, P56001W, P55633W, P55193W, P53530W, P49157W, P44232W, P26827W, P16789P	7318.53
P38657W, P36068W, P9247W, P48638W, P39529W, P36069W, P40499W, P36646W, P43839W, P36946W, P1483W, P8601P, P94469W, P34726W, P16788P, P85691W, P31607W	7372.65
P41627W, P69894W, P71527W, P78172W, P95040W, P15696P, P73717W, P71884W, P40592W, P40357W, P40356W, P28373W, P8601P	7336.15
P46210W,P92375W	7334.00

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Table DIX6-2. Potentiometric Surface Groundwater Elevations

SEO Permit	Calculated Groundwater Elevation
P43392W,P73899W	7351.50
P152206W	7336.00
P16922P	7326.90
P144071W,P159105W	7348.00
P124026W,P39298W	7348.50
P116191W	7329.00
P116195W	7322.00
P39844W	7355.00
P430C	7310.00
P36531W, P43721W, P64826W	7319.33
P72411W	7289.00
P57005W,P66932W	7303.00
P31363W	7315.00
P31362W	7246.00
P110152W	7306.00
P154C, P155C, P55505W, P55506W, P55507W, P72690W, P72691W, P72692W, P153C	7335.89
P102061W,P156466W,P30940W	7323.46
P15665W, P14875W, P100005W, P102084W, P84983W, P157586W, P92168W	7287.70
P105404W, P98130W, P98008W, P120043W	7298.50
P110852W, P18521P, P18522P	7278.33
P100993W, P109215W, P65485W	7293.33
P88874W	7304.00
P18520P, P158525P	7239.00
P100522W, P128164W, P24865W	7312.33
P71974W, P99246W	7327.50
P39385W	7319.70
P109769W	7327.00
P92077W	7299.00
P102266W, P85708W	7297.00
P101738W	7316.00
P100851W, P100860W	7309.00
P105184W, P17936P	7311.00
P105576W	7322.00
P101654W	7322.00
P2659W, P96058W	7326.50
P99770W, P99771W, P99772W, P99773W, P92936W	7332.60
P13695W, P31876W, P31745W	7330.33
P72810W	7338.00
P16921P	7332.00
P94793W	7450.00
P100462W, P149978W	7367.50
P109363W	7316.00
P49869W	7285.00
P95834W	7321.00
P94730W	7371.00
P101993W	7382.50
P123256W	7472.00
P16920P, P725G	7327.19
P16919P, P23G, P24716W	7346.00
P157931W	7304.00
P125627W, P157637W	7309.00
P144073W	7296.00
P109344W	7305.00
P107563W, P126866W	7339.00
P105082W	7343.47
P102615W	7314.00
P98640W	7321.00

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Table DIX6-2. Potentiometric Surface Groundwater Elevations

SEO Permit	Calculated Groundwater Elevation
P98471W	7335.00
P115635W	7359.00
P119006W	7338.00
P105088W	7324.67
P102304W	7338.00
P104810W	7353.00
P104443W	7340.00
P163598W	7433.00
P111480W	7334.00
P145651W	7380.00
P109771W	7309.54
P134391W	7352.00
P117662W	7375.00
P17935P	7346.00
P127132W	7756.66
P95938W	7343.08
P94924W	7365.77
MC-MW#1	7469.05
MC-MW#2	7500.57

Water levels and well location data from SEO
Topographic data from USGS

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Table DIX6-3. Groundwater Quality in the Vicinity of Laramie

Well or Spring Number[a]	Township - Range - Section[b]	Date Sample Collected	Field Temp. (°C)	Corrected Temp. (°C)	Field pH	milligrams/liter Ca	Mg	Na	K	Cl	SO_4	HCO_3	NO_3	SiO_4	Total Dissolved Solids	Specific Conductance
Casper Aquifer																
C4	17-72-31 cbb	7/15/1976	8.5	8.2	7.7	40	18	4.1	2.20	3.04	8	215	5.5	12.0	203	368
C7	16-72-05 dd	7/27/1976	8.2	7.0	7.7	40	17	3.3	.88	1.76	7	190	18.0	8.9	196	357
C13	16-72-15 cdd	7/19/1976	7.0	6.3	7.7	54	15	2.0	.46	.59	9	226	3.2	9.8	211	383
C14	16-73-19 dd	7/23/1976	12.5	7.2	7.6	44	12	1.9	.52	.11	5	195	5.0	8.4	178	327
C15	16-73-21 cbc	7/15/1976	13.8	13.2	7.6	27	20	4.6	1.05	1.38	25	167	4.0	10.1	180	328
C16	16-73-29 bca	8/5/1976	8.3	8.3	8.6	13	20	5.8	1.22	1.68	25	129	.8	2.9	139	269
C16		6/24/1976	9.5	9.7	8.3	18	20	7.0	1.08	1.99	27	146	1.0	5.5	159	297
C16		8/5/1976	12.8	14.5	8.0	25	20	7.0	1.39	1.98	26	167	5.3	7.6	181	329
C18	16-73-25 dad	6/30/1976	8.2	7.5	7.8	46	15	1.9	.61	.10	6	213	.5	8.2	188	348
C19	16-72-29 cc	7/26/1976	8.7	6.7	7.6	53	11	1.6	.65	.01	8	209	3.4	8.3	193	353
C20	16-73-26 bdd	7/16/1976	8.6	8.4	7.7	40	20	3.0	.85	.64	6	219	4.5	10.0	198	361
C22	16-73-33 acd	7/13/1976	11.8	11.8	8.0	31	21	6.5	1.25	.77	18	195	1.2	10.6	192	348
C23	16-73-35 dcb	8/4/1976	8.2	8.2	7.3	52	16	1.9	.71	.33	6	227	4.0	8.7	207	378
C25	15-73-02 bab	7/26/1976	9.6	8.6	7.4	49	17	2.0	.85	.11	6	233	2.0	8.6	205	302
C27	15-73-01 cbb	7/21/1976	8.7	8.6	7.4	50	17	2.1	.85	1.71	8	228	8.0	9.2	214	389
C30	15-73-01 dba1	7/20/1976	9.5	7.5	7.2	48	12	1.9	.68	.37	9	200	6.2	9.7	192	348
C32	15-73-01 dac	7/20/1976	12.2	7.4	7.1	50	15	1.6	.72	.01	7	220	5.5	10.0	203	369
C33	15-72-06 db	7/20/1976	8.3	6.9	7.5	57	13	2.0	.93	.05	10	231	8.1	10.5	220	393
C34	15-72-06 cc	7/20/1976	9.4	7.1	7.5	44	15	1.5	.83	.48	8	210	6.6	9.3	194	346
C35	15-72-03 cab	7/22/1976	6.0	6.0	7.1	62	5	1.6	.83	.05	7	212	2.2	9.0	197	357
C36	15-73-12 bcb1	8/3/1976	8.1	8.0	7.4	42	25	2.5	1.28	4.25	11	230	.8	8.9	214	404
C37	15-73-12 bcb2	7/23/1976	8.3	7.6	7.3	49	16	1.9	.76	5.40	7	223	4.9	8.7	208	375
C38	15-73-12 dbb	7/21/1976	8.6	7.5	7.3	51	15	1.6	.74	.37	6	229	5.0	9.1	208	380
C40	15-72-08 da	7/22/1976	8.2	6.4	7.4	60	15	1.3	.47	.03	7	251	4.9	8.2	225	408
C41	15-73-09 aab	7/21/1976	11.1	11.1	7.5	43	25	7.1	1.37	.43	28	244	2.0	9.9	242	425
C42	15-13-14 aba	6/30/1976	8.3	7.8	7.9	48	17	1.7	.86	.50	6	221	4.6	9.7	202	363
C43	15-72-14 bbc	7/22/1976	6.3	6.3	7.3	67	0	.9	.32	.04	6	208	5.0	6.7	194	343
C48	15-73-17 dcb	7/23/1976	12.8	12.8	7.5	27	22	6.7	1.10	1.70	30	174	3.8	8.7	191	343
C49	15-73-17 dbc	7/23/1976	13.2	13.2	7.6	35	26	9.0	1.13	.01	38	176	5.8	8.9	215	366
C51	15-72-20 baa	7/2/1976	6.4	6.3	7.5	59	9	2.2	.47	6.41	7	215	4.6	9.6	210	358
C52	15-72-20 aac	7/27/1976	7.7	6.3	7.5	54	12	1.6	.96	.37	6	223	3.7	8.6	208	376
C53	15-72-22 bad	7/22/1976	8.2	6.3	7.0	85	5	8.2	.67	25.60	8	250	16.0	7.8	285	502
C55	15-72-19 cbd	8/3/1976	6.9	6.6	7.3	52	13	1.5	.58	.16	6	213	4.9	8.4	197	366
C59	15-73-23 cca	7/2/1976	7.8	7.8	7.4	47	16	3.2	.95	2.98	10	215	4.2	9.6	206	375
C60	15-72-29 ccb	7/2/1976	7.1	6.8	7.6	57	12	1.9	.54	.44	10	214	7.0	13.2	213	378
C61	15-72-28 dda	8/3/1976	5.6	5.1	7.2	62	6	1.2	.50	.01	7	212	4.6	6.9	197	359
C65	15-73-34 ddc	7/7/1976	8.0	8.1	6.7	45	16	5.3	.91	4.86	17	203	5.8	10.1	210	379
Soldier Springs	15-73-23 dcc	7/23/1997	---	---	---	58.4	17.2	1.9	<1.0	3.50	12	218	<0.1	9.2	208	377
Casper/Satanka Mixed																
CR6	16-73-03 ac	7/15/1976	7.9	7.9	6.9	310	63	11.2	1.82	4.81	950	155	4.5	23.4	1449	1618
CR7	15-73-03 abd	7/8/1976	7.2	7.1	7.0	184	62	7.0	1.74	7.46	553	176	3.6	23.7	933	1189
CR8	16-73-35 ccd	7/8/1976	7.7	7.6	7.2	40	20	3.1	1.13	2.10	12	228	3.1	10.8	209	393
Satanka Shale																
S1	16-73-34 cab	7/13/1976	9.3	9.3	7.3	190	51	11.8	1.84	19.78	519	201	11.2	17.4	926	1204
Chugwater																
TC1	16-73-28 add	7/16/1976	8.7	8.6	7.2	308	97	15.6	2.08	3.85	1060	156	4.3	23.9	1596	1785
TC2	16-73-34 caa	7/13/1976	13.5	10.0	7.4	200	126	97.0	3.80	41.88	822	392	105.0	34.4	1619	1874
TC3	15-73-03 bdc	7/8/1976	9.0	8.9	7.2	480	92	15.0	2.20	7.35	1580	179	135.0	30.1	2300	2282
TC4	15-73-15 baa	6/30/1976	8.3	8.2	6.3	214	51	9.3	1.48	16.30	562	228	6.4	18.2	996	1233

Notes:

Data from Lundy, 1978

a) C = Casper aquifer, comprised of the Casper and Fountain formations,
S = Satanka Shale,
TC = Chugwater Formation,
CR = Combined Casper aquifer and Satanka Shale

b) United States Geological Service numbering system.

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Table DIX6-4. SEO Groundwater Quality Data in the Vicinity of the Permit Area

Well No. & Facility Name	Ca	Mg	HCO_3	CO_3	NO_2 as N	Hardness	pH	Conductivity
	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l		µmhos/cm
P45893W Soldier Springs #2*	48.9	15.4	181	0	1.4	189	7.8	373
P45895W Pope #4**	51	19	230	0	0	210	8.2	370
Turner #1**	49	22	240	0	0.01	210	8.2	380
Turner #2**	35	20	210	0	0.01	170	8.3	380
Turner #3**	36	29	240	0	0	210	8.3	340
P64826W Eisenhauer #1**	- -	- -	- - -	-	2.6	300	- - -	360
P9247W Attebery #1**	- -	- -	- - -	-	4.8	195	- - -	220
P15665W Fuchs #1**	- -	- -	- - -	-	3.9	556	- - -	720
P66932W Hanscom #1**	- -	- -	- - -	-	0.5	180	- - -	267
P65485W Beasley #1**	- -	- -	- - -	-	2.7	390	- - -	760

*Sampled by MCC and analyzed by Wyoming Analytical Labs, Laramie, Wyoming.

**Data provided by the Wyoming State Engineers Office (SEO).

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Table DIX6-5. Groundwater Quality Data in the Vicinity of the Permit Area

Date	Well No.	Water Elevation	Hardness mg/l	Alkalinity	Nitrate mg/l	Sulfate mg/l	Conductivity µmhos/cm	TDS mg/l	pH
11-Jun-98	P72810W	7320	225	177	1.3	7	353	230	7.68
	P94793W	7391	231	179	1.4	8	352	230	7.64
	P8769P	7495	221	177	1.3	7	353	230	7.69
	P95938W	7420	232	191	1.1	6	369	230	7.65
15-Jul-98	P72810W	7318	219	179	0.9	9	266	220	8.03
	P94793W	7390	215	182	1	8	334	220	7.91
	P8769P	7495	201	167	1	9	125	210	8.24
	P95938W	7410	238	195	0.8	7	301	220	7.88
18-Aug-98	P94793W	--	--	--	--	--	--	--	--
	P8769P	--	--	--	--	--	--	--	--
	P95938W	--	--	--	--	--	--	--	--
	Trip Blank	--	--	--	--	--	--	--	--

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Table DIX6-6. Groundwater Quality Data in the Permit Area

	Water Level	Groundwater Elevation	Lab Conductivity @ 25 °C	Total Dissolved Solids @ 180 °C	Total Alkalinity as CaCO3	Total Hardness as CaCO3	Nitrate + Nitrate as N	Total Petroleum Hydrocarbons
	ft-bgs	ft-msl	µmhos/cm	mg/L	mg/L	mg/L	mg/L	mg/L
SEO Permit #P95938W								
1/14/2004	205	7363.75	357	210	208	209	1.38	<1
3/10/2004	196	7372.75	354	220	207	206	1.31	<1
6/30/2004	176	7392.75	366	270	207	216	1.34	<1
8/24/2004	191	7377.75	392	220	207	198	1.39	<1
2/22/2005	198.1	7370.65	376	200	206	212	1.28	<1
6/21/2005	198.4	7370.35	349	220	208	205	1.23	<1
8/30/2005	197.58	7371.17	364	210	204	219	1.31	<1
12/15/2005	196.65	7372.1	395	220	206	211	1.31	<1
5/25/2006	197.92	7370.83	390	210	190	210	1.5	<5
7/31/2006	198.87	7369.88	392	210	213	212	1.39	<1
9/27/2006	198.93	7369.82	386	200	199	207	1.25	<1
12/7/2006	198.96	7369.79	375	190	196	209	1.14	<1
3/20/2007	197.92	7370.83	393	220	203	200	1.2	<1
6/25/2007	198.87	7369.88	392	250	210	200	0.58	<1
9/6/2007	198.93	7369.82	392	220	206	200	1.27	<1
11/29/2007	198.96	7369.79	397	220	204	209	1.1	<1
2/5/2008	NA		390	220	210	221	1.07	<5
5/29/2008	NA		370	200	191	203	1.08	<5
9/4/2008	NA		391	240	199	210	1.08	<5
12/10/2008	NA		376	210	240	201	1.03	<5
3/25/2009	N/A		364	230	205	208	1.22	<1
6/4/2009	N/A		388	220	246	194	1.03	<1
9/3/2009	N/A		376	180	204	206	1.2	<1
12/7/2009	N/A		356	210	249	206	1.16	<1

Total Depth 360'

Measuring Point Elevation 7668.75 [c]

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Table DIX6-6. Groundwater Quality Data in the Permit Area

	Water Level	Groundwater Elevation	Lab Conductivity @ 25 °C	Total Dissolved Solids @ 180 °C	Total Alkalinity as CaCO3	Total Hardness as CaCO3	Nitrate + Nitrate as N	Total Petroleum Hydrocarbons
	ft-bgs	ft-msl	µmhos/cm	mg/L	mg/L	mg/L	mg/L	mg/L
MC-MW#1								
6/6/2006	185.95	7488.12	380	220	210	210	1.3	<1
7/31/2006	185.7	7488.37	386	210	202	206	1.51	<1
9/27/2006	186.33	7487.74	374	210	187	201	1.42	<1
12/7/2006	187.4	7486.67	365	190	184	201	1.32	<1
3/19/2007	17.16 [a]		372	220	193	203	1.35	<1
6/25/2007	10.48 [a]		337	240	192	192	1.18	<1
9/6/2007	186.57	7487.5	380	210	193	195	1.45	<1
11/29/2007	186.61	7487.46	389	220	195	202	1.41	<1
2/5/2008	10.12 [a]		380	220	190	201	1.27	<1
5/29/2008	184.95	7489.12	362	190	181	189	1.26	7 [b]
9/4/2008	179.93	7494.14	367	230	185	204	1.75	<1
12/10/2008	180.56	7493.51	358	200	222	188	1.21	<1
3/25/2009	N/A		346	230	186	204	1.48	<5
6/4/2009	N/A		379	210	233	193	1.3	<5
9/3/2009	N/A		377	190	158	190	1.6	<5
12/7/2009	N/A		346	210	242	204	1.37	<5

Total Depth 380'

Measuring Point Elevation 7674.07 [c]

MC-MW#2

6/6/2006	189.43	7495.83	360	200	200	210	1.2	<5
7/31/2006	188.5	7496.76	364	210	194	199	1.37	<5
9/27/2006	189.33	7495.93	359	200	182	193	1.36	<5
12/7/2006	190.2	7495.06	356	200	178	198	1.25	<5
3/19/2007	192.39	7492.87	366	220	186	190	1.26	<1

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Table DIX6-6. Groundwater Quality Data in the Permit Area

	Water Level	Groundwater Elevation	Lab Conductivity @ 25 °C	Total Dissolved Solids @ 180 °C	Total Alkalinity as CaCO3	Total Hardness as CaCO3	Nitrate + Nitrate as N	Total Petroleum Hydrocarbons
	ft-bgs	ft-msl	µmhos/cm	mg/L	mg/L	mg/L	mg/L	mg/L
6/25/2007	9.31 [a]		365	240	185	186	0.64	<1
9/6/2007	9.29 [a]		373	190	188	194	1.39	<1
11/29/2007	195.56	7489.7	372	220	187	193	1.3	<1
2/5/2008	191.62	7493.64	370	210	190	190	1.21	<5
5/29/2008	185.45	7499.81	353	200	171	189	1.78	<5
9/4/2008	183.42	7501.84	357	210	183	194	1.79	<5
12/10/2008	183.74	7501.52	355	210	224	180	1.17	<5
3/25/2009	N/A		341	220	184	197	1.36	<5
6/4/2009	N/A		364	200	228	187	1.1	<5
9/3/2009	N/A		351	190	186	196	1.3	<5
12/7/2009	N/A		338	200	229	195	1.27	<5

Total Depth 380'

Measuring Point Elevation 7685.26 [c]

SEO Permit #P123256W

9/6/2007	10.09	7659.91	398	220	203	189	1.55	<1
11/29/2007	10.73	7659.27	388	230	193	200	1.53	<1
2/5/2008	10.18	7659.82	380	220	190	198	1.52	<5
5/29/2008	11.29	7658.71	367	210	181	195	1.44	<5
9/4/2008	10.23	7659.77	372	220	189	196	1.7	<5
12/10/2008	10.26	7659.74	370	230	225	194	1.35	<5
3/25/2009	N/A		359	250	192	208	1.65	<5
6/4/2009	N/A		379	220	236	199	1.35	<5
9/3/2009	N/A		370	190	192	204	1.6	<5
12/7/2009	N/A		352	210	238	204	1.53	<5

Total Depth 420'

Measuring Point Elevation 7670.00 [d]

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Table DIX6-6. Groundwater Quality Data in the Permit Area

Water Level	Groundwater Elevation	Lab Conductivity @ 25 °C	Total Dissolved Solids @ 180 °C	Total Alkalinity as CaCO3	Total Hardness as CaCO3	Nitrate + Nitrate as N	Total Petroleum Hydrocarbons
ft-bgs	ft-msl	µmhos/cm	mg/L	mg/L	mg/L	mg/L	mg/L

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Data collected by MCC

footnotes:

a The perceived rapid water elevation increase in MCMW#1 and #2 is a result of faulty measurements by the contractor. This issue has been addressed by MCC and WDEQ/LQD

b TPH is determined through use of EPA Method 1664A-" Method 1664 is a performance-based method applicable to aqueous matrices that requires the use of n-hexane as the extraction solvent and gravimetry as the determinative technique. Alternative extraction and concentration techniques are allowed, provided that all performance specifications are met. In addition, QC procedures designed to monitor precision and accuracy have been incorporated into Method 1664." -United States Environmental Protection Agency, Clean Water Act Analytical Methods, Method 1664. - http://water.epa.gov/scitech/methods/cwa/oil/1664.cfm TPH detection could have occured due to a spill or sampling/analysis error; but as this detection is a singular circumstance, it is likely erroneous.

c Monitoring well measuring point elevation surveyed September 2010

d The groundwater measuring point elevation (topography elevation) was approximated from the SEO database, per ¼, ¼ section.

Table DIX6-7. Surface Water Rights Within One-Half Mile of the Permit Area

Permit #	Township	Tns suffix	Range	Section	Quarter	Qtrqtr	Acres	Location	Status	Supply type	Adj New Use	Facility Name	Appropriation	An Source	An Priority	SW Uses	SW Facility Name	SW Applicant	SW Source	SW Priority	SW Una amt	SW Una unit
C36/522A	14	N	72	3	5	NENW			PU	ORI			Mrs. Maggie Williams, et al.	Gilmore Springs No. 2		STO	Gilmore Pipe Line No. 2			9/6/1911		
C36/522A	14	N	72	3	5	NENW		X	PUD	ORI			Mrs. Maggie Williams, et al.	Gilmore Springs No. 2		STO	Gilmore Pipe Line No. 2			9/6/1911		
P10895D	14	N	72	3	5	NENW			PU	ORI	STO	Gilmore Pipe Line No. 2			9/6/1911			ARTHUR WILLIAMS	Gilmore Springs No. 2		0.056	CFS
P10895D	14	N	72	3	5	NENW		X	PUD	ORI	STO	Gilmore Pipe Line No. 2			9/6/1911			ARTHUR WILLIAMS	Gilmore Springs No. 2		0.056	CFS
P14187S	14	N	72	5	6	NWNW	0	X	UNA		STO	Cotton Stock Reservoir			11/1/2000			COTTON HOLDINGS, L.L.C.	Gilmore Gulch		1.25	ACFT
P13372D	15	N	72	17	11	SWSW	8		EXP	ORI	STO, IRR	Spring Ditch			7/8/1913			THE COLORADO LAND WATER & LIVESTOCK CO. CORP.	Unnamed Spring		0.4	CFS
P14738D	15	N	72	17	11	SWSW		X	PUD	ORI	STO, IRR, DOM	Kassahn Ditch			12/10/1915			HERMAN G. KASSAHN	Perennial Springs		0.5	CFS
C42/634A	15	N	72	18	10	NWSW	24		ADJ	ORI			Herman G. Kassahn	Perennial Springs		IRR, STO, DOM	Kassahn Ditch			12/10/1915		
P14738D	15	N	72	18	10	NWSW	24		ADJ	ORI	STO, IRR, DOM	Kassahn Ditch			12/10/1915			HERMAN G. KASSAHN	Perennial Springs		0.5	CFS
C42/634A	15	N	72	18	11	SWSW	5.3		ADJ	ORI			Herman G. Kassahn	Perennial Springs		IRR, STO, DOM	Kassahn Ditch			12/10/1915		
P14738D	15	N	72	18	11	SWSW	5.3		ADJ	ORI	STO, IRR, DOM	Kassahn Ditch			12/10/1915			HERMAN G. KASSAHN	Perennial Springs		0.5	CFS
C42/634A	15	N	72	18	15	SWSE	1		ADJ	ORI			Herman G. Kassahn	Perennial Springs		IRR, STO, DOM	Kassahn Ditch			12/10/1915		
P14738D	15	N	72	18	15	SWSE	1		ADJ	ORI	STO, IRR, DOM	Kassahn Ditch			12/10/1915			HERMAN G. KASSAHN	Perennial Springs		0.5	CFS
C42/634A	15	N	72	18	16	SESE	5		ADJ	ORI			Herman G. Kassahn	Perennial Springs		IRR, STO, DOM	Kassahn Ditch			12/10/1915		
P14738D	15	N	72	18	16	SESE	5		ADJ	ORI	STO, IRR, DOM	Kassahn Ditch			12/10/1915			HERMAN G. KASSAHN	Perennial Springs		0.5	CFS
P13372D	15	N	72	19	1	NENE	20		EXP	ORI	STO, IRR	Spring Ditch			7/8/1913			THE COLORADO LAND WATER & LIVESTOCK CO. CORP.	Unnamed Spring		0.4	CFS
C57/325A	15	N	72	19	10	NWSW			PU	ORI			USDA, Forest Service	Ranger Spring		DOM	Pole Mountain Ranger Station Domestic Water Supply System Pipeline			2/28/1938		
P18881D	15	N	72	19	10	NWSW			PU	ORI	DOM	Pole Mountain Ranger Station Domestic Water Supply System Pipeline			2/28/1938			FOREST SERVICE U. S. A. DEPT. AGRICULTRUE	Ranger Spring		0.04	CFS
P9620D	15	N	72	20	4	SENE		X	PUD	ORI	IRR	Chris Klein Ditch No. 8			2/28/1910			CHRIS KLEIN	Laramie River		0.45	CFS
C35/249A	15	N	72	20	5	NENW			PU	ORI			Colorado Land, Water & Live Stock Company	Unnamed Spring		STO	No Ditch			11/26/1909		
C35/249A	15	N	72	20	5	NENW		X	PUD	ORI			Colorado Land, Water & Live Stock Company	Unnamed Spring		STO	No Ditch			11/26/1909		

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Table DIX6-7. Surface Water Rights Within One-Half Mile of the Permit Area

Permit #	Township	Tns suffix	Range	Section	Quarter	Qtrqtr	Acres	Location	Status	Supply type	Adj New Use	Facility Name	Appropriation	An Source	An Priority	SW Uses	SW Facility Name	SW Applicant	SW Source	SW Priority	SW Una amt	SW Una unit
P13372D	15	N	72	20	5	NENW		X	PUD	ORI	STO, IRR	Spring Ditch			7/8/1913			THE COLORADO LAND WATER & LIVESTOCK CO. CORP.	Unnamed Spring		0.4	CFS
P13448D	15	N	72	20	5	NENW		X	PUD	ORI	STO	Spring Ditch			4/11/1913			GUS JOHNSON	SPRING		0.2	CFS
P9399D	15	N	72	20	5	NENW			PU	ORI	STO	No Ditch			11/26/1909			CHRIS KLEIN	Unnamed Spring		0.067	CFS
P9399D	15	N	72	20	5	NENW		X	PUD	ORI	STO	No Ditch			11/26/1909			CHRIS KLEIN	Unnamed Spring		0.067	CFS
C41/528A	15	N	72	28	11	SWSW			PU	ORI			C. H. Thornton	Thornton Springs		STO, DOM	Thornton Reservoir			6/29/1915		
C41/528A	15	N	72	28	11	SWSW		X	PUO	ORI			C. H. Thornton	Thornton Springs		STO, DOM	Thornton Reservoir			6/29/1915		
C41/529A	15	N	72	28	11	SWSW			PU	RES			C. H. Thornton	Thornton Springs		RES	Thornton Ditch No. 1			6/26/1915		
C41/529A	15	N	72	28	11	SWSW		X	PUD	RES			C. H. Thornton	Thornton Springs		RES	Thornton Ditch No. 1			6/26/1915		
C41/530A	15	N	72	28	11	SWSW			PU	RES			C. H. Thornton	Thornton Springs		RES	Thornton Ditch No. 2			6/26/1915		
C41/530A	15	N	72	28	11	SWSW		X	PUD	RES			C. H. Thornton	Thornton Springs		RES	Thornton Ditch No. 2			6/26/1915		
C41/531A	15	N	72	28	11	SWSW		X	PUD	RES			C. H. Thornton	Thornton Springs		RES	Thornton Ditch No. 3			9/12/1916		
C41/531A	15	N	72	28	11	SWSW			PU	RES			C. H. Thornton	Thornton Springs		RES	Thornton Ditch No. 3			9/12/1916		
P13255D	15	N	72	28	11	SWSW			PU	RES	RES, STO, DOM	Thornton Ditch No. 1			6/26/1915			C. H. THORNTON	Thornton Springs		0.056	CFS
P13255D	15	N	72	28	11	SWSW		X	PUD	RES	RES, STO, DOM	Thornton Ditch No. 1			6/26/1915			C. H. THORNTON	Thornton Springs		0.056	CFS
P13256D	15	N	72	28	11	SWSW			PU	RES	RES, STO, DOM	Thornton Ditch No. 2			6/26/1915			C. H. THORNTON	Thornton Springs		0.056	CFS
P13256D	15	N	72	28	11	SWSW		X	PUD	RES	RES, STO, DOM	Thornton Ditch No. 2			6/26/1915			C. H. THORNTON	Thornton Springs		0.056	CFS
P14411D	15	N	72	28	11	SWSW		X	PUD	RES	RES, STO, DOM	Thornton Ditch No. 3			9/12/1916			C. H. THORNTON	Thornton Springs		0.056	CFS
P14411D	15	N	72	28	11	SWSW			PU	RES	RES, STO, DOM	Thornton Ditch No. 3			9/12/1916			C. H. THORNTON	Thornton Springs		0.056	CFS
P2865R	15	N	72	28	11	SWSW			PU	ORI	STO, DOM	Thornton Reservoir			6/29/1915			C.H. THORNTON	Thornton Springs		0.2	ACFT
P2865R	15	N	72	28	11	SWSW		X	PUO	ORI	STO, DOM	Thornton Reservoir			6/29/1915			C.H. THORNTON	Thornton Springs		0.2	ACFT
C48/168A	15	N	73	12	13	NESE			ADJ	ORI			City of Laramie and the Union Pacific Rail Road Company	City Springs Creek		MUN, RAI	City Ditch and Pipe Line (Ditch)			12/31/1868		
C76/317A	15	N	73	12	13	NESE			ADJ	ORI			City of Cheyenne, Board of Public Utilities	Rose Creek		MUN, IND, IRR	Little Snake Diversion Pipe Line			3/12/1954		
C76/317A	15	N	73	12	13	NESE			ADJ	ORI			City of Cheyenne, Board of Public Utilities	Rose Creek		MUN, IND, IRR	Little Snake Diversion Pipe Line			3/12/1954		
C76/319A	15	N	73	12	13	NESE			ADJ	ORI			City of Cheyenne, Board of Public Utilities	Harrison Creek		MUN, IND, IRR	Little Snake Diversion Pipe Line			3/12/1954		
C76/319A	15	N	73	12	13	NESE			ADJ	ORI			City of Cheyenne, Board of Public Utilities	Harrison Creek		MUN, IND, IRR	Little Snake Diversion Pipe Line			3/12/1954		
C76/321A	15	N	73	12	13	NESE			ADJ	ORI			City of Cheyenne, Board of Public Utilities	Needle Creek		MUN, IND, IRR, RES	Little Snake Diversion Pipe Line			8/26/1964		

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Table DIX6-7. Surface Water Rights Within One-Half Mile of the Permit Area

Permit #	Township	Tns suffix	Range	Section	Quarter	Qtrqtr	Acres	Location	Status	Supply type	Adj New Use	Facility Name	Appropriation	An Source	An Priority	SW Uses	SW Facility Name	SW Applicant	SW Source	SW Priority	SW Una amt	SW Una unit
C76/321A	15	N	73	12	13	NESE			ADJ	ORI			City of Cheyenne, Board of Public Utilities	Needle Creek		MUN, IND, IRR, RES	Little Snake Diversion Pipe Line			8/26/1964		
P22129D	15	N	73	12	13	NESE			ADJ	ORI	IND, IRR, MUN	Little Snake Diversion Pipe Line			3/12/1954			CITY OF CHEYENNE	Rose Creek		10.52	CFS
P22130D	15	N	73	12	13	NESE			ADJ	ORI	IND, IRR, MUN	Little Snake Diversion Pipe Line			3/12/1954			CITY OF CHEYENNE	Harrison Creek		13.6	CFS
P23195D	15	N	73	12	13	NESE			ADJ	ORI	RES, IND, IRR, MUN	Little Snake Diversion Pipe Line			8/26/1964			CITY OF CHEYENNE	Needle Creek		9.26	CFS
C48/168A	15	N	73	12	14	NWSE			ADJ	ORI			City of Laramie and the Union Pacific Rail Road Company	City Springs Creek		MUN, RAI	City Ditch and Pipe Line (Ditch)			12/31/1868		
C76/317A	15	N	73	12	14	NWSE			ADJ	ORI			City of Cheyenne, Board of Public Utilities	Rose Creek		MUN, IND, IRR	Little Snake Diversion Pipe Line			3/12/1954		
C76/317A	15	N	73	12	14	NWSE			ADJ	ORI			City of Cheyenne, Board of Public Utilities	Rose Creek		MUN, IND, IRR	Little Snake Diversion Pipe Line			3/12/1954		
C76/319A	15	N	73	12	14	NWSE			ADJ	ORI			City of Cheyenne, Board of Public Utilities	Harrison Creek		MUN, IND, IRR	Little Snake Diversion Pipe Line			3/12/1954		
C76/319A	15	N	73	12	14	NWSE			ADJ	ORI			City of Cheyenne, Board of Public Utilities	Harrison Creek		MUN, IND, IRR	Little Snake Diversion Pipe Line			3/12/1954		
C76/321A	15	N	73	12	14	NWSE			ADJ	ORI			City of Cheyenne, Board of Public Utilities	Needle Creek		MUN, IND, IRR, RES	Little Snake Diversion Pipe Line			8/26/1964		
C76/321A	15	N	73	12	14	NWSE			ADJ	ORI			City of Cheyenne, Board of Public Utilities	Needle Creek		MUN, IND, IRR, RES	Little Snake Diversion Pipe Line			8/26/1964		
P22129D	15	N	73	12	14	NWSE			ADJ	ORI	IND, IRR, MUN	Little Snake Diversion Pipe Line			3/12/1954			CITY OF CHEYENNE	Rose Creek		10.52	CFS
P22130D	15	N	73	12	14	NWSE			ADJ	ORI	IND, IRR, MUN	Little Snake Diversion Pipe Line			3/12/1954			CITY OF CHEYENNE	Harrison Creek		13.6	CFS
P23195D	15	N	73	12	14	NWSE			ADJ	ORI	RES, IND, IRR, MUN	Little Snake Diversion Pipe Line			8/26/1964			CITY OF CHEYENNE	Needle Creek		9.26	CFS
P13894D	15	N	73	12	15	SWSE		X	PUD	ORI	RES	Links Ditch #3			2/16/1916			JAMES HUNT	Dry Creek		0	CFS
P17620D	15	N	73	13	2	NWNE		X	PUD	ORI	RES	Woodhouse Supply Canal			10/15/1929			INC ROSEDALE DAIRY CO.	Telephone Canyon		0	CFS
P18040D	15	N	73	14	13	NESE		X	PUD	ORI	STE, IRR, MIS, MUN, DOM	Pope Springs Pipe Line			7/29/1931			CITY OF LARAMIE	Pope Springs		3.8	CFS
P9370D	15	N	73	14					UNA		MUN, DOM	Transmission Pipeline			11/10/1909			CITY OF LARAMIE	Soldier Springs			
T269-	15	N	73	23	0		50		ADJ	ORI			Otto Gramm	Soldier Creek		IRR	Gramm Ditch No.3			10/31/1886		
T271-	15	N	73	23	0		50		ADJ	ORI			Otto Gramm	Soldier Creek		IRR	Gramm Ditch No. 4			3/27/1889		
T271-	15	N	73	23	9	NESW			PU	ORI			Otto Gramm	Soldier Creek		IRR	Gramm Ditch No. 4			3/27/1889		
C42/016A	15	N	73	23	12	SESW		X	PUD	ORI			City of Laramie	Soldier Springs		DOM, MUN, RAIL	Inlet Pipeline			11/10/1909		
CR1/015A	15	N	73	23	12	SESW			PU	ORI			Carl Piper	Soldier Creek		DOM, STO	Piper No. 1 Reservoir			7/31/1915		

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Table DIX6-7. Surface Water Rights Within One-Half Mile of the Permit Area

Permit #	Township	Tns suffix	Range	Section	Quarter	Qtrqtr	Acres	Location	Status	Supply type	Adj New Use	Facility Name	Appropriation	An Source	An Priority	SW Uses	SW Facility Name	SW Applicant	SW Source	SW Priority	SW Una amt	SW Una unit
CR1/015A	15	N	73	23	12	SESW		X	PUO	ORI			Carl Piper	Soldier Creek		DOM, STO	Piper No. 1 Reservoir			7/31/1915		
CR1/016A	15	N	73	23	12	SESW			PU	ORI			Carl Piper	Soldier Creek		DOM, STO	Piper No. 2 Reservoir			7/31/1915		
CR1/016A	15	N	73	23	12	SESW		X	PUO	ORI			Carl Piper	Soldier Creek		DOM, STO	Piper No. 2 Reservoir			7/31/1915		
CR1/017A	15	N	73	23	12	SESW			PU	ORI			Carl Piper	Soldier Creek		DOM, STO	Piper No. 3 Reservoir			7/31/1915		
CR1/017A	15	N	73	23	12	SESW		X	PUO	ORI			Carl Piper	Soldier Creek		DOM, STO	Piper No. 3 Reservoir			7/31/1915		
P13437D	15	N	73	23	12	SESW		X	PUD	ORI	RES	Turner Inlet No. 2			7/23/1912			G. A. TURNER	Soldier Creek		0	CFS
P2926R	15	N	73	23	12	SESW			PU	ORI	STO, DOM	Piper #1 Reservoir			7/31/1915			CARL PIPER	Soldier Creek		0.05	ACFT
P2926R	15	N	73	23	12	SESW		X	PUO	ORI	STO, DOM	Piper #1 Reservoir			7/31/1915			CARL PIPER	Soldier Creek		0.05	ACFT
P2927R	15	N	73	23	12	SESW			PU	ORI	STO, DOM	Piper #2 Reservoir			7/31/1915			CARL PIPER	Soldier Creek		0.05	ACFT
P2927R	15	N	73	23	12	SESW		X	PUO	ORI	STO, DOM	Piper #2 Reservoir			7/31/1915			CARL PIPER	Soldier Creek		0.05	ACFT
P2928R	15	N	73	23	12	SESW			PU	ORI	STO, DOM	Piper #3 Reservoir			7/31/1915			CARL PIPER	Soldier Creek		0.05	ACFT
P2928R	15	N	73	23	12	SESW		X	PUO	ORI	STO, DOM	Piper #3 Reservoir			7/31/1915			CARL PIPER	Soldier Creek		0.05	ACFT
P4788E	15	N	73	23	12	SESW		X	UNA	ORI	STE, IRR, MUN, DOM	Soldier Springs Pipe Line (Inlet Pipe Line). , First Enlargement of Use			7/29/1931			WYOMING CITY OF LARAMIE	Soldier Creek		3.2	CFS
P9342D	15	N	73	23	12	SESW		X	PUD	ORI	RES, MUN, DOM	Laramie City Ditch			10/26/1909			CITY OF LARAMIE	Soldier Creek			
T266-	15	N	73	23	12	SESW		X	PUD	ORI			Otto Gramm	Soldier Creek		IRR	Gramm Ditch No. 1 & 2			4/21/1885		
T266-	15	N	73	23	12	SESW		X	PUD	ORI			Otto Gramm	Soldier Creek		IRR	Gramm Ditch No. 1 & 2			4/21/1885		
T266-	15	N	73	23	12	SESW	0	X	ADJ	ORI			Otto Gramm	Soldier Creek		IRR	Gramm Ditch No. 1 & 2			4/21/1885		
T266-	15	N	73	23	12	SESW	0	X	ADJ	ORI			Otto Gramm	Soldier Creek		IRR	Gramm Ditch No. 1 & 2			4/21/1885		
T269-	15	N	73	23	12	SESW		X	PUD	ORI			Otto Gramm	Soldier Creek		IRR	Gramm Ditch No.3			10/31/1886		
T271-	15	N	73	23	12	SESW			PU	ORI			Otto Gramm	Soldier Creek		IRR	Gramm Ditch No. 4			3/27/1889		
T263-	15	N	73	23	15	SWSE			DSC	ORI			Charles Connors	Soldier Creek		STO	Home Ditch			5/31/1870		
T263-	15	N	73	23	15	SWSE			DSC	ORI			Charles Connors	Soldier Creek		STO	Home Ditch			5/31/1870		
T263-	15	N	73	23	15	SWSE		X	PUD	ORI			Charles Connors	Soldier Creek		STO	Home Ditch			5/31/1870		
T263-	15	N	73	23	15	SWSE		X	PUD	ORI			Charles Connors	Soldier Creek		STO	Home Ditch			5/31/1870		
T266-	15	N	73	23	15	SWSE		X	PUD	ORI			Otto Gramm	Soldier Creek		IRR	Gramm Ditch No. 1 & 2			4/21/1885		
T266-	15	N	73	23	15	SWSE		X	PUD	ORI			Otto Gramm	Soldier Creek		IRR	Gramm Ditch No. 1 & 2			4/21/1885		
T266-	15	N	73	23	15	SWSE			DSC	ORI			Otto Gramm	Soldier Creek		IRR	Gramm Ditch No. 1 & 2			4/21/1885		
T266-	15	N	73	23	15	SWSE			DSC	ORI			Otto Gramm	Soldier Creek		IRR	Gramm Ditch No. 1 & 2			4/21/1885		
T271-	15	N	73	23	15	SWSE		X	PUD	ORI			Otto Gramm	Soldier Creek		IRR	Gramm Ditch No. 4			3/27/1889		
P9369D	15	N	73	23					ADJ		MUN, DOM	Inlet Pipeline			11/10/1909			CITY OF LARAMIE	Soldier Creek			
CR9/030A	15	N	73	24	2	NWNE		X	PUO	ORI			Fred Piper	Fred Draw		STO	Piper No. 3 Stock Reservoir			10/23/1979		
CR9/030A	15	N	73	24	2	NWNE			PU	ORI			Fred Piper	Fred Draw		STO	Piper No. 3 Stock Reservoir			10/23/1979		
P8632S	15	N	73	24	2	NWNE		X	PUO	ORI	STO	Piper No. 3 Stock Reservoir			10/23/1979			FRED PIPER	Fred Draw		0.58	ACFT
P8632S	15	N	73	24	2	NWNE			PU	ORI	STO	Piper No. 3 Stock Reservoir			10/23/1979			FRED PIPER	Fred Draw		0.58	ACFT
P5145R	15	N	73	24	3	SWNE			PU	ORI	STO	No. I Reservoir			10/3/1939			CARL PIPER	Piper Draw No. 1		0.31	ACFT
P5145R	15	N	73	24	3	SWNE		X	PUO	ORI	STO	No. I Reservoir			10/3/1939			CARL PIPER	Piper Draw No. 1		0.31	ACFT
P5146R	15	N	73	24	3	SWNE		X	PUO	ORI	STO	No. 2 Reservoir			10/3/1939			CARL PIPER	Piper Draw		0.75	ACFT
P5146R	15	N	73	24	3	SWNE			PU	ORI	STO	No. 2 Reservoir			10/3/1939			CARL PIPER	Piper Draw		0.75	ACFT
P5146R	15	N	73	24	14	NWSE			PU	ORI	STO	No. 2 Reservoir			10/3/1939			CARL PIPER	Piper Draw		0.75	ACFT
P11180R	15	N	73	25	16	SESE	0	X	UNA	STR	WIL	Ania Reservoir			7/9/2001			Brian Waitkus	Walter's Draw		0.07	ACFT
T266-	15	N	73	26	0		50		ADJ	ORI			Otto Gramm	Soldier Creek		IRR	Gramm Ditch No. 1 & 2			4/21/1885		

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Table DIX6-7. Surface Water Rights Within One-Half Mile of the Permit Area

Permit #	Township	Tns suffix	Range	Section	Quarter	Qrtqtr	Acres	Location	Status	Supply type	Adj New Use	Facility Name	Appropriation	An Source	An Priority	SW Uses	SW Facility Name	SW Applicant	SW Source	SW Priority	SW Una amt	SW Una unit
T266-	15	N	73	26	0		50		ADJ	ORI			Otto Gramm	Soldier Creek		IRR	Gramm Ditch No. 1 & 2			4/21/1885		
C11/082A	15	N	73	26	2	NWNE	4		ADJ	ORI			Carl Piper	Springs		IRR	Piper Ditch No. 1			7/16/1900		
C12/028A	15	N	73	26	2	NWNE	1		ADJ	ORI			Carl Piper	Springs		IRR	Piper Ditch No. 2			7/16/1900		
P2719D	15	N	73	26	2	NWNE	4		ADJ	ORI	IRR	Piper Ditch No. 1			7/16/1900			CARL PIPER	Springs		0.13	CFS
P2719D	15	N	73	26	2	NWNE		X	PUD	ORI	IRR	Piper Ditch No. 1			7/16/1900			CARL PIPER	Springs		0.13	CFS
P2720D	15	N	73	26	2	NWNE	1		ADJ	ORI	IRR	Piper Ditch No. 2			7/16/1900			CARL PIPER	Springs		0.09	CFS
P2720D	15	N	73	26	2	NWNE		X	PUD	ORI	IRR	Piper Ditch No. 2			7/16/1900			CARL PIPER	Springs		0.09	CFS
C11/082A	15	N	73	26	5	NENW	5		ADJ	ORI			Carl Piper	Springs		IRR	Piper Ditch No. 1			7/16/1900		
C12/028A	15	N	73	26	5	NENW	5		ADJ	ORI			Carl Piper	Springs		IRR	Piper Ditch No. 2			7/16/1900		
P2719D	15	N	73	26	5	NENW	5		ADJ	ORI	IRR	Piper Ditch No. 1			7/16/1900			CARL PIPER	Springs		0.13	CFS
P2720D	15	N	73	26	5	NENW	5		ADJ	ORI	IRR	Piper Ditch No. 2			7/16/1900			CARL PIPER	Springs		0.09	CFS
T266-	15	N	73	26	5	NENW			PU	ORI			Otto Gramm	Soldier Creek		IRR	Gramm Ditch No. 1 & 2			4/21/1885		
T266-	15	N	73	26	5	NENW			PU	ORI			Otto Gramm	Soldier Creek		IRR	Gramm Ditch No. 1 & 2			4/21/1885		
P12731R	15	N	73	36	1	NENE	0	X	UNA	STR	IND	Etchepare Sediment Pond No. 1 Reservoir			10/9/2006			Mountain Cement Company	Soldier Creek		5.66	ACFT

SOURCE: Wyoming State Engineer's Office Water Rights Database, 09/02/2009.

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Water Rights Database Abbreviations

Water rights described in this database represent what is of record in our office as entered on the computer (many of the computer entries have not been proofed for accuracy and may not reflect the entire record about a water right or its current status). The office records may or may not reflect the actual situation on the ground. Failure to exercise a water right, for 5 years, when water is available, may constitute grounds for forfeiture.

ABBREVIATIONS FOR STATUS:
A&C=ABANDONED AND CANCELLED
ABA=ABANDONED
ADJ=ADJUDICATED
AME=AMENDED (LANDS MOVED TO NEW LOCATION NO LONGER UNDER THIS PERMIT)
CAN=CANCELLED
DSC=DESCRIPTION
E&C=ELIMINATED AND CANCELLED
ELI=ELIMINATED
EXP=EXPIRED
GSE=GOOD STANDING PERMITTED TIME LIMITS HAVE BEEN EXTENDED
GST=GOOD STANDING
GSM=GOOD STANDING BUT MAP IS STILL REQUIRED
GSI=GOOD STANDING INCOMPLETE-REQUIRED NOTICES NOT RECEIVED-NOT YET EXPIRED
OTH=OTHER
PU=POINT OF USE NON IRRIGATION (NOT ACTUAL STATUS)
PUD=POINT OF DIVERSION (NOT ACTUAL STATUS)
PUE=POINT OF EXTENSION (NOT ACTUAL STATUS)
PUH=POINT OF DIVERSION (NOT ACTUAL STATUS)
PUO=POINT OF RESERVOIR OUTLET (NOT ACTUAL STATUS)
PUW=LOCATION OF WELL (NOT ACTUAL STATUS)
REJ=REJECTED BY THE STATE ENGINEER
REC=LANDS RECEIVED FROM ANOTHER PERMIT

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Table DIX6-7. Surface Water Rights Within One-Half Mile of the Permit Area

Permit #	Township	Tns suffix	Range	Section	Quarter	Qrtqtr	Acres	Location	Status	Supply type	Adj New Use	Facility Name	Appropriation	An Source	An Priority	SW Uses	SW Facility Name	SW Applicant	SW Source	SW Priority	SW Una amt	SW Una unit

REM=REMAINING
TEM=TEMPORARY
TRA=TRANSFERRED TO ANOTHER FACILITY
UNA=UNADJUDICATED
?=NO ENTRY IN THE DATABASE FOR THIS APPROPRIATION

ABBREVIATIONS FOR USES:
AQU=AQUACULTURE
BAT=BATHING
CBM-COAL BED METHANE
CHE=CHEMICAL
CIF=CONSUMPTIVE INSTREAM FLOW
COM=COMMERCIAL
CNG=COAL BED NATURAL GAS
CUL=CULINARY
DEW=DEWATERING
DOM=DOMESTIC
DRI=DRILLING
DSP=DOMESTIC SUPPLY
ENV=ENVIRONMENTAL
ERO=EROSION CONTROL
FIR=FIRE PROTECTION
FIS=FISH PROPAGATION
FLO=FLOOD CONTROL
FTH=FLOW THROUGH NON-CONSUMPTIVE
GWR=GROUND WATER RECHARGE
HEX=HEAT EXTRACTION
ICE=ICE CUTTING
IND=INDUSTRIAL
IRR=IRRIGATION
ISF=INSTREAM FLOW
MAI=MAINTENANCE
MAN=MANUFACTURING
MEC=MECHANICAL
MED=MEDICINAL
MIL=MILLING
MIN=MINING
MIS=MISCELLANEOUS
MON=MONITORING
MUN=MUNICIPAL
OIL=OIL REFINING/PRODUCTION
POW=POWER DEVELOPMENT
RAI=RAILROAD
REC=RECREATION
REF=REFINING
RES=RESERVOIR SUPPLY
SED=SEDIMENTATION
STE=STEAM ENGINE
STO=STOCK
TEM=TEMPORARY USE
TST=TEST WELL
UTI=PUBLIC UTILITY
W&S=WILD & SCENIC
WET=WETLANDS

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Table DIX6-7. Surface Water Rights Within One-Half Mile of the Permit Area

Permit #	Township	Tns suffix	Range	Section	Quarter	Qtrqtr	Acres	Location	Status	Supply type	Adj New Use	Facility Name	Appropriation	An Source	An Priority	SW Uses	SW Facility Name	SW Applicant	SW Source	SW Priority	SW Una amt	SW Una unit

WIL=WILDLIFE

ABBREVIATIONS FOR SUPPLY TYPES (SupTy):
ADD=ADDITIONAL SUPPLY FROM A WELL
ORI=ORIGINAL SUPPLY
STR=STORAGE SUPPLY (FOR RESERVOIR AND STOCK RESERVOIR PERMITS-MAY NOT APPEAR ON OLDER PERMITS)
SEC=SUPPLY FROM A RESERVOIR
SUP=SUPPLEMENTAL SUPPLY FROM ANOTHER SURFACE WATER SOURCE
SWS=SURFACE WATER SUPPLY (USED FOR FIRST SURFACE WATER SUPPLY FOR EXISTING GROUNDWATER SUPPLY)
RECORD SUFFIXES ARE DENOTED AS FOLLOWS:
A=ADJUDICATED (FINALIZED) RIGHTS; UNLESS THE RIGHT IS A TERRITORIAL APPROPRIATION, THERE WILL BE A MATCH IN THE AppNm COLUMN FROM ONE OF THE FOLLOWING PERMIT TYPES FOR THE UNADJUDICATED PORTION
C=WELL STATEMENTS OF CLAIM, FILED FROM 1947 TO 1957 FOR WELLS COMPLETED PRIOR TO APRIL 1, 1947
D=DITCH OR PIPELINE PERMIT
G= WELL REGISTRATIONS, FILED FOR WELLS COMPLETED AFTER APRIL 1, 1947
E=ENLARGEMENT OF A DITCH OR PIPELINE PERMIT
P=STOCK AND DOMESTIC USE WELLS COMPLETED PRIOR TO MAY 24, 1969 AND REGISTERED WITH THE STATE ENGINEER'S OFFICE PRIOR TO DECEMBER 31, 1972
R=RESERVOIR PERMIT
S=STOCK RESERVOIR PERMIT
U=UTAH PERMIT RECORDED IN UTAH; LANDS IN WYOMING
"W" PERMITS ARE FOR WELLS WITH A PRIORITY DATE FOR THE DATE OF FILING WITH THE STATE ENGINEER
RECORD PREFIXES ARE DENOTED AS FOLLOWS:
B= BEAR CREEK COURT DECREE
D= BALDWIN CREEK COURT DECREE
E= CLEAR CREEK COURT DECREE
H= HORSE CREEK COURT DECREE
K= CROW CREEK COURT DECREE
L= LARAMIE RIVER COURT DECREE
M= CRAZY WOMAN CREEK COURT DECREE
R= ROCK CREEK COURT DECREE
S= SWEETWATER CREEK COURT DECREE
T-TERRITORIAL APPROPRIATION
AN "X" IN THE LOC (LOCATION) FIELD INDICATES THE LOCATION OF A HEADGATE FOR A DITCH OR PIPELINE, AN OUTLET FOR A RESERVOIR OR STOCK RESERVOIR OR THE LOCATION OF WELL

THE FOLLOWING QUARTER-QUARTERS ARE DESIGNATED BY THE "Qtr" FIELD:
1=NE¼NE¼
2=NW¼NE¼
3=SW¼NE¼
4=SE¼NE¼
5=NE¼NW¼
6=NW¼NW¼
7=SW¼NW¼
8=SE¼NW¼
9=NE¼SW¼
10=NW¼SW¼
11=SW¼SW¼
12=SE¼SW¼
13=NE¼SE¼
14=NW¼SE¼
15=SW¼SE¼
16=SE¼SE¼

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Table DIX6-8. Groundwater Rights Within Three Miles of the Permit Area

PERMIT	PRIORITY	STATUS	TOWNSHIP	TNS_SUFFIX	RANGE	RNG_SUFFIX	SECTION	QTR	QTRQTR	LATITUDE	LONGITUDE	APPLICANT	FACILITY NAME	USES	YLD ACT	WELL DEPTH	STATIC DEPTH	MWBZ TOP	MWBZ BOTTOM	WELL LOG	CHEMICAL
P102500W	35216	GST	14	N	72	W	3	1	NENE	41.217	-105.4448	JOHN/HOLLY DORST	DORST #1	DOM	2	425	160	300	425	Yes	No
P98779W	34792	GST	14	N	72	W	3	1	NENE	41.217	-105.4448	DOUG BRYANT	MAUKA #1	DOM	7	265	106	160	250	Yes	No
P133074W	36965	GST	14	N	72	W	3	1	NENE	41.217	-105.4448	JEFFREY COUTURE / SHEILA ATWOOD	JEFF # 1	DOM	5	400	106	220	380	Yes	No
P109408W	35880	UNA	14	N	72	W	3	4	SENE	41.21343	-105.4447	HANRY F/KATHLEEN A WILLIAMS	WILLIAMS #1	DOM	0	0	0	0	0	No	
P106854W	35635	GST	14	N	72	W	3	5	NENW	41.21704	-105.4544	E ROBERT/JANE M ADAMS	BJADAMS #9	DOM	25	235	45	220	230	Yes	No
P106426W	35599	GST	14	N	72	W	3	6	NWNW	41.21706	-105.4591	JOHN P/MARY P ADAMS	ADAMS WELL #1	DOM	5	203	75	160	203	Yes	No
P115992W	36308	GST	14	N	72	W	3	6	NWNW	41.21706	-105.4591	MARGARET J KLINE	KLINE WELL #1	DOM	18	200	45	160	175	Yes	No
P101402W	35110	GST	14	N	72	W	3	9	NESW	41.20989	-105.4542	RICHARD FIGLIUZZI	RF1	DOM	5	400	185	265	400	Yes	No
P103296W	35278	GST	14	N	72	W	3	10	NWSW	41.20991	-105.459	JIM/CAROL MUNFORD	MUNFORD #1	DOM	4	425	153	245	425	Yes	No
P100729W	34992	GSE	14	N	72	W	3	11	SWSW	41.20633	-105.4589	JAMES L MEYERS	LONGVIEW #1	DOM,STO	0	0	0	0	0	No	
P99826W	34901	GST	14	N	72	W	3	11	SWSW	41.20633	-105.4589	LISA LINDEMANN	RECHARGE RANCH #1	DOM,STO	5	440	157	390	440	Yes	No
P108817W	35824	GST	14	N	72	W	3	12	SESW	41.2063	-105.4541	CHARLES M/DEBBIE A FANNING	FANNING #1	DOM	5	300	140	130	210	Yes	No
P19563P	366	GST	14	N	72	W	3	13	NESE	41.20984	-105.4446	WILLIAMS LAND & LIVESTOCK CO.	DOUBLE X RANCH #12	DOM,STO	15	4	0	Unknown	Unknown	No	No
P143437W	37348	GST	14	N	72	W	3	13	NESE	41.20984	-105.4446	DARYL/MARCIA LIPPINCOTT	THE BLUE GOOSE	DOM	5	600	140	520	580	Yes	No
P148804W	37636	GST	14	N	72	W	3	13	NESE	41.20984	-105.4446	ERIC J BRECHT	BRECHT #1	DOM	3	600	122	400	6000	Yes	No
P96838W	34575	GST	14	N	72	W	3	16	SESE	41.20624	-105.4445	PRONGHORN CONSTRUCTION, LTD	VAT #110 SPRING	DOM,STO	15	3	-4	0	0	Yes	No
P19569P	3834	GST	14	N	72	W	4	1	NENE	41.21707	-105.4639	WILLIAMS LAND & LIVESTOCK CO.	DOUBLE X RANCH #20	STO	10	3	0	Unknown	Unknown	No	No
P19570P	3865	GST	14	N	72	W	4	1	NENE	41.21707	-105.4639	WILLIAMS LAND & LIVESTOCK CO.	DOUBLE X RANCH #19	DOM	5	3	0	Unknown	Unknown	No	No
P102148W	35181	GST	14	N	72	W	4	3	SWNE	41.21349	-105.4686	WILLIAM HEMENOVER	HEMENOVER #1	DOM	3	500	270	480	505	Yes	No
P151714W	37776	GSI	14	N	72	W	4	4	SENE	41.2135	-105.4638	BRENT DOUGLAS AND LIZ YOUNG	ROCKAWAY #19	DOM						No	
P168611W	38533	GSI	14	N	72	W	4	4	SENE	41.2135	-105.4638	JOHN & SANDY MYERS	MYERS #1	DOM						No	
P121656W	36532	GST	14	N	72	W	4	5	NENW	41.21708	-105.4735	ELLIOT JOHNSON	E. JOHNSON #1	DOM	5	600	213	500	600	Yes	No
P111804W	36054	GST	14	N	72	W	4	9	NESW	41.20989	-105.4733	STEVEN/DONNA HODDER	Hodder #1	DOM	10	600	194	560	580	Yes	Yes
P147688W	37554	GST	14	N	72	W	4	14	NWSE	41.20991	-105.4685	ROBERT/JANE KITCHIN	KITCHIN #1	DOM	10	600	214	520	560	Yes	No
P19564P	14426	GST	14	N	72	W	5	5	NENW	41.21711	-105.4926	WILLIAMS LAND & LIVESTOCK CO.	DOUBLE X RANCH #8	STO	7	60	50	Unknown	Unknown	No	No
P127132W	36735	GST	14	N	72	W	5	5	NENW	41.21711	-105.4926	COTTON HOLDINGS, L.L.C.	COTTON #1	DOM,STO	20	240	160	160	240	Yes	No
P19580P	13666	GST	14	N	72	W	5	15	SWSE	41.20628	-105.4875	WILLIAMS LAND & LIVESTOCK CO.	DOUBLE X RANCH #7	STO	7	60	55	Unknown	Unknown	No	No
P160767W	38182	GSI	14	N	72	W	5	16	SESE	41.20628	-105.4827	BOB BOYSEN	BOYSEN #1	DOM						No	
P19565P	14061	GST	14	N	72	W	6	14	NWSE	41.20996	-105.5068	WILLIAMS LAND & LIVESTOCK CO.	DOUBLE X RANCH #6	STO	7	67	62	Unknown	Unknown	No	No
P19581P	14092	GST	14	N	72	W	7	8	SENW	41.19918	-105.5114	WILLIAMS LAND & LIVESTOCK CO.	DOUBLE X RANCH #5	STO	7	160	150	Unknown	Unknown	No	No
P19574P	8948	GST	14	N	72	W	9	11	SWSW	41.1919	-105.4779	WILLIAMS LAND & LIVESTOCK CO.	DOUBLE X #15	STO	10	6	0	Unknown	Unknown	No	No
P87343W	33675	GST	14	N	72	W	14	1	NENE	41.18817	-105.4254	STEVE M & CORRINE L SHEAFFER	CABIN #1	DOM	3	42	17	17	42	Yes	No
P19577P	8948	GST	14	N	72	W	17	1	NENE	41.1883	-105.4827	WILLIAMS LAND & LIVESTOCK CO.	DOUBLE X #11	STO	10	10	0	Unknown	Unknown	No	No
P149013W	37651	GST	14	N	73	W	1	3	SWNE	41.21389	-105.5236	DAVID J. RAPSON AND SHELLEY B. FAHNA	R & F #1	DOM	10	340	171	240	340	Yes	No
P152025W	37788	GST	14	N	73	W	1	4	SENE	41.21383	-105.5208	JENELLE R GADDIS	SPOON BAR #1	DOM,STO	10	320	139	260	320	Yes	No
P38303W	28291	GST	14	N	73	W	2	1	NENE	41.21755	-105.5399	RONALD W. AND GLENNA L. MARRS	STRUM 1	DOM,STO	12	246	186	196	240	Yes	No
P38304W	28291	GST	14	N	73	W	2	5	NENW	41.21764	-105.5495	FRANCIS D/LINDSAYS S GALEY	COULBOURN 1	DOM	20	255	152	200	250	Yes	No
P102243W	35191	GST	14	N	73	W	2	6	NWNW	41.21769	-105.5543	JOHN PERRY	PERRY #1	DOM,STO	18	80	60	60	80	Yes	No
P73055W	31639	GST	14	N	73	W	2	7	SWNW	41.21461	-105.5542	FRANCIS D/LINDSAYS S GALEY	LYMAN #1	STO	7	250	158	Unknown	240	Yes	No
P5769W	25730	GST	14	N	73	W	2	8	SENW	41.21449	-105.5494	THE DIRT FARM	BROW #3 (DEEPENED)	DOM,STO	25	200	80	110	215	Yes	No
P49103W	29046	GST	14	N	73	W	2	10	NWSW	41.21098	-105.5541	THOMAS E. BURRIS	BURRIS #1	DOM,STO	25	90	30	60	90	Yes	No
P5768W	25730	ADJ	14	N	73	W	2	10	NWSW	41.21098	-105.5541	THE DIRT FARM	BROW #2	STO,IRR	750	215	75	105	215	Yes	No
P72982W	31615	GST	14	N	73	W	2	10	NWSW	41.21098	-105.5541	ROBERT C. & LOUISE M. SEXTON	SEXTON #2	DOM,STO	25	90	36	60	80	Yes	Yes
P5767W	25730	GST	14	N	73	W	2	11	SWSW	41.20736	-105.5539	THE DIRT FARM	BROW #1	DOM	25	200	55	110	215	Yes	Yes
P75328W	32008	GST	14	N	73	W	2	11	SWSW	41.20736	-105.5539	JON JAMES SWECKARD	SWECK #1	DOM	13	140	60	100	140	Yes	No
P25334P	1827	GST	14	N	73	W	3	3	SWNE	41.21467	-105.5638	CASH CATTLE CO. INC	CASH #1	DOM,STO	25	8	1	Unknown	Unknown	No	No
P477C	9862	GST	14	N	73	W	4	12	SESW	41.20754	-105.5876	MONOLITH PORTLAND MIDWEST CO.	STOCK WELL #3	STO	75	237	30	Unknown	Unknown	No	
P3482P	10857	GST	14	N	73	W	10	16	SESE	41.19291	-105.5587	OTTO LEMBCKE	HOMESTEAD WELL #1	STO	10	120	40			No	
P3480P	23095	GST	14	N	73	W	11	14	NWSE	41.19719	-105.5442	OTTO LEMBCKE	RAILROAD WELL #1	STO	8	195	80	0		Yes	
P19579P	13301	GST	14	N	73	W	12	8	SENW	41.19952	-105.5299	WILLIAMS LAND & LIVESTOCK CO.	DOUBLE X RANCH #9	STO	7	70	65	Unknown	Unknown	No	No

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PERMIT	PRIORITY	STATUS	TOWNSHIP	TNS_SUFFIX	RANGE	RNG_SUFFIX	SECTION	QTR	QTRQTR	LATITUDE	LONGITUDE	APPLICANT	FACILITY NAME	USES	YLD ACT	WELL DEPTH	STATIC DEPTH	MWBZ TOP	MWBZ BOTTOM	WELL LOG	CHEMICAL
P3487P	7204	GST	14	N	73	W	13	12	SESW	41.17792	-105.53	OTTO LEMBCKE	SAWMILL WELL #1	STO	20	240	80			No	
P17742P	8750	GST	14	N	73	W	14	10	NWSW	41.1818	-105.5541	O. R. BELL**O. W. ROSE**CARL M. OCCH	THOMPSON #1	DOM,STO	5	60	20	Unknown	Unknown	No	No
P59464W	29977	GST	14	N	73	W	14	11	SWSW	41.17811	-105.5542	WILLIAM R. DALEY	DALEY #7	DOM,STO	25	165	93	145	165	Yes	No
P104799W	35447	GST	15	N	72	W	6	2	NWNE	41.30444	-105.5075	WILLIAM/GAY DEITRICH MACLEAN	WEM #1	DOM	13	380	246	190	380	Yes	No
P7213P	21451	GST	15	N	72	W	6	8	SENW	41.30087	-105.5123	HAROLD G. POND**ELVIRA POND	MARY #1	DOM,STO	10	310	284			No	
P7216P	21717	GST	15	N	72	W	6	8	SENW	41.30087	-105.5123	DON C. DUNLAVY**ANNA DUNLAVY	ANNA #1	DOM,STO	10	300	280			No	
P110663W	35969	GST	15	N	72	W	6	8	SENW	41.30087	-105.5123	LARRY D/MARY H HAYDEN-WING	HAYDEN-WING #1	DOM	13	340	161	180	340	Yes	No
P82843W	33044	GST	15	N	72	W	6	8	SENW	41.30087	-105.5123	DAVID W. KOCH	KOCH-1	DOM,STO	15	305	185	185	305	Yes	No
P143350W	37341	GST	15	N	72	W	6	8	SENW	41.30087	-105.5123	DONALD L. / TERESA L. JARVIS	DON JARVIS-1	DOM	10	400	243	280	400	Yes	No
P64233W	30470	GST	15	N	72	W	6	9	NESW	41.29724	-105.5122	BRADLEY D. & CHRISTINE M. EHLER	EHLER #1	DOM	10	355	175	275	355	Yes	No
P82588W	33022	GST	15	N	72	W	6	9	NESW	41.29724	-105.5122	TOM AND DONNA WHITSON	WHITSON #1	DOM	10	365	195	195	365	Yes	Yes
P82739W	33044	GST	15	N	72	W	6	9	NESW	41.29724	-105.5122	LESLIE A. AND DARNALL	DARNALL #1	DOM	10	330	200	200	330	Yes	Yes
P87572W	33702	GST	15	N	72	W	6	9	NESW	41.29724	-105.5122	RANDI S. MARTINSEN**JAMES R. STEIDTM	MARTINSEN #1	DOM	10	350	130	290	350	Yes	No
P87573W	33702	GST	15	N	72	W	6	9	NESW	41.29724	-105.5122	GEORGE AND PENNY REX	REX #1	DOM	10	340	120	300	340	Yes	No
P91130W	34065	GST	15	N	72	W	6	9	NESW	41.29724	-105.5122	JAMES AND DEBORAH MYERS	MYERS #1	DOM	10	340	162	300	340	Yes	No
P96067W	34528	GST	15	N	72	W	6	9	NESW	41.29724	-105.5122	KELLY W. STEINER	STEINER #1	DOM,STO	10	300	115	220	280	Yes	No
P118568W	36403	GST	15	N	72	W	6	10	NWSW	41.2973	-105.5165	FRANK BARROW	BARROWS #1	DOM	10	320	141	200	320	Yes	No
P92916W	34206	GST	15	N	72	W	6	10	NWSW	41.2973	-105.5165	CHARLES AND MARY DOLAN	DOLAN #1	DOM	10	280	145	240	280	Yes	No
P8764P	7570	GST	15	N	72	W	6	11	SWSW	41.29366	-105.5165	WARREN LIVE STOCK CO.	#1 BERNER MILL	STO	7	280	-1	Unknown	Unknown	No	No
P102189W	35186	GST	15	N	72	W	6	11	SWSW	41.29366	-105.5165	DAVID PESTOTNIK	PESTOTNIK WELL #2	DOM	10	320	150	200	300	Yes	No
P104497W	35390	GST	15	N	72	W	6	11	SWSW	41.29366	-105.5165	GLENN/NANCY HALSEY	HALSEY #1	DOM	10	340	161	260	300	Yes	No
P92885W	34226	GST	15	N	72	W	6	11	SWSW	41.29366	-105.5165	ROBERT M. AND SANDRA A. HONKEN	HONKEN #1	DOM,STO	7	320	155	280	300	Yes	No
P92886W	34226	GST	15	N	72	W	6	11	SWSW	41.29366	-105.5165	DR. DOUGLAS AND TERRI HONKEN	HONKEN #2	DOM,STO	10	340	162	280	340	Yes	No
P94642W	34395	GST	15	N	72	W	6	11	SWSW	41.29366	-105.5165	RICHARD J. COLLING	COLLING #2	DOM	10	340	145	300	340	Yes	No
P96040W	34515	GST	15	N	72	W	6	11	SWSW	41.29366	-105.5165	TIM SULLIVAN	SULLIVAN #1	DOM	10	300	149	260	300	Yes	No
P99073W	34821	GST	15	N	72	W	6	11	SWSW	41.29366	-105.5165	PINECONE INDUSTRIES, INC.	PINECONE #1	DOM	10	320	147	250	300	Yes	No
P136005W	37068	GST	15	N	72	W	6	11	SWSW	41.29366	-105.5165	CHARLES D. AND LYNN BENSON	BENSON # 1	DOM	10	360	160	320	340	Yes	No
P50618W	29174	GST	15	N	72	W	6	12	SESW	41.29361	-105.5121	WAYNE LANNING	LANNING #1	DOM	12	340	174	260	340	Yes	Yes
P50745W	29209	GST	15	N	72	W	6	12	SESW	41.29361	-105.5121	CHARLES EDGAR & GLORIA JEAN BELL	BELL #1	DOM	12	345	183	265	340	Yes	No
P57854W	29809	GST	15	N	72	W	6	12	SESW	41.29361	-105.5121	DALE C. & ANITA W. BRENTLINGER	BRENTLINGER #1	DOM,STO	7	365	167	246	347	Yes	No
P100045W	34933	GST	15	N	72	W	6	12	SESW	41.29361	-105.5121	JAMES J PAVLOVICH	PAVLOVICH #1	DOM	15	350	174	330	350	Yes	No
P95044W	34447	GST	15	N	72	W	6	12	SESW	41.29361	-105.5121	RAY AND PATRICIA MELLAS	HOKABE #1	DOM,STO	7	320	152	250	300	Yes	No
P50866W	29228	GST	15	N	72	W	6	14	NWSE	41.29715	-105.5074	HAROLD G. POND	DEEP #1	DOM	22	425	214	Unknown	Unknown	Yes	No
P7214P	24978	GST	15	N	72	W	6	14	NWSE	41.29715	-105.5074	RONALD C. SURDAM**JOYCE A. SURDAM	MARY #2	DOM,STO	10	320	280	277	320	Yes	No
P30657W	27610	GST	15	N	72	W	6	15	SWSE	41.29352	-105.5073	CARL F. PULS	PULS #1	DOM	15	71	10	30	42	Yes	No
P39792W	28376	GST	15	N	72	W	6	15	SWSE	41.29352	-105.5073	JOHN H. & JOANNE M. GEORGE	GEORGE #1	DOM	12	400	230	325	375	Yes	No
P9912W	26148	GST	15	N	72	W	6	15	SWSE	41.29352	-105.5073	PAUL R/CHRISTINE K WADE	WYATT'S #2	DOM	25	310	100	0	0	No	No
P71907W	31450	GST	15	N	72	W	6	15	SWSE	41.29352	-105.5073	JAY DEE & JULIE C. SCHAEFER	SCHAEFER #1	DOM	15	400	188	300	380	Yes	No
39/5/29W	38849	UNA	15	N	72	W	6	15	SWSE	41.29352	-105.5073	MERAV BENDAVID	35 BLACK ELK	DOM,STO						No	
P475W	22304	GST	15	N	72	W	6	16	SESE	41.29342	-105.5026	EDGAR RINEHART	RINEHART #1	DOM	5	380	100	365		Yes	
P91409W	34082	GST	15	N	72	W	6	16	SESE	41.29342	-105.5026	BRIAN F. AND SHELLEY J. TOWLER	TOWLER #1	DOM	8	425	265	380	425	No	No
P153272W	37830	GSI	15	N	72	W	6	16	SESE	41.29342	-105.5026	FOREST RAGLAND	RAGLAND 1	DOM						No	
P159096W	38124	GST	15	N	72	W	6	16	SESE	41.29342	-105.5026	WALDO ROTH	ROTH 1	DOM,STO	15	400	210	300	400	Yes	No
P131638W	36886	GST	15	N	72	W	7	2	NWNE	41.28989	-105.5073	PAUL G JR. REVOCABLE TRUST. ETCHEPAR	LAYCOCK SPRING WELL # 1	DOM,STO	13	400	182	280	400	Yes	No
P96994W	34596	GST	15	N	72	W	7	6	NWNW	41.28999	-105.5165	GEORGE HEARD	HEARD #1	DOM	10	300	128	200	300	Yes	No
P92885W	34226	GST	15	N	72	W	7	7	SWNW	41.28632	-105.5165	ROBERT M. AND SANDRA A. HONKEN	HONKEN #1	DOM,STO	7	320	155	280	300	Yes	No
P150325W	37719	GST	15	N	72	W	7	7	SWNW	41.28632	-105.5165	WILLIAM L. HANSEN	WM. HANSEN # 1	DOM	10	340	154	240	340	Yes	No
P98131W	34708	GST	15	N	72	W	7	11	SWSW	41.279	-105.5166	CITY OF LARAMIE	LARAMIE EAST #1	MON	0	325	182	0	0	Yes	No
P106853W	35608	GST	15	N	72	W	7	12	SESW	41.27896	-105.5121	CITY OF LARAMIE	LARAMIE EAST QUARRY #2	MON	0	301	197	253	301	Yes	No
P98132W	34708	GST	15	N	72	W	7	12	SESW	41.27896	-105.5121	CITY OF LARAMIE	LARAMIE EAST #2	MON	0	301	197	253	0	Yes	No

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Table DIX6-8. Groundwater Rights Within Three Miles of the Permit Area

PERMIT	PRIORITY	STATUS	TOWNSHIP	TNS_SUFFIX	RANGE	RNG_SUFFIX	SECTION	QTR	QTRQTR	LATITUDE	LONGITUDE	APPLICANT	FACILITY NAME	USES	YLD ACT	WELL DEPTH	STATIC DEPTH	MWBZ TOP	MWBZ BOTTOM	WELL LOG	CHEMICAL
P151006W	37743	GST	15	N	72	W	7	12	SESW	41.27896	-105.5121	THOMAS & KAREN BIENZ	ROCK AND A HARD PLACE WELL	DOM	25	400	187	330	340	Yes	No
P8765P	15605	GST	15	N	72	W	8	13	NESE	41.28273	-105.4834	JHD RANCH, LLC	#2 DUMMY MILL	STO	5	240	-1	Unknown	Unknown	No	No
P2553W	22646	GST	15	N	72	W	14	2	NWNE	41.27516	-105.4307	U.S. FOREST SERVICE	RIM ROCK SPRING #1	STO	5	5	-4	1	5	No	
P71442W	31357	GST	15	N	72	W	14	15	SWSE	41.26436	-105.4305	USDI FOREST SERVICE	U S F S #2	STO	2	25	13	13	Unknown	Yes	Yes
P2558W	18993	GST	15	N	72	W	15	3	SWNE	41.27183	-105.4498	U.S. FOREST SERVICE	BUCK SULLIVAN SPRING #1	STO	5	6	-4	1	2	No	
P106852W	35608	GST	15	N	72	W	18	5	NENW	41.27531	-105.5121	CITY OF LARAMIE	LARAMIE EAST QUARRY #1	MON	0	325	181	296	325	Yes	No
P98131W	34708	GST	15	N	72	W	18	5	NENW	41.27531	-105.5121	CITY OF LARAMIE	LARAMIE EAST #1	MON	0	325	182	0	0	Yes	No
P8769P	14875	GST	15	N	72	W	19	11	SWSW	41.24993	-105.5163	WARREN LIVE STOCK CO.	#6 KASSAHN MILL	STO	7	240	-1	Unknown	Unknown	No	No
P8770P	20353	GST	15	N	72	W	20	1	NENE	41.26095	-105.4831	JHD RANCH, LLC	#7 KLEIN SPRINGS MILL	STO	10	160	-1	Unknown	Unknown	No	No
P80876W	32776	GST	15	N	72	W	20	5	NENW	41.26083	-105.4926	WARREN LIVESTOCK CO.**USDI, BLM	KLEIN SPRING	STO	5	2	-4	Unknown	Unknown	No	No
P2557W	22646	GST	15	N	72	W	23	4	SENE	41.25697	-105.4258	U.S. FOREST SERVICE	BEACON SPRING #1	STO	5	5	-4	1	5	No	
P1171W	23469		15	N	72	W	23	9	NESW	41.25371	-105.4354	USDA FOREST SERVICE	TIE CITY SPRING	MIS	15	6	1	3	Unknown	Yes	No
P1178W	23488		15	N	72	W	23	9	NESW	41.25371	-105.4354	USDA FOREST SERVICE	LOWER TIE CITY #1	MIS	60	50	2	48	Unknown	Yes	No
P1180W	23488		15	N	72	W	23	12	SESW	41.25004	-105.4354	USDA FOREST SERVICE	UPPER TIE CITY #2	MIS	4	69	19	60	Unknown	Yes	No
P48866W	28979		15	N	72	W	23	14	NWSE	41.25353	-105.4306	REGION TWO USDA FOREST SERVICE	TIE CITY (LOWER) CAMPGROUND	MIS	5	60	22	37	60	Yes	No
P1166W	23468		15	N	72	W	23	15	SWSE	41.24989	-105.4306	USDA FOREST SERVICE	UPPER TIE CITY WELL #1	STO,MIS	10	35	20	25	Unknown	No	No
P61563W	30159	GST	15	N	72	W	24	5	NENW	41.26043	-105.4162	USA USDA FOREST SERVICE	K-C-SPRING 04-013	STO	25	5	-4	Unknown	Unknown	No	No
P1179W	23488		15	N	72	W	24	14	NWSE	41.25314	-105.4116	USDA FOREST SERVICE	YELLOW PINE #1	MIS	7	79	52	72	Unknown	Yes	No
P1176W	23488		15	N	72	W	24	15	SWSE	41.24953	-105.4116	USDA FOREST SERVICE	POLE CREEK #1	MIS	7	55	15	0	Unknown	No	No
P1177W	23488		15	N	72	W	24	15	SWSE	41.24953	-105.4116	USDA FOREST SERVICE	POLE CREEK #2	MIS	6	53	16	51	Unknown	Yes	No
P2180W	24922	ADJ	15	N	72	W	26	12	SESW	41.23524	-105.4351	WYOMING STATE HIGHWAY DEPARTMENT	SUMMIT REST AREA #1	MIS	15	222	27	27	222	Yes	No
P2181W	24922	ADJ	15	N	72	W	26	12	SESW	41.23524	-105.4351	WYOMING STATE HIGHWAY DEPARTMENT	SUMMIT REST AREA #2	MIS	10	202	25	24	202	Yes	No
P142927W	37306	UNA	15	N	72	W	26	12	SESW	41.23524	-105.4351	WYOMING DEPARTMENT OF TRANSPORTATION	ENL. SUMMIT REST AREA # 2	MIS	8	202	24.55	24	202	Yes	No
P80875W	32776	GST	15	N	72	W	28	10	NWSW	41.23919	-105.4782	WARREN LIVESTOCK CO.	GOVERNMENT SPRING	STO	5	2	-4	Unknown	Unknown	No	No
P8767P	13048	GST	15	N	72	W	28	13	NESE	41.2391	-105.4639	WARREN LIVE STOCK CO.	4 GOVERNMENT CANYON MILL	STO	7	165	-1	Unknown	Unknown	No	No
P8772P	11953	GST	15	N	72	W	29	12	SESW	41.23556	-105.4925	JHD RANCH, LLC	#9 PEANUT CANYON MILL	STO	10	80	-1	Unknown	Unknown	No	No
P8766P	21449	GST	15	N	72	W	33	3	SWNE	41.22825	-105.4686	WARREN LIVE STOCK CO.	#3 FRENCHY MILL	STO	5	190	-1	Unknown	Unknown	No	No
P83086W	33085	ADJ	15	N	72	W	35	2	NWNE	41.23145	-105.4304	WYOMING STATE HIGHWAY DEPT.	SUMMIT #4 WELL	MIS	25	77	13	21	66	Yes	Yes
P1165W	23469		15	N	72	W	35	5	NENW	41.23148	-105.4351	USDA FOREST SERVICE	HIDDEN VALLEY WELL #1	MIS	6	50	10	0	Unknown	No	No
P17934P	14245	GST	15	N	73	W	1	4	SENE	41.30096	-105.5209	WILLIAM Q. DESPAIN**DEANNA J. DESPAI	DESPAIN #1	STO	20	250	180	Unknown	Unknown	No	No
P7215P	23151	GST	15	N	73	W	1	4	SENE	41.30096	-105.5209	DAVID POND**MARY ETTA POND	MARY ETTA #1	DOM,STO	10	114	100	0		No	
P332G	20092	GST	15	N	73	W	1	7	SWNW	41.3009	-105.5353	THE GRAND STREET BOYS	RICE WELL	DOM,STO	6	130	72	104	130	Yes	
P39294W	28331	ADJ	15	N	73	W	1	7	SWNW	41.3009	-105.5353	GRAND STREET BOYS	BONE AND JOINT #1	MIS	20	140	64	100	125	Yes	Yes
P173003W	38705	GSI	15	N	73	W	1	7	SWNW	41.3009	-105.5353	LARAMIE VALLEY CHAPEL	LVC #1	MIS						No	
P29200W	27457	GST	15	N	73	W	1	9	NESW	41.29725	-105.5305	JOHN & JUDY SPIEGELBERG	JOHN & JUDY SPIEGELBERG #1	DOM	25	172	90	0	0	Yes	No
P29204W	27458	GST	15	N	73	W	1	9	NESW	41.29725	-105.5305	THOMAS A. AND LORA B. WESCHE	JOHNSON #1	DOM	25	150	97	0	0	Yes	No
P9098W	26078	GST	15	N	73	W	1	9	NESW	41.29725	-105.5305	M. E. DENZIN	DENZIN #2	DOM	20	180	130	155	180	Yes	No
P83018W	33080	GST	15	N	73	W	1	9	NESW	41.29725	-105.5305	RALPH E. STROUF	MISENHELTER #2	DOM	10	180	65	120	160	Yes	No
P1827W	24479	GST	15	N	73	W	1	10	NWSW	41.29722	-105.5353	PAUL SANDELS	SANDELS #1	DOM	10	104	59	75	104	Yes	
P3039P	24076	GST	15	N	73	W	1	10	NWSW	41.29722	-105.5353	DONALD G. RECTOR	RECTOR #1	DOM	25	135	62	0		Yes	
P28112P	27306	GST	15	N	73	W	1	10	NWSW	41.29722	-105.5353	MARSHALL COCKRAN	COCKRAN #1	DOM	25	125	35	0	0	No	No
P35807W	28136	GST	15	N	73	W	1	10	NWSW	41.29722	-105.5353	RICHARD A/SHAREE L WERON	STAHL #1	DOM	10	136	44	80	120	Yes	No
P41423W	28502	GST	15	N	73	W	1	10	NWSW	41.29722	-105.5353	RICHARD A/SHAREE L WERON	ENL STAHL #1	DOM	15	136	44	100	125	Yes	No
P48790W	29034	GST	15	N	73	W	1	10	NWSW	41.29722	-105.5353	STEVEN O. YUNDT**E. GENE YUNDT	YUNDT 1	DOM	12	140	47	100	140	Yes	No
P50744W	29207	GST	15	N	73	W	1	10	NWSW	41.29722	-105.5353	S. W. & GLADYS VOGEL	VOGEL #2	DOM	10	145	51	125	145	Yes	No
P53127W	29439	GST	15	N	73	W	1	10	NWSW	41.29722	-105.5353	LEWIS & BARBARA VAVRA	VAVRA #1	DOM,STO	12	145	61	100	145	Yes	No
P60347W	30068	GST	15	N	73	W	1	10	NWSW	41.29722	-105.5353	MICHAEL & CHRISTINE FLUTY	MIKE FLUTY #1	DOM	15	145	48	125	145	Yes	No
P62406W	30251	ADJ	15	N	73	W	1	10	NWSW	41.29722	-105.5353	VISTA VIEW ENTERPRISES**JOSEPH & BEN	MORENO #1	MIS	20	190	45	Unknown	Unknown	No	No
P93491W	34292	GST	15	N	73	W	1	10	NWSW	41.29722	-105.5353	JIM RECTOR	JIM #1	DOM	8	140	63	100	120	Yes	No
P99001W	34817	UNA	15	N	73	W	1	10	NWSW	41.29722	-105.5353	ANIMAL HEALTH CENTER L.L.C.	ANIMAL CENTER #1	MIS	20	150	54	100	150	Yes	No

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Table DIX6-8. Groundwater Rights Within Three Miles of the Permit Area

PERMIT	PRIORITY	STATUS	TOWNSHIP	TNS_SUFFIX	RANGE	RNG_SUFFIX	SECTION	QTR	QTRQTR	LATITUDE	LONGITUDE	APPLICANT	FACILITY NAME	USES	YLD ACT	WELL DEPTH	STATIC DEPTH	MWBZ TOP	MWBZ BOTTOM	WELL LOG	CHEMICAL
P17232P	21366	GST	15	N	73	W	1	11	SWSW	41.2947	-105.5353	ROBERT E. & EVELYN J. HASKELL	HASKELL #1	DOM	5	140	80	Unknown	Unknown	No	No
P29563P	27486	GST	15	N	73	W	1	11	SWSW	41.2947	-105.5353	H. W. & R. M. KENNEDY	KENNEDY #1	DOM	10	140	24	0	0	No	No
P31961W	27785	GST	15	N	73	W	1	11	SWSW	41.2947	-105.5353	NORMAN BOCK	BOCK #1	DOM	12	115	60	75	100	Yes	Yes
P36683W	28209	GST	15	N	73	W	1	11	SWSW	41.2947	-105.5353	STEVE M. SHEAFFER	SHEAFFER #1	DOM	12	140	39	118	140	Yes	No
P36820W	28213	GST	15	N	73	W	1	11	SWSW	41.2947	-105.5353	KEITH A. & JANE H. WOOLF	WOOLF #1	DOM	12	120	50	78	110	Yes	No
P37517W	28205	GST	15	N	73	W	1	11	SWSW	41.2947	-105.5353	ROBERT H. & LINDA G. SUTHERLAND	SUTHERLAND #1	DOM	15	93	60	0	0	No	No
P44236P	28689	GST	15	N	73	W	1	11	SWSW	41.2947	-105.5353	DANIEL C. & DORIS D. HUTTO	HUTTO 1	DOM,STO	10	141	78	0	0	No	No
P46354W	28879	GST	15	N	73	W	1	11	SWSW	41.2947	-105.5353	JAMES R. AND E. ADELE ENDICOTT	ENDICOTT #1	DOM	12	145	45	125	145	Yes	No
P6955W	25881	GST	15	N	73	W	1	11	SWSW	41.2947	-105.5353	K. E. NEELY**MERRY J. NEELY	NEELY #1	DOM	10	142	58	58	119	Yes	
P9828W	26140	GST	15	N	73	W	1	11	SWSW	41.2947	-105.5353	KENNETH W. TURNER**EDITH K. TURNER	TURNER #1	DOM	25	115	65	0	0	No	No
P51053W	29262	GST	15	N	73	W	1	11	SWSW	41.2947	-105.5353	RAYMOND E. SMITHSON	SMITHSON #1	DOM	25	165	47	85	165	Yes	No
P68776W	30971	GST	15	N	73	W	1	11	SWSW	41.2947	-105.5353	WILLIAM G. & MARILYN B. HEPWORTH	HEPWORTH #1	DOM,STO	12	115	49	80	100	Yes	No
P75083W	31959	GST	15	N	73	W	1	11	SWSW	41.2947	-105.5353	JOHN F. HARRISON	JFH #1	DOM	13	140	44	115	135	Yes	No
P110176W	35937	GST	15	N	73	W	1	11	SWSW	41.2947	-105.5353	CHARLES DUNLAP	DUNLAP #1	DOM	10	140	82	100	140	Yes	No
P115628W	36286	GST	15	N	73	W	1	11	SWSW	41.2947	-105.5353	GILBERT GARCIA/WANDA McGUIRE	GIL #1	DOM	10	160	57	120	160	Yes	Yes
P120109W	36453	GST	15	N	73	W	1	11	SWSW	41.2947	-105.5353	JOHN BRUCE EMBURY	Embury 1	DOM	25	160	56	120	160	Yes	No
P134178W	36999	GST	15	N	73	W	1	11	SWSW	41.2947	-105.5353	VIRGINIA A. / RICHARD C. ROMERO	ROMERO # 1	DOM,STO	13	180	45	120	180	Yes	No
P149944W	37694	GST	15	N	73	W	1	11	SWSW	41.2947	-105.5353	GLORIA J. THOMSON	THOMSON # 1	DOM	13	143	50.5	Unknown	Unknown	No	No
P371G	20218	UNA	15	N	73	W	1	12	SESW	41.29474	-105.5305	EDWARD N. BREAULT	DOT #1	IRR,DOM	40	112	77	98	112	Yes	
P1186W	23487	GST	15	N	73	W	1	12	SESW	41.29474	-105.5305	ED N. BREAULT	BREAULT #2	DOM	20	100	70	93		Yes	
P1663W	24236	GST	15	N	73	W	1	12	SESW	41.29474	-105.5305	FLOYD W. MCMICHAEL	MCMICHAEL #1	DOM	18	132	72	110	120	Yes	
P1776W	24319	GST	15	N	73	W	1	12	SESW	41.29474	-105.5305	EARL R. BEAN	BEAN #1	DOM	15	97	65	60	90	Yes	
P64834W	30517	GST	15	N	73	W	1	12	SESW	41.29474	-105.5305	ROBERT H. & LINDA G. SUTHERLAND	SUTHERLAND WELL #2	DOM	13	140	51	100	140	Yes	No
P97404W	34621	GST	15	N	73	W	1	12	SESW	41.29474	-105.5305	JAMES W. & DONNA LEE WHITCOMB	WHITCOMB #1	DOM	10	140	71	100	140	Yes	No
P134626W	37014	GST	15	N	73	W	1	12	SESW	41.29474	-105.5305	GEORGE / JUNE FRISON	FRISON -1	DOM	10	160	77	123	160	Yes	No
P149430W	37676	GST	15	N	73	W	1	12	SESW	41.29474	-105.5305	CONRAD & LYDIA KERCHER	ONE WELL	DOM	13	140	74	100	140	Yes	No
P168760W	38523	GSI	15	N	73	W	1	12	SESW	41.29474	-105.5305	CARL L. & CHRISTINE D. REYNOLDS	ORIOLE LANE #2	DOM						No	
P170191W	38623	GSI	15	N	73	W	1	12	SESW	41.29474	-105.5305	CORNERSTONE BUILDING & DEVELOPMENT I	CORNERSTONE #1	DOM						No	
P14030W	26450	GST	15	N	73	W	1	13	NESE	41.29731	-105.5209	ROBERT D. GUNN	GUNN #1	DOM	10	189	140	179	190	Yes	No
P14178W	26407	GST	15	N	73	W	1	13	NESE	41.29731	-105.5209	KEITH C. & DOROTHY L. BERKS	FULTON WATER -#336	DOM	15	197	135	152	197	Yes	No
P14588W	26463	GST	15	N	73	W	1	13	NESE	41.29731	-105.5209	JAMES W. ADAMS	JAMES W ADAMS #1	DOM	10	250	105	210	250	Yes	No
P27625W	27248	GST	15	N	73	W	1	13	NESE	41.29731	-105.5209	JON P. & ANGELA I. HOWDESHELL	HOWDESHELL #1	DOM	10	200	122	178	200	Yes	Yes
P33005W	27887	GST	15	N	73	W	1	13	NESE	41.29731	-105.5209	THOMAS D. & SYLVIA F. CROCKER	CROCKER #1	DOM	12	180	129	165	180	Yes	No
P54635W	29543		15	N	73	W	1	13	NESE	41.29731	-105.5209	GARY VINER	VINER #1		12	245	136	165	245	Yes	No
P55635W	29636	GST	15	N	73	W	1	13	NESE	41.29731	-105.5209	NORVAL L. & DORTHY J. SINGER	SINGER #1	DOM	10	205	95	165	200	Yes	Yes
P57676W	29803	GST	15	N	73	W	1	13	NESE	41.29731	-105.5209	HAROLD H. GILE**KATHLEEN A. POLLARE	KATHYS WELL 1 (ONE)	DOM	15	180	135	165	180	Yes	No
P64267W	30475	GST	15	N	73	W	1	13	NESE	41.29731	-105.5209	RICHARD A. & DIANE D. HEPPNER	HEPPNER #1	DOM	10	295	129	175	275	Yes	No
P75242W	31993	GST	15	N	73	W	1	13	NESE	41.29731	-105.5209	PAUL M. & SUSAN J. HARNSBERGER	HARNSBERGER #1	DOM	13	245	136	165	245	Yes	Yes
P86343W	33520	GST	15	N	73	W	1	13	NESE	41.29731	-105.5209	PRAIRIE HOMES INC.	NICHOLLS #2	DOM	10	200	160	180	190	Yes	No
P2335W	25041	GST	15	N	73	W	1	14	NWSE	41.29727	-105.5257	CLIFFORD D. FERRIS	FERRIS #1	DOM	15	180	105	140	180	No	
P3166P	25320	GST	15	N	73	W	1	14	NWSE	41.29727	-105.5257	WM. E. & BARBARA A. BITTNER	BOSWELL #1	DOM	12	176	50	0		Yes	
P3167P	25335	GST	15	N	73	W	1	14	NWSE	41.29727	-105.5257	KEITH ENSLEY	ENSLEY #1	DOM	12	155	90	0		Yes	
P3067P	24894	GST	15	N	73	W	1	14	NWSE	41.29727	-105.5257	M.E. DENZIN	DENZIN #1	DOM	10	150	121	0		Yes	
P14178W	26407	GST	15	N	73	W	1	14	NWSE	41.29727	-105.5257	KEITH C. & DOROTHY L. BERKS	FULTON WATER -#336	DOM	15	197	135	152	197	Yes	No
P29386W	27491	GST	15	N	73	W	1	14	NWSE	41.29727	-105.5257	RICHARD D. NICHOLLS	NICHOLLS #1	DOM	12	190	120	0	0	Yes	No
P33945W	27940	GST	15	N	73	W	1	14	NWSE	41.29727	-105.5257	WILLIAM R. & ELAINE R. MCGRAW	MCGRAW #1	DOM	9	197	135	167	197	Yes	No
P33946W	27940	GST	15	N	73	W	1	14	NWSE	41.29727	-105.5257	EARL F. & MILDRED L. MATHERS	MCGRAW #2	DOM	15	185	123	155	185	Yes	No
P35758W	28055	UNA	15	N	73	W	1	14	NWSE	41.29727	-105.5257	CITY OF LARAMIE**ALBANY COUNTY WYOMI	HUNTOON #1	MIS	0	182	121	142	180	Yes	No
P40108W	28391	GST	15	N	73	W	1	14	NWSE	41.29727	-105.5257	FRANK H. & LOUISE R. MOORE	MOORE #1	DOM	15	180	112	168	180	Yes	No
P45784W	28802	GST	15	N	73	W	1	14	NWSE	41.29727	-105.5257	MILE-HI REALTY	COBBLESTONE #6	DOM	12	225	122	150	220	Yes	No

Table DIX6-8. Groundwater Rights Within Three Miles of the Permit Area

PERMIT	PRIORITY	STATUS	TOWNSHIP	TNS_SUFFIX	RANGE	RNG_SUFFIX	SECTION	QTR	QTRQTR	LATITUDE	LONGITUDE	APPLICANT	FACILITY NAME	USES	YLD ACT	WELL DEPTH	STATIC DEPTH	MWBZ TOP	MWBZ BOTTOM	WELL LOG	CHEMICAL
P8290W	25995	GST	15	N	73	W	1	14	NWSE	41.29727	-105.5257	BILL WYATT	WYATT'S #1	DOM	20	170	90	135	155	Yes	No
P56746W	29711	GST	15	N	73	W	1	14	NWSE	41.29727	-105.5257	DAVID J. & JEANNE M. DUVALL	DUVALL #1	DOM	15	225	135	165	205	Yes	No
P75611W	32049	GST	15	N	73	W	1	14	NWSE	41.29727	-105.5257	LESTER L. BARNSON	DIANE #1 D & L	DOM	12	200	96	140	180	Yes	Yes
P85404W	33413	GST	15	N	73	W	1	14	NWSE	41.29727	-105.5257	SCOTT H. AND GAYLE A. ROBERTSON	ROBERTSON #1	DOM	18	240	120	220	240	Yes	Yes
P91956W	34136	GST	15	N	73	W	1	14	NWSE	41.29727	-105.5257	RYN INC.	SHERMAN HILLS 7-17	DOM	13	190	108	140	180	Yes	No
P14178W	26407	GST	15	N	73	W	1	15	SWSE	41.29358	-105.5257	KEITH C. & DOROTHY L. BERKS	FULTON WATER -#336	DOM	15	197	135	152	197	Yes	No
P27101W	27207	GST	15	N	73	W	1	15	SWSE	41.29358	-105.5257	RUSSELL L. & MARGARET K. WAMBEAM	WAMBEAM #1	DOM	10	170	60	150	170	Yes	No
P27350W	27187	GST	15	N	73	W	1	15	SWSE	41.29358	-105.5257	WILLIAM T. CARTER	CARTER #1	DOM	22	200	120	160	180	Yes	Yes
P29390W	27498	GST	15	N	73	W	1	15	SWSE	41.29358	-105.5257	WALTER E. SCHLUMPF	SCHLUMPF #1	DOM	10	150	135	0	0	Yes	No
P84597W	33311	GST	15	N	73	W	1	15	SWSE	41.29358	-105.5257	HELEN SEIFERT	SEIFERT #1	DOM	10	180	106	160	180	Yes	No
P97590W	34628	GST	15	N	73	W	1	15	SWSE	41.29358	-105.5257	ANDY SMITH	SMITH #1	DOM	10	200	121	160	195	Yes	No
P75484W	32022	GST	15	N	73	W	1	16	SESE	41.29364	-105.5209	RODNEY L. REDDING	REDDING #1	DOM	10	260	132	220	260	Yes	No
P14178W	26407	GST	15	N	73	W	1	16	SESE	41.29364	-105.5209	KEITH C. & DOROTHY L. BERKS	FULTON WATER -#336	DOM	15	197	135	152	197	Yes	No
P22448W	26763	GST	15	N	73	W	1	16	SESE	41.29364	-105.5209	RUDOLPH SUCHARDA	SUCHARDA #1	DOM	25	180	175	175	180	Yes	Yes
P24586W	26921	GST	15	N	73	W	1	16	SESE	41.29364	-105.5209	ROY M. BRECKENRIDGE	BRECKENRIDGE #1	DOM	15	184	100	0	0	Yes	No
P24726W	26949	GST	15	N	73	W	1	16	SESE	41.29364	-105.5209	DONALD W. & INGRID F. SEAY	SEAY #1	DOM	10	198	60	67	198	Yes	No
P26038W	27106	GST	15	N	73	W	1	16	SESE	41.29364	-105.5209	JAMES & SALLY RICHARD	RICHARD #1	DOM	25	175	110	149	175	Yes	No
P30239W	27571	GST	15	N	73	W	1	16	SESE	41.29364	-105.5209	DANIAL A. & JANET C. NETZEL	NETZEL #1	DOM	10	175	130	0	0	Yes	No
P30947W	27659	GST	15	N	73	W	1	16	SESE	41.29364	-105.5209	WAYNE P. TURCATO	TURCATO #1	DOM	12	200	135	175	200	Yes	No
P31059W	27660	GST	15	N	73	W	1	16	SESE	41.29364	-105.5209	GERALD LEBEDA	LEBEDA 1	DOM	15	198	127	170	198	Yes	No
P36385W	28191	GST	15	N	73	W	1	16	SESE	41.29364	-105.5209	JOHN P. WARNOCK	FISHER #1	DOM	7	255	126	5	250	Yes	No
P36886W	28216	GST	15	N	73	W	1	16	SESE	41.29364	-105.5209	FOUAD HOSSAM EL DIN AND LINDA ANN KO	SONNET #1	DOM	7	172	121	121	168	Yes	No
P37271W	28216	GST	15	N	73	W	1	16	SESE	41.29364	-105.5209	MICHAEL J. & SHARON DUNLAY	DUNLAY #1	DOM	12	131	51	90	120	Yes	No
P37280W	28228	GST	15	N	73	W	1	16	SESE	41.29364	-105.5209	SHELBY D. & JANET L. GERKING	STUCHLIK #1	DOM	8	212	129	205	206	Yes	No
P39386W	28345	GST	15	N	73	W	1	16	SESE	41.29364	-105.5209	LAURN W. & ELOISE D. WILHELM	WILHELM #1	DOM	12	240	160	160	240	Yes	No
P62643W	30273	GST	15	N	73	W	1	16	SESE	41.29364	-105.5209	STEVEN C. & CINDY L. YEOMAN	HURD #1	DOM	12	250	136	210	250	Yes	No
P63014W	30336	GST	15	N	73	W	1	16	SESE	41.29364	-105.5209	JOHN W. HURD	HURD #2	DOM	12	250	124	165	250	Yes	No
P63639W	30405	GST	15	N	73	W	1	16	SESE	41.29364	-105.5209	WILLIAM A. & JANET M. WOLF	WOLF #1	DOM	12	200	108	170	195	Yes	No
P63781W	30403	GST	15	N	73	W	1	16	SESE	41.29364	-105.5209	JON JAMES SWECKARD	SHERMAN 8301	DOM	10	170	114	130	170	Yes	No
P64837W	30523	GST	15	N	73	W	1	16	SESE	41.29364	-105.5209	T. A. SPILLIOS	T A SPILLIOS #1	DOM	13	250	109	210	250	Yes	No
P64838W	30525	GST	15	N	73	W	1	16	SESE	41.29364	-105.5209	JEFF & DEBRA BARRETT	BARRETT #1	DOM	13	210	119	170	210	Yes	No
P65267W	30553	GST	15	N	73	W	1	16	SESE	41.29364	-105.5209	YOUNG ROBERT A. & JANET E.	YOUNG #1	DOM	10	250	119	210	220	Yes	No
P68998W	31000	GST	15	N	73	W	1	16	SESE	41.29364	-105.5209	JOHN P. WARNOCK	ENL FISHER #1	DOM	5	255	126	210	250	Yes	No
P78252W	32430	GST	15	N	73	W	1	16	SESE	41.29364	-105.5209	JOHN JACKSON	JACKSON #2	DOM	10	260	127	180	260	Yes	No
P80311W	32714	GST	15	N	73	W	1	16	SESE	41.29364	-105.5209	RICHARD B. AND ELIZABETH H. SOUTHWEL	SOUTHWELL #1	DOM	15	250	125	230	250	Yes	Yes
P102063W	35171	UNA	15	N	73	W	1	16	SESE	41.29364	-105.5209	GLENN LEE JOHNSON	JOHNSON #1	DOM,STO	0	0	0	0	0	No	
P102064W	35171	GST	15	N	73	W	1	16	SESE	41.29364	-105.5209	GLENN LEE JOHNSON	JOHNSON #2	DOM,STO	13	260	125	240	260	Yes	No
P94810W	34417	GST	15	N	73	W	1	16	SESE	41.29364	-105.5209	ROGER AND PAT MCMICHEAL	MCMICHEAL #1	DOM	10	250	142	210	240	Yes	No
P95566W	34487	GST	15	N	73	W	1	16	SESE	41.29364	-105.5209	TOM RAINES	RAINES #1	DOM	8	320	147	280	300	Yes	No
P168908W	38520	GST	15	N	73	W	1	16	SESE	41.29364	-105.5209	DANNY L. & SHERRY L. REYNOLDS	REYNOLDS #1	DOM	25	300	165	240	300	Yes	No
P170575W	38644	GSI	15	N	73	W	2	2	NWNE	41.30448	-105.545	LARAMIE COUNTY COMMUNITY COLLEGE FOU	LCCC - WW #1	MIS						No	
P170576W	38644	GSI	15	N	73	W	2	2	NWNE	41.30448	-105.545	LARAMIE COUNTY COMMUNITY COLLEGE FOU	LCCC - WW #2	MIS						No	
P16157P	22067	GST	15	N	73	W	2	4	SENE	41.30088	-105.5401	PAUL W. & STELLA C. HOEL	HOEL #1	STO	0	125	-1	0	Unknown	No	Yes
38/1/517W	38792	UNA	15	N	73	W	2	4	SENE	41.30088	-105.5401	M & W INVESTMENTS	M&W INVESTMENTS -1	MIS						No	
P55507W	29616	ADJ	15	N	73	W	2	5	NENW	41.30446	-105.5498	CITY OF LARAMIE	TURNER #1	MUN	1400	240	6	85	240	Yes	Yes
P61724W	29887	ADJ	15	N	73	W	2	5	NENW	41.30446	-105.5498	CITY OF LARAMIE	ENL TURNER #1	MUN	800	240	6	85	240	Yes	Yes
P72689W	31568	ADJ	15	N	73	W	2	5	NENW	41.30446	-105.5498	CITY OF LARAMIE	ENL TURNER #1	MUN	300	240	9	85	240	Yes	Yes
P98011W	34684	GST	15	N	73	W	2	5	NENW	41.30446	-105.5498	CITY OF LARAMIE	TURNER #1 (1941)	MON	0	238	3	118	238	Yes	No
38/4/516W	38792	UNA	15	N	73	W	2	6	NWNW	41.30445	-105.5547	MATTHEW B. CLARK	KINGHILL WELL - 1	DOM						No	
P321G	20073	UNA	15	N	73	W	2	8	SENW	41.30084	-105.5498	MAX L. KRUEGER	KRUEGER WATER WELL	CUL,STO,IRR,DOM	0	110	43	62	110	Yes	

TFN 5 1/110

Table DIX6-8. Groundwater Rights Within Three Miles of the Permit Area

PERMIT	PRIORITY	STATUS	TOWNSHIP	TNS_SUFFIX	RANGE	RNG_SUFFIX	SECTION	QTR	QTRQTR	LATITUDE	LONGITUDE	APPLICANT	FACILITY NAME	USES	YLD ACT	WELL DEPTH	STATIC DEPTH	MWBZ TOP	MWBZ BOTTOM	WELL LOG	CHEMICAL
P99778W	34897	GST	15	N	73	W	2	8	SENW	41.30084	-105.5498	CITY OF LARAMIE	SHFCA-1	MON	0	360	18	300	360	Yes	No
P28014W	27299	GST	15	N	73	W	2	11	SWSW	41.29467	-105.5546	DONALD JONES	JONES #2	DOM	5	102	39	0	0	Yes	No
P321G	20073	UNA	15	N	73	W	2	14	NWSE	41.29719	-105.5449	MAX L. KRUEGER	KRUEGER WATER WELL	CUL,STO,IRR,DOM	0	110	43	62	110	Yes	
P145G	19204	UNA	15	N	73	W	2	15	SWSE	41.29468	-105.5449	MERLE HAMBY	HAMBY WELL	CUL,STO,IRR,DOM	40	97	60	90	97	Yes	
P148G	19213	UNA	15	N	73	W	2	15	SWSE	41.29468	-105.5449	MAXINE E. CHRISTENSEN	CHRISTENSEN WELL	STO,IRR,DOM	30	111	53	75	103	Yes	
P36906W	28185	GST	15	N	73	W	2	15	SWSE	41.29468	-105.5449	KERRY C. CHRISTENSEN	MACLAND #1	DOM	11	120	48	98	120	No	No
P99779W	34897	GST	15	N	73	W	2	15	SWSE	41.29468	-105.5449	CITY OF LARAMIE	SHFCA-2	MON	0	295	24	230	295	Yes	No
P136001W	37067	GST	15	N	73	W	2	15	SWSE	41.29468	-105.5449	REVIS MCELHENEY	MCELHENEY -1	DOM,STO	13	140	15	104	140	Yes	No
P56550W	29705	GST	15	N	73	W	2	16	SESE	41.29282	-105.5401	MARK A. SCOTT**RICHARD G. DUNN	D & S #1	DOM	15	105	39	85	105	Yes	No
P101265W	35086	GST	15	N	73	W	2	16	SESE	41.29282	-105.5401	ARVIN MARTINEZ	MARTINEZ #1	DOM	12	120	30	60	100	Yes	No
P144G	19193	UNA	15	N	73	W	2	16	SESE	41.29282	-105.5401	JULIE DUFFY	DUFFY WELL	STO,IRR,DOM	200	89	60	81	89	Yes	
P45194W	28760	GST	15	N	73	W	2	16	SESE	41.29282	-105.5401	ALVIN L. & WANDA B. CHAMBERLAIN	CHAMBERLAIN #1	DOM,STO	12	125	30	95	120	Yes	No
P63921W	30428	GST	15	N	73	W	2	16	SESE	41.29282	-105.5401	STEVEN J. & TAMARA T. LINSE	B & P PARTNERSHIP #1	DOM	8	135	50	129	135	Yes	No
P80298W	32706	GST	15	N	73	W	2	16	SESE	41.29282	-105.5401	MARK A. AND DEBRA L. SHANAHAN	SHANAHAN #1	DOM	15	140	50	90	150	Yes	No
P84941W	33353	GST	15	N	73	W	2	16	SESE	41.29282	-105.5401	DENNIS G. LESTER	LESTER #1	DOM,STO	13	120	26	90	100	Yes	No
P95607W	34491	GST	15	N	73	W	2	16	SESE	41.29282	-105.5401	DOUG & KELLY GAPTER	GAPTER #1	DOM	13	120	48	100	120	Yes	No
P88152W	33756	GST	15	N	73	W	3	1	NENE	41.30443	-105.5595	JARVIS A. BARTLETT	BARTLETT #1	DOM	25	165	1	0	0	Yes	No
P91042W	34044	GST	15	N	73	W	3	1	NENE	41.30443	-105.5595	JARVIS A. AND THELMA L. BARTLETT	BARTLETT #2	DOM	10	110	15	0	0	No	No
P91043W	34044	GST	15	N	73	W	3	1	NENE	41.30443	-105.5595	JARVIS A. AND THELMA L. BARTLETT	BARTLETT #3	DOM	7	45	10	0	0	No	No
P91044W	34044	GST	15	N	73	W	3	1	NENE	41.30443	-105.5595	JARVIS A. AND THELMA L. BARTLETT	BARTLETT #4	DOM	8	30	6	0	0	No	No
P99777W	34897	GST	15	N	73	W	3	1	NENE	41.30443	-105.5595	CITY OF LARAMIE	LAPFOR-1	MON	0	75	2	64	75	Yes	No
P99776W	34897	GST	15	N	73	W	3	2	NWNE	41.30441	-105.5644	CITY OF LARAMIE	LAPCA-1	MON	0	475	46	388	475	Yes	No
P25334P	1827	GST	15	N	73	W	3	3	SWNE	41.30078	-105.5643	CASH CATTLE CO. INC	CASH #1	DOM,STO	25	8	1	Unknown	Unknown	No	No
P303C	18901231	UNA	15	N	73	W	3	4	SENE	41.3008	-105.5595	UNION REALTY CO.	UNION REALTY COMPANY'S #2	STO,IND,IRR,DO	65	350	-1	Unknown	Unknown	No	
P99780W	34897	GST	15	N	73	W	3	4	SENE	41.3008	-105.5595	CITY OF LARAMIE	LAPRELE #1	MON	0	880	48	389	880	Yes	No
P89244W	33829	GST	15	N	73	W	3	8	SENW	41.30076	-105.5691	DARREL L. AND EDITH M. GODDARD	GODDARD #1	DOM	20	100	20	0	0	No	No
P115627W	36286	GST	15	N	73	W	3	10	NWSW	41.29715	-105.5739	DEREK/KEYSA GOTSCHALL	GOTSCHALL #1	DOM,STO	10	50	7	5	18	Yes	No
P13998P	14976	GST	15	N	73	W	3	11	SWSW	41.2947	-105.5739	LLOYD A. & ALTA R. LACY	EGBERT #2	DOM,STO	25	300	3	Unknown	Unknown	No	Yes
P13999P	14976	GST	15	N	73	W	3	11	SWSW	41.2947	-105.5739	LLOYD A. & ALTA R. LACY	EGBERT #1	DOM,STO	25	559	3	Unknown	Unknown	No	Yes
P105645W	35524	ADJ	15	N	73	W	3	13	NESE	41.29715	-105.5595	GARY J & SHIRLEY J LINFORD	PFEIFER #1	DOM,STO	25	460	-4	450	460	Yes	Yes
P110657W	35961	ADJ	15	N	73	W	3	13	NESE	41.29715	-105.5595	GARY J & SHIRLEY J LINFORD	PFEIFER #2	DOM	25	160	35	60	140	Yes	No
P111105W	35983	ADJ	15	N	73	W	3	13	NESE	41.29715	-105.5595	GARY J & SHIRLEY J LINFORD	Enl Pfeifer #2	MIS	75	160	35	60	80	Yes	No
P116690W	36329	ADJ	15	N	73	W	3	13	NESE	41.29715	-105.5595	GARY J & SHIRLEY J LINFORD	ENL PFEIFER #1	DOM,STO,MIS	25	460	-4	450	460	Yes	No
P59110W	29949	ADJ	15	N	73	W	3	15	SWSE	41.29285	-105.564	INC. UNITARIAN FELLOWSHIP OF LARAMIE	CHURCH #1	MIS	15	145	24	105	140	Yes	Yes
P100553W	34984	GST	15	N	73	W	3	15	SWSE	41.29285	-105.564	RACHEL CROWE	ISRAELSON #1	DOM	8	180	27	140	160	Yes	No
P10680P	13393	GST	15	N	73	W	8	4	SENE	41.28678	-105.5955	HARRIS F. PETERSON**JO ELLEN PETERSO	PETERSON #1	DOM	10	40	8	Unknown	Unknown	No	No
P10681P	13666	GST	15	N	73	W	8	4	SENE	41.28678	-105.5955	HARRIS F. PETERSON**JO ELLEN PETERSO	PETERSON #2	DOM	17	65	8	Unknown	Unknown	No	No
P10683P	13788	GST	15	N	73	W	8	4	SENE	41.28678	-105.5955	HARRIS F. PETERSON**JO ELLEN PETERSO	PETERSON #4	DOM	17	70	10	Unknown	Unknown	No	No
P10684P	14061	GST	15	N	73	W	8	4	SENE	41.28678	-105.5955	HARRIS F. PETERSON**JO ELLEN PETERSO	PETERSON #5	DOM	20	65	10	Unknown	Unknown	No	No
P21979P	14245	GST	15	N	73	W	8	4	SENE	41.28678	-105.5955	GEORGE W. HERRING	HERRING #1	DOM,STO	10	200	12	Unknown	Unknown	No	Yes
P10075P	19432	GST	15	N	73	W	8	4	SENE	41.28678	-105.5955	THOMAS R. KAFKA	KAFKA #1	DOM	5	87	26	Unknown	Unknown	No	No
P10682P	18840	GST	15	N	73	W	8	4	SENE	41.28678	-105.5955	HARRIS F. PETERSON**JO ELLEN PETERSO	PETERSON #3	DOM	17	96	8	Unknown	Unknown	No	No
P11999P	21915	GST	15	N	73	W	8	4	SENE	41.28678	-105.5955	JOE HARNDEN	HARNDEN #1	DOM	8	45	25	Unknown	Unknown	No	No
P25667W	27053	GST	15	N	73	W	8	4	SENE	41.28678	-105.5955	HARRIS F. & JO ELLEN PETERSON	PETERSON #6	DOM,STO	20	58	7	0	0	Yes	No
P28989P	27394	GST	15	N	73	W	8	4	SENE	41.28678	-105.5955	RALPH & MARGARET HARNDEN	HARNDEN #1	DOM,STO	2	50	10	0	0	No	No
P28990W	27394	GST	15	N	73	W	8	4	SENE	41.28678	-105.5955	RALPH & MARQUERITE HARNDEN	HARNDEN #2	DOM,STO	10	70	12	0	0	Yes	No
P16392P	14792	GST	15	N	73	W	8	13	NESE	41.28319	-105.5978	C. H. PERRY	PERRY RACING STABLE #1	STO	10	60	20	Unknown	Unknown	No	Yes
P17907P	25081	GST	15	N	73	W	8	13	NESE	41.28319	-105.5978	RALPH R. JOHNSTON**HAZEL M. JOHNSTON	JOHNSTON #2	DOM	25	100	20	0	Unknown	No	No
P17762P	16953	GST	15	N	73	W	8	16	SESE	41.27953	-105.5954	C. W. PERUE**SHIRLEY PERUE**VIOLA HO	HOLADAY #1	DOM,STO	3	35	20	25	35	Yes	No
P18507P	17684	GST	15	N	73	W	8	16	SESE	41.27953	-105.5954	LEO & VIRGINIA KERSTING	KERSTING #1	STO	25	50	22	Unknown	Unknown	No	Yes

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Table DIX6-8. Groundwater Rights Within Three Miles of the Permit Area

PERMIT	PRIORITY	STATUS	TOWNSHIP	TNS_SUFFIX	RANGE	RNG_SUFFIX	SECTION	QTR	QTRQTR	LATITUDE	LONGITUDE	APPLICANT	FACILITY NAME	USES	YLD ACT	WELL DEPTH	STATIC DEPTH	MWBZ TOP	MWBZ BOTTOM	WELL LOG	CHEMICAL
P17759P	18567	GST	15	N	73	W	8	16	SESE	41.27953	-105.5954	CLARENCE W. PERUE**SHIRLEY M. PERUE	PERUE #1	DOM,STO	5	98	21	30	50	Yes	No
P17760P	19175	GST	15	N	73	W	8	16	SESE	41.27953	-105.5954	CLARENCE W. PERUE**SHIRLEY M. PERUE	PERUE #2	DOM,STO	1	50	22	32	50	Yes	No
P17761P	19479	GST	15	N	73	W	8	16	SESE	41.27953	-105.5954	CLARENCE W. PERUE**SHIRLEY M. PERUE	PERUE #3	DOM,STO	3	53	18	30	53	Yes	No
P18526P	19479	GST	15	N	73	W	8	16	SESE	41.27953	-105.5954	S. B. ATKINSON	ATKINSON #1	DOM,STO	25	50	22	Unknown	Unknown	No	No
P13768W	26423	GST	15	N	73	W	8	16	SESE	41.27953	-105.5954	CLARENCE O. TUPPER	TUPPER #2	DOM	1	30	14	19	30	Yes	No
P42149W	28331		15	N	73	W	8	16	SESE	41.27953	-105.5954	INC. DELTA CONSTRUCTION	DELTA #1	MIS	7	65	17	50	65	Yes	No
P43302W	28627	GST	15	N	73	W	8	16	SESE	41.27953	-105.5954	WILLIAM E. & NANCY L. BRITTON	WEB II	DOM	10	65	17	20	60	Yes	No
P52623W	29402	GST	15	N	73	W	8	16	SESE	41.27953	-105.5954	RALPH R. JOHNSTON	RALPH R JOHNSON #3	DOM	25	75	15	45	65	Yes	No
P8147P	14976	GST	15	N	73	W	9	1	NENE	41.29011	-105.5785	M. BOYD MOODY**MARGARET MOODY	MOODY #1	DOM,STO	12	90	15	Unknown	Unknown	No	No
P16468P	24178	GST	15	N	73	W	9	1	NENE	41.29011	-105.5785	JOHN J. & CATHERINE A. TENCICK	ROTTMAN-TENCICK #116	DOM	15	330	23	0	Unknown	No	Yes
P33015W	27891	ADJ	15	N	73	W	9	1	NENE	41.29011	-105.5785	DALE POLEDNA, DALE POLEDNA II, JILL	ROBISON #1	MIS,DOM	25	780	0	730	780	Yes	No
P37677W	28153	ADJ	15	N	73	W	9	1	NENE	41.29011	-105.5785		ENL ROBISON #1	MIS	0	780	0	730	780	Yes	No
P44321W	28698	GST	15	N	73	W	9	3	SWNE	41.28657	-105.5833	LEROY J. & KAREN M. GABRIEL	GABRIEL #1	DOM	18	80	5	60	70	Yes	No
P35550W	28108	GST	15	N	73	W	9	4	SENE	41.28649	-105.5785	NORVAL D. JOHNSON	JOHNSON #3	DOM	25	340	305	304	340	Yes	No
P5961W	25727		15	N	73	W	9	8	SENW	41.28665	-105.5881	ALBANY COUNTY PEACE OFFICERS	A C P O #1	MIS	10	75	10	58	75	Yes	No
P172626W	38666	GSI	15	N	73	W	9	8	SENW	41.28665	-105.5881	JAMES & MARIAH OSBORNE	EQUINE MEADOWS WATER SUPPLY #1	MIS						No	
P145983W	37467	GST	15	N	73	W	9	9	NESW	41.28303	-105.5881	WYOMING DEQ/WQD	1842/PZ1 AND 1842/PZ2	MON	0	30	21	21	30	Yes	No
P32566W	27653		15	N	73	W	9	10	NWSW	41.28311	-105.5929	ALBANY COUNTY WYOMING	FAIRGROUNDS #1	STO,MIS	0	0	0	0	0	No	
P69484W	31114	GST	15	N	73	W	9	10	NWSW	41.28311	-105.5929	DOUGLAS P. & PATRICIA P. CAMPBELL	CAMPBELL #1	DOM	12	80	9	30	50	Yes	No
P167513W	38464	GSI	15	N	73	W	9	10	NWSW	41.28311	-105.5929	ALBANY CO. FAIRBOARD	FAIRGROUNS #2	MIS						No	
P34151W	27961	GST	15	N	73	W	9	14	NWSE	41.28294	-105.5833	ROGER R. & JONEL WILMOT	WILMOT #1	STO	2	100	15	30	100	Yes	No
P73265W	31672	GST	15	N	73	W	9	14	NWSE	41.28294	-105.5833	MORGAN & KAREN STILL	STILL #1	DOM,STO	13	380	2	360	380	Yes	No
P87021W	33644	ADJ	15	N	73	W	9	14	NWSE	41.28294	-105.5833	HAZEL RUTH SHEAFFER (TRUST)**DON MIL	SHEAFFER #1	MIS	15	150	-1	0	0	No	Yes
P5039P	14823	GST	15	N	73	W	9	16	SESE	41.27924	-105.5784	HOLLY HUNT**JULIA HUNT	HUNT #1	DOM,STO	10	380	10	Unknown	Unknown	No	No
P60694W	30082	GST	15	N	73	W	10	6	NWNW	41.29004	-105.5736	J. T. & ANNA L. PEELE	J T PEELE WELL #1	DOM	15	705	-4	630	705	Yes	No
P96123W	34535	GST	15	N	73	W	10	7	SWNW	41.28642	-105.5736	ROBERT A/LYNETTE S BEEMER	BEEMER #1	DOM,STO	10	214	29	41	140	Yes	Yes
P94971W	34430	GST	15	N	73	W	10	8	SENW	41.28636	-105.5688	ROBERT STOBART	STOBART #1	DOM	12	217	33	97	217	Yes	No
P95558W	34479	GST	15	N	73	W	10	8	SENW	41.28636	-105.5688	CHARLES F. YEOMAN JR	YEOMAN #1	DOM	15	180	10	0	0	Yes	Yes
P96124W	34535	GST	15	N	73	W	10	8	SENW	41.28636	-105.5688	LANNY HEITZ	LANNY HEITZ #1	DOM,STO	10	215	40	40	142	Yes	No
P89242W	33849	GST	15	N	73	W	10	9	NESW	41.28273	-105.5688	D. M. MITCHELL	MITCHELL #1	DOM	25	840	2	750	840	Yes	No
P182G	19409	UNA	15	N	73	W	10	10	NWSW	41.28279	-105.5736	RICHARD F. HECHT	HECHT #1 WELL	STO,IRR	60	196	12	150	196	Yes	
P2468P	25262	GST	15	N	73	W	10	10	NWSW	41.28279	-105.5736	DONALD JONES**SHIRLEY JONES**ELMO L.	P & J ENTERPRISES	DOM,STO	7	130	100	0		No	
P461C	12784	GST	15	N	73	W	10	11	SWSW	41.27916	-105.5736	RICHARD F. HECHT	AVIN NELSON #1 WELL	DOM;STO	5	196	12	Unknown	Unknown	No	
P181G	19409	UNA	15	N	73	W	10	11	SWSW	41.27916	-105.5736	JACK & JOY CRAMER	O.L. WILLE #1 WELL	STO,IRR	5	250	5	200	240	Yes	
P107404W	35677	GST	15	N	73	W	10	12	SESW	41.27909	-105.5688	RANDOLPH JOHNSON	GALLOWAY #1	DOM,STO	13	200	0	100	140	Yes	No
P107473W	35682	GST	15	N	73	W	10	12	SESW	41.27909	-105.5688	DOUGLAS M MITCHELL	MITCHELL #2	DOM	25	210	8	200	210	Yes	No
P2467P	25262	GST	15	N	73	W	10	14	NWSE	41.28268	-105.564	DONALD JONES**SHIRLEY JONES**ELMO L.	P. & J. ENTERPRISES #1	DOM,STO	7	170	125	0		No	
P154386W	37902	GST	15	N	73	W	10	14	NWSE	41.28268	-105.564	STEVEN & NANCY STUTZMAN	STUTZMAN -1	DOM,STO	13	200	16	151	165	Yes	No
P161486W	38224	GST	15	N	73	W	10	16	SESE	41.279	-105.5592	TODD AND IRENE JOHNSON	T&I JOHNSON #1	DOM	13	160	12	100	140	Yes	No
P40266W	28401	GST	15	N	73	W	11	14	NWSE	41.28259	-105.5449	DALE BRADLEY JONES	BRAD #2	DOM	12	300	29	260	290	Yes	No
P34766W	28033	GST	15	N	73	W	11	15	SWSE	41.27897	-105.5449	DONALD R. JONES	BRAD #1	DOM	12	145	40	100	130	Yes	No
P63564W	30411	GST	15	N	73	W	12	1	NENE	41.28999	-105.5209	JOHN W. HURD	HURD #3	DOM	12	250	105	210	250	Yes	No
P106649W	35622	GST	15	N	73	W	12	1	NENE	41.28999	-105.5209	GREG L/DIANNA L DERR	KERR #1	DOM,STO	10	300	149	240	280	Yes	No
P63533W	30404	GST	15	N	73	W	12	2	NWNE	41.28993	-105.5257	GLEN & LYNNE MUSSER	MUSSER #1	DOM,STO	10	200	80	160	200	Yes	No
P62398W	30249		15	N	73	W	12	3	SWNE	41.28629	-105.5258	LAMONT H. & DIANE M. PETERSON	DOM	MIS	12	185	100	145	185	Yes	No
P63334W	30383	GST	15	N	73	W	12	3	SWNE	41.28629	-105.5258	DEANNA & JAMES A. JOHNSON	JOHNSON #1	DOM	12	180	82	140	180	Yes	No
P72966W	31624	GST	15	N	73	W	12	3	SWNE	41.28629	-105.5258	MILO B. AND PATRICIA L. BEINTEMA	BEINTEMA #2	DOM	18	180	82	155	175	Yes	No
P77630W	32359	GST	15	N	73	W	12	3	SWNE	41.28629	-105.5258	A.F. DINT COWPER	LEBRUN #1	DOM	13	180	104	140	180	Yes	Yes
P109498W	35894	GST	15	N	73	W	12	3	SWNE	41.28629	-105.5258	FRANK/CONNIE HEDLEY	HEDLEY #1	DOM	10	180	84	160	180	Yes	No
P83076W	33087	GST	15	N	73	W	12	3	SWNE	41.28629	-105.5258	GARY C. WILKERSON	WILKERSON #1	DOM	10	180	104	140	180	Yes	No

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Table DIX6-8. Groundwater Rights Within Three Miles of the Permit Area

PERMIT	PRIORITY	STATUS	TOWNSHIP	TNS_SUFFIX	RANGE	RNG_SUFFIX	SECTION	QTR	QTRQTR	LATITUDE	LONGITUDE	APPLICANT	FACILITY NAME	USES	YLD ACT	WELL DEPTH	STATIC DEPTH	MWBZ TOP	MWBZ BOTTOM	WELL LOG	CHEMICAL
P94722W	34402	GST	15	N	73	W	12	3	SWNE	41.28629	-105.5258	JAMES KUMELOS**STEVEN W/WENDY J KALI	ROWDIE #1	DOM	10	180	105	160	180	Yes	No
P125275W	36655	GST	15	N	73	W	12	3	SWNE	41.28629	-105.5258	NICK VISSER	VISSER #1	DOM	15	200	95	120	200	Yes	No
P53955W	29494	GST	15	N	73	W	12	4	SENE	41.28633	-105.521	COBBLESTONE BLDG. & LANDSCAPE**CRAIG	COBBLESTONE #6	DOM	12	165	105	105	165	Yes	No
P1050W	23231	ADJ	15	N	73	W	12	5	NENW	41.28989	-105.5292	COUNTRY MEADOWS LTD.	DUEWEKE #2	MIS	60	109	50	0	Unknown	Yes	No
P29196W	27471	ADJ	15	N	73	W	12	5	NENW	41.28989	-105.5292	LTD. COUNTRY MEADOWS	VOGEL #1		35	120	56	80	120	Yes	No
P46209W	28838	GST	15	N	73	W	12	5	NENW	41.28989	-105.5292	ROGER A. CLARK	SUNDIAL #2	DOM	7	185	86	115	185	Yes	No
P49224W	29039	ADJ	15	N	73	W	12	5	NENW	41.28989	-105.5292	LTD.10020 E. GIRARD COUNTRY MEADOWS	ENL VOGLE #1	MIS	0	120	56	80	120	Yes	No
P49225W	29041	ADJ	15	N	73	W	12	5	NENW	41.28989	-105.5292	LTD. COUNTRY MEADOWS	ENL DUEWEKE #2	MIS	0	109	50	0	0	Yes	No
P55632W	29634	GST	15	N	73	W	12	5	NENW	41.28989	-105.5292	GARY J. MCQUADE	MCQUADE #1	DOM,STO	8	185	89	125	170	Yes	No
P59161W	29943	ADJ	15	N	73	W	12	5	NENW	41.28989	-105.5292	SETH A. AND LINDA K. REINHOLD	LIGHT HOUSE #1	DOM	20	185	87	105	180	Yes	No
P62980W	30330	GST	15	N	73	W	12	5	NENW	41.28989	-105.5292	WADE D. WYKERT	WADEW #1	DOM	16	185	111	145	185	Yes	No
P62982W	30333	GST	15	N	73	W	12	5	NENW	41.28989	-105.5292	ROGER MAX OR VICKI LEE PRENZLOW	PRENZLOW #1	DOM	15	165	77	145	165	Yes	No
P59577W	30018	GST	15	N	73	W	12	6	NWNW	41.28984	-105.5353	WILIAM & CARRIE JEAN MURDOCH	MURDOCH #1	DOM	15	165	77	105	145	Yes	No
P34315W	27977	GST	15	N	73	W	12	7	SWNW	41.28622	-105.5353	HAROLD P. & HELEN L. BROWN	BROWN #1	DOM,STO	7	100	48	0	0	No	No
P34316W	27977	ADJ	15	N	73	W	12	7	SWNW	41.28622	-105.5353	HAROLD P. & HELEN L. BROWN	BROWN #2	STO,MIS,DOM	25	135	24	125	135	No	No
P5W	630	GST	15	N	73	W	12	8	SENW	41.28626	-105.5292	WILLIAM P. & SUSAN IVERSON	WALLIS #1	DOM,STO	60	91	64			No	
P46205W	28814	ADJ	15	N	73	W	12	8	SENW	41.28626	-105.5292	LTD. COUNTRY MEADOWS	PRENZLOW #1	MIS	100	180	68	150	180	Yes	No
P61026W	30109	GST	15	N	73	W	12	8	SENW	41.28626	-105.5292	RUSSELL & INDIA JAIRELL	JAIRELL #1	DOM,STO	15	175	88	125	165	Yes	No
P63550W	30411	GST	15	N	73	W	12	8	SENW	41.28626	-105.5292	DEE PRIDGEN	D S INC #2	DOM,STO	10	185	86	145	165	Yes	No
P65133W	30547	GST	15	N	73	W	12	8	SENW	41.28626	-105.5292	CONRAD GORNEY	GORNEY #1	DOM	10	180	66	120	160	Yes	No
P68130W	30902	GST	15	N	73	W	12	8	SENW	41.28626	-105.5292	LARRY WHITE	WHITE #1	DOM	10	175	61	130	140	Yes	Yes
P105200W	35506	GST	15	N	73	W	12	8	SENW	41.28626	-105.5292	JOHN F NELSON	NELSON #1	DOM,STO	10	160	60	140	150	Yes	No
P95787W	34515	GST	15	N	73	W	12	8	SENW	41.28626	-105.5292	PAUL R. & SUSAN K. BULGRIN	BULGRIN #2	DOM,STO	10	160	80	140	160	Yes	No
P5W	630	GST	15	N	73	W	12	9	NESW	41.28262	-105.5293	WILLIAM P. & SUSAN IVERSON	WALLIS #1	DOM,STO	60	91	64			No	
P16789P	24562	GST	15	N	73	W	12	9	NESW	41.28262	-105.5293	PEGGY ALEXANDER	DUEWEKE #3	DOM	25	160	130	140	160	Yes	No
P26827W	27183	GST	15	N	73	W	12	9	NESW	41.28262	-105.5293	WILLIAM & CAROL DALEY	SHERLYNS #1	DOM	15	118	32	0	0	No	No
P44232W	28682	GST	15	N	73	W	12	9	NESW	41.28262	-105.5293	WYO WATER RESOURCES RESEARCH INSTITU	HUNTOON #2	MON	0	243	80	110	243	Yes	No
P49157W	29054	GST	15	N	73	W	12	9	NESW	41.28262	-105.5293	RONALD H. OLSEN	OLSEN #1	DOM	20	205	90	187	205	Yes	No
P53530W	29469	GST	15	N	73	W	12	9	NESW	41.28262	-105.5293	DOUG & ROBYN GUICE	GUICE #1	DOM	15	165	75	125	160	Yes	No
P55193W	29608	GST	15	N	73	W	12	9	NESW	41.28262	-105.5293	DEAN W. LEBEDA	LEBEDA #2	DOM	12	145	66	105	145	Yes	No
P55633W	29634	GST	15	N	73	W	12	9	NESW	41.28262	-105.5293	ALLEN SPITZ	SPITZ #1	DOM,STO	12	165	81	125	160	Yes	No
P56001W	29658	GST	15	N	73	W	12	9	NESW	41.28262	-105.5293	JOHN J. & PAMELA A. GALBREATH	GALBREATH #1	DOM	7	200	75	72	200	Yes	No
P56897W	29725	GST	15	N	73	W	12	9	NESW	41.28262	-105.5293	JAMES L. ROMSA	ADAMS #1	DOM	12	185	88	125	165	Yes	No
P63720W	30424	GST	15	N	73	W	12	9	NESW	41.28262	-105.5293	DAVE E. & LINDA C. DARTY	DARTY #1	DOM	25	175	51	105	125	Yes	No
P71912W	31456	GST	15	N	73	W	12	9	NESW	41.28262	-105.5293	WILLIAM E. & MARY S. WALDEN	WALDEN #1	DOM	15	190	72	130	170	Yes	Yes
P72312W	31525	GST	15	N	73	W	12	9	NESW	41.28262	-105.5293	MARK DAHL	DAHL #1	DOM	10	170	70	110	150	Yes	No
P72684W	31580	GST	15	N	73	W	12	9	NESW	41.28262	-105.5293	JACK OPPIE	JACK OPPIE #1	DOM	18	180	55	120	160	Yes	Yes
P73629W	31728	GST	15	N	73	W	12	9	NESW	41.28262	-105.5293	JOHN A. HAEFNER	HAEFNER #1	DOM	10	175	70	135	175	Yes	No
P76535W	32246	GST	15	N	73	W	12	9	NESW	41.28262	-105.5293	CHRISTEL B. AND DAVID E. WALRATH	WALRATH #1	DOM	13	160	61	110	140	Yes	Yes
P117430W	36361	GST	15	N	73	W	12	9	NESW	41.28262	-105.5293	JAMES C & CONNIE M PETRIE	ALEXANDER #1	DOM	10	235	123	200	235	Yes	No
P1483W	23886	GST	15	N	73	W	12	13	NESE	41.28266	-105.521	HERBERT D. POWNALL**CHRISTOS T. & JA	SMITH #1 WELL	DOM	25	163	140	140	160	Yes	
P16788P	22281	GST	15	N	73	W	12	13	NESE	41.28266	-105.521	JOYCE WHEELIS	WHEELIS #1	DOM	10	130	-1	0	Unknown	No	No
P8601P	24984	GST	15	N	73	W	12	13	NESE	41.28266	-105.521	ALVA L. JOHNSTON**MELVA P. JOHNSTON	JOHNSTON #1	DOM	18	132	100	100	132	Yes	No
P31607W	27737	GST	15	N	73	W	12	13	NESE	41.28266	-105.521	LARRY J. TAYLOR	TAYLOR #1	DOM	12	190	132	150	190	Yes	No
P34726W	27976	GST	15	N	73	W	12	13	NESE	41.28266	-105.521	RONALD D. AND-OR JANE A. ROMATZKE	R.D.R. #1	DOM	12	169	112	120	160	Yes	No
P36068W	28165	GST	15	N	73	W	12	13	NESE	41.28266	-105.521	W H COBBLESTONE BUILDING	COBBLESTONE #1	DOM	25	163	115	130	150	Yes	No
P36069W	28165	GST	15	N	73	W	12	13	NESE	41.28266	-105.521	W H COBBLESTONE BUILDING	COBBLESTONE #2	DOM	20	164	121	120	158	Yes	No
P36646W	28208	GST	15	N	73	W	12	13	NESE	41.28266	-105.521	JAMES J. FINNERTY	FINNERTY #1	DOM	12	175	92	145	170	Yes	No
P36946W	28216	GST	15	N	73	W	12	13	NESE	41.28266	-105.521	VINCE ARBOUR	VINCE MIX #1	DOM	19	175	97	125	163	Yes	No
P38657W	28292	GST	15	N	73	W	12	13	NESE	41.28266	-105.521	DANIEL H. & LYDIA L. DYCUS	ANDY 1	DOM	15	160	96	120	160	Yes	No

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Table DIX6-8. Groundwater Rights Within Three Miles of the Permit Area

PERMIT	PRIORITY	STATUS	TOWNSHIP	TNS_SUFFIX	RANGE	RNG_SUFFIX	SECTION	QTR	QTRQTR	LATITUDE	LONGITUDE	APPLICANT	FACILITY NAME	USES	YLD ACT	WELL DEPTH	STATIC DEPTH	MWBZ TOP	MWBZ BOTTOM	WELL LOG	CHEMICAL
P39529W	28345	GST	15	N	73	W	12	13	NESE	41.28266	-105.521	ALVA L. JOHNSTON**MELVA P. JOHNSTON	JOHNSTON #2	DOM	10	165	95	130	160	Yes	No
P40499W	28416	GST	15	N	73	W	12	13	NESE	41.28266	-105.521	SAMUEL C. & CLAUDINE M. RICCILLO	RICCILLO #1	DOM	12	165	105	0	0	Yes	No
P43839W	28664	GST	15	N	73	W	12	13	NESE	41.28266	-105.521	PAT MCDERNOTT (COBBLESTONE)	COBBLESTONE #5	DOM	12	170	118	130	170	Yes	No
P48638W	29032	GST	15	N	73	W	12	13	NESE	41.28266	-105.521	RAYMOND A. LEACH	LEACH #1	DOM	12	200	-1	0	0	Yes	No
P9247W	26066	GST	15	N	73	W	12	13	NESE	41.28266	-105.521	ALAN DEAN ATTEBERY**SHARON L. ATTEBE	A. D. ATTEBERY #1	DOM	12	175	116	0	0	Yes	Yes
P85691W	33445	GST	15	N	73	W	12	13	NESE	41.28266	-105.521	ALEXANDRA AND DAVID KIEFFER	KIEFFER #1	DOM	20	320	105	280	300	Yes	No
P94469W	34366	UNA	15	N	73	W	12	13	NESE	41.28266	-105.521	TERESA L. AND MARK D. BECK	BECK #1	DOM	10	200	130	160	200	Yes	No
P15696P	24725	GST	15	N	73	W	12	14	NWSE	41.28264	-105.5258	JAMES & RUTH WELKE	WELKE HOLE #1	DOM	10	160	110	0	Unknown	No	Yes
P8601P	24984	GST	15	N	73	W	12	14	NWSE	41.28264	-105.5258	ALVA L. JOHNSTON**MELVA P. JOHNSTON	JOHNSTON #1	DOM	18	132	100	100	132	Yes	No
P28373W	27234	GST	15	N	73	W	12	14	NWSE	41.28264	-105.5258	BYRA A. & MARILYN S. KITE	BOWERMAN 74	DOM	25	110	-4	0	0	No	No
P40356W	28401	GST	15	N	73	W	12	14	NWSE	41.28264	-105.5258	W. H. COBBELSTONE BUILDING**MARTIN M	COBBLESTONE #3	DOM	15	160	113	125	150	Yes	No
P40357W	28401	GST	15	N	73	W	12	14	NWSE	41.28264	-105.5258	W. H. COBBELSTONE BUILDING**WENDELL		DOM	15	150	95	120	140	Yes	No
P40592W	28429	GST	15	N	73	W	12	14	NWSE	41.28264	-105.5258	KENNETH B. JOHNSTON**BEULAH O. JOHNS	KANNON BALL #1	DOM	12	175	102	85	165	Yes	No
P41627W	28517	GST	15	N	73	W	12	14	NWSE	41.28264	-105.5258	W. H. DYCUS	DYCUS #1	DOM	25	120	90	90	120	Yes	No
P69894W	31167	GST	15	N	73	W	12	14	NWSE	41.28264	-105.5258	RONALD E. & BARBARA A. JAIRELL	HARTMAN #1	DOM	11	180	81	140	180	Yes	No
P71527W	31377	GST	15	N	73	W	12	14	NWSE	41.28264	-105.5258	PAMELA M. BALTIMORE	PEAK #1	DOM	4	175	89	135	170	Yes	No
P71884W	31457	GST	15	N	73	W	12	14	NWSE	41.28264	-105.5258	ALVA L. AND MELVA P. JOHNSTON	WELL #3	DOM	10	180	87	140	180	Yes	No
P73717W	31747	GST	15	N	73	W	12	14	NWSE	41.28264	-105.5258	JOSEPH L. AND FLORENCE C. PEAK	ENL PEAK #1	DOM	6	175	89	135	170	Yes	No
P78172W	32429	GST	15	N	73	W	12	14	NWSE	41.28264	-105.5258	KENT & JANICE MARSHALL	MARSHALL II	DOM	13	180	160	135	175	Yes	No
P95040W	34435	GST	15	N	73	W	12	14	NWSE	41.28264	-105.5258	DANIEL H. AND LYNDA DYCUS	WELL #2	DOM	10	160	95	140	160	Yes	No
P163693W	38299	GSI	15	N	73	W	12	14	NWSE	41.28264	-105.5258	LUKE & LEANNE SWECKARD	SWECKARD #2	DOM						No	
P46210W	28838	ADJ	15	N	73	W	12	15	SWSE	41.27898	-105.5259	INC. SUNDIAL ACRES	SUNDIAL HOMEOWNERS #1	MIS,DOM	25	178	83	120	170	Yes	No
P92375W	34184	GST	15	N	73	W	12	15	SWSE	41.27898	-105.5259	MIKE AND AMY KOPP	KOPP #1	DOM	13	180	105	140	160	Yes	No
P43392W	28632	GST	15	N	73	W	12	16	SESE	41.279	-105.5211	DAVID G. & JEAN L. EARNSHAW	EARNSHAW #1	DOM	12	180	116	135	180	Yes	No
P43899W	28667	GST	15	N	73	W	12	16	SESE	41.279	-105.5211	LISA MULLER SCOTT**MICHAEL JERRY SCO	MULLER-SCOTT WELL #1	DOM	12	195	133	165	195	Yes	No
P152206W	37809	GST	15	N	73	W	13	2	NWNE	41.27533	-105.5259	DR. DANIEL/KIMBERLY DALE	DALE #1	DOM	10	200	106	130	190	Yes	No
P16922P	20454	GST	15	N	73	W	13	6	NWNW	41.27533	-105.5354	FRED P. PIPER	PIPER #6	DOM,STO	25	500	80	Unknown	Unknown	No	No
P144071W	37370	GST	15	N	73	W	13	8	SENW	41.27171	-105.5293	ROB/KRISTA MICHAUD	MICHAUD -1	DOM,STO	20	123	55	110	123	Yes	No
P159105W	38124	GST	15	N	73	W	13	8	SENW	41.27171	-105.5293	LEONARD A SINNER, JR	SINNER #1	DOM	13	180	79	120	180	Yes	No
P39298W	28284	UNA	15	N	73	W	13	9	NESW	41.26807	-105.5317	RICHARD E. STROM	STROM #1	STO,IRR,DOM	15	177	68	161	171	Yes	No
P124026W	36602	GST	15	N	73	W	13	9	NESW	41.26807	-105.5317	JERRY/KATHY WALSH	Walsh #5	DOM,STO	13	160	41	70	120	Yes	No
P116191W	36318	GST	15	N	73	W	13	10	NWSW	41.26807	-105.5353	J.T/AIMEE WALSH WALSH**BILL DeJONG	WALSH 1	DOM,STO	10	160	40	65	100	Yes	No
P116195W	36319	GST	15	N	73	W	13	11	SWSW	41.26442	-105.5353	DOUGLAS L/KELLEY D GAPTER	GAPTER #1	DOM,STO	18	160	61	80	160	Yes	No
P39844W	28369	GST	15	N	73	W	14	1	NENE	41.27534	-105.5401	DONALD R. & SHIRLEY C. JONES	JODY #1	DOM	20	170	8	135	160	Yes	No
P430C	14245	GST	15	N	73	W	14	2	NWNE	41.27534	-105.5449	NORMAN E. STROM	BIG HOLLOW #3	STO	0	200	-6	Unknown	Unknown	No	
P36531W	28193	GST	15	N	73	W	14	5	NENW	41.27534	-105.5497	DONALD S. & BONNIE S. SWIATEK	KNOWLTON #2	DOM,STO	15	307	-4	206	260	Yes	No
P43721W	28654	GST	15	N	73	W	14	5	NENW	41.27534	-105.5497	DONALD S. & BONNIE S. SWIATEH	KNOWLTON #3	STO	5	260	-1	237	240	Yes	No
P64826W	30496	GST	15	N	73	W	14	5	NENW	41.27534	-105.5497	ROBERT L. & GERALDINE G. EISENHAUER	EISENHAUER #1	DOM	25	135	28	105	125	Yes	Yes
P72411W	31530	GST	15	N	73	W	14	7	SWNW	41.27172	-105.5544	ROGER & JONEL WILMOT	WILMOT #2	DOM,STO	15	460	-4	360	400	Yes	No
P57005W	29745	GST	15	N	73	W	14	8	SENW	41.27172	-105.5497	GEORGE H. & REBECCA I. PRENTICE	PRENTICE #1	DOM	20	100	36	60	80	Yes	No
P66932W	30783	GST	15	N	73	W	14	8	SENW	41.27172	-105.5497	ROBERT ROTEN & MARTHA HANSCOM	HANSCOM #1	DOM	13	375	-4	255	375	Yes	Yes
P31363W	27704	GST	15	N	73	W	14	9	NESW	41.26808	-105.5496	YRAMIRIS P. TRACY	FREDERICK #1	STO	25	100	-4	98	100	Yes	No
P31362W	27704	GST	15	N	73	W	14	10	NWSW	41.26808	-105.5544	YRAMIRIS P. TRACY	PAUL #1	STO	20	80	50	70	78	Yes	No
P110152W	35937	GST	15	N	73	W	14	11	SWSW	41.26445	-105.5544	LOUIE SCHILT	SCHILT #1	DOM	13	300	14	245	300	Yes	No
P153C	13676	ADJ	15	N	73	W	14	13	NESE	41.26808	-105.5401	CITY OF LARAMIE	POPE #1	MUN	550	156	16	143	156	Yes	
P154C	14048	ADJ	15	N	73	W	14	13	NESE	41.26808	-105.5401	CITY OF LARAMIE	POPE #2	MUN	515	162	12	Unknown	Unknown	Yes	
P155C	14426	ADJ	15	N	73	W	14	13	NESE	41.26808	-105.5401	CITY OF LARAMIE	POPE #3	MUN	590	158	13	Unknown	Unknown	No	
P55505W	29616	ADJ	15	N	73	W	14	13	NESE	41.26808	-105.5401	CITY OF LARAMIE	ENL POPE #3	MUN	250	158	18	Unknown	Unknown	No	No
P55506W	29616	ADJ	15	N	73	W	14	13	NESE	41.26808	-105.5401	CITY OF LARAMIE	POPE #4	MUN	1750	350	31	65	350	Yes	Yes
P55507W	29616	ADJ	15	N	73	W	14	13	NESE	41.26808	-105.5401	CITY OF LARAMIE	TURNER #1	MUN	1400	240	6	85	240	Yes	Yes

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Table DIX6-8. Groundwater Rights Within Three Miles of the Permit Area

PERMIT	PRIORITY	STATUS	TOWNSHIP	TNS_SUFFIX	RANGE	RNG_SUFFIX	SECTION	QTR	QTRQTR	LATITUDE	LONGITUDE	APPLICANT	FACILITY NAME	USES	YLD ACT	WELL DEPTH	STATIC DEPTH	MWBZ TOP	MWBZ BOTTOM	WELL LOG	CHEMICAL
P72690W	31568	ADJ	15	N	73	W	14	13	NESE	41.26808	-105.5401	CITY OF LARAMIE	ENL POPE #2	MUN	75	162	5	Unknown	Unknown	Yes	Yes
P72691W	31568	ADJ	15	N	73	W	14	13	NESE	41.26808	-105.5401	CITY OF LARAMIE	ENL POPE #3	MUN	50	158	13	Unknown	Unknown	No	No
P72692W	31568	ADJ	15	N	73	W	14	13	NESE	41.26808	-105.5401	CITY OF LARAMIE	ENL POPE #4 WELL	MUN	50	350	31	65	350	Yes	Yes
P30940W	27655	GST	15	N	73	W	14	16	SESE	41.26445	-105.5401	YRAMIRIS P. TRACY	YRAMIRIS #1	STO	5	145	55	0	0	Yes	Yes
P102061W	35171	GST	15	N	73	W	14	16	SESE	41.26445	-105.5401	ANDREW GENTRY	GENTRY #1	DOM	18	150	53	90	150	Yes	No
P156466W	38044	GST	15	N	73	W	14	16	SESE	41.26445	-105.5401	CHRIS & ANN SCHOEN	SCHOEN-3	STO	10	120	50	60	120	Yes	No
P170154W	38630	GSI	15	N	73	W	15	3	SWNE	41.27179	-105.564	LAURN W. & ELOISE D. WILHELM	WILHELM #1	DOM,STO						No	
P428C	13880	UNA	15	N	73	W	15	5	NENW	41.27547	-105.5688	NORMAN E. STROM	CONNERS #1	IRR,DOM	400	180	-6	Unknown	Unknown	No	
P429C	15565	UNA	15	N	73	W	15	5	NENW	41.27547	-105.5688	NORMAN E. STROM	CONNERS #2	STO,IRR	300	153	-6	Unknown	Unknown	No	
P101778W	35142	GST	15	N	73	W	15	6	NWNW	41.27554	-105.5736	B HIVE, INC.	B HIVE #2	DOM	10	140	7	80	120	Yes	No
P98508W	34774	GST	15	N	73	W	15	6	NWNW	41.27554	-105.5736	B HIVE, INC.	B HIVE #1	DOM	10	190	14	100	190	Yes	No
P431C	15400	UNA	15	N	73	W	15	8	SENW	41.27186	-105.5688	NORMAN E. STROM	ROSEDALE #4	STO,IRR	600	172	7	Unknown	Unknown	No	
P86027W	33478	UNA	15	N	73	W	15	9	NESW	41.26824	-105.5689	TOM MARTIN	MX #1	MIS	13	160	5	150	160	Yes	Yes
P4955W	25638	GST	15	N	73	W	15	11	SWSW	41.26467	-105.5737	RAY A. FIELD	RAY A. FIELD #1	DOM,STO	15	80	20	20	80	Yes	
38/8/517W	38792	UNA	15	N	73	W	15	13	NESE	41.26811	-105.5592	SWECKARD CONSTRUCTION	SWECKARD POPE -1	MIS						No	
P124407W	36612	GST	15	N	73	W	15	14	NWSE	41.26817	-105.564	MARIAN L. PAXTON	M. PAXTON #1	DOM	20	480	-4	435	480	Yes	No
P52906W	29417	ADJ	15	N	73	W	15	15	SWSE	41.26455	-105.5641	SETA CORPORATION	SETA #1	MIS	10	85	26	45	85	Yes	No
P92168W	34150	GST	15	N	73	W	15	16	SESE	41.26448	-105.5592	JOHN D. AND PAM D. AHRENHOLTZ	AHR001	DOM	13	90	28	65	70	Yes	Yes
P15665W	26532	GST	15	N	73	W	15	16	SESE	41.26448	-105.5592	RALPH W. FUCHS	FUCHS #001	DOM	20	60	34	42	54	Yes	Yes
P14875W	26520	GST	15	N	73	W	15	16	SESE	41.26448	-105.5592	GARY L. OLSON	OLSON #1	DOM	0	51	29	38	44	Yes	Yes
P100005W	34921	GST	15	N	73	W	15	16	SESE	41.26448	-105.5592	DAN L OLSON	D. OLSON	DOM	15	390	3	345	390	Yes	No
P102084W	35179	GST	15	N	73	W	15	16	SESE	41.26448	-105.5592	JOHN D. AND PAM D. AHRENHOLTZ	AHROO2	DOM	15	380	1	350	380	Yes	No
P84983W	33360	GST	15	N	73	W	15	16	SESE	41.26448	-105.5592	DAN L. OLSON	OLSON #2	DOM	13	100	20	50	70	Yes	No
P157586W	38076	GST	15	N	73	W	15	16	SESE	41.26448	-105.5592	HARRY & THERESA SCHLEGEL	SCHLEGEL-1	DOM	13	360	-4	300	360	Yes	No
P10709W	26232	GST	15	N	73	W	16	1	NENE	41.27561	-105.5784	JESSE C. JAMES	JESSE JAMES #1	DOM,STO	20	96	18	70	96	Yes	Yes
P20459W	26771	GST	15	N	73	W	16	1	NENE	41.27561	-105.5784	JOSEPH F. KRAFCZIK**J. F. KRAFCZIK	KRAFCZIK #1	DOM	10	60	12	45	60	Yes	Yes
P38152W	28272	GST	15	N	73	W	16	1	NENE	41.27561	-105.5784	JAMES H. PATTERSON	PATTERSON #1	DOM	12	127	9	102	110	Yes	No
P13470W	26392	GST	15	N	73	W	16	2	NWNE	41.27569	-105.5833	GEORGE J. PARKER**JANICE L. PARKER	PARKER #1	DOM,STO	25	422	402	402	410	Yes	Yes
P47152W	28934	GST	15	N	73	W	16	2	NWNE	41.27569	-105.5833	EVERETTE HARDEN**JUDITH R (ECKHARDT)	HARNDEN & ECKHARDT	DOM	19	385	-4	345	380	Yes	No
P60997W	30098	GST	15	N	73	W	16	2	NWNE	41.27569	-105.5833	KELVIN AHLSTROM**GARY RIEGEL	A & R #1	DOM	10	105	25	95	105	Yes	No
P81933W	32941	GST	15	N	73	W	16	2	NWNE	41.27569	-105.5833	EMORY AND KARLA SPIEGELBERG	SPIEGELBERG #1	DOM,STO	10	685	-4	600	685	Yes	No
P15363W	26567	GST	15	N	73	W	16	5	NENW	41.27578	-105.5881	EVERETT J. & EMMA JEAN HARNDEN	HARNDEN #1	DOM,STO	5	156	156	121	123	Yes	No
P17906P	20820	GST	15	N	73	W	16	6	NWNW	41.27586	-105.5929	RALPH R. JOHNSTON**HAZEL M. JOHNSTON	JOHNSTON #1	DOM,STO	25	50	16	Unknown	Unknown	No	No
P42415W	28354	ADJ	15	N	73	W	16	10	NWSW	41.26862	-105.5929	INC. THE CAVALRY MAN**GEORGE J. & MA	MARIAN #2	MIS	25	1050	800	800	0	No	Yes
P50539W	29161		15	N	73	W	16	10	NWSW	41.26862	-105.5929	INC. THE CAVALRYMAN**MARION J. FORBE	ENL MARION #2	STO	0	0	0	0	0	No	
P36529W	28192	GST	15	N	73	W	16	11	SWSW	41.265	-105.5929	RANDOLPH V. & LORRIE D. LEWIS	GARY JONES WELL #2	DOM,STO	25	300	10	0	0	No	No
P36675W	28206	GST	15	N	73	W	16	12	SESW	41.26491	-105.5881	GEORGE W. GILL	DIAMONDGILL #1	DOM	10	90	22	75	90	Yes	No
P26254W	27124	GST	15	N	73	W	16	13	NESE	41.26837	-105.5785	WILLIAM L. & MARGUERITE B. NELSON	NELSON #1	DOM	25	100	65	65	0	Yes	No
P42588W	28578	GST	15	N	73	W	16	13	NESE	41.26837	-105.5785	FRANK E. NEYMAN**DIANE M. LATOS	RASNAKE #1	DOM	12	125	-4	85	120	Yes	No
P44386W	28699	GST	15	N	73	W	16	13	NESE	41.26837	-105.5785	WILLIAM L. & MARGUERITE B. NELSON	OMALLEY #1	DOM	10	650	0	590	645	Yes	No
P57841W	29810	GST	15	N	73	W	16	13	NESE	41.26837	-105.5785	JOHN & SUSAN A. CHOINSKI	CHOINSKI #1	DOM	15	125	10	100	120	Yes	No
P73447W	31696	GST	15	N	73	W	16	14	NWSE	41.26845	-105.5833	CHARLES H. & KAY WOOD	WOOD #1	DOM	10	100	5	60	100	Yes	No
P62877W	30313	GST	15	N	73	W	16	15	SWSE	41.26483	-105.5833	ROBERT E. & MARTHA L. SMITH	SMITH #1	DOM,STO	25	130	30	Unknown	Unknown	No	No
P6406P	24938	GST	15	N	73	W	16	16	SESE	41.26475	-105.5785	FRED D. JAMES**ETHEL F. JAMES	JAMES #1	STO	20	100	14	0		Yes	
P10778W	26238	GST	15	N	73	W	16	16	SESE	41.26475	-105.5785	JACQUELINE HYSONG**ALVA HYSONG	HYSONG #1	DOM	25	115	9	60	115	Yes	No
P22755W	26847	GST	15	N	73	W	16	16	SESE	41.26475	-105.5785	LARRY M. & SHERRY A. HAMANN	HAMANN 1	DOM,STO	25	80	20	60	80	Yes	No
P42638W	28583	GST	15	N	73	W	16	16	SESE	41.26475	-105.5785	WILLIAM H. DANIELS**RUTH E. DANIELS	DANIELS #1	DOM	12	145	11	120	135	Yes	No
P48631W	29026	GST	15	N	73	W	16	16	SESE	41.26475	-105.5785	BARRY R. & SUSAN B. BALLARD	BALLARD #1	DOM,STO	12	156	29	125	150	Yes	Yes
P145006W	37400	GSE	15	N	73	W	16	16	SESE	41.26475	-105.5785	BARRY R./SUSAN BALLARD	ENL. BALLARD NO. 1	IRR						No	
P145007W	37400	GSE	15	N	73	W	16	16	SESE	41.26475	-105.5785	BARRY R./SUSAN BALLARD	BALLARD NO. 2	IRR						No	

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Table DIX6-8. Groundwater Rights Within Three Miles of the Permit Area

PERMIT	PRIORITY	STATUS	TOWNSHIP	TNS_SUFFIX	RANGE	RNG_SUFFIX	SECTION	QTR	QTRQTR	LATITUDE	LONGITUDE	APPLICANT	FACILITY NAME	USES	YLD ACT	WELL DEPTH	STATIC DEPTH	MWBZ TOP	MWBZ BOTTOM	WELL LOG	CHEMICAL
P24583W	26912	GST	15	N	73	W	17	1	NENE	41.27591	-105.5954	LELAND & MAIDA ANDERSON	ANDERSON #100	DOM	1	60	21	38	45	Yes	No
P34164W	27964	GST	15	N	73	W	17	1	NENE	41.27591	-105.5954	STEPHEN B. & FLORA C. GREGORY	GREGORY #1	DOM	20	73	15	0	0	No	No
P295G	19941	UNA	15	N	73	W	17	4	SENE	41.27091	-105.5977	OSCAR ROGERS	ROGERS #1 WELL	STO,IRR,DOM	300	85	20	80	85	Yes	
P29654W	27506	GST	15	N	73	W	17	4	SENE	41.27091	-105.5977	JAMES R. & MACELLE V. ACKERSON	ACKERSON #2	DOM	25	70	20	20	48	Yes	No
P31872W	27780	GST	15	N	73	W	17	4	SENE	41.27091	-105.5977	LELAND & MALDA ANDERSON	ANDERSON #200	DOM	20	80	20	50	80	Yes	Yes
P64161W	30468	GST	15	N	73	W	17	4	SENE	41.27091	-105.5977	R. KIM JOHNSON	JOHNSON #1	DOM,STO	20	102	16	80	84	Yes	No
P11197W	26246	GST	15	N	73	W	17	13	NESE	41.26869	-105.5978	PHILLIP L. TAYLOR	TAYLOR #1	DOM	15	70	25	54	70	Yes	No
P13775W	26427	GST	15	N	73	W	17	13	NESE	41.26869	-105.5978	JOE LEFEBRE	LEFEBRE #1	DOM	17	65	15	60	65	Yes	No
P58491W	29881	GST	15	N	73	W	17	13	NESE	41.26869	-105.5978	WILLIAM J. & SHIRLEY M. RUESCH	RUESCH #1	DOM	15	100	24	65	85	Yes	No
P2614W	25387	GST	15	N	73	W	17	16	SESE	41.26507	-105.5978	DENNIS GRAHAM	GRAHAM #1	DOM	10	80	25	60	80	Yes	
P62576W	30265	ADJ	15	N	73	W	17	16	SESE	41.26507	-105.5978	BOB D. ETHEL L. RADICH	B & E #1	DOM	25	122	14	20	110	Yes	No
P67227W	30811	GST	15	N	73	W	17	16	SESE	41.26507	-105.5978	DENNIS S. GRAHAM	GRAMHAM #2	DOM	10	100	15	30	70	Yes	No
P68867W	30932	ADJ	15	N	73	W	17	16	SESE	41.26507	-105.5978	BOB D. AND ETHAL L. RADICH	ENL B&E #1	STO,IRR	5	122	14	90	110	Yes	No
P92080W	34138	GST	15	N	73	W	17	16	SESE	41.26507	-105.5978	DARREL AND EDITH GODDARD	D & E GODDARD #1	DOM,STO	25	60	21	50	60	Yes	Yes
P129389W	36802	GST	15	N	73	W	17	16	SESE	41.26507	-105.5978	RACHEL M. WHITE	R. WHITE #1	DOM	18	70	16	32	70	Yes	No
P3011W	25470	ADJ	15	N	73	W	20	1	NENE	41.26144	-105.5978	JERRY M. DICK	ACKERSON #1	DOM	5	95	30	35	95	Yes	Yes
P44565W	28717	GST	15	N	73	W	20	1	NENE	41.26144	-105.5978	JIM BARNES	BARNES WELL 1	DOM	8	105	30	65	100	Yes	No
P45532W	28779	ADJ	15	N	73	W	20	1	NENE	41.26144	-105.5978	JERRY M. DICK	ENL ACKERSON #1	MIS,DOM	20	95	28	65	95	Yes	Yes
P45623W	28794	GST	15	N	73	W	20	1	NENE	41.26144	-105.5978	WILLIAM J. & LILLIAN R. BATES	BATES #1	DOM	8	105	29	85	100	Yes	No
P48478W	29012	GST	15	N	73	W	20	1	NENE	41.26144	-105.5978	FRED R. MORRISON**PAMELA LAYBOURN	MORRISON-LAYBOURN #1	DOM	12	100	30	60	100	Yes	No
P8645W	26051	ADJ	15	N	73	W	20	1	NENE	41.26144	-105.5978	GURNEY MCLEAN**HUBE KERSTING	MCLEAN WELL #1	MIS	25	114	26	85	112	Yes	No
P57500W	29782	GST	15	N	73	W	20	1	NENE	41.26144	-105.5978	STANLEY LYLE WILLMSCHEN	STAN #1	DOM	15	105	37	75	95	Yes	No
P61059W	30110	GST	15	N	73	W	20	1	NENE	41.26144	-105.5978	LOUISA PEREA	PEREA #1	DOM	10	100	29	60	80	Yes	No
P69629W	31128	GST	15	N	73	W	20	1	NENE	41.26144	-105.5978	DARL & SUE WOOLF	POOR JESSIE #1	DOM	10	100	17	Unknown	Unknown	Yes	No
P87627W	33717	GST	15	N	73	W	20	1	NENE	41.26144	-105.5978	LEO P. AND RUTH D. FERGUSON	LAUBACH #1	DOM	20	100	27	47	85	Yes	Yes
P13994W	26435	GST	15	N	73	W	20	4	SENE	41.25781	-105.5977	ANTONE NOVAK	NOVAK #1	DOM	17	98	35	90	100	Yes	No
P31878W	27793	GST	15	N	73	W	20	4	SENE	41.25781	-105.5977	THE BABBITT LIVING TRUST, KENNETH &	BABBITT #1	DOM,STO	15	100	34	45	80	Yes	Yes
P5361W	25692	GST	15	N	73	W	20	4	SENE	41.25781	-105.5977	ROBERT L. YEOMAN	YEOMAN WELL #1	DOM	55	118	55	15	85	Yes	No
P6487W	25834	GST	15	N	73	W	20	4	SENE	41.25781	-105.5977	ROBERT L. YEOMAN	YEOMAN #3	DOM	15	105	45	75	103	Yes	No
P6489W	25834	GST	15	N	73	W	20	4	SENE	41.25781	-105.5977	ROBERT L. YEOMAN	YEOMAN #5	DOM	15	119	55	85	118	Yes	No
P8485W	26015	GST	15	N	73	W	20	4	SENE	41.25781	-105.5977	ARTHUR HAWKINS	HAWKINS #2	DOM	15	117	35	85	87	Yes	Yes
P66420W	30734	GST	15	N	73	W	20	4	SENE	41.25781	-105.5977	ASSOCIATES FINANCIAL SERVICES	CARVER #1	DOM	25	435	120	335	425	No	No
P147816W	37537	UNA	15	N	73	W	20	4	SENE	41.25781	-105.5977	KENNETH P BABBITT	ENL. BABBITT NO. 1	MIS	10	100	34	45	80	Yes	Yes
P2846W	25448	GST	15	N	73	W	20	13	NESE	41.25416	-105.5977	THE BABBITT LIVING TRUST, KENNETH &	BABBITT #2		8	97	30	0	Unknown	Yes	No
P11418W	26268	GST	15	N	73	W	20	13	NESE	41.25416	-105.5977	DEARINGER REALTY	DEARINGER #1	DOM	15	103	35	70	103	Yes	No
P11419W	26268	GST	15	N	73	W	20	13	NESE	41.25416	-105.5977	DEARINGER REALTY	DEARINGER #2	DOM	15	100	30	70	100	Yes	No
P13995W	26435	GST	15	N	73	W	20	13	NESE	41.25416	-105.5977	G.H. DEARINGER	DEARINGER #3	DOM	15	97	40	70	95	Yes	No
P13996W	26435	GST	15	N	73	W	20	13	NESE	41.25416	-105.5977	G.H. DEARINGER	DEARINGER #4	DOM	20	102	40	70	95	Yes	No
P16736W	26639	GST	15	N	73	W	20	13	NESE	41.25416	-105.5977	DEARINGER REALTY	DEARINGER #5	DOM	15	100	40	90	100	Yes	No
P29377W	27478	GST	15	N	73	W	20	13	NESE	41.25416	-105.5977	JEFFREY P. CHILL	CHILL #1	DOM	20	94	27	0	0	Yes	No
P29615W	27513	GST	15	N	73	W	20	13	NESE	41.25416	-105.5977	THE BABBITT LIVING TRUST, KENNETH &	BABBITT #3	DOM	10	104	39	40	80	Yes	No
P38142W	28284	GST	15	N	73	W	20	13	NESE	41.25416	-105.5977	THOMAS MARTIN**KATHERINE MARTIN**DON	MARTIN #1	DOM	25	100	30	57	90	Yes	No
P43692W	28649	GST	15	N	73	W	20	13	NESE	41.25416	-105.5977	RICHARD L. PATTERSON	PATTERSON #1	DOM	12	100	37	60	100	Yes	No
P44894W	28738	GST	15	N	73	W	20	13	NESE	41.25416	-105.5977	LARRY J. & ELVINA M. FARNHAM	FARNHAM #1	DOM	19	100	36	60	80	Yes	No
P49479W	29090	GST	15	N	73	W	20	13	NESE	41.25416	-105.5977	STEPHEN L. ARTHUR	ARTHUR #2	DOM,STO	12	102	41	57	100	Yes	No
P9827W	26140	GST	15	N	73	W	20	13	NESE	41.25416	-105.5977	JOHN W. HARNEY**KAREN E. HARNEY	HARNEY #1	DOM	15	109	45	82	108	Yes	Yes
P56121W	29669	GST	15	N	73	W	20	13	NESE	41.25416	-105.5977	RICHARD L. PATTERSON	PATTERSON #2	DOM	12	105	37	65	85	Yes	Yes
P58082W	29832	GST	15	N	73	W	20	13	NESE	41.25416	-105.5977	STAN WILLMSCHEN	WILLMSCHEN #2	DOM	15	105	37	75	95	Yes	No
P61072W	30103	GST	15	N	73	W	20	13	NESE	41.25416	-105.5977	RICHARD E. ZIEMER	ZIEMER #1	DOM	15	100	30	60	80	Yes	No
P65242W	30550	GST	15	N	73	W	20	13	NESE	41.25416	-105.5977	DIANA M. SCHMITT	DMS #1	DOM	13	100	25	45	65	Yes	No

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Table DIX6-8. Groundwater Rights Within Three Miles of the Permit Area

PERMIT	PRIORITY	STATUS	TOWNSHIP	TNS_SUFFIX	RANGE	RNG_SUFFIX	SECTION	QTR	QTRQTR	LATITUDE	LONGITUDE	APPLICANT	FACILITY NAME	USES	YLD ACT	WELL DEPTH	STATIC DEPTH	MWBZ TOP	MWBZ BOTTOM	WELL LOG	CHEMICAL
P73768W	31755	GST	15	N	73	W	20	13	NESE	41.25416	-105.5977	JOSEPH & MARY LEONA PROTA	PROTA #2	DOM	10	100	34	70	90	Yes	No
P147817W	37537	UNA	15	N	73	W	20	13	NESE	41.25416	-105.5977	KENNETH P BABBITT	ENL. BABBITT NO. 2	MIS	17	97	30	30	97	Yes	No
P147818W	37537	UNA	15	N	73	W	20	13	NESE	41.25416	-105.5977	KENNETH P BABBITT	ENL. BABBITT NO. 3	MIS	15	104	39	40	80	Yes	No
P17415W	26641	GST	15	N	73	W	20	16	SESE	41.25052	-105.5978	DONALD T. & MARGARET F. RIGGS	RIGGS WELL #1	DOM	25	110	22	0	0	No	No
P26064W	27101	GST	15	N	73	W	20	16	SESE	41.25052	-105.5978	FRANK DAVID & SANDRA KAY GUFFEY	GUFFEY #1	DOM,STO	20	300	100	914	300	Yes	No
P31983W	27801	GST	15	N	73	W	20	16	SESE	41.25052	-105.5978	JERRY EUGENE MORRIS	MORRIS #1	DOM	2	84	36	0	0	Yes	No
P34412W	27981	GST	15	N	73	W	20	16	SESE	41.25052	-105.5978	REGY BLUNSOM	BLUNSOM #1	DOM,STO	10	100	35	50	100	Yes	Yes
P36006W	28163	GST	15	N	73	W	20	16	SESE	41.25052	-105.5978	ROGER L. WAGNER	R. WAGNER #1	DOM	20	98	41	60	98	Yes	No
P38324W	28296	GST	15	N	73	W	20	16	SESE	41.25052	-105.5978	JR. WHITMER. D. E.	WHITMER #1	DOM	25	100	41	50	95	Yes	No
P41872W	28536	GST	15	N	73	W	20	16	SESE	41.25052	-105.5978	MICHAEL F. STRICKER	STRICKER #1	DOM	9	105	40	70	100	Yes	No
P42585W	28578	GST	15	N	73	W	20	16	SESE	41.25052	-105.5978	JAMES N. & JOYCE A. PATRICK**A. K. &	PATRICK #1	DOM	12	95	38	65	90	Yes	Yes
P42587W	28578	GST	15	N	73	W	20	16	SESE	41.25052	-105.5978	JAMES N. & JOYCE A. PATRICK**A. K. &	PATRICK #3	DOM	12	105	38	60	100	Yes	No
P43482W	28641	GST	15	N	73	W	20	16	SESE	41.25052	-105.5978	JERRY M. DICK	DAWSON #1	DOM	19	105	30	50	80	Yes	Yes
P45630W	28797	GST	15	N	73	W	20	16	SESE	41.25052	-105.5978	STANLEY LYLE WILLMSHEN	LYLE #1	DOM	15	105	39	65	100	Yes	No
P46639W	28908	GST	15	N	73	W	20	16	SESE	41.25052	-105.5978	INC. HARDWOOD SPECIALTIES	PEIRENE FOUNTAIN	DOM	12	105	44	70	90	Yes	No
P46640W	28908	GST	15	N	73	W	20	16	SESE	41.25052	-105.5978	INC. HARDWOOD SPECIALTIES	LACHISH	DOM	12	105	44	65	85	Yes	No
P46642W	28908	GST	15	N	73	W	20	16	SESE	41.25052	-105.5978	INC. HARDWOOD SPECIALTIES	GIHON SPRING	DOM	12	105	44	65	85	Yes	No
P46643W	28908	GST	15	N	73	W	20	16	SESE	41.25052	-105.5978	INC. HARDWOOD SPECIALTIES	BETHLEHEM	DOM	12	105	44	65	100	Yes	No
P46644W	28908	GST	15	N	73	W	20	16	SESE	41.25052	-105.5978	INC. HARDWOOD SPECIALTIES	BEERSHEBA	DOM	12	105	44	70	90	Yes	No
P52872W	29410	GST	15	N	73	W	20	16	SESE	41.25052	-105.5978	L. STEPHEN & ALFREDA M. ALSWORTH	ALSWORTH #1	DOM	12	105	70	70	35	Yes	No
P100079W	34939	GST	15	N	73	W	20	16	SESE	41.25052	-105.5978	CODY HUMPHREY	HUMPHREY #1	DOM,STO	15	100	44	0	0	No	No
P147405W	37537	GSE	15	N	73	W	20	16	SESE	41.25052	-105.5978	KENNETH P BABBITT	BABBITT NO. 4	DOM						No	
P18523P	14976	GST	15	N	73	W	21	1	NENE	41.26112	-105.5785	JEAN BRITTON	AIRPORT-HOWE #4	STO	20	70	15	Unknown	Unknown	No	No
P2851W	25408	GST	15	N	73	W	21	1	NENE	41.26112	-105.5785	SAM EVANS	EVANS #1	DOM	5	90	30	30	70	Yes	
P39628W	28359	GST	15	N	73	W	21	13	NESE	41.25385	-105.5785	HARLAN D. SIMONSEN	EVANS #2	DOM	12	100	37	75	100	Yes	No
P105404W	35524	GST	15	N	73	W	22	1	NENE	41.26085	-105.5592	JAMES M/SANDRA K GABRIEL	JIM/SANDY #1	DOM	25	340	10	305	340	Yes	No
P120043W	36448	GST	15	N	73	W	22	1	NENE	41.26085	-105.5592	DUAINE WARNER	D.W. #1	DOM	13	310	-4	265	310	Yes	No
P98008W	34690	GST	15	N	73	W	22	1	NENE	41.26085	-105.5592	RODNEY R. & TAMMY L. JONES	JONES #1	DOM,STO	13	330	-4	290	330	Yes	No
P98130W	34708	GST	15	N	73	W	22	1	NENE	41.26085	-105.5592	JIM & VICKI JAIRELL	BISON #1	DOM,STO	15	350	0	305	350	Yes	No
P170795W	38589	GSI	15	N	73	W	22	1	NENE	41.26085	-105.5592	SOUTH OF LARAMIE WATER & SEWER DISTR	SOL NO. 1 WELL	MIS						No	
P18521P	12054	GST	15	N	73	W	22	3	SWNE	41.25728	-105.5641	JEAN BRITTON	PUMP HOWE #2	DOM,STO	25	180	-4	Unknown	Unknown	No	No
P18522P	12054	GST	15	N	73	W	22	3	SWNE	41.25728	-105.5641	JEAN BRITTON	HOWE DAM #3	STO	10	180	-4	Unknown	Unknown	No	No
P110852W	35983	GST	15	N	73	W	22	3	SWNE	41.25728	-105.5641	ROBERT W NIESENT	Neisent #1	DOM,STO	10	340	7	297	340	Yes	No
P65485W	30581	GST	15	N	73	W	22	4	SENE	41.25721	-105.5592	DANIEL H. & LINDA M. BEASLEY	BEASLEY #1	DOM	10	85	21	45	85	Yes	Yes
P100993W	35023	GST	15	N	73	W	22	4	SENE	41.25721	-105.5592	WILLIAM R JOLLEY	MEADOWLARK #1	DOM	15	320	-4	275	320	Yes	No
P109215W	35871	GST	15	N	73	W	22	4	SENE	41.25721	-105.5592	GARY LYNN PULS, JR.	PULS #1	DOM	13	320	15	285	320	Yes	No
P170122W	38614	GSI	15	N	73	W	22	4	SENE	41.25721	-105.5592	BONNIE & DAVE ATHEY	ATHEY #2	STO						No	
P99782W	34891	GST	15	N	73	W	22	5	NENW	41.26098	-105.5689	RANDOLPH V. & LORRIE D. LEWIS	LEWIS #1	DOM,STO	13	510	-4	470	510	Yes	No
P61221W	30119	GST	15	N	73	W	22	8	SENW	41.25734	-105.5689	JEAN BRITTON	BRITTON #1	DOM	15	225	1	145	185	Yes	No
P105407W	35527	GST	15	N	73	W	22	8	SENW	41.25734	-105.5689	DAVE/BONNIE ATHEY	ATHEY #1	DOM,STO	15	320	20	280	320	Yes	No
P165536W	38406	GSI	15	N	73	W	22	8	SENW	41.25734	-105.5689	DAVID & WENDY PRATT	ANCHOR 1	DOM						No	
P88874W	33805	GST	15	N	73	W	22	13	NESE	41.25357	-105.5592	ALAN AND MELISSA MERRILL	MERRILL #1	DOM	13	415	0	375	0	Yes	Yes
P18520P	13880	GST	15	N	73	W	22	14	NWSE	41.25364	-105.564	PEARL HOWE**JEAN BRITTON	HOWE #1	DOM	25	220	100	Unknown	Unknown	No	No
P18525P	21642	GST	15	N	73	W	22	14	NWSE	41.25364	-105.564	JEAN BRITTON	HOWE #6	DOM,STO	10	223	-4	216	223	Yes	No
P24865W	26946	GST	15	N	73	W	22	16	SESE	41.24994	-105.5592	KEITH & KATHLEEN PERRY	BURGESS #1	DOM,STO	10	110	-1	0	0	No	No
P100522W	34988	GST	15	N	73	W	22	16	SESE	41.24994	-105.5592	DAVID/JUDITH THOMPSON	MATTY #1	DOM	13	280	0	238	280	Yes	No
P128164W	36756	GST	15	N	73	W	22	16	SESE	41.24994	-105.5592	GERALD M. 7 GLORIA L. MAAS	DUSTIN #2	DOM	13	280	3	225	275	Yes	No
P71974W	31476	GST	15	N	73	W	23	2	NWNE	41.26082	-105.5448	ROBERT L. & JANE R. GONZALES	POLLY 1	DOM,STO	16	170	24	130	150	Yes	No
P99246W	34843	GST	15	N	73	W	23	2	NWNE	41.26082	-105.5448	TOM MARTIN	MX #2	DOM	15	140	41	100	140	Yes	No
P39385W	28342	GST	15	N	73	W	23	3	SWNE	41.2572	-105.5448	RICHARD E. STROM	STROM #2	DOM,STO	10	95	8	0	0	No	No

TFN 5 1/110

Table DIX6-8. Groundwater Rights Within Three Miles of the Permit Area

PERMIT	PRIORITY	STATUS	TOWNSHIP	TNS_SUFFIX	RANGE	RNG_SUFFIX	SECTION	QTR	QTRQTR	LATITUDE	LONGITUDE	APPLICANT	FACILITY NAME	USES	YLD ACT	WELL DEPTH	STATIC DEPTH	MWBZ TOP	MWBZ BOTTOM	WELL LOG	CHEMICAL
P109769W	35913	GST	15	N	73	W	23	4	SENE	41.2572	-105.54	DAVID L/ELAINE L MUSGROVE	MUSGROVE #1	DOM,STO	10	160	57	120	160	Yes	No
P92077W	34137	GST	15	N	73	W	23	5	NENW	41.26082	-105.5496	PAUL A. AND JUDY L. WILLIAMS	PAUL-JUDY #1	DOM	20	200	40	80	200	Yes	Yes
P102266W	35193	GST	15	N	73	W	23	6	NWNW	41.26082	-105.5544	DENNIS/LANA CRAIG	CRAIG #1	DOM	15	290	-4	250	290	Yes	No
P85708W	33450	GST	15	N	73	W	23	6	NWNW	41.26082	-105.5544	LYLE H. AND JANICE K. WOMACK	WOMACK #1	DOM	12	120	40	80	120	Yes	No
P101738W	35139	GST	15	N	73	W	23	7	SWNW	41.25718	-105.5544	JOSEPH TERRY/JUDY LYNN RINKER	RINKER #1	DOM	15	280	-4	235	280	Yes	No
P168617W	38530	GSI	15	N	73	W	23	7	SWNW	41.25718	-105.5544	JAMES E. & JANICE J. GARRETT	GARRETT ANCOR 1	DOM						No	
P170158W	38623	GSI	15	N	73	W	23	7	SWNW	41.25718	-105.5544	JOHN & SANDRA WELCH	WELCH WELL #1	DOM						No	
P170165W	38630	GSI	15	N	73	W	23	9	NESW	41.25356	-105.5496	MARK DOYLE	DOYLE #1	DOM						No	
38/3/580W	38825	UNA	15	N	73	W	23	9	NESW	41.25356	-105.5496	TORRY & JULIA WEIBEL	WEIBEL - 7	DOM,STO						No	
P100851W	34977	GST	15	N	73	W	23	10	NWSW	41.25355	-105.5544	DAVID/WENDY PRATT	BENCH HEART #1	DOM,STO	13	210	-4	165	210	Yes	No
P100860W	35010	GST	15	N	73	W	23	10	NWSW	41.25355	-105.5544	SHANE/LOREE COX	BENCH HEART #2	DOM	15	215	8	165	215	Yes	No
P168547W	38519	GSI	15	N	73	W	23	10	NWSW	41.25355	-105.5544	STEVE SMITH	SMITH #1	DOM						No	
P17936P	14245	GST	15	N	73	W	23	11	SWSW	41.24991	-105.5544	WILLIAM Q. DESPAIN**DEANNA J. DESPAI	DESPAIN #3	DOM,STO	25	200	-4	Unknown	Unknown	No	No
P105184W	35503	GST	15	N	73	W	23	11	SWSW	41.24991	-105.5544	TY BATTERSHELL	BATT #2	DOM,STO	25	200	-4	160	180	Yes	No
P105576W	35488	UNA	15	N	73	W	23	12	SESW	41.24992	-105.5495	CITY OF LARAMIE	SOLDIER #1	MIS	0	289	2	41	289	Yes	Yes
P101654W	35123	GST	15	N	73	W	23	13	NESE	41.25358	-105.5399	KEVIN NELSON	NELSON 1	DOM	13	200	63	160	200	Yes	No
P2659W	25398	GST	15	N	73	W	23	14	NWSE	41.25357	-105.5447	GENE A. & KAY B. PRATT	PRATT #1	DOM	10	60	20	20	60	Yes	
P96058W	34523	GST	15	N	73	W	23	14	NWSE	41.25357	-105.5447	ROBERT AND CAROLYN HELLING	HELLING #1	DOM,STO	20	200	35	95	200	Yes	No
P92936W	34239	GST	15	N	73	W	23	15	SWSE	41.24994	-105.5447	WYO WATER DEVELOPMENT COMM	SOLDIER MW #1	MON	0	130	16	30	130	Yes	No
P99770W	34897	GST	15	N	73	W	23	15	SWSE	41.24994	-105.5447	CITY OF LARAMIE	SOLDIER MW-2	MON	0	70	11	10	70	Yes	No
P99771W	34897	GST	15	N	73	W	23	15	SWSE	41.24994	-105.5447	CITY OF LARAMIE	SOLDIER MW-3	MON	0	85	14	27	85	Yes	No
P99772W	34897	GST	15	N	73	W	23	15	SWSE	41.24994	-105.5447	CITY OF LARAMIE	SOLDIER MW-4	MON	0	100	2	33	100	Yes	No
P99773W	34897	GST	15	N	73	W	23	15	SWSE	41.24994	-105.5447	CITY OF LARAMIE	SOLDIER MW-5	MON	0	100	44	64	100	Yes	No
P13695W	26413	GST	15	N	73	W	23	16	SESE	41.24995	-105.5399	ALFRED D. & CHERYLNN LEGAULT	LEGAULT #1	DOM	17	141	64	131	142	Yes	Yes
P31745W	27764	GST	15	N	73	W	23	16	SESE	41.24995	-105.5399	JOANNE LESLIE MORGAN**JAMES PATRICK	BK #1	DOM	12	100	54	65	100	Yes	No
P31876W	27788	GST	15	N	73	W	23	16	SESE	41.24995	-105.5399	CHARLES D. & NANCY K. LANE	LANE #1	DOM	20	100	40	74	100	Yes	No
P72810W	31601	GST	15	N	73	W	24	3	SWNE	41.25717	-105.5257	MOUNTAIN CEMENT COMPANY	MOUNTAIN CEMENT #1	STO	10	240	147	195	225	Yes	No
P16921P	16248	GST	15	N	73	W	24	10	NWSW	41.25356	-105.5352	FRED P. PIPER	PIPER #5	DOM,STO	20	180	80	Unknown	Unknown	No	No
P94793W	34422	GST	15	N	73	W	25	1	NENE	41.24628	-105.5208	SHAWN R. AND MINDY KING	KING #1	DOM	10	340	230	290	320	Yes	No
39/3/26W	38847	UNA	15	N	73	W	25	1	NENE	41.24628	-105.5208	PETE & HOLLY STEINKRAUS	STEINKRAUS #1	DOM						No	
P100462W	34968	GST	15	N	73	W	25	4	SENE	41.24266	-105.5209	BRIAN/CATHY BRAMEL	BRAMEL 1	DOM,STO	6	420	318	200	400	Yes	No
P149978W	37700	GST	15	N	73	W	25	4	SENE	41.24266	-105.5209	RICHARD AND CAROLYN MILLER	MILLER-3	DOM	10	500	231	440	460	Yes	No
P109363W	35884	GST	15	N	73	W	25	6	NWNW	41.24631	-105.5351	MARK/JAYNE WINGATE	WINGATE #1	DOM	10	280	128	190	280	Yes	No
P94869W	34428	GST	15	N	73	W	25	8	SENW	41.24266	-105.5292	PRAIRIE HOMES INC.	PEPPER #1	DOM	7	340	220	260	340	Yes	No
P95834W	34505	GST	15	N	73	W	25	10	NWSW	41.23905	-105.5351	GREGG & TERESA NICHOLAS	NICHOLAS OASIS #1	DOM	10	250	148	220	250	Yes	No
39/1/13W	38840	UNA	15	N	73	W	25	11	SWSW	41.2354	-105.5352	JAMES S. & ALEIDA M. WEGER	WEGER #1	DOM,STO						No	
P163285W	38278	GSI	15	N	73	W	25	12	SESW	41.23536	-105.5292	SANDRA B. BROME	GAGE ONE	DOM						No	
P94730W	34408	GST	15	N	73	W	25	14	NWSE	41.23904	-105.5257	RICHARD AND MICKEY UREN	MICKEY #1	DOM,STO	3	400	190	250	400	Yes	No
P101993W	35167	GST	15	N	73	W	25	15	SWSE	41.23536	-105.5257	JENNY KIDDER EBERHART	J.K. #3	DOM	3	350	225	210	350	Yes	No
P95938W	34499	GST	15	N	73	W	25	15	SWSE	41.23536	-105.5257	DEANNA AND MILLARD JOHNSON	JOHNSON #2	DOM	3	360	192	0	0	Yes	No
P123256W	36564	GST	15	N	73	W	25	16	SESE	41.23539	-105.5209	BRIAN/ANNA WAITKUS	Waitkus #1	DOM,st	10	420	198	320	420	Yes	No
P16920P	16254	GST	15	N	73	W	26	2	NWNE	41.24631	-105.5447	FRED P. PIPER	PIPER #4	DOM,STO	30	60	15	20	30	Yes	No
P725G	21164	UNA	15	N	73	W	26	2	NWNE	41.24631	-105.5447	FRED PIPER	PIPER #2	IRR	400	149	11	30	149	Yes	
P16919P	14746	GST	15	N	73	W	26	5	NENW	41.24629	-105.5495	FRED P. PIPER	PIPER #3	DOM,STO	20	50	-1	18	34	Yes	No
P23G	17643	UNA	15	N	73	W	26	5	NENW	41.24629	-105.5495	FRED P. PIPER	PIPER #1 WELL	STO,IRR	123	50	-6	30	50	Yes	
P24716W	26952	GST	15	N	73	W	26	5	NENW	41.24629	-105.5495	FRED P. PIPER	PIPER #7	DOM	14	66	-4	56	66	Yes	No
P157931W	38090	GST	15	N	73	W	27	1	NENE	41.2463	-105.5592	JOHN & JODY HOBERG	HOBERG #1	DOM,STO	13	460	37	392	460	Yes	No
P125627W	36669	GST	15	N	73	W	27	3	SWNE	41.24272	-105.564	DINO/GAIL TRUJILLO	D.A.G. #1	DOM,STO	18	200	22	130	131	Yes	No
P157637W	38083	GST	15	N	73	W	27	3	SWNE	41.24272	-105.564	RANDAL W SIX	SIX/ONE	DOM,STO	18	400	28	350	400	Yes	No
P167022W	38460	GSI	15	N	73	W	27	5	NENW	41.24643	-105.5689	JEFF & SUSAN BURY	BURY #1	DOM						No	

Table DIX6-8. Groundwater Rights Within Three Miles of the Permit Area

PERMIT	PRIORITY	STATUS	TOWNSHIP	TNS_SUFFIX	RANGE	RNG_SUFFIX	SECTION	QTR	QTRQTR	LATITUDE	LONGITUDE	APPLICANT	FACILITY NAME	USES	YLD ACT	WELL DEPTH	STATIC DEPTH	MWBZ TOP	MWBZ BOTTOM	WELL LOG	CHEMICAL
P18524P	14976	GST	15	N	73	W	27	6	NWNW	41.24649	-105.5737	JEAN BRITTON	HOWE #5	STO	20	102	50	Unknown	Unknown	No	No
P167011W	38461	GSI	15	N	73	W	27	6	NWNW	41.24649	-105.5737	DAVID SHIPLEY	THE LAND WELL	DOM,STO						No	
38/5/547W	38806	UNA	15	N	73	W	27	7	SWNW	41.24284	-105.5737	JEFFREY & LYNETTE MORRIS	JEFF MORRIS - 1	DOM,STO						No	
P77082W	32308	GST	15	N	73	W	27	9	NESW	41.23913	-105.5689	HOWARD L. WHITE	WHITE #1	DOM,STO	15	300	17	240	280	Yes	No
P144073W	37370	GST	15	N	73	W	27	14	NWSE	41.23907	-105.564	PATRICIA PARKER	P. PARKER # 1	DOM,STO	10	360	45	310	360	Yes	No
P109344W	35881	GST	15	N	73	W	27	15	SWSE	41.23543	-105.564	RO WERTHINGTON	WERTHINGTON #1	DOM,STO	9	200	25	97	98	Yes	No
P107563W	35698	GST	15	N	73	W	27	16	SESE	41.23538	-105.5592	NICHOLAS B/MARY K HUDSON	HUDSON #1	DOM,STO	12	200	54	138	139	Yes	No
P126866W	36725	GST	15	N	73	W	27	16	SESE	41.23538	-105.5592	TROY JENSEN	TROY JENSEN WATER WELL	DOM,STO	13	200	18	122	123	Yes	No
P51C	15127	UNA	15	N	73	W	28	2	NWNE	41.24664	-105.5833	CITY OF LARAMIE	K. F. KNUDSEN #1 WELL	STO,IRR	1000	336	32	Unknown	Unknown	No	
P76210W	32037	GST	15	N	73	W	28	4	SENE	41.24291	-105.5785	FLOYD & MAXINE WRIGHT**SHIRLEY LILLE	WRIGHT #2	STO	25	170	30	130	150	Yes	No
P61440W	30153	GST	15	N	73	W	28	7	SWNW	41.24315	-105.5929	RUSSELL & LOUISE HOFFNER	HOFFNER #1	DOM,STO	3	485	26	362	485	Yes	No
P218G	19633	GST	15	N	73	W	29	13	NESE	41.2396	-105.5977	MONOLITH PORTLAND MIDWEST COMPANY	STOCK WELL #7	STO	600	150	41	70	80	Yes	
P78190W	32423	GST	15	N	73	W	33	7	SWNW	41.2286	-105.5928	TEXACO REFINING & MARKETING INC.	MW 1	MON	0	25.5	18	22	25	Yes	No
P78191W	32423	GST	15	N	73	W	33	7	SWNW	41.2286	-105.5928	TEXACO REFINING & MARKETING INC.	MW 2	MON	0	25.5	18	22	25	Yes	No
P78192W	32423	GST	15	N	73	W	33	7	SWNW	41.2286	-105.5928	TEXACO REFINING & MARKETING INC.	MW 3	MON	0	25.5	17.5	24	Unknown	Yes	No
P78193W	32423	GST	15	N	73	W	33	7	SWNW	41.2286	-105.5928	TEXACO REFINING & MARKETING INC.	MW 4	MON	0	25	17.19	0	0	Yes	No
P78194W	32423	GST	15	N	73	W	33	7	SWNW	41.2286	-105.5928	TEXACO REFINING & MARKETING INC.	MW 5	MON	0	25	14.89	0	0	Yes	No
P17887P	14061	GST	15	N	73	W	34	5	NENW	41.23185	-105.5688	ALAN WRIGHT ESTATE	WRIGHT #1	DOM,STO	10	220	20	Unknown	Unknown	No	No
P105082W	35488	GST	15	N	73	W	34	16	SESE	41.21995	-105.5592	CITY OF LARAMIE	SIMPSON MW-1	MON	0	125	24	44	125	Yes	No
P102615W	35226	GST	15	N	73	W	35	1	NENE	41.23178	-105.5399	W. WILLIAM BRANTZ	BRANTZ #1	DOM	10	280	170	260	280	Yes	No
P98640W	34786	GST	15	N	73	W	35	2	NWNE	41.23177	-105.5447	ROBERT S. & CLARA M. PAWLOWSKI	PAWLOWSKI #1	DOM	10	200	125	160	200	Yes	No
P98471W	34764	GST	15	N	73	W	35	3	SWNE	41.22813	-105.5447	GARY R & MARY F BROWN	BROWN #1	DOM,STO	13	200	111	180	200	Yes	Yes
P115635W	36284	GST	15	N	73	W	35	4	SENE	41.22815	-105.5399	RUSTY/ELLEN CHILDRESS	R.& E. CHILDRESS #1	DOM,STO	10	240	144	180	240	Yes	No
P119006W	36420	GST	15	N	73	W	35	5	NENW	41.23175	-105.5495	WILLIAM A REILLY	SILVER SPRINGS 1	DOM,STO	20	200	81	120	200	Yes	No
P105088W	35492	GST	15	N	73	W	35	6	NWNW	41.23174	-105.5544	RICHARD L. AND DIANE H. TROTTER	TROTTER 3	DOM	10	150	58	110	150	Yes	No
P102304W	35202	GST	15	N	73	W	35	7	SWNW	41.2281	-105.5543	GARY A/BARBARA J YORK	YORK #1	DOM	13	160	51	120	140	Yes	No
P104810W	35440	GST	15	N	73	W	35	8	SENW	41.22812	-105.5495	ROLLIN H/CAROLYN A ABERNETHY	ABERNETHY #1	DOM	13	170	79	120	160	Yes	No
P104443W	35375	GST	15	N	73	W	35	9	NESW	41.22449	-105.5495	RICHARD SOMES	SOMES SUMMIT #1	DOM	10	300	155	220	300	Yes	No
P163598W	38296	GSI	15	N	73	W	35	11	SWSW	41.22084	-105.5543	BRADLEY & SHERRI WALGREN	WALGREN #1	DOM						No	
P111480W	36025	GST	15	N	73	W	35	12	SESW	41.22085	-105.5495	CHRISTINE/CHRISTOPHER STIMSON	Stimson #1	DOM	10	300	170	260	300	Yes	No
P145651W	37448	GST	15	N	73	W	35	13	NESE	41.22452	-105.5399	SHAWN/MARY BROWN	S BROWN NO. 1	DOM,STO	10	230	135	160	230	Yes	No
P109640W	35904	UNA	15	N	73	W	35	14	NWSE	41.2245	-105.5447	QUINTIN C/AUDREY L SCHANCK	SCHANCK #1	DOM,STO	0	0	0	0	0	No	
P109771W	35913	GST	15	N	73	W	35	14	NWSE	41.2245	-105.5447	STUART/LESLIE WOHL**STUART/LESLIE WO	WOHL #1	DOM	10	220	170	200	210	Yes	No
P134391W	37008	GST	15	N	73	W	35	15	SWSE	41.22087	-105.5447	JOHN /SARA CLUTE	CLUTE # 1	DOM,STO	10	300	167	220	280	Yes	No
P117662W	36388	GST	15	N	73	W	35	16	SESE	41.22089	-105.5399	Jason Smallwood	SMALLWOOD #1	DOM,STO	10	260	154	200	260	Yes	No
P17935P	14245	GST	15	N	73	W	36	6	NWNW	41.23176	-105.5351	WILLIAM Q. DESPAIN**DEANNA J. DESPAI	DESPAIN #2	STO	20	240	180	Unknown	Unknown	No	No
P165500W	38239	GSI	16	N	73	W	25	15	SWSE	41.32274	-105.5238	CREEK VIEW, LLC	JRC-1	MIS						No	
P73841W	31768	GST	16	N	73	W	34	15	SWSE	41.30803	-105.5644	MINI MART INC.	123 SW	MON	0	10.29	5.82	Unknown	Unknown	Yes	No
P73842W	31768	UNA	16	N	73	W	34	15	SWSE	41.30803	-105.5644	MINI MART INC.	123 SE	MON,MON	0	10.29	5.85	Unknown	Unknown	Yes	No
P73843W	31768	GST	16	N	73	W	34	15	SWSE	41.30803	-105.5644	MINI MART INC.	123 NE	MON	0	9.63	5.66	Unknown	Unknown	Yes	No
P81472W	32864	GST	16	N	73	W	34	15	SWSE	41.30803	-105.5644	MINI MART INC.	B 1	MON	0	14	6	5	15	Yes	No
P81473W	32864	GST	16	N	73	W	34	15	SWSE	41.30803	-105.5644	MINI MART INC.	B 2	MON	0	14	5.9	5	15	Yes	No
P81474W	32864	GST	16	N	73	W	34	15	SWSE	41.30803	-105.5644	MINI MART INC.	B 3	MON	0	14	6.5	5	15	Yes	No
P145980W	37467	GST	16	N	73	W	34	15	SWSE	41.30803	-105.5644	WYOMING DEQ/WQD	1034/PZ1 AND 1034/PZ2	MON	0	20	11	11	20	Yes	No
P379C	14884	UNA	16	N	73	W	34	16	SESE	41.30805	-105.5595	WILL L. CARLISLE	CARLISLE #1	IRR	8	108	90	106	108	No	
P145989W	37467	GST	16	N	73	W	34	16	SESE	41.30805	-105.5595	WYOMING DEQ/WQD	0501/MW1 AND 0501/MW2	MON	0	30	13	27	30	Yes	No
P165501W	38239	GSI	16	N	73	W	35	2	NWNE	41.31904	-105.5451	CREEK VIEW, LLC	JRA-1	MIS						No	
P55508W	29616	ADJ	16	N	73	W	35	12	SESW	41.30809	-105.5499	CITY OF LARAMIE	TURNER #2	MUN	1400	350	-4	70	350	Yes	Yes
P59131W	29887	ADJ	16	N	73	W	35	12	SESW	41.30809	-105.5499	CITY OF LARAMIE	ENL TURNER #2	MUN	200	350	1.5	70	350	Yes	Yes
P69160W	31015		16	N	73	W	35	12	SESW	41.30809	-105.5499	WYOMING STATE HIGHWAY DEPARTMENT	SPRING CREEK #1	MIS	0	99	13.5	17	100	Yes	No

Table DIX6-8. Groundwater Rights Within Three Miles of the Permit Area

PERMIT	PRIORITY	STATUS	TOWNSHIP	TNS_SUFFIX	RANGE	RNG_SUFFIX	SECTION	QTR	QTRQTR	LATITUDE	LONGITUDE	APPLICANT	FACILITY NAME	USES	YLD ACT	WELL DEPTH	STATIC DEPTH	MWBZ TOP	MWBZ BOTTOM	WELL LOG	CHEMICAL
P69161W	31015	ADJ	16	N	73	W	35	12	SESW	41.30809	-105.5499	WYOMING STATE HIGHWAY DEPARTMENT	SPRING CREEK #2	MIS	25	99	15.2	19	99	Yes	No

SOURCE: Wyoming State Engineer's Office Water Rights Database, 09/02/2009.

GENERAL DISCLAIMER: The data contained herein are provided AS IS and IN NO EVENT SHALL the State of Wyoming, its agencies or representatives, be LIABLE for any DAMAGES including, without limitation, damages resulting from lost data or profits or revenue the costs of recovering such data, the cost of substitute data, computer repair or replacement costs, claims by third parties for similar costs, or any special, direct or indirect, incidental, punitive or consequential damages of any kind whatsoever, arising out of the use of these data. The accuracy or reliability of the data IS NOT GUARANTEED or WARRANTED in ay way and the State of Wyoming, its agencies or representatives, EXPRESSLY DISCLAIM LIABILITY, whether expressed or implied, or of any kind whatsoever, including without limitation, liability for QUALITY, PERFORMANCE, MERCHANTABILITY AND FITNESS FOR THE PARTICULAR PURPOSE arising from the use of the data, NEITHER the State of Wyoming, NOR its agencies or representatives, including the State Engineer's Office, REPRESENT or ENDORSE the ACCURACY or RELIABILITY OF ANY INFORMATION contained in the database, as some of the data are provided by permit applicants and may not have been verified by the State of Wyoming, its agencies or representatives. The State of Wyoming, its agencies and representatives RESERVE THE RIGHT, at their sole discretion, WITHOUT OBLIGATION, to MODIFY, ADD OR REMOVE all or portions of the data , at any time, WITH OR WITHOUT NOTICE. This includes the correction of errors or omissions within the database. All data or information provided by the Wyoming State Engineer's Office shall be used and relied upon only at the USER'S SOLE RISK, and the user agrees to indemnify and hold harmless the State of Wyoming, its agencies or representatives, including the Wyoming State Engineer's Office, and its officials, officers, and employees, from any liability arising out of the use or distribution of these data.

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RECD MAR 07, 2013

Water Rights Database Abbreviations

Water rights described in this database represent what is of record in our office as entered on the computer (many of the computer entries have not been proofed for accuracy and may not reflect the entire record about a water right or its current status). The office records may or may not reflect the actual situation on the ground. Failure to exercise a water right, for 5 years, when water is available, may constitute grounds for forfeiture.

ABBREVIATIONS FOR STATUS:
A&C=ABANDONED AND CANCELLED
ABA=ABANDONED
ADJ=ADJUDICATED
AME=AMENDED (LANDS MOVED TO NEW LOCATION NO LONGER UNDER THIS PERMIT)
CAN=CANCELLED
DSC=DESCRIPTION
E&C=ELIMINATED AND CANCELLED
ELI=ELIMINATED
EXP=EXPIRED
GSE=GOOD STANDING PERMITTED TIME LIMITS HAVE BEEN EXTENDED
GST=GOOD STANDING
GSM=GOOD STANDING BUT MAP IS STILL REQUIRED
GSI=GOOD STANDING INCOMPLETE-REQUIRED NOTICES NOT RECEIVED-NOT YET EXPIRED
OTH=OTHER
PU=POINT OF USE NON IRRIGATION (NOT ACTUAL STATUS)
PUD=POINT OF DIVERSION (NOT ACTUAL STATUS)
PUE=POINT OF EXTENSION (NOT ACTUAL STATUS)
PUH=POINT OF DIVERSION (NOT ACTUAL STATUS)
PUO=POINT OF RESERVOIR OUTLET (NOT ACTUAL STATUS)
PUW=LOCATION OF WELL (NOT ACTUAL STATUS)
REJ=REJECTED BY THE STATE ENGINEER
REC=LANDS RECEIVED FROM ANOTHER PERMIT
REM=REMAINING
TEM=TEMPORARY
TRA=TRANSFERRED TO ANOTHER FACILITY
UNA=UNADJUDICATED
?=NO ENTRY IN THE DATABASE FOR THIS APPROPRIATION

ABBREVIATIONS FOR USES:
AQU=AQUACULTURE
BAT=BATHING

Table DIX6-8. Groundwater Rights Within Three Miles of the Permit Area

PERMIT	PRIORITY	STATUS	TOWNSHIP	TNS_SUFFIX	RANGE	RNG_SUFFIX	SECTION	QTR	QTRQTR	LATITUDE	LONGITUDE	APPLICANT	FACILITY NAME	USES	YLD ACT	WELL DEPTH	STATIC DEPTH	MWBZ TOP	MWBZ BOTTOM	WELL LOG	CHEMICAL

CBM-COAL BED METHANE
CHE=CHEMICAL
CIF=CONSUMPTIVE INSTREAM FLOW
COM=COMMERCIAL
CNG=COAL BED NATURAL GAS
CUL=CULINARY
DEW=DEWATERING
DOM=DOMESTIC
DRI=DRILLING
DSP=DOMESTIC SUPPLY
ENV=ENVIRONMENTAL
ERO=EROSION CONTROL
FIR=FIRE PROTECTION
FIS=FISH PROPAGATION
FLO=FLOOD CONTROL
FTH=FLOW THROUGH NON-CONSUMPTIVE
GWR=GROUND WATER RECHARGE
HEX=HEAT EXTRACTION
ICE=ICE CUTTING
IND=INDUSTRIAL
IRR=IRRIGATION
ISF=INSTREAM FLOW
MAI=MAINTENANCE
MAN=MANUFACTURING
MEC=MECHANICAL
MED=MEDICINAL
MIL=MILLING
MIN=MINING
MIS=MISCELLANEOUS
MON=MONITORING
MUN=MUNICIPAL
OIL=OIL REFINING/PRODUCTION
POW=POWER DEVELOPMENT
RAI=RAILROAD
REC=RECREATION
REF=REFINING
RES=RESERVOIR SUPPLY
SED=SEDIMENTATION
STE=STEAM ENGINE
STO=STOCK
TEM=TEMPORARY USE
TST=TEST WELL
UTI=PUBLIC UTILITY
W&S=WILD & SCENIC
WET=WETLANDS
WIL=WILDLIFE

ABBREVIATIONS FOR SUPPLY TYPES (SupTy):
ADD=ADDITIONAL SUPPLY FROM A WELL
ORI=ORIGINAL SUPPLY

TFN 5 1/110
DEC 0 MAR 07 2012

Table DIX6-8. Groundwater Rights Within Three Miles of the Permit Area

PERMIT	PRIORITY	STATUS	TOWNSHIP	TNS_SUFFIX	RANGE	RNG_SUFFIX	SECTION	QTR	QTRQTR	LATITUDE	LONGITUDE	APPLICANT	FACILITY NAME	USES	YLD ACT	WELL DEPTH	STATIC DEPTH	MWBZ TOP	MWBZ BOTTOM	WELL LOG	CHEMICAL

STR=STORAGE SUPPLY (FOR RESERVOIR AND STOCK RESERVOIR PERMITS-MAY NOT APPEAR ON OLDER PERMITS)
SEC=SUPPLY FROM A RESERVOIR
SUP=SUPPLEMENTAL SUPPLY FROM ANOTHER SURFACE WATER SOURCE
SWS=SURFACE WATER SUPPLY (USED FOR FIRST SURFACE WATER SUPPLY FOR EXISTING GROUNDWATER SUPPLY)

RECORD SUFFIXES ARE DENOTED AS FOLLOWS:
A=ADJUDICATED (FINALIZED) RIGHTS; UNLESS THE RIGHT IS A TERRITORIAL APPROPRIATION, THERE WILL BE A MATCH IN THE AppNm COLUMN FROM ONE OF THE FOLLOWING PERMIT TYPES FOR THE UNADJUDICATED PORTION
C=WELL STATEMENTS OF CLAIM, FILED FROM 1947 TO 1957 FOR WELLS COMPLETED PRIOR TO APRIL 1, 1947
D=DITCH OR PIPELINE PERMIT
G= WELL REGISTRATIONS, FILED FOR WELLS COMPLETED AFTER APRIL 1, 1947
E=ENLARGEMENT OF A DITCH OR PIPELINE PERMIT
P=STOCK AND DOMESTIC USE WELLS COMPLETED PRIOR TO MAY 24, 1969 AND REGISTERED WITH THE STATE ENGINEER'S OFFICE PRIOR TO DECEMBER 31, 1972
R=RESERVOIR PERMIT
S=STOCK RESERVOIR PERMIT
U=UTAH PERMIT RECORDED IN UTAH; LANDS IN WYOMING
"'W" PERMITS ARE FOR WELLS WITH A PRIORITY DATE FOR THE DATE OF FILING WITH THE STATE ENGINEER

RECORD PREFIXES ARE DENOTED AS FOLLOWS:
B= BEAR CREEK COURT DECREE
D= BALDWIN CREEK COURT DECREE
E= CLEAR CREEK COURT DECREE
H= HORSE CREEK COURT DECREE
K= CROW CREEK COURT DECREE
L= LARAMIE RIVER COURT DECREE
M= CRAZY WOMAN CREEK COURT DECREE
R= ROCK CREEK COURT DECREE
S= SWEETWATER CREEK COURT DECREE
T-TERRITORIAL APPROPRIATION
AN "X" IN THE LOC (LOCATION) FIELD INDICATES THE LOCATION OF A HEADGATE FOR A DITCH OR PIPELINE, AN OUTLET FOR A RESERVOIR OR STOCK RESERVOIR OR THE LOCATION OF WELL

THE FOLLOWING QUARTER-QUARTERS ARE DESIGNATED BY THE "Qtr" FIELD:
1=NE¼NE¼
2=NW¼NE¼
3=SW¼NE¼
4=SE¼NE¼
5=NE¼NW¼
6=NW¼NW¼
7=SW¼NW¼
8=SE¼NW¼
9=NE¼SW¼
10=NW¼SW¼
11=SW¼SW¼
12=SE¼SW¼
13=NE¼SE¼
14=NW¼SE¼
15=SW¼SE¼
16=SE¼SE¼

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Table DIX6-9. Ephemeral Drainage Characterization.

PEAK FLOW DATA

Design Storm	Measurement	Unit	Drainage Area											
			DA1	DA2	DA3	DA4	DA5	DA6	DA7	DA8	DA9	DA10	DA11	DA12
2-yr/24-hr	Peak Discharge	cfs	70.8	19.7	13.5	11.4	10.4	4.5	6.1	4.0	4.7	3.5	4.1	2.3
	Runoff Volume	ac-ft	48.6	10.2	5.3	4.7	3.2	1.4	1.4	1.3	1.1	1.1	1.1	0.7
10-yr/24-hr	Peak Discharge	cfs	402.8	125.1	98.4	77.5	74.5	32.4	41.7	28.9	32.4	24.9	28.9	16.1
	Runoff Volume	ac-ft	174.2	36.5	18.9	16.8	11.5	5.1	5.0	4.8	4.0	4.0	3.9	2.6
100-yr/24-hr	Peak Discharge	cfs	1213.1	381.5	287.1	231.8	220.8	96.6	119.4	83.7	93.4	74.3	84.2	48.4
	Runoff Volume	ac-ft	436.1	91.3	47.4	42.1	28.7	12.8	12.5	11.9	10.1	9.9	9.7	6.5

DRAINAGE BASIN DATA

Drainage Basin	Watershed Area (acre)	Average Basin Slope (%)	Sub-Watershed	Sub-Watershed Area (acre)	Average Channel Slope (%)	Drainage Density (mi/mi^2)
DA1	5228.9	18.75	DA1-1	246.1	6.70	3.83
			DA1-2	197.4	6.55	3.84
			DA1-3	149.3	2.49	6.41
			DA1-4	637.3	6.04	1.81
			DA1-5	190.4	12.14	2.66
			DA1-6	161.7	8.65	5.88
			DA1-7	108.3	5.04	4.20
			DA1-8	247.4	8.12	4.24
			DA1-9	174.4	4.21	2.38
			DA1-10	100.3	10.08	2.85
			DA1-11	102.7	10.04	4.98
			DA1-12	299.0	7.13	2.54
			DA1-13	102.9	11.31	3.89
			DA1-14	873.5	5.46	2.00
			DA1-15	351.4	5.99	2.53
			DA1-16	417.2	6.65	2.65
			DA1-17	57.3	9.03	4.21
			DA1-18	229.9	4.98	4.35
			DA1-19	275.4	3.18	3.39
			DA1-20	76.4	4.21	3.63
			DA1-21	57.0	2.62	3.63
			DA1-22	173.7	2.06	4.67
DA2	1095.3	16.01	DA2-1	228.7	8.54	2.87
			DA2-2	167.2	10.83	2.92
			DA2-3	228.5	5.67	3.33
			DA2-4	164.8	8.28	6.75
			DA2-5	95.8	3.63	4.81
			DA2-6	130.5	6.37	1.81
			DA2-7	79.8	3.63	4.68
DA3	568.0	14.47	DA3-1	230.6	7.07	3.13
			DA3-2	296.9	4.31	2.96
			DA3-3	40.5	2.77	7.15
DA4	505.4	9.90	DA4-1	319.0	5.17	3.70
			DA4-2	141.9	2.94	2.65
			DA4-3	44.6	2.65	5.15
DA5	344.3	9.90	DA5-1	180.1	4.96	5.99
			DA5-2	156.9	5.21	5.38
			DA5-3	7.3	3.35	19.17
DA6	153.1	6.18	-	-	3.90	3.42
DA7	150.2	10.98	-	-	5.22	4.50
DA8	142.7	17.81	-	-	9.69	4.30
DA9	120.9	10.98	-	-	4.21	4.68
DA10	119.2	7.52	-	-	4.00	6.96
DA11	115.8	5.84	-	-	6.46	3.26
DA12	77.6	15.83	-	-	10.92	5.95

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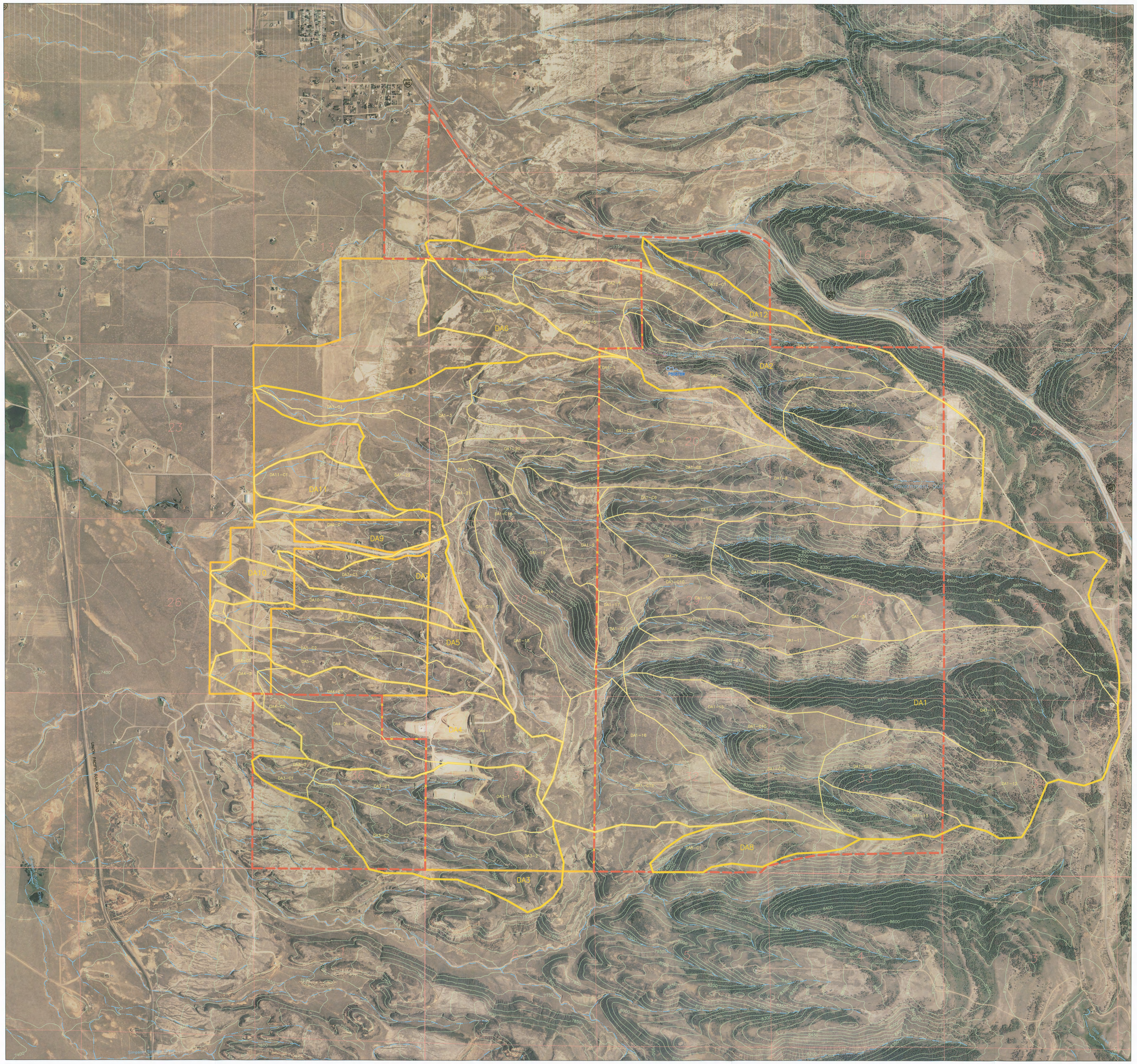
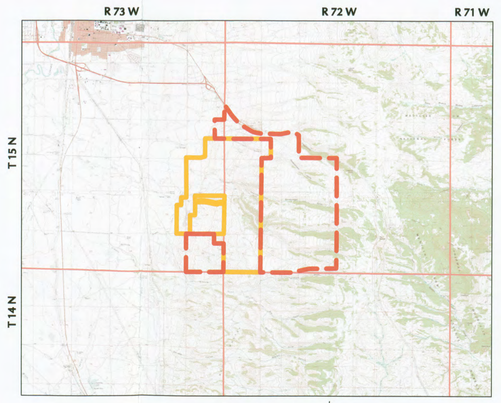
OCT 15, 2012

APPENDIX DIX6
MAPS

RECEIVED
APR 6 2010
WDEQ/LQD

5'/110





LOCATION MAP

0 10,000'
SCALE

DRAINAGE BASIN DATA

Drainage Basin	Watershed Area (acre)	Average Basin Slope (%)	Sub-Watershed	Sub-Watershed Area (acre)	Average Channel Slope (%)	Drainage Density (mi/mi²)
DA1	5228.9	18.75	DA1-1	246.1	6.70	3.83
			DA1-2	197.4	6.55	3.84
			DA1-3	149.3	2.49	6.41
			DA1-4	637.3	6.04	1.81
			DA1-5	190.4	12.14	2.66
			DA1-6	161.7	8.65	5.88
			DA1-7	108.3	5.04	4.20
			DA1-8	247.4	8.12	4.24
			DA1-9	174.4	4.21	2.38
			DA1-10	100.3	10.08	2.85
			DA1-11	102.7	10.04	4.98
			DA1-12	299.0	7.13	2.54
			DA1-13	102.9	11.31	3.89
			DA1-14	873.5	5.46	2.00
			DA1-15	351.4	5.99	2.53
			DA1-16	417.2	6.65	2.65
			DA1-17	57.3	9.03	4.21
			DA1-18	229.9	4.98	4.35
			DA1-19	275.4	3.18	3.39
			DA1-20	76.4	4.21	3.63
			DA1-21	57.0	2.62	3.63
			DA1-22	173.7	2.06	4.67
DA2	1095.3	16.01	DA2-1	228.7	8.54	2.87
			DA2-2	167.2	10.83	2.92
			DA2-3	228.5	6.67	3.33
			DA2-4	164.8	8.28	6.75
			DA2-5	95.8	3.63	4.81
			DA2-6	130.5	6.37	1.81
			DA2-7	79.8	3.63	4.68
DA3	568.0	14.47	DA3-1	230.6	7.07	3.13
			DA3-2	296.9	4.31	2.96
			DA3-3	40.5	2.77	7.15
DA4	505.4	9.90	DA4-1	319.0	5.17	3.70
			DA4-2	141.9	2.94	2.65
			DA4-3	44.6	2.65	5.15
DA5	344.3	9.90	DA5-1	180.1	4.96	5.99
			DA5-2	156.9	5.21	5.38
			DA5-3	7.3	3.35	19.17
DA6	153.1	6.18	-	-	3.90	3.42
DA7	150.2	10.98	-	-	5.22	4.50
DA8	142.7	17.81	-	-	9.69	4.30
DA9	120.9	10.98	-	-	4.21	4.68
DA10	119.2	7.52	-	-	4.00	5.96
DA11	115.8	5.84	-	-	6.46	3.26
DA12	77.6	15.83	-	-	10.92	5.95

CHANNEL DATA

Drainage Channel	Channel Length (mi)	Average Slope (%)	Channel Sinuosity
Government Gulch	4.87	4.46	1.04
Government Gully	3.52	5.77	1.04
DA1-C1	2.93	4.59	1.08
DA1-C2	1.19	6.55	1.05
DA1-C5	0.80	12.14	1.04
DA1-C6	1.47	8.65	1.03
DA1-C8	1.65	8.12	1.03
DA1-C10	0.46	10.08	1.05
DA1-C11	1.18	9.72	1.01
DA1-C12	2.58	6.52	1.03
DA1-C13	0.62	11.31	1.01
DA1-C14	4.51	4.52	1.04
DA1-C15	0.50	16.29	1.04
DA1-C16	1.72	6.65	1.04
DA1-C18	1.57	4.98	1.05
DA1-C19	0.44	12.84	1.01
DA2-C2	0.76	10.83	1.04
DA2-C3	0.56	14.98	1.04
DA2-C4	1.76	8.28	1.05
DA2-C6	0.36	6.37	1.01
DA3-C1	1.55	5.35	1.07
DA3-C2	1.36	4.31	1.08
DA4-C1	2.21	4.76	1.06
DA4-C2	0.58	2.94	1.03
DA5-C1	1.87	4.80	1.03
DA5-C2	1.34	5.21	1.04
DA6-C1	0.82	3.90	1.02
DA7-C1	1.04	5.22	1.04
DA8-C1	0.95	9.69	1.04
DA9-C1	0.89	4.21	1.01
DA10-C1	1.32	4.00	1.06
DA11-C1	0.59	6.46	1.03
DA12-C1	0.71	10.92	1.04

PEAK FLOW DATA

Design Storm	Measurement	Unit	Drainage Area											
			DA1	DA2	DA3	DA4	DA5	DA6	DA7	DA8	DA9	DA10	DA11	DA12
2-yr/24-hr	Peak Discharge	cfs	70.8	19.7	13.5	11.4	10.4	4.5	6.1	4.0	4.7	3.5	4.1	2.3
	Runoff Volume	ac-ft	48.6	10.2	5.3	4.7	3.2	1.4	1.4	1.3	1.1	1.1	1.1	0.7
10-yr/24-hr	Peak Discharge	cfs	402.8	125.1	96.4	77.5	74.5	32.4	41.7	28.9	32.4	24.9	28.9	16.1
	Runoff Volume	ac-ft	174.2	36.5	18.9	16.8	11.5	5.1	5.0	4.8	4.0	4.0	3.9	2.6
100-yr/24-hr	Peak Discharge	cfs	1213.1	381.5	287.1	231.8	220.8	96.6	119.4	83.7	93.4	74.3	84.2	46.4
	Runoff Volume	ac-ft	436.1	91.3	47.4	42.1	28.7	12.8	12.5	11.9	10.1	9.9	9.7	6.5

LEGEND

ETCHEPARE AMENDMENT CURRENT 298C PERMIT

298C-A8 AMENDMENT

DRAINAGE BASIN BOUNDARY

DRAINAGE SUB-BASIN BOUNDARY

EPHEMERAL CREEKS AND STREAMS

PERENNIAL CREEKS AND STREAMS

TOPOGRAPHIC CONTOURS

GROUNDWATER (SPRING) LOCATION AND PERMIT IDENTIFICATION TO NEAREST QUARTER-QUAR

SOURCE NOTES:

USDA, 2009. DIGITAL NAIP MAP OF ALBANY COUNTY, WYOMING.

USGS EROS DATA CENTER, SIOUX FALLS, SD. TOPOGRAPHIC DATA.

USGS, 1963 PHOTOREVISED 1978. DIGITAL 7.5 MINUTE QUADRANGLE OF RED BUTTES, WYO.

USGS, 1978, PHOTOREVISED 1978. DIGITAL 7.5 MINUTE QUADRANGLE OF LARAMIE, WY.

USGS, 1987. DIGITAL 7.5 MINUTE QUADRANGLE OF PILOT HILL, WY.

USGS, 1987. DIGITAL 7.5 MINUTE QUADRANGLE OF SHERMAN MOUNTAINS WEST, WY.

NOAA, 2009. HYDROMETEOROLOGICAL DESIGN STUDIES CENTER, NOAA ATLAS 2.

CIVIL SOFTWARE DESIGN, 1998. SEDCAD4 FOR WINDOWS.

TFN 5 1/110
RECD MAR 07, 2013

0 1,000'
SCALE

MAP DIX6-1

SURFACE WATER DRAINAGE BASINS

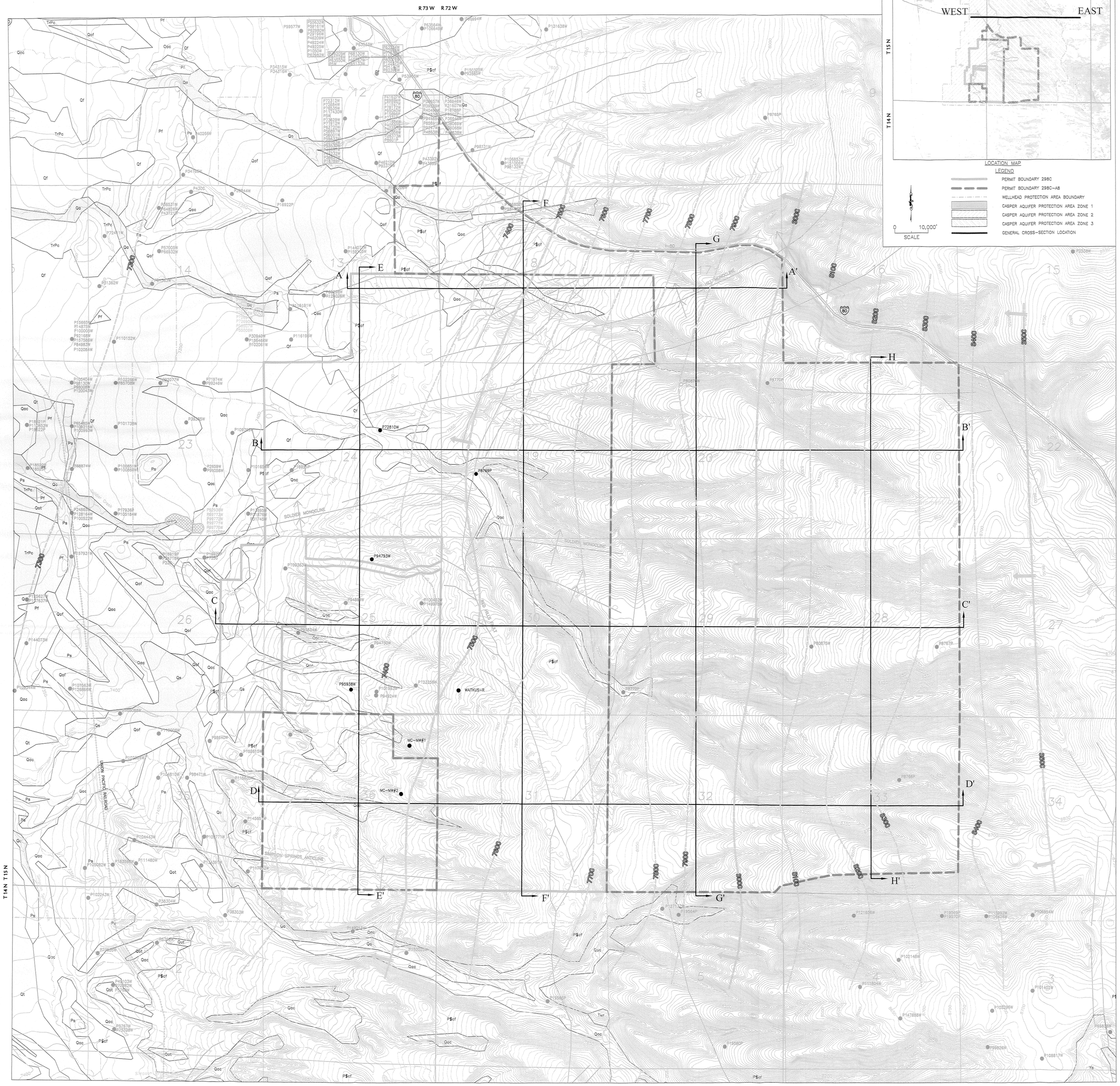
MOUNTAIN CEMENT COMPANY
ETCHEPARE QUARRY
PERMIT 298C-A8

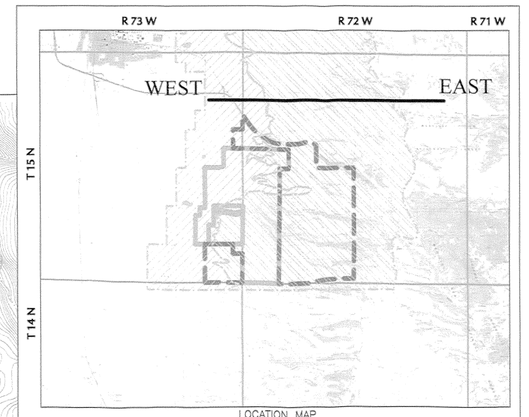
REVISED BY:	DATE:
WWC	01/13

MOUNTAIN CEMENT COMPANY
5 SAND CREEK ROAD
LARAMIE, WYOMING

WWC ENGINEERING
611 SKYLINE ROAD
LARAMIE, WY 82070

DESIGNED BY: FMT	DATE: 03/10
DRAWN BY: SDG	DATE: 03/10
CHECKED BY: MTS	DATE: 03/10
JOB NO: 2009083	
SHEET NO: 1 OF 1	





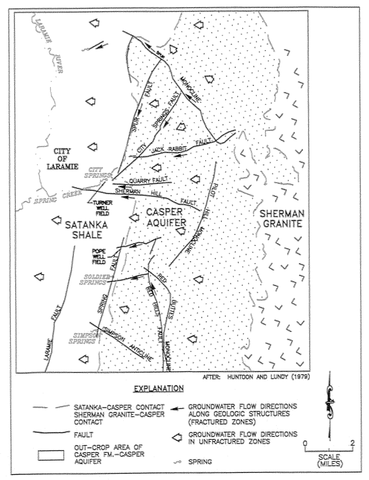
LOCATION MAP

LEGEND

- PERMIT BOUNDARY 298C
- PERMIT BOUNDARY 298C–A8
- WELLHEAD PROTECTION AREA BOUNDARY
- CASPER AQUIFER PROTECTION AREA ZONE 1
- CASPER AQUIFER PROTECTION AREA ZONE 2
- CASPER AQUIFER PROTECTION AREA ZONE 3
- GENERAL CROSS-SECTION LOCATION

PERIOD	FORMATION	LITHOLOGIC DESCRIPTION		APPROXIMATE THICKNESS FEET
PERMIAN	SATANKA SHALE	RED SHALE, SANDY SHALE AND SILTSTONE. SILTSTONE IS FINE TO COARSE, BUFF, ORANGE AND RED. SANDSTONE. LOCAL GYPSUM BEDS IN UPPER 80 FEET OF UNIT. CONTACT BETWEEN CASPER AND SATANKA IS GRADATIONAL. LOWER 10 FEET OF SATANKA HAS MORE RED SHALE, SILTSTONE, SANDSTONES AND MINOR RED SANDY SHALE.		250–320
		UNCONFORMITY		
	CASPER (INCLUDING FOUNTAIN FORMATION)	BUFF TO REDDISH, CALCAROUS TO QUARTZIC, VERY FINE TO COARSE GRAINED, WELL SORTED SANDSTONE. SANDSTONE IS SUBORDINATE WITH BUFF TO PURPLISH-GRAY LIMESTONE AND DOLOMITE BEDS THAT THIN TO THE SOUTH AND WEST. THE LIMESTONE AND DOLOMITE ARE 5–25 FEET THICK. OCCASIONAL THIN RED SHALE AT TOP AND BOTTOM OF LIMESTONE BEDS. CONTACT WITH UNDERLYING FOUNTAIN FORMATION WHICH IS LESS THAN 50 FEET THICK. THE CASPER FM. IS SUBDIVIDED INTO 5 INFORMAL MEMBERS, EPSILON – ALPHA.	EPSILON	60
			DELTA	100
			GAMMA	80
			BETA	120
			ALPHA	340
				650–700
PENNSYLVANIAN		UNCONFORMITY		
PRECAMBRIAN	SHERMAN GRANITE	IGNEOUS ROCK CONSISTING PRIMARILY OF GRANITE WITH GNEISS, ANORTHOSITE, AND GABBRO INTRUSIONS.		

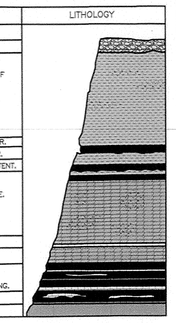
STRATIGRAPHIC COLUMN



GENERALIZED GROUNDWATER FLOW

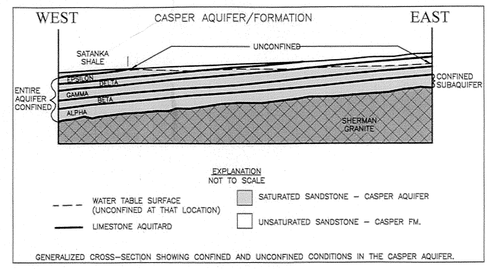
AGE	FORMATION	THICKNESS (FEET)	WATER SUPPLY
QUATERNARY	ALLUVIUM	0–45	CONTAINS SMALL AMOUNTS OF WATER.
CRETACEOUS	UNDIVIDED	6500	WATER YIELD DEPENDS ON LITHOLOGY. MAJORITY OF SECTION IS SHALE, AND YIELDS SMALL AMOUNTS OF WATER. SMALL AMOUNTS OF HIGHLY MINERALIZED WATER. SANDSTONES, NOTABLE IN THE FRONTIER FORMATION AND THE MESAVERDE GROUP, YIELD GOOD WATER SUPPLIES TO WELLS.
	CLOVERLY	115–236	SANDS CONTAIN HIGHLY MINERALIZED WATER.
JURASSIC	MORRISON	135–220	HIGHLY MINERALIZED BUT POTABLE WATER.
	SUNDANCE	0–200	CONTAINS WATER, BUT LIMITED AREAL EXTENT.
TRIASSIC	CHUGWATER	1100–1200	SULFATE-RICH WATER. USED FOR IRRIGATION WATER AND FOR STOCK WATERING NORTH AND SOUTH OF LARAMIE.
PERMAIN	FORELLE	9–25	YIELDS LITTLE OR NO WATER.
	SATANKA	230–300	SULFATE-RICH WATER USED FOR STOCK WATERING.
	CASPER	500–700	MOST IMPORTANT AQUIFER IN AREA. SUPPLIES WATER TO WELLS AND LARGE SPRINGS ON WEST FLANK OF LARAMIE RNG.
PENNSYLVANIAN	FOUNTAIN	20–50	INCLUDED IN "CASPER AQUIFER"
PRECAMBRIAN	UNDIVIDED		YIELDS SMALL AMOUNTS OF WATER.

LITHOLOGY



SANDSTONE – SILTSTONE; SHALE; LIMESTONE; DOLOMITE; GYPSUM; IGNEOUS – METAMORPHIC; GRAVEL

HYDROGEOLOGIC COLUMN



GENERALIZED CROSS-SECTION SHOWING CONFINED AND UNCONFINED CONDITIONS IN THE CASPER AQUIFER.

GENERAL CROSS-SECTION

REFER TO LOCATION MAP.

LEGEND

- PERMIT BOUNDARY 298C
- PERMIT BOUNDARY 298C–A8
- P101402W — GROUNDWATER LOCATION AND PERMIT IDENTIFICATION TO NEAREST QUARTER–QUARTER
- GROUNDWATER LOCATION AND PERMIT (POPE SPRINGS WELLFIELD)
- GROUNDWATER LOCATION AND PERMIT (SOLDIER SPRINGS WELLFIELD)
- P80876W — GROUNDWATER (SPRING) LOCATION AND PERMIT IDENTIFICATION TO NEAREST QUARTER–QUARTER
- MC–MW#2 — GROUNDWATER LOCATION AND PERMIT IDENTIFICATION FOR WELLS CURRENTLY USED TO MONITOR GROUNDWATER
- 8400 — EQUIPOTENTIAL CONTOUR
- POTENTIAL GROUNDWATER FLOW DIRECTION
- EPHEMERAL CREEKS AND STREAMS
- PERENNIAL CREEKS AND STREAMS
- HIGHWAYS
- 8750 — TOPOGRAPHIC CONTOURS
- WELLHEAD PROTECTION AREA BOUNDARY
- D — D' CROSS-SECTION LOCATION AND IDENTIFICATION

GEOLOGY LEGEND

Qa	ALLUVIAL DEPOSITS
Qs	WINDBLOWN DEPOSITS
Qac	MIXED ALLUVIUM AND COLLUVIUM
Qf	ALLUVIAL FAN DEPOSITS
Qt	QT TERRACE DEPOSITS
Qof	OLDER ALLUVIAL FAN DEPOSITS
Qot	QOT OLDER TERRACE DEPOSITS
Twr	WHITE RIVER FORMATION
TrPc	CHUGWATER FORMATION
Pf	FORELLE LIMESTONE
Ps	SATANKA SHALE
PScf	CASPER AND FOUNTAIN FORMATIONS, UNDIVIDED
Ys	SHERMAN GRANITE
	CONTACTS
	FAULTS
	MONOCLINE
	ANTICLINE

MAP NOTES:

POTENTIOMETRIC SURFACE APPROXIMATED USING WYOMING SEO GROUNDWATER LOCATION AND IDENTIFICATION AND USGS TOPOGRAPHIC DATA.

POTENTIOMETRIC GRADIENT 0.01 TO 0.12 FT/FT.

SOURCE NOTES:

ALBANY COUNTY GIS DEPARTMENT.

LARAMIE GIS DEPARTMENT.

THOMPSON, K. S., 1979. PREDICTION OF WATER LEVEL DECLINES IN THE CASPER AQUIFER IN THE VICINITY OF LARAMIE, WY. UNIVERSITY OF WYOMING MASTER OF SCIENCE THESIS.

USDA, 2009. DIGITAL NAIP MAP OF ALBANY COUNTY, WYOMING.

USGS EROS DATA CENTER, SIOUX FALLS, SD. TOPOGRAPHIC DATA.

USGS, 1963 PHOTOREVISED 1978. DIGITAL 7.5 MINUTE QUADRANGLE OF RED BUTTES, WYO.

USGS, 1978, PHOTOREVISED 1978. DIGITAL 7.5 MINUTE QUADRANGLE OF LARAMIE, WY.

USGS, 1987. DIGITAL 7.5 MINUTE QUADRANGLE OF PILOT HILL, WY.

USGS, 1987. DIGITAL 7.5 MINUTE QUADRANGLE OF SHERMAN MOUNTAINS WEST, WY.

WITTMAN HYDRO PLANNING ASSOCIATES, 2008. CASPER AQUIFER PROTECTION PLAN.

WESTERN WATER CONSULTANTS, INC., 1993. WELLHEAD PROTECTION AREA DELINEATION FOR TURNER WELL FIELD, POPE WELL FIELD SOLDIER SPRING, AND SIMPSON SPRINGS.

WESTERN WATER CONSULTANTS, INC., 1997. HYDROGEOLOGIC INVESTIGATION OF LAPRELE PARK PROJECT.

WESTERN WATER CONSULTANTS, INC., 1997. VOLUME II: TESTING AND EVALUATION OF PRODUCTION TEST WELLS, SPUR WELLFIELD PROJECT – PHASE I.

WYOMING GEOLIBRARY.

WYOMING SEO DATABASE, 09/02/09. GROUNDWATER LOCATION AND PERMIT IDENTIFICATION TO NEAREST QUARTER–QUARTER.

WSGS, 1995. PRELIMINARY GEOLOGIC MAP OF THE LARAMIE QUADRANGLE, ALBANY COUNTY, WYOMING, PGM–95–1.

WSGS, 2007. DIGITAL GEOLOGIC MAP OF THE LARAMIE 30X60 QUADRANGLE, ALBANY AND LARAMIE COUTIES, SOUTHEASTERN WYOMING.

TFN 5 1/110
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0 1,000'
SCALE

MAP DIX6-2

HYDROGEOLOGY

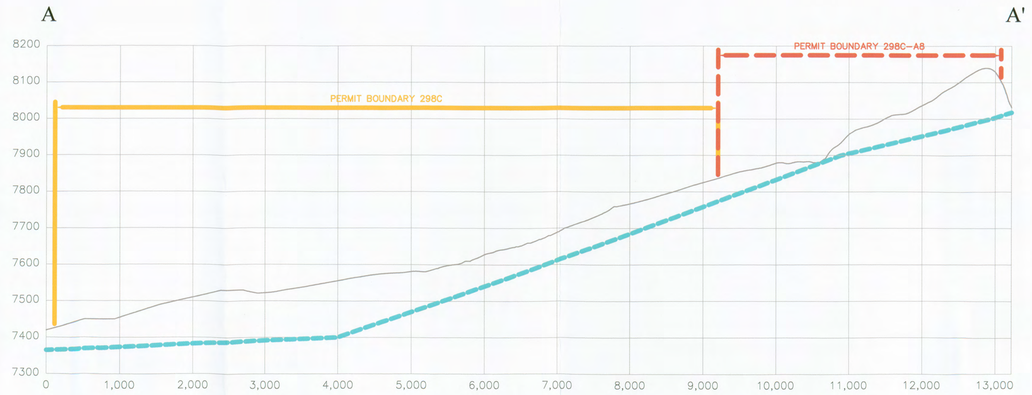
MOUNTAIN CEMENT COMPANY
ETCHEPARE QUARRY
PERMIT 298C–A8

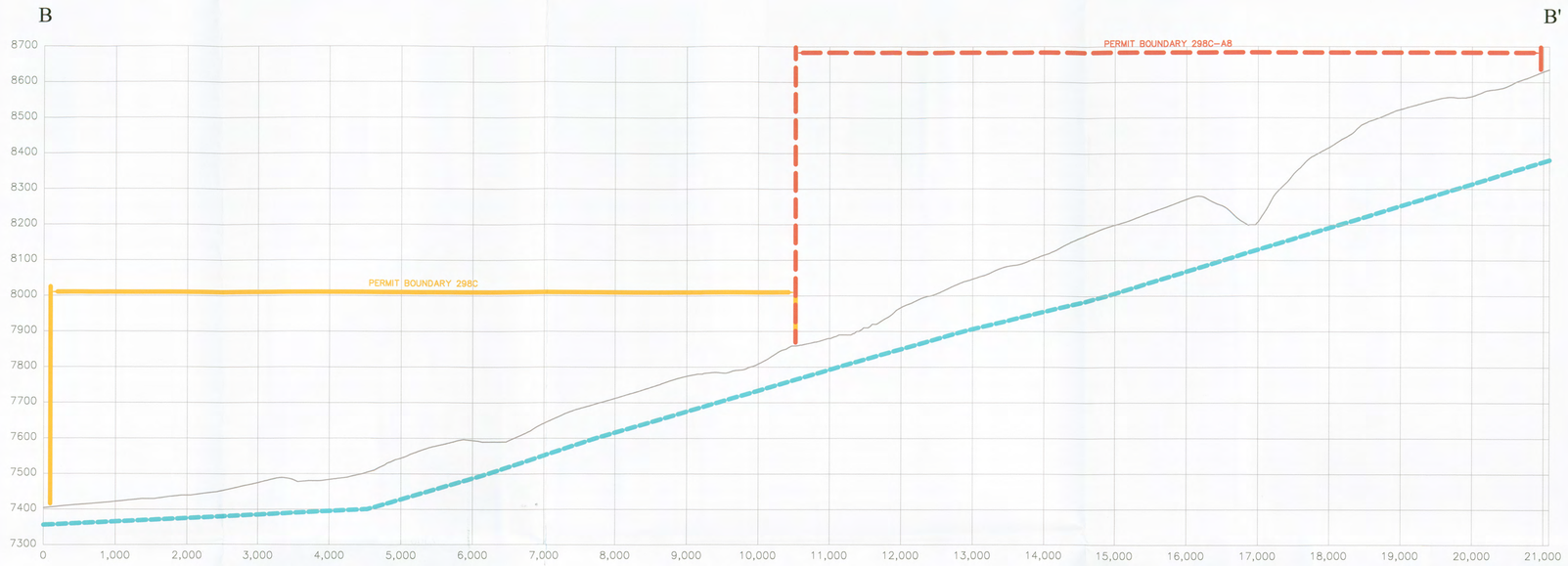
REVISED BY:	DATE:
WWC	01/13

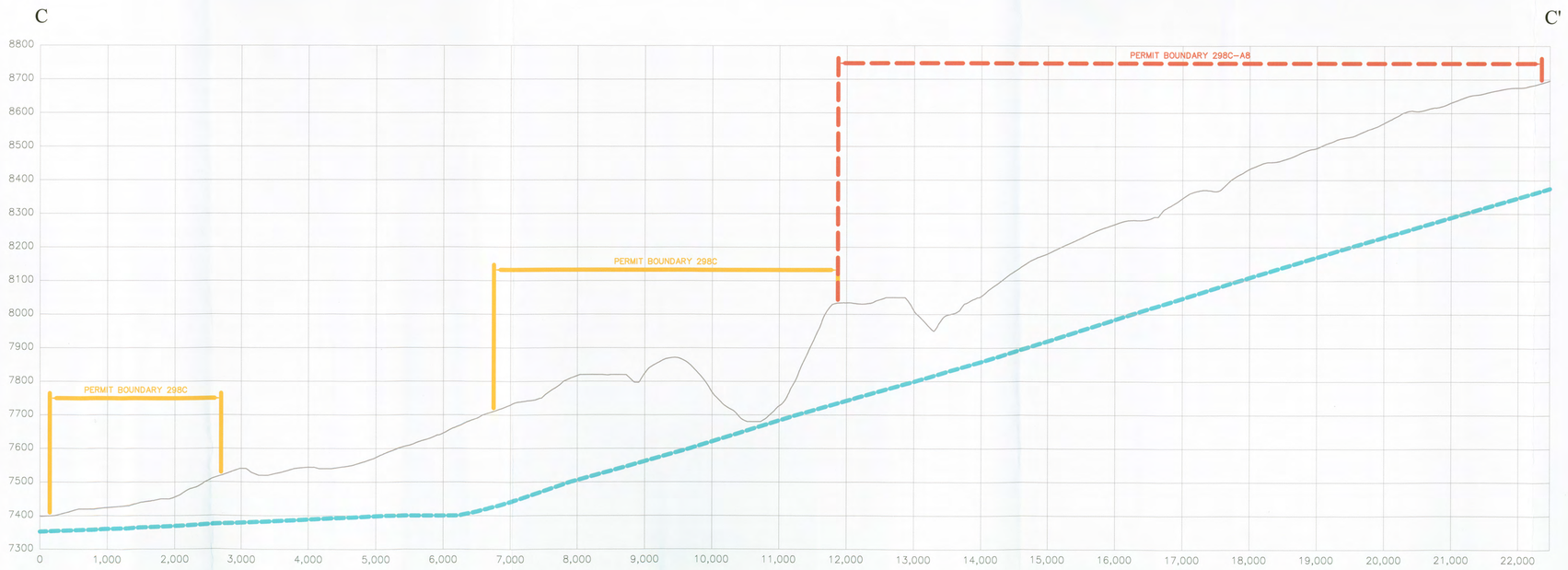
MOUNTAIN CEMENT COMPANY
5 SAND CREEK ROAD
LARAMIE, WYOMING

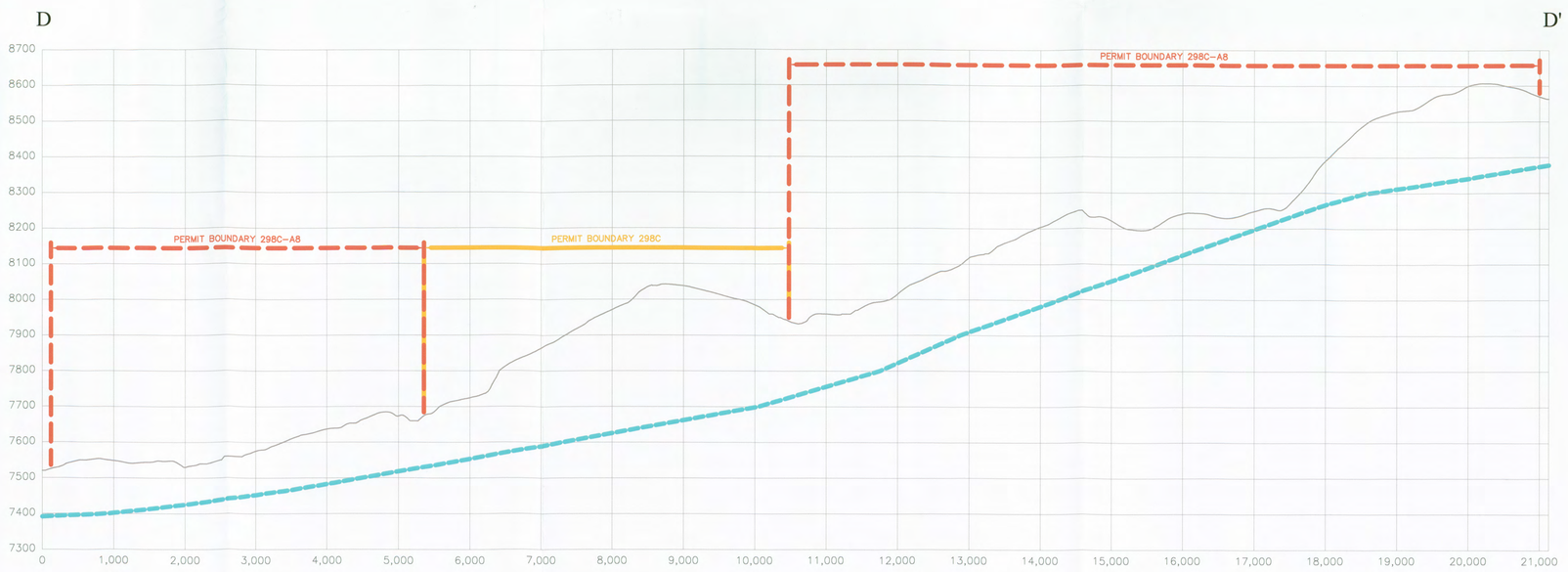
WWC ENGINEERING
611 SKYLINE ROAD
LARAMIE, WY 82070

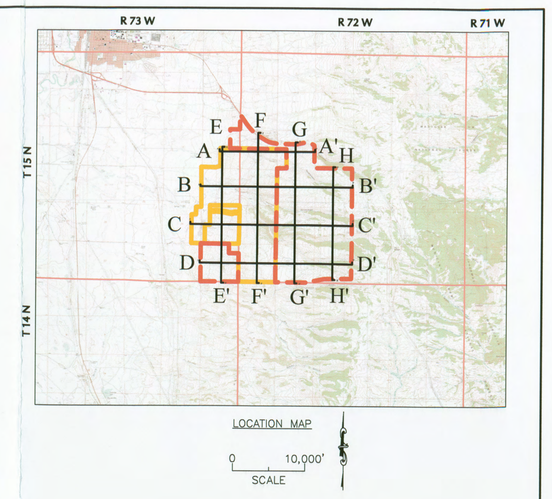
DESIGNED BY:	DATE:
TNS	03/10
DRAWN BY:	DATE:
SDG	03/10
CHECKED BY:	DATE:
MTS	03/10
JOB NO:	
2009083	
SHEET NO:	
1 OF 1	

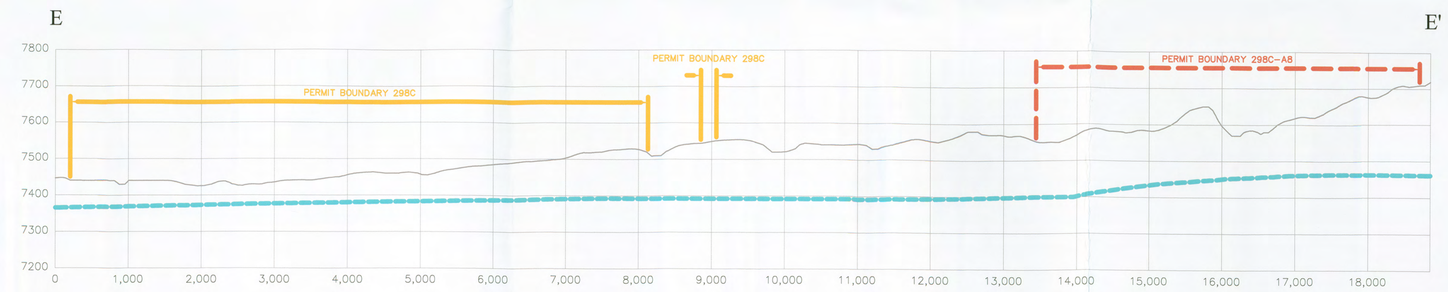


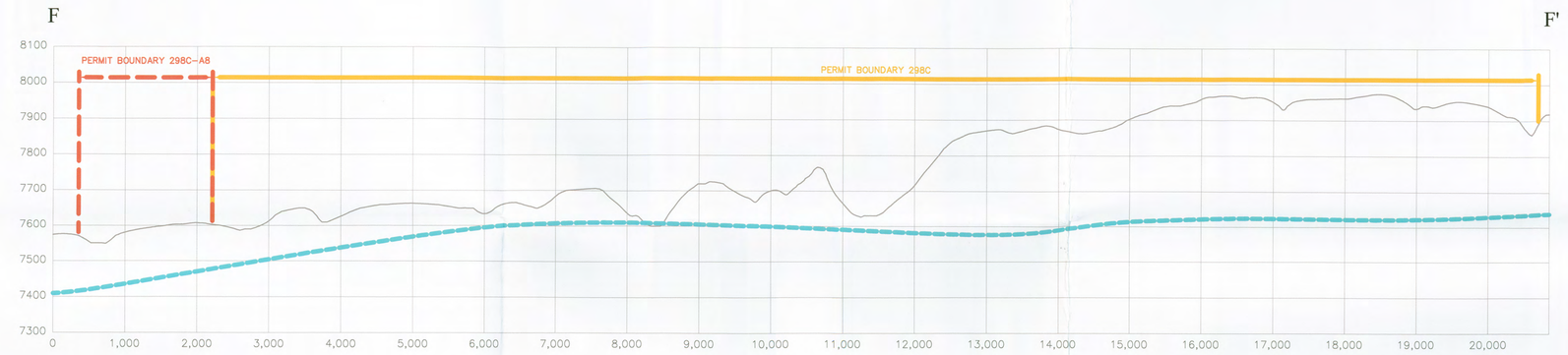


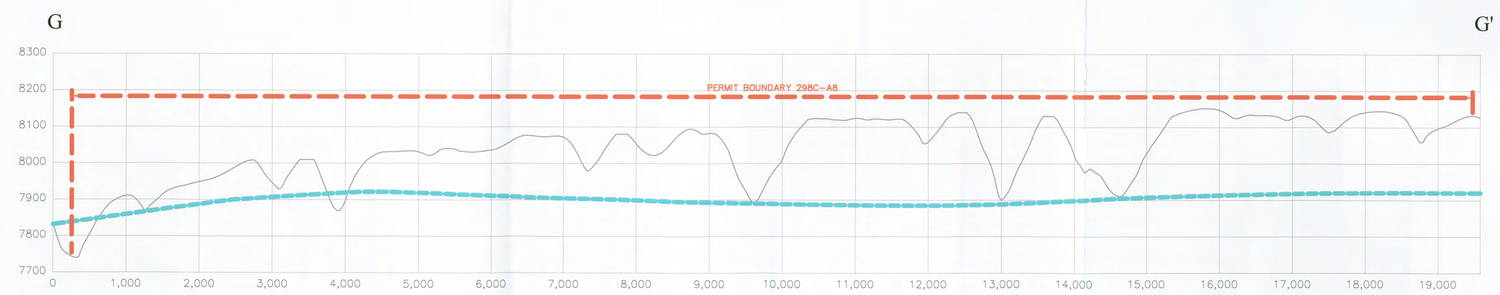


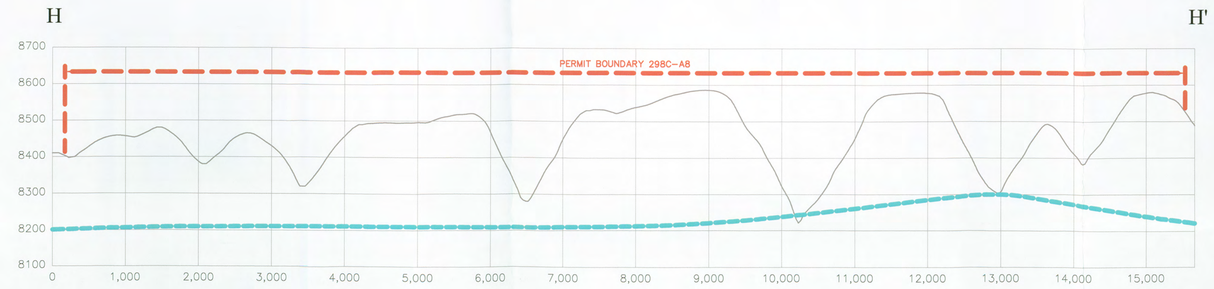












LEGEND

- PERMIT BOUNDARY 298C
- PERMIT BOUNDARY 298C-A8
- EXISTING GROUND
- POTENTIOMETRIC SURFACE

MAP NOTES:

POTENTIOMETRIC SURFACE APPROXIMATED USING WYOMING SEO GROUNDWATER LOCATION AND IDENTIFICATION AND USGS TOPOGRAPHIC DATA.

POTENTIOMETRIC GRADIENT 0.01 TO 0.12 FT/FT.

SOURCE NOTES:

USGS EROS DATA CENTER, SIOUX FALLS, SD. TOPOGRAPHIC DATA.

USGS, 1963 PHOTOREVISED 1978. DIGITAL 7.5 MINUTE QUADRANGLE OF RED BUTTES, WYO.

USGS, 1978, PHOTOREVISED 1978. DIGITAL 7.5 MINUTE QUADRANGLE OF LARAMIE, WY.

USGS, 1987. DIGITAL 7.5 MINUTE QUADRANGLE OF PILOT HILL, WY.

USGS, 1987. DIGITAL 7.5 MINUTE QUADRANGLE OF SHERMAN MOUNTAINS WEST, WY.

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0 1000' 0 200'
HORIZONTAL VERTICAL
SCALE

MAP DIX6-3

POTENTIOMETRIC SURFACE CROSS-SECTIONS A–H

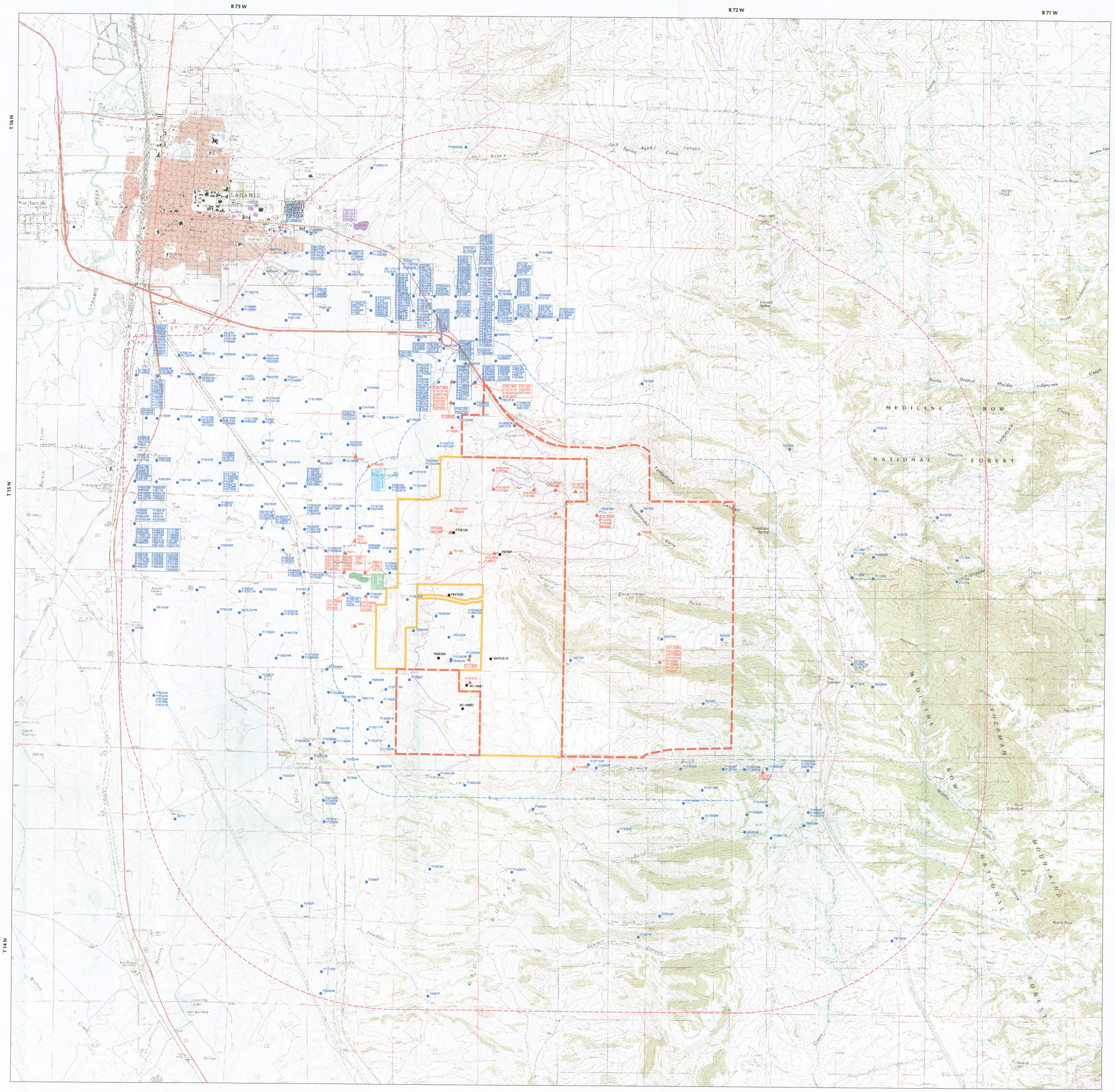
MOUNTAIN CEMENT COMPANY
ETCHEPARE QUARRY
PERMIT 298C–A8

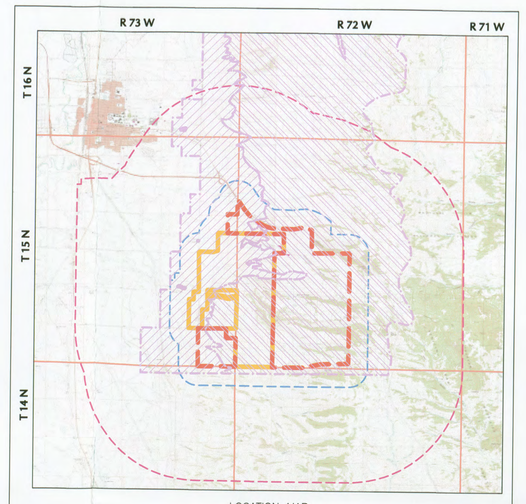
REVISED BY:	DATE:
WWC	01/13

MOUNTAIN CEMENT COMPANY
5 SAND CREEK ROAD
LARAMIE, WYOMING

WWC ENGINEERING
611 SKYLINE ROAD
LARAMIE, WY 82070

DESIGNED BY: TNS	DATE: 03/10
DRAWN BY: SDG	DATE: 03/10
CHECKED BY: MTS	DATE: 03/10
JOB NO: 2009083	
SHEET NO:	1 OF 1





LOCATION MAP

LEGEND

- PERMIT BOUNDARY 298C
- PERMIT BOUNDARY 298C–A8
- WELLHEAD PROTECTION AREA BOUNDARY
- CASPER AQUIFER PROTECTION AREA ZONE 1
- CASPER AQUIFER PROTECTION AREA ZONE 2
- CASPER AQUIFER PROTECTION AREA ZONE 3
- 1/2 MILE BOUNDARY
- 3 MILE BOUNDARY

0 10,000'
SCALE

LEGEND

- PERMIT BOUNDARY 298C
- PERMIT BOUNDARY 298C–A8
- 1/2 MILE BOUNDARY
- 3 MILE BOUNDARY
- P101402W — GROUNDWATER LOCATION AND PERMIT IDENTIFICATION TO NEAREST QUARTER–QUARTER
- P95550W — GROUNDWATER LOCATION AND PERMIT (TURNER WELLFIELD)
- P95550W — GROUNDWATER LOCATION AND PERMIT (POPE SPRINGS WELLFIELD)
- P130021W — GROUNDWATER LOCATION AND PERMIT (SOLDIER SPRINGS WELLFIELD)
- P80878W — GROUNDWATER (SPRING) LOCATION AND PERMIT IDENTIFICATION TO NEAREST QUARTER–QUARTER
- WC–MW2 — GROUNDWATER LOCATION AND PERMIT IDENTIFICATION FOR WELLS CURRENTLY USED TO MONITOR GROUNDWATER
- P13003R — SURFACE WATER LOCATION AND PERMIT IDENTIFICATION TO NEAREST QUARTER–QUARTER
- WELLHEAD PROTECTION AREA BOUNDARY

SOURCE NOTES:

ALBANY COUNTY GIS DEPARTMENT.

LARAMIE GIS DEPARTMENT.

USGS, 1963 PHOTOREVISED 1978. DIGITAL 7.5 MINUTE QUADRANGLE OF RED BUTTES, WYO.

USGS, 1978, PHOTOREVISED 1978. DIGITAL 7.5 MINUTE QUADRANGLE OF LARAMIE, WY.

USGS, 1987. DIGITAL 7.5 MINUTE QUADRANGLE OF PILOT HILL, WY.

USGS, 1987. DIGITAL 7.5 MINUTE QUADRANGLE OF SHERMAN MOUNTAINS WEST, WY.

WYOMING SEO DATABASE, 09/02/09. GROUNDWATER LOCATION AND PERMIT IDENTIFICATION TO NEAREST QUARTER–QUARTER.

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MAP DIX6-4

WATER RIGHTS

MOUNTAIN CEMENT COMPANY
ETCHEPARE QUARRY
PERMIT 298C–A8

REVISED BY:	DATE:
WWC	01/13

MOUNTAIN CEMENT COMPANY
5 SAND CREEK ROAD
LARAMIE, WYOMING

WWC ENGINEERING
811 BOYD AVE
LARAMIE, WY 82070

DESIGNED BY:	DATE:
TNS	03/10
DRAWN BY:	DATE:
SDG	03/10
CHECKED BY:	DATE:
MTS	03/10
JOB NO:	
2009083	
SHEET NO:	
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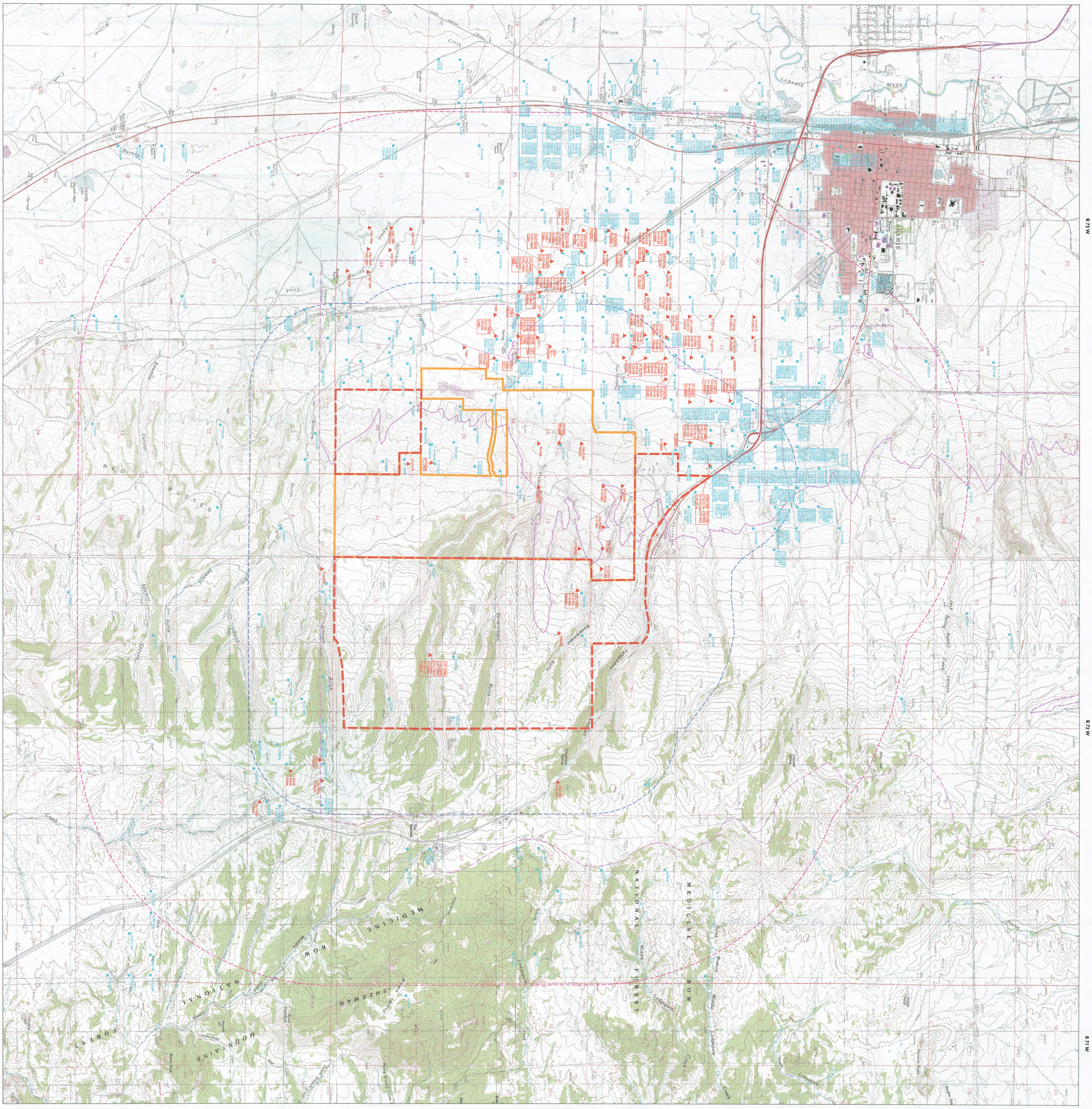


0 2,000'
SCALE

LEGEND

PERMIT BOUNDARY 298C

PERMIT BOUNDARY 298C-A8

1 MILE BOUNDARY

3 MILE BOUNDARY

P10140ZW GROUNDWATER LOCATION AND PERMIT IDENTIFICATION TO NEAREST QUARTER-QUARTER

P13003R SURFACE WATER LOCATION AND PERMIT IDENTIFICATION TO NEAREST QUARTER-QUARTER

WELLHEAD PROTECTION AREA BOUNDARY

CALCULATED 75 FT. OF SATANKA SHALE

SOURCE NOTES:

ALBANY COUNTY GIS DEPARTMENT.

LARAMIE GIS DEPARTMENT.

USGS, 1963 PHOTOREVISED 1978, DIGITAL 7.5 MINUTE QUADRANGLE OF RED BUTTES, WYO.

USGS, 1978, PHOTOREVISED 1978, DIGITAL 7.5 MINUTE QUADRANGLE OF LARAMIE, WY.

USGS, 1987, DIGITAL 7.5 MINUTE QUADRANGLE OF PILOT HILL, WY.

USGS, 1987, DIGITAL 7.5 MINUTE QUADRANGLE OF SHERMAN MOUNTAINS WEST, WY.

WYOMING SEO DATABASE, 09/02/09, GROUNDWATER LOCATION AND PERMIT IDENTIFICATION TO NEAREST QUARTER-QUARTER.

MAP DIX6-5

WATER RIGHTS

MOUNTAIN CEMENT COMPANY
ETCHEPARE QUARRY
PERMIT 298C-A8

MOUNTAIN CEMENT COMPANY
5 SAND CREEK ROAD
LARAMIE, WYOMING

WWC ENGINEERING
611 SKYLINE ROAD
LARAMIE, WY 82070

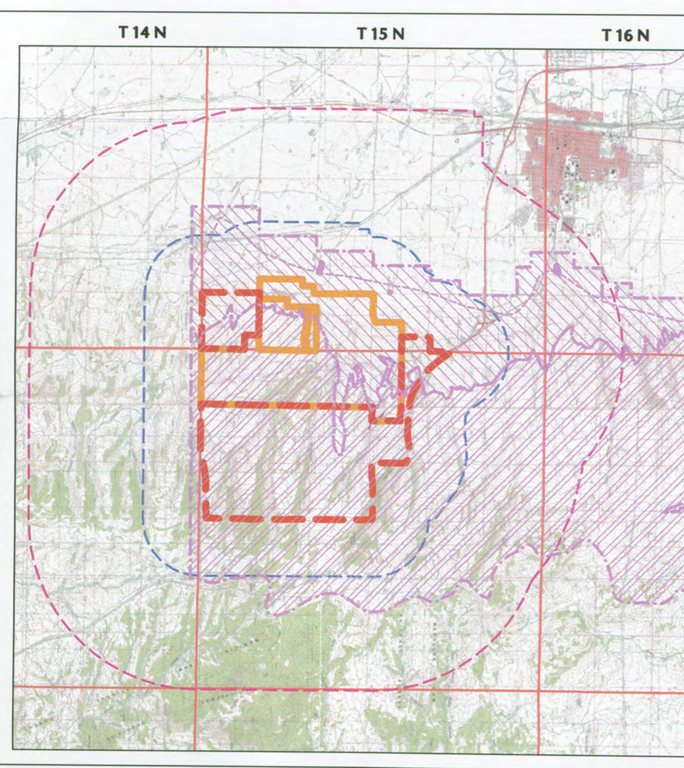
REVISED BY:	DATE:

DESIGNED BY: TNS	DATE: 03/10
DRAWN BY: SDG	DATE: 03/10
CHECKED BY: MTS	DATE: 03/10
JOB NO: 2009083	
SHEET NO: 1 OF 1	

RECEIVED APR 6 2010 WDEQ/LQD

5/1/10

LOCATION MAP



LEGEND

PERMIT BOUNDARY 298C

PERMIT BOUNDARY 298C-A8

WELLHEAD PROTECTION AREA BOUNDARY

CALCULATED 75 FT. OF SATANKA SHALE

CASPER AQUIFER PROTECTION AREA ZONE 1

CASPER AQUIFER PROTECTION AREA ZONE 2

CASPER AQUIFER PROTECTION AREA ZONE 3

1 MILE BOUNDARY

3 MILE BOUNDARY

0 10,000'
SCALE

APPENDIX DIX7

SOILS

Mountain Cement Company

Etchepare Limestone Quarry

Permit 298C-A8

Prepared by
Mountain Cement Company
April 2010
Revised February 2013

TFN 5 1/110
Approved:_____

TFN 5 1/110
RECD MAR 07,2013

APPENDIX DIX7 - SOILS

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DIX7.2 Methods	DIX7-2
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DIX7.2.2 Field Sampling	DIX7-3
DIX7.2.2 Laboratory Analysis	DIX7-3
DIX7.3 Results and Discussion	DIX7-4
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DIX7.3.2 Soil Mapping Unit Interpretation	DIX7-4
DIX7.3.3 Chemical and Physical Data	DIX7-11
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DIX7.3.5 Mapping Unit Descriptions	DIX7-24
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ADDENDA

Addendum DIX7A. USDA Natural Resources Conservation Service Custom Soil Resource Report for 298C-A8 Etchepare Expansion
Addendum DIX7B. Soil Sample Analysis Report for Amendment 8
Addendum DIX7C. Soil Sample Analysis Report from Amendment 7
Addendum DIX7D. Soil Sample Analysis Data from Bird (2009) Study

MAPS

Map DIX7-1 Soil Unit Map

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APPENDIX DIX7 - SOILS

DIX7.1 Introduction

The Etchepare Limestone quarry is located in Albany County, Wyoming, approximately five miles southeast of Laramie. Current access is by way of Howe Road. As shown on Map DIX7-1, the affected area is a portion of the western slope of the Laramie Range including foothills and limestone ridges separated by deep canyons. The area is located in Sections 17, 18, 19, 20, 21, 28, 29, 30, 31, 32, and 33 of T15N, R72W and Sec 36 of T15N, R73W. Topographical relief of the amendment area is variable with elevations ranging from 7400 feet to 8600 feet. The proposed amendment area occupies about 5000 acres and would increase the 298C permit to approximately 8400 acres while the proposed affected area encompasses about 3450 acres. Discussion in this appendix will center primarily on the affected area.

The information provided in this report includes the data necessary to determine the projected soil stripping depths and volumes for the entire affected area.

DIX7.2 Methods

DIX7.2.1 Soil Survey

USDA Soil Conservation Service (SCS) mapping and map unit descriptions were obtained from the USDA Natural Resources Conservation Service (NRCS 1998, 2010) and prior D7 Appendices of Permit 298C. Soil mapping units for the entire proposed permit area are listed in Table DIX7-1 and are shown on Map DIX7-1. Table DIX7-1 also includes the acreages and composition of soil mapping units within the proposed permit area. This NRCS soil survey data was used as the basis for evaluation of soils on the affected area. The SCS mapping units were

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used in conjunction with field and lab data from the prior A7 Amendment, Bird (2009), and this study to determine topsoil stripping depths for the soil series within the affected areas.

DIX7.2.2 Field Sampling

The NRCS soils map in Addendum DIX7A was used in the office to plan positions of 20 field sites for collecting soil samples. Mapping units most common in the proposed Areas-to-Affect were assigned four field sample sites. Less common map units were assigned zero to three field sample sites in proportion to their acreages (see Table DIX7-1 below).

At each sample site a soil pit was dug with pick and shovel. A sample of each perceived horizon was placed in a plastic bag labeled with depths and other information. Two bags were filled with soil from each extremely rocky horizon to provide the laboratory with enough fine material to complete all needed lab tests. Soils pits were dug down to what was perceived to be bedrock.

DIX7.2.2 Laboratory Analysis

Field and lab data were used in conjunction with the NRCS data to achieve minimum verification of salvageable soil depths and soil mapping unit boundaries.

Nicole Bird's (2009) soil analyses found in Addendum DIXD used the following lab methods. For pH and EC saturated paste methods were used as in LQD (1996) Guideline 1. For NO_3 and NH_4 a KCl extractable method was employed. Fe and Mo were extracted with DTPA-TEA. Extraction of Ca, K, Mg and Na was accomplished with CH_3COONH_4 (Bird 2009; Gavlak et al. 2005).

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For this A8 Amendment analyses were done by the Soil, Water, and Plant Testing Laboratory at Colorado State University according to Guideline 1 methods (see Addendum DIX7B for lab report and Table DIX7-2 for compiled data presentation).

DIX7.3 Results and Discussion

DIX7.3.1 Soil Survey

The accuracy and utility of the NRCS Soil Survey for this mine permit area was corroborated by field and lab data.

DIX7.3.2 Soil Mapping Unit Interpretation

An attempt was made to identify each soil sample site to a specific Soil Series. Then a row for each sample site was inserted into Table DIX7-1 under the table row for the relevant NRCS Soil Series for easy comparison of soil depth data. Soil series identifications are also indicated in Table DIX7-2.

Typical sites for seven represented soil series are located within one mile of proposed pits and are five are displayed on Map DIX7-1. The proximity of these typical sites to the permit area increases confidence in the applicability of the NRCS data to predict soil characteristics for this appendix.

Reciprocal Illumination between NRCS and MCC data. MCC and NRCS data sets proved complementary to one another. MCC field and lab data were used to interpret NRCS soil mapping units. MCC data served to confirm the geographic accuracy of the NRCS soil unit mapping units, supported the series-level composition of mapping units, and corroborated NRCS soil

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RECD MAR 07, 2013

characteristics including soil depths for mapping units and soil series. Conclusions about soil depths are shown in Table DIX7-1 by soil mapping unit and soil series.

Reciprocally, NRCS data was used to interpret MCC field and lab data. Study of MCC data in the context of the NRCS data gave reason to believe some soil pits for this Amendment were not dug all the way to bedrock. Apparently digging these pits deeper was stopped by large cobble that did not yield to pick and shovel, simulating hard bedrock. These sampling sites are marked with a dagger symbol (†) in the MCC Data column of Table DIX7-1 and both the Depth and Parent Material columns of Table DIX-2. Without the NRCS data, MCC data may have significantly underestimated available soil depths and volumes for reclamation.

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Table DIX7-1. Topsoil Availability for MCC's Etchepare Limestone Quarry Amended Permit Area by Mapping Unit. Explanatory notes: 1) The table is based on NRCS (1998, 2010) data and corroborated by MCC data in adjacent rows and columns. 2) The first column contains the NRCS Mapping Unit numbers in bold italics. The related second column contains NRCS Mapping Unit Names in italics then within each Mapping Unit its component Soil Series in italics, then, in bold, individual soil sample sites identified to the same Soil Series. 3) Values for the Projected Avg. Max. Salvage Topsoil Depth column were calculated as follows. For each applicable row the value in the % Composition column was multiplied by the depth in the NRCS Data column and placed in the Soil Yield column as a subtotal. Then these Soil Yield subtotals were added to produce the value in the Projected Avg. Max Salvage Topsoil Depth column for each mapping unit, except that the projections assume 1" depth of soil will unavoidably be lost in the salvage process. 4) A dagger symbol (†) in the MCC data column indicates a soil pit where soil depth may have been underestimated; this underestimation would be by mistaking for bedrock some cobble which did not yield to pick and shovel.

Mapping Unit # & Name		**Approx. Composition of Area**		**% Composition of Unit**	**Avg. Max. Topsoil Salvage Depth (in.)**			**Projected Avg. Max. Salvage Topsoil Depth (in.)**
	Component Series							
	Sample Site (Series)	**Acres**	**%**		**NRCS Data**	**(Soil Yield)**	**MCC Data**	
128	*Bruja-Canwall-Telecan Ass.*	1259	14.8					22
	Bruja			30	23	6.9		
	128-1 (Bruja)						18	
	128-2 (Bruja)						8†	
	128-3 (Bruja)						12†	
	Canwall			25	26	6.5		
	128-4 (Canwall)						5†	
	Telecan			15	60	9		
	Minor Components:							
	Rock Outcrop			10	0	0		
	Pilotpeak			10	14	1.4		
	Telecan-like			10	60	6		
141	*Cheadle-Passcreek Complex*	2418	28.4					13
	Cheadle			35	10	3.5		
	141-A7-2 (Cheadle)						16	
	141-1 (Cheadle)						18	

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Table DIX7-1 (continued). Topsoil Availability for MCC's Etchepare Limestone Quarry Amended Permit Area by Mapping Unit.

Mapping Unit # & Name	*Component Series*	Approx. Composition of Area		% Composition of Unit	Avg. Max. Topsoil Salvage Depth (in.)			Projected Avg. Max. Salvage Topsoil Depth (in.)
	Sample Site (Series)	**Acres**	**%**		**NRCS Data**	**(Soil Yield)**	**MCC Data**	
141	*(continued)*							
	141-3 (Cheadle)						10	
	141-4 (Cheadle)						9	
	Passcreek			25	22	5.5		
	141-2 (Passcreek)						20	
	141-NRCS Typical Passcreek				22			
	Rock Outcrop			20	0	0		
	Minor Components:							
	Cheadle sandy loam			5	15	0.75		
	Miracle			5	30	1.5		
	Nathale			5	30	1.5		
	Rimton			5	30	1.5		
158	*Fiveoh-Fiveoh-Ryan Park Complex*	473	5.6					35
	Fiveoh cobbly substratum			30	30	9		
	158-1 (Fiveoh, cobbly substratum						8†	
	Fiveoh			30	60	18		
	Ryan Park			25	60	15		
	Minor Components:							
	Canwall			7	30	2.1		
	Pilotpeak			7	14	0.98		
	sand-gravel bars			1	0	0		

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Table DIX7-1 (continued). Topsoil Availability for MCC's Etchepare Limestone Quarry Amended Permit Area by Mapping Unit.

Mapping Unit # & Name	*Component Series*	Approx. Composition of Area		% Composition of Unit	Avg. Max. Topsoil Salvage Depth (in.)			Projected Avg. Max. Salvage Topsoil Depth (in.)
	Sample Site (Series)	**Acres**	**%**		**NRCS Data**	**(Soil Yield)**	**MCC Data**	
160	*Fiveoh-Joemre*	72	0.8					(not mined)
174	*Joemre*	95	1.1					(not mined)
189	*Miracle-Cheadle Association*	12	0.1					23
	Miracle			45	33	14.85		
	Cheadle			30	16	4.8		
	189-1 (Cheadle)						12	
	Minor Components:							
	Passcreek			6	30	1.8		
	Cheadle			6	15	0.9		
	Miracle-like			6	30	1.8		
	sandy soils			4	un-stated	guess 0.24		
	rock outcrop			3	0	0		
191	*Nathale-Passcreek Complex*	1383	16.3					23
	Nathale			35	24	8.4		
	191-2 (Nathale)						13†	
	191-4 (Nathale)						13†	
	Passcreek cobbly subsoil			35	31	10.85		
	191-1 (Passcreek cobbly subsoil)						13†	
	191-3 (Passcreek cobbly subsoil)						46	
	Rock Outcrop			10	0	0		

(continued)

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Table DIX7-1 (continued). Topsoil Availability for MCC's Etchepare Limestone Quarry Amended Permit Area by Mapping Unit.

Mapping Unit # & Name		Approx. Composition of Area		% Composition of Unit	Avg. Max. Topsoil Salvage Depth (in.)			Projected Avg. Max. Salvage Topsoil Depth (in.)
	Component Series							
	Sample Site (Series)	**Acres**	**%**		**NRCS Data**	**(Soil Yield)**	**MCC Data**	
191	*(continued)*							
	Minor Components:							
	Cheadle			4	15	0.6		
	Miracle			4	30	1.2		
	Rimton			4	30	1.2		
	Cheadle-like			4	15	0.6		
	Miracle-like			4	30	1.2		
193	*Pilotpeak-Canwall Complex*	1776	20.9					21
	Pilotpeak			55	18	9.9		
	193-A7-3 (Pilotpeak)						18	
	193-2 (Pilotpeak)						7†	
	193-3 (Pilotpeak)						11†	
	Canwall			25	24	6		
	193-A7-1 (Canwall)						24	
	193-4 (Canwall)						20†	
	Minor components:							
	Bruja			6	30	1.8		
	Telecan			6	60	3.6		
	Tieside			6	15	0.9		
	Rock Outcrop			2	0	0		
	193-1 (Series unclear)						24	
195	*Mine Pits*	65	0.8		na		na	
	Mine Pits			100	0		0	

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Table DIX7-1 (continued). Topsoil Availability for MCC's Etchepare Limestone Quarry Amended Permit Area by Mapping Unit.

Mapping Unit # & Name		Approx. Composition of Area		% Composition of Unit	Avg. Max. Topsoil Salvage Depth (in.)			Projected Avg. Max. Salvage Topsoil Depth (in.)
	Component Series							
	Sample Site (Series)	**Acres**	**%**		**NRCS Data**	**(Soil Yield)**	**MCC Data**	
197	*Poposhia-Blazon Complex*	54	0.6					35
	Poposhia			50	60	30		
	Blazon			25	12	3		
	Minor Components:							
	Chaperton			10	30	0.3		
	Blazon-like			8	14	1.12		
	Blackhall			4	15	0.6		
	Satanka			3	35	1.05		
	197-1 (Series unclear)						2	
208	*Rimton-Passcreek-Miracle Complex*	602	7.1					30
	Rimton			40	39	15.6		
	208-1 (Rimton)						18†	
	Passcreek, cobbly subsoil			25	26	6.5		
	Miracle			15	31	4.65		
	Minor Components:							
	Cheadle			5	15	0.75		
	Nathale			5	30	1.5		
	Rock outcrop			5	0	0		
	Rimton-like			5	30	1.5		

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Table DIX7-1 (continued). Topsoil Availability for MCC's Etchepare Limestone Quarry Amended Permit Area by Mapping Unit.

Mapping Unit # & Name		Approx. Composition of Area		% Composition of Unit	Avg. Max. Topsoil Salvage Depth (in.)			Projected Avg. Max. Salvage Topsoil Depth (in.)
	Component Series							
	Sample Site (Series)	**Acres**	**%**		**NRCS Data**	**(Soil Yield)**	**MCC Data**	
214	*Rock Outcrop-Pilotpeak Complex*	220	2.6					8
	Rock Outcrop			50	0	0		
	Pilotpeak			25	11	2.75		
	Minor Components:							
	Bruja			9	30	2.7		
	Canwall			8	30	2.4		
	Pilotpeak-like			8	14	1.12		
234	*Tieside-Pilotpeak-Rock Outcrop Complex*	36	0.4					(not mined)
11	*Wycolo-Alcova Complex*	32	0.4					(not mined)
Totals - Area of Interest		***8501***	***100***	-	-	-	-	-

DIX7.3.3 Chemical and Physical Data

In Wyoming many soils rated unsuitable according to Guideline 1 support native plant communities adapted to harsh habitats. Soils should be evaluated on a case-by-case basis to judge whether their salvage will aid or hinder successful reclamation. (Guideline 1; Norton & Strom 2012) This appendix distinguishes between the term "suitable", which is a general guiding concept for soil salvage planning in Wyoming and the term "usable" which for this specific permit area corresponds to soil that should be salvaged as topsoil to promote successful reclamation despite its "suitability" status. In the case

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of this permit, such evaluation has been conducted while writing the permit and should at the time of soil salvage, preferably by the equipment operators, be evaluated for operator safety on steep slopes and in bouldery soil, and for potential damage to equipment due to boulders, cobble, etc.

Summary of Suitable Values. All values were in the suitable ranges for Silt %, Saturation %, and Conductivity.

For pH there was only one exception to suitable values; the re-spread, revegetated topsoil of Nicole Bird's (2009) sample 193-NB1 on the reclaimed Pit 7A of the Amendment 5 mine plan had a pH of 8.54. This pH is only slightly higher than the 5.5 to 8.5 suitable range, and is probably a result of minor contamination of the soil or the sample itself with the underlying backfilled overburden.

Summary of Parameters with Unsuitable and Marginal Values. Limitations as defined by Guideline 1 (LQD 1996) on the suitability of available soil for salvage were identified during this survey. These limitations (possibly in order of importance) include 1) depth to bedrock including soil-free rock outcrops, 2) coarse fragments, 3) high sand content, 4) high clay content, and 5) selenium, (see Table DIX7-2). Another limitation that may be more important than these is steep slopes as discussed below. Every effort will be made to salvage all "suitable" or "marginally suitable" soil and "unsuitable" but usable soil that will support plant growth. This essentially includes all material above bedrock that can reasonably be removed with scraper and dozer. Despite nine of 58 soil samples in the permit area being classified as "unsuitable" and the remainder being classified as "marginally suitable" by Guideline 1, the soils salvaged from the mined areas will be ideal for reclaiming sites to make habitats similar to pre-mine ecological conditions.

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Coarse fragments and Steep Slopes. Percent by volume of coarse fragments fell in the unsuitable range for nine of the 58 samples. Six samples fell into the marginally suitable range. In addition to the gravel and cobble which were sent to the lab in soil sample bags, many areas also have boulders on or in the soil which could not be sent to the lab. However, many plants native to the permit area are well adapted or even dependent on rocky soils. Also, rock in soil serves as a permanent defense against erosion, evidenced by some mining operations that successfully use rock as mulch for revegetation projects.

On steep slopes (or in cobbly or bouldery soil) where it may be unsafe to salvage soil with a scraper, it may still be safe and economical to salvage it with other equipment. It may be possible for a dozer to push the soil downhill into a re-spreadable topsoil pile or berm that will be easier and safer to access with a scraper after mining has lowered the hilltop. Soil salvage may also be possible with an excavator and haul truck by digging a level bench for each machine as stripping progresses. Any soil salvaging by dozer or excavator likely would leave well over an inch of the soil depth unsalvageable.

Soil texture. Every soil sample analyzed in this study fell into the marginal suitability range due to high sand content. The deepest two samples from site 193-3 fell into the marginal suitability range due to high clay content. All sampled horizons but the single horizon at site 193-3, a loam, fell into the marginal suitability range due to its USDA textural class, with the majority of samples being sandy loam (56), a few being sandy clay loam (8), and two being clay loam.

Selenium. For soil selenium (Se) concentrations the revised Guideline 1 (LQD 1996) Table I-2 says marginal suitability values are 0.3-0.8 ppm Se and are keyed to sampling vegetation at bond

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release, with >5ppm Se in vegetation considered unsuitable. The footnote on the marginal suitability column heading says "Evaluated on an individual basis for suitability."

One might ask about the source of selenium in the permit's soils, whether it comes from the Casper Formation underlying the soils or from westward in the Laramie valley by wind. For two of the five (40%) of the analyzed overburden/interburden samples the selenium levels were between 0.3 ppm and 0.8 ppm, the marginally suitable range for soil salvage. For soil samples analyzed, 17 of 54 (31%) had values in the same marginal range (0.3 ppm < [Se] < 0.8 ppm). This gives possible evidence the selenium comes from the soil's underlying parent material rather than wind-blown particles from the Laramie valley or elsewhere. Yet, selenium is not a limiting factor for use of groundwater from the Casper aquifer, indicating it is not abundant in the permeable layers of the formation. Also, there is not a clear geographic pattern to selenium distribution among soil samples for this permit amendment.

One may ask whether selenium is unacceptably high in certain soil horizons. When counting the number of soil sampling sites (Table DIX7-2) with a significant selenium concentration change with increasing depth the following tallies are produced. ("Significant selenium concentration change" is defined here as a downward transition between perceived soil horizons where a suitable value changes to marginal value or vice versa.) Twenty-three soil profiles were analyzed for selenium concentration; the following are the numbers of soil sampling sites that exhibited specific patterns of significant selenium concentration change with depth: an increase in Se, 2; a decrease, 3; neither, 17; decrease then increase then a 2nd decrease, 1.

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In all three site profiles where selenium increases with depth, positive factors in favor of soil salvage seem to outweigh the marginal selenium values. 1) At site 128-3, coarse fragments decrease with depth from marginal to suitable values, pH decreases toward neutral, and organic matter increases, plus the lower horizon would increase predicted salvage depth from five inches to eleven inches giving four votes in favor of salvaging all horizons. This would yield reclamation soil from this sampling site with a selenium concentration of 0.23 ppm, well within the suitable range by dilution. 2) At site 193-1, a marginal Se value in the lower horizon seems to be outweighed by opportunity to increase reclamation soil depth by salvaging both horizons. This would yield reclamation soil from this sampling site with a selenium concentration of 0.36 ppm, only slightly above the suitable concentration. 3) At site 191-3, marginal Se values in lower horizons seem to be again outweighed by opportunity to increase soil depth in reclamation areas by salvaging all horizons. This would yield reclamation soil from this sampling site with a selenium concentration of 0.46 ppm, firmly in the better half of the marginal suitability range.

Only minor incidences of two primary selenium indicator plants have been reported for the permit area. First, *Astragalus bisulcatus*, twogrooved milkvetch, was reported by Rocky Mountain Reclamation for the A7 Permit but was not sighted in any of the expanded permit area during the 2009 and 2010 field seasons of the A8 vegetation baseline study. Second, *Astragalus pectinatus*, narrowleaf milkvetch, was sighted once by Jeff Brasher in the permit area during the A8 vegetation inventory. There were only one to few plants in a very small area near the lower elevation edge of the permit area, likely growing in some soil brought in from the Laramie Plains a few miles away, or in one of the soil mapping units not to be disturbed by any future mining. The soils of the permit

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area itself are not strongly seleniferous and no selenium accumulator plants should be expected to persist or cause selenium poisoning.

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Table DIX7-2. Soil Sample Data. Explanatory Notes: 1) Parameters indicating "marginally suitable" or "unsuitable" soil per LQD Guideline 1 are indicated with an asterisk (*) or an exclamation point (!) respectively. In Wyoming many soils rated unsuitable according to Guideline 1 support native plant communities adapted to harsh habitats. Soils and their horizons should be evaluated on a case-by-case basis to judge whether their salvage will aid or hinder successful reclamation. (LQD 1996; Norton & Strom 2012) 2) The (underlying) Parent Material column refers to what kind of rock was found to be lying directly beneath the soil. It uses the following abbreviations: LS (limestone), SS (sandstone), R (rock), and U (unknown). All soils in this permit should be assumed to have both limestone and sandstone as part of their parent material. 3) A dagger symbol (†) indicates MCC soil pits where soil depth may have been underestimated; this underestimation would be by mistaking for bedrock some cobble which did not yield to pick and shovel. 4) The Organic Matter column has one row with a double dagger symbol (††) indicating the value is expressed as weight loss on ignition. 5) Color Abbreviations: drk (dark), lt (light), yell (yellowish), rdsh (reddish), brn (brown).

Sample #	Sampling Site	Soil Series	Section	Horizon	Depth (in.)	Parent Material	Bags/ Sample	pH	Color	Coarse fragments (% vol.)	Sand (%)	Silt (%)	Clay (%)	Texture	Organic Matter (%)	Saturation (%)	Conductivity (mmhos/cm)	Selenium (ppm)
652	193-A7-1	Canwall	36	1	0-3	-	-	7.4	-	0	70*	20	10	sandy loam*	1.8	38.5	0.43	<0.02
653				2	3-12	-	-	7.4	-	0	70*	16	14	sandy loam*	1.4	33.2	0.36	<0.02
654				3	12-16	-	-	7.5	-	0	66*	14	20	sandy clay loam*	0.7	36.8	0.38	<0.02
655				4	16-24	U	-	7.6	-	0	70*	12	18	sandy loam*	0.5	34.5	0.28	<0.02
656	141-A7-2	Cheadle	36	1	0-4	-	-	7.4	-	0	60*	24	16	sandy loam*	2.0	42.3	0.41	<0.02
657				2	4-9	-	-	7.4	-	0	62*	20	18	sandy loam*	1.6	40.8	0.39	<0.02
658				3	9-16	U	-	7.5	-	0	64*	20	16	sandy loam*	1.4	42.0	0.37	<0.02
659	193-A7-3	Pilotpeak	36	1	0-4	-	-	7.0	-	0	68*	18	14	sandy loam*	2.7	39.3	0.37	<0.02
660				2	4-14	-	-	7.2	-	3.3	60*	25	15	sandy loam*	1.9	38.0	0.34	<0.02
661				3	14-18	U	-	7.4	-	0	56*	26	18	sandy loam*	2.0	39.8	0.31	<0.02

(continued)

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Table DIX7-2 (continued). Soil Sample Data.

Sample #	Sampling Site	Soil Series	Section	Horizon	Depth (in.)	Parent Material	Bags/ Sample	pH	Color	Coarse fragments (% vol.)	Sand (%)	Silt (%)	Clay (%)	Texture	Organic Matter (%)	Saturation (%)	Conductivity (mmhos/cm)	Selenium (ppm)
na	141-typical pedon (NRCS)	Passcreek	17	A	0-4	-	-	>7	10YR4/3 brown	10	-	-	-	sandy loam*	-	-	-	-
				Bt	4-11	-	-	>7		10	-	-	-	sandy clay loam*	-	-	-	-
				Bk1	11-14	-	-	>7	7.5YR4/4 brown	60!	-	-	-	sandy loam*	-	-	-	-
				Bk2	14-22	LS	-	>7	10YR6/4 lt yell brn	60!	-	-	-	sandy loam*	-	-	-	-
1-1	193-NB1	Pilotpeak-Canwall complex	31	reveg	0-6	-	-	8.54*	2.5YR3/3 reddish brn	30*	-	-	-	clay loam*	-	-	0.1	-
2-1	193-NB2		31	reveg	0-6	-	-	8.47	5YR4/3 reddish brn	30*	-	-	-	clay loam*	-	-	0.2	-
1	128-1	Bruja	20	A	0-7	-	1	6.9	10YR4/4 drk yell brn	0.83	74*	14	12	sandy loam*	2.4	45.36	0.3	0.440*
2				B	7-18†	LS†	1	7.1	10YR4/4 drk yell brn	0.31	70*	17	13	sandy loam*	2.2	46.91	0.3	0.639*
3	128-2	Bruja	19	A	0-3	-	1	7.3	10YR4/4 drk yell brn	45.38!	73*	13	14	sandy loam*	2.3	45.64	0.4	0.221
4				B	3-8†	R†	1	7.4	10YR4/4 drk yell brn	32.39*	75*	10	15	sandy loam*	2.3	43.02	0.3	<0.001

(continued)

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Table DIX7-2 (continued). Soil Sample Data.

Sample #	Sampling Site	Soil Series	Section	Horizon	Depth (in.)	Parent Material	Bags/ Sample	pH	Color	Coarse fragments (% vol.)	Sand (%)	Silt (%)	Clay (%)	Texture	Organic Matter (%)	Saturation (%)	Conductivity (mmhos/cm)	Selenium (ppm)
5	128-3	Bruja	36	A1	0-5	-	1	7.0	10YR4/4 drk yell brn	31.61*	76*	11	13	sandy loam*	1.7	46.23	0.4	<0.001
6				A2	5-12†	R†	1	6.8	10YR4/4 drk yell brn	0.43	78*	9	13	sandy loam*	1.9	45.23	0.4	0.420*
7	128-4	Canwall	32	A	0-2.5	-	1	7.5	2.5YR4/4 reddish brn	10.32	74*	12	14	sandy loam*	1.4	37.61	0.3	0.380*
8				B	2.5-5†	R†	1	7.5		0.87	74*	12	14	sandy loam*	1.1	37.16	0.3	<0.001
9	141-1	Cheadle	33	1	0-5	-	1	7.3	10YR3/3 dark brown	5.31	61*	25	14	sandy loam*	4.8	60.62	0.6	0.162
10				2	5-12	-	1	7.6	10YR4/4 drk yell brn	16.58	53*	29	18	sandy loam*	4.7	57.45	0.4	<0.001
11				3	12-18	R	1	7.8		9.76	68*	14	18	sandy loam*	4.1	51.46	0.3	<0.001
12	141-2	Passcreek	31	1	0-4	-	1	7.3	5YR4/4 reddish brn	0.49	80*	8	12	sandy loam*	1.3	40.24	0.4	0.400*
13				2	4-16	-	1	7.4	5YR4/3 reddish brn	0.79	80*	6	14	sandy loam*	1.4	40.14	0.3	0.081
14				3	16-18	-	1	7.5	2.5YR4/4 reddish brn	33.06*	76*	8	16	sandy loam*	1.2	41.44	0.3	0.022
15				4	18-20	SS	1	7.5	5YR4/4 reddish brn	9.13	77*	7	16	sandy loam*	1.2	38.60	0.3	<0.001

(continued)

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Table DIX7-2 (continued). Soil Sample Data.

Sample #	Sampling Site	Soil Series	Section	Horizon	Depth (in.)	Parent Material	Bags/ Sample	pH	Color	Coarse fragments (% vol.)	Sand (%)	Silt (%)	Clay (%)	Texture	Organic Matter (%)	Saturation (%)	Conductivity (mmhos/cm)	Selenium (ppm)
16	141-3	Cheadle	29	A	0-10	LS	1	7.6	10YR4/3 brown	11.94	78*	7	15	sandy loam*	2.9	43.07	0.4	0.002
17	141-4	Cheadle	21	A	0-4	-	1	6.7	10YR3/4 dk yell brn	1.12	76*	9	15	sandy loam*	3.9	53.57	0.4	0.361*
18				B	4-9	LS	1	7.1		20.01	70*	11	19		2.8	49.10	0.3	0.062
19	158-1	Fiveoh, cobbly substratum	36	A	0-8†	R†	2	7.3	10YR4/4 drk yell brn	85.83!	77*	11	12	sandy loam*	4.2	51.28	0.6	0.500*
20	189-1	Cheadle	33	1	0-4	-	1	7.5	2.5YR4/4 reddish brn	0.30	79*	7	14	sandy loam*	1.7	45.74	0.3	0.381*
21				2	4-8	-	1	7.6		0.64	80*	5	15		2.0	39.95	0.4	0.500*
22				3	8-12	SS	1	7.7	2.5YR3/4 dk rdsh brn	0.77	72*	10	18		1.5	41.18	0.3	0.400*
23	191-1	Passcreek cobbly subsoil	19	A	0-3	-	1	7.5	10YR4/4 drk yell brn	60.40!	82*	5	13	sandy loam*	3.2	45.73	0.5	0.062
24				B	3-13†	LS†	1	7.8		59.16!	77*	7	16		2.6	44.57	0.3	<0.001
25	191-2	Nathale	21	A	0-3	-	1	7.6	10YR4/3 brown	39.66!	69*	14	17	sandy loam*	5.0	62.51	0.4	0.221
26				B	3-13†	LS†	1	7.7		62.56!	62*	19	19		4.9	54.68	0.4	0.022

(continued)

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Table DIX7-2 (continued). Soil Sample Data.

Sample #	Sampling Site	Soil Series	Section	Horizon	Depth (in.)	Parent Material	Bags/ Sample	pH	Color	Coarse fragments (% vol.)	Sand (%)	Silt (%)	Clay (%)	Texture	Organic Matter (%)	Saturation (%)	Conductivity (mmhos/cm)	Selenium (ppm)
27	191-3	Passcreek cobbly subsoil	29	1	0-4	-	1	6.9	10YR4/3 brown	0.25	66*	17	17	sandy loam*	2.6	40.93	0.5	0.400*
28				2	4-12	-	1	7.0	10YR5/3 brown	0.97	61*	21	18		0.9	36.09	0.3	0.221
29				3	12-30	-	1	7.3	10YR6/3 pale brown	1.25	60*	16	24	sandy clay loam*	0.6	31.61	0.2	0.679*
30				4	30-34	-	1	7.6	10YR5/4 yell brown	1.08	71*	7	22		1.6	26.98	0.2	0.599*
31				5	34-43	-	1	7.3	10YR4/4 drk yell brn	0.26	62*	5	33*		0.9	37.34	0.3	0.321*
32				6	43-46	SS	1	7.5		29.72*	59*	11	30*		1.0	41.51	0.4	<0.001
33	191-4	Nathale	17	A	0-13	LS	1	7.6	10YR4/4 drk yell brn	52.60!	80*	2	19	sandy loam*	2.0	36.56	0.3	0.022
34	193-1	(Series unclear)	18	A	0-10	-	1	7.5	10YR4/3 brown	1.31	72*	11	17	sandy loam*	2.9	48.09	0.4	0.002
35				B	10-24	LS	1	7.8	10YR5/3 brown	2.46	63*	18	19	sandy loam*	2.4	42.75	0.4	0.639*
36	193-2	Pilotpeak	31	A1	0-3	-	1	7.3	10YR4/4 drk yell brn	58.57!	54*	29	17	sandy loam*	2.0	42.18	0.5	0.002
37				A2	3-7†	R†	1	7.3		70.19!	72*	12	16	sandy loam*	2.5	44.36	0.6	0.081

(continued)

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Table DIX7-2 (continued). Soil Sample Data.

Sample #	Sampling Site	Soil Series	Section	Horizon	Depth (in.)	Parent Material	Bags/ Sample	pH	Color	Coarse fragments (% vol.)	Sand (%)	Silt (%)	Clay (%)	Texture	Organic Matter (%)	Saturation (%)	Conductivity (mmhos/cm)	Selenium (ppm)
38	193-3	Pilotpeak	20	A	0-11†	LS†	2	7.5	10YR4/3 brown	82.00!	51*	31	18	loam	5.5	63.59	0.5	<0.001
39	193-4	Canwall	19	A	0-4	-	1	7.7	2.5YR4/4	9.93	63*	16	21	sandy clay	3.1	42.38	0.3	0.360*
40				B	4-20+†	U†	1	7.9	reddish brn	10.92	52*	25	23	loam*	2.4	41.71	0.3	0.340*
41	197-1	(Series unclear)	20	A	0-2	LS	1	6.9	10YR4/3 brown	13.68	61*	21	18	sandy loam*	5.3	49.56	0.4	0.162
42	208-1	Rimton	21	1	0-2	-	1	6.5	10YR3/2	0.34	50*	27	23	sandy clay	9.3††	74.85	0.6	<0.001
43				2	2-10	-	1	6.1	very drk	1.10	52*	27	21	loam*	5.7	58.51	0.4	0.002
44				3	10-18†	LS†	1	7.1	greyish brn	3.86	55*	19	26		3.5	53.18	0.3	<0.001
Subtotals (A8)	**20 Sites**	-	-	**44 Samples**	-	-	**46 Bags**	-	-	-	-	-	-		-	-	-	-
Totals (A8+)	**26 Sites**	-	-	**58 Samples**	-	-	**na**	-	-	-	-	-	-		-	-	-	-

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DIX7.3.4 Depths for Each Soil Mapping Unit and Pit

This appendix shows that limited amounts of usable topsoil are available for salvage (see Table DIX7-1 for Soil Mapping Units). Projected soil replacement depths (average maximum stripping depths of usable soil; see Table DIX7-3) range from a low of 13 inches in Pit 2 and Pit 3 to a high of 22 inches in Pit 10A. The median projected soil depth is 17 inches. The projections assume 1 inch depth of soil will unavoidably be lost in the salvage process. Actual volumes salvaged may be less due to boulders, other coarse fragments, steep terrain, or inaccuracies of source data.

Equipment operators should assume this data is sufficiently representative of the permit area and where safe to do so should continue salvaging soil downward until they hit parent material, which will commonly be sandstone, limestone, or rarely red shale. Equipment operators may use this simple method: "If it's brown call it soil (despite rocks); if it's red, white, gray, or pink don't call it soil."

In some cases reclamation success could be further promoted by segregating stripped material into a third pile called "subsoil" in addition to the piles of topsoil and overburden. Equipment operators would recognize this subsoil by its being a brownish subsurface layer significantly rockier or sandier than other brownish layers at the stripping project site. Samples 36 and 37 in Table DIX-2 above would be an example of a site where rockiness could profitably be used as a signal to pile subsoil separately from topsoil. In reclamation the resulting subsoil pile would simply be spread first on the entire revegetation project area, followed by spreading the topsoil pile on top of the subsoil over the entire revegetation project area.

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Table DIX7-3. Projected Average Maximum Salvage Depth of Usable Topsoil for Each Pit Area. These depths assume MCC's current scraper methods leave an average depth of 1" of soil unsalvageable. Actual volumes salvaged may be less due to boulders, other coarse fragments, steep terrain, or inaccuracies of source data.

Pit Area	Projected Average Maximum Topsoil Salvage Depth (in.)
Pit 1	20
Pit 2	13
Pit 3	13
Pit 4	14
Pit 5A	17
Pit 5B	15
Pit 5C	15
Pit 5D	16
Pit 6	17
Pit 7A	19
Pit 7B	17
Pit 7C	16
Pit 8A	18
Pit 8B	16
Pit 9A	14
Pit 9B	18
Pit 9C	18
Pit 10A	22
Pit 10B	17
Pit 11	14

DIX7.3.5 Mapping Unit Descriptions

Complete soil mapping unit descriptions (NRCS 2010) are provided in Addendum DIX7A below.

DIX7.3.6 Profile Descriptions

Soil profile descriptions are provided in Addendum DIX7A below and Table DIX7-2 above.

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DIX7.3.7 Prime Farmland Assessment

Prime farmland does not exist within the proposed permit area nor within Albany County as a whole.

DIX7.4 Sources

Bird, N. A. 2009. Development and identification of the Rhizobiaceae nitrogen fixing symbiosis with Fabaceae as a nitrogen source in reclamation of disturbed lands in Wyoming. M.S. Thesis. Department of Renewable Resources, University of Wyoming, Laramie.

Gavlak, R., D. Horneck, and R. O. Miller. 2005. Soil, Plant and Water Reference Methods for the Western Region. WREP 125, 3rd edition.

LQD (Wyoming Department of Environmental Quality – Land Quality Division) 1996. Guideline 1 – Topsoil and Overburden. Cheyenne.

Norton, J. and C. Strom. 2012. Successful restoration of severely disturbed lands: identifying suitable soil for salvage prior to disturbance. B-1222. University of Wyoming Cooperative Extension Service and Wyoming Reclamation and Restoration Center (WRRC). Laramie. http://uwadmnweb.uwyo.edu/wrrc/projects.asp.

NRCS (USDA Natural Resources Conservation Service). 2010. Web Soil Survey. http://websoilsurvey.nrcs.usda.gov/app/HomePage.htm.

NRCS (USDA Natural Resources Conservation Service). 1998. Soil Survey of Albany County Area, Wyoming. US Government Printing Office.

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ADDENDUM DIX7A

USDA Natural Resources Conservation Service
Custom Soil Resource Report for 298C-A8 Etchepare Expansion

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United States Department of Agriculture

NRCS

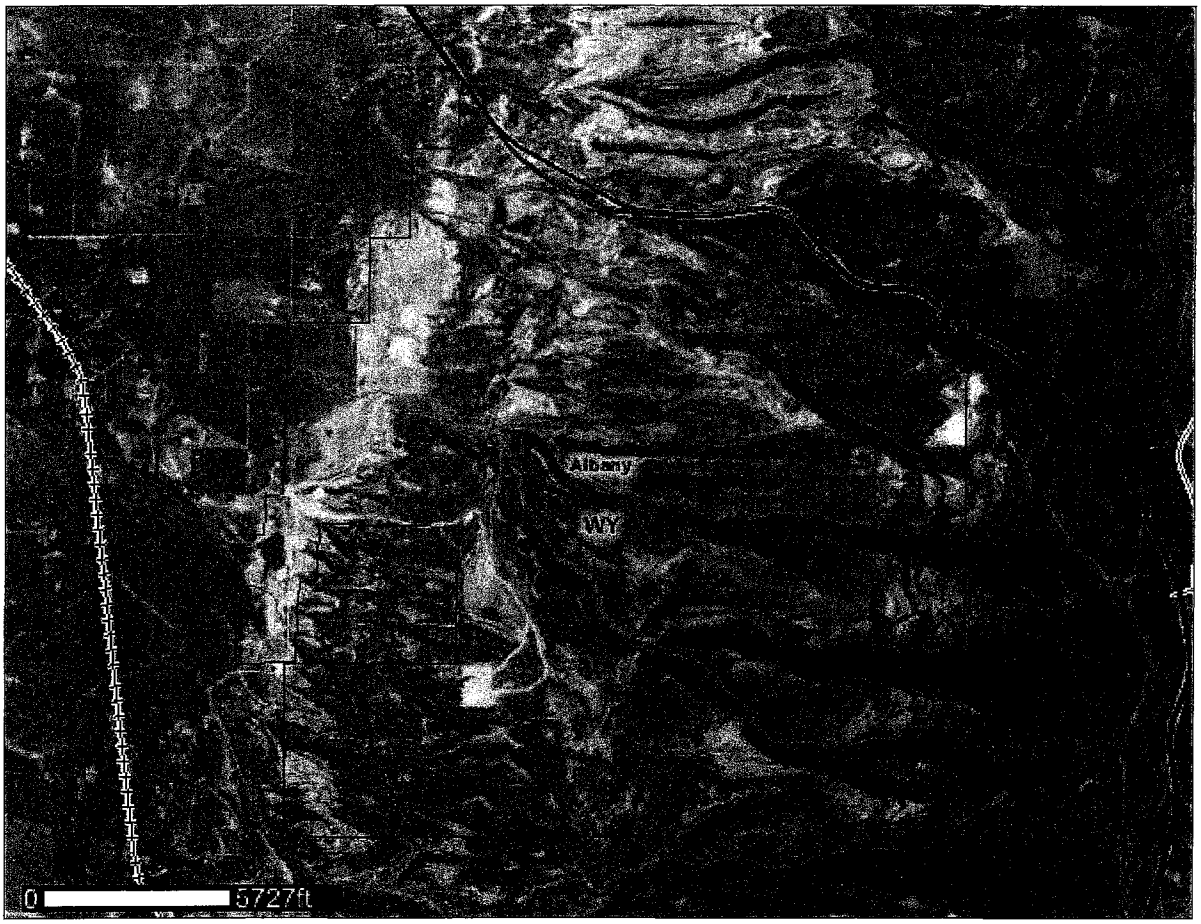
Natural Resources Conservation Service

A product of the National Cooperative Soil Survey, a joint effort of the United States Department of Agriculture and other Federal agencies, State agencies including the Agricultural Experiment Stations, and local participants

Custom Soil Resource Report for

Albany County Area, Wyoming

298C-A8 Etchepare Expansion



February 26, 2010

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Preface

Soil surveys contain information that affects land use planning in survey areas. They highlight soil limitations that affect various land uses and provide information about the properties of the soils in the survey areas. Soil surveys are designed for many different users, including farmers, ranchers, foresters, agronomists, urban planners, community officials, engineers, developers, builders, and home buyers. Also, conservationists, teachers, students, and specialists in recreation, waste disposal, and pollution control can use the surveys to help them understand, protect, or enhance the environment.

Various land use regulations of Federal, State, and local governments may impose special restrictions on land use or land treatment. Soil surveys identify soil properties that are used in making various land use or land treatment decisions. The information is intended to help the land users identify and reduce the effects of soil limitations on various land uses. The landowner or user is responsible for identifying and complying with existing laws and regulations.

Although soil survey information can be used for general farm, local, and wider area planning, onsite investigation is needed to supplement this information in some cases. Examples include soil quality assessments (http://soils.usda.gov/sqi/) and certain conservation and engineering applications. For more detailed information, contact your local USDA Service Center (http://offices.sc.egov.usda.gov/locator/app?agency=nrcs) or your NRCS State Soil Scientist (http://soils.usda.gov/contact/state_offices/).

Great differences in soil properties can occur within short distances. Some soils are seasonally wet or subject to flooding. Some are too unstable to be used as a foundation for buildings or roads. Clayey or wet soils are poorly suited to use as septic tank absorption fields. A high water table makes a soil poorly suited to basements or underground installations.

The National Cooperative Soil Survey is a joint effort of the United States Department of Agriculture and other Federal agencies, State agencies including the Agricultural Experiment Stations, and local agencies. The Natural Resources Conservation Service (NRCS) has leadership for the Federal part of the National Cooperative Soil Survey.

Information about soils is updated periodically. Updated information is available through the NRCS Soil Data Mart Web site or the NRCS Web Soil Survey. The Soil Data Mart is the data storage site for the official soil survey information.

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How Soil Surveys Are Made

Soil surveys are made to provide information about the soils and miscellaneous areas in a specific area. They include a description of the soils and miscellaneous areas and their location on the landscape and tables that show soil properties and limitations affecting various uses. Soil scientists observed the steepness, length, and shape of the slopes; the general pattern of drainage; the kinds of crops and native plants; and the kinds of bedrock. They observed and described many soil profiles. A soil profile is the sequence of natural layers, or horizons, in a soil. The profile extends from the surface down into the unconsolidated material in which the soil formed or from the surface down to bedrock. The unconsolidated material is devoid of roots and other living organisms and has not been changed by other biological activity.

Currently, soils are mapped according to the boundaries of major land resource areas (MLRAs). MLRAs are geographically associated land resource units that share common characteristics related to physiography, geology, climate, water resources, soils, biological resources, and land uses (USDA, 2006). Soil survey areas typically consist of parts of one or more MLRA.

The soils and miscellaneous areas in a survey area occur in an orderly pattern that is related to the geology, landforms, relief, climate, and natural vegetation of the area. Each kind of soil and miscellaneous area is associated with a particular kind of landform or with a segment of the landform. By observing the soils and miscellaneous areas in the survey area and relating their position to specific segments of the landform, a soil scientist develops a concept, or model, of how they were formed. Thus, during mapping, this model enables the soil scientist to predict with a considerable degree of accuracy the kind of soil or miscellaneous area at a specific location on the landscape.

Commonly, individual soils on the landscape merge into one another as their characteristics gradually change. To construct an accurate soil map, however, soil scientists must determine the boundaries between the soils. They can observe only a limited number of soil profiles. Nevertheless, these observations, supplemented by an understanding of the soil-vegetation-landscape relationship, are sufficient to verify predictions of the kinds of soil in an area and to determine the boundaries.

Soil scientists recorded the characteristics of the soil profiles that they studied. They noted soil color, texture, size and shape of soil aggregates, kind and amount of rock fragments, distribution of plant roots, reaction, and other features that enable them to identify soils. After describing the soils in the survey area and determining their properties, the soil scientists assigned the soils to taxonomic classes (units). Taxonomic classes are concepts. Each taxonomic class has a set of soil characteristics with precisely defined limits. The classes are used as a basis for comparison to classify soils systematically. Soil taxonomy, the system of taxonomic classification used in the United States, is based mainly on the kind and character of soil properties and the arrangement of horizons within the profile. After the soil scientists classified and named the soils in the survey area, they compared the

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individual soils with similar soils in the same taxonomic class in other areas so that they could confirm data and assemble additional data based on experience and research.

The objective of soil mapping is not to delineate pure map unit components; the objective is to separate the landscape into landforms or landform segments that have similar use and management requirements. Each map unit is defined by a unique combination of soil components and/or miscellaneous areas in predictable proportions. Some components may be highly contrasting to the other components of the map unit. The presence of minor components in a map unit in no way diminishes the usefulness or accuracy of the data. The delineation of such landforms and landform segments on the map provides sufficient information for the development of resource plans. If intensive use of small areas is planned, onsite investigation is needed to define and locate the soils and miscellaneous areas.

Soil scientists make many field observations in the process of producing a soil map. The frequency of observation is dependent upon several factors, including scale of mapping, intensity of mapping, design of map units, complexity of the landscape, and experience of the soil scientist. Observations are made to test and refine the soil-landscape model and predictions and to verify the classification of the soils at specific locations. Once the soil-landscape model is refined, a significantly smaller number of measurements of individual soil properties are made and recorded. These measurements may include field measurements, such as those for color, depth to bedrock, and texture, and laboratory measurements, such as those for content of sand, silt, clay, salt, and other components. Properties of each soil typically vary from one point to another across the landscape.

Observations for map unit components are aggregated to develop ranges of characteristics for the components. The aggregated values are presented. Direct measurements do not exist for every property presented for every map unit component. Values for some properties are estimated from combinations of other properties.

While a soil survey is in progress, samples of some of the soils in the area generally are collected for laboratory analyses and for engineering tests. Soil scientists interpret the data from these analyses and tests as well as the field-observed characteristics and the soil properties to determine the expected behavior of the soils under different uses. Interpretations for all of the soils are field tested through observation of the soils in different uses and under different levels of management. Some interpretations are modified to fit local conditions, and some new interpretations are developed to meet local needs. Data are assembled from other sources, such as research information, production records, and field experience of specialists. For example, data on crop yields under defined levels of management are assembled from farm records and from field or plot experiments on the same kinds of soil.

Predictions about soil behavior are based not only on soil properties but also on such variables as climate and biological activity. Soil conditions are predictable over long periods of time, but they are not predictable from year to year. For example, soil scientists can predict with a fairly high degree of accuracy that a given soil will have a high water table within certain depths in most years, but they cannot predict that a high water table will always be at a specific level in the soil on a specific date.

After soil scientists located and identified the significant natural bodies of soil in the survey area, they drew the boundaries of these bodies on aerial photographs and identified each as a specific map unit. Aerial photographs show trees, buildings, fields, roads, and rivers, all of which help in locating boundaries accurately.

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Soil Map

The soil map section includes the soil map for the defined area of interest, a list of soil map units on the map and extent of each map unit, and cartographic symbols displayed on the map. Also presented are various metadata about data used to produce the map, and a description of each soil map unit.

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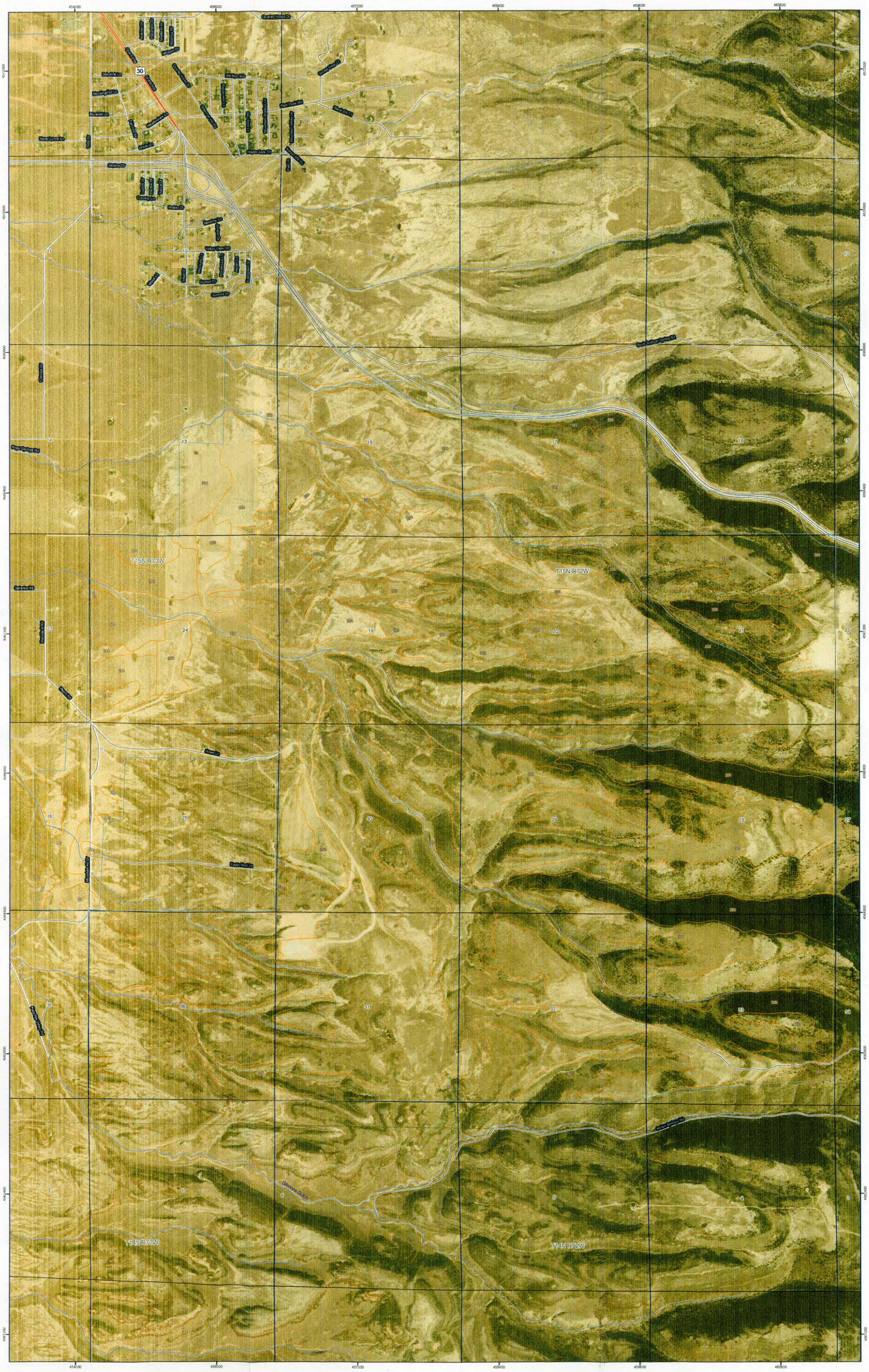

MAP LEGEND

Area of Interest (AOI)

- Area of Interest (AOI)

Soils

- Soil Map Units

Special Point Features

- Blowout
- Borrow Pit
- Clay Spot
- Closed Depression
- Gravel Pit
- Gravelly Spot
- Landfill
- Lava Flow
- Marsh or swamp
- Mine or Quarry
- Miscellaneous Water
- Perennial Water
- Rock Outcrop
- Saline Spot
- Sandy Spot
- Severely Eroded Spot
- Sinkhole
- Slide or Slip
- Sodic Spot
- Spoil Area
- Stony Spot
- Very Stony Spot
- Wet Spot
- Other

Special Line Features

- Gully
- Short Steep Slope
- Other

Political Features

- Cities
- PLSS Township and Range
- PLSS Section

Water Features

- Oceans
- Streams and Canals

Transportation

- Rails
- Interstate Highways
- US Routes
- Major Roads

MAP INFORMATION

Map Scale: 1:14,500 if printed on D size (22" × 34") sheet.

The soil surveys that comprise your AOI were mapped at 1:24,000.

Please rely on the bar scale on each map sheet for accurate map measurements.

Source of Map: Natural Resources Conservation Service
Web Soil Survey URL: http://websoilsurvey.nrcs.usda.gov
Coordinate System: UTM Zone 13N NAD83

This product is generated from the USDA-NRCS certified data as of the version date(s) listed below.

Soil Survey Area: Albany County Area, Wyoming
Survey Area Data: Version 6, Feb 21, 2007

Date(s) aerial images were photographed: 7/28/2006

The orthophoto or other base map on which the soil lines were compiled and digitized probably differs from the background imagery displayed on these maps. As a result, some minor shifting of map unit boundaries may be evident.

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Map Unit Legend

Albany County Area, Wyoming (WY601)			
Map Unit Symbol	**Map Unit Name**	**Acres in AOI**	**Percent of AOI**
128	Bruja-Canwall-Telecan association, 3 to 60 percent slopes	1,259.8	14.8%
141	Cheadle-Passcreek, cobbly subsoil-Rock outcrop complex, 5 to 25 percent slopes	2,418.1	28.4%
158	Fiveoh-Fiveoh, cobbly substratum-Ryan Park complex, 1 to 8 percent slopes	473.1	5.6%
160	Fiveoh, cobbly substratum-Joemre fine sandy loams, 1 to 5 percent slopes	72.2	0.8%
174	Joemre fine sandy loam, 3 to 6 percent slopes	95.9	1.1%
189	Miracle-Cheadle association, 5 to 20 percent slopes	12.0	0.1%
191	Nathale-Passcreek, cobbly subsoil-Rock outcrop complex, 10 to 60 percent slopes	1,383.8	16.3%
193	Pilotpeak-Canwall complex, 3 to 20 percent slopes	1,775.9	20.9%
195	Pits, mine	65.2	0.8%
197	Poposhia-Blazon complex, 3 to 15 percent slopes	54.6	0.6%
208	Rimton-Passcreek, cobbly subsoil-Miracle complex, 10 to 60 percent slopes	602.5	7.1%
214	Rock outcrop-Pilotpeak complex, 3 to 25 percent slopes	220.4	2.6%
234	Tieside-Pilotpeak-Rock outcrop complex, 3 to 10 percent slopes	35.9	0.4%
241	Wycolo-Alcova complex, 3 to 10 percent slopes	32.0	0.4%
Totals for Area of Interest		**8,501.1**	**100.0%**

Map Unit Descriptions

The map units delineated on the detailed soil maps in a soil survey represent the soils or miscellaneous areas in the survey area. The map unit descriptions, along with the maps, can be used to determine the composition and properties of a unit.

A map unit delineation on a soil map represents an area dominated by one or more major kinds of soil or miscellaneous areas. A map unit is identified and named according to the taxonomic classification of the dominant soils. Within a taxonomic class there are precisely defined limits for the properties of the soils. On the landscape, however, the soils are natural phenomena, and they have the characteristic variability of all natural phenomena. Thus, the range of some observed properties may extend beyond the limits defined for a taxonomic class. Areas of soils of a single taxonomic class rarely, if ever, can be mapped without including areas of other taxonomic classes. Consequently, every map unit is made up of the soils or miscellaneous areas for which it is named and some minor components that belong to taxonomic classes other than those of the major soils.

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Most minor soils have properties similar to those of the dominant soil or soils in the map unit, and thus they do not affect use and management. These are called noncontrasting, or similar, components. They may or may not be mentioned in a particular map unit description. Other minor components, however, have properties and behavioral characteristics divergent enough to affect use or to require different management. These are called contrasting, or dissimilar, components. They generally are in small areas and could not be mapped separately because of the scale used. Some small areas of strongly contrasting soils or miscellaneous areas are identified by a special symbol on the maps. If included in the database for a given area, the contrasting minor components are identified in the map unit descriptions along with some characteristics of each. A few areas of minor components may not have been observed, and consequently they are not mentioned in the descriptions, especially where the pattern was so complex that it was impractical to make enough observations to identify all the soils and miscellaneous areas on the landscape.

The presence of minor components in a map unit in no way diminishes the usefulness or accuracy of the data. The objective of mapping is not to delineate pure taxonomic classes but rather to separate the landscape into landforms or landform segments that have similar use and management requirements. The delineation of such segments on the map provides sufficient information for the development of resource plans. If intensive use of small areas is planned, however, onsite investigation is needed to define and locate the soils and miscellaneous areas.

An identifying symbol precedes the map unit name in the map unit descriptions. Each description includes general facts about the unit and gives important soil properties and qualities.

Soils that have profiles that are almost alike make up a *soil series.* Except for differences in texture of the surface layer, all the soils of a series have major horizons that are similar in composition, thickness, and arrangement.

Soils of one series can differ in texture of the surface layer, slope, stoniness, salinity, degree of erosion, and other characteristics that affect their use. On the basis of such differences, a soil series is divided into *soil phases.* Most of the areas shown on the detailed soil maps are phases of soil series. The name of a soil phase commonly indicates a feature that affects use or management. For example, Alpha silt loam, 0 to 2 percent slopes, is a phase of the Alpha series.

Some map units are made up of two or more major soils or miscellaneous areas. These map units are complexes, associations, or undifferentiated groups.

A *complex* consists of two or more soils or miscellaneous areas in such an intricate pattern or in such small areas that they cannot be shown separately on the maps. The pattern and proportion of the soils or miscellaneous areas are somewhat similar in all areas. Alpha-Beta complex, 0 to 6 percent slopes, is an example.

An *association* is made up of two or more geographically associated soils or miscellaneous areas that are shown as one unit on the maps. Because of present or anticipated uses of the map units in the survey area, it was not considered practical or necessary to map the soils or miscellaneous areas separately. The pattern and relative proportion of the soils or miscellaneous areas are somewhat similar. Alpha-Beta association, 0 to 2 percent slopes, is an example.

An *undifferentiated group* is made up of two or more soils or miscellaneous areas that could be mapped individually but are mapped as one unit because similar interpretations can be made for use and management. The pattern and proportion of the soils or miscellaneous areas in a mapped area are not uniform. An area can be

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made up of only one of the major soils or miscellaneous areas, or it can be made up of all of them. Alpha and Beta soils, 0 to 2 percent slopes, is an example.

Some surveys include *miscellaneous areas.* Such areas have little or no soil material and support little or no vegetation. Rock outcrop is an example.

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Albany County Area, Wyoming

128—Bruja-Canwall-Telecan association, 3 to 60 percent slopes

Map Unit Setting

Mean annual precipitation: 10 to 14 inches
Mean annual air temperature: 39 to 43 degrees F
Frost-free period: 85 to 110 days

Map Unit Composition

Bruja and similar soils: 30 percent
Canwall and similar soils: 25 percent
Telecan and similar soils: 15 percent
Minor components: 30 percent

Description of Bruja

Setting

Landform: Hills, ridges
Landform position (three-dimensional): Side slope
Down-slope shape: Linear
Across-slope shape: Convex
Parent material: Residuum weathered from limestone and sandstone and/or colluvium derived from limestone and sandstone

Properties and qualities

Slope: 20 to 60 percent
Depth to restrictive feature: 20 to 40 inches to paralithic bedrock
Drainage class: Well drained
Capacity of the most limiting layer to transmit water (Ksat): Moderately high (0.20 to 0.60 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Calcium carbonate, maximum content: 25 percent
Gypsum, maximum content: 1 percent
Maximum salinity: Nonsaline (0.0 to 2.0 mmhos/cm)
Available water capacity: Very low (about 1.1 inches)

Interpretive groups

Land capability classification (irrigated): 7e
Land capability (nonirrigated): 7e
Ecological site: ROCKY HILLS (10-14SE) (R034XY334WY)

Typical profile

0 to 5 inches: Very cobbly very fine sandy loam
5 to 23 inches: Extremely cobbly very fine sandy loam
23 to 60 inches: Unweathered bedrock

Description of Canwall

Setting

Landform: Hills, ridges
Landform position (three-dimensional): Side slope
Down-slope shape: Linear
Across-slope shape: Convex

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Parent material: Eolian deposits derived from limestone and/or colluvium derived from limestone

Properties and qualities

Slope: 10 to 30 percent
Depth to restrictive feature: 20 to 40 inches to lithic bedrock
Drainage class: Well drained
Capacity of the most limiting layer to transmit water (Ksat): Moderately low to moderately high (0.03 to 0.60 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Calcium carbonate, maximum content: 32 percent
Maximum salinity: Nonsaline (0.0 to 2.0 mmhos/cm)
Sodium adsorption ratio, maximum: 5.0
Available water capacity: Very low (about 1.7 inches)

Interpretive groups

Land capability classification (irrigated): 6e
Land capability (nonirrigated): 6e
Ecological site: SHALLOW SANDY (10-14SE) (R034XY366WY)

Typical profile

0 to 3 inches: Gravelly fine sandy loam
3 to 12 inches: Gravelly very fine sandy loam
12 to 26 inches: Very cobbly very fine sandy loam
26 to 60 inches: Unweathered bedrock

Description of Telecan

Setting

Landform: Alluvial fans, fan remnants
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Alluvium derived from limestone and sandstone

Properties and qualities

Slope: 3 to 6 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Well drained
Capacity of the most limiting layer to transmit water (Ksat): High (2.00 to 6.00 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Calcium carbonate, maximum content: 10 percent
Maximum salinity: Nonsaline (0.0 to 2.0 mmhos/cm)
Available water capacity: Moderate (about 8.1 inches)

Interpretive groups

Land capability classification (irrigated): 4e
Land capability (nonirrigated): 4e
Ecological site: SANDY (10-14SE) (R034XY350WY)

Typical profile

0 to 16 inches: Fine sandy loam
16 to 60 inches: Fine sandy loam

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Minor Components

Rock outcrop
Percent of map unit: 10 percent

Pilotpeak
Percent of map unit: 10 percent

Telecan-like
Percent of map unit: 10 percent

141—Cheadle-Passcreek, cobbly subsoil-Rock outcrop complex, 5 to 25 percent slopes

Map Unit Setting
Mean annual precipitation: 17 to 19 inches
Mean annual air temperature: 37 to 41 degrees F
Frost-free period: 40 to 60 days

Map Unit Composition
Cheadle and similar soils: 35 percent
Passcreek, cobbly subsoil, and similar soils: 25 percent
Rock outcrop: 20 percent
Minor components: 20 percent

Description of Cheadle

Setting
Landform: Mountain slopes
Landform position (three-dimensional): Mountainflank
Down-slope shape: Linear
Across-slope shape: Convex
Parent material: Residuum weathered from limestone and sandstone and/or colluvium derived from limestone and sandstone

Properties and qualities
Slope: 5 to 25 percent
Depth to restrictive feature: 10 to 20 inches to lithic bedrock
Drainage class: Well drained
Capacity of the most limiting layer to transmit water (Ksat): Moderately low to moderately high (0.03 to 0.60 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Calcium carbonate, maximum content: 5 percent
Available water capacity: Very low (about 1.0 inches)

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Interpretive groups

Land capability classification (irrigated): 7e
Land capability (nonirrigated): 7e
Ecological site: ROCKY HILLS (15-19SE) (R049XY134WY)

Typical profile

0 to 3 inches: Cobbly very fine sandy loam
3 to 7 inches: Very cobbly very fine sandy loam
7 to 10 inches: Very cobbly sandy loam
10 to 60 inches: Unweathered bedrock

Description of Passcreek, Cobbly Subsoil

Setting

Landform: Mountain slopes
Landform position (three-dimensional): Mountainflank
Down-slope shape: Linear
Across-slope shape: Convex
Parent material: Residuum weathered from limestone and sandstone and/or alluvium derived from limestone and sandstone

Properties and qualities

Slope: 5 to 25 percent
Depth to restrictive feature: 20 to 40 inches to lithic bedrock
Drainage class: Well drained
Capacity of the most limiting layer to transmit water (Ksat): Moderately low to moderately high (0.03 to 0.60 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Calcium carbonate, maximum content: 14 percent
Sodium adsorption ratio, maximum: 5.0
Available water capacity: Very low (about 2.3 inches)

Interpretive groups

Land capability classification (irrigated): 6e
Land capability (nonirrigated): 6e
Ecological site: LOAMY (15-19SE) (R049XY122WY)

Typical profile

0 to 4 inches: Fine sandy loam
4 to 11 inches: Sandy clay loam
11 to 22 inches: Very cobbly fine sandy loam
22 to 60 inches: Unweathered bedrock

Description of Rock Outcrop

Interpretive groups

Land capability classification (irrigated): 8s
Land capability (nonirrigated): 8s

Typical profile

0 to 60 inches: Unweathered bedrock

Minor Components

Cheadle sandy loam

Percent of map unit: 5 percent

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Miracle
Percent of map unit: 5 percent

Nathale
Percent of map unit: 5 percent

Rimton
Percent of map unit: 5 percent

158—Fiveoh-Fiveoh, cobbly substratum-Ryan Park complex, 1 to 8 percent slopes

Map Unit Setting
Mean annual precipitation: 10 to 14 inches
Mean annual air temperature: 39 to 43 degrees F
Frost-free period: 85 to 110 days

Map Unit Composition
Fiveoh, cobbly substratum, and similar soils: 30 percent
Fiveoh and similar soils: 30 percent
Ryan park and similar soils: 25 percent
Minor components: 15 percent

Description of Fiveoh

Setting
Landform: Hills
Landform position (three-dimensional): Side slope
Down-slope shape: Linear
Across-slope shape: Convex
Parent material: Alluvium derived from igneous, metamorphic and sedimentary rock

Properties and qualities
Slope: 1 to 8 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Well drained
Capacity of the most limiting layer to transmit water (Ksat): High (2.00 to 6.00 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Calcium carbonate, maximum content: 40 percent
Gypsum, maximum content: 1 percent
Maximum salinity: Nonsaline to very slightly saline (2.0 to 4.0 mmhos/cm)
Sodium adsorption ratio, maximum: 10.0
Available water capacity: Moderate (about 7.2 inches)

Interpretive groups
Land capability classification (irrigated): 4e

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Land capability (nonirrigated): 4e
Ecological site: SANDY (10-14SE) (R034XY350WY)

Typical profile

0 to 6 inches: Sandy loam
6 to 16 inches: Fine sandy loam
16 to 60 inches: Fine sandy loam

Description of Fiveoh, Cobbly Substratum

Setting

Landform: Hills
Landform position (three-dimensional): Side slope
Down-slope shape: Linear
Across-slope shape: Convex
Parent material: Alluvium derived from igneous, metamorphic and sedimentary rock

Properties and qualities

Slope: 1 to 8 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Well drained
Capacity of the most limiting layer to transmit water (Ksat): High (2.00 to 6.00 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Calcium carbonate, maximum content: 40 percent
Gypsum, maximum content: 1 percent
Maximum salinity: Nonsaline to very slightly saline (0.0 to 4.0 mmhos/cm)
Sodium adsorption ratio, maximum: 10.0
Available water capacity: Low (about 5.3 inches)

Interpretive groups

Land capability classification (irrigated): 4e
Land capability (nonirrigated): 4e
Ecological site: SANDY (10-14SE) (R034XY350WY)

Typical profile

0 to 3 inches: Sandy loam
3 to 22 inches: Sandy loam
22 to 31 inches: Cobbly sandy loam
31 to 60 inches: Very cobbly sandy loam

Description of Ryan Park

Setting

Landform: Hills
Landform position (three-dimensional): Side slope
Down-slope shape: Linear
Across-slope shape: Convex
Parent material: Alluvium derived from sandstone and/or eolian deposits derived from sandstone

Properties and qualities

Slope: 1 to 8 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Well drained
Capacity of the most limiting layer to transmit water (Ksat): High (2.00 to 6.00 in/hr)
Depth to water table: More than 80 inches

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Frequency of flooding: None
Frequency of ponding: None
Calcium carbonate, maximum content: 5 percent
Maximum salinity: Nonsaline (0.0 to 2.0 mmhos/cm)
Sodium adsorption ratio, maximum: 5.0
Available water capacity: Moderate (about 7.5 inches)

Interpretive groups
Land capability classification (irrigated): 4e
Land capability (nonirrigated): 4e
Ecological site: SANDY (10-14SE) (R034XY350WY)

Typical profile
0 to 3 inches: Fine sandy loam
3 to 18 inches: Fine sandy loam
18 to 60 inches: Gravelly sandy loam

Minor Components

Canwall
Percent of map unit: 7 percent

Pilotpeak
Percent of map unit: 7 percent

Sand-gravel bars
Percent of map unit: 1 percent

160—Fiveoh, cobbly substratum-Joemre fine sandy loams, 1 to 5 percent slopes

Map Unit Setting
Mean annual precipitation: 10 to 14 inches
Mean annual air temperature: 39 to 43 degrees F
Frost-free period: 85 to 110 days

Map Unit Composition
Fiveoh, cobbly substratum, and similar soils: 60 percent
Joemre and similar soils: 25 percent
Minor components: 15 percent

Description of Fiveoh, Cobbly Substratum

Setting
Landform: Alluvial fans, fan remnants
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Alluvium derived from igneous, metamorphic and sedimentary rock

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Properties and qualities

Slope: 1 to 3 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Well drained
Capacity of the most limiting layer to transmit water (Ksat): High (2.00 to 6.00 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Calcium carbonate, maximum content: 40 percent
Gypsum, maximum content: 1 percent
Maximum salinity: Nonsaline to very slightly saline (0.0 to 4.0 mmhos/cm)
Sodium adsorption ratio, maximum: 10.0
Available water capacity: Low (about 5.9 inches)

Interpretive groups

Land capability classification (irrigated): 4e
Land capability (nonirrigated): 4e
Ecological site: SANDY (10-14SE) (R034XY350WY)

Typical profile

0 to 3 inches: Fine sandy loam
3 to 18 inches: Fine sandy loam
18 to 41 inches: Fine sandy loam
41 to 60 inches: Very cobbly sandy loam

Description of Joemre

Setting

Landform: Alluvial fans, fan remnants
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Alluvium derived from igneous, metamorphic and sedimentary rock

Properties and qualities

Slope: 2 to 5 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Well drained
Capacity of the most limiting layer to transmit water (Ksat): High (2.00 to 6.00 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Calcium carbonate, maximum content: 20 percent
Gypsum, maximum content: 3 percent
Maximum salinity: Nonsaline (0.0 to 2.0 mmhos/cm)
Sodium adsorption ratio, maximum: 3.0
Available water capacity: Moderate (about 8.4 inches)

Interpretive groups

Land capability classification (irrigated): 4e
Land capability (nonirrigated): 4e
Ecological site: SANDY (10-14SE) (R034XY350WY)

Typical profile

0 to 4 inches: Fine sandy loam
4 to 18 inches: Fine sandy loam
18 to 60 inches: Loam

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Minor Components

Almy
Percent of map unit: 4 percent

Fiveoh
Percent of map unit: 4 percent

Rohonda
Percent of map unit: 4 percent

Wycolo
Percent of map unit: 3 percent

174—Joemre fine sandy loam, 3 to 6 percent slopes

Map Unit Setting
Mean annual precipitation: 10 to 14 inches
Mean annual air temperature: 39 to 43 degrees F
Frost-free period: 85 to 110 days

Map Unit Composition
Joemre and similar soils: 80 percent
Minor components: 20 percent

Description of Joemre

Setting
Landform: Alluvial fans, fan remnants
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Alluvium derived from igneous, metamorphic and sedimentary rock

Properties and qualities
Slope: 3 to 6 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Well drained
Capacity of the most limiting layer to transmit water (Ksat): High (2.00 to 6.00 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Calcium carbonate, maximum content: 20 percent
Gypsum, maximum content: 3 percent
Maximum salinity: Nonsaline (0.0 to 2.0 mmhos/cm)
Sodium adsorption ratio, maximum: 3.0
Available water capacity: Moderate (about 8.4 inches)

Interpretive groups
Land capability classification (irrigated): 4e
Land capability (nonirrigated): 4e

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Ecological site: SANDY (10-14SE) (R034XY350WY)

Typical profile

0 to 2 inches: Fine sandy loam
2 to 13 inches: Loam
13 to 60 inches: Fine sandy loam

Minor Components

Alcova

Percent of map unit: 5 percent

Almy

Percent of map unit: 5 percent

Fiveoh

Percent of map unit: 5 percent

Wycolo

Percent of map unit: 5 percent

189—Miracle-Cheadle association, 5 to 20 percent slopes

Map Unit Setting

Mean annual precipitation: 17 to 19 inches
Mean annual air temperature: 37 to 41 degrees F
Frost-free period: 40 to 60 days

Map Unit Composition

Miracle and similar soils: 45 percent
Cheadle and similar soils: 30 percent
Minor components: 25 percent

Description of Miracle

Setting

Landform: Mountain slopes
Landform position (three-dimensional): Mountainflank
Down-slope shape: Linear
Across-slope shape: Convex
Parent material: Residuum, colluvium and alluvium derived from sandstone, limestone & shale

Properties and qualities

Slope: 5 to 10 percent
Depth to restrictive feature: 20 to 40 inches to lithic bedrock
Drainage class: Well drained
Capacity of the most limiting layer to transmit water (Ksat): Moderately low to moderately high (0.03 to 0.60 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None

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Calcium carbonate, maximum content: 5 percent
Available water capacity: Low (about 4.4 inches)

Interpretive groups
Land capability classification (irrigated): 6e
Land capability (nonirrigated): 6e
Ecological site: LOAMY (15-19SE) (R049XY122WY)

Typical profile
0 to 4 inches: Fine sandy loam
4 to 28 inches: Sandy clay loam
28 to 33 inches: Sandy loam
33 to 60 inches: Unweathered bedrock

Description of Cheadle

Setting
Landform: Mountain slopes
Landform position (three-dimensional): Mountainflank
Down-slope shape: Linear
Across-slope shape: Convex
Parent material: Residuum weathered from limestone and sandstone and/or colluvium derived from limestone and sandstone

Properties and qualities
Slope: 8 to 20 percent
Depth to restrictive feature: 10 to 20 inches to lithic bedrock
Drainage class: Well drained
Capacity of the most limiting layer to transmit water (Ksat): Moderately low to moderately high (0.03 to 0.60 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Available water capacity: Very low (about 1.6 inches)

Interpretive groups
Land capability classification (irrigated): 7e
Land capability (nonirrigated): 7e
Ecological site: SHALLOW LOAMY (15-19SE) (R049XY162WY)

Typical profile
0 to 4 inches: Fine sandy loam
4 to 9 inches: Channery fine sandy loam
9 to 16 inches: Very channery fine sandy loam
16 to 60 inches: Unweathered bedrock

Minor Components

Passcreek
Percent of map unit: 6 percent

Cheadle
Percent of map unit: 6 percent

Miracle-like
Percent of map unit: 6 percent

Sandy soils
Percent of map unit: 4 percent

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Rock outcrop
Percent of map unit: 3 percent

191—Nathale-Passcreek, cobbly subsoil-Rock outcrop complex, 10 to 60 percent slopes

Map Unit Setting
Mean annual precipitation: 17 to 19 inches
Mean annual air temperature: 37 to 41 degrees F
Frost-free period: 40 to 60 days

Map Unit Composition
Passcreek, cobbly subsoil, and similar soils: 35 percent
Nathale and similar soils: 35 percent
Rock outcrop: 10 percent
Minor components: 20 percent

Description of Nathale

Setting
Landform: Mountain slopes
Landform position (three-dimensional): Mountainflank
Down-slope shape: Linear
Across-slope shape: Convex
Parent material: Residuum weathered from limestone and sandstone and/or colluvium derived from limestone and sandstone

Properties and qualities
Slope: 10 to 60 percent
Depth to restrictive feature: 20 to 40 inches to lithic bedrock
Drainage class: Well drained
Capacity of the most limiting layer to transmit water (Ksat): Moderately low to moderately high (0.03 to 0.60 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Calcium carbonate, maximum content: 20 percent
Maximum salinity: Nonsaline (0.0 to 2.0 mmhos/cm)
Available water capacity: Very low (about 1.4 inches)

Interpretive groups
Land capability classification (irrigated): 7e
Land capability (nonirrigated): 7e
Ecological site: COARSE UPLAND (15-19SE) (R049XY108WY)

Typical profile
0 to 4 inches: Gravelly fine sandy loam
4 to 11 inches: Very cobbly very fine sandy loam
11 to 24 inches: Very cobbly very fine sandy loam

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24 to 60 inches: Unweathered bedrock

Description of Passcreek, Cobbly Subsoil

Setting

Landform: Mountain slopes
Landform position (three-dimensional): Mountainflank
Down-slope shape: Linear
Across-slope shape: Convex
Parent material: Residuum weathered from limestone and sandstone and/or alluvium derived from limestone and sandstone

Properties and qualities

Slope: 10 to 60 percent
Depth to restrictive feature: 20 to 40 inches to lithic bedrock
Drainage class: Well drained
Capacity of the most limiting layer to transmit water (Ksat): Moderately low to moderately high (0.03 to 0.60 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Calcium carbonate, maximum content: 14 percent
Sodium adsorption ratio, maximum: 5.0
Available water capacity: Low (about 3.4 inches)

Interpretive groups

Land capability classification (irrigated): 7e
Land capability (nonirrigated): 7e
Ecological site: LOAMY (15-19SE) (R049XY122WY)

Typical profile

0 to 7 inches: Very fine sandy loam
7 to 16 inches: Sandy clay loam
16 to 31 inches: Very cobbly fine sandy loam
31 to 60 inches: Unweathered bedrock

Description of Rock Outcrop

Interpretive groups

Land capability classification (irrigated): 8s
Land capability (nonirrigated): 8s

Typical profile

0 to 60 inches: Unweathered bedrock

Minor Components

Cheadle

Percent of map unit: 4 percent

Miracle

Percent of map unit: 4 percent

Rimton

Percent of map unit: 4 percent

Cheadle

Percent of map unit: 4 percent

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Miracle-like
Percent of map unit: 4 percent

193—Pilotpeak-Canwall complex, 3 to 20 percent slopes

Map Unit Setting
Elevation: 6,000 to 7,800 feet
Mean annual precipitation: 10 to 14 inches
Mean annual air temperature: 39 to 43 degrees F
Frost-free period: 85 to 110 days

Map Unit Composition
Pilotpeak and similar soils: 55 percent
Canwall and similar soils: 25 percent
Minor components: 20 percent

Description of Pilotpeak

Setting
Landform: Cuestas
Landform position (three-dimensional): Mountainbase
Down-slope shape: Linear
Across-slope shape: Convex
Parent material: Colluvium and/or residuum weathered from limestone

Properties and qualities
Slope: 3 to 20 percent
Depth to restrictive feature: 7 to 20 inches to lithic bedrock
Drainage class: Well drained
Capacity of the most limiting layer to transmit water (Ksat): Moderately low to moderately high (0.03 to 0.60 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Calcium carbonate, maximum content: 35 percent
Gypsum, maximum content: 1 percent
Maximum salinity: Nonsaline to very slightly saline (2.0 to 4.0 mmhos/cm)
Sodium adsorption ratio, maximum: 5.0
Available water capacity: Very low (about 1.3 inches)

Interpretive groups
Land capability classification (irrigated): 7e
Land capability (nonirrigated): 7e
Ecological site: VERY SHALLOW (10-14SE) (R034XY376WY)
Other vegetative classification: VERY SHALLOW (10-14NP) (034XY376WY_1)

Typical profile
0 to 4 inches: Cobbly very fine sandy loam

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4 to 14 inches: Very cobbly very fine sandy loam
14 to 18 inches: Extremely cobbly very fine sandy loam
18 to 60 inches: Unweathered bedrock

Description of Canwall

Setting

Landform: Dipslopes
Landform position (three-dimensional): Mountainbase
Down-slope shape: Linear
Across-slope shape: Convex
Parent material: Colluvium and/or eolian deposits over residuum weathered from limestone

Properties and qualities

Slope: 3 to 20 percent
Depth to restrictive feature: 20 to 40 inches to lithic bedrock
Drainage class: Well drained
Capacity of the most limiting layer to transmit water (Ksat): Moderately low to moderately high (0.03 to 0.60 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Calcium carbonate, maximum content: 32 percent
Maximum salinity: Nonsaline (0.0 to 2.0 mmhos/cm)
Sodium adsorption ratio, maximum: 5.0
Available water capacity: Very low (about 2.1 inches)

Interpretive groups

Land capability classification (irrigated): 6e
Land capability (nonirrigated): 6e
Ecological site: SHALLOW SANDY (10-14SE) (R034XY366WY)

Typical profile

0 to 3 inches: Fine sandy loam
3 to 12 inches: Very fine sandy loam
12 to 24 inches: Very cobbly very fine sandy loam
24 to 60 inches: Unweathered bedrock

Minor Components

Bruja

Percent of map unit: 6 percent
Landform: Dipslopes
Landform position (three-dimensional): Mountainbase

Telecan

Percent of map unit: 6 percent
Landform: Dipslopes, drainageways
Landform position (three-dimensional): Mountainbase

Tieside

Percent of map unit: 6 percent
Landform: Dipslopes
Landform position (three-dimensional): Mountainbase

Rock outcrop

Percent of map unit: 2 percent

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Landform: Dipslopes
Landform position (three-dimensional): Mountainbase

195—Pits, mine

Map Unit Setting

Mean annual precipitation: 10 to 14 inches
Mean annual air temperature: 39 to 43 degrees F
Frost-free period: 85 to 110 days

Map Unit Composition

Pits, mine: 100 percent

Description of Pits, Mine

Interpretive groups

Land capability classification (irrigated): 8s
Land capability (nonirrigated): 8s

197—Poposhia-Blazon complex, 3 to 15 percent slopes

Map Unit Setting

Mean annual precipitation: 10 to 14 inches
Mean annual air temperature: 39 to 43 degrees F
Frost-free period: 85 to 110 days

Map Unit Composition

Poposhia and similar soils: 50 percent
Blazon and similar soils: 25 percent
Minor components: 25 percent

Description of Poposhia

Setting

Landform: Hills
Landform position (three-dimensional): Side slope
Down-slope shape: Linear
Across-slope shape: Convex
Parent material: Alluvium derived from sandstone, siltstone and shale

Properties and qualities

Slope: 3 to 10 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Well drained

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Capacity of the most limiting layer to transmit water (Ksat): Moderately high to high (0.60 to 2.00 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Calcium carbonate, maximum content: 15 percent
Gypsum, maximum content: 1 percent
Maximum salinity: Nonsaline to very slightly saline (0.0 to 4.0 mmhos/cm)
Sodium adsorption ratio, maximum: 10.0
Available water capacity: High (about 10.7 inches)

Interpretive groups
Land capability classification (irrigated): 4e
Land capability (nonirrigated): 4e
Ecological site: LOAMY (10-14SE) (R034XY322WY)

Typical profile
0 to 2 inches: Fine sandy loam
2 to 60 inches: Loam

Description of Blazon

Setting
Landform: Hills, ridges
Landform position (three-dimensional): Side slope
Down-slope shape: Linear
Across-slope shape: Convex
Parent material: Residuum weathered from shale

Properties and qualities
Slope: 8 to 15 percent
Depth to restrictive feature: 10 to 20 inches to paralithic bedrock
Drainage class: Well drained
Capacity of the most limiting layer to transmit water (Ksat): Very low to moderately high (0.00 to 0.20 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Calcium carbonate, maximum content: 15 percent
Gypsum, maximum content: 5 percent
Maximum salinity: Nonsaline to very slightly saline (0.0 to 4.0 mmhos/cm)
Sodium adsorption ratio, maximum: 5.0
Available water capacity: Very low (about 2.1 inches)

Interpretive groups
Land capability classification (irrigated): 7s
Land capability (nonirrigated): 7s
Ecological site: SHALLOW CLAYEY (10-14SE) (R034XY358WY)

Typical profile
0 to 2 inches: Loam
2 to 12 inches: Clay loam
12 to 60 inches: Unweathered bedrock

Minor Components

Chaperton
Percent of map unit: 10 percent

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Blazon-like
Percent of map unit: 8 percent

Blackhall
Percent of map unit: 4 percent

Satanka
Percent of map unit: 3 percent

208—Rimton-Passcreek, cobbly subsoil-Miracle complex, 10 to 60 percent slopes

Map Unit Setting

Mean annual precipitation: 17 to 19 inches
Mean annual air temperature: 37 to 41 degrees F
Frost-free period: 40 to 60 days

Map Unit Composition

Rimton and similar soils: 40 percent
Passcreek, cobbly subsoil, and similar soils: 25 percent
Miracle and similar soils: 15 percent
Minor components: 20 percent

Description of Rimton

Setting

Landform: Mountain slopes
Landform position (three-dimensional): Mountainflank
Down-slope shape: Linear
Across-slope shape: Convex
Parent material: Residuum weathered from limestone and sandstone and/or colluvium derived from limestone and sandstone

Properties and qualities

Slope: 10 to 60 percent
Depth to restrictive feature: 20 to 40 inches to paralithic bedrock
Drainage class: Well drained
Capacity of the most limiting layer to transmit water (Ksat): Moderately high (0.20 to 0.60 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Calcium carbonate, maximum content: 5 percent
Available water capacity: Low (about 5.0 inches)

Interpretive groups

Land capability classification (irrigated): 7e
Land capability (nonirrigated): 7e

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Typical profile

0 to 4 inches: Very fine sandy loam
4 to 15 inches: Fine sandy loam
15 to 32 inches: Sandy clay loam
32 to 39 inches: Very cobbly fine sandy loam
39 to 60 inches: Unweathered bedrock

Description of Passcreek, Cobbly Subsoil

Setting

Landform: Mountain slopes
Landform position (three-dimensional): Mountainflank
Down-slope shape: Linear
Across-slope shape: Convex
Parent material: Residuum weathered from limestone and sandstone and/or alluvium derived from limestone and sandstone

Properties and qualities

Slope: 10 to 60 percent
Depth to restrictive feature: 20 to 40 inches to lithic bedrock
Drainage class: Well drained
Capacity of the most limiting layer to transmit water (Ksat): Moderately low to moderately high (0.03 to 0.60 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Calcium carbonate, maximum content: 14 percent
Sodium adsorption ratio, maximum: 5.0
Available water capacity: Very low (about 2.7 inches)

Interpretive groups

Land capability classification (irrigated): 7e
Land capability (nonirrigated): 7e
Ecological site: SHALLOW LOAMY (15-19SE) (R049XY162WY)

Typical profile

0 to 7 inches: Fine sandy loam
7 to 17 inches: Cobbly fine sandy loam
17 to 26 inches: Very cobbly fine sandy loam
26 to 60 inches: Unweathered bedrock

Description of Miracle

Setting

Landform: Mountain slopes
Landform position (three-dimensional): Mountainflank
Down-slope shape: Linear
Across-slope shape: Convex
Parent material: Residuum, colluvium and alluvium derived from sandstone, limestone & shale

Properties and qualities

Slope: 10 to 40 percent
Depth to restrictive feature: 20 to 40 inches to lithic bedrock
Drainage class: Well drained
Capacity of the most limiting layer to transmit water (Ksat): Moderately low to moderately high (0.06 to 0.20 in/hr)

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Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Available water capacity: Low (about 4.3 inches)

Interpretive groups
Land capability classification (irrigated): 7e
Land capability (nonirrigated): 7e
Ecological site: LOAMY (15-19SE) (R049XY122WY)

Typical profile
0 to 6 inches: Fine sandy loam
6 to 31 inches: Sandy clay loam
31 to 60 inches: Unweathered bedrock

Minor Components

Cheadle
Percent of map unit: 5 percent

Nathale
Percent of map unit: 5 percent

Rock outcrop
Percent of map unit: 5 percent

Rimton-like
Percent of map unit: 5 percent

214—Rock outcrop-Pilotpeak complex, 3 to 25 percent slopes

Map Unit Setting
Mean annual precipitation: 10 to 14 inches
Mean annual air temperature: 39 to 43 degrees F
Frost-free period: 85 to 110 days

Map Unit Composition
Rock outcrop: 50 percent
Pilotpeak and similar soils: 25 percent
Minor components: 25 percent

Description of Rock Outcrop

Properties and qualities
Depth to restrictive feature: 0 inches to lithic bedrock
Capacity of the most limiting layer to transmit water (Ksat): Moderately low to moderately high (0.03 to 0.60 in/hr)
Available water capacity: Very low (about 0.0 inches)

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Interpretive groups

Land capability classification (irrigated): 8s
Land capability (nonirrigated): 8s

Typical profile

0 to 60 inches: Unweathered bedrock

Description of Pilotpeak

Setting

Landform: Hills, ridges
Landform position (three-dimensional): Side slope
Down-slope shape: Linear
Across-slope shape: Convex
Parent material: Residuum weathered from limestone and/or colluvium derived from limestone

Properties and qualities

Slope: 3 to 25 percent
Depth to restrictive feature: 7 to 20 inches to lithic bedrock
Drainage class: Well drained
Capacity of the most limiting layer to transmit water (Ksat): Moderately low to moderately high (0.03 to 0.60 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Calcium carbonate, maximum content: 25 percent
Gypsum, maximum content: 1 percent
Maximum salinity: Nonsaline to very slightly saline (2.0 to 4.0 mmhos/cm)
Sodium adsorption ratio, maximum: 5.0
Available water capacity: Very low (about 0.9 inches)

Interpretive groups

Land capability classification (irrigated): 7e
Land capability (nonirrigated): 7e
Ecological site: VERY SHALLOW (10-14SE) (R034XY376WY)
Other vegetative classification: VERY SHALLOW (10-14SE) (034XY376WY_2)

Typical profile

0 to 4 inches: Cobbly fine sandy loam
4 to 11 inches: Very cobbly very fine sandy loam
11 to 60 inches: Unweathered bedrock

Minor Components

Bruja

Percent of map unit: 9 percent

Canwall

Percent of map unit: 8 percent

Pilotpeak-like

Percent of map unit: 8 percent

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234—Tieside-Pilotpeak-Rock outcrop complex, 3 to 10 percent slopes

Map Unit Setting

Mean annual precipitation: 10 to 14 inches
Mean annual air temperature: 39 to 43 degrees F
Frost-free period: 85 to 110 days

Map Unit Composition

Pilotpeak and similar soils: 35 percent
Tieside and similar soils: 35 percent
Rock outcrop: 15 percent
Minor components: 15 percent

Description of Tieside

Setting

Landform: Hills, ridges
Landform position (three-dimensional): Side slope
Down-slope shape: Linear
Across-slope shape: Convex
Parent material: Residuum weathered from limestone, sandstone and shale

Properties and qualities

Slope: 3 to 10 percent
Depth to restrictive feature: 10 to 20 inches to paralithic bedrock
Drainage class: Well drained
Capacity of the most limiting layer to transmit water (Ksat): Moderately high (0.20 to 0.60 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Calcium carbonate, maximum content: 50 percent
Gypsum, maximum content: 3 percent
Maximum salinity: Nonsaline (0.0 to 2.0 mmhos/cm)
Available water capacity: Very low (about 2.3 inches)

Interpretive groups

Land capability classification (irrigated): 7s
Land capability (nonirrigated): 7s
Ecological site: SHALLOW SANDY (10-14SE) (R034XY366WY)

Typical profile

0 to 4 inches: Sandy loam
4 to 13 inches: Sandy loam
13 to 19 inches: Sandy loam
19 to 60 inches: Unweathered bedrock

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Description of Pilotpeak

Setting

Landform: Hills, ridges
Landform position (three-dimensional): Side slope
Down-slope shape: Linear
Across-slope shape: Convex
Parent material: Residuum weathered from limestone and/or colluvium derived from limestone

Properties and qualities

Slope: 3 to 10 percent
Depth to restrictive feature: 7 to 20 inches to lithic bedrock
Drainage class: Well drained
Capacity of the most limiting layer to transmit water (Ksat): Moderately low to moderately high (0.03 to 0.60 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Calcium carbonate, maximum content: 35 percent
Gypsum, maximum content: 1 percent
Maximum salinity: Nonsaline to very slightly saline (2.0 to 4.0 mmhos/cm)
Sodium adsorption ratio, maximum: 5.0
Available water capacity: Very low (about 0.7 inches)

Interpretive groups

Land capability classification (irrigated): 7s
Land capability (nonirrigated): 7s
Ecological site: ROCKY HILLS (10-14SE) (R034XY334WY)

Typical profile

0 to 1 inches: Cobbly fine sandy loam
1 to 5 inches: Very channery fine sandy loam
5 to 11 inches: Extremely channery fine sandy loam
11 to 60 inches: Unweathered bedrock

Description of Rock Outcrop

Properties and qualities

Depth to restrictive feature: 0 inches to lithic bedrock
Capacity of the most limiting layer to transmit water (Ksat): Moderately low to moderately high (0.03 to 0.60 in/hr)
Available water capacity: Very low (about 0.0 inches)

Interpretive groups

Land capability classification (irrigated): 8s
Land capability (nonirrigated): 8s

Typical profile

0 to 60 inches: Unweathered bedrock

Minor Components

Alcova

Percent of map unit: 5 percent

Rohonda

Percent of map unit: 5 percent

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Wycolo

Percent of map unit: 5 percent

241—Wycolo-Alcova complex, 3 to 10 percent slopes

Map Unit Setting

Mean annual precipitation: 10 to 14 inches
Mean annual air temperature: 39 to 43 degrees F
Frost-free period: 85 to 110 days

Map Unit Composition

Wycolo and similar soils: 45 percent
Alcova and similar soils: 35 percent
Minor components: 20 percent

Description of Wycolo

Setting

Landform: Hills, ridges
Landform position (three-dimensional): Side slope
Down-slope shape: Linear
Across-slope shape: Convex
Parent material: Residuum weathered from sandstone and shale and/or alluvium derived from sandstone and shale

Properties and qualities

Slope: 3 to 10 percent
Depth to restrictive feature: 20 to 40 inches to paralithic bedrock
Drainage class: Well drained
Capacity of the most limiting layer to transmit water (Ksat): Very low to moderately high (0.00 to 0.20 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Calcium carbonate, maximum content: 25 percent
Gypsum, maximum content: 1 percent
Maximum salinity: Nonsaline (0.0 to 2.0 mmhos/cm)
Available water capacity: Low (about 5.3 inches)

Interpretive groups

Land capability classification (irrigated): 4e
Land capability (nonirrigated): 4e
Ecological site: LOAMY (10-14SE) (R034XY322WY)

Typical profile

0 to 6 inches: Fine sandy loam
6 to 12 inches: Sandy clay loam
12 to 25 inches: Loam

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25 to 36 inches: Clay loam
36 to 60 inches: Unweathered bedrock

Description of Alcova

Setting

Landform: Hills
Landform position (three-dimensional): Side slope
Down-slope shape: Linear
Across-slope shape: Convex
Parent material: Alluvium derived from igneous and metamorphic rock

Properties and qualities

Slope: 3 to 10 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Well drained
Capacity of the most limiting layer to transmit water (Ksat): Moderately high to high (0.60 to 2.00 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Calcium carbonate, maximum content: 15 percent
Gypsum, maximum content: 1 percent
Maximum salinity: Nonsaline (0.0 to 2.0 mmhos/cm)
Sodium adsorption ratio, maximum: 5.0
Available water capacity: Moderate (about 6.4 inches)

Interpretive groups

Land capability classification (irrigated): 4e
Land capability (nonirrigated): 4e
Ecological site: LOAMY (10-14SE) (R034XY322WY)

Typical profile

0 to 4 inches: Gravelly sandy loam
4 to 24 inches: Gravelly sandy clay loam
24 to 60 inches: Very gravelly sandy clay loam

Minor Components

Joemre

Percent of map unit: 7 percent

Rohonda

Percent of map unit: 7 percent

Pilotpeak

Percent of map unit: 3 percent

Tieside

Percent of map unit: 3 percent

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References

American Association of State Highway and Transportation Officials (AASHTO). 2004. Standard specifications for transportation materials and methods of sampling and testing. 24th edition.

American Society for Testing and Materials (ASTM). 2005. Standard classification of soils for engineering purposes. ASTM Standard D2487-00.

Cowardin, L.M., V. Carter, F.C. Golet, and E.T. LaRoe. 1979. Classification of wetlands and deep-water habitats of the United States. U.S. Fish and Wildlife Service FWS/OBS-79/31.

Federal Register. July 13, 1994. Changes in hydric soils of the United States.

Federal Register. September 18, 2002. Hydric soils of the United States.

Hurt, G.W., and L.M. Vasilas, editors. Version 6.0, 2006. Field indicators of hydric soils in the United States.

National Research Council. 1995. Wetlands: Characteristics and boundaries.

Soil Survey Division Staff. 1993. Soil survey manual. Soil Conservation Service. U.S. Department of Agriculture Handbook 18. http://soils.usda.gov/

Soil Survey Staff. 1999. Soil taxonomy: A basic system of soil classification for making and interpreting soil surveys. 2nd edition. Natural Resources Conservation Service, U.S. Department of Agriculture Handbook 436. http://soils.usda.gov/

Soil Survey Staff. 2006. Keys to soil taxonomy. 10th edition. U.S. Department of Agriculture, Natural Resources Conservation Service. http://soils.usda.gov/

Tiner, R.W., Jr. 1985. Wetlands of Delaware. U.S. Fish and Wildlife Service and Delaware Department of Natural Resources and Environmental Control, Wetlands Section.

United States Army Corps of Engineers, Environmental Laboratory. 1987. Corps of Engineers wetlands delineation manual. Waterways Experiment Station Technical Report Y-87-1.

United States Department of Agriculture, Natural Resources Conservation Service. National forestry manual. http://soils.usda.gov/

United States Department of Agriculture, Natural Resources Conservation Service. National range and pasture handbook. http://www.glti.nrcs.usda.gov/

United States Department of Agriculture, Natural Resources Conservation Service. National soil survey handbook, title 430-VI. http://soils.usda.gov/

United States Department of Agriculture, Natural Resources Conservation Service. 2006. Land resource regions and major land resource areas of the United States, the Caribbean, and the Pacific Basin. U.S. Department of Agriculture Handbook 296. http://soils.usda.gov/

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United States Department of Agriculture, Soil Conservation Service. 1961. Land capability classification. U.S. Department of Agriculture Handbook 210.

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ADDENDUM DIX7B

Soil Sample Analysis Report for Amendment 8

TFN 5 1/110
RECD MAR 07, 2013

Permit 298C-A8
Etchepare LS Quarry
Revised: Feb. 2013

DIX7-30

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Jeff Brasher/Mountain Cement Co
5 Sand Creek Rd
Laramie WY 82070

DATE RECEIVED: 11-21-2012
DATE REPORTED: 12-21-2012

Project Etchepare Permit 298C-A8
* Extended sample ID's attached

RESEARCH SOIL ANALYSIS

Colorado State University
Soil, Water and Plant Testing Laboratory
Natural & Environmental Sciences Bldg - A319
Fort Collins, CO 80523-1120

(970) 491-5061 FAX: 491-2930

BILLING: **CC06448**

Lab #	Sample * ID #	Paste pH	% Coarse Fragments >2mm	Sand	Silt	Clay	Texture	Organic Matter	Saturation	Conductivity EC mmhos/cm	Extractable Selenium ppm
				%	%	%		%	%		
R1895	22	7.7	0.77	72	10	18	Sandy Loam	1.5	41.18	0.3	0.400
R1896	23	7.5	60.40	82	5	13	Sandy Loam	3.2	45.73	0.5	0.062
R1897	24	7.8	59.16	77	7	16	Sandy Loam	2.6	44.57	0.3	<0.001
R1898	25	7.6	39.66	69	14	17	Sandy Loam	5.0	62.51	0.4	0.221
R1899	26	7.7	62.56	62	19	19	Sandy Loam	4.9	54.68	0.4	0.022
R1900	27	6.9	0.25	66	17	17	Sandy Loam	2.6	40.93	0.5	0.400
R1901	28	7.0	0.97	61	21	18	Sandy Loam	0.9	36.09	0.3	0.221
R1902	29	7.3	1.25	60	16	24	Sandy Clay Loam	0.6	31.61	0.2	0.679
R1903	30	7.6	1.08	71	7	22	Sandy Clay Loam	1.6	26.98	0.2	0.599
R1904	31	7.3	0.26	62	5	33	Sandy Clay Loam	0.9	37.34	0.3	0.321
R1905	32	7.5	29.72	59	11	30	Sandy Clay Loam	1.0	41.51	0.4	<0.001
R1906	33	7.6	52.60	80	2	19	Sandy Loam	2.0	36.56	0.3	0.022
R1907	34	7.5	1.31	72	11	17	Sandy Loam	2.9	48.09	0.4	0.002
R1908	35	7.8	2.46	63	18	19	Sandy Loam	2.4	42.75	0.4	0.639
R1909	36	7.3	58.57	54	29	17	Sandy Loam	2.0	42.18	0.5	0.002
R1910	37	7.3	70.19	72	12	16	Sandy Loam	2.5	44.36	0.6	0.081
R1911	38	7.5	82.00	51	31	18	Loam	5.5	63.59	0.5	<0.001
R1912	39	7.7	9.93	63	16	21	Sandy Clay Loam	3.1	42.38	0.3	0.360
R1913	40	7.9	10.92	52	25	23	Sandy Clay Loam	2.4	41.71	0.3	0.340
R1914	41	6.9	13.68	61	21	18	Sandy Loam	5.3	49.56	0.4	0.162
R1915	42	6.5	0.34	50	27	23	Sandy Clay Loam	9.3*	74.85	0.6	<0.001
R1916	43	6.1	1.10	52	27	21	Sandy Clay Loam	5.7	58.51	0.4	0.002

* Expressed as weight loss on ignition

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Etchepare LS Quarry
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DIX7-31

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Project Etchepare Permit 298C-A8
* Extended sample ID's attached

RESEARCH SOIL ANALYSIS

Lab #	Sample * ID #	Paste pH	% Coarse Fragments >2mm	Sand	Silt	Clay	Texture	Organic Matter	Saturation	Conductivity EC mmhos/cm	Extractable Selenium ppm
				——%	——%	——%		——%	——%		
R1917	44	7.1	3.86	55	19	26	Sandy Clay Loam	3.5	53.18	0.3	<0.001
R1918	45	8.3								0.4	<0.001
R1919	46	7.8								0.5	0.380
R1920	47	7.6								0.8	<0.001
R1921	48	8.0								0.4	0.500
R1922	49	8.5								0.6	<0.001

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Project Etchepare Permit 298C-A8

RESEARCH SOIL ANALYSIS

Lab #	Sample ID #	Sampling Site	Section Section	Horizon Horizon	Depth Range	Underlying Parent Material	Bags/
R1874	1	128-1	20	A	0-7	-	1
R1875	2	128-1	-	B	7-18	limestone	1
R1876	3	128-2	19	A	0-3	-	1
R1877	4	128-2	-	B	3-8	rock	1
R1878	5	128-3	36	A1	0-5	-	1
R1879	6	128-3	-	A2	5-12	rock	1
R1880	7	128-4	32	A	0-2.5	-	1
R1881	8	128-4	-	B	2.5-5	rock	1
R1882	9	141-1	33	1	0-5	-	1
R1883	10	141-1	-	2	5-12	-	1
R1884	11	141-1	-	3	12-18	rock	1
R1885	12	141-2	31	1	0-4	-	1
R1886	13	141-2	-	2	4-16	-	1
R1887	14	141-2	-	3	16-18	-	1
R1888	15	141-2	-	4	18-20	sandstone	1
R1889	16	141-3	29	A	0-10	limestone	1
R1890	17	141-4	21	A	0-4	-	1
R1891	18	141-4	-	B	4-9	limestone	1
R1892	19	158-1	36	A	0-8	rock	2
R1893	20	189-1	33	1	0-4	-	1
R1894	21	189-1	-	2	4-8	-	1
R1895	22	189-1	-	3	8-12	sandstone	1
R1896	23	191-1	19	A	0-3	-	1

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Fort Collins, CO 80523-1120

(970) 491-5061 FAX: 491-2930

BILLING: **CC06448**

Project Etchepare Permit 298C-A8

RESEARCH SOIL ANALYSIS

Lab #	Sample ID #	Sampling Site	Section	Horizon	Depth Range (inches)	Underlying Parent Material	Bags/
R1897	24	191-1		B	3-13	limestone	1
R1898	25	191-2	21	A	0-3	-	1
R1899	26	191-2	-	B	3-13	limestone	1
R1900	27	191-3	29	1	0-4	-	1
R1901	28	191-3	-	2	4-12	-	1
R1902	29	191-3	-	3	12-30	-	1
R1903	30	191-3	-	4	30-34	-	1
R1904	31	191-3	-	5	34-43	-	1
R1905	32	191-3	-	6	43-46	sandstone	1
R1906	33	191-4	17	A	0-13	limestone	1
R1907	34	193-1	18	A	0-10	-	1
R1908	35	193-1	-	B	10-24	limestone	1
R1909	36	193-2	31	A1	0-3	-	1
R1910	37	193-2	-	A2	3-7	rock	1
R1911	38	193-3	20	A	0-11	limestone	2
R1912	39	193-4	19	A	0-4	-	1
R1913	40	193-4	-	B	4-20+	unknown	1
R1914	41	197-1	20	A	0-2	limestone	1
R1915	42	208-1	21	1	0-2	-	1
R1916	43	208-1	-	2	2-10	-	1
R1917	44	208-1	-	3	10-18	limestone	1
R1918	45	E7B ob					
R1919	46	E7Cob					
R1920	47	33-04					
R1921	48	33-05					
R1922	49	33-15					

ADDENDUM DIX7C

Soil Sample Analysis Report from Amendment 7

TFN 5 1/110
RECD MAR 07, 2013

Below is a photographically duplicated laboratory report from Amendment 7. All values in below that fall in marginal or unsuitable ranges are indicated in Table DIX7-2.

Permit 298C-A8
Etchepare LS Quarry
Revised: Feb. 2013

DIX7-35

TFN 5 1/110

Approved: _____

TFN 5 1/110
RECD MAR 07, 2013

Rocky Mountain Laboratories, Inc.

1633 Terra Avenue
Sheridan, WY 82801

Report ID: 010513652

Soil Analysis Report

InterMountain Resources
P.O. Box 1589
Laramie, WY 82801

Client Project ID: Topsoil

Set #0105S13652

Date Received: 12/01/05

Report Date: 12/21/05

Lab Id	Sample Id	Depths (Inches)	pH s.u.	Saturation %	EC @ 25°C dS/m	Calcium meq/L	Magnesium meq/L	Sodium meq/L	SAR
0105S13652	Sample 1	0 - 3	7.4	38.5	0.43	2.65	0.73	0.19	0.15
0105S13653	Sample 1 Canwall	3 - 12	7.4	33.2	0.36	2.56	0.79	0.22	0.17
0105S13654	Sample 1	12 - 16	7.5	36.8	0.38	2.34	0.93	0.44	0.34
0105S13655	Sample 1	16 - 24	7.6	34.5	0.28	1.59	0.77	0.24	0.22
0105S13656	Sample 2	0 - 4	7.4	42.3	0.41	2.99	0.81	0.16	0.12
0105S13657	Sample 2 Cheadle	4 - 9	7.4	40.8	0.39	2.67	0.75	0.41	0.31
0105S13658	Sample 2	9 - 16	7.5	42.0	0.37	2.64	0.73	0.21	0.16
0105S13659	Sample 3	0 - 4	7.0	39.3	0.37	2.54	0.51	0.20	0.16
0105S13660	Sample 3 Pilotpeak	4 - 14	7.2	38.0	0.34	2.57	0.36	0.21	0.17
0105S13661	Sample 3	14 - 18	7.4	39.8	0.31	2.45	0.45	0.18	0.15

These results only apply to the samples tested.

Abbreviations for extractants: PE= Saturated Paste Extract, H20Sol= water soluble,AB-DTPA= Ammonium Bicarbonate-DTPA, AAO= Acid Ammonium Oxalate
Abbreviations used in acid base accounting: T.S.= Total Sulfur, AB= Acid Base, ABP= Acid Base Potential, PyrS= Pyritic Sulfur, Pyr+Org= Pyritic Sulfur + Organic Sulfur, Neut. Pot.= Neutralization Potential
Miscellaneous Abbreviations: SAR= Sodium Adsorption Ratio, CEC= Cation Exchange Capacity, ESP= Exchangeable Sodium Percentage

Reviewed By: Joey Sheeley
Joey Sheeley, Soils Lab Supervisor

Permit 298C-A8
Etchepare LS Quarry
Revised: Feb. 2013

DIX7-36

Approved: _____

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Inter·Mountain Laboratories, Inc.

Report ID: 010513652

1633 Terra Avenue
Sheridan, WY 82801

Soil Analysis Report
InterMountain Resources
P.O. Box 1589
Laramie, WY 82801

Client Project ID: Topsoil
Date Received: 12/01/05

Set #0105S13652
Report Date: 12/21/05

Lab Id	Sample Id	Depths (Inches)	Coarse Fragments %	Sand %	Silt %	Clay %	Texture	Boron ppm	Selenium ppm	Organic Matter %
0105S13652	Sample 1	0 - 3	0.0	70.0	20.0	10.0	SANDY LOAM	0.27	<0.02	1.8
0105S13653	Sample 1 Carnwall	3 - 12	0.0	70.0	16.0	14.0	SANDY LOAM	0.21	<0.02	1.4
0105S13654	Sample 1	12 - 16	0.0	66.0	14.0	20.0	SANDY CLAY LOAM	0.27	<0.02	0.7
0105S13655	Sample 1	16 - 24	0.0	70.0	12.0	18.0	SANDY LOAM	0.19	<0.02	0.5
0105S13656	Sample 2	0 - 4	0.0	60.0	24.0	16.0	SANDY LOAM	0.17	<0.02	2.0
0105S13657	Sample 2 Cheadle	4 - 9	0.0	62.0	20.0	18.0	SANDY LOAM	0.16	<0.02	1.6
0105S13658	Sample 2	9 - 16	0.0	64.0	20.0	16.0	SANDY LOAM	0.16	<0.02	1.4
0105S13659	Sample 3	0 - 4	0.0	68.0	18.0	14.0	SANDY LOAM	0.22	<0.02	2.7
0105S13660	Sample 3 Pilotpeak	4 - 14	3.3	60.0	25.0	15.0	SANDY LOAM	0.21	<0.02	1.9
0105S13661	Sample 3	14 - 18	0.0	56.0	26.0	18.0	SANDY LOAM	0.24	<0.02	2.0

These results only apply to the samples tested.

Abbreviations for extractants: PE= Saturated Paste Extract, H20Sol= water soluble,AB-DTPA= Ammonium Bicarbonate-DTPA, AAO= Acid Ammonium Oxalate
Abbreviations used in acid base accounting: T.S.= Total Sulfur, AB= Acid Base, ABP= Acid Base Potential, PyrS= Pyritic Sulfur, Pyr+Org= Pyritic Sulfur + Organic Sulfur, Neut. Pot.= Neutralization Potential
Miscellaneous Abbreviations: SAR= Sodium Adsorption Ratio, CEC= Cation Exchange Capacity, ESP= Exchangeable Sodium Percentage

Reviewed By: Joey Shelley
Joey Shelley, Soils Lab Supervisor

ADDENDUM DIX7D

Soil Sample Analysis Data from Bird (2009) Study

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The following table is a photographically duplicated excerpt from Bird (2009).

Table 3.5 Analysis of Field Site Soil

	pH	EC (dS/m)	NO_3 (mg/kg)	Structure	Course material %	Color	Effervescence	Texture
Sample 1 0-15cm	8.54	0.1	1.5	Granular, fine	30	3,3 2.5YR	Extreme	Clay Loam
Sample 1 15-30cm	9.06	0.1	1.5	Granular, very fine	40	4,4 2.5YR	Extreme	Sandy Clay Loam
Sample 2 0-15cm	8.47	0.2	2	Granular, fine	30	4,3 5YR	Extreme	Clay Loam
Sample 2 15-30cm	9.30	0.1	2	Granular, very fine	40	4,6 5YR	Extreme	Sandy Clay Loam

NOTE: NO_3 was calculated for the whole 0-30cm for each sample before experiment began

	Ca (mg/kg)	K (mg/kg)	Mg (mg/kg)	Na (mg/kg)	Fe (mg/kg)	Mo (mg/kg)	NO_3 (mg/kg)	NH_4 (mg/kg)	P (mg/kg)
Sample 1 0-15cm	4200	320	340	120	4.4	0.02	9	1	7
Sample 1 15-30cm	4000	400	270	120	1.5	0.09	8	0	5
Sample 2 0-15cm	3600	70	240	50	1.8	0.01	4	0	5
Sample 2 15-30cm	4300	170	270	50	2.2	0.01	13	1	5

Note: the 15-30 cm depth ranges of both Bird's samples above are not re-spread soil but reclamation backfill comprised primarily of sandstone overburden. Therefore the even-numbered lines of the table are not relevant to the purposes of this permit appendix. All soil parameters for the odd-numbered lines in the above data represent re-spread topsoil; any of these values that fall in marginal or unsuitable ranges are indicated in Table DIX7-2. Parameters reported by Bird that are not in Table DIX7-2 are not addressed in LQD topsoil suitability criteria.

The values for electrical conductivity (EC) in this table are in different but equivalent units to those of Table DIX7-2 of this appendix and Table I-1 of LQD Guideline 1 (dS/m = mmhos/cm).

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__Map DIX7-1 __ insert map here after turning off mine pits layer

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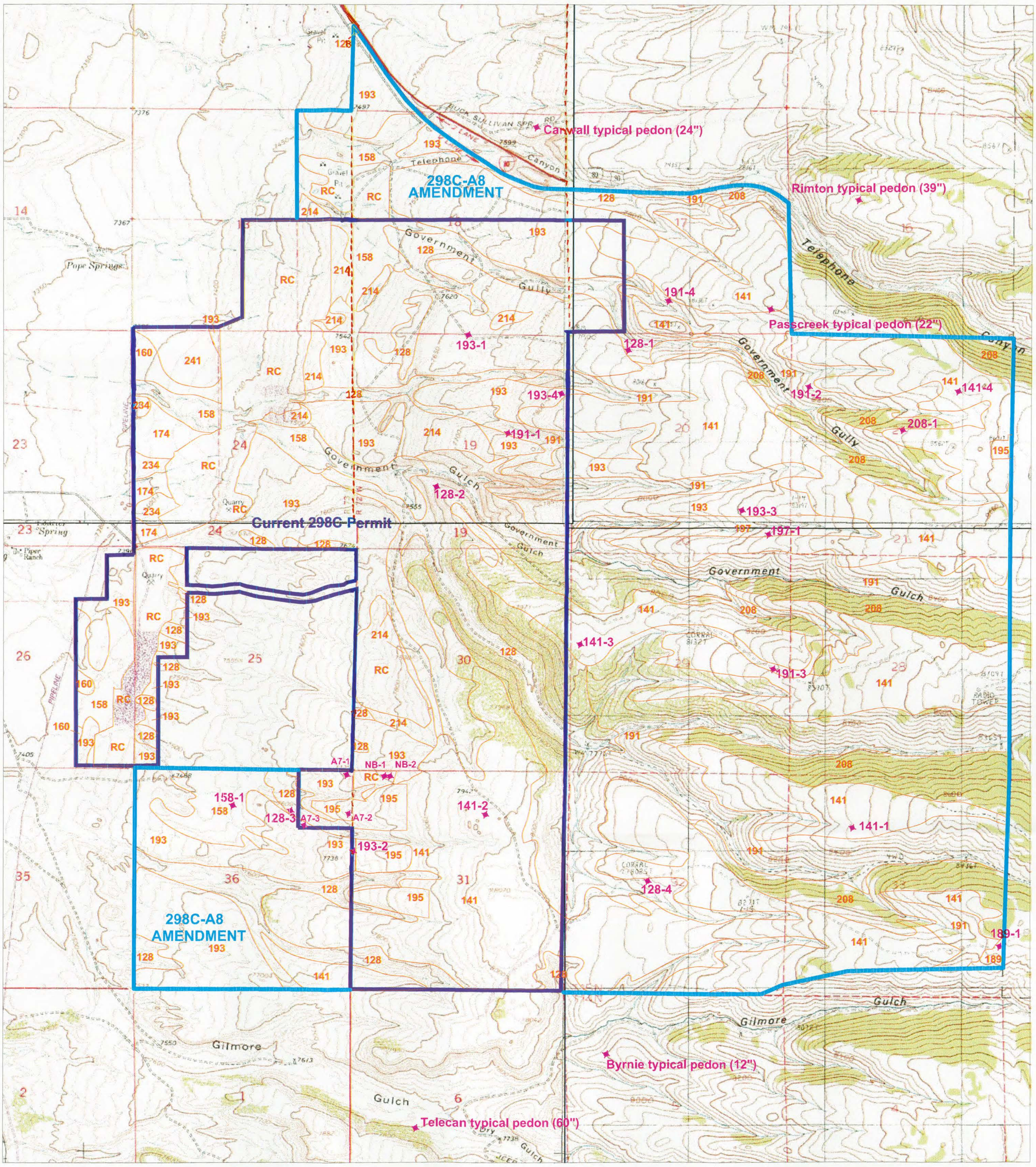

Soil Unit Legend

128 - Bruja-Canwall-Telecan Association
141- Cheadle-Passcreek Complex
158 - Fiveoh-Fiveoh-Ryan Park Complex
160 - Fiveoh-Joemre Complex
174 - Joemre
189 - Miracle-Cheadle Association
191 - Nathale-Passcreek Complex
193 - Pilotpeak-Canwall Complex
195 - Mine Pits
197 - Poposhia-Blazon Complex
208 - Rimton-Passcreek-Miracle Complex
214 - Rock Outcrop-Pilotpeak Complex
234 - Tieside-Pilotpeak-Rock Outcrop Complex
241 - Wycolo-Alcova Complex
RC - Reclamation

LEGEND

Current 298C Permit Boundary

Proposed 298C-A8 Amendment

141 — Soil Mapping Units

141-2
A7-3
Passcreek typical pedon (22") — Soil Sample Sites

1/4 mile — 1/2 mile — 1 mile
1320 ft — 2640 ft — 5280 ft

Map DIX7-1
Soil Units
Permit # 298C-A8
TFN 5 1/110
Etchepare Limestone Quarry

Revised By:	Date:		Design By:	Date:
AHM	7/27/10	Mountain Cement Company	AHM	3/18/10
Revised By:	Date:		Drawn By:	Date:
JWB	01/31/13		AHM	3/18/10
Revised By:	Date:	5 Sand Creek Rd. Laramie, Wyo. 82070 (307) 745-2687	Checked By:	Date:

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Mining Permit 298C
Mountain Cement Company

Amendment 298C-A8

Appendix DIX-8
Vegetation Inventory

Jeff Brasher, Ph.D.
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Revised September 2012

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APPENDIX DIX 8

VEGETATION INVENTORY

DIX 8.1 INTRODUCTION

Mountain Cement Company (MCC) is proposing to amend the existing Permit 298C to include two additional adjacent areas at their limestone quarry southeast of Laramie, in Albany Co., Wyoming. The vegetation baseline inventory and this appendix were completed by Jeff Brasher of MCC. Fieldwork for the study was done between May 2009 and December 2009, with minor observations for the species list and weed map during 2010.

The larger land area to be added to the permit will extend the permit eastward to the Medicine Bow National Forest Boundary, and northward to Interstate 80. The second land area to be added to the permit will add the unpermitted remainder of State Land Section 36 to the SW corner of the Permit. From downtown Laramie to the closest corner of the Permit will be approximately 4 miles southeast by air. The main access route to the Permit area will continue to be Howe Road. The Section 36 portion of the amendment area is situated adjacent the A5 Pit #6 currently being mined. The proposed new Permit area will vary in elevation from 7,385 to 8,740 feet. An Annual Report for the Permit will be submitted to DEQ-LQD detailing completed work in the permit area and plans for the upcoming year.

The total proposed amendment area is approximately 8515.7 acres and the area to be affected by mining operations is expected to encompass approximately 3397.5 acres of the total area. The affected area is expected to be mined over the next hundred or so years and mining in the new amendment area is proposed to start immediately following permit amendment application approval.

This vegetation study was designed to provide required baseline information for the amendment areas and future areas to be disturbed that are already approved from earlier amendments. One use of this baseline data will be to evaluate the suitability of the proposed Extended Reference Area or other Comparison Areas to judge revegetation success for bond releases. The study included mapping of vegetation types, disturbed areas, Noxious and Declared weeds, Plants of Special Concern, field photo points, small areas of concentrated beetle-kill, and small areas of recent tree blowdown. Field observations were made to add data to the Permit Species List and Weed Map during each month of the growing season from the initiation of fieldwork through the 2010 growing season for a period of well over 12 months. In July 2009 fieldwork for a vegetation cover study of 164 transects containing 486 quadrats was conducted covering the relevant bulk of the proposed Permit Area. In October thru December of 2009 field data was collected at 32 sites to estimate tree parameters in

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areas to be mined. These parameters included tree numbers, sizes, locations, species, bark beetle infestation, and beetle kill.

This study will be used to document some of the pre-mining land uses within the permit area and to both qualitatively and quantitatively describe the existing plant communities that have been and will be disturbed by mining activities. This data will be used to guide Mine and Reclamation Plans. It will also be used to steer the implementation of LQD bond release procedures in WDEQ/LQD in Guideline No. 2 and other LQD policy documents used to implement the Wyoming Environmental Quality Act.

DIX 8.2 OBJECTIVES

The vegetation study and report for this project are designed to meet the permit application requirements of W.S. 35-11-406(a)(vii), (b)(i) and (b)(iii); Sections 2, (a)(1)(A), 2(a)(1)(B), and 2(b)(3)(C) of chapter 2 of LQD Rules and Regulations and Sections 2(a)(1), 2(a)(2), 2(d)(1) through (9) of Chapter 3 of LQD Rules and Regulations. The major objective of the vegetation study is to provide information to determine when the post-mining reclaimed areas have met minimum requirements as established by state and federal regulations for vegetation cover. Other objectives include determining: (1) vegetation communities to be affected by mining operations, (2) plant species existing on the permit area, (3) the potential for threatened and endangered plant species, and (4) noxious weed species distribution.

DIX 8.3 METHODS

The vegetation study consists of: (1) mapping vegetation types, (2) describing the vegetation communities, (3) establishing and sampling the Comparison Areas, (4) sampling affected area sample site locations, (5) determining sample adequacy, (6) Conducting a tree inventory, (7) surveying for Threatened, Endangered, or other Plant Species of Concern, (8) surveying for Noxious and Declared weeds, and (9) compiling a plant species list. The vegetation inventory proposal to LQD is included as **Addendum DIX8 F**.

This Methods Section is organized with topics pertaining to the vegetation types first, then the tree inventory, then topics pertaining to individual species.

DIX 8.3.1 Classifying & Mapping Vegetation Types

Vegetation types have been mapped within the permit area and the standard half mile buffer around the permit boundary. Vegetation maps from the A5 and A7 Amendments and a separate unsubmitted vegetation study by Ron Schreibeis were used as starting information (see **Table DIX8-1**). Field mapping was done with an available USGS topographic map, enlarged to an appropriate scale. The field mapping focused on new unmapped areas of the

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proposed permit but also refined previous maps and made them consistent with the new mapping.

Previous Permit 298C vegetation maps included the following basic vegetation/land cover types: MS (Mixed Shrub/ Grassland), MM (Mountain Mahogany Shrubland), RF (Rock Flat/ Cushion Plant Community), MC (Mixed Shrub/ Conifer), SP (Stockpond), and DL (Disturbed Land). Notably there were very few acres mapped as MC (Mixed Shrub/ Conifer).

MSC (Mixed Shrub/ Conifer). Due to the increased land area and elevational range of the expanded permit, additional vegetation types are encountered beyond those of previous permit amendments.

To maintain as much consistency as possible with prior permit vegetation maps and keep the new vegetation classification as appropriately simple as possible, it was necessary early in the veg. mapping process to abandon Jim Orpet's A5 map vegetation type designation MC (Mixed Shrub/Conifer), expand its range of meanings, and rename the new concept MSC (Mixed Shrub/Conifer) to accommodate a wide range of moderate tree densities. MSC tree densities are less than the most densely forested high elevation areas of the permit which were given the designation MXC (Mixed Conifer Forest). Note that MXC and MSC are both different than Jim Orpet's A5 veg type MC; different in acronym, name, and concept (see **Table DIX8-1**).

As mapping fieldwork began, the vegetation classification was as described in the above paragraphs and similar to the general-purpose classification used by the Wyoming Governor's Sage-Grouse Conservation Initiative: Habitat Mapping Project for the Wyoming Game and Fish Commission (Rodemaker et al 2009).

Splitting Mixed Shrub/ Grassland Vegetation Types. During the course of vegetation mapping fieldwork, it became clear that the MS (Mixed Shrub/Grassland) communities of the study area differed in their dominant shrub species. The lower elevations of the study area and most of the sagebrush/grass communities of Permit Amendments 5, 7, and earlier amendments were dominated by black sagebrush (*Artemisia nova*), whereas the upper elevations of the study area and most of the new sections for the current permit amendment are dominated by mosaics of mountain big sagebrush (*Artemisia tridentata* var. *vaseyana*) and Wyoming three-tip sagebrush (*Artemisia tripartita* var. *rupicola*). Different sagebrush vegetation communities are routinely and justifiably (as in Rodemaker et al. 2009) considered different habitat types for wildlife. For similar reasons they would be expected to revegetate more successfully with different seed mixes. Thus this study differentiates the two sagebrush communities as Mixed Shrub/ Grassland (MS) and High Elevation Mixed Shrub Grassland (MSH). Sagebrush-dominated areas of veg. maps of earlier amendments were almost entirely MS (black sagebrush).

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Tree Cover versus Understory. After completion of fieldwork-- during data analysis, it became clear that the use of MSC (Mixed Shrub/ Conifer) in the vegetation classification is unsuitable for this study's purpose of guiding reclamation plans. Unsuitable, because the MSC veg. type has two very distinct understory vegetation types (MM and MSH) which correlate with different soil types and depths; thus they would likely be revegetated with different soil depths and seed mixes. Also, trees and their understory vegetation components are very likely to be planted in separate planting operations in different years. Still, the MSC veg. type has value in indicating moderate tree density.

To resolve this incompatibility between the use of MSC in the classification and later reclamation needs, the MSC (Mixed Shrub/ Conifer) vegetation type described above was split into two vegetation types based on understory shrub composition, yielding the new MSH-C (Coniferous High Elevation Mixed Shrubland) vegetation type and the new MM-C (Coniferous Mountain Mahogany Shrubland) vegetation type. Existing field data and aerial images were sufficient to accurately split the MSC veg. type into the new types and appropriately reassign the MSC cover study sample sites to the appropriate new veg. type categories of MSH-C and MM-C.

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Table DIX8-1. Summary of vegetation/ land cover types classification. To clarify the meaning of the vegetation map and related data in this Appendix, this table summarizes and contrasts the Vegetation/ Land Cover types used in previous Amendments (such as by Jim Orpet for A5), with the veg. types used in the current Appendix. Preliminary A8 Study results are also presented to clarify the rationale for the final A8 Classification. RD is added to designate (semi-) permanent roads such as haulroads, and public roads such as Interstate 80, which are more numerous in this amendment. RC (Reclaimed Land) is split out of DL (Disturbed Land). For further explanation see text section **DIX 8.3.1.**

Vegetation/Land Cover Type	Previous Amendments	Preliminary A8 results	This A8 Amendment	A8 Implied Tree Cover %
MS (Mixed Shrub/ Grassland)	MS	MS	**MS**	**<2**
MM (Mountain Mahogany Shrubland)	MM	MM	**MM**	**<2**
RF (Rock Flat/ Cushion Plant Community)	RF	RF	**RF**	**<2**
MC (Mixed Shrub/ Conifer)	MC (Orpet A5)	.	**.**	**na**
MSH (High Elevation Mixed Shrub/ Grassland)	.	MSH	**MSH**	**<2**
MSC (Mixed Shrub/ Conifer) (expanded concept)	.	MSC	**(MSH-C + MM-C)**	**>=2**
MSH-C (Coniferous High Elevation Mixed Shrubland)	.	.	**MSH-C**	**>=2**
MM-C (Coniferous Mountain Mahogany Shrubland)	.	.	**MM-C**	**>=2**
MXC (Mixed Conifer Forest)	.	.	**MXC**	**>>MSC**
SP (Stockpond)	SP	SP	**SP**	**na**
RD ((Semi-)permanent Road)	.	.	**RD**	**na**
RC (Reclaimed Land)	DL	RC	**RC**	**na**
DL (Disturbed Land)	DL	DL	**DL**	**na**

<u>Applications of the Vegetation Classification.</u> For purposes of the cover study MSH-C is lumped into the same category as MSH (High Elevation Mixed Shrubland). This is natural since the only difference they are based on is the difference between low tree cover (MSH

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estimated tree cover <2%) versus moderate cover (MXC tree cover >> MSH-C tree cover >= 2% tree cover). Similarly, MM and MM-C are lumped together in the cover study being only based on the same quantitative differences in tree cover (see **Table DIX8-1**). Lumping the two MM types and the two MSH types is most appropriate for cover study purposes such as deciding on Reclamation Plan seed mixes, and evaluating suitability of Extended Reference Area for herbaceous vegetation bond release criteria.

In contrast, the vegetation map, tree inventory map, and any Mine and Reclamation Plans pertaining to tree parameters the pair MSH and MSH-C and the pair MM and MM-C are kept separate for their specific information content. Having these categories separate will facilitate planning topics such as mining benefits versus tree replacement costs for different areas of a given pit.

Cover Study Sample locations are indicated on the Vegetation Map (see **Map DIX8-2**) as are prominent topographic surface features and many of the manmade structures such as fences and roads. **Table DIX8-2** includes pre-mine acreages for each vegetation type.

DIX 8.3.2 Cover Study Methods

Vegetation cover sampling was limited to July 2009, the summer period predicted to have the optimal combination of vegetation cover and species recognizability. The thirteen specific days of the month when the transect data were collected included the 9th, 10th, 11th, 13th, 15th, 17th, 18th, 21st, 23rd, 24th, 27th, 28th, and 29th.

The cover sampling methods were the same for the Affected Areas and EXREFA except for differences in numbers of sites to be sampled. The target sample size for the Affected Area was fifteen per veg. type (more if possible towards statistical adequacy). The target number for the EXREFA of most veg. types was ten. The exception was the RF veg. type, where no samples were expected since RF areas are to be reclaimed as a different veg. type. These numbers were decided on with the mutual understanding between MCC and LQD that smaller achieved sample sizes were likely to be acceptable for this baseline study given the circumstances of this study.

DIX 8.3.2.1 Grazing Exclosures & Study Extent

The vast majority of the new 298C permit area is covered by the vegetation sampling done July 2009 as described herein. Excluded and included permit areas are discussed separately below.

<u>Excluded Areas</u>. In part due to cattle grazing in the spring and summer of 2009 that MCC was not able to prevent, the vegetation cover study (but not other parts of the inventory such as rare plants, weeds, etc.) excludes the 298C permitted areas in Sections 13, 24, 25, and 26,

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the old Piper Quarry areas. This is appropriate as: these permit area legal Sections 1) contain no land to be mined in the future, 2) are peripheral to the permit area, 3) cover a relatively small area in relation to the proposed permit, 4) are lower in elevation than the rest of the permit, 5) are not owned by MCC, 6) have been revegetated for years and 7) are near bond release.

Included Areas. The following paragraph describes recent land management in the portion of the permit area included in the vegetation cover study. In the year of sampling and prior years, the Affected Areas and EXREFA were managed in the same ways, with the exception of mining and reclamation. Few if any cattle had grazed the area. Mountain Cement Company has conducted routine mineral exploration, mining, and reclamation activities documented by the standard permits and reports on file with LQD. On both the new Mountain Land and Cattle Property east and north of the A5 amendment and the A5 Amendment Area itself, Warren Livestock Company had periodically grazed a limited number of sheep in recent years. No sheep grazing was conducted the year of sampling by arrangements made June 2009 with Doug Samuelson of Warren Livestock. On old MCC A5 land, very limited big-game hunting by selected authorized employees of MCC had been allowed. On State Section 36 six of Jenelle Gaddis' horses graze the unpermitted 600 acres. DEQ deemed this horse impact insufficient to justify grazing exclosures for this cover sampling study.

DIX 8.3.2.2 Determining Sample Site Locations.

Following vegetation mapping, cover study sample site locations were determined in the office utilizing a randomization procedure.

A simple image editing program, Microsoft Paint, was used to generate a field of randomly placed points by using the Airbrush Tool to make black points on a white background with multiple passes from different angles. Then the same tool was used to thin these points where needed by painting white pixels over the black ones to adjust density. Empty spots were supplemented with dots made with the pencil tool. Then a square portion of this field of dots was chosen as a template to represent a 1 square mile legal section of land. The number of points in this square was estimated. The maximum number of sampling sites to be planned for the vegetation type for either the affected area or EXREFA was divided by the number of relevant legal land Sections in the study to get the number of sites per Section. The number of points (for example 66) in the computer image was divided by the number of sites needed per section. In the example case the result was the number five; thus each fifth point would be marked for use as a potential sampling site. This image with its 66 points was loaded into an AutoCAD map. Then each of the 66 points was duplicated as a small cross in AutoCAD. Then this set of 66 crosses was copied and pasted onto each of the 1 square mile land sections of the vegetation map. For each vegetation type and EXREFA to be sampled, the number of marked potential sampling points was counted. For categories

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having excess points, every Nth point was deleted similar to the process above. For categories having fewer points than needed, points were added in a similar fashion to produce a semi-random, semi-systematic set of the needed number of points. Each veg. type by necessity was handled separately because the acreage and spatial distribution of each was different, as can be seen on the vegetation map.

Candidate sample sites were categorized as priority A, B, and C. Priority A sites were to be generally sampled first, allowing for some B sites to be sampled when logistics required, or if A sites were unsuitable due to map inaccuracies, inclusions, or unexpected vegetation disturbance. C sites were an additional backup plan. The mapping proved to be sufficiently accurate so that at all but one site the study methods allowed a nearby alternate site to be used. Therefore, relatively few B sites were used, and very few if any C sites.

In the field, predetermined sample sites were located by scaling and then pacing from objects identifiable on the vegetation map. The seconds reading on a digital watch was used to choose a pair of single digit random numbers which were then used to select the exact location of the beginning point for the line transect by pacing north the number of steps indicated by the first digit, and east the number of paces indicated by the second digit. The amount of time between sites was variable, and nearly always many minutes, making the second reading on the watch nearly random. The zero meters point of the 5 meter tape was then staked at the starting point. The direction the cover transect would point was determined by another random number either from a published random numbers table or by multiplying the digital watch seconds readout by six to generate an azimuth ranging between from 0 and 360 degrees.

DIX 8.3.2.3 On-site Cover Data Collection Methods

After the five meter measuring tape was placed as described above, a Daubenmier quadrat was used. This quadrat measured 50cm X 20cm (1/10 m^2) and was made of PVC pipe. It was placed against the right-hand side of the measuring tape with the upper left corner at the 1 m point on the tape. Then ocular estimates of cover by species were recorded on the field form. Then two additional quadrats were read the same way at the 3m and 5m points on the extended measuring tape. The data from these three quadrats comprise one cover site sample. A sample number and site number were given to each sample point (cover transect) on the field form as the field data form was completed.

Built into the study design were two types of backup plans for if an office-chosen sampling site was found to be unsuitable on the ground. The site may be unsuitable due to inaccuracies in the draft vegetation map, small inclusions of a different veg. type in the veg. map polygon to be sampled, or minor disturbances such as if the sample transect falls on a 2-track road. The first option built into the study methods uses a prescribed method to move a number of paces away from the rejected site and start the transect there as a substitute

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location using the same sample code number but documenting the use of the alternate site with notes on the field form and a photograph of the nearby original office-chosen site. If neither of two attempts at a nearby substitute site, nor the original office-chose site is suitable for sampling the intended veg. cover type, the attempts are documented with notes on the field form and photos, and the field form is kept for records, but with no cover data collected. Site 6 of this study was just such a site (see **Figure 7, Photo 7942** in **Addendum DIX8 B**). No cover data was collected, but the field form (see **Addendum DIX8 C**) documents the attempt and the survey worker travelled to the next appropriate candidate site on the Draft Vegetation Map. At the new sample site no problems were encountered and the Site was numbered Site 7, Sample 6 on the field form.

DIX 8.3.2.4 Methods to Achieve Sample Adequacy

Within the prescribed July sampling timeframe as many samples as possible for each vegetation type and EXREFA were completed in an effort to satisfy the minimum sample sizes and to achieve statistical sample adequacy as described by LQD Guideline 2 and LQD (2008).

DIX 8.3.3 Tree Inventory Methods

A tree inventory was conducted with 2009 field data collection and subsequent data analysis using field data to interpret aerial imagery. Per LQD Guideline 2 and conversations with DEQ's Robin Jones, the goal of the inventory was to document tree density per unit area and specific disturbance areas by species and the three subjective size categories small, medium and large. Depending on the site, field data collected consisted of direct counts with a GPS unit, standard belt transects, and special transects. The default size for the belt transects was 50m X 5m but these dimensions were more often adjusted to facilitate quality data collection. Special transects were used where tree frequency was too low for standard belt transects, and for logistical reasons. Tree data from permit amendments A5 and A7 was also used in modeling but given less weight in the analysis. (For raw data see **Addendum DIX8 E.**) Field data site choice was not random but stratified by variables hypothesized to affect tree distribution; then when practical the exact position and orientation of the transect was chosen randomly. Field data was collected in areas 1) to be mined, EXREFA, and transition areas between the two; 2) sites known to represent common and less-common tree species, 3) differing aspects (N-facing, S-facing, etc.); 3) public land survey legal sections; and 4) all seven of the mapped native vegetation types (see **Map DIX8-4**).

The intent of the tree inventory was (R. Jones, pers. Com. 2009) to achieve sample sizes large enough to be representative for DEQ purposes and for MCC to analyze costs (of stripping, reclamation and tree replacement) versus mining benefits for areas containing trees.

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Tree inventory field data was collected after the cover sampling was completed to allow time for sufficient cover sampling during the narrow July cover sampling window. Specific dates of data collection included: an unrecorded date in September or October (small test site; data lost); October 22nd. 23rd, 26th, 27th; November 4th, 5th, 12th, 24th, and 30th; and December 1st of 2009 (see field data sheets in **Addendum DIX8 E)**.

The satellite images used were downloaded from the WyGISC Imagery Server (WyGISC 2011). The images are 2001 DOQ 1-meter resolution color infrared (CIR) files in the GeoTIFF/MrSID file format. Specifically, the files used were the following four USGS 7.5' Quadrangles: Laramie 41105-C5, Pilot Hill 41105-C4, Red Buttes 41105-B5, and Sherman Mountains West 41105-B4.

The satellite imagery was used in conjunction with: GPS data from a handheld Trimble GeoXM 2005 Series Pocket PC GPS unit (Trimble 2006) running ArcPad 7.0.1 software (ESRI 2006), paper field form data, DIVA-GIS software (Hijmans 2011), and AutoCAD 2006 LT (Autodesk 2006).

In the CIR images small trees were seldom discernable; medium-sized trees often were discernable as a small red to pink area representing the tree canopy and an adjacent black area representing the tree's shadow; and large trees were generally discernable except in areas of high tree density where the canopy became nearly continuous. A medium-sized or large tree was often recognizable in the CIR satellite images as a small red to pink area representing the tree canopy and an adjacent black area to the northwest representing the tree's shadow. Tree inventory map (**Map DIX8-4**) polygons and lines are labeled with a Polygon Number or Road Segment Number. This number corresponds to predictions of tree parameters detailed in **Table DIX8-22 - Tree Predictions by Map Polygon, Road Segment, and Numbered Pit.** These predictions may serve to inform potential adjustments to the mining plans if expected stripping and reclamation costs exceed projected benefits of mining an area. The tree predictions for lines and polygons could also be used if needed to compare tree parameters within different mapped vegetation types such as MXC (Mixed Conifer Forest) versus MSH-C (Coniferous High Elevation Mixed Shrubland).

Field data from some sites was used to model tree parameters in many veg. map polygons as it was representative of common conditions in the Areas to Affect. Field data from other sites was applicable to relatively few areas to be modeled, and data from some sites was not used to model parameters because the field data site was not found to be representative of any areas to be disturbed. (See **Addendum DIX8 E** for copies of field forms).

Observed areas of tree blow-down (BD) and areas of heavy beetle kill (BK) were mapped during the vegetation mapping fieldwork and are shown in **Map DIX8-2.**

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DIX 8.3.4 Plant Species List, Compilation Methods

A species list of vascular plants documented for the entire proposed permit area was compiled. Lists from prior Amendments were used as starting information, and other sources (RM 2010), were consulted. This literature work was supplemented by observations on each trip to the proposed permit area and herbarium specimen voucher collections when unrecognized plants were encountered. Species list field observations began May 2009 during vegetation mapping, continued during July cover sampling, and continued after cover sampling in August, September, and October. Follow-up observations were made from March to November of 2010 when additional species were encountered in the proposed permit area. Trips to the UW Herbarium were made as needed to verify study specimen identifications by comparison with authoritatively identified UW specimens. Selected specimens are to be deposited at the UW Herbarium. The taxonomy of the species list follows Snow's (2009) checklist. For species list see **Addendum DIX8 A, Table DIX8-19**.

DIX 8.3.5 Survey Methods for Plant Species of Special Concern

The rare plant species survey is intended to locate any populations of plants that are Federally Listed as Threatened, Endangered, or that are designated with other types of special public policy status intended to promote their conservation. If such plants are located the study allows mitigation measures to be taken to avoid potential harm to these plant populations.

The rare plant survey produced a watch list of plants of special concern that reasonably could be expected to be found in or near the study area or in habitats found in the study area. (For the list see **DIX 8.7.2 Species of Special Concern, Results.** Source lists included lists of species sought as Species of Special Concern in previous Amendments, species on the WYNDD List (Heidel 2007), and newly designated species of special concern to the Federal Government (BLM 2010).

Habitat and recognition information about the species on the survey's watch list were studied before fieldwork and reviewed periodically throughout the study's field season. Standard practice was that unknown plants were collected as herbarium specimens for later identification.

DIX 8.3.6 Noxious & Declared Weeds, Survey Methods

Two categories of weeds were watched for and mapped whenever encountered in the proposed permit area. The first category is the Wyoming Weed & Pest Control Act Designated List, or more simply called the Designated Noxious Weeds (WWPC 2008). The second category is Declared Weeds for Albany County (WYDOA 2008). These lists are available at the sources cited.

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DIX 8.3.7 Poisonous Plants, Survey Methods

Poisonous plants were watched for along with other types of plants. The methods are the same as described under headings above pertaining to the Plant Species List, Plants of Special Concern, and Noxious and Declared Weeds.

DIX 8.4 RESULTS & DISCUSSION

This Results and Discussion section is organized with topics pertaining to the vegetation types first, then the tree inventory, then topics pertaining to individual species.

DIX 8.4.1 Vegetation Map & General Vegetation:

Vegetation in the proposed permit area is generally typical of the west-facing slope of the Laramie Range along the eastern edge of the Laramie basin. Upland communities of sagebrush shrublands, mountain mahogany shrublands, sparsely-vegetated limestone rock flats, and dense coniferous forests comprise the vast majority of the plant communities into which the permit falls. Livestock grazing, wildlife habitat, and limestone mining have been the predominant land uses of the region for many decades. Residential home sites are becoming an ever increasing use of the lands adjacent to the proposed mining permit.

Vegetation Map. The vegetation map unit polygons are generally divided into smaller polygons where they cross pit boundary lines and legal Section lines. This is to facilitate tallying 1) the acreages of each mapping unit in Affected Areas, EXREFA, and the entire permit (see **Table DIX8-2**) and 2) trees in specific areas of numbered quarry pit areas. (See **Map DIX8-4** and **Table DIX8-22**.)

Observed areas of tree blow-down (BD) and areas of heavy beetle kill (BK) were mapped during the vegetation mapping fieldwork and are shown in **Map DIX8-2**. Beetle-killed areas have expanded notably between the Summer 2009 fieldwork and the time of submission of this Permit Appendix, easily doubling both in terms of individual trees and canopy area.

DIX 8.4.2 Specific Vegetation & Land Cover Type Descriptions

Under separate headings below are descriptions and discussions of each vegetation type and land cover type on the vegetation map. More detailed results of the vegetation cover study are found in section **DIX 8.4.3** below.

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DIX 8.4.2.1 MS (Mixed Shrub/ Grassland) Vegetation Type

The Mixed Shrub/Grassland vegetation type is dominated (ranked by average % cover) by 1) black sagebrush (*Artemisia nova*), 2) needleandthread grass (*Hesperostipa comata*), 3) western wheatgrass (*Elymus smithii*), 4) Sandberg bluegrass (*Poa secunda*), 5) Hood's phlox (*Phlox hoodii*), 6) prairie junegrass (*Koeleria macrantha*), 7) littleleaf pussytoes (*Antennaria microphylla*), 8) mat muhly (*Muhlenbergia richardsonis*), 9) Douglas rabbitbrush (*Chrysothamnus viscidiflorus*) 10) blue grama (*Bouteloua gracilis*), 11) prairie sagewort (*Artemisia frigida*), and 12) mutton bluegrass (*Poa fendleriana*).

This vegetation type dominates at the lowest elevations of the perrmit area and essentially disappears around the middle elevations of the proposed permit area, where it grades into the similar-looking but floristically different High Elevation Mixed Shrub/ Grassland (MSH) type. MS occurs on flats, ridges, hillsides, and in the bottoms of draws. Large areas of the proposed permit are a mosaic of these MS stands interrupted by stands of Mountain Mahogany Shrubland (MM) with MS found on the thicker, more developed soils and MM residing on thinner, rockier soils.

DIX 8.4.2.2 MM(-C) ((Coniferous-)Mountain Mahogany Shrubland) Veg. Type

The (Coniferous-) Mountain Mahogany Shrubland vegetation type is dominated (ranked by average % cover) by 1) mountain mahogany (*Cercocarpus montanus*), 2) needleandthread grass (*Hesperostipa comata*), 3) western wheatgrass (*Elymus smithii*), 4) Douglas rabbitbrush (*Chrysothamnus viscidiflorus*), 5) starry cerastium (*Cerastium arvense*), 6) bluebunch wheatgrass (*Elymus spicatus*), 7) black sagebrush (*Artemisia nova*), 8) golden sedge (*Carex aurea*), 9) hairy goldenaster (*Heterotheca villosa*), 10) alyssum (*Alyssum alyssoides*), 11) Sandberg bluegrass (*Poa secunda*), and 12) wheatgrass (*Elymus lanceolatus*).

This type occurs in draw bottoms and on ridges, hillsides, and limestone rock flats, having a direct association with strongly calcareous soils. In the proposed permit area it is absent at the very lowest elevations, very abundant in the middle elevation ranges, and almost absent at the highest elevations. Frequency of trees increases with elevation leading to this veg. type being split for some purposes of the study into two categories by tree cover: 1) Mountain Mahogany Shrubland (MM) and 2) Coniferous Mountain Mahogany Shrubland (MM-C). Older vegetation map data compared with current distributions give hints that Rock Flat/Cushion Plant Communities (RF) in the proposed area expand and contract over the years as MM(-C) encroaches into them and recedes away from their centers.

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DIX 8.4.2.3 RF (Rock Flat/Cushion Plant Community) Vegetation Type

The RF (Rock Flat/Cushion Plant Community) vegetation type is dominated (ranked by average % cover) by 1) bluebunch wheatgrass (*Elymus spicatus*), 2) mat muhly (*Muhlenbergia richardsonis*), 3) western wheatgrass (*Elymus smithii*), 4) Douglas rabbitbrush (*Chrysothamnus viscidiflorus*), 5) black sagebrush (*Artemisia nova*), 6) threetip sagebrush (*Artemisia tripartita* var. *rupicola*), 7) Sandberg bluegrass (*Poa secunda*), 8) Hood's phlox (*Phlox hoodii*), 9) nailwort (*Paronychia* sp.), 10) Fendler's sandwort (*Eremogone fendleri*), 11) mutton bluegrass (*Poa fendleriana*), and 12) desert alyssum (*Alyssum desertorum*).

This vegetation type occurs on flat to gently sloping limestone rock outcrops, the same limestone that is to be mined. These areas have minimal accumulations of very rocky soil and many low-profile, slow-growing cushion plants in addition to various plants from nearby veg. types. Vegetation is dominated by cryptogams and plants adapted to rock fractures and other places with little soil. These areas shed runoff water very rapidly due to having limited soil and vegetation on top of water-impermeable limestone.

DIX 8.4.2.4 MSH(-C) ((Coniferous-) High Elev. Mixed Shrub/ Grassland) Veg. Type

The (Coniferous-) High Elev. Mixed Shrub/ Grassland (MSH(-C)) veg. type is dominated (ranked by average % cover) by 1) western wheatgrass (*Elymus smithii*), 2) threetip sagebrush (*Artemisia tripartita* var. *rupicola*), 3) mountain big sagebrush (*Artemisia tridentata* var. *vaseyana*), 4) Idaho fescue (*Festuca idahoensis*), 5) needleandthread grass (*Hesperostipa comata*), 6) starry cerastium (*Cerastium arvense*), 7) Sandberg bluegrass (*Poa secunda*), 8) prairie junegrass (*Koeleria macrantha*), 9) Fendler's sandwort (*Eremogone fendleri*), 10) Hood's phlox (*Phlox hoodii*), 11) milkvetch (*Astragalus* sp.), and 12) western yarrow (*Achillea millefolium*).

This vegetation type is co-dominated by a mosaic of two dissimilar sagebrush species, *Artemisia tripartita* var. *rupicola*, and *Artemisia tridentata* var. *vaseyana*. The former species occupies drier microsites while the latter inhabits moister microsites, with the two occurring together in very many places. This veg. type is absent at the lowest elevations of the proposed permit area, forms in middle elevations in zone-inverted canyon bottoms as MSH with very few trees, becomes MSH-C at upper-middle-elevations, then again occurs as MSH without many trees on bald, sunny, dry, windswept ridgetops. MSH(-C) is the most common vegetation type at the highest elevations of the permit area.

DIX 8.4.2.5 MXC (Mixed Conifer Forest) Vegetation Type

The Mixed Conifer Forest (MXC) vegetation type is dominated (ranked by average % cover) by 1) limber pine (*Pinus flexilis*), 2) Douglas fir (*Pseudotsuga menziesii*), 3) subalpine fir

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(*Abies bifolia* var. *bifolia*), 4) spike fescue (*Leucopoa kingii*), 5) Geyer's sedge (*Carex geyeri*), 6) needleandthread grass (*Hesperostipa comata*), 7) golden sedge (*Carex aurea*), 8) German-madwort (*Asperugo procumbens*), 9) western wheatgrass (*Elymus smithii*), 10) hookedspur violet (*Viola adunca*), 11) mountain big sagebrush (*Artemisia tridentata* var. *vaseyana*), and 12) common juniper (*Juniperus communis*).

This vegetation type is dominated by conifers in much denser tree stands than those of the adjacent Coniferous Mountain Mahogany Shrublands (MM-C) and Coniferous High Elevation Mixed Shrub/ Grasslands (MSH-C). Quaking aspen (*Populus tremuloides*) appears in small areas but sometimes high densities within the vegetation type. This MXC vegetation type is only present at the higher elevations of the permit areas, mostly on N-facing slopes of high ridges, and is clearly visible from the floor of the Laramie Valley.

DIX 8.4.2.6 Minor Land Cover Types

To label other things besides natural vegetation in the vegetation map, four other Land Cover Types are used. Unlike previous amendments the label **Reclaimed Land (RC)** indicates revegetated mine areas, which earlier amendments included under Disturbed Land. **Disturbed Land (DL)** is used for unreclaimed quarry pits mined by either Mountain Cement Company or unrelated previous land users such as the Wyoming Department of Transportation. DL is also used in some places for developed land such as the equipment staging area at the Etchepare Quarry main gate. **Stockpond (SP)** is a land cover type carried over from earlier amendments. It is used for the few small man-made impoundments for watering livestock, whether they currently impound water or not. **Roads (RD)** is a land cover type adopted during the coarse of this vegetation inventory to accommodate improved permanent to semi-permanent roads (such as haulroads) that are much more common in this Amendment than earlier Amendments. A notable use of this land cover type designation is for Interstate 80, which lies within the half-mile buffer zone of the vegetation map.

DIX 8.4.3 Cover Study Results by Vegetation Type

The following tables summarize vegetation cover study field data. Individual sample transect data field forms are included in **Addendum DIX8 C**. Detailed summaries of both absolute and relative cover data are presented in **Tables DIX8-3** through **DIX8-11.**

In the tables below that summarize the cover study data, non-grass species are prefixed with a standardized (Brasher & Snow 2004) three-letter acronym indicating their family. Within families the species are in alphabetical order except where the purpose of the table is to rank species by abundance.

Lifeform categories not represented by data in a table are omitted from that table for simplicity.

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Table DIX8-2. Vegetation mapping unit acreages by areal extent, percent of total, and inclusion in cover study. The revegetated Piper Quarry areas of the permit were excluded from the vegetation cover study. This includes legal sections 24, 25, 26 and the Avery-owned part of Section 13. (See LQD Guideline 2, Appendix V, Table 1).

	Unaffected Area				Affected Area				Entire Permit Area			
	Tot. Ac.		% of Area		Tot. Ac.		% of Area		Tot. Ac.		% of Area	
Vegetation Type/ Mapping Unit	**Permit**	**Cover Study**	**Permit**	**Cov. Study**	**Permit**	**Cover Study**	**Permit**	**Cov. Study**	**Permit**	**Cov. Study**	**Permit**	**Cover Study**
Mixed Shrub/ Grassland (MS)	1586.2	1025.8	31.0	25.3	781.1	773.9	23.0	22.8	**2367.3**	**1799.7**	**27**	**24.1**
(Coniferous-) Mountain Mahogany Shrubland (MM(-C))	1648.9	1581.8	32.2	39.0	1010.2	1008.3	29.7	29.8	**2659.1**	**2590.1**	**31**	**34.4**
Rock Flat/Cushion Plant Community (RF)	49.5	28.3	1.0	0.7	125.9	125.9	3.7	3.7	**175.4**	**154.2**	**2.4**	**2.2**
(Coniferous-) High Elevation Mixed Shrub Grassland (MSH(-C))	739.9	739.9	14.5	18.2	1398.7	1398.7	41.2	41.3	**2138.6**	**2138.6**	**27.9**	**29.8**
Mixed Conifer Forest (MXC)	403.7	403.7	7.9	10.0	80.3	80.3	2.4	2.4	**484**	**484**	**5.2**	**6.2**
Reclaimed Land (RC)	553.6	140.3	10.8	3.5	1.3	0.2	.	.	**554.9**	**140.5**	**5.4**	**1.8**
Stockponds (SP)	1.1	1.1	0.02	0.03	.	.	.	.	**1.1**	**1.1**	**0.01**	**0.02**
Disturbed Land (DL)	104.7	104.7	2.0	2.6	.	.	.	.	**104.7**	**104.7**	**1**	**1.3**
Roads (RD) (haul- & permanent)	30.6	30.6	0.6	0.8	.	.	.	.	**30.6**	**30.6**	**0.3**	**0.4**
TOTAL S	**5118.2**	**4056.2**	**100**	**100**	**3397.5**	**3387.3**	**100**	**100**	**8515.7**	**7443.5**	**100**	**100**

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DIX 8.4.3.1 MS (Mixed Shrub/ Grassland) Vegetation Type

For a description and discussion of this vegetation type see Section **DIX8.4.2** above. For a detailed species composition comparison of Affected Areas versus EXREFA see **Table DIX8-3** below. For a ranked comparison of major species in Affected Areas versus EXREFA see **Table DIX8-4** below. For comparison of acreages of this vegetation type versus other veg. types see **Table DIX8-1** above.

Table DIX8-3. Mixed Shrub/ Grassland (MS) Veg. Type, summary of percent vegetation cover data. All values are means. Non-grass species prefixed with a standardized (Brasher & Snow 2004) three letter acronym indicating their family (see **Table DIX8-18** in **Addendum DIX8 A.** (See LQD Guideline 2, Appendix V, Table 2).

		Vegetation Cover (%)			
		Affected Area		EXREFA	
Life Form	**Scientific Name**	**Absolute**	**Relative**	**Absolute**	**Relative**
Perennial:					
Grasses:	Achnatherum hymenoides	-	-	0.02	0.02
	Bouteloua gracilis	1.26	1.53	0.44	0.62
	Elymus elymoides	-	-	0.02	0.02
	Elymus junceus	-	-	0.12	0.17
	Elymus lanceolatus	-	-	0.35	0.49
	Elymus X saundersii	0.09	0.11	-	-
	Elymus smithii	10.56	12.82	12.28	17.23
	Elymus spicatus	0.61	0.74	2.58	3.62
	Hesperostipa comata	12.89	15.64	9.12	12.80
	Koeleria macrantha	2.87	3.48	2.19	3.07
	Leucopoa kingii	0.26	0.31	1.14	1.60
	Muhlenbergia richardsonis	1.70	2.07	0.72	1.01
	Poa fendleriana	0.87	1.06	-	-
	Poa secunda	5.68	6.90	5.54	7.77
	grass sp.	0.39	0.47	0.98	1.37
	Subtotal*	**37.2**	**45.1**	**35.5**	**49.80**
Grass-like:					
	CYP Carex aurea	0.11	0.13	-	-
	CYP Carex sp.	0.74	0.90	0.44	0.62
	Subtotal*	**0.85**	**1.03**	**0.44**	**0.62**
Forbs:	ALL Allium textile	0.35	0.43	0.29	0.41
	API Musineon divaricatum	-	-	0.01	0.01
	API Musineon tenuifolium	0.31	0.37	-	-
	API sp.	0.02	0.02	-	-
	AST Achillea millefolium	-	-	0.23	0.32
	AST Antennaria microphylla	2.52	3.05	0.28	0.39
	AST Dieteria canescens var. canescens	-	-	0.11	0.15
	AST Erigeron nematophyllus	0.37	0.45	0.65	0.91

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	AST Erigeron ochroleucus	0.11	0.13	-	-
	AST Erigeron sp.	-	-	0.09	0.12
	AST Heterotheca villosa	0.78	0.94	0.09	0.13
	AST Packera sp?	-	-	0.15	0.21
	AST Tetraneuris acaulis	0.85	1.03	0.07	0.10
	AST Tetraneuris torreyana	-	-	0.09	0.13
	AST Tragopogon dubius	0.02	0.02	-	-
	BOR Mertensia humilis	0.16	0.20	0.07	0.09
	BRA Boechera holboellii	-	-	0.07	0.10
	BRA Draba oligosperma	0.13	0.16	-	-
	BRA Lesquerella alpina var. alpina	-	-	0.02	0.02
	BRA Lesquerella ludoviciana	0.13	0.16	0.06	0.09
	BRA Lesquerella montana	0.16	0.19	0.07	0.10
	BRA Lesquerella sp.?	0.02	0.02	-	-
	BRA Physaria sp.	-	-	0.05	0.07
	BRA sp.	0.07	0.09	-	-
	CRS Sedum lanceolatum	0.28	0.34	0.34	0.37
	CRY Cerastium arvense ssp. strictum	0.51	0.62	0.02	0.02
	CRY Eremogone hookeri	0.81	0.99	0.01	0.01
	CRY Minuartia rubella	-	-	0.05	0.07
	CRY Paronychia depressa	-	-	-	-
	CRY Paronychia sessiliflora	0.81	0.99	1.19	1.67
	FAB Astragalus flexuosus	0.02	0.02	-	-
	FAB Astragalus spatulatus	0.06	0.07	0.09	0.12
	FAB Astragalus sp.	0.37	0.45	0.02	0.02
	LAM Hedeoma drummondii	0.41	0.49	0.17	0.24
	MLN Toxicoscordion venenosum var. gramineum	-	-	0.02	0.02
	ORO Orobanche fasciculata	-	-	0.02	0.02
	PLG Eriogonum alatum	0.50	0.61	0.95	1.33
	PLG Eriogonum flavum var. flavum	0.04	0.04	-	-
	PLG Eriogonum umbellatum	0.28	0.34	0.33	0.47
	PLG Eriogonum sp.	0.04	0.05	0.09	0.12
	PLM Phlox hoodii	3.71	4.50	0.98	1.38
	PLM Phlox muscoides	-	-	0.46	0.64
	PTG Penstemon angustifolius var. angustifolius	-	-	0.04	0.05
	ROS Potentilla gracilis	-	-	0.04	0.05
	ROS Potentilla hippiana	0.17	0.20	-	-
	SAN Comandra umbellata	0.26	0.31	0.04	0.05
	family unknown	0.09	0.10	0.18	0.25
	Subtotal*	**14.3**	**17.4**	**7.4**	**10.4**
Subshrubs:	AST Artemisia frigida	1.11	1.35	0.80	1.12
	AST Artemisia ludoviciana	-	-	0.23	0.32
	AST Gutierrezia sarothrae	0.14	0.18	0.88	1.23

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	PLM Linanthus pungens	0.48	0.58	-	-
	Subtotal*	**1.7**	**2.1**	**1.9**	**2.7**
Shrubs:	AST Artemisia nova	22.16	26.89	19.59	27.48
	AST Artemisia tridentata var. vaseyana	-	-	1.09	1.53
	AST Artemisia tripartita var. rupicola	0.11	0.13	-	-
	AST Chrysothamnus viscidiflorus	1.14	1.39	1.31	1.83
	AST Chrysothamnus sp.	-	-	1.23	1.72
	AST Tetradymia canescens	-	-	0.05	0.07
	ROS Cercocarpus montanus	-	-	0.01	0.01
	Subtotal*	**23.4**	**28.4**	**23.3**	**32.7**
Annuals:					
Forbs:	AMA Chenopodium pratericola	-	-	0.03	0.04
	AMA Chenopodium sp.	0.02	0.03	-	-
	AMA Salsola australis	0.03	0.04	-	-
	BRA Alyssum desertorum	0.08	0.09	0.67	0.94
	BRA Camelina microcarpa	-	-	0.07	0.10
	BRA sp.	0.01	0.01	-	-
	Subtotal*	**0.14**	**0.17**	**0.77**	**1.09**
Non-vascular		6.74	8.18	2.00	2.81
	Subtotal*	**6.74**	**8.18**	**2.00**	**2.81**
	Total Vegetative Cover	**84.4**	**102.43****	**71.3**	**100.01****

* Subtotal across all species within a given life form category
**Different than 100.00 only by MS Excel rounding errors.

Table DIX8-4. Quantitative comparison of the Mixed Shrub/ Grassland (MS) Veg. Type Affected Area versus EXREFA. Only the 15 major cover species are included here. All values are means. (See LQD Guideline 2, Appendix V, Table 3).

	Absolute Cover %	
	Affected Area	**EXREFA**
PERENNIAL GRASSES AND GRASS-LIKE SPECIES		
Hesperostipa comata	12.89	9.12
Elymus smithii	10.56	12.28
Poa secunda	5.68	5.54
Koeleria macrantha	2.87	2.19
Muhlenbergia richardsonis	1.70	0.72
Bouteloua gracilis	1.26	0.44

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Poa fendleriana	0.87	-
Subtotal*	**35.83**	**30.29**
FORBS		
PLM Phlox hoodii	3.71	0.98
AST Antennaria microphylla	2.52	0.28
AST Tetraneuris acaulis	0.85	0.07
CRY Paronychia sessiliflora	0.81	1.19
CRY Eremogone hookeri	0.81	0.01
Subtotal*	**8.70**	**2.53**
SUBSHRUBS		
AST Artemisia frigida	1.11	0.80
Subtotal*	**1.11**	**0.80**
SHRUBS		
AST Artemisia nova	22.16	19.59
AST Chrysothamnus viscidiflorus	1.14	1.31
Subtotal*	**23.30**	**20.90**
TOTALS	**68.94**	**54.52**

* Subtotal across all major species within a life form category

DIX 8.4.3.2 MM(-C) ((Coniferous-) Mountain Mahogany Shrubland) Veg. Type

For a description and discussion of this vegetation type see Section **DIX8.4.2** above. For a detailed species composition comparison of Affected Areas versus EXREFA see **Table DIX8-5** below. For a ranked comparison of major species in Affected Areas versus EXREFA see **Table DIX8-6** below. For comparison of acreages of this vegetation type versus other veg. types see **Table DIX8-2** above.

Table DIX8-5. (Coniferous-) Mountain Mahogany Shrubland (MM(-C)), summary of percent vegetation cover data. All values are means. (See LQD Guideline 2, Appendix V, Table 2).

		Vegetation Cover (%)			
		Affected Area		EXREFA	
Life Form	**Scientific Name**	**Absolute**	**Relative**	**Absolute**	**Relative**
Perennial:					
Grasses:	Achnatherum hymenoides	-	-	0.77	0.95
	Elymus lanceolatus	1.08	1.49	0.0	0.0
	Elymus smithii	8.10	11.19	16.45	20.35
	Elymus spicatus	4.08	5.64	0.26	0.32
	Festuca idahoensis	0.31	0.43	-	-
	Festuca sp.?	-	-	0.23	0.29
	Hesperostipa comata	9.73	13.44	4.08	5.05
	Koeleria macrantha	-	-	0.05	0.06

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	Muhlenbergia richardsonis	0.31	0.43	0.13	0.16
	Poa arida	0.02	0.03	-	-
	Poa fendleriana	0.31	0.42	-	-
	Poa secunda	1.23	1.70	0.15	0.19
	Subtotal*	**25.2**	**33.3**	**21.3**	**26.4**
Grass-like:					
	CYP Carex aurea	1.86	2.58	0.03	0.03
	CYP Carex sp.	0.99	1.37	0.67	0.82
	Subtotal*	**2.86**	**3.95**	**0.69**	**0.86**
Forbs:	ALL Allium textile	0.43	0.60	0.28	0.35
	API Musineon divaricatum	0.08	0.11	-	-
	API Musineon tenuifolium	0.44	0.60	0.54	0.67
	API sp.	0.16	0.22	-	-
	AST Achillea millefolium	0.33	0.46	-	-
	AST Cirsium, native sp.	-	-	0.79	0.98
	AST Erigeron caespitosus	-	-	0.38	0.48
	AST Erigeron nematophyllus	0.61	0.84	0.48	0.60
	AST Erigeron ochroleucus	-	-	0.03	0.03
	AST Erigeron sp.	-	-	0.36	0.44
	AST Heterotheca villosa	1.53	2.11	-	-
	AST Packera fendleri	-	-	0.03	0.03
	AST Solidago simplex	0.02	0.03	-	-
	AST Taraxacum officinale	0.14	0.19	-	-
	AST Tetraneuris acaulis	0.37	0.51	0.08	0.10
	BOR Mertensia humilis	0.05	0.08	-	-
	BOR Mertensia viridis	-	-	0.26	0.32
	BOR Onosmodium molle var. occidentale	-	-	0.28	0.35
	BRA Draba oligosperma	0.02	0.02	-	-
	BRA Lesquerella?	-	-	0.03	0.03
	BRA Lesquerella montana	-	-	0.05	0.06
	BRA Physaria	-	-	0.02	0.02
	BRA Physaria?	0.01	0.02	-	-
	BRA sp.	-	-	0.08	0.10
	CRS Sedum lanceolatum	0.63	0.87	0.19	0.24
	CRY Cerastium arvense ssp. strictum	5.27	7.29	1.72	2.13
	CRY Eremogone fendleri	0.14	0.19	-	-
	CRY Eremogone hookeri	0.24	0.33	-	-
	CRY Paronychia depressa	0.60	0.83	-	-
	CRY Paronychia sessiliflora	-	-	0.54	0.66
	CRY Paronychia sp.	0.01	0.02	-	-
	FAB Astragalus spatulatus	0.14	0.19	-	-
	FAB Astragalus sp.	0.22	0.30	-	-
	LAM Hedeoma drummondii	0.04	0.05	-	-
	LIL Calochortus nuttallii	0.06	0.08	-	-
	LIN Linum perenne	0.03	0.04	0.05	0.06

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	MLN Toxicoscordion venenosum var. gramineum	0.04	0.05	-	-
	ORO Castilleja angustifolia	0.08	0.11	0.10	0.13
	ORO Castilleja flava	-	-	0.10	0.13
	PLG Eriogonum alatum	0.43	0.59	0.05	0.06
	PLG Eriogonum umbellatum	0.12	0.16	-	-
	PLG Eriogonum sp.	0.20	0.27	-	-
	PLM Ipomopsis spicata	0.10	0.14	-	-
	PLM Phlox hoodii	0.65	0.89	1.10	1.36
	PTG Penstemon angustifolius var. angustifolius	-	-	0.02	0.02
	RAN Delphinium nuttallianum	0.06	0.08	-	-
	RUB Galium boreale	0.08	0.11	0.31	0.38
	RUS Maianthemum stellatum	-	-	-	-
	SAN Comandra umbellata	0.14	0.19	0.05	0.06
	SAX Heuchera parvifolia	0.24	0.33	-	-
	VIO Viola nuttallii	-	-	0.10	0.13
	VIO Viola sp.	-	-	0.15	0.19
	family unknown	0.04	0.05	0.08	0.10
	Subtotal*	**13.7**	**18.9**	**8.2**	**10.2**
Subshrubs:					
	AST Artemisia frigida	-	-	1.44	1.78
	AST Gutierrezia sarothrae	0.08	0.11	0.40	0.49
	PLG Eriogonum sp.	0.06	0.08	-	-
	PLM Linanthus pungens	-	-	-	-
	Subtotal*	**0.1**	**0.2**	**1.8**	**2.3**
Shrubs:					
	AST Artemisia nova	2.06	2.85	4.77	5.90
	AST Artemisia tridentata var. vaseyana	0.94	1.30	0.03	0.03
	AST Artemisia tripartita var. rupicola	0.10	0.10	-	0.14
	AST Chrysothamnus viscidiflorus	7.82	7.82	8.85	10.95
	CAC Opuntia polyacantha	0.11	0.15	1.13	1.39
	GRS Ribes cereum	-	-	0.77	0.95
	ROS Cercocarpus montanus	16.17	22.36	26.71	33.05
	Subtotal*	**27.2**	**37.6**	**42.2**	**52.3**
Trees:	PIN Pinus flexilis	-	-	0.51	0.63
	Subtotal*	**-**	**-**	**0.51**	**0.63**
Annuals:					
Forbs:					
	AMA Chenopodium pratericola	0.02	0.03	-	-
	BOR Lappula occidentalis	0.02	0.03	-	-
	BRA Alyssum alyssoides	1.46	2.02	2.37	2.94
	BRA Alyssum desertorum	0.24	0.33	0.23	0.29
	BRA Camelina microcarpa	0.25	0.34	0.04	0.05

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	BRA Descurainia sp.	-	-	0.03	0.03
	BRA Draba nemorosa	0.01	0.02	-	-
	BRA sp.	0.14	0.19	-	-
	ORO Orthocarpus luteus	0.10	0.14	-	-
	PRM Androsace septentrionalis	-	-	0.03	0.03
	Subtotal*	**2.24**	**3.10**	**2.69**	**3.33**
Non-vascular		2.10	2.90	3.26	4.03
	Subtotal*	**2.10**	**2.90**	**3.26**	**4.03**
	Total Vegetative Cover	**73.4**	**100.0**	**80.81**	**100.0**

* Subtotal across all species within a given life form category

Table DIX8-6. Quantitative comparison of the (Coniferous-) Mountain Mahogany Shrubland (MM(-C)) Affected Area versus EXREFA. Only the 15 major cover species are included here. All values are means. (See LQD Guideline 2, Appendix V, Table 3).

	Absolute Cover %	
	Affected Area	**EXREFA**
PERENNIAL GRASSES AND GRASS-LIKE SPECIES		
Hesperostipa comata	9.73	4.08
Elymus smithii	8.10	16.45
Elymus spicatus	4.08	0.26
CYP Carex aurea	1.86	0.03
Poa secunda	1.23	0.15
Elymus lanceolatus	1.08	-
CYP Carex sp.	0.99	0.67
Subtotal*	**27.07**	**21.64**
Perennial FORBS		
CRY Cerastium arvense ssp. strictum	5.27	1.72
AST Heterotheca villosa	1.53	-
PLM Phlox hoodii	0.65	1.10
Subtotal*	**7.45**	**2.82**
SHRUBS		
ROS Cercocarpus montanus	16.17	26.71
AST Chrysothamnus viscidiflorus	7.82	8.85
AST Artemisia nova	2.06	4.77
AST Artemisia tridentata var. vaseyana	0.94	0.03

Subtotal*	**26.99**	**40.36**
Annual Forb		
BRA Alyssum alyssoides	1.46	2.37
Subtotal*	**1.46**	**2.37**
TOTALS	**62.97**	**67.19**

* Subtotal across all major species within a life form category

DIX 8.4.3.3 RF (Rock Flat/ Cushion Plant Community) Vegetation Type

For a description and discussion of this vegetation type see Section **DIX8.4.2** above. No detailed species composition comparison of Affected Areas versus EXREFA is provided because this veg. type is to be reclaimed as a different veg. type. Instead, **Table DIX8-7** below is a detailed species composition description of the veg. cover type for general informational purposes. Similarly, no ranked comparison of major species in Affected Areas versus EXREFA is provided for the same reasons. Instead, **Table DIX8-8** below is a ranked summary of major species in Affected Areas of this veg. type. For comparison of acreages of this vegetation type versus other veg. types see **Table DIX8-2** above.

Table DIX8-7. Rock Flat/ Cushion Plant Community (RF), summary of percent vegetation cover data. All values are means. (See LQD Guideline 2, Appendix V, Table 2).

		Vegetation Cover (%)	
		Affected Area	
Life Form	**Scientific Name**	**Absolute**	**Relative**
Perennial:			
Grasses:	Achnatherum hymenoides	0.37	1.13
	Calamagrostis montanensis	0.35	1.07
	Elymus smithii	2.35	7.16
	Elymus spicatus	4.91	14.94
	Hesperostipa comata	0.02	0.06
	Koeleria macrantha	0.35	1.07
	Muhlenbergia richardsonis	4.70	14.30
	Poa fendleriana	0.68	2.06
	Poa secunda	1.04	3.18
	Poa sp.	0.02	0.06
	Subtotal*	**14.1**	**42.8**
Forbs:	ALL Allium cernuum	0.14	0.42
	ALL Allium textile	0.29	0.90
	ALL Allium sp.	0.20	0.62
	API Musineon divaricatum	0.09	0.29
	API Musineon tenuifolium	0.19	0.59
	API unknown	0.01	0.03
	AST Antennaria microphylla	0.09	0.29

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	AST Erigeron nematophyllus	0.22	0.68
	AST Erigeron ochroleucus	0.07	0.20
	AST Erigeron sp.	0.33	1.00
	AST Symphyotrichum?	0.02	0.06
	AST Tetraneuris acaulis	0.55	1.69
	AST unknown	0.02	0.06
	BRA Lesquerella alpina var. alpina	0.01	0.03
	BRA Lesquerella montana	0.06	0.17
	BRA Physaria	0.05	0.15
	BRA Physaria?	0.02	0.07
	CRS Sedum lanceolatum	0.53	1.61
	CRY Cerastium arvense ssp. strictum	0.26	0.79
	CRY Eremogone fendleri	0.70	2.14
	CRY Eremogone hookeri	0.11	0.34
	CRY Paronychia sessiliflora	0.04	0.11
	CRY Paronychia sp.	0.71	2.15
	FAB Oxytropis multiceps	0.04	0.11
	FAB Trifolium dasyphyllum	0.09	0.28
	LAM Hedeoma drummondii	0.04	0.12
	PLG Eriogonum alatum	0.06	0.17
	PLG Eriogonum umbellatum	0.06	0.17
	PLG Eriogonum sp.	0.02	0.06
	PLM Phlox hoodii	0.79	2.41
	PTG Veronica?	0.06	0.17
	RAN Ranunculus sp.	0.04	0.11
	ROS Potentilla hippiana	0.07	0.07
	ROS Potentilla sp.	0.03	0.03
	SEL Selaginella densa	0.37	1.13
	family unknown	0.13	0.38
	Subtotal*	**6.5**	**19.5**
Shrubs:			
	AST Artemisia nova	1.57	4.77
	AST Artemisia tripartita var. rupicola	1.11	3.38
	AST Chrysothamnus viscidiflorus	1.94	5.92
	ROS Cercocarpus montanus	0.11	0.34
	Subtotal*	**4.7**	**14.4**
Annuals:			
Forbs:			
	BOR Lappula occidentalis	0.06	0.17
	BRA Alyssum alyssoides	0.57	1.75
	BRA Alyssum desertorum	0.68	2.07
	BRA Draba nemorosa	0.01	0.03
	BRA Malcolmia africana	0.19	0.56
	LIN Linum puberulum	0.02	0.06
	PRM Androsace septentrionalis	0.04	0.11
	family unknown	0.06	0.17

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	Subtotal*	**1.62**	**4.93**
Non-vascular		5.93	18.04
	Subtotal*	**5.93**	**18.04**
	Total Vegetation	**32.85**	**99.68**

* Subtotal across all species within a given life form category

Table DIX8-8. Quantitative summary of the Rock Flat/ Cushion Plant Community (RF) Affected Area. Only the 15 major cover species are included here. EXREFA does not apply and was not sampled because this community type is not to be reclaimed as RF. RF areas are to be reclaimed as Mixed Shrub/ Grassland (MS), High Elevation Mixed Shrub/ Grassland (MSH), or (optionally) to Mountain Mahogany (MM) Shrubland to match nearby land cover. All values are means. (See LQD Guideline 2, Appendix V, Table 3).

	Absolute Cover %
	Affected Area
PERENNIAL GRASSES AND GRASS-LIKE SPECIES	
Elymus spicatus	4.91
Muhlenbergia richardsonis	4.70
Elymus smithii	2.35
Poa secunda	1.04
Poa fendleriana	0.68
Subtotal*	**13.68**
PERENNIAL FORBS	
PLM Phlox hoodii	0.79
CRY Eremogone fendleri	0.70
CRY Paronychia sp.	0.71
AST Tetraneuris acaulis	0.55
CRS Sedum lanceolatum	0.53
Subtotal*	**3.28**
SHRUBS	
AST Chrysothamnus viscidiflorus	1.94
AST Artemisia nova	1.57
AST Artemisia tripartita var. rupicola	1.11
Subtotal*	**4.62**
ANNUAL FORBS	
BRA Alyssum desertorum	0.68
BRA Alyssum alyssoides	0.57
Subtotal*	**1.25**
TOTALS	**22.83**

* Subtotal across all major species within a life form category

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DIX 8.4.3.4 MSH(-C) ((Coniferous-) High Elevation Mixed Shrub/ Grassland) Veg. Type

For a description and discussion of this vegetation type see Section **DIX8.4.2** above. For a detailed species composition comparison of Affected Areas versus EXREFA see **Table DIX8-9** below. For a ranked comparison of major species in Affected Areas versus EXREFA see **Table DIX8-10** below. For comparison of acreages of this vegetation type versus other veg. types see **Table DIX8-2** above.

Table DIX8-9. (Coniferous-) High Elevation Mixed Shrub/ Grassland (MSH(-C)) Vegetation Type, summary of percent vegetation cover data. All values are means. (See LQD Guideline 2, Appendix V, Table 2).

		Vegetation Cover (%)			
		Affected Area		EXREFA	
Life Form	**Scientific Name**	**Absolute**	**Relative**	**Absolute**	**Relative**
Perennial:					
Grasses:					
	Bromus carinatus	-	-	1.61	1.57
	Calamagrostis montanensis	0.67	0.75	-	-
	Calamovilfa longifolia	-	-	0.90	0.88
	Elymus hispidus	0.18	0.20	-	-
	Elymus lanceolatus	0.55	0.62	2.73	2.66
	Elymus smithii	9.55	10.77	8.44	8.21
	Elymus spicatus	1.69	1.90	0.47	0.46
	Elymus trachycaulus	-	-	1.47	1.43
	Festuca idahoensis	7.71	8.70	6.63	6.44
	Festuca sp.?	-	-	0.50	0.49
	Hesperostipa comata	7.03	7.93	7.48	7.28
	Koeleria macrantha	4.14	4.67	1.46	1.42
	Leucopoa kingii	1.65	1.87	0.92	0.89
	Melica bulbosa	-	-	0.14	0.14
	Muhlenbergia richardsonis	0.12	0.13	1.01	0.99
	Nasella viridula	0.29	0.32	-	-
	Poa arida	0.60	0.67	4.73	4.60
	Poa fendleriana	1.50	1.69	-	-
	Poa glauca subsp. Rupicola	-	-	1.04	1.01
	Poa pratensis	-	-	3.89	3.78
	Poa secunda	4.33	4.88	0.97	0.94
	Poa sp.	0.51	0.58	0.76	0.74
	grass sp.	0.24	0.27	0.83	0.81
	Subtotal*	**39.35**	**44.38**	**40.8**	**39.6**
Grass-like:					
	CYP Carex aurea	0.48	0.54	-	-
	CYP Carex deweyana var. deweyana	-	-	0.56	0.54
	CYP Carex sp.	0.24	0.27	0.61	0.59

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	Subtotal*	**0.71**	**0.81**	**1.17**	**1.13**
Forbs:	ALL Allium cernuum	0.08	0.09	0.11	0.11
	ALL Allium textile	0.04	0.04	-	-
	ALL Allium sp.	0.12	0.13	0.10	0.10
	API Musineon divaricatum	-	-	0.04	0.04
	API Musineon tenuifolium	0.01	0.01	0.20	0.19
	API sp.	-	-	0.05	0.05
	AST Achillea millefolium	2.61	2.95	1.24	1.20
	AST Antennaria microphylla	0.96	1.08	1.17	1.13
	AST Antennaria rosea	-	-	0.19	0.19
	AST Cirsium canescens	0.10	0.11	-	-
	AST Cirsium flodmanii	0.01	0.01		
	AST Cirsium, native sp.	-	-	0.68	0.66
	AST Crepis runcinata	0.02	0.03		
	AST Erigeron caespitosus	-	-	0.1	0.1
	AST Erigeron eatonii var. eatonii	0.15	0.17	0.15	0.15
	AST Erigeron nematophyllus	0.71	0.81	0.31	0.31
	AST Erigeron ochroleucus	-	-	0.07	0.06
	AST Erigeron sp.	0.15	0.17	-	-
	AST Heterotheca villosa	-	-	0.29	0.28
	AST Packera fendleri	-	-	0.01	0.01
	AST Packera? – rosette	-	-	0.01	0.01
	AST Taraxacum officinale	0.68	0.77	1.11	1.08
	AST Tetraneuris acaulis	0.08	0.09	0.31	0.30
	AST Tragopogon dubius	-	-	0.01	0.01
	AST Townsendia hookeri	0.26	0.29	0.06	0.05
	BOR Mertensia humilis	0.02	0.02	0.09	0.09
	BRA Boechera drummondii	0.04	0.04	0.01	0.01
	BRA Boechera holboellii	0.03	0.03	-	-
	BRA Boechera sp.	-	-	0.01	0.01
	BRA Draba oligosperma	0.06	0.07	0.04	0.04
	BRA Lesquerella alpina var. alpina	-	-	0.03	0.03
	BRA Lesquerella ludoviciana	0.06	0.07	-	-
	BRA Lesquerella montana	0.07	0.08	0.06	0.05
	BRA Lesquerella sp.	0.02	0.03	-	-
	BRA Lesquerella?	-	-	0.01	0.01
	BRA unknown	-	-	0.01	0.01
	CAM Campanula parryi	-	-	0.07	0.06
	CAM Campanula rotundifolia	0.01	0.01	0.22	0.22
	CRS Sedum lanceolatum	0.50	0.57	0.38	0.37
	CRY Cerastium arvense ssp. strictum	6.29	7.09	2.25	2.19
	CRY Eremogone fendleri	3.19	3.60	0.19	0.19
	CRY Eremogone hookeri	0.02	0.03	-	-
	CRY Minuartia nuttallii var. nuttallii	-	-	0.03	0.03
	CRY Paronychia depressa	0.05	0.05	0.60	0.58
	CRY Paronychia sp.	0.32	0.36	0.49	0.48

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	CRY Pseudostellaria jamesiana	-	-	0.26	0.26
	FAB Astragalus flexuosus	-	-	0.38	0.36
	FAB Astragalus miser var. oblongifolius	0.19	0.21	0.08	0.08
	FAB Astragalus spatulatus	0.25	0.28	0.16	0.16
	FAB Astragalus sp.	2.70	3.05	1.02	0.99
	FAB Lupinus argenteus	-	-	0.13	0.12
	FAB Oxytropis deflexa	0.24	0.27	-	-
	FAB Oxytropis multiceps	0.24	0.27	0.08	0.08
	FAB Oxytropis sericea var. sericea	-	-	1.08	1.05
	FAB Oxytropis sp.	-	-	0.07	0.07
	FAB Vicia americana	0.05	0.05	1.32	1.28
	LAM Hedeoma drummondii	-	-	0.01	0.01
	LIL Calochortus nuttallii	0.03	0.03	0.60	0.58
	LIN Linum perenne	0.01	0.01	-	-
	MLN Toxicoscordion venenosum var. gramineum	0.12	0.13	-	-
	ORO Castilleja flava	0.07	0.08	0.55	0.54
	PLG Eriogonum alatum	0.12	0.13	0.01	0.01
	PLG Polygonum sp.	0.01	0.01	-	-
	PLM Phlox hoodii	2.78	3.13	0.82	0.6
	PTG Besseya wyomingensis	0.74	0.83	1.39	1.35
	PTG Plantago tweedyi	0.01	0.01	-	-
	RAN Ranunculus ranunculinus	0.02	0.03	0.10	0.09
	RAN Ranunculus	0.05	0.06	-	-
	ROS Potentilla argentea var. argentea	-	-	0.03	0.03
	ROS Potentilla concinna var. bicrenata	0.06	0.07	-	-
	RUB Galium boreale	0.02	0.03	0.36	0.35
	SAX Heuchera parvifolia	0.07	0.08	-	-
	VIO Viola nuttallii	-	-	0.18	0.18
	VIO Viola sp.	-	-	0.15	0.15
	family unknown	0.19	0.21	0.11	0.11
	Subtotal*	**24.65**	**27.81**	**19.6**	**19.0**
Subshrub:					
	AST Artemisia frigida	0.90	1.01	1.56	1.51
	Subtotal*	**0.90**	**1.01**	**1.56**	**1.51**
Shrubs:					
	AST Artemisia nova	0.18	0.20	0.97	0.95
	AST Artemisia tridentata var. vaseyana	8.58	9.68	22.09	21.49
	AST Artemisia tripartita var. rupicola	9.34	10.53	4.39	4.27
	AST Chrysothamnus viscidiflorus	1.19	1.34	-	-
	CPR Symphoricarpos oreophilus	-	--	0.04	0.04
	Subtotal*	**19.29**	**21.76**	**27.50**	**26.74**
Trees:	SAL Populus tremuloides	-	-	1.55	1.51

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	PIN Pinus flexilis	-	-	0.38	0.36
	PIN Pseudotsuga menziesii	-	-	0.14	0.13
	Subtotal*	**-**	**-**	**2.07**	**2.01**
Annual:					
Grasses:	Bromus japonicus	0.13	0.14	0.55	0.54
	Bromus tectorum	0.14	0.15	0.26	0.26
	Vulpia octoflora	0.02	0.03	0.21	0.20
	Subtotal*	**0.29**	**0.32**	**1.03**	**1.00**
Forbs:					
	AMA Chenopodium pratericola	0.05	0.06	-	-
	AMA Monolepis nuttaliana	0.01	0.02	-	-
	BOR Lappula occidentalis	0.13	0.14	0.15	0.14
	BRA Alyssum alyssoides	0.39	0.44	0.46	0.45
	BRA Alyssum desertorum	1.09	1.23	6.47	6.29
	BRA Descurainia sp.	-	-	0.01	0.01
	BRA Draba nemorosa	0.02	0.03	-	-
	BRA Halimolobos virgata	0.01	0.01	-	-
	ORO Orthocarpus luteus	0.02	0.03	0.08	0.08
	PLG Polygonum sawatchense ssp. sawatchense	0.01	0.01	0.18	0.17
	PLM Collomia linearis	-	-	0.15	0.15
	PRM Androsace septentrionalis	0.03	0.03	0.18	0.17
	family unknown	0.14	0.16	-	-
	Subtotal*	**1.91**	**2.15**	**7.69**	**7.48**
Non-vascular		1.56	1.76	1.48	1.44
	Subtotal*	**1.56**	**1.76**	**1.48**	**1.44**
	Total Vegetation	**88.67**	**100.00**	**102.82**	**100.00**

* Subtotal across all species within a given life form category

Table DIX8-10. Quantitative comparison of the (Coniferous-) High Elevation Mixed Shrub/ Grassland (MSH(-C)) Vegetation Type, Affected Area versus EXREFA. Only 15 major cover species are included here. All values are means. (See LQD Guideline 2, Appendix V, Table 3).

	Absolute Cover %	
	Affected Area	**EXREFA**
PERENNIAL GRASSES AND GRASS-LIKE SPECIES		
Elymus smithii	9.55	8.44
Festuca idahoensis	7.71	6.63
Hesperostipa comata	7.03	7.48

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Poa secunda	4.33	0.97
Koeleria macrantha	4.14	1.46
Elymus spicatus	1.69	0.47
Leucopoa kingii	1.65	0.92
Poa fendleriana	1.50	-
Subtotal*	**37.60**	**26.37**
FORBS		
CRY Cerastium arvense ssp. strictum	6.29	2.25
CRY Eremogone fendleri	3.19	0.19
PLM Phlox hoodii	2.78	0.82
FAB Astragalus sp.	2.70	1.02
AST Achillea millefolium	2.61	1.24
Subtotal*	**17.57**	**5.52**
SHRUBS		
AST Artemisia tripartita var. rupicola	9.34	4.39
AST Artemisia tridentata var. vaseyana	8.58	22.09
Subtotal*	**17.92**	**26.48**
TOTALS	**73.09**	**58.37**

* Subtotal across all major species within a life form category.

DIX 8.4.3.5 MXC (Mixed Conifer Forest) Vegetation Type

For a description and discussion of this vegetation type see Section **DIX8.4.2** above. For a detailed species composition comparison of Affected Areas versus EXREFA see **Table DIX8-11** below. For a ranked comparison of major species in Affected Areas versus EXREFA see **Table DIX8-12** below. For comparison of acreages of this vegetation type versus other veg. types see **Table DIX8-1** above.

Table DIX8-11. Mixed Conifer Forest (MXC) Vegetation Type, summary of percent vegetation cover data. All values are means. (See LQD Guideline 2, Appendix V, Table 2).

		Vegetation Cover (%)			
		Affected Area		EXREFA	
Life Form	**Scientific Name**	**Absolute**	**Relative**	**Absolute**	**Relative**
Perennial:					
Grasses:	Achnatherum hymenoides	0.63	0.44	-	-
	Elymus lanceolatus	-	-	1.33	0.74
	Elymus smithii	3.00	2.14	3.17	1.75

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	Elymus spicatus	0.77	0.55	-	-
	Hesperostipa comata	4.35	3.09	8.14	4.49
	Koeleria macrantha	0.10	0.07	0.37	0.20
	Leucopoa kingii	7.28	5.18	7.33	4.04
	Nasella viridula	2.02	1.44	0.33	0.18
	Poa fendleriana	0.73	0.52	0.70	0.39
	grass sp. unknown	0.63	0.44	-	-
	Subtotal*	**18.89**	**13.43**	**20.04**	**11.06**
Grass-like:					
	CYP Carex aurea	3.17	2.25	5.00	2.76
	CYP Carex geyeri	6.85	4.87	19.90	10.98
	CYP Carex sp.	0.85	0.61	2.67	1.47
	Subtotal*	**10.88**	**7.74**	**27.57**	**15.21**
Forbs:	API Cymopterus lemmonii	-	-	0.27	0.15
	API Musineon tenuifolium	0.06	0.04	0.17	0.09
	API Osmorhiza chilensis	0.06	0.04	-	-
	AST Achillea millefolium	0.20	0.14	0.87	0.48
	AST Antennaria rosea	0.04	0.03	-	-
	AST Arnica cordifolia	1.54	1.10	3.61	1.99
	AST Erigeron caespitosus	0.04	0.03	-	-
	AST Erigeron eatonii var. eatoni	0.01	0.01	-	-
	AST Erigeron nematophyllus	0.06	0.04	-	-
	AST Erigeron ochroleucus	0.11	0.08	-	-
	AST Heterotheca villosa	-	-	0.33	0.18
	AST Packera fendleri	0.04	0.03	-	-
	AST Solidago simplex	2.04	1.45	0.30	0.17
	AST Taraxacum officinale	1.47	1.05	0.23	0.13
	AST Tetraneuris acaulis	0.08	0.06	0.17	0.09
	AST sp.	-	-	0.20	0.11
	BOR Mertensia humilis	0.18	0.13	0.17	0.09
	BOR Onosmodium molle var. occidentale	0.01	0.01	-	-
	BOR Phacelia heterophylla?	0.21	0.15	-	-
	BRA Boechera holboellii	0.04	0.03	-	-
	BRA Lesquerella montana	0.02	0.01	-	-
	BRA Lesquerella?	0.02	0.01	-	-
	CAM Campanula rotundifolia	1.73	1.23	0.10	0.06
	CRS Sedum lanceolatum	0.29	0.21	0.07	0.04
	CRY Cerastium arvense ssp. strictum	0.49	0.35	0.60	0.33
	CRY Eremogone fendleri	0.36	0.26	0.67	0.37
	CRY Pseudostellaria jamesiana	0.01	0.01	-	-
	CRY Silene drummondii	-	-	0.07	0.04
	FAB Astragalus miser var. oblongifolius	0.23	0.08	-	-
	FAB Astragalus spatulatus	-	-	0.03	0.02
	FAB Astragalus sp.	0.21	0.15	0.17	0.09
	FAB Oxytropis deflexa	0.13	0.09	-	-

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	ONA Chamerion angustifolium var. canescens	0.02	0.01	-	-
	ORO Castilleja flava	0.10	0.07	-	-
	PLG Eriogonum umbellatum	0.21	0.15	0.47	0.26
	PLM Phlox hoodii	0.01	0.01	0.50	0.28
	PLM unknown	0.23	0.16	-	-
	PTG Besseya wyomingensis	0.35	0.25	0.43	0.24
	PTG Plantago tweedyi	-	-	0.07	0.04
	RAN Thalictrum	-	-	0.27	0.15
	RAN sp.	-	-	0.07	0.04
	ROS Fragaria vesca	0.55	0.39	-	-
	ROS Potentilla concinna var. bicrenata	-	-	0.13	0.07
	ROS Potentilla gracilis	0.10	0.07	-	-
	RUB Galium boreale	0.71	0.50	0.45	0.25
	RUS Maianthemum stellatum	-	-	0.07	0.04
	SAN Comandra umbellata	0.04	0.03	-	-
	SAX Lithophragma glabrum?	-	-	0.02	0.01
	SAX Saxifraga?	-	-	0.03	0.02
	VIO Viola adunca	2.44	1.73	0.40	0.22
	VIO Viola sp.	0.25	0.18	-	-
	family unknown	0.40	0.28	-	-
	Subtotal*	**15.13**	**10.67**	**10.93**	**6.03**
Subshrubs:	BER Berberis repens	0.42	0.30	9.67	5.33
	Subtotal*	**0.42**	**0.30**	**9.67**	**5.33**
Shrubs:	AST Artemisia tridentata var. vaseyana	2.35	1.67	-	-
	AST Chrysothamnus viscidiflorus	-	-	1.33	0.73
	CPR Symphoricarpos oreophilus	1.04	0.74	0.27	0.15
	CUP Juniperus communis	2.08	1.48	10.17	5.61
	GRS Ribes cereum	0.17	0.12	-	-
	ROS Cercocarpus montanus	-	-	0.30	0.17
	SAP Acer glabrum	-	-	0.03	0.02
	Subtotal*	**5.64**	**4.01**	**12.10**	**6.68**
Trees:	SAL Populus tremuloides	1.35	0.96	16.53	9.12
	PIN Abies bifolia var. bifolia	8.44	6.00	11.93	6.59
	PIN Pinus contorta	-	-	7.00	3.86
	PIN Pinus flexilis	33.04	23.50	9.07	5.01
	PIN Pseudotsuga menziesii	25.98	18.48	31.00	17.11
	Subtotal*	**68.81**	**48.94**	**75.54**	**41.69**
Annual:					
Grasses:					
	Bromus tectorum	0.21	0.15	-	-
	Subtotal*	**0.21**	**0.15**	**-**	**-**

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Forbs:					
	AMA Chenopodium rubrum	0.13	0.09	-	-
	AMA Chenopodium sp.	0.21	0.15	-	-
	BOR Asperugo procumbens	3.02	2.15	-	-
	BRA Alyssum desertorum	-	-	0.17	0.09
	BRA Descurainia sophia	0.04	0.03	-	-
	PLG Polygonum sawatchense ssp. sawatchense	0.19	0.13	0.2	0.1
	PLM Collomia linearis	0.15	0.10	-	-
	PRM Androsace septentrionalis	0.03	0.02	-	-
	PTG Veronica peregrina var. xalapensis	1.25	0.89	-	-
	Subtotal*	**5.00**	**3.56**	**0.38**	**0.21**
Non-vascular		15.65	11.13	24.99	13.79
	Subtotal*	**15.65**	**11.13**	**24.99**	**13.79**
	Total Vegetation	140.62	99.92	181.20	100.00

* Subtotal across all species within a given life form category

Table DIX8-12. Quantitative comparison of the Mixed Conifer Forest (MXC) Vegetation Type, Affected Area versus EXREFA. Only the 15 major cover species are included here. All values are means. (See LQD Guideline 2, Appendix V, Table 3).

	Absolute Cover %	
	Affected Area	**EXREFA**
PERENNIAL GRASSES AND GRASS-LIKE SPECIES		
Leucopoa kingii	7.28	7.33
CYP Carex geyeri	6.85	19.90
Hesperostipa comata	4.35	8.14
CYP Carex aurea	3.17	5.00
Elymus smithii	3.00	3.17
Nasella viridula	2.02	0.33
Subtotal*	**26.67**	**43.87**
PERENNIAL FORBS		
VIO Viola adunca	2.44	0.40
AST Solidago simplex	2.04	0.30
CAM Campanula rotundifolia	1.73	0.10
Subtotal*	**6.21**	**0.80**
SHRUBS		
AST Artemisia tridentata var.	2.35	-

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vaseyana		
CUP Juniperus communis	2.08	10.17
Subtotal*	**4.43**	**10.17**
TREES		
PIN Pinus flexilis	33.04	9.07
PIN Pseudotsuga menziesii	25.98	31.00
PIN Abies bifolia var. bifolia	8.44	11.93
Subtotal*	**67.46**	**52.00**
Annual Forbs		
BOR Asperugo procumbens	3.02	-
Subtotal*	**3.02**	**-**
TOTALS	**107.79**	**106.84**

* Subtotal across all major species within a life form category

DIX 8.4.4 Cover Sample Adequacy Results

For this study the Extended Reference Area (EXREFA) included all areas not to be mined in the permit area except areas associated with the reclaimed North Piper and South Piper Quarry areas, which were excluded from the cover study.

Minimum samples sizes from LQD Guideline 2 were met for all sampled categories. See **Addendum DIX8 F, Table DIX8-F-1** for proposed sample sizes and **Tables DIX8-13** and **DIX8-14** below for sample adequacy data based respectively on percent vegetation cover and percent total cover. Due to the logistical challenges of this vegetation study, vegetation cover study sample numbers were less than the Computed Adequate Sample Size except for the case of MSH-C Affected area % Total Cover. Every effort was made to achieve Sample Adequacy while dealing with the study's logistical challenges. The logistical challenges arose from the combination of 1) the prescribed stepwise site selection methods, and 2) the rugged topography of the study area. The prescribed site selection method included the use of the EXREFA concept in conjunction with a site selection plan that required the worker to pass up office-selected sites instead of sampling them until higher priority sites on a different ridge were sampled. This made it necessary to make repeated sampling visits to each ridge or canyon within the permit area rather than allowing adequate data collection in one or two visits. The rugged topography of the permit area largely restricts motorized travel to limited numbers of east-west trending 4WD 2-track roads, which mostly follow either a ridgetop or a canyon bottom. Though the sample sizes were not optimal, LQD (Robin Jones, pers. comm.) has said that Computed Adequate Sample Size would probably not be strictly necessary in the case of this study.

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Table DIX8-13. Summary of sample adequacy calculations for **% Vegetation Cover** using the formula of LQD (2008) and Statistical Table 2 of Ott (1993). (See LQD Guideline 2, Appendix V, Table 4).

	Vegetation Cover (%) x+1 S.D.	Actual Sample Size	Computed Adequate Sample Size	Computed z-value	Confidence Level Achieved (%)
AFFECTED AREA Grasslands					
MS	84.42 +/- 15.33	18	53	2.3364	99.01
MSH(-C)	88.67 +/- 28.22	28	39	1.6626	95.15
RF	32.85 +/- 22.00	18	122	0.6335	52.86
Shrublands & Forests					
MM(-C)	72.34 +/- 29.10	17	63	0.9757	83.40
MXC	140.62 +/- 48.86	16	47	1.1512	87.49
EXREFA Grasslands					
MS	71.29 +/- 27.86	19	59	1.2400	89.25
MSH(-C)	102.82 +/- 41.09	24	62	1.2258	89.07
Shrublands & Forests					
MM(-C)	80.81 +/- 39.0	13	90	0.8544	80.29
MXC	181.20 +/- 80.74	10	77	0.7097	76.11

Table DIX8-14. Summary of sample adequacy calculations for **% Total Cover** using the formula of LQD (2008) and Statistical Table 2 of Ott (1993). (See LQD Guideline 2, Appendix V, Table 4).

	Total Cover (%) x+1 S.D.	Actual Sample Size	Computed Adequate Sample Size	Computed z-value	Confidence Level Achieved (%)
AFFECTED AREA Grasslands					
1. MS	96.27 +/- 15.07	18	102	2.7095	99.66
2. MSH(-C)	99.66 +/- 25.45	28	26	2.0717	98.08
3. RF	86.45 +/- 31.42	18	36	1.1673	87.90
Shrublands & Forests					
1. MM(-C)	104.71 +/- 53.29	17	100	0.8101	79.10
2. MXC	183.72 +/- 45.37	16	24	1.6198	94.29
EXREFA Grasslands					
1. MS	81.72 +/- 24.25	19	34	1.4690	92.92
2. MSH(-C)	118.20 +/- 37.64	24	39	1.5383	93.82
Shrublands & Forests					
1. MM(-C)	110.50 +/- 38.20	13	46	1.0431	85.08
2. MXC	211.80 +/- 87.49	10	66	0.7655	75.17

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DIX 8.4.5 Extended Reference Areas Suitability

As indicated under **Methods**, areas to mine and EXREFA were sampled separately in the cover study to enable comparison. This is because ridgetops to be mined were hypothesized to generally have less vegetation cover than the adjacent unaffected ravines, which could affect the appropriateness of how the Extended Reference Area concept is applied for bond release studies. This hypothesis of differences was weakly supported by the data, calling the suitability of the EXREFA method into question for this permit (see **Table DIX8-15** below).

Table DIX8-15. Summary cover data from Affected Area and Extended Reference Area sampling. All values are means +/- one standard deviation. These data constitute the pre-mining values for use in the Extended Reference Area method for evaluating revegetation success. (See LQD Guideline 2, Appendix V, Table 5).

	AFFECTED AREA		Extended Reference Area	
	Absolute Vegetation Cover (%)	Absolute Total Cover (%)	Absolute Vegetation Cover (%)	Absolute Total Cover (%)
Grasslands				
1. MS	84.42 +/- 15.33	96.27 +/- 15.07	71.29 +/- 27.86	81.72 +/- 24.25
2. MSH(-C)	88.67 +/- 28.22	99.66 +/- 25.45	102.82 +/- 41.09	118.20 +/- 37.64
3. RF	32.85 +/- 22.00	86.45 +/- 31.42	NA	NA
Shrublands & Forests				
1. MM(-C)	72.34 +/- 29.10	104.71 +/- 53.29	80.81 +/- 39.0	110.50 +/- 38.20
2. MXC	140.62 +/- 48.86	183.72 +/- 45.37	181.20 +/- 80.74	211.80 +/- 87.49

Based only on the data in **Table DIX8-15**, above, one might conclude that the MS EXREFA would be suitable for bond release studies using the standard alpha level, but that for MSH(-C), MM(-C), and MXC the proposed EXREFA would not be appropriate for bond release studies, tending to make bond release unachievable. Following that logic, ridgetop area(s) to be mined in future years would likely make more appropriate REFA. An alternate standard for bond release could perhaps be approved that would use a larger value for alpha, so that a revegetation cover study parameter may only need to be, for example, 60% of the corresponding EXREFA cover study parameter. There may not be an established rational method to decide on a fair value of alpha in such a scenario. Perhaps there exists a different statistical method that would be appropriate.

An alternative interpretation of the data above may be as follows. This table (**DIX8-15**) should be interpreted in conjunction with sample adequacy information (**Table DIX8-13** and **Table DIX8-14**), which may lead one to the conclusion of insufficient data to evaluate the suitability of an EXREFA for a bond release comparison. Following this line of thinking, no vegetation type has confidence levels of 90% or greater for both % Vegetation Cover and %

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Total Cover for both Affected Area and EXREFA. Therefore, there is not sufficient evidence for or against the hypothesis that EXREFA would be suitable for future bond release studies in the proposed permit area.

MCC proposes that LQD make the assumption that a larger dataset would support the hypothesis that the vegetation cover of Affected Areas are statistically different than those of their proposed EXREFAs. MCC proposes that rather than EXREFA, REFA's should be specially selected for individual bond release studies considering elevation, aspect, topographic position (ridgetop not ravine), and concavity (ridgetop or hilltop not a ravine or depression). In many cases to avoid elevation being a confounding variable, it may be best to have one half of the REFA at a lower elevation than the revegetation and the other half at a higher elevation. Similar considerations may be possible for other likely variables. MCC will resolve with LQD the location, nature and areal extent of each necessary REFA at least three months before the desired sampling season.

DIX 8.4.6 Tree Inventory Results & Discussion

The tree inventory provides detailed spatially explicit projections for the numbers, kinds, and conditions of trees in the Affected Areas of the proposed permit.

Tree field forms with raw data for each tree field site are available in **Addendum DIX8 E.** Information from the field forms is collected in **Addendum DIX8 D**, **Table DIX8-20 - Tree Inventory Field Site Metadata** and **Table DIX8-21 - Tree Inventory Field Data By Field Site Code**. Locations of the Field Data Collection Sites are marked in **Map DIX8-4.**

A numerical summary of the results of the tree inventory are found in **Addendum DIX8 D**, **Table DIX8-22 - Tree Predictions by Map Polygon, Road Segment, and Numbered Pit.** This table summarizes each tree parameter of the Tree Inventory by Tree Prediction Polygon, Numbered Pit Area, and new road segment. The estimated Grand Total for all proposed disturbance for this Permit Application including Pits and Roads is 41,415 Affected Trees. Considering only limber pine (*Pinus flexilis*) plus Douglas fir (*Pseudotsuga menziesii*) the corresponding Grand Total is 30,662 Affected Trees.

The spatial distribution of trees and tree parameters in the permit area is indicated by **Map DIX8-4** used in conjunction with **Table DIX8-22.** The map contains Tree Prediction Polygons each labeled with a polygon number. A polygon may be looked up in **Table DIX8-22** by its polygon number to see predicted numbers, sizes, species, and conditions of trees within that polygon in 2009. Correspondingly, segments of proposed haulroads are labeled on the map with segment numbers that function like the polygon numbers described above. All proposed pit areas are included in Prediction Polygons, but proposed haulroad segments where no trees are predicted are not assigned segment numbers.

Due to the current beetle-kill epidemic, the live tree density and distribution data of 2009 only represent that one year. Thus the data are invalid for establishing future tree replacement performance standards. MCC accepts the offer from LQD to conduct counts of total live trees (by species) within one year prior to the initial disturbance for a new pit, pit expansion, or other construction. The tree counts are to be tracked cumulatively by disturbance unit in each Annual Report. Such tree counts will lead to specific tree replacement numbers and species for bond release evaluations.

DIX 8.4.7 Results for Individual Species

As described in LQD Guideline 2, Appendices I, III, and IV this portion of the vegetation inventory presents results and discussion pertaining to individual plant species documented in the A8 Permit Area.

DIX 8.4.7.1 Plant Species List, Results

Vascular plant species documented are listed by family acronym, scientific name, and common names under life form categories (perennial grasses, perennial forbs, perennial succulents (cacti), subshrubs, shrubs, trees, annual grasses, and annual forbs). See **Addendum DIX8 A, Table DIX8-19.** Methods used to construct this species list are described in section **DIX 8.3.4 Plant Species List, Compilation Methods.**

DIX 8.4.7.2 Species of Special Concern, Results

As described under **DIX 8.3.5 Survey Methods for Plant Species of Special Concern,** a watch list of species was produced for use in the inventory's fieldwork.

Species that were searched for or located in the survey are discussed below.

Achnatherum contractum (Poaceae). Synonym: *Oryzopsis contracta*. Common name: contracted Indian ricegrass. Conservation status: This species is no longer included on WYNDD concern list. Study Results: After the study this species is still not known from any 298C permit areas but only a historic specimen from a Laramie city water tower.

Astragalus tridactylicus (Fabaceae). Synonym: NA. Common name: three-fingered milkvetch. Conservation Status: WYNDD List, Potential concern; Heritage Rank G4/S2 (Heidel 2007). Study Results: Not found in A8 field inventory, not documented in A8 area nor found in WYNDD A5 survey. Distribution: It is found in similar habitat in Red Buttes area of the Laramie Range.

Boechera perennans (Brassicaceae). Synonym: *Arabis perennans*. Common name: perennial rockcress. Conservation Status: Species not included in WYNDD 2007 concern

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list (Heidel 2007). Study Results: Not found in A8 field survey, documented in the A8 area, nor found in WYNDD A5 survey. Distribution: The A5 permit (1995) says the species was previously known from vicinity of quarries but not located in A5 survey perhaps due to early phenology and/or outbreak of a yellow fungus on mustards that spring. NatureServe (2006; 2009-02-20 visit) indicates two occurrences in Albany Co. from 1980 and no others.

Carex parryana var. ***unica*** (Cyperaceae). Synonyms: *Carex parryana* ssp. *hallii*; *Carex hallii*. Common name: Hall's sedge. Conservation status: WYNDD Plant List, Peripheral (Low conservation priority); Heritage Rank: G4?Q, S1/S2 (Heidel 2007; Fertig 1999b). Study Results: The hypothetical habitat areas (Fertig 1999b) for this species in Government Gully were searched and plant specimens were collected for lab identification, but no occurrences of this species were found in this study.

Eriogonum arcuatum var. ***arcuatum*** (Polygonaceae). Synonym: *Eriogonum jamesii* var. *flavescens*. Common name: James' wild buckwheat. Conservation status: Formerly held conservation status but is no longer on the WYNDD List (Heidel 2007). Study Results: na.

Eriogonum exilifolium (Polygonaceae). Synonyms: NA. Common name: slender-leaved buckwheat. Conservation Status: WYNDD Plant List: Regional endemic (Medium conservation priority); Heritage Rank G3 S2; USFS Region 2 Sensitive (Heidel 2007). Study Results: Sought for but not found in current field inventory. Unknown from A8 area but sought in A-5 study. Distribution: Was to be sought in A8 study due to presence in Red Buttes area of Laramie range on red sandstone.

Packera crocata (Asteraceae). Synonyms: *Senecio crocatus*. Common name: saffron groundsel. Conservation Status: WYNDD List, Regional endemic (Medium conservation priority); SOLC (Species of Local Concern) in the Medicine Bow National Forest; Heritage Rank G4 S1? (Fertig 2000; Heidel 2007). Results: Sought but not found in field inventory; unknown from permit area.

Pinus flexilis (Pinaceae). Synonyms: NA. Common name: limber pine. Conservation status: Wyoming BLM Sensitive Species (BLM 2010-03-31). A planning discussion (LQD, R. Jones pers. Comm. 2009-06-05) for this vegetation appendix Study planning discussion with indicated this species as the most important tree species to be replaced in this permit expansion's Reclamation Plan. Study Results: This species has long been known to be the most common tree in the new permit area. Its distribution, abundance, and other parameters are detailed in section **DIX 8.4.6 Tree Inventory Results & Discussion.** (See also the photographs in **Addendum DIX8 B**, many of which include this species.)

Phacelia alba (Boraginaceae). Synonyms: *Phacelia neomexicana* var. *alba*. Additionally, this genus historically was placed in the family Hydrophyllaceae. Common names: white scorpion-weed, white phacelia. Conservation status: WYNDD List, Peripheral (Low

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conservation priority); SOLC (Species of Local Concern) in the Medicine Bow National Forest; Heritage Rank: Global G4G5, State S1. Study Results: Before this study the species was not documented in the proposed permit area. Voucher specimen JB 2009-08-12 s.n. (11:30am field site). Voucher site description: Albany County, Laramie Range, T15N R72W S20NW ¼ of NE 1/4. From dry ephemeral stream channel bottom in Government Gully ca. 50 m up the channel from where the soil surface of the wetland area became visibly wet. Dominant species at microsite were *Artemisia tridentata* ssp. *vaseyana*, *Gutierrezia sarothrae*, *Poa* sp., *Allyssum allysoides*, *Elymus smithii,* and *Bromus tectorum*. (See **Map DIX8-3; Fig. 13, Photo 8262**; and **Fig. 14, Photo 8257**).

Phacelia denticulata (Boraginaceae). Synonyms: NA. Historically placed in the family Hydrophyllaceae. Common name: Rocky Mountain phacelia. (See close-up photo of plants in **Figure 6, Photo 7636; Addendum DIX 8 B**). Conservation Status: WYNDD List, Regional endemic (Medium Conservation priority); SOLC (Species of Local Concern) in the Medicine Bow National Forest; NatureServe G3?S2 (Fertig 1999). Study Results: In this study, fieldwork documented a population extension beyond where it was already known (Fertig 1995) in the approved permit area. This population extension is farther west into section 36 (see **Map DIX8-3** showing presence in 1995, and areas of both documented presence and documented absence in 2009.). Voucher specimen JB 2009-08-24 s.n. Voucher Site Description: Albany Co., Laramie Range, T15N R73W, Section 36, Center of E half. Near drainage bottom W of open limestone Pit #6 of A5 mine plan; halfway between Pit #6 and the two-track road in Section 36 that crosses the drainage.

Physaria acutifolia* var. *acutifolia (Brassicaceae). Synonyms: NA. Common name: sharpleaf twinpod. Conservation Status: Status not documented on WYNDD website (Heidel 2007). NatureServe Status: G5 T4 (Apparently Secure) (NatureServe 2011). Study Results: The species has not been documented for the proposed permit area, nor was it encountered in the current study.

Sisyrinchium pallidum (Iridaceae). Synonyms: NA. Common Name: pale blue-eyed-grass. Conservation Status: WYNND Potential Concern List; Heritage Rank G2G3 S2S3, Range Context: Regional endemic/core, Wyoming Contribution Rank: High; formerly a C2 Candidate for listing under the Endangered Species Act; USFS Region 2: Sensitive. (Heidel 2007, Fertig & Heidel 2008). Study Results: Found Voucher specimen JB 2009-08-12 s.n. Voucher Site Description: Albany Co., Laramie Range, T15N R72W Either Section 30, 17, or 18. At or near wetland reach of Government Gully in conjunction with wetland inspection (see **Map DIX8-3**).

Sphaeromeria simplex (Asteraceae). Synonyms: *Tanacetum simplex*. Common name: Laramie false sage. Conservation status: USFS R2 Sensitive; former C2 Candidate under the Endangered Species Act; WYNND List High Priority; WY endemic; Heritage Status G2 S2; WY BLM Sensitive (Heidel 2007, Fertig 2006). Study Results: No new occurrence

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areas were found in 2009-2010 field seasons during extensive fieldwork. For known (Fertig 1995) occurrences see **Map DIX8-3**.

Species of Concern, Summary of Findings. In summary, there are now five documented plant species in the proposed permit area that have special status (see **Map DIX8-3**). New occurrences of the following rare plant species were found in the proposed permit area: *Phacelia denticulata*, *Phacelia alba*, and *Sisyrinchium pallidum*. Mountain Cement Company for years has protected *Sphaeromeria simplex* in the permit area with an easement which is monitored periodically by the Nature Conservancy and others. *Pinus flexilis* is the dominant tree of the expanded permit area **(see Map DIX8-4)** and has recently been given special conservation status as indicated above.

Species of Concern, Implications of Findings. This permit includes reasonable mitigation strategies which should be adequate to protect these plant species in the permit area. *Sphaeromeria simplex* is only known from areas where no new roads or pits are proposed. The three *Phacelia* and *Sisyrinchium* species are in steep drainages that are not proposed for mining and are to be protected from erosion and sedimentation by standard methods used in this and previous permits. *Pinus flexilis* is 1) common and abundant in the permit's unaffected acres, 2) is to receive special emphasis in the Reclamation Plan proportional to the number of trees removed from an area by mining, and 3) at any one time the mined area not yet replanted with *Pinus flexilis* will be very small in relation to the total area to be mined.

DIX 8.4.7.3 Noxious & Declared Weeds Found

The two tables below present the results of the Weed Survey portion of this vegetation inventory. **Table DIX8-16** indicates the relevant information about Noxious Weeds. **Table DIX8-17** contains the results for Declared Weeds. **Map DIX8-3** indicates the locations of each species from both of these tables. Survey methods used to generate this information are described in section **DIX 8.3.6.**

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Table DIX8-16. Wyoming Designated Noxious Weeds found. The complete list of Wyoming Designated Noxious Weeds is available online (Wyoming Weed & Pest Council 2008).

Family Acronym	Scientific Name	Common Name	Location(s) & Abundance	Notes
AST	*Arctium minus*	Burdock	Only found in Government Gully Wetland	.
AST	*Carduus nutans*	musk thistle	Common in a few disturbed and reclaimed areas of the proposed permit.	Control underway
AST	*Centaurea stroebe*	spotted knapweed	Moderate-sized infestation only. Found between I-80 and the reclaimed DOT quarry in sects. 18 & 13.	Under eradication plan.
AST	*Centaurea diffusa*	diffuse knapweed	1 plant found & pulled near reclaimed Sect. 18 DOT quarry. Small stand in MBNF across fence from permit area at unreclaimed USFS quarry in Section 21	Under eradication plan.
AST	*Cirsium arvense*	Canada thistle	Common and locally abundant in proposed permit area.	Control underway
BOR	*Cynoglossum officinale*	hound's-tongue	Common and widely distributed but nowhere abundant.	Control underway
BRA	*Cardaria* sp.	Whitetop	Only documented above A5 Pit 7A West Highwall, and reported on W Edge of Warren Pit Reclamation.	Under eradication plan
POA	*Elymus repens*	common quackgrass	A7 Amendment comment about Area C: "infrequent in small localities and .... uncommon throughout the study area."	Not found in current study
PTG	*Linaria dalmatica*	Dalmation toadflax	Several infestations of less than 1 acre found various places in proposed permit boundaries, none at locations disturbed by MCC.	Some infestations under eradication
PTG	*Linaria vulgaris*	common toadflax	Reported in A5 Amendment. Likely erroneous identification of *L. dalmatica*.	Not found in current study

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Table DIX8-17. Albany County Declared Weeds found. The complete list of Albany County Declared Weeds is available online (Wyoming Department of Agriculture 2008).

Family Acronym	Scientific Name	Common Name	Location(s) & Abundance	Notes
FAB	*Oxytropis* sp.	locoweed	No large concentrations observed.	native
POA	*Bromus tectorum*	cheatgrass	Common, widely distributed, and locally abundant in proposed permit area, no heavy stands larger than an acre.	.
RAN	*Delphinium* sp.	larkspur	No large concentrations observed.	native
SOL	*Hyoscyamus niger*	black henbane	Limited in distribution & abundance, restricted to roadsides, mining disturbance, and reclaimed areas.	.

DIX 8.4.7.4 Poisonous Plants Found

The poisonous plants documented for the proposed permit area are: larkspur (*Delphinium* sp.), meadow deathcamus (*Toxicoscordion venenosum* var. *gramineum*), locoweed (*Oxytropis* sp.), twogrooved milkvetch *(Astragalus bisulcatus)*, black henbane (*Hyoscyamus niger*), houndstongue (*Cynoglossum officinale*), spotted knapweed (*Centaurea stroebe*), and diffuse knapweed (*Centaurea diffusa*). No large concentrations of these species were observed. Also, the larkspur, deathcamus, milkvetch, and locoweed are native species.

Selenium Indicator Plants. Only minor incidences of two primary selenium indicator plants have been reported for the permit area. First, *Astragalus bisulcatus*, twogrooved milkvetch, was reported by Rocky Mountain Reclamation for the A7 Permit but was not sighted in any of the expanded permit area during the 2009 and 2010 field seasons of this study. Second, *Astragalus pectinatus*, narrowleaf milkvetch, was sighted once by Brasher in the permit area during the vegetation inventory. There were only one to few plants in a very small area near the lower elevation edge of the permit area, likely growing in some soil brought in from the Laramie Plains a few miles away. The soils of the permit area itself are not strongly seleniferous and no selenium accumulator plants should be expected to persist or cause selenium poisoning.

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DIX 8.5 REFERENCES

Autodesk. 2006. AutoCAD 2006 LT. Computer Software. http://usa.autodesk.com/. San Rafael, CA.

Brasher, J. W. & N. Snow. 2004. An online compilation: Weber's system of three-letter plant family acronyms. University of Northern Colorado Herbarium Website (http://www.unco.edu/biology/herbarium/). Greeley, CO.

Bureau of Land Management (BLM). 2010-03-31. Wyoming BLM Sensitive Species. US Department of Interior. Cheyenne, WY. Formerly online at (www.blm.gov/wy/st/en/programs/plant_conservation/status.html.) Not found 2011-02-22.

Dorn, R. D. 2001. Vascular Plants of Wyoming, 3rd ed. Mountain West Publishing, Cheyenne.

ESRI (Environmental Systems Research Institute). 2006. ArcPad 7.0.1. Computer Software for GPS. http://www.esri.com/. Redlands, CA.

Fertig, W. 1995. Sensitive Plant Survey of the Mountain Cement Limestone Quarry Site, Albany County, Wyoming. Wyoming Natural Diversity Database & The Nature Conservancy. Laramie, WY. (Included in Permit 298C-A5 as Addendum DVII8C of Appendix DVII8.)

Fertig, W. 1999a. State species abstract: *Phacelia denticulata*. http://www.uwyo.edu/wynddsupport/docs/Reports/SpeciesAbstracts/Phacelia_denticulata.pdf. University of Wyoming, Wyoming Natural Diversity Database. Laramie, WY.

Fertig, W. 1999b. State species abstract: *Carex parryana* var. *unica*. http://www.uwyo.edu/wynddsupport/docs/Reports/SpeciesAbstracts/Carex_parryana_unica.pdf. University of Wyoming, Wyoming Natural Diversity Database. Laramie, WY.

Fertig, W. 2000a. State species abstract: *Eriogonum exilifolium*. http://www.uwyo.edu/wynddsupport/docs/Reports/SpeciesAbstracts/Eriogonum_exilifolium.pdf. University of Wyoming, Wyoming Natural Diversity Database. Laramie, WY.

Fertig, W. 2000b. State species abstract: *Packera crocata*. http://www.uwyo.edu/wynddsupport/docs/Reports/SpeciesAbstracts/Packera_crocata.pdf. University of Wyoming, Wyoming Natural Diversity Database. Laramie, WY.

Fertig, W. 2006. State species abstract: *Sphaeromeria simplex.* http://www.uwyo.edu/wynddsupport/docs/Reports/SpeciesAbstracts/Sphaeromeria_simplex.pdf. University of Wyoming, Wyoming Natural Diversity Database. Laramie, WY.

Fertig, W. & B. Heidel. 2008. State species abstract: *Sisyrinchium pallidum.* http://www.uwyo.edu/wynddsupport/docs/Reports/SpeciesAbstracts/Sisyrinchium_pallidum.pdf. University of Wyoming, Wyoming Natural Diversity Database. Laramie, WY.

Heidel, B. 2007. 2007 Wyoming Plant Species of Concern List. Wyoming Natural Diversity Database, University of Wyoming, Laramie. http://www.uwyo.edu/wyndd.

Hijmans, R. J. 2011. DIVA-GIS Software Version 7.3.0.1. http://www.diva-gis.org.

LQD (Wyoming Department of Environmental Quality, Land Quality Division). 2008-10-14. Draft sample adequacy calculations and statistical procedures for revegetation success evaluation. http://deq.state.wy.us/lqd/downloads/Guidelines/draft_statistical_methods_for_coal_vegetation_analyses(10_14_08).pdf. Cheyenne, WY.

NatureServe. 2006. Species profile for Daggett rockcress (*Arabis demissa* var. *languida*). http://export.nbii.gov/xml/natureserv/html/Brassicaceae/0/ELEMENT_GLOBAL_2_154313.html#conservation. Arlington, VA. 2009-05-20 visit.

NatureServe Explorer. 2011-02-22 visit. Online Database record for *Physaria acutifolia* var. *acutifolia*. http://www.natureserve.org.

Nelson, B. E. 1984. Vascular plants of the Medicine Bow Range, 4th ed. Jelm Mountain Press. Laramie, WY.

Ott, R. L. 1993. An introduction to statistical methods and data analysis. 4th ed. Duxbury Press, Belmont, CA.

Rodemaker, E.J., J.D. Hamerlinck, J.R. Oakleaf, and Z.B. Shang. 2009. Wyoming Governor's Sage-Grouse Conservation Initiative: Habitat Mapping Project, Final Report to the Wyoming Game and Fish Commission. Wyoming Geographic Information Science Center, University of Wyoming, Laramie, WY.

Porter, C. L. 1949. Spring flora of the Laramie area. Rocky Mountain Herbarium, University of Wyoming, Laramie, WY.

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Porter, C. L. 1968. Spring flora of southeastern Wyoming. University of Wyoming Agricultural Experiment Station Bulletin 491.

RM (Rocky Mountain Herbarium) Online Specimen Database. Accessed 2010-01-04. http://www.rmh.uwyo.edu. Laramie, WY.

Snow, N. 2009. Checklist of Vascular Plants of the Southern Rocky Mountain Region, version 3. Bernice P. Bishop Museum, Honolulu, HI. http://www.swcoloradowildflowers.com/PDF/Plant%20Keys/SRMRChecklist_Version3_2009_Final.pdf.

Stromberg, M. R. & R. W. Lichvar. 1982. Baseline report for property of Monolith Portland Cement Company. Unpublished report prepared for the Nature Conservancy. (Cited in 298C-A5 permit.)

Trimble. 2005. Corporate Website. http://www.trimble.com. Sunnyvale, CA.

WYDOA (Wyoming Department of Agriculture). 2008. Weed and Pest Declared List for 2008. http://www.wyoweed.org. Cheyenne, WY.

WPPC (Wyoming Weed and Pest Council). 2008. Wyoming Designated Noxious Weeds, 2008 List. http://www.wyoweed.org/statelist.html. Cheyenne, WY.

WyGISC (Wyoming Geographic Information Science Center). 2011. WyGISC Imagery Server. http://wygl.wygisc.org/ImageryServer. University of Wyoming, Laramie.

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ADDENDUM DIX8 A

Plant Species List

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Below **Table DIX8-18** is provided to interpret the three-letter plant family acronyms used in the species list (**Table DIX8-19**) and elsewhere in this Vegetation Appendix.

Table DIX8-18. Plant Family Acronyms. Space-saving family acronyms are (Brasher & Snow 2004) used in this appendix for tables listing plant species. Here the acronyms are listed in alphabetical order next to the corresponding family names.

ALL	Alliaceae		BER	Berberidaceae
AMA	Amaranthaceae		BOR	Boraginaceae
ANA	Anacardiaceae		BRA	Brassicaceae
ATH	Anthericaceae		CAC	Cactaceae
API	Apiaceae		CAM	Campanulaceae
APO	Apocynaceae		CMC	Cleomaceae
ASG	Asparagaceae		CMM	Commelinaceae
AST	Asteraceae		CPR	Caprifoliaceae
BER	Berberidaceae		CRS	Crassulaceae
BOR	Boraginaceae		CRY	Caryophyllaceae
BRA	Brassicaceae		CUP	Cupressaceae
CAC	Cactaceae		DRY	Dryopteridaceae
CAM	Campanulaceae		ELT	Elatinaceae
CMC	Cleomaceae		ERI	Ericaceae
CMM	Commelinaceae		EQU	Equisetaceae
CPR	Caprifoliaceae		EUP	Euphorbiaceae
CRS	Crassulaceae		FAB	Fabaceae
CRY	Caryophyllaceae		GEN	Gentianaceae
CUP	Cupressaceae		GER	Geraniaceae
DRY	Dryopteridaceae		GRS	Grossulariaceae
ELT	Elatinaceae		IRI	Iridaceae
ERI	Ericaceae		JUN	Juncaceae
EQU	Equisetaceae		LAM	Lamiaceae
ALL	Alliaceae		LIL	Liliaceae
AMA	Amaranthaceae		LIN	Linaceae
ANA	Anacardiaceae		LOA	Loasaceae
ATH	Anthericaceae		MLN	Melanthiaceae
API	Apiaceae		MLV	Malvaceae
APO	Apocynaceae		NYC	Nyctaginaceae
ASG	Asparagaceae		ONA	Onagraceae
AST	Asteraceae		ORC	Orchidaceae

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Table DIX8-19. Plant Species List. Plant Species by life form and family documented for the Mountain Cement Company Permit 298C permit area including the Amendment 8 expansion. Taxonomy follows Snow's (2009) checklist.

Legend: JB= Brasher, JO= Jim Orpet, RM= UW Rocky Mountain Herbarium database, RS= Ron Schreibeis, S&L= Stromberg & Lichvar, TNC, cf.= compare, ?= uncertain identification as with an incomplete specimen. For family acronyms see Table DIX8-18.

Note: Some species included are biennial, others can vary between annual, biennial, and perennial; this table simplifies by calling a species either perennial or biennial.

Lifeform & Family	Scientific Name	Alternate Sci. Name	Common Name	298 ID Authority
Perennial Grasses				
POA	*Achnatherum hymenoides*	*Oryzopsis hymenoides*	indian ricegrass	JB,RMR,RM
POA	*Agropyron cristatum*	*Agropyron cristatum*	crested wheatgrass	RMR,RM
POA	*Agrostis stolonifera*	*Agrostis stolonifera*	creeping bentgrass	JB
POA	*Aristida purpurea var. longiseta*	*Aristida longiseta*	red threeawn	RMR
POA	*Bouteloua gracilis*	*Bouteloua gracilis*	blue grama	JB,RMR
POA	*Bromus carinatus*	*Bromus marginatus*	California brome	JB
POA	*Bromus catharticus*	*Bromus catharticus*	rescuegrass	JB?
POA	*Bromus inermis*	*Bromus inermis*	smooth brome	RMR
POA	*Calamagrostis montanensis*	*Calamagrostis montanensis*	plains reedgrass	JB,JO
POA	*Calamovilfa longifolia*	*Calamovilfa longifolia*	prairie sandreed	JB,RMR
POA	*Elymus elymoides*	*Sitanion hystrix*	bottlebrush squirreltail	JB,RMR
POA	*Elymus hispidus*	*Agropyron intermedium*	intermediate wheatgrass	JB,JO
POA	*Elymus junceus*	*Agropyron riparium, E. lanceolatus ssp. riparium*	streambank wheatgrass	JB
POA	*Elymus lanceolatus*	*Elymus lanceolatus*	wheatgrass	JB
POA	*Elymus lanceolatus var. lanceolatus*	*Agropyron dasystachyum, E. lanceolatus ssp. dasystachyum, E. lanceolatus*	thickspike wheatgrass	RMR
POA	*Elymus repens*	*Agropyron repens, Elytrigia repens*	common quackgrass	RMR
POA	*Elymus smithii*	*Agropyron smithii, Pascopyrum smithi*	western wheatgrass	JB,RMR,RM
POA	*Elymus spicatus*	*Agropyron spicatum, Pseudoroegneria spicata ssp. spicata*	bluebunch wheatgrass	JB,RMR,RM
POA	*Elymus trachycaulus*	*Agropyron trachycaulum*	slender wheatgrass	JB
POA	*Elymus X saundersii*	*Elymus X saundersii*	wheatgrass hybrid	JB

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Lifeform & Family	Scientific Name	Alternate Sci. Name	Common Name	298 ID Authority
Perennial Grasses, cont.				
POA	*Festuca idahoensis*	*Festuca idahoensis*	Idaho fescue	JB,RMR
POA	*Hesperostipa comata*	*Stipa comata*	needleandthread grass	JB,RMR,RM
POA	*Hordeum jubatum*	*Hordeum jubatum*	foxtail barley	JO
POA	*Koeleria macrantha*	*Koeleria macrantha, K. cristata*	prairie junegrass	JB,RMR,RM
POA	*Leucopoa kingii*	*Leucopoa kingii*	spike fescue	JB,RMR
POA	*Melica bulbosa var. bulbosa*	*Melica bulbosa*	oniongrass	JB
POA	*Melica spectabilis*	*Melica spectabilis*	purple oniongrass	RM vicinity
POA	*Muhlenbergia filiculmis*	*Muhlenbergia filiculmis*	slimstem muhly	RMR
POA	*Muhlenbergia richardsonis*	*Muhlenbergia richardsonis*	mat muhly	JB,RMR
POA	*Nasella viridula*	*Stipa viridula*	green needlegrass	JB,RMR
POA	*Phleum pratense*	*Phleum pratense*	timothy	JB
POA	*Poa arida*	*Poa arida*	plains bluegrass	JB
POA	*Poa compressa*	*Poa compressa*	Canada bluegrass	JB
POA	*Poa fendleriana*	*Poa fendleriana*	mutton bluegrass	JB,JO
POA	*Poa glauca ssp. rupicola*	*Poa glauca ssp. rupicola*	timberline bluegrass	JB
POA	*Poa pratensis*	*Poa pratensis*	Kentucky bluegrass	JB,RMR
POA	*Poa secunda*	*P. secunda, P. sandbergii, P. canbyi, P. juncifolia, P. secunda ssp. juncifolia*	Sandberg bluegrass, alkali bluegrass	JB,RMR,RM
POA	*Poa sp.*	*Poa sp.*	bluegrass	JB
POA	*Cinna latifolia*	*Cinna latifolia*	drooping woodreed	JB
Perennial: Grass-like				
CYP	*Carex aurea*	*Carex aurea*	golden sedge	JB
CYP	*Carex cf. douglasii*	*Carex cf. douglasii*	Douglas' sedge	JB
CYP	*Carex deweyana var. deweyana*	*Carex deweyana var. deweyana*	Dewey sedge	JB
CYP	*Carex filifolia*	*Carex filifolia*	threadleaf sedge	JB,RMR
CYP	*Carex geyeri*	*Carex geyeri*	Geyer's sedge	JB
CYP	*Carex nebrascensis*	*Carex nebrascensis*	Nebraska sedge	JB,JO
CYP	*Carex stenophylla*	*Carex eleocharis, C. duriuscula*	needleleaf sedge	RMR,RM
CYP	*Eleocharis palustris*	*Eleocharis palustris*	longstem spikerush	JO,RM
IRI	*Sisyrinchium pallidum*	*Sisyrinchium pallidum*	pale blue-eyed-grass	JB2009-08-12
JUN	*Juncus arcticus*	*Juncus balticus*	Baltic rush	JB,JO

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Lifeform & Family	Scientific Name	Alternate Sci. Name	Common Name	298 ID Authority
Perennial: Grass-like, cont.				
JUN	*Juncus compressus*	*Juncus compressus*	roundfruit rush	JB
JUN	*Juncus torreyi*	*Juncus torreyi*	Torrey's rush	JB
Perennial Forbs				
ALL	*Allium cernuum*	*Allium cernuum*	nodding onion	JB
ALL	*Allium geyeri var. geyeri*	*Allium geyeri var. geyeri*	Geyer's onion	RM vicinity
ALL	*Allium textile*	*Allium textile*	prairie onion	JB,RMR
API	*Cymopterus glomeratus*	*Cymopterus acaulis*	stemless springparsley	RMR
API	*Cymopterus lemmonii*	*Cymopterus lemmonii*	alpine false springparsley	JB,RM vicinity
API	*Cymopterus montanus*	*Cymopterus montanus*	springparsley	JO
API	*Harbouria trachypleura*	*Harbouria trachypleura*	whiskbroom parsley	RM vicinity
API	*Lomatium orientale*	*Lomatium orientale*	salt-and-pepper biscuitroot	JB,JO,RM
API	*Lomatium sp.*	*Lomatium spp.*	biscuitroot	JO
API	*Musineon divaricatum*	*Musineon divaricatum*	leafy musineon	JB,JO
API	*Musineon tenuifolium*	*Musineon tenuifolium*	slender wildparsley	JB,S&L,RM
API	*Osmorhiza chilensis*	*Osmorhiza chilensis*	sweetroot	JB
APO	*Asclepias speciosa*	*Asclepias speciosa*	showy milkweed	JB
AST	*Achillea millefolium*	*Achillea millefolium*	western yarrow	JB,RMR
AST	*Almutaster pauciflorus*	*Aster pauciflorus*	alkali marsh aster	JB
AST	*Ambrosia tomentosa*	*Ambrosia tomentosa*	skeletonleaf bursage	JB
AST	*Antennaria anaphaloides*	*Antennaria anaphaloides*	pearly pussytoes	RM vicinity
AST	*Antennaria corymbosa*	*Antennaria corymbosa*	flat-top pussytoes	JB
AST	*Antennaria dimorpha*	*Antennaria dimorpha*	low pussytoes	JO
AST	*Antennaria microphylla*	*Antennaria microphylla*	littleleaf pussytoes	JB,RMR
AST	*Antennaria rosea*	*Antennaria rosea*	rose pussytoes	JB,RMR
AST	*Arctium minus*	*Arctium minus*	common burdock	JB
AST	*Arnica cordifolia*	*Arnica cordifolia*	heartleaf arnica	JB
AST	*Artemisia campestris*	*Artemisia campestris*	common sagewort	RMR
AST	*Aster (see also Almutaster, Machaeranthera, Solidago, Symphyotrichum, Xanthisma)*	*Aster spp., "Aster"*	aster	RMR
AST	*Carduus nutans*	*Carduus nutans*	musk thistle	JB
AST	*Centaurea diffusa*	*Centaurea diffusa*	diffuse knapweed	JB

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Lifeform & Family	Scientific Name	Alternate Sci. Name	Common Name	298 ID Authority
Perennial Forbs, cont.				
AST	*Centaurea stroebe*	*Centaurea maculata*	spotted knapweed	JB
AST	*Cirsium arvense*	*Cirsium arvense*	Canada thistle	RMR
AST	*Cirsium canescens*	*Cirsium canescens*	Platte thistle	JB,RMR,RM
AST	*Cirsium flodmanii*	*Cirsium flodmanii*	Flodman's thistle	JB
AST	*Cirsium sp.*	*Cirsium sp.*	thistle	JB,RMR
AST	*Crepis acuminata*	*Crepis acuminata*	hawksbeard	JO
AST	*Crepis atribarba*	*Crepis atribarba*	slender hawksbeard	JB
AST	*Crepis runcinata*	*Crepis runcinata*	hawksbeard	JB
AST	*Dieteria canescens var. canescens*	*Machaeranthera canescens*	hoary aster	JB,JO
AST	*Erigeron caespitosus*	*Erigeron caespitosus*	tufted fleabane	JB
AST	*Erigeron eatonii var. eatonii*	*Erigeron eatonii var. eatonii*	Eaton's fleabane	JB,RM vicinity
AST	*Erigeron nematophyllus*	*Erigeron nematophyllus*	mat fleabane	JB,RMR,RM
AST	*Erigeron ochroleucus*	*Erigeron ochroleucus*	fleabane	JB,RMR,RM
AST	*Erigeron pumilus var. pumilus*	*Erigeron pumilus*	low fleabane	JB,RMR,RM
AST	*Erigeron vetensis*	*Erigeron vetensis*	fleabane	JO,RM
AST	*Grindelia squarrosa*	*Grindelia squarrosa*	curlycup gumweed	RMR
AST	*Heliomeris multiflora*	*Heliomeris multiflora*	showy goldeneye	JB
AST	*Heterotheca villosa*	*Heterotheca villosa, Chrysopsis villosa*	hairy goldenaster	JB,RMR
AST	*Liatris punctata*	*Liatris punctata*	dotted gayfeather	RMR
AST	*Lygodesmia juncea*	*Lygodesmia juncea*	skeletonweed	RMR
AST	*Machaeranthera tanacetifolia*	*Aster tanacetifolius*	prairie aster	RMR
AST	*Packera cana*	*Senecio canus*	wooly groundsel	JB,JO
AST	*Packera fendleri*	*Packera fendleri*	Fendler's ragwort	JB,RM vicinity
AST	*Ratibida columnifera*	*Ratibida columnifera*	prairie coneflower	JB,RM vicinity
AST	*Ratibida tagetes*	*Ratibida tagetes*	green prairie coneflower	JB
AST	*Senecio integerrimus var. exaltatus*	*Senecio integerrimus var. exaltatus*	Columbia ragwort	RM vicinity
AST	*Senecio integerrimus var. integerrimus*	*Senecio integerrimus*	lambstongue groundsel	JO,RM
AST	*Senecio riddellii*	*Senecio riddellii*	Riddell's ragwort	JB
AST	*Senecio spartioides var. spartioides*	*Senecio spartioides*	broom groundsel	RM
AST	*Solidago simplex*	*Solidago simplex*	Mt. Albert goldenrod	JB
AST	*Solidago sp.*	*Solidago sp.*	goldenrod	JO
AST	*Sonchus sp.*	*Sonchus sp.*	sow thistle	JB?

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Lifeform & Family	Scientific Name	Alternate Sci. Name	Common Name	298 ID Authority
Perennial Forbs, cont.				
AST	*Sphaeromeria simplex*	*Sphaeromeria simplex, Tanacetum simplex*	Laramie false sage	JB,RMR,RM
AST	*Stenotus acaulis*	*Haplopappus acaulis*	stemless goldenweed	RMR
AST	*Symphyotrichum chilense*	*Aster chilensis*	Pacific aster	JB
AST	*Taraxacum laevigatum*	*Taraxacum laevigatum*	smooth dandelion	JO
AST	*Taraxacum officinale*	*Taraxacum officinale*	common dandelion	RMR
AST	*Tetraneuris acaulis*	*Hymenoxys acaulis, Haplopappus acaulis*	stemless goldenweed	JB
AST	*Tetraneuris acaulis var. acaulis*	*Hymenoxys acaulis var. acaulis*	stemless actinea	RMR,RM
AST	*Tetraneuris acaulis var. caespitosa*	*Hymenoxys acaulis var. caespitosa*	stemless actinea	RM
AST	*Tetraneuris torreyana*	*Hymenoxys torreyana*	Torrey's four-nerve daisy	JB,JO,RM
AST	*Townsendia hookeri*	*Townsendia hookeri*	hoary townsendia	JB,RMR,RM
AST	*Tragopogon dubius*	*Tragopogon dubius*	yellow salsify, goatsbeard	JB,RMR
AST	*Xanthisma grindelioides var. grindelioides*	*Machaeranthera grindelioides*	spiney aster	JO
ATH	*Leucocrinum montanum*	*Leucocrinum montanum*	common starlilly, sand lily	RMR
BOR	*Cryptantha celosioides*	*Cryptantha bradburiana*	Northern cryptantha	JB,RMR
BOR	*Cynoglossum officinale*	*Cynoglossum officinale*	houndstongue	JB
BOR	*Lithospermum incisum*	*Lithospermum incisum*	narrowleaf gromwell	JO,RM
BOR	*Lithospermum ruderale*	*Lithospermum ruderale*	wayside gromwell	RMR
BOR	*Mertensia humilis*	*Mertensia humilis*	bluebell	JB,RMR
BOR	*Mertensia viridis*	*Mertensia viridis*	bluebell	JB,JO
BOR	*Onosmodium molle var. occidentale*	*Onosmodium molle var. occidentale*	western marbleseed	JB
BOR	*Phacelia heterophylla*	*Phacelia heterophylla*	varileaf phacelia	JB?
BRA	*Boechera demissa*	*Arabis demissia var. languida*	Daggett rock cress	JO?*
BRA	*Boechera drummondii*	*Boechera drummondii*	Drummond's rockcress	JB
BRA	*Boechera holboellii*	*Arabis holboellii*	rock cress	JB
BRA	*Boechera perennans*	*Arabis perennans*	perennial rockcress	?**

*Reported years ago but likely not present. See section DIX 8.4.7.2 Species of Special Concern, Results.
**Not found in in A8 or WYNND A5 field surveys. A5 permit says was previously known from vicinity of quarries but not located in A5 survey perhaps due to early phenology and/or outbreak of a yellow fungus on mustards that spring (1995).

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Perennial Forbs, cont.				
BRA	*Boechera spatifolia*	*Boechera spatifolia*	spoonleaf rockcress	RM vicinity
BRA	*Cardaria sp.*	*Cardaria sp.*	whitetop, hoary cress	JB
BRA	*Draba sp.*	*Draba sp.*	Draba	JB
BRA	*Draba oligosperma*	*Draba oligosperma*	snowbank draba	JB,JO,RM
BRA	*Erysimum asperum*	*Erysimum asperum*	plains wallflower	RMR
BRA	*Erysimum inconspicuum*	*Erysimum inconspicuum*	shy wallflower	RM
BRA	*Erysimum sp.*	*Erysimum sp.*	wallflower	JB
BRA	*Lepidium sp.*	*Lepidium sp.*	pepper-grass	JB
BRA	*Lesquerella alpina var. alpina*	*Lesquerella alpina*	bladderpod	JB,JO
BRA	*Lesquerella ludoviciana*	*Lesquerella ludoviciana, Physaria ludoviciana*	foothill bladderpod	JB,RMR,RM
BRA	*Lesquerella montana*	*Lesquerella montana, Physaria montana*	mountain bladderpod	JB,RMR,RM
BRA	*Lesquerella sp.*	*Lesquerella sp.*	bladderpod	JO
BRA	*Noccaea montana*	*Thlaspi montanum var. montanum*	alpine pennycress	JB
BRA	*Physaria spatulata*	*Physaria spatulata*	alpine bladderpod	RM
BRA	*Sisymbrium linifolium*	*Schoenocrambe linifolia*	plainsmustard	JB,JO
CAM	*Campanula parryi*	*Campanula parryi*	Parry's bellflower	JB
CAM	*Campanula rotundifolia*	*Campanula rotundifolia*	harebell	JB,JO
CMM	*Tradescantia occidentalis*	*Tradescantia occidentalis*	prairie spiderwort	RMR
CRS	*Sedum lanceolatum*	*Sedum lanceolatum*	wormleaf stonecrop	JB,RMR,RM
CRY	*Cerastium arvense ssp. strictum*	*Cerastium arvense*	starry cerastium	JB,RMR,RM
CRY	*Eremogone fendleri*	*Eremogone fendleri*	Fendler's sandwort	JB,RM
CRY	*Eremogone hookeri*	*Arenaria hookeri*	Hooker sandwort	JB,RMR,RM
CRY	*Minuartia nuttallii var. nuttallii*	*Minuartia nuttallii*	Nuttall's sandwort	JB
CRY	*Minuartia rubella*	*Minuartia rubella*	beautiful sandwort	JB,RM vicinity
CRY	*Paronychia depressa*	*Paronychia depressa*	nailwort	JB,JO,RM
CRY	*Paronychia sessiliflora*	*Paronychia sessiliflora*	nailwort	JB,JO,RM
CRY	*Pseudostellaria jamesiana*	*Stellaria jamesiana*	tuber starwort	JB
CRY	*Silene drummondii*	*Silene drummondii*	Drummond's campion	JB
DRY	*Cystopteris fragilis*	*Cystopteris fragilis*	brittle bladderfern	JB

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Perennial Forbs, cont.				
EQU	*Equisetum laevigatum*	*Equisetum laevigatum*	smooth horsetail	JB
EUP	*Euphorbia brachycera*	*Euphorbia robusta*	robust spurge	JO,RM
FAB	*Astragalus adsurgens var. robustior*	*Astragalus adsurgens*	standing milkvetch	RMR
FAB	*Astragalus bisulcatus*	*Astragalus bisulcatus*	twogrooved milkvetch	RMR
FAB	*Astragalus cicer*	*Astragalus cicer*	cicer milkvetch	JB
FAB	*Astragalus drummondii*	*Astragalus drummondii*	drummond milkvetch	RMR
FAB	*Astragalus flexuosus*	*Astragalus flexuosus*	pliant milkvetch	JB,JO
FAB	*Astragalus miser var. oblongifolius*	*Astragalus miser var. oblongifolius*	timber milkvetch	JB,RM vicinity
FAB	*Astragalus missouriensis*	*Astragalus missouriensis*	Missouri milkvetch	RMR
FAB	*Astragalus pectinatus*	*Astragalus pectinatus*	narrowleaf milkvetch	JB
FAB	*Astragalus purshii var. purshii*	*Astragalus purshii*	pursh milkvetch	RMR
FAB	*Astragalus shortianus*	*Astragalus shortianus*	Short's milkvetch	RMR
FAB	*Astragalus sp.*	*Astragalus sp.*	milkvetch	JO,RMR
FAB	*Astragalus spatulatus*	*Astragalus spatulatus*	spoonleaf milkvetch	JB,RMR,RM
FAB	*Dalea purpurea*	*Dalea purpurea*	purple prairieclover	RMR
FAB	*Lupinus argenteus*	*Lupinus argenteus*	lupine	JB,JO
FAB	*Lupinus plattensis*	*Lupinus plattensis*	Nebraska lupine	RM vicinity
FAB	*Lupinus polyphyllus var. humicola*	*Lupinus polyphyllus var. humicola*	rimrock lupine	RM vicinity
FAB	*Medicago lupulina*	*Medicago lupulina*	black medick	JB
FAB	*Medicago sativa*	*Medicago sativa*	alfalfa	JB
FAB	*Melilotus albus*	*Melilotus alba*	white sweetclover	RMR
FAB	*Melilotus officinalis*	*Melilotus officinalis*	yellow sweetclover	JO
FAB	*Onobrychis viciifolia*	*Onobrychis viciifolia*	sainfoin	JB
FAB	*Oxytropis deflexa*	*Oxytropis deflexa*	nodding locoweed	JB
FAB	*Oxytropis lambertii*	*Oxytropis lambertii*	Lambert locoweed	RMR
FAB	*Oxytropis multiceps*	*Oxytropis multiceps*	Nuttall's oxytrope	JB
FAB	*Oxytropis sericea var. sericea*	*Oxytropis sericea*	silky locoweed	JB
FAB	*Oxytropis sericea var. spicata*	*Oxytropis campestris var. spicata*	field locoweed	JB,RM vicinity
FAB	*Oxytropis sp.*	*Oxytropis sp.*	locoweed	JO
FAB	*Thermopsis rhombifolia*	*Thermopsis rhombifolia*	plains thermopsis	RMR

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Lifeform & Family	Scientific Name	Alternate Sci. Name	Common Name	298 ID Authority
Perennial Forbs, cont.				
FAB	*Trifolium dasyphyllum*	*Trifolium dasyphyllum*	whiproot clover	JB,JO,RM
FAB	*Trifolium gymnocarpum*	*Trifolium gymnocarpon*	clover	JO
FAB	*Trifolium sp.*	*Trifolium sp.*	clover	JO
FAB	*Vicia americana*	*Vicia americana*	American vetch	JB
GEN	*Frasera speciosa*	*Frasera speciosa*	elkweed	JO
GER	*Geranium atropurpureum var. cowenii*	*Geranium fremontii*	Fremont geranium	RMR
GER	*Geranium caespitosum*	*Geranium caespitosum*	pineywoods geranium	RM
LAM	*Hedeoma drummondii*	*Hedeoma drummondii*	mock pennyroyal	JB
LAM	*Scutellaria brittonii*	*Scutellaria brittonii*	Britton's skullcap	RM
LIL	*Calochortus gunnisonii var. gunnisonii*	*Calochortus gunnisonii var. gunnisonii*	Gunnison's mariposa lily	RM vicinity
LIL	*Calochortus nuttallii*	*Calochortus nuttallii*	sego (mariposa) lily	JB,RMR
LIN	*Linum lewisii var. lewisii*	*Linum lewisii*	lewis flax	RMR,RM
LIN	*Linum perenne*	*Linum lewisii 'Appar'*	blue flax	JB,RMR
LOA	*Mentzelia*	*Mentzelia*	blazingstar	RM vicinity
MLN	*Toxicoscordion venenosum var. gramineum*	*Zigadenus venenosus var. gramineus*	grassy deathcamas	JB,RMR,RM
MLV	*Sphaeralcea coccinea*	*Sphaeralcea coccinea*	scarlet globemallow	RMR
NYC	*Mirabilis linearis*	*Mirabilis linearis*	narrowleaf four o'clock	JB
ONA	*Chamerion angustifolium var. canescens*	*Epilobium angustifolium*	fireweed	JB
ONA	*Epilobium ciliatum*	*Epilobium ciliatum*	fringed willowherb	JB
ONA	*Oenothera nuttallii*	*Oenothera nuttallii*	Nuttall evening primrose	JO
ONA	*Oenothera sp.*	*Oenothera sp.*	eveningprimrose	RMR
ONA	*Oenothera suffrutescens*	*Gaura coccinea*	scarlet gaura	RMR
ORC	*Corallorhiza maculata*	*Corallorhiza maculata*	summer coralroot	JB
ORO	*Castilleja angustifolia*	*Castilleja angustifolia*	Indian paintbrush	JB,RMR
ORO	*Castilleja chromosa*	*Castilleja chromosa*	Wyoming Indian paintbrush	RMR
ORO	*Castilleja flava*	*Castilleja flava*	yellow Indian paintbrush	JB,RMR
ORO	*Orobanche fasciculata*	*Orobanche fasciculata*	purple broomrape	JB,RMR,RM
PLG	*Eriogonum alatum*	*Eriogonum alatum*	winged buckwheat	JB
PLG	*Eriogonum cernuum*	*Eriogonum cernuum*	nodding wildbuckwheat	RMR
PLG	*Eriogonum flavum var. flavum*	*Eriogonum flavum*	yellow wildbuckwheat	JB,RMR

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Lifeform & Family	Scientific Name	Alternate Sci. Name	Common Name	298 ID Authority
Perennial Forbs, cont.				
PLG	*Eriogonum ovalifolium var. purpureum*	*Eriogonum ovalifolium*	cushion wildbuckwheat	RMR,RM
PLG	*Eriogonum sp.*	*Eriogonum sp.*	wildbuckwheat	JB,JO
PLG	*Eriogonum umbellatum*	*Eriogonum umbellatum*	sulfur wildbuckwheat	JB,RMR
PLG	*Polygonum sp.*	*Polygonum sp.*	knotweed	JB
PLG	*Rumex crispus*	*Rumex crispus*	curly dock	JB
PLG	*Rumex venosus*	*Rumex venosus*	veiny dock	JO,RM
PLM	*Ipomopsis aggregata*	*Ipomopsis aggregata*	scarlet gilia, ipomopsis	JO
PLM	*Ipomopsis spicata*	*Ipomopsis spicata*	spiked ipomopsis	JB,RM
PLM	*Phlox hoodii*	*Phlox hoodii*	hoods phlox	JB,RMR
PLM	*Phlox multiflora*	*Phlox multiflora*	phlox	JB,RMR
PLM	*Phlox muscoides*	*Phlox bryoides*	squarestem phlox	JB,JO,RM
PRM	*Dodecatheon conjugens*	*Dodecatheon conjugens*	shooting star	JO
PTG	*Besseya wyomingensis*	*Besseya wyomingensis*	Wyoming kittentails	JB,JO
PTG	*Limosella aquatica*	*Limosella aquatica*	water mudwort	JB,RM
PTG	*Linaria dalmatica*	*Linaria dalmatica*	Dalmatian toadflax	JB
PTG	*Linaria vulgaris*	*Linaria vulgaris*	yellow toadflax	JO
PTG	*Penstemon albidus*	*Penstemon albidus*	white penstemon	RMR
PTG	*Penstemon angustifolius var. angustifolius*	*Penstemon angustifolius*	narrowleaf penstemon	JB,JO,RM
PTG	*Penstemon eriantherus*	*Penstemon eriantherus*	fuzzytongue penstemon	JB,JO
PTG	*Penstemon laricifolius*	*Penstemon laricifolius*	larchleaf penstemon	JB,JO
PTG	*Penstemon palmeri*	*Penstemon palmeri*	Palmer penstemon	RM vicinity
PTG	*Penstemon procerus var. procerus*	*Penstemon procerus var. procerus*	pincushion beardtongue	RM vicinity
PTG	*Penstemon sp.*	*Penstemon sp.*	penstemon	JO,RMR
PTG	*Penstemon strictus*	*Penstemon strictus*	Rocky Mountain penstemon	RM vicinity
PTG	*Plantago tweedyi*	*Plantago tweedyi*	Tweedy's plantain	JB
PTG	*Veronica americana*	*Veronica americana*	American speedwell	JB
RAN	*Aquilegia coerulea var. coerulea*	*Aquilegia coerulea var. coerulea*	Colorado blue columbine	RM vicinity
RAN	*Clematis hirsutissima*	*Clematis hirsutissima*	hairy clematis	JB

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Lifeform & Family	Scientific Name	Alternate Sci. Name	Common Name	298 ID Authority
Perennial Forbs, cont.				
RAN	*Delphinium nuttallianum*	*Delphinium nuttallianum, D. nelsonii*	Nuttall larkspur	JB,RMR
RAN	*Ranunculus aquatilis var. diffusa*	*Ranunculus aquatilis var. diffusa*	white water crowfoot	JB
RAN	*Ranunculus cymbalaria var. cymbalaria*	*Ranunculus cymbalaria var. cymbalaria*	alkali buttercup	JB
RAN	*Ranunculus glaberrimus var. ellipticus*	*Ranunculus glaberrimus var. ellipticus*	elliptical buttercup	JB
RAN	*Ranunculus ranunculinus*	*Ranunculus ranunculinus*	tadpole buttercup	JB
RAN	*Thalictrum sp.*	*Thalictrum sp.*	meadow-rue	JB
ROS	*Fragaria vesca*	*Fragaria vesca*	starvling strawberry	JB
ROS	*Geum triflorum*	*Geum triflorum*	prairiesmoke sieversia	RMR
ROS	*Potentilla argentea var. argentea*	*Potentilla argentea var. argentea*	silver cinquefoil	JB
ROS	*Potentilla bipinnatifida*	*Potentilla bipinnatifida*	tansy cinquefoil	JB
ROS	*Potentilla concinna var. bicrenata*	*Potentilla concinna var. bicrenata*	elegant cinquefoil	JB
ROS	*Potentilla fissa*	*Potentilla fissa*	bigflower cinquefoil	JB
ROS	*Potentilla gracilis*	*Potentilla gracilis*	northwest cinquefoil	JB,JO
ROS	*Potentilla hippiana*	*Potentilla hippiana*	woolly cinquefoil	JB;S&L
ROS	*Potentilla pensylvanica*	*Potentilla pensylvanica*	Pennsylvania cinquefoil	JO
ROS	*Potentilla sp.*	*Potentilla sp.*	cinquefoil	RMR
RUB	*Galium boreale*	*Galium boreale*	bedstraw	JB,JO
RUS	*Maianthemum stellatum*	*Maianthemum stellatum*	starry false lily of the valley	JB
SAN	*Comandra umbellata var. pallida*	*Comandra pallida, C. umbellata*	pale bastard-toadflax	JB,RMR
SAX	*Heuchera parvifolia*	*Heuchera parvifolia*	littleflower alumroot	JB
SAX	*Heuchera rubescens var. versicolor*	*Heuchera rubescens*	pink alumroot	JB?
SAX	*Lithophragma glabrum*	*Lithophragma glabrum*	bulbous woodland-star?	JB?
SAX	*Saxifraga occidentalis*	*Saxifraga occidentalis*	Alberta saxifrage	RM vicinity
SAX	*Saxifraga rhomboidea*	*Saxifraga rhomboidea*	diamondleaf saxifrage	JB
SAX	*Saxifraga sp.?*	*Saxifraga sp.?*	saxifrage?	JB
SCR	*Verbascum thapsus*	*Verbascum thapsus*	common mullein	JB
SEL	*Selaginella densa*	*Selaginella densa*	spikemoss selaginalla	JB, RMR

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Lifeform & Family	Scientific Name	Alternate Sci. Name	Common Name	298 ID Authority
Perennial Forbs				
URT	*Urtica dioica*	*Urtica dioica*	stinging nettle	JB
VAL	*Viola adunca*	*Viola adunca*	hookedspur violet	JB
VIO	*Viola nuttallii*	*Viola nuttallii*	yellow prairie violet	JB,JO
VIO	*Viola sp.*	*Viola sp.*	violet	JB
VRB	*Verbena bracteata*	*Verbena bracteata*	bigbract verbena	JO
VRB	*Verbena stricta*	*Verbena stricta*	hoary verbena	JB
Perennial: Succulents				
CAC	*Coryphantha vivipara*	*Mamillaria vivipara*	pincushion cactus	RMR
CAC	*Opuntia polyacantha*	*Opuntia polyacantha*	plains pricklypear	JB,RMR,RM
Perennial: Subshrubs				
AMA	*Krascheninnikovia lanata*	*Ceratoides lanata, Eurotia lanata*	common winterfat	JB,RMR
ASG	*Yucca glauca var. glauca*	*Yucca glauca var. glauca*	soapweed yucca	JB,RM
AST	*Artemisia frigida*	*Artemisia frigida*	prairie sagewort, "fringed sagewort"	JB,RMR
AST	*Artemisia ludoviciana*	*Artemisia ludoviciana*	Lousiana cudweed	JB,RMR
AST	*Gutierrezia sarothrae*	*Gutierrezia sarothrae, Xanthocephalum sarothrae*	broom snakeweed	JB,RMR
BER	*Berberis repens*	*Mahonia repens*	oregon grape	JB,JO
ERI	*Arctostaphylos uva-ursi*	*Arctostaphylos uva-ursi*	kinnikinnick	JB
PLG	*Eriogonum arcuatum var. arcuatum*	*Eriogonum jamesii var. flavescens*	James' wild buckwheat	WYNDD
PLG	*Eriogonum brevicaule*	*Eriogonum brevicaule*	shortstem buckwheat	JO
PLG	*Eriogonum effusum*	*Eriogonum effusum*	effuse wildbuckwheat, spreading buckwheat	RMR,RM
PLG	*Eriogonum microthecum*	*Eriogonum microthecum*	slender wild buckwheat	JO
PLG	*Eriogonum sp.*	*Eriogonum sp.*	wildbuckwheat	JB
PLM	*Linanthus pungens*	*Leptodactylon pungens*	granite pricklygilia	JO,RMR,RM

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Lifeform & Family	Scientific Name	Alternate Sci. Name	Common Name	298 ID Authority
Perennial: Shrubs				
AMA	*Atriplex canescens*	*Atriplex canescens*	four-winged saltbush	JB
ANA	*Rhus aromatica var. trilobata*	*Rhus trilobata*	skunkbush sumac	RMR
AST	*Artemisia nova*	*Artemisia nova*	black sagebrush	JB,RMR
AST	*Artemisia tridentata*	*Artemisia tridentata*	big sagebrush	JB
AST	*Artemisia tridentata var. tridentata*	*Artemisia tridentata var. tridentata*	basin big sagebrush	RMR,JB
AST	*Artemisia tridentata var. vaseyana*	*Artemisia tridentata var. pauciflora*	mountain big sagebrush	JB
AST	*Artemisia tridentata var. wyomingensis*	*Artemisia tridentata var. wyomingensis*	Wyoming big sagebrush	RMR
AST	*Artemisia tripartita var. rupicola*	*Artemisia tripartita*	threetip sagebrush	JB,RMR
AST	*Chrysothamnus sp. (or Ericameria sp.)*	*Chrysothamnus or Ericameria sp.*	rabbitbrush	JB
AST	*Chrysothamnus viscidiflorus*	*Chrysothamnus viscidiflorus*	Douglas rabbitbrush	JB,RMR
AST	*Ericameria nauseosa*	*Chrysothamnus nauseosus*	rubber rabbitbrush	JB,RMR,RM
AST	*Tetradymia canescens*	*Tetradymia canescens*	gray horsebrush	JB,RMR
CPR	*Symphoricapos oreophilus*	*Symphoricarpos oreophilus*	mountain snowberry	JB
CPR	*Symphoricarpos occidentalis*	*Symphoricarpos occidentalis*	snowberry	JO
CUP	*Juniperus communis*	*Juniperus communis*	common juniper	JB,RMR
GRS	*Ribes cereum*	*Ribes cereum*	wax currant	JB
GRS	*Ribes inerme var. inerme*	*Ribes inerme var. inerme*	whitestem gooseberry	JB
GRS	*Ribes sp.*	*Ribes sp.*	currant	JO
ROS	*Amelanchier alnifolia var. alnifolia*	*Amelanchier alnifolia var. alnifolia*	Saskatoon serviceberry	JB,RM vicinity
ROS	*Amelanchier utahensis*	*Amelanchier utahensis*	Utah serviceberry	JB
ROS	*Cercocarpus montanus var. montanus*	*Cercocarpus montanus*	true mountain mahogany, buckbrush	JB,RMR,RM
ROS	*Potentilla fruticosa*	*Potentilla fruticosa*	shrubby cinquefoil	JO
ROS	*Prunus virginiana var. melanocarpa*	*Prunus virginiana*	black chokecherry	JB
ROS	*Purshia tridentata*	*Purshia tridentata*	antelope bitterbrush	RMR
ROS	*Rosa woodsii*	*Rosa woodsii*	woods rose	JB,RMR
SAL	*Salix sp.*	*Salix sp.*	willow	JB
SAM	*Sambucus racemosa*	*Sambucus racemosa*	elderberry	JB
SAP	*Acer glabrum var. glabrum*	*Acer glabrum*	Rocky Mountain maple	JB,RM

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Perennial: Trees				
CUP	*Juniperus scopulorum*	*Juniperus scopulorum*	Rocky Mountain juniper	JB,RMR
PIN	*Abies bifolia var. bifolia*	*Abies lasiocarpa*	subalpine fir	JB,WY G&F*
PIN	*Picea engelmannii*	*Picea engelmannii*	Engelmann spruce	JB
PIN	*Pinus contorta*	*Pinus contorta*	lodgepole pine	JB
PIN	*Pinus flexilis*	*Pinus flexilis*	limber pine	JB,JO
PIN	*Pinus ponderosa*	*Pinus ponderosa*	ponderosa pine	JB,JO
PIN	*Pseudotsuga menziesii*	*Pseudotsuga menziesii*	Douglas fir	JB,JO
SAL	*Populus angustifolia*	*Populus angustifolia*	narrowleaf cottonwood	JB
SAL	*Populus sp.*	*Populus sp.*	cottonwood	JB
SAL	*Populus tremuloides*	*Populus tremuloides*	quaking aspen	JB
	*letter to MCC consultant, A. Travsky, Summer 2009			
Annual Grasses				
POA	*Bromus japonicus*	*Bromus japonicus*	Japanese brome	JB,RMR
POA	*Bromus tectorum*	*Bromus tectorum*	cheatgrass, downy brome	JB,RMR
POA	*Muhlenbergia filiformis*	*Muhlenbergia filiformis*	pullup muhly	JB,RM
POA	*Vulpia octoflora*	*Vulpia octoflora*	common sixweeksgrass	JB,RMR
Annual: Grass-like				
JUN	*Juncus bufonius*	*Juncus bufonius*	toad rush	JB
Annual Forbs				
AMA	*Amaranthus retroflexus*	*Amaranthus retroflexus*	redroot pigweed	RMR
AMA	*Chenopodium pratericola*	*Chenopodium pratericola*	narrowleaf goosefoot	JB,JO
AMA	*Chenopodium rubrum*	*Chenopodium rubrum*	red goosefoot	JB
AMA	*Chenopodium spp.*	*Chenopodium spp.*	lambsquarter, goosefoot	RMR
AMA	*Kochia scoparia*	*Bassia sieversiana*	fireweed summercypress, kochia	RMR
AMA	*Monolepis nuttaliana*	*Monolepis nuttaliana*	Nuttall monolepis	JB,RMR

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Lifeform & Family	Scientific Name	Alternate Sci. Name	Common Name	298 ID Authority
Annual Forbs, cont.				
AMA	*Salsola australis*	*Salsola iberica, S. kali*	Russian thistle, tumbleweed	JB,RMR
AST	*Helianthus annuus*	*Helianthus annuus*	sunflower	JB
BOR	*Asperugo procumbens*	*Asperugo procumbens*	German-madwort	JB
BOR	*Cryptantha fendleri*	*Cryptantha fendleri*	sanddune cryptantha	RM
BOR	*Cryptantha kelseyana*	*Cryptantha kelseyana*	Kelsey's cryptantha	JO,RM
BOR	*Lappula occidentalis*	*Lappula redowskii*	western stickseed	JB,RMR
BOR	*Lappula squarrosa*	*Lappula squarrosa*	European stickseed	RM
BOR	*Phacelia alba*	*Phacelia neomexicana var. alba*	white scorpion-weed, white phacelia	JB
BOR	*Phacelia denticulata*	*Phacelia denticulata*	Rocky Mountain phacelia	JB,RMR
BRA	*Alyssum alyssoides*	*Alyssum alyssoides*	alyssum	JB
BRA	*Alyssum desertorum*	*Alyssum desertorum*	desert alyssum	JB,RMR,RM
BRA	*Camelina microcarpa*	*Camelina microcarpa*	smallseed falseflax	JB,JO
BRA	*Capsella bursa-pastoris*	*Capsella bursa-pastoris*	shepherdspurse	RMR
BRA	*Chorispora tenella*	*Chorispora tenella*	musk mustard, "blue mustard"	RMR
BRA	*Descurainia pinnata*	*Descurainia pinnata*	pinnate tansymustard	RMR
BRA	*Descurainia sophia*	*Descurainia sophia*	flixweed tansymustard	JB,JO,RM
BRA	*Draba nemorosa*	*Draba nemorosa*	woodland draba	JB
BRA	*Halimolobos virgata*	*Halimolobos virgata*	halimolobos	JB,JO
BRA	*Lepidium densiflorum*	*Lepidium densiflorum*	prairie pepperweed	RMR
BRA	*Lepidium perfoliatum*	*Lepidium perfoliatum*	clasping pepperweed	RMR
BRA	*Malcolmia africana*	*Malcolmia africana*	malcolmia	JB
BRA	*Sisymbrium altissimum*	*Sisymbrium altissimum*	tumble mustard	RMR
BRA	*Thlaspi arvense*	*Thlaspi arvense*	field pennycress	RMR
CMC	*Cleome serrulata*	*Cleome serrulata*	Rocky Mountain beeplant	RMR
CRY	*Silene sp.*	*Silene sp.*	catchfly	JB
ELT	*Elatine rubella*	*Elatine triandra*	southwestern waterwort	RM
EUP	*Chamaesyce serpyllifolia*	*Chamaesyce serpyllifolia*	thymeleaf sandmat	JB
LIN	*Linum puberulum*	*Linum puberulum*	plains flax	JB
ORO	*Orthocarpus luteus*	*Orthocarpus luteus*	yellow owlclover	JB,RMR
PLG	*Polygonum aviculare*	*Polygonum aviculare*	prostrate knotweed	RMR

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Lifeform & Family	Scientific Name	Alternate Sci. Name	Common Name	298 ID Authority
Annual Forbs, cont.				
PLG	*Polygonum ramosissimum ssp. ramosissimum*	*Polygonum ramosissimum*	busy knotweed	JB
PLG	*Polygonum sawatchense ssp. sawatchense*	*Polygonum sawatchense ssp. sawatchense*	Johnston's knotweed	JB
PLM	*Collomia linearis*	*Collomia linearis*	tiny trumpet	JB,RM vicinity
PRM	*Androsace septentrionalis*	*Androsace septentrionalis*	pygmyflower rockjasmine	JB
PTG	*Collinsia parviflora*	*Collinsia parviflora*	Collinsia parviflora	JB?
PTG	*Veronica peregrina var. xalapensis*	*Veronica peregrina var. xalapensis*	hairy purslane speedwell	JB
SOL	*Hyoscyamus niger*	*Hyoscyamus niger*	black henbane	JB

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ADDENDUM DIX8 B

Vegetation Photographs

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Figure 1, Photo 6968. Looking westward along the northern edge of proposed Pit #5D. Left: RF veg. type on on ridgetop in proposed Affected Area. Right: MXC veg. type outside area to be mined, below ridge crest on steep north-facing slope. 21 May 2009.

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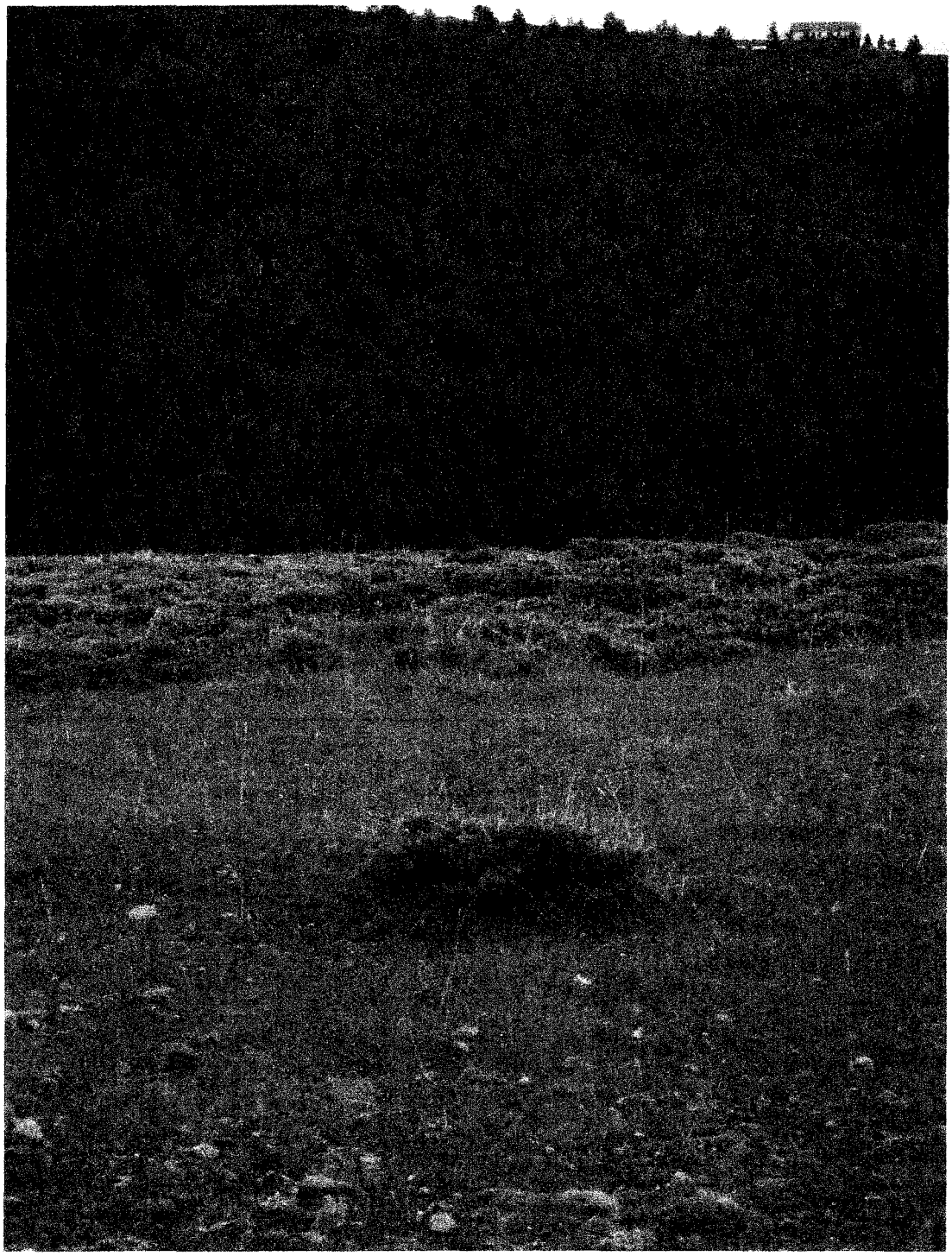

Figure 2, Photo 6978. Foreground: MSH (High Elevation Mixed Shrub/Grassland) Vegetation Type on "the Muffler" (Pit #5D area). Background: beetle-infested trees in dense MXC (Mixed Conifer Forest) in Gilmore Gulch, south of proposed permit area within ½ mile buffer zone. 22 May 2009.

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Figure 3, Photo 6992. Example of Disturbed Land (DL) cover type. Active area of MCC quarry at A5 Pit #7B, part of proposed Pit #1. 27 May 2009.

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Figure 4, Photo 7004. Center and Right: unreclaimed DOT limestone quarry including material stockpiles and spoil stockpile. Beyond stockpiles: area of Tree Site 1, in MSH-C veg. type. Foreground: MSH-C veg. type near east end of proposed Pit #8B. 27 May 2009.

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Figure 5, Photo 7007. Foreground: Example of MSH & MSH-C veg. types in the proposed 9B and 9C Pit areas. Background: unreclaimed DOT limestone quarry including a material stockpile and the haulroad out of the pit. Skyline: proposed A8 Permit boundary fence, adjacent Tree GPS8 Field Site, and Medicine Bow National Forest beyond. 27 May 2009.

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Figure 6, Photo 7636. Species of Concern: *Phacelia denticulata* (Boraginaceae) close-up. Drainage between A5 Pit #7B and A5 Pit #6, between proposed Pits #1 and #3. 23 June 2009.

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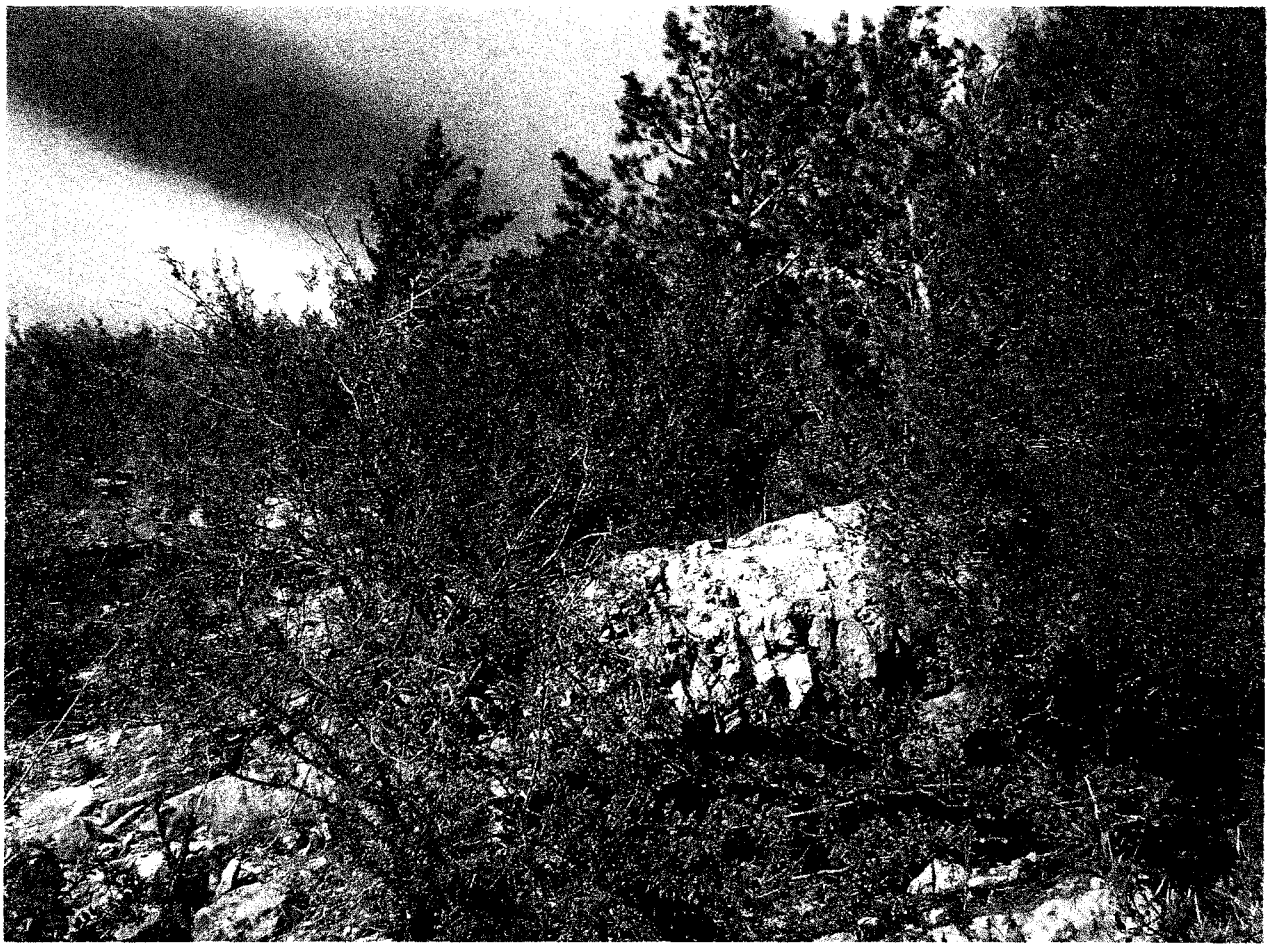

Figure 7, Photo 7942. Unsampled, Excluded Vegetation Cover Study Site 6. Site (now classified as MM-C veg. type) did not match the intended cover sampling plan (a regular MM veg. type site) based on the preliminary vegetation types classification (using MSC separately from MM and MSH). (For further explanation see section **DIX 8.3.1, Classifying & Mapping Vegetation Types** and **DIX8.3.2.3, On-site Cover Data Collection Methods**). Photo is an example of the MM-C veg. type west of proposed Pit #9A. 9 July 2009.

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Figure 8, Photo 7958. 1st attempt for Vegetation Cover Site 10. Site is an example of a transitional area between RF, MM & MS veg. types. 2nd attempt (Fig. 9, Photo 7959, below) was similarly unsuitable. 3rd attempt was satisfactory according to the study methods, and sampled for the RF veg. type. Location: proposed Pit #6 (North Boomerang). 10 July 2009.

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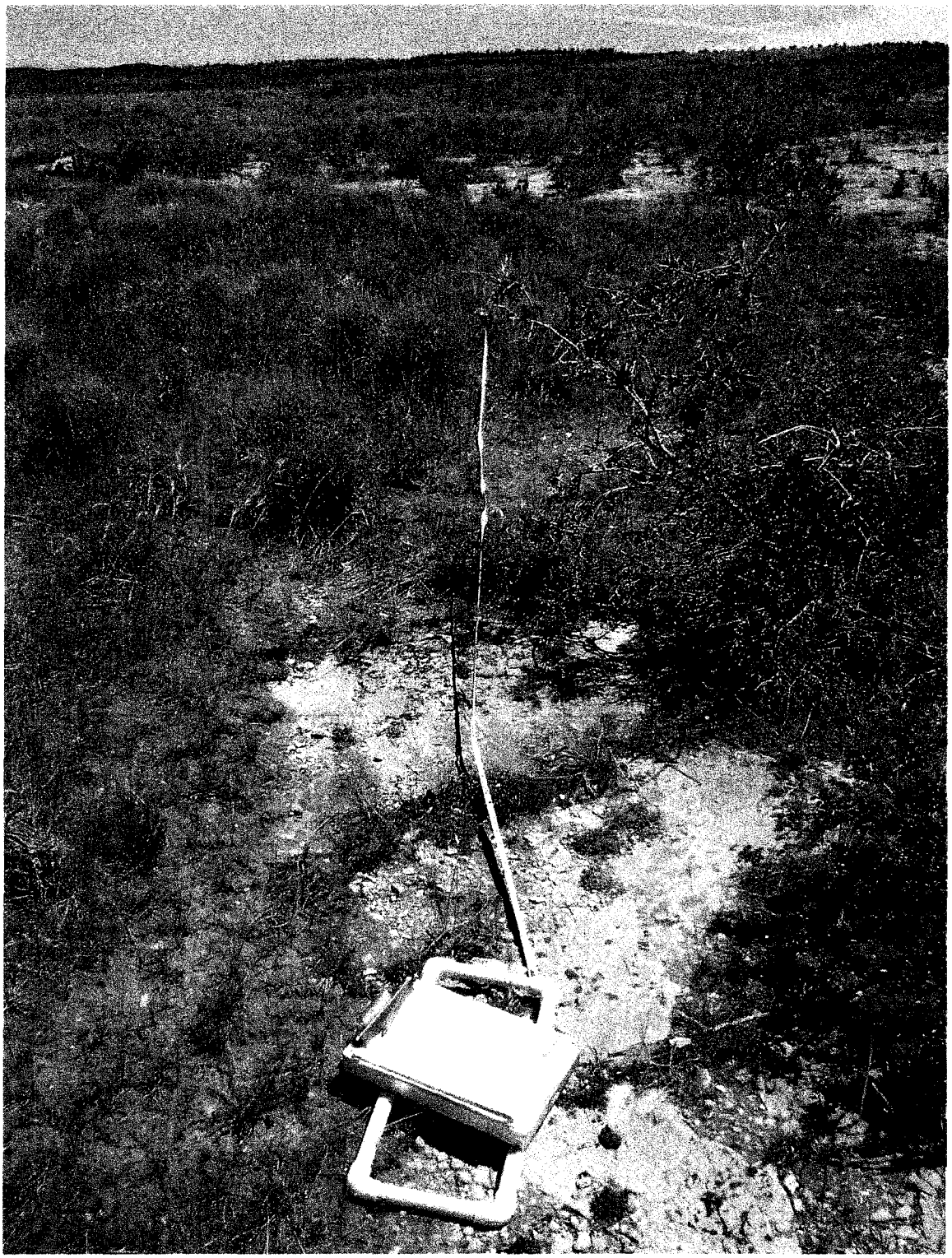

Figure 9, Photo 7959. 2nd attempt for Vegetation Cover Site 10. Site is an example of a transitional area of RF changing to MS. 3rd attempt was satisfactory according to the study methods, and sampled for the RF veg. type. Location: proposed Pit #6 (North Boomerang). 10 July 2009.

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Figure 10, Photo 7962. Vegetation Cover Study Site 16. 1st attempt location fell on a 2-track road. Following study methods a satisfactory nearby substitute site was chosen and sampled. Photo is an example of the MS veg. type near the dividing line between proposed Pits #3 and #5C. 11 July 2009.

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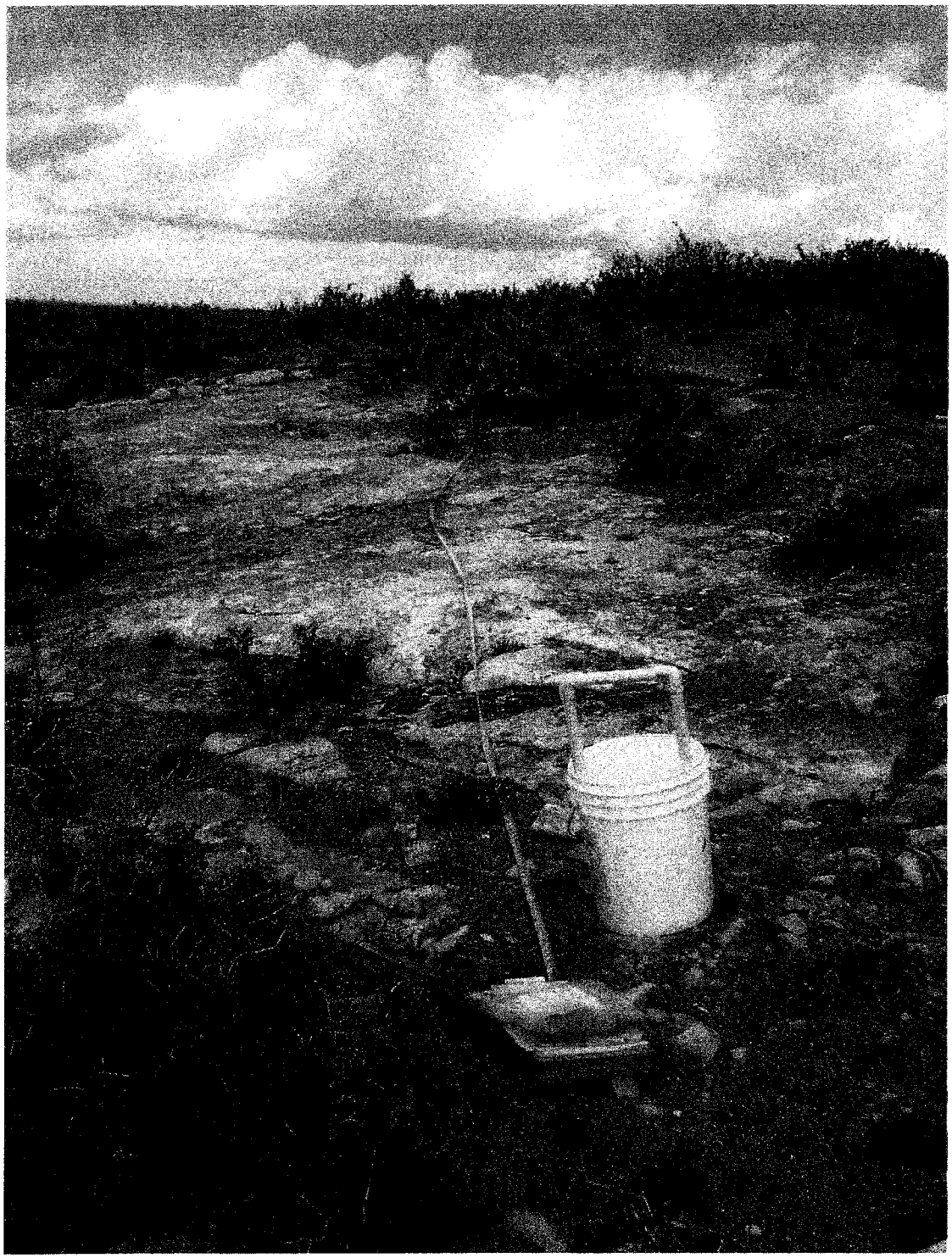

Figure 11, Photo 8040. Vegetation Cover Study Site 64A, 1st attempt. Site (shown) fell on a limestone rock outcrop. According to study methods, 2nd attempt was satisfactory for a MM veg. type sample. Photo shows an example of an RF inclusion in the MM veg. type west of proposed Pit #1. 21 July 2009.

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Figure 12, Photo 8065. Vegetation Cover Study Site 131, 1st attempt. Site (shown) was MM vegetation at edge between MM & MS stands. 2nd attempt nearby following method worked as a satisfactory MS site to sample. Photo is an example of MM veg. type in location of proposed Pit #3, south of open A5 Pit #6. 27 July 2009.

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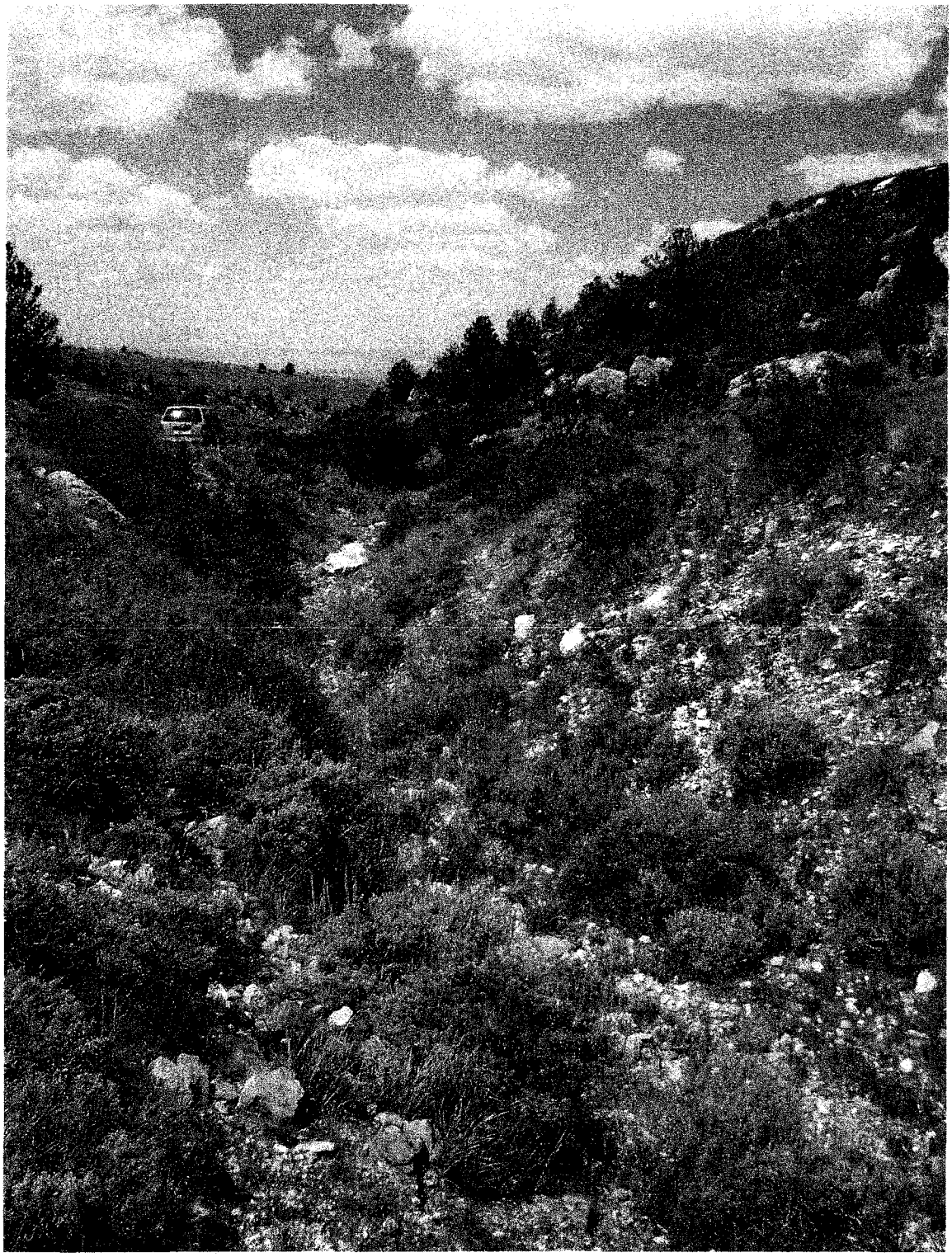

Figure 13, Photo 8262. Plant Species of Concern. Site of documented *Phacelia alba* (Boraginaceae) occurrence in Government Gully, looking westward down the canyon. Note the beetle-infested discolored tree in the background. 12 Aug. 2009.

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Figure 14, Photo 8257. Plant Species of Concern. Site of documented *Phacelia alba* (Boraginaceae) occurrence in Government Gully, looking eastward up the canyon. Location between proposed Pits #6 and #7A. 12 Aug. 2009.

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Figure 15, Photo 9266. Foreground: beginning of Tree Site 1 transect and example of MSH vegetation type at proposed Pit #9C. Background: unreclaimed DOT limestone quarry, an example of the DL (Disturbed Land) cover type. Background at skyline: MSH-C veg. type on edge of Medicine Bow National Forest. 22 Oct 2009.

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Figure 16, Photo 9267. Beginning of Tree Site 1 transect as in previous figure, Fig. 15, Photo 9266. Example of MSH (left) and MSH-C (right) veg. types. At proposed Pit #9C. 22 Oct. 2009.

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Figure 17, Photo 9268. Beginning of Tree Site 2 transect. More-densely-wooded part of a MSH map polygon, showing mountain big sagebrush in the foreground. Location: proposed Pit #9C. 22 Oct. 2009.

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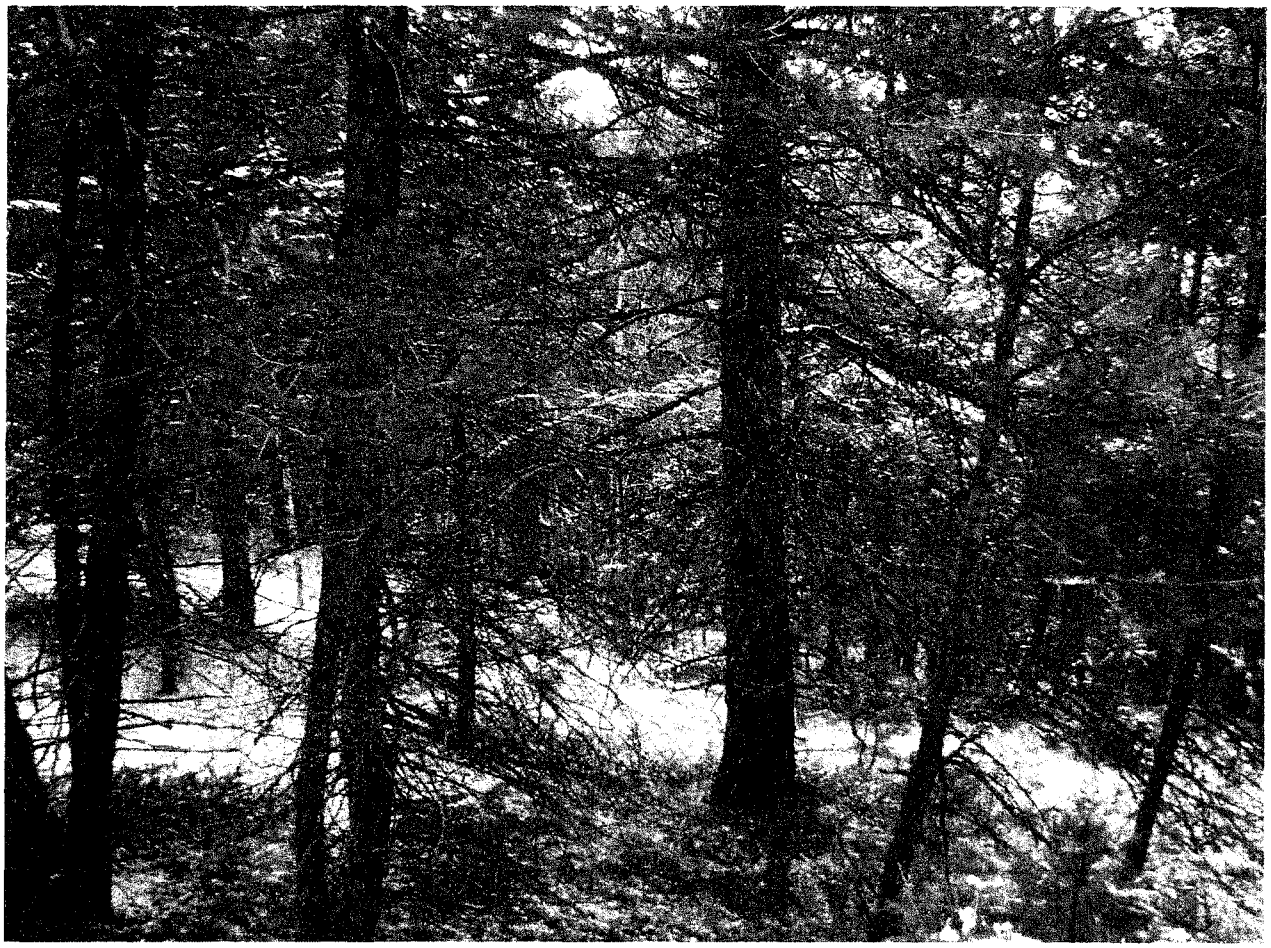

Figure 18, Photo 9271. Middle of Tree Site 3 transect. NE corner of proposed Pit #9B. Showing an example of the MXC veg. type. 22 Oct. 2009.

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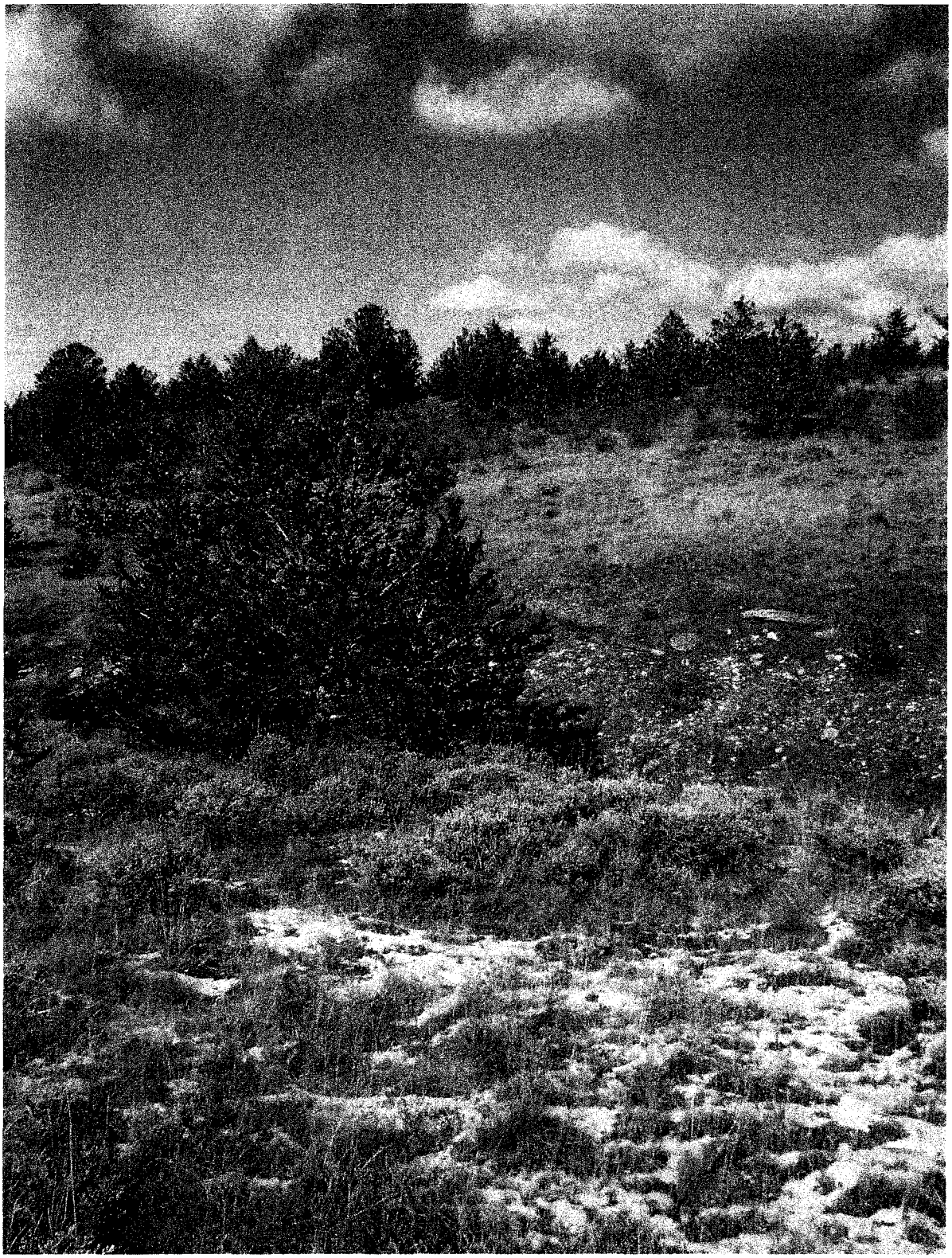

Figure 19, Photo 9276. Tree Site 4 transect. Looking northwest-ward from end of transect toward beginning of transect. Example of MSH-C veg. type at proposed Pit #5D. 23 Oct. 2009.

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Figure 20, Photo 9277. Tree Site 5 transect. Looking eastward along the transect. Example of MSH-C veg. type including a small quaking aspen (*Populus tremuloides*) stand. Location: at proposed Pit #5D. 23 Oct. 2009.

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Figure 21, Photo 9282. Tree Site 6 transect. Looking westward in direction of transect. An example of a more-heavily-wooded area of an MM-C veg. map polygon. Location: proposed Pit #5D. 23 Oct. 2009.

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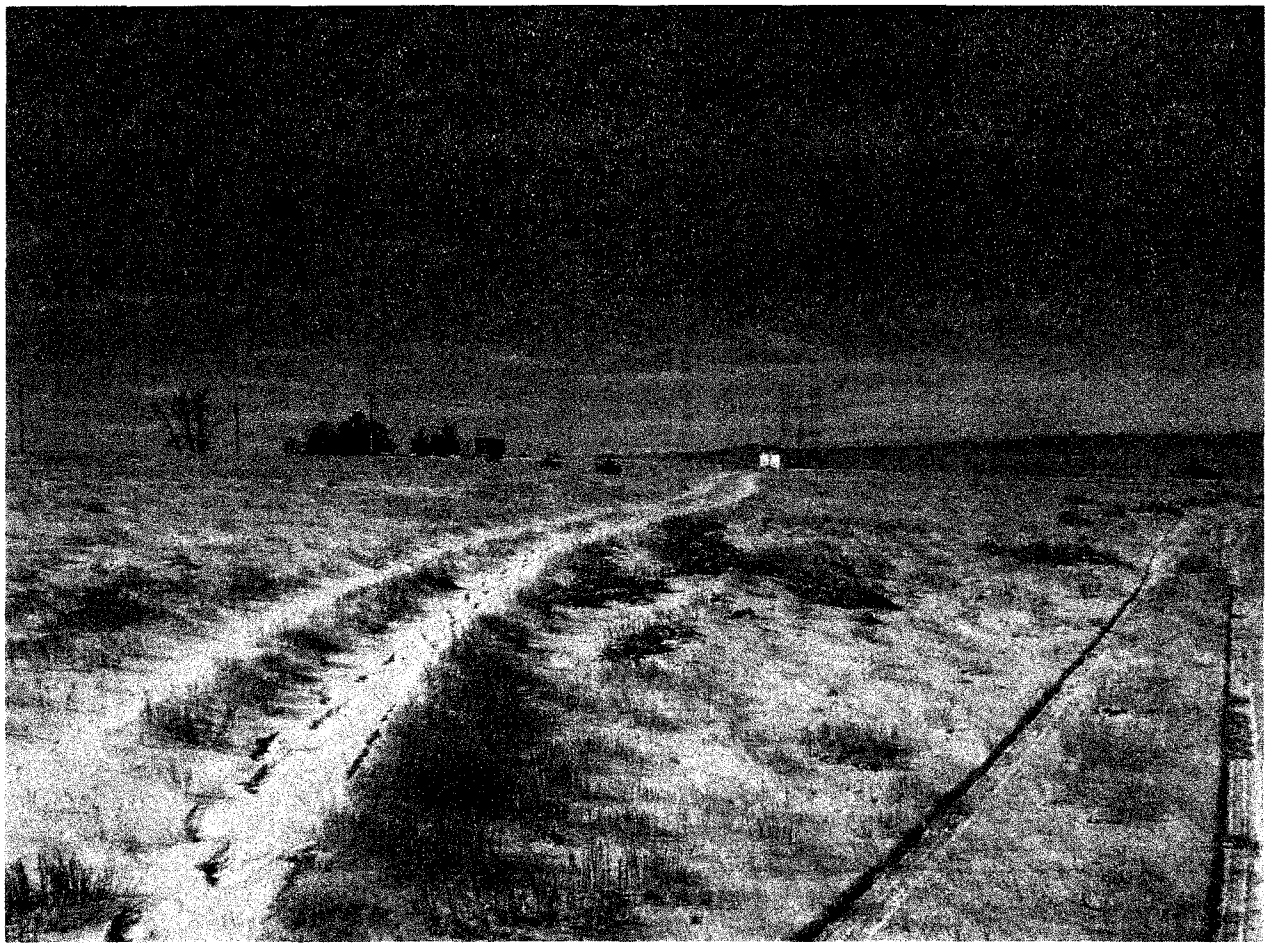

Figure 22, Photo 9308. Tree Site GPS3 at eastern end of proposed Pit #10B. Looking southwest-ward toward western end of tree data collection site. Laramie Plains Antenna & TVAssociation facilities at center. Example of MSH veg. type on ridgetop, and MSH-C veg. type at ridge crest. 26 Oct. 2009.

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Figure 23, Photo 9306. Tree Site GPS3 at eastern end of proposed Pit #10B. Looking southward along proposed permit boundary/ National Forest fence at east end of tree data collection site. Site begins on the ridgetop near the ridgeline and extends southward down the hill beyond. 26 Oct. 2009.

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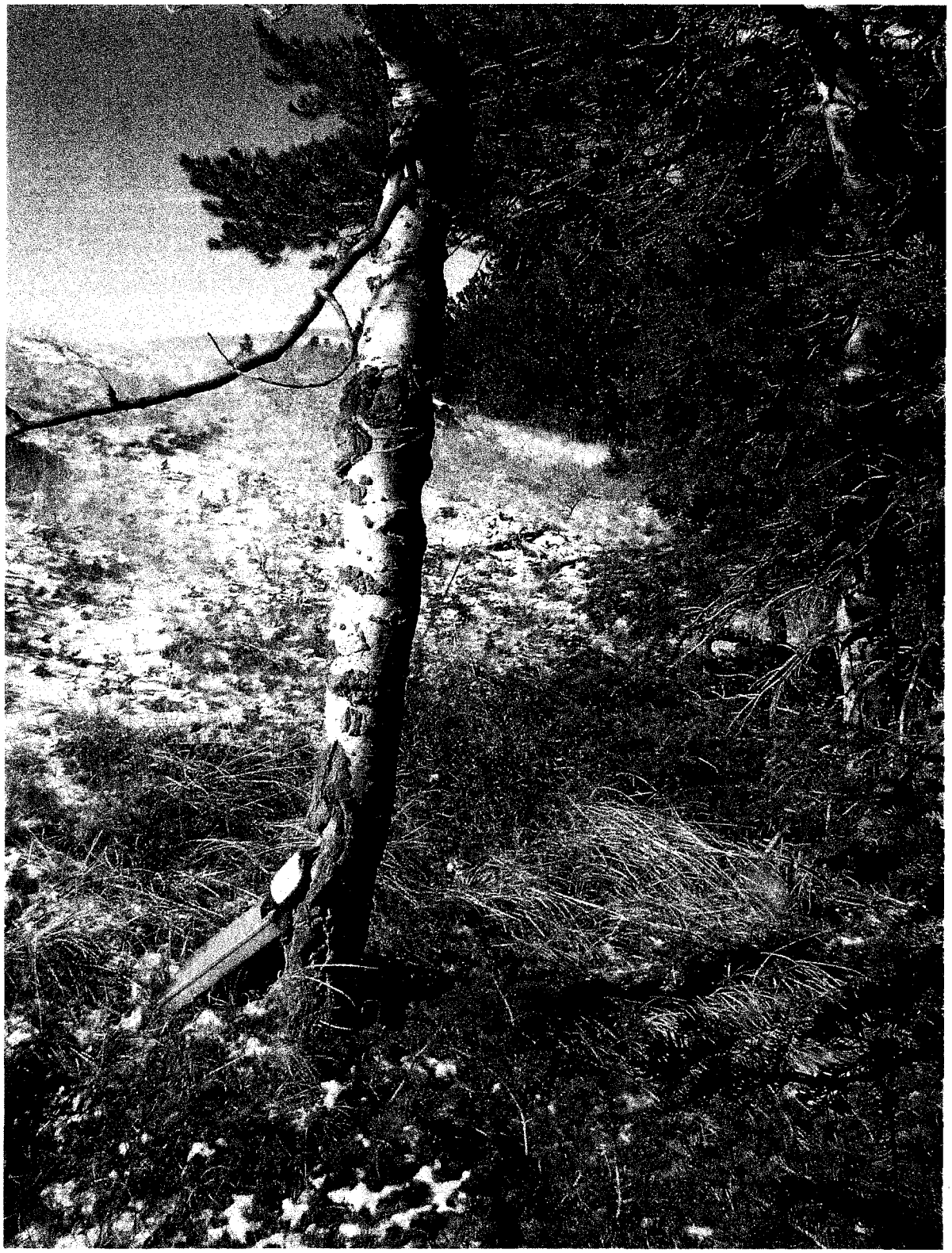

Figure 24, Photo 9309. Tree Sites 7 & 8, beginning of transects. Looking westward along Tree Site 7 transect. Example of MSH veg. type on the left and MXC veg. type on the right. Location: proposed Pit #10B. 26 Oct 2009.

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Figure 25, Photo 9314. Tree Sites 7 & 8, beginning of transects. Looking northward in the direction of Tree Site 8 transect. Example of MXC veg. type at proposed Pit #10B. 26 Oct 2009.

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Figure 26, Photo 9510. Upper left: example of RC (Reclaimed Land) Land Cover Type for Vegetation Map. (**Map DIX8-2**). Lower right: part of Tree Site #16 and Tree Site GPS9. Location: A5 Pit #7A. 9 Nov. 2009.

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ADDENDUM DIX8 C

Vegetation Cover Study Field Data Sheets

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Cont: 1/64

Veg. type (mark one): MS MM RF MSH MSC MXC

Date: 2009-07-09 Worker(s): Jeff Brasher & —

Legal (TRSQQ, etc.): 18 NW NW GPS (zero m): —

Other Location: W of dirt crossroads, S of I-80, N of reclaimed Piper Quarry

Pit Code (E9A etc.): — Position related to Pit (middle S side, W of Pit, etc.): —

EXREFA? (y/n) Transect Azimuth (degrees): 22° Site ID? 1 Sample ID 1

Lifeform	Sp	Q1 % Ab C	Q2 % Ab C	Q3 % Ab C	T Ab Cov	Av Ab C	% Rel C
P Grass	ELSM	2			2	0.7	1.9
	HESCOM		15		15	5	13.6
	PSE spi			6	6	2	5.4
Gram'oid	Carex – sterile	2	3	1	6	2	5.4
P Forb	PHho	1	<1	7	8.5	~~1.8~~ 2.8	~~4.9~~ 7.6
	COMumb	1	1		2	0.7	1.9
	Packera? sterile rosette	2	1	<1	3.5	1.2	3.3
	yellow S-merate	1	33		34	11.3	30.7
	HET vil	0.5	2		2.5	0.8	2.2
	(CRY) Eremogone hookeri	0.5			0.5	0.2	0.5
	Erigeron nematophyllus		1		1	0.3	0.8
	Cushion Astragalus (sterile)		2	2	4	1.3	3.5
	ERIOG collect (E. alatum)		1	10	11	3.7	10.1
	(PL ma) PHho			3	3	1	2.7
Subshrub	GUSq	2	–	0.5	2.5	0.8	2.2
Succ		–					
Shrub	ART nov	0.5		6	6.5	2.2	6
Tree		–					
A Grass		–					
A Forb	Allyssum desertorum	0.5			0.5	0.2	0.5
Non-vasc		0.5	<1	4	5	1.7	4.6
Litter		0.5	<1	1	2	0.7	
Rock		25	33	40	98	32.7	
B Grd		30	10	2	42	14	
T Per C		13	60	37	110	36.7	99.7
T Veg C		13.5	60	37	110.5	36.8	100
T Gr'd C		39	93.5	78	210.5	70.2	

Keep indet.

CRY Jaronychia sessi

AST spa

Collected near site: Draba oligosperma, Lesquerella alpina var. alpina, Poa secunda

100 / Avg N = 2.7

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Veg. type (mark one): MS MM RF MSH MSC MXC

Date: 2009-07- 09 Worker(s): Jeff Brasher & –

Legal (TRSQQ, etc.): S18 NW SE NW GPS (zero m): –

Other Location: Bottom of Fiber optic Rd S of I-80

Pit Code (E9A etc.): – Position related to Pit (middle S side, W of Pit, etc.): –

EXREFA? (Y/n) Transect Azimuth (degrees): 55 Site ID? 2 Sample ID 2

Lifeform	Sp	Q1 % Ab C	Q2 % Ab C	Q3 % Ab C	T Ab Cov	Av Ab C	% Rel C
P Grass	1 grass green bunch	10	–		10	3.3	4.0
	2 (KOma)	6			6	2	2.4
	3 blue-green (HFco)	10	20		30	10	12.2
	Elymus sim		15	45	60	20	24.3
	~~HFspt~~ → ELsp			40	40	13.3	16.2
				(T 95)			
Gram'oid							
P Forb	SEOlan		3		3	1	1.2
	PHho		5		5	1.7	2.1
	TOVeGR			1	1	0.3	0.1
Subshrub	ARFR	10	10	25	45	15	18.2
	GVSG	10	25		35	11.7	14.2
Succ							
Shrub	CHRvis	2			2	0.7	0.9
Tree							
A Grass							
A Forb	ALde		5	4	9	3	3.6
Non-vasc				<1	0.5	0.2	0.2
Litter		3	10	8	21	7	
Rock		10	4	–	14	4.7	
B Grd		6	5	1	12	4	
T Per C		48	78	111.5	237.5	79.2	96.4
T Veg C		48	83	115.5	246.5	82.2 *	100
T Grd C		61	97	123.5	281.5	93.8	

Note: Eriogonum alatum + Eriogeron DK nematophyllus ok + Penstemon laric. var. exilis + Paronychia sessiliflora ok + Eremogone hookeri + LESQ alp AIP ok + SAN-COM

MCC Permit 298C-A8 Baseline Veg Sampling Field Form

TEN 5 1/110
RECD MAR 15 2010

Veg. type (mark one): (MS) MM RF MSH MSC MXC

Date: 2009-07-09 Worker(s): Jeff Brasher & –

Legal (TRSQQ, etc.): 18 CN GPS (zero m): –

Other Location: S of I-80 SE of Buck Sullivan Rd overpass

Pit Code (E9A etc.): – Position related to Pit (middle S side, W of Pit, etc.): –

EXREFA? (y/n) Transect Azimuth (degrees): 3° (three) Site ID? 3 Sample ID 3

Lifeform	Sp	Q1 % Ab C	Q2 % Ab C	Q3 % Ab C	T Ab Cov	Av Ab C	% Rel C
P Grass	ELYM junceus	7			7	2.3	5.1
	1 HECO		9		9	3	6.7
	2 POSE			10	10	3.3	7.4
	3 ELSM			35	35	11.7	26.1
Gram'oid							
P Forb	Eriogonum alatum	3	30		33	11	24.6
	PHHO	4			4	1.3	2.9
	Erigeron nematophyllus	1		8	9	3	6.7
	ALFE	3	3	1	7	2.3	5.1
	LESQ alpi Alpi	1			1	0.3	0.7
Keep where	rosette	0.5			0.5	0.2	0.4
	SEDlan		<1	1	1.5	0.5	0.2
	PUSARIA			3	3	1	2.2
Subshrub	GUSA			1	1	0.3	0.7
Succ							
Shrub	CHRVIS		4		4	1.3	2.9
Tree							
A Grass							
A Forb	ALde		<1		0.5	0.2	0.4
Non-vasc		2	4	3	9	3	6.7
Litter		1	2	7	10	3.3	
Rock		20	30	6	56	18.7	
B Grd		20	50	25	95	31.7	
T Per C		21.5	50.5	62	134	44.7	
T Veg C		21.5	51	62	134.5	44.8	100
T Gr'd C		41.5	81	75	197.5	65.8	

Phlox hoodii collected at or near this site.

+31.7 100

97.5 Abs veg = 2.232

MCC Permit 298C-A8 Baseline Veg Sampling Field Form

TFN 5 1/110
RECD MAR 15, 2011

Veg. type (mark one): MS (MM) RF MSH MSC MXC

Date: 2009-07- 09 Worker(s): Jeff Brasher & –

Legal (TRSQQ, etc.): 18 C SE NE GPS (zero m): –

Other Location: Stone's throw from I-80, 2 stones throws from I-80 (S of)

Pit Code (E9A etc.): – Position related to Pit (middle S side, W of Pit, etc.): –

EXREFA? (y/n) Transect Azimuth (degrees): 27 Site ID? 4 Sample ID 4

Lifeform	Sp	Q1 % Ab C	Q2 % Ab C	Q3 % Ab C	T Ab Cov	Av Ab C	% Rel C
P Grass	F → ELsm	9.5	55		64.5	21.5	41.4
	~~Hra fi?~~ → MUri			4	4.1	1.3	2.5
Gram'oid							
P Forb	S-merous yellow cushion	9			9	3	5.7
	Erigeron nematophyllus	83	76		70	3.3	–
	TETaca	3			3	1	1.9
	(BRA)	3			3	1	1.9
	~~rosette 1~~	~~1~~	~~1~~		~~2~~	~~0.7~~	~~1.3~~
	PHho		4		4	1.3	2.5
	rosette 2		1		1	0.3	0.6
	SEDlon						
	~~Hyserfor~~ → LESQmon		1		1	0.3	0.6
	ALfe		1		1	0.3	0.6
Subshrub	GUsa	5	10	~~<1~~ 0.5	15.5	5.2	10
Succ							
Shrub							
Tree							
A Grass							
A Forb	ALde		0.5	0.5	1	0.3	0.6
Non-vasc		20	9	10	39	13	25
Litter		3	5	0.5	8.5	2.8	
Rock		25	5	70	100	33.3	
B Grd		15	9	13	37	12.3	
T Per C		52	88	14.5	154.5	51.6	99.4
T Veg C		52	88.5	15	155.5	51.9	100
T Grd C		80	98.5	85.5	264	88	

near transect: omarie

forbs, phlox sess.

leaf rosette

perennial

+15 / 95 <100 OK

+9 / 107.5 >100 OK

+13 / 98.5 <100 OK

Sum Abs Categ. = 50.9

MCC Permit 298C-A8 Baseline Veg Sampling Field Form

TFN 5 1/110
RECD MAR 15, 2011

Veg. type (mark one)	(MS)	MM	RF	MSH	MSC	MXC	
Date: 2009-07- 09	Worker(s): Jeff Brasher &						
Legal (TRSQQ, etc.):	18 N E SE	GPS (zero m):	–				
Other Location:	Tributary of Gout. Gully N of main channel						
Pit Code (E9A etc.): N of 6	Position related to Pit (middle S side, W of Pit, etc.):	N of N Boomerang					
EXREFA? (Y/n)	Transect Azimuth (degrees): 34	Site ID? 5	Sample ID 5				

Lifeform	Sp	Q1 % Ab C	Q2 % Ab C	Q3 % Ab C	T Ab Cov	Av Ab C	% Rel C
P Grass	KOma	10				3.3	
	Poa X sec.	30		25		18.3	
	Elymus sm	8	30			12.7	
	1 MUri	5				1.7	
	2. Ella		20			6.7	
	HEScom			10		3.3	
		~~(50)~~	(50)				
P Gram'oid							
	HETvil			3		1	
P Forb	ACHmil	4	6	3		4.3	
	SEDlan	1	6			2.3	
	~~PHYSARIA?~~ 1 ESQmont	1	1			0.7	
	Packera? rosette	1		4		1.7	
	(CRY) 1-CERAarve	1				0.3	
	1 opp lvs	<1	3	3		2.7	
	(CRY 2) Minuartia rubella	1		2		1	
HEDdru ←	~~(LAM) Scutellaria?~~		6	4		3.3	
	2 pointed lvs			<1		0.2	
	3 tiny - Paronychia ses.			<1		0.2	
Subshrub							
Succ							
Shrub	CHRvis	3				1	
Tree							
A Grass							
A Forb	Silene?	1				0.3	
Non-vasc		5	7	<1			
Litter		10	10	5			
Rock		20	29	10			
B Grd		15	2	8.5			
T Per C							
T Veg C							
T Gr'd C							

keep indet.

TFN 5 1/110
MAR 15, 2011

Veg. type (mark one): MS	MM	RF	MSH	MSC	MXC		
Date: 2009-07- 09	Worker(s): Jeff Brasher &						
Legal (TRSQQ, etc.): 17SESW	GPS (zero m):						
Other Location: Hill to N above Waters of US, Gant. Gully						Hand N Beaver	
Pit Code (E9A etc.): –	Position related to Pit (middle S side, W of Pit, etc.): Between 7A+6						
EXREFA? (y/n)	Transect Azimuth (degrees): 51	Site ID? 6	Sample ID –	Map inaccurate			
			Excluded site		1st Trip: 5		

– this is MSC w/n 40 co MM

Pic 5 7938 – 7945

Lifeform	Sp	Q1 % Ab C	Q2 % Ab C	Q3 % Ab C	T Ab Cov	Av Ab C	% Rel C
P Grass							
Gram'oid							
P Forb							
Subshrub							
Succ							
Shrub							
Tree							
A Grass							
A Forb							
Non-vasc							
Litter							
Rock							
B Grd							
T Per C							
T Veg C							
T Gr'd C							

TEN 5 1/110
RECD MAR 15, 2011

Veg. type (mark one): MS	MM	RF	MSH	MSC	MXC		
Date: 2009-07- 09 Worker(s): Jeff Brasher &							
Legal (TRSQQ, etc.): 23 NW GPS (zero m):							
Other Location: Govt Gully E of Windmill/Trough							
Pit Code (E9A etc.): S of 9A Position related to Pit (middle S side, W of Pit, etc.): W of 9A (The Pitchfork)							
EXREFA? (y/n) Transect Azimuth (degrees): mosquitos Site ID? 7 Sample ID 6							
						□	
Lifeform	Sp	Q1 % Ab C	Q2 % Ab C	Q3 % Ab C	T Ab Cov	Av Ab C	% Rel C
P Grass	Elymus sm.		30	30		20	
Gram'oid							
P Forb	Erigeron nematophyllus		1			0.3	
	Viola (sterile)		6			2	
	AL te			1		0.3	
Subshrub							
Succ							
Shrub	CEme	100	8			36	
	Ribes cereum	30				10	
Tree	PIFI	20				6.7	
A Grass							
A Forb	Ade			1		0.3	
	~~(BRA)~~ HILall			11		3.7	
Non-vasc		–	10	1		3.7	
Litter		–	–	5		1.7	
Rock		100	90	40		76.7	
B Grd		–	–	34		11.3	
T Per C							
T Veg C							
T Grd C							

At or near (geographically or numerically) this site collected Tetraneuris acaulis var. acaulis + Erigeron nematophyllus + LESQ alpi ALPI + MUHrichardsonis

MCC Permit 298C-A8 Baseline Veg Sampling Field Form

TFN 5 1/110
JD MAR 15, 2011

Veg. type (mark one): MS	(MM)	RF	MSH	MSC	MXC		
Date: 2009-07-09	Worker(s): Jeff Brasher &		—				
Legal (TRSQQ, etc.):	17 C SW GPS (zero m):						
Other Location: Elbow of N Boomerang, Gort. Gully							
Pit Code (E9A etc.): 5 of 6	Position related to Pit (middle S side, W of Pit, etc.):						
EXREFA? (y/n)	Transect Azimuth (degrees): 45		Site ID? 8	Sample ID 7			

Lifeform	Sp	Q1 % Ab C	Q2 % Ab C	Q3 % Ab C	T Ab Cov	Av Ab C	% Rel C
P Grass	bluebush	5		5		3.3	
	HESCOM	1	10			3.7	
	OKY hym			30		10	
Gram'oid							
P Forb	ALte	6				2	
	Cirsium neriie		30			10.3	
Subshrub	ARtr	6	20	20		15.3	
Succ	OPpo	30		10		13.3	
Shrub	CEMO	20				6.7	
Tree							
A Grass							
A Forb	(BRA) same as previous site (ALLall)		20	25		15	
Non-vasc		—	—	—			
Litter		15	5	20		13.3	
Rock		20	30	30		26.7	
B Grd		10	10	5		8.3	
T Per C							
T Veg C							
T Gr'd C							

TFN 5 1/110
RECD MAR 15, 2011

Veg. type (mark one): MS	MM	RF	MSH	MSC	MXC		
Date: 2009-07-09	Worker(s): Jeff Brasher &						
Legal (TRSQQ, etc.): 19 C of Nedge	GPS (zero m):						
Other Location: 19 C of Nedge							
Pit Code (E9A etc.): 7A	Position related to Pit (middle S side, W of Pit, etc.): fork of deformed finger						
EXREFA? (y/n) y	Transect Azimuth (degrees): 9	Site ID? 9	Sample ID 8				

Lifeform	Sp	Q1 % Ab C	Q2 % Ab C	Q3 % Ab C	T Ab Cov	Av Ab C	% Rel C
P Grass	Elymus sm.	25	10	30		21.7	
Gram'oid	Carex sterile	5	20	15		13.3	
P Forb	Astragalus	10		10		6.7	
	Antennaria nic.	1	15			5.3	
	rosette 1	1				0.3	
	PHLO	1	7	10		6.3	
	Eriogonum indet.	2				6.7	
	rosette 2		1			0.3	
Subshrub							
Succ							
Shrub	ARTNOV	25	10	20		18.3	
Tree							
A Grass							
A Forb							
Non-vasc		15	3	1	19	6.3	
Litter		5	10	12	27	9	
Rock		–	–	–	–	–	
B Grd		15	40	10	65	21.7	
T Per C							
T Veg C							
T Gr'd C							

TFN 5 1/110
DGD MAR 15, 2011

Veg. type (mark one): MS	MM	RF	MSH	MSC	MXC		
Date: 2009-07- 04	Worker(s): Jeff Brasher &						
Legal (TRSQQ, etc.): 18 SW SE	GPS (zero m):						
Other Location:							
Pit Code (E9A etc.): 7A	Position related to Pit (middle S side, W of Pit, etc.): West, Fork of Deformed Fringe.						
EXREFA? (y/n) y	Transect Azimuth (degrees): 30	Site ID? D	Sample ID 9				

Lifeform	Sp	Q1 % Ab C	Q2 % Ab C	Q3 % Ab C	T Ab Cov	Av Ab C	% Rel C
P Grass	(POA) MUHric	10	4				
	Hvelaunch		9				
Gram'oid							
P Forb	PHLO	1	2	6			
	Erigeron	1		1			
	Al fe	–	3				
	SEDlan		2				
	PHYSARIA		1				
	5-merous yellow (Paronychia)		1	2			
	rosette 1			<1			
Eram forb	Arenaria sterile			5			
	(AST)			<1			
	rosette 2			<1			
Subshrub							
Succ							
Shrub							
Tree							
A Grass							
A Forb	(BRH) → Linum puberulum	1					
	Draba & nemorosa	<1					
	ALae		1	2			
Non-vasc		–	–	–			
Litter		<1	1	<1			
Rock		10	4	5			
B Grd		75	50	70			
T Per C							
T Veg C							
T Gr'd C							

TFN 5 1/110
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Veg. type (mark one): MS MM (RF) MSH MSC MXC

Date: 2009-07-10 Worker(s): Jeff Brasher &

Legal (TRSQQ, etc.): 18 NESE GPS (zero m): -

Other Location: North Boomerang

Pit Code (E9A etc.): 6 Position related to Pit (middle S side, W of Pit, etc.): Near N edge

EXREFA? (y/n) n Transect Azimuth (degrees): ~~53~~ 16 Site ID? 11 Sample ID 10

1st transec is an ecotone transitioning betw Pic 7958 taken

Rockflat, MM + MS

Substitute: 40×6 = 240° + 0pN + 1p W + 24° - RF Δ to MS. Pic 7959,

Lifeform	Sp	Q1 % Ab C	Q2 % Ab C	Q3 % Ab C	T Ab Cov	Av Ab C	% Rel C
P Grass	Elymus sp.	5	15				
	1 - MURI	2	10				
	~~OPY~~ Thym → ACHthym		20				
Gram'oid							
P Forb	Erigeron	2					
	(CRY) CERAarve	2					
	SEDlan	1	10				
	2 - ~~Physaria~~ → LESalpALP		<1			0.2	
	Veronica?		3				
Subshrub	CHRvis		20				
Succ							
Shrub	ARno	12					
Tree							
A Grass							
A Forb	MALatr	10					
	ALde	<1	10				
				no pts			
Non-vasc		10	1	1			
Litter		1	15	<1			
Rock		25	-	40			
B Grd		50	5	56			
T Per C							
T Veg C							
T Gr'd C							

3rd Try: 3 5/6 sec × 6 = 22 1/6° + 33p + Azimuth 6° - worked.

TFN 5 1/110
RECD MAR 15, 2011

Veg. type (mark one): MS (MM) RF MSH MSC MXC

Date: 2009-07-10 Worker(s): Jeff Brasher &

Legal (TRSQQ, etc.): 18 NWSE GPS (zero m):

Other Location: N. Boomerang

Pit Code (E9A etc.): 6 Position related to Pit (middle S side, W of Pit, etc.): Near W edge toward W

EXREFA? (y/n) Transect Azimuth (degrees): 174° Site ID? 12 Sample ID 11

Lifeform	Sp	Q1 % Ab C	Q2 % Ab C	Q3 % Ab C	T Ab Cov	Av Ab C	% Rel C
P Grass	ELSmu Elymus - broad lvs	4	3	2			
	POA? → MUFI	16					
	HESCOM	30					
	ELla ← Elymus - narrow lvs (ELla)		5	50			
	1 ELSP		6				
		(60)					
Gram'oid							
P Forb	(CPM) Cerastium arvense	2					
	ALte	2		1			
	SEDlan	1					
	Physaria?	<1					
	PARDdeer			<1			
Subshrub	~~CHRVIS~~		~~11~~	~~2~~			
Succ	OPpo		<1				
Shrub	ARnd		2				
	CHVI		11	2			
Tree							
A Grass							
A Forb	ALAR		<1				
	LAPOCC		<1				
	CHENOPODIUM - sterile		<1				
Non-vasc		4	1	3			
Litter		2	2	1			
Rock		10	20	<1			
B Grd		30	60	30			
T Per C							
T Veg C							
T Grd C							

Collected immature specimen at or near here: c.f. Dieteria canescens.

TFN 5 1/110
RECD MAR 15, 2011

Veg. type (mark one): MS MM (RF) MSH MSC MXC

Date: 2009-07- 11 Worker(s): Jeff Brasher &

Legal (TRSQQ, etc.): Sect 33 NWSWGPS (zero m):

Other Location: The muffler

Pit Code (E9A etc.): 50 Position related to Pit (middle S side, W of Pit, etc.): Near N edge near sect line

EXREFA? (y/n) Transect Azimuth (degrees): 42 Site ID? 13 Sample ID 12

Lifeform	Sp	Q1 % Ab C	Q2 % Ab C	Q3 % Ab C	T Ab Cov	Av Ab C	% Rel C
P Grass	Poa sp bluegrass POSE	3	6	5			
	Elymus bluegrass ELSP			25			
Gram'oid							
P Forb	Allium cernuum	2		4			
	~~Cymopterus~~ MUSI diva	2	1			1	
	SEDlan		1	2			
	~~Astragalus~~ TRIFdasy			5			
Subshrub							
Succ							
Shrub							
Tree							
A Grass							
A Forb	ALLE	1					
Non-vasc		5	10	9			
Litter		12	<1	1			
Rock		80	90	10			
B Grd		–	–	20			
T Per C							
T Veg C							
T Gr'd C							

TFN 5 1/110
RECD MAR 15, 2011

Veg. type (mark one): MS MM (RF) MSH MSC MXC

Date: 2009-07- 11 Worker(s): Jeff Brasher &

Legal (TRSQQ, etc.): S 32 NE SE GPS (zero m):

Other Location: The Muffler

Pit Code (E9A etc.): 50 Position related to Pit (middle S side, W of Pit, etc.): Near N edge of sect line

EXREFA? (y/n) Transect Azimuth (degrees): 42 Site ID? 14 Sample ID 13

Lifeform	Sp	Q1 % Ab C	Q2 % Ab C	Q3 % Ab C	T Ab Cov	Av Ab C	% Rel C
MUT ← P Grass	Poa? as previous site	~~20~~ 10	~~50~~ 25	~~3~~ 1.5			
	Elspic	55	1	20			
	Poa fendl.	10	25	1.5			
Gram'oid							
P Forb	Allium cernuum	<1	1				
	- same as prev						
	SEOlan		1				
Paronychia →	Yellow Smerous		<1				
MUSIdiva ←	~~Gymnopteris~~ as prev.		2			0.7	
	Erigeron hemat.			10			
	Ranunculus			2			
Subshrub							
Succ							
Shrub							
Tree							
A Grass							
A Forb	ALde	<1		<1			
	LAPace			<1			
Non-vasc		20	10	3			
Litter		<1	1	4			
Rock		40	40	20			
B Grd		20	10	30			
T Per C							
T Veg C							
T Gr'd C							

TFN 5 1/110
RECD MAR 15 2011

Veg. type (mark one): MS (MM) RF MSH MSC MXC

Date: 2009-07- 11 Worker(s): Jeff Brasher &

Legal (TRSQQ, etc.): 32 C SE GPS (zero m):

Other Location: Muffler, main body, near its S edge

Pit Code (E9A etc.): 5D Position related to Pit (middle S side, W of Pit, etc.):

EXREFA? (y/n) Transect Azimuth (degrees): 270 Site ID? 15 Sample ID 14

Lifeform	Sp	Q1 % Ab C	Q2 % Ab C	Q3 % Ab C	T Ab Cov	Av Ab C	% Rel C
P Grass	Elymus Sm.	40	42	15			
Gram'oid							
P Forb	Erigeron nervor.	4					
	SEDlan	1		9			
	~~Silene~~ → Cerastium arvense	20		20			
alatum ← Eriogonum	sterile rosette (big)	10	1	6			
	PHLho	4	1	1			
keep as indet.	sterile in bud fam. indet.	1		1			
ALLcer →	ALLIUM as previ.	1		3			
	~~sterile rosette 2 (fam)~~						
	~~Orthocarpus luteus~~		~~1~~	~~5~~			
MUSlin ←	Cymopteris fas earlier	1	1				
Subshrub	Castilleja ana.			4			
Mertensia hum.	sterile cauline			<1			
Succ							
Shrub	ARtripRu		5				
Tree							
A Grass							
A Forb	Orthocarpus luteus			5			
Non-vasc		5	1	5			
Litter		7	10	15			
Rock		25	1	45			
B Grd		21	15	10			
T Per C							
T Veg C							
T Gr'd C							

TFN 5 1/110
RECD MAR 15, 2011

Veg. type (mark one): MS	MM	RF	MSH	MSC	MXC		
Date: 2009-07- 11	Worker(s): Jeff Brasher &						
Legal (TRSQQ, etc.): 33 SW	GPS (zero m):						
Other Location: Gilmore Gulch							
Pit Code (E9A etc.): 50	Position related to Pit (middle S side, W of Pit, etc.): S of 50						
EXREFA? (y/n)	Transect Azimuth (degrees): 38	Site ID? 16	Sample ID 15				
	mosquitos						
Lifeform	Sp	Q1 % Ab C	Q2 % Ab C	Q3 % Ab C	T Ab Cov	Av Ab C	% Rel C
P Grass	FLSim	30	20	0			
	HESCOM			25			
Gram'oid							
P Forb	Eriogonum ochroleucus	1				0.3	
	sterile rosette		1				
	PHHO		1				
105mollOCCI ← ← BOR	sterile cauline		1				
	" rosette	1				0.3	
	LIle			2			
BOR-MER TUIT ←	cauline in bud			10			
	Viola ?- sterile V. nuttallii			4			
lackera fendl ←	~~Phacelia - not P. alba - sterile~~			1			
	PLYSARTH			1			
Subshrub	PHHO			2			
Succ							
Shrub	CEmo	90	85	16			
	ARtrPA		1				
Tree							
A Grass							
A Forb	AL (big weedy alien)	15	5	5			
	(Alyssum alyssoides)						
Non-vasc		3	1	1			
Litter		1	4	20			
Rock		5	10	10			
B Grd		1	4	1			
T Per C							
T Veg C							
T Gr'd C							

TFN 5 1/110
RECD MAR 15, 2011

Veg. type (mark one): (MS) MM RF MSH MSC MXC

Date: 2009-07-11 Worker(s): Jeff Brasher &

Legal (TRSQQ, etc.): S 31 SESE GPS (zero m): –

Other Location: The Tailpipe

Pit Code (E9A etc.): 5C Position related to Pit (middle S side, W of Pit, etc.): toward SE edge Pic.

EXREFA? (y/n) Transect Azimuth (degrees): ~~306~~ (354) Site ID? 17 Sample ID 16 . Point in 2-trade 79162.

2nd try, random dist + direction, 59x6 = 354° + 16 p. Substitute site fine.

Lifeform	Sp	Q1 % Ab C	Q2 % Ab C	Q3 % Ab C	T Ab Cov	Av Ab C	% Rel C
P Grass	ELSm	1	7	30			
	HESCom	40	12	75			
Gram'oid							
P Forb	HETvil	9	3	30			
	Lesquerella lud.	4	2	1			
Eriogonum	Eriogonum? asperv.		4				
	rosette ~~[illegible]~~			2			
	Townsendia hookeri						
Subshrub	ARFr	20					
Succ							
Shrub							
Tree							
A Grass							
A Forb	Chenopodium - sterile		<1				
Non-vasc		–	–	–			
Litter		4	2	10			
Rock		<1	1	–			
B Grd		30	40	30			
T Per C							
T Veg C							
T Gr'd C							

TFN 5 1/110
RECD MAR 15, 2011

Veg. type (mark one): (MS) MM RF MSH MSC MXC

Date: 2009-07- 11 Worker(s): Jeff Brasher &

Legal (TRSQQ, etc.): S 31 SE SE GPS (zero m):

Other Location: Tailpipe

Pit Code (E9A etc.): 5C Position related to Pit (middle S side, W of Pit, etc.): toward SE edge

EXREFA? (y/n) Transect Azimuth (degrees): 01 Site ID? 18 Sample ID 17

1st B site

Lifeform	Sp	Q1 % Ab C	Q2 % Ab C	Q3 % Ab C	T Ab Cov	Av Ab C	% Rel C
P Grass	HESCOM	15	20	35			
	ELSM	15	25	10			
Gram'oid							
P Forb	PHHO	30		32			
	S-merous yellow cushion	1					
	Mertensia humilis	<1		1			
	SEOlan			<1			
	~~rosette~~			~~+~~			
Subshrub							
Succ							
Shrub	ARNO	1	45				
Tree							
A Grass							
A Forb							
Non-vasc		10	5	30			
Litter		10	5	40			
Rock		10	2	5			
B Grd		5	1	–			
T Per C							
T Veg C							
T Gr'd C							

PASec ← Paronychia

TFN 5 1/110
RECD MAR 15, 2011

Veg. type (mark one): MS	(MM)	RF	MSH	MSC	MXC		
Date: 2009-07- 11	Worker(s): Jeff Brasher &						
Legal (TRSQQ, etc.): S 31 SW SE	GPS (zero m):						
Other Location: S of Tailpipe Exhaust							
Pit Code (E9A etc.): 3	Position related to Pit (middle S side, W of Pit, etc.): S of Pit						
EXREFA? (y/n)	Transect Azimuth (degrees): 90	Site ID? 19	Sample ID B				

Lifeform	Sp	Q1 % Ab C	Q2 % Ab C	Q3 % Ab C	T Ab Cov	Av Ab C	% Rel C
P Grass	ELSm	5	25	9			
	HEScom		5				
Gram'oid	Carex - sterile		25				
P Forb	Silene ? Cerastium arvense	5		5			
	S-merous yellow cushion		11				
	Eriogonum hemat.		4				
	~~Phyllariaria rosette~~		1				
	SEDlan			<1			
Subshrub	~~CHRvit~~	~~<1~~	~~40~~	~~15~~			
Succ							
Shrub	ARno	20					
	CEmo	60		75			
	CHvi	<1	40	15			
Tree							
A Grass							
A Forb	(BRA) CAMmic	<1	1				
Non-vasc		–	8	1			
Litter		20	50	35			
Rock		1	4	5			
B Grd		–	10	–			
T Per C							
T Veg C							
T Gr'd C							

Parryphlox sessilifloria

LESOmont

TFN 5 1/110
RECD MAR 15, 2011

~ Samples ~

	MS	MM	RF	MSH	MSC	MX
to mine	IIII	IIII				
EXREFA	IIII	III	III			

Veg. type (mark one): (MS) MM RF MSH MSC MXC						
Date: 2009-07- 11 Worker(s): Jeff Brasher &						
Legal (TRSQQ, etc.): S 31 SE NE GPS (zero m):						
Other Location: Tailpipe						
Pit Code (E9A etc.): SB Position related to Pit (middle S side, W of Pit, etc.): E of SB						
EXREFA? (y/n) Transect Azimuth (degrees): 354 Site ID? 20 Sample ID 19						

Lifeform	Sp	Q1 % Ab C	Q2 % Ab C	Q3 % Ab C	T Ab Cov	Av Ab C	% Rel C
P Grass	ELsm	6	8				
	Poa secunda	8					
	MUri	10	11	15			
Gram'oid							
P Forb	PAset numerous yellow cushion	16	10	<1			
	SEDlan	<1					
Tetraneuris herrayana	rosette	<1	1	2			
	PHhu		1				
MUSIdac	Cymopterus as before			<1			
LEmo	Lesquerella as bef			<1			
Subshrub	~~CHRvil~~	~~1~~	~~15~~				
Succ							
Shrub	CHvi	1	15				
Tree							
A Grass							
A Forb							
Non-vasc		5	–	–			
Litter		3	2	1			
Rock		25	8	8			
B Grd		60	40	55			
T Per C							
T Veg C							
T Grd C							

TFN 5 1/110
RECD MAR 15 2011

Veg. type (mark one): MS	MM	RF	MSH	MSC	MXC		
Date: 2009-07- 13	Worker(s): Jeff Brasher &						
Legal (TRSQQ, etc.):	S 20 ~~T40S~~ ~~N~~	GPS (zero m):	—				
Other Location: The Hand (Pdm)							
Pit Code (E9A etc.): 7A	Position related to Pit (middle S side, W of Pit, etc.): N of Pit						
EXREFA? (y/n) ?	Transect Azimuth (degrees): 270	Site ID? 21	Sample ID 20				
	~~unless waters of US? not sure of US~~						

Lifeform		Sp	Q1 % Ab C	Q2 % Ab C	Q3 % Ab C	T Ab Cov	Av Ab C	% Rel C
	P Grass	Elymus sm	100					
		grass 1 ELsp	20	6				
		grass 2 KOma		3	2			
		grass 3 HEco			8			
	Gram'oid	Carex ~~X~~ aurea	30					
		Pseudostellaria jamesiana			0.5			
		rosette 3			1			
	P Forb	Galium boreale	2	3				
		rosette 1 lus ovate	16	1	4			
		rosette 2 lus spatulat	2					
		TARoff	1	1				
	BEswy	ACHmil		4	3			
		~~ASTRmoll?~~ miser var. obl.		2	2			
		~~Polygonum~~		5				
	(ainn)	lesquerella?		1				
		~~Arab(s)~~ Boechera holboellii		2				
		Silene? CERAarve			0.5			
	Subshrub	FRIOGONUM ~~X~~ umbell.		10				
		BERTep	20					
	Succ							
	Shrub	~~BERTep~~	~~20~~					
		SYMPoreo ~~X~~ var. utah.		20	26			
		ARTtridPA		<1				
Tree		PSme			2			
	A Grass							
	A Forb	PLM ANOR ~~sept?~~ COLline		5	1			
		Polygonum aviculare?		5				
Non-vasc		moss	—	—	1			
Litter			10	50	66			
Rock			0	—	—			
B Grd			5	—	—			
T Per C								
T Veg C								
T Gr'd C								

Sawatchense

Collected in 1 bag for samples 20-23: ELsm, ELsp, BRTR, KOma

TFN 5 1/110
RECD MAR 15, 2011

Veg. type (mark one): MS MM RF MSH MSC (MXC)

Date: 2009-07- 13 Worker(s): Jeff Brasher &

Legal (TRSQQ, etc.): S 20 NW GPS (zero m):

Other Location: The Hand (Palm)

Pit Code (E9A etc.): 7A Position related to Pit (middle S side, W of Pit, etc.): N of Pit

EXREFA? (y/n) (unless "waters of US") Transect Azimuth (degrees): 120 Site ID? 22 Sample ID 21

Lifeform	Sp	Q1 % Ab C	Q2 % Ab C	Q3 % Ab C	T Ab Cov	Av Ab C	% Rel C
P Grass							
Gram'oid							
P Forb	~~caulinel - REMT COLLline~~			1			
	rosette 1 - Viola adunca			2			
	rosette 2 - Mertensia humilis			2			
Subshrub							
Succ							
Shrub							
Tree	PSEmen	100	100	100			
A Grass	BROMUS tectorum	10	*	–			
A Forb	ASTpro	45	40	60			
	Veronica peregr. var. xal	10	20	30			
	Descurainia sophia	1	–	1			
	Chenopodium	1	5	4			
	COLLline - caulinel			1			
Non-vasc		–	–	–			
Litter		70	50	20			
Rock		1	1	4			
B Grd		1	10	5			
T Per C							
T Veg C							
T Gr'd C							

TFN 5 1/110
RECD MAR 15, 2011

Veg. type (mark one): MS	MM	RF	MSH	MSC	MXC		
Date: 2009-07- 13	Worker(s): Jeff Brasher &						
Legal (TRSQQ, etc.): 20 NW	GPS (zero m):						
Other Location: Deformed Finger							
Pit Code (E9A etc.): 7A	Position related to Pit (middle S side, W of Pit, etc.): Base of Finger, N edge						
EXREFA? (y/n)	Transect Azimuth (degrees): 12	Site ID? 23	Sample ID 22				

Lifeform	Sp	Q1 % Ab C	Q2 % Ab C	Q3 % Ab C	T Ab Cov	Av Ab C	% Rel C
P Grass	HESCOM	90	100				
	grass 1	4		10			
	~~AGSM~~ → ELSM			5			
Gram'oid							
P Forb	~~Stonef~~ → CERARV	10	1	30			
	ARHUMI	1	2				
Subshrub							
Succ							
Shrub	ARTRX PA	35	10				
	CEMO		90				
Tree							
A Grass							
A Forb	Nade	1					
Non-vasc		<1	–	–			
Litter		90	–	10			
Rock		–	–	–			
B Grd		–	–	–			
T Per C							
T Veg C							
T Gr'd C							

Collected in 1 bag for samples 20-23: ELsp, FEid, BRte, KOma

TFN 5 1/110
RECD MAR 15, 2011

Veg. type (mark one): MS MM RF MSH MSC MXC

Date: 2009-07- 13 Worker(s): Jeff Brasher &

Legal (TRSQQ, etc.): S20 NW GPS (zero m):

Other Location: DP formed Finger, N edge

Pit Code (E9A etc.): 7A Position related to Pit (middle S side, W of Pit, etc.): N edge

EXREFA? (y/n) Transect Azimuth (degrees): 272 Site ID? 24 Sample ID 23

Lifeform	Sp	Q1 % Ab C	Q2 % Ab C	Q3 % Ab C	T Ab Cov	Av Ab C	% Rel C
P Grass	ELSm	70	6				
	grass 1 (KDma)		8				
	Elymus 2 (ELsp)			<1			
Gram'oid	Carex aurea	40					
P Forb	~~Silene?~~ → Cerastium arvense	10	4	1			
	SEDlan		1				
	PHHo		2				
	~~Orthocarpus tot.~~			1			
	~~Arabis~~ → Boechera drum.			3			
	TAof			10			
BESwyo? ←	rosette - ovate (see tag)			1			
	1st site						
	rosette 2 - ~~Leptosiphon~~			1			
	Boechera holboellii			<1			
Subshrub	ARCr		2				
Succ							
Shrub	ARtridPA	1					
Tree							
A Grass							
A Forb	ALde	<1	2				
	Orthocarpus luts			1			
Non-vasc		–	4	–			
Litter		5	5	20			
Rock		–	5	5			
B Grd		–	70	16			
T Per C							
T Veg C							
T Gr'd C							

collected in 1 bag for sites 20-23: ELsp, FEid, KDma

TFN 5 1/110
RECD MAR 15, 2011

Veg. type (mark one): MS MM RF (MSH) MSC MXC

Date: 2009-07-13 Worker(s): Jeff Brasher &

Legal (TRSQQ, etc.): S 20 NE NW GPS (zero m):

Other Location: Near Deformed Pronghorn

Pit Code (E9A etc.): 7A Position related to Pit (middle S side, W of Pit, etc.): Quad N

EXREFA? (y/n) Transect Azimuth (degrees): Site ID? 25 Sample ID 24

Lifeform	Sp	Q1 % Ab C	Q2 % Ab C	Q3 % Ab C	T Ab Cov	Av Ab C	% Rel C
P Grass	EL SM	30	10	30			
	~~Festuca?~~ POSE	10					
	HESCOM	5	35	2			
P Graminoid	CareX?	2					
	~~Cleriteracaul. fr~~			2			
	SEDlan			2			
P Forb	rosette 1 - linear lvs (NAD)	2		1			
	rosette 2 - spatulate lvs (ORM)	<1					
	Smerous yellow cushion		12	10			
	DIAho		1				
	umbel		<1				
	Erigeron nemat.	1	2	<1			
	Lesquerella mont.	<1	1				
	TETaca		15	5			
	~~rosette 3 - red-green lin. lvs~~			~~<1~~			
	HETuil			20			
Subshrub	ARFr	15		4			
Shrub Succ							
Shrub	ARno	70					
Tree							
A Grass							
A Forb	ALde	1					
Non-vasc		–	<1	–			
Litter		1	8	5			
Rock		–	10	5			
B Grd		1	2	10			
T Per C							
T Veg C							
T Grd C							

ERY-Mimuartia nuttal

TOUSHOO

Paronychia

PST-ERIGO nemat.

TFN 5 1/110
RECD MAR 15, 2011

Veg. type (mark one): MS	MM	RF	(MSH)	MSC	MXC		
Date: 2009-07- 13 Worker(s): Jeff Brasher &							
Legal (TRSQQ, etc.): 520 NW GPS (zero m):							
Other Location: Deformed finger							
Pit Code (E9A etc.): 7A Position related to Pit (middle S side, W of Pit, etc.): N center of finger							
EXREFA? (y/n) Transect Azimuth (degrees): 330 Site ID? 26 Sample ID 25							
Intended ~~ebita~~ pit but in Voided Claims due to "Waters of the US".							

Lifeform	Sp	Q1 % Ab C	Q2 % Ab C	Q3 % Ab C	T Ab Cov	Av Ab C	% Rel C
P Grass	ELSm	5	15	5			
	Festuca & idah.	2		5			
	HESCom	2	20	50			
	KOEmac		1				
Gram'oid							
P Forb	Cirsium - native	4					
Paronychia sp. ←	S-meadus yellow cushion	10	1				
	rosette gray-green linear lvs	3	5				
	SEDlan	1					
	CALnut	5					
	HETvil	1					
indet ←	ASTRAGALUS rosette	1					
HEDaru ←	mint	1					
	PHIho	1					
keep indet →	Lesquerella?			1			
Subshrub	ARfr	4	20	40			
Succ							
Shrub							
Tree							
A Grass							
A Forb	ALde	1	3	<1			
Non-vasc		1	<1	<1			
Litter		10	2	1			
Rock		25	1	–			
B Grd		1	1	2			
T Per C							
T Veg C							
T Grd C							

TFN 5 1/110
RECD MAR 15, 2011

Veg. type (mark one): MS MM RF MSH MSC MXC

Date: 2009-07- 13 Worker(s): Jeff Brasher &

Legal (TRSQQ, etc.): S 20 NW GPS (zero m):

Other Location: Deformed Finger

Pit Code (E9A etc.): 7A Position related to Pit (middle S side, W of Pit, etc.): toward S edge of finger

EXREFA? (yes) Transect Azimuth (degrees): 130 Site ID? 27 Sample ID 26

Intended PE ~~EXREFA~~ but in voided claims due to "waters of the US."

Lifeform	Sp	Q1 % Ab C	Q2 % Ab C	Q3 % Ab C	T Ab Cov	Av Ab C	% Rel C
P Grass	ELSm	50	70	50			
	festuca?	20	1	15			
Gram'oid							
P Forb	PHhD			4			
Subshrub							
Succ							
Shrub							
Tree							
A Grass							
A Forb	ALde	80	20	20			
	LAPocc	10		<1			
	Descurainia	1	1				
	Chenopodium		<1				
Non-vasc		–	<1	–			
Litter		5	8	6			
Rock		–	–	5			
B Grd		–	2	1			
T Per C							
T Veg C							
T Gr'd C							

TFN 5 1/110
RECD MAR 15, 2011

Veg. type (mark one): MS	MM	RF	MSH	MSC	MXC		
Date: 2009-07- 13	Worker(s): Jeff Brasher &						
Legal (TRSQQ, etc.):	5 20NW	GPS (zero m):					
Other Location:	S edge Deformed finger						
Pit Code (E9A etc.):	7A	Position related to Pit (middle S side, W of Pit, etc.):					
EXREFA? (y/n)	Transect Azimuth (degrees): 270	Site ID? 28	Sample ID 27				

Lifeform	Sp	Q1 % Ab C	Q2 % Ab C	Q3 % Ab C	T Ab Cov	Av Ab C	% Rel C
P Grass	ELsm	30	3				
	HEScom			12			
Gram'oid	Carex - sterile		<1				
P Forb	TOXvenGRA	1					
	ALLtex	2	1				
HEPdru ←	mint	1	1				
	Erigeron hemat.		1				
Subshrub							
Succ							
Shrub	CEmo		60	15			
Tree							
A Grass							
A Forb	Alyssum - alien - large fr ('A. alyssoides')	3	20	12			
Non-vasc		1	1	2			
Litter		5	20	25			
Rock		15	10	4			
B Grd		1	20	1			
T Per C							
T Veg C							
T Gr'd C							

TFN 5 1/110
RECD MAR 15, 2011

Veg. type (mark one): MS	MM	RF	(MSH)	MSC	MXC		
Date: 2009-07- 13	Worker(s): Jeff Brasher &						
Legal (TRSQQ, etc.): S 20 NW	GPS (zero m):						
Other Location: Deformed Emergent							
Pit Code (E9A etc.): 7A	Position related to Pit (middle S side, W of Pit, etc.): Nedge						
EXREFA? (y/n)	Transect Azimuth (degrees): 45	Site ID? 29	Sample ID 28				
	Intended pit but in voided claims due to "waters of the US."						

Lifeform	Sp	Q1 % Ab C	Q2 % Ab C	Q3 % Ab C	T Ab Cov	Av Ab C	% Rel C
P Grass	HESCom	8	4				
	ELSm		5	5			
Gram'oid	Carex - Stonie	18		29			
P Forb	Erigeron nemat.	12	3	1			
	Smooth yellow aster	30	8	5			
	PHHo	6	2	1			
Paronychia depressa	rosette 1-gr lvs, linear	2					
ERIOG flavuETE	Festuorella?? ASTDOUHOO	1					
	SEDIan	<1					
	Umbel-MUTE	1	8	4		4.7	
	Draba oligosperma		1	2			
	Astragalus spat.		1				
LUPIALPI	rosette 2-lvs gray, linear		1	1			
Subshrub							
Succ							
Shrub							
Tree							
A Grass							
A Forb							
Non-vasc		<1	–	1			
Litter		5	5	5			
Rock		5	5	15			
B Grd		8	5	15			
T Per C							
T Veg C							
T Gr'd C							

TFN 5 1/110
DATE MAR 15, 2011

	MS	MM	RF	MSH	MSC	MXC
tomme	111	1111		111	11	111
CONA	~~111~~ 11	111	1111	1	1	

Veg. type (mark one): (MS)	MM	RF	MSH	MSC	MXC		
Date: 2009-07- 13	Worker(s): Jeff Brasher &						
Legal (TRSQQ, etc.):	S 18 SESW	GPS (zero m):	-				
Other Location:	Within reach of Club Finger						
Pit Code (E9A etc.): 7A	Position related to Pit (middle S side, W of Pit, etc.):	W of Club Finger					
EXREFA? (y/n)	Transect Azimuth (degrees): 90	Site ID? 30	Sample ID 29				

Lifeform	Sp	Q1 % Ab C	Q2 % Ab C	Q3 % Ab C	T Ab Cov	Av Ab C	% Rel C
P Grass	ELsm	10	10	30	50		
	AEScom	5	20	20	45	15	
	~~grass 1~~	2	5		7		
Gram'oid	sterile → Carex filifolia?	2	5		7		
P Forb	ALte	1	2		3	1	
	~~CANmic~~ → LESQludo	3			3	1	
	~~forb~~ → Mertensia hum.		3		3	1	
Subshrub							
Succ							
Shrub	AKno	25	22	45	92		
Tree							
A Grass							
A Forb	ALde	10	<1	1	11		
Non-vasc		–	–	–	–		
Litter		–	5	6	11		
Rock		–	–	–	–		
B Grd		1	2	2	5		
T Per C		46	62	95	153	52	
T Veg C							
T Gr'd C		56	69	104	229	76.3	

exp as indet

3) 156 (52
15
06

46
62
95
153

56
69
104
229

3) 229 (76.0
21
19
18
10

TEN 5 1/110
RECD MAR 15, 2011

Veg. type (mark one): (MS)	MM	RF	MSH	MSC	MXC		
Date: 2009-07- 13	Worker(s): Jeff Brasher &						
Legal (TRSQQ, etc.):	19 5W	GPS (zero m):					
Other Location:	W of the wishbone						
Pit Code (E9A etc.):	10A	Position related to Pit (middle S side, W of Pit, etc.):	W of Pit				
EXREFA? (y/n)	Transect Azimuth (degrees): 176	Site ID? 31	Sample ID 30				

Lifeform	Sp	Q1 % Ab C	Q2 % Ab C	Q3 % Ab C	T Ab Cov	Av Ab C	% Rel C
P Grass	HESCOM	80	25	15			
	ARGSM	10	10	10			
	KOMA		5	3			
Gram'oid							
P Forb	1	<1					
	2	<1					
	ALte		<1				
	Mertensia hum.		<1				
	Antennaria mic.			<1			
	PHHO			2			
Subshrub							
Succ							
Shrub	ARNO	20	10				
	ARTTR.ARA			62			
Tree							
A Grass							
A Forb	ALde	<1	10	2			
Non-vasc		–	–	–			
Litter		8	5	1			
Rock		–	–	–			
B Grd		5	10	1			
T Per C							
T Veg C							
T Gr'd C							

TFN 5 1/110
RECD MAR 15, 2011

Veg. type (mark one): MS	(MM)	RF	MSH	MSC	MXC		
Date: 2009-07- 13 Worker(s): Jeff Brasher &							
Legal (TRSQQ, etc.): 530 NW GPS (zero m):							
Other Location: Access Rd from Warren Pit to sect 19 + Gorst Gulch windmill, W of tip of Tailfin							
Pit Code (E9A etc.): 5A Position related to Pit (middle S side, W of Pit, etc.): W of Tailfin							
EXREFA? (y/n) Transect Azimuth (degrees): 290 Site ID? 32 Sample ID 31							

Lifeform	Sp	Q1 % Ab C	Q2 % Ab C	Q3 % Ab C	T Ab Cov	Av Ab C	% Rel C
P Grass	ELSm	30	20	10			
	Festuca?		9				
	HIES com			2			
Gram'oid							
R Forb	PHho	2	<1	1			
	SED lan	1		2			
	Erigeron	1					
	Lesquerella?	<1	<1				
	~~SEDlan~~			~~2~~			
Subshrub	~~CHRdou (CHVi)~~		~~21~~	~~10~~			
Succ							
Shrub	ARNO	11	9	20			
	CEmo			1			
	CHVi		21	100			
Tree							
A Grass							
A Forb	Allysum alyssoides	10	-				
	ALdo		4				
Non-vasc		2	—	—			
Litter		8	5	—			
Rock		10	-	—			
B Grd		1	15	—			
T Per C							
T Veg C							
T Gr'd C							

TFN 5 1/110
RECD MAR 15, 2011

Veg. type (mark one):	MS	MM	RF	MSH	MSC	MXC	
Date: 2009-07- 17	Worker(s): Jeff Brasher &						
Legal (TRSQQ, etc.):	8S NW	GPS (zero m):					
Other Location: Between warren Pit & Tailfan							
Pit Code (E9A etc.): 5A	Position related to Pit (middle S side, W of Pit, etc.):						
EXREFA? (y/n) y	Transect Azimuth (degrees): 172	Site ID? 37	Sample ID 32				

Lifeform	Sp	Q1 % Ab C	Q2 % Ab C	Q3 % Ab C	T Ab Cov	Av Ab C	% Rel C
P Grass	HESCom	40	70	20			
	ELSm	30	20	2			
	~~SIThys~~ → ELYely		1				
	~~PSEspi~~ → ELSp		2				
Gram'oid							
P Forb	~~ASTchil ? (Symphascen ?)~~			2			
	Erigeron nem.			2			
	~~Phlo~~ - Mertensia hum.			<1			
Subshrub							
Succ							
Shrub	ARnn		35	95			
Tree							
A Grass							
A Forb	MLde	5	1				
Non-vasc		<1	–	–			
Litter		5	–	–			
Rock		2	–	–			
B Grd		1	✓	–			
T Per C							
T Veg C							
T Gr'd C							

Delete Mechoen Mecscons

TFN 5 1/110
DECD MAR 15, 2011

Veg. type (mark one): MS MM (RF) MSH MSC MXC

Date: 2009-07-15 Worker(s): Jeff Brasher &

Legal (TRSQQ, etc.): GPS (zero m):

Other Location: The Pitchfork

Pit Code (E9A etc.): 9B Position related to Pit (middle S side, W of Pit, etc.):

EXREFA? (y/n) Transect Azimuth (degrees): 210 Site ID? 34 Sample ID 33

Lifeform	Sp	Q1 % Ab C	Q2 % Ab C	Q3 % Ab C	T Ab Cov	Av Ab C	% Rel C
P Grass	~~grass 1 (Koma?)~~	15	4				
	ELSm	12	9	30			
	Elymus 2 lg pl + lvs		20				
	POA ~~san~~ → Pose		2	20			
	grass 2 tinypl + lvs		5	5			
Gram'oid							
			(40)	(55)			
P Forb	Arenaria → Erion fend.	19	4	10			
	"cushion Phlox" lvs < 7mm	8	1	7			
	~~Stene → Geranium dru.~~	7	4	–			
	Eriogon 1 – E. ochroleucum	<1		–			
	Eriogon 2 – E. nemat.		1	1			
	Umbel		<1	–			
	SEDlan		1	2			
	~~rosette~~ Antennaria		<1	3			
	~~Astragalus mult.?~~			2			
Subshrub							
Succ							
Shrub	ART tripRu	25	7	28			
Tree							
A Grass							
A Forb	AND sep		1				
Non-vasc		2	3	8			
Litter		4	15	20			
Rock		–	–	–			
B Grd		5	5+	1+			
T Per C							
T Veg C							
T Grd C							

Antennaria mic.

Oxytropis mult.

TFN 5 1/110
RECD MAR 15, 2011

Veg. type (mark one): MS MM RF MSH MSC (MXC)

Date: 2009-07-15 Worker(s): Jeff Brasher &

Legal (TRSQQ, etc.): GPS (zero m):

Other Location: N of the Pitch forks in Telephone Canyon

Pit Code (E9A etc.): Position related to Pit (middle S side, W of Pit, etc.):

EXREFA? (y/n) Transect Azimuth (degrees): 24 Site ID? 35 Sample ID 34

Lifeform	Sp	Q1 % Ab C	Q2 % Ab C	Q3 % Ab C	T Ab Cov	Av Ab C	% Rel C
P Grass	~~Elymus~~		~~25~~	~~10~~			
Gram'oid	Carex geyeri		25	10			
P Forb	Galium boreale		<1	1			
rosette – P Forb	~~Heuchera → Swertia?~~		1				
Subshrub	BERrep	20	30	60			
Succ							
Shrub	JUco	100					
	PINfle		70				
Tree	PSEmen	100	50	90			
A Grass	POTR		100	90			
A Forb							
Non-vasc		–	10	15			
Litter		–	75	20			
Rock		–	–	–			
B Grd		–	–	–			
T Per C							
T Veg C							
T Gr'd C							

Carex collected near transect.

TFN 5 1/110
RECD MAR 15, 2011

Veg. type (mark one): MS MM RF MSH MSC (MXC)

Date: 2009-07- 15 Worker(s): Jeff Brasher &

Legal (TRSQQ, etc.): GPS (zero m):

Other Location: N of the Fitch Fork

Pit Code (E9A etc.): Position related to Pit (middle S side, W of Pit, etc.): N

EXREFA? (y/n) Transect Azimuth (degrees): 24 Site ID? 36 Sample ID 35

Lifeform	Sp	Q1 % Ab C	Q2 % Ab C	Q3 % Ab C	T Ab Cov	Av Ab C	% Rel C
P Grass	~~Elymus as before~~	60	1				
Gram'oid	Carex ~~(Falc-sedge?)~~ geyeri						
P Forb (site only → L. glabrum?)	~~Unobs → Lithospermum?~~	<1					
	ARNcordX		8	<1			
Subshrub	BERrep	50	62	10			
Succ							
Shrub	JUCom	60		30			
	~~[illegible]~~	~~50~~	~~62~~	~~10~~			
	ACEgla			1			
	POTR	60	100	100			
Tree	PICE	~~80~~					
A Grass	PSEmen		50	100			
A Forb							
Non-vasc		5	2	—			
Litter		10	25	40			
Rock		—	—	—			
B Grd		—	—	—			
T Per C							
T Veg C							
T Gr'd C							

TFN 5 1/110
RECD MAR 15, 2011

Veg. type (mark one): MS MM RF (MSH) (MSC) MXC

Date: 2009-07- 15 Worker(s): Jeff Brasher &

Legal (TRSQQ, etc.): GPS (zero m):

Other Location: N of the Pitchfork

Pit Code (E9A etc.): Position related to Pit (middle S side, W of Pit, etc.):

EXREFA? (y/n) Transect Azimuth (degrees): 240 Site ID? 37 Sample ID 36

Lifeform	Sp	Q1 % Ab C	Q2 % Ab C	Q3 % Ab C	T Ab Cov	Av Ab C	% Rel C
P Grass	Elymus spic.	2					
	fairy-ring grass (Muhlenbergia ?)	35	8	30			
	EL Sm		2	2			
	Poa secunda			<1			
Gram'oid							
P Forb	SEDlan	1	2				
	Ranunculus ranunculinus	3	3	1			
	Silene ? Cerastium	1	1				
	Smerous yellow cushion (Paronychia ?)		<1	2			
	rosette - Boechera drum.		<1				
	Allium cernuum			2			
	rosette - Erigeron nem.			1			
Subshrub							
Succ							
Shrub							
Tree							
A Grass							
A Forb							
Non-vasc		2	3	44			
Litter		5	<1	2			
Rock		40	45	35			
B Grd		50	59	1			
T Per C							
T Veg C							
T Gr'd C							

TFN 5 1/110
RECD MAR 15, 2011

Veg. type (mark one): MS MM RF (MSH) MSC MXC

Date: 2009-07- 15 Worker(s): Jeff Brasher &

Legal (TRSQQ, etc.): GPS (zero m):

Other Location: The Pitchfork

Pit Code (E9A etc.): 9R Position related to Pit (middle S side, W of Pit, etc.):

EXREFA? (y/n) Transect Azimuth (degrees): 270 Site ID? 38 Sample ID 37

Lifeform	Sp	Q1 % Ab C	Q2 % Ab C	Q3 % Ab C	T Ab Cov	Av Ab C	% Rel C
P Grass	ELsm ~~X~~	3	3	4			
	~~Poa sand~~ ?? FEid	57	55	45			
	~~HESCom~~ → NASvir		4	20			
		(60)		(75)			
Graminoid							
	Ranunculus ruwnalinus			<1			
P Forb	CALnut	1	<1	–			
	Allium cernuum			–			
	~~Silene~~ ?? Cerastium arv.	5		3			
	TARoff	3	10	4			
	PHLho ~~X~~ lvs < Tom	1	<1	5			
	~~HEU-fob~~ ?? parv.	<1		–			
	~~BESavo~~ ~~X~~		4	8			
Tom C ←	~~ANTENNARIA~~ as before		9	10			
	~~rosette-like iglo~~		<1	–			
	SEDlan		<1	–			
Subshrub	Galium boreale			2			
Succ							
Shrub	ART tridVA	22	10	–			
Tree							
A Grass							
A Forb	~~AND sep~~		~~X~~ 2.5				
Non-vasc		1	–	–			
Litter		20	5	5			
Rock		–	–	–			
B Grd		–	4	1			
T Per C							
T Veg C							
T Gr'd C							

TFN 5 1/110
REC'D MAR 15 2010

Veg. type (mark one): MS MM RF MSH MSC MXC

Date: 2009-07-15 Worker(s): Jeff Brasher &

Legal (TRSQQ, etc.): GPS (zero m):

Other Location: The Pitchfork

Pit Code (E9A etc.): 9B Position related to Pit (middle S side, W of Pit, etc.):

EXREFA? (y/n) Transect Azimuth (degrees): 340 Site ID? 39 Sample ID 38

Lifeform	Sp	Q1 % Ab C	Q2 % Ab C	Q3 % Ab C	T Ab Cov	Av Ab C	% Rel C
P Grass	Elymus spic. X	4					
	Poa ~~sand~~ secunda		15				
Gram'oid							
P Forb	SEDlan	12	5	1			
	rosette 1 ~6 lvs	<1	<1	1			
	~~rosette 2 ~20 lvs~~	<1		1			
ERInemat	rosette 3 - Eriogonum X	2.5	2	1			
	Allium textile		3				
	Ranunculus as bat		1				
	(R. ranunculinus)						
Subshrub							
Succ							
Shrub							
Tree							
A Grass							
A Forb	AL-de	1	1				
Non-vasc		6	20	10			
Litter		10		—			
Rock		60	60	98			
B Grd		10	1	—			
T Per C							
T Veg C							
T Gr'd C							

IT-TOWHEE

TFN 5 1/110
RECD MAR 15, 2011

Veg. type (mark one): MS MM RF (MSH) (MSC) MXC

Date: 2009-07-17 Worker(s): Jeff Brasher &

Legal (TRSQQ, etc.): S21 E½ GPS (zero m):

Other Location: The Pitch Fork - NW of #POT Quarry

Pit Code (E9A etc.): 9C Position related to Pit (middle S side, W of Pit, etc.): toward NE

EXREFA? (y/n) Transect Azimuth (degrees): 180 Site ID? 40 Sample ID 39

Lifeform	Sp	Q1 % Ab C	Q2 % Ab C	Q3 % Ab C	T Ab Cov	Av Ab C	% Rel C
Collected ELspt Elymus hispidus — P Grass	~~Poa?~~ KOMa	10					
	ELsm	10	5+	40+			
	~~Elymus thizomatus~~ same		~~30+~~				
	Elymus spicatus		15				
	Elymus hispidus		15				
		(20)					
Gram'oid							
	SEDlan	1		1			
P Forb	Astragalus-lus linear	5		2			
	Eriogonum nemati.	10		3			
	Eremogone fendler.	20	35+	25			
	S-meranus yellow cushion	4		4			
	PHlxo	2	1	4			
	~~Hoola?~~ - rosette lus radial - ca. lines	1		-			
	~~Eriogonum~~ rosette - lus linear	1	1	3			
	~~Eriogonum?~~ - rosette lus linear	2	1	1			
Substrub	~~Silene?~~ Cerast. arve.		20+	8			
	~~Umbel?~~ Lomatium ori-cnt.?		<1			0.2	
	"igloo-rosette" - Antennaria			<1			
Succ							
Shrub	ARTtrip Ru		8	9			
Tree							
A Grass							
A Forb	PRM-ANDRsept			<1			
Non-vasc		8	1	15			
Litter		2	2+	6			
Rock		3	<1	11			
B Grd		2	—	<1			
T Per C							
T Veg C		90					
T Grd C							

astrag. spat. ← Astragalus

Paronychia → S-meranus yellow cushion

Campan. rotun. ← ~~Hoola?~~

Indigo. ← Draba sp.

Townsendia hookeri ← ~~Eriogonum?~~

MUSTEN ← ~~Silene?~~ Cerast. arve.

TFN 5 1/110
RECD MAR 15, 2011

Veg. type (mark one): MS MM RF MSH MSC (MXC)

Date: 2009-07- 17 Worker(s): Jeff Brasher &

Legal (TRSQQ, etc.): S 21 E½ GPS (zero m):

Other Location: Pitchfork

Pit Code (E9A etc.): 9C Position related to Pit (middle S side, W of Pit, etc.): toward N edge

EXREFA? (y/n) Transect Azimuth (degrees): 330 Site ID? 41 Sample ID 40

Lifeform	Sp	Q1 % Ab C	Q2 % Ab C	Q3 % Ab C	T Ab Cov	Av Ab C	% Rel C
P Grass (collected: LEKi)	ELSim	10					
	grass 1 long hrs (HEco)	10					
	grass 2 tight rhizom	8					
	~~Poa pratensis~~ ?> fend.	12	6	12			
	grass 3 2 ft tall, ligule 1 mm.		30	10			
	= rhiz.						
P Gram'oid	Carex aurea	6					
	~~Arenaria~~ ?> Erem. fendl.		<1	5			
P Forb	~~Astragalus mult.~~	4	<1	2			
	TAof	4	9	4			
	(PLM) index	2	1	3			
	Viola adunca	2	3	5			
	~~rosette - Iris spatulata~~	1		-			
	Phacelia hetophylla?	10		-			
	SEDlan	1	1	<1			
	sterile - cauline	4	6	-			
	rosette 3 - also spatulate		<1	<1			
	~~unset - LOMaoke?~~		1	-		0.3	
Subshrub	~~Silene~~ ?> CERAS arven			2			
	~~tiglio rosette - Androsace~~			<1			
	~~(Ar-Sept?)~~						
Succ							
Shrub	ARtridPA	1		10			
Tree	PIEI	100	70	100			
A Grass							
A Forb	Androsace septi.			<1			
Non-vasc		50	3	2			
Litter		55	20	10			
Rock		-	4	2			
B Grd		-	1	-			
T Per C							
T Veg C							
T Gr'd C							

A. miser varobl.

ERIG coresp. - Aff

Campanula rotundif. ? VSO?

MUSteni

Beetle-Kill here including this PIEI.

TFN 5 1/110
REGD MAR 15, 2011

Veg. type (mark one): MS MM RF MSH MSC MXC

Date: 2009-07- 17 Worker(s): Jeff Brasher &

Legal (TRSQQ, etc.): S21 5E GPS (zero m):

Other Location: Pitchfork

Pit Code (E9A etc.): 9C Position related to Pit (middle S side, W of Pit, etc.): toward N edge

EXREFA? (y/n) Transect Azimuth (degrees): 180 Site ID? 42 Sample ID 41

Lifeform	Sp	Q1 % Ab C	Q2 % Ab C	Q3 % Ab C	T Ab Cov	Av Ab C	% Rel C
P Grass	NASUT bunch	30					
P Grass	keep indet. ← grass 1 - filiform blue lvs	22					
P Grass	~~Poa patensis?~~ ~~rhiz?~~	~~10~~					
		(65)					
Gram'oid							
P Forb	TAof	16					
P Forb	upanula rotundif. ← ~~Viola?~~ as before	20	1				
P Forb	Antennaria rosea	2					
P Forb	Galium boreale	10					
P Forb	umbel - OSMOchil	3				1	
P Forb	indet. ← (PLMO)X as previous site	5					
P Forb	Astrag. miser. var obl. ← ~~Astragalus nott.?~~	<1					
Subshrub							
Succ							
Shrub	JUCO		100				
Shrub	Psme			70			
Tree	PIFI	100	100	100			
A Grass							
A Forb							
Non-vasc		5	1	<1			
Litter		3	–	–			
Rock		–	–	–			
B Grd		–	–	–			
T Per C							
T Veg C							
T Gr'd C							

Near transect: Erigeron eatonii collected

TFN 5 1/110
RECD MAR 15, 2011

Veg. type (mark one): MS MM RF MSH MSC (MXC)

Date: 2009-07- 17 Worker(s): Jeff Brasher &

Legal (TRSQQ, etc.): S21SE GPS (zero m):

Other Location: Pitchfork

Pit Code (E9A etc.): 9C Position related to Pit (middle S side, W of Pit, etc.): toward S edge

EXREFA? (y/n) Transect Azimuth (degrees): 315 Site ID? 43 Sample ID 42

Lifeform	Sp	Q1 % Ab C	Q2 % Ab C	Q3 % Ab C	T Ab Cov	Av Ab C	% Rel C
P Grass	ELSm	10	8	4			
	NASvir		30				
Gram'oid	Carex ~bunch CARaur	60	8	11			
	~~ elk sedge?~~~						
	PHho			<1			
P Forb	ACHmil	<1					
	CASflava	1					
	Solidago simplex	12	26	60			
	Galium boreale	1					
	horzyr-ONOmolOCC	<1					
	~~Stelle~~ → CERarv		12	2			
	TAof		2				
	~~Lomatium~~ → musten		2			0.7	
	OYC-Tolianevis acaul. varia.			4			
	COMumb			2			
Subshrub							
Succ							
Shrub	ARtrid PA			6			
Tree	PIFI	80					
A Grass							
A Forb							
Non-vasc		–	–	–			
Litter		15	2	2			
Rock		–	–	<1			
B Grd		1	4	10			
T Per C							
T Veg C							
T Gr'd C							

TFN 5 1/110
RECD MAR 15, 2011

Veg. type (mark one): MS MM RF MSH MSC (MXC)

Date: 2009-07- 17 Worker(s): Jeff Brasher &

Legal (TRSQQ, etc.): S 21 SE GPS (zero m):

Other Location: Pitchfork

Pit Code (E9A etc.): gC Position related to Pit (middle S side, W of Pit, etc.): towards S edge?

EXREFA? (y/n) Transect Azimuth (degrees): 102 Site ID? 44 Sample ID 43

Lifeform	Sp	Q1 % Ab C	Q2 % Ab C	Q3 % Ab C	T Ab Cov	Av Ab C	% Rel C
P Grass	HESCOM	40+	5	50			
	ELSM	2					
	ACH hym			30			
				(80)			
Gram'oid	Carex-elk sedge?	10+	5	2			
	(C. geyeri)						
P Forb	~~Silene? → CERarv~~	3					
	~~Silvery rosette - Hygalrat?~~	1					
	Erigeron - E. caespit.			1			
	~~Thermopsis Packera foeti.~~			2			
	rosette - lus linear-spatul.			3			
	Erigeron -						
	(E. nematophyllus)						
Subshrub							
Succ							
Shrub							
Tree	PIFI		50	95			
A Grass							
A Forb							
Non-vasc		1	<1	2			
Litter		1	30+	5			
Rock		2+	30+	2			
B Grd		1	2+	=			
T Per C							
T Veg C							
T Grd C							

LESmon

MCC Permit 298C-A8 Baseline Veg Sampling Field Form

TFN 5 1/110
RECD MAR 15, 2011

Veg. type (mark one): MS MM RF MSH MSC (MXC)

Date: 2009-07- 17 Worker(s): Jeff Brasher &

Legal (TRSQQ, etc.): 5 21 SW GPS (zero m):

Other Location: Pitch Fork

Pit Code (E9A etc.): 9C Position related to Pit (middle S side, W of Pit, etc.): C towards W end

EXREFA? (y/n) Transect Azimuth (degrees): 280 Site ID? 45 Sample ID 44

Lifeform	Sp	Q1 % Ab C	Q2 % Ab C	Q3 % Ab C	T Ab Cov	Av Ab C	% Rel C
P Grass	NASUR	2	8	2			
	~~bunchgrass keep indet.~~			9			
	(LEKI)						
Gram'oid							
P Forb	ACHmil	2					
	Galium boreale			1			
	TAOf			<1			
AST	rosette-ERIGeato			<1			
Subshrub							
Succ							
Shrub	Ribes cereum	3				1	
	Symphoricarpos oreo.v.vt.	1	4				
Tree	PSme	80					
A Grass							
A Forb	Chenopodium rubrum	6					
Non-vasc		5	20	2			
Litter		90	30	96			
Rock		4	40	10			
B Grd		–	–	1			
T Per C							
T Veg C							
T Gr'd C							

TFN 5 1/110
REC'D MAR 15, 2011

Veg. type (mark one): MS MM RF MSH MSC (MXC)

Date: 2009-07- 17 Worker(s): Jeff Brasher &

Legal (TRSQQ, etc.): 5215W GPS (zero m):

Other Location: Pitchfork tip

Pit Code (E9A etc.): 9C Position related to Pit (middle S side, W of Pit, etc.): road S tip

EXREFA? (y/n) Transect Azimuth (degrees): 120 Site ID? 46 Sample ID 45

Lifeform	Sp	Q1 % Ab C	Q2 % Ab C	Q3 % Ab C	T Ab Cov	Av Ab C	% Rel C
P Grass	NASur			10			
P Grass	~~Elymus?~~ → HEco			<1			
Gram'oid							
P Forb	ARNcor X			20			
Subshrub							
Succ							
Shrub	Ribes as earlier		5			1.7	
Tree	PSme	100	100	100			
A Grass							
A Forb							
Non-vasc		1	100	1			
Litter		99	70	50			
Rock		–	–	–			
B Grd		–	–	–			
T Per C							
T Veg C							
T Gr'd C							

Ricereum ← Ribes

MCC Permit 298C-A8 Baseline Veg Sampling Field Form

TFN 5 1/110
RECD MAR 15, 2011

Veg. type (mark one): MS (MM) RF MSH (MSC) MXC

Date: 2009-07- 17 Worker(s): Jeff Brasher &

Legal (TRSQQ, etc.): 52 1 SW GPS (zero m):

Other Location: Pitchfork S tip

Pit Code (E9A etc.): 9C Position related to Pit (middle S side, W of Pit, etc.):

EXREFA? (y/n) Transect Azimuth (degrees): 18 Site ID? 47 Sample ID 46

Lifeform	Sp	Q1 % Ab C	Q2 % Ab C	Q3 % Ab C	T Ab Cov	Av Ab C	% Rel C
P Grass	ELSm	20	10	1			
Gram'oid	Carex		15				
P Forb	~~umbel~~ ~~Lomat?~~	4	1	3		2.7	
	Galium boreale	4		4			
	~~rosette ~~	1					
	Silene ?? CERA arve		6				
	TETaca		8				
Subshrub	~~CHVI~~	~~9~~					
Succ							
Shrub	~~CHVI~~						
	CEMO		35				
	CHVI	9					
Tree							
A Grass							
A Forb	ALde	1	<1				
	Allysum - lg frt alien (A. alyssoides)			<1			
Non-vasc		<1	1	–			
Litter		5	3	20			
Rock		6	1	15			
B Grd		20+	4+	50			
T Per C							
T Veg C							
T Grd C							

MUSten ← ERIGnem, (ASTE)

I'm hearing the call of raptor, I think. "Chil" pause "Chi..." "Choo..."

TFN 5 1/110
REC'D MAR 15, 2011

Veg. type (mark one): MS (MM) RF MSH (MSC) MXC

Date: 2009-07-17 Worker(s): Jeff Brasher &

Legal (TRSQQ, etc.): S21 SW GPS (zero m):

Other Location: Pitchfork S tip

Pit Code (E9A etc.): 9C Position related to Pit (middle S side, W of Pit, etc.): W of S tip (in harm's way)

EXREFA? Transect Azimuth (degrees): 180 Site ID? 48 Sample ID 47

Lifeform	Sp	Q1 % Ab C	Q2 % Ab C	Q3 % Ab C	T Ab Cov	Av Ab C	% Rel C
P Grass	ELSm	10	2	30			
	HESCOM		75				
Gram'oid							
P Forb	Galium - as earlier	12					
	~~Stellaria - as earlier~~ CEar	4	2	2			
	Erigeron caespit.	15					
	~~Iglos rosette - Androsace~~			~~1~~			
Subshrub							
Succ							
Shrub	CEmo	100		70			
Tree							
A Grass							
A Forb	Alde		2	1			
	Descurainia			1			
	Iglos rosette - ANDRsept			1			
Non-vasc		<1	-	-			
Litter		10	1	25			
Rock		-	3	-			
B Grd		-	10+	10			
T Per C							
T Veg C							
T Gr'd C							

earlby collected KY Tmult.

Afterwards on way back to truck via ~~site~~ sample 47 collected plant I earlier guessed was Phacelpart put in this site's sample bag. Looks like Packera. Det. Packera fendleri

Also near site collected Porcana, Porcana fendleri

TFN 3 1/110
RECD MAR 15, 2011

Veg. type (mark one): MS MM RF (MSH) MSC MXC

Date: 2009-07- 17 Worker(s): Jeff Brasher &

Legal (TRSQQ, etc.): S21 5E GPS (zero m):

Other Location: Ditch Fork

Pit Code (E9A etc.): 9C Position related to Pit (middle S side, W of Pit, etc.):

EXREFA? (y/n) Transect Azimuth (degrees): 9D Site ID? 49 Sample ID 48

Lifeform	Sp	Q1 % Ab C	Q2 % Ab C	Q3 % Ab C	T Ab Cov	Av Ab C	% Rel C
P Grass	KOma	3					
	ELsm	10	5	2			
	Poa 8 secunda	11	12				
	HFscom		5	30			
Gram'oid							
EREMfend P Forb	~~Arenaria~~ as earlier	3					
ASTRmiCB	~~Astragalus mollis~~	6		2			
	~~Silene~~ > CERarv	6	2				
	PHho	2	10	<1			
	Erigeron nemat.			1			
Subshrub							
Succ							
Shrub	ARTtridPA		25				
	ARtripRu			20			
Tree							
A Grass							
A Forb							
Non-vasc		—	—	—			
Litter		4	2	1			
Rock		—	—	—			
B Grd		15+	60	15			
T Per C							
T Veg C							
T Grd C							

TFN 5 1/110
RECD MAR 15, 2011

Veg. type (mark one): MS MM RF (MSH) MSC MXC

Date: 2009-07- 17 Worker(s): Jeff Brasher &

Legal (TRSQQ, etc.): S 21 SW GPS (zero m):

Other Location: Pitchfork

Pit Code (E9A etc.): 9C Position related to Pit (middle S side, W of Pit, etc.): close to S edge

EXREFA? (y/n) Transect Azimuth (degrees): 120 Site ID? 49A Sample ID 43A

Lifeform	Sp	Q1 % Ab C	Q2 % Ab C	Q3 % Ab C	T Ab Cov	Av Ab C	% Rel C
P Grass	ELSin	10	15	10			
	HESCom	2	16	40			
	~~Poa~~ ? CALAmont		12	2			
	KOma		2	1			
	LEUKin ?			3			
			(55)	(55)			
Gram'oid							
P Forb	Cirsium canescens	5	–	–			
Astag indet ←	~~Astragalus nutt.?~~	~~24~~	2	–			
	Silene ? CERarv	1	12	3			
	Erigeron	1	–	–			
	PHHo	6	2	4			
E. fend ← Eremogone ←	~~Arenaria?~~	3	–	5			
	rosette-Lesquerella mont.	1	–				
Subshrub	ARfr	6	3	12			
	~~Crtri~~	~~10~~					
Succ							
Shrub	ARTFOR		3	18			
	CHVI	10					
Tree							
A Grass							
A Forb							
Non-vasc		<1	–	–			
Litter		1	2	<1			
Rock		3	1	–			
B Grd		1	4	1			
T Per C							
T Veg C							
T Grd C							

TFN 5 1/110
RECD MAR 15, 2011

Veg. type (mark one): MS MM RF (MSH) MSC MXC

Date: 2009-07- 17 Worker(s): Jeff Brasher &

Legal (TRSQQ, etc.): 521 NE GPS (zero m):

Other Location: Pitch Fork

Pit Code (E9A etc.): 9A Position related to Pit (middle S side, W of Pit, etc.): N prong toward N edge + E end

EXREFA? (y/n) Transect Azimuth (degrees): 50 Site ID? 52 Sample ID 51

Lifeform		Sp	Q1 % Ab C	Q2 % Ab C	Q3 % Ab C	T Ab Cov	Av Ab C	% Rel C
	P Grass	Elsm	25	12	10			
		Poa ~~X~~ secunda	1	11	10			
		HE Scam			10			
		Koma			5			
				(20) RC	(40)			
	Gram'oid	Potentilla conc. var. bier.			1			
		TETaca			1			
		rosette 2		1	–			
		rosette 1		1	–			
	R Forb	Achmil	7	40	12			
Paronychia →		S-merous yelow cushion		–	–			
Eriogonum nem. ←		Eriogonum 1 - white rays	5	10	3			
		Antennaria micr.	1	–	–			
		~~Stene~~ CERAarve	4	2	–			
keep as fem. indet. ←		~~Eriogonum 2~~ - sterile rosett	5	–	–			
		~~CAST Eler? ORTHlute~~	1					
		TAof	<1	2	–			
		~~Arenaria~~ EREMpend	2	2	1			
		Astragalus ~~Adt~~ Tinel		1	1			
	Subshrub	PHho		9	3			
	Succ							
	Shrub	ARno			15			
Tree								
	A Grass							
	A Forb	ALde	1		–			
		ORTHlute	1					
Non-vasc			<1	1	–			
Litter			1	<1	1			
Rock			–	–	–			
B Grd			1	10	10			
T Per C								
T Veg C								
T Gr'd C								

MCC Permit 298C-A8 Baseline Veg Sampling Field Form

TFN 5 1/110
RECD MAR 15, 2011

Veg. type (mark one): (MS)	MM	RF	MSH	MSC	MXC		
Date: 2009-07-18 Worker(s): Jeff Brasher &							
Legal (TRSQQ, etc.): 531 ca. C of N, GPS (zero m):							
Other Location: Just S of old ETC Haul Road							
Pit Code (E9A etc.): #2 Position related to Pit (middle S side, W of Pit, etc.): toward E							
EXREFA? (y/n) Transect Azimuth (degrees): 248 Site ID? 53 Sample ID 52							

Lifeform	Sp	Q1 % Ab C	Q2 % Ab C	Q3 % Ab C	T Ab Cov	Av Ab C	% Rel C
P Grass	ELsm	7+	8+	5+			
Gram'oid							
P Forb	Allium t.	1	2	–			
	SEDlan	2	2	<1			
	~~Silene?~~ → CERarv	4+	1	<1			
	PHho	3	4				
	Erigeron nemat.		8	3			
ASR ← Paronychia →	5-merous yellow cushion		6				
	umbel tried-sente		1				
	~~rosette-AMA~~			~~<1~~			
	Mertensia hum.			<1			
	ann.						
Subshrub	~~CHvi~~	~~2~~	~~11~~				
Succ							
Shrub	ARnu	40+	9	80			
	CHvi	2	11				
Tree							
A Grass							
A Forb	AMA "rosette" SALSaust			<1			
Non-vasc		–	–	–			
Litter		2+	1	<1			
Rock		–	–	–			
B Grd		10+	6+	<1			
T Per C							
T Veg C							
T Gr'd C							

TFN 5 1/110
RECD MAR 15, 2011

Veg. type (mark one): MS MM RF (MSH) MSC MXC

Date: 2009-07- 17 Worker(s): Jeff Brasher &

Legal (TRSQQ, etc.): 521 SW GPS (zero m):

Other Location: pitchfork

Pit Code (E9A etc.): 9C Position related to Pit (middle S side, W of Pit, etc.): just S of Sedge

EXREFA? (y/n) Transect Azimuth (degrees): 315 Site ID? 50 Sample ID 49

Lifeform	Sp	Q1 % Ab C	Q2 % Ab C	Q3 % Ab C	T Ab Cov	Av Ab C	% Rel C
P Grass	ELSM	4	1	5			
	LEUM?	1					
	HESCOM			28			
			(35)	(30)			
Gram'oid							
P Forb	Astragalus mill.?	2					
Subshrub							
Succ							
Shrub	ART tri. PH	75	70				
Tree							
A Grass							
A Forb	ALde	10	15	10			
Non-vasc		<1	<1	<1			
Litter		5	10	4			
Rock		—	—	2			
B Grd		—	5	4			
T Per C							
T Veg C							
T Grd C							

Astrag. [illegible]

TFN 5 1/110
RECD MAR 15, 2011

Veg. type (mark one): MS MM RF (MSH) (MSC) MXC

Date: 2009-07-17 Worker(s): Jeff Brasher &

Legal (TRSQQ, etc.): 521 NE GPS (zero m):

Other Location: Pitchfork middle drong

Pit Code (E9A etc.): 9B Position related to Pit (middle S side, W of Pit, etc.): Toward S edge of drong

EXREFA? (y/n) Transect Azimuth (degrees): 120 Site ID? 51 Sample ID 50

Lifeform	Sp	Q1 % Ab C	Q2 % Ab C	Q3 % Ab C	T Ab Cov	Av Ab C	% Rel C
P Grass	grass - fillform bluelus	15	5				
	~~BROMUS carinatus?~~	20					
	Poa ? arida	20		+			
	HES com	20	10				
	Pl sm	20	30	30			
	~~grass 2~~ → FE id		5				
			(N100 RC)(55)	(65)			
Gram'oid	Carex		10				
P Forb	~~Silene~~ → CER parve	15	10	20			
	TAof	10	5	10			
	ACH mil		40				
	Ranunculus - dried up			4			
Subshrub							
Succ							
Shrub	ART tridVA	40	4	40			
Tree							
A Grass	BRte	10		0.5			
	BRja	10		0.5			
	/ Descurainia Sophia						
A Forb	mustard - siliques			–			
	ALde	2	40	10			
Non-vasc		–	–	<1			
Litter		1	1	4			
Rock		–	–	–			
B Grd		1	–	–			
T Per C							
T Veg C							
T Grd C							

Keepers: ~~Lifeform~~

heur transect: ann. BRA: Draba nemorosa

TFN 5 1/110
RECD MAR 15, 2011

Veg. type (mark one): MS	MM	RF	(MSH)	(MSC)	MXC		
Date: 2009-07- 17	Worker(s): Jeff Brasher &						
Legal (TRSQQ, etc.): 521 NE	GPS (zero m):						
Other Location: Pitch Fork							
Pit Code (E9A etc.): 9A	Position related to Pit (middle S side, W of Pit, etc.): N prong toward N edge + E end						
EXREFA? (y/(n))	Transect Azimuth (degrees): 50	Site ID? 52	Sample ID 51				

Lifeform		Sp	Q1 % Ab C	Q2 % Ab C	Q3 % Ab C	T Ab Cov	Av Ab C	% Rel C
	P Grass	Elym	25	12	10			
		Poa ~~x~~ secunda	1	11	10			
		HE Scam			10			
		KOma			5			
				(20) RC	(40)			
	Gram'oid	Potentilla conc. var. bier.			1			
		TETaca			1			
		rosette 2		1	–			
		rosette 1		1	–			
	P Forb	Achmil	7	40	17			
Paronychia →		S-merous yelow cushion		–	–			
Erigeron, nem. ←		Erigeron 1 - white rays	5	10	3			
		Antennaria micr.	1	–	–			
		~~Stene~~ → CERAarve	4	2	–			
keep as fam. indet. ←		~~Erigeron 2~~ - sterile rosette	5	–	–			
		~~GAST Elat~~ → ORTHlute	1					
		TAof	<1	2	–			
		~~Arenaria~~ CERAend	2	2	1			
		Astragalus ~~Adt~~ ~~Fine~~		1	1			
	Subshrub	PHho		9	3			
	Succ							
	Shrub	ARno			15			
Tree								
	A Grass							
	A Forb	ALde	1		–			
		ORTHlute	1					
Non-vasc			<1	1	–			
Litter			1	<1	1			
Rock			–	–	–			
B Grd			1	10	10			
T Per C								
T Veg C								
T Gr'd C								

TFN 5 1/110
RECD MAR 15, 2011

Veg. type (mark one): (MS) MM RF MSH MSC MXC

Date: 2009-07-18 Worker(s): Jeff Brasher &

Legal (TRSQQ, etc.): 531 ca. C of N, GPS (zero m):

Other Location: Just S of old E7C Haul Road

Pit Code (E9A etc.): #2 Position related to Pit (middle S side, W of Pit, etc.): toward E

EXREFA? (y/n) Transect Azimuth (degrees): 248 Site ID? 53 Sample ID 52

Lifeform	Sp	Q1 % Ab C	Q2 % Ab C	Q3 % Ab C	T Ab Cov	Av Ab C	% Rel C
P Grass	ELsm	7+	8+	5+			
Gram'oid							
P Forb	Allium t.	1	2	–			
	SEDlan	2	2	<1			
	~~Silene?~~ → CERarv	4+	1	<1			
	PHho	3	4				
	Erigeron nemat.		8	3			
ARL ← Paronychia →	s-merous yellow cushion		6				
	umbel dried-sterile		1				
	~~rosette-AMA~~			<1			
	Mertensia hum.			<1			
	ann.						
Subshrub	~~CHvi~~	~~2~~	~~11~~				
Succ							
Shrub	ARnn	40+	9	80			
	CHvi	2	11				
Tree							
A Grass							
A Forb	AMA "rosette" SALSaust			<1			
Non-vasc		–	–	–			
Litter		2+	1	<1			
Rock		–	–	–			
B Grd		10+	6+	<1			
T Per C							
T Veg C							
T Gr'd C							

TFN 5 1/110
RECD MAR 15, 2011

Veg. type (mark one): MS	MM	RF	MSH	MSC	MXC		
Date: 2009-07- 18 Worker(s): Jeff Brasher &							
Legal (TRSQQ, etc.): 531 NW GPS (zero m):							
Other Location: Tailpipe							
Pit Code (E9A etc.): 58 Position related to Pit (middle S side, W of Pit, etc.): Ea. w edge							
EXREFA? (y/n) Transect Azimuth (degrees): 264 Site ID? 21 Sample ID 53							

Lifeform	Sp	Q1 % Ab C	Q2 % Ab C	Q3 % Ab C	T Ab Cov	Av Ab C	% Rel C
P Grass	Poa & fendl.	20		10			
	HE Scom	30		10			
KOmq ←	grass 1 - narrower infl than the Poa	10		10			
	FLSm	5	10	70			
	Ring-poa (MUri)		7				
		(70)		(10)			
Gram'oid							
P Forb	Antennaria mic.	22					
	SFla	2					
	ALte	1					
	PHho	15	2				
M. hum. ←	Mertensia - sterile			1			
Subshrub							
Succ							
Shrub	ARns	8	10	35			
Tree							
A Grass							
A Forb	Ann. mustard beyond det.		<1				
Non-vasc		6	2	-			
Litter		1	6	5			
Rock		-	-	-			
B Grd		<1	8	-			
T Per C							
T Veg C							
T Gr'd C							

MCC Permit 298C-A8 Baseline Veg Sampling Field Form

TFN 5 1/110
RECD MAR 15 2011

Veg. type (mark one): (MS) MM RF MSH MSC MXC							
Date: 2009-07- 18 Worker(s): Jeff Brasher &							
Legal (TRSQQ, etc.): S31 NE NW GPS (zero m):							
Other Location: Exhaust							
Pit Code (E9A etc.): 2 Position related to Pit (middle S side, W of Pit, etc.): toward NE corner							
EXREFA? (y/n) Transect Azimuth (degrees): 36 Site ID? 55 Sample ID 54							
Lifeform	Sp	Q1 % Ab C	Q2 % Ab C	Q3 % Ab C	T Ab Cov	Av Ab C	% Rel C
P Grass	ELSm	1	2	10			
	Poa ~~R~~ as earlier (POFe)	2					
	HESCom	1		10			
	other - curly dried lvs	18	3				
	- bunch						
		(20)		(20)			
Gram'oid							
P Forb	~~Silene~~? Cerastium aru.	7	10	3			
	SEla	1	2	-			
	PHho	2	4	-			
	rosette		<1	-			
EREMhoo	~~cordifolium phlox~~ - lvs < 1cm			15			
	- in fl						
Subshrub							
Succ							
Shrub	ARno	20	79	85			
Tree							
A Grass							
A Forb							
Non-vasc		<1	<1	-			
Litter		2	1	<1			
Rock		-	-	-			
B Grd		10	8	-			
T Per C							
T Veg C							
T Gr'd C							

TFN 5 1/110
RECD MAR 15, 2011

Veg. type (mark one): MS MM RF (MSH) (MSC) MXC

Date: 2009-07- 18 Worker(s): Jeff Brasher &

Legal (TRSQQ, etc.): 533 SE GPS (zero m):

Other Location: Mufsler

Pit Code (E9A etc.): 50 Position related to Pit (middle S side, W of Pit, etc.): just N of E end

EXREFA? (y/n) Transect Azimuth (degrees): 110 Site ID? 56 Sample ID SS

Lifeform		Sp	Q1 % Ab C	Q2 % Ab C	Q3 % Ab C	T Ab Cov	Av Ab C	% Rel C
	P Grass	HEco	5	1	6			
		other 1 skinte	2	4	10			
		Grass 2 anthesis KOma		5	7			
		ELsm		1	10			
	Gram'oid				(35)			
		Townsendia hookeri	1					
		Mertensia hum.			<1			
	P Forb	Astragalus spat.	* 5	* → 6	-			
		Erigeron nemati.	& 1	1	-			
		umbel = MUSI diva	2	-	1		1	
A. spat	Astrag →	rosette 1 larger ←	2					
A. spat	Astrag →	rosette 2 smaller ←	2	6	-			
		Allium	<1	2	-			
ERFE ←	Eremopyr ←	Arenaria ?		2	5			
		Silene ? → CERam		8	6			
		JAof		2	-			
		PHho		2	-			
ETd ica ←	ASTR ←	rosette ? tower + broad-lvs			2			
	Subshrub							
	Succ							
	Shrub	ARtri2PA	<1	<1	-			
Tree		PIFl			25			
	A Grass							
	A Forb							
Non-vasc			1	2	<1			
Litter			15	2	6			
Rock			35	10	4			
B Grd			5	15	-			
T Per C								
T Veg C			40					
T Grd C								

MCC Permit 298C-A8 Baseline Veg Sampling Field Form

TFN 5 1/110
DGD MAR 15, 2011

Veg. type (mark one): MS	MM	RF	MSH	MSC	MXC		
Date: 2009-07- 18	Worker(s): Jeff Brasher &						
Legal (TRSQQ, etc.): S33SE	GPS (zero m):						
Other Location: Muffler							
Pit Code (E9A etc.): SD	Position related to Pit (middle S side, W of Pit, etc.): Ca. Nedge E end						
EXREFA? (y/n) Transect Azimuth (degrees): 350	Site ID? 57	Sample ID 56					

Lifeform		Sp	Q1 % Ab C	Q2 % Ab C	Q3 % Ab C	T Ab Cov	Av Ab C	% Rel C
	P Grass	Poa x (Pose) bomch	31.5	0.5	4.5			
		HEco	4	3	2			
		DLsm	2	2	1			
		~~other~~ → KOma	4	1	6			
		Poa fend.	1.5	0.5	4.5			
	Gram'oid							
				(15)				
	P Forb	Mertensia hum.	<1		–			
		Erigeron nemat.	3		2			
		PHho	2	3	3			
		~~Astragalus nutt.~~ → OXYmul	2		<1			
		~~Silene~~ → CERarv		12	1			
		rosette - Boechera holb.		<1	–			
		ACmi.			<1			
		SEla			2			
	Subshrub	ARfr	15		–			
	Succ							
	Shrub	ARtrTRu	21	19	35			
		ARtrnaPA		2	11			
Tree								
	A Grass							
	A Forb	mustard - siliques	1					
		- Halimolobos virgata						
Non-vasc			<1	–	–			
Litter			2	2	2			
Rock			<1	–	–			
B Grd			3	10	4			
T Per C								
T Veg C								
T Gr'd C								

TFN 5 1/110
RECD MAR 15, 2011

Veg. type (mark one): MS MM RF MSH MSC MXC

Date: 2009-07- 18 Worker(s): Jeff Brasher &

Legal (TRSQQ, etc.): 5 33 5F GPS (zero m):

Other Location: N of Muffler

Pit Code (E9A etc.): N of 5D Position related to Pit (middle S side, W of Pit, etc.):

EXREFA? (y/n) Transect Azimuth (degrees): 110 Site ID? 58 Sample ID 57

mosquitos

Lifeform	Sp	Q1 % Ab C	Q2 % Ab C	Q3 % Ab C	T Ab Cov	Av Ab C	% Rel C
P Grass	HEco	45	35	2			
	ELsm	~~45~~ 22.5	~~25~~ 12.5	~~10~~ 5			
	LEKi		3.5	10			
	ELlanc.	22.5	12.5	5			
			(100)	(40)			
Gram'oid							
P Forb	ACmi	1	8				
	~~Stene?~~ CEBer		4				
	TAof		1	3			
	Potentilla conc. var. bicr.			4			
	~~Astragalus mill?~~			5			
	~~Arenaria~~			20			
Subshrub							
Succ							
Shrub							
Tree							
A Grass							
A Forb	~~Polygonum articulare?~~ (P. sawatchense)	2		<1			
Non-vasc		<1	–	–			
Litter		3	1	1			
Rock		1	1	2			
B Grd		–	–	1			
T Per C							
T Veg C							
T Gr'd C							

Astr. ceb. ← ~~Astragalus mill?~~

EFFE ← Eremogone ← ~~Arenaria~~

TFN 5 1/110
RECD MAR 15, 2011

Veg. type (mark one): MS MM RF MSH MSC MXC

Date: 2009-07-18 Worker(s): Jeff Brasher &

Legal (TRSQQ, etc.): S 33 NW GPS (zero m):

Other Location: Muffler

Pit Code (E9A etc.): ~~Mx~~ S D Position related to Pit (middle S side, W of Pit, etc.):

EXREFA? (y/n) Transect Azimuth (degrees): 94 Site ID? 59 Sample ID 58

Lifeform	Sp	Q1 % Ab C	Q2 % Ab C	Q3 % Ab C	T Ab Cov	Av Ab C	% Rel C
Grass	ELsm	30	10	2			
	HECO	30	10				
	other Bouteloua		10				
	but round-cylindrical						
	leaves						
	Poa			3			
	LHki			5			
Gram'oid							
P Forb	~~Stone~~ → CEKaFV	4	2				
	~~Astragalus~~	4					
	Crep nu	2					
	Erigeron	1					
	CAlmt		1				
	Allium			2			
	Polygonum			1			
Subshrub							
Succ							
Shrub	ARtrvdPA		90	30			
Tree							
A Grass							
A Forb	~~Polygonum~~						
Non-vasc		<1	<1	<1			
Litter		1	3	1			
Rock		–	–	–			
B Grd		3	2	<1			
T Per C							
T Veg C							
T Gr'd C							

Kame

Aong Det

TFN 5 1/110
RECD MAR 15, 2011

Veg. type (mark one): MS MM RF (MSH) (MSC) MXC

Date: 2009-07- 13 Worker(s): Jeff Brasher &

Legal (TRSQQ, etc.): 33 N GPS (zero m):

Other Location: Muffler

Pit Code (E9A etc.): 50 Position related to Pit (middle S side, W of Pit, etc.):

EXREFA? (y/n) Transect Azimuth (degrees): 110 Site ID? 60 Sample ID 59

Lifeform	Sp	Q1 % Ab C	Q2 % Ab C	Q3 % Ab C	T Ab Cov	Av Ab C	% Rel C
P Grass	HECO	30	20	5			
	ELSm	20	10	20			
	cylindrical head → KOma	10	20	10			
	Poa indet.	5	15	20			
	LEKi	10	5	5			
Gram'oid							
				35			
P Forb	Astrag ~~mollis~~ indet.	19		—			
	Silene → CERarr	9	10	15			
	Gilb		5	—			
	Erigeron			5			
Subshrub	ARFr	10					
Succ							
Shrub	ARtri PA	3		20			
Tree							
A Grass							
A Forb							
Non-vasc		<1	<1	—			
Litter		1	2	—			
Rock		—	—	—			
B Grd		—	2	—			
T Per C							
T Veg C							
T Gr'd C							

TFN 5 1/110
RECD MAR 15, 2011

Veg. type (mark one): MS MM RF MSH MSC MXC

Date: 2009-07- 21 Worker(s): Jeff Brasher &

Legal (TRSQQ, etc.): S36 NW GPS (zero m):

Other Location:

Pit Code (E9A etc.): Position related to Pit (middle S side, W of Pit, etc.):

EXREFA? (y/n) Transect Azimuth (degrees): 180 Site ID? 61 Sample ID 60

Lifeform	Sp	Q1 % Ab C	Q2 % Ab C	Q3 % Ab C	T Ab Cov	Av Ab C	% Rel C
P Grass	FLSm	25	12	3			
	BOgr	–	8	2			
Gram'oid							
P Forb	PHho	3	3	1			
	ORfascidlata		1				
	Astragalus mutt, indet.		1				
	Allium te		1				
Subshrub	CHvi	2	R				
Succ							
Shrub	ARno	1	42	10			
	CHvi	2					
Tree							
A Grass							
A Forb	ALde	1					
	Chenopodium - narrowlvs as at Hutton-Jordan (C. pratericola)			1			
Non-vasc		<1	<1	3			
Litter		4	1	1			
Rock		–	–	–			
B Grd		20	19	30			
T Per C							
T Veg C							
T Gr'd C							

TFN 5 1/110
RECD MAR 15, 2011

Veg. type (mark one): (MS) MM RF MSH MSC MXC

Date: 2009-07-21 Worker(s): Jeff Brasher &

Legal (TRSQQ, etc.): S 36 NW GPS (zero m):

Other Location: Exhaust

Pit Code (E9A etc.): Position related to Pit (middle S side, W of Pit, etc.):

EXREFA? (y/n) (y) Transect Azimuth (degrees): 280 Site ID? 62 Sample ID 61

Lifeform	Sp	Q1 % Ab C	Q2 % Ab C	Q3 % Ab C	T Ab Cov	Av Ab C	% Rel C
P Grass	KOma	5	1				
	ELsm	15	20	15			
	HECO		2	1			
Gram'oid							
P Forb	PHho	2	5	1			
	Antennaria mic.	5		3			
M. hum. ←	Mertensia - dried up			1			
Subshrub							
Succ							
Shrub	ARnd	80	55	35			
Tree							
A Grass							
A Forb							
Non-vasc		3	1	1			
Litter		1	4	2			
Rock		-	-	-			
B Grd		1	10	5			
T Per C							
T Veg C							
T Gr'd C							

TFN 5 1/110
RECD MAR 15 2011

Veg. type (mark one): MS (MM) RF MSH MSC MXC

Date: 2009-07- 21 Worker(s): Jeff Brasher &

Legal (TRSQQ, etc.): S36 SW SE GPS (zero m):

Other Location: Exhaust

Pit Code (E9A etc.): 4 Position related to Pit (middle S side, W of Pit, etc.): S of 4

EXREFA? (y/n) Transect Azimuth (degrees): 100 Site ID? 63 Sample ID 102

Lifeform	Sp	Q1 % Ab C	Q2 % Ab C	Q3 % Ab C	T Ab Cov	Av Ab C	% Rel C
P Grass	Elsm	65	15	16			
	HECO		20	14			
Gram'oid							
P Forb	CERAN ← Silene? as before	25	10	–			
	Eriogon - dried up		3				
	Eriogonum ~~fasciculatum~~						
	E. alatum ← – tall infl. from rosette		2				
Subshrub	CHVI	1		1			
Succ							
Shrub	CEmo	100	30	100			
	CHVI	1		1			
Tree							
A Grass							
A Forb							
Non-vasc		1	15	–			
Litter		3	20	–			
Rock		–	5	–			
B Grd		–	1	–			
T Per C							
T Veg C							
T Gr'd C							

TFN 5 1/110
RECD MAR 15, 2011

Veg. type (mark one): MS (MM) RF MSH MSC MXC

Date: 2009-07-21 Worker(s): Jeff Brasher &

Legal (TRSQQ, etc.): S36 SE GPS (zero m):

Other Location: S of Exhaust

Pit Code (E9A etc.): S of 4 Position related to Pit (middle S side, W of Pit, etc.):

EXREFA? (y/n) Transect Azimuth (degrees): 354 Site ID? 64 Sample ID 63

Lifeform	Sp	Q1 % Ab C	Q2 % Ab C	Q3 % Ab C	T Ab Cov	Av Ab C	% Rel C
P Grass	ELsm	4	4				
	KOma	2					
	HECO		7				
	Poa secunda		6				
			(20				
Gram'oid	Carex- sterile CARaur	1					
P Forb	ALte	1					
	"cushion phlox" lvs <10mm	<1					
	Penstemon angust. var. angust. ~~Mertensia~~	<1					
	Erigeron nemat.	1	3				
	COum		2				
	~~Lorage~~ ONDmolDCC		10				
	PHho	<1	2				
Subshrub	CHvi	10					
Succ							
Shrub	CEmo			20			
	ARno			35			
	CHVI	10					
Tree							
A Grass							
A Forb							
Non-vasc		—	3	1			
Litter		1	1	1			
Rock		2	—	—			
B Grd		70	25	1			
T Per C							
T Veg C							
T Grd C							

TFN 5 1/110
RECD MAR 15, 2011

Veg. type (mark one): MS (MM) RF MSH MSC MXC

Date: 2009-07- 21 Worker(s): Jeff Brasher &

Legal (TRSQQ, etc.): S 36 SE GPS (zero m):

Other Location: Exhaust

Pit Code (E9A etc.): 3 Position related to Pit (middle S side, W of Pit, etc.): W trp

EXREFA? (y/n) y Transect Azimuth (degrees): 172 Site ID? 65 Sample ID 64

Lifeform	Sp	Q1 % Ab C	Q2 % Ab C	Q3 % Ab C	T Ab Cov	Av Ab C	% Rel C
P Grass	ELsp	5	2	1		3.7	
	HEco	6	3	10		6.3	
	ELsm	4	2	5		3.7	
	Poa-like prev. (Pose)	7	1	5		4.3	
Gram'oid							
P Forb	COum	3	–			1	
	PHho	1	–	1		0.7	
Subshrub	~~CHvi~~	~~10~~	~~20~~	~~4~~			
	Eriogonum	8	–			2.7	
Succ	OPpo			1		0.3	
Shrub	CHvi	10	20	4		11.3	
Tree							
A Grass							
A Forb	CAmmic		1	2		1	
Non-vasc		1	1	1		1	
Litter		3	2	3		2.7	
Rock		<1	<1	–		0.3	
B Grd		5	10	1		5.3	
T Per C							
T Veg C							
T Gr'd C							

(specimen missing)

TFN 5 1/110
RECD MAR 15, 2011

Veg. type (mark one): MS (MM) RF MSH MSC MXC

Date: 2009-07-21 Worker(s): Jeff Brasher &

Legal (TRSQQ, etc.): 536N Center GPS (zero m):

Other Location: W of Exhaust of Sect.

Pit Code (E9A etc.): 1 Position related to Pit (middle S side, W of Pit, etc.): W of proposed pit

EXREFA? (y/n) Transect Azimuth (degrees): Site ID? 65A Sample ID 64A First Attempt

fell on limestone rock outcrop. Pic 8040. 2nd Attempt fine.

Lifeform	Sp	Q1 % Ab C	Q2 % Ab C	Q3 % Ab C	T Ab Cov	Av Ab C	% Rel C
P Grass	Elrsm			5		1.7	
Gram'oid							
P Forb	umbel: MUte	1	8			3	
	Erogeron-sleeple		10			3.3	
Phacelia paronychia	smooths yellow cushion			1		0.3	
Subshrub	~~CHvi~~		~~<1~~				
Shrub Succ							
Shrub	CEmo		1	75		25.3	
	CHvi		<1			0.2	
Tree							
A Grass							
A Forb							
Non-vasc		1	1	1		1	
Litter		1	1	1		1	
Rock		90	~~sest~~ 17.5	90		62.5	
B Grd		5	1	1		2.3	
T Per C							
T Veg C							
T Grd C							

Pic taken of large nest in small sandstone cave - Raptor Nest. Between site & truck.

TFN 5 1/110
RECD MAR 15, 2011

Veg. type (mark one): (MS) MM RF MSH MSC MXC

Date: 2009-07- 21 Worker(s): Jeff Brasher &

Legal (TRSQQ, etc.): 530 NE GPS (zero m):

Other Location: SW of Exhaust

Pit Code (E9A etc.): 1 Position related to Pit (middle S side, W of Pit, etc.):

EXREFA? (y/n) Transect Azimuth (degrees): 340 Site ID? 66 Sample ID 65

Lifeform	Sp	Q1 % Ab C	Q2 % Ab C	Q3 % Ab C	T Ab Cov	Av Ab C	% Rel C
P Grass	ELSu	4	10	7			
	HECO	6	1				
Gram'oid							
P Forb	Erigeron - same	2					
	Antennaria - same			10			
	Pthe			10			
Subshrub	CHvi	1					
Succ							
Shrub	ARno	22	100	100			
	CHvi	1					
Tree							
A Grass							
A Forb							
Non-vasc		<1	1	–			
Litter		5	1	–			
Rock		–	–	–			
B Grd		30	–	1			
T Per C							
T Veg C							
T Gr'd C							

Enem. ← Erigeron
Amice ← Antennaria

TFN 5 1/110
RECD MAR 15, 2011

Veg. type (mark one)	MS	MM	RF	MSH	MSC	MXC	
Date: 2009-07- 21	Worker(s): Jeff Brasher &						
Legal (TRSQQ, etc.): 536	GPS (zero m):						
Other Location: Extract							
Pit Code (E9A etc.): Node 1	Position related to Pit (middle S side, W of Pit, etc.):						
EXREFA? (y/n)	Transect Azimuth (degrees):	Site ID? 101	Sample ID 106				

Lifeform	Sp	Q1 % Ab C	Q2 % Ab C	Q3 % Ab C	T Ab Cov	Av Ab C	% Rel C
P Grass	KOma	5	20	5			
	HEco	5	20	5			
	ELSm	5	20	20			
	Poa - same (POSe)		20	5			
			(80)	40			
Gram'oid							
P Forb	Erigeron - same	3		3			
	AHLo	1		1			
	~~Mertensia - same~~			2			
Subshrub							
Shrub Succ							
Shrub	ARNo	70	10	30			
Tree							
A Grass							
A Forb							
Non-vasc		<1	1	20			
Litter		1	1	1			
Rock		~~10~~ 1	–	–			
B Grd		10	–	1			
T Per C							
T Veg C							
T Gr'd C							

PSG-PENarg/ANG

TFN 5 1/110
RECD MAR 15, 2011

Veg. type (mark one): (MS) MM RF MSH MSC MXC

Date: 2009-07- 21 Worker(s): Jeff Brasher &

Legal (TRSQQ, etc.): S 36 NW GPS (zero m):

Other Location: W of Exhaust

Pit Code (E9A etc.): W of 1 Position related to Pit (middle S side, W of Pit, etc.):

EXREFA? (Y/n) Transect Azimuth (degrees): Site ID? 66 Sample ID 67

Lifeform	Sp	Q1 % Ab C	Q2 % Ab C	Q3 % Ab C	T Ab Cov	Av Ab C	% Rel C
P Grass	BOgr	10		5			
	Poa -sand (POse)	10	10	10			
	ELSm	20	10	5			
		(40)					
Gram'oid							
P Forb	STEDian	1					
	Mertensia hum.		1				
	PHHO		1				
Subshrub	~~CHVI~~	~~2~~		~~2~~			
Succ							
Shrub	ARNO		10	75			
	CHVI	2		2			
Tree							
A Grass							
A Forb							
Non-vasc		–	–	2			
Litter		1	4	1			
Rock		–	–	–			
B Grd		4	1	1			
T Per C							
T Veg C							
T Gr'd C							

TFN 5 1/110
RECD MAR 15, 2011

Veg. type (mark one): MS	MM	RF	MSH	MSC	MXC		
Date: 2009-07- 21	Worker(s): Jeff Brasher &						
Legal (TRSQQ, etc.): S 36 NW	GPS (zero m):						
Other Location: W of Exhaust							
Pit Code (E9A etc.): W of 1	Position related to Pit (middle S side, W of Pit, etc.):						
EXREFA? (y/n) Transect Azimuth (degrees): 270	Site ID? 61	Sample ID 68					

Lifeform	Sp	Q1 % Ab C	Q2 % Ab C	Q3 % Ab C	T Ab Cov	Av Ab C	% Rel C
P Grass	ELSin		3	1			
Gram'oid	Carex - sterile	12					
PHLmu SCOrd. ← P Forb	"cushion phlox" less < 1mm	10	8	8			
PASE ← Paronychia →	Smerous yellow cushion	4	1				
E.nem. ←	Eriogeron - same	8		1			
	Eriogonum		5				
A.spat. ←	Astragalus cushion - lavendar flr			1			
Subshrub							
Succ							
Shrub							
Tree							
A Grass							
A Forb							
Non-vasc		<1	<1	<1			
Litter		1	1	1			
Rock		25	20	25			
B Grd		10	6	10			
T Per C							
T Veg C							
T Gr'd C							

TFN 5 1/110
RECD MAR 15, 2011

Veg. type (mark one) (MS)	MM	RF	MSH	MSC	MXC		
Date: 2009-07- 21	Worker(s): Jeff Brasher &						
Legal (TRSQQ, etc.): S 30	GPS (zero m):						
Other Location: N of Etchepare Main Gate							
Pit Code (E9A etc.):	Position related to Pit (middle S side, W of Pit, etc.):						
EXREFA? (y)n)	Transect Azimuth (degrees): 172	Site ID? 70	Sample ID 69				

Lifeform	Sp	Q1 % Ab C	Q2 % Ab C	Q3 % Ab C	T Ab Cov	Av Ab C	% Rel C
P Grass	ELsm	8	30	20			
	Poa-same (POSE)	2	30	20			
	HEco		30	20			
	KOma			10			
				(70)			
Gram'oid							
P Forb	SFla			1			
Subshrub	~~CHvi~~	~~2~~		~~5~~			
	ARfr		<1				
	GUsa	2		5			
Succ							
Shrub	~~Chrysothamnus~~						
	~~CHvi~~	~~70~~					
	CEmo	<1					
	ARno	<1	1				
	Chrysothamnus not vorm.	70					
	~~CHvi~~	~~2~~		~~5~~			
Tree							
A Grass							
A Forb	ALde		1	1			
Non-vasc		–	1	–			
Litter		1	2	2			
Rock		–	–	<1			
B Grd		1	2	1			
T Per C							
T Veg C							
T Gr'd C							

TFN 5 1/110
RECD MAR 15,2011

Veg. type (mark one): MS	(MM)	RF	MSH	MSC	MXC		
Date: 2009-07- 21	Worker(s): ~~Jeff~~ Brasher &						
Legal (TRSQQ, etc.): S30 NW	GPS (zero m):						
Other Location: NE of main gate							
Pit Code (E9A etc.):	Position related to Pit (middle S side, W of Pit, etc.):						
EXREFA? (y/n)	Transect Azimuth (degrees): 6	Site ID? 71	Sample ID 70				

Lifeform	Sp	Q1 % Ab C	Q2 % Ab C	Q3 % Ab C	T Ab Cov	Av Ab C	% Rel C
P Grass	ELsm	20	7	15			
Gram'oid							
P Forb	CAclav	4					
	PHhu	~~2~~	2				
Subshrub	ARfr	10					
	~~CHvi~~		~~2~~				
Succ	OPpo	2		2			
Shrub	ARnu	10	70	10			
	CEmo	1					
	CHvi		2				
Tree							
A Grass							
A Forb							
Non-vasc		–	–	–			
Litter		4	2	4			
Rock		–	~~3~~ –	2			
B Grd		–	1	15			
T Per C							
T Veg C							
T Grd C							

TFN 5 1/110
RECD MAR 15, 2011

Veg. type (mark one): MS MM RF MSH MSC MXC

Date: 2009-07- 21 Worker(s): Jeff Brasher &

Legal (TRSQQ, etc.): 530 NW GPS (zero m):

Other Location: SE of main gate

Pit Code (E9A etc.): Position related to Pit (middle S side, W of Pit, etc.):

EXREFA? (y/n) Transect Azimuth (degrees): 354 Site ID? 72 Sample ID 71

Lifeform	Sp	Q1 % Ab C	Q2 % Ab C	Q3 % Ab C	T Ab Cov	Ay Ab C	% Rel C
P Grass	ELSm	1	1	1			
	~~Hrz~~ MUrr			1			
Gram'oid	Carex- sterile		1				
P Forb	umbel: MUsten	10	2			4	
Subshrub							
Succ							
Shrub	CEmo	40	15	<1			
Tree							
A Grass							
A Forb							
Non-vasc		2	5	7			
Litter		<1	—	<1			
Rock		75	90	98			
B Grd		10	<1	—			
T Per C							
T Veg C							
T Gr'd C							

TFN 5 1/110
RECD MAR 15, 2011

Veg. type (mark one): MS	(MM)	RF	MSH	MSC	MXC		
Date: 2009-07- 21	Worker(s): Jeff Brasher &						
Legal (TRSQQ, etc.): 530		GPS (zero m):					
Other Location: S of gate, W of warren pit							
Pit Code (E9A etc.): Warren	Position related to Pit (middle S side, W of Pit, etc.):						
EXREFA? (y/n)	Transect Azimuth (degrees): 320	Site ID? 73	Sample ID 72				

Lifeform	Sp	Q1 % Ab C	Q2 % Ab C	Q3 % Ab C	T Ab Cov	Av Ab C	% Rel C
P Grass	Elsm	10	98	60			
Gram'oid							
P Forb	PHho	5		25			
	~~Sitene~~ ?? OERarv	10		4			
	Alte	~~2~~	2				
	SEla			4			
Subshrub	~~CHVi~~	~~6~~		~~7~~			
Succ							
Shrub	CEmo	20	4				
	ARNO			1			
	CHVi	6		7			
Tree							
A Grass							
A Forb	Alt tasum alien-lg trtr	1		<1			
	(A. alyssoides)						
Non-vasc		20	—	4			
Litter		5	1	1			
Rock		—	—	6			
B Grd		—	1	8			
T Per C							
T Veg C							
T Grd C							

TFN 5 1/110
RECD MAR 15, 2011

Veg. type (mark one): MS	MM	RF	MSH	MSC	MXC		
Date: 2009-07- 21	Worker(s): Jeff Brasher &						
Legal (TRSQQ, etc.):	5 30 NW	GPS (zero m):					
Other Location: Tailgn							
Pit Code (E9A etc.): 5A	Position related to Pit (middle S side, W of Pit, etc.): toward trip						
EXREFA? (y/n)	Transect Azimuth (degrees):		Site ID? 74	Sample ID 73			

Lifeform	Sp	Q1 % Ab C	Q2 % Ab C	Q3 % Ab C	T Ab Cov	Av Ab C	% Rel C
P Grass	Muhlenbergia richi		16	60			
	ELsm		5				
	ELsp		10				
Gram'oid							
			(25)				
P Forb	TETaca	3					
	umbel: Musten	<1	10			3.5	
	rosette - PhySarta?			<1			
Subshrub	~~CHvi~~	~~2~~					
Succ							
Shrub	CHVi	2					
Tree							
A Grass							
A Forb							
Non-vasc		<1	<1	<1			
Litter		–	2	2			
Rock		95	20	1			
B Grd		4	<1	1			
T Per C							
T Veg C							
T Grd C							

TFN 5 1/110
RECD MAR 15, 2011

Veg. type (mark one): MS MM (RF) MSH MSC MXC

Date: 2009-07- 21 Worker(s): Jeff Brasher &

Legal (TRSQQ, etc.): S30 NW GPS (zero m):

Other Location: Tailfin

Pit Code (E9A etc.): 5A Position related to Pit (middle S side, W of Pit, etc.):

EXREFA? (y/n) Transect Azimuth (degrees): 120 Site ID? 75 Sample ID 74

Lifeform	Sp	Q1 % Ab C	Q2 % Ab C	Q3 % Ab C	T Ab Cov	Av Ab C	% Rel C
P Grass	Muhlenbergia asperifolia (MUri)	15	16				
Gram'oid							
P Forb	Phusaria? sterile	<1					
	Potentilla - sterile	<1		<1			
Subshrub							
Succ							
Shrub	CEmo	1					
Tree							
A Grass							
A Forb	crispy - umbel?	3					
Non-vasc		10	11	4			
Litter		<1	1	<1			
Rock		25	6	98			
B Grd		20	40	1			
T Per C							
T Veg C							
T Grd C							

TFN 5 1/110
RECD MAR 15, 2011

Veg. type (mark one): MS MM (RF) MSH MSC MXC

Date: 2009-07- 21 Worker(s): Jeff Brasher &

Legal (TRSQQ, etc.): S30 NW GPS (zero m):

Other Location: Tailfin

Pit Code (E9A etc.): 5A Position related to Pit (middle S side, W of Pit, etc.): toward tip

EXREFA? (y/n) Transect Azimuth (degrees): 190 Site ID? 76 Sample ID 75

Lifeform	Sp	Q1 % Ab C	Q2 % Ab C	Q3 % Ab C	T Ab Cov	Av Ab C	% Rel C
P Grass	ELsm	25	4				
	HEco	1					
Gram'oid							
P Forb	TEac	15	~~15~~ 1				
	~~Astragalus~~ lvs < 1cm	5	~~5~~	<1			
	Erigeron ochro.		3				
	Smaeows yellow cushion		2	1			
	~~Eri~~						
	~~Erigo Aster~~ Symphot?		1				
	DHho		1				
Subshrub	~~CHvi~~	~~1~~	~~12~~	~~2~~			
Succ							
Shrub	CHvi	1	12	2			
Tree							
A Grass							
A Forb							
Non-vasc		1	2	20			
Litter		2	2	<1			
Rock		3	25	92			
B Grd		<1	2	<1			
T Per C							
T Veg C							
T Gr'd C							

EREMhook ← Paronychia →

TFN 5 1/110
RECD MAR 15, 2011

Veg. type (mark one): MS	MM	(RF)	MSH	MSC	MXC		
Date: 2009-07- 21	Worker(s): Jeff Brasher &						
Legal (TRSQQ, etc.): 530 NW	GPS (zero m):						
Other Location: Tail fin							
Pit Code (E9A etc.): SA	Position related to Pit (middle S side, W of Pit, etc.):						
EXREFA? (y/n) y	Transect Azimuth (degrees): 240	Site ID? 77	Sample ID 76				

Lifeform	Sp	Q1 % Ab C	Q2 % Ab C	Q3 % Ab C	T Ab Cov	Av Ab C	% Rel C
P Grass	ELSP		1				
	Muhlenbergia rich.		7				
	ELSm			10			
Gram'oid							
P Forb	Paronychia → Numerous yell. cushion	1					
	Physaria? rosette	<1	<1				
	browned rosette		1				
	Erigeron			1			
	SEla			1			
Subshrub	~~CHVI~~	~~1~~	~~10~~	~~10~~			
Succ							
Shrub	ARNO			2			
	CHVI	1	10	10			
Tree							
A Grass							
A Forb	LAOC		1				
	ALdc		<1				
Non-vasc		<1	1	≥6			
Litter		<1	<1	1			
Rock		97	70	70			
B Grd		1	1	1			
T Per C							
T Veg C							
T Gr'd C							

TFN 5 1/110
DEQ MAR 15, 2011

Veg. type (mark one): MS MM RF MSH MSC MXC

Date: 2009-07- 21 Worker(s): Jeff Brasher &

Legal (TRSQQ, etc.): 530 NW GPS (zero m):

Other Location: Tailfin

Pit Code (E9A etc.): SA Position related to Pit (middle S side, W of Pit, etc.):

EXREFA? (y/n) Transect Azimuth (degrees): 18 Site ID? 78 Sample ID 76 77

Lifeform	Sp	Q1 % Ab C	Q2 % Ab C	Q3 % Ab C	T Ab Cov	Av Ab C	% Rel C
P Grass	ELsp	2	8	4			
	Muhlenbergia richi	1					
Gram'oid							
P Forb	PHho	<1		1			
	burnt forb	<1					
	Eriogonum umbK			3			
	Erigeron			3			
Subshrub	~~Gtlri~~		~~6~~	~~12~~			
Succ							
Shrub	ARno		20				
	CHvi		6	12			
Tree							
A Grass							
A Forb	ALde	<1	2	<1			
Non-vasc		6	1	10			
Litter		<1	2	3			
Rock		90	5	70			
B Grd		1	8	1			
T Per C							
T Veg C							
T Gr'd C							

TFN 5 1/110
RECD MAR 15, 2011

Veg. type (mark one): MS	(MM)	RF	MSH	MSC	MXC		
Date: 2009-07- 21	Worker(s): Jeff Brasher &						
Legal (TRSQQ, etc.): 530 SE-NW	GPS (zero m):						
Other Location: Tailfin							
Pit Code (E9A etc.): 5A	Position related to Pit (middle S side, W of Pit, etc.):						
EXREFA? (y/n) y	Transect Azimuth (degrees): 45	Site ID? 79	Sample ID 78				

Lifeform	Sp	Q1 % Ab C	Q2 % Ab C	Q3 % Ab C	T Ab Cov	Av Ab C	% Rel C
P Grass	ELSp	20	2	25			
	Poa - sanne (POse)		10				
Gram'oid							
P Forb	Erigeron nem.	5					
	~~Stenne??~~ CERarv	3	1	5			
	PHho		5				
Subshrub							
Succ							
Shrub	CEmo	15	95	<1			
	ARno			1			
Tree							
A Grass							
A Forb	Alyssum - lg frt - alien (A. alyssoides)	10	1	3			
Non-vasc		1	2	3			
Litter		6	10	5			
Rock		10	-	5			
B Grd		10	20	5			
T Per C							
T Veg C							
T Grd C							

TFN 5 1/110
REGD MAR 15, 2011

Veg. type (mark one): MS MM (RF) MSH MSC MXC

Date: 2009-07- 21 Worker(s): Jeff Brasher &

Legal (TRSQQ, etc.): S 30 GPS (zero m):

Other Location: Tail fin

Pit Code (E9A etc.): SA Position related to Pit (middle S side, W of Pit, etc.):

EXREFA? (y/n) Transect Azimuth (degrees): 150 Site ID? 80 Sample ID 79

Lifeform	Sp	Q1 % Ab C	Q2 % Ab C	Q3 % Ab C	T Ab Cov	Av Ab C	% Rel C
P Grass	ELsp	4	3	10			
Gram'oid							
P Forb	TEac	3	2				
	silver-white rosette	1	1	2			
	Eriogonum-y/tall infl	1	–	2			
Eriogon ERal	burnt cushion pl	1	–				
	Eriogon-burnt	1	2				
	Potentilla-sterile		1				
Paronychia →	Smerous ...	5	8	6			
	whitish Eriogonum			1			
	PHho			<1			
Subshrub	~~CHvi~~	~~8~~		~~2~~			
	~~Smerous...~~	~~5~~		~~6~~			
Succ							
Shrub	CHvi	8		2			
Tree							
A Grass							
A Forb							
Non-vasc		5	4	3			
Litter		2	1	3			
Rock		70	95	20			
B Grd		1	2	1			
T Per C							
T Veg C							
T Gr'd C							

TFN 5 1/110
RECD MAR 15, 2011

Veg. type (mark one): MS MM (RF) MSH MSC MXC

Date: 2009-07- 21 Worker(s): Jeff Brasher &

Legal (TRSQQ, etc.): S 30 SE NW GPS (zero m):

Other Location: Tailgate

Pit Code (E9A etc.): SA Position related to Pit (middle S side, W of Pit, etc.):

EXREFA? (y/n) Transect Azimuth (degrees): 170 Site ID? 81 Sample ID 80

Lifeform	Sp	Q1 % Ab C	Q2 % Ab C	Q3 % Ab C	T Ab Cov	Av Ab C	% Rel C
P Grass	ELsp			1			
Gram'oid							
P Forb	Potentilla hippeana	4					
EREha	~~Eriogonum phlox~~ 1vs<1cm	<1					
	TEac		1	4			
	Eriogonum		<1				
Paronychia	S-mersus..		<1	1			
	Physaria rosette			<1			
Subshrub	~~CHvi~~			~~4~~			
Succ							
Shrub	CHvi			4			
Tree							
A Grass							
A Forb							
Non-vasc		3	4	4			
Litter		–	<1	<1			
Rock		96	98	90			
B Grd		1	<1	1			
T Per C							
T Veg C							
T Gr'd C							

TFN 5 1/110
MAR 15, 2011

Veg. type (mark one): MS	MM	(RF)	MSH	MSC	MXC		
Date: 2009-07- 21	Worker(s): Jeff Brasher &						
Legal (TRSQQ, etc.): 530 NE SW	GPS (zero m):						
Other Location: Tailfin							
Pit Code (E9A etc.): SA	Position related to Pit (middle S side, W of Pit, etc.):						
EXREFA? (y/(n))	Transect Azimuth (degrees): 270	Site ID? 82	Sample ID 81				

Lifeform	Sp	Q1 % Ab C	Q2 % Ab C	Q3 % Ab C	T Ab Cov	Av Ab C	% Rel C
P Grass	ELsp		10				
	Muhlenbergia Richi.		4				
	Poa Inlet		1				
Gram'oid							
P Forb	Erigeron	2					
Paronychia →	S-merous...	2					
	SEla		1				
	TEac			1			
Subshrub	CHvi			3			
Shrub Succ							
Shrub	ARmo	9	<1				
	CEmo			5			
	CHvi			2			
Tree							
A Grass							
A Forb	ALde	<1	1				
Non-vasc		12	1	25			
Litter		<1	3	—			
Rock		52	10	92			
B Grd		40	1	—			
T Per C							
T Veg C							
T Grd C							

TFN 5 1/110
RECD MAR 15, 2011

Veg. type (mark one): MS	MM	(RF)	MSH	MSC	MXC		
Date: 2009-07- 21	Worker(s): Jeff Brasher &						
Legal (TRSQQ, etc.):	S30 N6SW	GPS (zero m):					
Other Location:	Tailem						
Pit Code (E9A etc.):	5A	Position related to Pit (middle S side, W of Pit, etc.):					
EXREFA? (y/n)	Transect Azimuth (degrees):	110	Site ID?	83	Sample ID	82	

Lifeform	Sp	Q1 % Ab C	Q2 % Ab C	Q3 % Ab C	T Ab Cov	Av Ab C	% Rel C
P Grass							
Gram'oid							
P Forb	SEla	1					
Subshrub							
Succ							
Shrub							
Tree							
A Grass							
A Forb							
Non-vasc		–	–	–			
Litter		–	1	1			
Rock		48	62	78			
B Grd		52	37	21			
T Per C							
T Veg C							
T Gr'd C							

TFN 5 1/110
REC'D MAR 15, 2011

Veg. type (mark one): MS	MM	RF	MSH	MSC	MXC		
Date: 2009-07- 21	Worker(s): Jeff Brasher &						
Legal (TRSQQ, etc.): 530 NE-SW	GPS (zero m):						
Other Location: Tailing							
Pit Code (E9A etc.): SA	Position related to Pit (middle S side, W of Pit, etc.):						
EXREFA? (y/n)	Transect Azimuth (degrees): 180	Site ID? 84	Sample ID 83				

Lifeform	Sp	Q1 % Ab C	Q2 % Ab C	Q3 % Ab C	T Ab Cov	Av Ab C	% Rel C
P Grass	HECO	10	10				
	EL sp	10	10				
Gram'oid							
P Forb	~~Sphaer~~ → CERarv	10	4				
	Erog umb.		5				
	PHHO		2				
Subshrub	~~CHVI~~		~~20~~				
Succ	OPpo	4					
Shrub	CEMO	<1	10	2			
	CHVI		20				
Tree							
A Grass							
A Forb	ALde	1					
Non-vasc		<1	1	8			
Litter		5	10	2			
Rock		<1	-	95			
B Grd		10	-	5			
T Per C							
T Veg C							
T Gr'd C							

TFN 5 1/110
RECD MAR 15, 2011

811	to mine	7+1	6+111	14 of 50	6	10 of 50	9+	15-50
811	EXREFA	15	11	8	2+	3 of 30	3+1	10-30

Veg. type (mark one): MS	MM	RF	MSH	MSC	MXC	OEQ	
Date: 2009-07-21	Worker(s): Jeff Brasher &						
Legal (TRSQQ, etc.): S30 NW	GPS (zero m):						
Other Location: Tailings							
Pit Code (E9A etc.): SA	Position related to Pit (middle S side, W of Pit, etc.): W of hit						
EXREFA? (Y/n)	Transect Azimuth (degrees): 180	Site ID? 95	Sample ID 84				

Lifeform	Sp	Q1 % Ab C	Q2 % Ab C	Q3 % Ab C	T Ab Cov	Av Ab C	% Rel C
P Grass	LEKI	5					
	ELSP	5	20	29			
	HECO		15	21			
	ELSM			20			
	KOMA			10			
				(65)			
Gram'oid							
				(0			
P Forb	PHHO	8		2			
	Erigeron-silver-white	1	2	2			
	SEla	1	2	<1			
	ALte		1				
Paronychia?	S-marosum (PASE)			2			
Subshrub	~~CHVI~~	~~4~~	~~10~~	~~<1~~			
Succ							
Shrub	TEca (TETRACANS)	2					
	ARTR	11	8	2			
	CHVI	4	10	<1			
Tree							
A Grass							
A Forb							
Non-vasc		1	—	<1			
Litter		2	1	4			
Rock		—	—	—			
B Grd		3	—	4			
T Per C							
T Veg C							
T Grd C							

798-4200

TFN 5 1/110
RECD MAR 15, 2011

Veg. type (mark one): MS (MM) RF (MSH) MSC MXC

Date: 2009-07-23 Worker(s): Jeff Brasher & —

Legal (TRSQQ, etc.): S23 C of Eddy GPS (zero m):

Other Location: Flame

Pit Code (E9A etc.): 10B Position related to Pit (middle S side, W of Pit, etc.): E end near gate

EXREFA? (y/n) — Transect Azimuth (degrees): 120 Site ID? 86 Sample ID 85

Lifeform	Sp	Q1 % Ab C	Q2 % Ab C	Q3 % Ab C	T Ab Cov	Av Ab C	% Rel C
P Grass	Poa fend.	3	10	8			
	other - mel <1cm (FEOA)	3	1				
	Elsm	3	10	2			
	Koma		10	1			
		(10)					
Gram'oid							
P Forb	~~Astragalus nutt?~~ (OXYmul)	3	–	3			
	~~Silene?~~ → CERarv	12	25	8			
	PHHO	2	2	30			
	Allium cernuum	4	2	1			
	~~rosette Eriogonum?~~ (Tomhawk)	1	–				
	SEla		1				
	Lesquerella mont.		1	1			
	Potentilla conc. var. bic.			1			
	~~Arenaria?~~ → EREMfend	5	4	10			
Subshrub							
Shrub Succ							
Shrub	ARtripRu		10	4			
Tree							
A Grass							
A Forb							
Non-vasc		3	2	1			
Litter		3	7	8			
Rock		1	–	<1			
B Grd		10	2	20			
T Per C							
T Veg C							
T Gr'd C							

Despite counts listed in Dom

TFN 5 1/110
RECD MAR 15 2011

Veg. type (mark one): MS MM RF MSH MSC MXC

Date: 2009-07- 23 Worker(s): Jeff Brasher &

Legal (TRSQQ, etc.): S 28 CoFEOPS (zero m):

Other Location: Flame

Pit Code (E9A etc.): 1D B Position related to Pit (middle S side, W of Pit, etc.): E end ~ gate

EXREFA? (y/n) Transect Azimuth (degrees): 349 Site ID? 87 Sample ID 86

Lifeform	Sp	Q1 % Ab C	Q2 % Ab C	Q3 % Ab C	T Ab Cov	Av Ab C	% Rel C
P Grass	ELsp	60					
	ELsm	10	10	4			
	KOma	14	1				
	Poa as prat (POfend)	15	10	3			
FEid ←	other from Sample 85		5				
		90	25				
Gram'oid							
EREfen ← P Forb	~~Arenaria?~~ as prov	15	6	1			
CERarv ←	~~Silene?~~ as usu	4	12	6			
	PHho	2	1	<1			
	Lesquerella		2				
	SEla		1	<1			
	Paronychia as hef.		5	1			
	~~Erigeron?~~ Townsendia h.			3			
	Astrag. cushion-simple lus			3			
	silvery (ASspat)						
	Erigeron nemati			3			
Subshrub							
Succ							
Shrub	ARtripRu	10					
Tree							
A Grass							
A Forb							
Non-vasc		1	5	10			
Litter		9	8	4			
Rock		1	8	55			
B Grd		<1	2	25			
T Per C							
T Veg C							
T Grd C							

TFN 5 1/110
RECD MAR 15, 2011

Veg. type (mark one): MS MM RF (MSH) MSC MXC

Date: 2009-07- 23 Worker(s): Jeff Brasher &

Legal (TRSQQ, etc.): S 28 C of E GPS (zero m):

Other Location: Flame

Pit Code (E9A etc.): 1DB Position related to Pit (middle S side, W of Pit, etc.): E End ~ fence S of Gate

EXREFA? (y/n) Transect Azimuth (degrees): 210 Site ID? 88 Sample ID 87

Lifeform	Sp	Q1 % Ab C	Q2 % Ab C	Q3 % Ab C	T Ab Cov	Av Ab C	% Rel C
P Grass	FEid	29	20	35			
	ELsm	10	10	29			
	KOma		10	10			
			35	65			
Gram'oid							
P Forb	~~Arenaria??~~ EREFen	3		-			
	~~Silene??~~ CERarv	8	8	11			
	Astrag. ~~mult?~~ → indet.	4	5	4			
	PHho	3	1	-			
Subshrub							
Succ							
Shrub	ARtrpRu	9	10	38			
Tree							
A Grass							
A Forb							
Non-vasc		1	1	1			
Litter		12	10	2			
Rock		<1	–	–			
B Grd		2	1	–			
T Per C							
T Veg C							
T Gr'd C							

TFN 5 1/110
RECD MAR 15, 2011

Veg. type (mark one): MS MM RF (MSH) MSC MXC

Date: 2009-07- 23 Worker(s): Jeff Brasher &

Legal (TRSQQ, etc.): S 29 C of E GPS (zero m):

Other Location: Flame - E edge

Pit Code (E9A etc.): 10B Position related to Pit (middle S side, W of Pit, etc.): N fence N of gate N of Proposed Pit

EXREFA? (y/n) Transect Azimuth (degrees): 84 Site ID? 89 Sample ID 88

Lifeform	Sp	Q1 % Ab C	Q2 % Ab C	Q3 % Ab C	T Ab Cov	Av Ab C	% Rel C
P Grass	LEKi	15		10			
	KOma	5	2				
	FEid	15	16	18			
Gram'oid							
		35					
P Forb	ALLcer ← Allium - as earlier	3		3			
	OXmul ← ~~Astragalus mult~~			6			
	~~Silene~~ → CERarv	5	10				
	PUho	2	4	10			
	SEla		1	-			
	Erigeron eatonii		2	4			
	E. fend. ← ~~Arenaria?~~ → Eremogone		4				
	PEwy			4			
	indet ← Astragalus 2 leafs	5	8	3			
	long&s, narrower, greener						
Subshrub							
Succ							
Shrub	ARTrPRu	60	69	27			
Tree							
A Grass							
A Forb	ANse (ANUsep)	5	5				
Non-vasc		-	<1	-			
Litter		1	2	12			
Rock		-	-	-			
B Grd		3	1	2			
T Per C							
T Veg C							
T Grd C							

TFN 5 1/110
RECD MAR 15, 2011

Veg. type (mark one): MS MM RF (MSH) MSC MXC

Date: 2009-07- 23 Worker(s): Jeff Brasher & —

Legal (TRSQQ, etc.): 528 C of Edge GPS (zero m):

Other Location: Flame

Pit Code (E9A etc.): 10 B Position related to Pit (middle S side, W of Pit, etc.): E edge, N of gate N of pit (prob)

EXREFA? (y/n) Transect Azimuth (degrees): 36 Site ID? 90 Sample ID 89

Lifeform	Sp	Q1 % Ab C	Q2 % Ab C	Q3 % Ab C	T Ab Cov	Av Ab C	% Rel C
P Grass	FEid	25	6	15			
	Poa secunda	10		15			
	other	10		30			
	KOma		1	20			
	ELSm		3	20			
		65		90			
Gram'oid							
P Forb	DEwy	3		5			
	Astrag, not ? indet	8		5			
indet ←	Astrag 2 as earlier	4	1	6			
	~~Fleve~~ → CERarv	2	1	10			
	CAlnut		1				
	SEla		4				
ERcato ←	Erigeron as earlier			5			
Subshrub							
Succ							
Shrub	ARtripRu	49	1	5			
Tree							
A Grass							
A Forb							
Non-vasc		<1	10	1			
Litter		9	8	3			
Rock		1	49	–			
B Grd		–	10	–			
T Per C							
T Veg C							
T Gr'd C							

TFN 5 1/110
RECD MAR 15, 2011

Veg. type (mark one): MS	MM	RF	(MSH)	MSC	MXC		
Date: 2009-07- 23	Worker(s): Jeff Brasher &						
Legal (TRSQQ, etc.):	528 C of E edge	GPS (zero m):					
Other Location:	Flame						
Pit Code (E9A etc.): 10B	Position related to Pit (middle S side, W of Pit, etc.): N of E edge						
EXREFA? (y/n)	Transect Azimuth (degrees): 22	Site ID? 91	Sample ID 90				

Lifeform	Sp	Q1 % Ab C	Q2 % Ab C	Q3 % Ab C	T Ab Cov	Av Ab C	% Rel C
P Grass	FEid	10	15	40			
	HECO	4		5			
	ELsm	4		5			
POse ←	Poa as earlier		5	19			
			20	65			
Gram'oid							
P Forb	SEla	10					
	CAmut	2		2			
	~~Stenet~~ → CEKarv	4	12	12			
keep as indet	AST rosette - ?Packera?	1					
	BEwy	2	5	15			
	Antennaria mich	3					
	TAof		3	3			
indet. ←	Astragalus 2 of earlier			10			
Subshrub							
Succ							
Shrub	ARtrid PA	4	2				
	ARtrip Ru		8	10			
Tree							
A Grass							
A Forb							
Non-vasc		1	2	–			
Litter		5	4	4			
Rock		10	–	–			
B Grd		11	2	–			
T Per C							
T Veg C							
T Gr'd C							

TFN 5 1/110
RECD MAR 15, 2011

Veg. type (mark one): MS MM RF MSH MSC MXC

Date: 2009-07- 23 Worker(s): Jeff Brasher &

Legal (TRSQQ, etc.): 528 SENE GPS (zero m):

Other Location: flame

Pit Code (E9A etc.): 10 B Position related to Pit (middle S side, W of Pit, etc.): N of NE edge

EXREFA? (y/n) Transect Azimuth (degrees): 96 Site ID? 92 Sample ID 91

Lifeform	Sp	Q1 % Ab C	Q2 % Ab C	Q3 % Ab C	T Ab Cov	Av Ab C	% Rel C
P Grass	FEid	10	15	10			
	Poa - as earlier (POSe)			10			
Gram'oid							
P Forb	Oxytropis sericea var. ser.	25	8	45			
	CAflava	20	14				
	Allium	5					
	~~Astrag. mult?~~	6					
	~~CASTELLEJA red~~		10				
	~~Silene? CERarv~~		4	12			
	~~ORTlut~~			~~3~~			
	CALmut			3			
	~~rosette-AST?~~			~~2~~			
	Erigeron caespit.			~~4~~ 6			
Subshrub							
Succ							
Shrub	ARtridPa	75	95	2			
Tree							
A Grass							
A Forb	ORTlut			3			
Non-vasc		–	1	–			
Litter		40	60	6			
Rock		–	–	–			
B Grd		–	–	4			
T Per C							
T Veg C							
T Gr'd C							

Astrag. mis. var. obl.

C. flava

TFN 5 1/110
RECD MAR 15, 2011

Veg. type (mark one): MS	MM	RF	(MSH)	MSC	MXC		
Date: 2009-07-23 Worker(s): Jeff Brasher &							
Legal (TRSQQ, etc.): S28 SE NE GPS (zero m):							
Other Location: flame							
Pit Code (E9A etc.): 10B Position related to Pit (middle S side, W of Pit, etc.): N of NE edge							
EXREFA? (y/n) Transect Azimuth (degrees): 354 Site ID? 93 Sample ID 92							

Lifeform	Sp	Q1 % Ab C	Q2 % Ab C	Q3 % Ab C	T Ab Cov	Av Ab C	% Rel C
P Grass	FEid	5		35			
	LEKT		5	35			
Gram'oid	Carex deweyana var. d.		5	35			
P Forb	Campanula rotundifolia	5					
	Silene ?> Cerastium arv.	2		10			
	BEwy	30					
	CALhut	4		6			
	Galium boreale	4					
	Antennaria rosea	4	5	5			
	TAof		4				
	CASfla		5				
Subshrub							
Succ							
Shrub	ARtrvlpa	100	100	10			
Tree							
A Grass							
A Forb							
Non-vasc		1	1	<1			
Litter		–	–	4			
Rock		–	–	–			
B Grd		–	–	–			
T Per C							
T Veg C							
T Gr'd C							

TFN 5 1/110
RECD MAR 15, 2011

Veg. type (mark one): MS MM RF MSH MSC (MXC)

Date: 2009-07-23 Worker(s): Jeff Brasher & —

Legal (TRSQQ, etc.): S28 SE NE GPS (zero m):

Other Location: Flame

Pit Code (E9A etc.): 10B Position related to Pit (middle S side, W of Pit, etc.): NE edge of proposed pit

EXREFA? (y/n) Transect Azimuth (degrees): 6 Site ID? 94 Sample ID 93

Lifeform	Sp	Q1 % Ab C	Q2 % Ab C	Q3 % Ab C	T Ab Cov	Av Ab C	% Rel C
P Grass							
Gram'oid							
	Carex geyeri	100	80	85			
P Forb	Arnica cord.		10	1			
	Viola adunca			10			
	Galium boreale			3			
Subshrub							
Succ							
Shrub							
	PSme		10	5			
Tree	PIFI	100	100	100			
A Grass							
A Forb							
Non-vasc		50	50	50			
Litter		40	30	10			
Rock		—	—	—			
B Grd		—	—	—			
T Per C							
T Veg C							
T Gr'd C							

TFN 5 1/110
RECD MAR 15, 2011

Veg. type (mark one): MS MM RF MSH MSC MXC

Date: 2009-07- 23 Worker(s): Jeff Brasher &

Legal (TRSQQ, etc.): 528 NE GPS (zero m):

Other Location: flame

Pit Code (E9A etc.): 108 Position related to Pit (middle S side, W of Pit, etc.): NW of Gate near NE edge of proposed pit

EXREFA? (y/n) Transect Azimuth (degrees): 30 Site ID? 95 Sample ID 94

Lifeform	Sp	Q1 % Ab C	Q2 % Ab C	Q3 % Ab C	T Ab Cov	Av Ab C	% Rel C
P Grass	NASvir		10	5			
Gram'oid	Carex geyeri	20	20	5			
P Forb	TAof	15	5	8			
	sterile cauline fam. indet.		5	10			
	Viola 1 - V. adunca	30	45	20			
	Fragaria vesca	10	5	–			
	~~Astragalus? different~~		5	1			
	Galium boreale		5	5			
	Potentilla grac. var. pulch.			5			
	Viola 2 - lrs longer			10			
	- sterile - keeps as indet.						
Subshrub							
Succ							
Shrub	ARtridPa		25				
	POtr	10	5				
Tree	Abies bifolia	100	5				
A Grass							
A Forb							
Non-vasc		30	10	20			
Litter		10	2	10			
Rock		1	–	–			
B Grd		–	–	5			
T Per C							
T Veg C							
T Grd C							

keeps as indet

Oxytrop sericea

TFN 5 1/110
RECD MAR 15, 2011

Veg. type (mark one): MS MM RF MSH MSC MXC

Date: 2009-07-23 Worker(s): Jeff Brasher &

Legal (TRSQQ, etc.): 528 NE GPS (zero m):

Other Location: flame

Pit Code (E9A etc.): 1DB Position related to Pit (middle S side, W of Pit, etc.): NE edge of Proposed Pit

EXREFA? (y/n) Transect Azimuth (degrees): 180 Site ID? 96 Sample ID 95

Lifeform	Sp	Q1 % Ab C	Q2 % Ab C	Q3 % Ab C	T Ab Cov	Av Ab C	% Rel C
P Grass							
Gram'oid							
	Carex	15		1			
P Forb	Viola - roundifolius	2					
	Galium boreale	4					
	Fragaria vesca	<1	10				
	ARN cord		25	8			
Subshrub							
Succ							
Shrub							
Tree	Psme	100	95	80			
A Grass							
A Forb							
Non-vasc		35	20	15			
Litter		70	10	70			
Rock		<1	–	–			
B Grd		–	–	–			
T Per C							
T Veg C							
T Gr'd C							

TFN 5 1/110
RECD MAR 15, 2011

Veg. type (mark one): MS	MM	RF	MSH	MSC	MXC		
Date: 2009-07- 23	Worker(s): Jeff Brasher &						
Legal (TRSQQ, etc.): S23 NE	GPS (zero m):						
Other Location: flame							
Pit Code (E9A etc.): 1DB	Position related to Pit (middle S side, W of Pit, etc.): NE edge						
EXREFA? (y/n) Transect Azimuth (degrees): 90	Site ID? 97	Sample ID 96					

Lifeform	Sp	Q1 % Ab C	Q2 % Ab C	Q3 % Ab C	T Ab Cov	Av Ab C	% Rel C
P Grass							
Gram'oid							
	Carex	25					
P Forb	~~EPIang~~ → CHAMEangus	1					
	ARNcor	10					
Subshrub							
Succ							
Shrub							
Tree	PSme	100	5	100			
A Grass							
A Forb							
Non-vasc		50	T	50			
Litter		60	100	100			
Rock		10	–	–			
B Grd		–	–	–			
T Per C							
T Veg C							
T Gr'd C							

TFN 5 1/110
RECD MAR 15, 2011

Veg. type (mark one): MS MM RF MSH MSC MXG

Date: 2009-07- 23 Worker(s): Jeff Brasher &

Legal (TRSQQ, etc.): S28SWNE GPS (zero m):

Other Location: Flame

Pit Code (E9A etc.): 10B Position related to Pit (middle S side, W of Pit, etc.): near NE edge of proposed pit

EXREFA? (y/n) Transect Azimuth (degrees): 350 Site ID? 90 Sample ID 97

Lifeform	Sp	Q1 % Ab C	Q2 % Ab C	Q3 % Ab C	T Ab Cov	Av Ab C	% Rel C
P Grass							
Gram'oid							
P Forb							
Subshrub							
Succ							
Shrub							
	POTR			50			
Tree	ABL ~~las~~ bif	100	100	100			
A Grass							
A Forb							
Non-vasc		50	50	50			
Litter		100	100	70			
Rock		-	-	-			
B Grd		-	-	-			
T Per C							
T Veg C							
T Gr'd C							

TFN 5 1/110
RECD MAR 15, 2011

Veg. type (mark one): MS MM RF MSH MSC MXC

Date: 2009-07- 23 Worker(s): Jeff Brasher &

Legal (TRSQQ, etc.): S 28 SW NE GPS (zero m):

Other Location: Flame

Pit Code (E9A etc.): 100 Position related to Pit (middle S side, W of Pit, etc.): N of NE edge of Pit

EXREFA? (y/n) Transect Azimuth (degrees): 45 Site ID? 99 Sample ID 98

Lifeform	Sp	Q1 % Ab C	Q2 % Ab C	Q3 % Ab C	T Ab Cov	Av Ab C	% Rel C
P Grass	grass			6			
	Carex			80			
Gram'oid							
P Forb	Viola adunca	12					
	ARNcor		20	5			
Subshrub	BERrep	12	10				
Succ							
Shrub	~~BERrep~~	~~12~~	~~10~~				
	Symphoricarpos oreo. v. ut.		8				
	Psme		10				
Tree	PIco	100	100	10			
A Grass							
A Forb							
Non-vasc		70	40	30 ~~20~~			
Litter		90	60	20			
Rock		–	–	–			
B Grd		–	–	–			
T Per C							
T Veg C							
T Gr'd C							

TFN 5 1/110
RECD MAR 15, 2011

Veg. type (mark one): MS MM RF (MSH) MSC MXC

Date: 2009-07- 23 Worker(s): Jeff Brasher &

Legal (TRSQQ, etc.): S28 NE GPS (zero m):

Other Location: Plume

Pit Code (E9A etc.): 1D B Position related to Pit (middle S side, W of Pit, etc.):

EXREFA? (y/n) Transect Azimuth (degrees): 38 Site ID? 100 Sample ID 99

Lifeform	Sp	Q1 % Ab C	Q2 % Ab C	Q3 % Ab C	T Ab Cov	Av Ab C	% Rel C
P Grass	ELSm	10	2	10			
	FEid	80	65	60			
	~~other~~ CALAM monta			10			
Gram'oid							
P Forb	CASfla	6					
	~~Astrag. mott?~~ → indet.	4					
	PHho	1					
	~~Sterne?~~ → CERarv		6	10			
	VICame		4				
	TAof		1				
Subshrub							
Succ							
Shrub	ARtrpRu	10	85	70			
Tree							
A Grass							
A Forb							
Non-vasc		1	<1	–			
Litter		2	1	1			
Rock		–	–	–			
B Grd		1	–	–			
T Per C							
T Veg C							
T Gr'd C							

TFN 5 1/110
RECD MAR 15, 2011

Veg. type (mark one): MS	MM	RF	MSH	MSC	MXC		
Date: 2009-07- 23 Worker(s): Jeff Brasher &							
Legal (TRSQQ, etc.): S28 SENW GPS (zero m):							
Other Location: flame							
Pit Code (E9A etc.): 108 Position related to Pit (middle S side, W of Pit, etc.):							
EXREFA? (y/n) Transect Azimuth (degrees): 360 Site ID? 101 Sample ID 100							

Lifeform	Sp	Q1 % Ab C	Q2 % Ab C	Q3 % Ab C	T Ab Cov	Av Ab C	% Rel C
P Grass	FEid	7	18	45			
	Poa secunda	3	-				
	LEki	1	-				
	other - KOma		5				
	ELsm		2				
	~~VULoct~~		~~2~~	2			
			25				
Gram'oid							
P Forb	~~Silene?~~ → CERarv	30	10	10			
	Allum	1					
	BEwy		6	15			
	~~Arenaria?~~ → Erem. fend.			4			
Subshrub							
Succ							
Shrub	ARtrDRu	40	85	12			
Tree							
A Grass	VULoct		2				
A Forb							
Non-vasc		-	-	-			
Litter		2	1	6			
Rock		-	-	-			
B Grd		1	2	3			
T Per C							
T Veg C							
T Gr'd C							

TFN 5 1/110
RECD MAR 15, 2011

Veg. type (mark one): MS	MM	RF	MSH	MSC	MXC		
Date: 2009-07- 23	Worker(s): Jeff Brasher &			—			
Legal (TRSQQ, etc.):	S23 SE	GPS (zero m):					
Other Location:	flame						
Pit Code (E9A etc.):	1DB	Position related to Pit (middle S side, W of Pit, etc.):			SE ~~at~~ Corner		
EXREFA? (y/n)	Transect Azimuth (degrees):	172	Site ID?	102	Sample ID	101	
	—				—		

Lifeform	Sp	Q1 % Ab C	Q2 % Ab C	Q3 % Ab C	T Ab Cov	Av Ab C	% Rel C
P Grass	LEKi	55	20	20			
	~~Flsm~~ → ELla		10	20			
	grass → Poa arida		10	20			
	HECO			10			
				75			
Gram'oid							
P Forb							
Subshrub							
Succ							
Shrub	ARtridPa	42		10			
Tree							
A Grass							
A Forb	Chenopodium ~~pratericola~~		2				
	~~brownea~~, fam. indet		12				
Non-vasc		<1	—	1			
Litter		—	12	15			
Rock		—	—	—			
B Grd		—	4	—			
T Per C							
T Veg C							
T Gr'd C							

Keep as ind.

TFN 5 1/110
RECD MAR 15, 2011

Veg. type (mark one): MS	MM	RF	(MSH)	MSC	MXC		
Date: 2009-07- 23 Worker(s): Jeff Brasher &							
Legal (TRSQQ, etc.): 5 23 GPS (zero m):							
Other Location: flame							
Pit Code (E9A etc.): 10B Position related to Pit (middle S side, W of Pit, etc.): toward SE corner – near Electronic site							
EXREFA? (y/n) Transect Azimuth (degrees): 276 Site ID? 103 Sample ID 102							

Lifeform	Sp	Q1 % Ab C	Q2 % Ab C	Q3 % Ab C	T Ab Cov	Av Ab C	% Rel C
P Grass	FEid	35	30	15			
	ELsm	35	30				
	Poa secunda			15			
Gram'oid							
P Forb	~~Silene?~~ → CERarv	30	2	1			
	Erigeron eatonii	5		8			
	Astrag. ~~mtt?~~ → indet.	15	4	10			
	→ PHLo	~~10~~ 11		10			
	~~Forbs PLM?~~	1					
Subshrub	ARfr		4	4			
Succ							
Shrub	ARtripRo		20				
Tree							
A Grass							
A Forb							
Non-vasc		3	2	5			
Litter		4	8	10			
Rock		–	1	2			
B Grd		1	4	5			
T Per C							
T Veg C							
T Gr'd C							

Collected at or near site: Boechera holboellii

TFN 5 1/110
RECD MAR 15, 2011

Veg. type (mark one): MS	MM	RF	MSH	MSC	MXC		
Date: 2009-07- 23 Worker(s): Jeff Brasher & —							
Legal (TRSQQ, etc.): S28 SE GPS (zero m):							
Other Location: flame							
Pit Code (E9A etc.): 1DB Position related to Pit (middle S side, W of Pit, etc.): toward SE corner							
EXREFA? (y/n) Transect Azimuth (degrees): 84 Site ID? 104 Sample ID 103							

Lifeform	Sp	Q1 % Ab C	Q2 % Ab C	Q3 % Ab C	T Ab Cov	Av Ab C	% Rel C
P Grass	KOma	5	-	10			
	ELsm	5	5				
	ELSD		5	10			
	grass → Calam. monta.		1				
Gram'oid							
P Forb	~~Arenaria~~ → EREM-fend	4	5	2			
	~~Erigeron~~ → TOWNhook	~~4~~ 2	~~2~~ 3	~~4~~ 2			
	Astragalus - lus simple (Aspate)	3	5	-			
	Paronychia depressa	2	2	-			
	~~Silene~~ → CERarv	10	1	4			
	Lesquerella mont.	2	-	1			
	PHho	1	5	16			
	rosette - Mertensia hum.	1					
	SEla		1				
	Allium		4				
Subshrub	Eriogonum nematophyllus	2	3	2			
Succ							
Shrub							
Tree							
A Grass							
A Forb	ALde	4	1	1			
Non-vasc		4	5	1			
Litter		6	5	5			
Rock		2	22	1			
B Grd		5	5	3			
T Per C							
T Veg C							
T Gr'd C							

TFN 5 1/110
RECD MAR 15, 2011

Veg. type (mark one): MS MM (RF) MSH MSC MXC

Date: 2009-07- 23 Worker(s): Jeff Brasher &

Legal (TRSQQ, etc.): S28 SE GPS (zero m):

Other Location: flame

Pit Code (E9A etc.): 10B Position related to Pit (middle S side, W of Pit, etc.):

EXREFA? (y/n) (y) Transect Azimuth (degrees): 126 Site ID? 105 Sample ID 104

Lifeform	Sp	Q1 % Ab C	Q2 % Ab C	Q3 % Ab C	T Ab Cov	Av Ab C	% Rel C
P Grass	grass → POSe	15	<1	5			
	ELSm			5			
		15					
Gram'oid							
P Forb	PHho	10		1			
	SEla	2					
	~~rosette - looks like a for~~	1					
	Allium	3		8			
	Lesquerella mont.			1			
	Selaginella ~~underwoodi~~ s. densa			20			
Subshrub							
Succ							
Shrub							
Tree							
A Grass							
A Forb	ALdc	2					
	Allyssum lg frts (A. alyssoides)	1		30			
	ANDRsept	1					
Non-vasc		3	1	4			
Litter		1	–	12			
Rock		55	100	5			
B Grd		16	–	30			
T Per C							
T Veg C							
T Gr'd C							

Androsace sept. ←

TFN 5 1/110
RECD MAR 15, 2011

Veg. type (mark one): MS	MM	RF	(MSH)	MSC	MXC		
Date: 2009-07- 23 Worker(s): Jeff Brasher & —							
Legal (TRSQQ, etc.): S27 SE GPS (zero m):							
Other Location: flame							
Pit Code (E9A etc.): 16B Position related to Pit (middle S side, W of Pit, etc.):							
EXREFA? (y/(n)) Transect Azimuth (degrees): 84 Site ID? 166 Sample ID 105							

Lifeform	Sp	Q1 % Ab C	Q2 % Ab C	Q3 % Ab C	T Ab Cov	Av Ab C	% Rel C
P Grass	ELsm	1	12	3			
	grass → POse			3			
Gram'oid							
P Forb	Arabis → Boechera holb.	1					
	SEla	3					
	~~Polygonum avic.?~~	~~<1~~					
Subshrub							
Succ							
Shrub	ARtridPa	80	10	70			
Tree							
A Grass	BRte	1					
A Forb	ALae	6	22	1			
	Allyssum alyssoides	2	20	1			
	Chenopodium prat.	1					
	mustard - Draba nemorosa	2					
	Polygonum sawatchense	<1					
Non-vasc		–	–	–			
Litter		60	10	20			
Rock		–	–	1			
B Grd		10	30	10			
T Per C							
T Veg C							
T Gr'd C							

TFN 5 1/110
RECD MAR 15, 2011

Veg. type (mark one): MS MM RF (MSH) MSC MXC

Date: 2009-07- 23 Worker(s): Jeff Brasher &

Legal (TRSQQ, etc.): S28 SE GPS (zero m):

Other Location: Same

Pit Code (E9A etc.): 1DB Position related to Pit (middle S side, W of Pit, etc.):

EXREFA? (y/(n)) Transect Azimuth (degrees): 126 Site ID? 107 Sample ID 106

Lifeform	Sp	Q1 % Ab C	Q2 % Ab C	Q3 % Ab C	T Ab Cov	Av Ab C	% Rel C
P Grass	ELsp	10		16			
	HECO	10	35	10			
	KOma	1		10			
	Mg mublY MUri	10					
	ELsm		35				
	Poa secunda		35				
	Elymus lanc.			16			
				65			
Gram'oid							
P Forb	SEla	2		4			
	Potentilla conc. var. bicr.	3					
	~~Stene~~ → CERarv	10		5			
	PHHo	2					
	~~Arenaria~~ → EREfen		1	12			
OX deflex ←	~~Oxytropis~~ as earlier			20			
Subshrub							
Shrub Succ							
Shrub	ARtripRu	9					
	ARtrarta		70	30			
Tree							
A Grass							
A Forb							
Non-vasc		5	1	<1			
Litter		10	40	10			
Rock		10	-	-			
B Grd		30	-	2			
T Per C							
T Veg C							
T Gr'd C							

TFN 5 1/110
RECD MAR 15, 2011

Veg. type (mark one): MS MM RF (MSH) MSC MXC

Date: 2009-07-23 Worker(s): Jeff Brasher &

Legal (TRSQQ, etc.): 5 28 NE GPS (zero m):

Other Location: flume

Pit Code (E9A etc.): 103 Position related to Pit (middle S side, W of Pit, etc.):

EXREFA? (y/n) Transect Azimuth (degrees): 78 Site ID? 108 Sample ID 107

Lifeform	Sp	Q1 % Ab C	Q2 % Ab C	Q3 % Ab C	T Ab Cov	Av Ab C	% Rel C
P Grass	KOma	30	10				
	POa secunda	30	30	30			
	ELsm	30	10				
		60					
Gram'oid							
P Forb	Silene ?? (erastium arv.	16	13	20			
	PHho	10	–				
	Astrag. ~~mult~~ ?? indet.	20	10	25			
	Antennaria - as bef.		<1	22			
	(A. microphylla)						
Subshrub							
Succ							
Shrub	ARtriPRu	25	20	36			
Tree							
A Grass							
A Forb							
Non-vasc		–	1	–			
Litter		4	10	5			
Rock		1	–	–			
B Grd		2	4	–			
T Per C							
T Veg C							
T Gr'd C							

TFN 5 1/110
RECD MAR 15, 2011

Veg. type (mark one): MS	MM	RF	(MSH)	MSC	MXC		
Date: 2009-07- 23 Worker(s): Jeff Brasher &							
Legal (TRSQQ, etc.): S 28 SW GPS (zero m):							
Other Location: flame							
Pit Code (E9A etc.): 108 Position related to Pit (middle S side, W of Pit, etc.): middle							
EXREFA? (y/n) Transect Azimuth (degrees): 264 Site ID? 109 Sample ID 108							

Lifeform	Sp	Q1 % Ab C	Q2 % Ab C	Q3 % Ab C	T Ab Cov	Av Ab C	% Rel C
P Grass	KOma	17	7	8			
	grass → CALAMmonta	17	8				
	ELsm	17	7	8			
	LEKi		2				
	EL sp			8			
Gram-oid	Paronychia	3		–			
	Astrag. nutt 2? indet.	20	4	18			
	Silene? → CERarv	11		<1			
P Forb	PHhd	4	2	–			
	SEla	1	–	1			
	Erigeron nem.		2	2			
	Antennaria mic.		15				
Subshrub							
Succ							
Shrub	ARtripu	30	8	20			
Tree							
A Grass							
A Forb	ALde		2				
Non-vasc		–	2	–			
Litter		6	5	<1			
Rock		–	–	<1			
B Grd		4	50	49			
T Per C							
T Veg C							
T Grd C							

TFN 5 1/110
RECD MAR 15, 2011

Veg. type (mark one): MS MM RF (MSH) MSC MXC

Date: 2009-07- 23 Worker(s): Jeff Brasher &

Legal (TRSQQ, etc.): S28 NWSW GPS (zero m):

Other Location: flame

Pit Code (E9A etc.): 1013 Position related to Pit (middle S side, W of Pit, etc.):

EXREFA? (y/n) Transect Azimuth (degrees): 84 Site ID? 110 Sample ID 109

Lifeform	Sp	Q1 % Ab C	Q2 % Ab C	Q3 % Ab C	T Ab Cov	Av Ab C	% Rel C
P Grass	FEid	30	24	48			
	Poa as earlier (POSE)	20					
	KOma	10	24	–			
		50					
Gram'oid							
P Forb	BEwy	6	2	15			
	Silene ?? Cerast. arvu	6	4	25			
	Astragalus ~~[illegible]~~ ?? [illegible]	12	12	20			
ANTmic	Antennaria as prev	10					
	TOveGR		8	2			
Subshrub							
Succ							
Shrub	ARtripRu	8	24	28			
Tree							
A Grass							
A Forb							
Non-vasc		–	–	–			
Litter		2	8	20			
Rock		–	–	–			
B Grd		1	–	–			
T Per C							
T Veg C							
T Grd C							

Collected @ or near here: –

TFN 5 1/110
RECD MAR 15, 2011

Veg. type (mark one): MS MM RF (MSH) MSC MXC

Date: 2009-07- 23 Worker(s): Jeff Brasher &

Legal (TRSQQ, etc.): S28 SE NW GPS (zero m):

Other Location: flame

Pit Code (E9A etc.): 1DB Position related to Pit (middle S side, W of Pit, etc.):

EXREFA? (y/n) 0 Transect Azimuth (degrees): 96 Site ID? 110A Sample ID 109A

Lifeform	Sp	Q1 % Ab C	Q2 % Ab C	Q3 % Ab C	T Ab Cov	Av Ab C	% Rel C
P Grass	Elymus spic.			10			
	grass → CALAmont		6				
	Elsm		6	20			
			30				
Graminoid							
	LESOlud			2			
	Erigeron nem.		3	<1			
	rosette 2-lvs to ~3cm		4	-			
P Forb	~~Arenaria?~~ → EREfen	7	5	22			
	~~Silene?~~ → CERarv	15	-	-			
	~~Astrag. nutt?~~	8		-			
	~~rosette Phacelia~~	1		-			
	SEla		3	-			
	Cirsium ~~canesc.~~ → flodm.		1	-			
	~~Erigoron~~ → Townsendia h.		~~6~~ 3	<1			
	PHho		3	25			
	~~rosette 1 lvs to 4cm~~		1				
OXlmul	~~Astragalus?~~		2	10			
Subshrub	~~CHvi~~	9					
	ARfr			7			
Succ							
Shrub	ARtripru	15		<1			
	CHvi	9					
Tree							
A Grass							
A Forb	CAMmic?			2			
Non-vasc		-	-	<1			
Litter		4	2	8			
Rock		2	3	1			
B Grd		12	15	2			
T Per C							
T Veg C							
T Grd C							

A. mizer var. obl.

Plantago tweedyi

TFN 5 1/110
RECD MAR 15, 2011

Veg. type (mark one): MS	MM	RF	MSH	MSC	MXC		
Date: 2009-07- 23	Worker(s): Jeff Brasher &						
Legal (TRSQQ, etc.): 5S8 SE NW	GPS (zero m):						
Other Location: flame							
Pit Code (E9A etc.): 10B	Position related to Pit (middle S side, W of Pit, etc.):						
EXREFA? (y/n)	Transect Azimuth (degrees): 354	Site ID? 111	Sample ID 110				

Lifeform	Sp	Q1 % Ab C	Q2 % Ab C	Q3 % Ab C	T Ab Cov	Av Ab C	% Rel C
P Grass	LEKI	7	4	2			
	FEid	8	10	2			
	KOma		6	3			
	Poa sec.		6	4			
				10			
Gram'oid							
			20				
P Forb	~~Silene~~ → CERHarve	5	18	5			
	BEwy	5	–	–			
	Heuchera/Tarulidia	5	–	–			
	~~Arenaria~~ → ERFMtend		20	–			
	Antennaria mic.		10	3			
	PHho		15	1			
	Allium		1	2			
	ERfaerm		4	–			
Indet. ←	Astrag ~~mult?~~		4	10			
Subshrub	ARfr		4				
Succ							
Shrub	ARtrvdPa	85	–	26			
Tree							
A Grass							
A Forb							
Non-vasc		–	–	<1			
Litter		15	5	12			
Rock		–	2	–			
B Grd		–	3	2			
T Per C							
T Veg C							
T Gr'd C							

TFN 5 1/110
RECD MAR 15, 2011

Veg. type (mark one): MS MM RF MSH MSC MXC

Date: 2009-07- 23 Worker(s): Jeff Brasher &

Legal (TRSQQ, etc.): 528 NW GPS (zero m):

Other Location: flame

Pit Code (E9A etc.): 608 Position related to Pit (middle S side, W of Pit, etc.):

EXREFA? (y/n) Transect Azimuth (degrees): 330 Site ID? 112 Sample ID 111

Lifeform	Sp	Q1 % Ab C	Q2 % Ab C	Q3 % Ab C	T Ab Cov	Av Ab C	% Rel C
P Grass	KOma	25	5				
	Elymus from prev sites (ELsm)	25	5	3			
	ELsp		1	2			
			10	5			
Gram'oid	LESQludo		2				
	Erigeron 2 - hrs silvery			1			
	CIRcan			2			
	LIperenne		1	-			
P Forb	TETaca	6		-			
	~~Arenaria?~~ EREfen	22	18	9			
	PHho	10	15	8			
	SETa	1		-			
	Erigeron 1	1		-			
	Paronychia	<1	1	8			
	Eriogonum - tall info (ERIala)	1	8	1			
	Astrag. mult. (indet)		6	2			
	Silene? → CERarv		9	4			
	~~Draba?~~ Astrag. spat.		3				
Subshrub	ARFr	4		8			
	~~GTu~~		10	6			
Succ							
Shrub	ARtrip Ru	11	6	-			
	CHVi		10	6			
Tree							
A Grass							
A Forb	~~CAMmic?~~		2	-			
Non-vasc		-	<1	3			
Litter		2	3	4			
Rock		-	3	10			
B Grd		1	4	8			
T Per C							
T Veg C							
T Gr'd C							

TFN 5 1/110
RECD MAR 15.2011

Veg. type (mark one): MS MM RF MSH MSC (MXC)

Date: 2009-07- 23 Worker(s): Jeff Brasher &

Legal (TRSQQ, etc.): S28 Sw1 GPS (zero m):

Other Location: flame

Pit Code (E9A etc.): 108 Position related to Pit (middle S side, W of Pit, etc.):

EXREFA? (y/n) Transect Azimuth (degrees): 30 Site ID? 113 Sample ID 112

Lifeform	Sp	Q1 % Ab C	Q2 % Ab C	Q3 % Ab C	T Ab Cov	Av Ab C	% Rel C
P Grass	HEco	30					
	LEKi		100	70			
Gram'oid							
P Forb	CASfl	4					
	~~Silene?~~ → CERarv	4					
indet. ←	~~Astrag. nuttall~~	10					
	Mertensia humi	2					
	SEla	<1					
Subshrub							
Succ							
Shrub	ARtriPa	70					
Tree	PIfl		100	100			
A Grass							
A Forb							
Non-vasc		–	–	10			
Litter		20	–	30			
Rock		–	–	–			
B Grd		–	–	–			
T Per C							
T Veg C							
T Gr'd C							

TFN 5 1/110
RECD MAR 15, 2011

Veg. type (mark one): MS MM RF (MSH) (MSC) MXC

Date: 2009-07-23 Worker(s): Jeff Brasher &

Legal (TRSQQ, etc.): S28 NWSW GPS (zero m):

Other Location: flame @ ~~upper~~ middle node

Pit Code (E9A etc.): 10B Position related to Pit (middle S side, W of Pit, etc.):

EXREFA? (y/n) Transect Azimuth (degrees): 130 Site ID? 114 Sample ID 113

Lifeform	Sp	Q1 % Ab C	Q2 % Ab C	Q3 % Ab C	T Ab Cov	Av Ab C	% Rel C
P Grass	KDma	10	30	10			
	Poa fendl.	30	30	10			
	ELSm		10	1			
	WEco			30			
Gram'oid							
P Forb	PHho	<1	6				
	ACmi		2				
	Lesquerella as earlier			1			
Subshrub	~~CHvi~~			~~65~~			
Succ							
Shrub	ARtripRu	65	–				
	CHvi			65			
Tree							
A Grass			–				
A Forb	ALdr	<1	–				
	Chenopodium prat.		<1				
	LAlocc		<1	<1			
	MDNnut			<1			
Non-vasc		–	2	–			
Litter		10	10	2			
Rock		–	25	2			
B Grd		4	1	25			
T Per C							
T Veg C							
T Grd C							

Collected at or near site: Draba nemorosa,

TFN 5 1/110
RECD MAR 15, 2011

Veg. type (mark one): MS MM RF (MSH) (MSC) MXC

Date: 2009-07-23 Worker(s): Jeff Brasher &

Legal (TRSQQ, etc.): 5 23 NW SW GPS (zero m):

Other Location: flume at middle node

Pit Code (E9A etc.): 10B Position related to Pit (middle S side, W of Pit, etc.):

EXREFA? (y/n) Transect Azimuth (degrees): 90 Site ID? 115 Sample ID 114

Lifeform	Sp	Q1 % Ab C	Q2 % Ab C	Q3 % Ab C	T Ab Cov	Av Ab C	% Rel C
P Grass	HEco	100	98	55			
	Elsm			55			
		100					
Gram'oid	Carex			10			
P Forb	~~Forb~~ ERFMhbokX	2					
	TAof			2			
Subshrub							
Succ							
Shrub							
Tree							
A Grass							
A Forb	LAoc	1	<1	8			
	MOnu	<1					
CHFpra	Chenopodium ni bat		<1				
	Allyssum alyssoides			10			
Non-vasc		–	–	–			
Litter		–	–	–			
Rock		–	1	–			
B Grd		–	1	–			
T Per C							
T Veg C							
T Grd C							

TFN 5 1/110
RECD MAR 15, 2011

Veg. type (mark one): MS	(MM)	RF	MSH	MSC	MXC		
Date: 2009-07- 23	Worker(s): Jeff Brasher &						
Legal (TRSQQ, etc.):	S29 NE	GPS (zero m):					
Other Location:	flame						
Pit Code (E9A etc.):	10B	Position related to Pit (middle S side, W of Pit, etc.):	below lowest node				
EXREFA? (y/n)	Transect Azimuth (degrees):	90	Site ID? 116	Sample ID 115			

Lifeform	Sp	Q1 % Ab C	Q2 % Ab C	Q3 % Ab C	T Ab Cov	Av Ab C	% Rel C
P Grass	ELSP	18	12	4			
	Poa -as prev (POfe)	<1					
	HECO		1				
Gram'oid							
P Forb	PH ho	4		3			
	~~Silene? → CERarv~~	3	8	4			
Subshrub	~~CHvi~~		~~30+~~	~~48~~			
Succ							
Shrub	CEmo	6		5			
	CHvi		30+	48			
Tree							
A Grass							
A Forb	Alyssum alyssoides	5	15	5			
BLA DRAwen ←	~~CANmic?~~ as bet	<1					
Non-vasc		4	5	1			
Litter		5	10+	4			
Rock		8	10	2			
B Grd		30+	40+	15			
T Per C							
T Veg C							
T Gr'd C							

TFN 5 1/110
RECD MAR 15, 2011

Veg. type (mark one): MS	(MM)	RF	MSH	MSC	MXC		
Date: 2009-07- 23 Worker(s): Jeff Brasher &							
Legal (TRSQQ, etc.): S 29 N ½ GPS (zero m):							
Other Location: flame							
Pit Code (E9A etc.): 10B Position related to Pit (middle S side, W of Pit, etc.):							
EXREFA? (y/(n)) Transect Azimuth (degrees): 350 Site ID? 117 Sample ID 116							

Lifeform	Sp	Q1 % Ab C	Q2 % Ab C	Q3 % Ab C	T Ab Cov	Av Ab C	% Rel C
P Grass	HECO	10	30	15			
	ELsm	4	5	15			
Gram'oid	Carex – sterile	12	10	–			
P Forb	HETvil	18	60	–			
	Allium textile	2		–			
	Silene? CERarv	4		4			
ERal	Eriogonum – full infl	2		2			
	Erigeron nem.		10	–			
	ACmi			8			
Subshrub							
Succ							
Shrub	CEmo		100				
Tree							
A Grass							
A Forb	ALdr	1		<1			
Non-vasc		–	–	1			
Litter		4	–	12			
Rock		–	–	–			
B Grd		1	–	2			
T Per C							
T Veg C							
T Gr'd C							

TFN 5 1/110
RECD MAR 15, 2011

Veg. type (mark one): MS	(MM)	RF	MSH	MSC	MXC		
Date: 2009-07- 23	Worker(s): Jeff Brasher &						
Legal (TRSQQ, etc.): 52a NW	GPS (zero m):						
Other Location: Flame							
Pit Code (E9A etc.): 10B	Position related to Pit (middle S side, W of Pit, etc.): below nodes						
EXREFA? (y/n) Y	Transect Azimuth (degrees): 90	Site ID? 118	Sample ID 117				

Lifeform	Sp	Q1 % Ab C	Q2 % Ab C	Q3 % Ab C	T Ab Cov	Av Ab C	% Rel C
P Grass	ELSm	13	18				
	HECD		15				
	Poa - as prev. (POFe)		15				
				(80)			
Gram'oid	Carex - sterile	13					
P Forb	Allium textile	2	-				
EREM hookeri	"cushion pink"	11	1				
Ipomopsis spicata	forb (PLMA)		3	2			
& Solidago simplex	rosette - Ascrestan		1				
	Eriogonum indet.			2			
	rosette 2 - Mertensiah.			1			
	Paronychia			<1			
	SEla			3			
	LIte perenne			<1			
Subshrub							
Succ							
Shrub	CEmo	8	-	25			
	ARno		40	20			
Tree							
A Grass							
A Forb	Allyssum alyssoides	1					
	ALde	<1	5	<1			
	mustard		1				
Non-vasc		5	1	-			
Litter		4	10	6			
Rock		40	-	-			
B Grd		15	2	1			
T Per C							
T Veg C							
T Gr'd C							

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mine 8+HHII 9+4+II 16 of 50 16 10 of 50 16 13+

4 MS for Sect 17 N 1/2 backup

EXREFA 15 11 0 8+III 3 of 30 4+HHI 10+

Veg. type (mark one): MS	MM	RF	MSH	MSC	MXC		
Date: 2009-07- 23	Worker(s): Jeff Brasher &						
Legal (TRSQQ, etc.): S 29 NW	GPS (zero m):						
Other Location: flame							
Pit Code (E9A etc.): 10B	Position related to Pit (middle S side, W of Pit, etc.): below Nodes						
EXREFA? (y/n) Y	Transect Azimuth (degrees): 120	Site ID? 119	Sample ID 118				

Lifeform	Sp	Q1 % Ab C	Q2 % Ab C	Q3 % Ab C	T Ab Cov	Av Ab C	% Rel C
P Grass	KOma	15	5	–			
	Elsm	15		25			
	Poa - as prev (POfe)	15					
	HEco		20	25			
Gram'oid							
P Forb	mustard	4		–			
	MERthuni ← rosette - as prev site	<1		–			
	PHho	5	4	4			
	alatum ← Eriogonum - tall, infl	4	9	4			
	COMumb		2	–			
	umbellatum ← Eriogonum 2 - silvery lvs			8			
Subshrub	ARfr		6	1			
Succ							
Shrub	ARtripRu	3		3			
	CHvi	2		–			
Tree							
A Grass							
A Forb							
Non-vasc		15	26	55			
Litter		5	4	4			
Rock		–	2	–			
B Grd		10	6	4			
T Per C							
T Veg C							
T Gr'd C							

TFN 5 1/110
RECD MAR 15, 2011

Veg. type (mark one): MS MM RF (MSH) MSC MXC

Date: 2009-07- 24 Worker(s): Jeff Brasher & —

Legal (TRSQQ, etc.): S 28 5E GPS (zero m):

Other Location: Cyn S of the Flame

Pit Code (E9A etc.): S of 10B Position related to Pit (middle S side, W of Pit, etc.):

EXREFA? (y/n) Transect Azimuth (degrees): 126 Site ID? 120 Sample ID 119

Lifeform	Sp	Q1 % Ab C	Q2 % Ab C	Q3 % Ab C	T Ab Cov	Av Ab C	% Rel C
P Grass	POpr	100	100	55			
	Bromus ~~erth~~ ? carinatus		10				
	~~grass~~ MELica bulbosa		10				
	HEco		10	10			
Gram'oid							
P Forb	TAof	25	1	5			
GAbo	Galium as yesterday	15	1	–			
A. microphylla	Antennaria-sterile		2	–			
C. rotundifolia	Campanula-as yest.			5			
Viola nuttallii	Viola 1 - lrs ~~t~~ orbiculata			~~H~~ 13			
	Viola 2 - lrs acute			2			
Subshrub							
Succ							
Shrub	ARtrdPa	95	65	3			
Tree							
A Grass							
A Forb							
Non-vasc		–	–	–			
Litter		–	40	15			
Rock		–	–	–			
B Grd		–	–	1			
T Per C							
T Veg C							
T Gr'd C							

TFN 5 1/110
RECD MAR 15, 2011

Veg. type (mark one): MS MM RF (MSH) MSC MXC

Date: 2009-07- 24 Worker(s): Jeff Brasher &

Legal (TRSQQ, etc.): S28 SE GPS (zero m):

Other Location: ~~SE~~ Cyn S of Flame, stone's throw from USFS gate + windmill

Pit Code (E9A etc.): 10B Position related to Pit (middle S side, W of Pit, etc.):

EXREFA? (y/n) Transect Azimuth (degrees): 210 Site ID? 121 Sample ID 120

Lifeform	Sp	Q1 % Ab C	Q2 % Ab C	Q3 % Ab C	T Ab Cov	Av Ab C	% Rel C
P Grass	ELYMUS (ELla)	30	40	40			
	Poa ~~x~~ arida	~~30~~ 15	~~60~~ 30	~~10~~ 5			
	Elymus 2 ~~sml~~ smaller (ELsm)		15	–			
	POpr			~~50~~ 25			
	KOma			1			
	Poa glauca var rupic.	15	30	5+25=30			
		50	100	100			
Gram'oid							
P Forb	TAof	2		–			
	ACmi		45	–			
Subshrub							
Succ							
Shrub							
Tree							
A Grass							
A Forb	BRte	15		–			
	Alde	100	90	95			
	Allyssum alyssoides		4	–			
Non-vasc		–	–	–			
Litter		–	–	–			
Rock		–	–	–			
B Grd		–	–	–			
T Per C							
T Veg C							
T Gr'd C							

TFN 5 1/110
RECD MAR 15, 2011

Veg. type (mark one): MS MM RF MSH MSC MXC

Date: 2009-07- 24 Worker(s): Jeff Brasher &

Legal (TRSQQ, etc.): 528 SE GPS (zero m):

Other Location: Cyn S of Flame, Downhill from S Boomerang

Pit Code (E9A etc.): 11 Position related to Pit (middle S side, W of Pit, etc.): near canyon bottom + rd

EXREFA? (y/n) Transect Azimuth (degrees): 30 Site ID? 122 Sample ID 121

Lifeform	Sp	Q1 % Ab C	Q2 % Ab C	Q3 % Ab C	T Ab Cov	Av Ab C	% Rel C
P Grass	LEKI	50	30	–			
	HECO		~~20~~ 10	–			
	NASvir		10				
Gram'oid	Carex geyeri	65	20	15			
P Forb	umbel: CY Mlem	3	3	–		2	
	rosette → Plantago tweedyi	2		–			
	ARNcor		1	8			
Subshrub							
Succ							
Shrub	JUCO		90	25			
	[illegible]		2				
	POtr		2	4			
	ABla bifolia		40	68			
Tree	PIfl	100	20	–			
A Grass							
A Forb							
Non-vasc		100	5	5			
Litter		17	40	40			
Rock		–	–	–			
B Grd		–	–	–			
T Per C							
T Veg C							
T Gr'd C							

TFN 5 1/110
RECD MAR 15, 2011

Veg. type (mark one): MS MM RF (MSH) MSC MXC

Date: 2009-07- 29 Worker(s): Jeff Brasher &

Legal (TRSQQ, etc.): S 78 SE GPS (zero m):

Other Location: Cyn S of Flame, Downhill from S Boomerang

Pit Code (E9A etc.): 11 Position related to Pit (middle S side, W of Pit, etc.): NE of Rt

EXREFA? (y/n) Transect Azimuth (degrees): 160 Site ID? 123 Sample ID 122

Lifeform	Sp	Q1 % Ab C	Q2 % Ab C	Q3 % Ab C	T Ab Cov	Av Ab C	% Rel C
P Grass	Poa arida	70	35	24			
	Festuca idi	20	35	24			
	ELSm	10	12	24			
	HECO		15				
	VUoc		15				
	KOma			24			
		25 90		80			
Gram'oid							
P Forb	Astragalus flex.	7	–	–			
	Antennaria microphylla	40	27	12			
	BEwy	1	5	–			
	PHHO	4	1	5			
	Potentilla argent. var arg.	2	–	–			
	Oxytropis			5			
	ORT lut			1			
	TAof			5			
	Polygonum			1			
Subshrub							
Succ							
Shrub	ARtripRU	10	9	11			
Tree							
A Grass	VUL oct		15				
A Forb	ORT lut			1			
	Polygonum sawatchense			1			
Non-vasc		1	1	–			
Litter		5	2	5			
Rock		–	–	–			
B Grd		1	–	3			
T Per C							
T Veg C							
T Gr'd C							

TFN 5 1/110
RECD MAR 15, 2011

Veg. type (mark one): MS MM RF (MSH) (MSC) MXC

Date: 2009-07- 24 Worker(s): Jeff Brasher &

Legal (TRSQQ, etc.): S28 SE GPS (zero m):

Other Location: 5' + downhill from the Flume, stone's throw W of Ruined Cabin

Pit Code (E9A etc.): 10B Position related to Pit (middle S side, W of Pit, etc.):

EXREFA? (Y/n) Transect Azimuth (degrees): 120 Site ID? 124 Sample ID 123

Lifeform	Sp	Q1 % Ab C	Q2 % Ab C	Q3 % Ab C	T Ab Cov	Av Ab C	% Rel C
P Grass	HECO	9	1	15			
	KOma	1					
Gram'oid							
P Forb	PHHO	10					
	mustard - LESQmont		<1	1			
ERal ←	Eriogonum - tall incl			1			
	umbel			3			
Subshrub	ARFR			6			
Succ							
Shrub	ARtrtdPa	70	100				
Tree							
A Grass							
A Forb	Allyssum alyssoides	4	1	<1			
Non-vasc		3	–	4			
Litter		1	–	1			
Rock		5	–	8			
B Grd		4	–	70			
T Per C							
T Veg C							
T Gr'd C							

TFN 5 1/110
RECD MAR 15, 2011

Veg. type (mark one): MS MM RF MSH MSC (MXC)

Date: 2009-07- 24 Worker(s): Jeff Brasher &

Legal (TRSQQ, etc.): S28 SE GPS (zero m):

Other Location: Cyn N of S Boomerang

Pit Code (E9A etc.): 11 Position related to Pit (middle S side, W of Pit, etc.):

EXREFA? (y/n) Transect Azimuth (degrees): 180 Site ID? 125 Sample ID 124

Lifeform	Sp	Q1 % Ab C	Q2 % Ab C	Q3 % Ab C	T Ab Cov	Av Ab C	% Rel C
P Grass							
Gram'oid	Carex as earlier (C. geyeri)	100	85	90			
P Forb	ARNcort	16	22	10			
	Viola acutelrs as earlier (VIOnut)			–			
GAbo ←	Galium as earlier		2	–			
Subshrub	BERrep	8	8	–			
Succ							
Shrub	~~BERrep~~	~~8~~	~~8~~				
	ABta mifolia		50				
	POtr	10		30			
Tree	PSme	100	100	30			
A Grass							
A Forb							
Non-vasc		20	10	–			
Litter		10	15	15			
Rock		–	–	–			
B Grd		–	–	–			
T Per C							
T Veg C							
T Gr'd C							

☒ Maianthemum stellatum collected next to quadrat here.

TFN 5 1/110
RECD MAR 15, 2011

Veg. type (mark one): MS	MM	RF	MSH	MSC	MXC		
Date: 2009-07- 29	Worker(s): Jeff Brasher &						
Legal (TRSQQ, etc.):	S 28 SW	GPS (zero m):					
Other Location:	Downhill from S Boomerang						
Pit Code (E9A etc.):	11	Position related to Pit (middle S side, W of Pit, etc.):					
EXREFA? (y/n)	Transect Azimuth (degrees):	912	Site ID?	126	Sample ID	125	

Lifeform	Sp	Q1 % Ab C	Q2 % Ab C	Q3 % Ab C	T Ab Cov	Av Ab C	% Rel C
P Grass							
Gram'oid	Carex – as prev.	8	11	3			
	(Carex geyeri)						
P Forb	ARNCor	15		3			
sterile	Thalyctrum ? indet.		8	–			
	forb RAN? indet.		2	–			
	Maianthemum stel.			2			
	as at prev.						
Subshrub							
Succ							
Shrub	BERrep	70					
	ABla		100	100			
Tree	PSme	100	90				
A Grass							
A Forb							
Non-vasc		1	60	90			
Litter		70	40	90			
Rock		–	–	–			
B Grd		–	–	–			
T Per C							
T Veg C							
T Gr'd C							

Spruce cones part of the litter

TFN 5 1/110
RECD MAR 15, 2011

Veg. type (mark one): MS MM RF MSH MSC (MXC)

Date: 2009-07- 24 Worker(s): Jeff Brasher &

Legal (TRSQQ, etc.): S28 SW GPS (zero m):

Other Location: Cyn. slope downhill from South Boomerang

Pit Code (E9A etc.): 11 Position related to Pit (middle S side, W of Pit, etc.):

EXREFA? (y/n) Transect Azimuth (degrees): 18 Site ID? 127 Sample ID 126

Lifeform	Sp	Q1 % Ab C	Q2 % Ab C	Q3 % Ab C	T Ab Cov	Av Ab C	% Rel C
P Grass	HECO	2	4				
Gram'oid	Carex as bef (CAge)	18	4	80			
	Mertensia hum.			2			
P Forb	Galium b. as bef	10					
	SEla	2					
	BEwy	5	4	4			
	TAof	1	2				
Keep as indet. } ASTX	rosette w/ linearis	2	3	1			
	ACmi	2					
	~~Arola?~~	~~1~~					
	umbel: CYMlem	2				0.7	
	Astragalus SPAT.	1					
	Campanula rotundifolia	~~2~~ 3					
Subshrub							
Succ							
Shrub							
Tree	PSme		10	100			
A Grass							
A Forb							
Non-vasc		50	15	1			
Litter		40	80	10			
Rock		–	–	–			
B Grd		–	–	–			
T Per C							
T Veg C							
T Gr'd C							

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Final Form

Veg. type (mark one): MS	MM	RF	(MSH)	MSC	MXC		
Date: 2009-07- 24 Worker(s): Jeff Brasher &							
Legal (TRSQQ, etc.): S 28 SWSW GPS (zero m): –							
Other Location: Cyn: downhill + N from the S Boomerang							
Pit Code (E9A etc.): 11 Position related to Pit (middle S side, W of Pit, etc.): –							
EXREFA? (Y/n) Transect Azimuth (degrees): 45 Site ID? 128 Sample ID 127							

Lifeform		Sp	Q1 % Ab C	Q2 % Ab C	Q3 % Ab C	T Ab Cov	Av Ab C	% Rel C
	P Grass	CAlon	25					
B.carin.		Bromus-as@windmill today	25	36	10			
		Poa arida	25	36				
		Elymus 1 (ELtrTr)	~~25~~ 50	36	~~10~~ 20			
		~~Elymus 2~~	~~25~~	~~36~~	~~10~~			
		HEco			10			
	Gram'oid							
	P Forb	TAof	7	10				
		Mertensia hum.	5		1			
		BEwy	1		5			
		ACmi		1	–			
Indposace		~~igloo rosette~~			~~3~~			
	Subshrub							
	Succ							
	Shrub	ARtrid PA		65	30			
Tree		PIFI	1	1				
	A Grass							
	A Forb	ANDsep			3			
Non-vasc			–	2	1			
Litter			–	–	10			
Rock			–	–	–			
B Grd			–	–	–			
T Per C								
T Veg C								
T Grd C								

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Final Form

Veg. type (mark one): MS	MM	RF	(MSH)	(MSC)	MXC		
Date: 2009-07- 24	Worker(s): Jeff Brasher &						
Legal (TRSQQ, etc.): S 29 SE		GPS (zero m): –					
Other Location: ~ 1/10 mi. W of prev. site, between the Flame + the S Boomerang							
Pit Code (E9A etc.):		Position related to Pit (middle S side, W of Pit, etc.):					
EXREFA? (Y/n)	Transect Azimuth (degrees): 65		Site ID? 129	Sample ID 128			

Lifeform	Sp	Q1 % Ab C	Q2 % Ab C	Q3 % Ab C	T Ab Cov	Av Ab C	% Rel C
P Grass	ELsm	32	45	20			
	ELsp	32					
	HECO	32	45	10			
Prairie ←	Poa as earlier today			10			
Gram'oid							
P Forb	Cirsium - native	45	–	–			
	Astragalus flexuosus	12	8	1			
	ACmi	2	–	–			
	mustard - LESQ mont	1	–	–			
	PHho	–	1	1			
	Tragopogon dubius	–	–	1			
	TAof	–	–	4			
Subshrub	ARfr	9	10	4			
Succ							
Shrub	ARtridPA	70		4			
Tree							
A Grass							
A Forb	Allyssum alyssoides		–	4			
Non-vasc		–	0.5	4			
Litter		10	2	55			
Rock		–	1	9			
B Grd		–	1	1			
T Per C							
T Veg C							
T Gr'd C							

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Final Form

Veg. type (mark one): MS	MM	RF	(MSH)	(MSC)	MXC		
Date: 2009-07- 24 Worker(s): Jeff Brasher &							
Legal (TRSQQ, etc.): 5 29 SE GPS (zero m):							
Other Location: N of Pit 11 - ~1/10 mi W of Prev. Site, between Flame + S. Boomerang							
Pit Code (E9A etc.): N of 11 Position related to Pit (middle S side, W of Pit, etc.): N of Pit							
EXREFA? (y/n) Transect Azimuth (degrees): 90° Site ID? 130 Sample ID 129							

Lifeform	Sp	Q1 % Ab C	Q2 % Ab C	Q3 % Ab C	T Ab Cov	Av Ab C	% Rel C
P Grass	Poa as earlier (P. arida)	25	4	~			
ELla ←	Elymus-lg heads as earlier	25	2	20			
	Bromus car, % as earlier	25	10	20			
ELsm ←	Elymus-sm heads as earlier	25	4	20			
	HECO	25	10	1			
	Poa, indet.	25	10	20			
Gram'oid							
P Forb	Silene? → CERarv	4	2	3			
	ACmi	2	–	1			
C.rotund. ←	Campanula - as earlier	–	4	2			
	BEwy	–	6	3			
VIAme ←	Vicia - as earlier	–	45	50			
Subshrub							
Succ							
Shrub	ARtridPA	80	90	60			
Tree							
A Grass							
A Forb							
Non-vasc		–	–	–			
Litter		–	–	–			
Rock		–	–	–			
B Grd		–	–	–			
T Per C							
T Veg C							
T Gr'd C							

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Veg. type (mark one): MS	(MM)	RF	MSH	MSC	MXC		
Date: 2009-07- 27	Worker(s): Jeff Brasher &						
Legal (TRSQQ, etc.):	S 31 SW	GPS (zero m):					
Other Location:	South of Pit 6	Exhaust					
Pit Code (E9A etc.): Pit 3	Position related to Pit (middle S side, W of Pit, etc.):						
EXREFA? (y/n)	Transect Azimuth (degrees): 196	Site ID? 131	Sample ID 130				

Lifeform	Sp	Q1 % Ab C	Q2 % Ab C	Q3 % Ab C	T Ab Cov	Av Ab C	% Rel C
P Grass	ELSm	6	1	25			
	HECO	2	1				
Gram'oid	Carex jonesii CARaur		90				
P Forb	~~Silene?~~	10	10	14			
	Astrag. ~~nuttallianus?!~~	4	4				
	SEla	1	1	1			
	ACmi		1				
	Mertensia hum.			<1			
	TOve GR			1			
Subshrub	~~CHVI~~	~~4~~					
	GUSA	4					
	Eriogonum - subshrub			3			
Succ							
Shrub	CEmo	25	1				
	ARno	30					
	~~Shrub Eriogonum~~			~~3~~			
	~~CHVI~~	~~4~~					
Tree							
A Grass							
A Forb	mustard	2					
Non-vasc		1	—	—			
Litter		10	10	19			
Rock		1	<1	<1			
B Grd		3	<1	4			
T Per C							
T Veg C							
T Gr'd C							

Cerastium arvense

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Veg. type (mark one): MS	~~MM~~	RF	MSH	MSC	MXC		
Date: 2009-07- 27	Worker(s): Jeff Brasher &						
Legal (TRSQQ, etc.): S 31 SW	GPS (zero m):						
Other Location: S. of Pit 6 Exhaust							
Pit Code (E9A etc.): Pit 3	Position related to Pit (middle S side, W of Pit, etc.):						
EXREFA? (y/n) Transect Azimuth (degrees): 18	Site ID? 132 Sample ID 131	Site was at edge between MM + MS stands - see pic 8065. 2nd Attempt right nearby worked.					

Lifeform	Sp	Q1 % Ab C	Q2 % Ab C	Q3 % Ab C	T Ab Cov	Av Ab C	% Rel C
P Grass	Elymus ~~X~~ sand. - dried up	5					
	LIEco	45	15	90			
	grass - KOma	10					
	ELSm	15	5	10			
Gram'oid				(90)			
P Forb	COMum	6					
	Eriogonum - tall infl.	4					
	ALte	3	2				
	PHho	1					
Subshrub	~~CHri~~			~~12~~			
Succ							
Shrub	ARno	15		40			
	CHri			12			
Tree							
A Grass							
A Forb	Chenopodium - no seedling			<1			
Non-vasc		1	-	1			
Litter		2	3	3			
Rock		-	8	<1			
B Grd		4	30	4			
T Per C							
T Veg C							
T Grd C							

Elymus X sand. ← Elymus X - dried up

ERal ← Eriogonum - tall infl.

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Veg. type (mark one): MS MM RF MSH MSC MXC

Date: 2009-07- 27 Worker(s): Jeff Brasher &

Legal (TRSQQ, etc.): 531 SW GPS (zero m):

Other Location: Exhaust

Pit Code (E9A etc.): 3 Position related to Pit (middle S side, W of Pit, etc.):

EXREFA? (y/n) Transect Azimuth (degrees): 104 Site ID? 133 Sample ID 132

Lifeform	Sp	Q1 % Ab C	Q2 % Ab C	Q3 % Ab C	T Ab Cov	Av Ab C	% Rel C
P Grass							
Gram'oid							
P Forb							
Subshrub							
Succ							
Shrub							
Tree							
A Grass							
A Forb							
Non-vasc		20	25	12			
Litter		–	–	–			
Rock		100	100	100			
B Grd		–	–	–			
T Per C							
T Veg C							
T Gr'd C							

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Veg. type (mark one): MS	(MM)	RF	MSH	MSC	MXC		
Date: 2009-07- 27	Worker(s): Jeff Brasher &						
Legal (TRSQQ, etc.): 536 SE	GPS (zero m):						
Other Location: Exhaust							
Pit Code (E9A etc.): Pit 3	Position related to Pit (middle S side, W of Pit, etc.):						
EXREFA? (y/n)	Transect Azimuth (degrees): 350	Site ID? 134	Sample ID 133				

Lifeform	Sp	Q1 % Ab C	Q2 % Ab C	Q3 % Ab C	T Ab Cov	Av Ab C	% Rel C
P Grass	ELsm		10	2			
	Poa arida		1				
	ELsp			<00			
Gram'oid							
P Forb	Eriogonum nematophyllus	2					
	SEla	3	4				
	ALte		3				
	rosette Eriogonum umbellatum		1				
Subshrub	~~CHvi~~	~~75~~	~~8~~				
Succ							
Shrub	CEmo		8	20			
	CHvi	75	8				
Tree							
A Grass							
A Forb	ALde		<1				
	CAminutx		<1	1			
	Chenopodium pratericola			<1			
Non-vasc		5	8	<1			
Litter		1	6	4			
Rock		5	8	10			
B Grd		11	55	0			
T Per C							
T Veg C							
T Gr'd C							

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Veg. type (mark one): MS	MM	RF	MSH	MSC	MXC		
Date: 2009-07-27 Worker(s): Jeff Brasher &							
Legal (TRSQQ, etc.): 5365E GPS (zero m):							
Other Location: Exhaust							
Pit Code (E9A etc.): 6 Position related to Pit (middle S side, W of Pit, etc.):							
EXREFA? (y/n) Transect Azimuth (degrees): 354 Site ID? 135 Sample ID 134							

Lifeform	Sp	Q1 % Ab C	Q2 % Ab C	Q3 % Ab C	T Ab Cov	Av Ab C	% Rel C
P Grass	ELSm	6	5	4			
Gram'oid							
P Forb	SRIa	1					
	TETaca		10				
MEHum	Mertensia ~~X~~ as earlier		<1				
	Erigeron nem.		2				
	forb-cauline (CAlmutt)			3			
	umbel: MUSI diva			2		0.7	
Subshrub	~~CHvi~~	~~80~~	~~9~~				
Succ							
Shrub	ARno	10					
	CEmo		1	90			
	CHvi	80	9				
Tree							
A Grass							
A Forb	CAMmic ~~X~~ as previ.		8				
CHEpra	Chenopodium as pram		<1				
Non-vasc		1	1	1			
Litter		1	90	80			
Rock		1	10	–			
B Grd		1	<1	–			
T Per C							
T Veg C							
T Gr'd C							

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Veg. type (mark one): MS	(MM)	RF	MSH	MSC	MXC		
Date: 2009-07- 22	Worker(s): Jeff Brasher &						
Legal (TRSQQ, etc.): 536 SE		GPS (zero m):					
Other Location: Exhaust							
Pit Code (E9A etc.): 3	Position related to Pit (middle S side, W of Pit, etc.):						
EXREFA? (y/n) (n)	Transect Azimuth (degrees): 354	Site ID? 136	Sample ID 135				

Lifeform	Sp	Q1 % Ab C	Q2 % Ab C	Q3 % Ab C	T Ab Cov	Av Ab C	% Rel C
P Grass	POSe	5	15				
	ELsm		10	5			
	ECo		15	5			
			(40)				
Gram'oid							
P Forb	~~Stone~~ CERarv	5	4	12			
	PHho		8				
	SEla		5				
	ALte		2	3			
	COMumb			4			
Subshrub	~~CHvi~~	~~50~~	~~20~~				
Succ							
Shrub	CEmo	100	58	85			
	CHvi	50	20				
Tree							
A Grass							
A Forb	mustard			4			
Non-vasc		1	4	2			
Litter		60	20	50			
Rock		–	–	1			
B Grd		–	–	–			
T Per C							
T Veg C							
T Gr'd C							

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Veg. type (mark one): MS MM (RF) MSH MSC MXC

Date: 2009-07- 27 Worker(s): Jeff Brasher &

Legal (TRSQQ, etc.): S31 NW GPS (zero m):

Other Location: Exhaust

Pit Code (E9A etc.): ~~Proposed~~ RF1 Position related to Pit (middle S side, W of Pit, etc.):

EXREFA? (y/(n)) Transect Azimuth (degrees): 60 Site ID? 137 Sample ID 136

Lifeform	Sp	Q1 % Ab C	Q2 % Ab C	Q3 % Ab C	T Ab Cov	Av Ab C	% Rel C
P Grass	ELsp	80		2			
	KOma			2			
	ELsm			2			
	MUri			60			
Gram'oid							
P Forb	PHho	1	<1	-			
	~~Stene?~~ → CERarv	1		-			
	SEla		<1	-			
	Paronychia sessiliflora			2			
	Lesquerella mont.			<1			
Subshrub	~~CHvi~~		~~13~~				
Succ							
Shrub	ARno	50					
	CHvi		13				
Tree							
A Grass							
A Forb							
Non-vasc		1	2	5			
Litter		-	2	5			
Rock		-	93	10			
B Grd		1	1	22			
T Per C							
T Veg C							
T Gr'd C							

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Veg. type (mark one): MS (MM) RF MSH MSC MXC

Date: 2009-07- 27 Worker(s): Jeff Brasher &

Legal (TRSQQ, etc.): 51 NW GPS (zero m):

Other Location: Exhaust

Pit Code (E9A etc.): Proposed #1 Position related to Pit (middle S side, W of Pit, etc.):

EXREFA? (y/n) n Transect Azimuth (degrees): 282 Site ID? 138 Sample ID 137

Lifeform	Sp	Q1 % Ab C	Q2 % Ab C	Q3 % Ab C	T Ab Cov	Av Ab C	% Rel C
P Grass	HEco	49	30	60			
	ELsm	45	20	30			
	Poa secunda		10	10			
		(90)	(60)	(90)			
Gram'oid							
P Forb	Silene ? → CERarv	20	3	9			
dry stem stalks only	Delphinium nuttallianum	3	—				
	TAof	2	3	2			
	PHho	1	2				
	Heuchera rubrifolia		1				
	SEla		2				
indef.	Astrag. as earlier		1	2			
	ACmi			5			
Subshrub							
Succ							
Shrub	ARno		2				
	ARtridPa			3			
Tree							
A Grass							
A Forb							
Non-vasc		—	\	—			
Litter		2	2	—			
Rock		—	\	—			
B Grd		—	3	—			
T Per C							
T Veg C							
T Gr'd C							

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Veg. type (mark one)	MS	MM	RF	MSH	MSC	MXC	
Date: 2009-07- 27	Worker(s): Jeff Brasher &						
Legal (TRSQQ, etc.): S3 | NW	GPS (zero m):						
Other Location: Exhaust							
Pit Code (E9A etc.): Proposed #2	Position related to Pit (middle S side, W of Pit, etc.):						
EXREFA? (y/n)	Transect Azimuth (degrees): 96	Site ID? ~~120~~ 139	Sample ID 117 | 38				

Lifeform	Sp	Q1 % Ab C	Q2 % Ab C	Q3 % Ab C	T Ab Cov	Av Ab C	% Rel C
P Grass	LEKI	8	3	2			
	KUma	1	3	2			
	POSe	1	3	2			
	Elsm		1	2			
Gram'oid							
P Forb	PHho	2		8			
	~~ERIpur?~~	~~10~~	~~12~~				
Mikum,	Martensia-burnt	2					
	ALte			3			
	rosette			1			
Subshrub	LINApum	10	12				
Succ							
Shrub	ARNO	75	32	7			
	~~ERIpur?~~	~~10~~	~~12~~				
Tree							
A Grass							
A Forb							
Non-vasc		2	1	–			
Litter		2	2+	10			
Rock		–	–	–			
B Grd		15	30+	40			
T Per C							
T Veg C							
T Gr'd C							

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Veg. type (mark one): MS MM RF MSH MSC MXC

Date: 2009-07- 27 Worker(s): Jeff Brasher &

Legal (TRSQQ, etc.): 531 NW GPS (zero m):

Other Location: Exhaust

Pit Code (E9A etc.): proposed 2 Position related to Pit (middle S side, W of Pit, etc.):

EXREFA? (y/n) Transect Azimuth (degrees): 348 Site ID? 140 Sample ID 139

Lifeform	Sp	Q1 % Ab C	Q2 % Ab C	Q3 % Ab C	T Ab Cov	Av Ab C	% Rel C
P Grass	POse	10	70	4			
	ELsm	1		4			
	KOma	1	1	4			
	BDgr			3			
Gram'oid							
P Forb	PHho	1	4	20			
	SEla			1			
	ALte			2			
Subshrub							
Succ							
Shrub	ARnO	70	22	2			
Tree							
A Grass							
A Forb	SAib → SALaus		1				
Non-vasc		1	1	1			
Litter		12	5	10			
Rock		–	–	–			
B Grd		–	30	40			
T Per C							
T Veg C							
T Gr'd C							

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Veg. type (mark one): (MS)	MM	RF	MSH	MSC	MXC		
Date: 2009-07-27	Worker(s): Jeff Brasher &						
Legal (TRSQQ, etc.):	S31 NE	GPS (zero m):					
Other Location:	Tail pipe						
Pit Code (E9A etc.):	SB	Position related to Pit (middle S side, W of Pit, etc.):					
EXREFA? (y/n)	Transect Azimuth (degrees):	46	Site ID?	41	Sample ID	40	

Lifeform	Sp	Q1 % Ab C	Q2 % Ab C	Q3 % Ab C	T Ab Cov	Av Ab C	% Rel C
P Grass	ELSp	14					
	KOma	2					
	MUri	10	11	44			
	ELSm		2				
		(25)					
Gram'oid							
	Erigeron nemati			2			
	cushion pink" (EREhoo)			12			
P Forb	TETaca	9		–			
	Paronychia sess.	8		2			
tentilla hippiana ←	~~Potentilla gracilis?~~	9		–			
	Eriogonum umbellatum	7		–			
	ALTe	2		<1			
	Umbel - Musin Tenui.	3		<1			
	PHHo	4		–			
	SEla	3	1	<1			
ERIola ←	~~Eriogonum - tall infl~~		2	–			
	Lesquerella? - rosette			1			
Subshrub	~~CHVi~~		1	3			
Shrub Succ							
Shrub	ARno	3					
	CHVi		1	3			
Tree							
A Grass							
A Forb							
Non-vasc		3	40	8			
Litter		9	1	2			
Rock		10	80	15			
B Grd		6	10	3			
T Per C							
T Veg C							
T Gr'd C							

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Veg. type (mark one): MS MM RF MSH MSC MXC

Date: 2009-07-27 Worker(s): Jeff Brasher &

Legal (TRSQQ, etc.): 5 3 1 NE GPS (zero m):

Other Location: Tailpipe

Pit Code (E9A etc.): 5b Position related to Pit (middle S side, W of Pit, etc.):

EXREFA? (y/n) Transect Azimuth (degrees): 76 Site ID? 42 Sample ID 141

Lifeform	Sp	Q1 % Ab C	Q2 % Ab C	Q3 % Ab C	T Ab Cov	Av Ab C	% Rel C
P Grass	KOma	10					
	HEco	1					
	MUri	18		2			
	LEKi	1					
	ELSm		1				
		(40)					
Gram'oid	Carex aurea		6				
Aspat. ←	Astragalus? simple lvs silvery			3			
LESmon ← P Forb	Lesquerella ? as prev	4	<1	–			
	Silene ? → CERarv	2	–	–			
	Umbel – as prev (MUSten)	3	2	8			
	TETaca	5	8	24			
ERIGoorr ←	Erigeron – as prev	3	3	–			
EREMhook ←	"cushion pink" as prev	8	–	–			
PASE ←	Paronychia	1	–	5			
	Draba oligosperma		2	5			
Tarwm ←	Eriogonum ? – silvery		2	–			
	PHHo		<1	1			
Subshrub	~~CHVi~~		~~4~~				
Succ							
Shrub	CHVi		4				
Tree							
A Grass							
A Forb							
Non-vasc		3	11	2			
Litter		4	1	4			
Rock		10	70	75			
B Grd		20	10	<1			
T Per C							
T Veg C							
T Gr'd C							

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Veg. type (mark one): (MS) MM RF MSH MSC MXC							
Date: 2009-07- 21 Worker(s): Jeff Brasher &							
Legal (TRSQQ, etc.): 530 5E GPS (zero m):							
Other Location: Tailfin							
Pit Code (E9A etc.): 5A Position related to Pit (middle S side, W of Pit, etc.):							
EXREFA? (y/n) Transect Azimuth (degrees): 340 Site ID? 143 Sample ID 142							
Lifeform	Sp	Q1 % Ab C	Q2 % Ab C	Q3 % Ab C	T Ab Cov	Av Ab C	% Rel C
P Grass	HECo	60	50	6		38.7	
	Poa - as prev (POSE)	20	21	6		15.7	
	Poa						
Gram'oid							
				(12)			
P Forb	MEhu ← Mertensia? - as prev	2				0.7	
	ALte			<1		0.2	
Subshrub	~~CHVi~~	~~11~~	~~10~~	~~<1~~			
	LINAprung as prev	1		3		1.3	
Succ							
Shrub	ARNO	10	70			26.7	
	~~LEPpun? as prev~~	~~1~~		~~3~~		~~1.3~~	
	CHVi	11	10	<1		7.2	
Tree							
A Grass							
A Forb	ALAe	1		<1		0.5	
Non-vasc		1	23	5		9.7	
Litter		12	30	11		14.3	
Rock		~~1~~ —	-	-		-	
B Grd		2	-	60		20.7	
T Per C						100.2	
T Veg C						100.7	100
T Gr'd C						114.5	

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Veg. type (mark one)	(MS)	MM	RF	MSH	MSC	MXC	
Date: 2009-07- 27	Worker(s): Jeff Brasher &						
Legal (TRSQQ, etc.): S 19 NW	GPS (zero m):						
Other Location: The Hand - tip of long finger							
Pit Code (E9A etc.): 7C	Position related to Pit (middle S side, W of Pit, etc.):						
EXREFA? (y/n)	Transect Azimuth (degrees): 186	Site ID? 144	Sample ID 143				

Lifeform	Sp	Q1 % Ab C	Q2 % Ab C	Q3 % Ab C	T Ab Cov	Av Ab C	% Rel C
P Grass	Poa - as prev (POSE)	30	40	15		28.3	
	HEco	30	2	20		17.3	
	Elsm	30	5	49		28	
	BOgr	10	45	10		21.7	
			(90)	90)			
Gram'oid							
P Forb	Antennaria microphylla	40	–	20		20	
	Lesquerella montana	1	–			0.3	
	Tragopogon dubius	1	–			0.3	
	Astragalus flex.	1	–			0.3	
	PHHo		8	15		7.7	
	Erigeron ochr. - as prev		–				
Subshrub							
Succ							
Shrub	ARno			4		1.3	
Tree							
A Grass							
A Forb	Alade	<1	1	<1		0.7	
Non-vasc		–	2	4		1	
Litter		1	8	7		5.3	
Rock		–	–	–		–	
B Grd		1	2	1		1.3	
T Per C							
T Veg C							
T Gr'd C							

TFN 5 1/110
RECD MAR 15, 2011

Veg. type (mark one): MS MM RF (MSH) (MSC) MXC

Date: 2009-07- 27 Worker(s): Jeff Brasher &

Legal (TRSQQ, etc.): S 20 NE GPS (zero m):

Other Location: The Hand - Palm

Pit Code (E9A etc.): 7A Position related to Pit (middle S side, W of Pit, etc.): N of Pit Area

EXREFA? (y/n) Transect Azimuth (degrees): 96 Site ID? 14K Sample ID 14H

Lifeform	Sp	Q1 % Ab C	Q2 % Ab C	Q3 % Ab C	T Ab Cov	Av Ab C	% Rel C
P Grass	Calamov. longi	5	20	15		13.3	
	~~BRcarinatus?~~	~~5~~	~~20~~	~~15~~		~~13.3~~	
	Poa Sarida	5	20	15		13.3	
	Elym elyX lanceolatus	5	20	15		13.3	
Gram'oid							
P Forb	Arni	9	-	-		3	
	~~Silene?~~	~~4~~	~~5~~	ID		6.3	
	Campanula parryi parryi	5	-	-		1.6	
	Viola	2	2	1		1.6	
	TAOF	5	1	3		3	
	Lupinus argenteus	5	4	-		3	
	Galium boreale	5	1	-		2	
	~~Gitar-72PLM-COLLline~~	~~5~~	~~5~~	~~1~~		~~3.7~~	
	~~Polygonum aviculare?~~	~~1~~	~~3~~	~~2~~		~~2~~	
Subshrub							
Succ							
Shrub	Symphoricarpos oreo			3		1	
	Psme			10		3.3	
Tree	POTR	2	100	10		37.3	
A Grass	BRte		3	1		1.3	
	BRjapo	5	20	15		13.3	
A Forb	ALLYSUM alyssoides		5	5		3.3	
	ALdc		10	10		6.7	
	PLM-COLLline	5	5	1		3.7	
	PLG-POLYsawa	1	3	2		2	
Non-vasc		-	-	-		0	
Litter		12	-	-		4	
Rock		-	-	-		0	
B Grd		-	-	-		0	
T Per C							
T Veg C							
T Gr'd C							

eudistellaria jamesiana

sawatchense

located at ee: Chlenbergia lliformis

TFN 5 1/110
RECD MAR 15, 2011

Veg. type (mark one): MS MM RF MSH MSC MXC

Date: 2009-07- 27 Worker(s): Jeff Brasher &

Legal (TRSQQ, etc.): S 20 NE GPS (zero m):

Other Location: Palm of Hand

Pit Code (E9A etc.): 7A Position related to Pit (middle S side, W of Pit, etc.): Foot 7A

EXREFA? (y/n) Transect Azimuth (degrees): 96 Site ID? 146 Sample ID 145

Lifeform	Sp	Q1 % Ab C	Q2 % Ab C	Q3 % Ab C	T Ab Cov	Av Ab C	% Rel C
P Grass	Ehsm	10	28	20		19.3	
	MEco	30	25	18		24.3	
	FFid		29	21		16.7	
Gram'oid							
P Forb	Astrag. notth. ? indet.	2		–		0.7	
	CASPa	1		–		0.3	
	~~Polygonum aviculare~~	~~1~~	~~2~~	~~1~~		~~1.3~~	
	ACmi		6	–		2	
	Erigeron ochr. ? indet		4	1		1.6	
	boechera			1		0.3	
	SEla			1		0.3	
Subshrub							
Succ							
Shrub	ARtridPa	50		35		28.3	
Tree							
A Grass							
A Forb	PLG-POLYsawa	1	2	1		1.3	
Non-vasc		1	–	–		0.3	
Litter		10	10	12		10.7	
Rock		–	–	–		–	
B Grd		4	10	3		5.7	
T Per C							
T Veg C							
T Gr'd C							

Just heard "Chi..." - eagle call?

TFN 5 1/110
RECD MAR 15, 2011

Veg. type (mark one): MS MM RF (MSH) (MSC) MXC

Date: 2009-07-27 Worker(s): Jeff Brasher &

Legal (TRSQQ, etc.): S 21 NW GPS (zero m):

Other Location: Palm of Hand

Pit Code (E9A etc.): 70 Position related to Pit (middle S side, W of Pit, etc.): East Pit area

EXREFA? (y/n) Transect Azimuth (degrees): 354 Site ID? 147 Sample ID 146

Lifeform	Sp	Q1 % Ab C	Q2 % Ab C	Q3 % Ab C	T Ab Cov	Av Ab C	% Rel C
P Grass	KOma	15	2	1		6	
	HEco	20	3	2		8.3	
	Poa as bef (P.arida)	15	4	3		7.3	
	Festuxxa idaho.	19	1	4		8	
		70					
Gram'oid	Carex - sterile			15		5	
P Forb	ACmi	1	5	3		3	
	BEwy	5	5	5		5	
	~~Sterile~~ → CERarv		25	1		8.7	
indet	AStrag. mult sp		5	-		1.7	
	CASMav		3	5		3.3	
	Viola as bef - mish		5	1		2	
Subshrub							
Succ							
Shrub	ARtridPa	70	90	80		80	
Tree							
A Grass							
A Forb							
Non-vasc		-	-	-		-	
Litter		10	35	60		35	
Rock		-	-	-		0	
B Grd		5	-	-		1.7	
T Per C							
T Veg C							
T Gr'd C							

TFN 5 1/110
RECD MAR 15, 2011

After 147

mine	1402	15	11 of 50	20	17 of 50	17	15+
CONA	15	11	0 of 0	11	11 of 30	8	10+

Veg. type (mark one): MS MM RF (MSH) (MSC) MXC

Date: 2009-07- 27 Worker(s): Jeff Brasher &

Legal (TRSQQ, etc.): S 28 NW GPS (zero m):

Other Location: S of heel of hand

Pit Code (E9A etc.): Position related to Pit (middle S side, W of Pit, etc.):

EXREFA? (y/n) Transect Azimuth (degrees): 6 Site ID? 1402 Sample ID 147

Lifeform	Sp	Q1 % Ab C	Q2 % Ab C	Q3 % Ab C	T Ab Cov	Av Ab C	% Rel C
P Grass	NEco	40	30	5		25	
	ELsm	1	3	10		4.7	
Gram'oid							
P Forb	PACfen ← Prodkera w/ Phacolaris	1				0.3	
Subshrub							
Succ							
Shrub							
Tree							
A Grass							
A Forb	Alyssum alyssoides	2	2	5		3.3	
Non-vasc		5	5	2		4	
Litter		5	5	5		5	
Rock		70	60	50		60	
B Grd		1	5	20		8.7	
T Per C							
T Veg C							
T Grd C							

TFN 5 1/110
RCD MAR 15, 2011

Veg. type (mark one): MS	MM	RF	MSH	MSC	(MXC)		
Date: 2009-07- 28	Worker(s): Jeff Brasher &				~		
Legal (TRSQQ, etc.): S 33	3w	GPS (zero m):					
Other Location: Muffler at/near branch							
Pit Code (E9A etc.): 50	Position related to Pit (middle S side, W of Pit, etc.): S of Kt Area						
EXREFA? (Y/n)	Transect Azimuth (degrees): 84	Site ID? 149	Sample ID 148				

Lifeform	Sp	Q1 % Ab C	Q2 % Ab C	Q3 % Ab C	T Ab Cov	Av Ab C	% Rel C
P Grass	HEco	10	20	5		11.7	
	Poa fend.	10	10	1		7	
	KDma		10	1		3.7	
	LEKi			55		18.3	
Gram'oid	Carex aurea	40	5	29		24.7	
P Forb	Silene? → CERarv	5	–	~		1.7	
	~~Lomatium?~~ → MUSten	4	–	1		1.7	
	HETvi	5	5	~		3.3	
	Eriogonum umbell.	3	4	+		2.7	
	ACmi		2	9		3.7	
	~~GEN~~ → Silene drummondii		2	–		0.7	
	TETsca			5		1.7	
Subshrub	~~CHvi?~~		~~40~~			~~13.3~~	
Succ							
Shrub	CHvi		40			13.3	
Tree							
A Grass							
A Forb							
Non-vasc		–	–	–		0	
Litter		15	10	18		14.3	
Rock		–	–	–		0	
B Grd		4	40	10		18	
T Per C							
T Veg C							
T Gr'd C							

TFN 5 1/110
RECD MAR 15, 2011

Veg. type (mark one): MS MM RF MSH MSC (MXC)

Date: 2009-07- 28 Worker(s): Jeff Brasher &

Legal (TRSQQ, etc.): 533 SW GPS (zero m):

Other Location: Muffler

Pit Code (E9A etc.): 50 Position related to Pit (middle S side, W of Pit, etc.): S of Pit Area

EXREFA? (y/n) Transect Azimuth (degrees): 204 Site ID? 150 Sample ID 149

Lifeform	Sp	Q1 % Ab C	Q2 % Ab C	Q3 % Ab C	T Ab Cov	Av Ab C	% Rel C
P Grass	HEco	20	70	5		31.7	
	ELsm	15				5	
	LEKi			40		13.3	
Gram'oid	Carex as prev (C. aurea)	60	1	15		25.3	
P Forb	ACmi	3	1	–		1.3	
	Silene? → CERarv	9	–	1		3	
	PHho	15	–	–		5	
	~~Polygonum as before~~		~~4~~			~~1.3~~	
	Eriogonum umb.		6	–		2	
	rosette 1 – lvs ~linear w/ purple			9		3	
	rosette 2 – linear-ovate – Mertensia hum.			3		1	
Subshrub							
Succ							
Shrub	CEmo			9		3	
Tree	PIEI			2		0.7	
A Grass							
A Forb	ALde	5				1.7	
	Polygonum sawatchense (as before)		4			1.3	
Non-vasc		–	–	–		0	
Litter		15	20	29		21.3	
Rock		–	–	–		0	
B Grd		4	4	–		2.7	
T Per C							
T Veg C							
T Grd C							

- Lots trees (~ 60%) here dead or dying w/ beetles
- Found + dug 1 hounds tongue plant (Caesp.) maybe not yet hit in a quadrat

JEN 5 1/110

MAR 15, 2011

MCC Permit 298C-A8 Baseline Veg Sampling Field Form

Veg. type (mark one): MS MM RF MSH MSC MXC

Date: 2009-07-28 Worker(s): Jeff Brasher &

Legal (TRSQQ, etc.): S33 near prev. GPS (zero m):

Other Location: Mueller near prev.

Pit Code (E9A etc.): 50 Position related to Pit (middle S side, W of Pit, etc.):

EXREFA? (y/n) Transect Azimuth (degrees): 264 Site ID? 151 Sample ID 150

Lifeform	Sp	Q1 % Ab C	Q2 % Ab C	Q3 % Ab C	T Ab Cov	Av Ab C	% Rel C
P Grass	ELSP	10	1			3.7	
	LEKI	5	<1	-		1.8	
	Poa - as prev. (POFe)	5				1.7	
	ELSm		5			1.7	
Gram'oid	Carex - as prev. (Carex aurea)	5				1.7	
P Forb	~~Arenaria?~~ → EREfen	10	2			4	
	Erigeron ochroleucus		5			1.7	
	SEla		9	2		3.7	
drosace sept. ←	~~rosette 1 - igloo rosette?~~		~~21~~			~~0.2~~	
	rosette 2 - Mertensia humi		<1			0.2	
Subshrub							
Shrub Succ							
Shrub							
Tree	PIFl	100	90			63.3	
A Grass							
A Forb	Androsace sept.		<1			0.2	
Non-vasc		-	2	10		4	
Litter		55	25	10		30	
Rock		-	8	90		32.7	
B Grd		-	25	10		11.7	
T Per C							
T Veg C							
T Gr'd C							

TFN 5 1/110
RECD MAR 15, 2011

Veg. type (mark one): MS	MM	RF	MSH	MSC	MXC		
Date: 2009-07- 28	Worker(s): Jeff Brasher &						
Legal (TRSQQ, etc.):	S 33 SW	GPS (zero m):					
Other Location:	Muffler near prev.						
Pit Code (E9A etc.):	5D	Position related to Pit (middle S side, W of Pit, etc.):					
EXREFA? (y/n)	Transect Azimuth (degrees): 168	Site ID? 152	Sample ID 151				

Lifeform	Sp	Q1 % Ab C	Q2 % Ab C	Q3 % Ab C	T Ab Cov	Av Ab C	% Rel C
P Grass	HE co	65				26.7	
	ELsm	5				1.7	
	LEKi	5	25	95		41.7	
Gram'oid	Carex - as prev	7	25			10.7	
	- in bunches not rhiz						
	(Carex aurea)						
P Forb	~~Polygonum - as before~~	~~4~~	~~-~~	~~-~~		~~1.3~~	
	Campanula - as before		20	32			
	rosette - Antennaria hum.		4	-		1.3	
	~~Viola~~		~~5~~	~~-~~			
	TA>E			5		1.7	
Subshrub							
Shrub Succ							
Shrub							
Tree	PIEI		1	100		33.7	
A Grass							
A Forb	PLG-POLsaw as bef	4	-	-		1.3	
Non-vasc		-	3	-		1	
Litter		80	75	-		41.7	
Rock		9	4	-		4.3	
B Grd		2	-	-		0.7	
T Per C							
T Veg C							
T Gr'd C							

C. rotundifolia

basal lvs of

~ 75% of tree foliage dead here (in 100m radius)

TFN 5 1/110
ACD MAR 15, 2011

Veg. type (mark one)	MS	MM	RF	MSH	MSC	MXC	
Date: 2009-07- 29	Worker(s): Jeff Brasher &						
Legal (TRSQQ, etc.): S19 NWSW	GPS (zero m):						
Other Location: Tip of Longest Finger							
Pit Code (E9A etc.): 7C	Position related to Pit (middle S side, W of Pit, etc.):						
EXREFA? (y/n) —	Transect Azimuth (degrees): 180	Site ID? 153	Sample ID 152				

Lifeform	Sp	Q1 % Ab C	Q2 % Ab C	Q3 % Ab C	T Ab Cov	Av Ab C	% Rel C
P Grass	NEco	4	10	9		7.7	
	Poa ~~sp. indet.~~ (POse)	4	20	21		15	
	ELsm	4	12	10		8.7	
	KOma	4	20	21		15	
Gram'oid							
			(60)				
P Forb	PHHO	3	–	–		1	
	~~ARoo~~						
	Antennaria micr.	25	3	2		10	
	"cushion pink" (EREhoo)	2	3	–		1.7	
	Eriogonum nemat.		11	–		3.7	
Subshrub							
Succ							
Shrub	ARno	60		75		15	
Tree							
A Grass							
A Forb	ALde		<1	–		0.2	
Non-vasc		1	1	1		1	
Litter		3	15	2		6.7	
Rock		–	–	–		0	
B Grd		5	5	3		4.3	
T Per C							
T Veg C							
T Gr'd C							

TFN 5 1/110
RECD MAR 15, 2011

Veg. type (mark one): (MS)	MM	RF	MSH	MSC	MXC		
Date: 2009-07- 29	Worker(s): Jeff Brasher &						
Legal (TRSQQ, etc.): S 18 SWSW	GPS (zero m):						
Other Location: W of Club Finger							
Pit Code (E9A etc.): 7A	Position related to Pit (middle S side, W of Pit, etc.): W of Pit Area						
EXREFA? (y/n)	Transect Azimuth (degrees): 40	Site ID? 154	Sample ID 153				

Lifeform	Sp	Q1 % Ab C	Q2 % Ab C	Q3 % Ab C	T Ab Cov	Av Ab C	% Rel C
P Grass	Poa - as earlier (Pose)	40	9	30		26.3	
	ELSM	5	9	30		14.7	
	HEco		9	12		7	
Gram'oid				(70)			
P Forb	ANmi ← Antennaria - as earlier		5			4.7	
	ALte			2		0.7	
	MEhu ← Rosette - Mertensia (as yesterday)			<1		0.2	
	PHlo			1		0.3	
Subshrub							
Succ							
Shrub	ARnO	75	77	30		60.7	
Tree							
A Grass							
A Forb							
Non-vasc		15	11	20		12	
Litter		10	3	10		7.7	
Rock		–	–	–		0	
B Grd		2	–	2		1.3	
T Per C							
T Veg C							
T Gr'd C							

TFN 5 1/110
RECD MAR 15, 2011

Veg. type (mark one) (MS) MM RF MSH MSC MXC

Date: 2009-07- 29 Worker(s): Jeff Brasher &

Legal (TRSQQ, etc.): S 18 SWSE GPS (zero m):

Other Location: (near all) Deformed finger

Pit Code (E9A etc.): 7A Position related to Pit (middle S side, W of Pit, etc.): W of area

EXREFA? (y/n) Transect Azimuth (degrees): 102 Site ID? 155 Sample ID 154

Lifeform	Sp	Q1 % Ab C	Q2 % Ab C	Q3 % Ab C	T Ab Cov	Av Ab C	% Rel C
P Grass	KOma	20	1			7	
	ELsm	30	8			12.6	
	ELsp	10	1			3.7	
	HEco	10	1	3		4.7	
	AChy		1			0.3	
	Poa - as earlier (Pose)			2		0.7	
			15				
Gram'oid							
P Forb	ALte	2				0.7	
	ERne ← Erigeron - as early today	4				1.3	
	ERal ← Eriogonum - tall incl	9		21		3.2	
	SEla	<1				0.2	
	PHho	1				0.3	
Subshrub	#1 - AST - GUSa	4				1.3	
Shrub Succ							
Shrub	ARno	4	70	49		41	
Tree							
A Grass							
A Forb	Chenopodium - common one		<1			0.2	
Non-vasc		1	1	1		1	
Litter		4	1	1		2	
Rock		–	8	30		12.7	
B Grd		1	8	30		13	
T Per C							
T Veg C							
T Gr'd C							

TFN 5 1/110
RECD MAR 15, 2011

Veg. type (mark one): (MS)	MM	RF	MSH	MSC	MXC		
Date: 2009-07-29	Worker(s): Jeff Brasher &						
Legal (TRSQQ, etc.): S 19 NW NE	GPS (zero m):						
Other Location: Club Finger near trp							
Pit Code (E9A etc.): 7A	Position related to Pit (middle S side, W of Pit, etc.):						
EXREFA? (y/n)	Transect Azimuth (degrees): 230	Site ID? 156	Sample ID 155				

Lifeform	Sp	Q1 % Ab C	Q2 % Ab C	Q3 % Ab C	T Ab Cov	Av Ab C	% Rel C
P Grass	ELsp	7	3	8		6.3	
	ELsm	8	2	7		5.7	
	KOma		8	9		5.7	
	HECO		7	10		5.7	
Gram'oid							
			20	35			
P Forb	ALTR	2	—	—		0.7	
	Paronychia (PASe)	11	10	—		7	
	"cushion pink" (EREhoo)	4	—	—		1.3	
	mint w/ pink fls (HEDdru)	11	11	—		7.3	
	Eriogonum ssp prom (ERInum)	4	—	—		1.3	
Subshrub	GIDsa	8	—			2.6	
	ARFr			15		5	
Succ							
Shrub	ARnn		27	50		25.7	
Tree							
A Grass							
A Forb							
Non-vasc		15	16	5		8.7	
Litter		2	4	3		3	
Rock		29	1	1		10.3	
B Grd		15	4	4		7.7	
T Per C							
T Veg C							
T Gr'd C							

TFN 5 1/110
RECD MAR 15, 201

Veg. type (mark one): MS	MM	RF	MSH	MSC	MXC		
Date: 2009-07- 29 Worker(s): Jeff Brasher &							
Legal (TRSQQ, etc.): 5 GPS (zero m):							
Other Location: E of TNC Easement							
Pit Code (E9A etc.): Position related to Pit (middle S side, W of Pit, etc.):							
EXREFA? (y/n) Transect Azimuth (degrees): 130 Site ID? 157 Sample ID 156							

Lifeform	Sp	Q1 % Ab C	Q2 % Ab C	Q3 % Ab C	T Ab Cov	Av Ab C	% Rel C
P Grass	ELSm	30	30	35		31.7	
	LEKi	30	30			20	
	Poa as earlior (Pose)		30			10	
	KOma		30			10	
keep as indet →	grass - bunch, sterile			10		3.3	
	grass green - not gray green						
Gram'oid							
			100				
P Forb	~~ARTlud~~	~~6~~	~~2~~	~~5~~		~~4.3~~	
	Potentilla fissa		2			0.7	
	Eriog. umbellat. X			19		6.3	
Subshrub	ARTlud	6	2	5		4.3	
Succ							
Shrub							
Tree							
A Grass							
A Forb	ALde	1				0.3	
Non-vasc		—	—	—		0	
Litter		2	—	2		1.3	
Rock		—	—	—		0	
B Grd		30	—	9		13	
T Per C							
T Veg C							
T Gr'd C							

TFN 5 1/110
RECD MAR 15, 2011

Veg. type (mark one): (MS) MM RF MSH MSC MXC

Date: 2009-07- 29 Worker(s): Jeff Brasher &

Legal (TRSQQ, etc.): S17 NESW GPS (zero m):

Other Location: N of bend in N Boomerang

Pit Code (E9A etc.): 6 Position related to Pit (middle S side, W of Pit, etc.):

EXREFA? (y/n) Transect Azimuth (degrees): 192 Site ID? 158 Sample ID 157

Lifeform	Sp	Q1 % Ab C	Q2 % Ab C	Q3 % Ab C	T Ab Cov	Av Ab C	% Rel C
P Grass	HEcO	5	2	15		7.3	
	ELsp	5	14	15		11.3	
	ELsm	5	4	15		8	
	Poa-as earlier (POSe)			15		5	
Gram'oid							
P Forb	Boechera holboellii	4		-		1.3	
	PHHO	2	2	-		1.3	
	~~cauline PASE?~~	~~<1~~				~~0.2~~	
	SEla		1	-		0.3	
	~~Lesquerella - common~~		~~1~~	~~3~~		~~1.3~~	
	TEFaca			4		1.3	
	LESQ ludo (2 of 3 pts)					0.9	
	LESQ mont (1 of 3 pts)					0.4	
Subshrub	~~CHvi~~		~~3~~	~~18~~			
	GUSa	<1				0.2	
Succ							
Shrub	ARnO	50	10	<1		20.2	
	gray horsebrush TETRAD CAN		1			0.3	
	CHvi		3	18		7	
Tree							
A Grass							
A Forb	CAMmicX			5		1.4	
Non-vasc		1	7	1		3	
Litter		3	2	4		3	
Rock		-	42	-		14	
B Grd		10	12	4		8.7	
T Per C							
T Veg C							
T Gr'd C							

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Veg. type (mark one): MS MM RF MSH MSC MXC

Date: 2009-07- 29 Worker(s): Jeff Brasher &

Legal (TRSQQ, etc.): S 19 GPS (zero m):

Other Location: Long Finger

Pit Code (E9A etc.): 7C Position related to Pit (middle S side, W of Pit, etc.):

EXREFA? (y/n) Transect Azimuth (degrees): 240 Site ID? 159 Sample ID 158

Lifeform	Sp	Q1 % Ab C	Q2 % Ab C	Q3 % Ab C	T Ab Cov	Av Ab C	% Rel C
P Grass	MUri	4	8			4	
	KDma		2	5		2.3	
	ELsp			5		1.7	
Gram'oid							
P Forb	SEla	2	1	–		1	
	ALte		19	4		4.3	
	Paronychia	–	2	6		2.7	
	PHHo		2	–		0.7	
	mint – (HEDaru)		2	–		0.7	
LEmo ←	Lesquerella – common		<1	1		0.5	
	rosette			3		1	
Subshrub							
Shrub Succ							
Shrub							
Tree							
A Grass							
A Forb	ALde	2	4	8		4.7	
	LAPocc		1	<1		0.5	
Non-vasc		15	20	10		15	
Litter		1	2	2		1.7	
Rock		75	29	39		47.7	
B Grd		10	10	10		10	
T Per C							
T Veg C							
T Gr'd C							

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RECD MAR 15, 2011

Veg. type (mark one): (MS) MM RF MSH MSC MXC

Date: 2009-07- 29 Worker(s): Jeff Brasher &

Legal (TRSQQ, etc.): 5 19 SE GPS (zero m):

Other Location: Long Finger

Pit Code (E9A etc.): 7C Position related to Pit (middle S side, W of Pit, etc.):

EXREFA? (y/n) Transect Azimuth (degrees): 48 Site ID? 160 Sample ID 159

Lifeform	Sp	Q1 % Ab C	Q2 % Ab C	Q3 % Ab C	T Ab Cov	Av Ab C	% Rel C
P Grass	HECO	9	20	12		13.7	
	ELSM	9	20	13		13.7	
	Poa- as earlier (POSE)	8	20	12		13.3	
	KOMA			13		4.3	
Gram'oid							
P Forb	LEMO	Lesquerella - common	3	-		1	
	rosette		1			0.3	
	PHHO			1		0.3	
Subshrub	ARFR		6	12		6	
	CHVI		5	-		1.7	
Succ							
Shrub	ARNO	80	-	10		30	
	CHVI		5	-		1.7	
Tree							
A Grass							
A Forb							
Non-vasc		5	19	30		18	
Litter		3	10	10		7.7	
Rock		1	5	-		2	
B Grd		1	6	10		5.3	
T Per C							
T Veg C							
T Grd C							

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Veg. type (mark one): MS	(MM)	RF	MSH	(MSC)	MXC		
Date: 2009-07-29 Worker(s): Jeff Brasher &							
Legal (TRSQQ, etc.): 5 GPS (zero m):							
Other Location: Palm of Hand							
Pit Code (E9A etc.): 7C Position related to Pit (middle S side, W of Pit, etc.):							
EXREFA? (y/n) Transect Azimuth (degrees): 360 Site ID? 161 Sample ID 160							

Lifeform	Sp	Q1 % Ab C	Q2 % Ab C	Q3 % Ab C	T Ab Cov	Av Ab C	% Rel C
P Grass	ELsp			30		10	
Gram'oid	Carex aurea	4	1	-		1.7	
	umbel 2		4	4		2.7	
	U /lus simple, silver						
P Forb	ASTRspat. ~~mobord - formerly Astrag.~~	3	4	-		2.3	
	~~Arenaria~~ → EREfen	3	-	4		2.3	
	ERal "Eriogonum tall	1	-	-		0.3	
	Draba oligosperma	1	-	-		0.3	
	TETaca	2	-	-		0.3	
	Eriogon nemati	2	2	2		2	
	musten umbel - Cymopterus?	1	4	-		1.7	
	~~LIlo~~ → LZNper	1	-	-		0.3	
	Paronychia depressa		20	10		10	
	Silene? → CEIkarv		4	5		3	
Subshrub	~~CHvi~~		3				
Shrub Succ							
Shrub	CEmo			70		23.3	
	CHvi		3			1	
Tree							
A Grass							
A Forb	Allyssum alyssoides		2			0.7	
Non-vasc		10	10	2		7.3	
Litter		1	2	5		2.7	
Rock		85	40	10		45	
B Grd		5	10	10		8.3	
T Per C							
T Veg C							
T Grd C							

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ADDENDUM DIX8 D

Tree Inventory Parameters by Pit and Road

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Table DIX8-20. Tree Inventory Field Site Metadata. Tree parameters from each Field Data Collection Site are found in **Table DIX8-21 -Tree Inventory Field Data By Field Site Code**. For use of mnemonic labels for numbered Pits see field data sheets **(Addendum DIX8 E)** and Tree Inventory **Map DIX8-4**.

Site Code*	Method	Date	Worker(s)**	Location Text	A8 Pit Code	Position at Pit
Transect 1	standard	2009-10-22	JWB	Pitchfork, South Prong, a little W of W-fence of DOT Pit	9C	middle
Transect 2	standard	2009-10-22	JWB	Pitchfork, South Prong, at DOT Pit a little W of W-topsoil pile & W fence	9C	middle
Transect 3	standard	2009-10-22	JWB	Pitchfork, Middle Prong, NE corner & N into Telephone Canyon	9B	straddling NE edge
Transect 4	standard	2009-10-23	JWB	Muffler, up center ridge just to S of 2-track	5D	toward S edge of main area below node
Transect 5	standard	2009-10-23	JWB	Muffler, in head of channel at node of Pit	5D	in channel between arms of pit at node, probably less than 200 ft. outside disturbance line
Transect 6	standard	2009-10-23	JWB	Muffler, body	5D	middle
Transect 7	standard	2009-10-26	JWB	Flame, dense conifer/aspen stand at break of hill along N edge of Pit near E end and TV/Radio towers***	10B	near N edge
Transect 8	standard	2009-10-26	JWB	Flame, dense conifer/aspen stand below break of hill along N edge of Pit near E end and TV/Radio towers***	10B	near N edge
Transect 9	special	2009-10-26	JWB	Flame, lower portion W of both nodes, down 2-track	10B	center of pit
Transect 10	special	2009-10-26	JWB	Flame, at and near N edge of tip (W end)	10B	center to N edge & a little beyond
Transect 11	standard	2009-10-27	JWB	In canyon between S Boomerang & Muffler (a fork of Govt. Gulch). Starts @ MBNF/MLC Fence in drainage bottom following drainage bottom despite bends.	near 5D	N of pit in drainage bottom
Transect 12	special	2009-10-27	JWB	South Boomerang, N edge, E of the node, extending N of proposed green line	11	straddling N edge
Transect 13	standard	2009-11-04	JWB	NE of Flame, between ridgetop and canyon bottom to the N along National Forest Boundary fence	near 10B	NE of E end
Transect 14	special	2005 or 2006, Summe	RS	Amendment 7 Area C southeast draw (S of mined pit)****	1, 2	N of A8 Pit 1 midsection, W of A8 Pit 2
Transect 15	special	2005 or 2006, Summe	RS	Amendment 7 Area C east-central draw (N of mined pit)****	1, 2	N of A8 Pit 1 midsection, W of A8 Pit 2
Transect 16	special	2009-11-12	JWB	Drainages to each side of Amendment 7 Area C mined pit****	1, 2	N of A8 Pit 1 midsection, W of A8 Pit 2
GPS1	GPS mapping	2009-09 or 2009-10	JWB & AHM	Generally on ridge running N/S thru Sect. 31. Methods development: only ~ 5 trees	3	Toward NE corner
GPS2	GPS mapping	2009-10-23	JWB	Tailpipe & Exhaust	3, 5C	Pit 3 straddling SE corner; Pit 5C straddling S tip
GPS3	GPS mapping	2009-10-26	JWB	Surrounding TV Antenna facilities & power lines at base of flame	10B	straddling SE corner
GPS4	GPS mapping	2009-10-26	JWB	Northward in Flame toward E end	10B	near center close to E end

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Site Code*	Method	Date	Worker(s)**	Location Text	A8 Pit Code	Position at Pit
GPS5	GPS mapping	2009-10-27	JWB	Both sides of pit line of Muffler	5D	straddling pit line near northern tip
GPS6	GPS mapping	2009-10-27	JWB	Downhill in drainage N of E arm of Muffler	5D, 11	N of E arm of 5D, S of E tip of 11
GPS7	GPS mapping	2009-11-04	JWB	The Hand & Pitchfork - the Base (@ E) starting in drainage on N edge of Hand & S edge of Pitchfork	8B, 9C	along entire E edge of Hand, starting at SE corner of Pitchfork
GPS8	GPS mapping	2009-11-05	JWB	From Hand/Pitchfork boundary N along MBNF fence into Telephone Cyn.	9C, 9B	all along E edge + farther N into Telephone Cyn.
GPS9	GPS mapping	2009-11-24	JWB	Drainage N of Amendment 7 Area C south pit****	1, 2	N of Amendment 7 Area C pit in drainage
GPS10	GPS mapping	2009-11-30	JWB	Around toe (W end) of Amendment 5 Pit 6	3	N, W, & S of A5 Pit 6
GPS11	GPS mapping	2009-11-30	JWB	Around Amendment 5 Pit 7A	2	N, C, & W of A5 pit area.
GPS12	GPS mapping	2009-11-30	JWB	Cottonwood drainage above (E of) Eagle's Nest Lane and Miller Residence & below (SW of) Warren Reclamation	2, 5A	W of 5A, N of 2
GPS13	GPS mapping	2009-12-01	JWB	From gate between Buck Sullivan Springs Rd. & E Skyline Rd. eastward up fiber optic road	near 6	N & W of Pit 6 area
GPS14	GPS mapping	2009-12-01	JWB	Fiber optic rd beginning at end of previous transect to accommodate denser trees by reducing transect width to only 20m on N side of rd.	near 6 & 9A	NE of Pit 6 area
GPS15	GPS mapping	2009-12-01	JWB	Club Finger: 2-track rd. & connections beginning at 4-way junction ca. Govt. Gully proceeding uphill to E almost to Sect. 21	7A	near center
GPS16	GPS mapping	2009-12-01	JWB	Hand, 2nd Finger: 2-track rd. or a connection, on ridge S of Govt. Gully.	7B	near center toward E end of 7B
GPS17	GPS mapping	2009-12-01	JWB	On foothill access rd heading S thru Sect. 19 to Govt. Gulch at Windmill.	7, 10	near westward tips of Fingers of the Hand
GPS18	GPS mapping	2009-12-01	JWB	From lower Govt. Gulch windmill going S along access rd. to current haulroad & Warren reclamation	7C, 10, 5	SW of 7C, W of 5 & 10
A5 Pit 1	direct count	1995	JO	SE end of Warren Quarry (mined & reclaimed)	5A	W of 5A
A5 Pit 2	direct count	1995	JO	Part of W lobe of A8 Pit 6	6	W lobe
A5 Pit 3	direct count	1995	JO	Part of W end of A8 Pit 7A	7A	part of W end
A5 Pit 4	direct count	1995	JO	Part of W end of A8 Pit 7C	7C	part of W end of 7C area
A5 Pit 5	direct count	1995	JO	Part of N end of A8 Pit 5A	5A	part of N end of pit 5A area
A5 Pit 6	direct count	1995	JO	Part of A8 Pit 3 (mined out)	3	part of Pit 3
A5 Pit 7	direct count	1995	JO	Part of A8 Pit 1 (mined out)	1	part of Pit 1 area
JWB Sites: 32						
Total Sites: 41						
*The Tree Inventory Map labels Transects 1-16 as "Tree Site 16" etc., GPS Data Sites as "Tree GPS 18", and Amendment 5 field data sites as "Tree data A5 Pit 2".						
**Workers: JWB (Jeff Brasher), AHM (Andy MacClugage), RS (Ron Schreibeis), JO (Jim Orpet)						
***Purposeful spatial overlap of Transects 7 & 8						
****Purposeful spatial overlap of Transects 14-16 and GPS9						

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Table DIX8-21. Tree Inventory Field Data By Field Site Code. For each tree species the column heading indicates an observed parameter, "#" for individual trees, "I" for trees discolored by beetle infestation in 2009, and "K" for standing, defoliated, beetle-killed trees in 2009. The location of each Field Data Collection Site is shown on **Map DIX8-4**. For metadata describing each site see **Table DIX8-20 - Tree Inventory Field Site Metadata** and photocopied Field Data Sheets (**Addendum DIX8 E**). Rows, columns, and cells only holding zeros may be omitted for simplicity.

Field Site Code, Size Class	limber pine			Rocky Mtn. juniper	ponderosa pine		Douglas fir		quaking aspen	subalpine fir			chokecherry	lodgepole pine		Engelmann spruce	Total Trees			Total limber pine + Douglas fir		
	#	I	K	#	#	I	#	K	#	#	I	K	#	#	K	#	#	I	K	#	I	K
Transect 1																						
S	7	1															**7**	1	0	**7**	1	0
M	3				1												**4**	0	0	**3**	0	0
L	2.5	1															**2.5**	1	0	**2.5**	1	0
Tot	12.5	2	0	0	1	0	0	0	0	0	0	0	0	0	0	0	**13.5**	2	0	**12.5**	2	0
Transect 2																						
S	16.5	1		3			1										**20.5**	1	0	**17.5**	1	0
M	22	4	1				0.5										**22.5**	4	1	**22.5**	4	1
L	10	2															**10**	2	0	**10**	2	0
Tot	48.5	7	1	3	0	0	1.5	0	0	0	0	0	0	0	0	0	**53**	7	1	**50**	7	1
Transect 3																						
S	8			2.5			34		36								**80.5**	0	0	**42**	0	0
M	15.5	2					17.5		79								**112**	2	0	**33**	2	0
L	1						24.5		5.5				1				**31.5**	0	0	**25.5**	0	0
Tot	24.5	2	0	2.5	0	0	76	0	120.5	0	0	0	1	0	0	0	**224**	2	0	**100.5**	2	0
Transect 4																						
S	29				4												**33**	0	0	**29**	0	0
M	10				1.5												**11.5**	0	0	**10**	0	0
L	1																**1**	0	0	**1**	0	0
Tot	40	0	0	0	5.5	0	0	0	0	0	0	0	0	0	0	0	**45.5**	0	0	**40**	0	0

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Field Site Code, Size Class	limber pine			Rocky Mtn. juniper	ponderosa pine		Douglas fir		quaking aspen	subalpine fir			chokecherry	lodgepole pine		Engelmann spruce	Total Trees			Total limber pine + Douglas fir		
	#	I	K	#	#	I	#	K	#	#	I	K	#	#	K	#	#	I	K	#	I	K
Transect 5																						
S	11			1					15								**27**	0	0	**11**	0	0
M	1.5								2.5								**4**	0	0	**1.5**	0	0
L	2								0.5								**2.5**	0	0	**2**	0	0
Tot	14.5	0	0	1	0	0	0	0	18	0	0	0	0	0	0	0	**33.5**	0	0	**14.5**	0	0
Transect 6																						
S	71.5						36										**107.5**	0	0	**107.5**	0	0
M	11.5						30										**41.5**	0	0	**41.5**	0	0
L	2						2										**4**	0	0	**4**	0	0
Tot	85	0	0	0	0	0	68	0	0	0	0	0	0	0	0	0	**153**	0	0	**153**	0	0
Transect 7																						
S	1						2			8.5							**11.5**	0	0	**3**	0	0
M	6.5						0.5			15		1					**22**	0	1	**7**	0	0
L	1.5						2.5		3.5	13.5		1					**21**	0	1	**4**	0	0
Tot	9	0	0	0	0	0	5	0	3.5	37	0	2	0	0	0	0	**54.5**	0	2	**14**	0	0
Transect 8																						
S							24		2	30.5		1					**56.5**	0	1	**24**	0	0
M	1.5						7		1	23	1	2					**32.5**	1	2	**8.5**	0	0
L							3	2	1.5	9.5		2					**14**	0	4	**3**	0	2
Tot	1.5	0	0	0	0	0	34	2	4.5	63	1	5	0	0	0	0	**103**	1	7	**35.5**	0	2
Transect 9																						
S	11				2												**13**	0	0	**11**	0	0
M	2				2	1	0.5										**4.5**	1	0	**2.5**	0	0
L	2				0.5		0.5										**3**	0	0	**2.5**	0	0
Tot	15	0	0	0	4.5	1	1	0	0	0	0	0	0	0	0	0	**20.5**	1	0	**16**	0	0

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Field Site Code, Size Class	limber pine			Rocky Mtn. juniper	ponderosa pine		Douglas fir		quaking aspen	subalpine fir			chokecherry	lodgepole pine		Engelmann spruce	Total Trees			Total limber pine + Douglas fir		
	#	I	K	#	#	I	#	K	#	#	I	K	#	#	K	#	#	I	K	#	I	K
Transect 10																						
S				1													**1**	0	0	**0**	0	0
M				4	1												**5**	0	0	**0**	0	0
L																	**0**	0	0	**0**	0	0
Tot	0	0	0	5	1	0	0	0	0	0	0	0	0	0	0	0	**6**	0	0	**0**	0	0
Transect 11																						
S	67.5				3		20		105	40							**235.5**	0	0	**87.5**	0	0
M	58		4				2		6	4.5							**70.5**	0	4	**60**	0	4
L	41		1						5	1.5							**47.5**	0	1	**41**	0	1
Tot	166.5	0	5	0	3	0	22	0	116	46	0	0	0	0	0	0	**353.5**	0	5	**188.5**	0	5
Transect 12																						
S	27						29										**56**	0	0	**56**	0	0
M	6.5						7		5.5								**19**	0	0	**13.5**	0	0
L	1		1.5				1.5		1								**3.5**	0	1.5	**2.5**	0	1.5
Tot	34.5	0	1.5	0	0	0	37.5	0	6.5	0	0	0	0	0	0	0	**78.5**	0	1.5	**72**	0	1.5
Transect 13																						
S	23		1				25		52	80				5			**185**	0	1	**48**	0	1
M	12						11		7	7				3	1		**40**	0	1	**23**	0	0
L	2						9		21	6				9	4		**47**	0	4	**11**	0	0
Tot	37	0	1	0	0	0	45	0	80	93	0	0	0	17	5	0	**272**	0	6	**82**	0	1
Transect 14																						
S				14													**14**	0	0	**0**	0	0
M				24													**24**	0	0	**0**	0	0
L				2													**2**	0	0	**0**	0	0
Tot	0	0	0	40	0	0	0	0	0	0	0	0	0	0	0	0	**40**	0	0	**0**	0	0

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Field Site Code, Size Class	limber pine			Rocky Mtn. juniper	ponderosa pine		Douglas fir		quaking aspen	subalpine fir			chokecherry	lodgepole pine		Engelmann spruce	Total Trees			Total limber pine + Douglas fir		
	#	I	K	#	#	I	#	K	#	#	I	K	#	#	K	#	#	I	K	#	I	K
Transect 15																						
S				17													**17**	0	0	**0**	0	0
M				3													**3**	0	0	**0**	0	0
L				1													**1**	0	0	**0**	0	0
Tot	0	0	0	21	0	0	0	0	0	0	0	0	0	0	0	0	**21**	0	0	**0**	0	0
Transect 16 (only species ID and metadata collected at this site)																						
Tot	0	0	0	all	0	0	0	0	0	0	0	0	0	0	0	0	**na**	na	na	**0**	0	0
GPS 1 (for methods testing; data was lost)																						
Tot	na	na	na	na	na	na	na	na	na	na	na	na	na	na	na	na	**na**	na	na	**na**	na	na
GPS 2																						
S	78				1												**79**	0	0	**78**	0	0
M	29				4												**33**	0	0	**29**	0	0
L																	**0**	0	0	**0**	0	0
Tot	107	0	0	0	5	0	0	0	0	0	0	0	0	0	0	0	**112**	0	0	**107**	0	0
GPS 3																						
S	96				2												**98**	0	0	**96**	0	0
M	43				1												**44**	0	0	**43**	0	0
L	15																**15**	0	0	**15**	0	0
Tot	154	0	0	0	3	0	0	0	0	0	0	0	0	0	0	0	**157**	0	0	**154**	0	0
GPS 4																						
S	2																**2**	0	0	**2**	0	0
M	2																**2**	0	0	**2**	0	0
L																	**0**	0	0	**0**	0	0
Tot	4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**4**	0	0	**4**	0	0

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Field Site Code, Size Class	limber pine			Rocky Mtn. juniper	ponderosa pine		Douglas fir		quaking aspen	subalpine fir			chokecherry	lodgepole pine		Engelmann spruce	Total Trees			Total limber pine + Douglas fir		
	#	I	K	#	#	I	#	K	#	#	I	K	#	#	K	#	#	I	K	#	I	K
GPS 5																						
S	22			15			2										**39**	0	0	**24**	0	0
M	27			7	1		1										**36**	0	0	**28**	0	0
L	5			2			1										**8**	0	0	**6**	0	0
Tot	54	0	0	24	1	0	4	0	0	0	0	0	0	0	0	0	**83**	0	0	**58**	0	0
GPS 6																						
S	6						21			3							**30**	0	0	**27**	0	0
M	6						6			1							**13**	0	0	**12**	0	0
L	4								5	4							**13**	0	0	**4**	0	0
Tot	16	0	0	0	0	0	27	0	5	8	0	0	0	0	0	0	**56**	0	0	**43**	0	0
GPS 7																						
S	95			1	6				1							1	**104**	0	0	**95**	0	0
M	43				2				2								**47**	0	0	**43**	0	0
L	21																**21**	0	0	**21**	0	0
Tot	159	0	0	1	8	0	0	0	3	0	0	0	0	0	0	1	**172**	0	0	**159**	0	0
GPS 8																						
S	58						30		1								**89**	0	0	**88**	0	0
M	20						16		2								**38**	0	0	**36**	0	0
L	8						12										**20**	0	0	**20**	0	0
Tot	86	0	0	0	0	0	58	0	3	0	0	0	0	0	0	0	**147**	0	0	**144**	0	0
GPS 9																						
S	1			20													**21**	0	0	**1**	0	0
M				1													**1**	0	0	**0**	0	0
L				6													**6**	0	0	**0**	0	0
Tot	1	0	0	27	0	0	0	0	0	0	0	0	0	0	0	0	**28**	0	0	**1**	0	0

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Field Site Code, Size Class	limber pine			Rocky Mtn. juniper	ponderosa pine		Douglas fir		quaking aspen	subalpine fir			chokecherry	lodgepole pine		Engelmann spruce	Total Trees			Total limber pine + Douglas fir		
	#	I	K	#	#	I	#	K	#	#	I	K	#	#	K	#	#	I	K	#	I	K
GPS 10																						
S				26													**26**	0	0	**0**	0	0
M	1																**1**	0	0	**1**	0	0
L				6													**6**	0	0	**0**	0	0
Tot	1	0	0	32	0	0	0	0	0	0	0	0	0	0	0	0	**33**	0	0	**1**	0	0
GPS 11																						
S	21			3	2												**26**	0	0	**21**	0	0
M	5																**5**	0	0	**5**	0	0
L																	**0**	0	0	**0**	0	0
Tot	26	0	0	3	2	0	0	0	0	0	0	0	0	0	0	0	**31**	0	0	**26**	0	0
GPS 12																						
S	2			21	2												**25**	0	0	**2**	0	0
M	2			5	1												**8**	0	0	**2**	0	0
L				6													**6**	0	0	**0**	0	0
Tot	4	0	0	32	3	0	0	0	0	0	0	0	0	0	0	0	**39**	0	0	**4**	0	0
GPS 13																						
S	17			1	1												**19**	0	0	**17**	0	0
M	11			1													**12**	0	0	**11**	0	0
L	1																**1**	0	0	**1**	0	0
Tot	29	0	0	2	1	0	0	0	0	0	0	0	0	0	0	0	**32**	0	0	**29**	0	0
GPS 14																						
S	8				1												**9**	0	0	**8**	0	0
M	7																**7**	0	0	**7**	0	0
L	2																**2**	0	0	**2**	0	0
Tot	17	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	**18**	0	0	**17**	0	0

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Field Site Code, Size Class	limber pine			Rocky Mtn. juniper	ponderosa pine		Douglas fir		quaking aspen	subalpine fir			chokecherry	lodgepole pine		Engelmann spruce	Total Trees			Total limber pine + Douglas fir		
	#	I	K	#	#	I	#	K	#	#	I	K	#	#	K	#	#	I	K	#	I	K
GPS 15																						
S	25																**25**	0	0	**25**	0	0
M	17	1		1			5										**23**	1	0	**22**	1	0
L	4	1					3										**7**	1	0	**7**	1	0
Tot	46	2	0	1	0	0	8	0	0	0	0	0	0	0	0	0	**55**	2	0	**54**	2	0
GPS 16																						
S	2																**2**	0	0	**2**	0	0
M	2																**2**	0	0	**2**	0	0
L																	**0**	0	0	**0**	0	0
Tot	4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**4**	0	0	**4**	0	0
GPS 17																						
S	5			4													**9**	0	0	**5**	0	0
M	1																**1**	0	0	**1**	0	0
L				3													**3**	0	0	**0**	0	0
Tot	6	0	0	7	0	0	0	0	0	0	0	0	0	0	0	0	**13**	0	0	**6**	0	0
GPS 18																						
S	2			21													**23**	0	0	**2**	0	0
M				26													**26**	0	0	**0**	0	0
L				16													**16**	0	0	**0**	0	0
Tot	2	0	0	63	0	0	0	0	0	0	0	0	0	0	0	0	**65**	0	0	**2**	0	0

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Field Site Code, Size Class	limber pine			Rocky Mtn. juniper	ponderosa pine		Douglas fir		quaking aspen	subalpine fir			chokecherry	lodgepole pine		Engelmann spruce	Total Trees			Total limber pine + Douglas fir		
	#	I	K	#	#	I	#	K	#	#	I	K	#	#	K	#	#	I	K	#	I	K
A5-pit1																						
Tot	4	na	na	16	4	na											**24**	na	na	**4**	na	na
A5-pit2																						
Tot	2	na	na	3		na											**5**	na	na	**2**	na	na
A5-pit3																						
Tot	0	na	na	0		na											**0**	na	na	**0**	na	na
A5-pit4																						
Tot	0	na	na	2	2	na											**4**	na	na	**0**	na	na
A5-pit5																						
Tot	9	na	na	27		na											**36**	na	na	**9**	na	na
A5-pit6																						
Tot	0	na	na	4		na											**4**	na	na	**0**	na	na
A5-pit7																						
Tot	6	na	na	85		na											**91**	na	na	**6**	na	na
Grand Totals																						
S	**712.5**	**2.0**	**1.0**	**150.5**	**24.0**		**224.0**		**212.0**	**162.0**		**1.0**		**5.0**		**1.0**	**1485.0**	**2**	**2**	**936.5**	**2.0**	**1.0**
M	**366.0**	**7.0**	**5.0**	**72.0**	**14.5**	**1.0**	**104.0**		**105.0**	**50.5**	**1.0**	**3.0**		**3.0**	**1.0**		**712.0**	**9**	**9**	**470.0**	**7.0**	**5.0**
L	**126.0**	**4.0**	**2.5**	**42.0**	**0.5**		**59.0**	**2.0**	**43.0**	**34.5**		**3.0**	**0.5**	**9.0**	**4.0**		**305.5**	**4**	**12**	**185.0**	**4.0**	**4.5**
Tot*	**1225.5**	**13.0**	**8.5**	**401.5**	**45.0**	**1.0**	**387.0**	**2.0**	**360.0**	**247.0**	**1.0**	**7.0**	**0.5**	**17.0**	**5.0**	**1.0**	**2684.5**	**15.0**	**22.5**	**1612.5**	**13.0**	**10.5**

***Species Totals here will be greater than the sums of size classes because included data from Amendment 5 did not report numbers by size class.**

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Table DIX8-22. Tree Predictions by Map Polygon, Road Segment, and Numbered Pit. For each tree species the column heading indicates an expected parameter, "#" for individual trees, "I" for trees discolored by beetle infestation in 2009, and "K" for standing, defoliated, beetle-killed trees in 2009. For use of mnemonic labels below see field data sheets (**Addendum DIX8 E**) and permit maps (such as **Map DIX8-4**). Rows and columns only holding zeros are omitted for simplicity.

Pit# (Mnemonic), Polygon #, Size Class	limber pine			Rocky Mtn. juniper	ponderosa pine		Douglas fir		quaking aspen	subalpine fir			chokecherry	Total Trees			Total limber pine + Douglas fir		
	#	I	K	#	#	I	#	K	#	#	I	K	#	#	I	K	#	I	K
Pit 1 (Exhaust; pit boundary used as prediction polygon)																			
S	116				39									**155**	0	0	**116**	0	0
M	107				6									**113**	0	0	**107**	0	0
L					65									**65**	0	0	**0**	0	0
Tot	223	0	0	0	110	0	0	0	0	0	0	0	0	**333**	0	0	**223**	0	0
Pit 2 (Exhaust; pit boundary used as polygon)																			
S	169				2									**171**	0	0	**169**	0	0
M	63				9									**72**	0	0	**63**	0	0
L														**0**	0	0	**0**	0	0
Tot	232	0	0	0	11	0	0	0	0	0	0	0	0	**243**	0	0	**232**	0	0
Pit 3 (Exhaust; pit boundary used as polygon)																			
S	265				89									**354**	0	0	**265**	0	0
M	245				13									**258**	0	0	**245**	0	0
L					148									**148**	0	0	**0**	0	0
Tot	510	0	0	0	250	0	0	0	0	0	0	0	0	**760**	0	0	**510**	0	0
Pit 4 (Exhaust; pit boundary used as polygon)																			
S				204										**204**	0	0	**0**	0	0
M	8													**8**	0	0	**8**	0	0
L				47										**47**	0	0	**0**	0	0
Tot	8	0	0	251	0	0	0	0	0	0	0	0	0	**259**	0	0	**8**	0	0

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Pit# (Mnemonic), Polygon #, Size Class	limber pine			Rocky Mtn. juniper	ponderosa pine		Douglas fir		quaking aspen	subalpine fir			chokecherry	Total Trees			Total limber pine + Douglas fir		
	#	I	K	#	#	I	#	K	#	#	I	K	#	#	I	K	#	I	K
Pit 5A (Tailfin; pit boundary used as polygon)																			
S	38			38	9									**85**	0	0	**38**	0	0
M	21			41	24									**86**	0	0	**21**	0	0
L	12			12	4									**28**	0	0	**12**	0	0
Tot	71	0	0	91	37	0	0	0	0	0	0	0	0	**199**	0	0	**71**	0	0
Pit 5B (Tailpipe; pit boundary used as polygon)																			
S	336				4									**340**	0	0	**336**	0	0
M	126				17									**143**	0	0	**126**	0	0
L														**0**	0	0	**0**	0	0
Tot	462	0	0	0	21	0	0	0	0	0	0	0	0	**483**	0	0	**462**	0	0
Pit 5C (Tailpipe; pit boundary used as polygon)																			
S	294				4									**298**	0	0	**294**	0	0
M	109				15									**124**	0	0	**109**	0	0
L														**0**	0	0	**0**	0	0
Tot	403	0	0	0	19	0	0	0	0	0	0	0	0	**422**	0	0	**403**	0	0
Pit 5D (Muffler)																			
Pit 5D Totals																			
S	4345	30		313	324		152		76					**5209**	30	0	**4497**	30	0
M	2108	123	30	101	138		86		166					**2599**	123	30	**2194**	123	30
L	491	60		34			68		12				1	**606**	60	0	**559**	60	0
Tot	6943	212	30	448	462	0	306	0	253	0	0	0	1	**8413**	212	30	**7250**	212	30

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Pit# (Mnemonic), Polygon #, Size Class	limber pine			Rocky Mtn. juniper	ponderosa pine		Douglas fir		quaking aspen	subalpine fir			chokecherry	Total Trees			Total limber pine + Douglas fir		
	#	I	K	#	#	I	#	K	#	#	I	K	#	#	I	K	#	I	K
Pit 5D Prediction Polygons																			
1																			
S	17			5			71		76					**169**	0	0	**88**	0	0
M	33	4					37		166					**235**	4	0	**69**	4	0
L	2						51		12				1	**66**	0	0	**54**	0	0
Tot	51	4	0	5	0	0	160	0	253	0	0	0	1	**470**	4	0	**211**	4	0
2																			
S	491	30		89			30							**610**	30	0	**521**	30	0
M	655	119	30				15							**669**	119	30	**669**	119	30
L	298	60					0							**298**	60	0	**298**	60	0
Tot	1443	208	30	89	0	0	45	0	0	0	0	0	0	**1577**	208	30	**1488**	208	30
3																			
S	3													**3**	0	0	**3**	0	0
M	1													**1**	0	0	**1**	0	0
L														**0**	0	0	**0**	0	0
Tot	4	0	0	0	0	0	0	0	0	0	0	0	0	**4**	0	0	**4**	0	0
4																			
S	2349				324									**2673**	0	0	**2349**	0	0
M	810				121									**931**	0	0	**810**	0	0
L	81													**81**	0	0	**81**	0	0
Tot	3240	0	0	0	445	0	0	0	0	0	0	0	0	**3685**	0	0	**3240**	0	0

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Pit# (Mnemonic), Polygon #, Size Class	limber pine			Rocky Mtn. juniper	ponderosa pine		Douglas fir		quaking aspen	subalpine fir			chokecherry	Total Trees			Total limber pine + Douglas fir		
	#	I	K	#	#	I	#	K	#	#	I	K	#	#	I	K	#	I	K
Pit 5D Prediction Polygons, cont.																			
5																			
S	200													**200**	0	0	**200**	0	0
M	74													**74**	0	0	**74**	0	0
L	3													**3**	0	0	**3**	0	0
Tot	277	0	0	0	0	0	0	0	0	0	0	0	0	**277**	0	0	**277**	0	0
6																			
S	116			116			27							**259**	0	0	**143**	0	0
M	71			54	9		18							**152**	0	0	**89**	0	0
L	18			18			9							**45**	0	0	**27**	0	0
Tot	205	0	0	188	9	0	54	0	0	0	0	0	0	**456**	0	0	**259**	0	0
7																			
S	139													**139**	0	0	**139**	0	0
M	51													**51**	0	0	**51**	0	0
L	2													**2**	0	0	**2**	0	0
Tot	192	0	0	0	0	0	0	0	0	0	0	0	0	**192**	0	0	**192**	0	0
8																			
S	478													**478**	0	0	**478**	0	0
M	175													**175**	0	0	**175**	0	0
L	65													**65**	0	0	**65**	0	0
Tot	718	0	0	0	0	0	0	0	0	0	0	0	0	**718**	0	0	**718**	0	0

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Pit# (Mnemonic), Polygon #, Size Class	limber pine			Rocky Mtn. juniper	ponderosa pine		Douglas fir		quaking aspen	subalpine fir			chokecherry	Total Trees			Total limber pine + Douglas fir		
	#	I	K	#	#	I	#	K	#	#	I	K	#	#	I	K	#	I	K
Pit 5D Prediction Polygons, cont.																			
9																			
S	367			102			24							**493**	0	0	**391**	0	0
M	160			47	8		16							**231**	0	0	**176**	0	0
L	19			16			8							**43**	0	0	**27**	0	0
Tot	546	0	0	165	8	0	48	0	0	0	0	0	0	**767**	0	0	**594**	0	0
10																			
S	13													**13**	0	0	**13**	0	0
M	5													**5**	0	0	**5**	0	0
L															0	0		0	0
Tot	18	0	0	0	0	0	0	0	0	0	0	0	0	**18**	0	0	**18**	0	0
Pit 6 (North Boomerang)																			
Pit 6 Totals																			
S	52			5	5									**62**	0	0	**52**	0	0
M	32													**32**	0	0	**32**	0	0
L	5													**5**	0	0	**5**	0	0
Tot	89	0	0	5	5	0	0	0	0	0	0	0	0	**99**	0	0	**89**	0	0
1																			
S	16				2									**18**	0	0	**16**	0	0
M	14													**14**	0	0	**14**	0	0
L	4													**4**	0	0	**4**	0	0
Tot	34	0	0	0	2	0	0	0	0	0	0	0	0	**36**	0	0	**34**	0	0

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Pit# (Mnemonic), Polygon #, Size Class	limber pine			Rocky Mtn. juniper	ponderosa pine		Douglas fir		quaking aspen	subalpine fir			chokecherry	Total Trees			Total limber pine + Douglas fir		
	#	I	K	#	#	I	#	K	#	#	I	K	#	#	I	K	#	I	K
Pit 6 Prediction Polygons, cont.																			
2																			
S	7				1									**8**	0	0	**7**	0	0
M	6													**6**	0	0	**6**	0	0
L															0	0		0	0
Tot	13	0	0	0	1	0	0	0	0	0	0	0	0	**14**	0	0	**13**	0	0
3																			
S	13				2									**15**	0	0	**13**	0	0
M	12													**12**	0	0	**12**	0	0
L	1													**1**	0	0	**1**	0	0
Tot	26	0	0	0	2	0	0	0	0	0	0	0	0	**28**	0	0	**26**	0	0
4																			
S	12													**12**	0	0	**12**	0	0
M															0	0		0	0
L															0	0		0	0
Tot	12	0	0	0	0	0	0	0	0	0	0	0	0	**12**	0	0	**12**	0	0
5																			
S	2													**2**	0	0	**2**	0	0
M															0	0		0	0
L															0	0		0	0
Tot	2	0	0	0	0	0	0	0	0	0	0	0	0	**2**	0	0	**2**	0	0

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Pit# (Mnemonic), Polygon #, Size Class	limber pine			Rocky Mtn. juniper	ponderosa pine		Douglas fir		quaking aspen	subalpine fir			chokecherry	Total Trees			Total limber pine + Douglas fir		
	#	I	K	#	#	I	#	K	#	#	I	K	#	#	I	K	#	I	K
Pit 6 Prediction Polygons, cont.																			
6																			
S	2			3										**5**	0	0	**2**	0	0
M															0	0		0	0
L															0	0		0	0
Tot	2	0	0	3	0	0	0	0	0	0	0	0	0	**5**	0	0	**2**	0	0
7																			
S				2										**2**	0	0	**2**	0	0
M															0	0		0	0
L															0	0		0	0
Tot	0	0	0	2	0	0	0	0	0	0	0	0	0	**2**	0	0	**2**	0	0
Pit 7A (Club Finger of Hand)																			
Pit 7A Totals																			
S	137	0	0	4	0	0	61	0	20	0	0	0	0	**223**	0	0	**198**	**0**	**0**
M	92	1	0	5	4	0	33	0	44	0	0	0	0	**179**	1	0	**125**	**1**	**0**
L	38	0	0	0	0	0	30	0	3	0	0	0	0	**70**	0	0	**67**	**0**	**0**
Tot	266	1	0	9	4	0	124	0	68	0	0	0	0	**472**	1	0	**390**	1	0
1																			
S	30			1			61		20					**113**	0	0	**91**	0	0
M	17	1					33		44					**95**	1	0	**50**	1	0
L	10						30		3					**42**	0	0	**39**	0	0
Tot	56	1	0	1	0	0	124	0	68	0	0	0	0	**250**	1	0	**180**	1	0

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Pit# (Mnemonic), Polygon #, Size Class	limber pine			Rocky Mtn. juniper	ponderosa pine		Douglas fir		quaking aspen	subalpine fir			chokecherry	Total Trees			Total limber pine + Douglas fir		
	#	I	K	#	#	I	#	K	#	#	I	K	#	#	I	K	#	I	K
Pit 7A Prediction Polygons, cont.																			
2																			
S	15													**15**	0	0	**15**	0	0
M	8				2									**10**	0	0	**8**	0	0
L	2													**2**	0	0	**2**	0	0
Tot	25	0	0	0	2	0	0	0	0	0	0	0	0	**27**	0	0	**25**	0	0
3																			
S	7													**7**	0	0	**7**	0	0
M	4				1									**5**	0	0	**4**	0	0
L	2													**2**	0	0	**2**	0	0
Tot	13	0	0	0	1	0	0	0	0	0	0	0	0	**14**	0	0	**13**	0	0
4																			
S	8													**8**	0	0	**8**	0	0
M	5				1									**6**	0	0	**5**	0	0
L	3													**3**	0	0	**3**	0	0
Tot	16	0	0	0	1	0	0	0	0	0	0	0	0	**17**	0	0	**16**	0	0
5																			
S	50													**50**	0	0	**50**	0	0
M	24			2										**26**	0	0	**24**	0	0
L	8													**8**	0	0	**8**	0	0
Tot	82	0	0	2	0	0	0	0	0	0	0	0	0	**84**	0	0	**82**	0	0

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Pit# (Mnemonic), Polygon #, Size Class	limber pine			Rocky Mtn. juniper	ponderosa pine		Douglas fir		quaking aspen	subalpine fir			chokecherry	Total Trees			Total limber pine + Douglas fir		
	#	I	K	#	#	I	#	K	#	#	I	K	#	#	I	K	#	I	K
Pit 7A Prediction Polygons, cont.																			
6																			
S	9													**9**	0	0	**9**	0	0
M	12			1										**13**	0	0	**12**	0	0
L	4													**4**	0	0	**4**	0	0
Tot	25	0	0	1	0	0	0	0	0	0	0	0	0	**26**	0	0	**25**	0	0
7																			
S	18			3										**21**	0	0	**18**	0	0
M	22			2										**24**	0	0	**22**	0	0
L	9													**9**	0	0	**9**	0	0
Tot	49	0	0	5	0	0	0	0	0	0	0	0	0	**54**	0	0	**49**	0	0
8																			
S																			
M																			
L																			
Tot	0	0	0	0	0	0	0	0	0	0	0	0	0	**0**	0	0	**0**	0	0
9																			
S																			
M																			
L																			
Tot	0	0	0	0	0	0	0	0	0	0	0	0	0	**0**	0	0	**0**	0	0

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Pit# (Mnemonic), Polygon #, Size Class	limber pine			Rocky Mtn. juniper	ponderosa pine		Douglas fir		quaking aspen	subalpine fir			chokecherry	Total Trees			Total limber pine + Douglas fir		
	#	I	K	#	#	I	#	K	#	#	I	K	#	#	I	K	#	I	K
Pit 7B (2nd Finger of Hand)																			
Pit 7B Totals																			
S	153				1									**154**	0	0	**153**	0	0
M	154			1										**155**	0	0	**154**	0	0
L	14			1										**15**	0	0	**14**	0	0
Tot	321	0	0	2	1	0	0	0	0	0	0	0	0	**324**	0	0	**321**	0	0
1																			
S	43													**43**	0	0	**43**	0	0
M	42													**42**	0	0	**42**	0	0
L	2													**2**	0	0	**2**	0	0
Tot	87	0	0	0	0	0	0	0	0	0	0	0	0	**87**	0	0	**87**	0	0
2																			
S	69													**69**	0	0	**69**	0	0
M	66													**66**	0	0	**66**	0	0
L	1													**1**	0	0	**1**	0	0
Tot	136	0	0	0	0	0	0	0	0	0	0	0	0	**136**	0	0	**136**	0	0
3																			
S	4				1									**5**	0	0	**4**	0	0
M	2													**2**	0	0	**2**	0	0
L	1													**1**	0	0	**1**	0	0
Tot	7	0	0	0	1	0	0	0	0	0	0	0	0	**8**	0	0	**7**	0	0

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Pit# (Mnemonic), Polygon #, Size Class	limber pine			Rocky Mtn. juniper	ponderosa pine		Douglas fir		quaking aspen	subalpine fir			chokecherry	Total Trees			Total limber pine + Douglas fir		
	#	I	K	#	#	I	#	K	#	#	I	K	#	#	I	K	#	I	K
Pit 7B Polygons, cont.																			
4																			
S	17			1										**18**	0	0	**17**	0	0
M	21			1										**22**	0	0	**21**	0	0
L	8													**8**	0	0	**8**	0	0
Tot	46	0	0	2	0	0	0	0	0	0	0	0	0	**48**	0	0	**46**	0	0
5																			
S	18													**18**	0	0	**18**	0	0
M	23													**23**	0	0	**23**	0	0
L	2													**2**	0	0	**2**	0	0
Tot	43	0	0	0	0	0	0	0	0	0	0	0	0	**43**	0	0	**43**	0	0
6																			
S	2													**2**	0	0	**2**	0	0
M														**0**	0	0	**0**	0	0
L														**0**	0	0	**0**	0	0
Tot	2	0	0	0	0	0	0	0	0	0	0	0	0	**2**	0	0	**2**	0	0
7																			
Tot	0	0	0	0	0	0	0	0	0	0	0	0	0	**0**	0	0	**0**	0	0
Pit 7C (Long Finger of Hand)																			
Pit 7C Totals																			
S	172			13	10									**195**	0	0	**172**	0	0
M	143			2	3									**148**	0	0	**143**	0	0
L	46			7	1									**54**	0	0	**46**	0	0
Tot	361	0	0	22	14	0	0	0	0	0	0	0	0	**397**	0	0	**361**	0	0

Pit# (Mnemonic), Polygon #, Size Class	limber pine			Rocky Mtn. juniper	ponderosa pine		Douglas fir		quaking aspen	subalpine fir			chokecherry	Total Trees			Total limber pine + Douglas fir		
	#	I	K	#	#	I	#	K	#	#	I	K	#	#	I	K	#	I	K
Pit 7C Prediction Polygons																			
1																			
S	17													**17**	0		**17**	0	0
M	16													**16**	0	0	**16**	0	0
L															0	0		0	0
Tot	33	0	0	0	0	0	0	0	0	0	0	0	0	**33**	0	0	**33**	0	0
2																			
S	24													**24**	0	0	**24**	0	0
M	20													**20**	0	0	**20**	0	0
L	1													**1**	0	0	**1**	0	0
Tot	45	0	0	0	0	0	0	0	0	0	0	0	0	**45**	0	0	**45**	0	0
3																			
S	20													**20**	0	0	**20**	0	0
M	19													**19**	0	0	**19**	0	0
L	3													**3**	0	0	**3**	0	0
Tot	42	0	0	0	0	0	0	0	0	0	0	0	0	**42**	0	0	**42**	0	0
4																			
S	50				10									**60**	0	0	**50**	0	0
M	22				3									**25**	0	0	**22**	0	0
L	15				1									**16**	0	0	**15**	0	0
Tot	87	0	0	0	14	0	0	0	0	0	0	0	0	**101**	0	0	**87**	0	0

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Pit# (Mnemonic), Polygon #, Size Class	limber pine			Rocky Mtn. juniper	ponderosa pine		Douglas fir		quaking aspen	subalpine fir			chokecherry	Total Trees			Total limber pine + Douglas fir		
	#	I	K	#	#	I	#	K	#	#	I	K	#	#	I	K	#	I	K
Pit 7C Polygons, cont.																			
5																			
S	2													**2**	0	0	**2**	0	0
M	1													**1**	0	0	**1**	0	0
L	1													**1**	0	0	**1**	0	0
Tot	4	0	0	0	0	0	0	0	0	0	0	0	0	**4**	0	0	**4**	0	0
6																			
S	53			2										**55**	0	0	**53**	0	0
M	65			2										**67**	0	0	**65**	0	0
L	26													**26**	0	0	**26**	0	0
Tot	144	0	0	4	0	0	0	0	0	0	0	0	0	**148**	0	0	**144**	0	0
7																			
Tot	0	0	0	0	0	0	0	0	0	0	0	0	0	**0**	0	0	**0**	0	0
8																			
S	7			8										**15**	0	0	**7**	0	0
M															0	0		0	0
L				5										**5**	0	0		0	0
Tot	7	0	0	13	0	0	0	0	0	0	0	0	0	**20**	0	0	**7**	0	0
9																			
S	1			1										**2**	0	0	**1**	0	0
M															0	0		0	0
L				1										**1**	0	0		0	0
Tot	1	0	0	2	0	0	0	0	0	0	0	0	0	**3**	0	0	**1**	0	0

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Pit# (Mnemonic), Polygon #, Size Class	limber pine			Rocky Mtn. juniper	ponderosa pine		Douglas fir		quaking aspen	subalpine fir			chokecherry	Total Trees			Total limber pine + Douglas fir		
	#	I	K	#	#	I	#	K	#	#	I	K	#	#	I	K	#	I	K
Pit 7C Polygons, cont.																			
10																			
S	1			1										**2**	0	0	**1**	0	0
M															0	0		0	0
L				1										**1**	0	0		0	0
Tot	1	0	0	2	0	0	0	0	0	0	0	0	0	**3**	0	0	**1**	0	0
Pit 8A (4th Finger of Hand)																			
Pit 8A Totals																			
S	168			6	7									**181**	0	0	**168**	0	0
M	156				5									**161**	0	0	**156**	0	0
L	13			3	2									**18**	0	0	**13**	0	0
Tot	337	0	0	9	14	0	0	0	0	0	0	0	0	**360**	0	0	**337**	0	0
1																			
S	42													**42**	0	0	**42**	0	0
M	40													**40**	0	0	**40**	0	0
L	2													**2**	0	0	**2**	0	0
Tot	84	0	0	0	0	0	0	0	0	0	0	0	0	**84**	0	0	**84**	0	0
2																			
S	34													**34**	0	0	**34**	0	0
M	32													**32**	0	0	**32**	0	0
L	2													**2**	0	0	**2**	0	0
Tot	68	0	0	0	0	0	0	0	0	0	0	0	0	**68**	0	0	**68**	0	0

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Pit# (Mnemonic), Polygon #, Size Class	limber pine			Rocky Mtn. juniper	ponderosa pine		Douglas fir		quaking aspen	subalpine fir			chokecherry	Total Trees			Total limber pine + Douglas fir		
	#	I	K	#	#	I	#	K	#	#	I	K	#	#	I	K	#	I	K
Pit 8A Prediction Polygons, cont.																			
3																			
S	54													**54**	0	0	**54**	0	0
M	48													**48**	0	0	**48**	0	0
L	2													**2**	0	0	**2**	0	0
Tot	104	0	0	0	0	0	0	0	0	0	0	0	0	**104**	0	0	**104**	0	0
4																			
S	21													**21**	0	0	**21**	0	0
M	20													**20**	0	0	**20**	0	0
L	3													**3**	0	0	**3**	0	0
Tot	44	0	0	0	0	0	0	0	0	0	0	0	0	**44**	0	0	**44**	0	0
5																			
S	8				2									**10**	0	0	**8**	0	0
M	4													**4**	0	0	**4**	0	0
L	2													**2**	0	0	**2**	0	0
Tot	14	0	0	0	2	0	0	0	0	0	0	0	0	**16**	0	0	**14**	0	0
6																			
S	3				1									**4**	0	0	**3**	0	0
M	2													**2**	0	0	**2**	0	0
L	1													**1**	0	0	**1**	0	0
Tot	6	0	0	0	1	0	0	0	0	0	0	0	0	**7**	0	0	**6**	0	0

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Pit# (Mnemonic), Polygon #, Size Class	limber pine			Rocky Mtn. juniper	ponderosa pine		Douglas fir		quaking aspen	subalpine fir			chokecherry	Total Trees			Total limber pine + Douglas fir		
	#	I	K	#	#	I	#	K	#	#	I	K	#	#	I	K	#	I	K
Pit 8A Prediction Polygons, cont.																			
7																			
S	20				4									**24**	0	0	**20**	0	0
M	3				5									**8**	0	0	**3**	0	0
L	1				2									**3**	0	0	**1**	0	0
Tot	24	0	0	0	11	0	0	0	0	0	0	0	0	**35**	0	0	**24**	0	0
8																			
S	2			2										**4**	0	0	**2**	0	0
M	7													**7**	0	0	**7**	0	0
L														**0**	0	0	**0**	0	0
Tot	9	0	0	2	0	0	0	0	0	0	0	0	0	**11**	0	0	**9**	0	0
9																			
S	3			4										**7**	0	0	**3**	0	0
M														**0**	0	0	**0**	0	0
L				3										**3**	0	0	**0**	0	0
Tot	3	0	0	7	0	0	0	0	0	0	0	0	0	**10**	0	0	**3**	0	0
Pit 8B (S Finger of Hand)																			
Pit 8B Totals																			
S	522	4		1	9									**532**	4	0	**522**	4	0
M	454	19			3									**457**	19	0	**454**	19	0
L	189	4	1											**189**	4	1	**189**	4	1
Tot	1165	27	1	1	12	0	0	0	0	0	0	0	0	**1178**	27	1	**1165**	27	1

Pit# (Mnemonic), Polygon #, Size Class	limber pine			Rocky Mtn. juniper	ponderosa pine		Douglas fir		quaking aspen	subalpine fir			chokecherry	Total Trees			Total limber pine + Douglas fir		
	#	I	K	#	#	I	#	K	#	#	I	K	#	#	I	K	#	I	K
Pit 8B Prediction Polygons, cont.																			
1																			
S	279													**279**	0	0	**279**	0	0
M	122													**122**	0	0	**122**	0	0
L	43				1									**44**	0	0	**43**	0	0
Tot	444	0	0	0	1	0	0	0	0	0	0	0	0	**445**	0	0	**444**	0	0
2																			
S	136	4												**136**	0	0	**136**	0	0
M	61	19	2											**61**	0	0	**61**	0	0
L	14	4	1											**14**	0	0	**14**	0	0
Tot	211	27	3	0	0	0	0	0	0	0	0	0	0	**211**	0	0	**211**	0	0
3																			
S	14													**14**	0	0	**14**	0	0
M	12													**12**	0	0	**12**	0	0
L	1													**1**	0	0	**1**	0	0
Tot	27	0	0	0	0	0	0	0	0	0	0	0	0	**27**	0	0	**27**	0	0
4																			
S	654				3									**657**	0	0	**654**	0	0
M	236				2									**238**	0	0	**236**	0	0
L	124													**124**	0	0	**124**	0	0
Tot	1014	0	0	0	5	0	0	0	0	0	0	0	0	**1019**	0	0	**1014**	0	0

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Pit# (Mnemonic), Polygon #, Size Class	limber pine			Rocky Mtn. juniper	ponderosa pine		Douglas fir		quaking aspen	subalpine fir			chokecherry	Total Trees			Total limber pine + Douglas fir		
	#	I	K	#	#	I	#	K	#	#	I	K	#	#	I	K	#	I	K
Pit 8B Prediction Polygons, cont.																			
5																			
S	12				3									**15**	0	0	**12**	0	0
M	6													**6**	0	0	**6**	0	0
L	3													**3**	0	0	**3**	0	0
Tot	21	0	0	0	3	0	0	0	0	0	0	0	0	**24**	0	0	**21**	0	0
6																			
S	13													**13**	0	0	**13**	0	0
M	7													**7**	0	0	**7**	0	0
L	4													**4**	0	0	**4**	0	0
Tot	24	0	0	0	0	0	0	0	0	0	0	0	0	**24**	0	0	**24**	0	0
7																			
S	3			3										**6**	0	0	**3**	0	0
M	10													**10**	0	0	**10**	0	0
Tot	13	0	0	3	0	0	0	0	0	0	0	0	0	**16**	0	0	**13**	0	0
Pit 9A (North Prong of Pitchfork)																			
Pit 9A Totals																			
S	173													**173**	0	0	**173**	0	0
M	166													**166**	0	0	**166**	0	0
L	8													**8**	0	0	**8**	0	0
Tot	347	0	0	0	0	0	0	0	0	0	0	0	0	**347**	0	0	**347**	0	0

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Pit# (Mnemonic), Polygon #, Size Class	limber pine			Rocky Mtn. juniper	ponderosa pine		Douglas fir		quaking aspen	subalpine fir			chokecherry	Total Trees			Total limber pine + Douglas fir		
	#	I	K	#	#	I	#	K	#	#	I	K	#	#	I	K	#	I	K
Pit 9A Prediction Polygons																			
1																			
S	163													**163**	0	0	**163**	0	0
M	156													**156**	0	0	**156**	0	0
L	8													**8**	0	0	**8**	0	0
Tot	327													**327**	0	0	**327**	0	0
2																			
S	10													**10**	0	0	**10**	0	0
M	10													**10**	0	0	**10**	0	0
Tot	20													**20**	0	0	**20**	0	0
Pit 9B (Middle Prong of Pitchfork)																			
Pit 9B Totals																			
S	781			86			20		280					**1167**	0	0	**801**	0	0
M	501	20		20					1440					**1961**	20	0	**501**	20	0
L	57						40		90					**187**	0	0	**97**	0	0
Tot	1339	20	0	106	0	0	60	0	1810	0	0	0	0	**3315**	20	0	**1399**	20	0
1																			
S	80			20			20		280					**400**	0	0	**100**	0	0
M	30	20							1440					**1470**	0	0	**30**	0	0
L	10			4			40		90				10	**154**	0	0	**50**	0	0
Tot	120	20	0	24	0	0	60	0	1810	0	0	0	10	**2024**	0	0	**180**	0	0

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Pit# (Mnemonic), Polygon #, Size Class	limber pine			Rocky Mtn. juniper	ponderosa pine		Douglas fir		quaking aspen	subalpine fir			chokecherry	Total Trees			Total limber pine + Douglas fir		
	#	I	K	#	#	I	#	K	#	#	I	K	#	#	I	K	#	I	K
Pit 9B Prediction Polygons, cont.																			
2																			
S	35													**35**	0	0	**35**	0	0
M	10													**10**	0	0	**10**	0	0
Tot	45	0	0	0	0	0	0	0	0	0	0	0	0	**45**	0	0	**45**	0	0
3																			
S	282			86										**368**	0	0	**282**	0	0
M	94													**94**	0	0	**94**	0	0
L	29													**29**	0	0	**29**	0	0
Tot	405	0	0	86	0	0	0	0	0	0	0	0	0	**491**	0	0	**405**	0	0
4																			
S	358													**358**	0	0	**358**	0	0
M	342													**342**	0	0	**342**	0	0
L	17													**17**	0	0	**17**	0	0
Tot	717	0	0	0	0	0	0	0	0	0	0	0	0	**717**	0	0	**717**	0	0
5																			
S	26													**26**	0	0	**26**	0	0
M	25													**25**	0	0	**25**	0	0
L	1													**1**	0	0	**1**	0	0
Tot	52	0	0	0	0	0	0	0	0	0	0	0	0	**52**	0	0	**52**	0	0

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Pit# (Mnemonic), Polygon #, Size Class	limber pine			Rocky Mtn. juniper	ponderosa pine		Douglas fir		quaking aspen	subalpine fir			chokecherry	Total Trees			Total limber pine + Douglas fir		
	#	I	K	#	#	I	#	K	#	#	I	K	#	#	I	K	#	I	K
Pit 9C (Pitchfork, South Prong)																			
Pit 9C Totals																			
S	1689	70		237			690		494					**3110**	70	0	**2379**	70	0
M	2062	298	68				360		1084					**3506**	298	68	**2422**	298	68
L	753	138		4			394		75				7	**1233**	138	0	**1147**	138	0
Tot	4505	506	68	241	0	0	1444	0	1652	0	0	0	7	**7848**	506	68	**5948**	506	68
1																			
S	648	27	0	115	0	0	644	0	494	0	0	0	0	**1902**	27	0	**1292**	27	0
M	840	136	27	0	0	0	337	0	1084	0	0	0	0	**2260**	136	27	**1177**	136	27
L	317	54	0	0	0	0	392	0	75	0	0	0	7	**791**	54	0	**710**	54	0
Tot	1805	217	27	115	0	0	1374	0	1652	0	0	0	7	**4953**	217	27	**3179**	217	27
2																			
S	648	39	0	118	0	0	39	0	0	0	0	0	0	**805**	39	0	**687**	39	0
M	864	157	39	0	0	0	20	0	0	0	0	0	0	**883**	157	39	**883**	157	39
L	393	79	0	0	0	0	0	0	0	0	0	0	0	**393**	79	0	**393**	79	0
Tot	1904	275	39	118	0	0	59	0	0	0	0	0	0	**2080**	275	39	**1963**	275	39
3																			
S	321													**321**	0	0	**321**	0	0
M	306													**306**	0	0	**306**	0	0
L	15													**15**	0	0	**15**	0	0
Tot	642	0	0	0	0	0	0	0	0	0	0	0	0	**642**	0	0	**642**	0	0

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Pit# (Mnemonic), Polygon #, Size Class	limber pine			Rocky Mtn. juniper	ponderosa pine		Douglas fir		quaking aspen	subalpine fir			chokecherry	Total Trees			Total limber pine + Douglas fir		
	#	I	K	#	#	I	#	K	#	#	I	K	#	#	I	K	#	I	K
Pit 9C Prediction Polygons, cont.																			
4																			
S	57	4		4			2							**57**	4		**59**	0	0
M	454	5	2				3							**45**	5	2	**457**	0	0
L	24	5		4			2							**24**	5		**26**	0	0
Tot	535	14	2	8	0	0	7	0	0	0	0	0	0	**126**	14	2	**542**	0	0
5																			
S	16				4									**20**	0	0	**16**	0	0
M	8													**8**	0	0	**8**	0	0
L	4													**4**	0	0	**4**	0	0
Tot	28	0	0	0	4	0	0	0	0	0	0	0	0	**32**	0	0	**28**	0	0
Pit 10A (Wishbone; pit boundary used as polygon)																			
S	4			3										**7**	0	0	**4**	0	0
M														**0**	0	0	**0**	0	0
L				2										**2**	0	0	**0**	0	0
Tot	4	0	0	5	0	0	0	0	0	0	0	0	0	**9**	0	0	**4**	0	0
Pit 10B (Flame)																			
Pit 10B Totals																			
S	2639	66		199	71		1450		114	1757		57		**6231**	66	57	**4089**	66	0
M	2366	271	71	9	53	20	453		57	1410	57	124		**4348**	348	195	**2818**	271	71
L	878	136			21		191	114	86	668		124		**1843**	136	238	**1069**	136	114
Tot	5882	473	71	208	145	20	2094	114	257	3835	57	305	0	**12422**	550	490	**7976**	473	186

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Pit# (Mnemonic), Polygon #, Size Class	limber pine			Rocky Mtn. juniper	ponderosa pine		Douglas fir		quaking aspen	subalpine fir			chokecherry	Total Trees			Total limber pine + Douglas fir		
	#	I	K	#	#	I	#	K	#	#	I	K	#	#	I	K	#	I	K
Pit 10B Prediction Polygons																			
1																			
S							1381		114	1757		57		**3253**	0	57	**1381**	0	0
M	148						400		57	1410	57	124		**2016**	57	124	**548**	0	0
L	14						176	114	86	668		124		**944**	0	238	**191**	0	114
Tot	162	0	0	0	0	0	1957	114	257	3835	57	305	0	**6213**	57	419	**2120**	0	114
2																			
S	796	48		145			48							**989**	48	0	**844**	48	0
M	1062	193	48				24							**1086**	193	48	**1086**	193	48
L	483	97					0							**483**	97	0	**483**	97	0
Tot	2340	338	48	145	0	0	72	0	0	0	0	0	0	**2557**	338	48	**2413**	338	48
3																			
S	149	9		27			9							**185**	9	0	**158**	9	0
M	198	36	9				5							**203**	36	9	**203**	36	9
L	90	18												**90**	18	0	**90**	18	0
Tot	437	63	9	27	0	0	14	0	0	0	0	0	0	**477**	63	9	**450**	63	9
4																			
S	64													**64**	0	0	**64**	0	0
M	26													**26**	0	0	**26**	0	0
L	3													**3**	0	0	**3**	0	0
Tot	93	0	0	0	0	0	0	0	0	0	0	0	0	**93**	0	0	**93**	0	0

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Pit# (Mnemonic), Polygon #, Size Class	limber pine			Rocky Mtn. juniper	ponderosa pine		Douglas fir		quaking aspen	subalpine fir			chokecherry	Total Trees			Total limber pine + Douglas fir		
	#	I	K	#	#	I	#	K	#	#	I	K	#	#	I	K	#	I	K
Pit 10B Prediction Polygons, cont.																			
5																			
S	828				18									**846**	0	0	**828**	0	0
M	383													**383**	0	0	**383**	0	0
L	134													**134**	0	0	**134**	0	0
Tot	1345	0	0	0	18		0	0	0	0	0	0	0	**1363**	0	0	**1345**	0	0
6																			
S	365				10		3							**378**	0	0	**368**	0	0
M	134				12	5	3							**149**	5	0	**137**	5	0
L	5				5									**13**	0	0	**5**	0	0
Tot	504	0	0	0	27	5	6	0	0	0	0	0	0	**540**	5	0	**510**	0	0
7																			
S	51													**51**	0	0	**51**	0	0
M	7													**7**	0	0	**7**	0	0
L	10													**10**	0	0	**10**	0	0
Tot	68	0	0	0	0	0	0	0	0	0	0	0	0	**68**	0	0	**68**	0	0
8																			
S	47	2		6	3		2							**58**	2	0	**49**	2	0
M	176	14	7		1		1							**178**	14	7	**177**	14	7
L	24	7												**24**	7	0	**24**	7	0
Tot	247	23	7	6	4	0	3	0	0	0	0	0	0	**260**	23	7	**250**	23	7

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Pit# (Mnemonic), Polygon #, Size Class	limber pine			Rocky Mtn. juniper	ponderosa pine		Douglas fir		quaking aspen	subalpine fir			chokecherry	Total Trees			Total limber pine + Douglas fir		
	#	I	K	#	#	I	#	K	#	#	I	K	#	#	I	K	#	I	K
Pit 10B Prediction Polygons, cont.																			
9																			
S	165	7		21	10		7							**203**	0	0	**172**	0	0
M	176	28	7		3		5							**184**	0	0	**181**	0	0
L	858	14			1									**859**	0	0	**858**	0	0
Tot	1199	49	7	21	14	0	12	0	0	0	0	0	0	**1246**	0	0	**1211**	0	0
10																			
S	165				30									**195**	0	0	**165**	0	0
M	20				37	15	15							**72**	0	0	**35**	0	0
L	30				15		15							**60**	0	0	**45**	0	0
Tot	215	0	0	0	82	15	30	0	0	0	0	0	0	**327**	0	0	**245**	0	0
11																			
S	2													**2**	0	0	**2**	0	0
M	8			2										**10**	0	0	**8**	0	0
L														**0**	0	0	**0**	0	0
Tot	10	0	0	2	0	0	0	0	0	0	0	0	0	**12**	0	0	**10**	0	0
12																			
S	7													**7**	0	0	**7**	0	0
M	28			7										**35**	0	0	**28**	0	0
Tot	35	0	0	7	0	0	0	0	0	0	0	0	0	**42**	0	0	**35**	0	0

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OCT 15 2010

Pit# (Mnemonic), Polygon #, Size Class	limber pine			Rocky Mtn. juniper	ponderosa pine		Douglas fir		quaking aspen	subalpine fir			chokecherry	Total Trees			Total limber pine + Douglas fir		
	#	I	K	#	#	I	#	K	#	#	I	K	#	#	I	K	#	I	K
Pit 11 (South Boomerang)																			
Pit 11 Totals																			
S	1725	10		104	19		150							**1997**	10	0	**1875**	10	0
M	824	38	10	35	5		10							**874**	38	10	**834**	38	10
L	373	19	65	10			5							**388**	19	65	**378**	19	65
Tot	2922	67	75	149	24	0	165	0	0	0	0	0	0	**3259**	67	75	**3087**	67	75
1																			
S	278						65							**343**	0	0	**343**	0	0
M	33													**33**	0	0	**33**	0	0
L	65		33											**65**	0	33	**65**	0	33
Tot	376	0	33	0	0	0	65	0	0	0	0	0	0	**441**	0	33	**441**	0	33
2																			
S	278						65							**343**	0	0	**343**	0	0
M	33													**33**	0	0	**33**	0	0
L	65		33											**65**	0	33	**65**	0	33
Tot	376	0	33	0	0	0	65	0	0	0	0	0	0	**441**	0	33	**441**	0	33
3																			
S	25	2		5			2							**31**	2	0	**26**	2	0
M	33	6	2				1							**34**	6	2	**34**	6	2
L	15	3												**15**	3	0	**15**	3	0
Tot	73	11	2	5	0	0	2	0	0	0	0	0	0	**80**	11	2	**75**	11	2

TEN 5 1/110

Pit# (Mnemonic), Polygon #, Size Class	limber pine			Rocky Mtn. juniper	ponderosa pine		Douglas fir		quaking aspen	subalpine fir			chokecherry	Total Trees			Total limber pine + Douglas fir		
	#	I	K	#	#	I	#	K	#	#	I	K	#	#	I	K	#	I	K
Pit 11 Prediction Polygons, cont.																			
4																			
S	132	8		24			8							**164**	8	0	**140**	8	0
M	176	32	8				4							**180**	32	8	**180**	32	8
L	80	16												**80**	16	0	**80**	16	0
Tot	388	56	8	24	0	0	12	0	0	0	0	0	0	**424**	56	8	**400**	56	8
5																			
S	89													**89**	0	0	**89**	0	0
M	35													**35**	0	0	**35**	0	0
L	3													**3**	0	0	**3**	0	0
Tot	127	0	0	0	0	0	0	0	0	0	0	0	0	**127**	0	0	**127**	0	0
6																			
S	99													**99**	0	0	**99**	0	0
M	35													**35**	0	0	**35**	0	0
L	1													**1**	0	0	**1**	0	0
Tot	135	0	0	0	0	0	0	0	0	0	0	0	0	**135**	0	0	**135**	0	0
7																			
S	663				14									**677**	0	0	**663**	0	0
M	306													**306**	0	0	**306**	0	0
L	107													**107**	0	0	**107**	0	0
Tot	1076	0	0	0	14	0	0	0	0	0	0	0	0	**1090**	0	0	**1076**	0	0

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OCT 15 2012

Pit# (Mnemonic), Polygon #, Size Class	limber pine			Rocky Mtn. juniper	ponderosa pine		Douglas fir		quaking aspen	subalpine fir			chokecherry	Total Trees			Total limber pine + Douglas fir		
	#	I	K	#	#	I	#	K	#	#	I	K	#	#	I	K	#	I	K
Pit 11 Prediction Polygons, cont.																			
8																			
S	9													**9**	0	0	**9**	0	0
M	3													**3**	0	0	**3**	0	0
L															0	0		0	0
Tot	12	0	0	0	0	0	0	0	0	0	0	0	0	**12**	0	0	**12**	0	0
9																			
S	152			75	5		10							**242**	0	0	**162**	0	0
M	171			35	5		5							**216**	0	0	**176**	0	0
L	36			10			5							**51**	0	0	**41**	0	0
Tot	359	0	0	120	10	0	20	0	0	0	0	0	0	**509**	0	0	**379**	0	0
All Pits Subtotal																			
S	**13777**	**180**	**0**	**1212**	**593**	**0**	**2524**	**0**	**985**	**1757**	**0**	**57**	**0**	**20848**	**180**	**57**	**16301**	**180**	**0**
M	**9738**	**770**	**179**	**214**	**295**	**20**	**941**	**0**	**2791**	**1410**	**57**	**124**	**0**	**15389**	**847**	**303**	**10678**	**770**	**179**
L	**2876**	**356**	**66**	**120**	**241**	**0**	**729**	**114**	**265**	**668**	**0**	**124**	**8**	**4906**	**356**	**305**	**3604**	**356**	**181**
Tot	**26390**	**1306**	**245**	**1546**	**1129**	**20**	**4193**	**114**	**4040**	**3835**	**57**	**305**	**8**	**41143**	**1383**	**665**	**30583**	**1306**	**360**

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OCT 15, 2012

Road Segment, Segment #, Size Class	limber pine			Rocky Mtn. juniper	ponderosa pine		Douglas fir		quaking aspen	subalpine fir			chokecherry	Total Trees			Total limber pine + Douglas fir		
	#	I	K	#	#	I	#	K	#	#	I	K	#	#	I	K	#	I	K
Road & Segment																			
(N Piper) Sect. 24NE to N Boomerang																			
Sect 24														**0**					
Sect 19														**0**					
Sect 18														**0**					
Branch to 7A Finger														**0**					
7A Staging Area														**0**					
Branch to 7B Finger														**0**					
(N Piper) Sect. 24SE to S Boomerang																			
Sect 24														**0**					
Sect 19														**0**					
1																			
Sect 30																			
S	6			19	1									**26**	0	0	**6**	0	0
M	2			8	1									**11**	0	0	**2**	0	0
L	1			3										**4**	0	0	**1**	0	0
Tot	9	0	0	30	2	0	0	0	0	0	0	0	0	**41**	0	0	**9**	0	0

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Road Segment, Segment #, Size Class	limber pine			Rocky Mtn. juniper	ponderosa pine		Douglas fir		quaking aspen	subalpine fir			chokecherry	Total Trees			Total limber pine + Douglas fir		
	#	I	K	#	#	I	#	K	#	#	I	K	#	#	I	K	#	I	K
(N Piper) Sect. 24SE to S Boomerang, cont.																			
2																			
Sect 29																			
S	23			29	1		2							**55**	0	0	**25**	0	0
M	22			11	2		1							**36**	0	0	**23**	0	0
L	5			5			1							**11**	0	0	**6**	0	0
Tot	50	0	0	45	3	0	4	0	0	0	0	0	0	**102**	0	0	**54**	0	0
10A to 10B Rd (Wishbone to Flame)																			
3																			
S	2			2										**4**	0	0	**2**	0	0
M				2	1									**3**	0	0	**0**	0	0
L				1										**1**	0	0	**0**	0	0
Tot	2	0	0	5	1	0	0	0	0	0	0	0	0	**8**	0	0	**2**	0	0
Branch to 10A (to Wishbone)														**0**					
Foothill Connector (joins 2 rds. From N Piper)														**0**					
Branch to N tip 5A (to N tip Tailfin)														**0**					
Branch to S end 5A (to S end Tailfin)														**0**					

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Road Segment, Segment #, Size Class	limber pine			Rocky Mtn. juniper	ponderosa pine		Douglas fir		quaking aspen	subalpine fir			chokecherry	Total Trees			Total limber pine + Douglas fir		
	#	I	K	#	#	I	#	K	#	#	I	K	#	#	I	K	#	I	K
4																			
Pit 8B to 9C																			
S	5													**5**	0	0	**5**	0	0
M	5													**5**	0	0	**5**	0	0
L														**0**	0	0	**0**	0	0
Tot	10	0	0	0	0	0	0	0	0	0	0	0	0	**10**	0	0	**10**	0	0
Sect 36 rds (Exhaust)																			
5																			
To Pit1 South finger																			
S	1			20										**21**	0	0	**1**	0	0
M				1										**1**	0	0	**0**	0	0
L				6										**6**	0	0	**0**	0	0
Tot	1	0	0	27	0	0	0	0	0	0	0	0	0	**28**	0	0	**1**	0	0
6																			
Branch to Pit 1 Middle Finger																			
S				10										**10**	0	0	**0**	0	0
M														**0**	0	0	**0**	0	0
L				3										**3**	0	0	**0**	0	0
Tot	0	0	0	13	0	0	0	0	0	0	0	0	0	**13**	0	0	**0**	0	0

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Road Segment, Segment #, Size Class	limber pine			Rocky Mtn. juniper	ponderosa pine		Douglas fir		quaking aspen	subalpine fir			chokecherry	Total Trees			Total limber pine + Douglas fir		
	#	I	K	#	#	I	#	K	#	#	I	K	#	#	I	K	#	I	K
Branch to Pit 1 North Finger														**0**					
7																			
To Pit 3																			
S	2			40										**42**	0	0	**2**	0	0
M	1			16										**17**	0	0	**1**	0	0
L				11										**11**	0	0	**0**	0	0
Tot	3	0	0	67	0	0	0	0	0	0	0	0	0	**70**	0	0	**3**	0	0
Branch to Pit 4														**0**					
All Roads Subtotals																			
S	39	0	0	120	2	0	2	0	0	0	0	0	0	**163**	0	0	**41**	0	0
M	30	0	0	38	4	0	1	0	0	0	0	0	0	**73**	0	0	**31**	0	0
L	6	0	0	29	0	0	1	0	0	0	0	0	0	**36**	0	0	**7**	0	0
Tot	75	0	0	187	6	0	4	0	0	0	0	0	0	**272**	0	0	**79**	0	0
Grand Totals (Pits + Rds)																			
S	**13816**	**180**	**0**	**1332**	**595**	**0**	**2526**	**0**	**985**	**1757**	**0**	**57**	**0**	**21011**	**180**	**57**	**16342**	**180**	**0**
M	**9768**	**770**	**179**	**252**	**299**	**20**	**942**	**0**	**2791**	**1410**	**57**	**124**	**0**	**15462**	**847**	**303**	**10709**	**770**	**179**	
L	**2882**	**356**	**66**	**149**	**241**	**0**	**730**	**114**	**265**	**668**	**0**	**124**	**8**	**4942**	**356**	**305**	**3611**	**356**	**181**
Tot	**26465**	**1306**	**245**	**1733**	**1135**	**20**	**4197**	**114**	**4040**	**3835**	**57**	**305**	**8**	**41415**	**1383**	**665**	**30662**	**1306**	**360**

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ADDENDUM DIX8 E

Tree Inventory Field Data Sheets

TFN 5 1/110
RECD MAR 15,2011

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RECD MAR 15.2011

MCC Tree Sampling Transect Field Form

Date: 2009-10-22 Worker(s): J. Brasher Transect placement & #: convenient logistics chosen 1

UTM Zone 13N Datum NAD83 Coordinates E 460958 N 4567041 (zero m)

UTM Zone 13N Datum _____ Coordinates E 461073 N 4567156 (end m)

Legal Location (TRSQQ): Sect 21 NE SE

Location text: a little west of W fence of DOT Pit on S prong of Pitcfork

Proposed Pit Code (9A etc.): 9C Position at Pit (middle S side toward center, etc.): middle

2 pics taken at beginning #5 9266+ 9267

Transect Azimuth (degrees): 37°

Transect Width (5m default or wider optional) 08 m A=1600 m² = 0.40 Ac

Transect Length (50m default, or longer optional): 160 m

Meters (m)	Size	PIfl	JUsc	PIpo	PSme	POtr	PIen	PIco	Other (specify)	Total trees	Total *P.m.* & *P.f.*	SID
0	S M L Tot	|| L:1								2 – 0.5	2 – 0.5 0.5	– 1 0.5
10	S M L Tot	||								2 – –	2 – –	– 111 –
20	S M L Tot	|| L:1								– 2 0.5	– 2 0.5	– 2 0.5
30	S M L Tot	1 1 L:1								1 1 0.5	1 1 0.5	– 2 0.5
40	S M L Tot	1								1 – –	1 – –	– 0 –
50	S M L Tot	L:1								– – 0.5	– – 0.5	– 1 0.5
(Sub-) Totals	S M L Tot	6 3 2 0.5 11 0.5								6 3 2 0.5 11 0.5	6 3 2 0.5 11 0.5	0 9 2 11

Key

Notation/Conventions

L
Tree on line,
part hanging out of transect,
count as 0.5 trees

Underscored tic – beetle-infested

(Circled tic) – standing beetle-killed

Fallen trees not counted as trees but considered litter

Size Classes

S small
M medium
L large

Species

JUsc
Juniperus scopulorum Rocky Mountain juniper

PIco
Pinus contorta
lodgepole pine

PIen
Picea engelmannii
Engelmann spruce

PIfl
Pinus flexilis
limber pine

PIpo
Pinus ponderosa
ponderosa pine

POtr
Populus tremuloides
quaking aspen

Psme
Pseudotsuga menziesii
Douglas fir

TFN 5 1/110
RECD MAR 15, 2011

CAO

Transect #: 1

Meters (m)	Size	PIfl	JUsc	PIpo	PSme	POtr	PIen	PIco	Other (specify)	Total trees	Total *P.m.* & *P.f.*	SID
(60)	S M L Tot	1 L:1								1 1 – 0.5	1 1 – 0.5	– 2 0.5
(70)	S M L Tot	0								0	0	– 1 –
(80)	S M L Tot	0								0	0	– 4 –
(90)	S M L Tot				1					0 1 0	0 1 0	– 1 1
(100)	S M L Tot	0								0	0	0
(110)	S M L Tot	0								0	0	0
(120)	S M L Tot	0								0	0	0
(130)	S M L Tot	0								0	0	0
(140)	S M L Tot	0								0	0	0
(150)	S M L Tot	1								1 – –	1 – –	0
Sub-Totals	S M L Tot	1 1 – 0.5 0.5 1.5 1.5			– 1 – 1					2 1 1 0.5 3.5	2 1 1 0.5 3.5	0 8 1.5 9.5
Sub Tots, from verso	S M L Tot	6 – 3 – 2 0.5 11 0.5								6 3 2 0.5 11 0.5	6 3 2 0.5 11 0.5	0 9 2 11
Grand Totals	S M L Tot	7 1 3 – 2.5 1 13.5 2			– 1 – 1					8 1 4 – 2.5 0.5 14.5 1.5	8 1 4 – 2.5 0.5 14.5 1.5	0 17 3.5 20.5

Area = 0.4 Ac

TFN 5 1/110
RECD MAR 15, 2011

MCC Tree Sampling Transect Field Form

Date: 2009-10-22 Worker(s): JWB Transect placement & #: (dense) convenient logistics chosen 2

UTM Zone 13N Datum NAD83 Coordinates E 468956 N 4567032 (zero m)

UTM Zone _____ Datum _____ Coordinates E 461148 N 4566844 (end m)

Pics: 9268+ 9969 of start + 9270 of end

Legal Location (TRSQQ): Sec 21 NESE

Location text: a little W of W topsoil pile + W fence @ DOT pit on S prong Pitchfork

Proposed Pit Code (9A etc.): 9C Position at Pit (middle S side toward center, etc.): middle

Transect Azimuth (degrees): 235

Transect Width (5m default or wider optional) 10 ~~5~~ m

Transect Length (50m default, or longer optional): 160 m

A = 1600 m² = 17,213 ft² = 0.40 Ac

Meters (m)	Size	PIfl	JUsc	PIpo	PSme	POtr	PIen	PIco	Other (specify)	Total trees	Total *P.m.* & *P.f.*
0 (STD: 1)	S M L Tot	II II								2 2 –	2 2 –
10 (1)	S M L Tot	II II								2 2 –	2 2 –
20 (1, 0.5)	S M L Tot	I II L=I								1 2 0.5	1 2 0.5
30 (1, L=II)	S M L Tot	L=I								0 0 0.5	0 0 0.5
40 (II)	S M L Tot	II L=I								2.5 1 – –	2.5 1 – –
50 (II)	S M L Tot	II II L=II								2 2 1 1	2 2 1 1
(Sub-) Totals (0, 8, 1.5, 9.5)	S M L Tot	9.5 1 8 1 2 19.5 2								9.5 1 8 1 2 19.5 2	9.5 1 8 1 2 19.5 2

Key

Notation/Conventions

L
Tree on line,
part hanging out of transect,
count as 0.5 trees

Underscored tic – beetle-infested

(Circled tic) – standing beetle-killed

Fallen trees not counted as trees but considered litter

Size Classes

S small
M medium
L large

Species

JUsc
Juniperus scopulorum Rocky Mountain juniper

PIco
Pinus contorta
lodgepole pine

PIen
Picea engelmannii
Engelmann spruce

PIfl
Pinus flexilis
limber pine

PIpo
Pinus ponderosa
ponderosa pine

POtr
Populus tremuloides
quaking aspen

Psme
Pseudotsuga menziesii
Douglas fir

TFN 5 1/110
RECD MAR 15, 2011 CAV

Transect #: 2

Meters (m) SID	Size	PIfl	JUsc	PIpo	PSme	POtr	PIen	PIco	Other (specify)	Total trees	Total *P.m.* & *P.f.*
(60) 11 1	S M L Tot	(1) L=1								– 1.5 (1) –	– 1.5 (1) –
(70) 11 1	S M L Tot	11 L=1								– 2 0.5	– 2 0.5
(80) 2.5	S M L Tot	IIII								4 – –	4 – –
(90) 3	S M L Tot	1								– 1 –	– 1 –
(100) 2	S M L Tot	L=1								– – 0.5	– – 0.5
(110) 11 1	S M L Tot	1 L=1 L=1								– 1.5 0.5	– 1.5 0.5
(120) 1 1	S M L Tot	1 L=11 L=1								– 2 0.5	– 2 0.5
(130) 3	S M L Tot	L=1 L=111	11		1					3 – 0.5 – 1.5 0.5	1 – 0.5 – 1.5 0.5
(140) III	S M L Tot	1 11 1 L=III	1		L=1					2 2.5 2.5	1 2 2.5
(150) –	S M L Tot	11 11 L=IIII 1 L=1								2 – 3.5 3 1.5 1.5	2 – 3.5 3 1.5 1.5
Sub-Totals 0 / 18.5 / 4 / 22.5	S M L Tot	7 – 14 3 (1) 8 2 29 (1) 5	3 – – 3		1 0.5 – 1.5					11 – 14.5 (1) 3 8 2 33.5 (1) 5	8 14.5 (1) 3 8 2 30.5 (1) 5
Sub-Tot from verso 0 / 8 / 1.5 / 9.5	S M L Tot	9.5 1 8 1 2 – 19.5 2								9.5 1 8 1 2 – 19.5 2	9.5 1 8 1 2 – 19.5 2
Grand Tot 0 / 26.5 / 5.5 / 32	S M L Tot	16.5 1 3 22 (1) 4 – 10 2 – 48.5 (1) 7 3			1 0.5 – 1.5					20.5 1 22.5 (1) 4 10 2 53.0 (1) 7	17.5 1 22.5 (1) 4 10 2 50 (1) 7

Area = 0.40 Ac

TFN 5 1/110
RECD MAR 15, 2011

MCC Tree Sampling Transect Field Form

Date: 2009-10-22 Worker(s): JWB Transect placement & #: chosen for logistically convenient MSC→MXC transition then randomly placed before visit 3

UTM Zone 13 N Datum NAD83 Coordinates E461203 N4567606 (zero m) →N4567755 E461260

UTM Zone ____ Datum ____ Coordinates (Forgot to take) computed: (end m) Pic 927079271 half way along transect after reading.

Legal Location (TRSQQ): S21 NE NE

Location text: NE corner of middle prong of Pitchfork

Proposed Pit Code (9A etc.): 9B Position at Pit (middle S side toward center, etc.): NE corner then past pit into Telephone Canyon

Transect Azimuth (degrees): 21

Transect Width (5m default or wider optional) 10 m Area = 1600 m² = 17,213 ft² = 0.40 Ac

Transect Length (50m default, or longer optional): 160 m

Meters (m) SID	Size	PIfl	JUsc	PIpo	PSme	POtr	PIen	PIco	Other (specify) PRUvir	Total trees	Total *P.m.* & *P.f.*
0 (0)	S M L Tot	0								0	0
10 (1)	S M L Tot	1 L:1	1 L:1							1.5 0.5 – 2	1 0.5 –
20 (1.5)	S M L Tot	– L:1								– – 0.5 0.5	– – 0.5
30 (6)	S M L Tot	– 1			1	11 9 1			PRUvir L:1	2 10 2.5 14.5	0 1 1
40 (10)	S M L Tot	1 L:1 5 L:1			1 L:11	6 26				8.5 31 1.5	2.5 5 1.5
50 (12)	S M L Tot	11 L:1 ~~卌~~ L:1	1			卌1 卌卌卌卌卌卌卌卌卌卌|| 111 L:111				8.5 43.5 1 3.5	2.5 6.5 1 0
(Sub-) Totals 30S	S M L Tot	6 12 1 1 19 1	1.5 1.5		1 – 2 3	14 72 4.5 90.5			 0.5 0.5	21 85 1 8 114 1	6 13 1 3 22 1
subtot (1st 30m of MXC)		4 11.5 0.5	1		1 – 2	14 72 4.5			– 0.5		

Subtot 30: 1.5 / 1 / Pf. 0.5 / 0.5 / 0.5; 0.5 / 0.5 / 0.5; 2.5 / 2.0 / Js1

Prunus virginiana

Key

Notation/Conventions

L
Tree on line,
part hanging out of transect,
count as 0.5 trees

Underscored tic – beetle-infested

(Circled tic) – standing beetle-killed

Fallen trees not counted as trees but considered litter

Size Classes

S small
M medium
L large

Species

JUsc
Juniperus scopulorum Rocky Mountain juniper

PIco
Pinus contorta
lodgepole pine

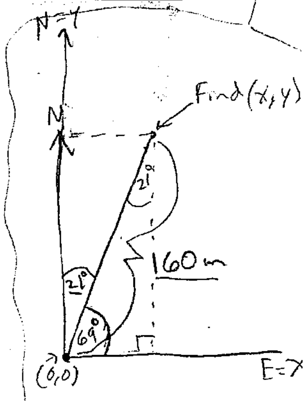
PIen
Picea engelmannii
Engelmann spruce

PIfl
Pinus flexilis
limber pine

PIpo
Pinus ponderosa
ponderosa pine

POtr
Populus tremuloides
quaking aspen

Psme
Pseudotsuga menziesii
Douglas fir



SOH CAH TOA

57m = x = sin 21° = 0.35837 = O / 160m

149m = y = cos 21° = 0.93358 = A / 160m

TFN 5 1/110
RECD MAR 15, 2011

Transect #: 3

Meters (m) SZD	Size	PIfl	JUsc	PIpo	PSme	POtr	PIen	PIco	Other (specify) PRUvir	Total trees	Total *P.m.* & *P.f.*
(60)	S		1			1				2	0
	M									–	–
	L				L:1	1				1.5	0.5
9	Tot									3.5	
(70)	S										
	M	0								0	
	L										
10	Tot										
(80)	S									–	–
	M	L:III			1 L:1					3	3
	L				L:1					0.5	0.5
4	Tot										
(90)	S	1	1							2	1
	M	L:1			II L:II					2.5	2.5
	L									1	1
6	Tot										
(100)	S									0.5	0.5
	M				L:1						
	L										
8	Tot										
(110)	S				IIII					4	4
	M				I L:5+6+2+1					8	8
	L				III L:5+4+III					11	11
10	Tot										
(120)	S					15+III				18	0
	M									–	–
	L				L:~~IIII~~					2.5	2.5
10	Tot										
(130)	S	1			IIII	III				8	5
	M					5+II				16	–
	L				L:II					1	1
9	Tot										
(140)	S				~~IIIIIIIIIIIIIIII~~ L:1					15.5	15.5
	M	I L:1			II L:1					4	4
	L				L:IIIII					2.5	2.5
16	Tot										
(150)	S				~~IIII~~ L:III					6.5	6.5
	M				II L:III					4	4
	L				L:~~IIII~~					2.5	2.5
13	Tot										
Sub Totals	S	2	1		33	22				58	35
	M	3.5 ↓	–		17.5	7				28	21
96	L	–	–		22.5	1				23.5	22.5
	Tot	5.5 ↓	1		73	30				109.5	78.5
sub tot from verso	S	6	1.5		1	14				21	6
	M	12 ↓	–		–	72				85 ↓	13 ↓
30.5	L	1	–		2	4.5			0.5	8	3
	Tot	19 ↓	1.5		3	90.5			0.5	114 ↓	22 ↓
Grand tot.	S	8	2.5		34	36			–	–	
	M	15.5 ↓	–		17.5	79			–	113 ↓	– ↓
126	L	1	–		24.5	5.5			0.5	31.5	25.5
5	Tot	24.5 ↓	2.5		76	120.5			0.5	? ↓	100.5 ↓

TFN 5 1/110
RECD MAR 15, 2011

MCC Tree Sampling Transect Field Form

these probably not finding GPS unit

Date: ~~2009-10-23~~ Worker(s): JWB Transect placement & #: chosen for dense Pf plus some Pp + next to Rd 4

UTM Zone 13 Datum NAD 83 Coordinates 459667E 4563374 N (zero m) GPS says E459709 N4563879

UTM Zone _____ Datum _____ Coordinates 459809E 4563546 N (end m) GPS says E459808 N4563549

Legal Location (TRSQQ): S33 NWSW

Location text: Just to S of 2-track I didn't know about Til Fall, up center of Muffler

Proposed Pit Code (9A etc.): 50 Position at Pit (middle S side toward center, etc.): Toward S edge of main area below node

Pics 9272+ 9273 at start

Transect Azimuth (degrees): 113

Transect Width (5m default or wider optional) 5(2x2.5) m

Transect Length (50m default, or longer optional): 160 m

283 / 180

Area = 800 m² = 0.20 Ac

Meters (m)	Size	PIfl	JUsc	PIpo	PSme	POtr	PIen	PIco	Other (specify)	Total trees	Total *P.m.* & *P.f.*	SID
0	S M L Tot	1 L:1								3 0.5 –	1 0.5 –	2
10	S M L Tot	1 1 L:1		1						2 1.5 –	1 1.5 –	3.5
20	S M L Tot	111 L:11		1 L:1						5 1.5 –	4 1 –	1 1 2
30	S M L Tot	13 L:1								13 0.5	13 0.5	1.5
40	S M L Tot	~~111~~ 1 L:111 L:1		1						6 2.5 0.5	6 1.5 0.5	3
50	S M L Tot	1 11 L:1 L:1								1 2.5 0.5	1 2.5 0.5	3
(Sub-) Totals	S M L Tot	26 7.5 1 34.5		4 1.5 – 5.5						30 9 1 40	26 7.5 1 34.5	15

Key

Notation/Conventions

L
Tree on line,
part hanging out of transect,
count as 0.5 trees

Underscored tic – beetle-infested

(Circled tic) – standing beetle-killed

Fallen trees not counted as trees but considered litter

Size Classes

S small
M medium
L large

Species

JUsc
Juniperus scopulorum Rocky Mountain juniper

PIco
Pinus contorta
lodgepole pine

PIen
Picea engelmannii
Engelmann spruce

PIfl
Pinus flexilis
limber pine

PIpo
Pinus ponderosa
ponderosa pine

POtr
Populus tremuloides
quaking aspen

Psme
Pseudotsuga menziesii
Douglas fir

TFN 5 1/110
RECD MAR 15, 2011

Transect #: 4

Meters (m)	Size	PIfl	JUsc	PIpo	PSme	POtr	PIen	PIco	Other (specify)	Total trees	Total *P.m.* & *P.f.*	SID
(60)	S M L Tot	L=1								– 0.5 –	– 0.5 –	2
(70)	S M L Tot	L=1								– 0.5 –	– 0.5 –	0
(80)	S M L Tot	0								0	0	0
(90)	S M L Tot	1								0.5 – –	0.5 – –	3
(100)	S M L Tot	0								0	0	0
(110)	S M L Tot	L=1 L=1								0.5 0.5 –	0.5 0.5 –	0
(120)	S M L Tot	L=1 L=1								0.5 0.5 –	0.5 0.5 –	2
(130)	S M L Tot	1								1 – –	1 – –	1
(140)	S M L Tot	L=1								– 0.5 –	– 0.5 –	1 1 2
(150)	S M L Tot	0								0	0	0
Sub-Totals	S M L Tot	3 2.5 – 5.5								3 2.5 – 5.5	3 2.5 – 5.5	10
Sub-Tot. from verso	S M L Tot	26 7.5 1 34.5		4 1.5 – 5.5						30 9 1 40	26 7.5 1 34.5	15
Grand Tot.	S M L Tot	29 10 1 40		4 1.5 – 5.5						33 11.5 1 45.5	29 10 1 40	25

Area = 0.2 AC

TFN 5 1/110
RECD MAR 15, 2011

MCC Tree Sampling Transect Field Form

Date: 2009-10-23 Worker(s): JWB Transect placement & #: chosen to include aspen 5

UTM Zone 13 Datum NAD83 Coordinates E 459 807 N 4563546 (zero m) → corrected to E459848 N4563559

UTM Zone _____ Datum _____ Coordinates E 459 997 N 4563516 (end m) → E459999 N45635

pics taken:

Legal Location (TRSQQ): 533 c of SW

Location text: In head of channel at node of 50 Pit (Mueller)

Proposed Pit Code (9A etc.): 50 Position at Pit (middle S side toward center, etc.): In channel between arms at node, prob w/in 200 ft of proposed pit lines

Transect Azimuth (degrees): 85

Transect Width (5m default or wider optional) 5 (2x2.5) m

Transect Length (50m default, or longer optional): 160 m

lost stylus along this transect

Area = 800 m² = 0.20 Ac

Meters (m)	Size	PIfl	JUsc	PIpo	PSme	POtr	PIen	PIco	Other (specify)	Total trees	Total *P.m.* & *P.f.*	SID
0	S M L Tot					~~IIII~~ II I L=II				7 2 —	0 0 —	11
10	S M L Tot	L=I L=II				~~IIII~~ III L=I L=I				8 1 1.5	0 0.5 1	4.5
20	S M L Tot	0								0	0	1
30	S M L Tot	0								0	0	0
40	S M L Tot	L=I								— — 0.5	— — 0.5	1
50	S M L Tot	II L=I L=I								2.5 — 0.5	2.5 — 0.5	0.5
(Sub-) Totals	S M L Tot	2.5 0.5 2 5				15 2.5 0.5 18				15.5 3 2.5 23	2.5 0.5 2 5	18

Key

Notation/Conventions

L
Tree on line,
part hanging out of transect,
count as 0.5 trees

Underscored tic – beetle-infested

(Circled tic) – standing beetle-killed

Fallen trees not counted as trees but considered litter

Size Classes

S small
M medium
L large

Species

JUsc
Juniperus scopulorum Rocky Mountain juniper

PIco
Pinus contorta
lodgepole pine

PIen
Picea engelmannii
Engelmann spruce

PIfl
Pinus flexilis
limber pine

PIpo
Pinus ponderosa
ponderosa pine

POtr
Populus tremuloides
quaking aspen

Psme
Pseudotsuga menziesii
Douglas fir

TFN 5 1/110
RECD MAR 15, 2011

✓ CAO

Transect #: 5

Meters (m)	Size	PIfl	JUsc	PIpo	PSme	POtr	PIen	PIco	Other (specify)	Total trees	Total *P.m.* & *P.f.*	SID
(60)	S M L Tot	II	I							4 – –	3 – –	1.5
(70)	S M L Tot	II								2 – –	2 – –	2
(80)	S M L Tot	II L:1								2 0.5	2 0.5	1
(90)	S M L Tot	0								0	0	0
(100)	S M L Tot	L:1 0								0.5 – –	0.5 – –	2
(110)	S M L Tot	L:1								– 0.5 –	– 0.5 –	1
(120)	S M L Tot	0								0	0	0
(130)	S M L Tot	0								0	0	0
(140)	S M L Tot	1								1 – –	1 – –	0
(150)	S M L Tot	0								0	0	0
Sub-Totals	S M L Tot	8.5 1 0 9.5	1 – – 1							9.5 1 0 10.5	8.5 1 0 9.5	7.5
subtot from verso		2.5 0.5 2 5				15 2.5 0.5 18				15.5 3 2.5 23	2.5 0.5 2 5	18
Grand tot.		11 1.5 2 14.5	1 – – 1			15 2.5 0.5 18				25 4 2.5 33.5	11 1.5 2 14.5	25.5

TFN 5 1/110
RECD MAR 15, 2011

MCC Tree Sampling Transect Field Form

Date: 2009-10-23 Worker(s): JWB Transect placement & #: chosen for PSme 6

UTM Zone 13N Datum NAD83 Coordinates E 459630 N 4563705 (zero m)

UTM Zone _____ Datum _____ Coordinates E 459509 N 4563709 (end m) Pics at start + end

Legal Location (TRSQQ): S32 NE SE

Location text: Body of Muffler

Proposed Pit Code (9A etc.): 5D Position at Pit (middle S side toward center, etc.): middle

Transect Azimuth (degrees): 257

Transect Width (5m default or wider optional) 10 m A=1200m² = 12,912 ft² = 0.30 Ac

Transect Length (50m default, or longer optional): 120 m

Meters (m)	Size	PIfl ☆	JUsc	PIpo	PSme ☆	POtr	PIen	PIco	Other (specify)	Total trees	Total *P.m.* & *P.f.*	SID
0	S M L Tot	11 1			11					4 1	4 1	2
10	S M L Tot	1								1	1	0
20	S M L Tot	11 -			11 L:1					2 - 0.5	2 - 0.5	1.5
30	S M L Tot	~~IIII~~ ~~IIII~~ ~~IIII~~ L:1 1			~~IIII~~					19.5 1 -	19.5 1 -	5
40	S M L Tot	~~IIII~~ ~~IIII~~			11					10 - -	10 - -	4.5
50	S M L Tot	~~IIII~~ ~~IIII~~ ~~IIII~~ 1			IIII 1 L:1					16 2.5 -	16 2.5 -	9
(Sub-) Totals	S M L Tot	38.5 3 - 41.5			15 1.5 1 17.5					53.5 4.5 1 59	53.5 4.5 1 59	22

Key

Notation/Conventions

L
Tree on line,
part hanging out of transect,
count as 0.5 trees

Underscored tic – beetle-infested

(Circled tic) – standing beetle-killed

Fallen trees not counted as trees but considered litter

Size Classes

S small
M medium
L large

Species

JUsc
Juniperus scopulorum Rocky Mountain juniper

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Pinus contorta
lodgepole pine

PIen
Picea engelmannii
Engelmann spruce

PIfl
Pinus flexilis
limber pine

PIpo
Pinus ponderosa
ponderosa pine

POtr
Populus tremuloides
quaking aspen

Psme
Pseudotsuga menziesii
Douglas fir

TFN 5 1/110
RECD MAR 15, 2011

CAD

Transect #: 6

Meters (m)	Size	PIfl ☆	JUsc	PIpo	PSme ☆	POtr	PIen	PIco	Other (specify)	Total trees	Total *P.m.* & *P.f.* ☆	SID
(60)	S M L Tot	11 L=11 L=1			1111 1 L=11					7 2.5 –	7 2.5 –	5
(70)	S M L Tot	111 L=11 L L=1			~~1111~~ L=1 111~~1111~~ L=11					9.5 15.5 –	9.5 15.5 –	5
(80)	S M L Tot	11 ~~1111~~ L=1 111 L=11 L=11			~~1111~~ L=1 1 L=11 L=1					15 6 1.5	15 6 1.5	8
(90)	S M L Tot	1 L=1			1 L=1					1 0.5 –	1 0.5 –	8
(100)	S M L Tot	~~1111~~ 1 L			1111					9 1	9	3
(110)	S M L Tot	~~1111~~ ~~1111~~ L=1 11 L=11			L=1					10.5 2 1.5	10.5 2 1.5	3
(120)	S M L Tot											
(130)	S M L Tot											
(140)	S M L Tot											
(150)	S M L Tot											
Sub-Totals	S M L Tot	33 8.5 2 43.5			21 28.5 1 50.5					54 37 3 94	54 37 3 94	32
subtot. from verso		38.5 3 – 41.5			15 1.5 1 17.5					53.5 4.5 1 59	53.5 4.5 1 59	22
Grand tot.		71.5 11.5 2 85			36 30 2 68					107.5 41.5 4 153	107.5 41.5 4 153	54

TFN 5 1/110
RECD MAR 15, 2011

MCC Tree Sampling Transect Field Form

chosen for ABCo trees + MXC to affect

Date: 2009-10-26 Worker(s): JWB Transect placement & #: MXC 7

UTM Zone 13 N Datum NAD 83 Coordinates E460 974 N4565719 (zero m)

UTM Zone _____ Datum _____ Coordinates E460949 N4565734 (end m)

Legal Location (TRSQQ): S28 SE NE

Location text: MXC area along N edge of proposed pit - dense conifer/aspen stand at break of hill

Proposed Pit Code (9A etc.): 10B Position at Pit (middle S side toward center, etc.):

N edge near base of flame - (e end near TV/Radio towers + MBNF)

Transect Azimuth (degrees): 267

A = 300 m² = 0.074 Ac

Transect Width (5m default or wider optional) 10 m to N of line (tape)

Transect Length (50m default, or longer optional): 30 m cold + windy troublesome

Meters (m)	Size	PIfl	JUsc	PIpo	PSme	POtr	PIen	PIco	Other (specify) ABco bi	Total trees beetle	Total P.m. & P.f.	SID
0	S	1			1 L:1				~~HHH~~ 1	9	2	
	M								~~HHH~~ L:0.11	6 ①	0.5	
overlaps site 8	L	L:1			1 L:11	111 L			~~HHH~~ L:11	16 ①	2.5	8
	Tot											
10	S				1				1 L:1	2.5	2.5	
	M	~~HHH~~ 1 L:111							~~HHH~~ 111 L:111	16	16	
*	L								11 L:11	4.5	4.5	
	Tot											5
20	S											
	M									0.5	-	
	L				L:1				L:1	0.5	0.5	
	Tot											3
30	S											
	M											
	L											
	Tot											
40	S											
	M											
	L											
	Tot											
50	S											
	M											
	L											
	Tot											
~~(Sub-)~~ Totals	S	1			2				8.5	11.5	3 -	
	M	6.5			0.5				15 ①	23 ①	7 -	
	L	2			2.5	3.5			13.5 ①	21.5 ①	4.5 -	14
	Tot	9.5			5	3.5			37 ②	55 ②	14.5 -	

Key

Notation/Conventions

L
Tree on line,
part hanging out of transect,
count as 0.5 trees

Underscored tic – beetle-infested

(Circled tic) – standing beetle-killed

Fallen trees not counted as trees but considered litter

Size Classes

S small
M medium
L large

Species

JUsc
Juniperus scopulorum Rocky Mountain juniper

PIco
Pinus contorta
lodgepole pine

PIen
Picea engelmannii
Engelmann spruce

PIfl
Pinus flexilis
limber pine

PIpo
Pinus ponderosa
ponderosa pine

POtr
Populus tremuloides
quaking aspen

Psme
Pseudotsuga menziesii
Douglas fir

Last 10m of transect:

	PIfl	PSme	ABli	Tot trees	Tot Pm+Pf
S	-	1	1.5	2.5	1
M	6.5	-	10 ①	16.5 ①	6.5
L	1.5	0.5	13 ①	15 ①	2
Tot	9	1.5	[illegible]	34 ②	9.5

$A_{10-30} = 200\ m^2 = 0.049\ Ac$

TFN 5 1/110
RECD MAR 15, 2011

CAD

Transect #: 7

Meters (m)	Size	PIfl	JUsc	PIpo	PSme	POtr	PIen	PIco	Other (specify)	Total trees	Total *P.m.* & *P.f.*
(60)	S M L Tot										
(70)	S M L Tot										
(80)	S M L Tot										
(90)	S M L Tot										
(100)	S M L Tot										
(110)	S M L Tot										
(120)	S M L Tot										
(130)	S M L Tot										
(140)	S M L Tot										
(150)	S M L Tot										
Totals	S M L Tot										

over →

TFN 5 1/110
RECD MAR 15, 2011

MCC Tree Sampling Transect Field Form

chosen for same start point + reasons + GPS problem

Date: 2009-10-26 Worker(s): JWB Transect placement & #: 8

UTM Zone 13N Datum NAD 83 Coordinates (use from prev.) E460974 N: 4565719 (zero m)

UTM Zone _____ Datum _____ Coordinates GPS touch to work (end m)

Legal Location (TRSQQ): S28SENE

Location text: copy from prev: MXC area along N edge of proposed pit - dense conifer/aspen stand below break of hill

Proposed Pit Code (9A etc.): 10B Position at Pit (middle S side toward center, etc.): copy from prev: N edge near base of flame - (e end ca. Radio towers + MBNF)

Transect Azimuth (degrees): previous + 90° = 357°

Transect Width (5m default or wider optional) 5 (2×2.5) m

Transect Length (50m default, or longer optional): 30 m shown cold becoming difficult

Area = 150 m² = 1,614 ft² = 0.037 Ac

Meters (m)	Size	PIfl	JUsc	PIpo	PSme	POtr	PIen	PIco	~~Other~~ (specify) Abies bifolia	Total trees	Total *P.m.* & *P.f.*	SID
0 (Overlaps site 7)	S				~~IIII~~ IIII				10			
	M								8.5			
	L				1 L:1 (1)	L:1			3			
	Tot								21.5			11
10	S				IIII+5+IIII				16 (1)			
	M				IIIIII				12.5 (3) 1			
	L								4.5			
	Tot								33.0 (3) 1			20
20	S				IIII	II			4.5			
	M	1 1			1	1			1.5			
	L				L:1				2 (2)			
	Tot								7.0 (2)			8
30	S											
	M											
	L											
	Tot											
40	S											
	M											
	L											
	Tot											
50	S											
	M											
	L											
	Tot											
~~(Sub-)~~ Totals	S	-			24	2			30.5 (11)	56.5 (1)	24	
	M	1.5			7	1			23 (2) 1	32.5 (2) 1	8.5	
	L	-			3 (2)	1.5			9.5 (2)	14 (4)	3 (2)	
	Tot	1.5			34 (2)	4.5			63.0 (5) 1	101.5 (7)	35.5 (2)	39

Key

Notation/Conventions

L
Tree on line,
part hanging out of transect,
count as 0.5 trees

Underscored tic – beetle-infested

(Circled tic) – standing beetle-killed

Fallen trees not counted as trees but considered litter

Size Classes

S small
M medium
L large

Species

JUsc
Juniperus scopulorum Rocky Mountain juniper

PIco
Pinus contorta
lodgepole pine

PIen
Picea engelmannii
Engelmann spruce

PIfl
Pinus flexilis
limber pine

PIpo
Pinus ponderosa
ponderosa pine

POtr
Populus tremuloides
quaking aspen

Psme
Pseudotsuga menziesii
Douglas fir

TFN 5 1/110
RECD MAR 15, 2011
CAD

Transect #: 8

Meters (m)	Size	PIfl	JUsc	PIpo	PSme	POtr	PIen	PIco	Other (specify)	Total trees	Total *P.m.* & *P.f.*
(60)	S M L Tot										
(70)	S M L Tot										
(80)	S M L Tot										
(90)	S M L Tot										
(100)	S M L Tot										
(110)	S M L Tot										
(120)	S M L Tot										
(130)	S M L Tot										
(140)	S M L Tot										
(150)	S M L Tot										
Totals	S M L Tot										

over

TFN 5 1/110
RECD MAR 15, 2011

MCC Tree Sampling Transect Field Form

Date: 2009-10-26 Worker(s): JWB Transect placement & #: chosen for logistical convenience after GPS problem 9 (special)

UTM Zone 13N Datum NAD83 Coordinates TBA (zero m) at Corral

UTM Zone _____ Datum _____ Coordinates TBA (end m) where MS ends + Δ to MM near 29/30 sect line

Legal Location (TRSQQ): 5 29 SE to NW along 2-track

Location text: Lower portion of the Flame below both nodes - down 2-track

Proposed Pit Code (9A etc.): 10B Position at Pit (middle S side toward center, etc.): center of pit

Transect Azimuth (degrees): various, perhaps average 275° Area = 229.6 ft x 2226 ft = 511089 = 11.7 AC

Transect Width (5m default or wider optional) 70 m = 2296 ft - to accommodate method

Transect Length (50m default, or longer optional): _____ m - measure w/ AutoCAD → 2226 ft long

corrected based on AutoCAD measurement

2226 / 160m x 3.28 = 4.24

SID

Meters (m) rough guess	Size	PIfl	JUsc	PIpo	PSme	POtr	PIen	PIco	Other (specify)	Total trees	Total *P.m.* & *P.f.*	
0	S M L Tot	0								0		0
~~10~~ 42.4	S M L Tot	0								0		4.5
~~20~~ 84.8	S M L Tot				L:1					0.5		0.5
~~30~~ 127.2	S M L Tot	1								1		2
~~40~~ 169.7	S M L Tot	L:1			L:1					1		4
~~50~~ 212.1	S M L Tot	0								0		1
(Sub-) Totals	S M L Tot	1 0.5 – 1.5			0.5 0.5 1					1 1 0.5 2.5	1 1 0.5 2.5	12

Key

Notation/Conventions

L
Tree on line,
part hanging out of transect,
count as 0.5 trees

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(Circled tic) – standing beetle-killed

Fallen trees not counted as trees but considered litter

Size Classes

S small
M medium
L large

Species

JUsc
Juniperus scopulorum Rocky Mountain juniper

PIco
Pinus contorta
lodgepole pine

PIen
Picea engelmannii
Engelmann spruce

PIfl
Pinus flexilis
limber pine

PIpo
Pinus ponderosa
ponderosa pine

POtr
Populus tremuloides
quaking aspen

Psme
Pseudotsuga menziesii
Douglas fir

TFN 5 1/110
RECD MAR 15, 2011

CAD

Transect #: 9

Meters (m) (rough guess)	Size	PIfl	JUsc	PIpo	PSme	POtr	PIen	PIco	Other (specify)	Total trees	Total *P.m.* & *P.f.*	SID
~~(60)~~ 254.5	S M L Tot	L:1								1		0
~~(70)~~ 296.9	S M L Tot			L:11						1		3.5
~~(80)~~ 339.3	S M L Tot	11		L:1						2.5		9 9
~~(90)~~ 381.7	S M L Tot	11		L:1 L:1						3		0
~~(100)~~ 424.2	S M L Tot	111 L:11		11								0
~~(110)~~ 466.6	S M L Tot	1 L:1								1.5		3
~~(120)~~ 509.0	S M L Tot									0		4
~~(130)~~ 551.4	S M L Tot									0		5
~~(140)~~ 593.8	S M L Tot	1								2		3
~~(150)~~ 636.2	S M L Tot	11 1								3		2
Sub-Totals	S M L Tot	10 1 2 13		2 2 1 0.5 4.5 1						12 3 1 2.5 17.5 1	0	29.5
Sub Tots. from verso	S M L Tot	1 0.5 – 1.5			– 0.5 0.5 1					1 1 0.5 2.5	1 1 0.5 2.5	12
Grand Tots	S M L Tot	11 1.5 2 14.5		2 2.5 1 1 5.5 1	– 0.5 0.5 1					13 14 1 3 20 1	11 1.5 2 14.5	37.5

Area = 11.7 AC

TFN 5 1/110
RECD MAR 15, 2011

MCC Tree Sampling Transect Field Form

chosen for logistical convenience after GPS quit

Date: 2009-10-26 Worker(s): JWB Transect placement & #: 10 (special)

UTM Zone 13 N Datum NAD 83 Coordinates TBA (zero m)

UTM Zone _____ Datum _____ Coordinates TBA (end m)

Legal Location (TRSQQ): S30 NE NE

Location text: at + near N edge of top of Flame

Proposed Pit Code (9A etc.): 10B Position at Pit (middle S side toward center, etc.):

center to N edge + a little beyond

Transect Azimuth (degrees): varies but avg ~ 280° 70m = 229.6ft

Transect Width (5m default or wider optional) 70 m - to accommodate sans-GPS method

Transect Length (50m default, or longer optional): ~~TBA~~ 422.8 m 1387ft per AutoCAD = 422.8 m rather than 130 m

Area = 229.6ft × 1387ft = 318,455 ft² = 7.31 Ac

422.8/1 = 3.2

SID

Meters (m) rough ocular est.	Size	PIfl	JUsc	PIpo	PSme	POtr	PIen	PIco	Other (specify)	Total trees	Total *P.m.* & *P.f.*	
0	S M L Tot									0	0	0
~~10~~ 32.5	S M L Tot									0	0	0
~~20~~ 65.1	S M L Tot									0	0	0
~~30~~ 97.6	S M L Tot									0	0	0
~~40~~ 130.1	S M L Tot		1 1 L-1							2.5	0	trees in small drainage
~~50~~ 162.6	S M L Tot									0	0	3
(Sub-) Totals	S M L Tot		1 1.5 2.5							1 1.5 2.5	0	3

Key

Notation/Conventions

L
Tree on line,
part hanging out of transect,
count as 0.5 trees

Underscored tic – beetle-infested

(Circled tic) – standing beetle-killed

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Size Classes

S small
M medium
L large

Species

JUsc
Juniperus scopulorum Rocky Mountain juniper

PIco
Pinus contorta
lodgepole pine

PIen
Picea engelmannii
Engelmann spruce

PIfl
Pinus flexilis
limber pine

PIpo
Pinus ponderosa
ponderosa pine

POtr
Populus tremuloides
quaking aspen

Psme
Pseudotsuga menziesii
Douglas fir

TFN 5 1/110
RECD MAR 15, 2011

CAD

Transect #: 10

Meters (m) (rough ocular estimate)	Size	PIfl	JUsc	PIpo	PSme	POtr	PIen	PIco	Other (specify)	Total trees	Total *P.m.* & *P.f.*	SID
~~(60)~~ 195.2	S M L Tot									0		3
~~(70)~~ 227.7	S M L Tot									0		1
~~(80)~~ 260.2	S M L Tot		1	1						2.5		2
~~(90)~~ 292.8	S M L Tot									0		1
~~(100)~~ 325.3	S M L Tot									0		0
~~(110)~~ 357.8	S M L Tot									0		0
~~(120)~~ 390.3	S M L Tot		1							1		0.5
(130)	S M L Tot											
(140)	S M L Tot											
(150)	S M L Tot											
sub – Totals	S M L Tot		0 2.5 – 2.5	1 1						0 3.5 – 3.5	0	7.5
sub tot from verso	S M L Tot		1 1.5 – 2.5							1 1.5 2.5	0	3
Grand Tot	S M L Tot		1 4 – 5	1 1						1 5 – 6	0	10.5

Area = 7.31 Ac

TFN 5 1/110
RECD MAR 15, 2011

MCC Tree Sampling Transect Field Form

chosen for spruce

Date: 2009-10-27 Worker(s): JWB Transect placement & #: 11

UTM Zone 13N Datum NAD 83 Coordinates E461288 N4564061 (zero m)

UTM Zone _____ Datum _____ Coordinates E461198 N4564071 (end m)

Legal Location (TRSQQ): S33 SE NW

Location text: In Cyn between S Boomerang + The ~~Flume~~ Muffler (A fork of Govt. Gulch) Starting at MBNF/MLC Fence in drainage bottom, following drainage bottom despite bends

Proposed Pit Code (9A etc.): N of 50 Position at Pit (middle S side toward center, etc.): N of Proposed Pit in drainage bottom

Transect Azimuth (degrees): varies by drainage, but N 273°

Transect Width (5m default or wider optional) 10 m (all to S of tape)

Transect Length (50m default, or longer optional): 120 m

A = 1200 m² = 12912 ft² = 0.30 Ac misdet. Dot ☆

Meters (m)	Size	PIfl ☆	JUsc ABbi	PIpo	PSme ☆	POtr	PIen	PIco	Other (specify) PISpun	Total trees	Total P.m. & P.f. ☆	SID
0	S	11			111			11	111	8	5	
	M	1 L:1111								3	3	
	L	L:V						1 L:1	11	3.5 1	1	
	Tot									9	9	15
10	S						1			1	0	
	M	L:1								0.5	0.5	
	L	L:1								0.5	0.5	
	Tot									1	1	8
20	S	111		11			1			6	3	
	M	~~IIII~~ III				~~IIII~~				8	8	
	L	L:1								5.5	0.5	
	Tot									19.5	11.5	4
30	S	~~IIII~~				—				5	5	
	M	6 6 3 1 7 1			1	~~IIII~~				18	18	
	L									4	0	
	Tot									27	23	10
40	S	5 4 4 7 + ~~IIII~~ 1 L:1			11	—	1		1 L:1	28	25.5	
	M	11 L:1			1	~~IIII~~	1			6 1	5	
	L	L:1								6 1	1	
	Tot									40 2	31.5	14
50	S	~~IIII~~ 1		1	111		~~IIII~~ L:~~IIII~~		111 L:~~IIII~~	23	9	
	M	1 1 1 ~~IIII~~ L:11				111	1			14	10	
	L	L:1								0.5	0.5	
	Tot									37.5	19.5	19
(Sub-) Totals	S	37.5		3	8	–	13.5	–	11.5	73.5	45.5	
	M	43 2			2	–	2	–	–	47 2	45 2	
	L	3.5 1			0	19	–	1.5 1	2	26 2	3.5 1	
	Tot	84 3		3	10	19	15.5	1.5 1	13.5	146.5 9	52.5 3	70
		☆			☆		25 2 2 29 combine w/				☆	

Key

Notation/Conventions

L
Tree on line,
part hanging out of transect,
count as 0.5 trees

Underscored tic – beetle-infested

(Circled tic) – standing beetle-killed

Fallen trees not counted as trees but considered litter

Size Classes

S small
M medium
L large

Species

JUsc
Juniperus scopulorum Rocky Mountain juniper

PIco
Pinus contorta
lodgepole pine

PIen
Picea engelmannii
Engelmann spruce

PIfl
Pinus flexilis
limber pine

PIpo
Pinus ponderosa
ponderosa pine

POtr
Populus tremuloides
quaking aspen

Psme
Pseudotsuga menziesii
Douglas fir

TFN 5 1/110
DESD MAR 15, 2011

CAD

Transect #: 11

Meters (m)	Size	PIfl	JUsc Abbi	PIpo	PSme	POtr	PIen	PIco	Other (specify)	Total trees	Total P.m. & P.f.	
(60)	S	1					11		11	5	1	5 I 0
	M					1			1	2	0	
	L	1					L: 1			2	1	
	Tot											12
(70)	S	~~1111~~			111		~~1111~~ 111 + 15 + 1111		12 + 7 + 2 + 5 + 3	64	8	
	M	1	11			111	1		1	8	1	
	L	1				L: 1111	L: 11		L: 11	5.5	1	
	Tot											25
(80)	S	5 ~~1111~~ 1	7 + 11		111		1 + 7 + 11			34	14	
	M	1 L: 111	1			1				4 ①	2 ①	
	L	1 L: 1	L: 1			L: 1			L: 1	2.5	1.5	
	Tot											17
(90)	S	1	5 ~~1111~~ 111				1		11 + 1	27	1	
	M	~~1111~~ 11	1			5	1			9	7	
	L		L: 1			L: 111				7	0	
	Tot											22
(100)	S	111	~~1111~~ 13		1111					25	8	
	M	1				1 L: 1				3.5 ①	2 ①	
	L					11 L: 11				3	0	
	Tot											17
(110)	S	~~1111~~ 1 L: 1	1		11	1				13.5	11.5	
	M	11 L: 1								3	2.5	
	L	1 L: 111	L: 1			~~1111~~ 111				11	2.5	
	Tot											13
(120)	S											
	M											
	L											
	Tot											
(130)	S											
	M											
	L											
	Tot											
(140)	S											
	M											
	L											
	Tot											
(150)	S											
	M											
	L											
	Tot	☆	Abbi		☆						☆	
Sub-Totals	S	30.5	40		12		40		40	162.5	42.5	
	M	15 ②	4.5		–		2		2	23.5 ②	15 ②	
	L	6	1.5		–		1.5		1.5	10.5	6	
	Tot	51.5 ②	46		12		43.5		43.5	196.5 ②	63.5 ②	96
Sub Tots from verso		37.5		3	8		25			73.5	45.5	
		43 ②			2		2		na	47 ②	45 ②	
		35 ①			0		2			26 ②	3.5 ①	
		84 ③	0	3	10		29			146.5 ④	52.5 ③	70
Grand Tots		67.5	40	3	20		105			236	88	
		58 ④	4.5		2		6			70.5 ④	60 ④	
		41 ①	1.5		0		5		na	36.5 ②	9.5 ①	
		135.5 ⑤	46	3	22		116			343 ⑥	116 ⑤	166
		☆			☆							

TFN 5 1/110
RECD MAR 15, 2011

☐ Rev H ☐ space

MCC Tree Sampling Transect Field Form

☐ "site" chosen for MXC on S Boomerang +

Date: 2009-10-27 Worker(s): JWB Transect placement & #: possible spruce 12 (special)

UTM Zone 13N Datum NAD83 Coordinates E 461198 N 4564071 (zero m)

UTM Zone _____ Datum _____ Coordinates E 460475 N 4564666 (end m)

Legal Location (TRSQQ): S33 NE NW

Location text: S. Boomerang, N edge, E of the node, maybe extending N of proposed greenline

Proposed Pit Code (9A etc.): 11 Position at Pit (middle S side toward center, etc.): straddling N edge, E of the node

Transect Azimuth (degrees): 345 A=450m² = 4842 ft² = 0.11 Ac

Transect Width (5m default or wider optional) 5 (2x2.5) m

Transect Length (50m default, or longer optional): 90 m

Meters (m)	Size	PIfl	JUsc	PIpo	PSme	POtr	PIen	PIco	Other (specify)	Total trees	Total *P.m.* & *P.f.*	SID
0	S	L:1			1							
	M	L:1										
	L	L:1										
	Tot	1.5										1.5
10	S	~~|||~~ 1			1							
	M											
	L	L:1										
	Tot	6 2										1
20	S	1										
	M	L:1										
	L	L:1										
	Tot	2 1										0.5
30	S	~~|||~~ L:1			~~|||~~							
	M				L:1							
	L	L:1										
	Tot	5 2										3
40	S											
	M	L:1										
	L											
	Tot	0.5										2
50	S	L:1			1							
	M	L:1										
	L											
	Tot	1										5
(Sub-) Totals	S	13 1.5			8 -					21 1.5	21 1.5	
	M	- 2.5			- 0.5					- 3	- 3	
	L	- 2.5			- 1					- 3.5	- 3.5	
	Tot	13 7.5			8 1.5					21 9	21 9	13
		20.5			9.5					30	30	

OVER ☐

Key

Notation/Conventions

L
Tree on line,
part hanging out of transect,
count as 0.5 trees

Underscored tic – beetle-infested

(Circled tic) – standing beetle-killed 1.5 PIfl

Fallen trees not counted as trees but considered litter; same for standing trees killed by other things than beetles

Size Classes

S small
M medium
L large

Species

JUsc
Juniperus scopulorum Rocky Mountain juniper

PIco
Pinus contorta
lodgepole pine

PIen
Picea engelmannii
Engelmann spruce

PIfl
Pinus flexilis
limber pine

PIpo
Pinus ponderosa
ponderosa pine

POtr
Populus tremuloides
quaking aspen

Psme
Pseudotsuga menziesii
Douglas fir

TFN 5 1/110
RECD MAR 15.2011

	PIfl	PSme	Tot trees	Tot PmPf
S	8.5	2	10.5	10.5
M	1	-	1	1
L	2	-	2	2

Inside Pit Line Area

4 m² = ~~0.011~~ Ac = 4842 ft² = 0.011 Ac

RAD

☐ ADD other trees 5" to key + check PRU v.rg.

D

Transect #: 12

Meters (m)	Size	PIfl	JUsc	PIpo	PSme	POtr	PIen	PIco	Other (specify)	Total trees	Total *P.m.* & *P.f.*	SID
(60)	S M L Tot	1 1										3
(70)	S M L Tot	~~IIII~~ IIIII 1 L-III 1			~~IIII~~ ~~IIII~~ IIII IIII L-I 1	L-~~IIII~~ IIII L-III						7
(80)	S M L Tot	III L-II			~~IIII~~ L- L-IIII	L-~~IIII~~						13
(90)	S M L Tot											
(100)	S M L Tot											
(110)	S M L Tot											
(120)	S M L Tot											
(130)	S M L Tot											
(140)	S M L Tot											
(150)	S M L Tot											
☐ Sub-Totals ☐ add BK	S M L Tot	13 - 2 2 - 15 2			21 4 2.5 1 26 2.5	5.5 1 6.5				44 16 2 62	44 10.5 1 55.5	23
		17			28.5	6.5				62	55.5	

Subtot p.l.	20	9.5		21 1.5 - 3 - 3.5 21 9	30 →0	30 →0	21 1.5 - 3 - 3.5 21 9
Living: Beetle-damaged							
Beetle-killed							
Grand Tot	37	38	6.5	66.5 19 5.5 91	→1.5 91	→1.5 85.5	68.5 13.5 4.5 86.5

SID 23
13
36

TFN 5 1/110
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MCC Tree Sampling Transect Field Form

Date: 2009-11-04 Worker(s): JWB Transect placement & #: N slope of Flame + GPS not work in tree stand 13

UTM Zone 13N Datum _____ Coordinates E 461290 N 4566769 (zero m)

UTM Zone _____ Datum _____ Coordinates E 461292 N 4565940 (end m)

Legal Location (TRSQQ): S28 N½ of E edge

Location text: BLM gate in Cyn N of the TV antennae southward to ridge top at base of Flame

Proposed Pit Code (9A etc.): _____ Position at Pit (middle S side toward center, etc.):

Transect Azimuth (degrees): 180°

Transect Width (5m default or wider optional) ±1 tree m Area varies, see CAD+GIS. Avg 10 ft.

Transect Length (50m default, or longer optional): ~200 m ~~TBA~~ est from AutoCAD

Area = 65560 ft² = 0.15 Ac

Meters (m) arbitrary	Size	PIfl	JUsc	PIpo	PSme	POtr	PIen	PIco	Other (specify) ABla ABli	Total trees	Total P.m. & P.f.	SID
0	S M L Tot	𝍸 |				𝍸 | + 13	||					22
~~10~~ 25	S M L Tot	𝍸 | |			𝍸 ||| 𝍸 |	8+5	| |	|| (|) (|)(|)(|)||	|			13
~~20~~ 50	S M L Tot	||(|)|| ||			𝍸 𝍸 𝍸 | 𝍸 𝍸 | ||||	||| ||||			𝍸 𝍸 𝍸 || ||| 𝍸 |			16
~~30~~ 75	S M L Tot					8			𝍸 𝍸 || ||			16
~~40~~ 100	S M L Tot	|		|	||| ||	| ||			𝍸 | + 9 + 𝍸 |			18
~~50~~ 125	S M L Tot	𝍸 | 𝍸 |			𝍸 |	𝍸 || ||| 𝍸 𝍸 𝍸 𝍸		||| || (|)|	𝍸 𝍸 𝍸 𝍸 |||| ||			19 OVER
(Sub-) Totals	S M L Tot	23 (1) 10 — 33 (1)			25 11 9 45	48 7 20 75		5 3 (1) 9 (4) 17 (5)	80 7 6 93	181 (1) 38 (1) 49 (4) 263 (6)	48 (1) 21 9 78 (1)	104

Key

Notation/Conventions

L
Tree on line,
part hanging out of transect,
count as 0.5 trees

Underscored tic – beetle-infested

(Circled tic) – standing beetle-killed

Fallen trees not counted as trees but considered litter

Size Classes

S small
M medium
L large

Species

JUsc
Juniperus scopulorum Rocky Mountain juniper

PIco
Pinus contorta
lodgepole pine

PIen
Picea engelmannii
Engelmann spruce

PIfl
Pinus flexilis
limber pine

PIpo
Pinus ponderosa
ponderosa pine

POtr
Populus tremuloides
quaking aspen

Psme
Pseudotsuga menziesii
Douglas fir

TFN 5 1/110
RECD MAR 15, 2011

✓CAD

Transect #: 13

Meters (m)	Size	PIfl	JUsc	PIpo	PSme	POtr	PIen	PIco	Other (specify) ABbi	Total trees	Total *P.m.* & *P.f.*	SID
~~(60)~~ 150	S					III						
	M	II										
	L	II				I						20
	Tot											
~~(70)~~ 175	S	Tree-free		MSH	community	on	ridge!			0	0	
	M											
	L											
	Tot											0
(80)	S											
	M											
	L											
	Tot											
(90)	S											
	M											
	L											
	Tot											
(100)	S											
	M											
	L											
	Tot											
(110)	S											
	M											
	L											
	Tot											
(120)	S											
	M											
	L											
	Tot											
(130)	S											
	M											
	L											
	Tot											
(140)	S											
	M											
	L											
	Tot											
(150)	S											
	M											
	L											
	Tot											
Totals	S					4				4	–	
	M	2				–				2	2	
	L	2				1				3	2	
	Tot	4				5				9	4	20
sub Tots from verso		27 (1)			25	48		5	80	181 (1)	48 (1)	
		10			11	7		3 (1)	7	38 (1)	21	
		–			9	20		9 (4)	6	44 (4)	9	
		33 (1)			45	75		17 (5)	93	263 (6)	78 (1)	104
Grand Tots		23 (1)			25	52		5	80	185 (1)	48 (1)	
		12			11	7		3 (1)	7	41 (1)	23	
		2			9	21		9 (4)	6	47 (4)	11	
		37 (1)			45	80		17 (5)	93	272 (6)	82 (1)	124

TFN 5 1/110
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MCC Tree Sampling Transect Field Form

Date: Summer ~~2008~~ 2005 or 2006 Worker(s): R. Schreibeis Transect placement & #: 14

UTM Zone_____ Datum _____ Coordinates _____ (zero m)

UTM Zone_____ Datum _____ Coordinates _____ (end m)

Legal Location (TRSQQ): ~~Area C~~ Sect. 36 Area C

Location text: Sect 36 Area C southeast draw (one of two main drainages in ~~E portion Sect. 36~~ Area C)

Proposed Pit Code (9A etc.): ~~between 3+4~~ Position at Pit (middle S side toward center, etc.): S of S Proposed pit ~~Drainage between pit #3 + pit #4 of draft mine plan~~, S of Area C mined pit

Transect Azimuth (degrees): na

Transect Width (5m default or wider optional) drainage m

Transect Length (50m default, or longer optional): unspecified m

See RMR Report: Draft of 298C Sect 36 Appendix D VIII 8 Vegetation Inventory dated 17 Apr. 2009 p. D VIII 8-11 + A7 Permit p. D VIII 8-11

per CAD assume Area = 6.14 Ac.

Meters (m) general count	Size	PIfl	JUsc	PIpo	PSme	POtr	PIen	PIco	Other (specify)	Total trees	Total P.m. & P.f.
0	S M (DBH ≥ 6") L (< 10') Tot		18 22 2							40	0
10	S M L Tot										
20	S M L Tot										
30	S M L Tot										
40	S M L Tot										
50	S M L Tot										
(Sub-) Totals	S M L Tot	—	~~40~~ 14 ~~22~~ 24 2 40	—	—	—	—	—	—	14 24 2 40	0

Key

Notation/Conventions

L
Tree on line,
part hanging out of transect,
count as 0.5 trees

Underscored tic – beetle-infested

(Circled tic) – standing beetle-killed

Fallen trees not counted as trees but considered litter

Size Classes — Definitions for this transect

S	small	
M	medium	DBH ≥ 6"
L	large	height > 10 ft.

Species

JUsc
Juniperus scopulorum Rocky Mountain juniper

PIco
Pinus contorta
lodgepole pine

PIen
Picea engelmannii
Engelmann spruce

PIfl
Pinus flexilis
limber pine

PIpo
Pinus ponderosa
ponderosa pine

POtr
Populus tremuloides
quaking aspen

Psme
Pseudotsuga menziesii
Douglas fir

TFN 5 1/110
RECD MAR 15, 2011

Transect #: 14

Meters (m)	Size	PIfl	JUsc	PIpo	PSme	POtr	PIen	PIco	Other (specify)	Total trees	Total *P.m.* & *P.f.*
(60)	S M L Tot										
(70)	S M L Tot										
(80)	S M L Tot										
(90)	S M L Tot										
(100)	S M L Tot										
(110)	S M L Tot										
(120)	S M L Tot										
(130)	S M L Tot										
(140)	S M L Tot										
(150)	S M L Tot										
Totals	S M L Tot										

over →

TFN 5 1/110
RECD MAR 15, 2011

MCC Tree Sampling Transect Field Form

Date: Summer ~~2008~~ 2005 or 2006 Worker(s): RSchreibeis Transect placement & #: drainages ~~of section~~ 15

UTM Zone_____ Datum _____ Coordinates _____ (zero m)

UTM Zone_____ Datum _____ Coordinates _____ (end m)

Legal Location (TRSQQ): _____ Sect. 36 Area C

Location text: Drainage between the 2 ~~pits #1 + #3~~ Proposed Area C Pits

Proposed Pit Code (9A etc.): A7 Area C South Position at Pit (middle S side toward center, etc.):

Section 36 east-central draw (in Area C)

Transect Azimuth (degrees): na

Transect Width (5m default or wider optional) drainage ~~m~~

Transect Length (50m default, or longer optional): unspecified m

per CAD assume Area = 7.58 Ac

See RMR Report Draft of 2008 Sect 36 Appendix D VIII 8 Vegetation Inventory dated 17 Apr 2009 p. D VIII 8-11 and A7 Permit p. D VIII 8-1

Meters (m) general count	Size ~~Definitions~~ criteria indicated for RS transect	PIfl	JUsc	PIpo	PSme	POtr	PIen	PIco	Other (specify)	Total trees	Total *P.m.* & *P.f.*
0	S M (DBH ≥ 6") L (≥ 10') Tot		18 2 1							21	0
10	S M L Tot										
20	S M L Tot										
30	S M L Tot										
40	S M L Tot										
50	S M L Tot										
(Sub-) Totals	S M L Tot	—	17 2 3 1 21	—	—	-	—	—	-	17 3 1 21	0

Key

Notation/Conventions

L
Tree on line,
part hanging out of transect,
count as 0.5 trees

Underscored tic – beetle-infested

(Circled tic) – standing beetle-killed

Fallen trees not counted as trees but considered litter

Size Classes — Definitions For this transect

S small
M medium DBH ≥ 6"
L large height > 10 ft.

Species

JUsc
Juniperus scopulorum Rocky Mountain juniper

PIco
Pinus contorta
lodgepole pine

PIen
Picea engelmannii
Engelmann spruce

PIfl
Pinus flexilis
limber pine

PIpo
Pinus ponderosa
ponderosa pine

POtr
Populus tremuloides
quaking aspen

Psme
Pseudotsuga menziesii
Douglas fir

TFN 5 1/110
RECD MAR 15, 2011
CAD

Transect #: 15

Meters (m)	Size	PIfl	JUsc	PIpo	PSme	POtr	PIen	PIco	Other (specify)	Total trees	Total *P.m.* & *P.f.*
(60)	S M L Tot										
(70)	S M L Tot										
(80)	S M L Tot										
(90)	S M L Tot										
(100)	S M L Tot										
(110)	S M L Tot										
(120)	S M L Tot										
(130)	S M L Tot										
(140)	S M L Tot										
(150)	S M L Tot										
Totals	S M L Tot										

Over →

TFN 5 1/110
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MCC Tree Sampling Transect Field Form

Date: 2009-9-12 Worker(s): JWB Transect placement & #: K6
UTM Zone_____ Datum _____ Coordinates _____ (zero m)
UTM Zone_____ Datum _____ Coordinates _____ (end m)
Legal Location (TRSQQ): S3 1+36
Location text: Drainages to each side of Area C Pit - only observed that all trees are JUsc
Proposed Pit Code (9A etc.): 1+2 Position at Pit (middle S side toward center, etc.):
N of Pit 1 midsection; W of Pit 2
Transect Azimuth (degrees): Varies
Transect Width (5m default or wider optional) → m line of sight within target drainages
Transect Length (50m default, or longer optional): m=(4290 ft)
Area NA

Meters (m)	Size	~~PIfl~~	JUsc all	~~PIpo~~	~~PSme~~	~~POtr~~	~~PIen~~	~~PIco~~	~~Other (specify)~~	Total trees	Total *P.m.* & *P.f.*
0	S M L Tot										
10	S M L Tot										
20	S M L Tot										
30	S M L Tot										
40	S M L Tot										
50	S M L Tot										
(Sub-) Totals	S M L Tot		all							not counted only ID	0

not counted only ID

Key

Notation/Conventions

L
Tree on line,
part hanging out of transect,
count as 0.5 trees

Underscored tic – beetle-infested

(Circled tic) – standing beetle-killed

Fallen trees not counted as trees but considered litter

Size Classes

S small
M medium
L large

Species

JUsc
Juniperus scopulorum Rocky Mountain juniper

PIco
Pinus contorta
lodgepole pine

PIen
Picea engelmannii
Engelmann spruce

PIfl
Pinus flexilis
limber pine

PIpo
Pinus ponderosa
ponderosa pine

POtr
Populus tremuloides
quaking aspen

Psme
Pseudotsuga menziesii
Douglas fir

TFN 5 1/110
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CAD

Transect #: 16

Meters (m)	Size	PIfl	JUsc	PIpo	PSme	POtr	PIen	PIco	Other (specify)	Total trees	Total *P.m.* & *P.f.*
(60)	S M L Tot										
(70)	S M L Tot										
(80)	S M L Tot										
(90)	S M L Tot										
(100)	S M L Tot										
(110)	S M L Tot										
(120)	S M L Tot										
(130)	S M L Tot										
(140)	S M L Tot										
(150)	S M L Tot										
Totals	S M L Tot										

not counted, only ID

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methods development: only ~5 trees of PIfl

MCC Tree Sampling Transect Field Form

site of 1st drill hole rec. flat tire

Date: 2009-10 9/ Worker(s): JWB+AM ~~Transect~~ site placement & #: GPS 1 data missing

UTM Zone 13 N Datum NAD 83 Coordinates _____ (zero m)

UTM Zone_____ Datum _____ Coordinates _____ (end m)

Legal Location (TRSQQ): S31

Location text: Generally on ridge running N/S thru sect 31

Proposed Pit Code (9A etc.): 3 Position at Pit (middle S side toward center, etc.): Toward NE corner

Transect Azimuth (degrees): na

Transect Width (5m default or wider optional) na m

Transect Length (50m default, or longer optional): na m

Data on Trimble GeoXM? assume not

Meters (m)	Size	PIfl	JUsc	PIpo	PSme	POtr	PIen	PIco	Other (specify)	Total trees	Total *P.m.* & *P.f.*
0	S M L Tot										
10	S M L Tot										
20	S M L Tot										
30	S M L Tot										
40	S M L Tot										
50	S M L Tot										
(Sub-) Totals	S M L Tot										

Key

Notation/Conventions

L
Tree on line,
part hanging out of transect,
count as 0.5 trees

Underscored tic – beetle-infested

(Circled tic) – standing beetle-killed

Fallen trees not counted as trees but considered litter

Size Classes

S small
M medium
L large

Species

JUsc
Juniperus scopulorum Rocky Mountain juniper

PIco
Pinus contorta
lodgepole pine

PIen
Picea engelmannii
Engelmann spruce

PIfl
Pinus flexilis
limber pine

PIpo
Pinus ponderosa
ponderosa pine

POtr
Populus tremuloides
quaking aspen

Psme
Pseudotsuga menziesii
Douglas fir

TFN 5 1/110
RECD MAR 15, 2011

CAO

~~Transect~~ Site #: GPS 1

Meters (m)	Size	PIfl	JUsc	PIpo	PSme	POtr	PIen	PIco	Other (specify)	Total trees	Total *P.m.* & *P.f.*
(60)	S M L Tot										
(70)	S M L Tot										
(80)	S M L Tot										
(90)	S M L Tot										
(100)	S M L Tot										
(110)	S M L Tot										
(120)	S M L Tot										
(130)	S M L Tot										
(140)	S M L Tot										
(150)	S M L Tot										
Totals	S M L Tot										

data lost

TFN 5 1/110
RECD MAR 15,2011

MCC Tree Sampling Transect Field Form

Date: 2009-10-23 Worker(s): JWB ~~Transect~~ Site placement & #: chosen for 2WD access GPS 2
UTM Zone 13 N Datum NAD83 Coordinates E457811 N4563607 ~~(zero m)~~ N end
UTM Zone _____ Datum _____ Coordinates E457734 N4563182 ~~(end m)~~ S end
Legal Location (TRSQQ): S31 SESE
Location text: Tailpipe + Exhaust
Proposed Pit Code (9A etc.): 3+5C Position at Pit (middle S side toward center, etc.):

Transect Azimuth (degrees): na
Transect Width (5m default or wider optional) na m
Transect Length (50m default, or longer optional): na m

Data on Trimble GeoXM
Area$_{CAD}$ = 27Ac

Meters (m)	Size	PIfl	JUsc	PIpo	PSme	POtr	PIen	PIco	Other (specify)	Total trees	Total *P.m.* & *P.f.*
0	S M L Tot										
10	S M L Tot										
20	S M L Tot										
30	S M L Tot										
40	S M L Tot										
50	S M L Tot										
(Sub-) Totals	S M L Tot										

over ↓

Key

Notation/Conventions

L
Tree on line,
part hanging out of transect,
count as 0.5 trees

Underscored tic – beetle-infested

(Circled tic) – standing beetle-killed

Fallen trees not counted as trees but considered litter

Size Classes

S small
M medium
L large

Species

JUsc
Juniperus scopulorum Rocky Mountain juniper

PIco
Pinus contorta
lodgepole pine

PIen
Picea engelmannii
Engelmann spruce

PIfl
Pinus flexilis
limber pine

PIpo
Pinus ponderosa
ponderosa pine

POtr
Populus tremuloides
quaking aspen

Psme
Pseudotsuga menziesii
Douglas fir

TFN 5 1/110
RECD MAR 15.2011
CAD

Site
~~Transect~~ #: GPS 2

Meters (m)	Size	PIfl	JUsc	PIpo	PSme	POtr	PIen	PIco	Other (specify)	Total trees	Total *P.m.* & *P.f.*
(60)	S M L Tot										
(70)	S M L Tot										
(80)	S M L Tot										
(90)	S M L Tot										
(100)	S M L Tot										
(110)	S M L Tot										
(120)	S M L Tot										
(130)	S M L Tot										
(140)	S M L Tot										
(150)	S M L Tot										
Totals	S M L Tot	78 29 – 107		1 4 – 5						79 33 – 112	78 29 – 107

TFN 5 1/110
REGD MAR 15, 2011

MCC Tree Sampling Transect Field Form

Date: 2009-10-26 Worker(s): JWB ~~Transect~~ Site placement & #: chosen for TV antenna site GPS 3
UTM Zone 13 N Datum NAD83 Coordinates E461097 N4565344 (~~zero m~~ Etch. Minerals) W end
UTM Zone _____ Datum _____ Coordinates E461282 N4565419 (end m) E end
Legal Location (TRSQQ): S28 SENE
Location text: Surrounding TV Antenna facilities + power lines at base of flame
Proposed Pit Code (9A etc.): 10B Position at Pit (middle S side toward center, etc.):
SE corner
Transect Azimuth (degrees): na
Transect Width (5m default or wider optional) na m
Transect Length (50m default, or longer optional): na m

Data in Trimble
Area$_{CAD}$ = 5.34 Ac

Meters (m)	Size	PIfl	JUsc	PIpo	PSme	POtr	PIen	PIco	Other (specify)	Total trees	Total *P.m.* & *P.f.*
0 MSH-C part	S M L Tot	93 43 15		2 1 -							
10	S M L Tot										
20	S M L Tot										
30	S M L Tot										
40	S M L Tot										
50	S M L Tot										
(Sub-) Totals	S M L Tot										

over ↓

Key

Notation/Conventions

L
Tree on line,
part hanging out of transect,
count as 0.5 trees

Underscored tic – beetle-infested

(Circled tic) – standing beetle-killed

Fallen trees not counted as trees but considered litter

Size Classes

S small
M medium
L large

Species

JUsc
Juniperus scopulorum Rocky Mountain juniper

PIco
Pinus contorta
lodgepole pine

PIen
Picea engelmannii
Engelmann spruce

PIfl
Pinus flexilis
limber pine

PIpo
Pinus ponderosa
ponderosa pine

POtr
Populus tremuloides
quaking aspen

Psme
Pseudotsuga menziesii
Douglas fir

TFN 5 1/110
RECD MAR 15, 2011

CAD

Site
~~Transect~~ #: GPS 3

Meters (m)	Size	PIfl	JUsc	PIpo	PSme	POtr	PIen	PIco	Other (specify)	Total trees	Total *P.m.* & *P.f.*
(60)	S M L Tot										
(70)	S M L Tot										
(80)	S M L Tot										
(90)	S M L Tot										
(100)	S M L Tot										
(110)	S M L Tot										
(120)	S M L Tot										
(130)	S M L Tot										
(140)	S M L Tot										
(150)	S M L Tot										
Totals	S M L Tot	96 43 15 139		2 1 – 3						98 44 15 142	98 44 15 142

TFN 5 1/110
RECD MAR 15, 2011

Riple map V

MCC Tree Sampling Transect Field Form

Date: 2009-10-26 Worker(s): JWB ~~Transect~~ Site placement & #: GPS4 chosen to test GPS

UTM Zone 13 N Datum NAD83 Coordinates E 460942 N4565558 ~~(zero m)~~ (w end)

UTM Zone _____ Datum _____ Coordinates E 460960 N4565550 (end m)(e end)

Legal Location (TRSQQ): S28 SENE

Location text: Northward in Flame toward e end

Proposed Pit Code (9A etc.): 10B Position at Pit (middle S side toward center, etc.):

Transect Azimuth (degrees): na Data in Trimble

Transect Width (5m default or wider optional) na m

Transect Length (50m default, or longer optional): na m

Area GPS = 0.027 Ac

Meters (m)	Size	PIfl	JUsc	PIpo	PSme	POtr	PIen	PIco	Other (specify)	Total trees	Total *P.m.* & *P.f.*
0	S	III									
	M										
1.9Ac = MSM portion	L										
	Tot	3									
10	S										
	M										
	L										
	Tot										
20	S										
	M										
	L										
	Tot										
30	S										
	M										
	L										
	Tot										
40	S										
	M										
	L										
	Tot										
50	S										
	M										
	L										
	Tot										
(Sub-) Totals	S										
	M										
	L										
	Tot										

over ↓

Key

Notation/Conventions

L
Tree on line,
part hanging out of transect,
count as 0.5 trees

Underscored tic – beetle-infested

(Circled tic) – standing beetle-killed

Fallen trees not counted as trees but considered litter

Size Classes

S small
M medium
L large

Species

JUsc
Juniperus scopulorum Rocky Mountain juniper

PIco
Pinus contorta
lodgepole pine

PIen
Picea engelmannii
Engelmann spruce

PIfl
Pinus flexilis
limber pine

PIpo
Pinus ponderosa
ponderosa pine

POtr
Populus tremuloides
quaking aspen

Psme
Pseudotsuga menziesii
Douglas fir

TFN 5 1/110
RECD MAR 15, 2011

CAD

Site
~~Transect~~ #: GPS 4

Meters (m)	Size	PIfl	JUsc	PIpo	PSme	POtr	PIen	PIco	Other (specify)	Total trees	Total *P.m.* & *P.f.*
(60)	S M L Tot										
(70)	S M L Tot										
(80)	S M L Tot										
(90)	S M L Tot										
(100)	S M L Tot										
(110)	S M L Tot										
(120)	S M L Tot										
(130)	S M L Tot										
(140)	S M L Tot										
(150)	S M L Tot										
Totals	S M L Tot	11 11 - 4								2 2 - 4	2 2 - 4

Area = 0.027 Ac

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MCC Tree Sampling Transect Field Form

Date: 2009-10-27 Worker(s): JWB ~~Transect~~ Site placement & #: chosen for dense MM stand GPS 5
UTM Zone 13N Datum NAD83 Coordinates E458624 N4564845 ~~(zero m)~~ N end
UTM Zone _____ Datum _____ Coordinates E458617 N4564649 (end m) S end
Legal Location (TRSQQ): Straddling sect 29/32 line
Location text: Both sides of N green line of Muffler
Proposed Pit Code (9A etc.): 5D Position at Pit (middle S side toward center, etc.):

Transect Azimuth (degrees): na
Transect Width (5m default or wider optional) na m
Transect Length (50m default, or longer optional): na m

Data in Trimble

Area = 4.52 Ac

Meters (m)	Size	PIfl	JUsc	PIpo	PSme	POtr	PIen	PIco	Other (specify)	Total trees	Total *P.m.* & *P.f.*
0 MSH Pit part = 0.81 Ac	S M L Tot	~~IIII~~ II 7	1 1								
10	S M L Tot										
20 MM Part	S M L Tot	13 8 2	13 5 2	1	1 1+1 1+1 1						
30	S M L Tot										
40	S M L Tot										
50	S M L Tot										
(Sub-) Totals	S M L Tot										

r = 44 m

over

Key

Notation/Conventions

L
Tree on line,
part hanging out of transect,
count as 0.5 trees

Underscored tic – beetle-infested

(Circled tic) – standing beetle-killed

Fallen trees not counted as trees but considered litter

Size Classes

S small
M medium
L large

Species

JUsc
Juniperus scopulorum Rocky Mountain juniper

PIco
Pinus contorta
lodgepole pine

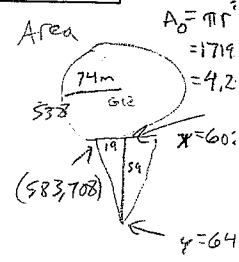
PIen
Picea engelmannii
Engelmann spruce

PIfl
Pinus flexilis
limber pine

PIpo
Pinus ponderosa
ponderosa pine

POtr
Populus tremuloides
quaking aspen

Psme
Pseudotsuga menziesii
Douglas fir



$A_D = \pi r^2$
$= 1719$
$= 4.2$

$A_\Delta = \frac{1}{2} bh$

$A_\Delta = bh = 1121 m^2 = 0.27$

Area GPS 5 = 4.52

TFN 5 1/110
MCD MAR 15, 2011

CAO

~~Transect~~ Site #: GPS 5

Meters (m)	Size	PIfl ☆	JUsc	PIpo	PSme ☆	POtr	PIen	PIco	Other (specify)	Total trees	Total *P.m.* & *P.f.* ☆
(60)	S M L Tot										
(70)	S M L Tot										
(80)	S M L Tot										
(90)	S M L Tot										
(100)	S M L Tot										
(110)	S M L Tot										
(120)	S M L Tot										
(130)	S M L Tot										
(140)	S M L Tot										
(150)	S M L Tot										
Totals	S M L Tot	22 27 5 41	15 7 2 24	- 1 - 1	2 1 1 4					39 23 8 70	24 15 6 45

Area = 4.52 Ac

TFN 5 1/110
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MCC Tree Sampling Transect Field Form

Date: 2009-10-27 Worker(s): JWB ~~Transect~~ Site placement & #: chosen for AbIa GPS 6

UTM Zone 13 N Datum NAD83 Coordinates E460698 N4564134 ~~(zero m)~~ (N end)

UTM Zone _____ Datum _____ Coordinates E460711 N4564113 ~~(end m)~~ (S end)

Legal Location (TRSQQ): S 33 SWNE

Location text: Downhill in drainage N of E arm of Muffler

Proposed Pit Code (9A etc.): N of 5D Position at Pit (middle S side toward center, etc.):

Transect Azimuth (degrees): na

Transect Width (5m default or wider optional) na m

Transect Length (50m default, or longer optional): na m

Data in Trimble ☐ file name ☐

Area = 0.099 Ac

Meters (m)	Size	PIfl	JUsc	PIpo	PSme	POtr	PIen	PIco	Other (specify) Abies	Total trees	Total *P.m.* & *P.f.*
0	S M L Tot										
10	S M L Tot										
20	S M L Tot										
30	S M L Tot										
40	S M L Tot										
50	S M L Tot										
~~(Sub-)~~ Totals	S M L Tot	6 6 4 16			21 6 – 27	– – 5 5			3 1 4 8	30 13 13 56	27 12 4 43

Key

Notation/Conventions

L
Tree on line,
part hanging out of transect,
count as 0.5 trees

Underscored tic – beetle-infested

(Circled tic) – standing beetle-killed

Fallen trees not counted as trees but considered litter

Size Classes

S small
M medium
L large

Species

JUsc
Juniperus scopulorum Rocky Mountain juniper

PIco
Pinus contorta
lodgepole pine

PIen
Picea engelmannii
Engelmann spruce

PIfl
Pinus flexilis
limber pine

PIpo
Pinus ponderosa
ponderosa pine

POtr
Populus tremuloides
quaking aspen

Psme
Pseudotsuga menziesii
Douglas fir

Area approx by semicircle r = 709-69 = 16

$A_a = \frac{\pi r^2}{2} = 401.9 m^2$

= 0.099 Ac

TFN 5 1/110
RECD MAR 15, 2011

CAD

Site
~~Transect~~ #: GPS 6

Meters (m)	Size	PIfl	JUsc	PIpo	PSme	POtr	PIen	PIco	Other (specify)	Total trees	Total *P.m.* & *P.f.*
(60)	S M L Tot										
(70)	S M L Tot										
(80)	S M L Tot										
(90)	S M L Tot										
(100)	S M L Tot										
(110)	S M L Tot										
(120)	S M L Tot										
(130)	S M L Tot										
(140)	S M L Tot										
(150)	S M L Tot										
Totals	S M L Tot										

over →

TFN 5 1/110
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MCC Tree Sampling Transect Field Form

Date: 2009-11-04 Worker(s): JWB Transect placement & #: To represent The Hand + Pitchfork + Flame) GPS 7

UTM Zone 13 N Datum _____ Coordinates E 461299 N 4566769 (zero m)

UTM Zone _____ Datum _____ Coordinates E 461290 N 4565937 (end m)

Legal Location (TRSQQ): ~~Pitchfork~~ S21 SESE

Location text: The Hand + ~~Pitchfork~~ the Base (at E) starting in drainage on N edge of of hand + S edge of Pitch-fork

Proposed Pit Code (9A etc.): 9C+esp 8B Position at Pit (middle S side toward center, etc.): ↑

Transect Azimuth (degrees): –

Transect Width (5m default or wider optional) ___ m 80 ft Avg per GIS+CAD

Transect Length (50m default, or longer optional): ___ m 2783 ft per CAD+GIS

so Area = 5.11 Ac

Meters (m)	Size	PIfl	JUsc	PIpo	PSme	POtr	PIen	PIco	Other (specify)	Total trees	Total *P.m.* & *P.f.*
0	S M L Tot										
10	S M L Tot										
20	S M L Tot										
30	S M L Tot										
40	S M L Tot										
50	S M L Tot										
~~(Sub-)~~ Totals	S M L Tot	95 43 21 162	1 – – 1	6 2 – 8		1 2 – 3	1 – – 1			104 47 21 172	95 43 21 162

Key

Notation/Conventions

L
Tree on line,
part hanging out of transect,
count as 0.5 trees

Underscored tic – beetle-infested

(Circled tic) – standing beetle-killed

Fallen trees not counted as trees but considered litter

Size Classes

S small
M medium
L large

Species

JUsc
Juniperus scopulorum Rocky Mountain juniper

PIco
Pinus contorta
lodgepole pine

PIen
Picea engelmannii
Engelmann spruce

PIfl
Pinus flexilis
limber pine

PIpo
Pinus ponderosa
ponderosa pine

POtr
Populus tremuloides
quaking aspen

Psme
Pseudotsuga menziesii
Douglas fir

TEN 5 1/110
MAR 15, 2011

CAD

Transect #: GPS 7

Meters (m)	Size	PIfl	JUsc	PIpo	PSme	POtr	PIen	PIco	Other (specify)	Total trees	Total *P.m.* & *P.f.*
(60)	S M L Tot										
(70)	S M L Tot										
(80)	S M L Tot										
(90)	S M L Tot										
(100)	S M L Tot										
(110)	S M L Tot										
(120)	S M L Tot										
(130)	S M L Tot										
(140)	S M L Tot										
(150)	S M L Tot										
Totals	S M L Tot										

over →

TFN 5 1/110
RECD MAR 15,2011

MCC Tree Sampling Transect Field Form

Pitchfork/ MBNF

Date: 2009-11-05 Worker(s): JWB Transect placement & #: fenceline GPS 8

UTM Zone 13 N Datum _____ Coordinates E 461298 N4566770 (zero m)

UTM Zone _____ Datum _____ Coordinates E 461301 N4567697 (end m)

Legal Location (TRSQQ): S21 E edge

Location text: From Hand/Pitchfork boundary N along MBNF fence into Telephone Cyn.

Proposed Pit Code (9A etc.): 9C + 9B Position at Pit (middle S side toward center, etc.):

All along E edge + farther N into Telephone Cyn.

Transect Azimuth (degrees): 0

Transect Width (5m default or wider optional) to 1st tree west - Avg ~ 7m = 22.96 ft = 1.67 Ac

Transect Length (50m default, or longer optional): 3172 ft ~~m~~ ~~TCB~~ per GIS+ CAD

Meters (m)	Size	PIfl	JUsc	PIpo	PSme	POtr	PIen	PIco	Other (specify)	Total trees	Total *P.m.* & *P.f.*
from GIS Area = 0.81Ac 0 Worthar CAD Polygon only	S	13.6			23.2	0.8					
	M	4.8			12.8	1.6					
	L	4.8			8.9						
	Tot										
Area = 0.26Ac from GIS 10 NSH-C portion of N. [illegible]	S	9									
	M	3									
	L										
	Tot										
from 20 Northern CAD Polygon	S	17			29	1					
	M	6			16	2					
	L	6			12						
	Tot										
30 more	S										
	M										
	L										
	Tot										
= 0.64Ac from GIS 40 Area on rock flat polygon	S	7									
	M	2									
	L										
	Tot										
50 38th of MXC	S										
	M										
	L										
	Tot										
~~(Sub-)~~ Totals	S	58			30	1				89	88
	M	20			16	2				38	36
	L	8			12	–				20	20
	Tot	86			58	3				147	144

$X_1 = 304$ $X_2 = 292$ $Y_1 = 293$ $Y_2 = 512$

Key

Notation/Conventions

L
Tree on line,
part hanging out of transect,
count as 0.5 trees

Underscored tic – beetle-infested

(Circled tic) – standing beetle-killed

Fallen trees not counted as trees but considered litter

Size Classes

S small
M medium
L large

Species

JUsc
Juniperus scopulorum Rocky Mountain juniper

PIco
Pinus contorta
lodgepole pine

PIen
Picea engelmannii
Engelmann spruce

PIfl
Pinus flexilis
limber pine

PIpo
Pinus ponderosa
ponderosa pine

POtr
Populus tremuloides
quaking aspen

Psme
Pseudotsuga menziesii
Douglas fir

TFN 5 1/110
RECD MAR 15, 2011

CAD

Transect #: GPS 8

Meters (m)	Size	PIfl	JUsc	PIpo	PSme	POtr	PIen	PIco	Other (specify)	Total trees	Total *P.m.* & *P.f.*
(60)	S M L Tot										
(70)	S M L Tot										
(80)	S M L Tot										
(90)	S M L Tot										
(100)	S M L Tot										
(110)	S M L Tot										
(120)	S M L Tot										
(130)	S M L Tot										
(140)	S M L Tot										
(150)	S M L Tot										
Totals	S M L Tot										

over →

TFN 5 1/110
RECD MAR 15, 2011

MCC Tree Sampling Transect Field Form

Date: 2009-11-29 Worker(s): JB Transect placement & #: convenience + to correlate w/ P.S. data GPS 9
UTM Zone_____ Datum _____ Coordinates _____ (zero m)
UTM Zone_____ Datum _____ Coordinates _____ (end m)
Legal Location (TRSQQ): Sect 36
Location text: drainage N of Area C South pit
Proposed Pit Code (9A etc.): Area C south Position at Pit (middle S side toward center, etc.):
N of Pit in drainage above site of future SRd. pond
Transect Azimuth (degrees): na
Transect Width (5m default or wider optional) – trees in my path while on other business – est. 2m wide
Transect Length (50m default, or longer optional): see GPS data m if needed → 2116 ft (CAD)
Area = 13,880 ft² = 0.32 AC

Meters (m)	Size	PIfl	JUsc N all trees	~~PIpo~~	~~PSme~~	~~POtr~~	~~PIen~~	~~PIco~~	~~Other~~ (specify)	Total trees	Total *P.m.* & *P.f.*
Ø A5 Pit 7A drainage thru rec	S M L Tot										
10	S M L Tot										
20	S M L Tot										
30	S M L Tot										
40	S M L Tot										
50	S M L Tot										
~~(Sub-)~~ Totals	S M L Tot	1 - - 1	20 1 6 27							21 1 6 28	1 - - 1

Key

Notation/Conventions

L
Tree on line,
part hanging out of transect,
count as 0.5 trees

Underscored tic – beetle-infested

(Circled tic) – standing beetle-killed

Fallen trees not counted as trees but considered litter

Size Classes

S small
M medium
L large

Species

JUsc
Juniperus scopulorum Rocky Mountain juniper

PIco
Pinus contorta
lodgepole pine

PIen
Picea engelmannii
Engelmann spruce

PIfl
Pinus flexilis
limber pine

PIpo
Pinus ponderosa
ponderosa pine

POtr
Populus tremuloides
quaking aspen

Psme
Pseudotsuga menziesii
Douglas fir

Js
Pc
Pe
Pp
Ponderosa
Pf
Pt
Pm

TFN 5 1/110
RECD MAR 15, 2011

Transect #: GPS 9

Meters (m)	Size	PIfl	JUsc	PIpo	PSme	POtr	PIen	PIco	Other (specify)	Total trees	Total *P.m.* & *P.f.*
(60)	S M L Tot										
(70)	S M L Tot										
(80)	S M L Tot										
(90)	S M L Tot										
(100)	S M L Tot										
(110)	S M L Tot										
(120)	S M L Tot										
(130)	S M L Tot										
(140)	S M L Tot										
(150)	S M L Tot										
Totals	S M L Tot										

over ↑

TFN 5 1/110
RECD MAR 15, 2011

MCC Tree Sampling Transect Field Form

Date: 2009-11-30 #1 Worker(s): JWB Transect placement & #: Around Toe of AS-E6 Pit GPS 10

UTM Zone_____ Datum _____ Coordinates _____ (zero m)

UTM Zone_____ Datum _____ Coordinates _____ (end m)

Legal Location (TRSQQ): _____

Location text: Around toe (W and) of E6 pit

Proposed Pit Code (9A etc.): ~~AS-E6~~ (AS#3) Position at Pit (middle S side toward center, etc.): N, W+S of pit area

Transect Azimuth (degrees): varies

Transect Width (5m default or wider optional) 50-100 area m

Transect Length (50m default, or longer optional): area m see ARCgis or AutoCAD

Area = 3.70 Ac

Meters (m)	Size	PIfl	JUsc	PIpo	PSme	POtr	PIen	PIco	Other (specify)	Total trees	Total *P.m.* & *P.f.*
0	S M L Tot										
10	S M L Tot										
20	S M L Tot										
30	S M L Tot										
40	S M L Tot										
50	S M L Tot										
(Sub-) Totals	S M L Tot										

over ↓

Key

Notation/Conventions

L
Tree on line,
part hanging out of transect,
count as 0.5 trees

Underscored tic – beetle-infested

(Circled tic) – standing beetle-killed

Fallen trees not counted as trees but considered litter

Size Classes

S small
M medium
L large

Species

JUsc
Juniperus scopulorum Rocky Mountain juniper

PIco
Pinus contorta
lodgepole pine

PIen
Picea engelmannii
Engelmann spruce

PIfl
Pinus flexilis
limber pine

PIpo
Pinus ponderosa
ponderosa pine

POtr
Populus tremuloides
quaking aspen

Psme
Pseudotsuga menziesii
Douglas fir

TFN 5 1/110
RECD MAR 15.2011

Transect #: GPS 10

Meters (m)	Size	PIfl	JUsc	PIpo	PSme	POtr	PIen	PIco	Other (specify)	Total trees	Total *P.m.* & *P.f.*
(60)	S M L Tot										
(70)	S M L Tot										
(80)	S M L Tot										
(90)	S M L Tot										
(100)	S M L Tot										
(110)	S M L Tot										
(120)	S M L Tot										
(130)	S M L Tot										
(140)	S M L Tot										
(150)	S M L Tot										
Totals	S M L Tot	- 1 - 1	26 - 6 32							26 1 6 33	- 1 - 1

TFN 5 1/110
RECD MAR 15, 2011

MCC Tree Sampling Transect Field Form Around 7A Pit

Date: 2009-11-30 #2 Worker(s): JwB Transect placement & #: GPS 11

UTM Zone_____ Datum _____ Coordinates _____ (zero m)

UTM Zone_____ Datum _____ Coordinates _____ (end m)

Legal Location (TRSQQ): S 31, 36, + 30

Location text: Around 7A Pit

Proposed Pit Code (9A etc.): A5-7A (A8-2) Position at Pit (middle S side toward center, etc.): N, ~~A~~ Center + W

Transect Azimuth (degrees): varies

Transect Width (5m default or wider optional) _____m

Transect Length (50m default, or longer optional): _____m see ARCgis or AutoCAD Area = 0.53 Ac (CAD)

Meters (m)	Size	PIfl	JUsc	PIpo	PSme	POtr	PIen	PIco	Other (specify)	Total trees	Total *P.m.* & *P.f.*
0	S M L Tot										
10	S M L Tot										
20	S M L Tot										
30	S M L Tot										
40	S M L Tot										
50	S M L Tot										
(Sub-) Totals	S M L Tot										

over ↓

Key

Notation/Conventions

L
Tree on line,
part hanging out of transect,
count as 0.5 trees

Underscored tic – beetle-infested

(Circled tic) – standing beetle-killed

Fallen trees not counted as trees but considered litter

Size Classes

S small
M medium
L large

Species

JUsc
Juniperus scopulorum Rocky Mountain juniper

PIco
Pinus contorta
lodgepole pine

PIen
Picea engelmannii
Engelmann spruce

PIfl
Pinus flexilis
limber pine

PIpo
Pinus ponderosa
ponderosa pine

POtr
Populus tremuloides
quaking aspen

Psme
Pseudotsuga menziesii
Douglas fir

TFN 5 1/110
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Transect #: GPS 11

Meters (m)	Size	PIfl	JUsc	PIpo	PSme	POtr	PIen	PIco	Other (specify)	Total trees	Total *P.m.* & *P.f.*
(60)	S M L Tot										
(70)	S M L Tot										
(80)	S M L Tot										
(90)	S M L Tot										
(100)	S M L Tot										
(110)	S M L Tot										
(120)	S M L Tot										
(130)	S M L Tot										
(140)	S M L Tot										
(150)	S M L Tot										
Totals	S M L Tot	1 ~~1111~~ ~~1111~~ ~~1111~~ ~~1111~~ ~~1111~~ – 26	111 – – 3	11 – – 2						26 4 – 31	23 4 – 29

TFN 5 1/110
RECD MAR 15, 2011

MCC Tree Sampling Transect Field Form

GR 12

Date: 2009-11-30 #3 Worker(s): JWB Transect placement & #: Cottonwood Drainage above Miller Res below warren pit

UTM Zone 13N Datum _____ Coordinates _____ (zero m)

UTM Zone _____ Datum _____ Coordinates _____ (end m)

Legal Location (TRSQQ): _____ S30

Location text: Cottonwood Drainage above Miller Residence on Eagle's Nest + below Warren Reclamation

Proposed Pit Code (9A etc.): _____ Position at Pit (middle S side toward center, etc.): _____

Transect Azimuth (degrees): varies but generally WNW

Transect Width (5m default or wider optional) walking path m – assume 2m or 6.56ft

Transect Length (50m default, or longer optional): → m see ARCview or AutoCAD → 1937.6ft

Area = 0.29 Ac

Meters (m)	Size	PIfl	JUsc	PIpo	PSme	POtr	PIen	PIco	Other (specify)	Total trees	Total *P.m.* & *P.f.*
0	S M L Tot										
10	S M L Tot										
20	S M L Tot										
30	S M L Tot										
40	S M L Tot										
50	S M L Tot										
(Sub-) Totals	S M L Tot										

over ↓

Key

Notation/Conventions

L
Tree on line,
part hanging out of transect,
count as 0.5 trees

Underscored tic – beetle-infested

(Circled tic) – standing beetle-killed

Fallen trees not counted as trees but considered litter

Size Classes

S small
M medium
L large

Species

JUsc
Juniperus scopulorum Rocky Mountain juniper

PIco
Pinus contorta
lodgepole pine

PIen
Picea engelmannii
Engelmann spruce

PIfl
Pinus flexilis
limber pine

PIpo
Pinus ponderosa
ponderosa pine

POtr
Populus tremuloides
quaking aspen

Psme
Pseudotsuga menziesii
Douglas fir

TFN 5 1/110
RECD MAR 15, 2011

Transect #: GPS12

Meters (m)	Size	PIfl ☆	JUsc	PIpo ☆	PSme	POtr	PIen	PIco	Other (specify)	Total trees	Total *P.m.* & *P.f.*
(60)	S M L Tot										
(70)	S M L Tot										
(80)	S M L Tot										
(90)	S M L Tot										
(100)	S M L Tot										
(110)	S M L Tot										
(120)	S M L Tot										
(130)	S M L Tot										
(140)	S M L Tot										
(150)	S M L Tot										
Totals	S M L Tot	2 2 - 4	21 5 6 32	2 1 - 3						25 8 6 39	4 3 - 7

☆ ☆

TFN 5 1/110
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MCC Tree Sampling Site Field Form

#1

Date: 2009-12-01 Worker(s): JWB Transect/Site placement & #: Fiber optic Rd. GPS 13
UTM Zone 13 N Datum _____ Coordinates E 457058 N 4569554 (zero m)
UTM Zone 13 N Datum NAD 83 Coordinates E 459260 N 4568415 (end m)
Legal Location (TRSQQ): NW¼ S 18 & S 17 e ½
Location text: From Buck Sullivan Spring Rd Gate up Fiber Optic Rd. on Rd - staying in truck counting trees within stone's throw
Proposed Pit Code (9A etc.): 6 Position at Pit (middle S side toward center, etc.): N+W of pit area, both sides of pit line
Transect Azimuth (degrees): various but following rd.
Transect/Site Width (5m default or wider optional): two stone's throw ~ 100m
Transect/Site Length (50m default, or longer optional): _____ m see ARCpad
Area = 77.7 AC (ROAD)

Meters (m) or _____	Size	PIfl	JUsc	PIpo	PSme	POtr	PIen	PIco	Other (specify)	Total trees	Total *P.m.* & *P.f.*
0	S M L Tot										
10	S M L Tot										
20	S M L Tot										
30	S M L Tot										
40	S M L Tot										
50	S M L Tot										
(Sub-) Totals (+over)	S M L Tot										

over ↓

Key

Notation/Conventions

L
Tree on line,
part hanging out of transect,
count as 0.5 trees

Underscored tic – beetle-infested

(Circled tic) – standing beetle-killed

Fallen trees not counted as trees but considered litter

Size Classes

S small
M medium
L large

Species

JUsc
Juniperus scopulorum Rocky Mountain juniper

PIco
Pinus contorta
lodgepole pine

PIen
Picea engelmannii
Engelmann spruce

PIfl
Pinus flexilis
limber pine

PIpo
Pinus ponderosa
ponderosa pine

POtr
Populus tremuloides
quaking aspen

Psme
Pseudotsuga menziesii
Douglas fir

TFN 5 1/110
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Transect/Site #: GPS 13

Meters (m) or _____	Size	PIfl	JUsc	PIpo	PSme	POtr	PIen	PIco	Other (specify)	Total trees	Total *P.m.* & *P.f.*
(60)	S M L Tot										
(70)	S M L Tot										
(80)	S M L Tot										
(90)	S M L Tot										
(100)	S M L Tot										
(110)	S M L Tot										
(120)	S M L Tot										
(130)	S M L Tot										
(140)	S M L Tot										
(150)	S M L Tot										
Totals	S M L Tot	17 ~~IIII~~ ~~IIII~~ I 1 28	1 1 – 2	1 – – 1						20 11 1 32	19 10 1 30

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#2 **MCC Tree Sampling Site Field Form** Fiber Optic Rd

Date: 2009-12-01 Worker(s): JWB Transect/Site placement & #: GPS 14
UTM Zone_____ Datum _____ Coordinates E459260 N4568415 (zero m)
UTM Zone_____ Datum _____ Coordinates _____ (end m)
Legal Location (TRSQQ): S17 SE
Location text: Fiber Optic Rd beginning at end of previous transect to accommodate denser trees by reducing transect width to only 20 m and on N side of Rd.
Proposed Pit Code (9A etc.): _____ Position at Pit (middle S side toward center, etc.): _____

Transect Azimuth (degrees): varies
Transect/Site Width (5m default or wider optional): 20 m(est).
Transect/Site Length (50m default, or longer optional): _____ m
As prev., still making counts without leaving track due to time, snow/storm coming
Area = 1.85 Ac per CAD;

Meters (m) or _____	Size	PIfl	JUsc	PIpo	PSme	POtr	PIen	PIco	Other (specify)	Total trees	Total *P.m.* & *P.f.*
0	S M L Tot										
10	S M L Tot										
20	S M L Tot										
30	S M L Tot										
40	S M L Tot										
50	S M L Tot										
(Sub-) Totals (+over)	S M L Tot										

over ↓

Key

Notation/Conventions

L
Tree on line,
part hanging out of transect,
count as 0.5 trees

Underscored tic – beetle-infested

(Circled tic) – standing beetle-killed

Fallen trees not counted as trees but considered litter

Size Classes

S small
M medium
L large

Species

JUsc
Juniperus scopulorum Rocky Mountain juniper

PIco
Pinus contorta
lodgepole pine

PIen
Picea engelmannii
Engelmann spruce

PIfl
Pinus flexilis
limber pine

PIpo
Pinus ponderosa
ponderosa pine

POtr
Populus tremuloides
quaking aspen

Psme
Pseudotsuga menziesii
Douglas fir

307-417

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Transect/Site #: GPS 14

Meters (m) or _____	Size	PIfl	JUsc	PIpo	PSme	POtr	PIen	PIco	Other (specify)	Total trees	Total *P.m.* & *P.f.*
(60)	S M L Tot										
(70)	S M L Tot										
(80)	S M L Tot										
(90)	S M L Tot										
(100)	S M L Tot										
(110)	S M L Tot										
(120)	S M L Tot										
(130)	S M L Tot										
(140)	S M L Tot										
(150)	S M L Tot										
Totals	S M L Tot	8 7 2 17		1 - - 1						9 7 2 18	9 7 2 18

Area = 1.85 Ac

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MCC Tree Sampling Site Field Form

(Cheyenne Pass)

Date: 2009-12-01 #3 Worker(s): JWB Transect/Site placement & #: Pioneer Rat Connections GPS 15

UTM Zone_____ Datum _____ Coordinates E457148 N 4568290 (zero m)

UTM Zone_____ Datum _____ Coordinates E459502 N4567426 (end m)

Legal Location (TRSQQ): S 18 T 5 20

Location text: Beginning at 4-way junction near Cort. ~~Gulch~~ Gully proceeding uphill to E almost to sect 21

Proposed Pit Code (9A etc.): 7A Position at Pit (middle S side toward center, etc.): N center

Transect Azimuth (degrees): varies but following rd generally E observations from truck rooftop ~~ant~~ GPS antenna + snow 0-2 ft deep.

Transect/Site Width (5m default or wider optional): 100 m

Transect/Site Length (50m default, or longer optional): _____ m

Area = 81.45 Ac per CAD

Meters (m) or _____	Size	PIfl	JUsc	PIpo	PSme	POtr	PIen	PIco	Other (specify)	Total trees	Total *P.m.* & *P.f.*
0	S M L Tot										
10	S M L Tot										
20	S M L Tot										
30	S M L Tot										
40	S M L Tot										
50	S M L Tot										
(Sub-) Totals (+over)	S M L Tot										

over ↓

Key

Notation/Conventions

L
Tree on line,
part hanging out of transect,
count as 0.5 trees

Underscored tic – beetle-infested

(Circled tic) – standing beetle-killed

Fallen trees not counted as trees but considered litter

Size Classes

S small
M medium
L large

Species

JUsc
Juniperus scopulorum Rocky Mountain juniper

PIco
Pinus contorta
lodgepole pine

PIen
Picea engelmannii
Engelmann spruce

PIfl
Pinus flexilis
limber pine

PIpo
Pinus ponderosa
ponderosa pine

POtr
Populus tremuloides
quaking aspen

Psme
Pseudotsuga menziesii
Douglas fir

TFN 5 1/110
RECD MAR 15, 2011

Transect/Site #: GPS 15

Meters (m) or	Size	PIfl	JUsc	PIpo	PSme	POtr	PIen	PIco	Other (specify)	Total trees	Total *P.m.* & *P.f.*
(60)	S M L Tot										
(70)	S M L Tot										
(80)	S M L Tot										
(90)	S M L Tot										
(100)	S M L Tot										
(110)	S M L Tot										
(120)	S M L Tot										
(130)	S M L Tot										
(140)	S M L Tot										
(150)	S M L Tot										
Totals	S M L Tot	25 – 17 1 9 1 46 2	– 1 – 1		– 5 3 8					25 0 23 1 7 1 55 2	25 0 22 1 7 1 54 2

all at upper end on rim of Gout. Gully.

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MCC Tree Sampling Site Field Form

#4

Cheyenne Pass Rd or a connection

Date: 2009-12-01 Worker(s): JWB Transect/Site placement & #: GPS 16

UTM Zone_____ Datum _____ Coordinates E459502 N4567426 (zero m)

UTM Zone_____ Datum _____ Coordinates E459561 N4567317 (end m)

Legal Location (TRSQQ): ~~S19~~ S20 part of transect N 100 m

Location text: Cheyenne Pass Rd, or a connection on Ridge S of Gov Gulch

Proposed Pit Code (9A etc.): 7A & 7B & 7C Position at Pit (middle S side toward center, etc.): N center toward E of 7A & maybe into 7B & 7C (see GIS)?

Transect Azimuth (degrees): varies but correlates w/ rd generally ESE all to N of Rd.

Transect/Site Width (5m default or wider optional): 20 m

Transect/Site Length (50m default, or longer optional): _____ m

Area = 0.82 Ac

below route departure all tree free S of Rd as road becomes undiscernable in snow. Gully

see GPS pt. (path) - I wasn't on GPS on Geo XM + rooftop antenna. Transect ended due to snow getting too deep + storm coming + vehicle overheating.

Meters (m) or _____	Size	PIfl	JUsc	PIpo	PSme	POtr	PIen	PIco	Other (specify)	Total trees	Total *P.m.* & *P.f.*
0	S M L Tot										
10	S M L Tot										
20	S M L Tot										
30	S M L Tot										
40	S M L Tot										
50	S M L Tot										
(Sub-) Totals (+over)	S M L Tot										

over ↓

Key

Notation/Conventions

L
Tree on line,
part hanging out of transect,
count as 0.5 trees

Underscored tic – beetle-infested

(Circled tic) – standing beetle-killed

Fallen trees not counted as trees but considered litter

Size Classes

S small
M medium
L large

Species

JUsc
Juniperus scopulorum Rocky Mountain juniper

PIco
Pinus contorta
lodgepole pine

PIen
Picea engelmannii
Engelmann spruce

PIfl
Pinus flexilis
limber pine

PIpo
Pinus ponderosa
ponderosa pine

POtr
Populus tremuloides
quaking aspen

Psme
Pseudotsuga menziesii
Douglas fir

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Transect/Site #: GPS 16

Meters (m) or _____	Size	PIfl	JUsc	PIpo	PSme	POtr	PIen	PIco	Other (specify)	Total trees	Total *P.m.* & *P.f.*
(60)	S M L Tot										
(70)	S M L Tot										
(80)	S M L Tot										
(90)	S M L Tot										
(100)	S M L Tot										
(110)	S M L Tot										
(120)	S M L Tot										
(130)	S M L Tot										
(140)	S M L Tot										
(150)	S M L Tot										
Totals	S M L Tot	11 11 – 4								2 2 – 4	2 2 – 4

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MCC Tree Sampling Site Field Form

Date: 2009-12-01 #5 Worker(s): JWB Transect/Site placement & #: Foothill 2-track Access Rd GPS 17

UTM Zone_____ Datum _____ Coordinates E 457119 N 4568233 (zero m)

UTM Zone_____ Datum _____ Coordinates _____ (end m)

Legal Location (TRSQQ): S18 E+19?

Location text: _____

Proposed Pit Code (9A etc.): 7 pits? Position at Pit (middle S side toward center, etc.):

S. 18 on Foothill Access Rd heading S thru sect 19 to Gort. Gulch @ Windmill

Transect Azimuth (degrees): ~ avg 180°

Transect/Site Width (5m default or wider optional): 300 m

Transect/Site Length (50m default, or longer optional): _____ m

Area = 121.6 Ac per CAD

Meters (m) or _____	Size	PIfl	JUsc	PIpo	PSme	POtr	PIen	PIco	Other (specify)	Total trees	Total *P.m.* & *P.f.*
0	S M L Tot										
10	S M L Tot										
20	S M L Tot										
30	S M L Tot										
40	S M L Tot										
50	S M L Tot										
(Sub-) Totals (+over)	S M L Tot										

over ↓

Key

Notation/Conventions

L
Tree on line,
part hanging out of transect,
count as 0.5 trees

Underscored tic – beetle-infested

(Circled tic) – standing beetle-killed

Fallen trees not counted as trees but considered litter

Size Classes

S small
M medium
L large

Species

JUsc
Juniperus scopulorum Rocky Mountain juniper

PIco
Pinus contorta
lodgepole pine

PIen
Picea engelmannii
Engelmann spruce

PIfl
Pinus flexilis
limber pine

PIpo
Pinus ponderosa
ponderosa pine

POtr
Populus tremuloides
quaking aspen

Psme
Pseudotsuga menziesii
Douglas fir

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Transect/Site #: GPS 17

Meters (m) or	Size	PIfl	JUsc	PIpo	PSme	POtr	PIen	PIco	Other (specify)	Total trees	Total *P.m.* & *P.f.*
(60) part in sect 18 (17.05 ac)	S	–								–	–
	M	1								1	1
	L	–								–	–
	Tot	1								1	1
(70)	S										
	M										
	L										
	Tot										
(80)	S										
	M										
	L										
	Tot										
(90)	S										
	M										
	L										
	Tot										
(100)	S										
	M										
	L										
	Tot										
(110)	S										
	M										
	L										
	Tot										
(120)	S										
	M										
	L										
	Tot										
(130)	S										
	M										
	L										
	Tot										
(140)	S										
	M										
	L										
	Tot										
(150)	S										
	M										
	L										
	Tot										
Totals	S	5	4							9	5
	M	1	–							1	1
	L	–	3							3	–
	Tot	6	7							13	6

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MCC Tree Sampling Site Field Form

#6

Date: 2009-12-01 Worker(s): JWB Transect/Site placement & #: Foothill 2-track Access Rd GPS 18

UTM Zone_____ Datum _____ Coordinates _____ (zero m)

UTM Zone_____ Datum _____ Coordinates _____ (end m)

Legal Location (TRSQQ): S19 + 30

Location text: From Lower Grt Gulch windmill going S along Access Rd. to Hawlrd.

Proposed Pit Code (9A etc.): 7C, 10, 5 Position at Pit (middle S side toward center, etc.): SW of 7C, W of 5+10

Transect Azimuth (degrees): +/- South Obs. from truck, - each side Rd.

Transect/Site Width (5m default or wider optional): 100 m

Transect/Site Length (50m default, or longer optional): _____ m see GIS

Area = 33.70 Ac per CAD

Meters (m) or _____	Size	PIfl	JUsc	PIpo	PSme	POtr	PIen	PIco	Other (specify)	Total trees	Total *P.m.* & *P.f.*
0	S M L Tot										
10	S M L Tot										
20	S M L Tot										
30	S M L Tot										
40	S M L Tot										
50	S M L Tot										
(Sub-) Totals (+over)	S M L Tot										

Over ↓

Key

Notation/Conventions

L
Tree on line,
part hanging out of transect,
count as 0.5 trees

Underscored tic – beetle-infested

(Circled tic) – standing beetle-killed

Fallen trees not counted as trees but considered litter

Size Classes

S small
M medium
L large

Species

JUsc
Juniperus scopulorum Rocky Mountain juniper

PIco
Pinus contorta
lodgepole pine

PIen
Picea engelmannii
Engelmann spruce

PIfl
Pinus flexilis
limber pine

PIpo
Pinus ponderosa
ponderosa pine

POtr
Populus tremuloides
quaking aspen

Psme
Pseudotsuga menziesii
Douglas fir

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Transect/Site #: GPS 18

Meters (m) or _____	Size	PIfl	JUsc	PIpo	PSme	POtr	PIen	PIco	Other (specify)	Total trees	Total *P.m.* & *P.f.*
(60)	S M L Tot										
(70)	S M L Tot										
(80)	S M L Tot										
(90)	S M L Tot										
(100)	S M L Tot										
(110)	S M L Tot										
(120)	S M L Tot										
(130)	S M L Tot										
(140)	S M L Tot										
(150)	S M L Tot										
Totals	S M L Tot	2 - - 2	21 26 16 63							23 26 16 65	2 - - 2

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A5 Tree Field Data for Pit Areas

Table DVII8-2. Numbers of Trees to be Affected by Quarries on the Mountain Cement Company Etchepare Amendment Area, 1995.

Quarry	Number of Trees by Species: Juniper	Limber Pine	Ponderosa Pine	Total	JB per AutoCAD Acres
1	16	4	4	24	13.4
2	3	2	-	5	30.7
3	-	-	-	0	36.5
4	2	-	-	2	25.1
5	27*	9	2	38	29.7
6	4	-	-	4	27.3
7	85*	6	-	91	69.7
TOTAL	137	21	6	164	

* Many of the trees associated with pits D and F were located within, or adjacent to drainages, and may not actually be removed during mining.

Juniper heights ranged from < 1 foot to about 15 feet and diameters from < 1 to 8 inches

Limber Pine heights ranged from < 1 foot to about 20 feet and diameters from < 1 inch to 10 inches.

Ponderosa Pine heights ranged from < 1 foot to about 20 feet and diameters from < 1 inch to 10 inches.

(298C- A5)

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ADDENDUM DIX8 F

Vegetation Inventory Proposal to DEQ-LQD

TFN 5 1/110
RECD MAR 15, 2011

Memo

To: Robin Jones, DEQ-LQD Vegetation Ecologist

From: Jeff Brasher, Ph.D., Mountain Cement Company

Re: Revised July 2009 Vegetation Sampling Proposal for Etchepare Limestone Quarry Permit 298C Amendment 8 Application

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Preliminary arrangements

Livestock Grazing Status. No livestock have been on the former MCC land and Warren Livestock land this growing season, and none are scheduled to be present on the Warren Livestock property until after sampling is completed, per verbal arrangements with Doug Samuelson made June 2009.

Six of Jenelle Gaddis' horses may have been on the state land Section 36 during this growing season, but MCC and LQD believe six horses on the unpermitted 600 acres will not require grazing exclosures for resampling in the current vegetation inventory.

In part due to cattle grazing in the spring and summer of 2009 that MCC was not able to prevent, the vegetation cover study (but not other parts of the inventory such as veg. map, tree inventory, rare plants, weeds, etc.) is to exclude the 298C permitted areas in Sections 13, 24, 25, and 26, the old Piper Quarry areas. This is appropriate as: these permit area legal Sections 1) contain no land to be mined in the future, 2) are peripheral to the permit area, 3) cover a relatively small area in relation to the proposed permit, 4) are lower in elevation than the rest of the permit, 5) are not owned by MCC, 6) have been revegetated for years, and 7) are near bond release.

Cindy Avery has grazed cattle this growing season on her land which is in the permit and not yet bond released. Much of the state land Section 26 which contains the reclaimed South Piper Quarry (298C) is leased by Cindy Avery and the reclamation likely had some cattle grazing there this growing season. Other landowners besides Avery and The State of Wyoming in these four sections include MCC, The Nature Conservancy, and a number of residential owners.

The bulk of the new 298C permit area pertains to the vegetation cover sampling to be done summer 2009 described in this sampling proposal. The entire proposed permit area is to be covered by all the other portions of the vegetation inventory.

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Proposed Methods

Vegetation Mapping. The vegetation map for the area to be permitted has been made, and is digitized in AutoCAD. The half mile buffer is nearly mapped and perhaps half digitized in AutoCAD. As recommended by Rich Vincent (phone conversation about 27 May 2009), the map is not enclosed here for simplicity, but is available upon request, and of course will be submitted with the formal final package to be reviewed by DEQ-LQD.

Vegetation Type Classification. The vegetation type classification used for this study is fully compatible with but expanded from the one used by Jim Orpet for the A5 Amendment and Ron Schreibeis for the A7 Amendment. Additional vegetation types (map units) needed to be added because the new eastern permit areas are significantly higher in elevation and contain deeper canyons.

While in the field mapping vegetation I decided that the mixed shrub/grassland communities at the higher elevations were significantly different in species composition from those at the lower elevations described in earlier permit amendments, even though they are very similar in general appearance. I have designated it High Elevation Mixed Shrub/ Grassland (MSH). Similarly, Orpet's A5 map unit called Mixed Shrub/ Conifer (MC) is broadened to include similar communities at higher elevations and given a new acronym (MSC) to avoid ambiguity between terms. A notable new vegetation type is Mixed Conifer Forest (MXC). Again, this is not to be confused with Orpet's A5 Mixed Shrub / Conifer map unit that he designated MC. For the current study Mixed Conifer Forest (MXC) designates dense conifer stands, much denser than conifer patches in the Mixed Shrub/ Conifer (MSC) map units (see **Table DIX8-F-1** below).

Some Affected Tree Areas are currently included on the vegetation map, but others are yet to be determined by the tree inventory. The higher elevation Warren Livestock acquisition has at least a few trees in perhaps the majority of map polygons. By definition the Mixed Conifer Forest (MXC) and Mixed Shrub/ Conifer (MSC) map units contain significant tree cover and automatically are Affected Tree Areas where they are inside proposed disturbance boundaries. Additionally, the tree inventory is to label each map polygon of each veg. type with projected tree parameters (see **Tree Inventory** below). Numbers of trees in these areas are to be estimated with aerial photos and belt transects or numbered by direct count.

The map unit Reclaimed Land (RC) is split out of the category Disturbed Land (DL). This to make the distinction between Reclaimed Land and other types of disturbed land such as abandoned, unreclaimed quarry pits that have been left behind be other entities not associated with MCC. Rock Flat / Cushion Plant (RF) areas with sparsely vegetated flat surfaces of limestone seams on gentle slopes were mapped like the major vegetation types. Contrastingly, narrow linear limestone outcrops on steep canyon sides and other steep slopes cover a very small proportion of the land surface and can appropriately be included as part of the surrounding vegetation types (map units).

Cover Transects & Quadrats. The plan is to use one five meter transect with three 1/10 square meter quadrats for each cover sample site. Data from the three quadrats will be recorded on one field form and comprise one sample data point for considerations of statistical sample size (N). The dimensions of the transect and quadrats were recommended for this study by R. Jones of DEQ-LQD. Quadrats will be sampled for cover by species (non-vascular plants in a separate category) including litter, rock, and bare soil. These data will be reported in both absolute and relative terms.

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Cover Sample Sizes & Vegetation Types. A sampling strategy with sample numbers for vegetation types is presented in tabular form (see **Table DIX8-F-1** below). This was developed in consultation with Guideline 2 and DEQ personnel with the understanding that if statistical adequacy is not met in this study due to circumstances the study is still likely to be acceptable for baseline purposes.

We do not wish to collect sample data on certain vegetation and land cover types in the table (below) as part of this vegetation inventory. The Stock Pond (SP) vegetation type is comprised of only three small stock ponds which do not have notable natural habitat value for plants or wildlife, and one doesn't hold water. Other than roads, the Disturbed Land (DL) vegetation type in the area to be permitted consists of one open, unreclaimed quarry in the Warren Livestock land acquisition that was mined by the Wyoming Department of Transportation, and the Permit 298C MCC disturbed lands that are not yet reclaimed. One or two haulroads in Section 24 are to be built across small reclaimed areas (2002 and pre-1990; totaling 1.6 Ac) according to our draft mine plan for this application. These roads may not be relocatable elsewhere due to the mountainous terrain in the upper elevations of the area to be permitted. Guideline 2 states that if a vegetation type is to have less than 10 Ac of disturbance it may be unnecessary to sample it. We have mapped these three land cover types (SP, DL, & RC) and included them in the other aspects of the vegetation inventory, but request to not sample them unless a need becomes clear. If a need for additional disturbance arises in one of those vegetation types a supplemental vegetation study could be done then.

Determining Sample Site Locations. After vegetation map computerization was completed, a computerized procedure was used involving elements of both randomized and systematic methods. Microsoft Paint was used to generate a field of randomly placed points by using the Airbrush Tool to make black points on a white background with multiple passes from different angles. Then the same tool was used to thin these points where needed by painting white pixels over the black ones to adjust density. Empty spots were supplemented with dots made with the pencil tool. Then a square portion of this field of dots was chosen as a template to represent a 1 square mile legal section of land. The number of points in this square was estimated. The maximum number of sampling sites to be planned from the table below was divided by the number of legal land sections in the study to get the number of sites per section. The number of points in the computer image was divided by the number of sites needed per section (in one example 66). In this example the result was five. Then each fifth point would be marked for use as a potential sampling site. This image with its 66 points was loaded into an AutoCAD map. Then each of the 66 points was duplicated as a small cross in AutoCAD. Then this set of 66 crosses was copied and pasted onto each of the 1 square mile land sections of the vegetation cover inventory. Then these points were superimposed on the AutoCAD vegetation map. For each vegetation type and EXREFA to be sampled, the number of marked potential sampling points was counted. For categories having excess points, every Nth point was deleted similar to the process above. For categories having fewer points than needed, points were added in a similar fashion to produce a semi-random, semi-systematic set of the needed number of points indicated in the table below.

In the field, sample sites are to be located by pacing from landmarks identifiable on the vegetation map or with GPS readings. A pair of single digit random numbers is then to be used to randomly select the exact site by moving north the number of paces indicated by the first digit, and west the number of paces indicated by the second digit. That will be the beginning of the transect (see Cover Transects & Quadrats above).

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To achieve sample adequacy for each vegetation category in areas to be disturbed and their corresponding EXREFAs, the minimum sample size for each will be sampled, then additional sites will be sampled based on statistical analysis of sample adequacy, or to reach the maximum number of required samples.

Sampling Contingency Plan. We expect some proportion of the office-chosen sampling sites will prove unsatisfactory upon arriving in the field. This could be due to 1) rock outcrop inclusions, 2) unmapped two-track roads, 3) other unmapped mined or developed areas, or 4) inaccuracies in drawing ordinary vegetation map polygons. Tree blow down and beetle kill, if encountered, would not rule out the use of a sampling site; the site would be sampled. By recommendation of Rich Vincent (LQD), an extra 20% to 40% of sites (backup plan sites) are planned on the map to allow inappropriate sampling sites to be excluded and still have sufficient numbers of sites planned in the office for use in the field. Upon deciding that a site is inappropriate, after documenting it with a photo and notes, the first remedy will be to repeat the procedure described above move a random number of paces north and east, then choose a random azimuth for the transect. If the original site and two additional attempts with this method fail to fall on a suitable site, the site should be excluded from sampling. Photographs and notes will be taken at the site to document the rationale for excluding the site. Backup plan sites will not be sampled unless all or most regular sampling sites have been either sampled or excluded. In summary, if a regular site is inappropriate, a substitute site can easily be chosen. Then, after visiting most or all regular sites, if the number of regular and substitute sites sampled is inadequate, backup sites will be visited and either sampled or replaced with sampled substitute sites.

Cover Sampling Timeframe. All the sampling of vegetation types/map units is to be accomplished between July 4th and July 31st. This will allow adequate time to get all the sampling done when the vegetative cover is at or near its yearly maximum. If problems with manpower scheduling, transportation, or other unforeseen difficulties arise, we ask that DEQ allow until August 15th for the sampling to be completed, but MCC commits to avoid postponing sampling for any but the most compelling reasons.

Tree Inventory. Tree inventory field data is to be collected after the vegetation cover sampling is completed to allow time for sufficient cover sampling during the narrow July cover sampling window. The trees of the permit area are not rendered unidentifiable by seasonal change; sampling them later in the summer or fall (or even spring 2010) will yield the same quality of data as if it were done during the peak ground cover season of summer. Per LQD Guideline 2 and conversations with DEQ's Robin Jones, the goal of the inventory is to document tree density per unit area and specific disturbance areas by species and the three subjective size categories small, medium and large. Numbers of beetle-killed and beetle-infested trees are also to be recorded at tree field data sites. Areas with notable tree blow-down and dramatic beetle-kill are also being included on the vegetation map.

Areas to be mined at the higher elevations of the proposed permit area contain many trees (almost exclusively conifers and aspen), more than can be inventoried with exact counts. The intent is to conduct a quality sampling study. The plan is to use aerial imagery in combination with on-the-ground belt transects; where appropriate, direct counts; and special transects if circumstances dictate a need. The default size for the belt transects is to be 50m X 5m but these dimensions may be adjusted and recorded to facilitate quality data collection. Field data site choice is to be stratified by variables hypothesized to affect tree distribution, then when practical the exact position and orientation of the transect is to be chosen randomly. The following are to

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be given consideration in choosing sample sites: areas 1) to be mined, EXREFA, and transition areas between the two; 2) sites known to represent common and less-common tree species, 3) differing aspects (N-facing, S-facing, etc.); 3) public land survey legal sections; and 4) all of the mapped native vegetation types.

The study will provide adequate information to DEQ while enabling MCC management to perform cost (of stripping, mining, reclamation, and tree replacement) versus benefit (of mineral extraction) analysis for wooded areas.

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Table DIX8-F-1. Sample sizes & site numbers for transects with quadrats. Legend: MS (Mixed Shrub/ Grassland), MM (Mountain Mahogany Shrubland), RF (Rock Flat/Cushion Plant Community), MSH (High Elevation Mixed Shrub/ Grassland), MSC (Mixed Shrub – Conifer; broadened from and including Orpet's 298C A-5 map unit MC (Mixed Shrub/ Conifer), MXC (Mixed Conifer Forest; sometimes including aspen; not = Orpet's MC (Mixed Shrub/Conifer)), DL (Disturbed Land; unlike A5 study not including Reclamation), RC (Reclaimed land), SP (Stockpond; only 3 of these to be in permit, all are small, and one doesn't hold water). RF vegetation EXREFA is not to be sampled because RF will be reclaimed as a different veg. type.

		DEQ Guideline 2		MS	MM	RF	MSH	MSC	MXC	DL	RC	SP	Totals
EXREFA	**Min.**	5		5	5	-	5	5	5	-	-	-	25
	Max.	30		30	30	-	30	30	30	-	-	-	150
	Target # above min.	5 then analyze		-	-	-	30	-	-	-	-	-	175 then analyze
Affected	**Min.**	7		7	7	7	7	7	7	-	-	-	42
	Max.	30		30	30	30	30	30	30	-	-	-	180
	Target # above min.	15 then analyze		-	-	30	30	-	-	-	-	-	88 then analyze
Total Transects	**Min.**			12	12	7	12	12	12	-	-	-	66
	Max.	60		60	60	30	60	60	60	-	-		330
	Target # above min.			-	-	30	60	-	-	-	-	-	263
Total Sites Planned (main + contingency)	**Min.**	-		-	-	-	-	-	-	-	-	-	138 to 161
	Max.	-		-	-	-	-	-	-	-	-	-	648 to 756

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MAPS

DIX8

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Map DIX8-1 Permit Location
Map DIX8-2 Permit Vegetation Map with Photo Points and Cover Sample Sites
Map DIX8-3 Weed & Rare Plant Map
Map DIX8-4 Tree Inventory Map

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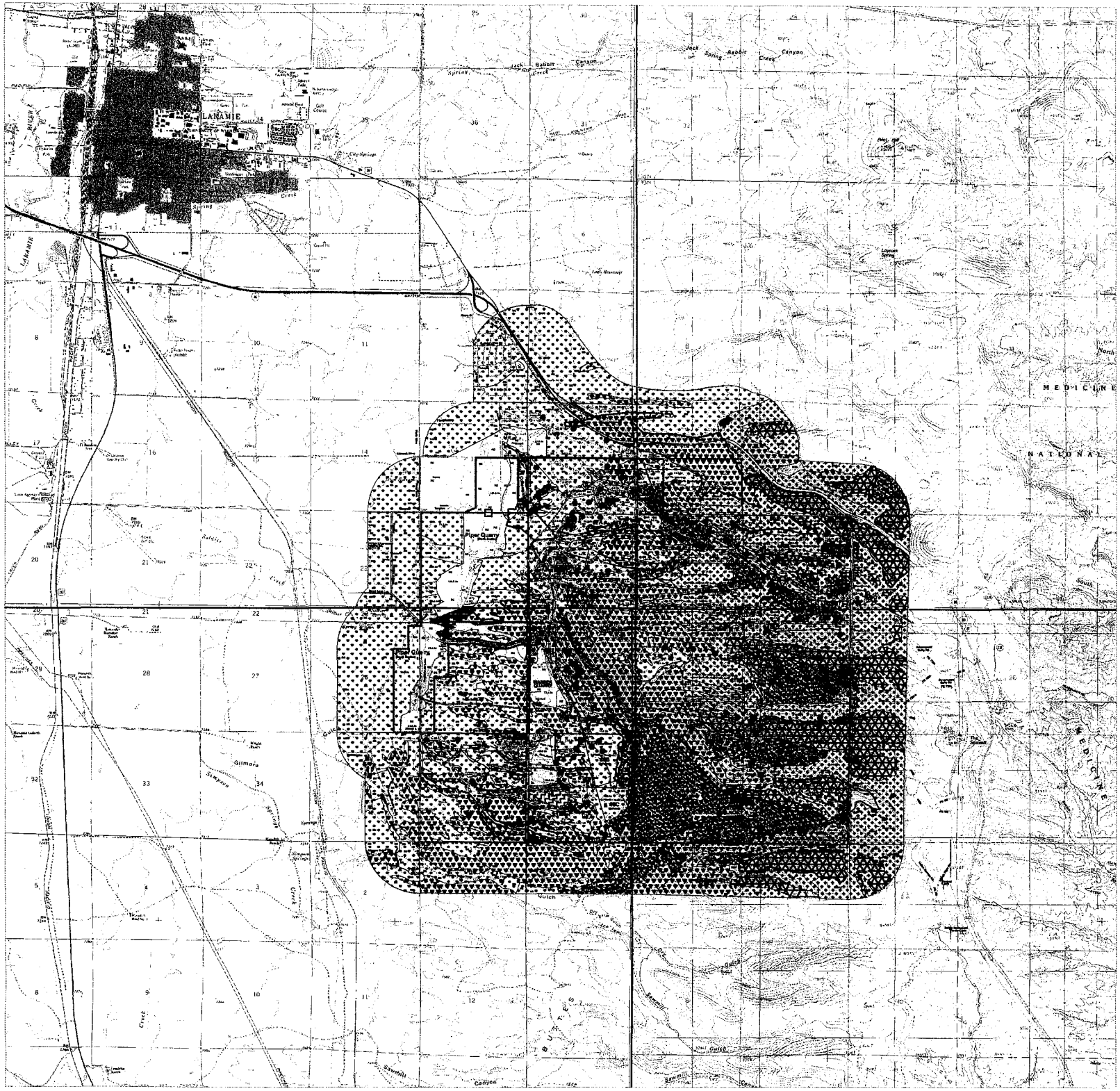
DTGD MAR 15,2011



LEGEND

Residential road

VEGETATION TYPES / MAP UNITS
within 1/2 mile buffer zone
outside permit boundary

(For other details see Maps DIX8-2, DIX8-3, and DIX8-4)

1 mile

5,280 ft

N

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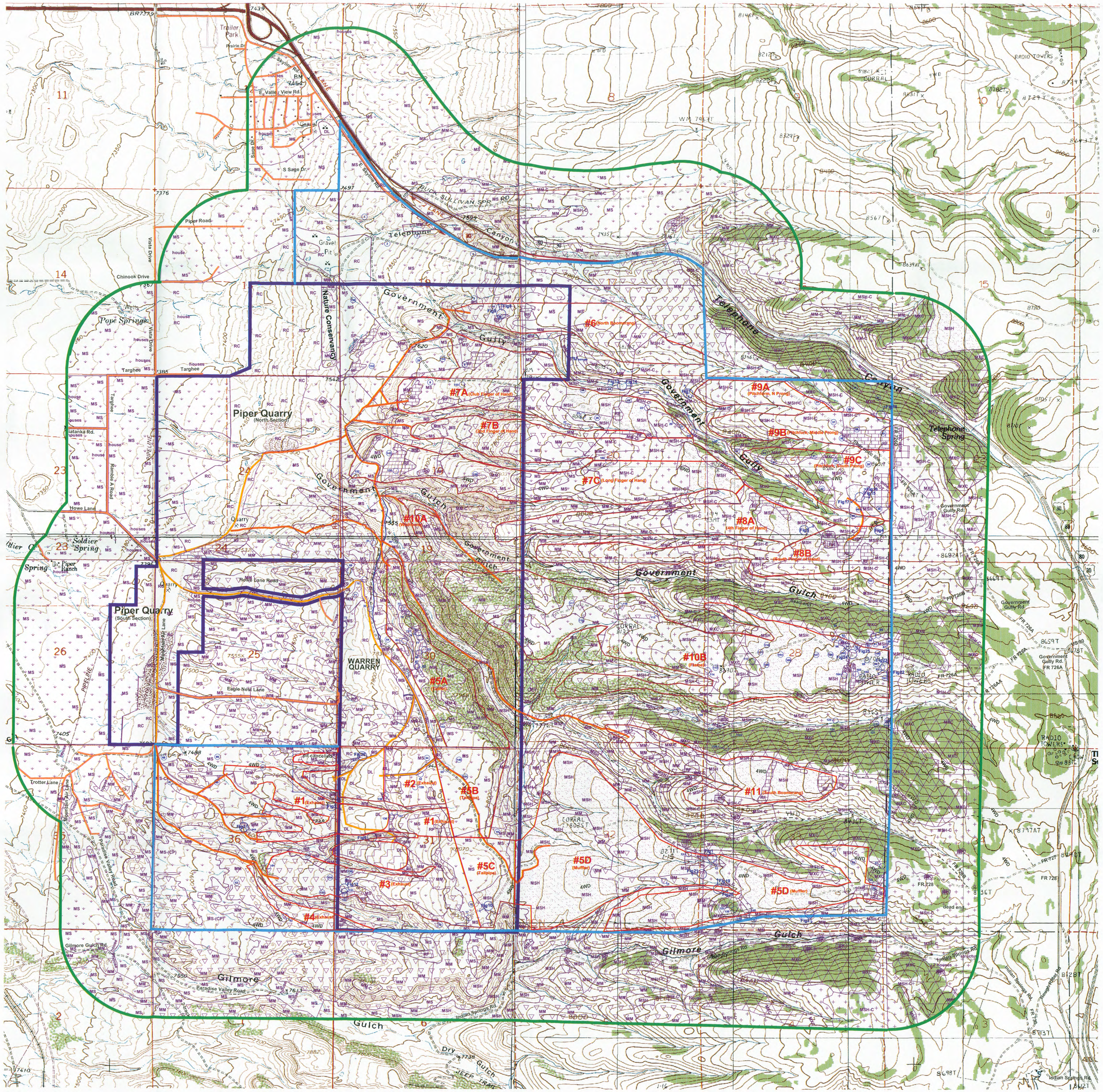
Map DIX8-1
Permit Location

Permit # 298C-A8
Etchepare Limestone Quarry

Revised By: JWB Date: 3/7/11	Mountain Cement Company	Design By: JWB Date: 3/7/11
Revised By: Date:		Drawn By: JWB Date: 3/7/11
Revised By: Date:		Checked By: Date:



LEGEND

- Proposed 298C-A8 Amendment Areas
- Currently Approved 298C Permit Area
- Half-mile buffer zone outside A8 Permit
- Proposed 298C-A8 Pit Areas to Affect, numeric Pit Codes, & Mnemonic labels for 1 or more numeric Pit Codes
- Current Haul Roads
- Proposed 298C-A8 Haul Roads
- Improved ranch access road
- Residential road
- Fences & gates

VEGETATION TYPES / MAP UNITS

- MS (Mixed Shrub/ Grassland)
- MM(-C) ((Coniferous-) Mountain Mahogany Shrubland)
- RF (Rock Flat/ Cushion Plant Community)
- MSH(-C) ((Coniferous-) High Elev. Mixed Shrub/ Grassland)
- MXC (Mixed Conifer Forest)
- no hatch — RC (Reclaimed Land)
- DL (Disturbed Land)
- SP (Stockpond)
- no hatch — RD ((Semi-)permanent Road)

SPECIAL VEG. MAP POLYGONS

- BK (Beetle-kill)
- BD (Blow-down)

134 — 159: 2009 Vegetation Cover Sample Sites, Affected Area & EXREFA

Fig 24, Fig 25: Photo Points

1/4 mile (1320 ft) — 1/2 mile (2640 ft) — 1 mile (5280 ft)

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CT 19, 2012

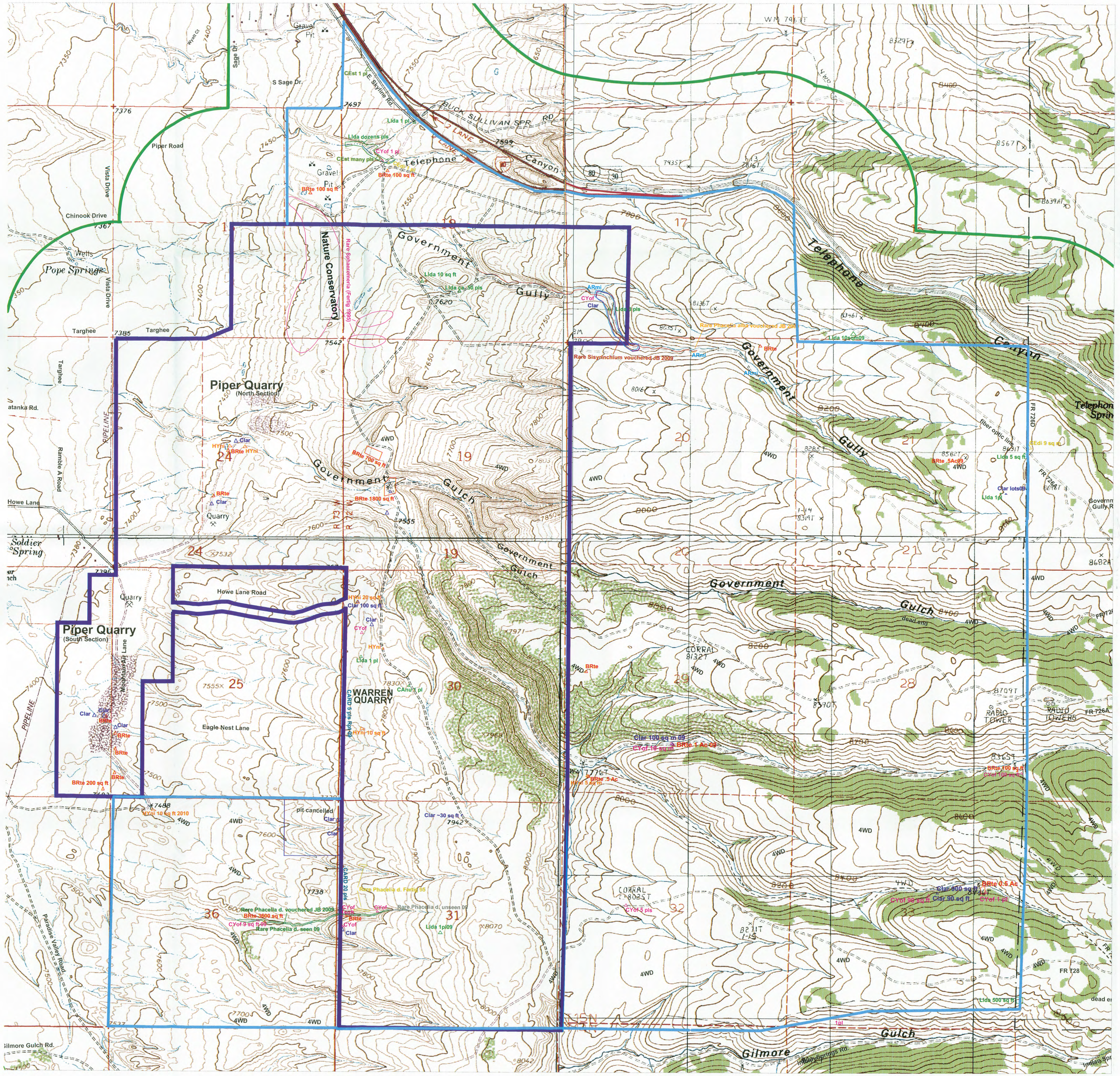
N

Map DIX8-2

Vegetation Map with Photo Points & Cover Sample Sites

Permit # 298C-A8
Etchepare Limestone Quarry

Revised By: JWB Date: 3/7/11	Mountain Cement Company	Design By: JWB Date: 3/7/11
Revised By: JWB Sept. 2012 Date:		Drawn By: JWB Date: 3/7/11
Revised By: Date:		Checked By: Date:



LEGEND

- Proposed 298C-A8 Amendment Areas
- Currently Approved 298C Permit Area
- Half-mile buffer zone outside A8 Permit

DESIGNATED NOXIOUS WEEDS

SCIENTIFIC NAME	(MAP LOCATION)
Arctium minus (ARmi)	(only Govt. Gully, see Sect 17)
Cardaria sp. (CARD)	(only W edge Sections 30 & 31)
Carduus nutans (CAnu)	(example in middle of Section 30)
Centaurea diffusa (CEdi)	(only DOT pits, Sects. 18 & 21)
Centaurea stroebe (CEst)	(only near DOT pit, Section 18 & Skyline Rd.)
Cirsium arvense (CIar)	(common, widely distributed)
Cynoglossum officinale (CYof)	(widely distributed)
Linaria dalmatica (LIda)	(widely scattered)

DECLARED WEEDS of ALBANY COUNTY

SCIENTIFIC NAME	(MAP LOCATION)
Bromus tectorum (BRte)	(widespread)
Hyoscyamus niger (HYni)	(mostly near roads)

PLANTS of SPECIAL CONCERN

Phacelia alba	(only Govt. Gully in Sect. 20)
2009 Absence of Phacelia denticulata	(only Sect. 31)
2009 Presence of Phacelia denticulata	(only Sects. 31 & 36)
1995 Presence of Phacelia denticulata (Fertig, Amendment 5,	only Sect. 31)
Range of possible locations of 2009 Sisyrinchium pallidum voucher collection	(only Govt. Gully Sects. 17, 18 & 20)
Sphaeromeria simplex distribution	(only parts of Sects. 13, 19, 24 & especially 18)

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1/4 mile — 1/2 mile — 1 mile
1320 ft — 2640 ft — 5280 ft

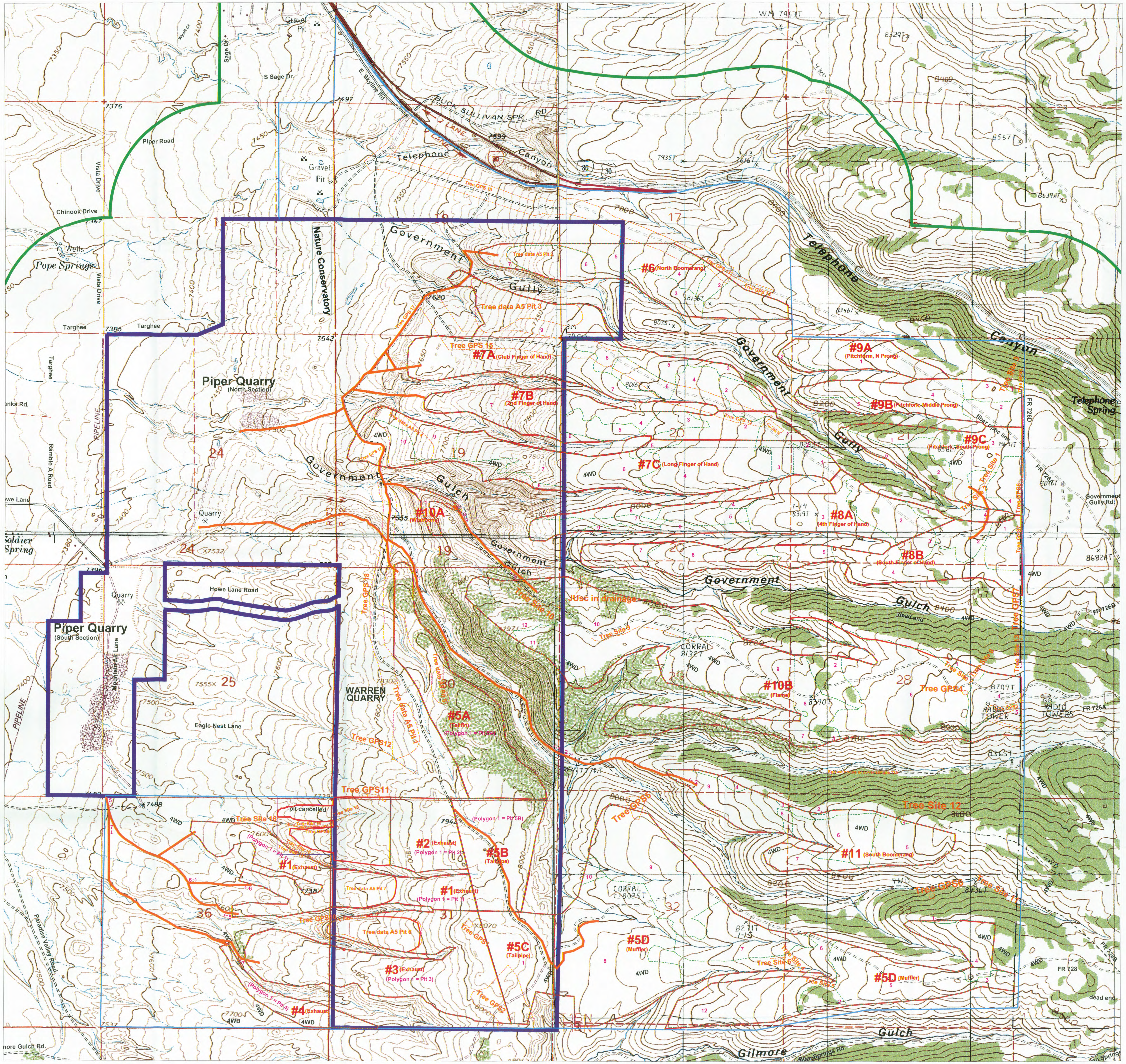
N

Map DIX8-3

Weed & Rare Plant Map

Permit # 298C-A8
Etchepare Limestone Quarry

Revised By: JWB Date: 3/7/11	Mountain Cement Company	Design By: JWB Date: 3/7/11
Revised By: JWB Sept. 2012 Date:		Drawn By: JWB Date: 3/7/11
Revised By: Date:		Checked By: Date:



LEGEND

Proposed 298C-A8 Amendment Areas

Currently Approved 298C Permit Area

Half-mile buffer zone outside A8 Permit

Proposed 298C-A8 Pit Areas to Affect, numeric Pit Codes, & Mnemonic labels for 1 or more numeric Pit Codes

Proposed 298C-A8 Haul Roads

Tree Field Data Sites

Polygon or line

Tree Site 13
Tree GPS 8
Tree data A5 Pit 3

Field Site Code Examples

(for data corresponding to Tree Field Data Sites see Table DIX8-20. Tree Inventory Field Site Metadata and Table DIX8-21. Tree Inventory Field Data By Field Site Code)

Tree Predictions

Polygon

12 Polygon Number

6 ↘ Road Segment Number & arrow

(for data corresponding to prediction polygons and road segments see Table DIX8-22 - Tree Predictions by Map Polygon, Road Segment, and Numbered Pit)

1/4 mile 1/2 mile 1 mile
1320 ft 2640 ft 5280 ft

N

Map DIX8-4

Tree Inventory Map

Permit # 298C-A8

Etchepare Limestone Quarry

Revised By: JWB	Date: 3/7/11	Mountain Cement Company 5 Sand Creek Rd. Laramie, Wyo. 82070 (307) 745-2687	Design By: JWB	Date: 3/7/11
Revised By: JWB Sept. 2012	Date:		Drawn By: JWB	Date: 3/7/11
Revised By:	Date:		Checked By:	Date:

Mine Permit 298C
Mountain Cement Company

Etchepare Permit Expansion
Amendment 298C-A8

Albany County, Wyoming

Appendix DIX9
Wildlife

Prepared for

Mountain Cement Company
5 Sand Creek Road
Laramie, WY 82070

And the
Wyoming Department of Environmental Quality
Land Quality Division
Cheyenne, WY 82001

Prepared by

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1116 Albin St.
Laramie, WY 82072

Revised: June 2012

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1.0 INTRODUCTION

Mountain Cement Company (MCC) plans to amend their existing Etchepare Mine Permit (Permit 298C) southeast of Laramie. This permit amendment number is 298C-A8 and the amendment additions are in the following two areas:

1. T15N, R73W, Section 36 (state section) – 640 acres
2. T15N, R72W, Sections 20, 21, 29, 28, 32, 33, and E ½ SW ¼ Section 17 – 3,920 acres

Permit area, vegetation types, and mining plan maps are provided elsewhere in this permit amendment application; therefore project area maps will not be presented in this Appendix. The purpose of this report is to document the baseline wildlife and wildlife habitats present on the site and in the vicinity and determine appropriate mitigation measures, if needed, to minimize impacts.

2.0 HABITAT DESCRIPTION

The Etchepare Permit Expansion covers 4,560 acres on rolling to hilly terrain. The northern-most boundary, which abuts Interstate 80, is approximately 1.5 miles southeast of the corporate limits of the city of Laramie. The amendment areas are contiguous with the existing Etchepare Permit area. Elevation ranges from 7,490 feet at the northwest and southwest corners and then rises to 8,600 feet along the eastern permit boundary. The amendment area's western boundary is in the rolling foothills and prairie habitat and then the elevation rises to the east, at first gradually and then more steeply, into the Pole Mountain area that rises beyond the eastern amendment boundary. The northeast boundary abuts the Medicine Bow National Forest.

The primary habitats on the proposed amendment area are sagebrush grassland and mountain mahogany shrub breaks. Additional habitats include cushion plant vegetation on ridge summits, a narrow strip of bottomland meadow in Government Gully, and woodland habitat primarily in the eastern third of the amendment area. There area also scattered rock outcrops, primarily along ridgelines at the lower elevations. Photographs of the habitat types are in Addendum A. Habitat types are shown on the vegetation map in Appendix D8.

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Mountain mahogany (*Cercocarpus montanus*) and big sagebrush (*Artemisia tridentata*) are the primary shrub species in the area. The sagebrush is typically 6 to 10 inches in height with areal coverage of 20 to 60 percent. The understory for both the sagebrush and mountain mahogany habitats includes such species as fringed sagebrush (*Artemisia frigida*), prickly pear cactus (*Opuntia polycantha*), phlox (*Phlox hoodii*), milkvetch (*Astragalus* spp.), wild onion (*Allium textile*), beardtongue (*Penstemon* spp.), locoweed (*Oxytropis sericea*), false dandelion (*Microseris cuspidata*), sand lily (*Leucocrinum montanum*), death camus (*Zigadenus nuttallii*), and haplopappus (*Haplopappus* spp.). Grasses include Junegrass (*Koeleria cristata*), fescue (*Fescue* spp.), and blue gramma (*Bouteloua gracilis*).

Cushion habitat, present in scattered patches primarily on ridge tops, includes haplopappus, chickweed (*Cerastium arvense*), American vetch (*Vicia americana*), fleabane (*Erigeron* spp.), fringed sagebrush and sandberg bluegrass (*Poa secunda*).

Woodland habitat, dominated by juniper (*Juniperus scopulorum*) and limber pine (*Pinus flexilis*), is present primarily at the higher elevations on the eastern third of the amendment area. The woodland habitat often intermixes with the shrubland and grassland habitats, forming a mosaic of the habitat types.

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3.0 METHODS

Wyoming Game and Fish Department (WGFD) and U.S. Fish and Wildlife Service (USFWS) personnel were contacted to obtain information on wildlife species and habitats of concern on the amendment area. Their responses are in Addendum B. In addition, the Wyoming Natural Diversity Database (WYNDD) was accessed to obtain a listing of wildlife reported on the amendment area and within a surrounding buffer area (WYNDD 2009).

Those threatened and endangered (T&E) wildlife species that need to be addressed by site surveys for individuals and/or surveys for suitable habitat are listed in Table 3-1. The list includes those species, which according to the USFWS, could occur in the area (USFWS correspondence, Addendum B). Federally listed plant species are addressed in Appendix D8-Vegetation.

Amber Travsky, a wildlife biologist with Real West, conducted field surveys in 2009 on May 28, June 17, and June 18 and in 2010 on January 2, and January 5. The survey area included the proposed permit amendment area and a 1.0-mile buffer zone.

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Table 3-1. Federally Listed Threatened, Endangered, and Candidate Wildlife Species Potentially Occurring Within the Amendment Area. [1]

Common Name	Scientific name	Status[2]	Key Habitat Characteristics	Potential on site
Birds				
Whooping crane[3]	*Grus americana*	E	Wetland marshes.	Unlikely
Interior least tern[3]	*Sterna antillarum athalassos*	E	Sandbars along rivers.	Unlikely
Piping plover[3]	*Charadrius melodus*	T	Sandbars along rivers.	Unlikely
Fish				
Pallid sturgeon[3]	*Scaphirhynchus albus*	E	Sand-covered portions of rivers.	Unlikely

[1] List provided by the U.S. Fish and Wildlife Service in correspondence dated July 2, 2009.

[2] Federal Status Definitions:
E = Endangered. T = Threatened

[3]Water depletions in the North Platte River may affect the species and/or critical habitat in downstream reaches in other states.

4.0 RESULTS

Those species previously reportedly observed on the site and listed in the WYNDD database are listed in Addendum C. The potential for the federally listed species to occur on the permit area is discussed below along with Species of Concern, raptors, big game and other wildlife.

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4.1 Threatened, Endangered and Candidate Species

In Albany County, concerns with the interior least tern, piping plover, whooping crane, and pallid sturgeon are due to water depletions in the North Platte River. They are listed for Albany County only because reduced water flow may affect the species and/or critical habitat in downstream reaches in other states. Because the proposed project will not result in any water depletions, no impacts to these species will occur and they will not be considered further.

No additional threatened or endangered wildlife species were indicated to be of concern on the site by the USFWS; therefore the proposed mine expansion will have no effect on any T&E wildlife species.

4.2 Species of Concern

The USFWS Web site (www.fws.gov) lists four wildlife species as Species of Concern which could occur in Albany County (USFWS 2010). The four species include the white-tailed prairie dog (*Cynomys leucurus*), bald eagle (*Haliaeetus leucocephalus*), greater sage-grouse (*Centrocercus urophasianus*), and mountain plover (*Charadrius montanus*). Each species is discussed in more detail below.

4.2.1 White-tailed Prairie Dog

The white-tailed prairie dog inhabits areas across western and central Wyoming, northwest Colorado, northeastern Utah, and a small area in south-central Montana. White-tailed prairie dogs typically inhabit moderately sloped grassland, desert grassland, and shrublands at altitudes between 5,500 to 9,800 feet (Keinath 2004). Black-tailed prairie dogs (*Cynomys ludovicianus*) are native to short-grass prairie habitats of western North America where they play an important role, both as an herbivore and as a prey species, in the prairie ecosystem (Hoogland 1995). They avoid heavy brush and tall grass areas due to the reduced visibility these habitats impose.

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No white-tailed or black-tailed prairie dogs were observed on the amendment area; therefore the proposed mine operations will have no affect on either of these species.

4.2.2 Bald Eagle

Winter roosting habitat for bald eagles most commonly includes areas close to (within 4 km) of coastal areas, bays, rivers, lakes, or other bodies of water that reflect the general availability of primary food sources including fish, waterfowl, and seabirds (Andrew and Mosher 1982, Green 1985, Campbell et al. 1990). Bald eagles preferentially roost in conifers or other sheltered sites in winter in some areas and they typically select larger, more accessible trees (Buehler et al. 1992).

Winter roosting habitat is present in the conifer habitat on the amendment area, although no eagles were observed during the site surveys. Bald eagle observations have been reported previously (WYNDD 2009), including two within the amendment area. It is expected bald eagles occasionally roost and forage in the area and in the vicinity. However, due to their incidental occurrence in the area, any disruption to roosting birds due to this project is unlikely; therefore the project will not affect this species.

4.2.3 Mountain Plover

The ground nesting mountain plover is typically found in areas of short (less than four inches) vegetation on slopes of less than five percent. Any short grass, very short shrub, or cushion plant community could be considered plover nesting habitat (Parrish et al. 1993), however, mountain plovers prefer shortgrass prairie with open, level or slightly rolling areas dominated by blue gramma and buffalograss (*Buchloe dactyloides*) (Graul 1975, dinsmore 1981, 1983)).

The amendment area is mostly rolling and hilly terrain, making it unsuitable for mountain plovers that prefer flat areas. Limited mountain plover habitat is present, however, in the cushion habitat on ridgetops and the species has been reported being observed on the site

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(WYNDD 2009). These areas of suitable habitat are of limited size and, as a result, likely provide only temporary stopping areas; it is unlikely this species nests in the area. The project is expected to have no affect on this species.

4.2.4 Greater Sage-grouse

Sage-grouse inhabit foothills, plains, and mountain slopes where sagebrush is present (American Ornithologists' Union 1983) or a mixture of sagebrush, meadows, and aspen in close proximity.

Sagebrush habitat is present in the area but it is limited in acreage and interspersed with mountain mahogany. The WGFD, in their correspondence about the proposed amendment, did not indicate any concerns with sage-grouse on the site or in the vicinity. Due to the hilly terrain and predominance of mountain mahogany, the area is only marginally suitable as sage-grouse habitat. Sage-grouse were listed on the WYNDD database as having been observed on the amendment area but, due to the limited amount of suitable habitat, it is not expected they would nest in the area; it's possible the observations were either historical (more than 10 years old) or were incidental and did not occur annually. The WGFD defines a lek as a traditional courtship display area attended by male sage-grouse in or adjacent to sagebrush dominated habitat. Before a site is considered a lek, it must be confirmed active for at least two years (WGFD 2006). The WGFD did not indicate any leks are in the area. Due to the lack of other evidence of sage-grouse use or extensive suitable habitat in the area, this project is expected to have no affect on the greater sage-grouse.

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4.3 Big Game

The three big game species expected and observed on the permit area and in the vicinity are elk (*Cervus elaphus*), pronghorn antelope (*Antilocapra americana*), and mule deer (*Odocoileus hemionus)*. White-tailed deer (*Odocoileus virginianus*) are also present in the area, although none were observed during site surveys. Moose (*Alces alces*) have also been reported in the Pole Mountain area and could wander onto the site.

Maps illustrating the seasonal ranges in the area for elk, pronghorn, and mule deer are in Addendum D. The amendment area is within crucial range for both elk and mule deer. It is classified as primarily spring/summer/fall or winter/yearlong for pronghorn, although crucial pronghorn range is immediately adjacent to the north. During winter surveys of the area in 2009 and 2010, all three species or their sign (tracks) were evident on the amendment area. Pronghorn were the most abundant during the January 2010 surveys. Snow cover was 100 percent on the area and tracks from all three species showed use primarily in the mountain mahogany hillsides. Use was hindered in the woodland habitat at the higher elevations (along the eastern boundary) due to snow depths averaging 8 to 15 inches with drifted areas considerably deeper. Several of the open ridgetops had snow-free patches due to wind action there was little evidence of use of these areas by big game; their preferred habitat was at the lower elevations.

4.4 Upland Game Birds

Upland game birds possible in the area include the sage-grouse already mentioned in Section 4.2.3, blue grouse (*Dendragapus obscurus*), and mourning doves (*Zenaidura macroura*).

Blue grouse inhabit coniferous forests in western North America, primarily in open habitats with a mixture of deciduous trees and shrubs (American Ornithologists' Union 1983). They prefer coniferous forest edges and aspen groves (*Populus tremuloides*) in the breeding season and coniferous forests in the winter (Aldrich 1963). While suitable habitat is present in the amendment area, this habitat will have minimal disturbance due to mining. Grouse may be

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temporarily displaced due to mining activities but the habitat will, for the most part, remain intact. As a result, this project is not expected to affect this species.

Mourning doves were observed on the amendment site. Mourning doves inhabit open woodland, forest edge, cultivated lands with scattered trees and bushes, parks and suburban areas, arid and desert country (generally near water) and second growth (American Ornithologists' Union 1983). These birds usually nest in trees or shrubs, sometimes on a stump or rock, on a ledge of a building, or on the ground. While individual birds may be displaced due to the mining operations, mourning doves are common in the area and suitable habitat is plentiful. Consequently, the proposed project is not expected to impact mourning dove populations on the site or in the vicinity.

4.5 Raptors

Five raptor nests are present within Section 36 (T15N, R73W) of the amendment area; no raptor nests were observed within the remainder of the amendment area. A golden eagle (*Aquila chrysaetos*) nest (GE-1) was reported in the 1995 Etchepare Permit but has never been located since Real West began conducting nesting surveys in 2004. Nests in the area are listed in Table 4-1. Nest identification numbers correspond to those used in the original mine permit. Of the five nests on the amendment area, none were active in 2009. A summary of the nests and their condition are provided below and photographs are in Addendum A; a map of the nest locations is in Addendum E. Specific descriptions of each of the nests within the amendment area are provided below.

Great horned owl nest (GHO 1) and ferruginous hawk nest (FH 4) in SWNE Section 36, T15N, R7W (Photo A-7 and A-8): The ferruginous hawk (*Buteo regalis*) nest on top of the rock outcrop consists only of a few scattered sticks and has likely not been used in at least five years. The rock alcove has considerable debris and evidence of use, possibly by busy-tailed woodrats (*Neotoma cinerea*). There is no evidence of avian use of the alcove in the form of feathers or

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castings. It is possible this alcove site has never been used by great horned owls (*Bubo virginianus*) or any other raptors.

Stick nests UN-5a and UN-5b in NENE Section 36, T51N, R73W (Photo A-9): These two nests are within the same juniper tree. One nest is in good condition and the other is deteriorating and in poor condition. Magpies (*Pica hudsonia*) may also used the nests, although no birds were observed at either nest or flying from the juniper tree in 2009.

Ferruginous hawk nest FH-1 (Photo A-10): This nest is on a rock outcrop and was man-created by placing sticks inside a tire. It is within the rural housing subdivision. There is no evidence of use of the nest and use by ferruginous hawks is unlikely due to the human activity in the vicinity.

Eight additional nests and two constructed nesting platforms are within one mile of the amendment boundary. Of these, only one was active in 2009. A ferruginous hawk nest (FH5), located within 0.25 mile of the Section 36 amendment boundary and within the existing permit area, was active in 2009.

Table 4-1. Raptor nests on or within one mile of the permit amendment area.

Nest I.D.	Legal	UTM (Zone 13, NAD 83)	Substrate	2009 Status	2009 Condition
Nests within amendment area					
FH-1	NENW Sec. 36, T15N, R73W	455370mE 4564420mN	Rock Outcrop	Inactive	Good
GHO-1[3]	SWNE Sec. 36, T15N, R73W	455762mE 4564069mN	Rock Outcrop	Inactive	Good
FH-4[3]	SWNE Sec. 36, T15N, R73W	455762mE 4564069mN	Rock Outcrop	Inactive	Poor
UN-5a	NENE Sec. 36, T15N, R73W	456402mE 4564414mN	Juniper	Inactive	Good
UN-5b	NENE Sec. 36, T15N, R73W	456397mE 4564404mN	Juniper	Inactive	Poor
GE-1	SESW Sec. 29, T15N, R72W	458916mE 4564606mN	Conifer	DNF	--

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Nest I.D.	Legal	UTM (Zone 13, NAD 83)	Substrate	2009 Status	2009 Condition
Nests within 1 mile of amendment boundary					
FH-2	SESE Sec. 18, T15N, R72W	458062mE 4568400mN	Rock Outcrop	Inactive	Poor
FH-3a	NWNW Sec. 1, T14N, R73W	455122mE 4562942mN	Rock Outcrop	Inactive	Fair
FH-3b	NWNW Sec 1, T14N, R73W	455240mE 4562752mN	Rock Outcrop	DNF	--
FH-5	SW Sec. 31, T15N, R72W	456879mE 4563738mN	Conifer	Active	Good
UN-1a	SW Sec. 30, T15N, R72W	456628mE 4565058mN	Juniper	Inactive	Good
UN-1b	NW Sec 31, T15N, R72W	45697mE 4564505mN	Juniper	Inactive	Poor[4]
UN-2	SW Sec. 31, T15N, R72W	456914mE 4563712mN	Snag	Inactive	Good
UN-3a[5]	SE Sec. 1, T14N, R73W	455913mE 4561718mN	Conifer	Not checked	--
UN-3b[5]	SE Sec. 1, T14N, R73W	455955mE 4561566mE	Conifer	Not checked	--
UN-4a	NW Sec. 5, T14N, R72W	458349mE 4562365mN	Conifer	DNF	--
UN-4b	NW Sec. 5, T14N, R72W	458579mE 4562613mN	Conifer	DNF	--
UN-6	NENE Sec. 36, T15N, R73W	456870mE 4564628mN	Rock Outcrop	Inactive	Good
UN-7	NWSW Sec. 30, T15N, R72W	456720mE 4565198mN	Conifer	Inactive	Good[4]
Platform –1	NE Sec. 31, T15N, R72W	457480mE 4564159mN	Man made	Inactive	Good
Platform-2	SE Sec. 25, T15N, R73W	456522mE 4564614mN	Man made	Inactive	Good

[1]Nest numbers correspond to those in the original permit application.
[2]DNF – Did not find.
[3]Same nest location with FH on top of rock outcrop and GHO in alcove.
[4] Likely a magpie nest
[5]These nests were included in the initial permit application but were not closely inspected due to lack of access on the private land and human activity and housing development in the vicinity.

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Additional raptor species expected in the area include red-tail hawks (*Buteo jamaicensis*), Swainson's hawk (*Buteo swainsoni*), American kestrel (*Falco sparverius*), northern harrier (*Circus cyaneus*), turkey vulture (*Cathartes aura*), and merlin (*Falco columbarius*). Rough-legged hawks (*Buteo lagopus*) likely winter in the area, although they were not observed during site surveys. Additional raptor species reported previously (WYNND 2009) include the northern goshawk (*Accipiter gentilis*), osprey (*Pandion haliaetus*), and peregrine falcon (*Falco peregrinus*). These later two species likely were only chance observations as the birds migrated through the area. The northern goshawk nests in timbered habitat and could be nesting within the denser woodland habitat in the adjacent National Forest.

4.6 Waterfowl and Shorebirds

Wetlands, shorelines, or other bodies of water are lacking on the amendment area. All drainages are ephemeral and do not contain water except following significant precipitation events. No waterfowl or shorebirds were observed during surveys of the area and none are expected except for brief flyovers.

4.7 Passerine Birds

A number of passerine bird species were observed on the amendment area. Species observed during the 2009/2010 surveys are listed in Table 4-2.

While mining activities could displace individuals if they are on the disturbance site, additional similar habitat is in the vicinity; therefore there is no expected impact to any passerine bird populations.

Table 4-2. Passerine birds observed on the amendment area and one-mile buffer.

Common Name	Scientific Name
Black-billed magpie	*Pica hudsonia*
Yellow-shafted flicker	*Colaptes auratus*

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Common Name	Scientific Name
American crow	*Corvus brachyrhynchos*
House finch	*Carpodacus mexicanus*
Brewer's blackbird	*Euphagus cyanocephalus*
Gray-headed Junco	*Junco hyemalis*
Chipping sparrow	*Spizella passerine*
Western wood peewee	*Contopus sordidulus*
Yellow-throat warbler	*Dendroica dominica*
Audubon's warbler	*Dendroica coronata*
Mourning dove	*Zenaida macroura*
Brewer's sparrow	*Spizella breweri*
American robin	*Turdus migratorius*
Violet-green swallow	*Tachycineta thalassina*
Rock wren	*Salpinctes obsoletus*
Downy woodpecker	*Picoides pubescens*
Mountain bluebird	*Sialia currucoides*
Western meadowlark	*Sturnella neglecta*
Song sparrow	*Melospiza melodia*
Lark bunting	*Calamospiza melanocorys*
Lark sparrow	*Chondestes grammacus*

4.8 Other Mammals

The only mammals observed on the amendment area or one-mile perimeter that have not been mentioned in previous sections are the desert cottontail (*Sylvilagus auduboni*) and least chipmunk (*Tamias minimus*). Coyote (*Canis latrans*) sign was also observed. Additional mammal species expected on the site and in the area include the red fox (*Vulpes vulpes*), American badger (*Taxidea taxus*), plains pocket gopher (*Geomys bursarius*), white-tailed jackrabbit (*Lepus townsendii*), meadow vole (*Microtus pennsylvanicus*), Richardson's ground squirrel (*Spermophilus richardsonii*), deer mouse (*Peromyscus maniculatus*), porcupine (*Erethizon dorsatum*), mountain lion (*Felis concolor*), and striped skunk (*Mephitis mephitis*).

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While mining activities could displace individuals if they are on the active mining site, additional similar habitat is in the vicinity; therefore there is no expected impact to any mammal populations.

4.9 Reptiles and Amphibians

The only amphibian species expected in the area is the boreal chorus frog (*Pseudacris triseriata*), which may inhabit the ephemeral creek area of Government Gully. Snake species potentially occurring in the area are the bullsnake (*Pituophis melanoleucas*), wandering garter snake (*Thamnophis elegans*), and prairie rattlesnake (*Crotalus viridis*).

While mining activities could displace individuals if they are on the active mining site, additional similar habitat is in the vicinity; therefore there is no expected impact to any reptile or amphibian populations.

4.10 Fish

Due to the lack of any perennial bodies of water on the site, no impacts to fish species will occur.

5.0 RECOMMENDED MITIGATION MEASURES

A summary of environmental consequences and the proposed mitigation measures are listed in Table 5-1. The area is crucial winter range for mule deer and elk and is adjacent to crucial winter range for pronghorn. No new construction will occur from November 15 through April 30 to minimize disturbance to big game in the area. Mining may continue within this time window in areas disturbed prior to the start of this timing period. Reclamation will include mountain mahogany in those areas where the shrubs existed prior to mining.

A number of raptor nests are within the amendment area or within 1-mile of the boundary. No

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construction would occur within 0.5-mile of any active raptor nest.

Table 5-1. Summary of Environmental Consequences and Recommended Mitigation Measures for the Proposed Amendment Area.

Resource/Impact	Mitigation
Threatened and Endangered Species: Habitat is lacking for the any threatened or endangered wildlife species.	No mitigation needed.
Bald Eagles: Roosting habitat is present for the bald eagle but there are no known communal night roosts.	Limited to fly-overs and temporary roosting; no mitigation needed.
Mountain Plovers: Habitat is marginal for the mountain plover and nesting is unlikely.	No mitigation needed.
Big Game Crucial winter range for mule deer and elk; near crucial habitat for pronghorn antelope.	No new construction or new disturbance from November 15 though April 15. Reclamation will include mountain mahogany shrublands.
Greater Sage-grouse No sage-grouse leks are within two miles and the site is marginal suitable sagebrush habitat.	No mitigation needed.
Raptors Five nests are within the amendment area and 8 nests and 2 platforms are within 1-mile of the amendment area.	No active construction within 0.5 mile of an active raptor nest during the nesting season (February 1 to July 31 for all raptor species).
Waterfowl and Shorebirds Habitat is lacking.	No mitigation needed.
Passerine Birds Prairie/woodland species common; habitat is plentiful in the area.	No mitigation needed.
Other Mammals Prairie/woodland species expected; habitat is plentiful in the area.	No mitigation needed.
Amphibians and Reptiles Minimal wetland habitat but species are possible; reptile species found in prairie/woodland habitat are possible.	No mitigation needed.
Fish No bodies of water will be affected by the project.	No mitigation needed.

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6.0 LITERATURE CITED

Aldrich, J. W. 1963. Geographic orientation of American tetraonidae. J. Wildl. Manage. 27(4):529-545.

American Ornithologists' Union (AOU), Committee on Classification and Nomenclature. 1983. Check-list of North American Birds. Sixth Edition. American Ornithologists' Union, Allen Press, Inc., Lawrence, Kansas.

Andrew, J.M. and J.A. Mosher. 1982. Bald eagle nest site selection and nesting habitat in Maryland. J. Wildlife Management 46:382-390.

Buehler, D. A., S. K. Chandler, T. J. Mersmann, J. D. Fraser, and J. K. D. Seegar. 1992. Nonbreeding Bald Eagle perch habitat on the northern Chesapeake Bay. Wilson Bulletin 104:540-545.

Campbell, R. W., N. K. Dawe, I. McTaggart-Cowan, J. M. Cooper, G. W. Kaiser, and M. C. E. McNall. 1990. The Birds of British Columbia. Volume 1. Nonpasserines: Introduction and loons through waterfowl. University of British Columbia Press, Vancouver, BC, Canada. 514pp.

Dinsmore, J.J. 1981. Mountain plovers, a synthesis of the literature and an annotated bibliography. 24pp.

Dinsmore, J.J. 1983. Mountain Plover *(Charadrius montanus)*. Pages 185-196 *in* J.S. Armburster (ed). Impacts of coal surface mining on 25 migratory bird species of high federal interest. USFWS Publ. OBS-83/35.

Graul, W.D. 1975. Breeding biology of the mountain plover. Wilson Bull. 87:6-31.

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Green, N. 1985. The Bald Eagle. Pp 508-531 in R.L. DiSilvestro, ed., Audubon Wildlife Report 1985. National Audubon Society, New York.

Hoogland, J.L. 1995. *The Black-Tailed Prairie Dog, Social Life of a Burrowing Mammal.* The University of Chicago Press, Chicago.

Keinath, D.A. 2004. Species Assessment for White-tailed Prairie Dog (*Cynomys leucurus*) in Wyoming prepared for Bureau of Land Management.

Parrish, T.L., S.H. Anderson, and W.F. Oelklaus. 1993. Mountain plover habitat selection in the Powder River Basin, Wyoming. Prairie Naturalist 25(3):219-226.

U.S. Fish and Wildlife Service. 2010. Species of Concern for Albany County, Wyoming. Web site: http://www.fws.gov.

Wyoming Game and Fish Department. 2006. Wyoming Sage-Grouse Definitions. Memo dated 12/08/06.

Wyoming Natural Diversity Database. 2009. Data compilation for A. Travsky, completed June 30, 2009. Unpublished report. Wyoming Natural Diversity Database, University of Wyoming, Laramie, Wyoming.

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ADDENDUM A

PHOTOGRAPHS

OF THE HABITAT TYPES
And
RAPTOR NESTS

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Photo A-1. Sagebrush grassland is prevalent on the proposed amendment area at the lower elevations.

Photo A-2. Mountain mahogany shrubland is the most common habitat at the lower to mid elevations, along the western third of the amendment area.

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Photo A-3. A narrow strip of bottomland meadow habitat is found in the drainage bottom of Government Gully. Water is present in the spring and following precipitation events.

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Photo A-4. While not a common habitat, grassland habitat is present in scattered patches along ridgetops.

Photo A-5. Rocky substrate with cushion habitat is found along open ridgelines.

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Photo A-6. Conifer habitat intermixes with shrubland and grassland along the eastern third of the amendment area.

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Photo A-7. The great horned owl (GHO 1) nest shows recent use possibly by bushy-tailed woodrats.

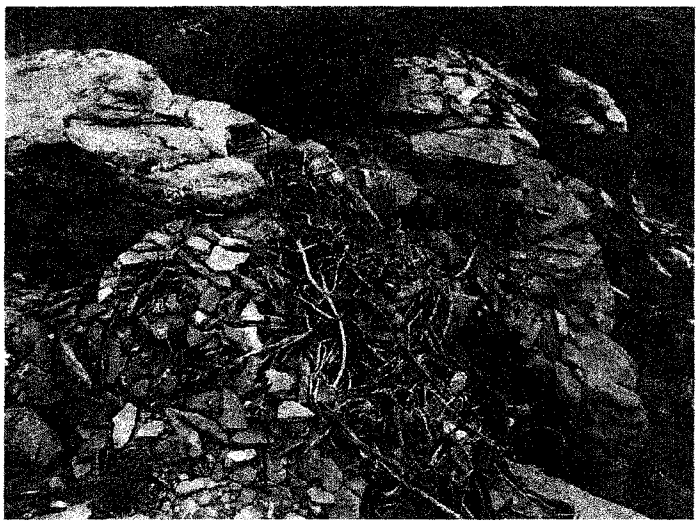

Photo A-8. Evidence of a ferruginous hawk nest (FH 4) is on the rock outcrop, above the woodrat nesting area (GHO 1). The nest is in poor condition with only minimal scattered sticks remaining.

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Photo A-9. Stick nest, UN-5b, is in a juniper tree. A second nest (UN-5a) is also in the same tree.

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Photo A-10. Ferruginous Hawk Nest FH-1 has been created by placing a pile of sticks inside a rubber tire. The nest is on a rock outcrop, within approximately 0.25 miles of a residential house.

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ADDENDUM B

Correspondence from:

U.S. Fish and Wildlife Service

Wyoming Game and Fish Department

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United States Department of the Interior

FISH AND WILDLIFE SERVICE

Ecological Services
5353 Yellowstone Road, Suite 308A
Cheyenne, Wyoming 82009

In Reply Refer To:
06E13000/WY12TA0124

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Bob Giurgevich, Project Manager
Aqua Terra Consultants, Inc.
2624 Heartland Drive
Sheridan, Wyoming 82801

Dear Mr. Giurgevich:

Thank you for your letter dated January 25, 2012, received in our office on January 27, regarding Permit No. 298C, TFN 5 1/110 concerning Mountain Cement Company's prospective mine permit amendment to the existing Etchepare limestone mining operation. This permit amendment, 298C-A8, includes two amendment areas within Albany County, Wyoming in the following locations:

1. T15N, R73W, Section 36 (state section) – 640 acres
2. T15N, R72W, Sections 20, 21, 28, 29, 32, 33, and E1/2 SW1/4 Section 17 – 3,920 acres

The permit amendment includes private, State, and Federal lands. The primary habitats on the proposed amendment area are sagebrush grassland and mountain mahogany shrub breaks. Additional habitats include cushion plant vegetation on ridge summits, a narrow strip of bottomland meadow in Government Gully, and woodland habitat primarily in the eastern third of the amendment area. The area also has scattered rock outcrops, primarily along ridgelines at the lower elevations.

Pursuant to Wyoming regulations, mining applicants are required to consult with the U.S. Fish and Wildlife Service (Service) prior to submission of the permit application to the Wyoming Department of Environmental Quality (Chapter 2, Regular Noncoal Mine Permit Applications, Section 1(f)). Therefore, we are providing general information that may assist the applicant in preparing their application. Please also note that because the project requires an action (e.g., an approval) from another Federal agency, the Service is required to consult directly with the other Federal agency related to endangered and threatened species unless that agency formally designates a non-Federal representative (50 CFR 402.08). The Bureau of Land Management will evaluate and consult with the Service as may be appropriate concerning the effects of this project to listed species and other areas of Service responsibility.

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In response to your request, the Service is providing you with recommendations for protective measures for threatened and endangered species in accordance with the Endangered Species Act of 1973, as amended (Act), 16 U.S.C. 1531 *et seq*. We are also providing recommendations concerning migratory birds in accordance with the Migratory Bird Treaty Act (MBTA), 16 U.S.C. 703, and the Bald and Golden Eagle Protection Act (BGEPA), 16 U.S.C. 668. Wetlands are afforded protection under Executive Orders 11990 (wetland protection) and 11988 (floodplain management), as well as section 404 of the Clean Water Act. Other fish and wildlife resources are considered under the Fish and Wildlife Coordination Act, as amended, 16 U.S.C. 661 *et seq*., and the Fish and Wildlife Act of 1956, as amended, 16 U.S.C. 742a-742j.

Additionally, you requested Service review of a wildlife report prepared for the mine expansion, Appendix DXI9, with specific comments needed on the content of Section 5.0. Previous correspondence on this project from the Service to Ms. Amber Travsky of Real West Natural Resource Consulting (WY09SL0272; letter dated July 2, 2009) was included as an attachment to the wildlife report. The information contained in that letter is still valid, but the Service has made two additions to the Service's Species List for Albany County. Prebles' meadow jumping mouse (*Zapus hudsonius preblei*) has been added as a threatened species, and greater sage-grouse (*Centrocercus urophasianus*) has been added as a candidate species. Our current species list for Albany County can be found at http://www.fws.gov/wyominges/PDFs/CountySpeciesLists/Albany.pdf.

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Greater sage-grouse: Your wildlife report states that no sage-grouse leks are within 2 miles of the proposed permit area and the site is marginal suitable sagebrush habitat. We recommend you contact the Wyoming Game and Fish Department to identify important greater sage-grouse habitats, recommended seasonal restrictions within the project area, and appropriate measures to minimize potential impacts from the proposed project. The Service recommends surveys and mapping of important greater sage-grouse habitats where local information is not available. The results of these surveys should be used in project planning to minimize potential impacts to this species. No project activities that may exacerbate habitat loss or degradation should be permitted in important habitats.

Preble's Meadow Jumping Mouse: Your wildlife report includes Preble's meadow jumping mouse in Table 4-1. Wildlife observed on the permit area or within a 4-mile buffer around the site, reported on the Wyoming Natural Diversity Database.

Federal listing status under the Act for Preble's meadow jumping mouse as a threatened species in Wyoming was reinstated on August 6, 2011 (76 FR 47490). Preble's meadow jumping mouse is a small rodent in the Zapodidae family and is one of 12 recognized subspecies of *Z. hudsonius*, the meadow jumping mouse. This species has a body length of 3 to 4 inches, a bicolored tail 4 to 6 inches in length, large hind feet adapted for jumping, and a distinct dark stripe down the middle of its back bordered on either side by gray to orange-brown fur. Their diet consists of seeds, fruits, fungi, and insects. Preble's meadow jumping mouse is primarily nocturnal or crepuscular, but has been observed during daylight. Hibernation occurs from October to May in small burrows the mouse excavates several centimeters underground.

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Preble's meadow jumping mouse exhibits a preference for lush vegetation along watercourses or herbaceous understories in wooded areas near water. The mouse occurs in low undergrowth consisting of grasses or forbs; in wet meadows and riparian corridors; or areas where tall shrubs and low trees provide adequate cover. The species uses upland habitats as far as 330 feet beyond the 100-year floodplain. In Wyoming, Preble's meadow jumping mouse has been documented in Albany, Laramie, Platte, and Converse Counties and may also occur in Goshen County. If a proposed project will disturb suitable habitat within any of these five counties, surveys should be conducted prior to any action. Due to the difficulty in identifying the Preble's meadow jumping mouse, surveys should be conducted by knowledgeable biologists trained in conducting these surveys.

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General Recommendation: We recommend any ground disturbing activities be undertaken outside of the migratory bird-nesting season (February 1 – August 31). If this is not possible, surveys for all migratory birds should be conducted on the permit site and within 0.5-mile (1 mile for ferruginous hawks) of the outside edge of the permit boundary prior to land clearing activities to determine if active migratory bird nests are present within the permit area.

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If surveys identify active raptor nests, please implement the species-specific buffers identified in attachment 2. These buffers should be utilized until the project is completed, or until the young fledge, or the nest fails and is no longer active that year. If avoidance of existing nests in not possible, mitigation measures should be developed in coordination with the Service and state wildlife agency to avoid nest failure.

Migratory Birds: The MBTA, enacted in 1918, prohibits the taking of any migratory birds, their parts, nests, or eggs except as permitted by regulations, and does not require intent to be proven. Section 703 of the MBTA states, "Unless and except as permitted by regulations ... it shall be unlawful at any time, by any means or in any manner, to ... take, capture, kill, attempt to take, capture, or kill, or possess ... any migratory bird, any part, nest, or eggs of any such bird..." The BGEPA, prohibits knowingly taking, or taking with wanton disregard for the consequences of an activity, any bald or golden eagles or their body parts, nests, or eggs, which includes collection, molestation, disturbance, or killing. Work that could lead to the take of a migratory bird or eagle, their young, eggs, or nests (for example, if you are going to erect new roads, or power lines in the vicinity of a nest), should be coordinated with our office before any actions are taken.

Removal or destruction of such nests, or causing abandonment of a nest could constitute violation of one or both of the above statutes. Removal of any active migratory bird nest or nest tree is prohibited. For golden eagles, inactive nest permits are limited to activities involving resource extraction or human health and safety. Mitigation, as determined by the local Service field office, may be required for loss of these nests. No permits will be issued for an active nest of any migratory bird species, unless removal of an active nest is necessary for reasons of human health and safety. Therefore, if nesting migratory birds are present on, or near the project area, timing is a significant consideration and needs to be addressed in project planning.
If nest manipulation is proposed for this project, the project proponent should contact the Service's Migratory Bird Office in Denver at 303-236-8171 to see if a permit can be issued for this project. No nest manipulation is allowed without a permit. If a permit cannot be issued, the

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Enclosure 1

Migratory Bird Species of Management Concern in Wyoming
(Migratory Birds of High Federal Interest)
Based on the *Wyoming Bird Conservation Plan* (Cerovski et al. 2000)
May 2, 2002
U.S. Fish and Wildlife Service, Wyoming Field Office,
5353 Yellowstone Road - Suite 308A, Cheyenne, Wyoming 82009

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The Wyoming Field Office of the U.S. Fish and Wildlife Service (Service) has compiled the following list from the ongoing work among State and Federal agencies, non-governmental organizations, and the interested public that produced the Wyoming Bird Conservation Plan. This list will now serve as our list of Migratory Bird Species of Management Concern in Wyoming, in place of the previous list based on the Migratory Nongame Birds of Management Concern in the United States: the 1995 List. The Wyoming Bird Conservation Plan identified priority species based on a number of criteria (see below) using the best information available for these generally un-studied species. In many cases, this list reflects identified threats to habitat because no information is available on the species population trends. In some cases it reflects identified population declines though no causal factors have been identified.

The following tables and explanatory text are taken directly from the Wyoming Bird Conservation Plan (Cerovski et al. 2000). For more information on this listing process, this report is available from our Wyoming Field Office, 5353 Yellowstone Road, Suite 308A, Cheyenne, Wyoming 82009; or Wyoming Game and Fish Department (WGFD), Nongame Branch, 260 Buena Vista, Lander, Wyoming 82520.

Table 1. **Level I Species (Conservation Action).** Species clearly needs conservation action. Includes species of which Wyoming has a high percentage of and responsibility for the breeding population, and the need for additional knowledge through monitoring and research into basic natural history, distribution, etc.

Species	PIF Score[a]	AI[b]	PT[c]	Primary Habitat Type(s)
Mountain Plover[d]	28	4	3	Shortgrass Prairie, Shrub-steppe
Trumpeter Swan	26	3	3	Wetlands
Sage Grouse	26	5	3	Shrub-steppe
McCown's Longspur	26	3	2	Shortgrass Prairie, Shrub-steppe
Baird's Sparrow	26	2	3	Shortgrass Prairie
Ferruginous Hawk	23	4	3	Shrub-steppe, Shortgrass Prairie
Brewer's Sparrow	23	5	5	Shrub-steppe, Mountain-foothills Shrub
Wilson's Phalarope	22	3	5	Wetlands
Franklin's Gull	22	3	3	Wetlands
Sage Sparrow	22	5	2	Shrub-steppe, Mountain-foothills Shrub

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Enclosure 1

Table 1. **Level I Species (Conservation Action)**, continued.

Species	PIF Score[a]	AI[b]	PT[c]	Primary Habitat Type(s)
Swainson's Hawk	21	3	3	Plains/Basin Riparian
Long-billed Curlew	21	2	3	Shortgrass Prairie
Short-eared Owl	20	3	3	Shortgrass Prairie
Northern Goshawk	19	4	3	High Elevation Conifer, Mid Elevation Conifer, Aspen
Peregrine Falcon	19	3	3	Specialized (cliffs)
Burrowing Owl	19	3	4	Shortgrass Prairie
Forster's Tern	19	2	3	Wetlands
Bald Eagle	18	3	3	Montane Riparian, Plains/Basin Riparian
Upland Sandpiper	18	2	2	Shortgrass Prairie
Black Tern	18	3	3	Wetlands
Whooping Crane	n/a	n/a	n/a	Wetlands
Piping Plover	n/a	n/a	n/a	Wetlands, Aquatic

[a] From the PIF Priority Database (Carter et al. 1997).
[b] AI ' Area Importance (from the PIF Priority Database, Carter et al. 1997).
[c] PT ' Population Trend (from the PIF Priority Database, Carter et al. 1997).
[d] Species in all capital letters previously appeared on the Service's 1995 list.

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Enclosure 1

Table 2. **Level II Species (Monitoring)**. The action and focus for the species is monitoring. Includes species of which Wyoming has a high percentage of and responsibility for the breeding population, species whose population trend is unknown, species that are peripheral for breeding in the habitat or state, or species for which additional knowledge is needed.

Species	PIF Score[a]	AI[b]	PT[c]	Primary Habitat Type(s)
Calliope Hummingbird	23	5	3	Mid Elevation Conifer, Montane Riparian
Lewis' Woodpecker	23	3	3	Low Elevation Conifer, Plains/Basin Riparian
Cassin's Kingbird	22	3	3	Juniper Woodland, Plains/Basin Riparian
Lark Bunting	22	4	4	Shortgrass Prairie, Shrub-steppe
American White Pelican	21	3	3	Aquatic
Williamson's Sapsucker	21	3	3	Mid Elevation Conifer
Black-backed Woodpecker	21	3	3	Mid Elevation Conifer, High Elevation Conifer
Gray Flycatcher	21	3	3	Juniper Woodland, Mountain-foothills Shrub
Juniper Titmouse [d]	21	3	3	Juniper Woodland
Dickcissel	21	3	3	Shortgrass Prairie
Chestnut-collared Longspur	21	2	3	Shortgrass Prairie
Harlequin Duck	20	3	3	Montane Riparian
Snowy Plover	20	3	3	Wetlands
Black-chinned Hummingbird	20	2	3	Plains/Basin Riparian, Shrub-steppe
Rufous Hummingbird	20	2	3	Mid Elevation Conifer
Red-naped Sapsucker	20	3	2	Aspen
Three-toed Woodpecker	20	4	3	Mid Elevation Conifer, High Elevation Conifer
Willow Flycatcher	20	3	4	Montane Riparian, Plains/Basin Riparian
Hammond's Flycatcher	20	2	3	High Elevation Conifer with Aspen, Montane Riparian
Cordilleran Flycatcher	20	3	3	Montane Riparian, Mid Elevation Conifer
Pygmy Nuthatch	20	3	3	Low Elevation Conifer
Marsh Wren	20	3	4	Wetlands
American Dipper	20	3	3	Montane Riparian
Plumbeous Vireo	20	3	3	Mid Elevation Conifer, Low Elevation Conifer
Townsend's Warbler	20	3	3	High Elevation Conifer, Mid Elevation Conifer
Dusky Flycatcher	19	3	2	Low Elevation Conifer, Aspen, Mountain-foothills Shrub

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Table 2. **Level II Species (Monitoring)**, continued.

Species	PIF Score[a]	AI[b]	PT[c]	Primary Habitat Type(s)
Western Bluebird	19	3	3	Juniper Woodland, Low Elevation Conifer
Sage Thrasher	19	5	2	Shrub-steppe
Grasshopper Sparrow	19	3	5	Shortgrass Prairie, Shrub-steppe
Bobolink	19	2	3	Shortgrass Prairie, Shrub-steppe
Common Loon	18	3	3	Wetlands
Black-billed Cuckoo	18	2	3	Plains/Basin Riparian
Red-headed Woodpecker	18	2	3	Plains/Basin Riparian, Low Elevation Conifer
Yellow-billed Cuckoo	18	3	3	Plains/Basin Riparian
Eastern Screech-Owl	18	3	3	Plains/Basin Riparian
Western Screech-Owl	18	3	3	Plains/Basin Riparian
Great Gray Owl	18	3	3	Mid Elevation Conifer, High Elevation Conifer
Boreal Owl	18	3	3	High Elevation Conifer
Broad-tailed Hummingbird	18	2	2	Montane Riparian, Plains/Basin Riparian, Mid Elevation Conifer
Western Scrub-Jay[d]	18	3	3	Juniper Woodland
Loggerhead Shrike	18	3	3	Shrub-steppe
Vesper Sparrow	18	5	4	Shrub-steppe
Lark Sparrow	18	3	4	Shrub-steppe
Golden-crowned Kinglet	17	3	3	High Elevation Conifer
MacGillivray's Warbler	17	3	1	Montane Riparian, Plains/Basin Riparian
Ash-throated Flycatcher[d]	16	2	3	Juniper Woodland
Bushtit[d]	16	3	3	Juniper Woodland
Brown Creeper	16	3	3	Mid Elevation Conifer, High Elevation Conifer
Merlin	15	3	3	Low Elevation Conifer
Sprague's Pipit	n/a	n/a	n/a	Grassland, Plains/Basin Riparian, Shortgrass Prairie
Barn Owl	n/a	n/a	n/a	Shortgrass Prairie, Urban
White-faced Ibis	n/a	n/a	n/a	Wetlands, Aquatic
American Bittern	n/a	n/a	n/a	Wetlands, Aquatic
Common Tern	n/a	n/a	n/a	Wetlands, Aquatic
Purple Martin	n/a	n/a	n/a	Wetlands, Aquatic/Basin Riparian, Montane Riparian

[a] From the PIF Priority Database (Carter et al. 1997).
[b] AI ' Area Importance (from the PIF Priority Database).
[c] PT ' Population Trend (from the PIF Priority Database).
[d] Nicholoff, S. 2002. Wyoming Bird Conservation Plan, Version 1.1. Wyoming Partners In Flight and Wyoming Game and Fish Department, Lander. In press.

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Wyoming Partners In Flight Process for Prioritizing Species

Wyoming Partners In Flight participants developed the current list of priority species based on a combination of the seven criteria in the national Partners In Flight Priority Database (Carter et al. 1997). This database serves as a defensible method of prioritizing both species and habitats in need of conservation. The criteria include Wyoming-dependent and Wyoming-independent factors. The Wyoming-independent criteria are constant over a species' range and do not vary for each species. The Wyoming-dependent criteria were the key components used to prioritize species and their conservation action needs. In the absence of any more rigorous statewide surveys, Breeding Bird Survey data dating back to 1968 were used to determine population trends in Wyoming.

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Criteria

Within each criterion below, a species was given a rank score ranging from 1 to 5, with 1 being the least critical rank and 5 the most critical. Each ranked species could potentially receive a low score of 7 and a high score of 35. However, setting conservation goals based only on total score could be misleading; therefore, each total score was reviewed in conjunction with its component parts. In Wyoming, species were initially ranked using total score, area importance, and population trend.

1. Relative Abundance (RA) - The abundance of a bird, in appropriate habitat within its entire range, relative to other bird species. This criterion gives an indication of a species' vulnerability to withstand cataclysmic environmental changes. A low score would indicate a higher relative abundance, therefore reducing the risk of complete extirpation from losses in one or more regions. Higher scores indicate a lower relative abundance, thus more vulnerability to drastic losses or population changes.

2. Breeding Distribution (BD) - A relative measure of breeding range size as a proportion of North America (defined as the main body of the continent, excluding Greenland, through Panama and the islands of the Caribbean, comprising an area of 22,059,680 km^2 [National Geographic Society 1993]), and as such it provides an index of a species' vulnerability to random environmental events. High scores indicate localized breeding, thus a higher likelihood of serious decline from drastic environmental changes. Low scores indicate wide breeding distribution, therefore less likelihood of extirpation. Used for breeding birds only.

3. Non-breeding Distribution (ND) - A relative measure of non-breeding, or winter, range size as a proportion of North America, and as such it provides an index of a species' vulnerability to random environmental events. High scores indicate localized distribution on the non-breeding grounds. Low scores indicate wide distribution on the non-breeding grounds, therefore less likelihood of extirpation. Used for wintering birds only.

4. Threats on Breeding Grounds (TB) - The ability of a habitat in an area to support populations of a species in that area. Two factors are considered here: 1) each species' demographic and ecological vulnerability (the potential inability of a species to recover from population loss by normal reproductive effort due to low reproductive rate, high juvenile mortality, or both; and the level of ecological specialization of a species and, hence, its potential

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inability to withstand environmental change), and 2) habitat loss or disruption (a combination of the amount of habitat or conditions necessary for survival and reproductive success that has been lost since 1945, and the amount that is anticipated to be lost in the future). High scores indicate either a large loss of habitat or a species that is an extreme ecological specialist. Low scores indicate a stable or increasing habitat or a species that is an ecological generalist. Used for both breeding and wintering birds.

5. Threats on Non-breeding Grounds (TN) - Range-wide threats on non-breeding, or winter, grounds. This is scored using the same criteria as threats on breeding grounds but reflects non-breeding issues, including migratory habitat. Used for wintering birds only.

6. Population Trend (PT) - The overall population trend of each species assigned independently for each state, province, or physiographic area. This criterion must meet two thresholds, reliability and magnitude, to warrant either a very high or very low score. When possible, a score was assigned using BBS data, which incorporated a population trend uncertainty score based on the statistical validity of the BBS data (i.e. a species must be detected on a minimum of 14 BBS routes per state for population trends to have statistical significance). This criterion was chosen to alert managers to species with modest, but certain, population declines.

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7. Area Importance (AI) - The abundance of a species within a state, province, or physiographic area relative to its abundance throughout its range. This criterion helps direct conservation efforts toward areas that are most important to a species' survival. Area Importance is scored locally; therefore, high scores indicate that a large proportion of the species' breeding or winter range occurs in Wyoming, or a species is using a habitat that is only available in Wyoming. Low scores indicate that a small proportion of the species' range occurs in Wyoming, or the preferred habitat is widespread across its range. Used for both breeding and wintering birds.

Priority Species

Priority bird species in Wyoming were identified from the PIF Priority Database (Carter et al. 1997) and by qualitative, informed decisions. Those species with a total score of 18 or above, Area Importance (AI) of 3 or above, and/or Population Trend (PT) of 3 or above from the database, or with a total score less than 18 but of significant local interest were identified as the highest priority species. However, as more information becomes available, the highest priority species for Wyoming may change, as this is a dynamic database that allows for updated information to be periodically inserted and reviewed. The primary habitat type or types required for breeding were identified for each species to determine the highest priority habitat types for the state.

Literature Cited

Carter, M. F., W. C. Hunter, D. N. Pashley, J. S. Bradley, C. S. Aid, J. Price, and G. S. Butcher. 1997. Setting landbird conservation priorities for states, provinces, and physiographic areas of North America. Partners In Flight Priority Database Final Report, Colorado Bird Observatory, Brighton.

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Cerovski, A., M. Gorges, T. Byer, K. Duffy, and D. Felley. 2000. Wyoming Bird Conservation Plan, Version 1.0. Wyoming Partners In Flight, Lander, WY.

Nicholoff, S. 2002. Wyoming Bird Conservation Plan, Version 1.1. Wyoming Partners In Flight and Wyoming Game and Fish Department, Lander. In press.

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U.S. Fish and Wildlife Service, Wyoming Ecological Services Field Office

Protections for Raptors

Raptors, or birds of prey, and the majority of other birds in the United States are protected by the Migratory Bird Treaty Act, 16 U.S.C. 703 (MBTA). A complete list of migratory bird species can be found in the Code of Federal Regulations at 50 CFR 10.13. Eagles are also protected by the Bald and Golden Eagle Protection Act, 16 U.S.C. 668 (Eagle Act).

The MBTA protects migratory birds, eggs and nests from possession, sale, purchase, barter, transport, import, export, and take. The regulatory definition of take, defined in 50 CFR 10.12, means to pursue, hunt, shoot, wound, kill, trap, capture, or collect, or attempt to hunt, shoot, wound, kill, trap, capture, or collect a migratory bird. Activities that result in the unpermitted take (e.g., result in death, possession, collection, or wounding) of migratory birds or their eggs are illegal and fully prosecutable under the MBTA. Removal or destruction of active nests (i.e., nests that contain eggs or young), or causing abandonment of an active nest, could constitute a violation of the MBTA, the Eagle Act, or both statutes. Removal of any active migratory bird nest or any structure that contains an active nest (e.g., tree) where such removal results in take is prohibited. Therefore, if nesting migratory birds are present on or near a project area, project timing is an important consideration during project planning. As discussed below, the Eagle Act provides additional protections for bald and golden eagles and their nests. For additional information concerning nests and protections under the MBTA, please see the U.S. Fish and Wildlife Service's (Service) Migratory Bird Permit Memorandum, MBMP-2.

The Service's Wyoming Ecological Services Field Office works to raise public awareness about the possible occurrence of birds in proposed project areas and the risk of violating the MBTA, while also providing guidance to minimize the likelihood that take will occur. We encourage you to coordinate with our office before conducting actions that could lead to the take of a migratory bird, their young, eggs, or active nests (e.g., construction or other activity in the vicinity of a nest that could result in a take). If nest manipulation is proposed for a project in Wyoming, the project proponent should also contact the Service's Migratory Bird Office in Denver at 303-236-8171 to see if a permit can be issued. Permits generally are not issued for an active nest of any migratory bird species, unless removal of the nest is necessary for human health and safety. If a permit cannot be issued, the project may need to be modified to ensure take of migratory birds, their young or eggs will not occur.

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For infrastructure (or facilities) that have potential to cause direct avian mortality (e.g., wind turbines, guyed towers, airports, wastewater disposal facilities, transmission lines), we recommend locating structures away from high avian-use areas such as those used for nesting, foraging, roosting or migrating, and the travel zones between high-use areas. If the wildlife survey data available for the proposed project area and vicinity do not provide the detail needed to identify normal bird habitat use and movements, we recommend collecting that information prior to determining locations for any infrastructure that may create an increased potential for avian mortalities. We also recommend contacting the Service's Wyoming Ecological Services office for project-specific recommendations.

Additional Protections for Eagles

The Eagle Act protections include provisions not included in the MBTA, such as the protection of unoccupied nests and a prohibition on disturbing eagles. Specifically, the Eagle Act prohibits knowingly taking, or taking with wanton disregard for the consequences of an activity, any bald or golden eagle or their body parts, nests, chicks or eggs, which includes collection, possession, molestation, disturbance, or killing. The term "disturb" is defined as "to agitate or bother a bald or golden eagle to a degree that causes, or is likely to cause, based on the best scientific information available, (1) injury to an eagle, (2) a decrease in its productivity, by substantially interfering with normal breeding, feeding, or sheltering behavior, or (3) nest abandonment, by substantially interfering with normal breeding, feeding, or sheltering behavior" (50 CFR 22.3 and see also 72 FR 31132).

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The Eagle Act includes limited exceptions to its prohibitions through a permitting process. The Service has issued regulations concerning the permit procedures for exceptions to the Eagle Act's prohibitions (74 FR 46836), including permits to take golden eagle nests which interfere with resource development or recovery operations (50 CFR 22.25). The regulations identify the conditions under which a permit may be issued (i.e., status of eagles, need for action), application requirements, and other issues (e.g., mitigation, monitoring) necessary in order for a permit to be issued.

For additional recommendations specific to Bald Eagles please see our Bald Eagle information web page (http://www.fws.gov/wyominges/Pages/Species/Species_SpeciesConcern/BaldEagle.html).

Recommended Steps for Addressing Raptors in Project Planning

Using the following steps in early project planning, agencies and proponents can more easily minimize impacts to raptors, streamline planning and permitting processes, and incorporate measures into an adaptive management program:

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1. Coordinate with appropriate Service offices, Wyoming Game and Fish Department, Tribal governments, and land-management agencies at the earliest stage of project planning.
2. Identify species and distribution of raptors occurring within the project area by searching existing data sources (e.g., Wyoming Game and Fish Department, Federal land-management agencies) and by conducting on-site surveys.
3. Plan and schedule short-term and long-term project disturbances and human-related activities to avoid raptor nesting and roosting areas, particularly during crucial breeding and wintering periods
4. Determine location and distribution of important raptor habitat, nests, roost sites, migration zones and, if feasible, available prey base in the project impact area.
5. Document the type, extent, timing, and duration of raptor activity in important use areas to establish a baseline of raptor activity.
6. Ascertain the type, extent, timing, and duration of development or human activities proposed to occur, and the extent to which this differs from baseline conditions.
7. Consider cumulative effects to raptors from proposed projects when added to past, present, and reasonably foreseeable actions. Ensure that project mitigation adequately addresses cumulative effects to raptors.
8. Minimize loss of raptor habitats and avoid long-term habitat degradation. Mitigate for unavoidable losses of high-valued raptor habitats, including (but not limited to) nesting, roosting, migration, and foraging areas.
9. Monitor and document the status of raptor populations and, if feasible, their prey base post project completion, and evaluate the success of mitigation efforts.
10. Document meaningful data and evaluations in a format that can be readily shared and incorporated into wildlife databases (contact the Service's Wyoming Ecological Services office for details).

Protection of nesting, wintering (including communal roost sites), and foraging activities is considered essential to conserving raptors. In order to promote the conservation of migratory bird populations and their habitats, Federal agencies should implement those strategies directed by Executive Order 13186, "Responsibilities of Federal Agencies To Protect Migratory Birds" (66 FR 3853).

Recommended Seasonal and Spatial Buffers to Protect Nesting Raptors

Because many raptors are particularly sensitive to disturbance (that may result in take) during the breeding season, we recommend implementing spatial and seasonal buffer zones to protect individual nest sites/territories (Table 1). The buffers serve to minimize visual and auditory impacts associated with human activities near nest sites. Ideally, buffers would be large enough to protect existing nest trees and provide for alternative or

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replacement nest trees. The size and shape of effective buffers vary depending on the topography and other ecological characteristics surrounding the nest site. In open areas where there is little or no forested or topographical separation, distance alone must serve as the buffer. Adequate nesting buffers will help ensure activities do not take breeding birds, their young or eggs. For optimal conservation benefit, we recommend that no temporary or permanent surface occupancy occur within species-specific spatial buffer zones. For some activities with very substantial auditory impacts (e.g., seismic exploration and blasting) or visual impacts (e.g., tall drilling rig), a larger buffer than listed in Table 1 may be necessary, please contact the Service's Wyoming Ecological Services office for project specific recommendations on adequate buffers.

As discussed above, for infrastructure that may create an increased potential for raptor mortalities, the spatial buffers listed in Table 1 may not be sufficient to reduce the incidence of raptor mortalities (for example, if a wind turbine is placed outside a nest disturbance buffer, but inadvertently still within areas of normal daily or migratory bird movements); therefore, please contact the Service's Wyoming Ecological Services office for project specific recommendations on adequate buffers.

Buffer recommendations may be modified on a site-specific or project-specific basis based on field observations and local conditions. The sensitivity of raptors to disturbance may be dependent on local topography, density of vegetation, and intensity of activities. Additionally, individual birds may be habituated to varying levels of disturbance and human-induced impacts. Modification of protective buffer recommendations may be considered where biologically supported and developed in coordination with the Service's Wyoming Ecological Services Field Office.

Because raptor nests are often initially not identified to species (e.g., preliminary aerial surveys in winter), we first recommend a generic raptor nest seasonal buffer guideline of January 15th – August 15th. Similarly, for spatial nesting buffers, until the nesting species has been confirmed, we recommend applying a 1-mile spatial buffer around the nest. Once the raptor species is confirmed, we then make species-specific and site-specific recommendations on seasonal and spatial buffers (Table 1).

Activities should not occur within the spatial/seasonal buffer of any nest (occupied or unoccupied) when raptors are in the process of courtship and nest site selection. Long-term land-use activities and human-use activities should not occur within the species-specific spatial buffer of occupied nests. Short-term land use and human-use activities proposed to occur within the spatial buffer of an occupied nest should only proceed during the seasonal buffer after coordination with the Service, State, and Tribal wildlife resources management agencies, and/or land-management agency biologists. If, after coordination, it is determined that due to human or environmental safety or otherwise unavoidable factors, activities require temporary incursions within the spatial and seasonal buffers, those activities should be planned to minimize impacts and monitored to determine whether impacts to birds occurred. Mitigation for habitat loss or degradation should be identified and planned in coordination with applicable agencies.

Please contact the Service's Wyoming Ecological Services Field Office if you have any questions regarding the status of the bald eagle, permit requirements, or if you require technical assistance regarding the MBTA, Eagle Act, or the above recommendations. The recommended spatial and seasonal buffers are voluntary (unless made a condition of permit or license) and are not regulatory, and they do not supersede provisions of the MBTA, Eagle Act, Migratory Bird Permit Memorandum (MBMP-2), and Endangered Species Act. Assessing legal compliance with the MBTA or the Eagle Act and the implementing regulations is ultimately the authority and responsibility of the Service's law enforcement personnel. Our recommendations also do not supersede Federal, State, local, or Tribal regulations or permit conditions that may be more restrictive.

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Table 1. Service's Wyoming Ecological Services Field Office's Recommended Spatial and Seasonal Buffers for Breeding Raptors

Raptors of Conservation Concern (see below for more information)

Common Name	Spatial buffer (miles)	Seasonal buffer
Golden Eagle	0.50	January 15 - July 31
Ferruginous Hawk	1.00	March 15 - July 31
Swainson's Hawk	0.25	April 1 - August 31
Bald Eagle	see Bald Eagle information web page[1]	
Prairie Falcon	0.50	March 1 - August 15
Peregrine Falcon	0.50	March 1 - August 15
Short-eared Owl	0.25	March15- August 1
Burrowing Owl	0.25	April 1 – September 15
Northern Goshawk	0.50	April 1 - August 15

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Additional Wyoming Raptors

Common Name	Spatial buffer (miles)	Seasonal buffer
Osprey	0.25	April 1 - August 31
Cooper's Hawk	0.25	March 15 – August 31
Sharp-shinned Hawk	0.25	March 15 – August 31
Red-tailed Hawk	0.25	February 1 – August 15
Rough-legged Hawk (winter resident only)	----	----
Northern Harrier	0.25	April 1 - August 15
Merlin	0.50	April 1 - August 15
American Kestrel	0.125	April 1 – August 15
Common Barn Owl	0.125	February 1 – September 15
Northern Saw-whet Owl	0.25	March 1 - August 31
Boreal Owl	0.25	February 1 – July 31
Long-eared Owl	0.25	February 1 – August 15
Great Horned Owl	0.125	December 1 – September 30
Northern Pygmy-Owl	0.25	April 1 – August 1
Eastern Screech -owl	0.125	March 1 – August 15
Western Screech-owl	0.125	March 1 – August 15
Great Gray Owl	0.25	March 15 – August 31

[1] http://www.fws.gov/wyominges/Pages/Species/Species_SpeciesConcern/BaldEagle.html

Raptors of Conservation Concern

The Service's Birds of Conservation Concern (2008) report identifies "species, subspecies, and populations of all migratory nongame birds that, without additional conservation actions, are likely to become candidates for listing" under the Endangered Species Act (16 U.S.C 1531 et seq.). This report is intended to stimulate coordinated and proactive conservation actions among Federal, State, and private partners. The Wyoming Partners in Flight Wyoming Bird Conservation Plan identifies priority bird species and habitats, and establishes objectives for bird populations and habitats in Wyoming. This plan also recommends conservation actions to accomplish the population and habitat objectives.

We encourage project planners to develop and implement protective measures for the Birds of Conservation Concern as well as other high-priority species identified in the Wyoming Bird Conservation Plan. For

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additional information on the Birds of Conservation Concern that occur in Wyoming, please see our Birds of Conservation Concern web page.

Additional Planning Resources

Avian Power Line Interaction Committee (APLIC). 2006. Suggested Practices for Avian Protection on Power Lines: The State of the Art in 2006. Edison Electric Institute, APLIC, and the California Energy Commission. Washington, D.C. and Sacramento, CA.

Edison Electric Institute and the Raptor Research Foundation. 1996. Suggested Practices for Raptor Protection on Power Lines - The State of the Art in 1996. Washington, D.C.

Edison Electric Institute's Avian Power Line Interaction Committee and U.S. Fish and Wildlife Service. 2005. Avian Protection Plan Guidelines.

Edison Electric Institute and the Raptor Research Foundation. 1994. Mitigating Bird Collisions with Power Lines - The State of the Art in 1994. Washington, D.C.

U.S. Fish and Wildlife Service. 2000. Siting, Construction, Operation and Decommissioning of Communications Towers and Tower Site Evaluation Form (Directors Memorandum September 14, 2000). Arlington, Virginia.

U.S. Fish and Wildlife Service. 2007. National Bald Eagle Management Guidelines. United States Department of Interior, Fish and Wildlife Service, Arlington, Virginia. 23 pp.

Wyoming Game and Fish Department Internet Link to Raptor Information

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References

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50 CFR 10.12 – Code of Federal Regulations. Title 50--Wildlife and Fisheries, Chapter I--United States Fish and Wildlife Service, Department of the Interior, Part 10--General Provisions.

50 CFR 10.13– Code of Federal Regulations. Title 50--Wildlife and Fisheries, Chapter I--United States Fish and Wildlife Service, Department of the Interior, Part 10--General Provisions.

50 CFR 22.3 – Code of Federal Regulations. Title 50--Wildlife and Fisheries, Chapter I--United States Fish and Wildlife Service, Department of the Interior, Part 22—Eagle Permits.

50 CFR 22.25– Code of Federal Regulations. Title 50--Wildlife and Fisheries, Chapter I--United States Fish and Wildlife Service, Department of the Interior, Part 22—Eagle Permits.

66 FR 3853 - Presidential Documents. Executive Order 13186 of January 10, 2001. Responsibilities of Federal Agencies To Protect Migratory Birds. Federal Register, January 17, 2001.

72 FR 31132 - Protection of Eagles; Definition of "Disturb". Final Rule. Federal Register, June 5, 2007.

74 FR 46836 - Eagle Permits; Take Necessary To Protect Interests in Particular Localities. Final Rule. Federal Register, September 11, 2009.

U.S. Fish and Wildlife Service. 2003. Migratory Bird Permit Memorandum, MBMP-2, Nest Destruction (Directors Memorandum April 15, 2003). Washington, D.C.

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U.S. Fish and Wildlife Service. 2008. Birds of Conservation Concern 2008. United States Department of Interior, Fish and Wildlife Service, Division of Migratory Bird Management, Arlington, Virginia. 85 pp.

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United States Department of the Interior

FISH AND WILDLIFE SERVICE

Ecological Services
5353 Yellowstone Road, Suite 308A
Cheyenne, Wyoming 82009

JUL 02 2009

In Reply Refer To:
ES-61411/2009SL0272

Ms. Amber Travsky
Owner/Wildlife Biologist
Real West Natural Resource Consulting
1116 Albin Street
Laramie, WY 82072

Dear Ms. Travsky:

Thank you for your letter of May 18, 2009, received in our office on May 19, regarding a permit application for the Mountain Cement Company (MCC) to expand an existing limestone mine southeast of the City of Laramie, in Albany County, Wyoming. The proposed expansion includes two areas adjacent to MCC's existing permit area and would include all of Section 36 of Township 15 North, Range 73 West; and Sections 20, 21,28, 29, 32, 33, and E1/2SW1/4Section 17 of Township 15 North, Range 72 West. The proposed additions would add a total of 3,920 acres to the permit area and would include sagebrush grassland, mountain mahogany shrub and woodland habitats.

The information you provided included a brief description of the project, including the size, location, and existing habitats. In addition, two topographic maps and an aerial photograph were included, which delineated the proposed area boundaries.

You have requested information regarding wildlife concerns. In response to your request, the U.S. Fish and Wildlife Service (Service) is providing you with a list of species covered under the Endangered Species Act (Act) of 1973, as amended (16 U.S.C. 1531 et seq.) and recommendations for protective measures for threatened and endangered species in accordance with the Act. We are also providing recommendations concerning migratory birds in accordance with the Migratory Bird Treaty Act (MBTA), 16 U.S.C. 703 and the Bald and Golden Eagle Protection Act (BGEPA), 16 U.S.C. 668. Wetlands are afforded protection under Executive Orders 11990 (wetland protection) and 11988 (floodplain management), as well as section 404 of the Clean Water Act. Other fish and wildlife resources are considered under the Fish and Wildlife Coordination Act and the Fish and Wildlife Act of 1956, as amended, 70 Stat. 1119, 16 U.S.C. 742a-742j.

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Endangered and Threatened Species

In accordance with Section 7(c) of the Act, we have determined that the following endangered or threatened species or their designated habitat may be present in the proposed project area. We would appreciate receiving information as to the current status of each of these species within the proposed project area.

Listed, Proposed, Candidate Species and their Designated and Proposed Critical Habitat that may be in the proposed Project Area

SPECIES	STATUS	Expected Occurrence
Platte River species (5 species)	Endangered/ Threatened	Downstream riverine habitat of the Platte River
Platte River species critical habitat – Whooping Crane (*Grus americana*)	Designated	Platte River system downstream of Wyoming (see 43 FR 20938)
Ute ladies'-tresses (*Spiranthes diluvialis*)	Threatened	Seasonally moist soils and wet meadows of drainages below 7,000 feet

Platte River Species: If the proposed action may lead to consumptive use of water or have the potential to affect water quality in the Platte River System, there may be impacts to threatened and endangered species inhabiting the downstream reaches of this river system. For more information on how to seek ESA coverage for water-related activities through the Platte River Recovery Implementation Program, please visit our web site at: http://www.fws.gov/platteriver.

Ute ladies'-tresses: Ute ladies'-tresses is a perennial, terrestrial orchid, 8 to 20 inches tall, with white or ivory flowers clustered into a spike arrangement at the top of the stem. *S. diluvialis* typically blooms from late July through August; however, depending on location and climatic conditions, it may bloom in early July or still be in flower as late as early October. *S. diluvialis* is endemic to moist soils near wetland meadows, springs, lakes, and perennial streams where it colonizes early successional point bars or sandy edges. The elevation range of known occurrences is 4,200 to 7,000 feet (although no known populations in Wyoming occur above 5,500 feet) in alluvial substrates along riparian edges, gravel bars, old oxbows, and moist to wet meadows. Soils where *S. diluvialis* have been found typically range from fine silt/sand, to gravels and cobbles, as well as to highly organic and peaty soil types. *S. diluvialis* is not found in heavy or tight clay soils or in extremely saline or alkaline soils. *S. diluvialis* seems intolerant of shade and small scattered groups are found primarily in areas where vegetation is relatively open. Surveys should be conducted by knowledgeable botanists trained in conducting rare plant surveys. *S. diluvialis* is difficult to survey for primarily due to its unpredictability of emergence of flowering parts and subsequent rapid desiccation of specimens. The Service does not maintain a list of "qualified" surveyors but can refer those wishing to become familiar with the orchid to experts who can provide training or services.

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Species of Concern

Black-tailed prairie dog: The Service is currently conducting a review to determine if the black-tailed prairie dog (*Cynomys ludovicianus*) warrants listing under the Act (73 FR 73211). Black-tailed prairie dogs may be found scattered in remnant populations throughout much of the range that it once occupied. A significant portion of existing occupied habitat rangewide occurs in a few large complexes. We encourage you to protect all prairie dog towns for their value to the prairie ecosystem and the many species that rely on them. We further encourage you to analyze potentially disturbed prairie dog towns for their value to future black-footed ferret reintroductions.

Migratory Birds: The MBTA, enacted in 1918, prohibits the taking of any migratory birds, their parts, nests, or eggs except as permitted by regulations, and does not require intent to be proven. Section 703 of the MBTA states, "Unless and except as permitted by regulations ... it shall be unlawful at any time, by any means or in any manner, to ... take, capture, kill, attempt to take, capture, or kill, or possess ... any migratory bird, any part, nest, or eggs of any such bird..." The BGEPA, prohibits knowingly taking, or taking with wanton disregard for the consequences of an activity, any bald or golden eagles or their body parts, nests, or eggs, which includes collection, molestation, disturbance, or killing.

Work that could lead to the take of a migratory bird or eagle, their young, eggs, or nests (for example, if you are going to erect new roads, or power lines in the vicinity of a nest), should be coordinated with our office before any actions are taken. Removal or destruction of such nests, or causing abandonment of a nest could constitute violation of one or both of the above statutes. Removal of any active migratory bird nest or nest tree is prohibited. For golden eagles, inactive nest permits are limited to activities involving resource extraction or human health and safety. Mitigation, as determined by the local Service field office, may be required for loss of these nests. No permits will be issued for an active nest of any migratory bird species, unless removal of an active nest is necessary for reasons of human health and safety. Therefore, if nesting migratory birds are present on, or near the project area, timing is a significant consideration and needs to be addressed in project planning.

If nest manipulation is proposed for this project, the project proponent should contact the Service's Migratory Bird Office in Denver at 303-236-8171 to see if a permit can be issued for this project. No nest manipulation is allowed without a permit. If a permit cannot be issued, the project may need to be modified to ensure take of a migratory bird or eagle, their young, eggs or nest will not occur.

Bald Eagle

The Service removed the bald eagle (*Haliaeetus leucocephalus*), except in portions of Arizona, from the list of threatened and endangered species protected under the Act (72 FR 37346; 73 FR 23966). However, the protections provided to the bald eagle under the BGEPA and the MBTA remain in place. The term "disturb" under the BGEPA has recently been defined as: "to agitate or bother a bald or golden eagle to a degree that causes, or is likely to cause, based on the best scientific information available, 1) injury to an eagle, 2) a decrease in its productivity, by substantially interfering with normal breeding, feeding, or sheltering behavior, or 3) nest

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abandonment, by substantially interfering with normal breeding, feeding, or sheltering behavior" (72 FR 31332). Please see our bald eagle web page for additional information at http://www.fws.gov/wyominges/Species_SpeciesConcern/BaldEagle.html.

Migratory Birds of High Federal Interest

The potential exists for Migratory Birds of High Federal Interest (MBHFI) to nest within or adjacent to the proposed permit area. The Service does not maintain site specific information on the nesting locations of the birds on the MBHFI list. Site-specific nest location information may be available from the WGFD, other applicable land management agencies, or can be determined through the use of species-specific surveys conducted on site in accordance with scientifically accepted protocols and guidelines. Once you determine which MBHFI occur on or near the project site, we can provide additional site and species-specific recommendations.

The Service's Wyoming Field Office has compiled a list of MBHFI (Attachment) from the ongoing work among State and Federal agencies, non-governmental organizations, and the interested public that produced the Wyoming Bird Conservation Plan. This list will now serve as our list of Migratory Bird Species of Management Concern in Wyoming, in place of the previous list based on the Migratory Nongame Birds of Management Concern in the United States: the 1995 List.

Wetlands/Riparian Areas: Wetlands may be impacted by the proposed project. Wetlands perform significant ecological functions which include: (1) providing habitat for numerous aquatic and terrestrial wildlife species, (2) aiding in the dispersal of floods, (3) improving water quality through retention and assimilation of pollutants from storm water runoff, and (4) recharging the aquifer. Wetlands also possess aesthetic and recreational values. If wetlands may be destroyed or degraded by the proposed action, those wetlands in the project area should be inventoried and fully described in terms of their functions and values. Acreage of wetlands, by type, should be disclosed and specific actions should be outlined to avoid, minimize, and compensate for all unavoidable wetland impacts.

Riparian or streamside areas are a valuable natural resource and impacts to these areas should be avoided whenever possible. Riparian areas are the single most productive wildlife habitat type in North America. They support a greater variety of wildlife than any other habitat. Riparian vegetation plays an important role in protecting streams, reducing erosion and sedimentation as well as improving water quality, maintaining the water table, controlling flooding, and providing shade and cover. In view of their importance and relative scarcity, impacts to riparian areas should be avoided. Any potential, unavoidable encroachment into these areas should be further avoided and minimized. Unavoidable impacts to streams should be assessed in terms of their functions and values, linear feet and vegetation type lost, potential effects on wildlife, and potential effects on bank stability and water quality. Measures to compensate for unavoidable losses of riparian areas should be developed and implemented as part of the project.

Plans for mitigating unavoidable impacts to wetland and riparian areas should include mitigation goals and objectives, methodologies, time frames for implementation, success criteria, and monitoring to determine if the mitigation is successful. The mitigation plan should also include a contingency plan to be implemented should the mitigation not be successful. In addition,

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wetland restoration, creation, enhancement, and/or preservation does not compensate for loss of stream habitat; streams and wetlands have different functions and provide different habitat values for fish and wildlife resources.

Best Management Practices (BMPs) should be implemented within the project area wherever possible. BMPs include, but are not limited to, the following: installation of sediment and erosion control devices (e.g., silt fences, hay bales, temporary sediment control basins, erosion control matting); adequate and continued maintenance of sediment and erosion control devices to insure their effectiveness; minimization of the construction disturbance area to further avoid streams, wetlands, and riparian areas; location of equipment staging, fueling, and maintenance areas outside of wetlands, streams, riparian areas, and floodplains; and re-seeding and re-planting of riparian vegetation native to Wyoming in order to stabilize shorelines and streambanks.

For our internal tracking purposes, the Service would appreciate notification of any decision made on this project (such as issuance of a permit or signing of a Record of Decision or Decision Memo). Notification can be sent in writing to the letterhead address or by electronic mail to FW6_Federal_Activities_Cheyenne@fws.gov.

We appreciate your efforts to ensure the conservation of Wyoming's fish and wildlife resources. If you have questions regarding this letter or your responsibilities under the Act and/or other authorities or resources described above, please contact Jim Kelly of my office at the letterhead address or phone (307) 772-2374, extension 232.

Sincerely,

for Scott Hicks

Brian T. Kelly
Field Supervisor
Wyoming Field Office

Enclosure

cc: WDEQ, Land Quality Division, District Supervisor, Cheyenne, WY (L. Spackman)
WGFD, Non-game Coordinator, Lander, WY (B. Oakleaf)
WGFD, Statewide Habitat Protection Coordinator, Cheyenne, WY (M. Flanderka)

Literature Cited

Litvaitis, J., J. A. Sherburne, and J. A. Bissonette. 1985. Influence of understory characteristics on snowshoe hare habitat use and density. Journal of Wildlife Management 49: 866-873.

Pietz, P. J. and J. R. Tester. 1983. Habitat selection by snowshoe hares in north central Minnesota. Journal of Wildlife Management 47: 686-696

Reeve, A., F. Lindzey, and S. Buskirk. 1986. Historic and recent distribution of the lynx in Wyoming. Wyoming Coop. Fish and Wildl. Res. U., Laramie, Wyoming. 55 pp.

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Wolff, J. O. 1980. The role of habitat patchiness in the population dynamics of snowshoe hare. Ecological Monographs 50: 111-130.

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WYOMING GAME AND FISH DEPARTMENT

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WER 7785.05
Aqua Terra Consultants Inc.
Baseline Wildlife Report for a
Prospective Amendment to the
Etchepare Mine
Permit No. 298C, TFN 5 1/110
Albany County

Bob Giurgevich
Project Manager
Aqua Terra Consultants Inc.
2624 Heartland Drive
Sheridan, WY 82801

Dear Mr. Giurgevich:

The staff of the Wyoming Game and Fish Department has reviewed the Baseline Wildlife Report for a Prospective Amendment to the Etchepare Mine Permit No. 298C, TFN 5 1/110 in Albany County. We offer the following comments for your consideration.

Terrestrial Considerations:

The document encapsulates the likely species and habitats that occur within the proposed amendment area. As noted, this area contains a substantial "stand" of mountain mahogany which is a highly sought shrub preferred by several ungulates species. Because of the vegetation that occurs at this site in combination with the terrain composition and aspect, this area provides important wintering habitat for mule deer and elk. The project boundary overlays the bulk of two WGFD mapped crucial winter ranges for elk and mule deer. Our crucial winter range stipulation recommends no human disturbance activity should occur from November 15 through April 30.

Specific to section 5 of Appendix D, we recommend our seasonal stipulation for big game crucial winter range. If activity will need to occur during the winter stipulation period, we recommend minimizing the footprint (size) of activity and minimizing machine operation and truck trips as much as possible. We appreciate including mountain mahogany in the reclamation plan. We suggest including additional native grasses and forbs as well, and including a nearby reference site for comparing reclamation progress.

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We recommend continued surveys on raptor nests and use of those nests. If nest sites become abandoned there may be opportunity for further platform installation. We recommend continued coordination with the US Fish and Wildlife Service office in Cheyenne.

Aquatic Considerations:

To minimize impacts to the aquatic resources within the project area, we recommend the following:

- Accepted best management practices should be implemented to ensure that all sediments and other pollutants are contained within the boundaries of the work area. Disturbed areas that are contributing sediment to surface waters as a result of project activities should be promptly re-vegetated to maintain water quality.

- Equipment should be serviced and fueled away from streams and riparian areas. Equipment staging areas should be at least 300 feet from riparian areas.

- Preventing the spread of aquatic invasive species (AIS) is a priority for the State of Wyoming, and in many cases, the intentional or unintentional spread of organisms from one body of water to another would be considered a violation of State statute and Wyoming Game and Fish Commission Regulations. To prevent the spread of AIS, we recommend the following:

  If equipment has been used in an area known to contain aquatic invasive species or suspected to contain aquatic invasive species, the equipment will need to be inspected by an authorized aquatic invasive species inspector certified in the state of Wyoming prior to its use in any Wyoming water. If aquatic invasive species are found, the equipment will need to be decontaminated.

  Decontamination may consist if either 1) Drain all water from equipment and compartments, Clean equipment of all mud, plants, debris, or animals, and Dry equipment for 5 days in summer (June, July & August); 18 days in Spring (March, April & May) and Fall (September, October & November); or 3 days in Winter (December, January & February) when temperatures are at or below freezing,

  Or

  2) Use a high pressure (3500 psi) hot water (140°F) pressure washer to thoroughly wash equipment and flush all compartments that may hold water.

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Mr. Bob Giurgevich
February 23, 2012
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Thank you for the opportunity to comment. If you have any questions or concerns, please contact Scott Gamo, Staff Terrestrial Biologist, at 307-777-4509.

Sincerely,

John Emmerich
Deputy Director

JE/mf/gb

cc: USFWS
Terry Creekmore, Laramie Region
Mike Snigg, Laramie Region
Lee Knox-Laramie Region

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June 18, 2009

WER 7785.05
Real West Natural Resource Consulting
Addition to Current Limestone Mine Permit
Mountain Cement Company
Albany County

Amber Travsky
Real West Natural Resource Consulting
1116 Albin Street
Laramie, WY 82072

Dear Ms. Travsky:

The staff of the Wyoming Game and Fish Department has reviewed the addition to the current Limestone Mine Permit by Mountain Cement Company in Albany County.

The major wildlife resources in the project include:

- Crucial mule deer winter range
- Crucial elk winter range
- Very close proximity (< ¼ mile) to crucial pronghorn winter range.
- Limestone outcrops that include potential roosting habitat for some species of bats
- Limber pine with some potential for primary and secondary cavity nesting species.
- Limited aspen, juniper, Douglas-fir, subalpine fir, Ponderosa Pine, Lodgepole Pine habitats which are important for a wide range of wildlife, and
- Big sagebrush, true mountain mahogany and other mountain shrubs.
- Although we have not conducted any detailed wildlife inventories, the permit area may provide occupied habitat for a number of wildlife including raptors and other Species of Greatest Conservation Need.

Based upon our experience with mining and reclamation in the area, the proposal would likely reduce seasonal habitat use for wildlife on the expanded permit area, result in displacement of wildlife on adjacent lands including public lands such as the National Forest, and may increase conflicts with homeowners in the vicinity. Cumulative effects should be considered, including increased subdivisions in the area, expanded pipelines and other utility corridors, reduced habitat quality due to pine beetles and climate change, and potential for increases in noxious weeds due to disturbance. We recommend a detailed wildlife inventory be performed including documentation of seasonal use. Sensitive habitats should be avoided as much as possible and

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Ms. Amber Travsky
June 18, 2009
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disturbed sites mitigated within the guidelines of our Commission's Mitigation Policy. Mitigation actions should include habitat improvements and protection on adjacent crucial ranges and other sensitive areas.

Thank you for the opportunity to comment. If you have any questions or concerns, please contact Rich Guenzel 307-745-5180.

Sincerely,

for John Emmerich
Deputy Director

JE:MF: gfb

cc: USFWS
Terry Creekmore

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ADDENDUM C

Wyoming Natural Diversity Database Wildlife Observation List

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Table 4-1. Wildlife observed on the permit area or within a 4-mile buffer around the site, reported on the Wyoming Natural Diversity Database.

Scientific Name	Common Name	Area
Amphibians		
Ambystoma tigrinum	Tiger Salamander	Buffer
Bufo boreas pop. 1	Boreal Western Toad (Southern Rocky Mountain Population)	Buffer
Bufo baxteri	Wyoming Toad	Buffer
Rana pipiens	Northern Leopard Frog	Buffer
Rana sylvatica pop. 2	Wood Frog (Southern Rockies Wood Frog)	Buffer
Birds		
Gavia immer	Common Loon	Buffer
Pelecanus erythrorhynchos	American White Pelican (Breeding Colonies)	Buffer
Egretta thula	Snowy Egret	Buffer
Plegadis chihi	White-faced Ibis	Buffer
Bucephala clangula	Common Goldeneye	Permit
Pandion haliaetus	Osprey	Buffer
Haliaeetus leucocephalus	Bald Eagle	Permit
Accipiter gentilis	Northern Goshawk	Permit
Buteo regalis	Ferruginous Hawk	Permit
Aquila chrysaetos	Golden Eagle	Permit
Falco columbarius	Merlin	Permit
Falco peregrinus	Peregrine Falcon	Buffer
Centrocercus urophasianus	Greater Sage Grouse	Permit
Grus canadensis	Sandhill Crane	Buffer
Charadrius montanus	Mountain Plover	Permit
Numenius americanus	Long-billed Curlew	Permit
Larus delawarensis	Ring-billed Gull (Breeding Colonies)	Permit
Larus californicus	California Gull (Breeding Colonies)	Permit
Sterna forsteri	Forster's Tern	Buffer
Coccyzus erythropthalmus	Black-billed Cuckoo	Buffer
Coccyzus americanus	Yellow-billed Cuckoo	Permit
Asio flammeus	Short-eared Owl	Permit
Melanerpes lewis	Lewis' Woodpecker	Permit
Sphyrapicus thyroideus	Williamson's Sapsucker	Buffer
Empidonax hammondii	Hammond's Flycatcher	Buffer
Aphelocoma californica	Western Scrub-Jay	Permit
Catherpes mexicanus	Canyon Wren	Buffer

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Scientific Name	Common Name	Area
Cinclus mexicanus	American Dipper	Permit
Regulus satrapa	Golden-crowned Kinglet	Permit
Oreoscoptes montanus	Sage Thrasher	Permit
Lanius ludovicianus	Loggerhead Shrike	Permit
Pheucticus ludovicianus	Rose-breasted Grosbeak	Buffer
Spizella breweri	Brewer's Sparrow	Permit
Amphispiza belli	Sage Sparrow	Buffer
Calcarius mccownii	Mccown's Longspur	Permit
Calcarius ornatus	Chestnut-collared Longspur	Permit
Leucosticte atrata	Black-rosy Finch	Permit
Leucosticte australis	Brown-capped Rosy Finch	Permit
Loxia leucoptera	White-winged Crossbill	Permit
Fish		
Oncorhynchus clarkii stomias	Greenback Cutthroat Trout	Buffer
Mammals		
Myotis thysanodes	Fringed Myotis (Statewide)	Buffer
Myotis volans	Long-legged Myotis	Permit
Lasionycteris noctivagans	Silver-haired Bat	Buffer
Lasiurus cinereus	Hoary Bat	Buffer
Corynorhinus townsendii	Townsend's Big-eared Bat	Buffer
Spermophilus elegans	Wyoming Ground Squirrel	Buffer
Cynomys leucurus	White-tailed Prairie Dog	Buffer
Thomomys clusius	Wyoming Pocket Gopher	Permit
Zapus hudsonius preblei	Preble's Meadow Jumping Mouse	Permit
Canis lupus	Gray Wolf	Buffer
Vulpes velox	Swift Fox	Buffer
Ursus arctos horribilis	Grizzly Bear	Permit
Mustela nigripes	Black-footed Ferret	Permit
Gulo gulo luscus	North American Wolverine	Buffer
Lutra canadensis	River Otter	Buffer
Lynx canadensis	Canada Lynx	Buffer
Reptiles		
Terrapene ornata	Ornate Box Turtle	Buffer

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ADDENDUM D

Big Game Ranges

Information and mapping from the Wyoming Geographic Information Science Center.

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Figure D-1. Aerial photograph of Amendment Area with Approximate Boundaries (to use as reference for the game range maps).

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Figure D-2. Mule Deer Ranges in the Area.

Figure D-3. Pronghorn Ranges in the Area.

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Figure D-4. Elk Ranges in the Area.

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APPENDIX E

Raptor Nest Map

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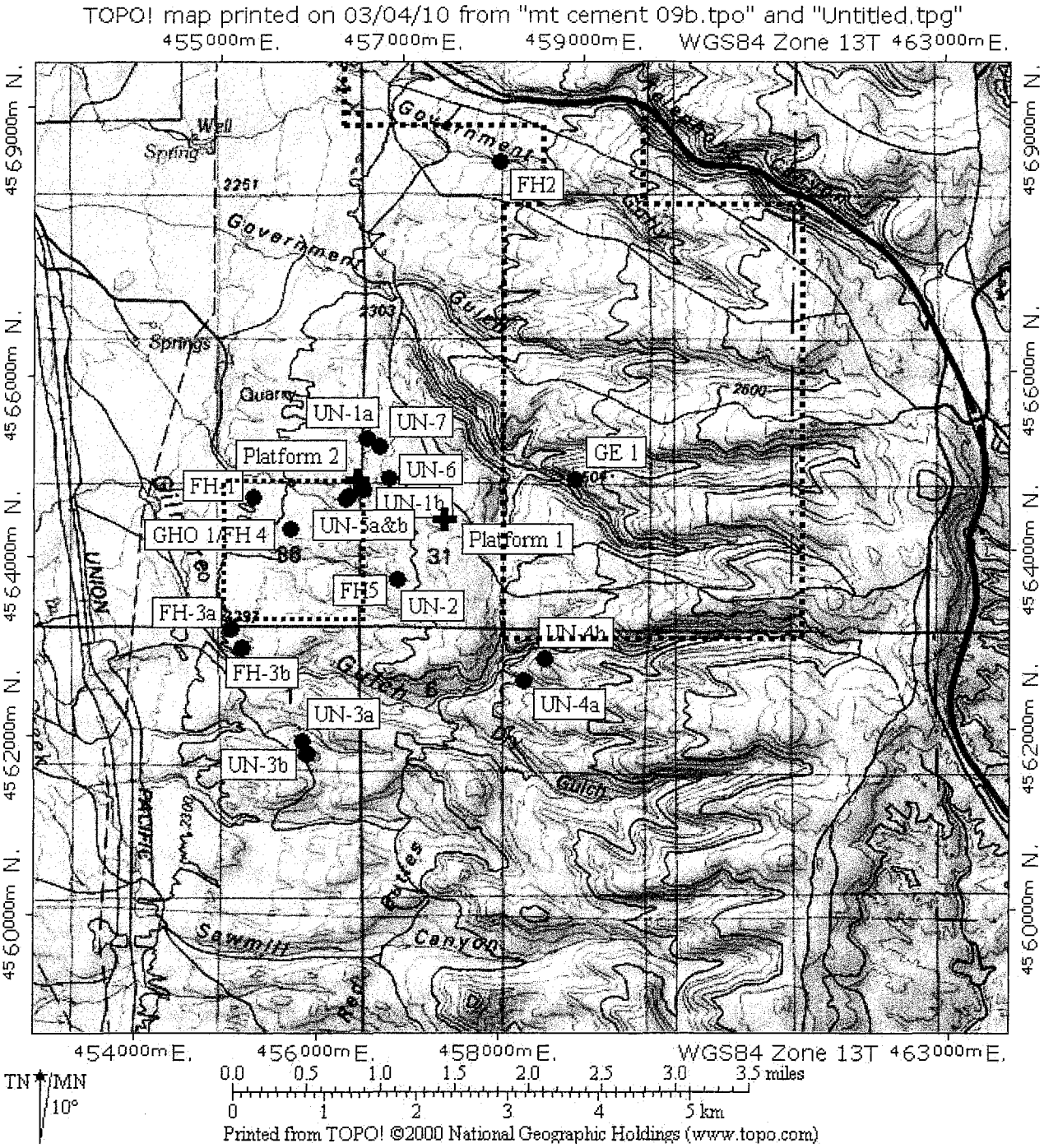
Figure E-1. Raptor nests observed and previously reported on the site and in the vicinity.



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APPENDIX DIX10
WETLANDS

JURISDICTIONAL AND PRELIMINARY

MOUNTAIN CEMENT COMPANY
ETCHEPARE QUARRY
PERMIT 298C-A8

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MAPS

DIX10-1 Jurisdictional and Potential Wetlands and other Waters of the United States within the Etchepare Quarry

APPENDIX

DIX10-A (Photos)
DIX10-B (Correspondence)

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RECD AUG 4 ,2011

DIX10.1.0 INTRODUCTION

The Mountain Cement Company, Etchepare Quarry (Permit 289C) is located in Albany County, Wyoming approximately 5 miles southeast of the town of Laramie. Map DIX10-1 shows the location of the original 298C, the 298C-A7 amendment area, and the 298C-A8 amendment area. Access to the Etchepare Quarry is by way of Howe Lane Road to the Etchepare Quarry mining pits.

This report is a recommended determination of jurisdictional wetlands and other waters of the United States within the 298C and 298C-A7 boundaries and a preliminary evaluation of potential jurisdictional wetlands and other waters of the United States that could occur within the 289C-A8 amendment area, which are under authority of the U.S. Army Corps of Engineers (COE) and U.S. Environmental Protection Agency (EPA) through Section 404 of the Clean Water Act CWA). These agencies retain the authority to amend or approve wetland delineations, and to make jurisdictional determinations on wetlands created by human activities. Waters of the U.S. (WoUS) include all areas subject to regulation by the COE pursuant to the CWA, to include special aquatic sites, of which wetlands is a subset. The definition of WoUS has been broadly interpreted to include most major water bodies, streams, intermittent drainages, mud flats, wetlands, sloughs, prairie potholes, wet meadows, playa lakes, and natural ponds. Special aquatic sites are defined as "geographic areas, large or small, possessing special ecological characteristics and productivity, habitat, wildlife protection, or other important and easily disrupted ecological values" (40 CFR 230.3[q-1]). Special aquatic sites include "sanctuaries and refuges, wetlands, mud flats, vegetated shallows, coral reefs, and riffle and pool complexes" (40 CFR 230, Subpart E).

Wetlands subject to CWA jurisdiction are known as "jurisdictional wetlands", while those wetlands not subject to CWA jurisdiction are known as "non-jurisdictional" wetlands. Compliance with Section 404 and its implementing regulations requires a sequence of avoidance, minimization of impact, and mitigation of wetlands. Precise definitions of WoUS or navigability are ultimately dependent on judicial interpretation and cannot be made conclusively by administrative agencies (33 CFR 329). A formal wetland delineation survey must be conducted prior to mining according to approved procedures (COE 1987) and submitted to COE for verification as to the amounts and types of jurisdictional wetlands and other waters present. Once the delineation has been verified, it is made part of the mine and reclamation permit.

In addition to wetlands, the 298C permit area may include jurisdictional other waters of the U.S., as defined by 33 CFR 328.3. These other waters of the U.S. are primarily ephemeral stream channels, open water, and other stream channels that carry water but do not meet the criteria for classification as wetlands.

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DIX10.2.0 METHODS

Jurisdictional wetlands evaluations within the Etchepare Quarry were completed in 1995 and 2005 and a preliminary evaluation was done in 2010 within the 298C-A8 permit area. The 1995 and 2010 evaluations were done according to the 1987 COE wetlands delineation Manual (COE 1987). Other "Waters of the United States" were determined according to definitions in 33 CFR 328.3. Due to the potential length of time between permit amendment approval and disturbance (over 150 years in some instances), a detailed wetlands delineation for the 289C-A8 amendment area was not completed at this time. A detailed wetlands delineation for each pit within the 298C-A8 amendment area will be completed at least 3 but not more than 5 years prior to disturbance of that pit. These delineations will be accomplished according to the most current version of the Interim Regional Supplement to the Corps of Engineers Wetlands Delineation Manual: Arid West Region. Other "Waters of the United States" will be determined according to definitions in 33 CFR 328.3. A Jurisdictional Wetlands Evaluation report for the amendment area pits slated for disturbance will be submitted to COE for verification and a revised Appendix DIX10 will be submitted to WDEQ/LQD. The dimensions of any jurisdictional wetlands and other waters will be determined by utilizing a handheld GPS unit in the field. Map measurements will be only used to determine the lengths of ephemeral streams classified as non-jurisdictional other waters of the United States. Information from published soil surveys conducted by the Natural Resources Conservation Service (NRCS) for Albany County will be used to supplement these surveys where applicable.

Preliminary potential wetlands and drainage classifications for the 298C-A8 amendment area were determined by examining U.S. Geological Survey (USGS) 1:24,000 scale quadrangle maps (Laramie, Pilot Hill, Sherman Mountain West, and Red Buttes), field observations, 2009 National Agriculture Imagery Program (NAIP) images, and U.S. Fish and Wildlife Service (USFWS) National Wetlands Inventory (NWI) maps. USGS topographic mapping identifies perennial streams with a solid blue line and intermittent and ephemeral streams as dotted lines. Initial surveys for potential wetlands were conducted in March 2010.

DIX10.3.0 RESULTS

The 1995 evaluation identified 0.7 acre of jurisdictional wetlands within the 298A permit boundary (MAP DIX10-1). Site ES-1 (SW¼SW¼ Section 17, T.15N., R.72W.) is a portion of an ephemeral stream that exhibits perennial flow due to the presence of flow from a permitted well (P80876W). The total wetland acreage delineated at this site was 0.3 acre. The site is documented in Photos 1 and 2 (Addendum DIX10-A). Site SP1 is a stockpond located in the SW¼SW¼ Section 18, T.15N., R.72W. The total wetland acreage delineated at this site was 0.2 acre with 0.2 acre of jurisdictional other waters of the U.S. The site is documented in Photo 3 (Addendum DIX10-A). COE verification for these two sites is included in Addendum DIX10-B. Table DIX10-1 lists the jurisdictional wetlands/other waters within the 298C permit boundary. The 1995 wetlands evaluation identified approximately 5.5 acres of non-jurisdictional other waters of the U.S (Table DIX10-1).

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No jurisdictional wetlands were delineated in 298C-A7 amendment area in the SW¼SW¼ Section 36, T.15N., R.73W. as a result of the 2005 evaluation. The 2005 wetlands evaluation identified approximately 1.0 acre of non-jurisdictional other waters of the U.S (Table DIX10-1).

No NWI classified wetlands were found within the 298C-A8 amendment area (USFWS 2010) during the 2010 preliminary wetlands evaluation. A portion of Government Gully in the NW¼ Section 20, T.15N., R.72W. apparently has perennial flow, in response of flow from a permitted well (P80876W - Map DIX10-1). This site is just up gradient of COE verified site ES1 and has the potential to be a jurisdictional wetland. Four other sites (SE¼SE¼Section 28, SW¼SW¼ Section 29, SE¼NE¼ Section 33, T.15N. R72W., and NW¼NW¼ Section 36, T.15N., R.73W) associated with overflow from stock watering locations are also potential jurisdictional wetlands (Map DIX10-1). Using USGS quadrangle maps and field observations, 33 stream channels were identified within the 298C-A8 amendment area (Map DIX10-1). All but a portion of one channel are classified as ephemeral (only flowing in response to rainfall or snow melt events). Potential isolated, non-jurisdictional, ephemeral stream channel other waters of the U.S. occupied approximately 152,405 feet (Table DIX10-1). Pit design for the amendment area generally avoids drainages and as such avoids the potential for disturbance to potential wetlands (Map DIX10-1).

DIX10.4.0 SUMMARY

This report discusses the COE verified wetlands within the Etchepare Quarry Permit 298C permit boundary and evaluates the potential for jurisdictional wetlands and jurisdictiona and non-jurisdictional other waters of the U.S. to occur within the 298C-A8 permit boundary. As a result of delineations completed in 1995 and 2005, a total of 0.7 acre of jurisdictional wetlands/other waters of the U.S. have been verified within the 298C permit boundary (Table DIX10-1 and Map DIX10-1). Due to the potential length of time between permit amendment approval and disturbance (over 150 years in some instances), a detailed wetland delineation for the 289C-A8 amendment area was not completed at this time. Five potential jurisdictional wetland sites were identified during the preliminary wetlands evaluation (Map DIX10-1). Detailed wetland delineations for 298C-A8 amendment areas scheduled for disturbance will be completed at least 3 but no more than 5 years prior to that disturbance. Potential wetlands and other waters of the U.S. will be evaluated according to the most current version of the Interim Regional Supplement to the Corps of Engineers Wetlands Delineation Manual: Arid West Region. Other waters of the U.S. will be determined according to definitions in 33 CFR 328.3. A Jurisdictional Wetlands Evaluation report including the 298C-A8 amendment area will be submitted to COE for verification and a revised Appendix DIX10 will be submitted to WDEQ/LQD based on the results of the COE verification. According to the Etchepare Quarry Permit 298C-A8 mine plan, none of the verified or potential wetlands would be disturbed.

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The 1995 and 2005 wetlands evaluations identified approximately 6.5 acres of non-jurisdictional other waters of the U.S. Potential isolated, non-jurisdictional, ephemeral stream

5/10

channel other waters of the U.S. within the 298C-A8 amendment area occupied approximately 152,405 feet.

DIX10.5.0 SOURCES

U.S. Fish and Wildlife Service (USFWS), 2010, National Wetlands Inventory Mapper, Available on the Internet at: <http://www.fws.gov/nwil/>.

U.S. Army Corps of Engineers (COE), 1987, Corps of Engineers Wetlands Delineation Manual, by the Environmental Laboratory, Department of the Army, Waterways Experiment Station.

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WDEQ/LQD

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APPENDIX DIX10

TABLES

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Table DIX10-1. Jurisdictional within the 298C Permit Boundary and Potential Wetlands and Other Waters of the U.S. within the 298C-A8 Amendment Area.

Channel Designation (See Map DIX10-1)	Jurisdictional Wetlands or Other Waters of the U.S. (Approximate Acres)	Potential Non-Jurisdictional Other Waters of the U.S.
1995 Evaluation		5.5 Acres
ES1	0.30 (Verified)	--
SP1	0.40 (Verified)	--
2005 Evaluation	0.0	1.0 Acre
2010 Evaluation		
Government Gulch	--	11,165 Feet
DA1-C-1	--	3,690 Feet
DA1-C-2	--	1,968 Feet
DA1-C-5	--	4,196 Feet
DA1-C-6	--	7,723 Feet
DA1-C-8	--	6,224 Feet
DA1-C-10	--	2,428 Feet
DA1-C-11	--	6,058 Feet
DA1-C-12	--	11,338 Feet
DA1-C-13	--	3,293 Feet
DA1-C-14	--	11,222 Feet
DA1-C-15	--	2,667 Feet
DA1-C-16	--	10,242 Feet
Government Gully	--	11,196 Feet
DA2-C2	--	4,044 Feet
DA2-C3	--	2,930 Feet
DA2-C4	--	6,496 Feet
DA3-C1	--	5,896 Feet
DA3-C2	--	4,549 Feet
DA3-C3	--	787 Feet
DA4-C1	--	2,183 Feet
DA4-C2	--	2,069 Feet
DA4-C3	--	192 Feet
DA4-C4	--	2,666 Feet
S36-C1	--	1,251 Feet
S36-C2	--	2,456 Feet
S36-C3	--	3,124 Feet
S36-C4	--	3,248 Feet
S36-C5	--	2,067 Feet
DA8-C1	--	4,761 Feet
Telephone Canyon	--	5,643 Feet
DA12-C1	--	2,865 Feet
S18-C1	--	1,768 Feet
Site 1	0.04 (Potential)	--
Site 2	0.54 (Potential)	--
Site 3	0.51 (Potential)	--
Site 4	0.11 (Potential)	--
Site 5	2.16 (Potential)	--
Total	**0.70 Acre Verified** **3.36 Acres Potential**	**6.5 Acres** **152,405 Feet**

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APPENDIX DIX10

MAPS

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WDEQ/LQD

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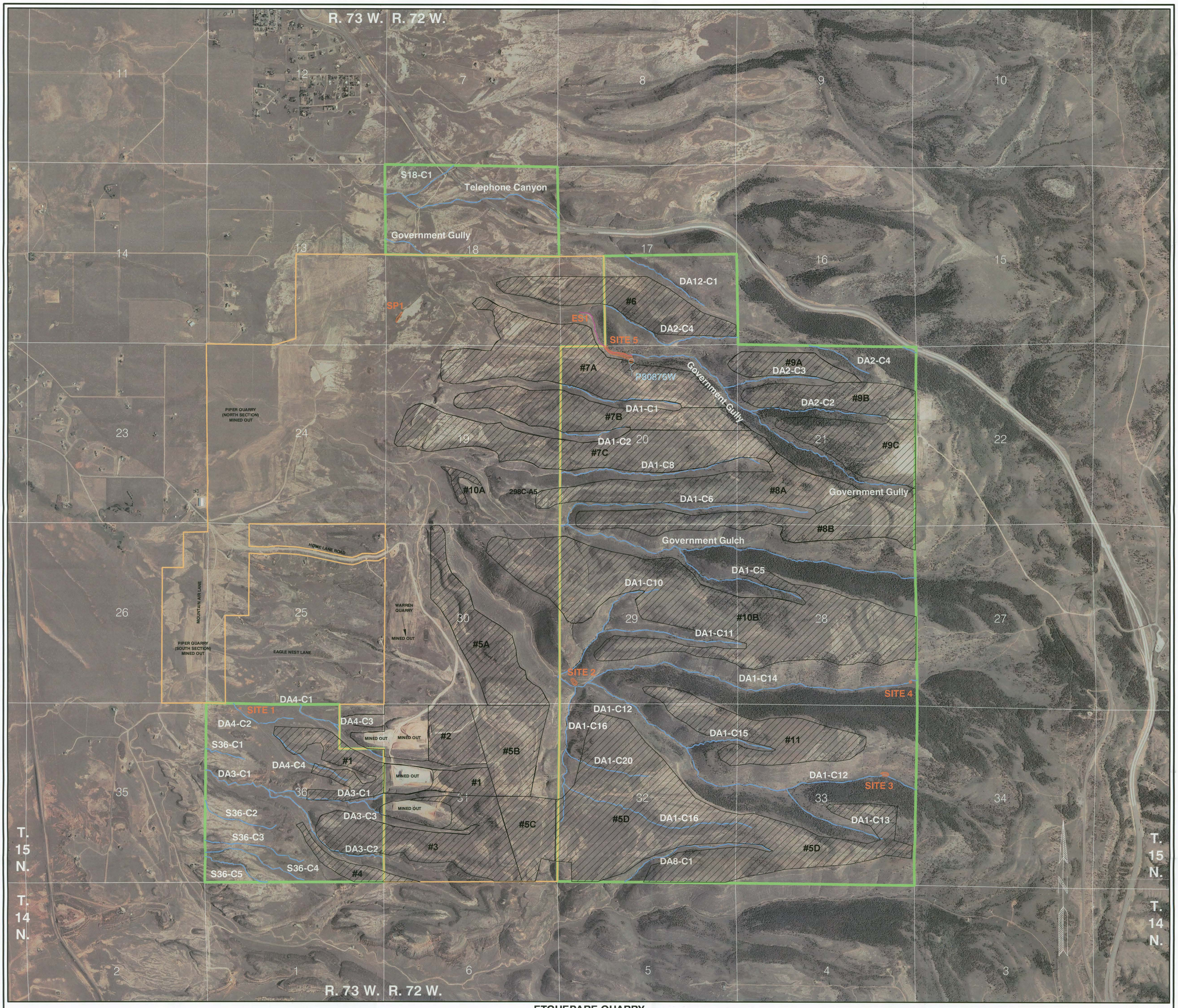

ETCHEPARE QUARRY

SCALE: 1" = 1000'

MAP DIX10-1

MOUNTAIN CEMENT

JURISDICTIONAL AND POTENTIAL WETLANDS AND OTHER WATERS OF THE U.S. WITHIN THE ETCHEPARE QUARRY

LEGEND

- Jurisdictional or Potential Jurisdictional Wetland
- Potential Other Waters of the U.S.
- Perennial Flow
- 298C-A8 Amendment Boundary
- 298C Permit Boundary
- Current Mine Areas
- 298C-A8 Mine Blocks

REVISIONS	
Date	By

WWC ENGINEERING
1849 TERRA AVE.
SHERIDAN, WY. 82801
(307) 672-0761

RECEIVED APR 15 2010 WDEQ/LQD

5/110

FILE: MC WETLANDS	Drawn By: MBM	Checked By: JDB	Date: 3/30/10	Scale: 1"=1000'

APPENDIX DIX10

APPENDIX D1X10-A (PHOTOS)

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WDEQ/LQD

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Photo 1. Well No. P80876W located immediately east of the Mountain Cement Etchepare Quarry permit area that supplies water to wetlands along Ephemeral Stream ES1, 1995.

Photo 2. Wetlands located along Ephemeral Stream ES1.

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Photo 3. Mountain Cement Company Etchepare Quarry Stockpond SP1, 1995.

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WDEQ/LQD

Appendix DIX10

Appendix DIX10-B

(Correspondence)

TFN 5 1/110
RECD AUG 4 ,2011

DEPARTMENT OF THE ARMY
CORPS OF ENGINEERS, OMAHA DISTRICT
WYOMING REGULATORY OFFICE
2232 DELL RANGE BOULEVARD, SUITE 210
CHEYENNE WY 82009-4942

REPLY TO
ATTENTION OF

September 28, 2010

Wyoming Regulatory Office

Mr. Jeff Brasher
Mountain Cement Company
5 Sand Creek Road
Laramie, Wyoming 82070

Dear Mr. Brasher:

This letter is in response to information we received from WWC Engineering (WWC) on September 3, 2010, concerning Department of the Army authorization to undertake limestone mining activities within a 600-acre area within the Etchepare Quarry Expansion (WYDEQ Permit # 289C-A8) near Laramie. The proposed 600-acre mining area is located on land managed by the State of Wyoming in Section 36, Township 15 North, Range 73 West, Albany County, Wyoming.

The U.S. Army Corps of Engineers regulates the placement of dredged and fill material into waters of the United States in accordance with Section 404 of the Clean Water Act (33 U.S.C. 1344). The term "waters of the United States" has been broadly defined by statute, regulation, and judicial interpretation to include all waters that were, are, or could be used in interstate commerce such as streams, reservoirs, lakes and adjacent wetlands. The Corps regulations are published in the *Code of Federal Regulations* as 33 CFR Parts 320 through 332. Information on Section 404 program requirements in Wyoming can be obtained from our web site at https://www.nwo.usace.army.mil/html/od-rwy/Wyoming.htm

We have reviewed the wetland delineation, maps, and pictures WWC provided along with aerial photographs of the area to be mined. We determined that the entire 600 acres is located in upland. Therefore, the mine permit area does not contain any waters of the United States as defined at 33 CFR Part 328.3(a).

In the March 28, 2000, edition of the *Federal Register* (Vol. 65, No. 60), the Corps implemented an administrative appeals process for jurisdictional determinations. This letter serves as an approved jurisdictional determination. The landowner and other affected parties may appeal any determination to the Northwestern Division Appeals Officer, Mr. David Gesl, by obtaining a Notification of Administrative Appeal Options and Process (NAO) form at our web site. Section "D" of the NAO explains the procedures for appeal. The NAO form must be submitted to Mr. Gesl at the address shown on the NAO form prior to **November 27, 2010**, or forfeit the right to an administrative appeal.

TFN 5 1/110
RECD AUG 4 ,2011

As a result of this analysis, we determined that Department of the Army authorization is not required for any limestone mining activities within the 600-acre area because it would not require any discharges of dredged or fill material into waters of the United States. This determination does not eliminate requirements to obtain any other applicable federal, state, tribal, or local permits.

Thank you for your interest in cooperating with requirements of the U.S. Army Corps of Engineers' regulatory program. Please contact Mr. Kevin Little at (307) 772-2300 and reference file NWO-2010-02201 if you have any questions.

Sincerely,

Matthew A. Bilodeau
Program Manager
Wyoming Regulatory Office

Copies Furnished:

Troy Summers
WWC Engineering
611 Skyline Road
Laramie, Wyoming 82070

The Omaha District, Regulatory Branch, Wyoming Regulatory Office is committed to providing quality and timely service to our customers. In an effort to improve customer service, please take a moment to complete a Customer Service Survey found on our web site at https://www.nwo.usace.army.mil/html/od-rwy/survey.htm Paper copies of the survey are also available upon request for those without Internet access.

TFN 5 1/110
RECD AUG 4 ,2011

APPENDIX EIX

Mountain Cement Co.

Etchepare Limestone Quarry

Permit #298C-A8

Prepared By:
Mountain Cement Co
Laramie, Wyoming
August 2012

Introduction

This appendix contains information pertaining to the original permit area as well as lands through this amendment, the A8 Amendment, as required by Form 1 item (e). The information is in the form of maps, or references to maps already existing within the application.

TFN 5 1/110
RECD OCT 15,2012

Form 1 item (e)

(i) Lands to be affected by mining are presented on Map MPIX-1.

(ii) Drainage areas within and surrounding the Permit Area are shown on Map DIX6-1.

(iii) The location and names of all roads, railroads, public/private right-of-ways and easements, utility lines, lakes, streams, creeks, springs, other surface water courses, oil wells, gas wells, and water wells adjacent to the permit area are shown on Map EIX-1.

(iv) There are no areas disturbed or proposed to be disturbed by subsurface/underground mining on or adjacent to the permit area.

(v) The names, addresses and boundary lines of the present surface landowners adjacent to the permit area are shown on Map EIX-2.

(vi) The location, ownership, and uses of all buildings on, or adjacent to lands to be affected are shown on Map EIX-2.

(vii) The permit boundary for the original 298C permit and successive amendments is shown on Map EIX-3.

APPENDIX EIX

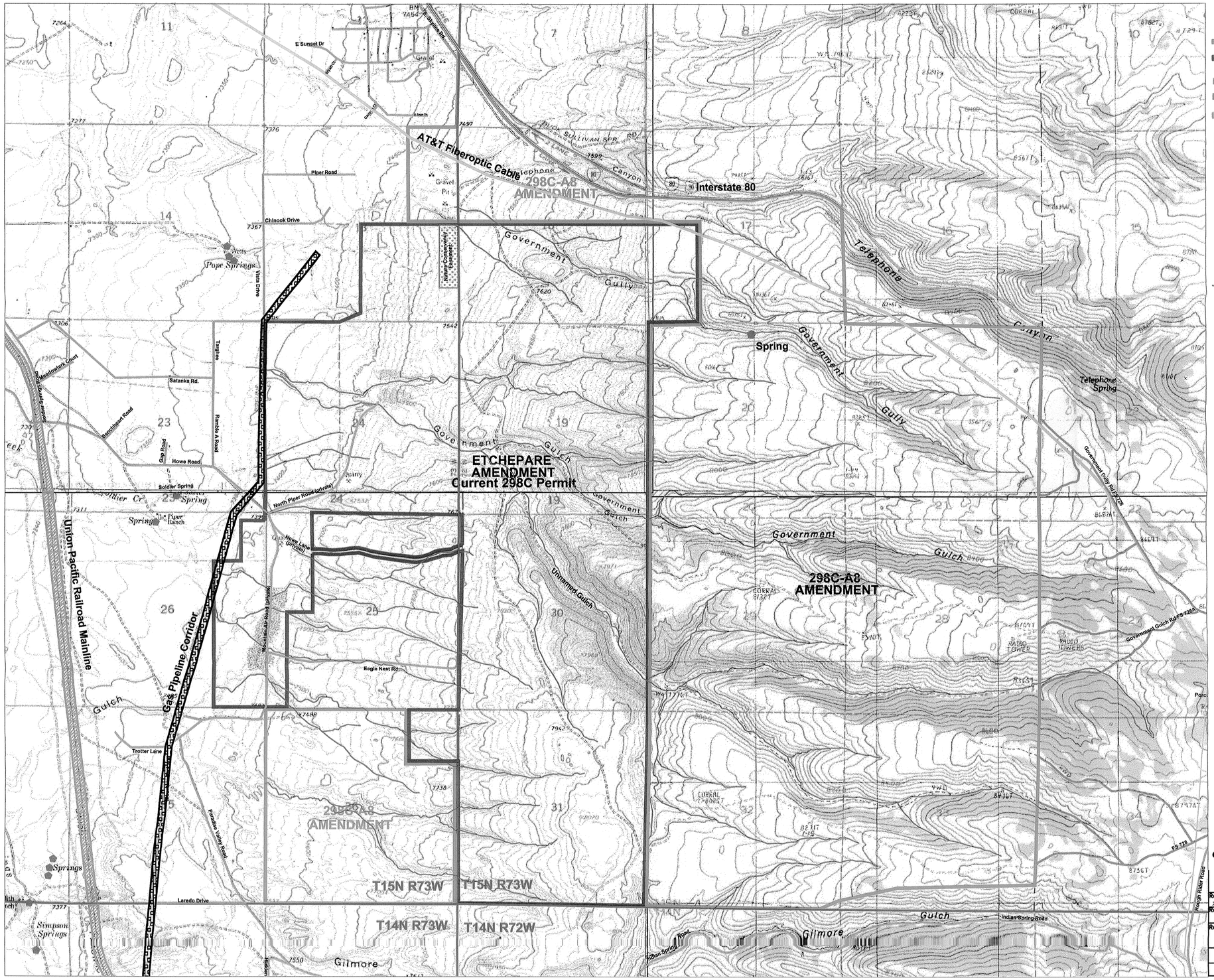
MAPS:

Map EIX-1

Map EIX-2

Map EIX-3

TFN 5 1/110
RECD OCT 15, 2012



LEGEND

- Proposed 298C-A8 Amendment Areas
- Currently Approved 298C Permit Area
- Current Residential Roads
- Current U.S. Forest Service Roads
- Private Road Right of Ways
- Laramie False Sage Area Nature Conservancy Easement
- Union Pacific Rail Road
- AT&T Fiberoptic Cable
- Creeks, Streams, and Surface Water Courses
- Spring
- Pipeline Corridor
- U.S. Interstate Route 80

For location of groundwater wells adjacent to the permit area, please see Map DIX6-5.

TFN 5 1/110
RECD MAR 07, 2013

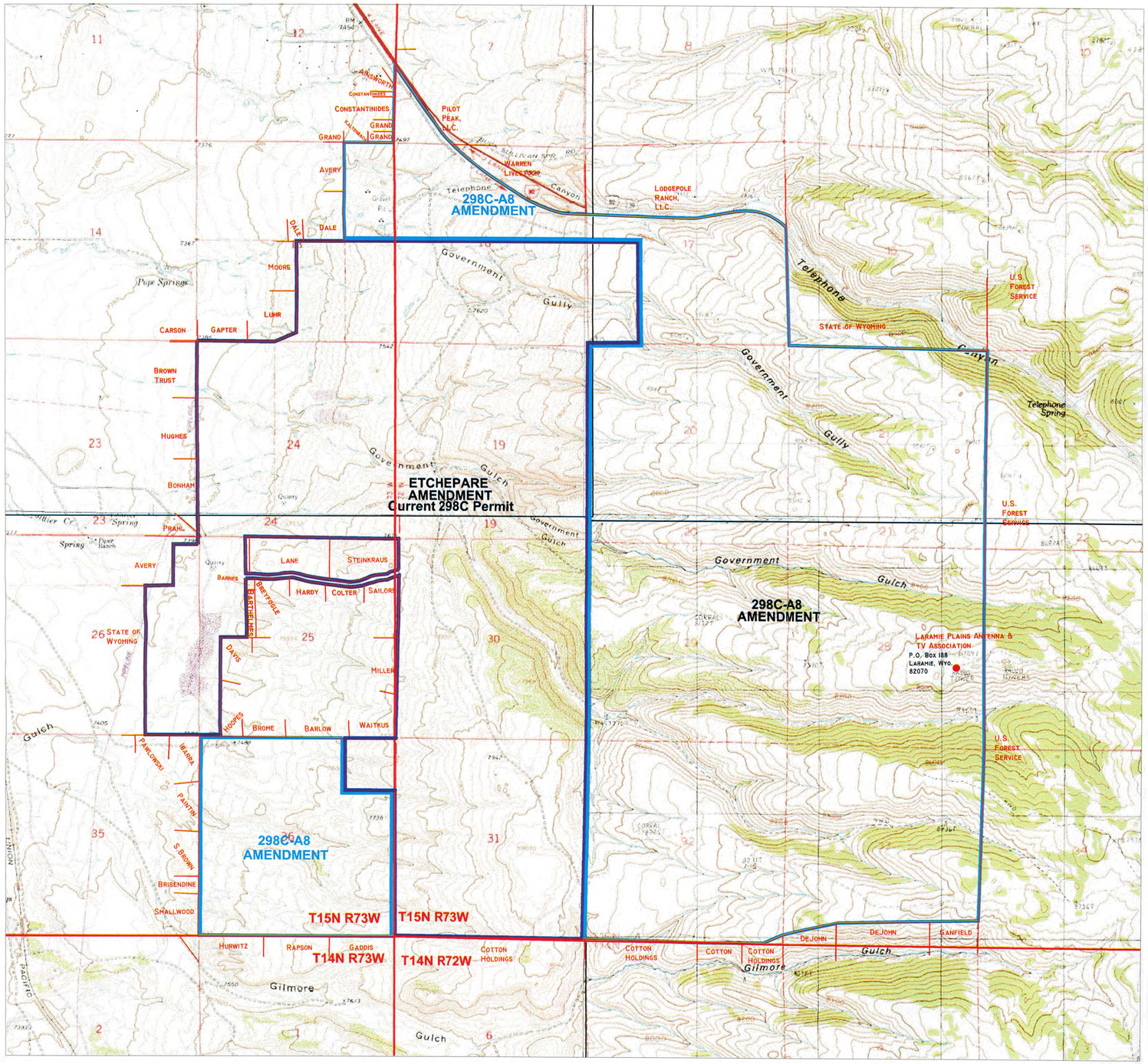
1/4 mile — 1/2 mile — 1 mile
1320 ft — 2640 ft — 5280 ft

Appendix EIX Map EIX-1

General Map of Amendment Area and Surrounding Area

Permit # 298C-A8
Etchepare Limestone Quarry

Revised By: AHM Date: 9/10/13	Mountain Cement Company 5 Sand Creek Rd. Laramie, Wyo. 82070 (307) 745-2687	Design By: AHM Date: 08/22/2012
Revised By: Date:		Drawn By: AHM Date: 08/22/2012
Revised By: Date:		Checked By: Date:



LEGEND

- Proposed 298C-A8 Amendment Areas
- Currently Approved 298C Permit Area
- Adjacent Surface Owner Boundary
- EXAMPLE — Surface Owner
- Structure with Address

0 — 1,320 feet — 2,640 feet — 1 mile

N

Appendix EIX Map EIX-2

Surface Owners of Record Adjacent to the Permit Area

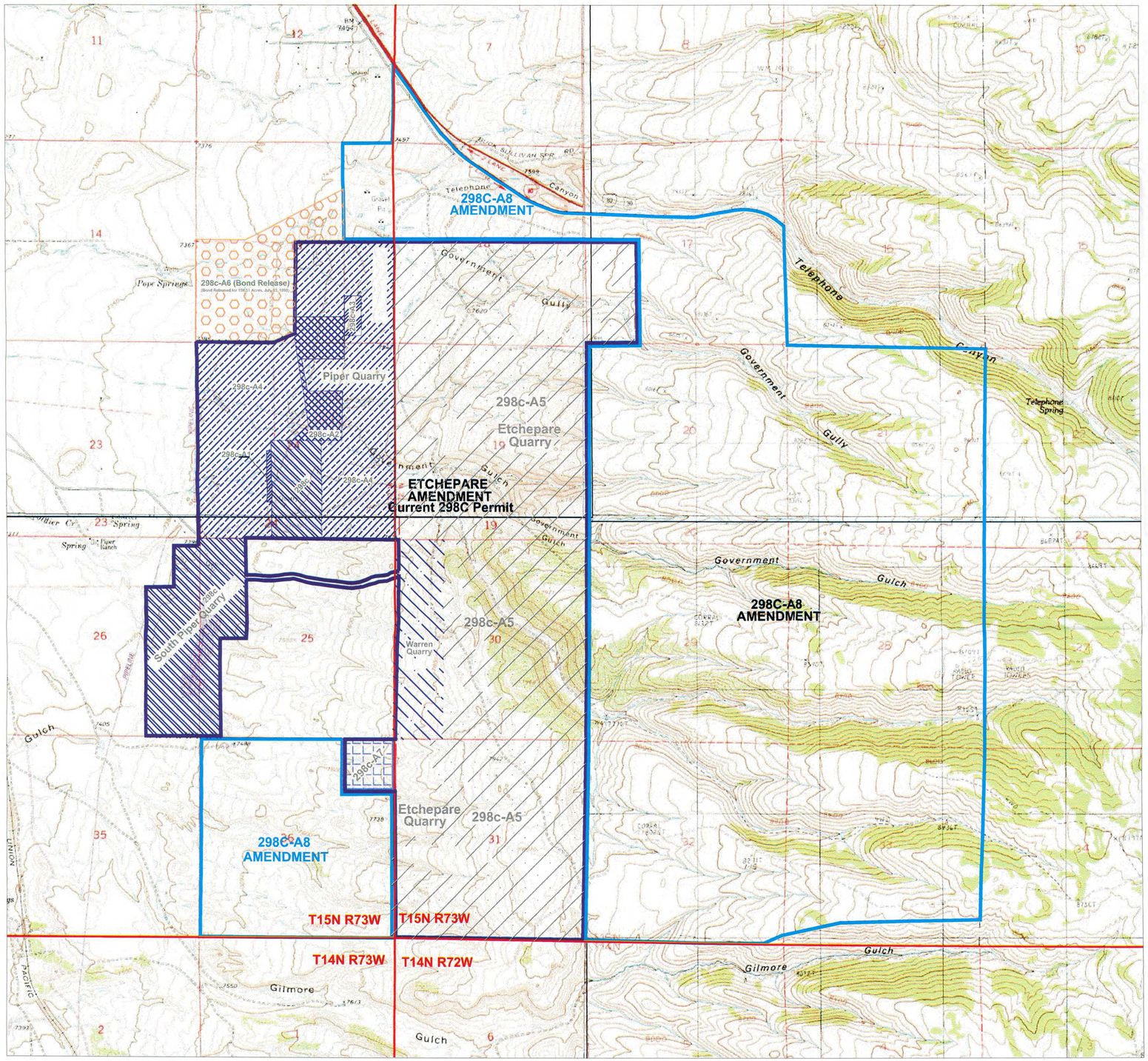
Permit # 298C-A8

Etchepare Limestone Quarry

TFN 5 1/110
OCT 15, 2012

Revised By:	Date:		Design By:	Date:
AHM & ADN	08/22/12	Mountain Cement Company	AHM	08/22/2012
Revised By:	Date:		Drawn By:	Date:
			AHM	08/22/2012
Revised By:	Date:		Checked By:	Date:

5 Sand Creek Rd.
Laramie, Wyo. 82070
(307) 745-2687



LEGEND

- Proposed 298C-A8 Amendment Areas
- Currently Approved 298C Permit Area
- 298C
- 298-A1
- 298C-A2
- 298C-A3
- 298-A4
- 298C-A5
- 298C-A6 Amendment Area (Bond Released)
- 298C-A7 Amendment Area
- 319C Warren Quarry

N

0 1,320 feet 2,640 feet 1 mile

Appendix EIX
Map EIX-3

TFN 5 1/110
OCT 15, 2012

Original Permit Area & Successive Amendments

Permit # 298C-A8
Etchepare Limestone Quarry

Revised By:	Date:
AHM & ADN	08/22/12
Revised By:	Date:
Revised By:	Date:

Mountain Cement Company
5 Sand Creek Rd.
Laramie, Wyo. 82070
(307) 745-2687

Design By:	Date:
AHM	08/22/2012
Drawn By:	Date:
AHM	08/22/2012
Checked By:	Date:

Appendix PIX

Parties to Receive Notice

Mountain Cement Co.

Etchepare Limestone Quarry

Permit #298C-A8

Prepared By:
Mountain Cement Co
Laramie, Wyoming
August 2012

Introduction

This appendix contains a list of surface owners to receive notice as described and required by W.S. § 35-11-406(j).

Last Name	*First Names*	*Mailing Address*	*City*	*State*	*Zip*
Adams	Mary P & John P	1204 Adams Ave	Rock Springs	WY	82901
sworth	Scott & Penne	5710 E Skyline Dr	Laramie	WY	82070
Arbour	Vincent P.	111 Ivinson	Laramie	WY	82070
Aukerman	Ryan A.	1520 Boswell Ct	Laramie	WY	82070
Avery	Richard & Cindy	3630 Howe Rd	Laramie	WY	82070
Baltimore	Jeffrey A.	4848 Juniper Dr	Laramie	WY	82070
Barlow	William A. & Lynnette L.	64 Eagles Nest Lane	Laramie	WY	82070
Barnes	Donald J. & Yvonda D.	P.O. Box 608	Laramie	WY	82073
Barthelmes	Craig P. & Beyer, Edith A.	130 Jackalope Ct	Laramie	WY	82070
Bienz	Thomas A. & Karen R.	1826 Beaufort	Laramie	WY	82072
Bonham	Peavy B. & Jennifer B.	4271 Howe Rd	Laramie	WY	82070
Boysen Revocable Trust	Robert D. & Penny B. Boysen	P.O. Box 1691	Laramie	WY	82073
Bredehoft	Roger A. & Wendy E.	4803 Ponderosa Lane	Laramie	WY	82070
Bressler	Wesley R. & Lurlene	3228 Mesquite Lane	Laramie	WY	82070
Breyfogle	William	P.O. Box 22	Centennial	WY	82055
Brian	Daniel P. & Debra L.	4808 Aspen Lane	Laramie	WY	82070
Brisendine	Michael R & Michelle	54 Paradise Valley Rd	Laramie	WY	82070
Brown	Shawn M., Gary & Mary F.	40 Paradise Valley Rd	Laramie	WY	82070
wn	Gary R. & Mary F.	9 Paradise Valley Rd	Laramie	WY	82070
uckner	Kim & Laura C.	5010 Valley View Rd	Laramie	WY	82070
Bureau of Land Management	Great Divide Resource Office	P.O. Box 670	Rawlins	WY	82301
Caithlin G. Grimes Revocable Trust	Grimes, Caithlin G. & Deirdre Odwyer	3317 Mesquite Lane	Laramie	WY	82070
Callaway Revocable Trust	Callaway, Wayne & Peggy	3401 Juniper Dr	Laramie	WY	82070
Carolyn B. Miller Living Trust	Richard H. Miller Living Trust	101 Eagle Nest Lane	Laramie	WY	82070
Carson	Jay G. & Cinthy A.	3025 Pope Springs Rd	Laramie	WY	82070
Castano	Matthew F. G	3630 Juniper	Laramie	WY	82070
Christensen	David J & Susan T	4388 Vista Dr	Laramie	WY	82070
City of Laramie		406 Invison	Laramie	WY	82070
Clute	John A. & Sara D.	222 Mountain Air Drive	Laramie	WY	82070
Colter	Chris & Jenny Revocable Trust	1332 Grafton	Laramie	WY	82070
Constantinides	Christos T. & Janet C.	5110 Summit Dr	Laramie	WY	82070
Cotton	Kathryn E. & Jean K.	2019 Carls Rd	Cheyenne	WY	82009
Cotton Holdings, LLC		5520 Yellowstone Rd	Cheyenne	WY	82009
Covell	James R.	3345 Juniper Dr	Laramie	WY	82070

Dale	Daniel & Kimberly	5146 Piper Rd	Laramie	WY	82070
David E. Walrath Living Trust	Christel B. Walrath Living Trust	3429 Wyatt Ct	Laramie	WY	82070
vid G. Earnshaw iving Trust	Jean L. Earnshaw Living Trust	3220 Aspen Lane	Laramie	WY	82070
Davis	Burton S. & Joann B.	P.O. Box 2194	Laramie	WY	82073
DeJohn	Kenneth D.	3236 E Grand Ave H-188	Laramie	WY	82070
DeVore	Michael A	PO Box 1148	Laramie	WY	82073
Doyle	Mark W. & Lynnette A.	P.O. Box 2292	Laramie	WY	82070
Dzialak	Matthew	PO Box 430	Laramie	WY	82073
Espinoza	Angela K. & Henry P.	3204 Ponderosa Lane	Laramie	WY	82070
Etchepare Jr. Revocable Trust	Paul G. Ethepare Jr.	P.O. Box 1163	Laramie	WY	82073
Ferris	Thomas J. & Rebecca L.	3001 Sage Dr	Laramie	WY	82070
Fisher	James R.	3220 Sage Dr	Laramie	WY	82070
Foulke	Thomas K.	4812 Ponderosa Lane	Laramie	WY	82070
Frank	Alan & Cheri C.	3305 Ponderosa Lane	Laramie	WY	82070
Fry	Harry Keener Jr. & Lisa S.	4935 Valley View	Laramie	WY	82070
Gaddis	Jenelle	182 Paradise Valley Rd	Laramie	WY	82070
Ganfield	Roger A.	P.O. Box 850	Guernsey	WY	82214
Gapter	Douglas L. & Kelly D.	35 Targhee	Laramie	WY	82070
Gonzales	Ronert L. & Jane R.	105 Satanka Road	Laramie	WY	82070
nd Avenue rporation		1404 Grand Ave	Laramie	WY	82070
Guice	Jimmy D. & Robyn A.	P.O. Box 310	Laramie	WY	82073
Haefner	John A. & R. Renee	4825 Sunset Dr	Laramie	WY	82070
Hansen	William L. & Nancy B.	6323 Grandview Drive	Laramie	WY	82070
Hardy	Scott & Melissa	5200 Howe Rd	Laramie	WY	82070
Hargraves	Garrie D. & Pamela E.	1402 Koster Rd	Cheyenne	WY	82009
Hargraves	Kent & Sandra	1064 S Davenport Dr.	Grantsville	UT	84029
Heard	George E. & Anna Maria	P.O. Box 2228	Laramie	WY	82073
Hedley	Frank A. & Connie L.	3125 Sage Dr	Laramie	WY	82070
Helling	Ronert F. & Carolyn W.	P.O. Box 762	Laramie	WY	82073
Henschel	Howard L. & Nanette R.	3725 Howe Ln	Laramie	WY	82070
Herbert D. Pownall Revocable Trust	Pownall, Herbert D.	5000 Sunset Dr	Laramie	WY	82070
Higham	Jill	5315 Meadow	Laramie	WY	82070
Hoopes	Verdon & Debbie	1505 Palomino Dr	Laramie	WY	82070
Hughes	Harlan & Lois	30 Ramble A Rd	Laramie	WY	82070
Hurwitz	Caroline Elizabeth	809 Ord St	Laramie	WY	82070
Ibarra	Mario A. & Troy J.	118 Mountain Air Rd	Laramie	WY	82070
Jacobs	James J. & Carol A.	3542 Sage Drive	Laramie	WY	82070
airell	Ronald E. & Barbara A.	5330 Meadow Lane	Laramie	WY	82070

Jauncey	William T & Marcia B	3204 Mesquite Lane	Laramie	WY	82070
Jenkins	Vicki & Mark Wheelis	2525 9th Ave West	Seattle	WA	98119
JHD Ranch LLC		1960 US HWY 85	Cheyenne	WY	82009
nson	Elliott E. & Elizabeth H.	P.O. Box 1655	Laramie	WY	82073
Johnson	James A. & Deanna S.	5203 Meadow Lane	Laramie	WY	82070
Johnson	Ory Joe	3215 Sage Dr	Laramie	WY	82070
Kaltenbach	C. Colin & Ruth H.	727 E Via Entrada	Tucson	AZ	85718
Kerr	Greg & Dianna	15 Kerr	Laramie	WY	82070
Kersting	James Patrick	4230 Howe Rd	Laramie	WY	82070
Kite	Byra A. III	3333 Sage Dr	Laramie	WY	82070
Kline	Margaret	PO Box 785	Laramie	WY	82073
Knopp	Larry V. & Roxi A.	4919 Wyatt Ct	Laramie	WY	82070
Kuhn	Vicki S.	PO Box 2870	Cheyenne	WY	82003
Lane	Phillip A	5051 Howe Lane	Laramie	WY	82070
Laramie Plains Antenna & TV Assoc.		PO Box 188	Laramie	WY	82070
Lazy JW Investment Company, LLC		4630 Vista Dr	Laramie	WY	82070
Lindahl	Peter M. & Joanne H.	5415 Meadow Lane	Laramie	WY	82070
Lodgepole Ranch LLC		1960 US HWY 85	Cheyenne	WY	82009
Luhr	Suzanne C. & Wesley L.	603 S 12th	Laramie	WY	82070
Machalek, Richard S.	Barnes, Donna A.	4915 Sunset Dr	Laramie	WY	82070
March	Jeffery J. & Cindy L.	3926 Canyon Court	Laramie	WY	82070
rshall	Kent G. & Janice J.	5505 Sunset Dr	Laramie	WY	82070
Martin	Tom	4285 Soldier Springs Rd	Laramie	WY	82070
Martin	William P	5530 Skyline Dr	Laramie	WY	82070
Matthew Brown Revocable Trust		680 State Rd 344	Edgewood	NM	87015
Maurer	Darren L & Emily J	PO Box 260034	Lakewood	CO	80226
McLean	Howard Lee & Katherine	5301 Wabash Ave	Terre Haute	IN	47803
Michael R. Boyd Living Trust	Michael R. & Cynthia S. Boyd	350 Gilmore Gulch	Laramie	WY	82070
Moffett	Mark A. & Mary B. Ruskey-Moffett	5520 Skyline Dr	Laramie	WY	82070
Monroe	Timothy Earl & Ruth	3203 Ponderosa Lane	Laramie	WY	82070
Montgomery	Donald L. & Carol L.	3350 Mesquite Lane	Laramie	WY	82070
Moore, Robert A.	Moldenhauer, Susan B.	4024 Pope Springs Rd	Laramie	WY	82070
Mountain West Farm Bureau	Mutual Insurance Company	P.O. Box 1348	Laramie	WY	82073
Myers	Sandra A & John E.	P.O. Box 543	Laramie	WY	82073
Nature Conservancy	Randy Craft	258 Main St, Ste #200	Lander	WY	82520
Nichols	Alan W. & Andrea C. Devita	3213 Mesquite Lane	Laramie	WY	82070

Novak	Lance	5306 Skyline Dr	Laramie	WY	82070
O'Donnell	Gregory W. & Debra L.	P.O. Box 1021	Laramie	WY	82070
Olsen	Ronald H. & Anne T.	4848 Sage Dr	Laramie	WY	82070
ntin	James A. & Jo Marie	14 Paradise Valley Rd	Laramie	WY	82070
Pajak	Mark W. & Nancy R.	1422 Bridger Rd	Laramie	WY	82070
Pantier	Vincent M. & Marti S.	4100 Howe Rd	Laramie	WY	82070
Paul	Margret M	3210 Evergreen Dr	Laramie	WY	82070
Pawlowski	Clara M.	P.O. Box 1825	Laramie	WY	82070
Pearson.	Michael A	1424 W. 31st Street	Cheyenne	WY	82001
Petrie	Connie M. & James C.	4804 Evergreen Dr	Laramie	WY	82070
Pilot Peak LLC		1960 US HWY 85	Cheyenne	WY	82009
Prahl	Kevin L. & Joanne M.	4310 Howe Rd	Laramie	WY	82070
Rapson	David J. & Shelley Fahnanstiel	170 Paradise Valley Rd	Laramie	WY	82070
Reif	F. David & Ilona J.	3340 Aspen Lane	Laramie	WY	82070
Reilly	William Alan	133 Mountain Air Dr	Laramie	WY	82070
Rhodine	Brent N. & Karen E.	3203 Juniper Dr	Laramie	WY	82070
Richards	Mary	3202 Aspen Lane	Laramie	WY	82070
Robbins	Craig D & Paula L	5148 Valley View Rd	Laramie	WY	82070
Rogers	Rodney D. & Mary N.	3320 Mesquite Lane	Laramie	WY	82070
Rollin	Robert Leon	2640 S Hubbard Rd	Lowellville	OH	44436
Rollin	Bernard E. & Linda M.	2101 E County Road 30	Fort Collins	CO	82525
Rollin H. Abernethy ng Trust	Carolyn A. Abernethy Living Trust	12 Trotter Ln	Laramie	WY	82070
Ronald Wayne Maars Trust	Glenna Louise Maars Trust	376 Gilmore Gulch	Laramie	WY	82070
Root	Margaret L.	3049 Sage Dr	Laramie	WY	82070
Rovani	Joseph R. Jr. & E. Margarita	5635 Sunset Dr	Laramie	WY	82070
Sailors	Erin M.	5710 Howe Rd	Laramie	WY	82070
Sandra B. Brome Living Trust	Sandra B. Brome	P.O. Box 2104	Laramie	WY	82073
Schaaf	Joseph G & Eva M	PO Box 658	Laramie	WY	82073
Scherer	Robert L. II	P.O. Box 2060	Laramie	WY	82073
Schroyer	Gordon L. & Julie M.	5300 Canyon Ranch Rd	Laramie	WY	82070
Schutterle	Robert J. & Kacee K.	1613 Hackney Dr	Laramie	WY	82070
Schutz	Marvin P & Mary Jo	7903 Powderhouse Rd	Cheyenne	WY	82009
Scott	Walter D. Scott & Suzanna L. Penningroth	3213 Juniper Dr	Laramie	WY	82070
Sinner	Leonard A. Jr.	600 S 2nd St	Laramie	WY	82070
Smallwood	Jason & Stacey	64 Paradise Valley Rd	Laramie	WY	82070
State of Wyoming	Off. of State Lands & Investments	Herschler Building 3-W	Cheyenne	WY	82002
Steinkraus	Peter B. & Holly B.	5949 Howe Lane	Laramie	WY	82070

Strom	Richard E.	P.O. Box 1513	Palmer Lake	CO	80133
Sundial Acres, Inc.	Malin, James	P.O. Box 1135	Hockessin	DE	19707
Sierczek	Clinton Andrew & Dennie Lynn	P.O. Box 2497	Laramie	WY	82070
Trotter	Richard L. & Diane H.	21 Trotter Ln.	Laramie	WY	82070
Ullrich	John A & Tracy A	27 Laredo Dr	Laramie	WY	82070
United States Forest Service	Laramie Ranger District	2468 Jackson St	Laramie	WY	82070
Uren	W. Richard & Mickey Ann	67 Eagle Nest Ln	Laramie	WY	82070
Walden	William E. & Mary S.	3428 Sage Dr	Laramie	WY	82070
Wallen	David F.	3201 Aspen Lane	Laramie	WY	82070
Walsh	Jerry B.	4820 Vista Dr	Laramie	WY	82070
Walsh	Jerry Travis & Aimee	4630 Vista Dr	Laramie	WY	82070
Warren Livestock, LLC		1961 US HWY 85	Cheyenne	WY	82009
Waitkus	Brian R.	P.O. Box 1411	Laramie	WY	82073
Webb	Eric B & Kathleen L.	5720 Gap Rd	Laramie	WY	82070
Wechsler	Perry J.	4810 Ponderosa Lane	Laramie	WY	82070
Weibel	Torry & Julia	5602 Gap Rd	Laramie	WY	82070
Wilkerson	Gary C. & Norma N.	5410 Meadow Lane	Laramie	WY	82070
Williams	Paul A. & Judy L.	122 Satanka Road	Laramie	WY	82070
Williams	Shannon Marie	3445 Evergreen	Laramie	WY	82070
Wirkert	Wade D.	5445 Valley View	Laramie	WY	82070
Young	Maude E.	12545 Northlake Court	Fairfax	VA	22033

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Mine Plan IX

PERMIT #298C-A8
Etchepare Limestone Quarry

SUBMITTED TO:
WYOMING DEPARTMENT OF ENVIRONMENTAL QUALITY
LAND QUALITY DIVISION
HERSCHLER BUILDING
CHEYENNE, WYOMING 82002

SUBMITTED BY:
MOUNTAIN CEMENT COMPANY
5 SAND CREEK ROAD
LARAMIE, WYOMING 82070
(307)745-4879

Submitted: April 2010

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Approved:_____

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MAPS

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Appendix MPIX-B
Groundwater Monitoring Results — MPIX-B1

Appendix MPIX-C
Groundwater Monitoring Protocol — MPIX-C1

Appendix MPIX-D
Legal Documents For Howe Lane & N. Piper Haulroad — MPIX-D1

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MPIX-1.0 **Site Location**

This mine plan covers Mountain Cement Company's *(a.k.a. MCC)* Etchepare Limestone Quarry, located approximately 7 miles southeast of Laramie, Wyoming in southern Albany County. More specifically it is located in Sections 7,17, 18, 19, 20, 21, 28, 29, 30, 31, 32, 33 T15N, R72W, Sections 13, 24, 24, 26, 36 T15N, R73W, 6th P.M. and occupies approximately 8434 acres (Map MPIX-1). The site varies in elevation from 7400' to 8700'. Mining activity will take place on approximately half of the permit area. Access to the mining areas will be provided by a network of haulroads; the particular road being used at anytime will be a result of the area being mined. The yearly and current projected mining activities will be updated and shown in the Annual Report (Permit No. 298C), and submitted to the LQD.

MPIX-2.0 **General Description**

MPIX-2.1 Type of Mine

The rock mined in this quarry is limestone. Limestone is a major raw mix component for the manufacture of Portland cement. At current cement production rates, approximately 840,000 tons of limestone will be removed each year from all of MCC's various limestone quarry sites. The limestone deposits in this quarry vary in quantity and quality; therefore, it is essential that MCC be able to quarry multiple pits at any given time for blending purposes. Also, due to the harshness and unpredictability of weather in the Laramie Basin, MCC must be able to access multiple pits in case of adverse weather conditions Mining in the this quarry will begin in the southern extents of the permit area and move west, then will move to the far north and progress southward as MCC mines eastward up the ridge crests, as shown on Map MPIX-1.

MPIX-2.2 Life of Mine

MCC estimates the reserve life of the Etchepare Limestone Quarry to be at least 125 years and could be at most 200 years. This reserve life estimate is based on an approximate annual limestone demand of 500,000 tons until 2027, when the Weaver Quarry becomes depleted; then an estimated 1.1 MTons (million tons) will be mined each year. The reserves are

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estimated to be approximately 200 MTons when taking into account mining 2 layers of limestone in approximately half the pits.

MPIX-2.3 Equipment

MCC owns and maintains an equipment fleet that is used at all of its quarries. That equipment currently includes portable jaw and cone crushers and associated van trailers, Caterpillar 972 and 988 wheel loaders, a Caterpillar D8 track-type tractor bulldozer, a Caterpillar 140 motor grader, 2 Caterpillar 637 open bowl wheel tractor-scrapers, a Caterpillar 320 hydraulic excavator, conveyors, several belly-dump haul trucks, and a skid steer loader. Equipment related to blasting will be used by a blasting contractor; this equipment currently includes a track mounted pneumatic rock hammer drill, and a blasting agent bulk straight truck. That drill is also used for exploratory drilling currently. In the future MCC may operate larger Off-Highway Quarry Haul Trucks, larger Mining Shovels, larger Wheel Loaders, and conveyor systems

MPIX-2.4 Nature of Ore Reserve

The permit area is located on the southeast side of the Laramie Basin, on the western flank of the Laramie Mountains. In the subject area, strata of Pennsylvanian and Permian Ages dip approximately 2° generally to the west-northwest away from the Laramie Mountains and toward the center of the basin. The stratum that outcrops within the permit area is primarily the limestones and sandstones of the Casper Formation. It has also been noted that there is a wide variability in the limestone strata, especially in thicknesses thinning from North to South, but also in the chemical, sedimentological, petrological, and paleontological composition. The limestone deposits mined may range from 10 to 20 feet in thickness; in nearly half of the pits MCC will mine 2 limestone deposits. For more information on the Nature of the Ore Reserve see the DIX5 Geology Appendix and the DIX3A & B Archeology & Paleontology Appendices.

MPIX-2.5 Other Minerals or Claims

There are no currently identified deposits of other minerals within the quarry area. No known other mineral claims exist within the quarry area.

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MPIX 3.0 **Description of Operation**

MPIX-3.1 Facilities

Permanent facilities will not be required on-site. Facilities related to washing, maintenance, etc. will not be required within the permit area. MCC maintains its equipment fleet at the truck shop, located at MCC's Laramie plant, which is less than 7-miles from mine site. There will be no permanent buildings, or processing plants. There will a portable crusher that MCC will use in the pits to stockpile crushed limestone.

MPIX-3.2 Access and Haul Roads

Currently there are approximately 4 miles of haulroads within the Etchepare Quarry. These are main arterial haulroads are Howe Lane, Mountain Air Lane, and the North Piper Haulroad. These roads will remain in place after mining is complete and left for residental and private use. Mountain Cement uses the roads in Section 25 (Howe Lane & Mountain Air Lane) pursuant to permanent right-of-ways in the west half of the section and an agreement & easement with landowners in the east half, as documented by the attached Final Mandate and Warranty Deed (see Appendix MPIX-D). Mountain Cement uses the road in Section 24 (North Piper Haulroad) pursuant to an agreement with the surface owner.

In addition to the currently established haulroads, MCC plans on constructing 10.3 miles of additional haulroads to create access to and from the existing arterial haulroads. The total possible mileage of haulroad will be approximately 16 mile. These additional haulroads will not be permanent and will be constructed as needed and removed when hauling on them is complete. These haulroads will be placed on top of existing two-track roads where possible, and then reduced back to two-track roads when hauling is complete. The location of these roads will be provided in the annual report; the bond will be updated annually to reflect the addition and removal of these roads.

Haulroads without paving may be treated with suitable dust suppressants, in addition to water, to control fugitive dust. The surface treatment will be maintained on a continuous basis for the period that the road is in use.

There will be one road used as an access route only. This route is Skyline Drive adjacent to the interstate. This route will be used for personnel access only.

Mountain Cement will get WDEQ-LQD approval for the construction of all haul roads, and will submit information pertaining to the design and locations of the roads.

MPIX-3.3 Power and Communication Lines

Power and communication lines are not expected to be needed for this project and no existing lines will be affected. However, in the event that new power lines are deemed necessary they will be constructed in accordance with design criteria specified in:

Olendorff, R.R., A.D. Miller, and R.N. Lehman. 1981. Suggested Practices for the Raptor Protection on Power lines -- the state of the art in 1981. Raptor Res. Rep. No. 4, Raptor Research Foundation, Inc. Univ. Minn., St. Paul.

MPIX-3.4 Solid Waste Disposal

Solid waste will not be produced at the site so disposal areas are not needed. Any waste material from equipment or other sources will be hauled to the cement plant for proper disposal or transfer.

MPIX-3.5 Railroads or Other Facilities (including Fueling)

There will be no rail systems constructed; all material movement will be done by equipment listed above. Conveyors may be installed and used when mining in certain areas of the permit, these conveyors will be temporary in nature.

MPIX-3.6 Limestone and Overburden Storage and Stockpiles

The limestone will be crushed and stockpiled in the mined out pits. When possible, overburden will be hauled directly to the former pit and be placed below grade for use in contouring. Overburden will also be used to construct roads where necessary. Although it is MCC's intent to utilize the overburden for backfilling as its being removed; Map MPIX-1 shows the likely location of overburden stockpiles when storage is necessary.

MPIX-3.7 Access Control Features

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The site will not present a hazard to the public or animals. Lockable metal gates will be installed on the North Piper Haulroad, Howe Lane, Mountain Air Lane entry, and at the end of Skyline Drive. These four entrances will have 4' x 8' signs (main entrance signs) posted with warnings describing site activities and restricting access to authorized personnel only. Pursuant to Wyoming Statute § 35-11-415(b)(i)these entrance signs will also have on them information relative to the operation; including the company name, address, phone number, LQD permit number, authorized agent contact information, the quarry's name, and MSHA Identification number.

The four main entry points will be locked during non-operating hours; all other access points will always remain locked. At the eastern edge of the permit boundary, MCC will lock the gates where U.S.F.S. roads dead end at the Mountain Land & Cattle property fence line, all other locks will be removed, and this fence line will be maintained regularly by MCC. In addition to removing all non-MCC locks from these gates, "Danger, No Trespassing" and "Restricted Area, Do Not Enter" signs will be posted at these gates. Existing livestock fencing will remain except in areas where mining will occur. All new fencing will be placed as needed to protect livestock, wildlife, and humans from hazardous operations.

MPIX-3.8 Storage and Equipment Refueling Areas

The Etchepare limestone quarry is within an area identified by the City of Laramie and Albany County as the Casper Aquifer Protection Area. Although Mountain Cement's quarries are identified as a Low Priority in the approved 2011 Casper Aquifer Protection Plan, Mountain Cement will employ Best Management Practices (BMP) to prevent adverse impacts to the Casper Aquifer. Areas away from the mine pits and blasting areas will be designated for the blasting magazines, rented portable toilet, storage shed containing equipment, tools, oil and antifreeze drums. (see MAP MPIX-1). A portable fuel tank may be located in the area away from the mine pits and blasting areas (as shown on MAP MPIX-1) for fueling equipment. Impermeable liners and berms will be used around any such fuel tank to prevent contamination of groundwater.

Mobile and track equipment used in the limestone mining process (including, but not limited to those listed in the above Equipment Section) may be refueled via fuel tanker trucks in designated mobile equipment refueling areas throughout the quarries. These refueling areas will be moved or

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additional refueling areas will be constructed as necessary. (MCC will provide a map showing the location of these mobile refueling areas with its annual report). While fueling, a catch-pan/bucket will be utilized to catch any drips or spills. A spill kit will be placed at all equipment refueling area to mitigate small spills.

Each equipment refueling area will be constructed as follows:

1. The refueling area will be large enough to accommodate a fuel truck and the single largest piece of mobile equipment to be used in the quarry;
2. The refueling area will be constructed on intact limestone on the quarry floor and will be covered with a minimum of 40mm plastic and shale or fine sand;
3. A layer of shale of sufficient thickness to prevent damage to the plastic liner will be placed on the plastic;
4. A spill kit will be located in the mobile refueling area;
5. A U-shaped berm will be place at the down gradient end of the refueling area with the opening facing up gradient. The berm will be made of fine grained material, i.e. fines left over after screening. The berm will be sized in such a way as to contain the maximum possible spill; and
6. Appropriate signage will be placed in the refueling area.

Prior to beginning the first use of any refueling area, MCC will submit a letter to DEQ/LQD signed by MCC's Environmental Manager, certifying that the mobile refueling area has been constructed or modified in compliance with the above standards.

The portable crusher/screening plants are powered by diesel or gasoline generators. These generators have in-line primary fuel tank which will be located on a plastic liner. MCC will construct secondary containment consisting of a plastic-lined berm designed to contain the full contents of any such in-line fuel tank or other fuel storage units. The generator will be refueled by truck as necessary. While fueling, a catch-pan/bucket will be utilized to catch any drips or spills.

All seams in plastic liners will be installed in such a manner that they will not be contaminant pathways. When a fueling area or containment is decommissioned any underlying material and plastic liners will be properly disposed of or be decontaminated prior to reuse.

General equipment maintenance will be done at the plant. However, if it is necessary to repair a piece of equipment while at the quarry drop cloths will be used to catch any drips or spills.

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Spill kits at all refueling areas contain a shovel, absorbents and disposal bags. Small spills will be cleaned up using the spill kits. Larger spills will be cleaned up immediately utilizing mobile equipment (i.e. backhoes, loaders, haul trucks, etc.). All contaminated material will be transported off-site and disposed of appropriately.

MCC will notify Wyoming Department of Environmental Quality, Water Quality Division of all spills of refined crude oil products (i.e. gasoline, diesel motor fuel, etc.) which occur in quantities greater than twenty-five (25) gallons. Notification to the division will be as follows: a) MCC will verbally report spills of greater than twenty-five (25) gallons to the division within twenty-four (24) hours, including notify the division of the type, quantity, and location of the release, and of the response, containment, and cleanup actions which MCC has taken or MCC proposes to take; and b) MCC will submit a written report to the division within seven (7) days following the reportable spill, describing the reportable release and steps taken to prevent a recurrence.

Mountain Cement also commits to notifying City of Laramie and/or or Albany County in the event of a spill, as outlined in the approved 2011 Casper Aquifer Protection Plan.

MPIX-4 .0 **Mining Method and Schedule**

MPIX-4.1 Topsoil and Subsoil

Topsoil, subsoil, and any plant growth media will be salvaged as topsoil. Topsoil material will be salvaged using wheel loaders, track-type tractor dozers, and/or wheel tractor scrapers. Please see Table DIX7-2 for projected soil salvage depths. The material will be replaced using the same equipment. Topsoil will be stockpiled for later replacement adjacent to the pits (Map MPIX-1). All topsoil piles will be identified with signs; they will also be toe-ditched/bermed to protect them from erosion. The topsoil piles will be seeded with a temporary seed mix. Each mining pit will have its topsoil placed on top of the highwall adjacent to the pit. After the topsoil is removed and stored, MCC will begin to remove overburden. Please refer to section RPIX-5.0 (specifically Table RPIX-2) in the reclamation plan for the temporary seed mixture.

MPIX-4.2 Pit Excavation

MCC will most use surface mining methods to mine their limestone. This involves removing the overburden from an area on the ridge top, mining the limestone from edge to edge then replacing the overburden back on the mined surface in a configuration and slope similar to that of pre-mine topography.

Overburden in the area ranges from 0 to 25 feet in thickness with an expected average of 10 feet. The overburden is largely weathered sandstone, unsuitable limestone, and regolith, or a combination of those. The limestone will be exposed by removing the overburden with mobile equipment listed above. Overburden will either be directly hauled to where it can immediately be used in backfilling or, when necessary, it will be stockpiled for later use in backfilling. Where MCC will mine 2 layers of limestone the interburden will be hauled or stockpiled as backfill material, the interburden maybe as thick as 30 feet in areas. The wheel tractor scrapers will act to compact the overburden material as it is being placed.

The overburden may also be used to construct roads when necessary; when the roads are removed the overburden will be used in backfilling a nearby pit. There are no combustible, toxic, acid forming, or radioactive materials in the topsoil, overburden, or limestone that needs to be disposed of, treated, or covered. There will be times when MCC will use the overburden material to construct haulroads. The location of overburden stockpiles and placement for contouring and backfilling will be updated on the annual report maps.

MPIX-4.3 Limestone Handling

After overburden is removed the limestone will be drilled and blasted. Section MPIX4.4 through MPIX-4.6 present blasting procedures. When a section of rock has been blasted, the shot-rock will be loaded into belly-dump haul trucks using the large wheel loaders, and transported to the plant for further processing.

MCC will have their portable crusher unit in the quarry the majority of the time, excepting when it is being used at another quarry. When crushing the shot-rock, MCC may utilize multiple large wheel loaders; one to load haul trucks and the other to feed the crusher. The crusher will be place in or adjacent to the current mining pit to remain as time and fuel efficient as possible. The crushed material will be stockpiled on previously mined areas and will

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be piled at the angle of repose allowed by the height of the conveyor or the maximum lift heigh of the front-end loaders. MCC will haul from the crushed stockpile or shot-rock piles as deeme necessary by the cement plant's operation.

As mining progresses toward the drainage/lateral edges of pits a highwall remnant or an in situ barrier will be left for use in reclamation. This barrier will be used to support the backfill material, holding the lateral edges of fill in place to prevent slumping and sliding. The height of this barrier will be determined on a per pit basis; the barrier will be as high as the highwall at its highest, and no less than half the height of the highwall at its shortest.

In addition to controlling dust as outlined in Section MPIX-4.9, MCC has in the past and will continue to dowse the shot rock and crushed material piles when they are being loaded from on very dry and windy days. Furthermore, the portable crushing unit is equipped with water sprays to control the dust when crushing the shot rock. Mountain Cement will adhere to the requirements of the WDEQ-Air Quality Division concerning water use for dust suppression and crushing equipment.

MPIX-4.4 Blasting

It is necessary for MCC to blast in order to mine limestone. When blasting is required, MCC agrees to comply with the following conditions:

A. General Conditions for All Blasting:

1. MCC agrees to use blasting methods and techniques as described in "Rock Blasting & Explosives Engineering" handbook, Per-Anders Persson, Roger Holmberg, and Jaimin Lee, 1994.

2. The coal surface mine blasting limitations for peak particle velocity and PSI over pressure contained in Chapter 6 of the most current Department of Environmental Quality, Land Quality Division, Coal Rules and Regulations will be applicable to this quarry operation. Those responsible for performing blasting will be advised of the location of any inhabited structure, pipeline, cable right-of-way, and groundwater wells. The responsible party will adjust their detonation design appropriately.

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3. The drilling and blasting contractor will complete an individual record for each blast. Each record will be maintained at the MCC main office and will be available to WDEQ/LQD personnel during normal compliance inspections and to the WDEQ/LQD Administrator upon request. Each individual blast record will be maintained for a minimum of three years from the date of the blast.

   The records will contain the following information:

   a. Name of permittee, operator, or other person conducting the blast;
   b. Location, date and time of blast;
   c. Name, signature, and certification number of blaster conducting blast;
   d. Distance to and direction of nearest dwelling;
   e. Type of material blasted;
   f. Diameter and depth of holes;
   g. Types of explosives used;
   h. Number of holes loaded and detonated;
   i. Number of delays and number of holes per delay detonated;
   j. Maximum weight of explosion detonated within any 8-millisecond period;
   k. Initiation systems;
   l. Type and length of stemming;
   m. Direction and speed of prevailing wind at time of blast;
   n. Burden;
   o. Spacing;
   p. Total Amount of explosives;
   q. General weather conditions; and
   r. Shot diagram showing free faces, north arrow, initiation location, and delay pattern.

4. MCC will observe Wyoming Statutes, Article 5 - Shot-Firers. State certified blasters conduct all blasting.

5. MCC will attempt to limit blasting to two times a week. This schedule may be accelerated if there is a material shortage or if overburden must also be blasted.

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6. MCC will try to avoid blasting when the wind is toward any residence or residential area within one mile of the permit boundary. If a blast is prepared when the wind is toward a residence or residential area, the blaster may nonetheless detonate the blast.

7. No blasting will take place prior to sunrise or after sunset.

B. <u>Additional Requirements when Blasting in the Proximity of Homes.</u>

8. When MCC blasts within 500 feet of its permit boundary in the proximity of homes, the following additional procedures will be followed:

a. The shot pattern will be decreased to an 8 X 8 pattern;

b. The diameter of the holes will be decreased to no more than 3 ½ inches;

c. MCC will use adequate stemming to reduce flyrock; and

d. All other procedures will be followed as previously described.

C. <u>Additional Requirements when Blasting Upwind from Homes.</u>

9. When blasting occurs upwind from nearby homes the following additional procedures apply:

a. MCC will use its best efforts to prevent blasting between the hours of 12:00 PM to 1:00 PM, and after 3:00 PM;

b. MCC will use its best efforts to avoid blasting when there is low cloud cover or a temperature inversion;

c. MCC will use its best efforts to avoid blasting when the wind is blowing in the direction of nearby residences; and

d. In the event that MCC is required to set off a blast when the wind is in the direction of nearby homes, or when there is a temperature inversion, the Company will call (i) any nearby neighbors expected to be affected by the blast, and (ii) DEQ-LQD prior to setting off any such blast.

Because there may be times when the foregoing conditions may come into conflict, it shall be understood that the foregoing conditions are listed in order of priority, with the first being the most important, and the last being the least important. Once holes are loaded with

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blasting material it is understood that the blast must take place during that same day for safety reasons.

MPIX-4.5 Air Blast Limitations

Airblast at any dwelling, public building, school, church and community or institutional building located outside of the permit area shall not exceed the limits set forth in the current version of the WDEQ/LQD Coal R&R Chapter 6, Section 4(b)(i).

At the request of the Administrator, the operator shall conduct periodic monitoring to ensure compliance with the airblast standards. The Administrator may request copies of complaints when blasting in sensitive areas, and in areas where there is reason to believe airblast limits may be exceeded. The measuring systems shall have a upper-end flat frequency response of at least 200 Hz.

MPIX-4.6 Peak Particle Velocity Limitations

Maximum peak particle velocity applicable when seismograph records are provided for each blast:

Distance (D) from the Blasting Site in Feet	[1]Maximum allowable peak particle velocity (vmax) for ground vibration in inches/seconds [1]	[2]Scaled distance factor to be applied without seismic monitoring
0 to 300	1.25	50
301 to 5,000	1.00	55
5,001 and beyond	0.75	65

[1]Ground vibration shall be measured as the particle velocity. Particle velocity shall be recorded in three mutually perpendicular directions. The maximum allowable peak particle velocity shall apply to each of the three measurements.

[2]Applicable to the scaled-distance equation of the following paragraph.

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An operator may use the scaled-distance equation, $W=(D/Ds)^2$, to determine the allowable charge weight of explosives that can be detonated in any 8 millisecond period without seismic monitoring (where W = the maximum weight of explosives, in pounds; D = the distance, in feet, from the blasting site to the nearest protected structure; and Ds = the scaled-distance factor, which may initially be approved by the Administrator using the values for scaled distance factor listed in the above paragraph).

MPIX-4.7 Mine Sequence

The mine sequence will progress as shown on Maps MPIX-1 and MPIX-2. MPIX-1 outlines the location and general sequence of mining areas while MPIX-2 shows the individual pit area locations and mining direction within the larger mining areas. The quarrying/disturbance areas are labeled as consecutive mining areas #1 through #11, with some broken down further into areas numbered # 5A, 5B, etc. Mining will begin in the southwestern portion of the permit area in pit 1 of Area # 1 and progress eastward uphill. From Area #1, the mining will move to # 2 and then to #3 and so on. In Area #3, mining again moves eastward and uphill before making the final move south to Area #4. From Area #4 mining moves northward to Area #5; mining will progress from north to south through Areas #5A, B, C. Area #5D may not be mined for limestone, but for aggregate; in short, it would be skipped over in sequence. Area #6 is the northern most mining area in the permit, mining here will progress from west to east. From Area #6 mining continues in a south-southeasterly direction through the #7 and #8 Areas. The #9 Areas lay just north of the #8 Areas, mining in the #9 Areas will progress from east to west, and move southward at the completion of each pit. Areas #10 and #11 are the final quarries to be mined, both pits progress from west to east. The individual pits in Areas #7, 8, 9, 10, and 11 will be mined for 2 layers of limestone.

Pits 1-17 are approx. 15 acres, designed to yield roughly 500,000 Tons of limestone. The remaining pits, 18-126, are roughly 30 acres in size, designed to yield approximately 1.1 MTons where mining one layer or 2.2 MTons where mining 2 layers. Each block/pit corresponds roughly to one year. This is because the Weaver Quarry will be depleted in 2027 so all limestone will be coming from the Etchepare and the cement plant will have a increased production rate in the next decade which will require 25% more limestone.

Each pit will be reclaimed in a similar sequence to how it is mined; one year's overburden will be directly hauled to backfill and contour the prior year's disturbance. See the Reclamation Plan, RPIX, for further details on reclamation activities. MCC plans to mine, or at least have accessible, multiple pits simultaneously; this is necessary because extenuating circumstances (adverse weather conditions, snow drifts, etc. or limestone quality) may make doing so essential to keep the cement plant running. As a result of the same circumstances, it will be necessary for MCC to have the ability to crush and haul limestone outside of normal operating hours. The yearly current and projected mine sequence will be updated and shown in more detail in the annual reports.

MPIX-4.8 Mining Hydrology

The Permit Area contains approximately 12 major drainages, labeled DA1 through DA12, identified on Map DIX6-1. The major drainages are divided into sub drainage areas and their channels are also identified on the map. The nomenclature for naming the drainages is as follows: for instance, DA1 identifies a major drainage, DA1-1 identifies a smaller drainage, 1, within the larger drainage, DA1; DA1-C1 identifies a channel, C1, within the larger drainage DA1. Mountain Cement will continue to seek Jurisdictional Wetlands Determinations by the U.S. Army Corp of Engineers as mining progresses, as described in the Appendix DIX10. The mining hydrology is described below:

MPIX-4.8.1 Surface Water Control Plan

Toe ditches/berms will be placed around all topsoil stockpiles and the affected areas where sediment transport is of concern. The haulroads will also be toe ditched to prevent sediment transport from the site. Overburden stockpiles and highwalls will be utilized to restrict any stormwater from leaving the disturbed area. Map MPIX-1 shows the proposed locations of overburden and topsoil stockpiles.

The sheer size and topography of the permit area make the need for controlling surface water inevitable; however, the mining areas are on the several ridge tops and will be bermed on the down gradient and lateral edges keep sediment from leaving the disturbed areas. Also, mining the ridge tops will allow the mining pits to collect surface water in them, which will keep sediment

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from leaving the disturbance area. Overburden and topsoil piles may also be placed in configurations to assist in the capture of sediment. Topsoil piles will be toe ditched/bermed to help mitigate soil transport from the stockpiles. Areas of concern are the drainage bottoms and places where MCC will have their haul and access roads. The haulroads will also be toe ditched to prevent sediment transport from the site. Where MCC will have culverts and crossings they will construct them with accepted construction practices, appropriate culverts type and size, and the necessary sediment control modules.

One or more of the following methods will be employed to control sediment movement: sediment ponds, toe ditches/berms, rock check dams, straw/hay bale check dams, or silt fencing. Please see the Figure MPIX-1 for details of rock check dams. The method(s) to control sediment movement in these sections is as follows:

Mining approximately 10-feet of limestone in the pit area will create both a highwall and depression area to passively capture and impound surface water. MCC will be mining in an upgradient direction in all but one pit, 10A, this means that the majority of the pits will utilize passive collection of sediment carrying surface water. Sediment control devices (rock berms, rock check dams, etc.) will be employed along the perimeter of the affected areas, as described above. During mining, all runoff from the affected area will be captured and diverted into the active pit to prevent sediment transport into the native drainages. Sediment control devices will be employed for in-line sediment control inside the drainage. Where practical, rock check dams will be used to control sediment migration. Where it is impractical, straw/hay bale check dams and/or silt fencing will be used to control sediment migration. If deemed necessary by MCC and WDEQ, sediment ponds will be installed where there are no other options, however, the sediment ponds for use during mining should not be confused with separate ones designed for use in during reclamation; those are described in the reclamation plan. Map MPIX-1 shows the general predicted locations sediment control devices.

MPIX-4.8.2 Facility Ponds

Though MCC is only planning to use the mining pits as sediment ponding areas during mining, if it is deemed necessary, MCC will permit and construct engineered sediment ponds; and if necessary revise this permit.

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MPIX-4.8.3 Sediment Control Structures

During mining operations sediment will be controlled and kept from leaving the site. Rock check dams or other sediment control devices will be utilized where sediment ponding areas will not effectively control sediment transport. For more detail on the construction of the rock check dams see Figure MPIX-1. During reclamation activities additional ASCM's and sediment ponds will be necessary. See Reclamation Plan for further details.

Examples of sediment control measures that maybe used and their descriptions are:

Rock Check Dams- these measures are typically constructed of cobble-sized blasted limestone, 3"-5" in diameter. These are generally placed in existing drainages and are constructed to filter as well as mitigate water's speed.

Straw Bales- these are generally small, lightweight measures that are placed on the downhill side of disturbance/reclamation areas. They are typically keyed into place in shallow trenches constructed perpendicular to water's direction of flow. They are also typically staked into place with lath or rebar. They work as a filtration and flow mitigation measure.

Earthen Berms- Berms are constructed on the margins of a disturbance/reclamation area. They are made of overburden and are placed to keep run-off within the area.

Silt Fence- similar to straw bales, silt fencing is a textile material that is keyed into shallow trenches dug perpendicular to water flow. They are staked into place and used to filter out/retain sediment.

MPIX-4.8.4 Sediment Traps and Storm Water Ponding Areas

The major method to control and mitigate sediment runoff from the mine sites will be passive stormwater ponding areas, formed by pit highwalls during mining.

MPIX-4.8.5 Culverts and Drainage Ditches

The locations of all culverts are shown on Map MPIX-1. The service life of any culvert will very depending on its location; it may be as short as 5 years and may be as long as 50 years. There will be an estimated total of 28 culvert crossings, 9 already existing. However, no more than 5 will

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be installed at any time except for the 7 left as permanent additions to the North and South Piper Reclamations. If a need arises to increase the number of culverts or change the location of a crossing DEQ/LQD will be notified. Seventeen additional channels will be crossed during the life of the quarry using culverts. None of the culverts will be utilized for the entire life of the quarry and will be limited to a service life of approximately 20 years or less. All culvert sizing was based on 100 year, 24 hour storm events using the methods of the Bureau of Public Roads and the Federal Highway Administration publication Hydraulic Design of Culverts. Where necessary the culverts will be armored with rip rap aprons that were also sized appropriately. Please see Table 1 below for the culvert sizing parameters and resultant culvert options. The addendum prepared by Western Water Consultants will be housed at the MCC main office as reference.

Table 1. Etchepare Mine Plan Culverts

Culvert Information					Circular Culverts								Pipe Arch Culverts			
					Required Barrel Diameter								Required Barrel Dimensions			
					Hw/D=2				Hw/D=3				Hw/D=2		Hw/D=3	
Culvert Name	Culvert Location	Peak Discharge (cfs)	Culvert Length (ft)	Culvert Slope (%)	1 Barrel (in)	2 Barrels (in)	3 Barrels (in)	4 Barrels (in)	1 Barrel (in)	2 Barrels (in)	3 Barrels (in)	4 Barrels (in)	B (in)	D (in)	B (in)	D (in)
CUL-1	DA1-3	196.3	80	2.39	60	48	36	-	54	42	36	30	73	55	72	44
CUL-2	DA1-1	101.1	80	5.33	48	36	30	-	42	30	30	24	58	36	58	36
CUL-3	DA1-20	432.8	80	2.87	78	60	54	48	72	54	48	42	98	69	84	61
CUL-4	DA1-21	660.3	80	2.46	96	72	60	54	84	66	60	48	117	79	103	71
CUL-5	DA1-18	71.9	80	4.24	42	30	24	-	36	30	24	-	50	31	50	31
CUL-6	DA1-18	71.9	80	4.15	42	30	24	-	36	30	24	-	50	31	50	31
CUL-7	DA1-18	31.4	80	3.76	30	24	18	-	30	24	18	-	36	22	36	22
CUL-8	DA1-19	568.0	80	2.92	90	66	60	54	78	60	54	48	114	77	98	69
CUL-9	DA1-17	91.7	80	7.89	42	36	30	24	42	30	24	-	58	36	50	31
CUL-10	DA1-14	152.6	80	5.43	54	42	36	30	48	36	30	-	72	44	65	40
CUL-11	DA1-16	74.9	80	3.82	42	30	30	24	36	30	24	-	58	36	50	31
CUL-12	DA2-5	314.7	80	4.01	72	54	48	42	66	48	42	36	84	60	73	55
CUL-13	DA2-1	26.2	80	7.37	27	24	18	-	24	18	-	-	36	22	36	22
CUL-14	DA3-2	172.8	80	3.57	54	42	36	-	54	42	36	30	72	44	65	40
CUL-15	DA4-2	38.6	80	3.26	30	24	-	-	30	24	18	-	43	27	36	22
CUL-16	DA6	55.7	80	4.45	36	30	24	-	36	24	18	-	50	31	43	27
CUL-17	DA17	9.4	80	4.44	18	-	-	-	18	-	-	-	-	-	-	-

Notes:

-Hydrology calculations for contributing drainage areas were performed using the hydrology/sedimentology program SEDCAD.

-Culverts were sized using Bureau of Public Roads (Jan 1963) method for culverts with inlet control and verified using methods described in the Federal Highway Adminstration (FHWA) publication NHI-01-020, Rev. 5,2005 (Hydraulic Design of Highway Culverts).

-Culvert crossings were designed to pass the 100-year storm event without overtopping the road or causing significant damage to the road surface.

The amendment area lies within the second and third protection zones of the Casper Aquifer (refer to Map DIX6-3 of the hydrology section, Potentiometric Surface Map). The limestone beds (1-9) are grouped by alpha, beta, gamma, delta and epsilon (α-ε) members (Lundy 1978). The aquifer lies within the Casper formation, which is exposed to the surface at the west flank of the Laramie Range. It has a documented history of fractures and extensive

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exposures of porous sandstones (City Ordinance 2003). Because of possible contamination via fractures and/or porous exposed sandstones, an Aquifer Protection Overlay (APO) was implemented in 2003 for both the city of Laramie and Albany County.

Although the possibility of leaks and spills may be present, impacts of the Etchepare Quarry to water resources will be minimal, if not undetectable because of MCC's Pollution Prevention Plan and Spill Mitigation Plan as well as the nature of the mine. The quarry sites occur on limestone surfaces, not penetrable sandstone and will not occur as deep as the aquifer or aquitard. Mining will have no measurable impact to groundwater recharge, groundwater quality, or any permitted water rights in the area. History shows that in all the years that Monolith Portland Cement and MCC have mined the within the aquifer zone there has never been a spill or emission of significance.

There will be no short term or long term affects to the aquifer. The aquifer will not experience any water quality changes as a result of mining activities. The depth to the potentiometric surface of the Casper Aquifer below the affected areas ranges from 50 to over 300 feet. Mining will not occur within the water bearing strata of the aquifer nor will mining 2 layers occur in places where the water table is within 50 feet of the surface. The quality of water that runs in the drainages will not be affected by mining activities, as MCC will have constructed ASCMs and/or sediment ponds to allow the sediment to settle out; or impounded in stormwater ponding areas created by the highwalls of the mine area

Appendix MPIX-A contains the Stormwater Pollution Prevention Plan for the Etchepare Quarry. This document contains additional information regarding erosion and spill prevention, as well as information regarding the management team, training, and incident response.

If MCC encounters groundwater during the mining of any pit within the Etchepare Permit Area, the operations in the pit will cease. Within 48 hours, MCC will contact the LQD to provide a reasonable schedule to develop a plan to mitigate the impacts to groundwater and modify this Mine & Reclamation Plan as necessary.

MPIX-4.8.6 <u>Surface Water and Ground Water Monitoring During Mining</u>

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In consultation with DEQ/LQD, it was determined that a surface water monitoring program would not be necessary, However, post-mining surface water monitoring may be considered with future consultation with the DEQ/LQD.

Currently, seven groundwater wells are monitored in the permit area. Four of the wells are Mountain Cement's, or are used through a Temporary Use Permit with the State of Wyoming; three of the wells belong to private landowners. The wells with private ownership are sampled with permission of the landowner. All wells are monitored quarterly for static water level and water quality. Water quality samples are collected in accordance with LQD Guideline 8. The analyte suite has been established through past consultations with WDEQ/LQD to address potential types of impacts caused by mining. Groundwater monitoring results are listed on Table DIX6-6 (update table) and the wells are located on Map DIX6-2(update map).

Table -2. Groundwater Monitoring Well Ownership (as of July 2012)

Groundwater Wells	Ownership
P95938W	Private
MCMW #1(No SEO #)	Mountain Cement, Temporary Use Permit # 1516 w/ Wyo O.S.L. & I
MCMW #2 (P168948W)	Mountain Cement, Temporary Use Permit # 1516 w/ Wyo O.S.L. & I
P72810W	Private
P8769P	Mountain Cement
P94793W	Private
Waitkus-R (No SEO #)	Mountain Cement

Future groundwater monitoring program plans will be established through consultation with the WDEQ/LQD. This consultation will include determining the quantity and location of future monitoring wells, and may include changes to the analyte suite.

MCC has been conducting sampling for several years and has the physical and chemical characteristics of the water on record, please see Appendix MPIX-B for additional quarterly groundwater sampling results by year and well for the Etchepare Quarry. The analysis includes testing for hardness, alkalinity, nitrate, petroleum hydrocarbons, conductivity and recording ground water levels. Additionally, for information concerning Groundwater Monitoring Procedures please see Appendix MPIX-C Groundwater Sampling Procedures. Locations of the Monitoring Wells are shown on Map MPIX-2. Please See Map MPIX-1 for mine pit names and locations.

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Table -3. Groundwater Monitoring Parameters and Frequency

Groundwater Wells	Frequency	Parameters and Units (for all wells)
P95938W	Quarterly	Static Water Depth, Feet Lab Conductivity @ 25 °C in µmhos/cm Total Dissolved Solids @ 180 °C in mg/L Total Alkalinity as CaCO3 in mg/L Total Hardness as CaCO3 in mg/L Nitrate + Nitrate as N in mg/L Total Petroleum Hydrocarbons in mg/L
MCMW #1(No SEO #)	Quarterly	
MCMW #2 (P168948W)	Quarterly	
P72810W	Quarterly	
P8769P	Quarterly	
P94793W	Quarterly	
Waitkus-R (No SEO #)	Quarterly	

Mountain Cement is well-informed concerning the sensitivity of the Casper Aquifer and is familiar with the Casper Aquifer Protection Plan. To that end, Mountain Cement makes its groundwater monitoring data readily available for review at the Mountain Cement Front Office during regular business hours. Mountain Cement will contact the Albany County Planning Office to provide them information regarding Mountain Cement's groundwater monitoring program. Mountain Cement will also consider incorporating two of its monitoring wells into the County's larger Casper Aquifer Protection Plan well network.

MPIX-4.9 Public Nuisance and Safety

This operation will not adversely impact human life or the environment. MCC hauls from the Etchepare Limestone Quarry during the day, 365 days a years. The main stem of the haul route is and will be Howe Road/County Road 22 for the life of the mine. From where Howe Road ends access is currently gained by utilizing Howe Lane, there will be 2 alternate routes to Howe Lane, as discussed in MPIX 3.2. For more information regarding hours of operation please see Section MPIX-4.9.1

Current production rates at the cement plant and the Weaver Limestone Quarry make it necessary to haul approximately 20 large-haul truck loads a day from the Etchepare Quarry. When the Weaver Quarry reaches the end of its mine life all limestone will come from the Etchepare Quarry, thereby increasing the truck loads hauled from there to 50, between the small

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and large haul trucks. For the sake of safety and wildlife protection all haul roads and main access roads within the permit area will have a maximum posted speed limit of 35 miles per hour.

To shield neighbors from light and sounds MCC will construct berms when and where appropriate to block sounds and lights of equipment and effects of blasting in the quarry. These berms will prevent light given off by equipment from reaching houses when night operations are necessary. Light plants will be situated such that the lights will face downward toward the work site and away from residences to reduce light pollution.

MCC's blasting contractor takes the greatest of care and precautions when drilling and blasting. They follow the most stringent safety guidelines to insure no one on or near the mine site are put in danger by the operation. No blasting will be performed at night. Please see the Blasting Section, Section MPIX-4.4, of the mine plan for details.

The effects of dust created by blasting, crushing, and hauling activities on nearby residences will be minimized to by the use of dust suppressants (e.g. water, magnesium chloride). The effects of dusting caused by blasting will be minimized by coordinating all blasts with the wind direction and weather conditions. It is MCC's policy to not blast when wind is blowing towards residences and there isn't sufficient distance to disperse the dust cloud.

To further avoid becoming a public nuisance MCC will not disturb the red sandstone monoliths and outcrops that are present in Section 36, as shown outside of the mining blocks on the Mine Plan maps. Mountain Cement reserves the right to disturb the monoliths and outcrops that fall within the mining blocks but may decide to mine around them, leaving them undisturbed. Past communications with Summit Estate residents indicated that they'd like for the monoliths to remain undisturbed as they serve a value to the wildlife and the viewscape.

MPIX-4.9.1 Hours of Operation

The cement plant is a 24 hour/day, 365 days/year operation; therefore, it is necessary that Mountain Cement reserve the right to operating its quarries 24 hours/day. However, under normal circumstances, the quarries will typically only operate from dawn to dusk. Drilling and blasting will take place during daylight hours for more info on blasting see Section MPIX-4.4. Crushing typically takes place during daylight hours, but Mountain Cement may crush at night.

Equipment maintenance will mostly occur during normal operating hours, but may happen during the night shift when the equipment is parked. During regular operations the quarry will operate during the above window. Due to the dynamic nature of the cement industry, the operating hours will change as dictated by market demands, and planned and unplanned plant and crusher downtimes. When operating outside of the typical hours, Mountain Cement will use best management practices to reduce the inconvenience to neighbors and traffic.

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MPIX-4.10 Archaeological and Paleontological Resources

No significant archeological or paleontological resources have been discovered within the permit area. If, during the course of mining, previously unidentified, cultural resources are discovered, the applicant shall ensure that the sites is not disturbed and shall notify the regulatory authority. The operator shall ensure that the resource is properly evaluated in terms of National Register Eligibility Criteria. Should a resource be found eligible for listing; in consultation with the regulatory authority and the State Historical and Preservation Office, the operator shall confer with and obtain the approval of these agencies concerning development and implementation of mitigation measures. For more details on the Archeological and Paleontological Resources within the permit area please see Appendix DIX3.

MPIX-4.11 Wildlife Monitoring and Protection Plan

The Appendix DIX9 contains information regarding threatened & endangered species, species of concern, and other wildlife that potentially exists within the permit area. Correspondence from the Wyoming Game and Fish and the U.S. Fish and Wildlife Service are attached therewith. Several of the terrestrial and aquatic recommendations are included below.

Five Raptor nests are within the amendment area and 8 nests and 2 platforms are within 1-mile of the amendment area; at this time they are all inactive, and are surveyed annually. In the event a raptor nest does become active or a new nest is constructed within an area to be affected, the U.S. Fish and Wildlife Service (USFWS) will be contacted and mitigation developed.

MCC will also continue to work with the USFWS to determine protection, mitigation and monitoring requirements for raptor nests located within ½ mile of active operations. Any cages placed over nests will be removed following mining. The appropriate state permits will also be acquired. Mitigation will consist of platforms erected in designated areas not impacted from near-future mining activities. The exact location of these platforms will be coordinated with the USFWS prior to placement. Any other raptor nests which become established within ½ mile of activities will be reported to the USFWS and approved mitigation developed when deemed necessary.

Use of the area by other birds of federal interest will also be reported to the USFWS and mitigation implemented when necessary. Any observations of Threatened & and Endangered

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species (T & E) will be reported to the USFWS Ecological Services Office in Cheyenne and to the state Regulatory Authority.

Mountain Cement has included the possibility of Mountain Mahogany stands in its reclamation plan, as it is a highly sought shrub by many ungulate species. Mountain Cement has also added additional native grasses and forbs to the reclamation plan for the benefit of the ungulates.

Potential habitat for black-footed ferrets (prairie dog towns) does not occur within one mile of the area to be affected (see Appendix DIX9-Wildlife for further details). Also refer to the correspondence section, DIX9 Addendum B.

Best management practices will be used to ensure that sediment and pollutants are contained within the work areas, and disturbed areas contributing sediment will be bermed and re-vegetated promptly.

Equipment will be fueled and serviced away from streams and drainage areas; and equipment will be staged at least 300 feet from riparian areas.

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Amendment 298C-A8

Mine Plan

Etchepare Limestone Quarry

Maps

MPIX-1

MPIX-2

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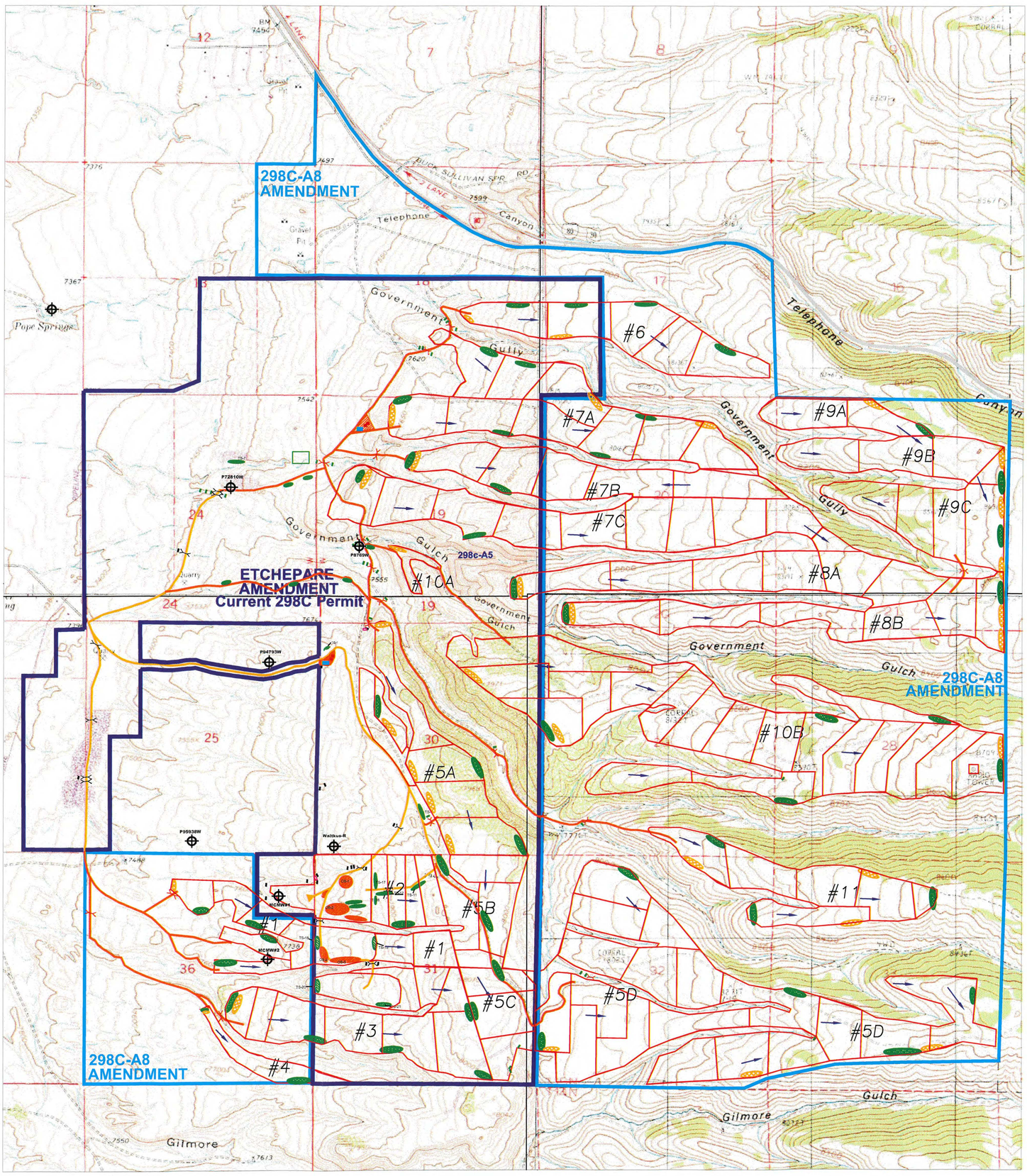

LEGEND

- Proposed 298C-A8 Amendment Areas
- Currently Approved 298C Permit Area
- #6 Proposed 298C-A8 Disturbance Areas
- Mining Direction
- Current Haul Roads
- Proposed 298C-A8 Haul Roads
- Current Topsoil Stockpiles
- Current Overburden Stockpiles
- Proposed Topsoil Stockpiles
- Proposed Overburden Stockpiles
- Existing Culverts
- Proposed Culvert
- Existing ASCMs
- Proposed ASCMs
- Current Refueling Sites
- Proposed Refueling Site
- Powder Magazines
- Proposed Powder Magazines
- Storage Shed (Tools, Oil, & Antifreeze)
- Proposed Storage Shed (Tools, Oil, & Antifreeze)
- Groundwater Wells
- Highway Interstate 80

N

1/4 mile 1/2 mile 1 mile
1320 ft 2640 ft 5280 ft

Map MPIX-1
Mine Plan Map
Permit # 298C-A8
Etchepare Limestone Quarry

Revised By:	Date:	Design By:	Date:
AHM	8/24/12	AHM	2/12/10
Revised By:	Date:	Drawn By:	Date:
AHM	2/10/13		
Revised By:	Date:	Checked By:	Date:
JWB	4/10/13		

Mountain Cement Company
5 Sand Creek Rd.
Laramie, Wyo. 82070
(307) 745-2687

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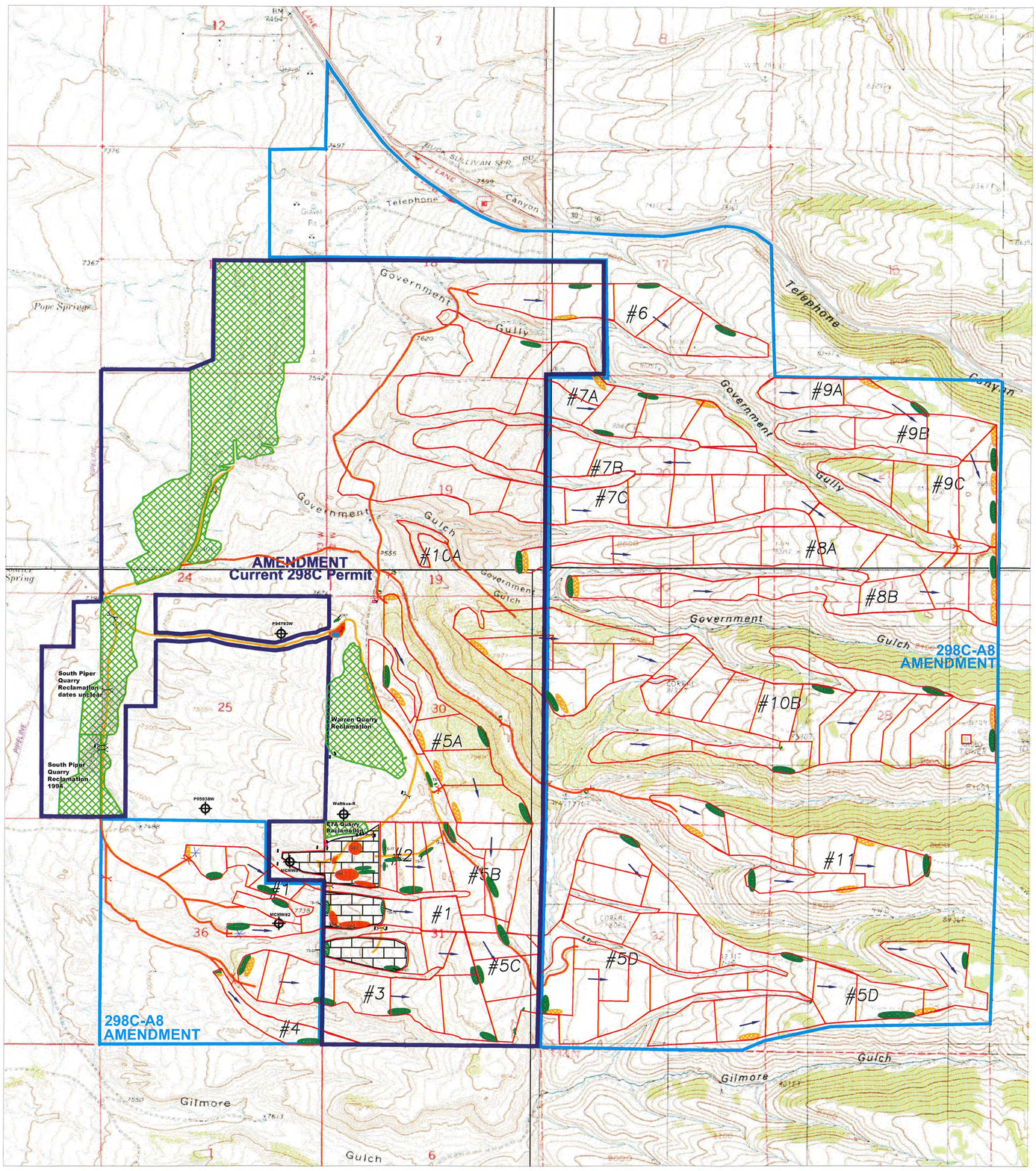

LEGEND

- Highway Interstate 80
- Proposed 298C-A8 Amendment Areas
- Currently Approved 298C Permit Area
- Mining Direction
- 1 — Mining Sequence (1-126), roughly one year per block
- Currently Disturbed
- Reclaimed Lands
- MCMW#2 — Groundwater Monitoring Well

N

1/4 mile 1/2 mile 1 mile
1320 ft 2640 ft 5280 ft

Map MPIX-2
Mine Sequence Map
Permit # 298C-A8
Etchepare Limestone Quarry

Revised By:	Date:	Mountain Cement Company	Design By:	Date:
AHM	8/24/2012		AHM	2/12/10
Revised By:	Date:		Drawn By:	Date:
AHM	2/10/13			
Revised By:	Date:	5 Sand Creek Rd. Laramie, Wyo. 82070 (307) 745-2687	Checked By:	Date:
JWB	4/10/13			
Revised By:	Date:			
JWB	10/08/13			

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Amendment 298C-A8
Mine Plan
Etchepare Limestone Quarry

Figures
MPIX

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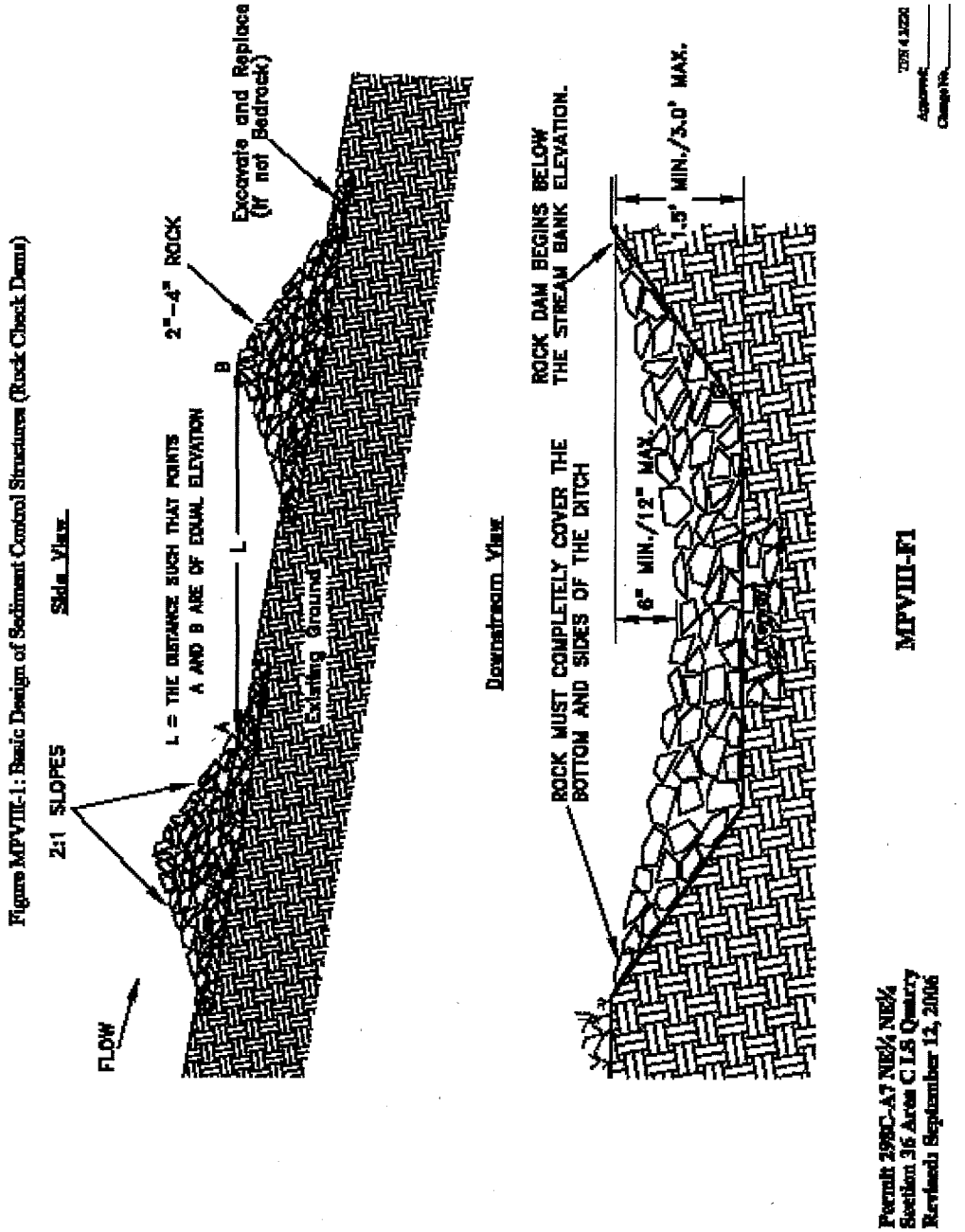
Figure MPIX-1: Basic Design of Sediment Control



S tructure
s*

* Adapted from Virginia Department of Conservation and Recreation (1992)

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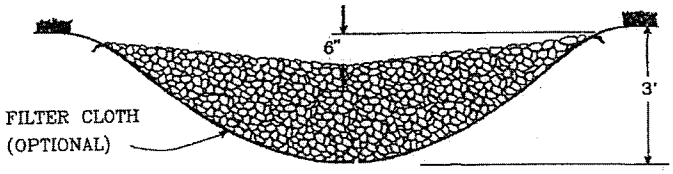
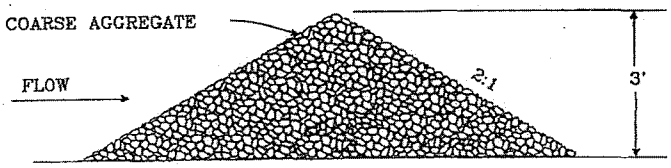
Figure MPIX-1 (cont'd): Basic Design of Sediment Control Structures*

ROCK CHECK DAM

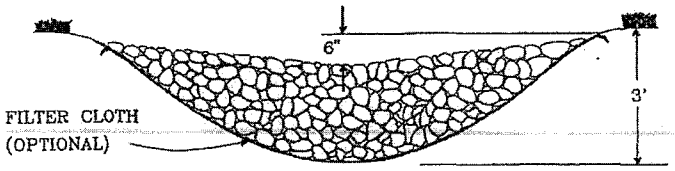
2 ACRES OR LESS OF DRAINAGE AREA:



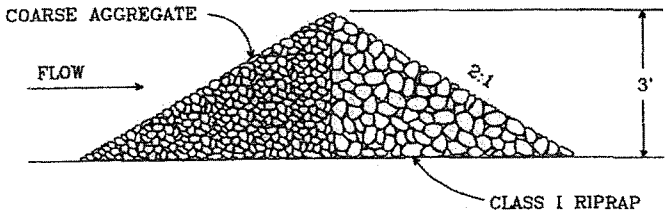
(DOWNSTREAM VIEW)



2–10 ACRES OF DRAINAGE AREA:



(DOWNSTREAM VIEW)



* Adapted from Virginia Department of Conservation and Recreation (1992)

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STORMWATER POLLUTION PREVENTION PLAN (SWPPP)

For

ETCHEPARE LIMESTONE QUARRY

[INCLUDING THE RECLAIMED PIPER AND WARREN QUARRIES]

MOUNTAIN CEMENT COMPANY LARAMIE, WYOMING

Updated July 2012

Permit Authorization Number WYR320346

Submitted to:

Wyoming Department of Environmental Quality
Water Quality Division
Herschler Building
122 West 25th Street
Cheyenne, Wyoming 82002

Submitted by:

Mountain Cement Company
5 Sand Creek Road
Laramie, Wyoming 82070

MPIX-A

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CERTIFICATION

I certify under penalty of law that this document and all attachments were prepared under my direction or supervision in accordance with a system designed to assure that qualified personnel properly gathered and evaluated the information submitted. Based on my inquiry of the person or persons who manage the system, or those persons directly responsible for gathering the information, the information submitted is, to the best of my knowledge and belief, true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment for knowing violations.

Signed_____ Date_____
Phil Lane
Plant manager
Mountain Cement Co.

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SECTION I

INTRODUCTION

The Etchepare Limestone Quarry is located approximately 5 miles southeast of Laramie, Wyoming. The Etchepare Limestone Quarry permit consists of the active Etchepare Limestone Quarry and the reclaimed Piper and Warren Quarries; the quarry is permitted with the Wyoming Dept of Environmental Quality Land Quality Division; permit number 298C. Mountain Cement Company will extract approximately 500,000 tons of limestone from these quarry pits each year. Limestone is a raw material used in the manufacturing of cement. The amount of material removed annually and; thereby, the life of the quarry will be dependent on economic conditions and the cement market.

The Stormwater Pollution Prevention Plan (SWPPP) describes practices and procedures for preventing stormwater and snowmelt runoff from being contaminated. The plan fulfills the requirements of Appendix B of the National Pollutant Discharge Elimination System (NPDES). Potential contaminants from these quarries include suspended sediment and mobile equipment fluids.

SECTION II

POLLUTION PREVENTION TEAM

The employee responsible for environmental compliance at the MCC plant and quarries is:

Environmental Manager
Mountain Cement Company
5 Sand Creek Road
Laramie, Wyoming 82070
(307) 745-4879

The Environmental Manager at the MCC facility is the SWPPP Team Leader for the quarry and is the contact person for the Wyoming Department of Environmental Quality (WDEQ). The Team Leader will implement the SWPPP developed in this document. The Environmental Manager must have a thorough knowledge of the Etchepare Limestone Quarry including site layout and operation. The Environmental Manager's current responsibilities include an understanding of the environmental requirements of the MCC plant and affiliated operations.

The Environmental Manager, or his designee, will perform quarterly inspections of all the pollution control structures and activities associated with the quarry's SWPPP, and will also be responsible for revising the SWPPP to accommodate growth of operational changes at the quarry. The Environmental Manager will keep all records, submit all reports, and coordinate

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employee training. The records documenting all applicable testing and monitoring results and a copy of the SWPPP will be available for inspection by WDEQ personnel at the plant. Certification of this report will be done by the MCC Plant Manager.

Mountain Cement Company is committed to providing the Environmental Manager and other appropriate personnel with continuing classroom and field training recommended or required by the WDEQ. If the Environmental Manager cannot fulfill all obligations under this SWPPP due to organizational changes within the company or for any other reasons, MCC will designate a new SWPPP Team Leader within six (6) months.

SECTION III

DESCRIPTION OF POTENTIAL POLLUTION SOURCES

Limestone is mined at the Etchepare Quarry for the manufacture of Portland cement. The limestone is mined, crushed, and screened and stockpiled until ready to be hauled to the cement plant. The crushed rock is transported to the plant as needed for use in the production of cement. The Etchepare Quarry is one of Mountain Cement's two active limestone quarries.

The potential pollutants for the Etchepare Quarry are suspended sediment from the disturbed areas and fuel, oil, hydraulic fluids, or antifreeze from equipment used in the quarry.

The primary method to control and minimize sediment runoff from the mine site will involve diverting water into stormwater ponding areas where sediment will be allowed to settle. These ponds will be capable of retaining design stormwater quantities as required by the Land Quality Division's Guideline No. 13. Natural low areas and highwalls will be utilized to impound all surface water. Drainage ditches will also be used to funnel water away from the active pit if deemed necessary. Check dams or hay bales will be placed strategically in the ditches to reduce the amount of sediment in the discharged water.

Topsoil stockpiles will be toe-ditched and revegetated to reduce the transport of soil and sediment from the stockpiles.

Overburden stockpiles will also be used as a berm at the boundary of the disturbed area when needed. This will further reduce migration of suspended sediment from leaving the disturbance area of the quarry.

There is limited storage of diesel fuel at the quarry. Secondary containment is provided for any storage of the diesel fuel, including utilizing a double-walled tank and lined containment area. Mobile equipment is refueled by truck. Mobile equipment is only left at the mine site when needed, mobile equipment is not parked or stored at the mine long term.

Earthen berms of overburden will surround the disturbed areas to contain runoff and prevent contaminants from leaving the disturbed area. Ditches will be constructed along the sides

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roadways. Sediment control such as check dams or hay bales will be placed inside ditches when necessary to reduce sediment loss from the disturbance site.

BEST MANAGEMENT PRACTICES (BMP)

1. The stormwater ponding areas will be inspected quarterly to ensure the integrity of the impoundments.

2. The berm(s) around the disturbed area will be inspected quarterly for breaks or undercuts.

3. The ditches around topsoil stockpiles will be inspected quarterly for breaks or sediment buildup.

4. The ditches along the access road will be inspected quarterly for breaks or sediment buildup. The ditches will be revegetated to minimize erosion.

5. During reclamation operations, berms will be constructed around the equipment parking area.

6. Any fluids temporarily stored at the site will be situated inside secondary containment and will not be located near disturbance boundaries.

7. Diesel fuel storage is only allowed in double-walled tanks placed in a lined containment area.

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SECTION IV

SITE MAP

The site map of the Etchepare Limestone Quarry shows the future location of the stormwater ponds, the containment berms around the disturbed area, the toe-ditches around the topsoil stockpiles and the ditches along the access road. All stormwater runoff from the disturbed area is retained within the quarry area. Due to the nature of the screening operations, the diesel fuel storage tank will be moved as necessary.

SECTION V

DRAINAGE

Stormwater is limited to the disturbed area by a stormwater pond and a containment berm. Toe-ditches surround the topsoil stockpiles preventing sediment from the stockpiles from contaminating runoff. Runoff from the disturbed areas will be retained in the quarry pit. Once mining activities cease in the quarry, the area will be reclaimed and erosion will be reduced to pre-disturbance levels.

SECTION VI

INVENTORY OF EXPOSED MATERIALS

Topsoil, overburden and limestone will be stockpiled within the disturbance areas. To minimize stormwater contamination, topsoil stockpiles are toe-ditched. Topsoil is revegetated within one year of being stockpiled. The sediment from the limestone stockpiles and the disturbed area is retained within the quarry pit by berms and sediment control devices.

SECTION VII

SPILLS AND LEAKS

There have been no significant spills or leaks at the Etchepare Limestone Quarry. All spills and leaks will be immediately contained and cleaned up and reported to the Environmental Manager. Appropriate agencies will be notified in the case of reportable spills or leaks and all incidents will be recorded and kept on file in the Environmental Manager's office.

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SECTION VIII

SAMPLING DATA

The NPDES Permit for the Etchepare Quarry does not require stormwater sampling. MCC has not conducted any stormwater sampling at this site.

SECTION IX

RISK IDENTIFICATION AND SUMMARY OF POTENTIAL POLLUTION SOURCES

All activities related to the Etchepare Limestone Quarry are confined to within the disturbance area or the containment ditches. Toe-ditches and berms are constructed to control water runoff. Equipment used at the quarry will be fueled, parked, and maintained using best management practices. Therefore, the risk of pollution due to stormwater runoff is highly unlikely.

SECTION X

MEASURES AND CONTROLS

1. Good housekeeping

The Etchepare Limestone Quarry has a controlled stormwater discharge points. Good housekeeping procedures include keeping all operations within the boundaries of the disturbed area. Stockpiles and stormwater ponds will be removed or incorporated into the reclamation plan. Post-mining surface water impoundments are not planned for the area.

During mining operations and future reclamation activities:

- Equipment maintenance, parking, and refueling will be kept within the boundaries of the disturbed area
- Contaminated soil in the equipment parking areas will be removed and disposed of in a permitted landfill or incinerator.
- Equipment will be brought to the quarry as needed for operations and reclamation tasks. This equipment will be removed immediately following the completion of these activities.

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2. Preventive Maintenance

Quarry preventive maintenance practices involve quarterly inspection of the reclamation area containment berms for breaks, undercutting, and debris or sediment buildup. The sediment control ditches will also be inspected for sediment buildup, obstructions, and debris.

During mining operations and future reclamation activities:

- All equipment will be routinely maintained to ensure proper operation.

3. Spill Prevention and Response Procedures

Diesel fuel is stored for a generator at the Etchepare Limestone Quarry. Operation and reclamation activities may potentially create small spills of fuel, oil, hydraulic fluids, or antifreeze onto the ground. Contaminated soil will be disposed of in a permitted landfill or incinerator. Quarry employees have been trained to quickly respond to any and all spills so the possibility of discharging any equipment fluids is highly unlikely.

4. Inspections

The SWPPP Team Leader will inspect the Etchepare Limestone Quarry a minimum of quarterly for compliance with the SWPPP. The inspection will also track the progress of the SWPPP. The results of the inspection and the progress of the SWPPP will be recorded and retained at the MCC Plant site with the SWPPP for a minimum of three years.

After reclamation is complete, the Etchepare Quarry will be inspected yearly to ensure that soil erosion has stabilized and that sediment control structures and revegetation measures are effectively protecting stormwater runoff from the quarry.

A Notice of Termination (Appendix 1) will be filed with the Wyoming Department of Environmental Quality, Water Quality Division after three yearly inspections with no evidence of sediment leaving the quarry disturbed area.

5. Employee Training

Employee training will occur once a year for all MCC employees working in MCC's quarries. The training sessions will include an overview of the Etchepare Limestone Quarry operation and the MCC Plant site. The NPDES permits for the plant and the Etchepare Quarry will also be discussed. The training session will also include:

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- The identity of the SWPPP Team Leader.
- A list of potential stormwater pollution sources and their location at the Etchepare Limestone Quarry.
- Good housekeeping procedures discussed in Section X, Part 1 of the SWPPP will be presented. The responsibilities of the employees regarding the SWPPP will be emphasized.
- Preventive Maintenance Procedures discussed in Section X, Part 2 of the SWPPP will be discussed. The responsibilities of the employees regarding the SWPPP will be emphasized.
- Inspections, monitoring and sampling plans for the Etchepare Limestone Quarry will be discussed.
- The Best Management Practices described in the SWPPP for the quarry will be discussed.
- Mountain Cement Company's SWPPP implementation schedule and enforcement policy for the Etchepare Limestone Quarry will be discussed.

6. Record Keeping and Internal Reporting Procedures

The SWPPP Team Leader will make quarterly inspections of the Etchepare Limestone Quarry to ensure proper operation of the SWPPP. Records will be kept at the MCC Plant with the SWPPP for the Etchepare Limestone Quarry.

Activities recorded include:

- Records of spills or leaks including the time, date, and weather conditions when the incident occurred.
- Records of training sessions
- Maintenance, repair, or construction of stormwater management structures.
- Inspection findings and corrective actions required

7. Non-Storm Discharges

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The drainage system at the Etchepare Limestone Quarry is above ground. There are currently no non-storm discharge points at the quarry.

8. Sediment and Erosion Control

The Etchepare Limestone Quarry will be surrounded by earthen berms to contain soil erosion and storm water runoff. Sediment will be prevented from migrating outside the quarry site by the stormwater ponds and rock check dams and/or hay bales in the drainage ditches. Toe-ditches will surround the topsoil stockpiles to prevent stormwater erosion. Topsoil stockpiles will also be vegetated to inhibit erosion. Quarry reclamation will also include revegetating the disturbed area. The vegetation and reclamation plan will limit erosion from the Etchepare Limestone Quarry.

9. Management of Runoff

All stormwater runoff form the Etchepare Limestone Quarry will be retained within the disturbed area boundary using ponds, berms, ditches, and the natural site drainage.

SECTION XI

COMPREHENSIVE SITE COMPLIANCE EVALUATION

During the quarterly inspections of the Etchepare Limestone Quarry, the SWPPP Team Leader will evaluate the operation and effectiveness of the SWPPP. The evaluation will determine if measures to contain stormwater runoff sediment within the disturbed area are adequate or if other stormwater runoff control is needed. The inspection will also evaluate the condition of the SWPPP control measures. The inspection will ensure that no sediment is escaping the control devices. After reclamation, the inspections will determine if the erosion control structures and revegetation measures are adequate to prevent further erosion from the reclaimed area. After the reclaimed area has stabilized, a Notice of Termination will be filed.

A report summarizing any observations made by the inspector(s) will be signed by the inspector(s) and retained on file for at least three years. The author of the report and the date and

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time of the inspection will also be recorded. Any deficiencies or potential deficiencies will be corrected as soon as possible.

SECTION XII

CONSISTENCY WITH OTHER PLANS

This plan includes several Good Housekeeping Procedures and follows many of EPA's Best Management Practices outlined in Stormwater Management for Industrial Activities. The SWPPP will include sediment control measures and slope stabilization techniques associated with the quarry reclamation plan.

APPENDIX 1

NOTICE OF TERMINATION

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NOTICE OF TERMINATION REQUIREMENTS

The Notice of Termination shall include:

1. The mailing address of the industrial site for which the notification is submitted. Where a mailing address is not available, the location of the approximate center of the site must be described in terms of the latitude and longitude to the nearest 15 seconds, or the nearest section, township and range to the nearest quarter;

2. The name, address and telephone number of the operator addressed by the Notice of Termination;

3. The NPDES Permit number for the storm water discharge identified by the Notice of Termination;

4. The indication of whether the stormwater discharges associated with the industrial activity have been eliminated or the operator of the discharges has changed;

5. The following certification signed in accordance with the signatory requirements of this permit:

   "I certify under penalty of law that all storm water discharges associated with industrial activity from the identified facility that are authorized by an NPDES general permit have been eliminated or that I am no longer the operator of the industrial activity. I understand that by submitting this notice of termination that I am no longer authorized to discharge stormwater associated with industrial activity under this general permit

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and that discharging pollutants in storm water associated with industrial activity to waters of the United States is unlawful under the Clean Water Act where the discharge is not authorized by an NPDES permit. I also understand that the submittal of the notice of termination does not release an operator from liability for any violations of this permit or the Clean Water Act."

For the purposes of certification, elimination of storm water discharges associated with industrial activity means that all disturbed soils at the identified facility have been finally stabilized and temporary erosion and sediment control measures have been removed at an appropriate time, or that all storm water discharges associated with construction activities from the identified site that are authorized by a NPDES general permit have otherwise been eliminated.

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APPENDIX MPIX-B

Quarterly Groundwater Monitoring Results by Year and Well

Table I-Resluts for the "Brome" well, SEO Permit #P95938W

Parameter (2004)	**1/14/04**	**3/10/04**	**6/30/04**	**8/24/04**
Depth to Water, Feet	205	196.0	176.0	191.0
Lab Conductivity @ 25 °C, µmhos/cm	357	354	366	392
Total Dissolved Solids @ 180 °C, (mg/L)	210	220	270	220
Total Alkalinity as $CaCO_3$, (mg/L)	208	207	207	207
Total Hardness (mg/L) as $CaCO_3$, mg/L	209	206	216	198
Nitrate - Nitrite as N (mg/L)	1.38	1.31	1.34	1.39
Total Petroleum Hydrocarbons, TPH 418.1, (mg/L)	<1; i.e., ND	<1; i.e., ND	<1; i.e., ND	<1; i.e., ND
Parameter (2005)	**2/22/05**	**6/21/05**	**8/30/05**	**12/15/05**
Depth to Water, Feet	198.1	198.4	197.58	196.65
Lab Conductivity @ 25 °C, µmhos/cm	376	349	364	395
Total Dissolved Solids @ 180 °C, (mg/L)	200	220	210	220
Total Alkalinity as $CaCO_3$, (mg/L)	206	208	204	206
Total Hardness (mg/L) as $CaCO_3$, mg/L	212	205	219	211
Nitrate - Nitrite as N (mg/L)	1.28	1.23	1.31	1.31
Total Petroleum Hydrocarbons, TPH 418.1, (mg/L)	<1; i.e., ND	<1; i.e., ND	<1; i.e., ND	<1; i.e., ND
Parameter (2006)	**5/25/06**	**7/31/06**	**9/27/06**	**12/7/06**
Depth to Water, Feet	197.92	198.87	198.93	198.96
Lab Conductivity @ 25 °C, µmhos/cm	390	392	386	375
Total Dissolved Solids @ 180 °C, (mg/L)	210	210	200	190
Total Alkalinity as $CaCO_3$, (mg/L)	190	213	199	196
Total Hardness (mg/L) as $CaCO_3$, mg/L	210	212	207	209
Nitrate - Nitrite as N (mg/L)	1.5	1.39	1.25	1.14
Total Petroleum Hydrocarbons, TPH 418.1, (mg/L)	<5; i.e., ND	<1; i.e., ND	<1; i.e., ND	<1; i.e., ND
Parameter (2007)	**3/20/07**	**6/25/07**	**9/6/07**	**11/29/07**
Depth to Water, Feet	197.92?	198.87?	198.93?	198.96?
Lab Conductivity @ 25 °C, µmhos/cm	393	392	392	397
Total Dissolved Solids @ 180 °C, (mg/L)	220	250	220	220
Total Alkalinity as $CaCO_3$, (mg/L)	203	210	206	204
Total Hardness (mg/L) as $CaCO_3$, mg/L	200	200	200	209
Nitrate - Nitrite as N (mg/L)	1.20	0.58	1.27	1.10
Total Petroleum Hydrocarbons, TPH 418.1, (mg/L)	<1; i.e., ND	<1; i.e., ND	<1; i.e., ND	<1; i.e., ND

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Parameter (2008)	**2/5/08**	**5/29/08**	**9/4/08**	**12/10/08**
Depth to Water, Feet	NM	NM	NM	NM
Lab Conductivity @ 25 °C, µmhos/cm	390	370	391	376
Total Dissolved Solids @ 180 °C, (mg/L)	220	200	240	210
Total Alkalinity as $CaCO_3$, (mg/L)	210	191	199	240
Total Hardness (mg/L) as $CaCO_3$, mg/L	221	203	210	201
Nitrate - Nitrite as N (mg/L)	1.07	1.08	1.08	1.03
Total Petroleum Hydrocarbons, TPH 418.1, (mg/L)	<5; i.e., ND	<5; i.e., ND	<5; i.e., ND	<5; i.e., ND
Parameter (2009)	**3/25/09**	**6/4/09**	**9/3/09**	**12/7/09**
Depth to Water, Feet	NM	NM	NM	NM
Lab Conductivity @ 25 °C, µmhos/cm	364	388	376	356
Total Dissolved Solids @ 180 °C, (mg/L)	230	220	180	210
Total Alkalinity as $CaCO_3$, (mg/L)	205	246	204	249
Total Hardness (mg/L) as $CaCO_3$, mg/L	208	194	206	206
Nitrate - Nitrite as N (mg/L)	1.22	1.03	1.2	1.16
Total Petroleum Hydrocarbons, TPH 418.1, (mg/L)	<1; i.e., ND	<1; i.e., ND	<1; i.e., ND	<1; i.e., ND
Parameter (2010)	**3/10**	**6/10**	**9/10**	**12/10**
Depth to Water, Feet	NM	NM	NM	NM
Lab Conductivity @ 25 °C, µmhos/cm	341	368	387	381
Total Dissolved Solids @ 180 °C, (mg/L)	210	220	210	220
Total Alkalinity as $CaCO_3$, (mg/L)	249	200	197	199
Total Hardness (mg/L) as $CaCO_3$, mg/L	188	193	201	211
Nitrate - Nitrite as N (mg/L)	1.14	1.27	2.4	1.9
Total Petroleum Hydrocarbons, TPH 418.1, (mg/L)	<5; i.e., ND	<5; i.e., ND	<5; i.e., ND	<5; i.e., ND
Parameter (2011)	**3/31/11**	**6/8/11**	**9/15/11**	**12/19/11**
Depth to Water, Feet	NM	NM	NM	NM
Lab Conductivity @ 25 °C, µmhos/cm	339	294	387	360
Total Dissolved Solids @ 180 °C, (mg/L)	210	220	200	200
Total Alkalinity as $CaCO_3$, (mg/L)	204	202	197	202
Total Hardness (mg/L) as $CaCO_3$, mg/L	198	201	209	202
Nitrate - Nitrite as N (mg/L)	1.4	1.2	1.3	1.3
Total Petroleum Hydrocarbons, TPH 418.1, (mg/L)	<5; i.e., ND	<5; i.e., ND	<5; i.e., ND	<5; i.e., ND

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Table II - Results for "*MCMW#1*" monitoring well.

Parameter (2006)	**6/6/06**	**7/31/06**	**9/27/06**	**12/7/06**
Depth to Water, Feet	185.95	185.7	186.33	187.4
Lab Conductivity @ 25 °C, µmhos/cm	380	386	374	365
Total Dissolved Solids @ 180 °C, (mg/L)	220	210	210	190
Total Alkalinity as $CaCO_3$, (mg/L)	210	202	187	184
Total Hardness (mg/L) as $CaCO_3$, mg/L	210	206	201	201
Nitrate - Nitrite as N (mg/L)	1.3	1.51	1.42	1.32
Total Petroleum Hydrocarbons, TPH 418.1, (mg/L)	<1; i.e.,ND	<1; i.e.,ND	<1; i.e., ND	<1; i.e.,ND
Parameter (2007)	**3/19/07**	**6/25/07**	**9/6/07**	**11/29/07**
Depth to Water, Feet	17.16	10.48	186.57	186.61
Lab Conductivity @ 25 °C, µmhos/cm	372	337	380	389
Total Dissolved Solids @ 180 °C, (mg/L)	220	240	210	220
Total Alkalinity as $CaCO_3$, (mg/L)	193	192	193	195
Total Hardness (mg/L) as $CaCO_3$, mg/L	203	192	195	202
Nitrate - Nitrite as N (mg/L)	1.35	1.18	1.45	1.41
Total Petroleum Hydrocarbons, TPH 418.1, (mg/L)	<1; i.e.,ND	<1; i.e.,ND	<1; i.e., ND	<1; i.e.,ND
Parameter (2008)	**2/5/08**	**5/29/08**	**9/4/08**	**12/10/08**
Depth to Water, Feet	10.12	184.95	179.93	180.56
Lab Conductivity @ 25 °C, µmhos/cm	380	362	367	358
Total Dissolved Solids @ 180 °C, (mg/L)	220	190	230	200
Total Alkalinity as $CaCO_3$, (mg/L)	190	181	185	222
Total Hardness (mg/L) as $CaCO_3$, mg/L	201	189	204	188
Nitrate - Nitrite as N (mg/L)	1.27	1.26	1.75	1.21
Total Petroleum Hydrocarbons, TPH 418.1, (mg/L)	<1; i.e., ND	7	<1; i.e., ND	<1; i.e., ND
Parameter (2009)	**3/25/09**	**6/4/09**	**9/3/09**	**12/7/09**
Depth to Water, Feet	NM	NM	NM	NM
Lab Conductivity @ 25 °C, µmhos/cm	346	379	377	346
Total Dissolved Solids @ 180 °C, (mg/L)	230	210	190	210
Total Alkalinity as $CaCO_3$, (mg/L)	186	233	158	242
Total Hardness (mg/L) as $CaCO_3$, mg/L	204	193	190	204
Nitrate - Nitrite as N (mg/L)	1.48	1.3	1.6	1.37
Total Petroleum Hydrocarbons, TPH 418.1, (mg/L)	<5; i.e., ND	<5; i.e., ND	N/A	<5; i.e., ND
Parameter (2010)	**3/10**	**6/10**	**9/10**	**12/10**
Depth to Water, Feet	181.0	180.1	171.6	172.2
Lab Conductivity @ 25 °C, µmhos/cm	327	367	359	350
Total Dissolved Solids @ 180 °C, (mg/L)	200	220	160	200
Total Alkalinity as $CaCO_3$, (mg/L)	238	193	197	200
Total Hardness (mg/L) as $CaCO_3$, mg/L	180	193	198	210
Nitrate - Nitrite as N (mg/L)	1.29	1.53	1.5	1.6
Total Petroleum Hydrocarbons, TPH 418.1, (mg/L)	<5; i.e., ND	<5; i.e., ND	<5; i.e., ND	<5; i.e., ND

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Parameter (2011)	3/31/11	6/8/11	9/15/11	12/19/11
Depth to Water, Feet	172.3	168.9	167.9	168.6
Lab Conductivity @ 25 °C, µmhos/cm	330	243	380	360
Total Dissolved Solids @ 180 °C, (mg/L)	220	210	190	200
Total Alkalinity as $CaCO_3$, (mg/L)	192	186	183	188
Total Hardness (mg/L) as $CaCO_3$, mg/L	190	203	200	194
Nitrate - Nitrite as N (mg/L)	1.8	1.6	1.6	1.9
Total Petroleum Hydrocarbons, TPH 418.1, (mg/L)	<5; i.e., ND	<5; i.e., ND	<5; i.e., ND	<5; i.e., ND

Table III – Results for the *"MCMW#2"* monitoring well.

Parameter (2006)	6/6/06	7/31/06	9/27/06	12/7/06
Depth to Water, Feet	189.43	188.5	189.33	190.2
Lab Conductivity @ 25 °C, µmhos/cm	360	364	359	356
Total Dissolved Solids @ 180 °C, (mg/L)	200	210	200	200
Total Alkalinity as $CaCO_3$, (mg/L)	200	194	182	178
Total Hardness (mg/L) as $CaCO_3$, mg/L	210	199	193	198
Nitrate - Nitrite as N (mg/L)	1.2	1.37	1.36	1.25
Total Petroleum Hydrocarbons, TPH 418.1, (mg/L)	<5; i.e., ND	<5; i.e., ND	<5; i.e., ND	<5; i.e., ND
Parameter (2007)	**3/19/07**	**6/25/07**	**9/6/07**	**11/29/07**
Depth to Water, Feet	192.39	9.31	9.29	195.56
Lab Conductivity @ 25 °C, µmhos/cm	366	365	373	372
Total Dissolved Solids @ 180 °C, (mg/L)	220	240	190	220
Total Alkalinity as $CaCO_3$, (mg/L)	186	185	188	187
Total Hardness (mg/L) as $CaCO_3$, mg/L	190	186	194	193
Nitrate - Nitrite as N (mg/L)	1.26	0.64	1.39	1.30
Total Petroleum Hydrocarbons, TPH 418.1, (mg/L)	<1; i.e., ND	<1; i.e., ND	<1; i.e., ND	<1; i.e., ND
Parameter (2008)	**2/5/08**	**5/29/08**	**9/4/08**	**12/10/08**
Depth to Water, Feet	191.62	185.45	183.42	183.74
Lab Conductivity @ 25 °C, µmhos/cm	370	353	357	355
Total Dissolved Solids @ 180 °C, (mg/L)	210	200	210	210
Total Alkalinity as $CaCO_3$, (mg/L)	190	171	183	224
Total Hardness (mg/L) as $CaCO_3$, mg/L	190	189	194	180
Nitrate - Nitrite as N (mg/L)	1.21	1.78	1.79	1.17
Total Petroleum Hydrocarbons, TPH 418.1, (mg/L)	<5; i.e., ND	<5; i.e., ND	<5; i.e., ND	<5; i.e., ND

Parameter (2009)	**3/25/09**	**6/4/09**	**9/3/09**	**12/7/09**
Depth to Water, Feet	NM	NM	NM	NM
Lab Conductivity @ 25 °C, µmhos/cm	341	364	351	338
Total Dissolved Solids @ 180 °C, (mg/L)	220	200	190	200
Total Alkalinity as $CaCO_3$, (mg/L)	184	228	186	229
Total Hardness (mg/L) as $CaCO_3$, mg/L	197	187	196	195
Nitrate - Nitrite as N (mg/L)	1.36	1.1	1.3	1.27
Total Petroleum Hydrocarbons, TPH 418.1, (mg/L)	<5; i.e., ND	<5; i.e., ND	<5; i.e., ND	<5; i.e., ND
Parameter (2010)	**3/10**	**6/10**	**9/10**	**12/10**
Depth to Water, Feet	182.8	182.6	170.8	173.3
Lab Conductivity @ 25 °C, µmhos/cm	Not Sampled (couldn't access well with equipment)	364	355	350
Total Dissolved Solids @ 180 °C, (mg/L)		220	180	190
Total Alkalinity as $CaCO_3$, (mg/L)		187	191	188
Total Hardness (mg/L) as $CaCO_3$, mg/L		190	194	195
Nitrate - Nitrite as N (mg/L)		1.61	1.5	1.5
Total Petroleum Hydrocarbons, TPH 418.1, (mg/L)		<5; i.e., ND	<5; i.e., ND	<5; i.e., ND
Parameter (2011)	**3/31/11**	**6/8/11**	**9/15/11**	**12/19/11**
Depth to Water, Feet	174.4	172.2	167.0	169.2
Lab Conductivity @ 25 °C, µmhos/cm	323	281	370	342
Total Dissolved Solids @ 180 °C, (mg/L)	200	210	190	190
Total Alkalinity as $CaCO_3$, (mg/L)	187	184	182	187
Total Hardness (mg/L) as $CaCO_3$, mg/L	188	199	198	188
Nitrate - Nitrite as N (mg/L)	1.6	1.4	1.5	1.5
Total Petroleum Hydrocarbons, TPH 418.1, (mg/L)	<5; i.e., ND	<5; i.e., ND	<5; i.e., ND	<5; i.e., ND

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Table IV- Results from the "Waitkus-R" well

Parameter (2007)	**3/19/07**	**6/25/07**	**9/6/07**	**11/29/07**
Depth to Water, Feet	No Data Well Not Installed Yet		10.09	10.73
Lab Conductivity @ 25 °C, µmhos/cm			398	388
Total Dissolved Solids @ 180 °C, (mg/L)			220	230
Total Alkalinity as $CaCO_3$, (mg/L)			203	193
Total Hardness (mg/L) as $CaCO_3$, mg/L			189	200
Nitrate - Nitrite as N (mg/L)			1.55	1.53
Total Petroleum Hydrocarbons, TPH 418.1, (mg/L)			<1; i.e., ND	<1; i.e., ND
Parameter (2008)	**2/5/08**	**5/29/08**	**9/4/08**	**12/10/08**
Depth to Water, Feet	10.18	11.29	10.23	10.26
Lab Conductivity @ 25 °C, µmhos/cm	380	367	372	370
Total Dissolved Solids @ 180 °C, (mg/L)	220	210	220	230
Total Alkalinity as $CaCO_3$, (mg/L)	190	181	189	225
Total Hardness (mg/L) as $CaCO_3$, mg/L	198	195	196	194
Nitrate - Nitrite as N (mg/L)	1.52	1.44	1.7	1.35
Total Petroleum Hydrocarbons, TPH 418.1, (mg/L)	<5; i.e.,ND	<5; i.e.,ND	<5; i.e., ND	<5; i.e., ND
Parameter (2009)	**3/25/09**	**6/4/09**	**9/3/09**	**12/7/09**
Depth to Water, Feet	NM	NM	NM	NM
Lab Conductivity @ 25 °C, µmhos/cm	359	379	370	352
Total Dissolved Solids @ 180 °C, (mg/L)	250	220	190	210
Total Alkalinity as $CaCO_3$, (mg/L)	192	236	192	238
Total Hardness (mg/L) as $CaCO_3$, mg/L	208	199	204	204
Nitrate - Nitrite as N (mg/L)	1.65	1.35	1.6	1.53
Total Petroleum Hydrocarbons, TPH 418.1, (mg/L)	<5; i.e.,ND	<5; i.e., ND	<5; i.e., ND	<5; i.e., ND
Parameter (2010)	**3/10**	**6/10**	**9/10**	**12/10**
Depth to Water, Feet	11.2	10.1	NM	NM
Lab Conductivity @ 25 °C, µmhos/cm	337	365	367	357
Total Dissolved Solids @ 180 °C, (mg/L)	210	220	190	210
Total Alkalinity as $CaCO_3$, (mg/L)	237	189	194	193
Total Hardness (mg/L) as $CaCO_3$, mg/L	185	192	202	196
Nitrate - Nitrite as N (mg/L)	1.46	1.64	1.7	1.7
Total Petroleum Hydrocarbons, TPH 418.1, (mg/L)	<5; i.e., ND	<5; i.e., ND	<5; i.e., ND	<5; i.e., ND
Parameter (2011)	**3/31/11**	**6/8/11**	**9/15/11**	**12/19/11**
Depth to Water, Feet	NM	NM	NM	< 200
Lab Conductivity @ 25 °C, µmhos/cm	335	294	384	360
Total Dissolved Solids @ 180 °C, (mg/L)	210	210	200	200
Total Alkalinity as $CaCO_3$, (mg/L)	194	189	186	191
Total Hardness (mg/L) as $CaCO_3$, mg/L	196	208	207	195
Nitrate - Nitrite as N (mg/L)	1.9	1.6	1.6	1.7
Total Petroleum Hydrocarbons, TPH 418.1, (mg/L)	<5; i.e., ND	<5; i.e., ND	<5; i.e., ND	<5; i.e., ND

Table V - Groundwater characteristics summary table for the "*Windmill*" P8769 monitoring well.

Parameter (2010)	**3/10**	**6/10**	**9/10**	**12/10**
Depth to Water, Feet	Not Sampled	Not Sampled	38.2	39.4
Lab Conductivity @ 25 °C, µmhos/cm			355	Not Sampled (Frozen)
Total Dissolved Solids @ 180 °C, (mg/L)			210	
Total Alkalinity as $CaCO_3$, (mg/L)			195	
Total Hardness (mg/L) as $CaCO_3$, mg/L			203	
Nitrate - Nitrite as N (mg/L)			1.4	
Total Petroleum Hydrocarbons, TPH 418.1, (mg/L)			<5; i.e., ND	
Parameter (2011)	**3/31/11**	**6/8/11**	**9/15/11**	**12/19/11**
Depth to Water, Feet	40.5	37.27	34.85	34.98
Lab Conductivity @ 25 °C, µmhos/cm	Well Not Sampled/ Windmill Off for Winter	272	386	Well Not Sampled/ Windmill Off for Winter
Total Dissolved Solids @ 180 °C, (mg/L)		220	230	
Total Alkalinity as $CaCO_3$, (mg/L)		203	186	
Total Hardness (mg/L) as $CaCO_3$, mg/L		210	210	
Nitrate - Nitrite as N (mg/L)		1.5	1.8	
Total Petroleum Hydrocarbons, TPH 418.1, (mg/L)		<5; i.e., ND	<5; i.e., ND	

Table VI - Groundwater characteristics summary table for the "*Avery*" P72810W, monitoring well.

Parameter (2010)	**3/10**	**6/10**	**9/10**	**12/10**
Depth to Water, Feet	Not Sampled	Not Sampled	NM	NM
Lab Conductivity @ 25 °C, µmhos/cm			358	351
Total Dissolved Solids @ 180 °C, (mg/L)			190	210
Total Alkalinity as $CaCO_3$, (mg/L)			190	191
Total Hardness (mg/L) as $CaCO_3$, mg/L			196	202
Nitrate - Nitrite as N (mg/L)			1.6	1.7
Total Petroleum Hydrocarbons, TPH 418.1, (mg/L)			<5; i.e., ND	<5; i.e., ND
Parameter (2011)	**3/31/11**	**6/8/11**	**9/15/11**	**12/19/11**
Depth to Water, Feet	NM	NM	NM	NM
Lab Conductivity @ 25 °C, µmhos/cm	339	271	382	358
Total Dissolved Solids @ 180 °C, (mg/L)	210	220	190	200
Total Alkalinity as $CaCO_3$, (mg/L)	191	195	184	190
Total Hardness (mg/L) as $CaCO_3$, mg/L	193	208	204	196
Nitrate - Nitrite as N (mg/L)	1.8	1.6	1.8	1.8
Total Petroleum Hydrocarbons, TPH 418.1, (mg/L)	<5; i.e., ND	<5; i.e., ND	<5; i.e., ND	<5; i.e., ND

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Table VI - Groundwater characteristics summary table for the *"Lane"* P94793W monitoring well.

Parameter (2010)	**3/10**	**6/10**	**9/10**	**12/10**
Depth to Water, Feet	Not Sampled	Not Sampled	NM	NM
Lab Conductivity @ 25 °C, µmhos/cm			360	360
Total Dissolved Solids @ 180 °C, (mg/L)			190	220
Total Alkalinity as $CaCO_3$, (mg/L)			194	195
Total Hardness (mg/L) as $CaCO_3$, mg/L			194	197
Nitrate - Nitrite as N (mg/L)			1.8	2.1
Total Petroleum Hydrocarbons, TPH 418.1, (mg/L)			<5; i.e., ND	<5; i.e., ND
Parameter (2011)	**3/31/11**	**6/8/11**	**9/15/11**	**12/19/11**
Depth to Water, Feet	NM	NM	NM	NM
Lab Conductivity @ 25 °C, µmhos/cm	337	258	386	354
Total Dissolved Solids @ 180 °C, (mg/L)	210	210	200	200
Total Alkalinity as $CaCO_3$, (mg/L)	194	180	187	188
Total Hardness (mg/L) as $CaCO_3$, mg/L	194	196	204	190
Nitrate - Nitrite as N (mg/L)	1.9	1.7	1.9	1.9
Total Petroleum Hydrocarbons, TPH 418.1, (mg/L)	<5; i.e., ND	<5; i.e., ND	<5; i.e., ND	<5; i.e., ND

APPENDIX MPIX-C

GROUNDWATER SAMPLING PROCEDURES

Permit 298C-A8
Etchepare LS Quarry
Submitted: April 2010

TFN .....
Approved:_____

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GROUNDWATER SAMPLING PROCEDURES

These procedures follow WDEQ/SHWD Guidelines #15

A. PRELIMINARY ACTIVITIES

I. Contact the laboratory that will be performing the analyses and provide them with the types of tests to be performed. *(The laboratory should be certified by the State or Federal Government)*

II. Order the following:
   a. Appropriate sample bottles
   b. Labels
   c. Relevant instructions about sampling, storage and transportation
   d. Chain of Custody forms
   e. Trip Blanks
   f. Samples will be placed in a cooler filled with ice immediately after collection and kept cool during overnight delivery to the laboratory.

III. Prepare field notes and enter the following information at the sampling site:
   a. Date and time of measuring and/or sampling
   b. Names of field personnel
   c. Weather conditions
   d. State Engineer's Office ID number of well(s)
   e. Brief description of well (*e.g.,* casing, pump, cover, seal)
   f. Static water level
   g. How many gallons of water were evacuated prior to sampling
   h. Description of any abnormal physical conditions of the evacuated water (*e.g.,* appearance, odor, *etc.*)

IV. Take the following to the monitoring well:
   a. Key to unlock well cover [if necessary]
   b. Field note forms (see below)
   c. Five gallon bucket to measure amount of water purged
   d. Disposable bailer(s) and bailing cord [if pump will not be used]
   e. Cleaning rags
   f. Roll of paper towels
   g. Squeeze bottle filled with distilled water
   h. Trash bag
   i. Sample bottles
   j. Cooler

B. OPENING WELL FOR MEASUREMENTS AND SAMPLING

I. Be sure that the well opening and the area immediately around the opening is clean (*e.g.,* no dirt, oil, grease, or other contaminants are present).

II. Cease all activities in the area that may disturb surrounding dirt from entering the well.

C. DECONTAMINATION OF EQUIPMENT AND HANDS

I. If using bailers, use disposable units. The use of disposable bailers (one per well) will substantially reduce the amount of decontamination work necessary.

II. If necessary, clean equipment with Simple Green, Alconox or other similar detergent and rinse with copious amounts of distilled water. Dry with a clean paper towel.

III. Be sure that hands are clean and void of potential contaminants when handling equipment and sample bottles (wear clean gloves if necessary).

IV. Avoid hand contact with water to be analyzed.

D. STATIC WATER LEVELS

I. When measuring static water levels, measure from the same point (*e.g.,* north side of casing) so measurements are consistent.

II. Prior to measuring the static water level, ensure that the water level probe is decontaminated.

III. Lower the decontaminated water level probe into the well until the audible signal on the probe is triggered or the light comes on.

IV. Determine the precise measurement by repeatedly raising and lowering the probe to converge on the exact location.

V. If necessary, determine the total depth of the water using a decontaminated gauge. If the total depth is determined, calculate the volume of water in the well. The result from the following equations is one (1) well volume:

   a. For a 2" diameter well: multiply the lineal feet of water by 0.16 gallons/foot

   b. For a 4" diameter well: multiply the lineal feet of water by 0.67 gallons/foot

E. PURGE/BAILING THE WELL

I. Because the water standing in a well prior to sampling may not represent existing ground water quality, stagnant water should be removed from the well prior to sampling.

II. Purging can be accomplished with either a bailer or a pump rig.

   a. If a bailer is used, a disposable or clean bailer must be used for each well.

   b. A bailer may be re-used only if it is thoroughly decontaminated prior to bailing.

   c. A portable pump rig may also be decontaminated before pumping each well.

III. Use a clean tarp or other type of cover to provide a clean surface onto which the cleaned sampling equipment and bailing rope can be placed if the equipment is to be placed on the ground or other surfaces.

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IV. Using a decontaminated bailer rope of sufficient length to reach the bottom of the well casing, secure one end to a secure object to prevent the loss of the bailer down the well.

V. A new rope must be used for each well or the rope should be thoroughly rinsed with distilled water between well samples.

VI. Lower the bailer slowly into the well.

VII. Pull the bailer out of the well, keeping the cord from contacting any contaminated surface, including the ground.

VIII. Purge at least three (3) well volumes from the well before collecting ground water samples or bail until the well is dry, whichever occurs first.

a. If the well is bailed dry prior to the removal of 3 well volumes, purging is complete and sampling may proceed.

b. The following equations are used to determine the quantity of water to be purged:

1. For 2" wells: the number of gallons to be purged = 3 *times* the result in D.V.a.
2. For 4" wells: the number of gallons to be purged = 3 *times* the result in D.V.b.

c. The bailer should be lowered to the bottom of the well during purging to ensure removal of old, standing water in the well and encourage the movement of fresh water into the well.

d. Water bailed from the well can be poured into a plastic 5-gallon bucket to keep track of the volume of water bailed from the well.

IX. The total volume of water purged from the well should be recorded in the field notes.

X. Any abnormal observations of the water purged should also be recorded (*e.g.,* color, odor, silt, sheen, *etc.*)

F. GROUNDWATER SAMPLING

I. After at least three well volumes have been purged from the well or the well is purged dry, collect groundwater samples.

II. If the well water was silty during bailing, wait until the sediment has settled before sampling.

III. Review instructions regarding sampling and storage received from the laboratory

IV. Review the permit application to determine if there are requirements such as the number and type of quality assurance samples that should be collected.

V. Prior to sampling, an appropriately labeled sample bottle should be readied. Care should be taken not to spill any preservatives that the laboratory added to the bottle.

VI. If a disposable bailer is not being used, an equipment blank should be collected by pouring distilled water into the decontaminated bailer and then into the "blank" sample bottle.

VII. Lower the bailer and rope (previously decontaminated if necessary) slowly into the well to a depth sufficient to submerge the bailer.

VIII. Samples should be collected from the center of the well's water column. Avoid sampling near the bottom of the well as the water will tend to be silty.

IX. Pull the bailer out of the well, keeping the rope from contacting any contaminated surfaces.

X. The water sample should be poured into each sample bottle which is then tightly capped and placed in the cooler if not to be returned to the laboratory in a short time.

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XI. When filling the sample bottles, do not touch the bailer to the sample bottle. Preservatives in the sample bottle are a potential source of contamination to the well water *via* the bailer.

XII. If the well is equipped with a lockable cap, secure the cap on the well when finished sampling.

XIII. Pick up all trash and place in trash bag for disposal.

G. CHAIN OF CUSTODY

I. Once the samples are collected, insert the bottles inside the protective bags provided by the laboratory and carefully place in a ice-filled cooler.

II. Complete the Chain of Custody form:
   a. Date and time of sampling
   b. Project name
   c. Names of samplers
   d. State of Engineers' Office's I.D. number of well
   e. Types of tests to be performed by the laboratory
   f. The sampler must sign and date the form(s)
   g. The cooler should be sealed with custody seals and tamper-resistant tape, and the custody seals should be signed and dated by the sampler.
   h. If not using a local laboratory, the cooler should be shipped by an overnight carrier such as Federal Express or UPS.
   i. Upon arrival at the laboratory, the cooler should be opened and the Chain of Custody form signed and dated by the laboratory personnel accepting the samples.

III. Send a copy of the Chain of Custody with the test results to the Department of Environmental Quality, Land Quality Division.

H. RESAMPLING

I. If valid test results indicate an elevated level of any pollutant, the Division will be immediately notified and attempts to re-test will begin promptly after the results are known. The time frame for retesting will be as soon as is reasonable. Factors such as weather; access to the wells; obtaining landowners' permission and abiding with their schedule; contracting a well service company to assist; ordering sampling supplies such as bottles, coolers and Chain of Custody forms; and availability of the laboratory to do the testing must be considered in scheduling a repeat test. In the latter case, samples cannot be shipped on Fridays or the day before holidays in order for the samples to be shipped overnight and checked in at the laboratory during the next morning.

II. Number of repeat tests necessary:
   a. An invalid blank result indicating a detectable level of an analyte invalidates the entire test. In such a case, the test will be repeated but, under no circumstances, can the results of the test be considered valid.
   b. Assuming a valid blank result is obtained (i.e., negative findings) but an elevated level of a pollutant is detected in the test sample, the test will be repeated at least twice in a reasonable period of time. Factors such as those

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listed in H.I. dictate the time frame for retesting

I. MONITORING WELLS FOR THE ETCHEPARE QUARRY (as of July 2012)

I. The single closest down gradient well will be used as mining progresses, outlined in below and in Map MPIXI-2. Groundwater monitoring wells are designated to be monitored when mining occurs in their respective limestone pit. For each designated limestone reservoir, assigned groundwater wells will be monitored quarterly during mine activity.

Etchepare Pit	Available Groundwater Wells
2, 5A, & 5B	***P95938W & Waitkus-R***
2, 5B, & 5C	***MCMW #1***
1, 5C	***MCMW #2***
6, 7A, 7B, & 7C	***P72810W***
6, 7A, 7B, 7C, 10A, & 10B	***P8769P***
5A	***P94793W***

II. Sampling has already commenced at well P95938W, Waitkus-R, MCMW#1, and MCMW#2. The test results are found in the Mine's Annual Report. Test results will continue to be submitted with the mine's annual report. Future well locations will be decided after consultation with the DEQ.

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APPENDIX MPIX-D

Legal Documents for Howe Lane & N. Piper Haulroad

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STATE OF WYOMING)
) ss.
COUNTY OF ALBANY)

IN THE DISTRICT COURT
SECOND JUDICIAL DISTRICT
CIVIL ACTION NO. 24205

IN DISTRICT COURT
JAN 27 1995

MILLARD C. JOHNSON and
DEANNA J. JOHNSON,

Plaintiffs,

vs.

MOUNTAIN CEMENT COMPANY,
a Wyoming Joint Venture or
Partnership,

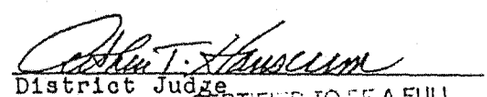
Defendant,

FINAL JUDGMENT UPON MANDATE

THIS MATTER having come before the Court upon the Complaint of Plaintiffs and the Counterclaim of Defendant, Partial Summary Judgment in favor of Plaintiffs having been reversed by the Wyoming Supreme Court, this Court finds in accordance with the directives of the Wyoming Supreme Court that the easement across the East 1/2 of Section 25, Township 15 North, Range 73 West of the 6th P.M., Albany County, Wyoming, as more fully described in the document entitled "Agreement and Easement", a copy of which is attached hereto and incorporated herein by reference, should be and is hereby declared to be existing, and was not terminated by the actions of any party, and will remain existing until terminated in accordance with the provisions of the aforesaid "Agreement and Easement."

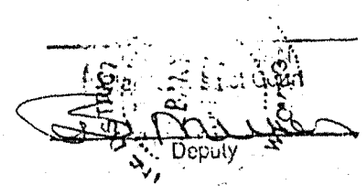
IT IS FURTHER ORDERED that all previous Orders of this Court in this matter, not in conflict with this Final Judgment, ~~are final and~~ shall remain in full force and effect. AH

SO ORDERED, ADJUDGED, AND DECREED, this 27 day of January, 1995.



District Judge

CERTIFIED TO BE A FULL
TRUE, AND CORRECT COPY.



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AGREEMENT AND EASEMENT

THIS AGREEMENT AND EASEMENT made and executed as of the 31st day of December, 1981, by and between William Q. Despain and Deanna J. Despain whose address is Howe Lane in the County of Albany, State of Wyoming, hereinafter called "Grantors", and MONOLITH PORTLAND CEMENT COMPANY, a Nevada Corporation, with its principal office located at 1025 North Brand Boulevard in the City of Glendale, State of California, the owner and operator of a plant for the manufacture of Portland Cement located in the County of Albany, State of Wyoming, hereinafter called "Grantee",

W I T N E S S E T H:

1. WHEREAS, Grantors are the owners of, among other lands, the East One-half of Section 25, Township 15 North, Range 73 West of the 6th Principal Meridian, in the County of Albany, State of Wyoming, and

2. WHEREAS, Grantee has the right, and so intends, to extract limestone and other materials (hereinafter "material") from certain lands lying East of the aforementioned Section 25, and

3. WHEREAS, Grantee's cement plant in the County of Albany, State of Wyoming, is west of the lands from which Grantee has the right to extract material, all as above mentioned, and Grantee shall be required to transport material extracted from the said lands to Grantee's plant;

NOW, THEREFORE,

In consideration of these presents, the royalty to be paid Grantors as hereinafter provided and Ten and no/100 ($10.00) Dollars paid to Grantors by Grantee, receipt of which Ten and no/100 ($10.00) Dollars is hereby acknowledged, it is agreed by and between the parties that:

DEPOSITION EXHIBIT
LD Despain
7-29-93 D1

1. Grantors do hereby for themselves, their heirs, executors, administrators, successors and assigns grant, assign and set over to the Grantee its successors and assigns an easement for a right of way for a road for the purpose of hauling material to Grantee's plant in Albany County, Wyoming, hereinafter called "the road", said right of way being more particularly described as follows:

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A strip of land 75' in width in the NE ¼ of Section 25 T15N R73W 6th P.M., Albany County, Wyoming, beginning and ending at the legal boundaries of said NE ¼ of Section 25, and lying 37.5' to the right and 37.5' to the left of a centerline described as follows:

Beginning at point #7 on the North-South centerline of said Section 25, from which point the N ¼ corner of the said Section 25 bears N01°47'02"W 746.18'; and proceeding thence S83°11'49"E 1314.95' to point #8;
thence S86°03'04"E 504.00' to point # 9;
thence N69°24'50"E 219.53' to point #10;
thence N79°17'44"E 162.18' to point #11;
thence S85°47'17"E 135.10' to point #12;
thence N87°27'23"E 141.19' to point #13;
thence N65°15'50"E 179.84' to point #14;
thence N62°13'01"E 184.57' to point #16
on the East line of said Section 25, which point #16 bears S00°03'18"E 787.84' from the NE corner of said Section 25, all as shown on the accompanying plat dated March 10, 1981.

a copy of which said plat dated March 10, 1981 is attached hereto, marked Exhibit A, and made a part hereof.

2. The said easement shall continue for so long a period as Grantee shall, in Grantee's sole discretion, require the road to enable Grantee to transport material to Grantee's aforementioned plant, and the said easement shall run with the land, and any subsequent conveyances of any interest in the land over and across which the said easement runs shall be subject to the said easement.

3. Grantee shall file this instrument for record in the office of the County Clerk and ex-officio registrar of Deeds of the County of Albany, State of Wyoming.

4. Grantee shall file for record in the office of the County Clerk and ex-officio registrar of Deeds of the County of Albany,

SITE
HIBIT
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State of Wyoming, a release of the easement herein granted within thirty (30) days following the date on which Grantee has not used the road for one continuous twelve month period, and the failure of the Grantee to so file a release shall entitle Grantors, on demand made by them on Grantee, to be paid as liquidated damages for any and all loss occasioned Grantors by such failure the sum of Two Thousand and No/100 ($2,000.00) Dollars.

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Grantee shall within a reasonable time following Grantee's none-use of the road for such continuous twelve month period re-seed the road and fill in and re-seed the borrow pits created in the construction and maintenance of the road.

5. Grantee shall provide and maintain a cattle guard and gate in the road at the point where the road leaves said Section 25, Township 15 North, Range 73 West of the 6th Principal Meridian and enters the Section immediately East of the said Section 25.

6. Grantee's employees, or contractors engaged by Grantee to construct the road, may enter on the land subject to this easement, and on land adjacent thereto, incident to the construction and maintenance of the road, provided, however, that such employees or contractors shall limit and restrict their entry upon such lands as is reasonably necessary to construct and maintain the road.

7. Grantee shall furnish to Grantors all posts, barbed wire, and other materials necessary to build a legal fence, one mile in length, said fence to be erected along the South boundary of Section 25, Township 15 North, Range 73 West of the 6th P.M. Grantee shall deliver said posts, barbed wire and other materials to Grantors by depositing same at intervals along the said South boundary line of the said section. Grantors shall furnish at the hourly rate of $5.00 per hour all labor necessary to erect the said fence, and Grantee shall, upon completion of said fence,

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period and One Thousand and No/100 ($1,000.00) Dollars.

9. Grantee agrees to seek approval for the construction of a road, said road to be described as follows:

> A road 35 feet in width commencing at Point 19 on the attached Exhibit A, and running thence on the same bearing as the present road running from Point 18 on the said Exhibit to Point 19 to a Point 135 feet West of the West boundary line of Section 25, Township 15 North, Range 73 West, of the 6th P.M., thence in a generally Southerly direction, to Point 23 on the said Exhibit.

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Grantee agrees to commence work on the said road from Point 19 to Point 23, upon (a) completing all excavation and reclamation work Grantee determines to, or is required to, do in the W½SW¼, Section 25, Township 15 North, Range 73 West of the 6th P.M. and the E½SE¼, Section 26, Township 15 North, Range 73 West of the 6th P.M., and (b) receiving authority and final approval for the construction of the said road from any political agency asserting the right to grant or deny approval for the construction of said road.

Grantee shall pay all costs necessary to the construction of said road, including among said costs expenses incurred in seeking the aforementioned authority and approval.

Grantee further agrees to exercise reasonable diligence in constructing said road upon the accomplishment of items (a) and (b), hereinabove.

Grantee will install a cattle guard in the road from Point 19 to Point 23 as hereinabove described at that point where the said road will cross the West boundary of Section 25, Township 15 North, Range 73 West, of the 6th P.M.

10. Grantee agrees to pay Grantor, separate and apart from the royalty agreed by Grantee to be paid Grantor in the paragraph numbered 8, hereinabove, monthly, commencing one month and ten days following the hauling of the first load of stack-dust over the road described in the paragraph

pay Grantors the charges for the said labor, provided, however, that the said labor charges to be paid Grantors by Grantee shall not in any event exceed the total sum of $1,500.00.

In addition to furnishing the posts, barbed wire and other materials all as aforementioned, Grantee agrees to, at its sole cost and expense, drill the post holes necessary to erect the above mentioned fence at such points along the aforementioned boundary as Grantors shall designate.

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Grantors hereby grant unto Grantee the right to enter onto the East one-half (E½) of said Section 25 for all purposes incident to the erection of said fence. Grantee hereby grants unto Grantors the right to enter the West one-half (W½) of the said Section 25 for all purposes incident to the erection of said fence.

8. Grantee shall as part of the consideration for the easement herein granted pay Grantors the sum of one and one-half cents ($.015) per ton of material hauled by Grantee (or by a contractor or contractors employed by Grantee) over the road. Payment of the royalties herein provided shall be made by Grantee to Grantors monthly, the first such payment to be made one month and ten days following the hauling of the first load of material over the road, and subsequent payments to be made to Grantors by Grantee at monthly intervals thereafter. It is specifically provided, however, that in the event that the roylaties so paid Grantors by Grantee for any six month period as herein defined, to-wit: the first six month period to end six months after the date of the first such monthly payment, and each subsequent six month period to end at six month intervals thereafter; prior to Grantee's cessation of use of the road for a period of twelve consecutive months total less than One Thousand and No/100 ($1,000.00) Dollars, Grantee shall pay Grantors the difference between the total monthly royalties so paid by Grantee to Grantors during such six month

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numbered 9, hereinabove, the sum of one and one-half cents ($.015) per ton of stack-dust hauled over the said road. The royalty herein provided to be paid Grantor by Grantee for the hauling of stack-dust shall not be subject to the provisions of the paragraph numbered 8, hereinabove, with respect of payment of One Thousand and No/100 ($1,000.00) Dollars or any other fixed sum as is provided to be paid in the said paragraph numbered 8, hereinabove.

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11. Grantors shall erect at their own cost and expense a legal fence along the West boundary of Section 25, Township 15 North, Range 73 West, of the 6th P.M.

12. Grantors, and each of them do hereby, each for himself and herself, release and waive all rights under and by virtue of the homestead exemption laws of the State of Wyoming with respect of the lands subject to the easement granted hereunder for so long as the said easement shall, under the terms hereof, be in effect.

GRANTORS

William A Despain Deanna J. Despain

GRANTEE

MONOLITH PORTLAND CEMENT COMPANY

(Seal)

ATTEST: Diane L. Babashoff
Secretary

By: [illegible]
President

STATE OF WYOMING)
) SS.
COUNTY OF ALBANY)

The foregoing instrument was acknowledged before me by William A. Despain and Deanna J. Despain this 31st day of December, 1981.

Witness my hand and official seal.

Horace M. MacNillan II
Notary Public

My Commission Expires:
8/28/82

5/11

STATE OF CALIFORNIA)
) SS.
COUNTY OF LOS ANGELES

The foregoing instrument was acknowledged before me by Bill B. Betz, President of Monolith Portland Cement Company this 31st day of December, 1981.

Witness my hand and official seal.

Donald J. Holt
Notary Public

My Commission Expires:
December 2, 1985

OFFICIAL SEAL
DONALD J. HOLT
NOTARY PUBLIC - CALIFORNIA
PRINCIPAL OFFICE IN
LOS ANGELES COUNTY
My Commission Exp. Dec. 2, 1985

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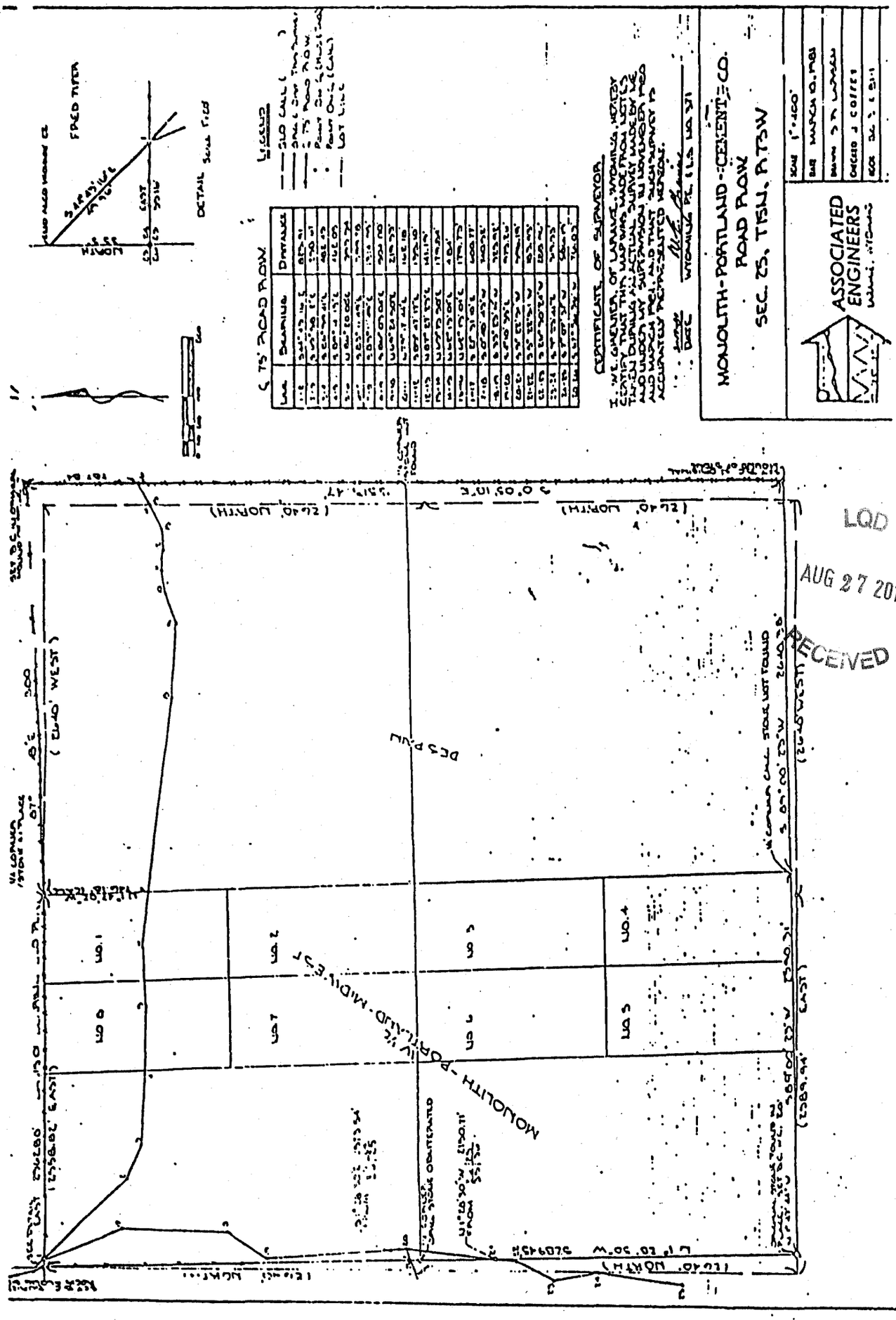

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Exhibit A

LIMITED WARRANTY DEED

MONOLITH PORTLAND CEMENT COMPANY, a Nevada Corporation, with its principal office at 1025 N. Brand Blvd., Glendale, California, Grantor, for and in consideration of TEN AND NO/100 ($10.00) DOLLARS AND OTHER GOOD AND VALUABLE CONSIDERATION in hand paid, receipt whereof is hereby acknowledged, CONVEYS AND WARRANTS only as to whomsoever may claim by through or under Grantor to: William B. Despain and Deanna J. Despain, husband and wife, Grantees, whose address is House Lane, Laramie, Wyoming 82070 the following described real estate, situate in Albany County and State of Wyoming, hereby releasing and waiving all rights under and by virtue of the homestead exemption laws of the State, to-wit:

> The W½ of Section 25, Township 15 North, Range 73 West of the 6th Principal Meridian, subject to all easements, restrictions, or reservations now filed of record in the office of the County Clerk and ex-officio registrar of deeds of the County of Albany, State of Wyoming, ~~and reserving to Grantor two 75 feet wide rights of way for two roads~~ on and over the land described in Exhibits A and B attached hereto and made a part hereof.

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Signed on behalf of MONOLITH PORTLAND CEMENT COMPANY by a duly authorized officer of said Corporation this 31st day of December, 1981.

MONOLITH PORTLAND CEMENT COMPANY

BY: Bill B. Betz
President

ATTEST: Diane L. Babaoff
Secretary

STATE OF CALIFORNIA)
) SS.
COUNTY OF LOS ANGELES)

The foregoing instrument was acknowledged before me by Bill B. Betz, President of Monolith Portland Cement Company this 31st day of December, 1981.

Witness my hand and official seal.

Donald J. Hoag
Notary Public

My Commission Expires:
December 2, 1985

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LEGAL DESCRIPTION OF ROAD RIGHT-OF-WAY TO BE RETAINED

BY MONOLITH PORTLAND CEMENT COMPANY.

REVISED MARCH 18, 1981 AND SUPERCEDING

ANY PRIOR DESCRIPTION

A strip of land 75' in width in the N 1/2 NW 1/4, Lot 8, and Lot 1, of Section 25 T15N R73W 6th P.M., Albany County, Wyoming, and lying 37.5' to the right and 37.5' to the left of a centerline described as follows:

Beginning at point #1 on the North line of said Section 25 which point bears East 35.16' from the NW corner of the said Section 25 and proceeding thence S44°43'16"E 825.91' to point #2;
thence S65°58'12"E 258.67' to point #3;
thence S86°59'41"E 482.45' to point #4;
thence S89°14'13"E 462.03' to point #5;
thence N86°20'00"E 393.54' to point #6;
thence S83°11'49"E 399.78' to point #7 on the North-South centerline of said Section 25, from which point #7 the N 1/4 corner of said Section 25 bears N01°47'02"W 746.18', the 75' Right-Of-Way thus described beginning and ending at the legal boundaries of the subdivisions described above, as shown on the accompanying plat dated March 10, 1981.

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The above description is based on my most recent survey of the road described and as illustrated on the exhibit dated March 10, 1981.

W. E. Grenier

W. E. Grenier
Wyo. P.E. & L.S. No. 371

June, 19, 1981

Exhibit A

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LEGAL DESCRIPTION OF EXISTING HAUL ROAD IN SECTION 25,

T15N R73W 6th P.M., ALBANY COUNTY, WYOMING

MARCH 18, 1981

A strip of land 75' in width in the W 1/2 W 1/2 of Section 25, T15N R73W 6th P.M., Albany County, Wyoming, beginning and ending at the legal boundaries of the W 1/2 W 1/2 of said Section 25, and lying 37.5' to the right and 37.5' to the left of a centerline described as follows:

Beginning at point #1 on the North line of said Section 25 which point #1 bears East 35.16' from the Northwest corner of said Section 25, and proceeding thence
S21°31'10"E 600.77' to point #17;
thence S00°48'43"W 740.52' to point #18;
thence S33°23'14"W 325.92' to point #19;
thence S04°10'35"E 975.26' to point #20;
thence S05°22'54"W 596.19' to point #21
on the West line of said Section 25, which point #21 bears N01°28'30"W 2150.71' from the Southwest corner of said Section 25.

In addition, beginning at the said point #20 and proceeding thence S67°56'36"W 76.03' to point #26 on the West line of said Section 25, which point #26 bears S01°28'30"E 2573.54' from the Northwest corner of said Section 25, all as shown on the accompanying plat dated March 10, 1981.

The above description is based on my most recent survey of the road described and as illustrated on the exhibit dated March 10, 1981.

W. E. Grenier
Wyo. P.E. & L.S. No. 371

Exhibit B

LQD
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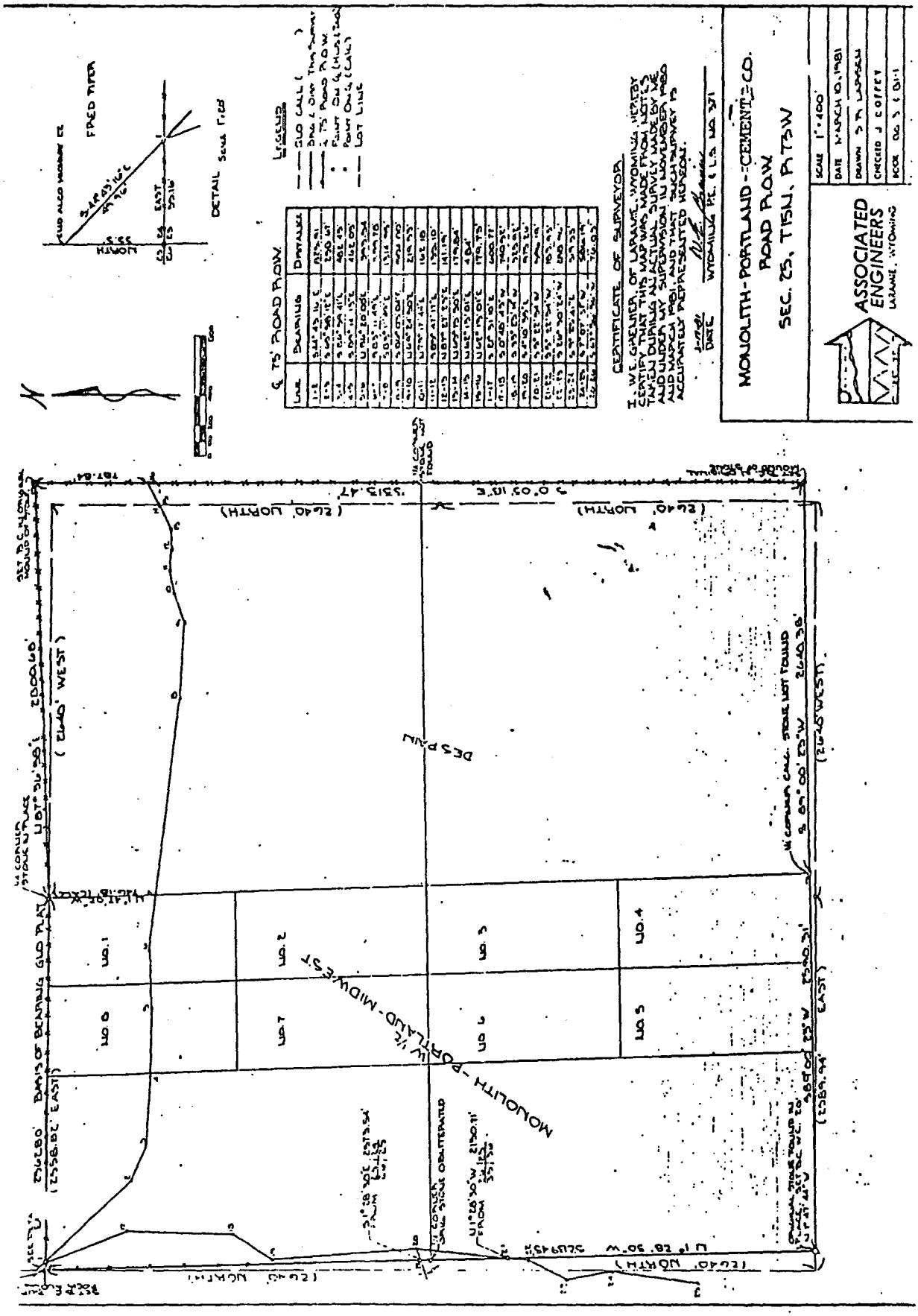

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Plat accompanying Exhibits A and B.

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SURFACE OWNER CONSENT
(Haul Road)

Richard Avery & Cindy Avery, whose address is 3630 Howe Road, Laramie, Wyoming 82070, ("Surface Owner") is the owner of the surface estate to Section 24 (All), Township 15 North, Range 73 West, 6th P.M., Albany County, Wyoming (the "Lands").

Mountain Cement Company, a Nevada corporation, whose address is 5 Sand Creek Road, Laramie, Wyoming, 82070, has constructed, operates and maintains a haul road across the Lands for transporting mined raw materials from its properties to the east of its Cement Plant located at 5 Sand Creek Road.

Surface Owner hereby gives its consent to Mountain Cement Company, to leave the haul road in good condition upon completion of its mining activities for the Surface Owner's (including their successors and assigns) use.

Dated this 5th day of August 2013.

Richard Avery

Cindy Avery

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STATE OF WYOMING)
)
COUNTY OF ALBANY)

The above and foregoing Surface Owner Consent was acknowledged before me by Richard Avery and Cindy Avery on this 5th day of August 2013.

WITNESS my hand and official seal.

CAROL DIEBOLD NOTARY PUBLIC
COUNTY OF ALBANY STATE OF WYOMING
MY COMMISSION EXPIRES JUNE 12, 2017

Carol Diebold
Notary Public

My Commission Expires: June 12, 2017

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Reclamation Plan IX

PERMIT #298C-A8
Etchepare Limestone Quarry Expansion

RP IX

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SUBMITTED TO:
WYOMING DEPARTMENT OF ENVIRONMENTAL QUALITY
LAND QUALITY DIVISION
HERSCHLER BUILDING
CHEYENNE, WYOMING 82002

SUBMITTED BY:
MOUNTAIN CEMENT COMPANY
5 SAND CREEK ROAD
LARAMIE, WYOMING 82070
(307)745-4879

Submitted: September 2012
Revised: April 2013

TFN 5 1/110
Approved:_____

5 1/110

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RPIX-1.0 Post-Mining Land Use

The post-mining land use for the reclamation will be grazing and pasture areas for livestock. The reclamation will also serve as grazing areas and habitat for species of native wildlife. The reclamation will not be used for recreational purposes.

RPIX-2.0 Backfilling and Contouring Plan for Affected Lands

RPIX-2.1 General Considerations

The surface configuration of the reclaimed area will be consistent with the post-mining land use, which is for livestock grazing and wildlife habitat. In all cases MCC will blend the reclaimed lands in with the native topography. The limestone lies in horizontal benches so it will be possible to mine all the limestone in a bench from drainage boundary to drainage boundary, effectively just lowering the terrain by the thickness of the limestone. The mining, backfilling, grading, and contouring will be done in such a manner to preserve the original major drainages. A berm along the edge of a mining area will protect native drainages as well as workers and equipment. This berm will be used later in reclamation according to its composition, as fill material or topsoil.

Prior to mining an area Mountain Cement will calculate the overburden to limestone ratio using drill hole data; this will guide site-specific backfill planning. When mining is completed, the next steps will be backfilling, grading, compacting, and contouring. In backfilling, generally any limestone fill material should be positioned first because it is hard and often large. Then sandstone fill should be positioned. Contouring will allow through-drainage but otherwise ideally should leave an overall surface that is not planar, but at least slightly concave to reduce wind erosion, promote vegetation establishment, and where needed to conserve fill material. Other areas will have predominantly convex post-mine topographies due to high ratios of overburden to limestone.

Post-mine slopes will be comparable to pre-mine slopes and not steeper than 3:1, with the possible exception of unreduced highwall features described below. In many places post-

mine slopes will be less steep than pre-mine slopes because ridge tops will be lowered. Table RPIX-1, containing the average slope measurements prior to mining and the location of the measurements is included below.

Table RPIX-1. Measured Average Pre-Mine Slope and Locations.

Slope Measurement Location	Measured Average Pre-Mine Slope (Δ elevation in feet per 1 ft. horizontal)
Pit #1, East-West Transect	.075
Pit #3, East-West Transect	.058
Pit #5A, South-North Transect	.075
Pit #5D, East-West Transect	.061
Pit #6, East-West Transect	.080
Pit #7A/B/C, East-West Transect	.048
Pit #8A/B, East-West Transect	.068
Pit #9A/B/C, East-West Transect	.083
Pit #10A, East-West Transect	.068
Pit #11, East-West Transect	.081

Backfilling is expected to employ several types of heavy equipment. A bulldozer will be used for large quantities moved short distances, and for working on top of steep slopes, loose blasted limestone or other rough surfaces. Off-highway articulated haul trucks are likely to be used for moving material either short or long distances, being loaded with an excavator or front end loader. Sandstone fill may be moved with wheel scrapers.

RPIX-2.2 Regrading Scenarios Based on Overburden Depth

Plans for backfilling and recontouring mined areas will vary in this permit area due to two main factors: 1) the ratio of overburden to limestone at a specific site, and 2) whether cost-benefit analysis dictates one or two layers of limestone should be mined at a given site. Other factors will also come into play over the hundred-plus-year lifetime of this mining permit. Some of these include A) how much limestone is left unmined in a pit due to impurities, and B) changes in the costs and benefits of mining and cement production. Planning every detail of

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RECD MAR 07, 2013

reclamation for each pit this many decades in advance likely would not be useful. Descriptions and general criteria for differing methods follow.

When Overburden Depth **Equals** Limestone Depth. In areas where there are roughly equal amounts of overburden and limestone the pit will be backfilled using the pit's own overburden and/or overburden from adjacent pits. The backfill will then be graded and contoured, ideally to a topography that is slightly concave over much of its surface area.

When Overburden Depth **Exceeds** Limestone Depth. In areas where there is an abundance of overburden, i.e. where the overburden is 1.5 times the amount of limestone the pit will first be backfilled. The surplus overburden will be used in some combination of the following ways. It may be 1) stockpiled for later use, 2) hauled directly to another area needing fill, or 3) built into convex reclamation topography on top of the backfilled pit.

When **Limestone** Depth **Exceeds** Overburden Depth. In areas where limestone depth exceeds overburden depth Mountain Cement will produce a slightly concave to clearly concave post-mine topography (for example see Map RPIX-4). For such a topography MCC would use available options to

a. create through-drainage by backfilling the downhill highwall and/or blasting a channel described below
b. backfill remaining highwalls to a maximum concave slope of 3:1, except for any approved cliff features (unreduced highwall)
c. where possible use additional available fill to
    i. line the remaining pit floor
    ii. create geomorphologically plausible irregularities, interrupting long slopes, straight lines and simple geometric shapes, and producing a sinuous, asymmetrically branching drainage route with at least one branch.
    iii. further reduce slopes

Available options to improve an area's earth balance and achieve an appropriate concave post-mine topography may be used singly or in any combination. These options are described below in roughly descending order of desirability.

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1) Use available sandstone/overburden/interburden fill material from a nearby stockpile or stripping project.

2) Drill and blast the highwall(s) to do one or both of the following:

A. reduce the highwall and/or produce fill material. This can include harvesting all permitted limestone from the lateral edges of mining areas.

B. create through drainage by opening a broad channel potentially half as deep as the low point of the pit floor through to the adjacent native drainage. This may be done before or after revegetation establishment. This channel may be i) left as an erosion-resistant bare rock channel, ii) topsoiled and revegetated, or iii) left as bare rock but with one or more low temporary or permanent check dams that will catch sediment and grow volunteer vegetation.

(Drawbacks to these reclamation blasting options include 1) the cost and environmental impacts of blasting, and 2) the need to either haul less of the pit's limestone to the cement plant or get a Non-Significant Revision (NSR) approved to disturb area slightly outside the disturbance limit.)

3) Haul overburden a greater distance from a non-adjacent place within the permit area. (The drawbacks of this include increased environmental impact by heavy equipment and increased cost of hauling.)

4) Leave one or more lengths of highwall unreduced or partially reduced according to plans given below. (The drawbacks of unreduced highwalls include the liability of leaving a fall hazard to people and wildlife, and the need to make arrangements with interested parties such as LQD; but see also the benefits described below.)

5) Mine less limestone than permitted but strip as much as the entire permitted disturbance area to generate additional fill material. (The drawbacks of this approach include high cost per ton of extracted limestone, increased environmental impact by heavy equipment, and possibly "unwarranted increase in the amount of affected lands" (LQD Noncoal R&R Chap.3 Sect. 2 (b)(ii)(A)).

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RPIX-2.3 Possible Unreduced Highwalls

RPIX-2.3.1 Why Unreduced Highwalls?

Mountain Cement anticipates the possible need to leave unreduced or partially reduced highwalls in one or more places over the life of this permit to reduce environmental impact and cost, and to enhance wildlife habitat.

Reduce Environmental Impact. Environmental impact would be reduced by some or all of the following: 1) less heavy equipment fuel, replacement, lubricants, noise, and dust, 2) reduced explosives use, 3) potentially less land affected, 4) avoiding the need to bring fill material from outside the permit area which could bring Noxious Weeds and/or water pollutants, and 5) replacing mined native cliff habitats with reclamation cliff features (unreduced highwall, as described below).

Wildlife Habitat Enhancement. Unreduced highwalls create valuable habitat for various birds, including raptors, as well as reptiles and small mammals. They also act as windbreaks and wintering habitat for larger mammals like elk, mule deer, and pronghorn.

Small, low, natural limestone and sandstone cliffs are found various places in the permit area. One example is near the tip of proposed Pit 7C, uphill from the old 2-track ranch road that crosses through the tip of the 7C Pit area. A low limestone cliff faces west toward the valley, then bends around to the north, then forms a small box canyon, then continues eastward forming the break of the ridge, totaling several hundred feet of horizontal length. Cliffs of similar height but less length are common throughout the permit area on the upper portions of steep canyon walls. They are formed over geologic time where the less-cohesive sandstone is eroded away from the base of a more erosion-resistant bed of limestone. A few examples of these low cliffs are even visible from Interstate 80 in Telephone Canyon. Small resistant sandstone cliffs can be found in a few places. One example is the "Camelback" feature on top of the ridge at the northern, downhill tip of proposed Pit 5A.

If left as permanent reclamation, unreduced highwalls would serve to partially replace some of the low cliff habitats lost to mining the permit area. At the same time optional bare rock features under unreduced highwalls would partially replace rock-flat habitat lost to mining.

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Areas of bare rock on the ground allow birds and other small animals an open vegetation-free place where an approaching predator can be seen from greater distance. These bare rock surfaces also provide habitat for lichens. Variation in vegetation is increased by producing a small habitat directly downhill from the rock for plant species that require slightly more soil moisture.

Cost. Among other reasons, leaving unreduced highwalls in one or more places likely would reduce Mountain Cement's reclamation costs. Cost considerations are a legitimate factor in reclamation planning under the Wyoming Non-Coal Rules and Regulations. LQD Noncoal R&R Chap.3 Sect. 2(b)(iii)(A) includes the text "not possible to reduce pitwalls, based on the character of the rock encountered or economic considerations…."

RPIX-2.3.2 Configuration of an Unreduced Highwall

Mountain Cement does not anticipate leaving any vertical highwall segments longer than 150 feet or higher than 12 feet in permanent reclamation.

An envisioned unreduced highwall could be limestone or sandstone. MCC limestone highwalls are nearly vertical, averaging over 85 degrees from horizontal. MCC sandstone highwalls are less cohesive and not as close to vertical, standing at an average angle over 80 degrees. In this permit area both types of rock show high competence, meaning they hold together well in the highwall and do not readily crumble and fall on their own.

Below an unreduced highwall could be regular respread revegetated topsoil ranging from a 3:1 slope to level, or a rubble zone of bare broken limestone or sandstone ranging from the angle of repose (simulating a natural colluvial slope) to level (also simulating naturally-occurring conditions in parts of the permit area.) The horizontal size of a rubble zone would be limited to extend not more than 20 feet horizontally outward from the unreduced highwall.

Berms are not planned above or below an unreduced highwall as they would appear clearly man-made, in opposition to the concept of making reclamation blend in with the surrounding native landscape.

A representative situation where an unreduced highwall may be used is proposed Pit 4. For a map with an included diagram see Map RPIX-4.

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RPIX-2.3.3 Location(s) of Unreduced Highwall(s)

No highwall areas will be left unreduced in the following special areas. 1) Minor drainages where a waterfall would form during heavy runoff events causing erosion below the unreduced highwall. 2) On the downhill edge of a pit where water could be impounded. 3) In direct line of sight from a neighbor's residence less than 1 mile away unless by the neighbor's written approval. 4) Next to a post-mine road or fence. 5) Along a neighbor's property line.

How many segments of unreduced highwalls may be necessary? This reclamation plan is optimized to avoid the necessity of leaving unreduced segments of pit highwalls, but it could become necessary. The history of this mining permit and the two permits that were combined with this permit goes back to 1975. Since then no highwalls have been left intact and it may be possible to continue that trend throughout the life of the permit.

RPIX-2.3.4 Communications with Interested Parties

Decisions regarding details and location of any unreduced highwall as permanent reclamation will be done in consultation with the Wyoming Game and Fish Department. MCC will gain approval of a Non-Significant Revision (NSR) to the mining permit before leaving an unreduced highwall. MCC will not leave an unreduced highwall visible from a neighbor's house within one mile except by written approval of the neighbor with a copy filed with LQD. If not on surface owned by MCC, MCC will obtain written approval from the surface owner and file a copy with LQD. If the land is leased for grazing when a decision is approved to leave an intact highwall in permanent reclamation MCC will inform the grazing lessee of the location and permanent status of the unreduced highwall.

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RPIX-2.4 Erosion and Sedimentation Control

Erosion and sedimentation will be controlled through various and common means of sediment control measures, other than sediment ponds. Storm water runoff and off-site water

will be kept away from reclamation areas through the proper use of straw bales, and silt fencing around the perimeter. Likewise, on-site water and runoff from within the reclamation area will have sediment removed from it through the same means as stated above. The measures will be maintained and sediment cleaned out to prevent failure. In addition to the measures mentioned above, erosion control blankets, geo-textiles, and hydromulches may be used to assist in plant growth. When vegetation has grown to a sufficient cover percentage MCC will consult with DEQ/LQD *(a.k.a. Department of Environmental Quality/Land Quality Division)* and remove the measures; the geo-textiles and erosion control blankets degrade and become part of the reclamation.

Examples of sediment control measures that maybe used and their descriptions are:
Rock Check Dams- these measures are typically constructed of cobble-sized blasted limestone, 3"-5" in diameter. These are generally placed in existing drainages and are constructed to filter as well as mitigate water's speed.
Straw Bales- these are generally small, lightweight measures that are placed on the downhill side of disturbance/reclamation areas. They are typically keyed into place in shallow trenches constructed perpendicular to water's direction of flow. They are also typically staked into place with lath or rebar. They work as a filtration and flow mitigation measure.
Earthen Berms- Berms are constructed on the margins of a disturbance/reclamation area. They are made of overburden and are placed to keep run-off within the area.
Silt Fence- similar to straw bales, silt fencing is a textile material that is keyed into shallow trenches dug perpendicular to water flow. They are staked into place and used to filter out/retain sediment.

RPIX-2.5 Drainage Reconstruction

The mining will be occurring on the tops of the east-west running ridges so MCC doesn't anticipate having to mine through but a handful of ephemeral drainages. For the most part the only surface water drainage features that will be affected are the existing swales and sub-ridges that occur on land to be disturbed. The Post-Mining Topography surface will have swales and undulations placed in it to mimic the native topography, increase drainage density, and abate

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storm water runoff energy. The goal of this is to have the surface water flow as it did prior to mining, in a general east to west direction and down the steep slopes separating the drainage bottoms from the ridge tops. In areas where an ephemeral drainage or sub-drainage is affected by mining, reclamation will be as such to allow a smooth transition where the reclaimed drainage meets the native drainage; this will reduce the risks of scouring, head cutting, and being left with a perched disconnected drainage. If necessary, gabions and rip rap lined pools will be placed where potential head cuts may develop. The reclaimed drainages will be bed rock controlled and will be constructed with the pre-mine sinuosity and slope in mind. MCC doesn't anticipate having any areas where water is unduly impounded. When specific crossings are no longer needed for mining purposes they will have their culverts, corrugated metal or high density plastic pipe, removed and stored. The crossing will have all of its base material, fines, and comingled detritus dug out of the channel.

Slope conditions will be as such to allow animals and humans access with out being in danger, to allow the movement of surface water with out impounding any, and to allow vegetative cover to root with out being hampered by rilling. Due to the nature of the mining activity, the post-mining slope will be very similar to that of the pre-mining slope, which is a 5-10% grade. Please see Map RPIX-2 Post-Mining Topography for the post-mining surface.

RPIX-3.0 Surface Preparation for Topsoil/Subsoil Replacement

The final surface before reclamation in any area commences will be the floor of the quarry; a limestone surface. Generally speaking, nothing will be done to the floor to prepare it for reclamation; however, where necessity dictates, the floor may be ripped with a track-type tractor dozer to assist in creating drainages.

RPIX-4.0 Topsoil/Subsoil Replacement

The backfill will be brought to final grade and scarified using a motor grader. Topsoil will be replaced using scrapers and will be graded to the Post-Mining elevations using a motor grader. Scrapers will replace topsoil from nearby stockpiles or the topsoil will be hauled directly

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from a neighboring area that is being stripped. Direct hauling will be the preferred method of replacement. This method allows the native seed bank, soil biota, and some of the soil structure to remain intact at the time of permanent seeding.

When possible areas will be regraded in the summer of each year; the area regraded will be the disturbance from earlier that year and later the year before. For instance, the fall 2015-spring 2016 disturbance would be regraded during the summer of 2016. More specifically, in the late spring/early summer the disturbed area would have backfill hauled from either a stockpile or the next year's mining area, worked to the proper grade, and scarified. The area will be topsoiled then promptly seeded in the fall after September 15th or at least before June 15th. There are no planned special soil reconstruction procedures.

Most if not all areas affected will have topsoil placed them according to methods discussed above. Though the pre-mine landscape includes several rock flats, accounting for nearly 100 acres, they too will be mined through and regraded like the rest of the affected areas and revegetated. The affected areas will have a minimum of 8 inches of topsoil placed on them, with the exception of any areas to be revegetated with mountain mahogany, which likely will receive only one half inch of topsoil. Reconstructed drainages and interfluve areas will have less topsoil placed on them than the areas between drainages and the microtopography will be constructed to create through drainage.

RPIX-5.0 Revegetation Practices

Previous MCC mining permits each had only one or two permanent reclamation seed mixtures. For this permit revision the much greater variation in elevation, soils, and pre-mine vegetation strongly indicate the need for three to four different revegetation seed prescriptions. If a single mix was designed for the whole permit area problems would result. Little if any mountain mahogany would grow. For other pre-mine vegetation types and their geographic locations it would be difficult to achieve bond release because some proportion of the seed mix species would always be poorly adapted. This would waste money on each seed purchase and waste opportunity to progress quickly toward revegetation bond release.

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Described here are four prescriptions for permanent reclamation seedings. The first is an optional plan for establishing mountain mahogany (*Cercocarpus montanus*) which should not be planted in a mix with other species. MCC proposes this mountain mahogany plan as optional because success is uncertain and costs may be prohibitive. The other three prescriptions of the four are implementations of multispecies seed mixtures corresponding to other pre-mine vegetation communities.

Mountain Mahogany. Mountain mahogany (MM) revegetation is an uncertain part of the reclamation plan and is expected to use little of the available topsoil. Therefore, it would be desirable to plant the MM areas as soon as possible before adjacent grass-dominated revegetation types. This would reserve some topsoil in case MM areas later need to be converted to other vegetation types by spreading additional topsoil and reseeding. This would guard against the need to bring in topsoil from off-site in the event that MM revegetation fails.

MCC reserves the flexibility to use other methods (such as plug seedlings) to establish MM, but the likely method is below. The following seeding plan for MM is based on a study of the literature, discussions with MM experts, and observations from small experiments at the MCC Etchepare and Weaver limestone quarries.

- preferentially plant MM areas adjacent to intact stands of MM
- topsoil specifics:
    - use freshly stripped, direct hauled TS from a MM stand to provide 3 kinds of necessary soil microbes and a matching native seed bank
    - spread only a very thin layer of TS (target depth 1.3 cm or less)
- use locally collected seed, probably hand-thrown (or experimentally test other seed sources before large-scale use)
- apply mulch for shade, temperature control, and to hold soil moisture
- if needed broadcast additional seed in subsequent years to increase shrub density
- allow other plant species to volunteer within the MM area over time to achieve plant diversity, if necessary after bond release

Multi-species Permanent Seed Mixtures. The two permanent seed mixture tables below list a number of species for each life form that may be used. Some species will always be used

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while others are optional and will be included based on cost and availability of the seed, expected response, landowner desires, and apparent results from past on-site use. Species not responding well to local soil, slope, and climatic conditions will be used less and species providing noticeable cover, production, and density in prior plantings will be utilized most often.

For each life form, an appropriate number of species and pounds of Pure Live Seed (PLS) will be seeded. For cool season grasses and perennial forbs, at least four species for each life form will be used in each seed mixture. One or more options for warm season grasses are provided. Acceptable ranges of PLS/acre are provided for each life form category in each seed mixture. Number of seeds per pound is provided to aid implementation of the seed mixtures.

Mixed Shrub/ Grassland (MS) Revegetation. One of the dominant pre-mine vegetation types at lower elevations of the permit area is Mixed Shrub/ Grassland (MS). A flexible permanent seed mixture has been developed to accommodate both this pre-mine native vegetation type and the similar High Elevation Mixed Shrub/ Grassland (MSH) type discussed below. Table RPIX-2, below, lists seed choices, potential seeding rates, and an example implementation for each included vegetation type.

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Table RPIX-2. MS-MSH (Mixed Shrub/ Grassland and High Elevation Mixed Shrub/ Grassland) Permanent Reclamation Seed Mixture. In the example columns a zero (instead of white space) recommends against sowing in that vegetation type because it may not perform well there.

Scientific Name	Common Name	Preferred Cultivar	Seeds /Lb	Lbs. PLS/Ac	MS Example Lbs PLS/Ac	MSH Example Lbs PLS/Ac
Cool Season Grasses: (min. of 6 spp. selected; max. of 4 spp. & 7 Lbs PLS wheatgrasses; max. total thickspike & streambank w.g. 3 Lbs)				**8-12**	**10**	**9.5**
Achnatherum hymenoides	Indian ricegrass	Nezpar	141,000	0-2		
Elymus elymoides	bottlebrush squirreltail	VNS*	192,000	0-3		
Elymus lanceolatus ssp. *lanceolatus*	thickspike wheatgrass	Critana	154,000	1-3	1.5	1.5
Elymus lanceolatus ssp. *lanceolatus*	streambank wheatgrass	Sodar	156,000	0.5-2	1.5	1.5
Elymus smithii	western w.g.	Rosana	110,000	(1.5-)3-5	2	2
Elymus spicatus	bluebunch w.g.	Whitmar	140,000	(0-)1-3		
Elymus trachycaulus	slender wheatgrass	Pryor	159,000	0-2	1	
Elymus wawawaiensis	Snake River w.g.	Secar	140,000	(0-)1-3	1	1
Festuca idahoensis	Idaho fescue	VNS*	450,000	0-3	1	2
Festuca saximontana	Rocky Mountain fescue	VNS*	1,202,000	0-2		
Hesperostipa comata	needle-and-thread g.	VNS*	115,000	0-1		
Koeleria macrantha	prairie junegrass	VNS*	2,315,400	0(-2)	0.5	0.5
Nassella viridula	green needlegrass	Lodorm	181,000	0-1(-2)	0.5	
Poa secunda	Canby bluegrass	Canbar	926,000	0-3	2	1
Warm Season Grasses: (minimum of 1 selected)				**1-3**	**1**	**2**
Bouteloua gracilis	blue grama	**	825,000	0-3***		1
Muhlenbergia montana	mountain muhly	VNS*	1,500,000	0-2	1	1
Schizachyrium scoparium	little bluestem	Camper	260,000	0-1		
Forbs, by family: (minimum of 4 selected)				**3-4**	**3**	**3**
AST *Achillea millefolium*	western yarrow	VNS	2,852,012	0-1	0.25	1
AST *Gaillardia aristata*	Indian blanket flower	VNS*	132,000	0-1	0.25	
AST *Machaeranthera tanacetifolia*	prairie aster	VNS*	496,000	0 or 1		
AST *Ratibida columnifera*	prairie coneflower	VNS*	1,230,000	0-0.5		
AST *Symphyotrichum ascendens*	Pacific aster	VNS*	2,668,000	0-0.5		0.5
BRA *Cleome serrulata*	Rocky Mountain beeplant	VNS*	65,900	0 or 1-2	1	0
FAB *Dalea candida* var. *candida*	white prairie clover	VNS*	278,000	0-1†††		1
FAB *Dalea purpurea*	purple prairie clover	Kaneb-hulled	210,000	0 or 1†††	1	1
FAB *Onobrychis viciifolia*	sainfoin	Nova, Melrose	30,240	0-3†††	0.5	0.5
FAB *Vicia americana*	American vetch	VNS*	32,833	0-2†††	0	
MLV *Sphaeralcea coccinea*	scarlet globemallow	VNS*	500,000	0-1		0
PTG *Penstemon strictus*	Rocky Mountain penstemon	Bandera	592,000	0-1		

(continued)

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(Continued) **Table RPIX-2, MS-MSH (Mixed Shrub/ Grassland and High Elevation Mixed Shrub/ Grassland) Permanent Reclamation Seed Mixture.**

Scientific Name	Common Name	Preferred Cultivar	Seeds /Lb	Lbs. PLS/Ac	MS Example Lbs PLS/Ac	MSH Example Lbs PLS/Ac
Subshrubs: (minimum of 1 selected)				**1-2**	**1.5**	**1.5**
Artemisia frigida	prairie sagewort, fringed sagewort	VNS*	4,536,000	0.5-2	1	1
Artemisia ludoviciana	Louisiana cudweed	VNS*	4,048,000	0-1		
Krascheninnikovia lanata	Winterfat	VNS*	56,700	0.5-2.5	0.5	0.5
Shrubs: (minimum of 1 selected)				**1-2**	**2**	**2**
Artemisia nova	black sagebrush	VNS*	952,700	0-1†		
Artemisia tridentata var. *wyomingensis*	Wyoming big sagebrush	VNS*				
Atriplex canescens	Fourwing saltbush	Wytana or High Elev.	78,000	0.25-0.5	0.5	
Chrysothamnus viscidiflorus	Douglas rabbitbrush	VNS*	783,000	0.5-1	1	1
Ericameria nauseosa	rubber rabbitbrush	VNS*	400,000	0-1	0.5	1
		Total Lbs PLS per Acre		**17.50††**	**17.50††**	**17.50††**

*Variety Not Specified: northern collection preferred (WY, northern CO, MT, northern UT, ID, Canada, etc.)
**Wyoming collection if available at reasonable cost; otherwise substitute Hachita, Lovington or another northern collection.
***For good establishment blue grama seed should be broadcast rather than drilled so seeding method may influence seeding rate.
†For good sagebrush establishment hand-throw seed on snow after drilling OR broadcast by machine before drilling rest of mix.
††This table shows drill seeding rates; rates should be increased to 35 Lbs PLS per Acre where broadcast seeding is necessary.
†††Legumes should be planted with an appropriate strain of rhizobial innoculum unless data suggests appropriate rhizobia are already present in the soil such as in Bird (2009). Sainfoin is non-native but disappears after about six years; meanwhile it is a good nitrogen-fixer, is good for livestock and wildlife, and is a good nurse-plant for other reclamation plants.

High Elevation Mixed Shrub/ Grassland (MSH) Revegetation. One of the dominant pre-mine vegetation types at higher elevations of the permit area is High Elevation Mixed Shrub/ Grassland (MSH). A flexible permanent seed mixture has been developed in accordance with both this pre-mine native vegetation and the similar Mixed Shrub/ Grassland (MS) vegetation type described above. Table RPIX-2, above, lists seed choices, potential seeding rates, and an example implementation for each vegetation type.

Mixed Conifer Forest (MXC) Revegetation. The most visually dominant pre-mine vegetation type at higher elevations of the permit area is Mixed Conifer Forest (MXC). A flexible permanent seed mixture has been developed in accordance with the understory of this pre-mine native vegetation type. (See tree replacement details below). Table RPIX-3, below, lists seed choices, potential seeding rates, and an example implementation.

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Table RPIX-3. MXC (Mixed Conifer Forest) Permanent Reclamation Seed Mixture.

Scientific Name	Common Name	Preferred Cultivar	Seeds /Lb	Lbs. PLS/Ac	Example Lbs PLS/Ac
Cool Season Grasses: (min. of 6 spp. selected; max. of 4 spp. & 7 Lbs PLS wheatgrasses; max. total thickspike & streambank w.g. 3 Lbs)				**8-13**	**12**
Achnatherum hymenoides	Indian ricegrass	Nezpar	141,000	0-1.5	
Bromus carinatus	mountain bromegrass	Bromar	106,680	0-2	1
Elymus lanceolatus ssp. *lanceolatus*	thickspike wheatgrass	Critana	154,000	0-3	1.5
Elymus lanceolatus ssp. *lanceolatus*	streambank wheatgrass	Sodar	156,000	0.5-2	1.5
Elymus smithii	western w.g.	Rosana	110,000	(1.5-)3-5	2
Elymus spicatus	bluebunch w.g.	Whitmar	140,000	0-1.5	
Elymus trachycaulus	slender wheatgrass	Pryor	159,000	0-2	0.5
Elymus wawawaiensis	Snake River w.g.	Secar	140,000	0.5-1.5	1.5
Festuca idahoensis	Idaho fescue	VNS*	450,000	0-3	1.5
Festuca saximontana	Rocky Mountain fescue	VNS*	1,202,000	0 or 1-2	1
Hesperostipa comata	needle-and-thread grass	VNS*	115,000	0-1	
Koeleria macrantha	prairie junegrass	VNS*	2,315,400	0.5-2	0.5
Nassella viridula	green needlegrass	Lodorm	181,000	0-1	
Poa secunda	Canby bluegrass	Canbar	926000	0-2	1
Warm Season Grasses: (optional due to elevation & habitat)				**0-3**	**1**
Bouteloua gracilis	blue grama	**	825000	0-3	
Muhlenbergia montana	mountain muhly	VNS*	1,500,000	0-2	1
Forbs, by family: (minimum of 4 selected)				**3-4**	**3.5**
AST *Achillea millefolium*	western yarrow	VNS*	2,852,012	0.25-2	1
AST *Symphyotrichum ascendens*	Pacific aster	VNS*	2,668,000	0-0.5	0.5
CAM *Campanula rotundifolia*	harebell	VNS*	1,200,000	0-0.25	
FAB *Dalea candida* var. *candida*	white prairie clover	VNS*	278000	0-1†††	1
FAB *Dalea purpurea*	purple prairie clover	Kaneb-hulled	210,000	0 or 1†††	1
ONA *Chamerion angustifolium*	fireweed	VNS*	8,500,000	0-0.25 ††††	0
PLG *Eriogonum umbellatum*	sulphur buckwheat	VNS*	209,000	0-1	
(from these lists of shrubs and subshrubs chose 2+ species total)					
Subshrub:				**0-2**	**0.5**
Artemisia frigida	prairie sagewort	VNS*	4,536,000	0-2	
Berberis repens	creeping barberry	VNS*	54,000	0-2	0.5
Shrubs:				**0-1**	**0.5**
Artemisia tridentata var. *vaseyana*	mountain big sagebrush	VNS*	2,500,000	0-1†	0.5
Rosa woodsii	Woods rose	VNS*	45,300	0-1	
Symphoricarpos oreophilus	mountain snowberry	VNS*	54,700	0-1	
			Total Lbs PLS per Acre	**17.50††**	**17.50††**

*Variety Not Specified: northern collection preferred (WY, northern CO, MT, northern UT, ID, Canada, etc.)
**Wyoming collection if available at reasonable cost; otherwise substitute Hachita, Lovington or another northern collection.
***For good establishment blue grama seed should be broadcast rather than drilled so seeding method may influence seeding rate.
†For good sagebrush establishment hand-throw seed on snow after drilling OR broadcast by machine before drilling rest of mix.
††This table shows drill seeding rates; rates should be increased to 35 Lbs PLS per Acre where broadcast seeding is necessary.
†††Legumes should be planted with an appropriate strain of rhizobial innoculum unless data suggests appropriate rhizobia are already present in the soil such as in Bird (2009).
††††Attention: This species may cause problems in establishing conifers (Pavek 1992).

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If MCC chooses not to attempt mountain mahogany revegetation on a site that was formerly a MM stand the MS-MSH (Mixed Shrub/ Grassland and High Elevation Mixed Shrub/ Grassland) seed mixture should be used with guidance from the pre-mine vegetation map. Former RF (Rock Flat/ Cushion Plant Community) Vegetation Map Units should be revegetated using the MS-MSH seed mix, or with mountain mahogany if limited topsoil availability or other factors lead MCC to choose this vegetation type.

The multi-species seed mixes will be drill seeded. The typical target seed depth will range from ¼ inch to a ½ inch below the surface, but small seeds may be simultaneously broadcast and dragged if machinery used is so equipped. When and if broadcast seeding is required, the seeding rate will be doubled. Discing etc. will be done along the contours of the area to be seeded to assist in erosion control. In addition to contour discing, vegetation mats, and other sediment control measures may be used to prevent the erosion of soil from the areas to be seeded. No soil amendment is anticipated, but may be applied if a need is identified. Fall seeding will occur after September 15th and spring seedings will occur before May 15th. Mulch will be applied at the rate of 2 tons per acre and will be certified weed free and anchored with crimping techniques. At this time MCC is investigating the use of hydromulching to determine its feasibility; this technique may also be adopted.

Topsoil stockpiles that will be in existence for more than 1 year and temporarily disturbed areas will be seeded with a flexible, temporary, perennial seed mixture. This seed mix will be used to prevent erosion from topsoil piles and stabilize disturbed areas until permanent reclamation can occur. Table RPIX-4 lists the temporary seed mix species and seeding rates.

Table RPIX-4. Temporary Seed Mixture.

Scientific Name	Common Name	Preferred Cultivar	lbs. PLS/Ac	Example PLS/Ac
Elymus lanceolatus ssp. lanceolatus	thickspike wheatgrass	Critana	1-3	2
Elymus lanceolatus ssp. lanceolatus	streambank wheatgrass	Sodar	1-3	2
Elymus smithii	western wheatgrass	Rosana	4-6	5
Elymus trachycaulus	slender wheatgrass	Pryor	2-4	4
Nasella viridula	green needlegrass	Lodorm	0-1	0
Onobrychis viciifolia	sainfoin	Nova, Melrose	0-3†	2
		Total Lbs PLS per Acre	**15**	**15**

†Legumes should be planted with an appropriate strain of rhizobial innoculum unless data suggests appropriate rhizobia are already present in the soil such as in Bird (2009).

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Appropriate methods will be used to protect seeded areas. The revegetated areas will be protected from domestic grazing either through the erection of temporary fencing or arrangements will be made in advance with ranchers to graze their livestock elsewhere until bond release is reached. Fencing will also help minimize the amount of grazing pressure from wildlife. County Declared Weeds and Designated Noxious Weeds are to be controlled for a minimum of five years on permanently reclaimed lands in preparation for bond release. See the Integrated Weed Management Plan in Addendum RPIX-A

Tree replacement methods. MCC will likely allow one or more years after planting of the prescribed seed mix for an area before beginning tree replacement, allowing the seed mix to begin establishment before receiving traffic necessary to replace trees.

Tree replacement is likely to be most successful if replacement trees are positioned near the sites of the pre-mine trees they replace. Predictions of tree parameters for numbered pits and parts of them are provided in Vegetation Appendix Table DIX8-22. More importantly, the section below on revegetation success performance standards describes how trees to be affected in each stripping campaign are to be inventoried and tracked to guide later replacement.

At present, transplant of small trees in the form of plug seedlings is the most successful and cost-effective method for growing our species of trees in mine reclamation. The most likely source of transplant material is the University of Idaho Center for Forest Nursery and Seedling Research, http://seedlings.uidaho.com. An alternate source of plug seedlings the local office of the USDA Natural Resource Conservation Service or Conservation District. In 2012 prices range from $0.38 each (for Douglas fir and lodgepole pine as 5 cubic inch root plugs in quantities of 100 or more) to $2.25 each (for our other species as 20 cubic inch root plugs in quantities less than 200). Timing of planting is critical to tree survival. Nursery stock should be ordered and delivered well ahead of time and kept cold in coolers until weather and soil conditions are right for transplanting. There should be no snow on the ground but one or more heavy snowstorms yet to come before summer. These conditions are most likely in parts of February and March in our permit area. Probably a hoedad, tree shovel, or other specialized tree-planting tool will be used to help get the plugs properly planted without undue drying out.

MCC will likely use some combination of methods to protect transplanted trees and reduce their mortality rates. Available methods include: 1) careful handling of nursery stock in

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terms of mechanical damage, temperature, humidity, and wait time before transplant, 2) planting on the north or east sides of stumps, logs, large rocks, or man-made shelters (such as windwalls, http://www.lrcd.net/) , 3) removing vegetation and leaf litter in a 30" x 30" square at the transplant site before planting, 4) placing tree fertilizer in the hole but a few inches deeper than or to one side of the root plug, 5) watering any dry plugs before planting, 7) one or more waterings during the first growing season, 8) controlling weeds for 3 or more years, 8) discouraging herbivores with spray-on repellants, mesh-type tubing, and/or solid tubes 8-12" tall (one option is called Rigid Seedling Protector Tubes http://www.forestry-suppliers.com/product_pages/View_Catalog_Page.asp?mi=16201&title=Rigid+Seedling+Protector+Tubes), and 9) placing a wooden stake next to a transplant to protect it from feet and vehicles. A good reference to guide MCC in its tree planting efforts is the University of Idaho's publication (Dumroese, 2012-09-17 visit) "How to Plant Seedling Trees for Idaho's Farms and Forests" available at http://seedlings.uidaho.com/Content/Assets/Plant%20Your%20Seedlings%20Right%202a.pdf.

Some transplanted trees will die, so MCC likely will want to plant a selected number of trees initially, then plant again after a year or more has passed to replace trees that have died, bringing the numbers up to meet bond release criteria.

Other types, sources, and timings of transplants may be attempted if desired by MCC. Seeding rather than transplanting may be attempted if MCC chooses, especially if successful new methods of seeding these species arise.

Tree Replacement Success Standards. The tree species to be removed and replaced for this permit fall into two importance categories per LQD policy.

1) Most important: limber pine (*Pinus flexilis*). The bond release criterion will be replacement at a ratio of 1:2 for replaced trees to pre-mine trees, except for in any MM revegetation which will have a different criterion to be negotiated with LQD.
2) Less important tree species including: Douglas fir (*Pseudotsuga menziesii*), ponderosa pine (*Pinus ponderosa*), lodgepole pine (*Pinus contorta*), subalpine fir (*Abies bifolia*), Engelmann spruce (*Picea engelmannii*), Rocky Mountain juniper (*Juniperus scopulorum*), black chokecherry (*Prunus virginiana*), quaking aspen (*Populus*

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unlikely within the ordinary five years, studies or other preparations for bond release through a special arrangement should begin, in order to make bond release achievable within ordinary revegetation timeframes such as nine years.

Similarly, tree replacement standards for any MM revegetation should be negotiated between MCC and LQD as a MM revegetation project develops over time. Tree replacement standards for any MM revegetation areas should be lower than such standards for other revegetation types because tree replacement is likely to have special difficulties and extra costs. Below are some likely difficulties. Seeding MM, waiting 1 or 2 years, then transplanting trees as with other revegetation types may cause unacceptable amounts of damage to young MM plants. Seeding MM, waiting enough years for MM plants to have well-developed root systems that are likely to resprout after stems are smashed, then transplanting trees may present an unacceptable delay of bond release and still cause unacceptable damage to MM plants. Planting tree seeds along with MM seeds may not produce trees. Transplanting trees into a site before seeding MM would have the drawback that if MM revegetation failed and the site was spread with additional soil and planted with a multi-species seed mix, the transplanted trees would have to be sacrificed or avoided by equipment.

General Vegetation Performance Bond Release Standards. For revegetation with the above MS-MSH and MXC seed mixes, revegetation shall be deemed to be complete and eligible for full bond release when:

(1) the non-tree vegetation species of the reclaimed land are self-renewing under natural conditions prevailing at the site;

(2) the total vascular vegetation cover of desirable perennial species (excluding alien Designated Noxious and County Declared Weed species) is at least statistically equal to the total vascular vegetation cover of desirable perennial species on the area before mining;

(3) the species diversity and composition are suitable for the approved post-mining land use;

(4) tree replacement performance standards above are achieved; and

(5) the requirements in (1), (2), (3) and (4) are achieved during one growing season, no earlier than the fifth full growing season on the reclaimed lands.

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To document achievement of the above criteria, a vegetation study should be conducted following standard methods pre-approved by LQD. A Reference Area (REFA) for a given study should be agreed upon between MCC and LQD at least three months before sampling begins following the reasoning discussed in the Vegetation Appendix Section 8.4.5.

RPIX-6.0 Final Hydrologic Restoration

The drainage system after reclamation will be just as it was before mining occurred. MCC, though mining near drainages, will not be mining through or below the level of adjacent drainages. There will be no need for reconstructing major drainage channels. However, there are places in affected areas where the reclamation will be contoured to reflect the microtopography and undulations of the pre-mining landscape and drainage systems. The reclamation will be constructed with a higher drainage density than that of the pre-mine topography. Increasing the drainage density will keep runoff volumes and velocities manageable and less erosive. Please see Maps RPIX-2 and RPIX-4. No impoundments or sediment ponds are planned at this time. The final water quantity and quality will be unchanged from the pre-mining quality and quantity. Please see Appendix MPIX-1 for quarterly groundwater quality results by year and well for the Etchepare Quarry.

The drainage systems for the reclaimed areas will be constructed as to mimic the native pre-mine drainage system. The affected areas will have the minor drainages and subdrainages reconstructed through backfilling and contouring allow them to drain as they did prior to mining. They will have undulations and interfluves constructed in them to increase drainage density. The reclaimed areas will drain to the main drainages through native channels. No wetlands will be affected by the operation; any possible wetlands occur in the drainage bottoms and the mining operations will take place on the ridge tops.

MCC doesn't anticipate the operation having any affect on the hydrology of the surrounding area. Mining will not be taking place in the aquifer (lower water-saturated levels of the Casper Formation) and will be at least 50 feet above the potentiometric surface in all pits. Furthermore, the mining will remain well above the elevation of the adjacent drainage bottoms.

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MCC will not attempt to mine two limestone layers in places where they are not absolutely sure that they will remain above the elevation of adjacent drainages or remain at least 50' above the potentiometric surface. As discussed in the Mine Plan, MPIX, the greatest precautions will be taken to avoid spilling or releasing any amount of contaminants.

RPIX-7.0 Special Reclamation Standards

There will be no permanent facilities or utilities that require special reclamation. All storage facilities will be mobile or constructed with such method that will allow for disassembly and remobilization. It is anticipated that utilities such as power lines will not be necessary at this point; should they become necessary, they will be constructed in such a way to avoid undue degradation and removed according to DEQ/LQD Guideline No. 12. There will be no rail road spurs or shops with in the permit area.

Howe Lane, Mountain Air Road, and the North Piper Haul Roads will be left in their current condition when mining is complete. This will be done pursuant to Mountain Cement's easements and right of ways discussed in the roads discussion in the Mine Plan. Mountain Air Road and Howe Lane are residential roads as well as haul roads; after the completion of mining the will revert to residential roads. The North Piper Haul Road is owned by Rich & Cindy Avery; after the completion of mining the road will be left for their use as a ranch road. Attached is royalty documentation for Howe Lane Haul Road as previous acceptance by the landowners that the road would be left as-is.

Other than the roads described above, all haul roads will be reclaimed after mining and hauling is complete; this includes roads that will be constructed in State of Wyoming Section 36 and all haul roads within the 298c permit area. The road base will be ripped with the ripper teeth on the grader and be hauled off and used as fill or to upgrade roads elsewhere. The reclaimed road surface will be topsoiled and seeded with the appropriate seed mix. In instances where haul roads have been upgraded or built on pre-existing two-track roads, these roads will be reduced and restored to pre-existing two-track condition. Roads will only be left in place after consultation with, and receiving written permission from, the landowner.

Howe Lane, Mountain Air Road, and the North Piper Haul Roads will be left in their current condition when mining is complete. This will be done pursuant to Mountain Cement's easements and right of ways discussed in the roads discussion in the Mine Plan. Mountain Air Road and Howe Lane are residential roads as well as haul roads; after the completion of mining the will revert to residential roads. The North Piper Haul Road is owned by Rich & Cindy Avery; after the completion of mining the road will be left for their use as a ranch road. Attached as Appendix MPIX-D is the Final Judgement and Warranty Deed for Howe Lane Haul Road as previous acceptance by the landowners that the road would be left as-is; and the necessary Consent from the Avery's.

Other than the roads described above, all haul roads will be reclaimed after mining and hauling is complete; this includes roads that will be constructed in State of Wyoming Section 36 and all haul roads within the 298c permit area. The road base will be ripped with the ripper teeth on the grader and be hauled off and used as fill or to upgrade roads elsewhere. The reclaimed road surface will be topsoiled and seeded with the appropriate seed mix. In instance where haul roads have been upgraded or built on pre-existing two-track roads, these roads will be reduced and restored to pre-existing two-track condition. Roads will only be left in place after consultation with, and receiving written permission from, the landowner.

If after the completion of mining Mountain Cement decides to reclaim the portion of Howe Lane Haul Road on its surface it will be done as described above.

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RPIX-8.0 Reclamation Schedule

In most cases each pit will be backfilled when stripping the proceeding pit. For instance, pit 1 will be backfilled and contoured with the overburden and, if occurring, interburden from pit 2. This work will take place in the spring and summer so that the fill will be ready for topsoil in the summer and ready fro seeding in the fall. In this case, the topsoil will be hauled from pit 1's stockpile or directly hauled from pit 2. Every attempt will be made to have seeding done in the fall. The following spring pit 2 would have its reclamation started while opening pit 3. The current Etchepare 6 & 7 pits will be reclaimed and seeded prior opening the proposed pit 1.

RPIX-9.0 Reclamation Costs

RPIX-10.0 References

Bird, N. 2009. Development and identification of the Rhizobiaceae nitrogen-fixing symbiosis with Fabaceae as a nitrogen source in reclamation of disturbed lands in Wyoming. Soil Science and Environmental Natural Resources. MS. Thesis, University of Wyoming, Laramie.

Brooks, A. C. 1962. An ecological study of *Cercocarpus montanus* and adjacent communities in part of the Laramie Basin. M.S. Thesis, University of Wyoming, Laramie.

Brotherson, J. D., J. N. Davis & L. Greenwood. 1980. Diameter-age relationships of two species of mountain mahogany. J. Range Manage. 33:367-370.

Dumroese, R. K., D. L. Wenny & Y. C. Barkley. Visited 2012-09-17. How to Plant Seedling Trees for Idaho's Farms and Forests, 3rd Revision. University of Idaho Publication CIS 528. Moscow, ID. Available at http://seedlings.uidaho.com/Content/Assets/Plant%20Your%20Seedlings%20Right%20 a.pdf.

Pavek, D. S. 1992, visited 2013-01-06. *Chamerion angustifolium*. In: Fire Effects Information System, [Online]. U.S. Department of Agriculture, Forest Service, Rocky Mountain Research Station, Fire Sciences Laboratory (Producer). Available at http://www.fs.fed.us/database/feis/.

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RECD MAR 07,201

__insert **Addendum A Integrated Weed Management Plan** here
from file RPIX A Weed Mgmt Plan.docx

TFN 5 1/110

Approve: _____

TFN 5 1/110
RECD MAR 07, 2013

Amendment 298C-A8
Reclamation Plan
Etchepare Limestone Quarry

Maps

RPIX-1

RPIX-2

RPIX-3

RPIX-4

TFN 5 1/110

Approved: _____

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298C-A8 AMENDMENT

ETCHEPARE AMENDMENT
Current 298C Permit

298C-A8 AMENDMENT

298C-A8 AMENDMENT

Pope Springs

Telephone Canyon

Government Gulch

Government Gully

Gilmore Gulch

#1 #3 #4 #5A #5B #5C #5D #6 #7A #7B #7C #8A #8B #9A #9B #9C #10A #10B #11

LEGEND

Highway Interstate 80

Proposed 298C Permit Boundary

Current 298C Permit Boundary

#5D Proposed Disturbance Areas

The contour interval is 10' and 20' on the west half of the map and 40' on the east half

N

1/4 mile 1/2 mile 1 mile
0 ft 1320 ft 2640 ft 5280 ft

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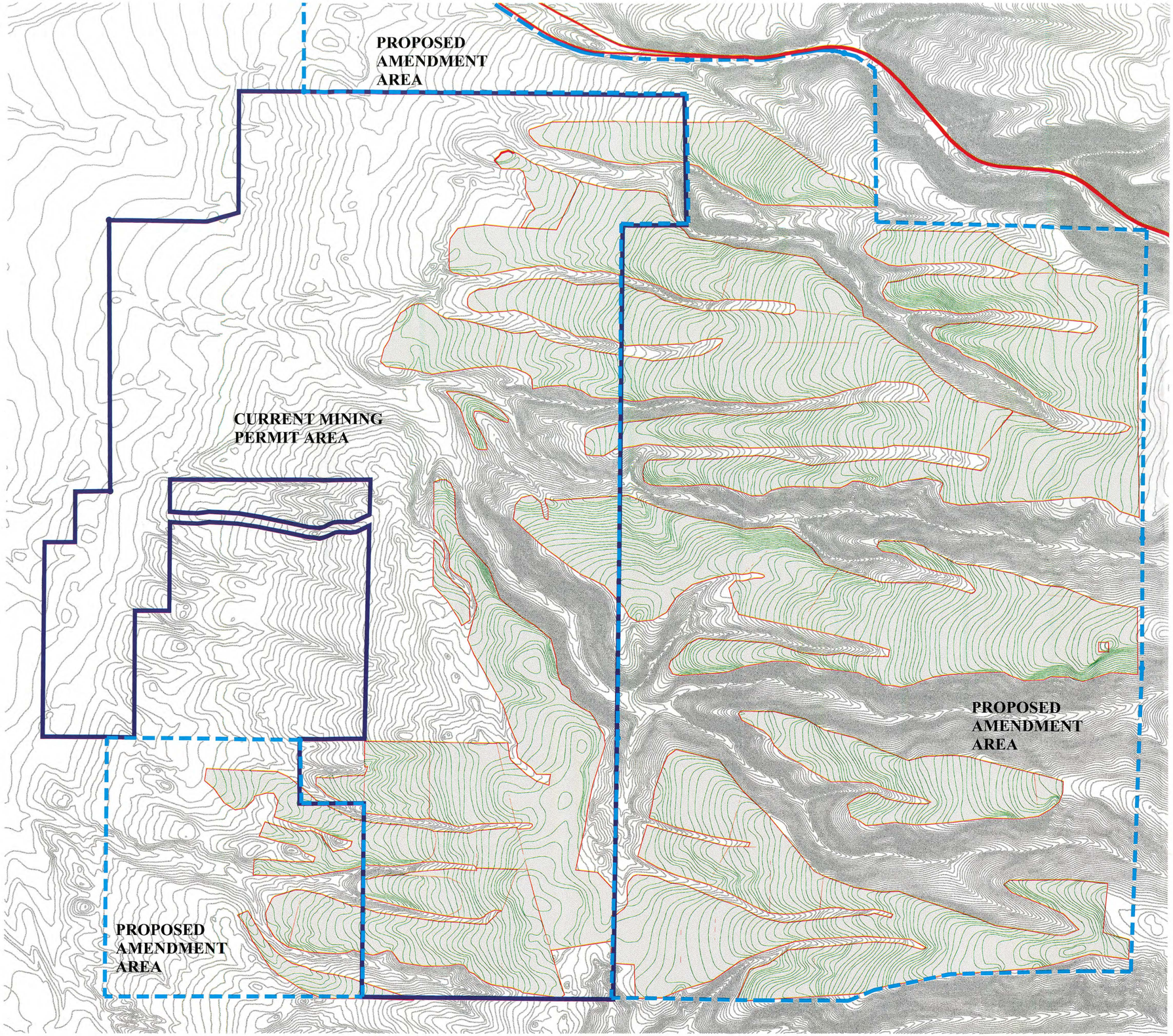
MapRPIX-1
Pre-Mine Topography
Permit # 298C-A8
Etchepare Limestone Quarry

Revised By:	Date:	Design By:	Date:
AHM	8/24/12	AHM	3/12/10
Revised By:	Date:	Drawn By:	Date:
AHM	2/10/13		
Revised By:	Date:	Checked By:	Date:
JWB	4/10/13		

Mountain Cement Company
5 Sand Creek Rd.
Laramie, Wyo. 82070
(307) 745-2687

5/1/10



LEGEND

Current 298C Permit Boundary

Proposed 298C-A8 Permit Amendment

Highway Interstate 80

Post Mine Contour lines (10 foot intervals)

The Countour Interval is 10'

N

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1/4 mile 1/2 mile 1 mile
0 ft 1320 ft 2640 ft 5280 ft

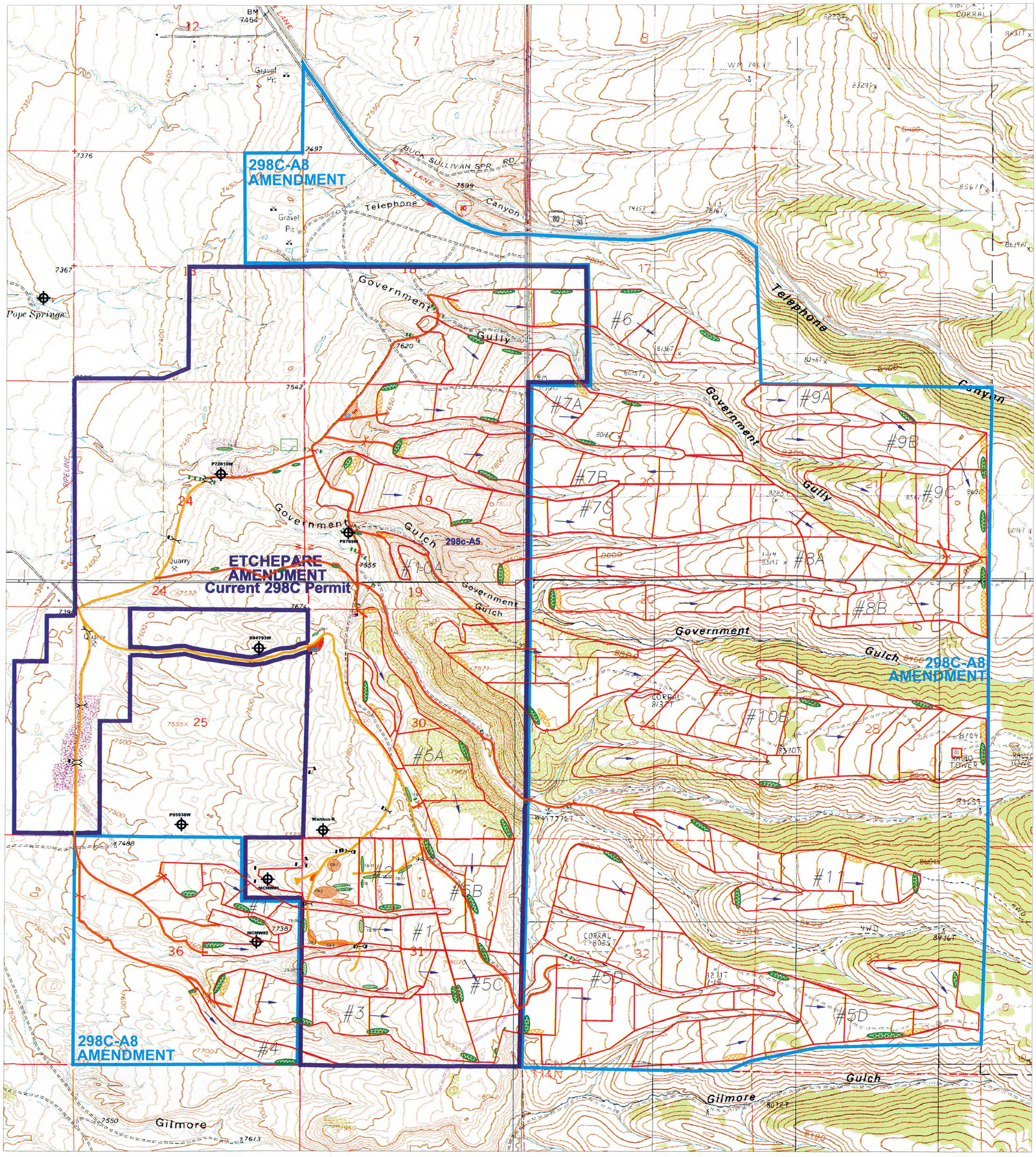
Map RPIX-2

Post-Mine Topography

Permit # 298C-A8

Etchepare Limestone Quarry

Revised By:	Date:		Design By:	Date:
AHM	8/24/12	Mountain Cement Company	AHM	3/12/10
Revised By:	Date:		Drawn By:	Date:
JWB	4/10/13			
Revised By:	Date:	5 Sand Creek Rd. Laramie, Wyo. 82070 (307) 745-2687	Checked By:	Date:



LEGEND

Highway Interstate 80

Proposed 298C-A8 Amendment Areas

Currently Approved 298C Permit Area

3 Reclamation Sequence (1-126)

Currently Disturbed

Reclaimed Lands
(for specific years see the Etchepare 298C Annual Report)

N

1/4 mile 1/2 mile 1 mile
1320 ft 2640 ft 5280 ft

LQD
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5/1/10

Map RPIX-3
Reclamation Sequence Map
Permit # 298C-A8
Etchepare Limestone Quarry

Revised By:	Date:	Design By:	Date:
AHM	8/24/2012	AHM	2/12/10
Revised By:	Date:	Drawn By:	Date:
AHM	2/10/2013		
Revised By:	Date:	Checked By:	Date:
JWB	4/10/2013		

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Map Legend

post mine countour lines

A8 Permit Boundary

Approved A5 Permit Boundary

through drainage

through drainage

7600'

Pit #3

7685'

through drainage

Pit #4

Sect 36 T15NR73W
State

fenceline

rubble zone on
ground below
unreduced highwall
40' x 10'

Sect 31 T15NR72W
MCC

unreduced highwall
100' x 10'

over 1 mile from
residences to
unreduced highwall

7700'

7800'

fenceline

fenceline

Section Line

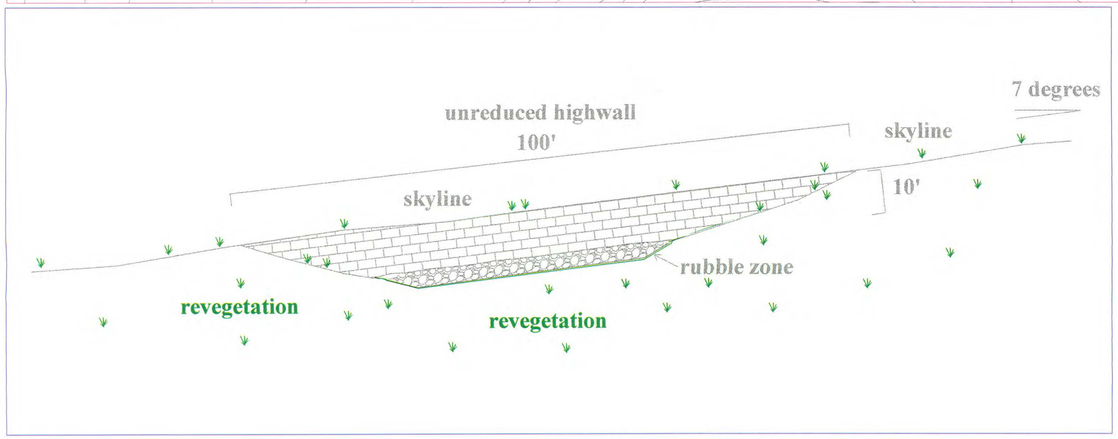
view from any
residences blocked

Sect 6 T14NR72W
private

Sect 1 T14NR73W
private

N

1/32 mile 1/16 mile 1/8 mile
0 ft 165 ft 330 ft 660 ft



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Map RPIX-4
Example of a Hypothetical Unreduced Highwall

Permit # 298C-A8 **Etchepare Limestone Quarry**

Revised By: JB Date: February 2013	Mountain Cement Company 5 Sand Creek Rd. Laramie, Wyo. 82070 (307) 745-2687	Design By: JB & AM Date: 2010-2013
Revised By: Date:		Drawn By: JB & AM Date: 2010-2013
Revised By: Date:		Checked By: Date: