POWER
RESOURCES

Power Resources, Inc.

NORTH BUTTE ISL SATELLITE PROJECT

CAMPBELL COUNTY, WYOMING

VOLUME I

Supportive Information for
Wyoming DEQ Permit to Mine
and
USNRC Source Material License Amendment

March 2006

NORTH BUTTE ISL PROJECT

URANIUM SOLUTION MINE

Campbell County, Wyoming

Volume I

Baseline and Supportive Information for

Wyoming D.E.Q. Permit to Mine Application

and

U.S.N.R.C. Source Material License Application

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The State
of Wyoming

Jim Geringer, Governor

Department of Environmental Quality

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

November 29, 2001

Mr. William F. Kearney
Manager-Health, Safety & Environmental Affairs
Power Resources, Inc.
P.O. Box 1210
Glenrock, WY 82637

RE: Approval of Transfer for Permit No. 632, TFNs 4 3/8 & 4 5/9, Change No. 9
Approval of Change of Owner for WQD Permits 01-436 & 01-439

Dear Mr. Kearney:

With the recommendation of Glenn Mooney, Senior Analyst, District III, your pending permit transfer and license to mine referenced above have been approved effective this date. This action is labeled as Change No. 9 to Permit No. 632. Royal Bank of Canada letter of credit no. 6320/S22017 has been accepted in the amount of Thirty-Two Thousand Five Hundred Dollars ($32,500) to cover the reclamation costs associated with Permit No. 632. Copies of your approved permit transfer application, license to mine, and bond are enclosed.

As stated on the Form 1(t), Page 4, No. 4, acceptance of the approved permit transfer obligates the operator to abide by the standard conditions specified in the original permit. Please be advised the following conditions have been placed on the permit transfer:

No. 1

Three (3) months prior to commencement of operations, the operator shall furnish a detailed bond estimate acceptable to the Division. A reclamation bond based on this estimate shall be submitted to the Land Quality Division and approved by the Division prior to commencement of project construction.

No. 2

Prior to construction of the septic system a Water Quality Division Permit to Construct will be obtained.

No. 3

All evaporation ponds will have an approved monitoring plan prior to commencement of construction.

As of this date no further mining activity may take place by Pathfinder Mines Corporation under Permit No. 632 and License to Mine No. 632-L2 and Uranez, U.S.A., Inc. under License to Mine No. 632-L1.

Also, enclosed are "Change of Owner" permits from the Water Quality Division. These "permits to construct" were originally issued under numbers 77-242 and 92-106, but have now been assigned new numbers as described above.

Please contact the Department of Revenue, Herschler Building, Second Floor West, Cheyenne, WY 82002 (307-777-7961), for severance tax information.

Should you should have any questions, please feel free to contact the District III office in Sheridan (307-672-6488).

Sincerely,

Richard A. Chancellor
Administrator
Land Quality Division

Dennis Hemmer
Director
Dept. of Environmental Quality

DH:RAC:DH:dkv

Enclosure

xc: District III w/encl.
Donna Wichers, Pathfinder Mines Corporation

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

STATE OF WYOMING

DEPARTMENT OF ENVIRONMENTAL QUALITY
LAND QUALITY DIVISION
APPLICATION FOR
PERMIT TRANSFER

1. (a) Name, telephone number, and mailing address of transferor (current permittee): Pathfinder Mines Corporation (307) 234-5019
P.O. Box 730, Mills, Wyoming 82644

(b) Location of mining operation (county): Campbell

(c) Permit number to be transferred: 632 (North Butte ISL Project)

(d) The total number of acres in the permit area and the total number of acres approved to affect by the operation through date of transfer.

Permit Acres		Approved Acreage to Affect	
Original Permit	989	Original Permit	343
Approved Amendments	50.29	Approved Amendments	-
Total Acres	1039.29	Total Acres	343

Attach a legal description of above acreages as Appendix "C" and original USGS Quad Map(s) with permit and amendment areas clearly shown and identified.

2. (a) Name, telephone number, and mailing address of transferee (proposed permittee): Power Resources, Inc.
P.O. Box 1210, Glenrock, WY. 82637

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

Name: Fletcher T. Newton Address: 274 Union Blvd. Suite 310
Title: President Phone No: Lakewood, Colorado 80228 (720) 879-8140
Name: Steven P. Collings Address: same as above
Title: Senior V.P. of Operations Phone No:
Name: William F. Kearney Address: P.O. Box 1210, Glenrock, WY. 82637
Title: Manager of Health, Safety & Env. Affairs Phone No: (307) 358-6541
Name: Address:
Title: Phone No:

3. Name, telephone number, and address of the agent or person of the Transferee to whom any notices under the provisions of the Wyoming Environmental Quality Act, Land Quality Division or Rules and Regulations adopted thereunder may be sent: William F. Kearney, Manager of Health, Safety & Env. Affairs, Power Resources, Inc. P.O. Box 1210, Glenrock, WY 82637

4. The provisions of the transferred 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.

Initial FTN Date 10/20/01

Permit No. 632
TFN No. 4 3/8

5. **For surface coa g operations**right of entry to or inspection of ı ation, premises, records, or equipment shall not require advance notice.

SWORN STATEMENT OF TRANSFEROR

State of Wyoming)
)ss
County of Natrona)

I Guy Lauret being duly sworn on my oath that I am the Transferor (or President or Vice President if the Transferor is a corporation) for the foregoing permit transfer; that I have read the said application and fully know the contents thereof; that all statements contained in the permit transfer application are true and correct to my best knowledge and belief; by execution of this statement I certify that Transferor is in full compliance with the Wyoming Environmental Quality Act, the Rules and Regulations promulgated thereunder, and the terms and conditions of Mining Permit No. 632. Approval of this transfer by the Department of Environmental Quality does not constitute a conclusion that the Transferor is in full compliance.

Dated this 02 day of October, 2001

Signature: _____

Name: Guy Lauret
(Printed or typed)

(Corporate Seal)

Title: President

The foregoing instrument was acknowledged before me by Guy Lauret this 02 day of October, 2001.

Witness my hand and official seal.

_____
(Notary Public or Secretary if a Corporation)

THOMAS W. PENNINGTON SECRETARY

_____
(Name printed or typed)

(Notary Seal)

My Commission Expires: _____

Initial PTN Date 10/30/01

Permit No. 632
TFN No. 4 2/9

FINAL SWORN STATEMENT OF TRANSFEREE

State of WYOMING)
)ss
County of CONVERSE)

I Fletcher T. Newton being duly sworn on my oath that I am the Transferee (or President or Vice President if the Transferee is a corporation) for the foregoing mining permit transfer; that I have read the said application and fully know the contents thereof; that I further agree to be bound by all of the terms and conditions of the original permit and any amendments, revisions, or renewals thereof and accept all unfulfilled reclamation liabilities of statutes, rules and of the permit; that all statements contained in the permit transfer application are true and correct to my best knowledge and belief, by execution of this statement I certify that Power Resources, Inc. Transferee, or entities controlled by or under common control with the transferee has the right and power by legal estate owned to mine from the land for which this permit transfer is desired; that transferee or entities controlled by or under common control with the transferee has not forfeited, or is not involved in forfeiture proceedings for, a bond posted for reclamation purposes; and if a **surface coalmining application**that transferee or entities controlled by or under common control with the transferee 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 the 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 applicant; and by completion and submission of this application, hereby give consent to 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.

Dated this 30 day of October, 2001.

Signature: Fletcher T. Newton

Name: FLETCHER T. NEWTON
(Printed or typed)

(Corporate Seal)

Title: PRESIDENT

The foregoing instrument was acknowledged before me by Fletcher T. Newton this 30 day of October, 2001.

Witness my hand and official seal.

Dawn E. Ensor
(Notary Public or Secretary if a Corporation)

NOTARY PUBLIC
DAWN E. ENSOR
COUNTY OF NATRONA
STATE OF WYOMING
My Commission Expires April 20, 2002

Notary Seal

Dawn E. Ensor
(Name printed or typed)

My Commission Expires: 4-20-02

Form 1(t)
Rev. 6/00
Page 3 of 4

Initial FTN Date 10/30/01

Permit No. 632
TFN No. 4 3/8

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

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

1. This permit transfer grants only the right to affect the lands described in Appendix "C" of the permit.

2. The transferee has acquired a good and sufficient reclamation bond fully executed and signed. The bond shall be effective on the date of transfer.

3. The transferee, or such other person as required by W.S. §35-11-410, has acquired a license to mine for lands described in Appendix "C" of the permit.

4. Acceptance of the approved permit transfer obligates the operator to abide by the standard conditions specified in the original permit. Any condition and/or special condition attached to this permit transfer shall supersede and/or replace any conflicts with the original permit, amendments, coal renewals or any revision.

1. Three (3) months prior to commencemnt of operations, the operator shall furnish a detailed bond estimate acceptable to the Division. A reclamation bond based on this estimate shall be submitted to the Land Quality division and approved by the Division prior to commencement of project construction.
2. Prior to construction of the septic system a Water Quality Division Permit to Construct will be obtained.
3. All evaporation ponds will have an approved monitoring plan prior to commencement of construction.

APPROVED: (for)
Administrator
Land Quality Division
Department of Environmental Quality

APPROVED:
Director
Department of Environmental Quality

Effective Date: November 29, 2001

Form 1(t)
Rev. 6/00
Page 4 of 4

Initial FTN Date 10/30/01

Permit No. 632
TFN No. 4 3/8

PATHFINDER
A Cogema Resources Company

July 13, 1999

Mr. Glenn Mooney
District III Senior
Geologist Land
Quality Division
Wyoming Department of Environmental
Quality 1043 Coffeen Ave., Suite D
Sheridan, Wyoming 82801

RE: Mine Permit No. 632, DEQ letter dated May 25,1999 -Wildlife
Monitoring NSR, TFN 3 21263.

Dear Mr. Mooney:

The enclosed materials and following discussion are submitted by Pathfinder in response to your letter of May 25, 1999. We have also elected to propose an additional modification of the North Butte wildlife monitoring program in the form of deleting the requirement to conduct big game surveys. This move was prompted by our review of the May 21, 1999 correspondence from Bill Wichers, Wyoming Game and Fish Department Deputy Director, to Rick Chancellor, Land Quality Division, in which it was recommended that big game monitoring be discontinued on all existing mine sites. In light of the extensive previous big game monitoring conducted at North Butte, and the lack of big game migration corridors or critical habitat on or adjacent to the permit area, it would seem logical to eliminate big game surveys from the North Butte wildlife monitoring program. In light of the timing of this revision request, it appears to be an opportune time to also address the lack of need for big game surveys as discussed in Mr. Wicher's letter. Accordingly, we have deleted any reference to big game surveys in the enclosed revised permit text pages.

Specific responses to the First Review comments enclosed under cover of the May 25 letter are as follows:

Item 3. LQD comment: Please add some information relating to the timing of notifications ... .

PMC response: Revised text pages 16-13 and 16-13a commit to notifying DEQILQD within thirty days of a decision to commence construction and to resolve with LQD the schedule for the commencement of wildlife monitoring prior to the start of construction. Pathfinder feels that there is a potential for a scenario in which actual construction could begin prior to any new wildlife surveys. For instance, if a decision was made in late spring to proceed, construction might begin that summer. The first wildlife surveys that could be accomplished would occur the following spring. We feel it is important to have
the flexibility to proceed without having to conduct another wildlife survey immediately prior to construction. Such a requirement might cause needless delays of up to ten months in construction.

Item 4. LQD comment: Concern over the elimination of the discussion of wildlife surveys from Section 13.4.4.

PMC response: The enclosed revision of page 13-39 includes a discussion of the wildlife surveys.

Item 5a. LQD comment: Eliminate reference to "operational" in the description of the wildlife monitoring program in Section 16.5.2.

PMC response: The word "operational" has been deleted from the text. Section 16.5.2 now refers to "annual" wildlife monitoring, consistent with Section 13.4.4.

Item 5b. LQD comment: Commitment to notify LQD and Wyoming Game and Fish Department concerning the intent to begin construction.

PMC response: See the revised text Section 16.5.2.

We trust that the enclosed modifications address your concerns. Please call me if you have any questions.

Sincerely,

T. W. Hardgrove
Manager, Environmental and Regulatory Services

Enclosures

cc: D. L. Wichers
W. W. Heili/C. W. Toal
USNRC, Washington, DC

PATHFINDER
A Cogema Resources Company

April 22, 1999

Mr. Bob Giurgevich
District III Supervisor
Land Quality Division
Wyoming Department of Environmental
Quality 1043 Coffeen Ave., Suite D
Sheridan, Wyoming 82801

RE: Mine Permit No. 632, DEQ letter dated April 8, 1999 - Failure to conduct wildlife monitoring.

Dear Mr. Giurgevich:

Pathfinder Mines Corporation-has reviewed its DEQ/LQD correspondence files for the North Butte Project, -Mine Permit No. 632, and has concluded that there was justification for the suspension of the wildlife monitoring program for the project without specific formal approval of such a - suspension 'by the Land Quality Division. The following background discussion is provide in support of our conclusion:

1. Permit to Mine No. 632, January 30, 1991, issued to Uranerz U.S.A., Inc., with State Decision Document attached. Page 10 of the State Decision Document makes the sole reference to wildlife monitoring as follows: "Proposed operational wildlife monitoring for the North Butte ISL project area is presented in Section 16.5.2, in Volume 1...." Section 16.5.2 of the permit document describes the operational wildlife monitoring program which would become effective in the year that actual operations begin. It is our interpretation that the wildlife monitoring program described in Section 13.4.4 of the permit is a description of the operational wildlife monitoring program, provided as part of the D-9 wildlife appendix.

2. Subsequent to Permit No. 632 transfer from Uranerz to Pathfinder on March 5, 1991, Pathfinder submitted the first annual report to the LQD under the permit, covering the period February 1, 1991 to January 30, 1992. That report was submitted to the LQD on January 30, 1992. Page 1 of the report states that no monitoring activities occurred at the North Butte site in 1991. Glenn Mooney's review of that report was transmitted to Pathfinder under cover of a letter dated February 10, 1992. He notes on page 1 of the review memorandum that "... no monitoring was done on the property in 1991." Subsequent discussion of monitoring in the memorandum makes no mention of wildlife monitoring, and there was no citation of any deficiency relative to the lack of wildlife monitoring during 1991. Pathfinder interprets the memorandum to mean that in 1992 DEQ/LQD accepted the concept that the only wildlife monitoring required by thepermit was specific to the commencement of operations.

3. The 1992 Annual Report, dated January 25, 1993, describes the conduction of a wildlife survey (the first one done on the property by Pathfinder) in preparation for the startup of construction. As noted under item 6 on page 8, "The only monitoring activity which occurred at the North Butte project site during 1992 was the annual operational wildlife survey, described in Section 16.5.2 of Permit to Mine No. 632....In anticipation of a July, 1992 startup of construction, the annual wildlife survey commenced in February of 1992

due to, the requirement for winter big game surveys and early spring grouse lek counts."' It is clear from the description in that annual report that, the wildlife monitoring undertaken in 1992 was specific to an anticipated start of operations. That process of doing an annual operational wildlife survey each year continued through 1997 because each year the start of construction was anticipated. Early in 1998 it became apparent that there would be no construction activities that year and, consistent with our past approach to operational wildlife monitoring, there was no need to accomplish the monitoring in anticipation of startup. A similar situation exists in 1999, and no wildlife monitoring is planned this year.

Pathfinder feels that the above information documents the intent of the wildlife monitoring program to provide information on possible impacts of operational activities on wildlife. The description in Section 13.4.4 of the mine permit document is the operational wildlife monitoring program which is the focus of the discussion of monitoring in LQD Guideline No. 5 (i.e., monitoring of the effect of mining on wildlife species in question). Pathfinder also feels that a more than ample amount of baseline wildlife data on North Butte has been accumulated over a six year period (1992-1997). We therefore request a non-substantial permit revision to eliminate the reference to wildlife monitoring in Section 13.4.4 of the mine permit document, and to clarify that future wildlife monitoring will be associated with the actual commencement of construction and subsequent operations. Supporting materials for this revision are enclosed.

Sincerely,

T. W. Hardgrove
Manager, Environmental and Regulatory Services

Enclosures

cc: D. L. Withers
W. W. Heili/C. W. Toal
USNRC, Washington, DC

INDEX SHEET FOR MINE PERMIT AMENDMENTS OR REVISIONS

MINE COMPANY NAME: Power Resources Inc.
MINE NAME: North Butte ISL Project **PERMIT NO.:** 632
Statement:

I, T. W.Hardgrove, an authorized representative of Pathfinder Mines Corporation, declare that only the items listed on this and all consecutively numbered Index Sheets are intended as revisions to the current permit document. In the event that other changes Inadvertently occurred due to this revision, those unintentional alterations will not be considered approved. Please initial and date.

VOLUME NUMBER	PAGE, MAP OR OTHER PERMIT ENTRY TO BE REMOVED	PAGE, MAP OR OTHER PERMIT TO BE ADDED	DESCRIPTION OF CHANGE
I	page xi	page xi	Includes reference to a section 13.4.4 (but deletes big game surveys).
	page xii	page xii	Re-incorporates a portion of the Table of Contents mistakenly omitted in a March '92 revision.
	page xiii	page xiii	Replaces essentially the same page but with the correct reference to section 15.11.1 per the March '92 revision.
	page xv page 13-39	page xv page 13-39	Deletes reference to the annual big game survey. Includes revised description of annual wildlife surveys, deleting reference to annual big game surveys.
	page 16-13	page 16-13	Discusses conditions for start-up of annual wildlife monitoring. Deletes reference to the annual big game survey.
	none page 16-14	page 16-13a page 16-14	Continues above discussion. Deletes top-two text lines concerning the annual big game survey.
II	NO CHANGE		
III	NO CHANGE		

NOTES:
1. Include all revision or change elements and a brief description of or reason for each revision element.
2. List all revision or change elements in sequence by volume number; number index sheets sequentially as needed.
3. If there are no revisions to one or more volumes, include an entry for that volume staling NO CHANGE

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VOLUME NUMBER	PAGE, MAP OR OTHER PERMIT ENTRY TO BE REMOVED	PAGE, MAP OR OTHER PERMIT TO BE ADDED	DESCRIPTION OF CHANGE
I	page xi	page xi	Deletes reference to a section 13.4.4
	page 13-36	page 13-36	Modifies text under "13.4.3 MITIGATION AND MONITORING" to clarify that the wildlife monitoring plan is described in section 16.5.2
	page 13-39	page 13-.39	Deletes section 13.4.4
	page 16-13	page 16-13	Clarifies when operational wildlife monitoring will begin

NOTES:
1. Include fill revision or change elements and a brief description of or reason for each revision element.
2. List all revision or change elements in sequence by volume number; number index sheets sequentially as needed.
3. If there Arc no revisions to one or more volumes, include an entry for that volume stating NO CHANGE.

T CHAIR LAND COMPANY

February 22, 1989

Mr. George Hartman
Uranerz U.S.A., Inc.
190 Pronghorn
Casper, WY 82601

Re: North Butte Project

Dear Mr. Hartman:

Over the past several months we have had discussions with you and Mr. Catchpole regarding the proposed in situ mining operations to take place on certain T Chair Land Company lands (referred to by Uranerz as the North Butte ISL Project). It is the desire of the T Chair Land Company to have Uranerz incorporate the following into the mining and reclamation plans for the North Butte ISL Project.

1. After all mining, reclamation, and decommissioning activities have been completed at the North Butte mine, the T Chair Land Company desires to have the ownership of the processing plant building transferred from Uranerz to the T Chair Land Company. It is our understanding that if the buildings, for any reason, cannot be decontaminated, the ownership will not be transferred to the. T Chair Land Company. Instead, the building will be disposed of in accordance with regulatory requirements.

2. The approximate 1.6 miles of access road from the oilfield road to the processing plant improves access to our ranch lands. For this reason, the T Chair Land Company may or may not desire to have the mine access road left as is once all mining and reclamation activities have been completed. The T Chair Land Company wants to reserve the option of not having the 1.6 mile mine access road reclaimed following the completion of all mining and aquifer restoration activities.

3. The method of construction of the mine access road and the wellfield access roads, and the reclamation plans for these roads are completely acceptable to the T Chair Land Company.

4. The seed mixture described in the Reclamation Plan section of the North Butte ISL Project permit application is acceptable to the T Chair Land Company. It is the strong desire of the T Chair Land Company to not include sage brush or shrubs in the reclamation seed mixture.

If Uranerz finds it necessary, the T Chair Land Company will be willing to discuss with the DEQ staff its desires- in regard to land reclamation at the North Butte ISL Project.

Sincerely,

T CHAIR LAND COMPANY

SURFACE OWNER'S CONSENT

I, Patricia Clark, General Partner of the T Chair Land Company, A Wyoming Limited Partnership, do hereby certify that the T Chair Land Company owns the surface estate to the following described lands:

Township 44 North, Range 76 West, 6th PM, Campbell County, Wyoming

Section 18: Lot 4, SE/4SW/4
Section 19: Lots 1, 2, EI2NW/4, E/2

Township 44 North, Range 76 West, 6th PM, Campbell County, Wyoming

Section 13: S/2NE14, NI2SEI4, NFJ4SW/4, SE/4SE/4, SE/4SW/4
Section 23: SE/4SE14
Section 24: N/2NWI4, SE/4NW14, NE/4NE/4, S/2SW/4, SW/4SE/4
Section 25: W/2NE/4, NW/4, N/2SW/4

I have examined the mine plan and reclamation plan prepared by Pathfinder Mines Corporation in compliance with the Wyoming Environmental Quality Act of 1973, as amended. The T Chair Land Company does hereby approve said mine and reclamation plans and consents to the Pathfinder Mines Corporation execution of said mine and reclamation programs upon said lands as proposed therein.

Executed this 29th day of July 1992.

WITNESS T CHAIR LAND COMPANY

(THIS PAGE INTENTIONALLY LEFT BLANK.)

T- CHAIR RANCH
Box A-140
GILLETTE, WYOMING 82716 PHONE: 464-1227

January 8, 1990

Land Quality Division
Department of Environmental Quality
Cheyenne, WY

To Whom It May Concern:

This letter is in reference to the mine access road being proposed by Uranerz U.S.A, for the North Butte ISL project.

As a few of you may remember, last spring a small group of people from the DEQ and Uranerz came out to the ranch and I explained to you the method I used in the building and reseeding of the road north of our ranch. After explaining my methods we had a little chat. It seems now that the DEQ does not understand the method or does not wish to recognize the landowners' desires. The method we used on the road north of the ranch house is the method we want Uranerz to use at the North Butte site. We do not favor this method because Uranerz wants it, we favor it because we want it.

I have successfully used this method of road construction, which involves removing the top layer of good topsoil (which I believe you call the A horizon) and temporarily windrowing it to each side. Then the borrow ditch is cut with the subsoil
from the ditch going onto the road bed to elevate it. This helps to keep snow from drifting on the road. The topsoil is then placed in the drainage ditch on each side of the road and reseeded.

I believe in this method as far as keeping the good topsoil in its place - on top! Reseeding takes place quicker in the good topsoil which reduces wind and water erosion. I have a problem with mixing the 2nd layer of topsoil (B horizon) in with the good topsoil as it slows down the reseeding and the more material you move the more you are

T- CHAIR RANCH
Box A-140
GILLETTE, WYOMING 82716 PHONE: 464-1227

going to lose. Also, we want the amount of soil placed in storage piles and windrows to be kept to an absolute minimum. These piles result in a loss of soil from erosion plus natural grass is covered up and not available for grazing.

As a reminder, final reclamation involves the windrowing of the a horizon soil in the ditch to the outside of the backslope, removing the gravel from the road bed, ripping the road bed and placing the subsoil (Bhorizon) back in the ditch, ripping the road surface and ditch area again, replacing the good topsoil on top of the subsoil and reseeding. We
believe that this procedure will adequately reclaim the road.

If the method being proposed for access road construction is not acceptable we want to know why. If we were going to build a temporary ranch road up to the site of the planned processing plant we would use the method that is being proposed. As the landowners whose livelihood depends on good range land, we are sure that the method we use to construct roads prevents topsoil loss and will make for good reclamation when the time comes.

Gene Mankin

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February 22, 1989

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190 Pronghorn
Casper, WY 82601

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Executed this 29th day of July 1992.

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T- CHAIR RANCH
Box A-140
GILLETTE, WYOMING 82716 PHONE: 464-1227

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Gene Mankin

URANERZ U.S.A., INC.

190 Pronghorn • Casper, Wyoming • 82601

Telephone: (307) 234-9169

Telecopy: (307) 235-1244

March 7, 1989

Mr. Roger Shaffer
Land Quality Division Administrator
Department of Environmental Quality
Herschler Building - Third Floor
122 West 25th Street
Cheyenne, WY 82002

Re: North Butte ISL Project
Permit to Mine Application
License to Mine Application

Dear Mr. Shaffer:

Uranerz U.S.A., Inc. herewith submits (in triplicate) a Permit to Mine application (Form 1-UIC) and a License to Mine application (Form 3) for the commercial scale North Butte ISL Project to be located in Campbell County, Wyoming. The North Butte ISL Project will be an in situ uranium mine producing about 600,000 to 1,000,000 pounds of yellowcake each year. Also enclosed is a check in the amount of $2,025.00 to cover the application fees.

Uranerz' Permit to Mine application includes a three volume Supportive Information Document which is being submitted in triplicate (no BLM surface or Mineral). The NRC has received the same Supportive Information Document. Any changes in the Supportive Information Document required by the NRC or DEQ will be put on revised pages and mailed to both agencies for insertion into the document. It should be noted that in the lower left corner of each page of the Supportive Information Document (except Figures) is a blank box for the Land Quality Division to use as a space for the check-in stamp. As discussed during pre-licensing, Uranerz is herewith including with this application submittal a separate Archeological Report on the North Pumpkin Buttes Area (two copies).

The Uranerz staff is looking forward to working with the DEQ staff during the license application review process to resolve any conflicts as early as possible. Please contact me at the Uranerz Casper office if there are any questions regarding the North Butte ISL Project license application submittal.

Sincerely,

URANERZ U.S.A., INC.

Glenn J. Catchpole
Manager of Regulatory Affairs

GJC:jm
Encl.

URANERZ U.S.A., INC.

190 Pronghorn • Casper, Wyoming • 82601

Telephone: (307) 234-9169

Telecopy: (307) 235-1244

March 7, 1989

Mr. Edward F. Hawkins, Section Chief
U.S. Nuclear Regulatory Commission
Operating Facility Section I
USNRC Uranium Recovery Field Office
Lakewood Office
Lakewood Office Plaza
730 Simms Street, Suite 100A
Golden, CO 80401

Re: North Butte ISL Project
Source Material License
Application

Dear Mr. Hawkins:

Uranerz U.S.A., Inc. herewith submits (in quadruplicate) a Source Material License Application for the commercial scale North Butte ISL project to be located in Campbell County, Wyoming. The North Butte ISL project will be an in situ uranium mine producing about 600,000 to 1,000,000 pounds of yellowcake each year. Also enclosed is a check in the amount of $150.00 to cover the application fee.

Uranerz' Source Material License Application includes Form NRC-2, plus a three volume supportive information document. The Wyoming DEQ will also receive the same supportive information document with Uranerz' Permit to Mine and License to Mine applications to be submitted to the State in a matter of days. Any changes in the Supportive Information Document required by the NRC or DEQ will be put on revised pages and mailed to both agencies for insertion into the document. As discussed during pre-licensing, Uranerz is herewith including with this application submittal a separate Archeological Report on the North Pumpkin Butte area (two copies).

The Uranerz staff is looking forward to working with the NRC staff during the license application review process to resolve any conflicts as early as possible. Please contact me at the Uranerz Casper office if there are any questions regarding the North Butte project license application submittal.

Sincerely,

URANERZ U.S.A., INC.

Glenn J. Catchpole
Manager of Regulatory Affairs

GJC:jm
Encl.

NOTE: Do not fold this form. Use typewriter or print neatly with black ink. Submit three (3) copies one of which must be an original Form 1-UIC as supplied by the Department of Environmental Quality, Land Quality Division.

STATE OF WYOMING

DEPARTMENT OF ENVIRONMENTAL QUALITY
LAND QUALITY DIVISION

APPLICATION FOR IN-SITU PERMIT TO MINE OR AMENDMENT TO AN IN-SITU PERMIT TO MINE

1. (a) Name, telephone number, and mailing address of applicant: Uranerz U.S.A., Inc.
307-234-9169 190 Pronghorn
Casper, WY 82601

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

Name: Karl-Ernst Kegel Address: Postfach 170210, 5300 Bonn 1
Federal Republic of Germany
Title: President Phone No. 011-49-228-557-211

Name: Dr. Hikmet Akin Address: 165 S. Union Blvd., Suite 280
Denver, CO 80228
Title: Vice President Mining Projects Phone No. 303-985-1511

Name: George J. Hartman Address: 190 Pronghorn
Casper, WY 82601
Title: General Manager In Situ Leach Project Phone No. 307-234-9169

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

2. Name and mailing address 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: Glenn J. Catchpole
Uranerz U.S.A., Inc.
190 Pronghorn, Casper, WY 82601

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 not 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.

Permit No. _____

TFN No. _____

(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 States 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.

(d) APPENDIX "D"

For in situ operations, this appendix shall include a description of the land which shall include: Soils, vegetation, wildlife, and surface hydrologic information consistent with the extent and nature of the proposed surface disturbance including descriptions of the soil, indigenous wildlife, natural gamma radiation background for lands to be impacted by radioactive materials, the vegetative cover, meteorological information and a description of any surface water and adjudicated water rights within the proposed permit area or on adjacent lands; a description of the general geology including geochemistry and lithology of the permit area; a characterization of the production zone and aquifers that may be affected including applicable hydrologic and water chemistry data to describe the projected effects of the mining activities.

(e) APPENDIX "E"

A map or maps with the boundary of the proposed permit (amendment) area 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: Uranium

5. Estimated dates of commencement and termination of the proposed operation:

Start: June 15, 1991 Terminate: June 15, 2017

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		Estimate of Affected Areas	
Original Permit		Original Permit	
Approved Amendments		Approved Amendments	
This Application	989	This Application	343
Total Acres	989	Total Acres	343

7. The name, if any, by which the permit (amendment) lands or any part thereof are known: North Butte ISL Project

8. The nearest town, village, or city: Savageton, Wyoming

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. For coal mining operations:

(a) Each application shall contain the additional information as required in Chapter III Section 3 of the Land Quality Division 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 Rules and Regulations Chapter XIII, Section 2.b. and c.;

(c) Right of entry to or inspection of any operation, premises, records or equipment shall not require advance notice;

(d) A sworn statement that the applicant has paid the reclamation fee for this and all coal mining operations under the jurisdiction of P.L. 95-87 as required by Title IV of that law;

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

Permit No. _____

TFN No. _____

11. 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. 35-11-428 and Chapter XXI of the Land Quality Division Rules and Regulations.

12. 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.

FINAL SWORN STATEMENT

State of Colorado)
) ss
County of Jefferson)

I Hikmet Akin 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 Uranerz U.S.A., Inc. has the right and power by legal estate owner to mine from the land for which this permit (amendment) is desired; that Uranerz U.S.A., Inc. has not forfeited, or is not involved in forfeiture proceedings for, a bond posted for reclamation purposes; and by completion and submission of this application, hereby give consent to 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.

Dated this _____ day of _____, 19____.

Signature _____
Hikmet Akin

Title Vice President Mining Projects

(seal)

_____
Notary Public or Secretary if a Corporation

Form 1-UIC
Rev. 1-84
Page 3 of 4

Permit No._____

TFN No. _____

THE STATE OF WYOMING

DEPARTMENT OF ENVIRONMENTAL QUALITY SS.

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 (amendment) grants only the right to affect the land described in Appendix "C" of the application.

For purposes of Wyoming's UIC Program:

a. All reports required by this permit and other requested information shall be signed by the person who signed the Final Sworn Statement or his duly authorized representative. A person is a duly authorized representative only if:

   (1) The authorization is made in writing by the person who signed the Final Sworn Statement;

   (2) The authorization specifies either an individual or position having responsibility for the overall operation of the regulated facility or activity; and

   (3) The written authorization is submitted to the Administrator. If an authorization is no longer accurate because a different individual has responsibility for the overall operation of the facility, a new authorization must be submitted to the Administrator prior to, or together with any reports or information to be signed by an authorized representative.

b. In addition to the requirements of W.S. 35-11-430(b), the permittee shall retain copies of all reports required by this permit, and records of all data used to complete the application for this permit, for a period of at least three (3) years from the date of the report or application.

c. The permittee is required to conduct operations in accordance with terms and conditions of the approved permit. The permittee is required at all times to properly operate and maintain all facilities and systems of treatment and control (and related appurtenances) which are installed or used to achieve permit compliance. Proper operation and maintenance includes effective performance, adequate funding, adequate operator staffing and training and adequate laboratory and process controls, including appropriate quality assurance procedures.

d. The permittee shall monitor the operation in accordance with the plan approved in the permit. Results of the monitoring program shall be reported quarterly to the administrators. Results of mechanical integrity and other periodic tests required by the Administrator shall be reported with the first quarterly report following the completion of the test.

_____

_____

_____

Approved: _____
Administrator
Land Quality Division
Department of Environmental Quality

Approved: _____
Director
Department of Environmental Quality

Effective Date: _____

Permit No. _____

TFN No. _____

APPROVED: _____
Administrator
Water Quality Division
Department of Environmental Quality

Form 1-UIC
Rev. 1-84
Page 4 of 4

NOTE: Do not fold this form. Use typewriter or print neatly with black ink. Submit three (3) copies one of which must be an original Form 3 as supplied by the Department of Environmental Quality, Land Quality Division.

STATE OF WYOMING
DEPARTMENT OF ENVIRONMENTAL QUALITY
LAND QUALITY DIVISION
APPLICATION FOR
LICENSE TO MINE

This application in duplicate for a license to mine is submitted in accordance with the provisions of the Wyoming statute 35-11-410.

1. Name, telephone number, and mailing address of applicant: Uranerz U.S.A., Inc.
307-234-9169 190 Pronghorn
Casper, WY 82601

2. Location of mining operation (County): Campbell

3. (a) A copy of the mining permit, submitted herewith, for the lands which are to be affected by the proposed mining operation:

Permit No. _____ Issued _____ day of _____ ,19____.

(b) If the applicant is other than the permit holder, a copy of the instrument of permission submitted herewith, from the permit holder granting to the applicant the right thereto;

4. If the applicant is other than the permit holder:

(a) A statement that the applicant has never had a permit issued by the Administrator revoked;

(b) Or license to mine issued by the board revoked;

(c) Or bond posted to comply with the act forfeited for intentional and substantial violation of the provisions of this act.

5. Maps showing the location and the numbers of acres to be affected by the proposed mining operation for the first year of operation if less than the full extent of the permit area.

(Map of affected area may be submitted with legal description if desired). The scale of maps shall be reasonable so as to show necessary detail, width of map not to exceed 48".

Suggested scales:	Up to 10 acres	- 1" = 100'
	Up to 40 acres	- 1" = 200'
	40 acres or more	1" = 400'

6. Date (month and year) when operation will commence: June 1991
Estimated date (year) of termination of the proposed mining operation: 2017

7. A fee of $25.00

8. Name, telephone number, and address of the person or persons to whom any notice under the provisions of the Wyoming Environmental Quality Act, Land Quality Division or Rules and Regulations adopted thereunder may be sent: Glenn J. Catchpole
307-234-9169 Uranerz U.S.A., Inc.
190 Pronghorn, Casper, WY 82601

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

FINAL SWORN STATEMENT

State of Colorado)
)ss.
County of Jefferson)

I Hikmet Akin being duly sworn on my oath that I am
Name (typed or printed)
the applicant (or the President or Vice President if the applicant is a corporation) for the foregoing "License to Mine"; that I have read the said application and fully know the contents, thereof; and tnat all statements contained in the License to Mine application are true and correct to my best knowledge and belief.

Dated this _____ day of _____, 19 89 .

Signature _____

Title Vice President Mining Projects

(seal)

_____
Notary Public or Secretary if a Corporation

This application when returned to you with the validating signature of the Administrator of the Land Quality Division, Department of Environmental Quality, becomes your License No. _____. Effective date:_____.

Dept. of Environmental Quality
State of Wyoming

Dept. of Environmental Quality
Land Quality Division
State of Wyoming

Approved by:

By:_____
Director

_____
Administrator

Form 3
March, 1987
Page 2 of 2

FORM NRC-2
(7-77)
10 CFR 40

Approved by GAC
R0203

U.S. NUCLEAR REGULATORY COMMISSION

APPLICATION FOR SOURCE MATERIAL LICENSE

Pursuant to the regulations in Title 10, Code of Federal Regulations, Chapter 1, Part 40, application is hereby made for a license to receive, possess, use, transfer, deliver or import into the United States, source material for the activity or activities described.

1. (Check one)
- [x] (a) New license
- [ ] (b) Amendment to License No. _____
- [ ] (c) Renewal of License No. _____
- [ ] (d) Previous License No. _____

2. NAME OF APPLICANT
Uranerz U.S.A., Inc.

3. PRINCIPAL BUSINESS ADDRESS
190 Pronghorn
Casper, WY 82601

4. STATE THE ADDRESS(ES) AT WHICH SOURCE MATERIAL WILL BE POSSESSED OR USED
Sections 18 and 19, T. 44 N., R. 75 W., 6th PM, Campbell County, Wyoming
Sections 13, 23, 24, and 25, T. 44 N., R. 76 W., 6th PM, Campbell County, Wyoming

5. NAME OF PERSON TO BE CONTACTED CONCERNING THIS APPLICATION
Glenn J. Catchpole

6. TELEPHONE NO. OF INDIVIDUAL NAMED IN ITEM 5
307-234-9169

7. DESCRIBE PURPOSE FOR WHICH SOURCE MATERIAL WILL BE USED
Source material will be produced as a raw material most likely for eventual nuclear fuel fabrication at other locations. In situ solution mining techniques will be used to recover the uranium from the sandstone formation. The uranium product (yellowcake) will be shipped from the mine site in either slurry or dried form.

8. STATE THE TYPE OR TYPES, CHEMICAL FORM OR FORMS, AND QUANTITIES OF SOURCE MATERIAL YOU PROPOSE TO RECEIVE, POSSESS, USE, OR TRANSFER UNDER THE LICENSE

(a) TYPE	(b) CHEMICAL FORM	(c) PHYSICAL FORM (*Including % U or Th.*)	(d) MAXIMUM AMOUNT AT ANY ONE TIME *(kilograms)*
NATURAL URANIUM	Sodium uranyl tricarbonate	Uranyl carbonate loaded ion exchange resin	Unrestricted
URANIUM DEPLETED IN THE U-235 ISOTOPE			
THORIUM (ISOTOPE)			

(e) MAXIMUM TOTAL QUANTITY OF SOURCE MATERIAL YOU WILL HAVE ON HAND AT ANY TIME *(kilograms)*
Unrestricted

9. DESCRIBE THE CHEMICAL, PHYSICAL, METALLURGICAL, OR NUCLEAR PROCESS OR PROCESSES IN WHICH THE SOURCE MATERIAL WILL BE USED, INDICATING THE MAXIMUM AMOUNT OF SOURCE MATERIAL INVOLVED IN EACH PROCESS AT ANY ONE TIME, AND PROVIDING A THOROUGH EVALUATION OF THE POTENTIAL RADIATION HAZARDS ASSOCIATED WITH EACH STEP OF THOSE PROCESSES.
Alkaline leach with oxidant will be used to recover uranium from a mineralized zone. Due to low uranium concentration in the raw material, there will be insignificant external radiation exposure hazard associated with this activity (see supportive information document).

10. LIST THE NAMES AND ATTACH A RESUME OF THE TECHNICAL QUALIFICATIONS INCLUDING TRAINING AND EXPERIENCE OF APPLICANT'S SUPERVISORY PERSONNEL AND THE PERSON RESPONSIBLE FOR THE RADIATION SAFETY PROGRAM (OR OF APPLICANT IF AN INDIVIDUAL).
George J. Hartman *Presently utilizing contract RSO services
Glenn J. Catchpole
Pei-Cheng Hsu
RSO to be designated later*

11. DESCRIBE THE EQUIPMENT AND FACILITIES WHICH WILL BE USED TO PROTECT HEALTH AND MINIMIZE DANGER TO LIFE OR PROPERTY AND RELATE THE USE OF THE EQUIPMENT AND FACILITIES TO THE OPERATIONS LISTED IN ITEM 9: INCLUDE: (a) RADIATION DETECTION AND RELATED INSTRUMENTS (including film badges, dosimeters, counters, air sampling, and other survey equipment as appropriate. The description of radiation detection instruments should include the instrument characteristics such as type of radiation detected, window thickness, and the range(s) of each instrument).
See supportive information document

(b) METHOD, FREQUENCY, AND STANDARDS USED IN CALIBRATING INSTRUMENTS LISTED IN (a) ABOVE, INCLUDING AIR SAMPLING EQUIPMENT (for film badges, specify method of calibrating and processing, or name supplier).
See supportive information document.

11(c). VENTILATION EQUIPMENT WHICH WILL BE USED IN OPERATIONS WHICH PRODUCE DUST, FUMES, MISTS, OR GASES, INCLUDING PLAN VIEW SHOWING TYPE AND LOCATION OF HOOD AND FILTERS. MINIMUM VELOCITIES MAINTAINED AT HOOD OPENINGS AND PROCEDURES FOR TESTING SUCH EQUIPMENT.

See supportive information document.

12. DESCRIBE PROPOSED PROCEDURES TO PROTECT HEALTH AND MINIMIZE DANGER TO LIFE AND PROPERTY AND RELATE THESE PROCEDURES TO THE OPERATIONS LISTED IN ITEM 9: INCLUDE: (a) SAFETY FEATURES AND PROCEDURES TO AVOID NONNUCLEAR ACCIDENTS, SUCH AS FIRE, EXPLOSION, ETC., IN SOURCE MATERIAL STORAGE AND PROCESSING AREAS.

See supportive information document.

(b) EMERGENCY PROCEDURES IN THE EVENT OF ACCIDENTS WHICH MIGHT INVOLVE SOURCE MATERIAL.

See supportive information document.

(c) DETAILED DESCRIPTION OF RADIATION SURVEY PROGRAM AND PROCEDURES.

See supportive information document.

13. WASTE PRODUCTS: *If none will be generated, state "None" opposite (a), below. If waste products will be generated, check here* ☒ *and explain on a supplemental sheet:*

(a) Quantity and type of radioactive waste that will be generated.

(b) Detailed procedures for waste disposal. See supportive information document.

14. IF PRODUCTS FOR DISTRIBUTION TO THE GENERAL PUBLIC UNDER AN EXEMPTION CONTAINED IN 10 CFR 40 ARE TO BE MANUFACTURED, USE A SUPPLEMENTAL SHEET TO FURNISH A DETAILED DESCRIPTION OF THE PRODUCT, INCLUDING:

(a) PERCENT SOURCE MATERIAL IN THE PRODUCT AND ITS LOCATION IN THE PRODUCT.

(b) PHYSICAL DESCRIPTION OF THE PRODUCT INCLUDING CHARACTERISTICS, IF ANY, THAT WILL PREVENT INHALATION OR INGESTION OF SOURCE MATERIAL THAT MIGHT BE SEPARATED FROM THE PRODUCT.

(c) BETA AND BETA PLUS GAMMA RADIATION LEVELS (*Specify instrument used, date of calibration and calibration technique used*) AT THE SURFACE OF THE PRODUCT AND AT 12 INCHES.

(d) METHOD OF ASSURING THAT SOURCE MATERIAL CANNOT BE DISASSOCIATED FROM THE MANUFACTURED PRODUCT.

CERTIFICATE

(This item must be completed by applicant)

15. *The applicant, and any official executing this certificate on behalf of the applicant named in Item 2, certify that this application is prepared in conformity with Title 10, Code of Federal Regulations, Part 40, and that all information contained herein, including any supplements attached hereto, is true and correct to the best of our knowledge and belief.*

BY: _____
(Signature)

Dated _____

Glenn J. Catchpole
(Print or type name)

Manager of Regulatory Affairs
(Title of certifying official authorized to act on behalf of the applicant)

WARNING: 18 U.S.C. Section 1001; Act of June 25, 1948; 62 Stat. 749; makes it a criminal offense to make a willfully false statement or representation to any department or agency of the United States as to any matter within its jurisdiction.

Form NRC-2 (7-77)

T CHAIR LAND COMPANY

February 22, 1989

Mr. George Hartman
Uranerz U.S.A., Inc.
190 Pronghorn
Casper, WY 82601

Re: North Butte Project

Dear Mr. Hartman:

Over the past several months we have had discussions with you and Mr. Catchpole regarding the proposed in situ mining operations to take place on certain T Chair Land Company lands (referred to by Uranerz as the North Butte ISL Project). It is the desire of the T Chair Land Company to have Uranerz incorporate the following into the mining and reclamation plans for the North Butte ISL Project.

1. After all mining, reclamation, and decommissioning activities have been completed at the North Butte mine, the T Chair Land Company desires to have the ownership of the processing plant building transferred from Uranerz to the T Chair Land Company. It is our understanding that if the buildings, for any reason, cannot be decontaminated, the ownership will not be transferred to the T Chair Land Company. Instead, the building will be disposed of in accordance with regulatory requirements.

2. The approximate 1.6 miles of access road from the oilfield road to the processing plant improves access to our ranch lands. For this reason, the T Chair Land Company may or may not desire to have the mine access road left as is once all mining and reclamation activities have been completed. The T Chair Land Company wants to reserve the option of not having the 1.6 mile mine access road reclaimed following the completion of all mining and aquifer restoration activities.

3. The method of construction of the mine access road and the wellfield access roads, and the reclamation plans for these roads are completely acceptable to the T Chair Land Company.

4. The seed mixture described in the Reclamation Plan section of the North Butte ISL Project permit application is acceptable to the T Chair Land Company. It is the strong desire of the T Chair Land Company to not include sage brush or shrubs in the reclamation seed mixture.

If Uranerz finds it necessary, the T Chair Land Company will be willing to discuss with the DEQ staff its desires in regard to land reclamation at the North Butte ISL Project.

Sincerely,

T CHAIR LAND COMPANY

Patricia Clark

SURFACE OWNER'S CONSENT

I, Patricia Clark, General Partner of the T Chair Land Company, A Wyoming Limited Partnership, do hereby certify that the T Chair Land Company owns the surface estate to the following described lands:

Township 44 North, Range 75 West, 6th PM, Campbell County, Wyoming

Section 18: Lot 4, SE/4SW/4
Section 19: Lots 1, 2, E/2NW/4, E/2

Township 44 North, Range 76 West, 6th PM, Campbell County, Wyoming

Section 13: S/2NE/4, N/2SE/4, NE/4SW/4, SE/4SE/4, SE/4SW/4
Section 23: SE/4SE/4
Section 24: N/2NW/4, SE/4NW/4, NE/4NE/4, S/2SW/4, SW/4SE/4
Section 25: W/2NE/4, NW/4, N/2SW/4

I have examined the mine plan and reclamation plan prepared by Pathfinder Mines Corporation in compliance with the Wyoming Environmental Quality Act of 1973, as amended. The T Chair Land Company does hereby approve said mine and reclamation plans and consents to the Pathfinder Mines Corporation execution of said mine and reclamation programs upon said lands as proposed therein.

Executed this 29 day of July, 1992.

WITNESS

Kristy Minkin

T CHAIR LAND COMPANY

Patricia Clark

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T-CHAIR RANCH
BOX A-140
GILLETTE, WYOMING 82716
PHONE: 464-1227

January 8, 1990

Land Quality Division
Department of Environmental Quality
Cheyenne, WY

To Whom It May Concern:

This letter is in reference to the mine access road being proposed by Uranerz U.S.A. for the North Butte ISL project.

As a few of you may remember, last spring a small group of people from the DEQ and Uranerz came out to the ranch and I explained to you the method I used in the building and reseeding of the road north of our ranch. After explaining my methods we had a little chat. It seems now that the DEQ does not understand the method or does not wish to recognize the land owners desires. The method we used on the road north of the ranch house is the method we want Uranerz to use at the North Butte site. We do not favor this method because Uranerz wants it, we favor it because we want it.

I have successfully used this method of road construction which envolves removing the top layer of good topsoil (which I believe you call the A horizon) and temporarily windrowing it to each side. Then the borrow ditch is cut with the subsoil from the ditch going onto the road bed to elevate it. This helps to keep snow from drifting on the road. The topsoil is then placed in the drainage ditch on each side of the road and reseeded.

I believe in this method as far as keeping the good topsoil in its place - on top! Reseeding takes place quicker in the good topsoil which reduces wind and water erosion. I have a problem with mixing the 2nd layer of topsoil (B horizon) in with the good topsoil as it slows down the reseeding and the more material you move the more you are going to lose. Also, we want the amount of soil placed in storage piles and windrows to be kept to an absolute minimum. These

"OUR BUSINESS" "OUR WEAKNESS"

T-CHAIR RANCH
BOX A-140
GILLETTE, WYOMING 82716
PHONE: 464-122

piles result in a loss of soil from erosion plus natural grass is covered up and not available for grazing.

As a reminder, final reclaimation involves the windrowing of the A horizon soil in the ditch to the outside of the backslope, removing the gravel from the road bed, ripping the road bed and placing the subsoil(Bhorizon) back in the ditch, ripping the road surface and ditch area again, replacing the good topsoil on top of the subsoil and reseeding. We believe that this procedure will adequately reclaim the road.

If the method being proposed for access road construction is not acceptable we want to know why. If we were going to build a temporary ranch road up to the site of the planned processing plant we would use the method that is being proposed. As the landowners whos livelihood depends on good range land, we are sure that the method we use to construct roads prevents topsoil loss and will make for good reclaimation when the time comes.

Gene Mankin

Gene Mankin

1. GENERAL PROJECT DESCRIPTION

1.1 PROJECT SUMMARY

The North Butte Project is designed to mine uranium from roll front type deposits that are located approximately 600 feet below the surface using in situ leach (ISL) mining Technology. The project will be a commercial scaled operation extracting some 600,000 pounds per year of uranium oxide (U_3O_8) from three sand horizons averaging approximately 50 to 100 feet thick each. All three sand members are saturated with water and are under confined aquifer conditions within the Wasatch formation. After the uranium has been extracted from the in place ore deposit it will be concentrated by loading onto solid ion exchange resin. The uranium product will then be stripped from
the resin, precipitated and dried at the proposed North Butte processing facility. The salable production will next be trucked off site to enter the Nuclear fuel cycle.

Commercial scale ISL well fields will be installed at the site to accomplish the mining and the processing of the uranium product will be conducted at the SR-HUP. All equipment will - be purchased for the North Butte operation as there are no facilities or equipment on site. The equipment purchased for the North Butte ISL Project will be of a proven design.

Beginning in early 1980's and continuing through 1986 UUS conducted piloting tests at two locations in close proximity to the North Butte Site using standard uranium leaching techniques of sodium carbonate/bicarbonate and oxygen. These operations were successful, which lead to the ultimate acquisition of the North Butte property from the Cleveland Cliffs Iron Company in 1987.

The North Butte production complex will be composed of well fields and auxiliary facilities including office accommodations, evaporation ponds, disposal well and surface discharge area as explained below.

The Processing Plant will take place at SR-HUP. The SR-HUP facilities consist of process building, various solution holding tanks, ion exchange reaction vessels, pumps, plumbing, filter sections, precipitation section and a drying unit. Various office accommodations are located in the process building. The process facility will be designed to accommodate resin elution and product processing from other uranium concentrating (satellite) sites.

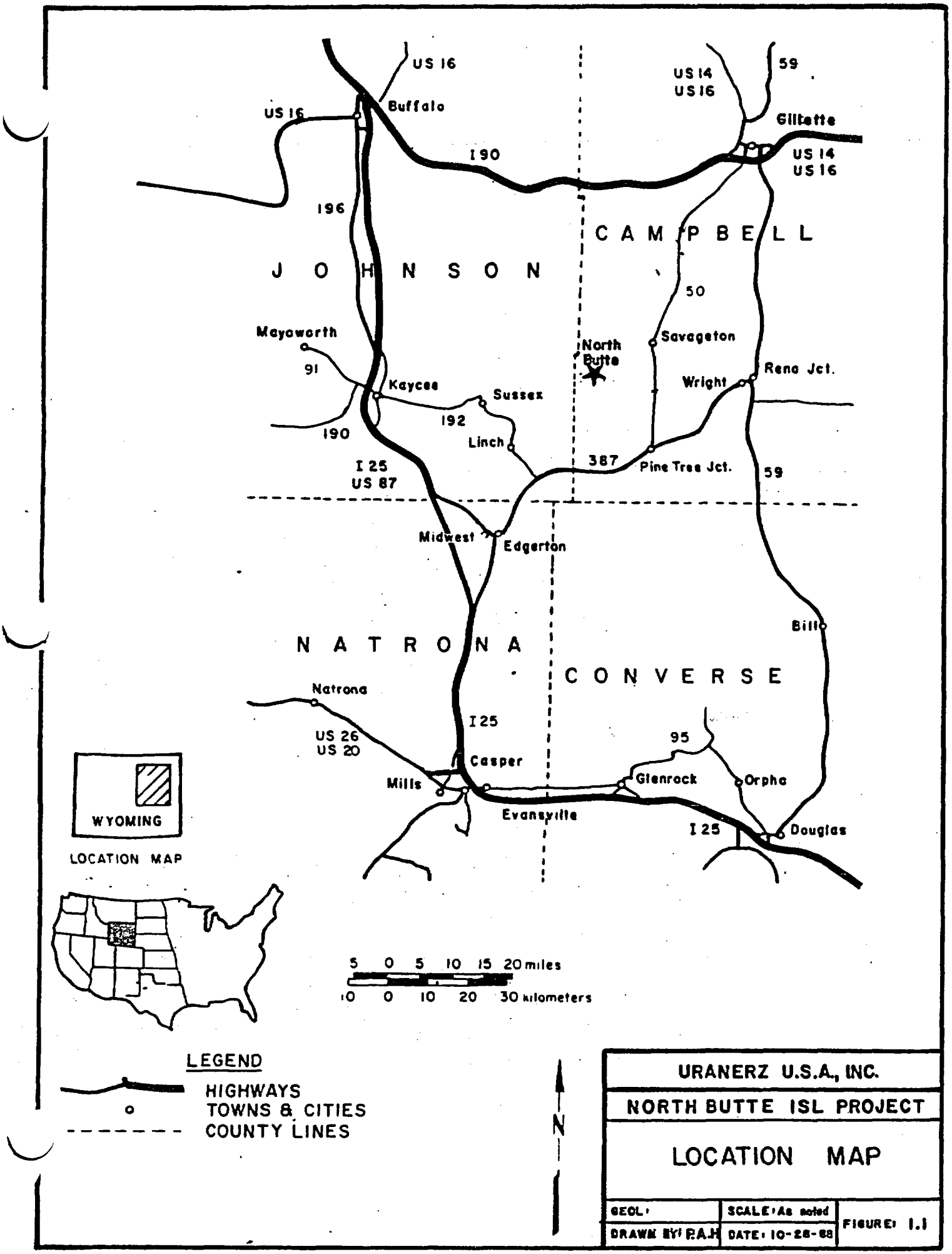
The well fields will have injection, recovery and monitoring wells with the appropriate equipment to transfer the mined solution to trucks for shipment to SR-HUP. The wells will be completed in the confined mine aquifer labeled "A", "B", and/or "C" sand members depending upon the location of the economically concentrated ore. All of the sand members comprising the mine aquifer are flat lying with no known faults.

The two evaporation ponds will have artificial impermeable membrane liners and an act primarily as a holding facility in the event the disposal well cannot accommodate waste solutions during maintenance periods, etc. The disposal well will be installed and serve as a final elimination mechanism to solutions with high salt content.

Due to the size of the ore body and depending upon the market price of uranium, the North Butte ISL project is planned to operate a minimum of twenty-five years. The estimated mine life including reclamation, as reflected in the Mine Plan Section of this document is some 26 years.

1.2 PROJECT LOCATION

The North Butte in situ leach and processing facility is located in southwest Campbell County, Wyoming about 42 air miles south-southwest of Gillette, Wyoming. Figure 1.1 is a map that shows the general location of the North Butte project. The permit area includes portions of Sections 18 and 19 of Township 44 North, Range 75 West and



URANERZ U.S.A., INC.

NORTH BUTTE ISL PROJECT

LOCATION MAP

GEOL:	SCALE: As noted	FIGURE: 1.1
DRAWN BY: P.A.H	DATE: 10-28-88	

portions of Sections 13, 23, 24 and 25 of Township 44 North, Range 76 West. Part of the project site is located on the Franklin Brown ranch with the remainder of the surface ownership belonging to Power Resources, Inc. Access is by state highway 50, south from Gillette to Savageton, then a west and south on Campbell county and an existing oil field road to the existing plant site access road located in Section 25 of T.44 N.,R.76 W. At that point, the road is used exclusively for North Butte mining activities, and progresses approximately 0.9 miles to the site.

1.3 PROJECT OWNERS

PRI purchased the North Butte property from Pathfinder Mines Corporation who purchased it from Uranerz, U.S.A. in February 1991. Effective March 5, 1991, the Wyoming Department of Environmental Quality (WDEQ) transferred Permit to Mine No. 632 to Pathfinder. Permit to Mine No. 632 authorizes the commercial uranium ISL operations addressed by this permit application document. This permit application still refers to Uranerz, U.S.A. as the owner and operator. Wherever Uranerz, or Pathfinder appears in this document, one should understand that this is now Power Resources Inc.

The corporate offices for Power Resources Inc. a subsidency of CAMECO are located in Saskatoon, Saskatchewan, Canada . The President and CEO of Powe Resources Inc. reports directly to the President of CAMECO whose offices are also located in Saskatoon, Saskatchewan. The current offices for the North Butte operation are located in Douglas, Wyoming. Power Resources Inc. owns and operates other ISL uranium mines in Wyoming, notably in the Powder River Basin and the Gas Hills.

1.4 MINING OPERATIONS

1.4.1 WELLFIELD

The orebody at the commercial North Butte ISL Project will be divided into ten mining units. Each mining unit will consist of approximately 65 five spot patterns which will be used to extract the uranium from the sandstone formation. The pattern area will be comprised of approximately 15 surface acres for each mining unit. The uranium, which lies in a confined aquifer in the Wasatch Formation, will be removed by circulating leach solutions through the mineralized portions of the sandstone at a nominal flow rate of up to 4,000 gpm.

The mineralized or target sand for the solution mining operation at the North Butte site is referred to locally as the mining sand. The injection and recovery wells will be completed only in the mineralized zones of the "A", "B" and "C" sand members of the mining sand to insure as little dilution as possible. The method of well drilling and completion will involve casing the hole, cementing the annulus, and either underreaming or drilling under the casing to expose the mineralized interval.

Horizontal and vertical monitor wells will be installed in and around the wellfield to insure containment of the leaching solutions. A slight over production from the wellfield will keep groundwater moving into the operating mining unit. Additionally, information on wellfield flow rates and pressures will be collected routinely to monitor for excessive injection or recovery in any portion of the mining unit.

Following the extraction of the uranium from the orebody aquifer using solution mining techniques, the groundwater affected by the mining operation will be restored to a quality consistent with regulatory requirements. The techniques to be utilized for groundwater restoration at the North Butte site will be similar to those employed by PRI during the successful Smith Ranch-HUP groundwater restoration effort.

1.4.2 PROCESSING PLANT

Once the elution is transported from North Butte to Smith Ranch HUP the process is designed to extract the uranium compound from the wellfield solution and produce the final yellowcake product. The elution, precipitation, and yellowcake drying facilities at this location will be capable of processing uranium loaded resin from other uranium mining facilities. Department of Transportation (DOT) approved trailers will be used to
transport the resin to and from other uranium mining facilities. The leaching solution or lixiviant will consist of a diluted sodium carbonate/bicarbonate solution plus an oxidant.

The process equipment, with the exception of most of the chemical storage tanks, soda ash silo, and yellowcake storage, will be housed in an insulated metal building. The metal process building is 80 feet by 150 feet with eaves 20 feet high. The office area, approximately 40 feet by 80 feet, will be adjacent to the process building. A personnel trailer may be located in the vicinity of the process and office facilities. This trailer would be used as a kitchen and as sleeping quarters for the relief operators.

The liquid effluent from the process will be treated and routed to the artificially lined solar evaporation ponds. Treated water meeting the requirements of a NPDES permit will be surface discharged to a tributary of Willow Creek The waste solution from the precipitation and yellowcake circuits will be filtered and disposed of in the deep disposal well.

1.5 RECLAMATION AND AQUIFER RESTORATION OPERATIONS

At the appropriate stages in the life of the North Butte project, reclamation of the land surface and restoration of the affected aquifer(s) will take place. Reclamation and restoration activities will commence as soon as practicable once mining in a wellfield has terminated. The goal of reclamation will be to return all affected lands to their pre-mining use of livestock grazing and wildlife habitat, and the goal of restoration will be to return the water quality in affected

aquifer(s) to acceptable regulatory standards. PRI successfully demonstrated its capability to restore aquifers affected by solution mining during the SR-HUP Project located in the Converse County.

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APPENDIX A
OWNERS OF RECORD OF SURFACE AND MINERAL RIGHTS WITHIN THE PERMIT AREA (NORTH BUTTE)

Township 44 North, Range 75 West, 6th P.M.

Section 18: that part of S^2SW^4 included in U.S. Mineral Patent 49-77-0020 where the surface was previously patented under the Stockraising Homestead Act.

Section 19: that part of the N^2N^2 and Lots 10 & 11 included in U.S. Mineral Patent 49-77-0020 where the surface was previously patented under the Stockraising Homestead Act and those parts of Lots 10 lying within a tract of land Beginning at the common corner of Sections 18 and 19, Township 44 North, Range 75 West, 6th P.M. and Sections 13 and 24, Township 44 North, Range 76 West, 6th P.M., Thence S 80°12' E a distance of 4,341.29 feet to a point on the permit boundary, Thence S 01°45' W a distance of 597 feet to the point of beginning, Thence S 01°45' W a distance of 374 feet to a point, Thence N 88°09' W a distance of 2,838.1 feet to a point, Thence S 72°04' E a distance of 115.6 feet to a point, Thence along the arc of a curve to the right with a starting angle of N 77°37' E, an ending angle of N 17°56' E and a radius of 700 feet, a distance of 692.5 feet to a point, Thence S 17°31' E a distance of 938.9 feet to a point, Thence S 28°55' E a distance of 158.0 feet to a point, Thence S 42°41' E a distance of 219.3 feet to a point, Thence S 60°45' E a distance of 842.3 feet to a point, Thence S 29°15' W a distance of 200.0 feet to a point, Thence N 60°45' W a distance of 842.0 feet to a point, Thence N 50°30' W a distance of 125.8 feet to a point, Thence N 40°08' W a distance of 165.6 feet to a point, Thence along the arc of a curve to the right with a starting angle of S 72°29' W, an ending angle of S 49°44' W and a radius of 600 feet, a distance of 238.3 feet to a point, Thence N 17°31' W a distance of 943.0 feet to a point, Thence along the arc of a curve to the left with a starting angle of N 75°00' E, an ending angle of N 17°56' E and a radius of 500 feet, a distance of 498.1 feet to a point, Thence N 72°04' W a distance of 2,247.2 feet to a point, Thence along the arc of a curve to the right with a starting angle of S 55°20' W, an ending angle of S 15°47' W and a radius of 700 feet, a distance of 483.3 feet to a point, Thence N 89°28' E a distance of 86.1 feet to a point, Thence N 00°32' W a distance of 600 feet to a point, Thence S 88°05' E a distance of 1,275.0 feet to a point, Thence S 01°51' E a distance of 600 feet to a point, Thence S 88°09' E a distance of 2,999.4 feet to the point of beginning.

Township 44 North, Range 76 West, 6th P.M.

Section 13: that part of the SW^4NE^4, E^2SW^4, N^2SE^4, SE^4SE^4 included in U.S. Mineral Patent 49-77-0020 where the surface was previously patented under the Stockraising Homestead Act.

Section 24: $N^2N^2SE^4SW^4$, that part of NE^4NE^4, N^2NW^4, SE^4NW^4 included in U.S. Mineral Patent 49-77-0020 and that part of S^2SW^4 included in U.S. Mineral Patent 49-77-0019 where the surface was previously patented under the Stockraising Homestead Act.

Section 25: that part of the NW^4 included in U.S. Mineral Patent 49-77-0019 where the surface was previously patented under the Stockraising Homestead Act.

SURFACE OWNER:	T. CHAIR LAND COMPANY 1024 Brown Road Gillette, Wyoming 82718
MINERAL OWNERS: All Minerals excluding Coal, Oil & Gas	POWER RESOURCES, INC. P.O. Box 1210 Glenrock, Wyoming 82637
Coal, Oil & Gas	THE UNITED STATES OF AMERICA Bureau of Land Management P.O. Box 1828 Cheyenne, Wyoming 82003
LEASE OWNERS (oil & gas)	
Township 44 North, Range 75 West, 6th P.M. Section 18: that part of MS 681 lying within S^2SW^4	EXXON MOBIL CORPORATION P.O. Box 4697 Houston, Texas 77210
Township 44 North, Range 75 West, 6th P.M. Section 19: that part of MS 681 lying within the N^2NW^4, NW^4NE^4 Township 44 North, Range 76 West, 6th P.M. Section 13: that part of MS 681 lying in N^2SE^4, SE^4SE^4 Section 24: that part of MS 681 lying in the N^2NW^4, SE^4NW^4	CONOCO PHILLIPS COMPANY P.O. Box 2197 Houston, Texas 77252
Township 44 North, Range 76 West, 6th P.M. Section 13: that part of MS 681 lying in SE^4SW^4	GULF COAST OIL & GAS COMPANY P.O. Box 1684 Midland, Texas 79702
Township 44 North, Range 76 West, 6th P.M. Section 13: that part of MS 681 lying within SW^4NE^4 Section 24: that part of MS 681 lying in NE^4NE^4	WYOMING RESOUCES CORPORATION 1508 Mountain View Road Rapid City, South Dakota 57702 PENDRAGON RESOURCES, II, LP 621 17th Street, Suite 750 Denver, Colorado 80293 NPC, INC. 550 North 31st Street, Suite 500 Billings, Montana 59101
Township 44 North, Range 76 West, 6th P.M. Section 24: that part of MS 681 lying in S^2SW^4	LANCE OIL & GAS COMPANY, INC. 1099 18th Street

Suite 1200
Denver, Colorado 80202

WILLIAMS PRODUCTION RMT COMPANY
1515 Arapahoe Street
Tower 3, Suite 1000
Denver, Colorado 80202

Township 44 North, Range 76 West, 6th P.M.
Section 25: that part of MS 681 lying in N^2NW^4, SE^4NW^4

WYOMING RESOUCES CORPORATION
1508 Mountain View Road
Rapid City, South Dakota 57702

PENDRAGON RESOURCES, II, LP
621 17th Street, Suite 750
Denver, Colorado 80293

Township 44 North, Range 75 West, 6th P.M.
Section 19: those parts of Lots 7-9 & 14 lying within a tract of land Beginning at the common corner of Sections 18 and 19, Township 44 North, Range 75 West, 6th P.M. and Sections 13 and 24, Township 44 North, Range 76 West, 6th P.M., Thence S 80°12' E a distance of 4,341.29 feet to a point on the permit boundary, Thence S 01°45' W a distance of 597 feet to the point of beginning, Thence S 01°45' W a distance of 374 feet to a point, Thence N 88°09' W a distance of 2,838.1 feet to a point, Thence S 72°04' E a distance of 115.6 feet to a point, Thence along the arc of a curve to the right with a starting angle of N 77°37' E, an ending angle of N 17°56' E and a radius of 700 feet, a distance of 692.5 feet to a point, Thence S 17°31' E a distance of 938.9 feet to a point, Thence S 28°55' E a distance of 158.0 feet to a point, Thence S 42°41' E a distance of 219.3 feet to a point, Thence S 60°45' E a distance of 842.3 feet to a point, Thence S 29°15' W a distance of 200.0 feet to a point, Thence N 60°45' W a distance of 842.0 feet to a point, Thence N 50°30' W a distance of 125.8 feet to a point, Thence N 40°08' W a distance of 165.6 feet to a point, Thence along the arc of a curve to the right with a starting angle of S 72°29' W, an ending angle of S 49°44' W and a radius of 600 feet, a distance of 238.3 feet to a point, Thence N 17°31' W a distance of 943.0 feet to a point, Thence along the arc of a curve to the left with a starting angle of N 75°00' E, an ending angle of N 17°56' E and a radius of 500 feet, a distance of 498.1 feet to a point, Thence N 72°04' W a distance of 2,247.2 feet to a point, Thence along the arc of a curve to the right with a starting angle of S 55°20' W, an ending angle of S 15°47' W and a radius of 700 feet, a distance of 483.3 feet to a point, Thence N 89°28' E a distance of 86.1 feet to a point, Thence N 00°32' W a distance of 600 feet to a point, Thence S 88°05' E a distance of 1,275.0 feet to a point, Thence S 01°51' E a distance of 600 feet to a point, Thence S 88°09' E a distance of 2,999.4 feet to the point of beginning.

SURFACE OWNER:

T. CHAIR LAND COMPANY
1024 Brown Road
Gillette, Wyoming 82718

MINERAL OWNER:
All Minerals including Coal, Oil & Gas

THE UNITED STATES OF AMERICA
Bureau of Land Management
P.O. Box 1828
Cheyenne, Wyoming 82003

All Locatable Minerals including uranium
Township 44 North, Range 75 West, 6th P.M.
Section 19: Lot 14

POWER RESOURCES, INC.
P.O. Box 1210
Glenrock, Wyoming 82637

LEASE OWNERS
(oil & gas)

Township 44 North, Range 75 West, 6th P.M.
Section 19: Lots 7-9

CONOCO PHILLIPS COMPANY
P.O. Box 2197
Houston, Texas 77252

Township 44 North, Range 75 West, 6th P.M.
Section 19: that part of NW4SE4 lying within a tract of land beginning at the common corner of Sections 18 and 19, Township 44 North, Range 75 West, 6th P.M. and Sections 13 and 24, Township 44 North, Range 76 West, 6th P.M., Thence S 80°12' E a distance of 4,341.29 feet to a point on the permit boundary, Thence S 01°45' W a distance of 597 feet to the point of beginning, Thence S 01°45' W a distance of 374 feet to a point, Thence N 88°09' W a distance of 2,838.1 feet to a point, Thence S 72°04' E a distance of 115.6 feet to a point, Thence along the arc of a curve to the right with a starting angle of N 77°37' E, an ending angle of N 17°56' E and a radius of 700 feet, a distance of 692.5 feet to a point, Thence S 17°31' E a distance of 938.9 feet to a point, Thence S 28°55' E a distance of 158.0 feet to a point, Thence S 42°41' E a distance of 219.3 feet to a point, Thence S 60°45' E a distance of 842.3 feet to a point, Thence S 29°15' W a distance of 200.0 feet to a point, Thence N 60°45' W a distance of 842.0 feet to a point, Thence N 50°30' W a distance of 125.8 feet to a point, Thence N 40°08' W a distance of 165.6 feet to a point, Thence along the arc of a curve to the right with a starting angle of S 72°29' W, an ending angle of S 49°44' W and a radius of 600 feet, a distance of 238.3 feet to a point, Thence N 17°31' W a distance of 943.0 feet to a point, Thence along the arc of a curve to the left with a starting angle of N 75°00' E, an ending angle of N 17°56' E and a radius of 500 feet, a distance of 498.1 feet to a point, Thence N 72°04' W a distance of 2,247.2 feet to a point, Thence along the arc of a curve to the right with a starting angle of S 55°20' W, an ending angle of S 15°47' W and a radius of 700 feet, a distance of 483.3 feet to a point, Thence N 89°28' E a distance of 86.1 feet to a point, Thence N 00°32' W a distance of 600 feet to a point, Thence S 88°05' E a distance of 1,275.0 feet to a point, Thence S 01°51' E a distance of 600 feet

to a point, Thence S 88°09' E a distance of 2,999.4 feet to the point of beginning.

SURFACE OWNER:	T. CHAIR LAND COMPANY 1024 Brown Road Gillette, Wyoming 82718
MINERAL OWNER: All Minerals including Coal, Oil & Gas	STATE OF WYOMING Office of State Lands & Investments 122 West 25th Street Cheyenne, Wyoming 82002
LEASE OWNER (oil & gas)	CH4 ENERGY, LLC 2813 S. Hulen S-225 Fort Worth, Texas 76109

Township 44 North, Range 76 West, 6th P.M.

Section 13: that part of SE^4NW^4, S^2SW^4 and SW^4SE^4 included in U.S. Mineral Patent 49-77-0020.

Section 23: that part of E^2NE^4, NE^4SE^4 included in U.S. Mineral Patent 49-77-0020, that part of E^2SE^4 included in U.S. Mineral Patent 49-77-0019.

Section 24: that part of N^2NE^4, SW^4NE^4, NW^4SE^4, N^2SW^4 and SW^4NW^4 included in U.S. Mineral Patent 49-77-0020, that part of N^2SW^4 and NW^4SE^4 included in U.S. Mineral Patent 49-77-0019.

SURFACE OWNER:	POWER RESOURCES, INC. P.O. Box 1210 Glenrock, Wyoming 82637
MINERAL OWNERS: All Minerals excluding Coal, Oil & Gas	POWER RESOURCES, INC. P.O. Box 1210 Glenrock, Wyoming 82637
Coal, Oil & Gas	THE UNITED STATES OF AMERICA Bureau of Land Management P.O. Box 1828 Cheyenne, Wyoming 82003

LEASE OWNER
(oil & gas)

Township 44 North, Range 76 West, 6th P.M. Section 23: that part of MS 681 lying in E^2NE^4, NE^4SE^4 Section 24: that part of MS 681 lying in W^2NE^4, NW^4SE^4	WYOMING RESOUCES CORPORATION 1508 Mountain View Road Rapid City, South Dakota 57702 PENDRAGON RESOURCES, II, LP 621 17th Street, Suite 750 Denver, Colorado 80293 NPC, INC. 550 North 31st Street, Suite 500 Billings, Montana 59101
Township 44 North, Range 76 West, 6th P.M. Section 13: that part of MS 681 lying in the SW^4SW^4	GULF COAST OIL & GAS COMPANY P.O. Box 1684 Midland, Texas 79702
Township 44 North, Range 76 West, 6th P.M. Section 13: that part of MS 681 lying in SE^4NW^4, SW^4SE^4 Section 24: that part of MS 681 lying in SW^4NW^4	CONOCO PHILLIPS COMPANY P.O. Box 2197 Houston, Texas 77252
Township 44 North, Range 76 West, 6th P.M. Section 24: that part of MS 681 lying in the N^2SW^4	LANCE OIL & GAS COMPANY, INC. 1099 18th Street Suite 1200 Denver, Colorado 80202 WILLIAMS PRODUCTION RMT COMPANY 1515 Arapahoe Street Tower 3, Suite 1000 Denver, Colorado 80202

APPENDIX B
OWNERS OF RECORD OF SURFACE AND MINERAL RIGHTS ADJACENT TO THE PERMIT AREA (NORTH BUTTE)

Township 44 North, Range 75 West, 6th P.M.

Section 17: **Lots 12 & 13**

Section 18: **Lots 7-12, 14-19**

Section 19: **Lots 6 & 13, those parts of Lots 7-9 & 14 lying outside a tract of land beginning at the common corner of Sections 18 and 19, Township 44 North, Range 75 West, 6th P.M. and Sections 13 and 24, Township 44 North, Range 76 West, 6th P.M., Thence S 80°12' E a distance of 4,341.29 feet to a point on the permit boundary, Thence S 01°45' W a distance of 597 feet to the point of beginning, Thence S 01°45' W a distance of 374 feet to a point, Thence N 88°09' W a distance of 2,838.1 feet to a point, Thence S 72°04' E a distance of 115.6 feet to a point, Thence along the arc of a curve to the right with a starting angle of N 77°37' E, an ending angle of N 17°56' E and a radius of 700 feet, a distance of 692.5 feet to a point, Thence S 17°31' E a distance of 938.9 feet to a point, Thence S 28°55' E a distance of 158.0 feet to a point, Thence S 42°41' E a distance of 219.3 feet to a point, Thence S 60°45' E a distance of 842.3 feet to a point, Thence S 29°15' W a distance of 200.0 feet to a point, Thence N 60°45' W a distance of 842.0 feet to a point, Thence N 50°30' W a distance of 125.8 feet to a point, Thence N 40°08' W a distance of 165.6 feet to a point, Thence along the arc of a curve to the right with a starting angle of S 72°29' W, an ending angle of S 49°44' W and a radius of 600 feet, a distance of 238.3 feet to a point, Thence N 17°31' W a distance of 943.0 feet to a point, Thence along the arc of a curve to the left with a starting angle of N 75°00' E, an ending angle of N 17°56' E and a radius of 500 feet, a distance of 498.1 feet to a point, Thence N 72°04' W a distance of 2,247.2 feet to a point, Thence along the arc of a curve to the right with a starting angle of S 55°20' W, an ending angle of S 15°47' W and a radius of 700 feet, a distance of 483.3 feet to a point, Thence N 89°28' E a distance of 86.1 feet to a point, Thence N 00°32' W a distance of 600 feet to a point, Thence S 88°05' E a distance of 1,275.0 feet to a point, Thence S 01°51' E a distance of 600 feet to a point, Thence S 88°09' E a distance of 2,999.4 feet to the point of beginning.**

Section 20: **Lots 4, 9 & 16**

Section 30: **Lots 6, 16 & 18**

Township 44 North, Range 76 West, 6th P.M.

Section 11: **That part of SE^4SE^4 lying east of a line which extends diagonally from a point which is 850 feet west of the southeast corner of said section 11 to the northwest corner of the SE^4SE^4 of said section 11.**

Section 12: **SW^4SW^4**

Section 13: **Lots 1, 2, N^2NW4, that part of SE^4SW^4, SW^4NE^4, N^2SE^4 & NE^4SW^4 not included in U.S. Mineral Patent No. 49-77-0020.**

Section 14: **SE^4SE^4, that portion of the SW^4NW^4 & NW^4SW^4 of section 13 and SE^4NE^4, NE^4SE^4 & SW^4SE^4 of section 14 lying east of a line beginning at a point 850 feet west of the northeast corner of said section 14, thence South 500 feet, thence S 26°50' E 1,883 feet, thence S 58°33' E 498 feet, thence S 45°00' W 283 feet, thence South 1000 feet, thence S 66°30' W 627 feet, thence N 66°15' W 584 feet, thence S 24°50' W 373 feet, thence S 2°30' W 752 feet, thence S 58°20' W to a point on the south line of said section 14 which is 586 feet from the southeast corner of the SW^4SE^4 of said section 14.**

Section 23: **Lots 1, 2, 3, SE^4SE^4, W^2E^2, NE^4NW^4, NE^4SW^4, that part of SE^4NW^4 lying south and east of a fence line beginning at the southwest corner of the SE^4NW^4 of said section 23, thence N 43°55' E to a point on the north boundary of the $SE^4NW^4$of said section 23, which point is 49 feet west of the northeast corner of the SE^4NW^4 of said section 23.**

Section 24: **Lots 1 & 2, E^2SE^4, SE^4NE^4, that part of the N^2NW^4 not included in U.S. Mineral Patent No. 44-77-0020, that part of the SW^4SW^4 not included in U.S. Mineral Patent No. 44-77-0019.**

Section 25: **S^2SE^4, that part of W^2NW^4 not included in U.S. Mineral Patent No. 44-77-0019.**

Section 26: **NE^4, S^2SE^4**

Section 35: **N^2NE^4**

SURFACE OWNER:

T. CHAIR LAND COMPANY
1024 Brown Road
Gillette, Wyoming 82718

MINERAL OWNER:
All Minerals including Coal, Oil & Gas

THE UNITED STATES OF AMERICA
Bureau of Land Management
P.O. Box 1828
Cheyenne, Wyoming 82003

All Locatable Minerals including uranium
Township 44 North, Range 75 West, 6th P.M.
Section 17: part of Lot 14
Section 19: Lot 14
Section 20: Lots 4, 9 & 16
Section 30: Lots 6, 16 & 18
Township 44 North, Range 76 West, 6th P.M.
Section 25: SE^4SW^4, part of SW^4SW^4

POWER RESOURCES, INC.
P.O. Box 1210
Glenrock, Wyoming 82637

LEASE OWNERS
(oil & gas)

Township 44 North, Range 75 West, 6th P.M.
Section 18: Lots 7-12, 15-18

EXXON MOBIL CORPORATION
P.O. Box 4697
Houston, Texas 77210

Township 44 North, Range 75 West, 6th P.M.
Section 19: Lots 6-9, 13 & 14, NE^4NW^4
Section 20: Lots 9 & 16

CONOCO PHILLIPS COMPANY
P.O. Box 2197
Houston, Texas 77252

Section 30: Lots 6, 16 & 18
Township 44 North, Range 76 West, 6th P.M.
Section 13: Lot 1, N^2NW^4, that part of N2SE4 lying outside MS 681, that part of the SW^4NW^4 lying east of a line beginning at a point 850 feet west of the northeast corner of said section 14, thence South 500 feet, thence S 26º50' E 1,883 feet, thence S 58º33' E 498 feet, thence S 45º00' W 283 feet, thence South 1000 feet, thence S 66º30' W 627 feet, thence N 66º15' W 584 feet, thence S 24º50' W 373 feet, thence S 2º30' W 752 feet, thence S 58º20' W to a point on the south line of said section 14 which is 586 feet from the southeast corner of the SW^4SE^4 of said section 14
Section 24: that part of the NW^4 lying outside MS 681

Township 44 North, Range 75 West, 6th P.M.
Section 17: Lots 12 & 13
Section 18: Lots 14 & 19
Section 20: Lot 4
Township 44 North, Range 76 West, 6th P.M.
Section 11: that part of the SE^4SE^4 lying east of a line which extends diagonally from a point which is 850 feet west of the southeast corner of said section 11 to the northwest corner of the SE^4SE^4 of said section 11.
Section 12: SW^4SW^4
Section 13: that part of the SW^4NE^4 lying outside of MS 681
Section 24: SE^4SE, that part of the SW^4SW^4 lying outside MS 681

LANCE OIL & GAS COMPANY, INC.
1099 18th Street
Suite 1200
Denver, Colorado 80202

WILLIAMS PRODUCTION RMT COMPANY
1515 Arapahoe Street
Tower 3, Suite 1000
Denver, Colorado 80202

Township 44 North, Range 76 West, 6th P.M.
Section 23: Lots 1-3, NE^4SW^4, NW^4SE^4, W^2NE^4, that part of SE^4NW^4 lying south and east of a fence line beginning at the southwest corner of the SE^4NW^4 of said section 23, thence N 43º55' E to a point on the north boundary of the SE^4NW^4 of said section 23, which pint is 49 feet west of the northeast corner of the SE^4NW^4 of said section 23.
Section 35: N^2NE^4

WYOMING RESOUCES CORPORATION
1508 Mountain View Road
Rapid City, South Dakota 57702

PENDRAGON RESOURCES, II, LP
621 17th Street, Suite 750
Denver, Colorado 80293

NPC, INC.
550 North 31st Street, Suite 500
Billings, Montana 59101

Township 44 North, Range 76 West, 6th P.M.
Section 14: SE^4SE^4, that part of the NE^4SE^4 lying east of a line beginning at a point 850 feet west of the northeast corner of said section 14, thence South 500 feet, thence S 26º50' E 1,883 feet, thence S 58º33' E 498 feet, thence S 45º00' W 283 feet, thence South 1000 feet, thence S 66º30' W 627 feet, thence N 66º15' W 584 feet, thence S 24º50' W 373 feet, thence S 2º30' W 752 feet, thence S 58º20' W to a point on the south line of said section 14 which is 586 feet from the southeast corner of the SW^4SE^4 of said section 14

LANCE OIL & GAS COMPANY, INC.
1099 18th Street
Suite 1200
Denver, Colorado 80202

WILLIAMS PRODUCTION RMT COMPANY
1515 Arapahoe Street
Tower 3, Suite 1000
Denver, Colorado 80202

ABO PETROLEUM CORPORATION
105 South 4th Street
Artesia, New Mexico 88210-2123

YATES DRILLING COMPANY
105 South 4th Street
Artesia, New Mexico 88210-2123

SHARBRO OIL LTD. CO.
105 South 4th Street
Artesia, New Mexico 88210-2123

MYCO INDUSTRIES, INC.
105 South 4th Street
Artesia, New Mexico 88210-2123

YATES PETROLEUM CORPORATION
105 South 4th Street
Artesia, New Mexico 88210-2123

Township 44 North, Range 76 West, 6th P.M.
Section 13: Lot 2, NE^4SW^4, that part of the SE^4SW^4 lying outside MS 681
Section 14: that part of the NW^4SW^4 of section 13 and SE^4NE^4 of Section 14 which lies east of a line beginning at a point 850 feet west of the northeast corner of said section 14, thence South 500 feet, thence S 26º50' E 1,883 feet, thence S 58º33' E 498 feet, thence S 45º00' W 283 feet, thence South 1000 feet, thence S 66º30' W 627 feet, thence N 66º15' W 584 feet, thence S 24º50' W 373 feet, thence S 2º30' W 752 feet, thence S 58º20' W to a point on the south line of said section 14 which is 586 feet from the southeast corner of the SW^4SE^4 of said section 14

GULF COAST OIL & GAS COMPANY
P.O. Box 1684
Midland, Texas 79702

Township 44 North, Range 76 West, 6th P.M.
Section 23: SW^4SE^4
Section 25: SW^4SW^4, SW^4NW^4
Section 26: W^2NE^4, SE^4NE^4, S^2SE^4

WYOMING RESOUCES CORPORATION
1508 Mountain View Road
Rapid City, South Dakota 57702

PENDRAGON RESOURCES, II, LP
621 17th Street, Suite 750
Denver, Colorado 80293

ABO PETROLEUM CORPORATION
105 South 4th Street
Artesia, New Mexico 88210-2123

YATES DRILLING COMPANY
105 South 4th Street
Artesia, New Mexico 88210-2123

MYCO INDUSTRIES, INC.
105 South 4th Street
Artesia, New Mexico 88210-2123

YATES PETROLEUM CORPORATION
105 South 4th Street
Artesia, New Mexico 88210-2123

Township 44 North, Range 76 West, 6th P.M.
Section 23: that part of SE^4SE lying outside of MS 681

WYOMING RESOUCES CORPORATION
1508 Mountain View Road

Section 25: SE^4SW^4, that part of N^2NW^4 and SE^4NW^4 lying outside of MS 681
Section 26: NE^4NE^4

Rapid City, South Dakota 57702

PENDRAGON RESOURCES, II, LP
621 17th Street, Suite 750
Denver, Colorado 80293

Township 44 North, Range 75 West, 6th P.M.
Section 18: Lot 20
Section 19: Lot 5, 11-12, 15, that part of Lot 10 lying outside a tract of land beginning at the common corner of Sections 18 and 19, Township 44 North, Range 75 West, 6th P.M. and Sections 13 and 24, Township 44 North, Range 76 West, 6th P.M., Thence S 80°12' E a distance of 4,341.29 feet to a point on the permit boundary, Thence S 01°45' W a distance of 597 feet to the point of beginning, Thence S 01°45' W a distance of 374 feet to a point, Thence N 88°09' W a distance of 2,838.1 feet to a point, Thence S 72°04' E a distance of 115.6 feet to a point, Thence along the arc of a curve to the right with a starting angle of N 77°37' E, an ending angle of N 17°56' E and a radius of 700 feet, a distance of 692.5 feet to a point, Thence S 17°31' E a distance of 938.9 feet to a point, Thence S 28°55' E a distance of 158.0 feet to a point, Thence S 42°41' E a distance of 219.3 feet to a point, Thence S 60°45' E a distance of 842.3 feet to a point, Thence S 29°15' W a distance of 200.0 feet to a point, Thence N 60°45' W a distance of 842.0 feet to a point, Thence N 50°30' W a distance of 125.8 feet to a point, Thence N 40°08' W a distance of 165.6 feet to a point, Thence along the arc of a curve to the right with a starting angle of S 72°29' W, an ending angle of S 49°44' W and a radius of 600 feet, a distance of 238.3 feet to a point, Thence N 17°31' W a distance of 943.0 feet to a point, Thence along the arc of a curve to the left with a starting angle of N 75°00' E, an ending angle of N 17°56' E and a radius of 500 feet, a distance of 498.1 feet to a point, Thence N 72°04' W a distance of 2,247.2 feet to a point, Thence along the arc of a curve to the right with a starting angle of S 55°20' W, an ending angle of S 15°47' W and a radius of 700 feet, a distance of 483.3 feet to a point, Thence N 89°28' E a distance of 86.1 feet to a point, Thence N 00°32' W a distance of 600 feet to a point, Thence S 88°05' E a distance of 1,275.0 feet to a point, Thence S 01°51' E a distance of 600 feet to a point, Thence S 88°09' E a distance of 2,999.4 feet to the point of beginning.
Section 20: Lots 5 & 13
Section 30: Lots 7, 10, 11, 14, 15, 17, 19 & 20

SURFACE OWNER:

T. CHAIR LAND COMPANY
1024 Brown Road
Gillette, Wyoming 82718

MINERAL OWNERS:
All Minerals excluding Coal, Oil & Gas

POWER RESOURCES, INC.
P.O. Box 1210
Glenrock, Wyoming 82637

Coal	THE UNITED STATES OF AMERICA Bureau of Land Management P.O. Box 1828 Cheyenne, Wyoming 82003
Oil & Gas	KEVIN PFISTER 2001 Parkwood Portland, Texas 78474
	WILLIAM JAMES PFISTER AND CHERYL ANN PFISTER and their successor Trustee of the William James Pfister and Cheryl Ann Pfister Trust Agreement, a revocable trust dated April 12, 2005 1752 N. Heights Sheridan, Wyoming 82801
	MICHAEL PFISTER 262 Braeshire Drive Ballwin, Missouri 63021
	NEAL PFISTER 26268 7th Avenue Parkway Denver, Colorado 80206
	SAM RATCLIFF P.O. Box 2306 Gillette, Wyoming 82717
	CONNAGHAN LTD P.O. Box 566 Cheyenne, Wyoming 82003
	JAMES K. HAYS P.O. Box 3000 Gillette, Wyoming 82717
	JOSEPH M. HAYS 204 West Juniper Lane Gillette, Wyoming 82716
	ELLBOGEN PROPERTY MANAGEMENT, LTD for the benefit of the John P. Ellbogen Foundation P.O. Box 1928 Casper, Wyoming 82602
	WILLIAM L. PEASE P.O. Box 3107 Gillette, Wyoming 82716
LEASE OWNERS: (oil & gas) Township 44 North, Range 75 West, 6th P.M. Section 18: Lot 20	WILLIAMS PRODUCTION RMT COMPANY 1515 Arapahoe Street, Tower 3, Suite 1000 Denver, Colorado 80202
	LANCE OIL & GAS COMPANY 1099 18th Street, Suite 1200

Denver, Colorado 80202

CONOCO/PHILLIPS COMPANY
P.O. Box 2197
Houston, Texas 77252

XTO ENERGY INC.
810 Houston Street
Fort Worth, Texas 76102

(coalbed methane)
Township 44 North, Range 75 West, 6th P.M.
Section 19: Lots 5, 10-12, 15
Section 20: Lots 5 & 13
Section 30: Lots 7, 10, 11, 14, 15, 17, 19 & 20

DEVON ENERGY CORPORATION (Nevada)
20 North Broadway, Suite 1500
Oklahoma City, Oklahoma 73102

WILLIAMS PRODUCTION RMT COMPANY
1515 Arapahoe Street, Tower 3, Suite 1000
Denver, Colorado 80202

LANCE OIL AND GAS COMPANY, INC.
12200 North Pecos Street
Denver, Colorado 80234

DEVON PRODUCTION COMPANY, L.P.
20 North Broadway
Oklahoma City, Oklahoma 73102-8260

ANDARKO PETROLEUM CORPORATION
Harris County, Texas

CONOCO/PHILLIPS COMPANY
P.O. Box 2197
Houston, Texas 77252-2197

PATSY L. LARSON
P.O. Box 2306
Gillette, Wyoming 82717

Township 44 North, Range 75 West, 6th P.M.
Section 19: Lots 4, E^{2}SW^{4}
Township 44 North, Range 76 west, 6th P.M.
Section 25: NE^{4}NE^{4}

SURFACE OWNER:

T. CHAIR LAND COMPANY
1024 Brown Road
Gillette, Wyoming 82718

MINERAL OWNERS:
All Minerals excluding Oil & Gas

POWER RESOURCES, INC.
P.O. Box 1210
Glenrock, Wyoming 82637

Oil & Gas

PATRICIA CLARK
1026 Brown Road
Gillette, Wyoming 82718

KRISTY MANKIN
1031 Brown Road
Gillette, Wyoming 82718

MARY LEHRER
c/o T-Chair Land Company
S-570
Gillette, Wyoming 82716

T-CHAIR LAND COMPANY
S-570
Gillette, Wyoming 82716

LEASE OWNERS:
(oil & gas)

VISTA ENERGY LLC
730 17th Street, Suite 925
Denver, Colorado 80202

SAMUEL GARY OIL PRODUCER, INC.
4 Inverness Court East
Englewood, Colorado 80110

WILLIAMS PRODUCTION RMT COMPANY
1515 Arapahoe, Tower 3, Suite 1000
Denver, Colorado 80202

LANCE OIL AND GAS COMPANY, INC.
12200 North Pecos Street
Denver, Colorado 80234

GMQ LIMITED LIABILITY COMPANY
1720 South Bellaire Street
Penthouse Suite
Denver, Colorado 80222-4304

CONOCO/PHILLIPS COMPANY
P.O. Box 2197
Houston, Texas 77252-2197

HEADINGTON OIL COMPANY, L.P.
7557 Rambler Road, Suite 1100
Dallas, Texas 75231-2305

AMR ENERGY CORPORATION
1500 Fidelity Union Tower
Dallas, Texas 75201

DWG & COMPANY
a Colorado General Partnership

PENWELL PROPERTIES, LLC
3838 Turtle Creek Blvd
Suite 1316
Dallas, Texas 75219

PRESIDIO EXPLORATION, INC.
5613 DTC Parkway, Suite 800
Englewood, Colorado 80111-3035

ACKMAN RESOURCES, LLC
a Colorado Limited Liability Company

Township 44 North, Range 75 West, 6th P.M.
Section 20: Lots 10-12, 14 & 15
Section 29: Lots 4, 5, 12 & 13
Section 30: Lots 5, 8, 9, 12, 13
Township 44 North, Range 76 west, 6th P.M.
Section 24: SW^4SE^4
Section 25: W^2NE^4, SE^4NE^4, SE^4

SURFACE OWNER:

T. CHAIR LAND COMPANY
1024 Brown Road
Gillette, Wyoming 82718

MINERAL OWNER:
All Minerals excluding Oil & Gas

POWER RESOURCES, INC.
P.O. Box 1210
Glenrock, Wyoming 82637

Oil & Gas

PATRICIA CLARK
1026 Brown Road
Gillette, Wyoming 82718

KRISTY MANKIN
1031 Brown Road
Gillette, Wyoming 82718

MARY LEHRER
c/o T-Chair Land Company
S-570
Gillette, Wyoming 82716

T-CHAIR LAND COMPANY
S-570
Gillette, Wyoming 82716

LEASE OWNERS:
(oil & gas)

VISTA ENERGY LLC
730 17th Street, Suite 925
Denver, Colorado 80202

SAMUEL GARY OIL PRODUCER, INC.
4 Inverness Court East
Englewood, Colorado 80110

WILLIAMS PRODUCTION RMT COMPANY
1515 Arapahoe, Tower 3, Suite 1000
Denver, Colorado 80202

LANCE OIL AND GAS COMPANY, INC.
12200 North Pecos Street
Denver, Colorado 80234

GMQ LIMITED LIABILITY COMPANY
1720 South Bellaire Street

Penthouse Suite
Denver, Colorado 80222-4304

CONOCO/PHILLIPS COMPANY
P.O. Box 2197
Houston, Texas 77252-2197

HEADINGTON OIL COMPANY, L.P.
7557 Rambler Road, Suite 1100
Dallas, Texas 75231-2305

AMR ENERGY CORPORATION
1500 Fidelity Union Tower
Dallas, Texas 75201

DWG & COMPANY
a Colorado General Partnership

PENWELL PROPERTIES, LLC
3838 Turtle Creek Blvd
Suite 1316
Dallas, Texas 75219

PRESIDIO EXPLORATION, INC.
5613 DTC Parkway, Suite 800
Englewood, Colorado 80111-3035

ACKMAN RESOURCES, LLC
a Colorado Limited Liability Company

Township 44 North, Range 76 west, 6th P.M.
Section 23: SE^4SW^4
Section 25: N^2SW^4
Section 26: N^2SE^4, E^2NW^4

SURFACE OWNER:

T. CHAIR LAND COMPANY
1024 Brown Road
Gillette, Wyoming 82718

MINERAL OWNERS:
All Minerals excluding Coal, Oil & Gas

POWER RESOURCES, INC.
P.O. Box 1210
Glenrock, Wyoming 82637

Coal

THE UNITED STATES OF AMERICA
Bureau of Land Management
P.O. Box 1828
Cheyenne, Wyoming 82003

Oil & Gas

OWEN MOFFETT AND MARY LOU MOFFETT, Trustees of the Owen Moffett and Mary Lou Moffett Revocable Trust
dated October 3, 1991
1001 South Madison
Webb City, Missouri 64870

BILL G. MCLAUGHLIN &
HAZEL K. MCLAUGHLIN, husband & wife
6567 Hereford Road

Joplin, Missouri 64804

WILLIAM L. SHANER
1730 East Rose Lane
Phoenix, Arizona 85016

KARL REME SHANER AND
JOAN LOUISE SHANER, husband & wife
Route 1, Box 304
Joplin, Missouri 64801

A. ALAN SHANER AND
GERTRUDE E. SHANER, husband & wife
814 Poplar Drive
Sikeston, Missouri 63801

DELORES JEAN VAN ARSDALE
aka DOROTHEA S. VAN ARSDALE
3236 East 28th Street
Tulsa, Oklahoma 74114

PHYLLIS LIGON
1205 Challenger
Austin, Texas 78734

GENE W. SHANER
P.O. Box 8447
Batcliff, Texas 77518

BEVERLY GLOVER
801 Bunker Hill
Houston, Texas 77024

HELEN S. HANKINS
201 Wildwood Court
Loveland, Ohio 45140

SAM RATCLIFF
P.O. Box 2306
Gillette, Wyoming 82717

CONNAGHAN LTD
P.O. Box 566
Cheyenne, Wyoming 82003

JAMES K.HAYS
P.O. Box 3000
Gillette, Wyoming 82717

JOSEPH M. HAYS
204 West Juniper Lane
Gillette, Wyoming 82716

ELLBOGEN PROPERTY MANAGEMENT,
LTD for the benefit of the
John P. Ellbogen Foundation
P.O. Box 1928
Casper, Wyoming 82602

	WILLIAM L. PEASE P.O. Box 3107 Gillette, Wyoming 82716
LEASE OWNERS: (oil & gas) Township 44 North, Range 76 West, 6th P.M. Section 25: N^2SW^4	DEVON ENERGY PRODUCTION COMPANY, L.P. 20 North Broadway Oklahoma City, Oklahoma 73102-8260
	WILLIAMS PRODUCTION RMT COMPANY 1515 Arapahoe Street, Tower 3, Suite 1000 Denver, Colorado 80202
	LANCE OIL AND GAS COMPANY, INC. 12200 North Pecos Street Denver, Colorado 80234
Township 44 North, Range 76 West, 6th P.M. Section 23: SE^4SW^4 Section 26: N^2SE^4, E^2NW^4	DEVON ENERGY CORPORATION (Nevada) 20 North Broadway, Suite 1500 Oklahoma City, Oklahoma 73102
	WILLIAMS PRODUCTION RMT COMPANY 1515 Arapahoe Street, Tower 3, Suite 1000 Denver, Colorado 80202
	LANCE OIL AND GAS COMMPANY, INC. 12200 North Pecos Street Denver, Colorado 80234
	DEVON PRODUCTIONCOMPANY, L.P. 20 North Broadway Oklahoma City, Oklahoma 73102-8260
	ANDARKO PETROLEUM CORPORATION Harris County, Texas
	CONOCO/PHILLIPS COMPANY P.O. Box 2197 Houston, Texas 77252-2197
Township 44 North, Range 75 West, 6th P.M. **Section 7: Lot 17** **Township 44 North, Range 76 West, 6th P.M.** **Section 12: SE^4SW^4, S^2SE^4** **Section 13: N^2NE^4, SE^4NE^4**	
SURFACE OWNER:	T. CHAIR LAND COMPANY 1024 Brown Road Gillette, Wyoming 82718
MINERAL OWNERS: Coal	THE UNITED STATES OF AMERICA Bureau of Land Management P.O. Box 1828 Cheyenne, Wyoming 82003
All Minerals excluding Coal	JOSEPH KIRKPATRICK WARREN AND

RUTH E. WARREN, husband and wife
Joint Tenants
2941 Midvale Avenue
Los Angeles, California 90064

SAM RATCLIFF
P.O. Box 2306
Gillette, Wyoming 82717

CONNAGHAN LTD
P.O. Box 566
Cheyenne, Wyoming 82003-0566

JAMES K. HAYS
P.O. Box 3000
Gillette, Wyoming 82717

JOSEPH M. HAYS
204 West Juniper Lane
Gillette, Wyoming 82716

ELLBOGEN PROPERTY MANAGEMENT,
LTD for the benefit of the
John P. Ellbogen Foundation
P.O. Box 1928
Casper, Wyoming 82602

WILIAM L. PEASE
P.0. Box 3107
Gillette, Wyoming 82716

LYNNE M. BAALMAN
LYNNE M. ROMANCHUK AND MARK E.
BAALMAN, wife and husband
as Joint Tenants
4650 North Flintwood Road
Parker, Colorado 80134

WYOTEX OIL COMPANY
5501 W. Milan Place
Denver, Colorado 80235

JONATHAN S. RODERICK AND CAROL
RODERICK, husband and wife
as Joint Tenants
6154 W. 83rd Way
Arvada, Colorado 80003

U.S. MINERALS, LLC
P.O. Box 3357
Englewood, Colorado 80155

PATSY L. LARSON
P.O. Box 2306
Gillette, Wyoming 82717

LOUIS A. OSWALD III,
Trustee of the Oswald Family Trust
dated April 27, 1998

P.O. Box 36157
Denver, Colorado 80236

MONENERGY EXPLORATION COMPANY
410 17th Street, Suite 2001
Denver, Colorado 80202

LEASE OWNERS:
(oil & gas)
Township 44 North, Range 75 West, 6th P.M.
Section 7: Lot 17
Township 44 North, Range 76 West, 6th P.M.
Section 12: SE^4SW^4, S^2SE^4
Section 13: N^2NE^4, SE^4NE^4

DAKOTA-TEX OIL COMPANY
4545 S. Monaco, Suite 144
Denver, Colorado 80237

PENNACO ENERGY, INC.
5555 San Felipe
Houston, Texas 77056

Township 44 North, Range 75 West, 6th P.M.
Section 7: Lot 17

WILLIAMS PRODUCTION RMT COMPANY
1515 Arapahoe Street, Tower 3, Suite 1000
Denver, Colorado 80202

LANCE OIL & GAS COMPANY
1099 18th Street, Suite 1200
Denver, Colorado 80202

WYOMING RESOURCES CORPORATION
1508 Mountain View Road, Suite 105
Rapid City, South Dakota 57702

LYNNE M. BAALMAN AND MARK E. BAALMAN, wife and husband as
Joint Tenants with right of survivorship
4650 North Flintwood Road
Parker, Colorado 80134

WYOTEX OIL COMPANY
5501 W. Milan Place
Denver, Colorado 80235

JONATHAN S. RODERICK AND CAROL RODERICK, husband and wife
as Joint Tenants
6154 W. 83rd Way
Arvada, Colorado 80003

CONOCO/PHILLIPS COMPANY
P.O. Box 2197
Houston, Texas 77252

XTO ENERGY INC.
810 Houston Street
Fort Worth, Texas 76102

Township 44 North, Range 75 West, 6th P.M.
Section 18: Lot 13

SURFACE OWNER:

T. CHAIR LAND COMPANY
1024 Brown Road
Gillette, Wyoming 82718

MINERAL OWNERS: Coal	THE UNITED STATES OF AMERICA Bureau of Land Management P.O. Box 1828 Cheyenne, Wyoming 82003
All Minerals excluding Coal	CLIFFORD J. DEKKER AND RAMONA D. DEKKER Route 1 Clark, South Dakota 57225
	CLIFFORD J. DEKKER, Executor of the Estate of Edith R. Heiden Route 1 Clark, South Dakota 57225
	ERLENE M. HANSON AND EVERETT D. HANSON, wife and husband Route 1 Clark, South Dakota 57225
	ORVILLE HOFFMAN AND GENEVA HOFFMAN, husband and wife 307 North Smith Street Clark, South Dakota 57225
	DALE HOFFMAN AND KAREN HOFFMAN, husband and wife R.R. 1, Box 19 Clark, South Dakota 57225
	MARLENE FARQUHAR AND JAMES FARQUHAR, wife and husband 5205 West 34th Street Sioux Falls, South Dakota 57106
	NEIL HOFFMAN AND RENAE HOFFMAN, husband and wife 2935 West Wescott Drive Phoenix, Arizona 95027
LEASE OWNERS: (coalbed methane)	CLIFFORD J. DEKKER AND RAMONA D. DEKKER, husband and wife R.R. 1, Box 33 Clark, South Dakota 57225
	ERLENE M. HANSON AND EVERETT D. HANSON, wife and husband R.R. 1, Box 61 Clark, South Dakota 57225
	DALE HOFFMAN AND KAREN HOFFMAN, husband and wife R.R. 1, Box 19 Clark, South Dakota 57225

(oil & gas)

BARRETT RESOURCE CORPORATION
1515 Arapahoe Street, Tower 3, Suite 1000
Denver, Colorado 80202

LANCE OIL AND GAS COMPANY, INC.
12200 North Pecos Street
Denver, Colorado 80234

Township 44 North, Range 75 West, 6th P.M.

Section 19: that part of NW4SE4 lying outside a tract of land Beginning at the common corner of Sections 18 and 19, Township 44 North, Range 75 West, 6th P.M. and Sections 13 and 24, Township 44 North, Range 76 West, 6th P.M., Thence S 80°12' E a distance of 4,341.29 feet to a point on the permit boundary, Thence S 01°45' W a distance of 597 feet to the point of beginning, Thence S 01°45' W a distance of 374 feet to a point, Thence N 88°09' W a distance of 2,838.1 feet to a point, Thence S 72°04' E a distance of 115.6 feet to a point, Thence along the arc of a curve to the right with a starting angle of N 77°37' E, an ending angle of N 17°56' E and a radius of 700 feet, a distance of 692.5 feet to a point, Thence S 17°31' E a distance of 938.9 feet to a point, Thence S 28°55' E a distance of 158.0 feet to a point, Thence S 42°41' E a distance of 219.3 feet to a point, Thence S 60°45' E a distance of 842.3 feet to a point, Thence S 29°15' W a distance of 200.0 feet to a point, Thence N 60°45' W a distance of 842.0 feet to a point, Thence N 50°30' W a distance of 125.8 feet to a point, Thence N 40°08' W a distance of 165.6 feet to a point, Thence along the arc of a curve to the right with a starting angle of S 72°29' W, an ending angle of S 49°44' W and a radius of 600 feet, a distance of 238.3 feet to a point, Thence N 17°31' W a distance of 943.0 feet to a point, Thence along the arc of a curve to the left with a starting angle of N 75°00' E, an ending angle of N 17°56' E and a radius of 500 feet, a distance of 498.1 feet to a point, Thence N 72°04' W a distance of 2,247.2 feet to a point, Thence along the arc of a curve to the right with a starting angle of S 55°20' W, an ending angle of S 15°47' W and a radius of 700 feet, a distance of 483.3 feet to a point, Thence N 89°28' E a distance of 86.1 feet to a point, Thence N 00°32' W a distance of 600 feet to a point, Thence S 88°05' E a distance of 1,275.0 feet to a point, Thence S 01°51' E a distance of 600 feet to a point, Thence S 88°09' E a distance of 2,999.4 feet to the point of beginning.

SURFACE OWNER:

T. CHAIR LAND COMPANY
1024 Brown Road
Gillette, Wyoming 82718

MINERAL OWNER:
All Minerals including Coal, Oil & Gas

STATE OF WYOMING
Office of State Lands & Investments
122 West 25th Street
Cheyenne, Wyoming 82002

LEASE OWNER
(oil & gas)

CH4 ENERGY, LLC
2813 S. Hulen S-225
Fort Worth, Texas 76109

Township 44 North, Range 76 West, 6th P.M.

Section 11: **that part of the SE^4SE^4 lying west of a line which extends diagonally from a point which is 850 feet west of the southeast corner of said section 11 to the northwest corner of the SE^4SE^4 of said section 11.**

Section 13: **that part of the SW^4NW^4 and NW^4SW^4 of section 13 and SE^4NE^4, NE^4SE^4 and SW^4SE^4 of section 14 which lies west of a line beginning at a point 850 feet west of the northeast corner of said section 14, thence South 500 feet, thence S 26°50' E 1,883 feet, thence S 58°33' E 498 feet, thence S 45°00' W 283 feet, thence South 1000 feet, thence S 66°30' W 627 feet, thence N 66°15' W 584 feet, thence S 24°50' W 373 feet, thence S 2°30' W 752 feet, thence S 58°20' W to a point on the south line of said section 14 which is 586 feet from the southeast corner of the SW^4SE^4 of said section 14**

Section 14: **N^2NE^4, SW^4NE^4, NW^4SE^4**

Section 23: **NE^4NW^4, that part of the SE^4NW^4 lying north and west of a fence line beginning at the southwest corner of the SE^4NW^4 of said section 23, thence N 43°55" E to a point of the north boundary of the SE^4NW^4 of said section 23 which point is 49 feet west of the northeast corner of the SE^4NW^4 of said section 23.**

SURFACE OWNER:

JOHN O. CHRISTENSEN
932 Black & Yellow Road
Gillette, Wyoming 82716

MINERAL OWNER:
All Minerals including Coal, Oil & Gas

THE UNITED STATES OF AMERICA
Bureau of Land Management
P.O. Box 1828
Cheyenne, Wyoming 82003

LEASE OWNER
(oil & gas)

Township 44 North, Range 76 West, 6th P.M.

Section 23: NE^4NW^4, that part of the SE^4NW^4 lying north and west of a fence line beginning at the southwest corner of the SE^4NW^4 of said section 23, thence N 43°55' E to a point on the north boundary line of theSE^4NW^4 of said section 23 which point is 49 feet west of the northeast corner of the SE^4NW^4 of said section 23.

WYOMING RESOUCES CORPORATION
1508 Mountain View Road
Rapid City, South Dakota 57702

PENDRAGON RESOURCES, II, LP
621 17th Street, Suite 750
Denver, Colorado 80293

NPC, INC.
550 North 31st Street, Suite 500
Billings, Montana 59101

Township 44 North, Range 76 West, 6th P.M.

Section 13: that part of the NW^4SW^4 of section 13 and the SE^4NE^4 of section 14 which lies west of a line beginning at a point 850 feet west of the northeast corner of said section 14, thence South 500 feet, thence S 26°50' E 1,883 feet, thence S 58°33' E 498 feet, thence S 45°00'

GULF COAST OIL & GAS COMPANY
P.O. Box 1684
Midland, Texas 79702

W 283 feet, thence South 1000 feet, thence S 66º30' W 627 feet, thence N 66º15' W 584 feet, thence S 24º50' W 373 feet, thence S 2º30' W 752 feet, thence S 58º20' W to a point on the south line of said section 14 which is 586 feet from the southeast corner of the SW^4SE^4 of said section 14

Section 14: N^2NE^4, SW^4NE^4

Township 44 North, Range 76 West, 6th P.M.
Section 11: that part of SE^4SE^4 lying west of a line which extends diagonally from a point which is 850 feet west of the southeast corner of said section 11 to the northwest corner of the SE^4SE^4 of said section 11.

LANCE OIL & GAS COMPANY, INC.
1099 18th Street
Suite 1200
Denver, Colorado 80202

WILLIAMS PRODUCTION RMT COMPANY
1515 Arapahoe Street
Tower 3, Suite 1000
Denver, Colorado 80202

Township 44 North, Range 76 West, 6th P.M.
Section 14: NW^4SE^4, that part of NE^4SE^4 and SW^4SE^4 lying west of a line beginning at a point 850 feet west of the northeast corner of said section 14, thence South 500 feet, thence S 26º50' E 1,883 feet, thence S 58º33' E 498 feet, thence S 45º00' W 283 feet, thence South 1000 feet, thence S 66º30' W 627 feet, thence N 66º15' W 584 feet, thence S 24º50' W 373 feet, thence S 2º30' W 752 feet, thence S 58º20' W to a point on the south line of said section 14 which is 586 feet from the southeast corner of the SW^4SE^4 of said section 14

LANCE OIL & GAS COMPANY, INC.
1099 18th Street
Suite 1200
Denver, Colorado 80202

WILLIAMS PRODUCTION RMT COMPANY
1515 Arapahoe Street
Tower 3, Suite 1000
Denver, Colorado 80202

ABO PETROLEUM CORPORATION
105 South 4th Street
Artesia, New Mexico 88210-2123

YATES DRILLING COMPANY
105 South 4th Street
Artesia, New Mexico 88210-2123

SHARBRO OIL LTD. CO.
105 South 4th Street
Artesia, New Mexico 88210-2123

MYCO INDUSTRIES, INC.
105 South 4th Street
Artesia, New Mexico 88210-2123

YATES PETROLEUM CORPORATION
105 South 4th Street
Artesia, New Mexico 88210-2123

Township 44 North, Range 76 West, 6th P.M.
Section 13: that part of SW^4NW^4 lying west of a line beginning at a point 850 feet west of the northeast corner of said section 14, thence South 500 feet, thence S 26º50' E 1,883 feet, thence S 58º33' E 498 feet, thence S 45º00' W 283 feet, thence South 1000 feet, thence S 66º30' W 627 feet, thence N 66º15' W 584 feet, thence S 24º50' W 373 feet, thence S 2º30' W 752 feet, thence S 58º20' W

CONOCO PHILLIPS COMPANY
P.O. Box 2197
Houston, Texas 77252

to a point on the south line of said section 14 which is 586 feet from the southeast corner of the SW^4SE^4 of said section 14

Township 44 North, Range 76 West, 6th P.M.
Section 36: N^2N^2

SURFACE OWNER:	STATE OF WYOMING Office of State Lands & Investments 122 West 25th Street Cheyenne, Wyoming 82002
MINERAL OWNER: All Minerals including Coal, Oil & Gas	STATE OF WYOMING Office of State Lands & Investments 122 West 25th Street Cheyenne, Wyoming 82002
LEASE OWNER (oil & gas)	WYOMING RESOUCES CORPORATION 1508 Mountain View Road Rapid City, South Dakota 57702 PENDRAGON RESOURCES, II, LP 621 17th Street, Suite 750 Denver, Colorado 80293

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.

RIGHT TO MINE

Beginning at the common corner of Section 18 and 19, Township 44 North, Range 75 West and Sections 13 and 24, Township 44 North, Range 76 West, Thence S 80º12' E a distance of 4,341.29 feet to a point on the permit boundary, the point of beginning, Thence S 01º45' W a distance of 597.0 feet to a point, Thence N 88º09' W a distance of 2,999.4 feet to a point, Thence N 01º51' E a distance of 600.0 feet to a point, Thence N 88º05' W a distance of 1,275.0 feet to a point, Thence S 00º32' E a distance of 600 feet to a point, Thence S 89º28' W a distance of 1,500.0 feet to a point, Thence S 00º32' E a distance of 3,000.0 feet to a point, Thence S 89º28' W a distance of 1,165.52 feet to a point, Thence S 00º10' E a distance of 3,636.27 feet to a point, Thence S 89º50' W a distance of 1,506.0 feet to a point, Thence N 00º10' W a distance of 1,500.0 feet to a point, Thence S 89º50' W a distance of 600.0 feet to a point, Thence N 00º10' W a distance of 1,490.0 feet to a point, Thence S 89º50' W a distance of 600.0 feet to a point, Thence N 00º10' W a distance of 4,479.0 feet to a point, Thence N 89º50' E a distance of 600.0 feet to a point, Thence N 00º10' W a distance of 1,500.0 feet to a point, Thence N 89º50' E a distance of 1,200.0 feet to a point, Thence S 00º10' E a distance of 1,500.0 feet to a point, Thence N 89º50' E a distance of 546.98 feet to a point, Thence N 0º32' W a distance of 3,365.06 feet to a point, Thence N 89º28' E a distance of 1,500.0 feet to a point, Thence S 00º32' E a distance of 600.0 feet to a point, Thence N 89º28' E a distance of 1,500.0 feet to a point, Thence S 00º32' E a distance of 1,202.88 feet to a point, Thence S 88º09' E a distance of 2,849.32 feet to a point, Thence S 01º51' W a distance of 1,200.0 feet to a point, Thence S 88º09' E a distance of 1,500.0 feet to a point, Thence S 01º51' W a distance of 600.0 feet to the point of beginning.

COUNTY of Campbell _____ Subtotal Above Acres 964.63

Municipal Corporation _____ Total Permit (Amendment) Acres 1,036.86

_____	_____	_____	_____
Reviewed (compiled), DEQ/LQD	Date	Applicant Signature	Date

_____ _____ Permit No. _____

Checked, DEQ/LQD Date

TFN _____

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.

NO RIGHT TO MINE

Beginning at the common corner of Sections 18 and 19, Township 44 North, Range 75 West, 6th P.M. and Sections 13 and 24, Township 44 North, Range 76 West, 6th P.M., Thence S 80º12' E a distance of 4,341.29 feet to a point on the permit boundary, Thence S 01º45' W a distance of 597 feet to the point of beginning, Thence S 01º45' W a distance of 374 feet to a point, Thence N 88º09' W a distance of 2,838.1 feet to a point, Thence S 72º04' E a distance of 115.6 feet to a point, Thence along the arc of a curve to the right with a starting angle of N 77º37' E, an ending angle of N 17º56' E and a radius of 700 feet, a distance of 692.5 feet to a point, Thence S 17º31' E a distance of 938.9 feet to a point, Thence S 28º55' E a distance of 158.0 feet to a point, Thence S 42º41' E a distance of 219.3 feet to a point, Thence S 60º45' E a distance of 842.3 feet to a point, Thence S 29º15' W a distance of 200.0 feet to a point, Thence N 60º45' W a distance of 842.0 feet to a point, Thence N 50º30' W a distance of 125.8 feet to a point, Thence N 40º08' W a distance of 165.6 feet to a point, Thence along the arc of a curve to the right with a starting angle of S 72º29' W, an ending angle of S 49º44' W and a radius of 600 feet, a distance of 238.3 feet to a point, Thence N 17º31' W a distance of 943.0 feet to a point, Thence along the arc of a curve to the left with a starting angle of N 75º00' E, an ending angle of N 17º56' E and a radius of 500 feet, a distance of 498.1 feet to a point, Thence N 72º04' W a distance of 2,247.2 feet to a point, Thencealong the arc of a curve to the right with a starting angle of S 55º20' W, an ending angle of S 15º47' W and a radius of 700 feet, a distance of 483.3 feet to a point, Thence N 89º28' E a distance of 86.1 feet to a point, Thence N 00º32' W a distance of 600 feet to a point, Thence S 88º05' E a distance of 1,275.0 feet to a point, Thence S 01º51' E a distance of 600 feet to a point, Thence S 88º09' E a distance of 2,999.4 feet to the point of beginning.

COUNTY of Campbell _____ Subtotal Above Acres 72.23

Municipal Corporation _____ Total Permit (Amendment) Acres 1,036.86

Reviewed (compiled), DEQ/LQD	Date	Applicant Signature	Date
Checked, DEQ/LQD	Date		

Permit No. _____

TFN _____

5. APPENDIX "D-l", LAND USE AND DEMOGRAPHY

5.1 LAND RESOURCES

Cattle and sheep ranching is the major land use in the region surrounding the proposed project site. About 94% of the land in the Powder River Basin is classified as rangeland. Native rangeland vegetation provides the majority of the livestock forage in the region. Major native forage species are blue grama grass (Bouteloua gracilis), western wheatgrass (Asropvron smithii), needlegrasses (Stioa slm.), prairie junegrass (Koeleria cristata), and numerous forbs.

The extraction of energy related minerals is the major industrial land use in the Powder River Basin. The production of coal, uranium, oil and gas have been factors in the economy of the area. The closest coal mining operation to the project area is the Jacobs Ranch coal mine located approximately 32 miles east. Relative to uranium mining, there are no open pit or underground operations in the area. Although, Malapai Resources does have a producing in situ uranium mine located approximately nine miles northwest of the project area. There are no other types of mining operations in the North Butte area.

Oil and gas exploration and development within the North Butte area has been on a steady increase since 1976 with the discovery of the Hartzog Draw field. This field, with 161 wells, is approximately twenty miles long and four miles wide with a northwest-southeast trend. The North Butte project lies about in the middle of the field on the southwestern edge.

The North Butte site and the surrounding area is composed of predominantly private land, although there are parcels of state, and federal (BLM) owned land. Even with federal ownership of land within the area, recreational use is very limited. Landowners control access to the federal and state parcels of land and therefore limit access for recreational purposes. Hunting of antelope and mule deer are permitted by landowners consent only.

Sage grouse are also hunted to a very limited extent. Fishing activity within the area is nonexistent as there are no lakes, streams, or rivers that provide adequate habitat.

5.2 DEMOGRAPHY

The proposed project is located in the southwest corner of Campbell County. Campbell County covers 3,043,840 acres (4,756 square miles) and is ranked seventh in size within Wyoming. Ownership within the county is 13% Federal (396,689 acres), 8.4% state and local (256,440 acres) and 78.5% private (2,390,711' acres). The population of the county according to 1980 census was 24,367. There are a total of 251 acres of irrigated land, 91,098 acres of dry land farming and 2,031,733 acres of range land. The total number of farmsteads is 1,962. Campbell County has one school district with 22 school enrollment during the 1985-86 school year was 8,143 students and a daily average attendance of 7,564.

Figure 1.1 provides a generalized map of the area surrounding the North Butte project. Table 5.1 provides information on ranches that are located within the immediate area of the project.

TABLE 5.1
Ranches Within Project Area

Ranch	Direction	Distance
Pfister Ranch	SSE	1.2 miles
Jack Christensen	W	3.5 miles
Pumpkin Butte Ranch	SE	4.3 miles
Schlautaaann Ranch	NE	4.4 miles
Ruby Ranch	ESE	6.0 miles
Gilberts Ranch	NEE	6.1 miles
Bud Christensen	N	6.6 miles
Cainblin Ranch	ESE	6.7 miles
John Groves	NE	7.2 miles

An examination of towns within the Powder River Basin and their location from the North Butte project is presented in Table 5.2.

TABLE 5.2			
Towns Within the Powder River Basin			
Town	Direction	Distance	Population*
Edgerton	SW	30.4 miles	259
Gillette	NE	40.8 miles	12,234
Kaycee	W	36.0 miles	271
Linch	SW	18.4 miles	200
Midwest	SW	31.2 miles	638
Savageton	NE	8.8 miles	9
Sussex	SW	18.4 miles	4
Wright	E	22.0 miles	1700

*Population from 1980 census or latest estimate.

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6. APPENDIX 'D-2", BRIEF HISTORY OF THE AREA

6.1 PROJECT BACKGROUND

The proposed North Butte in situ uranium mine property is located in southwest Campbell County about 42 air miles southwest of Gillette. A general location map and a USGS quadrangle map identifying the North Butte 1039 acre permit area are presented in Figure 1.1 (Page 1-3) and Figure 6.1 (Volume II) respectively. A legal description of the permit area is presented in Section 4 (Appendix "C"). The permit area occupies portions of T44N, R75W and T44N, R76W, Campbell County, Wyoming and is situated on the southeast flank of North Pumpkin Butte. The topography of the North Butte permit area consists of rolling upland terrain dissected by numerous erosional drainages which discharge to Willow Creek, an ephemeral stream that cuts through the southern tip of the permit boundary.

The surface ownership of the entire permit area is private (see Section 2.) and is used for livestock grazing. Part of the surface is owned by the T Chair Livestock Company and the remainder is owned by Power Resource, Inc. The uranium mineral underlying the permit area, except for approximately 36 acres of the incidental boundary revision lands added to the permit area in 1992, was patented by the Cleveland-Cliffs Iron Company and is now owned by PRI. In the late 1970's Cleveland-Cliffs owned the uranium
mineral within the permit area and planned to start an underground mine at the North Butte property. Cleveland-Cliffs performed environmental and cultural studies at the site, and submitted a permit to mine application to the Department of Environmental Quality for an underground mine. The application was subsequently withdrawn.

Pathfinder plans to mine the North Butte ore body using in situ solution mining techniques and as such surface disturbances will be minimal. 4WhfhkWr is not aware of any man made structures within the permit area other than several water wells, environmental monitoring stations and a trailer house. No old cabins or other evidence of earlier occupation of the land is visible on the surface and there are no known or marked historical sites located within the permit area. As discussed in Archaeological section of this application (Appendix "D-3"), if subsurface cultural remains are found during construction activities the appropriate state and federal agencies will be contacted.

The following discussion of the history of the Pumpkin Buttes reveals that the Buttes have been used as landmarks for travelers and land occupants for centuries; however, no official historical designation has been placed on these geologic features by the State or federal government although the Pumpkin Buttes has been under consideration as a National Natural Landmark for some time. PRI planned solution mining activities in Campbell County will not impact the continued use of the Pumpkin Buttes in general and North Butte, in particular, as a regional landmark.

6.2 HISTORICAL LITERATURE SURVEY

In 1980 the Cleveland-Cliffs Iron Company commissioned a historical literature survey of the Pumpkin Buttes area in connection with the permitting of their planned underground uranium mine. The study was performed for Cleveland-Cliffs by Sande Oliver and Bill Bryans. The following is a summary of their historical survey.

6.2.1 PREHISTORY

The Pumpkin Buttes area in general was the scene of various Indian activities. Local residents have found many barricades and relics on top of the Buttes indicating that the area was once the site of intertribal warfare. Evidence also exists that several Indian camps were in the area. The Buttes made and ideal spot from which the Indians first watched for the dark herds of buffalo and later the movement of troops and wagons along the Bozeman Trail.

It appears from historical records that the Indians contributed to the naming of the Buttes. The Sioux called them "Wa-ga-mu Pa-ha", commonly translated as "Gourd Hill". Speculation on the origin of this name varies. Some think the name refers to a gourd growing on the Buttes, while others associate the name with an Indian dance ceremony in which gourd rattles were used. Exactly how the Gourd Hill designation became Pumpkin Buttes remains unclear. Since gourds and pumpkins are somewhat alike, perhaps an error in translating the Sioux language occurred.

PRI personnel, as well as others, think the name "Pumpkin Buttes" may have come from the blocks of weathered Wasatch sandstones in the area that are almost perfectly rounded. They vary in size from about 0.3 meters to 1.5 meters. Level areas at the toes of the Butte slopes are sometimes covered with hundreds of these objects which look somewhat like pumpkins from a distance.

The results of field work to locate and investigate prehistoric sites within the proposed permit area is contained in Section 7 (Appendix "D-3") of this permit to mine application.

6.2.2 EARLY EURO-AMERICAN EXPLORATION: 1851-1863

The Pumpkin Buttes region has stood much like an isolated island in the earliest history of Euro-Americans in Wyoming. In 1811, Wilson Price Hunt led a party of Astorians bound for the Pacific Northwest across present-day Campbell County. However, the Astorians passed well to the north of the Buttes. The mountain men and fur traders trapping in the Powder River Basin undoubtedly passed through or near the,. area, but apparently no written record of their doing so exists. From 1840 to the outbreak of the Civil War, and estimated 250,000 migrants traveled to Oregon and California along the North Platte-Sweetwater corridor, located over 60 miles south of the Buttes. Thus, only a few Euro-Americans came into the study area and recorded their impressions of it prior to the establishment of the Bozeman Trail in 1864.

One of the first Euro-Americans known to have passed through the area was the Jesuit missionary, Father Pierre De Smet. De Smet first entered the Oregon missionary in 1840 and in July of that year celebrated the first mass in what is now Wyoming near present day Daniel (Sublette County). In 1841, he established the Jesuit Mission of St. Mary's in the Bitterroot Valley. For about ten years De Smet intermittently traveled in Wyoming, Idaho, Oregon, Washington and portions of the Dakotas missionizing the various Indian tribes. At the urging of

the Indian Superintendent D.D. Mitchell, De Smet participated in the famous peace council that resulted in the Treaty of Fort Laramie of 1851. The Jesuit missionary left his station at Fort Union, located at the mouth of the Yellowstone River, on August 17, 1851. Delegates from the Crow and Assinboin nations accompanied him. On August 27th the party reached the Powder River. De Smet recorded in his diary" "The Valley of the Powder River, in the neighborhood of the Gourd Buttes, which are in sight, is three to four miles wide". De Smet's diary entry appears to be the first Euro-American written reference to the Pumpkin Buttes and indicates that the Buttes served as a prominent landmark. Given his long association with the Indians it is not surprising that he referred to the Buttes as the "Gourd Buttes".

6.2.3 THE SCIENTIFIC FRONTIER: 1855-1870

Until 1856, no scientific expedition took note of the Pumpkin Buttes area. In that year Lieutenant Gouveneur Kemble Warren, an officer in the United States Army Corps of Topographical Engineers, passed by the area and advised his superiors in Washington D.C. that the area deserved some attention.

Lieutenant Gouveneur Warren's primary purpose, as set down in 1855, was to help better define the Dakota Territory. The government also hoped to establish a transportation network through the Sioux country over which troops and supplies could be carried. In 1855, Warren's unit took part in the Battle of Blue Water Creek. Following this confrontation, it was believed that the scientific aspect of the expedition could begin. Thus, in 1856, Warren proceeded to hire civilian experts for his party. Ferdinand V. Hayden was among those recruited by Warren. Hayden's field research in the Dakotas from 1853 to 1855 had already distinguished him as the prominent expert on geology and paleontology in the area.

Warren's route in 1856 took the party to the Yellowstone and Powder River country. During the expedition's second year, separate groups broke off for field studies. On one of these forays, Hayden and a detachment caught sight, of the Pumpkin Buttes. The group did not investigate the area, but they were so struck by the Buttes that they persuaded Warren to include a note on his map urging future expeditions to investigate the area. This appears to be the first time that the Pumpkin Buttes area was alluded to on any scientific map.

The significance of Warren's suggestion is borne out by the effect it had on the Army Corps' succeeding expedition. In 1859, Captain William F. Raynolds commanded an expedition which followed the Belle Fourche, Yellowstone and Big Horn Rivers. Mindful of Warren's report and map, Raynolds also recruited the services of Ferdinand Hayden. As the party's topographer, Raynolds chose J. Hudson Snowdert The famous mountain man Jim Bridger, whose tales of the Yellowstone country were already evoking great interest, served as their chief guide. Bridger almost certainly knew the study area well, and since it interested both Raynolds and Hayden, the Pumpkin Buttes area was included in their itinerary. Raynold's official report to the Secretary of War, published after the Civil War, and Hayden's own study both featured accounts of the Buttes area and with detailed descriptions. Raynold's topographical map also scientifically delineated the area for the first time.

The scientific frontier played an important role in the development of the Pumpkin Buttes country. The information and description provided by Warren, Raynolds, and Hayden laid the foundation for future knowledge of the study area's vegetation, topography, and geology. Thus, the efforts of these early scientists-explorers also contributed to the area's subsequent emergence as a cattle ranching region and its importance as a site of uranium deposits. In addition to its scholarly achievements, the scientific frontier also gave rise to some of the area's most intriguing folklore.

6.2.4 THE MILITARY FRONTIER AND THE BOZEMAN TRAIL: 1863-1877

In the early 1860s, several gold strikes in present-day Montana excited the American public's imagination. Isaac I. Stevens' Northern Pacific Railroad Survey of 1853 first reported the existence of gold in the region, and by 1964 Virginia City and Helena had been established. The growth and development of the region associated with gold mining prompted Congress to create Montana Territory on May 26, 1864.

John Bozeman, one of the territory's earlier settlers, became interested in locating a cross-country road to the eastern states. Bozeman desired a road that would shorten the distance that had to be traveled by the old trails in order to reach the Montana gold fields. Previous miners had reached the diggings by one of two routes. They traveled either up the Missouri River by way of Fort Benton, or overland along the Oregon Trail to Fort Hall and then back into Montana. Disgusted by these roundabout routes, Bozeman left the mining camp of Bannack in the winter of 1862-1863 determined to find a shorter route.

The Bozeman Trail, Bozeman cutoff, or Montana Road (it is referred to by all these names) shortened the route to the rich gold fields by about 400 miles. The new route left the Oregon Trail northwest of Fort Laramie near present-day Douglas, Wyoming. The road continued northwest, skirting the eastern base of the Big Horn Mountains, then along the Yellowstone River Valley to the mines. John Bozeman guided the first wagon train along this route in 1864. At the same time, Jim Bridger--the old trapper, mountain man, and guide--led a train to Montana by a different route on the west side of the Big Horns. Bridger declared that Bozeman's route was "impractical." Bridger, traveling along his rival road with several weeks' head start, reached the Yellowstone Valley only slightly ahead of Bozeman. Clearly, Bozeman's road seemed to be the quickest route to Montana. It satisfied the public's demand for a more direct route to Montana, but by passing through the Sioux Indians' sacred Powder River country, the Bozeman Trail touched off four years of warfare.

The Bozeman Trail passed several miles southwest of the Pumpkin Buttes region. Until the trail's abandonment in 1868, the four distinct Pumpkin Buttes became an established landmark to Bozeman Trail travelers. In a relatively flat prairie region, the Buttes indicated to travelers approximate distances between Fort Laramie and the Powder River, as well as scores of other prominent destinations. Lewis H. Smith, an engineer who accompanied Colonel J. A. Sawyer's Wagon Road Expedition in 1865, even published a table listing the mileage from the Buttes to other important landmarks enroute to Montana.

The Buttes were the site of extensive activity during the brief life of the Bozeman Trail. Indian raiders frequently used their cover as a hiding place from which to surprise passing wagon trains. Indians often retreated back to the safety of the Buttes area after attacking trains. Evidence also exists that emigrants sought the Pumpkin Buttes as cover from Indian raiders. A stone fortress at the top of Middle Butte is believed to date back to the Bozeman Trail days. In one documented incident, Whites at this fortress sent smoke signals to Fort Reno where the soldiers, upon observing the message, rushed to the aid of the besieged emigrants. The existence of rifle pits in the area further indicates that emigrants used the Buttes for defensive measures. Certainly, emigrant, soldier, and Indian alike sought the Buttes in order to gain a tactical advantage in combat situations.

By 1865 the federal government became interested in a direct route to the Montana gold fields. After four years of Civil War, the United States Treasury was virtually bankrupt, and the government hoped to bolster the Treasury by inducing more prospectors to make the trip to Montana. Thus, the government financed a survey of a direct route from Sioux City, Iowa to Montana via the Niobrara River. Colonel James A. Sawyer led this expedition which included engineers and prospectors. In addition, the party was escorted by two companies of former Confederate soldiers who had sworn oaths of allegiance in exchange for release from military prisons.

Closely associated with the Sawyer Survey was Brigadier General Patrick E. Connor's Powder River Expedition. This expedition was prompted by the demands of civil and military leaders that the government punish the hostile Indians who had been raiding freely across the plains in retaliation for the 1864 Sand Creek Massacre. The Powder River Expedition, an elaborate plan on paper, subscribed to the philosophy that only an effective show of force could ensure open lines of American travel and communication to Montana.

Both the Sawyer and the Connor expeditions experienced tremendous difficulty with the Indians who were upset not only because of Sand Creek, but also because of the huge influx of emigrants passing through their Powder River hunting grounds. Connor's Expedition failed to meet its objectives due to a variety of reasons: a late start; slowness in obtaining supplies, inadequate

guides; and, clever tactics by the Indians. Two of Connor's three columns suffered severely from Indian raids, losing many horses and rations to the Natives. Connor's own column managed to destroy an Arapaho village and established a fort on the Powder River, approximately thirty miles northwest of Pumpkin Buttes. First known as Camp Connor, this post later became Fort Reno.

The Powder River campaign afforded several participants the opportunity to make firsthand observations of the Pumpkin Buttes. As Connor's column marched from Fort Laramie, Captain H. E. Palmer, a member of the expedition, described the Pumpkin Buttes region:

> In front, and a little to the northeast could be seen the four columns of the Pumpkin Buttes, and fifty miles further east, Bear Butte, and beyond, a faint outline of the Black Hills. The atmosphere was so wonderfully clear and bright that one could imagine that he could see the eagles on the crags of Pumpkin Buttes, full forty miles away.

Several days before reaching the sight where General Conner ordered the construction of his post, Captain Rockafellow, while searching for water, offered another contemporary description of the Buttes: "Pon Keen (Pumpkin) Buttes are four mountains which lay north and south, are level apparently and the same height. Elevations above plains more than two hundred feet." These observations strongly indicate that the Buttes were the dominant landmark on the Bozeman Trail before the Big Horn Mountains and could be seen from vast distances.

The Pumpkin Buttes segment of the trail appeared to be one of the most uncomfortable stretches of the Montana Road. Both the Connor and Sawyer Expeditions of 1865 had trouble finding water in the region. Captain Sawyer remarked that his expedition never had to leave the "track" for grass or water except at Pumpkin Buttes, "where there is good grass, but no water to be relied on for thirty miles." Engineer Lewis H. Smith of the Sawyer party later complained: "On the whole route (the Bozeman Road) there is only one spot where there is not running water within short distance--the break is only thirty miles in length, and occurs at Pumpkin Butte, the place where the Bozeman trail unites with the new line. Water can be had for the trouble of sinking, even there."

One of the most historically significant events in the annals of the Pumpkin Buttes region occurred when Sawyer's column was attacked by Sioux and Cheyenne warriors. Sawyer's expedition had traveled up the North Fork of the Cheyenne River and crossed to the Belle Fourche which they followed upstream toward Pumpkin Buttes. Near Beaver Creek's junction with the Cheyenne River, Sawyer noted the discovery of wagon ruts supposedly made by W. F. Raynold's Topographic Corps expedition which passed through the Pumpkin Buttes region in 1859. After attempting to skirt the north side of the Buttes and finding that badlands country unbearable because of a lack of water, Sawyer turned his expedition south hoping to find a gap between the Buttes or to travel southwest of them to the Bozeman Trail. Nat Hedges, a member of the expedition was killed on August 13th while scouting for water only a mile from the expedition's camp on the east side of the Buttes. Two days later, the Sioux and Cheyenne attacked at sunrise. Sawyers reported that:

> "the bluffs around at sunrise were covered with Indians to the number of 500 to 600, and fighting was commenced by their charging down over the plains and shooting into the corral; each charge was repulsed, however, and at about noon they called for peace."

Two other sources report that the Indians kept Sawyer pent-up for three to four days. George Bird Grinnell stated that "several thousand" Indians attacked Sawyer. Albert M. Holman, a teamster with the expedition, later recalled that the fight lasted intermittently for three days. The Indians finally agreed to halt all hostilities if the Whites would provide them with a wagonload of flour, sugar, coffee, and tobacco. Holman speculated that the large number of dead Indian ponies later found in nearby gullies indicated a high amount of Indian casualties. Weasel Bear, a Cheyenne present at the fight remembered that two wagon loads of provisions were captured from Sawyer's contingent. He also asserted that "(We) would have wiped out the whole outfit if General Connor had not come up with his artillery..." Holman's account of the incident verified Weasel Bear's assertion. Holman stated that the Indians became disposed toward peace when they noticed soldiers traveling rapidly toward the Buttes from the direction of Fort Connor.

Several soldiers agree that the famous Oglala Sioux chieftain Red Cloud played a leading role in the harassment of Sawyer's command. One Indian source relates that the Cheyennes at the battle were led by Dull Knife, the noted war chief who from 1876 to 1878 caused a great deal of trouble for the United States Cavalry. Stanley Vestal, who did extensive research among the Sioux, contends that the Indians' motivation for the hostilities of 1865 stemmed from a belief that the Whites had broken previous treaty agreements by marching into the Powder River area.

While Sawyer's besieged group nervously waited on the east side of the pumpkin Buttes, the expedition's scouts searched the countryside for an acceptable path leading through to the Bozeman Trail. Ultimately, one was discovered, and the party crossed between the Pumpkin Buttes. Eventually, they reached the Bozeman Road at the Dry Fork of the Powder River. On October 12, 1865, the Sawyer Expedition finally reached Virginia City.

Sawyer's road never developed into an important route for either emigrants or freighting. The inhospitable terrain and determined Indian resistance partially account for this. In addition, the Sawyer or Niobrara Road proved to be no better than the Platte River route which paralleled it to the south. The building of the union Pacific Railroad across the plains in 1866 and 1867 further undermined the importance of Sawyer's road.

After the negligible results of Connor's 1865 military expedition, the government looked toward 1866 with hopes that the Powder River Sioux would come into Fort Laramie and make peace. Simultaneously, the War Department, responding to travelers' pleas for better protection along the Bozeman Road to Montana, sent Colonel Henry Beebe Carrington and the 2nd Battalion, 18th U.S. Infantry to the Powder River region to construct military posts for the protection of the Montana bound pioneers.

A peace parley began at Fort Laramie in June 1866. While these important negotiations were underway, Carrington's command passed by Laramie on their way to the Bozeman Trail. This angered many of the Sioux who would only consent to a treaty providing for the abandonment of the Montana Road by the Whites. Yet, in complete disregard to the temper of Indians but in obedience to his orders, Carrington continued northward to bolster the command at Fort Reno (formerly Camp Connor). Carrington was also to construct two new posts in the Powder River region. Upon seeing Carrington continue northward, several of the most noted patriotic chiefs, including Red Cloud, broke off treaty negotiations and vowed to resist all Whites passing through the sacred Big Horn country. Despite all the difficulties, a treaty was finally negotiated at Fort Laramie, but the chiefs who signed it were neither a very impressive nor an influential lot. They were mainly "friendlies" or "Laramie loafers;" chiefs not representative of their whole tribe who were motivated by their desire for White man's goods rather than tribal patriotism.

Nine days out of Fort Laramie the Carrington party sighted "a little to the northeast ...the four columns of Pumpkin Buttes." Margaret Carrington, Colonel Carrington's wife described them thus: "These buttes are landmarks for the travelers from all directions, and (are) nearly seven hundred feet high." Later that same year another military traveler attested to the Buttes' prominence as a landmark. Private A.A. Ostrander, marching from Fort Laramie to Fort Reno, asked the company scout about landmarks in the region. Ostrander later recalled the scout's response to his query.

> "Them's the Big Horn Mountains, ' the guide explained. 'When we get a little farther along you can see the top of Cloud Peak, but that's way up beyond (Fort) Phil Kearney.' Away off to the east were some high buttes, and I wondered if they were the same ones I had seen back on the trail. "Them's Pumpkin Buttes," he told me. "You'll be seeing them all the time you stay at Reno."'

While Carrington's troops rested at Fort Reno, Indians stampeded the fort's herd of stock on July 4, 1866. A company of cavalry was immediately dispatched to punish the raiders and recapture the herd. The soldiers chased the herd all night before finally overtaking it at Pumpkin Buttes, about thirty miles from the post. Another contradictory account of this incident recalls that the herd was stampeded not because of Indians but because of a hail storm. Yet another source indicates that the Indians, after running off the stock, led the troops into the Pumpkin Buttes area where they effectively lost the pursuing cavalrymen. In any event, the stock was returned the next evening. According to one eyewitness, the stampeded herd incident could have been much more serious. Private William Murphy believed that had the Indians captured the stock, Forts Phil Kearney and C. F. Smith might never have been built.

Carrington's troops continued their march deep into Indian Territory. On July 16, 1866 the troops formally marked the dimensions for Fort Phil Kearney. After doing so, in William Murphy's words, "hardly a day passed at Fort Phil Kearney, up to December 21, 1866--the day of the (Fetterman) massacre--that we did not see Indians, and others at Fort Reno and Fort C.F. Smith had about the same experience." While at Fort Phil Kearney, Margaret Carrington described the view from the foothills west of the Fort.

> "In the northwest is the beautiful valley of the Tongue River and its tributaries, with the Panther Mountains beyond. Westward, the Big Horn Mountain range continues its cragged front, past Piney Summit and Rocky Face Ridge, until lost to view. Eastward, the Black Hills, beyond Reno, and Pumpkin Buttes, loom up at a distance of a hundred miles..."

Mrs. Carrington's description further indicates that the Buttes served as one of the most significant and prominent landmarks in the Powder River country.

In December 1866, Indians attacked a wood train near Fort Phil Kearney. A relief party led by Captain W. F. Fetterman pursued the Indians into the wilderness and was ambushed. All eighty-two members of Fetterman's party were killed on December 21st. John (Portugee) Phillps volunteered to take news of the Fetterman Massacre to the world. To accomplish this, Phillips traveled through hostile Indian country in the midst of a blizzard. One source claims that Phillips found the Pumpkin Buttes a useful landmark in finding his way in the blinding snow. Certainly, Phillips might have also used the cover afforded by the Buttes to hide from the numerous war parties reported in the area.

Congress appointed a commission to investigate the Fetterman Massacre. The commission concluded that the policy of having the military occupy the Bozeman Trail without Indian consent had precipitated the troubles. Meanwhile, fighting along the trail never ceased throughout 1867. In early 1868, Congress named a peace commission that was to negotiate with the hostile tribes of the Powder River region. Red Cloud, the leader of the Sioux, had indicated that he was willing to make peace provided that the government abandoned the Bozeman Road and its forts. This was accomplished with the Fort Laramie Treaty of 1868 which officially closed the Bozeman Trail and guaranteed "forever" the Indians' claim to the sacred Powder River region. Once more, the Pumpkin Buttes area reverted back to the control of its Native peoples.

From 1868 to 1876, the Indians, especially the Oglala Sioux, effectively controlled the region surrounding the study area. One historian asserts that during these years the Sioux began raiding outside territorial limits that they had agreed to in 1868. To further complicate matters, General George Armstrong Custer led a major scientific expedition into the Black Hills region in 1874. The reports that this expedition had found evidence of gold touched off a rush to this area sacred to the Sioux. Most of the prospective mining region was within the Sioux reservation outlined by the Treaty of 1868, and initially the government used the army to keep prospectors out. However, there were simply not enough available troops to effectively block off all possible routes entering the Black Hills.

With violence between miners and Indians virtually inevitable, the government sought to remedy the tense situation in 1875 by offering to purchase the Black Hills from the Sioux. The principal patriotic chieftains of the Sioux immediately refused. Yet something clearly had to be done; miners were flocking into the Black Hills daily causing the Sioux to become angered. In November 1875, the Indian Bureau issued an ultimatum calling for recalcitrant Indians to report to assigned reservations by January 1876 or face the threat of being forcibly rounded up by the army. Many of the Sioux ignored this order and the army made plans for a spring campaign to enforce the ultimatum.

Brigadier General George Crook launched an expedition against the roving Indians in the early months of 1876. On March 1st, Crook's troops left Fort Fetterman and marched north in search of its enemies. John G. Bourke, the expedition's chronicler, described the scene as they approached the Powder River country: "On our left, the snow-clad masses of the Big Horn range rose slowly above the horizon, and on the right the sullen, inhospitable outline of the Pumpkin Buttes." After spending several frigid nights on the old Bozeman Trail near the Buttes, Crook's command pushed north and engaged Sioux and Cheyenne warriors in several battles. Among these engagements was the famous Rosebud fight of June 17, 1876 which preceded Custer's disaster at the Little Big Horn by only eight days.

Following the Custer tragedy, the army pressed the recalcitrant Indians with more intensity than ever. Fort Fetterman became the rendezvous point for a large military expedition during October 1876. This campaign, with columns under Crook, Colonel Wesley Merritt, and Colonel R. S. MacKenzie,- scoured the Indians last refuge--the Powder River country. The army hoped to force the natives to surrender and become reservation Indians.' While moving north past Pumpkin Buttes and old Fort Reno, MacKenzie's Indian scouts discovered Dull Knife's Cheyenne village of 175 lodges on the Red Fork of the Powder River, twenty-three miles west of present-day Kaycee, Wyoming. Colonel MacKenzie charged the village with over one thousand cavalrymen and Indian scouts early on the morning of November 26th. Caught by surprise, the Indians fled into the nearby hills. Estimates of Indian casualties ranged from fourteen to eighteen killed, while five soldiers were reported dead.

With the poorly-clad Indians fleeing north and facing frigid temperatures, the army turned south to search the region for any other hostile Indian activity. On December 5th, the troops stopped in sub-zero temperatures at a "poor camping ground" by Pumpkin Buttes. The troops then continued south to Fort Fetterman to await their next orders. Many hostile Indians remained off the reservation during the winter of 1876-1877, but, with the exception of Dull Knife's band, the soldiers failed to find any of them. The rest escaped beyond the cavalry's reach into Montana.

The surprise attack on Dull Knife's village effectively ended Indian resistance to White incursions both within the study area and Wyoming Territory. Major military campaigns wound down in the spring of 1877, but a continued military presence was kept in the region. Forts Laramie, Reno (later McKinney), and Fetterman functioned for several more years. The period from 1860 to 1877 witnessed a tremendous intercultural struggle for possession of the Powder River Basin region.

6.2.5 THE LIVESTOCK FRONTIER AND PERMANENT SETTLEMENT: 1878 -PRESENT

Two distinct periods mark the cattlemen's frontier in the Pumpkin Buttes region. The open range cattle industry lasted from the time the area was secured from Indians in about 1878 until the disastrous winter of 1886-1887. Although some homesteading occurred late in this period, the open range cattle industry contributed little to the area's permanent settlement and development. It was with the establishment of homestead-based ranches during the 1890s and early twentieth century that permanent settlement came to the Pumpkin Buttes region.

Cattle were first brought into present-day Campbell County in 1866. In that year, Nelson Story drove a herd of Texas cattle along the Bozeman Trail enroute to Montana. At this time the Sioux chieftains Red Cloud and Crazy Horse roamed the area requiring Nelson to be always on the alert of a possible Indian attack. Cattle continued to be driven along the Bozeman Trail after Story's pioneering effort, but it was not until the removal of the Indians from the area that the open range cattle industry came to the Pumpkin Buttes area.

During the open range cattle industry, operators attempted to maximize use of the free unfenced grasslands. Often the cattle belonging to the large ranching concerns grazed over an extended region. For example, Moreton and Dick Frewen's "76" Ranch, located near Kaycee, unofficially claimed land for 200 miles east. It is possible that some of the "76" herd found their way into the Pumpkin Buttes region. The Hoe Ranch, headquartered in Johnson County, ran cattle in the Buttes area. The 1882 brand book of the Wyoming Stock Growers Association identifies at least two outfits utilizing the range along Pumpkin Creek, north of the Buttes. The John M. Adams outfit of Sidney, Nebraska used the range from Beaver Dam to Middle Creek, while Creighton and Company of Antelope, Wyoming ran cattle along Horse and Pumpkin Creek. The Creighton outfit ran as many as five thousand head of cattle and had been operating in the area since around 1875.

With stock spread throughout such a vast area, a round up became necessary each spring in order to allow calving and to take an account of each herd. In 1884, the Wyoming Stock Growers Association's round up district number 16 included the Pumpkin Buttes range. The Association instructed that the round up would begin May 10th at the Matthews' Ranch on the Belle Fourche River. From there it would proceed to the Pumpkin Buttes and then down the Belle Fourche and its tributaries to Devil's Tower. The drive was to continue working Donkey, Horse, and Cottonwood Creeks before culminating at the mouth of the Little Powder River. A round up such as this required considerable coordination and a sizeable labor supply. Joe Elliot, a stock detective in Wyoming and South Dakota during the 1880s and 1890s, worked a round up which employed upwards of 300 men and herded 12,000 cattle near the Pumpkin Buttes in a single day.

Sheep and horses joined cattle in grazing upon the range of the Pumpkin Buttes area. Sheepmen and cattlemen have traditionally disliked one another, but the study area escaped the range warfare that was experienced in other areas of northeast Wyoming in the late nineteenth century.

Perhaps the creation of a deadline separating sheep and cattle country prevented bloodshed. A deadline was established in the vicinity of North Butte; the area around the Butte was designated cattle country, while west of there was sheep country. Ranchers also used the Pumpkin Buttes area for grazing the saddle and work horses so vital to their cattle operations.

Outlaws found the Pumpkin Buttes an ideal spot for hiding themselves from the law during the period of the open range cattle industry. "Big Nose George" Parrot and his gang attempted to wreck and rob a Union Pacific train near Rawlins by pulling the spikes from the rails. After a section boss discovered the loose rails and flagged down the train, the thwarted criminals fled. While on the way to Montana, the gang hid at Pumpkin Buttes. Ultimately, George was captured in Montana and returned to Rawlins where he was lynched by vigilantes in March 1881.

In 1883, Frank Smith built a small cabin and homesteaded some land in the Pumpkin Buttes area. Tradition dictates that after Smith abandoned this cabin it was used as a meeting place for rustlers and other outlaws. In the 1930s a skeleton was found in a crevass of North Butte. With the skeleton were boots and spurs and it contained a bullet-hole in the skull. A resident of the area at the time of the skeleton's discovery speculated that the remains were those of a cowboy who had been killed and robbed of his savings. Exactly when this alleged murder occurred is uncertain.

Winter losses were a regular part of the open range cattle business, but few operators could anticipate the losses associated with the severe winter of 1886-1887. During this winter, blizzards, deep snows, and frozen water holes resulted in a heavy loss of cattle left on the open range. T. A. Larson estimates that the whole of Wyoming losses totaled not much more than fifteen percent. However, in Crook County, which at this time included the Pumpkin Buttes region, losses were put at forty-five percent. Historians generally credit this severe winter with the closing of the open range cattle industry, but in reality it was merely the culminating catastrophe. In 1884, the cattle market began to sag, partially due to foreign competition in the export trade. From 1885 to 1887 a drought reduced the carrying capacity of the Wyoming range. To worsen matters, by 1887 much of that range had been overgrazed. All those factors combined with the harsh winter to cause the virtual collapse of the open range cattle industry by 1887.

Despite the closing of the open range cattle industry after the winter of 1886-1887, the Pumpkin Butte area appears to have remained open range for some time. A cursory examination of the General Land Office records reveals that only . sporadic homesteading occurred prior to the 1916 passage of the Stock Raising Homestead Act. This holds true especially for the area included in the North Butte Mine site.

Permanent settlement of the Pumpkin Buttes area apparently began with the 1883 homestead of Frank Smith. Smith's homestead cabin reportedly included a fireplace built partially of iron collected from an Indian battlefield at the foot of the Buttes. As related above, local residents believe that Smith's cabin was used as a meeting place for rustlers and outlaws. The examination of General Land Office Records failed to reveal Smith's homestead entry; he evidently settled in a portion of the Pumpkin Buttes area outside the immediate vicinity of the North Butte Mine site. Prentice W. Coulton and Edson E. Sawyer also took out early homesteads in the area around the Buttes.

John Franklin Brown, also known as Pumpkin Butte Brown, homesteaded and established the N-V Ranch in 1896. His location along Willow Creek placed him just west of North Butte. Brown came to the area after helping his brother operate a ranch near Pine Bluffs. For thirteen years the Browns lived in their three room homestead cabin. Evidence indicates that the Browns were able to expand their ranch by having each of their four children file their own homesteads when they came of legal age--a common practice. Brown also purchased Frank Smith's old homestead. Descendants of John Franklin Brown still ranch in the Pumpkin Buttes country.

John Christensen was another pioneer rancher of the Pumpkin Buttes region. Exactly when he arrived in the area remains uncertain, but at least one source dates the Christensens' ranch to the 1890s. Fred Christensen followed his father into ranching and established his own homestead during the first decade of the twentieth-century.

The Fred Christensen Ranch eventually came to include his father's and that of his wife's father, Earl Brown, a son of pioneer rancher John Franklin Brown. The United State Geological Survey map of North Butte, Wyoming (1953) locates the Christensen Ranch headquarters in Section 21, Township 44 North, Range 76 West; just west of the North Butte Mine site.

In 1916, the Stock Raising Homestead Act became law. This legislation allowed entries on up to 640 acres of land classified as grazing of forage crop land. The entry needed only to be in "reasonably compact form," and could not contain lands of merchantable timber nor be suited for irrigation. Most notably to the ranchers in the Pumpkin Buttes region, the Stock Raising Homestead Act reserved coal and mineral rights to the federal government. During the 1950s, this provision would lead to controversy concerning uranium exploitation in the area.

The first entry made under the provisions of the Stock Raising Homestead Act in the area occurred in 1919, and ultimately a patent was denied on this claim. It was not until 1920 that most people sought to take advantage of the Act. From 1921 to the closing of the public domain to entry by the Taylor Grazing Act of 1934, fifteen Stock Raising Homestead entries were made. All fifteen received patents. Undoubtedly, some of these entries were made by those making regular homestead entries at the same time--during the 1920s the Land Office awarded at least six regular homestead patents in the area. Still other Stock Raising Homesteads probably represent efforts to expand already existing ranches. While the evidence indicates that reactions to the Stock Raising Homestead Act was rather slow, it played a major role in developing the land ownership patterns in the area of the. North Butte Mine site. Also, it aided the region's livestock economy by allowing ranchers to augment their privately owned grazing lands.

The Taylor Grazing Act, in addition to closing the public domain to entry, created the Grazing Service. This federal agency administered a program by which grazing lands were leased to ranchers on a per-unit basis. In July 1946, an executive order merged the Grazing Service with the newly created Bureau of Land Management. It is the Bureau of Land Management which today administers the federal lands within the Pumpkin Buttes region. Leased BLM grazing lands continue to play an important role in contemporary livestock operations by allowing larger operations than would otherwise be possible.

6.2.6 TWENTIETH CENTURY PUMPKIN BUTTES AND CAMPBELL COUNTY

The Pumpkin Buttes lie in the southwest corner of Campbell County, but this has not always been true. From the organization of Wyoming Territory in 1868 until 1875 the Buttes were part of the original Albany County. From 1875 to 1890, Crook County included the study area. With Wyoming statehood in 1890 came a reorganization of counties once again, and the Pumpkin Buttes were included in the newly created Weston County. Finally, the Eleventh Wyoming Legislature created present-day Campbell County on February 13, 1911, and the county was formally organized on May 23. The legislature designated Gillette as the seat for this 4,742 square mile county named after Wyoming's first territorial governor, John A. Campbell.

The Pumpkin Buttes region has remained insulated from much of Campbell County's development. The completion of the Burlington and Missouri Railroad, now known as the Burlington-Northern, to Gillette in 1892 appears to have diverted attention away from the southwest corner of the county. The livestock oriented economy and lifestyle established during the 1880s continues to dominate the region even today.

After the removal of the Indian population, the federal government owned all the land within present-day Campbell County. Eventually, much of this land passed into private ownership through various land laws such as the Homestead Act of 1862 and the Stock Raising Homestead Act of 1916. Today, private lands comprise 80.7% of the county's area, federal lands 12.7%, and state lands 6.6%. The percentage of federally owned land in Campbell County stands far below the 48% statewide figure. Land within the Pumpkin Buttes area is predominantly privately owned, although some public lands exist immediately adjacent to the Buttes. While most land is privately owned, the federal government retains 84.5% of the county's mineral rights. This leaves only 9.5% of these rights in private hands, with the other 6% belonging to the state.

Traditionally, agriculture has dominated land use in the county. Livestock grazing began in the late nineteenth century and continues to be the dominant agricultural use of land in the county. This holds especially true for the Pumpkin Buttes area. During the twentieth century ranchers have enhanced their operations by growing hay for winter feed along the creek bottomlands and leasing grazing lands from the BLM. Farming in the county has been concentrated in its south-central and west-central portions, and thus lies outside of the study area.

Since the end of World War II, mineral production has become an increasingly important use of land within Campbell County. The first commercial oil field discovery in the county occurred in 1948, but it was not until the 1960s that oil and natural gas production assumed vast importance. By 1973, Campbell County led the state in oil production and was second in production of natural gas. Oil and gas fields dot much of the county, but affected land can still be used for grazing.

Coal is perhaps the most abundant mineral resource found in Campbell County. Early settlers used coal to heat farm and ranch houses, and Gillette utilized coal in their initial electrical power plant. In 1910, an executive order withdrew coal lands within the study area from entry and established the Pumpkin Buttes Coalfield. To date, no known coal production has taken place in the Pumpkin Buttes Coalfield, although Sun Oil Company proposed opening a strip mine north of Savagton in 1976.

While coal remains the leading mineral resource in the county as a whole, the Pumpkin Buttes region contains abundant uranium deposits. These deposits lie primarily in the sandstones of the Wasatch Formation. The discovery of uranium in the area during the 1950s marked the beginning of a new era in its historical development. The prospector and mining entrepreneur entered into competition with the rancher in making use of the Buttes' resources, and at times the mining and ranching interests clashed.

Dr. J. David Love first directed attention to the uranium deposits in the Pumpkin Buttes area. During October 1950, the United States Geological Survey flew over the region with a DC-3 airplane equipped with geiger counters. This aerial survey revealed potential uranium deposits, and Dr. Love later led a ground survey designed to verify the aerial findings.

Love and two companions found a ledge of brown sandstone containing especially rich ore which assayed at 15% uranium. Foul weather prevented a detailed investigation of the area. Love and his colleagues spent the winter of 1950-51 analyzing their information and writing a report which they sent to Washington, D.C. on March 4, 1951. Two weeks later, Secretary of the Interior Oscar Chapman publicly announced the discovery of uranium in the Pumpkin Buttes area of Wyoming.

The discovery prompted the Department of Interior to withdraw 65,343 acres of land in the area from entry or mineral claims. The federal government then conducted a detailed survey of the area. The withdrawn land was concentrated within Townships 42, 43, and 44 North of Ranges 75 and 76 West, 6th P.M.. This included the proposed permit area. All of the public lands in the withdrawal were leased to ranchers under provisions of the Taylor Grazing Act, and ranchers held surface rights to 38,920 acres of the withdrawn land. Ranchers also owned thirty percent of its mineral rights. Thus, when the federal government announced that the withdrawn area would be opened for entry and mineral claims, the stage was set for a confrontation between ranchers and uranium prospectors. A Casper newspaper expected the opening of the Pumpkin Buttes area for uranium prospecting "to touch off one of the maddest land scrambles in Wyoming's history.

The Pumpkin Buttes region was opened for filing on November 17, 1955. No violence occurred, and only about 400 prospectors entered the area on the first day. Bitterly cold weather and reports that the uranium deposits had been overrated probably discouraged many would-be prospectors. Most claims filed that day were in the district's southern end where Atomic Energy Commission reports indicated that the uranium potential was most promising.

In the long run, the Pumpkin Butte uranium rush proved to be something of a bust. Only eight or ten profitable mines resulted. Processing was a problem as ores initially had to be shipped to Edgemont, South Dakota for milling. Between 1953 and 1967, only 55 uranium mines operated in all of Campbell County, and their total production equaled about one month's production from one of the large uranium open pit mines that operated in the state in the late 1970's.

The significance of the Pumpkin Buttes uranium deposits stems from the fact that it was the first discovery of commercial grade ore in the state. Also, experimentation with Pumpkin Butte ore resulted in a better understanding of the geologic processes which produce ore concentrations. Models derived from the Pumpkin Buttes experience have guided subsequent uranium exploration in Wyoming.

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7. APPENDIX "D-3", ARCHAEOLOGY

The proposed North Butte in situ uranium mine property is located in southwest Campbell County about 42 air miles southwest of Gillette. A general location map and a USGS quadrangle map identifying the North Butte 1039 acre permit area are presented in Figure 1.1 (Page 1-3) and Figure 6.1 (Volume II) respectively. A legal description of the permit area is presented in Section 4 (Appendix "C"). The permit area occupies portions of T44N, R75W and T44N, R76W, Campbell County, Wyoming and is situated on the southeast flank of North Pumpkin Butte. The topography of the North Butte permit area consists of rolling upland terrain dissected by numerous erosional drainages which discharge to Willow Creek, an ephemeral stream that cuts through the southern tip of the permit boundary.

The surface ownership of the entire permit area is private (see Section 2.) and is used for livestock grazing. Part of the surface is owned by the T Chair Livestock Company and the remainder is owned by Power Resources Inc.. The uranium mineral underlying the permit area, except for approximately 43 acres of the incidental boundary revision lands added to the permit area in 1992, was patented by the Cleveland-Cliffs Iron Company and is now owned by Pathfinder. In the late 1970's Cleveland-Cliffs owned the uranium mineral within the permit area and planned to start an underground mine at the North Butte property. Cleveland-Cliffs performed environmental and cultural studies at the site, and submitted a permit to mine application to the Department of Environmental Quality for an underground mine. The application was subsequently withdrawn.

In connection with Cleveland-Cliff's mine permitting process, an archaeology investigation of the North Butte permit area was performed by the Office of the Wyoming State Archaeologist. A copy of their report entitled "Archeology Of the Pumpkin Buttes: Final Report On The Archeological Investigations Carried Out In The Cleveland Cliffs Iron Company North Butte Permit Area, Campbell County, Wyoming" is being submitted with this permit application as a separate document.

The geographical area covered by the report includes all of Pathfinder's permit area. The cover sheet from the report along with a reprint of the conclusion section follows this page.

In October, 1992, Pathfinder included into the permit boundary approximately 50 acres of adjacent lands (incidental boundary revision). The lands are non-federal, privately owned surface. Pathfinder's plans for these lands are the installation of up to three (3) monitor wells for observation of mining solution containment. Actual surface disturbance from the well sites will only comprise approximately .01 acres each. The 50 acres of MR lands were included in the original archaeological study performed by the State Archaeologist in 1980 for Cleveland Cliffs. The 1980 survey found no archaeological sites on the MR lands. Therefore, for the purpose of the MR, no additional archaeological investigations were conducted.

The conclusion section of the Office of the Wyoming State Archeologist's report states that archeological clearance is recommended with the stipulation that, if subsurface cultural remains are found during construction activities the appropriate state and federal agencies will be contacted immediately. Power Resources Inc. will fully comply with this stipulation. The conclusion section also states that "no additional investigation is recommended". Since the proposed in situ solution mining operation involves substantially less surface disturbance than Cleveland-Cliffs planned underground mining operation, it is felt that the conclusion section of the State Archeologist's report is applicable to Pathfinder's planned mining activities.

ARCHEOLOGY OF THE PUMPKIN BUTTES: FINAL REPORT ON THE ARCHEOLOGICAL INVESTIGATIONS CARRIED OUT IN THE CLEVELAND CLIFFS IRON COMPANY NORTH BUTTE PERMIT AREA, CAMPBELL COUNTY, WYOMING

By

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Prepared For:

CLEVELAND CLIFFS IRON COMPANY

Submitted By:

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Department of Anthropology
University of Wyoming
.Laramie, Wyoming 82071

Project Number: WY-295-78
Antiquities Permit Number: 8O-WY-086

July 1980

CONCLUSIONS

Archeological investigations carried out on the Cleveland Cliffs North Butte Permit Area have shown considerable evidence for prehistoric human occupation of the Pumpkin Buttes. In all, 25 new archeological sites were found and recorded. Of these, three were found to contain significant subsurface remains (48CA409, 48CA420, and 48CA425). The remaining sites were determined to be primarily surface manifestations. As all artifacts were recovered from these sites no additional investigation is recommended. Thus, archeological clearance is recommended for these remaining sites with the stipulation that, if subsurface cultural remains are found during construction activities the appropriate state and federal agencies be contacted immediately.

Beyond the requisite management goals, research into the patterns of past human occupation in the Pumpkin Buttes area has been enhanced in the course of this project. New information has been found and interpretations been put forward to attempt to explain the hours and whys of past human occupation of the area. The information herein presented will undoubtedly serve as a reference point for further investigations into the archeology of the Powder River Basin. The Cleveland Cliffs Iron Company is to be acknowledged and gratefully thanked for its support in the effort.

8.0 APPENDIX "D-4", CLIMATOLOGY

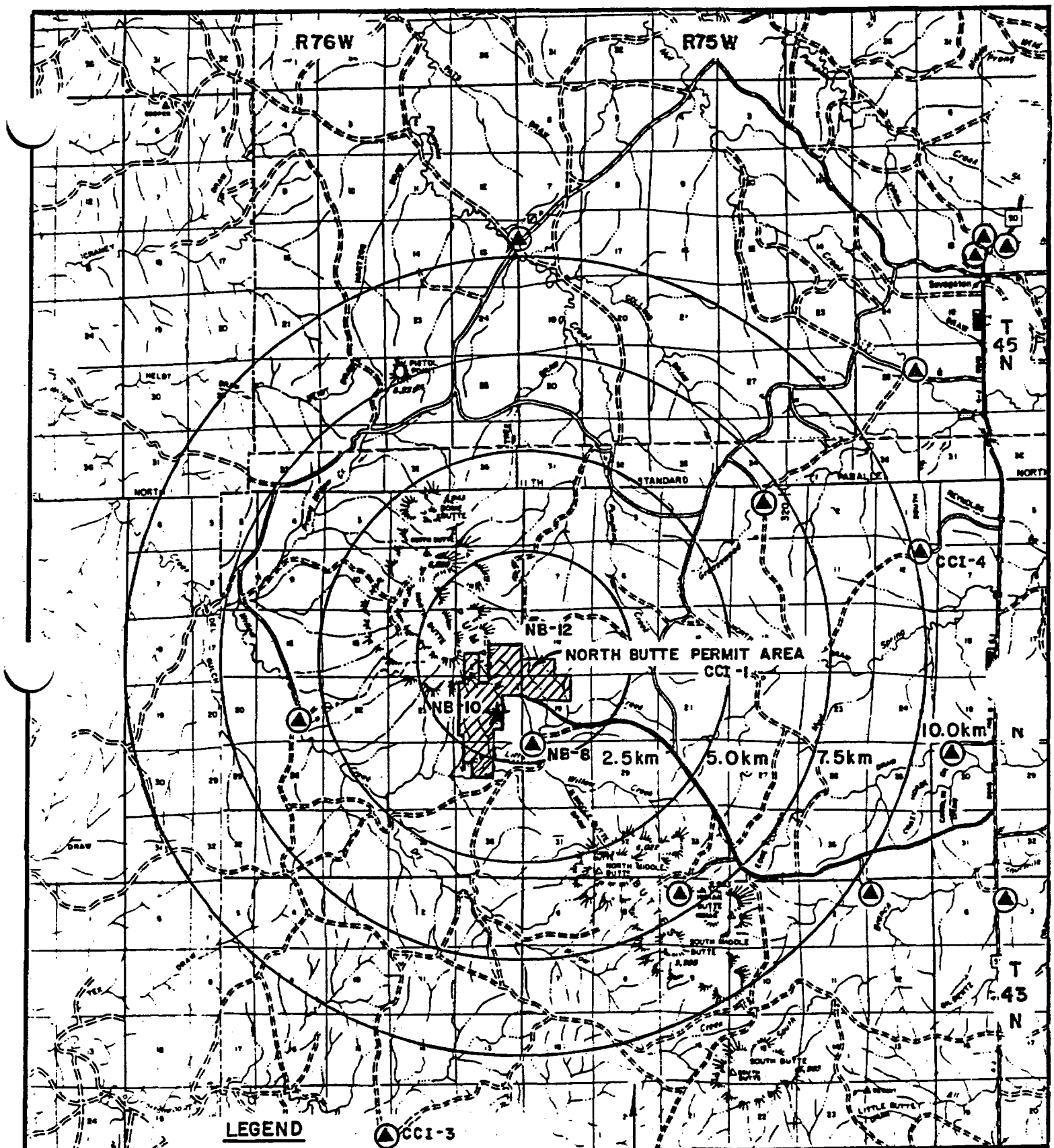
8.1 DATA SOURCES

During 1978 and 1979, Cleveland Cliffs Iron Company (CCI) operated a meteorological data base acquisition program in the Pumpkin Buttes area. Among the parameters that the program monitored were wind speed and direction, temperature, particulate concentrations, relative humidity and determination of atmospheric stability through the use of sounding balloons. Data from the Cleveland Cliffs monitoring program was used in the preparation of the meteorological section of the North Butte permit application. Additional data was also obtained from various weather monitoring stations: those being Kaycee, Midwest, Casper and one location 18 miles southeast of Gillette, Wyoming.

The approximate location of the weather monitoring stations relative to the North Butte site are: Kaycee - 36 miles west, Gillette - 20 miles northeast, Midwest - 32 miles southwest and the Casper station is 68 miles southwest. The Gillette monitoring station was discontinued after 1985. Figure 8.1 indicates the location of the Cleveland Cliffs monitoring stations, Uranerz monitoring sites, permit area and residences within the region.

8.2 GENERAL CONDITIONS

Climatic conditions within the Powder River Basin area can be classified as being semiarid. Precipitation in the Powder River Basin varies by location in relation to the Big Horn Mountains. Rates diminish in both an easterly direction from the mountains and in a southerly direction. The Gillette area receives greater amounts of precipitation than the southern part of the basin. More than 70% of the annual precipitation occurs during the growing season of late spring and summer months in the form of thunderstorms. Monthly snowfall amounts are relatively uniform from November through February and a bit heavier in March and April. Snow has occurred as early as September and as late as early June. Temperatures vary from highs during the summer of near 100°F to lows during the winter of -40°F.



REVISED: 7/16/92

8.3 PRECIPITATION

Precipitation within the Powder River Basin is variable. In 1982, Gillette received an estimated 29.62 inches of precipitation while other monitoring stations for that same year received 10 inches less. During a dry year, 1979, the Kaycee and Casper stations recorded only 9.20 and 9.87 inches respectively while Gillette received 15.29 inches. Over the last' 1 1 years average annual precipitation amounts for' the monitoring stations are: Casper 11.22 inches; Gillette 15.72 inches; Kaycee 11.55 inches and Midwest 13.21 inches. Annual precipitation for the North Butte site is estimated at 14 inches. Maximum average snowfall amounts for the Casper station are presented in Table 8.1.

TABLE 8.1

Maximum Snowfall Amounts (inches)
For Monthly and 24 Hour Period

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Year
Monthly	24.0	23.8	36.2	56.3	24.6	3.0		T	11.5	16.1	37.1	62.8	62.8
Year	1987	1952	1975	1973	1978	1969		1964	1982	1986	1983	1982	1982
24 Hour	14.0	11.0	14.6	16.5	14.1	3.0		T	6.8	13.3	14.3	31.1	31.1
Year	1987	1987	1954	1973	1950	1969		1964	1982	1986	1983	1982	1982

Tables 8.3, 8.4, 8.5 and- 8.6 provide precipitation information for the past 11 years for the Casper, Gillette, Kaycee and Midwest stations.

8.4 RELATIVE HUMIDITY

Relative humidity is dependent upon moisture content and the temperature of the air. Average monthly relative humidity data from Casper are presented in Table 8.2. From these data relative humidity in the early morning is shown to average 71 percent, while the average is 44 percent in the afternoon. However, summer afternoons typically experience relative humidity percentages in the 20's and 30's while winter afternoon's relative humidity is typically near 60 percent.

TABLE 8.2													
Average Relative Humidity (°/o) Casper, Wyoming													
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Year
Hour 05	69	70	73	75	78	76	70	67	68	69	70	69	71
Hour 11	60	58	54	48	44	68	62	62	67	45	54	59	47
Hour 17	62	57	48	42	40	33	27	25	31	41	56	62	44
Hour 23	69	69	70	69	69	63	55	53	59	64	67	68	65

TABLE 8.3													
Precipitation Data Casper, Wyoming													
Monthly Precipitation (inches) CASPER													
Source: Climatological Data, U.S. Dept. of Commerce, Environmental Service													
Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annul
1977	0.35	0.69	1.05	1.07	1.93	0.19	1.88	0.34	0.30	0.71	0.79	0.71	10.01
1978	0.70	0.75	0.93	1.05	6.46	1.40	2.62	0.93	0.26	0.40	0.94	1.20	17.64
1979	0.40	0.39	0.82	0.83	2.25	1.31	0.95	2.66	0.18	0.50	0.75	0.36	9.87
1980	0.81	0.63	1.19	0.35	2.82	0.10	0.85	0.65	0.10	0.64	0.74	0.37	9.25
1981	0.46	0.22	0.77	1.56	3.51	0.37	1.27	0.50	0.23	0.76	0.75	0.43	10.84
1982	0.41	0.33	0.60	1.25	2.10	4.15	1.92	0.88	3.40	1.18	0.55	3.71	20.48
1983	0.42	0.35	2.29	2.28	1.40	3.76	2.61	0.75	0.250	0.88	2.72	0.75	18.41
1984	1.19	0.48	1.59	2.23	1.33	1.34	2.26	0.25	0.50	0.71	0.70	0.78	13.36
1985	0.79	0.61	0.52	1.25	1.37	1.32	1.57	0.09	1.09	0.46	1.56	1.05	11.68
1986	0.36	0.89	0.55	1.89	1.33	4.06	0.88	0.27	1.31	2.63	1.48	0.27	15.92
1987	1.42	1.42	1.43	0.35	1.40	0.70	1.93	1.80	0.59	0.55	0.77	0.63	12.99

TABLE 8.4													
Precipitation Data Gillette, Wyoming													
Monthly Precipitation (inches) GILLETTE													
Source: CLimatoiogical Data, U.S. Dept. of Commerce, Environmental Service													
YEAR	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annul
1977	1.10	0.98	1.57	0.81	2.08	2.45	1.27	3.96	2.16	2.43	0.74	0.99	20.54
1978	0.62	1.07	0.38	2.28	11.1	0.71	1.69	1.14	0.89	0.40	1.47	1.18	22.93
1979	0.45	0.75	0.30	1.321	1.89	4.05	2.87	1.55	0.46	0.85	0.57	0.23	15.29
1980	0.73	0.75	1.00	0.63	3.75	2.07	0.48	3.62	0.78	1.03	0.55	0.64	16.03
1981	0.28	0.57	1.27	0.48	4.54	1.38	2.82	2.32	0.27	0.93	0.25	0.67	15.78
1982	0.75	0.27	1.82	1.73	4.82	3.65	3.34	4.39	4.38	2.15	0.54	1.78	29.62
1983	0.27	0.25	1.35	1.30	2.30	1.27	0.38	1.92	0.40	2.35	1.35	1.01	14.15
1984	0.65	0.30	1.40	3.75	1.75	2.30	0.25	0.36	0.45	0.30	1.25	0.31	13.07
1985	0.78	0.20	1.75	1.34	2.70	2.45	2.11	0.17	1.47	-----	-----	-----	-----
1986	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
1987	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----

TABLE 8.5													
Precipitation Data Kaycee, Wyoming													
Monthly Precipitation (inches) KAYCEE													
Source- Climatological Data, U.S. Dept. of Commerce, Environmental Service													
YEAR	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annul
1977	0.30	0.30	1.45	1.20	3.35	0.84	1.01	1.87	0.97	0.71	0.60	0.72	13.32
1978	0.64	0.57	0.60	1.98	7.05	1.48	2.47	0.73	0.83	0.29	0.88	1.14	18.66
1979	0.49	0.25	0.42	1.56	2.35	0.35	0.84	1.09	0.45	0.96	0.30	0.14	9.20
1980	0.63	0.33	0.67	0.57	3.36	0.89	0.61	2.48	0.45	0.77	0.50	0.32	11.58
1981	0.30	0.33	1.25	0.52	4.91	1.13	1.12	0.84	0.37	0.81	0.46	0.55	12.69
1982	0.49	0.12	1.27	1.11	2.54	4.34	2.80	0.60	3.74	1.51	0.24	1.04	19.80
1983	0.12	0.11	0.90	0.95	2.23	1.87	0.57	1.58	0.2	1.73	1.29	0.89	12.44
1984	0.86	0.26	0.70	1.40	0.88	2.71	0.96	0.36	0.51	0.51	0.72	0.17	10.10
1985	0.45	0.42	0.67	1.11	3.40	1.30	0.41	0.12	1.66	0.36	1.04	0.28	11.22
1986	0.27	0.85	0.41	2.22	2.12	1.10	1.30	0.57	1.14	-----	-----	0.10	-----
1987	0.70	0.70	0.59	2.88	2.88	1.90	2.14	0.99	1.57	0.41	1.18	0.07	16.01

TABLE 8.6													
Precipitation Data Midwest, Wyoming													
Monthly Precipitation (inches) MIDWEST													
Source: Climatological Data, U.S. Dept of Commerce, Environmental Service													
Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annul
1977	0.36	2.60	1.53	3.48	0.33	1.22	3.12	1.60	1.30	1.40	0.83	1.11	18.52
1978	1.26	0.83	0.46	2.02	6.10	1.26	2.23	0.83	0.70	0.12	1.20	1.72	18.73
1979	0.50	0.66	0.54	1.61	1.82	1.96	0.51	1.41	1.15	0.95	0.88	0.20	12.19
1980	1.01	0.36	1.20	0.88	2.67	1.18	0.47	1.19	0.12	0.84	0.79	0.63	11.35
1981	0.36	0.48	1.34	0.73	4.58	0.24	2.27	0.38	0.56	0.95	0.65	0.38	12.92
1982	0.39	0.29	1.64	1.39	-----	-----	2.18	1.07	3.64	1.82	-----	-----	-----
1983	-----	-----	-----	-----	-----	-----	-----	-----	-----	1.51	1.63	0.85	-----
1984	-----	-----	-----	-----	-----	-----	1.40	0.22	0.21	-----	-----	0.21	-----
1985	0.29	0.48	-----	-----	1.08	1.94	1.33	-----	1.13	0.78	-----	-----	-----
1986	0.02	0.13	1.23	1.41	1.44	2.82	0.04	0.00	0.15	2.68	0.79	0.73	-----
1987	-----	0.70	1.05	0.14	3.01	3.46	2.57	-----	-----	-----	-----	0.95	-----

8.5 TEMPERATURE

Average annual temperature for the four monitoring sites ranges from 44°F to 47°F. The average for Gillette is 44.3°F, Casper 45.2°F, Kaycee 45.7°F, and Midwest 47.4°F. Tables 8.8, 8.9, 8.10 and 8.11 are temperature data for Casper, Gillette, Kaycee and Midwest.

8.6 EVAPORATION

The closest site to the permit area where evaporation data are available is Gillette, Wyoming, approximately 20 miles northeast of the permit area. Data from this site indicates that, on the average, evaporation of 43 inches occurs in the five months of May through September. July normally has the highest evaporation loss, averaging approximately 9 to 10 inches.

8.7 SKY COVER

The sky cover data from the Casper Weather Bureau Station are presented in Table 8.7. These data imply that cloudy days are most prevalent in the winter months and that clear days are most common in the summer months.

TABLE 8.7

Mean Sky Cover (tenths)
(sunrise - sunset)

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Year
6.7	6.7	6.9	6.8	6.7	5.3	4.4	4.5	4.6	5.3	6.3	6.3	5.9

TABLE 8.8

Temperature Data
Casper, Wyoming

Average Monthly Temperatures (°F) CASPER

Source: ClimatoLogicai Data, U.S. Dept. of Commerce, Environmental Service

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annul
1977	20.2	30.9	31.3	46.5	55.1	69.4	71.7	66.1	60.3	48.8	33.3	24.9	46.5
1978	17.1	22.3	37.2	44.6	49.6	63.6	69.6	66.8	60.2	47.9	26.9	13.2	43.3
1979	5.1	23.6	39.0	43.7	49.3	61.8	72.7	67.7	62.1	47.8	26.5	28.7	44.0
1980	16.4	27.5	31.0	44.2	51.6	64.4	72.2	66.4	59.7	46.5	33.8	34.3	45.7
1981	31.4	29.9	38.0	48.3	51.4	64.3	71.8	69.2	62.0	44.4	39.0	27.3	48.1
1982	20.1	25.7	36.6	41.1	51.1	60.3	70.7	73.7	56.9	45.2	32.2	23.3	44.7
1983	31.2	31.5	36.3	38.0	48.4	60.4	71.2	74.8	60.3	49.7	31.2	10.9	45.3
1984	21.9	27.5	34.4	39.1	54.5	61.5	70.4	71.2	52.5	40.1	34.8	22.9	44.2
1985	16.1	19.8	33.3	45.5	55.3	61.3	71.6	66.7	53.4	45.3	20.3	21.3	42.5
1986	31.6	28.5	42.8	44.4	50.9	67.4	69.0	69.3	55.5	45.9	32.0	26.2	47.0
1987	23.1	28.4	32.4	49.7	57.5	64.8	70.7	66.2	58.7	46.7	35.5	23.8	46.5

TABLE 8.9

Temperature Data
Gillette, Wyoming

Average Monthly Temperatures (°F) GILLETTE

Source: Climatological Data, U.S. Dept. of Commerce, Environmental Services

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annul
1977	14.9	29.0	31.3	46.3	54.9	65.9	69.8	63.9	58.6	48.1	30.8	20.0	44.4
1978	15.1	18.9	33.8	43.4	49.9	60.7	67.2	65.8	59.8	47.4	25.6	13.4	41.8
1979	6.8	20.7	34.8	41.4	50.1	61.2	68.5	66.1	64.4	48.2	28.1	30.4	43.4
1980	17.8	26.8	31.0	45.7	53.8	63.9	71.8	65.6	59.0	46.1	34.5	32.4	45.7
1981	31.4	29.9	38.0	48.3	51.4	64.3	71.8	69.2	62.0	44.4	39.0	27.3	48.1
1982	15.4	24.6	32.0	39.5	49.2	57.7	68.1	70.2	55.3	44.5	30.7	23.3	42.5
1983	29.3	33.1	35.2	37.9	47.3	59.9	72.2	75.0	58.5	48.5	32.0	7.6	44.7
1984	23.4	29.5	34.0	38.7	20.6	59.3	69.8	71.5	52.9	42.0	34.7	21.5	44.0
1985	17.7	20.1	32.2	46.6	55.3	59.7	71.0	66.2	53.3	-----	-----	-----	-----
1986	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
1987	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----

TABLE 8.10

Temperature Data
Kaycee, Wyoming

Average Monthly Temperatures (°F) KAYCEE

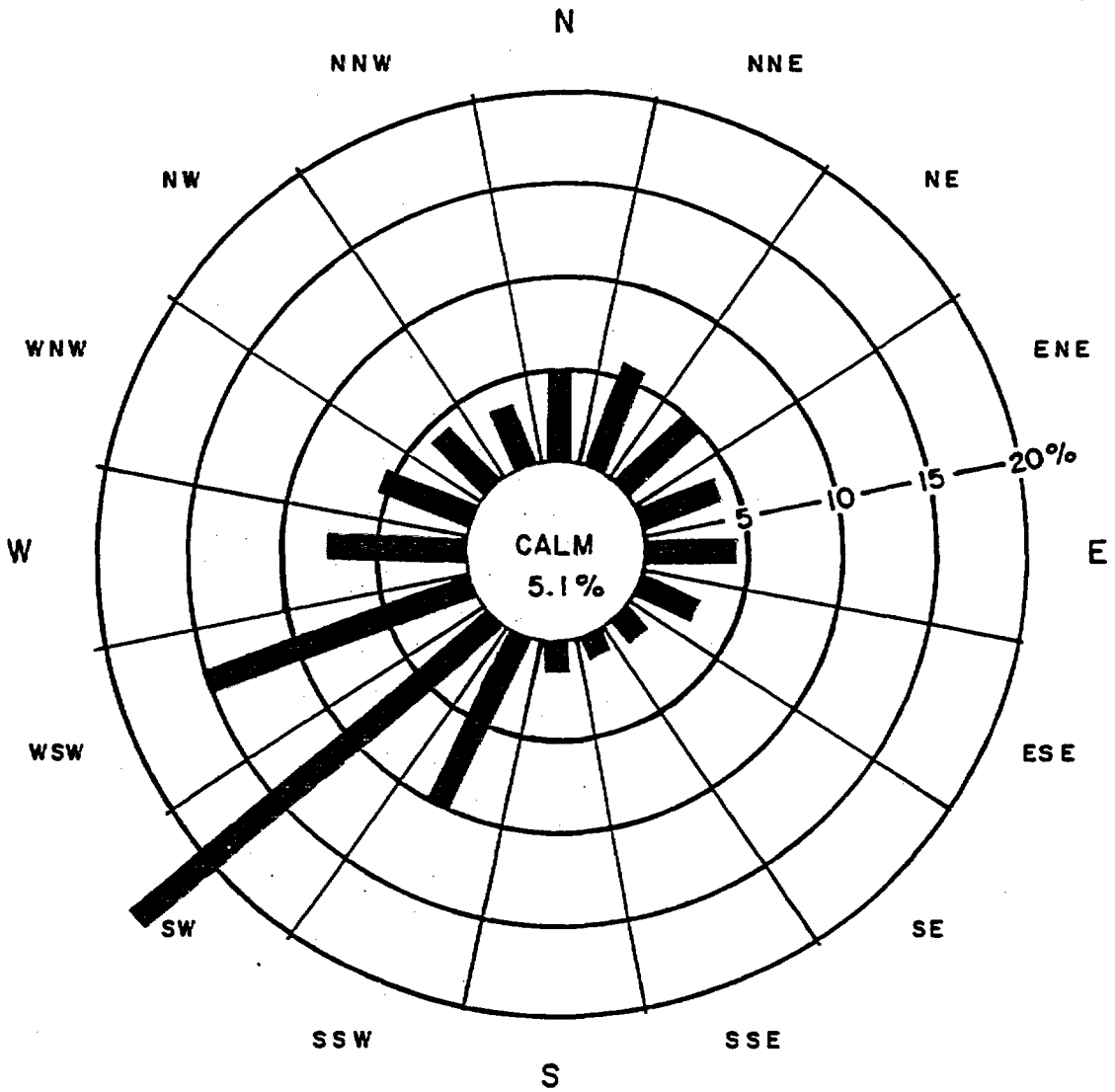
Source: Climatological Data, U.S. Dept. of Commerce, Environmental Services

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annul
1977	17.9	31.3	33.6	47.3	55.0	66.9	70.1	65.1	58.7	47.7	32.4	24.0	45.8
1978	16.6	22.5	37.9	46.4	51.5	63.2	63.2	66.1	60.9	47.9	25.6	12.3	43.3
1979	4.6	23.8	36.8	44.2	52.3	63.8	71.2	67.8	63.3	50.1	27.5	32.5	44.8
1980	19.9	30.0	33.8	45.9	53.9	65.7	73.6	66.8	59.8	47.3	34.8	36.1	47.3
1981	32.3	29.7	38.6	49.0	52.9	63.6	73.3	69.5	61.8	46.0	39.7	27.0	48.6
1982	17.8	27.8	36.1	41.6	51.0	59.5	69.5	72.9	56.0	45.6	32.9	26.1	44.7
1983	32.2	33.7	37.7	39.9	49.5	62.2	71.3	74.1	59.9	50.2	33.1	8.5	46.0
1984	24.6	31.0	35.8	40.7	55.0	63.0	72.6	72.1	54.8	42.6	36.0	22.9	45.9
1985	16.4	22.9	34.8	47.7	57.1	63.0	71.6	67.5	53.4	45.9	16.7	20.9	43.2
1986	32.9	27.8	43.8	45.8	52.2	68.3	-----	69.6	55.8	-----	-----	26.4	-----
1987	25.1	30.7	34.7	48.7	57.6	65.7	69.9	66.0	58.9	47.3	38.1	25.6	47.4

TABLE 8.11													
Temperature Data Midwest, Wyoming													
Average Monthly Temperatures (°F) MIDWEST													
Source: Climatological Data, U.S. Dept. of Commerce, Environmental Services													
Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annul
1977	-----	32.6	35.3	49.2	57.1	70.2	-----	-----	61.5	50.2	33.6	25.4	-----
1978	17.7	24.0	38.7	46.7	52.1	63.6	70.5	67.3	61.2	49.9	27.7	14.0	44.5
1979	9.0	24.4	37.4	45.9	53.7	64.1	71.7	69.0	64.2	51.2	28.6	30.9	45.8
1980	19.6	30.5	35.3	46.5	55.3	66.37	74.1	68.4	61.3	48.5	34.7	35.8	48.0
1981	33.3	31.1	39.7	20.9	54.0	66.1	73.6	70.2	63.8	47.0	40.6	29.0	49.9
1982	20.8	28.6	37.7	43.9	-----	-----	72.3	75.8	58.1	47.8	-----	-----	-----
1983	-----	-----	-----	-----	-----	-----	-----	-----	-----	51.7	33.9	10.4	-----
1984	23.2	28.6	35.8	41.1	55.7	63.9	72.6	73.0	57.3	-----	37.2	24.2	-----
1985	20.6	23.9	37.3	-----	58.4	63.4	73.3	-----	55.9	48.5	16.7	21.4	-----
1986	31.8	26.7	43.3	44.8	52.9	70.0	70.9	72.4	57.0	47.5	33.9	36.9	49.0
1987	27.7	33.8	35.7	53.2	61.6	67.3	71.5	-----	-----	-----	-----	24.7	-----

8.8 WIND

Wind roses for Casper and the North Pumpkin Butte area are presented in Figures 8.2 and 8.3. As indicated, the predominate wind direction in the Casper area is from the southwest at over 25% of the time. Calm conditions exist 5.1% of the time as compared to the North Pumpkin Butte site which is calm just 0.8% of the time. The predominate wind directions at the North Pumpkin Butte location are from the southeast and the southwest at 13% of the time. It should be noted that wind patterns in the North Pumpkin Butte area are influenced by the Pumpkin Buttes which stand approximately 1000 feet higher then the surrounding plains.



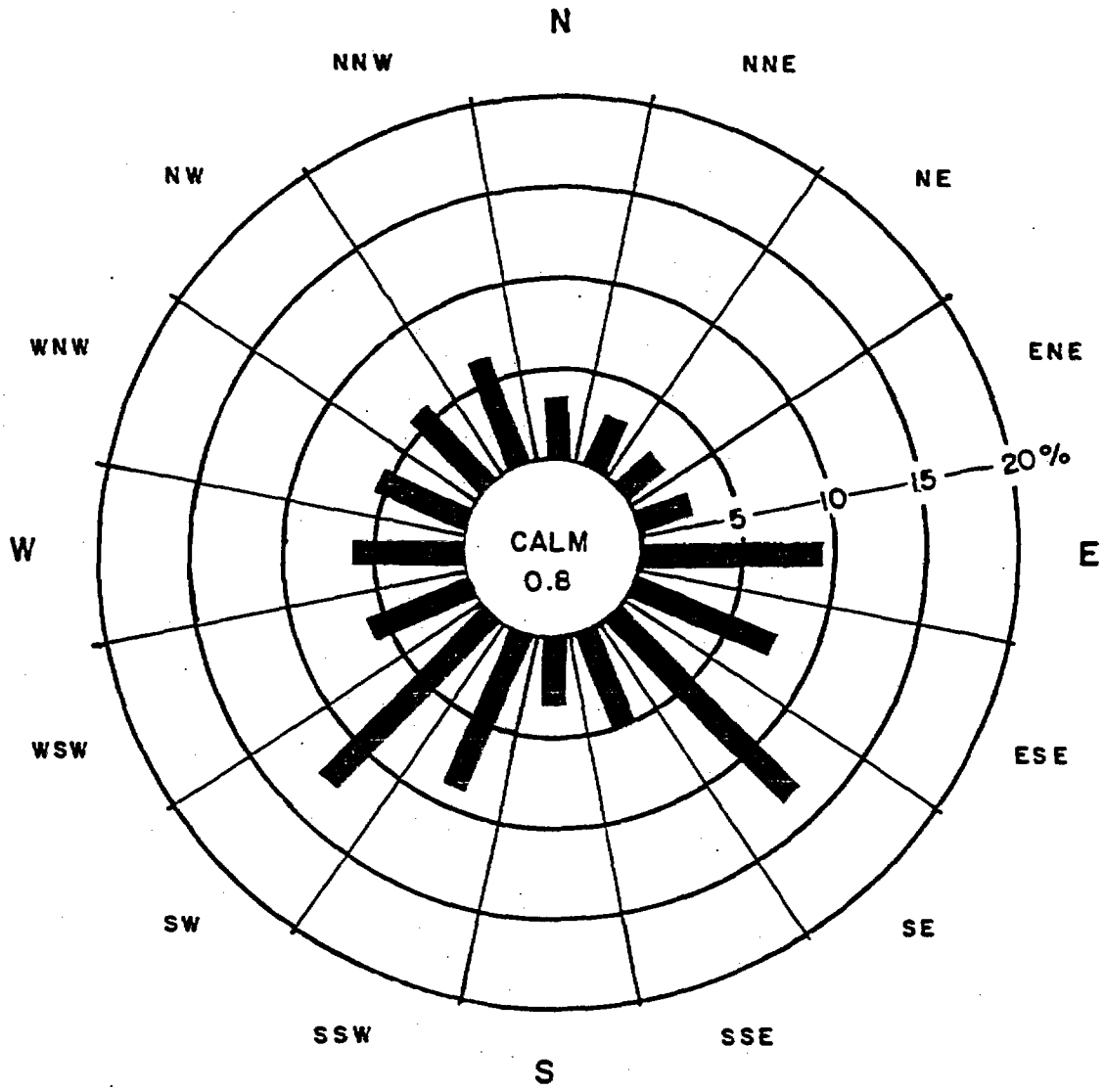
ANNUAL PERCENT FREQUENCY
OF SURFACE WIND DIRECTION
ALL STABILITY CLASSES

CASPER, WYO.

March 1950 - December 1959

From National Weather Service Data

Figure 8.2



ANNUAL PERCENT FREQUENCY
OF SURFACE WIND DIRECTION
ALL STABILITY CLASSES
PUMPKIN BUTTES, WYO.

October 1978 - October 1979

Figure 8.3

8.9 AIR QUALITY

8.9.1 REGULATORY STANDARDS

The Wyoming Department of Environmental Quality, Air Quality Division (WDEQ, AQD) has set ambient air quality standards for total suspended particulate at 60 ug/m^3 annual geometric mean and 150 ug/m^3 for a 24 hour period.

The WDEQ, AQD was contacted bay Uranerz-to discuss the planned operations at the North Butte site. It was determined-4y WDEQ, AQD that due to the minimal amount of surface disturbance and vehicular traffic associated with the operation that an analysis for prevention of significant deterioration (PSD) will not be required. However, at the Nuclear Regulatory Commissions request, a monitoring program for determination of airborne radionuclide concentrations was conducted.

8.9.2 MONITORING PROGRAMS

RADIONUCLIDE

The Nuclear Regulatory Commission requested that a monitoring program be conducted for the assessment of airborne radionuclides. As per this request, Uranerz established three high volume air samplers. One at the closest residence to the mill site, that being the Pfister Ranch, one upwind of the mill site at the western property boundary, and one at the mill site. Sampling was conducted on a monthly basis. The sampling program was established December 1987 and conducted through December 1988. Results of the airborne radiological monitoring program are presented in Section 14 (Tables 14.8 and 14.9).

PARTICULATE

During 1978-79, Cleveland Cliffs Iron conducted a particulate sampling program at several locations in the North Butte area. This program was conducted to develop a database for use in permit applications of a uranium mine and milling operation. Total particulate concentrations were monitored at three sites by high volume samplers over a period of 24 hours once every six days. Two samplers (la and lb) were located at Site 1 for comparison purposes. Results of the monitoring program are presented in Table 8.12.

TABLE 8.12					
Suspended Particulate Concentrations					
Geometric mean, standard geometric deviation maximum and minimum of total suspended particulate concentrations in the Pumpkin Buttes area. Data developed by Cleveland-Cliffs Iron Company. (Units: ug/m^3)					
		SITE			
		1a	1b	3	4
Geometric Mean	Winter	9.6	8.7	9.6	11.2
	Spring	12.0	11.5	14.8	15.1
	Summer	21.9	22.9	22.4	25.1
	Fall	22.9	20.9	24.6	17.0
Maximum	Winter	15.0	14.8	18.5	17.4
	Spring	23.6	23.2	24.8	27.2
	Summer	49.6	52.4	62.0	65.8
	Fall	51.7	43.5	48.3	90.1
Minimum	Winter	4.5	4.1	5.3	4.5
	Spring	4.0	4.9	8.0	6.8
	Summer	6.1	6.6	4.1	1.2
	Fall	5.9	3.1	8.0	1.3
Geometric Mean	Annual	16.6	15.9	17.4	17.0

The location of the Cleveland-Cliffs Iron monitoring sites can be found on Figure 8.1.

Uranerz did not conduct any additional sampling to specifically establish baseline conditions for particulate concentrations. Although, through the airborne radionuclide sampling program, particulate concentration information was obtained. It is recognized that the monthly sampling frequency cannot be directly compared to the regular six day cycle of a normal program. This information can only be used as a general indication as to what actual background concentrations may be. For the three monitoring sites, average concentrations are as follows:

Pfister-NB8 18.4 ug/m3
Camp-NB1O 13.1 ug/m3
Buck-NB12 13.1 ug/m3

The Pfister-NB8 site is adjacent to an oil field access road and therefore would be expected to have higher readings then the other two sites. Car np-NB10 and BuckNB12 are rather isolated and would be expected to provide a better representation of background conditions. High volume sampling results are presented in Table 8.13.

8.9.3 IMPACTS

Impacts on air quality associated with the operation of the North Butte site will be very minimal. Access to the site will be via six and a half miles of Campbell County maintained gravel road, one and three quarters mile of ranch/oil field access road and about one and a half miles of new access road. The county and ranch road are used by numerous oil filed service vehicles as this area is within the Hartzog Draw Oil Field. The closest residence to the access route is that of the Pfister Ranch which is located approximately three-fourths of a mile southwest of the proposed new access road. With the prevailing wind direction out of the southwest, dust produced by mining operations and vehicular traffic will generally be blown to the northeast and not affect ranching operations.

Particulate emissions associated with actual mining operations will, also be very minimal. Within the permit area, it is estimated that there will be 343 acres of affected land with stripping of topsoil on only about 50 areas or less. A motorized patrol will be used to grade well field access roads for drilling equipment and maintenance of the well field itself. Whenever possible, natural vegetation will be left undisturbed within the well field to serve as a deterrent to wind erosion.

It is estimated that on a daily average there will be 7 passenger vehicles entering the North Butte site. In addition, six semitrailers will travel to the site per week. For the purpose of calculating particulate emissions, the well field was not considered a significant emitting source.

Factors used in the calculation of particulate emissions are as follows:

TABLE 8.13									
High Volume Air Sampling Results by Location									
	Pfister – NB8			Camp – NB10			Buck-NB12		
Date	Vol.	Min.	Partic.	Vol.	Min.	Partic.	Vol.	Min.	Partic.
	(m^3)		(ug/m^3)	(m^3)		(ug/m^3)	(m^3)		(ug/m^3)
Dec, 87	5008.6	2992	16.8	5461.0	2993	9.7	4925.8	2962	7.9
Jan, 88	4888.1	2920	6.4	5416.6	2920	4.7	4839.0	2910	4.4
Feb, 88	4839.5	2891	7.6	5370.2	2895	5.1	4814.4	2895	5.6
Mar, 88	4927.4	3110	11.9	5249.7	2993	7.7	4846.3	2952	8.4
Apr, 88	4767.8	2954	16.5	4944.8	2972	14.6	4967.1	3030	14.3
May, 88	3812.6	2992	15.0	3956.2	3005	9.0	4215.1	2985	8.2
Jun, 88	3825.4	3065	22.9	4302.6	3065	17.2	4314.0	3060	19.7
Jul, 88	4342.5	3215	24.8	4260.2	3225	20.3	4264.5	3240	21.4
Aug, 88	5302.4	4020	59.0	5129.5	3985	34.1	5207.5	4168	36.8
Sep, 88	5995.8	4240	17.3	5877.0	4236	16.9	5926.2	4285	15.9
Oct, 88	5932.1	4103	5.3	5865.1	4128	5.4	----	720	----
Nov, 88	6017.4	4308	4.6	6130.0	4316	5.1	5290.2	3685	7.0
Dec, 88	4450.1	3135	13.0	6161.6	4281	7.0	6277.6	4309	7.1
Total			221.4			156.8			156.7
Arithmetic Mean			18.4			13.1			13.1

Silt Factor for River Basin	= 8.6%
Days/year of precipitation	= 100 days
Days/year of operation	= 360 days
Access Road to North Butte Site (dirt)	= 10 miles
Conversion Factor, Ton/yr to g/sec	= 0.0288

Using these factors, calculation of particulate emissions is as follows:

$$E = 0.81 \times 8.6(siltfactor) \times \frac{40}{30} mph \times \frac{365-100}{365} \times 0.62 = 4.18 \frac{lb}{vmt}$$

$$E(emissionfactor) = 4.18 \frac{lb}{vmt}$$

Employee Traffic:

$$7 \frac{veh}{day} \times 10mi \times 2 \times 4.18 \frac{lb}{vmt} \times \frac{4}{4} wheelfactor @ 360 \frac{day}{year} = 105.34 \frac{T}{year} = 3.07 \frac{g}{\sec}$$

Service Vehicles:

$$0.86 \frac{truck}{day} \times 10mi \times 2 \times 4.18 \frac{lb}{vmt} \times \frac{18}{4} wheelfactor @ 360 \frac{day}{year} = 58.24 \frac{T}{year} = 1.7 \frac{g}{\sec}$$

Calculations for particulate emissions resulting from site construction of buildings and support facilities has not been taken into consideration. During the construction of the-mill, it is felt that there will not be a significant change in vehicular traffic patterns as compared to that of actual operation of the facility. From the above calculations, it is estimated that an emission rate of 163.58 tons/year can be expected. As this is below the 250 tons/year threshold for PSD review, an analysis to determine air quality impact is considered unnecessary.

9. APPENDIX "D-5", GEOLOGY AND TOPOGRAPHY

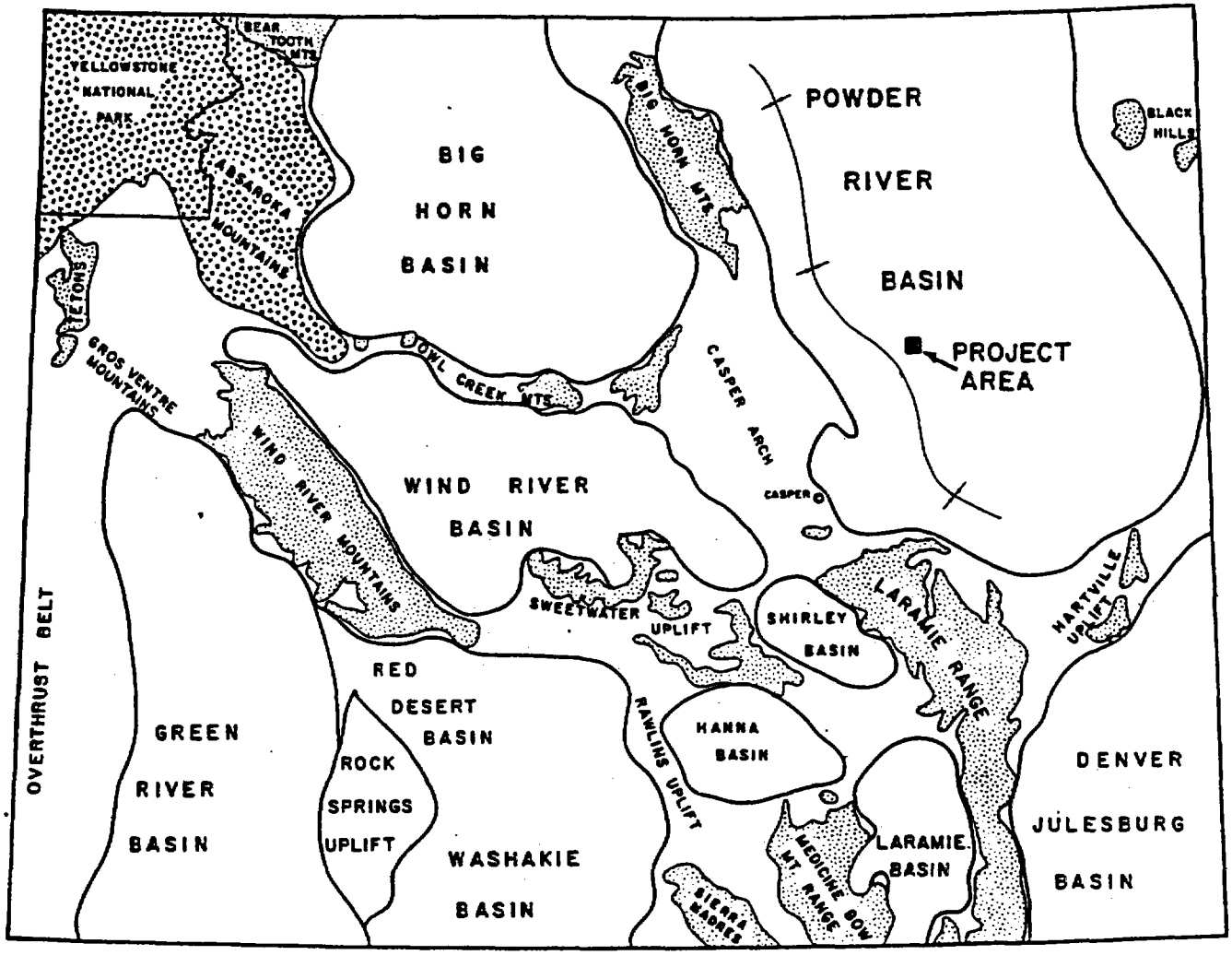
9.1 GENERAL GEOLOGIC DESCRIPTION

The Powder River Basin is a large structural and topographic depression parallel to the Rocky Mountain trend. The Basin is bounded on the south by the Hartville Uplift and the Laramie Range, on the east by the Black Hills, and the Big Horn Mountains and the Casper Arch on the west. The Miles City Arch in southeastern Montana forms the northern boundary of the Basin.

The Basin is an asymmetrical syncline with its axis closely paralleling the western margin. During sediment deposition, the structural axis (the line of greatest material accumulation) shifted westward resulting in the asymmetry present in the Basin. On the eastern flank of the Basin, sedimentary rock strata dip gently to the west at approximately 0.5 to 3 degrees. On the western flank, the strata dip more steeply, 0.5 to 15 degrees to the east towards the axis of the Basin, with the dip increasing as distance from the axis increases. The North Butte site location within the Powder River Basin is shown in Figure 9.1.

The North Butte solution mining site is situated in the Eocene Wasatch Formation off the southeast flank of North Pumpkin Butte in Campbell County. The mineralized sand members are in the lower part of the formation, at an approximate average depth of 500 feet to 650 feet. The host sands are primarily arkosic in composition, very friable, and contain substantial. organic debris and carbonaceous stringers. There are periodic small, localized, sandy shale intervals within the sand, but the main body of the sand is relatively free of interstitial shale, although the sands thicken and thin. to the point of removal in some areas.

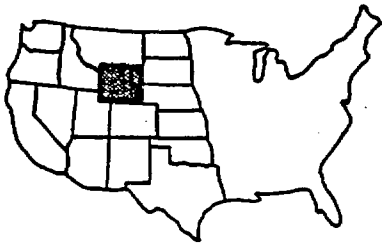
There are three primary mineralized sand members in the North Butte mining sand. These sand members are identified by Uranerz as "C", "B", and "A" in descending order: The "C" sand member is the shallowest and the "A" sand member being the deepest. The primary ore bearing member of the three is the "B" sand. In most proportions of the permit area these sand members are separate and distinct. However, in a substantial portion of the area, the separating aquicludes between the sands thin and allow vertical contact between either the "A" and "B" members or the "B" and "C" members. In these areas there are effectively only two mining members in the North Butte mining sand.



PRECAMBRIAN ROCK

TERTIARY VOLCANICS

SYNCLINAL AXIS



40 20 0 50 100 miles

SCALE

N

URANERZ U.S.A., INC.		
NORTH BUTTE ISL PROJECT		
STRUCTURAL MAP OF WYOMING		
GEOL:	SCALE: As noted	FIGURE: 9.1
DRAWN BY: D.L.	DATE 9-22-82	

The North Butte mining sand, with its three sand members, is bounded above and below by impermeable shale layers. The upper and lower aquicludes are composed of shales, silty shales and shaley lignite interbeds.

The ore body is a typical Powder River Basin roll front deposit. In the North Butte area the oxidation front extends from the northeast to the southwest. The sand members also have several vertically superimposed individual roll fronts. Due to the occasional vertical contact between the mineralized sand members there are often several smaller fronts, which overlay each other.

In the North Butte ore deposit the uranium mineralization is present as amorphous uranium oxide, or sooty pitchblende with some subordinate carnotite. The host sandstones are composed of quartz, feldspars, and rock fragments with locally occurring carbon fragments. Grain size ranges from very fine-grained sand to small granules. The sandstone is weakly to moderately cemented and friable. Occasional occurrences of pyrite and calcite as cementing materials can be observed. The uranium is deposited upon individual detrital sand grains or upon and within authigenic clays in the interstices. The interstitial clays present are primarily montmorillonite with lesser amounts of kaolinite. Hematite, along with minor limonite, are common oxidation products of pyrite within the host rock. Accessory biotite and muscovite are also present.

9.2 TOPOGRAPHY

The permit area is located about one mile southeast of the North Pumpkin Butte, in southwest Campbell County, Wyoming. The lateral extent of the permit area covers about 1039 acres a comprising portions of Sections 18 and 19 of Township 44 North, Range 75 West and portions of Sections 13, 23, 24, and 25 of Township 44 North, Range 76 West.

In the eastern and southern portions of the permit area the topography is fairly level although moderately dissected by ephemeral stream channels. In the northern and western portions the slope of the topography increases and the drainages become more incised due to the proximity of North Butte. The surface elevations range from about 4,900 feet in the extreme south to about 5,700 feet above sea level near the flank of North Butte.

The proposed well fields or mining units will occupy approximately the designated areas as shown in the site plan layout Figure 9.2 (Volume II). The planned processing facility and evaporation ponds site, located in the most topographically suitable area, are also shown in Figure 9.2 (Volume II).

The overall topographic condition of the permit area is that of flat to gently sloping terrain with two moderate to large drainages in the western portion and three moderate to small drainages in the east. All the drainages are ephemeral in nature and generally trend from the north to the south, eventually forming tributaries to Willow Creek which runs from east to west, crossing the extreme southern tip of the permit area. In the western portion of the permit area the terrain is more sloped with the drainages more incised. The surface consists of alternating sands and sandy shales in a repeating facies environment. Letdown material is minor except in the northwest portion where there is extensive slide material present from the erosion of North Butte. This material consists of upper Wasatch Formation and lower White River Formation materials which form the walls and cap rock of North Butte, respectively.

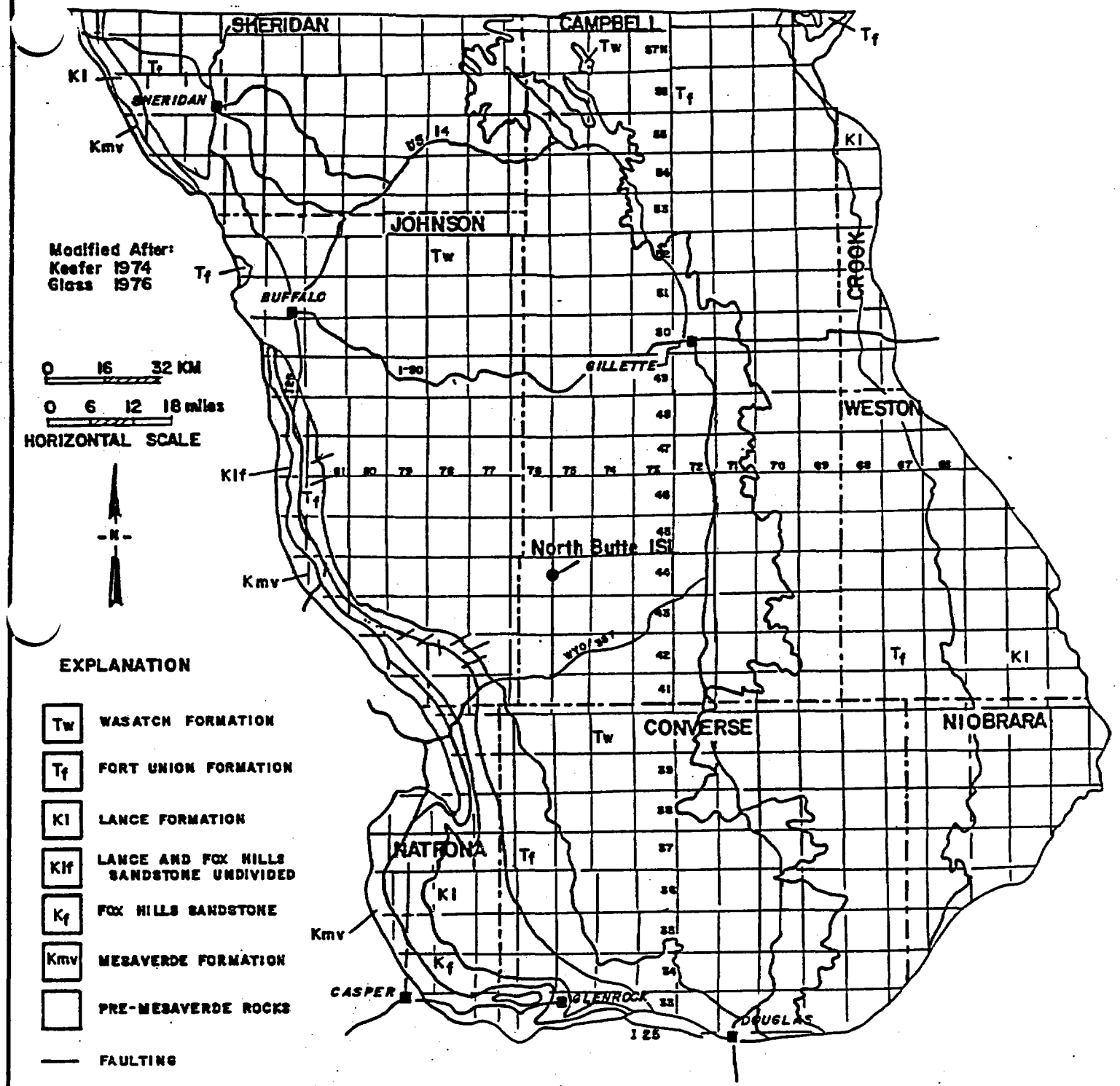
9.3 STRATIGRAPHY

The Powder River Basin incorporates a sedimentary rock sequence that approaches 15,000 feet thick along the synclinal axis. These sedimentary rocks range in age from Tertiary (3 million to 70 million years. B.P.) to Cambrian (500 million to 570 million years B.P.). The Tertiary rock units were deposited in fluviatile to lacustrine environments in a cyclic fashion.

The Tertiary fluvial system had a general drainage direction from south to north. Source areas of the sediments were primarily located to the south and southwest. Today the drainage systems, both surface and subsurface, still generally follow the Tertiary paleodrainage trends. Rock types generally consist of sandstones, siltstones, shales, and numerous coal seams. The Tertiary rock units outcropping within the Basin are the Fort Union Formation (Paleocene), the Wasatch Formation (Eocene), and the White River Formation (Oligocene). The North Butte mine site is located within the Wasatch Formation as seen in Figure 9.3. The basement rocks of the Powder River Basin are sediments of Paleozoic and Mesozoic age. Today, these igneous and metamorphic rocks form the outcrop rim around the Basin.

The Wasatch Formation consists of brown to gray claystone, siltstone, and carbonaceous shales interbedded with buff sandstone lenses and coal beds. In the vicinity of the Pumpkin Buttes, the Wasatch Formation is predominantly a pink, to red and gray, variegated sequence. The Formation has a maximum thickness of about 3,500 feet within the Powder River Basin. In the Pumpkin Buttes area, it is about 1,500 feet thick (Troyer et al, 1954). The base of the Wasatch Formation in the permit area is about 1,350 feet below the surface.

In the Central Powder River Basin, the Wasatch can be divided into a lower siltstone unit, about 500 feet thick, a middle unit, 200 - 300 feet thick, containing numerous sandstone beds, and an upper siltstone unit (Troyer et al, 1954). The uranium mineralized sandstone beds in the middle unit are commonly more than 100 feet thick, and can be several miles long and wide in the vicinity of Pumpkin Buttes. These units are composed of fine to coarse-grained, cross-bedded, arkosic sandstone locally containing stringers and lenses of conglomerate. The sandstone is usually poorly to moderately indurated and often slightly calcareous. The sandstone beds are typically separated by siltstones and claystones, ranging from 10 to over 100 feet thick.



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NORTH BUTTE ISL PROJECT

GEOLOGIC MAP OF THE POWDER RIVER BASIN

GEOL: DRR	1:1,600,000	FIGURE: 9.3
DRAWN BY: P.A.H.	DATE: 11-1-88	

Wasatch Formation sandstones in the Powder River Basin are often good aquifers with groundwater movement generally trending to the north. Groundwater movements followed, more or less, the same general direction during the geologic history of the Basin. Oxidation fronts in the sandstone units moved predominantly from the south and southwest towards the north on the west side of the Basin axis and from the south and southeast on the east side of the axis, once again toward the north, forming uranium enrichment zones. Geologic cross sections through the ore body at the North Butte site are presented in Section 15.2, Ore Body Description.

9.3.1 A STRATIGRAPHIC COLUMN OF THE NORTH BUTTE AREA

A stratigraphic column of the Pumpkin Buttes area is included as Figure 9.4. The lithology of the north Pumpkin Buttes area is presented in Table 9.1.

9.4 STRUCTURE

The structural attitude of the beds is nearly horizontal in the Basin with only a slight dip of 0.5 to 1.5 degrees to the northwest. Evidence of structural instability at the North Butte site such as faulting has not been observed either by field observations or through drill hole correlation. The closest known faulting and/or significant folding is present approximately 16 miles to the west of the site along Pine Ridge.

9.5 SEISMICITY

The area of central Wyoming where the North Butte site is located lies in a relatively quiet seismic region of the United States. Although distant earthquakes may produce shocks strong enough to be felt in the Powder River Basin, the region is ranked as one of minor seismic risk, as shown on Figure 9.5. Few earthquakes capable of producing damage have originated in this region. The seismically active region closest to the site is the Intermountain Seismic Belt of the Western United. States which extends in a northerly direction between Arizona and British Columbia. It is characterized by shallow earthquake foci between 10 and 25 miles in depth, and normal faulting. Part of this seismic belt extends along the Wyoming-Idaho border, more than 200 miles west of the permit area and is the most probable source of earthquakes affecting the project site.

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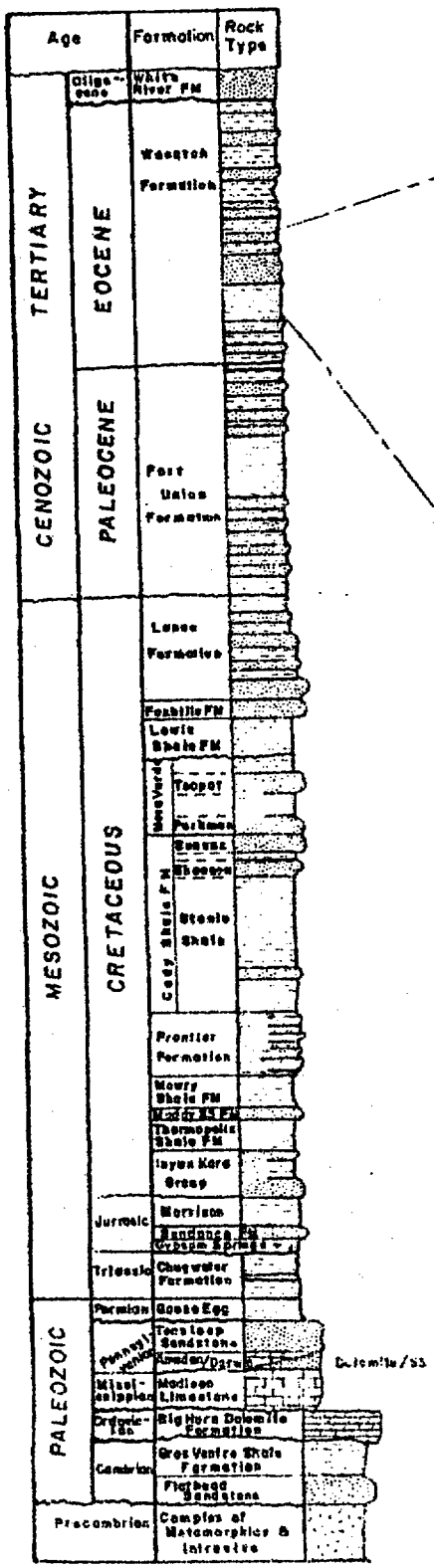
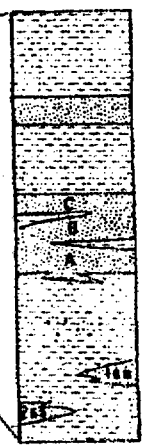
Post Oligocene Deposition
has been removed by erosion



Wasatch Formation
of the
North Butte Project



F Sand

Upper Aquitard

North Butte Mining Sand
Consisting of the A, B & C
Members.

Lower Aquitard

1 and 2 Sands

LEGEND

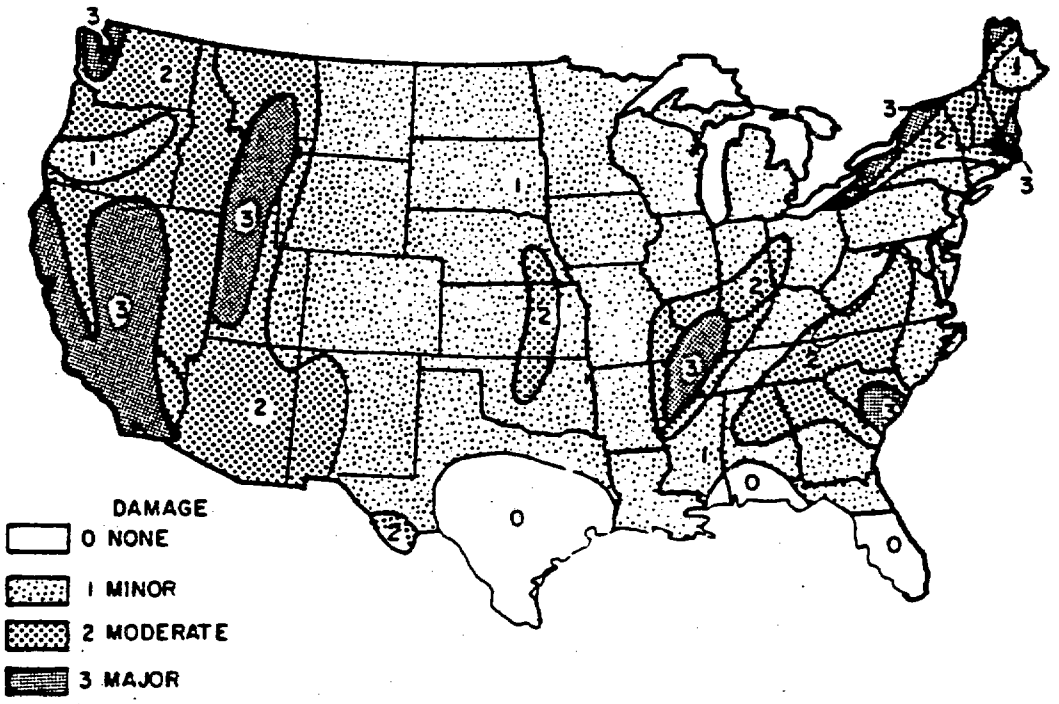
- Conglomerate
- Coarse-grained to pebbly massive sandstone
- Fine-to medium grained massive sandstone
- Shale
- Coal
- Limestone
- Dolomite
- Gypsum
- Igneous and Metamorphic Rock
- Unconformity (A Surface of Erosion)

FM = Formation

TABLE 9.1

LITHOLOGY OF THE NORTH PUMPKIN BUTTE AREA

Surface to "F" Sand	62' to 650' in depth, various interbedded silts, shales, poorly developed sand lenses and coaly intervals.
"F" Sand	22' to 99' thick. Avg. 58' thick. Consists of very fine grained, moderate to sorting, poorly cemented, friable, and containing some lignitic intervals. Not mineralized in the mining areas.
"F-C" Aquitard	56' to 186' thick. Avg. 99' thick. Consists of silts, shales, coaly seams and poorly developed, discontinuous shaley or silty sand stringers.
"C-B-A" Sands	(North Butte Mining Sand) 135' to 368' thick, averaging 286'. Medium. light gray to moderate red in color. Very coarse to very fine grain size with medium grain predominating. Usually poorly consolidated and friable with occasional hard calcareous intervals. Moderately clean and well sorted some detrital carbon and associated mica and pyrite. Heavily mineralized in some areas.
"A-I" Aquitard	99' to 275' thick. Avg. 208' thick. Consists of siltstone, shales and lignitic intervals with an occasional poorly developed discontinuous sandy lense.
"1" Sand	0' to 68' thick. Avg. 40'. Sand consists of medium gray, medium grain sand poorly sorted and slightly shaley. Sand is discontinuous and spotty. The thicknesses of the overlying shale indicate several poorly developed discontinuous sand lenses instead of one continuous unit.



Seismic risk map of the United States. Source: Modified from S. T. Algermissen, *United States Earthquakes*, U. S. Government Printing Office, Washington, D.C., 1968.

URANERZ U.S.A., INC.		
NORTH BUTTE ISL PROJECT		
SEISMIC RISK MAP of THE UNITED STATES		
GEOL:	SCALE: NONE	FIGURE: 9.5
DRAWN BY: P.A.H.	DATE: 4-12-88	

9.6 EXPLORATION HOLES

Through the 21 years from 1967 through 1988, approximately 2,720 exploration and predevelopment, and development wells were drilled in and around the North Butte permit area. These holes and wells were drilled by The Cleveland Cliffs Iron Company and Uranerz. To the best of Uranerz' knowledge, the holes drilled prior to 1979 were drilled with natural mud and bentonite when necessary. The wells were plugged and sealed in such a manner as to be acceptable to Wyoming regulations at the time. The regulations evolved with time and after 1979, to the best of Uranerz' knowledge, all exploration holes were drilled and abandoned in compliance with Wyoming Statute 35-11-404.

Figure 9.6 (Volume II) is a drill hole location map showing abandoned exploration holes within the permit area. Table 9.2 is a tabulation of all the abandoned exploration holes. A description of the abandonment procedures follows Table 9.2.

TABLE 9.2

ABANDONED DRILL HOLES - NORTH BUTTE PERMIT AREA

TOWN SHIP	RANGE	SECT	HOLE #	COORDINATE NORTH	COORDINATE EAST	ELEV	TD	Date Abandoned	Abandonment Procedure
44	75	18	4	145882	69634	5150	600	No data	
44	75	18	5	145457	68729	5141	600	No data	
44	75	18	6	145032	67823	5172	600	No data	
44	75	18	7	143796	67769	5141	660	07-26-68	1
44	75	18	8	143792	68169	5131	660	07-26-68	1
44	75	18	9	143789	68569	5127	640	07-26-68	1
44	75	18	10	143785	68969	5121	622	07-27-68	1
44	75	18	11	143781	69369	5096	620	08-01-68	1
44	75	18	12	143778	69769	5117	640	08-01-68	1
44	75	18	13	143774	70169	5112	600	08-01-68	1
44	75	18	14	143987	68771	5125	640	11-25-68	1
44	75	18	15	143594	67967	5131	653	10-31-68	1
44	75	18	16	143592	68167	5126	640	11-22-68	1
44	75	18	17	143590	68367	5123	641	11-23-68	1
44	75	18	18	143589	68567	5123	640	11-22-68	1
44	75	18	19	143587	68767	5124	640	11-23-68	1
44	75	18	20	143585	68967	5124	663	11-23-68	1
44	75	18	21	143583	69167	5136	680	11-23-68	1
44	75	18	22	143581	69367	5132	659	10-30-68	1
44	75	18	23	143580	69567	5121	620	10-29-68	1
44	75	18	24	143578	69767	5110	740	10-29-68	1
44	75	18	25	143576	69967	5091	600	10-29-68	1
44	75	18	26	143787	68769	5125	580	11-26-68	1
44	75	18	27	143783	69169	5119	640	10-30-68	1
44	75	18	28	143943	68957	5119	620	10-30-68	1
44	75	18	29	143983	69171	5118	640	11-26-68	1
44	75	18	31	144187	68773	5131	620	11-25-68	1
44	75	18	32	144385	68975	5132	660	11-24-68	1
44	75	18	33	144183	69173	5125	620	11-26-68	1
44	75	18	34	143788	68669	5126	618	12-13-68	1
44	75	18	35	143786	68819	5124	600	12-14-68	1
44	75	18	36	143785	68919	5121	620	12-16-68	1
44	75	18	37	143782	69269	5113	620	12-16-68	1
44	75	18	38	143784	69069	5118	600	12-18-68	1
44	75	18	39	143788	68619	5127	628	12-19-68	1
44	75	18	40	143787	68719	5126	638	12-22-68	1
44	75	18	41	143786	68869	5123	636	12-23-68	1
44	75	18	42	143783	69219	5120	618	01-03-69	1
44	75	18	43	143782	69319	5112	609	01-03-69	1
44	75	18	44	143784	69119	5121	598	01-08-69	1
44	75	18	45	143785	69019	5119	591	01-11-69	1
44	75	18	46	143424	70166	5095	580	09-02-69	1
44	75	18	47	143885	68970	5122	620	09-03-69	1

TABLE 9.2 (Cont.)

ABANDONED DRILL HOLES - NORTH BUTTE PERMIT AREA

TOWN SHIP	RANGE	SECT	HOLE #	COORDINATE NORTH	COORDINATE EAST	ELEV	TD	Date Abandoned	Abandonment Procedure
44	75	18	48	143835	68970	5119	616	09-03-69	1
44	75	18	49	143985	68971	5119	618	09-04-69	1
44	75	18	50	143735	68969	5122	620	09-05-69	1
44	75	18	51	144035	68971	5117	618	09-05-69	1
44	75	18	52	144085	68972	5123	619	09-02-69	1
44	75	18	53	143685	68968	5123	618	09-03-69	1
44	75	18	54	143635	68968	5124	614	09-08-69	1
44	75	18	55	143943	68947	5122	620	10-06-69	1
44	75	18	56	143784	69094	5120	626	07-09-74	2
44	75	18	57	143428	69766	5125	595	01-06-77	2
44	75	18	58	143628	69768	5095	695	01-07-77	2
44	75	18	59	143528	69767	5114	600	01-07-77	2
44	75	18	60	143478	69766	5123	735	01-10-77	2
44	75	18	61	143431	69366	5134	655	01-10-77	2
44	75	18	63	143481	69366	5135	660	01-11-77	2
44	75	18	64	143435	68966	5129	641	01-11-77	2
44	75	18	65	143531	69367	5135	662	01-12-77	2
44	75	18	66	143535	68967	5126	637	01-12-77	2
44	75	18	67	143485	68966	5128	633	01-12-77	2
44	75	18	68	143540	68367	5123	637	01-12-77	2
44	75	18	69	143440	68366	5122	640	01-12-77	2
44	75	18	70	143640	68368	5121	618	01-13-77	2
44	75	18	71	143444	67966	5128	676	01-14-77	1
44	75	18	72	143490	68366	5124	651	01-14-77	2
44	75	18	73	143544	67967	5130	636	01-14-77	1
44	75	18	74	143494	67966	5129	637	01-14-77	1
44	75	18	75	143631	69368	5130	663	02-25-77	2
44	75	18	76	143681	69368	5120	639	03-07-77	2
44	75	18	77	143476	67767	5134	780	07-22-77	2
44	75	18	78	143492	68166	5123	740	08-03-77	2
44	75	18	79	143582	69267	5138	680	02-22-78	2
44	75	18	80	143584	69067	5129	660	02-22-78	2
44	75	18	81	143484	69066	5133	660	02-23-78	2
44	75	18	82	143482	69266	5139	660	02-23-78	2
44	75	18	83	143684	69068	5126	660	02-24-78	2
44	75	18	84	143683	69168	5131	660	02-24-78	2
44	75	18	85	143688	68668	5123	620	05-25-78	2
44	75	18	86	143687	68768	5125	620	05-26-78	2
44	75	18	87	143686	68868	5124	620	05-26-78	2
44	75	18	88	143887	68770	5124	620	05-26-78	2
44	75	18	89	143886	68870	5122	620	05-26-78	2
44	75	18	90	143986	68871	5124	620	05-26-78	2
44	75	18	91	143588	68667	5121	620	05-30-78	1

TABLE 9.2 (Cont.)

ABANDONED DRILL HOLES - NORTH BUTTE PERMIT AREA

TOWN SHIP	RANGE	SECT	HOLE #	COORDINATE NORTH	COORDINATE EAST	ELEV	TD	Date Abandoned	Abandonment Procedure
44	75	18	92	143586	68871	5124	640	05-30-78	1
44	75	18	93	143590	68467	5125	640	05-30-78	1
44	75	18	94	143481	69466	5134	660	05-30-78	1
44	75	18	95	143479	69660	5122	660	05-30-78	2
44	75	18	96	143682	69268	5132	620	05-31-78	2
44	75	18	97	143486	68866	5125	620	06-01-78	2
44	75	18	98	143487	68766	5125	620	06-01-78	2
44	75	18	99	143593	68067	5129	660	06-01-78	2
44	75	18	100	143488	68666	5119	620	06-01-78	2
44	75	18	101	144087	68772	5122	620	06-01-78	2
44	75	18	102	143493	68066	5127	640	06-01-78	2
44	75	18	103	143580	69467	5127	660	06-02-78	2
44	75	18	104	143490	68467	5123	620	06-05-78	2
44	75	18	105	143480	69566	5129	640	06-05-78	2
44	75	18	106	143489	68566	5125	620	06-05-78	2
44	75	18	107	143888	68670	5127	620	06-06-78	2
44	75	18	108	143483	69166	5137	660	06-06-78	2
44	75	18	109	143988	68671	5127	620	06-06-78	2
44	75	18	110	144088	68672	5129	620	06-06-78	2
44	75	18	111	144083	69172	5122	620	06-06-78	2
44	75	18	112	144086	68887	5121	620	06-06-78	2
44	75	18	113	143477	69866	5120	600	06-06-78	2
44	75	18	114	143889	68570	5128	640	06-09-78	2
44	75	18	115	143696	67975	5134	660	06-14-78	2
44	75	18	116	143889	68470	5129	640	06-15-78	2
44	75	18	117	143989	68571	5129	640	06-15-78	2
44	75	18	118	144089	68572	5131	640	06-15-78	2
44	75	18	119	143884	69070	5119	640	06-15-78	2
44	75	18	120	143591	68267	5113	620	06-16-78	2
44	75	18	121	143789	68469	5128	640	06-19-78	2
44	75	18	122	143989	68471	5130	640	06-20-78	2
44	75	18	123	144089	68472	5132	640	06-20-78	2
44	75	18	124	144189	68573	5132	640	06-20-78	2
44	75	18	125	144186	68873	5130	640	06-22-78	2
44	75	18	126	144084	69072	5124	641	06-22-78	2
44	75	18	127	143984	69071	5113	641	06-22-78	2
44	75	18	128	144188	68673	5130	640	06-22-78	2
44	75	18	129	144185	68973	5127	640	06-27-78	2
44	75	18	130	144286	68874	5134	640	06-28-78	2
44	75	18	131	144082	69272	5117	640	06-28-78	2
44	75	18	132	144189	68473	5134	640	06-28-78	2
44	75	18	133	144289	68574	5133	660	06-28-78	2
44	75	18	134	144288	68674	5132	640	06-28-78	2

TABLE 9.2 (Cont.)

ABANDONED DRILL HOLES - NORTH BUTTE PERMIT AREA

TOWN SHIP	RANGE	SECT	HOLE #	COORDINATE NORTH	COORDINATE EAST	ELEV	TD	Date Abandoned	Abandonment Procedure
44	75	18	135	143491	68266	5112	620	07-24-78	2
44	75	18	136	143579	69667	5114	620	07-25-78	2
44	75	18	137	143670	69453	5118	620	07-25-78	2
44	75	18	138	143982	69271	5114	620	07-26-78	2
44	75	18	139	143883	69170	5109	620	07-28-78	2
44	75	18	140	143882	69270	5116	620	08-04-78	2
44	75	18	141	143700	69568	5095	600	08-04-78	2
44	75	18	142	143780	69469	5097	600	08-04-78	2
44	75	18	143	143679	69668	5097	600	08-07-78	2
44	75	18	144	143425	70241	5079	680	08-10-78	2
44	75	18	145	143689	68568	5125	640	08-11-78	2
44	75	18	146	143475	70216	5074	680	08-11-78	2
44	75	18	147	143692	68168	5128	640	08-14-78	2
44	75	18	148	143890	68370	5118	620	08-16-78	2
44	75	18	149	143523	70267	5105	700	08-17-78	2
44	75	18	150	143573	70267	5106	700	08-18-78	2
44	75	18	151	143426	69966	5111	600	08-25-78	2
44	75	18	152	143836	67820	5140	800	08-28-78	3
44	75	18	153	143960	67890	5142	900	09-27-79	2
44	75	18	154	144500	69150	5131	1000	12-05-79	2
44	75	19	1	143392	68166	5122	640	07-25-68	1
44	75	19	2	142992	68162	5113	640	07-25-68	1
44	75	19	3	143389	68566	5121	620	07-26-68	1
44	75	19	4	142989	68562	5107	620	07-26-68	1
44	75	19	5	143385	68966	5125	640	07-27-68	1
44	75	19	6	143381	69366	5129	634	07-27-68	1
44	75	19	7	143378	69766	5124	620	07-27-68	1
44	75	19	8	143324	70069	5109	600	07-31-68	1
44	75	19	9	143371	70565	5100	600	08-01-68	1
44	75	19	10	142971	70562	5093	600	08-01-68	1
44	75	19	11	142974	70162	5112	620	08-02-68	1
44	75	19	12	142571	70558	5089	600	08-02-68	1
44	75	19	13	142967	70962	5062	540	08-02-68	1
44	75	19	14	142567	70958	5085	560	08-02-68	1
44	75	19	15	142167	70955	5081	560	08-03-68	1
44	75	19	16	142171	70555	5082	600	08-03-68	1
44	75	19	17	143176	69964	5119	720	10-27-68	1
44	75	19	17A	138160	71319	5060	600	08-14-68	1
44	75	19	18	143376	69966	5113	765	10-25-68	1
44	75	19	19	143174	70164	5109	600	10-26-68	1
44	75	19	20	143172	70364	5075	600	10-29-68	1
44	75	19	21	142972	70362	5098	600	10-28-68	1
44	75	19	22	142772	70360	5097	600	10-26-68	1

TABLE 9.2 (Cont.)

ABANDONED DRILL HOLES - NORTH BUTTE PERMIT AREA

TOWN SHIP	RANGE	SECT	HOLE #	COORDINATE NORTH	COORDINATE EAST	ELEV	TD	Date Abandoned	Abandonment Procedure
44	75	19	23	142771	70560	5081	600	10-28-68	1
44	75	19	24	142769	70760	5090	600	10-26-68	1
44	75	19	25	142569	70758	5064	600	10-26-68	1
44	75	19	26	142371	70556	5086	600	11-27-68	1
44	75	19	27	142369	70756	5084	600	10-26-68	1
44	75	19	28	142367	70956	5065	560	10-26-68	1
44	75	19	29	142169	70755	5081	560	11-27-68	1
44	75	19	30	143394	67966	5125	660	11-01-68	1
44	75	19	31	143390	68366	5118	637	11-26-68	1
44	75	19	32	143387	68766	5119	640	11-25-68	1
44	75	19	33	143383	69166	5136	680	11-23-68	1
44	75	19	34	143380	69566	5125	640	11-27-68	1
44	75	19	35	142419	70757	5083	560	09-02-69	1
44	75	19	36	143224	70164	5105	600	09-02-69	1
44	75	19	37	142319	70756	5083	560	09-02-69	1
44	75	19	38	142469	70757	5074	540	09-03-69	1
44	75	19	39	142269	70756	5082	560	09-03-69	1
44	75	19	40	142519	70758	5064	540	09-04-69	1
44	75	19	41	143274	70165	5101	580	09-04-69	1
44	75	19	42	142219	70755	5082	560	09-04-69	1
44	75	19	43	143124	70163	5111	580	09-05-69	1
44	75	19	44	143324	70165	5094	560	09-05-69	1
44	75	19	45	143374	70166	5096	560	09-05-69	1
44	75	19	46	143299	70165	5099	560	10-09-69	1
44	75	19	47	143249	70164	5101	530	01-13-70	1
44	75	19	48	142444	70757	5079	520	10-16-69	1
44	75	19	49	142625	70500	5089	560	07-23-71	1
44	75	19	50	142000	71300	5103	560	No data	
44	75	19	51	142000	71100	5070	520	No data	
44	75	19	52	142000	70750	5078	540	No data	
44	75	19	53	142571	70155	5091	700	09-13-71	1
44	75	19	54	142294	70756	5082	560	07-08-74	2
44	75	19	55	143384	67966	5125	622	07-21-76	2
44	75	19	56	142678	70530	5068	600	07-21-76	2
44	75	19	57	142000	70850	5064	540	No data	
44	75	19	58	142000	70932	5052	520	No data	
44	75	19	59	142974	70212	5111	700	01-03-77	1
44	75	19	60	142571	70508	5089	560	01-03-77	2
44	75	19	61	142975	70112	5110	600	01-04-77	1
44	75	19	62	142168	70805	5080	675	01-04-77	2
44	75	19	63	142971	70512	5079	560	01-05-77	1
44	75	19	64	142167	71005	5055	535	01-05-77	2
44	75	19	65	142973	70262	5107	580	01-05-77	1

TABLE 9.2 (Cont.)

ABANDONED DRILL HOLES - NORTH BUTTE PERMIT AREA

TOWN SHIP	RANGE	SECT	HOLE #	COORDINATE NORTH	COORDINATE EAST	ELEV	TD	Date Abandoned	Abandonment Procedure
44	75	19	66	142167	70905	5066	535	01-05-77	2
44	75	19	67	143328	69765	5119	600	01-06-77	1
44	75	19	68	142970	70612	5092	575	01-06-77	2
44	75	19	69	142570	70608	5077	560	01-06-77	2
44	75	19	70	142973	70312	5103	575	01-06-77	2
44	75	19	71	142570	70658	5070	540	01-07-77	2
44	75	19	72	142168	70855	5075	535	01-06-77	2
44	75	19	73	142569	70708	5065	540	01-07-77	2
44	75	19	74	142568	70808	5076	555	01-07-77	2
44	75	19	75	142170	70605	5082	560	01-10-77	2
44	75	19	76	143278	69765	5117	735	01-07-77	2
44	75	19	77	142171	70505	5082	660	01-10-77	2
44	75	19	78	143331	69365	5123	635	01-11-77	2
44	75	19	79	143335	68965	5127	738	01-11-77	2
44	75	19	80	143281	69365	5117	637	01-12-77	2
44	75	19	81	143285	68965	5123	642	01-12-77	2
44	75	19	82	143231	69364	5113	738	01-03-77	2
44	75	19	83	143340	68365	5104	743	01-13-77	2
44	75	19	84	143344	67965	5126	758	01-13-77	2
44	75	19	85	143235	68964	5119	742	01-13-77	2
44	75	19	86	143181	69364	5109	640	01-14-77	2
44	75	19	87	143185	68964	5115	635	01-14-77	1
44	75	19	88	143294	67965	5125	639	01-14-77	2
44	75	19	89	143244	67964	5124	641	01-18-77	1
44	75	19	90	143290	68365	5100	602	01-18-77	2
44	75	19	91	143135	68963	5110	642	01-18-77	2
44	75	19	92	143131	69363	5106	744	01-20-77	2
44	75	19	93	143085	68963	5106	642	01-20-77	2
44	75	19	94	143081	69363	5103	604	01-21-77	2
44	75	19	95	143194	67964	5122	624	01-21-77	2
44	75	19	96	143228	69764	5116	700	01-24-77	2
44	75	19	97	143035	68962	5100	623	01-24-77	2
44	75	19	98	143381	69366	5129	735	01-10-77	2
44	75	19	99	143178	69764	5114	700	01-25-77	2
44	75	19	100	143240	68364	5111	642	01-26-77	2
44	75	19	101	143128	69763	5112	715	01-26-77	2
44	75	19	102	143144	67963	5121	639	01-27-77	2
44	75	19	103	143078	69763	5109	635	01-27-77	2
44	75	19	104	143094	67963	5119	619	01-27-77	2
44	75	19	105	143031	69362	5100	719	01-27-77	2
44	75	19	106	142975	70062	5109	635	01-28-77	2
44	75	19	107	143044	67962	5117	618	01-28-77	2
44	75	19	108	142981	69361	5098	701	01-28-77	2

TABLE 9.2 (Cont.)

ABANDONED DRILL HOLES - NORTH BUTTE PERMIT AREA

TOWN SHIP	RANGE	SECT	HOLE #	COORDINATE NORTH	COORDINATE EAST	ELEV	TD	Date Abandoned	Abandonment Procedure
44	75	19	109	143028	69762	5106	635	01-31-77	2
44	75	19	110	142976	70012	5110	635	02-01-77	2
44	75	19	111	142994	67962	5111	619	02-01-77	2
44	75	19	112	143190	68364	5116	619	02-01-77	2
44	75	19	113	143140	68363	5115	619	02-02-77	2
44	75	19	114	142931	69361	5095	599	02-02-77	2
44	75	19	115	143090	68363	5112	619	02-07-77	2
44	75	19	116	142944	67962	5112	618	02-07-77	2
44	75	19	117	142881	69361	5092	598	02-14-77	2
44	75	19	118	143040	68362	5111	618	02-14-77	2
44	75	19	119	142990	68362	5109	618	02-14-77	2
44	75	19	120	142831	69361	5090	718	02-15-77	2
44	75	19	121	142940	68362	5108	615	02-15-77	2
44	75	19	122	142894	67961	5114	618	02-16-77	2
44	75	19	123	142844	67961	5114	618	02-16-77	2
44	75	19	124	142794	67960	5114	643	02-25-77	2
44	75	19	125	143069	67963	5118	680	08-09-77	1
44	75	19	126	143365	68365	5110	620	08-11-77	1
44	75	19	127	142931	69411	5094	700	02-10-78	2
44	75	19	128	143180	69564	5105	720	02-10-78	2
44	75	19	129	143081	69463	5101	700	02-10-78	2
44	75	19	130	143328	69815	5121	720	02-13-78	2
44	75	19	131	143279	69665	5113	720	02-13-78	2
44	75	19	132	143276	69965	5117	720	02-14-78	2
44	75	19	133	143023	70262	5106	720	02-14-78	2
44	75	19	134	143124	70213	5106	720	02-14-78	2
44	75	19	135	143080	69563	5100	700	02-14-78	2
44	75	19	136	143226	69964	5119	720	02-15-78	2
44	75	19	137	143179	69664	5107	720	02-15-78	2
44	75	19	138	143326	69965	5115	720	02-15-78	1
44	75	19	139	142881	69411	5092	700	02-15-78	2
44	75	19	140	142981	69462	5096	700	02-15-78	2
44	75	19	141	143181	69464	5107	720	02-16-78	2
44	75	19	142	142980	69562	5094	700	02-16-78	1
44	75	19	143	143079	69663	5102	720	02-16-78	2
44	75	19	144	142782	69260	5089	700	02-16-78	2
44	75	19	145	143280	69565	5114	720	02-16-78	2
44	75	19	146	142979	69662	5097	720	02-17-78	2
44	75	19	147	143023	70312	5103	720	02-17-78	2
44	75	19	148	143379	69666	5119	720	02-17-78	2
44	75	19	149	142882	69261	5093	700	02-17-78	2
44	75	19	150	142880	69561	5090	700	02-17-78	2
44	75	19	151	143281	69465	5116	720	02-17-78	2

TABLE 9.2 (Cont.)

ABANDONED DRILL HOLES - NORTH BUTTE PERMIT AREA

TOWN SHIP	RANGE	SECT	HOLE #	COORDINATE NORTH	COORDINATE EAST	ELEV	TD	Date Abandoned	Abandonment Procedure
44	75	19	152	142982	69262	5098	700	02-21-78	2
44	75	19	153	142883	69161	5094	700	02-21-78	2
44	75	19	154	143384	69066	5134	660	02-21-78	2
44	75	19	155	143174	70214	5103	700	02-22-78	2
44	75	19	156	142781	69460	5086	700	02-22-78	2
44	75	19	157	142881	69461	5091	700	02-22-78	2
44	75	19	158	142983	69162	5098	725	02-23-78	2
44	75	19	159	142783	69160	5081	700	02-23-78	2
44	75	19	160	142681	69459	5083	700	02-23-78	2
44	75	19	161	143022	70362	5094	700	02-23-78	2
44	75	19	162	143340	69565	5121	720	02-24-78	2
44	75	19	163	143386	68866	5124	660	02-24-78	2
44	75	19	164	142780	69560	5085	700	02-24-78	2
44	75	19	165	142884	69061	5092	720	02-27-78	2
44	75	19	166	143224	70214	5101	720	02-27-78	2
44	75	19	167	143210	68964	5117	600	04-11-78	1
44	75	19	168	143253	69764	5116	720	04-12-78	1
44	75	19	169	142882	69286	5093	700	04-17-78	1
44	75	19	170	142984	69062	5099	740	05-26-78	2
44	75	19	171	142781	69360	5088	720	05-26-78	2
44	75	19	172	142784	69060	5089	720	05-26-78	2
44	75	19	173	142885	68961	5086	720	05-26-78	2
44	75	19	174	143382	69266	5132	660	05-30-78	1
44	75	19	175	143377	69866	5121	720	05-30-78	2
44	75	19	176	143284	69065	5127	660	05-30-78	2
44	75	19	177	143184	69064	5115	640	05-30-78	2
44	75	19	178	142682	69259	5086	700	05-31-78	2
44	75	19	179	143082	69263	5104	620	05-31-78	2
44	75	19	180	143182	69264	5112	620	05-31-78	2
44	75	19	181	143084	69063	5106	620	05-31-78	2
44	75	19	182	143275	70215	5088	700	06-02-78	2
44	75	19	183	142683	69159	5084	700	06-02-78	2
44	75	19	185	143083	69163	5105	620	06-05-78	2
44	75	19	186	143183	69164	5114	640	06-05-78	2
44	75	19	187	143282	69265	5122	640	06-05-78	2
44	75	19	188	143283	69165	5127	640	06-05-78	2
44	75	19	189	143388	68666	5115	620	06-06-78	2
44	75	19	190	143393	68066	5125	640	06-07-78	2
44	75	19	191	142886	68861	5099	720	06-07-78	2
44	75	19	192	143022	70412	5073	680	06-07-78	2
44	75	19	193	143381	69466	5129	640	06-07-78	2
44	75	19	194	142684	69059	5091	720	06-08-78	2
44	75	19	195	142988	68662	5106	740	06-09-78	2

TABLE 9.2 (Cont.)

ABANDONED DRILL HOLES - NORTH BUTTE PERMIT AREA

TOWN SHIP	RANGE	SECT	HOLE #	COORDINATE NORTH	COORDINATE EAST	ELEV	TD	Date Abandoned	Abandonment Procedure
44	75	19	196	142990	68462	5108	740	06-09-78	2
44	75	19	197	142893	68061	5107	740	06-09-78	2
44	75	19	198	143289	68565	5112	620	06-13-78	2
44	75	19	199	143288	68665	5111	620	06-13-78	2
44	75	19	200	143286	68865	5116	620	06-13-78	2
44	75	19	201	142887	68761	5102	620	06-13-78	2
44	75	19	202	143090	68463	5112	620	06-14-78	2
44	75	19	203	143091	68263	5114	620	06-14-78	2
44	75	19	204	143191	68264	5118	620	06-14-78	2
44	75	19	205	143291	68265	5119	620	06-14-78	2
44	75	19	206	143186	68864	5109	620	06-16-78	2
44	75	19	207	143292	68165	5122	640	06-16-78	2
44	75	19	209	142772	70460	5070	660	06-21-78	2
44	75	19	210	143293	68065	5123	640	06-27-78	2
44	75	19	211	143192	68164	5119	640	06-27-78	2
44	75	19	212	142793	68060	5110	640	06-27-78	2
44	75	19	213	143089	68563	5109	640	06-27-78	2
44	75	19	214	142572	70308	5100	700	06-27-78	2
44	75	19	215	143186	68565	5095	620	06-28-78	2
44	75	19	216	142774	70210	5104	700	06-28-78	2
44	75	19	217	143193	68064	5121	640	06-28-78	2
44	75	19	218	143093	68063	5118	640	06-29-78	2
44	75	19	219	143092	68163	5116	640	06-29-78	2
44	75	19	220	142993	68062	5115	640	06-29-78	2
44	75	19	221	143187	68764	5106	620	06-29-78	2
44	75	19	222	142892	68162	5110	640	06-30-78	2
44	75	19	223	142792	68160	5103	620	06-30-78	2
44	75	19	224	142778	69760	5089	700	07-07-78	1
44	75	19	225	142776	69960	5098	700	07-08-78	1
44	75	19	226	142368	70806	5082	560	07-10-78	2
44	75	19	227	142777	69860	5094	700	07-10-78	2
44	75	19	228	142677	69859	5088	700	07-18-78	2
44	75	19	229	142876	69961	5103	720	07-18-78	2
44	75	19	230	143087	68763	5098	620	07-19-78	2
44	75	19	231	142986	68862	5092	620	07-19-78	2
44	75	19	232	143190	68464	5110	620	07-19-78	2
44	75	19	233	143390	68466	5117	620	07-19-78	2
44	75	19	234	143188	68664	5100	620	07-20-78	2
44	75	19	235	142985	68962	5094	620	07-20-78	2
44	75	19	236	142368	70856	5079	560	07-20-78	2
44	75	19	237	143290	68465	5105	620	07-20-78	2
44	75	19	238	143391	68266	5108	620	07-24-78	2
44	75	19	239	142987	68762	5103	620	07-24-78	2

TABLE 9.2 (Cont.)

ABANDONED DRILL HOLES - NORTH BUTTE PERMIT AREA

TOWN SHIP	RANGE	SECT	HOLE #	COORDINATE NORTH	COORDINATE EAST	ELEV	TD	Date Abandoned	Abandonment Procedure
44	75	19	240	142772	70410	5086	680	07-24-78	2
44	75	19	241	142770	70610	5083	560	07-25-78	2
44	75	19	242	142367	70906	5070	540	07-25-78	2
44	75	19	243	142783	70498	5070	540	07-25-78	2
44	75	19	244	142775	70060	5102	700	07-26-78	2
44	75	19	245	142354	70706	5084	560	07-26-78	2
44	75	19	246	143287	68780	5111	620	07-26-78	2
44	75	19	247	143086	68863	5089	620	07-27-78	2
44	75	19	248	142370	70656	5085	560	07-27-78	2
44	75	19	249	143088	68648	5102	620	07-27-78	2
44	75	19	250	142770	70660	5085	560	07-28-78	2
44	75	19	251	142874	70161	5108	720	07-31-78	2
44	75	19	252	142676	69959	5093	700	08-01-78	2
44	75	19	253	142370	70606	5085	560	08-01-78	2
44	75	19	254	142576	69958	5086	680	08-01-78	2
44	75	19	255	142575	70058	5093	700	08-03-78	2
44	75	19	256	142875	70061	5105	700	08-03-78	2
44	75	19	257	142774	70160	5102	580	08-03-78	2
44	75	19	258	142773	70260	5106	580	08-03-78	2
44	75	19	259	142769	70710	5090	560	08-04-78	2
44	75	19	260	142775	70110	5101	580	08-07-78	2
44	75	19	261	142773	70310	5109	580	08-07-78	2
44	75	19	262	143325	70241	5077	680	08-07-78	2
44	75	19	263	142476	69957	5079	1000	08-08-78	2
44	75	19	264	143375	70241	5077	680	08-08-78	2
44	75	19	265	142475	70057	5085	680	08-08-78	2
44	75	19	266	142376	69957	5076	680	08-09-78	2
44	75	19	267	142375	70057	5080	680	08-10-78	2
44	75	19	268	142276	69956	5084	700	08-10-78	2
44	75	19	269	142275	70056	5088	700	08-11-78	2
44	75	19	270	142477	69857	5078	680	08-14-78	2
44	75	19	271	142174	70154	5085	700	08-14-78	2
44	75	19	272	142377	69857	5073	680	08-14-78	2
44	75	19	273	142577	69858	5083	680	08-15-78	2
44	75	19	274	142274	70156	5085	700	08-15-78	2
44	75	19	275	142175	70055	5093	700	08-15-78	2
44	75	19	276	142173	70255	5081	680	08-15-78	2
44	75	19	277	142873	70201	5107	700	08-16-78	2
44	75	19	278	142176	69955	5098	700	08-16-78	2
44	75	19	279	142177	69855	5079	680	08-18-78	2
44	75	19	280	142785	68960	5096	720	08-23-78	2
44	75	19	281	142786	68860	5099	720	08-24-78	2
44	75	19	282	142872	70361	5094	700	08-24-78	2

TABLE 9.2 (Cont.)

ABANDONED DRILL HOLES - NORTH BUTTE PERMIT AREA

TOWN SHIP	RANGE	SECT	HOLE #	COORDINATE NORTH	COORDINATE EAST	ELEV	TD	Date Abandoned	Abandonment Procedure
44	75	19	283	142787	68760	5099	720	08-25-78	2
44	75	19	284	142788	68660	5099	720	08-28-78	2
44	75	19	285	142888	68661	5104	720	09-12-78	2
44	75	19	286	142789	68560	5100	720	09-12-78	2
44	75	19	287	142889	68561	5104	620	09-14-78	2
44	75	19	288	142790	68460	5103	620	09-15-78	2
44	75	19	289	142790	68360	5104	740	09-20-78	2
44	75	19	290	142890	68461	5105	620	09-20-78	2
44	75	19	291	142890	68361	5107	620	09-20-78	2
44	75	19	292	142791	68260	5103	640	09-21-78	2
44	75	19	293	142891	68261	5108	620	09-21-78	2
44	75	19	294	142991	68262	5112	620	09-22-78	2
44	75	19	306	143165	68363	5115	560	04-04-79	1
44	75	19	307	142344	70756	5082	540	05-07-79	1
44	75	19	308	143199	70164	5106	546	05-08-79	1
44	75	19	309	143150	70950	5093	700	09-04-79	1
44	75	19	309UC	143280	69565	5114	720	07-06-88	2
44	76	13	G58	144607	66918	5183	600	11-14-67	1
44	76	13	G59	144395	66466	5191	755	11-28-67	1
44	76	13	G60	144183	66013	5205	800	11-15-67	1
44	76	13	G61	143970	65560	5207	800	11-17-67	1
44	76	13	1	144607	66918	5183	600	No data	
44	76	13	2	144395	66466	5191	755	No data	
44	76	13	3	144183	66013	5205	800	No data	
44	76	13	4	143970	65560	5207	800	No data	
44	76	13	5	144207	66573	5183	804	07-11-68	1
44	76	13	6	144210	66173	5200	760	07-11-68	1
44	76	13	7	144607	66577	5193	740	07-12-68	1
44	76	13	8	144610	66177	5209	761	07-13-68	1
44	76	13	9	145010	66181	5221	760	07-13-68	1
44	76	13	10	145007	66580	5207	740	07-13-68	1
44	76	13	11	144603	66977	5181	720	07-15-68	1
44	76	13	12	144203	66973	5168	740	07-15-68	1
44	76	13	13	143803	67006	5155	700	07-15-68	1
44	76	13	14	143807	66569	5176	720	07-15-68	1
44	76	13	15	143810	66169	5194	740	07-16-68	1
44	76	13	16	143407	66566	5186	740	07-16-68	1
44	76	13	17	143403	66966	5157	700	07-16-68	1
44	76	13	18	143799	67369	5150	666	07-16-68	1
44	76	13	19	143399	67366	5138	680	07-17-68	1
44	76	13	20	145003	66980	5194	720	07-17-68	1
44	76	13	21	145407	66584	5219	760	07-18-68	1
44	76	13	22	145410	66184	5235	800	07-18-68	1

TABLE 9.2 (Cont.)

ABANDONED DRILL HOLES - NORTH BUTTE PERMIT AREA

TOWN SHIP	RANGE	SECT	HOLE #	COORDINATE NORTH	COORDINATE EAST	ELEV	TD	Date Abandoned	Abandonment Procedure
44	76	13	23	145810	66187	5250	780	07-18-68	1
44	76	13	24	145414	65784	5256	820	07-20-68	1
44	76	13	25	145018	65712	5277	840	07-19-68	1
44	76	13	26	145017	65380	5313	900	07-20-68	1
44	76	13	27	144614	65777	5237	820	07-22-68	1
44	76	13	28	144617	65377	5284	880	07-22-68	1
44	76	13	29	145814	65787	5270	820	07-23-68	1
44	76	13	30	145417	65384	5294	840	07-24-68	2
44	76	13	31	144217	65373	5211	800	07-24-68	1
44	76	13	32	143396	67766	5131	660	07-24-68	1
44	76	13	33	144221	64973	5232	800	07-29-68	1
44	76	13	34	145021	64980	5380	1000	07-30-68	1
44	76	13	35	144100	64543	5240	800	07-30-68	1
44	76	13	36	144621	64976	5306	880	07-31-68	1
44	76	13	37	146134	65813	5269	800	08-05-68	1
44	76	13	38	145817	65387	5299	840	08-05-68	1
44	76	13	39	143817	65369	5207	800	08-07-68	1
44	76	13	40	143881	65019	5210	760	08-07-68	1
44	76	13	44	143617	65417	5193	820	11-07-68	1
44	76	13	45	143619	65168	5186	780	11-16-68	1
44	76	13	46	143854	65169	5195	760	11-16-68	1
44	76	13	47	144017	65271	5202	761	10-31-68	1
44	76	13	48	144019	65171	5214	798	11-01-68	1
44	76	13	49	144021	65016	5219	798	11-01-68	1
44	76	13	50	144023	64721	5221	780	11-02-68	1
44	76	13	52	144219	65073	5230	840	10-31-68	1
44	76	13	53	144328	65409	5257	880	11-06-68	1
44	76	13	54	144419	65175	5227	821	11-02-68	1
44	76	13	55	144421	64975	5264	860	11-04-68	1
44	76	13	56	144423	64775	5316	960	11-06-68	1
44	76	13	57	144619	65177	5289	900	11-04-68	1
44	76	13	58	144616	65577	5252	820	11-07-68	1
44	76	13	59	144612	65939	5224	820	11-13-68	1
44	76	13	60	144608	66377	5194	740	11-29-68	1
44	76	13	61	144605	66777	5187	742	11-18-68	1
44	76	13	62	144805	66778	5194	720	11-19-68	1
44	76	13	63	144807	66578	5200	780	11-20-68	1
44	76	13	64	144808	66379	5205	760	11-29-68	1
44	76	13	65	144810	66178	5214	780	11-12-68	1
44	76	13	66	144812	65978	5233	820	11-12-68	1
44	76	13	67	144814	65778	5250	818	11-15-68	1
44	76	13	68	144816	65578	5265	840	11-08-68	1
44	76	13	69	144817	65378	5289	824	11-08-68	1

TABLE 9.2 (Cont.)

ABANDONED DRILL HOLES - NORTH BUTTE PERMIT AREA

TOWN SHIP	RANGE	SECT	HOLE #	COORDINATE NORTH	COORDINATE EAST	ELEV	TD	Date Abandoned	Abandonment Procedure
44	76	13	70	144819	65178	5326	920	11-06-68	1
44	76	13	71	145016	65580	5287	860	11-08-68	1
44	76	13	72	145012	65980	5237	800	11-12-68	1
44	76	13	73	145008	66380	5214	800	11-19-68	1
44	76	13	74	145207	66582	5213	740	11-18-68	1
44	76	13	75	145208	66382	5218	759	11-18-68	1
44	76	13	76	145210	66182	5228	800	11-11-68	1
44	76	13	77	145212	65982	5239	806	11-09-68	1
44	76	13	78	145214	65782	5255	801	11-09-68	1
44	76	13	79	145216	65582	5272	822	11-11-68	1
44	76	13	80	145416	65584	5273	820	11-11-68	1
44	76	13	81	145412	65984	5244	800	11-09-68	1
44	76	13	82	145612	65986	5252	806	11-14-68	1
44	76	13	83	145614	65786	5263	800	11-15-68	1
44	76	13	84	145616	65586	5286	840	11-30-68	1
44	76	13	85	145816	65587	5285	820	11-14-68	1
44	76	13	86	145812	65987	5258	780	11-14-68	1
44	76	13	87	146014	65789	5271	820	11-15-68	1
44	76	13	88	144410	66175	5206	800	11-13-68	1
44	76	13	89	144408	66375	5195	760	11-13-68	1
44	76	13	90	144407	66575	5186	760	11-20-68	1
44	76	13	91	144405	66775	5180	720	11-20-68	1
44	76	13	92	144205	66773	5172	740	11-20-68	1
44	76	13	93	144005	66771	5166	720	11-21-68	1
44	76	13	94	144008	66985	5160	700	11-21-68	1
44	76	13	95	144001	67171	5159	705	11-21-68	1
44	76	13	96	143801	67170	5152	681	11-21-68	1
44	76	13	97	143601	67167	5143	680	11-22-68	1
44	76	13	98	143599	67367	5144	680	11-21-68	1
44	76	13	99	143598	67567	5141	660	11-22-68	1
44	76	13	100	143596	67767	5138	640	10-31-68	1
44	76	13	101	143401	67166	5134	660	11-22-68	1
44	76	13	102	143398	67566	5136	660	11-22-68	1
44	76	13	103	144204	66873	5165	738	01-11-69	1
44	76	13	104	144203	66923	5168	740	01-11-69	1
44	76	13	105	144206	66673	5177	737	01-13-69	1
44	76	13	106	144207	66473	5187	750	01-13-69	1
44	76	13	107	144208	66373	5191	736	01-16-69	1
44	76	13	108	144209	66323	5193	740	01-16-69	1
44	76	13	109	144209	66273	5195	738	01-16-69	1
44	76	13	110	144210	66223	5197	750	01-17-69	1
44	76	13	111	144204	66808	5171	708	02-04-69	1
44	76	13	112	144205	66708	5175	722	02-04-69	1

TABLE 9.2 (Cont.)

ABANDONED DRILL HOLES - NORTH BUTTE PERMIT AREA

TOWN SHIP	RANGE	SECT	HOLE #	COORDINATE NORTH	COORDINATE EAST	ELEV	TD	Date Abandoned	Abandonment Procedure
44	76	13	113	144206	66623	5180	727	02-15-69	1
44	76	13	114	144207	66523	5185	724	02-17-69	1
44	76	13	115	144208	66423	5189	723	02-17-69	1
44	76	13	116	144414	65775	5227	814	07-29-69	1
44	76	13	117	143498	67567	5138	680	09-05-69	1
44	76	13	118	143903	66970	5158	700	09-06-69	1
44	76	13	119	143548	67567	5139	660	09-06-69	1
44	76	13	120	143853	66970	5157	700	09-08-69	1
44	76	13	121	143953	66971	5160	695	09-08-69	1
44	76	13	122	143648	67568	5143	660	09-08-69	1
44	76	13	123	144053	66972	5162	700	09-08-69	1
44	76	13	124	143753	66969	5150	680	09-09-69	1
44	76	13	125	144562	65976	5222	800	09-09-69	1
44	76	13	126	144662	65977	5225	800	09-09-69	1
44	76	13	127	144512	65976	5221	800	09-10-69	1
44	76	13	128	144462	65975	5219	800	09-10-69	1
44	76	13	129	144019	65221	5204	780	09-10-69	1
44	76	13	130	144018	65321	5196	774	09-10-69	1
44	76	13	131	143801	67219	5152	679	09-22-69	1
44	76	13	132	143802	67119	5151	676	09-22-69	1
44	76	13	133	144458	66375	5197	740	09-23-69	1
44	76	13	134	143802	67069	5147	678	09-23-69	1
44	76	13	135	143803	67019	5154	700	09-23-69	1
44	76	13	136	144508	66376	5197	740	09-23-69	1
44	76	13	137	144358	66374	5194	740	09-24-69	1
44	76	13	138	144558	66377	5197	740	09-24-69	1
44	76	13	139	144762	65978	5231	810	09-24-69	1
44	76	13	140	144712	65977	5228	810	09-25-69	1
44	76	13	141	143803	66919	5147	700	09-26-69	1
44	76	13	142	144017	65421	5217	786	09-26-69	1
44	76	13	143	143814	65769	5194	620	10-08-69	1
44	76	13	144	143816	65569	5202	640	10-08-69	1
44	76	13	145	144214	65773	5213	655	10-08-69	1
44	76	13	146	144216	65573	5222	800	10-08-69	1
44	76	13	147	144014	65771	5200	660	10-09-69	1
44	76	13	148	144416	65575	5239	820	10-09-69	1
44	76	13	149	143523	67567	5139	630	10-21-69	1
44	76	13	150	144008	66995	5160	675	10-25-69	1
44	76	13	151	144020	65071	5212	785	12-14-70	1
44	76	13	152	144016	65521	5212	784	12-14-70	1
44	76	13	153	144015	65621	5207	902	12-15-70	1
44	76	13	154	144021	65021	5216	783	12-16-70	1
44	76	13	155	144017	65471	5214	783	12-16-70	1

TABLE 9.2 (Cont.)

ABANDONED DRILL HOLES - NORTH BUTTE PERMIT AREA

TOWN SHIP	RANGE	SECT	HOLE #	COORDINATE NORTH	COORDINATE EAST	ELEV	TD	Date Abandoned	Abandonment Procedure
44	76	13	156	144015	65571	5209	785	12-17-70	1
44	76	13	157	144014	65671	5204	702	12-18-70	1
44	76	13	158	145207	66482	5218	740	09-10-71	1
44	76	13	159	145312	65886	5247	800	09-10-71	1
44	76	13	160	145612	65886	5258	900	09-13-71	1
44	76	13	161	145587	65886	5257	800	07-08-74	2
44	76	13	162	143803	67019	5154	698	07-08-74	2
44	76	13	163	144017	65296	5201	766	07-09-74	2
44	76	13	164	144441	62745	5803	1580	09-11-75	2
44	76	13	165	143651	67168	5147	801	01-14-77	2
44	76	13	166	143751	67169	5151	682	01-17-77	2
44	76	13	167	143851	67170	5154	681	01-17-77	2
44	76	13	168	143698	67568	5144	663	01-17-77	2
44	76	13	169	143448	67566	5136	660	01-17-77	2
44	76	13	170	143551	67167	5138	663	01-18-77	2
44	76	13	171	144609	66327	5194	860	01-19-77	2
44	76	13	172	144815	65628	5260	944	01-19-77	1
44	76	13	173	143501	67167	5138	658	01-20-77	2
44	76	13	174	144815	65678	5257	861	01-20-77	2
44	76	13	175	143800	67269	5151	661	01-27-77	2
44	76	13	176	143901	67171	5155	682	01-21-77	2
44	76	13	177	143804	66869	5159	701	01-26-77	2
44	76	13	178	143451	67166	5135	659	01-26-77	2
44	76	13	179	144608	66427	5188	680	01-28-77	2
44	76	13	180	145207	66532	5215	740	02-01-77	2
44	76	13	181	143800	67319	5150	659	01-31-77	2
44	76	13	182	143701	67168	5149	679	01-31-77	2
44	76	13	183	145612	65936	5255	824	02-02-77	2
44	76	13	184	144607	66527	5192	720	02-02-77	2
44	76	13	185	144019	65246	5202	803	02-08-77	2
44	76	13	186	143951	67171	5157	703	02-14-77	2
44	76	13	187	144606	66627	5191	740	02-14-77	2
44	76	13	188	144051	67171	5160	703	02-14-77	2
44	76	13	189	144606	66677	5190	740	02-15-77	2
44	76	13	190	145208	66432	5218	760	02-16-77	2
44	76	13	191	145613	65836	5260	795	02-16-77	2
44	76	13	192	145611	66036	5250	801	02-16-77	2
44	76	13	193	145614	65736	5265	795	02-17-77	2
44	76	13	194	145213	65832	5250	798	02-17-77	2
44	76	13	195	145210	66232	5226	803	02-17-77	2
44	76	13	196	145211	66132	5230	763	02-17-77	2
44	76	13	197	144415	65675	5232	919	02-17-77	2
44	76	13	198	144607	66477	5193	720	02-18-77	2

TABLE 9.2 (Cont.)

ABANDONED DRILL HOLES - NORTH BUTTE PERMIT AREA

TOWN SHIP	RANGE	SECT	HOLE #	COORDINATE NORTH	COORDINATE EAST	ELEV	TD	Date Abandoned	Abandonment Procedure
44	76	13	199	145611	66086	5247	803	02-18-77	2
44	76	13	200	145212	65932	5242	798	02-18-77	2
44	76	13	201	145206	66632	5212	740	02-18-77	2
44	76	13	202	145214	65732	5259	799	02-18-77	2
44	76	13	203	144605	66727	5187	720	02-21-77	2
44	76	13	204	144816	65528	5270	858	02-21-77	2
44	76	13	205	145611	66136	5244	798	02-22-77	2
44	76	13	206	145212	66032	5236	778	02-22-77	2
44	76	13	207	145213	65882	5246	798	02-25-77	2
44	76	13	208	145211	66082	5232	778	02-25-77	2
44	76	13	209	144814	65728	5255	819	02-28-77	2
44	76	13	210	144417	65375	5259	859	02-28-77	1
44	76	13	211	144017	65371	5205	776	03-01-77	2
44	76	13	212	145215	65682	5263	819	03-02-77	2
44	76	13	213	145209	66282	5223	779	03-02-77	2
44	76	13	214	144414	65725	5229	799	03-03-77	2
44	76	13	215	144415	65625	5236	819	03-03-77	2
44	76	13	216	144612	66027	5220	799	03-03-77	2
44	76	13	217	144816	65478	5276	858	03-04-77	2
44	76	13	218	144413	65825	5224	799	03-04-77	2
44	76	13	219	144609	66277	5202	780	03-07-77	2
44	76	13	220	144611	66077	5217	780	03-07-77	2
44	76	13	221	143810	66219	5190	854	03-08-77	2
44	76	13	222	143811	66119	5196	739	03-08-77	2
44	76	13	223	144410	65419	5253	819	03-09-77	2
44	76	13	224	143811	66069	5196	738	03-09-77	2
44	76	13	225	144483	66375	5197	740	03-11-77	2
44	76	13	226	144817	65428	5283	860	03-10-77	2
44	76	13	227	144610	66222	5206	780	03-11-77	2
44	76	13	228	144537	65976	5222	771	03-15-77	1
44	76	13	229	144416	65525	5243	803	03-14-77	2
44	76	13	230	144611	66127	5213	782	03-14-77	2
44	76	13	231	143809	66269	5187	743	03-15-77	2
44	76	13	232	144587	65986	5222	745	03-17-77	1
44	76	13	233	143805	66614	5177	723	03-15-77	2
44	76	13	234	144816	65553	5269	839	03-18-77	1
44	76	13	235	145613	65861	5259	800	03-21-77	1
44	76	13	236	144418	65325	5250	837	03-22-77	2
44	76	13	237	144416	65475	5248	819	03-22-77	2
44	76	13	238	143576	67167	5137	658	03-24-77	1
44	76	13	239	143809	66319	5183	720	04-22-77	2
44	76	13	240	143808	66369	5179	720	05-12-77	2
44	76	13	241	143807	66519	5176	718	05-12-77	2

TABLE 9.2 (Cont.)

ABANDONED DRILL HOLES - NORTH BUTTE PERMIT AREA

TOWN SHIP	RANGE	SECT	HOLE #	COORDINATE NORTH	COORDINATE EAST	ELEV	TD	Date Abandoned	Abandonment Procedure
44	76	13	242	143807	66469	5178	718	05-13-77	2
44	76	13	243	144418	65275	5249	833	05-23-77	2
44	76	13	244	144419	65225	5241	834	06-08-77	2
44	76	13	251	144420	65025	5262	818	07-01-77	2
44	76	13	252	144421	64925	5268	840	07-06-77	2
44	76	13	253	143821	64969	5180	640	07-19-77	2
44	76	13	254	143820	65069	5205	660	07-19-77	2
44	76	13	255	143820	65119	5180	620	08-12-77	2
44	76	13	256	143821	64919	5167	600	08-16-77	2
44	76	13	258	143822	64869	5183	600	08-19-77	2
44	76	13	259	143822	64819	5199	640	08-22-77	2
44	76	13	260	143823	64769	5201	680	08-24-77	2
44	76	13	261	143823	64719	5214	680	08-24-77	1
44	76	13	262	143821	65019	5207	640	09-06-77	2
44	76	13	266	143796	67700	5143	782	09-30-77	1
44	76	13	267	143619	65218	5178	740	11-07-77	2
44	76	13	268	143620	65118	5174	740	11-07-77	2
44	76	13	269	144617	65427	5271	860	11-09-77	2
44	76	13	270	145018	65330	5317	760	11-10-77	2
44	76	13	271	143617	65368	5190	760	11-10-77	2
44	76	13	272	144618	65327	5290	880	11-11-77	2
44	76	13	273	145016	65530	5290	880	11-14-77	2
44	76	13	274	144415	65600	5238	800	11-16-77	1
44	76	13	275	145210	66157	5229	320	11-22-77	1
44	76	13	276	143649	67368	5145	660	02-10-78	2
44	76	13	277	143549	67367	5142	660	02-10-78	2
44	76	13	278	143446	67766	5133	640	02-10-78	2
44	76	13	279	143699	67368	5146	660	02-10-78	2
44	76	13	280	143499	67367	5141	660	02-13-78	2
44	76	13	281	143546	67767	5136	640	02-13-78	2
44	76	13	282	143646	67768	5138	660	02-13-78	2
44	76	13	283	143696	67768	5139	660	02-14-78	2
44	76	13	284	143749	67369	5148	660	02-15-78	2
44	76	13	285	143449	67366	5140	660	02-24-78	2
44	76	13	286	143810	66144	5195	620	03-15-78	1
44	76	13	287	145611	66061	5248	780	04-14-78	1
44	76	13	288	143822	64844	5194	615	04-12-78	1
44	76	13	289	143600	63950	5316	1000	04-21-78	2
44	76	13	290	144110	63860	5352	1000	04-27-78	2
44	76	13	291	143846	67700	5144	780	05-31-78	1
44	76	13	292	143846	67725	5143	700	06-01-78	1
44	76	13	293	143496	67700	5136	660	06-02-78	1
44	76	13	294	143696	67700	5151	780	06-03-78	1

TABLE 9.2 (Cont.)

ABANDONED DRILL HOLES - NORTH BUTTE PERMIT AREA

TOWN SHIP	RANGE	SECT	HOLE #	COORDINATE NORTH	COORDINATE EAST	ELEV	TD	Date Abandoned	Abandonment Procedure
44	76	13	295	143696	67450	5146	760	06-13-78	1
44	76	13	296	144005	66721	5170	720	06-07-78	2
44	76	13	297	144003	67021	5160	700	06-07-78	2
44	76	13	298	144003	66921	5159	700	06-07-78	2
44	76	13	299	144806	66628	5199	740	06-08-78	1
44	76	13	300	145006	66630	5205	740	06-08-78	2
44	76	13	301	144807	66528	5202	740	06-08-78	2
44	76	13	302	145007	66530	5209	740	06-08-78	2
44	76	13	303	144808	66428	5204	740	06-08-78	2
44	76	13	304	145008	66430	5212	740	06-08-78	2
44	76	13	305	144408	66425	5193	740	06-09-78	2
44	76	13	306	144811	66078	5223	660	06-09-78	2
44	76	13	307	144409	66325	5198	760	06-09-78	2
44	76	13	308	144008	66371	5190	760	06-12-78	2
44	76	13	309	144411	66125	5207	760	06-12-78	2
44	76	13	310	145009	66330	5216	740	06-12-78	2
44	76	13	311	144410	66225	5203	760	06-12-78	2
44	76	13	312	144809	66328	5201	740	06-12-78	2
44	76	13	313	144812	66028	5228	820	06-12-78	2
44	76	13	314	145007	66480	5210	740	06-12-78	2
44	76	13	315	144806	66678	5197	740	06-13-78	2
44	76	13	316	144807	66478	5203	740	06-13-78	2
44	76	13	318	144004	66821	5168	720	06-19-78	2
44	76	13	319	144004	66871	5162	700	06-19-78	2
44	76	13	320	144002	67071	5155	700	06-19-78	2
44	76	13	323	145009	66280	5217	760	06-20-78	2
44	76	13	324	144009	66271	5191	740	06-20-78	2
44	76	13	325	144008	66471	5188	740	06-21-78	2
44	76	13	326	144409	66275	5200	760	06-21-78	2
44	76	13	327	144811	66128	5218	700	06-21-78	2
44	76	13	328	144411	66075	5212	760	06-22-78	2
44	76	13	329	145412	66034	5242	800	06-22-78	2
44	76	13	330	145412	65934	5247	819	06-22-78	2
44	76	13	331	145413	65834	5252	252	06-23-78	2
44	76	13	332	144216	65523	5225	801	06-23-78	2
44	76	13	333	144215	65623	5218	780	06-23-78	2
44	76	13	334	145414	65734	5260	859	06-23-78	2
44	76	13	335	144412	66025	5214	761	06-23-78	2
44	76	13	336	143816	65519	5204	780	06-26-78	2
44	76	13	337	143815	65619	5201	781	06-26-78	1
44	76	13	338	144009	66321	5190	755	06-26-78	2
44	76	13	339	144010	66221	5192	739	06-26-78	2
44	76	13	340	145413	65884	5249	815	06-26-78	2

TABLE 9.2 (Cont.)

ABANDONED DRILL HOLES - NORTH BUTTE PERMIT AREA

TOWN SHIP	RANGE	SECT	HOLE #	COORDINATE NORTH	COORDINATE EAST	ELEV	TD	Date Abandoned	Abandonment Procedure
44	76	13	341	143616	65568	5196	760	06-26-78	2
44	76	13	342	144002	67121	5159	680	06-27-78	2
44	76	13	343	144805	66728	5196	740	06-29-78	2
44	76	13	344	144006	66671	5175	740	06-29-78	2
44	76	13	345	144412	65874	5222	800	06-30-78	2
44	76	13	346	145415	65684	5264	840	06-30-78	2
44	76	13	347	144212	66023	5207	760	06-30-78	2
44	76	13	348	144407	66525	5189	740	06-30-78	2
44	76	13	349	144213	65823	5212	780	07-05-78	2
44	76	13	350	144214	65723	5214	780	07-05-78	2
44	76	13	351	145411	66084	5240	800	07-05-78	2
44	76	13	352	144010	66171	5195	740	07-05-78	2
44	76	13	353	144217	65473	5228	800	07-05-78	2
44	76	13	354	144809	66278	5207	740	07-05-78	2
44	76	13	355	143615	65618	5196	760	07-05-78	2
44	76	13	356	144006	66621	5180	720	07-05-78	2
44	76	13	357	143616	65518	5192	760	07-06-78	2
44	76	13	358	145915	65634	5269	820	07-06-78	2
44	76	13	359	144613	65877	5231	820	07-06-78	2
44	76	13	360	143817	65469	5206	780	07-06-78	2
44	76	13	361	144613	65827	5234	820	07-06-78	2
44	76	13	362	144614	65727	5241	840	07-07-78	2
44	76	13	363	143615	65668	5193	760	07-07-78	2
44	76	13	364	144611	65977	5224	820	07-07-78	2
44	76	13	365	144412	65925	5220	800	07-08-78	2
44	76	13	366	144011	66121	5198	740	07-08-78	2
44	76	13	367	144212	65973	5209	760	07-08-78	2
44	76	13	368	145411	66134	5238	800	07-08-78	2
44	76	13	369	144211	66073	5205	760	07-08-78	2
44	76	13	370	144007	66571	5184	740	07-10-78	2
44	76	13	371	145018	65280	5325	900	07-10-78	2
44	76	13	372	144213	65873	5211	780	07-10-78	2
44	76	13	373	144412	65975	5217	800	07-10-78	2
44	76	13	374	144215	65673	5215	780	07-10-78	2
44	76	13	375	144207	65423	5230	800	07-11-78	2
44	76	13	376	144616	65527	5251	820	07-11-78	2
44	76	13	377	143817	65419	5208	780	07-11-78	2
44	76	13	378	144616	65477	5264	860	07-11-78	2
44	76	13	379	143617	65468	5191	760	07-11-78	2
44	76	13	380	143614	65718	5190	740	07-12-78	2
44	76	13	381	144615	65627	5248	820	07-12-78	2
44	76	13	382	144212	65923	5210	780	07-12-78	2
44	76	13	383	144007	66521	5185	720	07-12-78	2

TABLE 9.2 (Cont.)

ABANDONED DRILL HOLES - NORTH BUTTE PERMIT AREA

TOWN SHIP	RANGE	SECT	HOLE #	COORDINATE NORTH	COORDINATE EAST	ELEV	TD	Date Abandoned	Abandonment Procedure
44	76	13	384	144211	66123	5202	760	07-12-78	2
44	76	13	385	145814	65737	5274	820	07-13-78	1
44	76	13	386	145811	66037	5255	820	07-13-78	2
44	76	13	387	145812	65937	5261	820	07-13-78	2
44	76	13	388	145813	65837	5267	820	07-13-78	2
44	76	13	389	145815	65637	5281	840	07-13-78	2
44	76	13	390	145816	65537	5289	840	07-13-78	2
44	76	13	391	145813	65887	5263	820	07-14-78	2
44	76	13	392	145815	65687	5277	840	07-14-78	2
44	76	13	393	144810	66228	5210	760	07-14-78	2
44	76	13	394	145816	65487	5292	840	07-14-78	2
44	76	13	395	144615	65677	5244	820	07-14-78	2
44	76	13	396	144220	65123	5229	820	07-14-78	2
44	76	13	397	145015	65630	5284	880	07-17-78	2
44	76	13	398	144221	65023	5231	820	07-18-78	2
44	76	13	399	145025	66245	5219	760	08-21-78	2
44	76	13	400	144391	66665	5180	740	08-22-78	2
44	76	13	401	144415	66725	5178	740	08-23-78	2
44	76	13	402	144406	66625	5183	740	08-24-78	2
44	76	13	403	145014	65780	5265	840	08-25-78	1
44	76	13	404	145017	65420	5307	880	08-28-78	2
44	76	13	405	143896	67700	5145	820	08-01-78	1
44	76	13	406	144221	64923	5236	920	09-12-78	2
44	76	13	407	143881	63903	5322	960	09-15-78	2
44	76	13	408	144222	64873	5236	800	09-25-78	2
44	76	13	409	144675	65252	5301	880	09-25-78	2
44	76	13	410	143618	65335	5184	740	09-25-78	2
44	76	13	411	144167	63963	5348	980	09-26-78	2
44	76	13	412	144036	64931	5223	660	09-26-78	2
44	76	13	413	143836	65319	5200	780	09-27-78	2
44	76	13	414	143985	64812	5214	660	09-27-78	2
44	76	13	415	146012	65939	5262	840	09-28-78	2
44	76	13	416	146015	65639	5281	860	09-29-78	1
44	76	13	417	144217	64832	5230	780	09-29-78	2
44	76	13	418	143812	66019	5195	740	09-29-78	2
44	76	13	419	146011	66039	5258	820	09-29-78	2
44	76	13	420	145012	65930	5244	800	10-02-78	2
44	76	13	421	146016	65539	5288	880	10-02-78	2
44	76	13	422	143814	65719	5196	760	10-02-78	2
44	76	13	423	143813	65869	5188	740	10-02-78	2
44	76	13	424	143618	65268	5153	720	10-02-78	2
44	76	13	425	143813	65819	5192	740	10-04-78	2
44	76	13	426	144166	64014	5345	980	10-04-78	2

TABLE 9.2 (Cont.)

ABANDONED DRILL HOLES - NORTH BUTTE PERMIT AREA

TOWN SHIP	RANGE	SECT	HOLE #	COORDINATE NORTH	COORDINATE EAST	ELEV	TD	Date Abandoned	Abandonment Procedure
44	76	13	427	143815	65669	5199	740	10-04-78	2
44	76	13	428	143814	65224	5175	720	10-04-78	2
44	76	13	429	143818	65269	5193	740	10-06-78	1
44	76	13	430	146017	65439	5297	860	10-10-78	2
44	76	13	431	145011	66080	5227	780	10-10-78	2
44	76	13	432	145012	66030	5231	780	10-11-78	1
44	76	13	433	145011	66130	5223	780	10-12-78	2
44	76	13	434	144020	65121	5212	780	10-12-78	2
44	76	13	435	144021	64971	5219	780	10-20-78	2
44	76	13	436	143806	66669	5179	720	10-20-78	2
44	76	13	437	144101	67172	5162	680	10-23-78	2
44	76	13	438	143608	66417	5176	720	10-25-78	1
44	76	13	439	145216	65432	5292	880	10-26-78	2
44	76	13	440	143805	66769	5171	720	10-26-78	2
44	76	13	442	143805	66719	5177	720	10-27-78	2
44	76	13	443	143606	66617	5163	700	10-27-78	2
44	76	13	444	143804	66819	5164	700	10-27-78	2
44	76	13	445	143610	66217	5177	720	10-27-78	2
44	76	13	446	145189	65275	5332	900	10-30-78	2
44	76	13	447	143610	66167	5176	720	10-30-78	2
44	76	13	448	143608	66367	5181	720	10-31-78	2
44	76	13	449	143609	66267	5180	720	10-31-78	2
44	76	13	450	143607	66567	5166	700	10-31-78	2
44	76	13	451	143608	66467	5171	700	10-31-78	2
44	76	13	452	143573	66649	5162	700	10-31-78	2
44	76	13	453	145219	65232	5335	900	11-02-78	2
44	76	13	454	143609	66317	5182	720	11-02-78	2
44	76	13	455	143607	66517	5168	700	11-02-78	2
44	76	13	456	143605	66717	5160	700	11-02-78	2
44	76	13	457	143613	65817	5185	740	02-14-79	2
44	76	13	458	143612	65917	5182	720	02-14-79	2
44	76	13	459	143612	66017	5179	720	02-15-79	2
44	76	13	460	144012	65921	5199	760	02-15-79	2
44	76	13	461	144012	66021	5202	760	02-16-79	2
44	76	13	462	143622	64818	5213	760	03-30-79	2
44	76	13	463	143726	67169	5149	859	04-25-79	1
44	76	13	464	144483	66400	5196	698	05-16-79	1
44	76	13	465	143629	66818	5158	700	05-23-79	1
44	76	13	466	143592	66917	5149	680	05-24-79	2
44	76	13	467	143611	67017	5146	680	05-24-79	2
44	76	13	468	143602	67117	5140	680	05-24-79	2
44	76	13	469	144900	67400	5192	1120	12-03-79	2
44	76	13	470UC	143784	67168	5152	780	07-12-88	2

TABLE 9.2 (Cont.)

ABANDONED DRILL HOLES - NORTH BUTTE PERMIT AREA

TOWN SHIP	RANGE	SECT	HOLE #	COORDINATE NORTH	COORDINATE EAST	ELEV	TD	Date Abandoned	Abandonment Procedure
44	76	23	45	141600	62450	5116	706	12-03-70	1
44	76	23	84	140400	62450	5079	780	01-24-78	2
44	76	23	85	139800	62450	5051	760	01-26-78	2
44	76	23	86	140600	62450	5073	780	01-26-78	2
44	76	23	87	141200	62450	5106	800	01-30-78	2
44	76	23	88	140200	62450	5073	780	01-30-78	2
44	76	23	89	140000	62450	5071	780	01-31-78	2
44	76	23	90	139400	62450	5038	740	02-17-78	2
44	76	23	91	141800	62450	5160	760	02-21-78	2
44	76	23	92	139600	62450	5043	780	02-01-78	2
44	76	24	G62	141270	66833	5105	660	11-15-67	1
44	76	24	G64	140845	65927	5091	800	11-17-67	1
44	76	24	G66	140421	65022	5058	660	11-18-67	1
44	76	24	G68	139996	64116	5050	680	11-19-67	1
44	76	24	G70	139572	63211	5031	600	11-20-67	1
44	76	24	2	140845	65927	5091	800	No data	
44	76	24	3	140421	65022	5058	660	No data	
44	76	24	4	139996	64116	5050	680	No data	
44	76	24	5	139572	63211	5031	600	No data	
44	76	24	7	143003	66962	5165	700	07-17-68	1
44	76	24	8	142996	67762	5126	660	07-25-68	1
44	76	24	9	142940	65295	5154	780	08-08-68	1
44	76	24	10	143021	64962	5189	780	08-08-68	1
44	76	24	11	142567	65373	5172	740	08-09-68	1
44	76	24	12	142621	64959	5232	860	08-09-68	1
44	76	24	13	142217	65355	5175	742	08-12-68	1
44	76	24	14	142215	65655	5142	700	08-12-68	1
44	76	24	15	142614	65758	5149	746	08-13-68	1
44	76	24	16	141814	65751	5131	680	08-13-68	1
44	76	24	17	142221	64955	5255	820	08-13-68	1
44	76	24	18	141818	65351	5155	700	08-13-68	1
44	76	24	19	141418	65348	5132	700	08-14-68	1
44	76	24	20	141414	65748	5111	600	08-14-68	1
44	76	24	21	141018	65344	5105	640	08-14-68	1
44	76	24	22	141021	64944	5121	700	11-30-68	1
44	76	24	23	140621	64940	5081	620	12-02-68	1
44	76	24	24	140618	65340	5079	660	12-02-68	1
44	76	24	25	140221	64937	5053	600	12-02-68	1
44	76	24	26	141421	64948	5167	740	12-03-68	1
44	76	24	27	141821	64951	5219	820	12-03-68	1
44	76	24	28	140625	64541	5072	620	12-04-68	1
44	76	24	29	140225	64537	5053	605	12-04-68	1
44	76	24	30	141825	64551	5285	860	12-05-68	1

TABLE 9.2 (Cont.)

ABANDONED DRILL HOLES - NORTH BUTTE PERMIT AREA

TOWN SHIP	RANGE	SECT	HOLE #	COORDINATE NORTH	COORDINATE EAST	ELEV	TD	Date Abandoned	Abandonment Procedure
44	76	24	31	141425	64548	5255	865	12-06-68	1
44	76	24	32	141428	64148	5183	800	12-06-68	1
44	76	24	33	141828	64151	5188	780	12-06-68	1
44	76	24	34	142225	64555	5291	880	12-07-68	1
44	76	24	35	139825	64533	5024	540	12-07-68	1
44	76	24	36	139425	64530	5032	560	12-07-68	1
44	76	24	37	139821	64933	5012	536	12-09-68	1
44	76	24	38	139421	64930	5021	560	12-09-68	1
44	76	24	39	139428	64130	5048	597	12-09-68	1
44	76	24	40	139828	64133	5050	580	12-09-68	1
44	76	24	41	138628	64123	5040	580	12-10-68	1
44	76	24	42	139028	64126	5046	596	12-10-68	1
44	76	24	43	139025	64526	5021	557	12-10-68	1
44	76	24	44	138625	64522	5012	576	12-10-68	1
44	76	24	45	138221	64770	5003	556	12-11-68	1
44	76	24	46	138225	64519	5001	540	12-11-68	1
44	76	24	47	138286	63778	5014	560	12-12-68	1
44	76	24	48	138636	63323	4996	558	12-12-68	1
44	76	24	49	139837	62931	5059	592	12-12-68	1
44	76	24	50	139432	63730	5065	508	12-12-68	1
44	76	24	51	139860	63321	5052	600	12-13-68	1
44	76	24	52	140236	63337	5082	620	12-13-68	1
44	76	24	53	140000	63600	5073	620	07-14-69	1
44	76	24	54	140400	63600	5086	639	07-14-69	1
44	76	24	55	140804	63643	5079	640	07-15-69	1
44	76	24	56	139000	63800	5041	576	07-15-69	1
44	76	24	57	140800	63200	5149	675	07-15-69	1
44	76	24	58	140800	62800	5159	680	07-16-69	1
44	76	24	59	140000	63200	5066	600	07-16-69	1
44	76	24	60	140408	63193	5106	632	07-16-69	1
44	76	24	61	141200	63200	5153	700	07-16-69	1
44	76	24	62	141600	63525	5122	675	07-18-69	1
44	76	24	63	141600	63200	5175	721	07-18-69	1
44	76	24	64	141200	63600	5094	627	07-18-69	1
44	76	24	65	142000	63200	5165	720	07-18-69	1
44	76	24	66	142000	63600	5140	695	07-19-69	1
44	76	24	67	142400	63200	5194	758	07-19-69	1
44	76	24	68	142000	64000	5178	760	07-19-69	1
44	76	24	69	142800	63200	5209	780	07-21-69	1
44	76	24	70	142400	63600	5164	720	07-21-69	1
44	76	24	71	143105	63248	5226	800	07-21-69	1
44	76	24	72	142400	64000	5169	735	07-22-69	1
44	76	24	73	142800	62761	5337	900	07-22-69	1

TABLE 9.2 (Cont.)

ABANDONED DRILL HOLES - NORTH BUTTE PERMIT AREA

TOWN SHIP	RANGE	SECT	HOLE #	COORDINATE NORTH	COORDINATE EAST	ELEV	TD	Date Abandoned	Abandonment Procedure
44	76	24	74	142393	62825	5256	880	07-24-69	1
44	76	24	75	142000	62800	5250	812	07-24-69	1
44	76	24	76	138233	63669	5001	520	09-25-69	1
44	76	24	77	138233	63619	4994	520	09-26-69	1
44	76	24	78	138232	63719	5008	540	09-26-69	1
44	76	24	79	138233	63569	4989	520	09-26-69	1
44	76	24	80	138232	63769	5013	550	09-27-69	1
44	76	24	81	138231	63819	5009	538	09-27-69	1
44	76	24	82	141425	64498	5243	800	09-27-69	1
44	76	24	83	141424	64598	5230	791	09-27-69	1
44	76	24	84	139822	64883	5027	560	09-29-69	1
44	76	24	85	139821	64983	5012	538	09-29-69	1
44	76	24	86	140800	63250	5137	674	09-30-69	1
44	76	24	87	140800	63150	5157	700	09-30-69	1
44	76	24	88	139822	64833	5037	577	10-01-69	1
44	76	24	89	139822	64783	5028	560	10-01-69	1
44	76	24	90	141424	64648	5210	753	10-01-69	1
44	76	24	91	140800	63300	5125	660	10-02-69	1
44	76	24	92	141426	64448	5241	800	10-02-69	1
44	76	24	93	140800	63350	5117	656	10-02-69	1
44	76	24	94	139833	64733	4996	520	10-03-69	1
44	76	24	95	141422	64798	5183	740	10-03-69	1
44	76	24	96	138230	63919	5005	540	10-03-69	1
44	76	24	97	138600	63800	5027	560	10-04-69	1
44	76	24	98	141423	64698	5200	760	10-04-69	1
44	76	24	99	139600	63600	5061	600	10-04-69	1
44	76	24	100	141200	64000	5114	660	10-06-69	1
44	76	24	101	138230	63969	5006	538	10-06-69	1
44	76	24	102	138231	63869	5004	537	10-06-69	1
44	76	24	103	140800	63950	5077	540	10-06-69	1
44	76	24	104	140315	64000	5053	520	10-06-69	1
44	76	24	105	142210	66195	5112	560	10-07-69	1
44	76	24	106	141422	64747	5191	760	10-07-69	1
44	76	24	107	143014	65762	5163	600	10-07-69	1
44	76	24	108	141810	66236	5103	600	10-08-69	1
44	76	24	109	142999	67422	5135	560	10-09-69	1
44	76	24	110	142400	67600	5136	540	10-09-69	1
44	76	24	111	142000	67000	5140	540	10-10-69	1
44	76	24	112	142000	66600	5114	540	10-10-69	1
44	76	24	113	142400	66600	5140	538	10-10-69	1
44	76	24	114	141585	66646	5087	520	10-11-69	1
44	76	24	115	142800	67000	5156	560	10-11-69	1
44	76	24	116	142800	66600	5178	540	10-11-69	1

TABLE 9.2 (Cont.)

ABANDONED DRILL HOLES - NORTH BUTTE PERMIT AREA

TOWN SHIP	RANGE	SECT	HOLE #	COORDINATE NORTH	COORDINATE EAST	ELEV	TD	Date Abandoned	Abandonment Procedure
44	76	24	117	141200	66200	5095	560	10-11-69	1
44	76	24	118	142800	66200	5135	620	10-14-69	1
44	76	24	119	139000	63400	5015	572	10-27-69	1
44	76	24	120	142223	64755	5303	920	11-17-69	1
44	76	24	121	142220	65055	5229	800	11-18-69	1
44	76	24	122	142222	64855	5274	880	11-19-69	1
44	76	24	123	142223	64705	5330	920	11-20-69	1
44	76	24	124	142220	65105	5219	793	11-21-69	1
44	76	24	125	142221	65005	5241	840	11-22-69	1
44	76	24	126	142222	64905	5264	860	11-22-69	1
44	76	24	127	142222	64805	5287	880	11-24-69	1
44	76	24	128	142219	65155	5209	777	11-25-69	1
44	76	24	129	142216	65555	5152	738	11-26-69	1
44	76	24	130	142224	64655	5319	920	11-28-69	1
44	76	24	131	142218	65305	5182	740	01-28-70	1
44	76	24	132	142217	65405	5169	720	01-28-70	1
44	76	24	133	138225	64019	5007	538	01-29-70	1
44	76	24	134	139820	65083	5028	560	01-28-70	1
44	76	24	135	141421	64998	5159	758	01-30-70	1
44	76	24	136	142217	65455	5163	716	01-30-70	1
44	76	24	137	139820	65033	5022	540	01-30-70	1
44	76	24	138	138229	64069	5007	518	01-31-70	1
44	76	24	139	139819	65183	5040	560	01-31-70	1
44	76	24	140	141420	65048	5155	740	01-31-70	1
44	76	24	141	140800	63000	5181	760	02-02-70	1
44	76	24	142	142216	65505	5157	695	02-03-70	1
44	76	24	143	138228	64119	5007	540	02-03-70	1
44	76	24	144	139836	63283	5052	579	02-03-70	1
44	76	24	145	140800	63800	5047	599	02-04-70	1
44	76	24	146	140800	63700	5075	540	02-04-70	1
44	76	24	147	139837	63183	5055	580	02-04-70	1
44	76	24	148	139835	63433	5053	598	02-05-70	1
44	76	24	149	139836	63233	5053	579	02-05-70	1
44	76	24	150	140800	63500	5101	560	02-05-70	1
44	76	24	151	140800	63750	5051	520	02-05-70	1
44	76	24	152	139832	63733	5075	536	02-06-70	1
44	76	24	153	140800	63050	5176	720	02-06-70	1
44	76	24	154	139830	63833	5070	520	02-06-70	1
44	76	24	155	140800	63450	5107	573	02-06-70	1
44	76	24	156	141422	64898	5174	760	02-07-70	1
44	76	24	157	141422	64848	5177	757	02-07-70	1
44	76	24	158	139831	63883	5066	560	02-09-70	1
44	76	24	159	139831	63783	5074	537	02-09-70	1

TABLE 9.2 (Cont.)

ABANDONED DRILL HOLES - NORTH BUTTE PERMIT AREA

TOWN SHIP	RANGE	SECT	HOLE #	COORDINATE NORTH	COORDINATE EAST	ELEV	TD	Date Abandoned	Abandonment Procedure
44	76	24	160	139712	64953	5010	680	06-18-70	1
44	76	24	161	139421	65015	5033	720	06-19-70	1
44	76	24	162	139036	64496	5023	700	06-20-70	1
44	76	24	163	139547	63301	5041	740	06-20-70	1
44	76	24	164	139553	62706	5044	720	06-23-70	1
44	76	24	165	138481	63296	4989	682	06-23-70	1
44	76	24	166	138756	63894	5054	740	06-23-70	1
44	76	24	167	139182	64948	5014	540	07-11-70	1
44	76	24	168	139118	64947	4998	540	08-18-70	1
44	76	24	169	140200	63200	5081	760	09-12-70	1
44	76	24	170	140200	63600	5087	780	09-12-70	1
44	76	24	171	139800	63600	5064	760	09-12-70	1
44	76	24	172	140200	62800	5092	780	09-12-70	1
44	76	24	173	139000	63600	5023	721	09-15-70	1
44	76	24	174	139000	63450	5015	702	09-16-70	1
44	76	24	175	139000	63300	5015	705	09-16-70	1
44	76	24	176	139000	63250	5013	702	09-17-70	1
44	76	24	177	139000	63350	5015	703	09-17-70	1
44	76	24	178	139000	63900	5053	584	09-29-70	1
44	76	24	179	139000	63500	5017	563	09-29-70	1
44	76	24	180	139000	64000	5065	502	09-29-70	1
44	76	24	181	139000	63550	5019	562	09-29-70	1
44	76	24	182	139000	64050	5064	502	09-29-70	1
44	76	24	183	139027	64326	5025	560	11-02-70	1
44	76	24	184	140623	64740	5074	620	11-02-70	1
44	76	24	185	139023	64726	5007	540	11-02-70	1
44	76	24	186	139020	65026	5009	521	11-02-70	1
44	76	24	187	140622	64840	5073	621	11-03-70	1
44	76	24	188	140624	64641	5085	620	11-03-70	1
44	76	24	189	139025	64426	5023	560	11-03-70	1
44	76	24	190	139023	64626	5022	540	11-03-70	1
44	76	24	191	139021	64976	4993	519	11-04-70	1
44	76	24	192	139022	64826	4981	500	11-04-70	1
44	76	24	193	140623	64690	5087	620	11-04-70	1
44	76	24	194	140620	65040	5074	618	11-04-70	1
44	76	24	195	142800	63400	5197	742	11-04-70	1
44	76	24	196	141600	63800	5118	683	11-04-70	1
44	76	24	197	140618	65240	5080	620	11-05-70	1
44	76	24	198	142800	63150	5215	764	11-05-70	1
44	76	24	199	142800	63000	5248	800	11-05-70	1
44	76	24	200	140622	64890	5080	622	11-06-70	1
44	76	24	201	139026	64376	5023	560	11-06-70	1
44	76	24	202	139024	64576	5021	543	11-06-70	1

TABLE 9.2 (Cont.)

ABANDONED DRILL HOLES - NORTH BUTTE PERMIT AREA

TOWN SHIP	RANGE	SECT	HOLE #	COORDINATE NORTH	COORDINATE EAST	ELEV	TD	Date Abandoned	Abandonment Procedure
44	76	24	203	139020	65076	5002	520	11-10-70	1
44	76	24	204	139023	64776	4999	520	11-18-70	1
44	76	24	205	140619	65140	5081	640	11-18-70	1
44	76	24	206	139000	63750	5036	560	11-19-70	1
44	76	24	207	139000	63650	5026	581	11-19-70	1
44	76	24	208	143015	65662	5163	720	11-19-70	1
44	76	24	209	141600	63900	5127	681	11-20-70	1
44	76	24	210	143017	65362	5169	740	11-20-70	1
44	76	24	211	143019	65162	5172	720	11-20-70	1
44	76	24	212	141600	63000	5215	900	11-20-70	1
44	76	24	213	143017	65462	5141	714	11-23-70	1
44	76	24	214	143016	65562	5151	720	11-23-70	1
44	76	24	215	141600	64000	5149	697	11-23-70	1
44	76	24	216	143020	65062	5182	780	11-23-70	1
44	76	24	217	139000	63700	5030	461	11-24-70	1
44	76	24	218	141600	62900	5221	902	11-24-70	1
44	76	24	219	143020	65112	5177	760	11-24-70	1
44	76	24	220	143018	65262	5160	721	11-24-70	1
44	76	24	221	141600	64100	5172	743	11-25-70	1
44	76	24	222	141600	63100	5191	883	11-25-70	1
44	76	24	223	143019	65212	5163	720	11-25-70	1
44	76	24	224	143018	65312	5166	720	11-25-70	1
44	76	24	225	143014	65712	5162	720	11-30-70	1
44	76	24	226	143015	65612	5165	720	11-30-70	1
44	76	24	227	143016	65512	5122	880	12-01-70	1
44	76	24	228	141600	63400	5129	859	12-01-70	1
44	76	24	229	141600	62500	5132	819	12-01-70	1
44	76	24	230	143013	65862	5161	700	12-01-70	1
44	76	24	231	141600	63450	5126	681	12-02-70	1
44	76	24	232	141600	63700	5107	660	12-02-70	1
44	76	24	233	141600	64050	5164	722	12-02-70	1
44	76	24	234	141600	62550	5140	703	12-02-70	1
44	76	24	235	143013	65912	5159	620	12-02-70	1
44	76	24	236	141600	63485	5123	681	12-03-70	1
44	76	24	237	141600	63650	5113	680	12-03-70	1
44	76	24	238	141600	63750	5113	683	12-03-70	1
44	76	24	239	141600	63050	5201	906	12-04-70	1
44	76	24	240	141600	62700	5170	705	12-04-70	1
44	76	24	241	143012	65962	5158	700	12-04-70	1
44	76	24	242	143200	63350	5245	887	12-04-70	1
44	76	24	243	142400	63800	5176	743	12-07-70	1
44	76	24	244	139838	63033	5058	740	12-07-70	1
44	76	24	245	141600	63600	5089	643	12-07-70	1

TABLE 9.2 (Cont.)

ABANDONED DRILL HOLES - NORTH BUTTE PERMIT AREA

TOWN SHIP	RANGE	SECT	HOLE #	COORDINATE NORTH	COORDINATE EAST	ELEV	TD	Date Abandoned	Abandonment Procedure
44	76	24	246	140800	63100	5166	840	12-07-70	1
44	76	24	247	143012	66012	5157	620	12-08-70	1
44	76	24	248	140624	64591	5081	620	12-08-70	1
44	76	24	249	139024	64676	5018	542	12-08-70	1
44	76	24	250	143200	63700	5367	1026	12-08-70	1
44	76	24	251	142400	63700	5164	884	12-09-70	1
44	76	24	252	142400	63000	5216	920	12-09-70	1
44	76	24	253	141600	62800	5191	763	12-09-70	1
44	76	24	254	142400	63400	5143	721	12-09-70	1
44	76	24	255	143017	65412	5153	700	12-10-70	1
44	76	24	256	141600	63300	5149	705	12-10-70	1
44	76	24	257	142400	63650	5164	744	12-10-70	1
44	76	24	258	143011	66062	5156	624	12-10-70	1
44	76	24	259	142400	62600	5248	840	12-11-70	1
44	76	24	260	143200	63550	5318	1000	12-11-70	1
44	76	24	261	142400	62900	5234	840	12-12-70	1
44	76	24	262	142400	63300	5182	744	12-12-70	1
44	76	24	263	142400	63900	5166	663	12-14-70	1
44	76	24	264	142400	62500	5217	826	12-15-70	1
44	76	24	265	142400	63250	5188	740	12-15-70	1
44	76	24	266	143200	63100	5246	885	12-16-70	1
44	76	24	267	142400	63500	5167	726	12-16-70	1
44	76	24	268	142400	63100	5205	760	12-17-70	1
44	76	24	269	143200	63600	5334	355	12-17-70	1
44	76	24	270	139837	63133	5056	740	12-18-70	1
44	76	24	271	143010	66162	5146	600	12-18-70	1
44	76	24	272	142400	63950	5167	664	12-19-70	1
44	76	24	273	142400	63150	5200	740	12-20-70	1
44	76	24	274	141200	66400	5092	520	09-07-71	1
44	76	24	275	140224	64687	5042	582	09-09-71	1
44	76	24	276	142000	66800	5126	800	09-09-71	1
44	76	24	277	141425	64573	5237	811	07-09-74	2
44	76	24	278	141600	63425	5128	684	07-10-74	2
44	76	24	279	143105	63253	5226	820	07-10-74	2
44	76	24	280	138232	63744	5210	706	07-11-74	2
44	76	24	281	138233	63589	4990	600	07-16-76	2
44	76	24	282	139600	62990	5043	580	07-16-76	2
44	76	24	283	141545	62490	5150	680	07-23-76	1
44	76	24	284	141535	63667	5109	660	07-19-76	2
44	76	24	285	142196	64855	5277	880	07-20-76	2
44	76	24	286	143394	67366	5139	680	07-21-76	2
44	76	24	288	143351	67165	5132	655	02-07-77	2
44	76	24	289	143301	67165	5131	655	02-25-77	2

TABLE 9.2 (Cont.)

ABANDONED DRILL HOLES - NORTH BUTTE PERMIT AREA

TOWN SHIP	RANGE	SECT	HOLE #	COORDINATE NORTH	COORDINATE EAST	ELEV	TD	Date Abandoned	Abandonment Procedure
44	76	24	290	143251	67164	5140	678	03-04-77	2
44	76	24	291	143013	65812	5162	700	03-10-77	2
44	76	24	292	142400	66550	5138	820	03-11-77	2
44	76	24	293	142400	66650	5141	580	03-16-77	2
44	76	24	294	142400	66500	5138	580	03-16-77	2
44	76	24	295	142400	66700	5145	560	03-16-77	2
44	76	24	296	142214	65705	5137	821	03-17-77	2
44	76	24	297	141813	65851	5123	820	03-17-77	2
44	76	24	298	141414	65698	5112	803	03-18-77	2
44	76	24	299	141813	65801	5126	680	03-21-77	2
44	76	24	300	142215	65605	5147	702	03-21-77	2
44	76	24	301	142615	65608	5108	765	03-22-77	2
44	76	24	302	142214	65755	5125	683	03-22-77	2
44	76	24	303	140400	63550	5092	538	03-22-77	2
44	76	24	304	139831	63813	5072	522	03-23-77	1
44	76	24	305	140400	63250	5103	778	03-23-77	2
44	76	24	306	141200	63100	5166	837	03-23-77	2
44	76	24	307	141024	64644	5122	678	03-23-77	2
44	76	24	308	143199	70164	5106	546	03-24-77	2
44	76	24	309	138232	63694	5005	540	04-11-77	1
44	76	24	310	142400	66620	5140	555	04-21-77	1
44	76	24	311	141024	64594	5124	698	04-22-77	2
44	76	24	312	141023	64694	5130	678	04-22-77	2
44	76	24	313	142800	66950	5161	860	04-22-77	2
44	76	24	314	141813	65901	5121	660	04-22-77	2
44	76	24	315	141560	63678	5106	660	04-25-77	1
44	76	24	316	143201	67164	5140	662	04-25-77	2
44	76	24	317	142800	63225	5204	862	04-26-77	2
44	76	24	318	142223	64785	5290	880	04-26-77	1
44	76	24	319	139150	64947	4999	540	04-27-77	2
44	76	24	320	141425	64523	5242	954	05-02-77	1
44	76	24	321	143019	65237	5159	720	04-29-77	1
44	76	24	322	141824	64601	5289	860	05-03-77	2
44	76	24	323	139821	64908	5112	486	05-03-77	1
44	76	24	324	142400	63175	5196	738	05-04-77	1
44	76	24	325	139825	64913	5018	562	05-05-77	1
44	76	24	326	141653	63647	5116	680	05-10-77	2
44	76	24	327	140400	63150	5108	782	05-05-77	2
44	76	24	328	139836	63333	5052	743	05-09-77	2
44	76	24	329	139000	64100	5054	482	05-09-77	2
44	76	24	330	142616	65558	5109	662	05-09-77	2
44	76	24	331	142615	65658	5134	702	05-10-77	2
44	76	24	332	141200	63000	5185	858	05-12-77	2

TABLE 9.2 (Cont.)

ABANDONED DRILL HOLES - NORTH BUTTE PERMIT AREA

TOWN SHIP	RANGE	SECT	HOLE #	COORDINATE NORTH	COORDINATE EAST	ELEV	TD	Date Abandoned	Abandonment Procedure
44	76	24	333	142800	66900	5167	600	05-12-77	2
44	76	24	334	143151	67163	5141	578	05-12-77	2
44	76	24	335	142799	66850	5172	720	05-13-77	2
44	76	24	336	143101	67163	5141	578	05-13-77	2
44	76	24	337	141812	65951	5119	660	05-13-77	2
44	76	24	338	141415	65648	5114	650	05-13-77	2
44	76	24	339	140845	65725	5082	778	05-13-77	2
44	76	24	340	141413	65798	5108	560	05-13-77	2
44	76	24	341	141825	64501	5274	860	05-20-77	2
44	76	24	342	141200	66250	5094	760	05-20-77	2
44	76	24	343	141415	65598	5116	557	05-20-77	2
44	76	24	344	141824	64651	5283	863	05-20-77	2
44	76	24	345	142213	65805	5108	578	05-20-77	2
44	76	24	346	141025	64544	5123	678	05-20-77	2
44	76	24	347	141200	63650	5084	623	05-24-77	2
44	76	24	348	142617	65408	5162	718	05-23-77	2
44	76	24	349	142218	65255	5188	743	05-23-77	2
44	76	24	350	141416	65548	5118	560	05-23-77	2
44	76	24	351	142400	63850	5165	656	05-23-77	2
44	76	24	352	139421	64980	5032	560	05-25-77	2
44	76	24	353	139420	65080	5032	560	05-25-77	2
44	76	24	354	140400	63650	5081	542	05-25-77	2
44	76	24	355	138223	64719	5002	703	05-25-77	2
44	76	24	356	138623	64672	5011	703	05-26-77	2
44	76	24	357	140400	63700	5076	538	05-26-77	2
44	76	24	358	138623	64722	5012	680	05-26-77	2
44	76	24	359	142000	63650	5125	703	06-01-77	2
44	76	24	360	140950	65725	5087	538	05-27-77	2
44	76	24	361	138222	64819	5001	682	05-27-77	2
44	76	24	362	141365	65597	5113	659	05-27-77	2
44	76	24	363	138636	63273	4996	683	05-27-77	2
44	76	24	364	141465	65598	5119	659	05-27-77	2
44	76	24	365	140400	63750	5072	522	05-27-77	2
44	76	24	366	140900	65725	5085	537	05-27-77	2
44	76	24	367	138631	63873	5037	478	05-31-77	2
44	76	24	368	141515	65599	5123	663	05-31-77	2
44	76	24	369	138630	63923	5038	478	05-31-77	2
44	76	24	370	141315	65597	5110	563	06-01-77	2
44	76	24	371	140223	64737	5037	582	06-02-77	2
44	76	24	372	139823	64683	5001	542	06-02-77	2
44	76	24	373	140224	64637	5045	582	06-02-77	2
44	76	24	374	141565	65599	5125	663	06-02-77	2
44	76	24	375	139422	64880	4999	540	06-03-77	2

TABLE 9.2 (Cont.)

ABANDONED DRILL HOLES - NORTH BUTTE PERMIT AREA

TOWN SHIP	RANGE	SECT	HOLE #	COORDINATE NORTH	COORDINATE EAST	ELEV	TD	Date Abandoned	Abandonment Procedure
44	76	24	376	141812	66001	5111	640	06-03-77	2
44	76	24	377	141615	65599	5128	663	06-03-77	2
44	76	24	378	139840	62833	5059	579	06-06-77	2
44	76	24	379	139824	64633	5020	562	06-06-77	2
44	76	24	380	140224	64587	5056	582	06-06-77	2
44	76	24	381	141025	64494	5123	683	06-06-77	2
44	76	24	382	143200	63300	5243	884	06-07-77	2
44	76	24	383	142800	63450	5208	783	06-07-77	2
44	76	24	384	142800	63350	5198	763	06-07-77	2
44	76	24	385	142800	63100	5222	884	06-08-77	2
44	76	24	386	141665	65600	5131	679	06-08-77	2
44	76	24	387	140223	64787	5033	581	06-09-77	2
44	76	24	388	139422	64830	4990	540	06-09-77	2
44	76	24	389	141200	63700	5059	623	06-09-77	2
44	76	24	390	142213	65855	5100	603	06-09-77	2
44	76	24	391	142617	65458	5152	699	06-10-77	2
44	76	24	392	138631	63823	5034	484	06-10-77	2
44	76	24	393	138223	64669	5001	684	06-14-77	2
44	76	24	394	138624	64622	5011	682	06-14-77	2
44	76	24	395	140400	63675	5079	522	06-15-77	1
44	76	24	396	141573	62495	5132	660	06-16-77	2
44	76	24	397	142000	63700	5133	703	06-20-77	2
44	76	24	398	142800	63300	5172	723	06-20-77	2
44	76	24	399	138635	63373	4996	678	06-22-77	2
44	76	24	400	138637	63223	4997	682	06-23-77	2
44	76	24	401	139435	63380	5040	723	06-23-77	2
44	76	24	402	141200	63500	5106	641	06-23-77	2
44	76	24	403	139436	63330	5038	719	06-24-77	2
44	76	24	404	139435	63430	5042	719	06-24-77	2
44	76	24	405	139432	63780	5064	498	06-24-77	2
44	76	24	406	139432	63680	5060	498	06-24-77	1
44	76	24	407	139841	62733	5063	498	06-27-77	2
44	76	24	408	139434	63480	5043	499	06-27-77	1
44	76	24	409	143200	63400	5262	940	06-29-77	2
44	76	24	410	143200	63600	5334	1000	06-28-77	2
44	76	24	411	142213	65905	5099	662	06-30-77	2
44	76	24	412	142400	62700	5274	840	06-30-77	2
44	76	24	413	141811	66051	5109	663	06-30-77	2
44	76	24	414	143200	63256	5254	901	07-01-77	2
44	76	24	415	139022	64876	4972	499	07-01-77	2
44	76	24	416	142000	63750	5150	720	07-05-77	2
44	76	24	417	142000	63500	5142	694	07-05-77	2
44	76	24	418	142800	63700	5258	843	07-06-77	2

TABLE 9.2 (Cont.)

ABANDONED DRILL HOLES - NORTH BUTTE PERMIT AREA

TOWN SHIP	RANGE	SECT	HOLE #	COORDINATE NORTH	COORDINATE EAST	ELEV	TD	Date Abandoned	Abandonment Procedure
44	76	24	419	142000	62700	5246	920	07-07-77	2
44	76	24	420	142212	65954	5094	654	07-07-77	2
44	76	24	421	141715	65600	5135	680	07-07-77	2
44	76	24	422	141765	65601	5138	683	07-08-77	2
44	76	24	423	143200	63500	5298	996	07-08-77	2
44	76	24	424	140623	64791	5072	601	07-08-77	2
44	76	24	425	142000	63400	5122	680	07-08-77	2
44	76	24	426	142212	66005	5122	663	07-08-77	2
44	76	24	427	142800	63750	5259	816	07-11-77	2
44	76	24	428	142000	62600	5215	824	07-11-77	2
44	76	24	429	142614	65708	5140	712	07-11-77	2
44	76	24	430	142211	66055	5127	663	07-11-77	2
44	76	24	431	142400	63050	5207	760	07-12-77	2
44	76	24	432	142000	62900	5225	805	07-12-77	2
44	76	24	433	143200	63450	5289	956	07-12-77	2
44	76	24	434	142000	63300	5149	721	07-12-77	2
44	76	24	435	142000	63000	5199	757	07-13-77	2
44	76	24	436	142000	63100	5178	742	07-13-77	2
44	76	24	437	142000	62500	5194	778	07-13-77	2
44	76	24	438	140400	63300	5101	764	07-13-77	2
44	76	24	439	140400	63050	5109	641	07-14-77	2
44	76	24	440	139437	63180	5029	563	07-14-77	2
44	76	24	441	140400	62950	5111	644	07-14-77	2
44	76	24	442	141200	62900	5190	731	07-14-77	2
44	76	24	443	141200	62600	5122	703	07-15-77	2
44	76	24	444	141200	62500	5112	649	07-15-77	2
44	76	24	445	141200	63300	5136	684	07-15-77	2
44	76	24	446	141200	63400	5123	657	07-15-77	2
44	76	24	447	141200	64050	5120	641	07-18-77	2
44	76	24	448	141200	62800	5160	700	07-18-77	2
44	76	24	449	141200	62700	5138	683	07-18-77	2
44	76	24	450	141200	62550	5116	808	07-19-77	2
44	76	24	451	142790	63650	5250	822	07-19-77	2
44	76	24	452	140400	62900	5112	635	07-20-77	2
44	76	24	453	142800	63800	5270	782	07-20-77	2
44	76	24	454	139436	63280	5035	559	07-20-77	2
44	76	24	455	141200	62650	5128	825	07-20-77	2
44	76	24	456	138622	64822	4974	527	07-20-77	2
44	76	24	457	142000	62650	5232	840	07-21-77	2
44	76	24	458	142000	62550	5204	754	07-22-77	2
44	76	24	459	142800	63550	5260	833	07-22-77	2
44	76	24	460	139437	63230	5032	559	07-27-77	2
44	76	24	461	142800	63850	5275	740	07-27-77	2

TABLE 9.2 (Cont.)

ABANDONED DRILL HOLES - NORTH BUTTE PERMIT AREA

TOWN SHIP	RANGE	SECT	HOLE #	COORDINATE NORTH	COORDINATE EAST	ELEV	TD	Date Abandoned	Abandonment Procedure
44	76	24	462	138621	64922	4966	517	07-28-77	2
44	76	24	463	139437	63130	5031	555	07-28-77	2
44	76	24	464	139438	63030	5032	559	07-28-77	2
44	76	24	465	140400	63000	5108	640	07-28-77	2
44	76	24	466	139431	63830	5068	497	07-29-77	2
44	76	24	467	139434	63530	5045	574	07-29-77	2
44	76	24	468	139439	62930	5033	560	07-29-77	2
44	76	24	469	139438	63080	5032	564	08-01-77	2
44	76	24	470	139430	63930	5069	500	08-01-77	2
44	76	24	471	138634	63473	5002	700	08-01-77	2
44	76	24	472	139440	62830	5037	560	08-01-77	2
44	76	24	473	139433	63580	5049	520	08-02-77	2
44	76	24	474	139431	63880	5070	500	08-02-77	2
44	76	24	475	139430	63980	5063	519	08-02-77	2
44	76	24	476	139441	62730	5037	560	08-02-77	2
44	76	24	477	138634	63523	5006	538	08-03-77	2
44	76	24	478	138635	63423	4998	677	08-03-77	2
44	76	24	479	142000	63550	5141	719	08-10-77	1
44	76	24	480	142000	63450	5141	718	08-10-77	1
44	76	24	481	138633	63573	5012	558	08-11-77	2
44	76	24	482	138622	64872	4952	513	08-11-77	1
44	76	24	483	138621	64972	4953	497	08-11-77	1
44	76	24	484	140671	64941	5087	520	08-12-77	2
44	76	24	485	138633	63623	5016	562	08-12-77	2
44	76	24	486	141110	66145	5093	539	08-12-77	2
44	76	24	487	140721	64941	5092	560	08-12-77	2
44	76	24	488	140768	65342	5089	520	08-12-77	2
44	76	24	489	141815	65601	5142	680	08-15-77	2
44	76	24	490	141469	65198	5146	680	08-15-77	2
44	76	24	491	138633	63673	5021	558	08-15-77	2
44	76	24	492	141010	66144	5090	541	08-15-77	2
44	76	24	493	142800	63600	5255	816	08-15-77	2
44	76	24	494	138632	63723	5026	562	08-16-77	1
44	76	24	495	138632	63773	5030	558	08-16-77	2
44	76	24	496	139000	63200	5012	542	08-16-77	1
44	76	24	497	140868	65343	5095	540	08-16-77	2
44	76	24	498	138620	65022	4984	500	08-17-77	2
44	76	24	499	138630	63973	5039	475	08-16-77	2
44	76	24	500	141200	63550	5098	562	08-16-77	2
44	76	24	501	141060	66145	5091	515	08-17-77	2
44	76	24	502	140960	66144	5088	523	08-17-77	2
44	76	24	503	141814	65701	5134	680	08-17-77	2
44	76	24	504	138637	63173	4997	535	08-17-77	2

TABLE 9.2 (Cont.)

ABANDONED DRILL HOLES - NORTH BUTTE PERMIT AREA

TOWN SHIP	RANGE	SECT	HOLE #	COORDINATE NORTH	COORDINATE EAST	ELEV	TD	Date Abandoned	Abandonment Procedure
44	76	24	505	140968	65344	5101	700	08-18-77	2
44	76	24	506	141419	65198	5142	680	08-18-77	2
44	76	24	507	141865	65602	5144	683	08-18-77	2
44	76	24	508	141815	65651	5137	680	08-18-77	2
44	76	24	509	141200	63350	5129	583	08-18-77	2
44	76	24	510	141200	63450	5115	573	08-18-77	2
44	76	24	511	138637	63123	4997	537	08-19-77	2
44	76	24	512	142400	62750	5275	840	08-19-77	2
44	76	24	513	141915	65602	5145	683	08-19-77	2
44	76	24	514	141269	65196	5131	680	08-19-77	2
44	76	24	515	140400	63100	5113	636	08-22-77	2
44	76	24	516	141118	65345	5112	660	08-22-77	2
44	76	24	517	141965	65603	5145	678	08-22-77	2
44	76	24	518	142400	62650	5256	800	08-22-77	2
44	76	24	519	141169	65195	5122	680	08-23-77	2
44	76	24	520	141068	65345	5108	680	08-23-77	2
44	76	24	521	142200	62650	5235	800	08-23-77	2
44	76	24	522	142200	63300	5156	720	08-23-77	2
44	76	24	523	142600	63250	5192	820	08-24-77	2
44	76	24	524	142200	63650	5152	724	08-24-77	2
44	76	24	525	143000	63200	5211	860	08-24-77	2
44	76	24	526	141000	63350	5126	660	08-25-77	2
44	76	24	527	142200	63600	5152	723	08-25-77	2
44	76	24	528	141800	63650	5115	660	08-25-77	2
44	76	24	529	142200	62600	5218	764	08-25-77	2
44	76	24	530	143000	63502	5247	960	08-26-77	2
44	76	24	531	142600	63650	5219	820	08-26-77	2
44	76	24	532	141400	63650	5092	640	08-29-77	2
44	76	24	533	140600	63700	5077	540	08-29-77	2
44	76	24	534	143000	63250	5186	820	09-13-77	2
44	76	24	535	143000	63150	5245	880	08-30-77	2
44	76	24	536	142200	63450	5136	700	08-30-77	2
44	76	24	537	139631	63882	5070	522	09-01-77	2
44	76	24	538	141000	63250	5139	680	08-30-77	2
44	76	24	539	142200	62550	5208	760	09-01-77	2
44	76	24	540	141400	62550	5143	844	09-01-77	2
44	76	24	541	140600	62900	5141	684	09-01-77	2
44	76	24	542	139631	63832	5074	520	09-01-77	2
44	76	24	543	142000	62750	5246	796	09-02-77	2
44	76	24	544	141000	62650	5109	804	09-02-77	2
44	76	24	545	142000	63350	5134	703	09-02-77	2
44	76	24	546	139632	63782	5075	520	09-02-77	2
44	76	24	547	141800	62550	5159	740	08-31-77	2

TABLE 9.2 (Cont.)

ABANDONED DRILL HOLES - NORTH BUTTE PERMIT AREA

TOWN SHIP	RANGE	SECT	HOLE #	COORDINATE NORTH	COORDINATE EAST	ELEV	TD	Date Abandoned	Abandonment Procedure
44	76	24	548	142000	63250	5162	723	09-06-77	2
44	76	24	549	141400	63850	5112	660	09-06-77	2
44	76	24	550	140800	62900	5175	720	09-07-77	2
44	76	24	551	140800	62500	5084	640	09-07-77	2
44	76	24	552	143000	63400	5218	940	09-07-77	2
44	76	24	553	142600	63200	5202	764	09-07-77	2
44	76	24	554	142200	63500	5148	720	09-07-77	2
44	76	24	555	143000	63100	5258	880	09-08-77	2
44	76	24	556	143000	63650	5328	1000	09-08-77	2
44	76	24	557	140800	62600	5103	640	09-08-77	2
44	76	24	558	141600	63350	5137	700	09-09-77	2
44	76	24	559	141000	63150	5156	844	09-09-77	2
44	76	24	560	141800	63800	5133	700	09-09-77	2
44	76	24	561	140800	62700	5132	660	09-09-77	2
44	76	24	562	142200	62500	5197	740	09-12-77	2
44	76	24	563	141800	62500	5158	740	09-12-77	2
44	76	24	564	142650	62800	5312	860	09-14-77	2
44	76	24	565	141800	63350	5157	720	09-14-77	2
44	76	24	566	140600	63750	5070	520	09-14-77	2
44	76	24	567	142600	63750	5229	820	09-15-77	2
44	76	24	568	141400	63750	5098	660	09-15-77	2
44	76	24	569	143000	63550	5287	940	09-16-77	2
44	76	24	570	139622	64881	5003	520	09-16-77	2
44	76	24	571	140600	62800	5147	820	09-19-77	1
44	76	24	572	141400	62500	5138	680	09-19-77	2
44	76	24	573	141400	62600	5148	820	09-19-77	2
44	76	24	574	141800	62600	5159	700	09-20-77	2
44	76	24	575	142200	63800	5143	640	09-20-77	2
44	76	24	576	141000	62550	5099	780	09-21-77	2
44	76	24	577	141400	63700	5092	640	09-21-77	2
44	76	24	578	141000	63900	5083	540	09-21-77	2
44	76	24	579	141800	63550	5129	680	09-22-77	2
44	76	24	580	142200	63900	5148	720	09-22-77	2
44	76	24	581	143000	63050	5261	820	09-26-77	2
44	76	24	582	142600	63000	5262	900	09-26-77	2
44	76	24	583	142600	63300	5178	740	09-27-77	2
44	76	24	584	141800	63400	5145	720	09-27-77	2
44	76	24	585	142600	63700	5230	820	09-28-77	2
44	76	24	586	142200	63850	5148	720	09-28-77	2
44	76	24	587	142650	63000	5253	880	09-29-77	2
44	76	24	588	141625	64500	5273	840	09-29-77	2
44	76	24	589	140600	63800	5061	520	09-29-77	2
44	76	24	590	142600	62800	5303	860	09-30-77	2

TABLE 9.2 (Cont.)

ABANDONED DRILL HOLES - NORTH BUTTE PERMIT AREA

TOWN SHIP	RANGE	SECT	HOLE #	COORDINATE NORTH	COORDINATE EAST	ELEV	TD	Date Abandoned	Abandonment Procedure
44	76	24	591	141800	63500	5118	680	09-30-77	2
44	76	24	592	141000	63850	5082	520	09-30-77	2
44	76	24	593	140824	64642	5101	660	10-03-77	2
44	76	24	594	141224	64596	5175	720	10-03-77	2
44	76	24	595	141400	63800	5098	660	10-03-77	2
44	76	24	596	141000	63100	5166	840	10-04-77	2
44	76	24	597	141625	64550	5271	820	10-04-77	2
44	76	24	598	139124	64627	5015	540	10-04-77	2
44	76	24	599	142024	64603	5286	860	10-05-77	2
44	76	24	600	141626	64450	5265	820	10-05-77	2
44	76	24	601	139630	63932	5065	520	10-05-77	2
44	76	24	602	140824	64592	5095	640	10-06-77	2
44	76	24	603	140423	64684	5062	600	10-06-77	2
44	76	24	604	142600	63100	5242	880	10-06-77	2
44	76	24	605	141800	63450	5129	680	10-07-77	2
44	76	24	606	141800	63900	5137	700	10-07-77	2
44	76	24	607	142992	63600	5314	1000	10-07-77	1
44	76	24	608	142600	63850	5227	600	10-13-77	1
44	76	24	609	142606	63830	5227	740	10-14-77	1
44	76	24	610	138774	64624	5015	700	10-17-77	2
44	76	24	611	138824	64624	5017	680	10-20-77	2
44	76	24	612	141000	63750	5069	520	10-21-77	2
44	76	24	613	141800	63850	5124	700	10-21-77	2
44	76	24	614	142600	62600	5257	840	10-21-77	2
44	76	24	615	142550	62800	5293	860	10-24-77	2
44	76	24	616	142600	63600	5202	800	10-24-77	2
44	76	24	617	142600	63150	5218	780	10-24-77	2
44	76	24	618	139622	64831	5013	520	10-24-77	1
44	76	24	619	142600	63050	5256	900	10-25-77	2
44	76	24	620	142600	63350	5177	760	10-26-77	2
44	76	24	621	142024	64653	5292	880	10-25-77	2
44	76	24	622	139221	64978	5010	680	10-26-77	2
44	76	24	623	142200	63700	5151	720	10-26-77	2
44	76	24	624	141800	63300	5175	740	10-26-77	2
44	76	24	625	142200	63250	5161	740	10-27-77	2
44	76	24	626	142200	63350	5154	740	10-27-77	2
44	76	24	627	139074	64627	5017	540	10-27-77	2
44	76	24	628	142025	64553	5274	820	10-28-77	2
44	76	24	629	141800	63950	5142	720	10-28-77	2
44	76	24	630	141000	62600	5101	800	10-28-77	2
44	76	24	631	142200	63150	5173	740	10-28-77	2
44	76	24	632	141400	64000	5142	700	10-28-77	2
44	76	24	633	140023	64735	5019	560	10-28-77	2

TABLE 9.2 (Cont.)

ABANDONED DRILL HOLES - NORTH BUTTE PERMIT AREA

TOWN SHIP	RANGE	SECT	HOLE #	COORDINATE NORTH	COORDINATE EAST	ELEV	TD	Date Abandoned	Abandonment Procedure
44	76	24	634	139430	63905	5070	520	10-31-77	1
44	76	24	635	141225	64546	5177	720	10-31-77	2
44	76	24	636	141224	64646	5170	720	10-31-77	2
44	76	24	637	140823	64692	5103	640	11-01-77	2
44	76	24	638	138244	63905	5006	700	11-02-77	1
44	76	24	639	139174	64627	5018	540	11-02-77	2
44	76	24	640	142200	63200	5167	720	11-03-77	2
44	76	24	641	141000	63500	5103	645	11-03-77	2
44	76	24	642	141400	63450	5126	660	11-04-77	2
44	76	24	643	142400	66575	5139	660	11-04-77	1
44	76	24	644	140825	64542	5092	640	11-04-77	2
44	76	24	645	140424	64639	5069	600	11-04-77	2
44	76	24	646	139437	63205	5032	720	11-07-77	1
44	76	24	647	142013	65903	5120	680	11-08-77	2
44	76	24	648	142413	65807	5124	700	11-08-77	2
44	76	24	649	141390	65597	5115	660	11-10-77	1
44	76	24	650	142416	65557	5137	680	11-09-77	2
44	76	24	651	143176	67164	5141	580	11-10-77	1
44	76	24	652	140423	64739	5057	600	11-11-77	2
44	76	24	653	141750	65601	5137	680	11-11-77	1
44	76	24	654	139221	64928	5016	680	11-14-77	2
44	76	24	655	139220	65028	5006	660	11-14-77	2
44	76	24	656	141580	63450	5124	680	11-15-77	2
44	76	24	657	143000	63450	5235	205	11-15-77	1
44	76	24	658	138874	64625	5018	600	11-15-77	2
44	76	24	659	143000	63300	5207	840	11-16-77	2
44	76	24	660	142600	63550	5200	800	11-16-77	2
44	76	24	661	142025	64503	5267	840	11-17-77	2
44	76	24	662	143217	65414	5130	680	11-18-77	2
44	76	24	663	139636	63332	5044	720	11-18-77	2
44	76	24	664	139222	64878	5009	660	11-23-77	2
44	76	24	665	138800	64000	5056	480	11-23-77	2
44	76	24	666	138800	63450	5006	700	11-28-77	2
44	76	24	667	139230	63928	5059	500	11-28-77	2
44	76	24	668	142500	62800	5284	840	11-29-77	2
44	76	24	669	139236	63328	5027	720	11-29-77	2
44	76	24	670	140000	63250	5064	740	11-30-77	2
44	76	24	671	139636	63282	5037	740	11-30-77	2
44	76	24	672	138800	63950	5059	500	11-30-77	2
44	76	24	673	138800	63400	5005	700	12-02-77	2
44	76	24	674	139232	63678	5041	600	12-02-77	2
44	76	24	675	139231	63878	5054	500	12-02-77	2
44	76	24	676	140000	63300	5063	740	12-05-77	2

TABLE 9.2 (Cont.)

ABANDONED DRILL HOLES - NORTH BUTTE PERMIT AREA

TOWN SHIP	RANGE	SECT	HOLE #	COORDINATE NORTH	COORDINATE EAST	ELEV	TD	Date Abandoned	Abandonment Procedure
44	76	24	677	139637	63232	5041	720	12-05-77	2
44	76	24	678	139235	63378	5029	720	12-06-77	2
44	76	24	679	139236	63278	5025	720	12-06-77	2
44	76	24	680	140000	63350	5062	740	12-07-77	2
44	76	24	681	139234	63528	5035	600	12-07-77	2
44	76	24	682	140000	63150	5066	600	12-08-77	2
44	76	24	683	139635	63382	5050	600	12-08-77	2
44	76	24	684	138800	63500	5010	700	12-12-77	2
44	76	24	685	139231	63828	5049	500	12-12-77	2
44	76	24	686	139230	63978	5064	500	12-12-77	2
44	76	24	687	138433	63671	5006	720	12-12-77	2
44	76	24	688	139235	63428	5030	580	12-13-77	2
44	76	24	689	140000	63100	5069	600	12-13-77	2
44	76	24	690	138800	63900	5057	500	12-13-77	2
44	76	24	691	138800	63600	5020	720	12-14-77	2
44	76	24	692	139637	63182	5041	600	12-14-77	2
44	76	24	693	138432	63721	5011	720	12-14-77	2
44	76	24	694	138800	63350	5004	700	12-15-77	2
44	76	24	695	138433	63621	5002	540	12-15-77	2
44	76	24	696	139237	63228	5023	720	12-16-77	2
44	76	24	697	139232	63728	5043	500	01-04-78	2
44	76	24	698	138800	63250	5004	700	01-04-78	2
44	76	24	699	140200	63300	5079	761	01-04-78	2
44	76	24	700	138433	63571	4998	720	01-04-78	2
44	76	24	701	139233	63628	5030	600	01-04-78	2
44	76	24	702	139237	63178	5022	700	01-05-78	2
44	76	24	703	140200	63250	5080	760	01-06-78	2
44	76	24	704	138432	63771	5016	560	01-05-78	2
44	76	24	705	138799	63539	5013	720	01-05-78	2
44	76	24	706	138800	63300	5004	700	01-05-78	2
44	76	24	707	139232	63778	5045	500	01-05-78	2
44	76	24	708	138434	63521	4995	700	01-06-78	2
44	76	24	709	140200	62850	5089	780	01-06-78	2
44	76	24	710	140200	62750	5093	780	01-06-78	2
44	76	24	711	139233	63578	5037	502	01-06-78	2
44	76	24	712	139237	63128	5022	720	01-09-78	2
44	76	24	713	140400	62750	5121	800	01-09-78	2
44	76	24	714	138800	63200	5003	720	01-09-78	2
44	76	24	715	140000	62700	5081	780	01-09-78	2
44	76	24	716	138800	63650	5025	720	01-10-78	2
44	76	24	717	138434	63471	4992	670	01-10-78	2
44	76	24	718	140400	62650	5106	802	01-10-78	2
44	76	24	719	139886	63284	5056	740	01-11-78	2

TABLE 9.2 (Cont.)

ABANDONED DRILL HOLES - NORTH BUTTE PERMIT AREA

TOWN SHIP	RANGE	SECT	HOLE #	COORDINATE NORTH	COORDINATE EAST	ELEV	TD	Date Abandoned	Abandonment Procedure
44	76	24	720	139050	63400	5018	720	01-11-78	2
44	76	24	721	139887	63184	5058	760	01-11-78	2
44	76	24	722	138800	63700	5031	742	01-11-78	2
44	76	24	723	138686	63323	4998	700	01-11-78	2
44	76	24	724	138683	63573	5014	721	01-11-78	2
44	76	24	725	138684	63523	5008	720	01-11-78	2
44	76	24	726	138281	63819	5012	700	01-12-78	2
44	76	24	727	138683	63623	5019	720	01-12-78	2
44	76	24	728	138282	63769	5013	700	01-12-78	2
44	76	24	729	138281	63869	5008	702	01-12-78	2
44	76	24	730	139886	63234	5057	740	01-12-78	2
44	76	24	731	138435	63421	4989	680	01-13-78	2
44	76	24	732	139800	62600	5059	760	01-16-78	2
44	76	24	733	140050	63200	5069	760	01-16-78	2
44	76	24	734	138435	63371	4988	682	01-17-78	2
44	76	24	735	138682	63723	5029	740	01-17-78	2
44	76	24	736	138424	64571	5006	680	01-17-78	2
44	76	24	737	138224	64619	5001	681	01-18-78	2
44	76	24	738	139600	62500	5048	742	01-18-78	2
44	76	24	739	140000	62750	5076	761	01-19-78	2
44	76	24	740	139800	62550	5056	760	01-19-78	2
44	76	24	741	139800	62650	5062	760	01-19-78	2
44	76	24	742	140000	62650	5088	781	01-20-78	2
44	76	24	743	138624	64572	5011	682	01-20-78	2
44	76	24	744	140200	62700	5098	782	01-23-78	2
44	76	24	745	140400	62550	5090	783	01-23-78	2
44	76	24	746	140600	62600	5090	782	01-23-78	2
44	76	24	747	140050	63150	5070	760	01-24-78	2
44	76	24	748	141250	62500	5113	800	01-26-78	2
44	76	24	749	138238	63019	4982	680	01-26-78	2
44	76	24	750	138437	63171	4990	700	01-26-78	2
44	76	24	751	138675	64523	5013	680	01-26-78	2
44	76	24	752	138425	64521	5006	680	01-29-78	2
44	76	24	753	138224	64569	5000	680	01-29-78	2
44	76	24	754	140600	63150	5143	820	01-27-78	2
44	76	24	755	140450	63200	5112	782	01-27-78	2
44	76	24	756	138823	64724	5013	680	01-27-78	2
44	76	24	757	139220	65078	5012	680	01-27-78	2
44	76	24	758	139072	64877	4987	660	01-27-78	2
44	76	24	759	138437	63221	4988	700	01-27-78	2
44	76	24	760	141000	63050	5177	860	01-30-78	2
44	76	24	761	138600	62650	5006	720	01-27-78	2
44	76	24	762	141400	63000	5213	900	01-30-78	2

TABLE 9.2 (Cont.)

ABANDONED DRILL HOLES - NORTH BUTTE PERMIT AREA

TOWN SHIP	RANGE	SECT	HOLE #	COORDINATE NORTH	COORDINATE EAST	ELEV	TD	Date Abandoned	Abandonment Procedure
44	76	24	763	140600	62500	5079	550	01-30-78	1
44	76	24	764	138600	62750	4999	720	01-30-78	2
44	76	24	765	141250	62600	5122	820	01-30-78	2
44	76	24	766	140850	63200	5143	840	01-31-78	2
44	76	24	767	140000	62600	5090	780	01-31-78	2
44	76	24	768	141400	62750	5151	840	01-31-78	2
44	76	24	769	140400	62700	5114	800	01-31-78	2
44	76	24	770	140850	62700	5121	820	01-31-78	2
44	76	24	771	140590	62500	5080	780	01-30-78	2
44	76	24	772	138237	63169	4983	700	01-31-78	2
44	76	24	773	140400	62600	5098	800	01-31-78	2
44	76	24	774	140400	62500	5074	780	01-31-78	2
44	76	24	775	138600	62900	4998	720	02-01-78	2
44	76	24	776	139334	64629	5019	700	05-16-78	2
44	76	24	777	141200	62950	5192	880	02-01-78	2
44	76	24	778	140600	62550	5086	780	02-01-78	2
44	76	24	779	138283	63669	5003	700	02-01-78	2
44	76	24	780	138225	64469	5001	683	02-01-78	2
44	76	24	781	141000	63000	5190	880	02-01-78	2
44	76	24	782	138800	63100	5003	720	02-01-78	2
44	76	24	783	138600	62850	4998	700	02-02-78	2
44	76	24	784	138426	64421	5008	680	02-01-78	2
44	76	24	785	138625	64472	5012	680	02-02-78	2
44	76	24	786	138823	64674	5017	680	02-02-78	2
44	76	24	787	138236	63319	4980	683	02-02-78	2
44	76	24	788	138483	63621	5006	700	02-02-78	2
44	76	24	789	141000	63200	5147	840	02-02-78	2
44	76	24	790	138283	63619	4996	700	02-02-78	2
44	76	24	791	138800	63050	5004	700	02-02-78	2
44	76	24	792	140800	62650	5120	840	02-02-78	2
44	76	24	793	138800	62750	5006	720	02-02-78	2
44	76	24	794	143346	67765	5130	640	02-02-78	2
44	76	24	795	138600	62800	4998	700	02-03-78	2
44	76	24	796	140850	63150	5150	840	02-03-78	2
44	76	24	797	138638	63073	4997	700	02-03-78	2
44	76	24	798	138800	63150	5003	700	02-03-78	2
44	76	24	799	140400	62800	5124	820	02-03-78	2
44	76	24	800	140600	63200	5136	820	02-03-78	2
44	76	24	801	138237	63219	4982	700	02-03-78	2
44	76	24	802	138275	64519	5003	680	02-03-78	2
44	76	24	803	138800	62850	5006	720	02-03-78	2
44	76	24	804	138282	63719	5010	695	02-06-78	2
44	76	24	805	139000	62750	5018	720	02-06-78	2

TABLE 9.2 (Cont.)

ABANDONED DRILL HOLES - NORTH BUTTE PERMIT AREA

TOWN SHIP	RANGE	SECT	HOLE #	COORDINATE NORTH	COORDINATE EAST	ELEV	TD	Date Abandoned	Abandonment Procedure
44	76	24	806	138800	62800	5006	720	02-06-78	2
44	76	24	807	138425	64471	5006	682	02-06-78	2
44	76	24	808	138283	63569	4991	700	02-06-78	2
44	76	24	809	141250	62900	5187	880	02-07-78	2
44	76	24	810	139000	62650	5025	720	02-07-78	2
44	76	24	811	141200	63050	5178	860	02-07-78	2
44	76	24	812	141400	62850	5185	865	02-07-78	2
44	76	24	813	138682	63673	5024	740	02-09-78	2
44	76	24	814	141400	63050	5197	860	02-09-78	2
44	76	24	815	138682	63773	5035	725	02-09-78	2
44	76	24	816	138284	63519	4988	680	02-09-78	2
44	76	24	817	139200	62550	5037	740	02-09-78	2
44	76	24	818	140600	62650	5102	800	02-10-78	2
44	76	24	819	143296	67765	5129	640	02-10-78	2
44	76	24	820	139200	62650	5036	740	02-13-78	2
44	76	24	821	143246	67764	5127	660	02-13-78	2
44	76	24	822	138438	63071	4990	700	02-13-78	2
44	76	24	823	138234	63469	4982	680	02-13-78	2
44	76	24	824	138438	63021	4990	700	02-13-78	2
44	76	24	825	138687	63173	4998	700	02-15-78	2
44	76	24	826	139000	62700	5022	740	02-15-78	2
44	76	24	827	139200	62600	5040	740	02-15-78	2
44	76	24	828	139400	62500	5042	740	02-15-78	2
44	76	24	829	138437	63121	4990	560	02-16-78	2
44	76	24	830	143196	67764	5126	660	02-16-78	2
44	76	24	831	142200	62750	5252	860	02-17-78	2
44	76	24	832	143146	67763	5124	640	02-17-78	2
44	76	24	833	139639	62982	5045	740	02-17-78	2
44	76	24	834	142550	63000	5251	880	02-21-78	2
44	76	24	835	143096	67763	5123	640	02-21-78	2
44	76	24	836	139639	62932	5046	740	02-22-78	2
44	76	24	837	142400	62850	5247	880	02-22-78	2
44	76	24	838	142946	67762	5126	660	02-21-78	2
44	76	24	839	140000	62950	5072	760	02-22-78	2
44	76	24	840	142896	67761	5126	660	02-23-78	2
44	76	24	841	139600	62550	5052	760	02-23-78	2
44	76	24	842	139400	62550	5044	760	02-23-78	2
44	76	24	843	139638	63032	5044	740	02-23-78	2
44	76	24	844	140000	63050	5070	760	02-24-78	2
44	76	24	845	142846	67761	5126	660	02-24-78	2
44	76	24	846	140200	63000	5089	780	02-24-78	2
44	76	24	847	139638	63082	5044	780	02-27-78	2
44	76	24	848	140000	63000	5071	760	02-28-78	2

TABLE 9.2 (Cont.)

ABANDONED DRILL HOLES - NORTH BUTTE PERMIT AREA

TOWN SHIP	RANGE	SECT	HOLE #	COORDINATE NORTH	COORDINATE EAST	ELEV	TD	Date Abandoned	Abandonment Procedure
44	76	24	849	141400	62900	5190	880	02-28-78	2
44	76	24	850	139600	62600	5050	760	03-01-78	2
44	76	24	851	139400	62650	5037	735	03-01-78	2
44	76	24	852	140800	62750	5139	820	03-01-78	1
44	76	24	853	140000	62900	5071	760	03-03-78	2
44	76	24	854	142050	62750	5256	860	03-03-78	1
44	76	24	855	142200	62800	5250	860	03-06-78	2
44	76	24	856	139200	62700	5030	740	03-07-78	2
44	76	24	857	138634	63498	5004	720	03-14-78	2
44	76	24	858	139000	62800	5015	740	03-14-78	2
44	76	24	859	140200	62950	5090	780	03-15-78	2
44	76	24	860	140200	63050	5088	780	03-15-78	2
44	76	24	861	138683	63543	5011	720	03-16-78	2
44	76	24	862	139238	63078	5022	720	03-16-78	2
44	76	24	863	140200	63350	5077	760	03-16-78	2
44	76	24	864	140600	62950	5139	820	03-17-78	2
44	76	24	865	138431	63821	5020	560	03-17-78	2
44	76	24	866	141400	62800	5170	860	03-20-78	2
44	76	24	867	138431	63871	5020	460	03-20-78	2
44	76	24	868	140200	63100	5085	780	03-20-78	2
44	76	24	869	141225	62575	5120	820	03-21-78	1
44	76	24	870	138430	63921	5021	460	03-21-78	2
44	76	24	871	140200	63150	5082	780	03-21-78	2
44	76	24	872	139229	64028	5059	500	03-21-78	2
44	76	24	873	140000	62675	5085	780	03-22-78	1
44	76	24	874	139487	63180	5032	740	03-22-78	2
44	76	24	875	138430	63971	5022	460	03-22-78	2
44	76	24	876	139236	63253	5023	705	03-23-78	1
44	76	24	877	138237	63119	4983	700	03-23-78	2
44	76	24	878	138429	64021	5023	460	03-23-78	2
44	76	24	879	138436	63271	4988	700	03-27-78	2
44	76	24	880	138649	64547	5012	680	03-27-78	2
44	76	24	881	142000	63325	5146	720	03-28-78	1
44	76	24	882	140600	62850	5149	840	03-28-78	2
44	76	24	883	141024	64619	5126	680	03-29-78	1
44	76	24	884	140600	63650	5083	540	03-28-78	2
44	76	24	885	140600	62700	5118	800	03-29-78	2
44	76	24	886	139221	65003	5006	660	03-30-78	1
44	76	24	887	141400	62950	5203	900	03-30-78	2
44	76	24	888	142850	63300	5183	820	03-30-78	2
44	76	24	889	140600	63250	5133	660	03-30-78	2
44	76	24	890	140600	62525	5081	780	03-31-78	1
44	76	24	891	142200	62850	5231	840	03-31-78	2

TABLE 9.2 (Cont.)

ABANDONED DRILL HOLES - NORTH BUTTE PERMIT AREA

TOWN SHIP	RANGE	SECT	HOLE #	COORDINATE NORTH	COORDINATE EAST	ELEV	TD	Date Abandoned	Abandonment Procedure
44	76	24	892	141400	63500	5118	660	03-31-78	2
44	76	24	893	141000	62950	5203	900	04-03-78	2
44	76	24	894	141400	63400	5133	680	04-03-78	2
44	76	24	895	139633	63632	5066	540	04-03-78	2
44	76	24	896	139633	63582	5063	520	04-04-78	2
44	76	24	897	142850	63400	5201	860	04-04-78	2
44	76	24	898	141225	64496	5178	740	04-04-78	2
44	76	24	899	139632	63682	5068	520	04-04-78	2
44	76	24	900	141223	64696	5164	740	04-05-78	2
44	76	24	901	140823	64742	5097	640	04-05-78	2
44	76	24	902	140023	64785	5036	560	04-05-78	2
44	76	24	903	140023	64685	5002	540	04-05-78	2
44	76	24	904	138621	64947	4954	660	04-06-78	1
44	76	24	905	139224	64628	5017	520	04-06-78	2
44	76	24	906	141800	64000	5154	720	04-06-78	2
44	76	24	907	142800	63325	5186	840	04-07-78	1
44	76	24	908	142023	64703	5315	900	04-07-78	2
44	76	24	909	139021	64926	4981	660	04-07-78	2
44	76	24	910	139623	64781	5001	520	04-07-78	2
44	76	24	911	143038	65262	5162	720	04-10-78	2
44	76	24	912	142600	63800	5227	700	04-10-78	2
44	76	24	913	140600	63600	5087	540	04-10-78	2
44	76	24	914	142750	63400	5194	840	04-10-78	2
44	76	24	915	141223	64746	5159	720	04-11-78	2
44	76	24	916	141226	64446	5173	740	04-11-78	2
44	76	24	917	140822	64792	5104	640	04-11-78	2
44	76	24	918	142026	64453	5261	860	04-12-78	1
44	76	24	919	141800	63600	5127	680	04-12-78	1
44	76	24	920	141400	63350	5143	700	04-12-78	1
44	76	24	921	141000	63600	5090	640	04-12-78	1
44	76	24	922	142023	64753	5307	900	04-13-78	2
44	76	24	923	141222	64796	5154	720	04-13-78	2
44	76	24	924	140022	64835	5044	580	04-13-78	2
44	76	24	925	140024	64635	5029	560	04-14-78	2
44	76	24	926	140600	63550	5090	560	04-17-78	2
44	76	24	927	142200	63400	5143	716	04-18-78	2
44	76	24	928	140600	63300	5124	660	04-18-78	2
44	76	24	929	140022	64885	5052	580	04-18-78	2
44	76	24	930	142026	64403	5253	860	04-19-78	2
44	76	24	931	142022	64803	5284	880	04-20-78	2
44	76	24	932	142400	63455	5168	720	04-20-78	2
44	76	24	933	140423	64789	5055	600	04-20-78	2
44	76	24	934	140600	63500	5094	540	04-20-78	2

TABLE 9.2 (Cont.)

ABANDONED DRILL HOLES - NORTH BUTTE PERMIT AREA

TOWN SHIP	RANGE	SECT	HOLE #	COORDINATE NORTH	COORDINATE EAST	ELEV	TD	Date Abandoned	Abandonment Procedure
44	76	24	935	142400	63350	5173	740	04-21-78	2
44	76	24	936	142200	63050	5186	740	04-21-78	2
44	76	24	937	142818	65310	5154	720	04-24-78	2
44	76	24	938	141222	64846	5149	720	04-24-78	2
44	76	24	939	140021	64935	5049	580	04-24-78	2
44	76	24	940	139274	64628	5019	680	04-24-78	2
44	76	24	941	142417	65457	5161	720	04-25-78	2
44	76	24	942	140600	63000	5139	820	04-25-78	2
44	76	24	943	140034	64590	5028	560	04-25-78	2
44	76	24	944	139623	64731	4992	540	04-25-78	2
44	76	24	945	141400	63550	5109	660	04-25-78	2
44	76	24	946	143218	65314	5165	720	04-26-78	2
44	76	24	947	142200	63100	5179	720	04-26-78	2
44	76	24	948	140600	63450	5098	560	04-26-78	1
44	76	24	949	141222	64896	5147	720	04-26-78	2
44	76	24	950	138772	64818	4982	520	04-26-78	2
44	76	24	951	138422	64821	4994	540	04-26-78	2
44	76	24	952	142417	65407	5167	720	04-27-78	2
44	76	24	953	141221	64946	5141	720	04-27-78	2
44	76	24	954	139324	64629	5019	700	05-15-78	2
44	76	24	955	139637	63132	5043	740	05-15-78	2
44	76	24	956	142413	65907	5123	680	05-15-78	2
44	76	24	957	142600	63495	5185	740	05-16-78	1
44	76	24	958	142011	66053	5103	680	05-16-78	1
44	76	24	959	138235	63419	4981	520	05-16-78	2
44	76	24	960	140822	64842	5112	660	05-22-78	2
44	76	24	961	142416	65507	5153	700	05-22-78	2
44	76	24	962	139074	64577	5022	680	05-22-78	2
44	76	24	963	141217	65396	5115	660	05-22-78	2
44	76	24	964	143214	65764	5185	740	05-22-78	2
44	76	24	965	141800	63750	5131	680	05-22-78	2
44	76	24	966	142818	65260	5165	740	05-22-78	2
44	76	24	967	139487	63230	5034	720	05-24-78	2
44	76	24	968	140997	63550	5097	600	05-24-78	2
44	76	24	969	142022	64853	5276	860	05-24-78	2
44	76	24	970	142200	63350	5151	720	05-24-78	2
44	76	24	971	141629	64600	5261	840	05-25-78	2
44	76	24	972	140850	63175	5149	600	05-25-78	2
44	76	24	973	138423	64771	5005	680	05-25-78	2
44	76	24	979	143400	67316	5140	660	06-21-78	2
44	76	24	980	143399	67416	5132	660	06-21-78	2
44	76	24	981	143403	67016	5151	700	06-21-78	1
44	76	24	982	143401	67216	5140	680	06-27-78	2

TABLE 9.2 (Cont.)

ABANDONED DRILL HOLES - NORTH BUTTE PERMIT AREA

TOWN SHIP	RANGE	SECT	HOLE #	COORDINATE NORTH	COORDINATE EAST	ELEV	TD	Date Abandoned	Abandonment Procedure
44	76	24	983	143202	67114	5147	680	06-29-78	2
44	76	24	984	143400	67266	5141	680	06-29-78	2
44	76	24	985	143214	65714	5184	740	07-06-78	2
44	76	24	986	143213	65814	5177	740	07-07-78	2
44	76	24	987	142600	66750	5170	720	07-07-78	2
44	76	24	988	139073	64777	4987	680	07-07-78	2
44	76	24	989	138822	64824	4982	500	07-07-78	2
44	76	24	990	143398	67516	5136	660	07-08-78	2
44	76	24	991	143215	65664	5177	720	07-11-78	2
44	76	24	992	143213	65864	5170	720	07-12-78	1
44	76	24	993	143220	65114	5182	780	07-12-78	2
44	76	24	994	142600	66650	5162	700	07-14-78	2
44	76	24	995	140950	65925	5089	640	07-14-78	2
44	76	24	996	141615	65649	5126	680	07-17-78	2
44	76	24	997	141616	65549	5131	680	07-17-78	2
44	76	24	998	141218	65346	5118	680	07-17-78	2
44	76	24	999	142016	65503	5156	680	07-18-78	2
44	76	24	1000	139075	64527	5022	700	07-31-78	2
44	76	24	1001	139434	64620	5030	680	07-13-78	2
44	76	24	1002	143201	67214	5126	660	08-09-78	2
44	76	24	1003	143402	67066	5144	680	08-09-78	2
44	76	24	1004	143403	66916	5164	700	08-10-78	2
44	76	24	1005	143202	67064	5153	680	08-16-78	2
44	76	24	1006	143200	67314	5136	660	08-17-78	2
44	76	24	1007	143203	67014	5161	700	08-18-78	2
44	76	24	1008	143199	67414	5134	660	08-22-78	2
44	76	24	1009	143203	66964	5170	700	08-22-78	2
44	76	24	1010	143199	67364	5135	660	08-23-78	2
44	76	24	1011	143198	67564	5130	660	08-25-78	2
44	76	24	1012	143148	67563	5132	660	08-25-78	2
44	76	24	1013	143248	67564	5132	660	08-28-78	2
44	76	24	1014	143098	67563	5135	660	08-28-78	2
44	76	24	1015	139073	64727	5000	660	08-30-78	2
44	76	24	1016	138423	64721	5006	940	08-31-78	2
44	76	24	1017	139073	64677	5011	680	09-01-78	2
44	76	24	1018	140837	64892	5111	660	09-01-78	2
44	76	24	1019	139424	64580	5030	940	09-05-78	2
44	76	24	1020	139224	64578	5026	680	09-05-78	2
44	76	24	1021	138424	64671	5007	680	09-06-78	2
44	76	24	1022	141623	64682	5230	820	09-07-78	2
44	76	24	1023	140821	64942	5103	660	09-07-78	2
44	76	24	1024	139225	64528	5026	680	09-07-78	2
44	76	24	1025	138424	64621	5006	680	09-07-78	2

TABLE 9.2 (Cont.)

ABANDONED DRILL HOLES - NORTH BUTTE PERMIT AREA

TOWN SHIP	RANGE	SECT	HOLE #	COORDINATE NORTH	COORDINATE EAST	ELEV	TD	Date Abandoned	Abandonment Procedure
44	76	24	1026	139425	64480	5032	680	09-11-78	2
44	76	24	1027	139625	64531	5037	700	09-13-78	2
44	76	24	1028	139475	64530	5033	680	09-13-78	2
44	76	24	1029	139625	64482	5037	700	09-14-78	2
44	76	24	1030	142787	65360	5152	720	09-15-78	2
44	76	24	1031	143220	65064	5183	760	09-19-78	2
44	76	24	1032	142819	65210	5172	740	09-19-78	2
44	76	24	1033	143219	65164	5182	760	09-19-78	2
44	76	24	1034	139626	64432	5038	700	09-21-78	2
44	76	24	1035	139825	64483	5027	700	09-21-78	2
44	76	24	1036	139826	64383	5044	720	09-22-78	2
44	76	24	1037	139848	64634	5021	700	09-22-78	2
44	76	24	1038	139824	64583	5021	700	09-25-78	2
44	76	24	1039	140026	64385	5033	720	09-25-78	2
44	76	24	1040	140161	64520	5050	720	09-26-78	2
44	76	24	1041	139826	64433	5037	720	09-27-78	2
44	76	24	1042	140327	64302	5044	720	09-26-78	2
44	76	24	1043	140900	65925	5087	1040	09-27-78	2
44	76	24	1044	142819	65160	5180	740	09-27-78	2
44	76	24	1045	141614	65699	5123	1060	09-27-78	2
44	76	24	1046	143219	65214	5184	740	09-28-78	2
44	76	24	1047	143221	65014	5185	760	09-28-78	2
44	76	24	1048	139925	64484	5027	720	09-28-78	2
44	76	24	1049	142820	65110	5187	760	09-29-78	2
44	76	24	1050	142606	66558	5155	700	10-02-78	2
44	76	24	1051	142820	65060	5197	760	10-03-78	2
44	76	24	1052	142206	66605	5126	1060	10-03-78	2
44	76	24	1053	142853	65456	5148	720	10-03-78	2
44	76	24	1054	143218	65264	5170	720	10-03-78	2
44	76	24	1055	141614	65749	5121	680	10-04-78	2
44	76	24	1056	141616	65499	5134	680	10-05-78	2
44	76	24	1057	141468	65348	5135	680	10-05-78	2
44	76	24	1058	141219	65146	5130	700	10-05-78	2
44	76	24	1059	141020	65094	5113	680	10-06-78	2
44	76	24	1060	142821	65010	5203	780	10-06-78	1
44	76	24	1061	140820	65042	5094	660	10-06-78	2
44	76	24	1062	141016	65494	5099	660	10-06-78	2
44	76	24	1063	141617	65449	5138	680	10-09-78	2
44	76	24	1064	142600	66450	5150	680	10-09-78	2
44	76	24	1065	141368	65347	5128	700	10-09-78	2
44	76	24	1066	142206	66655	5129	660	10-09-78	2
44	76	24	1067	142207	66555	5121	660	10-09-78	2
44	76	24	1068	141218	65296	5121	700	10-10-78	2

TABLE 9.2 (Cont.)

ABANDONED DRILL HOLES - NORTH BUTTE PERMIT AREA

TOWN SHIP	RANGE	SECT	HOLE #	COORDINATE NORTH	COORDINATE EAST	ELEV	TD	Date Abandoned	Abandonment Procedure
44	76	24	1069	142600	66500	5151	680	10-10-78	2
44	76	24	1070	142205	66705	5133	660	10-11-78	2
44	76	24	1071	142207	66505	5127	660	10-11-78	2
44	76	24	1072	140821	64992	5099	660	10-11-78	2
44	76	24	1073	140820	65092	5092	660	10-11-78	2
44	76	24	1074	141015	65594	5095	660	10-12-78	2
44	76	24	1075	141617	65399	5142	680	10-12-78	2
44	76	24	1076	141816	65551	5145	680	10-13-78	2
44	76	24	1077	142620	65059	5211	780	10-13-78	2
44	76	24	1078	142420	65107	5216	760	10-13-78	2
44	76	24	1079	142017	65453	5162	700	10-13-78	2
44	76	24	1080	142205	66755	5136	660	10-13-78	2
44	76	24	1081	142016	65553	5151	700	10-13-78	2
44	76	24	1082	141016	65544	5097	640	10-16-78	2
44	76	24	1083	141015	65644	5093	640	10-16-78	2
44	76	24	1084	142017	65403	5168	700	10-16-78	2
44	76	24	1085	140819	65142	5096	660	10-16-78	2
44	76	24	1086	141417	65398	5128	680	10-16-78	2
44	76	24	1087	141420	65098	5149	700	10-16-78	2
44	76	24	1088	141416	65498	5121	680	10-17-78	2
44	76	24	1089	141418	65298	5135	680	10-17-78	2
44	76	24	1090	141816	65501	5148	680	10-17-78	2
44	76	24	1091	142017	65353	5174	720	10-17-78	2
44	76	24	1092	141416	65447	5125	680	10-17-78	2
44	76	24	1093	142015	65603	5145	680	10-18-78	2
44	76	24	1094	142815	65660	5157	720	10-18-78	2
44	76	24	1095	141817	65451	5151	680	10-18-78	2
44	76	24	1096	142020	65103	5212	760	10-18-78	2
44	76	24	1097	143215	65614	5173	720	10-18-78	2
44	76	24	1098	142018	65303	5181	740	10-18-78	2
44	76	24	1099	142620	65108	5201	760	10-19-78	2
44	76	24	1100	142419	65157	5208	760	10-19-78	2
44	76	24	1101	142420	65057	5225	780	10-19-78	2
44	76	24	1102	143406	66616	5181	720	10-19-78	2
44	76	24	1103	142015	65653	5140	680	10-19-78	2
44	76	24	1104	143407	66516	5186	720	10-19-78	2
44	76	24	1105	141817	65401	5155	700	10-19-78	2
44	76	24	1106	142018	65253	5187	760	10-20-78	2
44	76	24	1107	142019	65153	5203	740	10-20-78	2
44	76	24	1108	142800	67050	5150	680	10-23-78	2
44	76	24	1109	143404	66866	5169	700	10-20-78	2
44	76	24	1110	142418	65307	5182	720	10-20-78	2
44	76	24	1111	142814	65710	5155	720	10-23-78	2

TABLE 9.2 (Cont.)

ABANDONED DRILL HOLES - NORTH BUTTE PERMIT AREA

TOWN SHIP	RANGE	SECT	HOLE #	COORDINATE NORTH	COORDINATE EAST	ELEV	TD	Date Abandoned	Abandonment Procedure
44	76	24	1112	143408	66466	5186	720	10-23-78	2
44	76	24	1113	143406	66666	5176	720	10-24-78	2
44	76	24	1114	142014	65703	5136	680	10-24-78	2
44	76	24	1115	142417	65357	5174	700	10-24-78	2
44	76	24	1116	142418	65257	5192	740	10-24-78	2
44	76	24	1117	142619	65158	5195	740	10-24-78	2
44	76	24	1118	142618	65308	5178	740	10-24-78	2
44	76	24	1119	143216	65514	5174	720	10-25-78	2
44	76	24	1120	142019	65203	5194	720	10-25-78	2
44	76	24	1121	142014	65753	5133	660	10-25-78	2
44	76	24	1122	142814	65760	5154	700	10-25-78	2
44	76	24	1123	142011	66103	5109	640	10-25-78	2
44	76	24	1124	142600	66400	5147	680	10-25-78	2
44	76	24	1125	143001	67212	5134	660	10-26-78	2
44	76	24	1126	142013	65803	5130	660	10-26-78	2
44	76	24	1127	142600	66350	5143	680	10-27-78	2
44	76	24	1128	143000	67312	5122	640	10-27-78	2
44	76	24	1129	142811	66060	5147	720	10-30-78	2
44	76	24	1130	142618	65258	5183	740	10-30-78	2
44	76	24	1131	141612	65949	5113	640	10-30-78	2
44	76	24	1132	142812	66010	5148	680	10-31-78	2
44	76	24	1133	141000	65925	5091	600	10-31-78	2
44	76	24	1134	141613	65899	5115	640	11-01-78	2
44	76	24	1135	142811	66110	5147	680	11-01-78	2
44	76	24	1136	141612	65999	5113	640	11-01-78	2
44	76	24	1137	142619	65208	5189	760	11-01-78	2
44	76	24	1138	143000	67262	5126	660	11-01-78	2
44	76	24	1139	142999	67362	5121	660	11-02-78	2
44	76	24	1140	143199	67464	5133	660	11-02-78	2
44	76	24	1141	141611	66049	5112	660	11-02-78	2
44	76	24	1142	141613	65849	5116	640	11-02-78	2
44	76	24	1143	142412	65957	5134	720	11-03-78	2
44	76	24	1144	141050	65925	5092	640	11-03-78	2
44	76	24	1145	141819	65151	5184	760	11-03-78	2
44	76	24	1146	142419	65207	5201	740	11-03-78	2
44	76	24	1147	141618	65249	5155	700	11-03-78	2
44	76	24	1148	138800	63800	5053	480	01-23-79	2
44	76	24	1149	139600	66000	5069	770	01-23-79	2
44	76	24	1150	139600	65800	5063	740	01-24-79	2
44	76	24	1151	140075	66200	5071	740	01-24-79	2
44	76	24	1152	138800	62950	5005	740	01-25-79	1
44	76	24	1153	139000	62900	5013	565	01-25-79	1
44	76	24	1154	139004	62900	5014	720	01-29-79	2

TABLE 9.2 (Cont.)

ABANDONED DRILL HOLES - NORTH BUTTE PERMIT AREA

TOWN SHIP	RANGE	SECT	HOLE #	COORDINATE NORTH	COORDINATE EAST	ELEV	TD	Date Abandoned	Abandonment Procedure
44	76	24	1155	138794	62941	5005	740	01-30-79	1
44	76	24	1156	139000	63000	5012	720	01-30-79	2
44	76	24	1157	139000	63100	5012	720	01-31-79	2
44	76	24	1158	139600	66200	5052	720	01-31-79	2
44	76	24	1159	139600	65280	5040	720	02-01-79	2
44	76	24	1160	140400	66000	5069	740	02-01-79	2
44	76	24	1161	140000	65675	5055	720	02-02-79	2
44	76	24	1162	139200	62800	5024	720	02-02-79	2
44	76	24	1163	139239	62928	5024	740	02-02-79	2
44	76	24	1164	139238	63028	5023	720	02-05-79	2
44	76	24	1165	139491	62730	5039	740	02-05-79	2
44	76	24	1166	139490	62830	5040	740	02-05-79	2
44	76	24	1167	139489	62930	5036	740	02-06-79	1
44	76	24	1168	139488	63030	5036	740	02-06-79	2
44	76	24	1169	139640	62832	5047	740	02-06-79	2
44	76	24	1170	139889	62934	5063	760	02-07-79	2
44	76	24	1171	139890	62834	5062	760	02-07-79	2
44	76	24	1172	139891	62734	5068	760	02-07-79	2
44	76	24	1173	140200	62600	5096	800	02-09-79	2
44	76	24	1174	140200	63450	5075	520	02-09-79	2
44	76	24	1175	140400	63450	5095	560	02-09-79	2
44	76	24	1176	140200	63550	5084	560	02-09-79	2
44	76	24	1177	140200	63650	5087	560	02-12-79	2
44	76	24	1178	140000	63850	5068	480	02-12-79	2
44	76	24	1179	139995	63850	5067	520	02-12-79	2
44	76	24	1180	140000	63450	5062	520	02-12-79	2
44	76	24	1181	140000	63800	5072	540	02-13-79	2
44	76	24	1182	139634	63482	5059	520	02-13-79	2
44	76	24	1183	140200	63600	5087	560	02-13-79	2
44	76	24	1184	140200	63700	5086	560	02-14-79	2
44	76	24	1185	143413	65816	5180	720	02-16-79	2
44	76	24	1186	143412	65916	5174	720	02-16-79	2
44	76	24	1187	143411	66116	5168	720	02-20-79	2
44	76	24	1188	143409	66316	5172	720	02-20-79	2
44	76	24	1189	143408	66416	5182	740	02-20-79	2
44	76	24	1190	143209	66314	5163	720	02-21-79	2
44	76	24	1191	143208	66414	5173	720	02-21-79	2
44	76	24	1192	143207	66514	5184	720	02-21-79	2
44	76	24	1193	143206	66614	5193	740	02-23-79	2
44	76	24	1194	143205	66714	5189	720	02-23-79	2
44	76	24	1195	143410	66216	5165	700	02-23-79	2
44	76	24	1196	143212	66014	5165	720	02-26-79	2
44	76	24	1197	143210	66205	5156	700	02-26-79	2

TABLE 9.2 (Cont.)

ABANDONED DRILL HOLES - NORTH BUTTE PERMIT AREA

TOWN SHIP	RANGE	SECT	HOLE #	COORDINATE NORTH	COORDINATE EAST	ELEV	TD	Date Abandoned	Abandonment Procedure
44	76	24	1198	143009	66312	5155	680	02-26-79	2
44	76	24	1199	143008	66412	5164	700	02-27-79	2
44	76	24	1200	143007	66512	5176	720	02-27-79	2
44	76	24	1201	143006	66612	5186	720	02-27-79	2
44	76	24	1202	143005	66712	5180	720	02-28-79	2
44	76	24	1203	142800	66300	5148	680	02-28-79	2
44	76	24	1204	142800	66400	5159	700	02-28-79	2
44	76	24	1205	142800	66500	5170	720	03-01-79	2
44	76	24	1206	142800	66700	5181	720	03-01-79	2
44	76	24	1207	142813	65810	5152	680	03-01-79	2
44	76	24	1208	142813	65910	5150	680	03-02-79	2
44	76	24	1209	142611	66108	5138	680	03-02-79	2
44	76	24	1210	142612	66008	5141	680	03-02-79	2
44	76	24	1211	142613	65908	5140	680	03-05-79	2
44	76	24	1212	142400	66100	5131	680	03-05-79	2
44	76	24	1213	142400	66300	5134	660	03-06-79	2
44	76	24	1214	142400	66400	5142	680	03-06-79	2
44	76	24	1215	142209	66305	5128	660	03-06-79	2
44	76	24	1216	142208	66405	5131	660	03-06-79	2
44	76	24	1217	143206	66664	5192	720	03-07-79	2
44	76	24	1218	143207	66564	5189	720	03-07-79	2
44	76	24	1219	138800	63750	5037	480	03-07-79	2
44	76	24	1220	143414	65766	5186	720	03-12-79	2
44	76	24	1221	138800	63850	5049	480	03-12-79	2
44	76	24	1222	143413	65866	5177	720	03-14-79	2
44	76	24	1223	142208	66355	5130	600	03-14-79	2
44	76	24	1224	139200	62750	5025	720	03-19-79	2
44	76	24	1225	139200	62850	5023	720	03-19-79	2
44	76	24	1226	140200	63750	5082	560	03-20-79	2
44	76	24	1227	139491	62780	5040	740	03-21-79	2
44	76	24	1228	139490	62880	5037	740	03-21-79	2
44	76	24	1229	142208	66455	5129	660	03-22-79	2
44	76	24	1230	140200	63800	5077	540	03-22-79	2
44	76	24	1231	141100	65925	5095	620	03-22-79	2
44	76	24	1232	141213	65846	5098	640	03-23-79	2
44	76	24	1233	141212	65946	5099	640	03-23-79	2
44	76	24	1234	141211	66046	5097	640	03-26-79	2
44	76	24	1235	141210	66146	5095	640	03-26-79	2
44	76	24	1236	141214	65746	5099	640	03-26-79	2
44	76	24	1237	141215	65646	5103	640	03-27-79	2
44	76	24	1238	141216	65546	5108	660	03-27-79	2
44	76	24	1239	141610	66134	5108	660	03-27-79	2
44	76	24	1240	141411	66098	5103	660	03-27-79	2

TABLE 9.2 (Cont.)

ABANDONED DRILL HOLES - NORTH BUTTE PERMIT AREA

TOWN SHIP	RANGE	SECT	HOLE #	COORDINATE NORTH	COORDINATE EAST	ELEV	TD	Date Abandoned	Abandonment Procedure
44	76	24	1241	141412	65998	5104	660	03-28-79	2
44	76	24	1242	141410	66198	5102	660	03-28-79	2
44	76	24	1243	141413	65898	5105	640	03-28-79	2
44	76	24	1244	141019	65194	5109	680	03-28-79	2
44	76	24	1245	141619	65149	5164	720	03-29-79	2
44	76	24	1246	141819	65201	5178	720	03-30-79	2
44	76	24	1247	143412	66006	5169	720	04-02-79	2
44	76	24	1248	139262	63228	5024	527	04-11-79	1
44	76	24	1249	141450	64523	5243	200	04-10-79	1
44	76	24	1250	141450	64510	5244	773	04-26-79	1
44	76	24	1251	143417	65516	5182	782	08-08-68	1
44	76	24	1252	143417	65366	5144	723	06-10-77	2
44	76	24	1253	143417	65416	5171	722	06-24-77	2
44	76	24	1254	143417	65466	5183	735	06-24-77	2
44	76	24	1255	143416	65566	5182	738	06-27-77	2
44	76	24	1256	143415	65616	5183	725	06-30-77	2
44	76	24	1257	143415	65666	5188	738	09-06-77	2
44	76	24	1258	143414	65716	5191	744	09-09-77	2
44	76	24	1259	143204	66814	5191	720	05-21-79	2
44	76	24	1260	143004	66822	5178	720	05-21-79	2
44	76	24	1261	143420	65116	5186	743	06-24-77	2
44	76	24	1262	143420	65066	5198	763	08-17-77	2
44	76	24	1263	143421	65016	5196	764	09-06-77	2
44	76	24	1264	143419	66731	5170	700	10-25-78	2
44	76	24	1265	143421	64966	5197	772	08-08-68	1
44	76	24	1266	143419	65166	5179	763	11-16-68	1
44	76	24	1267	141022	64794	5128	660	05-24-76	2
44	76	24	1268	141220	65046	5135	700	05-25-79	2
44	76	24	1269	141622	64850	5206	780	05-25-79	2
44	76	24	1270	141623	64749	5220	800	05-29-79	2
44	76	24	1271	142621	65009	5225	780	05-31-79	2
44	76	24	1272	142421	65007	5236	780	05-31-79	2
44	76	24	1273	142422	64907	5154	820	06-01-79	2
44	76	24	1274	142422	64807	5288	860	06-01-79	2
44	76	24	1275	141823	64751	5268	840	06-01-79	2
44	76	24	1276	142021	64953	5248	820	06-04-79	2
44	76	24	1277	141822	64851	5249	820	06-04-79	2
44	76	24	1278	141835	62912	5245	800	06-04-79	2
44	76	24	1279	141699	63160	5186	760	06-05-79	2
44	76	24	1280	141841	63053	5198	760	06-05-79	2
44	76	24	1287	138368	67440	5045	700	07-20-83	2
44	76	24	1288	138400	62800	4996	720	07-25-83	2
44	76	25	F80	SE 1/4	SE 1/4	5095	585	10-17-67	1

TABLE 9.2 (Cont.)

ABANDONED DRILL HOLES - NORTH BUTTE PERMIT AREA

TOWN SHIP	RANGE	SECT	HOLE #	COORDINATE NORTH	COORDINATE EAST	ELEV	TD	Date Abandoned	Abandonment Procedure
44	76	25	Z87	137561	64280	4980	680	10-25-68	1
44	76	25	Z89	137125	63387	4961	660	10-23-68	1
44	76	25	Z91	NW 1/4	NE 1/4	4952	620	10-25-68	1
44	76	25	2	137561	64280	4980	680	No data	
44	76	25	3	137125	63387	4961	660	No data	
44	76	25	5	137828	64115	4984	540	12-11-68	1
44	76	25	6	137825	64515	4989	540	12-11-68	1
44	76	25	7	137832	63715	4977	520	12-11-68	1
44	76	25	8	138000	63800	4992	520	10-24-69	1
44	76	25	9	138000	64200	4997	520	10-24-69	1
44	76	25	10	137600	64200	4980	516	10-24-69	1
44	76	25	11	137600	63800	4979	500	10-24-69	1
44	76	25	12	137200	63800	4967	495	10-25-69	1
44	76	25	13	136800	64200	4971	674	10-25-69	1
44	76	25	14	136800	63800	4965	420	10-25-69	1
44	76	25	15	137200	64200	4972	988	10-25-69	1
44	76	25	16	136400	64215	4905	320	10-27-69	1
44	76	25	17	136400	64600	4910	338	10-27-69	1
44	76	25	18	136000	64600	4970	390	10-27-69	1
44	76	25	19	137200	64600	4984	675	10-30-69	1
44	76	25	20	136400	65000	4978	678	10-31-69	1
44	76	25	21	136756	65060	4941	620	10-31-69	1
44	76	25	22	136800	64600	4937	612	10-31-69	1
44	76	25	23	137200	64900	4975	654	11-05-69	1
44	76	25	24	137600	64900	4981	650	11-05-69	1
44	76	25	25	138000	64600	4981	700	11-05-69	1
44	76	25	26	136000	65000	4974	672	11-05-69	1
44	76	25	27	136981	63284	4960	640	06-16-70	1
44	76	25	28	136976	63884	4967	660	06-17-70	1
44	76	25	29	137836	62691	4977	680	06-17-70	1
44	76	25	30	136471	64480	4909	580	06-17-70	1
44	76	25	31	137271	64486	4985	660	06-18-70	1
44	76	25	32	137412	64938	4974	660	06-19-70	1
44	76	25	33	136697	64929	4978	660	06-19-70	1
44	76	25	34	137876	63891	4983	680	06-28-70	1
44	76	25	35	136800	64800	4934	618	09-15-70	1
44	76	25	36	137600	64800	4989	683	09-15-70	1
44	76	25	37	136000	64800	4972	664	09-15-70	1
44	76	25	38	137600	64600	4986	682	09-15-70	1
44	76	25	39	137600	64400	4983	705	09-16-70	1
44	76	25	40	136000	64900	4973	660	09-16-70	1
44	76	25	41	137600	64650	4987	682	09-16-70	1
44	76	25	42	137600	64550	4985	675	09-16-70	1

TABLE 9.2 (Cont.)

ABANDONED DRILL HOLES - NORTH BUTTE PERMIT AREA

TOWN SHIP	RANGE	SECT	HOLE #	COORDINATE NORTH	COORDINATE EAST	ELEV	TD	Date Abandoned	Abandonment Procedure
44	76	25	43	137600	64000	4978	682	09-16-70	1
44	76	25	44	136000	64950	4973	660	09-17-70	1
44	76	25	45	137600	64500	4985	675	09-17-70	1
44	76	25	46	137600	64450	4984	682	09-17-70	1
44	76	25	47	137600	64700	4987	681	09-17-70	1
44	76	25	48	136800	64850	4915	617	09-18-70	1
44	76	25	49	137600	64100	4979	680	09-18-70	1
44	76	25	50	137600	63200	4961	660	09-18-70	1
44	76	25	51	136800	63400	4960	660	09-18-70	1
44	76	25	52	136800	64950	4914	599	09-18-70	1
44	76	25	53	137600	64950	4981	649	09-18-70	1
44	76	25	54	137600	63000	4965	660	09-19-70	1
44	76	25	55	137600	64750	4988	681	09-19-70	1
44	76	25	56	136800	65000	4926	610	09-19-70	1
44	76	25	57	136800	65050	4936	616	09-19-70	1
44	76	25	58	136000	64850	4973	660	09-19-70	1
44	76	25	59	137600	63100	4963	660	09-21-70	1
44	76	25	60	136800	63300	4954	660	09-21-70	1
44	76	25	61	137600	64250	4980	679	09-21-70	1
44	76	25	62	137600	64150	4980	655	09-21-70	1
44	76	25	63	137600	64850	4985	678	09-21-70	1
44	76	25	64	138000	64000	4990	680	09-22-70	1
44	76	25	65	137800	64400	4987	680	09-22-70	1
44	76	25	66	137400	64500	4981	680	09-22-70	1
44	76	25	67	137400	64200	4976	680	09-22-70	1
44	76	25	68	137200	64000	4970	677	09-22-70	1
44	76	25	69	137000	64400	4973	660	09-22-70	1
44	76	25	70	136600	64400	4906	620	09-22-70	1
44	76	25	71	137000	64800	4967	660	09-22-70	1
44	76	25	72	136200	65000	4976	680	09-22-70	1
44	76	25	73	136000	64400	4967	660	09-22-70	1
44	76	25	74	136100	64400	4967	300	09-22-70	1
44	76	25	75	136800	64650	4937	636	09-23-70	1
44	76	25	76	136800	64550	4936	634	09-23-70	1
44	76	25	77	137600	65000	4955	655	09-23-70	1
44	76	25	78	136800	64400	4937	637	09-23-70	1
44	76	25	79	137600	63900	4976	671	09-26-70	1
44	76	25	80	137600	64300	4981	686	09-26-70	1
44	76	25	81	136800	64700	4937	636	09-26-70	1
44	76	25	82	136800	64350	4942	636	09-26-70	1
44	76	25	83	136800	64450	4936	640	09-26-70	1
44	76	25	84	136800	64750	4937	620	09-28-70	1
44	76	25	85	136800	64500	4935	626	09-28-70	1

TABLE 9.2 (Cont.)

ABANDONED DRILL HOLES - NORTH BUTTE PERMIT AREA

TOWN SHIP	RANGE	SECT	HOLE #	COORDINATE NORTH	COORDINATE EAST	ELEV	TD	Date Abandoned	Abandonment Procedure
44	76	25	86	137600	64350	4982	677	09-28-70	1
44	76	25	87	137600	63950	4976	678	09-28-70	1
44	76	25	88	136800	64300	4958	641	09-28-70	1
44	76	25	89	136800	64250	4971	662	09-29-70	1
44	76	25	90	137600	63700	4972	674	09-29-70	1
44	76	25	91	137200	64400	4975	662	11-05-70	1
44	76	25	92	137200	64300	4973	660	11-06-70	1
44	76	25	93	137200	64100	4971	669	11-06-70	1
44	76	25	94	137200	64500	4976	660	11-16-70	1
44	76	25	95	137200	64700	4997	682	11-16-70	1
44	76	25	96	137200	63900	4969	660	11-17-70	1
44	76	25	97	136400	64400	4908	597	11-17-70	1
44	76	25	98	136400	64300	4906	599	11-17-70	1
44	76	25	99	137200	64800	5005	679	11-18-70	1
44	76	25	100	136400	64900	4977	661	11-18-70	1
44	76	25	101	137200	65000	4959	639	11-18-70	1
44	76	25	102	136400	64500	4909	602	11-19-70	1
44	76	25	103	136400	64700	4909	581	11-19-70	1
44	76	25	104	136409	64794	4915	560	12-20-70	1
44	76	25	105	136975	64400	4973	660	07-11-74	2
44	76	25	106	137059	64175	4970	680	07-15-76	2
44	76	25	107	137600	64575	4985	502	02-21-77	1
44	76	25	108	137020	64400	4973	660	03-01-77	1
44	76	25	109	136800	64325	4951	635	03-06-77	1
44	76	25	110	136800	64675	4938	639	03-09-77	2
44	76	25	111	136400	65050	4978	517	03-10-77	2
44	76	25	112	136400	64950	4977	520	03-10-77	2
44	76	25	113	136400	64920	4977	522	04-11-77	1
44	76	25	114	137851	63891	4982	680	04-14-77	1
44	76	25	115	137200	63950	4969	681	04-15-77	1
44	76	25	116	137600	64925	4975	502	04-21-77	1
44	76	25	117	136435	64490	4908	600	04-27-77	1
44	76	25	118	137600	65050	4929	457	05-04-77	2
44	76	25	119	137200	64250	4973	659	05-23-77	2
44	76	25	120	137600	64050	4979	662	05-24-77	2
44	76	25	121	137200	64050	4971	658	05-26-77	2
44	76	25	122	137600	63850	4977	500	05-26-77	2
44	76	25	123	137600	63750	4975	498	05-26-77	2
44	76	25	124	137200	63850	4968	659	05-26-77	2
44	76	25	125	136400	64750	4903	433	07-06-77	2
44	76	25	126	136400	64350	4908	581	07-06-77	2
44	76	25	127	137200	64850	4990	500	07-06-77	2
44	76	25	128	137200	64750	5004	693	07-07-77	2

TABLE 9.2 (Cont.)

ABANDONED DRILL HOLES - NORTH BUTTE PERMIT AREA

TOWN SHIP	RANGE	SECT	HOLE #	COORDINATE NORTH	COORDINATE EAST	ELEV	TD	Date Abandoned	Abandonment Procedure
44	76	25	129	137200	64650	4990	684	07-07-77	2
44	76	25	130	137200	64450	4976	675	07-07-77	2
44	76	25	131	136800	64900	4914	442	07-08-77	2
44	76	25	132	137200	64550	4979	679	07-11-77	1
44	76	25	133	137200	64950	4967	483	07-12-77	2
44	76	25	134	137200	65050	4946	458	07-13-77	2
44	76	25	135	136390	64850	4977	499	07-14-77	2
44	76	25	136	136000	64750	4971	502	07-14-77	2
44	76	25	137	137200	64150	4972	675	08-03-77	2
44	76	25	138	137200	64350	4975	673	08-04-77	2
44	76	25	139	136400	64550	4909	429	08-04-77	2
44	76	25	140	136400	64450	4909	576	08-04-77	2
44	76	25	141	136400	64650	4909	416	08-04-77	2
44	76	25	142	136000	64700	4970	494	08-04-77	2
44	76	25	143	136000	64550	4969	498	08-08-77	2
44	76	25	144	136000	64650	4970	498	08-08-77	2
44	76	25	145	136000	64500	4968	496	08-09-77	2
44	76	25	146	136400	64250	4905	580	08-09-77	2
44	76	25	147	136000	65050	4975	502	08-17-77	2
44	76	25	148	137800	63800	4983	500	10-10-77	1
44	76	25	149	136350	64250	4906	380	10-21-77	1
44	76	25	150	137900	64050	4986	680	10-14-77	1
44	76	25	151	137400	64100	4975	680	10-17-77	2
44	76	25	152	137400	64150	4975	535	10-18-77	2
44	76	25	153	137400	64050	4974	480	10-18-77	2
44	76	25	154	137900	64100	4987	660	10-18-77	2
44	76	25	155	137900	64000	4985	680	10-19-77	2
44	76	25	156	137900	64150	4989	680	10-19-77	2
44	76	25	157	137400	63950	4973	660	10-20-77	2
44	76	25	158	137400	64000	4974	480	10-20-77	2
44	76	25	159	136600	64750	4912	440	11-17-77	2
44	76	25	160	137400	64400	4980	660	01-05-78	2
44	76	25	161	137400	64300	4978	660	01-05-78	2
44	76	25	162	137900	64450	4990	680	01-06-78	2
44	76	25	163	137900	63900	4984	680	01-06-78	2
44	76	25	164	137900	64400	4989	681	01-09-78	2
44	76	25	165	137900	63800	4983	681	01-09-78	2
44	76	25	166	137400	63850	4971	680	01-10-78	2
44	76	25	167	137400	64350	4979	682	01-10-78	2
44	76	25	168	137900	64500	4991	681	01-11-78	2
44	76	25	169	137400	63900	4972	680	01-12-78	2
44	76	25	170	137400	63800	4971	682	01-12-78	2
44	76	25	171	137900	63850	4984	680	01-13-78	2

TABLE 9.2 (Cont.)

ABANDONED DRILL HOLES - NORTH BUTTE PERMIT AREA

TOWN SHIP	RANGE	SECT	HOLE #	COORDINATE NORTH	COORDINATE EAST	ELEV	TD	Date Abandoned	Abandonment Procedure
44	76	25	172	137900	63950	4984	681	01-13-78	2
44	76	25	173	137800	63100	4969	681	01-13-78	2
44	76	25	174	137900	64350	4989	683	01-13-78	2
44	76	25	175	137600	63150	4963	680	01-13-78	2
44	76	25	176	137600	63050	4964	520	01-13-78	2
44	76	25	177	137400	64250	4977	660	01-16-78	2
44	76	25	178	137400	64450	4980	660	01-16-78	2
44	76	25	179	137800	63000	4970	680	01-16-78	2
44	76	25	180	137000	64250	4971	662	01-17-78	2
44	76	25	181	137900	63750	4980	680	01-17-78	2
44	76	25	182	137000	64350	4972	662	01-17-78	2
44	76	25	183	138000	63000	4976	682	01-18-78	2
44	76	25	184	137400	63200	4957	682	01-19-78	2
44	76	25	185	137000	64450	4974	661	01-20-78	2
44	76	25	186	138000	63100	4973	681	01-23-78	2
44	76	25	187	137400	63100	4959	662	01-23-78	2
44	76	25	188	137200	63200	4958	660	01-24-78	2
44	76	25	189	137400	63000	4961	522	01-27-78	2
44	76	25	190	137900	63700	4977	681	01-27-78	2
44	76	25	191	137800	63200	4967	540	02-03-78	2
44	76	25	192	137000	64500	4974	660	02-06-78	2
44	76	25	193	137000	64300	4972	680	02-06-78	2
44	76	25	194	137000	64200	4971	660	02-06-78	2
44	76	25	195	137200	63100	4951	680	02-06-78	2
44	76	25	196	137400	64750	4997	680	02-06-78	2
44	76	25	197	137900	64550	4992	680	02-07-78	2
44	76	25	198	137400	64800	5003	700	02-09-78	2
44	76	25	199	137400	64700	4993	680	02-09-78	2
44	76	25	200	137250	63800	4968	700	02-09-78	2
44	76	25	201	138000	63050	4975	700	02-09-78	2
44	76	25	202	137900	64600	4992	670	02-09-78	2
44	76	25	203	137400	63050	3050	960	02-09-78	2
44	76	25	204	137400	63150	4951	660	02-10-78	2
44	76	25	205	137200	63150	4953	660	02-10-78	2
44	76	25	206	137400	64650	4988	680	02-13-78	2
44	76	25	207	136250	64400	4899	600	02-14-78	2
44	76	25	208	137900	64650	4993	680	02-14-78	2
44	76	25	209	136600	64300	4907	600	02-14-78	2
44	76	25	210	137800	63050	4970	680	02-14-78	2
44	76	25	211	137800	63150	4965	540	02-15-78	2
44	76	25	212	137000	64150	4970	660	02-15-78	2
44	76	25	213	136200	65050	4977	680	02-16-78	2
44	76	25	214	137400	64600	4984	660	02-16-78	2

TABLE 9.2 (Cont.)

ABANDONED DRILL HOLES - NORTH BUTTE PERMIT AREA

TOWN SHIP	RANGE	SECT	HOLE #	COORDINATE NORTH	COORDINATE EAST	ELEV	TD	Date Abandoned	Abandonment Procedure
44	76	25	215	136200	64950	4975	680	02-16-78	2
44	76	25	216	137000	64100	4969	660	02-16-78	2
44	76	25	217	136600	64350	4906	580	02-17-78	2
44	76	25	218	138000	63250	4973	540	02-23-78	2
44	76	25	219	137000	64050	4969	660	02-23-78	2
44	76	25	220	137200	63700	4966	680	02-23-78	2
44	76	25	221	135800	64900	4962	660	02-24-78	2
44	76	25	222	137600	64725	4988	400	02-27-78	2
44	76	25	223	137200	64225	4973	500	02-28-78	2
44	76	25	224	136800	64275	4964	660	03-06-78	1
44	76	25	225	137400	64125	4975	400	03-07-78	1
44	76	25	226	137000	64000	4968	660	03-07-78	2
44	76	25	227	137400	64725	4995	680	03-17-78	2
44	76	25	228	137000	64550	4975	680	03-21-78	2
44	76	25	229	137900	63650	4974	680	03-22-78	2
44	76	25	230	137000	64600	4975	520	03-22-78	2
44	76	25	231	138000	63200	4974	540	03-23-78	2
44	76	25	232	136600	64700	4912	460	03-23-78	2
44	76	25	233	138000	63150	4974	680	03-27-78	2
44	76	25	234	136200	64850	4974	520	03-27-78	1
44	76	25	235	136200	64750	4973	520	03-27-78	1
44	76	25	236	136200	64900	4975	520	03-28-78	2
44	76	25	237	136200	64800	4974	500	03-28-78	2
44	76	25	238	137000	63950	4968	660	03-29-78	2
44	76	25	239	136600	64650	4911	600	03-29-78	2
44	76	25	240	137400	64550	4981	660	03-31-78	2
44	76	25	241	137900	64525	4991	680	04-04-78	1
44	76	25	242	136800	64425	4934	560	04-05-78	1
44	76	25	243	136600	64600	4911	600	04-06-78	2
44	76	25	244	136600	64450	4905	600	04-06-78	2
44	76	25	245	136250	64500	4905	600	04-06-78	2
44	76	25	246	136600	64550	4910	600	04-07-78	2
44	76	25	247	136600	64500	4905	600	04-14-78	2
44	76	25	248	136250	64350	4895	600	04-14-78	2
44	76	25	249	136250	64450	4901	320	04-14-78	2
44	76	25	250	135800	65000	4955	800	04-17-78	2
44	76	25	251	136250	64300	4896	400	04-18-78	2
44	76	25	252	137400	64850	4995	680	04-19-78	2
44	76	25	253	136250	64250	4894	400	04-19-78	2
44	76	25	254	137000	64850	4960	640	04-19-78	2
44	76	25	255	137000	64750	4971	660	04-20-78	2
44	76	25	256	135800	64950	4957	660	04-20-78	2
44	76	25	257	137900	64850	4995	680	04-20-78	2

TABLE 9.2 (Cont.)

ABANDONED DRILL HOLES - NORTH BUTTE PERMIT AREA

TOWN SHIP	RANGE	SECT	HOLE #	COORDINATE NORTH	COORDINATE EAST	ELEV	TD	Date Abandoned	Abandonment Procedure
44	76	25	258	136250	64200	4895	600	04-21-78	2
44	76	25	259	135600	64900	4962	660	04-21-78	2
44	76	25	260	136200	64700	4972	660	04-21-78	2
44	76	25	261	137900	64800	4995	680	04-24-78	2
44	76	25	262	136800	64000	4967	680	04-24-78	2
44	76	25	263	137000	64700	4973	400	04-24-78	2
44	76	25	264	136000	64300	4966	500	04-24-78	2
44	76	25	265	137900	64750	4994	680	04-25-78	2
44	76	25	266	135600	64850	4957	640	04-25-78	2
44	76	25	267	136200	64650	4972	500	04-25-78	2
44	76	25	268	137400	65010	4963	800	04-26-78	1
44	76	25	269	136600	64800	4904	440	04-26-78	2
44	76	25	270	135600	64800	4954	640	04-27-78	2
44	76	25	271	135800	64800	4968	500	05-15-78	2
44	76	25	272	137400	63700	4969	680	05-15-78	2
44	76	25	273	136200	64600	4971	500	05-15-78	2
44	76	25	274	137400	65050	4963	520	05-15-78	1
44	76	25	275	137900	64700	4994	520	05-15-78	2
44	76	25	276	136600	64250	4906	600	05-16-78	1
44	76	25	277	136800	63900	4966	660	05-16-78	2
44	76	25	278	136800	64100	4969	660	05-16-78	2
44	76	25	279	137000	64900	4954	480	05-16-78	1
44	76	25	280	136800	64150	4969	660	05-24-78	2
44	76	25	281	136800	64050	4968	660	05-24-78	2
44	76	25	282	135600	64950	4965	360	05-24-78	2
44	76	25	283	137850	63200	4968	680	05-25-78	2
44	76	25	284	138050	63200	4975	680	05-25-78	2
44	76	25	285	136250	64150	4893	580	07-28-78	2
44	76	25	286	136600	64200	4904	600	08-29-78	2
44	76	25	287	136580	65000	4976	900	08-29-78	2
44	76	25	288	135800	64700	4968	500	08-30-78	2
44	76	25	289	137000	65000	4913	460	08-30-78	2
44	76	25	290	135600	65000	4968	360	08-30-78	2
44	76	25	291	136600	64150	4907	600	08-31-78	2
44	76	25	292	137000	65050	4915	640	09-01-78	2
44	76	25	293	135865	64600	4966	500	09-05-78	2
44	76	25	294	135800	64750	4967	500	09-06-78	2
44	76	25	295	136580	64950	4971	420	09-06-78	2
44	76	25	296	136580	65050	4974	680	09-08-78	2
44	76	25	297	136600	64050	4967	660	09-08-78	2
44	76	25	298	136000	64200	4964	500	09-08-78	2
44	76	25	299	137900	64200	4988	680	09-13-78	2
44	76	25	300	137900	64250	4988	680	09-13-78	2

TABLE 9.2 (Cont.)

ABANDONED DRILL HOLES - NORTH BUTTE PERMIT AREA

TOWN SHIP	RANGE	SECT	HOLE #	COORDINATE NORTH	COORDINATE EAST	ELEV	TD	Date Abandoned	Abandonment Procedure
44	76	25	301	137900	64300	4988	680	09-14-78	2
44	76	25	308	137400	63300	4960	680	01-09-79	2
44	76	25	309	137400	63400	4963	680	01-10-79	2
44	76	25	310	137400	63500	4966	680	01-10-79	2
44	76	25	311	137200	63300	4960	680	01-10-79	2
44	76	25	312	137200	63400	4961	680	01-11-79	2
44	76	25	313	137200	63500	4963	660	01-11-79	2
44	76	25	314	137200	63600	4964	660	01-11-79	2
44	76	25	315	137400	63600	4967	680	01-12-79	2
44	76	25	316	137000	63600	4962	660	01-12-79	2
44	76	25	317	137000	63700	4964	660	01-12-79	2
44	76	25	318	137000	63800	4966	660	01-15-79	2
44	76	25	319	136800	63600	4963	660	01-15-79	2
44	76	25	320	136800	63700	4964	660	01-15-79	2
44	76	25	321	136600	63700	4963	660	01-15-79	2
44	76	25	322	136600	63800	4964	660	01-16-79	2
44	76	25	323	136600	63600	4962	660	01-16-79	2
44	76	25	324	136600	63900	4966	660	01-16-79	2
44	76	25	325	136400	63700	4963	600	01-17-79	2
44	76	25	326	137600	63300	4954	660	01-17-79	2
44	76	25	327	137600	63400	4962	680	01-17-79	2
44	76	25	328	137600	63500	4965	680	01-17-79	2
44	76	25	329	137600	63600	4968	680	01-18-79	2
44	76	25	330	137800	63600	4969	680	01-18-79	2
44	76	25	331	137800	63500	4968	680	01-18-79	2
44	76	25	332	137800	63413	4965	680	01-18-79	2
44	76	25	333	138000	63500	4973	680	01-19-79	2
44	76	25	334	137800	63300	4965	680	01-19-79	2
44	76	25	335	138021	63382	4972	700	01-19-79	2
44	76	25	336	135850	64400	4965	660	03-16-79	2
44	76	25	337	135850	64300	4964	660	03-16-79	2
44	76	25	338	135850	64200	4962	660	03-16-79	2
44	76	25	339	135850	64500	4964	660	03-19-79	2
44	76	25	340	137400	63550	4966	400	03-21-79	2
44	76	25	341	137400	63650	4968	400	03-21-79	2
44	76	25	342	137200	63650	4965	400	03-22-79	2
44	76	25	343	137200	63550	4963	400	03-22-79	2
44	76	25	344	136600	63850	4965	660	03-29-79	2
44	76	25	345	136600	63750	4964	660	03-29-79	2
44	76	25	346	136600	63950	4966	380	03-29-79	2
44	76	25	347	137000	64375	4974	618	04-09-79	1
44	76	25	348	136450	63900	4965	640	05-17-79	2
44	76	25	349	136450	63850	4965	655	05-17-79	2

TABLE 9.2 (Cont.)

ABANDONED DRILL HOLES - NORTH BUTTE PERMIT AREA

TOWN SHIP	RANGE	SECT	HOLE #	COORDINATE NORTH	COORDINATE EAST	ELEV	TD	Date Abandoned	Abandonment Procedure
44	76	25	350	136450	63800	4964	660	05-17-79	2
44	76	25	351	136500	64000	4964	660	05-17-79	2
44	76	25	352	136200	63800	4919	620	05-18-79	2
44	76	25	353	136200	63700	4921	620	05-18-79	2
44	76	25	354	136050	63800	4918	620	05-18-79	2
44	76	25	355	136000	63700	4927	620	05-18-79	2
44	76	25	356	135850	64150	4961	660	05-21-79	2
44	76	25	357	136000	64000	4905	600	05-22-79	2
44	76	25	358	135850	64000	4902	600	05-22-79	2
44	76	25	359	135850	63900	4901	600	05-22-79	2
44	76	25	360	135850	63850	4899	600	05-22-79	2
44	76	25	361	136200	63915	4906	600	05-23-79	1
44	76	25	362	136215	64000	4905	600	05-23-79	1
44	76	25	363	136680	64100	4934	620	05-23-79	1

ABANDONMENT PROCEDURES:

Abandonment Procedure #	Definition
1	Holes typically drilled prior to 1977. These holes were sealed with drill and natural muds commonly used to drill exploration and core holes. No additional materials were added to increase the solids or viscosity. The holes were surface sealed and staked for identification.
2	Holes drilled from 1977 to present. Holes were sealed with additional high solids (fortified) bentonite circulated at T.D. or abandonment muds as specified in Wyoming Statute 35-11-404. Holes were sealed and staked for identification.

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10. APPENDIX "D-6", HYDROLOGY

10.1 GROUNDWATER HYDROLOGY

10.1.a. REGIONAL GROUNDWATER SETTING

The North Butte permit area is located within the southern portion of the Powder River Basin. The Powder River Basin is part of the Great Plains physiographic province and is a structural and topographic basin of approximately 64,750 km2 (25,000 square miles) located in eastern Wyoming and southern Montana. The basin is bounded on the east by the Black Hills and on the west by the Bighorn Mountains. The southern boundary is the Laramie Range and Hartville Uplift, and the Miles City Arch in Montana forms the basin's northern extent. The most dominant topographic features within the area are the Pumpkin Buttes. The North Butte permit area is located on the southeast flank of the North Pumpkin Butte.

The Powder River Basin incorporates a sedimentary rock sequence that approaches 15,000 feet thick along the synclinal axis. These sedimentary rocks range in age from Tertiary (3 million to 70 million years, B.P.) to Cambrian (500 million to 570 million years, B.P.). The Tertiary fluvial system had a general drainage direction from south to north. Today the drainage systems, both surface and subsurface, still generally follow the Tertiary paleodrainage trends. The Tertiary rock units outcropping within and surrounding the North Butte permit area are the Wasatch Formation (Eocene) and the White River Formation (Oligocene).

The North Butte site is located slightly west of the axis of the Powder River Basin syncline. Each of the aquifers of interest exist in the Wasatch formation. This formation is a fluvial deposit and contains alternating layers of sands and shales. The major sands can be correlated for miles, and are the basis for regional aquifers in the Powder River Basin. Regionally, combined with the underlying Fort Union Formation, the Wasatch is developed extensively by shallow domestic and stock wells. Locally, the Wasatch Formation is developed mainly as a source of groundwater for livestock use.

Recharge to the sands of the Wasatch is mainly on their outcrops, with some influx of groundwater from a vertical movement through adjacent aquitards. Flow in the aquifers generally moves to the north along the paleodrainage trends, with a small portion of the groundwater discharging to streams. Aquifer properties are locally unpredictable due to large variations in local lithologies. Transmissivities within the Wasatch are known to range anywhere from 1 to 5,000 gpd/ft.

Extensive chemical data exists for the Wasatch aquifer system. Due to the discontinuous nature of the water-bearing sandstones, water quality concentrations within the system can be quite variable. Typically, total dissolved solids (TDS) content varies from less than 250 mg/l to over 6,500 mg/l, with a general decrease in TDS with increasing depth for parts of the aquifer (Feathers, et.al., 1981). Waters containing less than 500 mg/l TDS are generally enriched with bicarbonate, while higher TDS waters generally exhibit higher dissolved sulfates.

10.1.1 SUMMARY OF AQUIFER AND AQUITARD PROPERTIES

Two North Butte sites (SS2 and SSE) were tested in 1988 to define the aquifer and aquitard properties. The detailed hydrologic analyses and supporting data are contained in Volume III, Groundwater Supplement. One multi-well test was conducted at the SS2 site and is referred to in this report as HYDRO Test NB1. Two multi-well tests were performed at the SSE site. These tests are referred to as HYDRO Tests NB2 and NB3. Table A-1 of Volume III, the Groundwater Supplement, Part A, presents the basic well data for wells used to define the aquifer properties. The aquifer pump test plans for the SSE and SS2 site were approved prior to running the tests by the NRC and the LQD/DEQ in letters dated March 22, 1988, and April 24, 1988, respectively.

In addition to determining the aquifer properties at each site, HYDRO Test NBI was designed to evaluate the Upper aquitard and HYDRO Test NB2 was designed to evaluate the Lower aquitard. The capitalized words "Upper" and "Lower" aquitards refer to the specific aquitard between the "C" and "F" sands and the aquitard between the "A" and "1" sands, respectively. Several pump tests previously conducted by Cleveland-Cliffs were analyzed and used for additional points of information.

The North Butte in situ site is located on the outcrop of the Wasatch Formation. The stratigraphy of the Wasatch at this site consists of alternating layers of sand and shale with lignite marker beds. The mineable ore exists in three sand members ("A", "B" and "C") at North Butte. These three sand members are directly connected at some locations in the North Butte area, and are essentially one sand unit referred to as the mining sand. The "B" and "C" sands are connected at the SS2 site (NB I test) and are tested as one unit. The "BC" sand is 162 feet thick at the SS2 site. Generally, when the "B" and "C" sands are separately delineated, they are roughly 100 feet and 50 feet thick, respectively. Figure 10.1 presents a schematic of the geologic setting of the HYDRO Test No.NB1 (SS2) site). This figure also shows the relative position of the next overlying aquifer, namely the "F" sand and the overlying aquitard, "FBC", which is approximately 100 feet thick at this location.

Figure 10.2 presents a schematic of the geologic setting of the SSE site, which is the location of the NB2 and NB3 tests. This schematic shows that the tested ore sand, "A", at this site is 71 feet thick with an approximately 45 feet thick Lower aquitard ("Al"). The Lower aquitard ("Al") isolates the mining zone ("A", "B" and "C" sand members) and is between the "A" and "1" sands. The "1" sand is a marginal sand at the SSE site and is approximately 30 feet thick. Figures 10.3 and 10.4 present the locations of the cluster of wells at the SS2 (NB1 test) and SSE (tests NB2 and NB3) sites, respectively.

In October, 1992, Pathfinder incorporated into the permit boundary 50 acres of adjacent lands (incidental boundary revision). These lands are located along the southern border of the eastern arm of the permit area. The geologic zones present within the IBR area are simply extensions of those present within the adjacent portion of the permit area. The mineralized sands within the IBR area are the "A" and "B" sands, as best shown on Crossections C-C' and G-G', Figures 15.4 and 15.8 respectively, Volume II. Because the IBR lands are only a 400' extension of the current permit boundary, general groundwater hydrologic conditions should essentially be the same as those described for the "A" and "B" sand aquifers and associated aquitards. The "A" and "B" sand aquifer properties were determined primarily from pump tests conducted at the SSE site, described in more detail following. Additional information on the aquifer properties of these zones is contained in Volume III, Groundwater Supplement.

Groundwater quality within the IBR area is also anticipated to be essentially the same as that described in Section 10.1.4, following, for the sands within the permit area. Specific water quality information will be. obtained from the MR area prior to operations as the land will be used for the installation of ore zone perimeter monitor wells.

"BC" SAND AQUIFER

The "B" and "C" sands are discussed as a single unit in this section due to the fact that they are combined at the SS2 location. Short tests were conducted on these units separately at the SS1 site by Cleveland Cliffs. These tests will be discussed separately at the end of this section.

The "BC" sand aquifer was tested by pumping fully penetrating "BC" well SSM2M. Proximal "BC" sand aquifer wells SS2BC1, SS2BC2 and SS2MP were monitored for drawdown. In addition, outlying "B" and "C" wells 11-2, 7-1 and 7-2 were also monitored.

A summary of results from HYDRO Test NB 1, are presented in Table 10.1, Summary of Aquifer Properties. Table 10.1 first presents the range of aquifer properties obtained from the straight line method (Jacob), followed by the range from the Hantush type curve match and, finally, the recovery results.

The transmissivities for the observation wells obtained from Test No. NB1 from the straight line method varied from 526 to 883 gal/day/ft (7.56 E-5 to 1.27 E-4 m2/sec).

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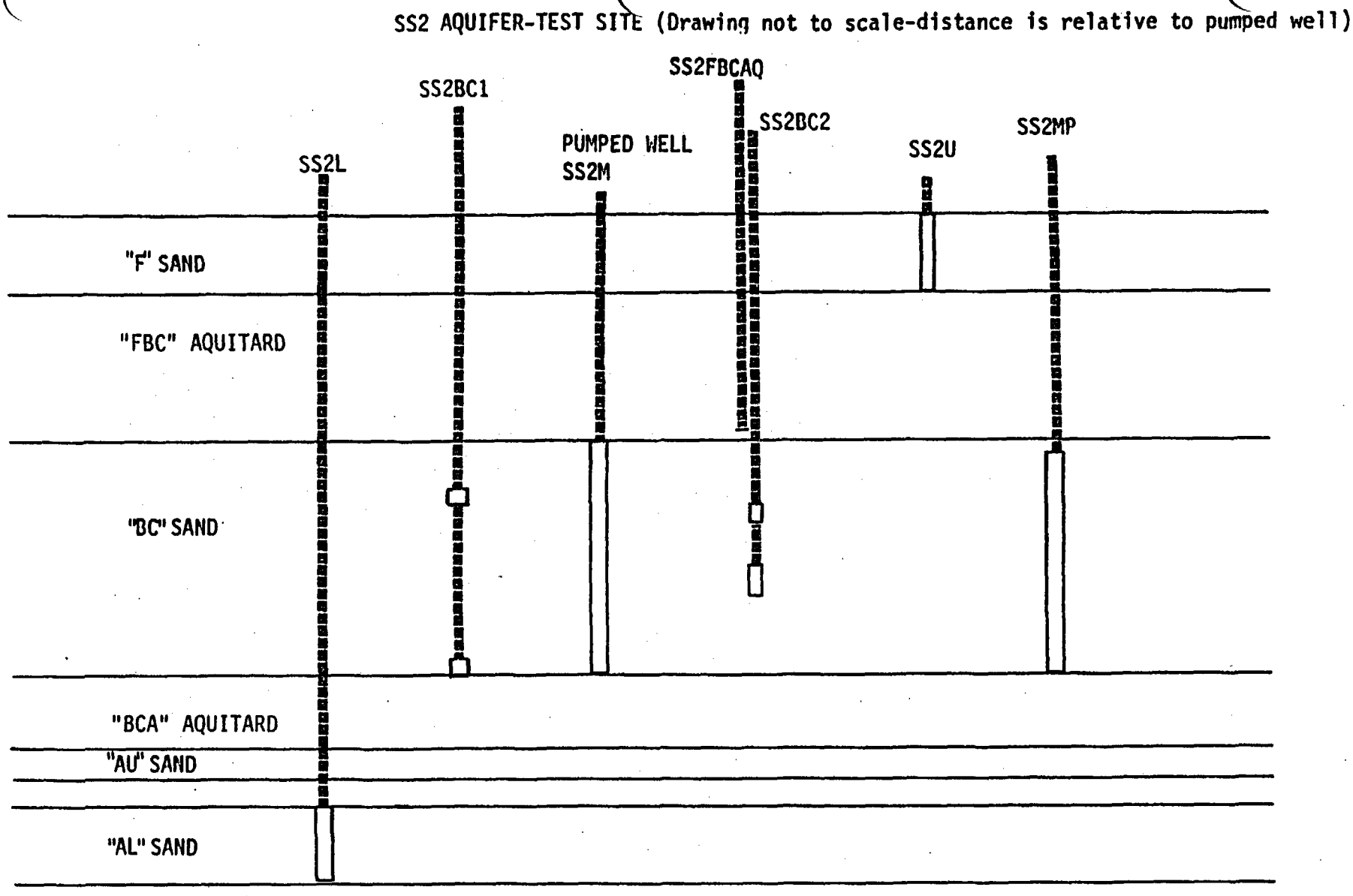

FIGURE 10.1 CROSS SECTION SCHEMATIC OF GEOLOGIC CONDITIONS AT HYDRO TEST NO. NB1.

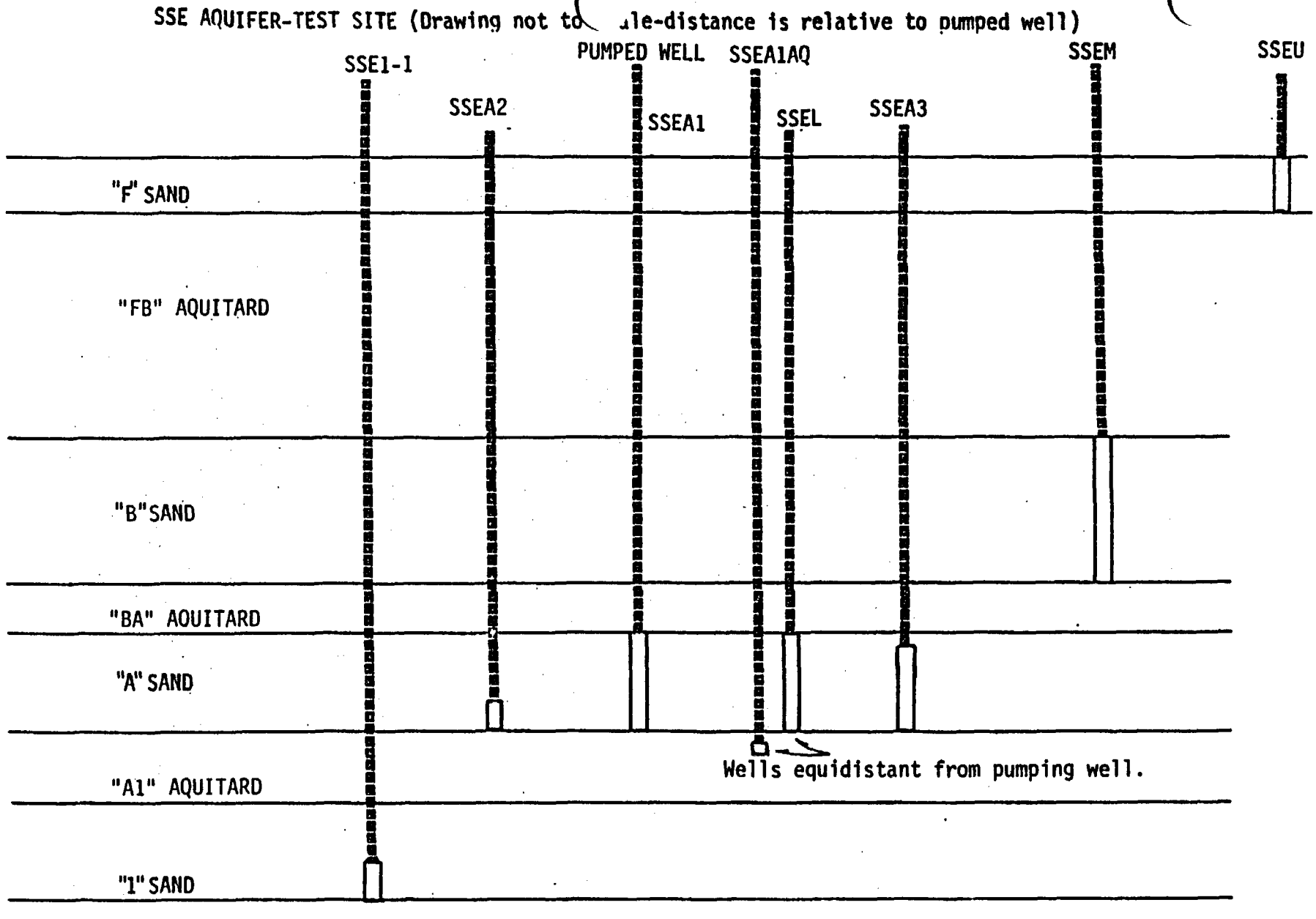

FIGURE 10.2 CROSS SECTION SCHEMATIC OF GEOLOGIC CONDITIONS AT HYDRO TESTS NO. NB2 AND NB3.

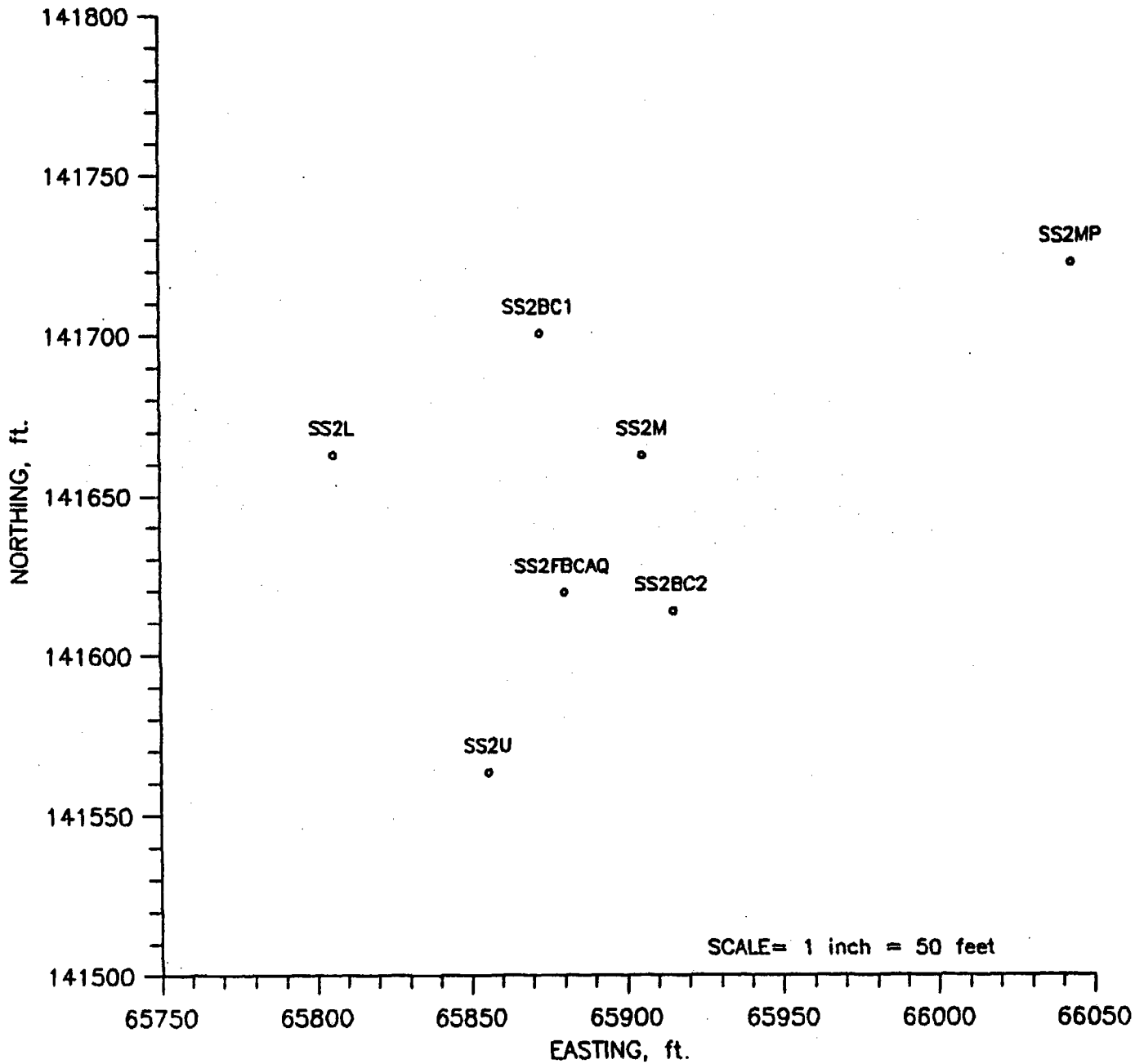

FIGURE 10.3 LOCATION OF THE HYDRO TEST NO. NB1 WELLS, SS2 SITE, SECTION 24, T44N, R76W.

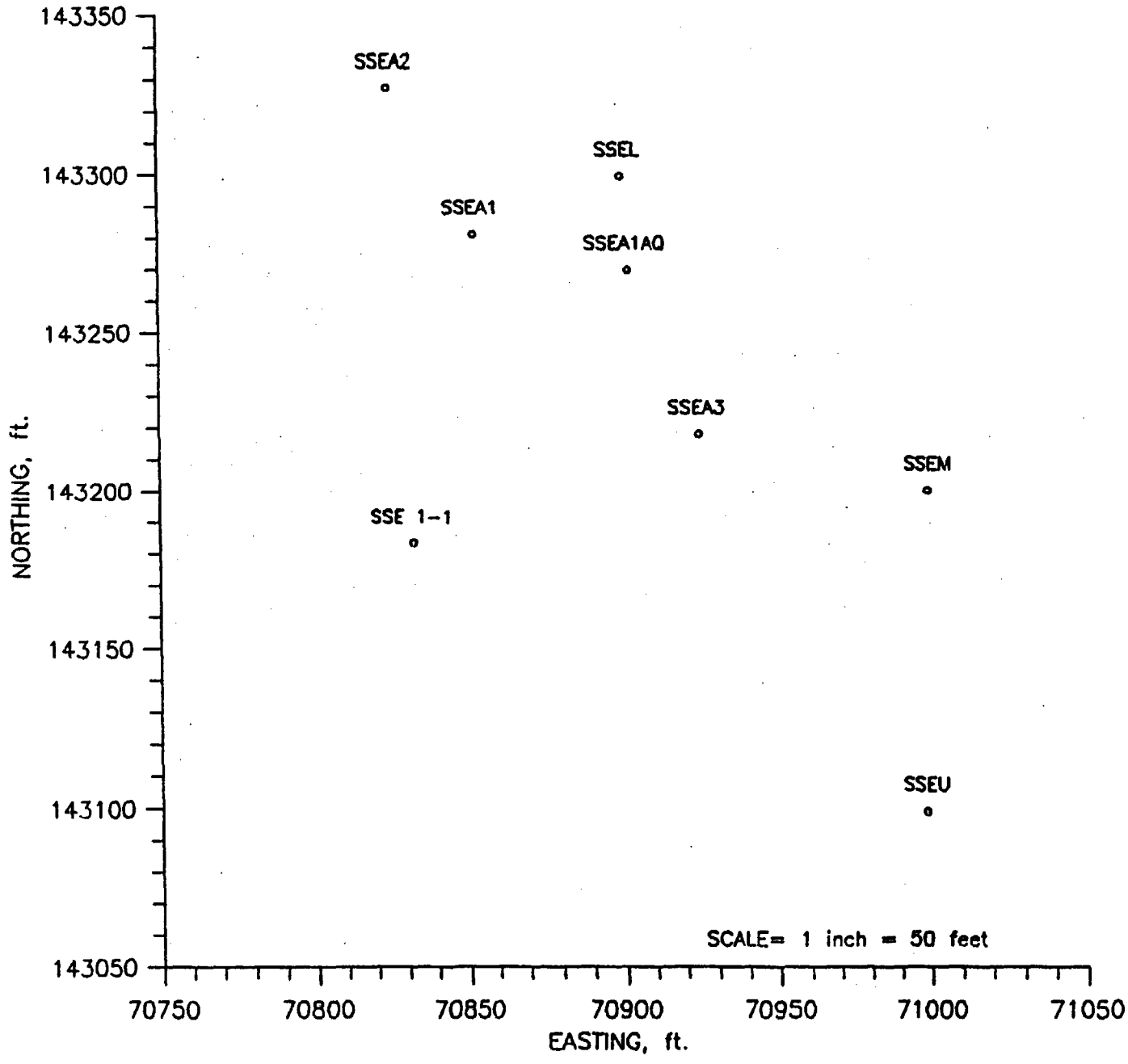

FIGURE 10.4 LOCATION OF THE HYDRO TESTS NO. NB2 AND NB3 WELLS, SSE SITE, SECTION 19, T44N, R75W

TABLE 10.1 RANGE OF AQUIFER PROPERTIES AT NORTH BUTTE.

SEMI-LOG (STRAIGHT LINE)

TEST NO.	AQUIFER	AQUIFER THICKNESS (ft)	T (gpd/ft)	T (sq m/sec)	K (gpd/sq ft)	K (ft/day)	K (millidarcy)	K (cm/sec)	S
NB1	"BC"	162	526-883	7.56E-5 - 1.27E-4	3.25-5.45	0.434-0.729	186-312	1.5E-4 - 2.6E-4	5.5E-5 - 3.6E-4
NB2	"A"	71	342-366	4.92E-5 - 5.26E-5	4.82-5.15	0.644-0.689	275-295	2.3E-4 - 2.4E-4	5.3E-5 - 6.8E-5
NB3	"A"	71	333-440	4.79E-5 - 6.33E-5	4.69-6.20	0.627-0.829	268-354	2.2E-4 - 2.9E-4	4.7E-5 - 1.2E-4
SS1	"C"	61	774-1100	1.11E-4 - 1.58E-4	12.7-18.0	1.70-2.41	727-1030	6.0E-4 - 8.51E-4	4.5E-5
SS1	"B"	53	1120	1.61E-4	21.1	2.83	1210	9.99E-4	-
SS1	"A"	126	1060	1.52E-4	6.44	1.13	483	3.99E-4	-
SSE	"F"	35	1440	2.07E-4	41.1	5.50	2350	1.94E-3	-
SSE	"B"	107	1040	1.50E-4	9.72	1.30	556	4.59E-4	-
SSE	"A"	72	181	2.60E-5	2.51	0.34	145	1.20E-4	-

LOG-LOG (THEIS OR HANTUSH)

TEST NO.	AQUIFER	T (gpd/ft)	T (sq m/sec)	K (gpd/sq ft)	K (ft/day)	K (millidarcy)	K (cm/sec)	S
NB1	"BC"	543-827	7.81E-5 - 1.19E-4	3.35-5.10	0.448-0.682	192-292	1.6E-4 - 2.4E-4	4.4E-5 - 2.6E-4
NB2	"A"	320-340	4.60E-5 - 4.89E-5	4.51-4.79	0.603-0.640	258-274	2.1E-4 - 2.3E-4	7.6E-5 - 8.[illegible]E-5
NB3	"A"	304-380	4.37E-5 - 5.46E-5	4.28-5.35	0.572-0.715	245-306	2.0E-4 - 2.5E-4	8.6E-5 - 1.9E-4
SS1	"C"	1100	1.58E-4	18.0	2.41	1030	8.51E-4	4.5E-5

THEIS RECOVERY

TEST NO.	AQUIFER	T (gpd/ft)	T (sq m/sec)	K (gpd/sq ft)	K (ft/day)	K (millidarcy)	K (cm/sec)
NB1	"BC"	617-706	8.87E-5 - 1.01E-4	3.81-4.36	0.509-0.583	218-249	1.8E-4 - 2.1E-4
NB2	"A"	190-213	2.73E-5 - 3.06E-5	2.68-3.00	0.358-0.401	153-171	1.3E-4 - 1.4E-4
SS1	"C"	647-747	9.30E-5 - 1.07E-4	10.6-12.2	1.42-1.64	607-701	5.01E-4 - 5.79E-4
SS1	"B"	1020	1.47E-4	19.2	2.57	1100	9.07E-4
SS1	"A"	834	1.20E-4	6.62	0.88	376	3.11E-4
SSE	"F"	689	9.91E-5	19.7	2.63	1120	9.28E-4
SSE	"B"	1030	1.48E-4	9.63	1.29	552	4.55E-4
SSE	"A"	201	2.89E-5	2.79	0.37	158	1.31E-4

A very similar range of values was observed from the Hantush type curve matches (543 to 827 gal/day/ft or 7.81E-5 to 1.19E-4 sq m/sec, see Table 10.1). The recovery straight line solution also yielded similar transmissivity values ranging from 617 to 706 gal/day/ft (8.87E-5 to 1.0IE-4 sq m/sec).

An average transmissivity obtained from the Hantush log-log analysis of 630 gal/day/ft (9.06E-5 sq m/sec) is thought to best represent the "BC" aquifer in this area because this method accounts for a leaky aquitard.

The hydraulic conductivity (permeability) of the "BC" sand was obtained by dividing the transmissivity of the aquifer by the aquifer thickness at the pumped well. Permeabilities of 0.448 to 0.562 ft/day (192 to 240 millidarcy) were obtained from the Hantush analysis of HYDRO Test No. NBI for the "BC" aquifer. An average horizontal permeability of 0.52 ft/day (223 millidarcy) is thought to best represent the "BC" aquifer at the SS2 site.

The "BC" sand is a confined aquifer at the SS2 site and, therefore the storage coefficient is the storage parameter to be used for this aquifer. The storage coefficient varied from 2.IE-4 to 2.6E-4 using the Hantush methodology. A storage coefficient of 2.4E-4 is thought to best represent the "BC" aquifer at the SS2 site.

Two wells completed in the "B" sand aquifer and two wells completed in the "C" aquifer were tested by Cleveland Cliffs while under their ownership. One of the "B" sand wells is located at the SS1 North Butte site and is labeled SS IM. The transmissivity values determined for the "B" sand aquifer at the SSIM location ranged from 1,020 and 1,120 gal/day/ft. (1.47E-4 and 1.61E-4 sq m/sec). A permeability of between 2.57 to 2.83 feet/day (1,100 to 1,210 millidarcy) was also determined for the "B" aquifer.

The "B" sand aquifer well SSEM tested at the SSE site yielded a transmissivity value of approximately 1,040 gal/day/ft (1.50E-4 sq m/sec). The "B" sand aquifer at this site has a permeability of 1.30 ft/day (556 millidarcy).

The "C" sand aquifer was tested at the SS1 site (see Figure A-4 of Groundwater Supplement, Part A, Volume III) by three pump tests using wells SS1U and SS1UP. The tests yielded transmissivity values of between 647 to 1,100 gal/day/ft (9.30E-5 and 1.58E-4 sq m/sec) and permeabilities of between 1.42 to 2.41 ft/day (607 to 1030 millidarcy). A storage coefficient of 4.5E-5 was determined from these tests.

Table 10.1 presents a summary of aquifer properties at North Butte. An average permeability of 1.0 ft/day (429 millidarcy) is thought best to be used for the "B" and "C" aquifers at locations where test results are not available. This value is recommended because it is greater than that determined for the SS2 site, but is significantly less than the SS1 site and slightly less than the value determined for the SSE site. Transmissivities of areas where tests are not available should be calculated from this permeability and the aquifer thickness at the desired location. A storage coefficient of 1.5E-4 is recommended to be used for the "B" or "C" aquifer where test values are not available.

"A" SAND AQUIFER

Two HYDRO tests were performed 'on the "A" sand aquifer at the SSE site. These tests are referred to as HYDRO Tests NB2 and NB3. The drawdown Jacob straight line and Theis log-log analysis yield values very similar to each other for the SSE wells. The transmissivity values ranged from 304 to 440 gal/day/ft (4.4E-5 to 6.3E-5 sq m/sec) with permeabilities between 0.57 to 0.83 ft/day (245 to 354 millidarcy). An average transmissivity of 340 gal/day/ft (4.89E-5 sq m/sec) best represents the transmissivity at the SSE site. Storage coefficients of between 4.7E-5 to 1.8E-4 were determined from the test with an average value of 7.0E-5.

Two other single-well tests were conducted in the "A" sand aquifer by Cleveland Cliffs. A short test on well SSEL yielded a lower transmissivity than those determined in HYDRO tests NB2 and NB3. This value is not indicative of the aquifer properties at the site. Well SS1L, also completed in the "A" sand aquifer, was tested. The transmissivity of the aquifer at this location was determined to be 1,060 and 834 gal/day/ft (1.52E-4 and 1.2E-4 sq m/sec) from the Jacob straight line and Theis recovery analysis, respectively. Permeability ranged from 1.13 to 0.88 ft/day (483 to 376 millidarcy).

An average horizontal permeability of 0.9 ft/day (385 millidarcy) is recommended to be used in areas where test results are not available for the "A" aquifer. Transmissivity should be calculated from the average permeability and the aquifer thickness. A storage coefficient of 8.5E-5 is recommended to be used for the "A" aquifer.

AQUITARDS

Neuman and Witherspoon's method was used to analyze drawdown data from the aquitard wells. Table 10.2 presents the summary of aquitard properties determined by the Neuman-Witherspoon method, and also presents comparative vertical permeability results determined from the Hantush leaky aquifer matches and the core samples in the laboratory. The Neuman-Witherspoon analysis produced vertical permeabilities of 3.4E-8 cm/sec (0.035 ft/yr) and 4.1E-8 cm/sec (0.042 ft/yr) for the Upper aquitard and the Lower aquitard, respectively. The values for the Upper aquitard and the Lower aquitard vertical permeability are similar. Specific storage values of 1.94E-5 and 1.67E-5 were determined for the Upper and Lower aquitards, respectively.

The modified Hantush leaky aquifer matches produced vertical permeabilities from 6.7E-9 to 6.9E-8 cm/sec (6.9E-3 to 7.3E-2 ft/yr). The upper range of these values is approximately twice as large as the Upper aquitard vertical permeability from the Neuman-Witherspoon method, but it was assumed that all leakage came from the Upper aquitard in the Hantush calculation. If some leakage was derived from the aquitard below the "BC" sand, then the Hantush results would be smaller.

Cores from the Upper and Lower aquitard intervals were loaded in a triaxial machine to simulate the field conditions and measure laboratory vertical permeabilities. The coefficient of compressibility and porosity (void ratio) were also measured on these cores. Table 10.2 also presents the laboratory results for the cores from wells SS2FBCAQ and SSEAIAQ. The laboratory vertical permeabilities were 6.4E-9 and 1.3E-8 cm/sec (6.6E-3 and 1.4E-2 ft/yr) for the Upper and Lower aquitard wells, respectively.

TABLE 10.2 SUMMARY OF AQUITARD PROPERTIES AT NORTH BUTTE				
		NEUMAN-WITHERSPOON		
		VERTICAL PERMEABILITY		
Well Number	Aquitard	(ft/day)	(ft/year)	(cm/sec)
SS2FBCAQ	Upper	9.6 E-5	3.5 E-2	3.4 E-8
SSEA1AQ	Lower	1.2 E-4	4.2 E-2	4.1 E-8

		MODIFIED HANTUSH		
VERTICAL PERMEABILITY				
Well Number	Aquitard	(ft/day)	(ft/year)	(cm/sec)
SS2BC1	Upper	2.0 E-4	7.3 E-2	6.9 E-8
SS2BC2	Upper	1.3 E-4	4.7 E-2	4.5 E-8
SS2MP	Upper	7.8 E-5	2.8 E-2	2.7 E-8
11-2	Upper	1.7 E-4	6.2 E-2	6.0 E-8
7-1	Upper	8.2 E-5	3.0 E-2	2.9 E-8
7-2	Upper	1.9 E-5	6.9 E-3	6.7 E-9

			LABORATORY		
Well Number	Vertical (ft/day)	Permeability (cm/sec)	Coefficient of Compressibility (sq. ft/lb)	Porosity	Specific Storage (lb/ft)
SS2FCBAQ	1.8 E-5	6.4 E-9	3.8 E-7	0.222	1.94 E-5
SSEA1AQ	3.7 E-5	1.3 E-8	3.3 E-7	0.233	1.67 E-5

The laboratory values are smaller for both aquitards than the Neuman-Witherspoon values. The field measured Neuman-Witherspoon values are greater than the average value from the Hantush method even with the conservative assumption of all leakage from the Upper aquitard and they are also significantly greater than the laboratory results. The use of the Neuman-Witherspoon results are conservative considering all analysis.

ADJACENT AQUIFERS

The adjacent aquifers in HYDRO Tests NBI, NB2 and NB3 were monitored for drawdown. In test NB1, the Upper adjacent aquifer to the "BC" sand, the "F" sand, was monitored during the test by using well SS2U. Approximately 0.2 feet of drawdown was observed in this well during the test. The Lower adjacent aquifer (AL sand) at the SS2 site showed no signs of drawdown during the test or recovery phases of the test in wells SS2L or I 1-I.

The lower "1" sand and upper "B" and "F" sands at the SSE site were measured during both HYDRO Tests NB2 and NB3. In addition, two "B" and one "C" sand aquifer wells, located a radius of 2,954 to 3,710 feet from the pumping well, were measured during test NB2. The lower "1" sand showed 0.4 feet of drawdown during the pump test. In all other adjacent aquifer wells in the NB2 test and during the NB3 test, no drawdown was apparent from pumping "A" sand aquifer well SSEAI.

10.1.2 GROUNDWATER FLOW

The "BC" aquifer groundwater was flowing to the northwest through the site in August 1988. The water-level elevation map (see Figure A-5 in pocket of Volume III, Groundwater Supplement, Part A) presents the "BC" groundwater levels. The piezometric surface for these two aquifers were combined in this area due to the fact that they are connected, in some areas, within the permit area and their heads are very similar where they are separated in the permit area.

The gradient of the groundwater in the "BC" aquifer was 0.0061 ft/ft in the North Butte area. This value yields a groundwater movement rate of 0.061 ft/day (22.3 ft/yr) or 1.9 cm/day from an average permeability of 1.0 ft/day (427.6 millidarcy) and an effective porosity of 0.1.

The "A" sand aquifer flows north and slightly northwest through the North Butte permit area. The general overall gradient of the groundwater was 0.015 ft/ft in the area of the North Butte site. This value yields a groundwater movement rate of 0.135 ft/day (49.3 ft/yr) or 4.11 cm/day from an average permeability} of 0.9 ft/day (385 millidarcy) and an effective porosity of 0.1.

The groundwater flow direction of the "F" sand aquifer is notably different than the "A", "BC" and "1" sands. Groundwater was flowing to the west-southwest through the site in August of 1988. Figure A-5 in Volume III, Groundwater Supplement, Part A (pocket) shows the August, 1988 water-level elevation contours. An average gradient through the site is 0.0076 ft/ft in the area of the North Butte site. This value yields a groundwater movement rate of 0.418 ft/day (153 ft/yr) or 12.7 cm/day from an estimated permeability of 5.5 ft/day (2,352 millidarcy) and an effective porosity of 0.1. The permeability of 5.5 ft/day was determined from a Cleveland Cliffs pump test and appears to be high for an average permeability. Therefore, the groundwater velocity estimate is most likely high for average conditions in the "F" aquifer.

Figure A-6 of Volume III, Groundwater Supplement, Part A shows the water-level elevation contours for October 1979 for the "1" sand. Water levels presented on this map were obtained by Cleveland Cliffs when the permit area was under their ownership. The water-level elevation for well SSEI-1 is from August 1988. The gradient of the groundwater was 0.0067 ft/ft in the area of the North Butte site. This value yields a groundwater movement rate of 0.0335 ft/day (12.2 ft/yr) or 1.02 cm/day from an estimated permeability of 0.5 ft/day (214 millidarcy) and an effective porosity of 0.1.

10.1.3 CONFINEMENT OF AQUIFERS

The water-level head in the "BC" aquifer is 70.3 feet lower than the water-level head in the "F" aquifer at well SS2U. These data indicate that the Upper aquitard is adequately confined between the "F" and "BC" aquifers. The gradient between the "F" sand and the lower portion of the "FBC" aquitard is 0.113 ft/ft (10.4)/(100-8). Groundwater was moving at a rate of 4.0E-2 ft/yr (3.8E-8 cm/sec) through the Upper aquitard toward the "BC" sand prior to the test. This estimate is based on the above gradient, a vertical permeability of 3.5E-2 ft/yr (3.4E-8 cm/sec) and an effective porosity of 0.1. These data show that it takes 2500 years for water to flow from the "F" sand to the "BC" aquifer through the 100 feet of aquitard.

Approximately 0.2 feet of drawdown occurred during the recovery phase (approximately three days) of the NBI test in the "F" sand well, SS2U. This is a small amount of water-level change over three days and could have been from some other distant stress on the "F" aquifer.

Drawdowns of less than 0.2 feet occurred in the upper aquifer ("F" sand) well SS2U after pumping stopped in the NBI pump test. A thick aquitard exists between the "F" and "BC" sands. Drawdowns in the "BC" observation wells indicated leakage to the aquifer during the NBI test. The vertical permeability, of the aquitard from the leakage curve analysis is very similar to those obtained from the Neuman-Witherspoon test. Therefore, the leakage observed in the aquifer's observation wells must be from natural movement of water out of the aquitard and into the aquifer. An open drill hole in the area of the NBI pump test should cause a very large deflection of the drawdown curve from a significant amount of leakage.

An open drill hole connection should have resulted in a cone of depression in the "F" aquifer and a mound in the "BC" aquifer due to the 70 feet of greater head in the "F" aquifer. The static piezometric surfaces for these two aquifers do not indicate a source of water to the "BC" aquifer in this area. The observed small drawdown in the upper aquifer is probably due to some outside stress on the "F" aquifer and not movement through an open drill hole.

The water level in the "A" aquifer and "Al" aquitard indicates that water is presently flowing from the "A" aquifer to the Lower aquitard. The gradient between the "A" aquifer and the Lower aquitard yields a value of 0.53 ft/ft (4.1/7_75). Groundwater is presently moving at a rate of 2.2E-1 ft/yr (2.2E-7 cm/sec) through the Lower aquitard from the "A" sand. This value was obtained from a permeability of 4.2E-2 ft/yr (4.1E-8 cm/sec) and an effective porosity of 0.1. It presently takes groundwater 200 years to travel from the "A" aquifer to the "I" aquifer through the 45 feet of aquitard at the SSE site.

A rise in the water levels in the "A" aquifer occurred during the pumping of the "BC" aquifer in the NBI test. This rise is most likely due to a change in the stress on the "A" aquifer other than the "BC" pumping. No significant drawdown occurred in the "A" aquifer from the "BC" sand pumping.

Approximately 0.4 feet of drawdown occurred in the "1" sand well SSEI-1 during the pumping and recovery phases of the NB2 test which stressed the "A" aquifer. A significant rising trend existed in this well. A small decline in this trend would indicate some drawdown. It is likely that the observed drawdown is actually a decline in the rising trend in this well.

These tests show that the mining zone is adequately confined by the Upper aquitard from the "F" sand aquifer and by the Lower aquitard from the "I" sand aquifer. These aquitards should not allow movement of mining solution through the aquitard and into the adjacent aquifers during the operation of the proposed in situ mine.

10.1.4 GROUNDWATER QUALITY

The groundwater sampling program at the North Butte site was started by Cleveland Cliffs Iron Company in October 1978. The Cleveland Cliffs sampling ended in July 1981. Additional samples were taken by Uranerz in April 1988.

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The monitor well data included three sample points in the A-sand, two in the B-sand, one in the C-sand, one in the BC-sand, and three in the F-sand. The sampling well locations are identified in Figure 10.5 (Volume II). Sampling information for each location are tabulated as follows:

Aquifer/Sand	Well No.	Period	No. of Samples
Ore Body/A-sand	SSE-L (313-W)	10/80 -04/88	5
	SSI-L (302-W)	10/78-04/88	10
	SS2-L (1282-W)	10/80 -04/88	5
Ore Body/B-sand	SSE-M (310-W)	10/79 -04/88	6
	SSI-M (303-W)	11/78 -04/88	10
Ore Body/C-sand	SSI-U (304-W)	10/78 -04/88	10
Ore Body/BC-sand	SS2-M (1283-W)	10/80 -04/88	5
Upper/F-sand	SSE-U (311-W)	08/79 -04/88	7
	SS2-U (1281-W)	10/80 -04/88	6
	SS 1-F (364-W)	10/80 -04/88	5

All the water samples collected from the North Butte ISL project were assayed by outside commercial laboratories. Sampling and analyses were performed in full compliance with the Land Quality Division, Wyoming DEQ Guildlines in effect at the time.

The baseline water quality data for these aquifers are presented in Tables 10.3 through 10.7. A summary of the water quality data from the various sands for key parameters are presented in Tables 10.8 through 10.13. Uranerz drilled and completed a well in the Lower Aquifer "1" sand as a part of Hydro Test NB2: In addition to serving as an observation well for the aquifer pump test, Uranerz planned to sample the well for water quality analysis. Due to the fact that the "1" sand is so poorly developed and discontinuous it is not possible to pump the well long enough to get a representative sample.

Company: Uranerz U.S.A. Inc.
Project: North Butte ISL Mine
Aquifer: A-sand (ore Body Aquifer)
Name of Well: SSE-L (313-W)

Date Sampled	10121/80	01/14/81	04/23/81	07/23/81	04/14/88
Field Temperature, centigrade	9	13	13.8	14.5	14
pH, Units, Field	8.5	8.25	7.4	7.1	8.04
pH, Units, Lab	7.84	7.67	8.14	7.72	8.16
Conductivity, umhos/cm, Field Ambient	1911	1584	1350	2272	1680
Conductivity, umhos/cm, at 15 centigrade	1612	1270	1667	1606	1668
TDS, Evaporated at 180 centigrade	1202	1070	1168	1207	1214
Sodium	218	230	255	243	271
Potassium	5	8	9	10	5.7
Calcium	80	88	84	86	80.7
Magnesium	46	15	17	16	13.8
Sulfate	762	695	733	707	762
Chloride	7	5	7	5	5.5
Carbonate	0	0	0	0	0
Bicarbonate	73	71	88	81	80.5
Ammonia	<0.05	<0.05	<0.05	<0.05	0.1
Nitrate	<0.05	<0.05	<0.05	0.07	0.03
Fluoride	<0.1	<0.1	<0.1	<0.1	<0.1
Total Alkalinity as CaCO3	60	58	72	67	66
Boron	<0.01	<0.01	<0.01	<0.01	<0.1
Aluminum	0.05	<0.05	0.11	<0.05	<0.1
Arsenic	<0.005	<0.005	<0.005	<0.005	0.002
Barium	<0.03	<0.03	<0.03	<0.03	<0.1
Cadmium	<0.002	0.003	<0.002	<0.002	<0.01
Chromium	<0.01	<0.01	<0.01	<0.01	<0.05
Copper	0.01	0.01	0.02	0.01	<0.01
Iron	0.03	0.25	0.27	0.01	<0.05
Lead	<0.01	<0.01	<0.01	<0.01	<0.05
Manganese	0.05	0.14	0.11	0.11	0.13
Mercury	<0.0005	<0.0005	<0.0005	<0.0005	<0.001
Nickel	<0.02	<0.02	<0.02	<0.02	<0.05
Selenium	<0.005	<0.005	<0.005	<0.005	<0.001
Zinc	0.014	0.018	0.012	0.01	<0.01
Molybdenum	<0.05	<0.05	<0.05	<0.05	<0.1
uranium-as U308	0.019	0.006	0.028	0.003	0.0039
vanadium as V205	<0.05	<0.05	<0.05	<0.05	<0.1
Radium 226, pCi/l	0.2	1.6	1.1	6.9	0.6

Notes: All units mg/l unless otherwise noted.
The symbol "<" means not detected at level indicated.
A blank means analysis not performed.

Company: Uranerz U.S.A. Inc.
Project: North Butte ISL Mine
Aquifer: A-sand (Ore Body Aquifer)
Name of Well: SS1-L (302-W)

Date Sampled	10/12/78	02/14/79	04/17/79	08/06/79	10/26/79	10/23/80	01/14/81	04/29/81	07/29/81	04/15/88
Field Temperature, centigrade	11	3	12	16	14	10.8	11	11.4	11.3	11.6
pH, Units, Field	9.3	7.5	7.8	7.9	9.2	7.6	7.94	7.5	7.7	8.08
pH, Units, Lab						7.66	7.51	6.79	7.71	7.98
Conductivity, umhos/cm, Field Ambient	1680	1740	1440	1450	1610	1272	1348	1280	1501	1222
Conductivity, umhos/cm, at 15 centigrade						1195	1314		1240	1358
TDS, Evaporated at180centigrade	912	688	828	847	852	856	901	806	779	870
Sodium	198	186	200	240	233	198	228	206	191	219
Potassium	4.6	38	3.9	4.4	4.5	5	5	7	7	4.4
Calcium	41	37	40	42	49	44	42	41	42	45.3
Magnesium	8.8	7.3	8.4	10	10	12	12	11	14	10.8
Sulfate	496	344	476	501	504	460	542	458	443	500
Chloride	4.3	9	4.6	3.6	4	5	5	7	5	4.4
Carbonate	7	0	0	7	5	0	0	0	0	0
Bicarbonate	115	193	127	120	111	122	117	146	136	131
Ammonia	0.09	0.04	<0.1	0.11	0.03	<0.05	0.14	<0.05	<0.05	0.05
Nitrate	0.054	0.01	0.005	0.15	<0.05	<0.05	<0.05	<0.05	<0.05	0.02
Fluoride	0:1	0.39	0.1	0.12	0.08	<0.1	0.27	0.14	0.14	0.1
Total Alkalinity as CaCO3	106	158	104	110	102	100	96	120	112	108
Boron	0.3	0.6	<0.01	0.1	0.2	<0.01	<0.01	<0.01	<0.01	<0.1
Aluminum	<0.1	0.2	<0.05	<0.3	<0.1	0.15	<0.05	<0.05	<0.05	<0.1
Arsenic	<0.003	<0.005	<0.005	<0.002	<0.002	<0.005	<0.005	<0.005	<0.005	0.001
Barium	<0.1	<0.3	<0.03	<0.3	<0.1	<0.03	<0.03	<0.03	<0.03	<0.1
Cadmium	<0.01	<0.002	<0.002	<0.01	<0.01	0.004	0.005	<0.002	<0.002	<0.01
Chromium	<0.01	<0.01	<0.01	<0.02	<0.02	<0.01	<0.01	<0.01	<0.01	<0.05
Copper	0.02	<0.01	<0.01	<0.01	0.03	<0.01	<0.01	0.01	0.02	<0.01
Iron	<0.01	0.07	0.1	<0.01	<0.01	0.03	0.1	0.11	0.02	<0.05
Lead	<0.01	0.03	0.02	0.04	<0.02	<0.01	<0.01	<0.01	<0.01	<0.05
Manganese	<0.01	0.05	0.01	<0.01	<0.01	<0.01	<0.01	0.02	0.01	0.01
Mercury	<0.0005	<0.0005	<0.0005	<0.001	0.0004	<0.0005	<0.0005	<0.0005	<0.0005	<0.001
Nickel	0.02	0.03	<0.02	0.02	<0.01	<0.02	<0.02	<0.02	<0.02	<0.05
Selenium	<0.003	<0.005	<0.005	<0.001	<0.002	<0.005	<0.005	<0.0005	<0.005	0.011
Zinc	<0.01	0.09	<0.005	0.02	<0.01	0.009	0.009	0.032	0.06	<0.01
Molybdenum	<0.1	<0.05	<0.05	<0.2	<0.1	<0.05	<0.05	<0.05	<0.05	<0.1
Uranium as U308	0.014	0.001	0.002	0.006	0.006	0.008	0.003	0.005	0.006	0.0101
Vanadium as V205	<0.1	<0.05	<0.05	<0.7	<0.1	<0.05	<0.05	<0.05	<0.05	<0.1
Radium 226, pCi/l	53	0	1	0		2.7	5	1.2	1.7	82.4

Notes: All units mg/l unless otherwise noted.
The symbol 11<11 means not detected at level indicated.
A blank means analysis not performed.

Company: Uranerz U.S.A. Inc.
Project: North Butte ISL
Mine Aquifer: A-sand (Ore Body Aquifer)
Name of Well: SS2-L (1282-W)

Date Sampled	10/21/80	01/15/81	04/25/81	07/24/81	04/14/88
Field Temperature, centigrade	12	11.5	14	14.5	15.8
pH, Units, Field	8.4	8.53	7.7	7	7.86
pH, Units, Lab	8.55	7.81	8.18	7.78	8.19
Conductivity, umhos/cm, Field Ambient	1006	896	1073	1085	990
Conductivity, umhos/cm, at 15 centigrade	958	928	1021	979	1028
TOS, Evaporated at 180 centigrade	618	698	641	639	704
Sodium	174	173	178	176	192
Potassium	6	4	5	6	3.3
Calcium	20	18	22	20	19.8
Magnesium	2	5	6	5	3.71
Sulfate	340	340	339	340	366
Chloride	8	7	5	8	6.6
Carbonate	19	0	0	0	0
Bicarbonate	68	98	128	112	117
Ammonia	<0.05	<0.05	<0.05	<0.05	0.09
Nitrate	<0.05	<0.05	<0.05	0.05	0.01
Fluoride	<0.1	0.33	0.24	0.27	0.18
Total Alkalinity as CaC03	88	80	105	92	96
Boron	<0.01	<0.01	<0.01	<0.01	<0.1
Aluminum	0.19	<0.05	0.1	<0.05	<0.1
Arsenic	<0.005	<0.005	<0.005	<0.005	0.001
Barium	<0.03	<0.03	<0.03	<0.03	<0.1
Cadmium	<0.002	<0.002	<0.002	<0.002	<0.01
Chromium	<0.01	<0.01	<0.01	<0.01	<0.05
Copper	<0.01	0.01	<0.01	0.03	<0.01
Iron	0.02	0.56	0.03	0.06	<0.05
Lead	<0.01	<0.01	<0.01	<0.01	<0.05
Manganese	<0.01	0.03	0.01	0.02	0.03
Mercury	<0.0005	<0.0005	<0.0005	<0.0005	<0.001
Nickel	<0.02	<0.02	<0.02	<0.02	<0.05
Selenium	<0.005	<0.005	<0.005	<0.005	0.001
Zinc	0.007	0.063	0.011	0.14	<0.01
Molybdenum	<0.05	<0.05	<0.05	<0.05	<0.1
Uranium as U308	0.01	<0.001	0.004	0.003	0.0023
Vanadium as V205	<0.05	<0.05	<0.05	<0.05	<0.1
Radium 226, pCi/l	0.5	1.6	0.5	1.2	0.5

Notes: All units mg/l unless otherwise noted.
The symbol "<" means not detected at level indicated. A blank means analysis not performed.

Company: Uranerz U.S.A. Inc.
Project: North Butte ISL Mine
Aquifer: B-sand (Ore Body Aquifer)Name of Well: SSE-m (310-W)

Date Sampled	10/02/79	10/21/80	01/14/81	04/23/81	07/23/81	04/14/88	
Field Temperature, centigrade	20	15.5	9	13	14	13.6	
pH, Units, Field	8.4	7.4	9.85	8.9	7.8	9.28	8.6
pH, Units, Lab		8.12	8.72	8.48	7.68	8.53	8.3
Conductivity, umhos/cm, Field Ambient	570	1862	1810	2094	2171	1760	1878
Conductivity, umhos/cm, at 15 centigrade		1747	1481	1697	1683	1765	1675
TOS, Evaporated at 180 centigrade	1390	1285	1274	1264	1243	1344	
Sodium	298	254	257	242	221	264	
Potassium	7.3	7	11	11	12	7.5	
Calcium	112	112	112	108	108	108	
Magnesium	23	24	21	27	21	23	
Sulfate	877	824	795	790	739	861	
Chloride	4.6	5	5	8	6	5.2	
Carbonate	2	0	22	5	0	1.1	
Bicarbonate	67	73	64	88	73	70.3	
Ammonia	0.11	<0.05	<0.05	<0.05	<0.05	0.07	
Nitrate	0.7	<0.05	<0.05	<0.05	<0.05	0.14	
Fluoride	0.09	<0.1	0.14	<0.01	<0.1	<0.1	
Total Alkalinity as CaC03	59	60	89	80	60	59.6	
Boron	<0.1	<0.01	<0.01	<0.01	<0.01	<0.1	
Aluminum	<0.4	<0.05	<0.05	0.06	<0.05	<0.1	
Arsenic	0.005	<0.005	<0.005	<0.005	<0.005	0.001	
Barium	<0.2	<0.03	<0.03	<0.03	<0.03	<0.1	
Cadmium	<0.01	<0.002	0.004	<0.002	<0.002	<0.01	
Chromium	<.08	<0.01	<0.01	<0.01	<0.01	<0.05	
Copper	<0.03	0.01	0.01	<0.01	0.01	<0.01	
Iron	0.04	0.03	0.2	0.02	0.03	<0.05	
Lead	<.08	<0.01	<0.01	<0.0i	<0.01	<0.05	
Manganese	0.08	0.03	0.09	0.07	0.06	0.1	
Mercury	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.001	
Nickel	<0.04	<0.02	<0.02	<0.02	<0.02	<0.05	
Selenium	0.002	<0.005	<0.005	<0.005	<0.005	0.001	
Zinc	0.03	0.01	0.048	0.003	0.2	<0.01	
Molybdenum	<0.2	<0.05	<0.05	<0.05	<0.05	<0.1	
Uranium as U308	0.003	0.023	0.002	0.003	<0.001	0.0039	
Vanadium as V205	<0.2	<0.05	<0.05	<0.05	<0.05	<0.1	
Radium 226, pCi/l		0.2	1.7	0.8	1.3	1.5	

Notes: ALL units mg/l unless otherwise noted.
The symbol "<" means not detected at level indicated. A blank means analysis not performed.

Company Uranerz U.S.A. Inc.
Project: North Butte ISL
Mine Aquifer: B-sand (Ore Body Aquifer)
Name of Well: S51-m (303-W)

Date Sampled	11/08/78	02/14/79	04/17/79	08/06/79	10/24/79	10/23/80	01/20/81	04/28/81	07/29/81	04/15/88
Field Temperature, centigrade	18	3	14	16	18	9	12.5	12.5	12	11.6
pH, Units, Field	8	7.8	8.1	8.3	7.2	7.4	7.96	8.1	7.7	8.07
pH, Units, Lab						7.73	7.58	7.95	7.63	7.98
Conductivity, umhos/cm, Field Ambient	1500	2100	1380	1490	1500	1303	1325	1431	1475	1230
Conductivity, umhos/cm, at 15 centigrade						1217	1310		1260	1332
TDS, Evaporated at 180 centigrade	902	866	862	891	897	794	937	838	808	908
Sodium	182	232	208	250	233	197	234	205	191	221
Potassium	41	8.8	5.7	4.9	5.1	5	5	7	8	4.3
Calcium	38	37	41	47	56	47	52	47	51	43.8
Magnesium	12	10	8.9	11	14	10	10	14	10	9.6
Sulfate	511	512	522	532	528	465	563	450	453	530
Chloride	9	5.8	4.5	3.5	4.2	5	4	11	5	4.4
Carbonate	0	0	0	7	4	0	0	0	0	0
Bicarbonate	120	104	111	115	119	112	120	171	127	112
Ammonia	0.02	0.03	0.1	0.12	0.03	<0.05	<0.05	<0.05	<0.05	0.05
Nitrate	0.23	0.02	0.05	0.21	<0.05	<0.05	<0.05	<0.05	<0.05	0.01
Fluoride	0.11	0.17	0.2	0.08	0.06	<0.1	0.26	0.12	0.15	0.1
Total Alkalinity as CaCO3	98	85	91	108	104	92	99	140	105	91.4
Boron	<0.1	<0.01	<0.01	0.1	<0.1	<0.01	<0.01	<0.01	<0.01	<0.1
Aluminum	<0.1	0.7	<0.05	<0.3	<0.1	0.13	<0.05	<0.05	<0.05	<0.1
Arsenic	<0.003	<0.005	<0.005	<0.002	<0.002	<0.005	<0.005	<0.005	<0.005	0.001
Barium	<0.1	<0.03	<0.03	<0.3	<0.1	<0.03	<0.03	<0.03	<0.03	<0.1
Cadmium	<0.01	<0.002	<0.002	<0.01	<0.01	0.01	0.004	<0.002	<0.002	<0.01
Chromium	<0.01	<0.01	<0.01	<0.02	<0.02	<0.01	<0.01	<0.01	<0.01	<0.05
Copper	0.04	0.2	<0.01	<0.01	<0.01	0.02	<0.01	<0.01	<0.01	<0.01
Iron	0.23	0.33	0.08	0.01	<0.01	0.02	0.03	0.08	0.01	<0.05
Lead	<0.01	0.13	0.04	0.02	<0.02	<0.01	<0.01	<0.01	<0.01	<0.05
Manganese	<0.01	0.03	0.01	<0.01	<0.01	<0.01	<0.01	0.03	0.01	<0.01
Mercury	<0.0005	<0.0005	<0.0005	<0.001	<0.0003	<0.0005	<0.0095	<0.0005	<0.0005	<0.001
Nickel	<0.01	0.07	<0.02	0.02	<0.01	<0.02	<0.02	<0.02	<0.02	<0.05
Selenium	<0.003	<0.005	<0.005	<0.001	<0.002	<0.005	<0.005	<0.05	<0.005	<0.001
Zinc	0.03	0.19	<0.005	0.04	0.17	0.012	0.006	0.006	0.1	<0.01
Molybdenum	0.4	<0.05	<0.05	<0.2	<0.1	<0.05	<0.05	<0.05	<0.05	<0.1
Uranium as U308	0.023	0.012	0.014	0.014	0.015	0.023	0.007	0.016	0.005	0.0183
Vanadium as V205	<0.1	<0.05	<0.05	<0.4	<0.1	<0.05	<0.05	<0.05	<0.05	<0.1
Radium 226, pCi/l	3.3	0	0.2			1.1	2.7	1.3	7.8	2.8

Notes: ALL units mg/l unless otherwise noted.
The symbol "<" means not detected at level indicated.
A blank means analysis not performed.

Company: Uranerz U.S.A. Inc.
Project: North Butte ISL Mine
Aquifer: C-sand (Ore Body Aquifer)
Name of Well: SS1-u (304-W)

Date Sampled	10/13/78	02/14/79	04/17/79	08/06/79	10/26/79	10/23/80	01/20/81	04/29/81	07/29/81	04/15/88
Field Temperature, centigrade	13	3	14	17	16	11	13	11.5	11.8	13
pH, Units, Field	9.1	8.4	7.2	8.1	7.3	7.6	8.2	8	7.9	8.19
pH, Units, Lab						7.78	7.65	8.07	7.84	7.99
Conductivity, umhos/cm, Field Ambient	1635	2010	1415	1380	1560	1292	1309	1331	1483	1206
Conductivity, umhos/cm, at 15 centigrade						1161	1258		1140	1282
TDS, Evaporated at 180 centigrade	920	797	820	833	848	814	847	826	855	864
Sodium	221	230	209	240	230	194	213	212	215	216
Potassium	5.8	13	66	5.1	4.8	6	5	7	7	4.2
Calcium	41	36	29	37	42	43	40	38	37	38.9
Magnesium	10	7.3	7.8	11	13	12	11	10	13	9.3
Sulfate	506	502	505	514	508	450	501	450	500	500
Chloride	4.6	9.1	4.6	3.4	4	4	5	8	6	5.1
Carbonate	0	0	0	5	4	0	0	0	0	0
Bicarbonate	111	37	85	97	96	124	105	146	115	104
Ammonia	0.19	0.07	<0.01	0.13	0.05	<0.05	<0.05	<0.05	<0.05	0.05
Nitrate	0.21	0.02	0.01	0.22	0.08	<0.05	<0.05	<0.05	<0.05	0.01
Fluoride	0.09	0.12	0.07	0.08	0.07	<0.1	0.18	0.17	0.17	0.1
Total Alkalinity as CaCO3	91	48	70	87	86	102	86	120	95	85.4
Boron	0.6	0.4	<0.01	0.7	0.3	<0.01	<0.01	<0.01	<0.01	<0.1
Aluminum	<0.1	0.2	<0.05	<0.3	<0.1	0.15	<0.05	<0.05	<0.05	<0.1
Arsenic	<0.003	<0.005	<0.005	<0.002	<0.002	<0.005	<0.005	<0.005	<0.005	0.001
Barium	<0.1	<0.03	<0.03	<0.3	<0.1	<0.03	<0.03	<0.03	<0.03	<0.1
Cadmium	<0.01	<0.03	<0.002	<0.01	<0.01	0.006	0.003	<0.002	<0.002	<0.01
Chromium	<0.01	<0.002	<0.01	<0.02	0.02	<0.01	<0.01	<0.01	<0.01	<0.05
Copper	<0.01	0.03	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Iron	<0.01	0.08	0.03	0.07	<0.01	0.03	0.24	0.06	0.01	<0.05
Lead	<0.01	0.03	<0.01	0.04	<0.02	<0.01	<0.01	<0.01	<0.01	<0.05
Manganese	<0.01	<0.01	0.01	<0.01	<0.01	<0.01	0.01	0.02	0.01	<0.01
Mercury	<0.0005	<0.0005	<0.0005	<0.001	<0.0003	<0.0005	<0.0005	<0.0005	<0.0005	<0.001
Nickel	<0.02	0.03	<0.02	<0.02	<0.01	<0.02	<0.02	<0.02	<0.02	<0.05
Selenium	0.008	<0.005	<0.005	<0.001	<0.002	<0.005	<0.005	<0.005	<0.005	<0.001
Zinc	<0.01	0.04	<0.005	0.06	0.1	0.18	0.008	<0.005	0.08	<0.01
Molybdenum	<0.1	<0.05	<0.05	<0.2	<0.1	<0.05	<0.05	<0.05	<0.05	<0.1
Uranium as U308	0.005	0.01	0.01	0.012	0.009	0.018	0.024	0.013	0.006	0.0079
Vanadium as V205	<0.1	<0.05	<0.05	<0.4	<0.1	<0.05	<0.05	<0.05	<0.05	<0.1
Radium 226, pCi/l	54	6.1	15.6	0	0	1.1	2.7	1.1	2.1	16.2

Notes: ALL units mg/l unless otherwise noted.
The symbol 11<11 means not detected at level indicated.
A blank means analysis not performed.

Company: Uranerz U.S.A. Inc.
Project: North Butte ISL Mine
Aquifer: BC-sand (Ore Body Aquifer)
Name of Well: SS2-m (1283-W)

Date Sampled	10/21/80	01/15/81	04/25/81	07/24/81	04/15/88
Field Temperature, centigrade	12.5	11.5	13.2	13.2	12
pH, units, Field	7.9	8.28	8.1	7.6	7.98
pH, Units, Lab	8.13	7.66	8.15	7.9	7.9
Conductivity, umhos/cm, Field Ambient	1325	1236	1433	1550	1325
Conductivity, umhos/cm, at 15 centigrade	1262	1310	1338	1265	1395
TDS, Evaporated at 180 centigrade	878	913	878	812	922
Sodium	212	235	212	198	226
Potassium	5	6	7	8	4.8
Calcium	44	40	38	43	44.3
Magnesium	12	11	17	11	9.7
Sulfate	520	560	510	473	537
Chloride	4	5	5	5	4.8
Carbonate	0	0	0	0	0
Bicarbonate	88	93	110	102	107
Ammonia	<0.05	<0.05	<0.05	<0.05	0.06
Nitrate	<0.05	<0.05	<0.05	0.12	0.03
Fluoride	<0.1	0.33	0.13	0.15	<0.1
Total Alkalinity as CaCO3	72	76	90	84	87.8
Boron	<0.01	<0.01	<0.01	<0.01	<0.1
Aluminum	<0.05	<0.05	<0.05	<0.05	<0.1
Arsenic	<0.005	<0.005	<0.005	<0.005	0.001
Barium	<0.03	<0.03	<0.03	<0.03	<0.1
Cadmium	<0.002	0.004	<0.002	<0.002	<0.01
Chromium	<0.01	<0.01	<0.01	<0.01	<0.05
Copper	<0.01	0.01	0.01	0.02	<0.01
Iron	0.06	0.25	0.03	0.01	<0.05
Lead	<0.01	<0.01	<0.01	<0.01	<0.05
Manganese	<0.01	0.02	0.03	0.03	0.04
Mercury	<0.0005	<0.0005	<0.0005	<0.0005	<0.001
Nickel	<0.02	<0.02	<0.02	<0.02	<0.05
Selenium	0.016	<0.005	<0.005	<0.005	0.003
Zinc	0.019	0.015	0.013	0.12	<0.01
Molybdenum	<0.05	<0.05	<0.05	<0.05	<0.1
Uranium as U308	0.086	0.015	0.02	0.012	0.0104
Vanadium as V205	<0.05	<0.05	<0.05	<0.05	<0.1
Radium 226, pCi/l	0.5	5.1	0.8	1.5	12.9

Notes: All units mg/l unless otherwise noted.
The symbol "<" means not detected at level indicated.
A blank means analysis not performed.

Company: Uranerz U.S.A.
Inc. Project: North Butte ISL Mine
Aquifer: F-sand (Upper Aquifer)
Name of Well: SS2-u (1281-W)

Date Sampled	10/21/80	01/15/81	04/25/81
Field Temperature, centigrade	13	9.5	12.3
pH, Units, field	7.9	7.93	7.9
pH, Units, Lab	7.96	7.51	8
Conductivity, umhos/cm, Field Ambient	981	886	1052
Conductivity, umhos/cm, at 15 centigrade	845	950	
TDS, Evaporated at 180 centigrade	574	628	694
Sodium	152	164	170
Potassium	5	5	6
Calcium	31	34	38
Magnesium	4	9	12
Sulfate	268	325	365
Chloride	5	5	14
Carbonate	0	0	0
Bicarbonate	168	163	171
Ammonia	<0.05	<0.05	<0.05
Nitrate	<0.05	<0.05	<0.05
Fluoride	<0.1	0.33	0.18
Total Alkalinity as CaC03	138	134	140
Boron	<0.01	<0.01	<0.01
Aluminum	0.13	<0.05	0.09
Arsenic	<0.005	<0.005	<0.005
Barium	<0.03	<0.03	<0.03
Cadmium	<0.002	<0.002	<0.002
Chromium	<0.01	<0.01	<0.01
Copper	<0.01	0.01	0.02
Iron	0.04	0.37	0.02
Lead	<0.01	<0.01	<0.01
Manganese	<0.01	0.03	0.04
Mercury	<0.0005	<0.0005	<0.0005
Nickel	<0.02	<0.02	<0.02
Selenium	<0.005	<0.005	<0.005
Zinc	0.007	0.037	0.048
Molybdenum	<0.05	<0.05	<0.05
Uranium as U308	0.048	<0.001	0.007
Vanadium as V205	<0.05	<0.05	<0.05
Radium 226, pCi/l	0.5	1.3	1

Notes: All units mg/l unless otherwise noted.
The symbol "<" means not detected at level indicated. A blank means analysis not performed.

Company: Uranerz U.S.A. Inc.
Project: North Butte ISL Mine
Aquifer: F-sand (Upper Aquifer)
Name of Well; SSE-u (311-W)

Date Sampled	08/27/79	10/29/80	01/14/81	04/23/81	07/23/81	04/14/88	(Split) 04/14/88	
Field Temperature, centigrade	23	10	12.5	11.3	12.2	11.8	11.8	
pH, Units, Field	7.8	7.6	8.55	8.3	7.9	7.78	7.78	7.95
pH, Units, Lab		7.8	7.71	8.15	7.95	8.24	8.2	8.0
Conductivity, umhos/cm, Field Ambient	770	621	610	819	854	660	660	713
Conductivity, umhos/cm, at 15 centigrade		617	706	642	673	677	627	657
TOS, Evaporated at 180 centigrade	431	443	428	431	435	466	400	
Sodium	131	130	124	115	122	129	120	
Potassium	3.9	6	6	6	8	4	6	
Calcium	21	19	12	24	21	19.8	20	
Magnesium	5.5	4	8	11	5	4.7	6	
Sulfate	142	118	160	126	136	156	164	
Chloride	3	30	4	6	3	3.8	4	
Carbonate	0	0	0	0	0	0	<1	
Bicarbonate	222	238	212	268	224	214	214	
Ammonia	0.05	<0.05	<0.05	<0.05	<0.05	0.16	<0.1	
Nitrate	0.44	<0.05	<0.05	<0.05	<0.05	0.02	<0.1	
Fluoride	0.16	<0.1	0.3	0.2	0.24	0.2	0.2	
Total Alkalinity as CaC03	182	195	174	220	200	175	175	
Boron	<0.1	<0.01	<0.01	<0.01	<0.01	<O.1	<0.2	
Aluminum	<0.4	0.05	<0.05	<0.05	<0.05	<0.1	<0.1	
Arsenic	0.003	<0.005	<0.005	<0.005	<0.005	0.001	<. 004	
Barium	<0.1	<0.03	<0.03	<0.03	<0.03	<0.1	0.01	
Cadmium	<0.01	0.013	<0.002	<0.002	<0.002	<0.01	<0.01	
Chromium	<. 08	<0.01	<0.01	<0.01	<0.01	<0.05	<0.05	
Copper	<0.03	0.01	0.01	<0.01	0.01	<0.01	<0.04	
Iron	<0.4	0.03	0.48	0.1	0.03	<0.05	<0.05	
Lead	0.13	<0.01	<0.01	<0.01	<0.01	<0.05	<0.05	
Manganese	<0.02	<0.01	0.02	0.03	0.06	0.01	<0.02	
Mercury	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.001	<. 0004	
Nickel	<0.04	<0.02	<0.02	<0.02	<0.02	<0.05	<0.05	
Selenium	0.001	<0.005	<0.005	<0.005	<0.005	0.006	<0.001	
Zinc	0.03	<0.005	0.149	0.006	0.05	<0.01	<0.02	
Molybdenum	<0.3	<0.05	<0.05	<0.05	<0.05	<0.1	<0.02	
Uranium as U308	0.001	0.002	0.002	0.008	0.004	0.0844	0.002	
Vanadium as V205	<0.2	<0.05	<0.05	<0.05	<0.05	<0.1	<0.03	
Radium 226, pCi/L		0.3	0.8	0.7	1.2	<0.2	0	

Notes: All units mg/l unless otherwise noted.
The symbol "<" means not detected at level indicated.
A blank means analysis not performed.

TABLE 10.7 - BASELINE GROUNDWATER QUALITY DATA (Cont'd)

Company: Uranerz U.S.A. Inc.
Project: North Butte ISL Mine
Aquifer: F-sand (Upper Aquifer)
Name of Well: S51-f (364-W)

Date Sampled	10/23180	01/20/81	04/29/81	07/29/81	04/15/88
Field Temperature, centigrade	10	11.5	11	11.2	11.8
pH, Units, Field	7.6	7.55	7.6	7.6	7.83
pH, Units, Lab	7.7	7.36	7.75	7.79	7.77
Conductivity, umhos/cm, Field Ambient	1524	1494	1526	1779	1527
Conductivity, umhos/cm, at 15 centigrade	1386	1541		1490	1634
TDS, Evaporated at 180 centigrade	1054	1088	1028	958	1214
Sodium	206	217	205	194	226
Potassium	8	8	9	9	6.8
Calcium	88	102	94	92	98.4
Magnesium	22	2	22	21	26.2
Sulfate	554	540	556	532	669
Chloride	3	4	8	4	4.8
Carbonate	0	0	0	0	0
Bicarbonate	220	195	219	215	212
Ammonia	<0.05	0.12	<0.05	<0.05	0.05
Nitrate	<0.05	<0.05	<0.05	<0.05	0.01
Fluoride	<0.1	0.22	0.17	0.14	0.11
Total Alkalinity as CaC03	180	162	180	176	174
Baron	<0.01	<0.01	<0.01	<0.01	<0.1
Aluminum	0.09	<0.05	<0.05	<0.05	<0.1
Arsenic	<0.005	<0.005	<0.005	<0.005	0.001
Barium	<0.03	<0.03	<0.03	<0.03	<0.1
Cadmium	0.014	0.002	<0.002	<0.002	<0.01
Chromium	<0.01	<0.01	<0.01	<0.01	<0.05
Copper	<0.01	0.01	0.01	<0.01	<0.01
Iron	0.07	0.11	0.1	0.02	0.02
Lead	<0.01	<0.01	<0.01	<0.01	<0.05
Manganese	0.06	0.07	0.08	0.03	0.07
Mercury	<0.0005	<0.0005	<0.0005	<0.0005	<0.001
Nickel	<0.02	<0.02	<0.02	<0.02	<0.05
Selenium	<0.005	<0.005	<0.005	<0.005	0.01
Zinc	0.041	0.01	0.021	0.01	<0.01
Molybdenum	<0.05	<0.05	<0.05	<0.05	<0.1
Uranium as U308	0.016	0.002	0.001	0.002	0.0028
Vanadium as V205	<0.05	<0.05	<0.05	<0.05	<0.1
Radium 226, pCi/l	1.5	5.7	4.2	4.2	5.1

Notes: All units mg/l unless otherwise noted.
The symbol "<" means not detected at level indicated.
A blank means analysis not performed.

TABLE 10.8 - BASELINE GUZMWATER QUALITY DATA

Company: Uranerz U.S.A. Inc.
Project: North Butte ISL Mine
Aquifer: A-sand (Ore Body Aquifer)
Number of Wells: 3

Date Sampled	No. of Samples	Average	Maximum	Minimum
Field Temperature, centigrade				
pH, Units, Field				
pH, Units, Lab	15	7.85	8.55	6.79
Conductivity, umhos/an, Field Ambient				
Conductivity, umhos/cm, at 15 centigrade	14	1275	1668	928
TD6, Evaporated at 180 centigrade	20	875	1214	618
Sodium	20	210	271	173
Potassium				
Calcium				
Magnesium				
Sulfate	20	505	762	339
Chloride	20	5.8	9	3.6
Carbonate				
Bicarbonate	20	112	193	68
'mmonia				
itrate				
Fluoride				
Total Alkalinity as CaC03				
Boron				
Aluminum				
Arsenic				
Barium				
Cadmium				
Chromium				
Copper				
Iron	20	0.092*	0.56	<0.01
Lead				
Manganese	20	0.040*	0.14	<0.01
Mercury				
Nickel				
Selenium				
Zinc				
Molybdenum				
Uranium as U308	20	0.007*	0.028	<0.001
Vanadium as V205				
Radium 226, pCi/1	19	8.51	82.4	0

Notes: All units mg/1 unless otherwise noted.
The symbol "<" means not detected at level indicated.

Power Resources Inc.

The symbol "*" means the actual average value is lower thanthe value shown

TABLE 10.9 – BASELINE GROUNDWATER QUALITY DATA

Company: Uranerz U.S.A. Inc.
Project: North Butte ISL Mine
Aquifer: B-sand (Ore Body Aquifer)
Number of Wells : 2

Date Sampled	No. of Samples	Average	Maximum	Minimum
Field Temperature, centigrade				
pH, Units, Field				
pH, Units, Lab	10	8.04	8.72	7.58
Conductivity, umhos/cm, Field Ambient				
Conductivity, umhos/cm, at 15 centigrade	9	1499	1765	1217
TLS, Evaporated at 180 centigrade	16	1031	1390	794
Sodium	16	231	298	182
Potassium				
Calcium				
Magnesium				
Sulfate	16	622	877	450
Chloride	16	5.6	11	3.5
Carbonate				
Bicarbonate	16	103	171	64
Ammonia				
Nitrate				
Fluoride				
Total Alkalinity as CaC03				
Boron				
Aluminum				
Arsenic				
Barium				
Cadmium				
Chromium				
Copper				
Iron	16	0.076*	0.33	<0.01
Lead				
Manganese	16	0.036*	0.1	<0.01
Mercury				
Nickel				
Selenium				
Zinc				
Molybdenum				
Uranium as U308	16	0.011*	0.023	<0.001
Vanadium as V205				
Radium 226, pCi/l	13	1.90	7.8	0

Notes: All units mg/l unless otherwise noted. The symbol "<" means not detected at level indicated.
The symbol "*" means the actual average value is lower than the value shown.

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TABLE 10.10 – BASELINE GROUNGWATER QUALITY DATA

Company: Uranerz U.S.A. Inc.
Project: North Butte ISL Mine
Aquifer: C-sand (Ore Body Aquifer)
Number of Wells: 1

Date Sampled	No. of Samples	Average	Maximum	Minimum
Field Temperature, centigrade				
pH, Units, Field				
pH, Units, Lab	5	7.87	8.07	7.65
Conductivity, umhos/cm, Field Ambient				
Conductivity, umhos/cm, at 15 centigrade	4	1210	1282	1140
TDS, Evaporated at 180 centigrade	10	842	920	797
Sodium		10	218	240 194
Potassium				
calcium				
Magnesium				
Sulfate	10	494	514	450
Chloride	10	5.4	9.1	3.4
Carbonate				
Bicarbonate	10	102	146	37
Ammonia				
Nitrate				
Fluoride				
Total Alkalinity as CaO03				
Boron				
Aluminum				
Arsenic				
Barium				
Cadmium				
Chromium				
Copper				
Iron	10	0.059*	0.24	<0.01
Lead				
Manganese	10	0.011*	0.02	<0.01
Mercury				
Nickel				
Selenium				
Zinc				
Molybdenum				
Uranium as U308	10	0.011	0.024	0.005
Vanadium as V205				
Radium 226, pCi/1	10	9.89*	54	<0.2

Notes: All units mg/1 unless otherwise noted.
The symbol "<" means not detected at level indicated.
The symbol "*" means the actual average value is lower than the value shown.

TABLE 10.11 - BASELINE GPCUNDWATER QUALITY DATA

Company: Uranerz U.S.A. Inc.
Project: North Butte ISL Mine
Aquifer: BC-sand (Ore Body Aquifer)
Number of Wells: 1

Date Sampled	No. of Samples	Average	Maximum	Minimum
Field Temperature, centigrade				
pH, Units, Field				
pH, Units, Lab	5	7.95	8.15	7.66
Conductivity, umhos/cm, Field Ambient				
Conductivity, umhos/cm, at 15 centigrade	5	1314	1395	1262
TLS, Evaporated at 180 centigrade	5	881	922	812
Sodium	5	217	235	198
Potassium				
Calcium				
Magnesium				
Sulfate	5	520	560	473
Chloride	5	4.8	5	4
Carbonate				
Bicarbonate	5	100	110	88
Ammonia				
Nitrate				
Fluoride				
Total Alkalinity as CaC03				
Boron				
Aluminum				
Arsenic				
Barium				
Cadmium				
Chromium				
Copper				
Iron	5	0.080*	0.25	<0.05
Lead				
Manganese	5	0.026*	0.04	<0.01
Mercury				
Nickel				
Selenium				
Zinc				
Molybdenum				
Uranium as U308	5	0.029	0.086	0.0104
Vanadium as V205				
Radium 226, pCi/l	5	4.16	12.9	0.5

Notes: All units mg/1 unless otherwise noted.
The symbol "<" means not detected at level indicated.
The symbol 11*11 means the actual average value is lower than the value shown.

TABLE 10.12 – BASELINE GROUND QUALITY DATA

Company: Uranerz U.S.A. Inc.
Project: North Butte ISL Mine
Aquifer: F-sand (Upper Aquifer)
Number of Wells: 3

Date Sampled	No. of Samples	Average	Maximum	Minimum
Field Temperature, centigrade				
pH, Units, Field				
pH, Units, Lab	17	7.88	8.28	7.36
Conductivity, umhos/cm, Field Ambient				
Conductivity, umhos/cm, at 15 centigrade	16	912	1634	0
TD6, Evaporated at 180 centigrade	18	672	1214	400
Sodium	18	160	226	115
Potassium				
Calcium				
Magnesium				
Sulfate	18	319	669	118
Chloride	18	6.4	30	3
Carbonate				
Bicarbonate	18	204	268	156
Ammonia				
Nitrate				
Fluoride				
Total Alkalinity as CaC03				
Boron				
Aluminum				
Arsenic				
Barium				
Cadmium				
Chromium	18	0.113*	0.48	<0.05
Copper				
Iron				
Lead	18	0.035*	0.08	<0.01
Manganese				
Mercury				
Nickel				
Selenium				
Zinc				
Molybdenum				
Uranium as U308	18	0.066*	1	<0.001
Vanadium as V205				
Radium 226, pCi/l	17	1.74*	5.7	<0.2

Notes: All units mg/l unless otherwise noted.
The symbol "<" means not detected at level indicated.
The symbol "*" means the actual average value is lower than the value shown.

TABLE 10.13 - BASELINE GROUND WATER QUALITY DATA

Company: Uranerz U.S.A. Inc.
Project: North Butte ISL Mine
Aquifer: A, B, C, and BC-sands (Mineralized Sand Aquifer)
Number of Wells: 7

Date Sampled	No. of Samples	Average	Maximum	Minimum
Field Temperature, centigrade				
pH, Units, Field				
pH, Units, Lab	35	7.92	8.72	6.79
Conductivity, umhos/cm, Field Ambient				
Conductivity, umhos/cm, at 15 centigrade	32	1336	1765	928
TDS, Evaporated at 180 centigrade	51	918	1390	618
Sodium	51	219	298	173
Potassium				
Calcium				
Magnesium				
Sulfate	51	541	877	339
Chloride	51	5.6	11	3.4
Carbonate				
Bicarbonate	51	106	193	37
Ammonia				
Nitrate				
Fluoride				
Total Alkalinity as CaC03				
Boron				
Aluminum				
Arsenic				
Barium				
Cadmium				
Chromium				
Copper				
Iron	51	0.079*	0.56	<0.01
Lead				
Manganese	51	0.031*	0.14	<0.01
Mercury				
Nickel				
Selenium				
Zinc				
Molybdenum				
Uranium as U3O8	51	0.011*	0.086	<0.001
Vanadium as V205				
Radium 226, pCi/l	47	6.51	82.4	0

Notes: All units mg/l unless otherwise noted.
The symbol "<" means not detected at level indicated.
The symbol N*" means the actual average value is lower than the value shown.

'xcluding Uranerz owned wells, there are three known water wells with pumps installed located on the permit area and on adjacent land. All three wells are utilized by the T Chair Land Company for stock watering plus the Pfister Ranch well is also used for domestic purposes other than drinking and cooking. The wells are identified on Figure 10.5 (Volume II) as Pfister Ranch, Red Barrel No: 1, and North Butte No. 1. Uranetz has no information on the depth, completion interval, water level or yield of-these wells except Red Barrel No. 1 (See Table 10.17). However, in September 1988, the three wells were sampled for baseline purposes and the results of the water quality analyses are presented in Table 10.14.

10.2 SURFACE WATER HYDROLOGY

10.2.1 PHYSICAL DESCRIPTION

The North Butte permit is located in the Willow Creek drainage which is a tributary of the Powder River. The permit area is some 15 miles upstream of the confluence of Willow Creek and and Powder River. The Powder River is tributary to the Yellowstone River which is part of the Missouri River drainage basin. Willow Creek flows in a westerly direction through the southern tip of the permit area. The Willow Creek drainage system is shown in Figure 10.6 (Volume II).

The size of the Willow Creek drainage basin above the Dry Willow Creek confluence is approximately 13.6 square miles. The short reach of the Willow Creek channel within the permit boundary is at an elevation of 4,900 feet MSL. The gradient of the stream channel within the permit area is about 99 feet per mile (0.0187 ft/ft), and the active stream channel averages about 14 feet in width. The length of the Willow Creek stream channel within the permit area is approximately 2,165 feet. Figures 6.1 (Volume 11) and 9.2 (Volume II) show the Willow Creek drainage basin in the vicinity of the North Butte permit area.

Willow Creek is classified as an ephemeral stream in the permit area. The stream flows only in response to heavy snow melt and to large convective rainstorms. The stream channel typically flows intermittently in the spring and early summer and is dry the remainder of the year except during major thunderstorms in the area. In 1988 there was no significant flow in Willow Creek at the North Butte site.

Company: Uranerz U.S.A. Inc.
Project: North Butte ISL Mine
Aquifer: Unknown
Names of Wells:

Date Sampled	Pfister Ranch 09/08/88	Red Barrel 09/08/88	North Butte #1 09/08/88
Field Temperature, centigrade	14.2	12.7	13.6
pH, Units, Field	6.84	7.34	8.6
pH, Units, Lab	7.97	7.7	7.39
Conductivity, umhos/cm, Field Ambient	1281	1158	1002
Conductivity, umhos/cm, at 15 centigrade	1311	1214	907
TD5, Evaporated at 180 centigrade	916	814	578
Sodium	187	180	150
Potassium	6.6	4.9	3.3
Calcium	80.2	63.1	30.6
Magnesium	16.1	14.4	6.2
Sulfate	580	456	274
Chloride	5.7	6.5	4.2
Carbonate	0	0	0
Bicarbonate	109	176	156
Ammonia	<0.05	1.09	<0.05
Nitrate	0.04	0.63	0.55
Fluoride	<0.1	0.18	0.16
Total Alkalinity as CaC03	89	144	128
Boron	<0.1	<0.1	<0.1
Aluminum	<0.1	<0.1	<0.1
Arsenic	0.002	0.001	<0.001
Barium	<0.1	<0.1	<0.1
Cadmium	<0.01	<0.01	<0.01
Chromium	<0.05	<0.05	<0.05
Copper	<0.01	<0.01	<0.01
Iron	0.08	1.2	0.91
Lead	<0.05	<0.05	<0.05
Manganese	0.04	0.17	0.03
Mercury	<0.001	<0.001	<0.001
Nickel	<0.05	<0.05	<0.05
Selenium	0.007	0.004	0.005
Zinc	0.08	0.01	0.15
Molybdenum	<0.1	<0.1	<0.1
Uranium as U308	0.0104	0.0158	<0.0003
Vanadium as V205<0.1	<0.1	<0.1	<0.1
Radium 226, pCi/l	23.7	0.4	1

Notes: All units mg/l unless otherwise noted.
The symbol "<" means not detected at level indicated.
A blank means analysis not performed.

Power Resources Inc.

NORTH BUTTE WELL INVENTORY
FOR
POWER RESOURCES, INC.

BY

HYDRO-ENGINEERING, LLC

APRIL, 2005

George L. Hoffman

GEORGE L. HOFFMAN, P.E.
HYDROLOGIST

4/22/05

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1.0 Introduction

A well inventory was conducted for the wells located in the North Butte permit area and also within an area extending one half mile from the permit area. This well inventory was conducted on March 29, 2005. A Brunton hand held GPS Model MNS was used for measurement of the field locations.

2.0 Inventory of wells

The well inventory is listed in Table 1. This table presents our field coordinates, the permit number, well name and available Power Resources, Inc. (PRI) state plane coordinates. A comments column is also included in this table. Figure 10.5 shows that location of the wells in the inventory. The field coordinates that are listed in red in Table 1 were used to post these well locations while the PRI coordinates were used for the remainder of the sites. Where used, the PRI coordinates are considered the most accurate available coordinates.

2.1 Monitor Wells

The majority of the wells located in the North Butte inventory are mine monitoring wells. The North Butte mine wells have a series designation of B, M, NBHW, P, T, S and U for the monitor wells. Several Brown series monitoring wells from the old American Nuclear proposed mine area are also included within the North Butte monitoring wells. An alluvial well, Brown V was not found and was likely washed out because it was located in the bottom of the draw. Also, a permitted monitoring well SS1(F) PU was not found at the SS1 monitoring site. The monitor well MN1 could not be found. No coordinates were available for well P9, and it was not located during the inventory.

2.2 Stock and Domestic Wells

The Brown # 1 stock well was not found. A dugout pond in the bottom of the channel was the only water source found in this area. This well is permitted as a five foot depth well and, therefore, this dug out may be the equivalent of this permitted well. The Brown #2 well was not field checked. An old windmill was found in the northern portion of the inventory area and has been labeled as the UNK1 well. The windmill is not operational at this time. The only other stock well located was the Red Barrel No. 1 well which is permit P63604W. The Brown T well is used at the Pfister ranch for domestic and stock water purposes. Well PW-1 is located at the old mine camp area.

2.3 CBM Wells

Seven CBM wells were located within the well inventory area. One of these CBM wells is in the northwestern portion of the area, while the remaining six wells are located in the southern portion of the well inventory area. None of the CBM wells are connected to a

gas collection system and no pipelines have been constructed to date. CBM well T Chair 43-18-4475 did have a generator at the site and is equipped for testing of this well.

3.0 Other Points Located

3.1 Oil Drill Holes

Three dry oil drill holes were located at the permit site. These are the FED BY No. 1, Equity Fed-1 and the Pumpkin Fed-1 drill holes. These are presented on Figure 10.5 along with the monitoring and water wells.

3.2 Other Casings

Other casings found at this site were a three-inch casing in the draw in the southeast quarter of Section 18 and four three-inch casings that are located on the east side of the P series of wells. These five three-inch casings may not be wells but were located in the well survey and are listed as UNK2 through UNK6. A 3/4 inch casing located near well P6 was also included in the GPS survey and is labeled UNK7. This casing is likely part of the P series wells. The P series wells were installed by Cleveland Cliffs but this well could not be positively identified with a P series designation.

3.3 Dams and Quarter Corner

Four dams were also located during the well inventory and are also listed on Table 1 as Dam 1 through Dam 4. A quarter corner location was also located and is shown in the tabulation as S19/S20 for the quarter corner between Sections 19 and 20.

TABLE 1. WELL INVENTORY

Field Coordinates		S. Eng.		PRI Coordinates		
East	North	Permit	Well Name	East	North	Comments
301936	1134886		B-1	301956	1134912	5" PVC
301497	1135340		B-2	301506	1135365	5" PVC
301287	1135846		B-3B	301292	1135872	5" PVC
300766	1136034		B-4	300765	1136044	5" PVC
300385	1136251		B-5A	300385	1136256	5" PVC
299905	1136147		B-6	299916	1136150	5" PVC
300001	1136547		B-7	301605	1136637	5" PVC
299413	1135855		B-8	299416	1135851	5" PVC
300033	1135799		B-9	300052	1135821	5" PVC
		P15068P	BROWN #1	294280	1140730	did not find well, found dug out
		P15069P	BROWN #2	293525	1137840	on top of butte, did not field check
		P50567W	BROWN A	306510	1132980	not in field check area
299170	1129895	P50568W	BROWN B	300700	1129890	5" PVC
302656	1130366	P50569W	BROWN C	304164	1130399	5" PVC, no cap, broke
301416	1129232	P50570W	BROWN D	302946	1129240	6" PVC
301397	1129135	P50571W	BROWN E	302933	1129141	5" PVC
		P50572W	BROWN F	302600	1128550	not in field check area
		P50573W	BROWN G	305510	1125440	not in field check area
293761	1127084	P50574W	BROWN H	295274	1127079	5" PVC
		P50575W	BROWN I	304000	1128810	not in field check area
304891	1129892	P50576W	BROWN J	306411	1129912	4" PVC, no cap
		P50577W	BROWN K	306630	1129640	not in field check are
303890	1132557	P50578W	BROWN L	305361	1132527	4.3" fiberglass
303834	1132594	P50579W	BROWN M	305337	1132683	no cap, 8" steel
303883	1132666	P50580W	BROWN N	305337	1132684	no cap, 4.3" fiberglass
305499	1133644	P50581W	BROWN O	307212	1133675	4.3" fiberglass, no cap, washout around well
		P50582W	BROWN P.	308660	1128350	not in field check area
		P50583W	BROWN Q	305500	1125920	not in field check area
303948	1132605	P50584W	BROWN R	305399	1132631	4.3" fiberglass
300647	1131329		BROWN S	302191	1131331	5" PVC
300687	1131329		BROWN T	302212	1131342	5" PVC w/pump
300158	1128876		BROWN U	301681	1128894	4" PVC, no cap
			BROWN V	295330	1128850	not found, likely washed out
303008	1133125		BROWN W	304530	1133142	4" PVC, no cap
296854	1127455	P134568W	CBM A25-7			6" steel
304207	1134126		DAM 1			
303985	1138349		DAM 2			
294482	1130093		DAM 3			
302398	1130843		DAM 4			
295798	1132847		Equity Fed-1	296339	1132897	oil drill hole
298554	1136927		FED BY No.-1	299398	1136785	oil drill hole
302309	1135209	P87751W	M1	302311	1135221	5" PVC
301927	1135675	P87752W	M2	301940	1135681	5" PVC
301616	1136170	P87753W	M3	301626	1136176	5" PVC
301240	1136339	P87754W	M4	301248	1136347	5" PVC
300894	1136531	P87755W	M5	300907	1136539	5" PVC
300545	1136747	P87756W	M6	300554	1136752	5" PVC
300302	1137072	P87757W	M7	300311	1137065	5" PVC
299902	1137094	P87758W	M8	299907	1137091	5" PVC
299561	1136940	P87759W	M9	299556	1136941	5" PVC
299263	1136652	P87760W	M10	299271	1136651	5" PVC
298949	1136486	P87761W	M-11	298946	1136442	5" PVC
298612	1136216	P87762W	M-12	298620	1136201	5" PVC
298638	1135809	P87763W	M-13	298643	1135806	5" PVC
298893	1135375	P87764W	M-14	298893	1135353	5" PVC
299601	1135361	P87765W	M15	299601	1135361	5" PVC
300321	1135238	P87766W	M16	300326	1135251	5" PVC

TABLE 1. WELL INVENTORY

Field Coordinates		S. Eng.		PRI Coordinates		
East	North	Permit	Well Name	East	North	Comments
301123	1135320	P87767W	M17	301138	1135326	5" PVC
301442	1134739	P87768W	M18	301450	1134752	5" PVC
301918	1134400	P87769W	M19	301921	1134401	5" PVC
302457	1134643	P87770W	M20	302460	1134662	5" PVC
		P53741W	MN 1			not found
300315	1137047	P54603W	MN-3	300310	1137052	4.3 fiberglass, corrected PRI coor. relative to M7
294346	1134418		NB No.1	294651	1134373	6" steel, w/pump
297923	1136764	P104126W	NBHW-1			4.5" yellowmine
297697	1137769	P104127W	NBHW-2			4.5" yellowmine
296714	1138357	P104128W	NBHW-3			4.5" yellowmine
296533	1137582	P104129W	NBHW-4			4.5" yellowmine
296223	1136571	P104130W	NBHW-5			4.5" yellowmine
296352	1135555	P104131W	NBHW-6			4.5" yellowmine
296609	1134569	P104132W	NBHW-7			4.5" yellowmine
295940	1133769	P104133W	NBHW-8			4.5" yellowmine
295889	1132767	P104134W	NBHW-9			4.5" yellowmine
295973	1131576	P104135W	NBHW-10			4.5" yellowmine
295708	1130747	P104136W	NBHW-11			4.5" yellowmine
295706	1129776	P104137W	NBHW-12			4.5" yellowmine
295918	1128359	P104138W	NBHW-13			4.5" yellowmine
295699	1129205	P104139W	NBHW-14			4.5" yellowmine
294815	1129986	P104140W	NBHW-15			4.5" yellowmine
294747	1131026	P104141W	NBHW-16			4.5" yellowmine
294464	1132025	P104142W	NBHW-17			4.5" yellowmine
294198	1132969	P104143W	NBHW-18			4.5" yellowmine
294583	1133972	P104144W	NBHW-19			4.5" yellowmine
294528	1134969	P104145W	NBHW-20			4.5" yellowmine
298887	1136420	P53746W	P 1 L	299711	1136427	P-1-6, 6" yellowmine
299041	1136406	P74579W	P 1 M	299894	1136420	P1-13, 6" steel, no cap
298922	1136419	P53744W	P 1 U	299788	1136427	1-A, 3-3/4" PVC, prob. 3 - series, no cap
298945	1135751	P53749W	P 2 L	299811	1135775	P-2C, 6" yellowmine
298880	1135776	P53748W	P 2 M	299726	1135781	P-2B, 6" yellowmine
298919	1135763	P53747W	P 2 U	299767	1135778	P-2A, 2 series, 3/4" PVC, no cap
298925	1136273	P53750W	P 3	299761	1136283	6" yellowmine
298914	1136055	P53751W	P 4	299756	1136088	6" yellowmine
298669	1136240	P53752W	P 5	299489	1136278	6" yellowmine
299184	1136264	P53753W	P 6	300080	1136279	6" yellowmine
298666	1135954	P53754W	P 7	299486	1135982	6" yellowmine
299119	1135968	P53755W	P 8	299996	1135990	6" yellowmine
		P53756W	P 9			in area of B-9
298925	1138277	P53757W	P 10	299756	1138317	322-P, 3 - 3/4" PVC, 10 series but 2, no cap
297208	1134963	P53758W	P 11			11 series, 3 - 3/4" PVC, no caps
298919	1136504	P53759W	P 12	299758	1136527	P-P-12, 3 - 3/4" PVC, 12 series
294349	1134273		PUMPKIN FED -1	294658	1134290	oil drill hole
294914	1132524		PW-1	295265	1132562	w/pump
293797	1126780	P63604W	Red Barrel No. 1	294077	1127500	4.3 fiberglass
304502	1133364		S19/S20			1/4 cor.
		P53780W	SS1 (F) P U			not located in field
295559	1129626	P53779W	SS1 (F) U	296039	1129607	4.3" fiberglass
295690	1129551	P53764W	SS1 L	296150	1129530	4.5" PVC
295602	1129546	P53762W	SS1 M	296079	1129546	4.5" PVC
295840	1129568	P53765W	SS1 P L	296300	1129547	3/4" PVC, Est. PRI coor. from field difference to SS1L
295473	1129469	P53763W	SS1 P M	295950	1129469	3/4" PVC, est. PRI coor. from field difference to SS1M
295428	1129700	P53761W	SS1 P U	295881	1129665	2" PVC
295647	1129619	P53760W	SS1 U	296120	1129610	4.5" PVC
295661	1129758	P53960W	SS1-V	296150	1129736	3/4" PVC

TABLE 1. WELL INVENTORY

Field Coordinates		S. Eng.		PRI Coordinates		
East	North	Permit	Well Name	East	North	Comments
297081	1134266	P76612W	SS2BC 1	297754	1134275	4.5" yellowmine
297120	1134181	P76613W	SS2BC 2	297804	1134129	4.5" yellowmine
297085	1134193	P76614W	SS2FBC AQ	297733	1134182	4.5" yellowmine
297014	1134224	P53785W	SS2 L	297636	1134225	4.3" fiberglass
297111	1134229	P53783W	SS2 M	297736	1134227	4.3" fiberglass
296892	1134262	P53786W	SS2 P L	297607	1134293	2" PVC
297261	1134276	P74578W	SS2 P M	297919	1134282	2" PVC
297010	1134045	P53782W	SS2 P U	297689	1133990	4.3" fiberglass
297057	1134133	P53781W	SS2 U	297720	1134120	4.3" fiberglass
302038	1135729	P76618W	SSE1 1	303298	1135743	4.4" yellowmine
302052	1135844	P76616W	SSEA 1	303323	1135817	4.5" w/pump
302096	1135831	P76619W	SSEA1 AQ	303380	1135858	4.4" yellowmine
302035	1135874	P76615W	SSEA 2	303295	1135864	4.4" yellowmine
302122	1135776	P76617W	SSEA 3	303425	1135815	4.4" yellowmine
302017	1135832		SSEA UNK	303276	1135796	4.4" yellowmine
302092	1135862	P53772W	SSE L	303375	1135890	4.3" fiberglass
302205	1135751	P53771W	SSE M	303497	1135797	5" PVC
302200	1135642	P53770W	SSE U	303497	1135685	5" PVC
291532	1128846	P53769W	SSW L	291506	1128793	5" PVC
291646	1128820	P53768W	SSW LM	291616	1128794	5" PVC
291658	1128681	P53766W	SSW U	291620	1128690	5" PVC
291531	1128743	P53767W	SSW UM	291499	1128699	5" PVC
296885	1131305	P135681W	T-CHAIR 24S-15	297000	1131500	6" steel
298317	1129971	P135682W	T-CHAIR 25S-1	298300	1130000	6" steel
297047	1128886	P135680W	T-CHAIR 25S-7	297000	1128800	6" steel
303651	1129954	P143830W	T-CHAIR 30S-1	303000	1130000	6" steel
299388	1128508	P135683W	T-CHAIR 30S-5			6" steel
303902	1137973	P149751W	T-CHAIR 43-18-4475	303000	1138000	no pipeline, 6" steel
301829	1135172	P87774W	UM1	301841	1135201	5" PVC
301356	1135700	P87775W	UM2	301366	1135701	5" PVC
300870	1135972	P87776W	UM3	300874	1135974	5" PVC
300253	1136271	P87777W	UM4	300257	1136271	5" PVC
299887	1136505	P87778W	UM5	299901	1136558	5" PVC
299688	1136028	P87779W	UM6	299686	1136030	5" PVC
299255	1135875	P87780W	UM7	299251	1135863	5" PVC
300068	1135854	P87781W	UM8	300086	1135860	5" PVC
300504	1135831	P87782W	UM9A	300496	1135838	5" PVC
303054	1139294		UNK1			windmill 4" steel
303073	1136670		UNK2			3" PVC, may not be well, no cap
299419	1136407		UNK3			3" PVC, may not be well, no cap
299433	1136432		UNK4			3" PVC, may not be well, no cap
299438	1136498		UNK5			3" PVC, may not be well, no cap
299407	1136468		UNK6			3" PVC, may not be well, no cap
298944	1136413		UNK7			3/4" PVC, no cap
301751	1135228	P87784W	UUM1	301766	1135251	5" PVC
300223	1136283	P87785W	UUM2	300229	1136282	5" PVC

NOTE: State Engineer file permit name Brown Piezometer 1 was changed on this table to Brown L and North Butte R 5 to P 5.

Red numbers indicate which field coordinates used in posting of well locations.

10.3 WATER RIGHTS, WELLS, WATER USE AND NEAREST MUNICIPAL WATER SOURCE

10.3.1 WATER RIGHTS AND WELLS

10.3.1.1 SURFACE WATER

There are 4 adjudicated surface water rights within the North Butte permit area and within one-half of a mile of the permit area boundary according to the State Engineer's records. All 4 surface water rights are for either reservoirs or stock reservoirs. There are no surface water rights for diversion of direct flows from Willow Creek or its tributaries within this area. A listing of the adjudicated surface water rights is presented in Table 10.16 and a map showing the approximate locations (nearest quarter quarter) of the surface water rights is presented in Figure 10.8 (Volume II).

10.3.1.2 GROUNDWATER AND WELLS

A tabulation of all adjudicated groundwater (well) rights within the proposed permit area and within three miles of the permit boundary is presented in Table 10.17 (LQD Rules & Regs. Chap. II, Sec. 2(a)(i)(J)I)). In addition to the name of the well and owner, the tabulation includes the permit number, location (nearest quarter quarter), and total depth (if known). Figure 10.8 (Volume II) is a map which shows the approximate location of the adjudicated groundwater water rights within the permit area and within three miles of the permit area boundary. A map showing the location of known water wells and abandoned oil and gas wells within the permit area and on adjacent lands is presented in Figure 10.5 (Volume II). There are no known oil and gas wells within the permit area and on adjacent lands except for the seven coalbed wells that are discussed in the next section.

10.3.2 WATER USE

The limited surface water supplies within and adjacent to the permit area are used for livestock and wildlife watering. Even in wet years, the flow in Willow Creek in the vicinity of the permit area is limited to a couple of months, and in dry years (e.g. 1988) there is essentially no flow during the entire 12 month period. Stock reservoirs in the area provide additional sources of water for livestock and wildlife, but are typically dry in the absence of recent runoff producing events.

The water wells within and adjacent to the permit area are used primarily for livestock watering and for industrial purposes. The industrial use consists of water for exploration drilling, coal bed methane production, and environmental wells for water quality monitoring and hydrologic studies. There are two domestic wells within or adjacent to the proposed North Butte permit area. One well is located at the man camp and is owned by Power Resources, Inc. and the other is located at the Pfister ranch buildings. The water from these two wells is not suitable for drinking. The residents at the Pfister ranch haul their drinking and cooking water to their house. When PRI personnel are using the man camp they bring their drinking water from town. The unadjudicated Pfister well is

the Brown T well which has a total depth of 496 feet and completed between 390 and 470 feet below the land surface. The man camp well is identified as North Butte PW-1 (permit no. P54464W) in Table 10.17.

A total of seven coal bed methane wells were found within the inventory area. None of these coal bed methane wells are presently connected to a collection system and no pipelines have been constructed into the area. The well permit numbers are P134568W, P135680 through P135683W, P143830W and P149751W. The permit for P134568W indicates it is cancelled but the well head looks very similar to the other six coal bed methane wells.

10.3.3 NEAREST MUNICIPAL WATER SOURCE

The nearest municipal water source is located at the unincorporated community of Savageton, Wyoming which is located some 10 air miles northeast of the North Butte ISL project. The Savageton water system consists of a well, supply tank and distribution lines. The system will serve up to 15 trailer homes. The well is 700 feet deep with 6 inch steel casing and has a 5 horsepower pump. Information on completion interval, depth to water and yield is not available. The distribution system consists of 2 inch diameter plastic pipe. According to the operator, the water from the well is potable.

TABLE 10.16
Tabulation of Adjudicated Surface Water Rights
(Permit area and within three miles of permit boundary)

Name of Facility	Name of Applicant	Storage Capacity		Location						Permit No.
Shering Pen Reservoir	EARL BROWN	39.9	ACFT	SENE	19	44	N	75	W	P5485R
Shering Pen Reservoir	EARL BROWN	39.9	ACFT	NWNW	20	44	N	75	W	P5485R
Shering Pen Reservoir	EARL BROWN	39.9	ACFT	SWNW	20	44	N	75	W	P5485R
Pfister #2 Stock Reservoir	BROWN LAND COMPANY	0.01	ACFT	SENE	19	44	N	75	W	P8158S
Pfister #3 Stock Reservoir	BROWN LAND COMPANY	0.01	ACFT	SWSW	19	44	N	75	W	P8159S
North Butte Evaporation Pond 1 and Pond 2 Reservoir	POWER RESOURCES INC.	13.42	ACFT	NWSE	24	44	N	76	W	P9806R

TABLE 10.17
Tabulation of Adjudicated Groundwater Rights
(Permit area and within three miles of permit boundary)

Permit Name	Permit No.	Owner	Location						Total Depth (feet)	Producing Interval (feet)
OLD MAID #1	P119027W	T-CHAIR LAND COMPANY	SESE	2	43	N	76	W	300	Unknown
T-C RANCH 2S-5	P140506W	T-CHAIR LAND COMPANY** DEVON ENERGY PRODUCTION COMPANY, L.P.	SWNW	2	43	N	76	W		
T-C RANCH 2S-9	P140507W	T-CHAIR LAND COMPANY** DEVON ENERGY PRODUCTION COMPANY, L.P.	NESE	2	43	N	76	W		
T-C RANCH 2S-13	P140508W	T-CHAIR LAND COMPANY** DEVON ENERGY PRODUCTION COMPANY, L.P.	SWSW	2	43	N	76	W		
T-C RANCH 2S-15	P140509W	T-CHAIR LAND COMPANY** DEVON ENERGY PRODUCTION COMPANY, L.P.	SWSE	2	43	N	76	W		
WEST OLD MAIDS WELL #1	P15106W	BROWN LAND COMPANY	SWNE	3	43	N	76	W	275	125 - 275
WELL WEST OF WIDOW WOMEN #1	P29162W	FRANKLIN BROWN	NESW	3	43	N	76	W	720	540 - 705
7MW7	P100650W	COGEMA MINING, INC.	SWSW	3	44	N	76	W	660	605 - 645
7MW9	P100652W	COGEMA MINING, INC.	SWSW	3	44	N	76	W	670	430 - 650
7MW11	P100654W	COGEMA MINING, INC.	NWSW	3	44	N	76	W	650	585 - 630
7MW13	P100656W	COGEMA MINING, INC.	NWSW	3	44	N	76	W	600	570 - 600
7MW15	P100658W	COGEMA MINING, INC.	NWSW	3	44	N	76	W	640	370 - 620
7SM2	P106370W	COGEMA MINING, INC.	SWSW	3	44	N	76	W	350	210 - 240
7DM1	P106382W	COGEMA MINING, INC.	NWSW	3	44	N	76	W	780	385 - 445
7DM2	P106383W	COGEMA MINING, INC.	SWSW	3	44	N	76	W	750	690 - 750
7TW4	P106394W	COGEMA MINING, INC.	SWSW	3	44	N	76	W	525	380 - 450
CR WELLFIELD #7A	P107850W	COGEMA MINING, INC.	NWSW	3	44	N	76	W		
CR WELLFIELD #7B	P107851W	COGEMA MINING, INC.	SWSW	3	44	N	76	W		
#39 HELDT DRAW UNIT	P39112W	JOHN CHRISTENSEN	SWNE	3	44	N	76	W	1010	970 - 994
NPHW-14	P99338W	COGEMA MINING, INC.	SWSW	3	44	N	76	W	620	580 - 620
PUMPKIN BUTTES RANCH 21-4-4375	P158575W	WILLIAMS PRODUCTION RMT COMPANY** WY STATE BOARD OF LAND COMMISSIONERS	NENW	4	43	N	75	W		
HARTZOG FEDERAL 21-4-4475BG	37/1/285W	XTO ENERGY INC.	NENW	4	44	N	75	W		
HARTZOG FEDERAL 14-4-4475BG	37/2/285W	XTO ENERGY INC.	SWSW	4	44	N	75	W		
HARTZOG FEDERAL 23-4-4475BG	37/3/285W	XTO ENERGY INC.	NESW	4	44	N	75	W		
HARTZOG FEDERAL 12-4-4475BG	37/4/285W	XTO ENERGY INC.	SWNW	4	44	N	75	W		
SCHLAUTMANN #14	P14912P	ALBERT W. & MARY E. SCHLAUTMANN	SESW	4	44	N	75	W	170	Unknown
HARTZOG DRAW UNIT WATER SUPPLY WELL #1	P52981W	EXXON COMPANY U.S.A.**ALBERT W. SCHLAUTMAN	NWSE	4	44	N	75	W	7252	6040 - 6846
ENL OF HARTZOG DRAW UNIT WATER SUPPLY WELL #1	P59134W	ALBERT W. SCHLAUTMANN** EXXON MOBIL CORPORATION	NWSE	4	44	N	75	W	7252	6040 - 6846
HARTZOG DRAW UNIT POTABLE WATER WELL #1	P60219W	ALBERT W. SCHLAUTMANN** EXXON MOBIL CORPORATION	NWSE	4	44	N	75	W	921	750 - 915
HARTZOG DRAW SEPARATION FACILITY	P81754W	EXXON MOBIL CORPORATION	SWSE	4	44	N	75	W	-1	Unknown
SHOGRIN FEDERAL #1	P88747W	EXXON CORPORATION	NENW	4	44	N	75	W	1600	1300 - 1446
SHOGRIN FEDERAL #1	P88747W	EXXON CORPORATION	NESW	4	44	N	75	W	1600	1300 - 1446
SHOGRIN FEDERAL #1	P88747W	EXXON CORPORATION	SWSE	4	44	N	75	W	1600	1300 - 1446
6MW17	P100660W	COGEMA MINING, INC.	SESE	4	44	N	76	W	540	365 - 540
6MW38	P100662W	COGEMA MINING, INC.	NESE	4	44	N	76	W	600	400 - 600
6MW34	P100677W	COGEMA MINING, INC.	NESE	4	44	N	76	W	540	360 - 540
7MW19	P106349W	COGEMA MINING, INC.	NESE	4	44	N	76	W	580	380 - 570
7SM1	P106369W	COGEMA MINING, INC.	NESE	4	44	N	76	W	335	335 - 355
7SM4	P106372W	COGEMA MINING, INC.	NESE	4	44	N	76	W	345	325 - 345
7SM6	P106374W	COGEMA MINING, INC.	SESE	4	44	N	76	W	355	339 - 353
7SM7	P106375W	COGEMA MINING, INC.	SESE	4	44	N	76	W	335	325 - 335
7SM9	P106377W	COGEMA MINING, INC.	SESE	4	44	N	76	W	355	325 - 345
7DM4A	P106385W	COGEMA MINING, INC.	NESE	4	44	N	76	W	760	560 - 610
7TW1	P106391W	COGEMA MINING, INC.	SESE	4	44	N	76	W	535	380 - 440
7TW2	P106392W	COGEMA MINING, INC.	SESE	4	44	N	76	W	530	370 - 440
7TW3	P106393W	COGEMA MINING, INC.	SESE	4	44	N	76	W	525	390 - 450
CR WELLFIELD #7C	P107852W	COGEMA MINING, INC.	NESE	4	44	N	76	W		
CR WELLFIELD #7D	P107853W	COGEMA MINING, INC.	SESE	4	44	N	76	W		
7MW42	P108341W	COGEMA MINING, INC.	NESE	4	44	N	76	W	620	365 - 605
7MW43	P108342W	COGEMA MINING, INC.	NESE	4	44	N	76	W	600	350 - 600
NPHW-9	P99333W	COGEMA MINING, INC.	SESE	4	44	N	76	W	620	435 - 620
NPHW-11	P99335W	COGEMA MINING, INC.	NESE	4	44	N	76	W	560	390 - 560
NPHW-16	P99340W	COGEMA MINING, INC.	SESE	4	44	N	76	W	620	480 - 620
PADEN #1	P103967W	RUBY RANCH	SWSW	5	43	N	75	W	650	570 - 630
CONNIE #2	P12283P	INC. RUBY RANCH	NWSE	5	43	N	75	W	350	Unknown
RECTOR WELL #22	P24098P	JOHN CHRISTENSEN	SWSW	5	44	N	75	W	40	31 - 39
SHOGRIN FEDERAL #1	P88747W	EXXON CORPORATION	NENW	5	44	N	75	W	1600	1300 - 1446
SHOGRIN FEDERAL #1	P88747W	EXXON CORPORATION	NESE	5	44	N	75	W	1600	1300 - 1446
SHOGRIN FEDERAL #1	P88747W	EXXON CORPORATION	NESW	5	44	N	75	W	1600	1300 - 1446
SHOGRIN FEDERAL #1	P88747W	EXXON CORPORATION	SENE	5	44	N	75	W	1600	1300 - 1446

TABLE 10.17
Tabulation of Adjudicated Groundwater Rights
(Permit area and within three miles of permit boundary)

Permit Name	Permit No.	Owner	Location						Total Depth (feet)	Producing Interval (feet)
NORTH DRY WILLOW #1	P116152W	T-CHAIR LAND COMPANY	NESE	6	43	N	75	W	1132	660 - 765
T CHAIR LIVESTOCK COMPANY #7 1	P52445W	WOODS PETROLEUM CORPORATION	NESE	6	43	N	75	W	1132	660 - 765
T CHAIR LIVESTOCK COMPANY #7 1	P69239W	DIAMOND SHAMROCK EXPLORATION COMPANY	NESE	6	43	N	75	W	1132	660 - 765
RECTOR #1	P67378W	JOHN CHRISTENSEN	NESE	6	44	N	75	W	363	310 - 340
SHOGRIN FEDERAL #1	P88747W	EXXON CORPORATION	NENE	6	44	N	75	W	1600	1300 - 1446
SHOGRIN FEDERAL #1	P88747W	EXXON CORPORATION	NENW	6	44	N	75	W	1600	1300 - 1446
SHOGRIN FEDERAL #1	P88747W	EXXON CORPORATION	NESE	6	44	N	75	W	1600	1300 - 1446
T CHAIR 14-7-4475	P163412W	LANCE OIL & GAS COMPANY, INC	SWSW	7	44	N	75	W		
SHOGRIN FEDERAL #1	P88747W	EXXON CORPORATION	NENE	7	44	N	75	W	1600	1300 - 1446
NORTH PFISTER #2	P118938P	BROWN LAND COMPANY	SWNE	8	44	N	75	W	250	220 - 250
1-8-44-75 JORDAN	P13299P	NAOMI A. JORDAN	SENW	8	44	N	75	W	-1	9 - Unknown
HARTZOG 23-8-4475BG	P159076W	CH 4 ENERGY, LLC	NESW	8	44	N	75	W		
HARTZOG 21-8-4475BG	P159077W	CH 4 ENERGY, LLC	NENW	8	44	N	75	W		
SHOGRIN FEDERAL #1	P88747W	EXXON CORPORATION	NENE	8	44	N	75	W	1600	1300 - 1446
SHOGRIN FEDERAL #1	P88747W	EXXON CORPORATION	NENW	8	44	N	75	W	1600	1300 - 1446
SHOGRIN FEDERAL #1	P88747W	EXXON CORPORATION	NESE	8	44	N	75	W	1600	1300 - 1446
SHOGRIN FEDERAL #1	P88747W	EXXON CORPORATION	NESW	8	44	N	75	W	1600	1300 - 1446
SHOGRIN FEDERAL #1	P88747W	EXXON CORPORATION	NENE	9	44	N	75	W	1600	1300 - 1446
SHOGRIN FEDERAL #1	P88747W	EXXON CORPORATION	NENW	9	44	N	75	W	1600	1300 - 1446
SHOGRIN FEDERAL #1	P88747W	EXXON CORPORATION	NESE	9	44	N	75	W	1600	1300 - 1446
SHOGRIN FEDERAL #1	P88747W	EXXON CORPORATION	NESW	9	44	N	75	W	1600	1300 - 1446
SHOGRIN FEDERAL #1	P88747W	EXXON CORPORATION	NWNE	9	44	N	75	W	1600	1300 - 1446
SHOGRIN FEDERAL #1	P88747W	EXXON CORPORATION	NWNW	9	44	N	75	W	1600	1300 - 1446
7MW8	P100651W	COGEMA MINING, INC.	SENE	9	44	N	76	W	650	405 - 555
7MW10	P100653W	COGEMA MINING, INC.	SENE	9	44	N	76	W	640	370 - 535
7MW12	P100655W	COGEMA MINING, INC.	NENE	9	44	N	76	W	650	480 - 550
7MW14	P100657W	COGEMA MINING, INC.	NENE	9	44	N	76	W	640	490 - 555
7MW16	P100659W	COGEMA MINING, INC.	SENE	9	44	N	76	W	720	495 - 610
7MW18	P100661W	COGEMA MINING, INC.	SENE	9	44	N	76	W	720	470 - 310
7MW20	P100664W	COGEMA MINING, INC.	NESE	9	44	N	76	W	650	415 - 560
7MW22	P100666W	COGEMA MINING, INC.	NESE	9	44	N	76	W	640	410 - 625
7MW24	P100668W	COGEMA MINING, INC.	NESE	9	44	N	76	W	670	500 - 655
7MW26	P100670W	COGEMA MINING, INC.	SENE	9	44	N	76	W	660	430 - 650
7MW28	P100672W	COGEMA MINING, INC.	SENE	9	44	N	76	W	650	370 - 625
7MW30	P100674W	COGEMA MINING, INC.	NENE	9	44	N	76	W	590	340 - 580
7MW32	P100676W	COGEMA MINING, INC.	NENE	9	44	N	76	W	620	470 - 600
6DM2	P100702W	COGEMA MINING, INC.	SENW	9	44	N	76	W	660	440 - 660
7MW21	P106350W	COGEMA MINING, INC.	NESE	9	44	N	76	W	620	360 - 535
7MW23	P106351W	COGEMA MINING, INC.	NESE	9	44	N	76	W	670	410 - 660
7MW25	P106352W	COGEMA MINING, INC.	NESE	9	44	N	76	W	670	405 - 650
7MW27	P106353W	COGEMA MINING, INC.	SWNE	9	44	N	76	W	660	390 - 635
7MW29	P106354W	COGEMA MINING, INC.	SWNE	9	44	N	76	W	630	365 - 630
7MW31	P106355W	COGEMA MINING, INC.	NWNE	9	44	N	76	W	590	450 - 520
7MW33	P106356W	COGEMA MINING, INC.	NWNE	9	44	N	76	W	620	460 - 530
7MW34	P106357W	COGEMA MINING, INC.	NWNE	9	44	N	76	W	600	355 - 430
7MW35	P106358W	COGEMA MINING, INC.	NWNE	9	44	N	76	W	620	350 - 530
7SM8	P106376W	COGEMA MINING, INC.	SESE	9	44	N	76	W	250	215 - 235
7SM10	P106378W	COGEMA MINING, INC.	NESE	9	44	N	76	W	360	355 - 360
7SM11	P106379W	COGEMA MINING, INC.	SENE	9	44	N	76	W	250	210 - 235
7SM12	P106380W	COGEMA MINING, INC.	SENE	9	44	N	76	W	395	380 - 390
7SM13	P106381W	COGEMA MINING, INC.	NESE	9	44	N	76	W	370	235 - 255
7TW5	P106395W	COGEMA MINING, INC.	NENE	9	44	N	76	W	460	395 - 450
7TW6	P106396W	COGEMA MINING, INC.	NENE	9	44	N	76	W	520	365 - 420
CR WELLFIELD #7F	P107855W	COGEMA MINING, INC.	NENE	9	44	N	76	W		
CR WELLFIELD #7G	P107856W	COGEMA MINING, INC.	SENE	9	44	N	76	W		
CR WELLFIELD #7H	P107857W	COGEMA MINING, INC.	NESE	9	44	N	76	W		
HELDT #4	P28847W	JOHN CHRISTENSEN	SESW	9	44	N	76	W	600	Unknown
NPHW-8	P99332W	COGEMA MINING, INC.	NENE	9	44	N	76	W	660	480 - 660
NPHW-12	P99336W	COGEMA MINING, INC.	NESE	9	44	N	76	W	640	465 - 640
HARTZOG FEDERAL 12-10-4475BG	P165267W	XTO ENERGY INC.	SWNW	10	44	N	75	W		
7MW1	P100644W	COGEMA MINING, INC.	NWNW	10	44	N	76	W	700	505 - 680
7MW2	P100645W	COGEMA MINING, INC.	SWNW	10	44	N	76	W	710	470 - 690
7MW3	P100646W	COGEMA MINING, INC.	NWNW	10	44	N	76	W	665	505 - 585
7MW4	P100647W	COGEMA MINING, INC.	SWNW	10	44	N	76	W	660	410 - 570
7MW5	P100648W	COGEMA MINING, INC.	NWNW	10	44	N	76	W	650	470 - 540
7SM3	P106371W	COGEMA MINING, INC.	NWNW	10	44	N	76	W	395	380 - 395
7SM5	P106373W	COGEMA MINING, INC.	NWNW	10	44	N	76	W	390	225 - 270
7DM3A	P106384W	COGEMA MINING, INC.	NWNW	10	44	N	76	W	780	435 - 520
CR WELLFIELD #7I	P107858W	COGEMA MINING, INC.	SWNW	10	44	N	76	W		
CR WELLFIELD #7J	P107859W	COGEMA MINING, INC.	NWNW	10	44	N	76	W		
RM 03S	P67277W	USDI, BLM** COGEMA MINING, INC.	NWNW	10	44	N	76	W	260	235 - 255
RM 03	P67278W	USDI, BLM** COGEMA MINING, INC.	NWNW	10	44	N	76	W	550	500 - 550
RM 03D	P67282W	USDI, BLM** MALAPAI RESOURCES CO.	NWNW	10	44	N	76	W	700	700 - 760

TABLE 10.17
Tabulation of Adjudicated Groundwater Rights
(Permit area and within three miles of permit boundary)

Permit Name	Permit No.	Owner	Location						Total Depth (feet)	Producing Interval (feet)
NPHW-13	P99337W	COGEMA MINING, INC.	NWNW	10	44	N	76	W	580	495 - 580
NBHW-1	P104126W	POWER RESOURCES INC	SESE	13	44	N	76	W	720	514 - 597
NBHW-2	P104127W	POWER RESOURCES INC	NWSE	13	44	N	76	W	760	557 - 723
NBHW-3	P104128W	POWER RESOURCES INC	NWSE	13	44	N	76	W	810	642 - 805
NBHW-4	P104129W	POWER RESOURCES INC	SWSE	13	44	N	76	W	760	665 - 735
NBHW-5	P104130W	POWER RESOURCES INC	SWSE	13	44	N	76	W	635	572 - 765
BROWN #1	P15068P	BROWN LAND COMPANY	NWNW	13	44	N	76	W	5	1 - 5
NORTH BUTTE P 1 U	P53744W	POWER RESOURCES INC	SESE	13	44	N	76	W	700	472 - 522
NORTH BUTTE P 1 L	P53746W	POWER RESOURCES INC	SESE	13	44	N	76	W	800	720 - 756
NORTH BUTTE P 3	P53750W	POWER RESOURCES INC	SESE	13	44	N	76	W	780	727 - 750
NORTH BUTTE P 4	P53751W	POWER RESOURCES INC	SESE	13	44	N	76	W	660	533 - 625
NORTH BUTTE P 5	P53752W	POWER RESOURCES INC	SESE	13	44	N	76	W	760	549 - 642
NORTH BUTTE P 10	P53757W	POWER RESOURCES INC	NESE	13	44	N	76	W	720	597 - 654
NORTH BUTTE P 12	P53759W	POWER RESOURCES INC	SESE	13	44	N	76	W	660	542 - 646
NORTH BUTTE P 1 M 291P	P74579W	POWER RESOURCES INC	SESE	13	44	N	76	W	780	719 - 770
M11	P87761W	POWER RESOURCES INC	SESE	13	44	N	76	W	660	540 - 640
M12	P87762W	POWER RESOURCES INC	SESE	13	44	N	76	W	650	545 - 640
BROWN #2	P15069P	BROWN LAND COMPANY	NESE	14	44	N	76	W	3	1 - 3
SCHLAUTMANN #13	P14911P	ALBERT W. & MARY E. SCHLAUTMANN	SWNE	15	44	N	75	W	80	Unknown
NORTH MW-A	P164527W	XTO ENERGY, INC	NWSW	15	44	N	75	W		
SHOGRIN FEDERAL #1	P88747W	EXXON CORPORATION	NENW	15	44	N	75	W	1600	1300 - 1446
SHOGRIN FEDERAL #1	P88747W	EXXON CORPORATION	NESW	15	44	N	75	W	1600	1300 - 1446
HARTZOG STATE 43-16-4475BG	P159067W	CH 4 ENERGY, LLC** WY STATE BOARD OF LAND COMMISSIONERS	NESE	16	44	N	75	W		
HARTZOG STATE 41-16-4475BG	P159068W	CH 4 ENERGY, LLC** WY STATE BOARD OF LAND COMMISSIONERS	NENE	16	44	N	75	W		
HARTZOG STATE 34-16-4475BG	P159069W	CH 4 ENERGY, LLC** WY STATE BOARD OF LAND COMMISSIONERS	SWSE	16	44	N	75	W		
HARTZOG STATE 32-16-4475BG	P159070W	CH 4 ENERGY, LLC** WY STATE BOARD OF LAND COMMISSIONERS	SWNE	16	44	N	75	W		
HARTZOG STATE 21-16-4475BG	P159071W	CH 4 ENERGY, LLC** WY STATE BOARD OF LAND COMMISSIONERS	NENW	16	44	N	75	W		
HARTZOG STATE 12-16-4475BG	P159072W	CH 4 ENERGY, LLC** WY STATE BOARD OF LAND COMMISSIONERS	SWNW	16	44	N	75	W		
STATE 14-16-4475	P159290W	LANCE OIL & GAS COMPANY, INC.	SWSW	16	44	N	75	W		
STATE 14-16-4475	P162427W	LANCE OIL & GAS COMPANY, INC** WY STATE BOARD OF LAND COMMISSIONERS	SWSW	16	44	N	75	W		
SAVAGETON EQUITY STATE #1	P35814W	NAOMI A. JORDAN**WYO BOARD OF LAND COMMISSIONERS	NESE	16	44	N	75	W	760	300 - 760
SHOGRIN FEDERAL #1	P88747W	EXXON CORPORATION	NENE	16	44	N	75	W	1600	1300 - 1446
SHOGRIN FEDERAL #1	P88747W	EXXON CORPORATION	NENW	16	44	N	75	W	1600	1300 - 1446
SHOGRIN FEDERAL #1	P88747W	EXXON CORPORATION	NESE	16	44	N	75	W	1600	1300 - 1446
ENL CR WELLFIELD #5E	P104864W	COGEMA MINING, INC.	SWSW	16	44	N	76	W	360	230 - 360
ENL CR WELLFIELD #5G	P104866W	COGEMA MINING, INC.	NENW	16	44	N	76	W	480	420 - 480
ENL CR WELLFIELD #5H	P104867W	COGEMA MINING, INC.	NWSW	16	44	N	76	W	440	380 - 440
ENL CR WELLFIELD #5I	P104868W	COGEMA MINING, INC.	NESW	16	44	N	76	W	460	360 - 460
ENL CR WELLFIELD #5J	P104869W	COGEMA MINING, INC.	SENW	16	44	N	76	W	480	340 - 480
ENL CR WELLFIELD #5K	P104870W	COGEMA MINING, INC.	NWNW	16	44	N	76	W	460	400 - 460
NORTH BUTTE CS STATE #1	P113643W	WYO BOARD OF LAND COMMISSIONERS** YATES PETROLEUM CORPORATION	SENE	16	44	N	76	W		
NORTH BUTTE CS STATE #7	P132838W	YATES PETROLEUM CORP.** WY STATE BOARD OF LAND COMMISSIONERS	NESW	16	44	N	76	W		
NORTH BUTTE CS STATE #5	P132839W	YATES PETROLEUM CORP.** WY STATE BOARD OF LAND COMMISSIONERS	SWNE	16	44	N	76	W		
5 MW1	P96159W	COGEMA MINING, INC.	SENW	16	44	N	76	W	599	340 - 599
5 MW2	P96160W	COGEMA MINING, INC.	NWSW	16	44	N	76	W	462	260 - 462
5 MW3	P96161W	COGEMA MINING, INC.	SENW	16	44	N	76	W	643	345 - 643
5 MW4	P96162W	COGEMA MINING, INC.	SWNW	16	44	N	76	W	500	272 - 496
5 MW5	P96163W	COGEMA MINING, INC.	NENW	16	44	N	76	W	678	330 - 678
5 MW6	P96164W	COGEMA MINING, INC.	SENW	16	44	N	76	W	580	282 - 530
5 MW7	P96165W	COGEMA MINING, INC.	NENW	16	44	N	76	W	625	338 - 625
5 MW8	P96166W	COGEMA MINING, INC.	SENW	16	44	N	76	W	560	310 - 543
5 MW10	P96168W	COGEMA MINING, INC.	SENW	16	44	N	76	W	574	320 - 574
5 MW12	P96170W	COGEMA MINING, INC.	SWNW	16	44	N	76	W	540	315 - 540
5 MW14	P96172W	COGEMA MINING, INC.	NWNW	16	44	N	76	W	574	255 - 574
5 MW16	P96174W	COGEMA MINING, INC.	NWNW	16	44	N	76	W	593	320 - 588
5 MW18	P96176W	COGEMA MINING, INC.	NWNW	16	44	N	76	W	575	310 - 575
5 MW20	P96178W	COGEMA MINING, INC.	NENW	16	44	N	76	W	588	260 - 588
5 MW50	P96198W	COGEMA MINING, INC.	SWSW	16	44	N	76	W	480	255 - 480
5 MW52	P96200W	COGEMA MINING, INC.	SWSW	16	44	N	76	W	433	230 - 430
5 MW54	P96202W	COGEMA MINING, INC.	SWSW	16	44	N	76	W	435	225 - 420
5 MW56	P96204W	COGEMA MINING, INC.	SWSW	16	44	N	76	W	460	245 - 460
5 MW58	P96206W	COGEMA MINING, INC.	NWSW	16	44	N	76	W	480	280 - 475
5 MW59	P96207W	COGEMA MINING, INC.	SESW	16	44	N	76	W	460	315 - 445
5 MW60	P96208W	COGEMA MINING, INC.	NWSW	16	44	N	76	W	500	280 - 485
5 MW61	P96209W	COGEMA MINING, INC.	SESW	16	44	N	76	W	440	275 - 435

TABLE 10.17
Tabulation of Adjudicated Groundwater Rights
(Permit area and within three miles of permit boundary)

Permit Name	Permit No.	Owner	Location						Total Depth (feet)	Producing Interval (feet)
5 MW62	P96210W	COGEMA MINING, INC.	NWSW	16	44	N	76	W	480	280 - 440
5 MW63	P96211W	COGEMA MINING, INC.	NESW	16	44	N	76	W	500	240 - 480
5 MW64	P96212W	COGEMA MINING, INC.	NWSW	16	44	N	76	W	480	285 - 480
5 MW65	P96213W	COGEMA MINING, INC.	NESW	16	44	N	76	W	500	280 - 465
5 MW66	P96214W	COGEMA MINING, INC.	NWSW	16	44	N	76	W	480	280 - 460
5 MW67	P96215W	COGEMA MINING, INC.	NESW	16	44	N	76	W	520	300 - 520
5 MW68	P96216W	COGEMA MINING, INC.	NWSW	16	44	N	76	W	480	275 - 350
5 MW69	P96217W	COGEMA MINING, INC.	NESW	16	44	N	76	W	560	315 - 540
5 SM3	P96221W	COGEMA MINING, INC.	SWSW	16	44	N	76	W	270	255 - 265
5 SM5	P96223W	COGEMA MINING, INC.	NWSW	16	44	N	76	W	210	185 - 200
5 SM6	P96224W	COGEMA MINING, INC.	NESW	16	44	N	76	W	230	205 - 230
5 SM7	P96225W	COGEMA MINING, INC.	NWNW	16	44	N	76	W	245	160 - 245
5 DM3	P96231W	COGEMA MINING, INC.	SWSW	16	44	N	76	W	670	630 - 660
5 DM5	P96233W	COGEMA MINING, INC.	NWSW	16	44	N	76	W	640	425 - 625
5 DM7	P96235W	COGEMA MINING, INC.	NENW	16	44	N	76	W	680	420 - 680
5 DM8T	P96236W	COGEMA MINING, INC.	NWSW	16	44	N	76	W	525	320 - 525
CR WELLFIELD #5E	P99007W	COGEMA MINING, INC.	SWSW	16	44	N	76	W	360	230 - 360
CR WELLFIELD #5G	P99009W	COGEMA MINING, INC.	NENW	16	44	N	76	W	480	420 - 480
CR WELLFIELD #5H	P99010W	COGEMA MINING, INC.	NWSW	16	44	N	76	W	440	380 - 440
CR WELLFIELD #5I	P99011W	COGEMA MINING, INC.	NESW	16	44	N	76	W	460	360 - 460
CR WELLFIELD #5J	P99012W	COGEMA MINING, INC.	SENW	16	44	N	76	W	480	340 - 480
CR WELLFIELD #5K	P99013W	COGEMA MINING, INC.	NWNW	16	44	N	76	W	460	400 - 460
5DM9T	P99267W	COGEMA MINING, INC.	NESW	16	44	N	76	W	560	335 - 480
5TW1	P99268W	COGEMA MINING, INC.	NENW	16	44	N	76	W	620	500 - 620
CCI #2	P89253W	T-CHAIR LAND COMPANY	NWSE	17	44	N	75	W	440	370 - 420
ENL CR WELLFIELD #5C	P104862W	COGEMA MINING, INC.	SESE	17	44	N	76	W	460	300 - 460
WCPW 1	P48981W	COGEMA MINING, INC.	SESE	17	44	N	76	W	450	310 - 500
WCOW 1	P48982W	COGEMA MINING, INC.	SESE	17	44	N	76	W	350	306 - Unknown
WCOW 2	P48983W	COGEMA MINING, INC.	SESE	17	44	N	76	W	502	310 - 500
WCOW 3	P48984W	COGEMA MINING, INC.	SESE	17	44	N	76	W	450	306 - 505
WCOW-4	P48985W	COGEMA MINING, INC.	SESE	17	44	N	76	W	290	235 - 260
WCOW 6	P48987W	COGEMA MINING, INC.	SESE	17	44	N	76	W	450	311 - 505
WCOW 7	P48988W	COGEMA MINING, INC.	SESE	17	44	N	76	W	450	304 - 502
WCOW 8	P48989W	COGEMA MINING, INC.	SESE	17	44	N	76	W	450	305 - 505
RM 02	P64546W	USDI, BLM** COGEMA MINING, INC.	SESE	17	44	N	76	W	325	290 - 450
WCOW 5	P72816W	COGEMA MINING, INC.	SESE	17	44	N	76	W	645	620 - 697
5 MW40	P95863W	COGEMA MINING, INC.	SESE	17	44	N	76	W	520	280 - 520
5 MW42	P95864W	COGEMA MINING, INC.	SESE	17	44	N	76	W	500	260 - 500
5 MW44	P95865W	COGEMA MINING, INC.	SESE	17	44	N	76	W	540	280 - 540
5 MW46	P95866W	COGEMA MINING, INC.	SESE	17	44	N	76	W	520	300 - 520
5 DM4	P96232W	COGEMA MINING, INC.	SESE	17	44	N	76	W	720	640 - 710
CR WELLFIELD #5C	P99005W	COGEMA MINING, INC.	SESE	17	44	N	76	W	465	278 - 465
T-CHAIR RANCH 43-18-4475	P149751W	WILLIAMS PRODUCTION RMT COMPANY	NESE	18	44	N	75	W		
NORTH BUTTE MN 1	P53741W	POWER RESOURCES INC	SESW	18	44	N	75	W	966	908 - 955
NORTH BUTTE P 6	P53753W	POWER RESOURCES INC	SWSW	18	44	N	75	W	660	528 - 621
M4	P87754W	POWER RESOURCES INC	SESW	18	44	N	75	W	580	472 - 560
M5	P87755W	POWER RESOURCES INC	SESW	18	44	N	75	W	640	512 - 615
M6	P87756W	POWER RESOURCES INC	SESW	18	44	N	75	W	640	515 - 600
M7	P87757W	POWER RESOURCES INC	SWSW	18	44	N	75	W	640	180 - 520
M8	P87758W	POWER RESOURCES INC	SWSW	18	44	N	75	W	640	455 - 615
M9	P87759W	POWER RESOURCES INC	SWSW	18	44	N	75	W	640	485 - 630
M10	P87760W	POWER RESOURCES INC	SWSW	18	44	N	75	W	640	535 - 630
UM3	P87776W	POWER RESOURCES INC	SESW	18	44	N	75	W	340	295 - 322
UM4	P87777W	POWER RESOURCES INC	SWSW	18	44	N	75	W	360	295 - 335
UM5	P87778W	POWER RESOURCES INC	SWSW	18	44	N	75	W	360	270 - 295
UM6	P87779W	POWER RESOURCES INC	SWSW	18	44	N	75	W	350	250 - 320
UUM2	P87785W	POWER RESOURCES INC	SWSW	18	44	N	75	W	220	190 - 197
BROWN PIEZOMETER L	P50578W	POWER RESOURCES INC	NESE	19	44	N	75	W	640	576 - 640
BROWN PIEZOMETER M	P50579W	POWER RESOURCES INC	NESE	19	44	N	75	W	528	421 - 528
BROWN PIEZOMETER N	P50580W	POWER RESOURCES INC	NESE	19	44	N	75	W	405	315 - 405
BROWN PIEZOMETER R	P50584W	POWER RESOURCES INC	NESE	19	44	N	75	W	520	420 - 520
NORTH BUTTE P 8	P53755W	POWER RESOURCES INC	NWNW	19	44	N	75	W	760	720 - 742
NORTH BUTTE P 9	P53756W	POWER RESOURCES INC	NENW	19	44	N	75	W	640	459 - 549
NORTH BUTTE SSE U	P53770W	POWER RESOURCES INC	NWNE	19	44	N	75	W	291	256 - 290
NORTH BUTTE SSE M	P53771W	POWER RESOURCES INC	NWNE	19	44	N	75	W	556	447 - 551
NORTH BUTTE SSE L	P53772W	POWER RESOURCES INC	NWNE	19	44	N	75	W	680	604 - 667
SSEA 1	P76615W	POWER RESOURCES INC	NWNE	19	44	N	75	W	668	600 - 670
SSEA 2	P76616W	POWER RESOURCES INC	NWNE	19	44	N	75	W	670	601 - 670
SSEA 3	P76617W	POWER RESOURCES INC	NWNE	19	44	N	75	W	666	594 - 660
SSEI 1	P76618W	POWER RESOURCES INC	NWNE	19	44	N	75	W	740	598 - 670
SSEA1 AQ	P76619W	POWER RESOURCES INC	NWNE	19	44	N	75	W	677.5	595 - 670
M1	P87751W	POWER RESOURCES INC	NWNE	19	44	N	75	W	560	440 - 520
M2	P87752W	POWER RESOURCES INC	NWNE	19	44	N	75	W	560	465 - 540
M3	P87753W	POWER RESOURCES INC	SESW	19	44	N	75	W	580	470 - 585
M15	P87765W	POWER RESOURCES INC	NWNW	19	44	N	75	W	640	430 - 590

TABLE 10.17
Tabulation of Adjudicated Groundwater Rights
(Permit area and within three miles of permit boundary)

Permit Name	Permit No.	Owner	Location						Total Depth (feet)	Producing Interval (feet)
M16	P87766W	POWER RESOURCES INC	NENW	19	44	N	75	W	640	465 - 595
M17	P87767W	POWER RESOURCES INC	NENW	19	44	N	75	W	560	455 - 555
M18	P87768W	POWER RESOURCES INC	NENW	19	44	N	75	W	560	440 - 530
M19	P87769W	POWER RESOURCES INC	SWNE	19	44	N	75	W	560	430 - 530
M20	P87770W	POWER RESOURCES INC	NWNE	19	44	N	75	W	560	465 - 540
UM1	P87774W	POWER RESOURCES INC	NWNE	19	44	N	75	W	320	205 - 285
UM2	P87775W	POWER RESOURCES INC	NENW	19	44	N	75	W	420	275 - 320
UM7	P87780W	POWER RESOURCES INC	NWNW	19	44	N	75	W	320	265 - 295
UM8	P87781W	POWER RESOURCES INC	NWNW	19	44	N	75	W	340	295 - 330
UM9	P87782W	POWER RESOURCES INC	NENW	19	44	N	75	W	340	290 - 320
UUM1	P87784W	POWER RESOURCES INC	NWNE	19	44	N	75	W	180	115 - 145
BROWN PIEZOMETER A	P50567W	POWER RESOURCES INC	NESW	20	44	N	75	W	320	199 - 315
BROWN PIEZOMETER O (OH)	P50581W	POWER RESOURCES INC	SWNW	20	44	N	75	W	580	434 - 580
HARTZOG FEDERAL 41-21-4475BG	37/1/297W	CH 4 ENERGY, LLC	NENE	21	44	N	75	W		
EAST PFISTER #1	P11892P	BROWN LAND COMPANY	NESE	21	44	N	75	W	335	307 - 330
ENL CR WELLFIELD #5C	P104865W	COGEMA MINING, INC.	NWNW	21	44	N	76	W	561	480 - 561
HOUSE WELL #3	P24084P	JOHN CHRISTENSEN	NWSE	21	44	N	76	W	450	Unknown
BUTTE PASTURE WELL #9 (DEEPENED)	P24868P	JOHN CHRISTENSEN	NWSE	21	44	N	76	W	160	Unknown
BARN #30	P30147W	JOHN CHRISTENSEN	NESE	21	44	N	76	W	660	420 - 545
5 MW47B	P96196W	COGEMA MINING, INC.	NWNW	21	44	N	76	W	600	430 - 600
5 MW49	P96197W	COGEMA MINING, INC.	NWNW	21	44	N	76	W	560	355 - 560
5 MW51	P96199W	COGEMA MINING, INC.	NWNW	21	44	N	76	W	560	430 - 560
5 MW53	P96201W	COGEMA MINING, INC.	NENW	21	44	N	76	W	560	395 - 560
5 MW55	P96203W	COGEMA MINING, INC.	NENW	21	44	N	76	W	500	335 - 345
5 MW57	P96205W	COGEMA MINING, INC.	NENW	21	44	N	76	W	470	350 - 470
5 SM2	P96220W	COGEMA MINING, INC.	NWNW	21	44	N	76	W	340	310 - 320
5 DM2	P96230W	COGEMA MINING, INC.	NWNW	21	44	N	76	W	760	715 - 750
CR WELLFIELD #5F	P99008W	COGEMA MINING, INC.	NWNW	21	44	N	76	W	561	480 - 561
HARTZOG FEDERAL 23-22-4475BG	37/2/297W	CH 4 ENERGY, LLC	NESW	22	44	N	75	W		
HARTZOG FEDERAL 34-22-4475BG	37/3/297W	CH 4 ENERGY, LLC	SWSE	22	44	N	75	W		
JORDAN #9 MW-A	P164530W	XTO ENERGY, INC	NESW	22	44	N	75	W		
TRAIN CS FEDERAL # 1	P145914W	YATES PETROLEUM CORP.	NENW	22	44	N	76	W		
NBHW-6	P104131W	POWER RESOURCES INC	NENW	24	44	N	76	W	600	535 - 707
NBHW-7	P104132W	POWER RESOURCES INC	SENW	24	44	N	76	W	610	525 - 685
NBHW-8	P104133W	POWER RESOURCES INC	NESW	24	44	N	76	W	640	517 - 635
NBHW-9	P104134W	POWER RESOURCES INC	NESW	24	44	N	76	W	560	396 - 547
NBHW-10	P104135W	POWER RESOURCES INC	SESW	24	44	N	76	W	490	318 - 495
NBHW-11	P104136W	POWER RESOURCES INC	NENW	24	44	N	76	W	665	335 - 657
NBHW-12	P104137W	POWER RESOURCES INC	SENW	24	44	N	76	W	646	317 - 644
NBHW-13	P104138W	POWER RESOURCES INC	SENW	24	44	N	76	W	470	265 - 540
NBHW-14	P104139W	POWER RESOURCES INC	SENW	24	44	N	76	W	520	203 - 630
NBHW-15	P104140W	POWER RESOURCES INC	NENW	24	44	N	76	W	350	282 - 382
NBHW-16	P104141W	POWER RESOURCES INC	SWSW	24	44	N	76	W	670	333 - 664
NBHW-17	P104142W	POWER RESOURCES INC	NESW	24	44	N	76	W	555	365 - 547
NBHW-18	P104143W	POWER RESOURCES INC	NESW	24	44	N	76	W	630	480 - 769
NBHW-19	P104144W	POWER RESOURCES INC	SWNW	24	44	N	76	W	660	493 - 657
NBHW-20	P104145W	POWER RESOURCES INC	NWNW	24	44	N	76	W	630	552 - 717
T CHAIR RANCH 24S-15	P135681W	DEVON ENERGY PRODUCTION CO. LP	SWSE	24	44	N	76	W		
NORTH BUTTE P 2 U	P53747W	POWER RESOURCES INC	NENE	24	44	N	76	W	760	720 - 744
NORTH BUTTE P 2 M	P53748W	POWER RESOURCES INC	NENE	24	44	N	76	W	800	720 - 795
NORTH BUTTE P 2 L	P53749W	POWER RESOURCES INC	NENE	24	44	N	76	W	1000	522 - 620
NORTH BUTTE P 7	P53754W	POWER RESOURCES INC	NENE	24	44	N	76	W	660	539 - 633
NORTH BUTTE P 11	P53758W	POWER RESOURCES INC	NWNE	24	44	N	76	W	820	458 - 649
N BUTTE SS2 U	P53781W	POWER RESOURCES INC	SWNE	24	44	N	76	W	377	304 - 363
N BUTTE SS2 P U	P53782W	POWER RESOURCES INC	SWNE	24	44	N	76	W	378	293 - 375
N BUTTE SS2 M	P53783W	POWER RESOURCES INC	SWNE	24	44	N	76	W	645	466 - 635
N BUTTE SS2 L	P53785W	POWER RESOURCES INC	SWNE	24	44	N	76	W	780	714 - 772
N BUTTE SS2 P L	P53786W	POWER RESOURCES INC	SWNE	24	44	N	76	W	800	708 - 780
N BUTTE SS2 P M 1285P	P74578W	POWER RESOURCES INC	SWNE	24	44	N	76	W	640	306 - 363
SS2BC 1	P76612W	POWER RESOURCES INC	SWNE	24	44	N	76	W	640	467 - 634
SS2BC 2	P76613W	POWER RESOURCES INC	SWNE	24	44	N	76	W	650	465 - 647
SS2FBC AQ	P76614W	POWER RESOURCES INC	SWNE	24	44	N	76	W	459	306 - 359
M13	P87763W	POWER RESOURCES INC	NENE	24	44	N	76	W	640	470 - 640
M14	P87764W	POWER RESOURCES INC	NENE	24	44	N	76	W	640	480 - 630
PB-CBM A25-7	P134568W	Devon Energy production Company, L.P.** T CHAIR RANCH	NWSE	25	44	N	76	W		
T CHAIR RANCH 25S-7	P135680W	DEVON ENERGY PRODUCTION CO. LP	SWNE	25	44	N	76	W		
T CHAIR RANCH 25S-1	P135682W	DEVON ENERGY PRODUCTION CO. LP	NENE	25	44	N	76	W		
BROWN PIEZOMETER H	P50574W	POWER RESOURCES INC	NWSW	25	44	N	76	W	200	92 - 200
NORTH BUTTE P SS1 U	P53760W	POWER RESOURCES INC	NENW	25	44	N	76	W	372	315 - 372
NORTH BUTTE SS1 P U	P53761W	POWER RESOURCES INC	NENW	25	44	N	76	W	354	Unknown

TABLE 10.17
Tabulation of Adjudicated Groundwater Rights
(Permit area and within three miles of permit boundary)

Permit Name	Permit No.	Owner	Location						Total Depth (feet)	Producing Interval (feet)
NORTH BUTTE SS1 M	P53762W	POWER RESOURCES INC	NENW	25	44	N	76	W	454	340 - 380
NORTH BUTTE SS1 P M	P53763W	POWER RESOURCES INC	NENW	25	44	N	76	W	446	Unknown
NORTH BUTTE SS1 L	P53764W	POWER RESOURCES INC	NENW	25	44	N	76	W	654	401 - 515
NORTH BUTTE SS1 P L	P53765W	POWER RESOURCES INC	NENW	25	44	N	76	W	606	Unknown
N BUTTE SS1 (F) U	P53779W	POWER RESOURCES INC	NENW	25	44	N	76	W	185	146 - 184
N BUTTE SS1 (F) P U	P53780W	POWER RESOURCES INC	NENW	25	44	N	76	W	191	143 - 178
RED BARREL #1	P63604W	T-CHAIR LIVESTOCK CO.	SWNW	25	44	N	76	W	525	375 - 420
NORTH BUTTE SSW U	P53766W	POWER RESOURCES INC	SENE	26	44	N	76	W	216	166 - 216
NORTH BUTTE SSW UM	P53767W	POWER RESOURCES INC	SWNE	26	44	N	76	W	346	305 - 346
NORTH BUTTE SSW LM	P53768W	POWER RESOURCES INC	SWNE	26	44	N	76	W	483	354 - 477
NORTH BUTTE SSW L	P53769W	POWER RESOURCES INC	SWNE	26	44	N	76	W	605	566 - 602
PUMPKIN BUTTES RANCH 23-27-4475	P144907W	WILLIAMS PRODUCTION RMT COMPANY	NESW	27	44	N	75	W	1530	1449 - 1522
PUMPKIN BUTTES 14-27-4475	P162032W	LANCE OIL & GAS COMPANY, INC	SWSW	27	44	N	75	W		
PUMPKIN BUTTES 32-27-4475	P162033W	LANCE OIL & GAS COMPANY, INC	SWNE	27	44	N	75	W		
PUMPKIN BUTTES 34-27-4475	P162035W	LANCE OIL & GAS COMPANY, INC	SWSE	27	44	N	75	W		
CALVING SHED #18	P24095P	JOHN CHRISTENSEN	NWNW	27	44	N	76	W	140	Unknown
BEECHER NE WELL #25	P24101P	JOHN CHRISTENSEN	SWSW	28	44	N	76	W	340	
DEL GULCH #35	P43598W	JOHN CHRISTENSEN	NWNW	28	44	N	76	W	464	365 - 454
DOBIE HILL WELL #1	P114048W	T-CHAIR LAND COMPANY	SWSE	29	44	N	75	W	640	583 - 610
T CHAIR LAND 29S-1	P143827W	DEVON ENERGY PRODUCTION COMPANY, L.P.	NENE	29	44	N	75	W		
T CHAIR LAND 29S-3	P143828W	DEVON ENERGY PRODUCTION COMPANY, L.P.	NENW	29	44	N	75	W		
T CHAIR LAND 29S-5	P143829W	DEVON ENERGY PRODUCTION COMPANY, L.P.	SWNW	29	44	N	75	W		
BROWN PIEZOMETER G	P50573W	POWER RESOURCES INC	SWSW	29	44	N	75	W	320	265 - 320
BROWN PIEZOMETER J	P50576W	POWER RESOURCES INC	NWNW	29	44	N	75	W	110	80 - 110
BROWN PIEZOMETER K	P50577W	POWER RESOURCES INC	NENW	29	44	N	75	W	124	115 - 124
BROWN PIEZOMETER P	P50582W	POWER RESOURCES INC	SENE	29	44	N	75	W	595	567 - 595
BROWN PIEZOMETER Q	P50583W	POWER RESOURCES INC	SWSW	29	44	N	75	W	600	464 - 600
T CHAIR LAND 30S-5	P135683W	DEVON ENERGY PRODUCTION CO. LP	SWNW	30	44	N	75	W		
T CHAIR LAND 30S-1	P143830W	DEVON ENERGY PRODUCTION COMPANY, L.P.	NENE	30	44	N	75	W		
T CHAIR LAND 30S-9	P143831W	DEVON ENERGY PRODUCTION COMPANY, L.P.	NESE	30	44	N	75	W		
BROWN #5	P36013W	FRANKLIN BROWN	SWNE	30	44	N	75	W	540	412 - 518
BROWN PIEZOMETER B	P50568W	POWER RESOURCES INC	NWNW	30	44	N	75	W	300	200 - 280
BROWN PIEZOMETER C	P50569W	POWER RESOURCES INC	NWNE	30	44	N	75	W	340	220 - 300
BROWN PIEZOMETER D	P50570W	POWER RESOURCES INC	SENW	30	44	N	75	W	305	200 - 305
BROWN PIEZOMETER E	P50571W	POWER RESOURCES INC	SENW	30	44	N	75	W	300	204 - 300
BROWN PIEZOMETER F	P50572W	POWER RESOURCES INC	SWNE	30	44	N	75	W	160	21 - 160
BROWN PIEZOMETER I (EYE)	P50575W	POWER RESOURCES INC	SWNW	30	44	N	75	W	80	68 - 80
HANK 1	P33463W	RIO ALGOM MINING CORP	NWSE	31	44	N	75	W	440	354 - 433
CITIES SERVICE BROWN (WS)	P48652W	BROWN LAND COMPANY	NWNW	31	44	N	75	W	702	535 - 590
SHOGRIN FEDERAL #2 (PISTOL POINT)	P108947W	USDI, BLM	NESW	31	45	N	75	W	1730	1440 - 1578
SHOGRIN FEDERAL #1	P88747W	EXXON CORPORATION	NWSE	31	45	N	75	W	1600	1300 - 1446
SHOGRIN FEDERAL #1	P88747W	EXXON CORPORATION	NWSW	31	45	N	75	W	1600	1300 - 1446
SHOGRIN FEDERAL #1	P88747W	EXXON CORPORATION	NWSE	32	45	N	75	W	1600	1300 - 1446
SHOGRIN FEDERAL #1	P88747W	EXXON CORPORATION	NWSW	32	45	N	75	W	1600	1300 - 1446
PUMPKIN BUTTES RANCH 34-33-4475	P144906W	WILLIAMS PRODUCTION RMT COMPANY	SWSE	33	44	N	75	W	1705	1593 - 1683
PUMPKIN BUTTES FED 43-33-4475	P159410W	LANCE OIL & GAS COMPANY, INC.	NESE	33	44	N	75	W		
CAMBLIN 14-33-4475	P162422W	LANCE OIL & GAS COMPANY, INC	SWSW	33	44	N	75	W		
DRY PASTURE #2	P24083P	JOHN CHRISTENSEN	NENE	34	44	N	76	W	160	Unknown
WC - MN 1	P53791W	RIO ALGOM MINING CORP	SWSE	35	44	N	76	W	210	148 - 202
PB-CBM A36-8	P115897W	WY STATE BOARD OF LAND COMMISSIONERS** WYOMING RESOURCES CORPORATION	SESE	36	44	N	76	W	1601	1422 - 1586
PB-CBM A36-7	P115898W	WY STATE BOARD OF LAND COMMISSIONERS** WYOMING RESOURCES CORPORATION	NWSE	36	44	N	76	W	1340	1265 - 1324
PB-CBM A36-6	P115899W	WY STATE BOARD OF LAND COMMISSIONERS** WYOMING RESOURCES CORPORATION	SESW	36	44	N	76	W	1417	1303 - 1384
PB-CBM A36-5	P115900W	WY STATE BOARD OF LAND COMMISSIONERS** WYOMING RESOURCES CORPORATION	NWSW	36	44	N	76	W	1476	1336 - 1470

TABLE 10.17
Tabulation of Adjudicated Groundwater Rights
(Permit area and within three miles of permit boundary)

Permit Name	Permit No.	Owner	Location						Total Depth (feet)	Producing Interval (feet)
PB-CBM A36-4	P115901W	WY STATE BOARD OF LAND COMMISSIONERS** WYOMING RESOURCES CORPORATION	SENE	36	44	N	76	W	1586	1508 - 1624
PB-CBM A36-3	P115902W	WY STATE BOARD OF LAND COMMISSIONERS** WYOMING RESOURCES CORPORATION	NWNE	36	44	N	76	W	1683	1571 - 1668
PB-CBM A36-2	P115903W	WY STATE BOARD OF LAND COMMISSIONERS** WYOMING RESOURCES CORPORATION	SENW	36	44	N	76	W	1620	1477 - 1615
PB-CBM A36-1	P115904W	WY STATE BOARD OF LAND COMMISSIONERS** WYOMING RESOURCES CORPORATION	NWNW	36	44	N	76	W	1690	1558 - 1684
PUMPKIN BUTTES SHANNON UNIT - WATER SOURCE WELL	P131197W	WY STATE BOARD OF LAND COMMISSIONERS** WYOMING RESOURCES CORPORATION	SWSW	36	44	N	76	W	5155	4900 - 5155

NOTE: State Engineer file permit name Brown Piezometer 1 was changed on this table to Brown Piezometer L and North Butte R 5 to North Butte P 5.

P87761W, P87762W, P87763W and P87764W are listed in T75W in the SEO records but were changed to T76W in this table.

11. APPENDIX "D-7", SOIL S

11.1 SCOPE AND OBJECTIVES

This report presents information on the soils occurring on Pathfinder Mines Corporation's North Butte permit area. The area has been previously surveyed, on a large scale, by the U.S. Department of Agriculture, Soil Conservation Service (SCS), and, on a smaller scale, by SCS personnel in 1978 and 1979. In order to bring the 1978-79 work up to current standards, additional field work was initiated in 1988. The major objective of both site-specific studies was to define the existing topsoil resource within the survey area and determine the extent, availability, and suitability of soils material for use in reclamation.

This report has been divided into the following additional sections: METHODOLOGY - Review of Existing Information; 1978-79 Soil Survey; 1988 Soil Survey; Soil Sampling, Description and Analysis; Evaluation of Soil Suitability as a Plant Growth Medium in conjunction with quantitative soil analysis; and Topsoil Volume Calculations; RESULTS AND DISCUSSION - including prime farmland and a summary of the features considered to be the most significant to the 1988 study, in conjunction with previous work. Interpretations are based on the information in site-specific series descriptions and mapping unit descriptions, as well as previously published data of the same or similar soils by the Soil Conservation Service.

October, 1992, Pathfinder incorporated into the permit boundary approximately 50 acres of adjacent lands located along the southern border of the permit area's eastern arm. Soil boundaries for this area added to Figure 11.1 were taken from soils mapping conducted by Cleveland Cliffs in 1978-79, which covered an area larger than the current permit boundary. As no new soils groups occur within this area, no changes have been made to the following sections.

11.2 METHODOLOGY

11.2.1 REVIEW OF EXISTING LITERATURE

The soils of this portion of Campbell County have been mapped by the USDA Soil Conservation Service. Although the soil survey has not been published, it is available in "open file form".

'dditional soil mapping of the current permit area, with the exception of the proposed access road, was conducted in '8-79 by a consultant for Cleveland-Cliffs Iron Co. This previous study was used as a basis for the current field work and subsequent report.

11.2.2 SOIL SURVEY

11.2.2.1 THE 1978-79 SOIL SURVEY

Methodology within this earlier study was in accordance with the standards of the National Cooperative Soil Survey Program. Soils mapping involved the inventory of soil types on the survey area, defining associations and series boundaries by photointerpretation, and field survey and sampling. Field verification included examination of physical characteristics of the soils to determine depth, color, texture, structure, horizon boundaries, and reaction (presence of lime and approximate pH). Soil mapping unit boundaries were delineated on aerial photographs by SCS personnel and transferred to an aerial photo composite of the permit area at a scale of 1"=500' and corrected for distortion (Figure 11.1, Volume II).

Soil samples were collected during the summer of 1979 for analysis. As requested by Mr. Don Crecilius, WDEQ, sample site locations were selected to adequately represent the soils of the area to be disturbed and taken within those areas. Soil profiles were sampled and categorized in the spring and early summer of 1979 and samples were analyzed according to parameters outlined in the current WDEQ Guideline 1 at the time.

Personal contact with SCS personnel, at the time of the earlier work, and follow-up chemical analysis indicated no problems such as excessive salt concentration within the soils of the survey area.

Mapping unit descriptions and profile descriptions for fifteen points including the four points sampled for analysis were compiled for the 1978-79 work.

2.2.2 THE 1988 SOIL SURVEY

Refinement of the existing soil map in 1988 was accomplished according to techniques and procedures of the National Cooperative Soil Survey. Guideline No. 1 (November, 1984) of the Wyoming Department of Environmental Quality, Land Quality Division was used as a guide during all phases of this latter work.

A reconnaissance of the survey area was used to determine the validity of the previous soil survey and to familiarize the field personnel with the area. Soil profiles were examined on a widely scattered basis according to physiographic configuration. Information derived from these profiles was compared with existing SCS data to determine which soils were likely to occur on specific landscape positions.

Following the reconnaissance survey, a higher intensity soil survey was conducted. Actual soil boundaries were delineated in the field by exposing additional soil profiles to determine the nature and extent of soil series present on the survey area.

The soil boundaries were delineated on the I"=500' scale photo base map (Figure IL 1, Volume II). The previous SCS data for the site was available throughout the field survey.

11.2.3 1988 SOIL SAMPLING, DESCRIPTION, AND ANALYSIS

r discussions with state personnel, all soils were sampled and described by exposing the solum with a shovel and then sampling below this point with a bucket auger. The physical and, where possible, chemical nature of each horizon within the sampled profile was described and recorded in the field using standard SCS survey techniques. The sampling site was marked in the field with a numbered stake, and its location and number were plotted on the field map. The sampled soil material was placed in clean, labeled, polyethylene plastic bags, and was kept cool and as dry as possible to limit chemical changes. At the end of the sampling program, the samples were transported to Energy Laboratories in Casper for shipment to Billings.

total of 17 sites were sampled in 1988 for analysis and corresponding soil profile descriptions written. This additional npling and profile description would supplement the 1978-79 sampling and profile descriptions. Soil mapping unit designations and associated acreages are presented in Table 11.1.

11.2.4 EVALUATION OF SOIL SUITABILITY AS A PLANT GROWTH MEDIUM

Refer to discussion within 1988 individual profile descriptions.

11.2.5 TOPSOIL VOLUME CALCULATIONS

Refer to Table 11.2.

11.2.6 1988 PROJECT PARTICIPANTS

Western Environmental, Inc. performed the 1988 soil survey field work and compiled that information and analysis received from Uranerz. All soil analysis was handled under separate contract by Uranerz.

ie soils map associated with this work was submitted to Uranerz for drafting.

11.3 RESULTS AND DISCUSSION

11.3.1 SOIL SURVEY

11.3.1.1 THE 1978-79 SOIL SURVEY

No general discussion.

11.3.1.2 THE 1988 SOIL SURVEY

The soils occurring on the proposed North Butte permit area are typical of the semiarid grasslands of the western United States. Due to prevailing climate and vegetation conditions, organic matter is accumulated slowly, and soils have developed with light-colored surfaces. Subsoil color is usually light brown or yellowish brown.

The greatest proportion of the upland soils of the survey area are residual (developed in place) and are formed from weathered sedimentary bedrock, mpstly sandstone and shale. Most developed soils reflect the character of the bedrock. Areas of sandy and medium-textured friable soils are underlain by sandstone and sandy shale. Heavy clay soils are underlain by clayey shale. Depending primarily on the parent material from which the soils have formed, these soils vary widely in both depth and suitability of the material for topsoiling.

Stream channels of the survey area are characterized by alluvial soils such as the Kishona (Kim) series. These soils are developed from a variety of material washed from the uplands and redeposited along the stream courses. The soils formed in alluvium reflect the character of the weathered, transported material. These soils often have a generally dark friable surface that contains a fair amount of organic matter.

11.3.2 SOIL SAMPLING AND ANALYSIS

11.3.2.1 THE 1.978-79 SOIL SURVEY

Applicable mapping unit descriptions and profile descriptions are provided.

11.3.2.2 THE 1988 SOIL SURVEY

As can be seen in the 1988 profile descriptions and analysis, several of the pH's within the soils sampled were slightly lower than that normally found in the specified soil series. These lower pH values are likely results of geologic conditions within the survey area.

Lab analysis of the 1988 soil samples did not include percent fine sands. This made detailed differentiation between series partially dependent on this value somewhat difficult. However, based on field observations of fine sands within individual peds as well as topographic position and overall lab texture, series designation was determined.

Silt content of some of the samples was higher than expected with the resultant lab textures not specifically matching field textures. Since many of the differences were related to clay content, it is assumed total dispersion of the soil sample may not have been attained.

The sampled Shingle turned out to have higher clay content than that normally defined for the series. Therefore, the sample was labeled Samday (Samsil) and the report adjusted accordingly.

No prime farmland was indicated within the North Butte permit area.

TABLE 11.1
SOIL MAPPING UNIT ACREAGES

Map Designation	Description (soil series, slope percent)	Acreacte	%
50/AB	Bidznan clay loam, 0 to 6	189.5	9.0
BO	Bawbac sandy loam, 6 to 15	89.6	9.1
PA	Panaleed clay loam, 6 to 10	49.0	4.9
75/BC	Custm an loam, 3 to 10	114.1	11.5
b45/AB	Forkwood loam, 0 to 6	44.9	9.6
1A	Haverdad, 0 to 3	11.3	1.1
FC /AB	Kishona loam, 0 to 6	5.7	0.6
a62/AB	Hiland loam, 0 to 6	31.7	3.2
a62/C	Hiland fine sandy loam, 6 to 10	12.9	1.3
Re/C	Renohill loam, 6 to 14	2.8	0.3
SH	Shingle clay loam, 3 to 30	15.8	1.6
H-G	Shingle clay loam, gullied	131.6	13.3
15]./DE	Shingle-Rock Outcrop, 10 to 60	29.8	3.0
347/D	Shingle-Rock Outcrop-Samday 10 to 30	152.1	15.4
TA	Taluce sandy loam, 15 to 40	55.1	5.6
TH	Theedle loam, 3 to 15	23.0	2.3
TE	Terro sandy loam, 6 to 15	18.5	1.9
TUR	Turnercrest loam, 3 to 10	6.5	0.7
354/AB	Ulm-Bidnan assoc., gently sloping	33.2	3.4
394/CD	Cushman-Bowbac assoc., rolling	12.9	1.3
Zg/B	Zigweid loam, 3 to 6	3.9	0.4
D	Disturbed	5.1	0.5
	TOTALS	989.0	100.0

TABLE 11.2
NORM B LT= E TOPSOIL VOLUME DEIEF NATION

ıp esignation	Description	Average Depth (inches)	Estimated Volumes (cubic yds)
50/AB	Bidman clay loam	60	721,967
BO	Bowbac sandy loam	36	433,664
PA	Pan leed loam	36	237,160
75/BC	Cushman loam	36	552,244
b45/AB	Forkwood loam	60	765,527
1A	Haverdad	30	45,577
KI/AB	Kishona loam	60	45,980
a62/AB	Hiland loam	60	255,713
a62/C	Hi-land fine sandy loam	60	104,060
Re/C	Renohi.ll clay	30	11,293
I	Shingle clay loam	15	31,863
SH-G	Shingle, gullied	6	106,157
151/DE	Shingle-Rock outcrop	6	24,039
347/D	Shingle-Rock- Samday	6	122,694
TA	Taluce sandy loam	15	111,118
TH	Theedle loam	36	111,320
TE	Terro sandy loam	36	89,540
TUR	Turnercrest loam	36	31,460
354/AB	Ulm-Bidman	60	267,813
394/CD	Cushman-Bowbac	36	621436
ZgB	Zigweid loam, 3 to 6	60	31,460
D	Disturbed	0	0
	TOTAL		4,163,085

Power Resources Inc.

1.4 MAPPING UNIT DESCRIPTIONS

Unit BO Bowbac sandy loam

The Bowbac sandy loam map unit consists of gently sloping to moderately steep, welldrained soils that formed in slopewash alluvium and residuum derived primarily from sandstone. Slopes range from 6 to 15 percent. The vegetation consists of various grasses and big sagebrush.

Included in this unit are small areas of Cushman clay loam. These inclusions comprise less than 10 percent of the total acreage within this mapping unit.

Within individual profiles, permeability is moderately rapid, and the available water capacity is moderate. The effective rooting depth is 20 to 40 inches.

These soils are used primarily for range.

Unit 75/BC Cushman loam

e Cushman loam map unit consists of sloping and moderately steep, well-drained soils that formed in residuumweathered from loarnstone on uplands. Slopes range from 3 to 10 percent. The vegetation consists of various grasses, big sagebrush, and cactus.

Included in this unit are small areas of Parmleed clay loam. These inclusions comprise less than 5 percent of the total acreage within this mapping unit.

Within individual profiles, permeability is moderately rapid, and the available water capacity is low to moderate. The effective rooting depth is 20 to 40 inches.

These soils are used for range and wildlife habitat.

nit KI/AB Kishona loam

e Kishona loam map unit consists of nearly level, well-drained soils that formed in alluvium on alluvial fans and old terraces. Slopes range from 0 to 6 percent. The vegetation consists of various grasses, big sagebrush, and cactus.Included in this unit are small areas of Zigweid loam and Shingle clay loam. These inclusions comprise less than 10 percent of the total acreage within this mapping unit.

Within individual profiles, permeability is moderately rapid, and the available water capacity. is moderate to high. The effective rooting depth is more than 60 inches.

These soils are used for range and wildlife habitat. Unit

PA Parmleed clay loam

The Parmleed clay loam map unit consists of nearly level to moderately steep, welldrained soils that formed in residuum weathered from loamstone and shale on the lower parts of rolling uplands. Slopes range from 6 to 10 percent. The vegetation consists of various grasses, cactus, and big sagebrush.

luded in this unit are small areas of Cushman clay loam and Renohill loam. These inclusions comprise less than 10 percent of the total acreage within this mapping unit.

Within individual profiles, permeability is slow, and the available water capacity is high. The effective rooting depth is 20 to 40 inches.

These soils are used primarily for range.

'nit Re/C Renohill loam

'e Renohill loam map unit consists of nearly level to moderately steep, well-drained soils that formed in residuum weathered from shale on upland ridges and hillsides. Slopes range from 6 to 14 percent. The vegetation consists of big sagebrush and various grasses.

Included in this unit are small areas of Parmleed clay loam and Cushman clay loam. These inclusions comprise less than 15 percent of the total acreage within this mapping unit.

Within individual profiles, permeability is slow, and the available water capacity is moderate. The effective rooting depth is 20 to 40 inches.

These soils are used for range and wildlife habitat.

Unit SH Shingle clay loam

The Shingle clay loam map unit consists of gently sloping to steep, well-drained soils that formed in residuum derived from sandstone and loamstone on ridgetops and hillsides.' Slopes range from 3 to 30 percent. The vegetation consists of 'arious grasses and upland sedges.

Included in this unit are small areas of Cushman clay loam, Theedle loam, Kishona loam, and Zigweid loam. These 'inclusions comprise less than 20 percent of the total acreage within this mapping unit.

Within individual profiles, permeability is moderately rapid to slow, and the available water capacity is low. The effective rooting depth is 6 to 18 inches.

These soils are used primarily for range.

Unit SH-G Shingle clay loam. gullied

The Shingle, gullied map unit consists of shallow, well drained, medium to finetextured soils that formed in sediments of the Fort Union and Wasatch formations. They occur as actively eroding gullies in uplands which produce extremely steep and moderately steep topography. The vegetation consists of scattered grasses and shrubs.

Included in this unit are small areas of Theedle loam and Kishona loam. These inclusions comprise less than 20 percent of the total acreage within this Mapping unit.

Within individual profiles, permeability is slow to moderate, and available water capacity is low to moderate. The effective rooting depth is 10 to 20 inches on the shallow sites.

These soils are used for rangeland and wildlife habitat.

Unit TA Taluce sandy loam

The Taluce sandy loam map unit consists of moderately steep to steep, excessivelydrained soils that formed in residuum weathered from sandstone on ridges. Slopes range from 15 to 40 percent. The vegetation consists of various grasses, upland sedges, and cactus.

Included in this unit are small areas of Turnercrest loam, Bowbac sandy loam, Terro sandy loam and Shingle clay loam. These inclusions comprise less than 20 percent of the total acreage within this mapping unit.

Within individual profiles, permeability is moderately rapid, and the available water capacity is low. The effective rooting depth is 6 to 18 inches.

These soils are used for range and wildlife habitat.

Unit TE Terro sandy loam

The Terro sandy loam map unit consists of gently sloping to moderately steep, welldrained soils that formed in residuum derived primarily from sandstone. Slopes range from 6 to 15 percent. The vegetation consists of various grasses and upland sedges.

Included in this unit are small areas of Bowbac sandy loam, Turnercrest loam, and Taluce sandy loam. These inclusions comprise less than 10 percent Qf the total acreage within this mapping unit.

Within individual profiles, permeability is rapid, and the available water capacity is moderate to low. The effective rooting depth is 20 to 40 inches.These soils are used primarily for range.

Unit TH Theedle loam

The Theedle loam map unit consists of sloping and moderately steep, well-drained soils that formed in residuum weathered from loamstone on uplands. Slopes range from 3 to 15 percent. The vegetation consists of various grasses, big sagebrush, and cactus.

Included in this unitt are small areas of Shingle clay loam and Cushman clay loam. These inclusions comprise less than 10 percent of the total acreage within this mapping unit.

Within individual profiles, permeability is moderately rapid, and the available water capacity is low to moderate. The effective rooting depth is 20 to 40 inches.

These soils are used for range and wildlife habitat.

Unit TUR Turnercrest loam

'e Turnercrest loam map unit consists of gently sloping to moderately steep, welldrained soils that formed in eolian osits and residuum derived primarily from sandstone. Slopes range from 3 to 10 percent. The vegetation consists of various grasses and upland sedges.

Included in this unit are small areas of Bowbac sandy loam, Taluce sandy loam, and Terro sandy loam. These inclusions comprise less than 10 percent of the total acreage within this mapping unit.

Within individual profiles, permeability is rapid, and the available water capacity is low to moderate. The effective rooting depth is 20 to 40 inches.

These soils are used primarily for range.

Unit Za/B Ziaweid loam

The Zigweid loam map unit consists of nearly level, well-drained soils that formed in alluvium derived from sandstone and loamstone on alluvial fans. Slopes range from 3 to 6 percent. The vegetation consists of various grasses.

cluded in this unit are small areas of Kishona loam. These inclusions comprise less than 10 percent of the total acreage within this mapping unit.

Within individual profiles, permeability is moderately rapid, and the available water capacity is high. The effective rooting depth is more than 60 inches.

These soils are used for range and wildlife habitat.

DMAN

Unit 354AB Ulm-Bidman association, gently sloping Unit
50/AB Bidman clay loam, 0 to 6 percent slopes

The Bidman series is a member of the fine, montmorillonitic, mesic family of Ustollic Paleargids. Typically, Bidman soils have very friable, medium granular, slightly acid E horizons resting abruptly on fine textured Bt horizons having prismatic and angular blocky structure, and fine to medium-textured Bk horizons in which secondary calcium carbonate has accumulated.

Description of Typical Profile

A typical example of the Bidman series was described and sampled for chemical analysis approximately 2150 feet east of the west section line of Section 25 and 4060 feet south of the north section line of Section 25, Township 44 North, Range 76 West (Sample Point No. 88-1).

0 to 3 inches. Light brownish gray (10YR 6/2) clay loam, dark grayish brown (10YR 4/2) moist; weak, thin, platy structure parting to very fine granular; soft, very friable; mildly alkaline (pH 7.4); abrupt, smooth boundary.

Bt 3 to 20 inches. Brown (IOYR 5/3) silty clay, dark brown (10YR 4/3) moist; strong, medium, prismatic structure parting to strong, medium, angular blocky; hard, firm, very sticky and very plastic; mildly alkaline (pH 7.5); clear, wavy boundary.

20 to 36 inches. Light yellowish-brown (2.5Y 6/3) silty clay, light olive brown (2.5Y 5/3) moist; weak, coarse, prismatic structure parting to moderate, coarse, angular and subangular blocky; hard, very friable, sticky and plastic; mildly alkaline; gradual, wavy boundary.

Bk1 36 to 40 inches. Light olive-brown (2.5Y 5/3) silty clay, olive brown (2.5Y 4/3) moist; massive; hard, very friable; sticky and slightly plastic; mildly alkaline; gradual, wavy boundary.

Bk2 40 to 60 inches. Light olive-brown (2.5Y 5/3) clay loam, olive brown (2.5Y 4/3) moist; massive; hard, very friable; mildly alkaline; slightly sticky and slightly plastic; mildly alkaline (pH 7.4).

Range of Characteristics on the Survey Area

Depth to calcareous material was greater than that normally found in the series.

Silt content of the 3 to 20 inch and 20 to 40 inch intervals is within or barely exceeding the upper range for the series and may not be typical throughout the survey area.

Reaction of the E horizon is slightly higher than that generally found in the series.
action of the Bk horizons is lower than that generally found in the series.

Depth of Material Appearing Suitable for Topsoil

Depth of material appearing suitable on the survey area for the Bidman series ranged from 45 inches to 60 inches, but average depth of material appearing suitable for the series was approximately 60 inches.

't BO Bowbac sandy loam, 6 to 15 percent slopes

The Bowbac series is a member of the fine-loamy, mixed, mesic family of Ustollic Haplargids. Typically, Bowbac soils have very friable granular A horizons, moderately well developed Bt horizons with prismatic structure that when disturbed break to subangular blocks, and medium-textured Bk horizons in which secondary calcium carbonate has accumulated underlain with soft, calcareous, sandstone.

Description of Typical Profile

A typical example of the Bowbac series was described and sampled for chemical analysis approximately 1850 feet east of the west section line of Section 13 and 140 feet north of the south section line of Section 13, Township 44 North, Range 76 West (Sample Point No. 88-9).

A 0 to 3 inches. Brown (10YR 5/3) sandy loam, dark brown (10YR 4/3) moist; moderate, coarse, granular structure; slightly hard, friable, slightly sticky and slightly plastic; medium acid; clear, smooth boundary.

AB 3 to 6 inches. Brown (10YR 5/3) sandy loam, dark brown (10YR 4/3) moist; moderate, coarse, granular structure; slightly hard, friable, slightly sticky and slightly plastic; medium acid; clear, smooth boundary.

Bt 6 to 12 inches. Brown (10YR 5/3) sandy clay loam, dark brown (10YR 4/3) moist; moderate, coarse, prismatic structure parting to moderate medium and coarse subangular blocky; very hard, firm, sticky and plastic; neutral; clear, smooth boundary..

Btk 12 to 14 inches. Pale-brown (10YR 6/3) sandy clay loam, brown (10YR 5/3) moist; weak, medium, subangular blocky structure; hard, firm, slightly sticky and slightly plastic; mildly alkaline; clear, smooth boundary.

Bk 14 to 36 inches. Pale brown (IOYR 6/3) sandy clay loam, brown (10YR 5/3) moist; massive; slightly hard, friable, slightly sticky and slightly plastic; mildly alkaline (ph 7.7); abrupt, wavy boundary.

Cr 36 inches plus. Soft, calcareous sandstone.

Range of Characteristics on the Survey Area

Depth to paralithic contact varied from 24 to 39 inches.

Reaction of the A horizon is lower than that generally found in the series.

Depth of Material Appearing Suitable for Topsoil

Depth of material appearing suitable on the survey area for the Bowbac series was approximately 36 inches.

Unit 75/BC Cushman loam, 3 to 10 percent slopes

The Cushman series is a member of the fine-loamy, mixed, mesic family of Ustollic Haplargids. Typically, Cushman soils have very friable granular A horizons, Bt horizons with prismatic structure that when disturbed break to angular and subangular blocks, and medium-textured, calcareous Bk horizons underlain with stratified calcareous shales and loamstone.

Description of Typical Profile

A typical example of the Cushman series was described and sampled for chemical analysis approximately 575 feet east of the west section line of Section 25 and 275 feet south of the north section line of Section 25, Township 44 North, Range 76 West (Sample Point No. 88-3).

A 0 to 3 inches. Light brownish gray (IOYR 6/2) loam, dark grayish brown (10YR 4/2) moist; weak, thin, platy structure parting to moderate, medium, crumb; soft, very friable; slightly sticky and slightly plastic; neutral; clear, smooth boundary.

AB 3 to 6 inches. Brown (1 OYR 5/3) loam, dark brown (IOYR 4/3) moist; moderate, medium, granular structure; soft, friable, slightly sticky and slightly plastic; neutral; clear, smooth boundary.

Bt 6 to 22 inches. Brown (IOYR 5/3) clay loam, dark brown (10YR 4/3) moist; strong, medium, prismatic structure parting to moderate, medium, subangular blocky; slightly hard, friable, sticky and plastic; neutral; clear, smooth boundary.

Btk 22 to 26 inches. Pale brown (10YR 6/3) clay loam, yellowish-brown (10YR 5/4) moist; moderate, medium, subangular blocky; slightly hard, friable, slightly sticky and slightly plastic; mildly alkaline; clear, smooth boundary.

Bkl 26 to 28 inches. Pale brown (10YR 6/3) loam, yellowish-brown (10YR 5/4) moist; massive; hard, friable, slightly sticky and slightly plastic; mildly alkaline; gradual, wavy boundary.

Bk2 28 to 36 inches. Pale brown (IOYR 6/3) loam, brown (JOYR 5/3) moist; massive; hard, friable, slightly sticky and slightly plastic; mildly alkaline.

Cr 36 inches plus. Weathered, calcareous shales.

Range of Characteristics on the Survey Area

Depth to paralithic contact ranged from 24 inches to 39 inches.

action of the B horizons is lower than that generally found in the series.

Death of Material Appearing Suitable for Topsoil

Depth of material appearing suitable on the survey area for the Cushman series ranged from 24 to 39 inches, but average depth of material appearing suitable for topsoil was approximately 36 inches.

FORK WOOD

(formerly Fort Collins)

Unit b45/AB Forkwood loam, 0 to 6 percent slopes

The Forkwood series is a member of the fine-loamy, mixed, mesic family of Ustollic Haplargids. Typically, Forkwood soils have friable granular A horizons, Bt horizons with prismatic structure that when disturbed break to sub angular blocks, and medium-textured Bk horizons in which secondary calcium carbonate has accumulated.

Description of Typical Profile

A typical example of the Forkwood series was described and sampled for chemical analysis approximately 2850 feet east of the west section line of Section 24 and 2350 feet north of the south section line of Section 24, Township 44 North, Range 76 West (Sample Point No. 88-6).

A 0 to 5 inches. Light brownish gray (IOYR 6/2) loam, dark grayish brown (10YR 4/2) moist; moderate, fine, granular structure; soft, very friable, nonsticky and nonplastic; slightly acid (pH 6.2); clear, smooth boundary.

Bt 1 5 to 8 inches. Grayish-brown (10YR 5/2) loam, dark grayish brown (10YR 4/2) moist; moderate, fine subangular blocky structure; slightly hard, friable, slightly sticky and slightly plastic; slightly acid; clear, smooth boundary.

Bt 2 8 to 26 inches. Brown (10YR 5/3) loam, dark brown (IOYR 4/3) moist; weak, medium, subangular blocky; slightly hard, firm, slightly sticky and slightly plastic; slightly acid; clear, smooth boundary.

Bt k 26 to 30 inches. Pale-brown (JOYR 6./3) loam, brown (10YR 5/3) moist; weak, coarse, subangular blocky structure; loose, friable, slightly sticky and nonplastic; mildly alkaline; clear, smooth boundary.

FORK WOOD (cont.)

Bk 1 30 to 48 inches. Pale-brown (10YR 6/3) loam, brown (IOYR 5/3) moist; massive; loose, friable, nonsticky and nonplastic; mildly alkaline; gradual, wavy boundary.

Bk 2 48 to 60 inches. Light brownish gray (2.5Y 6/2) sandy loam, dark grayish brown (2.5Y 4/2) moist; massive; loose, very friable, nonsticky and nonplastic; mildly alkaline (pH 7.7).

Range of Characteristics on the Survey Area

Depth to paralithic ranged from 41 inches to greater than 60 inches.
Reaction throughout the profile is lower than that generally found in the series.

Depth of Material Appearing Suitable for Topsoil

Average depth of material appearing suitable for the Forkwood series was greater than 60 inches.

FORK WOOD

(formerly Fort Collins)

Unit b45/AB Forkwood loam, 0 to 6 percent slopes

The Forkwood series is a member of the fine-loamy, mixed, mesic family of Ustollic Haplargids. Typically, Forkwood soils have friable granular A horizons, Bt horizons with prismatic structure that when disturbed break to subangular blocks, and medium-textured Bk horizons in which secondary calcium carbonate has accumulated.

Description of Typical Profile

A typical example of the Forkwood series was described and sampled for chemical analysis approximately 2050 feet west of the east section line of Section 24 and 2350 feet south of the north section line of Section 24, Township 44 North, Range 76 West (Sample Point No. 88-13).

A 0 to 4 inches. Light brownish gray (10YR 6/2) loam, dark grayish brown (IOYR 4/2) moist; moderate, fine, granular structure; soft, very friable, nonsticky and nonplastic; medium acid; clear, smooth boundary.

AB 4 to 6 inches. Grayish-brown (10YR 5/2) loam, dark grayish brown (10YR 4/2) moist; moderate, fine, granular structure; soft, friable, slightly sticky and nonplastic; medium acid; clear, smooth boundary.

Bt 6 to 18 inches. Grayish-brown (IOYR 5/2) sandy clay loam, dark grayish brown (10YR 4/2) moist; strong, medium prismatic structure parting to moderate, coarse subangular blocky; hard, firm, slightly sticky and slightly plastic; slightly acid; clear, smooth boundary.

FORKWOOD (cont.)

BC 18 to 22 inches. Brown (10YR 5/3) sandy clay loam, dark brown (10YR 4/3) moist; weak, medium, subangular blocky; slightly hard, firm, slightly sticky and slightly plastic; slightly acid; clear, wavy boundary.

Cl 22 to 30 inches. .Pale-brown (10YR 6/3) sandy clay loam, brown (10YR 5/3) moist; massive; hard, firm, slightly sticky and slightly plastic; neutral; clear, smooth boundary.

C2 30 to 41 inches. Light brownish gray (10YR 6/2) sandy clay loam, brown (10YR 5/3) moist; massive; hard, friable, slightly sticky and slightly plastic; mildly alkaline.

Range of Characteristics on the Survey Area

Depth to paralithic ranged from 41 inches to greater than 60 inches.

Reaction throughout the profile is lower than that generally found in the series.

Depth of Material Appearing Suitable for Topsoil

Average depth of material appearing suitable for the Forkwood series was greater than 60 inches.

HILAND
(formerly Olney)

Unit a62/AB Hiland loam, 0 to 6 percent slopes

The Hiland series is a member of the fine-loamy, mixed, mesic family of Ustollic Haplargids. Typically, Hiland soils have friable granular noncalcareous A horizons, moderately well developed Bt horizons with prismatic structure, medium to coarse textured Bk horizons in which secondary calcium carbonate has accumulated, and medium to coarse-textured C-horizons.

Description of Typical Profile

A typical example of the Hiland series was described and sampled for chemical analysis approximately 2125 feet east of the west section line of Section 24 and 75 feet north of the south section line of Section 24, Township 44 North, Range 76 West (Sample Point No. 88-4).

A 0 to 6 inches. Grayish brown (10YR 5/2) loam, dark grayish brown (10YR 4/2) moist; weak, fine, granular structure; soft, very friable, nonsticky and nonplastic; neutral (pH 6.9); clear, smooth boundary.

Bt 1 6 to 17 inches. Light yellowish-brown (10YR 6/4) clay loam, yellowish brown (10YR 5/4) moist; moderate, medium, prismatic structure parting to moderate, medium, angular blocky structure; slightly hard, friable, slightly sticky and slightly plastic; neutral; clear, wavy boundary.

Bt 2 17 to 19 inches. Light yellowish-brown (10YR 6/4) clay loam, yellowish brown (10YR 5/4) moist; moderate, medium subangular blocky structure; slightly hard, friable, slightly sticky and slightly plastic; neutral; clear, wavy boundary.

HILAND (cont.)

Bk 1 19 to 42 inches. Very pale brown (10YR 7/3) loam, pale brown (10YR 6/3) moist; massive; slightly hard, friable, slightly sticky and nonplastic; mildly alkaline (pH 7.7); gradual, wavy boundary.

Bk 2 42 to 60 inches. Pale-brown (10YR 6/3) loam, brown (1OYR 5/3) moist; massive; soft, very friable, nonsticky and nonplastic; mildly alkaline (pH 7.7).

Range of Characteristics on the Survey Area

Within the Bt horizon at this location, the percent of clay was slightly over the range for a fine-loamy family. Overall, this sample was heavier than that normally found in the series.

Depth of Material Appearing Suitable for Topsoil

Depth of material appearing suitable on the survey area for the Hiland series was greater than 60 inches.

HILAND
(formerly Olney)

Unit a62/AB Hiland loam, 0 to 6 percent slopes

The Hiland series is a member of the fine-loamy, mixed, mesic family of Ustollic Haplargids. Typically, Hiland soils have friable granular noncalcareous A horizons, moderately well developed Bt horizons with prismatic structure, medium to coarse textured Bk horizons in which secondary calcium carbonate has accumulated, and medium to coarse-textured C-horizons.

Description of Typical Profile

A typical example of the Hiland series was described and sampled for chemical analysis approximately 2350 feet east of the west section line of Section 24 and 2350 feet south of the north section line of Section 24, Township 44 North, Range 76 West (Sample Point No. 88-7).

A 0 to 7 inches. Grayish brown (10YR 5/2) loam, dark grayish brown (10YR 4/2) moist; weak, fine, granular structure; soft, very friable, nonsticky and nonplastic; medium acid (pH 5.8); clear, smooth boundary.

Bt 7 to 24 inches. Light yellowish-brown (10YR 6/4) loam, yellowish brown (10YR 5/4) moist; moderate, medium prismatic structure parting to moderate, medium subangular blocky; hard, firm, slightly sticky and slightly plastic; medium acid (pH 5.9); clear, wavy boundary.

C1 24 to 42 inches. Very pale brown (10YR 7/3) loam, pale brown (10YR 6/3) moist; massive; lightly hard, firm, slightly sticky and slightly plastic; neutral (pH 6.7); clear, wavy boundary.

HILAND (cont.)

C2 42 to 48 inches. Light brownish gray (10YR 6/2) loam, brown (IOYR 5/3) moist; massive; hard, friable, slightly sticky and slightly plastic; mildly alkaline; clear, wavy boundary.

Ck 2 48 to 60 inches. Light gray (IOYR 7/2) loam, light brownish gray (IOYR 6/2) moist; massive; hard, friable, slightly sticky and slightly plastic; mildly alkaline.

Range of Characteristics on the Survey Area

Surface pH values were generally lower than that found within the series. In addition, the clay content of the Bt is on the lower end of the range for the series.

Depth of Material Appearing Suitable for Topsoil

Average depth of material appearing suitable for the Hiland series was greater than 60 inches.

KISHONA
(formerly Kim)

Unit KI/AB Kishona loam, 0 to 6 percent slopes

The Kishona series is a member of the fine-loamy, mixed, calcareous, mesic family of Ustic Torriorthents. Typically, Kishona soils have friable granular A horizons, weak subangular blocky Bk horizons, and fine to medium-textured, massive C-horizons.

Description of Typical Profile

A typical example of the Kishona series was described and sampled for chemical analysis approximately 2400 feet west of the east section line of Section 24 and 1900 feet north of the south section line of Section 24, Township 44 North, Range 76 West (Sample Point No. 88-12).

A 0 to 3 inches. Light brownish-gray (10YR 6/2) loam, dark grayish brown (IOYR 4/2) moist; weak, fine, granular structure; slightly hard, friable, nonsticky and nonplastic; medium acid (pH 5.6); clear, wavy boundary.

Bk 3 to 15 inches. Yellowish brown (10YR 5/4) loam, dark yellowish brown (IOYR 4/4) moist; weak, coarse, subangular blocky structure; slightly hard, friable, nonsticky and slightly plastic; medium acid (pH 5.8); gradual, wavy boundary.

C1 15 to 30 inches. Yellowish. brown (10YR 5/4) loam, dark yellowish brown (10YR 4/4) moist; massive; slightly hard, friable, nonsticky and nonplastic; medium acid (pH 6.0); clear, smooth boundary.

C2 30 to 48 inches. Yellowish brown (1 OYR 5/4) loam, dark yellowish brown (10YR 4/4) moist; massive; firm, friable, nonsticky and nonplastic; slightly acid (pH 6.5); clear smooth boundary.

KISHONA (cont.)

C2 48 to 60 inches. Yellowish brown (10YR 5/4) loam, dark yellowish brown (10YR 4/4) moist; massive; firm, friable, nonsticky and nonplastic; neutral (pH 6.7).

Range of Characteristics on the Survey Area

Reaction throughout the profile is lower than that generally found in the series.

Depth of Material Appearing Suitable for Topsoil

Depth of material appearing suitable on the survey area for the Kishona series was greater than 60 inches.

PARMLEED
(formerly Briggsdale)

Unit PA Parmleed clay loam, 6 to 10 percent slopes

The Parmleed series is a member of the fine, montmorillonitic, mesic family of Ustollic Paleargids. Typically, Parmleed soils have friable granular A or E horizons, Bt horizons with strong prismatic structure, and fine-textured Bk horizons in which secondary calcium carbonate has accumulated. They overlie interbedded shale at depths between 20 and 40 inches.

Description of Typical Profile

A typical example of the Parmleed series was described and sampled for chemical analysis approximately 1910 feet west of the east section line of Section 13 and 225 feet north of the south section line of Section 13, Township 44 North, Range 76 West (Sample Point No. 88-16).

E 0 to 3 inches. Light brownish-gray (10YR 6/2) clay loam, dark grayish brown (IOYR 4/2) moist; weak, thin, platy structure parting to fine granular; soft, very friable; medium acid (pH 6.0); abrupt, smooth boundary.

Bt 3 to 15 inches. Dark brown (7.5YR 4/2) clay loam, dark brown (7.5YR 3/2) moist; weak, medium, prismatic structure parting to moderate, medium, subangular blocky; hard, firm, sticky and plastic; slightly acid; clear, wavy boundary.

Bt k 15 to 18 inches. Brown (10YR 5/3) clay loam, dark-brown (IOYR 4/3) moist; moderate, coarse, subangular blocky; hard, friable; mildly alkaline; gradual, wavy boundary.

PARMLEED (cont.)

Bk 1 18 to 21 inches. Brown (IOYR 5/3) clay loam, dark-brown (IOYR 4/3) moist; massive; hard, friable; mildly alkaline; gradual, wavy boundary.

Bk 2 21 to 30 inches. Light brownish gray (10YR 6/2) clay loam, dark grayish brown (IOYR 4/2) moist; massive; hard, very friable; mildly alkaline.

Range of Characteristics on the Survey Area

Depth to paralithic contact ranged from 26 to 37 inches.

Texture of the E horizon is heavier than that generally found in the series and may represent past erosion of this layer at this particular sample site.

Reaction of the E and Bt horizons is lower than that generally found in the series.

Depth of Material Appearing Suitable for Topsoil

Depth of material appearing suitable on the survey area for the Parmleed ranged from 26 inches to 37 inches, but average depth of material appearing suitable for the series was approximately 36 inches.

PARMLEED
(formerly Briggsdale)

Unit PA Parmleed clay loam, 6 to 10 percent slopes

The Parmleed series is a member of the fine, montmorillonitic, mesic family of Ustollic Paleargids. Typically, Parmleed soils have friable granular A or E horizons, Bt horizons with strong prismatic structure, and fine-textured Bk horizons in which secondary calcium carbonate has accumulated. They overlie interbedded shale at depths between 20 and 40 inches.

Description of Typical Profile

A typical example of the Parmleed series was described and sampled for chemical analysis approximately 2200 feet west of the east section line of Section 24 and 2000 feet north of the south section line of Section 24, Township 44 North, Range 76 West (Sample Point No. 88-11).

A 0 to 4 inches. Light brownish gray (10YR 6/2) loam, dark grayish brown (10YR 4/2) moist; moderate, medium, granular structure; soft, friable; slightly sticky and slightly plastic; very strongly acid (pH 5.0); clear, smooth boundary.

Bt 1 4 to 7 inches. Brown (IOYR 5/3) clay loam, dark brown (10YR 3/3) moist; weak, medium, prismatic structure parting to moderate medium subangular blocky; slightly hard, friable, sticky and plastic; slightly acid; clear, smooth boundary.

Bt 2 7 to 14 inches. Brown (10YR 5/3) clay loam, dark brown (IOYR 3/3) moist; strong, medium, prismatic structure parting to moderate, medium, subangular blocky; hard, firm, sticky and plastic; slightly acid; clear, smooth boundary.

PARMLEED (cont.)

Bt 3 14 to 17 inches. Pale brown (10YR 6/3) clay loam, brown (IOYR 5/3) moist; weak, medium, subangular blocky; slightly hard, friable, slightly sticky and slightly plastic; slightly acid; clear, smooth boundary.

Bk 17 to 30 inches. Pale brown (I OYR 6/3) clay. loam, yellowish-brown (IOYR 5/4) moist; massive; hard, friable, slightly sticky and slightly plastic; mildly alkaline (pH 7.5); gradual, wavy boundary.

Cr 30 inches plus. Weathered calcareous shale and loamstone and fragments.

Range of Characteristics on the Survey Area

Depth to paralithic contact ranged from 24 inches to 39 inches.

This sample point represents a Parmleed inclusion within an area mapped as Cushman.

Depth of Material Appearing Suitable for Topsoil

Depth of material appearing suitable on the survey area for the Parmleed series ranged from 26 to 37 inches, but average depth of material appearing suitable for topsoil was approximately 36 inches.

RENOHILL

Unit Re/C Renohill clay, 6 to 14 percent slopes

The Renohill series is a member of the fine, montmorillonitic, mesic family of Ustollic Haplargids. Typically, Renohill soils have friable granular A horizons, Bt horizons with prismatic to blocky structure, and moderately fine to fine textured calcareous Bk horizons in which secondary calcium carbonate has accumulated. Substratums of sedimentary bedrock generally occur greater than 40 inches.

Description of Typical Profile

A typical example of the Renohill series was described and sampled for chemical analysis approximately 590 feet west of the east section line of Section 13 and 1650 feet north of the south section line of Section 13, Township 44 North, Range 76 West (Sample Point No. 88-17).

A 0 to 3 inches. Light brownish-gray (10YR 6/2) clay, dark grayish brown (10YR 4/2) moist; strong, fine, granular structure; soft, very friable, sticky and plastic; slightly acid (pH 6.2); clear, smooth boundary.

B t 3 to 11 inches. Grayish-brown (2.5Y 5/2) clay (field estimate texture), dark grayish-brown (2.5Y 4/2) moist; moderate, medium, prismatic structure parting to moderate, medium angular blocky; hard, friable, very sticky and very plastic; neutral (pH 7.2); gradual, wavy boundary.

Bt k 11 to 15 inches. Light yellowish-brown (2.5Y 6/3) clay loam (field estimate texture), light olive-brown (2.5Y 5/3) moist; weak, coarse, subangular blocky structure; hard, firm, plastic; mildly alkaline; gradual, smooth boundary.

RENOHILL (cont.)

B k 15 to 23 inches. Light yellowish-brown (2.5Y 6/3) clay loam (field estimate texture), light olive-brown (2.5Y 5/3) moist; massive; very hard, firm; mildly alkaline.

C 23 to 30 inches. Light yellowish-brown (2.5Y 6/3) clay loam (field estimate texture), light olive-brown (2.5Y 5/3) moist; some shale fragments; massive; slightly hard, friable, slightly sticky; moderately alkaline.

C r 30 inches plus. Soft, calcareous shale.

Range of Characteristics on the Survey Area

Depth to bedrock ranged from 24 to 38 inches.

Reaction of the A and B-horizons is lower than that generally found in the series. Texture of the A horizon is heavier than that generally found in the series but may be a result of minor surface erosion at the sample site.

Depth of Material Appearing Suitable for Topsoil

Depth of material appearing suitable on the survey area for the Renohill series was approximately 30 inches.

SAMDAY*
(formerly Samsil)

Unit SM Samday silty clay, 3 to 30 percent slopes

The Samday series is a member of the clayey, montmorillonitic, calcareous, mesic, shallow family of Ustic Torriorthents. Typically, Samday soils have friable platy A horizons with fine textured transitional layers that grade to unweathered shale at shallow depths.

Description of Typical Profile

A typical example of the Samday series was described and sampled for chemical analysis approximately 410 feet west of the east section line of Section 13 and 1470 feet north of the south section line of Section 13, Township 44 North, Range 76 West (Sample Point No. 88-15).

A 0 to 3 inches. Grayish-brown '(2.5Y 5/2) silty clay, dark grayish-brown (2.5Y 4/2) moist; moderate, medium, platy structure parting to weak, fine granular structure; soft, very friable, slightly sticky and slightly plastic; slightly acid (pH 6.4); clear, smooth boundary.

Ck 3 to 13 inches. Light yellowish-brown (2.5Y 6/4) silty clay, light olive brown (2.5Y 5/4) moist; massive structure; hard, firm; neutral (pH 7.0); gradual, wavy boundary.

Cr 13 inches plus. Yellowish-gray, calcareous shale. *

*Shingle Unit SH

SAMDAY (cont.)

Range of Characteristics on the Survey Area

Depth to bedrock ranged from 5 to 18 inches.

Reaction throughout the profile is lower than that generally found in the series.

Depth of Material Appearing Suitable for Topsoil

Depth of material appearing suitable on the survey area for the Samday series ranged from 5 to 18 inches. Average depth of material appearing suitable for topsoil was approximately 12 inches.

TALUCE
(formerly Tassel)

Unit TA Taluce sandy loam, 15 to 40 percent slopes

The Taluce series is a member of the loamy, mixed, calcareous, mesic, shallow family of Ustic Torriorthents. Typically, Taluce soils have very friable, fine granular A horizons and calcareous C horizons underlain by sandstone bedrock.

Description of Typical Profile

A typical example of the Taluce series was described and sampled for chemical analysis approximately 2280 feet east of the west section line of Section 24 and 1125 feet south of the north section line of Section 24, Township 44 North, Range 76 West (Sample Point No. 88-14).

A 0 to 3 inches. Yellowish-brown (10YR 5/4) sandy loam, dark yellowish-brown (10YR 4/4) moist; moderate, medium, granular structure; loose, very friable, nonsticky and nonplastic; neutral (pH 7.3); clear, smooth boundary.

C 3 to. 18 inches. Light yellowish-brown (10YR 6/4) sandy loam, yellowish brown (10YR 5/4) moist; moderate, medium, granular structure; soft, very friable, nonsticky and nonplastic; mildly alkaline (pH 7.6).

Cr 18 inches plus. Soft, calcareous sandstone.

TALUCE (cont.)

Range of Characteristics on the Survey Area

Depth to bedrock varied from 6 to 18 inches.

Reaction throughout the profile is lower than that generally found in the series.

Depth of Material Appearing Suitable for Topsoil

Depth of material appearing suitable on the survey area for the Taluce series ranged from 6 to 18 inches. Average depth of material appearing suitable for topsoil was approximately 15 inches.

TERRO
(formerly Terry)

Unit TE Terro sandy loam, 6 to 15 percent slopes

The Terro series is a member of the coarse-loamy, mixed, mesic family of Ustollic Haplargids. Typically, Terro soils have friable granular A horizons, Bt horizons with weak, medium subangular blocky structure, and medium-textured Bk horizons in which secondary calcium carbonate has accumulated.

Description of Typical Profile

A typical example of the Terro series was described and sampled for chemical analysis approximately 2260 feet east of the west section line of Section 13 and 250 feet north of the south section line of Section 13, Township 44 North, Range 76 West (Sample Point No. 88-10).

A 0 to 3 inches. Light brownish-gray (10YR 6/2) sandy loam, dark grayish-brown (IOYR 4/2) moist; weak, fine, granular structure; soft, friable, nonsticky and nonplastic; neutral (pH 6.6); clear, smooth boundary.

Bt 3 to 15 inches. Pale brown (10YR 6/3) sandy loam, brown (10YR 5/3) moist; weak, medium, prismatic structure parting to weak, medium subangular blocky; slightly hard, very friable, slightly sticky and nonplastic; neutral (pH 6.6); clear, smooth boundary.

Bk 15 to 38 inches. Pale-brown (IOYR 6/3) loam, brown (10YR 4/3) moist; weak, fine, subangular blocky structure; slightly hard, friable, slightly sticky and slightly plastic; mildly alkaline (pH 7.5); gradual, wavy boundary.

Cr 38 inches plus. Soft, calcareous sandstone.

TERRO (cont.)

Range of Characteristics on the Survey Area

Depth to paralithic contact varied from 24 to 39 inches.

Depth of Material Appearing Suitable for Topsoil

Depth of material appearing suitable on the survey area for the Terro series was approximately 36 inches.

TURNERCREST
(formerly Nelson)

Unit TUR Turnercrest loam, 3 to 10 percent slopes

The Turnercrest series is a member of the coarse-loamy, mixed, calcareous, mesic family of Ustic Torriorthents. Typically, Turnercrest soils have friable granular A horizons and medium to coarse-textured, calcareous C horizons.

Description of Typical Profile

A typical example of the Turnercrest series was described and sampled for chemical analysis approximately 2410 feet east of the west section line of Section 13 and 25 feet north of the south section line of Section 13, Township 44 North, Range 76 West (Sample Point No. 88-8).

A 0 to 4 inches. Brown (10YR 5/3) loam, dark brown (10YR 3/3) moist; weak, fine, granular -structure; soft, very friable, nonsticky and nonplastic; neutral (pH 7.3); clear, smooth boundary.

Bw 4 to 10 inches. Brown (10YR 5/3) loam, dark brown (10YR 4/3) moist; weak, medium, subangular blocky; soft, friable, slightly sticky and slightly plastic; mildly alkaline; gradual, smooth boundary.

C 1 10 to 24 inches. Light gray (2.5Y 7/2) loam, light brownish gray (2.5Y 6/2) moist; massive; slightly hard, friable, slightly sticky and slightly plastic; mildly alkaline; clear, wavy boundary.

C 2 24 to 39 inches. Light gray (2.5Y 7/2) sandy loam, light brownish gray (2.5Y 6/2) moist; massive; slightly hard, friable, nonsticky and nonplastic; mildly alkaline (pH 7.5); clear, wavy boundary.

TURNERCREST (cont.)

Cr 39 inches plus. Soft, calcareous sandstone.

Range of Characteristics on the Survey Area

Depth to paralithic ranged from 30 to 39 inches.

Reaction of the A horizon is slightly lower than that generally found in the series.

Depth of Material Appearing Suitable for Topsoil

Depth of material appearing suitable on the survey area for the Turnercrest series was approximately 36 inches.

ULM*

Unit UL Ulm silty clay, 3 to 6 percent slopes

The Ulm series is a member of the fine, montmorillonitic, mesic family of Ustollic Haplargids. Typically, Ulm soils have friable granular A horizons, well developed Bt horizons, and medium-textured, calcareous Bk horizons.

Description of Typical Profile

A typical example of the Ulm series was described and sampled for chemical analysis approximately 1350 feet east of the west section line of Section 25 and 1350 feet south of the north section line of Section 25, Township 44 North, Range 76 . West (Sample Point No. 88-2).

A 0 to 3 inches. Light brownish-gray (IOYR 6/2) silty clay, dark grayish-brown (IOYR 4/2) moist; moderate, fine, granular structure; soft, very friable, slightly sticky and slightly plastic; neutral; clear, smooth boundary.

Bw 3 to 9 inches. Light brownish gray (10YR 6/2) silty clay, dark grayish brown (IOYR 4/2) moist; moderate, fine subangular blocky parting to moderate, medium granular; slightly hard, friable, slightly sticky and slightly plastic; neutral; clear, smooth boundary.

Bt 9 to 24 inches. Brown (10YR 5/3) silty clay, dark brown (10YR 4/3) moist; strong, medium prismatic structure parting to strong, fine angular and subangular blocky; very hard, friable, sticky and slightly plastic; mildly alkaline; gradual, smooth boundary.

Bt k 24 to 30 inches.. Light olive-brown (2.5Y 5/3) silty clay, olive brown (2.5Y 4/3) moist; moderate, medium subangular blocky; very hard, friable, sticky and slightly plastic; mildly alkaline; gradual, smooth boundary.

ULM (cont.)

Bk l 30 to 36 inches. Light yellowish-brown (2.5Y 6/3) silty clay, light olive-brown (2.5Y 5/3) moist; massive; hard, friable, sticky and slightly plastic; mildly alkaline; gradual, wavy boundary.

Cl 36 to 48 inches. Light yellowish-brown (2.5Y 6/4) silty clay, light olive-brown (2.5Y 5/4) moist; massive; hard, friable, sticky and slightly plastic; mildly alkaline; gradual, wavy boundary.

C2 48 to 60 inches. Light yellowish-brown (2.5Y 6/4) silty clay, light olive-brown (2.5Y 5/4) moist; massive; hard, friable, slightly sticky and slightly plastic; mildly alkaline (ph 7.4).

Range of Characteristics on the Survey Area

Analyzed textures varied significantly from field textures. It is assumed that total sample dispersion may not have been achieved and the silt content of the resultant analysis may be too high.

Depth of Material Appearing Suitable for Topsoil

Depth of material appearing suitable on the survey area for the Ulm series was greater than 60 inches.

ZIGWEID

Unit Zg/B Zigweid loam, 3 to 6 percent slopes

The Zigweid series is a member of the fine-loamy, mixed, mesic family of Ustollic Camborthids. Typically, Zigweid soils have friable granular A horizons, weakly developed Bw horizons, and medium-textured, calcareous Bk horizons.

Description of Typical Profile

A typical example of the Zigweid series was described and sampled for chemical analysis approximately 700 feet east of the west section line of Section 24 and 800 feet south of the north section line of Section 24, Township 44 North, Range 76 West (Sample Point No. 88-5).

A 0 to 6 inches. Light brownish-gray (2.5Y 6/2) loam, dark grayish brown (2.5Y 4/2) moist; strong, medium, granular structure; soft, very friable, slightly sticky and slightly plastic; neutral (pH 7.3); clear, smooth boundary.

Bw 6 to 11 inches. Light olive-brown (2.5Y 5/3) silty clay loam, olive-brown (2.5Y 4/3) moist; weak, medium, prismatic structure paring to moderate, medium, subangular blocky; hard, friable, slightly sticky and slightly plastic; mildly alkaline (pH 7.5); gradual, smooth boundary.

Bk 1 11 to 30 inches. Light brownish-gray (2.5Y 6/2) loam, grayish brown (2.5Y 5/2) moist; massive; slightly hard, friable, slightly sticky and slightly plastic; mildly alkaline (pH 7.5); gradual, wavy boundary.

Bk 1 30 to 48 inches. Light brownish-gray (2.5Y 6/2) loam, grayish brown (2.5Y 5/2) moist; massive; slightly hard, friable, slightly sticky and slightly plastic; mildly alkaline (pH 7.6); gradual, wavy boundary.

ZIGWEID (cont.)

Bk2 48 to 60 inches. Light brownish-gray (2.5Y 6/2) silty clay loam, grayish brown (2.5Y 5/2) moist; massive; hard, friable, slightly sticky and slightly plastic; mildly alkaline (pH 7.4).

Range of Characteristics on the Survey Area

Depth to calcareous material was greater than that normally found in the series. Reaction throughout the profile is lower than that generally found in the series.

Depth of Material Appearing Suitable for Topsoil

Depth of material appearing suitable on the survey area for the Zigweid series was greater than 60 inches.

11.6 1988 SOIL ANALYTICAL RESULTS

Bidman clay loam
(Sample Point 88-1)

Depth (inches)	Sand	Silt	Clay	Texture	Coarse Fragments %
			Mechanical Analysis		
0-3	32	41	27	CL	<2
3-20	12	45	43	SiC	<2
20-40	8	47	45	SiC	<2
40-60	32	39	29	CL	<2

Depth (inches)	B ppm	Se ppm	Organic Carbon %	Saturation. %	Lime ppm
0-3	0.3	0.01	3.75	34.0	2.3
3-20	0.4	<0.01	4.40	43.1	3.8
20-40	1.0	0.01	4.54	50.7	5.6
40-60	0.6	0.19	3.05	30.6	3.6

Depth (inches)	pH paste		Saturation Extract: Elect. Cond. (mmhos/cm)	Cations: Ca (meg/ l liter)	Mg (meg/ l liter)	Na (meg/ l liter)	SAR
0-3	7.4	0.92	7.0	1.89		0.37	0.18
3-20	7.5	0.75	3.70	2.08		0.76	0.45
20-40	7.6	0.97	3.55	2.97		3.39	1.88
40-60	7.4	3.90	27.0	21.3		10.2	2.08

Bowbac Sandy Loam
(Sample Point 88-9)

Depth (inches)	Sand	Silt	Clay	Texture	Coarse Fragments %
			Mechanical Analysis		
0-6	60	23	17	SL	<2
6-14	54	25	21	SCL	<2
14-36	50	27	23	SCL	<2

Depth (inches)	B ppm	Se ppm	Organic Carbon %	Saturation %	Lime ppm
0-6	0.3	<0.01	3.07	40.0	0.5
6-14	0.1	<0.01	3.17	40.3	2.1
14-36	<0.1	<0.01	2.89	40.5	6.2

Depth (inches)	pH paste	Elect. Cond. (mmhos/cm)	Saturation Extract Cations Ca (meg/liter)	Mg (meg/liter)	Na (meg/liter)	SAR
0-6	6.0	0.63	3.69	1.12	0.15	0.10
6-14	7.0	0.76	5.22	1.19	0.16	0.09
14-36	7.7	0.55	1.95	1.61	0.83	0.62

Cushman loam
(Sample Point 88-3)

Depth (inches)	Sand	Silt	Clay	Texture	Coarse Fragments
			Mechanical Analysis		
0-6	38	43	19	L	<2
6-26	38	34	28	CL	<2
26-36	48	30	22	L	<2

Depth (inches)	B ppm	Se ppm	Organic Carbon %	Saturation %	Lime ppm
0-6	<0.1	<0.01	2.79	26.8	0.8
6-26	<0.1	<0.01	3.28	34.6	1.1
26-36	0.2	<0.01	2.76	39.5	7.5

Depth (inches)	pH paste		Saturation Extract				
			Elect. Cond. (mmhos/cm)	Cations			
				Ca	Mg	Na	SAR
				meg/ liter			
0-6	7.1	0.66	3.78	1.68		0.28	0.17
6-26	7.1	0.80	4.31	2.35		0.46	0.25
26-36	7.6	0.74	3.13	2.68		0.87	0.51

Power Resources Inc.

Forkwood loam
(formerly Fort Collins)

(Sample Point 88-6)

Mechanical Analysis

Depth (inches)	Sand	Silt	Clay	Texture	Coarse Fragments %
0-5	50	34	16	L	<2
5-26	44	31	25	L	<2
26-48	40	37	23	L	<2
48-60	58	27	15	SL	<2

Depth. (inches)	B ppm	Se ppm	Organic Carbon %	Satur. %	Lime ppm
0-5	0.1	<0.01	2.40	21.8	<0.1
5-26	0.1	<0.01	3.08	39.8	<0.1
26-48	0.1	<0.01	3.54	40.0	5.2
48-60	0.3	<0.01	2.33	33.3	2.2

Saturation Extract

Depth (inches)	pH paste		Elect. Cond. (mmhos/cm)	Cations Ca	Mg	Na	SAR
				------meg/ liter------			
0-5	6.2	0.44	2.15	1.06		0.18	0.14
5-26	6.5	0.54	2.51	1.24		0.22	0.16
26-48	7.6	0.53	2.37	1.60		0.82	0.58
48-60	7.7	0.82	2.53	2.19		2.77	1.80

Power Resources Inc.

Hiland loam
(formerly Olney)

(Sample Point 88-4)

Mechanical Analysis

Depth (inches)	Sand	Silt	Clay	Texture	Coarse Fragments
0-6	42	28	20	L	<2
6-19	22	42	36	CL	<2
19-42	40	36	24	L	<2
42-60	46	32	22	L	<2

Depth (inches)	B ppm	Se ppm	Organic Carbon %	Satur. %	Lime ppm
0-6	0.1	<0.01	2.99	27.9	0.9
6-19	0.1	0.01	3.89	41.8	1.0
19-42	0.2	<0.01	3.04	33.1	6.2
42-60	0.4	0.02	2.62	29.0	4.3

Saturation Extract

Depth (inches)	pH paste	Elect. Cond. (mmhos/cm)	Cations Ca	Mg	Na	SAR
			-----meg/ liter-----			
0-6	6.9	0.88	4.85	2.29	0.17	0.09
6-19	6.9	0.87	4.58	2.54	0.51	0.27
19-42	7.7	0.64	2.00	1.86	1.36	0.98
42-60	7.7	1.20	3.21	3.63	4.11	2.22

Hiland loam
(formerly Olney)
(Sample Point 88-7)

Mechanical Analysis

Depth (inches)	Sand	Silt	Clay	Texture	Coarse Fragments
0-7	48	37	15	L	<2
7-24	48	32	20	L	<2
24-42	42	36	22	L	<2
42-60	48	30	22	L	<2

Depth (inches)	B ppm	Se ppm	Organic Carbon %	Satur. %	Lime ppm
0-7	0.3	<0.01	4.37	41.7	<0.1
7-24	0.2	<0.01	2.74	33.9	<0.1
24-42	0.3	<0.01	2.51	39.7	<0.1
42-60	0.2	<0.01	2.70	39.9	1.0

Saturation Extract

Depth (inches)	pH paste	Elect. Cond. (mmhos/cm)	Cations Ca	Mg	Na	SAR
			——meg/ liter——			
0-7	5.8	0.50	2.80	1.18	0.14	0.10
7-24	5.9	0.48	2.70	1.05	0.20	0.15
24-42	6.7	0.58	2.76	1.10	0.25	0.18
42-60	7.4	0.67	3.44	1.46	0.30	0.19

Power Resources Inc..

Forkwood loam
(formerly Fort Collins)
(Sample Point 88-13)

Depth (inches)	Sand	Silt	Clay	Texture	Coarse Fragments
			Mechanical Analysis		
0-6	50	32	18	L	<2
6-22	48	26	26	SCL	<2
22-41	50	26	24	SCL	<2

Depth (inches)	B ppm	Se ppm	Organic Carbon %	Satur. %	Lime ppm
0-6	0.3	<0.01	2.18	32.5	0.2
6-22	0.1	<0.01	3.41	39.0	0.3
22-41	0.1	<0.01	3.00	36.6	1.7

Saturation Extract

Depth (inches)	pH paste	Elect. Cond. (mmhos/cm)	Cations Ca	Mg	Na	SAR
			meg/ liter			
0-6	5.8	0.68	3.28	1.58	0.18	0.12
6-22	6.2	0.38	1.98	0.94	0.17	0.14
22-41	7.0	1.80	9.26	4.77	0.43'	0.16

Power Resources Inc.

Kishona loam
(formerly Kim)
(Sample Point 88-12)

Mechanical Analysis

Depth (inches)	Sand	Silt	Clay	Texture	Coarse Fragments
0-3	36	39	25	L	<2
3-15	38	37	25	L	<2
15-30	42	35	23	L	<2
30-48	48	31	21	L	<2
48-60	48	29	23	L	<2

Depth (inches)	B ppm	Se ppm	Organic Carbon %	Satur. %	Lime ppm
0-3	0.3	0.02	6.33	61.9	0.5
3-15	0.2	<0.01	3.51	42.4	0.9
15-30	0.3	<0.01	2.89	36.7	0.3
30-48	0.3	<0.01	2.62	35.7	0.3
48-60	0.3	<0.01	2.51	34.2	0.3

Saturation Extract

Depth (inches)	pH paste	Elect. Cond. (mmhos/cm)	Cations Ca	Mg	Na	SAR
			-----meg/ liter-----			
0-3	5.6	1.10	7.00	2.73	0.28	0.13
3-15	5.8	0.50	2.82	0.97	0.11	0.08
15-30	6.0	0.28	1.66	0.47	0.11	0.11
30-48	6.5	0.31	1.73	0.51	0.18	0.17
48-60	6.7	0.40	2.42	0.66	0.14	0.11

Power Resources Inc.

Turnercrest loam
(formerly Nelson)
(Sample Point 88-8)

Depth (inches)	Sand	Silt	Clay	Texture	Coarse Fragments %
			Mechanical Analysis		
0-4	50	32	18	L	<2
4-24	56	23	21	L	<2
24-39	60	21	19	SL	<2

Depth (inches)	B ppm	Se ppm	Organic Carbon %	Satur. %	Lime ppm
0-4	0.2	<0.01	2.54	36.0	0.5
4-24	0.1	<0.01	2.27	42.5	1.1
24-39	0.1	0.02	2.13	34.7	1.1

Depth (inches)	pH paste		Elect. Cond. (mmhos/cm)	Saturation Extract Cations Ca	Mg	Na	SAR
				——meg/ liter——			
0-4	7.3	0.63	3.69	0.99		0.17	0.11
4-24	7.5	0.53	3.13	0.98		0.52	0.36
24-39	7.5	1.30	8.18	2.67		1.55	0.67

Parmleed loam
(formerly Briggsdale)
(Sample Point 88-11)

Mechanical Analysis

Depth (inches)	Sand	Silt	Clay	Texture	Coarse Fragments %
0-4	36	39	25	L	<2
4-17	20	37	43	C	<2
17-30	36	33	31	CL	<2

Depth (inches)	B ppm	Se ppm	Organic Carbon %	Satur. %	Lime ppm
0-4	0.2	<0.01	4.15	44.7	0.5
4-17	0.2	<0.01	4.32	59.8	0.8
17-30	0.2	<0.01	3.51	48.3	3.7

Saturation Extract

Depth (inches)	pH paste		Elect. Cond. (mmhos/cm)	Cations Ca	Mg	Na	SAR
				-----meg/ liter-----			
0-4	5.0	0.93	4.25	2.23		0.20	0.11
4-17	6.3	0.83	3.77	2.12		0.46	0.27
17-30	7.5	0.73	3.45	2.14		0.55	0.33

Parmleed clay loam
(formerly Briggsdale)
(Sample Point 88-16)

Mechanical Analysis

Depth (inches)	Sand	Silt	Clay	Texture	Coarse Fragments %
0-3	40	30	30	CL	<2
3-18	30	32	38	CL	<2
18-30	38	32	30	CL	<2

Depth (inches)	B ppm	Se ppm	Organic Carbon %	Satur. %	Lime ppm
0-3	0.3	<0.01	3.94	45.5	0.3
3-18	0.4	<0.01	4.16	51.4	0.3
18-30	0.3	0.02	3.18	44.3	1.1

Saturation Extract

Depth (inches)	pH paste		Elect. Cond. (mmhos/cm)	Cations Ca	Mg	Na	SAR
				------meg/ liter------			
0-3	6.0	0.56	2.60	1.34		0.20	0.14
3-18	6.3	0.37	1.47	0.76		0.29	0.27
18-30	7.4	0.60	2.63	1.46		1.13	0.79

Renohill clay
(Sample Point 88-17)
Mechanical Analysis

Depth (inches)	Sand	Silt	Clay	Texture	Coarse Fragments %
			Mechanical Analysis		
0-3	20	34	46	C	<2
3-15	NS	NS	NS	NS	<2
15-30	NS	NS	NS	NS	<2

Depth (inches)	B ppm	Se ppm	Organic Carbon %	Satur. %	Lime ppm
0-3	0.4	<0.01	5.12	56.2	0.8
3-15	NS	NS	NS	60.4	NS
15-30	NS	NS	NS	74.9	NS

Depth (inches)	pH paste		Elect. Cond. (mmhos/cm)	Saturation Extract Cations Ca	Mg	Na	SAR
				-----meg/ liter-----			
0-3	6.2	0.48	1.83	1.46		0.65	0.51
3-15	7.2	0.48	1.76	1.42		2.16	1.72
15-30	7.5	1.50	4.06	4.27		8.15	3.99

NS = Insufficient Sample

Power Resources Inc.

Samday silty clay
(formerly Samsil)
(Sample Point 88-15)

Mechanical Analysis

Depth (inches)	Sand	Silt	Clay	Texture	Coarse Fragments %
0-3	18	42	40	SiC	<2
3-13	16	42	42	SiC	<2

Depth (inches)	B ppm	Se ppm	Organic Carbon %	Satur. %	Lime ppm
0-3	0.3	<0.01	4.74	59.9	0.6
3-13	0.3	<0.01	4.74	51.3	1.0

Saturation Extract

Depth (inches)	pH paste	Elect. Cond. (mmhos/cm)	Cations Ca	Mg	Na	SAR
			——meg/ liter——			
0-3	6.4	0.82	3.04	2.72	1.06	0.62
3-13	7.0	0.70	2.09	1.59	2.19	1.61

Power Resources Inc.

Taluce sandy loam
(formerly Tassel)
(Sample Point 88-14)

Depth (inches)	Sand	Silt	Clay	Texture	Coarse Fragments %
			Mechanical Analysis		
0-3	72	16	12	SL	<2
3-18	76	12	12	SL	<2

Depth (inches)	B ppm	Se ppm	Organic Carbon %	Satur. %	Lime ppm
0-3	0.3	<0.01	3.14	35.5	1.0
3-18	<0.1	<0.01	2.29	32.4	2.4

Depth (inches)	pH paste	Elect. Cond. (mmhos/cm)	Cations Ca	Mg	Na	SAR
			Saturation Extract			
			-----meg/ liter-----			
0-3	7.3	0.78	5.64	0.61	0.16	0.09
3-18	7.6	0.45	3.12	0.35	0.11	0.08

Power Resources Inc.

Terro sandy loam
(formerly Terry)
(Sample Point 88-10)

Depth (inches)	Sand	Silt	Clay	Texture	Coarse Fragments %
			Mechanical Analysis		
0-3	62	23	15	SL	<2
3-15	62	21	17	SL	<2
15-38	50	29	21	L	<2

Depth (inches)	B ppm	Se ppm	Organic Carbon %	Satur. %	Lime ppm
0-3	<0.1	<0.01	2.61	35.8	0.5
3-15	0.2	<0.01	2.52	35.8	0.6
15-38	0.1	<0.01	2.96	40.2	3.8

Depth (inches)	pH paste		Elect. Cond. (mmhos/cm)	Cations Ca	Mg	Na	SAR
				Saturation Extract			
				——meg/ liter——			
0-3	6.6	0.49	3.00	0.99		0.15	0.11
3-15	6.6	0.45	3.01	0.87		0.13	0.09
15-38	7.5	0.55	3.51	0.93		0.16	0.11

Power Resources Inc.

Ulm silty clay
(Sample Point 88-2)

Mechanical Analysis

Depth (inches)	Sand	Silt	Clay	Texture	Coarse Fragments %
0-9	10	49	41	SiC	<2
9-30	6	49	45	SiC	<2
30-48	4	51	45	SiC	<2
48-60	1	56	43	SiC	<2

Depth (inches)	B ppm	Se ppm	Organic Carbon %	Satur. %	Lime ppm
0-9	0.2	<0.01	4.60	46.0	1.1
9-30	0.3	<0.01	4.45	47.5	4.5
30-48	0.9	0.04	4.45	49.7	5.9
48-60	0.4	0.29	4.52	46.0	4.7

Saturation Extract

Depth (inches)	pH paste		Elect. Cond. (mmhos/cm)	Cations Ca	Mg	Na	SAR
				-----meg/ liter-----			
0-9	6.9	0.74	4.10	2.13		0.59	0.34
9-30	7.5	0.72	3.26	2.04		1.11	0.68
30-48	7.6	1.50	5.53	4.75		5.05	2.23
48-60	7.4	3.80	26.8	19.0		8.9	1.86

Zigweid loam
(Sample Point 88-5)

Depth (inches)	Sand	Silt	Clay	Texture	Coarse Fragments %
			Mechanical Analysis		
0-6	30	44	26	L	<2
6-11	20	52	28	SiCL	<2
11-30	26	48	26	L	<2
30-48	32	42	26	L	<2
48-60	14	58	28	SiCL	<2

Depth (inches)	B ppm	Se ppm	Organic Carbon %	Satur. %	Lime ppm
0-6	0.2	<0.01	3.48	35.0	4.8
6-11	0.2	<0.01	3.33	35.3	5.8
11-30	0.2	<0.01	3.24	33.6	6.1
30-48	<0.1	0.01	3.04	32.1	5.5
48-60	0.1	0.02	3.37	35.0	5.0

Depth (inches)	pH paste		Elect. Cond. (mmhos/cm)	Saturation Extract: Cations Ca	Mg	Na	SAR
				——meg/ liter——			
0-6	7.3	0.65	4.28	0.96		0.19	0.12
6-11	7.5	0.55	3.67	0.73		0.38	0.26
11-30	7.5	0.64	3.73	0.78		0.41	0.27
30-48	7.6	0.77	4.92	1.44		0.24	0.13
48-60	7.4	2.80	27.3	8.96		0.69	0.16

Power Resources Inc.

11.7 1978-79 MAPPING UNIT DESCRIPTIONS

1A - Haverson loam. 0 to 3 percent slopes*

The Haverson soil is a deep, well-drained loamy soil. It developed in highly stratified, calcareous recent alluvium derived from mixed sources. It occurs on floodplains and low terraces of stream and drainages at elevations of 3,800 to 5,000 feet. The average annual rainfall ranges from 10 to 14 inches. Average annual air temperature is about 44°F., and the average frost-free season is about 140 days. Small areas of Glenburg fine sand were included in mapping.

In a typical profile the surface layer is light brownish gray loam about 6 inches thick. The subsoil and substratum are light brownish gray loam stratified with thin lenses of clay loam and fine sandy loam about 54 inches thick.

Permeability is moderate. Available water capacity is moderate to high. Effective rooting depth is 60 inches or more. Surface runoff is slow to medium and erosion hazard is moderate.

This soil is used for rangeland and wildlife habitat.

Capability unity IVe2, dryland; Lowland range site (10 to 14 inch precipitation zone).

*1A - Haverdad loam, 0 to 3 percent slopes

b45 - Fort Collins loam. 0 to 6 percent slopes*

The Fort Collins soil is a deep, well-drained loamy soil which occurs throughout the county. It developed in thick, calcareous alluvial fan and valley-filling fan sediments derived from sedimentary bedrock and is on uplands and elevations of 3,800 to 5,000 feet. The average annual rainfall ranges from 10 to 14 inches.

Average annual air temperature is about 44°F., and the average frost-free season is about 140 days. Although the slopes range from 0 to 6 percent, they are mostly about 3 percent. Small areas of Stoneham loam were included in mapping.

In a typical profile the surface layer is light brownish gray loam about 4 inches thick. The subsoil is light brownish gray light clay loam about 11 inches thick. The substratum is light yellowish brown light clay loam about 45 inches thick and is underlain with shale bedrock at depths of 40 to 60+ inches.

Permeability is moderate. Available water capacity is moderate to high. Effective rooting depth is 40 to 60+ inches. Surface runoff is slow to medium, and the erosion hazard is moderate.

This soil is used for rangeland, wildlife habitat, and dryland cultivation. Capability unit IVe2, dryland; Loamy range site (10 to 14 inch precipitation zone).

*b45/AB - Forkwood loam, 0 to 6 percent slopes

50/AB - Bidman loam. 0 to 6 percent slopes

The Bidman soil is a deep, well-drained, loamy soil which occurs throughout the county. It developed in thick, calcareous, alluvial fan and valley-filling fan sediments derived from sedimentary bedrock and is on uplands at elevations of 3,800 to 5,000 feet. The average rainfall ranges from 10 to 14 inches, the average annual air temperature is about 44°F., and the average frost-free season is about 140 days. Although the slopes range from 0 to 6 percent, they are mostly about 3 percent. Small areas of Ulm loam were included in mapping.

In a typical profile the surface layer is light gray loam about 4 inches thick. The subsoil is brown clay about 15 inches thick. The lower portion of the subsoil is light olive brown clay. The substratum is calcareous, grayish brown clay to 60 inches in depth.

Permeability is slow. The available water capacity is moderate. Effective rooting depth is 60 inches or more. Surface runoff is slow to medium and erosion hazard is moderate.

This soil is used for rangeland, wildlife habitat, and dryland cultivation.

Capability unity IVe2, dryland; Loamy range site (10 to 14 inch precipitation zone).

a62/AB - Olney fine sandy loam, 0 to 6 percent slopes*

The Olney soil is a deep, well-drained sandy soil which occurs throughout the county. It developed in thick, moderately coarse-textured, calcareous parent materials on nearly level to gently annual rainfall ranges from 10 to 14 inches, and the average annual air temperature is about 44°F. The average frost-free season is about 140 days. Small areas of Vona fine sandy loam were included in mapping. Locally, the parent materials may have been reworked.

In a typical profile the surface layer is light gray fine sandy loam about 4 inches thick. The subsoil is pale brown sandy clay loam about 23 inches thick. The substratum is light yellowish brown sandy loam about 21 inches thick.

Permeability is rapid. Available water capacity is moderate. Effective rooting depth is 60 inches or more. Surface runoff is slow and the erosion hazard is severe.

This soil is used for rangeland, wildlife habitat, and dryland cultivation.

Capability unit IVe5, dryland; Sandy range site (10 to 14 inch precipitation zone).

*a62/AB - Hiland loam, 0 to 6 percent slopes

a62/C - Olney fine sandy loam, 6 to 10 percent slopes*

The Olney soil is a deep, well-drained sandy soil which occurs throughout the county. It developed in thick, moderately coarse-textured, calcareous parent materials derived from sandier strata of the Wasatch beds on side slopes at elevations of 3,800 to 5,000 feet. The average annual rainfall ranges from 10 to 14 inches. The average annual air temperature is about 44°F. The average frost-free season is about 140 days. Small areas of Pugsley sandy loam were included in mapping. Pugsley soils usually occur on the upper portions of the side slopes. It has sandy clay loam subsoils and is underlain with bedrock at depths of 20 to 40 inches.

In a typical profile the surface layer is light gray fine sandy loam about 4 inches thick. The subsoil is pale brown sandy clay loam about 23 inches thick. The substratum is light yellowish brown sandy loam about 21 inches thick.

Permeability is rapid. The available water capacity is moderate. Effective rooting depth is 60 inches or more. Surface runoff is slow to medium, and erosion hazard is severe.

This soil is used for rangeland, wildlife habitat, and dryland cultivation.

Capability unit Vies, dryland; Sandy range site (10 to 14 inch precipitation zone).

*A62/C - Hiland fine sandy loam, 6 to 10 percent slopes

75/B - Cushman very fine sandy loam, 3 to 6 percent slopes*

The Cushman soil is a moderately deep, well-drained loamy soil in the southern portion of Campbell County. It developed from calcareous sediments derived from sedimentary bedrock and is on gently sloping upland basins and large valley-filling fans at elevations between 3,800 and 5,000 feet. The average annual rainfall ranges from 10 to 14 inches. The average annual air temperature is about 44°F., and the average frost-free season is about 144 days. Small areas of Fort Collins loam were included in mapping.

In a typical profile the surface layer is light brownish gray very fine sandy loam, about 4 inches thick. The subsoil is brown very fine sandy clay loam 17 inches thick. The substratum is grayish brown very fine sandy clay loam about 6 inches thick and is underlain with soft, very fine-grained sandstone and loamstone bedrock at a depth of 23 inches.

The Cushman soil has a moderate permeability. Effective rooting depth is 20 to 40 inches. Available water capacity is moderate. Surface runoff is medium and, the hazard of erosion is moderate.

This soil is used for rangeland, wildlife habitat, and dryland cultivation.

Capability unit IVe2, dryland; Loamy range site (10 to 14 inch precipitation zone).

* 75/BC Cushman loam, 3 to 10 percent slopes

151 /DE - Shingle-Rock outcrop complex. 10 to 60 percent slopes

This association consists of moderately steep to very steep soils and Rock outcrop on side slopes and ridge tops at elevations between 3,800 and 5,000 feet. This complex is about 60 percent Shingle clay loam, 10 to 60 percent slopes, and about 40 percent Rock outcrop, 10 to 60 percent slopes. The Shingle soil doesn't occupy any particular position in the landscape but will occur on the ridge tops and lower portions of the side slopes. The side slopes are usually dissected by numerous deep gullies which drain into nearby intermittent streams.

Included with this complex are areas of Thedalund and Kim soils. The Thedalund soil usually occurs in association with the Shingle soils. It has loam substrata which are underlain with shale bedrock at a depth of 20 to 40 inches. The Kim soils usually occur on the lower portions of the side slopes. It has clay loam substrata and is underlain with shale bedrock at depths of 40 to 60+ inches. These inclusions make up about 20 percent of the total acreage.

The Shingle soil is a shallow, well-drained soil. It formed in calcareous, moderately alkaline sediments derived from moderately fine-textured sedimentary shales. The average annual precipitation ranges from 10 to 14 inches, and the average annual air temperature is about 44°F.

In a representative Shingle profile the surface layer is light brown gray clay loam about 4 inches thick. The substratum is light yellowish brown clay loam about 11 inches thick which is underlain with soft, calcareous shale at a depth of 15 inches.

The Shingle soil has a moderate permeability. Effective rooting depth ranges from 10 to 20 inches. Available water capacity is low. Surface runoff is rapid, and the hazard of erosion is severe.

The Rock outcrop consists of multi-colored, calcareous to noncalcareous, medium to fine-textured, soft to hard shales and siltstones. It usually occurs on side slopes where geologic erosion has prevented soils from developing.

151 /DE - Shingle-Rock outcrop complex, 10 to 60 percent slopes (cont.)

This complex is used for rangeland and wildlife habitat.

Shingle soils: Capability unit VIIe14, dryland: Shallow Loamy range site (10 to 14 inch precipitation zone).

Rock outcrop: Capability unit VIIIe83; Range site not assigned.

347/D - Shingle-Rock outcrop-Samsil complex. 10 to 30 percent slopes*

This complex consists of sloping to moderately steep soils on side slopes and ridge crests in the uplands at elevations between 3800 and 5000 feet. This complex is about 50 percent Shingle clay loam, 10 to 30 percent slopes, about 30 percent Rock outcrop, 10 to 30 percent slopes, and about 20 percent Samsil clay, 10 to 30 percent slopes. Neither soil nor Rock outcrop occupies any particular position in the landscape in relation to each other but is dependent upon the type of parent material present. The side slopes in this unit may be dissected by numerous small drain I ages in some areas. The Shingle soil has clay loam subsoils which are underlain with soft, calcareous shale bedrock at a depth of 10 to 20 inches. The Samsil soil has clay substrata which is underlain with soft, calcareous shale bedrock at depths of 10 to 20 inches.

Included with this complex in mapping are areas of Thedalund loam and Kim clay loam. The Thedalund soils have loam substrata which are underlain with soft, calcareous bedrock at depths of 20 to 40 inches and usually occur on the upper portions of the side slopes. The Kim soils have clay loam soils and usually occur on the lower portions of the side slopes. These inclusions make up about 15 percent of the total acreage.

The Shingle soil is a shallow, well-drained soil. It formed in calcareous, moderately alkaline sediments derived from moderately fine-textured sedimentary shales. The average annual precipitation range from 10 to 14 inches, and the average annual air temperature is about 44°F.

In a representative Shingle profile the surface layer is light brownish gray clay loam about 4 inches thick. The substratum is light yellowish brown clay loam about 11 inches thick which is underlain with soft, calcareous shale at a depth of 15 inches.

The Shingle soil has a moderate permeability. Effective rooting depth ranges from 10 to 20 inches. Available water capacity is low. Surface runoff is rapid and the hazard of erosion is severe.

347/D - Shingle-Rock outcrop-Samsil complex, 10 to 30 percent slopes* (cont.)

The Rock outcrop consists of multi-colored, calcareous to noncalcareous, medium to fine-textured, soft to hard shales and siltstones.

The Samsil soil is a shallow, well-drained soil. It formed in fine-textured, calcareous, moderately alkaline materials derived from sedimentary bedrock. The average annual precipitation is about 10 to 14 inches, and the average annual air temperature is about 44°F.

In a representative Samsil profile the surface layer is light brownish gray clay about 5 inches thick. The substratum is light yellowish brown clay about 9 inches thick which is underlain with calcareous clayey shale at a depth of 14 inches.

The Samsil soil has a slow permeability. Effective rooting depth ranges from 10 to 20 inches. Available water capacity is low to moderate. Surface runoff is rapid and the hazard of erosion is severe.

This complex is used for rangeland and wildlife habitat.

Shingle soils: Capability unit V11el4, dryland; Shallow Loamy range site (10 to 14 inch precipitation zone).

Rock outcrop: Capability unit VIIIe83; Range site not assigned.

Samsil soils: Capability unit V11314, dryland; Shallow Clayey range site (10 to 14 inch precipitation zone).

*347/D - Shingle-Rock outcrop-Samday complex, 10 to 30 percent slopes

354/AB - Ulm-Bidman association. Gently sloping

This association consists of nearly level to gently sloping soils on valley-filling fans and side slopes at elevations between 3,800 and 5,000 feet. This association is about 60 percent Ulm loam, 0 to 6 percent slopes, and about 40 percent Bldman loam, 0 to 6 percent slopes. Neither soil occupies any particular position in the landscape. The Ulm soil has heavy clay loam subsoils and is underlain with bedrock at depths of 40 to 60+ inches. The Bidman soil has clay subsoils and is underlain with bedrock at depths of 40 to 60+ inches.

Included with this association in mapping are areas of Briggsdale and Absted soils. The Briggsdale soil usually occurs on the upper portions of valley-filling fans and side slopes. It has clay subsoils and is underlain with bedrock at depths of 20 to 40 inches. The Absted soil usually occurs on the lower portions of the valley-filling fans and side slopes. It has clay subsoils and is underlain with bedrock at depths of 40 to 60+ inches. These inclusions make up about 10 percent of the total acreage.

The Ulm soil is a deep, well-drained soil. It formed in calcareous, moderately alkaline materials derived from sedimentary shales. The average annual precipitation ranges from 10 to 14 inches, and the average annual air temperature is about 44°F.

In a representative Ulm profile, the surface layer is light brownish gray loam about 5 inches thick. The subsoil is brown heavy clay loam about 17 inches thick. The substratum is light yellowish brown clay loam about 38 inches thick.

The Ulm soil has a slow permeability. Effective rooting depth ranges from 20 to 40 inches. Available water capacity is moderate. Surface runoff is moderate, and the hazard of erosion is moderate.

The Bidman soil is a deep, well-drained soil. It formed in calcareous, moderately alkaline materials derived from sedimentary shales. The average annual precipitation ranges from 10 to 14 inches, and the average annual air temperature is about 44°F.

354/AB - Ulm-Bidman association. gently sloping (cont.)

In a representative Bidman profile the surface layer is light gray loam about 4 inches thick. The subsoil is brown clay about 15 inches thick. The lower portion of the subsoil is light olive brown clay. The substratum is calcareous grayish brown clay to 60 inches in depth.

The Bidman soil has a slow permeability. Effective rooting depth ranges from 40 to 60+ inches. Available water capacity is moderate. Surface runoff is moderate and the hazard of erosion is moderate.

This association is used for rangeland, wildlife habitat, and dryland cultivation.

Capability unit IVe2, dryland; Loamy range site (10 to 14 inch precipitation zone).

394/CD - Cushman-Bowbac association, rolling

This association consists of rolling soils on upland hills, ridges, and valley side slopes at elevations between 3,800 and 5,000 feet. This association is about 55 percent Cushman loam, 6 to 15 percent slopes, and about 45 percent Bowbac sandy loam, 6 to 15 percent slopes. Neither soil occupies any particular position in the landscape in relation to each other, and their occurrence is dependent upon the type of parent material present. The Cushman soil has light sandy clay loam subsoils and is underlain with bedrock at depths of 20 to 40 inches. The Bowbac soil 4as sandy clay loam subsoils and is underlain with bedrock at depths of 20 to 40 inches.

Included with this association in mapping are small areas of Tassel and Thedalund soils. The Tassel soil usually occurs in association with the Bowbac soil. It has a paralithic contact between 10 and 20 inches. The Thedalund soil usually occurs in association with the Cushman soil. It lacks an argillic horizon and has paralithic contact at depths of 20 to 40 inches. These inclusions make up about 10 percent of the total acreage.

The Cushman soil is a moderately deep, well-drained soil. It formed in calcareous, moderately alkaline materials derived from sedimentary shales. The average annual precipitation ranges from 10 to 14 inches, and the average annual air temperature is about 44°F.

In a representative Cushman profile the surface layer is light brownish gray loam about 4 inches thick. The subsoil is light brown very fine sandy clay loam about 13 inches thick. The substratum is grayish light brown very fine sandy loam about 6 inches thick and is underlain with soft very fine-grained sandstone and loamstone bedrock at a depth of 23 inches.

The Cushman soil has a moderate permeability. Effective rooting depth ranges from 20 to 40 inches. Available water capacity is moderate. Surface runoff is moderate to rapid and the hazard of erosion is moderate to severe.

394/CD - Cushman-Bowbac association, rolling (cont.)

The Bowbac soil is a moderately deep, well-drained soil. It formed in polylithologic parent materials derived from sedimentary bedrock. The average annual precipitation ranges from 10 to 40 inches, and the average annual air temperature is about 47°F.

In a representative Bowbac profile the surface layer is brown sandy loam about 4 inches thick. The subsoil is brown sandy clay loam about 13 inches thick. The substratum is light gray very fine sandy clay loam-about 12 inches thick which is underlain with calcareous interbedded shale and sandstone at a depth of 29 inches.

The Bowbac soil has a rapid permeability. Effective rooting depth ranges from 20 to 40 inches. Available water capacity is moderate. Surface runoff is moderate and the hazard of erosion is severe.

This association is used for rangeland, wildlife habitat, and dryland cultivation.

Cushman soils: Capability unit VIe2, dryland; Loamy range site (10 to 14 inch precipitation zone).

Bowbac soils: Capability unit VIe5, dryland; Sandy range site (10 to 14 inch precipitation zone).

11.8 1978-79 SOILS SERIES DESCRIPTIONS

HAVERSON SERIES*

Typical Pedon: Haverson clay loam - Rangeland
(colors are for dry soil unless otherwise noted)

Al 0-4"	Brown (10YR 5/3) clay loam, dark brown (10YR 4/3) moist; medium and fine subangular blocky structure; hard, very friable, sticky and plastic; slightly calcareous; mildly alkaline (pH 7.6); clear smooth boundary.
AC 4-12"	Grayish brown (10YR 5/2) clay loam, dark grayish brown '(10YR 4/2) moist; massive; very hard, firm, sticky and plastic; slightly calcareous; mildly alkaline (pH 7.6); clear smooth boundary.
C1 12-22"	Yellowish brown (10YR 5/4) clay loam, dark brown (10YR 4/3) moist; massive; hard, friable, sticky and plastic; slightly calcareous; mildly alkaline (pH 7.8); clear smooth boundary.
C2 22-40"	Yellowish brown (IOYR 5/4) clay loam, dark brown (10YR 4/3) moist; massive; slightly hard, very friable, very sticky and plastic; slightly calcareous; mildly alkaline (pH 7.8); clear smooth boundary.
C3 40-92"	Light olive brown (2.5Y 5/4) clay loam, olive brown (2.5Y 4/4) moist; massive; hard, friable, very sticky and plastic; slightly calcareous; mildly alkaline (pH 7.8); gradual wavy boundary.
C4r 92-100"	Calcareous olive brown soft weathered claystone.

Type Location: TL-I North Butte Area, Campbell County, Wyoming.

Note: All soil horizons' were sampled at this type location. The C3 (40-92") horizon was subsampled: 40-58", 58-68", 68-84", and 84-92".

* Haverdad

FORT COLLINS SERIES*

Typical Pedon: Fort Collins loam - Rangeland

(colors are for dry soil unless otherwise noted)

A1 0-4"	Brown (10YR 5/3) loam, dark grayish brown (10YR 4/2) moist; weak medium and fine subangular blocky structures; slightly hard, very friable, slightly sticky and slightly plastic; mildly alkaline (pH 7.4); clear smooth boundary.
B1 4-7"	Brown (IOYR 5/3) loam, dark grayish brown (10YR 4/2) moist; moderate medium and fine subangular blocky structure; hard, very friable, sticky and slightly plastic; neutral (pH 7.2); clear smooth boundary.
B21t 7-16"	Brown (IOYR 5/3) loam, dark grayish brown (IOYR 4/2) moist; moderate coarse and medium prismatic structure that parts to moderate coarse and medium subangular blocks; hard, friable, sticky and plastic; few patches of glossy coatings on faces of peds; mildly alkaline (pH 7.4); clear smooth boundary.
B22t 16-27"	Yellowish brown (IOYR 5/4) clay loam, dark brown (10YR 4/3) moist; moderate coarse and medium prismatic structure that parts to coarse and medium angular blocks; very hard, firm, sticky and plastic; patches of wax-like coatings on faces of peds, in root channels and lips of the larger pores; mildly alkaline (pH 7.5); clear smooth boundary.

* Forkwood

FORT COLLINS SERIES (cont.)

B3ca 27-42" Yellowish brown (10YR 5/4) sandy clay loam, dark brown (10YR 4/3) moist; weak medium and fine subangular blocky structure; slightly hard, very friable, sticky and slightly plastic; very few patches of glossy coatings on faces of peds; calcareous only in locations of large soft rounded masses; mildly alkaline (pH 7.6); gradual smooth boundary.

Cca 42-60" Light yellowish brown (10YR 6/4) sandy clay loam, yellowish brown (IOYR 5/4) moist; massive; soft, very friable, slightly sticky and slightly plastic; strongly calcareous, lime mainly disseminated; mildly alkaline (pH 7.8).

Type Location: TL-2 North Butte Area, Campbell County, Wyoming.

OLNEY SERIES*

Typical Pedon: Olney sandy loam - Rangeland
(colors are for dry soil unless otherwise noted)

Al 0-2"	Brown (10YR 5/3) sandy loam, dark grayish brown (10YR 4/2) moist; weak fine and very fine granular structure; soft, very friable, slightly sticky; neutral (pH 7.2); clear smooth boundary.
B1 2-4"	Brown (10YR 5/3) sandy loam, dark brown (10YR 4/3) moist; moderate coarse and medium subangular blocky structure; slightly hard, very friable, sticky and slightly plastic; mildly alkaline (pH 7.4); clear smooth boundary.
B2t 4-15"	Reddish brown (10YR 5/6) sandy clay loam, dark yellowish brown (10YR 4/4) moist; strong coarse prismatic structure that parts to strong coarse subangular locks; hard, friable, sticky and plastic; patches of wax-like coatings on faces of peds, along root channels and lips of large pores; mildly alkaline (pH 7.5); clear smooth boundary.
B3 15-25"	Reddish brown (10YR 5/6) sandy clay loam, dark reddish brown (10YR 4/6) moist; moderate coarse prismatic structure that parts to moderate coarse and medium subangular blocks; hard, very friable, sticky and plastic; calcareous in a few spots; mildly alkaline (pH 7.6); gradual smooth boundary.
Cca 25-60"	Reddish brown (10YR 5/6) sandy loam, dark reddish brown (10YR 4/6) moist; massive; soft, very friable, slightly sticky and slightly plastic; strongly calcareous, lime mainly disseminated; moderately alkaline (pH 8.0).

Type Location: TL-3 North Butte Area, Campbell County, Wyoming.

* Hiland

CUSHMAN SERIES

Typical Pedon: Cushman loam - Rangeland

(colors are for air dry soil unless otherwise noted).

Al 0-2"	Brown (10YR 5/3) loam, dark brown (10YR 4/3) moist; weak medium and fine subangular blocky structure; slightly hard, very friable, slightly sticky and slightly plastic; neutral (pH 7.2); clear smooth boundary.
BI 2-5"	Brown (IOYR 5/3) clay loam, dark brown (IOYR 4/3) moist; weak medium prismatic structure that parts to moderate medium and fine subangular blocks; hard, friable, sticky and plastic; mildly alkaline (pH 7.4); clear smooth boundary.
B2t 5-15"	Yellowish brown (IOYR 5/4) clay loam, dark yellowish brown (10YR 4/4) moist; moderate coarse prismatic structure that parts to moderate coarse and medium subangular blocks; hard, friable, sticky and plastic; patches of glossy and wax-like coatings on faces of peds and lips of large pores; mildly alkaline (pH 7.5); clear smooth boundary.
B3 15-23"	Light reddish brown (IOYR 6/6) sandy clay loam, yellowish brown (10YR 4/4) moist; weak medium and fine subangular blocky structure; hard, very friable, sticky and plastic; calcareous in spots; mildly alkaline (pH 7.6); gradual smooth boundary.
C I 23-34"	Light reddish brown (IOYR 6/6) sandy clay loam, yellowish brown (IOYR 5/4) moist; massive; slightly hard, very friable, sticky and slightly plastic; calcareous in spots; mildly alkaline (pH 7.6); clear wavy boundary.
C2r 34-46"	Soft weathered calcareous sandstone.

Type Location: TL-4 North Butte Area, Campbell County, Wyoming.

BOWBAC SERIES

Typical Pedon: Bowbac sandy loam - Rangeland

(colors are for air dry soil unless otherwise noted)

Al 0-2"	Brown (10YR 5/3) sandy loam, dark brown (10YR 4/3) moist; weak fine granular structure; soft, very friable, slightly sticky; neutral (pH 7.2); clear smooth boundary.
B1 2-4"	Yellowish brown (10YR 5/4) sandy loam, dark brown (IOYR 4/3) moist; moderate medium and fine subangular blocky structure; slightly hard, very friable, slightly sticky and slightly plastic; mildly alkaline (pH 7.4); clear smooth boundary.
B2 t 4-15"	Yellowish brown (10YR 5/4) sandy clay loam, dark yellowish brown (1 OYR 4/4) moist; moderate coarse prismatic structure that parts to moderate coarse and medium subangular blocks; slightly hard, very friable, sticky and plastic; thin nearly continuous glossy coatings and patches of wax-like coatings on faces of peds; clay bridging between sand grains; mildly alkaline (pH 7.5); gradual smooth boundary.
B3 15-21"	Yellowish brown (IOYR 5/4) sandy clay loam, dark yellowish brown (IOYR 4/4) moist; weak medium and fine subangular blocky structure; slightly hard, very friable, slightly sticky and slightly plastic; mildly alkaline (pH 7.6); gradual smooth boundary.
Cl ca 21-35"	Light yellowish brown (10YR 6/4) sandy loam, yellowish brown (10YR 5/4) moist; massive; soft, very, friable, slightly sticky; strongly calcareous; lime mainly disseminated; moderately alkaline (pH 8.0); gradual wavy boundary.
C2r 35-50"	Soft weathered brown calcareous sandstone.

Type Location: TL-5 North Butte Area, Campbell County, Wyoming.

THEDALUND SERIES*

Typical Pedon: Thedalund loam - Rangeland
(colors are for air dry soil unless otherwise noted).

A1 0-4" Brown (10YR 5/3) loam, dark brown (10YR 4/3) moist; weak fine and very fine subangular blocky structure; slightly hard, very friable, sticky and plastic; mildly calcareous; moderately alkaline (pH 8.0); clear smooth boundary.

C1 4-22" Yellowish brown (10YR 5/4) loam, dark yellowish brown (10YR 4/4) moist; massive; hard, friable, sticky and plastic; strongly calcareous; moderately alkaline (pH 8.0); gradual wavy boundary.

C2r 22-32" Soft weathered calcareous brown loamstone.

Type Location: TL-6 North Butte Area, Campbell County, Wyoming.

Note: This series was sampled at this location. Each soil horizon was sampled.

The resultant laboratory data shows less clay in the 10 to 22 inch textural control section (14.6%) than the 18% lower limit allowed for the Thedalund Series. Experience has shown, however, that higher silt and lower clay readings are obtained by the hydrometer method used here. Better correlation is obtained between the pipette method and field textures, especially in areas of montmorillonite clays.

*Thredle.

CUSHMAN SERIES

Tvoical Pedon: Cushman loam - Rangeland
(colors are for air dry soil unless otherwise noted).

A1 0-2" - Light brown (10YR 6/3) loam, brown (IOYR 5/3) moist; weak medium and fine subangular blocky structure; slightly hard, very friable, slightly sticky and slightly plastic; mildly alkaline (pH 7.6); clear smooth boundary.

B2t 2-10" - Light yellowish brown (10YR 6/4) loam, brown (10YR 5/3) moist; moderate medium prismatic structure that parts to moderate medium and fine subangular blocks; hard, friable, sticky and plastic; patches of glossy and wax-like coatings on faces of peds, in root channels, and lips of large pores; calcareous in spots; mildly alkaline (pH 7.6); clear smooth boundary.

B3 ca 10-18" Light yellowish brown (IOYR 6/4) loam, brown (IOYR 5/3) moist; moderate coarse and medium subangular blocky structure; hard, very friable, sticky and plastic; strongly calcareous; mildly alkaline (pH 7.8); gradual smooth boundary.

Cl ca 18-34" Light yellowish brown (10YR 6/4) loam, brown (10YR 5/3) moist; massive; slightly hard, very friable, sticky and plastic; strongly calcareous; moderately alkaline (pH 8.0); gradual wavy boundary.

C2 r 34-46" Soft weathered calcareous brown loamstone.

Type Location: TL-7 North Butte Area, Campbell County, Wyoming.

Note: This series was sampled at this location. Each soil horizon was sampled.

CUSHMAN SERIES (Cont.)

The resultant laboratory data shows less clay in the 2 to 18 inch textural control section (weighted average 16.6%) than the 18% lower limit allowed for the Cushman Series. Experience has shown, however, that higher silt and lower clay readings are obtained by the hydrometer method used here. Better correlation is obtained between the pipette method and field textures, especially in areas of montmorillonite clays.

TASSEL SERIES*

Typical Pedon: Tassel sandy loam - Rangeland
(colors are for air dry soil unless otherwise noted)

Al 0-3"	Brown (10YR 5/3) sandy loam, dark brown (10YR 4/3) moist; weak very fine granular structure; soft, very friable; mildly-alkaline (pH 7.4); clear smooth boundary.
C1 3-12"	Brown (10YR 5/3) sandy loan, dark brown (10YR 4/3) moist; massive; soft, very friable; slightly calcareous; mildly alkaline (pH 7.6); gradual wavy boundary.
C2r 12-20"	Calcareous yellowish brown soft weathered sandstone.

Type Location: TL-8 North Butte Area, Campbell County, Wyoming.

* Taluce

NELSON SERIES*

Typical Pedon: Nelson sandy loam - Rangeland
(colors are for air dry soil unless otherwise noted)

A1 0-3" Brown (10YR 5/3) sandy loam, dark brown (10YR 4/3) moist; weak fine granular structure; soft, very friable; mildly alkaline (pH 7.4); clear smooth boundary.

Cl 3-23" Yellowish brown (10YR 5/4) sandy loam, dark yellowish brown (10YR 4/4) moist; soft, very friable; slightly calcareous; mildly alkaline (pH 7.6); gradual wavy boundary.

C2r 23-30" Slightly hard calcareous yellowish brown weathered sandstone.

Type Location: TL-9 North Butte Area, Campbell County, Wyoming.

* Turnercrest

BIDMAN SERIES

Typical Pedon: Bidman loam - Rangeland
(colors are for air dry soil unless otherwise noted).

A2 0-3" Light grayish brown (10YR 6/2) loam dark grayish brown (IOYR 4/2) moist; thin vesicular crust, weak fine granular structure; soft, very friable, slightly sticky and slightly plastic; neutral (pH,7.2); abrupt smooth boundary.

B2t 3-21" Brown (IOYR 5/3) clay, dark grayish brown (10YR 4/2) moist; strong coarse prismatic structure that parts to strong coarse and medium angular blocks; extremely hard, very firm, very sticky and plastic; nearly continuous wax-like coatings on faces of peds; mildly alkaline (pH 7.4); clear smooth boundary.

B3 ca 21-26" Light brown (10YR 6/3) clay loam, brown (10YR 5/3) moist; moderate coarse prismatic structure that parts to moderate coarse and medium angular blocks; very hard, firm, sticky and plastic; strongly calcareous; moderately alkaline (pH 8.0); gradual smooth boundary.

Cl ca 26-52" Light brown (IOYR 6/3) loam, brown (IOYR 5/3) moist; massive; slightly hard, very friable, sticky and plastic; strongly calcareous; moderately alkaline (pH 8.2); gradual wavy boundary.

C2r 52-60" Slightly hard, weathered, mixed calcareous sandstone, siltstone and shale.

Type Location: TL-10 North Butte Area, Campbell County, Wyoming.

Note: This series was sampled at this location for soil' analysis. All soil horizons were sampled.

BRIGGSDALE SERIES*

Typical Pedon: Briggsdale fine sandy loam - Rangeland
(colors are for air dry soil unless otherwise noted).

A2 0-2" Light grayish brown (10YR 6/2) fine sandy loam, dark grayish brown (10YR 4/2) moist; moderate fine and very fine granular structure; soft, very friable; neutral (pH 7.2); abrupt smooth boundary.

B21t 2-6" Dark yellowish brown (10YR 4/4) clay, dark brown (IOYR 3.5/3) moist; moderate coarse prismatic structure, parts to moderate coarse angular blocks; hard, firm, sticky, plastic; thin nearly continuous glossy coating on faces of peds; mildly alkaline (pH 7.4); clear smooth boundary.

B22t 6-11" Dark yellowish brown (10YR 4/4) clay, dark brown (10.YR 3.5/3) moist; strong coarse prismatic structure that parts to strong coarse and medium angular blocks; very hard, very firm, very sticky and plastic; thin nearly continuous glossy coatings and patches of wax-like coatings on all faces of peds; mildly alkaline (pH 7.4); clear smooth boundary.

B3 11-20" Yellowish brown (10YR 5/4) loam, dark yellowish brown (10YR 4/4) moist; weak coarse prismatic structure that parts to weak coarse and medium angular blocks; hard, friable, sticky and plastic; mildly alkaline (pH 7.5); clear smooth boundary.

Clca 20-30" Very pale brown (10YR 7/3) sandy clay loam, light brown (lOYr 6/3) moist; weak coarse subangular blocky structure; hard, friable, sticky and slightly plastic; very strongly calcareous; moderately alkaline (pH 8.0)' gradual wavy boundary.

C2r 30-60" Soft calcareous weathered pale brown sandy shale.

Type Location: TL-11 North Butte Area, Campbell County, Wyoming. *

BIDMAN SERIES

Typical Pedon: Bidman loam - Rangeland
(colors are for air dry soil unless otherwise noted).

A2 0-2" Light grayish brown (10YR 6/2) fine sandy loam, dark grayish brown (10YR 4/2) moist; moderate fine and very fine granular structure; soft, very friable; neutral (pH 7.2); abrupt smooth boundary.

B21t. 2-7" Dark grayish brown (10YR 4.5/2) clay loam, dark grayish brown (10YR 4/2) moist; moderate coarse prismatic structure that parts to moderate coarse angular blocks; very hard, firm, very sticky and plastic; thin nearly continuous glossy coatings on faces of peds; mildly alkaline (pH 7.4); clear smooth boundary.

B22t 7-16" Dark yellowish brown (10YR 4/4) clay, dark brown (10YR 3.5/3) moist; strong medium prismatic structure that parts to strong medium and fine angular blocks; very hard, very firm, very sticky and plastic; thin nearly continuous glossy coatings and patches of wax-like coatings on all faces of peds; mildly alkaline (pH 7.4); clear smooth boundary.

B3 16-22" Yellowish brown (10YR 5/4) loam, dark yellowish brown (IOYR 4/4) moist; weak coarse prismatic structure that parts to weak coarse and medium angular blocks; hard, friable, sticky and plastic; mildly alkaline (pH 7.5); clear smooth boundary.

Clca 22-40" Very pale brown (IOYR 7/3) sandy clay loam, light yellowish brown (IOYR 6/3) moist; weak coarse subangular blocky structure; hard, friable, sticky and plastic; very strongly calcareous; moderately alkaline (pH 8.0); gradual wavy boundary.

C2r 40-52" Soft calcareous weathered pale brown sandy shale.

Type Location: TL-12 North Butte Area, Campbell County, Wyoming.

BIDMAN SERIES

Typical Pedon: Bidman loam - Rangeland
(colors are for air dry soil unless otherwise noted).

A2 0-3" Light grayish brown (10YR 6/2) loam dark grayish brown (10YR 4/2) moist; moderate fine and very fine granular structure; soft, very friable; neutral (pH 7.2); abrupt smooth boundary.

B21t 3-7" Dark yellowish brown (10YR 4/4) clay loam, dark brown (10YR 3.5/3) moist; moderate coarse prismatic structure that parts to moderate coarse and medium angular blocks; hard, firm, sticky and plastic; thin nearly continuous glossy coatings on faces of peds; mildly alkaline (pH 7.4); clear smooth boundary.

B22t 7-14" Dark yellowish brown (10YR 4/4) clay, dark brown (IOYR 3.5/3) moist; strong medium prismatic structure that parts to strong medium and fine angular blocks; very hard, very firm, very sticky and plastic; thin nearly continuous glossy coatings and patches of wax-like coatings on all faces of peds; mildly alkaline (pH 7.4); clear smooth boundary.

B3 14-18" Yellowish brown (IOYR 5/4) loam, dark yellowish brown (10YR 4/4) moist; weak coarse prismatic structure that parts to weak coarse and medium angular blocks; hard, friable, sticky and plastic; mildly alkaline (pH 7.5); clear smooth boundary.

Clca 18-40" Very pale brown (10YR 7/3) sandy clay loam, light yellowish brown (IOYR 6/3) moist; massive; hard, friable, sticky and plastic; very strongly calcareous; moderately alkaline (pH 8.0); gradual wavy boundary.

C2r 40-50" Soft calcareous weathered pale brown sandy shale.

Type Location: TL-13 North Butte Area, Campbell County, Wyoming.

FORT COLLINS SERIES*

Typical Pedon: Fort Collins sandy loam - Rangeland
(colors are for air dry soil unless otherwise noted)

A1 0-2" Brown (10YR 5/3) sandy loam, dark brown (10YR 4/3) moist; moderate fine and very fine granular structure; slightly hard, very friable, slightly sticky, noncalcareous;clear smooth boundary.

B21t 2-5" Brown (7.5YR 5/4) sandy clay loam (having less' than 35% fine or coarse sands), dark brown (7.5YR 5/4) moist; moderate very coarse prismatic structure that parts to moderate very coarse and coarse subangular blocks; hard, friable, slightly sticky and slightly plastic; clay bridging between sand grains; noncalcareous; clear smooth boundary.

B22t 5-11" Brown (10YR 5/4) sandy clay loam (having less than 35% fine sand or coarser), dark brown (7.5YR 4/4) moist; strong coarse prismatic structure that parts to strong coarse and medium angular blocks; hard, friable, slightly sticky and slightly plastic; clay bridging between sand grains; noncalcareous; clear smooth boundary.

B3 11-35" Light brown (7.5YR 6/4) sandy clay loam, brown (7.5YR 5/4) moist; weak coarse and moderate subangular blocky structure; slightly hard, very friable, slightly sticky and slightly plastic; noncalcareous; gradual smooth boundary.

Cca 35-50" Light brown (7.5YR 6/4) sandy loam, dark brown (7.5YR 4/4) moist; massive; soft, very friable; strongly calcareous.

Type Location: TL-15 North Butte Area, Campbell County, Wyoming. *

Forkwood

1978-79 SOIL ANALYTICAL RESULTS

Bidman

(Sample Point TL-10)

Depth (inches)	Very Fine Sand %	Sand %	Silt %	Clay %	Texture
			Mechanical Analysis		
0-3	16.4	15.2	52.8	15.6	SiL
3-21	5.0	16.6	37.8	40.6	C
21-26	12.6	37.0	26.8	23.6	SCL
26-52	17.9	28.9	30.4	22.8	L

Depth	Se ppm	Organic Matter %	Saturation. %
0-3	<0.1	2.60	49.0
3-21	0.1	1.68	61.5
21-26	0.3	0.95	46.6
26-52	<0.1	0.87	50.4

Depth (inches)	pH paste		Saturation Extract				
			Elect. Cond.	Cations			
			(mmhos/cm)	Ca	Mg	Na	SAR
				-----meg/ l liter-----			
0-3	6.5	0.5	4.0	2.0		0.1	0.1
3-21	6.1	0.3	1.7	1.0		0.2	.0.1
21-26	7.7	0.3	1.9	1.3		0.2	0.1
26-52	7.9	0.3	1.5	1.5		0.7	0.6

Samples analyzed by Core Laboratories for Cleveland Cliffs- August 1979.

Power Resources Inc.

Haverson*
(Sample Point TL-1)

Depth (inches)	Mechanical Analysis: Very Fine Sand %	Sand %	Silt %	Clay %	Texture
0-4	6.0	30.8	34.8	28.4	CL
4-12	7.5	23.3	39.2	30.0	CL
12-22	11.1	27.7	31.2	30.0	CL
22-40	11.0	19.8	37.2	32.0	CL
40-58	10.9	29.9	28.0	31.2	CL
58-68	11.1	13.7	42.0	33.2	CL
68-84	8.3	24.5	32.0	35.2	CL
84-92	8.3	36.5	26.0	29.2	CL

Depth	Se ppm	Organic Matter %	Saturation. %
0-4	0.1	3.84	64.4
4-12	0.1	2.75	59.5
12-22	<0.1	1.30	50.3
22-40	0.1	1.30	52.4
40-58	<0.1	1.47	49.6
58-68	<0.1	0.87	58.1
68-84	<0.1	0.92	52.8
84-92	<0.1	0.58	44.7

* Haverdad

Haverson* (cont.)
(Sample Point TL-1)

Depth (inches)	pH paste		Saturation Extract				
			Elect. Cond.	Cations			
			(mmhos/cm)	Ca	Mg	Na	SAR
				-----meg/ l liter-----			
0-4	6.8	0.7	6.2	1.8		0.3	0.1
4-12	6.9	0.6	5.3	1.4		0.1	<0.1
12-22	7.5	0.3	2.8	0.7		0.1	0.1
22-40	7.7	0.3	2.3	0.6		0.1	0.1
40-58.	7.7	0.2	2.0	0.6		0.1	0.1
58-68	7.7	0.2	1.7	0.5		0.1	0.1
68-84	7.8	0.2	1.6	0.5		0.1	0.1
84-92	7.8	0.3	1.8	0.5		0.1	0.1

Samples analyzed by Core Laboratories for Cleveland Cliffs - August 1979.

* Haverdad

Cushman
(Sample Point TL-7)

Mechanical Analysis

Depth (inches)	Very Fine Sand %	Sand %	Silt %	Clay %	Texture
0-2	22.9	27.9	38.8	10.4	L
2-10	16.2	32.6	35.8	15.4	L
10-18	11.5	41.3	29.2	18.0	SL
18-34	12.7	38.9	32.8	15.6	L

Depth	Se ppm	Organic Matter %	Saturation. %
0-2	0.1	2.23	50.5
2-10	0.1	2.20	55.0
10-18	0.1	1.01	49.3
18-34	0.1	0.78	46.0

Depth (inches)	pH paste		Saturation Extract				
			Elect. Cond.	Cations			
			(mmhos/cm)	Ca	Mg	Na	SAR
				------meg/ l liter------			
0-3	7.2	0.6	5.2	1.3		0.1	<0.1
3-21	7.1	0.4	4.0	1.1		0.1	<0.1
21-26	7.7	0.3	2.7	1.2		0.1	0.1
26-52	7.9	0.3	2.0	1.3		0.1	0.1

Samples analyzed by Core Laboratories for Cleveland Cliffs - August 1979.

Power Resources Inc.

Thedalund*
(Sample Point TL-6)

Depth (inches)	Very Fine Sand %	Sand %	Silt %	Clay %	Texture
			Mechanical Analysis		
0-4	23.4	24.2	40.8	11.16	L
4-22	21.9	21.7	41.8	14.,6	L

Depth	Se ppm	Organic Matter %	Saturation. %
0-4	<0.1	2.83	53.9
2-22	<0.1	1.88	57.9

Depth (inches)	pH paste	Saturation Extract				
		Elect. Cond.	Cations			
		(mmhos/cm)	Ca	Mg	Na	SAR
			------meg/ l liter------			
0-4	7.4	0.5	4.8	0.8	0.1	<0.1
4-22	7.4	0.4	3.1	0.8	0.1	0.1

Samples analyzed by Core Laboratories for Cleveland Cliffs - August 1979.

*Theedle

Power Resources Inc.

SECTION 11.10

SOIL ANALYSIS METHODOLOGY

ENERGY LABORATORIES, INC.
P.O. BOX 3258 • 1·07 SOUTH BROADWAY • BILLINGS, MT 59107-3258 • PHONE (406) 252-6325

SOIL & OVERBURDEN ANALYSIS FEE SCHEDULE
1987

PARAMETER	METHOD	UNIT	PRICE
Acid-base Potential	(1) p 43-51	T CaCO3/1COT	$15.00
Acid Potential, Furnace Oxidation	(1) p 43-51	meq H/100g	10.00
Ammonia as N, KCl ext.	(3) met. 54-2	ppm	5.00
Arsenic, Hot Water ext.	(3) met 20-3	ppm	8.00
Barium	(4) p 600-2	ppm	5.00
Base Saturation		%	20.00
Beryllium	(4) p 600-2	ppm	5.00
Boron	(3) met 75-4	ppm	5.00
Cadmium	(4) p 600-2	ppm	5.00
Calcium, sat. paste	(5) met 2,3a	meq/l	5.00
Cation Exchange Capacity	(3) met 57-2	meq/100g	15.00
Chromium	(4) p 600-2	ppm	5.00
Coarse Fragments	(10) 205,213-216	%	5.00
Conductivity, sat. paste	(5) met 3a,4b	mhos/cm	4.50
Copper	(4) p 600-2	ppm	5.00
Cyanide	(2) 335.2 CN-M	ppm	43.00
Exchangeable Sodium Percentage	(8)	%	25.00
Iron	(4) p 600-2	ppm	5.00
Lead	(4) p 600-2	ppm	5.00
Lime	(5) met 23c	%	5.00
Magnesium, saturated paste ext.	(4) met 2,3a	meq/l	5.00
Manganese	(4) p 600-2	ppm	5.00
Mercury	(2) 245.5	ppm	5.00
Molybdenum (MO) amm. oxal.	(3) met 74-2	ppm	8.00
Molybdenum (VI)(NH4)2CO3	(6)	ppm	8.00
Molybdenum (VI) ABDTPA	(9)	ppm	5.00
Neutralization Potential	(1) p 43-51	T CaCO3/1COT	5.00
Nickel	(4) p 600-2	ppm	5.00
Nitrate as N	(3) met 54-2	ppm	5.00
Total Nitrogen			15.00
Organic Carbon	(5) 29-3	%	5.00
Organic Matter	(5) p 105	%	5.00
pH, saturated paste	(5) met 21a	Std. units	4.00
Phosphorus, Sodium Bicarbonate	(3) met 75-4	ppm	5.00
Potassium	(3) met 71.3	ppm	5.00
SAR (Includes Ca, Mg, Na)	(5) met 23b	unitless	15.00
Saturation Percentage	(5) 2,3a	%	4.50
Selenium	(3) met 80-3	ppm	8.00
Silver	(2) 245.5	ppm	5.00
Sodium, extractable	(5) met 18	meq/100g	5.00
Sodium, available	(5) met 18	meq/100g	5.00
Sodium, sat. paste ext.	(5) met 2,3a	meq/l	5.00
Sulfur Forms, Furnace Oxidation	(8)	%	18.50
Texture (PSA) sand, silt, clay	(7)	%	5.00
Very Fine Sand	140/270 mesh	%	4.50
Zinc	(4) p 600-2	ppm	5.00

SOIL & OVERBURDEN ANALYSIS FEE SCHEDULE
1987

REFERENCES

(1) Mine Spoil Pot. Soil/Water Quality, B.M. Smith
(2) EPA-500/4-79-020, USEPA 1979
(3) Methods of Soil Analysis, ASA Memo #9
(4) Soil Science Society of America, Vol. 35 #4,1
(5) USDA Handbook #60, USDA 1954
(6) Procedure from KY D.E.Q., VLEK, 1975
(7) USDA Handbook #18
(8) Field & Laboratory Methods, Sobek, 1978
(9) Procedure from KY D.E.Q.
(10) Soil Survey Manual

United States
Department of
Agriculture

Soil
Conservation
Service

311 N. Lakeway Road, Suite 300
Gillette, Wyoming 82716

RECEIVED
MAR 17 1988

March 15, 1989

Mr. Gary Saunders
Applied Ecosystems
P. O. Box 1217
Casper, Wyoming 82602

Gary Saunders,

On March 9, 1988, I reviewed the soils maps for Western, UMC's proposed permit areas on the Rolo property in Converse County and the North Butte property in Campbell County. There are no soils in these permit areas that will qualify as Prime Farmland.

Paul Lapeno
Soil Scientist
Soil Conservation Service
201 W. Lakeway, Suite 300
Gillette, Wyoming 82716

Enclosure

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12. APPENDIX "D-8" VEGETATION INVENTORY

12.1 INTRODUCTION

Prior to implementing baseline studies for the licensing of the North Butte ISL Project, meetings were held with the Department of Environmental Quality - Land Quality Division to determine the requirements for the vegetation baseline. It was determined that the previous owner, Uranerz, would not need site specific production and cover data for the North Butte site if they used the Extended Reference Area (EXREFA) concept. Uranerz would, however, need to provide a vegetation map, discuss the communities and species present and provide a comparison of vegetation studies previously conducted in the region.

Further, it was agreed that the existing vegetation data would be acceptable in lieu of a new study provided that the existing data were generally confirmed, that the threatened and endangered species surveys were updated, and that the plant species list was updated and verified. Also, a written integration of existing vegetation surveys in the region was agreed upon to be included along with assumptions, differences, and deficiencies which may result from such a combination. Verification surveys of existing North Butte data were conducted by Applied Ecosystems. The reports from the four area vegetation investigations have previously been submitted to the LQD and the NRC as Volume IV, Vegetation Supplement, Ruth and North Butte Projects. The four investigations presented in Volume N are as follows:

1. Uranerz Ruth R & D Vegetation Report; 1981
2. Cleveland Cliffs North Butte Vegetation Report; 1979
3. Cleveland Cliffs Greasewood Creek Vegetation Report; 1980
4. Cleveland Cliffs Regional Vegetation Survey Report; 1978

In October, 1992, Pathfinder incorporated into the permit boundary approximately 50 acres of a adjacent lands (incidental boundary revision - IBR), located along the- southern border of the permit area's eastern arm. The vegetation within the IBR area was previously surveyed by Cleveland Cliffs in 1978-79, when the proposed permit area was larger than that currently in place.

Figure 12.1 has been updated to include the vegetation types within the IBR area. The vegetation types within the IBR area are the same as those for the current permit area, with the exception that no juniper-grassland type is present. The IBR area will only be used for the installation of perimeter ore zone monitor wells, therefore no changes have been made to Table 12.2, affected acreage.

12.2 VEGETATION TYPES (MAPPING UNITS)

For the North Butte permit area, four mapping units were used to delineate the vegetation types (Table 12.1, Figure 12.1, Volume II). The mapping units are sagebrush-grassland, grassland, bottomland and juniper-sagebrush. The following sections provide a description of each mapping unit. Tables 12.1 and 12.2 present acreages and percentages for the vegetation types in the permit area and within affected areas. The vegetation types are shown in photographs 1-4.

12.2.1 SAGEBRUSH-GRASSLAND

The sagebrush-grassland vegetation type generally occurs in both upland and lowland areas and is characterized by the presence of big sagebrush Artemisia tridentata) and grasses which include western wheatgrass (Agronvron smithii), blue grama (Bouteloua racil is), needle-and-thread Stjpa comata , green needlegrass (Stipa viridula) and prairie junegrass (Koeleria cri tats Other common species include threadleaf sedge (Carex filifolia , brome (Bromus sip_), fringed sagewort Artemisia frigida and pricklypear cactus (Opuntia polvacantha).

The sagebrush-grassland vegetation type comprises 646.7 acres or 62.2 percent of the permit area. This type also comprises 207.2 acres or 60.4 percent of the affected area.

12.2.2 GRASSLAND

The grassland vegetation type occupies 358.75 acres or 34.5 percent of the permit area and 129.3 a acres or 37.7 percent of the affected area. This type occurs on level to sloping upland sites, along ridgetops and in areas where disturbances from previous exploration activities have been reclaimed.

The grassland type is characterized by the dominance of grasses and grasslike species including western wheatgrass (Aarotivron smithii), blue grama (Bouteloua gracilis), needle-andthread Sti comata), green needlegrass (Stipa viridula) and prairie junegrass (Koeleria cristata). Other common species include.threadleaf sedge Carex filifolia) and brome (Bromus sip.). Big sagebrush Artemisia tridentata) occurs in the grassland type but to a lesser extent than it is found in the sagebrush-grassland type.

12.2.3 BOTTOMLAND

The bottomland vegetation type occurs in lowland areas along streams and washes. This type occupies 25.75 acres or 2.5 percent of the permit area and approximately 5.7 acres or 1.7 percent of the affected area. Vegetation in this type is characterized primarily by grasses including western wheatgrass, meadow barley (Hordeum, brachyantherum), bluegrass Tog pp.,,), Timothy (Phleum pratense) and green needlegrass. Other common species include brome, western yarrow Achillea millefolium), lupine (Lupinus spn.), prairie clover (Petalosteman sgp,) and common dandelion (Taraxacum officinale). The Plains cottonwood (Populus deltoides is found as scattered individuals along Willow Creek in the bottomland type.

12.2.4 JUNIPER-SAGEBRUSH

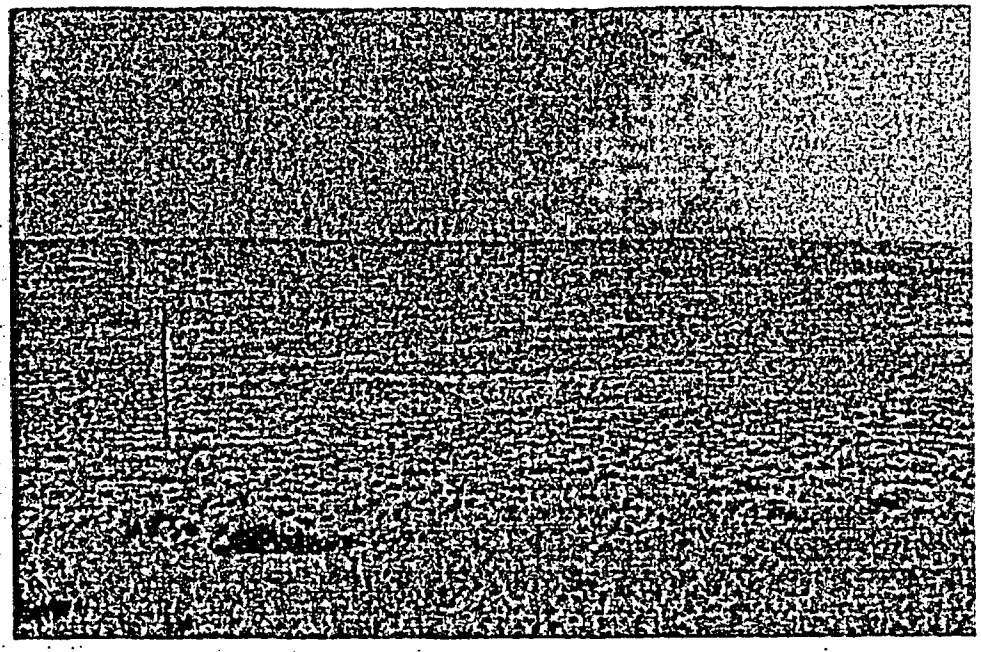
The juniper-sagebrush vegetation type is found on shallow soils of the steep slopes of North Butte and on the slopes of washes near the butte. This vegetation type occupies 8.1 acres or less than one percent of the permit area and is characterized by the presence of (Juniperus scopulorum).

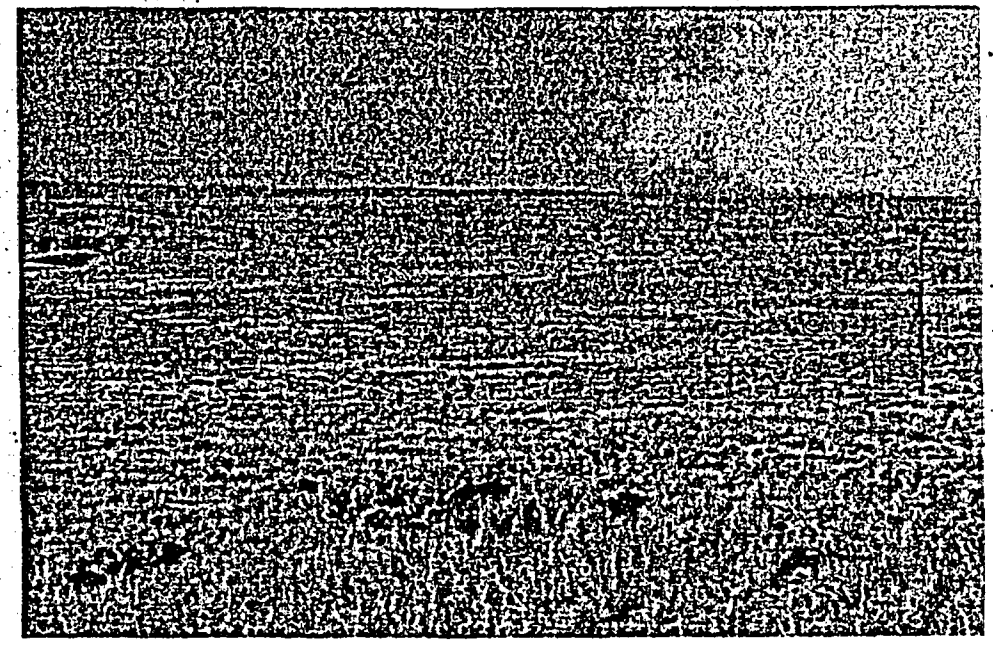
Table 12.1
Vegetation Type Acreages for the North Butte Permit Area

Vegetation Type	Acreage	% of Permit Area
Sagebrush-Grassland	646.7	62.2
Grassland	358.75	34.5
Bottomland	25.75	2.5
Juniper-Sagebrush	8.1	0.8
TOTAL	1039.3	100.0

TABLE 12.2
Vegetation Type Acreages for the Affected
Areas on the North Butte Permit Area

Vegetation Type	Acreage Affected	%of Affected Acreage	% of Total Vegetation Type Affected
Sagebrush-Grassland	207.2	60.4	34.2
Grassland	129.3	37.7	38.3
Bottomland	5.7	1.7	24.5
Juniper Sagebrush	0.8	0.2	10.0
TOTAL	343.0	100.0	





Photographs 1 and 2
Sagebrush/Grassland Vegetation Type
with Interspersed grasslands

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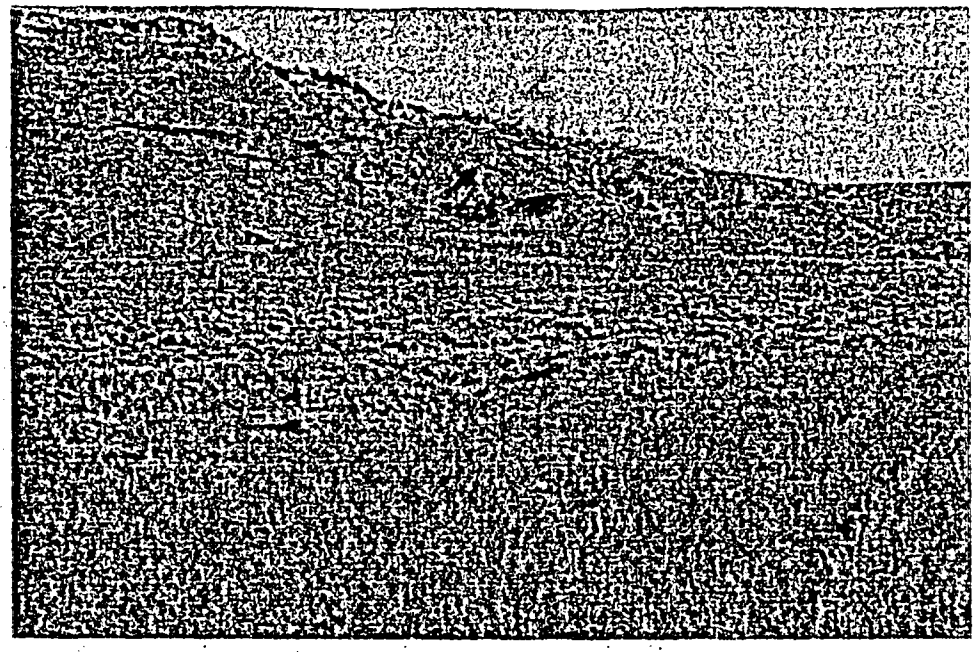

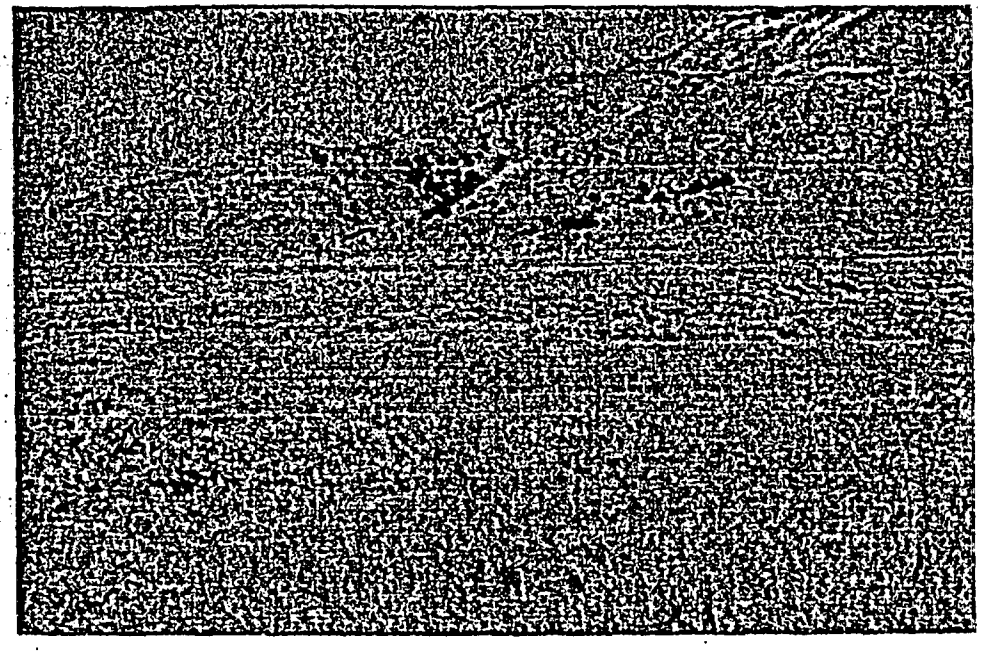

Photographs 3 and 4
Grasslands mixed with Sagebrush/Grassland
Junipers visible on North Butte

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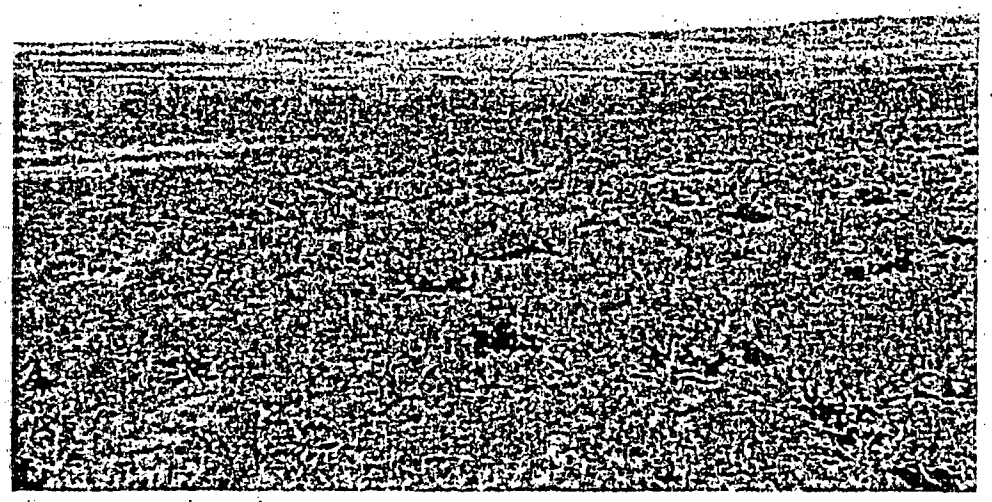
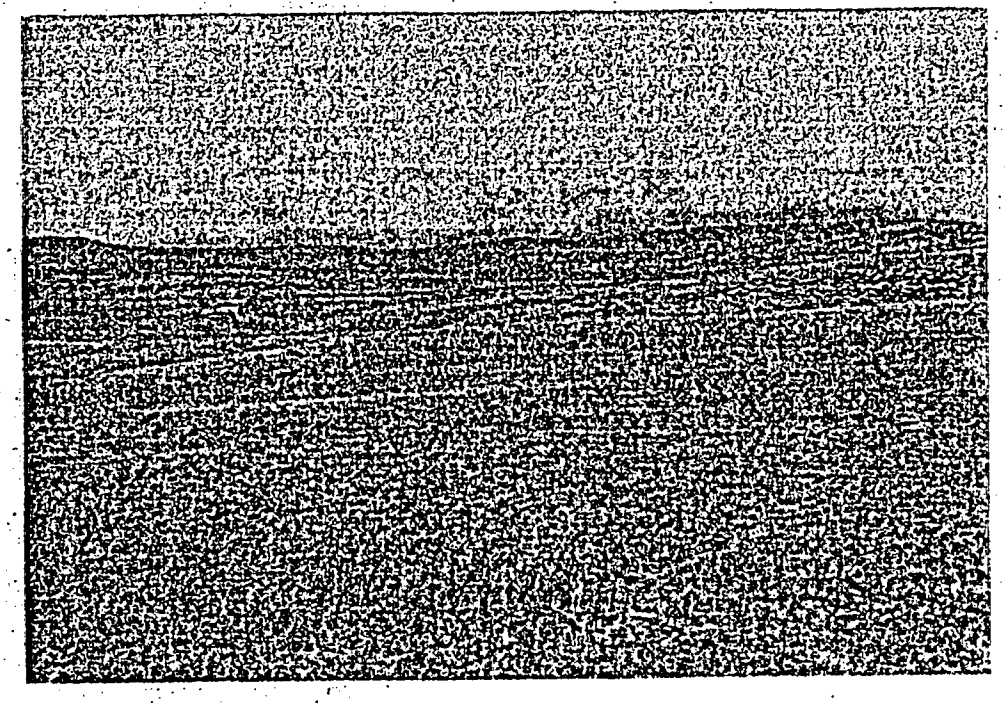
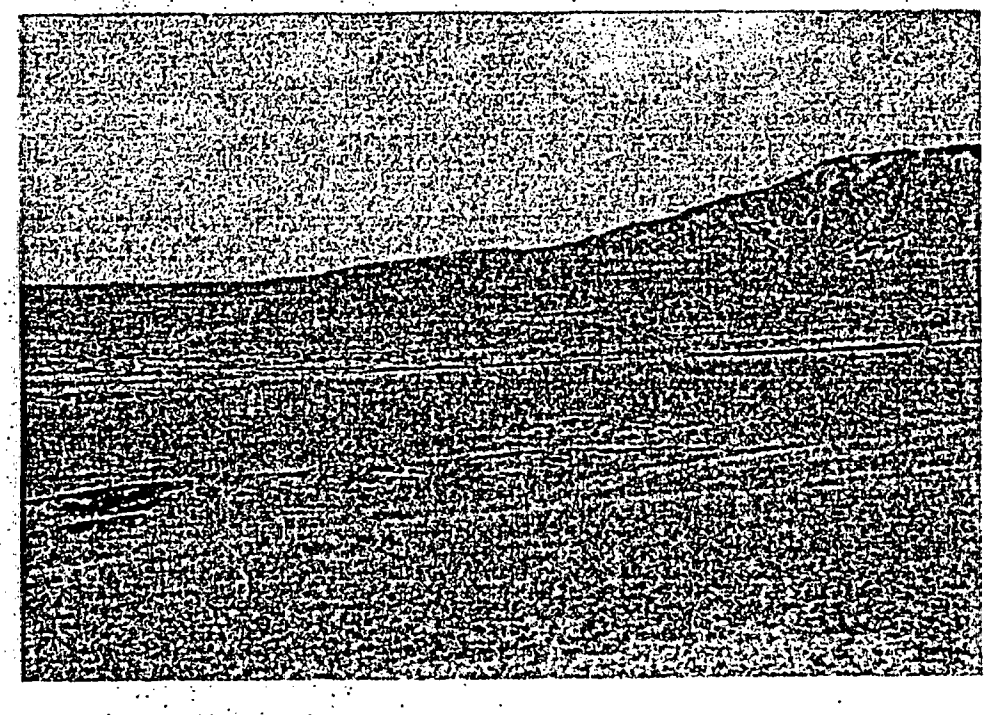


Photograph 1a
Sagebrush/Grassland Vegetation Type
Western Portion of IBR Area; April 5, 1993



Photograph 2a
Grassland Vegetation Type
Eastern Portion of IBR Area; April 5, 1993

Photograph 3a
Bottomland Vegetation Type
IBR Area; April 5, 1993



Photograph 4a
Sagebrush/Grassland (Distant), Bottomland (Middle) and
Grassland (Foreground) Vegetation Types
IBR Area, April 5, 1993

12.2.5 SPECIES LIST

Plant species observed on the North Butte permit area are listed in Table 12.3. Seven noxious weed species quackgrass (Aeropyron re ens , western ragweed (Ambrosia psliostachva), burdock (Arctium minus , Canada thistle (irsium arvense , Cheatgrass brome (Bromus tectorum), Tansy mustard (Descurainia pinnata) and American licorice (Glvcvrrhiza lepidota) were encountered on the permit area. Although these species are scattered throughout the permit area, none of them comprise a dominant species individually or in combination over a contiguous area of greater than 3 acres. Also, one selenium indicator, two-grooved Milkvetch (Astragalus 'bisulcatus) was encountered.

TABLE 12.3

VEGETATION SPECIES LIST

Life Form	Scientific Name	Common Name
Grass	Agropyron cristatum	Crested Wheatgrass
	Agropyron dasystachyum	Thickspike Wheatgrass
	Agrapyron repens	Quackgrass
	Agropyron riparium	Streambanc Wheatgrass
	Western Wheatgrass	Agropyron smithii
	Agropyron spicatun	Bluebunc eatgrass
	Agropyron spicatum Inerme	Beardless Bluebunch Wheatgrass
	Agrapyron trachyaulum	Slender Wheatgrass
	Agropyron triichophorum	Pubescent Wheatgrass
	Aristida longiseta	Red Three-Awn
	Bouteloua gracilis	Blue Grama
	Bromus inermis	Smooth Brome
	Bromus japonicus	Japanese Brome
	Bromus Tectorum	Cheatgrass Brome
	Calamovilfa longifolia	Prairie Sandreed
	Distichlis Stricta	Inland Saltgrass
	Elymus Canadensis	Canada Wildrye
	Elymus Ciereus	Basin Wildrye
	Festuca app.	Fescue
	Hordeum Jubatum	Foxtail Barley
	Koeleria Cristata	Prairie Junegrass
	Oryzopsis Hymenoides	Indian Ricegrass
	Phluem Pratense	Common Timothy
	Poa Arida	Plains Bluegrass
	Poa Canbyi	Canby Bluegrass
	Poa Secumda	Sandberg Bluegrass
	Polypogon Monspeliensis	Rabbitfoot Grass
	Sitanion Hystrix	Bottlebrush Squirreltail
	Stipa Comata	Needle – and – Thread
	Stipa Viridula	Green Needlegrass

TABLE 12-3 (cont.)
VEGETATION SPECIES LIST

ife Form	Scientific Name	Common Name
orb	Abronia fragrans	Snowball Sarriverbena
	Achillea millefolium	Cammon Yarrow
	Agoseris glauca	Pale Agoseris
	Allium textile	Textile Onion
	Ambrosia psliostachya	Western Ragweed
	Arctium minus	Burdock
	Asclepias spp.	Milkweed
	Asclepias speciosa	Showy Mipweed
	Aster adscendens	Longleaf Aster
	Aster falcatus	Whiteprairie Aster
	Astragalus bisulcatus	Twrogrooved Milkvetch
	Astragalus geyeri	Geyer Milkvetch
	Astragalus spatulatus	Tufted Milkvetch
	Calochortus Eurycarpis	Mariposalily
	Camelina microcarpa	Littlepod Falseflax
	Casilleja sulphurea	Sulpher Paintbrush
	Cerastium arvense	Starry Cerastium
	Cienopodium album	Lambsquarter Goosefoot
	Cirsium arvense	Canada Thistle
	Cirsium canescens	Thistle
	Cirsium vulgare	Bull Thistle
	Cleome serrulata	Bee Spiderflaaer
	Ctyptarith celosioides	Northern C'ryptantha
	Delphinium geyeri	Geyer Larkspur
	Descurainia pinnata	Tansymustard
	Erigeron ochroleucus	Fleabane
	EriogornIIn brevicaule	Wild Buckwheat
	Eriogonum ovalifolium	Cushion Eriogonum
	Gaura coccinea	Scarlet Gaura
	Glycyrrhiza lepidota	American Licorice
	Grindelia squarrosa	Curlycup Gumweed
	Haplopappus grerxdeloides	Goldenweed
	Helianthus annus	Common Sunflower
	Heterotheca villosa	Hairy Goldenaster
	Kochia scoparia	Fireweed Summercypress
	Lepidiwn densiflorum	Prairie Peppexweed
	Lesquerella ludoviciana	Silver Bladderpod
	Lithospermum incisum	Narrowleaf Gromwell
	Lupins argenteus	Silvery Lupine
	Lygodesmia junoea	Rush Skeletonplant
	Machaeranthera canescens	Hoary Aster
	Melilotus alba	White Sweetclover
	Melilotus officinalis	Yellow Sweetclover
	Mentha arvensis	Field Mint

TABLE 12-3 (cont.)
VEGETATION SPECIES LIST

Form	Scientific Name	Common Name
Forb (cont.)	Mertensiz linearis	Bluebell
	Oenothera coronopifolia	Eveningprimrnse
	Orenothera caespitosa	Gumbo Lily
	Orobanche fasciulata	Brocanrape
	Oxytropis lagopus	Locoweed
	Penstemon angustifolia	Narrowleaf Penstemmon
	Petalostemon occidentale	Prairie Clove
	Phlox hoodii	Hood Phlox
	Plantago patagonica	Wooly Plantain
	Plantago spinulosa	Spiny Indianwheat
	Psoralea esculenta	Breadroot Scurfpea
	Psoralea lanceolata	Temon Scurfpea
	Psoralea tenuiflora	Slimflower Scurfpea
	Ranunculus spp.	Buttercup
	Ratibida columinifera	Coneflawer
	Rumex Crispus	Curly Dock
	Salsola kali	Russianthistle
	Sisymbriuan altissimimm	Tumbling Hedgemustard
	Sisymbrium linifolium	Tumblemustax
	Sphaeraleea coccinea	Scarlet Globemallow
	Taraxacum officinale	Common Dandelion
	Thlaspi arvense	Field Pennycress
	Tragopogon dubius	Salsify
	Vicia Americana	American Vetch
	Xanthium strumnarium	Cocklebur
	Zigadenus veneosus	Meadow Deathcamas
Sub-Shrub	Artenisia ludoviciana	Louisiana Sagewort
	Artemisia frigida	Fringed Sagewort
	Artemisia pedatifida	Birdfoot Sagewort
	Ceratoides lanata	Ccmmon Winterfat
	Gutierrez is sarothrae	Broom Snakeweed
Shrub	Artemsia cana	Silver Sagebrush
	Artemisia tridentate	Big Sagebrush
	Atriplex caneseens	Fourwing Salthrush
	Chrysothamnus nauseosus	Rubber Rabbitbrush
	Chrysothamnus viscidiflorus	Douglas Rabbitbrush
	Juniperus scopulorum	Junipur
	Prunes virginiana	Chokecherry
	Symphoricarpos occidentalis	Snowberry

TABLE 12-3 (cont.)
VEGETATION SPECIES LIST

·fe Form	Scientific Name	Common Name
·ree	Populus deltoids	Eastern Cottonwood
	Pinus flexilus	Lumber Pine
Succulent	Opuntia polyacantha	Plains Pricklypear
	Mammillaria vivipara	Ball Cactus
	Yucca glauca	Yucca
Bryophyte	Lichen spp.	Lichen

12.3 STUDY COMPARISONS

This section contains a comparison of cover and productivity data from studies conducted on the North Butte permit area and others done in the region. Information was obtained from studies conducted at the following uranium properties:

Studies	Data Collected By
Uranerz - Ruth Property	NUS
Cleveland Cliffs - North Butte Property	Kilbourn/NUS & CCI staff
'eveland Cliffs - Greasewood Creek Property	Mine Reclamation Consultants
Cotter Corp. - Charlie Property	Mariah
Malapai Resources - Christensen Ranch Property	Mariah
Wyoming Minerals - Irigaray Property	Mariah

In using data from these various studies several differences in the sites and the studies need to be pointed out. These sites, although in the same general region (see Figure 12-2, General Location Map, Volume II) they each have their own localized geographical settings and are located in two different drainage basins (Powder River and Belle Fourche). Due to the different geographical settings, differences in structural composition of the vegetation will occur because of the different environmental conditions (soil, slope, microclimates, etc.) that will prevail. The Ruth property is located a few miles east of Pine Ridge along the Dry Fork of the Powder. River with elevations ranging from about 4,800 to 5,000 feet. The North Butte property is located adjacent to North Pumpkin Butte (elevation 6,050 feet) in the Powder River

drainage basin, and is bisected by numerous deeply incised drainages. The elevation at the North Butte property ranges in elevation from 4,900 to 5,700 feet. The Greasewood Creek property is ›cated in gently rolling uplands of the Belle Fourche River drainage basin. Elevations on the ›perty range from about.5,160 to 5,300 feet. The Christensen Ranch and Charlie properties are essentially the same area. They are located just west of North Pumpkin Butte in the Powder River drainage basin with elevations ranging from about 4,500 to 5,400 feet. The topography consists of rolling prairie with numerous drainages and Cottonwood bottomlands. The Irigaray property is located just east of the Powder River and ~s characterized by broad valleys and gently rolling uplands which have been extensively dissected. Elevations range from about 4,200 feet along the Powder River to 4,700 feet.

Another difference is that these studies, done over a nine year period, were conducted according to the DEQ Vegetation Guideline which has undergone a number of revisions during that time period. What was considered adequate in 1978 may not be adequate in 1988, and as such, some deficiencies in data are to be expected.

These studies were also conducted by different individuals over the years which would tend to add variability in mapping and map unit descriptions. Also, even though the studies were conducted according to the guideline, each person setting up and conducting a study could ›knowingly be adding some bias that would cause differences between the studies. As ›eviously mentioned, these sites are in the same general region, but each site may have different vegetative characteristics.

Since the referenced studies were conducted over a nine year period, seasonal variability (wet years and dry years) could significantly affect the vegetative productivity. Grazing practices and land use by the landowners prior to conducting the surveys would also affect the productivity, and species composition of the study areas.

In spite of the above mentioned differences which can be expected when comparing data from these studies, it is felt that sufficient similarity exists to provide an adequate picture of the existing environment at the North Butte site. Even though current site specific data and tests of sample adequacy are lacking for the North Butte site, subsequent sampling of the EXREFA's and the reclaimed areas will provide sufficient data to determine the success of reclamation.

In the following sections two tables compare productivity and cover data at some of the study sites. Site specific data for the Ruth R & D study, the Cleveland Cliffs North Butte regional and Peasewood Creek studies are provided as a Vegetative Supplement (Volume IV) to this section. Data from the Christensen Ranch and Irigaray studies can be found in the respective license application documents.

12.3.1 PRODUCTIVITY

The following table, Table 12.4, presents productivity data from various studies in the region. These production numbers, while rather hard to compare due to different terminologies for the vegetation types, it is apparent that the lowland/bottomland types have the greatest production, over 100g/m2, while the upland types tend to range between 40 to 60 g/m2.

TABLE 12.4
Summary of Productivity Data

·getation Type	Ruth[1] g/m^2	N. Butte[2] g/m^2	Greasewood[3] g/m^2	Charlie[4] g/m^2	Irigaray[5] g/m^2	N. Butte[6] g/m^2
Grassland		42.4		26	38	54.1
Sagebrush/Grassland		57.1	56.5			44.1
Bottomland Sagebrush				136	150	
Upland Sagebrush			55.1	59	87	
Bottomland		162.3				140
Upland	42.06					
Lowland	131.71					

1- Uranerz 1981
2- Cleveland-Cliffs 1979
3- Cleveland Cliffs 1980
4- Cotter Corp. 1980
5- Wyoming Minerals 1979
6- Cleveland-Cliffs 1978

12.3.2 COVER DATA

Total Vegetative cover data for several studies in the region are presented in Table 12.5.

TABLE 12.5

·dy/ Vegetation Type	Vegetative Cover %	Bare Ground	Litter/ rock	Vegetation Litter/rock
Ruth[1]				
Grassland	62	24	14	76
Sagebrush/Grassland	76	12	12	88
Drainage/BottomLand	89	0	11	100
N. Butte[2]				
Grassland	66	14	20	86
Sagebrush/Grassland	57	16	25	82
Bottomland	72	8	20	92
Malapai[3]				
Grassland	61	32	7	69
Riparian	85	9	6	91
BottomLand Sage	78	11	10	88
Upland Sage/Grassland	68	21	11	79

1- Uranerz 1980
2- Cleveland-Cliffs 1979
3- Malepai 1986

As can be seen in the Table, the riparian and bottomland types, as expected, have the highest percentage of ground cover while grassland and sagebrush areas are lower but tend to be somewhat equal to each other with regards to percentage of ground cover. These data are thought to be indicative of conditions to be found throughout the North Butte permit area.

12.4 EXTENDED REFERENCE AREA

One Extended Reference Area (EXREFA) was selected adjacent to the North Butte permit area. This area, shown on Figure 12.1, Volume II is located primarily in a grassland area and will be used in determining reclamation/revegetation success after mining. This EXREFA was located outside of the North Butte permit area to avoid disturbance during mining activities. Two views of the EXREFA, taken in 1988, are shown on Photographs 5 and 6. A third photograph (Photograph 5a) was taken on April 5, 1993, which shows the sagebrush/grassland vegetation type located within the southwestern/central portion of the EXREFA.

12.5 LAND USE AND GRAZING HISTORY

The following information on land use and grazing was provided by Mr. Brown, landowner of the lands located within the permit area.

Livestock grazing has been the historical land use in the permit area for many years although there has been some intermittent uranium production and exploration activity and oil and gas activity. Cattle are the primary domestic livestock that currently utilize the rangeland within the permit area, although sheep and horses are also grazed in the area at times. To improve the grass on the permit area, the landowner commonly burns sagebrush during the spring.

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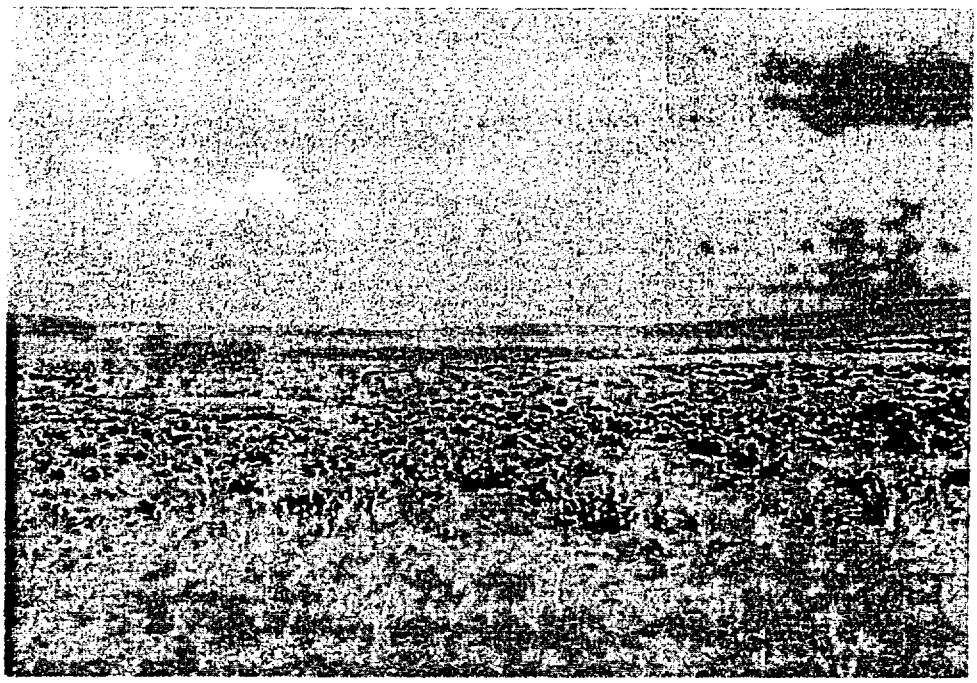

Photograph 5a
Sagebrush/Grassland and Grasslands Vegetation Types
Reference Area; April 5, 1993

12.6 VALUE OF MAJOR VEGETATION SPECIES

Vegetation species present on the permit area can provide information on the area's ability to support the existing land use of livestock grazing. The post-mining reclamation/revegetation efforts will attempt to establish species that will support the planned land use of livestock grazing. The value of some of the major vegetative species are discussed below:

Agroovron smithii is a native, cool-season, sod forming grass with very strong rhizomes. This grass is palatable and nutritious when green in spring and moderately so during other times of the year. Its vigorous rhizomes make it one of the more tolerant of the desirable and abundant grasses to grazing pressure and drought. As a genus, Agrovvron is fairly important to livestock and wildlife.

Stipa comata is a cool-season perennial bunchgrass that begins growing in early spring. It provides fair to good forage, especially when green. If grazed during the time awns are present, physical injury may result to eyes, mouth, and flesh of sheep. Larger livestock seldom are bothered. It is best grazed before awns appear or after they drop. It is seldom planted because of the undesirable awns.

Poa secunda is one of the first grasses to green-up in early spring. During early spring to early summer, it is palatable to all classes of livestock, becoming somewhat less preferred in the summer when cured. By autumn, it is frequently selected by all livestock again.

Bouteloua aracilis is a warm season sod forming short grass. Although normally low in productivity, it is nutritious to all classes of livestock even during the winter.

Bromus iaoonicus and B tectorum are annuals common on disturbed areas. These species are generally considered undesirable forage species and are palatable only as a green plant in the autumn and spring.

OrvzoD-sis hvmenoides is a native cool-season, densely tufted bunchgrass. It is an excellent forage with both leaves and seeds relished by livestock throughout the year.

Koeleria cristata- is a short-lived perennial bunchgrass occurring as small tufts. When green it is good forage palatable to all livestock, becoming less preferred with maturity. It is easily overgrazed because it greens earlier than most other native grasses and becomes less abundant as grazing pressures increase.

Carex, filifolia is valuable as an early green forage, since it begins to green in early April. During this time, it is highly palatable, becoming tough and dry by late June. On medium to coarse textured soils, it increases with heavy grazing pressure by cattle but decreases with similar pressure by sheep. On fine textured soils abundance decreases with use by either kind of livestock.

Artemisia tridentata the most abundant shrub on the permit area, is generally an undesirable forage species for livestock. Its nutritive value is frequently exceptionally high but because of bitter resins it is often low in palatability.

Artemisia cana, another shrub common on the permit area, is generally of little value for summer grazing. It does furnish good to excellent browse in fall and winter for all classes of livestock. It is perhaps the best of the Artemisia genus for forage, being particularly useful when snow cover is deep.

12.7 SUMMARY

The North Butte ISL permit area is located in a semi-arid region with severe winters, cool summers and about 14 inches of precipitation annually. Grasses on the site are primarily cool-season, sod forming and bunchgrasses. Artemisia tridentata is the dominant shrub species on the permit area. Along Willow Creek, numerous Pooulus deltoides are found. Junipers are common on the slopes of North Butte and the drainages leading away from the Butte.

The permit area encompasses approximately 1,039 acres and supports four vegetation types. These types and their respective percentages on the permit area are as follows:

Sagebrush/Grassland	62.2%
Grassland	34.5%
Bottomland	2.5%
Juniper/Sagebrush	0.8%

A total of 120 plant species were identified on the permit area. Of these, five noxious weed species and one selenium indicator species were encountered during field surveys. No plant species currently listed or proposed for listing as threatened or endangered by the U.S. Fish and Wildlife Service were observed on the permit area.

One Extended Reference Area was established in an area that will not be disturbed for the life of the mine. This area will be used to evaluate post-mining revegetation success.

The permit area is currently used as rangeland for domestic livestock and provides wildlife habitat.

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13. APPENDIX "D-9" WILDLIFE

13.1 INTRODUCTION

Baseline wildlife studies for Pathfinder's North Butte ISL project were initiated in the fall of 1987 by Applied ECOsystems. Data collected by Bio/West in 1978-1979 was also used as supplemental information. The North Butte permit area encompasses approximately 1039 acres situated in southwestern Campbell County, Wyoming (Figure 13.1). The elevation (4,900 to 5,700 feet) and topography of the permit area are generally typical of the rolling plains to the east and northeast of the continental divide in Wyoming. The major features in the vicinity of the permit area are prominent mesas called the Pumpkin Buttes that rise to about 6,050 feet -in elevation. Surficial drainage networks coming off the permit area exhibit normally intermittent flows that are part of the headwater system of the north-flowing Powder River. Field investigations of big game, mammalian predators, small and medium sized mammals, raptors, game birds, passerine birds, herptiles, and threatened and endangered species were conducted on the permit area and adjacent habitats.

In October, 1992, Pathfinder incorporated into the permit boundary approximately 50 acres of adjacent lands, located along the southern border of the permit area's eastern arm. No additional wildlife data was collected for these lands as the previous surveys covered the permit area plus one-half to one mile, thus including these lands. Annual wildlife surveys conducted in 1992 reconfirmed that no sage grouse leks or raptor nests are present on the lands.

13.2 METHODS

Particular attention was given to important wildlife species and their habitats. For purposes of this study, important wildlife habitat was classed into two categories: habitat critical to the support of important wildlife species (e.g. threatened or endangered animals, animals protected by state or federal law, game species) and habitat offering environmental situations that add diversity to the region (e.g. streams, trees). Personnel from Applied ECOsystems responsible for collecting field data during wildlife surveys were Gary Saunders and Timothy Lane. Mr. K. Gary Somerville provided quality assurance. Dates of wildlife observations are provided in Table 13.1A and survey routes are shown on the Wildlife Observation Map, Figure 15.1 (Volume II). All surveys were done under favorable field conditions.

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Since many of the important wildlife species are mobile (e.g. raptors, pronghorn, deer), the proposed project could affect animals that also occur in habitat adjacent to the areas to be mined. Therefore, certain wildlife studies were conducted in areas adjacent to the permit area. Scientific names of wildlife which were observed or are likely to occur on the permit area are listed in Tables 13.1, 13.2 and 13.3.

TABLE 13-1

POTENTIAL MAMMALIAN INHABITANTS

Scientific Nomenclature	Common Name
INSECTIVORA	
Soricidae	
Sorex cinereus	Masked shrew
Sorex merriami	Merriam's shrew
CHIROPTERA	
Vespertilionidae	
Myotis lucifugus*	Little brown myotis [1]
Myotis evotis*	Long-eared myotis [1]
Eptesicus fuscu*	Big Brown Bat [1]
Myotis leibii*	Small footed myotis [1]
Myotis volans*	Long-legged myotis [1]
Plecotus townsendii	Townsend's big-eared bat
Lasiurus cinereus	Hoary bat
LAGOMORPHA	
Leporidae	
Lepus californicus	Black-tailed jack rabbit
Lepus townsendii*	White tailed jack rabbit
Sylvilagus audubonii*	Desert cottontail
Sylvilagus nuttallii	Nuttall's cottontail

* Verified Inhabitant
1 Observed during the 1979 Cleveland-Cliffs study

TABLE 13-1 (cont'd)

POTENTIAL MAMMALIAN INHABITANTS

Scientific Nomenclature	Common Name
RODENTIA	
Sciuridae	
Cynomys ludoviciana	Black-tailed prairie dog
Eutamias minimum*	Least chipmunk
Spermophilus richardsonii	Richardson's ground squirrel
Spermophilus tridecemlineatus*	Thirteen-lined ground squirrel
Geomyidae	
Thomomys talpoides*	Northern pocket gopher
Heteromyidae	
Perognathus fasciatus*	Olive-backed pocket mouse
Dipodomys ordii*	Ord's kangaroo rat
Cricetidae	
Microtus ochrogaster*	Prairie vole
Microtus pennsylvanicus*	Meadow vole
Lagurus curtatus*	Sagebrush vole
Microtus longicaudus*	Long-tailed vole
Neotoma cinerea*	Bushy-tailed wood rat
Onychomys leucogaster*	Northern grasshopper mouse

* Verified Inhabitant
1 Observed during the 1979 Cleveland-Cliffs study

TABLE 13-1 (cont'd)

POTENTIAL MAMMALIAN INHABITANTS

Scientific Nomenclature	Common Name
RODENTIA (cont.)	
Cricetidae (cont.)	
Peromyscus maniculatus*	Deer mouse
Reithrodontomys megalotis*	Western harvest mouse
Odatra zibethicus	Muskrat
Zapedidae	
Zapus princeps	western jumping mouse
Erethizontidae	
Erethizon dorsatum	Porcupine
CARNIVORA	
Canidae	
Canis latrans*	Coyote
Vulpes vulpes*	Red fox
Mustelidae	
Mephitis mephitis*	Striped skunk
Spilogale putorius	Spotted skunk

* Verified Inhabitant
1 Observed during the 1979 Cleveland-Cliffs study

TABLE 13-1 (cont'd)

POTENTIAL MAMMALIAN INHABITANTS

Scientific Nomenclature	Common Name
CARNIVORA (cont.)	
Mustelidae (cont.)	
Taxidea taxus*	Badger
Mustela frenata	Long-tailed weasel
Mustela vison	Mink
Felidae	
Felis rufus	Bobcat[1]
Felis concolor	Mountain lion[1]
Procyonaidae	
procyon lotor	Raccoon
ARTIODACTYLA	
Antilocapridae	
Antilocapra americana*	Pronghorn
Cervidae	
Odocoileus hemionus*	Mule deer

* Verified Inhabitant

1 Observed during the 1979 Cleveland-Cliffs study

TABLE 13-2

BIRD SPECIES OBSERVED OR LIKELY TO OCCUR ON
OR NEAR THE URANERZ NORTH BUTTE ISL PRCIJECT SITE

Latin Name (1)	Common Name	Status (2)
ANATIDAE		
Branta Canadensis	Canada goose	L, M
Anas platyrhynchos	Mallard	L, B
Anas strepera	Gadwall	L, B
Areas acuta	Pintail	L, M
Anas crecca	Green-ringed teal	L, M
Anas discors	Blue-winged teal	L, B
Areas cyanoptera	Cinnamon teal	L, B
Anas Americana	American wigeon	L, M
Areas clypeata	Northern shovler	L, M
Aythya Americana	Redhead	L, M
Aythya valisineri a	Canvasback	L, M
Aythya collaris	Ring-necked duck	U, M
Aythya affinis	Lesser scaup	L, M
Bucephala albeola	Bufflehead	U, M
Oxjura jamaicensis	Ruddy duck	L, M
Mergus merganser	Common merganser	R
Cathartes aura	Turkey vulture	L, S

TABLE 13-2 (cont'd)

BIRD SPECIES OBSERVED OR IM= TO OCCUR ON
OR NEAR THE URANERZ NORTH BUTTE ISL PROJECT SITE

Latin Name (1)	Common Name	Status (2)
ACCIPITRIDAE		
Accipiter striates	Sharp-shinned hawk	L, B
Accipiter cooperii	Cooper' s hawk	L, B
Accipiter gentiles	Goshawk	U, W
Buteo jamaicensis	Red-tailed hawk	O, R
Buteo swairnsonii	Stiainso's hawk	0, B
Buteo lagopus	Rough-legged hawk	O, W
Buteo regalis	Ferruginous hawk	O, R
Aquila chysaetos	Golden eagle	0, R
Haliaeetus leucocephalus	Bald eagle	0, W
Circus cyaneus	Marsh Hawk	0, R
FALODNIAE		
Falco mexicanus	Prairie falcon	0, R
Falco peregrinus	Peregrine falcon	U, M
Falco columbarius	Merlin	L, M
Falco sparverius	American kestrel	0, R
Falco rusticolus	Gyrfalcon	U, W
TETRAONIDAE		
Centrocercus urophasianus	Sage grouse	O, R
Dendragapus obscurus	Blue grouse	U, R

TABLE 13-2 (cont'd)

BIRD SPECIES OBSERVED OR L KELY W OCQJR ON
OR NEAR TEIE URANERZ NORTH BUTTE ISL PROJECT SITE

Latin Name (1)	Common Name	Status (2)
PHASIANIDAE		
Alectoris chukar	Chukar partridge	U, R
Perdix perdix	Gray partridge	L, R
RALLIDAE		
Fulica americana	American coot	L, S
Rallus limicola	Virginia rail	L, B
Porzana carolina	Sora	L, B
RECURVIROSTRIDE		
Recurvirostra americana	American Avocet	L, M
CHARADRIUS		
Charadrius vociferous	Killdeer	0, B
Pluvialis squatarola	Black-bellied plover	U, M

TABLE 13-2 (cont ' d)

BIRD SPECIES OBSERVED OR LIKELY TO OCCUR ON OR NEAR THE URANERZ BUTTE ISL PROJECT SITE

Latin Name (1)	Common Name	Status (2)
SCOLOPACIDAE		
Limosa fedoa	Marbled godwit	U, M
Bartramia longicauda	Upland sandpiper	L, S
Actitis maculate	Spotted sandpiper	L, B
Tringa solitaria	Solitary sandpiper	L, M
Tringa melanoleucus	Greater yellowlegs	L, M
Tringa flavipes	Lesser yellowlegs	L, M
Catoptrophorus semipalmatus	Willet	U, M
Limnodromus scologaceus	Long – billed dowitcher	U, M
Micropalama himanotopus	Stilt sandpiper	U, M
Calidris Melanotos	Pectora sandpiper	L, M
Calidris bairdii	Baird's sandpiper	L, M
Calidris minutilla	Least sandpiper	U, M
Calidris pusillus	Semipalmated sandpiper	U, M
Calidris mauri	Western sandpiper	U, M
PHALAROPODIDAE		
Steganopus tricolor	Wilson's phalarope	Q, M
Lobipes lobatus	Northern parlarope	L, M

TABLE 13-2 (cont'd)

BIRD SPECIES OBSERVED OR LIKELY TO OCCUR ON
OR NEAR THE URANERZ NORTH BUTTE ISL PROJECT SITE

Latin Name (1)	Common Name	Status (2)
LARIDAE		
Larus argentatus	Herring gull	U, M
Larus californicus	California gull	L, M
Laurus delawaresis	Ring – billed gull	U, M
Larus pipixcan	Franklin's gull	L, S
COLUMBIDAE		
Zenaida macroura	Mourning dove	0, B
STRIGIDAE		
Otus asio	Screech owl	U, R
Bubo virginianus	Great horned owl	0, R
Glaucidium gnoma	Pygmy owl	U, R
Athene cunicularia	Burrowing owl	L, B
Asio otus	Long-eared owl	L, W
Asio flammeus	Short-eared owl	L, W
Nyctea scandiaca	Snowy owl	U, W
CAPRIMULGIDAE		
Phalaenoptilus nuttalli	Poor-will	0, B
Chordeiles minor	Conmxon nighthawk	0, B

TABLE 13-2 (cont'd)

BIRD SPECIES OBSERVED OR LIKELY TO OCCUR ON
OR NEAR THE URANERZ NORTH BUTIE ISL PRQTECT SITE

Latin Name (1)	Common Name	Status (2)
APODIDAE		
Aeronautes saxatalis	White-throated swift	L, S
TROCHILIDAE		
Selasphorus platycercus	Broad-tailed hummingbird	L, S
ALCEDINIDAE		
Megaceryle alcyon	Belted kingfisher	L, R
PICIDAE		
Colaptes auratus	Common flicker	0, R
Melanerpes erythrncephalus	Red headed woodpecker	0, B
Sphyrapicus varius	Yellow bellied sapsucker	L, M
Picoides villosus	Hairy woodpecker	U, R
Picoides pubescexis	Downy woodpecker	0, R

TABLE 13-2 (cont'd)

BIRD SPECIES OBSERVED OR LIKELY TO OCCUR ON
OR NEAR THE URANERZ NORTH BUTTE ISL PROJECT SITE

Latin Name (1)	Common Name	Status (2)
TYRANNIDAE		
Tyrannus tyrannus	Eastern kingbird	O, B
Tyrannus verticalis	Western kingbird	O, B
Sayornis saya	Say's phoebe	O, B
Empidonax trailli	Willow flycatcher	U, B
Empidonax minims	Least flycatcher	O, B
Empidonax difficilis	Western flycatcher	0, B
Contopus sordidulus	Western wood pewee	0, B
ALAUDIDAE		
Eremophila alpestris	Horned lark	O, R
HIIRJNDINIDAE		
Tachycineta thalassina	Violet-green swallow	0, S
Iridoprocne bicolor	Tree swallow	L, B
Riparia riparia	Bank swallow	O, B
Steligdopteryx ruficollis	Rough-winged swallow	L, B

TABLE 13-2 (cont'd)

BIRD SPECIES OBSERVED OR LIKELY TO OCCUR ON
OR NEAR THE URANERZ NORTH BUTTE ISL PROJECT SITE

Latin Name (1)	Common Name	Status (2)
CORVIDAE		
Cyanocitta cristata	Blue jay	U, R
Aphelocama coerulescens	Scrub jay	U, R
Gymnorhinus cyanocephalus	Pinyan jay	0, R
Pica pica	Black-billed magpie	0, R
Coleus corax	Cammon raven	L, R
Corvus brachyrhynchos	Common crow	L, R
PARIUAE		
Panes atricapillus	Black-capped chickadee	L, R
Pants gambeli	Mountain chickadee	L, W
SITTIDAE		
Sitter carolinensis	White-breasted nuthatch	L, R
Sitta canadensis	Red-breasted nuthatch	0, W
CERTHIDAE		
Certhia familiaris	Brown creeper	O, W
THRAUPIDAE		
Piranga ludaviciana	Western tanager	L, B

TABLE 13-2 (cont'd)

BIRD SPECIES OBSERVED OR LIKELY TO OCCUR ON
OR NEAR THE URANERZ NORTH BUTTE ISL PROJECT SITE

Latin Name (1)	Common Name	Status (2)
TROGIDDYTIBM		
Troglodytes aedon	House wren	O, B
Salpinctes obsoletus	Rock, wren	O, B
Cistothorus palustris	Marsh wren	U, B
MTMTDAE		
Dumetella carolinensis	Gray catbird	U, B
Tom ruftaa	Brown thrasher	U, B
Oreoscoptes montanus	Sage thrasher	O, B
TURDIDAE		
Turdus migratorius	American robin	O, B
Catharus guttatus	Hermit thrush	M
Catharsis ustulatus	Swainson's thrush	L, M
Siala sialis	Eastern bluebird	U, B
Siala mexicana	Western bluebird	L, B
Siala curricoides	Mountain bluebird	0, B
SYLVIIDAE		
Regulus calendula	Ruby-crowned kinglet	L, M

TABLE 13-2 (cont'd)

BIRD SPECIES OBSERVED OR LIKELY TO OCCUR ON
OR NEAR THE URANERZ NORTH BUTTE ISL PROJECT SITE

Latin Name (1)	Common Name	Status (2)
MOTACILLIDAE		
Anthus spinoletta	Water pipit	L, B
BOMBYCILLIDAE		
Bombycilla garrulus	Bohemian waxwing	O, W
Bombycilla cedrorum	Cedar waxwing	L, M
LANIIDAE		
Lanius excubitor	Northern shrike	L, W
Lanius ludovicianus	Loggerhead Shrike	O, B
STURNIDAE		
Sturnus vulgaris	Stirling	O, R
VIPEONIDAE		
Vireo olivaceous	Red-eyed vireo	L, B
Vireo solitarius	Solitary vireo	L, M
Vireo gilvus	warbling vireo	0, B

TABLE 13-2 (cont'd)

BIRD SPECIES OBSERVED OR LIKELY TO OCCUR ON
OR NEAR THE URANERZ NORTH BUTTE ISL PROJECT SITE

Latin Name (1)	Common Name	Status (2)
PARULILIAE		
Mniotilla varia	Black and white warbler	L, M
Vermivora celata	Orange-crowned warbler	L, M
Dendroica petchia	Yellow warbler	O, B
Denroica coronata	Yellow-rumped warbler	L, M
Seiunas novaboracensis	Northern waterthrush	L, M
Geothlypis trichas	Common yellowthroat	L, B
Icteria virens	Yellow breasted chat	U, B
Oporornis tolmiei	MacGillivray' s warbler	U, M
Wilsonia pusilla	Wilson's warbler	L, M
Setophaga ruticilla	American redstart	L, B
Passer domesticus	House sparrow	O, R
ICTERIDAE		
Dolichonyx oryzivorus	Bobolink	U, S
Sturnella neglecta	Western meadowlark	O, R
Xanthocephalus xanthocephalus	Yellow-headed blackbird	L, B
Agelaius phoeniceus	Red-winged blackbird	O, B
Euphagus cyanocephalus	Brewer's blackbird	O, B
Quiscalus quiscula	Common grackle	O, B
Molothrus ater	Brown-headed cowbird	O, B
Icterus galbula	Northern oriole	O, B
Icterus bullockii	Bullock's oriole	L, S

TABLE 13-2 (cont'd)

BIRD SPECIES OBSERVED OR LIKELY TO OCCUR ON
OR NEAR THE URANERZ NORTH BUTTE ISL PROJECT SITE

Latin Name (1)	Common Name	Status (2)
FRINGILLIDAE		
Pheucticus melarocphipalus	Black-headed grosbeak	L, B
Hesperiphona verspertina	Evening grosbeak	L, W
Passerine amoena	Lazuli bunting	L, B
Passerina cyanea	Indigo bunting	U, S
Carpodacus pur pur eus	Purple finch	U, N
Carpodacus cassinii	Cassin's finch	U, W
Carpodac us mexicanus	House finch	L, R
Leucosticte tephrocotis	Gray-crowned rosy finch	L, W
Carduelis flamnea	Common redpoll	U, W
Carduelis pinus	Pine siskin	L, R
Spinus tristis	American goldfinch	L, R
Pipilo chlorurus	Green-tailed towhee	L, B
Pipilo erythrophtalmus	Rufous-sided towhee	L, B
Calamospiza melanocorys	Lark bunting	L, B
Passerculus sandwichensis	Savannah sparrow	L, B
Poccetes gramineus	Vesper sparrow	O, B
Chondestes gramnacus	Lark sparrow	O, B
Junco hyemalis	Dark-eyed junco	L, W
Spizella arborea	Tree sparrow	L, W
Spizella passerine	Chipping sparrow	L, B
Spizella pallida	Clay-colored sparrow	L, S

TABLE 13-2 (cont'd)

BIRD SPECIES OBSERVED OR LIKELY TO OCCUR ON
OR NEAR THE URANERZ NORTH BUTTE ISL PROTECT SITE

Latin Name (1)	Common Name	Status (2)
FRINGILLIDAE (cont.)		
Spizella breweri	Brewer's sparrow	O, B
Zonotrichia leucophrys	White-crowned sparrow	L, M
Zonotrichia albicolis	White-throated sparrow	U, M
Melospiza lincolnii	Lincoln's sparrow	L, B
Melospiza melodia	Song Sparrow	L, B
Calcarius macownii	McCown's longspur	L, B
Calcarius lapponicus	Lapland longspur	L, W
Calcarius ornatus	Chestnut-collared longspur	L, B
Plectrophenax nivalis	Snow bunting	O, W

1. Nomenclature based on AOU (1957, 1973, 1976)
2. Status
   - O - observed
   - L - Likely
   - U - Unlikely, but possible; either this area is peripheral range or no suitable habitat is found on the site.
   - B - Breeder
   - M - Migrant
   - W - Winter Visitor
   - R - Year-round resident
   - S - Summer resident

TABLE 13-3

AMPHIBIANS AND REPTILES OBSERVED OR EXPECTED
TO OCCUR WITHIN THE URANERZ RUTH ISL PROJECT SITE

Latin Name	English Name	Status[2]
AMPHIBIA		
Ambystana tigriunum	Tiger Salamander	O
Scaphiopus bombifrons	Plains Spadefoot	L
Bufo cognatus	Great Plains Toad	L
B. woodhousei	Rocky Mountain Toad	L
Rana pipiens	Leopard Frog	O
Pseudacris triseriata	Western Chorus Frog	L
REPTILIA		
Sceloporus graciosus	Sagebrush Lizard	O
Phrynosoma douglassii	Short-horned Lizard	O
Heterodon nasicus	Plains Hognose Snake	L
Coluber constrictor	Yellow-bellied Racer	L
Pituophis melanoleucus	Gopher (Bull) Snake	O
Lampropeltis triangulum	Pale Milk Snake	U
Thamnophis sirtalis	Common Garter Snake	L
T. elegans	Wandering Garter Snake	L
T. radix	Plains Garter Snake	O
Crotalus viridis	Western (Prairie) Rattlesnake	O

[2]Status

O - Observed L - Likely to occur U - Not likely to occur

13.2.1 SITE RECONNAISSANCE

A thorough vehicle and foot reconnaissance of the study area was conducted in the fall of 1987 and spring of 1988. The purpose of the field reconnaissance was to:

Determine the habitat types in the area.

Identify and map areas that could be important to wildlife (e.g. potential raptor nest sites, sage grouse leks) so that these sites could be closely monitored during baseline study.

During a meeting with DEQ-LQD it was determined that the permit area should have a one (1) miles buffer zone for raptors and one-half mile zone for sage grouse. This study area can be characterized by four primary vegetative types.

1. Grassland with low sagebrush density - Much of the upland areas east and north of the permit area was classified as this habitat type. The topography of the area covered by this type can be generally characterized as a gently rolling plain.

2. Grassland with high sagebrush density - This type covers much of the permit area.

3. North Butte - This classification includes the base, slopes, rimrock and rocky outcrops. Sagebrush-juniper habitat is found along the base and sides of the butte. Topographically, the area covered by this habitat type consists of steep-banked ridges and draws. Limber pine-juniper habitat is located in scattered pockets below the top of North Butte on steep slopes. The rimrock encompasses the top of North Butte and consists of nearly vertical walls of sandstone that have been extensively weathered.

4. Cottonwoods - This habitat type is located along the Willow Creek drainage.

13.2.2 SURVEY OF EXISTING INFORMATION

Compilation of existing information on wildlife resources was one of the initial tasks, which continued throughout the project as new sources were identified and additional data became available. Information on wildlife in the North Butte study area was solicited from the Wyoming Game and Fish Department, Bureau of Land Management, and ranchers in the project area and from records acquired by Uranerz from the previous mineral rights owner.

Existing information was reviewed for its relevance in describing baseline wildlife conditions for the project area. All pertinent wildlife data were used to supplement observations and data gathered on site during the course of the field program.

13.2.3 BIG GAME

Big game surveys for the North Butte project were conducted throughout the winter, spring and summer of 1988. In addition to specific surveys for big game, big game were opportunistically surveyed in conjunction with other field activities on the project area.

During surveys, one or two observers traversed the study area by vehicle and on foot and recorded all big game observed. Surveys were conducted throughout the daylight hours as well as early morning and late in the evening when the animals are more active and more likely to be observed. The topography of the study area afforded views of both large areas and relatively limited views of small areas.

13.2.4 MEDIUM-SIZED AND SMALL MAMMALS AND PREDATORS

A list of medium-sized and small mammals and predators found in habitats similar to those on the permit area was developed based on literature and- existing information from a 1978-1979 survey. Presence of the animals on site was documented through observation of the animal or characteristic sign such as tracks, scat, burrows and

skeletons. Burrows and dens observed on site were examined to determine the species that constructed them.

13.2.5 AVIFAUNA

Studies conducted to determine the presence, habitat association and production of avifauna on the North Butte project area focused on raptors, sage grouse, passerine and other bird species. In addition to specific surveys discussed below, opportunistic sightings of raptors, sage grouse, and other birds were recorded during field activities. Avifauna nomenclature conforms to The Checklist of North American Birds (AOU 1957) and subsequent revisions (AOU 1973, AOU1976).

13.2.6 RAPTORS

Potential raptor nesting sites such as cottonwood trees, North Butte, or other areas where raptors were frequently observed within the study area were identified and mapped during all field activities and a specific raptor nest search was conducted during the spring of 1988. Two survey methods were used during the raptor nest search. The skyline watch was used to survey potential raptor nesting on and near the permit area. Adult raptors will leave the nest site to forage at least once and often several times, each day during the time when they have young. Raptors nesting in the area would, therefore, be observed flying to forage and back to the nest during skyline watches that last several hours. The study area was also searched by vehicle and on foot during the raptor nest survey. A biologist identified potential nest sites such as cottonwood trees or the rimrock on North Butte and intensively searched for raptors, nests, and sign such as whitewash from excrement. On-foot searches were concentrated on the permit area and areas adjacent to the permit area. Raptor winter use was surveyed during January 1988 and during winter big game surveys. The dates of raptor nest searches and visitations were as follows:

01/19/88	03/31/88	05/26/88
02/26/88	04/07/88	06/07/88
03/09/88	04/13/88	06/13/88
03/18/88	04/20/88	06/14/88
03/22/88	04/25/88	06/21/88
03/24/88	05/05/88	03/28/88
03/28/88	05/13/88	

13.2.7 SAGE GROUSE

A sage grouse leis search was conducted during March and April 1988. During the survey biologists searched for leks on the study area from various vantage points and by driving through the study area. The survey was conducted at dawn when biologists searched for grouse with the aid of 7-power binoculars and listened for the characteristic sounds made by strutting males.

13.2.8 PASSERINE AND OTHER BIRDS

No special surveys were conducted for passerine and other birds. However, all species observed on the study area were recorded.

13.2.9 HERPETOFAUNA

Surveys for reptiles and amphibians on the North Butte study area were conducted in conjunction with all field activities. A list of species found in habitats similar to those on the permit area was developed based on literature and existing information.

13.2.10 THREATENED AND ENDANGERED SPECIES

During all field activities on the North Butte study area, particular attention was given to document the status of species protected by the Endangered Species Act of 1973 (16 USC 1531). The area lies within the range of three endangered species: Bald eagle (Haliaeetus leucoceDhalus), Peregrine falcon-(Falco neregrinus anatum), and the Black-footed ferret

(Mustela nigrioes). Habitat and presence of Bald eagles and Peregrine falcons were evaluated in conjunction with studies for other raptors as discussed in Section 13.2.6.

13.2.11 FISHERIES AND AQUATICS

No studies were conducted on fisheries or aquatic resources because there is no suitable habitat within the permit area.

13.3 RESULTS AND DISCUSSION

13.3.1 BIG GAME

Pronghorn and mule deer were the only big game species observed on the study area during baseline investigations.

During winter surveys all pronghorn sightings took place north and east of the North Butte permit area, primarily adjacent to the county road 1 1/4 miles east of the permit area. The pronghorn were observed in this area in groups ranging in size from 4 to 56 individuals. As the weather improved during spring, these groups began to breakup and disperse. During the spring, summer. and fall, relatively few pronghorn were actually observed on the permit area proper. During this time they were most frequently observed on the eastern third of the permit area and in the 1/2 mile perimeter area to the north and east of the permit area.

Although the Wyoming Game and Fish classifies the study area as winter/yearlong range, pronghorn appear to favor areas outside of the study area during the winter. During other seasons of the year, they make use of habitat within the study area. Two production counts were conducted prior to the hunting season on the study area. These counts yielded ratios of approximately 77 fawns:100 doe and 25 bucks:100 doe. Due to the small size of the study area and the small sample size, these ratios could be highly variable. Also, the highly mobile pronghorn moves freely throughout the study area and adjacent lands and the occurrence of a few additional animals on the study area when the count is

conducted can greatly affect the ratios. One post hunt count was conducted which yielded a fawn:100 doe ratio of 57 and a buck:100 doe ratio of 15.

Mule deer were observed on the study area throughout the year. All mule deer sightings were on North Butte and its flanks, along unnamed drainages leading away from the Butte and along the Willow Creek drainage to the south of the permit area. North Butte, the rough and broken terrain around the butte and drainages in the area, appear to fulfill requirements as both winter and summer range for mule deer in the study area.

Two pre-hunt production counts yielded a fawn:100 doe ratio of 63 and a buck:100 doe ratio of 16. One post hunt survey yielded ratios of 58 fawns: 100 doe and 25 bucks:100 doe. As with the pronghorn count, these figures could be highly variable due to the small sample size and study area. Also, mule deer are not as visible as pronghorn due to the rough, broken terrain where they were most often observed. Consultation with Mr. Harry Harju, WGFD did not reveal the presence of any big game migration corridors or critical habitats.

Big game and other wildlife observations showing group consistency, location, habitat type and activity are presented in Table 13.3A using Wyoming Game and Fish Department Wildlife Observation forms and associated copies.

Pronghorn and mule deer observations are shown on Figure 13.1, Volume Ii.

13.3.2 MEDIUM-SIZED AND SMALL MAMMALS AND PREDATORS

A list of mammals whose range and habitat requirements coincide with the North Butte study area is presented in Table 13.1. Those species documented on the study area are also identified in the Table.

TABLE 13.1A

NAME Uranerz North Butte Project

MONTH Dec YEAR 1987

WILDLIFE OBSERVATION FORM

( ) AFFIL ( ) DISTRICT ( ) LEAVE BLANK

DAY	SPECIES	SEX	Circle All Estimates: Adult	Yrlg.	Juv.	Uncl.	Spec Age	Location: 1/4 Twp. Or Sec.	Twp.	Rng.	Hunt Area NO.	Degree Block NO.	HAB DESC. NO.	MORT. CODE NO.	ACT. CODE NO.	NOTES
18	935	M	5					Sec 23	44	76	23		4.10		13	
		F	15													
		?			8			NWSE								
18	352	M						SEC 17	44	75			4.10		17	
		F														
		?	2		1			SWSE								
21	932	M	1					SEC 25	44	75	19		4.10		14	
		F	3													
		?						NENE								
	932	M	2					SEC 13	44	76	19				14	
		F														
		?						SWSW								
21	932	M	2					SEC22	44	76					5	
		F														
		?						SWSE								
21	903	M						SEC 12	44	76			4.10		15	
		F														
		?	1					SESE								
21	915	M						SEC 26	44	76			4.10		14	
		F														
		?	1					NENW								
21	349	M						SEC 13	44	76			4.10		3	
		F														
		?	1					NWSW								

Use 1 line for each animal when specific age over 1 + is to be recorded.
Circle any number entered that represents a partial count of a group of animals.

TABLE 13.1A

Continued

NAME Uranerz North Butte Project

MONTH Dec YEAR 1987

WILDLIFE OBSERVATION FORM

( ) AFFIL ( ) DISTRICT ( ) LEAVE BLANK

DAY	SPECIES	SEX	Circle All Estimates				Spec Age	Location			Hunt Area NO.	Degree Block NO.	HAB DESC. NO.	MORT. CODE NO.	ACT. CODE NO.	NOTES
			Adult	Yrlg.	Juv.	Uncl.		1/4 Twp. Or Sec.	Twp.	Rng.						
21	352	M						SEC 7	44	75					17	
		F														
		?	1					SESW								
21	349	M						SEC 13	44	76					17	
		F														
		?	1					NWSW								
		M														
		F														
		?														
		M														
		F														
		?														
		M														
		F														
		?														
		M														
		F														
		?														
		M														
		F														
		?														
		M														
		F														
		?														

Use 1 line for each animal when specific age over 1 + is to be recorded.
Circle any number entered that represents a partial count of a group of animals.

TABLE 13.1A

Continued

NAME Uranerz North Butte Project

MONTH Jan YEAR 1988

WILDLIFE OBSERVATION FORM

( ) AFFIL ( ) DISTRICT ( ) LEAVE BLANK

DAY	SPECIES	SEX	Circle All Estimates: Adult	Yrlg.	Juv.	Uncl.	Spec Age	Location: 1/4 Twp. Or Sec.	Twp.	Rng.	Hunt Area NO.	Degree Block NO.	HAB DESC. NO.	MORT. CODE NO.	ACT. CODE NO.	NOTES
19	932	M	6					SEC 7	44	75	19		4.10		5	
		F	15													
		?		12				SWSE								
19	352	M						SEC 7	44	75					17	
		F														
		?	1					SESW								
19	935	M	16					SEC 21	44	75	23		4.10		5	
		F	41													
		?		32				NWNW								
		M														
		F														
		?														
		M														
		F														
		?														
		M														
		F														
		?														
		M														
		F														
		?														
		M														
		F														
		?														

Use 1 line for each animal when specific age over 1 + is to be recorded.
Circle any number entered that represents a partial count of a group of animals.

Power Resources Inc.

TABLE 13.1A

Continued

NAME Uranerz North Butte Project

MONTH Feb YEAR 1988

WILDLIFE OBSERVATION FORM

( ) AFFIL ( ) DISTRICT ( ) LEAVE BLANK

DAY	SPECIES	SEX	Circle All Estimates: Adult	Yrlg.	Juv.	Uncl.	Spec Age	Location: 1/4 Twp. Or Sec.	Twp.	Rng.	Hunt Area NO.	Degree Block NO.	HAB DESC. NO.	MORT. CODE NO.	ACT. CODE NO.	NOTES
26	349	M						SEC 13	44	76					17	
		F														
		?	1					SWSE								
26	347	M						SEC 13	44	76					17	
		F														
		?	1					NWNW								
26	935	M						SEC 16	44	75	23		4.10		5	
		F														
		?				37		NWSW								
	935	M	1					SEC 16	44	76	23		4.10		5	
		F														
		?						NENE								
26	935	M						SEC 28	44	75	23		4.10		5	
		F														
		?				57		NENW								
		M														
		F														
		?														
		M														
		F														
		?														
		M														
		F														
		?														

Use 1 line for each animal when specific age over 1 + is to be recorded.
Circle any number entered that represents a partial count of a group of animals.

TABLE 13.1A

Continued

NAME Uranerz North Butte Project

MONTH Mar YEAR 1988

WILDLIFE OBSERVATION FORM

( ) AFFIL ( ) DISTRICT ( ) LEAVE BLANK

DAY	SPECIES	SEX	Circle All Estimates: Adult	Yrlg.	Juv.	Uncl.	Spec Age	Location: 1/4 Twp. Or Sec.	Twp.	Rng.	Hunt Area NO.	Degree Block NO.	HAB DESC. NO.	MORT. CODE NO.	ACT. CODE NO.	NOTES
9	309	M	4					SEC 21	44	75			7.00		1	
		F														
		?						SW 1/4								
9	349	M						SEC 17	44	75					17	
		F														
		?	1					SWSE								
9	349	M						SEC 24	44	76					17	
		F														
		?						NWSE								
9	935	M	5					SEC 17	44	75	23		4.10		5	
		F	12													
		?		8				SWNW								
9	935	M	1					SEC 13	44	76	23		4.10		14	
		F	1													
		?						SESE								
9	932	M						SEC 23	44	76	14		4.10		5	
		F	13													
		?		1				SWNE								
18	309	M	5					SEC 21	44	75			7.00		1	
		F														
		?						SW 1/4								
18	349	M						SEC 19	44	75					17	
		F														
		?	1					SWSW								

Use 1 line for each animal when specific age over 1 + is to be recorded.
Circle any number entered that represents a partial count of a group of animals.

TABLE 13.1A
Continued

NAME Uranerz North Butte Project

MONTH Mar YEAR 1988

WILDLIFE OBSERVATION FORM

( ) AFFIL ( ) DISTRICT ( ) LEAVE BLANK

DAY	SPECIES	SEX	Circle All Estimates: Adult	Yrlg.	Juv.	Uncl.	Spec Age	Location: 1/4 Twp. Or Sec.	Twp.	Rng.	Hunt Area NO.	Degree Block NO.	HAB DESC. NO.	MORT. CODE NO.	ACT. CODE NO.	NOTES
22	309	M	9					SEC 21 SW 1/4	44	75			7.00		1	
		F														
		?														
24	309	M	6					SEC 21 SW 1/4	44	75			7.00		1	
		F														
		?														
24	932	M						SEC 25 SENW	44	76	19		4.10		5	
		F														
		?				26										
	932	M						SEC 23 SESE	44	76	19		4.10		5	
		F	6													
		?														
31	932	M						SEC 24 NWSE	44	76	19		4.10		5	
		F														
		?				15										
31	309	M	6					SEC 21 SW 1/4	44	75			7.00		1	
		F														
		?														
31	309	M	6					SEC 18 SW 1/4	44	75			7.00		1	
		F														
		?														
31	932	M						SEC 24 NESW	44	76	19		4.10		5	
		F														
		?				11										

Use 1 line for each animal when specific age over 1 + is to be recorded.
Circle any number entered that represents a partial count of a group of animals.

Power Resources Inc.

TABLE 13.1A

Continued

NAME Uranerz North Butte Project

MONTH Mar YEAR 1988

WILDLIFE OBSERVATION FORM

( ) AFFIL ( ) DISTRICT ( ) LEAVE BLANK

DAY	SPECIES	SEX	Circle All Estimates: Adult	Yrlg.	Juv.	Uncl.	Spec Age	Location: 1/4 Twp. Or Sec.	Twp.	Rng.	Hunt Area NO.	Degree Block NO.	HAB DESC. NO.	MORT. CODE NO.	ACT. CODE NO.	NOTES
31	932	M						SEC 24	44	76		4.1		14		
		F	6	2												
		?						NESW								
31	932	M	1					SEC 25	44	76		4.1		13		
		F	10													
		?		6				NWNE								
18	932	M						SEC 14	44	76		5		13		
		F	4													
		?						SWNE								
		M														
		F														
		?														
		M														
		F														
		?														
		M														
		F														
		?														
		M														
		F														
		?														
		M														
		F														
		?														

Use 1 line for each animal when specific age over 1 + is to be recorded.
Circle any number entered that represents a partial count of a group of animals.

Power Resources Inc.

TABLE 13.1A

Continued

NAME Uranerz North Butte Project

MONTH Apr YEAR 1988

WILDLIFE OBSERVATION FORM

( ) AFFIL ( ) DISTRICT ( ) LEAVE BLANK

DAY	SPECIES	SEX	Circle All Estimates: Adult	Yrlg.	Juv.	Uncl.	Spec Age	Location: 1/4 Twp. Or Sec.	Twp.	Rng.	Hunt Area NO.	Degree Block NO.	HAB DESC. NO.	MORT. CODE NO.	ACT. CODE NO.	NOTES
7	309	M	9					SEC 21	44	75			7.00		1	
		F	2													
		?						SW 1/4								
7	355	M						SEC 14	44	76					17	
		F														
		?	2					SWNW								
7	331	M						SEC 19	44	75					17	
		F														
		?	2					SENE								
7	349	M						SEC 25	44	76					3	
		F														
		?	2					SWNE								
7	932	M						SEC 24	44	76	19		4.10		14	
		F	12													
		?		5				SWSW								
7	935	M	1					SEC 24	44	76	23		4.10		14	
		F														
		?						SWSW								
7	342	M						SEC 14	44	76					17	
		F														
		?	1					SESW								
13	309	M	1					SEC 18	44	75			7.00		1	
		F														
		?						SW 1/4								

Use 1 line for each animal when specific age over 1 + is to be recorded.
Circle any number entered that represents a partial count of a group of animals.

Power Resources Inc.

TABLE 13.1A

Continued

NAME Uranerz North Butte Project

MONTH Apr YEAR 1988

WILDLIFE OBSERVATION FORM

( ) AFFIL ( ) DISTRICT ( ) LEAVE BLANK

DAY	SPECIES	SEX	Circle All Estimates: Adult	Yrlg.	Juv.	Uncl.	Spec Age	Location: 1/4 Twp. Or Sec.	Twp.	Rng.	Hunt Area NO.	Degree Block NO.	HAB DESC. NO.	MORT. CODE NO.	ACT. CODE NO.	NOTES
13	309	M	11					SEC 21	44	75			7.00		1	
		F														
		?						SW 1/4								
13	355	M						SEC 14	44	76					17	
		F														
		?	1					SWNW								
20	309	M	10					SEC 21	44	75			7.00		1	
		F														
		?						SW 1/4								
	932	M						SEC 24	44	76			4.10		5	
		F	8													
		?		5				NWSW								
20	348	M						SEC 23	44	76					17	
		F														
		?	1					NESW								
		M														
		F														
		?														
		M														
		F														
		?														
		M														
		F														
		?														

Use 1 line for each animal when specific age over 1 + is to be recorded.
Circle any number entered that represents a partial count of a group of animals.

TABLE 13.1A

Continued

NAME Uranerz North Butte Project

MONTH May YEAR 1988

WILDLIFE OBSERVATION FORM

( ) AFFIL ( ) DISTRICT ( ) LEAVE BLANK

DAY	SPECIES	SEX	Circle All Estimates: Adult	Yrlg.	Juv.	Uncl.	Spec Age	Location: 1/4 Twp. Or Sec.	Twp.	Rng.	Hunt Area NO.	Degree Block NO.	HAB DESC. NO.	MORT. CODE NO.	ACT. CODE NO.	NOTES
5	309	M	3					SEC 21	44	75			7.00		1	
		F														
		?						SW 1/4								
5	349	M						SEC 21	44	75					17	
		F														
		?	1					NWSW								
5	349	M						SEC 25	44	76					3	
		F														
		?	2					SWNE								
	915	M						SEC 24	44	76			4.10		14	
		F														
		?	1					SWSW								
13	309	M	1					SEC 21	44	75			7.00		1	
		F														
		?						SW 1/4								
13	349	M						SEC 24	44	76					3	
		F														
		?	1					SWNE								
		M														
		F														
		?														
		M														
		F														
		?														

Use 1 line for each animal when specific age over 1 + is to be recorded.
Circle any number entered that represents a partial count of a group of animals.

TABLE 13.1A

Continued

NAME Uranerz North Butte Project

MONTH Jun YEAR 1988

WILDLIFE OBSERVATION FORM

( ) AFFIL ( ) DISTRICT ( ) LEAVE BLANK

DAY	SPECIES	SEX	Circle All Estimates: Adult	Yrlg.	Juv.	Uncl.	Spec Age	Location: 1/4 Twp. Or Sec.	Twp.	Rng.	Hunt Area NO.	Degree Block NO.	HAB DESC. NO.	MORT. CODE NO.	ACT. CODE NO.	NOTES
7	360	M						SEC 19	44	75					3	
		F														
		?	1					SWSW								
13	337	M						SEC 14	44	76					17	
		F														
		?	1					NENE								
13	349	M						SEC 23	44	76					17	
		F														
		?	1					NENW								
		M														
		F														
		?														
		M														
		F														
		?														
		M														
		F														
		?														
		M														
		F														
		?														
		M														
		F														
		?														

Use 1 line for each animal when specific age over 1 + is to be recorded.
Circle any number entered that represents a partial count of a group of animals.

TABLE 13.1A

Continued

NAME Uranerz North Butte Project

MONTH Jul YEAR 1988

WILDLIFE OBSERVATION FORM

( ) AFFIL ( ) DISTRICT ( ) LEAVE BLANK

DAY	SPECIES	SEX	Circle All Estimates				Spec Age	Location			Hunt Area NO.	Degree Block NO.	HAB DESC. NO.	MORT. CODE NO.	ACT. CODE NO.	NOTES
			Adult	Yrlg.	Juv.	Uncl.		1/4 Twp. Or Sec.	Twp.	Rng.						
22	349	M						SEC 25	44	76					3	
		F														
		?			2			SWNE								
		M														
		F														
		?														
		M														
		F														
		?														
		M														
		F														
		?														
		M														
		F														
		?														
		M														
		F														
		?														
		M														
		F														
		?														
		M														
		F														
		?														

Use 1 line for each animal when specific age over 1 + is to be recorded.
Circle any number entered that represents a partial count of a group of animals.

TABLE 13.1A

Continued

NAME Uranerz North Butte Project

MONTH Aug YEAR 1988

WILDLIFE OBSERVATION FORM

( ) AFFIL ( ) DISTRICT ( ) LEAVE BLANK

DAY	SPECIES	SEX	Circle All Estimates: Adult	Yrlg.	Juv.	Uncl.	Spec Age	Location: 1/4 Twp. Or Sec.	Twp.	Rng.	Hunt Area NO.	Degree Block NO.	HAB DESC. NO.	MORT. CODE NO.	ACT. CODE NO.	NOTES
18	349	M						SEC 19	44	75					17	
		F														
		?	2		1			SWSW								
19	349	M						SEC 25	44	76					17	
		F														
		?	2					SWNE								
19	349	M						SEC 36	44	76					17	
		F														
		?	1					NWNW								
		M														
		F														
		?														
		M														
		F														
		?														
		M														
		F														
		?														
		M														
		F														
		?														
		M														
		F														
		?														

Use 1 line for each animal when specific age over 1 + is to be recorded.
Circle any number entered that represents a partial count of a group of animals.

TABLE 13.1A

Continued

NAME Uranerz North Butte Project

MONTH Sep YEAR 1988

WILDLIFE OBSERVATION FORM

( ) AFFIL ( ) DISTRICT ( ) LEAVE BLANK

DAY	SPECIES	SEX	Circle All Estimates: Adult	Yrlg.	Juv.	Uncl.	Spec Age	Location: 1/4 Twp. Or Sec.	Twp.	Rng.	Hunt Area NO.	Degree Block NO.	HAB DESC. NO.	MORT. CODE NO.	ACT. CODE NO.	NOTES
17	935	M	2					SEC 18	44	75	23		4.10		5	
		F	9													
		?		8				SWNE								
17	935	M	1					SEC 19	44	75	23		4.10		13	
		F														
		?						NENE								
17	935	M						SEC 20	44	75	23		4.10		5	
		F	2													
		?		3				SENE								
17	935	M	1					SEC 13	44	76	23		4.10		14	
		F	4													
		?		3				NENE								
17	935	M						SEC 25	44	76	23		4.10		5	
		F	8													
		?		6				SESE								
17	935	M	2					SEC 26	44	76	23		4.10		13	
		F														
		?						NENW								
17	932	M						SEC 13	44	76	19		3.20		13	
		F	8													
		?		6				SWSW								
17	932	M	2					SEC 14	44	76	19		5.00		14	
		F														
		?						NWSW								

Use 1 line for each animal when specific age over 1 + is to be recorded.
Circle any number entered that represents a partial count of a group of animals.

Power Resources Inc.

TABLE 13.1A

Continued

NAME Uranerz North Butte Project

MONTH Sep YEAR 1988

WILDLIFE OBSERVATION FORM

( ) AFFIL ( ) DISTRICT ( ) LEAVE BLANK

DAY	SPECIES	SEX	Circle All Estimates: Adult	Yrlg.	Juv.	Uncl.	Spec Age	Location: 1/4 Twp. Or Sec.	Twp.	Rng.	Hunt Area NO.	Degree Block NO.	HAB DESC. NO.	MORT. CODE NO.	ACT. CODE NO.	NOTES
17	932	M	1					SEC 24	44	76	19		4.10		5	
		F	3													
		?		2				NWNW								
17	932	M						SEC 25	44	76	19		4.10		5	
		F	5													
		?		3				SWNE								
27	932	M						SEC 24	44	76	19		4.10		13	
		F	8													
		?		5				SENW								
27	932	M	1					SEC 13	44	76	19		5.00		5	
		F	11													
		?		7				SWSW								
27	932	M	1					SEC 25	44	76	19		4.10		5	
		F														
		?						SENE								
27	932	M	1					SEC 26	44	76	19		4.10		5	
		F	5													
		?		2				SENE								
27	935	M	3					SEC 18	44	75	23		4.10		5	
		F	13													
		?		8				NENE								
27	935	M	1					SEC 13	44	76	23		4.10		13	
		F														
		?						SENE								

Use 1 line for each animal when specific age over 1 + is to be recorded.
Circle any number entered that represents a partial count of a group of animals.

TABLE 13.1A

Continued

NAME Uranerz North Butte Project

MONTH Sept YEAR 1988

WILDLIFE OBSERVATION FORM

( ) AFFIL ( ) DISTRICT ( ) LEAVE BLANK

DAY	SPECIES	SEX	Circle All Estimates				Spec Age	Location			Hunt Area NO.	Degree Block NO.	HAB DESC. NO.	MORT. CODE NO.	ACT. CODE NO.	NOTES
			Adult	Yrlg.	Juv.	Uncl.		1/4 Twp. Or Sec.	Twp.	Rng.						
27	935	M	1					SEC 24	44	76	23		4.10		5	
		F	3													
		?		2				NWNW								
27	935	M						SEC 25	44	76	23		4.10		14	
		F	5													
		?		3				SENW								
		M														
		F														
		?														
		M														
		F														
		?														
		M														
		F														
		?														
		M														
		F														
		?														
		M														
		F														
		?														
		M														
		F														
		?														

Use 1 line for each animal when specific age over 1 + is to be recorded.
Circle any number entered that represents a partial count of a group of animals.

TABLE 13.1A
Continued

NAME Uranerz North Butte Project

MONTH Nov YEAR 1988

WILDLIFE OBSERVATION FORM

( ) AFFIL ( ) DISTRICT ( ) LEAVE BLANK

DAY	SPECIES	SEX	Circle All Estimates: Adult	Yrlg.	Juv.	Uncl.	Spec Age	Location: 1/4 Twp. Or Sec.	Twp.	Rng.	Hunt Area NO.	Degree Block NO.	HAB DESC. NO.	MORT. CODE NO.	ACT. CODE NO.	NOTES
4	935	M	1					SEC 30	44	75	23		4.10		13	
		F														
		?						NWNE								
4	935	M	1					SEC 18	44	75	23		4.10		5	
		F	7													
		?		3				NENE								
4	935	M						SEC 18	44	75	23		4.10		15	
		F	3													
		?		2				NWSW								
4	935	M						SEC 16	44	75	23		4.10		5	
		F	9													
		?		5				SWNW								
	935	M	2					SEC 26	44	76	23		4.10		14	
		F	14													
		?		9				NESW								
4	935	M	1					SEC 25	44	76	23		4.10		13	
		F														
		?						SESE								
4		M						SEC 14	44	76	19		5.00		13	
		F	4													
		?		3				SESE								
4		M	1					SEC 14	44	76	19		5.00		13	
		F														
		?						SWSW								

Use 1 line for each animal when specific age over 1 + is to be recorded.
Circle any number entered that represents a partial count of a group of animals.

Power Resources Inc.

TABLE 13.1A

Continued

NAME Uranerz North Butte Project

MONTH Nov YEAR 1988

WILDLIFE OBSERVATION FORM

( ) AFFIL ( ) DISTRICT ( ) LEAVE BLANK

DAY	SPECIES	SEX	Circle All Estimates: Adult	Yrig.	Juv.	Uncl.	Spec Age	Location: 1/4 Twp. Or Sec.	Twp.	Rng.	Hunt Area NO.	Degree Block NO.	HAB DESC. NO.	MORT. CODE NO.	ACT. CODE NO.	NOTES
4	932	M	1					SEC 13 SWSW	44	76	19		4.40		13	
		F														
		?														
4	932	M						SEC 24 NWNW	44	76	19		4.10		5	
		F	7													
		?		4												
4	932	M	1					SEC 25 NWNE	44	76	19		4.10		5	
		F	1													
		?														
		M														
		F														
		?														
		M														
		F														
		?														
		M														
		F														
		?														
		M														
		F														
		?														
		M														
		F														
		?														

Use 1 line for each animal when specific age over 1 + is to be recorded.
Circle any number entered that represents a partial count of a group of animals.

Power Resources Inc.

No active prairie dog colonies are located on or within one-half mile of the North Butte permit area. Two old prairie dog colonies (Figure 13.1, Volume II) located near the permit area were poisoned in the late 1970's and have not been re-established.

During morning and evening hours, coyote, red fox and badgers were observed in the study area vicinity. Also, one striped skunk was observed near ranch buildings at the Pfister Place. While these species were rarely seen, they are believed to be common in the Pumpkin Buttes vicinity.

White-tailed jackrabbits were common throughout the study area while cottontails were most common around man made structures at the Pfister Place. Numerous mice and voles inhabit the study area of which the deer mouse is likely the most common.

During a previous study conducted by Cleveland-Cliffs Iron Company, mist netting was conducted to determine bat species inhabiting the area. The species verified during this survey are listed in Table 13.1.

13.3.3 AVIFAUNA

13.3.4 RAPTORS

Raptor species observed on or in the vicinity of the study area are listed in Table 13.2. Raptor sightings are shown on Figure 13.1, Volume II.

No raptor nests were located on the North Butte permit area. Within one mile of the permit area several nest sites were located on North Butte, however, none of these nests appeared to be active during 1988.

Golden eagles were the most conspicuous year-round residents in the study area and vicinity. They were observed frequently throughout the year flying over the study area or roosting on fence posts and power poles. During studies conducted by Cleveland-Cliffs in 1978-1979, an active golden eagle nest was located on the southeast point of North Butte. No trace of this nest could be found during 1988.

Bald eagles were only observed in the vicinity of the study area during the winter months. A total of seven individuals were sighted during the period from December through March. Of these seven, six were adults and one immature. No known bald eagle roosts or winter concentration areas are known to occur in the vicinity of the study area. Bald eagle activity in the Pumpkin Buttes area probably begins with their arrival sometime in November and their departure sometime in March or April. The origins of the bald eagles wintering in the area are unknown.

Other raptors observed during the spring. and summer of 1988, are the red-tailed hawk, marsh hawk, ferruginous hawk, Swainson's hawk, rough-legged hawk, American kestrel and the prairie falcon. Of these species, only the rough-legged hawk, a winter resident, is not known to nest in the Pumpkin Buttes area. While the other species are known to nest in the area, no active nests were located during J988.

13.3.5 GAME BIRDS

No sage grouse leks are located within the North Butte permit area. There are however, two strutting grounds located in the near vicinity which are shown on Figure 13.1, Volume II. According to Wyoming Game and Fish records, these leks are known as the North Butte lek (T44N, R75W, Section 18) and the Gilbertz III lek (T44N, R75W, Section 21). The first observation of cocks on the Gilbertz III lek was during the second week in March when four individuals were observed. The maximum number of cocks observed was during the first two weeks of April when 10 and I I were observed. The final observation of strutting activity on this lek was during the second week of May when two individuals were observed. The following table lists the maximum number of cocks observed on this lek during the past ten years.

Year	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988
Cocks Seen	60+	46	39	NC	NC	17	8	9	NC	11

NC - No count conducted

Cocks were first observed on the North Butte lek during the last week of March 1988 when four and six individuals were observed on two consecutive days. Subsequent checks of this lek did not reveal any strutting cocks until mid-April when a lone individual was observed. Only two known counts have been done on this lek in the past. One, conducted in 1979, counted six cocks and the other in 1981 counted three. Use of the North Butte lek appears to be relatively low and it may be that it is a satellite of the Gilbertz III lek.

No sage grouse nests were observed on the permit area but it is likely that some individuals nest on or adjacent to the permit area. During June, female sage grouse and their broods were observed throughout the permit area in the sagebrush and grassland habitat types.

Mourning doves were the only other upland game bird observed within the study area. They are quite common and were most often observed in the juniper habitat on the flanks of North Butte. During the late 1970's, a flock of approximately 20 gray partridge were cften seen within the permit area. None were observed during the current study and they may no longer inhabit the area since suitable habitat is limited.

No waterfowl were observed in the study area.

13.3.6 PASSERINE AND OTHER BIRDS

A list of bird species observed and potentially occurring on the study area are presented in Table 13.2.

The permit area proper supports an avifauna typical of grassland-sagebrush habitats in central Wyoming. North Butte, along with the juniper, pines and small springs on its flanks, provides additional habitat for species which might not otherwise be present, thereby increasing the overall diversity of the area.

13.3.7 HERPTILES

A list of herptiles that could occur and those that were observed on the North Butte study area are presented in Table 13.3.

13.3.8 THREATENED, ENDANGERED AND OTHER SPECIES OF SPECIAL CONCERN

Three Federally listed endangered species, the bald eagle, peregrine falcon and blackfooted ferret, are potential inhabitants of the study area. Bald eagles are commonly observed in the vicinity of the study area during the winter months. The Pumpkin Buttes provide roosting areas for the eagles, which likely hunt throughout the surrounding region. Live streams for foraging are lacking in the Pumpkin Buttes area. While suitable nesting substrate is available on the Buttes, no known nesting has occurred in the area. As noted in previous studies, bald eagles may winter in the vicinity but migrate to more suitable habitat in the spring. Peregrine falcons are considered a rare migrant and winter visitant in Wyoming. Suitable nesting substrate for the peregrine is available on the rimrock areas of the Buttes. However, no known nesting has occurred in the area. One positive sighting of a peregrine falcon was reported in April 1979, near North Butte. Sightings of peregrines in the area would most likely be a chance occurrence while individuals are migrating through the area.

Black-footed ferrets are not expected to occur on the permit or study area due to the absence of active prairie dog colonies.

Three species considered rare in Wyoming, the burrowing owl, spotted bat and the pale milk snake, could potentially occur in the study area. Habitat for the burrowing owl, prairie dog colonies, are absent on the study area and the owl is not likely to occur. The rimrock of the Buttes seems to provide suitable habitat for the spotted bat. However, the spotted bat is only known to occur in the Big Horn Basin and is not likely to occur in the study area. The pale milk snake is secretive in nature and occupies a variety of habitats ranging from coniferous forests, broadleaf woodlands,

and river bottoms to rocky hillsides, prairie and sand dunes. It is not known if it inhabits the study area.

13.3.9 IMPORTANT WILDLIFE HABITATS

Three habitat types, existing within the study area, have been identified as being important to wildlife of the area. These are: 1) Drainages with cottonwoods and junipers which can be of importance to mule deer and migratory and breeding birds; 2) Juniper and pine stands on the slopes of North Butte which attract birds that may not otherwise inhabit the area and; 3) The rimrock area of North Butte which provides important nesting, roosting and perching habitat for raptorial species.

13.3.10 AQUATIC FAUNA

Due to the lack of water on the study area, no investigations of aquatic fauna were conducted.

13.3.11 RECREATION

Sport hunting is the only form of outdoor recreation on the study area.. As most land in the area is private surface, hunting access is restricted by the landowner who generally allows only pronghorn hunting.

13.4 WILDLIFE MANAGEMENT

PLAN 13.4.1 INTRODUCTION

Site-specific baseline vegetation and wildlife data for the North Butte ISL Project area combined with the proposed mine plan form the basis for assessment of potential impacts to wildlife resources resulting from the proposed development. The objectives of this plan are to identify impacts and define procedures for minimizing undesirable effects of mine development on the wildlife resources in the North Butte ISL Project area.

The proposed project involves the construction and operation of an in-situ solution uranium mine located in portions of Sections 18 and 19 T44N, R75W and Sections 13, 24 and 25, T44N, R76W. The project will involve seven mine units, plant facilities and liquid effluent evaporation ponds. The mining is expected to be completed in 16 years, after which, the affected aquifers will be restored, all structures except those left for landowner use, will be removed, wastes disposed of and all affected surface areas reclaimed.

13.4.2 IMPACTS

Impacts on wildlife from mining activities may be classified as either short term or long-term. Short-term impacts are those that result directly from and occur during mining operations but, assuming reclamation efforts are successful, cease after reclamation. Long-term impacts are those that persist even after successful reclamation efforts. Long-term impacts usually result indirectly from mining activities and are much more difficult to identify and evaluate (e.g. potential permanent reduction in the local pronghorn population as a result of decreased quantity and quality of forage due to changes in nutrient cycling). Most of the impacts identified for the North Butte ISL project area resulting from development activities are considered to be of a short-term nature provided reclamation is successful.

Impacts may occur at a number of different levels of population organization ranging from the individual through herds or groups to the entire population. Since most of the anticipated impacts on the North Butte ISL Project Area are of a short-term nature or are restricted to the disturbed site and immediately adjacent areas, few lasting effects are anticipated at the regional population level for most species (e.g., the partial elimination of small mammals or mammalian predators during mining activities but the full recovery to baseline population levels after successful reclamation).

The general categories of potential impact to wildlife resources expected from the development at the North Butte ISL Project and severity ratings of each impact on the wildlife components in the study area are presented in Table 13.4. This table is the basis for the subsequent discussion of

impact to wildlife in the North Butte ISL Project Area.

13.4.2.1 MODIFICATION OF VEGETATION

Vegetation will be temporally removed from approximately 49 acres presently covered by upland habitats. The disturbed area will not be suitable for wildlife habitat while the mine is operating and reclamation will not replace equivalent

TABLE 13.4

Ratings for Potential Impacts
on Wildlife Components

Impactors 1,2

	A	B	C	D	E
Pronghorn	3	4	3	3	3
Mule Deer	3	4	3	3	3
Other Mammals	3	4	3	3	3
Predators	3	4	3	3	3
Game Birds	3	4	3	3	3
Raptors	3	4	3	3	3
Other Avifauna	3	4	3	3	3
Herptiles	3	4	3	3	3
Important Habitat	4	4	4	-	4
Recreation	4	4	4	4	4
T&E Species	4	4	4	4	4

1

A – Modification of Vegitation

B – Water Supply Alterations

C – Airborne Emmissions

D – Direct Wildlife Mortality

E – Presence of Development,
Associated Humans and Noise

2 Impact Ratings

1 = Severe

2 = Moderate

3 - Slight

4 - Unanticipated

habitat immediately. The severity of this impact on wildlife is variable among the wildlife species occurring in the area.

Pronghorn and mule deer use the area as summer/yearlong range. Individuals that normally grazed or bedded in and adjacent to areas to be affected will likely move to suitable adjacent habitat. The removal, by the project, of a small amount of habitat will have slight overall impact. Mammalian predators will also likely use undisturbed habitat nearby rather than the disturbed area. The primary impact on predators due to modification of vegetation will likely be loss of potential prey due to the reduction in small mammals in affected areas. However, factors other than the amount of prey (e.g., coyote hunting and poisoning) may limit some of the predators in the area. Although small and medium-sized mammals will be reduced in the affected areas, they are expected to re-invade the area after mining is completed and vegetation is reestablished after reclamation.

No active raptor nests are known to occur in the vicinity of the proposed operations. The main impact on raptors due to vegetation modification is associated with the reduction of small mammal prey species on affected areas. This reduction in potential prey may affect those raptors which hunt in the area but it is not expected to limit raptor populations in the area.

Habitat used for nesting by passerine birds will be reduced. However, populations outside of the localized disturbed areas are not expected to be adversely affected and passerines should re-invade the areas upon re-establishment of vegetation after reclamation.

Relatively few reptiles and amphibians inhabit the areas to be affected and, therefore, relatively few herptiles should be affected:

Impacts on threatened or endangered species due to vegetation modification are not anticipated.

13.4.2.2 WATER SUPPLY ALTERATIONS

Water resources, which are an important component of wildlife habitat, are absent on the North Butte permit area. Drainages and impoundments in the vicinity only contain water for brief periods following snow melt or precipitation events. Therefore, the North Butte ISL project is not likely to affect any water supply currently available to wildlife. However, the water supply for wildlife could be increased during the life of the mine if surface discharge of water is conducted.

13.4.2.3 AIRBORNE EMISSIONS

Airborne emissions are expected to have little if any impact on wildlife species in the area. Air quality regulations that limit the kind and amount of emissions, including the release of radioactive gases, must be met. An increase in airborne particulates, during construction activities, may allow vegetation downwind from the operation to be covered with more dust than usual. This could potentially cause a decrease in vegetation productivity which would decrease forage available to wildlife. However, this potential impact would be limited to areas adjacent to development which would be avoided by most wildlife species. Emissions from the facility will be monitored and maintained within safe radiological protection limits for man, so no major radiological impact to wildlife is anticipated.

13.4.2.4 DIRECT WILDLIFE MORTALITY

Direct mortality may occur to wildlife such as small mammals and young birds that inhabit areas to be disturbed and that are not able to move rapidly enough to avoid equipment. This mortality may be severe at the localized disturbance but most of these animals reproduce rapidly and should re-invade the area if proper habitat is provided by reclamation.

The other major potential source of direct mortality will be vehicle-wildlife collisions. Although this impact could affect all wildlife species, the primary concern will be for pronghorn, mule deer, medium-sized mammals and raptors.

Approximately 50 Uranerz employees will be involved in the construction and operation of the North Butte ISL facility. Access to the site is provided by an existing county road extending northwest from Highway 50 to the North Butte ISL access road. The terrain is relatively open, which allows good visibility, so most collisions with pronghorn and mule deer can be avoided. The potential for collisions with raptors is present if carrion on or along the road attracts and holds them near the roadway. Due to the limited number of vehicle-wildlife collisions expected, the overall affect of direct wildlife mortality attributed to the North Butte ISL Project is expected to be slight.

13.4.2.5 PRESENCE OF DEVELOPMENT, ASSOCIATED HUMANS AND NOISE

Increased human activity associated with mine development increases the potential impact on several wildlife species. Most wild animals, particularly those that are hunted, avoid contact with humans by moving away. The distance they move depends on numerous factors-,including intensity and duration of human activity, cover, topography, weather, species of animal and previous experience of animals with humans. This avoidance reaction, increases the habitat rendered less suitable for wildlife. This impact could be moderate-to severe for individual animals in the vicinity of the development. However, the small-size of the project area limits the severity of impact at the herd level.

Wildlife oriented recreation may be affected in several ways. Personnel at the mine will participate in wildlife viewing. Hunters may not hunt near the mine for aesthetic reasons while others may be attracted due to improved access. Poaching by workers is discouraged by requirements that personnel on duty at the mine not possess firearms on site. Hunting in the project area is controlled by the landowners.

The operation of the North Butte ISL project should have no effect on either the Gilbertz III or the North Butte sage grouse leks. The North Butte lek is located east of (and outside of) the permit area where no activities are planned. The Gilbertz III lek is located on both sides of the county road about two miles east of the permit area. Traffic to the mine will normally be coming from the south and exiting the county road before passing the Gilbertz III lek area. The same is true of traffic leaving

the mine. This lek area is already influenced by the substantial oil and gas related traffic that uses the county road.

Human activity and unsuitable habitat conditions on disturbed sites are expected to keep most wildlife out of potentially dangerous areas such as the recovery facility and evaporation ponds. These potentially dangerous areas will be fenced to exclude large wildlife and livestock. Uranerz does not plan to fence the sell field areas. If the well fields are fenced, Type III fencing design (Guideline No. 10) will be utilized. Plans to mitigate and monitor potential impacts associated with the development are presented in; the next section.

13.4.3 MITIGATION AND MONITORING

Severe impacts on, or long-term reduction in wildlife populations due to the proposed development are not expected in the vicinity of the North Butte ISL Project. However, several different types of lest severe, but nonetheless adverse, impacts will occur. Mitigating measures are not possible for all impacts, however, reduction of impact and mitigation measures that are possible are described in this section. The operational wildlife monitoring plan to document changes in wildlife use of the area is described in Section 16.5.2. Such monitoring will be conducted throughout the operational life of the project so that impact mitigation measures can be modified if necessary. The U.S. Fish and Wildlife Service Endangered Species Office in Helena, Montana will be notified in the event a federal listed threatened or endangered species not reported in the baseline study begins to use the permit area or adjoining surfaces.

13.4.3.1 MODIFICATION OF VEGETATION

The reclamation plan for the North Butte ISL Project commits Uranerz to restoration of disturbed areas as' soon as practicable. The reclamation plan describes measures to be employed in re-establishing vegetation, a major habitat component necessary for wildlife habitation. Revegetation success will be monitored at appropriate intervals so reclamation can be modified, if necessary, to assure that areas will not be out of production any longer

than necessary. Additionally, only the minimum area necessary for the project will be disturbed.

To encourage successful reclamation as soon as possible after disturbance, Uranerz will use tested and acceptable reclamation techniques and land owner approved seed mixtures that are adapted to the conditions on the permit area. Vegetation establishment will also be enhanced by natural invasion. The linear, relatively narrow configuration of the ore body, which determines the size and shape of the disturbed area in the well field, is conducive to more 'rapid invasion than would a similar amount of disturbed land that was more consolidated. Also, dot stripping topsoil from the well field areas will reduce disturbed acreage and encourage more rapid revegetation.

Successful reclamation will produce vegetation cover that will probably be repopulated first by small mammals and passerine birds. Although the initial diversity of small mammal and passerine bird species in the reclaimed area may be low, their numbers should be sufficient to restore any prey base lost to raptors and mammalian predators. During the summer, pronghorn and mule deer may use the reclaimed area, bur they will likely bed down in undisturbed areas that have more dense cover than the reclaimed area.

13.4.3.2 WATER SUPPLY ALTERATIONS

The water supply in the project area will not be affected by the proposed operations.

13.4.3.3 DIRECT WILDLIFE MORTALITY

Uranerz will encourage safe driving habits and reasonable speed while driving on the access road to reduce the potential for wildlife-vehicle collisions. The amount of traffic for the North Butte ISL Project will not likely cause wildlife-vehicle collisions to the point that additional measures will be necessary.

During the life of the project the evaporation ponds will be inspected at least monthly for wildlife. Results of the monthly inspection will be included in the Annual Reports. During the monthly inspection of the ponds the entire shoreline will be walked to determine if any waterfowl or other wildlife mortalities have occurred. If dead or emaciated birds or other wildlife are found, they will be picked up, labeled, and frozen in a plastic bag. The District III Game and Fish Department in Sheridan will be notified immediately. Uranerz will have all power lines at the North Butte site constructed so as to avoid raptor electrocution as outlined in Olendoff R.R., A. D. Miller and R. M Lehman, 1981.

13.4.3.4 PRESENCE OF DEVELOPMENT, ASSOCIATED HUMANS AND NOISE

Several measures to reduce potential adverse impacts on wildlife due to the presence of the development, associated humans and noise will be implemented. Potentially dangerous areas such as the evaporation ponds and processing facility will be fenced to exclude large terrestrial wildlife. Although the use of evaporation ponds by wildlife is not expected due to the presence of humans nearby and fencing, they will be periodically monitored. If monitoring of potentially dangerous areas indicate that wildlife are being attracted to those areas and subsequently harmed, appropriate techniques will be employed to reduce the impact.

Nesting raptorial birds are particularly susceptible to disturbance impacts.: in the vicinity of their nesting sites. Unusual disturbance sear an active nest site may cause birds to abandon their nests. The licensee will monitor all known raptor nests and potential nesting sites on a yearly basis. Any active raptor nests will be protected from disturbance -during the reproductive season. If a nest cannot be avoided during operations, the appropriate state and federal agencies will be consulted to determine mitigative measures. A special purpose permit will be obtained from the U.S. Fish and Wildlife Service in the event it becomes necessary to "take" a raptor nest. Permit acquisition will be coordinated with the U.S.F.W.S. Ecological Services Office in Cheyenne and sufficient lead time will be allowed for development of a mitigation plan, should one be deemed necessary.

Employees will be instructed to avoid harassment of all wildlife in the vicinity of the project area. Any employee or contractor involved in deliberate acts of wildlife harassment will receive appropriate reprimands.

13.4.4 ANNUAL WILDLIFE SURVEYS

13.4.4.1 ANNUAL RAPTOR SURVEYS

An annual raptor survey will be conducted each spring on the permit area and within a one mile perimeter of the permit area. The species, status, and reproduction success will be determined for all active nests observed in the survey area. The data from the annual raptor survey will be included in the Annual report to the Land Quality Division.

13.4.4.2 ANNUAL GAME BIRD SURVEYS

An annual sage grouse survey will be conducted each March-April period within a one mile perimeter of the permit area. The survey will include two counts of each known lek at approximately 7 to 10 day intervals. Searches will be conducted for new or previously unrecorded leks in suitable habitat areas. The number of males and females counted on each lek, along with the dates and conditions under which counts were made will be recorded. The data from the annual sage grouse survey will be included in the Annual Report to the Land Quality Division.

14. APPENDIX "D-10", PRE-MINING RADIOLOGICAL ASSESSMENT

14.1 ENVIRONMENTAL BASELINE RADIOLOGICAL DATA

To characterize the baseline (pre-mining) radiological conditions at the North Butte ISL project site, a number of sampling programs were implemented. These included sampling programs for vegetation, soils and sediment, a gamma survey, thermoluminescent dosimetry, atmospheric radon-222, and air particulates. These baseline data are presented in the following sub-sections along with a description of the sampling program.

14.1.1 CONCENTRATIONS IN VEGETATION

The North Butte permit area is rangeland used primarily for livestock grazing and wildlife habitat. Vegetation samples were collected at three locations (Figure 10.7, Volume II) adjacent to the air monitoring sites during the month of June 1988. The samples were delivered to a commercial laboratory and analyzed for Th-230, Ra-226, Pb-210 and U(nat). The results of these analyses are presented in Table 14.1.

TABLE 14.1

Pre-Operational Radiological
Vegetation Samples

Sample Site	Th-230 uCi/kg ($x 10^{-5}$)	Ra-226 uCi/kg ($x 10^{-5}$)	Pb-210 uCi/kg ($x 10^{-5}$)	U(nat) mg/kg
NB 8	0.09±0.37	0.09±1.30	0.32±0.96	0.0535
NB 10	0.00±0.19	0.00±1.10	0.00±0.52	0.0444
NB 12	0.21±0.42	4.30±1.60	0.89±0.94	0.0444

14.1.2 CONCENTRATIONS IN SOIL

Radiological soil samples were collected at the three air monitoring sites (Figure 10.7, Volume II). The samples were collected in increments of • 0-5 cm, 5-10 cm, and 10-15 cm at each site and analyzed for Th-230, Ra-226, Pb-210 and U(nat). The results of these analyses are presented in Table 14.2.

Soil samples will be collected along 'the drainage where the surface discharge point will be located (Figure 10.7, Volume II). Samples will be collected in increments of 05 cm and 5-15 cm upstream from the discharge point, at the discharge point and at two locations downstream, and analyzed for Ra-226 and U(nat). The results of these analysis will be presented prior to any construction activity at the site.

14.1.3 CONCENTRATIONS IN SEDIMENT

Sediment samples were collected at two locations (Figure 10.7, Volume II) on Willow Creek and from a small impoundment on the permit area as part of the pre- operational radiological sampling program. The two sample sites (SWS 1 and SWS 2) on Willow Creek were located upstream and downstream of areas where run-off from the permit area enters the creek. The analyses for the sediment samples, which were analyzed for Th-230, Ra-226, Pb-210 and U(nat), are presented in Table 14.3.

TABLE 14.2

Pre-Operational Radiological

Soil Samples

Sample Site and Depth		Th-230 pCi/g	Ra-226 pCi/g	Pb-210 pCi/g	U(nat) pCi/g
	0-5 cm	0.07±0.32	2.07±1.27	1.16±1.28	2.03
NB 8	5-10cm	0.00±0.31	0.00±1.18	0.00±1.30	1.96
	10-15cm	0.06±0.32	1.66±1.26	0.86±1.22	2.20
	0-5 cm	0.22±0.34	2.20±1.28	1.15±1.31	3.21
NB 10	5-10cm	0.00±0.32	0.00±1.04	0.25±1.23	2.71
	10-15cm	0.00±0.33	0.00±1.10	0.22±1.26	3.05
	0-5 cm	0.26±0.35	1.57±1.26	0.85±1.25	3.25
NB 12	5-10cm	0.21±0.35	0.13±1.21	0.26±1.30	3.38
	10-15cm	0.24±0.34	1.47±1.25	0.67±1.21	3.38

TABLE 14.3

Pre-Operational Radiological

Sediment Samples

Sample Size	Th-230 pCi/g	Ra-226 pCi/g	Pb-210 pCi/g	U(nat) pCi/g
SWS 1	0.00+0.33	0.00+1.19	0.00+1.08	2.37
SWS 2	0.15+0.36	1.26+1.25	0.45+1.22	2.37
SWS 3	0.16+0.36	1.16+1.24	0.31+1.32	2.50

14.1.4 GAMMA SURVEY

The previous owners of the North Butte property had conducted a gamma survey over the entire permit area on a 500 foot grid system in 1979. Rather than conducting a entire new gamma survey, Uranerz elected to conduct a verification survey of 20 randomly selected points (Figure 14.1, Volume II) to determine if an entirely new survey was warranted. At the randomly selected verification sample sites, a digital rate meter with a NaI(T1) scintillation detector was used to determine the gamma levels at each of the sites, three readings were taken and then averaged for the I uR/Hr reading. The mean gamma reading for the verification survey was 11.7 uR/Hr with a standard deviation of 0.56 uR/Hr. The gamma readings obtained during the verification survey were slightly lower than those obtained during the 1979 survey and were within a normal background range of 11 to 13 uR/Hr. The difference between the readings for the original and verifications surveys could be attributed to: different instrumentation, methodologies, soil moisture conditions and the fact that disturbances and drill hole cuttings on the ground surface were present, which have since been reclaimed and revegetated. Since the verification gamma readings were slightly lower than the 1979 readings, which were considered to be in a normal background range, it was determined that a new survey of the entire permit area was not warranted.

In addition to the verification gamma survey points, gamma readings were made at ten background sites located away from the ore-bodies and at 19 sites where the plant facilities and evaporation ponds will be located. All gamma readings taken on the North Butte permit area are presented in Table 14.4 and on Figure 14.1, Volume II.

TABLE 14.4

Pre-Operational Verification Gamma Survey

Sample Point	Gamma uR/Hr	Sample Point	Gamma uR/Hr	Sample Point	Gamma uR/Hr
V-1	11	PF-1	11	B-1	12
V-2	11	PF-2	11	B-2	11
V-3	12	PF-3	11	B-3	11
V-4	12	PF-4	12	B-4	12
V-5	11	PF-5	12	B-5	11
V-6	12	PF-6	12	B-6	12
V-7	13	PF-7	12	B-7	11
V-8	12	PF-8	12	B-8	11
V-9	12	PF-9	11	B-9	12
V-10	12	PF-10	12	B-10	12
V-11	12	PF-11	12		
V-12	12	PF-12	12		
V-13	12	PF-13	11		
V-14	11	PF-14	12		
V-15	11	PF-15	12		
V-16	11	PF-16	11		
V-17	12	PF-17	12		
V-18	12	PF-18	12		
V-19	11	PF-19	11		
V-20	12				

In conjunction with the gamma survey, surface soil samples were collected at all twenty verification sample sites. All 20 samples were analyzed for Ra-226 with ten percent also being analyzed for Th-230, Pb-210 and U(nat). Surface soil samples were also collected at the ten background sites and at five of the plant facilities/ evaporation pond sites and analyzed for Ra-226. The results of these analyses are presented in Table 14.5. An additional gamma survey will be conducted at the evaporation ponds locations prior to construction and prior to the synthetic liner being installed.

TABLE 14.5

Pre-Operational Gamma Survey

Surface Soil Samples

Sample Point	Th-230 pCi/g	Ra-226 pCi/g	Pb-210 pCi/g	U(nat) pCi/g
V-1		0.13±1.21		
V-2		0.88±1.26		
V-3		0.22±1.26		
V-4		0.69±1.23		
V-5		1.01±1.24		
V-6		1.47±1.25		
V-7		1.29±1.25		
V-8		0.94±1.24		
V-9	0.08+0.35	0.75±1.23	0.00+1.31	1.59
V-10		0.03±1.21		
V-11		1.29±1.25		
V-12		0.35±1.22		
V-13	0.12+0.37	0.63±1.23	0.00+1.27	2.44
V-14		0.00±1.19		
V-15		0.00±1.21		
V-16		0.00±1.18		
V-17		0.57±1.22		
V-18		1.22±1.24		
V-19		0.91±1.23		
V-20		0.00±1.20		
PF-2		0.00±1.18		
PF-5		0.50±1.22		
PF-6		2.10±1.27		
PF-12		0.13±1.21		
PF-15		0.63±1.23		
B-1		0.85±1.23		
B-2		0.91±1.23		
B-3		0.00±1.20		
B-4		0.00±1.20		
B-5		0.00±1.18		
B-6		0.00±1.20		
B-7		0.00±1.20		
B-8		1.04±1.24		
B-9		1.07±1.24		
B-10		0.47±1.22		

14.1.5 THERMOLUMINESCENT DOSIMETRY

Gamma exposure rates were measured at six locations on and adjacent to the North Butte Property using thermoluminescent dosimeters (TLD's) which were changed on a quarterly basis. The TLD locations are shown on Figure 10.7, Volume 11) and the results are presented in Table 14.6.

TABLE 14.6

Thermoluminescent Dosimetry

Gamma Exposure Rates

Sample Site	1st Quarter Ave. MREM+SD	12/87-02/31 MREM/wk	2nd Quarter Ave. MREM+SD	03/31-06/30 MREM/wk
NB 8	32.0 ± 4.0	2.04	33.6 ± 5.0	1.94
NB 9	34.4 ± 13.5	2.19	32.4 ± 2.7	1.87
NB 10	32.8 ± 9.5	2.09	34.4 ± 11.4	1.99
NB 11	30.6 ± 1.7	1.95	31.2 ± 3.3	1.80
NB 12	36.0 ± 8.6	2.29	34.0 ± 5.3	1.97
NB 13	32.0 ± 5.1	2.04	33.6 ± 7.3	1.94
Control	27.8 ± 2.2	1.77	34.6 ± 6.4	2.00

Sample Site	3rd Quarter Ave. MREM+SD	06/30-09/30 MREM/wk	4th Quarter Ave. MREM+SD	10/01-12/31 MREM/wk
NB 8	LOST		37.2 ± 13.3	1.91
NB 9	40.8 ± 7.4	2.16	37.2 ± 18.5	1.91
NB 10	38.2 ± 11.4	2.03	33.4 ± 1.1	1.72
NB 11	39.8 ± 9.9	2.11	33.4 ± 4.8	1.72
NB 12	41.6 ± 7.2	2.21	38.0 ± 19.3	1.96
NB 13	LOST		LOST	
Control	39.4 ± 7.9	2.09	34.8 ± 2.2	1.79

14.1.6 TMOSPHERIC RADON-222

Atmospheric Rn-222.was monitored continuously at the same locations as the TLD's using passive Trak-Etch radon monitors. These monitors were quarterly basis at the same time that the TLD's were changed. radon monitoring are presented in Table 14.7.

TABLE 14.7
Radon-222 Concentrations

Sample Site	1st Quarter 01/06/88-03/31/88 Ave. Radon Conc. pCi/1	% STD Dev	2nd Quarter 03/31/88-06/30/88 Ave. Radon Conc. pCi/1	%STD Dev
NB 8	0.6	21.8	2.0	18.0
NB 9	0.4	37.8	0.8	19.6
NB 10	0.4	35.4	1.1	19.6
NB 11	0.4	28.9	0.5	23.6
NB 12	0.7	20.9	1.1	19.6
NB 13	0.7	20.9	1.0	20.0

Sample Site	3rd Quarter 06/30/88-09/30/88 Ave. Radon Conc. pCi/1	% STD Dev	4th Quarter 09/30/88-01/03/89 Ave. Radon Conc. pCi/1	%STD Dev
NB 8	0.5	23.6	1.0	17.4
NB 9	0.6	22.4	0.6	21.8
NB 10	0.8	18.6	0.5	22.9
NB 11	0.3	33.3	1.1	16.9
NB 12	.0.8	18.9	0.7	20.4
NB 13	1.9	17.7	0.5	24.3

14.1.7 AIR PARTICULATES

Radiological air particulates were measured at three locations (Figure 10.7, Volume 11) using Hi-Volume air samplers. Samples were collected once each month with between 4,000 and 5,000 cubic meters of air passing through the samplers. The monthly samples were composited on a quarterly basis and analyzed for Th-230, Ra-226, Pb210 and U(nat). The results of this sampling program are presented in Table 14.8.

TABLE 14.8
Pre-Operational Radiological
Air Particulates
First Quarter (Jan, Feb, Mar 1988)

Sample Site	Th-230 pCi/m^3	Ra-226 pCi/m^3	Pb-210 pCi/m^3	U (nat) pCi/m^3
NB-8	0.15±0.52E-4	1.67±0.31E-4	1.4L2.Q3E-4	1.43E-6
NB 10	0.37±0.51E-4	1.15±0.28E-4	0.80±2.01E-4	1.43E-6
NB 12	0.37±0.46E-4	0.53±0.23E-4	0.47±2.18E-4	1.66E-6

Second Quarter (Apr, May, Jun 1988)

Sample Site	Th-230 pCi/m^3	Ra-226 pCi/m^3	Pb-210 pCi/m^3	U (nat) pCi/m^3
NB 8	0.66±0.62E-4	2.60±0.60E-4	1.58±2.39E-4	2.58E-6
NB 10	1.09±0.92E-4	3.26±0.55E-4	2.73±2.46E-4	3.11E-6
NB 12	0.52±0.50E-4	2.67±0.52E-4	1.9L2.27E-4	1.70E-6

Third Quarter (Jul, Aug, Sep 1988)

Sample Site	Th-230 pCi/m^3	Ra-226 pCi/m^3	Pb-210 pCi/m^3	U (nat) pCi/m^3
NB 8	0.09±0.81E-4	1.10±0.32E-4	0.59±1.98E-4	3.19E-7
NB 10	0.85±0.67E-4	1.13±0.26E-4	0.75±2.22E-4	2.78E-5
NB 32	0.62±0.56E-4	1.66±0.49E-4.	0.98±2.06E-4	1.10E-6

Fourth Quarter (Oct, Nov, Dec 1988)

Sample Site	Th-230 pCi/m^3	Ra-226 pCi/m^3	Pb-210 pCi/m^3	U (nat) pCi/m^3
NB 8	0.21±0.59E-4	3.54±1.71E-5	0.29±1.95E-4	3.66E-7
NB 10	0.37±0.55E-4	4.96±2.09E-5	0.07±2.00E-4	3.31E-7
NB 12	0.44±1.05E-4	8.65±3.11E-5	0.51±2.37E-4	3.46E-7

14.1.7 CONCENTRATIONS IN GROUNDWATER

The water in the ore body aquifer (including "A", "B", "C", and "BC" sands) at the North Butte site contains naturally elevated levels of radium-226 based on the water quality sampling that has taken place. This condition is normal for aquifers in Wyoming containing significant uranium mineralization because of the complex geochemical environment. The radium-226 values from water samples collected in the ore body aquifer range from <0.2 to 82.4 pCi/l with an average of 6.51 pCi/1. The radium-226 values for each sampling event for each sampling well are presented in I Section 10.1.6, Groundwater Quality. As individual mining units are base lined for water quality prior to mining, it is expected that some restoration sampling wells will have radium-226 concentrations significantly higher than 82.4 pCi/1.

The ore body aquifer also contains radon-222 which will be released above ground as a gas when the water coming from the well field is exposed to atmospheric pressure. No measurements of the radon-222 concentrations in the ore body aquifer have been made at the North Butte site; however, the values should be similar to other ISL projects in Wyoming. The operational procedures and monitoring program for safely dealing with the radon-222 gas released during mining is discussed later in this document in Sections 15, 16 and 19.

14.1.8 CONCENTRATIONS IN SURFACE WATER

Surface water sampling points were established at three locations (Figure 10.7, Volume II), Willow Creek upstream (SWS 1), Willow Creek downstream (SWS 2) and at a small impoundment (SWS 3). Throughout 1988, no water was observed in Willow Creek or the impoundment. Therefore, no samples were collected for analysis. The year of 1988 was extremely dry in the central Powder River Basin. Water samples will be collected and analyzed in 1989, if possible, and the data will be forwarded to the DEQ and NRC.

14.2 RADIOLOGICAL IMPACT ON BIOTA OTHER THAN MAN

The in situ mining process being proposed for the North Butte facility is similar to the operation that was conducted and monitored during the Ruth Research and Development phase. The Ruth R & D operation was monitored for any and all potential releases to the environment for over two years with no radiological impacts on any biota including man. The proposed operations for commercial mining have incorporated basically all of the same operational procedures except that the product shipped from the site will be in a dried form.

The operationally proven techniques and experience of the company will be used to insure that the potential for any accidents or spills can be eliminated or minimized.

14.3 RADIOLOGICAL IMPACT ON MAN 14.3.1 AIRBORNE RADON-222

At the North Butte facility, there are two primary sources for airborne radon. One source is from the plant building vents from any open or unpressurized process tanks, such as lixiviant makeup. The other source is from the venting of injection and production wellheads in the well field area. Very little radon is emanated at the evaporation ponds as most of the radon has decayed or been released prior to reaching the evaporation ponds.

While there are these potential sources, it should be noted that the amounts being released are extremely small and that simple dispersion within the atmosphere will reduce the potential emigration from the property to zero. A computer dispersion model, MILDOS, has been used by Pathfinder at the highest potential flow rate of 4,000 GPM to show that there is no radiological impact to the nearest residence from radon, assuming that 100% of the radon present in the formation is released (see Section 19.8). The Ruth R & D facility was monitored during the two years of operation and the property boundary monitors remained within background levels the entire time: This situation has been experienced at other ISL facilities as well.

14.3.2 AIRBORNE PARTICULATES

Airborne particulates will be minimal at the North Butte facility. The only likely source of airborne particulates is in the yellowcake dryer room. Environmental controls and frequent monitoring will insure that safe working conditions are maintained at all times. Any accidents or spills will be contained and cleaned up before any potential particulates can or will be generated. Again, utilizing the data and operational experience of the Ruth R & D, no particulates will be expected. Operational monitoring for radioactive airborne particulates will take place inside the building as discussed in Section 19.1 of this document.

14.3.3 ATMOSPHERIC DISPERSION COMPUTER PROGRAM (MILDOS)

The MILDOS modeling description and results for radionuclide atmospheric dispersion at the North Butte facility is presented in Section 19.8. Background data and operational information from the proposed Ruth satellite operation have been included in the North Butte MILDOS computer run.

15.9 MINE ACCESS ROAD

For access to the North Butte facilities, Power Resources Inc. plans on upgrading an existing access road originally built by Cleveland Cliffs Iron Company for use in developing the North Butte orebody. This plan is opposed to the original Uranerz plan of building a new access road in Section 19, T.44N., R.75W., which is approved in this permit document. The existing access road takes off from the main oil field road at a point within the permit boundary located in the NE¼ NW¼, Section 25, T.44N., R.76W. (see Figure 9.2, Volume II). From this point on, the road will be used exclusively for access to the ISL wellfields and processing facilities. Power Resources Inc. plans to upgrade the existing road, with the road design being limited to minor alignment changes and upgrading the level of service (topwidth, surfacing and grading). A 20 foot topwidth will be provided with three to six inches of crushed gravel or scoria. Power Resources Inc. will verify the condition of existing culverts in the road (see Section 15.9.1), and provide miscellaneous drainage. The upgrading of the existing access road will comply with the landowner's desires as stated in this permit document, and with applicable portion of Land Quality Rules and Regulation Chapter IV, Section 2.(i)(i)-(viii).

Uranerz, U.S.A. had planned to construct a new access road for entrance to the North Butte project. The corridor for this road is contained within the permit boundary and is some 1.6 miles in length starting near the corner of the southeast quarter of Section 19, T.44N., R.75W., where it departs the main oil field road (see Figure 9.2, Volume II). Power Resources Inc. does not intend to construct this road at this time, but has left the information regarding the roadway intact within this document, should a necessity arise in the future to construct the road. For this reason, this particular road has been redesignated the "auxiliary access road," and the discussion pertaining to this road within this document will remain. The legal description of the auxiliary access road is presented in Section 4 (Appendix C).

The auxiliary access road will be approximately 20 feet in width and will cross two small drainages identified as Crossing A and Crossing B on the Site Plan Map (Figure 9.2, Volume II). Culverts will be used at both crossing locations to maintain all weather access. The auxiliary access road will be constructed by blading the top six to eight inches of soil to each side and constructing a drain on each side with the topsoil windrowed to the outside of each drain. The subsoil from the construction of the drain will be placed in the bottom of the drain and seeded. A typical road cross section is shown in Figure 15.23. A three to six inch layer of gravel or scoria will be placed on the road bed surface. A listing of topsoil volumes and soil types for the auxiliary access road are found in Table 15.1.a. A two-foot buffer zone will exist on each side of the road where topsoil will not be placed.

There are no areas along the proposed auxiliary access road route that will require any significant cutting. At the two culvert crossings some fill material will be required. The fill material will be obtained from sites adjacent the road and within the permit area. The "A" and "B" horizon topsoil will be removed, stockpiled and seeded from the sites used for obtaining fill material.

Following the completion of all mining and reclamation activities, the land owner desires that the auxiliary access road be reclaimed (if built) as described in Section 17.3 of this document. Briefly, reclamation of the road consists of picking up the gravel or scoria from the road bed, discing, re-applying the stored topsoil and seed. Even if the stored topsoil is not re-applied to the road bed, the existing 3-plus feet on the average of remaining in place topsoil will provide sufficient plant growth material to re-establish vegetation.

The proposed method of road construction for this short 1.6 mile segment is simple and inexpensive to construct, and causes minimal impact to the land resource. Other techniques which require the stripping of all topsoil along the road route take native land out of use at the stockpile locations and a substantial amount of fill (gravel or scoria) must replace the topsoil to prevent large erosion channels from forming on the road. The land from where the fill material is obtained is impacted unnecessarily by this method. The land owner has successfully used the proposed method of road construction on the ranch property.

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TABLE 15.1a

North Butte Project
Soils Crossed by the
Auxiliary Access Road

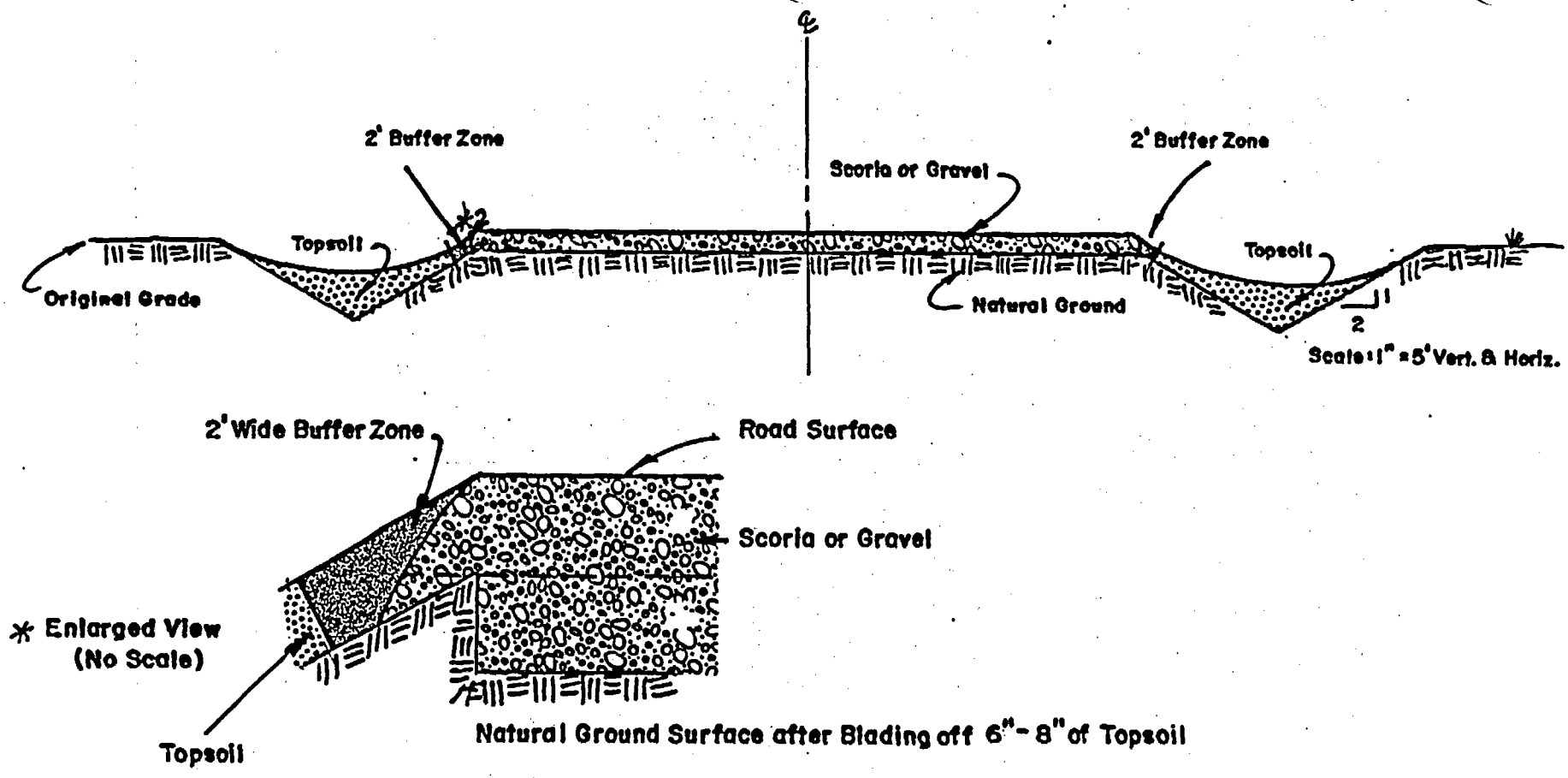
Map Symbol	Soil Type	Soil Horizons and Depths(in.)		
		E	A	AB
50/AB	Bidman	0-3		
75/BC	Cushman		0-3	3-6
45/AB	Forkwood		0-4	4-6
a62/AB	Hiland		0-7	
KI/AB	Kishona		0-3	
PA	Parmleed		0-4	
SH-G	Shingle		0-3	
TA	Taluce		0-3	
TUR	Turnercrest		0-4	

TABLE 15.1a (continued)

North Butte Project
Auxiliary Access Road
Topsoil Volumes

Soil Type	Feet of Roadway	Acres	Volumes (cu.yd.) A Horizons
Bidman	1,920	2.29	2,475.3
Cushman	380	0.45	486.4
Forkwood	2,730	3.26	3,523.8
Hiland	535	0.64	691.8
Kishona	340	0.41	443.2
Parmleed	100	0.12	129.7
Shingle	530	0.63	681.0
Taluce	1,385	1.65	1,783.5
Turnercrest	430	0.51	551.3
	TOTALS	9.96	10,766.0

NOTE: Width of mine access road surface and ditches is 52 feet (20 foot surface with 16 feet for ditching on either side).



Note: Blade 6" to 8" of Topsoil to sides with slight Crown in middle. Blade Drainage Ditch on each side then line Drainage Ditch with Topsoil. Fill Roadbed with 3" - 6" of Gravel or Scoria.

Revised: 3-27-92
Revised: 5-10-90
Revised: 1-29-90

POWER RESOURCES, INC.		
NORTH BUTTE ISL PROJECT		
AUXILIARY ACCESS ROAD TYPICAL CROSS-SECTION		
GEOL:	SCALE: None	FIGURE: 15.2
DRAWN BY: R.A.H.	DATE: 1-18-89	

15.9.1 STREAM CROSSINGS: CULVERT AND FORD DESIGNS

During the life of the permit, it may be necessary to construct some road crossings on ephemeral channels within the North Butte permit area. Possible stream crossings will consist of either a gravel bottomed ford in places where the channel and flood plain geometry allows for easy crossing or culverts where a ford is not practical. Potential stream crossing locations and contributing drainage basins upstream are presented on Figure 10.6 (Volume II). Figure 10.9 (Volume II) also presents the drainage basin divides and the cross section locations. There are three possible culvert crossings and three ford crossings of tributaries to Willow Creek of the Powder River. Table 15.2 presents the drainage basin parameters used in the analysis which are labeled SC1 through SC6. In the larger basins in which culverts may be used in the construction, the drainage basins have been broken into several sub-basins. This was performed in order that unique areas of each basin could be modeled separately.

The 10-year, 6-hour meteorological event has been used in the design as agreed upon in prior discussions with WDEQ personnel. The 2-year, 6-hour event was also used in combined ford and culvert crossings. The point rainfall depths associated with the 10-year and 2-year events have been determined to be 2.25 and 1.43 inches, respectively. These depths were obtained by the use of the National Oceanic and Atmospheric Administration (NOAA) Precipitation Frequency Atlas of the Western United States – Wyoming Atlas 2 (Miller et al, 1973). The storm distributions were determined through regression techniques presented in the NOAA Atlas. The cumulative rainfall depths for the 5-minute, 15-minute, 60-minute, 2-hour, and 3-hour intervals are 0.493, 0.969, 1.70, 1.85 and 1.98 inches, respectively, for the 10-year event and 0.293, 0.576, 1.01, 1.10 and 1.23 inches, respectively, for the 2-year event.

The HEC-1 computer model, adapted for a microcomputer (Army Corps of Engineers, 1985) was used to calculate the peak flow and run-off hydrographs using the above rainfall depths. HEC-1 is a flood hydrograph package developed by the Army Corps of Engineers and used extensively in their applications. The SCS Dimensionless Unit Hydrograph option of the model was employed in this design. This model

TABLE 15.2 DRAINAGE BASIN PARAMETERS FOR THE NORTH BUTTE PROJECT AREA.

BASIN	AREA (acres)	AREA (sq mi)	H LENGTH (ft)	H HEIGHT (ft)	tc (hr)	tL (hr)	CHANNEL SLOPE	PEAK DISCHARGE 10YR, 6HR (cfs)	PEAK DISCHARGE 2YR, 6HR (cfs)
SC1a	694.57	1.085	15190	980	0.6195	0.3716	-	488	-
SC1b	792.56	1.238	11960	305	0.7367	0.4419	-	412	-
SC1a+b	-	-	-	-	-	-	-	887	-
SC1c	735.21	1.149	8520	241	0.5452	0.3270	-	454	-
SC1d	211.97	0.3312	6160	151	0.4487	0.2692	-	147	-
SC1a-d	2434.31	3.804	-	-	-	-	0.080	1375	-
SC2a	251.01	0.3922	9100	677	0.3952	0.2371	-	189	42
SC2b	86.96	0.1359	4160	117	0.3146	0.1887	-	73	16
SC2a+b	337.97	0.5281	-	-	-	-	0.029	256	57
SC3	233.48	0.3648	7490	646	0.3214	0.1928	0.024	197	-
SC4	118.14	0.1846	6760	916	0.2496	0.1497	0.027	100	-
SC5	175.83	0.2747	5940	941	0.2127	0.1276	0.025	159	-
SC6	128.37	0.2006	4540	776	0.1680	0.1008	0.038	120	-

NOTE: Curve Number = 76

produces a triangular precipitation distribution where the depth for the 5-minute duration occurs during the central part of the storm. The other rainfall increments are computed by the program using the 15-minute, 60- minute, 2-hour, 3-hour and 6-hour depths and arranged such that the second largest value precedes the largest or 5-minute value. The third largest value follows the largest value and the fourth largest value precedes the second largest value. This order continues until the entire 6-hour storm is distributed.

The maximum computation interval for the basins was calculated to be less than or approximately equal to 29 percent of the time of lag. This is the value recommended by the Army Corps of Engineers and is very similar to the 20 percent time of concentration recommended by Small Dams (1977, page 75). Computation intervals of 5.0 and 3.0 minutes were used in the analysis for basins SC1 and SC2, respectively. A computation interval of 2.0 minutes was used in all other basins.

The time of lag of a basin was calculated by the following two equations presented in Barfield et al (1981):

$$tc = (0.0078/60)(L^{0.77})(L/H)^{0.385}$$

where: tc = Time of concentration (hours),
L = Hydrologic length (feet),
H = Relief along hydrologic length (feet),
^ = Exponentiation.

$$tL = 0.6tc$$

where: tL = Time of lag (hours),
tc = Defined above.

Table 15.2 presents the parameters used in the analysis.

The curve number is a parameter developed by the Soil Conservation Service used to define the infiltration during a rainfall event. An average curve number 76, used to calculate abstraction for the 10-year storm, reflects average ground moisture prior to the rainfall event or an Antecedent Moisture Condition II (AMC II).

The peak discharges calculated for each basin are presented in Table 15.2. The peak discharge of the 10-year, 6-hour event of the SC1, SC2 and SC5 basins is 1375, 256 and 159 cfs, respectively. Possible ford crossing locations are calculated to have discharges from the 10-year, 6-hour flow of 197, 100 and 128 cfs for basins SC3, SC4 and SC6, respectively. It should be noted that the calculated discharges do not account for potential flood volume storage within the several stock ponds in the basin. For conservatism, the presence of the stock ponds is not incorporated in the analysis even though, under average conditions, a large amount of abstraction of the run-off would occur as a result of these stock ponds.

Ford crossings may be used for basins SC3, SC4 and SC5. These basins are not located on the mine access road to the plant site. Many stable ford crossings are present surrounding the North Butte Permit area. Examination of these existing crossings indicates that a ford will provide for a stable means of crossing the streams and that environmental damage does not occur from their use. The fords will be protected by means of sized rock laid in the crossing locations. Figures 15.24 through 15.26 present the cross sections of the preliminary ford crossings, the stage-discharge values and the discharge of the 10-year, 6-hour event. The Mannings equation was used to determine the average velocity in each channel cross section. A Mannings roughness coefficient of 0.03 was used for conservatism and to allow for the possibility of sediment infilling.

The rock size has been determined by assuming a specific gravity of 165 pounds/cubic feet and using the following modified Isbash equation [plate 29, Army Corps of Engineering (ACOE), EM 1110-2-1601, 1970].

CROSS SECTION NAME- SC3

slope= .02400 (ft/ft); roughness=.03000

DEPTH (ft.)	AREA (sq. ft.)	WETTED P (ft.)	RADIUS (ft.)	VELOCITY (ft./sec.)	Q (cfs)
.100	.22	5.36	.041	.916	.20
.200	.95	7.40	.128	1.958	1.86
.300	1.74	9.23	.189	2.530	4.40
.400	2.73	10.19	.268	3.198	8.73
.500	3.76	11.02	.341	3.757	14.13
.600	5.00	12.04	.415	4.283	21.41
.800	7.49	14.03	.534	5.064	37.93
1.000	10.50	16.20	.648	5.763	60.51
1.200	14.00	18.29	.765	6.438	90.14
1.400	17.66	20.08	.879	7.063	124.73
1.600	21.75	21.54	1.010	7.744	168.44
1.800	26.02	23.39	1.112	8.261	214.95

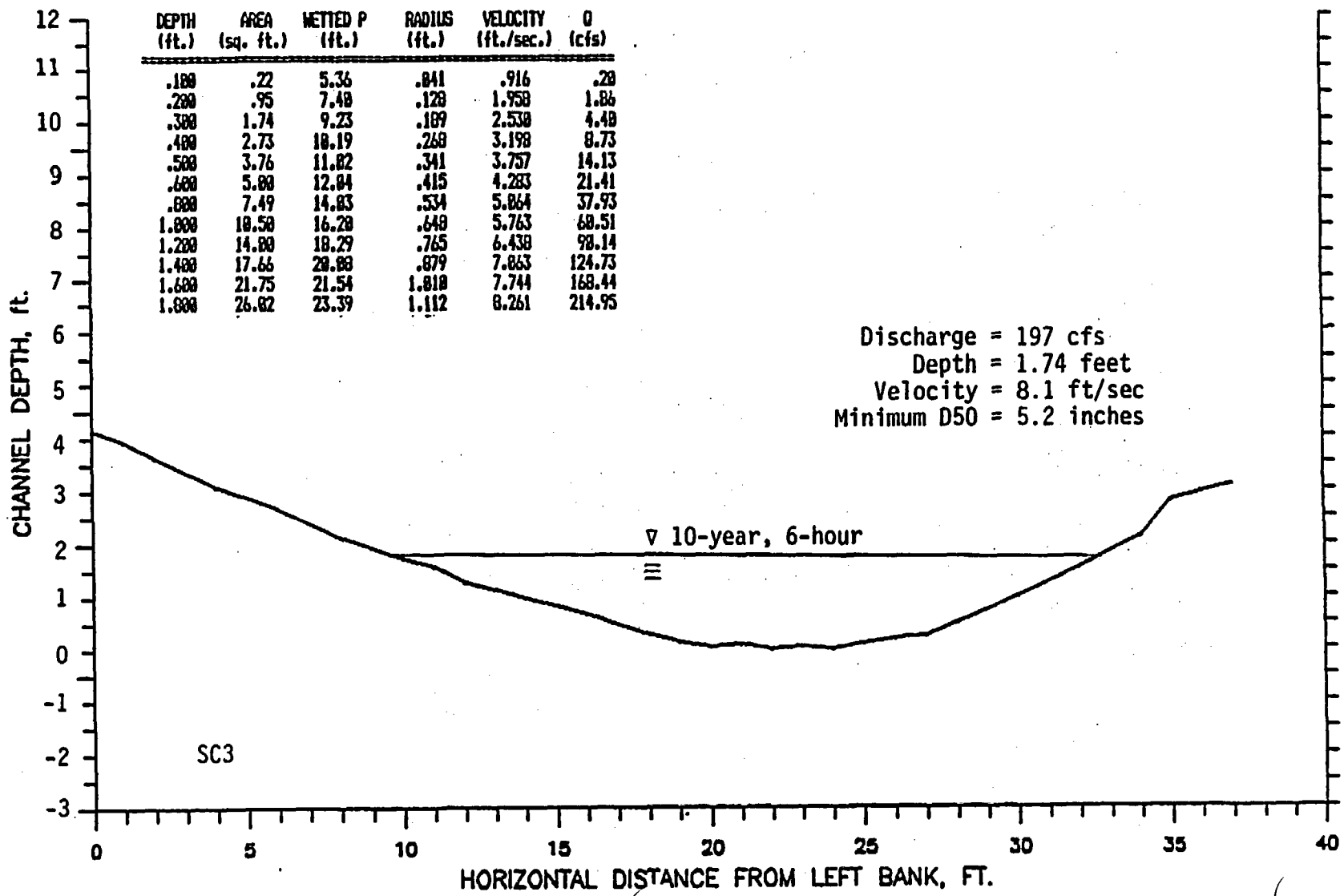


FIGURE 15.24 FORD CROSS SECTION SC3.

CROSS SECTION NAME- SC4

slope= .02700 (ft/ft); roughness=.03000

DEPTH (ft.)	AREA (sq. ft.)	WETTED P (ft.)	RADIUS (ft.)	VELOCITY (ft./sec.)	Q (cfs)
.100	.23	4.82	.048	1.074	.25
.200	1.12	13.24	.085	1.573	1.76
.300	3.34	35.28	.095	1.695	5.66
.400	7.41	37.94	.195	2.747	20.36
.500	10.33	40.55	.255	3.200	33.08
.600	14.98	43.16	.347	4.031	60.38
.800	24.47	48.35	.506	5.183	126.83

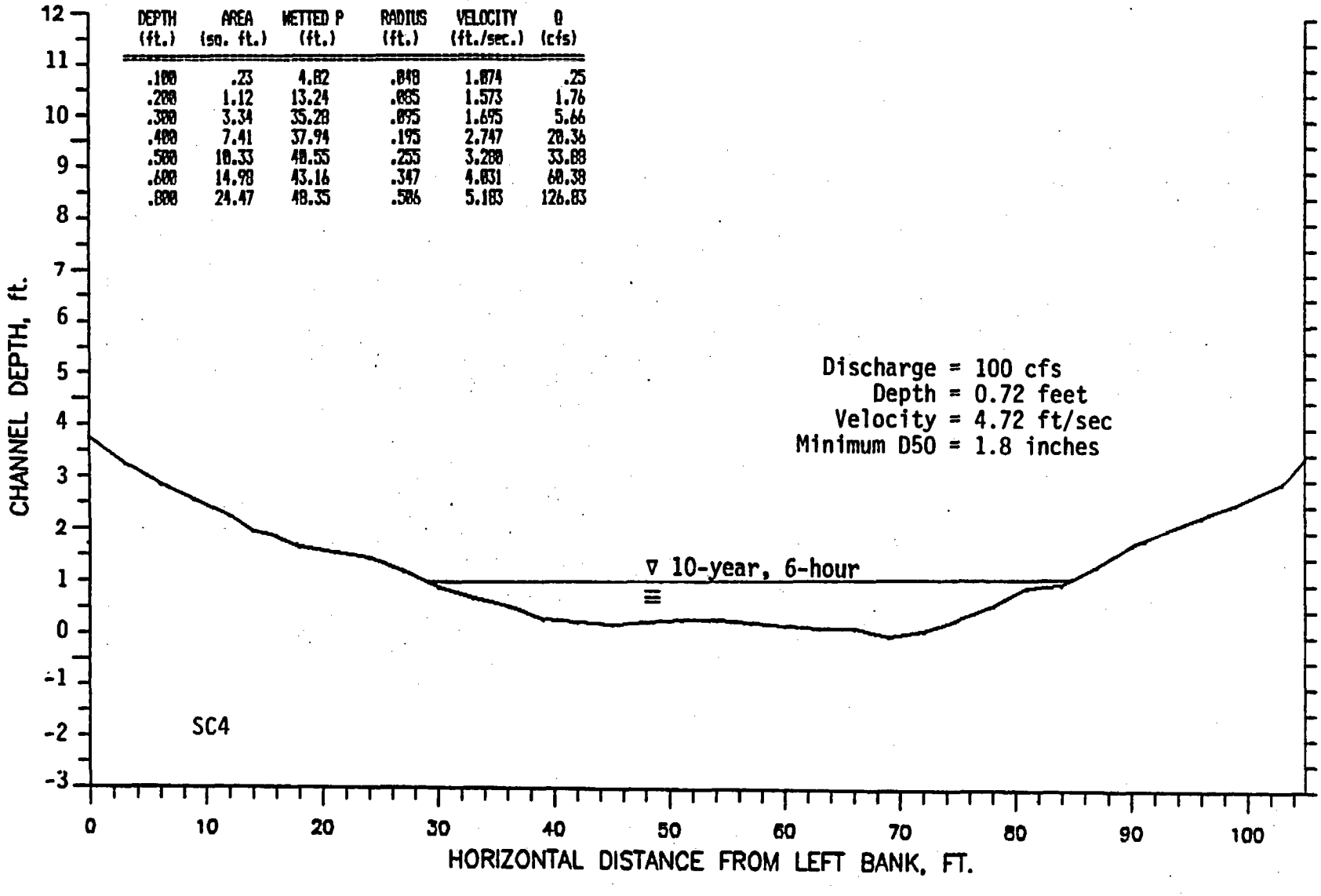


FIGURE 15.25 FORD CROSS SECTION SC4.

CROSS SECTION NAME- SC6

slope= .03800 (ft/ft); roughness=.03800

DEPTH (ft.)	AREA (sq. ft.)	WETTED P (ft.)	RADIUS (ft.)	VELOCITY (ft./sec.)	Q (cfs)
.100	.29	5.02	.058	1.447	.42
.200	1.15	11.37	.101	2.102	2.42
.300	1.98	13.96	.142	2.633	5.21
.400	4.09	18.53	.221	3.536	14.46
.500	6.73	34.93	.193	3.230	21.74
.600	10.53	38.92	.271	4.050	42.65
.800	21.39	59.40	.360	4.900	104.82
1.000	34.12	67.80	.503	6.126	209.00

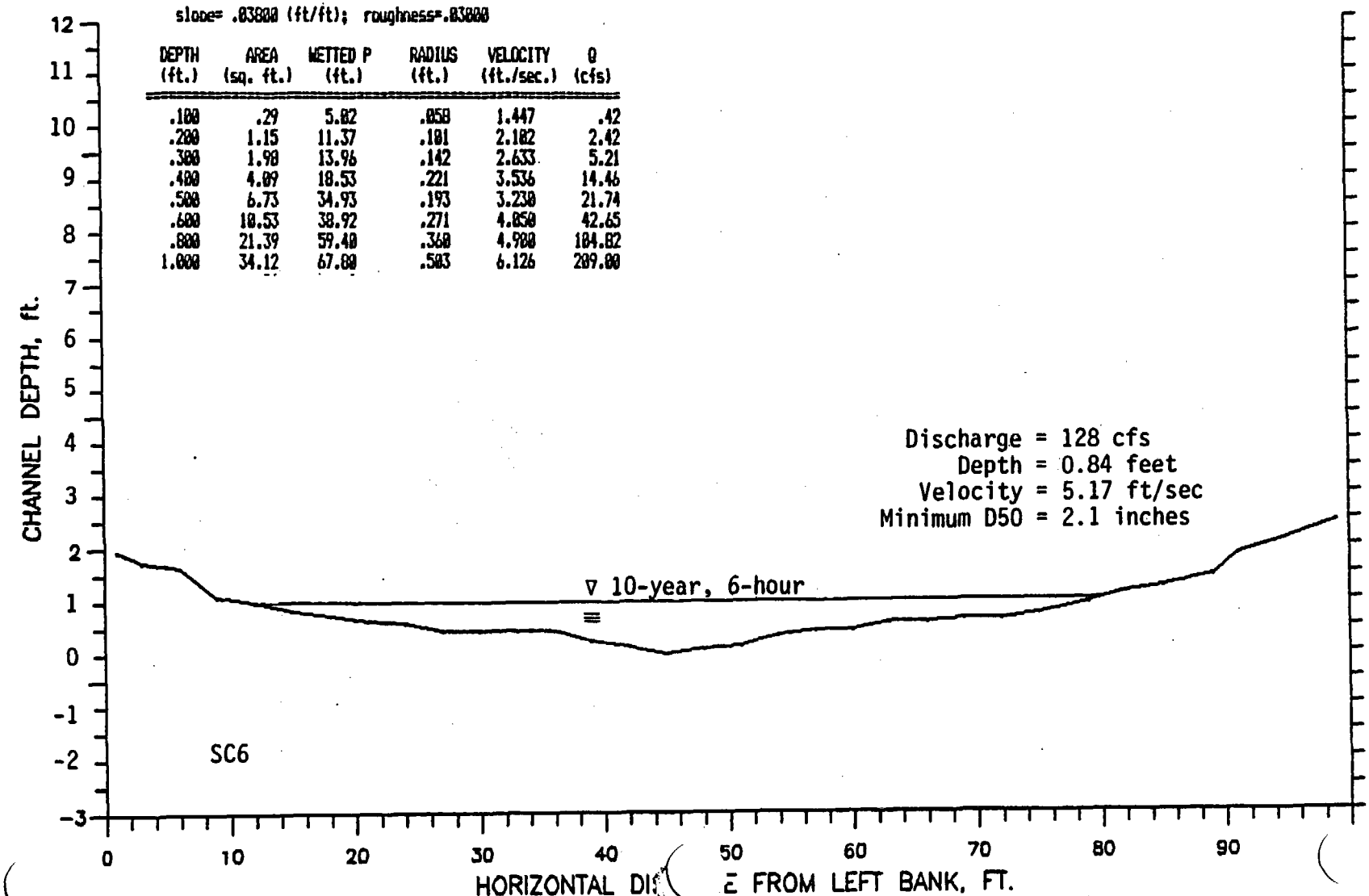


FIGURE 15.26 FORD CROSS SECTION SC6.

$W50 = 2.44 \times 1.0E\text{-}5\ V^6$

where W50 = Weight of lower limit of the 50 percent or lighter stone, in pounds,

V = Velocity, in ft/sec,

^ = Exponentiation.

The highest velocity of the flow of 8.3 ft/sec determined in the three ford crossings and two combined ford and culvert crossings was in crossing SC3 and this value will be used in the design of all ford crossings. The 50 percent by weight or finer gravel size that will protect the ford from this velocity of flow will be greater than or equal to 5.5 inches in diameter (Figure 15.24). The rock will be well graded and placed at least to a thickness of eight inches in the ford. The diameter of rock required for the other crossings are also presented in Figures 15.25 and 15.26.

Culverts are proposed to be placed in the two drainage crossing locations on the main access road to the facility. In addition, one existing culvert at SC5 may be utilized in place. Figure 10.9 (Volume II) presents culvert locations SC1, SC2 and SC5. In the location of SC2 and SC5, the diameter of the culverts needed to entirely pass the 10-year flow would require to great an amount of fill to provide a crossing. For this reason, it is not feasible to design culverts on the SC2 and SC5 locations to pass the design 10-year, 6-hour event. It is the purpose of these structures to provide a dry crossing for the majority of days during the seasons when flow occurs and yet to allow for out of bank natural flow conditions during high flow periods. A stream crossing of this design, therefore, should pass low flows completely, but allow for non-erosive flows adjacent to the culvert structure when a peak of a larger event occurs. The lower flow event that the culvert should pass is the flow from the 2-year, 6-hour rainfall event of 1.43 inches.

Presently, there is one 21-inch culvert in place at the proposed SC5 location. This culvert is placed approximately 4.0 feet below the roadbed. Examination of the site indicates that some flow does occur over the roadbed at times, although erosion from this flow is not significant. A discharge of 30 cfs corresponds to a 2-year event for SC5. The culvert that is presently at this location will flow at approximately

19 cfs when there is a headwater depth of 4.0 feet. This value was determined using the culvert discharge nomograph presented in AISI (1971) and reproduced in Figure 15.27. A type three entrance condition was assumed in this calculation. This small difference in discharge and culvert capacity does not warrant replacement of the culvert. Figure 15.28 presents the flow characteristics of the 2-year event. It is evident from this figure that a flow depth of 0.45 feet and velocity of 2.6 ft/sec would occur over the roadbed during this event. The discharge from the 10-year, 6-hour rainfall event will flow over the ford at a depth of 1.1 feet and a velocity of 4.7 ft/sec. The minimum D50 of the well graded rock for this ford must be at least 1.8 inches in diameter and placed to a depth of 8.0 inches.

The optimum culvert design at the SC2 location consists of the placement of one, 30-inch culvert to be placed on the channel bed with a slope of greater than or equal to 0.016 ft/ft. This culvert will be covered to a depth of two feet. Figure 15.29 presents the design of the culvert crossing.

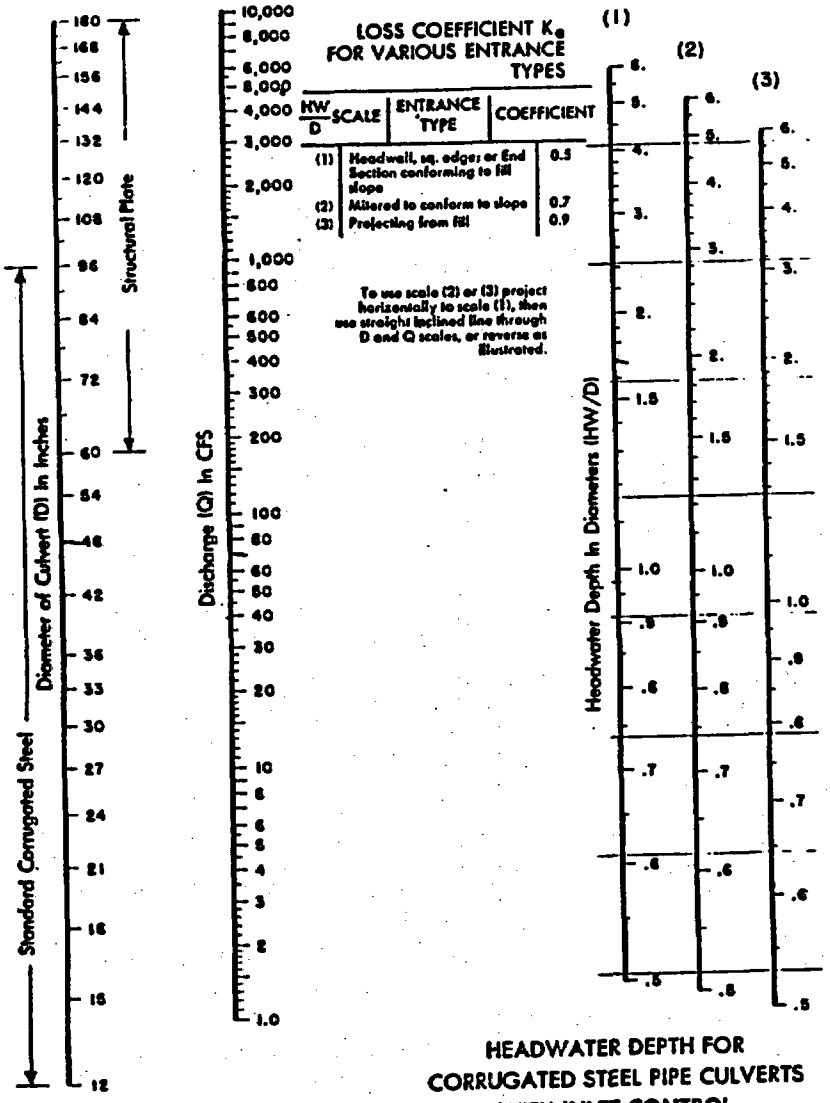
A 40 feet wide combination riprapped spillway and roadway adjacent to and placed at a level of the top of the culvert will allow for vehicle traffic. Therefore, during the rare higher magnitude flows, water will pass through the culvert and over the armored road on the floodplain adjacent to the culvert structure. The culvert design, at a minimum, must pass a discharge of 60 cfs from the 2-year, 6-hour rainfall event. The discharge of the culverts without a large headwater depth is computed using the Hazen-Williams equation. The Hazen-Williams equation for uniform flow is:

$$Q = 1.318\ ACR^{0.63}\ s^{0.54} (ft^3/sec, ft, sec)$$

where: Q = Flow rate,

C = Hazen-Williams Friction Coefficient (140 for galvanized conduit),

R = Hydraulic radius (the ratio of the pipe flow crosssectional area, A to the wetted perimeter of the flow cross section),



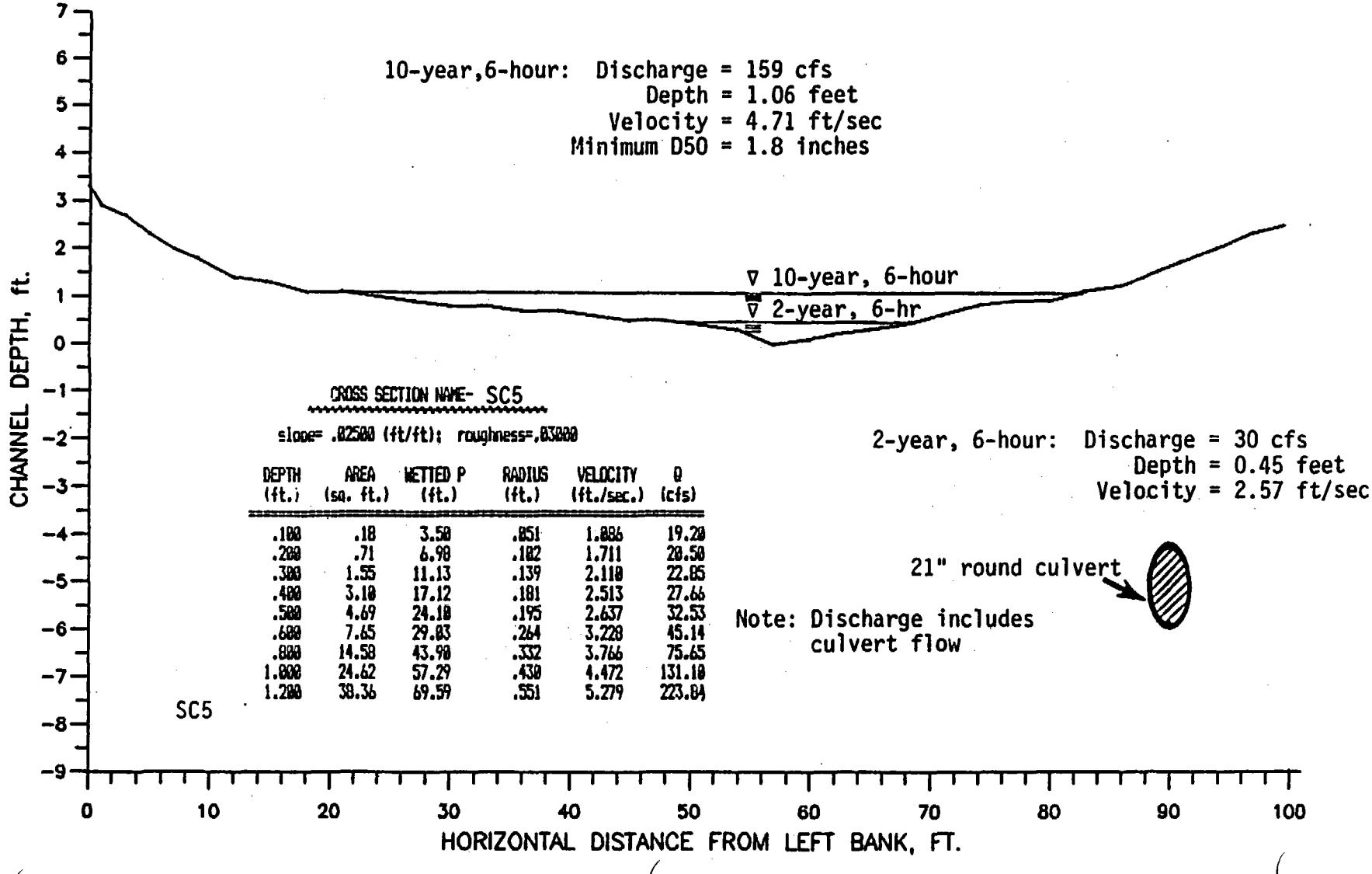
HEADWATER DEPTH FOR CORRUGATED STEEL PIPE CULVERTS WITH INLET CONTROL

Notes: From Handbook of Steel Drainage and Highway Construction Products, American Iron and Steel Institute (1971)

Entrance type 3 used for NB5.

Entrance type 2 used for NB1.

FIGURE 15.27 DISCHARGE OF INLET CONTROLLED CULVERTS.



CROSS SECTION NAME- SC5

slope= .02500 (ft/ft); roughness=.03000

DEPTH (ft.)	AREA (sq. ft.)	WETTED P (ft.)	RADIUS (ft.)	VELOCITY (ft./sec.)	Q (cfs)
.100	.18	3.50	.051	1.086	19.20
.200	.71	6.90	.102	1.711	20.50
.300	1.55	11.13	.139	2.110	22.85
.400	3.10	17.12	.181	2.513	27.66
.500	4.69	24.10	.195	2.637	32.53
.600	7.65	29.03	.264	3.220	45.14
.800	14.50	43.90	.332	3.766	75.65
1.000	24.62	57.29	.430	4.472	131.10
1.200	38.36	69.59	.551	5.279	223.04

FIGURE 15.28 FORD-CULVERT CROSS SECTION SC5.

SIMPLE CHANNEL:

BASIN- NB2 Storm- 10 Yrs.. 6 hr.

xxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxx

INPUT:

DISCHARGE	=	100.00 CFS
SLOPE	=	.02900 FT./FT.
MANNING'S ROUGHNESS COEFFICIENT	=	.03000
RIGHT SIDE SLOPE OF FIRST STAGE	=	8.00 :1
LEFT SIDE SLOPE OF FIRST STAGE	=	8.00 :1
BOTTOM WIDTH OF FIRST STAGE	=	40.00 FT.

OUTPUT:

=> AREA	=	30.14 FT.**2
=> WETTED PERIMETER	=	50.7 FT.
=> HYDRAULIC RADIUS	=	.594 FT.
=> TOP WIDTH OF FLOW	=	50.64 FT.
=> TOTAL DEPTH OF FLOW	=	.665 FT.
=> FROUDE NUMBER	=	1.361
=> AVERAGE VELOCITY	=	5.98 FT./SEC.

THE LOWER W50 (ISBASH)= 1.11 LBS., D50= .234 FT.

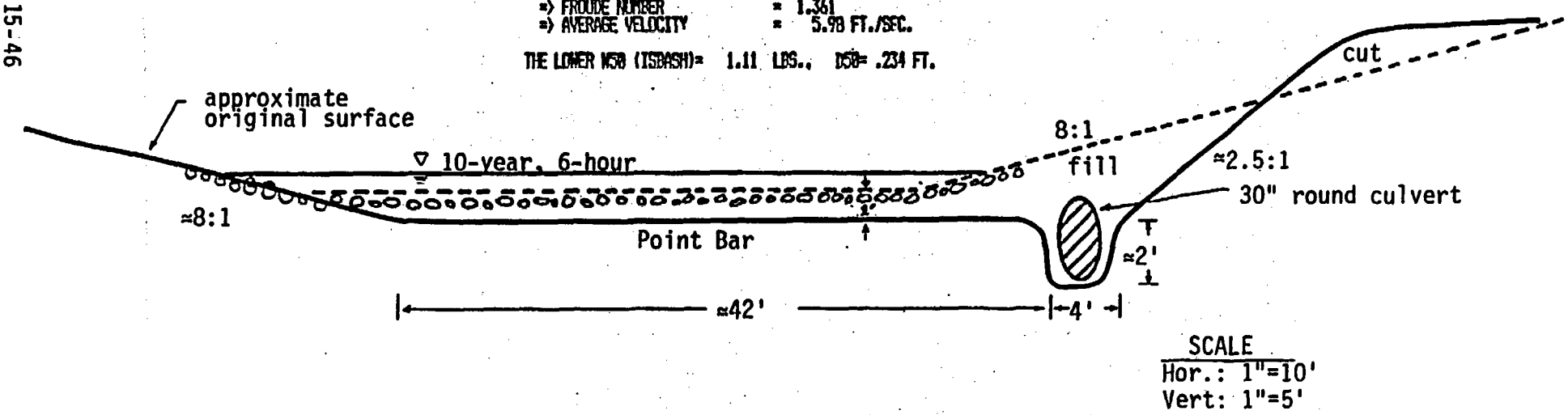


FIGURE 15.29 FORD CULVERT CROSSING SC2.

s = Energy grade line slope (which is equal to the channel bed slope for uniform flow),

^ = Exponentiation.

This equation applies in cases where the flow depth is less than or equal to 1.9 times the radius of the culvert. At the SC2 crossing location, the valley slope is 0.029ft/ft. Using a conservative sinuosity of 1.8, the channel slope computes to be 0.016 ft/ft. Using the maximum flow depth calculated by this equation, or 28.2 inches, a discharge of 77 cfs is calculated. Therefore, one 30-inch culvert is adequate to convey the design 2-year, 6-hour flow event at this location. Figure 15.29 presents the flow of the 10-year, 6-hour event over the spill zone. The discharge of this event is 256 cfs minus 77 cfs which will flow through the culvert. Therefore, a peak discharge of approximately 180 cfs will flow over the spillway during the 10-year event. Using a valley slope of 0.029, a conservative roughness of 0.03 and the 40 feet wide spillway with 8:1 sideslopes yields an average velocity of 6.0 ft/sec. The modified Isbash equation indicates that the diameter of the 50 percent or finer rock should be greater than or equal to 2.8 inches.

Location SC1 [see Figure 10.9 (Volume II)] is the third and largest culvert crossing possible at the site. Figure 15.30 presents a cross section of this crossing. This location requires at least 15 feet of fill in the drainage to make vehicle traffic feasible due to the incised nature of this channel. The depth of fill allows for a significant amount of temporary storage volume during a run-off event. This storage, therefore, facilitates using a smaller culvert to pass the run-off from the 10-year, 6-hour event. To model this feature, values of volume of storage versus stage were input into the reservoir option of the HEC-1 model. In addition, discharges through a culvert for various stages of headwaters were also input into the model. The HEC-1 program was then used to model the inflow hydrograph, the change in storage over time and the outflow hydrograph at this location. The stage during the peak of the storage behind crossing SC1 was limited to prevent spillage by changing the culvert diameter. It was found that a 5.0-foot diameter culvert was sufficient to prevent this spillage. Figure 15.31 presents the HEC-1 inputs and the HEC-1 results. The discharges through the culvert for a given headwater depth were determined using

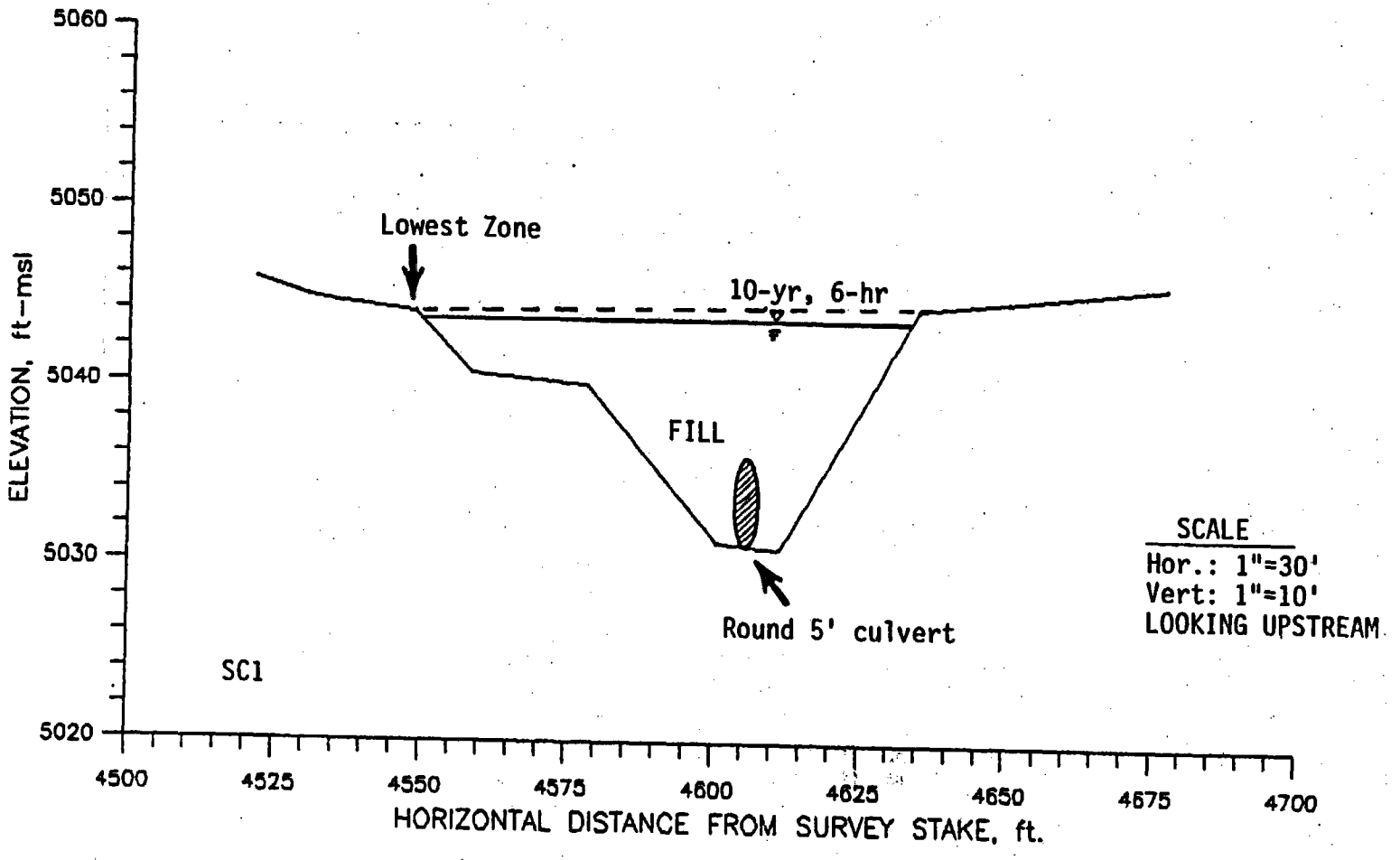


FIGURE 15.30 CULVERT CROSSING SC1.

MODEL INPUTS

Storage (acre ft)	.0	8.0	30.9	70.7						
Elevation (ft-msl - 5100)	30.00	35.00	40.00	45.00						
Culvert Discharge (cfs)	0. 330.	40.	55.	90.	125.	170.	205.	260.	295.	300.
Elevation (ft.- msl - 5100)	30.00 47.00	32.50	33.00	34.00	35.00	37.00	39.00	42.00	44.00	45.00

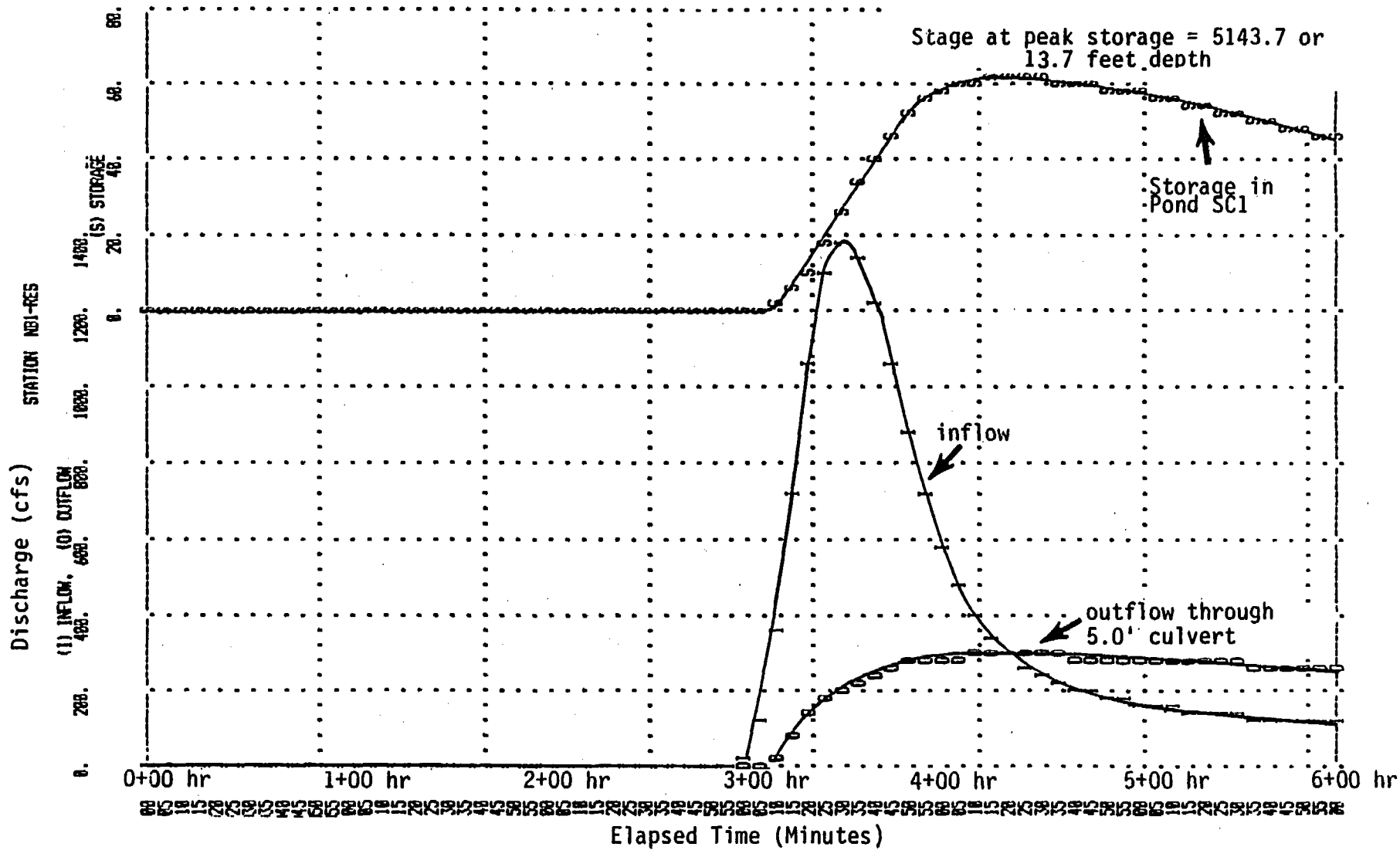


FIGURE 15.31 INFLOW AND OUTFLOW HYDROGRAPHS OF 10-YEAR, 6-HOUR DISCHARGE AT SC1.

the nomograph reproduced in Figure 15.27. Two factors indicate that this is a conservative design. First, the calculated 10-year, 6-hour discharge from the basin is greater than what would actually be expected due to the presence of several large stock ponds in the area. Secondly, the discharge through a culvert computed by this method is for culverts that are placed at slopes of less than 0.002. The culvert slope at this crossing will be that of the channel or a slope of approximately 0.008. Comparison with the Hazen-Williams equation which includes the slope variable indicates that the discharge through the culvert will be greater than that predicted in this analysis. It should be noted on Figure 15.30, that the low point on the fill will be over to one side, in order that flows exceeding the 10-year event will spill in an area which overlies natural ground and, therefore, the structure will not be jeopardized.

15.10 WELL FIELD ACCESS ROAD CONSTRUCTION

A series of roads will be constructed along the well field in order to provide access for drill rigs, pump pulling units, maintenance vehicles, etc. These well field roads will be designed and constructed in such a manner so as to minimize the amount of land disturbance and keep reclamation costs as low as practicable.

Additionally, the road design is intended to provide year around access to the well field in both dry and wet seasons. Possible locations of the well field access roads are shown in Figure 9.2 (Volume II) Power Resources Inc. will utilize a combination of water bars, ditch cut-outs and riprap to prevent excessive erosion on those portions of the road that have a steep grade.

Construction of the well field access roads consists of blading the top six to eight inches of soil to each side and constructing a drain on each side with the "A" horizon topsoil windrowed to the outside of each drain. After the drain is constructed the topsoil will be placed in the bottom of the drain and seeded. A listing of topsoil volume, depths and soil types is presented in Table 15.2a. The road width will be approximately 12 feet. A layer of about three inches of gravel, conglomerate or scoria material will be placed on top of the bladed surface to provide an all weather base. Figure 15.32 is a typical cross section of the well field access roads. This method of

TABLE 15.2a

North Butte Project
Soils Crossed by Well field
Access Roads

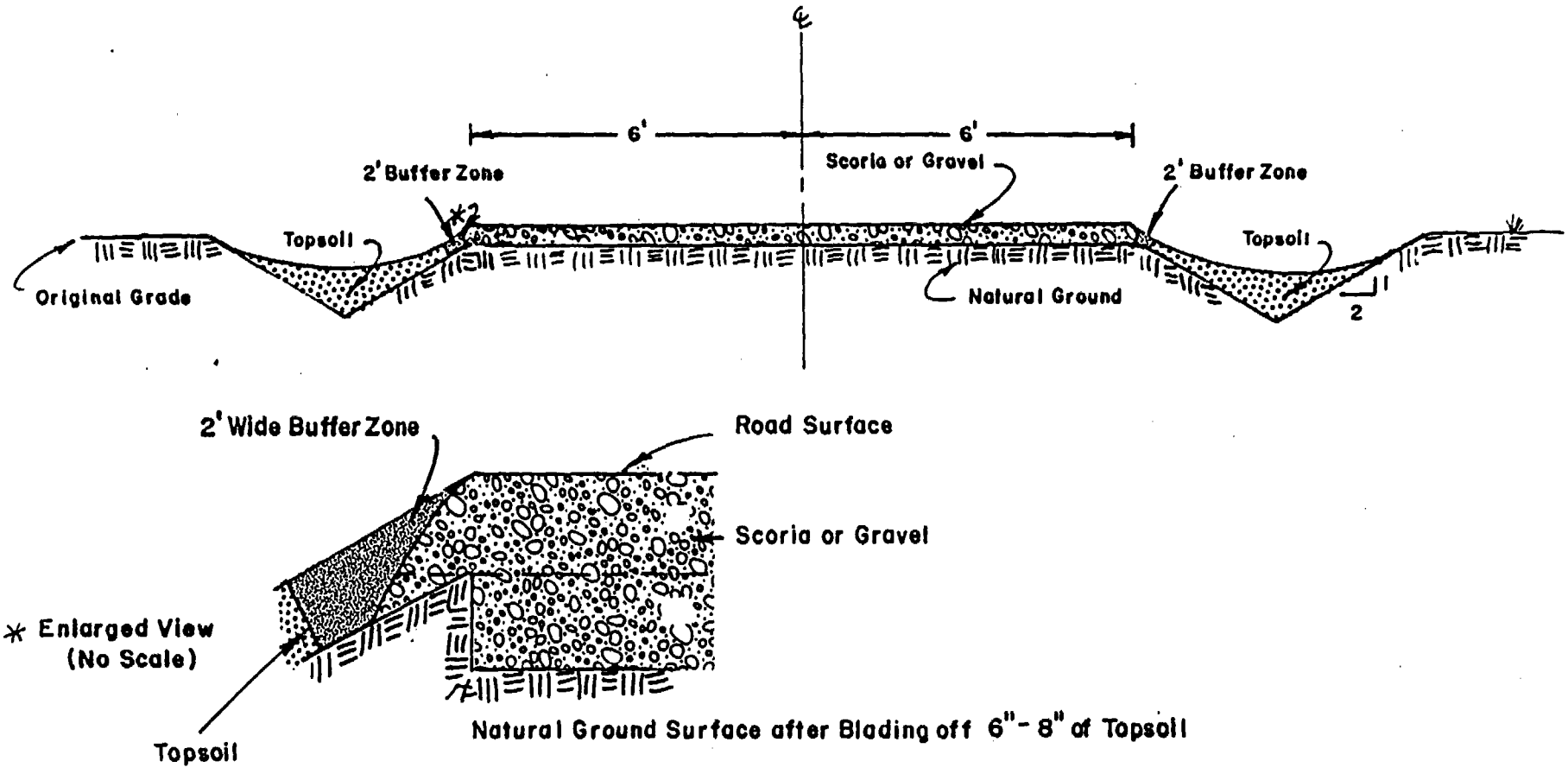
Map Symbol	Soil Type	Soil Horizons and Depths(in.)				
		E	A	A1	AB	AC
50/AB	Bidman	0-3				
BO	Bowbac		0-3		3-6	
75/BC	Cushman		0-3		3-6	
b45/AB	Forkwood		0-4		4-6	
1A	Haverdad			0-4		4-12
a62/AB	Hiland 1		0-7			
a62/C	Hiland fsl				0-2	
KI/AB	Kishona		0-3			
PA	Parmleed		0-4			
SH	Shingle		0-3			
SH-G	Shingle-gullied		0-3			
347/D	Shingle-Rock Outcrop-Samday		0-3			
TA	Taluce		0-3			
TE	Terro		0-3			
TH	Theedle			0-4		
354/AB	Ulm-Bidman association		0-3			

TABLE 15.2a(continued)

North Butte Project
Well Field Access Roads
Topsoil Volumes

Soil Type	Feet of Roadway	Acres	Volumes (cu.yd.) A Horizons
Bidman	1,850	1.36	1,470.1
Bowbac	3,600	2.64	2,853.7
Cushman	3,765	2.76	2,983.4
Forkwood	4,490	3.30	3,567.1
Haverdad	275	0.20	216.2
Hiland l	1,325	0.97	1,048.5
Hiland fsl	450	0.33	356.7
Kishona	200	0.15	162.1
Parmleed	940	0.69	745.8
Shingle	980	0.72	778.3
Shingle gullied	940	0.69	745.8
Association	5,420		
Shingle 50%		1.99	2,151.1
Rock Outcrop 30%		1.19	0.0
Samday 20%		0.80	864.7
Taluce	1,000	0.73	789.1
Terro	510	0.37	399.9
Theedle	590	0.43	464.8
Association	770		
Ulm 60%		0.34	367.5
Bidman 40%		0.23	248.6
	TOTALS	19.89	20,213.4

NOTE: Width of road disturbance is calculated at 32 ft. (12 ft. surface with 10 feet for ditching on either side).



Note: Blade 6" to 8" of Topsoil to sides with slight Crown in middle. Blade Drainage Ditch on each side then line Drainage Ditch with Topsoil. Fill Roadbed with (3") of Gravel or Scoria.

Revised: 5-10-90
Revised: 1-29-90

POWER RESOURCES, INC.	
NORTH BUTTE ISL PROJECT	
WELLFIELD ACCESS ROAD TYPICAL CROSS-SECTION	
GEOL:	SCALE: Non[illegible] FIGURE: 15.32
DRAWN BY: R.H.	DATE: 1-18-90

construction will keep the driving surface higher than the adjacent land providing for good drainage and preventing bogs from forming during the wet season. A two feet buffer will exist on each side of the road where topsoil will not be placed. As reflected in the land owner consent form, the rancher fully supports this method of construction of wellfield access roads at the North Butte ISL project. At the conclusion of all mining and restoration operations in a mining unit, the wellfield access roads will be reclaimed as described in Section 17.2.

Within the wellfields the wells will be installed in rows with the feeder pipelines running along the rows. Access to the wells will be provided by establishing a two track service road down every other row and connecting to the wellfield access road. Pathfinder will install minor culvert crossings, where necessary, to allow access from the wellfield access road into the wellfield.

During the life of the mine it will be necessary for the wellfield access roads to cross drainage channels at four locations within the permit area. These locations are shown on Figure 9.2 (Volume II). The crossings will consist of three gravel bottomed fords and one culvert/ford crossing placed where the flood plain geometry is suitable for fords (see Section 15.9.1).

15.11 EVAPORATION PONDS

Pathfinder plans to utilize a combination of deep well injection, evaporation ponds and surface discharge (under the NPDES system during restoration) to dispose of wastewater effluents that will be generated from the North Butte ISL process. Two evaporation ponds will be constructed for the temporary storage of process wastewater that will be injected into the deep disposal well. During normal operations, one of the evaporation ponds will receive relatively low-TDS water from the wellfield bleed stream. The wellfield bleed stored in this pond will be used for backwashing the process sand filters in the plant and will be disposed of in the deep injection well as needed. During restoration, the pond will receive the wellfield bleed stream from groundwater sweep. This water will be treated for radium removal and surface discharged under a state NPDES permit or disposed of via the deep injection well. The second evaporation pond will receive higher-TDS waters from the plant processes such as spent eluant, plant washdowns and brine from the reverse osmosis unit. This water will also be temporarily stored in the pond as necessary prior to disposal in the deep well.

The two evaporation ponds designed for the North Butte project are not intended for use as a primary disposal system, i.e. sized for active evaporation of all waste streams, although their evaporation rate at maximum operating level is 5 GPM on an annual basis. Rather, the ponds are actually holding ponds, sized to store a 40 GPM bleed stream for a 30-day time period to allow for maintenance or repair of the deep disposal well. The target operating parameter of the deep injection well is 150 GPM maximum, at 2,000 psi surface injection pressure; two deep wells are permitted for the North Butte ISL project, each with a 150 GPM capacity. Pathfinder plans to install only one deep well initially, and operate it at a rate less than the maximum 150 GPM. One well should be more than sufficient to accommodate the maximum wastewater production of 40 GPM during operations, plus the additional brine from aquifer restoration activities. Power Resources, Inc., operator of the Highland Uranium Project located 40 miles southeast of the North Butte site, has been successfully injecting wastewater into the same deep formations as Pathfinder plans for the past three years at a constant rate of 110 GPM.

The evaporation ponds will be located to the south of the process plant site, in the NW¼ SE¼ of Section 24, T.44 N., R.76 W. (see Figure 15.1, Volume II). Pathfinder has conducted extensive geotechnical studies for the evaporation pond site, and has found the site to be very suitable for pond construction. The detailed engineering for the ponds, as well as geotechnical studies, were provided to Pathfinder by Western Water Consultants, Inc. of Sheridan, Wyoming. The engineering design details for the two evaporation ponds (Ponds 1 and 2), complete with on-site geotechnical analyses, are provided in Section 15.11.1 of this document. A summary of the pond designs is provided in the following paragraphs.

In summary, Pathfinder will construct two evaporation ponds, each lined with synthetic membrane liners underlain by leak detection systems. Two lining systems have been evaluated by Pathfinder, a single synthetic liner system and a double synthetic liner system. Each system provides equivalent levels of environmental protection, and each is designed to meet the requirements of the NRC Regulatory Guideline 3.11 with regard to the use of synthetic and natural materials for ponds at uranium recovery facilities. The final selection of the lining system will be based on construction bid prices. The two liner system versus the single may be more cost effective if the sand for the single liner pond is too expensive due to availability and transportation charges. A summary of the construction details of each type of pond is provided as follows:

Single Synthetic Liner Evaporation Pond - The primary liner will consist of 36 mil, reinforced Hypalon (TM) which will be placed over a leak detection system which consists of the transport media (sand or gravel) and a collection system of 3-inch diameter slotted PVC pipes which drain to sumps. The collection pipes are placed in compacted, gravel-filled trenches at the perimeters of the pond bottoms; the bases of the ponds will be graded to slope toward the sides to facilitate the drainage of any leakage to the nearest collection pipe. The collection pipes will be sloped in approximately 70-foot long sections on each side of the ponds to drain to six sumps which will serve as collection points for the leak detection system. Taps consisting of 4-inch PVC pipe will be installed at each sump to allow inspection and sampling. The operational characteristics for the single synthetic lined pond are:

Dimensions:	Trapezoidal, 3H:1V side slopes 475 ft. long x 107 ft. wide at the maximum depth
Normal Operating Level:	5.0 ft., combined capacity (two ponds) of 2,111,370 gallons
Maximum Operating Level:	8.5 ft., combined capacity of 4,287,907 gallons
Overtopping Water Level:	9.5 ft., combined capacity of 4,691,934 gallons

(Note: the above water levels allow for the contents of either pond, when operating at or below the normal operating level, to be transferred into the other pond while still maintaining 1.0 foot of freeboard below the overtopping level. The maximum operating level is used only when a leak occurs, or if one pond is full and the other pond is empty.)

Pathfinder prefers the single synthetic liner pond system as it is the standard design used at other ISL facilities and has a proven track record with respect to operations and environmental protection. The double synthetic liner system will be considered if construction costs for the single liner system are prohibitive.

Double Synthetic Liner Evaporation Pond - Two synthetic liners are used to surround a highly permeable medium-density polyethylene netting (geonet) as the leak detection system. The top liner is 36 mil, reinforced Hypalon (TM) and serves as the primary liner. The geonet and bottom liner (secondary liner) serves as the leak detection system. The geonet will function in much the same manner as the sand in the single liner option, to convey any leakage between the two liners to the leak detection piping, which will consist of 3-inch diameter slotted PVC pipe placed in gravel-filled trenches along the sides of the pond bottoms. The floors of the ponds are also graded to slope toward the sides to facilitate

the drainage of any leakage to the nearest collection pipe. The collection system for the double liner pond is identical to the single liner pond with six collection sumps with 4-inch diameter PVC taps installed at each of the sumps to allow inspection and sampling. Operational characteristics for the double liner ponds are:

Dimensions:	Trapezoidal, 2H:1V side slopes 467 ft. long, 92 ft. wide at the maximum depth
Normal Operating Level:	5.4 ft., combined capacity (two ponds) of 2,143,953 gallons
Maximum Operating Level:	9.5 ft., combined capacity of 4,372,622 gallons
Overtopping Water Level:	10.5 ft., combined capacity of 4,993,213 gallons

(Note: The above water levels allow for the contents of either pond, when operating at or below the normal operating level, to be transferred into the other pond while still maintaining 1.0 foot of freeboard below the overtopping level.)

The operational monitoring plan and reclamation plan for the evaporation ponds are covered in Sections 16.9 and 17.2.3, respectively.

15.11.1 DETAILED POND DESIGN AND GEOTECHNICAL ANALYSES

(Western Water Consultants, Inc. report entitled "Engineering Design Report for Evaporation Ponds 1 and 2 at the Pathfinder Mines Corporation North Butte ISL Project", January, 1992.)

ENGINEERING DESIGN REPORT FOR EVAPORATION PONDS 1 AND 2 AT THE PATHFINDER MINES CORPORATION NORTH BUTTE ISL PROJECT

January 2, 1992

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ENGINEERING DESIGN REPORT FOR EVAPORATION PONDS 1 AND 2 AT THE PATHFINDER MINES CORPORATION NORTH BUTTE ISL PROJECT

1.0 INTRODUCTION

This report presents design information for two evaporation ponds to be constructed at the Pathfinder Mines Corporation North Butte in-situ leaching uranium mine located in southwestern Campbell County, Wyoming. Engineering design information presented in the report is intended to support an application for a minor revision to Mine Permit No. 632 that is to be submitted to the Wyoming Department of Environmental Quality (WDEQ). The design information presented herein will be submitted to the Wyoming State Engineer's Office (SEO) and the United States Nuclear Regulatory Commission (NRC). The design of these facilities was developed in full consideration of the criteria and requirements of the NRC as well as the WDEQ and SEO. This report was prepared by staff engineers and geologists of Western Water Consultants, Inc. (WWC) of Sheridan, Wyoming under the direct supervision of Doyl M. Fritz, Wyoming Professional Engineer No. 1467. Soil testing and laboratory analyses were performed by Chen-Northern, Inc. of Casper, Wyoming under subcontract to WWC.

2.0 QUANTITY AND CHARACTERISTICS OF WASTEWATER

Pathfinder Mines Corporation plans to use a combination of deep well injection, evaporation ponds, and surface discharge (under the National Pollutant Discharge Elimination System) to dispose of wastewater effluents that will be generated from the North Butte uranium solution mining process. The two evaporation ponds described in this report will be utilized for temporary storage of process wastewater that will be injected into the deep disposal well, used for sand filter backwashing, or treated for radium removal prior to surface discharge (during aquifer restoration).

During normal operations, one of the evaporation ponds will receive relatively low-TDS water from the wellfield bleed stream. The wellfield bleed stored in this pond will be used for backwashing the process sand filters in the plant and will be disposed of in the deep injection well as needed. During restoration, the pond will receive the wellfield bleed stream from ground-water sweep. This water will be treated for radium removal and surface-discharged under a state discharge permit or disposed of via the deep injection well. The second evaporation pond will receive higher-TDS waters from the plant processes such as spent eluant, plant washdowns, and brine from the reverse osmosis units. This water will be temporarily stored in the pond as necessary prior to disposal in the deep well.

It is not possible to precisely predict for either pond just how much water from any given source will be in the pond at any given time. The ponds are both sized with adequate freeboard to pump the entire contents of one into the other in the event that one of the ponds develops a leak. The water in either pond could be a mixture of all the process and waste streams described above. Anticipated water quality concentration ranges for the waters stored in the ponds are as follows (all concentrations are in milligrams per liter unless otherwise noted):

bicarbonate	500 to 2,000
chloride	2,000 to 50,000
sulfate	450 to 2,000
sodium	800 to 7,500
TDS	3,000 to 75,000
pH	5.0 to 9.0
uranium	<0.1 to 15.0
radium - 226	<1.0 to 2,000 picocuries per liter

Both evaporation ponds will be lined with synthetic membrane liners underlain by leak detection systems. Liner details as well as operational monitoring of the leak detection system are described in later sections of this report.

3.0 POND DESIGN

3.1 Location and Capacity of Ponds

The proposed evaporation ponds are located in the NW¼SE¼ of Section 24, T.44 N., R.76 W. of the Sixth Principal Meridian, Campbell County, Wyoming. The location of the ponds is shown on Sheet 1 of 5 of the plans accompanying this report. The ponds will be located south of the extraction plant and approximately 3,000 feet from the channel of Willow Creek, an ephemeral tributary of the Powder River. The proposed pond site is on a bench between two minor unnamed tributaries of Willow Creek. The elevation of the bottom of the ponds is approximately 5,061 feet above mean sea level (msl). The elevation of the ground-water table is approximately 4,888 feet msl, or about 173 feet below the pond bottoms. This information is based on water level measurements from a field well (UW-53781) located approximately 500 feet to the north of the proposed construction site.

During the design of the evaporation ponds, two lining systems were investigated, termed Option A (single synthetic liner system) and Option B (double synthetic liner system). Option A will function hydraulically as a double liner system since the materials used to construct the compacted earthen bottom exhibit very small permeabilities (see Section 4.0). The two options will provide equivalent levels of environmental protection, and final selection will be based on contract bid prices. Detailed plan views and cross sections of the two options are included on Sheets 2 and 4 of 5, respectively, of the accompanying plans. The evaporation pond descriptions are as follows:

- Option A: The pond cross sections are trapezoidal, with 3H:1V side slopes. The pond bottoms are 418 feet long by 50 feet wide, and the pond dimensions at the maximum depth of 9.5 feet are 475 feet long by 107 feet wide. Three water levels were considered during the pond design: (1) normal operating level (NWL), (2) maximum operating level (HWL), and (3) overtopping water level. The NWL of the ponds corresponds to a depth of 5.0 feet and a combined capacity for both ponds of 6.48 acre-feet (2,111,370 gallons). The HWL is at a depth of 8.5 feet, at which the combined capacity is 13.16 acre feet (4,287,907 gallons). At the overtopping water level of 9.5 feet, the ponds have a combined capacity of 14.40 acre-feet (4,691,934 gallons). The proposed water levels allow for the contents of either pond, when operating

at or below the NWL, to be transferred into the other pond while still maintaining 1.0 foot of freeboard below the overtopping level. The capacity between the NWL and the HWL is termed auxiliary capacity (see Sheet 1 of 5 of the accompanying plans).

- Option B: The pond cross sections are trapezoidal, with 2H:1V side slopes. The pond bottoms are 425 feet long by 50 feet wide, and the pond dimension at the maximum depth of 10.5 feet are 467 feet long by 92 feet wide. The NWL of the ponds corresponds to a depth of 5.4 feet and a combined capacity for both ponds of 6.58 acre feet (2,143,953 gallons). The HWL is at a depth of 9.5 feet, at which the combined capacity is 13.42 acre feet (4,372,622 gallons). At the overtopping water level of 10.5 feet, the ponds have a combined capacity of 15.34 acre-feet (4,993,213 gallons). The proposed water levels again allow for the contents from either pond, when operating at or below the NWL, to be transferred into the other pond while still maintaining 1.0 foot of freeboard below the overtopping level.

3.2 Pond Liners and Leak Detection Systems

The evaporation ponds for both options presented above are designed to meet the requirements of the NRC with regard to the use of synthetic and natural materials for liners and leak detection systems in evaporation ponds at uranium recovery facilities. The liners for the two options will be installed in accordance with manufacturer's specifications utilizing the anchoring methods shown on the accompanying plans. The evaporation ponds will be equipped with leak detection systems as follows:

- Option A: The leak detection system for the single liner option consists of three parts - the primary Hypalon$_{TM}$ liner, the transport media (fine sand or gravel), and the piping system. The sand will drain to collection pipes, which will in turn drain to sumps. The collection pipes will be 3-inch diameter slotted PVC pipes in gravel-filled trenches (see Sheet 3 of 5 of the accompanying plans) at the perimeters of the ponds. The bases of the ponds will be graded to slope toward the sides to facilitate the drainage of any leakage to the nearest collection pipe. The collection pipes will be sloped in approximately 70-foot long sections on each side of the ponds to drain to six sumps which will serve as collection points for the leak detection system. Taps consisting of 4-inch diameter PVC pipe will be installed at each sump to allow inspection and sampling of the sumps.

  The use of sand beneath the Hypalon$_{TM}$ liners in Option A should reduce the need for constructing air vents beneath the liner since gases produced under the liner would be vented through the sand.

- **Option B:** The designs of the evaporation pond liner and leak detection system for the double liner option are shown on Sheet 5 of 5 of the accompanying plans. This option consists of two impermeable synthetic liners surrounding a highly permeable medium-density polyethylene netting (geonet). The top liner (primary membrane) will be Hypalon$_{TM}$ as in Option A and will provide an impermeable containment barrier. The bottom liner (secondary liner) is high density polyethylene (HDPE) and will serve as a backup containment system for the primary liner. The geonet will function in much the same manner as the sand in Option A to convey any leakage between the two liners to the leak detection piping, which will consist of 3-inch diameter slotted PVC pipe placed in gravel-filled trenches along the sides of the pond bottoms. The floors of the ponds will be graded to slope toward the sides to facilitate the drainage of any leakage to the nearest collection pipe. The collection pipes located on both sides of the ponds will be sloped to drain to six sumps consisting of 6-inch PVC pipe tees. The sumps will serve as collection points for the leak detection system. Taps consisting of 4-inch diameter PVC will be installed at each of the sumps to allow inspection and sampling of the sumps.

  To vent any gases which may form under the liner system, the pond bottoms will be constructed with a longitudinal slope from the midpoint upwards to the ends and a gravel-filled trench will be constructed along the longitudinal centerlines of the ponds. Any gas pressure under the ponds will force gases along this relief trench to the ends of the ponds, where it will be vented (see Sheet 5 of 5 of the plans accompanying this report).

3.3 Suitability of Lining Materials for North Butte Project Waste Waters

The use of a Hypalon$_{TM}$ or primary geomembrane will provide a puncture and tear resistant inner liner for the ponds. Hypalon$_{TM}$ is highly resistant to photo and chemical degradation. This material has been used extensively in this type of application and its performance in the containment of waste waters similar to those expected to occur at the North Butte project is well documented.

The geonet and the secondary liner in Option B exhibit the same resistance to degradation as the primary liner system. The physical properties for each of the components for the lining systems are included in Appendix A.

4.0 GEOTECHNICAL STUDIES

4.1 Site Investigation

A geotechnical site investigation was conducted to test foundation conditions and borrow materials for the construction of the evaporation pond. The site investigation included geotechnical drilling and soil sampling. Laboratory analyses were performed on collected soil samples for use in the engineering evaluation of slope stability described in Section 4.3 of this report.

The field investigation was conducted on November 21, 22, and 23, 1991 and included four test borings, HP-1 through HP-4, at the site of the proposed evaporation ponds. The locations of these test borings are shown on Sheet 1 of 5 of the plans. Borings HP-1 and HP-2 were completed at the northern ends of the ponds, the area from which borrow material will be excavated for use in constructing embankments around the southern ends of the ponds. All borings at the pond site were completed to a total depth approximately 20 feet below the proposed pond bottom elevations. During drilling, penetration tests were performed at frequent intervals, and the penetration effort (blows per foot) along with the classification of California tube samples were logged in the field. Field samples were obtained from drill cuttings at specified intervals and were bagged and labeled for laboratory testing. Soil boring logs for test holes HP-1 through HP-4 are presented in Appendix B of this report.

The soils encountered in the drill holes were found to be generally similar, with moderate stratigraphic variations in texture. The subsurface soils in the project area can be described as consisting of light brown, stiff to very stiff sandy or silty clay of low to medium plasticity. Variations in texture are attributable to varying sand content. Analysis according to the Unified Soil Classification System resulted in a CL classification for the bulk of these soils, with some sand found in localized strata. In general, the available borrow materials, when mixed as they will be during normal construction activities, are excellent materials for use in construction of the pond embankments. This conclusion is supported by the factors of safety calculated during the slope stability analyses described in Section 4.3 of this report.

4.2 Results of Soil Testing

Due to the similarity of the soils encountered during the borings, bagged samples from test holes HP-1 through HP-4 were composited for analysis. In addition, samples from specific depths at HP-1, HP-2, and HP-3 were tested. Testing performed by the laboratory included sieve analyses, compaction testing, direct shear tests of remolded and undisturbed samples, Atterberg limit tests, one-dimensional swell-consolidation tests, and falling head permeability tests. The laboratory tests that were conducted are summarized in Table 1. A summary of relevant test results is shown on Table 2, and copies of the laboratory test reports are included in Appendix C.

Table 1. Summary of Completed Laboratory Soil Tests

Test Hole	Depth (ft)	Tests
HP-1	4	Atterberg limits and -200 analysis One-dimensional, swell-consolidation test
	9	Atterberg limits and -200 analysis One-dimensional, swell-consolidation test
HP-2	0-20	Atterberg limits and -200 analysis Gradation-hydrometer analysis Falling head (liner) permeability test Laboratory compaction test Direct shear test - remolded sample
	9	Direct shear test - undisturbed sample
HP-3	4	Atterberg limits and -200 analysis Direct shear test - undisturbed sample
	19	Atterberg limits and -200 analysis
HP-4	0-14	Atterberg limits and -200 analysis Gradation-hydrometer analysis Falling head (liner) permeability test Laboratory compaction test Direct shear test - remolded sample

Table 2. Summary of Relevant Laboratory Soil Test Results

Test boring:	HP-1		HP-2		HP-3		HP-4
Depth (ft):	4	9	0-20	9	4	19	0-14.5
Natural moisture (%)	8	7	5	2	8	9	6
Natural dry density (pcf):	93	103	—	103	93	113	—
Atterberg limits:							
LL (%):	36	29	28	18	35	42	36
PI (%):	10	13	14	—	16	25	20
-#200 (%)	59	60	54	23	82	93	82
Permeability (cm/sec):	—	—	4.8×10^{-6}	—	—	—	3.8×10^{-6}
Maximum dry density (pcf):	—	—	116.5	—	—	—	109.9
Opt. moisture content (%)	—	—	12.9	—	—	—	14.3
Direct shear tests:							
Sample (1)	—	—	Remld.	Undis.	Undis.	—	Remld.
Cohesion (psf):	—	—	300	0	250	—	200
Friction angle (degrees)	—	—	34	35	24	—	38
Soil classification (2):	CL	CL	CL	SM	CL	CL	CL

(1) Remld. -- remolded sample, Undis. -- undisturbed sample.
(2) Classification by WWC Inc. according to the Unified Soil Classification System.

Compaction testing of composite samples from HP-2 and HP-4 was conducted according to ASTM D-698 to determine the optimum moisture contents and corresponding maximum dry densities of these soils. The values of maximum dry density for these samples were 116.5 and 109.9 pounds per cubic foot (pcf), respectively. Optimum moisture content was 12.9 percent for the HP-2 sample and 14.3 percent for the HP-4 sample.

Direct shear tests (ASTM D-3080) were conducted on remolded composite samples from test holes HP-2 and HP-4 and on undisturbed samples from test holes HP-2 and HP-3. The two sets of tests were used to provide data for use in the slope stability analyses discussed in Section 4.3 of this report. Test results from the two remolded samples were used to derive soil strength characteristics for typical compacted embankment fill material, while test data from the two undisturbed samples provided soil strength characteristics for typical pond foundation soil. The WWC geologist on site during the boring operations indicated that the undisturbed sample from a 9-foot depth in test hole HP-2 was from a sand lens. The resultant

soil parameters derived from direct shear test data for this sample are therefore not typical of the soils in the area of the evaporation ponds.

Falling head permeability tests (ASTM D-5084) were conducted on the two composite samples from test holes HP-2 and HP-4. The sample specimens were remolded to approximately 95 percent of the maximum dry density in accordance with ASTM D-698 prior to testing. The compacted permeabilities of the samples are shown on Table 2.

4.3 Slope Stability Evaluation

A computer evaluation of slope stability was conducted for the proposed evaporation ponds at the Pathfinder ISL Mine. The computer program SB-SLOPE (Von Gunten Engineering Software, 1984 and 1991) was used to perform the evaluation. The program is based on the simplified Bishop method and employs an interactive search procedure to find the critical failure surface.

For the purpose of this study, the "worst case" condition was determined to occur for Option B at a cross section through the outer embankment on the southeast side of the evaporation ponds at station 9 + 58, near test hole HP-4. The location and geometry of this section are shown on Sheet 4 of 5 of the drawings that accompany this report. This section was chosen for evaluation because it exhibits the highest effective embankment height and the steepest interior embankment slope (2H:1V).

Engineering soil properties that are required for an analysis of slope stability include cohesion, friction angle, and in-situ density (unit weight). For this study, engineering properties for typical foundation and embankment soils were derived from soil testing completed by Chen-Northern, Inc. as described in part 4.2 of this report.

Engineering properties of soil to be used for compacted embankment fill were based on data from direct shear tests of remolded composite samples from test holes HP-2 and HP-4. Soil excavated from the area around bore holes HP-1 and HP-2 will comprise most of the compacted fill material used for construction of the embankments. The test values for maximum dry density, cohesion, and friction angle

from the HP-2 sample are more conservative (have smaller strength) than those from the HP-4 sample. Soil parameters used for typical embankment material were therefore those derived from the HP-2 sample. Density of compacted embankment material was assumed to be 110.6 pounds per cubic foot (pcf), which is 95% of the reported maximum dry density of 116.5 pcf for the HP-2 sample. The soil friction angle used for these stability analyses was 34 degrees, and a cohesion value of 300 pounds per square foot (psf) was also used. These values are all within the range of typical values for a CL soil (USBR, 1987).

Soil properties used for the pond foundation soil were based on data from direct shear tests of an undisturbed sample from test hole HP-3. As noted in Section 4.2 of this report, the undisturbed sample from test hole HP-2 was considered to be unrepresentative of the soils in the area of the proposed evaporation ponds. Based on the test results for the HP-3 sample, an average wet density of 100.4 pcf was used, as were a friction angle of 24 degrees and cohesion of 250 psf. A summary of soil strength parameters used in the slope stability analyses are included in Table 3.

In addition to soil strength parameters, data required for the computer modeling study includes coordinate data for the ground surface and the proposed evaporation pond embankment. Ground surface elevations used in the study were based on the assumption that three feet of topsoil and subsoil will be removed before the placement of compacted fill. Since the ponds will be lined and all construction will occur above the local water table, no phreatic surfaces are considered in the stability analyses of the pond embankment and foundation.

Four embankment conditions were considered, two each for both the interior and exterior embankment slopes. Both embankment slopes were analyzed with and without seismic loading conditions. The interior slope was analyzed assuming no water in the pond while the exterior slope was analyzed using a technique of applied distributed loads on the pond floor and interior embankment to simulate the maximum storage pool in the pond. This technique is used to analyze lined reservoir embankments in which there is no phreatic surface. A seismic coefficient of 0.05 was used in the calculation of the dynamic safety factors as recommended for this region

by the Mine Safety and Health Administration (MSHA, 1979). The minimum factors of safety generated by the computer slope stability analyses are graphically illustrated by Figures 1 through 4 and summarized in Table 4.

Table 3. Summary of Soil Strength Parameters Used in Slope Stability Analyses

EMBANKMENT SOIL	
Sample from which parameters were derived	HP-2, 0-20 ft.
Maximum dry density, pcf	116.5
95% maximum dry density, pcf	110.6
Cohesion, psf	300
Friction angle, degrees	34
FOUNDATION SOIL	
Sample from which parameters were derived	HP-3 @ 4 ft.
Soil unit weight, pcf	100.4
Cohesion, psf	250
Friction angle, degrees	24

5.0 GENERAL CONSTRUCTION AND MATERIAL SPECIFICATIONS

5.1 Earthwork Specifications

The soil types discussed in this report are suitable for the construction of the proposed evaporation ponds. The silty to sandy clay soils which will be used to construct the evaporation ponds exhibit permeabilities which are sufficiently low to reduce or inhibit infiltration if a leak should occur. A professional engineer licensed to practice in the State of Wyoming will be available during construction to assure that suitable foundation and borrow materials are used.

SB-SLOPE

Simplified Bishop Slope Stability Analysis

PROJECT: PATHFINDER EVAPORATION POND CASE 1, END OF CONSTRUCTION, STATIC

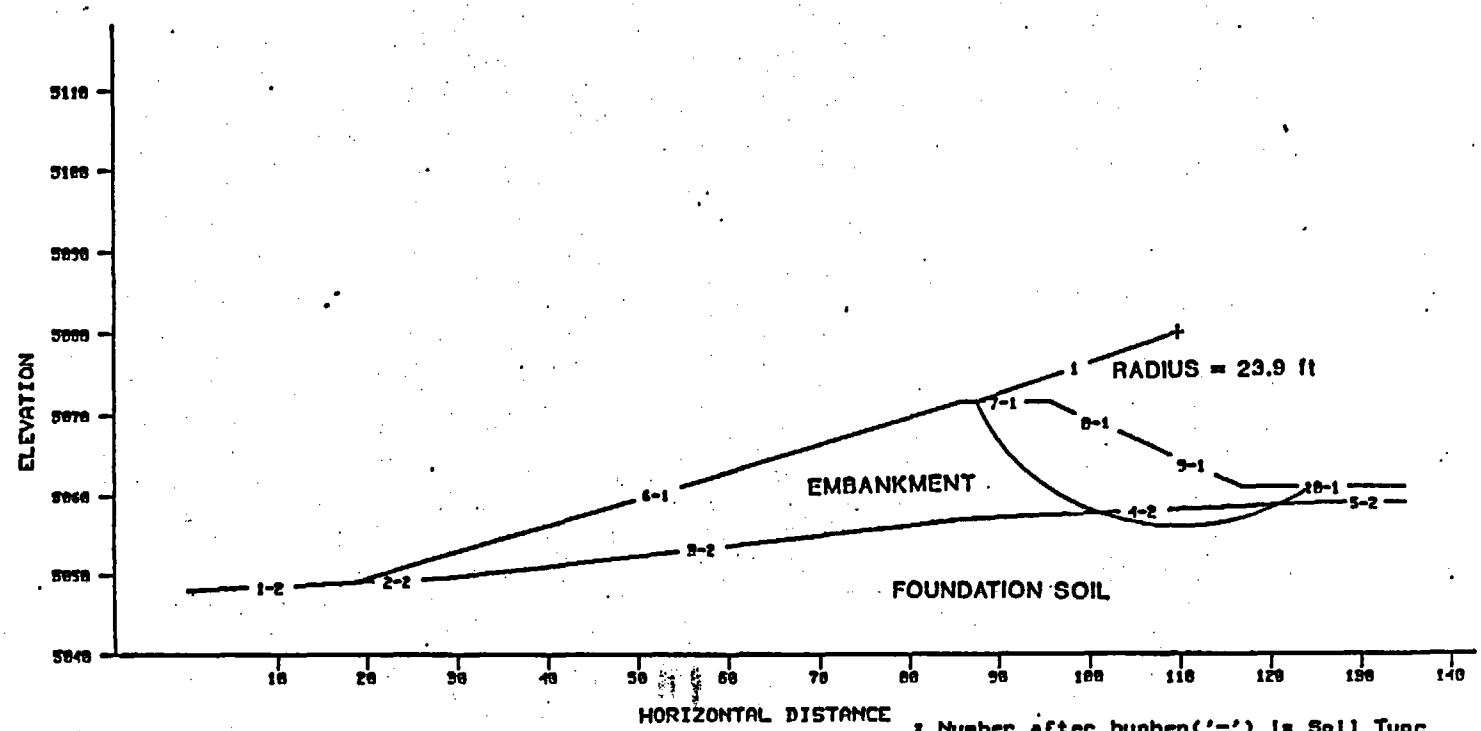
LOCATION: PATHFINDER MINE EVAPORATION PONDS, MAXIMUM INSIDE SLOPE

FILE: PATHFDRA

COMPLETE SLOPE CROSS SECTION SHOWN

SOIL*	DENSITY	COHESION	PHI
1	110.6	900.0	34.0
2	100.4	250.0	24.0

CIRCLE	X	Y	RADIUS	FS
1	110.0	5080.0	23.9	3.63



* Number after hyphen('-') is Soil Type

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Figure 1. Critical Failure Surface for Case 1 - Interior Slope, Pond Empty, Static Conditions

SB-SLOPE

Simplified Bishop Slope Stability Analysis

PROJECT: PATHFINDER EVAPORATION POND CASE 2, END OF CONSTRUCTION, EARTHQUK

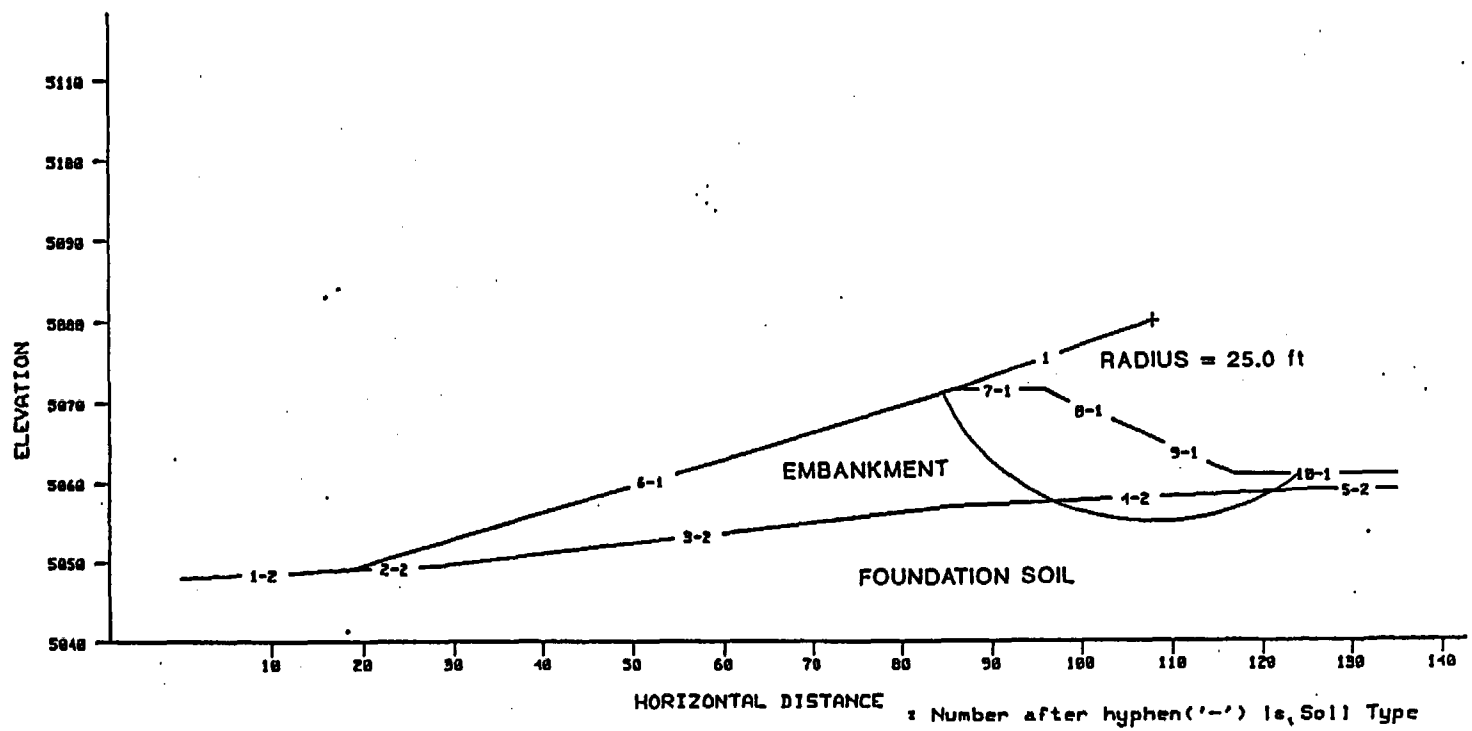
LOCATION: PATHFINDER MINE EVAPORATION PONDS, MAXIMUM INSIDE SLOPE

FILE: PATHFDRB

COMPLETE SLOPE CROSS SECTION SHOWN

SOIL#	DENSITY	COHESION	PHI
1	110.6	300.0	34.0
2	100.4	250.0	24.0

CIRCLE	X	Y	RADIUS	FS
1	108.0	5080.0	25.0	3.25



* Number after hyphen('-') is Soil Type

WESTERN WATER CONSULTANTS, INC.

Figure 2. Critical Failure Surface for Case 2 - Interior Slope, Pond Empty, Earthquake Conditions

SB-SLOPE

Simplified Bishop Slope Stability Analysis

PROJECT: PATHFINDER EVAPORATION POND CASE 3, LONG TERM STABILITY, STATIC

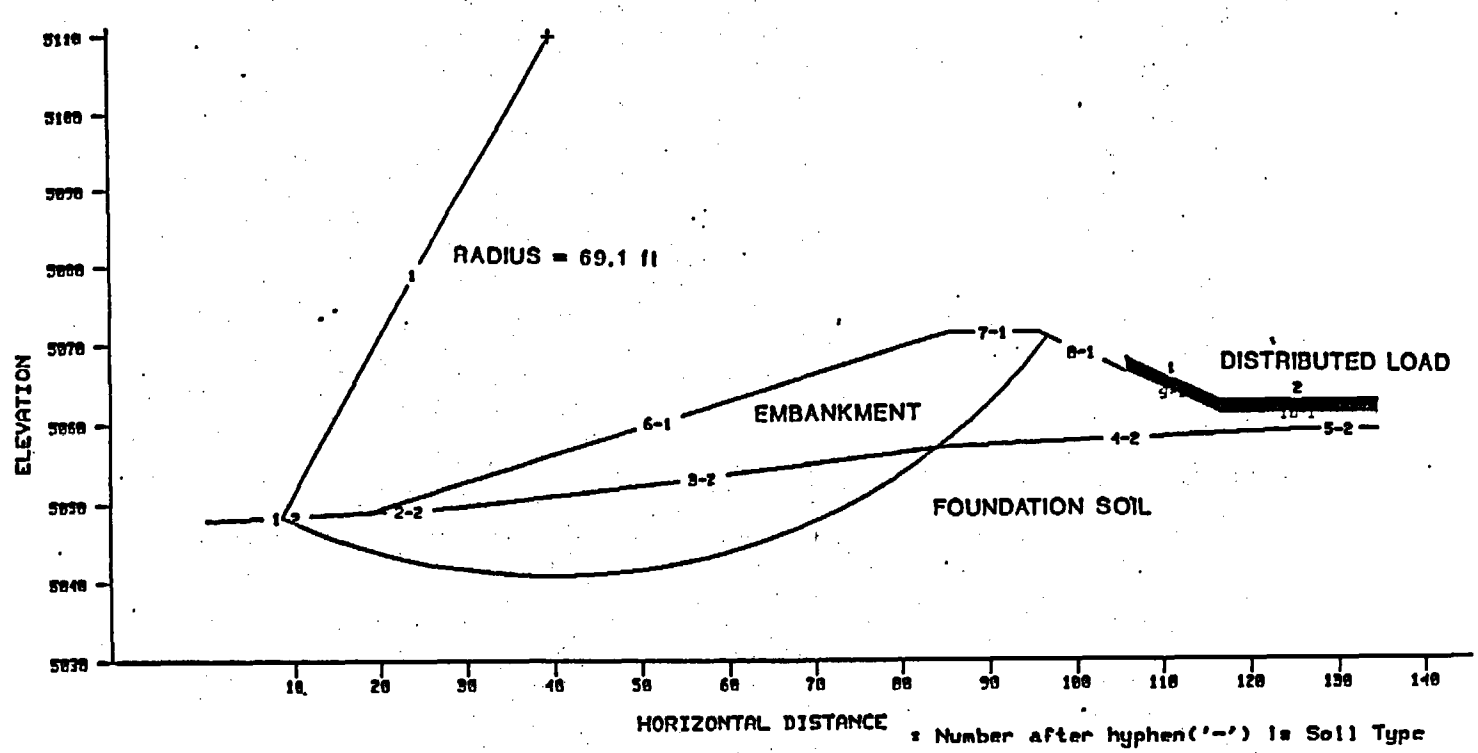
LOCATION: PATHFINDER MINE EVAPORATION PONDS, MAXIMUM OUTSIDE SLOPE

FILE: PATHFDRC

COMPLETE SLOPE CROSS SECTION SHOWN

SOIL#	DENSITY	COHESION	PHI
1	110.6	300.0	34.0
2	100.4	250.0	24.0

CIRCLE	X	Y	RADIUS	FS
1	40.0	5110.0	69.1	2.70



: Number after hyphen('-') is Soil Type

WESTERN WATER CONSULTANTS, INC.

Figure 3. Critical Failure Surface for Case 3 - Exterior Slope, Pond Full, Static Conditions

SB-SLOPE

Simplified Bishop Slope Stability Analysis

PROJECT: PATHFINDER EVAPORATION POND CASE 4, LONG TERM STABILITY, EARTHQUK

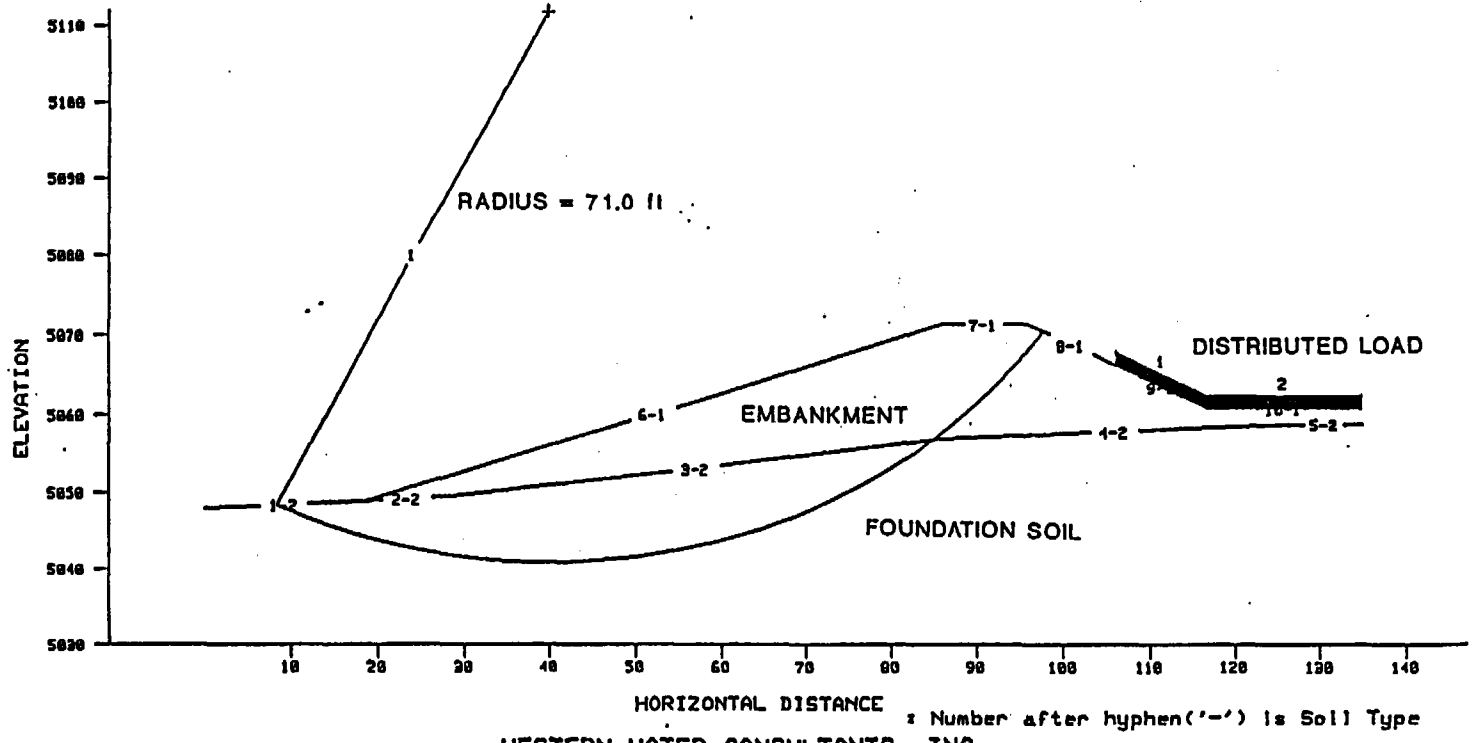
LOCATION: PATHFINDER MINE EVAPORATION PONDS, MAXIMUM OUTSIDE SLOPE

FILE: PATHFDRD

COMPLETE SLOPE CROSS SECTION SHOWN

SOIL#	DENSITY	COHESION	PHI
1	110.6	300.0	34.0
2	100.4	250.0	24.0

CIRCLE	X	Y	RADIUS	FS
1	40.0	5112.0	71.0	2.33



: Number after hyphen('-') is Soil Type

WESTERN WATER CONSULTANTS, INC.

Figure 4. Critical Failure Surface for Case 4 - Exterior Slope, Pond Full, Earthquake Conditions

Table 4. Summary of Embankment Slope Stability Analyses

Earthquake (seismic) coefficients used: Vertical -- 0.05 Horizontal -- 0.05					
		Center Point Coordinates			
Case	Condition	X	Y	Radius	Minimum FS
INTERIOR SLOPE WITH POND EMPTY					
1	Static	110.0	5080.0	23.9	3.63
2	Earthquake	108.0	5080.0	25.0	3.25
EXTERIOR SLOPE WITH POND FULL					
3	Static	40.0	5110.0	69.1	2.70
4	Earthquake	40.0	5112.0	71.0	2.33

To maintain low permeabilities under the impoundments and to minimize settlement, the following specifications shall be adhered to during construction:

- Prior to the placement of fill, the work area will be cleared of all suitable topsoil, timber, brush, trash and other organic material. Suitable topsoil will be removed from the work area to an approximate depth of 36 inches, with final topsoil salvage depths being determined in the field at the time of construction. Salvaged topsoil will be placed in a stockpile and seeded with a temporary (interim) seed mix to protect the stockpile from erosion.

- Fill to be placed in embankments will be clean and free of organic matter, frozen material, and rocks greater than 4 inches in the maximum dimension.

- All fill placed for embankment construction will be compacted to a minimum of 95 percent of the Standard Proctor maximum dry density as determined by ASTM D-698. The fill shall be placed in uniform, successive six-inch (compacted) horizontal layers at a uniform moisture content within plus 2 or minus 4 percent of the optimum moisture content as determined by ASTM D-698.

- The foundation soils at the bottom of the ponds will be scarified or ripped to a depth of a least two feet and watered or aerated as necessary to bring the moisture content within plus 2 or minus 4 percent of the optimum moisture content and compacted to a density of not less than 95 percent of the maximum dry density as determined by ASTM D-698.

- Following trenching operations, all ditches or trenches in the bottoms of the ponds will be brought to within plus 2 or minus 4 percent of optimum moisture content and compacted to within 95 percent of the maximum dry density as determined by ASTM D-698.

- Sand used for leak detection purposes will contain no more than five (5) percent material by weight capable of passing #200 mesh, will contain no particles larger than one-half inch, and will exhibit a hydraulic conductivity greater than 1×10^{-5} cm/s.

5.2 Leak Detection Systems

- Option A: The leak detection system will be installed at the grades and slopes shown on the plans and covered with clean, washed gravel. Any trenching or regrading required during installation of the leak detection system will be followed by scarification, wetting, and compaction to within 95 percent of Standard Proctor maximum dry density as described in Section 5.1 above.

  After the leak detection piping and gravel have been installed, the pond bottoms and sides will be covered with clean washed sand which will be smoothed to the grades and slopes shown on the plans. Sand used in the leak detection system will conform to the specifications included in Section 5.1 above.

- Option B: The leak detection system for this option will be installed to the liners, and grades shown on the accompanying plans. Gas relief trenches and leak detection piping ditches will be constructed and the bottoms compacted as specified in Section 5.1. Prior to the placement of the secondary liner all surface irregularities will be removed to assure a smooth contact surface.

  The secondary liner will be installed in accordance with the manufacturer's recommended installation methods. After the secondary liner is installed the leak detection piping will be installed with gravel covering to the designed lines and grades.

  Geonet leak detection media will be placed above the secondary liner in accordance with the manufacturer's recommended installation procedures prior to the installation of the primary liner.

5.3 Pond Lining Systems

After the leak detection system has been constructed and inspected, the liner will be installed in accordance with the manufacturer's specifications. The reinforced

liner will be anchored in backfilled trenches located three feet from the interior embankment crest and extending at least two feet into the crest of the berm as shown on the plans. All pipes extending through the liner will be booted and sealed according to the liner manufacturer's specifications. All seams will be inspected and air tested in accordance with the liner manufacturer's recommended testing procedure for the material involved.

6.0 REFERENCES

Mine Safety and Health Administration, 1979, Design Guidelines for Coal Refuse Piles and Water, Sediment, or Slurry Impoundments and Impounding Structures.

U.S. Department of the Interior, Bureau of Reclamation, Design of Small Dams, 3rd Edition, 1987.

Von Gunten Engineering Software, Inc., 1984 and 1991, GEOSYSTEM (TM) Software for Slope Stability Analysis.

Wagner, A.A., 1957, The Use of the Unified Soil Classification System by the Bureau of Reclamation, Proceedings of the 4th International Conference of Soil Mechanics and Foundation Engineering, London, Vol. 1.

APPENDIX A

Synthetic Pond Liner Physical Properties

Table A-1. Physical Properties of Hypalon$_{(TM)}$ Membrane Liner

PROPERTY	TEST METHOD	SPECIFIED VALUES
Gauge, nominal (mils)		36
Plies, reinforcing 10 x 10 1000d polyester		1
Thickness, minimum (mils)	ASTM D-751	
Overall	Optical Method	34
Over scrim		11
Breaking strength (pounds, minimum (lbs))	ASTM D-751, Method A	200
Tear strength (pounds, minimum)		
1. Initial	ASTM D-751	80
2. After aging	Modified	35
Low temperature flexibility (°F)	ASTM D-2136, 1/8 in. mandrel, 4 hrs - Pass	-40
Dimensional stability (each direction percent change maximum)	ASTM D-1204, 212°F, 1 hr.	2
Volatile loss, maximum, for 30 mil unsupported sheet (percent)	ASTM D-1203, Method A	0.5
Resistance to soil burial (maximum percent change from original values)		
a. 30-mil unsupported sheet	ASTM D-3084 (per ASTM paragraph 9.5)	
1. Breaking strength		5
2. Elongation at break		20
3. Modulus at 100% elongation		20
b. Membrane fabric breaking strength	ASTM D-751, Method A	25
Hydrostatic resistance, minimum (psi)	ASTM D-751, Method A Procedure 1	250
Ply adhesion, each direction, minimum (lbs/in)	ASTM D-413, Machine Method	8
	ASTM D-413, Modified Method	10
Water absorption, maximum, 30 mil unsupported sheet (percent weight gain)	ASTM D-471	
	14 days @ 70°F	1.5
	30 days @ 70°F	2.0
	120 days @ 70°F	2.0
	14 days @ 158°F	30.0
	30 days @ 158°F	30.0
	120 days @ 158°F	30.0

Table A-2. Physical Properties of 30 Mil High Density Polyethylene (HDPE) Membrane Secondary Liner

PROPERTY	TEST METHOD	SPECIFIED VALUES
PHYSICAL PROPERTIES		
Gauge of Material (mils)	ASTM D-1593	30 (±5%)
Specific Gravity (g/cc)	ASTM D-792 A	0.94 5
Minimum Tensile Properties	ASTM D-638	
Tensile @ Yield (psi)		2,000
Tensile @ Break (psi)		3,800
Elongation @ Yield (%)		13
Elongation @ Break (%)		600
Modulas of Elasticity (psi)		80,000
Tear Resistance, Minimum (psi)	ASTM D-1004 Die C	700
Low Tem. Brittleness (°C)	ASTM D-746 B	-75
Resistance to Soil Burial (%)	ASTM D-3083 (NSF SPEC 54)	
Tensile @ Yield		± 10
Tensile @ Break		± 10
Elongation @ Yield		± 10
Elongation @ Break		± 10
Modulas of Elasticity		± 10
Environmental Stress Crack Res. (hrs)	ASTM D-1693 (NSF SPEC 54)	2,000
Carbon Content (%)	ASTM D-1603	2-3
Carbon Dispersion (score)	ASTM D-3015	A-2
Melt Index (g/10m)	ASTM D-1238	< 1.0
Puncture Resistance (lbs)	FTMS 101 C	30
Water Vapor Transmission (GM-MIL/24 HR/100 in²/90°/RH)		0.5
Hydrostatic Resistance (psi)	ASTM D-751 A	450
SEAL SEAMING PROPERTIES		
Bonded Seam Strength, Shear (ppi)	ASTM D-3083	130 (min.)
Bonded Seam Strength, Peel (ppi)	ASTM D-413	90 (min.)
Peel Adhesion, Minimum (ppi)	ASTM D-413	Film Tear Bond
Resistance to Soil Burial	ASTM D-3083	
Bonded Seam Strength Change (%)		-20
Peel Adhesion		Film Tear Bond

Table A-3. Physical Properties of Medium Density Polyethylene Geonet

Property	
Raw Material (All Domestic and Virgin Material)	Polyethylene
Manufacturing	Extruded
Color	Black
Carbon Black (%)	2
Density & Polymer (g/cm^3)	0.936
Melt Index (g/10 min.)	1.10
Tensile Strength (Mach. Direction) (lbs/in)	53
Tensile Strength (Trans. Direction) (lbs/in)	31
Elongation to Break (Mach. Direction) (%)	925
Elongation to Break (Trans. Direction) (%)	425
Porosity	0.81 - 0.84
U.V. Resistance	Stable

APPENDIX B

Soil Boring Logs

WWC ENGINEERING INC.

ENGINEERING AND HYDROLOGY AND HYDROGEOLOGY

LOG OF BOREHOLE	BOREHOLE HP-1	PAGE 1 OF 2
PROJECT: North Butte ISL LOCATION: N 140613.1 E 65803.5 GROUND ELEVATION: 5074.91 SURVEYED: YES X NO	DRILLER: Joe Highsmith, Chen-Northern Inc. LOGGED BY: M. Wolf, WWC RIG: CME 55 auger BIT(S): Hollow stem FLUID: Occasional water	DATE: TIME: START: 11/22/91 START: 12:40 FINISH: 11/22/91 FINISH: 3:25 GEOPHYS LOG: NO TOTAL DEPTH: 40 ft. HOLE DIA: 4 in.

ELEV	DEPTH	ASTM D2487 SYMBOL	DESCRIPTION OF MATERIALS (ASTM D2488)	BPF	WL	TESTS OR NOTES
	0-4		More sandy clay than in liner			
	4-5	CL	Sandy clay, light buff, very stiff, friable, sands are poorly sorted, fine to coarse grained, dry, $CaCO_3$	29		(CAL)
	9-10	CL	Clay, sandy, buff, hard, poorly sorted, abundant $CaCO_3$ veinlets, slightly moist.	50		(CAL)
	14-15		SM, sand, buff, silty, non-plastic, hard, $CaCO_3$ less than above, sand poorly sorted.	50		(CAL)
	19-20		Top of liner is CL, light grey brown and very small coal chips, very plastic bottom of liner is SC, very fine sand, slight moisture.	38		(CAL)
	24-25		Clay, sandy, buff, very stiff, friable, granular, slight moisture, sands are very fine grained.	28		(CAL)
			At 26 feet driller says material stiffened up, cuttings suggest claystone or clay with minor sand.			
	29-30		Top liner is as above, clay, sandy, buff; shoe and bottom liner is clayey sand with large 3/4" pink sandstone clasts	26		(CAL)
	30-34		Fast penetration of auger, seems fairly soft. Cuttings collected from auger flights are very clayey, slight moisture as bit was pulled, cutting on the last ~2 ft. are brick red sandy clay.			Apparent contact: Tertiary Wasatch at approximately 33 feet.
	34-35		Slow penetration, sandstone, salmon pink/red, hematite staining, moist, very hard, friable, moderately well sorted, fairly uniform, fine grained, must have penetrated pink sandstone at approximately 33 ft.	50/6"		(CAL)
	39-40		As above, little less pink	50/4"		(CAL)

LOG OF BOREHOLE			BOREHOLE HP-1	PAGE 2		OF 2

NOTES:

Ring samples were obtained using a 2-in. inside diameter/ 3-in. outside diameter ring-lined barrel sampling assembly. See ASTM D-3550.

Composite Samples (DBS): Bag 1: 0 ft. - 20 ft.
Bag 2: 20 ft. - 34 ft.

Water Check:
11/23/91, 8:08 AM, boring was checked for water with an electronic well probe, was dry at 40 ft.

ABBREVIATIONS:

SWL - Static Water Level
SPT - Standard Penetration Test with Split Barrel Sample (ASTM D-1586)
CAL - California Tube Sample
ST - Shelby Tube Sample
DBS - Disturbed Bulk Sample

WWC ENGINEERING INC.

ENGINEERING AND HYDROLOGY AND HYDROGEOLOGY

LOG OF BOREHOLE JOB #1097	BOREHOLE HP-2	PAGE 1 OF 2
PROJECT: North Butte ISL LOCATION: N 140582.6 E 65929.7 GROUND ELEVATION: 5075.21 SURVEYED: YES XX NO	DRILLER: Joe Highsmith, Chen-Northern Inc. LOGGED BY: M. Wolf, WWC RIG: CME 55 auger BIT(S): Hollow stem FLUID: None	DATE: TIME: START: 11/22/91 START: 9:40 FINISH: 11/22/91 FINISH: 12:25 GEOPHYS LOG: NO TOTAL DEPTH: 40 ft. HOLE DIA: 4 in.

ELEV	DEPTH	ASTM D2487 SYMBOL	DESCRIPTION OF MATERIALS (ASTM D2488)	BPF	WL	TESTS OR NOTES
	4-5		Top two rings - clay, sandy, $CaCO_3$; bottom rings - clayey, sandy, silty, less clay; only bottom ring saved, slight moisture.	32		(CAL)
	9-10	SC	Top rings, CL, sandy (not saved), contact with sand in ring 2; bottom ring (saved) SM, medium to coarse-grained, buff, loose, slight moisture.	32		(CAL)
	14-15		Top 1-1/2 rings - CL -SC, buff; bottom 1-1/2 rings - GP, fine gravel with coarse sand, light grey brown, some red pebbles, $CaCO_3$, mottled. Only bottom ring (gravel) saved-dense, granular, friable.	40		(CAL) Apparent Contact: Tertiary Wasatch at Approximately 18 feet.
	19-20		Top ring - CL, buff, medium plasticity; bottom 2 rings - sand, SP, poorly consolidated, $CaCO_3$, Fe-stained, fine to medium grained, dense, granular, friable, only slight moisture.	50		(CAL)
	24-25		Top rings - CL, sandy, one may be slough in top ring; bottom ring - SW, fine sand, buff, medium stiff, friable, probably bedrock, slight moisture. Note: Also saving bags of auger cuttings, are much more clayey than brass liners indicated.			(CAL)
	29-30		Sand - SP, buff, fine to medium-grained, very stiff, friable, poorly consolidated, non-plastic poorly graded sands, very fine to medium grained. Top 1-1/2 liners -hole slough - clay, sandy. Bottom liner - sand, few coal particles.	50		(CAL)
	34-35		Sand - SP, buff, fine to medium grained, as above (more moist) but not yet wet.	29		(CAL)
	39-40		Note: From 35 ft. to 39 ft., material got significantly more soft; sand, SP, drilling rate became faster, sand as above, moist, non-plastic. Top 1-1/2 liners is clay, sandy, wet from introduction of water to get cuttings out.	29		(CAL)
	0-20	CL	(DBS) Composite bag sample from auger cuttings, clay, with sand, buff, slight moisture.			

LOG OF BOREHOLE JOB #1097	BOREHOLE HP-2	PAGE 2 OF 2

ELEV	DEPTH	ASTM D2487 SYMBOL	DESCRIPTION OF MATERIALS (ASTM D2488)	BPF	WL	TESTS OR NOTES

NOTES:

Ring samples were obtained using a 2-in. inside diameter/3-in. outside diameter ring-lined barrel sampling assembly. See ASTM D-3550.

Composite samples (DBS): Bag 1: 0 ft. - 20 ft.
Bag 2: 20 ft. - 30 ft.

Water Checks:
11/22/91 at 12:24: probed hole for water, no water, depth 39.8 ft.
11/23/91 at 8:11: boring checked for water, hole was still dry at 39.5 ft.

ABBREVIATIONS:

SWL - Static Water Level
SPT - Standard Penetration Test with Split Barrel Sample (ASTM D-1586)
CAL - California Tube Sample
ST - Shelby Tube Sample
DBS - Disturbed Bulk Sample

WWC ENGINEERING INC.

ENGINEERING AND HYDROLOGY AND HYDROGEOLOGY

LOG OF BOREHOLE Job #1097	BOREHOLE HP-3	PAGE 1 OF 1
PROJECT: North Butte ISL LOCATION: N 140288.2 E 65716.9 GROUND ELEVATION: 5064.21 SURVEYED: YES XX NO	DRILLER: Joe Highsmith, Chen-Northern Inc. LOGGED BY: M. Wolf RIG: CME-55 auger BIT(S): Hollow stem FLUID: Occasional water	DATE: TIME: START: 11/22/91 START: 3:34 FINISH: 11/22/91 FINISH: 4:30 GEOPHYS LOG: NO TOTAL DEPTH: 20 ft. HOLE DIA: 4 in.

ELEV	DEPTH	ASTM D2487 SYMBOL	DESCRIPTION OF MATERIALS (ASTM D2488)	BPF	WL	TESTS OR NOTES
	4-5	CL	Top 8 in. has dark organics, clay, slightly sandy, very light brown, $CaCO_3$ granular, friable, very stiff, dry to slightly moist	20		(CAL)
	9-10		Clay, slightly sandy, same as above, abundant clay, moist, friable, very stiff, abundant $CaCO_3$	22		(CAL)
	14-15		Thin fine gravel lens at 13 ft., maybe 6 in. thick, sand, silty, buff grey, friable, slight moisture, very stiff, poorly sorted; sand ranges from very fine to medium-grained, slight coarse fraction, maybe few small pebbles from gravel lens.	33		(CAL)
	19-20		Clay, sandy, buff, very stiff.	32		(CAL)

NOTES:

Ring Samples were obtained using a 2-in. inside diameter/3-in. outside diameter ring-lined barrel sampling assembly. See ASTM D-3550.

Composite sample (DBS): 0 ft. - 19 ft., boring remained dry.

ABBREVIATIONS:

SW - Static Water Level
SPT - Standard Penetration Test with Split Barrel Sample (ASTM D-1586)
CAL - California Tube Sample
ST - Shelby Tube Sample
DBS - Disturbed Bulk Sample

WWC ENGINEERING INC.

ENGINEERING AND HYDROLOGY AND HYDROGEOLOGY

LOG OF BOREHOLE	BOREHOLE HP-4	PAGE 1 OF 1
PROJECT: Job #1097 LOCATION: N 140251.8 E 65828.7 GROUND ELEVATION: 5064.01 SURVEYED: YES XX NO	DRILLER: Joe Highsmith, Chen-Northern Inc. LOGGED BY: M. Wolf RIG: CME-55 auger BIT(S): Hollow stem FLUID: None	DATE: START: 11/23/91 FINISH: 11/23/91 TIME: START: 8:35 FINISH: 9:28 GEOPHYS LOG: NO TOTAL DEPTH: 20 ft. HOLE DIA: 4 in.

ELEV	DEPTH	ASTM D2487 SYMBOL	DESCRIPTION OF MATERIALS (ASTM D2488)	BPF	WL	TESTS OR NOTES
	4-5		Clay, buff, slight sand, very stiff, granular, friable, slight moisture, very plastic	20		
	9-10		Sand, clayey, buff, very stiff, very granular and friable, slight moisture.	18		
	14-15		Top ring - CL, buff as above; bottom ring-sand, buff, very fine. Sand at ≈14 1/2 ft., very friable, moderately well sorted, may be Wasatch Formation, non-plastic.	18		
	19-20		Sand, buff, moderate clay, slight plastic, friable, slight moisture.	24		
	0-14 1/2	CL	(DBS) Composite sample auger cuttings: clay with sand, buff, medium to low plasticity, slight moisture.			

NOTES:

Ring samples were obtained using a 2-in. inside diameter/3-in. outside diameter ring-lined barrel sampling assembly. See ASTM D-3550.

Composite sample (DBS): 0 ft. - 14.5 ft.

ABBREVIATIONS:

SWL - Static Water Level
SPT - Standard Penetration Test with Split Barrel Sample (ASTM D-1586)
CAL - California Tube Sample
ST - Shelby Tube Sample
DBS - Disturbed Bulk Sample

APPENDIX C

Laboratory Test Reports

Chen Chern, Inc.

JOB NO. 9 33

PAGE 1 OF 1

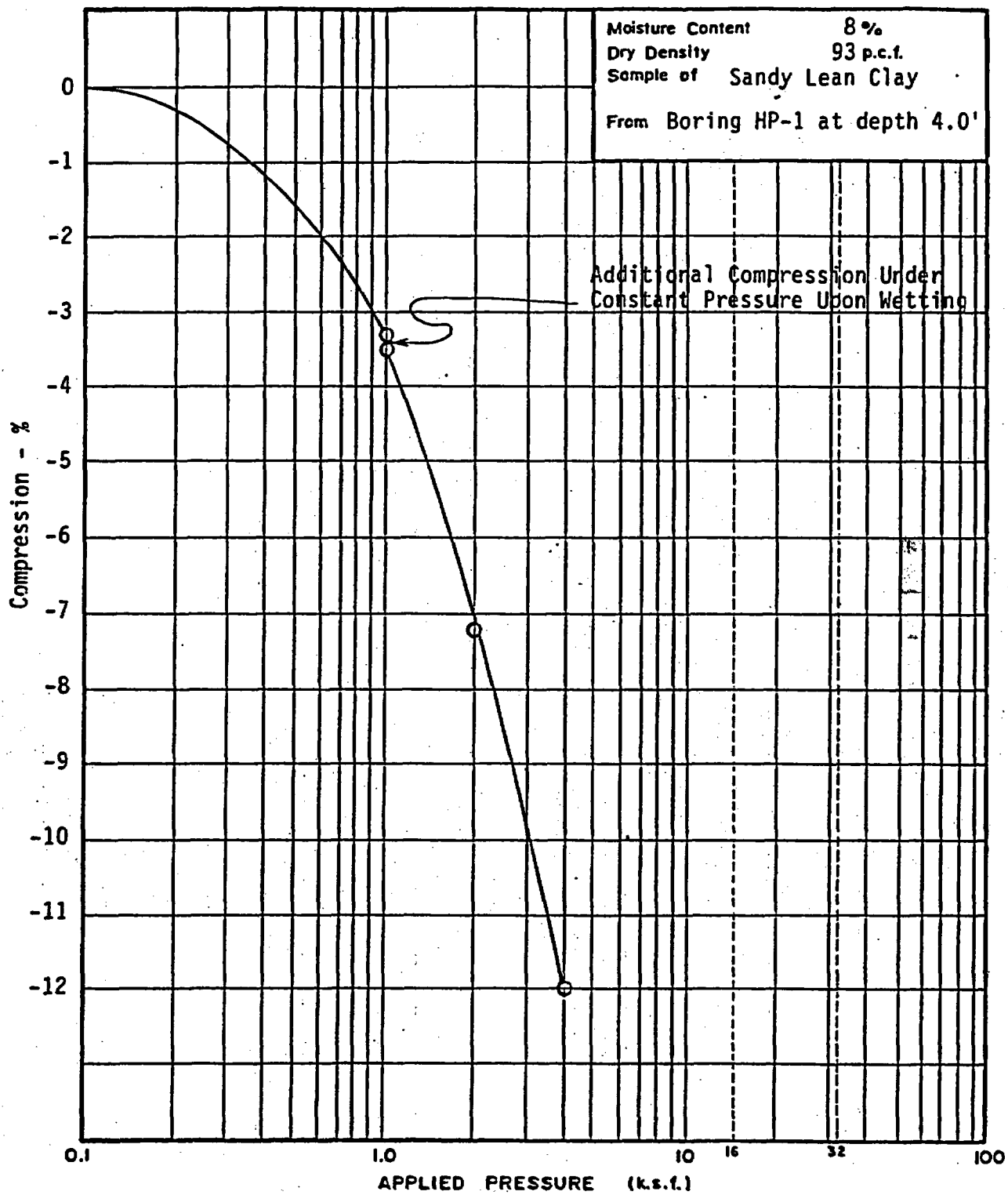
TABLE I
SUMMARY OF LABORATORY TEST RESULTS

BORING	DEPTH (feet)	NATURAL MOISTURE (%)	NATURAL DRY DENSITY (p.c.f.)	ATTERBERG LIMITS		UNCONFINED COMPRESSIVE STRENGTH (p.s.f.)	WATER SOLUBLE SULFATE (%)	GRADATION ANALYSIS			SOIL TYPE
				LIQUID LIMIT (%)	PLASTICITY INDEX (%)			+#4 (%)	-#4 +#200 (%)	-#200 (%)	
HP-1	4.0	8	93	36	10					59	Sandy Lean Clay
	9.0	7	103	29	13					60	Sandy Lean Clay
HP-2	0.0-20.0	5		28	14			1	45	54	Sandy Lean Clay
	9.0	2	103	18	NP					23	Silty Sand
HP-3	4.0	8	93	35	16					82	Sandy Lean Clay
	19.0	9	113	42	25					93	Lean Clay
HP-4	0.0-14.5	6		36	20			0	18	82	Sandy Lean Clay
P-1	7.5	6		28	10					78	Sandy Lean Clay
P-2	2.5	7		35	19					70	Sandy Lean Clay
O-1	5.0	6		26	13					46	Sandy Lean Clay

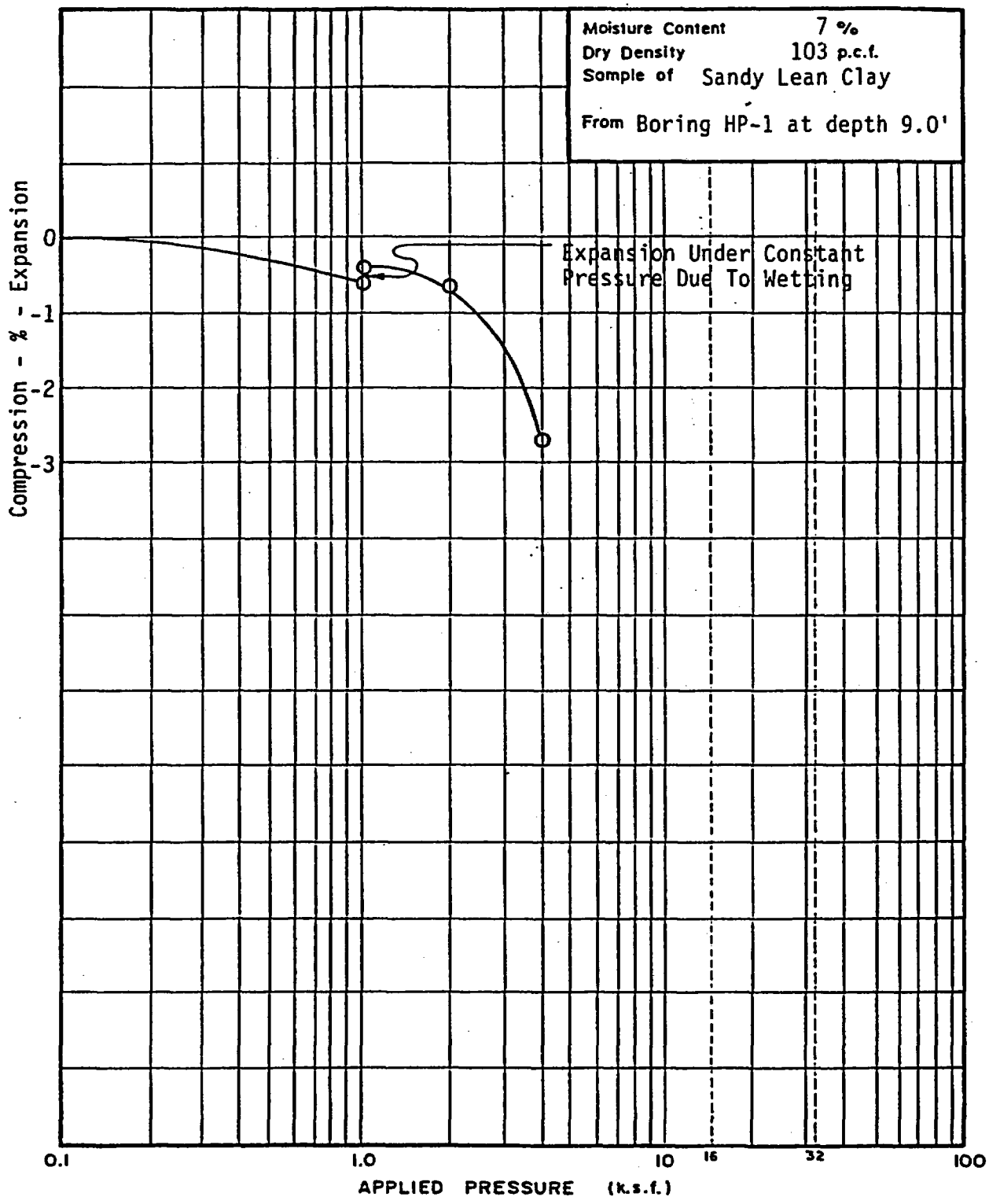
TABLE II

FALLING HEAD PERMEABILITY TESTS

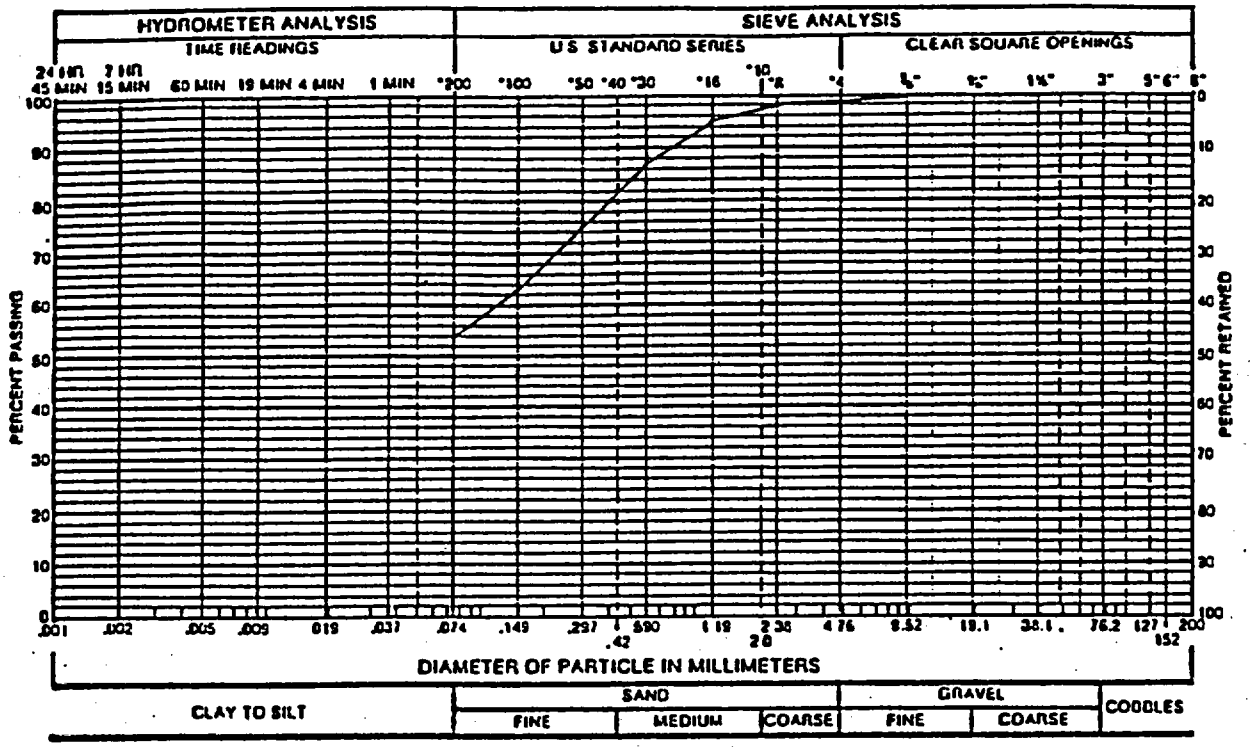
Boring	Depth (ft)	Remolded Moisture Content (%)	Remolded Dry Density (pcf)	Permeability (cm/sec)
HP-2	0-20	12.2	111	$4.8X10^{-8}$
HP-4	0-14	14.3	104.6	$3.8X10^{-8}$



92-4333	Chen Northern, Inc.	SWELL-CONSOLIDATION TEST RESULTS	Fig. A-1

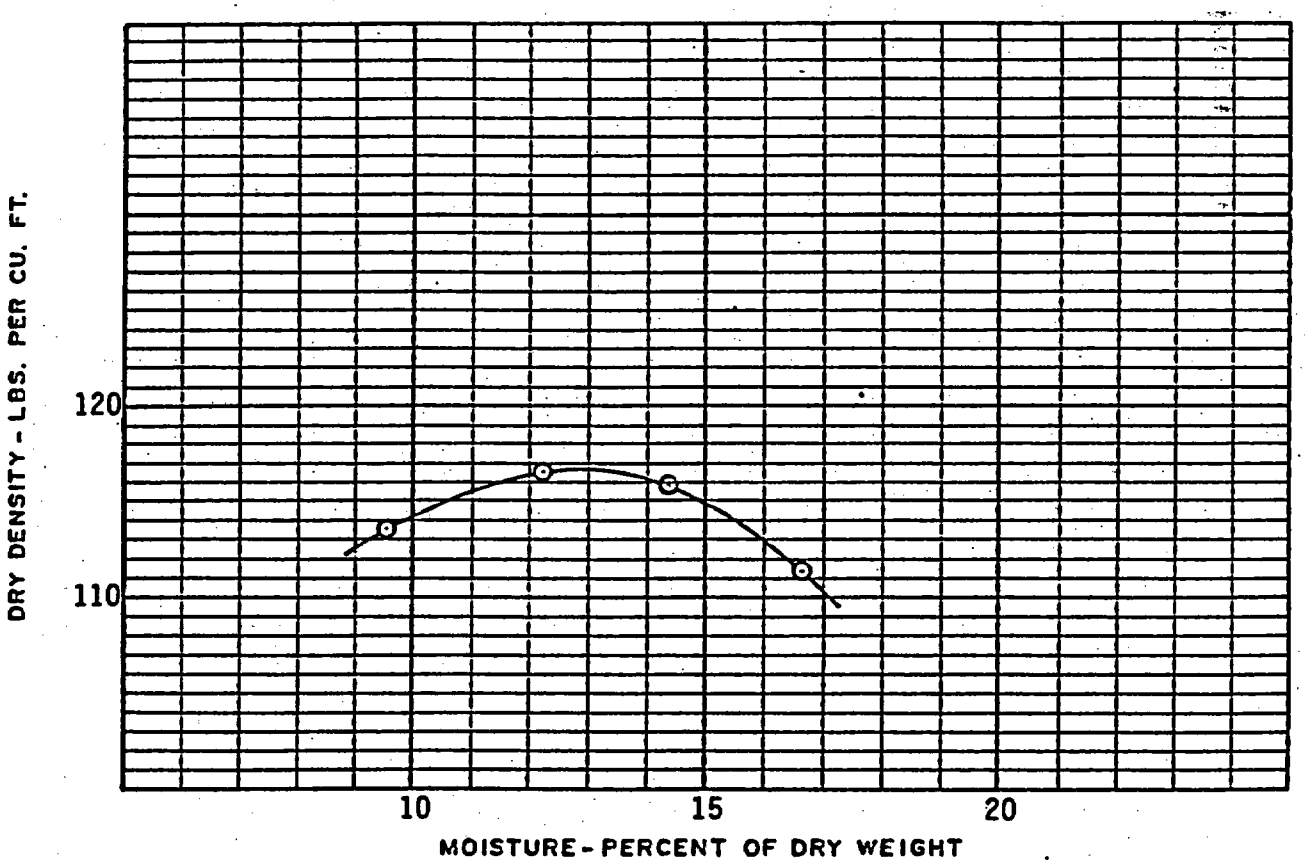


92-4333	Chen Northern, Inc.	SWELL-CONSOLIDATION TEST RESULTS	Fig. A-2



GRAVEL 1 % SAND 45 % SILT AND CLAY 54%

LIQUID LIMIT 28 % PLASTICITY INDEX 14%



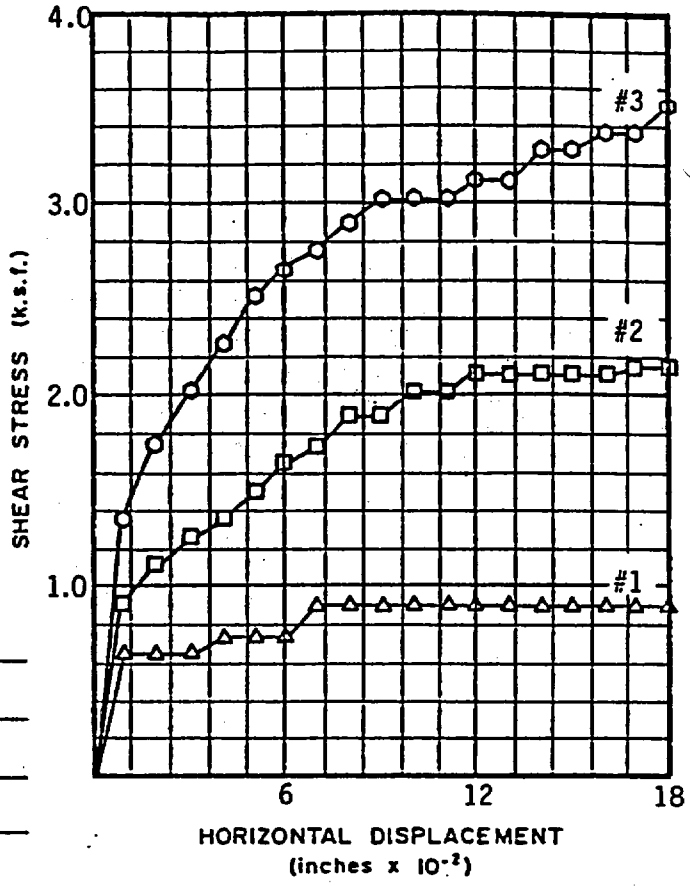
COMPACTION TEST PROCEDURE ASTM D698, Method "A"

MAX. DRY DENSITY (p.c.f.) 116.5 OPTIMUM MOIST. CONT. (%) 12.9

SAMPLE OF Sandy Lean Clay FROM Boring HP-2 at depth 0.0' to 20.0'

92-4333	Chen Northern, Inc.	GRADATION AND COMPACTION TEST RESULTS	Fig. A-3

TEST NUMBER	1	2	3
FROM	Boring HP-2 at Depth 0.0' to 20.0'		
HEIGHT (inch)	1.00	1.00	1.00
DIAMETER (inch)	1.94	1.94	1.94
MOISTURE CONTENT (%)	12.2	12.2	12.2
DRY DENSITY (p.c.f.)	110.9	111.1	111.1
CONSOL. LOAD (k.s.f.)	1.0	3.0	5.0
NORMAL LOAD (k.s.f.)	1.0	3.0	5.0
SHEAR STRESS (k.s.f.)	0.9	2.3	3.5

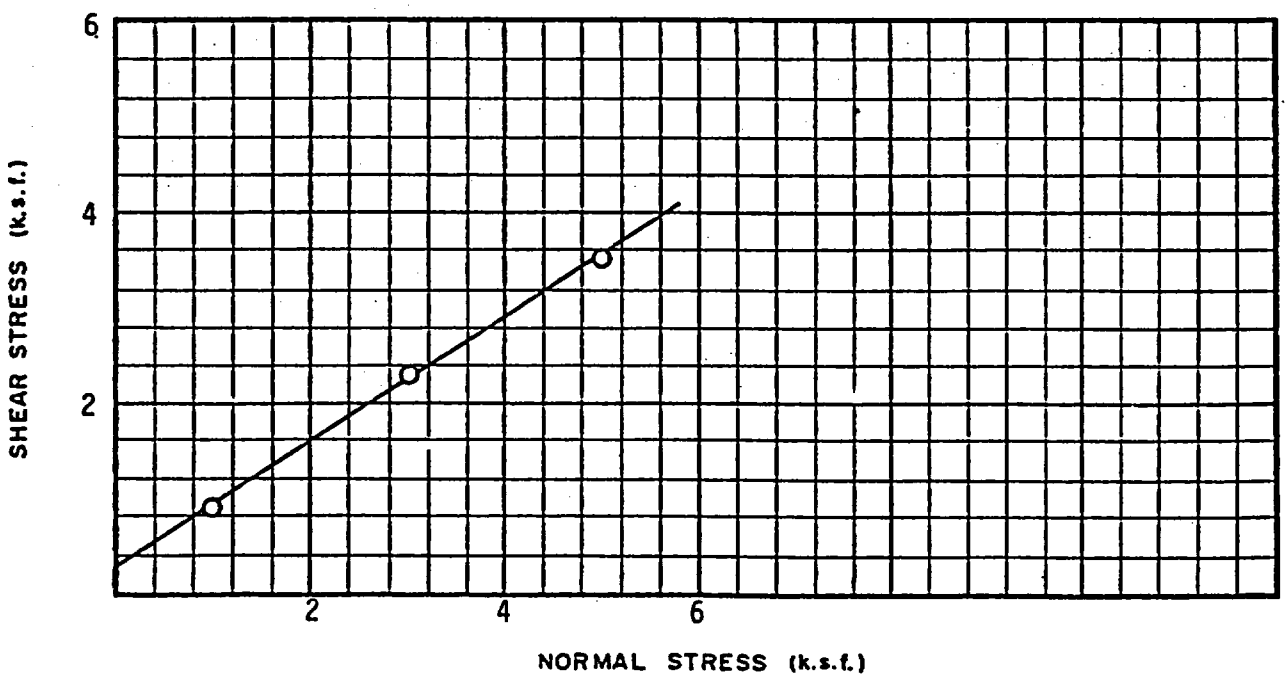


TYPE OF SPECIMEN Remolded

SAMPLE OF Sandy Lean Clay

TYPE OF TEST Consolidated, Drained

TAN ø 0.675 ø 34° COHESION (k.s.f.) 0.3



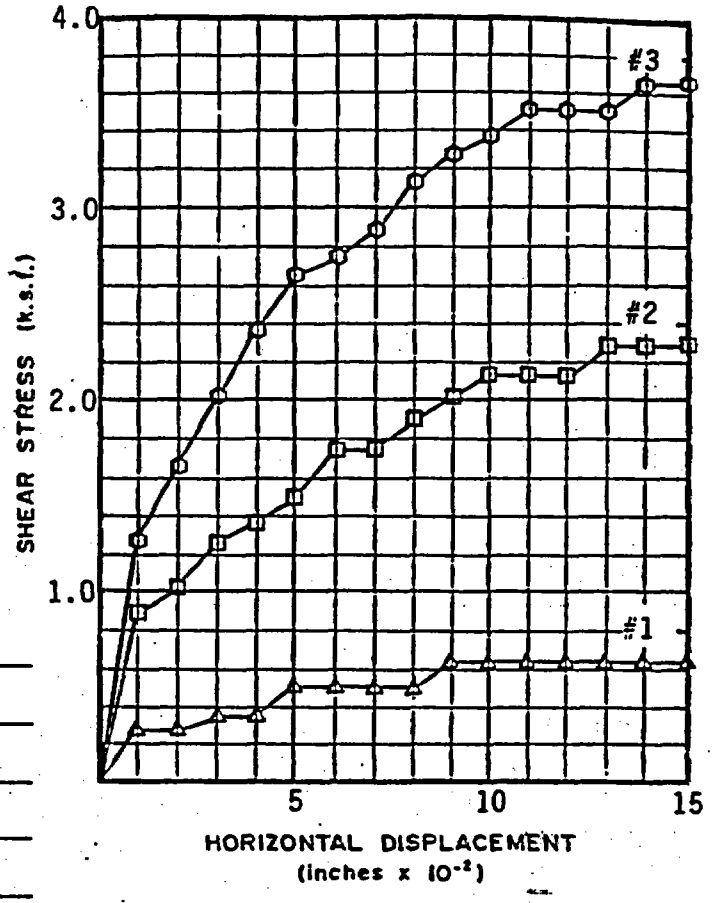
92-4333	Chen Northern, Inc.	DIRECT SHEAR TEST RESULTS	Fig. A-4

TEST NUMBER	1	2	3
FROM	Boring HP-2 at Depth 9.0'		
HEIGHT (inch)	1.00	1.00	1.00
DIAMETER (inch)	1.94	1.94	1.94
MOISTURE CONTENT (%)	1.3	2.4	1.3
DRY DENSITY (p.c.f.)	106.5	98.7	103.4
CONSOL. LOAD (k.s.f.)	1.0	3.0	5.0
NORMAL LOAD (k.s.f.)	1.0	3.0	5.0
SHEAR STRESS (k.s.f.)	0.6	2.2	3.6

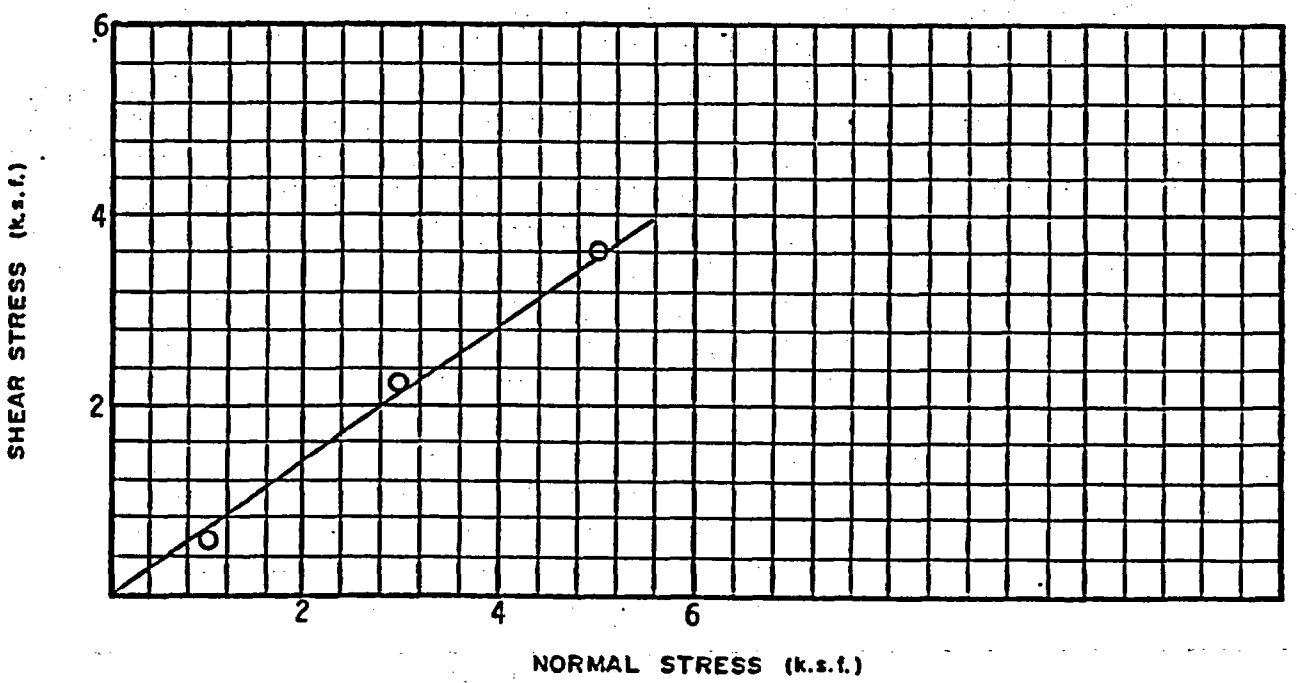
TYPE OF SPECIMEN Undisturbed

SAMPLE OF Silty Sand

TYPE OF TEST Consolidated, Drained

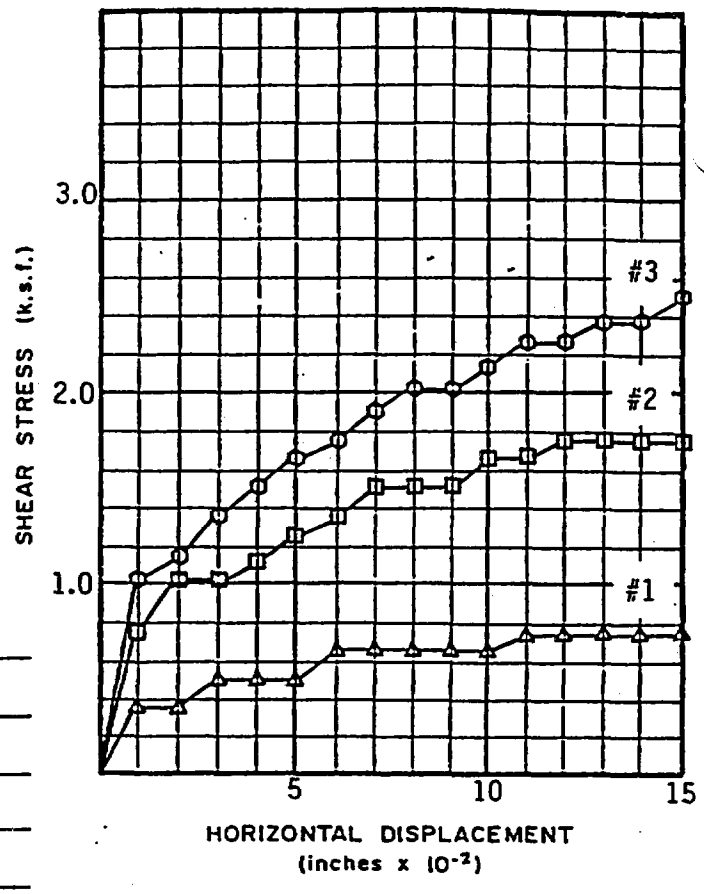


TAN Ø 0.700 Ø 35° COHESION (k.s.f.) 0.0



92-4333	Chen Northern, Inc.	DIRECT SHEAR TEST RESULTS	Fig. A-5

TEST NUMBER	1	2	3
FROM	Boring HP-3 at Depth 4.0'		
HEIGHT (inch)	1.00	1.00	1.00
DIAMETER (inch)	1.94	1.94	1.94
MOISTURE CONTENT (%)	6.4	7.8	10.1
DRY DENSITY (p.c.f.)	94.1	94.2	90.1
CONSOL. LOAD (k.s.f.)	1.0	3.0	5.0
NORMAL LOAD (k.s.f.)	1.0	3.0	5.0
SHEAR STRESS (k.s.f.)	0.7	1.8	2.5

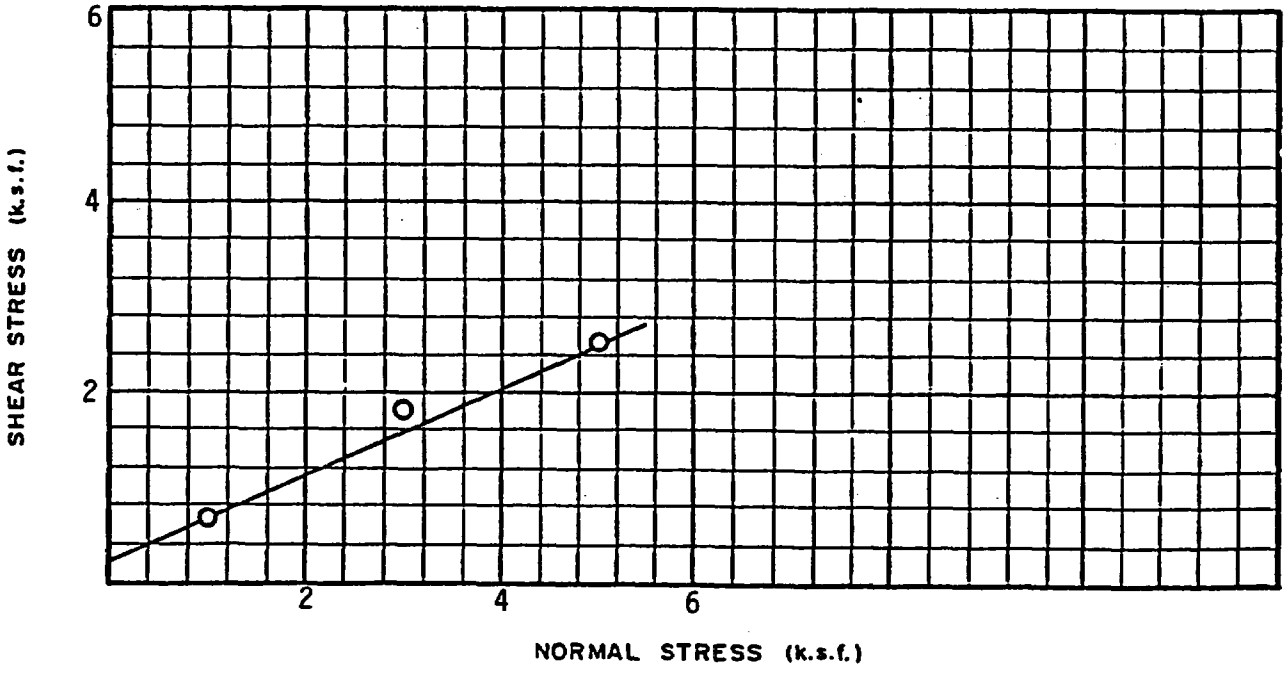


TYPE OF SPECIMEN Undisturbed

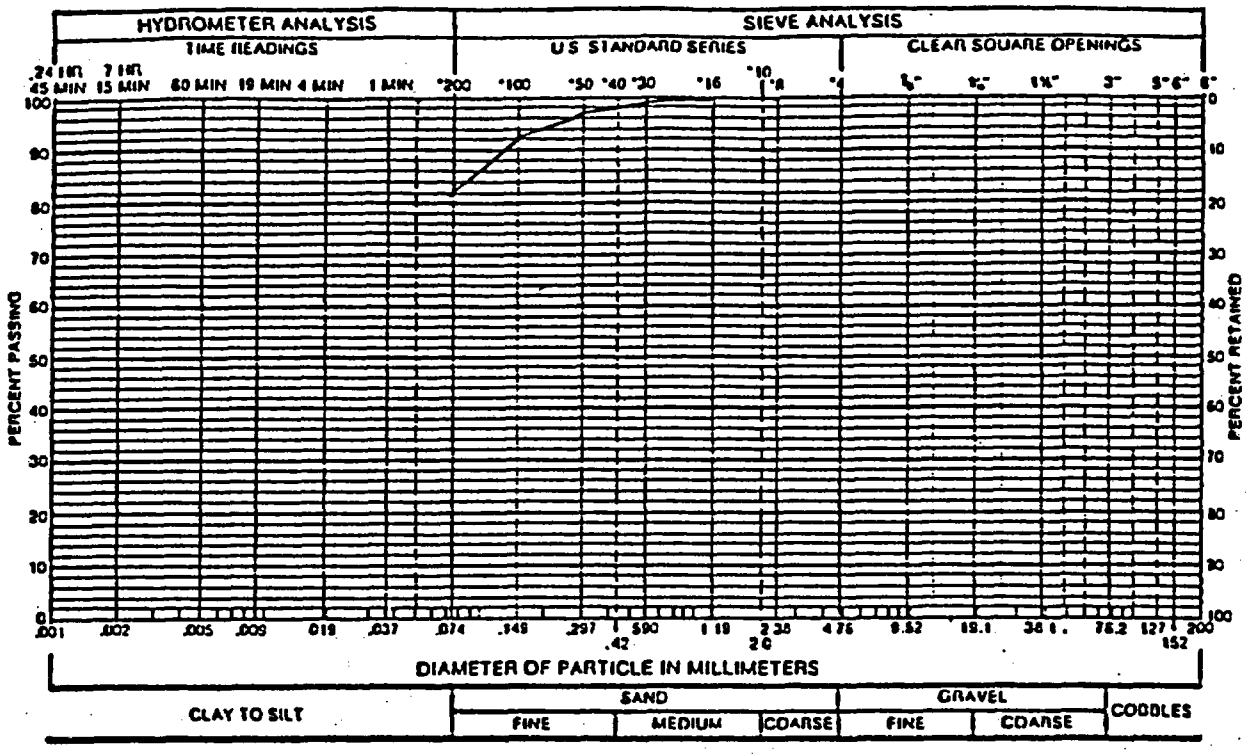
SAMPLE OF Sandy Lean Clay

TYPE OF TEST Consolidated, Drained

TAN Ø 0.445 Ø 24° COHESION (k.s.f.) 0.25

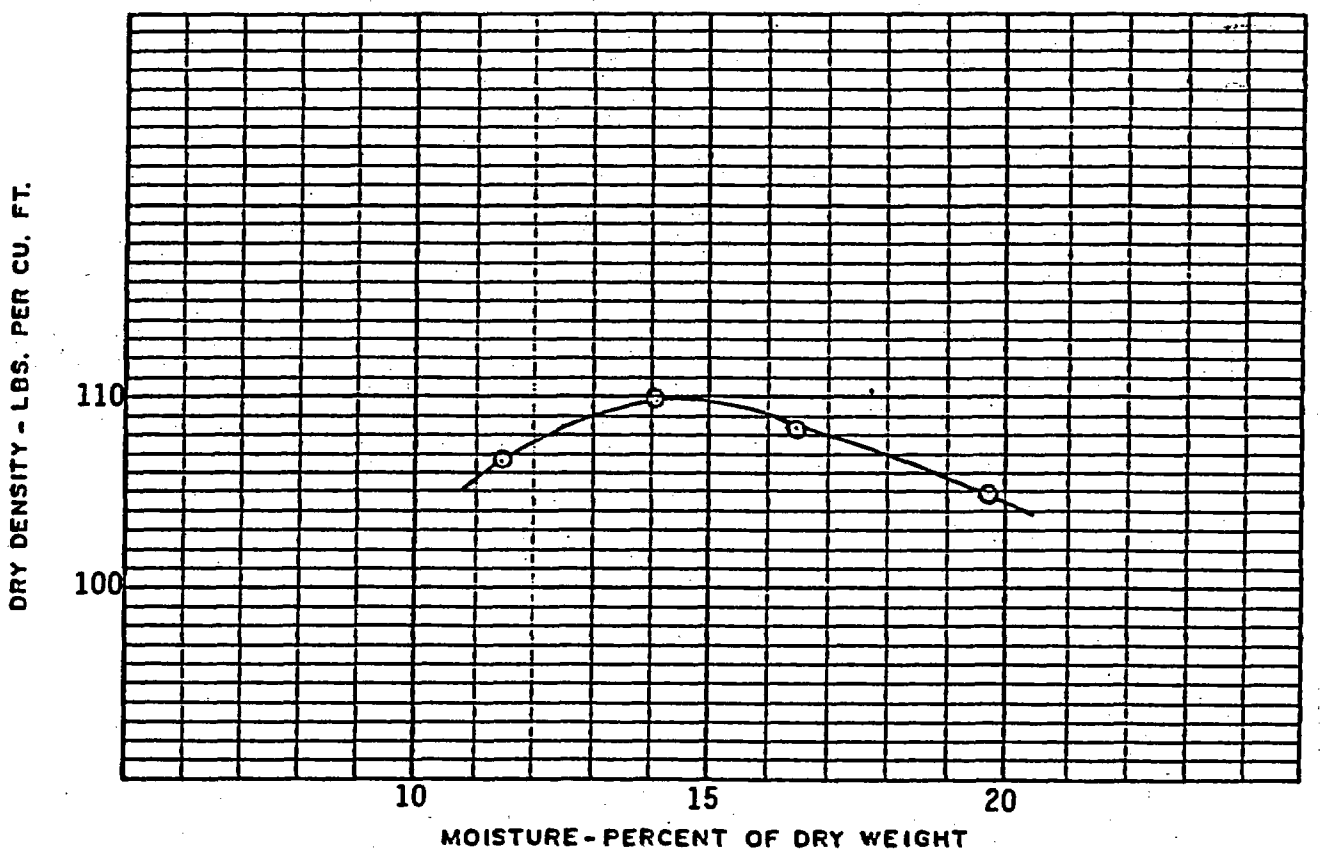


92-4333	Chen Northern, Inc.	DIRECT SHEAR TEST RESULTS	Fig. A-6



GRAVEL 0% SAND 18 % SILT AND CLAY 82 %

LIQUID LIMIT 36 % PLASTICITY INDEX 20 %



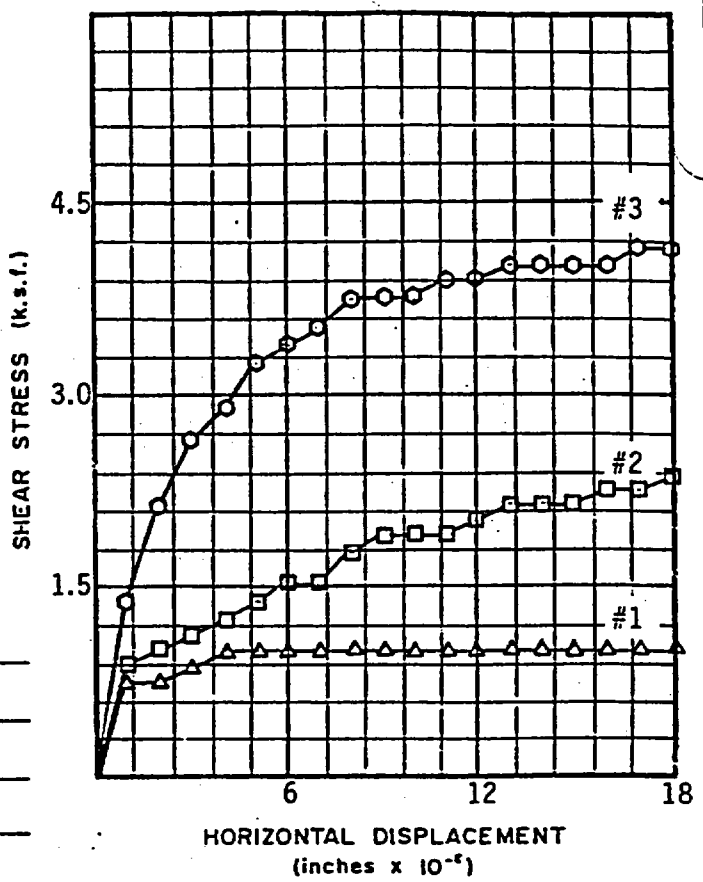
COMPACTION TEST PROCEDURE ASTM D698, Method "A"

MAX. DRY DENSITY (p.c.f.) 109.9 OPTIMUM MOIST. CONT. (%) 14.3

SAMPLE OF Sandy Lean Clay FROM Boring HP-4 at depth 0.0' to 14.5'

92-4333	Chen Northern, Inc.	GRADATION AND COMPACTION TEST RESULTS	Fig. A-7

TEST NUMBER	1	2	3
FROM	Boring HP-4 at Depth 0.0' to 14.5'		
HEIGHT (inch)	1.00	1.00	1.00
DIAMETER (inch)	1.94	1.94	1.94
MOISTURE CONTENT (%)	14.1	14.1	14.1
DRY DENSITY (p.c.f.)	104.8	104.5	104.7
CONSOL. LOAD (k.s.f.)	1.0	3.0	5.0
NORMAL LOAD (k.s.f.)	1.0	3.0	5.0
SHEAR STRESS (k.s.f.)	1.0	2.4	4.1

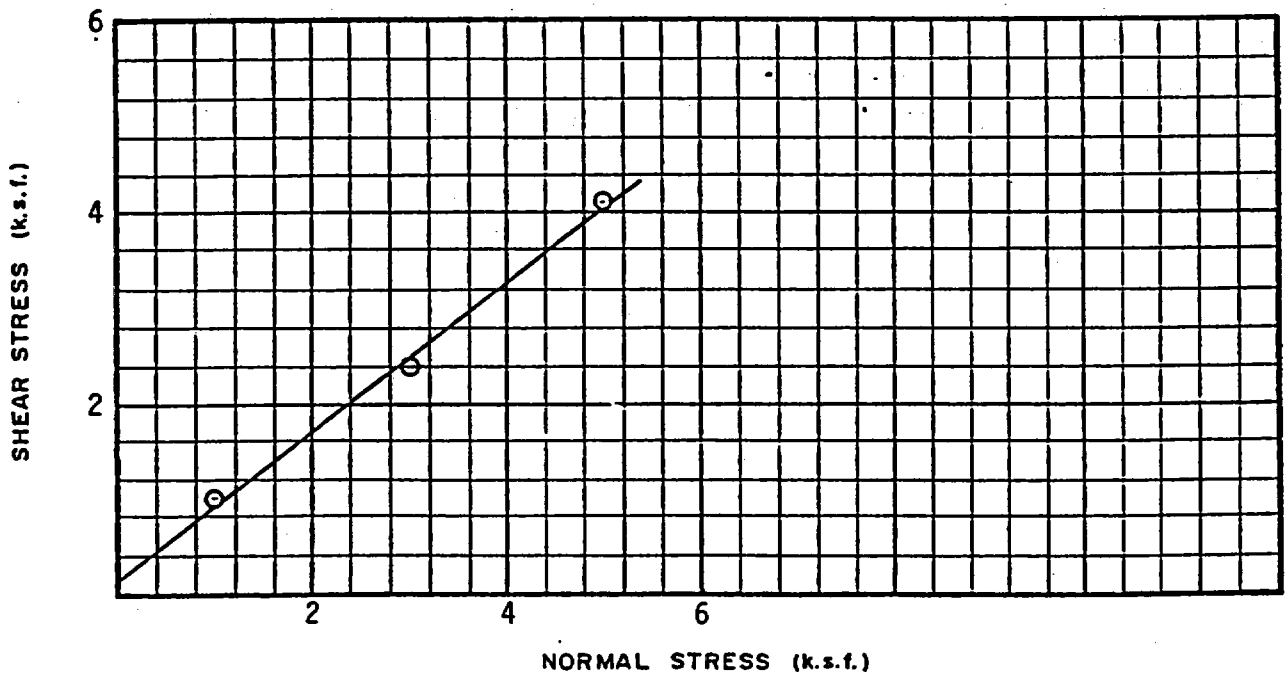


TYPE OF SPECIMEN Remolded

SAMPLE OF Sandy Lean Clay

TYPE OF TEST Consolidated, Drained

TAN ø 0.781 ø 38° COHESION (k.s.f.) 0.2



92-4333	Chen Northern, Inc.	DIRECT SHEAR TEST RESULTS	Fig. A-8

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"LOCATION MAP AND PLAN VIEW, NORTH BUTTE ISL PROJECT EVAPORATION PONDS", SHEET 1 OF 5

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D-05

SECTION 16.12

SPACING OF ORE SAND MONITORING WELLS ADJACENT TO THE NORTH BUTTE INSITU WELL FIELD

FOR:
URANERZ U.S.A., INC.

BY:
HYDRO-ENGINEERING
JANUARY, 1990

GEORGE L. HOFFMAN, P.E.
HYDROLOGIST

Revised Feb. 1, 1990

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1.0 INTRODUCTION

This report presents the recommended ore sand monitor well spacing for the North Butte insitu well field. It is recommended that horizontal excursion monitoring wells be located within the zone in the aquifer where the well field controls the ground-water movement. The zone of control or gradient reversal is created by the bleed rate from the well field. The procedure presented in Hydro-Engineering (1989) that predicts the drawdowns from the bleed rate was used, with an adjustment for the natural ground-water gradient to determine if the well field controls the flow. The well field controls the flow within the zone of ground-water reversal. Recommendations on the selection of monitoring well spacing concludes this report.

2.0 ZONE OF CONTROL FOR MINING UNIT #1

The placement of monitoring wells in the ore sand aquifer needs to be within the zone where the ground-water flow is controlled by the operation of the mining unit. The bleed from the mining unit creates a zone around the mine where the head is lower than outside of this zone. This reversal zone causes ground water in this area to flow to the mining unit and for purposes of this report is called the zone of control. The zone of control is the area of ground-water reversal in the two downgradient sides of the well field and also includes the two upgradient sides. The ground-water flow direction at the North Butte mining unit #1 well field is north 34.5 degrees west. Therefore this site has two upgradient and two downgradient sides. Flow from the upgradient sides of the well field enters the well field area prior to the operation. The bleed rate will only increase the gradient in the two upgradient sides toward the well field. Therefore, the flow on these two sides of the well field is controlled by the well field also. Figure 2-1 of Hydro-Engineering (1989), presents a cross section of the hydraulic gradient adjacent to a well field. The zone of reversal is shown downgradient of the well field where the ground-water is flowing back to the well field. Beyond the zone of reversal the ground-water flow continues downgradient. The zone of control includes the two reversal (downgradient) sides and the two upgradient sides.

The following presents our evaluation of the zone of control around the eastern half of mining unit #1. Only the eastern half

of mining unit #1 was simulated because this area is the initial start-up region. Drawdowns at distances from the mining unit are first estimated by summing the individual drawdowns. The drawdowns are adjusted for the natural ground-water gradient to estimate the changes in the piezometric surface with distance from mining unit #1.

2.1 DRAWDOWN ESTIMATES

The appropriate ground-water flow model for the North Butte site is the Hantush modified leaky model. The Theis (1935), non-leaky confined aquifer model was used in this analysis because the modified Hantush is not available in Walton's (1989) program. The leaky drawdowns would be slightly less than the Theis predictions but the water-level changes should be very similar. The use of a partially penetrating well model is not necessary due to the length of time and distances where the drawdowns are needed. The following procedures are the same as those outlined in Hydro-Engineering (1989).

The WELFLO program presented in Walton (1989) was used to compute drawdowns from the Theis equation. This program has the advantage that it computes drawdowns along grid lines and therefore several lines of drawdowns are developed with one execution.

2.1.1 WELL FIELD SIMULATION

The total production from the recovery wells is slightly higher than the total injection rate. This difference is called

the bleed rate and is planned to be one percent of the total recovery rate for the North Butte site. The bleed rate, not the recovery and injection rates, becomes the important rate with time. The zone of reversal was simulated with only the bleed rate for the eastern half of mining unit #1. Figure 2-1 shows the outer limits (dashed line) of mining unit #1. The eastern half of this area is being simulated by 85 nodes that are 100 feet on each side. The modelled area is shown on Figure 2-1 as a solid line. Average total bleed rate of one percent for the 85 nodes is 0.35 gpm per node for a total recovery rate for this mining unit of 3000 gpm. The total bleed rate of 30 gpm for this simulation is applied uniformly over the well field area but could be applied unevenly if the well field was planned to be operated with a non-uniform bleed.

The drawdown calculations for the example consists of 85 pumping (bleed) sites with drawdowns simulated over a 25 by 23 grid. Table 2-1 presents the list of input parameters that are initially listed with the output from the WELFLO program. The output listing does not list the first three inputs: enter 1 for printer, enter 1 for non leaky condition and enter 1 for fully penetrating wells. Table 2-1 presents the remainder of the input data. Table 2-2 presents the listing of the simulated drawdowns from the program output. The well field bleed locations are presented in Table 2-1 for each of the 85 stresses. The drawdowns west of the southwest corner of the well field are presented in the number 1 I nodes from 13 through 1 J nodes. Figure 2-1 shows the

grid used to calculate the drawdown adjacent to the North Butte mining unit #1.

2.1.2 AQUIFER PROPERTIES

Average aquifer properties (transmissivity and storage coefficient) from the multi-well pump test are found in Volume III of Uranerz (1989). Properties that are thought best representative of the area along the line of drawdowns used for the reversal determination should be used. A transmissivity of 750 gal/day/ft and a storage coefficient of 0.00015 are thought to best represent the B aquifer in this area.

2.2 GRADIENT REVERSAL

The pre-mine hydraulic gradient in the ore sand aquifer is integrated with the drawdown calculations to determine the zone that the bleed has caused the gradient to be towards the well field. This zone is where the gradient has been reversed on the down gradient sides of the well field. Monitoring in the ore sand aquifer is recommended within the zone of control where the bleed controls the flow in the aquifer. The zone of control includes the upgradient sides of the well field because ground-water flow in this area moves to the well field.

A pre-mine gradient of 0.0057 ft/ft means that more than 0.57 feet of additional drawdown is needed in the next closest drawdown node (100 foot spacing) for reversal to exist along drawdown lines that are downgradient to the ground-water flow direction. The ground-water flow direction at the North Butte mining unit #1 is

north 34.5 degrees west. Therefore, the drawdown difference required for lines of drawdown to the north of the well field is 0.47 feet (0.57 x cosine 34.5 degrees). The angle between the lines of drawdowns on the west side of the well field and the flow direction is 55.5 degrees. The drawdown change required for a reversal on the west side is therefore 0.32 (0.57 x cosine 55.5). Figure 2-2 presents the drawdown changes along five lines extending from this well field. The change in drawdown in the two northern lines between 100 foot node points needs to be 0.47 feet for the gradient to be reversed. Therefore, the reversal in this area extends greater than 1200 feet from the northern edge of the well field. The reversal extends a greater distance to the west of the well field because a drawdown change of 0.32 feet is needed in this direction to obtain a ground-water reversal.

The western half of mining unit #1 was not simulated but the zone of reversal will be very similar to the eastern half reversal because the area of withdrawal is very similar and the bleed rate will be the same. Therefore, a zone of reversal of greater than 1200 feet should exist as well field development progresses from the eastern to the western half of mining unit #1.

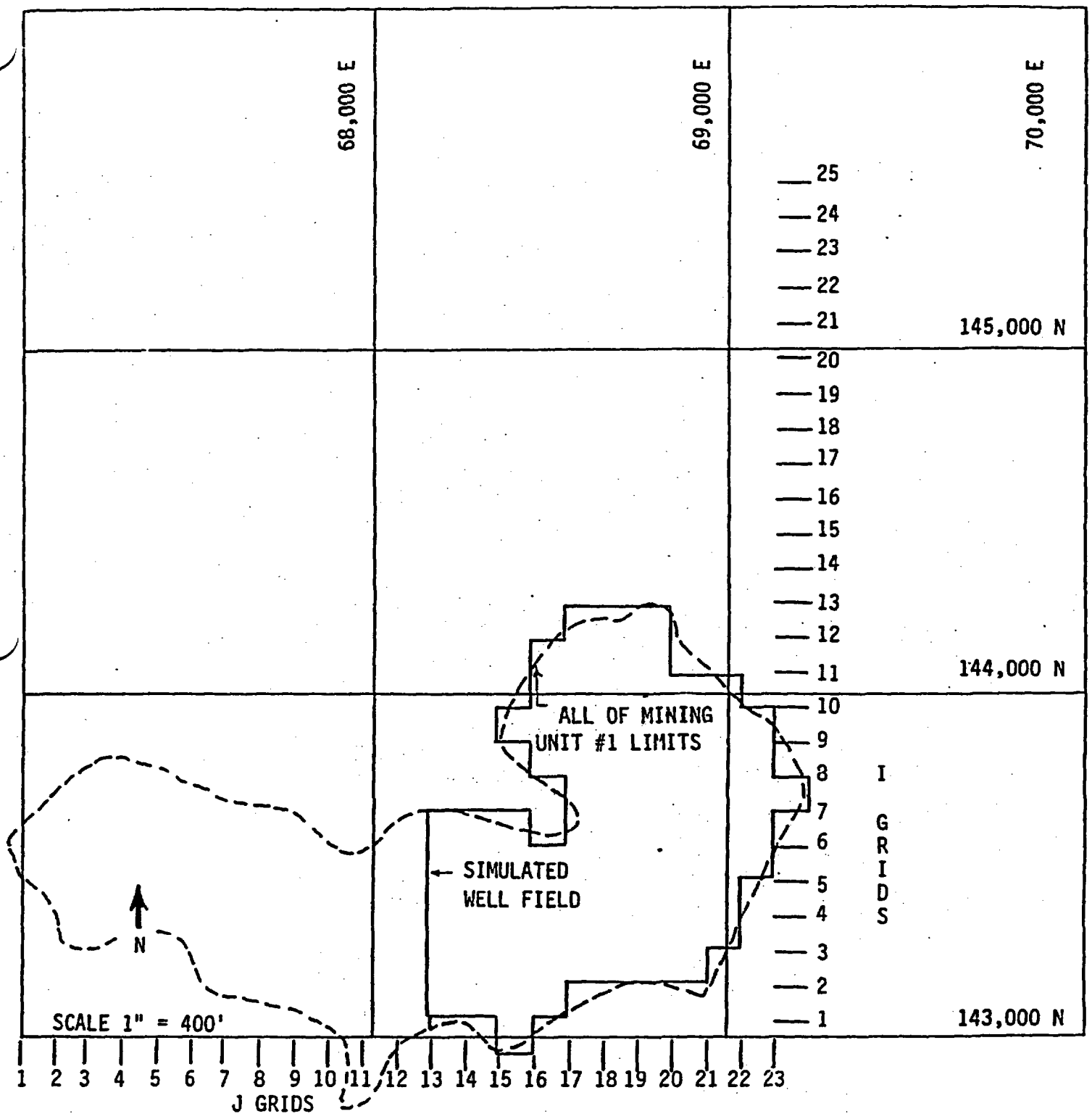

FIGURE 2-1. LOCATION OF WELL FIELD AND SIMULATED DRAWDOWN GRID

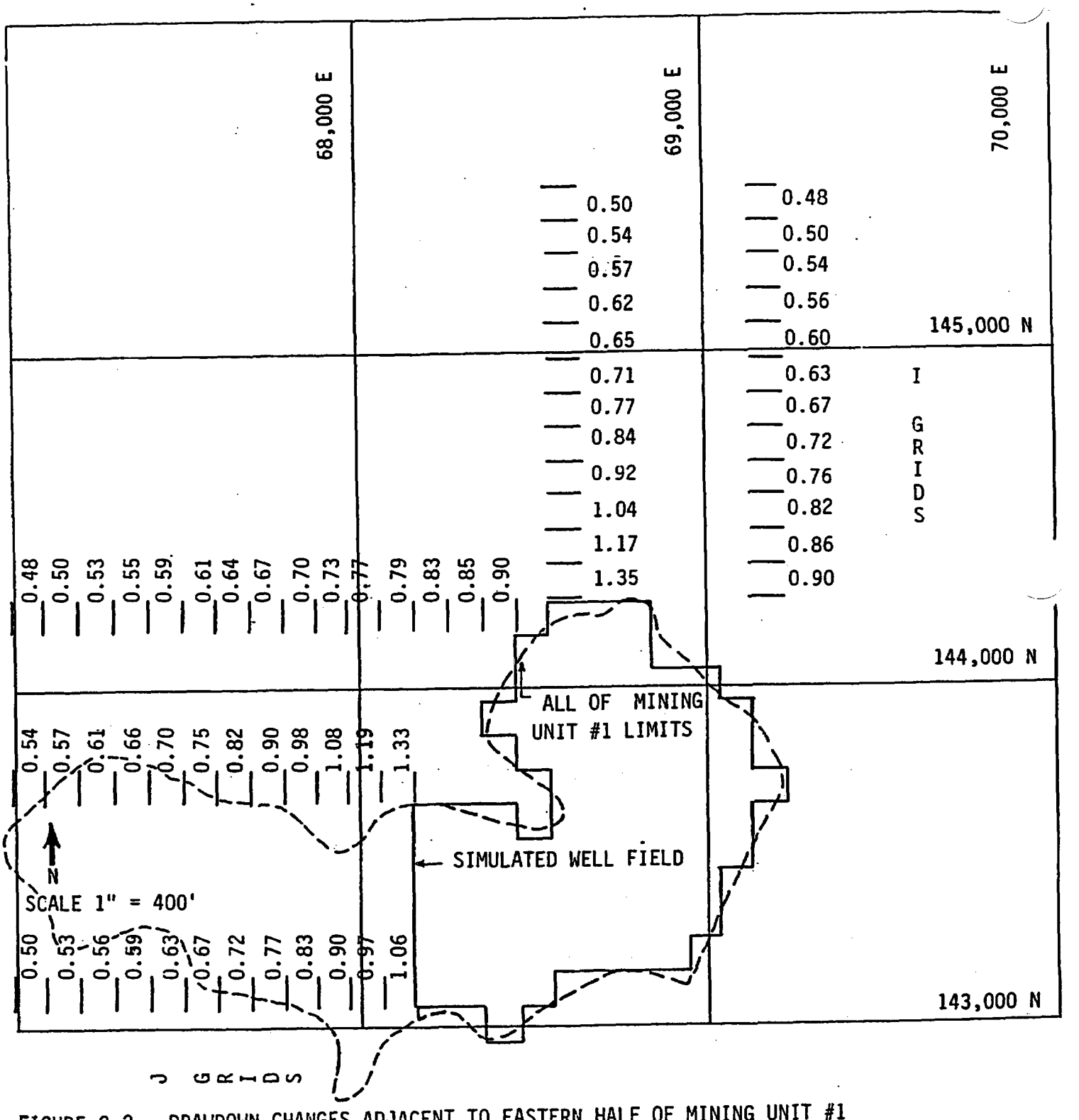

FIGURE 2-2. DRAWDOWN CHANGES ADJACENT TO EASTERN HALF OF MINING UNIT #1

TABLE 2-1. INPUT PARAMETERS FOR THE NORTH BUTTE MINING UNIT #1 SIMULATION

```
DATA INPUT FOR NORTH BUTTE FIRST HALF MINING UNIT 1 30GPM BLEED

GENERAL DATA BASE:

Number of simulation periods for which drawdown
or recovery is to be calculated 1
Simulation period number= 1
Duration of simulation period in days=  365.000

DATA INPUT FOR NORTH BUTTE FIRST HALF MINING UNIT 1 30GPM BLEED

GENERAL DATA BASE:

Number of simulation periods for which drawdown
or recovery is to be calculated 1
Simulation period number= 1
Duration of simulation period in days=  365.000

DATA INPUT FOR NORTH BUTTE FIRST HALF MINING UNIT 1 30GPM BLEED

GENERAL DATA BASE:

Number of simulation periods for which drawdown
or recovery is to be calculated 1
Simulation period number= 1
Duration of simulation period in days=  365.000

DATA INPUT FOR NORTH BUTTE FIRST HALF MINING UNIT 1 30GPM BLEED

GENERAL DATA BASE:

Number of simulation periods for which drawdown
or recovery is to be calculated 1
Simulation period number= 1
Duration of simulation period in days=  365.000
Number of grid columns= 25
Number of grid rows= 23
Grid spacing in ft=   100.00
X-coordinate of upper-left grid node in ft=     0.00
Y-coordinate of upper-left grid node in ft= -1200.00
Simulation period number= 1
Number of production, injection, and image wells
active during simulation period= 85
Well number= 1
X-coordinate of well in ft=   -50.00
Y-coordinate of well in ft=   250.00
Well discharge in gpm=    0.35
Duration of pump operation during simulation period
in days=  365.000
Well radius in ft=  0.50
Simulation period number= 1
Number of production, injection, and image wells
active during simulation period= 85
Well number= 2
X-coordinate of well in ft=    50.00
Y-coordinate of well in ft=    50.00
Well discharge in gpm=    0.35
Duration of pump operation during simulation period
in days=  365.000
Well radius in ft=  0.50
Simulation period number= 1
Number of production, injection, and image wells
active during simulation period= 85
Well number= 3
```

TABLE 2-1. INPUT PARAMETERS FOR THE NORTH BUTTE MINING UNIT #1 SIMULATION (continued)

```
X-coordinate of well in ft=    50.00
Y-coordinate of well in ft=   150.00
Well discharge in gpm=    0.35
Duration of pump operation during simulation period
in days=  365.000
Well radius in ft=  0.50
Simulation period number= 1
Number of production, injection, and image wells
active during simulation period= 85
Well number= 4
X-coordinate of well in ft=    50.00
Y-coordinate of well in ft=   250.00
Well discharge in gpm=    0.35
Duration of pump operation during simulation period
in days=  365.000
Well radius in ft=  0.50
Simulation period number= 1
Number of production, injection, and image wells
active during simulation period= 85
Well number= 5
X-coordinate of well in ft=    50.00
Y-coordinate of well in ft=   350.00
Well discharge in gpm=    0.35
Duration of pump operation during simulation period
in days=  365.000
Well radius in ft=  0.50
Simulation period number= 1
Number of production, injection, and image wells
active during simulation period= 85
Well number= 6
X-coordinate of well in ft=   150.00
Y-coordinate of well in ft=    50.00
Well discharge in gpm=    0.35
Duration of pump operation during simulation period
in days=  365.000
Well radius in ft=  0.50
Simulation period number= 1
Number of production, injection, and image wells
active during simulation period= 85
Well number= 7
X-coordinate of well in ft=   150.00
Y-coordinate of well in ft=   150.00
Well discharge in gpm=    0.35
Duration of pump operation during simulation period
in days=  365.000
Well radius in ft=  0.50
Simulation period number= 1
Number of production, injection, and image wells
active during simulation period= 85
Well number= 8
X-coordinate of well in ft=   150.00
Y-coordinate of well in ft=   250.00
Well discharge in gpm=    0.35
Duration of pump operation during simulation period
in days=  365.000
Well radius in ft=  0.50
Simulation period number= 1
Number of production, injection, and image wells
active during simulation period= 85
Well number= 9
X-coordinate of well in ft=   150.00
Y-coordinate of well in ft=   350.00
Well discharge in gpm=    0.35
Duration of pump operation during simulation period
in days=  365.000
```

(continued)

```
Well radius in ft=  0.50
Simulation period number= 1
Number of production, injection, and image wells
active during simulation period= 85
Well number= 10
X-coordinate of well in ft=   150.00
Y-coordinate of well in ft=   450.00
Well discharge in gpm=    0.35
Duration of pump operation during simulation period
in days=  365.000
Well radius in ft=  0.50
Simulation period number= 1
Number of production, injection, and image wells
active during simulation period= 85
Well number= 11
X-coordinate of well in ft=   150.00
Y-coordinate of well in ft=   550.00
Well discharge in gpm=    0.35
Duration of pump operation during simulation period
in days=  365.000
Well radius in ft=  0.50
Simulation period number= 1
Number of production, injection, and image wells
active during simulation period= 85
Well number= 12
X-coordinate of well in ft=   150.00
Y-coordinate of well in ft=   650.00
Well discharge in gpm=    0.35
Duration of pump operation during simulation period
in days=  365.000
Well radius in ft=  0.50
Simulation period number= 1
Number of production, injection, and image wells
active during simulation period= 85
Well number= 13
X-coordinate of well in ft=   150.00
Y-coordinate of well in ft=   750.00
Well discharge in gpm=    0.35
Duration of pump operation during simulation period
in days=  365.000
Well radius in ft=  0.50
Simulation period number= 1
Number of production, injection, and image wells
active during simulation period= 85
Well number= 14
X-coordinate of well in ft=   250.00
Y-cuordinate of well in ft=    50.00
Well discharge in gpm=    0.35
Duration of pump operation during simulation period
in days=  365.000
Well radius in ft=  0.50
Simulation period number= 1
Number of production, injection, and image wells
active during simulation period= 85
Well number= 15
X-coordinate of well in ft=   250.00
Y-coordinate of well in ft=   150.00
Well discharge in gpm=    0.35
Duration of pump operation during simulation period
in days=  365.000
Well radius in ft=  0.50
Simulation period number= 1
Number of production, injection, and image wells
active during simulation period= 85
Well number= 16
X-coordinate of well in ft=   250.00
Y-coordinate of well in ft=   250.00
```

TABLE 2-1. INPUT PARAMETERS FOR THE NORTH BUTTE MINING UNIT #1 SIMULATION (continued)

```
Well discharge in gpm=    0.35
Duration of pump operation during simulation period
in days=  365.000
Well radius in ft=  0.50
Simulation period number= 1
Number of production, injection, and image wells
active during simulation period= 85
Well number= 17
X-coordinate of well in ft=   250.00
Y-coordinate of well in ft=   350.00
Well discharge in gpm=    0.35
Duration of pump operation during simulation period
in days=  365.000
Well radius in ft=  0.50
Simulation period number= 1
Number of production, injection, and image wells
active during simulation period= 85
Well number= 18
X-coordinate of well in ft=   250.00
Y-coordinate of well in ft=   450.00
Well discharge in gpm=    0.35
Duration of pump operation during simulation period
in days=  365.000
Well radius in ft=  0.50
Simulation period number= 1
Number of production, injection, and image wells
active during simulation period= 85
Well number= 19
X-coordinate of well in ft=   250.00
Y-coordinate of well in ft=   550.00
Well discharge in gpm=    0.35
Duration of pump operation during simulation period
in days=  365.000
Well radius in ft=  0.50
Simulation period number= 1
Number of production, injection, and image wells
active during simulation period= 85
Well number= 20
X-coordinate of well in ft=   250.00
Y-coordinate of well in ft=   650.00
Well discharge in gpm=    0.35
Duration of pump operation during simulation period
in days=  365.000
Well radius in ft=  0.50
Simulation period number= 1
Number of production, injection, and image wells
active during simulation period= 85
Well number= 21
X-coordinate of well in ft=   250.00
Y-coordinate of well in ft=   750.00
Well discharge in gpm=    0.35
Duration of pump operation during simulation period
in days=  365.000
Well radius in ft=  0.50
Simulation period number= 1
Number of production, injection, and image wells
active during simulation period= 85
Well number= 22
X-coordinate of well in ft=   250.00
Y-coordinate of well in ft=   850.00
Well discharge in gpm=    0.35
Duration of pump operation during simulation period
in days=  365.000
Well radius in ft=  0.50
Simulation period number= 1
Number of production, injection, and image wells
active during simulation period= 85
```

TABLE 2-1. INPUT PARAMETERS FOR THE NORTH BUTTE MINING UNIT #1 SIMULATION (continued)

```
Well number= 23
X-coordinate of well in ft=   350.00
Y-coordinate of well in ft=    50.00
Well discharge in gpm=    0.35
Duration of pump operation during simulation period
in days=  365.000
Well radius in ft=  0.50
Simulation period number= 1
Number of production, injection, and image wells
active during simulation period= 85
Well number= 24
X-coordinate of well in ft=   350.00
Y-coordinate of well in ft=   150.00
Well discharge in gpm=    0.35
Duration of pump operation during simulation period
in days=  365.000
Well radius in ft=  0.50
Simulation period number= 1
Number of production, injection, and image wells
active during simulation period= 85
Well number= 25
X-coordinate of well in ft=   350.00
Y-coordinate of well in ft=   250.00
Well discharge in gpm=    0.35
Duration of pump operation during simulation period
in days=  365.000
Well radius in ft=  0.50
Simulation period number= 1
Number of production, injection, and image wells
active during simulation period= 85
Well number= 26
X-coordinate of well in ft=   350.00
Y-coordinate of well in ft=   350.00
Well discharge in gpm=    0.35
Duration of pump operation during simulation period
in days=  365.000
Well radius in ft=  0.50
Simulation period number= 1
Number of production, injection, and image wells
active during simulation period= 85
Well number= 27
X-coordinate of well in ft=   350.00
Y-coordinate of well in ft=   450.00
Well discharge in gpm=    0.35
Duration of pump operation during simulation period
in days=  365.000
Well radius in ft=  0.50
Simulation period number= 1
Number of production, injection, and image wells
active during simulation period= 85
Well number= 28
X-coordinate of well in ft=   350.00
Y-coordinate of well in ft=   550.00
Well discharge in gpm=    0.35
Duration of pump operation during simulation period
in days=  365.000
Well radius in ft=  0.50
Simulation period number= 1
Number of production, injection, and image wells
active during simulation period= 85
Well number= 29
X-coordinate of well in ft=   350.00
Y-coordinate of well in ft=   650.00
Well discharge in gpm=    0.35
Duration of pump operation during simulation period
in days=  365.000
```

TABLE 2-1. INPUT PARAMETERS FOR THE NORTH BUTTE MINING UNIT #1 SIMULATION (continued)

```
Well radius in ft=  0.50
Simulation period number= 1
Number of production, injection, and image wells
active during simulation period= 85
Well number= 30
X-coordinate of well in ft=   350.00
Y-coordinate of well in ft=   750.00
Well discharge in gpm=    0.35
Duration of pump operation during simulation period
in days=  365.000
Well radius in ft=  0.50
Simulation period number= 1
Number of production, injection, and image wells
active during simulation period= 85
Well number= 31
X-coordinate of well in ft=   350.00
Y-coordinate of well in ft=   850.00
Well discharge in gpm=    0.35
Duration of pump operation during simulation period
in days=  365.000
Well radius in ft=  0.50
Simulation period number= 1
Number of production, injection, and image wells
active during simulation period= 85
Well number= 32
X-coordinate of well in ft=   450.00
Y-coordinate of well in ft=    50.00
Well discharge in gpm=    0.35
Duration of pump operation during simulation period
in days=  365.000
Well radius in ft=  0.50
Simulation period number= 1
Number of production, injection, and image wells
active during simulation period= 85
Well number= 33
X-coordinate of well in ft=   450.00
Y-coordinate of well in ft=   150.00
Well discharge in gpm=    0.35
Duration of pump operation during simulation period
in days=  365.000
Well radius in ft=  0.50
Simulation period number= 1
Number of production, injection, and image wells
active during simulation period= 85
Well number= 34
X-coordinate of well in ft=   450.00
Y-coordinate of well in ft=   250.00
Well discharge in gpm=    0.35
Duration of pump operation during simulation period
in days=  365.000
Well radius in ft=  0.50
Simulation period number= 1
Number of production, injection, and image wells
active during simulation period= 85
Well number= 35
X-coordinate of well in ft=   450.00
Y-coordinate of well in ft=   350.00
Well discharge in gpm=    0.35
Duration of pump operation during simulation period
in days=  365.000
Well radius in ft=  0.50
Simulation period number= 1
Number of production, injection, and image wells
active during simulation period= 85
Well number= 36
X-coordinate of well in ft=   450.00
Y-coordinate of well in ft=   450.00
Well discharge in gpm=    0.35
```

TABLE 2-1. INPUT PARAMETERS FOR THE NORTH BUTTE MINING UNIT #1 SIMULATION (continued)

```
Duration of pump operation during simulation period
in days=  365.000
Well radius in ft=  0.50
Simulation period number= 1
Number of production, injection, and image wells
active during simulation period= 85
Well number= 37
X-coordinate of well in ft=   450.00
Y-coordinate of well in ft=   550.00
Well discharge in gpm=    0.35
Duration of pump operation during simulation period
in days=  365.000
Well radius in ft=  0.50
Simulation period number= 1
Number of production, injection, and image wells
active during simulation period= 85
Well number= 38
X-coordinate of well in ft=   450.00
Y-coordinate of well in ft=   650.00
Well discharge in gpm=    0.35
Duration of pump operation during simulation period
in days=  365.000
Well radius in ft=  0.50
Simulation period number= 1
Number of production, injection, and image wells
active during simulation period= 85
Well number= 39
X-coordinate of well in ft=   450.00
Y-coordinate of well in ft=   750.00
Well discharge in gpm=    0.35
Duration of pump operation during simulation period
in days=  365.000
Well radius in ft=  0.50
Simulation period number= 1
Number of production, injection, and image wells
active during simulation period= 85
Well number= 40
X-coordinate of well in ft=   450.00
Y-coordinate of well in ft=   850.00
Well discharge in gpm=    0.35
Duration of pump operation during simulation period
in days=  365.000
Well radius in ft=  0.50
Simulation period number= 1
Number of production, injection, and image wells
active during simulation period= 85
Well number= 41
X-coordinate of well in ft=   450.00
Y-coordinate of well in ft=   950.00
Well discharge in gpm=    0.35
Duration of pump operation during simulation period
in days=  365.000
Well radius in ft=  0.50
Simulation period number= 1
Number of production, injection, and image wells
active during simulation period= 85
Well number= 42
X-coordinate of well in ft=   550.00
Y-coordinate of well in ft=    50.00
Well discharge in gpm=    0.35
Duration of pump operation during simulation period
in days=  365.000
Well radius in ft=  0.50
Simulation period number= 1
Number of production, injection, and image wells
active during simulation period= 85
Well number= 43
```

TABLE 2-1. INPUT PARAMETERS FOR THE NORTH BUTTE MINING UNIT #1 SIMULATION (continued)

```
X-coordinate of well in ft=   550.00
Y-coordinate of well in ft=   150.00
Well discharge in gpm=    0.35
Duration of pump operation during simulation period
in days=  365.000
Well radius in ft=  0.50
Simulation period number= 1
Number of production, injection, and image wells
active during simulation period= 85
Well number= 44
X-coordinate of well in ft=   550.00
Y-coordinate of well in ft=   250.00
Well discharge in gpm=    0.35
Duration of pump operation during simulation period
in days=  365.000
Well radius in ft=  0.50
Simulation period number= 1
Number of production, injection, and image wells
active during simulation period= 85
Well number= 45
X-coordinate of well in ft=   550.00
Y-coordinate of well in ft=   450.00
Well discharge in gpm=    0.35
Duration of pump operation during simulation period
in days=  365.000
Well radius in ft=  0.50
Simulation period number= 1
Number of production, injection, and image wells
active during simulation period= 85
Well number= 46
X-coordinate of well in ft=   550.00
Y-coordinate of well in ft=   550.00
Well discharge in gpm=    0.35
Duration of pump operation during simulation period
in days=  365.000
Well radius in ft=  0.50
Simulation period number= 1
Number of production, injection, and image wells
active during simulation period= 85
Well number= 47
X-coordinate of well in ft=   550.00
Y-coordinate of well in ft=   650.00
Well discharge in gpm=    0.35
Duration of pump operation during simulation period
in days=  365.000
Well radius in ft=  0.50
Simulation period number= 1
Number of production, injection, and image wells
active during simulation period= 85
Well number= 48
X-coordinate of well in ft=   550.00
Y-coordinate of well in ft=   750.00
Well discharge in gpm=    0.35
Duration of pump operation during simulation period
in days=  365.000
Well radius in ft=  0.50
Simulation period number= 1
Number of production, injection, and image wells
active during simulation period= 85
Well number= 49
X-coordinate of well in ft=   550.00
Y-coordinate of well in ft=   850.00
Well discharge in gpm=    0.35
Duration of pump operation during simulation period
in days=  365.000
Well radius in ft=  0.50
Simulation period number= 1
```

TABLE 2-1. INPUT PARAMETERS FOR THE NORTH BUTTE MINING UNIT #1 SIMULATION (continued)

```
Number of production, injection, and image wells
active during simulation period= 85
Well number= 50
X-coordinate of well in ft=   550.00
Y-coordinate of well in ft=   950.00
Well discharge in gpm=    0.35
Duration of pump operation during simulation period
in days=  365.000
Well radius in ft=  0.50
Simulation period number= 1
Number of production, injection, and image wells
active during simulation period= 85
Well number= 51
X-coordinate of well in ft=   650.00
Y-coordinate of well in ft=   450.00
Well discharge in gpm=    0.35
Duration of pump operation during simulation period
in days=  365.000
Well radius in ft=  0.50
Simulation period number= 1
Number of production, injection, and image wells
active during simulation period= 85
Well number= 52
X-coordinate of well in ft=   650.00
Y-coordinate of well in ft=   550.00
Well discharge in gpm=    0.35
Duration of pump operation during simulation period
in days=  365.000
Well radius in ft=  0.50
Simulation period number= 1
Number of production, injection, and image wells
active during simulation period= 85
Well number= 53
X-coordinate of well in ft=   650.00
Y-coordinate of well in ft=   650.00
Well discharge in gpm=    0.35
Duration of pump operation during simulation period
in days=  365.000
Well radius in ft=  0.50
Simulation period number= 1
Number of production, injection, and image wells
active during simulation period= 85
Well number= 54
X-coordinate of well in ft=   650.00
Y-coordinate of well in ft=   750.00
Well discharge in gpm=    0.35
Duration of pump operation during simulation period
in days=  365.000
Well radius in ft=  0.50
Simulation period number= 1
Number of production, injection, and image wells
active during simulation period= 85
Well number= 55
X-coordinate of well in ft=   650.00
Y-coordinate of well in ft=   850.00
Well discharge in gpm=    0.35
Duration of pump operation during simulation period
in days=  365.000
Well radius in ft=  0.50
Simulation period number= 1
Number of production, injection, and image wells
active during simulation period= 85
Well number= 56
X-coordinate of well in ft=   650.00
Y-coordinate of well in ft=   950.00
Well discharge in gpm=    0.35
```

TABLE 2-1. INPUT PARAMETERS FOR THE NORTH BUTTE MINING UNIT #1 SIMULATION (continued)

```
Duration of pump operation during simulation period
in days=  365.000
Well radius in ft=  0.50
Simulation period number= 1
Number of production, injection, and image wells
active during simulation period= 85
Well number= 57
X-coordinate of well in ft=   650.00
Y-coordinate of well in ft=  1050.00
Well discharge in gpm=    0.35
Duration of pump operation during simulation period
in days=  365.000
Well radius in ft=  0.50
Simulation period number= 1
Number of production, injection, and image wells
active during simulation period= 85
Well number= 58
X-coordinate of well in ft=   750.00
Y-coordinate of well in ft=   350.00
Well discharge in gpm=    0.35
Duration of pump operation during simulation period
in days=  365.000
Well radius in ft=  0.50
Simulation period number= 1
Number of production, injection, and image wells
active during simulation period= 85
Well number= 59
X-coordinate of well in ft=   750.00
Y-coordinate of well in ft=   450.00
Well discharge in gpm=    0.35
Duration of pump operation during simulation period
in days=  365.000
Well radius in ft=  0.50
Simulation period number= 1
Number of production, injection, and image wells
active during simulation period= 85
Well number= 60
X-coordinate of well in ft=   750.00
Y-coordinate of well in ft=   550.00
Well discharge in gpm=    0.35
Duration of pump operation during simulation period
in days=  365.000
Well radius in ft=  0.50
Simulation period number= 1
Number of production, injection, and image wells
active during simulation period= 85
Well number= 61
X-coordinate of well in ft=   750.00
Y-coordinate of well in ft=   650.00
Well discharge in gpm=    0.35
Duration of pump operation during simulation period
in days=  365.000
Well radius in ft=  0.50
Simulation period number= 1
Number of production, injection, and image wells
active during simulation period= 85
Well number= 62
X-coordinate of well in ft=   750.00
Y-coordinate of well in ft=   750.00
Well discharge in gpm=    0.35
Duration of pump operation during simulation period
in days=  365.000
Well radius in ft=  0.50
Simulation period number= 1
Number of production, injection, and image wells
active during simulation period= 85
```

TABLE 2-1. INPUT PARAMETERS FOR THE NORTH BUTTE MINING UNIT #1 SIMULATION (continued)

```
Well number= 63
X-coordinate of well in ft=   750.00
Y-coordinate of well in ft=   850.00
Well discharge in gpm=    0.35
Duration of pump operation during simulation period
in days=  365.000
Well radius in ft=  0.50
Simulation period number= 1
Number of production, injection, and image wells
active during simulation period= 85
Well number= 64
X-coordinate of well in ft=   750.00
Y-coordinate of well in ft=   950.00
Well discharge in gpm=    0.35
Duration of pump operation during simulation period
in days=  365.000
Well radius in ft=  0.50
Simulation period number= 1
Number of production, injection, and image wells
active during simulation period= 85
Well number= 65
X-coordinate of well in ft=   850.00
Y-coordinate of well in ft=   250.00
Well discharge in gpm=    0.35
Duration of pump operation during simulation period
in days=  365.000
Well radius in ft=  0.50
Simulation period number= 1
Number of production, injection, and image wells
active during simulation period= 85
Well number= 66
X-coordinate of well in ft=   850.00
Y-coordinate of well in ft=   350.00
Well discharge in gpm=    0.35
Duration of pump operation during simulation period
in days=  365.000
Well radius in ft=  0.50
Simulation period number= 1
Number of production, injection, and image wells
active during simulation period= 85
Well number= 67
X-coordinate of well in ft=   850.00
Y-coordinate of well in ft=   450.00
Well discharge in gpm=    0.35
Duration of pump operation during simulation period
in days=  365.000
Well radius in ft=  0.50
Simulation period number= 1
Number of production, injection, and image wells
active during simulation period= 85
Well number= 68
X-coordinate of well in ft=   850.00
Y-coordinate of well in ft=   550.00
Well discharge in gpm=    0.35
Duration of pump operation during simulation period
in days=  365.000
Well radius in ft=  0.50
Simulation period number= 1
Number of production, injection, and image wells
active during simulation period= 85
Well number= 69
X-coordinate of well in ft=   850.00
Y-coordinate of well in ft=   650.00
Well discharge in gpm=    0.35
Duration of pump operation during simulation period
in days=  365.000
```

TABLE 2-1. INPUT PARAMETERS FOR THE NORTH BUTTE MINING UNIT #1 SIMULATION (continued)

```
Well radius in ft=  0.50
Simulation period number= 1
Number of production, injection, and image wells
active during simulation period= 85
Well number= 70
X-coordinate of well in ft=   850.00
Y-coordinate of well in ft=   750.00
Well discharge in gpm=    0.35
Duration of pump operation during simulation period
in days=  365.000
Well radius in ft=  0.50
Simulation period number= 1
Number of production, injection, and image wells
active during simulation period= 85
Well number= 71
X-coordinate of well in ft=   850.00
Y-coordinate of well in ft=   850.00
Well discharge in gpm=    0.35
Duration of pump operation during simulation period
in days=  365.000
Well radius in ft=  0.50
Simulation period number= 1
Number of production, injection, and image wells
active during simulation period= 85
Well number= 72
X-coordinate of well in ft=   850.00
Y-coordinate of well in ft=   950.00
Well discharge in gpm=    0.35
Duration of pump operation during simulation period
in days=  365.000
Well radius in ft=  0.50
Simulation period number= 1
Number of production, injection, and image wells
active during simulation period= 85
Well number= 73
X-coordinate of well in ft=   950.00
Y-coordinate of well in ft=   350.00
Well discharge in gpm=    0.35
Duration of pump operation during simulation period
in days=  365.000
Well radius in ft=  0.50
Simulation period number= 1
Number of production, injection, and image wells
active during simulation period= 85
Well number= 74
X-coordinate of well in ft=   950.00
Y-coordinate of well in ft=   450.00
Well discharge in gpm=    0.35
Duration of pump operation during simulation period
in days=  365.000
Well radius in ft=  0.50
Simulation period number= 1
Number of production, injection, and image wells
active during simulation period= 85
Well number= 75
X-coordinate of well in ft=   950.00
Y-coordinate of well in ft=   550.00
Well discharge in gpm=    0.35
Duration of pump operation during simulation period
in days=  365.000
Well radius in ft=  0.50
Simulation period number= 1
Number of production, injection, and image wells
active during simulation period= 85
Well number= 76
```

TABLE 2-1. INPUT PARAMETERS FOR THE NORTH BUTTE MINING UNIT #1 SIMULATION (continued)

```
X-coordinate of well in ft=   950.00
Y-coordinate of well in ft=   650.00
Well discharge in gpm=    0.35
Duration of pump operation during simulation period
in days=  365.000
Well radius in ft=  0.50
Simulation period number= 1
Number of production, injection, and image wells
active during simulation period= 85
Well number= 77
X-coordinate of well in ft=   950.00
Y-coordinate of well in ft=   750.00
Well discharge in gpm=    0.35
Duration of pump operation during simulation period
in days=  365.000
Well radius in ft=  0.50
Simulation period number= 1
Number of production, injection, and image wells
active during simulation period= 85
Well number= 78
X-coordinate of well in ft=   950.00
Y-coordinate of well in ft=   850.00
Well discharge in gpm=    0.35
Duration of pump operation during simulation period
in days=  365.000
Well radius in ft=  0.50
Simulation period number= 1
Number of production, injection, and image wells
active during simulation period= 85
Well number= 79
X-coordinate of well in ft=  1050.00
Y-coordinate of well in ft=   350.00
Well discharge in gpm=    0.35
Duration of pump operation during simulation period
in days=  365.000
Well radius in ft=  0.50
Simulation period number= 1
Number of production, injection, and image wells
active during simulation period= 85
Well number= 80
X-coordinate of well in ft=  1050.00
Y-coordinate of well in ft=   450.00
Well discharge in gpm=    0.35
Duration of pump operation during simulation period
in days=  365.000
Well radius in ft=  0.50
Simulation period number= 1
Number of production, injection, and image wells
active during simulation period= 85
Well number= 81
X-coordinate of well in ft=  1050.00
Y-coordinate of well in ft=   550.00
Well discharge in gpm=    0.35
Duration of pump operation during simulation period
in days=  365.000
Well radius in ft=  0.50
Simulation period number= 1
Number of production, injection, and image wells
active during simulation period= 85
Well number= 82
X-coordinate of well in ft=  1050.00
Y-coordinate of well in ft=   650.00
Well discharge in gpm=    0.35
Duration of pump operation during simulation period
in days=  365.000
Well radius in ft=  0.50
Simulation period number= 1
```

TABLE 2-1. INPUT PARAMETERS FOR THE NORTH BUTTE MINING UNIT #1 SIMULATION (continued)

```
Number of production, injection, and image wells
active during simulation period= 85
Well number= 83
X-coordinate of well in ft=  1150.00
Y-coordinate of well in ft=   450.00
Well discharge in gpm=    0.35
Duration of pump operation during simulation period
in days=  365.000
Well radius in ft=  0.50
Simulation period number= 1
Number of production, injection, and image wells
active during simulation period= 85
Well number= 84
X-coordinate of well in ft=  1150.00
Y-coordinate of well in ft=   550.00
Well discharge in gpm=    0.35
Duration of pump operation during simulation period
in days=  365.000
Well radius in ft=  0.50
Simulation period number= 1
Number of production, injection, and image wells
active during simulation period= 85
Well number= 85
X-coordinate of well in ft=  1150.00
Y-coordinate of well in ft=   650.00
Well discharge in gpm=    0.35
Duration of pump operation during simulation period
in days=  365.000
Well radius in ft=  0.50
Number of observation wells for which time-
drawdown tables are desired 0
Aquifer transmissivity in gpd/ft=     750.00
Aquifer storativity as a decimal= 0.000150
```

TABLE 2-2. DRAWDOWN CHANGES ADJACENT TO NORTH BUTTE MINING UNIT #1

'ODAL COMPUTATION RESULTS:

ULATION PERIOD DURATION IN DAYS: 365.000

'ALUES OF DRAWDOWN OR RECOVERY (FT) AT NODES:

-ROW	I-COLUMN 1	2	3	4	5	6	7	8	9	10
1	23.55	23.68	23.78	23.86	23.91	23.92	23.91	23.87	23.79	23.70
2	24.05	24.20	24.31	24.40	24.45	24.46	24.45	24.40	24.32	24.21
3	24.58	24.74	24.87	24.97	25.02	25.04	25.02	24.97	24.87	24.75
4	25.14	25.32	25.47	25.57	25.64	25.66	25.63	25.57	25.46	25.32
5	25.73	25.94	26.10	26.22	26.29	26.32	26.29	26.21	26.09	25.92
6	26.36	26.60	26.79	26.92	27.00	27.02	26.99	26.90	26.75	26.57
7	27.03	27.31	27.53	27.68	27.77	27.79	27.74	27.63	27.47	27.25
8	27.75	28.07	28.33	28.51	28.61	28.62	28.56	28.43	28.23	27.97
9	28.52	28.90	29.20	29.41	29.53	29.54	29.46	29.29	29.05	28.74
10	29.35	29.81	30.17	30.42	30.55	30.55	30.44	30.22	29.93	29.57
11	30.25	30.81	31.26	31.55	31.70	31.68	31.52	31.24	30.87	30.44
12	31.22	31.93	32.49	32.85	33.00	32.95	32.71	32.34	31.88	31.37
13	32.28	33.22	33.91	34.34	34.52	34.42	34.04	33.50	32.95	32.36
14	33.26	34.42	35.25	35.76	35.97	35.84	35.34	34.69	34.08	33.40
15	34.03	35.28	36.21	36.81	37.07	36.96	36.46	35.83	35.27	34.55
16	34.43	35.79	36.83	37.53	37.85	37.77	37.37	36.92	36.45	35.72
17	34.45	35.92	37.13	37.94	38.37	38.40	38.17	37.85	37.38	36.63
18	34.29	35.80	37.14	38.06	38.60	38.80	38.72	38.42	37.90	37.12
19	34.01	35.51	36.89	37.87	38.50	38.79	38.80	38.53	38.00	37.20
0	33.57	35.00	36.35	37.36	38.04	38.41	38.47	38.23	37.70	36.86
1	32.96	34.22	35.48	36.51	37.23	37.65	37.76	37.55	37.02	36.17
22	32.23	33.28	34.34	35.29	36.04	36.53	36.69	36.50	35.99	35.13
23	31.45	32.32	33.16	33.93	34.59	35.07	35.27	35.12	34.61	33.85

-ROW	I-COLUMN 11	12	13	14	15	16	17	18	19	20
1	23.57	23.43	23.26	23.07	22.87	22.65	22.43	22.19	21.94	21.69
2	24.07	23.91	23.72	23.52	23.30	23.06	22.81	22.55	22.29	22.02
3	24.59	24.41	24.21	23.98	23.73	23.48	23.21	22.93	22.64	22.35
4	25.15	24.94	24.71	24.46	24.19	23.90	23.61	23.30	22.99	22.68
5	25.73	25.49	25.24	24.96	24.66	24.34	24.02	23.69	23.35	23.02
6	26.34	26.08	25.79	25.47	25.14	24.79	24.44	24.08	23.71	23.35
7	26.98	26.69	26.36	26.01	25.64	25.25	24.86	24.47	24.08	23.68
8	27.67	27.33	26.95	26.56	26.14	25.72	25.29	24.86	24.44	24.01
9	28.39	28.00	27.57	27.13	26.66	26.19	25.72	25.25	24.79	24.34
10	29.15	28.70	28.22	27.71	27.19	26.67	26.15	25.64	25.14	24.65
11	29.96	29.43	28.88	28.30	27.72	27.14	26.57	26.01	25.47	24.95
12	30.81	30.20	29.56	28.91	28.25	27.61	26.98	26.37	25.79	25.23
13	31.70	30.99	30.25	29.51	28.77	28.05	27.36	26.71	26.08	25.48
14	32.64	31.82	30.96	30.10	29.27	28.47	27.72	27.01	26.34	25.71
15	33.65	32.67	31.66	30.67	29.73	28.85	28.03	27.27	26.56	25.90
16	34.72	33.57	32.34	31.19	30.13	29.16	28.28	27.48	26.74	26.05
17	35.63	34.37	32.95	31.60	30.43	29.39	28.47	27.63	26.86	26.15
18	36.10	34.83	33.32	31.84	30.59	29.52	28.56	27.70	26.92	26.20
19	36.13	34.84	33.33	31.84	30.60	29.52	28.56	27.70	26.92	26.20
0	35.71	34.37	32.97	31.62	30.44	29.40	28.47	27.62	26.85	26.14
1	34.97	33.64	32.39	31.22	30.15	29.17	28.29	27.47	26.73	26.04
22	34.00	32.84	31.75	30.72	29.75	28.86	28.03	27.26	26.55	25.88
23	32.92	31.98	31.05	30.15	29.29	28.47	27.71	26.99	26.32	25.69

TABLE 2-2. DRAWDOWN CHANGES ADJACENT TO NORTH BUTTE MINING UNIT #1

J-ROW	I-COLUMN 21	22	23	24	25	26	27	28	29	30
1	21.44	21.18	20.92	20.66	20.39					
2	21.74	21.47	21.19	20.91	20.64					
3	22.05	21.76	21.47	21.17	20.88					
4	22.37	22.05	21.74	21.43	21.12					
5	22.68	22.34	22.01	21.68	21.36					
6	22.99	22.63	22.28	21.93	21.59					
7	23.30	22.91	22.54	22.17	21.81					
8	23.60	23.19	22.79	22.40	22.02					
9	23.89	23.46	23.04	22.63	22.23					
10	24.17	23.71	23.27	22.84	22.42					
11	24.44	23.95	23.49	23.04	22.60					
12	24.69	24.18	23.69	23.22	22.77					
13	24.92	24.38	23.86	23.38	22.91					
14	25.11	24.55	24.02	23.51	23.03					
15	25.28	24.70	24.15	23.63	23.14					
16	25.41	24.81	24.25	23.72	23.21					
17	25.50	24.88	24.31	23.77	23.27					
18	25.54	24.92	24.34	23.80	23.29					
19	25.54	24.92	24.34	23.80	23.29					
20	25.49	24.88	24.30	23.77	23.26					
21	25.40	24.80	24.23	23.70	23.20					
22	25.26	24.68	24.13	23.61	23.12					
23	25.09	24.53	23.99	23.49	23.01					

3.0 RECOMMENDED SPACING FOR THE NORTH BUTTE WELL FIELD

Horizontal excursion monitoring wells are recommended to be placed within the area where the well field controls the groundwater flow (zone of control). The spacing of the monitoring wells from the North Butte mining unit #1 well field could be near 1200 feet in all directions of the well field and still be within the zone of control. A recommended spacing of approximately 400 feet on all sides places the monitoring wells significantly inside the reversal zone. This spacing is close enough for early detection of excursions and well within the zone of control.

This analysis shows that horizontal containment is going to be easier on the west side than the north side. Containment will also be even easier on the east and south sides (upgradient) due to the aid of the natural gradient. Recommendation for spacing between monitoring wells is based on the areas most likely to have an excursion. Figure 3-1 shows the recommended spacing and the limits of the spacing on each side of the well field depending on the flow direction. A spacing between monitoring wells of 400 feet is recommended on the north and northwest downgradient sides of the well field. Spacing on the north side of the well field which has an angle of 34.5 degrees is recommended to be 600 feet. Spacing between monitoring wells on the northeast side of the well field is recommended to be 600 feet. Spacing between monitoring wells on the upgradient sides of the well field is recommended to be 1000 feet. These recommended spacings between monitoring wells are

based on the fact that certain sides of the well field are much less likely to have an excursion as can be seen by the simulation of gradients.

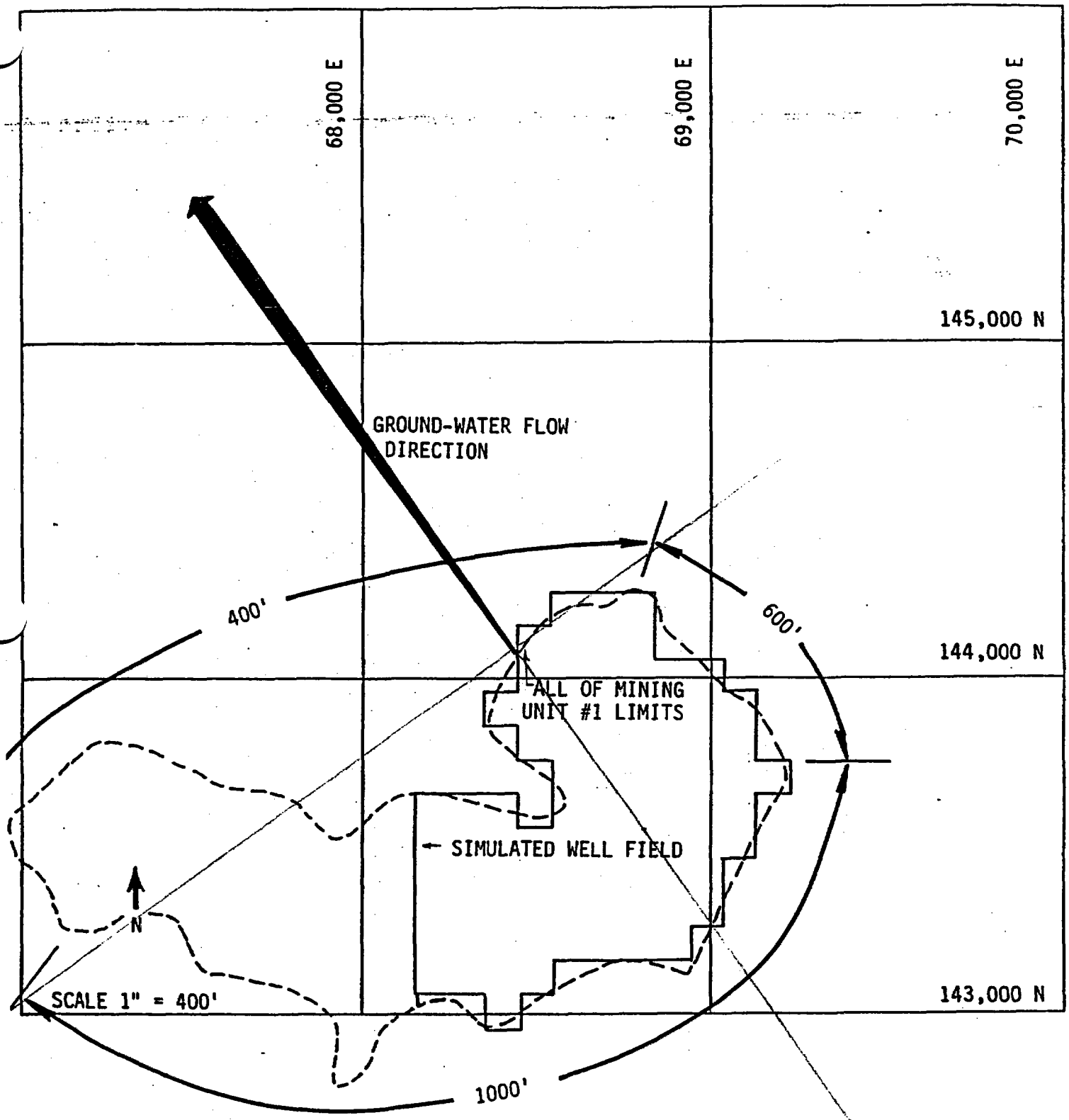

FIGURE 3-1. RECOMMENDED SPACING BETWEEN MONITORING WELLS FOR NORTH BUTTE MINING UNIT #1

4.0 EXCURSION RETRIEVAL

The well field simulated in section 2 was re-simulated at an increased bleed rate of 45 gpm (1.5 percent) and 60 gpm (2 percent). The additional one-half and one percent increase in the bleed rates were simulated to occur in the west six nodes. Wells 2, 6, 14, 23, 32 and 42 in Table 2-1 were the six bleed rates to be increased to 2.85 and 5.35 gpm for the two simulations. The following changes in drawdowns were predicted from the two simulations:

CHANGES IN DRAWDOWNS WEST OF NORTH BUTTE (FT)

	1.5% BLEED		2% BLEED	
	TIME (DAYS)		TIME (DAYS)	
DISTANCE FROM WELL FIELD (FT)	20	60	20	60
1150	0.88	.90	1.24	1.28
1050	0.94	0.97	1.34	1.37
950	1.02	1.04	1.46	1.48
850	1.11	1.13	1.60	1.63
750	1.23	1.24	1.76	1.78
650	1.35	1.37	1.96	1.99
550	1.51	1.53	2.22	2.24
450	1.72	1.73	2.54	2.56
350	1.97	1.99	2.96	2.97
250	2.33	2.34	3.53	3.54
150	2.79	2.79	4.30	4.31
50	3.37	3.38	5.25	5.26

A correction of 0.32 ft. per 100 feet for the gradient is needed to obtain the change in head between two 100 foot nodes. Therefore the predicted gradients toward the well field at the proposed monitoring well location (400 feet) after 20 and 60 days of increased rate are .015 and 0.015 ft/ft for the 1.5 percent bleed rate. The two percent bleed rate produced gradients of 0.024 and 0.024 ft/ft at the monitoring well proposed location. This analysis shows that one simulation would be adequate instead of the simulations for 20 and 60 days. The average ground-water movement rates back to the well field are estimated to be 0.15 ft/day and 0.24 ft/day for the 1.5 and two percent bleeds respectively (based on permeability of 1 ft/day and effective porosity of 0.1). These movement rates will require travel times of 67 and 42 days, respectively for the water to move ten feet back to the well field. The excursion is "controlled" at the beginning of the period because contaminated water is moving back toward the well field. The well on excursion status will most likely be off excursion prior to the end of the above stated periods due to the hydro-chemical nature of an excursion.

5.0 REFERENCES

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POWER RESOURCES INC NORTH BUTTE URANIUM PROJECT
SURETY ESTIMATE
FIRST YEAR OF OPERATION

Total Restoration and Reclamation Cost Estimate		
I.	GROUNDWATER RESTORATION COST	$2,429,505
II.	EQUIPMENT REMOVAL & DISPOSAL COST	$107,631
III.	BUILDING DEMOLITION AND DISPOSAL COST	$633,819
IV.	WELLFIELD BUILDINGS & EQUIPMENT REMOVAL & DISPOSAL COST	$69,298
V.	WELL ABANDONMENT COST	$136,699
VII.	TOTAL MISCELLANEOUS RECLAMATION COST	$112,920
	SUBTOTAL RECLAMATION AND RESTORATION COST ESTIMATE	$3,489,872
	CPI ESCALATOR- July 1,1998 to Feb. 28, 2005 (17.5%)	$610,728
	SUBTOTAL	$4,100,600
	ADMINISTRATIVE, OVERHEAD, AND CONTINGENCY ITEMS (25%)	$1,025,150
	TOTAL	$5,125,750
	TOTAL CALCULATED SURETY (IN 2004 DOLLARS)	$5,125,800

POWER RESOURCES INC NORTH BUTTE URANIUM PROJECT
SURETY ESTIMATE
FIRST YEAR OF OPERATION

Ground Water Restoration	Mine Unit-1
PV Assumptions	
Wellfield Area (ft2)	1,050,576
Wellfield Area (acres)	24.1
Affected Ore Zone Area (ft2)	1,050,576
Avg. Completed Thickness	17
Porosity	0.27
Flare Factor	1.5
Affected Volume (ft3)	26,789,688
Kgallons per Pore Volume	54,104
Number of Patterns in Unit(s)	
Current	101
Estimated next report period	0
Total Estimated	101
Number of Wells in Unit(s)	
Production Wells	
Current	101
Estimated next report period	0
Total Estimated	101
Injection Wells	
Current	175
Estimated next report period	0
Total Estimated	175
Monitoring Wells	
Current	38
Estimated next report period	0
Total Estimated	38
Number of Wells per Wellfield	314
Total Number of Wells	
Average Well Depth (ft)	750
I. Ground Water Sweep Costs	
PV's Required	1
Total Kgals for Treatment	54,104
Ground Water Sweep Unit Cost ($/Kgal)	$0.57
Total Ground Water Sweep Costs	$30,995
II. Reverse Osmosis Costs	
PV's Required	5
Total Kgals for Treatment	270,522
Reverse Osmosis Unit Cost ($/Kgal)	$1.26
Total Reverse Osmosis Costs	$341,345
III. Chemical Reductant Costs	
Total Kgals for Treatment (2 Pore Volumes)	108209
Chemical Reductant Unit Cost ($/Kgal)	$0.29
Total Chemical Reductant Costs	$31,381
IV. Elution Costs	
A. Elution Processing Costs	
Kgals/Elution Required	35,000
Number of Elutions	9
Processing Unit Cost ($/Elution)	$525
Subtotal Processing Costs	$4,725
B. Deep Well Injection Costs	
Deep Well Injection Volume (Kgals/Elution)	12
Total Kgals for Injection	108
Deep Well Injection Unit Cost ($/Kgals)	$1.39
Subtotal Deep Well Injection Costs	$150
Total Elution Costs	$4,875

POWER RESOURCES INC NORTH BUTTE URANIUM PROJECT
SURETY ESTIMATE
FIRST YEAR OF OPERATION

Ground Water Restoration									**Mine Unit-1**
V.	**Monitoring and Sampling Costs**								
	A.	**Active Restoration Period**							
		Estimated Restoration Period (Years)							**5**
		1.	**UCL Sampling**						
				# of Wells					**36**
				$/sample					**$20**
				Samples/Year					**6**
		Sub-total Restoration Analyses							**$21,600**
	B.	**Stability Period**							
		Estimated Stabilization Period (Years)							**1**
		1.	**Full Suite Analyses**						
				# of Wells					**10**
				Samples/Year					**3**
				$/sample					**$150**
		2.	**Short List Analyses**						
				# of Wells					**10**
				Samples/Year					**9**
				$/sample					**$34**
		Sub-total Stability Analyses							**$7,560**
	Total Monitoring and Sampling Costs								**$29,160**
VI.	**Mechanical Integrity Test (MIT) Costs**								
		Five Year MIT Unit Cost ($/well)							**$71**
		Number of Wells (30% of Inj. and Rest. Wells)							**53**
	Total Mechanical Integrity Testing Cost								**$3,728**
TOTAL WELLFIELD RESTORATION COST									**$441,484**
VII.	**Building Utility Costs**								**Central Plant**
		Electricity ($/Month)							**$8,500**
		Natural Gas ($/Month)							**$2,500**
		Number of Months							**48**
	Total Building Utility Costs								**$528,000**
XI.	**Vehicle Operation Costs**								
		Number of Pickup Trucks/Pulling Units (Gas)							**5**
		Unit Cost in $/hr (WDEQ Guideline No.12, Table D-1)							**$10.13**
		Unit Cost in $/hr (July 1998 dollars w/o escalator)							**$8.80**
		Average Operating Time (Hrs/Year)							**1000**
		Total Number of Years (Average)							**4**
	Total Vehicle Operation Costs								**$176,021**
XII.	**Labor Costs**								
		Number of Environmental Managers/RSOs							**1**
		$/Year							**$60,000**
		Number of Restoration Managers							**1**
		$/Year							**$50,000**
		Number of Environmental Technicians							**1**
		$/Year							**$28,000**
		Number of Operators/Laborers							**4**
		$/Year							**$28,000**
		Number of Maintenance Technicians							**2**
		$/Year							**$28,000**
		Number of Years							**4**
	Total Labor Costs								**$1,224,000**
XIII.	**Capital Costs**								
		Purchase RO Unit (800 gpm Unit)							**$60,000**
	Total Capital Costs								**$60,000**
TOTAL GROUND WATER RESTORATION COSTS									**$2,429,505**

POWER RESOURCES INC NORTH BUTTE URANIUM PROJECT
SURETY ESTIMATE
FIRST YEAR OF OPERATION

Equipment Removal and Loading	CPP Ion Ex. Plant	Central Plant	Dryer Building
I. Removal and Loading Costs			
A. Tankage			
Number of Tanks	13	51	0
Volume of Tank Construction Material (ft^3)	835	1340	300
1. Labor			
Number of Persons	3	3	3
Ft^3/Day	25	25	25
Number of Days	33	54	12
$/Day/Person	$112	$112	$112
Subtotal Labor Costs	$11,228	$18,010	$4,032
2. Equipment			
Number of Days	33	54	12
$/Day	$338	$338	$338
Subtotal Equipment Costs	$11,295	$18,117	$4,056
Subtotal Tankage Removal and Loading Costs	$22,523	$36,127	$8,088
B. PVC/Steel Pipe			
PVC Pipe Footage	2800	5000	
Average PVC Pipe Diameter (inches)	3	3	3
Shredded PVC Pipe Volume Reduction (ft^3/ft)	0.016	0.016	0.016
Volume of Shredded PVC Pipe (ft^3)	45	80	0
Steel Pipe Footage	1100	0	0
Average Steel Pipe Diameter (inches)	6	0	0
Volume (ft^3)	216	0	0
1. Labor			
Number of Persons	2	2	2
Ft/Day	200	200	200
Number of Days	19.5	25	0
$/Day/Person	$112	$112	$112
Subtotal PVC/Steel Pipe Labor Costs	$4,368	$5,600	$0
Subtotal PVC/Steel Pipe Removal and Loading Costs	$4,368	$5,600	$0
C. Pumps			
Number of Pumps	21	43	0
Average Volume (ft^3/pump)	4.93	4.93	0
Volume of Pumps (ft^3)	103.53	211.99	0
1. Labor			
Number of Persons	1	1	1
Pumps/Day	2	2	2
Number of Days	10.5	21.5	0
$/Day/Person	$112	$112	$112
Subtotal Labor Costs	$1,176	$2,408	$0
Subtotal Pump Removal and Loading Costs	$1,176	$2,408	$0
D. Dryer			
Dryer Volume (ft^3)			200
1. Labor			
Number of Persons	0	0	5
Ft^3/Day	0	0	175
Number of Days	0	0	2
$/Day/Person	$112	$112	$112
Total Labor Cost	$0	$0	$1,120

POWER RESOURCES INC NORTH BUTTE URANIUM PROJECT
SURETY ESTIMATE
FIRST YEAR OF OPERATION

									CPP Ion Ex. Plant	Central Plant	Dryer Building
Equipment Removal and Loading											
			Total Dryer Dismantling and Loading Cost						$0	$0	$1,120
		Subtotal Equipment Removal and Loading Costs per Facility							$28,067	$44,135	$9,208
		Total Equipment Removal and Loading Costs							**$81,410**		
II.	**Transportation and Disposal Costs (NRC-Licensed Facility)**										
	A.	Tankage									
			Volume of Tank Construction Material (ft^3)						835	1340	300
			Volume for Disposal Assuming 10% Void Space (ft^3)						919	1474	330
			Transportation and Disposal Unit Cost ($/$ft^3$)						$5.62	$5.62	$5.62
		Subtotal Tankage Transportation and Disposal Costs							$5,165	$8,284	$1,855
	B.	PVC / Steel Pipe									
			Volume of Shredded PVC Pipe (ft^3)						44.8	80	0
			Volume for Disposal Assuming 10% Void Space (ft^3)						49	88	0
			Volume of Steel Pipe (ft^3)						296	0	0
			Volume for Disposal Assuming 10% Void Space (ft^3)						326	0	0
			Transportation and Disposal Unit Cost ($/$ft^3$)						$5.62	$5.62	$5.62
		Subtotal PVC Pipe Transportation and Disposal Costs							$2,108	$495	$0
	C.	Pumps									
			Volume of Pumps (ft^3)						103.53	271	0
			Volume for Disposal Assuming 10% Void Space (ft^3)						114	298	0
			Transportation and Disposal Unit Cost ($/$ft^3$)						$5.62	$5.62	$5.62
		Subtotal Pump Transportation and Disposal Costs							$641	$1,675	$0
	D.	Dryer									
			Dryer Volume (ft^3)						0	0	400
			Volume for Disposal Assuming Dryer Remains Intact (ft^3)						0	0	400
			Transportation and Disposal Unit Cost ($/$ft^3$)						$5.62	$5.62	$5.62
		Total Dryer Transportation and Disposal Costs							$0	$0	$2,248
		Subtotal Equipment Transportation and Disposal Costs per Facility							$7,914	$10,454	$4,103
		Total Equipment Transportation and Disposal Costs							**$22,471**		
III.	**Health and Safety Costs**										
		Radiation Safety Equipment							$1,250	$1,250	$1,250
	Total Health and Safety Costs								**$3,750**		
SUBTOTAL EQUIPMENT REMOVAL AND DISPOSAL COSTS PER FACILITY									$37,231	$55,839	$14,561
TOTAL EQUIPMENT REMOVAL AND DISPOSAL COSTS									**$107,631**		

POWER RESOURCES INC NORTH BUTTE URANIUM PROJECT
SURETY ESTIMATE
FIRST YEAR OF OPERATION

Building Demolition and Disposal	CPP Ion Ex. Plant	Central Plant	Dryer Building	Office Building	Shop Building	DDW Buildings	Yellowcake Storage	Warehouse Building	Fresh Water Pumphouse
I. Decontamination Costs									
A. Wall Decontamination									
Area to be Decontaminated (ft^2)	10,810	15,900	0	0	0	0	3100	0	0
Application Rate (Gallons/ft^2)	1	1	1	1	1	1	1	1	1
HCl Acid Wash, including labor ($/Gallon)	$0.50	$0.50	$0.50	$0.50	$0.50	$0.50	$0.50	$0.50	$0.50
Subtotal Wall Decontamination Costs	$5,405	$7,950	$0	$0	$0	$0	$1,550	$0	$0
B. Concrete Floor Decontamination									
Area to be Decontaminated (ft^2)	11,550	16,500	3,500	0	0	0	2750	0	0
Application Rate (Gallons/ft^2)	4	4	4	4	4	4	4	4	4
HCl Acid Wash, including labor ($/Gallon)	$0.50	$0.50	$0.50	$0.50	$0.50	$0.50	$0.50	$0.50	$0.50
Subtotal Concrete Floor Decontamination Costs	$23,100	$33,000	$7,000	$0	$0	$0	$5,500	$0	$0
C. Deep Well Injection Costs									
Total Kgals for Injection	57.01	81.9	14	0	0	0	14.1	0	0
Deep Well Injection Unit Cost ($/Kgals)	$4.12	$1.39	$1.39	$1.39	$1.39	$1.39	$4.60	$1.39	$1.39
Subtotal Deep Well Injection Costs	$235	$114	$19	$0	$0	$0	$65	$0	$0
Subtotal Decontamination Costs per Building	$28,740	$41,064	$7,019	$0	$0	$0	$7,115	$0	$0
Total Decontamination Costs	$83,938								
II. Demolition Costs									
A. Building									
Assumptions:									
Dryer bldg, demolition unit cost of $0.73/$ft^3$ for additional radiation safety equipment									
Area of Building(ft^2)	11,550	16,500	3,500	9,934	7,028	500	2750	8,739	832
Volume of Building (ft^3)	346,500	577,500	122,500	248,350	175,700	4,000	55,000	174,780	8,320
Demolition Unit Cost per WDEQ Guideline No.12,App.K ($/$ft^3$)	$0.171	$0.171	$0.171	$0.171	$0.171	$0.171	$0.171	$0.171	$0.171
Unit Cost in $/$ft^3$ (July 1998 dollars w/o escalator)	$0.15	$0.15	$0.15	$0.15	$0.15	$0.15	$0.15	$0.15	$0.15
Subtotal Building Demolition Costs	$51,478	$85,797	$18,199	$36,896	$26,103	$594	$8,171	$25,966	$1,236
B. Concrete Floor									
Area of Concrete Floor (ft^2)	11,550	16,500	3500	9,934	7,028	0	2750	8,739	832
Demolition Unit Cost per WDEQ Guideline No.12,App.K ($/$ft^2$)	$3.17	$3.17	$3.17	$3.17	$3.17	$3.17	$3.05	$3.17	$3.17
Unit Cost in $/$ft^2$ (July 1998 dollars w/o escalator)	$2.75	$2.75	$2.75	$2.75	$2.75	$2.75	$2.65	$2.75	$2.75
Subtotal Concrete Floor Demolition Costs	$31,810	$45,443	$9,639	$27,359	$19,356	$0	$7,287	$24,068	$2,291
C. Concrete Footing									
Length of Concrete Footing (ft)	430	514	237	399	335	89	210	374	115
Demolition Unit Cost per WDEQ Guide. No.12,App.K ($/lin. ft)	$11.45	$11.45	$11.45	$11.45	$11.45	$11.45	$11.15	$11.45	$11.45
Unit Cost in $/lin. ft (July 1998 dollars w/o escalator)	$9.95	$9.95	$9.95	$9.95	$9.95	$9.95	$9.69	$9.95	$9.95
Subtotal Concrete Footing Demolition Costs	$4,276	$5,111	$2,354	$3,966	$3,336	$890	$2,032	$3,720	$1,148
Subtotal Demolition Costs per Building	$87,564	$136,351	$30,192	$68,221	$48,795	$1,484	$17,490	$53,754	$4,675
Total Demolition Costs	$448,526								
III. Disposal Costs									
A. Building									
Volume of Building (cy)	12833	21389	4537	9198	6507	148	2037	6473	308
1. On-Site									
Assumptions:									
On-site disposal cost of $0.54/cy									
Percentage (%)	100	100	100	100	100	100	100	100	100
Volume for Disposal (cubic yards)	12833	21389	4537	9198	6507	148	2037	6473	308
Disposal Unit Cost ($/cy)	$0.54	$0.54	$0.54	$0.54	$0.54	$0.54	$0.54	$0.54	$0.54
Subtotal On-Site Disposal Costs	$6,930	$11,550	$2,450	$4,967	$3,514	$80	$1,100	$3,496	$166
2. NRC-Licensed Facility									

POWER RESOURCES INC NORTH BUTTE URANIUM PROJECT
SURETY ESTIMATE
FIRST YEAR OF OPERATION

Building Demolition and Disposal	CPP Ion Ex. Plant	Central Plant	Dryer Building	Office Building	Shop Building	DDW Buildings	Yellowcake Storage	Warehouse Building	Fresh Water Pumphouse
Percentage (%)	0	0	0	0	0	0	0	0	0
Volume for Disposal (ft^3)	0	0	0	0	0	0	0	0	0
Volume for Disposal Assuming 10% Void Space (ft^3)	0	0	0	0	0	0	0	0	0
Transportation and Disposal Unit Cost ($/$ft^3$)	$5.62	$5.62	$5.62	$5.62	$5.62	$5.62	$5.62	$5.62	$5.62
Subtotal NRC-Licensed Facility Disposal Costs	$0	$0	$0	$0	$0	$0	$0	$0	$0
Subtotal Building Disposal Costs	$6,930	$11,550	$2,450	$4,967	$3,514	$80	$1,100	$3,496	$166
B. Concrete Floor									
Area of Concrete Floor (ft^2)	11550	16500	3500	9934	7028	0	2750	8739	1186
Average Thickness of Concrete Floor (ft)	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75
Volume of Concrete Floor (ft^3)	8662.5	12375	2625	7450.5	5271	0	2062.5	6554.25	889.5
Volume of Concrete Floor (cy)	321	458	97	276	195	0	76	243	33
1. On-Site									
Percentage (%)	75	75	75	100	100	100	75	100	100
Volume for Disposal (cy)	241	344	73	276	195	0	57	243	33
Disposal Unit Cost per WDEQ Guideline No.12,App.K ($/cy)	$4.69	$4.69	$4.69	$4.69	$4.69	$4.69	$4.69	$4.69	$4.69
Unit Cost in $/cy (July 1998 dollars w/o escalator)	$4.07	$4.07	$4.07	$4.07	$4.07	$4.07	$4.07	$4.07	$4.07
Subtotal On-Site Disposal Costs	$980	$1,401	$297	$1,124	$795	$0	$233	$989	$134
2. NRC-Licensed Facility									
Assumptions:									
Additional $2.00/$ft^3$ for segregation of concrete									
Percentage (%)	25	25	25	0	0	0	25	0	0
Volume for Disposal (ft^3)	2888	3094	656	0	0	0	516	0	0
Segregation and Loading Unit Cost ($/$ft^3$)	$2.00	$2.00	$2.00	$2.00	$2.00	$2.00	$2.00	$2.00	$2.00
Transportation and Disposal Unit Cost ($/$ft^3$)	$5.62	$5.62	$5.62	$5.62	$5.62	$5.62	$5.62	$5.62	$5.62
Subtotal NRC-Licensed Facility Disposal Costs	$22,007	$23,574	$5,001	$0	$0	$0	$3,929	$0	$0
Subtotal Concrete Floor Disposal Costs	$22,987	$24,975	$5,298	$1,124	$795	$0	$4,162	$989	$134
C. Concrete Footing									
Length of Concrete Footing (ft)	430	514	237	399	335	89	210	374	124
Average Depth of Concrete Footing (ft)	4	4	4	4	4	4	4	4	4
Average Width of Concrete Footing (ft)	1	1	1	1	1	1	1	1	1
Volume of Concrete Footing (ft^3)	1720	2055	947	1595	1341	358	839	1496	496
Volume of Concrete Footing (cy)	64	76	35	59	50	13	31	55	18
Disposal Unit Cost per WDEQ Guideline No.12,App.K ($/cy)	$4.69	$4.69	$4.69	$4.69	$4.69	$4.69	$4.69	$4.69	$4.69
Unit Cost in $/cy (July 1998 dollars w/o escalator)	$4.07	$4.07	$4.07	$4.07	$4.07	$4.07	$4.07	$4.07	$4.07
Subtotal Concrete Footing Disposal Costs	$260	$310	$143	$241	$202	$54	$127	$226	$75
Subtotal Disposal Costs per Building	$30,177	$36,835	$7,891	$6,332	$4,511	$134	$5,389	$4,711	$375
Total Disposal Costs	$96,355								
III. Health and Safety Costs									
Radiation Safety Equipment	$1,000	$1,000	$1,000	$1,000	$0	$0	$1,000	$0	$0
Total Health and Safety Costs	$5,000								
SUBTOTAL BUILDING DEMOLITION AND DISPOSAL COSTS	$147,481	$215,250	$46,102	$75,553	$53,306	$1,618	$30,994	$58,465	$5,050
TOTAL BUILDING DEMOLITION AND DISPOSAL COSTS	$633,819								

POWER RESOURCES INC NORTH BUTTE URANIUM PROJECT
SURETY ESTIMATE
FIRST YEAR OF OPERATION

Wellfield Buildings and Equipment Removal and Disposal								Mine Unit-1
I.	Wellfield Piping							
		Assumptions:						
			Number of Header Houses per Wellfield					5
			Length of Piping per Header House (ft)					2000
			Total Length of Piping (ft)					10000
	A.	Removal and Loading						
			Wellfield Piping Removal Unit Cost ($/ft of pipe)					$0.31
		Subtotal Wellfield Piping Removal and Loading Costs						$3,100
	B.	Transport and Disposal Costs (NRC-Licensed Facility)						
			Average Diameter of Piping (inches)					2
			Chipped Volume Reduction (ft^3/ft)					0.005
			Chipped Volume per Wellfield (ft^3)					50
			Volume for Disposal Assuming 10% Void Space (ft^3)					55
			Transportation and Disposal Unit Cost ($/$ft^3$)					$5.62
		Subtotal Wellfield Piping Transport and Disposal Costs						$309
	Wellfield Piping Costs per Wellfield							$3,409
	C.	Capitol Costs						
			PVC Pipe Shredder					$40,000
	Total Wellfield Piping Costs							$43,409
II.	Well Pumps and Tubing							
		Assumptions:						
			Pump and tubing removal costs included under ground water restoration labor c					
			60% of production/injection wells contain pumps and/or tubing					
	A.	Pump and Tubing Transportation and Disposal						
				Number of Production Wells				101
				Number of Injection Wells				175
		1.	Pump Volume					
				Number of Production Wells with Pumps				61
				Average Pump Volume (ft^3)				1
				Pump Volume per Wellfield (ft^3)				61
		2.	Tubing Volume					
				Assumptions:				
					Average tubing length/wellfield based on average well depth minus 25 ft			
				Number of Production Wells with Tubing				61
				Number of Injection Wells with Tubing				105
				Average Tubing Length per Well (ft)				725
				Tubing Length per Wellfield (ft)				120350
				Diameter of Production Well Fiberglass Tubing (inches)				2
				Diameter of Injection Well HDPE Tubing (inches)				1.25
				Chipped Volume Reduction (ft^3/ft)				0.005
				Chipped Volume per Wellfield (ft^3)				602
			Volume of Pump and Tubing (ft^3)					663

POWER RESOURCES INC NORTH BUTTE URANIUM PROJECT
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Wellfield Buildings and Equipment Removal and Disposal	Mine Unit-1
Volume for Disposal Assuming 10% Void Space (ft^3)	729
Transportation and Disposal Unit Cost ($/$ft^3$)	$5.62
Total Pump and Tubing Costs	$4,097
III. Buried Trunkline	
Assumptions:	
Length of Trunkline Trench (ft)	2600
A. Removal and Loading	
Main Pipeline Removal Unit Cost ($/ft of trench)	$0.85
Subtotal Trunkline Removal and Loading Costs	$2,210
B. Transport and Disposal Costs (NRC-Licensed Facility)	
1. 3" HDPE Trunkline	
Piping Length (ft)	2600
Chipped Volume Reduction (ft^3/ft)	0.022
Chipped Volume (ft^3)	57.2
2. 6" HDPE Trunkline	
Piping Length (ft)	5200
Chipped Volume Reduction (ft^3/ft)	0.078
Chipped Volume (ft^3)	405.6
3. 8" HDPE Trunkline	
Piping Length (ft)	5000
Chipped Volume Reduction (ft^3/ft)	0.15
Chipped Volume (ft^3)	750
3. 10" HDPE Trunkline	
Piping Length (ft)	0
Chipped Volume Reduction (ft^3/ft)	0.277
Chipped Volume (ft^3)	0
4. 12" HDPE Trunkline	
Piping Length (ft)	0
Chipped Volume Reduction (ft^3/ft)	0.293
Chipped Volume (ft^3)	0
5. 14" HDPE Trunkline	
Piping Length (ft)	0
Chipped Volume Reduction (ft^3/ft)	0.359
Chipped Volume (ft^3)	0
5. 16" HDPE Trunkline	
Piping Length (ft)	2600
Chipped Volume Reduction (ft^3/ft)	0.4
Chipped Volume (ft^3)	1040
Total Trunkline Chipped Volume (ft^3)	2252.8
Volume for Disposal Assuming 10% Void Space (ft^3)	2478
Transportation and Disposal Unit Cost ($/$ft^3$)	$5.62

POWER RESOURCES INC NORTH BUTTE URANIUM PROJECT
SURETY ESTIMATE
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Wellfield Buildings and Equipment Removal and Disposal	Mine Unit-1
Subtotal Trunkline Transport and Disposal Costs	$13,926
Total Trunkline Decommissioning Costs	$16,136
IV. Well Houses	
Total Quantity	5
Average Well House Volume (ft^3)	12.5
A. Removal	
Total Volume (ft^3)	62.5
Demolition Unit Cost per WDEQ Guideline No.12,App.K ($\$/ft^3$)	$0.165
Unit Cost in $\$/ft^3$ (July 1998 dollars w/o escalator)	$0.14
Subtotal Well House Demolition Costs	$9
B. Survey and Decontamination	
Assumptions:	
Cost per Well House	$5
Subtotal Survey and Decontamination Costs	$25
C. Disposal at NRC licensed Facility	
Total Volume (cy)	2
Volume for Disposal Assuming 10% Void Space (cy)	3
Transportation and Disposal Unit Cost ($\$/ft^3$)	$5.62
Subtotal NRC Licensed Facility Disposal Costs	$17
Total Well House Removal and Disposal Costs	$51
VI. Header Houses	
Total Quantity	5
Average Header House Volume (ft^3)	2700
A. Removal	
Total Volume (ft^3)	13500
Demolition Unit Cost per WDEQ Guideline No.12,App.K ($\$/ft^3$)	$0.171
Unit Cost in $\$/ft^3$ (July 1998 dollars w/o escalator)	$0.15
Subtotal Building Demolition Costs	$2,006
B. Survey and Decontamination	
Assumptions:	
Cost per Header House	$200
Subtotal Survey and Decontamination Costs	$1,000
C. Disposal	
Total Volume (cy)	500
Volume for Disposal Assuming 10% Void Space (cy)	550
Disposal Unit Cost per WDEQ Guideline No.12,App.K ($/cy)	$5.44
Unit Cost in $/cy (July 1998 dollars w/o escalator)	$4.73
Subtotal On-Site Disposal Costs	$2,599
Total Header House Removal and Disposal Costs	$5,605

POWER RESOURCES INC NORTH BUTTE URANIUM PROJECT
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FIRST YEAR OF OPERATION

Wellfield Buildings and Equipment Removal and Disposal		Mine Unit-1
TOTAL WELLFIELD BUILDINGS AND EQUIPMENT REMOVAL AND DISPOSAL COSTS		$69,298

POWER RESOURCES INC NORTH BUTTE URANIUM PROJECT
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Well Abandonment			**Mine Unit-1**
I.	**Well Abandonment (Wellfields)**		
	# of Production Wells		101
	# of Injection Wells		175
	# of Monitoring Wells		38
	Total Number of Wells		314
	Average Diameter of Casing (inches)		5
	Average Depth (ft)		725
	Well Abandonment Unit Cost ($/well)		$280
	Total Wellfield Abandonment Costs		**$87,999**
II.	**Waste Disposal Well Abandonment**		**DDW#1**
	A. Unit Cost Per Foot of Depth (Based on Wyoming Oil		$4.87
	and Gas Conservation Commission average cost/ft)		
	B. Depth of Well (ft)		10000
	Total Waste Disposal Well Abandonment Costs		**$48,700**
TOTAL WELL ABANDONMENT COSTS			**$136,699**

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Miscellaneous Reclamation				
I.	**CPP/Office Area/Warehouse/Maint. Shop/Chem. Storage/Yard Reclamation**			
	Assumptions			
	Concrete Pad= 0.3 acres			
	Total Area = 10.57 acres			
A.	Concrete Pad			
	Area of Concrete Pad (ft^2)			13068
	Demolition Unit Cost per WDEQ Guideline No.12,App.K ($/$ft^2$)			$3.17
	Unit Cost in $/$ft^2$ (July 1998 dollars w/o escalator)			$2.75
	Average Thickness of Concrete Floor (ft)			0.50
	Volume of Concrete Floor (ft^3)			6,534
	Volume of Concrete Floor (cy)			242
	On-Site Disposal Unit Cost per WDEQ Guideline No.12,App.K ($/cy)			$4.69
	Unit Cost in $/cy (July 1998 dollars w/o escalator)			$4.07
	Subtotal Concrete Pad Demolition and Disposal Costs			$36,977
B.	Gravel Road Base Removal			
	Assumptions			
	Average haul distance (ft)			1000
	Gravel Road Base Width (ft)			
	Gravel Road Base Area (acres)			8.0
	Average Road Base Depth (ft)			0.5
	Volume of Road Base (cy)			6453
	Removal Unit Cost per WDEQ Guideline No.12, App.C ($/cy)			$0.71
	Unit Cost in $/cy (July 1998 dollars w/o escalator)			$0.62
	Subtotal Gravel Road Base Removal Costs			$3,981
B.	Ripping Overburden with Dozer			
	Overburden Surface Area (acres)			10.6
	Ripping Unit Cost per WDEQ Guideline No.12, App.I1 ($/acre)			$663.93
	Unit Cost in $/acre (July 1998 dollars w/o escalator)			$576.83
	Subtotal Ripping Overburden Costs			$6,097
C.	Topsoil Application			
	Assumptions:			
	Area of surface disturbance (ft^2)			460426
	Average thickness of topsoil (ft)			1
	Average haul distance (ft)			2000
	Surface grade (%)			0%
	Volume of Topsoil (cy)			17,053
	Topsoil Unit Cost per WDEQ Guideline No.12, App.C ($/cy)			$0.92
	Unit Cost in $/cy (July 1998 dollars w/o escalator)			$0.80
	Subtotal Topsoil Application Costs			$13,630
D.	Discing/Seeding			
	Assumptions			
	Surface Area (acres)			10.57

POWER RESOURCES INC NORTH BUTTE URANIUM PROJECT
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Miscellaneous Reclamation								
			Discing/Seeding Unit Cost ($/acre)					$200
		Total Discing/Seeding Costs						$2,114
	Total CPF/Office/Yard Area Reclamation							**$58,818**
II.	**Access Road Reclamation**							**CPP Access Rd.**
	A.	Assumptions						
			Surface grade					1%
		Length of Road (ft)						7000
		Width of Road (ft)						40
		Area of road (acres)						4.75
	B.	Gravel Road Base Removal						
			Assumptions					
				Average haul distance (ft)				1000
			Gravel Road Base Width (ft)					30
			Gravel Road Base Area (acres)					4.82
			Average Road Base Depth (ft)					0.5
			Volume of Road Base (cy)					3889
			Removal Unit Cost per WDEQ Guideline No.12, App.C ($/cy)					$0.71
			Unit Cost in $/cy (July 1998 dollars w/o escalator)					$0.62
		Subtotal Gravel Road Base Removal Costs						$2,399
	C.	Ripping Overburden with Dozer						
			Overburden Surface Area (acres)					4.8
			Ripping Unit Cost per WDEQ Guideline No.12, App.11 ($/acre)					$663.93
			Unit Cost in $/acre (July 1998 dollars w/o escalator)					$576.83
		Subtotal Ripping Overburden Costs						$2,740
	D.	Topsoil Application						
			Assumptions					
				Average haul distance (ft)				1500
			Topsoil Surface Area (ft^2)					206910
			Depth of Topsoil (ft)					0.5
			Volume of Topsoil (cy)					3832
			Topsoil Unit Cost per WDEQ Guideline No.12, App.C ($/cy)					$1.50
			Unit Cost in $/cy (July 1998 dollars w/o escalator)					$1.30
		Subtotal Topsoil Application Costs						$4,993
	E.	Discing/Seeding						
			Assumptions					
			Surface Area (acres)					4.8
			Discing/Seeding Unit Cost ($/acre)					$200
		Subtotal Discing/Seeding Costs						$950
	Subtotal Reclamation Costs per Access Road							$11,082
	Total Access Road Reclamation Costs							**$17,919**
III.	**Trunk Lines #1 and #2**							**Trunk Line #1 (To MU-1)**

Miscellaneous Reclamation								
			Length of Trench (ft)					4000
	A.	Removal and Loading						
			Main Pipeline Removal Unit Cost ($/ft of trench)					$0.85
		Subtotal Trunkline Removal and Loading Costs						$3,400
	B.	Transport and Disposal Costs (NRC-Licensed Facility)						
		1.	3" HDPE Trunkline					
				Piping Length (ft)				4000
				Chipped Volume Reduction (ft^3/ft)				0.022
				Chipped Volume (ft^3)				88
		2.	6" HDPE Trunkline					
				Piping Length (ft)				8000
				Chipped Volume Reduction (ft^3/ft)				0.078
				Chipped Volume (ft^3)				624
		3.	8" HDPE Trunkline					
				Piping Length (ft)				0
				Chipped Volume Reduction (ft^3/ft)				0.15
				Chipped Volume (ft^3)				0
		3.	10" HDPE Trunkline					
				Piping Length (ft)				0
				Chipped Volume Reduction (ft^3/ft)				0.277
				Chipped Volume (ft^3)				0
		4.	12" HDPE Trunkline					
				Piping Length (ft)				0
				Chipped Volume Reduction (ft^3/ft)				0.293
				Chipped Volume (ft^3)				0
		5.	14" HDPE Trunkline					
				Piping Length (ft)				0
				Chipped Volume Reduction (ft^3/ft)				0.359
				Chipped Volume (ft^3)				0
		5.	16" HDPE Trunkline					
				Piping Length (ft)				4000
				Chipped Volume Reduction (ft^3/ft)				0.4
				Chipped Volume (ft^3)				1600
			Total Trunkline Chipped Volume (ft^3)					2312
			Volume for Disposal Assuming 10% Void Space (ft^3)					2543
			Transportation and Disposal Unit Cost (NRC-Licensed Facility) ($/$ft^3$)					$5.62
		Subtotal Pipeline Disposal Costs						$14,292
	C.	Discing/Seeding						
			Assumptions:					

Miscellaneous Reclamation					
			Width of Pipeline Trench (ft)		4
			Area of Pipeline Trench (acres)		0.4
			Discing/Seeding Unit Cost ($/acre)		$200
		Subtotal Discing/Seeding Costs			$73
	Subtotal Reclamation Costs per Pipeline				$17,765
	Total Pipeline Reclamation Costs				**$17,765**
IV.	**Settling Basin/Evap. Pond Reclamation**				**Evaporation Pond**
	A.	Soil Sampling and Monitoring			
			Number of Soil Samples		10
			$/Sample		$60
		Subtotal Soil Sampling and Monitoring Costs			$600
	B.	Liner/Subsoil Removal and Disposal			
			Removal and Loading Unit Cost based on engineer's design		
			report and Cat Performance Handbook		
			Width of Pond (ft)		112
			Length of Pond (ft)		487
			Depth of Pond (ft)		10
			Surface area of pond (ft^2)		54544
			Surface area of both ponds (ft^2)		109088
		1.	Removal and Loading		
			Volume of Geotextile Liner (cy)		272.72
			GeotextileLiner Removal and Loading Unit Cost ($/cy)		$3
			Liner Removal and Loading Costs		$818
			PVC Pipe Footage		920
			Average PVC Pipe Diameter (inches)		3
			PVC Pipe Removal Costs (base on previous estimates for piping removal)		$1,008
			Subtotal Removal and Loading Costs		$1,826
		2.	Transportation and Disposal		
			Volume of Geotextile Liner (ft^3)		272.72
			Volume of Geotextile Liner @ 40% void (ft^3)		455
			Shredded PVC Pipe Volume Reduction (ft^3/ft)		0.016
			Volume of Shredded PVC Pipe (ft^3)		15
			Transportation and Disposal Unit Cost ($/$ft^3$)		$5.62
			Subtotal Transportation and Disposal Costs		$2,637
		Subtotal Liner Removal and Disposal Costs			$4,463
	C.	Grade and Contour			
			Volume of Embankment Material (CY)		16,900
			Average Grade (%)		0
			Distance (ft)		100
			Material Moving Unit Cost per WDEQ Guideline No.12, App.E ($/cy)		$0.092
			Unit Cost in $/cy (July 1998 dollars w/o escalator)		$0.08
			Subtotal Grade and Contour Costs		$1,351
	C.	Topsoil Application			

POWER RESOURCES INC NORTH BUTTE URANIUM PROJECT
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Miscellaneous Reclamation										
			Assumptions:							
					Area of surface disturbance (ft^2)					115000
					Average thickness of topsoil (ft)					1
					Average haul distance (ft)					1000
					Surface grade (%)					0%
			Volume of Topsoil (cy)							4,259
			Topsoil Unit Cost per WDEQ Guideline No.12, App.C ($/cy)							$0.71
			Unit Cost in $/cy (July 1998 dollars w/o escalator)							$0.62
		Subtotal Topsoil Application Costs								$2,627
	D.	Discing/Seeding								
			Assumptions:							
					Area of surface disturbance (acres)					2.6
			Discing/Seeding Unit Cost ($/acre)							$200
		Subtotal Discing/Seeding Costs								$520
	Total Settling Basin/Evap. Ponds Reclamation Costs									$9,561
V.	**Miscellaneous Structures**									
	B.	Potable Water Wells								
			Total Depth (ft) (Two 5-inch Diameter Wells, @ 750 ft)							1,500
			Well Abandonment Unit Cost ($/100 ft)							$6.70
		Subtotal Potable Water Wells Abandonment Costs								$100.50
	C.	Fuel Area								
			Concrete Floor							
					Area of Concrete Floor (ft^2)					375
					Demolition Unit Cost per WDEQ Guideline No.12,App.K ($/$ft^2$)					$3.17
					Unit Cost in $/$ft^2$ (July 1998 dollars w/o escalator)					$2.75
			Subtotal Concrete Floor Demolition Costs							$1,033
			Concrete Footing							
					Length of Concrete Footing (ft)					77
					Demolition Unit Cost per WDEQ Guide. No.12,App.K ($/lin. ft)					$11.45
					Unit Cost in $/lin. ft (July 1998 dollars w/o escalator)					$9.95
			Subtotal Concrete Footing Demolition Costs							$771
		Subtotal Fuel Area Costs								$1,804
	Total Miscellaneous Structures Reclamation Costs									$2,938
I.	**Wellfield Pattern Area, Laydown Area, and Road Reclamation**									
		Area (acres)								29.6
		Disking/Seeding Unit Cost ($/acre)								$200
	Subtotal Pattern Area, Laydown Area, and Road Reclamation Costs									$5,920
	Total Wellfield Area Reclamation Costs									$5,920
TOTAL MISCELLANEOUS RECLAMATION COSTS										**$112,920**

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RADIUM TREATMENT			
Assumptions:			
1.	Based on actual 1998 operating costs from Satellite No. 2		
Radium Treatment Costs per 1000 Gallons			
	Chemical	= $	0.177
	Filtration	= $	0.021
	Electricity	= $	0.019
	By Product Disposal of Sludge	= $	0.097
TOTAL RADIUM TREATMENT COSTS PER 1000 GALLONS		= $	0.31

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GROUNDWATER SWEEP (GWS)

Assumptions:

1. All pumps are 5 hp pumping at 5.0 gpm
2. Cost of electricity = $0.03/kwh
3. All water pumped is disposed at WDW with a 20 hp pump
4. Repair and maintenance costs estimated at $0.03/1000 gallons
5. Process sampling and analysis costs estimated at $0.03/1000 gallons
6. Labor costs are not included

Wellfield Pumping Costs per 1000 Gallons

$$\frac{1000\ \text{gal}}{} \times \frac{5\ \text{hp}}{5\ \text{gpm}} \times \frac{1\ \text{hr}}{60\ \text{min}} \times \frac{0.746\ \text{kwh}}{\text{hp}} \times \frac{\$\ 0.03}{\text{kwh}} = \$\ 0.37$$

Pumping to WDW Costs per 1000 Gallons

$$\frac{1000\ \text{gal}}{} \times \frac{75\ \text{hp}}{200\ \text{gpm}} \times \frac{1\ \text{hr}}{60\ \text{min}} \times \frac{0.746\ \text{kwh}}{\text{hp}} \times \frac{\$\ 0.03}{\text{kwh}} = \$\ 0.14$$

Repair and Maintenance Costs per 1000 Gallons = $ 0.03

Process Sampling and Analysis Costs per 1000 Gallons = $ 0.03

TOTAL GWS COSTS PER 1000 GALLONS = $ 0.57

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REVERSE OSMOSIS (RO)												
Assumptions:												
1.	Based on actual 1998 operating costs at Satellite No. 1. Verified by											
	Hydranautics RO System Design Software, Version 6.0 (1995)											
2.	Cost of electricity = $0.03/kwh											
3.	80% permeate/20% reject split											
4.	Membrane life of 4 years with a cost of $695 per membrane element											
5.	Includes cost of pumping from wellfield to RO Unit											
6.	The 20% reject is disposed at WDW with a 20 hp pump at actual cost of											
	$0.14/1000 gallons											
7.	The permeate is returned to the wellfield with a 20 hp pump at actual cost of											
	$0.019/1000 gallons											
8.	Process sampling and analysis costs estimated at $0.03/1000 gallons											
9.	Labor costs are not included											
Reverse Osmosis Costs per 1000 Gallons												
	Electricity						= $	0.17				
	Chemicals						= $	0.26				
	Membrane Replacement						= $	0.15				
	Repair and Maintenance						= $	0.26				
	Pumping from Wellfield						= $	0.37				
	Pumping to Wellfield						=$	0.019				
	Pumping to WDW											
		$	0.14	X	0.2		= $	0.0028				
	Process Sampling and Analysis						= $	0.03				
TOTAL RO COSTS PER 1000 GALLONS							= $	1.26				

POWER RESOURCES INC NORTH BUTTE URANIUM PROJECT
SURETY ESTIMATE
FIRST YEAR OF OPERATION

CHEMICAL REDUCTANT			
Assumptions:			
1.	Bioremediation is utilized		
2.	Based on actual 2003-2004 operating costs during restoration activities		
TOTAL CHEMICAL REDUCTANT COSTS PER Kgal		**= $**	**0.33**
	July 1998 Dollars	**= $**	**0.29**

POWER RESOURCES INC NORTH BUTTE URANIUM PROJECT
SURETY ESTIMATE
FIRST YEAR OF OPERATION

ELUTION PROCESSING			
Assumptions:			
1.	Based on actual operating costs		
TOTAL PROCESSING COSTS PER ELUTION		**= $**	**525**

POWER RESOURCES INC NORTH BUTTE URANIUM PROJECT
SURETY ESTIMATE
FIRST YEAR OF OPERATION

DEEP WELL INJECTION

Assumptions:

1. Pump 75 hp pumping at 200 gpm
2. Cost of electricity = $0.03/kwh
3. Repair and maintenance costs based on average injection volume of 8,000,000 gallons per year
4. Repair and maintenance costs estimated at $1.25/1000 gallons
5. Chemical costs based on average injection volume of 8,000,000 gallons per year
6. Labor costs are not included

Waste Disposal Pumping Costs per 1000 Gallons

$$\frac{1000\ \text{gal}}{} \times \frac{75\ \text{hp}}{200\ \text{gpm}} \times \frac{1\ \text{hr}}{60\ \text{min}} \times \frac{0.746\ \text{kwh}}{\text{hp}} \times \frac{\$\ 0.03}{\text{kwh}} = \$\ 0.14$$

Repair and Maintenance Costs per 1000 Gallons = $ 1.25

TOTAL DEEP WELL INJECTION COSTS PER 1000 GALLONS = $ 1.39

POWER RESOURCES INC NORTH BUTTE URANIUM PROJECT
SURETY ESTIMATE
FIRST YEAR OF OPERATION

WELL ABANDONMENT

Assumptions:

1. Use backhoe for 0.5 hr/well to dig and reclaim pit at cost of $50/hr.
2. Use hose reel/tow vehicle for 2 hr/well to pull hoses and pump plug gel at cost of $35/hr.
3. Use cementer/tow vehicle for 1 hr/well to pump plug gel at cost of $45/hr.
4. Labor for backhoe, hose reel, cementer will require 2 workers at 3.5 hr/well at cost of $15/hr.
5. Materials include one hole plug at $1.75 and one sack of plug gel/100 ft of 5 inch well casing.

Cost of plug gel is $6.70/sack.

Well Abandonment Costs

Fixed Costs									
Backhoe									
	0.5	hours	X	$	50	per hour		=$	25.00
Hose Reel/Tow Vehicle									
	2	hours	X	$	35	per hour		=$	70.00
Cementer/Tow Vehicle									
	1	hours	X	$	45	per hour		=$	45.00
Labor									
	7	man hours	X	$	15.00	per man hour		=$	105.00
Materials									
	1	hole plug	X	$	1.75	per hole plug		=$	1.75
					Total Fixed Costs			=$	246.75
Variable Costs		(per 100 ft of well depth)							
Materials									
	1	sack plug gel per 100 feet	X	$	6.70	per sack		=$	6.70

Cost per Well per Unit of Average Depth

Well Depth (ft)	
450	=$ 277
500	=$ 280
550	=$ 284
600	=$ 287
650	=$ 290
700	=$ 294
750	=$ 297
800	=$ 300
850	=$ 304
900	=$ 307
950	=$ 310

POWER RESOURCES INC NORTH BUTTE URANIUM PROJECT
SURETY ESTIMATE
FIRST YEAR OF OPERATION

FIVE YEAR MECHANICAL INTEGRITY TESTS (MIT)															
Assumptions:															
1.	Based on 1999 PRI costs.														
2.	Use Pulling Unit for 0.25 hr/well at cost of $45/hr.														
3.	Use MIT Unit for 1.5 hr/well at cost of $20/hr.														
4.	Labor for operation of pulling unit will require 2 workers at $15/hr														
5.	Labor for operation of MIT Unit will require 1 worker at $15/hr														
MIT Costs per Well															
Equipment:															
	Pulling Unit														
		0.25	hours	X	$	45	per hour					=$	11.25		
	MIT Unit														
		1.5	hours	X	$	20	per hour					=$	30.00		
Labor:															
	Pulling Unit														
		0.25	hours	X	$	15	per hour	X	2	workers		=$	$7.50		
	MIT Unit														
		1.5	hours	X	$	15	per hour					=$	22.50		
							MIT COST PER WELL					=$	71		

POWER RESOURCES INC NORTH BUTTE URANIUM PROJECT
SURETY ESTIMATE
FIRST YEAR OF OPERATION

MAIN PIPELINE REMOVAL

Assumptions:

1. Trenching with trackhoe at 1500 ft/day
2. Pipeline extraction and backfilling with trackhoe at 1500 ft/day
3. Trackhoe rental: $1600/week
4. Fuel cost: $9/operating hour
5. Trackhoe operation requires 1 worker at $15/hour
6. Pipeline extraction requires 2 workers at $15/hour (in addition to trackhoe operator)
7. Pipelines removed simutaneously
8. Includes removal of manholes
9. Operating schedule: 8 hrs/day, 5 days/week

Main Pipeline Removal Costs per ft of Trench

Equipment											
	Trackhoe										
		$	1600	X	1	week	X	2	days	=$	0.43
		week			5	days		1500	ft		
	Fuel										
		$	9	X	8	hrs	X	2	days	=$	0.10
		hour			1	day		1500	ft		
Labor											
	Trackhoe Operation										
		$	15	X	8	man hrs	X	2	days	=$	0.16
		man hr			1	day		1500	ft		
	Pipeline Extraction										
		$	15	X	16	man hrs	X	1	day	=$	0.16
		man hr			1	day		1500	ft		

MAIN PIPELINE REMOVAL COST PER FT OF TRENCH =$ 0.85

POWER RESOURCES INC NORTH BUTTE URANIUM PROJECT
SURETY ESTIMATE
FIRST YEAR OF OPERATION

WELLFIELD PIPING REMOVAL

Assumptions:

1. Trenching with backhoe at 3000 ft/day
2. Pipeline extraction and backfilling with backhoe at 3000 ft/day
3. Backhoe rental: $750/week
4. Fuel cost: $9/operating hour
5. Backhoe operation requires 1 worker at $15/hour
6. Pipeline extraction requires 2 workers at $15/hour (in addition to trackhoe operator)
7. Operating schedule: 8 hrs/day, 5 days/week

Main Pipeline Removal Costs per ft of Pipe

Equipment												
	Backhoe											
		$	750	X	1	week	X	2	days	=$	0.10
		week			5	days		3000	ft		
	Fuel											
		$	9	X	8	hrs	X	2	days	=$	0.05
		hour			1	day		3000	ft		
Labor												
	Backhoe Operation											
		$	15	X	8	man hrs	X	2	days	=$	0.08
		man hr			1	day		3000	ft		
	Pipeline Extraction											
		$	15	X	16	man hrs	X	1	day	=$	0.08
		man hr			1	day		3000	ft		
	MAIN PIPELINE REMOVAL COST PER FT OF PIPE									=$	0.31

POWER RESOURCES INC NORTH BUTTE URANIUM PROJECT
SURETY ESTIMATE
FIRST YEAR OF OPERATION

WELLFIELD ROAD RECLAMATION

Assumptions (Roads constructed before January 1, 1997):

1. Gravel road base removed at cost of $0.60/cy/1000 ft (WDEQ Guideline No. 12, App. C, Level Ground, 500 ft haul)
2. Gravel road base: average depth = 0.25 ft, average width = 10 ft
3. Roads scarified prior to topsoil application at cost of $36.30/acre (WDEQ Guideline No. 12, Appendix P)
4. Grading of scarified roads prior to topsoil application at cost of $38.45/acre (WDEQ Guideline No. 12, Appendix G)
5. Topsoil applied at cost of $0.60/cy/1000 ft (WDEQ Guideline No. 12, App. C, Level Ground, 500 ft haul)
6. Stripped topsoil: average depth = 0.67 ft, average width = 25 ft
7. Discing/seeding cost of $200/acre is based on actual contractor costs

Gravel Road Base Removal Costs per 1000 ft of Road

$$\frac{1000\ ft \times 0.25\ ft \times 10\ ft \times \frac{1\ cy}{27\ ft^3} \times \frac{\$0.60}{cy}}{} = \$56$$

Scarification Costs per 1000 ft of Road

$$\frac{1000\ ft \times 25\ ft \times \frac{1\ acre}{4.356E+04\ ft^2} \times \frac{\$36.30}{acre}}{} = \$21$$

Grading Costs per 1000 ft of Road

$$\frac{1000\ ft \times 25\ ft \times \frac{1\ acre}{4.356E+04\ ft^2} \times \frac{\$38.45}{acre}}{} = \$22$$

Topsoil Application Costs per 1000 ft of Road

$$\frac{1000\ ft \times 0.67\ ft \times 25\ ft \times \frac{1\ cy}{27\ ft^3} \times \frac{\$0.60}{cy}}{} = \$372$$

Discing/Seeding Costs per 1000 ft of Road

$$\frac{1000\ ft \times 25\ ft \times \frac{1\ acre}{4.356E+04\ ft^2} \times \frac{\$200}{acre}}{} = \$115$$

TOTAL WELLFIELD ROAD RECLAMATION COSTS PER 1000 FT OF ROAD (BEFORE JANUARY 1, 1997) = $ 586

Assumptions (Roads constructed after January 1, 1997):

1. Gravel road base will not be removed
2. Roads scarified prior to topsoil application at cost of $36.30/acre (WDEQ Guideline No. 12, Appendix P)
3. Grading of scarified roads prior to topsoil application at cost of $38.45/acre (WDEQ Guideline No. 12, Appendix G)
4. Topsoil applied at cost of $0.60/cy/1000 ft (WDEQ Guideline No. 12, App. C, Level Ground, 500 ft haul)
5. Stripped topsoil: average depth = 0.4 ft, average width = 20 ft
6. Discing/seeding cost of $200/acre is based on actual contractor costs

Scarification Costs per 1000 ft of Road

$$\frac{1000\ ft \times 20\ ft \times \frac{1\ acre}{4.356E+04\ ft^2} \times \frac{\$36.30}{acre}}{} = \$17$$

Grading Costs per 1000 ft of Road

$$\frac{1000\ ft \times 20\ ft \times \frac{1\ acre}{4.356E+04\ ft^2} \times \frac{\$38.45}{acre}}{} = \$18$$

Topsoil Application Costs per 1000 ft of Road

$$\frac{1000\ ft \times 0.40\ ft \times 20\ ft \times \frac{1\ cy}{27\ ft^3} \times \frac{\$0.60}{cy}}{} = \$178$$

Discing/Seeding Costs per 1000 ft of Road

$$\frac{1000\ ft \times 20\ ft \times \frac{1\ acre}{4.356E+04\ ft^2} \times \frac{\$200}{acre}}{} = \$92$$

TOTAL WELLFIELD ROAD RECLAMATION COSTS PER 1000 FT OF ROAD (AFTER JANUARY 1, 1997) = $ 305

POWER RESOURCES INC NORTH BUTTE URANIUM PROJECT
SURETY ESTIMATE
FIRST YEAR OF OPERATION

BYPRODUCT MATERIAL TRANSPORTATION AND DISPOSAL											
Assumptions:											
1.	Based on actual 2001-2002 contracted costs for transportation to and disposal at an										
	NRC-licensed disposal facility.										
2.	Includes profit for transporter and disposal facility.										
3.	All types of waste shipped vi bulk container (30-yd^3 dumpster or 30-yd^3 dump truck).										
4.	Each shipment contains 30,000 lbs of material.										
		Transportation Cost				**Disposal Cost**			**Total**		
			$ 66.67	/yd^3	+	$ 85.00	/yd^3	=	$ 151.67	/yd^3	
								=	$ 5.62	/ft^3	

POWER RESOURCES INC NORTH BUTTE URANIUM PROJECT
SURETY ESTIMATE
FIRST YEAR OF OPERATION

DISKING/SEEDING						
Assumptions:						
1.	Based on actual contractor costs					
TOTAL DISKING/SEEDING COSTS PER ACRE					= $	200

POWER RESOURCES INC NORTH BUTTE URANIUM PROJECT
SURETY ESTIMATE
FIRST YEAR OF OPERATION

Abbreviations/Acronyms		
$	Dollars	
$/Kgal	Dollars per 1000 gallons	
avg	average	
ft	feet	
ft2	square feet	
ft3	cubic feet	
gal	gallon	
gpm	gallons per minute	
H&S	Health and Safety	
H2S	Hydrogen Sulfide	
H2SO4	Sulfuric Acid	
HCl	Hydrochloric Acid	
Hp	Horsepower	
Kgal	1000 gallons	
Kwh	Kilowatt-hours	
NaOH	Caustic Soda	
OD	Outside Diameter	
PPE	personal protective equipment	
PV	Pore Volume Estimate	
reqm't	requirement	
RO	Reverse Osmosis	
WDW	Waste Disposal Well	
yd3	cubic yards	
yr	year	

18. APPENDIX "E", MAPS

18.1 LANDS TO BE AFFECTED BY MINING

The Lands To Be Affected By Mining are shown in Figure 6.1, U.S.G.S. North Butte, Wyoming Quadrangle (Volume II) and in Figure 9.2, North Butte Site Plan Layout (Volume II).

18.2 DRAINAGE AREA

The Drainage Area is shown in Figure 10.6 (Volume II), Surface Drainage Map.

18.3 ROADS, RAILROADS, RIGHTS-OF-WAY, EASEMENTS, ETC.

The Roads, Railroads, Rights-of-Way, Easements, Etc. are shown in Figure 9.2, North Butte Site Plan Layout (Volume II) and in the figures in Section 2. of this document.

18.4 AREAS OF DISTURBANCE

The Areas Of Disturbance are shown in Figure 9.2, North Butte Site Plan Layout (Volume II) and in Figure 15.1 (Volume II), Facilities Site Plan- Plant Area. Several other figures in this document relate to Areas Of Disturbance.

18.5 SURFACE OWNERS AND OCCUPANTS

The map showing Surface Owners is presented in Section 2. and Section 3. of this document (Appendix "A", Owners Of Record Within Permit Area and Appendix "B", Owners Of Record On Adjacent Lands). There are no "Occupants" within the permit area, but there is one occupied ranch house (mobile home) within the adjacent lands boundary in the southwest corner of Section 19, T. 44 N., R. 75 W. (see Figure 9.2, Volume II). One family lives in the mobile home on a year around basis.

18.6 LOCATION, OWNERSHIP AND USES OF BUILDINGS

The only permanent buildings within the permit area and on adjacent lands are the ranch buildings located in the southwest quarter of Section 19, T. 44 N., R. 75 W. (refer to the previous section). Uranerz has a trailer located in the permit area in the southwest corner of Section 24, T. 44 N., R. 76 W. that is used as a temporary field office.

19.8 ATMOSPHERIC DISPERSION COMPUTER PROGRAM RESULTS

The atmospheric radiation dispersion computer model used for the Ruth project is called MILDOS. Uranerz used MILDOS to estimate the radiological concentrations resulting from the planned in situ operations at the North Butte and Ruth ISL Projects. The operational plan for the Ruth facility states that there will not be a dryer on-site and that uranium loaded resin will be shipped to an NRC licensed mine for final processing. Accordingly, the MILDOS modeling for the satellite Ruth facility was incorporated into the model run for the planned North Butte facility which will most likely receive the uranium loaded resin. Background data and operational information from the Ruth R & D project were included in the North Butte model run. This procedure was discussed in advance with the NRC- Denver office. The input data for the two computer runs addressing both the 10 CFR 20 and 40 CFR 190 regulations and the computer output are contained in the MILDOS Program Supplement starting on page 19-32.

The meteorological data which were input for the MILDOS computer model was the October 1978 through September 1979 data set. These data were collected by AeroViroment for Cleveland-Cliffs Iron Company for a proposed uranium mining/milling operation at the North Butte site. The data set includes hourly average wind speed, wind direction, and sigma theta values collected at the 10 meter exposure level. These data were processed to produce hourly stability classifications using the EPA suggested Number 8. This technique uses sigma theta data along with wind speed to estimate the Turner Stability Classes.

MILDOS PROGRAM SUPPLEMENT

Population and Individual Dose Commitments

Enecotech Letter

Input Parameters, Attachment A

40 CFR 190 Results, Attachment B

10 CFR 20 Results, Attachment C

EnecoTech

June 30, 1988

RECEIVED
JUL 05 1988

Applied ECOsystems
Attn: Mr.Timothy Lane
P.O. Box 1817
Casper, Wyoming 82602

Dear Mr. Lane,

This letter transmits the updated model results for the MILDOS computer model results for the North Butte and Ruth Sites. The change was that the radon production which occurs at the both the North Butte and Ruth Site was improperly located at just the North Butte site. The updated MILDOS run is included as Attachment C and is intended to replace Attachment C in our original report.

All the source locations and source strengths were transmitted to EnecoTech with the exception of the particulate emissions from the proposed yellowcake dryer. The source strengths transmitted were 961.4 Ci/year radon emissions from the surge tank vents at the North Butte processing facility and 10.13 from the pond. Of the 961.4 Ci/year production emissions, one third of those are assumed to be emitted at the Ruth site and two thirds are assumed to be emitted at the North Butte site.

The 40 CFR 190 results do not change from the previous modeling expect in how the 1,000,000 pounds per year production rate is calculated. Attachment A presents these calculations assuming 300 days per year production and a production rate of 140 pounds per hour.

If you have any questions concerning the results of the modeling or the modeling input, please call at your convenience. Also the graphical wind roses will follow under seperate cover.

Sincerely,

James A. Kuenning

James A. Kuenning
Senior Meteorologist

Trinity Place, Suite 700 • 1801 Broadway • Denver, Colorado 80202 • (303) 293-2703

ATTACHMENT A

ATTACHMENT I

URANIUM EMISSIONS FROM YELLOWCAKE DRYER

1. Operation assumes a production rate of 140 pounds per hour, 24 hours per day and 300 days per year. This yields an annual production of approximately 1,000,000 pounds (1,008,000).

2. One pound of yellowcake (U_3O_8) is

$$(238*3)/\ (238*3 + 16*8) = 0.848 \text{ pounds } {}^{238}U$$

3. Assume 0.1% of the yellowcake production goes up the stack (NUREG 4088). Yellowcake assumed 95% pure.

$$\text{Annual emissions} = 0.95 * 0.848 * 1{,}000{,}000 * 0.001$$
$$= 805.6 \text{ pounds per year}$$

4. Assume activity of uranium is 333,000 pCi per gram of uranium.

$$805.6 * 453.6 * 333{,}000 / 10^{12} = 0.1206 \text{ Ci/year}$$

5. According to NUREG-4088, ${}^{230}Th$ emissions are 0.005 of uranium emissions. Likewise, ${}^{210}Pb$ and ${}^{226}Ra$ emissions are 0.001 of the uranium emissions.

$${}^{230}Th = 0.005 * 0.1206 = .0006029 \text{ Ci/year}$$
$${}^{226}Ra = 0.001 * 0.1206 = .0001206 \text{ Ci/year}$$
$${}^{210}Pb = 0.001 * 0.1206 = .0001206 \text{ Ci/year}$$

ATTACHMENT A (cont)

SITE SPECIFIC INFORMATION
RUTH/NORTH BUTTE PROPERTIES

Parameter	Value
Average ore quality, U_3O_8, in ore body	0.150%
Ore Radon-222 activity, assuming equilibrium with U-238	226 pci/g
Operating days per year (plant factor)	350 Days
Dimensions of ore body	
Area per year to be mined	13.0 Acres
Average thickness of body	1.98 m (6.5 ft)
Average screened interval	1.67 m (5.5 ft)
Average production flow rate	3000 gpm
Formation Porosity	30%
Process Recovery	95%
Leaching Efficiency	70%
Rock Density	1.91 g/cm^3
Restoration Flow Rate	1000 gpm
Production Cell Parameters	
Residence time (production)	3 days
Residence time (restoration)	8 days
Type of cell pattern	7 & 5 spot
Radius	17 m (55.76 ft)
Average cell flow rate	
Annual Rn-222 emission from production	
Annual Rn-222 emission from restoration	
Source Stack Description	Surge Tank Vent
Stack height	12.1 m (39.68 ft)
Stack diameter	0.18 m (0.59 ft)
Stack exit velocity	2.0 m/s (6.56 ft/s)
Source stack description	Thermal Dryer
Stack height	22.8 m (75 ft)
Stack diameter	
Stack exit velocity	0.9 m^3/s

ATTACHMENT A (cont)

SOURCE AND RECEPTOR COORDINATES
RUTH/NORTH BUTTE PROPERTIES

	East (km)	North (km)	Elevation (m)
Sources			
1. Yellowcake Dryer Stack	0	0	22.7
2. Surge Tank Vents	0	0	18.1
3. Ruth Site	-11.58	-19.95	1
Receptors			
1. North 100 Meters	0	0.10	1
2. East 150 Meters	0.10	0	1
3. West 150 Meters	-0.10	0	1
4. South 100 Meters	0	-0.10	1
5. Pfister Ranch	0.699	-1.781	1
6. Pumpkin Butte Ranch	3.926	-5.637	1
7. W. Schlautmann Ranch	5.836	4.144	1
8. L. Gilberts Ranch	9.600	2.407	1
9. Earl Camblin Ranch	10.513	-2.346	1
10. John Groves	9.447	6.704	1
11. Town of Savagetown	11.123	8.837	1
12. Ruby Ranch	11.336	-5.789	1
13. Jack Christensen	-5.348	-1.523	1
14. Bud Christensen	0.152	10.056	1

YELLOWCAKE DRYING AND PACKAGING DATA
RUTH/NORTH BUTTE PROPERTIES

Processing rates for drying and packaging	0.064 MT/hr (141.0 LB/hr)
Estimated annual yellowcake production rate	454 MT/yr (1,000,000 LB/yr)
Expected yellowcake purity, U_3O_8 by weight	95%
Any measured airborne effluent concentrations	_____/yr
Effluents estimated using NUREG/CR-4088	_____/yr _____/yr _____/yr
Stacks, heights and airflows	Drying 22.8 m Airflow 0.9 m^3/s
Drying and packaging exhaust through a single stack which is 22.7 m above the ground surface	Packaging _____ m, m^3/s Other _____ m, m^3/s
Anticipated release rate for dryer stack, the packaging area ventilation exhaust, and any yellowcake storage area ventilation	Dryer Stack _____ kg/hr Packaging Stack _____ kg/hr Other _____ kg/hr
Drying and packaging operations are carried out	24 hrs/day
Dryer Operating Time	300 days/year
Description of all ventilation air filtration equipment with design, expected and minimum efficiencies (if applicable)	See Section _____ Estimated at _____

ATTACHMENT A (cont)

MISCELLANEOUS DATA
RUTH/NORTH BUTTE PROPERTIES

Fraction of year during which cattle graze locally	Est. 90%
Fraction of cattle feed obtained by grazing	Est. 90%
Fraction of stored cattle feed grown locally	Est. 50%
Acreage required to graze 1 animal unit (450 kg) for one month (AUM)	1.4 ha
Length of growing season	5.5 m/yr
Fraction of locally produced vegetables consumed locally	100%
Fraction of locally produced meat consumed locally	>5%
Fraction of locally produced milk consumed locally	100%

ATTACHMENT B

40 CFR 190 RESULTS

IMBER OF SOURCES= 1

NO.	KM X	KM Y	M Z	KM2 AREA	U-238	TH-230	CI/YEAR RA-226	PB-210	RN-222	ID	PSIZE SET	M/SEC EXIT VEL	SOURCE NAME
1	.00	.00	22.70	.0000	1.21E-01	6.03E-04	1.21E-04	1.21E-04	0.00E+00	1101	1	1.00E+00	YELLOWCAKE DRYER ST

INPUT TAILS ACTIVITIES, PCI/G

SET	URANIUM	THORIUM	RADIUM	LEAD
1	1.14E+01	2.71E+02	2.84E+02	2.84E+02
2	1.71E+01	4.07E+02	4.27E+02	4.27E+02
3	2.28E+01	5.43E+02	5.70E+02	5.70E+02

PARTICLE SIZES AND FRACTIONAL DISTRIBUTION

SET	1.0	1.0	5.0	35.0	PDEN
1	1.000	.000	.000	.000	8.900
2	.000	1.000	.000	.000	2.400
3	.000	.000	.300	.700	2.400

PARTICULATE SOURCE STRENGTH MULTIPLIERS BY TIME STEP, 1 TIME STEP(S) USED FOR THIS RUN

SOURCE NUMBER	TSTEP 1 1.00YRS	TSTEP 2 5.00YRS	TSTEP 3 5.00YRS	TSTEP 4 5.00YRS	TSTEP 5 5.00YRS	TSTEP 6 5.00YRS	TSTEP 7 5.00YRS	TSTEP 8 5.00YRS	TSTEP 9 5.00YRS	TSTEP10 5.00YRS
1	1.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00

RADON SOURCE STRENGTH MULTIPLIERS BY TIME STEP, 1 TIME STEP(S) USED FOR THIS RUN

SOURCE NUMBER	TSTEP 1 1.00YRS	TSTEP 2 5.00YRS	TSTEP 3 5.00YRS	TSTEP 4 5.00YRS	TSTEP 5 5.00YRS	TSTEP 6 5.00YRS	TSTEP 7 5.00YRS	TSTEP 8 5.00YRS	TSTEP 9 5.00YRS	TSTEP10 5.00YRS
1	1.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00

JOINT FREQUENCY IN PERCENT, DIRECTION INDICATES WH ERE WIND IS FROM FREQWS= .12983, .25466, .19842, .21152, .12782, .07796

MPH	N	NNE	NE	ENE	E	ESE	SE	SSE	S	SSW	SW	WSW	W	WNW	NW	NNW	TOTALS
STABILITY CLASS 1																	
1.5	.0000	.0000	.0000	.0000	.0000	.0000	.0000	.0000	.0000	.0000	.0000	.0000	.0000	.0000	.0000	.0000	.0000
5.5	.0000	.0000	.0000	.0000	.0220	.0650	.0000	.0220	.0870	.0220	.0000	.0000	.0000	.0440	.0000	.0220	.2840
10.0	.0000	.0000	.0220	.0000	.0000	.0000	.0000	.0220	.0000	.0000	.0220	.0000	.0650	.0000	.0000	.0000	.1310
15.5	.0000	.0000	.0000	.0000	.0000	.0000	.0000	.0000	.0000	.0000	.0000	.0000	.0000	.0000	.0000	.0000	.0000
21.5	.0000	.0000	.0000	.0000	.0000	.0000	.0000	.0000	.0000	.0000	.0000	.0000	.0000	.0000	.0000	.0000	.0000
28.0	.0000	.0000	.0000	.0000	.0000	.0000	.0000	.0000	.0000	.0000	.0000	.0000	.0000	.0000	.0000	.0000	.0000
ALL	.0000	.0000	.0220	.0000	.0220	.0650	.0000	.0440	.0870	.0220	.0220	.0000	.0650	.0440	.0000	.0220	.4150
STABILITY CLASS 2																	
1.5	.0000	.0000	.0220	.0220	.0220	.0000	.0000	.0000	.0000	.0000	.0000	.0220	.0000	.0000	.0000	.0000	.0880
5.5	.0000	.0870	.0220	.0220	.0000	.0650	.0440	.0650	.0000	.0220	.0440	.0000	.0440	.0440	.0000	.0220	.4810
10.0	.0000	.0000	.0440	.0000	.0440	.0000	.0440	.0000	.0220	.0000	.0000	.0440	.1090	.0650	.0650	.0000	.4370
15.5	.0000	.0000	.0000	.0000	.0220	.0000	.0220	.0000	.0000	.0000	.0000	.0000	.0000	.0000	.0220	.0000	.0660
21.5	.0000	.0000	.0000	.0000	.0000	.0000	.0000	.0000	.0000	.0000	.0000	.0000	.0000	.0000	.0000	.0000	.0000
28.0	.0000	.0000	.0000	.0000	.0000	.0000	.0000	.0000	.0000	.0000	.0000	.0000	.0000	.0000	.0000	.0000	.0000
ALL	.0000	.0870	.0880	.0440	.0880	.0650	.1100	.0650	.0220	.0220	.0440	.0660	.1530	.1090	.0870	.0220	1.0720
STABILITY CLASS 3																	
1.5	.0220	.0220	.0000	.0440	.0000	.0000	.0220	.0220	.0000	.0220	.0000	.0440	.0440	.0220	.0220	.0000	.2860
5.5	.0220	.0440	.0000	.0440	.0440	.0650	.1520	.0870	.0650	.0440	.0220	.0650	.0440	.0870	.0440	.0440	.8730
10.0	.0650	.0650	.0220	.0870	.0220	.0000	.0870	.0440	.0870	.0220	.0220	.1090	.1520	.1310	.1520	.0440	1.1110
15.5	.0000	.0000	.0220	.0220	.0220	.0220	.0000	.0220	.0000	.0220	.0000	.0440	.0440	.0440	.0000	.0000	.2640
21.5	.0000	.0000	.0000	.0000	.0000	.0000	.0000	.0000	.0000	.0000	.0000	.0000	.0000	.0000	.0000	.0000	.0000
.0	.0000	.0000	.0000	.0000	.0000	.0000	.0000	.0000	.0000	.0000	.0000	.0000	.0000	.0000	.0000	.0000	.0000
[illegible]	.1090	.1310	.0440	.1970	.0880	.0870	.2610	.1750	.1520	.1100	.0440	.2620	.2840	.2840	.2180	.0880	2.5340
STABILITY CLASS 4																	
1.5	.0870	.0650	.1310	.1740	.3270	.5010	.3270	.1960	.2830	.1090	.1310	.1520	.2830	.4140	.2180	.0220	3.4200
5.5	.1520	.2180	.2830	.2180	.2610	.5660	.9580	.3270	.3270	.1960	.2400	.4790	.6530	.6320	.2830	.1960	5.9890
10.0	.3050	.4360	.2400	.2400	.0870	.3920	.8060	.5880	.4360	.4570	.7840	.7620	.5880	.7620	.8490	.6100	8.3420
15.5	.9150	1.2200	.4790	.3480	.5010	.9800	1.4160	.9580	.6320	2.8530	3.7460	1.6330	1.0240	.7190	1.0450	2.0250	20.4940
21.5	.5880	.3920	.0650	.0000	.0870	.4790	1.2630	.1740	.1740	2.3080	3.1140	.8060	.3480	.2830	.7190	1.9380	12.7380
28.0	.5660	.1310	.0870	.0000	.0650	.1520	.4790	.1520	.0650	1.4590	3.0490	.4360	.0440	.0220	.4790	.6100	7.7960
ALL	2.6130	2.4620	1.2850	.9800	1.3280	3.0700	5.2490	2.3950	1.9170	7.3820	11.0640	4.2680	2.9400	2.8320	3.5930	5.4010	58.7790
STABILITY CLASS 5																	
1.5	.0440	.1090	.1960	.2400	.5660	.4360	.4570	.1960	.1090	.2180	.2180	.1520	.4570	.1520	.1520	.1090	3.8110
5.5	.1960	.1960	.1310	.3920	.5440	1.5680	2.3080	.5010	.3920	.3270	.2180	.3270	.4790	.6970	.3920	.3050	8.9730
10.0	.3700	.3270	.2830	.1740	.3920	.7620	2.0910	.6320	.4140	.6750	.7400	.3480	.6530	.6750	.7190	.5660	9.8210
15.5	.0220	.0220	.0000	.0000	.0220	.0220	.0000	.0000	.0000	.1090	.0650	.0000	.0220	.0000	.0440	.0000	.3280
21.5	.0000	.0000	.0000	.0000	.0000	.0000	.0000	.0000	.0000	.0220	.0220	.0000	.0000	.0000	.0000	.0000	.0440
28.0	.0000	.0000	.0000	.0000	.0000	.0000	.0000	.0000	.0000	.0000	.0000	.0000	.0000	.0000	.0000	.0000	.0000
ALL	.6320	.6540	.6100	.8060	1.5240	2.7880	4.8560	1.3290	.9150	1.3510	1.2630	.8270	1.6110	1.5240	1.3070	.9800	22.9770
STABILITY CLASS 6																	
1.5	.1310	.0870	.2830	.4140	.4570	.7840	.6750	.4570	.2610	.1740	.3050	.3480	.5230	.1520	.1960	.1310	5.3780
5.5	.1310	.0870	.2180	.2180	.5230	1.5030	2.4610	.8710	.4140	.2400	.1960	.2400	.6100	.4570	.5660	.1310	8.8660
10.0	.0000	.0000	.0000	.0000	.0000	.0000	.0000	.0000	.0000	.0000	.0000	.0000	.0000	.0000	.0000	.0000	.0000
15.5	.0000	.0000	.0000	.0000	.0000	.0000	.0000	.0000	.0000	.0000	.0000	.0000	.0000	.0000	.0000	.0000	.0000
[illegible]	.0000	.0000	.0000	.0000	.0000	.0000	.0000	.0000	.0000	.0000	.0000	.0000	.0000	.0000	.0000	.0000	.0000
28.0	.0000	.0000	.0000	.0000	.0000	.0000	.0000	.0000	.0000	.0000	.0000	.0000	.0000	.0000	.0000	.0000	.0000
ALL	.2620	.1740	.5010	.6320	.9800	2.2870	3.1360	1.3280	.6750	.4140	.5010	.5880	1.1330	.6090	.7620	.2620	14.2440
ALL	3.6160	3.5080	2.5500	2.6590	4.0300	8.3620	13.6120	5.3360	3.7680	9.3010	12.9380	6.0110	6.1860	5.4020	5.9670	6.7750	100.0210

INDIVIDUAL RECEPTOR LOCATION DATA 14 LOCATIONS INPUT THIS RUN

I	LOCATION NAMES	X(KM)	Y(KM)	Z(M)	DIST(KM)	TYPE	I	LOCATION NAMES	X(KM)	Y(KM)	Z(M)	DIST(KM)	TYPE
1	NORTH 100 METERS	.00	.10	1.00	.10	10	8	L. GILBERTS RANCH	9.60	2.41	1.00	9.90	10
2	EAST 150 METERS	.10	.00	1.00	.10	10	9	EARL CAMBLIN RANCH	10.51	-2.35	1.00	10.77	10
3	WEST 150 METERS	-.10	.00	1.00	.10	10	10	JOHN GROVES	9.45	6.70	1.00	11.58	10
4	SOUTH 100 METERS	.00	-.10	1.00	.10	10	11	TOWN OF SAVAGETOWN	11.12	8.84	1.00	14.21	10
5	PFISTER RANCH	.70	-1.78	1.00	1.91	10	12	RUBY RANCH	11.34	-5.79	1.00	12.73	10
6	PUMPKIN BUTTE RANCH	3.93	-5.64	1.00	6.87	10	13	JACK CHRISTENSEN	-5.35	-1.52	1.00	5.56	10
7	W. SCHLAUTMANN RANCH	5.84	4.14	1.00	7.16	10	14	BUD CHRISTENSEN	.15	10.06	1.00	10.06	10

MISCELLANEOUS INPUTTABLE PARAMETER VALUES

DM	TSTART	FFORI	FHAYI	FFORP	FHAYP	FPR(1)	FPR(2)	FPR(3)	ACTRAT
1000.00	1988.00	.50	.50	.50	.50	2800.00	3200.00	1130.00	2.50

IPACT EQUALS 0,

JC EQUALS 0, 0, 0, 1, 0, 0, 1, 1, 1, 0

TIME STEP DATA....	STEP NAMES	LENGTH, YRS	IFTODO
1	after 1 years	2.00	1

XRHO EQUALS 1.5, 2.5, 3.5, 4.5, 7.5, 15.0, 25.0, 35.0, 45.0, 55.0, 65.0, 75.0,

POPULATION DISTRIBUTION

KILOMETERS,	N .0	NNE 22.5	NE 45.0	ENE 67.5	E 90.0	ESE 112.5	SE 135.0	SSE 157.5	S 180.0	SSW 202.5	SW 225.0	WSW 247.5	W 270.0	WNW 292.5	NW 315.0	NNW 337.5
1.0- 2.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2.0- 3.0	0	0	0	0	0	0	4	0	0	0	0	0	0	0	0	0
3.0- 4.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
4.0- 5.0	0	0	0	0	0	0	0	0	0	0	0	0	6	0	0	0
5.0-10.0	0	0	4	8	2	6	3	0	0	0	0	0	6	0	0	2
10.0-20.0	3	10	2	5	6	5	4	0	0	7	0	0	0	6	4	2
20.0-30.0	3	60	2	5	6	10	8	2	0	4	0	300	10	0	0	2
30.0-40.0	5	5	5	1700	5	10	4	5	2	0	4	8	30	10	4	2
40.0-50.0	10	5	10	4	2	8	4	5	2	8	1200	4	15	2	0	0
50.0-60.0	5	20	10	0	0	5	4	6	2	2	0	2	310	10	2	6
60.0-70.0	5	700	10	2	4	5	10	4	4	50	4	5	35	15	4	0
70.0-80.0	3	12234	15	3	12	10	10	50	90	40	12	8	15	35	12	4
1.0-80.0	34	13034	58	1727	37	59	51	72	100	111	1220	327	427	78	26	18

TOTAL 1-80 KM POPULATION IS 17379 PERSONS

TIME STEP NUMBER 1, after 1 years DURATION IN YRS IS... 2.0

EXPOSURE PATHWAY IS INHAL EXPOSED ORGAN IS WH.BODY

DOSES SHOWN BELOW ARE ANNUAL POPULATION DOSE COMMITMENTS, PERSON-REM PER YEAR

DIRECTION	XRHO 1.5	XRHO 2.5	XRHO 3.5	XRHO 4.5	XRHO 7.5	XRHO 15.0	XRHO 25.0	XRHO 35.0	XRHO 45.0	XRHO 55.0	XRHO 65.0	XRHO 75.0
N	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	2.856E-06	1.027E-06	8.525E-07	9.928E-07	3.184E-07	2.186E-07	9.455E-08
NNE	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	1.429E-05	3.464E-05	1.578E-06	9.961E-07	2.740E-06	6.990E-05	9.275E-04
NE	0.000E+00	0.000E+00	0.000E+00	0.000E+00	2.414E-05	3.488E-06	1.427E-06	1.980E-06	2.537E-06	1.768E-06	1.304E-06	1.502E-06
ENE	0.000E+00	0.000E+00	0.000E+00	0.000E+00	3.365E-05	5.485E-06	2.078E-06	3.738E-04	5.421E-07	0.000E+00	1.314E-07	1.479E-07
E	0.000E+00	0.000E+00	0.000E+00	0.000E+00	1.225E-05	8.898E-06	3.113E-06	1.290E-06	3.024E-07	0.000E+00	2.710E-07	5.908E-07
ESE	0.000E+00	0.000E+00	0.000E+00	0.000E+00	2.980E-05	6.887E-06	5.144E-06	2.609E-06	1.229E-06	4.956E-07	3.412E-07	4.920E-07
SE	0.000E+00	1.263E-04	0.000E+00	0.000E+00	1.412E-05	5.231E-06	3.948E-06	1.014E-06	6.062E-07	3.978E-07	6.966E-07	5.110E-07
SSE	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	8.668E-07	1.192E-06	7.536E-07	6.216E-07	3.015E-07	2.855E-06
S	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	2.701E-07	1.676E-07	1.133E-07	1.625E-07	2.735E-06
SSW	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	4.447E-06	1.011E-06	0.000E+00	6.858E-07	1.169E-07	2.113E-06	1.273E-06
SW	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	4.004E-07	7.092E-05	0.000E+00	1.074E-07	2.354E-07
WSW	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	6.612E-05	8.531E-07	2.444E-07	7.733E-08	1.310E-07	1.490E-07
W	0.000E+00	0.000E+00	0.000E+00	8.437E-05	2.969E-05	0.000E+00	3.569E-06	4.991E-06	1.383E-06	1.758E-05	1.311E-06	3.908E-07
WNW	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	1.489E-05	0.000E+00	4.014E-06	4.421E-07	1.342E-06	1.311E-06	2.097E-06
NW	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	1.599E-05	0.000E+00	2.818E-06	0.000E+00	4.921E-07	6.518E-07	1.360E-06
NNW	0.000E+00	0.000E+00	0.000E+00	0.000E+00	1.104E-05	2.794E-06	9.845E-07	4.807E-07	0.000E+00	5.210E-07	0.000E+00	1.682E-07

TOTAL DOSE COMMITMENT IS 2.102E-03 PERSON-REM/YR

TIME STEP NUMBER 1, after 1 years DURATION IN YRS IS... 2.0

EXPOSURE PATHWAY IS INHAL EXPOSED ORGAN IS BONE

DOSES SHOWN BELOW ARE ANNUAL POPULATION DOSE COMMITMENTS, PERSON-REM PER YEAR

DIRECTION	XRHO 1.5	XRHO 2.5	XRHO 3.5	XRHO 4.5	XRHO 7.5	XRHO 15.0	XRHO 25.0	XRHO 35.0	XRHO 45.0	XRHO 55.0	XRHO 65.0	XRHO 75.0
N	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	4.885E-05	1.757E-05	1.458E-05	1.698E-05	5.447E-06	3.739E-06	1.617E-06
NNE	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	2.445E-04	5.925E-04	2.699E-05	1.704E-05	4.688E-05	1.196E-03	1.587E-02
NE	0.000E+00	0.000E+00	0.000E+00	0.000E+00	4.130E-04	5.967E-05	2.440E-05	3.387E-05	4.340E-05	3.025E-05	2.231E-05	2.569E-05
ENE	0.000E+00	0.000E+00	0.000E+00	0.000E+00	5.757E-04	9.384E-05	3.554E-05	6.394E-03	9.273E-06	0.000E+00	2.248E-06	2.531E-06
E	0.000E+00	0.000E+00	0.000E+00	0.000E+00	2.096E-04	1.522E-04	5.325E-05	2.207E-05	5.174E-06	0.000E+00	4.636E-06	1.011E-05
ESE	0.000E+00	0.000E+00	0.000E+00	0.000E+00	5.098E-04	1.178E-04	8.799E-05	4.463E-05	2.102E-05	8.478E-06	5.836E-06	8.416E-06
SE	0.000E+00	2.160E-03	0.000E+00	0.000E+00	2.415E-04	8.949E-05	6.753E-05	1.735E-05	1.037E-05	6.805E-06	1.192E-05	8.742E-06
SSE	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	1.483E-05	2.039E-05	1.289E-05	1.063E-05	5.157E-06	4.884E-05
S	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	4.621E-06	2.867E-06	1.938E-06	2.781E-06	4.679E-05
SSW	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	7.608E-05	1.729E-05	0.000E+00	1.173E-05	2.000E-06	3.614E-05	2.177E-05
SW	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	6.850E-06	1.213E-03	0.000E+00	1.837E-06	4.027E-06
WSW	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	1.131E-03	1.459E-05	4.182E-06	1.323E-06	2.240E-06	2.550E-06
W	0.000E+00	0.000E+00	0.000E+00	1.443E-03	5.079E-04	0.000E+00	6.105E-05	8.539E-05	2.366E-05	3.007E-04	2.243E-05	6.685E-06
WNW	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	2.547E-04	0.000E+00	6.867E-05	7.563E-06	2.295E-05	2.242E-05	3.588E-05
NW	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	2.736E-04	0.000E+00	4.821E-05	0.000E+00	8.417E-06	1.115E-05	2.326E-05
NNW	0.000E+00	0.000E+00	0.000E+00	0.000E+00	1.888E-04	4.779E-05	1.684E-05	8.222E-06	0.000E+00	8.913E-06	0.000E+00	2.877E-06

TOTAL DOSE COMMITMENT IS 3.596E-02 PERSON-REM/YR

TIME STEP NUMBER 1, after 1 years DURATION IN YRS IS... 2.0

EXPOSURE PATHWAY IS INHAL EXPOSED ORGAN IS AVG.LUNG

DOSES SHOWN BELOW ARE ANNUAL POPULATION DOSE COMMITMENTS, PERSON-REM PER YEAR

DIRECTION	XRHO 1.5	XRHO 2.5	XRHO 3.5	XRHO 4.5	XRHO 7.5	XRHO 15.0	XRHO 25.0	XRHO 35.0	XRHO 45.0	XRHO 55.0	XRHO 65.0	XRHO 75.0
N	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	3.017E-04	1.085E-04	9.007E-05	1.049E-04	3.364E-05	2.309E-05	9.990E-06
NNE	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	1.510E-03	3.660E-03	1.667E-04	1.052E-04	2.895E-04	7.385E-03	9.800E-02
NE	0.000E+00	0.000E+00	0.000E+00	0.000E+00	2.551E-03	3.685E-04	1.507E-04	2.092E-04	2.681E-04	1.869E-04	1.378E-04	1.587E-04
ENE	0.000E+00	0.000E+00	0.000E+00	0.000E+00	3.555E-03	5.796E-04	2.195E-04	3.949E-02	5.727E-05	0.000E+00	1.388E-05	1.563E-05
E	0.000E+00	0.000E+00	0.000E+00	0.000E+00	1.295E-03	9.402E-04	3.289E-04	1.363E-04	3.195E-05	0.000E+00	2.863E-05	6.243E-05
ESE	0.000E+00	0.000E+00	0.000E+00	0.000E+00	3.149E-03	7.277E-04	5.435E-04	2.756E-04	1.298E-04	5.236E-05	3.605E-05	5.198E-05
SE	0.000E+00	1.334E-02	0.000E+00	0.000E+00	1.491E-03	5.527E-04	4.171E-04	1.072E-04	6.405E-05	4.203E-05	7.360E-05	5.399E-05
SSE	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	9.158E-05	1.259E-04	7.962E-05	6.567E-05	3.185E-05	3.017E-04
S	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	2.854E-05	1.771E-05	1.197E-05	1.717E-05	2.890E-04
SSW	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	4.699E-04	1.068E-04	0.000E+00	7.246E-05	1.235E-05	2.232E-04	1.345E-04
SW	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	4.231E-05	7.493E-03	0.000E+00	1.135E-05	2.487E-05
WSW	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	6.986E-03	9.014E-05	2.583E-05	8.170E-06	1.384E-05	1.575E-05
W	0.000E+00	0.000E+00	0.000E+00	8.914E-03	3.137E-03	0.000E+00	3.771E-04	5.274E-04	1.462E-04	1.857E-03	1.385E-04	4.129E-05
WNW	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	1.573E-03	0.000E+00	4.241E-04	4.671E-05	1.417E-04	1.385E-04	2.216E-04
NW	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	1.690E-03	0.000E+00	2.978E-04	0.000E+00	5.199E-05	6.886E-05	1.636E-04
NNW	0.000E+00	0.000E+00	0.000E+00	0.000E+00	1.166E-03	2.952E-04	1.040E-04	5.078E-05	0.000E+00	5.505E-05	0.000E+00	1.777E-05

TOTAL DOSE COMMITMENT IS 2.221E-01 PERSON-REM/YR

TIME STEP NUMBER 1, after 1 years DURATION IN YRS IS... 2.0

EXPOSURE PATHWAY IS INHAL EXPOSED ORGAN IS BRONCHI

DOSES SHOWN BELOW ARE ANNUAL POPULATION DOSE COMMITMENTS, PERSON-REM PER YEAR

DIRECTION	XRHO 1.5	XRHO 2.5	XRHO 3.5	XRHO 4.5	XRHO 7.5	XRHO 15.0	XRHO 25.0	XRHO 35.0	XRHO 45.0	XRHO 55.0	XRHO 65.0	XRH(75.(
N	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E
NNE	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E
NE	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E
ENE	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E·
E	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E·
ESE	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+
SE	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+
SSE	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+
S	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+
SSW	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+
SW	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+(
WSW	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+(
W	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+(
WNW	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+(
NW	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+0
NNW	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+0

TOTAL DOSE COMMITMENT IS 0.000E+00 PERSON-REM/YR

TIME STEP NUMBER 1, after 1 years DURATION IN YRS IS... 2.0

EXPOSURE PATHWAY IS GROUND EXPOSED ORGAN IS WH.BODY

DOSES SHOWN BELOW ARE ANNUAL POPULATION DOSE COMMITMENTS, PERSON-REM PER YEAR

DIRECTION	XRHO 1.5	XRHO 2.5	XRHO 3.5	XRHO 4.5	XRHO 7.5	XRHO 15.0	XRHO 25.0	XRHO 35.0	XRHO 45.0	XRHO 55.0	XRHO 65.0	XR. 75.
N	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	1.632E-07	5.869E-08	4.872E-08	5.674E-08	1.819E-08	1.249E-08	5.403
NNE	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	8.167E-07	1.979E-06	9.017E-08	5.692E-08	1.566E-07	3.994E-06	5.300
NE	0.000E+00	0.000E+00	0.000E+00	0.000E+00	1.380E-06	1.993E-07	8.152E-08	1.132E-07	1.450E-07	1.011E-07	7.453E-08	8.581
ENE	0.000E+00	0.000E+00	0.000E+00	0.000E+00	1.923E-06	3.135E-07	1.187E-07	2.136E-05	3.098E-08	0.000E+00	7.509E-09	8.454
E	0.000E+00	0.000E+00	0.000E+00	0.000E+00	7.003E-07	5.085E-07	1.779E-07	7.371E-08	1.728E-08	0.000E+00	1.549E-08	3.376E
ESE	0.000E+00	0.000E+00	0.000E+00	0.000E+00	1.703E-06	3.935E-07	2.939E-07	1.491E-07	7.021E-08	2.832E-08	1.950E-08	2.811E
SE	0.000E+00	7.216E-06	0.000E+00	0.000E+00	8.067E-07	2.989E-07	2.256E-07	5.796E-08	3.464E-08	2.273E-08	3.980E-08	2.920E
SSE	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	4.953E-08	6.811E-08	4.306E-08	3.552E-08	1.723E-08	1.632E
S	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	1.544E-08	9.577E-09	6.476E-09	9.289E-09	1.563E-
SSW	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	2.541E-07	5.777E-08	0.000E+00	3.919E-08	6.682E-09	1.207E-07	7.272E-
SW	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	2.288E-08	4.053E-06	0.000E+00	6.138E-09	1.345E-
WSW	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	3.778E-06	4.875E-08	1.397E-08	4.419E-09	7.484E-09	8.517E-
W	0.000E+00	0.000E+00	0.000E+00	4.821E-06	1.697E-06	0.000E+00	2.039E-07	2.852E-07	7.905E-08	1.005E-06	7.493E-08	2.233E-(
WNW	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	8.509E-07	0.000E+00	2.294E-07	2.526E-08	7.667E-08	7.489E-08	1.198E-(
NW	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	9.138E-07	0.000E+00	1.610E-07	0.000E+00	2.812E-08	3.725E-08	7.769E-0
NNW	0.000E+00	0.000E+00	0.000E+00	0.000E+00	6.308E-07	1.597E-07	5.626E-08	2.747E-08	0.000E+00	2.977E-08	0.000E+00	9.610E-0

TOTAL DOSE COMMITMENT IS 1.201E-04 PERSON-REM/YR

TIME STEP NUMBER 1, after 1 years DURATION IN YRS IS... 2.0

EXPOSURE PATHWAY IS CLOUD EXPOSED ORGAN IS WH.BODY

DOSES SHOWN BELOW ARE ANNUAL POPULATION DOSE COMMITMENTS, PERSON-REM PER YEAR

DIRECTION	XRHO 1.5	XRHO 2.5	XRHO 3.5	XRHO 4.5	XRHO 7.5	XRHO 15.0	XRHO 25.0	XRHO 35.0	XRHO 45.0	XRHO 55.0	XRHO 65.0	XRH(75.(
N	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	1.334E-11	4.796E-12	3.981E-12	4.636E-12	1.487E-12	1.021E-12	4.415E
NNE	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	6.674E-11	1.617E-10	7.368E-12	4.651E-12	1.280E-11	3.264E-10	4.331E
NE	0.000E+00	0.000E+00	0.000E+00	0.000E+00	1.127E-10	1.629E-11	6.661E-12	9.246E-12	1.185E-11	8.258E-12	6.090E-12	7.012E
ENE	0.000E+00	0.000E+00	0.000E+00	0.000E+00	1.571E-10	2.561E-11	9.702E-12	1.745E-09	2.531E-12	0.000E+00	6.136E-13	6.908E-
E	0.000E+00	0.000E+00	0.000E+00	0.000E+00	5.722E-11	4.155E-11	1.454E-11	6.023E-12	1.412E-12	0.000E+00	1.265E-12	2.759E-
ESE	0.000E+00	0.000E+00	0.000E+00	0.000E+00	1.392E-10	3.216E-11	2.402E-11	1.218E-11	5.737E-12	2.314E-12	1.593E-12	2.297E-
SE	0.000E+00	5.896E-10	0.000E+00	0.000E+00	6.591E-11	2.443E-11	1.843E-11	4.736E-12	2.830E-12	1.858E-12	3.253E-12	2.386E-
SSE	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	4.047E-12	5.565E-12	3.519E-12	2.902E-12	1.408E-12	1.333E-
S	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	1.261E-12	7.825E-13	5.291E-13	7.590E-13	1.277E-
SSW	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	2.077E-11	4.720E-12	0.000E+00	3.202E-12	5.460E-13	9.864E-12	5.942E-:
SW	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	1.870E-12	3.312E-10	0.000E+00	5.015E-13	1.099E-1
WSW	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	3.087E-10	3.984E-12	1.141E-12	3.611E-13	6.115E-13	6.960E-1
W	0.000E+00	0.000E+00	0.000E+00	3.940E-10	1.386E-10	0.000E+00	1.666E-11	2.331E-11	6.460E-12	8.208E-11	6.123E-12	1.825E-1
WNW	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	6.953E-11	0.000E+00	1.874E-11	2.064E-12	6.265E-12	6.120E-12	9.793E-1
NW	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	7.467E-11	0.000E+00	1.316E-11	0.000E+00	2.298E-12	3.043E-12	6.348E-1
NNW	0.000E+00	0.000E+00	0.000E+00	0.000E+00	5.154E-11	1.305E-11	4.597E-12	2.244E-12	0.000E+00	2.433E-12	0.000E+00	7.853E-1:

TOTAL DOSE COMMITMENT IS 9.815E-09 PERSON-REM/YR

TIME STEP NUMBER 1, after 1 years DURATION IN YRS IS... 2.0

EXPOSURE PATHWAY IS VEG.ING EXPOSED ORGAN IS WH.BODY

DOSES SHOWN BELOW ARE ANNUAL POPULATION DOSE COMMITMENTS, PERSON-REM PER YEAR

DIRECTION	XRHO 1.5	XRHO 2.5	XRHO 3.5	XRHO 4.5	XRHO 7.5	XRHO 15.0	XRHO 25.0	XRHO 35.0	XRHO 45.0	XRHO 55.0	XRHO 65.0	XRHC 75.0
N	4.491E-04	3.623E-04	2.873E-04	2.346E-04	7.416E-04	7.620E-04	4.569E-04	3.184E-04	2.384E-04	1.869E-04	1.517E-04	1.261E
NNE	5.600E-04	4.344E-04	3.477E-04	2.899E-04	9.805E-04	1.144E-03	7.705E-04	5.894E-04	4.784E-04	4.022E-04	3.465E-04	3.034E-
NE	7.020E-04	5.485E-04	4.376E-04	3.627E-04	1.208E-03	1.396E-03	9.519E-04	7.396E-04	6.093E-04	5.192E-04	4.526E-04	4.007E-
ENE	5.270E-04	4.200E-04	3.307E-04	2.687E-04	8.421E-04	8.782E-04	5.546E-04	4.106E-04	3.254E-04	2.686E-04	2.280E-04	1.974E-
E	8.017E-04	6.408E-04	5.009E-04	4.033E-04	1.227E-03	1.187E-03	6.924E-04	4.818E-04	3.631E-04	2.872E-04	2.351E-04	1.971E-
ESE	5.847E-04	4.519E-04	3.602E-04	2.989E-04	9.943E-04	1.103E-03	6.865E-04	4.872E-04	3.688E-04	2.910E-04	2.368E-04	1.969E-
SE	5.246E-04	4.213E-04	3.394E-04	2.827E-04	9.420E-04	1.047E-03	6.586E-04	4.735E-04	3.639E-04	2.920E-04	2.417E-04	2.045E-
SSE	3.908E-04	3.056E-04	2.462E-04	2.064E-04	7.078E-04	8.455E-04	5.784E-04	4.451E-04	3.619E-04	3.041E-04	2.615E-04	2.286E-1
S	2.591E-04	2.061E-04	1.648E-04	1.364E-04	4.504E-04	5.086E-04	3.354E-04	2.522E-04	2.012E-04	1.663E-04	1.410E-04	1.216E-0
SSW	2.665E-04	2.040E-04	1.617E-04	1.338E-04	4.450E-04	5.086E-04	3.373E-04	2.558E-04	2.059E-04	1.716E-04	1.466E-04	1.273E-0
SW	3.470E-04	2.794E-04	2.166E-04	1.724E-04	5.063E-04	4.656E-04	2.679E-04	1.869E-04	1.419E-04	1.131E-04	9.317E-05	7.852E-0
WSW	4.448E-04	3.587E-04	2.759E-04	2.174E-04	6.187E-04	5.362E-04	2.941E-04	1.991E-04	1.468E-04	1.135E-04	9.088E-05	7.457E-0
W	6.978E-04	5.505E-04	4.247E-04	3.377E-04	9.907E-04	8.848E-04	4.763E-04	3.107E-04	2.215E-04	1.665E-04	1.300E-04	1.043E-0
WNW	1.177E-03	9.781E-04	7.796E-04	6.368E-04	1.996E-03	1.987E-03	1.136E-03	7.496E-04	5.309E-04	3.938E-04	3.032E-04	2.398E-0
NW	1.524E-03	1.279E-03	1.044E-03	8.741E-04	2.924E-03	3.200E-03	1.932E-03	1.316E-03	9.542E-04	7.223E-04	5.654E-04	4.535E-0
NNW	6.349E-04	5.344E-04	4.280E-04	3.506E-04	1.105E-03	1.118E-03	6.570E-04	4.488E-04	3.301E-04	2.549E-04	2.043E-04	1.683E-04

TOTAL DOSE COMMITMENT IS 9.966E-02 PERSON-REM/YR

WARNING--POPULATION FOOD INGESTION DOSES SHOWN ABOVE HAVE NOT BEEN CORRECTED TO REFLECT POTENTIAL FOOD EXPORT AND MAY EXCEED DOSES ACTUALLY RECEIVED BY THE POPULATION OF THIS REGION. SEE SUMMARY TABLE FOR THIS INFORMATION.

TIME STEP NUMBER 1, after 1 years DURATION IN YRS IS... 2.0

EXPOSURE PATHWAY IS VEG.ING EXPOSED ORGAN IS BONE

DOSES SHOWN BELOW ARE ANNUAL POPULATION DOSE COMMITMENTS, PERSON-REM PER YEAR

DIRECTION	XRHO 1.5	XRHO 2.5	XRHO 3.5	XRHO 4.5	XRHO 7.5	XRHO 15.0	XRHO 25.0	XRHO 35.0	XRHO 45.0	XRHO 55.0	XRHO 65.0	XRHO 75.0
N	7.330E-03	5.913E-03	4.688E-03	3.829E-03	1.210E-02	1.244E-02	7.457E-03	5.196E-03	3.891E-03	3.051E-03	2.475E-03	2.059E-03
NNE	9.139E-03	7.090E-03	5.675E-03	4.731E-03	1.600E-02	1.867E-02	1.257E-02	9.618E-03	7.808E-03	6.564E-03	5.654E-03	4.952E-03
NE	1.146E-02	8.952E-03	7.141E-03	5.920E-03	1.972E-02	2.279E-02	1.554E-02	1.207E-02	9.944E-03	8.473E-03	7.386E-03	6.540E-03
ENE	8.601E-03	6.855E-03	5.397E-03	4.386E-03	1.374E-02	1.433E-02	9.052E-03	6.701E-03	5.311E-03	4.383E-03	3.720E-03	3.221E-03
E	1.308E-02	1.046E-02	8.174E-03	6.583E-03	2.002E-02	1.938E-02	1.130E-02	7.863E-03	5.927E-03	4.687E-03	3.837E-03	3.216E-03
ESE	9.542E-03	7.376E-03	5.878E-03	4.878E-03	1.623E-02	1.799E-02	1.120E-02	7.951E-03	6.019E-03	4.749E-03	3.864E-03	3.214E-03
SE	8.561E-03	6.876E-03	5.539E-03	4.614E-03	1.537E-02	1.709E-02	1.075E-02	7.727E-03	5.939E-03	4.765E-03	3.944E-03	3.338E-03
SSE	6.377E-03	4.988E-03	4.018E-03	3.369E-03	1.155E-02	1.380E-02	9.440E-03	7.265E-03	5.907E-03	4.963E-03	4.268E-03	3.730E-03
S	4.229E-03	3.364E-03	2.689E-03	2.226E-03	7.350E-03	8.301E-03	5.473E-03	4.116E-03	3.284E-03	2.715E-03	2.301E-03	1.985E-03
SSW	4.350E-03	3.329E-03	2.639E-03	2.184E-03	7.263E-03	8.300E-03	5.505E-03	4.174E-03	3.360E-03	2.801E-03	2.393E-03	2.078E-03
SW	5.664E-03	4.559E-03	3.535E-03	2.814E-03	8.263E-03	7.599E-03	4.373E-03	3.051E-03	2.316E-03	1.846E-03	1.521E-03	1.281E-03
WSW	7.259E-03	5.855E-03	4.503E-03	3.548E-03	1.010E-02	8.752E-03	4.800E-03	3.250E-03	2.395E-03	1.852E-03	1.483E-03	1.217E-03
W	1.139E-02	8.984E-03	6.931E-03	5.511E-03	1.617E-02	1.444E-02	7.774E-03	5.071E-03	3.615E-03	2.717E-03	2.122E-03	1.702E-03
WNW	1.921E-02	1.596E-02	1.272E-02	1.039E-02	3.257E-02	3.242E-02	1.853E-02	1.223E-02	8.664E-03	6.428E-03	4.948E-03	3.914E-03
NW	2.487E-02	2.087E-02	1.704E-02	1.427E-02	4.772E-02	5.223E-02	3.153E-02	2.147E-02	1.557E-02	1.179E-02	9.227E-03	7.401E-03
NNW	1.036E-02	8.721E-03	6.986E-03	5.721E-03	1.803E-02	1.825E-02	1.072E-02	7.324E-03	5.387E-03	4.160E-03	3.335E-03	2.746E-03

TOTAL DOSE COMMITMENT IS 1.627E+00 PERSON-REM/YR

WARNING--POPULATION FOOD INGESTION DOSES SHOWN ABOVE HAVE NOT BEEN CORRECTED TO REFLECT POTENTIAL FOOD EXPORT AND MAY EXCEED DOSES ACTUALLY RECEIVED BY THE POPULATION OF THIS REGION. SEE SUMMARY TABLE FOR THIS INFORMATION.

TIME STEP NUMBER 1, after 1 years DURATION IN YRS IS... 2.0

EXPOSURE PATHWAY IS MEAT ING EXPOSED ORGAN IS WH.BODY

DOSES SHOWN BELOW ARE ANNUAL POPULATION DOSE COMMITMENTS, PERSON-REM PER YEAR

DIRECTION	XRHO 1.5	XRHO 2.5	XRHO 3.5	XRHO 4.5	XRHO 7.5	XRHO 15.0	XRHO 25.0	XRHO 35.0	XRHO 45.0	XRHO 55.0	XRHO 65.0	XRH 75.
N	2.999E-05	2.419E-05	1.918E-05	1.566E-05	4.951E-05	5.088E-05	3.050E-05	2.126E-05	1.592E-05	1.248E-05	1.013E-05	8.422E
NNE	3.739E-05	2.900E-05	2.321E-05	1.935E-05	6.546E-05	7.639E-05	5.144E-05	3.935E-05	3.194E-05	2.685E-05	2.313E-05	2.026E
NE	4.686E-05	3.662E-05	2.921E-05	2.422E-05	8.067E-05	9.321E-05	6.356E-05	4.938E-05	4.068E-05	3.466E-05	3.021E-05	2.675E
ENE	3.519E-05	2.804E-05	2.208E-05	1.794E-05	5.622E-05	5.863E-05	3.703E-05	2.741E-05	2.173E-05	1.793E-05	1.522E-05	1.318E
E	5.353E-05	4.278E-05	3.344E-05	2.693E-05	8.190E-05	7.926E-05	4.623E-05	3.217E-05	2.424E-05	1.918E-05	1.570E-05	1.316E
ESE	3.903E-05	3.017E-05	2.405E-05	1.995E-05	6.639E-05	7.361E-05	4.583E-05	3.253E-05	2.462E-05	1.943E-05	1.581E-05	1.315E
SE	3.502E-05	2.813E-05	2.266E-05	1.887E-05	6.289E-05	6.989E-05	4.397E-05	3.161E-05	2.430E-05	1.949E-05	1.614E-05	1.366E-
SSE	2.609E-05	2.041E-05	1.644E-05	1.378E-05	4.726E-05	5.645E-05	3.862E-05	2.972E-05	2.416E-05	2.030E-05	1.746E-05	1.526E-
S	1.730E-05	1.376E-05	1.100E-05	9.106E-06	3.007E-05	3.396E-05	2.239E-05	1.684E-05	1.343E-05	1.110E-05	9.414E-06	8.121E-
SSW	1.780E-05	1.362E-05	1.080E-05	8.935E-06	2.971E-05	3.396E-05	2.252E-05	1.708E-05	1.375E-05	1.146E-05	9.787E-06	8.501E-
SW	2.317E-05	1.865E-05	1.446E-05	1.151E-05	3.380E-05	3.109E-05	1.789E-05	1.248E-05	9.476E-06	7.551E-06	6.220E-06	5.242E-1
WSW	2.970E-05	2.395E-05	1.842E-05	1.451E-05	4.131E-05	3.580E-05	1.964E-05	1.330E-05	9.798E-06	7.578E-06	6.068E-06	4.979E-0
W	4.659E-05	3.675E-05	2.835E-05	2.255E-05	6.614E-05	5.907E-05	3.180E-05	2.074E-05	1.479E-05	1.111E-05	8.679E-06	6.962E-0
WNW	7.859E-05	6.530E-05	5.205E-05	4.251E-05	1.332E-04	1.326E-04	7.581E-05	5.004E-05	3.544E-05	2.629E-05	2.024E-05	1.601E-0
NW	1.018E-04	8.539E-05	6.969E-05	5.836E-05	1.952E-04	2.137E-04	1.290E-04	8.784E-05	6.371E-05	4.822E-05	3.775E-05	3.028E-0
NNW	4.239E-05	3.568E-05	2.858E-05	2.340E-05	7.377E-05	7.466E-05	4.386E-05	2.996E-05	2.204E-05	1.702E-05	1.364E-05	1.123E-0

TOTAL DOSE COMMITMENT IS 6.654E-03 PERSON-REM/YR

WARNING--POPULATION FOOD INGESTION DOSES SHOWN ABOVE HAVE NOT BEEN CORRECTED TO REFLECT POTENTIAL FOOD EXPORT AND MAY EXCEED DOSES ACTUALLY RECEIVED BY THE POPULATION OF THIS REGION. SEE SUMMARY TABLE FOR THIS INFORMATION.

TIME STEP NUMBER 1, after 1 years DURATION IN YRS IS... 2.0

EXPOSURE PATHWAY IS MEAT ING EXPOSED ORGAN IS BONE

DOSES SHOWN BELOW ARE ANNUAL POPULATION DOSE COMMITMENTS, PERSON-REM PER YEAR

DIRECTION	XRHO 1.5	XRHO 2.5	XRHO 3.5	XRHO 4.5	XRHO 7.5	XRHO 15.0	XRHO 25.0	XRHO 35.0	XRHO 45.0	XRHO 55.0	XRHO 65.0	XRHO 75.0
N	4.863E-04	3.923E-04	3.110E-04	2.540E-04	8.030E-04	8.251E-04	4.947E-04	3.448E-04	2.582E-04	2.024E-04	1.642E-04	1.366E-
NNE	6.063E-04	4.704E-04	3.765E-04	3.139E-04	1.062E-03	1.239E-03	8.343E-04	6.381E-04	5.180E-04	4.355E-04	3.751E-04	3.286E-
NE	7.601E-04	5.940E-04	4.738E-04	3.928E-04	1.308E-03	1.512E-03	1.031E-03	8.008E-04	6.598E-04	5.622E-04	4.900E-04	4.339E-
ENE	5.706E-04	4.548E-04	3.581E-04	2.910E-04	9.118E-04	9.509E-04	6.005E-04	4.446E-04	3.524E-04	2.908E-04	2.468E-04	2.137E-
E	8.681E-04	6.938E-04	5.423E-04	4.367E-04	1.328E-03	1.285E-03	7.497E-04	5.217E-04	3.932E-04	3.110E-04	2.545E-04	2.134E-
ESE	6.331E-04	4.894E-04	3.900E-04	3.236E-04	1.077E-03	1.194E-03	7.433E-04	5.275E-04	3.993E-04	3.151E-04	2.564E-04	2.132E-
SE	5.680E-04	4.562E-04	3.675E-04	3.061E-04	1.020E-03	1.134E-03	7.131E-04	5.127E-04	3.941E-04	3.161E-04	2.617E-04	2.215E-
SSE	4.231E-04	3.309E-04	2.666E-04	2.235E-04	7.664E-04	9.155E-04	6.263E-04	4.820E-04	3.919E-04	3.293E-04	2.832E-04	2.475E-
S	2.806E-04	2.232E-04	1.784E-04	1.477E-04	4.876E-04	5.508E-04	3.631E-04	2.731E-04	2.179E-04	1.801E-04	1.527E-04	1.317E-(
SSW	2.886E-04	2.209E-04	1.751E-04	1.449E-04	4.819E-04	5.507E-04	3.652E-04	2.769E-04	2.229E-04	1.858E-04	1.587E-04	1.379E-(
SW	3.758E-04	3.025E-04	2.345E-04	1.867E-04	5.482E-04	5.042E-04	2.901E-04	2.024E-04	1.537E-04	1.225E-04	1.009E-04	8.502E-(
WSW	4.816E-04	3.884E-04	2.987E-04	2.354E-04	6.699E-04	5.806E-04	3.185E-04	2.156E-04	1.589E-04	1.229E-04	9.840E-05	8.075E-(
W	7.556E-04	5.960E-04	4.598E-04	3.657E-04	1.073E-03	9.581E-04	5.157E-04	3.364E-04	2.398E-04	1.802E-04	1.408E-04	1.129E-0
WNW	1.275E-03	1.059E-03	8.441E-04	6.895E-04	2.161E-03	2.151E-03	1.230E-03	8.116E-04	5.748E-04	4.265E-04	3.283E-04	2.597E-0
NW	1.650E-03	1.385E-03	1.130E-03	9.465E-04	3.166E-03	3.465E-03	2.092E-03	1.425E-03	1.033E-03	7.820E-04	6.122E-04	4.910E-0
NNW	6.875E-04	5.786E-04	4.635E-04	3.796E-04	1.196E-03	1.211E-03	7.113E-04	4.859E-04	3.574E-04	2.760E-04	2.212E-04	1.822E-0

TOTAL DOSE COMMITMENT IS 1.079E-01 PERSON-REM/YR

WARNING--POPULATION FOOD INGESTION DOSES SHOWN ABOVE HAVE NOT BEEN CORRECTED TO REFLECT POTENTIAL FOOD EXPORT AND MAY EXCEED DOSES ACTUALLY RECEIVED BY THE POPULATION OF THIS REGION. SEE SUMMARY TABLE FOR THIS INFORMATION.

TIME STEP NUMBER 1, after 1 years DURATION IN YRS IS... 2.0

EXPOSURE PATHWAY IS MILK ING EXPOSED ORGAN IS WH.BODY

DOSES SHOWN BELOW ARE ANNUAL POPULATION DOSE COMMITMENTS, PERSON-REM PER YEAR

DIRECTION	XRHO 1.5	XRHO 2.5	XRHO 3.5	XRHO 4.5	XRHO 7.5	XRHO 15.0	XRHO 25.0	XRHO 35.0	XRHO 45.0	XRHO 55.0	XRHO 65.0	XRHO 75.0
N	2.540E-05	2.049E-05	1.624E-05	1.327E-05	4.194E-05	4.309E-05	2.584E-05	1.800E-05	1.348E-05	1.057E-05	8.577E-06	7.133E-
NNE	3.167E-05	2.456E-05	1.966E-05	1.639E-05	5.544E-05	6.470E-05	4.357E-05	3.333E-05	2.705E-05	2.274E-05	1.959E-05	1.716E-
NE	3.969E-05	3.102E-05	2.474E-05	2.051E-05	6.833E-05	7.895E-05	5.383E-05	4.182E-05	3.445E-05	2.936E-05	2.559E-05	2.266E-
ENE	2.980E-05	2.375E-05	1.870E-05	1.520E-05	4.762E-05	4.966E-05	3.136E-05	2.322E-05	1.840E-05	1.519E-05	1.289E-05	1.116E-
E	4.533E-05	3.623E-05	2.832E-05	2.281E-05	6.936E-05	6.713E-05	3.915E-05	2.724E-05	2.053E-05	1.624E-05	1.329E-05	1.114E-1
ESE	3.306E-05	2.556E-05	2.037E-05	1.690E-05	5.623E-05	6.235E-05	3.882E-05	2.755E-05	2.085E-05	1.645E-05	1.339E-05	1.113E-1
SE	2.966E-05	2.382E-05	1.919E-05	1.599E-05	5.327E-05	5.920E-05	3.724E-05	2.677E-05	2.058E-05	1.651E-05	1.367E-05	1.157E-1
SSE	2.210E-05	1.728E-05	1.392E-05	1.167E-05	4.002E-05	4.781E-05	3.271E-05	2.517E-05	2.047E-05	1.720E-05	1.479E-05	1.292E-1
S	1.465E-05	1.166E-05	9.318E-06	7.712E-06	2.547E-05	2.876E-05	1.896E-05	1.426E-05	1.138E-05	9.405E-06	7.973E-06	6.878E-0
SSW	1.507E-05	1.153E-05	9.144E-06	7.567E-06	2.516E-05	2.876E-05	1.907E-05	1.446E-05	1.164E-05	9.705E-06	8.290E-06	7.200E-0
SW	1.962E-05	1.580E-05	1.225E-05	9.749E-06	2.863E-05	2.633E-05	1.515E-05	1.057E-05	8.026E-06	6.395E-06	5.268E-06	4.440E-0
WSW	2.515E-05	2.029E-05	1.560E-05	1.229E-05	3.498E-05	3.032E-05	1.663E-05	1.126E-05	8.299E-06	6.418E-06	5.139E-06	4.217E-0
W	3.946E-05	3.113E-05	2.401E-05	1.910E-05	5.602E-05	5.003E-05	2.693E-05	1.757E-05	1.252E-05	9.413E-06	7.351E-06	5.896E-0
WNW	6.656E-05	5.531E-05	4.408E-05	3.601E-05	1.129E-04	1.123E-04	6.421E-05	4.239E-05	3.002E-05	2.227E-05	1.714E-05	1.356E-0
NW	8.618E-05	7.233E-05	5.902E-05	4.943E-05	1.653E-04	1.810E-04	1.092E-04	7.440E-05	5.396E-05	4.084E-05	3.197E-05	2.564E-05
NNW	3.590E-05	3.022E-05	2.420E-05	1.982E-05	6.248E-05	6.323E-05	3.715E-05	2.538E-05	1.867E-05	1.441E-05	1.155E-05	9.516E-06

TOTAL DOSE COMMITMENT IS 5.636E-03 PERSON-REM/YR

WARNING--POPULATION FOOD INGESTION DOSES SHOWN ABOVE HAVE NOT BEEN CORRECTED TO REFLECT POTENTIAL FOOD EXPORT AND MAY EXCEED DOSES ACTUALLY RECEIVED BY THE POPULATION OF THIS REGION. SEE SUMMARY TABLE FOR THIS INFORMATION.

TIME STEP NUMBER 1, after 1 years DURATION IN YRS IS... 2.0

EXPOSURE PATHWAY IS MILK ING EXPOSED ORGAN IS BONE

DOSES SHOWN BELOW ARE ANNUAL POPULATION DOSE COMMITMENTS, PERSON-REM PER YEAR

DIRECTION	XRHO 1.5	XRHO 2.5	XRHO 3.5	XRHO 4.5	XRHO 7.5	XRHO 15.0	XRHO 25.0	XRHO 35.0	XRHO 45.0	XRHO 55.0	XRHO 65.0	XRHO 75.0
N	4.073E-04	3.285E-04	2.605E-04	2.127E-04	6.725E-04	6.910E-04	4.143E-04	2.887E-04	2.162E-04	1.695E-04	1.375E-04	1.144E-04
NNE	5.078E-04	3.939E-04	3.153E-04	2.629E-04	8.890E-04	1.037E-03	6.986E-04	5.344E-04	4.338E-04	3.647E-04	3.142E-04	2.752E-04
NE	6.365E-04	4.974E-04	3.968E-04	3.289E-04	1.096E-03	1.266E-03	8.632E-04	6.706E-04	5.525E-04	4.708E-04	4.104E-04	3.633E-04
ENE	4.779E-04	3.809E-04	2.998E-04	2.437E-04	7.636E-04	7.963E-04	5.029E-04	3.723E-04	2.951E-04	2.435E-04	2.067E-04	1.790E-04
E	7.270E-04	5.810E-04	4.542E-04	3.657E-04	1.112E-03	1.076E-03	6.278E-04	4.369E-04	3.293E-04	2.604E-04	2.132E-04	1.787E-04
ESE	5.301E-04	4.098E-04	3.266E-04	2.710E-04	9.016E-04	9.998E-04	6.225E-04	4.417E-04	3.344E-04	2.638E-04	2.147E-04	1.786E-04
SE	4.756E-04	3.820E-04	3.078E-04	2.563E-04	8.542E-04	9.493E-04	5.972E-04	4.293E-04	3.300E-04	2.647E-04	2.192E-04	1.855E-04
SSE	3.543E-04	2.771E-04	2.233E-04	1.872E-04	6.418E-04	7.667E-04	5.245E-04	4.036E-04	3.282E-04	2.758E-04	2.371E-04	2.073E-04
S	2.350E-04	1.869E-04	1.494E-04	1.237E-04	4.084E-04	4.612E-04	3.041E-04	2.287E-04	1.825E-04	1.508E-04	1.279E-04	1.103E-04
SSW	2.417E-04	1.849E-04	1.466E-04	1.213E-04	4.035E-04	4.612E-04	3.058E-04	2.319E-04	1.867E-04	1.556E-04	1.329E-04	1.155E-04
SW	3.147E-04	2.533E-04	1.964E-04	1.563E-04	4.591E-04	4.222E-04	2.429E-04	1.695E-04	1.287E-04	1.025E-04	8.448E-05	7.120E-05
WSW	4.033E-04	3.253E-04	2.502E-04	1.971E-04	5.610E-04	4.862E-04	2.667E-04	1.806E-04	1.331E-04	1.029E-04	8.241E-05	6.762E-05
W	6.327E-04	4.991E-04	3.851E-04	3.062E-04	8.983E-04	8.023E-04	4.319E-04	2.817E-04	2.008E-04	1.509E-04	1.179E-04	9.455E-05
WNW	1.067E-03	8.869E-04	7.069E-04	5.774E-04	1.810E-03	1.801E-03	1.030E-03	6.797E-04	4.814E-04	3.571E-04	2.749E-04	2.175E-04
NW	1.382E-03	1.160E-03	9.465E-04	7.926E-04	2.651E-03	2.902E-03	1.752E-03	1.193E-03	8.652E-04	6.549E-04	5.127E-04	4.112E-04
NNW	5.757E-04	4.846E-04	3.881E-04	3.179E-04	1.002E-03	1.014E-03	5.957E-04	4.069E-04	2.993E-04	2.312E-04	1.853E-04	1.526E-04

TOTAL DOSE COMMITMENT IS 9.037E-02 PERSON-REM/YR

WARNING--POPULATION FOOD INGESTION DOSES SHOWN ABOVE HAVE NOT BEEN CORRECTED TO REFLECT POTENTIAL FOOD EXPORT AND MAY EXCEED DOSES ACTUALLY RECEIVED BY THE POPULATION OF THIS REGION. SEE SUMMARY TABLE FOR THIS INFORMATION.

TIME STEP NUMBER 1, after 1 years DURATION IN YRS IS... 2.0

SUMMARY PRINT OF POPULATION DOSES COMPUTED FOR TSTEP 1--DOSES SHOWN ARE ANNUAL POPULATION DOSE COMMITMENTS, PERSON-REM PER YE

DOSES RECEIVED BY PEOPLE WITHIN 80 KILOMETERS

PATHWAY	WH.BODY	BONE	AVG.LUNG	LIVER	KIDNEY	BRONCHI
INHAL	2.102E-03	3.596E-02	2.221E-01	1.404E-04	8.486E-03	0.000E+00
GROUND	1.201E-04	1.201E-04	1.201E-04	1.201E-04	1.201E-04	1.201E-04
CLOUD	9.815E-09	9.815E-09	9.815E-09	9.815E-09	9.815E-09	9.815E-09
VEG.ING	8.514E-03	1.390E-01	8.514E-03	4.014E-04	2.903E-02	8.514E-03
MEAT ING	1.848E-04	2.997E-03	1.848E-04	1.784E-05	6.660E-04	1.848E-04
MILK ING	9.011E-04	1.445E-02	9.011E-04	7.496E-06	2.885E-03	9.011E-04
RNPLUS50	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00
TOTALS	1.182E-02	1.925E-01	2.318E-01	6.872E-04	4.119E-02	9.720E-03

DOSES RECEIVED BY PEOPLE BEYOND 80 KILOMETERS

PATHWAY	WH.BODY	BONE	AVG.LUNG	LIVER	KIDNEY	BRONCHI
INHAL	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00
GROUND	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00
CLOUD	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00
VEG.ING	9.115E-02	1.488E+00	9.115E-02	4.297E-03	3.108E-01	9.115E-02
MEAT ING	6.469E-03	1.049E-01	6.469E-03	6.246E-04	2.332E-02	6.469E-03
MILK ING	4.735E-03	7.592E-02	4.735E-03	3.939E-05	1.516E-02	4.735E-03
RNPLUS50	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00
TOTALS	1.024E-01	1.668E+00	1.024E-01	4.961E-03	3.493E-01	1.024E-01

TOTAL DOSES COMPUTED OVER ALL POPULATIONS

PATHWAY	WH.BODY	BONE	AVG.LUNG	LIVER	KIDNEY	BRONCHI
INHAL	2.102E-03	3.596E-02	2.221E-01	1.404E-04	8.486E-03	0.000E+00
GROUND	1.201E-04	1.201E-04	1.201E-04	1.201E-04	1.201E-04	1.201E-04
CLOUD	9.815E-09	9.815E-09	9.815E-09	9.815E-09	9.815E-09	9.815E-09
VEG.ING	9.966E-02	1.627E+00	9.966E-02	4.698E-03	3.398E-01	9.966E-02
MEAT ING	6.654E-03	1.079E-01	6.654E-03	6.425E-04	2.398E-02	6.654E-03
MILK ING	5.636E-03	9.037E-02	5.636E-03	4.688E-05	1.804E-02	5.636E-03
RNPLUS50	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00
TOTALS	1.142E-01	1.861E+00	3.342E-01	5.648E-03	3.905E-01	1.121E-01

TIME STEP NUMBER 1, after 1 years DURATION IN YRS IS... 2.0

INDIVIDUAL RECEPTOR PARTICULATE CONCENTRATIONS

NO.	NAME	PTSZ	AIRBORNE CONCENTRATIONS, PCI/M3 U-238	TH-230	RA-226	PB-210	GROUND CONCENTRATIONS, PCI/M2 U-238	TH-230	RA-226	PI
1	NORTH 100 METERS	1	1.429E-03	7.145E-06	1.434E-06	1.431E-06	5.487E+02	2.743E+00	5.503E-01	5.50
1	NORTH 100 METERS	2	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.00
1	NORTH 100 METERS	3	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.00
1	NORTH 100 METERS	4	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.00
	CONCENTRATION TOTALS		1.429E-03	7.145E-06	1.434E-06	1.431E-06	5.487E+02	2.743E+00	5.503E-01	5.503
2	EAST 150 METERS	1	1.619E-03	8.093E-06	1.624E-06	1.620E-06	6.215E+02	3.107E+00	6.233E-01	6.233
2	EAST 150 METERS	2	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000
2	EAST 150 METERS	3	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E
2	EAST 150 METERS	4	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E
	CONCENTRATION TOTALS		1.619E-03	8.093E-06	1.624E-06	1.620E-06	6.215E+02	3.107E+00	6.233E-01	6.233E
3	WEST 150 METERS	1	1.101E-03	5.504E-06	1.105E-06	1.102E-06	4.227E+02	2.113E+00	4.239E-01	4.239E-
3	WEST 150 METERS	2	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+
3	WEST 150 METERS	3	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+
3	WEST 150 METERS	4	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+
	CONCENTRATION TOTALS		1.101E-03	5.504E-06	1.105E-06	1.102E-06	4.227E+02	2.113E+00	4.239E-01	4.239E-(
4	SOUTH 100 METERS	1	1.651E-04	8.255E-07	1.657E-07	1.653E-07	6.339E+01	3.169E-01	6.357E-02	6.357E-0
4	SOUTH 100 METERS	2	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+0
4	SOUTH 100 METERS	3	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+0
4	SOUTH 100 METERS	4	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+0
	CONCENTRATION TOTALS		1.651E-04	8.255E-07	1.657E-07	1.653E-07	6.339E+01	3.169E-01	6.357E-02	6.357E-02
5	PFISTER RANCH	1	1.552E-03	7.758E-06	1.557E-06	1.553E-06	5.957E+02	2.978E+00	5.974E-01	5.974E-01
5	PFISTER RANCH	2	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00
5	PFISTER RANCH	3	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00
5	PFISTER RANCH	4	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00
	CONCENTRATION TOTALS		1.552E-03	7.758E-06	1.557E-06	1.553E-06	5.957E+02	2.978E+00	5.974E-01	5.974E-01
6	PUMPKIN BUTTE RANCH	1	2.301E-04	1.150E-06	2.308E-07	2.303E-07	8.833E+01	4.416E-01	8.858E-02	8.858E-02
6	PUMPKIN BUTTE RANCH	2	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00
6	PUMPKIN BUTTE RANCH	3	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00
6	PUMPKIN BUTTE RANCH	4	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00
	CONCENTRATION TOTALS		2.301E-04	1.150E-06	2.308E-07	2.303E-07	8.833E+01	4.416E-01	8.858E-02	8.858E-02
7	W. SCHLAUTMANN RANCH	1	2.675E-04	1.337E-06	2.684E-07	2.678E-07	1.027E+02	5.134E-01	1.030E-01	1.030E-01
7	W. SCHLAUTMANN RANCH	2	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00
7	W. SCHLAUTMANN RANCH	3	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00
7	W. SCHLAUTMANN RANCH	4	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00
	CONCENTRATION TOTALS		2.675E-04	1.337E-06	2.684E-07	2.678E-07	1.027E+02	5.134E-01	1.030E-01	1.030E-01
8	L. GILBERTS RANCH	1	1.322E-04	6.611E-07	1.327E-07	1.324E-07	5.077E+01	2.538E-01	5.091E-02	5.091E-02
8	L. GILBERTS RANCH	2	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00
8	L. GILBERTS RANCH	3	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00
8	L. GILBERTS RANCH	4	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00
	CONCENTRATION TOTALS		1.322E-04	6.611E-07	1.327E-07	1.324E-07	5.077E+01	2.538E-01	5.091E-02	5.091E-02

TIME STEP NUMBER 1, after 1 years DURATION IN YRS IS... 2.0

INDIVIDUAL RECEPTOR PARTICULATE CONCENTRATIONS

NO.	NAME	PTSZ	AIRBORNE CONCENTRATIONS, PCI/M3 U-238	TH-230	RA-226	PB-210	GROUND CONCENTRATIONS, PCI/M2 U-238	TH-230	RA-226	P
9	EARL CAMBLIN RANCH	1	1.275E-04	6.374E-07	1.279E-07	1.276E-07	4.895E+01	2.447E-01	4.909E-02	4.9(
9	EARL CAMBLIN RANCH	2	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0(
9	EARL CAMBLIN RANCH	3	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.00
9	EARL CAMBLIN RANCH	4	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.00(
	CONCENTRATION TOTALS		1.275E-04	6.374E-07	1.279E-07	1.276E-07	4.895E+01	2.447E-01	4.909E-02	4.90
10	JOHN GROVES	1	1.099E-04	5.493E-07	1.102E-07	1.100E-07	4.218E+01	2.109E-01	4.230E-02	4.230
10	JOHN GROVES	2	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000(
10	JOHN GROVES	3	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E
10	JOHN GROVES	4	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E
	CONCENTRATION TOTALS		1.099E-04	5.493E-07	1.102E-07	1.100E-07	4.218E+01	2.109E-01	4.230E-02	4.230E
11	TOWN OF SAVAGETOWN	1	7.940E-05	3.969E-07	7.966E-08	7.948E-08	3.048E+01	1.524E-01	3.057E-02	3.057E-
11	TOWN OF SAVAGETOWN	2	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+
11	TOWN OF SAVAGETOWN	3	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+
11	TOWN OF SAVAGETOWN	4	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+(
	CONCENTRATION TOTALS		7.940E-05	3.969E-07	7.966E-08	7.948E-08	3.048E+01	1.524E-01	3.057E-02	3.057E-(
12	RUBY RANCH	1	8.474E-05	4.236E-07	8.502E-08	8.482E-08	3.253E+01	1.626E-01	3.263E-02	3.263E-0
12	RUBY RANCH	2	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+0(
12	RUBY RANCH	3	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+0(
12	RUBY RANCH	4	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00
	CONCENTRATION TOTALS		8.474E-05	4.236E-07	8.502E-08	8.482E-08	3.253E+01	1.626E-01	3.263E-02	3.263E-02
13	JACK CHRISTENSEN	1	3.190E-04	1.595E-06	3.200E-07	3.193E-07	1.225E+02	6.122E-01	1.228E-01	1.228E-01
13	JACK CHRISTENSEN	2	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00
13	JACK CHRISTENSEN	3	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00
13	JACK CHRISTENSEN	4	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00
	CONCENTRATION TOTALS		3.190E-04	1.595E-06	3.200E-07	3.193E-07	1.225E+02	6.122E-01	1.228E-01	1.228E-01
14	BUD CHRISTENSEN	1	9.134E-05	4.566E-07	9.164E-08	9.143E-08	3.507E+01	1.753E-01	3.517E-02	3.517E-02
14	BUD CHRISTENSEN	2	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00
14	BUD CHRISTENSEN	3	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00
14	BUD CHRISTENSEN	4	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00
	CONCENTRATION TOTALS		9.134E-05	4.566E-07	9.164E-08	9.143E-08	3.507E+01	1.753E-01	3.517E-02	3.517E-02

TIME STEP NUMBER 1, after 1 years DURATION IN YRS IS... 2.0

INDIVIDUAL RECEPTOR RADON AND RADON DAUGHTER CONCENTRATIONS

	AIRBORNE CONCENTRATIONS, PCI/M3								GROUND CONCENTRATIONS, PCI/M2			
NO.	RN-222	PO-218	PB-214	BI-214	PB-210	BI-210	PO-210	WL	PO-218	PB-214	BI-214	PB-210
1	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00
2	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00
3	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00
4	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00
5	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00
6	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00
7	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00
8	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00
9	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00
10	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00
11	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00
12	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00
13	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00
14	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00

TIME STEP NUMBER 1, after 1 years DURATION IN YRS IS... 2.0

JMBER 1 NAME=NORTH 100 METERS X= .0KM, Y= .1KM, Z= 1.0M, DIST= .1KM, IRTYPE=10

40CFR190 ANNUAL DOSE COMMITMENTS COMPUTED FOR THIS LOCATION, MREM/YR

AGE	PATHWAY	WH.BODY	BONE	AVG.LUNG	LIVER	KIDNEY	BRONCHI
INFANT	INHAL	3.11E-02	5.32E-01	3.28E+00	2.08E-03	1.25E-01	0.00E+00
INFANT	GROUND	1.68E-03	1.68E-03	1.68E-03	1.68E-03	1.68E-03	1.68E-03
INFANT	CLOUD	1.45E-07	1.45E-07	1.45E-07	1.45E-07	1.45E-07	1.45E-07
INFANT	VEG.ING	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
INFANT	MEAT ING	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
INFANT	MILK ING	1.73E-02	2.26E-01	1.73E-02	9.86E-05	4.77E-02	1.73E-02
INFANT	TOTALS	5.00E-02	7.59E-01	3.30E+00	3.85E-03	1.75E-01	1.90E-02

AGE	PATHWAY	WH.BODY	BONE	AVG.LUNG	LIVER	KIDNEY	BRONCHI
CHILD	INHAL	3.11E-02	5.32E-01	3.28E+00	2.08E-03	1.25E-01	0.00E+00
CHILD	GROUND	1.68E-03	1.68E-03	1.68E-03	1.68E-03	1.68E-03	1.68E-03
CHILD	CLOUD	1.45E-07	1.45E-07	1.45E-07	1.45E-07	1.45E-07	1.45E-07
CHILD	VEG.ING	1.03E-02	1.69E-01	1.03E-02	3.77E-04	2.83E-02	1.03E-02
CHILD	MEAT ING	7.69E-04	1.25E-02	7.69E-04	5.60E-05	2.15E-03	7.69E-04
CHILD	MILK ING.	1.01E-02	1.66E-01	1.01E-02	7.10E-05	2.70E-02	1.01E-02
CHILD	TOTALS	5.40E-02	8.80E-01	3.31E+00	4.26E-03	1.85E-01	2.29E-02

AGE	PATHWAY	WH.BODY	BONE	AVG.LUNG	LIVER	KIDNEY	BRONCHI
TEENAGER	INHAL	3.11E-02	5.32E-01	3.28E+00	2.08E-03	1.25E-01	0.00E+00
TEENAGER	GROUND	1.68E-03	1.68E-03	1.68E-03	1.68E-03	1.68E-03	1.68E-03
TEENAGER	CLOUD	1.45E-07	1.45E-07	1.45E-07	1.45E-07	1.45E-07	1.45E-07
TEENAGER	VEG.ING	5.79E-03	9.42E-02	5.79E-03	2.86E-04	2.23E-02	5.79E-03
TEENAGER	MEAT ING	4.25E-04	6.88E-03	4.25E-04	4.08E-05	1.67E-03	4.25E-04
TEENAGER	MILK ING	4.06E-03	6.58E-02	4.06E-03	3.74E-05	1.52E-02	4.06E-03
TEENAGER	TOTALS	4.30E-02	7.00E-01	3.30E+00	4.12E-03	1.66E-01	1.20E-02

AGE	PATHWAY	WH.BODY	BONE	AVG.LUNG	LIVER	KIDNEY	BRONCHI
ADULT	INHAL	3.11E-02	5.32E-01	3.28E+00	2.08E-03	1.25E-01	0.00E+00
ADULT	GROUND	1.68E-03	1.68E-03	1.68E-03	1.68E-03	1.68E-03	1.68E-03
ADULT	CLOUD	1.45E-07	1.45E-07	1.45E-07	1.45E-07	1.45E-07	1.45E-07
ADULT	VEG.ING	5.66E-03	9.24E-02	5.66E-03	3.17E-04	2.16E-02	5.66E-03
ADULT	MEAT ING	5.29E-04	8.58E-03	5.29E-04	5.64E-05	2.04E-03	5.29E-04
ADULT	MILK ING	1.52E-03	2.46E-02	1.52E-03	1.56E-05	5.63E-03	1.52E-03
ADULT	TOTALS	4.05E-02	6.59E-01	3.29E+00	4.14E-03	1.56E-01	9.39E-03

TIME STEP NUMBER 1, after 1 years DURATION IN YRS IS... 2.0

IMBER 1 NAME=NORTH 100 METERS X= .0KM, Y= .1KM, Z= 1.0M, DIST= .1KM, IRTYPE=10

TOTAL ANNUAL DOSE COMMITMENTS COMPUTED FOR THIS LOCATION, MREM/YR

AGE	PATHWAY	WH.BODY	BONE	AVG.LUNG	LIVER	KIDNEY	BRONCHI
INFANT	INHAL	3.11E-02	5.32E-01	3.28E+00	2.08E-03	1.25E-01	0.00E+00
INFANT	GROUND	1.78E-03	1.78E-03	1.78E-03	1.78E-03	1.78E-03	1.78E-03
INFANT	CLOUD	1.45E-07	1.45E-07	1.45E-07	1.45E-07	1.45E-07	1.45E-07
INFANT	VEG.ING	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
INFANT	MEAT ING	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
INFANT	MILK ING	1.73E-02	2.26E-01	1.73E-02	9.86E-05	4.77E-02	1.73E-02
INFANT	TOTALS	5.01E-02	7.59E-01	3.30E+00	3.95E-03	1.75E-01	1.91E-02

AGE	PATHWAY	WH.BODY	BONE	AVG.LUNG	LIVER	KIDNEY	BRONCHI
CHILD	INHAL	3.11E-02	5.32E-01	3.28E+00	2.08E-03	1.25E-01	0.00E+00
CHILD	GROUND	1.78E-03	1.78E-03	1.78E-03	1.78E-03	1.78E-03	1.78E-03
CHILD	CLOUD	1.45E-07	1.45E-07	1.45E-07	1.45E-07	1.45E-07	1.45E-07
CHILD	VEG.ING	1.03E-02	1.69E-01	1.03E-02	3.77E-04	2.83E-02	1.03E-02
CHILD	MEAT ING	7.69E-04	1.25E-02	7.69E-04	5.60E-05	2.15E-03	7.69E-04
CHILD	MILK ING	1.01E-02	1.66E-01	1.01E-02	7.10E-05	2.70E-02	1.01E-02
CHILD	TOTALS	5.41E-02	8.80E-01	3.31E+00	4.36E-03	1.85E-01	2.30E-02

AGE	PATHWAY	WH.BODY	BONE	AVG.LUNG	LIVER	KIDNEY	BRONCHI
TEENAGER	INHAL	3.11E-02	5.32E-01	3.28E+00	2.08E-03	1.25E-01	0.00E+00
TEENAGER	GROUND	1.78E-03	1.78E-03	1.78E-03	1.78E-03	1.78E-03	1.78E-03
TEENAGER	CLOUD	1.45E-07	1.45E-07	1.45E-07	1.45E-07	1.45E-07	1.45E-07
TEENAGER	VEG.ING	5.79E-03	9.42E-02	5.79E-03	2.86E-04	2.23E-02	5.79E-03
TEENAGER	MEAT ING	4.25E-04	6.88E-03	4.25E-04	4.08E-05	1.67E-03	4.25E-04
TEENAGER	MILK ING	4.06E-03	6.58E-02	4.06E-03	3.74E-05	1.52E-02	4.06E-03
TEENAGER	TOTALS	4.31E-02	7.00E-01	3.30E+00	4.22E-03	1.66E-01	1.21E-02

AGE	PATHWAY	WH.BODY	BONE	AVG.LUNG	LIVER	KIDNEY	BRONCHI
ADULT	INHAL	3.11E-02	5.32E-01	3.28E+00	2.08E-03	1.25E-01	0.00E+00
ADULT	GROUND	1.78E-03	1.78E-03	1.78E-03	1.78E-03	1.78E-03	1.78E-03
ADULT	CLOUD	1.45E-07	1.45E-07	1.45E-07	1.45E-07	1.45E-07	1.45E-07
ADULT	VEG.ING	5.66E-03	9.24E-02	5.66E-03	3.17E-04	2.16E-02	5.66E-03
ADULT	MEAT ING	5.29E-04	8.58E-03	5.29E-04	5.64E-05	2.04E-03	5.29E-04
ADULT	MILK ING	1.52E-03	2.46E-02	1.52E-03	1.56E-05	5.63E-03	1.52E-03
ADULT	TOTALS	4.06E-02	6.59E-01	3.29E+00	4.24E-03	1.57E-01	9.49E-03

TIME STEP NUMBER 1, after 1 years DURATION IN YRS IS... 2.0

NUMBER 2 NAME=EAST 150 METERS X= .1KM, Y= .0KM, Z= 1.0M, DIST= .1KM, IRTYPE=10

40CFR190 ANNUAL DOSE COMMITMENTS COMPUTED FOR THIS LOCATION, MREM/YR

AGE	PATHWAY	WH.BODY	BONE	AVG.LUNG	LIVER	KIDNEY	BRONCHI
INFANT	INHAL	3.52E-02	6.02E-01	3.72E+00	2.35E-03	1.42E-01	0.00E+00
INFANT	GROUND	1.90E-03	1.90E-03	1.90E-03	1.90E-03	1.90E-03	1.90E-03
INFANT	CLOUD	1.64E-07	1.64E-07	1.64E-07	1.64E-07	1.64E-07	1.64E-07
INFANT	VEG.ING	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
INFANT	MEAT ING	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
INFANT	MILK ING	1.96E-02	2.56E-01	1.96E-02	1.12E-04	5.41E-02	1.96E-02
INFANT	TOTALS	5.67E-02	8.60E-01	3.74E+00	4.36E-03	1.98E-01	2.15E-02

AGE	PATHWAY	WH.BODY	BONE	AVG.LUNG	LIVER	KIDNEY	BRONCHI
CHILD	INHAL	3.52E-02	6.02E-01	3.72E+00	2.35E-03	1.42E-01	0.00E+00
CHILD	GROUND	1.90E-03	1.90E-03	1.90E-03	1.90E-03	1.90E-03	1.90E-03
CHILD	CLOUD	1.64E-07	1.64E-07	1.64E-07	1.64E-07	1.64E-07	1.64E-07
CHILD	VEG.ING	1.17E-02	1.91E-01	1.17E-02	4.27E-04	3.20E-02	1.17E-02
CHILD	MEAT ING	8.71E-04	1.42E-02	8.71E-04	6.34E-05	2.44E-03	8.71E-04
CHILD	MILK ING	1.15E-02	1.88E-01	1.15E-02	8.04E-05	3.06E-02	1.15E-02
CHILD	TOTALS	6.12E-02	9.97E-01	3.75E+00	4.82E-03	2.09E-01	2.60E-02

AGE	PATHWAY	WH.BODY	BONE	AVG.LUNG	LIVER	KIDNEY	BRONCHI
TEENAGER	INHAL	3.52E-02	6.02E-01	3.72E+00	2.35E-03	1.42E-01	0.00E+00
TEENAGER	GROUND	1.90E-03	1.90E-03	1.90E-03	1.90E-03	1.90E-03	1.90E-03
TEENAGER	CLOUD	1.64E-07	1.64E-07	1.64E-07	1.64E-07	1.64E-07	1.64E-07
TEENAGER	VEG.ING	6.56E-03	1.07E-01	6.56E-03	3.24E-04	2.53E-02	6.56E-03
TEENAGER	MEAT ING	4.82E-04	7.79E-03	4.82E-04	4.62E-05	1.89E-03	4.82E-04
TEENAGER	MILK ING	4.60E-03	7.46E-02	4.60E-03	4.24E-05	1.72E-02	4.60E-03
TEENAGER	TOTALS	4.87E-02	7.93E-01	3.73E+00	4.66E-03	1.88E-01	1.35E-02

AGE	PATHWAY	WH.BODY	BONE	AVG.LUNG	LIVER	KIDNEY	BRONCHI
ADULT	INHAL	3.52E-02	6.02E-01	3.72E+00	2.35E-03	1.42E-01	0.00E+00
ADULT	GROUND	1.90E-03	1.90E-03	1.90E-03	1.90E-03	1.90E-03	1.90E-03
ADULT	CLOUD	1.64E-07	1.64E-07	1.64E-07	1.64E-07	1.64E-07	1.64E-07
ADULT	VEG.ING	6.41E-03	1.05E-01	6.41E-03	3.59E-04	2.43E-02	6.41E-03
ADULT	MEAT ING	6.00E-04	9.72E-03	6.00E-04	6.39E-05	2.31E-03	6.00E-04
ADULT	MILK ING	1.72E-03	2.79E-02	1.72E-03	1.76E-05	6.37E-03	1.72E-03
ADULT	TOTALS	4.58E-02	7.46E-01	3.73E+00	4.69E-03	1.77E-01	1.06E-02

TIME STEP NUMBER 1, after 1 years DURATION IN YRS IS... 2.0

NUMBER 2 NAME=EAST 150 METERS X= .1KM, Y= .0KM, Z= 1.0M, DIST= .1KM, IRTYPE=10

TOTAL ANNUAL DOSE COMMITMENTS COMPUTED FOR THIS LOCATION, MREM/YR

AGE	PATHWAY	WH.BODY	BONE	AVG.LUNG	LIVER	KIDNEY	BRONCHI
INFANT	INHAL	3.52E-02	6.02E-01	3.72E+00	2.35E-03	1.42E-01	0.00E+00
INFANT	GROUND	2.01E-03	2.01E-03	2.01E-03	2.01E-03	2.01E-03	2.01E-03
INFANT	CLOUD	1.64E-07	1.64E-07	1.64E-07	1.64E-07	1.64E-07	1.64E-07
INFANT	VEG.ING	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
INFANT	MEAT ING	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
INFANT	MILK ING	1.96E-02	2.56E-01	1.96E-02	1.12E-04	5.41E-02	1.96E-02
INFANT	TOTALS	5.68E-02	8.60E-01	3.74E+00	4.47E-03	1.98E-01	2.16E-02

AGE	PATHWAY	WH.BODY	BONE	AVG.LUNG	LIVER	KIDNEY	BRONCHI
CHILD	INHAL	3.52E-02	6.02E-01	3.72E+00	2.35E-03	1.42E-01	0.00E+00
CHILD	GROUND	2.01E-03	2.01E-03	2.01E-03	2.01E-03	2.01E-03	2.01E-03
CHILD	CLOUD	1.64E-07	1.64E-07	1.64E-07	1.64E-07	1.64E-07	1.64E-07
CHILD	VEG.ING	1.17E-02	1.91E-01	1.17E-02	4.27E-04	3.20E-02	1.17E-02
CHILD	MEAT ING	8.71E-04	1.42E-02	8.71E-04	6.34E-05	2.44E-03	8.71E-04
CHILD	MILK ING	1.15E-02	1.88E-01	1.15E-02	8.04E-05	3.06E-02	1.15E-02
CHILD	TOTALS	6.13E-02	9.97E-01	3.75E+00	4.93E-03	2.09E-01	2.61E-02

AGE	PATHWAY	WH.BODY	BONE	AVG.LUNG	LIVER	KIDNEY	BRONCHI
TEENAGER	INHAL	3.52E-02	6.02E-01	3.72E+00	2.35E-03	1.42E-01	0.00E+00
TEENAGER	GROUND	2.01E-03	2.01E-03	2.01E-03	2.01E-03	2.01E-03	2.01E-03
TEENAGER	CLOUD	1.64E-07	1.64E-07	1.64E-07	1.64E-07	1.64E-07	1.64E-07
TEENAGER	VEG.ING	6.56E-03	1.07E-01	6.56E-03	3.24E-04	2.53E-02	6.56E-03
TEENAGER	MEAT ING	4.82E-04	7.79E-03	4.82E-04	4.62E-05	1.89E-03	4.82E-04
TEENAGER	MILK ING	4.60E-03	7.46E-02	4.60E-03	4.24E-05	1.72E-02	4.60E-03
TEENAGER	TOTALS	4.89E-02	7.93E-01	3.73E+00	4.78E-03	1.89E-01	1.37E-02

AGE	PATHWAY	WH.BODY	BONE	AVG.LUNG	LIVER	KIDNEY	BRONCHI
ADULT	INHAL	3.52E-02	6.02E-01	3.72E+00	2.35E-03	1.42E-01	0.00E+00
ADULT	GROUND	2.01E-03	2.01E-03	2.01E-03	2.01E-03	2.01E-03	2.01E-03
ADULT	CLOUD	1.64E-07	1.64E-07	1.64E-07	1.64E-07	1.64E-07	1.64E-07
ADULT	VEG.ING	6.41E-03	1.05E-01	6.41E-03	3.59E-04	2.45E-02	6.41E-03
ADULT	MEAT ING	6.00E-04	9.72E-03	6.00E-04	6.39E-05	2.31E-03	6.00E-04
ADULT	MILK ING	1.72E-03	2.79E-02	1.72E-03	1.76E-05	6.37E-03	1.72E-03
ADULT	TOTALS	4.59E-02	7.47E-01	3.73E+00	4.80E-03	1.77E-01	1.07E-02

TIME STEP NUMBER 1, after 1 years DURATION IN YRS IS... 2.0

NUMBER 3 NAME=WEST 150 METERS X= -.1KM, Y= .0KM, Z= 1.0M, DIST= .1KM, IRTYPE=10

40CFR190 ANNUAL DOSE COMMITMENTS COMPUTED FOR THIS LOCATION, MREM/YR

AGE	PATHWAY	WH.BODY	BONE	AVG.LUNG	LIVER	KIDNEY	BRONCHI
INFANT	INHAL	2.39E-02	4.10E-01	2.53E+00	1.60E-03	9.67E-02	0.00E+00
INFANT	GROUND	1.29E-03	1.29E-03	1.29E-03	1.29E-03	1.29E-03	1.29E-03
INFANT	CLOUD	1.12E-07	1.12E-07	1.12E-07	1.12E-07	1.12E-07	1.12E-07
INFANT	VEG.ING	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
INFANT	MEAT ING	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
INFANT	MILK ING	1.33E-02	1.74E-01	1.33E-02	7.60E-05	3.68E-02	1.33E-02
INFANT	TOTALS	3.86E-02	5.85E-01	2.54E+00	2.97E-03	1.35E-01	1.46E-02

AGE	PATHWAY	WH.BODY	BONE	AVG.LUNG	LIVER	KIDNEY	BRONCHI
CHILD	INHAL	2.39E-02	4.10E-01	2.53E+00	1.60E-03	9.67E-02	0.00E+00
CHILD	GROUND	1.29E-03	1.29E-03	1.29E-03	1.29E-03	1.29E-03	1.29E-03
CHILD	CLOUD	1.12E-07	1.12E-07	1.12E-07	1.12E-07	1.12E-07	1.12E-07
CHILD	VEG.ING	7.95E-03	1.30E-01	7.95E-03	2.90E-04	2.18E-02	7.95E-03
CHILD	MEAT ING	5.93E-04	9.64E-03	5.93E-04	4.31E-05	1.66E-03	5.93E-04
CHILD	MILK ING	7.82E-03	1.28E-01	7.82E-03	5.47E-05	2.08E-02	7.82E-03
CHILD	TOTALS	4.16E-02	6.78E-01	2.55E+00	3.28E-03	1.42E-01	1.77E-02

AGE	PATHWAY	WH.BODY	BONE	AVG.LUNG	LIVER	KIDNEY	BRONCHI
TEENAGER	INHAL	2.39E-02	4.10E-01	2.53E+00	1.60E-03	9.67E-02	0.00E+00
TEENAGER	GROUND	1.29E-03	1.29E-03	1.29E-03	1.29E-03	1.29E-03	1.29E-03
TEENAGER	CLOUD	1.12E-07	1.12E-07	1.12E-07	1.12E-07	1.12E-07	1.12E-07
TEENAGER	VEG.ING	4.46E-03	7.26E-02	4.46E-03	2.21E-04	1.72E-02	4.46E-03
TEENAGER	MEAT ING	3.28E-04	5.30E-03	3.28E-04	3.14E-05	1.28E-03	3.28E-04
TEENAGER	MILK ING	3.13E-03	5.07E-02	3.13E-03	2.88E-05	1.17E-02	3.13E-03
TEENAGER	TOTALS	3.32E-02	5.39E-01	2.54E+00	3.17E-03	1.28E-01	9.21E-03

AGE	PATHWAY	WH.BODY	BONE	AVG.LUNG	LIVER	KIDNEY	BRONCHI
ADULT	INHAL	2.39E-02	4.10E-01	2.53E+00	1.60E-03	9.67E-02	0.00E+00
ADULT	GROUND	1.29E-03	1.29E-03	1.29E-03	1.29E-03	1.29E-03	1.29E-03
ADULT	CLOUD	1.12E-07	1.12E-07	1.12E-07	1.12E-07	1.12E-07	1.12E-07
ADULT	VEG.ING	4.36E-03	7.12E-02	4.36E-03	2.44E-04	1.66E-02	4.36E-03
ADULT	MEAT ING	4.08E-04	6.61E-03	4.08E-04	4.35E-05	1.57E-03	4.08E-04
ADULT	MILK ING	1.17E-03	1.90E-02	1.17E-03	1.20E-05	4.33E-03	1.17E-03
ADULT	TOTALS	3.12E-02	5.08E-01	2.54E+00	3.19E-03	1.21E-01	7.23E-03

TIME STEP NUMBER 1, after 1 years DURATION IN YRS IS... 2.0

JMBER 3 NAME=WEST 150 METERS X= -.1KM, Y= .0KM, Z= 1.0M, DIST= .1KM, IRTYPE=10

TOTAL ANNUAL DOSE COMMITMENTS COMPUTED FOR THIS LOCATION, MREM/YR

AGE	PATHWAY	WH.BODY	BONE	AVG.LUNG	LIVER	KIDNEY	BRONCHI
INFANT	INHAL	2.39E-02	4.10E-01	2.53E+00	1.60E-03	9.67E-02	0.00E+00
INFANT	GROUND	1.37E-03	1.37E-03	1.37E-03	1.37E-03	1.37E-03	1.37E-03
INFANT	CLOUD	1.12E-07	1.12E-07	1.12E-07	1.12E-07	1.12E-07	1.12E-07
INFANT	VEG.ING	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
INFANT	MEAT ING	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
INFANT	MILK ING	1.33E-02	1.74E-01	1.33E-02	7.60E-05	3.68E-02	1.33E-02
INFANT	TOTALS	3.86E-02	5.85E-01	2.54E+00	3.04E-03	1.35E-01	1.47E-02

AGE	PATHWAY	WH.BODY	BONE	AVG.LUNG	LIVER	KIDNEY	BRONCHI
CHILD	INHAL	2.39E-02	4.10E-01	2.53E+00	1.60E-03	9.67E-02	0.00E+00
CHILD	GROUND	1.37E-03	1.37E-03	1.37E-03	1.37E-03	1.37E-03	1.37E-03
CHILD	CLOUD	1.12E-07	1.12E-07	1.12E-07	1.12E-07	1.12E-07	1.12E-07
CHILD	VEG.ING	7.95E-03	1.30E-01	7.95E-03	2.90E-04	2.18E-02	7.95E-03
CHILD	MEAT ING	5.93E-04	9.64E-03	5.93E-04	4.31E-05	1.66E-03	5.93E-04
CHILD	MILK ING	7.82E-03	1.28E-01	7.82E-03	5.47E-05	2.08E-02	7.82E-03
CHILD	TOTALS	4.17E-02	6.78E-01	2.55E+00	3.36E-03	1.42E-01	1.77E-02

AGE	PATHWAY	WH.BODY	BONE	AVG.LUNG	LIVER	KIDNEY	BRONCHI
TEENAGER	INHAL	2.39E-02	4.10E-01	2.53E+00	1.60E-03	9.67E-02	0.00E+00
TEENAGER	GROUND	1.37E-03	1.37E-03	1.37E-03	1.37E-03	1.37E-03	1.37E-03
TEENAGER	CLOUD	1.12E-07	1.12E-07	1.12E-07	1.12E-07	1.12E-07	1.12E-07
TEENAGER	VEG.ING	4.46E-03	7.26E-02	4.46E-03	2.21E-04	1.72E-02	4.46E-03
TEENAGER	MEAT ING	3.28E-04	5.30E-03	3.28E-04	3.14E-05	1.28E-03	3.28E-04
TEENAGER	MILK ING	3.13E-03	5.07E-02	3.13E-03	2.88E-05	1.17E-02	3.13E-03
TEENAGER	TOTALS	3.32E-02	5.40E-01	2.54E+00	3.25E-03	1.28E-01	9.29E-03

AGE	PATHWAY	WH.BODY	BONE	AVG.LUNG	LIVER	KIDNEY	BRONCHI
ADULT	INHAL	2.39E-02	4.10E-01	2.53E+00	1.60E-03	9.67E-02	0.00E+00
ADULT	GROUND	1.37E-03	1.37E-03	1.37E-03	1.37E-03	1.37E-03	1.37E-03
ADULT	CLOUD	1.12E-07	1.12E-07	1.12E-07	1.12E-07	1.12E-07	1.12E-07
ADULT	VEG.ING	4.36E-03	7.12E-02	4.36E-03	2.44E-04	1.66E-02	4.36E-03
ADULT	MEAT ING	4.08E-04	6.61E-03	4.08E-04	4.35E-05	1.57E-03	4.08E-04
ADULT	MILK ING	1.17E-03	1.90E-02	1.17E-03	1.20E-05	4.33E-03	1.17E-03
ADULT	TOTALS	3.13E-02	5.08E-01	2.54E+00	3.27E-03	1.21E-01	7.31E-03

TIME STEP NUMBER 1, after 1 years DURATION IN YRS IS... 2.0

NUMBER 4 NAME=SOUTH 100 METERS X= .0KM, Y= -.1KM, Z= 1.0M, DIST= .1KM, IRTYPE=10

40CFR190 ANNUAL DOSE COMMITMENTS COMPUTED FOR THIS LOCATION, MREM/YR

AGE	PATHWAY	WH.BODY	BONE	AVG.LUNG	LIVER	KIDNEY	BRONCHI
INFANT	INHAL	3.59E-03	6.14E-02	3.79E-01	2.40E-04	1.45E-02	0.00E+00
INFANT	GROUND	1.94E-04	1.94E-04	1.94E-04	1.94E-04	1.94E-04	1.94E-04
INFANT	CLOUD	1.68E-08	1.68E-08	1.68E-08	1.68E-08	1.68E-08	1.68E-08
INFANT	VEG.ING	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
INFANT	MEAT ING	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
INFANT	MILK ING	2.00E-03	2.61E-02	2.00E-03	1.14E-05	5.51E-03	2.00E-03
INFANT	TOTALS	5.78E-03	8.77E-02	3.82E-01	4.45E-04	2.02E-02	2.19E-03

AGE	PATHWAY	WH.BODY	BONE	AVG.LUNG	LIVER	KIDNEY	BRONCHI
CHILD	INHAL	3.59E-03	6.14E-02	3.79E-01	2.40E-04	1.45E-02	0.00E+00
CHILD	GROUND	1.94E-04	1.94E-04	1.94E-04	1.94E-04	1.94E-04	1.94E-04
CHILD	CLOUD	1.68E-08	1.68E-08	1.68E-08	1.68E-08	1.68E-08	1.68E-08
CHILD	VEG.ING	1.19E-03	1.95E-02	1.19E-03	4.36E-05	3.26E-03	1.19E-03
CHILD	MEAT ING	8.89E-05	1.45E-03	8.89E-05	6.47E-06	2.49E-04	8.89E-05
CHILD	MILK ING	1.17E-03	1.91E-02	1.17E-03	8.20E-06	3.12E-03	1.17E-03
CHILD	TOTALS	6.24E-03	1.02E-01	3.82E-01	4.92E-04	2.13E-02	2.65E-03

AGE	PATHWAY	WH.BODY	BONE	AVG.LUNG	LIVER	KIDNEY	BRONCHI
TEENAGER	INHAL	3.59E-03	6.14E-02	3.79E-01	2.40E-04	1.45E-02	0.00E+00
TEENAGER	GROUND	1.94E-04	1.94E-04	1.94E-04	1.94E-04	1.94E-04	1.94E-04
TEENAGER	CLOUD	1.68E-08	1.68E-08	1.68E-08	1.68E-08	1.68E-08	1.68E-08
TEENAGER	VEG.ING	6.69E-04	1.09E-02	6.69E-04	3.31E-05	2.58E-03	6.69E-04
TEENAGER	MEAT ING	4.91E-05	7.95E-04	4.91E-05	4.71E-06	1.92E-04	4.91E-05
TEENAGER	MILK ING	4.69E-04	7.61E-03	4.69E-04	4.32E-06	1.76E-03	4.69E-04
TEENAGER	TOTALS	4.97E-03	8.09E-02	3.81E-01	4.76E-04	1.92E-02	1.38E-03

AGE	PATHWAY	WH.BODY	BONE	AVG.LUNG	LIVER	KIDNEY	BRONCHI
ADULT	INHAL	3.59E-03	6.14E-02	3.79E-01	2.40E-04	1.45E-02	0.00E+00
ADULT	GROUND	1.94E-04	1.94E-04	1.94E-04	1.94E-04	1.94E-04	1.94E-04
ADULT	CLOUD	1.68E-08	1.68E-08	1.68E-08	1.68E-08	1.68E-08	1.68E-08
ADULT	VEG.ING	6.54E-04	1.07E-02	6.54E-04	3.66E-05	2.50E-03	6.54E-04
ADULT	MEAT ING	6.12E-05	9.91E-04	6.12E-05	6.52E-06	2.36E-04	6.12E-05
ADULT	MILK ING	1.75E-04	2.85E-03	1.75E-04	1.80E-06	6.50E-04	1.75E-04
ADULT	TOTALS	4.68E-03	7.61E-02	3.80E-01	4.79E-04	1.81E-02	1.08E-03

TIME STEP NUMBER 1, after 1 years DURATION IN YRS IS... 2.0

NUMBER 4 NAME=SOUTH 100 METERS X= .0KM, Y= -.1KM, Z= 1.0M, DIST= .1KM, IRTYPE=10

TOTAL ANNUAL DOSE COMMITMENTS COMPUTED FOR THIS LOCATION, MREM/YR

AGE	PATHWAY	WH.BODY	BONE	AVG.LUNG	LIVER	KIDNEY	BRONCHI
INFANT	INHAL	3.59E-03	6.14E-02	3.79E-01	2.40E-04	1.45E-02	0.00E+00
INFANT	GROUND	2.05E-04	2.05E-04	2.05E-04	2.05E-04	2.05E-04	2.05E-04
INFANT	CLOUD	1.68E-08	1.68E-08	1.68E-08	1.68E-08	1.68E-08	1.68E-08
INFANT	VEG.ING	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
INFANT	MEAT ING	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
INFANT	MILK ING	2.00E-03	2.61E-02	2.00E-03	1.14E-05	5.51E-03	2.00E-03
INFANT	TOTALS	5.79E-03	8.77E-02	3.82E-01	4.56E-04	2.02E-02	2.20E-03

AGE	PATHWAY	WH.BODY	BONE	AVG.LUNG	LIVER	KIDNEY	BRONCHI
CHILD	INHAL	3.59E-03	6.14E-02	3.79E-01	2.40E-04	1.45E-02	0.00E+00
CHILD	GROUND	2.05E-04	2.05E-04	2.05E-04	2.05E-04	2.05E-04	2.05E-04
CHILD	CLOUD	1.68E-08	1.68E-08	1.68E-08	1.68E-08	1.68E-08	1.68E-08
CHILD	VEG.ING	1.19E-03	1.95E-02	1.19E-03	4.36E-05	3.26E-03	1.19E-03
CHILD	MEAT ING	8.89E-05	1.45E-03	8.89E-05	6.47E-06	2.49E-04	8.89E-05
CHILD	MILK ING	1.17E-03	1.91E-02	1.17E-03	8.20E-06	3.12E-03	1.17E-03
CHILD	TOTALS	6.25E-03	1.02E-01	3.82E-01	5.03E-04	2.13E-02	2.66E-03

AGE	PATHWAY	WH.BODY	BONE	AVG.LUNG	LIVER	KIDNEY	BRONCHI
TEENAGER	INHAL	3.59E-03	6.14E-02	3.79E-01	2.40E-04	1.45E-02	0.00E+00
TEENAGER	GROUND	2.05E-04	2.05E-04	2.05E-04	2.05E-04	2.05E-04	2.05E-04
TEENAGER	CLOUD	1.68E-08	1.68E-08	1.68E-08	1.68E-08	1.68E-08	1.68E-08
TEENAGER	VEG.ING	6.69E-04	1.09E-02	6.69E-04	3.31E-05	2.58E-03	6.69E-04
TEENAGER	MEAT ING	4.91E-05	7.95E-04	4.91E-05	4.71E-06	1.92E-04	4.91E-05
TEENAGER	MILK ING	4.69E-04	7.61E-03	4.69E-04	4.32E-06	1.76E-03	4.69E-04
TEENAGER	TOTALS	4.98E-03	8.09E-02	3.81E-01	4.87E-04	1.92E-02	1.39E-03

AGE	PATHWAY	WH.BODY	BONE	AVG.LUNG	LIVER	KIDNEY	BRONCHI
ADULT	INHAL	3.59E-03	6.14E-02	3.79E-01	2.40E-04	1.45E-02	0.00E+00
ADULT	GROUND	2.05E-04	2.05E-04	2.05E-04	2.05E-04	2.05E-04	2.05E-04
ADULT	CLOUD	1.68E-08	1.68E-08	1.68E-08	1.68E-08	1.68E-08	1.68E-08
ADULT	VEG.ING	6.54E-04	1.07E-02	6.54E-04	3.66E-05	2.50E-03	6.54E-04
ADULT	MEAT ING	6.12E-05	9.91E-04	6.12E-05	6.52E-06	2.36E-04	6.12E-05
ADULT	MILK ING	1.75E-04	2.85E-03	1.75E-04	1.80E-06	6.50E-04	1.75E-04
ADULT	TOTALS	4.69E-03	7.61E-02	3.80E-01	4.90E-04	1.81E-02	1.10E-03

TIME STEP NUMBER 1, after 1 years DURATION IN YRS IS... 2.0

JMBER 5 NAME=PFISTER RANCH X= .7KM, Y= -1.8KM, Z= 1.0M, DIST= 1.9KM, IRTYPE=10

40CFR190 ANNUAL DOSE COMMITMENTS COMPUTED FOR THIS LOCATION, MREM/YR

AGE	PATHWAY	WH.BODY	BONE	AVG.LUNG	LIVER	KIDNEY	BRONCHI
INFANT	INHAL	3.37E-02	5.77E-01	3.57E+00	2.25E-03	1.36E-01	0.00E+00
INFANT	GROUND	1.82E-03	1.82E-03	1.82E-03	1.82E-03	1.82E-03	1.82E-03
INFANT	CLOUD	1.58E-07	1.58E-07	1.58E-07	1.58E-07	1.58E-07	1.58E-07
INFANT	VEG.ING	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
INFANT	MEAT ING	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
INFANT	MILK ING	1.88E-02	2.45E-01	1.88E-02	1.07E-04	5.18E-02	1.88E-02
INFANT	TOTALS	5.43E-02	8.24E-01	3.59E+00	4.18E-03	1.90E-01	2.06E-02

AGE	PATHWAY	WH.BODY	BONE	AVG.LUNG	LIVER	KIDNEY	BRONCHI
CHILD	INHAL	3.37E-02	5.77E-01	3.57E+00	2.25E-03	1.36E-01	0.00E+00
CHILD	GROUND	1.82E-03	1.82E-03	1.82E-03	1.82E-03	1.82E-03	1.82E-03
CHILD	CLOUD	1.58E-07	1.58E-07	1.58E-07	1.58E-07	1.58E-07	1.58E-07
CHILD	VEG.ING	1.12E-02	1.83E-01	1.12E-02	4.09E-04	3.07E-02	1.12E-02
CHILD	MEAT ING	8.35E-04	1.36E-02	8.35E-04	6.08E-05	2.34E-03	8.35E-04
CHILD	MILK ING	1.10E-02	1.80E-01	1.10E-02	7.71E-05	2.93E-02	1.10E-02
CHILD	TOTALS	5.86E-02	9.56E-01	3.59E+00	4.62E-03	2.00E-01	2.49E-02

AGE	PATHWAY	WH.BODY	BONE	AVG.LUNG	LIVER	KIDNEY	BRONCHI
TEENAGER	INHAL	3.37E-02	5.77E-01	3.57E+00	2.25E-03	1.36E-01	0.00E+00
TEENAGER	GROUND	1.82E-03	1.82E-03	1.82E-03	1.82E-03	1.82E-03	1.82E-03
TEENAGER	CLOUD	1.58E-07	1.58E-07	1.58E-07	1.58E-07	1.58E-07	1.58E-07
TEENAGER	VEG.ING	6.29E-03	1.02E-01	6.29E-03	3.11E-04	2.42E-02	6.29E-03
TEENAGER	MEAT ING	4.62E-04	7.47E-03	4.62E-04	4.43E-05	1.81E-03	4.62E-04
TEENAGER	MILK ING	4.41E-03	7.15E-02	4.41E-03	4.06E-05	1.65E-02	4.41E-03
TEENAGER	TOTALS	4.67E-02	7.60E-01	3.58E+00	4.47E-03	1.81E-01	1.30E-02

AGE	PATHWAY	WH.BODY	BONE	AVG.LUNG	LIVER	KIDNEY	BRONCHI
ADULT	INHAL	3.37E-02	5.77E-01	3.57E+00	2.25E-03	1.36E-01	0.00E+00
ADULT	GROUND	1.82E-03	1.82E-03	1.82E-03	1.82E-03	1.82E-03	1.82E-03
ADULT	CLOUD	1.58E-07	1.58E-07	1.58E-07	1.58E-07	1.58E-07	1.58E-07
ADULT	VEG.ING	6.15E-03	1.00E-01	6.15E-03	3.44E-04	2.35E-02	6.15E-03
ADULT	MEAT ING	5.75E-04	9.32E-03	5.75E-04	6.13E-05	2.22E-03	5.75E-04
ADULT	MILK ING	1.65E-03	2.68E-02	1.65E-03	1.69E-05	6.11E-03	1.65E-03
ADULT	TOTALS	4.39E-02	7.15E-01	3.58E+00	4.50E-03	1.70E-01	1.02E-02

TIME STEP NUMBER 1, after 1 years DURATION IN YRS IS... 2.0

NUMBER 5 NAME=PFISTER RANCH X= .7KM, Y= -1.8KM, Z= 1.0M, DIST= 1.9KM, IRTYPE=10

TOTAL ANNUAL DOSE COMMITMENTS COMPUTED FOR THIS LOCATION, MREM/YR

AGE	PATHWAY	WH.BODY	BONE	AVG.LUNG	LIVER	KIDNEY	BRONCHI
INFANT	INHAL	3.37E-02	5.77E-01	3.57E+00	2.25E-03	1.36E-01	0.00E+00
INFANT	GROUND	1.93E-03	1.93E-03	1.93E-03	1.93E-03	1.93E-03	1.93E-03
INFANT	CLOUD	1.58E-07	1.58E-07	1.58E-07	1.58E-07	1.58E-07	1.58E-07
INFANT	VEG.ING	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
INFANT	MEAT ING	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
INFANT	MILK ING	1.88E-02	2.45E-01	1.88E-02	1.07E-04	5.18E-02	1.88E-02
INFANT	TOTALS	5.44E-02	8.24E-01	3.59E+00	4.29E-03	1.90E-01	2.07E-02

AGE	PATHWAY	WH.BODY	BONE	AVG.LUNG	LIVER	KIDNEY	BRONCHI
CHILD	INHAL	3.37E-02	5.77E-01	3.57E+00	2.25E-03	1.36E-01	0.00E+00
CHILD	GROUND	1.93E-03	1.93E-03	1.93E-03	1.93E-03	1.93E-03	1.93E-03
CHILD	CLOUD	1.58E-07	1.58E-07	1.58E-07	1.58E-07	1.58E-07	1.58E-07
CHILD	VEG.ING	1.12E-02	1.83E-01	1.12E-02	4.09E-04	3.07E-02	1.12E-02
CHILD	MEAT ING	8.35E-04	1.36E-02	8.35E-04	6.08E-05	2.34E-03	8.35E-04
CHILD	MILK ING	1.10E-02	1.80E-01	1.10E-02	7.71E-05	2.93E-02	1.10E-02
CHILD	TOTALS	5.87E-02	9.56E-01	3.59E+00	4.73E-03	2.00E-01	2.50E-02

AGE	PATHWAY	WH.BODY	BONE	AVG.LUNG	LIVER	KIDNEY	BRONCHI
TEENAGER	INHAL	3.37E-02	5.77E-01	3.57E+00	2.25E-03	1.36E-01	0.00E+00
TEENAGER	GROUND	1.93E-03	1.93E-03	1.93E-03	1.93E-03	1.93E-03	1.93E-03
TEENAGER	CLOUD	1.58E-07	1.58E-07	1.58E-07	1.58E-07	1.58E-07	1.58E-07
TEENAGER	VEG.ING	6.29E-03	1.02E-01	6.29E-03	3.11E-04	2.42E-02	6.29E-03
TEENAGER	MEAT ING	4.62E-04	7.47E-03	4.62E-04	4.43E-05	1.81E-03	4.62E-04
TEENAGER	MILK ING	4.41E-03	7.15E-02	4.41E-03	4.06E-05	1.65E-02	4.41E-03
TEENAGER	TOTALS	4.68E-02	7.60E-01	3.58E+00	4.58E-03	1.81E-01	1.31E-02

AGE	PATHWAY	WH.BODY	BONE	AVG.LUNG	LIVER	KIDNEY	BRONCHI
ADULT	INHAL	3.37E-02	5.77E-01	3.57E+00	2.25E-03	1.36E-01	0.00E+00
ADULT	GROUND	1.93E-03	1.93E-03	1.93E-03	1.93E-03	1.93E-03	1.93E-03
ADULT	CLOUD	1.58E-07	1.58E-07	1.58E-07	1.58E-07	1.58E-07	1.58E-07
ADULT	VEG.ING	6.15E-03	1.00E-01	6.15E-03	3.44E-04	2.35E-02	6.15E-03
ADULT	MEAT ING	5.75E-04	9.32E-03	5.75E-04	6.13E-05	2.22E-03	5.75E-04
ADULT	MILK ING	1.65E-03	2.68E-02	1.65E-03	1.69E-05	6.11E-03	1.65E-03
ADULT	TOTALS	4.40E-02	7.16E-01	3.58E+00	4.60E-03	1.70E-01	1.03E-02

TIME STEP NUMBER 1, after 1 years DURATION IN YRS IS... 2.0

UMBER 6 NAME=PUMPKIN BUTTE RANCH X= 3.9KM, Y= -5.6KM, Z= 1.0M, DIST= 6.9KM, IRTYPE=10

40CFR190 ANNUAL DOSE COMMITMENTS COMPUTED FOR THIS LOCATION, MREM/YR

AGE	PATHWAY	WH.BODY	BONE	AVG.LUNG	LIVER	KIDNEY	BRONCHI
INFANT	INHAL	5.00E-03	8.56E-02	5.29E-01	3.34E-04	2.02E-02	0.00E+00
INFANT	GROUND	2.70E-04	2.70E-04	2.70E-04	2.70E-04	2.70E-04	2.70E-04
INFANT	CLOUD	2.34E-08	2.34E-08	2.34E-08	2.34E-08	2.34E-08	2.34E-08
INFANT	VEG.ING	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
INFANT	MEAT ING	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
INFANT	MILK ING	2.78E-03	3.63E-02	2.78E-03	1.59E-05	7.68E-03	2.78E-03
INFANT	TOTALS	8.06E-03	1.22E-01	5.32E-01	6.20E-04	2.82E-02	3.05E-03

AGE	PATHWAY	WH.BODY	BONE	AVG.LUNG	LIVER	KIDNEY	BRONCHI
CHILD	INHAL	5.00E-03	8.56E-02	5.29E-01	3.34E-04	2.02E-02	0.00E+00
CHILD	GROUND	2.70E-04	2.70E-04	2.70E-04	2.70E-04	2.70E-04	2.70E-04
CHILD	CLOUD	2.34E-08	2.34E-08	2.34E-08	2.34E-08	2.34E-08	2.34E-08
CHILD	VEG.ING	1.66E-03	2.72E-02	1.66E-03	6.07E-05	4.55E-03	1.66E-03
CHILD	MEAT ING	1.24E-04	2.01E-03	1.24E-04	9.01E-06	3.47E-04	1.24E-04
CHILD	MILK ING	1.63E-03	2.67E-02	1.63E-03	1.14E-05	4.35E-03	1.63E-03
CHILD	TOTALS	8.69E-03	1.42E-01	5.32E-01	6.85E-04	2.97E-02	3.69E-03

AGE	PATHWAY	WH.BODY	BONE	AVG.LUNG	LIVER	KIDNEY	BRONCHI
TEENAGER	INHAL	5.00E-03	8.56E-02	5.29E-01	3.34E-04	2.02E-02	0.00E+00
TEENAGER	GROUND	2.70E-04	2.70E-04	2.70E-04	2.70E-04	2.70E-04	2.70E-04
TEENAGER	CLOUD	2.34E-08	2.34E-08	2.34E-08	2.34E-08	2.34E-08	2.34E-08
TEENAGER	VEG.ING	9.32E-04	1.52E-02	9.32E-04	4.61E-05	3.59E-03	9.32E-04
TEENAGER	MEAT ING	6.85E-05	1.11E-03	6.85E-05	6.57E-06	2.68E-04	6.85E-05
TEENAGER	MILK ING	6.54E-04	1.06E-02	6.54E-04	6.02E-06	2.45E-03	6.54E-04
TEENAGER	TOTALS	6.93E-03	1.13E-01	5.31E-01	6.63E-04	2.68E-02	1.92E-03

AGE	PATHWAY	WH.BODY	BONE	AVG.LUNG	LIVER	KIDNEY	BRONCHI
ADULT	INHAL	5.00E-03	8.56E-02	5.29E-01	3.34E-04	2.02E-02	0.00E+00
ADULT	GROUND	2.70E-04	2.70E-04	2.70E-04	2.70E-04	2.70E-04	2.70E-04
ADULT	CLOUD	2.34E-08	2.34E-08	2.34E-08	2.34E-08	2.34E-08	2.34E-08
ADULT	VEG.ING	9.12E-04	1.49E-02	9.12E-04	5.10E-05	3.48E-03	9.12E-04
ADULT	MEAT ING	8.52E-05	1.38E-03	8.52E-05	9.09E-06	3.28E-04	8.52E-05
ADULT	MILK ING	2.44E-04	3.97E-03	2.44E-04	2.51E-06	9.06E-04	2.44E-04
ADULT	TOTALS	6.51E-03	1.06E-01	5.30E-01	6.67E-04	2.52E-02	1.51E-03

TIMEE STEP NUMBER 1, after 1 years DURATION IN YRS IS... 2.0

NUMBER 6 NAME=PUMPKIN BUTTE RANCH X= 3.9KM, Y= -5.6KM, Z= 1.0M, DIST= 6.9KM, IRTYPE=10

TOTAL ANNUAL DOSE COMMITMENTS COMPUTED FOR THIS LOCATION, MREM/YR

AGE	PATHWAY	WH.BODY	BONE	AVG.LUNG	LIVER	KIDNEY	BRONCHI
INFANT	INHAL	5.00E-03	8.56E-02	5.29E-01	3.34E-04	2.02E-02	0.00E+00
INFANT	GROUND	2.86E-04	2.86E-04	2.86E-04	2.86E-04	2.86E-04	2.86E-04
INFANT	CLOUD	2.34E-08	2.34E-08	2.34E-08	2.34E-08	2.34E-08	2.34E-08
INFANT	VEG.ING	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
INFANT	MEAT ING	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
INFANT	MILK ING	2.78E-03	3.63E-02	2.78E-03	1.59E-05	7.68E-03	2.78E-03
INFANT	TOTALS	8.07E-03	1.22E-01	5.32E-01	6.36E-04	2.82E-02	3.07E-03

AGE	PATHWAY	WH.BODY	BONE	AVG.LUNG	LIVER	KIDNEY	BRONCHI
CHILD	INHAL	5.00E-03	8.56E-02	5.29E-01	3.34E-04	2.02E-02	0.00E+00
CHILD	GROUND	2.86E-04	2.86E-04	2.86E-04	2.86E-04	2.86E-04	2.86E-04
CHILD	CLOUD	2.34E-08	2.34E-08	2.34E-08	2.34E-08	2.34E-08	2.34E-08
CHILD	VEG.ING	1.66E-03	2.72E-02	1.66E-03	6.07E-05	4.55E-03	1.66E-03
CHILD	MEAT ING	1.24E-04	2.01E-03	1.24E-04	9.01E-06	3.47E-04	1.24E-04
CHILD	MILK ING	1.63E-03	2.67E-02	1.63E-03	1.14E-05	4.35E-03	1.63E-03
CHILD	TOTALS	8.71E-03	1.42E-01	5.32E-01	7.01E-04	2.97E-02	3.71E-03

AGE	PATHWAY	WH.BODY	BONE	AVG.LUNG	LIVER	KIDNEY	BRONCHI
TEENAGER	INHAL	5.00E-03	8.56E-02	5.29E-01	3.34E-04	2.02E-02	0.00E+00
TEENAGER	GROUND	2.86E-04	2.86E-04	2.86E-04	2.86E-04	2.86E-04	2.86E-04
TEENAGER	CLOUD	2.34E-08	2.34E-08	2.34E-08	2.34E-08	2.34E-08	2.34E-08
TEENAGER	VEG.ING	9.32E-04	1.52E-02	9.32E-04	4.61E-05	3.59E-03	9.32E-04
TEENAGER	MEAT ING	6.85E-05	1.11E-03	6.85E-05	6.57E-06	2.68E-04	6.85E-05
TEENAGER	MILK ING	6.54E-04	1.06E-02	6.54E-04	6.02E-06	2.45E-03	6.54E-04
TEENAGER	TOTALS	6.94E-03	1.13E-01	5.31E-01	6.79E-04	2.68E-02	1.94E-03

AGE	PATHWAY	WH.BODY	BONE	AVG.LUNG	LIVER	KIDNEY	BRONCHI
ADULT	INHAL	5.00E-03	8.56E-02	5.29E-01	3.34E-04	2.02E-02	0.00E+00
ADULT	GROUND	2.86E-04	2.86E-04	2.86E-04	2.86E-04	2.86E-04	2.86E-04
ADULT	CLOUD	2.34E-08	2.34E-08	2.34E-08	2.34E-08	2.34E-08	2.34E-08
ADULT	VEG.ING	9.12E-04	1.49E-02	9.12E-04	5.10E-05	3.48E-03	9.12E-04
ADULT	MEAT ING	8.52E-05	1.38E-03	8.52E-05	9.09E-06	3.28E-04	8.52E-05
ADULT	MILK ING	2.44E-04	3.97E-03	2.44E-04	2.51E-06	9.06E-04	2.44E-04
ADULT	TOTALS	6.53E-03	1.06E-01	5.30E-01	6.83E-04	2.52E-02	1.53E-03

TIME STEP NUMBER 1, after 1 years DURATION IN YRS IS... 2.0

NUMBER 7 NAME=W. SCHLAUTMANN RANCH X= 5.8KM, Y= 4.1KM, Z= 1.0M, DIST= 7.2KM, IRTYPE=10

40CFR190 ANNUAL DOSE COMMITMENTS COMPUTED FOR THIS LOCATION, MREM/YR

AGE	PATHWAY	WH.BODY	BONE	AVG.LUNG	LIVER	KIDNEY	BRONCHI
INFANT	INHAL	5.82E-03	9.95E-02	6.15E-01	3.88E-04	2.35E-02	0.00E+00
INFANT	GROUND	3.14E-04	3.14E-04	3.14E-04	3.14E-04	3.14E-04	3.14E-04
INFANT	CLOUD	2.72E-08	2.72E-08	2.72E-08	2.72E-08	2.72E-08	2.72E-08
INFANT	VEG.ING	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
INFANT	MEAT ING	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
INFANT	MILK ING	3.23E-03	4.22E-02	3.23E-03	1.85E-05	8.93E-03	3.23E-03
INFANT	TOTALS	9.37E-03	1.42E-01	6.18E-01	7.21E-04	3.27E-02	3.55E-03

AGE	PATHWAY	WH.BODY	BONE	AVG.LUNG	LIVER	KIDNEY	BRONCHI
CHILD	INHAL	5.82E-03	9.95E-02	6.15E-01	3.88E-04	2.35E-02	0.00E+00
CHILD	GROUND	3.14E-04	3.14E-04	3.14E-04	3.14E-04	3.14E-04	3.14E-04
CHILD	CLOUD	2.72E-08	2.72E-08	2.72E-08	2.72E-08	2.72E-08	2.72E-08
CHILD	VEG.ING	1.93E-03	3.16E-02	1.93E-03	7.06E-05	5.29E-03	1.93E-03
CHILD	MEAT ING	1.44E-04	2.34E-03	1.44E-04	1.05E-05	4.03E-04	1.44E-04
CHILD	MILK ING	1.90E-03	3.10E-02	1.90E-03	1.33E-05	5.05E-03	1.90E-03
CHILD	TOTALS	1.01E-02	1.65E-01	6.19E-01	7.97E-04	3.45E-02	4.29E-03

AGE	PATHWAY	WH.BODY	BONE	AVG.LUNG	LIVER	KIDNEY	BRONCHI
TEENAGER	INHAL	5.82E-03	9.95E-02	6.15E-01	3.88E-04	2.35E-02	0.00E+00
TEENAGER	GROUND	3.14E-04	3.14E-04	3.14E-04	3.14E-04	3.14E-04	3.14E-04
TEENAGER	CLOUD	2.72E-08	2.72E-08	2.72E-08	2.72E-08	2.72E-08	2.72E-08
TEENAGER	VEG.ING	1.08E-03	1.76E-02	1.08E-03	5.36E-05	4.18E-03	1.08E-03
TEENAGER	MEAT ING	7.96E-05	1.29E-03	7.96E-05	7.64E-06	3.12E-04	7.96E-05
TEENAGER	MILK ING	7.60E-04	1.23E-02	7.60E-04	7.00E-06	2.85E-03	7.60E-04
TEENAGER	TOTALS	8.05E-03	1.31E-01	6.17E-01	7.71E-04	3.11E-02	2.24E-03

AGE	PATHWAY	WH.BODY	BONE	AVG.LUNG	LIVER	KIDNEY	BRONCHI
ADULT	INHAL	5.82E-03	9.95E-02	6.15E-01	3.88E-04	2.35E-02	0.00E+00
ADULT	GROUND	3.14E-04	3.14E-04	3.14E-04	3.14E-04	3.14E-04	3.14E-04
ADULT	CLOUD	2.72E-08	2.72E-08	2.72E-08	2.72E-08	2.72E-08	2.72E-08
ADULT	VEG.ING	1.06E-03	1.73E-02	1.06E-03	5.93E-05	4.05E-03	1.06E-03
ADULT	MEAT ING	9.91E-05	1.61E-03	9.91E-05	1.06E-05	3.82E-04	9.91E-05
ADULT	MILK ING	2.84E-04	4.61E-03	2.84E-04	2.91E-06	1.05E-03	2.84E-04
ADULT	TOTALS	7.57E-03	1.23E-01	6.16E-01	7.75E-04	2.93E-02	1.76E-03

TIME STEP NUMBER 1, after 1 years DURATION IN YRS IS... 2.0

NUMBER 7 NAME=W. SCHLAUTMANN RANCH X= 5.8KM, Y= 4.1KM, Z= 1.0M, DIST= 7.2KM, IRTYPE=10

TOTAL ANNUAL DOSE COMMITMENTS COMPUTED FOR THIS LOCATION, MREM/YR

AGE	PATHWAY	WH.BODY	BONE	AVG.LUNG	LIVER	KIDNEY	BRONCHI
INFANT	INHAL	5.82E-03	9.95E-02	6.15E-01	3.88E-04	2.35E-02	0.00E+00
INFANT	GROUND	3.32E-04	3.32E-04	3.32E-04	3.32E-04	3.32E-04	3.32E-04
INFANT	CLOUD	2.72E-08	2.72E-08	2.72E-08	2.72E-08	2.72E-08	2.72E-08
INFANT	VEG.ING	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
INFANT	MEAT ING	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
INFANT	MILK ING	3.23E-03	4.22E-02	3.23E-03	1.85E-05	8.93E-03	3.23E-03
INFANT	TOTALS	9.38E-03	1.42E-01	6.18E-01	7.39E-04	3.27E-02	3.57E-03

AGE	PATHWAY	WH.BODY	BONE	AVG.LUNG	LIVER	KIDNEY	BRONCHI
CHILD	INHAL	5.82E-03	9.95E-02	6.15E-01	3.88E-04	2.35E-02	0.00E+00
CHILD	GROUND	3.32E-04	3.32E-04	3.32E-04	3.32E-04	3.32E-04	3.32E-04
CHILD	CLOUD	2.72E-08	2.72E-08	2.72E-08	2.72E-08	2.72E-08	2.72E-08
CHILD	VEG.ING	1.93E-03	3.16E-02	1.93E-03	7.06E-05	5.29E-03	1.93E-03
CHILD	MEAT ING	1.44E-04	2.34E-03	1.44E-04	1.05E-05	4.03E-04	1.44E-04
CHILD	MILK ING	1.90E-03	3.10E-02	1.90E-03	1.33E-05	5.05E-03	1.90E-03
CHILD	TOTALS	1.01E-02	1.65E-01	6.19E-01	8.15E-04	3.46E-02	4.31E-03

AGE	PATHWAY	WH.BODY	BONE	AVG.LUNG	LIVER	KIDNEY	BRONCHI
TEENAGER	INHAL	5.82E-03	9.95E-02	6.15E-01	3.88E-04	2.35E-02	0.00E+00
TEENAGER	GROUND	3.32E-04	3.32E-04	3.32E-04	3.32E-04	3.32E-04	3.32E-04
TEENAGER	CLOUD	2.72E-08	2.72E-08	2.72E-08	2.72E-08	2.72E-08	2.72E-08
TEENAGER	VEG.ING	1.08E-03	1.76E-02	1.08E-03	5.36E-05	4.18E-03	1.08E-03
TEENAGER	MEAT ING	7.96E-05	1.29E-03	7.96E-05	7.64E-06	3.12E-04	7.96E-05
TEENAGER	MILK ING	7.60E-04	1.23E-02	7.60E-04	7.00E-06	2.85E-03	7.60E-04
TEENAGER	TOTALS	8.07E-03	1.31E-01	6.17E-01	7.89E-04	3.12E-02	2.26E-03

AGE	PATHWAY	WH.BODY	BONE	AVG.LUNG	LIVER	KIDNEY	BRONCHI
ADULT	INHAL	5.82E-03	9.95E-02	6.15E-01	3.88E-04	2.35E-02	0.00E+00
ADULT	GROUND	3.32E-04	3.32E-04	3.32E-04	3.32E-04	3.32E-04	3.32E-04
ADULT	CLOUD	2.72E-08	2.72E-08	2.72E-08	2.72E-08	2.72E-08	2.72E-08
ADULT	VEG.ING	1.06E-03	1.73E-02	1.06E-03	5.93E-05	4.05E-03	1.06E-03
ADULT	MEAT ING	9.91E-05	1.61E-03	9.91E-05	1.06E-05	3.82E-04	9.91E-05
ADULT	MILK ING	2.84E-04	4.61E-03	2.84E-04	2.91E-06	1.05E-03	2.84E-04
ADULT	TOTALS	7.59E-03	1.23E-01	6.16E-01	7.94E-04	2.93E-02	1.78E-03

TIME STEP NUMBER 1, after 1 years DURATION IN YRS IS... 2.0

MBER 8 NAME=L. GILBERTS RANCH X= 9.6KM, Y= 2.4KM, Z= 1.0M, DIST= 9.9KM, IRTYPE=10

40CFR190 ANNUAL DOSE COMMITMENTS COMPUTED FOR THIS LOCATION, MREM/YR

AGE	PATHWAY	WH.BODY	BONE	AVG.LUNG	LIVER	KIDNEY	BRONCHI
INFANT	INHAL	2.88E-03	4.92E-02	3.04E-01	1.92E-04	1.16E-02	0.00E+00
INFANT	GROUND	1.55E-04	1.55E-04	1.55E-04	1.55E-04	1.55E-04	1.55E-04
INFANT	CLOUD	1.34E-08	1.34E-08	1.34E-08	1.34E-08	1.34E-08	1.34E-08
INFANT	VEG.ING	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
INFANT	MEAT ING	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
INFANT	MILK ING	1.60E-03	2.09E-02	1.60E-03	9.13E-06	4.42E-03	1.60E-03
INFANT	TOTALS	4.63E-03	7.02E-02	3.06E-01	3.56E-04	1.62E-02	1.75E-03

AGE	PATHWAY	WH.BODY	BONE	AVG.LUNG	LIVER	KIDNEY	BRONCHI
CHILD	INHAL	2.88E-03	4.92E-02	3.04E-01	1.92E-04	1.16E-02	0.00E+00
CHILD	GROUND	1.55E-04	1.55E-04	1.55E-04	1.55E-04	1.55E-04	1.55E-04
CHILD	CLOUD	1.34E-08	1.34E-08	1.34E-08	1.34E-08	1.34E-08	1.34E-08
CHILD	VEG.ING	9.55E-04	1.56E-02	9.55E-04	3.49E-05	2.61E-03	9.55E-04
CHILD	MEAT ING	7.12E-05	1.16E-03	7.12E-05	5.18E-06	1.99E-04	7.12E-05
CHILD	MILK ING	9.39E-04	1.53E-02	9.39E-04	6.57E-06	2.50E-03	9.39E-04
CHILD	TOTALS	5.00E-03	8.14E-02	3.06E-01	3.94E-04	1.71E-02	2.12E-03

AGE	PATHWAY	WH.BODY	BONE	AVG.LUNG	LIVER	KIDNEY	BRONCHI
TEENAGER	INHAL	2.88E-03	4.92E-02	3.04E-01	1.92E-04	1.16E-02	0.00E+00
TEENAGER	GROUND	1.55E-04	1.55E-04	1.55E-04	1.55E-04	1.55E-04	1.55E-04
TEENAGER	CLOUD	1.34E-08	1.34E-08	1.34E-08	1.34E-08	1.34E-08	1.34E-08
TEENAGER	VEG.ING	5.36E-04	8.72E-03	5.36E-04	2.65E-05	2.07E-03	5.36E-04
TEENAGER	MEAT ING	3.94E-05	6.37E-04	3.94E-05	3.78E-06	1.54E-04	3.94E-05
TEENAGER	MILK ING	3.76E-04	6.09E-03	3.76E-04	3.46E-06	1.41E-03	3.76E-04
TEENAGER	TOTALS	3.98E-03	6.48E-02	3.05E-01	3.81E-04	1.54E-02	1.11E-03

AGE	PATHWAY	WH.BODY	BONE	AVG.LUNG	LIVER	KIDNEY	BRONCHI
ADULT	INHAL	2.88E-03	4.92E-02	3.04E-01	1.92E-04	1.16E-02	0.00E+00
ADULT	GROUND	1.55E-04	1.55E-04	1.55E-04	1.55E-04	1.55E-04	1.55E-04
ADULT	CLOUD	1.34E-08	1.34E-08	1.34E-08	1.34E-08	1.34E-08	1.34E-08
ADULT	VEG.ING	5.24E-04	8.55E-03	5.24E-04	2.93E-05	2.00E-03	5.24E-04
ADULT	MEAT ING	4.90E-05	7.94E-04	4.90E-05	5.22E-06	1.89E-04	4.90E-05
ADULT	MILK ING	1.41E-04	2.28E-03	1.41E-04	1.44E-06	5.20E-04	1.41E-04
ADULT	TOTALS	3.74E-03	6.10E-02	3.05E-01	3.83E-04	1.45E-02	8.69E-04

TIME STEP NUMBER 1, after 1 years DURATION IN YRS IS... 2.0

NUMBER 8 NAME=L. GILBERTS RANCH X= 9.6KM, Y= 2.4KM, Z= 1.0M, DIST= 9.9KM, IRTYPE=10

TOTAL ANNUAL DOSE COMMITMENTS COMPUTED FOR THIS LOCATION, MREM/YR

AGE	PATHWAY	WH.BODY	BONE	AVG.LUNG	LIVER	KIDNEY	BRONCHI
INFANT	INHAL	2.88E-03	4.92E-02	3.04E-01	1.92E-04	1.16E-02	0.00E+00
INFANT	GROUND	1.64E-04	1.64E-04	1.64E-04	1.64E-04	1.64E-04	1.64E-04
INFANT	CLOUD	1.34E-08	1.34E-08	1.34E-08	1.34E-08	1.34E-08	1.34E-08
INFANT	VEG.ING	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
INFANT	MEAT ING	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
INFANT	MILK ING	1.60E-03	2.09E-02	1.60E-03	9.13E-06	4.42E-03	1.60E-03
INFANT	TOTALS	4.64E-03	7.02E-02	3.06E-01	3.65E-04	1.62E-02	1.76E-03

AGE	PATHWAY	WH.BODY	BONE	AVG.LUNG	LIVER	KIDNEY	BRONCHI
CHILD	INHAL	2.88E-03	4.92E-02	3.04E-01	1.92E-04	1.16E-02	0.00E+00
CHILD	GROUND	1.64E-04	1.64E-04	1.64E-04	1.64E-04	1.64E-04	1.64E-04
CHILD	CLOUD	1.34E-08	1.34E-08	1.34E-08	1.34E-08	1.34E-08	1.34E-08
CHILD	VEG.ING	9.55E-04	1.56E-02	9.55E-04	3.49E-05	2.61E-03	9.55E-04
CHILD	MEAT ING	7.12E-05	1.16E-03	7.12E-05	5.18E-06	1.99E-04	7.12E-05
CHILD	MILK ING	9.39E-04	1.53E-02	9.39E-04	6.57E-06	2.50E-03	9.39E-04
CHILD	TOTALS	5.01E-03	8.14E-02	3.06E-01	4.03E-04	1.71E-02	2.13E-03

AGE	PATHWAY	WH.BODY	BONE	AVG.LUNG	LIVER	KIDNEY	BRONCHI
TEENAGER	INHAL	2.88E-03	4.92E-02	3.04E-01	1.92E-04	1.16E-02	0.00E+00
TEENAGER	GROUND	1.64E-04	1.64E-04	1.64E-04	1.64E-04	1.64E-04	1.64E-04
TEENAGER	CLOUD	1.34E-08	1.34E-08	1.34E-08	1.34E-08	1.34E-08	1.34E-08
TEENAGER	VEG.ING	5.36E-04	8.72E-03	5.36E-04	2.65E-05	2.07E-03	5.36E-04
TEENAGER	MEAT ING	3.94E-05	6.37E-04	3.94E-05	3.78E-06	1.54E-04	3.94E-05
TEENAGER	MILK ING	3.76E-04	6.09E-03	3.76E-04	3.46E-06	1.41E-03	3.76E-04
TEENAGER	TOTALS	3.99E-03	6.48E-02	3.05E-01	3.90E-04	1.54E-02	1.12E-03

AGE	PATHWAY	WH.BODY	BONE	AVG.LUNG	LIVER	KIDNEY	BRONCHI
ADULT	INHAL	2.88E-03	4.92E-02	3.04E-01	1.92E-04	1.16E-02	0.00E+00
ADULT	GROUND	1.64E-04	1.64E-04	1.64E-04	1.64E-04	1.64E-04	1.64E-04
ADULT	CLOUD	1.34E-08	1.34E-08	1.34E-08	1.34E-08	1.34E-08	1.34E-08
ADULT	VEG.ING	5.24E-04	8.55E-03	5.24E-04	2.93E-05	2.00E-03	5.24E-04
ADULT	MEAT ING	4.90E-05	7.94E-04	4.90E-05	5.22E-06	1.89E-04	4.90E-05
ADULT	MILK ING	1.41E-04	2.28E-03	1.41E-04	1.44E-06	5.20E-04	1.41E-04
ADULT	TOTALS	3.75E-03	6.10E-02	3.05E-01	3.92E-04	1.45E-02	8.78E-04

TIME STEP NUMBER 1, after 1 years DURATION IN YRS IS... 2.0

.BER 9 NAME=EARL CAMBLIN RANCH X= 10.5KM, Y= -2.3KM, Z= 1.0M, DIST= 10.8KM, IRTYPE=10

40CFR190 ANNUAL DOSE COMMITMENTS COMPUTED FOR THIS LOCATION, MREM/YR

AGE	PATHWAY	WH.BODY	BONE	AVG.LUNG	LIVER	KIDNEY	BRONCHI
INFANT	INHAL	2.77E-03	4.74E-02	2.93E-01	1.85E-04	1.12E-02	0.00E+00
INFANT	GROUND	1.50E-04	1.50E-04	1.50E-04	1.50E-04	1.50E-04	1.50E-04
INFANT	CLOUD	1.29E-08	1.29E-08	1.29E-08	1.29E-08	1.29E-08	1.29E-08
INFANT	VEG.ING	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
INFANT	MEAT ING	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
INFANT	MILK ING	1.54E-03	2.01E-02	1.54E-03	8.80E-06	4.26E-03	1.54E-03
INFANT	TOTALS	4.46E-03	6.77E-02	2.95E-01	3.44E-04	1.56E-02	1.69E-03

AGE	PATHWAY	WH.BODY	BONE	AVG.LUNG	LIVER	KIDNEY	BRONCHI
CHILD	INHAL	2.77E-03	4.74E-02	2.93E-01	1.85E-04	1.12E-02	0.00E+00
CHILD	GROUND	1.50E-04	1.50E-04	1.50E-04	1.50E-04	1.50E-04	1.50E-04
CHILD	CLOUD	1.29E-08	1.29E-08	1.29E-08	1.29E-08	1.29E-08	1.29E-08
CHILD	VEG.ING	9.21E-04	1.51E-02	9.21E-04	3.36E-05	2.52E-03	9.21E-04
CHILD	MEAT ING	6.86E-05	1.12E-03	6.86E-05	4.99E-06	1.92E-04	6.86E-05
CHILD	MILK ING	9.05E-04	1.48E-02	9.05E-04	6.33E-06	2.41E-03	9.05E-04
CHILD	TOTALS	4.82E-03	7.85E-02	2.95E-01	3.80E-04	1.65E-02	2.04E-03

AGE	PATHWAY	WH.BODY	BONE	AVG.LUNG	LIVER	KIDNEY	BRONCHI
TEENAGER	INHAL	2.77E-03	4.74E-02	2.93E-01	1.85E-04	1.12E-02	0.00E+00
TEENAGER	GROUND	1.50E-04	1.50E-04	1.50E-04	1.50E-04	1.50E-04	1.50E-04
TEENAGER	CLOUD	1.29E-08	1.29E-08	1.29E-08	1.29E-08	1.29E-08	1.29E-08
TEENAGER	VEG.ING	5.17E-04	8.40E-03	5.17E-04	2.56E-05	1.99E-03	5.17E-04
TEENAGER	MEAT ING	3.79E-05	6.14E-04	3.79E-05	3.64E-06	1.49E-04	3.79E-05
TEENAGER	MILK ING	3.62E-04	5.87E-03	3.62E-04	3.34E-06	1.36E-03	3.62E-04
TEENAGER	TOTALS	3.84E-03	6.25E-02	2.94E-01	3.67E-04	1.48E-02	1.07E-03

AGE	PATHWAY	WH.BODY	BONE	AVG.LUNG	LIVER	KIDNEY	BRONCHI
ADULT	INHAL	2.77E-03	4.74E-02	2.93E-01	1.85E-04	1.12E-02	0.00E+00
ADULT	GROUND	1.50E-04	1.50E-04	1.50E-04	1.50E-04	1.50E-04	1.50E-04
ADULT	CLOUD	1.29E-08	1.29E-08	1.29E-08	1.29E-08	1.29E-08	1.29E-08
ADULT	VEG.ING	5.05E-04	8.24E-03	5.05E-04	2.83E-05	1.93E-03	5.05E-04
ADULT	MEAT ING	4.72E-05	7.65E-04	4.72E-05	5.03E-06	1.82E-04	4.72E-05
ADULT	MILK ING	1.35E-04	2.20E-03	1.35E-04	1.39E-06	5.02E-04	1.35E-04
ADULT	TOTALS	3.61E-03	5.88E-02	2.94E-01	3.70E-04	1.40E-02	8.38E-04

TIME STEP NUMBER 1, after 1 years DURATION IN YRS IS... 2.0

NUMBER 9 NAME=EARL CAMBLIN RANCH X= 10.5KM, Y= -2.3KM, Z= 1.0M, DIST= 10.8KM, IRTYPE=10

TOTAL ANNUAL DOSE COMMITMENTS COMPUTED FOR THIS LOCATION, MREM/YR

AGE	PATHWAY	WH.BODY	BONE	AVG.LUNG	LIVER	KIDNEY	BRONCHI
INFANT	INHAL	2.77E-03	4.74E-02	2.93E-01	1.85E-04	1.12E-02	0.00E+00
INFANT	GROUND	1.58E-04	1.58E-04	1.58E-04	1.58E-04	1.58E-04	1.58E-04
INFANT	CLOUD	1.29E-08	1.29E-08	1.29E-08	1.29E-08	1.29E-08	1.29E-08
INFANT	VEG.ING	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
INFANT	MEAT ING	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
INFANT	MILK ING	1.54E-03	2.01E-02	1.54E-03	8.80E-06	4.26E-03	1.54E-03
INFANT	TOTALS	4.47E-03	6.77E-02	2.95E-01	3.52E-04	1.56E-02	1.70E-03

AGE	PATHWAY	WH.BODY	BONE	AVG.LUNG	LIVER	KIDNEY	BRONCHI
CHILD	INHAL	2.77E-03	4.74E-02	2.93E-01	1.85E-04	1.12E-02	0.00E+00
CHILD	GROUND	1.58E-04	1.58E-04	1.58E-04	1.58E-04	1.58E-04	1.58E-04
CHILD	CLOUD	1.29E-08	1.29E-08	1.29E-08	1.29E-08	1.29E-08	1.29E-08
CHILD	VEG.ING	9.21E-04	1.51E-02	9.21E-04	3.36E-05	2.52E-03	9.21E-04
CHILD	MEAT ING	6.86E-05	1.12E-03	6.86E-05	4.99E-06	1.92E-04	6.86E-05
CHILD	MILK ING	9.05E-04	1.48E-02	9.05E-04	6.33E-06	2.41E-03	9.05E-04
CHILD	TOTALS	4.83E-03	7.85E-02	2.95E-01	3.89E-04	1.65E-02	2.05E-03

AGE	PATHWAY	WH.BODY	BONE	AVG.LUNG	LIVER	KIDNEY	BRONCHI
TEENAGER	INHAL	2.77E-03	4.74E-02	2.93E-01	1.85E-04	1.12E-02	0.00E+00
TEENAGER	GROUND	1.58E-04	1.58E-04	1.58E-04	1.58E-04	1.58E-04	1.58E-04
TEENAGER	CLOUD	1.29E-08	1.29E-08	1.29E-08	1.29E-08	1.29E-08	1.29E-08
TEENAGER	VEG.ING	5.17E-04	8.40E-03	5.17E-04	2.56E-05	1.99E-03	5.17E-04
TEENAGER	MEAT ING	3.79E-05	6.14E-04	3.79E-05	3.64E-06	1.49E-04	3.79E-05
TEENAGER	MILK ING	3.62E-04	5.87E-03	3.62E-04	3.34E-06	1.36E-03	3.62E-04
TEENAGER	TOTALS	3.85E-03	6.25E-02	2.94E-01	3.76E-04	1.49E-02	1.08E-03

AGE	PATHWAY	WH.BODY	BONE	AVG.LUNG	LIVER	KIDNEY	BRONCHI
ADULT	INHAL	2.77E-03	4.74E-02	2.93E-01	1.85E-04	1.12E-02	0.00E+00
ADULT	GROUND	1.58E-04	1.58E-04	1.58E-04	1.58E-04	1.58E-04	1.58E-04
ADULT	CLOUD	1.29E-08	1.29E-08	1.29E-08	1.29E-08	1.29E-08	1.29E-08
ADULT	VEG.ING	5.05E-04	8.24E-03	5.05E-04	2.83E-05	1.93E-03	5.05E-04
ADULT	MEAT ING	4.72E-05	7.65E-04	4.72E-05	5.03E-06	1.82E-04	4.72E-05
ADULT	MILK ING	1.35E-04	2.20E-03	1.35E-04	1.39E-06	5.02E-04	1.35E-04
ADULT	TOTALS	3.62E-03	5.88E-02	2.94E-01	3.78E-04	1.40E-02	8.46E-04

TIME STEP NUMBER 1, after 1 years DURATION IN YRS IS... 2.0

/MBER 10 NAME=JOHN GROVES X= 9.4KM, Y= 6.7KM, Z= 1.0M, DIST= 11.6KM, IRTYPE=10

40CFR190 ANNUAL DOSE COMMITMENTS COMPUTED FOR THIS LOCATION, MREM/YR

AGE	PATHWAY	WH.BODY	BONE	AVG.LUNG	LIVER	KIDNEY	BRONCHI
INFANT	INHAL	2.39E-03	4.09E-02	2.52E-01	1.60E-04	9.65E-03	0.00E+00
INFANT	GROUND	1.29E-04	1.29E-04	1.29E-04	1.29E-04	1.29E-04	1.29E-04
INFANT	CLOUD	1.12E-08	1.12E-08	1.12E-08	1.12E-08	1.12E-08	1.12E-08
INFANT	VEG.ING	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
INFANT	MEAT ING	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
INFANT	MILK ING	1.33E-03	1.73E-02	1.33E-03	7.58E-06	3.67E-03	1.33E-03
INFANT	TOTALS	3.85E-03	5.83E-02	2.54E-01	2.96E-04	1.34E-02	1.46E-03

AGE	PATHWAY	WH.BODY	BONE	AVG.LUNG	LIVER	KIDNEY	BRONCHI
CHILD	INHAL	2.39E-03	4.09E-02	2.52E-01	1.60E-04	9.65E-03	0.00E+00
CHILD	GROUND	1.29E-04	1.29E-04	1.29E-04	1.29E-04	1.29E-04	1.29E-04
CHILD	CLOUD	1.12E-08	1.12E-08	1.12E-08	1.12E-08	1.12E-08	1.12E-08
CHILD	VEG.ING	7.93E-04	1.30E-02	7.93E-04	2.90E-05	2.17E-03	7.93E-04
CHILD	MEAT ING	5.91E-05	9.62E-04	5.91E-05	4.30E-06	1.65E-04	5.91E-05
CHILD	MILK ING	7.80E-04	1.27E-02	7.80E-04	5.46E-06	2.08E-03	7.80E-04
CHILD	TOTALS	4.15E-03	6.77E-02	2.54E-01	3.27E-04	1.42E-02	1.76E-03

AGE	PATHWAY	WH.BODY	BONE	AVG.LUNG	LIVER	KIDNEY	BRONCHI
TEENAGER	INHAL	2.39E-03	4.09E-02	2.52E-01	1.60E-04	9.65E-03	0.00E+00
TEENAGER	GROUND	1.29E-04	1.29E-04	1.29E-04	1.29E-04	1.29E-04	1.29E-04
TEENAGER	CLOUD	1.12E-08	1.12E-08	1.12E-08	1.12E-08	1.12E-08	1.12E-08
TEENAGER	VEG.ING	4.45E-04	7.24E-03	4.45E-04	2.20E-05	1.72E-03	4.45E-04
TEENAGER	MEAT ING	3.27E-05	5.29E-04	3.27E-05	3.14E-06	1.28E-04	3.27E-05
TEENAGER	MILK ING	3.12E-04	5.06E-03	3.12E-04	2.88E-06	1.17E-03	3.12E-04
TEENAGER	TOTALS	3.31E-03	5.38E-02	2.53E-01	3.17E-04	1.28E-02	9.19E-04

AGE	PATHWAY	WH.BODY	BONE	AVG.LUNG	LIVER	KIDNEY	BRONCHI
ADULT	INHAL	2.39E-03	4.09E-02	2.52E-01	1.60E-04	9.65E-03	0.00E+00
ADULT	GROUND	1.29E-04	1.29E-04	1.29E-04	1.29E-04	1.29E-04	1.29E-04
ADULT	CLOUD	1.12E-08	1.12E-08	1.12E-08	1.12E-08	1.12E-08	1.12E-08
ADULT	VEG.ING	4.35E-04	7.10E-03	4.35E-04	2.44E-05	1.66E-03	4.35E-04
ADULT	MEAT ING	4.07E-05	6.60E-04	4.07E-05	4.34E-06	1.57E-04	4.07E-05
ADULT	MILK ING	1.17E-04	1.89E-03	1.17E-04	1.20E-06	4.32E-04	1.17E-04
ADULT	TOTALS	3.11E-03	5.07E-02	2.53E-01	3.18E-04	1.20E-02	7.22E-04

TIME STEP NUMBER 1, after 1 years DURATION IN YRS IS... 2.0

NUMBER 10 NAME=JOHN GROVES X= 9.4KM, Y= 6.7KM, Z= 1.0M, DIST= 11.6KM, IRTYPE=10

TOTAL ANNUAL DOSE COMMITMENTS COMPUTED FOR THIS LOCATION, MREM/YR

AGE	PATHWAY	WH.BODY	BONE	AVG.LUNG	LIVER	KIDNEY	BRONCHI
INFANT	INHAL	2.39E-03	4.09E-02	2.52E-01	1.60E-04	9.65E-03	0.00E+00
INFANT	GROUND	1.37E-04	1.37E-04	1.37E-04	1.37E-04	1.37E-04	1.37E-04
INFANT	CLOUD	1.12E-08	1.12E-08	1.12E-08	1.12E-08	1.12E-08	1.12E-08
INFANT	VEG.ING	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
INFANT	MEAT ING	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
INFANT	MILK ING	1.33E-03	1.73E-02	1.33E-03	7.58E-06	3.67E-03	1.33E-03
INFANT	TOTALS	3.85E-03	5.84E-02	2.54E-01	3.04E-04	1.35E-02	1.47E-03

AGE	PATHWAY	WH.BODY	BONE	AVG.LUNG	LIVER	KIDNEY	BRONCHI
CHILD	INHAL	2.39E-03	4.09E-02	2.52E-01	1.60E-04	9.65E-03	0.00E+00
CHILD	GROUND	1.37E-04	1.37E-04	1.37E-04	1.37E-04	1.37E-04	1.37E-04
CHILD	CLOUD	1.12E-08	1.12E-08	1.12E-08	1.12E-08	1.12E-08	1.12E-08
CHILD	VEG.ING	7.93E-04	1.30E-02	7.93E-04	2.90E-05	2.17E-03	7.93E-04
CHILD	MEAT ING	5.91E-05	9.62E-04	5.91E-05	4.30E-06	1.65E-04	5.91E-05
CHILD	MILK ING	7.80E-04	1.27E-02	7.80E-04	5.46E-06	2.08E-03	7.80E-04
CHILD	TOTALS	4.16E-03	6.77E-02	2.54E-01	3.35E-04	1.42E-02	1.77E-03

AGE	PATHWAY	WH.BODY	BONE	AVG.LUNG	LIVER	KIDNEY	BRONCHI
TEENAGER	INHAL	2.39E-03	4.09E-02	2.52E-01	1.60E-04	9.65E-03	0.00E+00
TEENAGER	GROUND	1.37E-04	1.37E-04	1.37E-04	1.37E-04	1.37E-04	1.37E-04
TEENAGER	CLOUD	1.12E-08	1.12E-08	1.12E-08	1.12E-08	1.12E-08	1.12E-08
TEENAGER	VEG.ING	4.45E-04	7.24E-03	4.45E-04	2.20E-05	1.72E-03	4.45E-04
TEENAGER	MEAT ING	3.27E-05	5.29E-04	3.27E-05	3.14E-06	1.28E-04	3.27E-05
TEENAGER	MILK ING	3.12E-04	5.06E-03	3.12E-04	2.88E-06	1.17E-03	3.12E-04
TEENAGER	TOTALS	3.32E-03	5.38E-02	2.53E-01	3.24E-04	1.28E-02	9.27E-04

AGE	PATHWAY	WH.BODY	BONE	AVG.LUNG	LIVER	KIDNEY	BRONCHI
ADULT	INHAL	2.39E-03	4.09E-02	2.52E-01	1.60E-04	9.65E-03	0.00E+00
ADULT	GROUND	1.37E-04	1.37E-04	1.37E-04	1.37E-04	1.37E-04	1.37E-04
ADULT	CLOUD	1.12E-08	1.12E-08	1.12E-08	1.12E-08	1.12E-08	1.12E-08
ADULT	VEG.ING	4.35E-04	7.10E-03	4.35E-04	2.44E-05	1.66E-03	4.35E-04
ADULT	MEAT ING	4.07E-05	6.60E-04	4.07E-05	4.34E-06	1.57E-04	4.07E-05
ADULT	MILK ING	1.17E-04	1.89E-03	1.17E-04	1.20E-06	4.32E-04	1.17E-04
ADULT	TOTALS	3.12E-03	5.07E-02	2.53E-01	3.26E-04	1.20E-02	7.29E-04

TIME STEP NUMBER 1, after 1 years DURATION IN YRS IS... 2.0

NUMBER 11 NAME=TOWN OF SAVAGETOWN X= 11.1KM, Y= 8.8KM, Z= 1.0M, DIST= 14.2KM, IRTYPE=10

40CFR190 ANNUAL DOSE COMMITMENTS COMPUTED FOR THIS LOCATION, MREM/YR

AGE	PATHWAY	WH.BODY	BONE	AVG.LUNG	LIVER	KIDNEY	BRONCHI
INFANT	INHAL	1.73E-03	2.95E-02	1.82E-01	1.15E-04	6.97E-03	0.00E+00
INFANT	GROUND	9.32E-05	9.32E-05	9.32E-05	9.32E-05	9.32E-05	9.32E-05
INFANT	CLOUD	8.06E-09	8.06E-09	8.06E-09	8.06E-09	8.06E-09	8.06E-09
INFANT	VEG.ING	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
INFANT	MEAT ING	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
INFANT	MILK ING	9.60E-04	1.25E-02	9.60E-04	5.48E-06	2.65E-03	9.60E-04
INFANT	TOTALS	2.78E-03	4.22E-02	1.83E-01	2.14E-04	9.72E-03	1.05E-03

AGE	PATHWAY	WH.BODY	BONE	AVG.LUNG	LIVER	KIDNEY	BRONCHI
CHILD	INHAL	1.73E-03	2.95E-02	1.82E-01	1.15E-04	6.97E-03	0.00E+00
CHILD	GROUND	9.32E-05	9.32E-05	9.32E-05	9.32E-05	9.32E-05	9.32E-05
CHILD	CLOUD	8.06E-09	8.06E-09	8.06E-09	8.06E-09	8.06E-09	8.06E-09
CHILD	VEG.ING	5.73E-04	9.37E-03	5.73E-04	2.09E-05	1.57E-03	5.73E-04
CHILD	MEAT ING	4.27E-05	6.95E-04	4.27E-05	3.11E-06	1.20E-04	4.27E-05
CHILD	MILK ING	5.64E-04	9.20E-03	5.64E-04	3.94E-06	1.50E-03	5.64E-04
CHILD	TOTALS	3.00E-03	4.89E-02	1.84E-01	2.36E-04	1.03E-02	1.27E-03

AGE	PATHWAY	WH.BODY	BONE	AVG.LUNG	LIVER	KIDNEY	BRONCHI
TEENAGER	INHAL	1.73E-03	2.95E-02	1.82E-01	1.15E-04	6.97E-03	0.00E+00
TEENAGER	GROUND	9.32E-05	9.32E-05	9.32E-05	9.32E-05	9.32E-05	9.32E-05
TEENAGER	CLOUD	8.06E-09	8.06E-09	8.06E-09	8.06E-09	8.06E-09	8.06E-09
TEENAGER	VEG.ING	3.22E-04	5.23E-03	3.22E-04	1.59E-05	1.24E-03	3.22E-04
TEENAGER	MEAT ING	2.36E-05	3.82E-04	2.36E-05	2.27E-06	9.25E-05	2.36E-05
TEENAGER	MILK ING	2.26E-04	3.66E-03	2.26E-04	2.08E-06	8.46E-04	2.26E-04
TEENAGER	TOTALS	2.39E-03	3.89E-02	1.83E-01	2.29E-04	9.24E-03	6.64E-04

AGE	PATHWAY	WH.BODY	BONE	AVG.LUNG	LIVER	KIDNEY	BRONCHI
ADULT	INHAL	1.73E-03	2.95E-02	1.82E-01	1.15E-04	6.97E-03	0.00E+00
ADULT	GROUND	9.32E-05	9.32E-05	9.32E-05	9.32E-05	9.32E-05	9.32E-05
ADULT	CLOUD	8.06E-09	8.06E-09	8.06E-09	8.06E-09	8.06E-09	8.06E-09
ADULT	VEG.ING	3.15E-04	5.13E-03	3.15E-04	1.76E-05	1.20E-03	3.15E-04
ADULT	MEAT ING	2.94E-05	4.77E-04	2.94E-05	3.14E-06	1.13E-04	2.94E-05
ADULT	MILK ING	8.44E-05	1.37E-03	8.44E-05	8.64E-07	3.13E-04	8.44E-05
ADULT	TOTALS	2.25E-03	3.66E-02	1.83E-01	2.30E-04	8.69E-03	5.22E-04

TIME STEP NUMBER 1, after 1 years DURATION IN YRS IS... 2.0

NUMBER 11 NAME=TOWN OF SAVAGETOWN X= 11.1KM, Y= 8.8KM, Z= 1.0M, DIST= 14.2KM, IRTYPE=10

TOTAL ANNUAL DOSE COMMITMENTS COMPUTED FOR THIS LOCATION, MREM/YR

AGE	PATHWAY	WH.BODY	BONE	AVG.LUNG	LIVER	KIDNEY	BRONCHI
INFANT	INHAL	1.73E-03	2.95E-02	1.82E-01	1.15E-04	6.97E-03	0.00E+00
INFANT	GROUND	9.87E-05	9.87E-05	9.87E-05	9.87E-05	9.87E-05	9.87E-05
INFANT	CLOUD	8.06E-09	8.06E-09	8.06E-09	8.06E-09	8.06E-09	8.06E-09
INFANT	VEG.ING	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
INFANT	MEAT ING	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
INFANT	MILK ING	9.60E-04	1.25E-02	9.60E-04	5.48E-06	2.65E-03	9.60E-04
INFANT	TOTALS	2.79E-03	4.22E-02	1.83E-01	2.19E-04	9.72E-03	1.06E-03

AGE	PATHWAY	WH.BODY	BONE	AVG.LUNG	LIVER	KIDNEY	BRONCHI
CHILD	INHAL	1.73E-03	2.95E-02	1.82E-01	1.15E-04	6.97E-03	0.00E+00
CHILD	GROUND	9.87E-05	9.87E-05	9.87E-05	9.87E-05	9.87E-05	9.87E-05
CHILD	CLOUD	8.06E-09	8.06E-09	8.06E-09	8.06E-09	8.06E-09	8.06E-09
CHILD	VEG.ING	5.73E-04	9.37E-03	5.73E-04	2.09E-05	1.57E-03	5.73E-04
CHILD	MEAT ING	4.27E-05	6.95E-04	4.27E-05	3.11E-06	1.20E-04	4.27E-05
CHILD	MILK ING	5.64E-04	9.20E-03	5.64E-04	3.94E-06	1.50E-03	5.64E-04
CHILD	TOTALS	3.01E-03	4.89E-02	1.84E-01	2.42E-04	1.03E-02	1.28E-03

AGE	PATHWAY	WH.BODY	BONE	AVG.LUNG	LIVER	KIDNEY	BRONCHI
TEENAGER	INHAL	1.73E-03	2.95E-02	1.82E-01	1.15E-04	6.97E-03	0.00E+00
TEENAGER	GROUND	9.87E-05	9.87E-05	9.87E-05	9.87E-05	9.87E-05	9.87E-05
TEENAGER	CLOUD	8.06E-09	8.06E-09	8.06E-09	8.06E-09	8.06E-09	8.06E-09
TEENAGER	VEG.ING	3.22E-04	5.23E-03	3.22E-04	1.59E-05	1.24E-03	3.22E-04
TEENAGER	MEAT ING	2.36E-05	3.82E-04	2.36E-05	2.27E-06	9.25E-05	2.36E-05
TEENAGER	MILK ING	2.26E-04	3.66E-03	2.26E-04	2.08E-06	8.46E-04	2.26E-04
TEENAGER	TOTALS	2.40E-03	3.89E-02	1.83E-01	2.34E-04	9.25E-03	6.70E-04

AGE	PATHWAY	WH.BODY	BONE	AVG.LUNG	LIVER	KIDNEY	BRONCHI
ADULT	INHAL	1.73E-03	2.95E-02	1.82E-01	1.15E-04	6.97E-03	0.00E+00
ADULT	GROUND	9.87E-05	9.87E-05	9.87E-05	9.87E-05	9.87E-05	9.87E-05
ADULT	CLOUD	8.06E-09	8.06E-09	8.06E-09	8.06E-09	8.06E-09	8.06E-09
ADULT	VEG.ING	3.15E-04	5.13E-03	3.15E-04	1.76E-05	1.20E-03	3.15E-04
ADULT	MEAT ING	2.94E-05	4.77E-04	2.94E-05	3.14E-06	1.13E-04	2.94E-05
ADULT	MILK ING	8.44E-05	1.37E-03	8.44E-05	8.64E-07	3.13E-04	8.44E-05
ADULT	TOTALS	2.25E-03	3.66E-02	1.83E-01	2.36E-04	8.70E-03	5.27E-04

TIME STEP NUMBER 1, after 1 years DURATION IN YRS IS... 2.0

NUMBER 12 NAME=RUBY RANCH X= 11.3KM, Y= -5.8KM, Z= 1.0M, DIST= 12.7KM, IRTYPE=10

40CFR190 ANNUAL DOSE COMMITMENTS COMPUTED FOR THIS LOCATION, MREM/YR

AGE	PATHWAY	WH.BODY	BONE	AVG.LUNG	LIVER	KIDNEY	BRONCHI
INFANT	INHAL	1.84E-03	3.15E-02	1.95E-01	1.23E-04	7.44E-03	0.00E+00
INFANT	GROUND	9.95E-05	9.95E-05	9.95E-05	9.95E-05	9.95E-05	9.95E-05
INFANT	CLOUD	8.60E-09	8.60E-09	8.60E-09	8.60E-09	8.60E-09	8.60E-09
INFANT	VEG.ING	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
INFANT	MEAT ING	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
INFANT	MILK ING	1.02E-03	1.34E-02	1.02E-03	5.85E-06	2.83E-03	1.02E-03
INFANT	TOTALS	2.97E-03	4.50E-02	1.96E-01	2.28E-04	1.04E-02	1.12E-03

AGE	PATHWAY	WH.BODY	BONE	AVG.LUNG	LIVER	KIDNEY	BRONCHI
CHILD	INHAL	1.84E-03	3.15E-02	1.95E-01	1.23E-04	7.44E-03	0.00E+00
CHILD	GROUND	9.95E-05	9.95E-05	9.95E-05	9.95E-05	9.95E-05	9.95E-05
CHILD	CLOUD	8.60E-09	8.60E-09	8.60E-09	8.60E-09	8.60E-09	8.60E-09
CHILD	VEG.ING	6.12E-04	1.00E-02	6.12E-04	2.23E-05	1.67E-03	6.12E-04
CHILD	MEAT ING	4.56E-05	7.42E-04	4.56E-05	3.32E-06	1.28E-04	4.56E-05
CHILD	MILK ING	6.02E-04	9.82E-03	6.02E-04	4.21E-06	1.60E-03	6.02E-04
CHILD	TOTALS	3.20E-03	5.22E-02	1.96E-01	2.52E-04	1.09E-02	1.36E-03

AGE	PATHWAY	WH.BODY	BONE	AVG.LUNG	LIVER	KIDNEY	BRONCHI
TEENAGER	INHAL	1.84E-03	3.15E-02	1.95E-01	1.23E-04	7.44E-03	0.00E+00
TEENAGER	GROUND	9.95E-05	9.95E-05	9.95E-05	9.95E-05	9.95E-05	9.95E-05
TEENAGER	CLOUD	8.60E-09	8.60E-09	8.60E-09	8.60E-09	8.60E-09	8.60E-09
TEENAGER	VEG.ING	3.43E-04	5.59E-03	3.43E-04	1.70E-05	1.32E-03	3.43E-04
TEENAGER	MEAT ING	2.52E-05	4.08E-04	2.52E-05	2.42E-06	9.88E-05	2.52E-05
TEENAGER	MILK ING	2.41E-04	3.90E-03	2.41E-04	2.22E-06	9.03E-04	2.41E-04
TEENAGER	TOTALS	2.55E-03	4.15E-02	1.95E-01	2.44E-04	9.86E-03	7.09E-04

AGE	PATHWAY	WH.BODY	BONE	AVG.LUNG	LIVER	KIDNEY	BRONCHI
ADULT	INHAL	1.84E-03	3.15E-02	1.95E-01	1.23E-04	7.44E-03	0.00E+00
ADULT	GROUND	9.95E-05	9.95E-05	9.95E-05	9.95E-05	9.95E-05	9.95E-05
ADULT	CLOUD	8.60E-09	8.60E-09	8.60E-09	8.60E-09	8.60E-09	8.60E-09
ADULT	VEG.ING	3.36E-04	5.48E-03	3.36E-04	1.88E-05	1.28E-03	3.36E-04
ADULT	MEAT ING	3.14E-05	5.09E-04	3.14E-05	3.35E-06	1.21E-04	3.14E-05
ADULT	MILK ING	9.00E-05	1.46E-03	9.00E-05	9.23E-07	3.34E-04	9.00E-05
ADULT	TOTALS	2.40E-03	3.91E-02	1.95E-01	2.46E-04	9.27E-03	5.57E-04

TIME STEP NUMBER 1, after 1 years DURATION IN YRS IS... 2.0

NUMBER 12 NAME=RUBY RANCH X= 11.3KM, Y= -5.8KM, Z= 1.0M, DIST= 12.7KM, IRTYPE=10

TOTAL ANNUAL DOSE COMMITMENTS COMPUTED FOR THIS LOCATION, MREM/YR

AGE	PATHWAY	WH.BODY	BONE	AVG.LUNG	LIVER	KIDNEY	BRONCHI
INFANT	INHAL	1.84E-03	3.15E-02	1.95E-01	1.23E-04	7.44E-03	0.00E+00
INFANT	GROUND	1.05E-04	1.05E-04	1.05E-04	1.05E-04	1.05E-04	1.05E-04
INFANT	CLOUD	8.60E-09	8.60E-09	8.60E-09	8.60E-09	8.60E-09	8.60E-09
INFANT	VEG.ING	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
INFANT	MEAT ING	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
INFANT	MILK ING	1.02E-03	1.34E-02	1.02E-03	5.85E-06	2.83E-03	1.02E-03
INFANT	TOTALS	2.97E-03	4.50E-02	1.96E-01	2.34E-04	1.04E-02	1.13E-03

AGE	PATHWAY	WH.BODY	BONE	AVG.LUNG	LIVER	KIDNEY	BRONCHI
CHILD	INHAL	1.84E-03	3.15E-02	1.95E-01	1.23E-04	7.44E-03	0.00E+00
CHILD	GROUND	1.05E-04	1.05E-04	1.05E-04	1.05E-04	1.05E-04	1.05E-04
CHILD	CLOUD	8.60E-09	8.60E-09	8.60E-09	8.60E-09	8.60E-09	8.60E-09
CHILD	VEG.ING	6.12E-04	1.00E-02	6.12E-04	2.23E-05	1.67E-03	6.12E-04
CHILD	MEAT ING	4.56E-05	7.42E-04	4.56E-05	3.32E-06	1.28E-04	4.56E-05
CHILD	MILK ING	6.02E-04	9.82E-03	6.02E-04	4.21E-06	1.60E-03	6.02E-04
CHILD	TOTALS	3.21E-03	5.22E-02	1.96E-01	2.58E-04	1.09E-02	1.36E-03

AGE	PATHWAY	WH.BODY	BONE	AVG.LUNG	LIVER	KIDNEY	BRONCHI
TEENAGER	INHAL	1.84E-03	3.15E-02	1.95E-01	1.23E-04	7.44E-03	0.00E+00
TEENAGER	GROUND	1.05E-04	1.05E-04	1.05E-04	1.05E-04	1.05E-04	1.05E-04
TEENAGER	CLOUD	8.60E-09	8.60E-09	8.60E-09	8.60E-09	8.60E-09	8.60E-09
TEENAGER	VEG.ING	3.43E-04	5.59E-03	3.43E-04	1.70E-05	1.32E-03	3.43E-04
TEENAGER	MEAT ING	2.52E-05	4.08E-04	2.52E-05	2.42E-06	9.88E-05	2.52E-05
TEENAGER	MILK ING	2.41E-04	3.90E-03	2.41E-04	2.22E-06	9.03E-04	2.41E-04
TEENAGER	TOTALS	2.56E-03	4.15E-02	1.95E-01	2.50E-04	9.87E-03	7.15E-04

AGE	PATHWAY	WH.BODY	BONE	AVG.LUNG	LIVER	KIDNEY	BRONCHI
ADULT	INHAL	1.84E-03	3.15E-02	1.95E-01	1.23E-04	7.44E-03	0.00E+00
ADULT	GROUND	1.05E-04	1.05E-04	1.05E-04	1.05E-04	1.05E-04	1.05E-04
ADULT	CLOUD	8.60E-09	8.60E-09	8.60E-09	8.60E-09	8.60E-09	8.60E-09
ADULT	VEG.ING	3.36E-04	5.48E-03	3.36E-04	1.88E-05	1.28E-03	3.36E-04
ADULT	MEAT ING	3.14E-05	5.09E-04	3.14E-05	3.35E-06	1.21E-04	3.14E-05
ADULT	MILK ING	9.00E-05	1.46E-03	9.00E-05	9.23E-07	3.34E-04	9.00E-05
ADULT	TOTALS	2.41E-03	3.91E-02	1.95E-01	2.51E-04	9.28E-03	5.62E-04

TIME STEP NUMBER 1, after 1 years DURATION IN YRS IS... 2.0

:MBER 13 NAME=JACK CHRISTENSEN X= -5.3KM, Y= -1.5KM, Z= 1.0M, DIST= 5.6KM, IRTYPE=10

40CFR190 ANNUAL DOSE COMMITMENTS COMPUTED FOR THIS LOCATION, MREM/YR

AGE	PATHWAY	WH.BODY	BONE	AVG.LUNG	LIVER	KIDNEY	BRONCHI
INFANT	INHAL	6.94E-03	1.19E-01	7.33E-01	4.63E-04	2.80E-02	0.00E+00
INFANT	GROUND	3.74E-04	3.74E-04	3.74E-04	3.74E-04	3.74E-04	3.74E-04
INFANT	CLOUD	3.24E-08	3.24E-08	3.24E-08	3.24E-08	3.24E-08	3.24E-08
INFANT	VEG.ING	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
INFANT	MEAT ING	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
INFANT	MILK ING	3.86E-03	5.04E-02	3.86E-03	2.20E-05	1.07E-02	3.86E-03
INFANT	TOTALS	1.12E-02	1.69E-01	7.37E-01	8.60E-04	3.90E-02	4.23E-03

AGE	PATHWAY	WH.BODY	BONE	AVG.LUNG	LIVER	KIDNEY	BRONCHI
CHILD	INHAL	6.94E-03	1.19E-01	7.33E-01	4.63E-04	2.80E-02	0.00E+00
CHILD	GROUND	3.74E-04	3.74E-04	3.74E-04	3.74E-04	3.74E-04	3.74E-04
CHILD	CLOUD	3.24E-08	3.24E-08	3.24E-08	3.24E-08	3.24E-08	3.24E-08
CHILD	VEG.ING	2.30E-03	3.77E-02	2.30E-03	8.41E-05	6.30E-03	2.30E-03
CHILD	MEAT ING	1.72E-04	2.79E-03	1.72E-04	1.25E-05	4.80E-04	1.72E-04
CHILD	MILK ING	2.27E-03	3.69E-02	2.27E-03	1.58E-05	6.03E-03	2.27E-03
CHILD	TOTALS	1.21E-02	1.96E-01	7.38E-01	9.50E-04	4.12E-02	5.11E-03

AGE	PATHWAY	WH.BODY	BONE	AVG.LUNG	LIVER	KIDNEY	BRONCHI
TEENAGER	INHAL	6.94E-03	1.19E-01	7.33E-01	4.63E-04	2.80E-02	0.00E+00
TEENAGER	GROUND	3.74E-04	3.74E-04	3.74E-04	3.74E-04	3.74E-04	3.74E-04
TEENAGER	CLOUD	3.24E-08	3.24E-08	3.24E-08	3.24E-08	3.24E-08	3.24E-08
TEENAGER	VEG.ING	1.29E-03	2.10E-02	1.29E-03	6.39E-05	4.98E-03	1.29E-03
TEENAGER	MEAT ING	9.49E-05	1.54E-03	9.49E-05	9.11E-06	3.72E-04	9.49E-05
TEENAGER	MILK ING	9.07E-04	1.47E-02	9.07E-04	8.35E-06	3.40E-03	9.07E-04
TEENAGER	TOTALS	9.60E-03	1.56E-01	7.36E-01	9.19E-04	3.71E-02	2.67E-03

AGE	PATHWAY	WH.BODY	BONE	AVG.LUNG	LIVER	KIDNEY	BRONCHI
ADULT	INHAL	6.94E-03	1.19E-01	7.33E-01	4.63E-04	2.80E-02	0.00E+00
ADULT	GROUND	3.74E-04	3.74E-04	3.74E-04	3.74E-04	3.74E-04	3.74E-04
ADULT	CLOUD	3.24E-08	3.24E-08	3.24E-08	3.24E-08	3.24E-08	3.24E-08
ADULT	VEG.ING	1.26E-03	2.06E-02	1.26E-03	7.07E-05	4.82E-03	1.26E-03
ADULT	MEAT ING	1.18E-04	1.91E-03	1.18E-04	1.26E-05	4.55E-04	1.18E-04
ADULT	MILK ING	3.39E-04	5.50E-03	3.39E-04	3.47E-06	1.26E-03	3.39E-04
ADULT	TOTALS	9.03E-03	1.47E-01	7.35E-01	9.24E-04	3.49E-02	2.10E-03

TIME STEP NUMBER 1, after 1 years DURATION IN YRS IS... 2.0

NUMBER 13 NAME=JACK CHRISTENSEN X= -5.3KM, Y= -1.5KM, Z= 1.0M, DIST= 5.6KM, IRTYPE=10

TOTAL ANNUAL DOSE COMMITMENTS COMPUTED FOR THIS LOCATION, MREM/YR

AGE	PATHWAY	WH.BODY	BONE	AVG.LUNG	LIVER	KIDNEY	BRONCHI
INFANT	INHAL	6.94E-03	1.19E-01	7.33E-01	4.63E-04	2.80E-02	0.00E+00
INFANT	GROUND	3.96E-04	3.96E-04	3.96E-04	3.96E-04	3.96E-04	3.96E-04
INFANT	CLOUD	3.24E-08	3.24E-08	3.24E-08	3.24E-08	3.24E-08	3.24E-08
INFANT	VEG.ING	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
INFANT	MEAT ING	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
INFANT	MILK ING	3.86E-03	5.04E-02	3.86E-03	2.20E-05	1.07E-02	3.86E-03
INFANT	TOTALS	1.12E-02	1.69E-01	7.37E-01	8.82E-04	3.91E-02	4.25E-03

AGE	PATHWAY	WH.BODY	BONE	AVG.LUNG	LIVER	KIDNEY	BRONCHI
CHILD	INHAL	6.94E-03	1.19E-01	7.33E-01	4.63E-04	2.80E-02	0.00E+00
CHILD	GROUND	3.96E-04	3.96E-04	3.96E-04	3.96E-04	3.96E-04	3.96E-04
CHILD	CLOUD	3.24E-08	3.24E-08	3.24E-08	3.24E-08	3.24E-08	3.24E-08
CHILD	VEG.ING	2.30E-03	3.77E-02	2.30E-03	8.41E-05	6.30E-03	2.30E-03
CHILD	MEAT ING	1.72E-04	2.79E-03	1.72E-04	1.25E-05	4.80E-04	1.72E-04
CHILD	MILK ING	2.27E-03	3.69E-02	2.27E-03	1.58E-05	6.03E-03	2.27E-03
CHILD	TOTALS	1.21E-02	1.96E-01	7.38E-01	9.72E-04	4.12E-02	5.14E-03

AGE	PATHWAY	WH.BODY	BONE	AVG.LUNG	LIVER	KIDNEY	BRONCHI
TEENAGER	INHAL	6.94E-03	1.19E-01	7.33E-01	4.63E-04	2.80E-02	0.00E+00
TEENAGER	GROUND	3.96E-04	3.96E-04	3.96E-04	3.96E-04	3.96E-04	3.96E-04
TEENAGER	CLOUD	3.24E-08	3.24E-08	3.24E-08	3.24E-08	3.24E-08	3.24E-08
TEENAGER	VEG.ING	1.29E-03	2.10E-02	1.29E-03	6.39E-05	4.98E-03	1.29E-03
TEENAGER	MEAT ING	9.49E-05	1.54E-03	9.49E-05	9.11E-06	3.72E-04	9.49E-05
TEENAGER	MILK ING	9.07E-04	1.47E-02	9.07E-04	8.35E-06	3.40E-03	9.07E-04
TEENAGER	TOTALS	9.63E-03	1.56E-01	7.36E-01	9.41E-04	3.72E-02	2.69E-03

AGE	PATHWAY	WH.BODY	BONE	AVG.LUNG	LIVER	KIDNEY	BRONCHI
ADULT	INHAL	6.94E-03	1.19E-01	7.33E-01	4.63E-04	2.80E-02	0.00E+00
ADULT	GROUND	3.96E-04	3.96E-04	3.96E-04	3.96E-04	3.96E-04	3.96E-04
ADULT	CLOUD	3.24E-08	3.24E-08	3.24E-08	3.24E-08	3.24E-08	3.24E-08
ADULT	VEG.ING	1.26E-03	2.06E-02	1.26E-03	7.07E-05	4.82E-03	1.26E-03
ADULT	MEAT ING	1.18E-04	1.91E-03	1.18E-04	1.26E-05	4.55E-04	1.18E-04
ADULT	MILK ING	3.39E-04	5.50E-03	3.39E-04	3.47E-06	1.26E-03	3.39E-04
ADULT	TOTALS	9.05E-03	1.47E-01	7.35E-01	9.46E-04	3.49E-02	2.12E-03

TIME STEP NUMBER 1, after 1 years DURATION IN YRS IS... 2.0

NUMBER 14 NAME=BUD CHRISTENSEN X= .2KM, Y= 10.1KM, Z= 1.0M, DIST= 10.1KM, IRTYPE=10

40CFR190 ANNUAL DOSE COMMITMENTS COMPUTED FOR THIS LOCATION, MREM/YR

AGE	PATHWAY	WH.BODY	BONE	AVG.LUNG	LIVER	KIDNEY	BRONCHI
INFANT	INHAL	1.99E-03	3.40E-02	2.10E-01	1.33E-04	8.02E-03	0.00E+00
INFANT	GROUND	1.07E-04	1.07E-04	1.07E-04	1.07E-04	1.07E-04	1.07E-04
INFANT	CLOUD	9.28E-09	9.28E-09	9.28E-09	9.28E-09	9.28E-09	9.28E-09
INFANT	VEG.ING	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
INFANT	MEAT ING	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
INFANT	MILK ING	1.10E-03	1.44E-02	1.10E-03	6.30E-06	3.05E-03	1.10E-03
INFANT	TOTALS	3.20E-03	4.85E-02	2.11E-01	2.46E-04	1.12E-02	1.21E-03

AGE	PATHWAY	WH.BODY	BONE	AVG.LUNG	LIVER	KIDNEY	BRONCHI
CHILD	INHAL	1.99E-03	3.40E-02	2.10E-01	1.33E-04	8.02E-03	0.00E+00
CHILD	GROUND	1.07E-04	1.07E-04	1.07E-04	1.07E-04	1.07E-04	1.07E-04
CHILD	CLOUD	9.28E-09	9.28E-09	9.28E-09	9.28E-09	9.28E-09	9.28E-09
CHILD	VEG.ING	6.60E-04	1.08E-02	6.60E-04	2.41E-05	1.81E-03	6.60E-04
CHILD	MEAT ING	4.92E-05	8.00E-04	4.92E-05	3.58E-06	1.38E-04	4.92E-05
CHILD	MILK ING	6.49E-04	1.06E-02	6.49E-04	4.54E-06	1.73E-03	6.49E-04
CHILD	TOTALS	3.45E-03	5.63E-02	2.11E-01	2.72E-04	1.18E-02	1.46E-03

AGE	PATHWAY	WH.BODY	BONE	AVG.LUNG	LIVER	KIDNEY	BRONCHI
TEENAGER	INHAL	1.99E-03	3.40E-02	2.10E-01	1.33E-04	8.02E-03	0.00E+00
TEENAGER	GROUND	1.07E-04	1.07E-04	1.07E-04	1.07E-04	1.07E-04	1.07E-04
TEENAGER	CLOUD	9.28E-09	9.28E-09	9.28E-09	9.28E-09	9.28E-09	9.28E-09
TEENAGER	VEG.ING	3.70E-04	6.02E-03	3.70E-04	1.83E-05	1.43E-03	3.70E-04
TEENAGER	MEAT ING	2.72E-05	4.40E-04	2.72E-05	2.61E-06	1.06E-04	2.72E-05
TEENAGER	MILK ING	2.60E-04	4.21E-03	2.60E-04	2.39E-06	9.73E-04	2.60E-04
TEENAGER	TOTALS	2.75E-03	4.48E-02	2.11E-01	2.63E-04	1.06E-02	7.64E-04

AGE	PATHWAY	WH.BODY	BONE	AVG.LUNG	LIVER	KIDNEY	BRONCHI
ADULT	INHAL	1.99E-03	3.40E-02	2.10E-01	1.33E-04	8.02E-03	0.00E+00
ADULT	GROUND	1.07E-04	1.07E-04	1.07E-04	1.07E-04	1.07E-04	1.07E-04
ADULT	CLOUD	9.28E-09	9.28E-09	9.28E-09	9.28E-09	9.28E-09	9.28E-09
ADULT	VEG.ING	3.62E-04	5.91E-03	3.62E-04	2.03E-05	1.38E-03	3.62E-04
ADULT	MEAT ING	3.38E-05	5.48E-04	3.38E-05	3.61E-06	1.30E-04	3.38E-05
ADULT	MILK ING	9.71E-05	1.57E-03	9.71E-05	9.95E-07	3.60E-04	9.71E-05
ADULT	TOTALS	2.59E-03	4.21E-02	2.10E-01	2.65E-04	1.00E-02	6.00E-04

TIME STEP NUMBER 1, after 1 years DURATION IN YRS IS... 2.0

NUMBER 14 NAME=BUD CHRISTENSEN X= .2KM, Y= 10.1KM, Z= 1.0M, DIST= 10.1KM, IRTYPE=10

TOTAL ANNUAL DOSE COMMITMENTS COMPUTED FOR THIS LOCATION, MREM/YR

AGE	PATHWAY	WH.BODY	BONE	AVG.LUNG	LIVER	KIDNEY	BRONCHI
INFANT	INHAL	1.99E-03	3.40E-02	2.10E-01	1.33E-04	8.02E-03	0.00E+00
INFANT	GROUND	1.14E-04	1.14E-04	1.14E-04	1.14E-04	1.14E-04	1.14E-04
INFANT	CLOUD	9.28E-09	9.28E-09	9.28E-09	9.28E-09	9.28E-09	9.28E-09
INFANT	VEG.ING	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
INFANT	MEAT ING	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
INFANT	MILK ING	1.10E-03	1.44E-02	1.10E-03	6.30E-06	3.05E-03	1.10E-03
INFANT	TOTALS	3.20E-03	4.85E-02	2.11E-01	2.52E-04	1.12E-02	1.22E-03

AGE	PATHWAY	WH.BODY	BONE	AVG.LUNG	LIVER	KIDNEY	BRONCHI
CHILD	INHAL	1.99E-03	3.40E-02	2.10E-01	1.33E-04	8.02E-03	0.00E+00
CHILD	GROUND	1.14E-04	1.14E-04	1.14E-04	1.14E-04	1.14E-04	1.14E-04
CHILD	CLOUD	9.28E-09	9.28E-09	9.28E-09	9.28E-09	9.28E-09	9.28E-09
CHILD	VEG.ING	6.60E-04	1.08E-02	6.60E-04	2.41E-05	1.81E-03	6.60E-04
CHILD	MEAT ING	4.92E-05	8.00E-04	4.92E-05	3.58E-06	1.38E-04	4.92E-05
CHILD	MILK ING	6.49E-04	1.06E-02	6.49E-04	4.54E-06	1.73E-03	6.49E-04
CHILD	TOTALS	3.46E-03	5.63E-02	2.11E-01	2.78E-04	1.18E-02	1.47E-03

AGE	PATHWAY	WH.BODY	BONE	AVG.LUNG	LIVER	KIDNEY	BRONCHI
TEENAGER	INHAL	1.99E-03	3.40E-02	2.10E-01	1.33E-04	8.02E-03	0.00E+00
TEENAGER	GROUND	1.14E-04	1.14E-04	1.14E-04	1.14E-04	1.14E-04	1.14E-04
TEENAGER	CLOUD	9.28E-09	9.28E-09	9.28E-09	9.28E-09	9.28E-09	9.28E-09
TEENAGER	VEG.ING	3.70E-04	6.02E-03	3.70E-04	1.83E-05	1.43E-03	3.70E-04
TEENAGER	MEAT ING	2.72E-05	4.40E-04	2.72E-05	2.61E-06	1.06E-04	2.72E-05
TEENAGER	MILK ING	2.60E-04	4.21E-03	2.60E-04	2.39E-06	9.73E-04	2.60E-04
TEENAGER	TOTALS	2.76E-03	4.48E-02	2.11E-01	2.69E-04	1.06E-02	7.70E-04

AGE	PATHWAY	WH.BODY	BONE	AVG.LUNG	LIVER	KIDNEY	BRONCHI
ADULT	INHAL	1.99E-03	3.40E-02	2.10E-01	1.33E-04	8.02E-03	0.00E+00
ADULT	GROUND	1.14E-04	1.14E-04	1.14E-04	1.14E-04	1.14E-04	1.14E-04
ADULT	CLOUD	9.28E-09	9.28E-09	9.28E-09	9.28E-09	9.28E-09	9.28E-09
ADULT	VEG.ING	3.62E-04	5.91E-03	3.62E-04	2.03E-05	1.38E-03	3.62E-04
ADULT	MEAT ING	3.38E-05	5.48E-04	3.38E-05	3.61E-06	1.30E-04	3.38E-05
ADULT	MILK ING	9.71E-05	1.57E-03	9.71E-05	9.95E-07	3.60E-04	9.71E-05
ADULT	TOTALS	2.59E-03	4.21E-02	2.10E-01	2.71E-04	1.00E-02	6.06E-04

ATTACHMENT C

10 CFR 20 RESULTS

NUMBER OF SOURCES= 4

	KM X	KM Y	M Z	KM2 AREA	CI/YEAR U-238	TH-230	RA-226	PB-210	RN-222	ID	PSIZE SET	M/SEC EXIT VEL	SOURCE NAME
1	.00	.00	22.70	.0000	1.21E-01	6.03E-04	1.21E-04	1.21E-04	0.00E+00	1101	1	1.00E+00	YELLOW CAKE DRYER
2	.00	.00	18.10	.0000	0.00E+00	0.00E+00	0.00E+00	0.00E+00	6.47E+02	1102	0	1.00E-02	SURGE TANK VENTS NOR
3	-11.58	-19.95	18.10	.0000	0.00E+00	0.00E+00	0.00E+00	0.00E+00	3.25E+02	1103	0	1.00E-02	SURGE TANK VENTS RUT
4	.00	.00	1.00	.0000	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.01E+01	1104	0	1.00E-02	POND LOCATION

INPUT TAILS ACTIVITIES, PCI/G

SET	URANIUM	THORIUM	RADIUM	LEAD
1	1.14E+01	2.71E+02	2.84E+02	2.84E+02
2	1.71E+01	4.07E+02	4.27E+02	4.27E+02
3	2.28E+01	5.43E+02	5.70E+02	5.70E+02

PARTICLE SIZES AND FRACTIONAL DISTRIBUTION

SET	1.0	1.0	5.0	35.0	PDEN
1	1.000	.000	.000	.000	8.900
2	.000	1.000	.000	.000	2.400
3	.000	.000	.300	.700	2.400

PARTICULATE SOURCE STRENGTH MULTIPLIERS BY TIME STEP, 1 TIME STEP(S) USED FOR THIS RUN

SOURCE NUMBER	TSTEP 1 1.00YRS	TSTEP 2 5.00YRS	TSTEP 3 5.00YRS	TSTEP 4 5.00YRS	TSTEP 5 5.00YRS	TSTEP 6 5.00YRS	TSTEP 7 5.00YRS	TSTEP 8 5.00YRS	TSTEP 9 5.00YRS	TSTEP10 5.00YRS
1	1.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00
2	1.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00
3	1.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00
4	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00

RADON SOURCE STRENGTH MULTIPLIERS BY TIME STEP, 1 TIME STEP(S) USED FOR THIS RUN

SOURCE	TSTEP 1 1.00YRS	TSTEP 2 5.00YRS	TSTEP 3 5.00YRS	TSTEP 4 5.00YRS	TSTEP 5 5.00YRS	TSTEP 6 5.00YRS	TSTEP 7 5.00YRS	TSTEP 8 5.00YRS	TSTEP 9 5.00YRS	TSTEP10 5.00YRS
1	1.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00
2	1.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00
3	1.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00
4	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00

JOINT FREQUENCY IN PERCENT, DIRECTION INDICATES WH ERE WIND IS FROM FREQWS= .12983, .25466, .19842, .21152, .12782, .07796

MPH	N	NNE	NE	ENE	E	ESE	SE	SSE	S	SSW	SW	WSW	W	WNW	NW	NNW	TOTALS
STABILITY CLASS 1																	
	.0000	.0000	.0000	.0000	.0000	.0000	.0000	.0000	.0000	.0000	.0000	.0000	.0000	.0000	.0000	.0000	.0000
5.5	.0000	.0000	.0000	.0000	.0220	.0650	.0000	.0220	.0870	.0220	.0000	.0000	.0000	.0440	.0000	.0220	.2840
10.0	.0000	.0000	.0220	.0000	.0000	.0000	.0000	.0220	.0000	.0000	.0220	.0000	.0650	.0000	.0000	.0000	.1310
15.5	.0000	.0000	.0000	.0000	.0000	.0000	.0000	.0000	.0000	.0000	.0000	.0000	.0000	.0000	.0000	.0000	.0000
21.5	.0000	.0000	.0000	.0000	.0000	.0000	.0000	.0000	.0000	.0000	.0000	.0000	.0000	.0000	.0000	.0000	.0000
28.0	.0000	.0000	.0000	.0000	.0000	.0000	.0000	.0000	.0000	.0000	.0000	.0000	.0000	.0000	.0000	.0000	.0000
ALL	.0000	.0000	.0220	.0000	.0220	.0650	.0000	.0440	.0870	.0220	.0220	.0000	.0650	.0440	.0000	.0220	.4150
STABILITY CLASS 2																	
1.5	.0000	.0000	.0220	.0220	.0220	.0000	.0000	.0000	.0000	.0000	.0000	.0220	.0000	.0000	.0000	.0000	.0880
5.5	.0000	.0870	.0220	.0220	.0000	.0650	.0440	.0650	.0000	.0220	.0440	.0000	.0440	.0440	.0000	.0220	.4810
10.0	.0000	.0000	.0440	.0000	.0440	.0000	.0440	.0000	.0220	.0000	.0000	.0440	.1090	.0650	.0650	.0000	.4370
15.5	.0000	.0000	.0000	.0000	.0220	.0000	.0220	.0000	.0000	.0000	.0000	.0000	.0000	.0000	.0220	.0000	.0660
21.5	.0000	.0000	.0000	.0000	.0000	.0000	.0000	.0000	.0000	.0000	.0000	.0000	.0000	.0000	.0000	.0000	.0000
28.0	.0000	.0000	.0000	.0000	.0000	.0000	.0000	.0000	.0000	.0000	.0000	.0000	.0000	.0000	.0000	.0000	.0000
ALL	.0000	.0870	.0880	.0440	.0880	.0650	.1100	.0650	.0220	.0220	.0440	.0660	.1530	.1090	.0870	.0220	1.0720
STABILITY CLASS 3																	
1.5	.0220	.0220	.0000	.0440	.0000	.0000	.0220	.0220	.0000	.0220	.0000	.0440	.0440	.0220	.0220	.0000	.2860
5.5	.0220	.0440	.0000	.0440	.0440	.0650	.1520	.0870	.0650	.0440	.0220	.0650	.0440	.0870	.0440	.0440	.8730
10.0	.0650	.0650	.0220	.0870	.0220	.0000	.0870	.0440	.0870	.0220	.0220	.1090	.1520	.1310	.1520	.0440	1.1110
15.5	.0000	.0000	.0220	.0220	.0220	.0220	.0000	.0220	.0000	.0220	.0000	.0440	.0440	.0440	.0000	.0000	.2640
21.5	.0000	.0000	.0000	.0000	.0000	.0000	.0000	.0000	.0000	.0000	.0000	.0000	.0000	.0000	.0000	.0000	.0000
28.0	.0000	.0000	.0000	.0000	.0000	.0000	.0000	.0000	.0000	.0000	.0000	.0000	.0000	.0000	.0000	.0000	.0000
ALL	.1090	.1310	.0440	.1970	.0880	.0870	.2610	.1750	.1520	.1100	.0440	.2620	.2840	.2840	.2180	.0880	2.5340
ITY CLASS 4																	
	0870	.0650	.1310	.1740	.3270	.5010	.3270	.1960	.2830	.1090	.1310	.1520	.2830	.4140	.2180	.0220	3.4200
5.5	.1520	.2180	.2830	.2180	.2610	.5660	.9580	.3270	.3270	.1960	.2400	.4790	.6530	.6320	.2830	.1960	5.9890
10.0	.3050	.4360	.2400	.2400	.0870	.3920	.8060	.5880	.4360	.4570	.7840	.7620	.5880	.7620	.8490	.6100	8.3420
15.5	.9150	1.2200	.4790	.3480	.5010	.9800	1.4160	.9580	.6320	2.8530	3.7460	1.6330	1.0240	.7190	1.0450	2.0250	20.4940
21.5	.5880	.3920	.0650	.0000	.0870	.4790	1.2630	.1740	.1740	2.3080	3.1140	.8060	.3480	.2830	.7190	1.9380	12.7380
28.0	.5660	.1310	.0870	.0000	.0650	.1520	.4790	.1520	.0650	1.4590	3.0490	.4360	.0440	.0220	.4790	.6100	7.7960
ALL	2.6130	2.4620	1.2850	.9800	1.3280	3.0700	5.2490	2.3950	1.9170	7.3820	11.0640	4.2680	2.9400	2.8320	3.5930	5.4010	58.7790
STABILITY CLASS 5																	
1.5	.0440	.1090	.1960	.2400	.5660	.4360	.4570	.1960	.1090	.2180	.2180	.1520	.4570	.1520	.1520	.1090	3.8110
5.5	.1960	.1960	.1310	.3920	.5440	1.5680	2.3080	.5010	.3920	.3270	.2180	.3270	.4790	.6970	.3920	.3050	8.9730
1.0	.3700	.3270	.2830	.1740	.3920	.7620	2.0910	.6320	.4140	.6750	.7400	.3480	.6530	.6750	.7190	.5660	9.8210
.5	.0220	.0220	.0000	.0000	.0220	.0220	.0000	.0000	.0000	.1090	.0650	.0000	.0220	.0000	.0440	.0000	.3280
.5	.0000	.0000	.0000	.0000	.0000	.0000	.0000	.0000	.0000	.0220	.0220	.0000	.0000	.0000	.0000	.0000	.0440
0	.0000	.0000	.0000	.0000	.0000	.0000	.0000	.0000	.0000	.0000	.0000	.0000	.0000	.0000	.0000	.0000	.0000
	.6320	.6540	.6100	.8060	1.5240	2.7880	4.8560	1.3290	.9150	1.3510	1.2630	:8270	1.6110	1.5240	1.3070	.9800	22.9770
ABILITY CLASS 6																	
	.1310	.0870	.2830	.4140	.4570	.7840	.6750	.4570	.2610	.1740	.3050	.3480	.5230	.1520	.1960	.1310	5.3780
	.1310	.0870	.2180	.2180	.5230	1.5030	2.4610	.8710	.4140	.2400	.1960	.2400	.6100	.4570	.5660	.1310	8.8660
	.0000	.0000	.0000	.0000	.0000	.0000	.0000	.0000	.0000	.0000	.0000	.0000	.0000	.0000	.0000	.0000	.0000
	.0000	.0000	.0000	.0000	.0000	.0000	.0000	.0000	.0000	.0000	.0000	.0000	.0000	.0000	.0000	.0000	.0000
	.0000	.0000	.0000	.0000	.0000	.0000	.0000	.0000	.0000	.0000	.0000	.0000	.0000	.0000	.0000	.0000	.0000
	.0000	.0000	.0000	.0000	.0000	.0000	.0000	.0000	.0000	.0000	.0000	.0000	.0000	.0000	.0000	.0000	.0000
		1740	.5010	.6320	.9800	2.2870	3.1360	1.3280	.6750	.4140	.5010	.5880	1.1330	.6090	.7620	.2620	14.2440
	.6160	3.5080	2.5500	2.6590	4.0300	8.3620	13.6120	5.3360	3.7680	9.3010	12.9380	6.0110	6.1860	5.4020	5.9670	6.7750	100.0210

INDIVIDUAL RECEPTOR LOCATION DATA 14 LOCATIONS INPUT THIS RUN

I	LOCATION NAMES	X(KM)	Y(KM)	Z(M)	DIST(KM)	TYPE	I	LOCATION NAMES	X(KM)	Y(KM)	Z(M)	DIST(KM)	TYPE
1	NORTH 100 METERS	.00	.10	1.00	.10	0	8	L. GILBERTS RANCH	9.60	2.41	1.00	9.90	0
2	EAST 150 METERS	.10	.00	1.00	.10	0	9	EARL CAMBLIN RANCH	10.51	-2.35	1.00	10.77	0
3	WEST 150 METERS	-.10	.00	1.00	.10	0	10	JOHN GROVES	9.45	6.70	1.00	11.58	0
4	SOUTH 100 METERS	.00	-.10	1.00	.10	0	11	TOWN OF SAVAGETOWN	11.12	8.84	1.00	14.21	0
5	PFISTER RANCH	.70	-1.78	1.00	1.91	0	12	RUBY RANCH	11.34	-5.79	1.00	12.73	0
6	PUMPKIN BUTTE RANCH	3.93	-5.64	1.00	6.87	0	13	JACK CHRISTENSEN	-5.35	-1.52	1.00	5.56	0
7	W. SCHLAUTMANN RANCH	5.84	4.14	1.00	7.16	0	14	BUD CHRISTENSEN	.15	10.06	1.00	10.06	0

MISCELLANEOUS INPUTTABLE PARAMETER VALUES

DM	TSTART	FFORI	FHAYI	FFORP	FHAYP	FPR(1)	FPR(2)	FPR(3)	ACTRAT
1000.00	1988.00	.33	.66	.33	.66	320.00	1400.00	230.00	2.50

IPACT EQUALS 0, 1, 1, 2,

JC EQUALS 0, 0, 0, 1, 0, 0, 0, 0, 1, 0

TIME STEP DATA....	STEP NAMES	LENGTH, YRS	IFTODO
1	after 1 years	2.00	1

XRHO EQUALS 1.5, 2.5, 3.5, 4.5, 7.5, 15.0, 25.0, 35.0, 45.0, 55.0, 65.0, 75.0,

POPULATION DISTRIBUTION

:TERS,	N .0	NNE 22.5	NE 45.0	ENE 67.5	E 90.0	ESE 112.5	SE 135.0	SSE 157.5	S 180.0	SSW 202.5	SW 225.0	WSW 247.5	W 270.0	WNW 292.5	NW 315.0	NNW 337.5
1.0- 2.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2.0- 3.0	0	0	0	0	0	0	4	0	0	0	0	0	0	0	0	0
3.0- 4.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
4.0- 5.0	0	0	0	0	0	0	0	0	0	0	0	0	6	0	0	0
5.0-10.0	0	0	4	8	2	6	3	0	0	0	0	0	6	0	0	2
10.0-20.0	3	10	2	5	6	5	4	0	0	7	0	0	0	6	4	2
20.0-30.0	3	60	2	5	6	10	8	2	0	4	0	300	10	0	0	2
30.0-40.0	5	5	5	1700	5	10	4	5	2	0	4	8	30	10	4	2
40.0-50.0	10	5	10	4	2	8	4	5	2	8	1200	4	15	2	0	0
50.0-60.0	5	20	10	0	0	5	4	6	2	2	0	2	310	10	2	6
60.0-70.0	5	700	10	2	4	5	10	4	4	50	4	5	35	15	4	0
.0	3	12234	15	3	12	10	10	50	90	40	12	8	15	35	12	4
1.0-80.0	34	13034	58	1727	37	59	51	72	100	111	1220	327	427	78	26	18

TOTAL 1-80 KM POPULATION IS 17379 PERSONS

TIME STEP NUMBER 1, after 1 years DURATION IN YRS IS... 2.0

EXPOSURE PATHWAY IS INHAL EXPOSED ORGAN IS WH.BODY

DOSES SHOWN BELOW ARE ANNUAL POPULATION DOSE COMMITMENTS, PERSON-REM PER YEAR

DIRECTION	XRHO 1.5	XRHO 2.5	XRHO 3.5	XRHO 4.5	XRHO 7.5	XRHO 15.0	XRHO 25.0	XRHO 35.0	XRHO 45.0	XRHO 55.0	XRHO 65.0	XRHO 75.0
N	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	3.059E-06	1.234E-06	1.194E-06	1.668E-06	6.507E-07	5.455E-07	2.875E-07
NNE	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	1.489E-05	3.825E-05	1.876E-06	1.289E-06	3.894E-06	1.096E-04	1.611E-03
NE	0.000E+00	0.000E+00	0.000E+00	0.000E+00	2.443E-05	3.645E-06	1.585E-06	2.374E-06	3.317E-06	2.539E-06	2.064E-06	2.625E-06
ENE	0.000E+00	0.000E+00	0.000E+00	0.000E+00	3.426E-05	5.902E-06	2.495E-06	5.150E-04	8.704E-07	0.000E+00	2.906E-07	3.829E-07
E	0.000E+00	0.000E+00	0.000E+00	0.000E+00	1.249E-05	9.669E-06	3.890E-06	1.932E-06	5.597E-07	0.000E+00	7.915E-07	2.147E-06
ESE	0.000E+00	0.000E+00	0.000E+00	0.000E+00	3.020E-05	7.242E-06	5.909E-06	3.451E-06	1.930E-06	9.325E-07	7.537E-07	1.276E-06
SE	0.000E+00	1.264E-04	0.000E+00	0.000E+00	1.431E-05	5.512E-06	4.660E-06	1.347E-06	8.923E-07	6.475E-07	1.301E-06	1.109E-06
SSE	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	9.962E-07	1.423E-06	9.842E-07	8.922E-07	4.773E-07	4.977E-06
S	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	3.496E-07	2.353E-07	1.794E-07	2.924E-07	5.600E-06
SSW	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	4.754E-06	1.128E-06	0.000E+00	9.274E-07	1.764E-07	3.574E-06	2.422E-06
SW	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	7.391E-07	1.671E-04	0.000E+00	4.066E-07	1.109E-06
WSW	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	1.063E-04	1.936E-06	7.332E-07	3.057E-07	6.824E-07	1.004E-06
W	0.000E+00	0.000E+00	0.000E+00	8.492E-05	3.036E-05	0.000E+00	5.106E-06	1.003E-05	3.903E-06	6.855E-05	6.944E-06	2.736E-06
WNW	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	1.588E-05	0.000E+00	5.937E-06	8.429E-07	3.382E-06	4.347E-06	9.123E-06
NW	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	1.660E-05	0.000E+00	3.504E-06	0.000E+00	8.407E-07	1.361E-06	3.503E-06
NNW	0.000E+00	0.000E+00	0.000E+00	0.000E+00	1.121E-05	2.986E-06	1.181E-06	6.772E-07	0.000E+00	1.124E-06	0.000E+00	5.680E-07

TOTAL DOSE COMMITMENT IS 3.236E-03 PERSON-REM/YR

TIME STEP NUMBER 1, after 1 years DURATION IN YRS IS... 2.0

EXPOSURE PATHWAY IS INHAL EXPOSED ORGAN IS BONE

DOSES SHOWN BELOW ARE ANNUAL POPULATION DOSE COMMITMENTS, PERSON-REM PER YEAR

DIRECTION	XRHO 1.5	XRHO 2.5	XRHO 3.5	XRHO 4.5	XRHO 7.5	XRHO 15.0	XRHO 25.0	XRHO 35.0	XRHO 45.0	XRHO 55.0	XRHO 65.0	XRHO 75.0
N	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	5.519E-05	2.399E-05	2.522E-05	3.797E-05	1.578E-05	1.391E-05	7.618E-06
NNE	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	2.632E-04	7.048E-04	3.625E-05	2.616E-05	8.276E-05	2.431E-03	3.712E-02
NE	0.000E+00	0.000E+00	0.000E+00	0.000E+00	4.220E-04	6.454E-05	2.933E-05	4.613E-05	6.767E-05	5.421E-05	4.593E-05	6.061E-05
ENE	0.000E+00	0.000E+00	0.000E+00	0.000E+00	5.944E-04	1.068E-04	4.853E-05	1.079E-02	1.948E-05	0.000E+00	7.200E-06	9.839E-06
E	0.000E+00	0.000E+00	0.000E+00	0.000E+00	2.169E-04	1.762E-04	7.742E-05	4.202E-05	1.318E-05	0.000E+00	2.082E-05	5.851E-05
ESE	0.000E+00	0.000E+00	0.000E+00	0.000E+00	5.222E-04	1.289E-04	1.118E-04	7.080E-05	4.282E-05	2.207E-05	1.867E-05	3.281E-05
SE	0.000E+00	2.165E-03	0.000E+00	0.000E+00	2.475E-04	9.823E-05	8.967E-05	2.769E-05	1.927E-05	1.457E-05	3.071E-05	2.735E-05
SSE	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	1.885E-05	2.757E-05	2.006E-05	1.905E-05	1.063E-05	1.148E-04
S	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	7.092E-06	4.973E-06	3.994E-06	6.820E-06	1.359E-04
SSW	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	8.560E-05	2.095E-05	0.000E+00	1.925E-05	3.850E-06	8.159E-05	5.750E-05
SW	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	1.738E-05	4.204E-03	0.000E+00	1.114E-05	3.119E-05
WSW	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	2.382E-03	4.826E-05	1.938E-05	8.426E-06	1.939E-05	2.913E-05
W	0.000E+00	0.000E+00	0.000E+00	1.460E-03	5.288E-04	0.000E+00	1.089E-04	2.420E-04	1.020E-04	1.886E-03	1.976E-04	7.963E-05
WNW	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	2.856E-04	0.000E+00	1.285E-04	2.003E-05	8.640E-05	1.169E-04	2.544E-04
NW	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	2.926E-04	0.000E+00	6.955E-05	0.000E+00	1.926E-05	3.320E-05	8.992E-05
NNW	0.000E+00	0.000E+00	0.000E+00	0.000E+00	1.941E-04	5.375E-05	2.294E-05	1.433E-05	0.000E+00	2.767E-05	0.000E+00	1.531E-05

TOTAL DOSE COMMITMENT IS 7.122E-02 PERSON-REM/YR

TIME STEP NUMBER 1, after 1 years DURATION IN YRS IS... 2.0

EXPOSURE PATHWAY IS INHAL EXPOSED ORGAN IS AVG.LUNG

DOSES SHOWN BELOW ARE ANNUAL POPULATION DOSE COMMITMENTS, PERSON-REM PER YEAR

DIRECTION	XRHO 1.5	XRHO 2.5	XRHO 3.5	XRHO 4.5	XRHO 7.5	XRHO 15.0	XRHO 25.0	XRHO 35.0	XRHO 45.0	XRHO 55.0	XRHO 65.0	XRHO 75.0
N	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	3.034E-04	1.102E-04	9.295E-05	1.106E-04	3.643E-05	2.584E-05	1.161E-05
NNE	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	1.515E-03	3.690E-03	1.692E-04	1.077E-04	2.992E-04	7.719E-03	1.037E-01
NE	0.000E+00	0.000E+00	0.000E+00	0.000E+00	2.553E-03	3.699E-04	1.521E-04	2.125E-04	2.746E-04	1.933E-04	1.442E-04	1.681E-04
ENE	0.000E+00	0.000E+00	0.000E+00	0.000E+00	3.561E-03	5.831E-04	2.230E-04	4.068E-02	6.003E-05	0.000E+00	1.522E-05	1.761E-05
E	0.000E+00	0.000E+00	0.000E+00	0.000E+00	1.297E-03	9.466E-04	3.354E-04	1.417E-04	3.412E-05	0.000E+00	3.301E-05	7.552E-05
ESE	0.000E+00	0.000E+00	0.000E+00	0.000E+00	3.152E-03	7.306E-04	5.499E-04	2.827E-04	1.357E-04	5.604E-05	3.952E-05	5.858E-05
SE	0.000E+00	1.334E-02	0.000E+00	0.000E+00	1.493E-03	5.551E-04	4.231E-04	1.100E-04	6.645E-05	4.413E-05	7.868E-05	5.902E-05
SSE	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	9.267E-05	1.279E-04	8.156E-05	6.795E-05	3.333E-05	3.195E-04
S	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	2.921E-05	1.828E-05	1.253E-05	1.827E-05	3.131E-04
SSW	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	4.725E-04	1.078E-04	0.000E+00	7.449E-05	1.285E-05	2.355E-04	1.441E-04
SW	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	4.516E-05	8.302E-03	0.000E+00	1.386E-05	3.222E-05
WSW	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	7.324E-03	9.924E-05	2.994E-05	1.009E-05	1.847E-05	2.294E-05
W	0.000E+00	0.000E+00	0.000E+00	8.919E-03	3.143E-03	0.000E+00	3.900E-04	5.697E-04	1.673E-04	2.286E-03	1.859E-04	6.101E-05
WNW	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	1.582E-03	0.000E+00	4.403E-04	5.008E-05	1.589E-04	1.640E-04	2.807E-04
NW	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	1.695E-03	0.000E+00	3.035E-04	0.000E+00	5.492E-05	7.483E-05	1.617E-04
NNW	0.000E+00	0.000E+00	0.000E+00	0.000E+00	1.168E-03	2.968E-04	1.057E-04	5.244E-05	0.000E+00	6.012E-05	0.000E+00	2.113E-05

TOTAL DOSE COMMITMENT IS 2.316E-01 PERSON-REM/YR

TIME STEP NUMBER 1, after 1 years DURATION IN YRS IS... 2.0

EXPOSURE PATHWAY IS INHAL EXPOSED ORGAN IS BRONCHI

DOSES SHOWN BELOW ARE ANNUAL POPULATION DOSE COMMITMENTS, PERSON-REM PER YEAR

DIRECTION	XRHO 1.5	XRHO 2.5	XRHO 3.5	XRHO 4.5	XRHO 7.5	XRHO 15.0	XRHO 25.0	XRHO 35.0	XRHO 45.0	XRHO 55.0	XRHO 65.0	XRHO 75.0
N	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	1.219E-03	6.857E-04	7.856E-04	1.184E-03	4.707E-04	3.875E-04	1.963E-04
NNE	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	4.114E-03	1.359E-02	7.687E-04	5.748E-04	1.818E-03	5.219E-02	7.683E-01
NE	0.000E+00	0.000E+00	0.000E+00	0.000E+00	4.868E-03	1.027E-03	5.625E-04	9.515E-04	1.419E-03	1.120E-03	9.164E-04	1.155E-03
ENE	0.000E+00	0.000E+00	0.000E+00	0.000E+00	8.475E-03	2.321E-03	1.295E-03	3.018E-01	5.331E-04	0.000E+00	1.729E-04	2.179E-04
E	0.000E+00	0.000E+00	0.000E+00	0.000E+00	3.387E-03	4.409E-03	2.437E-03	1.373E-03	4.169E-04	0.000E+00	5.609E-04	1.431E-03
ESE	0.000E+00	0.000E+00	0.000E+00	0.000E+00	6.479E-03	2.377E-03	2.792E-03	2.076E-03	1.304E-03	6.555E-04	5.305E-04	8.811E-04
SE	0.000E+00	1.758E-02	0.000E+00	0.000E+00	3.176E-03	1.935E-03	2.653E-03	9.092E-04	6.321E-04	4.603E-04	9.316E-04	7.884E-04
SSE	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	6.152E-04	8.520E-04	6.277E-04	5.658E-04	2.993E-04	3.037E-03
S	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	3.740E-04	2.027E-04	1.444E-04	2.220E-04	4.008E-03
SSW	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	4.435E-03	4.482E-03	0.000E+00	7.600E-04	1.310E-04	2.484E-03	1.590E-03
SW	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	1.320E-03	2.211E-01	0.000E+00	3.844E-04	9.175E-04
WSW	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	2.359E-01	3.506E-03	1.020E-03	3.421E-04	6.620E-04	8.511E-04
W	0.000E+00	0.000E+00	0.000E+00	1.782E-02	9.371E-03	0.000E+00	5.787E-03	1.400E-02	5.054E-03	7.743E-02	6.935E-03	2.424E-03
WNW	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	6.691E-03	0.000E+00	4.993E-03	8.084E-04	3.349E-03	4.155E-03	8.166E-03
NW	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	5.236E-03	0.000E+00	2.054E-03	0.000E+00	6.279E-04	1.068E-03	2.774E-03
NNW	0.000E+00	0.000E+00	0.000E+00	0.000E+00	2.801E-03	1.224E-03	6.820E-04	4.679E-04	0.000E+00	8.739E-04	0.000E+00	4.139E-04

TOTAL DOSE COMMITMENT IS 1.909E+00 PERSON-REM/YR

TIME STEP NUMBER 1, after 1 years DURATION IN YRS IS... 2.0

EXPOSURE PATHWAY IS GROUND EXPOSED ORGAN IS WH.BODY

DOSES SHOWN BELOW ARE ANNUAL POPULATION DOSE COMMITMENTS, PERSON-REM PER YEAR

DIRECTION	XRHO 1.5	XRHO 2.5	XRHO 3.5	XRHO 4.5	XRHO 7.5	XRHO 15.0	XRHO 25.0	XRHO 35.0	XRHO 45.0	XRHO 55.0	XRHO 65.0	XRHO 75.0
N	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	5.646E-07	2.651E-07	2.769E-07	3.960E-07	1.529E-07	1.240E-07	6.249E-08
NNE	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	2.356E-06	6.628E-06	3.419E-07	2.409E-07	7.322E-07	2.046E-05	2.958E-04
NE	0.000E+00	0.000E+00	0.000E+00	0.000E+00	3.463E-06	5.805E-07	2.741E-07	4.270E-07	6.050E-07	4.616E-07	3.696E-07	4.596E-07
ENE	0.000E+00	0.000E+00	0.000E+00	0.000E+00	5.230E-06	1.081E-06	5.154E-07	1.113E-04	1.887E-07	0.000E+00	5.926E-08	7.452E-08
E	0.000E+00	0.000E+00	0.000E+00	0.000E+00	1.975E-06	1.904E-06	8.918E-07	4.663E-07	1.357E-07	0.000E+00	1.772E-07	4.528E-07
ESE	0.000E+00	0.000E+00	0.000E+00	0.000E+00	4.397E-06	1.228E-06	1.170E-06	7.636E-07	4.474E-07	2.168E-07	1.723E-07	2.834E-07
SE	0.000E+00	1.612E-05	0.000E+00	0.000E+00	2.106E-06	9.624E-07	1.019E-06	3.202E-07	2.155E-07	1.545E-07	3.067E-07	2.558E-07
SSE	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	2.300E-07	3.200E-07	2.263E-07	2.013E-07	1.053E-07	1.064E-06
S	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	1.147E-07	6.539E-08	4.680E-08	7.210E-08	1.306E-06
SSW	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	1.447E-06	1.079E-06	0.000E+00	2.502E-07	4.382E-08	8.358E-07	5.368E-07
SW	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	3.537E-07	6.140E-05	0.000E+00	1.112E-07	2.706E-07
WSW	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	6.174E-05	9.270E-07	2.772E-07	9.545E-08	1.879E-07	2.463E-07
W	0.000E+00	0.000E+00	0.000E+00	1.230E-05	5.054E-06	0.000E+00	1.730E-06	3.889E-06	1.395E-06	2.158E-05	1.956E-06	6.941E-07
WNW	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	3.016E-06	0.000E+00	1.611E-06	2.446E-07	9.827E-07	1.208E-06	2.375E-06
NW	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	2.777E-06	0.000E+00	7.721E-07	0.000E+00	2.062E-07	3.380E-07	8.589E-07
NNW	0.000E+00	0.000E+00	0.000E+00	0.000E+00	1.720E-06	5.591E-07	2.597E-07	1.619E-07	0.000E+00	2.764E-07	0.000E+00	1.284E-07

TOTAL DOSE COMMITMENT IS 6.893E-04 PERSON-REM/YR

TIME STEP NUMBER 1, after 1 years DURATION IN YRS IS... 2.0

EXPOSURE PATHWAY IS CLOUD EXPOSED ORGAN IS WH.BODY

DOSES SHOWN BELOW ARE ANNUAL POPULATION DOSE COMMITMENTS, PERSON-REM PER YEAR

DIRECTION	XRHO 1.5	XRHO 2.5	XRHO 3.5	XRHO 4.5	XRHO 7.5	XRHO 15.0	XRHO 25.0	XRHO 35.0	XRHO 45.0	XRHO 55.0	XRHO 65.0	XRHO 75.0
N	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	1.902E-05	1.159E-05	1.363E-05	2.075E-05	8.286E-06	6.837E-06	3.466E-06
NNE	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	5.557E-05	2.103E-04	1.263E-05	9.741E-06	3.134E-05	9.085E-04	1.345E-02
NE	0.000E+00	0.000E+00	0.000E+00	0.000E+00	5.194E-05	1.376E-05	8.595E-06	1.548E-05	2.387E-05	1.920E-05	1.589E-05	2.017E-05
ENE	0.000E+00	0.000E+00	0.000E+00	0.000E+00	1.082E-04	3.536E-05	2.143E-05	5.161E-03	9.255E-06	0.000E+00	3.038E-06	3.839E-06
E	0.000E+00	0.000E+00	0.000E+00	0.000E+00	4.623E-05	7.018E-05	4.146E-05	2.390E-05	7.317E-06	0.000E+00	9.900E-06	2.529E-05
ESE	0.000E+00	0.000E+00	0.000E+00	0.000E+00	7.618E-05	3.578E-05	4.682E-05	3.597E-05	2.286E-05	1.154E-05	9.362E-06	1.557E-05
SE	0.000E+00	9.103E-05	0.000E+00	0.000E+00	3.638E-05	2.861E-05	4.411E-05	1.561E-05	1.100E-05	8.066E-06	1.639E-05	1.390E-05
SSE	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	9.790E-06	1.406E-05	1.066E-05	9.765E-06	5.213E-06	5.316E-05
S	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	5.783E-06	3.286E-06	2.436E-06	3.825E-06	6.980E-05
SSW	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	5.138E-05	3.154E-05	0.000E+00	1.232E-05	2.225E-06	4.303E-05	2.780E-05
SW	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	2.208E-05	3.833E-03	0.000E+00	6.771E-06	1.619E-05
WSW	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	3.698E-03	5.986E-05	1.783E-05	6.025E-06	1.169E-05	1.504E-05
W	0.000E+00	0.000E+00	0.000E+00	2.126E-04	1.361E-04	0.000E+00	9.830E-05	2.426E-04	8.861E-05	1.365E-03	1.224E-04	4.283E-05
WNW	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	1.062E-04	0.000E+00	8.714E-05	1.421E-05	5.903E-05	7.335E-05	1.443E-04
NW	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	7.827E-05	0.000E+00	3.561E-05	0.000E+00	1.105E-05	1.885E-05	4.899E-05
NNW	0.000E+00	0.000E+00	0.000E+00	0.000E+00	3.578E-05	1.911E-05	1.158E-05	8.146E-06	0.000E+00	1.540E-05	0.000E+00	7.313E-06

TOTAL DOSE COMMITMENT IS 3.214E-02 PERSON-REM/YR

TIME STEP NUMBER 1, after 1 years DURATION IN YRS IS... 2.0

EXPOSURE PATHWAY IS VEG.ING EXPOSED ORGAN IS WH.BODY

DOSES SHOWN BELOW ARE ANNUAL POPULATION DOSE COMMITMENTS, PERSON-REM PER YEAR

DIRECTION	XRHO 1.5	XRHO 2.5	XRHO 3.5	XRHO 4.5	XRHO 7.5	XRHO 15.0	XRHO 25.0	XRHO 35.0	XRHO 45.0	XRHO 55.0	XRHO 65.0	XRHO 75.0
N	8.793E-05	7.114E-05	5.669E-05	4.663E-05	1.524E-04	1.811E-04	1.437E-04	1.378E-04	1.425E-04	1.520E-04	1.639E-04	1.770E-04
NNE	1.096E-04	8.520E-05	6.845E-05	5.736E-05	1.983E-04	2.521E-04	1.981E-04	1.809E-04	1.768E-04	1.788E-04	1.842E-04	1.916E-04
NE	1.373E-04	1.076E-04	8.612E-05	7.176E-05	2.447E-04	3.099E-04	2.486E-04	2.317E-04	2.299E-04	2.353E-04	2.444E-04	2.556E-04
ENE	1.032E-04	8.246E-05	6.526E-05	5.343E-05	1.735E-04	2.111E-04	1.743E-04	1.720E-04	1.802E-04	1.930E-04	2.080E-04	2.241E-04
E	1.569E-04	1.258E-04	9.883E-05	8.021E-05	2.536E-04	2.929E-04	2.376E-04	2.359E-04	2.538E-04	2.818E-04	3.131E-04	3.457E-04
ESE	1.144E-04	8.868E-05	7.097E-05	5.923E-05	2.022E-04	2.492E-04	1.946E-04	1.882E-04	1.966E-04	2.087E-04	2.157E-04	2.242E-04
SE	1.027E-04	8.268E-05	6.689E-05	5.604E-05	1.917E-04	2.379E-04	1.990E-04	1.844E-04	1.728E-04	1.655E-04	1.713E-04	1.817E-04
SSE	7.650E-05	6.000E-05	4.854E-05	4.093E-05	1.440E-04	1.908E-04	1.641E-04	1.380E-04	1.363E-04	1.378E-04	1.414E-04	1.452E-04
S	5.077E-05	4.055E-05	3.261E-05	2.722E-05	9.335E-05	1.224E-04	9.903E-05	9.318E-05	8.745E-05	8.991E-05	9.422E-05	9.916E-05
SSW	5.222E-05	4.011E-05	3.199E-05	2.668E-05	9.183E-05	1.201E-04	8.914E-05	8.354E-05	8.315E-05	8.519E-05	8.866E-05	9.292E-05
SW	6.798E-05	5.494E-05	4.288E-05	3.449E-05	1.065E-04	1.245E-04	1.369E-04	1.301E-04	1.416E-04	1.562E-04	1.718E-04	1.877E-04
WSW	8.709E-05	7.051E-05	5.459E-05	4.347E-05	1.307E-04	1.512E-04	1.634E-04	1.884E-04	2.023E-04	2.206E-04	2.442E-04	2.676E-04
W	1.366E-04	1.081E-04	8.388E-05	6.730E-05	2.068E-04	2.343E-04	2.145E-04	2.462E-04	2.820E-04	3.181E-04	3.558E-04	3.907E-04
WNW	2.303E-04	1.918E-04	1.535E-04	1.261E-04	4.072E-04	4.667E-04	3.633E-04	3.589E-04	3.885E-04	4.314E-04	4.749E-04	5.223E-04
NW	2.981E-04	2.505E-04	2.050E-04	1.723E-04	5.871E-04	6.978E-04	5.083E-04	4.467E-04	4.332E-04	4.439E-04	4.744E-04	5.117E-04
NNW	1.242E-04	1.048E-04	8.434E-05	6.952E-05	2.260E-04	2.639E-04	2.059E-04	1.963E-04	2.066E-04	2.244E-04	2.461E-04	2.696E-04

TOTAL DOSE COMMITMENT IS 3.457E-02 PERSON-REM/YR

WARNING--POPULATION FOOD INGESTION DOSES SHOWN ABOVE HAVE NOT BEEN CORRECTED TO REFLECT POTENTIAL FOOD EXPORT AND MAY EXCEED DOSES ACTUALLY RECEIVED BY THE POPULATION OF THIS REGION. SEE SUMMARY TABLE FOR THIS INFORMATION.

TIME STEP NUMBER 1, after 1 years DURATION IN YRS IS... 2.0

EXPOSURE PATHWAY IS VEG.ING EXPOSED ORGAN IS BONE

DOSES SHOWN BELOW ARE ANNUAL POPULATION DOSE COMMITMENTS, PERSON-REM PER YEAR

DIRECTION	XRHO 1.5	XRHO 2.5	XRHO 3.5	XRHO 4.5	XRHO 7.5	XRHO 15.0	XRHO 25.0	XRHO 35.0	XRHO 45.0	XRHO 55.0	XRHO 65.0	XRHO 75.0
N	1.436E-03	1.163E-03	9.286E-04	7.658E-04	2.534E-03	3.157E-03	2.685E-03	2.722E-03	2.926E-03	3.203E-03	3.515E-03	3.843E-03
NNE	1.789E-03	1.392E-03	1.120E-03	9.405E-04	3.278E-03	4.292E-03	3.531E-03	3.364E-03	3.407E-03	3.546E-03	3.737E-03	3.955E-03
NE	2.242E-03	1.758E-03	1.409E-03	1.177E-03	4.046E-03	5.290E-03	4.450E-03	4.326E-03	4.447E-03	4.677E-03	4.965E-03	5.282E-03
ENE	1.685E-03	1.348E-03	1.069E-03	8.777E-04	2.888E-03	3.693E-03	3.258E-03	3.382E-03	3.672E-03	4.029E-03	4.418E-03	4.819E-03
E	2.562E-03	2.056E-03	1.619E-03	1.318E-03	4.225E-03	5.161E-03	4.519E-03	4.739E-03	5.287E-03	6.012E-03	6.783E-03	7.565E-03
ESE	1.868E-03	1.449E-03	1.162E-03	9.718E-04	3.349E-03	4.277E-03	3.555E-03	3.654E-03	3.989E-03	4.356E-03	4.580E-03	4.823E-03
SE	1.677E-03	1.351E-03	1.095E-03	9.195E-04	3.177E-03	4.091E-03	3.688E-03	3.585E-03	3.457E-03	3.379E-03	3.573E-03	3.853E-03
SSE	1.249E-03	9.808E-04	7.949E-04	6.717E-04	2.385E-03	3.275E-03	2.999E-03	2.572E-03	2.635E-03	2.739E-03	2.872E-03	2.999E-03
S	8.294E-04	6.633E-04	5.347E-04	4.478E-04	1.557E-03	2.141E-03	1.826E-03	1.796E-03	1.729E-03	1.827E-03	1.955E-03	2.091E-03
SSW	8.530E-04	6.561E-04	5.244E-04	4.387E-04	1.529E-03	2.090E-03	1.600E-03	1.574E-03	1.626E-03	1.714E-03	1.823E-03	1.943E-03
SW	1.110E-03	8.987E-04	7.034E-04	5.678E-04	1.785E-03	2.242E-03	2.765E-03	2.709E-03	3.024E-03	3.388E-03	3.765E-03	4.143E-03
WSW	1.422E-03	1.153E-03	8.951E-04	7.155E-04	2.195E-03	2.757E-03	3.329E-03	4.012E-03	4.390E-03	4.842E-03	5.403E-03	5.953E-03
W	2.230E-03	1.767E-03	1.374E-03	1.107E-03	3.459E-03	4.208E-03	4.261E-03	5.179E-03	6.097E-03	6.980E-03	7.876E-03	8.696E-03
WNW	3.760E-03	3.133E-03	2.512E-03	2.069E-03	6.753E-03	8.107E-03	6.815E-03	7.188E-03	8.124E-03	9.260E-03	1.035E-02	1.150E-02
NW	4.866E-03	4.092E-03	3.352E-03	2.822E-03	9.679E-03	1.184E-02	9.115E-03	8.477E-03	8.616E-03	9.142E-03	1.002E-02	1.100E-02
NNW	2.029E-03	1.713E-03	1.381E-03	1.141E-03	3.752E-03	4.592E-03	3.845E-03	3.883E-03	4.261E-03	4.756E-03	5.308E-03	5.883E-03

TOTAL DOSE COMMITMENT IS 6.586E-01 PERSON-REM/YR

WARNING--POPULATION FOOD INGESTION DOSES SHOWN ABOVE HAVE NOT BEEN CORRECTED TO REFLECT POTENTIAL FOOD EXPORT AND MAY EXCEED DOSES ACTUALLY RECEIVED BY THE POPULATION OF THIS REGION. SEE SUMMARY TABLE FOR THIS INFORMATION.

TIME STEP NUMBER 1, after 1 years DURATION IN YRS IS... 2.0

EXPOSURE PATHWAY IS MEAT ING EXPOSED ORGAN IS WH.BODY

DOSES SHOWN BELOW ARE ANNUAL POPULATION DOSE COMMITMENTS, PERSON-REM PER YEAR

DIRECTION	XRHO 1.5	XRHO 2.5	XRHO 3.5	XRHO 4.5	XRHO 7.5	XRHO 15.0	XRHO 25.0	XRHO 35.0	XRHO 45.0	XRHO 55.0	XRHO 65.0	XRHO 75.0
N	1.956E-05	1.588E-05	1.272E-05	1.055E-05	3.569E-05	4.820E-05	4.542E-05	4.938E-05	5.549E-05	6.245E-05	6.977E-05	7.718E-05
NNE	2.437E-05	1.899E-05	1.532E-05	1.291E-05	4.569E-05	6.304E-05	5.580E-05	5.652E-05	5.997E-05	6.463E-05	6.989E-05	7.543E-05
NE	3.053E-05	2.397E-05	1.927E-05	1.615E-05	5.644E-05	7.802E-05	7.076E-05	7.310E-05	7.862E-05	8.550E-05	9.304E-05	1.008E-04
ENE	2.294E-05	1.840E-05	1.465E-05	1.209E-05	4.075E-05	5.670E-05	5.510E-05	6.102E-05	6.902E-05	7.778E-05	8.683E-05	9.589E-05
E	3.489E-05	2.806E-05	2.217E-05	1.815E-05	5.974E-05	8.016E-05	7.820E-05	8.765E-05	1.018E-04	1.187E-04	1.359E-04	1.531E-04
ESE	2.544E-05	1.978E-05	1.590E-05	1.336E-05	4.684E-05	6.369E-05	5.824E-05	6.492E-05	7.462E-05	8.407E-05	9.000E-05	9.597E-05
SE	2.283E-05	1.844E-05	1.499E-05	1.264E-05	4.446E-05	6.110E-05	6.166E-05	6.379E-05	6.365E-05	6.370E-05	6.889E-05	7.559E-05
SSE	1.702E-05	1.339E-05	1.088E-05	9.235E-06	3.336E-05	4.873E-05	4.915E-05	4.332E-05	4.656E-05	5.007E-05	5.383E-05	5.723E-05
S	1.130E-05	9.066E-06	7.341E-06	6.184E-06	2.206E-05	3.288E-05	3.032E-05	3.160E-05	3.138E-05	3.424E-05	3.749E-05	4.076E-05
SSW	1.162E-05	8.966E-06	7.197E-06	6.054E-06	2.160E-05	3.182E-05	2.556E-05	2.689E-05	2.913E-05	3.176E-05	3.461E-05	3.755E-05
SW	1.513E-05	1.228E-05	9.660E-06	7.854E-06	2.552E-05	3.598E-05	5.144E-05	5.215E-05	5.976E-05	6.801E-05	7.632E-05	8.454E-05
WSW	1.938E-05	1.575E-05	1.229E-05	9.894E-06	3.146E-05	4.509E-05	6.260E-05	7.902E-05	8.810E-05	9.831E-05	1.105E-04	1.224E-04
W	3.037E-05	2.412E-05	1.884E-05	1.527E-05	4.921E-05	6.728E-05	7.781E-05	1.008E-04	1.220E-04	1.416E-04	1.612E-04	1.788E-04
WNW	5.119E-05	4.273E-05	3.435E-05	2.841E-05	9.468E-05	1.231E-04	1.158E-04	1.325E-04	1.571E-04	1.839E-04	2.088E-04	2.342E-04
NW	6.623E-05	5.576E-05	4.577E-05	3.864E-05	1.342E-04	1.729E-04	1.454E-04	1.463E-04	1.575E-04	1.739E-04	1.958E-04	2.188E-04
NNW	2.763E-05	2.338E-05	1.889E-05	1.569E-05	5.270E-05	6.989E-05	6.497E-05	7.057E-05	8.119E-05	9.325E-05	1.059E-04	1.187E-04

TOTAL DOSE COMMITMENT IS 1.143E-02 PERSON-REM/YR

WARNING--POPULATION FOOD INGESTION DOSES SHOWN ABOVE HAVE NOT BEEN CORRECTED TO REFLECT POTENTIAL FOOD EXPORT AND MAY EXCEED DOSES ACTUALLY RECEIVED BY THE POPULATION OF THIS REGION. SEE SUMMARY TABLE FOR THIS INFORMATION.

TIME STEP NUMBER 1, after 1 years DURATION IN YRS IS... 2.0

EXPOSURE PATHWAY IS MEAT ING EXPOSED ORGAN IS BONE

DOSES SHOWN BELOW ARE ANNUAL POPULATION DOSE COMMITMENTS, PERSON-REM PER YEAR

DIRECTION	XRHO 1.5	XRHO 2.5	XRHO 3.5	XRHO 4.5	XRHO 7.5	XRHO 15.0	XRHO 25.0	XRHO 35.0	XRHO 45.0	XRHO 55.0	XRHO 65.0	XRHO 75.0
N	3.177E-04	2.586E-04	2.081E-04	1.736E-04	6.038E-04	8.893E-04	9.187E-04	1.054E-03	1.221E-03	1.399E-03	1.581E-03	1.762E-03
NNE	3.956E-04	3.090E-04	2.501E-04	2.117E-04	7.632E-04	1.118E-03	1.064E-03	1.137E-03	1.252E-03	1.384E-03	1.524E-03	1.666E-03
NE	4.956E-04	3.899E-04	3.145E-04	2.648E-04	9.437E-04	1.389E-03	1.357E-03	1.477E-03	1.646E-03	1.835E-03	2.031E-03	2.229E-03
ENE	3.726E-04	2.996E-04	2.396E-04	1.991E-04	6.907E-04	1.052E-03	1.114E-03	1.297E-03	1.510E-03	1.732E-03	1.956E-03	2.176E-03
E	5.664E-04	4.567E-04	3.627E-04	2.990E-04	1.015E-03	1.504E-03	1.611E-03	1.896E-03	2.264E-03	2.681E-03	3.099E-03	3.512E-03
ESE	4.131E-04	3.218E-04	2.597E-04	2.193E-04	7.857E-04	1.146E-03	1.147E-03	1.364E-03	1.627E-03	1.872E-03	2.027E-03	2.179E-03
SE	3.707E-04	3.001E-04	2.449E-04	2.076E-04	7.464E-04	1.102E-03	1.235E-03	1.342E-03	1.373E-03	1.396E-03	1.533E-03	1.701E-03
SSE	2.764E-04	2.180E-04	1.779E-04	1.517E-04	5.598E-04	8.760E-04	9.682E-04	8.734E-04	9.745E-04	1.074E-03	1.175E-03	1.265E-03
S	1.837E-04	1.479E-04	1.204E-04	1.022E-04	3.755E-04	6.100E-04	6.038E-04	6.595E-04	6.701E-04	7.476E-04	8.314E-04	9.136E-04
SSW	1.889E-04	1.462E-04	1.180E-04	9.993E-05	3.665E-04	5.854E-04	4.923E-04	5.486E-04	6.162E-04	6.881E-04	7.623E-04	8.369E-04
SW	2.458E-04	2.003E-04	1.585E-04	1.300E-04	4.391E-04	6.956E-04	1.118E-03	1.159E-03	1.351E-03	1.552E-03	1.752E-03	1.948E-03
WSW	3.148E-04	2.567E-04	2.015E-04	1.637E-04	5.430E-04	8.865E-04	1.370E-03	1.782E-03	2.010E-03	2.259E-03	2.551E-03	2.832E-03
W	4.932E-04	3.928E-04	3.085E-04	2.519E-04	8.423E-04	1.297E-03	1.668E-03	2.255E-03	2.777E-03	3.254E-03	3.721E-03	4.141E-03
WNW	8.308E-04	6.949E-04	5.607E-04	4.663E-04	1.593E-03	2.259E-03	2.352E-03	2.861E-03	3.501E-03	4.170E-03	4.779E-03	5.390E-03
NW	1.075E-03	9.060E-04	7.455E-04	6.316E-04	2.229E-03	3.047E-03	2.795E-03	3.008E-03	3.381E-03	3.834E-03	4.394E-03	4.965E-03
NNW	4.485E-04	3.804E-04	3.087E-04	2.578E-04	8.884E-04	1.285E-03	1.313E-03	1.508E-03	1.792E-03	2.097E-03	2.408E-03	2.719E-03

TOTAL DOSE COMMITMENT IS 2.359E-01 PERSON-REM/YR

WARNING--POPULATION FOOD INGESTION DOSES SHOWN ABOVE HAVE NOT BEEN CORRECTED TO REFLECT POTENTIAL FOOD EXPORT AND MAY EXCEED DOSES ACTUALLY RECEIVED BY THE POPULATION OF THIS REGION. SEE SUMMARY TABLE FOR THIS INFORMATION.

TIME STEP NUMBER 1, after 1 years DURATION IN YRS IS... 2.0

EXPOSURE PATHWAY IS MILK ING EXPOSED ORGAN IS WH.BODY

DOSES SHOWN BELOW ARE ANNUAL POPULATION DOSE COMMITMENTS, PERSON-REM PER YEAR

DIRECTION	XRHO 1.5	XRHO 2.5	XRHO 3.5	XRHO 4.5	XRHO 7.5	XRHO 15.0	XRHO 25.0	XRHO 35.0	XRHO 45.0	XRHO 55.0	XRHO 65.0	XRHO 75.0
N	7.679E-06	6.198E-06	4.919E-06	4.023E-06	1.281E-05	1.358E-05	8.754E-06	6.755E-06	5.741E-06	5.201E-06	4.925E-06	4.803E-06
NNE	9.573E-06	7.430E-06	5.951E-06	4.967E-06	1.687E-05	2.005E-05	1.399E-05	1.122E-05	9.624E-06	8.616E-06	7.946E-06	7.485E-06
NE	1.200E-05	9.382E-06	7.489E-06	6.215E-06	2.080E-05	2.451E-05	1.736E-05	1.415E-05	1.234E-05	1.120E-05	1.044E-05	9.929E-06
ENE	9.010E-06	7.185E-06	5.663E-06	4.609E-06	1.455E-05	1.570E-05	1.062E-05	8.612E-06	7.589E-06	7.031E-06	6.736E-06	6.597E-06
E	1.371E-05	1.096E-05	8.577E-06	6.918E-06	2.121E-05	2.135E-05	1.361E-05	1.070E-05	9.383E-06	8.830E-06	8.660E-06	8.705E-06
ESE	9.995E-06	7.730E-06	6.166E-06	5.123E-06	1.713E-05	1.943E-05	1.278E-05	9.942E-06	8.467E-06	7.611E-06	6.990E-06	6.593E-06
SE	8.968E-06	7.207E-06	5.811E-06	4.845E-06	1.623E-05	1.847E-05	1.248E-05	9.689E-06	7.987E-06	6.874E-06	6.287E-06	5.958E-06
SSE	6.681E-06	5.228E-06	4.215E-06	3.538E-06	1.220E-05	1.490E-05	1.077E-05	8.494E-06	7.325E-06	6.559E-06	6.038E-06	5.653E-06
S	4.431E-06	3.528E-06	2.824E-06	2.341E-06	7.790E-06	9.092E-06	6.314E-06	5.074E-06	4.275E-06	3.840E-06	3.568E-06	3.389E-06
SSW	4.558E-06	3.490E-06	2.771E-06	2.296E-06	7.690E-06	9.053E-06	6.168E-06	4.954E-06	4.264E-06	3.831E-06	3.548E-06	3.359E-06
SW	5.934E-06	4.781E-06	3.711E-06	2.960E-06	8.784E-06	8.541E-06	6.049E-06	4.821E-06	4.404E-06	4.262E-06	4.260E-06	4.337E-06
WSW	7.605E-06	6.138E-06	4.727E-06	3.733E-06	1.074E-05	9.971E-06	6.867E-06	6.002E-06	5.525E-06	5.387E-06	5.488E-06	5.672E-06
W	1.193E-05	9.417E-06	7.273E-06	5.794E-06	1.716E-05	1.619E-05	1.025E-05	8.532E-06	7.933E-06	7.807E-06	7.963E-06	8.217E-06
WNW	2.012E-05	1.673E-05	1.334E-05	1.091E-05	3.441E-05	3.532E-05	2.186E-05	1.650E-05	1.402E-05	1.289E-05	1.240E-05	1.236E-05
NW	2.605E-05	2.187E-05	1.786E-05	1.497E-05	5.024E-05	5.596E-05	3.529E-05	2.578E-05	2.060E-05	1.761E-05	1.599E-05	1.510E-05
NNW	1.085E-05	9.140E-06	7.328E-06	6.009E-06	1.906E-05	1.990E-05	1.257E-05	9.557E-06	8.110E-06	7.391E-06	7.075E-06	6.990E-06

TOTAL DOSE COMMITMENT IS 1.966E-03 PERSON-REM/YR

WARNING--POPULATION FOOD INGESTION DOSES SHOWN ABOVE HAVE NOT BEEN CORRECTED TO REFLECT POTENTIAL FOOD EXPORT AND MAY EXCEED DOSES ACTUALLY RECEIVED BY THE POPULATION OF THIS REGION. SEE SUMMARY TABLE FOR THIS INFORMATION.

TIME STEP NUMBER 1, after 1 years DURATION IN YRS IS... 2.0

EXPOSURE PATHWAY IS MILK ING EXPOSED ORGAN IS BONE

DOSES SHOWN BELOW ARE ANNUAL POPULATION DOSE COMMITMENTS, PERSON-REM PER YEAR

DIRECTION	XRHO 1.5	XRHO 2.5	XRHO 3.5	XRHO 4.5	XRHO 7.5	XRHO 15.0	XRHO 25.0	XRHO 35.0	XRHO 45.0	XRHO 55.0	XRHO 65.0	XRHO 75.0
N	1.231E-04	9.942E-05	7.893E-05	6.459E-05	2.061E-04	2.211E-04	1.459E-04	1.160E-04	1.019E-04	9.520E-05	9.270E-05	9.259E-05
NNE	1.535E-04	1.192E-04	9.547E-05	7.971E-05	2.712E-04	3.244E-04	2.292E-04	1.865E-04	1.628E-04	1.484E-04	1.393E-04	1.335E-04
NE	1.924E-04	1.505E-04	1.201E-04	9.973E-05	3.344E-04	3.967E-04	2.847E-04	2.358E-04	2.092E-04	1.932E-04	1.834E-04	1.773E-04
ENE	1.445E-04	1.152E-04	9.086E-05	7.399E-05	2.342E-04	2.557E-04	1.771E-04	1.475E-04	1.336E-04	1.271E-04	1.247E-04	1.247E-04
E	2.198E-04	1.758E-04	1.376E-04	1.111E-04	3.414E-04	3.485E-04	2.287E-04	1.860E-04	1.691E-04	1.647E-04	1.662E-04	1.710E-04
ESE	1.603E-04	1.240E-04	9.892E-05	8.222E-05	2.755E-04	3.150E-04	2.112E-04	1.689E-04	1.485E-04	1.376E-04	1.294E-04	1.247E-04
SE	1.438E-04	1.156E-04	9.322E-05	7.777E-05	2.610E-04	2.996E-04	2.072E-04	1.647E-04	1.385E-04	1.213E-04	1.135E-04	1.100E-04
SSE	1.071E-04	8.385E-05	6.763E-05	5.679E-05	1.961E-04	2.415E-04	1.780E-04	1.414E-04	1.241E-04	1.132E-04	1.060E-04	1.009E-04
S	7.106E-05	5.659E-05	4.531E-05	3.759E-05	1.254E-04	1.481E-04	1.047E-04	8.584E-05	7.347E-05	6.745E-05	6.403E-05	6.205E-05
SSW	7.309E-05	5.599E-05	4.446E-05	3.687E-05	1.238E-04	1.473E-04	1.013E-04	8.287E-05	7.276E-05	6.670E-05	6.303E-05	6.081E-05
SW	9.516E-05	7.669E-05	5.956E-05	4.755E-05	1.416E-04	1.404E-04	1.056E-04	8.686E-05	8.226E-05	8.205E-05	8.401E-05	8.717E-05
WSW	1.219E-04	9.846E-05	7.586E-05	5.995E-05	1.733E-04	1.646E-04	1.209E-04	1.115E-04	1.064E-04	1.067E-04	1.111E-04	1.168E-04
W	1.913E-04	1.510E-04	1.167E-04	9.304E-05	2.765E-04	2.658E-04	1.768E-04	1.558E-04	1.516E-04	1.544E-04	1.615E-04	1.696E-04
WNW	3.227E-04	2.683E-04	2.141E-04	1.751E-04	5.534E-04	5.743E-04	3.650E-04	2.863E-04	2.539E-04	2.429E-04	2.414E-04	2.468E-04
NW	4.177E-04	3.507E-04	2.864E-04	2.401E-04	8.072E-04	9.046E-04	5.792E-04	4.327E-04	3.555E-04	3.132E-04	2.935E-04	2.854E-04
NNW	1.740E-04	1.466E-04	1.176E-04	9.645E-05	3.066E-04	3.237E-04	2.095E-04	1.643E-04	1.446E-04	1.364E-04	1.345E-04	1.363E-04

TOTAL DOSE COMMITMENT IS 3.306E-02 PERSON-REM/YR

WARNING--POPULATION FOOD INGESTION DOSES SHOWN ABOVE HAVE NOT BEEN CORRECTED TO REFLECT POTENTIAL FOOD EXPORT AND MAY EXCEED DOSES ACTUALLY RECEIVED BY THE POPULATION OF THIS REGION. SEE SUMMARY TABLE FOR THIS INFORMATION.

TIME STEP NUMBER 1, after 1 years DURATION IN YRS IS... 2.0

PRINT OF POPULATION DOSES COMPUTED FOR TSTEP 1--DOSES SHOWN ARE ANNUAL POPULATION DOSE COMMITMENTS, PERSON-REM PER YEAR

DOSES RECEIVED BY PEOPLE WITHIN 80 KILOMETERS

PATHWAY	WH.BODY	BONE	AVG.LUNG	LIVER	KIDNEY	BRONCHI
INHAL	3.236E-03	7.122E-02	2.316E-01	9.122E-03	3.782E-02	1.909E+00
GROUND	6.893E-04	6.893E-04	6.893E-04	6.893E-04	6.893E-04	6.893E-04
CLOUD	3.214E-02	3.214E-02	3.214E-02	3.214E-02	3.214E-02	3.214E-02
VEG.ING	2.584E-02	4.924E-01	2.584E-02	8.280E-02	2.961E-01	2.584E-02
MEAT ING	7.254E-04	1.497E-02	7.254E-04	3.446E-03	1.115E-02	7.254E-04
MILK ING	1.544E-03	2.597E-02	1.544E-03	1.468E-03	8.670E-03	1.544E-03
RNPLUS50	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00
TOTALS	6.418E-02	6.373E-01	2.926E-01	1.297E-01	3.866E-01	1.970E+00

DOSES RECEIVED BY PEOPLE BEYOND 80 KILOMETERS

PATHWAY	WH.BODY	BONE	AVG.LUNG	LIVER	KIDNEY	BRONCHI
INHAL	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00
GROUND	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00
CLOUD	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00
VEG.ING	8.727E-03	1.663E-01	8.727E-03	2.797E-02	1.000E-01	8.727E-03
MEAT ING	1.070E-02	2.209E-01	1.070E-02	5.084E-02	1.644E-01	1.070E-02
MILK ING	4.215E-04	7.089E-03	4.215E-04	4.007E-04	2.367E-03	4.215E-04
RNPLUS50	8.549E+00	1.166E+02	1.943E+00	8.549E+00	8.549E+00	5.440E+01
TOTALS	8.569E+00	1.170E+02	1.963E+00	8.628E+00	8.816E+00	5.442E+01

TOTAL DOSES COMPUTED OVER ALL POPULATIONS

PATHWAY	WH.BODY	BONE	AVG.LUNG	LIVER	KIDNEY	BRONCHI
INHAL	3.236E-03	7.122E-02	2.316E-01	9.122E-03	3.782E-02	1.909E+00
GROUND	6.893E-04	6.893E-04	6.893E-04	6.893E-04	6.893E-04	6.893E-04
CLOUD	3.214E-02	3.214E-02	3.214E-02	3.214E-02	3.214E-02	3.214E-02
VEG.ING	3.457E-02	6.586E-01	3.457E-02	1.108E-01	3.961E-01	3.457E-02
MEAT ING	1.143E-02	2.359E-01	1.143E-02	5.428E-02	1.756E-01	1.143E-02
MILK ING	1.966E-03	3.306E-02	1.966E-03	1.869E-03	1.104E-02	1.966E-03
RNPLUS50	8.549E+00	1.166E+02	1.943E+00	8.549E+00	8.549E+00	5.440E+01
TOTALS	8.633E+00	1.176E+02	2.255E+00	8.758E+00	9.203E+00	5.639E+01

TIME STEP NUMBER 1, after 1 years DURATION IN YRS IS... 2.0

INDIVIDUAL RECEPTOR PARTICULATE CONCENTRATIONS

			AIRBORNE CONCENTRATIONS, PCI/M3				GROUND CONCENTRATIONS, PCI/M2			
N	NAME	PTSZ	U-238	TH-230	RA-226	PB-210	U-238	TH-230	RA-226	PB-210
1	NORTH 100 METERS	1	1.429E-03	7.145E-06	1.434E-06	1.431E-06	9.382E+02	4.690E+00	9.409E-01	9.409E-01
1	NORTH 100 METERS	2	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00
1	NORTH 100 METERS	3	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00
1	NORTH 100 METERS	4	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00
	CONCENTRATION TOTALS		1.429E-03	7.145E-06	1.434E-06	1.431E-06	9.382E+02	4.690E+00	9.409E-01	9.409E-01
2	EAST 150 METERS	1	1.619E-03	8.093E-06	1.624E-06	1.620E-06	1.063E+03	5.313E+00	1.066E+00	1.066E+00
2	EAST 150 METERS	2	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00
2	EAST 150 METERS	3	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00
2	EAST 150 METERS	4	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00
	CONCENTRATION TOTALS		1.619E-03	8.093E-06	1.624E-06	1.620E-06	1.063E+03	5.313E+00	1.066E+00	1.066E+00
3	WEST 150 METERS	1	1.101E-03	5.504E-06	1.105E-06	1.102E-06	7.228E+02	3.613E+00	7.249E-01	7.249E-01
3	WEST 150 METERS	2	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00
3	WEST 150 METERS	3	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00
3	WEST 150 METERS	4	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00
	CONCENTRATION TOTALS		1.101E-03	5.504E-06	1.105E-06	1.102E-06	7.228E+02	3.613E+00	7.249E-01	7.249E-01
4	SOUTH 100 METERS	1	1.651E-04	8.255E-07	1.657E-07	1.653E-07	1.084E+02	5.419E-01	1.087E-01	1.087E-01
4	SOUTH 100 METERS	2	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00
4	SOUTH 100 METERS	3	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00
4	SOUTH 100 METERS	4	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00
	'TRATION TOTALS		1.651E-04	8.255E-07	1.657E-07	1.653E-07	1.084E+02	5.419E-01	1.087E-01	1.087E-01
5	PFISTER RANCH	1	1.552E-03	7.758E-06	1.557E-06	1.553E-06	1.019E+03	5.093E+00	1.022E+00	1.022E+00
5	PFISTER RANCH	2	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00
5	PFISTER RANCH	3	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00
5	PFISTER RANCH	4	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00
	CONCENTRATION TOTALS		1.552E-03	7.758E-06	1.557E-06	1.553E-06	1.019E+03	5.093E+00	1.022E+00	1.022E+00
6	PUMPKIN BUTTE RANCH	1	2.301E-04	1.150E-06	2.308E-07	2.303E-07	1.510E+02	7.551E-01	1.515E-01	1.515E-01
6	PUMPKIN BUTTE RANCH	2	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00
6	PUMPKIN BUTTE RANCH	3	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00
6	PUMPKIN BUTTE RANCH	4	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00
	CONCENTRATION TOTALS		2.301E-04	1.150E-06	2.308E-07	2.303E-07	1.510E+02	7.551E-01	1.515E-01	1.515E-01
7	W. SCHLAUTMANN RANCH	1	2.675E-04	1.337E-06	2.684E-07	2.678E-07	1.756E+02	8.779E-01	1.761E-01	1.761E-01
7	W. SCHLAUTMANN RANCH	2	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00
7	W. SCHLAUTMANN RANCH	3	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00
7	W. SCHLAUTMANN RANCH	4	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00
	CONCENTRATION TOTALS		2.675E-04	1.337E-06	2.684E-07	2.678E-07	1.756E+02	8.779E-01	1.761E-01	1.761E-01
8	L. GILBERTS RANCH	1	1.322E-04	6.611E-07	1.327E-07	1.324E-07	8.681E+01	4.340E-01	8.706E-02	8.706E-02
8	L. GILBERTS RANCH	2	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00
8	L. GILBERTS RANCH	3	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00
8	L. GILBERTS RANCH	4	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00
	CONCENTRATION TOTALS		1.322E-04	6.611E-07	1.327E-07	1.324E-07	8.681E+01	4.340E-01	8.706E-02	8.706E-02

TIME STEP NUMBER 1, after 1 years DURATION IN YRS IS... 2.0

INDIVIDUAL RECEPTOR PARTICULATE CONCENTRATIONS

			AIRBORNE CONCENTRATIONS, PCI/M3				GROUND CONCENTRATIONS, PCI/M2			
N	NAME	PTSZ	U-238	TH-230	RA-226	PB-210	U-238	TH-230	RA-226	PB-210
9	EARL CAMBLIN RANCH	1	1.275E-04	6.374E-07	1.279E-07	1.276E-07	8.370E+01	4.184E-01	8.394E-02	8.394E-02
9	EARL CAMBLIN RANCH	2	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00
9	EARL CAMBLIN RANCH	3	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00
9	EARL CAMBLIN RANCH	4	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00
	CONCENTRATION TOTALS		1.275E-04	6.374E-07	1.279E-07	1.276E-07	8.370E+01	4.184E-01	8.394E-02	8.394E-02
10	JOHN GROVES	1	1.099E-04	5.493E-07	1.102E-07	1.100E-07	7.213E+01	3.606E-01	7.234E-02	7.234E-02
10	JOHN GROVES	2	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00
10	JOHN GROVES	3	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00
10	JOHN GROVES	4	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00
	CONCENTRATION TOTALS		1.099E-04	5.493E-07	1.102E-07	1.100E-07	7.213E+01	3.606E-01	7.234E-02	7.234E-02
11	TOWN OF SAVAGETOWN	1	7.940E-05	3.969E-07	7.966E-08	7.948E-08	5.212E+01	2.606E-01	5.227E-02	5.227E-02
11	TOWN OF SAVAGETOWN	2	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00
11	TOWN OF SAVAGETOWN	3	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00
11	TOWN OF SAVAGETOWN	4	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00
	CONCENTRATION TOTALS		7.940E-05	3.969E-07	7.966E-08	7.948E-08	5.212E+01	2.606E-01	5.227E-02	5.227E-02
12	RUBY RANCH	1	8.474E-05	4.236E-07	8.502E-08	8.482E-08	5.563E+01	2.781E-01	5.579E-02	5.579E-02
12	RUBY RANCH	2	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00
12	RUBY RANCH	3	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00
12	RUBY RANCH	4	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00
	'ITRATION TOTALS		8.474E-05	4.236E-07	8.502E-08	8.482E-08	5.563E+01	2.781E-01	5.579E-02	5.579E-02
1.	ACK CHRISTENSEN	1	3.190E-04	1.595E-06	3.200E-07	3.193E-07	2.094E+02	1.047E+00	2.100E-01	2.100E-01
13	JACK CHRISTENSEN	2	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00
13	JACK CHRISTENSEN	3	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00
13	JACK CHRISTENSEN	4	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00
	CONCENTRATION TOTALS		3.190E-04	1.595E-06	3.200E-07	3.193E-07	2.094E+02	1.047E+00	2.100E-01	2.100E-01
14	BUD CHRISTENSEN	1	9.134E-05	4.566E-07	9.164E-08	9.143E-08	5.997E+01	2.998E-01	6.014E-02	6.014E-02
14	BUD CHRISTENSEN	2	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00
14	BUD CHRISTENSEN	3	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00
14	BUD CHRISTENSEN	4	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00
	CONCENTRATION TOTALS		9.134E-05	4.566E-07	9.164E-08	9.143E-08	5.997E+01	2.998E-01	6.014E-02	6.014E-02

TIME STEP NUMBER 1, after 1 years DURATION IN YRS IS... 2.0

INDIVIDUAL RECEPTOR RADON AND RADON DAUGHTER CONCENTRATIONS

	AIRBORNE CONCENTRATIONS, PCI/M3								GROUND CONCENTRATIONS, PCI/M2			
	RN-222	PO-218	PB-214	BI-214	PB-210	BI-210	PO-210	WL	PO-218	PB-214	BI-214	PB-210
1	1.322E+01	2.649E+00	2.163E-01	1.501E-01	2.983E-06	6.689E-08	3.114E-11	4.385E-06	2.098E+00	2.098E+00	2.098E+00	5.403E-01
2	2.035E+01	4.201E+00	2.649E-01	1.525E-01	3.002E-06	6.721E-08	3.124E-11	6.239E-06	3.328E+00	3.328E+00	3.328E+00	5.436E-01
3	1.305E+01	3.919E+00	2.774E-01	1.527E-01	2.978E-06	6.635E-08	3.546E-11	6.013E-06	3.104E+00	3.104E+00	3.104E+00	5.394E-01
4	6.346E+00	1.551E+00	2.049E-01	1.515E-01	2.997E-06	6.665E-08	3.578E-11	3.202E-06	1.229E+00	1.229E+00	1.229E+00	5.427E-01
5	6.836E+00	5.782E+00	2.180E+00	1.086E+00	4.119E-06	6.861E-08	3.229E-11	2.106E-05	4.579E+00	4.579E+00	4.579E+00	7.460E-01
6	1.678E+00	1.668E+00	1.231E+00	9.729E-01	7.483E-06	9.574E-08	2.653E-11	1.159E-05	1.321E+00	1.321E+00	1.321E+00	1.355E+00
7	1.995E+00	1.976E+00	1.490E+00	1.250E+00	9.730E-06	1.337E-07	6.709E-11	1.425E-05	1.565E+00	1.565E+00	1.565E+00	1.762E+00
8	1.500E+00	1.500E+00	1.335E+00	1.197E+00	1.278E-05	1.897E-07	8.195E-11	1.278E-05	1.188E+00	1.188E+00	1.188E+00	2.314E+00
9	1.421E+00	1.421E+00	1.279E+00	1.138E+00	1.258E-05	1.868E-07	6.913E-11	1.219E-05	1.126E+00	1.126E+00	1.126E+00	2.278E+00
10	1.091E+00	1.089E+00	9.174E-01	8.036E-01	1.052E-05	1.888E-07	1.348E-10	8.771E-06	8.629E-01	8.629E-01	8.629E-01	1.905E+00
11	8.580E-01	8.579E-01	7.428E-01	6.576E-01	1.057E-05	2.192E-07	1.510E-10	7.102E-06	6.795E-01	6.795E-01	6.795E-01	1.914E+00
12	9.217E-01	9.222E-01	8.335E-01	7.366E-01	9.379E-06	1.630E-07	7.707E-11	7.923E-06	7.304E-01	7.304E-01	7.304E-01	1.699E+00
13	2.881E+00	2.879E+00	2.483E+00	2.141E+00	1.105E-05	8.483E-08	2.537E-11	2.354E-05	2.280E+00	2.280E+00	2.280E+00	2.002E+00
14	1.009E+00	1.009E+00	9.045E-01	8.019E-01	8.562E-06	1.356E-07	6.705E-11	8.616E-06	7.994E-01	7.994E-01	7.994E-01	1.551E+00

TIME STEP NUMBER 1, after 1 years DURATION IN YRS IS... 2.0

NUMBER 1 NAME=NORTH 100 METERS X= .0KM, Y= .1KM, Z= 1.0M, DIST= .1KM, IRTYPE= 0

RESULTS OF MPC CHECK AT THIS LOCATION

	U-238	U-234	TH-230	RA-226	RN-222(WL)	PB-210	BI-210	PO-210
CONC., PCI/M3	1.43E-03	1.43E-03	7.14E-06	1.43E-06	4.39E-06	4.41E-06	1.50E-06	1.43E-06
MPC, PCI/M3	5.00E+00	4.00E+00	8.00E-02	2.00E+00	3.33E-02	4.00E+00	2.00E+02	7.00E+00
FRACTION OF MPC	2.86E-04	3.57E-04	8.93E-05	7.17E-07	1.32E-04	1.10E-06	7.49E-09	2.04E-07

SUM OF FRACTIONS EQUALS 8.66E-04

NUMBER 2 NAME=EAST 150 METERS X= .1KM, Y= .0KM, Z= 1.0M, DIST= .1KM, IRTYPE= 0

RESULTS OF MPC CHECK AT THIS LOCATION

	U-238	U-234	TH-230	RA-226	RN-222(WL)	PB-210	BI-210	PO-210
CONC., PCI/M3	1.62E-03	1.62E-03	8.09E-06	1.62E-06	6.24E-06	4.62E-06	1.69E-06	1.62E-06
PCI/M3	5.00E+00	4.00E+00	8.00E-02	2.00E+00	3.33E-02	4.00E+00	2.00E+02	7.00E+00
RACTION OF MPC	3.24E-04	4.05E-04	1.01E-04	8.12E-07	1.87E-04	1.16E-06	8.44E-09	2.31E-07

SUM OF FRACTIONS EQUALS 1.02E-03

TIME STEP NUMBER 1, after 1 years DURATION IN YRS IS... 2.0

NUMBER 3 NAME=WEST 150 METERS X= -.1KM, Y= .0KM, Z= 1.0M, DIST= .1KM, IRTYPE= 0

RESULTS OF MPC CHECK AT THIS LOCATION

	U-238	U-234	TH-230	RA-226	RN-222(WL)	PB-210	BI-210	PO-210
CONC., PCI/M3	1.10E-03	1.10E-03	5.50E-06	1.10E-06	6.01E-06	4.08E-06	1.17E-06	1.10E-06
MPC, PCI/M3	5.00E+00	4.00E+00	8.00E-02	2.00E+00	3.33E-02	4.00E+00	2.00E+02	7.00E+00
FRACTION OF MPC	2.20E-04	2.75E-04	6.88E-05	5.52E-07	1.81E-04	1.02E-06	5.84E-09	1.57E-07

SUM OF FRACTIONS EQUALS 7.47E-04

NUMBER 4 NAME=SOUTH 100 METERS X= .0KM, Y= -.1KM, Z= 1.0M, DIST= .1KM, IRTYPE= 0

RESULTS OF MPC CHECK AT THIS LOCATION

	U-238	U-234	TH-230	RA-226	RN-222(WL)	PB-210	BI-210	PO-210
CONC., PCI/M3	1.65E-04	1.65E-04	8.25E-07	1.66E-07	3.20E-06	3.16E-06	2.32E-07	1.65E-07
PCI/M3	5.00E+00	4.00E+00	8.00E-02	2.00E+00	3.33E-02	4.00E+00	2.00E+02	7.00E+00
FRACTION OF MPC	3.30E-05	4.13E-05	1.03E-05	8.28E-08	9.61E-05	7.91E-07	1.16E-09	2.36E-08

SUM OF FRACTIONS EQUALS 1.82E-04

TIME STEP NUMBER 1, after 1 years DURATION IN YRS IS... 2.0

NUMBER 5 NAME=PFISTER RANCH X= .7KM, Y= -1.8KM, Z= 1.0M, DIST= 1.9KM, IRTYPE= 0

RESULTS OF MPC CHECK AT THIS LOCATION

	U-238	U-234	TH-230	RA-226	RN-222(WL)	PB-210	BI-210	PO-210
CONC., PCI/M3	1.55E-03	1.55E-03	7.76E-06	1.56E-06	2.11E-05	5.67E-06	1.62E-06	1.55E-06
MPC, PCI/M3	5.00E+00	4.00E+00	8.00E-02	2.00E+00	3.33E-02	4.00E+00	2.00E+02	7.00E+00
FRACTION OF MPC	3.10E-04	3.88E-04	9.70E-05	7.78E-07	6.32E-04	1.42E-06	8.11E-09	2.22E-07

SUM OF FRACTIONS EQUALS 1.43E-03

NUMBER 6 NAME=PUMPKIN BUTTE RANCH X= 3.9KM, Y= -5.6KM, Z= 1.0M, DIST= 6.9KM, IRTYPE= 0

RESULTS OF MPC CHECK AT THIS LOCATION

	U-238	U-234	TH-230	RA-226	RN-222(WL)	PB-210	BI-210	PO-210
CONC., PCI/M3	2.30E-04	2.30E-04	1.15E-06	2.31E-07	1.16E-05	7.71E-06	3.26E-07	2.30E-07
PCI/M3	5.00E+00	4.00E+00	8.00E-02	2.00E+00	3.33E-02	4.00E+00	2.00E+02	7.00E+00
RACTION OF MPC	4.60E-05	5.75E-05	1.44E-05	1.15E-07	3.48E-04	1.93E-06	1.63E-09	3.29E-08

SUM OF FRACTIONS EQUALS 4.68E-04

TIME STEP NUMBER 1, after 1 years DURATION IN YRS IS... 2.0

NUMBER 7 NAME=W. SCHLAUTMANN RANCH X= 5.8KM, Y= 4.1KM, Z= 1.0M, DIST= 7.2KM, IRTYPE= 0

RESULTS OF MPC CHECK AT THIS LOCATION

	U-238	U-234	TH-230	RA-226	RN-222(WL)	PB-210	BI-210	PO-210
CONC., PCI/M3	2.67E-04	2.67E-04	1.34E-06	2.68E-07	1.43E-05	1.00E-05	4.01E-07	2.68E-07
MPC, PCI/M3	5.00E+00	4.00E+00	8.00E-02	2.00E+00	3.33E-02	4.00E+00	2.00E+02	7.00E+00
FRACTION OF MPC	5.35E-05	6.69E-05	1.67E-05	1.34E-07	4.28E-04	2.50E-06	2.01E-09	3.83E-08

SUM OF FRACTIONS EQUALS 5.68E-04

NUMBER 8 NAME=L. GILBERTS RANCH X= 9.6KM, Y= 2.4KM, Z= 1.0M, DIST= 9.9KM, IRTYPE= 0

RESULTS OF MPC CHECK AT THIS LOCATION

	U-238	U-234	TH-230	RA-226	RN-222(WL)	PB-210	BI-210	PO-210
CONC., PCI/M3	1.32E-04	1.32E-04	6.61E-07	1.33E-07	1.28E-05	1.29E-05	3.22E-07	1.32E-07
PCI/M3	5.00E+00	4.00E+00	8.00E-02	2.00E+00	3.33E-02	4.00E+00	2.00E+02	7.00E+00
FRACTION OF MPC	2.64E-05	3.31E-05	8.26E-06	6.63E-08	3.84E-04	3.23E-06	1.61E-09	1.89E-08

SUM OF FRACTIONS EQUALS 4.55E-04

TIME STEP NUMBER 1, after 1 years DURATION IN YRS IS... 2.0

NUMBER 9 NAME=EARL CAMBLIN RANCH X= 10.5KM, Y= -2.3KM, Z= 1.0M, DIST= 10.8KM, IRTYPE= 0

RESULTS OF MPC CHECK AT THIS LOCATION

	U-238	U-234	TH-230	RA-226	RN-222(WL)	PB-210	BI-210	PO-210
CONC., PCI/M3	1.28E-04	1.28E-04	6.37E-07	1.28E-07	1.22E-05	1.27E-05	3.14E-07	1.28E-07
MPC, PCI/M3	5.00E+00	4.00E+00	8.00E-02	2.00E+00	3.33E-02	4.00E+00	2.00E+02	7.00E+00
FRACTION OF MPC	2.55E-05	3.19E-05	7.97E-06	6.40E-08	3.66E-04	3.18E-06	1.57E-09	1.82E-08

SUM OF FRACTIONS EQUALS 4.35E-04

NUMBER 10 NAME=JOHN GROVES X= 9.4KM, Y= 6.7KM, Z= 1.0M, DIST= 11.6KM, IRTYPE= 0

RESULTS OF MPC CHECK AT THIS LOCATION

	U-238	U-234	TH-230	RA-226	RN-222(WL)	PB-210	BI-210	PO-210
CONC., PCI/M3	1.10E-04	1.10E-04	5.49E-07	1.10E-07	8.77E-06	1.06E-05	2.99E-07	1.10E-07
PCI/M3	5.00E+00	4.00E+00	8.00E-02	2.00E+00	3.33E-02	4.00E+00	2.00E+02	7.00E+00
FRACTION OF MPC	2.20E-05	2.75E-05	6.87E-06	5.51E-08	2.63E-04	2.66E-06	1.49E-09	1.57E-08

SUM OF FRACTIONS EQUALS 3.22E-04

TIME STEP NUMBER 1, after 1 years DURATION IN YRS IS... 2.0

NUMBER 11 NAME=TOWN OF SAVAGETOWN X= 11.1KM, Y= 8.8KM, Z= 1.0M, DIST= 14.2KM, IRTYPE= 0

RESULTS OF MPC CHECK AT THIS LOCATION

	U-238	U-234	TH-230	RA-226	RN-222(WL)	PB-210	BI-210	PO-210
CONC., PCI/M3	7.94E-05	7.94E-05	3.97E-07	7.97E-08	7.10E-06	1.06E-05	2.99E-07	7.96E-08
MPC, PCI/M3	5.00E+00	4.00E+00	8.00E-02	2.00E+00	3.33E-02	4.00E+00	2.00E+02	7.00E+00
FRACTION OF MPC	1.59E-05	1.98E-05	4.96E-06	3.98E-08	2.13E-04	2.66E-06	1.49E-09	1.14E-08

SUM OF FRACTIONS EQUALS 2.57E-04

NUMBER 12 NAME=RUBY RANCH X= 11.3KM, Y= -5.8KM, Z= 1.0M, DIST= 12.7KM, IRTYPE= 0

RESULTS OF MPC CHECK AT THIS LOCATION

	U-238	U-234	TH-230	RA-226	RN-222(WL)	PB-210	BI-210	PO-210
CONC., PCI/M3	8.47E-05	8.47E-05	4.24E-07	8.50E-08	7.92E-06	9.46E-06	2.48E-07	8.49E-08
[illegible] PCI/M3	5.00E+00	4.00E+00	8.00E-02	2.00E+00	3.33E-02	4.00E+00	2.00E+02	7.00E+00
[illegible]RACTION OF MPC	1.69E-05	2.12E-05	5.30E-06	4.25E-08	2.38E-04	2.37E-06	1.24E-09	1.21E-08

SUM OF FRACTIONS EQUALS 2.84E-04

TIME STEP NUMBER 1, after 1 years DURATION IN YRS IS... 2.0

NUMBER 13 NAME=JACK CHRISTENSEN X= -5.3KM, Y= -1.5KM, Z= 1.0M, DIST= 5.6KM, IRTYPE= 0

RESULTS OF MPC CHECK AT THIS LOCATION

	U-238	U-234	TH-230	RA-226	RN-222(WL)	PB-210	BI-210	PO-210
CONC., PCI/M3	3.19E-04	3.19E-04	1.59E-06	3.20E-07	2.35E-05	1.14E-05	4.04E-07	3.19E-07
MPC, PCI/M3	5.00E+00	4.00E+00	8.00E-02	2.00E+00	3.33E-02	4.00E+00	2.00E+02	7.00E+00
FRACTION OF MPC	6.38E-05	7.97E-05	1.99E-05	1.60E-07	7.07E-04	2.84E-06	2.02E-09	4.56E-08

SUM OF FRACTIONS EQUALS 8.73E-04

NUMBER 14 NAME=BUD CHRISTENSEN X= .2KM, Y= 10.1KM, Z= 1.0M, DIST= 10.1KM, IRTYPE= 0

RESULTS OF MPC CHECK AT THIS LOCATION

	U-238	U-234	TH-230	RA-226	RN-222(WL)	PB-210	BI-210	PO-210
CONC., PCI/M3	9.13E-05	9.13E-05	4.57E-07	9.16E-08	8.62E-06	8.65E-06	2.27E-07	9.15E-08
PCI/M3	5.00E+00	4.00E+00	8.00E-02	2.00E+00	3.33E-02	4.00E+00	2.00E+02	7.00E+00
FRACTION OF MPC	1.83E-05	2.28E-05	5.71E-06	4.58E-08	2.59E-04	2.16E-06	1.14E-09	1.31E-08

SUM OF FRACTIONS EQUALS 3.08E-04

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