Ross ISR Project USNRC License Application
Crook County, Wyoming

December 2010

Environmental Report
Volume 3 of 3
Addenda

STRATA ENERGY

TABLE OF CONTENTS

VOLUME 1 OF 3

CHAPTER 1 - INTRODUCTION

CHAPTER 2 - ALTERNATIVES

CHAPTER 3 - DESCRIPTION OF THE AFFECTED ENVIRONMENT

TABLE OF CONTENTS (CONTINUED)

VOLUME 2 OF 3

TABLE OF CONTENTS (CONTINUED)

VOLUME 2 OF 3

TABLE OF CONTENTS (CONTINUED)

VOLUME 3 OF 3

LIST OF ADDENDA

TABLE OF CONTENTS (CONTINUED)

VOLUME 3 OF 3

ADDENDUM 1.6-A

PUBLIC INVOLVEMENT

1.0 PUBLIC INVOLVEMENT

1.1 Public Involvement Planning

1.1.1 Plan Document

In January 2010, Strata established a Public Involvement Plan to set forth specific strategies and methods for the engagement of private citizens, businesses, government entities and other organizations potentially affected by the Ross ISR Project. The Public Involvement Plan document is described herein:

1.1.2 Plan Goals

The goals of the Public Involvement Plan are to:

1. Establish and maintain the legitimacy of Strata Energy and the Ross ISR Project, the process used to inform the public about the project, and the legitimacy of assumptions used and decisions made in the development of the project;
2. Identify all potentially affected stakeholders;
3. Understand the stakeholder perspective of the project and perceived impacts to stakeholders;
4. Articulate and clarify key issues and proposed solutions through key messages and development of message dissemination methods;
5. Identify all potentially relevant problems;
6. Generate solutions to problems;
7. Send and receive communications and take steps to see that they are understood;
8. Search for common ground; and
9. Mediate polarized interests as necessary.

1.1.3 Public Involvement Values

In developing its Public Involvement Plan, Strata established a set of values that serve as guiding principles in its interaction with stakeholders:

- Active solicitation of public input
- Sharing of information
- Adherence to process

- Responsible and respectful interactions with landowners and use of landowner properties
- Timely response to landowner concerns
- Hiring locally and making equipment purchases locally wherever possible
- Open acknowledgment of issues of importance to the public and what Strata is doing to mitigate risks

1.2 Public Involvement Methods

1.2.1 Field office outreach

Strata maintains an open-door policy to the public at its corporate office in Gillette and its field office located at Oshoto, Wyoming, near the proposed project area. Local landowners are encouraged to visit the field office as needed to discuss matters of concern, including but not limited to drilling progression, site disturbance, and reclamation.

Field office staff makes regular contact with landowners in and around the proposed project area, working to minimize drilling impacts, coordinate reclamation activities, and share information about project progress.

1.2.2 Media releases

In March of 2010, Strata prepared a media release to introduce the Ross ISR project to the public. The release was picked up in a Sundance Times article on March 18. Subsequent media releases and advertising are planned to promote public understanding of different aspects of the project and to encourage participation in future public forums.

1.2.3 Community Participation

To establish its intention with regard to community participation and public involvement, and to provide residents of communities near the proposed project area with ready access to company contact information, Strata maintains membership with the Chambers of Commerce in the communities of Hulett, Moorcroft, Sundance and Gillette.

1.2.4 Public Forums

1.2.4.1 Crook County Uranium Roundtable

In April of 2010, Strata requested an audience with the Crook County Land Use Planning and Zoning Commission (CCLUP&ZC) to share information on the status of the Ross ISR Project and to identify and discuss items of

mutual interest. The CCLUP&ZC subsequently organized a public roundtable on ISR uranium recovery to promote public dialogue regarding proposed ISR projects in and around Crook County. The roundtable included presentations by the NRC, WDEQ, Strata, Powertech, and RNPOW. Strata gave a brief overview of the proposed Ross ISR Project, presented a summary of public, local government and regulatory concerns identified to date, and solicited input regarding additional concerns that might not have been previously identified.

Strata representatives answered questions from roundtable attendees at the public forum and in a subsequent *Sundance Times* article dated July 8, 2010. Questions fell into four general categories:

1. The adequacy of the regulatory permitting and inspection process
2. The potential for and measures to address spills and excursions
3. Negative effects of ISR and exploration activities on water quality and quantity
4. Recourse of locals if groundwater should become contaminated

1.2.5 Stakeholder Meetings

Since initiation of the Ross ISR Project in July 2009, Strata has hosted regular quarterly meetings with stakeholders to share information regarding project progress, to describe various aspects of the proposed project, and to begin to identify and address public concerns. Table 1.6-1 provides a list of stakeholders consulted to date (December 2010).

September 2009

Approximately 19 stakeholders attended the first quarterly stakeholder meeting, held at the Oshoto Community Bible Church on September 29, 2009. The purpose of this initial meeting was to introduce Strata to the community, to promote understanding of ISR uranium recovery methods, and to hear concerns of the community with regard to locating an ISR facility in the area. Topics discussed included:

- Uranium supply and demand
- US uranium mining history
- History of uranium development in the Lance District
- Introduction to Peninsula Minerals/Strata
- Strata development goals
- Strata development activities to date

- ISR uranium recovery process
- Permitting process and regulatory oversight
- Well field development process and considerations
- Reclamation planning
- Q&A

January 2010

On January 15, 2010, Strata hosted a stakeholder meeting at the Oshoto church to introduce the project team and to provide an overview of the permitting process. Invitations were emailed and/or mailed to local government representatives, regulatory agencies, landowners, and mineral owners. Approximately 16 area stakeholders participated in the meeting. Topics discussed included:

- ISR uranium recovery process
- Traditional method of identifying confining layers and ore-bearing layers
- Strata 3-dimensional resource model
- Incorporation of historical (Nubeth) data into Strata model
- Mineral zone water quality in the Lance District
- Monitoring requirements and proposed monitoring methods to be used on Ross ISR project
- Site characteristics assessment, including baseline characterization, cultural and historic preservation assessment, wildlife and vegetation inventories, etc.
- Well field and plant design process
- Q&A

April 2010

Over 25 stakeholders attended the quarterly stakeholder meeting held on April 27, 2010 at the Oshoto church. Meeting invitations were emailed and/or mailed to local government representatives, regulatory agencies, landowners, and mineral owners. The purpose of the meeting was to provide an overview of stakeholder concerns identified to date, water and wastewater management, and upcoming site activities. Topics discussed included:

- Concerns identified by stakeholders, including:
    - NRC
    - BLM
    - USFWS

    - WDEQ
    - WGFD
    - Crook County officials
    - PRBRC/RNPOW
    - Local landowners
- Baseline data collection efforts completed to date
- Identification of water management as a primary stakeholder concern
- Water management challenges identified to date
- What Strata is doing to address water management challenges
- Overview of Introduction of deep injection wells as a disposal method
- Use of injection wells in other industries, location of existing injection wells near Ross ISR Project
- Depth of injection wells relative to drinking water aquifers

Strata invited the landowner from Wyoming's Irigaray ISR uranium recovery facility to attend the April meeting to answer landowner questions about considerations in having an ISR uranium recovery facility on one's property. No formal presentation was given in this regard; stakeholders were free to speak freely with the Irigaray landowner at their discretion.

October 2010

Personal invitations were extended to stakeholders to attend the NRC review held at the proposed project area on October 26-28, 2010. Stakeholders were invited to participate in a tour of the proposed project area, to observe the NRC review process, and to listen to and ask questions following the NRC debrief on the final day of the review. Two local landowners attended the tour and/or debrief, as did representatives from two local NGOs, the Crook County Commission, and US Congresswoman Cynthia Lummis' office.

Questions and concerns stated by stakeholders included:

- Reproduction quality of graphics and maps and potential effect on public comment period
- Cooperation between NRC and BLM on the NEPA process
- Security and safety during production
- Employment of local residents in construction, mining and production
- Water quality preservation
- Potential drawdown and projected recovery of area aquifers

January 2011

Strata is currently planning the next quarterly stakeholder meeting to be held at the Oshoto Church in January 2011. Meeting invitations will be emailed and/or mailed to local government representatives, regulatory agencies, landowners, and mineral owners. The purpose of the January meeting will be to recap Strata's December submission of a combined source and 11e.(2) byproduct material license application to construct and operate an ISR facility at the proposed Ross project site. The meeting is further intended to present results to date of baseline monitoring efforts, present the groundwater and geologic model, and to communicate to stakeholders what they may expect in the coming months as the permitting process continues.

1.2.6 Advocacy Group (NGO) Outreach

Strata has taken a proactive role in soliciting input from citizen advocacy organizations active in northeastern Wyoming. In February of 2010, Strata representatives met with representatives of two such organizations, the PRBRC and PRBRC affiliate RNPOW. The purpose of that meeting was to introduce the Ross ISR Project, establish an open and ongoing dialogue between Strata and the two organizations, and identify the primary concerns shared by PRBRC and RNPOW members.

Topics discussed included:

- Introduction to Peninsula Minerals/Strata
- Strata development goals
- Overview of potential development throughout the Lance District
- Overview of development activities to date at Ross and Barber prospects
- Description of ISR uranium recovery process
- Description of traditional method of identifying confining layers and ore-bearing layers
- Introduction of Strata's 3-dimensional geologic resource model and groundwater model
- Description of work done to date toward permitting at the Ross project
- Overview of monitoring requirements and proposed monitoring methods to be used on Ross ISR project
- Overview of well field development process and considerations
- Discussion of current mineral zone water quality and restoration requirements, results from other projects (South Texas)

- Overview of preliminary water management plan
- Background information on naturally occurring baseline radiation levels
- Description of site characteristics assessment, including baseline characterization, cultural and historic preservation assessment, wildlife and vegetation inventories, etc.
- Q&A

Strata has subsequently maintained regular contact with PRBRC and RNPOW representatives, providing information regarding project team qualifications and progress toward submission of this license application, and responding to PRBRC member concerns.

1.2.7 Tribal Outreach

Strata has identified at least 23 Native American tribes as stakeholders that may have an interest in, or may be potentially affected by, the Ross ISR Project. The identified tribes are located within 700 miles of the project boundary and/or have been identified by the National Park Service as having a potential cultural affiliation with Devil's Tower National Monument, located 11 miles east of the project area.

In order to ensure that these tribes are made aware of the Ross ISR project and have opportunity to comment with regard to any perceived impacts to the tribe, NRC sent letters of notification on November 19, 2010to 15 tribes describing Strata's intent to submit a combined source and 11e.(2) byproduct material license application to construct and operate an ISR facility at the proposed Ross project site.

Strata understands that following acceptance of the license application, NRC will meet or communicate with all know federally recognized tribes in the area with a potential interest to establish protocol and procedure for government-to-government interaction on the matter.

1.3 Ongoing Public Involvement

In keeping with its public involvement values, Strata has identified a variety of methods to facilitate communication to and from the public throughout the permitting process and beyond, including:

- Participation in local community organizations
- Regular meetings with project area stakeholders
- Direct mailing to project stakeholders about significant project developments or upcoming stakeholder meetings

- Regular media releases and media advertising regarding Strata activities, public outreach values, and methods for the public to provide feedback
- Educational presentations to schools, clubs and organizations about the sciences and technologies related to ISR uranium recovery
- Interactive website containing Strata project information, news, educational information and links, corporate structure, investment, and employment opportunities.

1.4 Public Involvement Efficacy and Modification

Strata maintains an up-to-date assessment of public values, priorities, perceptions and concerns regarding the proposed Ross ISR Project in order to ensure that public concerns are addressed in this combined source and 11e.(2) byproduct material license application, in Strata's exploration and permitting activities, and ultimately in Strata's uranium recovery and processing operations.

Public concerns identified through the outreach activities described above fall into the following general categories:

- Surface damage to properties from development activities
- Visual impacts of development activities and of wellfield after development
- Condition of roadway, road damage, dust control, repairs to existing roads
- Potential contamination of groundwater and surface water
- Potential effects on surrounding aquifers
- Waste management
- Spills
- Site security
- Reclamation
- Effect on property values and potential restrictions on future land use
- Transparency and disclosure
- Employment of local residents

Strata's Public Involvement Plan is a dynamic document and is modified as necessary to better respond to public concerns as additional needs are identified.

Table 1.6-1 Stakeholders Consulted

Name	Category	Representing	Address	Consultations	Context
Anderson, Shannon	NGO	Powder River Basin Resource Council	923 N. Main St. Sheridan, WY 82801	2+	Potential excursions, groundwater impacts, transparency, NRC review
Baron, Joe	Local Government	Crook County Attorney	PO Box 397 Sundance, WY	3	Stakeholder meetings
Berger, Harry	Landowner		965 Cabin Creek Road Oshoto, WY	1+	Stakeholder meetings, surface impacts, baseline monitoring, reclamation, plant location
Berger, Larry (Gene)	Landowner		965 Cabin Creek Road Oshoto, WY	1+	Stakeholder meetings, surface impacts, baseline monitoring, reclamation, plant location
Brislawn, Emmett (D)	Landowner		2740 D Road Oshoto, WY	1+	Stakeholder meetings, surface impacts
Brislawn, Josie	Landowner		2740 D Road Oshoto, WY	1+	Stakeholder meetings, surface impacts
Brubaker, Larry	Landowner (Irigary)		2394 Irigary Road Kaycee, WY	1	Stakeholder meetings
Burch, Becky	Landowner		2411 D Road Oshoto, WY	3+	Stakeholder meetings, surface impacts, baseline monitoring, reclamation
Burch, Stormy	Landowner		2411 D Road Oshoto, WY	3+	Stakeholder meetings, surface impacts, baseline monitoring, reclamation
Dennis, Kelly	Local Government	Crook County Commission	PO Box 96 Moorcroft, WY	5+	Stakeholder meetings, road maintenance, County planning, relationship with other operators, NRC review
Dennis, Wade	Area Resident		PO Box 96 Moorcroft, WY	1	Stakeholder meetings
Dickey, Gayle	Landowner		78 Upper Clear Creek Rd. Buffalo, WY	1	Stakeholder meetings
Duncan, Fred	Local Government	Crook County Planning	309 Cleveland Street Sundance, WY	2+	Stakeholder meetings, road maintenance, County planning
Eitel, Delbert	Landowner		PO Box 338 Kaycee, WY	1	Stakeholder meetings
Garman, Wayne	Local Government	Crook County Natural Resource District	118 S. 21st St. Sundance, WY	1	Stakeholder meetings
Hadley, Jim	Local Government	Crook County Commission	309 Cleveland Street Sundance, WY	4	Stakeholder meetings, road maintenance, County planning
Hilty, Jinx	Local Government	Crook County Natural Resource District	118 S. 21st St. Sundance, WY	1+	Stakeholder meetings
Jones, Jim	NGO	Ranchers & Neighbors Protecting Our Water	735 New Haven Rd. Hulett, WY	1+	Stakeholder meetings, potential excursions, groundwater impacts, transparency
Jones, Matt	Federal Government	Representative Cynthia Lummis, R-Wyo	45 E. Loucks St. Sheridan, WY	1	NRC review
Lyons, Tim	Local Government	Crook County LUP&Z	PO Box 848 Sundance, WY	2+	Stakeholder meetings, road maintenance, County planning

Table 1.6-1 Stakeholders Consulted

McCullough, Judith	Landowner		116 D Road Moorcroft, WY	3+	Stakeholder meetings, surface impacts, reclamation
Moline, John A. Jr.	Local Government	Crook County Commission	309 Cleveland Street Sundance, WY	2	Stakeholder meetings, road maintenance, County planning
Otwell, Randall	Landowner		3005 New Haven Rd.Oshoto, WY	1+	Stakeholder meetings, surface impacts, baseline monitoring, reclamation
Perry, Carleton	Landowner		377 Lower Prairie Dog Road Sheridan, WY	1	Stakeholder meetings
Perry, Jackie	Landowner		377 Lower Prairie Dog Road Sheridan, WY	1	Stakeholder meetings
Reynolds, Florence	Landowner		2720 New Haven Road Oshoto, WY	1	Stakeholder meetings
Semlek, Mark	Landowner		1307 D Road Moorcroft, WY	1	Stakeholder meetings
Stinton, Mrs. Wesley	Area Resident		Unknown	1	Stakeholder meetings
Stinton, Wesley	Area Resident		Unknown		Stakeholder meetings
Strong, Carol	Landowner		3003 New Haven Road	3+	Stakeholder meetings, surface impacts, baseline monitoring, reclamation
Tope, Jay	NGO, Landowner	Landowner/PRBRC	Unknown	1+	Potential excursions, groundwater impacts, transparency
Tope, Wilma	NGO, Landowner	Powder River Basin Resource Council	Unknown	2+	Stakeholder meetings, potential excursions, groundwater impacts, transparency, NRC review
Viviano, Pam	NGO		735 New Haven Rd. Hulett, WY	3+	Stakeholder meetings, potential excursions, groundwater impacts, transparency, NRC review
Wesley, Bernadette	Landowner		35 Oshoto Road Oshoto, WY	1+	Stakeholder meetings, surface impacts, baseline monitoring, reclamation
Wesley, TJ	Landowner, Mineral Owner		35 Oshoto Road Oshoto, WY	1+	Stakeholder meetings, surface impacts, baseline monitoring, reclamation, plant location, NRC review
West, Darla	Landowner		2040 New Haven Rd. Oshoto, WY	1+	Stakeholder meetings, reclamation, NRC review
West, Will	Landowner		2040 New Haven Rd. Oshoto, WY	1+	Stakeholder meetings, reclamation
Westover, Clint	Landowner		1754 D Road Oshoto, WY	3	Stakeholder meetings
Westover, Twitter	Landowner		1754 D Road Oshoto, WY	3	Stakeholder meetings
Wood, Dale	Landowner		271 Bertha Road Moorcroft, WY	3+	Stakeholder meetings, surface impacts, baseline monitoring, reclamation

Table 1.6-1 Stakeholders Consulted

Wood, Sherrie	Landowner		271 Bertha Road Moorcroft, WY	1	Stakeholder meetings
Zimmerschied, Bob	Landowner		PO Box 217 Buffalo, WY	2	Stakeholder meetings
Zimmerschied, Dan	Landowner		Unknown	1	Stakeholder meetings
Zimmerschied, DeDe	Landowner		Unknown	1	Stakeholder meetings
Zimmerschied, George	Landowner		Unknown	1	Stakeholder meetings
Zimmerschied, Grace	Landowner		300 Cabin Creek Road Oshoto, WY	1	Stakeholder meetings

ADDENDUM 3.2-A

ADJACENT ROAD NETWORK TRAFFIC ANALYSIS

Ross ISR Project
Crook County, Wyoming

Adjacent Road Network Traffic Analysis

Prepared for:

Strata Energy, Inc.
P.O. Box 2318
406 W. 4th Street
Gillette, WY 82717

December 2010

WWC ENGINEERING
Serving the Rocky Mountain region since 1980.
www.wwcengineering.com

Ross ISR Project
Crook County, Wyoming

Adjacent Road Network
Traffic Analysis

Prepared for: Strata Energy, Inc.
P.O. Box 2318
406 W. 4th St.
Gillette, Wyoming 82717

Prepared by: WWC Engineering
1849 Terra Avenue
Sheridan, Wyoming 82801
(307) 672-0761
Fax: (307) 674-4265

Principal Author: Benjamin Weaver, P.E., Project Engineer

Reviewed by: Jack Fritz, P.E., Project Engineer

TABLE OF CONTENTS

LIST OF FIGURES

LIST OF TABLES

LIST OF APPENDICES

Adjacent Road Network
Traffic Analysis
For
Ross ISR Project
Crook County, Wyoming

Background

Strata Energy, Inc. (Strata) began conducting baseline studies for the proposed Ross ISR project in January 2010. These baseline studies are included in the Environmental Report (ER) and the Technical Report (TR) which will be submitted to the United States Nuclear Regulatory Commission (NRC or the "Commission") as part of an application for a combined source and 11e.(2) byproduct material license to construct and operate an *in-situ* leach uranium recovery (ISR) facility at the proposed Ross ISR project site in Crook County.

The proposed Ross ISR Project will include a series of sequentially developed wellfield modules utilizing injection and recovery wells for uranium recovery, a monitor well network for detection of potential excursions of recovery solutions outside the ore body/recovery zone, and a central processing plant (CPP) consisting of ion exchange (IX) columns, resin stripping/elution facilities, precipitation circuit, water treatment, recycling and disposal systems, yellowcake drying and packaging facilities, and a vanadium recovery circuit. In addition to uranium and vanadium production, the proposed Ross ISR project will include waste management facilities, office and laboratory buildings, storage facilities and other structures or facilities used to house work areas and equipment.

Existing Transportation Network

As part of the baseline investigations for the proposed Ross ISR Project, Strata has conducted traffic studies to document existing traffic use of routes in the immediate vicinity of the project. Transportation routes within 50 miles of the proposed Ross ISR Project include Interstate highways, non-Interstate U.S. highways, state highways, county roads and local roads. The major corridors that could be used to access the

proposed project area include Interstate 90 approximately 20 miles south, U.S. Highway 14 approximately 10 miles southeast, State Highway 59 approximately 20 miles west and U.S. Highway 212 approximately 40 miles northeast. Regional and local transportation routes are shown on Figure 1.

The primary access to the proposed project area is along CR 68 (D Road) and CR 164 (the New Haven Road) from the south. The primary access route can be further described beginning at I-90 exit 153:

- Drive south on U.S. 14/16 for 0.1 mile
- Turn right and drive west on Highway 51 for 1.4 miles
- Turn right and drive north on CR 12 (Bertha Road) for 0.1 mile
- Turn right and drive north on CR 68 (D Road) for 18.3 miles
- Turn right and drive north on CR 164 (the New Haven Road) for 3.0 miles
- Turn left at the primary access road (future access road)

The total distance from I-90 exit 153 to the Ross ISR Project main access road is approximately 23 miles.

D Road is a 45-mile long north-south road which intersects with Bertha Road at I-90 near Moorcroft and connects with CR 85 (Rocky Point Road) 3 miles south of Rocky Point, Wyoming. This road is a two-lane paved/gravel road about 30 to 35 feet wide with posted speed limits of 55 mph for cars and 45 mph for trucks. The pavement section ends approximately 3 miles north from the intersection of D Road and Bertha Road. From the end of the pavement the road surface consists of reclaimed asphalt pavement (RAP) which has been “rotomilled” and blended with crushed base and subbase for approximately 7.3 miles. Beyond this section to the intersection with the New Haven Road, D Road has a gravel type surface. The New Haven Road is a two-lane crushed shale road approximately 25 to 30 feet wide. The speed limit is posted at 45 mph; however, the posted sign is located about 2 miles north of the proposed Ross ISR Project area. Therefore, northbound traffic traveling to the project area from D Road may not be aware of the change in speed limit. However, county speed limits on all roads not posted is 45 mph.

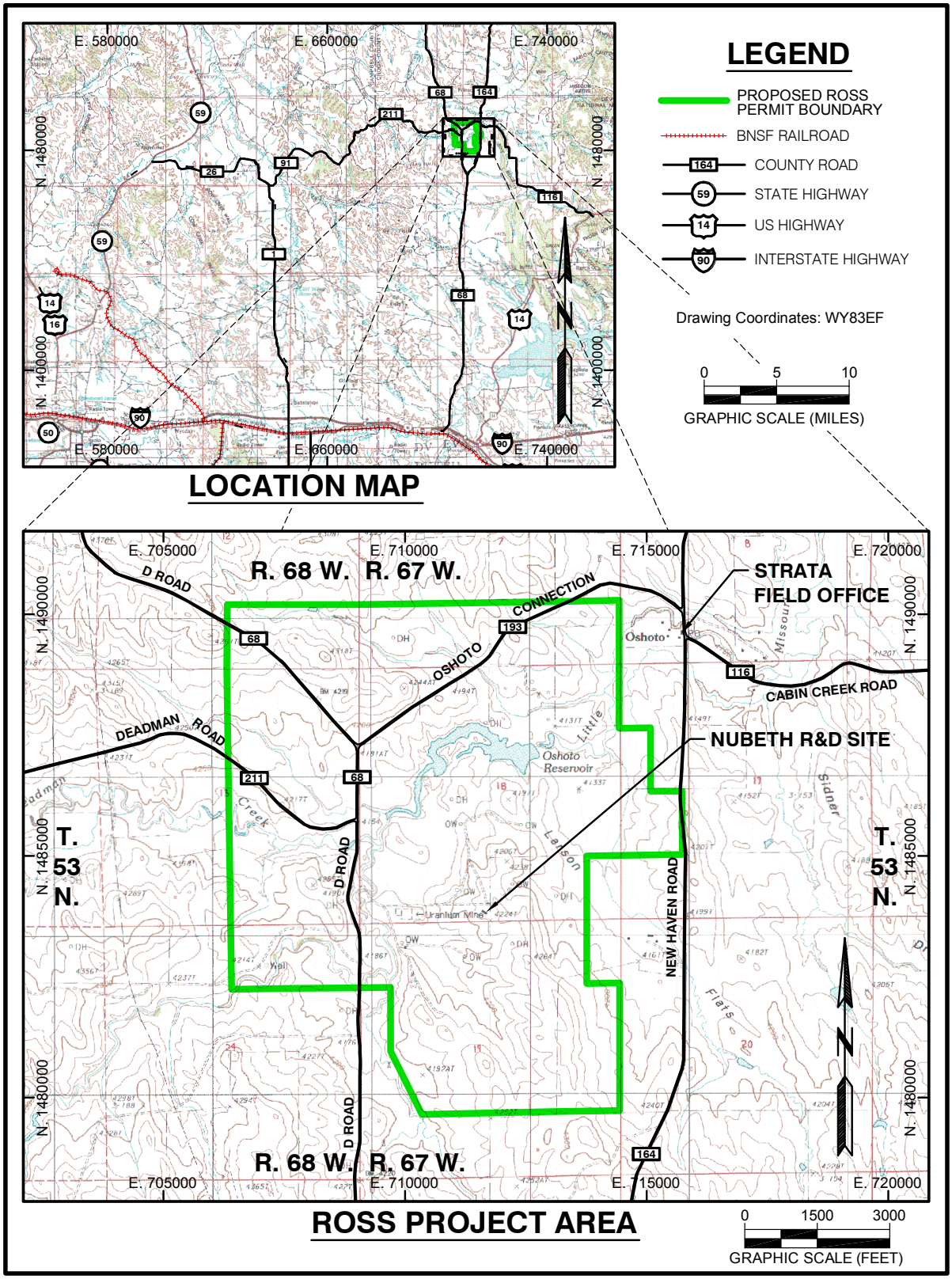

Figure 1. Existing Transportation Network

CR 193 (Oshoto Connection) is a two-lane crushed shale road and connects D Road to the New Haven Road along the northern portion of the proposed Ross ISR Project area. Deadman Road is a two-lane gravel road and connects to D Road 13 miles east of the intersection with CR 10 (Bergreen Road). All access roads to the project location are maintained year-round by Crook County. Routine maintenance includes snow removal, debris removal, blading and grading operations, and miscellaneous road repairs.

Traffic Study

Strata conducted a 2-week traffic study from May 20 to June 4, 2010 to quantify existing traffic conditions of the local road network. The goal of the traffic study was to collect baseline data for vehicle volumes, vehicle classifications and vehicle speeds to quantify pre-development conditions. The overall results for volume, classification and speed from the study are presented in Appendix A, Appendix B and Appendix C, respectively. Ten traffic counters were placed at designated locations within or adjacent to the proposed Ross ISR Project area to collect traffic data along each roadway segment and at all points where traffic is expected to access the area using public roadways. Figure 2 displays the traffic counter locations. Photos of each traffic counter installation are shown in Appendix G.

During the traffic study Strata was conducting exploratory drilling activities on May 20 and May 28 through June 4, 2010. Traffic levels during these days were not representative of baseline conditions and were not included in the analysis for volume and classification. The filtered data for the baseline volume and classification analyses, which omit these dates, are provided in Appendix D and Appendix E, respectively.

It is also important to note that Crook County was performing construction operations along D Road from the New Haven Road intersection to the Deadman Road intersection. Construction activities and detours contributed to slightly higher traffic volumes than expected on the New Haven Road and lower traffic volumes on D Road, respectively.

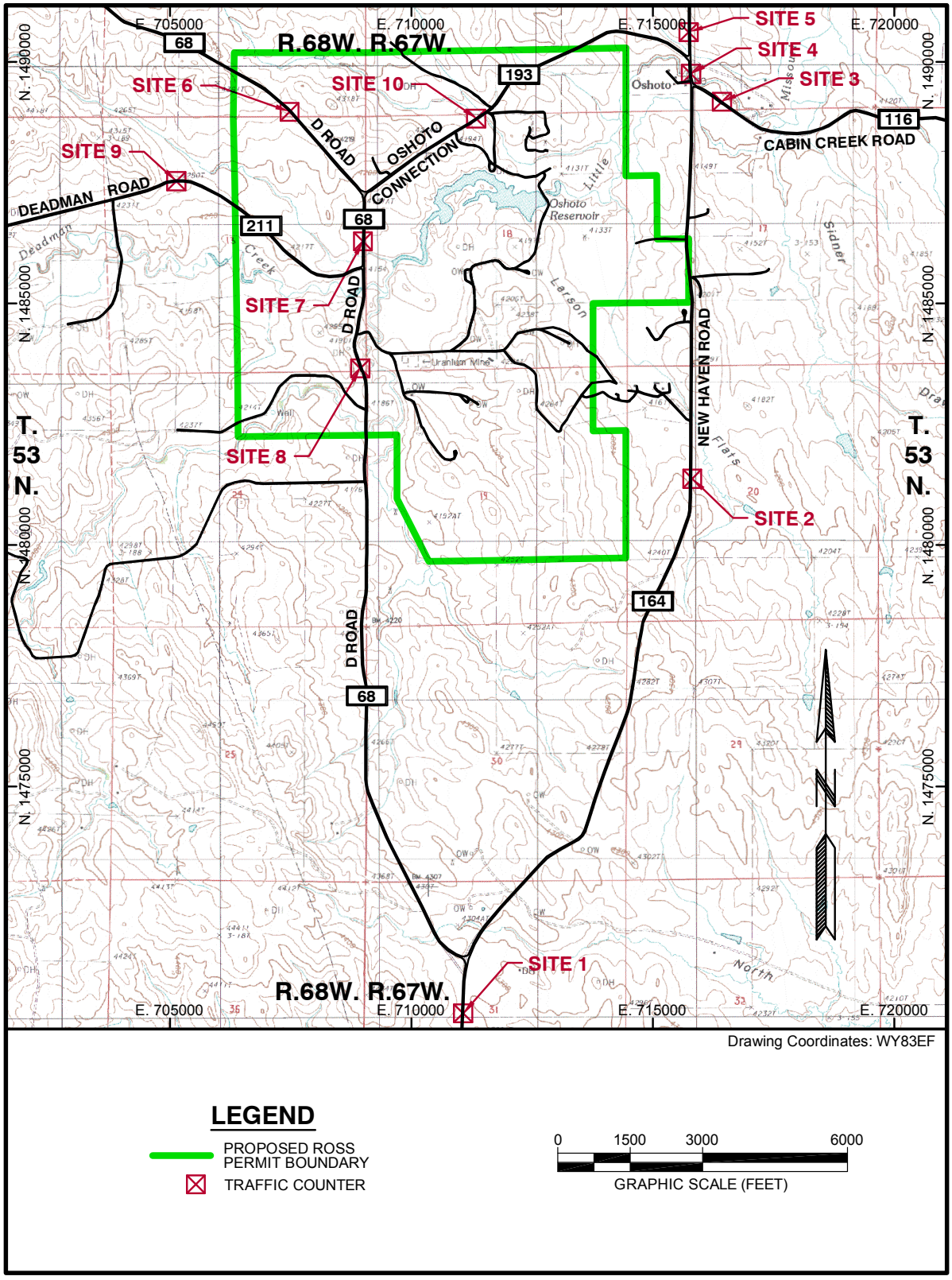

Figure 2. 2010 Traffic Counter Locations

Equipment

The 2010 traffic study was conducted using Apollo portable classifier data collectors from Diamond Traffic Products. The data collectors were equipped with solar panels and batteries, which allowed the units to function continuously during the study. Each data collector recorded the lane, time, axles, speed, length, gap and headway for each vehicle. Using computer algorithms the data were sorted into separate categories of vehicle classification using the Federal Highway Administration (FHWA) standard vehicle classification system, which includes 13 vehicle classes. This method allowed Strata to determine the amount and type of traffic at each counter location.

Each traffic counter included two road tubes, which were installed perpendicular to the flow of traffic at a fixed distance apart. This installation method allowed the counter processor to determine the direction of travel, the speed of the vehicle, and determine the vehicle classification according to the differential time each axle contacted each road tube.

Results

The 2010 traffic study results are presented in Table 1. The results indicate that some roadway sections have relatively high truck traffic percentages which may be attributed to other industries such as bentonite mining and are not associated with the proposed Ross ISR project. As previously stated, five exploratory drill rigs were in operation during a portion of the 2010 traffic study. These rigs were in operation on May 20 and from May 28 to June 4, 2010. The data collected during these times were not used in the analysis of traffic volumes or truck percentages. The results reported in Table 1 provide the most current existing data available used to quantify future traffic impacts along the roadway network.

The 2010 traffic study conducted by Strata also provided data for truck traffic volumes on each segment. During the study, the roadway network near the proposed Ross ISR project area was experiencing 5% to 13% truck traffic. The highest percentage of truck traffic was on the Oshoto Connection, between the New Haven

Table 1. 2010 Strata Traffic Study Results

SITE	COUNTY ROAD NUMBER	SITE DESCRIPTION	ADT[1] (veh/day)	Trucks[1] (%)	50th %tile Speed (mph)	85th %tile Speed (mph)
1	68	D Road (South of New Haven Road Intersection)	114	7%	50.8	59.2
2	164	New Haven Road (South of Proposed Facilities Site)	108	10%	49.3	57.7
3	116	Cabin Creek Road (East of New Haven Road Intersection)	63	9%	37.6	46.4
4	164	New Haven Road (South of Oshoto Connection Intersection and North of Cabin Creek Road Intersection)	138	8%	26.1	37.7
5	164	New Haven Road (North of Oshoto Connection Intersection)	58	12%	38.3	48.3
6	68	D Road (North of Oshoto Connection Intersection)	62	10%	42.0	51.9
7	68	D Road (South of Oshoto Connection Intersection and North of Deadman Road Intersection)	49	5%	38.8	47.9
8	68	D Road (South of Deadman Road Intersection)	25	6%	36.1	46.5
9	211	Deadman Road (West of D Road Intersection)	19	9%	32.1	39.6
10	193	Oshoto Connection (Just West of Center between D Road and New Haven Road)	87	13%	39.9	49.0

[1]Note: The traffic study was conducted from May 20 to June 4, 2010, but the time period May 20 and May 28 through June 4 was filtered out of the ADT and Trucks results due to interference from Strata exploratory drilling activities.

Road and D Road. The majority of truck traffic is attributed to bentonite mining near the project area.

Research on the safety of unpaved roads is presented in the National Cooperative Highway Research Program (NCHRP) Report 362 (NCHRP 1994). This report established that crash rates are generally higher for unpaved roads than for paved roads with traffic volumes of 250 vehicles per day or more. There were no road segments in or adjacent to the proposed Ross ISR Project area with an Average Daily Traffic (ADT) greater than 250 vehicles per day in the 2010 traffic studies. Additional information is available from the American Association of State Highway and Transportation Officials (AASHTO). The risk assessment conducted in the AASHTO Guidelines for Geometric Design of Very Low-Volume Local Roads (ADT ≤ 400) indicates that roads in rural areas generally reach the threshold at which paving the road would be expected to result in one less severe crash every 10 to 15 years at 300 to 350 vehicles per day (AASHTO 2001).

Speeds were analyzed during the 2010 traffic study, and the data indicate vehicle speeds were relatively high for unpaved surfaces. The speeds reported in Table 1 include the 50th percentile (median) and 85th percentile speeds. The 85th percentile speeds are those speeds at which 85% of the drivers drove at or below. High driving speeds are likely a result of drivers' familiarity with the roadway, low traffic volumes, and lack of enforcement. As traffic volumes increase the vehicle speeds will likely decrease. A decrease in speed may help to minimize deterioration of the gravel roadway surfaces, reduce dust and noise, and reduce the risk of accidents.

Roadway Conditions

To analyze and document the existing roadway conditions Strata assessed the majority of the roadway segments in the adjacent roadway network in November 2010 using the Asphalt Pavement Surface Evaluation and Rating (PASER) Manual (University of Wisconsin 2002) and the Gravel PASER Manual (University of Wisconsin 2002). The PASER analysis uses a visual method to assess the roadway condition. To more accurately analyze the conditions the roadway segments in the adjacent roadway

network were broken down into smaller more defined sections which were comprised of similar surfacing types and conditions.

The Ashpalt PASER manual details four major categories of common asphalt pavement surface distress:

1. Surface defects: raveling, flushing, polishing
2. Surface deformation: rutting, rippling and shoving, settling, frost heave
3. Cracking: transverse, reflective, longitudinal, block and alligator cracks
4. Patches and potholes

In a similar manner, the Gravel PASER manual details five road conditions that can be used to evaluate and rate gravel roads:

1. Crown – the height and condition of crown, and an unrestricted slope of roadway from the center across the shoulders to the ditches
2. Drainage – the ability of roadside ditches and under-road culverts to carry water away from the road
3. Gravel layer – adequate thickness and quality of gravel to carry the traffic loads
4. Surface deformation – washboarding, potholes and ruts
5. Surface defects – dust and loose aggregate

Results

Seven separate roadway segments were analyzed. The completed Asphalt and Gravel PASER rating forms are provided in Appendix F of this report. The critical segments in the adjacent roadway network are along D Road and the New Haven Road from the south as explained in previous sections above. The conclusions for each analyzed segment associated with the primary access route are as follows:

- The paved section of D Road is in poor condition due to cracking, rutting, and potholes.
- The RAP section of D Road was recently upgraded and is in good condition.

- The gravel section of D Road to the intersection of the New Haven Road is in good condition.
- The gravel (shale) section of the New Haven Road to the proposed primary access road is in good condition.

These conditions can be used as a baseline; however, the surface conditions of the gravel roadway segments can change very rapidly and are very sensitive to maintenance schedules. Environmental conditions and increased traffic can impact the surface condition dramatically. With routine maintenance activities, such as grading the road surfaces, conditions can be significantly improved.

Conclusion

Strata understands that impacts to the transportation system from the proposed Ross ISR project cannot be avoided but impacts can be minimized and corrective measures can be implemented through collaborative efforts between all parties affected. The traffic data collected in this study can be utilized to develop a roadway management system which can be used to quantify impacts directly related to the development of the proposed Ross ISR facility. Currently the traffic volumes on roads surrounding the project area are low and well within the acceptable volumes for gravel surfaced roadways. The existing roadway gravel surfaces with some preventative maintenance measures should provide adequate roadways for the local residents, ranchers, livestock haulers, bentonite transport, oil and gas operators, and recreational users. Some preventative maintenance measures may include additional grading operations and/or placing additional gravel surfacing in localized reaches to provide adequate surfacing thickness for the additional traffic and loading. It will likely be unnecessary to provide a paved surface to this facility as the anticipated traffic volumes are only likely to peak above 350 vehicles per day during the construction phase of the project. Strata understands that additional maintenance will be necessary along the primary access route and Strata will work with Crook County to provide adequate reimbursement for its associated share of any damages.

Any additional mitigation measures will be coordinated with Crook County and upon concurrence of all parties will be implemented if required. These measures include providing dust control along the primary access route and providing additional signing to keep traffic properly directed to the site. Additional signs may also include no use of engine brakes to aid in noise reduction near residences and other road users along the primary access route. Strata will also investigate the potential to re-route traffic (e.g., seasonally or during specific project phases) to reduce local impacts. Speed limits will be addressed to increase roadway safety, decrease dust emissions, decrease roadway damage and decrease noise levels. Strata has implemented a company policy to address speed limits; however, additional signing and enforcement along the primary access route would benefit other road users also. Strata proposes to work directly with Crook County to mitigate any impacts related to the development of the proposed Ross ISR Project.

References

American Association of State Highway and Transportation Officials (AASHTO), 2001, Guidelines for Geometric Design of Very Low-Volume Local Roads.

National Cooperative Highway Research Program (NCHRP), 1994, Report 362, Roadway Widths for Low-Volume Roads, Transportation Research Board, Washington, D.C.

University of Wisconsin, 2002, Asphalt PASER Manual, Pavement Surface Evaluation and Rating, UW Transportation Information Center, available from website on the Internet as of December 2010: <http://tic.engr.wisc.edu/>

University of Wisconsin, 2002, Gravel PASER Manual, Pavement Surface Evaluation and Rating, UW Transportation Information Center available from website on the Internet as of December 2010: <http://tic.engr.wisc.edu/>

APPENDIX A
OVERALL VOLUMES PER COUNTER SUMMARY

Basic Volume Summary: Site 001
D Road (South of New Haven Road Intersection)
Grand Total For Data From: 09:30 - 05/20/2010 To: 09:14 - 06/04/2010

Lane	Direction	Total Count	% of Total	# Of Days	ADT	Avg. Period	Avg. Hour	AM Total & Percent		PM Total & Percent	
#1.	Northbound	1092	49.7%	14.98	73	0.8	3	625	57.2%	467	42.8%
#3.	Southbound	1103	50.3%	14.98	74	0.8	3.1	416	37.7%	687	62.3%
Total		2195		14.98	147	1.6	6.1	1041	47.4%	1154	52.6%

Lane	Direction	Peak AM Hour		Date	Peak AM Factor	Peak PM Hour		Date	Peak PM Factor
#1.	Northbound	08:45 =	23	05/27/2010	0.639	12:45 =	15	06/03/2010	0.536
#3.	Southbound	10:15 =	13	05/27/2010	0.542	17:15 =	22	06/03/2010	0.500

Basic Volume Summary: Site 002
New Haven Road (South of Proposed Facilities Site)
Grand Total For Data From: 10:15 - 05/20/2010 To: 09:14 - 06/04/2010

Lane	Direction	Total Count	% of Total	# Of Days	ADT	Avg. Period	Avg. Hour	AM Total & Percent		PM Total & Percent	
#1.	Northbound	1009	49.8%	14.96	67	0.7	2.8	543	53.8%	466	46.2%
#3.	Southbound	1018	50.2%	14.96	68	0.7	2.8	384	37.7%	634	62.3%
Total		2027		14.96	135	1.4	5.6	927	45.7%	1100	54.3%

Lane	Direction	Peak AM Hour		Date	Peak AM Factor	Peak PM Hour		Date	Peak PM Factor
#1.	Northbound	09:00 =	17	05/27/2010	0.531	16:15 =	16	06/03/2010	0.444
#3.	Southbound	10:15 =	14	05/27/2010	0.700	17:00 =	19	06/03/2010	0.594

Basic Volume Summary: Site 003
Cabin Creek Road (East of New Haven Road Intersection)
Grand Total For Data From: 10:45 - 05/20/2010 To: 09:29 - 06/04/2010

Lane	Direction	Total Count	% of Total	# Of Days	ADT	Avg. Period	Avg. Hour	AM Total & Percent		PM Total & Percent	
#1.	Westbound	546	51.2%	14.95	37	0.4	1.5	227	41.6%	319	58.4%
#3.	Eastbound	520	48.8%	14.95	35	0.4	1.4	199	38.3%	321	61.7%
Total		1066		14.95	72	0.8	2.9	426	40.0%	640	60.0%

Lane	Direction	Peak AM Hour		Date	Peak AM Factor	Peak PM Hour		Date	Peak PM Factor
#1.	Westbound	08:30 =	11	06/04/2010	0.688	12:30 =	10	06/02/2010	0.357
#3.	Eastbound	09:15 =	10	05/30/2010	0.357	15:45 =	10	05/20/2010	0.500

Basic Volume Summary: Site 004
New Haven Road (South of Oshoto Connection Instersection and North of Cabin Creek Road Intersection)
Grand Total For Data From: 11:30 - 05/20/2010 To: 09:44 - 06/04/2010

Lane	Direction	Total Count	% of Total	# Of Days	ADT	Avg. Period	Avg. Hour	AM Total & Percent		PM Total & Percent	
#1.	Northbound	1524	50.2%	14.92	102	1.1	4.3	687	45.1%	837	54.9%
#3.	Southbound	1513	49.8%	14.92	101	1.1	4.2	605	40.0%	908	60.0%
Total		3037		14.92	203	2.2	8.5	1292	42.5%	1745	57.5%

Lane	Direction	Peak AM Hour		Date	Peak AM Factor	Peak PM Hour		Date	Peak PM Factor
#1.	Northbound	08:30 =	24	06/02/2010	0.500	13:00 =	22	06/03/2010	0.688
#3.	Southbound	11:00 =	17	06/02/2010	0.607	17:15 =	23	06/03/2010	0.639

Basic Volume Summary: Site 005
New Haven Road (North of Oshoto Connection Instersection)
Grand Total For Data From: 12:00 - 05/20/2010 To: 09:59 - 06/04/2010

Lane	Direction	Total Count	% of Total	# Of Days	ADT	Avg. Period	Avg. Hour	AM Total & Percent		PM Total & Percent	
#1.	Southbound	551	50.0%	14.91	37	0.4	1.5	254	46.1%	297	53.9%
#3.	Northbound	551	50.0%	14.91	37	0.4	1.5	172	31.2%	379	68.8%
Total		1102		14.91	74	0.8	3	426	38.7%	676	61.3%

Lane	Direction	Peak AM Hour		Date	Peak AM Factor	Peak PM Hour		Date	Peak PM Factor
#1.	Southbound	07:45 =	10	06/02/2010	0.625	16:30 =	10	05/31/2010	0.625
#3.	Northbound	09:45 =	9	06/03/2010	0.450	13:00 =	11	06/02/2010	0.393

Basic Volume Summary: Site 006
D Road (North of Oshoto Connection Intersection)
Grand Total For Data From: 12:30 - 05/20/2010 To: 10:14 - 06/04/2010

Lane	Direction	Total Count	% of Total	# Of Days	ADT	Avg. Period	Avg. Hour	AM Total & Percent		PM Total & Percent	
#1.	Southbound	576	51.0%	14.91	39	0.4	1.6	241	41.8%	335	58.2%
#3.	Northbound	554	49.0%	14.91	37	0.4	1.5	259	46.8%	295	53.2%
Total		1130		14.91	76	0.8	3.1	500	44.2%	630	55.8%

Lane	Direction	Peak AM Hour		Date	Peak AM Factor	Peak PM Hour		Date	Peak PM Factor
#1.	Southbound	09:15 =	16	06/01/2010	0.571	13:30 =	13	05/20/2010	0.406
#3.	Northbound	09:00 =	11	05/27/2010	0.393	18:30 =	10	05/20/2010	0.312

Basic Volume Summary: Site 007
D Road (South of Oshoto Connection Intersection and North of Deadman Road Intersection)
Grand Total For Data From: 13:00 - 05/20/2010 To: 10:14 - 06/04/2010

Lane	Direction	Total Count	% of Total	# Of Days	ADT	Avg. Period	Avg. Hour	AM Total & Percent		PM Total & Percent	
#1.	Southbound	772	51.0%	14.89	52	0.5	2.2	391	50.6%	381	49.4%
#3.	Northbound	743	49.0%	14.89	50	0.5	2.1	302	40.6%	441	59.4%
Total		1515		14.89	102	1	4.3	693	45.7%	822	54.3%

Lane	Direction	Peak AM Hour		Date	Peak AM Factor	Peak PM Hour		Date	Peak PM Factor
#1.	Southbound	09:15 =	15	06/01/2010	0.750	12:30 =	15	06/03/2010	0.625
#3.	Northbound	10:45 =	11	06/03/2010	0.393	17:00 =	17	06/03/2010	0.531

Basic Volume Summary: Site 008
D Road (South of Deadman Road Intersection)
Grand Total For Data From: 13:45 - 05/20/2010 To: 10:44 - 06/04/2010

Lane	Direction	Total Count	% of Total	# Of Days	ADT	Avg. Period	Avg. Hour	AM Total & Percent		PM Total & Percent	
#1.	Southbound	220	49.8%	14.88	15	0.2	0.6	115	52.3%	105	47.7%
#3.	Northbound	222	50.2%	14.88	15	0.2	0.6	131	59.0%	91	41.0%
Total		442		14.88	30	0.4	1.2	246	55.7%	196	44.3%

Lane	Direction	Peak AM Hour		Date	Peak AM Factor	Peak PM Hour		Date	Peak PM Factor
#1.	Southbound	09:45 =	8	06/04/2010	0.667	17:30 =	6	05/30/2010	0.500
#3.	Northbound	09:45 =	7	06/04/2010	0.583	12:00 =	4	05/21/2010	0.500

Basic Volume Summary: Site 009
Deadman Road (West of D Road Intersection)
Grand Total For Data From: 14:30 - 05/20/2010 To: 10:29 - 06/04/2010

Lane	Direction	Total Count	% of Total	# Of Days	ADT	Avg. Period	Avg. Hour	AM Total & Percent		PM Total & Percent	
#1.	Eastbound	151	45.2%	14.82	10	0.1	0.4	85	56.3%	66	43.7%
#3.	Westbound	183	54.8%	14.82	12	0.1	0.5	130	71.0%	53	29.0%
Total		334		14.82	22	0.2	0.9	215	64.4%	119	35.6%

Lane	Direction	Peak AM Hour		Date	Peak AM Factor	Peak PM Hour		Date	Peak PM Factor
#1.	Eastbound	08:30 =	4	05/24/2010	0.333	17:15 =	6	06/03/2010	0.750
#3.	Westbound	09:15 =	8	06/01/2010	0.667	16:15 =	5	06/03/2010	0.312

Basic Volume Summary: Site 010
Oshoto Connection (Just West of Center between D Road and New Haven Road)
Grand Total For Data From: 15:00 - 05/20/2010 To: 10:44 - 06/04/2010

Lane	Direction	Total Count	% of Total	# Of Days	ADT	Avg. Period	Avg. Hour	AM Total & Percent		PM Total & Percent	
#1.	Eastbound	1060	49.5%	14.82	72	0.7	3	391	36.9%	669	63.1%
#3.	Westbound	1080	50.5%	14.82	73	0.8	3	560	51.9%	520	48.1%
Total		2140		14.82	145	1.5	6	951	44.4%	1189	55.6%

Lane	Direction	Peak AM Hour		Date	Peak AM Factor	Peak PM Hour		Date	Peak PM Factor
#1.	Eastbound	09:45 =	15	06/01/2010	0.750	12:00 =	19	05/28/2010	0.679
#3.	Westbound	09:45 =	20	06/04/2010	0.556	12:30 =	18	06/03/2010	0.750

APPENDIX B
OVERALL CLASSIFICATIONS PER COUNTER SUMMARY

Basic Axle Class Summary: Site 001
D Road (South of New Haven Road Intersection)
Axle Data Summary From: 09:30 - 05/20/2010 To: 09:14 - 06/04/2010

Description / FHWA Class	Lane	Direction	#1 Cycle	#2 Cars	#3 2A-4T	#4 Buses	#5 2A-SU	#6 3A-SU	#7 4A-SU	#8 4A-ST	#9 5A-ST	#10 6A-ST	#11 5A-MT	#12 6A-MT	#13 Other	Total	Total Trucks / % Trucks
TOTAL COUNT :	#1.	Northbound	2	247	696	0	10	30	8	8	28	0	3	0	55	1087	142
	#3.	Southbound	8	242	690	0	12	29	8	17	20	2	3	1	62	1094	154
Total			10	489	1386	0	22	59	16	25	48	2	6	1	117	2181	296
Percents :	#1.	Northbound	0%	23%	64%	0%	1%	3%	1%	1%	3%	0%	0%	0%	5%	50%	
	#3.	Southbound	1%	22%	63%	0%	1%	3%	1%	2%	2%	0%	0%	0%	6%	50%	
Total			0%	22%	64%	0%	1%	3%	1%	1%	2%	0%	0%	0%	5%	100%	14%
Days & ADT :	#1.	Northbound	14.9	72													
	#3.	Southbound	14.9	73													
Total			14.9	145													

Basic Axle Class Summary: Site 002
New Haven Road (South of Proposed Facilities Site)
Axle Data Summary From: 10:15 - 05/20/2010 To: 09:14 - 06/04/2010

Description / FHWA Class	Lane	Direction	#1 Cycle	#2 Cars	#3 2A-4T	#4 Buses	#5 2A-SU	#6 3A-SU	#7 4A-SU	#8 4A-ST	#9 5A-ST	#10 6A-ST	#11 5A-MT	#12 6A-MT	#13 Other	Total	Total Trucks / % Trucks
TOTAL COUNT :	#1.	Northbound	6	238	608	0	18	34	8	9	28	1	4	0	55	1009	157
	#3.	Southbound	7	235	606	0	11	33	8	17	19	2	5	2	73	1018	170
Total			13	473	1214	0	29	67	16	26	47	3	9	2	128	2027	327
Percents :	#1.	Northbound	1%	24%	60%	0%	2%	3%	1%	1%	3%	0%	0%	0%	5%	50%	
	#3.	Southbound	1%	23%	60%	0%	1%	3%	1%	2%	2%	0%	0%	0%	7%	50%	
Total			1%	23%	60%	0%	1%	3%	1%	1%	2%	0%	0%	0%	6%	100%	16%
Days & ADT :	#1.	Northbound	14.9	67													
	#3.	Southbound	14.9	68													
Total			14.9	135													

Basic Axle Class Summary: Site 003
Cabin Creek Road (East of New Haven Road Intersection)
Axle Data Summary From: 10:45 - 05/20/2010 To: 09:29 - 06/04/2010

Description / FHWA Class	Lane	Direction	#1 Cycle	#2 Cars	#3 2A-4T	#4 Buses	#5 2A-SU	#6 3A-SU	#7 4A-SU	#8 4A-ST	#9 5A-ST	#10 6A-ST	#11 5A-MT	#12 6A-MT	#13 Other	Total	Total Trucks / % Trucks
TOTAL COUNT :	#1.	Westbound	9	127	359	0	5	4	1	2	15	7	0	0	14	543	48
	#3.	Eastbound	4	130	335	0	6	7	0	2	16	9	0	0	8	517	48
Total			13	257	694	0	11	11	1	4	31	16	0	0	22	1060	96
Percents :	#1.	Westbound	2%	23%	66%	0%	1%	1%	0%	0%	3%	1%	0%	0%	3%	51%	
	#3.	Eastbound	1%	25%	65%	0%	1%	1%	0%	0%	3%	2%	0%	0%	2%	49%	
Total			1%	24%	65%	0%	1%	1%	0%	0%	3%	2%	0%	0%	2%	100%	9%
Days & ADT :	#1.	Westbound	14.9	36													
	#3.	Eastbound	14.9	34													
Total			14.9	70													

Basic Axle Class Summary: Site 004
New Haven Road (South of Oshoto Connection Instersection and North of Cabin Creek Road Intersection)
Axle Data Summary From: 11:30 - 05/20/2010 To: 09:44 - 06/04/2010

Description / FHWA Class	Lane	Direction	#1 Cycle	#2 Cars	#3 2A-4T	#4 Buses	#5 2A-SU	#6 3A-SU	#7 4A-SU	#8 4A-ST	#9 5A-ST	#10 6A-ST	#11 5A-MT	#12 6A-MT	#13 Other	Total	Total Trucks / % Trucks
TOTAL COUNT :	#1.	Northbound	58	467	789	1	11	20	8	27	15	6	5	3	102	1512	198
	#3.	Southbound	21	354	917	1	15	35	8	42	31	10	3	0	71	1508	216
Total			79	821	1706	2	26	55	16	69	46	16	8	3	173	3020	414
Percents :	#1.	Northbound	4%	31%	52%	0%	1%	1%	1%	2%	1%	0%	0%	0%	7%	50%	
	#3.	Southbound	1%	23%	61%	0%	1%	2%	1%	3%	2%	1%	0%	0%	5%	50%	
Total			3%	27%	56%	0%	1%	2%	1%	2%	2%	1%	0%	0%	6%	100%	14%
Days & ADT :	#1.	Northbound	14.9	101													
	#3.	Southbound	14.9	101													
Total			14.9	202													

Basic Axle Class Summary: Site 005
New Haven Road (North of Oshoto Connection Instersection)
Axle Data Summary From: 12:00 - 05/20/2010 To: 09:59 - 06/04/2010

Description / FHWA Class	Lane	Direction	#1 Cycle	#2 Cars	#3 2A-4T	#4 Buses	#5 2A-SU	#6 3A-SU	#7 4A-SU	#8 4A-ST	#9 5A-ST	#10 6A-ST	#11 5A-MT	#12 6A-MT	#13 Other	Total	Total Trucks / % Trucks
TOTAL COUNT :	#1.	Southbound	24	151	208	0	3	1	0	4	3	3	3	0	149	549	166
	#3.	Northbound	0	171	278	0	4	1	0	2	40	1	0	0	54	551	102
Total			24	322	486	0	7	2	0	6	43	4	3	0	203	1100	268
Percents :	#1.	Southbound	4%	28%	38%	0%	1%	0%	0%	1%	1%	1%	1%	0%	27%	50%	
	#3.	Northbound	0%	31%	50%	0%	1%	0%	0%	0%	7%	0%	0%	0%	10%	50%	
Total			2%	29%	44%	0%	1%	0%	0%	1%	4%	0%	0%	0%	18%	100%	24%
Days & ADT :	#1.	Southbound	14.9	36													
	#3.	Northbound	14.9	36													
Total			14.9	72													

Basic Axle Class Summary: Site 006
D Road (North of Oshoto Connection Intersection)
Axle Data Summary From: 12:30 - 05/20/2010 To: 10:14 - 06/04/2010

Description / FHWA Class	Lane	Direction	#1 Cycle	#2 Cars	#3 2A-4T	#4 Buses	#5 2A-SU	#6 3A-SU	#7 4A-SU	#8 4A-ST	#9 5A-ST	#10 6A-ST	#11 5A-MT	#12 6A-MT	#13 Other	Total	Total Trucks / % Trucks
TOTAL COUNT :	#1.	Southbound	2	111	372	0	6	19	6	9	21	7	2	0	14	569	84
	#3.	Northbound	2	92	383	0	6	14	9	3	24	6	3	0	6	548	71
Total			4	203	755	0	12	33	15	12	45	13	5	0	20	1117	155
Percents :	#1.	Southbound	0%	20%	65%	0%	1%	3%	1%	2%	4%	1%	0%	0%	2%	51%	
	#3.	Northbound	0%	17%	70%	0%	1%	3%	2%	1%	4%	1%	1%	0%	1%	49%	
Total			0%	18%	68%	0%	1%	3%	1%	1%	4%	1%	0%	0%	2%	100%	14%
Days & ADT :	#1.	Southbound	14.9	38													
	#3.	Northbound	14.9	36													
Total			14.9	74													

Basic Axle Class Summary: Site 007
D Road (South of Oshoto Connection Intersection and North of Deadman Road Intersection)
Axle Data Summary From: 13:00 - 05/20/2010 To: 10:14 - 06/04/2010

Description / FHWA Class	Lane	Direction	#1 Cycle	#2 Cars	#3 2A-4T	#4 Buses	#5 2A-SU	#6 3A-SU	#7 4A-SU	#8 4A-ST	#9 5A-ST	#10 6A-ST	#11 5A-MT	#12 6A-MT	#13 Other	Total	Total Trucks / % Trucks
TOTAL COUNT :	#1.	Southbound	7	161	498	0	6	46	0	25	18	3	3	0	5	772	106
	#3.	Northbound	7	167	474	0	2	40	9	13	18	3	0	0	10	743	95
Total			14	328	972	0	8	86	9	38	36	6	3	0	15	1515	201
Percents :	#1.	Southbound	1%	21%	65%	0%	1%	6%	0%	3%	2%	0%	0%	0%	1%	51%	
	#3.	Northbound	1%	22%	64%	0%	0%	5%	1%	2%	2%	0%	0%	0%	1%	49%	
Total			1%	22%	64%	0%	1%	6%	1%	2%	2%	0%	0%	0%	1%	100%	13%
Days & ADT :	#1.	Southbound	14.8	52													
	#3.	Northbound	14.8	50													
Total			14.8	102													

Basic Axle Class Summary: Site 008
D Road (South of Deadman Road Intersection)
Axle Data Summary From: 13:45 - 05/20/2010 To: 10:44 - 06/04/2010

Description / FHWA Class	Lane	Direction	#1 Cycle	#2 Cars	#3 2A-4T	#4 Buses	#5 2A-SU	#6 3A-SU	#7 4A-SU	#8 4A-ST	#9 5A-ST	#10 6A-ST	#11 5A-MT	#12 6A-MT	#13 Other	Total	Total Trucks / % Trucks
TOTAL COUNT :	#1.	Southbound	6	16	168	0	4	4	0	1	16	0	1	0	4	220	30
	#3.	Northbound	4	13	171	0	3	2	0	4	18	0	1	0	2	218	30
Total			10	29	339	0	7	6	0	5	34	0	2	0	6	438	60
Percents :	#1.	Southbound	3%	7%	76%	0%	2%	2%	0%	0%	7%	0%	0%	0%	2%	50%	
	#3.	Northbound	2%	6%	78%	0%	1%	1%	0%	2%	8%	0%	0%	0%	1%	50%	
Total			2%	7%	77%	0%	2%	1%	0%	1%	8%	0%	0%	0%	1%	100%	14%
Days & ADT :	#1.	Southbound	14.8	14													
	#3.	Northbound	14.8	14													
Total			14.8	28													

Basic Axle Class Summary: Site 009
Deadman Road (West of D Road Intersection)
Axle Data Summary From: 14:30 - 05/20/2010 To: 10:29 - 06/04/2010

Description / FHWA Class	Lane	Direction	#1 Cycle	#2 Cars	#3 2A-4T	#4 Buses	#5 2A-SU	#6 3A-SU	#7 4A-SU	#8 4A-ST	#9 5A-ST	#10 6A-ST	#11 5A-MT	#12 6A-MT	#13 Other	Total	Total Trucks / % Trucks
TOTAL COUNT :	#1.	Eastbound	1	11	123	0	4	5	0	1	1	1	0	0	2	149	14
	#3.	Westbound	5	18	134	0	2	2	2	2	5	0	2	0	8	180	23
Total			6	29	257	0	6	7	2	3	6	1	2	0	10	329	37
Percents :	#1.	Eastbound	1%	7%	83%	0%	3%	3%	0%	1%	1%	1%	0%	0%	1%	45%	
	#3.	Westbound	3%	10%	74%	0%	1%	1%	1%	1%	3%	0%	1%	0%	4%	55%	
Total			2%	9%	78%	0%	2%	2%	1%	1%	2%	0%	1%	0%	3%	100%	11%
Days & ADT :	#1.	Eastbound	14.8	10													
	#3.	Westbound	14.8	12													
Total			14.8	22													

Basic Axle Class Summary: Site 010
Oshoto Connection (Just West of Center between D Road and New Haven Road)
Axle Data Summary From: 15:00 - 05/20/2010 To: 10:44 - 06/04/2010

Description / FHWA Class	Lane	Direction	#1 Cycle	#2 Cars	#3 2A-4T	#4 Buses	#5 2A-SU	#6 3A-SU	#7 4A-SU	#8 4A-ST	#9 5A-ST	#10 6A-ST	#11 5A-MT	#12 6A-MT	#13 Other	Total	Total Trucks / % Trucks
TOTAL COUNT :	#1.	Eastbound	14	210	638	0	9	26	12	33	12	13	6	0	84	1057	195
	#3.	Westbound	5	216	719	0	8	44	19	8	34	10	4	0	10	1077	137
Total			19	426	1357	0	17	70	31	41	46	23	10	0	94	2134	332
Percents :	#1.	Eastbound	1%	20%	60%	0%	1%	2%	1%	3%	1%	1%	1%	0%	8%	50%	
	#3.	Westbound	0%	20%	67%	0%	1%	4%	2%	1%	3%	1%	0%	0%	1%	50%	
Total			1%	20%	64%	0%	1%	3%	1%	2%	2%	1%	0%	0%	4%	100%	16%
Days & ADT :	#1.	Eastbound	14.8	71													
	#3.	Westbound	14.8	72													
Total			14.8	143													

APPENDIX C
OVERALL SPEEDS PER COUNTER SUMMARY

Column Speed Study Summary: Site 001
D Road (South of New Haven Road Intersection)
Data From: 09:30 - 05/20/2010 To: 09:14 - 06/04/2010

Description	10mph Pace	Mean	Percents (MPH)							Overspeeds (MPH)										Total
		(MPH)	15%	30%	50%	67%	70%	85%	95%	> 30	%	> 45	%	> 50	%	> 55	%	> 60	%	
Grand Total #1:	50-60 (47%)	51.8	43.1	47.8	52.3	55.7	56.4	59.8	67.0	1071	98.5%	880	81.0%	662	60.9%	384	35.3%	154	14.2%	1087
Grand Total #3:	45-55 (47%)	49.2	40.7	44.9	49.1	52.7	53.3	58.0	64.0	1083	99.0%	759	69.4%	497	45.4%	245	22.4%	118	10.8%	1094
Comb. Total :	45-55 (46%)	50.5	41.7	46.3	50.8	54.1	54.8	59.2	65.0	2154	98.8%	1639	75.1%	1159	53.1%	628	28.8%	270	12.4%	2181

Column Speed Study Summary: Site 002
New Haven Road (South of Proposed Facilities Site)
Data From: 10:15 - 05/20/2010 To: 09:14 - 06/04/2010

Description	10mph Pace	Mean	Percents (MPH)							Overspeeds (MPH)										Total
		(MPH)	15%	30%	50%	67%	70%	85%	95%	> 30	%	> 45	%	> 50	%	> 55	%	> 60	%	
Grand Total #1:	45-55 (52%)	51.6	45.1	48.3	52.1	54.9	55.9	59.2	64.0	992	98.3%	857	84.9%	621	61.5%	328	32.5%	124	12.3%	1009
Grand Total #3:	41-51 (48%)	46.2	37.8	42.2	46.6	49.6	50.4	54.0	59.7	990	97.2%	581	57.1%	315	30.9%	120	11.8%	50	4.9%	1018
Comb. Total :	45-55 (49%)	48.9	40.6	45.3	49.3	52.8	53.4	57.7	62.8	1982	97.8%	1437	70.9%	934	46.1%	447	22.1%	174	8.6%	2027

Column Speed Study Summary: Site 003
Cabin Creek Road (East of New Haven Road Intersection)
Data From: 10:45 - 05/20/2010 To: 09:29 - 06/04/2010

Description	10mph Pace	Mean	Percents (MPH)							Overspeeds (MPH)										Total
		(MPH)	15%	30%	50%	67%	70%	85%	95%	> 30	%	> 45	%	> 50	%	> 55	%	> 60	%	
Grand Total #1:	35-45 (44%)	38.0	28.8	33.1	38.0	42.1	42.6	47.3	52.8	452	83.2%	113	20.8%	46	8.5%	21	3.9%	4	0.7%	543
Grand Total #3:	35-45 (48%)	36.4	28.6	32.9	37.3	40.8	41.6	44.3	48.5	429	83.0%	66	12.8%	17	3.3%	6	1.2%	1	0.2%	517
Comb. Total :	35-45 (46%)	37.2	29.0	33.2	37.6	41.3	42.0	46.4	52.1	881	83.1%	178	16.8%	63	5.9%	27	2.5%	5	0.5%	1060

Column Speed Study Summary: Site 004
New Haven Road (South of Oshoto Connection Instersection and North of Cabin Creek Road Intersection)
Data From: 11:30 - 05/20/2010 To: 09:44 - 06/04/2010

Description	10mph Pace	Mean	Percents (MPH)							Overspeeds (MPH)										Total
		(MPH)	15%	30%	50%	67%	70%	85%	95%	> 30	%	> 45	%	> 50	%	> 55	%	> 60	%	
Grand Total #1:	20-30 (41%)	26.4	12.5	21.7	26.3	31.5	32.4	38.8	46.7	551	36.4%	89	5.9%	38	2.5%	17	1.1%	4	0.3%	1512
Grand Total #3:	20-30 (51%)	25.9	15.5	22.2	26.2	29.5	30.3	36.4	42.9	459	30.4%	47	3.1%	15	1.0%	6	0.4%	1	0.1%	1508
Comb. Total :	20-30 (46%)	26.2	14.5	22.0	26.1	30.3	31.4	37.7	44.6	1008	33.4%	135	4.5%	53	1.8%	23	0.8%	5	0.2%	3020

Column Speed Study Summary: Site 005
New Haven Road (North of Oshoto Connection Instersection)
Data From: 12:00 - 05/20/2010 To: 09:59 - 06/04/2010

Description	10mph Pace	Mean	Percents (MPH)							Overspeeds (MPH)										Total
		(MPH)	15%	30%	50%	67%	70%	85%	95%	> 30	%	> 45	%	> 50	%	> 55	%	> 60	%	
Grand Total #1:	35-45 (46%)	39.5	30.6	35.9	39.3	43.3	44.1	49.3	53.7	470	85.6%	151	27.5%	74	13.5%	22	4.0%	9	1.6%	549
Grand Total #3:	31-41 (44%)	37.3	28.1	32.5	37.2	41.2	42.1	47.2	52.7	441	80.0%	106	19.2%	48	8.7%	15	2.7%	4	0.7%	551
Comb. Total :	35-45 (43%)	38.4	28.6	33.9	38.3	42.4	43.1	48.3	53.9	909	82.6%	256	23.3%	120	10.9%	37	3.4%	13	1.2%	1100

Column Speed Study Summary: Site 006
D Road (North of Oshoto Connection Intersection)
Data From: 12:30 - 05/20/2010 To: 10:14 - 06/04/2010

Description	10mph Pace	Mean	Percents (MPH)							Overspeeds (MPH)										Total
		(MPH)	15%	30%	50%	67%	70%	85%	95%	> 30	%	> 45	%	> 50	%	> 55	%	> 60	%	
Grand Total #1:	40-50 (39%)	42.9	32.7	37.8	43.1	47.7	48.3	53.3	58.6	511	89.8%	253	44.5%	135	23.7%	63	11.1%	29	5.1%	569
Grand Total #3:	36-46 (45%)	40.1	31.3	36.6	41.1	44.3	45.4	49.4	53.9	476	86.9%	169	30.8%	74	13.5%	26	4.7%	13	2.4%	548
Comb. Total :	35-45 (41%)	41.6	32.0	37.2	42.0	46.4	47.1	51.9	58.1	985	88.2%	422	37.8%	207	18.5%	89	8.0%	42	3.8%	1117

Column Speed Study Summary: Site 007
D Road (South of Oshoto Connection Intersection and North of Deadman Road Intersection)
Data From: 13:00 - 05/20/2010 To: 10:14 - 06/04/2010

Description	10mph Pace	Mean	Percents (MPH)							Overspeeds (MPH)										Total
		(MPH)	15%	30%	50%	67%	70%	85%	95%	> 30	%	> 45	%	> 50	%	> 55	%	> 60	%	
Grand Total #1:	35-45 (46%)	38.2	27.1	34.8	39.5	43.0	43.7	48.1	53.4	616	79.8%	188	24.4%	80	10.4%	26	3.4%	8	1.0%	772
Grand Total #3:	35-45 (47%)	37.3	26.9	33.7	38.2	42.0	42.7	47.5	53.0	601	80.9%	153	20.6%	72	9.7%	21	2.8%	11	1.5%	743
Comb. Total :	35-45 (46%)	37.8	27.0	34.4	38.8	42.6	43.2	47.9	53.3	1215	80.2%	341	22.5%	150	9.9%	47	3.1%	19	1.3%	1515

Column Speed Study Summary: Site 008
D Road (South of Deadman Road Intersection)
Data From: 13:45 - 05/20/2010 To: 10:44 - 06/04/2010

Description	10mph Pace	Mean	Percents (MPH)							Overspeeds (MPH)										Total
		(MPH)	15%	30%	50%	67%	70%	85%	95%	> 30	%	> 45	%	> 50	%	> 55	%	> 60	%	
Grand Total #1:	31-41 (39%)	34.3	22.7	28.2	36.2	38.5	38.9	43.5	48.2	152	69.1%	33	15.0%	9	4.1%	7	3.2%	6	2.7%	220
Grand Total #3:	36-46 (39%)	36.3	27.0	31.9	37.3	41.9	42.3	47.2	52.6	163	74.8%	40	18.3%	16	7.3%	8	3.7%	6	2.8%	218
Comb. Total :	35-45 (37%)	35.3	23.5	30.5	36.1	40.5	41.3	46.5	52.4	314	71.7%	73	16.7%	25	5.7%	15	3.4%	12	2.7%	438

Column Speed Study Summary: Site 009
Deadman Road (West of D Road Intersection)
Data From: 14:30 - 05/20/2010 To: 10:29 - 06/04/2010

Description	10mph Pace	Mean	Percents (MPH)							Overspeeds (MPH)										Total
		(MPH)	15%	30%	50%	67%	70%	85%	95%	> 30	%	> 45	%	> 50	%	> 55	%	> 60	%	
Grand Total #1:	26-36 (48%)	30.5	22.6	27.2	31.8	33.3	36.7	38.1	42.8	80	53.7%	7	4.7%	0	0.0%	0	0.0%	0	0.0%	149
Grand Total #3:	31-41 (48%)	32.6	26.5	28.1	32.7	37.0	37.3	42.1	47.3	117	65.0%	10	5.6%	1	0.6%	0	0.0%	0	0.0%	180
Comb. Total :	25-35 (47%)	31.6	23.2	27.8	32.1	35.9	36.5	39.6	43.4	197	59.9%	17	5.2%	1	0.3%	0	0.0%	0	0.0%	329

Column Speed Study Summary: Site 010
Oshoto Connection (Just West of Center between D Road and New Haven Road)
Data From: 15:00 - 05/20/2010 To: 10:44 - 06/04/2010

Description	10mph Pace	Mean	Percents (MPH)							Overspeeds (MPH)										Total
		(MPH)	15%	30%	50%	67%	70%	85%	95%	> 30	%	> 45	%	> 50	%	> 55	%	> 60	%	
Grand Total #1:	40-50 (42%)	41.5	31.1	37.4	42.6	46.7	47.3	52.1	57.7	915	86.6%	410	38.8%	206	19.5%	85	8.0%	27	2.6%	1057
Grand Total #3:	35-45 (49%)	36.2	26.8	32.9	37.6	40.9	41.6	44.8	49.8	843	78.3%	152	14.1%	51	4.7%	15	1.4%	6	0.6%	1077
Comb. Total :	35-45 (44%)	38.8	28.4	35.2	39.9	43.6	44.2	49.0	54.7	1757	82.3%	562	26.3%	257	12.0%	100	4.7%	33	1.5%	2134

APPENDIX D
FILTERED VOLUMES PER COUNTER SUMMARY

Basic Volume Summary: Site 001
D Road (South of New Haven Road Intersection)

		Northbound	Southbound	Total	Avg
		Lane 1	Lane 3	veh/day	veh/day
5/20/2010	*	58	90	148	175
5/21/2010		65	61	126	114
5/22/2010		41	37	78	
5/23/2010		40	43	83	
5/24/2010		52	58	110	
5/25/2010		53	57	110	
5/26/2010		66	71	137	
5/27/2010		78	77	155	
5/28/2010		79	76	155	
5/29/2010		65	58	123	
5/30/2010		61	65	126	
5/31/2010		75	82	157	
6/1/2010		89	94	183	
6/2/2010		107	101	208	
6/3/2010		126	120	246	
6/4/2010	*	37	13	50	
Total Veh		1092	1103	2195	
ADT		73	74	147	

No exploratory drill rigs operating
Exploratory Drilling
* Begin and end count days account for 24 hours of data

Basic Volume Summary: Site 002
New Haven Road (South of Proposed Facilities Site)

		Northbound	Southbound	Total	Avg
		Lane 1	Lane 3	veh/day	veh/day
5/20/2010	*	49	79	128	160
5/21/2010		58	56	114	108
5/22/2010		36	34	70	
5/23/2010		33	37	70	
5/24/2010		53	58	111	
5/25/2010		55	58	113	
5/26/2010		62	68	130	
5/27/2010		74	72	146	
5/28/2010		77	74	151	
5/29/2010		59	52	111	
5/30/2010		55	52	107	
5/31/2010		63	68	131	
6/1/2010		86	91	177	
6/2/2010		99	96	195	
6/3/2010		118	110	228	
6/4/2010	*	32	13	45	
Total Veh		1009	1018	2027	
ADT		67	68	135	

No exploratory drill rigs operating
Exploratory Drilling
* Begin and end count days account for 23 hours of data

Basic Volume Summary: Site 003
Cabin Creek Road (East of New Haven Road Intersection)

		Westbound Lane 1	Eastbound Lane 3	Total veh/day	Avg veh/day
5/20/2010	*	38	41	79	78
5/21/2010		40	43	83	63
5/22/2010		19	22	41	
5/23/2010		33	27	60	
5/24/2010		24	22	46	
5/25/2010		39	35	74	
5/26/2010		37	35	72	
5/27/2010		32	34	66	
5/28/2010		33	33	66	
5/29/2010		30	29	59	
5/30/2010		35	28	63	
5/31/2010		38	30	68	
6/1/2010		34	36	70	
6/2/2010		52	48	100	
6/3/2010		44	47	91	
6/4/2010	*	18	10	28	
Total Veh		546	520	1066	
ADT		37	35	72	

No exploratory drill rigs operating
Exploratory Drilling
* Begin and end count days account for 23 hours of data

Basic Volume Summary: Site 004
New Haven Road (South of Oshoto Connection Instersection and North of Cabin Creek Road Intersection)

		Northbound Lane 1	Southbound Lane 3	Total veh/day	Avg veh/day
5/20/2010	*	81	110	191	261
5/21/2010		80	81	161	138
5/22/2010		46	46	92	
5/23/2010		48	45	93	
5/24/2010		58	61	119	
5/25/2010		80	75	155	
5/26/2010		82	86	168	
5/27/2010		91	90	181	
5/28/2010		129	124	253	
5/29/2010		106	96	202	
5/30/2010		107	98	205	
5/31/2010		118	119	237	
6/1/2010		134	142	276	
6/2/2010		156	153	309	
6/3/2010		168	166	334	
6/4/2010	*	40	21	61	
Total Veh		1524	1513	3037	
ADT		102	101	203	

No exploratory drill rigs operating
Exploratory Drilling
* Begin and end count days account for 22 hours of data

Basic Volume Summary: Site 005
New Haven Road (North of Oshoto Connection Instersection)

		Southbound	Northbound	Total	Avg
		Lane 1	Lane 3	veh/day	veh/day
5/20/2010	*	27	33	60	88
5/21/2010		37	32	69	58
5/22/2010		19	22	41	
5/23/2010		24	27	51	
5/24/2010		25	24	49	
5/25/2010		28	31	59	
5/26/2010		37	37	74	
5/27/2010		32	30	62	
5/28/2010		38	37	75	
5/29/2010		26	31	57	
5/30/2010		31	32	63	
5/31/2010		54	56	110	
6/1/2010		49	47	96	
6/2/2010		44	45	89	
6/3/2010		63	58	121	
6/4/2010	*	17	9	26	
Total Veh		551	551	1102	
ADT		37	37	74	

No exploratory drill rigs operating
Exploratory Drilling
* Begin and end count days account for 22 hours of data

Basic Volume Summary: Site 006
D Road (North of Oshoto Connection Intersection)

		Southbound	Northbound	Total	Avg
		Lane 1	Lane 3	veh/day	veh/day
5/20/2010	*	58	36	94	88
5/21/2010		34	37	71	62
5/22/2010		24	22	46	
5/23/2010		21	21	42	
5/24/2010		26	22	48	
5/25/2010		43	40	83	
5/26/2010		36	34	70	
5/27/2010		35	37	72	
5/28/2010		44	46	90	
5/29/2010		18	19	37	
5/30/2010		32	32	64	
5/31/2010		31	25	56	
6/1/2010		54	46	100	
6/2/2010		51	50	101	
6/3/2010		59	64	123	
6/4/2010	*	10	23	33	
Total Veh		576	554	1130	
ADT		39	37	76	

No exploratory drill rigs operating
Exploratory Drilling
* Begin and end count days account for 22 hours of data

Basic Volume Summary: Site 007
D Road (South of Oshoto Connection Intersection and North of Deadman Road Intersection)

		Southbound Lane 1	Northbound Lane 3	Total veh/day	Avg veh/day
5/20/2010	*	39	42	81	149
5/21/2010		27	29	56	49
5/22/2010		11	11	22	
5/23/2010		6	6	12	
5/24/2010		21	19	40	
5/25/2010		40	37	77	
5/26/2010		35	37	72	
5/27/2010		31	30	61	
5/28/2010		64	65	129	
5/29/2010		63	60	123	
5/30/2010		57	51	108	
5/31/2010		81	78	159	
6/1/2010		81	78	159	
6/2/2010		80	81	161	
6/3/2010		106	102	208	
6/4/2010	*	30	17	47	
Total Veh		772	743	1515	
ADT		52	50	102	

No exploratory drill rigs operating
Exploratory Drilling
* Begin and end count days account for 21 hours of data

Basic Volume Summary: Site 008
D Road (South of Deadman Road Intersection)

		Southbound	Northbound	Total	Avg
		Lane 1	Lane 3	veh/day	veh/day
5/20/2010	*	7	7	14	34
5/21/2010		12	14	26	25
5/22/2010		7	9	16	
5/23/2010		8	8	16	
5/24/2010		12	11	23	
5/25/2010		20	17	37	
5/26/2010		18	21	39	
5/27/2010		9	10	19	
5/28/2010		18	18	36	
5/29/2010		9	11	20	
5/30/2010		13	7	20	
5/31/2010		26	23	49	
6/1/2010		16	17	33	
6/2/2010		15	18	33	
6/3/2010		19	19	38	
6/4/2010	*	11	12	23	
Total Veh		220	222	442	
ADT		15	15	30	

No exploratory drill rigs operating
Exploratory Drilling
* Begin and end count days account for 21 hours of data

Basic Volume Summary: Site 009
Deadman Road (West of D Road Intersection)

		Eastbound	Westbound	Total	Avg
		Lane 1	Lane 3	veh/day	veh/day
5/20/2010	*	4	2	6	25
5/21/2010		14	14	28	19
5/22/2010		7	9	16	
5/23/2010		6	6	12	
5/24/2010		9	10	19	
5/25/2010		9	10	19	
5/26/2010		7	9	16	
5/27/2010		12	14	26	
5/28/2010		11	13	24	
5/29/2010		10	11	21	
5/30/2010		4	5	9	
5/31/2010		6	7	13	
6/1/2010		17	20	37	
6/2/2010		12	15	27	
6/3/2010		19	22	41	
6/4/2010	*	4	16	20	
Total Veh		151	183	334	
ADT		10	12	22	

No exploratory drill rigs operating
Exploratory Drilling
* Begin and end count days account for 20 hours of data

Basic Volume Summary: Site 010
Oshoto Connection (Just West of Center between D Road and New Haven Road)

		Eastbound Lane 1	Westbound Lane 3	Total veh/day	Avg veh/day
5/20/2010	*	42	21	63	196
5/21/2010		45	46	91	87
5/22/2010		25	22	47	
5/23/2010		21	21	42	
5/24/2010		40	38	78	
5/25/2010		52	52	104	
5/26/2010		62	58	120	
5/27/2010		63	66	129	
5/28/2010		102	106	208	
5/29/2010		81	82	163	
5/30/2010		75	80	155	
5/31/2010		90	89	179	
6/1/2010		115	111	226	
6/2/2010		108	106	214	
6/3/2010		114	124	238	
6/4/2010	*	25	58	83	
Total Veh		1060	1080	2140	
ADT		72	73	145	

No exploratory drill rigs operating
Exploratory Drilling
* Begin and end count days account for 20 hours of data

APPENDIX E
FILTERED CLASSIFICATIONS PER COUNTER SUMMARY

Basic Classification Summary: Site 001
D Road (South of New Haven Road Intersection)

		#1 Cycle	#2 Cars	#3 2A-4T	#4 Buses	#5 2A-SU	#6 3A-SU	#7 4A-SU	#8 4A-ST	#9 5A-ST	#10 6A-ST	#11 5A-MT	#12 6A-MT	#13 Other	Total	Total Trucks	% Trucks	Avg veh/day
5/20/2010	*	2	30	83	0	2	5	2	9	12	0	1	0	2	148	33	22%	18%
5/21/2010		0	26	92	0	2	2	0	0	2	0	0	0	2	126	8	6%	7%
5/22/2010		0	23	52	0	2	0	0	1	0	0	0	0	0	78	3	4%	
5/23/2010		0	23	57	0	0	0	0	1	0	0	0	0	2	83	3	4%	
5/24/2010		0	27	76	0	4	1	1	1	0	0	0	0	0	110	7	6%	
5/25/2010		1	28	77	0	2	0	0	0	2	0	0	0	0	110	4	4%	
5/26/2010		0	27	96	0	4	1	0	2	3	1	0	0	3	137	14	10%	
5/27/2010		1	33	88	0	3	3	5	3	2	1	2	0	3	144	22	15%	
5/28/2010		0	31	116	0	1	5	0	0	1	0	0	0	1	155	8	5%	
5/29/2010		0	26	90	0	0	5	1	0	1	0	0	0	0	123	7	6%	
5/30/2010		0	35	82	0	0	3	1	0	0	0	0	0	5	126	9	7%	
5/31/2010		1	47	78	0	0	3	4	0	0	0	0	0	24	157	31	20%	
6/1/2010		4	39	101	0	0	13	2	2	1	0	2	0	19	183	39	21%	
6/2/2010		1	42	122	0	0	10	0	1	6	0	0	1	25	208	43	21%	
6/3/2010		0	41	147	0	2	5	0	3	17	0	1	0	29	245	57	23%	
6/4/2010	*	0	11	29	0	0	3	0	2	1	0	0	0	2	48	8	17%	
														Total	2181	296	14%	

No exploratory drill rigs operating
Exploratory Drilling
* Begin and end count days account for 24 hours of data

Basic Classification Summary: Site 002
New Haven Road (South of Proposed Facilities Site)

		#1 Cycle	#2 Cars	#3 2A-4T	#4 Buses	#5 2A-SU	#6 3A-SU	#7 4A-SU	#8 4A-ST	#9 5A-ST	#10 6A-ST	#11 5A-MT	#12 6A-MT	#13 Other	Total	Total Trucks	% Trucks	Avg veh/day
5/20/2010	*	1	26	69	0	1	5	2	6	14	1	1	0	2	128	32	25%	21%
5/21/2010		0	26	79	0	3	1	1	0	1	0	0	1	2	114	9	8%	10%
5/22/2010		0	21	44	0	2	0	0	2	0	0	0	0	1	70	5	7%	
5/23/2010		2	20	40	0	1	0	0	3	0	1	0	0	3	70	8	11%	
5/24/2010		1	26	69	0	3	2	1	3	2	0	0	0	4	111	15	14%	
5/25/2010		2	30	72	0	3	5	0	0	1	0	0	0	0	113	9	8%	
5/26/2010		1	27	90	0	4	1	0	1	4	0	0	0	2	130	12	9%	
5/27/2010		0	32	92	0	1	5	4	2	2	0	2	0	6	146	22	15%	
5/28/2010		1	31	110	0	2	5	0	0	1	0	0	0	1	151	9	6%	
5/29/2010		0	26	76	0	0	6	1	0	1	0	0	0	1	111	9	8%	
5/30/2010		0	34	61	0	2	4	0	0	0	0	1	0	5	107	12	11%	
5/31/2010		0	43	55	0	0	3	4	0	0	0	1	0	25	131	33	25%	
6/1/2010		0	39	98	0	1	14	1	2	1	0	2	0	19	177	40	23%	
6/2/2010		1	40	110	0	1	9	0	3	5	0	0	1	25	195	44	23%	
6/3/2010		4	40	126	0	5	3	2	3	14	1	1	0	29	228	58	25%	
6/4/2010	*	0	12	23	0	0	4	0	1	1	0	1	0	3	45	10	22%	
														Total	2027	327	16%	

No exploratory drill rigs operating
Exploratory Drilling
* Begin and end count days account for 23 hours of data

Basic Classification Summary: Site 003
Cabin Creek Road (East of New Haven Road Intersection)

		#1 Cycle	#2 Cars	#3 2A-4T	#4 Buses	#5 2A-SU	#6 3A-SU	#7 4A-SU	#8 4A-ST	#9 5A-ST	#10 6A-ST	#11 5A-MT	#12 6A-MT	#13 Other	Total	Total Trucks	% Trucks	Avg veh/day
5/20/2010	*	2	12	46	0	0	1	0	0	0	2	0	0	16	79	19	24%	10%
5/21/2010		0	15	58	0	2	3	0	0	5	0	0	0	0	83	10	12%	9%
5/22/2010		3	4	26	0	3	0	1	0	0	0	0	0	0	37	4	11%	
5/23/2010		0	15	44	0	0	0	0	1	0	0	0	0	0	60	1	2%	
5/24/2010		0	8	32	0	0	0	0	2	4	0	0	0	0	46	6	13%	
5/25/2010		0	13	48	0	2	1	0	0	4	5	0	0	1	74	13	18%	
5/26/2010		0	16	48	0	3	0	0	0	4	1	0	0	0	72	8	11%	
5/27/2010		1	13	52	0	0	0	0	0	0	0	0	0	0	66	0	0%	
5/28/2010		3	25	33	0	0	2	0	0	0	3	0	0	0	66	5	8%	
5/29/2010		2	18	36	0	0	0	0	0	3	0	0	0	0	59	3	5%	
5/30/2010		0	24	39	0	0	0	0	0	0	0	0	0	0	63	0	0%	
5/31/2010		2	29	35	0	1	0	0	0	0	0	0	0	1	68	2	3%	
6/1/2010		0	14	49	0	0	3	0	0	3	0	0	0	1	70	7	10%	
6/2/2010		0	26	69	0	0	0	0	0	2	1	0	0	1	99	4	4%	
6/3/2010		0	18	62	0	0	1	0	0	5	4	0	0	1	91	11	12%	
6/4/2010	*	0	7	17	0	0	0	0	1	1	0	0	0	1	27	3	11%	
														Total	1060	96	9%	

No exploratory drill rigs operating
Exploratory Drilling
* Begin and end count days account for 23 hours of data

Basic Classification Summary: Site 004
New Haven Road (South of Oshoto Connection Instersection and North of Cabin Creek Road Intersection)

		#1 Cycle	#2 Cars	#3 2A-4T	#4 Buses	#5 2A-SU	#6 3A-SU	#7 4A-SU	#8 4A-ST	#9 5A-ST	#10 6A-ST	#11 5A-MT	#12 6A-MT	#13 Other	Total	Total Trucks	% Trucks	Avg veh/day
5/20/2010	*	4	42	94	0	1	5	0	11	10	1	0	0	23	191	51	27%	19%
5/21/2010		3	43	99	0	1	2	0	2	3	0	0	0	8	161	16	10%	8%
5/22/2010		4	32	52	0	1	0	0	1	0	0	0	0	2	92	4	4%	
5/23/2010		1	19	67	0	0	0	0	2	0	0	0	0	4	93	6	6%	
5/24/2010		2	26	86	0	2	0	0	0	0	0	0	0	3	119	5	4%	
5/25/2010		2	39	100	0	3	1	1	0	1	4	0	0	2	153	12	8%	
5/26/2010		2	23	126	0	7	0	0	1	3	3	0	0	3	168	17	10%	
5/27/2010		5	46	111	0	0	3	5	2	2	1	2	0	4	181	19	10%	
5/28/2010		5	74	157	0	1	8	0	1	1	3	0	1	2	253	17	7%	
5/29/2010		2	57	116	0	1	6	1	9	3	0	1	0	2	198	23	12%	
5/30/2010		7	76	104	0	1	3	0	8	0	0	0	0	6	205	18	9%	
5/31/2010		6	87	100	0	1	1	4	8	0	0	1	1	26	235	42	18%	
6/1/2010		8	75	142	1	1	14	2	7	3	0	2	0	21	276	51	18%	
6/2/2010		11	88	151	1	3	7	1	6	5	1	0	1	27	302	52	17%	
6/3/2010		15	77	172	0	2	3	1	10	13	3	2	0	35	333	69	21%	
6/4/2010	*	2	17	29	0	1	2	1	1	2	0	0	0	5	60	12	20%	
														Total	3020	414	14%	

No exploratory drill rigs operating
Exploratory Drilling
* Begin and end count days account for 22 hours of data

Basic Classification Summary: Site 005
New Haven Road (North of Oshoto Connection Instersection)

		#1 Cycle	#2 Cars	#3 2A-4T	#4 Buses	#5 2A-SU	#6 3A-SU	#7 4A-SU	#8 4A-ST	#9 5A-ST	#10 6A-ST	#11 5A-MT	#12 6A-MT	#13 Other	Total	Total Trucks	% Trucks	Avg veh/day
5/20/2010	*	2	18	14	0	0	0	0	0	6	0	0	0	20	60	26	43%	33%
5/21/2010		1	18	36	0	1	1	0	1	2	0	1	0	8	69	14	20%	12%
5/22/2010		0	18	20	0	0	0	0	1	0	0	0	0	2	41	3	7%	
5/23/2010		2	17	26	0	0	0	0	1	0	0	0	0	5	51	6	12%	
5/24/2010		1	22	26	0	0	0	0	0	0	0	0	0	0	49	0	0%	
5/25/2010		2	24	29	0	2	0	0	0	0	0	0	0	2	59	4	7%	
5/26/2010		1	17	39	0	4	0	0	0	4	0	0	0	9	74	17	23%	
5/27/2010		1	19	32	0	0	1	0	0	1	0	0	0	8	62	10	16%	
5/28/2010		2	24	33	0	0	0	0	0	5	0	0	0	11	75	16	21%	
5/29/2010		1	16	35	0	0	0	0	0	1	0	0	0	4	57	5	9%	
5/30/2010		1	20	36	0	0	0	0	0	0	0	0	0	6	63	6	10%	
5/31/2010		3	27	32	0	0	0	0	1	10	1	1	0	35	110	48	44%	
6/1/2010		2	26	40	0	0	0	0	1	0	1	1	0	25	96	28	29%	
6/2/2010		2	23	33	0	0	0	0	1	3	1	0	0	25	88	30	34%	
6/3/2010		3	24	48	0	0	0	0	0	9	1	0	0	36	121	46	38%	
6/4/2010	*	0	9	7	0	0	0	0	0	2	0	0	0	7	25	9	36%	
														Total	1100	268	24%	

No exploratory drill rigs operating
Exploratory Drilling
* Begin and end count days account for 22 hours of data

Basic Classification Summary: Site 006
D Road (North of Oshoto Connection Intersection)

		#1 Cycle	#2 Cars	#3 2A-4T	#4 Buses	#5 2A-SU	#6 3A-SU	#7 4A-SU	#8 4A-ST	#9 5A-ST	#10 6A-ST	#11 5A-MT	#12 6A-MT	#13 Other	Total	Total Trucks	% Trucks	Avg veh/day
5/20/2010	*	0	16	51	0	2	4	4	3	4	0	0	0	3	87	20	23%	18%
5/21/2010		0	9	53	0	0	0	0	1	6	0	0	0	2	71	9	13%	10%
5/22/2010		0	3	40	0	2	0	0	0	0	0	0	0	0	45	2	4%	
5/23/2010		0	3	37	0	0	0	0	1	0	0	0	0	1	42	2	5%	
5/24/2010		0	5	41	0	2	0	0	0	0	0	0	0	0	48	2	4%	
5/25/2010		0	11	60	0	2	0	0	0	5	5	0	0	0	83	12	14%	
5/26/2010		0	5	58	0	2	0	0	0	4	1	0	0	0	70	7	10%	
5/27/2010		2	12	45	0	0	2	5	2	0	1	2	0	1	72	13	18%	
5/28/2010		0	21	58	0	1	4	0	0	2	3	0	0	1	90	11	12%	
5/29/2010		0	10	25	0	0	0	0	0	2	0	0	0	0	37	2	5%	
5/30/2010		0	18	39	0	0	0	0	1	0	1	0	0	5	64	7	11%	
5/31/2010		0	18	25	0	0	0	4	0	4	0	0	0	5	56	13	23%	
6/1/2010		1	16	66	0	0	9	1	2	2	0	2	0	1	100	17	17%	
6/2/2010		1	25	64	0	0	6	1	0	4	0	0	0	0	101	11	11%	
6/3/2010		0	27	75	0	1	8	0	1	8	2	0	0	1	123	21	17%	
6/4/2010	*	0	4	18	0	0	0	0	1	4	0	1	0	0	28	6	21%	
														Total	1117	155	14%	

No exploratory drill rigs operating
Exploratory Drilling
* Begin and end count days account for 22 hours of data

Basic Classification Summary: Site 007
D Road (South of Oshoto Connection Intersection and North of Deadman Road Intersection)

		#1 Cycle	#2 Cars	#3 2A-4T	#4 Buses	#5 2A-SU	#6 3A-SU	#7 4A-SU	#8 4A-ST	#9 5A-ST	#10 6A-ST	#11 5A-MT	#12 6A-MT	#13 Other	Total	Total Trucks	% Trucks	Avg veh/day
5/20/2010	*	2	13	56	0	0	7	1	2	0	0	0	0	0	81	10	12%	17%
5/21/2010		0	9	43	0	1	2	0	1	0	0	0	0	0	56	4	7%	5%
5/22/2010		0	4	17	0	1	0	0	0	0	0	0	0	0	22	1	5%	
5/23/2010		0	0	12	0	0	0	0	0	0	0	0	0	0	12	0	0%	
5/24/2010		0	4	36	0	0	0	0	0	0	0	0	0	0	40	0	0%	
5/25/2010		2	8	66	0	0	1	0	0	0	0	0	0	0	77	1	1%	
5/26/2010		0	5	58	0	1	1	0	1	6	0	0	0	0	72	9	13%	
5/27/2010		2	8	46	0	0	3	0	0	0	0	0	0	2	61	5	8%	
5/28/2010		1	30	79	0	0	9	0	0	9	1	0	0	0	129	19	15%	
5/29/2010		1	35	72	0	2	8	0	2	3	0	0	0	0	123	15	12%	
5/30/2010		0	37	60	0	0	6	0	5	0	0	0	0	0	108	11	10%	
5/31/2010		0	38	87	0	0	6	2	5	16	2	0	0	3	159	34	21%	
6/1/2010		1	35	96	0	0	16	2	7	0	0	0	0	2	159	27	17%	
6/2/2010		3	46	87	0	0	11	1	6	1	3	0	0	3	161	25	16%	
6/3/2010		2	49	125	0	2	12	2	8	1	0	2	0	5	208	32	15%	
6/4/2010	*	0	7	32	0	1	4	1	1	0	0	1	0	0	47	8	17%	
														Total	1515	201	13%	

No exploratory drill rigs operating
Exploratory Drilling
* Begin and end count days account for 21 hours of data

Basic Classification Summary: Site 008
D Road (South of Deadman Road Intersection)

		#1 Cycle	#2 Cars	#3 2A-4T	#4 Buses	#5 2A-SU	#6 3A-SU	#7 4A-SU	#8 4A-ST	#9 5A-ST	#10 6A-ST	#11 5A-MT	#12 6A-MT	#13 Other	Total	Total Trucks	% Trucks	Avg veh/day
5/20/2010	*	0	1	13	0	0	0	0	0	0	0	0	0	0	14	0	0%	15%
5/21/2010		0	2	24	0	0	0	0	0	0	0	0	0	0	26	0	0%	6%
5/22/2010		0	0	15	0	1	0	0	0	0	0	0	0	0	16	1	6%	
5/23/2010		0	1	15	0	0	0	0	0	0	0	0	0	0	16	0	0%	
5/24/2010		0	3	19	0	1	0	0	0	0	0	0	0	0	23	1	4%	
5/25/2010		6	4	26	0	0	1	0	0	0	0	0	0	0	37	1	3%	
5/26/2010		0	3	27	0	2	0	0	0	5	0	1	0	1	39	9	23%	
5/27/2010		2	2	14	0	0	1	0	0	0	0	0	0	0	19	1	5%	
5/28/2010		2	1	21	0	0	0	0	1	10	0	1	0	0	36	12	33%	
5/29/2010		0	3	17	0	0	0	0	0	0	0	0	0	0	20	0	0%	
5/30/2010		0	2	18	0	0	0	0	0	0	0	0	0	0	20	0	0%	
5/31/2010		0	1	28	0	1	0	0	2	17	0	0	0	0	49	20	41%	
6/1/2010		0	1	31	0	0	1	0	0	0	0	0	0	0	33	1	3%	
6/2/2010		0	1	29	0	0	2	0	0	1	0	0	0	0	33	3	9%	
6/3/2010		0	2	27	0	2	1	0	1	1	0	0	0	4	38	9	24%	
6/4/2010	*	0	2	15	0	0	0	0	1	0	0	0	0	1	19	2	11%	
														Total	438	60	14%	

No exploratory drill rigs operating
Exploratory Drilling
* Begin and end count days account for 21 hours of data

Basic Classification Summary: Site 009
Deadman Road (West of D Road Intersection)

		#1 Cycle	#2 Cars	#3 2A-4T	#4 Buses	#5 2A-SU	#6 3A-SU	#7 4A-SU	#8 4A-ST	#9 5A-ST	#10 6A-ST	#11 5A-MT	#12 6A-MT	#13 Other	Total	Total Trucks	% Trucks	Avg veh/day
5/20/2010	*	0	0	5	0	0	1	0	0	0	0	0	0	0	6	1	17%	13%
5/21/2010		1	3	20	0	1	2	0	1	0	0	0	0	0	28	4	14%	9%
5/22/2010		0	2	14	0	0	0	0	0	0	0	0	0	0	16	0	0%	
5/23/2010		0	1	10	0	0	0	0	0	0	0	0	0	1	12	1	8%	
5/24/2010		1	2	15	0	0	0	0	0	0	0	0	0	1	19	1	5%	
5/25/2010		1	3	15	0	0	0	0	0	0	0	0	0	0	19	0	0%	
5/26/2010		0	3	11	0	0	1	0	0	0	0	0	0	1	16	2	13%	
5/27/2010		0	2	19	0	0	1	1	0	0	0	0	0	3	26	5	19%	
5/28/2010		1	2	19	0	0	0	0	0	0	0	1	0	1	24	2	8%	
5/29/2010		0	3	15	0	0	0	0	0	3	0	0	0	0	21	3	14%	
5/30/2010		0	0	9	0	0	0	0	0	0	0	0	0	0	9	0	0%	
5/31/2010		0	0	13	0	0	0	0	0	0	0	0	0	0	13	0	0%	
6/1/2010		0	3	29	0	3	0	0	1	1	0	0	0	0	37	5	14%	
6/2/2010		0	3	15	0	1	1	0	0	0	1	0	0	2	23	5	22%	
6/3/2010		1	2	34	0	1	1	1	0	0	0	1	0	0	41	4	10%	
6/4/2010	*	1	0	14	0	0	0	0	1	2	0	0	0	1	19	4	21%	
														Total	329	37	11%	

No exploratory drill rigs operating
Exploratory Drilling
* Begin and end count days account for 20 hours of data

Basic Classification Summary: Site 010
Oshoto Connection (Just West of Center between D Road and New Haven Road)

		#1 Cycle	#2 Cars	#3 2A-4T	#4 Buses	#5 2A-SU	#6 3A-SU	#7 4A-SU	#8 4A-ST	#9 5A-ST	#10 6A-ST	#11 5A-MT	#12 6A-MT	#13 Other	Total	Total Trucks	% Trucks	Avg veh/day
5/20/2010	*	4	13	38	0	0	0	0	4	3	0	0	0	1	63	8	13%	19%
5/21/2010		3	12	63	0	2	2	0	0	5	1	0	0	3	91	13	14%	13%
5/22/2010		0	5	36	0	1	0	0	0	0	0	0	0	5	47	6	13%	
5/23/2010		0	2	36	0	0	1	0	0	0	0	0	0	3	42	4	10%	
5/24/2010		1	5	68	0	2	0	0	0	0	0	0	0	2	78	4	5%	
5/25/2010		5	14	69	0	2	1	0	0	2	4	0	0	7	104	16	15%	
5/26/2010		0	9	93	0	3	1	0	1	4	1	0	0	8	120	18	15%	
5/27/2010		2	23	83	0	1	3	3	2	1	0	2	0	9	129	21	16%	
5/28/2010		0	47	129	0	2	10	1	2	6	7	0	0	4	208	32	15%	
5/29/2010		0	44	94	0	0	5	2	9	3	1	1	0	4	163	25	15%	
5/30/2010		1	43	90	0	0	6	3	2	0	0	1	0	9	155	21	14%	
5/31/2010		0	45	90	0	1	4	5	4	10	4	1	0	14	178	43	24%	
6/1/2010		1	45	138	0	1	18	5	9	1	0	2	0	6	226	42	19%	
6/2/2010		1	58	121	0	0	11	7	2	2	3	1	0	8	214	34	16%	
6/3/2010		1	50	154	0	2	5	4	3	6	2	2	0	8	237	32	14%	
6/4/2010	*	0	11	55	0	0	3	1	3	3	0	0	0	3	79	13	16%	
														Total	2134	332	16%	

No exploratory drill rigs operating
Exploratory Drilling
* Begin and end count days account for 20 hours of data

APPENDIX F
2010 GRAVEL PASER RATINGS

Strata Energy Road

~~Sample~~ Inventory Form

Inventory Date 11-4-10

By Ben Weaver, Rod Full...

SEGMENT & LOCATION

Road/Name D-Road (Co Rd 68) Segment No. 1

From State Highway 14 To End of pavement

Length 3.40 Miles

USE & CLASSIFICATION

Road Classification Rural roadway ADT

Access To Rural

ROADWAY DATA

Surface Type Pavement

Surface Condition Rating 3

Drainage Rating 4

Comments pavement placed 30+ years

GEOMETRICS

Surface Width Shoulder Width

Urban Roadway Width

Horizontal Alignment Rating

Vertical Alignment Rating

R/W Width

Comments

OTHER

Comments

IMPROVEMENT HISTORY

Year	Work Completed	Estimated Cost
2010	Filled in pot holes	N/A

37

Strata Energy Road

Sample Inventory Form

Inventory Date 11-4-10

By Ron Weaver Rod Fuller

SEGMENT & LOCATION

Road/Name D-Road (Co Rd 68) Segment No. 2

From End of pavement To End of recycled pavement

Length 6.87 miles

USE & CLASSIFICATION

Road Function Major Average Daily Traffic

Land Use Agriculture, Industrial, Miners

ROADWAY CONDITION DATA

Crown Good Gravel Depth/Quality Good

Ditch and Culvert Adequacy Good

Roadway Condition Rating 4 Good

Special or Spot Problems None

Comments This 6.87 mile section is newly recycled pavement (Summer 2010). Regular maintenance occurs.

GEOMETRICS

Width of Traveled Way

Horizontal Alignment Rating

Vertical Alignment Rating

R/W Width Approximately 35'

Comments

OTHER

Comments

IMPROVEMENT HISTORY

Year	Work Completed	Estimated Cost
2010	Pavement was ripped up and recycled	

31

Strata Energy Road

~~Sample~~ Inventory Form

Inventory Date 11-4-10

By Ron Weaver, Rod Fuller

SEGMENT & LOCATION

Road/Name D-Road (Co Rd 68) Segment No. 3

From End of recycled pavement To D-Road (Co Rd 68)/New Haven-Oxbow Rd intersection

Length 8.04 miles

USE & CLASSIFICATION

Road Function Major Average Daily Traffic

Land Use Agriculture, Industrial, Mining

ROADWAY CONDITION DATA

Crown Good Gravel Depth/Quality Good

Ditch and Culvert Adequacy Good

Roadway Condition Rating 4 - Good

Special or Spot Problems None

Comments Road has good quality/quantity gravel. Routine maintenance occurs

GEOMETRICS

Width of Traveled Way

Horizontal Alignment Rating

Vertical Alignment Rating

R/W Width

Comments

OTHER

Comments

IMPROVEMENT HISTORY

Year	Work Completed	Estimated Cost

31

Strata Energy Road

~~Sample~~ Inventory Form

Inventory Date 11-4-10

By Ben Weaver, Rod Fuller

SEGMENT & LOCATION

Road/Name D-Road (Co Rd 68) Segment No. 4

From D-Road/New Haven Rd - To Oshoto Rd (Co Rd 193) Intersection

Length 3.14

USE & CLASSIFICATION

Road Function Major Average Daily Traffic

Land Use Agriculture, Industrial, Mining

ROADWAY CONDITION DATA

Crown Excellent - New Const. Gravel Depth/Quality Excellent - New construction

Ditch and Culvert Adequacy Excellent - new construction

Roadway Condition Rating 5

Special or Spot Problems None

Comments This portion of D-Road newly reconstructed summer 2010. Scoria used for material.

GEOMETRICS

Width of Traveled Way

Horizontal Alignment Rating

Vertical Alignment Rating

R/W Width

Comments

OTHER

Comments

IMPROVEMENT HISTORY

Year	Work Completed	Estimated Cost
2010	road reconstruction.	—

31

Strata Energy Road

~~Sample~~ Inventory Form

Inventory Date 11-4-10

By Ben Weaver, Rod Fuller

SEGMENT & LOCATION

Road/Name Oshoto Rd/Co Rd 193 Segment No. 5

From D-Road/Oshoto Rd intersection To Oshoto Rd/New Haven-Oshoto Rd Intersection

Length 1.51

USE & CLASSIFICATION

Road Function Major Average Daily Traffic

Land Use Agriculture, Industrial, Mining

ROADWAY CONDITION DATA

Crown Good Gravel Depth/Quality Fair

Ditch and Culvert Adequacy Good

Roadway Condition Rating 4

Special or Spot Problems Dust

Comments Road material is Mowry shale from nearby shale pit. Very dusty when dry. Routine maintenance occurs.

GEOMETRICS

Width of Traveled Way

Horizontal Alignment Rating

Vertical Alignment Rating

R/W Width

Comments

OTHER

Comments

IMPROVEMENT HISTORY

Year	Work Completed	Estimated Cost

31

Strata Energy Road

~~Sample~~ Inventory Form

Inventory Date 11-4-10

By Ben Weaver, Rod Fuller

SEGMENT & LOCATION

Road/Name New Haven - Oshoto Co Rd Segment No. 6

From D-Road / New Haven - Oshoto Co Rd Intersection To New Haven - Oshoto Co Rd. / Oshoto Rd Intersection

Length 3.79

USE & CLASSIFICATION

Road Function Major Average Daily Traffic

Land Use Agriculture, Industrial, Mining

ROADWAY CONDITION DATA

Crown Good Gravel Depth/Quality Fair

Ditch and Culvert Adequacy Good

Roadway Condition Rating 4 - Good

Special or Spot Problems Dust

Comments Road material is mowry shale from nearby shale pit. Dusty when dry. Routine maintenance occurs.

GEOMETRICS

Width of Traveled Way

Horizontal Alignment Rating

Vertical Alignment Rating

R/W Width

Comments

OTHER

Comments

IMPROVEMENT HISTORY

Year	Work Completed	Estimated Cost

31

Strata Energy Road

~~Sample~~ Inventory Form

Inventory Date 11-4-10

By Ben Weaver, Rod Fuller

SEGMENT & LOCATION

Road/Name Cabin Creek Rd - (CO Rd 116) Segment No. 7

From New Haven-Ochoto Rd/CoRd116 Intersection To 1 mile down road

Length 1 mile

USE & CLASSIFICATION

Road Function Minor Average Daily Traffic

Land Use Agriculture, Industrial, Mining

ROADWAY CONDITION DATA

Crown Good Gravel Depth/Quality Fair

Ditch and Culvert Adequacy Good

Roadway Condition Rating 4

Special or Spot Problems Dust

Comments Road Material is Mowry shale from nearby shale pit. Dusty when dry. Routine maintenance occurs

GEOMETRICS

Width of Traveled Way

Horizontal Alignment Rating

Vertical Alignment Rating

R/W Width

Comments

OTHER

Comments

IMPROVEMENT HISTORY

Year	Work Completed	Estimated Cost

31

APPENDIX G
2010 STRATA TRAFFIC STUDY COUNTER LOCATION PHOTOS

Site 001 New Haven Road Looking North

Site 002 New Haven Road Looking North

Site 003 Cabin Creek Road Looking West

Site 004 New Haven Road Looking South

Site 005 New Haven Road Looking South

Site 006 D Road Looking Southeast

Site 007 D Road Looking North

Site 008 D Road Looking South

Site 009 Deadman Road Looking East

Site 010 Oshoto Connection Looking East

ADDENDUM 3.3-A

SOILS TABLES

Table 1. Soil Mapping Unit Acreages

Map Symbol	Map Unit Description	Permit Acreage	% Total Project Area
AB	Absted very fine sandy loam	262.70	15.26
AS	Ascalon fine sandy loam	265.87	15.45
BI	Bidman loam	226.02	13.13
BO	Bone loam	113.79	6.61
CU	Cushman very fine sandy loam	47.15	2.74
FO	Forkwood loam	336.63	19.56
NU	Nunn clay loam	219.60	12.76
SH	Shingle clay loam	58.81	3.42
TA	Tassel fine sandy loam	43.31	2.52
TE	Terro sandy loam	87.03	5.06
VO	Vona fine sandy loam	40.31	2.34
WATER	Water	20.13	1.17
Total		**1721.31**	**100.00**

Table 2. Soil Mapping Unit Disturbance Acreages for Plant Site Option One

Map Symbol	Map Unit Description	Disturbance Acreage	% Total Plant Site Area
AB	Absted very fine sandy loam	9.13	18.38
BI	Bidman loam	23.06	46.43
FO	Forkwood loam	17.48	35.19
Total		**49.67**	**100.00**

Table 3. Soil Mapping Unit Disturbance Acreages for Plant Site Option Two

Map Symbol	Map Unit Description	Disturbance Acreage	% Total Plant Site Area
BI	Bidman loam	5.44	14.69
CU	Cushman very fine sandy loam	4.97	13.42
FO	Forkwood loam	8.43	22.76
NU	Nunn clay loam	5.95	16.06
SH	Shingle clay loam	5.59	15.09
TA	Tassel fine sandy loam	6.66	17.98
Total		**37.04**	**100.00**

Table 4. Soil Series Sample Summary

Soil Series	Number of Profiles Sampled for Chemical Analysis	Soil Sample Number
Absted very fine sandy loam	1	78
Ascalon fine sandy loam	1	75
Bidman loam	1	80
Bone loam	1	40
Cushman very fine sandy loam	1	42
Forkwood loam	1	18
Nunn clay loam	1	81
Shingle clay loam	1	77
Tassel fine sandy loam	1	64
Terro sandy loam	1	19
Vona fine sandy loam	1	16
Total	**11**	**---**

Table 5. Soil Series Sample Summary for Plant Site Option One

Soil Series	Number of Profiles Sampled for Chemical Analysis	Soil Sample Number
Absted very fine sandy loam	2	PS-4, PS-7
Bidman loam	5	PS-3, PS-5, PS-6, PS-8, PS-9
Forkwood loam	3	PS-1, PS-2, PS-10
Total	**10**	**---**

Table 6. Soil Series Sample Summary for Plant Site Option Two

Soil Series	Number of Profiles Sampled for Chemical Analysis	Soil Sample Number
Bidman loam	1	PS-13
Cushman very fine sandy loam	1	42
Forkwood loam	1	PS-14
Nunn clay loam	1	PS-12
Shingle clay loam	1	PS-16
Tassel fine sandy loam	1	PS-18
Total	**6**	**---**

Table 7. Marginal and Unsuitable Parameters within Sampled Profiles

Soil Sample Number	Soils Series	Depth (in)	Marginal[1]	Unsuitable[1]
18	Forkwood	17-60	Selenium	---
75	Ascalon	40-60	pH	---
78	Absted	14-43	Saturation %	---
		14-60	---	SAR
		14-43	Texture	---
		29-60	Selenium	---
80	Bidman	17-33	Texture	---
PS-1	Forkwood	44-60	pH	---
		44-60	Saturation %	---
		28-60	---	SAR
		44-60	Texture	---
		54-60	Selenium	---
PS-2	Forkwood	0-4	Texture	---
		28-36	Texture	---
		52-60	Selenium	---
PS-3	Bidman	0-32	Texture	---
		52-60	Texture	---
PS-4	Absted	12-60	---	SAR
		0-60	Texture	---
		36-52	pH	---
		36-60	EC	---
		24-60	Selenium	---
PS-5	Bidman	5-18	Saturation %	---
		5-18	SAR	---
		0-32	Texture	---
PS-6	Bidman	42-60	EC	---
		6-42	SAR	---
		42-60	---	SAR
		16-42	Texture	---
		42-60	Selenium	---
PS-7	Absted	40-52	pH	---
		52-60	---	pH
		18-52	EC	----
		4-60	---	SAR
		0-18	Texture	---
PS-8	Bidman	6-19	---	SAR
		19-60	SAR	---
		0-60	Texture	---
		30-60	Selenium	---
PS-9	Bidman	5-60	pH	---
		5-18	Saturation %	---
		18-60	EC	---
		5-60	---	SAR
		0-60	Texture	---
		18-60	Selenium	---
PS-10	Forkwood	6-21	SAR	---
		40-60	SAR	---
		6-40	Texture	---
PS-12	Nunn	4-14	Texture	---
PS-14	Forkwood	19-48	Texture	---

[1]Marginal and unsuitable parameters determined by comparing lab analysis with Table I-2 (Criteria to establish topsoil suitability) from WDEQ/LQD Guideline 1.

Table 8. Trends in Marginal and Unsuitable Parameters for Soil Series

Soils Series	Unsuitable/Marginal Parameter[1]
Absted very fine sandy loam	Saturation %, SAR, Texture, Selenium, pH, EC
Ascalon fine sandy loam	pH
Bidman loam	Texture, Saturation %, SAR, Selenium, EC
Bone loam	---
Cushman very fine sandy loam	---
Forkwood loam	Selenium, pH, Saturation %, SAR,Texture
Nunn clay loam	Texture
Shingle clay loam	---
Tassel fine sandy loam	---
Terro sandy loam	---
Vona fine sandy loam	---

[1]Marginal and unsuitable parameters determined by comparing lab analysis with Table I-2 (Criteria to establish topsoil suitability) from WDEQ LQD Guideline 1.

Table 9. Approximate Soil Salvage Depths

Map Symbol	Mapping Unit Description	Permit Acreage[1]	Salvage Depth[2] (feet)	Total Volume of Topsoil[3] (ac-ft)
AB	Absted very fine sandy loam	262.70	0.83	218.92
AS	Ascalon fine sandy loam	265.87	0.83	221.55
BI	Bidman loam	226.02	1.92	433.21
BO	Bone loam	113.79	5.00	568.95
CU	Cushman very fine sandy loam	47.15	1.83	86.43
FO	Forkwood loam	336.63	1.67	561.04
NU	Nunn clay loam	219.60	3.00	658.79
SH	Shingle clay loam	58.81	0.92	53.90
TA	Tassel fine sandy loam	43.31	0.42	18.04
TE	Terro sandy loam	87.03	1.50	130.54
VO	Vona fine sandy loam	40.31	1.25	50.38
WATER	Water	20.13	0.00	0.00
Average Salvage Depth of Project Area[4]		**---**	**1.74**	**---**
Total		**1,721.31**	**---**	**3,001.75**

[1]Found in Table 1 of this addendum.
[2]Found in Addendum 3.3-B under Topsoil Suitability. These salvage depths take in account all 26 sample locations.
[3]Calculated by multiplying permit acreage by salvage depth in feet, as shown in Table II-1 (Topsoil Volume Summary) of WDEQ/LQD Guideline 1.
[4]Calculated as the average of the weighted average salvage depths found in Addendum 3.3-B.

Table 10. Approximate Soil Salvage Depths for Plant Site Option One

Map Symbol	Mapping Unit Description	Permit Acreage[1]	Salvage Depth[2] (feet)	Total Volume of Topsoil[3] (ac-ft)
AB	Absted very fine sandy loam	9.13	0.67	6.09
BI	Bidman loam	23.06	1.50	34.59
FO	Forkwood loam	17.48	1.75	30.59
Average Salvage Depth of Plant Site Area[4]		**---**	**1.43**	**---**
Total		**49.67**	**---**	**71.27**

[1]Found in Table 1 of this addendum.
[2]Found in Addendum 3.3-B under Topsoil Suitability.
[3]Calculated by multiplying permit acreage by salvage depth in feet, as shown in Table II-1 (Topsoil Volume Summary) of WDEQ LQD Guideline 1.
[4]Calculated as the average of the weighted average salvage depths found in Addendum 3.3-B.

Table 11. Approximate Soil Salvage Depths for Plant Site Option Two

Map Symbol	Mapping Unit Description	Permit Acreage[1]	Salvage Depth[2] (feet)	Total Volume of Topsoil[3] (ac-ft)
BI	Bidman loam	5.44	2.83	15.41
CU	Cushman very fine sandy loam	4.97	1.83	9.11
FO	Forkwood loam	8.43	1.58	13.35
NU	Nunn clay loam	5.95	2.67	15.87
SH	Shingle clay loam	5.59	0.50	2.80
TA	Tassel fine sandy loam	6.66	0.50	3.33
Average Salvage Depth of Plant Site Area[4]		**---**	**1.89**	**---**
Total		**31.60**	**---**	**59.86**

[1]Found in Table 1 of this addendum.
[2]Found in Addendum 3.3-B under Topsoil Suitability.
[3]Calculated by multiplying permit acreage by salvage depth in feet, as shown in Table II-1 (Topsoil Volume Summary) of WDEQ/LQD Guideline 1.
[4]Calculated as the average of the weighted average salvage depths found in Addendum 3.3-B.

Table 12. Wind and Water Erosion Hazards

Map Unit Symbol	Soil Series	Water Erosion Hazard[1]	Wind Erosion Hazard[2]
AB	Absted very fine sandy loam	Moderate	Moderate
AS	Ascalon fine sandy loam	Slight	Moderate
BI	Bidman loam	Moderate	Moderate
BO	Bone loam	Moderate	Slight
CU	Cushman very fine sandy loam	Moderate	Slight
FO	Forkwood loam	Moderate	Slight
NU	Nunn clay loam	Slight	Slight
SH	Shingle clay loam	Moderate	Moderate
TA	Tassel fine sandy loam	Slight	Moderate
TE	Terro sandy loam	Slight	Moderate
VO	Vona fine sandy loam	Negligible	Severe

[1]Based on Kw factor of A horizon from the NRCS Soil Data Mart {http://soildatamart.nrcs.usda.gov/}
[2]Based on Wind Erodibility Group from the NRCS Soil Data Mart {http://soildatamart.nrcs.usda.gov/}

ADDENDUM 3.3-B

SOIL MAPPING UNIT DESCRIPTIONS

BASED ON 1983 CROOK COUNTY SOIL SURVEY
AND NRCS SOIL DATA MART INFORMATION

Absted very fine sandy loam – AB

This map unit consists of very deep, well drained soils that formed in slopewash alluvium derived mainly from sodic shale. Slopes range from 0 to 25 percent. The Absted soil occurs on fan remnants, alluvial fans, hillslopes and terraces at elevations between 3,500 and 5,500 feet.

The average annual precipitation ranges from 10 to 14 inches. The mean annual air temperature is approximately 48 degrees Fahrenheit, and the average frost-free season is approximately 105 to 130 days.

Permeability within the Absted soil is slow. The available water capacity is moderate. Effective rooting depth is 60 inches or more. Surface runoff ranges from slow to rapid. The hazard of water or wind erosion is moderate.

Topsoil Suitability

This map unit is a fair source of topsoil to 10 inches based on an average of 2010 sample locations. According to WDEQ/LQD Guideline 1, the following marginal or unsuitable parameters were found:

Soil Sample 78

- marginal saturation percentage from 14 to 43 inches
- marginal texture from 14 to 43 inches
- marginal selenium values from 29 to 60 inches
- unsuitable SAR values from 14 to 60 inches

Soil Sample PS-4

- marginal pH from 36 to 52 inches
- marginal texture from 0 to 60 inches
- marginal selenium values from 24 to 60 inches
- marginal EC values from 36 to 60 inches
- unsuitable SAR values from 12 to 60 inches

Soil Sample PS-7

- marginal texture from 0 to 18 inches
- marginal EC values from 18 to 52 inches
- marginal pH from 40 to 52 inches
- unsuitable pH from 52 to 60 inches
- unsuitable SAR values from 4 to 60 inches

The 10-inch salvage depth was used to calculate topsoil salvage volumes for the Absted series.

Ascalon fine sandy loam – AS

This map unit consists of very deep, well drained soils that formed in moderate coarse textured calcareous material. Slopes range from 0 to 25 percent. The Ascalon soil occurs on upland hillslopes and tableland plains at elevations between 4,000 and 6,000 feet.

The average annual precipitation ranges from 13 to 17 inches. The mean annual air temperature is approximately 49 to 53 degrees Fahrenheit, and the average frost-free season is approximately 130 to 160 days.

Permeability within the Ascalon soil is moderate. The available water capacity is moderate. Effective rooting depth is 60 inches or more. Surface runoff ranges from low to high. The hazard of water erosion is slight and the hazard of wind erosion is moderate.

Topsoil Suitability

This map unit is a fair source of topsoil to 10 inches based on an average of 2010 sample locations. According to WDEQ/LQD Guideline 1, the following marginal or unsuitable parameters were found:

Soil Sample 75

- marginal pH from 40 to 60 inches

The 10-inch salvage depth was used in Table 3.3-A.9 in Addendum 3.3-A to calculate topsoil salvage volumes for the Ascalon series.

Bidman loam – BI

This map unit consists of very deep, well-drained soils formed in alluvium weathered from shale bedrock. Slopes range from 0 to 25 percent. The Bidman soil occurs on alluvial fans, fan remnants, terraces, ridges, and hills at elevations between 2,600 and 6,000 feet.

The average annual precipitation ranges from 10 to 14 inches. The mean annual air temperature is approximately 47 to 66 degrees Fahrenheit, and the average frost-free season is approximately 100 to 130 days.

Permeability within the Bidman soil is slow. The available water capacity is high. Effective rooting depth is 60 inches or more. Surface runoff ranges from low to high. The hazard of water or wind erosion is moderate.

Topsoil Suitability

This map unit is a fair source of topsoil to 23 inches based on an average of 2010 sample locations. According to WDEQ/LQD Guideline 1, the following marginal or unsuitable parameters were found:

Soil Sample 80

- marginal texture from 17 to 33 inches

Soil Sample PS-3

- marginal texture from 0 to 32 inches and 52 to 60 inches

Soil Sample PS-5

- marginal texture from 0 to 32 inches
- marginal SAR values from 5 to 18 inches
- marginal saturation percentage from 5 to 18 inches

Soil Sample PS-6

- marginal SAR from 6 to 42 inches
- marginal texture from 16 to 42 inches
- marginal selenium values from 42 to 60 inches
- marginal EC values from 42 to 60 inches
- unsuitable SAR values from 42 to 60 inches

Soil Sample PS-8

- marginal SAR from 19 to 60 inches
- marginal texture from 0 to 60 inches
- marginal selenium values from 30 to 60 inches
- unsuitable SAR values from 6 to 19 inches

Soil Sample PS-9

- marginal pH from 5 to 60 inches
- marginal saturation percentage from 5 to 18 inches
- marginal texture from 0 to 60 inches
- marginal selenium values from 18 to 60 inches
- marginal EC values from 18 to 60 inches
- unsuitable SAR values from 5 to 60 inches

The 23-inch salvage depth was used in Table 3.3-A.9 in Addendum 3.3-A to calculate topsoil salvage volumes for the Bidman series.

Bone loam – BO

This map unit consists of very deep, well drained soils formed in slopewash alluvium. Slopes range from 0 to 20 percent. The Bone soil occurs on fan aprons, alluvial fans, fan piedmonts, and hill backslope positions at elevations between 4,500 and 6,000 feet.

The average annual precipitation ranges from 10 to 14 inches. The mean annual air temperature is approximately 43 to 51 degrees Fahrenheit, and the average frost-free season is approximately 110 to 130 days.

Permeability within the Bone soil is very slow. The available water capacity is low. Effective rooting depth is 60 inches or more. Surface runoff ranges from slow to rapid. The hazard of water erosion is moderate and the hazard of wind erosion is slight.

Topsoil Suitability

This map unit is a fair source of topsoil to 40 inches based on an average of 2009 sample locations. According to WDEQ/LQD Guideline 1, no marginal or unsuitable parameters were found.

The 60-inch salvage depth was used in Table 3.3-A.9 in Addendum 3.3-A to calculate topsoil salvage volumes for the Bone series.

Cushman very fine sandy loam – CU

This map unit consists of moderately deep, well drained soils formed in slopewash alluvium and residuum from interbedded shales and siltstone and fine-grained argillaceous sandstone. Slopes range from 0 to 20 percent. The Cushman soil occurs on buttes, fan remnants, hills, piedmonts, ridges and terraces at elevations between 3,500 and 6,000 feet.

The average annual precipitation ranges from 10 to 14 inches. The mean annual air temperature is approximately 43 to 51 degrees Fahrenheit, and the average frost-free season is approximately 105 to 130 days.

Permeability within the Cushman soil is moderate. The available water capacity is low. Effective rooting depth is 20 to 40 inches. Surface runoff is medium. The hazard of water erosion is moderate and the hazard of wind erosion is slight.

Topsoil Suitability

This map unit is a fair source of topsoil to 22 inches based on an average of 2010 sample locations. According to WDEQ/LQD Guideline 1, no marginal or unsuitable parameters were found.

The 22-inch salvage depth was used in Table 3.3-A.9 in Addendum 3.3-A to calculate topsoil salvage volumes for the Cushman series.

Forkwood loam – FO

This map unit consists of very deep, well drained soils formed in alluvium. Slopes range from 0 to 15 percent. The Forkwood soil occurs on terraces, alluvial fans, fan remnants, hills, ridges and pediments at elevations between 3,500 and 6,000 feet.

The average annual precipitation ranges from 10 to 14 inches. The mean annual air temperature is approximately 43 to 51 degrees Fahrenheit, and the average frost-free season is approximately 105 to 130 days.

Permeability within the Forkwood soil is moderate. The available water capacity is high. Effective rooting depth is 60 inches or more. The hazard of water erosion is moderate and the hazard of wind erosion is slight.

Topsoil Suitability

This map unit is a fair source of topsoil to 20 inches based on an average of 2010 sample locations. According to WDEQ/LQD Guideline 1, the following marginal or unsuitable parameters were found:

Soil Sample 18

- marginal selenium values from 17 to 60 inches

Soil Sample PS-1

- marginal pH from 44 to 60 inches
- marginal saturation percentage from 44 to 60 inches
- marginal texture from 44 to 60 inches
- marginal selenium values from 54 to 60 inches
- unsuitable SAR values from 28 to 60 inches

Soil Sample PS-2

- marginal texture from 0 to 4 inches and 28 to 36 inches
- marginal selenium values from 52 to 60 inches

Soil Sample PS-10

- marginal SAR values from 6 to 21 inches and 40 to 60 inches
- marginal texture from 6 to 40 inches

Soil Sample PS-14

- marginal texture from 19 to 48 inches

The 20-inch salvage depth was used in Table 3.3-A.9 in Addendum 3.3-A to calculate topsoil salvage volumes for the Forkwood series.

Nunn clay loam – NU

This map unit consists of very deep, well drained soils that formed in loess and mixed alluvium. Slopes range from 0 to 25 percent. The Nunn soil occurs on terraces or alluvial fans, and in drainage ways at elevations between 3,500 and 5,000 feet.

The average annual precipitation is 13 inches. The mean annual air temperature is approximately 47 to 53 degrees Fahrenheit, and the average frost-free season is approximately 120 to 210 days.

Permeability within the Nunn soil is moderately slow to slow. The available water capacity is high. Effective rooting depth is 60 inches or more. Surface runoff ranges from negligible to very high. The hazard of water or wind erosion is Slight.

Topsoil Suitability

This map unit is a fair source of topsoil to 36 inches based on an average of 2010 sample locations. According to WDEQ/LQD Guideline 1, the following marginal or unsuitable parameters were found:

Soil Sample PS-12

- marginal texture from 4 to 14 inches

The 36-inch salvage depth was used in Table 3.3-A.9 in Addendum 3.3-A to calculate topsoil salvage volumes for the Nunn series.

Shingle clay loam – SH

This map unit consists of well drained soils that are very shallow or shallow to bedrock, and formed in residuum and colluvium derived from interbedded shale and sandstone or in alluvium from mudstone. Slopes range from 0 to 80 percent. The Shingle soil occurs on bedrock controlled hillslopes and ridges at elevations between 3,200 and 6,500 feet.

The average annual precipitation ranges from 10 to 14 inches. The mean annual air temperature is approximately 43 to 51 degrees Fahrenheit, and the average frost-free season is approximately 105 to 130 days.

Permeability within the Shingle soil is moderate. The available water capacity is very low. Effective rooting depth is 10 to 20 inches. Surface runoff is medium to high, depending upon slope. The hazard of water or wind erosion is moderate.

Topsoil Suitability

This map unit is a fair source of topsoil to 11 inches based on an average of 2010 sample locations. According to WDEQ/LQD Guideline 1, no marginal or unsuitable parameters were found.

The 11-inch salvage depth was used in Table 3.3-A.9 in Addendum 3.3-A to calculate topsoil salvage volumes for the Shingle series.

Tassel fine sandy loam – TA

This map unit consists of very shallow or shallow, well drained soils formed in residuum weathered from sandstone. Slopes range from 0 to 70 percent. The Tassel soil occurs on uplands at elevations between 3,500 and 6,500 feet.

The average annual precipitation ranges from 12 to 18 inches. The mean annual air temperature is approximately 46 to 52 degrees Fahrenheit, and the average frost-free season is approximately 110 to 120 days.

Permeability within the Tassel soil is moderately rapid. The available water capacity is very low. Effective rooting depth is 10 to 20 inches. Surface runoff ranges from slow to rapid. The hazard of water erosion is slight and the hazard of wind erosion is moderate.

Topsoil Suitability

This map unit is a fair source of topsoil to 5 inches based on an average of 2010 sample locations. According to WDEQ/LQD Guideline 1, no marginal or unsuitable parameters were found.

The 5-inch salvage depth was used in Table 3.3-A.9 in Addendum 3.3-A to calculate topsoil salvage volumes for the Tassel series.

Terro sandy loam – TE

This map unit consists of moderately deep, well drained soils formed in residuum, alluvium, colluvial slopewash or eolian materials derived primarily from soft sandstone. Slopes range from 0 to 30 percent. The Terro soil occurs on gently to steeply sloping hills, ridges, fan remnants, terraces and plateaus at elevations between 3,600 and 6,500 feet.

The average annual precipitation ranges from 10 to 14 inches. The mean annual air temperature is approximately 47 to 51 degrees Fahrenheit, and the average frost-free season is approximately 105 to 130 days.

Permeability within the Terro soil is moderately rapid. The available water capacity is very low. Effective rooting depth is 20 to 40 inches. Surface runoff ranges from low to high. The hazard of water erosion is slight and the hazard of wind erosion is moderate.

Topsoil Suitability

This map unit is a fair source of topsoil to 18 inches based on an average of 2010 sample locations. According to WDEQ/LQD Guideline 1, no marginal or unsuitable parameters were found.

The 18-inch salvage depth was used in Table 3.3-A.9 in Addendum 3.3-A to calculate topsoil salvage volumes for the Terro series.

Vona fine sandy loam – VO

This map unit consists of very deep, well or somewhat excessively drained soils that formed in eolian or partly wind reworked alluvial materials. Slopes range from 0 to 30 percent. The Vona soil occurs on hills, ridges, plains and uplands and is frequently parallel to major river channels at elevations between 4,000 and 6,500 feet.

The average annual precipitation ranges from 14 to 17 inches. The mean annual air temperature is approximately 47 to 53 degrees Fahrenheit, and the average frost-free season is approximately 125 to 165 days.

Permeability within the Vona soil is moderately rapid. The available water capacity is moderate. Effective rooting depth is 60 inches or more. Surface runoff is low. The hazard of water erosion is negligible and the hazard of wind erosion is severe.

Topsoil Suitability

This map unit is a fair source of topsoil to 15 inches based on an average of 2010 sample locations. According to WDEQ/LQD Guideline 1, no marginal or unsuitable parameters were found.

The 15-inch salvage depth was used in Table 3.3-A.9 in Addendum 3.3-A to calculate topsoil salvage volumes for the Vona series.

ADDENDUM 3.3-C

SAMPLED SOIL SERIES DESCRIPTIONS

VONA sandy loam

SOIL MAPPING UNIT: VO

SOIL SAMPLE LOCATION: #16

TYPICAL PEDON: Vona sandy loam, rangeland. (Colors are for dry soil unless otherwise noted)

The Vona series consists of very deep, well or somewhat excessively drained soils that formed in eolian or partly wind reworked alluvial materials. Vona soils are on hills, ridges, plains and uplands and are frequently parallel to major river channels. Slopes range from 0 to 30 percent. The mean annual precipitation is about 36 centimeters (14 inches) and means annual temperature is about 10 degrees C. (50 degrees F.)

A--0 to 5 inches; light brownish gray (10YR 6/2) sandy loam, dark grayish brown (10YR 4/2) moist; moderate fine granular structure; soft, very friable; non-effervescent; slightly acid (pH 6.4); clear smooth boundary.

AB--5 to 15 inches; brown (10YR 5/3) sandy loam, brown (10YR 4/3) moist; weak medium subangular blocky structure parting to moderate medium granular; slightly hard, very friable; non-effervescent; neutral (pH 7.1); clear smooth boundary.

Bk1--15 to 29 inches; brown (10YR 5/3) sandy loam, brown (10YR 4/3) moist; weak very coarse prismatic structure parting to moderate coarse subangular blocks; hard, friable; few distinct clay films on both horizontal and vertical faces of peds, and clay bridging between sand grains; moderately effervescent; slightly alkaline (pH 7.8); clear smooth boundary.

Bk2--29 to 42 inches; pale brown (10YR 6/3) sandy loam, brown (10YR 5/3) moist; weak and moderate coarse subangular blocky structure; slightly hard, very friable; few faint clay films and a small amount of clay bridging between sand grains; few fine calcium carbonates occurring as concretions; strongly effervescent; moderately alkaline (pH 7.9); gradual wavy boundary.

C--42 to 54 inches; very pale brown (10YR 7/3) loamy sand, brown (10YR 5/3); moist; massive; slightly hard, very friable; non-effervescent; moderately alkaline (pH 8.0); gradual wavy boundary.

Cr--54 to 60 inches; non-effervescent brown sandstone.

TYPE LOCATION: Crook County, Wyoming; refer to waypoint 16 on Figure 3.3-9 in the ER.

RANGE IN CHARACTERISTICS (according to official series description): Soil moisture: moist intermittently April through September, and moist in some part for 45 consecutive days from July 15th to September 1st.
Moisture regime: ustic bordering on aridic
Mean annual soil temperature: 9 to 12 degrees C. (48 to 53 degrees F.)
Mean summer soil temperature: 19 to 23 degrees C. (67 to 74 degrees F.)

Depth to secondary calcium carbonate: 20 to 81 centimeters (8 to 32 inches)
Depth to the argillic horizon base: 25 to 102 centimeters (10 to 40 inches)
Weighted average organic carbon content in the upper 15 inches: exceeds .5 percent and decreases uniformly with depth
Rock fragment content: 0 to 15 percent

A horizon:
Hue: 10YR or 2.5Y
Value: 4 to 6, 3 to 5 moist
Chroma: 2 to 4
Texture: fine sandy loam, sandy loam, or loamy sand
Reaction: neutral or slightly alkaline (pH 6.8 to 7.8)

Bt horizon: (Btk in some pedons)
Hue: 7.5YR to 2.5Y
Value: 4 to 6, 4 or 5 moist
Chroma: 2 to 4
Reaction: neutral to moderately alkaline (pH 7.0 to 8.4)
Texture: sandy loam, but includes fine sandy loam
Clay content: 8 to 18 percent
Silt content: 5 to 35 percent
Sand content: 52 to 85 percent with more than 35 percent fine sand or coarser.

Bk horizons: (C horizon in some pedons)
Hue: 10YR or 2.5Y
Value: 5 to 7, 4 to 6 moist
Chroma: 2 to 4
Texture: sandy loam, fine sandy loam, loamy sand, or loam
Reaction: moderately alkaline or strongly alkaline (pH 8.0 to 8.6)
Calcium carbonate equivalent: 2 to 15 percent.

TAXONOMIC CLASS: Coarse-loamy, mixed, superactive, mesic Aridic Haplustalfs

SUITABILITY FOR TOPSOIL (according to WDEQ/LQD Guideline 1): no marginal or unsuitable parameters were found. Estimated salvage depth is 15 inches.

GEOGRAPHIC SETTING (according to official series description):

Landscape: upland and hills
Landform: hills, ridges and plains frequently paralleling major river channels.
Slopes: range from 0 to 30 percent.
Parent material: eolian or partly wind reworked alluvial parent materials.
Elevation: 1219 to 1981 meters (4,000 to 6,500 feet)
Mean annual precipitation: 36 to 43 centimeters (14 to 17 inches), 25 centimeters (10 inches) of which falls during the months of April to September.
Mean annual temperature: 8 to 12 degrees C. (47 to 53 degrees F.)
Mean summer temperature: 19 to 23 degrees C. (66 to 74 degrees F.)
Frost free period: 125 to 165 days.

VARIATION FROM TYPICAL SERIES: The depth to paralithic contact is slightly shallower than typical. The pH is slightly more acidic in the A horizon in this profile.

FORKWOOD sandy loam

SOIL MAPPING UNIT: FO

SOIL SAMPLE LOCATION: #18

TYPICAL PEDON: Forkwood sandy loam - utilized as rangeland. (Colors are for dry soil unless otherwise stated)

The Forkwood series consists of very deep, well drained soils formed in alluvium. Forkwood soils are on terraces, alluvial fans, fan remnants, hills, ridges and pediments. Slopes range from 0 to 15 percent. The mean annual precipitation is about 11 inches, and the mean annual air temperature is about 45 degrees F.

A--0 to 6 inches; brown (10YR 5/3) sandy loam, dark grayish brown (10YR 4/2) moist; weak fine granular structure; soft, very friable, slightly sticky and slightly plastic; many fine and medium roots throughout; non-effervescent; moderately acid (pH 5.9); abrupt smooth boundary.

Bt1--6 to 17 inches; brown (10YR 5/3) clay loam, brown (10YR 4/3) moist; strong medium angular blocky structure; slightly hard, friable, moderately sticky and moderately plastic; common fine and medium roots throughout; common distinct clay films on faces of peds; non-effervescent; moderately alkaline (pH 7.9); clear smooth boundary.

Btk1--17 to 30 inches; light brownish gray (2.5Y 6/2) clay loam, dark grayish brown (2.5Y 4/2) moist; strong medium angular blocky structure; hard, firm, moderately sticky and moderately plastic; few fine and medium roots throughout; few faint clay films on faces of peds; few masses of carbonates; strongly effervescent; moderately alkaline (pH 7.9); clear smooth boundary.

Btk2--30 to 36 inches; light brownish gray (2.5Y 6/2) sandy clay loam, light olive brown (2.5Y 5/4) moist; moderate medium subangular blocky structure parting to weak fine subangular blocky; slightly hard, friable, slightly sticky and sligtly plastic; few fine roots throughout; few fine threads and masses of carbonates throughout; strongly effervescent; moderately alkaline (pH 8.1); gradual wavy boundary.

Btk3--36 to 46 inches; light brownish gray (2.5Y 6/2) sandy clay loam, grayish brown (2.5Y 5/2) moist; massive; soft, very friable, slightly sticky and slightly plastic; few fine roots throughout; few masses of carbonates throughout; strongly effervescent; moderately alkaline (pH 8.0).

BCk--46 to 60 inches; light brownish gray (2.5Y 6/2) sandy clay loam, grayish brown (2.5Y 5/2) moist; massive; soft, very friable, slightly sticky and slightly plastic; few fine roots throughout; few masses of carbonates throughout; moderately effervescent; moderately alkaline (pH 8.0).

TYPE LOCATION: Crook County, Wyoming; refer to waypoint 18 on Figure 3.3-9 in the ER.

RANGE IN CHARACTERISTICS (according to official series description): Depth to the base of the argillic horizon is 10 to 33 inches, and depth to continuous horizons of carbonate accumulation is 10 to 33 inches. Rock fragments range from 0 to 15 percent. The soil is dry in the moisture control section more than half the time cumulative that the soil temperature at a depth of 20 inches is 41 degrees F., which occurs about April 21-27, and is dry in all parts of the moisture control section for at least 60 consecutive days from July 15 to October 25 and for at least 90 cumulative days during this period. The mean annual soil temperature ranges from 47 to 53 degrees F., and the soil temperature at a depth of 20 inches is 41 degrees F. or more for 175 to 192 days. EC ranges from 0 to 4 mmhos/cm throughout the profile. Bedrock is deeper than 60 inches.

The A horizon has hue of 2.5Y or 10YR, value of 4 to 6 dry and 3 to 5 moist, and chroma of 2 to 4. A vesicular crust occurs on some pedons. Texture is very fine sandy loam, loam, clay loam or fine sandy loam. Reaction is neutral through moderately alkaline.

The Bt horizon has hue of 2.5Y, 10YR or 7.5YR, value of 4 to 7 dry and 3 to 5 moist, and chroma of 2 to 4. Texture is loam or clay loam with 18 to 35 percent clay and more than 15 but less than 35 percent fine sand or coarser. Reaction is neutral through moderately alkaline.

The Btk horizon has hue of 2.5Y or 10YR, value of 4 to 7 dry and 3 to 5 moist, and chroma of 2 to 4. Texture is loam or clay loam. It is slightly alkaline or moderately alkaline. It has 3 to 12 percent calcium carbonate equivalent.

The Bk horizon has hue of 5Y, 2.5Y or 10YR, value of 5 to 7 dry and 4 to 6 moist, and chroma of 2 to 4. Texture is loam, fine sandy loam, very fine sandy loam or clay loam. This horizon has 1 to 14 percent authigenic calcium carbonate accumulation. It is moderately alkaline or strongly alkaline.

The C horizon, when present, has hue of 5Y to 10YR, value of 5 to 7 dry, 4 to 6 moist, and chroma of 2 to 4. Carbonates range from 1 to 8 percent and are mostly allogenic. ESP ranges from 4 to 12. Reaction is moderately or strongly alkaline.

TAXONOMIC CLASS: Fine-loamy, mixed, superactive, mesic Ustic Haplargids

SUITABILITY FOR TOPSOIL (according to WDEQ/LQD Guideline 1, 1994): Marginal selenium values were found from 17-60". Estimated salvage depth is 17 inches.

GEOGRAPHIC SETTING (according to official series description): Forkwood soils are on terraces, alluvial fans, fan remnants, hills, ridges and pediments. Slopes are 0 to 15 percent. The soils formed in slopewash alluvium derived from interbedded shales and argillaceous sandstone. Elevations are 3,500 to 6,000 feet. The average annual precipitation is 10 to 14 inches with over half of the annual precipitation falling in April, May, and June and less than one inch falling in each month of July, August, September, and October. The mean annual air temperature ranges from 43 to 51 degrees F. The estimated frost-free season is about 105 to 130 days depending upon elevation, aspect, and air drainage.

VARIATION FROM TYPICAL SERIES: The pH is more acidic in the A horizon in this profile.

TERRO sandy loam

SOIL MAPPING UNIT: TE

SOIL SAMPLE LOCATION: #19

TYPICAL PEDON: Terro sandy loam--on west facing slope of 10 percent-rangeland. (Colors are for dry soil unless otherwise stated)

The Terro series consists of well drained soils that are moderately deep to soft bedrock. They formed on gently to steeply sloping hills, ridges, fan remnants, terraces and plateaus in residuum, alluvium, colluvial slopewash or eolian materials derived primarily from soft sandstone. Slopes are 0 to 30 percent. The mean annual precipitation is about 12 inches, and the mean annual air temperature is about 47 degrees F.

A--0 to 5 inches; light brownish gray (10YR 6/2) sandy loam, dark grayish brown (10YR 4/2) moist; weak fine granular structure; soft, very friable, nonsticky and nonplastic; many fine and very fine roots; non-effervescent; slightly acid (pH 6.3); clear smooth boundary.

Bw--5 to 18 inches; pale brown (10YR 6/3) sandy loam, brown (10YR 4/3) moist; weak medium prismatic structure parting to weak medium subangular blocky; slightly hard, very friable, nonsticky and nonplastic; many fine roots; common faint clay bridges between sand grains; non-effervescent; neutral (pH 7.2); clear wavy boundary.

Ck1--18 to 26 inches; pale brown (10YR 6/3) sandy loam, brown (10YR 4/3) moist; weak fine subangular blocky structure; slightly hard, very friable, nonsticky and nonplastic; few fine and medium roots; moderately effervescent, calcium carbonate disseminated and as few distinct masses; moderately alkaline (pH 7.9); clear wavy boundary.

Ck2--26 to 36 inches; light gray (10YR 7/2) loamy sand, light brownish gray (10YR 6/2) moist; massive; slightly hard, friable, nonsticky and nonplastic; strongly effervescent, calcium carbonate disseminated and as common, distinct, irregularly shaped masses; slightly alkaline (pH 7.8); gradual wavy boundary.

Cr--34 to 60 inches; non-calcareous gray weathered sandstone.

TYPE LOCATION: Crook County, Wyoming; refer to waypoint 19 on Figure 3.3-9 in the ER.

RANGE IN CHARACTERISTICS (according to official series description): Depth to horizons of continuous calcium carbonate accumulation ranges from 15 to 22 inches. Depth to the base of the argillic horizon is 10 to 22 inches. Depth to bedrock ranges from 20 to 40 inches. Rock fragments as channers range from 0 to 10 percent. The soil is dry in the moisture control section more than half the time cumulative that the soil temperature at a depth of 20 inches is 41 degrees F., which occurs about April 21-27, and is dry in all parts of the moisture control section for at least 60 consecutive days from July 15 to October 25 and for at least 90 cumulative days during this period. The

mean annual soil temperature is 48 to 51 degrees F., and the soil temperature at a depth of 20 inches is 41 degrees F. or more for 175 to 192 days.

The A horizon has hue of 2.5Y or 10YR, value of 5 to 7 dry, 3 to 5 moist, and chroma 1 to 3. It has textures of sandy loam, fine sandy loam or very fine sandy loam. Reaction is neutral or slightly alkaline.

The Bt horizon has hue of 2.5Y, 10YR or 7.5YR, value of 5 to 7 dry, 3 to 5 moist, and chroma of 2 to 4. It is sandy loam or fine sandy loam with clay ranging from 10 to 18 percent. Oriented clay occurs as bridges holding mineral grains together. Reaction is neutral or slightly alkaline.

The Bk horizon has hue of 7.5YR to 2.5Y, value of 5 to 7 dry, 4 to 6 moist, and chroma of 2 to 4. Texture is sandy loam, fine sandy loam, loamy sand or loamy fine sand. Reaction is slightly alkaline to strongly alkaline.

The C horizon, when present, has hue of 10YR or 2.5Y, value of 5 or 6 dry, 4 or 5 moist, and chroma of 3 or 4. Texture is fine sandy loam, sandy loam, loamy sand or loamy fine sand. Reaction is neutral or slightly alkaline. Calcium carbonate is 0 to 4 percent.

The Cr horizon is soft calcareous sandstone or sandstone interbedded with shale.

TAXONOMIC CLASS: Coarse-loamy, mixed, superactive, mesic Ustic Haplargids

SUITABILITY FOR TOPSOIL (according to WDEQ/LQD Guideline 1, 1994): no marginal or unsuitable parameters were found. Estimated salvage depth is 18 inches.

GEOGRAPHIC SETTING (according to official series description): The Terro soils are on nearly level to steeply sloping hills, ridges, fan remnants, terraces and plateaus. Slopes range from 0 to 30 percent. The soils formed in residuum, alluvium and colluvium. Elevation is 3600 to 6,500 feet. The average annual precipitation is 10 to 14 inches, and the average annual temperature is 47 to 51 degrees F. The frost-free season is 105 to 130 days.

VARIATION FROM TYPICAL SERIES: The pH is more acidic in the A horizon in this profile.

BONE clay loam

SOIL MAPPING UNIT: BO

SOIL SAMPLE LOCATION: #40

TYPICAL PEDON: Bone clay loam-rangeland. (Colors are for dry soil unless otherwise stated)

The Bone Series consists of very deep, well drained soils formed in slopewash alluvium on fan aprons, alluvial fans, fan piedmonts, and hill backslope positions. The sediments are derived from sodic shales. Slopes are 0 to 20 percent and simple but may be complex and rolling where the area has undergone dissection by ephemeral streams that it may be complex and rolling. The mean annual precipitation is about 13 inches, and the mean annual air temperature is about 46 degrees F.

A--0 to 6 inches; light gray (10YR 7/2) clay loam, grayish brown (10YR 5/2) moist; vesicular crust; hard, friable, slightly sticky, slightly plastic; few medium roots; moderately acid (pH 5.7); abrupt smooth boundary.

Bt1--6 to 19 inches; brown (10YR 5/3) clay loam, brown (10YR 4/3) moist; weak fine columnar structure parting to weak fine angular blocky; hard, firm, sticky and plastic; few medium roots; common moderately thick clay films on faces of peds; non-effervescent, common fine and medium soft masses of calcium carbonates; moderately acid (pH 5.9); clear smooth boundary.

Bt2--19 to 30 inches; brown (10YR 5/3) clay loam, olive brown (2.5Y 4/4) moist; weak medium subangular blocky fragments; hard, firm, sticky and plastic; non-effervescent; slightly acid (pH 6.2); clear smooth boundary.

Bt3--30 to 40 inches; light olive brown (2.5Y 5/4) clay loam; olive brown (2.5Y 4/4) moist; massive, platelets of rock structure about 60 percent of horizon that are disorientated; hard, firm, sticky and plastic; non-effervescent; neutral (pH 6.6); clear smooth boundary.

Bt4--40 to 50 inches; grayish brown (10YR 5/2) clay loam, dark grayish brown (10YR 4/2) moist; massive with 60 percent platelets of rock structure which are disoriented; non-effervescent; neutral (pH 6.9).

Bt5--50 to 60 inches; grayish brown (10YR 5/2) clay loam, dark grayish brown (10YR 4/2) moist; massive with 60 percent platelets of rock structure which are disoriented; non-effervescent; neutral (pH 6.8).

TYPE LOCATION: Crook County, Wyoming; refer to waypoint 40 on Figure 3.3-9 in the ER.

RANGE IN CHARACTERISTICS (according to official series description): These soils are usually leached free of carbonates through the E and upper Bt horizon but may be calcareous to the surface through recharge. They are always calcareous at a depth of 5 inches. Depth to the base of the Bt horizon is 2 to 5 inches. The Exchangeable Sodium

Percentage is always greater than 15 in all horizons except the thin surface E horizon. ESP ranges from 15 to 35. Coarse fragments of soft shale range from 0 to 5 percent. The concentrations of carbonates and gypsum appear to be inherited from the parent materials in the C horizons with only minor illuvial concentrations in the horizon immediately below the thin Bt horizon in some pedons. The EC typically increases with depth. The soil is dry in the moisture control section more than half the time cumulative that the soil temperature at a depth of 20 inches is 41 degrees F. and is never moist in some or all parts for as long as 60 consecutive days when the soil temperature at a depth of 20 inches is 41 degrees F., which occurs about April 21-27, but is dry in all parts of the moisture control section for at least 60 consecutive days from July 15 to October 25 and for at least 90 cumulative days during this period. The mean annual soil temperature is 47 to 53 degrees F., and the soil temperature at a depth of 20 inches is 41 degrees F. or more for 175 to 192 days. Bedrock is deeper than 60 inches.

The E horizon has hue of 10YR, 2.5Y or 5Y, value of 6 to 8 dry and 4 to 6 moist, and chroma of 2 or 3. Texture is typically a loam or fine sandy loam but may be light clay loam in some pedons. Reaction is neutral or slightly alkaline. EC is 0 to 2 mmhos. Some pedons may have A horizons. When present, they have similar properties to the E horizon.

The Bt or Btk horizon has hue of 10YR, 2.5Y or 5Y, value of 5 or 6 dry and 3 or 4 moist, and chroma of 2 or 3. Texture is heavy clay loam or clay with 35 to 50 percent clay. The Bt and Btk horizons are less than 3 inches thick and are diagnostic only at the series level. Reaction ranges from moderately alkaline to very strongly alkaline and are usually buffered with salts when moderately alkaline. EC ranges from 2 to 8 mmhos. ESP is 15 to 35.

The C horizon has hue of 10YR, 2.5Y or 5Y, value of 5 to 7 dry and 4 to 6 moist, and chroma of 2 to 4. Texture is typically heavy clay loam or clay but may be silty clay loam or silty clay in some pedons. Carbonates and gypsum are about equally dispersed throughout this horizon with some local accumulation. Salts more soluble than gypsum are common. EC ranges from 4 to 16 mmhos depending upon landscape position. ESP is 15 to 35 percent. Reaction is moderately alkaline to very strongly alkaline. Bk horizons may occur immediately below the Bt and have the properties as defined for the C.

TAXONOMIC CLASS: Fine, smectitic, calcareous, mesic Ustic Torriorthents

SUITABILITY FOR TOPSOIL (according to WDEQ/LQD Guideline 1, 1994): no marginal or unsuitable parameters were found. Estimated salvage depth is 60 inches.

GEOGRAPHIC SETTING (according to official series description): Bone soils occur as slick spots on fan aprons, alluvial fans, fan piedmonts, and hill backslope positions. They are usually less than a half acre in size but may be 5 to 10 acres in size in some areas. They dominate the landscape in many places. Slopes are 0 to 20 percent but are normally 0 to 3 percent since the surface, under natural conditions, tends to level itself. Elevations range from 4,500 to 6,000 feet. The average annual precipitation is 13 inches with over half of the annual precipitation falling in April, May, and June and

less than one inch falling in each month of July, August, September, and October. Precipitation ranges from 10 to 14 inches. The mean annual air temperature is about 46 degrees F., but ranges from 43 to 51 degrees F. The frost-free season is about 110 to 130 days.

VARIATION FROM TYPICAL SERIES: This profile is less calcareous than typical. The pH is more acidic throughout the profile than typical.

CUSHMAN loam

SOIL MAPPING UNIT: CU

SOIL SAMPLE LOCATION: #42

TYPICAL PEDON: Cushman loam-on south facing slope of about 3 percent under native grass vegetation. (Colors are for dry soil unless otherwise stated)

The Cushman series consists of well drained soils that are moderately deep to bedrock. These soils formed in slopewash alluvium and residuum from interbedded shales and siltstone and fine-grained argillaceous sandstone. Cushman soils are on buttes, fan remnants, hills, piedmonts, ridges and terraces. Slopes are 0 to 20 percent. The mean annual precipitation is about 13 inches, and the mean annual air temperature is about 45 degrees F.

A--0 to 6 inches; light brownish gray (10YR 6/2) loam, dark brown (10YR 3/3) moist; moderate medium granular structure; soft, friable, slightly sticky and slightly plastic; common very fine, fine, and few medium roots; non-effervescent; moderately acid (pH 5.7); clear smooth boundary.

Bt1--6 to 14 inches; brown (10YR 5/3) sandy clay loam, dark yellowish brown (10YR 3/4) moist; weak medium prismatic structure parting to moderate medium subangular blocky; slightly hard, friable, moderately sticky and moderately plastic; common very fine, fine and few medium roots; few faint clay films on faces of peds and lining pores; non-effervescent; slightly acid (pH 6.1); clear smooth boundary.

Bt2--14 to 22 inches; yellowish brown (10YR 5/4) sandy clay loam, dark yellowish brown (10YR 4/4) moist; moderate coarse prismatic structure parting to strong medium angular blocky; hard, firm, moderately sticky and moderately plastic; few fine, medium and coarse roots; common distinct clay films on faces of peds, lining pores and root channels; non-effervescent; neutral (pH 7.3); clear wavy boundary.

Cr--22 to 36 inches; calcareous sedimentary rock, shale and sandstone.

TYPE LOCATION: Crook County, Wyoming; refer to waypoint 42 on Figure 3.3-9 in the ER.

RANGE IN CHARACTERISTICS (according to official series description): Depth to a paralithic contact and bedrock is typically about 28 to 32 inches but ranges from 20 to 40 inches. Depth to continuous horizons of carbonate accumulation is 7 to 26 inches. Depth to the base of the argillic horizon ranges from 10 to 26 inches. Rock fragments range from 0 to 15 percent and are soft shale channers or semirounded sandstone pebbles. The soil is dry in the moisture control section more than half the time cumulative that the soil temperature at a depth of 20 inches is 41 degrees F., which occurs about April 21-27, and is dry in all parts of the moisture control section for at least 60 consecutive days from July 15 to October 25 and for at least 90 cumulative days during this period. The mean annual soil temperature is 47 to 53 degrees F., and the soil temperature at a depth of 20 inches is 41 degrees F. or more for 175 to 192 days. EC ranges from 0 to 2 mmhos throughout.

The A horizon has hue of 10YR or 2.5Y, value of 4 to 6 dry, 3 to 5 moist, and chroma of 2 to 4. Reaction is neutral or slightly alkaline.

The Bt horizon has hue of 10YR or 2.5Y, value of 4 to 6 dry, 3 to 5 moist, and chroma of 2 to 4. Texture of the Bt is clay loam or loam with 20 to 35 percent clay and more than 15 percent but less than 35 percent fine sand or coarser. Reaction is neutral to moderately alkaline.

The Btk horizon has hue of 10YR or 2.5Y, value of 5 to 7 dry, 4 to 6 moist, and chroma of 2 to 4. Texture is loam or clay loam with 20 to 35 percent clay. Reaction is moderately alkaline or strongly alkaline. Calcium carbonate ranges from 3 to 12 percent.

The Bk horizon has hue of 10YR and 2.5Y, value of 6 to 8 dry, 4 to 6 moist, and chroma of 2 to 4. Texture is loam or clay loam with 20 to 30 percent total clay of which about 2 to 4 percent is carbonate clay. Reaction is typically moderately alkaline but may be strongly alkaline when sodic shales are present. Calcium carbonate equivalent is 5 to 15 percent, but some horizons may exceed 15 percent but are discontinuous or too thin to be considered as a calcic.

The Cr is weakly consolidated sedimentary rock. It is primarily calcareous shale; but siltstone or thinly interbedded fine grained argillaceous sandstone is common. The rock is typically moderately alkaline or strongly alkaline when crushed, but slightly alkaline or neutral shales are not uncommon.

TAXONOMIC CLASS: Fine-loamy, mixed, superactive, mesic Ustic Haplargids

SUITABILITY FOR TOPSOIL (according to WDEQ/LQD Guideline 1, 1994): no marginal or unsuitable parameters were found. Estimated salvage depth is 22 inches.

GEOGRAPHIC SETTING (according to official series description): Cushman soils are on buttes, fan remnants fan piedmonts, hills and ridges. Slopes range from 0 to 20 percent. The soils formed in moderately fine textured slopewash alluvium and residuum. Surface erosion is common in overgrazed areas, and some thin eolian deposits overlie these soils in some areas. Elevations are 3,500 to 6,000 feet. The mean annual precipitation is 13 inches and ranges from 10 to 14 inches with over half of the annual precipitation falling in April, May, and June and less than one inch falling in each month of July, August, September and October. The mean annual temperature is 43 to 51 degrees F. The frost-free season is about 105 to 130 days depending upon elevation, aspect, and air drainage.

VARIATION FROM TYPICAL SERIES: The texture is courser than typical from 6-22". The depth to paralithic contact is slightly shallower than typical. This profile is less calcareous than typical. This profile is more acidic that typical.

TASSEL sandy loam

SOIL MAPPING UNIT: TA

SOIL SAMPLE LOCATION: #64

TYPICAL PEDON: Tassel sandy loam with a slope of 15 percent in rangeland. (Colors are for dry soil unless otherwise stated)

The Tassel series consists of very shallow or shallow, well drained soils formed in residuum weathered from sandstone on uplands. Permeability is moderately rapid. Slopes range from 0 to 70 percent. The mean annual precipitation is about 15 inches and the mean annual air temperature is about 48 degrees F at the type location.

A--0 to 4 inches; light brownish gray (10YR 6/2) sandy loam, dark grayish brown (10YR 4/2) moist; weak medium granular structure; soft, very friable; 3 percent sandstone gravel by volume; non-effervescent; slightly alkaline (pH 7.5); gradual smooth boundary.

Ck--4 to 10 inches; light gray (10YR 7/2) sandy loam, grayish brown (10YR 5/2) moist; massive; slightly hard, friable; 10 percent sandstone gravel and cobbles by volume; strongly effervescent; slightly alkaline (pH 7.7); gradual smooth boundary.

Cr--10 to 24 inches; calcareous weathered sandstone.

TYPE LOCATION: Crook County, Wyoming; refer to waypoint 64 on Figure 3.3-9 in the ER.

RANGE IN CHARACTERISTICS (according to official series description):

Depth to carbonates: 0 to 3 inches
Particle-size control section: clay content ranges from 5 to 12 percent, but averages 10 percent or less; sand content that ranges from 52 to 75 percent
Depth to the Cr horizon: typically 10 to 20 inches, but ranges from 6 to 20
Reaction: slightly alkaline or moderately alkaline throughout the profile.

A horizon:
Hue: 10YR or 2.5Y
Value: 4 to 7 and 3 to 6 moist
Chroma: 2 to 4
Texture: typically fine sandy loam, but ranges to include very fine sandy loam, loamy very fine sand, sandy loam, loamy sand or loamy fine sand
Notes: Where the A horizon has mollic colors, it lacks sufficient thickness to qualify for a mollic epipedon. Some pedons have an AC horizon that is intermediate in color and texture between the A and C horizon.

C horizon:
Hue: 10YR, 2.5Y or 5Y
Value: 5 to 8 and 4 to 7 moist
Chroma of 2 or 3

Texture: typically fine sandy loam, but the range includes very fine sandy loam with less than 12 percent clay, sandy loam, loamy very fine sand and loamy fine sand

TAXONOMIC CLASS: Loamy, mixed, superactive, calcareous, mesic, shallow Ustic Torriorthents

SUITABILITY FOR TOPSOIL (according to WDEQ/LQD Guideline 1, 1994): no marginal or unsuitable parameters were found. Estimated salvage depth is 4 inches.

GEOGRAPHIC SETTING (according to official series description):

Landscape: uplands
Slopes: 0 to 70 percent
Parent material: loamy, calcareous, weathered sandstone residuum
Mean annual air temperature: 46 to 52 degrees F
Mean annual precipitation: 12 to 18 inches.

VARIATION FROM TYPICAL SERIES: There is no variation from the typical series.

ASCALON sandy clay loam

SOIL MAPPING UNIT: AS

SOIL SAMPLE LOCATION: #75

TYPICAL PEDON: Ascalon sandy clay loam, grassland. (Colors are for dry soil unless otherwise noted.)

The Ascalon series consists of very deep, well drained soils that formed in moderate coarse textured calcareous material. Ascalon soils are on upland hillslopes and tableland plains. Slopes range from 0 to 25 percent. The mean annual precipitation is about 41 centimeters (16 inches) and the mean annual air temperature is about 10 degrees C (49 degrees F) at the type location.

A--0 to 4 inches; grayish brown (10YR 5/2) sandy clay loam, very dark grayish brown (10YR 3/2) moist; moderate very fine granular structure; soft, very friable; 3 percent pebbles; non-effervescent; neutral (pH 7.3); clear smooth boundary.

BA--4 to 10 inches; grayish brown (10YR 5/2) sandy clay loam, very dark grayish brown (10YR 3/2) moist; weak subangular blocky structure parting to moderate medium granular; slightly hard, very friable; few faint clay films on faces of peds; 3 percent pebbles; non-effervescent; slightly alkaline (pH 7.5); clear smooth boundary.

Ck1--10 to 24 inches; brown (10YR 5/3) sandy clay loam, dark brown (10YR 3/3) moist; moderate medium prismatic structure parting to moderate medium subangular blocks; very hard, very friable; many distinct clay films on faces of peds; 3 percent pebbles; strongly effervescent; slightly alkaline (pH 7.8); gradual smooth boundary.

Ck2--24 to 34 inches; brown (10YR 5/3) sandy loam, brown (10YR 4/3) moist; moderate medium prismatic structure parting to moderate medium subangular blocks; very hard, very friable; common distinct clay films on faces of peds and in root channels; strongly effervescent; moderately alkaline (pH 8.1); clear smooth boundary.

Ck3--34 to 40 inches; light gray (2.5Y 7/2) clay loam, light olive brown 2.5Y 5/3) moist; weak medium subangular blocky structure; hard, very friable; concretions, thin seams and streaks of calcium carbonate; few faint clay films on faces of some peds; 5 percent pebbles, strongly effervescent; moderately alkaline (pH 8.3); gradual smooth boundary.

Ck4--40 to 60 inches; pale yellow (2.5Y 7/3) sandy clay loam, light olive brown (2.5Y 5/3) moist; massive; slightly hard, very friable; 5 percent pebbles; non-effervescent; strongly alkaline (pH 8.6).

TYPE LOCATION: Crook County, Wyoming; refer to waypoint 75 on Figure 3.3-9 in the ER.

RANGE IN CHARACTERISTICS (according to official series description):

Mean annual soil temperature: 8 to 15 degrees C (47 to 58 degrees F).
Mean summer soil temperature: 15 to 26 degrees C (59 to 78 degrees F).
Mollic epipedon: thickness ranges from 18 to 51 centimeters (7 to 20 inches)
Depth to secondary calcium carbonate: 20 to 76 centimeters (8 to 30 inches)
Depth to the base of the Bt horizon: 38 to 76 centimeters (15 to 30 inches)
Organic carbon: ranges from .6 to 2 percent in the mollic epipedon and decreases uniformly with depth.
Rock fragments: range from 0 to 15 percent but are usually less than 5 percent.

A horizon:
Hue: 2.5Y or 10YR
Value: 4 or 5 dry, 2 or 3 moist
Chroma: 2 or 3
Texture: loamy sand, sandy loam, fine sandy loam or loam.
Structure: primarily granular or subangular blocky
Consistence: soft or slightly hard
Reaction: neutral or slightly alkaline (pH 6.6 to 7.6).

Bt horizons:
Hue: 2.5Y to 7.5YR
Value: 4 to 6 dry, 3 or 4 moist
Chroma: 2 to 4
Texture: sandy clay loam
Clay content: 18 to 35 percent
Silt content: 5 to 30 percent
Sand content: 50 to 75 percent (more than 35 percent is fine sand or coarser, but with only minor amounts of medium to coarse angular granitic sand.
Reaction: neutral through slightly alkaline

Bk horizons:
Hue: 2.5Y or 10YR
Value: 5 to 7 dry, 4 to 6 moist
Chroma: 2 to 4
Texture: fine sandy loam, sandy loam, sandy clay loam, and loam.
Reaction: moderately or strongly alkaline
Calcium carbonate equivalent: 5 to 15 percent
Coarse fragment content: variable range below 40 inches.

C horizon: if present,
Hue: 2.5Y or 10YR
Value: 6 or 7 dry, 5 or 6 moist
Chroma: 2 to 4
Texture: loamy fine sand, sandy loam, and sandy clay loam.

TAXONOMIC CLASS: Fine-loamy, mixed, superactive, mesic Aridic Argiustolls

SUITABILITY FOR TOPSOIL (according to WDEQ/LQD Guideline 1, 1994): Marginal pH values were found from 40-60". Estimated salvage depth is 10 inches.

GEOGRAPHIC SETTING (according to official series description):

Parent material: thick, moderately coarse textured, calcareous material.
Landform: hills and plains
Slope: 0 to 25 percent
Elevation: 1219 to 1829 meters (4000 to 6000 feet).
Mean annual precipitation: 33 to 43 centimeters (13 to 17 inches), with peak periods of precipitation occurring during the spring and summer.
Mean annual temperature: 10 to 12 degrees C (49 to 53 degrees F).
Average summer temperature: 20 to 23 Degree C (68 to 73 degrees F).
Frost-free season: about 130 to 160 days.

VARIATION FROM TYPICAL SERIES: The texture is finer from 34-40" than typical. There are Ck horizons in place of the typical Bt and Bk horizons.

SHINGLE clay loam

SOIL MAPPING UNIT: SH

SOIL SAMPLE LOCATION: #77

TYPICAL PEDON: Shingle clay loam-rangeland. (Colors are for dry soil unless otherwise stated.)

The Shingle series consists of well drained soils that are very shallow or shallow to bedrock. They formed in residuum and colluvium derived from interbedded shale and sandstone or in alluvium from mudstone. Shingle soils are on bedrock controlled hillslopes and ridges. Slopes are 0 to 80 percent. The mean annual precipitation is about 13 inches, and the mean annual temperature is 45 degrees F.

A--0 to 4 inches; light brownish gray (10YR 6/2) clay loam, dark grayish brown (10YR 4/2) moist; moderate very fine granular structure; soft, very friable, moderately sticky and moderately plastic; non-effervescent; neutral (pH 7.1); clear smooth boundary.

Bw--4 to 15 inches; light yellowish brown (2.5Y 6/3) clay loam, light olive brown (2.5Y 5/3) moist; weak medium subangular blocky structure; hard, friable, moderately sticky and moderately plastic; slightly effervescent, calcium carbonate disseminated; slightly alkaline (pH 7.6); gradual smooth boundary.

Ck--15 to 20 inches; light yellowish brown (2.5Y 6/3) silty clay loam, light olive brown (2.5Y 5/3) moist; massive; hard, variable, moderately sticky and moderately plastic; strongly effervescent, calcium carbonate disseminated; slightly alkaline (pH 7.6); clear wavy boundary.

Cr--20 to 36 inches; calcareous gray weathered shale and yellow sandstone.

TYPE LOCATION: Crook County, Wyoming; refer to waypoint 77 on Figure 3.3-9 in the ER.

RANGE IN CHARACTERISTICS (according to official series description):

Depth to soft bedrock and paralithic contact ranges from 4 to 20 inches. The mean annual soil temperature is 47 to 53 degrees F. The soils commonly are calcareous throughout, but some pedons are leached to 6 inches. The particle size control section averages 20 to 35 percent clay and has more than 15 percent but less than 35 percent fine or coarser sand. The soil is usually dry. The moisture control section is usually moist in April, May and early June. It is dry for 60 consecutive days or more during the 90 day period following the summer solstice. EC is 0 to 2 mmhos throughout.

The A horizon has hue of 5Y through 7.5YR, value of 5 through 7 dry, 3 through 6 moist, and chroma of 1 through 6. Reaction is neutral through strongly alkaline. Some pedons have a light gravel lag on the surface. Texture is loam, silt loam, clay loam, silty clay loam, cobbly loam, and gravelly clay loam. Rock fragments or shale channers range from 0 to 35 percent.

A Bw or AC horizon, when present, has the combined properties of the A and C horizons.

The C horizon has hue of 5Y through 7.5YR, value of 4 through 7 dry, 3 through 6 moist, and chroma of 1 through 6. It is loam, silt loam, clay loam or silty clay loam. Rock fragments or shale channers range from 0 to 35 percent. Reaction is slightly alkaline through strongly alkaline.

TAXONOMIC CLASS: Loamy, mixed, superactive, calcareous, mesic, shallow Ustic Torriorthents

SUITABILITY FOR TOPSOIL (according to WDEQ/LQD Guideline 1, 1994): no marginal or unsuitable parameters were found. Estimated salvage depth is 15 inches.

GEOGRAPHIC SETTING (according to official series description): The Shingle soils occur on all hillslope positions. Slopes are 0 to 80 percent. These soils formed in colluvium and residuum weathered from soft, interbedded sandstone and shale or in alluvium from mudstone. Elevation is 3,200 to 6,500 feet. The mean annual precipitation is about 10 to 14 inches, most of which falls in April, May, and June. The mean annual temperature is about 45 degrees F.but ranges from 43 to 51 degrees F. The frost-free season is about 105 to 130 days.

VARIATION FROM TYPICAL SERIES: There is no variation from the typical series.

ABSTED clay loam

SOIL MAPPING UNIT: AB

SOIL SAMPLE LOCATION: #78

TYPICAL PEDON: Absted clay loam-on south facing slope of about one percent under native grass vegetation. (Colors are for dry soil unless otherwise stated)

The Absted series consists of very deep, well drained soils that formed in slopewash alluvium derived mainly from sodic shale. Absted soils are on fan remnants, alluvial fans, hillslopes and terraces. Slopes are 0 to 25 percent. The mean annual precipitation is about 13 inches, and the mean annual air temperature is about 48 degrees F.

A--0 to 6 inches; light gray (10YR 7/2) clay loam, very dark grayish brown (10YR 3/2) moist; strong thick platy structure parting to strong thin platy; slightly hard, very friable, slightly sticky and nonplastic; common fine and very fine roots; non-effervescent; neutral (pH 7.1); abrupt smooth boundary.

Btk1--6 to 14 inches; brown (10YR 5/3) clay loam, dark grayish brown (10YR 4/2) moist; strong medium columnar structure parting to strong medium and fine angular blocky; very hard, firm, sticky and plastic; few fine and medium roots; many prominent clay films on faces of peds; moderately effervescent; moderately alkaline (pH 8.0); clear smooth boundary.

Btk2--14 to 29 inches; brown (10YR 5/3) clay, dark grayish brown (10YR 4/2) moist; strong medium angular blocky structure; very hard, friable, sticky and plastic; few fine and medium roots; common distinct clay films on faces of peds; moderately effervescent; calcium carbonate and gypsum as common fine filaments and threads; moderately alkaline (pH 8.4); clear smooth boundary.

Btkn1--29 to 35 inches; pale brown (10YR 6/3) clay, dark grayish brown (10YR 4/2) moist; moderate coarse subangular blocky structure; very hard, firm, sticky and plastic; moderately effervescent; many prominent threads of calcium carbonate and gypsum; moderately alkaline (pH 8.1).

Btkn2--35 to 43 inches; pale brown (10YR 6/3) clay, dark grayish brown (10YR 4/2) moist; moderate coarse subangular blocky structure; very hard, firm, sticky and plastic; moderately effervescent; many prominent threads of calcium carbonate and gypsum; moderately alkaline (pH 8.3).

Btkn3--43 to 60 inches; pale brown (10YR 6/3) clay loam, dark grayish brown (10YR 4/2) moist; moderate coarse subangular blocky structure; very hard, firm, sticky and plastic; strongly effervescent; many prominent threads of calcium carbonate and gypsum; strongly alkaline (pH 8.5).

TYPE LOCATION: Crook County, Wyoming; refer to waypoint 78 on Figure 3.3-9 in the Environmental Report.

RANGE IN CHARACTERISTICS (according to official series description):

Depth to horizons of continuous calcium carbonate accumulations is 6 to 20 inches. Depth to layers with ESP greater than 15 is more than 7 inches. Rock fragments in the control section range from 0 to 15 percent and is mostly gravel. These soils are usually dry, but are moist in some or all parts of the moisture control section in April, May, and early June in most years. The moisture control section is dry for more than 60 consecutive days during the 90 day period following the summer solstice. The mean annual soil temperature is 47 to 53 degrees F. The soil temperature at 20 inches is 41 degrees F. or warmer for 175 to 195 days. Organic carbon in upper 40 cm. of the profile is .6 to .8 percent.

The A horizon has hue of 10YR, 2.5Y or 5Y; 10YR hue has value of 5 to 7 dry and 3 to 6 moist, and chroma of 2 or 3; 2.5Y and 5Y hues have value of 5 or 6 dry and 4 or 5 moist. Textures are sandy loam, sandy clay loam, fine sandy loam, very fine sandy loam or loam. Reaction is neutral or slightly alkaline.

The E horizon has hue of 10YR, 2.5Y or 5Y; 10YR hue has value of 5 to 7 dry and 3 to 6 moist, and chroma of 2 or 3. Textures are silty clay loam, fine sandy loam, very fine sandy loam, silt loam, loam or clay loam. Reaction is typically neutral through moderately alkaline but is slightly acid in some pedons. This horizon is absent in some pedons.

The Bt horizon has hue of 10YR, 2.5Y or 7.5YR; 10YR and 2.5Y hues have value of 4 to 7 dry and 3 to 5 moist, and chroma of 2 to 4; 7.5YR hue has chroma 3 or 4; Textures are silty clay, clay, clay loam or silty clay loam with clay ranging from 35 to 50 percent, silt from 15 to 50 percent, and sand from 10 to 45 percent. Exchangeable sodium is 3 to 12 percent. It is slightly alkaline to strongly alkaline.

The Btkn horizon has hue of 10YR, 2.5Y or 5Y, value of 5 or 6 dry and 4 or 5 moist, and chroma of 2 or 3 in 10YR hue and 2 to 4 in 2.5Y hue. Textures are the same as for the Bt horizon. Reaction is strongly or very strongly alkaline. Exchangeable sodium is greater than 15 percent. Salinity is 4 to 15 mmhos/cm.

The Bkn or Bkny horizons have hue of 10YR, 2.5Y or 5Y, value of 5 to 7 dry and 4 to 6 moist, and chroma of 2 or 3 in 10YR hue and 2 to 4 in 2.5Y and 5Y. Textures are the same as for the Bt and Btkn horizons. Exchangeable sodium is 10 to 30 percent. Calcium carbonate equivalent is 6 to 15 percent. Salinity ranges from 8 to 16 mmhos/cm. Reaction is moderately through very strongly alkaline.

The C horizon, when present, has the same range in texture, reaction, and color as the Bkn horizon. Exchangeable sodium is 10 to 30 percent.

TAXONOMIC CLASS: Fine, smectitic, mesic Haplic Ustic Natrargids

SUITABILITY FOR TOPSOIL (according to WDEQ/LQD Guideline 1, 1994): Marginal values were found for texture and saturation percentage from 14-43" and for selenium from 29-60". Unsuitable values were found for SAR from 14-60". Estimated salvage depth is 14 inches.

GEOGRAPHIC SETTING (according to official series description): Absted soils are on hillslopes, terraces, fan remnants, alluvial fans, piedmonts and fan aprons. Slopes are 0 to 25 percent. These soils formed in alluvium derived from alkaline shale. Some areas have an eolian influence on the surface layer. Elevation is 3500 to 5500 feet. The mean annual precipitation is 10 to 14 inches with more than half falling in April, May and June. The frost-free period is 105 to 130 days.

VARIATION FROM TYPICAL SERIES: There is no variation from the typical series.

BIDMAN clay loam

SOIL MAPPING UNIT: BI

SOIL SAMPLE LOCATION: #80

TYPICAL PEDON: Bidman clay loam-grassland. (Colors are for dry soil unless otherwise noted)

The Bidman series consists of very deep, well drained soils that formed in alluvium weathered from shale bedrock. Bidman soils are on alluvial fans, fan remnants, terrace, ridges and hills. Slopes are 0 to 25 percent. The mean annual precipitation is about 12 inches, and the mean annual air temperature is about 47 degrees F.

A--0 to 5 inches; light brownish gray (10YR 6/2) clay loam, dark grayish brown (2.5Y 4/2) moist; weak thin platy structure that parts to very fine granules; soft, very friable; uncoated sand grains; noneffervescent; slightly acid (pH 6.1); abrupt smooth boundary.

Bt1--5 to 17 inches; brown (10YR 5/3) clay loam, brown (10YR 4/3) moist; strong medium prismatic structure that parts to strong medium angular blocky; hard, very sticky and very plastic; many prominent clay films on faces of peds, in channels and pores; few streaks of bleached sand grains in the upper 2 inches; noneffervescent; slightly acid (pH 6.4); clear wavy boundary.

Bt2--17 to 33 inches; light yellowish brown (2.5Y 6/3) clay, light olive brown (2.5Y 5/3) moist; weak coarse prismatic structure that parts to moderate coarse angular and subangular blocks; extremely hard, very friable; sticky and plastic; few distinct clay films on faces of peds; noneffervescent; neutral (pH 7.2); gradual wavy boundary.

Btk1--33 to 52 inches; light olive brown (2.5Y 5/3) clay loam, olive brown (2.5Y 4/3) moist; massive; hard, very friable, sticky and slightly plastic; strongly effervescent, calcium carbonate as soft masses; moderately alkaline (pH 7.9).

Btk2--52 to 60 inches; light olive brown (2.5Y 5/3) clay loam, olive brown (2.5Y 4/3) moist; massive; hard, very friable, sticky and slightly plastic; strongly effervescent; slightly alkaline (pH 7.8).

TYPE LOCATION: Crook County, Wyoming; refer to waypoint 80 on Figure 3.3-9 in the ER.

RANGE IN CHARACTERISTICS (according to official series description): Depth to calcareous material ranges from 8 to 26 inches. Depth to the base of the argillic horizon range from 15 to 36 inches. Organic carbon ranges from .6 to 1.5 percent in the surface horizons and decreases uniformly with increasing depth. Cation exchange capacity ranges from 60 to 90 milliequivalents per 100 grams of clay. Rock fragments are typically less than 2 percent but ranges from 0 to 15 percent. This soil is dry in the moisture control section more than half the time cumulative that the soil temperature at a depth of 20 inches is 41 degrees F. It is never moist in some or all parts for as long as 60 consecutive days during this same period. It is dry in all parts of the

moisture control section for at least 60 consecutive days from July 15 to October 25 and for at least 90 cumulative days during this period. The mean annual soil temperature is 47 to 53 degrees F., and the soil temperature at a depth of 20 inches is 41 degrees F. or warmer for 175 to 195 days. The mean summer soil temperature at depth of 20 inches ranges from 59 to 65 degrees F.

The E horizon has hue of 2.5Y or 10YR, value of 5 to 7 dry, 4 or 5 moist, and chroma of 2 to 4. It usually has platy structure but has granular structure in some pedons. It is loam, very fine sandy loam or sandy loam. It is soft or slightly hard. Reaction is slightly acid to slightly alkaline. Some pedons have an A horizon.

The Bt horizon has hue of 2.5Y, 10YR or 7.5YR, value of 5 or 6 dry, 4 or 5 moist, and chroma of 2 to 4. It is silty clay, silty clay loam, clay loam or clay but has 35 to 50 percent clay, 15 to 45 percent silt, and 15 to 45 percent sand with more than 15 percent fine or coarser sand. This horizon typically has prismatic structure but has columnar or angular blocky structure in some pedons. It has oriented clay films in some part. Reaction is neutral to moderately alkaline. EC is 0 to 8 mmhos/cm.

The Btk horizon has hue of 10YR or 2.5Y, value of 5 or 6 and 4 or 5 moist, and chroma of 2 to 4. It is clay loam, silty clay loam, clay or silty clay. It is slightly alkaline to strongly alkaline. It has a calcium carbonate equivalent of 5 to 12 percent. It has an EC of 0 to 2 mmhos/cm and 4 to 12 in the saline phase.

The Bk horizon ranges from 5Y, 2.5Y or 10YR, value of 5 to 7 dry, 4 to 6 moist, and chroma of 2 to 4. It is clay loam, loam, sandy clay loam, or light clay. This horizon has 6 to 14 percent calcium carbonate equivalent. Reaction is moderately alkaline or strongly alkaline. EC is 0 to 12 mmhos.

Some pedons have a C horizon below 40 inches that have properties that are similar to the Bk horizon. A gravelly substratum phase is recognized.

TAXONOMIC CLASS: Fine, smectitic, mesic Ustic Paleargids

SUITABILITY FOR TOPSOIL (according to WDEQ/LQD Guideline 1, 1994): Marginal texture values were found from 17-33". Estimated salvage depth is 33 inches.

GEOGRAPHIC SETTING (according to official series description): The Bidman soils are on alluvial fans, fan remnants, terraces, ridges and hills. Elevation is 2,600 to 6,000 feet. Slopes range from 0 to 25 percent. These soils formed in thick, calcareous alluvial sediments derived from sedimentary rock. At the type location the mean annual temperature is 47 degrees F., and the mean summer temperature is 66 degrees F. The average annual precipitation is about 12 inches with about half the precipitation in April, May, and June. Precipitation ranges from 10 to 14 inches. The frost-free season is 100 to 130 days.

VARIATION FROM TYPICAL SERIES: The pH is slightly more acidic than typical from 5-17".

NUNN clay loam

SOIL MAPPING UNIT: NU

SOIL SAMPLE LOCATION: #81

TYPICAL PEDON: Nunn clay loam - grassland. (Colors are for dry soil unless otherwise noted)

The Nunn series consists of very deep, well drained soils that formed in loess and mixed alluvium. Nunn soils are on terraces or alluvial fans, and in drainageways. Slopes range from 0 to 25 percent. The mean annual precipitation is about 14 inches and the mean annual air temperature is about 48 degrees F.

A--0 to 5 inches; grayish brown (10YR 5/2) clay loam, very dark grayish brown (10YR 3/2) moist; moderate medium granular structure; soft, very friable; non-effervescent; moderately acid (pH 5.9); clear smooth boundary.

Bt--5 to 21 inches; grayish brown (10YR 5/2) clay loam, very dark grayish brown (10YR 3/2) moist; weak medium prismatic structure parting to moderate medium subangular blocky; hard, very friable, sticky and plastic; few faint clay films on faces of peds; non-effervescent; slightly alkaline (pH 7.4); clear smooth boundary.

Btk1--21 to 40 inches; pale brown (10YR 6/3) loam, brown (10YR 4/3) moist; moderate medium and coarse prismatic structure parting to moderate medium subangular blocky; very hard, firm, very sticky and very plastic; many distinct clay films on faces of peds; moderately effervescent; moderately alkaline (pH 7.9); clear smooth boundary.

Btk2--40 to 51 inches; pale brown (10YR 6/3) clay loam, brown (10YR 5/3) moist; weak medium subangular blocky structure; very hard, firm, very plastic; few faint clay films on faces of peds; visible calcium carbonate occurring as small concretions; strongly effervescent; moderately alkaline (pH 8.2); gradual smooth boundary.

Ck--51 to 60 inches; light yellowish brown (10YR 6/4) sandy loam, dark yellowish brown (10YR 4/4) moist; massive; very hard, firm, sticky and plastic; visible calcium carbonate occurring as concretions, thin seams and streaks; violently effervescent; moderately alkaline (pH 8.4); gradual smooth boundary.

TYPE LOCATION: Crook County, Wyoming; refer to waypoint 81 on Figure 3.3-9 in the ER.

RANGE IN CHARACTERISTICS (according to official series description): Mean annual soil temperature at depth of 20 inches is 47 to 54 degrees F, and mean summer temperature is 59 to 79 degrees F. The mollic epipedon is 7 to 19 inches thick, depth to lime is 10 to 30 inches, and the solum is 16 to 46 inches thick. Organic carbon in the mollic epipedon ranges from .8 to 3 percent. The soil is typically 90 to 100 percent base-saturated. Rock fragments are typically less than 5 percent and range from 0 to 15 percent. The soil temperature at depth of 20 inches is 41 degrees F or warmer for

about 200 to 240 days. The soils are moist in some part of the moisture control section for about 56 to 152 days while the soil temperature is 41 degrees F or above.

The A horizon has hue of 5Y to 7.5YR, value of 4 or 5, 2 or 3 moist, and chroma of 1 to 3. Usually it has granular or crumb structure but the structure is subangular blocky in some pedons. This horizon is soft or slightly hard. It is slightly acid to slightly alkaline.

The Bt horizon has hue of 5Y to 7.5YR, value of 3 to 7, 2 to 6 moist, and chroma of 2 to 5. It is typically clay, silty clay loam or clay loam and has 35 to 50 percent clay, 15 to 45 percent silt, and 15 to 45 percent sand with more than 15 percent, being fine sand or coarser. Some pedons have sandy clay loam textures in the lower parts of the argillic layer, however, the weighted clay average is greater than 35 percent in the control section. It is slightly acid to moderately alkaline. CEC of the Bt horizon ranges from 60 to 90 millequivalents per 100 grams of clay.

The Bk or C horizon has hue of 5Y to 7.5YR, value of 5 to 7, 4 to 6 moist, and chroma of 2 to 4. They are typically clay loam with more than 28 percent clay, however, where the C horizon has less than 28 percent clay it contains more than 15 percent fine or coarser sand and has a texture of sandy clay loam, loam or sandy loam. These horizons are slightly alkaline to strongly alkaline and have 4 to 15 percent calcium carbonate equivalent.

TAXONOMIC CLASS: Fine, smectitic, mesic Aridic Argiustolls

SUITABILITY FOR TOPSOIL (according to WDEQ/LQD Guideline 1, 1994): no marginal or unsuitable parameters were found. Estimated salvage depth is 40 inches.

GEOGRAPHIC SETTING (according to official series description): The Nunn soils are on terraces or alluvial fans, or in drainageways. Slope gradients range from 0 to 25 percent. The soils formed in mixed alluvium. At the type location the average annual precipitation is 13 inches, 9 inches of which falls during the months of April through September. Mean annual air temperature is 47 to 53 degrees F, and an average summer temperature is 67 degrees F. The frost-free period is 120 to 210 days.

FORKWOOD sandy clay loam

SOIL MAPPING UNIT: FO

SOIL SAMPLE LOCATION: PS-1

TYPICAL PEDON: Forkwood sandy clay loam - utilized as rangeland. (Colors are for dry soil unless otherwise stated)

The Forkwood series consists of very deep, well drained soils formed in alluvium. Forkwood soils are on terraces, alluvial fans, fan remnants, hills, ridges and pediments. Slopes range from 0 to 15 percent. The mean annual precipitation is about 11 inches, and the mean annual air temperature is about 45 degrees F.

A--0 to 5 inches; brown (10YR 5/3) sandy clay loam, dark grayish brown (10YR 4/2) moist; weak fine granular structure; soft, very friable, slightly sticky and slightly plastic; many fine and medium roots throughout; non-effervescent; moderately acid (pH 5.9); abrupt smooth boundary.

Bt1--5 to 16 inches; brown (10YR 5/3) sandy clay loam, brown (10YR 4/3) moist; strong medium angular blocky structure; slightly hard, friable, moderately sticky and moderately plastic; common fine and medium roots throughout; common distinct clay films on faces of peds; non-effervescent; neutral (pH 6.7); clear smooth boundary.

Btk1--16 to 28 inches; light brownish gray (2.5Y 6/2) sandy clay loam, dark grayish brown (2.5Y 4/2) moist; strong medium angular blocky structure; hard, firm, moderately sticky and moderately plastic; few fine and medium roots throughout; few faint clay films on faces of peds; few masses of carbonates; strongly effervescent; slightly alkaline (pH 7.6); clear smooth boundary.

Btk2--28 to 44 inches; light brownish gray (2.5Y 6/2) sandy loam, light olive brown (2.5Y 5/4) moist; moderate medium subangular blocky structure parting to weak fine subangular blocky; slightly hard, friable, slightly sticky and sligtly plastic; few fine roots throughout; few fine threads and masses of carbonates throughout; strongly effervescent; moderately alkaline (pH 8.3); gradual wavy boundary.

Btk3--44 to 54 inches; light brownish gray (2.5Y 6/2) clay, grayish brown (2.5Y 5/2) moist; massive; soft, very friable, slightly sticky and slightly plastic; few fine roots throughout; few masses of carbonates throughout; violently effervescent; strongly alkaline (pH 8.8).

Btk4--54 to 60 inches; light brownish gray (2.5Y 6/2) clay, grayish brown (2.5Y 5/2) moist; massive; soft, very friable, slightly sticky and slightly plastic; few fine roots throughout; few masses of carbonates throughout; strongly effervescent; strongly alkaline (pH 8.6).

TYPE LOCATION: Crook County, Wyoming; refer to waypoint PS-1 on Figure 3.3-9 in the ER.

RANGE IN CHARACTERISTICS (according to official series description): Depth to the base of the argillic horizon is 10 to 33 inches, and depth to continuous horizons of carbonate accumulation is 10 to 33 inches. Rock fragments range from 0 to 15 percent. The soil is dry in the moisture control section more than half the time cumulative that the soil temperature at a depth of 20 inches is 41 degrees F., which occurs about April 21-27, and is dry in all parts of the moisture control section for at least 60 consecutive days from July 15 to October 25 and for at least 90 cumulative days during this period. The mean annual soil temperature ranges from 47 to 53 degrees F., and the soil temperature at a depth of 20 inches is 41 degrees F. or more for 175 to 192 days. EC ranges from 0 to 4 mmhos/cm throughout the profile. Bedrock is deeper than 60 inches.

The A horizon has hue of 2.5Y or 10YR, value of 4 to 6 dry and 3 to 5 moist, and chroma of 2 to 4. A vesicular crust occurs on some pedons. Texture is very fine sandy loam, loam, clay loam or fine sandy loam. Reaction is neutral through moderately alkaline.

The Bt horizon has hue of 2.5Y, 10YR or 7.5YR, value of 4 to 7 dry and 3 to 5 moist, and chroma of 2 to 4. Texture is loam or clay loam with 18 to 35 percent clay and more than 15 but less than 35 percent fine sand or coarser. Reaction is neutral through moderately alkaline.

The Btk horizon has hue of 2.5Y or 10YR, value of 4 to 7 dry and 3 to 5 moist, and chroma of 2 to 4. Texture is loam or clay loam. It is slightly alkaline or moderately alkaline. It has 3 to 12 percent calcium carbonate equivalent.

The Bk horizon has hue of 5Y, 2.5Y or 10YR, value of 5 to 7 dry and 4 to 6 moist, and chroma of 2 to 4. Texture is loam, fine sandy loam, very fine sandy loam or clay loam. This horizon has 1 to 14 percent authigenic calcium carbonate accumulation. It is moderately alkaline or strongly alkaline.

The C horizon, when present, has hue of 5Y to 10YR, value of 5 to 7 dry, 4 to 6 moist, and chroma of 2 to 4. Carbonates range from 1 to 8 percent and are mostly allogenic. ESP ranges from 4 to 12. Reaction is moderately or strongly alkaline.

TAXONOMIC CLASS: Fine-loamy, mixed, superactive, mesic Ustic Haplargids

SUITABILITY FOR TOPSOIL (according to WDEQ/LQD Guideline 1, 1994): Marginal values were found for pH from 44-60", for texture from 44-60", for saturation percentage at 44-60" and for selenium from 54-60". Unsuitable values were found for SAR from 28-60". Estimated salvage depth is 28 inches.

GEOGRAPHIC SETTING (according to official series description): Forkwood soils are on terraces, alluvial fans, fan remnants, hills, ridges and pediments. Slopes are 0 to 15 percent. The soils formed in slopewash alluvium derived from interbedded shales and argillaceous sandstone. Elevations are 3,500 to 6,000 feet. The average annual precipitation is 10 to 14 inches with over half of the annual precipitation falling in April, May, and June and less than one inch falling in each month of July, August, September, and October. The mean annual air temperature ranges from 43 to 51

degrees F. The estimated frost-free season is about 105 to 130 days depending upon elevation, aspect, and air drainage.

VARIATION FROM TYPICAL SERIES: The pH is more acidic than typical in the A horizon. The texture is coarser than typical from 5-28 inches and finer than typical from 44-60 inches.

FORKWOOD silty clay

SOIL MAPPING UNIT: FO

SOIL SAMPLE LOCATION: PS-2

TYPICAL PEDON: Forkwood silty clay - utilized as rangeland. (Colors are for dry soil unless otherwise stated)

The Forkwood series consists of very deep, well drained soils formed in alluvium. Forkwood soils are on terraces, alluvial fans, fan remnants, hills, ridges and pediments. Slopes range from 0 to 15 percent. The mean annual precipitation is about 11 inches, and the mean annual air temperature is about 45 degrees F.

A--0 to 4 inches; brown (10YR 5/3) silty clay, dark grayish brown (10YR 4/2) moist; weak fine granular structure; soft, very friable, slightly sticky and slightly plastic; many fine and medium roots throughout; non-effervescent; neutral (pH 7.1); abrupt smooth boundary.

Bt1--4 to 15 inches; brown (10YR 5/3) silty clay loam, brown (10YR 4/3) moist; strong medium angular blocky structure; slightly hard, friable, moderately sticky and moderately plastic; common fine and medium roots throughout; common distinct clay films on faces of peds; non-effervescent; slightly alkaline (pH 7.7); clear smooth boundary.

Bt2--15 to 28 inches; light brownish gray (2.5Y 6/2) silty clay loam, dark grayish brown (2.5Y 4/2) moist; strong medium angular blocky structure; hard, firm, moderately sticky and moderately plastic; few fine and medium roots throughout; few faint clay films on faces of peds; few masses of carbonates; slightly effervescent; slightly alkaline (pH 7.8); clear smooth boundary.

Btk1--28 to 36 inches; light brownish gray (2.5Y 6/2) silty clay, light olive brown (2.5Y 5/4) moist; moderate medium subangular blocky structure parting to weak fine subangular blocky; slightly hard, friable, slightly sticky and sligtly plastic; few fine roots throughout; few fine threads and masses of carbonates throughout; strongly effervescent; slightly alkaline (pH 7.7); gradual wavy boundary.

Btk2--36 to 52 inches; light brownish gray (2.5Y 6/2) silty clay loam, grayish brown (2.5Y 5/2) moist; massive; soft, very friable, slightly sticky and slightly plastic; few fine roots throughout; few masses of carbonates throughout; moderately effervescent; slightly alkaline (pH 7.7).

Bt3--52 to 60 inches; light brownish gray (2.5Y 6/2) clay loam, grayish brown (2.5Y 5/2) moist; massive; soft, very friable, slightly sticky and slightly plastic; few fine roots throughout; few masses of carbonates throughout; slightly effervescent; moderately alkaline (pH 7.9).

TYPE LOCATION: Crook County, Wyoming; refer to waypoint PS-2 on Figure 3.3-9 in the ER.

RANGE IN CHARACTERISTICS (according to official series description): Depth to the base of the argillic horizon is 10 to 33 inches, and depth to continuous horizons of carbonate accumulation is 10 to 33 inches. Rock fragments range from 0 to 15 percent. The soil is dry in the moisture control section more than half the time cumulative that the soil temperature at a depth of 20 inches is 41 degrees F., which occurs about April 21-27, and is dry in all parts of the moisture control section for at least 60 consecutive days from July 15 to October 25 and for at least 90 cumulative days during this period. The mean annual soil temperature ranges from 47 to 53 degrees F., and the soil temperature at a depth of 20 inches is 41 degrees F. or more for 175 to 192 days. EC ranges from 0 to 4 mmhos/cm throughout the profile. Bedrock is deeper than 60 inches.

The A horizon has hue of 2.5Y or 10YR, value of 4 to 6 dry and 3 to 5 moist, and chroma of 2 to 4. A vesicular crust occurs on some pedons. Texture is very fine sandy loam, loam, clay loam or fine sandy loam. Reaction is neutral through moderately alkaline.

The Bt horizon has hue of 2.5Y, 10YR or 7.5YR, value of 4 to 7 dry and 3 to 5 moist, and chroma of 2 to 4. Texture is loam or clay loam with 18 to 35 percent clay and more than 15 but less than 35 percent fine sand or coarser. Reaction is neutral through moderately alkaline.

The Btk horizon has hue of 2.5Y or 10YR, value of 4 to 7 dry and 3 to 5 moist, and chroma of 2 to 4. Texture is loam or clay loam. It is slightly alkaline or moderately alkaline. It has 3 to 12 percent calcium carbonate equivalent.

The Bk horizon has hue of 5Y, 2.5Y or 10YR, value of 5 to 7 dry and 4 to 6 moist, and chroma of 2 to 4. Texture is loam, fine sandy loam, very fine sandy loam or clay loam. This horizon has 1 to 14 percent authigenic calcium carbonate accumulation. It is moderately alkaline or strongly alkaline.

The C horizon, when present, has hue of 5Y to 10YR, value of 5 to 7 dry, 4 to 6 moist, and chroma of 2 to 4. Carbonates range from 1 to 8 percent and are mostly allogenic. ESP ranges from 4 to 12. Reaction is moderately or strongly alkaline.

TAXONOMIC CLASS: Fine-loamy, mixed, superactive, mesic Ustic Haplargids

SUITABILITY FOR TOPSOIL (according to WDEQ/LQD Guideline 1, 1994): Marginal values were found for selenium from 52-60” and for texture from 0-4” and 28-36”. Estimated salvage depth is 28 inches.

GEOGRAPHIC SETTING (according to official series description): Forkwood soils are on terraces, alluvial fans, fan remnants, hills, ridges and pediments. Slopes are 0 to 15 percent. The soils formed in slopewash alluvium derived from interbedded shales and argillaceous sandstone. Elevations are 3,500 to 6,000 feet. The average annual precipitation is 10 to 14 inches with over half of the annual precipitation falling in April, May, and June and less than one inch falling in each month of July, August, September, and October. The mean annual air temperature ranges from 43 to 51

degrees F. The estimated frost-free season is about 105 to 130 days depending upon elevation, aspect, and air drainage.

VARIATION FROM TYPICAL SERIES: This profile has more silt than typical from 0 to 52 inches.

BIDMAN silty clay

SOIL MAPPING UNIT: BI

SOIL SAMPLE LOCATION: PS-3

TYPICAL PEDON: Bidman silty clay-grassland. (Colors are for dry soil unless otherwise noted)

The Bidman series consists of very deep, well drained soils that formed in alluvium weathered from shale bedrock. Bidman soils are on alluvial fans, fan remnants, terrace, ridges and hills. Slopes are 0 to 25 percent. The mean annual precipitation is about 12 inches, and the mean annual air temperature is about 47 degrees F.

A--0 to 6 inches; light brownish gray (10YR 6/2) silty clay, dark grayish brown (2.5Y 4/2) moist; weak thin platy structure that parts to very fine granules; soft, very friable; uncoated sand grains; non-effervescent; slightly acid (pH 6.4); abrupt smooth boundary.

Bt1--6 to 21 inches; brown (10YR 5/3) silty clay, brown (10YR 4/3) moist; strong medium prismatic structure that parts to strong medium angular blocky; hard, very sticky and very plastic; many prominent clay films on faces of peds, in channels and pores; few streaks of bleached sand grains in the upper 2 inches; slightly effervescent; slightly alkaline (pH 7.7); clear wavy boundary.

Btk1--21 to 32 inches; light yellowish brown (2.5Y 6/3) silty clay, light olive brown (2.5Y 5/3) moist; weak coarse prismatic structure that parts to moderate coarse angular and subangular blocks; extremely hard, very friable; sticky and plastic; few distinct clay films on faces of peds; moderately effervescent; moderately alkaline (pH 8.1); gradual wavy boundary.

Btk2--32 to 42 inches; light olive brown (2.5Y 5/3) silty clay loam, olive brown (2.5Y 4/3) moist; massive; hard, very friable, sticky and slightly plastic; moderately effervescent, calcium carbonate as soft masses; moderately alkaline (pH 8.1).

Bt2--42 to 60 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; slightly effervescent; moderately alkaline (pH 8.1).

TYPE LOCATION: Crook County, Wyoming; refer to waypoint PS-3 on Figure 3.3-9 in the ER.

RANGE IN CHARACTERISTICS (according to official series description): Depth to calcareous material ranges from 8 to 26 inches. Depth to the base of the argillic horizon range from 15 to 36 inches. Organic carbon ranges from .6 to 1.5 percent in the surface horizons and decreases uniformly with increasing depth. Cation exchange capacity ranges from 60 to 90 milliequivalents per 100 grams of clay. Rock fragments are typically less than 2 percent but ranges from 0 to 15 percent. This soil is dry in the moisture control section more than half the time cumulative that the soil temperature at a depth of 20 inches is 41 degrees F. It is never moist in some or all parts for as

long as 60 consecutive days during this same period. It is dry in all parts of the moisture control section for at least 60 consecutive days from July 15 to October 25 and for at least 90 cumulative days during this period. The mean annual soil temperature is 47 to 53 degrees F., and the soil temperature at a depth of 20 inches is 41 degrees F. or warmer for 175 to 195 days. The mean summer soil temperature at depth of 20 inches ranges from 59 to 65 degrees F.

The E horizon has hue of 2.5Y or 10YR, value of 5 to 7 dry, 4 or 5 moist, and chroma of 2 to 4. It usually has platy structure but has granular structure in some pedons. It is loam, very fine sandy loam or sandy loam. It is soft or slightly hard. Reaction is slightly acid to slightly alkaline. Some pedons have an A horizon.

The Bt horizon has hue of 2.5Y, 10YR or 7.5YR, value of 5 or 6 dry, 4 or 5 moist, and chroma of 2 to 4. It is silty clay, silty clay loam, clay loam or clay but has 35 to 50 percent clay, 15 to 45 percent silt, and 15 to 45 percent sand with more than 15 percent fine or coarser sand. This horizon typically has prismatic structure but has columnar or angular blocky structure in some pedons. It has oriented clay films in some part. Reaction is neutral to moderately alkaline. EC is 0 to 8 mmhos/cm.

The Btk horizon has hue of 10YR or 2.5Y, value of 5 or 6 and 4 or 5 moist, and chroma of 2 to 4. It is clay loam, silty clay loam, clay or silty clay. It is slightly alkaline to strongly alkaline. It has a calcium carbonate equivalent of 5 to 12 percent. It has an EC of 0 to 2 mmhos/cm and 4 to 12 in the saline phase.

The Bk horizon ranges from 5Y, 2.5Y or 10YR, value of 5 to 7 dry, 4 to 6 moist, and chroma of 2 to 4. It is clay loam, loam, sandy clay loam, or light clay. This horizon has 6 to 14 percent calcium carbonate equivalent. Reaction is moderately alkaline or strongly alkaline. EC is 0 to 12 mmhos.

Some pedons have a C horizon below 40 inches that have properties that are similar to the Bk horizon. A gravelly substratum phase is recognized.

TAXONOMIC CLASS: Fine, smectitic, mesic Ustic Paleargids

SUITABILITY FOR TOPSOIL (according to WDEQ/LQD Guideline 1, 1994): Marginal texture values were found from 0-32” and 52-60”. Estimated salvage depth is 60 inches.

GEOGRAPHIC SETTING (according to official series description): The Bidman soils are on alluvial fans, fan remnants, terraces, ridges and hills. Elevation is 2,600 to 6,000 feet. Slopes range from 0 to 25 percent. These soils formed in thick, calcareous alluvial sediments derived from sedimentary rock. At the type location the mean annual temperature is 47 degrees F., and the mean summer temperature is 66 degrees F. The average annual precipitation is about 12 inches with about half the precipitation in April, May, and June. Precipitation ranges from 10 to 14 inches. The frost-free season is 100 to 130 days.

VARIATION FROM TYPICAL SERIES: The A horizon is finer than typical. This profile has more silt from 32-60 inches than typical.

ABSTED silty clay

SOIL MAPPING UNIT: AB

SOIL SAMPLE LOCATION: PS-4

TYPICAL PEDON: Absted silty clay-on south facing slope of about one percent under native grass vegetation. (Colors are for dry soil unless otherwise stated)

The Absted series consists of very deep, well drained soils that formed in slopewash alluvium derived mainly from sodic shale. Absted soils are on fan remnants, alluvial fans, hillslopes and terraces. Slopes are 0 to 25 percent. The mean annual precipitation is about 13 inches, and the mean annual air temperature is about 48 degrees F.

A--0 to 5 inches; light gray (10YR 7/2) silty clay, very dark grayish brown (10YR 3/2) moist; strong thick platy structure parting to strong thin platy; slightly hard, very friable, slightly sticky and nonplastic; common fine and very fine roots; non-effervescent; slightly acid (pH 6.4); abrupt smooth boundary.

Bt--5 to 12 inches; brown (10YR 5/3) silty clay, dark grayish brown (10YR 4/2) moist; strong medium columnar structure parting to strong medium and fine angular blocky; very hard, firm, sticky and plastic; few fine and medium roots; many prominent clay films on faces of peds; slightly effervescent; slightly alkaline (pH 7.8); clear smooth boundary.

Btk1--12 to 24 inches; brown (10YR 5/3) silty clay, dark grayish brown (10YR 4/2) moist; strong medium angular blocky structure; very hard, friable, sticky and plastic; few fine and medium roots; common distinct clay films on faces of peds; moderately effervescent; calcium carbonate and gypsum as common fine filaments and threads; strongly alkaline (pH 8.5); clear smooth boundary.

Btkn1--24 to 36 inches; pale brown (10YR 6/3) silty clay, dark grayish brown (10YR 4/2) moist; moderate coarse subangular blocky structure; very hard, firm, sticky and plastic; strongly effervescent; many prominent threads of calcium carbonate and gypsum; moderately alkaline (pH 8.4).

Btkn2--36 to 52 inches; pale brown (10YR 6/3) silty clay, dark grayish brown (10YR 4/2) moist; moderate coarse subangular blocky structure; very hard, firm, sticky and plastic; strongly effervescent; many prominent threads of calcium carbonate and gypsum; strongly alkaline (pH 8.6).

Btk2--52 to 60 inches; pale brown (10YR 6/3) silty clay, dark grayish brown (10YR 4/2) moist; moderate coarse subangular blocky structure; very hard, firm, sticky and plastic; strongly effervescent; many prominent threads of calcium carbonate and gypsum; strongly alkaline (pH 8.5).

TYPE LOCATION: Crook County, Wyoming; refer to waypoint PS-4 on Figure 3.3-9 in the ER.

RANGE IN CHARACTERISTICS (according to official series description):

Depth to horizons of continuous calcium carbonate accumulations is 6 to 20 inches. Depth to layers with ESP greater than 15 is more than 7 inches. Rock fragments in the control section range from 0 to 15 percent and is mostly gravel. These soils are usually dry, but are moist in some or all parts of the moisture control section in April, May, and early June in most years. The moisture control section is dry for more than 60 consecutive days during the 90 day period following the summer solstice. The mean annual soil temperature is 47 to 53 degrees F. The soil temperature at 20 inches is 41 degrees F. or warmer for 175 to 195 days. Organic carbon in upper 40 cm. of the profile is .6 to .8 percent.

The A horizon has hue of 10YR, 2.5Y or 5Y; 10YR hue has value of 5 to 7 dry and 3 to 6 moist, and chroma of 2 or 3; 2.5Y and 5Y hues have value of 5 or 6 dry and 4 or 5 moist. Textures are sandy loam, sandy clay loam, fine sandy loam, very fine sandy loam or loam. Reaction is neutral or slightly alkaline.

The E horizon has hue of 10YR, 2.5Y or 5Y; 10YR hue has value of 5 to 7 dry and 3 to 6 moist, and chroma of 2 or 3. Textures are silty clay loam, fine sandy loam, very fine sandy loam, silt loam, loam or clay loam. Reaction is typically neutral through moderately alkaline but is slightly acid in some pedons. This horizon is absent in some pedons.

The Bt horizon has hue of 10YR, 2.5Y or 7.5YR; 10YR and 2.5Y hues have value of 4 to 7 dry and 3 to 5 moist, and chroma of 2 to 4; 7.5YR hue has chroma 3 or 4; Textures are silty clay, clay, clay loam or silty clay loam with clay ranging from 35 to 50 percent, silt from 15 to 50 percent, and sand from 10 to 45 percent. Exchangeable sodium is 3 to 12 percent. It is slightly alkaline to strongly alkaline.

The Btkn horizon has hue of 10YR, 2.5Y or 5Y, value of 5 or 6 dry and 4 or 5 moist, and chroma of 2 or 3 in 10YR hue and 2 to 4 in 2.5Y hue. Textures are the same as for the Bt horizon. Reaction is strongly or very strongly alkaline. Exchangeable sodium is greater than 15 percent. Salinity is 4 to 15 mmhos/cm.

The Bkn or Bkny horizons have hue of 10YR, 2.5Y or 5Y, value of 5 to 7 dry and 4 to 6 moist, and chroma of 2 or 3 in 10YR hue and 2 to 4 in 2.5Y and 5Y. Textures are the same as for the Bt and Btkn horizons. Exchangeable sodium is 10 to 30 percent. Calcium carbonate equivalent is 6 to 15 percent. Salinity ranges from 8 to 16 mmhos/cm. Reaction is moderately through very strongly alkaline.

The C horizon, when present, has the same range in texture, reaction, and color as the Bkn horizon. Exchangeable sodium is 10 to 30 percent.

TAXONOMIC CLASS: Fine, smectitic, mesic Haplic Ustic Natrargids

SUITABILITY FOR TOPSOIL (according to WDEQ/LQD Guideline 1, 1994): Marginal values were found for texture from 0-60", for pH from 36-52", for EC from 36-60" and for selenium from 24-60". Unsuitable values were found for SAR from 12-60". Estimated salvage depth is 12 inches.

GEOGRAPHIC SETTING (according to official series description): Absted soils are on hillslopes, terraces, fan remnants, alluvial fans, piedmonts and fan aprons. Slopes are 0 to 25 percent. These soils formed in alluvium derived from alkaline shale. Some areas have an eolian influence on the surface layer. Elevation is 3500 to 5500 feet. The mean annual precipitation is 10 to 14 inches with more than half falling in April, May and June. The frost-free period is 105 to 130 days.

VARIATION FROM TYPICAL SERIES: The A horizon is finer and slightly more acidic than typical

BIDMAN silty clay

SOIL MAPPING UNIT: BI

SOIL SAMPLE LOCATION: PS-5

TYPICAL PEDON: Bidman silty clay-grassland. (Colors are for dry soil unless otherwise noted)

The Bidman series consists of very deep, well drained soils that formed in alluvium weathered from shale bedrock. Bidman soils are on alluvial fans, fan remnants, terrace, ridges and hills. Slopes are 0 to 25 percent. The mean annual precipitation is about 12 inches, and the mean annual air temperature is about 47 degrees F.

A--0 to 5 inches; light brownish gray (10YR 6/2) silty clay, dark grayish brown (2.5Y 4/2) moist; weak thin platy structure that parts to very fine granules; soft, very friable; uncoated sand grains; non-effervescent; slightly acid (pH 6.5); abrupt smooth boundary.

Bt1--5 to 18 inches; brown (10YR 5/3) silty clay, brown (10YR 4/3) moist; strong medium prismatic structure that parts to strong medium angular blocky; hard, very sticky and very plastic; many prominent clay films on faces of peds, in channels and pores; few streaks of bleached sand grains in the upper 2 inches; slightly effervescent; moderately alkaline (pH 7.9); clear wavy boundary.

Bt2--18 to 32 inches; light yellowish brown (2.5Y 6/3) clay, light olive brown (2.5Y 5/3) moist; weak coarse prismatic structure that parts to moderate coarse angular and subangular blocks; extremely hard, very friable; sticky and plastic; few distinct clay films on faces of peds; slightly effervescent; slightly alkaline (pH 7.8); gradual wavy boundary.

Btk1--32 to 48 inches; light olive brown (2.5Y 5/3) silty clay loam, olive brown (2.5Y 4/3) moist; massive; hard, very friable, sticky and slightly plastic; moderately effervescent, calcium carbonate as soft masses; moderately alkaline (pH 8.0).

Btk2--48 to 60 inches; light olive brown (2.5Y 5/3) silty clay loam, olive brown (2.5Y 4/3) moist; massive; hard, very friable, sticky and slightly plastic; moderately effervescent; moderately alkaline (pH 8.1).

TYPE LOCATION: Crook County, Wyoming; refer to waypoint PS-5 on Figure 3.3-9 in the ER.

RANGE IN CHARACTERISTICS (according to official series description): Depth to calcareous material ranges from 8 to 26 inches. Depth to the base of the argillic horizon range from 15 to 36 inches. Organic carbon ranges from .6 to 1.5 percent in the surface horizons and decreases uniformly with increasing depth. Cation exchange capacity ranges from 60 to 90 milliequivalents per 100 grams of clay. Rock fragments are typically less than 2 percent but ranges from 0 to 15 percent. This soil is dry in the moisture control section more than half the time cumulative that the soil temperature at a depth of 20 inches is 41 degrees F. It is never moist in some or all parts for as

long as 60 consecutive days during this same period. It is dry in all parts of the moisture control section for at least 60 consecutive days from July 15 to October 25 and for at least 90 cumulative days during this period. The mean annual soil temperature is 47 to 53 degrees F., and the soil temperature at a depth of 20 inches is 41 degrees F. or warmer for 175 to 195 days. The mean summer soil temperature at depth of 20 inches ranges from 59 to 65 degrees F.

The E horizon has hue of 2.5Y or 10YR, value of 5 to 7 dry, 4 or 5 moist, and chroma of 2 to 4. It usually has platy structure but has granular structure in some pedons. It is loam, very fine sandy loam or sandy loam. It is soft or slightly hard. Reaction is slightly acid to slightly alkaline. Some pedons have an A horizon.

The Bt horizon has hue of 2.5Y, 10YR or 7.5YR, value of 5 or 6 dry, 4 or 5 moist, and chroma of 2 to 4. It is silty clay, silty clay loam, clay loam or clay but has 35 to 50 percent clay, 15 to 45 percent silt, and 15 to 45 percent sand with more than 15 percent fine or coarser sand. This horizon typically has prismatic structure but has columnar or angular blocky structure in some pedons. It has oriented clay films in some part. Reaction is neutral to moderately alkaline. EC is 0 to 8 mmhos/cm.

The Btk horizon has hue of 10YR or 2.5Y, value of 5 or 6 and 4 or 5 moist, and chroma of 2 to 4. It is clay loam, silty clay loam, clay or silty clay. It is slightly alkaline to strongly alkaline. It has a calcium carbonate equivalent of 5 to 12 percent. It has an EC of 0 to 2 mmhos/cm and 4 to 12 in the saline phase.

The Bk horizon ranges from 5Y, 2.5Y or 10YR, value of 5 to 7 dry, 4 to 6 moist, and chroma of 2 to 4. It is clay loam, loam, sandy clay loam, or light clay. This horizon has 6 to 14 percent calcium carbonate equivalent. Reaction is moderately alkaline or strongly alkaline. EC is 0 to 12 mmhos.

Some pedons have a C horizon below 40 inches that have properties that are similar to the Bk horizon. A gravelly substratum phase is recognized.

TAXONOMIC CLASS: Fine, smectitic, mesic Ustic Paleargids

SUITABILITY FOR TOPSOIL (according to WDEQ/LQD Guideline 1, 1994): Marginal values were found for texture from 0-32", for saturation percent from 5-18" and for SAR from 5-18". Estimated salvage depth is 5 inches.

GEOGRAPHIC SETTING (according to official series description): The Bidman soils are on alluvial fans, fan remnants, terraces, ridges and hills. Elevation is 2,600 to 6,000 feet. Slopes range from 0 to 25 percent. These soils formed in thick, calcareous alluvial sediments derived from sedimentary rock. At the type location the mean annual temperature is 47 degrees F., and the mean summer temperature is 66 degrees F. The average annual precipitation is about 12 inches with about half the precipitation in April, May, and June. Precipitation ranges from 10 to 14 inches. The frost-free season is 100 to 130 days.

VARIATION FROM TYPICAL SERIES: The A horizon is finer than typical. This profile has more silt from 32-60 inches than typical.

BIDMAN sandy clay loam

SOIL MAPPING UNIT: BI

SOIL SAMPLE LOCATION: PS-6

TYPICAL PEDON: Bidman sandy clay loam-grassland. (Colors are for dry soil unless otherwise noted)

The Bidman series consists of very deep, well drained soils that formed in alluvium weathered from shale bedrock. Bidman soils are on alluvial fans, fan remnants, terrace, ridges and hills. Slopes are 0 to 25 percent. The mean annual precipitation is about 12 inches, and the mean annual air temperature is about 47 degrees F.

A--0 to 6 inches; light brownish gray (10YR 6/2) sandy clay loam, dark grayish brown (2.5Y 4/2) moist; weak thin platy structure that parts to very fine granules; soft, very friable; uncoated sand grains; non-effervescent; strongly acid (pH 5.5); abrupt smooth boundary.

Bt--6 to 16 inches; brown (10YR 5/3) sandy clay loam, brown (10YR 4/3) moist; strong medium prismatic structure that parts to strong medium angular blocky; hard, very sticky and very plastic; many prominent clay films on faces of peds, in channels and pores; few streaks of bleached sand grains in the upper 2 inches; non-effervescent; slightly alkaline (pH 7.5); clear wavy boundary.

Btk1--16 to 42 inches; light yellowish brown (2.5Y 6/3) clay, light olive brown (2.5Y 5/3) moist; weak coarse prismatic structure that parts to moderate coarse angular and subangular blocks; extremely hard, very friable; sticky and plastic; few distinct clay films on faces of peds; violently effervescent, calcium carbonate as soft masses; moderately alkaline (pH 8.0); gradual wavy boundary.

Btk2--42 to 60 inches; light olive brown (2.5Y 5/3) clay loam, olive brown (2.5Y 4/3) moist; massive; hard, very friable, sticky and slightly plastic; violently effervescent, calcium carbonate as soft masses; moderately alkaline (pH 8.3).

TYPE LOCATION: Crook County, Wyoming; refer to waypoint PS-6 on Figure 3.3-9 in the ER.

RANGE IN CHARACTERISTICS (according to official series description): Depth to calcareous material ranges from 8 to 26 inches. Depth to the base of the argillic horizon range from 15 to 36 inches. Organic carbon ranges from .6 to 1.5 percent in the surface horizons and decreases uniformly with increasing depth. Cation exchange capacity ranges from 60 to 90 milliequivalents per 100 grams of clay. Rock fragments are typically less than 2 percent but ranges from 0 to 15 percent. This soil is dry in the moisture control section more than half the time cumulative that the soil temperature at a depth of 20 inches is 41 degrees F. It is never moist in some or all parts for as long as 60 consecutive days during this same period. It is dry in all parts of the moisture control section for at least 60 consecutive days from July 15 to October 25 and for at least 90 cumulative days during this period. The mean annual soil temperature is 47 to 53 degrees F., and the soil temperature at a depth of 20 inches is

41 degrees F. or warmer for 175 to 195 days. The mean summer soil temperature at depth of 20 inches ranges from 59 to 65 degrees F.

The E horizon has hue of 2.5Y or 10YR, value of 5 to 7 dry, 4 or 5 moist, and chroma of 2 to 4. It usually has platy structure but has granular structure in some pedons. It is loam, very fine sandy loam or sandy loam. It is soft or slightly hard. Reaction is slightly acid to slightly alkaline. Some pedons have an A horizon.

The Bt horizon has hue of 2.5Y, 10YR or 7.5YR, value of 5 or 6 dry, 4 or 5 moist, and chroma of 2 to 4. It is silty clay, silty clay loam, clay loam or clay but has 35 to 50 percent clay, 15 to 45 percent silt, and 15 to 45 percent sand with more than 15 percent fine or coarser sand. This horizon typically has prismatic structure but has columnar or angular blocky structure in some pedons. It has oriented clay films in some part. Reaction is neutral to moderately alkaline. EC is 0 to 8 mmhos/cm.

The Btk horizon has hue of 10YR or 2.5Y, value of 5 or 6 and 4 or 5 moist, and chroma of 2 to 4. It is clay loam, silty clay loam, clay or silty clay. It is slightly alkaline to strongly alkaline. It has a calcium carbonate equivalent of 5 to 12 percent. It has an EC of 0 to 2 mmhos/cm and 4 to 12 in the saline phase.

The Bk horizon ranges from 5Y, 2.5Y or 10YR, value of 5 to 7 dry, 4 to 6 moist, and chroma of 2 to 4. It is clay loam, loam, sandy clay loam, or light clay. This horizon has 6 to 14 percent calcium carbonate equivalent. Reaction is moderately alkaline or strongly alkaline. EC is 0 to 12 mmhos.

Some pedons have a C horizon below 40 inches that have properties that are similar to the Bk horizon. A gravelly substratum phase is recognized.

TAXONOMIC CLASS: Fine, smectitic, mesic Ustic Paleargids

SUITABILITY FOR TOPSOIL (according to WDEQ/LQD Guideline 1, 1994): Marginal values were found for texture from 16-52", for selenium from 42-60", for EC from 42-60" and for SAR from 6-42". Unsuitable values were found for SAR from 42-60". Estimated salvage depth is 16 inches.

GEOGRAPHIC SETTING (according to official series description): The Bidman soils are on alluvial fans, fan remnants, terraces, ridges and hills. Elevation is 2,600 to 6,000 feet. Slopes range from 0 to 25 percent. These soils formed in thick, calcareous alluvial sediments derived from sedimentary rock. At the type location the mean annual temperature is 47 degrees F., and the mean summer temperature is 66 degrees F. The average annual precipitation is about 12 inches with about half the precipitation in April, May, and June. Precipitation ranges from 10 to 14 inches. The frost-free season is 100 to 130 days.

VARIATION FROM TYPICAL SERIES: The texture is coarser from 6 to 16 inches than typical. The A horizon is more acidic than typical.

ABSTED silty clay

SOIL MAPPING UNIT: AB

SOIL SAMPLE LOCATION: PS-7

TYPICAL PEDON: Absted silty clay-on south facing slope of about one percent under native grass vegetation. (Colors are for dry soil unless otherwise stated)

The Absted series consists of very deep, well drained soils that formed in slopewash alluvium derived mainly from sodic shale. Absted soils are on fan remnants, alluvial fans, hillslopes and terraces. Slopes are 0 to 25 percent. The mean annual precipitation is about 13 inches, and the mean annual air temperature is about 48 degrees F.

A--0 to 4 inches; light gray (10YR 7/2) silty clay, very dark grayish brown (10YR 3/2) moist; strong thick platy structure parting to strong thin platy; slightly hard, very friable, slightly sticky and nonplastic; common fine and very fine roots; non-effervescent; neutral (pH 6.6); abrupt smooth boundary.

Bt1--4 to 18 inches; brown (10YR 5/3) clay, dark grayish brown (10YR 4/2) moist; strong medium columnar structure parting to strong medium and fine angular blocky; very hard, firm, sticky and plastic; few fine and medium roots; many prominent clay films on faces of peds; non-effervescent; slightly alkaline (pH 7.8); clear smooth boundary.

Btn1--18 to 30 inches; brown (10YR 5/3) clay loam, dark grayish brown (10YR 4/2) moist; strong medium angular blocky structure; very hard, friable, sticky and plastic; few fine and medium roots; common distinct clay films on faces of peds; slightly effervescent; calcium carbonate and gypsum as common fine filaments and threads; moderately alkaline (pH 8.1); clear smooth boundary.

Btn2--30 to 40 inches; pale brown (10YR 6/3) clay loam, dark grayish brown (10YR 4/2) moist; moderate coarse subangular blocky structure; very hard, firm, sticky and plastic; non-effervescent; many prominent threads of soluble salts and gypsum; moderately alkaline (pH 8.3).

Btk1--40 to 52 inches; pale brown (10YR 6/3) clay loam, dark grayish brown (10YR 4/2) moist; moderate coarse subangular blocky structure; very hard, firm, sticky and plastic; violently effervescent; many prominent threads of calcium carbonate and gypsum; strongly alkaline (pH 8.6).

Btk2--52 to 60 inches; pale brown (10YR 6/3) clay loam, dark grayish brown (10YR 4/2) moist; moderate coarse subangular blocky structure; very hard, firm, sticky and plastic; violently effervescent; many prominent threads of calcium carbonate and gypsum; very strongly alkaline (pH 9.1).

TYPE LOCATION: Crook County, Wyoming; refer to waypoint PS-7 on Figure 3.3-9 in the ER.

RANGE IN CHARACTERISTICS (according to official series description):

Depth to horizons of continuous calcium carbonate accumulations is 6 to 20 inches. Depth to layers with ESP greater than 15 is more than 7 inches. Rock fragments in the control section range from 0 to 15 percent and is mostly gravel. These soils are usually dry, but are moist in some or all parts of the moisture control section in April, May, and early June in most years. The moisture control section is dry for more than 60 consecutive days during the 90 day period following the summer solstice. The mean annual soil temperature is 47 to 53 degrees F. The soil temperature at 20 inches is 41 degrees F. or warmer for 175 to 195 days. Organic carbon in upper 40 cm. of the profile is .6 to .8 percent.

The A horizon has hue of 10YR, 2.5Y or 5Y; 10YR hue has value of 5 to 7 dry and 3 to 6 moist, and chroma of 2 or 3; 2.5Y and 5Y hues have value of 5 or 6 dry and 4 or 5 moist. Textures are sandy loam, sandy clay loam, fine sandy loam, very fine sandy loam or loam. Reaction is neutral or slightly alkaline.

The E horizon has hue of 10YR, 2.5Y or 5Y; 10YR hue has value of 5 to 7 dry and 3 to 6 moist, and chroma of 2 or 3. Textures are silty clay loam, fine sandy loam, very fine sandy loam, silt loam, loam or clay loam. Reaction is typically neutral through moderately alkaline but is slightly acid in some pedons. This horizon is absent in some pedons.

The Bt horizon has hue of 10YR, 2.5Y or 7.5YR; 10YR and 2.5Y hues have value of 4 to 7 dry and 3 to 5 moist, and chroma of 2 to 4; 7.5YR hue has chroma 3 or 4; Textures are silty clay, clay, clay loam or silty clay loam with clay ranging from 35 to 50 percent, silt from 15 to 50 percent, and sand from 10 to 45 percent. Exchangeable sodium is 3 to 12 percent. It is slightly alkaline to strongly alkaline.

The Btkn horizon has hue of 10YR, 2.5Y or 5Y, value of 5 or 6 dry and 4 or 5 moist, and chroma of 2 or 3 in 10YR hue and 2 to 4 in 2.5Y hue. Textures are the same as for the Bt horizon. Reaction is strongly or very strongly alkaline. Exchangeable sodium is greater than 15 percent. Salinity is 4 to 15 mmhos/cm.

The Bkn or Bkny horizons have hue of 10YR, 2.5Y or 5Y, value of 5 to 7 dry and 4 to 6 moist, and chroma of 2 or 3 in 10YR hue and 2 to 4 in 2.5Y and 5Y. Textures are the same as for the Bt and Btkn horizons. Exchangeable sodium is 10 to 30 percent. Calcium carbonate equivalent is 6 to 15 percent. Salinity ranges from 8 to 16 mmhos/cm. Reaction is moderately through very strongly alkaline.

The C horizon, when present, has the same range in texture, reaction, and color as the Bkn horizon. Exchangeable sodium is 10 to 30 percent.

TAXONOMIC CLASS: Fine, smectitic, mesic Haplic Ustic Natrargids

SUITABILITY FOR TOPSOIL (according to WDEQ/LQD Guideline 1, 1994): Marginal values were found for texture from 0-18", for EC from 18-52" and for pH from 40-52". Unsuitable values were found for SAR from 4-60" and for pH from 52-60". Estimated salvage depth is 4 inches.

GEOGRAPHIC SETTING (according to official series description): Absted soils are on hillslopes, terraces, fan remnants, alluvial fans, piedmonts and fan aprons. Slopes are 0 to 25 percent. These soils formed in alluvium derived from alkaline shale. Some areas have an eolian influence on the surface layer. Elevation is 3500 to 5500 feet. The mean annual precipitation is 10 to 14 inches with more than half falling in April, May and June. The frost-free period is 105 to 130 days.

VARIATION FROM TYPICAL SERIES: The A horizon is finer than typical.

BIDMAN silty clay

SOIL MAPPING UNIT: BI

SOIL SAMPLE LOCATION: PS-8

TYPICAL PEDON: Bidman silty clay-grassland. (Colors are for dry soil unless otherwise noted)

The Bidman series consists of very deep, well drained soils that formed in alluvium weathered from shale bedrock. Bidman soils are on alluvial fans, fan remnants, terrace, ridges and hills. Slopes are 0 to 25 percent. The mean annual precipitation is about 12 inches, and the mean annual air temperature is about 47 degrees F.

A--0 to 6 inches; light brownish gray (10YR 6/2) silty clay, dark grayish brown (2.5Y 4/2) moist; weak thin platy structure that parts to very fine granules; soft, very friable; uncoated sand grains; non-effervescent; slightly alkaline (pH 7.4); abrupt smooth boundary.

Bt1--6 to 19 inches; brown (10YR 5/3) silty clay, brown (10YR 4/3) moist; strong medium prismatic structure that parts to strong medium angular blocky; hard, very sticky and very plastic; many prominent clay films on faces of peds, in channels and pores; few streaks of bleached sand grains in the upper 2 inches; slightly effervescent; moderately alkaline (pH 8.4); clear wavy boundary.

Btk1--19 to 30 inches; light yellowish brown (2.5Y 6/3) clay, light olive brown (2.5Y 5/3) moist; weak coarse prismatic structure that parts to moderate coarse angular and subangular blocks; extremely hard, very friable; sticky and plastic; few distinct clay films on faces of peds; moderately effervescent, calcium carbonate as soft masses; moderately alkaline (pH 8.3); gradual wavy boundary.

Btk2--30 to 44 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; moderately effervescent, calcium carbonate as soft masses; moderately alkaline (pH 8.3).

Btk3--44 to 60 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; moderately effervescent, calcium carbonate as soft masses; moderately alkaline (pH 8.2).

TYPE LOCATION: Crook County, Wyoming; refer to waypoint PS-8 on Figure 3.3-9 in the ER.

RANGE IN CHARACTERISTICS (according to official series description): Depth to calcareous material ranges from 8 to 26 inches. Depth to the base of the argillic horizon range from 15 to 36 inches. Organic carbon ranges from .6 to 1.5 percent in the surface horizons and decreases uniformly with increasing depth. Cation exchange capacity ranges from 60 to 90 milliequivalents per 100 grams of clay. Rock fragments are typically less than 2 percent but ranges from 0 to 15 percent. This soil is dry in the moisture control section more than half the time cumulative that the soil temperature at a depth of 20 inches is 41 degrees F. It is never moist in some or all parts for as

long as 60 consecutive days during this same period. It is dry in all parts of the moisture control section for at least 60 consecutive days from July 15 to October 25 and for at least 90 cumulative days during this period. The mean annual soil temperature is 47 to 53 degrees F., and the soil temperature at a depth of 20 inches is 41 degrees F. or warmer for 175 to 195 days. The mean summer soil temperature at depth of 20 inches ranges from 59 to 65 degrees F.

The E horizon has hue of 2.5Y or 10YR, value of 5 to 7 dry, 4 or 5 moist, and chroma of 2 to 4. It usually has platy structure but has granular structure in some pedons. It is loam, very fine sandy loam or sandy loam. It is soft or slightly hard. Reaction is slightly acid to slightly alkaline. Some pedons have an A horizon.

The Bt horizon has hue of 2.5Y, 10YR or 7.5YR, value of 5 or 6 dry, 4 or 5 moist, and chroma of 2 to 4. It is silty clay, silty clay loam, clay loam or clay but has 35 to 50 percent clay, 15 to 45 percent silt, and 15 to 45 percent sand with more than 15 percent fine or coarser sand. This horizon typically has prismatic structure but has columnar or angular blocky structure in some pedons. It has oriented clay films in some part. Reaction is neutral to moderately alkaline. EC is 0 to 8 mmhos/cm.

The Btk horizon has hue of 10YR or 2.5Y, value of 5 or 6 and 4 or 5 moist, and chroma of 2 to 4. It is clay loam, silty clay loam, clay or silty clay. It is slightly alkaline to strongly alkaline. It has a calcium carbonate equivalent of 5 to 12 percent. It has an EC of 0 to 2 mmhos/cm and 4 to 12 in the saline phase.

The Bk horizon ranges from 5Y, 2.5Y or 10YR, value of 5 to 7 dry, 4 to 6 moist, and chroma of 2 to 4. It is clay loam, loam, sandy clay loam, or light clay. This horizon has 6 to 14 percent calcium carbonate equivalent. Reaction is moderately alkaline or strongly alkaline. EC is 0 to 12 mmhos.

Some pedons have a C horizon below 40 inches that have properties that are similar to the Bk horizon. A gravelly substratum phase is recognized.

TAXONOMIC CLASS: Fine, smectitic, mesic Ustic Paleargids

SUITABILITY FOR TOPSOIL (according to WDEQ/LQD Guideline 1, 1994): Marginal values were found for texture from 0-60", for SAR from 19-60" and for selenium from 30-60". Unsuitable values were found for SAR from 6-19". Estimated salvage depth is 6 inches.

GEOGRAPHIC SETTING (according to official series description): The Bidman soils are on alluvial fans, fan remnants, terraces, ridges and hills. Elevation is 2,600 to 6,000 feet. Slopes range from 0 to 25 percent. These soils formed in thick, calcareous alluvial sediments derived from sedimentary rock. At the type location the mean annual temperature is 47 degrees F., and the mean summer temperature is 66 degrees F. The average annual precipitation is about 12 inches with about half the precipitation in April, May, and June. Precipitation ranges from 10 to 14 inches. The frost-free season is 100 to 130 days.

VARIATION FROM TYPICAL SERIES: The A horizon is finer than typical. This profile has more silt than typical from 30-60 inches.

BIDMAN silty clay

SOIL MAPPING UNIT: BI

SOIL SAMPLE LOCATION: PS-9

TYPICAL PEDON: Bidman silty clay-grassland. (Colors are for dry soil unless otherwise noted)

The Bidman series consists of very deep, well drained soils that formed in alluvium weathered from shale bedrock. Bidman soils are on alluvial fans, fan remnants, terrace, ridges and hills. Slopes are 0 to 25 percent. The mean annual precipitation is about 12 inches, and the mean annual air temperature is about 47 degrees F.

A--0 to 5 inches; light brownish gray (10YR 6/2) silty clay, dark grayish brown (2.5Y 4/2) moist; weak thin platy structure that parts to very fine granules; soft, very friable; uncoated sand grains; non-effervescent; neutral (pH 7.3); abrupt smooth boundary.

Bt1--5 to 18 inches; brown (10YR 5/3) silty clay, brown (10YR 4/3) moist; strong medium prismatic structure that parts to strong medium angular blocky; hard, very sticky and very plastic; many prominent clay films on faces of peds, in channels and pores; few streaks of bleached sand grains in the upper 2 inches; slightly effervescent; strongly alkaline (pH 8.6); clear wavy boundary.

Btk1--18 to 38 inches; light yellowish brown (2.5Y 6/3) silty clay, light olive brown (2.5Y 5/3) moist; weak coarse prismatic structure that parts to moderate coarse angular and subangular blocks; extremely hard, very friable; sticky and plastic; few distinct clay films on faces of peds; moderately effervescent, calcium carbonate as soft masses; strongly alkaline (pH 8.7); gradual wavy boundary.

Btk2--38 to 52 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; moderately effervescent, calcium carbonate as soft masses; strongly alkaline (pH 8.8).

Btk3--52 to 60 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; strongly effervescent, calcium carbonate as soft masses; strongly alkaline (pH 8.9).

TYPE LOCATION: Crook County, Wyoming; refer to waypoint PS-9 on Figure 3.3-9 in the ER.

RANGE IN CHARACTERISTICS (according to official series description): Depth to calcareous material ranges from 8 to 26 inches. Depth to the base of the argillic horizon range from 15 to 36 inches. Organic carbon ranges from .6 to 1.5 percent in the surface horizons and decreases uniformly with increasing depth. Cation exchange capacity ranges from 60 to 90 milliequivalents per 100 grams of clay. Rock fragments are typically less than 2 percent but ranges from 0 to 15 percent. This soil is dry in the moisture control section more than half the time cumulative that the soil temperature at a depth of 20 inches is 41 degrees F. It is never moist in some or all parts for as long as 60 consecutive days during this same period. It is dry in all parts of the

moisture control section for at least 60 consecutive days from July 15 to October 25 and for at least 90 cumulative days during this period. The mean annual soil temperature is 47 to 53 degrees F., and the soil temperature at a depth of 20 inches is 41 degrees F. or warmer for 175 to 195 days. The mean summer soil temperature at depth of 20 inches ranges from 59 to 65 degrees F.

The E horizon has hue of 2.5Y or 10YR, value of 5 to 7 dry, 4 or 5 moist, and chroma of 2 to 4. It usually has platy structure but has granular structure in some pedons. It is loam, very fine sandy loam or sandy loam. It is soft or slightly hard. Reaction is slightly acid to slightly alkaline. Some pedons have an A horizon.

The Bt horizon has hue of 2.5Y, 10YR or 7.5YR, value of 5 or 6 dry, 4 or 5 moist, and chroma of 2 to 4. It is silty clay, silty clay loam, clay loam or clay but has 35 to 50 percent clay, 15 to 45 percent silt, and 15 to 45 percent sand with more than 15 percent fine or coarser sand. This horizon typically has prismatic structure but has columnar or angular blocky structure in some pedons. It has oriented clay films in some part. Reaction is neutral to moderately alkaline. EC is 0 to 8 mmhos/cm.

The Btk horizon has hue of 10YR or 2.5Y, value of 5 or 6 and 4 or 5 moist, and chroma of 2 to 4. It is clay loam, silty clay loam, clay or silty clay. It is slightly alkaline to strongly alkaline. It has a calcium carbonate equivalent of 5 to 12 percent. It has an EC of 0 to 2 mmhos/cm and 4 to 12 in the saline phase.

The Bk horizon ranges from 5Y, 2.5Y or 10YR, value of 5 to 7 dry, 4 to 6 moist, and chroma of 2 to 4. It is clay loam, loam, sandy clay loam, or light clay. This horizon has 6 to 14 percent calcium carbonate equivalent. Reaction is moderately alkaline or strongly alkaline. EC is 0 to 12 mmhos.

Some pedons have a C horizon below 40 inches that have properties that are similar to the Bk horizon. A gravelly substratum phase is recognized.

TAXONOMIC CLASS: Fine, smectitic, mesic Ustic Paleargids

SUITABILITY FOR TOPSOIL (according to WDEQ/LQD Guideline 1, 1994): Marginal values were found for texture from 0-60", for selenium from 18-60", for pH from 5-60", for saturation percent from 5-18" and for EC from 18-60". Unsuitable values were found for SAR from 5-60". Estimated salvage depth is 5 inches.

GEOGRAPHIC SETTING (according to official series description): The Bidman soils are on alluvial fans, fan remnants, terraces, ridges and hills. Elevation is 2,600 to 6,000 feet. Slopes range from 0 to 25 percent. These soils formed in thick, calcareous alluvial sediments derived from sedimentary rock. At the type location the mean annual temperature is 47 degrees F., and the mean summer temperature is 66 degrees F. The average annual precipitation is about 12 inches with about half the precipitation in April, May, and June. Precipitation ranges from 10 to 14 inches. The frost-free season is 100 to 130 days.

VARIATION FROM TYPICAL SERIES: The A horizon is finer than typical. This profile has more silt than typical from 38-60 inches.

FORKWOOD silty clay loam

SOIL MAPPING UNIT: FO

SOIL SAMPLE LOCATION: PS-10

TYPICAL PEDON: Forkwood silty clay loam - utilized as rangeland. (Colors are for dry soil unless otherwise stated)

The Forkwood series consists of very deep, well drained soils formed in alluvium. Forkwood soils are on terraces, alluvial fans, fan remnants, hills, ridges and pediments. Slopes range from 0 to 15 percent. The mean annual precipitation is about 11 inches, and the mean annual air temperature is about 45 degrees F.

A--0 to 6 inches; brown (10YR 5/3) silty clay loam, dark grayish brown (10YR 4/2) moist; weak fine granular structure; soft, very friable, slightly sticky and slightly plastic; many fine and medium roots throughout; non-effervescent; neutral (pH 6.6); abrupt smooth boundary.

Btk1--6 to 21 inches; brown (10YR 5/3) silty clay, brown (10YR 4/3) moist; strong medium angular blocky structure; slightly hard, friable, moderately sticky and moderately plastic; common fine and medium roots throughout; common distinct clay films on faces of peds; moderately effervescent; moderately alkaline (pH 8.3); clear smooth boundary.

Btk2--21 to 40 inches; light brownish gray (2.5Y 6/2) silty clay, dark grayish brown (2.5Y 4/2) moist; strong medium angular blocky structure; hard, firm, moderately sticky and moderately plastic; few fine and medium roots throughout; few faint clay films on faces of peds; few masses of carbonates; moderately effervescent; moderately alkaline (pH 8.0); clear smooth boundary.

Btk3--40 to 54 inches; light brownish gray (2.5Y 6/2) silty clay loam, light olive brown (2.5Y 5/4) moist; moderate medium subangular blocky structure parting to weak fine subangular blocky; slightly hard, friable, slightly sticky and sligtly plastic; few fine roots throughout; few fine threads and masses of carbonates throughout; violently effervescent; moderately alkaline (pH 8.3); gradual wavy boundary.

C--54 to 60 inches; light brownish gray (2.5Y 6/2) loam, grayish brown (2.5Y 5/2) moist; massive; soft, very friable, slightly sticky and slightly plastic; few fine roots throughout; few masses of carbonates throughout; slightly effervescent; moderately alkaline (pH 8.2).

TYPE LOCATION: Crook County, Wyoming; refer to waypoint PS-10 on Figure 3.3-9 in the ER.

RANGE IN CHARACTERISTICS (according to official series description): Depth to the base of the argillic horizon is 10 to 33 inches, and depth to continuous horizons of carbonate accumulation is 10 to 33 inches. Rock fragments range from 0 to 15

percent. The soil is dry in the moisture control section more than half the time cumulative that the soil temperature at a depth of 20 inches is 41 degrees F., which occurs about April 21-27, and is dry in all parts of the moisture control section for at least 60 consecutive days from July 15 to October 25 and for at least 90 cumulative days during this period. The mean annual soil temperature ranges from 47 to 53 degrees F., and the soil temperature at a depth of 20 inches is 41 degrees F. or more for 175 to 192 days. EC ranges from 0 to 4 mmhos/cm throughout the profile. Bedrock is deeper than 60 inches.

The A horizon has hue of 2.5Y or 10YR, value of 4 to 6 dry and 3 to 5 moist, and chroma of 2 to 4. A vesicular crust occurs on some pedons. Texture is very fine sandy loam, loam, clay loam or fine sandy loam. Reaction is neutral through moderately alkaline.

The Bt horizon has hue of 2.5Y, 10YR or 7.5YR, value of 4 to 7 dry and 3 to 5 moist, and chroma of 2 to 4. Texture is loam or clay loam with 18 to 35 percent clay and more than 15 but less than 35 percent fine sand or coarser. Reaction is neutral through moderately alkaline.

The Btk horizon has hue of 2.5Y or 10YR, value of 4 to 7 dry and 3 to 5 moist, and chroma of 2 to 4. Texture is loam or clay loam. It is slightly alkaline or moderately alkaline. It has 3 to 12 percent calcium carbonate equivalent.

The Bk horizon has hue of 5Y, 2.5Y or 10YR, value of 5 to 7 dry and 4 to 6 moist, and chroma of 2 to 4. Texture is loam, fine sandy loam, very fine sandy loam or clay loam. This horizon has 1 to 14 percent authigenic calcium carbonate accumulation. It is moderately alkaline or strongly alkaline.

The C horizon, when present, has hue of 5Y to 10YR, value of 5 to 7 dry, 4 to 6 moist, and chroma of 2 to 4. Carbonates range from 1 to 8 percent and are mostly allogenic. ESP ranges from 4 to 12. Reaction is moderately or strongly alkaline.

TAXONOMIC CLASS: Fine-loamy, mixed, superactive, mesic Ustic Haplargids

SUITABILITY FOR TOPSOIL (according to WDEQ/LQD Guideline 1, 1994): Marginal values were found for texture from 6-40" and for SAR from 6-21" and 40-60". Estimated salvage depth is 6 inches.

GEOGRAPHIC SETTING (according to official series description): Forkwood soils are on terraces, alluvial fans, fan remnants, hills, ridges and pediments. Slopes are 0 to 15 percent. The soils formed in slopewash alluvium derived from interbedded shales and argillaceous sandstone. Elevations are 3,500 to 6,000 feet. The average annual precipitation is 10 to 14 inches with over half of the annual precipitation falling in April, May, and June and less than one inch falling in each month of July, August, September, and October. The mean annual air temperature ranges from 43 to 51 degrees F. The estimated frost-free season is about 105 to 130 days depending upon elevation, aspect, and air drainage.

VARIATION FROM TYPICAL SERIES: This profile has more silt than typical from 0-54 inches.

NUNN clay loam

SOIL MAPPING UNIT: NU

SOIL SAMPLE LOCATION: PS-12

TYPICAL PEDON: Nunn clay loam - grassland. (Colors are for dry soil unless otherwise noted)

The Nunn series consists of very deep, well drained soils that formed in loess and mixed alluvium. Nunn soils are on terraces or alluvial fans, and in drainageways. Slopes range from 0 to 25 percent. The mean annual precipitation is about 14 inches and the mean annual air temperature is about 48 degrees F.

A--0 to 4 inches; grayish brown (10YR 5/2) clay loam, very dark grayish brown (10YR 3/2) moist; moderate medium granular structure; soft, very friable; non-effervescent; moderately acid (pH 6.0); clear smooth boundary.

Bt--4 to 14 inches; grayish brown (10YR 5/2) silty clay, very dark grayish brown (10YR 3/2) moist; weak medium prismatic structure parting to moderate medium subangular blocky; hard, very friable, sticky and plastic; few faint clay films on faces of peds; non-effervescent; neutral (pH 6.9); clear smooth boundary.

Btk1--14 to 32 inches; pale brown (10YR 6/3) clay loam, brown (10YR 4/3) moist; moderate medium and coarse prismatic structure parting to moderate medium subangular blocky; very hard, firm, very sticky and very plastic; many distinct clay films on faces of peds; moderately effervescent; moderately alkaline (pH 7.9); clear smooth boundary.

Btk2--32 to 44 inches; pale brown (10YR 6/3) clay loam, brown (10YR 5/3) moist; weak medium subangular blocky structure; very hard, firm, very plastic; few faint clay films on faces of peds; visible calcium carbonate occurring as small concretions; strongly effervescent; moderately alkaline (pH 8.1); gradual smooth boundary.

Ck--44 to 60 inches; light yellowish brown (10YR 6/4) loam, dark yellowish brown (10YR 4/4) moist; massive; very hard, firm, sticky and plastic; visible calcium carbonate occurring as concretions, thin seams and streaks; moderately effervescent; moderately alkaline (pH 8.2); gradual smooth boundary.

TYPE LOCATION: Crook County, Wyoming; refer to waypoint PS-12 on Figure 3.3-9 in the ER.

RANGE IN CHARACTERISTICS (according to official series description): Mean annual soil temperature at depth of 20 inches is 47 to 54 degrees F, and mean summer temperature is 59 to 79 degrees F. The mollic epipedon is 7 to 19 inches thick, depth to lime is 10 to 30 inches, and the solum is 16 to 46 inches thick. Organic carbon in the mollic epipedon ranges from .8 to 3 percent. The soil is typically 90 to 100 percent base-saturated. Rock fragments are typically less than 5 percent and range from 0 to 15 percent. The soil temperature at depth of 20 inches is 41 degrees F or warmer for

about 200 to 240 days. The soils are moist in some part of the moisture control section for about 56 to 152 days while the soil temperature is 41 degrees F or above.

The A horizon has hue of 5Y to 7.5YR, value of 4 or 5, 2 or 3 moist, and chroma of 1 to 3. Usually it has granular or crumb structure but the structure is subangular blocky in some pedons. This horizon is soft or slightly hard. It is slightly acid to slightly alkaline.

The Bt horizon has hue of 5Y to 7.5YR, value of 3 to 7, 2 to 6 moist, and chroma of 2 to 5. It is typically clay, silty clay loam or clay loam and has 35 to 50 percent clay, 15 to 45 percent silt, and 15 to 45 percent sand with more than 15 percent, being fine sand or coarser. Some pedons have sandy clay loam textures in the lower parts of the argillic layer, however, the weighted clay average is greater than 35 percent in the control section. It is slightly acid to moderately alkaline. CEC of the Bt horizon ranges from 60 to 90 millequivalents per 100 grams of clay.

The Bk or C horizon has hue of 5Y to 7.5YR, value of 5 to 7, 4 to 6 moist, and chroma of 2 to 4. They are typically clay loam with more than 28 percent clay, however, where the C horizon has less than 28 percent clay it contains more than 15 percent fine or coarser sand and has a texture of sandy clay loam, loam or sandy loam. These horizons are slightly alkaline to strongly alkaline and have 4 to 15 percent calcium carbonate equivalent.

TAXONOMIC CLASS: Fine, smectitic, mesic Aridic Argiustolls

SUITABILITY FOR TOPSOIL (according to WDEQ/LQD Guideline 1, 1994): Marginal texture values were found from 4-14". Estimated salvage depth is 32 inches.

GEOGRAPHIC SETTING (according to official series description): The Nunn soils are on terraces or alluvial fans, or in drainageways. Slope gradients range from 0 to 25 percent. The soils formed in mixed alluvium. At the type location the average annual precipitation is 13 inches, 9 inches of which falls during the months of April through September. Mean annual air temperature is 47 to 53 degrees F, and an average summer temperature is 67 degrees F. The frost-free period is 120 to 210 days.

VARIATION FROM TYPICAL SERIES: The A horizon is more acidic than typical.

BIDMAN clay loam

SOIL MAPPING UNIT: BI

SOIL SAMPLE LOCATION: PS-13

TYPICAL PEDON: Bidman clay loam-grassland. (Colors are for dry soil unless otherwise noted)

The Bidman series consists of very deep, well drained soils that formed in alluvium weathered from shale bedrock. Bidman soils are on alluvial fans, fan remnants, terrace, ridges and hills. Slopes are 0 to 25 percent. The mean annual precipitation is about 12 inches, and the mean annual air temperature is about 47 degrees F.

A--0 to 5 inches; light brownish gray (10YR 6/2) clay loam, dark grayish brown (2.5Y 4/2) moist; weak thin platy structure that parts to very fine granules; soft, very friable; uncoated sand grains; non-effervescent; slightly acid (pH 6.5); abrupt smooth boundary.

Bt1--5 to 14 inches; brown (10YR 5/3) clay loam, brown (10YR 4/3) moist; strong medium prismatic structure that parts to strong medium angular blocky; hard, very sticky and very plastic; many prominent clay films on faces of peds, in channels and pores; few streaks of bleached sand grains in the upper 2 inches; non-effervescent; neutral (pH 7.3); clear wavy boundary.

Bt2--14 to 34 inches; light yellowish brown (2.5Y 6/3) clay loam, light olive brown (2.5Y 5/3) moist; weak coarse prismatic structure that parts to moderate coarse angular and subangular blocks; extremely hard, very friable; sticky and plastic; few distinct clay films on faces of peds; non-effervescent; slightly alkaline (pH 7.8); gradual wavy boundary.

Btk1--34 to 48 inches; light olive brown (2.5Y 5/3) clay loam, olive brown (2.5Y 4/3) moist; massive; hard, very friable, sticky and slightly plastic; strongly effervescent, calcium carbonate as soft masses; moderately alkaline (pH 8.2).

Btk2--48 to 60 inches; light olive brown (2.5Y 5/3) clay loam, olive brown (2.5Y 4/3) moist; massive; hard, very friable, sticky and slightly plastic; strongly effervescent, calcium carbonate as soft masses; moderately alkaline (pH 8.0).

TYPE LOCATION: Crook County, Wyoming; refer to waypoint PS-13 on Figure 3.3-9 in the ER.

RANGE IN CHARACTERISTICS (according to official series description): Depth to calcareous material ranges from 8 to 26 inches. Depth to the base of the argillic horizon range from 15 to 36 inches. Organic carbon ranges from .6 to 1.5 percent in the surface horizons and decreases uniformly with increasing depth. Cation exchange capacity ranges from 60 to 90 milliequivalents per 100 grams of clay. Rock fragments are typically less than 2 percent but ranges from 0 to 15 percent. This soil is dry in the moisture control section more than half the time cumulative that the soil temperature at a depth of 20 inches is 41 degrees F. It is never moist in some or all parts for as

long as 60 consecutive days during this same period. It is dry in all parts of the moisture control section for at least 60 consecutive days from July 15 to October 25 and for at least 90 cumulative days during this period. The mean annual soil temperature is 47 to 53 degrees F., and the soil temperature at a depth of 20 inches is 41 degrees F. or warmer for 175 to 195 days. The mean summer soil temperature at depth of 20 inches ranges from 59 to 65 degrees F.

The E horizon has hue of 2.5Y or 10YR, value of 5 to 7 dry, 4 or 5 moist, and chroma of 2 to 4. It usually has platy structure but has granular structure in some pedons. It is loam, very fine sandy loam or sandy loam. It is soft or slightly hard. Reaction is slightly acid to slightly alkaline. Some pedons have an A horizon.

The Bt horizon has hue of 2.5Y, 10YR or 7.5YR, value of 5 or 6 dry, 4 or 5 moist, and chroma of 2 to 4. It is silty clay, silty clay loam, clay loam or clay but has 35 to 50 percent clay, 15 to 45 percent silt, and 15 to 45 percent sand with more than 15 percent fine or coarser sand. This horizon typically has prismatic structure but has columnar or angular blocky structure in some pedons. It has oriented clay films in some part. Reaction is neutral to moderately alkaline. EC is 0 to 8 mmhos/cm.

The Btk horizon has hue of 10YR or 2.5Y, value of 5 or 6 and 4 or 5 moist, and chroma of 2 to 4. It is clay loam, silty clay loam, clay or silty clay. It is slightly alkaline to strongly alkaline. It has a calcium carbonate equivalent of 5 to 12 percent. It has an EC of 0 to 2 mmhos/cm and 4 to 12 in the saline phase.

The Bk horizon ranges from 5Y, 2.5Y or 10YR, value of 5 to 7 dry, 4 to 6 moist, and chroma of 2 to 4. It is clay loam, loam, sandy clay loam, or light clay. This horizon has 6 to 14 percent calcium carbonate equivalent. Reaction is moderately alkaline or strongly alkaline. EC is 0 to 12 mmhos.

Some pedons have a C horizon below 40 inches that have properties that are similar to the Bk horizon. A gravelly substratum phase is recognized.

TAXONOMIC CLASS: Fine, smectitic, mesic Ustic Paleargids

SUITABILITY FOR TOPSOIL (according to WDEQ/LQD Guideline 1, 1994): no marginal or unsuitable parameters were found. Estimated salvage depth is 34 inches.

GEOGRAPHIC SETTING (according to official series description): The Bidman soils are on alluvial fans, fan remnants, terraces, ridges and hills. Elevation is 2,600 to 6,000 feet. Slopes range from 0 to 25 percent. These soils formed in thick, calcareous alluvial sediments derived from sedimentary rock. At the type location the mean annual temperature is 47 degrees F., and the mean summer temperature is 66 degrees F. The average annual precipitation is about 12 inches with about half the precipitation in April, May, and June. Precipitation ranges from 10 to 14 inches. The frost-free season is 100 to 130 days.

VARIATION FROM TYPICAL SERIES: The A horizon is finer than typical.

FORKWOOD loam

SOIL MAPPING UNIT: FO

SOIL SAMPLE LOCATION: PS-14

TYPICAL PEDON: Forkwood loam - utilized as rangeland. (Colors are for dry soil unless otherwise stated)

The Forkwood series consists of very deep, well drained soils formed in alluvium. Forkwood soils are on terraces, alluvial fans, fan remnants, hills, ridges and pediments. Slopes range from 0 to 15 percent. The mean annual precipitation is about 11 inches, and the mean annual air temperature is about 45 degrees F.

A--0 to 6 inches; brown (10YR 5/3) loam, dark grayish brown (10YR 4/2) moist; weak fine granular structure; soft, very friable, slightly sticky and slightly plastic; many fine and medium roots throughout; non-effervescent; very strongly acid (pH 5.0); abrupt smooth boundary.

Bt--6 to 19 inches; brown (10YR 5/3) clay loam, brown (10YR 4/3) moist; strong medium angular blocky structure; slightly hard, friable, moderately sticky and moderately plastic; common fine and medium roots throughout; common distinct clay films on faces of peds; non-effervescent; slightly acid (pH 6.4); clear smooth boundary.

Btk1--19 to 32 inches; light brownish gray (2.5Y 6/2) clay, dark grayish brown (2.5Y 4/2) moist; strong medium angular blocky structure; hard, firm, moderately sticky and moderately plastic; few fine and medium roots throughout; few faint clay films on faces of peds; few masses of carbonates; strongly effervescent; moderately alkaline (pH 8.3); clear smooth boundary.

Btk2--32 to 48 inches; light brownish gray (2.5Y 6/2) clay, light olive brown (2.5Y 5/4) moist; moderate medium subangular blocky structure parting to weak fine subangular blocky; slightly hard, friable, slightly sticky and sligtly plastic; few fine roots throughout; few fine threads and masses of carbonates throughout; strongly effervescent; slightly alkaline (pH 7.9); gradual wavy boundary.

Btk3--48 to 60 inches; light brownish gray (2.5Y 6/2) clay loam, grayish brown (2.5Y 5/2) moist; massive; soft, very friable, slightly sticky and slightly plastic; few fine roots throughout; few masses of carbonates throughout; strongly effervescent; moderately alkaline (pH 8.1).

TYPE LOCATION: Crook County, Wyoming; refer to waypoint PS-14 on Figure 3.3-9 in the ER.

RANGE IN CHARACTERISTICS (according to official series description): Depth to the base of the argillic horizon is 10 to 33 inches, and depth to continuous horizons of carbonate accumulation is 10 to 33 inches. Rock fragments range from 0 to 15 percent. The soil is dry in the moisture control section more than half the time cumulative that the soil temperature at a depth of 20 inches is 41 degrees F., which occurs about April 21-27, and is dry in all parts of the moisture control section for at

least 60 consecutive days from July 15 to October 25 and for at least 90 cumulative days during this period. The mean annual soil temperature ranges from 47 to 53 degrees F., and the soil temperature at a depth of 20 inches is 41 degrees F. or more for 175 to 192 days. EC ranges from 0 to 4 mmhos/cm throughout the profile. Bedrock is deeper than 60 inches.

The A horizon has hue of 2.5Y or 10YR, value of 4 to 6 dry and 3 to 5 moist, and chroma of 2 to 4. A vesicular crust occurs on some pedons. Texture is very fine sandy loam, loam, clay loam or fine sandy loam. Reaction is neutral through moderately alkaline.

The Bt horizon has hue of 2.5Y, 10YR or 7.5YR, value of 4 to 7 dry and 3 to 5 moist, and chroma of 2 to 4. Texture is loam or clay loam with 18 to 35 percent clay and more than 15 but less than 35 percent fine sand or coarser. Reaction is neutral through moderately alkaline.

The Btk horizon has hue of 2.5Y or 10YR, value of 4 to 7 dry and 3 to 5 moist, and chroma of 2 to 4. Texture is loam or clay loam. It is slightly alkaline or moderately alkaline. It has 3 to 12 percent calcium carbonate equivalent.

The Bk horizon has hue of 5Y, 2.5Y or 10YR, value of 5 to 7 dry and 4 to 6 moist, and chroma of 2 to 4. Texture is loam, fine sandy loam, very fine sandy loam or clay loam. This horizon has 1 to 14 percent authigenic calcium carbonate accumulation. It is moderately alkaline or strongly alkaline.

The C horizon, when present, has hue of 5Y to 10YR, value of 5 to 7 dry, 4 to 6 moist, and chroma of 2 to 4. Carbonates range from 1 to 8 percent and are mostly allogenic. ESP ranges from 4 to 12. Reaction is moderately or strongly alkaline.

TAXONOMIC CLASS: Fine-loamy, mixed, superactive, mesic Ustic Haplargids

SUITABILITY FOR TOPSOIL (according to WDEQ/LQD Guideline 1, 1994): Marginal texture values were found from 19-48". Estimated salvage depth is 19 inches.

GEOGRAPHIC SETTING (according to official series description): Forkwood soils are on terraces, alluvial fans, fan remnants, hills, ridges and pediments. Slopes are 0 to 15 percent. The soils formed in slopewash alluvium derived from interbedded shales and argillaceous sandstone. Elevations are 3,500 to 6,000 feet. The average annual precipitation is 10 to 14 inches with over half of the annual precipitation falling in April, May, and June and less than one inch falling in each month of July, August, September, and October. The mean annual air temperature ranges from 43 to 51 degrees F. The estimated frost-free season is about 105 to 130 days depending upon elevation, aspect, and air drainage.

VARIATION FROM TYPICAL SERIES: The texture is finer than typical from 6 to 48 inches. The pH is more acidic from 0-19 inches.

SHINGLE loam

SOIL MAPPING UNIT: SH

SOIL SAMPLE LOCATION: PS-16

TYPICAL PEDON: Shingle loam-rangeland. (Colors are for dry soil unless otherwise stated.)

The Shingle series consists of well drained soils that are very shallow or shallow to bedrock. They formed in residuum and colluvium derived from interbedded shale and sandstone or in alluvium from mudstone. Shingle soils are on bedrock controlled hillslopes and ridges. Slopes are 0 to 80 percent. The mean annual precipitation is about 13 inches, and the mean annual temperature is 45 degrees F.

A--0 to 6 inches; light brownish gray (10YR 6/2) loam, dark grayish brown (10YR 4/2) moist; moderate very fine granular structure; soft, very friable, moderately sticky and moderately plastic; non-effervescent; neutral (pH 6.6); clear smooth boundary.

C--6 to 10 inches; light yellowish brown (2.5Y 6/3) loam, light olive brown (2.5Y 5/3) moist; massive; hard, variable, moderately sticky and moderately plastic; strongly effervescent, calcium carbonate disseminated; slightly alkaline (pH 7.4); clear wavy boundary.

Cr--10 to 36 inches; calcareous gray weathered shale.

TYPE LOCATION: Crook County, Wyoming; refer to waypoint PS-16 on Figure 3.3-9 in the ER.

RANGE IN CHARACTERISTICS (according to official series description):

Depth to soft bedrock and paralithic contact ranges from 4 to 20 inches. The mean annual soil temperature is 47 to 53 degrees F. The soils commonly are calcareous throughout, but some pedons are leached to 6 inches. The particle size control section averages 20 to 35 percent clay and has more than 15 percent but less than 35 percent fine or coarser sand. The soil is usually dry. The moisture control section is usually moist in April, May and early June. It is dry for 60 consecutive days or more during the 90 day period following the summer solstice. EC is 0 to 2 mmhos throughout.

The A horizon has hue of 5Y through 7.5YR, value of 5 through 7 dry, 3 through 6 moist, and chroma of 1 through 6. Reaction is neutral through strongly alkaline. Some pedons have a light gravel lag on the surface. Texture is loam, silt loam, clay loam, silty clay loam, cobbly loam, and gravelly clay loam. Rock fragments or shale channers range from 0 to 35 percent.

A Bw or AC horizon, when present, has the combined properties of the A and C horizons.

The C horizon has hue of 5Y through 7.5YR, value of 4 through 7 dry, 3 through 6 moist, and chroma of 1 through 6. It is loam, silt loam, clay loam or silty clay loam.

Rock fragments or shale channers range from 0 to 35 percent. Reaction is slightly alkaline through strongly alkaline.

TAXONOMIC CLASS: Loamy, mixed, superactive, calcareous, mesic, shallow Ustic Torriorthents

SUITABILITY FOR TOPSOIL (according to WDEQ/LQD Guideline 1, 1994): no marginal or unsuitable parameters were found. Estimated salvage depth is 6 inches.

GEOGRAPHIC SETTING (according to official series description): The Shingle soils occur on all hillslope positions. Slopes are 0 to 80 percent. These soils formed in colluvium and residuum weathered from soft, interbedded sandstone and shale or in alluvium from mudstone. Elevation is 3,200 to 6,500 feet. The mean annual precipitation is about 10 to 14 inches, most of which falls in April, May, and June. The mean annual temperature is about 45 degrees F.but ranges from 43 to 51 degrees F. The frost-free season is about 105 to 130 days.

VARIATION FROM TYPICAL SERIES: There is no variation from the typical series.

TASSEL sandy loam

SOIL MAPPING UNIT: TA

SOIL SAMPLE LOCATION: PS-18

TYPICAL PEDON: Tassel sandy loam with a slope of 15 percent in rangeland. (Colors are for dry soil unless otherwise stated)

The Tassel series consists of very shallow or shallow, well drained soils formed in residuum weathered from sandstone on uplands. Permeability is moderately rapid. Slopes range from 0 to 70 percent. The mean annual precipitation is about 15 inches and the mean annual air temperature is about 48 degrees F at the type location.

A--0 to 6 inches; light brownish gray (10YR 6/2) sandy loam, dark grayish brown (10YR 4/2) moist; weak medium granular structure; soft, very friable; 3 percent sandstone gravel by volume; non-effervescent; moderately acid (pH 5.9); gradual smooth boundary.

C--6 to 18 inches; light gray (10YR 7/2) sandy loam, grayish brown (10YR 5/2) moist; massive; slightly hard, friable; 10 percent sandstone gravel and cobbles by volume; non-effervescent; neutral (pH 6.6); gradual smooth boundary.

Cr--18 to 48 inches; calcareous sandstone.

TYPE LOCATION: Crook County, Wyoming; refer to waypoint PS-18 on Figure 3.3-9 in the ER.

RANGE IN CHARACTERISTICS (according to official series description):

Depth to carbonates: 0 to 3 inches
Particle-size control section: clay content ranges from 5 to 12 percent, but averages 10 percent or less; sand content that ranges from 52 to 75 percent
Depth to the Cr horizon: typically 10 to 20 inches, but ranges from 6 to 20
Reaction: slightly alkaline or moderately alkaline throughout the profile.

A horizon:
Hue: 10YR or 2.5Y
Value: 4 to 7 and 3 to 6 moist
Chroma: 2 to 4
Texture: typically fine sandy loam, but ranges to include very fine sandy loam, loamy very fine sand, sandy loam, loamy sand or loamy fine sand
Notes: Where the A horizon has mollic colors, it lacks sufficient thickness to qualify for a mollic epipedon. Some pedons have an AC horizon that is intermediate in color and texture between the A and C horizon.

C horizon:
Hue: 10YR, 2.5Y or 5Y
Value: 5 to 8 and 4 to 7 moist
Chroma of 2 or 3

Texture: typically fine sandy loam, but the range includes very fine sandy loam with less than 12 percent clay, sandy loam, loamy very fine sand and loamy fine sand

TAXONOMIC CLASS: Loamy, mixed, superactive, calcareous, mesic, shallow Ustic Torriorthents

SUITABILITY FOR TOPSOIL (according to WDEQ/LQD Guideline 1, 1994): no marginal or unsuitable parameters were found. Estimated salvage depth is 6 inches.

GEOGRAPHIC SETTING (according to official series description):

Landscape: uplands
Slopes: 0 to 70 percent
Parent material: loamy, calcareous, weathered sandstone residuum
Mean annual air temperature: 46 to 52 degrees F
Mean annual precipitation: 12 to 18 inches.

VARIATION FROM TYPICAL SERIES: This profile is less calcareous than typical. The pH is more acidic than typical.

ADDENDUM 3.3-D

SOIL LABORATORY ANALYSIS

Inter-Mountain Laboratories, Inc.
1673 Terra Avenue. Sheridan, Wyoming 82801
(307) 672-8945

Soil Analysis Report
Western Water Consultants
1849 Terra
Sheridan, WY 82801

Report ID: S1008307001

Project: Baseline Sampling
Date Received: 8/17/2010

Date Reported: 9/15/2010
Work Order: S1008307

Lab ID	Sample ID	Depths	pH	Saturation	Electrical Conductivity	Organic Matter LOI	PE Calcium	PE Magnesium	PE Sodium	SAR
		Inches	s.u.	%	dS/m	%	meq/L	meq/L	meq/L	
S1008307-001	#78	0-6	7.1	56.3	1.07	3.2	6.57	2.94	0.97	0.45
S1008307-002	#78	6-14	8.0	59.6	0.93	1.9	1.12	1.00	6.43	6.24
S1008307-003	#78	14-29	8.4	82.4	3.80	2.0	4.14	6.91	29.3	12.5
S1008307-004	#78	29-35	8.1	83.6	7.49	2.4	16.2	34.2	73.2	14.6
S1008307-005	#78	35-43	8.3	101	5.64	1.7	5.42	13.6	51.1	16.6
S1008307-006	#78	43-60	8.5	70.1	4.38	1.3	1.98	5.03	35.3	18.8
S1008307-007	#75	0-4	7.3	41.8	0.60	2.3	3.38	1.00	0.31	0.21
S1008307-008	#75	4-10	7.5	43.0	0.53	2.1	2.80	0.92	0.32	0.23
S1008307-009	#75	10-24	7.8	44.5	0.52	1.7	2.18	1.03	0.75	0.59
S1008307-010	#75	24-34	8.1	43.7	0.45	1.3	1.32	1.39	0.64	0.55
S1008307-011	#75	34-40	8.3	63.5	0.57	1.7	0.90	2.41	0.83	0.65
S1008307-012	#75	40-60	8.6	41.3	0.76	1.1	0.46	1.74	4.19	3.99
S1008307-013	#80	0-5	6.1	51.6	0.60	4.4	2.13	1.48	0.33	0.24
S1008307-014	#80	5-17	6.4	55.9	0.42	3.0	0.88	0.71	0.67	0.76
S1008307-015	#80	17-33	7.2	64.6	0.42	2.4	0.59	0.67	1.50	1.89
S1008307-016	#80	33-52	7.9	57.4	1.84	2.0	6.85	7.58	6.53	2.43
S1008307-017	#80	52-60	7.8	49.9	3.32	1.6	23.2	24.4	10.1	2.06
S1008307-018	#40	0-6	5.7	50.5	0.43	4.1	1.21	0.76	0.16	0.16
S1008307-019	#40	6-19	5.9	47.7	0.48	2.9	1.31	1.31	0.54	0.47
S1008307-020	#40	19-30	6.2	48.3	0.41	2.6	1.23	0.95	0.67	0.65

These results apply only to the samples tested.

Abbreviations for extractants: PE= Saturated Paste Extract, H20Sol= water soluble,AB-DTPA= Ammonium Bicarbonate-DTPA, AAO= Acid Ammonium Oxalate
Abbreviations used in acid base accounting: T.S.= Total Sulfur, AB= Acid Base, ABP= Acid Base Potential, PyrS= Pyritic Sulfur, Pyr+Org= Pyritic Sulfur + Organic Sulfur, Neutral. Pot.= Neutralization Potential
Miscellaneous Abbreviations: SAR= Sodium Adsorption Ratio, CEC= Cation Exchange Capacity, ESP= Exchangeable Sodium Percentage

Reviewed by: Karen A Secor
Karen Secor, Soil Lab Supervisor

Inter-Mountain Laboratories, Inc.
1673 Terra Avenue. Sheridan, Wyoming 82801
(307) 672-8945

Soil Analysis Report
Western Water Consultants
1849 Terra
Sheridan, WY 82801

Report ID: S1008307001

Project: Baseline Sampling
Date Received: 8/17/2010

Date Reported: 9/15/2010
Work Order: S1008307

Lab ID	Sample ID	Depths Inches	Sand %	Silt %	Clay %	Texture	Coarse Fragment %	Available Selenium ppm	Available Boron ppm
S1008307-001	#78	0-6	29.0	37.0	34.0	Clay Loam	<0.01	<0.02	0.28
S1008307-002	#78	6-14	27.0	38.0	35.0	Clay Loam	<0.01	<0.02	0.30
S1008307-003	#78	14-29	21.0	36.0	43.0	Clay	<0.01	0.06	1.43
S1008307-004	#78	29-35	21.0	34.0	45.0	Clay	<0.01	0.44	1.71
S1008307-005	#78	35-43	15.0	38.0	47.0	Clay	<0.01	0.41	0.84
S1008307-006	#78	43-60	26.0	41.0	33.0	Clay Loam	<0.01	0.15	0.53
S1008307-007	#75	0-4	58.0	20.0	22.0	Sandy Clay Loam	0.78	<0.02	0.31
S1008307-008	#75	4-10	57.0	21.0	22.0	Sandy Clay Loam	0.07	<0.02	0.16
S1008307-009	#75	10-24	60.0	19.0	21.0	Sandy Clay Loam	<0.01	<0.02	0.09
S1008307-010	#75	24-34	61.0	21.0	18.0	Sandy Loam	<0.01	<0.02	0.08
S1008307-011	#75	34-40	35.0	33.0	32.0	Clay Loam	<0.01	<0.02	0.14
S1008307-012	#75	40-60	61.0	19.0	20.0	Sandy Clay Loam	<0.01	<0.02	0.30
S1008307-013	#80	0-5	27.0	44.0	29.0	Clay Loam	<0.01	<0.02	0.38
S1008307-014	#80	5-17	26.0	38.0	36.0	Clay Loam	<0.01	<0.02	0.34
S1008307-015	#80	17-33	26.0	33.0	41.0	Clay	<0.01	<0.02	0.65
S1008307-016	#80	33-52	35.0	31.0	34.0	Clay Loam	<0.01	<0.02	1.12
S1008307-017	#80	52-60	42.0	28.0	30.0	Clay Loam	<0.01	0.09	0.96
S1008307-018	#40	0-6	41.0	32.0	27.0	Clay Loam	<0.01	<0.02	0.38
S1008307-019	#40	6-19	37.0	34.0	29.0	Clay Loam	<0.01	<0.02	0.48
S1008307-020	#40	19-30	38.0	33.0	29.0	Clay Loam	<0.01	<0.02	0.52

These results apply only to the samples tested.

Abbreviations for extractants: PE= Saturated Paste Extract, H20Sol= water soluble,AB-DTPA= Ammonium Bicarbonate-DTPA, AAO= Acid Ammonium Oxalate
Abbreviations used in acid base accounting: T.S.= Total Sulfur, AB= Acid Base, ABP= Acid Base Potential, PyrS= Pyritic Sulfur, Pyr+Org= Pyritic Sulfur + Organic Sulfur, Neutral. Pot.= Neutralization Potential
Miscellaneous Abbreviations: SAR= Sodium Adsorption Ratio, CEC= Cation Exchange Capacity, ESP= Exchangeable Sodium Percentage

Reviewed by: Karen A Secor
Karen Secor, Soil Lab Supervisor

Inter-Mountain Laboratories, Inc.
1673 Terra Avenue, Sheridan, Wyoming 82801
(307) 672-8945

Soil Analysis Report
Western Water Consultants
1849 Terra
Sheridan, WY 82801

Report ID: S1008307001

Project: Baseline Sampling
Date Received: 8/17/2010

Date Reported: 9/15/2010
Work Order: S1008307

Lab ID	Sample ID	Depths	pH	Saturation	Electrical Conductivity	Organic Matter LOI	PE Calcium	PE Magnesium	PE Sodium	SAR
		Inches	s.u.	%	dS/m	%	meq/L	meq/L	meq/L	
S1008307-021	#40	30-40	6.6	48.9	0.45	1.9	1.53	1.08	0.61	0.53
S1008307-022	#40	40-50	6.9	58.4	0.57	2.2	2.25	1.44	0.52	0.38
S1008307-023	#40	50-60	6.8	53.7	0.49	1.8	1.74	1.20	0.46	0.38
S1008307-024	#18	0-6	5.9	32.4	0.42	2.5	0.26	0.27	1.76	3.40
S1008307-025	#18	6-17	7.9	72.7	2.14	2.8	1.86	3.68	14.8	8.90
S1008307-026	#18	17-30	7.9	62.8	5.70	1.8	22.5	37.6	41.5	7.57
S1008307-027	#18	30-36	8.1	55.3	4.71	1.1	11.1	20.3	32.1	8.11
S1008307-028	#18	36-46	8.0	50.6	4.67	1.2	11.0	20.1	34.5	8.76
S1008307-029	#18	46-60	8.0	46.5	5.80	1.1	18.8	30.0	47.4	9.60
S1008307-030	#81	0-5	5.9	60.3	0.60	4.4	1.96	1.62	0.33	0.25
S1008307-031	#81	5-21	7.4	50.4	0.54	2.4	1.89	1.47	0.39	0.30
S1008307-032	#81	21-40	7.9	42.6	0.69	1.3	1.70	1.91	1.62	1.21
S1008307-033	#81	40-51	8.2	59.5	0.74	1.6	0.57	1.19	4.16	4.44
S1008307-034	#81	51-60	8.4	37.8	0.86	1.3	0.50	1.03	5.75	6.56
S1008307-035	#77	0-4	7.1	52.0	1.04	3.2	5.82	2.32	1.67	0.83
S1008307-036	#77	4-15	7.6	59.4	2.55	2.3	9.38	5.60	14.9	5.46
S1008307-037	#77	15-20	7.6	67.9	3.97	1.4	24.3	13.3	23.5	5.43
S1008307-038	#64	0-4	7.5	47.8	1.11	2.8	7.12	2.02	0.42	0.19
S1008307-039	#64	4-10	7.7	47.9	0.63	2.5	3.17	1.19	0.19	0.13
S1008307-040	#19	0-5	6.3	38.5	0.32	2.0	0.99	0.45	0.23	0.27

These results apply only to the samples tested.

Abbreviations for extractants: PE= Saturated Paste Extract, H20Sol= water soluble,AB-DTPA= Ammonium Bicarbonate-DTPA, AAO= Acid Ammonium Oxalate
Abbreviations used in acid base accounting: T.S.= Total Sulfur, AB= Acid Base, ABP= Acid Base Potential, PyrS= Pyritic Sulfur, Pyr+Org= Pyritic Sulfur + Organic Sulfur, Neutral. Pot.= Neutralization Potential
Miscellaneous Abbreviations: SAR= Sodium Adsorption Ratio, CEC= Cation Exchange Capacity, ESP= Exchangeable Sodium Percentage

Reviewed by: Karen A Secor
Karen Secor, Soil Lab Supervisor

Inter-Mountain Laboratories, Inc.
1673 Terra Avenue, Sheridan, Wyoming 82801
(307) 672-8945

Soil Analysis Report
Western Water Consultants
1849 Terra
Sheridan, WY 82801

Report ID: S1008307001

Project: Baseline Sampling
Date Received: 8/17/2010

Date Reported: 9/15/2010
Work Order: S1008307

Lab ID	Sample ID	Depths Inches	Sand %	Silt %	Clay %	Texture	Coarse Fragment %	Available Selenium ppm	Available Boron ppm
S1008307-021	#40	30-40	43.0	29.0	28.0	Clay Loam	<0.01	<0.02	0.38
S1008307-022	#40	40-50	38.0	29.0	33.0	Clay Loam	<0.01	<0.02	0.29
S1008307-023	#40	50-60	43.0	28.0	29.0	Clay Loam	<0.01	<0.02	0.40
S1008307-024	#18	0-6	61.0	23.0	16.0	Sandy Loam	<0.01	<0.02	0.26
S1008307-025	#18	6-17	37.0	24.0	39.0	Clay Loam	<0.01	0.02	0.76
S1008307-026	#18	17-30	41.0	22.0	37.0	Clay Loam	<0.01	0.20	1.06
S1008307-027	#18	30-36	54.0	18.0	28.0	Sandy Clay Loam	<0.01	0.16	0.82
S1008307-028	#18	36-46	58.0	17.0	25.0	Sandy Clay Loam	0.17	0.18	0.86
S1008307-029	#18	46-60	61.0	17.0	22.0	Sandy Clay Loam	<0.01	0.15	0.75
S1008307-030	#81	0-5	23.0	41.0	36.0	Clay Loam	<0.01	<0.02	0.42
S1008307-031	#81	5-21	35.0	37.0	28.0	Clay Loam	<0.01	<0.02	0.29
S1008307-032	#81	21-40	41.0	36.0	23.0	Loam	<0.01	<0.02	0.44
S1008307-033	#81	40-51	32.0	36.0	32.0	Clay Loam	<0.01	<0.02	0.63
S1008307-034	#81	51-60	58.0	24.0	18.0	Sandy Loam	<0.01	<0.02	0.36
S1008307-035	#77	0-4	33.0	33.0	34.0	Clay Loam	<0.01	<0.02	0.32
S1008307-036	#77	4-15	28.0	33.0	39.0	Clay Loam	<0.01	<0.02	0.29
S1008307-037	#77	15-20	12.0	51.0	37.0	Silty Clay Loam	<0.01	<0.02	0.78
S1008307-038	#64	0-4	60.0	23.0	17.0	Sandy Loam	<0.01	<0.02	0.27
S1008307-039	#64	4-10	66.0	19.0	15.0	Sandy Loam	<0.01	<0.02	0.27
S1008307-040	#19	0-5	78.0	8.0	14.0	Sandy Loam	<0.01	<0.02	0.27

These results apply only to the samples tested.

Abbreviations for extractants: PE= Saturated Paste Extract, H20Sol= water soluble,AB-DTPA= Ammonium Bicarbonate-DTPA, AAO= Acid Ammonium Oxalate
Abbreviations used in acid base accounting: T.S.= Total Sulfur, AB= Acid Base, ABP= Acid Base Potential, PyrS= Pyritic Sulfur, Pyr+Org= Pyritic Sulfur + Organic Sulfur, Neutral. Pot.= Neutralization Potential
Miscellaneous Abbreviations: SAR= Sodium Adsorption Ratio, CEC= Cation Exchange Capacity, ESP= Exchangeable Sodium Percentage

Reviewed by: Karen A Secor
Karen Secor, Soil Lab Supervisor

Inter-Mountain Laboratories, Inc.
1673 Terra Avenue, Sheridan, Wyoming 82801
(307) 672-8945

Soil Analysis Report
Western Water Consultants
1849 Terra
Sheridan, WY 82801

Report ID: S1008307001

Project: Baseline Sampling
Date Received: 8/17/2010

Date Reported: 9/15/2010
Work Order: S1008307

Lab ID	Sample ID	Depths Inches	pH s.u.	Saturation %	Electrical Conductivity dS/m	Organic Matter LOI %	PE Calcium meq/L	PE Magnesium meq/L	PE Sodium meq/L	SAR
S1008307-041	#19	5-18	7.2	37.5	0.45	1.4	2.08	0.79	0.23	0.19
S1008307-042	#19	18-26	7.9	40.8	0.48	1.1	1.93	0.81	0.46	0.39
S1008307-043	#19	26-36	7.8	40.9	0.61	1.0	2.38	1.35	0.30	0.22
S1008307-044	#16	0-5	6.4	39.8	0.38	2.4	1.34	0.52	0.35	0.36
S1008307-045	#16	5-15	7.1	41.3	0.41	1.8	1.92	0.64	0.50	0.44
S1008307-046	#16	15-29	7.8	36.5	0.41	1.2	1.91	0.64	0.46	0.40
S1008307-047	#16	29-42	7.9	39.6	0.39	1.1	1.48	0.98	0.44	0.40
S1008307-048	#16	42-54	8.0	40.7	0.40	0.8	1.23	1.11	0.43	0.40
S1008307-049	#22	0-4	8.8	102	14.5	1.0	1.88	8.48	206	90.4
S1008307-050	#22	4-18	9.3	79.5	8.20	0.5	0.73	1.30	79.7	79.3
S1008307-051	#22	18-33	9.2	113	10.1	0.4	1.38	2.98	122	82.7
S1008307-052	#22	33-52	9.2	92.9	10.8	0.5	1.48	3.92	130	79.2
S1008307-053	#22	52-60	9.1	81.1	5.49	0.5	0.95	0.46	57.9	69.1
S1008307-054	#42	0-6	5.7	48.3	0.39	4.1	1.29	0.78	0.25	0.25
S1008307-055	#42	6-14	6.1	48.7	0.28	2.5	0.97	0.65	0.20	0.22
S1008307-056	#42	14-22	7.3	49.4	0.41	2.0	2.10	1.04	0.21	0.17

These results apply only to the samples tested.

Abbreviations for extractants: PE= Saturated Paste Extract, H20Sol= water soluble,AB-DTPA= Ammonium Bicarbonate-DTPA, AAO= Acid Ammonium Oxalate
Abbreviations used in acid base accounting: T.S.= Total Sulfur, AB= Acid Base, ABP= Acid Base Potential, PyrS= Pyritic Sulfur, Pyr+Org= Pyritic Sulfur + Organic Sulfur, Neutral. Pot.= Neutralization Potential
Miscellaneous Abbreviations: SAR= Sodium Adsorption Ratio, CEC= Cation Exchange Capacity, ESP= Exchangeable Sodium Percentage

Reviewed by: Karen A Secor
Karen Secor, Soil Lab Supervisor

Inter-Mountain Laboratories, Inc.
1673 Terra Avenue, Sheridan, Wyoming 82801
(307) 672-8945

Soil Analysis Report
Western Water Consultants
1849 Terra
Sheridan, WY 82801

Report ID: S1008307001

Project: Baseline Sampling
Date Received: 8/17/2010

Date Reported: 9/15/2010
Work Order: S1008307

Lab ID	Sample ID	Depths Inches	Sand %	Silt %	Clay %	Texture	Coarse Fragment %	Available Selenium ppm	Available Boron ppm
S1008307-041	#19	5-18	80.0	7.0	13.0	Sandy Loam	<0.01	<0.02	0.30
S1008307-042	#19	18-26	80.0	7.0	13.0	Sandy Loam	0.36	<0.02	0.24
S1008307-043	#19	26-36	82.0	7.0	11.0	Loamy Sand	0.27	<0.02	0.22
S1008307-044	#16	0-5	72.0	11.0	17.0	Sandy Loam	<0.01	<0.02	0.25
S1008307-045	#16	5-15	66.0	15.0	19.0	Sandy Loam	0.39	<0.02	0.18
S1008307-046	#16	15-29	78.0	8.0	14.0	Sandy Loam	3.16	<0.02	0.12
S1008307-047	#16	29-42	76.0	9.0	15.0	Sandy Loam	1.34	<0.02	0.12
S1008307-048	#16	42-54	83.0	5.0	12.0	Loamy Sand	0.11	<0.02	0.20
S1008307-049	#22	0-4	10.0	48.0	42.0	Silty Clay	<0.01	0.36	1.10
S1008307-050	#22	4-18	50.0	30.0	20.0	Loam	<0.01	0.08	0.95
S1008307-051	#22	18-33	22.0	48.0	30.0	Clay Loam	<0.01	0.17	1.44
S1008307-052	#22	33-52	35.0	40.0	25.0	Loam	<0.01	0.21	0.99
S1008307-053	#22	52-60	30.0	48.0	22.0	Loam	<0.01	0.03	0.77
S1008307-054	#42	0-6	38.0	37.0	25.0	Loam	<0.01	<0.02	0.35
S1008307-055	#42	6-14	50.0	20.0	30.0	Sandy Clay Loam	<0.01	<0.02	0.27
S1008307-056	#42	14-22	62.0	14.0	24.0	Sandy Clay Loam	<0.01	<0.02	0.17

These results apply only to the samples tested.

Abbreviations for extractants: PE= Saturated Paste Extract, H20Sol= water soluble,AB-DTPA= Ammonium Bicarbonate-DTPA, AAO= Acid Ammonium Oxalate
Abbreviations used in acid base accounting: T.S.= Total Sulfur, AB= Acid Base, ABP= Acid Base Potential, PyrS= Pyritic Sulfur, Pyr+Org= Pyritic Sulfur + Organic Sulfur, Neutral. Pot.= Neutralization Potential
Miscellaneous Abbreviations: SAR= Sodium Adsorption Ratio, CEC= Cation Exchange Capacity, ESP= Exchangeable Sodium Percentage

Reviewed by: Karen A Secor
Karen Secor, Soil Lab Supervisor

Inter-Mountain Laboratories, Inc.
1673 Terra Avenue. Sheridan, Wyoming 82801
(307) 672-8945

Soil Analysis Report
Western Water Consultants
1849 Terra
Sheridan, WY 82801

Report ID: S1008304001

Project: Baseline Sampling
Date Received: 8/17/2010

Date Reported:
Work Order: S1008304

Lab ID	Sample ID	Depths Inches	pH s.u.	Saturation %	Electrical Conductivity dS/m	Organic Matter LOI %	PE Calcium meq/L	PE Magnesium meq/L	PE Sodium meq/L	SAR
S1008304-001	PS-1	0-5	5.9	43.1	0.78	4.1	3.57	1.36	1.14	0.72
S1008304-002	PS-1	5-16	6.7	47.5	0.56	3.2	1.79	1.09	1.12	0.93
S1008304-003	PS-1	16-28	7.6	42.0	0.69	2.0	2.62	1.83	1.50	1.01
S1008304-004	PS-1	28-44	8.3	33.7	1.33	1.3	0.63	0.96	13.9	15.6
S1008304-005	PS-1	44-54	8.8	123	3.15	2.1	0.50	2.04	28.3	25.1
S1008304-006	PS-1	54-60	8.6	117	5.37	3.5	1.49	10.3	56.5	23.3
S1008304-007	PS-2	0-4	7.1	59.3	0.88	4.7	5.53	2.83	0.52	0.25
S1008304-008	PS-2	4-15	7.7	64.7	0.54	3.8	3.25	1.53	0.76	0.49
S1008304-009	PS-2	15-28	7.8	56.9	0.60	2.9	2.56	1.10	1.12	0.83
S1008304-010	PS-2	28-36	7.7	59.8	0.98	2.6	3.71	1.91	3.55	2.12
S1008304-011	PS-2	36-52	7.7	56.7	2.00	2.9	8.55	5.91	9.43	3.51
S1008304-012	PS-2	52-60	7.9	55.7	2.86	2.2	11.5	11.0	17.3	5.17
S1008304-013	PS-3	0-6	6.4	71.4	1.48	5.2	4.62	3.50	6.03	2.99
S1008304-014	PS-3	6-21	7.7	62.0	1.11	4.2	2.43	2.25	5.25	3.44
S1008304-015	PS-3	21-32	8.1	57.9	0.99	2.1	0.88	1.17	5.82	5.75
S1008304-016	PS-3	32-42	8.1	54.4	0.88	2.8	0.95	1.07	5.86	5.84
S1008304-017	PS-3	42-60	8.1	57.6	1.99	1.8	3.94	4.76	14.6	6.99
S1008304-018	PS-4	0-5	6.4	68.9	0.58	7.6	1.72	1.09	0.69	0.58
S1008304-019	PS-4	5-12	7.8	62.8	0.82	3.9	0.69	0.50	5.17	6.72
S1008304-020	PS-4	12-24	8.5	68.5	3.09	2.9	1.77	3.06	27.3	17.6

These results apply only to the samples tested.

Abbreviations for extractants: PE= Saturated Paste Extract, H20Sol= water soluble,AB-DTPA= Ammonium Bicarbonate-DTPA, AAO= Acid Ammonium Oxalate
Abbreviations used in acid base accounting: T.S.= Total Sulfur, AB= Acid Base, ABP= Acid Base Potential, PyrS= Pyritic Sulfur, Pyr+Org= Pyritic Sulfur + Organic Sulfur, Neutral. Pot.= Neutralization Potential
Miscellaneous Abbreviations: SAR= Sodium Adsorption Ratio, CEC= Cation Exchange Capacity, ESP= Exchangeable Sodium Percentage

Reviewed by: Karen A Secor
Karen Secor, Soil Lab Supervisor

Inter-Mountain Laboratories, Inc.
1673 Terra Avenue, Sheridan, Wyoming 82801
(307) 672-8945

Soil Analysis Report
Western Water Consultants
1849 Terra
Sheridan, WY 82801

Report ID: S1008304001

Project: Baseline Sampling
Date Received: 8/17/2010

Date Reported:
Work Order: S1008304

Lab ID	Sample ID	Depths Inches	Sand %	Silt %	Clay %	Texture	Coarse Fragment %	Available Selenium ppm	Available Boron ppm
S1008304-001	PS-1	0-5	56.0	24.0	20.0	Sandy Clay Loam	0.09	<0.02	0.30
S1008304-002	PS-1	5-16	54.0	21.0	25.0	Sandy Clay Loam	<0.01	<0.02	0.30
S1008304-003	PS-1	16-28	57.0	20.0	23.0	Sandy Clay Loam	1.09	<0.02	0.22
S1008304-004	PS-1	28-44	73.0	13.0	14.0	Sandy Loam	0.93	<0.02	0.28
S1008304-005	PS-1	44-54	31.0	28.0	41.0	Clay	<0.01	0.06	0.97
S1008304-006	PS-1	54-60	19.0	30.0	51.0	Clay	19.9	0.17	1.32
S1008304-007	PS-2	0-4	7.0	47.0	46.0	Silty Clay	<0.01	<0.02	0.74
S1008304-008	PS-2	4-15	8.0	53.0	39.0	Silty Clay Loam	21.7	<0.02	0.60
S1008304-009	PS-2	15-28	18.0	46.0	36.0	Silty Clay Loam	<0.01	<0.02	0.41
S1008304-010	PS-2	28-36	18.0	42.0	40.0	Silty Clay	12.5	<0.02	0.90
S1008304-011	PS-2	36-52	12.0	51.0	37.0	Silty Clay Loam	<0.01	0.07	0.80
S1008304-012	PS-2	52-60	22.0	43.0	35.0	Clay Loam	11.8	0.12	1.18
S1008304-013	PS-3	0-6	10.0	43.0	47.0	Silty Clay	<0.01	<0.02	1.06
S1008304-014	PS-3	6-21	17.0	42.0	41.0	Silty Clay	<0.01	0.02	1.20
S1008304-015	PS-3	21-32	6.0	52.0	42.0	Silty Clay	<0.01	0.04	1.44
S1008304-016	PS-3	32-42	11.0	51.0	38.0	Silty Clay Loam	<0.01	<0.02	1.34
S1008304-017	PS-3	42-60	4.0	55.0	41.0	Silty Clay	<0.01	<0.02	1.74
S1008304-018	PS-4	0-5	11.0	43.0	46.0	Silty Clay	<0.01	<0.02	0.76
S1008304-019	PS-4	5-12	8.0	49.0	43.0	Silty Clay	<0.01	<0.02	0.62
S1008304-020	PS-4	12-24	12.0	45.0	43.0	Silty Clay	<0.01	0.04	1.17

These results apply only to the samples tested.

Abbreviations for extractants: PE= Saturated Paste Extract, H20Sol= water soluble,AB-DTPA= Ammonium Bicarbonate-DTPA, AAO= Acid Ammonium Oxalate
Abbreviations used in acid base accounting: T.S.= Total Sulfur, AB= Acid Base, ABP= Acid Base Potential, PyrS= Pyritic Sulfur, Pyr+Org= Pyritic Sulfur + Organic Sulfur, Neutral. Pot.= Neutralization Potential
Miscellaneous Abbreviations: SAR= Sodium Adsorption Ratio, CEC= Cation Exchange Capacity, ESP= Exchangeable Sodium Percentage

Reviewed by: Karen A Secor
Karen Secor, Soil Lab Supervisor

Inter-Mountain Laboratories, Inc.
1673 Terra Avenue. Sheridan, Wyoming 82801
(307) 672-8945

Soil Analysis Report
Western Water Consultants
1849 Terra
Sheridan, WY 82801

Report ID: S1008304001

Project: Baseline Sampling
Date Received: 8/17/2010

Date Reported:
Work Order: S1008304

Lab ID	Sample ID	Depths	pH	Saturation	Electrical Conductivity	Organic Matter LOI	PE Calcium	PE Magnesium	PE Sodium	SAR
		Inches	s.u.	%	dS/m	%	meq/L	meq/L	meq/L	
S1008304-021	PS-4	24-36	8.4	67.9	7.88	2.8	18.3	34.7	79.4	15.4
S1008304-022	PS-4	36-52	8.6	65.6	10.8	2.4	18.2	55.6	123	20.2
S1008304-023	PS-4	52-60	8.5	67.8	10.8	1.7	18.8	57.9	132	21.4
S1008304-024	PS-5	0-5	6.5	63.9	0.82	5.4	1.78	1.80	5.71	4.27
S1008304-025	PS-5	5-18	7.9	82.6	1.88	3.9	1.40	1.45	13.6	11.4
S1008304-026	PS-5	18-32	7.8	76.0	5.39	3.7	19.7	20.1	38.1	8.55
S1008304-027	PS-5	32-48	8.0	50.7	5.85	2.1	18.7	27.8	45.5	9.44
S1008304-028	PS-5	48-60	8.1	54.7	6.34	1.9	19.6	32.6	50.3	9.84
S1008304-029	PS-6	0-6	5.5	45.2	0.81	3.7	1.00	0.71	3.02	3.26
S1008304-030	PS-6	6-16	7.5	41.3	1.61	2.7	1.21	1.11	13.4	12.4
S1008304-031	PS-6	16-42	8.0	75.1	6.66	2.7	18.0	31.0	57.1	11.5
S1008304-032	PS-6	42-60	8.3	68.1	8.42	2.1	18.6	41.1	81.9	15.0
S1008304-033	PS-7	0-4	6.6	60.2	1.18	3.9	0.51	0.53	7.21	9.97
S1008304-034	PS-7	4-18	7.8	79.9	6.95	3.3	19.3	29.3	60.3	12.2
S1008304-035	PS-7	18-30	8.1	58.4	8.24	2.1	18.4	42.7	84.4	15.3
S1008304-036	PS-7	30-40	8.3	58.1	9.83	1.8	19.3	46.5	113	19.7
S1008304-037	PS-7	40-52	8.6	61.2	11.2	1.6	19.9	47.9	131	22.6
S1008304-038	PS-7	52-60	9.1	70.8	7.80	1.3	3.54	13.3	69.7	24.0
S1008304-039	PS-8	0-6	7.4	64.2	0.79	4.5	1.33	1.10	2.84	2.58
S1008304-040	PS-8	6-19	8.4	70.9	1.58	3.7	0.90	0.85	11.6	12.4

These results apply only to the samples tested.

Abbreviations for extractants: PE= Saturated Paste Extract, H20Sol= water soluble,AB-DTPA= Ammonium Bicarbonate-DTPA, AAO= Acid Ammonium Oxalate
Abbreviations used in acid base accounting: T.S.= Total Sulfur, AB= Acid Base, ABP= Acid Base Potential, PyrS= Pyritic Sulfur, Pyr+Org= Pyritic Sulfur + Organic Sulfur, Neutral. Pot.= Neutralization Potential
Miscellaneous Abbreviations: SAR= Sodium Adsorption Ratio, CEC= Cation Exchange Capacity, ESP= Exchangeable Sodium Percentage

Reviewed by: Karen A Secor
Karen Secor, Soil Lab Supervisor

Inter-Mountain Laboratories, Inc.
1673 Terra Avenue, Sheridan, Wyoming 82801
(307) 672-8945

Soil Analysis Report
Western Water Consultants
1849 Terra
Sheridan, WY 82801

Report ID: S1008304001

Project: Baseline Sampling
Date Received: 8/17/2010

Date Reported:
Work Order: S1008304

Lab ID	Sample ID	Depths inches	Sand %	Silt %	Clay %	Texture	Coarse Fragment %	Available Selenium ppm	Available Boron ppm
S1008304-021	PS-4	24-36	8.0	45.0	47.0	Silty Clay	9.11	0.13	1.37
S1008304-022	PS-4	36-52	8.0	43.0	49.0	Silty Clay	<0.01	0.31	1.82
S1008304-023	PS-4	52-60	11.0	49.0	40.0	Silty Clay	<0.01	0.34	1.85
S1008304-024	PS-5	0-5	8.0	43.0	49.0	Silty Clay	<0.01	<0.02	0.62
S1008304-025	PS-5	5-18	4.0	39.0	57.0	Silty Clay	<0.01	<0.02	1.32
S1008304-026	PS-5	18-32	3.0	37.0	60.0	Clay	<0.01	0.03	1.31
S1008304-027	PS-5	32-48	16.0	51.0	33.0	Silty Clay Loam	<0.01	0.06	1.03
S1008304-028	PS-5	48-60	15.0	54.0	31.0	Silty Clay Loam	<0.01	0.07	1.19
S1008304-029	PS-6	0-6	55.0	24.0	21.0	Sandy Clay Loam	4.09	<0.02	0.43
S1008304-030	PS-6	6-16	56.0	23.0	21.0	Sandy Clay Loam	<0.01	<0.02	0.41
S1008304-031	PS-6	16-42	35.0	25.0	40.0	Clay	3.90	0.07	0.54
S1008304-032	PS-6	42-60	35.0	28.0	37.0	Clay Loam	<0.01	0.19	0.95
S1008304-033	PS-7	0-4	16.0	43.0	41.0	Silty Clay	<0.01	<0.02	0.53
S1008304-034	PS-7	4-18	4.0	36.0	60.0	Clay	<0.01	0.05	0.60
S1008304-035	PS-7	18-30	24.0	37.0	39.0	Clay Loam	<0.01	0.05	0.61
S1008304-036	PS-7	30-40	42.0	28.0	30.0	Clay Loam	<0.01	0.06	0.67
S1008304-037	PS-7	40-52	33.0	33.0	34.0	Clay Loam	<0.01	0.07	0.82
S1008304-038	PS-7	52-60	35.0	34.0	31.0	Clay Loam	<0.01	0.05	0.70
S1008304-039	PS-8	0-6	9.0	43.0	48.0	Silty Clay	<0.01	<0.02	0.81
S1008304-040	PS-8	6-19	9.0	40.0	51.0	Silty Clay	<0.01	<0.02	1.40

These results apply only to the samples tested.

Abbreviations for extractants: PE= Saturated Paste Extract, H20Sol= water soluble,AB-DTPA= Ammonium Bicarbonate-DTPA, AAO= Acid Ammonium Oxalate
Abbreviations used in acid base accounting: T.S.= Total Sulfur, AB= Acid Base, ABP= Acid Base Potential, PyrS= Pyritic Sulfur, Pyr+Org= Pyritic Sulfur + Organic Sulfur, Neutral. Pot.= Neutralization Potential
Miscellaneous Abbreviations: SAR= Sodium Adsorption Ratio, CEC= Cation Exchange Capacity, ESP= Exchangeable Sodium Percentage

Reviewed by: Karen A Secor
Karen Secor, Soil Lab Supervisor

Inter-Mountain Laboratories, Inc.
1673 Terra Avenue. Sheridan, Wyoming 82801
(307) 672-8945

Soil Analysis Report
Western Water Consultants
1849 Terra
Sheridan, WY 82801

Report ID: S1008304001

Project: Baseline Sampling
Date Received: 8/17/2010

Date Reported:
Work Order: S1008304

Lab ID	Sample ID	Depths Inches	pH s.u.	Saturation %	Electrical Conductivity dS/m	Organic Matter LOI %	PE Calcium meq/L	PE Magnesium meq/L	PE Sodium meq/L	SAR
S1008304-041	PS-8	19-30	8.3	74.8	4.87	3.1	10.6	11.7	37.0	11.1
S1008304-042	PS-8	30-44	8.3	78.1	6.19	3.0	18.1	18.9	46.1	10.7
S1008304-043	PS-8	44-60	8.2	77.3	6.30	2.7	17.8	19.4	51.2	11.9
S1008304-044	PS-9	0-5	7.3	72.1	1.00	4.9	1.70	1.26	4.79	3.94
S1008304-045	PS-9	5-18	8.6	80.9	2.11	2.7	0.99	0.89	15.1	15.6
S1008304-046	PS-9	18-38	8.7	67.5	9.35	2.4	16.8	34.9	97.5	19.2
S1008304-047	PS-9	38-52	8.8	72.4	9.64	2.1	14.7	32.7	97.7	20.1
S1008304-048	PS-9	52-60	8.9	71.2	10.2	2.0	16.0	35.7	113	22.1
S1008304-049	PS-10	0-6	6.6	56.2	0.81	4.7	0.71	0.89	4.63	5.18
S1008304-050	PS-10	6-21	8.3	75.5	1.72	3.8	1.16	1.41	13.1	11.6
S1008304-051	PS-10	21-40	8.0	73.0	5.47	2.7	19.7	20.9	41.1	9.13
S1008304-052	PS-10	40-54	8.3	67.6	2.47	2.2	1.54	2.14	18.7	13.8
S1008304-053	PS-10	54-60	8.2	46.5	2.45	1.4	1.50	1.88	17.0	13.1
S1008304-054	PS-12	0-4	6.0	52.2	0.77	4.5	2.49	2.18	1.06	0.69
S1008304-055	PS-12	4-14	6.9	59.6	0.58	3.5	1.82	1.76	0.30	0.22
S1008304-056	PS-12	14-32	7.9	50.7	0.51	2.4	1.04	1.31	0.51	0.47
S1008304-057	PS-12	32-44	8.1	47.1	0.80	2.2	0.71	1.80	3.45	3.08
S1008304-058	PS-12	44-60	8.2	41.5	1.36	1.7	1.09	2.09	7.09	5.63
S1008304-059	PS-13	0-5	6.5	54.8	0.78	4.7	3.11	1.56	0.19	0.13
S1008304-060	PS-13	5-14	7.3	51.6	0.60	3.5	2.09	1.23	0.50	0.39

These results apply only to the samples tested.

Abbreviations for extractants: PE= Saturated Paste Extract, H20Sol= water soluble,AB-DTPA= Ammonium Bicarbonate-DTPA, AAO= Acid Ammonium Oxalate
Abbreviations used in acid base accounting: T.S.= Total Sulfur. AB= Acid Base, ABP= Acid Base Potential, PyrS= Pyritic Sulfur. Pyr+Org= Pyritic Sulfur + Organic Sulfur, Neutral. Pot.= Neutralization Potential
Miscellaneous Abbreviations: SAR= Sodium Adsorption Ratio, CEC= Cation Exchange Capacity, ESP= Exchangeable Sodium Percentage

Reviewed by: Karen A Secor
Karen Secor, Soil Lab Supervisor

Inter-Mountain Laboratories, Inc.
1673 Terra Avenue. Sheridan, Wyoming 82801
(307) 672-8945

Soil Analysis Report
Western Water Consultants
1849 Terra
Sheridan, WY 82801

Report ID: S1008304001

Project: Baseline Sampling
Date Received: 8/17/2010

Date Reported:
Work Order: S1008304

Lab ID	Sample ID	Depths Inches	Sand %	Silt %	Clay %	Texture	Coarse Fragment %	Available Selenium ppm	Available Boron ppm
S1008304-041	PS-8	19-30	3.0	42.0	55.0	Clay	<0.01	0.06	1.57
S1008304-042	PS-8	30-44	6.0	36.0	58.0	Silty Clay	<0.01	0.19	1.46
S1008304-043	PS-8	44-60	6.0	40.0	54.0	Silty Clay	<0.01	0.19	1.29
S1008304-044	PS-9	0-5	6.0	41.0	53.0	Silty Clay	<0.01	<0.02	0.84
S1008304-045	PS-9	5-18	6.0	46.0	48.0	Silty Clay	<0.01	0.04	0.96
S1008304-046	PS-9	18-38	6.0	43.0	51.0	Silty Clay	<0.01	0.33	1.07
S1008304-047	PS-9	38-52	9.0	41.0	50.0	Silty Clay	<0.01	0.26	1.46
S1008304-048	PS-9	52-60	7.0	43.0	50.0	Silty Clay	<0.01	0.23	1.66
S1008304-049	PS-10	0-6	13.0	49.0	38.0	Silty Clay Loam	<0.01	<0.02	0.58
S1008304-050	PS-10	6-21	11.0	41.0	48.0	Silty Clay	<0.01	<0.02	0.93
S1008304-051	PS-10	21-40	9.0	42.0	49.0	Silty Clay	<0.01	0.05	1.05
S1008304-052	PS-10	40-54	13.0	50.0	37.0	Silty Clay Loam	<0.01	0.07	0.84
S1008304-053	PS-10	54-60	39.0	37.0	24.0	Loam	<0.01	0.07	0.57
S1008304-054	PS-12	0-4	31.0	40.0	29.0	Clay Loam	<0.01	<0.02	0.46
S1008304-055	PS-12	4-14	17.0	42.0	41.0	Silty Clay	<0.01	<0.02	0.31
S1008304-056	PS-12	14-32	27.0	39.0	34.0	Clay Loam	<0.01	<0.02	0.39
S1008304-057	PS-12	32-44	38.0	32.0	30.0	Clay Loam	<0.01	<0.02	0.72
S1008304-058	PS-12	44-60	46.0	30.0	24.0	Loam	<0.01	<0.02	1.02
S1008304-059	PS-13	0-5	36.0	36.0	28.0	Clay Loam	<0.01	<0.02	0.46
S1008304-060	PS-13	5-14	32.0	39.0	29.0	Clay Loam	0.48	<0.02	0.32

These results apply only to the samples tested.

Abbreviations for extractants: PE= Saturated Paste Extract, H20Sol= water soluble,AB-DTPA= Ammonium Bicarbonate-DTPA, AAO= Acid Ammonium Oxalate
Abbreviations used in acid base accounting: T.S.= Total Sulfur, AB= Acid Base, ABP= Acid Base Potential, PyrS= Pyritic Sulfur, Pyr+Org= Pyritic Sulfur + Organic Sulfur, Neutral. Pot.= Neutralization Potential
Miscellaneous Abbreviations: SAR= Sodium Adsorption Ratio, CEC= Cation Exchange Capacity, ESP= Exchangeable Sodium Percentage

Reviewed by: Karen A Secor
Karen Secor, Soil Lab Supervisor

Inter-Mountain Laboratories, Inc.
1673 Terra Avenue, Sheridan, Wyoming 82801
(307) 672-8945

Soil Analysis Report
Western Water Consultants
1849 Terra
Sheridan, WY 82801

Report ID: S1008304001

Project: Baseline Sampling
Date Received: 8/17/2010

Date Reported:
Work Order: S1008304

Lab ID	Sample ID	Depths	pH	Saturation	Electrical Conductivity	Organic Matter LOI	PE Calcium	PE Magnesium	PE Sodium	SAR
		inches	s.u.	%	dS/m	%	meq/L	meq/L	meq/L	
S1008304-061	PS-13	14-34	7.8	53.9	0.59	2.8	0.62	0.60	2.81	3.60
S1008304-062	PS-13	34-48	8.2	56.4	0.87	2.5	0.85	1.21	4.43	4.37
S1008304-063	PS-13	48-60	8.0	59.1	1.17	2.9	1.34	2.44	5.58	4.06
S1008304-064	PS-14	0-6	5.0	43.2	0.69	3.3	1.10	1.36	1.16	1.04
S1008304-065	PS-14	6-19	6.4	42.8	0.78	2.6	0.33	0.50	4.48	6.97
S1008304-066	PS-14	19-32	8.3	68.8	2.48	1.9	2.12	5.59	15.6	7.96
S1008304-067	PS-14	32-48	7.9	64.3	5.18	1.7	18.1	32.3	27.3	5.43
S1008304-068	PS-14	48-60	8.1	60.8	3.11	1.5	3.87	8.37	17.7	7.14
S1008304-069	PS-16	0-6	6.6	55.0	0.71	3.2	2.90	1.69	0.28	0.19
S1008304-070	PS-16	6-10	7.4	53.2	0.63	2.0	2.59	1.43	0.18	0.13
S1008304-071	PS-18	0-6	5.9	48.6	0.55	2.6	1.94	0.90	0.15	0.12
S1008304-072	PS-18	6-18	6.6	48.0	0.48	1.6	1.65	0.80	0.14	0.12

These results apply only to the samples tested.

Abbreviations for extractants: PE= Saturated Paste Extract, H20Sol= water soluble,AB-DTPA= Ammonium Bicarbonate-DTPA, AAO= Acid Ammonium Oxalate
Abbreviations used in acid base accounting: T.S.= Total Sulfur, AB= Acid Base, ABP= Acid Base Potential, PyrS= Pyritic Sulfur, Pyr+Org= Pyritic Sulfur + Organic Sulfur, Neutral. Pot.= Neutralization Potential
Miscellaneous Abbreviations: SAR= Sodium Adsorption Ratio, CEC= Cation Exchange Capacity, ESP= Exchangeable Sodium Percentage

Reviewed by: Karen A Secor
Karen Secor, Soil Lab Supervisor

Inter-Mountain Laboratories, Inc.
1673 Terra Avenue, Sheridan, Wyoming 82801
(307) 672-8945

Soil Analysis Report
Western Water Consultants
1849 Terra
Sheridan, WY 82801

Report ID: S1008304001

Project: Baseline Sampling
Date Received: 8/17/2010

Date Reported:
Work Order: S1008304

Lab ID	Sample ID	Depths Inches	Sand %	Silt %	Clay %	Texture	Coarse Fragment %	Available Selenium ppm	Available Boron ppm
S1008304-061	PS-13	14-34	37.0	30.0	33.0	Clay Loam	<0.01	<0.02	0.24
S1008304-062	PS-13	34-48	32.0	33.0	35.0	Clay Loam	<0.01	<0.02	0.30
S1008304-063	PS-13	48-60	31.0	31.0	38.0	Clay Loam	0.68	<0.02	0.62
S1008304-064	PS-14	0-6	45.0	33.0	22.0	Loam	<0.01	<0.02	0.37
S1008304-065	PS-14	6-19	39.0	33.0	28.0	Clay Loam	<0.01	<0.02	0.61
S1008304-066	PS-14	19-32	28.0	32.0	40.0	Clay	2.59	0.02	0.74
S1008304-067	PS-14	32-48	25.0	32.0	43.0	Clay	<0.01	0.04	0.78
S1008304-068	PS-14	48-60	32.0	32.0	36.0	Clay Loam	<0.01	0.08	0.60
S1008304-069	PS-16	0-6	46.0	28.0	26.0	Loam	<0.01	<0.02	0.21
S1008304-070	PS-16	6-10	50.0	28.0	22.0	Loam	<0.01	<0.02	0.27
S1008304-071	PS-18	0-6	68.0	18.0	14.0	Sandy Loam	<0.01	<0.02	0.29
S1008304-072	PS-18	6-18	65.0	17.0	18.0	Sandy Loam	<0.01	<0.02	0.18

These results apply only to the samples tested.

Abbreviations for extractants: PE= Saturated Paste Extract, H20Sol= water soluble,AB-DTPA= Ammonium Bicarbonate-DTPA, AAO= Acid Ammonium Oxalate
Abbreviations used in acid base accounting: T.S.= Total Sulfur, AB= Acid Base, ABP= Acid Base Potential, PyrS= Pyritic Sulfur, Pyr+Org= Pyritic Sulfur + Organic Sulfur, Neutral. Pot.= Neutralization Potential
Miscellaneous Abbreviations: SAR= Sodium Adsorption Ratio, CEC= Cation Exchange Capacity, ESP= Exchangeable Sodium Percentage

Reviewed by: Karen A Secor
Karen Secor, Soil Lab Supervisor

ADDENDUM 3.3-E

PRIME FARMLAND DESIGNATION

As you requested, here is a summary of "potentially" Prime and Unique Farmlands for T53N, R67W, Sections 7, 17, 18, and 19 and T53N, R68W, Sections 12, 13, and 24.

T53N, R67W, Section 17: Soils 77 and 78 present T53N, R67W, Section 18: Soil 78 present T53N, R68W, Section 13: Soil 161 present

Prime and Other Important Farmlands

Crook County, Wyoming

Map symbol	Map unit name	Farmland classification
11	Alice fine sandy loam, 2 to 6 percent slopes	Prime farmland if irrigated
21	Barnum silt loam, 0 to 3 percent slopes	Prime farmland if irrigated
77	Haverson loam, 0 to 1 percent slopes	Prime farmland if irrigated
78	Haverson loam, 1 to 6 percent slopes	Prime farmland if irrigated
80	Haverson silty clay loam, 0 to 2 percent slopes	Prime farmland if irrigated
160	Satanta loam, 0 to 1 percent slopes	Prime farmland if irrigated
161	Satanta loam, 1 to 6 percent slopes	Prime farmland if irrigated
185	Tilford silt loam, 0 to 1 percent slopes	Prime farmland if irrigated
186	Tilford silt loam, 1 to 6 percent slopes	Prime farmland if irrigated
197	Vale silt loam, 0 to 1 percent slopes	Prime farmland if irrigated
198	Vale silt loam, 1 to 6 percent slopes	Prime farmland if irrigated
204	Wages loam, 1 to 6 percent slopes	Prime farmland if irrigated

Please note that these soils are only considered prime if they are irrigated.

- Jason Nehl

ADDENDUM 3.3-F

SOIL SAMPLE PHOTOGRAPHS

Photo 1: Profile view of Sample Point 16

Photo 2: General view of Sample Point 16

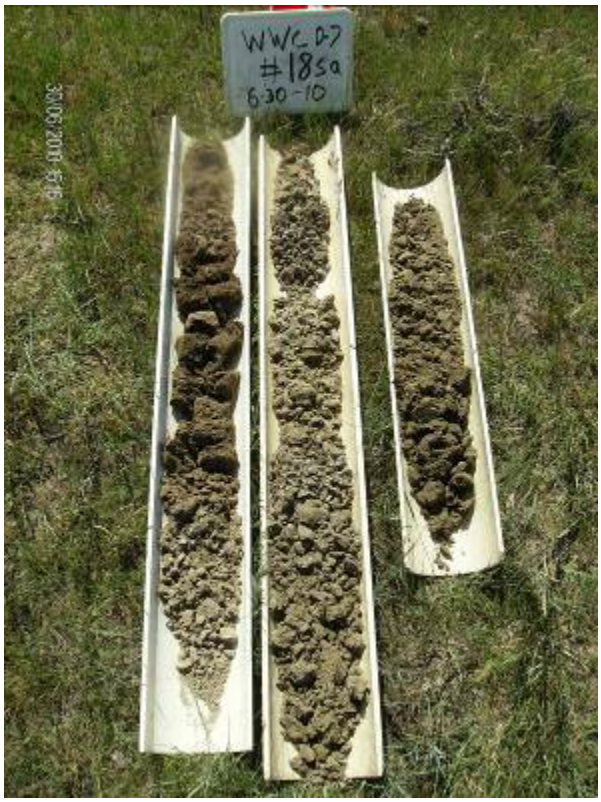

Photo 3: Profile view of Sample Point 18

Photo 4: General view of Sample Point 18

Photo 5: Profile view of Sample Point 19

Photo 6: General view of Sample Point 19

Photo 7: Profile view of Sample Point 40

Photo 8: General view of Sample Point 40

Photo 9: Profile view of Sample Point 42

Photo 10: General view of Sample Point 42

Photo 11: Profile view of Sample Point 64

Photo 12: General view of Sample Point 64

Photo 13: Profile view of Sample Point 75

Photo 14: General view of Sample Point 75

Photo 15: Profile view of Sample Point 77

Photo 16: General view of Sample Point 77

Photo 17: Profile view of Sample Point 78

Photo 18: General view of Sample Point 78

Photo 19: Profile view of Sample Point 80

Photo 20: General view of Sample Point 80

Photo 21: Profile view of Sample Point 81

Photo 22: General view of Sample Point 81

Photo 23: Profile view of Sample Point PS-1

Photo 24: General view of Sample Point PS-1

Photo 25: Profile view of Sample Point PS-2

Photo 26: General view of Sample Point PS-2

Photo 27: Profile view of Sample Point PS-3

Photo 28: General view of Sample Point PS-3

Photo 29: Profile view of Sample Point PS-4

Photo 30: General view of Sample Point PS-4

Photo 31: Profile view of Sample Point PS-5

Photo 32: General view of Sample Point PS-5

Photo 33: Profile view of Sample Point PS-6

Photo 34: General view of Sample Point PS-6

Photo 35: Profile view of Sample Point PS-7

Photo 36: General view of Sample Point PS-7

Photo 37: Profile view of Sample Point PS-8

Photo 38: General view of Sample Point PS-8

Photo 39: Profile view of Sample Point PS-9

Photo 40: General view of Sample Point PS-9

Photo 41: Profile view of Sample Point PS-10

Photo 42: General view of Sample Point PS-10

Photo 43: Profile view of Sample Point PS-12

Photo 44: General view of Sample Point PS-12

Photo 45: Profile view of Sample Point PS-13

Photo 46: General view of Sample Point PS-13

Photo 47: Profile view of Sample Point PS-14

Photo 48: General view of Sample Point PS-14

Photo 49: Profile view of Sample Point PS-16

Photo 50: General view of Sample Point PS-16

Photo 51: Profile view of Sample Point PS-18

Photo 52: General view of Sample Point PS-18