# SOILS, PRIME AND UNIQUE FARMLANDS TECHNICAL REPORT 

for the<br>Environmental Impact Statement on Public Service Company of New Mexico's Proposed New Mexico Generating Station and Possible New Town

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# United States Department of the Interior 

BUREAU OF LAND MANAGEMENT<br>NEW MEXICO STATE OFFICE<br>P.O. BOX 1449<br>SANTAFE, NEW MEXICO 87501

October 1982

## Dear Interested Citizen:

Attached is one of twenty-two technical reports developed as a basis for writing the Environmental Impact Statement on Public Service Company of New Mexico's Proposed New Mexico Generating Station and Possible New Town (NMGS EIS). (A list of the technical reports is attached.)

These technical reports provide detailed information on the existing environment, methods used for the impact analysis, and related data supportive of the analysis and conclusions presented in the EIS. These reports should be retained for use with the Draft and Final EIS and other documents related to BLM's San Juan Basin Action Plan (SJBAP).

The Draft NMGS EIS will be filed with the Environmental Protection Agency and released for public review on November 30, 1982. Comments on the Draft EIS will be due by close of business February 7, 1983, at the BLM New Mexico State Office. Because of the large volume of material presented in the technical reports, the BLM is distributing these reports in advance of the Draft EIS to provide sufficient time for public review. The technical reports will be available for public review at the places indicated on the attached list. Copies will also be available from the BLM New Mexico State Office, U.S. Post Office and Federal Building, Santa Fe , for a copy fee.

Informational public meetings are scheduled for December 1982 to provide a public forum to clarify questions and concerns about the SJBAP proposals and the related environmental documents, which will all have been issued by that time. The meetings are scheduled as follows:

- December 14, Civic Center, Farmington, 3 to 9 PM
- December 14, Convention Center, Albuquerque, 3 to 9 PM
- December 15, Chapter House, Crownpoint, 3 to 9 PM
- December 16, Holiday Inn, Gallup, 3 to 9 PM
- December 16, Kachina Lodge, Taos, 3 to 9 PM

In addition, formal public hearings will be held in January 1983 to solicit public comments on the SJBAP Proposals. These meetings are scheduled as follows:

- January 10, Chapter House, Crownpoint, beginning at 1:00 PM
- January 12, Civic Center, Farmington, beginning at 9:00 AM
- January 14 (and 15 th if necessary because of the number of registrants), Four Seasons Motor Lodge, Albuquerque, I-40 and Carlisle Blvd., beginning at 9:00 AM (each day)


## page 2

Questions on the public meetings, hearings, and the technical reports themselves should be directed to:

Leslie M. Cone
NMGS Project Manager
BLM, New Mexico State Office
P.O. Box 1449

Santa Fe , NM 87501
(505) 988-6184 FTS 476-6184

> Sincerely yours,


## List of Technical Reports

1. Purpose and Need
2. Project Description
3. Alternatives to the Project
4. Site Alternatives
5. Permit Reconnaissance
6. Air Quality
7. Geologic Setting
8. Mineral Resources
9. Paleontology
10. Soils, Prime and Unique Farmlands
11. Hydrology
12. Water Quality
13. Vegetation
14. Wildife and Aquatic Biology
15. Threatened and Endangered Species
16. Cultural Resources
17. Visual Resources
18. Recreation Resources
19. Wilderness Values
20. Transportation
21. Social and Economic Conditions
22. Land Use Controls and Constraints

## Availability of Technical Reports for Public Review

Individual copies of the technical reports can be obtained for a copy fee. Inquiries should be directed to:

```
Bureau of Land Management, New Mexico State Office
Title Records and Public Assistance Section (943B)
U.S. Post Office and Federal Building
P.O. Box }144
Santa Fe, NM }8750
(505) 988-6107 FTS 476-6107
```

Copies of the reports are available for public review at the locations listed below. [Formal and informal cooperating agencies are denoted by an asterisk (*).]

## BUREAU OF LAND MANAGEMENT OFFICES

## New Mexico State Office

NMGS Project Staff (934A)
Room 122, Federal Building Cathedral Place
P.O. Box 1449

Santa Fe , NM 87501
(505) 988-6184 FTS 476-6184

San Juan Energy Projects Staff (911)
Room 129, Federal Building
Cathedral Place
P.O. Box 1449

Santa Fe, NM 87501
(505) 988-6226 FTS 476-6226

Public Affairs Staff (912)
Room 2016
U.S. Post Office and Federal Building P.O. Box 1449

Santa Fe , NM 87501
(505) 988-6316 FTS 476-6316

Division of Resources (930)
509 Camino de los Marquez, Suite 3 P.O. Box 1449

Santa Fe , NM 87501
(505) 988-6212 FTS 476-6212

Albuquerque District Office
3550 Pan American Freeway NE
P.O. Box 6770

Albuquerque, NM 87107
(505) 766-2455 FTS 474-2455

Farmington Resource Area Headquarters
900 La Plata Road
P.O. Box 568

Farmington, NM 87401
(505) 325-3581

Taos Resource Area Office
Montevideo Plaza
P.O. Box 1045

Taos, NM 87571
(505) 758-8851

Socorro District Office
198 Neel Avenue
P.0. Box 1219

Socorto, NM 87801
(505) 835-0412 FTS 476-6280

Las Cruces District Office
1705 N. Valley Drive
P.0. Box 1420

Las Cruces, NM 88001
(505) 524-8551 FTS 571-8312

Roswell District Office
1717 W. Second Street
P.O. Box 1397

Roswell, NM 88201
(505) 622-7670 FTS 476-9251

Carlsbad Resource Area Headquarters
114 S. Halagueno Street
P.O. Box 506

Carlsbad, NM 88220
(505) 887-6544

| Division of Rights-of-Way (330) |
| :---: |
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| Washington, D.C. 20240 |
| (202) 343-5441 FTS 343-5441 |
| USDI, Bureau of Land Management |
| Denver Service Center ( $\mathrm{D}-460$ ) |
| Techinical Publications Library |
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| NEW MEXICO STATE AGENCIES |
| New Mexico State Environmental |
| Improvement Division* |
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| P.0. Box 968 |
| Santa Fe , NM 87503 |
| (505) 827-5217, ext. 2416 |
| New Mexico Energy and Minerals |
| Department* |
| 525 Camino de los Marquez |
| P.O. Box 2770 |
| Santa Fe , NM 87503 |
|  |  |
|  |
| State Historic Preservation Officer 505 Don Gasper Avenue |
|  |  |
|  |
| New Mexico Natural Resource Department* |
| Villagra Building |
| Santa Fe, NM 87503 |
| (505) 827-5531 |
| New Mexico Public Service Commission* |
| Bataan Memorial Building Santa Fe , NM 827-3361 (505) 827-3361 |
|  |  |
|  |  |
|  |
|  |
| Santa Fe, NM 87503 |
| (505) 827-2423 |
| New Mexico State Planning Office* |
| 505 Don Gasper Avenue |
| Santa Fe, NM 87503 |
| (505) 827-5191 |

## OTHER ORGANIZATIONS

Public Service Company of New Mexico Alvarado Square P.O. Box 2268

Albuquerque, NM 87158
(505) 848-2700

Woodward-Clyde Consultants, Inc.
3 Embarcadero Center, Suite 700
San Francisco, California 94111
(415) 956-7070

PUBLIC AND UNIVERSITY LIBRARIES
Reading copies of the NMGS EIS and associated technical reports will be available at the following public and university libraries:

State and Public Libraries
Albuquerque Public Library
501 Copper Avenue NW
Albuquerque, NM 87102
Aztec Public Library
201 W. Chaco
Aztec, NM 87401
Crownpoint Community Library
c/o Lioness Club, P.O. Box 731
Crownpoint, NM 87313
Cuba Public Library
Box 5, La Jara
Cuba, NM 87027
Farmington Public Library 302 N. Orchard Farmington, NM 87401

Gallup Public Library
115 W . Hill Avenue
Gallup, NM 87301
Mother Whiteside Memorial
Library (Public)
525 W. High Street
P.O. Box 96

Grants, NM 87020
New Mexico State Library
325 Don Gaspar Avenue
Santa Fe , NM 87503

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Bureau of Indian Affairs*
Albuquerque Area Office
123 4th Street
P.O. Box 2088
Albuquerque, NM }8719
(505) 766-3374 FTS 474-3374
Bureau of Indian Affairs*
Eastern Navajo Agency
P.O. Box }32
Crownpoint, NM }8731
(505) 786-5228
Bureau of Indian Affairs*
Navajo Area Office
Box M - Mail Code 305
Window Rock, AZ }8651
(602) 871-5151 FTS 479-5314
Bureau of Reclamation*
Upper Colorado Regional Office
125 S. State Street
P.O. Box }1156
Salt Lake City, UT }8414
(801) 524-5463 FTS 588-5463
Minerals Management Service*
South Central Region
505 Marquette Avenue NW, Suite 815
Albuquerque, NM 87102
(505) 766-1173 FTS 474-1173
Minerals Management Service*
Resource Evaluation Office
4 1 1 ~ N . ~ A u b u r n ~
Farmington, NM }8740
(505) 327-7397 FTS 57 2-6254
National Park Service*
Southwest Regional Office
1100 01d Santa Fe Trail
Santa Fe, NM }8750
(505) 988-6375 FTS 476-6375
```


## National Park Service*

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Environmental Coordination Office
Pinon Building, 1220 St. Francis Drive
P.O. Box }72
Santa Fe, NM }8750
(505) 988-6681 FTS 476-6681
```

U.S. Fish and Wildife Service*
Field Supervisor, Ecological Services
3530 Pan American Highway, Suite C
Albuquerque, NM 87107
(505) 766-3966 FTS 479-3966
U.S. Geological Survey (WRD)*
505 Marquette Avenue, Room 720
Albuquerque, NM 87101
(505) 766-2810 FTS 474-2817

OTHER FEDERAL AGENCIES AND ORGANIZATIONS
Environmental Protection Agency*
Region VI
1201 Elm Street
Dallas, TX 75270
(214) 767-2716 FTS 729-2716

Nava io Tribe*
c/o Division of Resources
P.O. Box 308

Window Rock, AZ 86515
(602) $871-6592$

Pueblo of Zia*
General Delivery
San Ysidro, NM 87053
(505) 867-3304

Soil Conservation Service*
424 N. Mesa Verde
Aztec, NM 87410
(505) 334-9437
U.S. Corps of Engineers*
P.O. Box 1580

Albuquerque, NM 87103
(505) 766-2657 FTS 474-2657

USDA, Forest Service*
717 Gold Avenue
Albuquerque, NM 87102
(505) 474-1676 FTS 474-1676

USDA, Forest Service*
District Ranger
Mt. Taylor Ranger District
201 Roosevelt Avenue
Grants, NM 87020
(505) 287-8833
Harwood Foundation Library(Public)
25 LeDoux
P.O. Box 766
Taos, NM ..... 87571
University/College Libraries
University of New Mexico
General Library
Albuquerque, NM 87131
Navajo Community College Library
Shiprock Branch
P.O. Box 580
Shiprock, AZ 87420
Northern New Mexico Community College
P.O. Box 250
Espanola, NM 87532
New Mexico State University
San Juan Campus
4601 College Blvd.
Farmington, NM ..... 87401
University of New Mexico, Gallup Campus
Learning Resources Center
200 College Road
Gallup, NM 87301
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1500 Third Street
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Santa Fe , NM 87501

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for the
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Prepared by
Woodward-Clyde Consultants
for the
U.S. Department of the Interior Bureau of Land Management
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NEW MEXICO GENERATING STATION

## BACKGROUND

Included in the recent Council on Environmental Quality Regulations (1979) are several important objectives to reduce excessive paperwork in the preparation of environmental impact statements (EISs):

- Discuss only briefly issues other than significant ones.
- Emphasize the portions of the EIS that are useful to decision makers and the public and reduce emphasis on background material.
- Prepare analytic rather than encyclopedic EISs.

In order to accomp lish these objectives and still provide the depth and background required for an analytic impact statement, this technical report has been prepared for the New Mexico Generating Station (NMGS) project. In this report, impacts that were not identified as significant but which are still considered important by the public or technical specialists are analyzed. Background material is provided for those issues and impacts that were considered necessary for the comparison of alternatives. Impacts that were not identified as significant or important by the public and by technical
preparers are summarized, and reasons for their elimination from detailed analysis are discussed.

SUMMARY DESCRIPTION OF PROJECT COMPONENTS

Public Service Company of New Mexico (PNM) proposes to construct a 2000-megawatt (MW) coal-fired electric generation plant approximately 35 miles south of Farmington, New Mexico, in San Juan County (Map 1-1). The proposed NMGS, at ultimate development, would have four $500-\mathrm{MW}$ generating units. Each generating unit would include a turbine generator area, coal pulverizer area, boiler area, particulate removal system, $\mathrm{SO}_{2}$ removal system, and chimney stack. The proposed arrangement of these and other power plant components is shown in Figure l-1. For the environmental analysis, it was assumed that comercial operation of the first $500-\mathrm{MW}$ unit would begin in 1990 and that other units would start operating during the 1990 s.

Coal for NMGS would be acquired through long-term contracts with Sunbelt Mining and Arch Minerals (Proposed Action) or other producers in the San Juan Basin (alternative coal supply). Coal acquired from a joint venture of Sunbelt and Arch Minerals would be supplied from surface mines (referred to as the Bisti mine in this analysis) in the immediate vicinity of the proposed plant site. Coal acquired from other producers in the San Juan Basin would be hauled from mines located as much as 30 miles from the proposed plant site. Coal required for NMGS would average 7.5 million tons per year, or a total of 300 million tons over the 40 -year project life.

The proposed fuel-handling system would involve hauling coal from the Bisti mine (or other mine locations) by truck to a receiving facility located adjacent to the NMGS site. Coal would then be transferred via conveyor belt from the receiving station to active or


emergency storage piles. All coal-handling and processing operations after active storage would be enclosed. Surfaces of emergency storage piles would be treated with a nontoxic stabilizing agent, and all storage piles and coal-processing areas would be designed so that runoff from precipitation would be diverted to the plant's water treatment system. Any coal spills from conveyor belts would be promptly removed, and percolation beneath on-site stockpiles would be controlled. Alternative fuel-handling systems include the delivery of coal from the Bisti mine to receiving station by conveyor and storage of primary crushed emergency coal on Sunbelt property north of the NMGS site.

Atmospheric emissions from the plant would be controlled by systems designed to meet applicable federal and New Mexico regulations. Control systems being considered include:

- Particulates - fabric filter (Proposed Action) and electrostatic precipitator
- $\mathrm{SO}_{2}$ - wet limestone scrubbing or lime spray drying
- $\mathrm{NO}_{\mathrm{x}}$ - dual-register burner, tangentially fired steam generator, or controlled-flow/split-flame burner

Four types of waste would be derived from coal used in NMGS: bottom ash, fly ash, coal pulverizer rejects, and flue gas desulfurization (FGD) products (sludge). Under existing laws and regulations, none of these wastes are considered hazardous. Fly ash and FGD by-products would be mechanically mixed and hauled by enddump truck to previously mined portions of the coal mine. Disposal areas would be prepared for receiving ash by backfilling with mine overburden. Ash would then be dumped and spread in layers over the
mine overburden. After the ash was placed and spread, it would be covered with layers of overburden and surface soil or topsoil and then a vegetative cover would be established. Bottom ash and pulverizer rejects would be collected for disposal in dewatering bins and then hauled by end-dump trucks for disposal into previously mined portions of the coal mine. Procedures for disposal would be the same as for fly ash.

The water management system would contain all equipment necessary to treat and supply all the plant makeup water and potable water. The power plant would be designed and operated as a zero-discharge plant; wastewater would be reused by cascading it to uses requiring successively lower water quality. Used water, degraded to the extent that it could not be economically treated for further in-plant use, would be used for transport and disposal of plant-generated wastes or would be discharged to evaporation ponds (Figure 1-1). Evaporation ponds would be lined with impervious material to limit seepage losses.

Water supplies available for NMGS are believed to be sufficient to construct an all-wet heat-rejection system, based on evaporative cooling, and to use forced-draft cooling towers (Figure 1-1). Coolingtower makeup water would be drawn from the nearby raw-water storage reservoir. The makeup water would replace the tower losses from evaporation, drift, and blowdown. If sufficient water could not be secured for a totally evaporative system, a water-cooling system employing both dry and conventional wet towers might be required.

The estimated water requirement for NMGS, with four units operating at rated capacity and a heat-rejection system equipped with wet-cooling towers, would be 35,000 acre-feet per year. In order to supply this quantity of water to NMGS, the Proposed Action would
involve acquiring rights to 35,000 acre-feet of water per year from the San Juan River, storing the water in the Navajo Reservoir for release upon demand, and using the natural channel of the San Juan River for delivery of water to a diversion facility downstream. If the total quantity of water required for a wet-cooling system cannot be acquired from the San Juan River, the applicant proposes to develop a well field in the vicinity of NMGS. Water from this well field would be used to make up the balance of water required for a wetcooling system. A second alternative water supply system would be based on a total supply of 20,000 acre-feet per year from the San Juan River and the use of a combination of wet- and dry-cooling towers designed to perform within the supply constraint.

The Proposed Action for a water delivery system would include the construction of a diversion facility in the vicinity of Farmington; an alternative location would be near the State Highway 44 bridge crossing at Bloomfield (Map 1-2). Pumps at the diversion facility would discharge water into two 36 -inch pipelines that would deliver water to a 4000-acre-foot storage reservoir near NMGS (Map 1-1) and ultimately to the power plant. The approximately 40 -mile proposed pipeline (PI) would generally require 90 -foot construction rights-ofway (ROW) and would parallel the new and old portions of Highway 371 (Map 1-1). An alternative water pipeline route, P2, would begin at an intake pumping station near Bloomfield and would end at the proposed terminal storage reservoir. A 49 -mile alternative water pipeline route, P 3 , would also originate at an intake pumping station near Bloomfield and would terminate at the proposed storage reservoir near NMGS .

In order to deliver power from NMGS to various load centers, it would be necessary to integrate the plant into the existing bulk

transmission systems of PNM and neighboring utilities. Thus the proposed transmission system would consist of a $500-\mathrm{kilovolt} \cdot(\mathrm{kV})$ loop linking NMGS with PNM's approved 500-kV Four Corners-Ambrosia-Pajarito (FC-A-P) line, located approximately 5 miles west of NMGS, and two $500-\mathrm{kV}$ lines linking NMGS with the Albuquerque distribution and load center at the proposed Rio Puerco Station (Map 1-1). The NMGSAlbuquerque system would be installed in phases: the $500-\mathrm{k} \nabla$ loop in 1990 with commencement of commercial operation of Unit 1 , the first $500-\mathrm{kV}$ line with Unit 2 in 1993 , and the second $500-\mathrm{kV}$ line with Unit 4 in 1998.

Four routes are considered technically and economically feasible for construction of the $500-\mathrm{kV}$ transmission system. Route T 2 is proposed for the first $500-\mathrm{kV}$ line and route Tl is proposed for the second $500-\mathrm{kV}$ line; routes T 3 and T 4 are alternatives to the Proposed Action. The total distance traversed would be similar for the two proposed and two alternative corridors: 101 miles (T2), 107 miles (T1), 105 miles (T3), and 126 miles (T4). With the exception of tower sites, the proposed 200 -foot ROW could support other compatible land uses, such as grazing. PNM would keep the transmission line ROW closed and would patrol the line by helicopter each month. Lands disturbed by heavy equipment and temporary access roads would be restored to their original condition.

Table 1-1 displays construction work force estimates over time. Construction employment for station facilities would reach peaks of 1515 employees in 1987 and 1530 employees in 1992. Operations employment at station facilities would increase steadily, from 30 employees in 1989 to 900 employees in 1999 when all four units are expected to be on-line.
C700A.S3 - (PNN I \& PNM II) - 1
Table 1-1. NMGS CONSTRUCTION AND OPERATION EMPIOYMENT

| Year | Intake <br> Pipeline and <br> Reservoir | $500-\mathrm{kV}$ <br> Trans- <br> mission <br> Line | NMCS |  |  |  |  |  |  |  |  |  | TotalEmployment | $\begin{array}{r} \text { Annual } \\ \text { t Change } \end{array}$ |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
|  |  |  | Construction |  |  |  |  | Operation |  |  |  |  |  |  |
|  |  |  | Unit 1 | Unit 2 | Unit 3 | Unit 4 | Total | Unit 1 | Unit 2 | Unit 3 | Unit 4 | Total |  |  |
| 1985 | - | - | 85 | - | - | - | 85 | - | - | - | - | - | 85 | +85 |
| 1986 | - | - | 800 | - | - | - | 800 | - | - | - | - | - | 800 | +715 |
| 1987 | 115 | - | 1515 | - | - | - | 1630 | - | - | - | - | - | 1630 | +830 |
| 1988 | 295 | 104 | 1180 | 30 | - | - | 1505 | - | - | - | - | - | 1505 | -125 |
| 1989 | - | - | 360 | 450 | - | - | 914 | 30 | - | - | - | 30 | 944 | -560 |
| 1990 | - | - | 100 | 940 | 40 | - | 1080 | 200 | - | - | - | 200 | 1280 | +336 |
| 1991 | - | - | - | 750 | 570 | - | 1320 | 250 | - | - | - | 250 | 1570 | +290 |
| 1992 | - | - | - | 270 | 1260 | - | 1530 | 250 | 24 | - | - | 274 | 1804 | +234 |
| 1993 | - | - | - | 105 | 955 | 30 | 1090 | 250 | 160 | - | - | 410 | 1500 | -304 |
| 1994 | - | 78 | - | - | 325 | 435 | 838 | 250 | 200 | 30 | - | 480 | 1318 | -182 |
| 1995 | - | - | - | - | 90 | 940 | 1030 | 250 | 200 | 200 | - | 650 | 1680 | +362 |
| 1996 | - | - | - | - | - | 775 | 775 | 250 | 200 | 250 | - | 700 | 1475 | -205 |
| 1997 | - | - | - | - | - | 255 | 255 | 250 | 200 | 250 | 24 | 724 | 979 | -496 |
| 1998 | - | - | - | - | - | 95 | 95 | 250 | 200 | 250 | 160 | 860 | 955 | -24 |
| 1999 | - | - | - | - | - | - | 0 | 250 | 200 | 250 | 200 | 900 | 900 | -55 |

Source: PNM 1980, unpublished data.

C700A.S2 (PNM I \& PNM II) - 7

According to PNM (unpublished data, 1980), estimated construction employment skill requirements would be as follows:

Skill

Boilermakers 9.4
Pipefitters 14.2
Electricians 14.4
Carpenters 5.6
Ironworkers 10.0
Operators 10.0
Laborers 9.0
Teamsters 4.1
Cement masons 0.8
Millwrights 3.3
Insulators 4.0
Sheetmetal workers 1.1
Painters 1.2
Others 0.5
Supervision 12.4

The above estimates are averaged for construction of all four units.

SAN JUAN BASIN ACTION PLAN OVERVIEW AND RELATIONSHIP OF THE NMGS EIS TO ACTIONS INCLUDED IN THE PLAN

The proposed site for the NMGS is located in the San Juan Basin of northwestern New Mexico. The Bureau of Land Management (BLM) is responsible for the management of much of the land and mineral resources in this area, and currently has six separate but
interrelated proposals under consideration within the basin. In order to respond to these, the BLM has developed a San Juan Basin Action Plan (SJBAP). This plan provides for the organizational arrangements whereby the environmental analyses and decision making can be implemented in a timely and efficient manner. The plan describes the process for preparation of three site-specific EISs (including the NMGS EIS) and three Environmental Assessments (EAs):

- Coal Preference Right Lease Applications (EA)
- San Juan River Regional Coal Leasing (EIS)
- Wilderness Study Areas (WSAs) (EIS)
- New Mexico Generating Station (EIS)
- Ute Mountain Land Exchange (EA)
- Bisti Coal Lease Exchange (EA)

In addition to these documents, the action plan provides for the preparation of a Cumulative Overview (CO). The CO is intended to focus on the cumulative impacts that would result from the proposed actions analyzed in the EISs and EAs listed above and therefore to facilitate public review and decision making. As a result of this organization, the impact analysis in the NMGS EIS and technical background reports concentrates on the impacts expected to result from the specific NMGS components proposed. The cumulative impacts expected to result from the proposed NMGS, in addition to the cumulative impacts of other proposals to be developed in the same time period, are described in the CO .

BASELINE CONDITIONS ASSUMED FOR THE NMGS TECHNICAL REPORT IMPACT ANALYSES

The site-specific impact analysis for this technical report was based on the affected environment and available resources that would
be existing at the time of construction and operation of the NMGS facility. Since construction at the NMGS facility would not begin until 1985, certain assumptions regarding project development in the San Juan Basin were necessary. Two levels of project development were considered, along with criteria for each, in developing a status for the various non-SJBAP actions proposed for the San Juan Basin area.

- Baseline 1 - The projects considered in this level of development are those that have approval and are to be built or under construction in 1985. This level represents the projected existing environment without the proposals included in the SJBAP.
- Baseline 2 - The projects considered in this level are in some phase of the application stage. In this level, Baseline 1 projects are added to any projects in Baseline 2 along with any revision in resource production or uses (e.g., coal).

Where differences in Baselines 1 and 2 affect the results of impact analyses, discussion is provided. If no differences are identified, it should be assumed that consideration of the two different baselines did not alter the impact analyses.

A complete list of projects and comprehensive location maps for Baselines 1 and 2 are provided in Appendix $C$ of the NMGS EIS.

## ORGANIZATION OF THE REPORT

Section 2.0 of this technical report describes the assumptions and methodological approach used in the assessment of potential impacts of the Proposed Action on the affected environment. In
addition, Section 2.0 contains a definition of the study area and identification of data sources.

Section 3.0, Affected Environment, contains baseline data on existing conditions in the study area, as well as projections of future conditions without the Proposed Action. Information on historical trends is presented where it is useful in providing a basis for predicting most likely future trends. The description of projected future trends takes into consideration the changes in the environment that are expected to occur as a result of the projects identified in Baseline 1. This provides a reasonable estimate of the future existing environment against which the potential impacts of the Proposed Action and alternatives can be assessed.

Section 4.0 describes the potential effects of implementing the Proposed Action and alternatives. Impacts identified are measured against indicators of significance in order to estimate the importance of the impact to the affected human environment. (Potential impacts associated with alternatives to the Proposed Action are compared in Section 9.0.)

In Section 5.0, mitigation measures are suggested. These measures would help to alleviate the potentially significant adverse impacts or enhance the beneficial impacts identified in the Section 4.0 analysis. Those potentially adverse impacts for which no appropriate mitigation measures have been suggested are discussed in Section 6.0 as "unavoidable adverse impacts."

SOILS

## Geographic Area of Influence

Direct impacts to the soils resource would occur primarily on areas directly disturbed (e.g., NMGS site, pipeline and transmission line ROWs and associated surface facilities, reservoir site, and borrow areas) during construction, operation, and maintenance of the Proposed Action or alternatives.

Indirect impacts to the soils resource would result primarily from increased off-road vehicle (ORV) access to previously inaccessible areas. Construction of new ROWs (e.g., pipeline and transmission lines) would allow some previously inaccessible areas to be accessible to ORVs. The degree and areal extent of such disturbances are unknown, but would probably be limited to about 5 miles on each side of new ROWs.

## Indicators of Impact Significance

Indicators of impact significance included the degree and areal extent of disturbances, erosion susceptibility, and reclamation potential of the areas that would be directly affected during construction, operation, and maintenance of the various project components. Impacts to the soils resource were considered significant if there is a high probability that soil erosion would not be held to
acceptable levels and disturbed areas would not be able to revegetate. An "acceptable" soil erosion level is defined as the amount of soil loss that would not significantly affect the long-term productivity and stability of disturbed areas. Findings were based on analyses of soils and terrain traversed and on erosion control and reclamation measures presented in the project description (see Chapter 1.0 of the EIS).

Determination of potential problem soil areas was accomplished by analyzing published soil maps and surveys and through discussions with applicable resource agency personnel (Soil Conservation Service and BLM). Construction and erosion control/reclamation measures presented in the project description were assessed as to their adequacy for protecting against significant impacts to the soils resource. Erosion control and reclamation measures were proposed for consideration of inclusion in the project description or BLM ROW stipulations when findings from the analysis warranted.

## Methods for Data Collection

A thorough literature search of existing soils data within the applicable portion of the San Juan Basin region was conducted. The applicable soils data sources used include Soil Conservation Service (SCS) soil surveys/publications and SCS Form 5, Soil Interpretation Tables; SCS/New Mexico State University, Agricultural Experiment Station, research reports; and a PNM-contracted soil survey for the NMGS site.

An aerial reconnaissance and partial ground survey of proposed and alternate project components was performed. SCS and BLM personnel were contacted for additional soils information.

## Interrelationships with Baselines 1 and 2

Consideration of the energy and resource-related projects in Baselines 1 and 2 generally does not change the potential soils resource impacts attributable to the NMGS project. The one exception is the interrelationship between the NMGS project and the Navajo Indian Irrigation Project (NIIP). Potential impacts are discussed under the applicable project components.

## PRIME AND UNIQUE FARMLANDS

## Geographic Area of Influence

Significant impacts to Prime or Unique Farmlands would occur only on areas that would be taken out of production by surface facilities associated with the Proposed Action or alternatives (e.g., NMGS, San Juan River intake, pipeline pump stations, reservoir site, or transmission towers/substations). This is based on the premise that topsoiling would be performed on all temporarily disturbed irrigated cropland areas.

## Indicators of Impact Significance

Impacts were considered significant if any Prime or Unique Farmlands would be taken out of production by surface facilities associated with the Proposed Action or alternatives.

## Methods for Data Collection

Appropriate SCS offices were contacted for information regarding the locations of Prime and Unique Farmlands in the project area. Data sources included the Prime Farmland list (by soil mapping unit) for San Juan County and locational descriptions provided by SCS personnel. Additionally, SCS/New Mexico State University, Agricultural Experiment Station, research reports were used to

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ascertain potential Prime Farmland areas within the proposed and alternate transmission corridors.
Interrelationships with Baselines 1 and 2
Consideration of the energy and resource-related projects in Baselines 1 and 2 generally does not change the potential impacts to Prime and Unique Farmlands. The one exception is the interrelationship between the NMGS project and the NIIP. Potential impacts are discussed under the applicable project components.
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Soils maps ( $1: 24,000$ and $1: 62,500$ scales) for the proposed NMGS site, proposed and alternate main water pipelines, and proposed and alternate terminal storage reservoirs are available for review at the BLM New Mexico State Office in Santa Fe. Maps ( $1: 250,000$ scale) showing the soils identified within the proposed and alternate transmission corridors are also available for review at that location.

The soils in the San Juan Basin that would potentially be affected by the proposed NMGS project or alternatives have resulted primarily from erosion and weathering of sedimentary parent materials (e.g., sandstone, shale, and siltstone). Surface textures are primarily sandy, but range from fine sand to clay. Many of the identified soils are moderately to highly susceptible to wind-induced soil erosion, while water erosion susceptibility is generally low to moderate.

Overall, the soils identified in the project area are not very productive because of low available moisture, low organic matter content, and undesirable physical and chemical characteristics.

## Proposed NMGS Site

The proposed NMGS site is within the San Juan River Valley Mesas and Plateaus portion of the Western Range and Irrigated Region (SCS 1978a). The area is underlain by deep Tertiary fill resting on rocks of Late Cretaceous age. Annual precipitation generally ranges from 6 to 10 inches at the site. Five different soil associations were identified at the proposed NMGS site. Table 1 lists and characterizes the identified soils.

The soils identified within the proposed NMGS site are primarily deep, and well to somewhat excessively drained. Surface textures of the soils identified at the site range from fine sand to clay. These soils are forming in alluvial, eolian, and residual materials derived primarily from sandstone, shale, and siltstone on mesas, plateaus, intermittent drainageways, and escarpments. The terrain slopes range mainly from nearly level to moderately sloping, but a small, steep area of Badland-Rock Outcrop is present on the south-central portion of the site. Badland-Rock Outcrop comprises approximately 2 percent of the total site area. Topsoil availability at the site is limited due to generally shallow soil surface layers, and the majority (approximately 80 percent) of the existing topsoil is of fair to poor quality due to undesirable surface textures (e.g., too sandy or clayey) or excess salt/sodium. These soils are characterized by a low to high wind erosion hazard, and a primarily moderate water erosion hazard. Sandy-textured soils such as Sheppard, Fruitland, Stumble, and Duneland are highly susceptible to wind erosion. Soils which contain a high percentage of clay or silt particles are normally the most susceptible to water erosion, but unstabilized sandy soils occurring in drainages (e.g., Riverwash) are also highly susceptible to water erosion. The soils at the site are mildy to strongly alkaline. Shrink-swell potential of the identified soils is primarily low to moderate, but the Notal soil has a high shrink-swell
table 1. charactiristics of the sons identified at hie praposed mes


[^1](1) Buchanan, B. 1978. Soils field research, soils map. Prepared (under contract) for Public Service Coupany of New Mexico. Albuquerque, New Mexico. (2) U.S. Soil Conservation Service (SCS). 1980. Soil survey of San Juan County, New Hexico, eastern part.
(3) Applicable SCS Form 5 - Soil Interpretation Tables.
potential. These soils are used primarily for livestock grazing and wildlife habitat.

## Water Supply System

Proposed Main Water Pipeline P1. Pipeline route P1 is within the San Juan River Valley Mesas and Plateaus portion of the Western Range and Irrigated Region (SCS 1978a). Annual precipitation along P1 is usually about 8 inches. Twenty-three different soil phases, series, associations, or complexes were identified along this route. Table 2 lists (by mileposts) and characterizes the identified soils.

The soils identified along the pipeline route $P 1$ are primarily deep and well to somewhat excessively drained. Surface textures range from fine sand to clay. These soils are forming in alluvial, eolian, and residual materials derived primarily from sandstone, shale, and siltstone on mesas, plateaus, drainageways, valley bottoms, valley sides, and alluvial fans. The terrain slopes range mainly from nearly level to moderately sloping, although a small area of moderately sloping to steep Badland would be traversed near Moncisco Mesa (between MP 15.45-16.8). Approximately 5.1 miles of Badland (nonstony, barren shale) and Badland-Rock Outcrop would be traversed by this pipeline route. Topsoil availability along this pipeline route is limited due to generally shallow soil surface layers, and the majority of the existing topsoil is of fair to poor quality due to undesirable surface textures (e.g., too sandy or clayey) or excess salt/sodium. The Blackston (mileposts [MP] 0.05-0.10; adit/shaft portion), Persayo (MP 0.1-0.6; 0.65-0.75; 0.85-2.70; and 2.85-3.30) and Muff (MP 17.30-19.2; 22.85-22.90; and 23.40-23.50) soils are difficult to reclaim if the topsoil is removed and not replaced. Susceptibility to wind-induced soil erosion ranges from low to high, but it is primarily moderate to high. Susceptibility to water-induced

| Milepost | $\operatorname{Map}_{\text {Syabol }}$ | Soil Phase, Series, Associationa, or Couplear and Deacription | Soil Phase or Series | Depth to Bedrock (inches) | $\begin{gathered} \text { Slope } \\ (\boldsymbol{Z}) \end{gathered}$ | Depth to High Kater Table (feet) | $\begin{gathered} \text { Reaction } \\ (\mathrm{pH}) \end{gathered}$ | $\underset{\substack{\text { Salinity } \\ \text { (monos } \\ \text { cal }}}{\text { and }}$ | Hydrologic Group | $\begin{aligned} & \text { VEGG } \\ & \text { Class } \end{aligned}$ | 'R' | 'T' | Comments |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| 0.00.05 | W | Herlos: Deep, econewhat poorly drained, loan and clay loan soils formed on level and nearly level floodplains and terraces from alluvium derived primarily from sandstone and ahale. Stratified and, gravel, and cobbles below 60 inches. | Herlog | $60+$ | $0-1$ | 2-5 | 7.9-9.0 | 2-4 | c | 8 | . 37 | 5 | Low wind erosion hazard, woderate water erosion hazand, fair topsoil (too clayey), 8 inch precipitation zove. Strink-avell potential is low to moderate, high corrosion hazard to uncoated steel, not well suited to urtan developwent (wetmess). |
| 0.05-0.10 ${ }^{2}$ | H | Haplargids-Blackston-Torriorthente: Shallow to deep, well to excesaively drained, cobbly aandy loan, cobbly sandy clay lomen, gravelly loan, gravelly clay loem, cobbly lown, and clay loam soile formed on moderately sloping to steep terraces, mesas, and plateans from allurium derived from mixed sources. | Heplargids Blackstoa Torriorthents | $\begin{gathered} 10-60+ \\ 60+ \\ 10-20 \end{gathered}$ | $\begin{aligned} & 8-50 \\ & 8-40 \\ & 8-50 \end{aligned}$ | $\begin{aligned} & M \\ & >6 \\ & M \end{aligned}$ | $\stackrel{\mathrm{M}}{7.9-8.4} \underset{\mathrm{M}}{ }$ | $\begin{aligned} & \mathrm{M} \\ & 2-4 \\ & \mathrm{M} \end{aligned}$ | $\begin{aligned} & \mathrm{M} \\ & \mathrm{~B} \\ & \mathrm{M} \end{aligned}$ | $\begin{aligned} & \mathrm{M} \\ & 5 \\ & \mathrm{M} \end{aligned}$ | $\begin{aligned} & \mathrm{M} \\ & .17 \\ & \mathbf{M} \end{aligned}$ | $\begin{aligned} & \mathrm{M} \\ & 1 \\ & \mathbf{n} \end{aligned}$ | Low wind erosion hazard, low to high uater erosion hazard, poor topeoil (area reclaim), 9 inch precipitation zone. Shrink-awell potential is low, high corrosion hazard to uncoated steel. |
| $0.10-0.20^{2}$ | BC | Badland Rock Outcrop-Persayo: Shallow, well drained, clay loasa, and silty clay loam soils formed on steep bills, ridges, and breake in material derived primarily from shale. Includes steep, nonstory, barren shale on uplends that are dissected by deep intermittent drainageways and gullies, and barren aandstone outcrope on steep to very ateep ridges, benches, and eacarpments. | Badland <br> Rock Outcrop <br> Persayo | $\begin{gathered} 0 \\ 0 \\ 10-20 \end{gathered}$ | $\begin{aligned} & 30-50 \\ & 40-70 \\ & 30-40 \end{aligned}$ | $\begin{aligned} & >6 \\ & >6 \\ & >6 \end{aligned}$ | $\begin{gathered} \mathrm{M} \\ \mathrm{M} \\ 7.9-9.0 \end{gathered}$ | $\begin{aligned} & \text { MM } \\ & \text { M } \\ & <8 \end{aligned}$ | $\begin{aligned} & \text { M } \\ & M \\ & \text { D } \end{aligned}$ | $\begin{aligned} & \mathrm{M} \\ & \mathrm{M} \\ & \mathbf{L L} \end{aligned}$ | $\begin{aligned} & \mathrm{MM} \\ & \mathbf{M M} \\ & .37 \end{aligned}$ | $\begin{aligned} & M \\ & M \\ & 1 \end{aligned}$ | Hoderate wind and water erosion harand, poor topsoil (area reclaim), 8 inch precipitation zone. Sharinkswell potential is moderate, high corrosion hazard to umocated ateel. |
| 0.20-0.60 | PA | Parb-Persayo-Rock Outcrop: Very shallow to shallow, excessively and well drained, fine sandy loam, sandy clay loam, clay loan, and silty clay loem soils formed on gently sloping to moderately steep hilla and breaks from residum derived from sand stone and ahale. Includes barren andstone outcrops on strongly sloping to moderately steep benches, ridges, and breaks. | Parb <br> Persayo Rock Outcrop | $\begin{gathered} 5-20 \\ 10-20 \\ 0 \end{gathered}$ | $\begin{array}{r} 3-30 \\ 3-30 \\ 10-30 \end{array}$ | $\begin{aligned} & >6 \\ & >6 \\ & >6 \end{aligned}$ | $\begin{aligned} & 7.4-8.4 \\ & 7.9-9.0 \\ & \mathrm{~m} \end{aligned}$ | $\begin{aligned} & <8 \\ & <8 \\ & \text { MM } \end{aligned}$ | $\begin{aligned} & \mathrm{D} \\ & \mathrm{D} \\ & \mathrm{M} \end{aligned}$ | $\begin{aligned} & 3 \\ & 4 \mathrm{~L} \\ & \mathrm{M} \end{aligned}$ | $\begin{aligned} & .32 \\ & .37 \\ & \mathrm{M} \end{aligned}$ | $\begin{aligned} & 1 \\ & 1 \\ & 1 \end{aligned}$ | Hoderate wind and water erosion harard, poor topsoil (Persayo portionarea reclaim, 8 inch precipitation zone. Shrink-swell potential is low to moderate, low to high corrosion hazard to uncoated steel. |
| 0.60-0.65 | Ay | Avaloa: Deep, well drained, loam soile formed on level to gently sloping mease and platems from allivial and colian materials derived primarily from and stove and abale. | Avalon | $60+$ | 0-3 | $>$ | 7.98.4 | 2-8 | B | 4. | . 43 | 3 | Moderate vind erosion hazard, high water erosion hazard, fair topboil (excess salt), 8 inch precipitation zone. Shrink-swell potential is low, soil is slightly saline, high corrosion hazard to uncosted steel. |
| 0.65-0.75 | PA | Parb-Persayo-Rock Outcrop: Very shallow to shallow, excessively and well drained, fine sandy looen, sandy clay loas, clay loas, and silty clay loem soils forved on gently sloping to moderately steep hilla and breaks from residuma derived from sandstone and shale. Includes barrea sandstone steep benches, ridgee, and breaks. outcrops an atrongly sloping to moderately | Farb <br> Persayo <br> Bock Outcrop | $\begin{gathered} 5-20 \\ 10-20 \\ 0 \end{gathered}$ | $\begin{array}{r} 3-30 \\ 3-30 \\ 10-30 \end{array}$ | $\begin{aligned} & >6 \\ & >6 \\ & >6 \end{aligned}$ | $\begin{aligned} & 7.4-8.4 \\ & 7.9-9.0 \end{aligned}$ | $\begin{aligned} & Q \\ & <8 \\ & M \end{aligned}$ | $\begin{aligned} & \mathrm{D} \\ & \mathrm{D} \\ & \mathbf{M} \end{aligned}$ | $\begin{aligned} & 3 \\ & 4 \mathrm{~L} \\ & \mathrm{M} \end{aligned}$ | $\begin{aligned} & .32 \\ & .37 \\ & \text { M4 } \end{aligned}$ | $\begin{aligned} & 1 \\ & 1 \\ & \mathbf{M} \end{aligned}$ | Hoderate wind and water erosion harard, poor topaoil (Persayo portiorarea reclaim, 8 inch precipitation zone. Sarink-arell potential is low to moderate, low to high corrosion hazard to uncoated steel. |
| 0.75-0.85 | 4 A | Avaloa: Deep, well drained, loan soils formed an level to gently sloping mesas and plateaus from allivial and colim materials derived primarily from andstone and sbale. | Avalon | $60+$ | 0-3 | 7 | 7.9-8.4 | 2-8 | B | 4. | . 43 | 3 | Moderate vind erosion hazard, high weter erosion hazard, fair topooil (excess salt), 8 inch precipitation race. Shrink-swell potential is low , soil is slightly saline, high cor rosion hazard to uncoated ateel. |

Table 2. characteristics of the soins identified aionc main hater pipenine mait Pl (cont inved)

| Milepost | Map Syuthol | Soil Phase, Series, Asociatipa, or Complex and Description | Soil Phase or Series | Depth to Bedrock (inches) | Slope (z) | Depth to High Water Table (feet) | Soil Reaction (pH) | Salinity (mohos/ ca) | Hydrologic Grap | $\begin{aligned} & \text { WEC } \\ & \text { Class } \end{aligned}$ | 'K' | 'T' | Comments |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| 0.85-1.95 | FA | Parb-Persayo-Rock Outcrop: Very shallow to shallow, excessively and well drained, fine sandy. loam, sandy clay loam, clay loam, and silty clay laam soils formed on gently sloping to moderately steep hills and breaks from residism derived from santstone and shale. Includes barren sandstone outcrops an strongly sloping to moderately steep benches, ridges, and breaks. | Farb <br> Persayo Rock Outcrop | $\begin{gathered} 5-20 \\ 10-20 \\ 0 \end{gathered}$ | $\begin{array}{r} 3-30 \\ 3-30 \\ 10-30 \end{array}$ | $\begin{aligned} & >6 \\ & >6 \\ & >6 \end{aligned}$ | $\begin{gathered} 7.4-8.4 \\ 7.9-9.0 \\ \mathrm{M} \end{gathered}$ | $\begin{aligned} & <2 \\ & <8 \\ & N \end{aligned}$ | $\begin{aligned} & \mathrm{D} \\ & \mathrm{D} \\ & \mathrm{NA} \end{aligned}$ | $\begin{aligned} & 3 \\ & 4 \mathrm{~L} \\ & \mathrm{M} \end{aligned}$ | $\begin{aligned} & .32 \\ & .37 \\ & \mathrm{~N} \end{aligned}$ | $\begin{aligned} & 1 \\ & 1 \\ & N \end{aligned}$ | Moderate wind and water erosion hazand, poor topsoil (Persayo portionarea reclaim), 8 inch precipitation zone. Strink-swell potential is low to moderate, low to high corrosion hazard to uncoated steel. |
| 1.95-2.70 | FX | Fruitland-Persayo-Sheppard: Deep and shallow, well to someshat excessively drained, sandy loam, fine sandy loan, clay loan, loany fine sand, and fine sand soils fomed on moderately sloping to moderately steep hills, mesas, plateaus, fans, and breaks from alluvim, residnan, and eolian materials derived from sandstone and shale. | Fruitland <br> Persayo <br> Sheppard | $\begin{gathered} 60+ \\ 10-20 \\ 60+ \end{gathered}$ | $\begin{aligned} & 5-30 \\ & 5-30 \\ & 5-30 \end{aligned}$ | $\begin{aligned} & >6 \\ & >6 \\ & >6 \end{aligned}$ | $\begin{aligned} & 7.4-8.4 \\ & 7.9-9.0 \\ & 7.98 .4 \end{aligned}$ | $\begin{aligned} & <4 \\ & <8 \\ & <2 \end{aligned}$ | $\begin{aligned} & \text { B } \\ & \text { D } \\ & \text { A } \end{aligned}$ | $\begin{aligned} & 3 \\ & 4 \mathrm{~L} \\ & 2 \end{aligned}$ | $\begin{aligned} & .14 \\ & .37 \\ & .15 \end{aligned}$ | $\begin{aligned} & 5 \\ & 1 \\ & 5 \end{aligned}$ | Moderate to high wind erosion hazard, low to moderate water erosion hazard, topsoil is poor (Perssyo portion-area reclaim), 8 inch precipitation zone. Shrink-swell potential is low to moderste, high corrosion hazard to urcoated steel. |
| 2.7-2.85 | Av | Avalon: Deep, well drained, sandy loam, and fine sandy loam soils formed on gently sloping mesas and plateaus from alluvial and eolian materials derived primarily from sandstone and shale. | Avalon | $60+$ | 2-5 | 76 | 7.9-8.4 | 2-8 | B | 3 | . 37 | 3 | Hoderate wind and water erosion hazard, topsoil is fair (excess salt), 8 inch precipitation zone. Shrinkswell potential is low, soil is slightly saline, high corrosion hazard to uncoated steel. |
| 2.85-3.05 | FX | Pruitland-Persayo-Sheppard: Deep and shallow, well to sanewhat excessively drained, sandy loam, fine sandy loan, clay loan, loany fine sand, and fine sand soils formed on moderately sloping to moderately steep hills, mesas, platears, fans, and breaks from alluvim, residum, and eolian materials derived from sandstone and shale. | Fruitland <br> Persayo <br> Stheppard | $\begin{gathered} 60+ \\ 10-20 \\ 60+ \end{gathered}$ | $\begin{aligned} & 5-30 \\ & 5-30 \\ & 5-30 \end{aligned}$ | $\begin{aligned} & >6 \\ & 26 \\ & >6 \end{aligned}$ | $\begin{aligned} & 7.4-8.4 \\ & 7.9-9.0 \\ & 7.9-8.4 \end{aligned}$ | $\begin{aligned} & <4 \\ & <8 \\ & <2 \end{aligned}$ | $\begin{aligned} & \text { B } \\ & \text { D } \\ & \text { A } \end{aligned}$ | $\begin{aligned} & 3 \\ & 4 \mathrm{~L} \\ & 2 \end{aligned}$ | $\begin{aligned} & .24 \\ & .37 \\ & .15 \end{aligned}$ | $\begin{aligned} & 5 \\ & 1 \\ & 5 \end{aligned}$ | Moderate to high vind erosion hazard, low to moderate water erosion hazard, topsoil is poor (Persayo portion-area reclaim), 8 inch precipitation zone. Strink-swell potential is low to moderate, high corrosion hazard to urcosted steel. |
| 3.05-3.15 | BC | Badland-Rock Outcrop-Persayo: Shallow, well drained, clay loam, and silty clay loan soils formed on steq hills, ridges, and breaks in material derived primarily from shale. Includes steep, nonstory, barren shale on uplands that are dissected by deep intermittent drainageways and gullies, and barren aandstone outcrops on steep to very steep ridges, benches, and escarpuents. | Badland <br> Rock Outcrop <br> Perbayo | $\begin{gathered} 0 \\ 0 \\ 10-20 \end{gathered}$ | $\begin{aligned} & 30-50 \\ & 40-70 \\ & 30-40 \end{aligned}$ | $\begin{aligned} & 26 \\ & 26 \\ & 26 \end{aligned}$ | $\begin{gathered} \mathrm{NH} \\ \mathrm{NH} \\ 7.9-9.0 \end{gathered}$ | $\begin{aligned} & \mathrm{M} \\ & \mathrm{~N} \\ & <8 \end{aligned}$ | $\begin{aligned} & N A \\ & M \\ & \mathrm{D} \end{aligned}$ | $\begin{aligned} & N A \\ & N A \\ & \text { 4L } \end{aligned}$ | $\begin{aligned} & N H \\ & N H \\ & .37 \end{aligned}$ | $\begin{aligned} & \mathrm{N} \\ & \mathrm{M} \\ & 1 \end{aligned}$ | Hoderate vind and water erosion hazand, poor topsoil (area reclaim), 8 inch precipitation zone. Strinkowell potential is moderate, high corrosion hazard to uncoated steel. |
| 3.15-3.30 | EX | Fruitland-Persayo-Sheppard: Deep and shallow, well to somenhat excessively drained, sandy loam, fine sandy loan, clay lousin, loany fine sand, and fine aand soils fomed on moderately sloping to moderately steep hills, mesas, plateans, fans, and breaks from alluvium, residnam, and eolian materials derived from sandstone and shale. | Fruitland <br> Persayo <br> Sheppard | $\begin{gathered} 60+ \\ 10-20 \\ 60+ \end{gathered}$ | $\begin{aligned} & 5-30 \\ & 5-30 \\ & 5-30 \end{aligned}$ | $\begin{aligned} & >6 \\ & >6 \\ & >6 \end{aligned}$ | $\begin{aligned} & 7.4-8.4 \\ & 7.9-9.0 \\ & 7.98 .4 \end{aligned}$ | $\begin{aligned} & <4 \\ & <8 \\ & <2 \end{aligned}$ | $\begin{aligned} & \text { B } \\ & \text { D } \\ & \text { A } \end{aligned}$ | $\begin{aligned} & 3 \\ & 4 \mathrm{~L} \\ & 2 \end{aligned}$ | $\begin{aligned} & .24 \\ & .37 \\ & .15 \end{aligned}$ | $\begin{aligned} & 5 \\ & 1 \\ & 5 \end{aligned}$ | Moderate to high vind erosion hazard, low to moderate uater erosion hazard, topsoil is poor (Persayo portion-area reclaim), 8 inch precipitation zone. Strink-suell potential is low to moderate, high corrosion hazard to urcoated steel. |
| 3.30-3.65 | Sd | Sheppard-Mayqueen-Shiprock: Deep, sawewhat excessively and well drained, loany fine sand, fine sand, and fine sandy loam soils formed on level to moderately sloping mesas and plateaus frow alluvial and eolian materials derived from sandstone, shale, and mixed saurces. | Sheppard Mayqueen Shiprock | $\begin{aligned} & 60+ \\ & 60+ \\ & 60+ \end{aligned}$ | $\begin{aligned} & 5-8 \\ & 2-8 \\ & 0-5 \end{aligned}$ | $\begin{aligned} & >6 \\ & >6 \\ & >6 \end{aligned}$ | $\begin{aligned} & 7.9-8.4 \\ & 7.9-8.4 \\ & 7.4-8.4 \end{aligned}$ | $\begin{aligned} & <2 \\ & <2 \\ & <2 \end{aligned}$ | $\begin{aligned} & \text { A } \\ & \text { B } \\ & \text { B } \end{aligned}$ | $\begin{aligned} & 2 \\ & 2 \\ & 3 \end{aligned}$ | $\begin{aligned} & .15 \\ & . .24 \\ & . .44 \end{aligned}$ | $\begin{aligned} & 5 \\ & 5 \\ & 5 \end{aligned}$ | Moderate to high wind erosion hazard, low to moderate water erosion hazard, topsoil is poor to good, 8 inch precipitation zone. Shrink-swell poterr tial is low, high corrosion hazard to uncoated steel. |



| Milepoat |  | Soil Phace, Series, Asoociatipa, or Capplea and Description | Soil Phase or Seriea | Depth to Bedrock (inches) | $\underset{(X)}{\text { Slope }}$ | Depth to High Kater Table (feet) | $\begin{gathered} \text { Soil } \\ \text { Beaction } \\ (\mathrm{p} \mathbb{1}) \end{gathered}$ | $\underset{\substack{\text { Salinity } \\(\text { mathos } \\ \text { cal }}}{ }$ | $\begin{aligned} & \text { Hydro- } \\ & \text { logic } \\ & \text { Cocoup } \end{aligned}$ | $\begin{gathered} \text { Kerg } \\ \text { CLas: } \end{gathered}$ | 'x' | 'T' | Comerent: |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| 3.65-3.90 | $A v / \Delta x$ | Avalon: Deep, well drained, andy loan, fine anndy lom, and loan mill. formed on gently to moderately aloping mesas and platemes from allivial and oolian materials derived primarily from andatove and absle. | Avalo | $60+$ | 2-8 | $\chi$ | 7.9-8.4 | 2-8 | B | 3 | 37 | 3 | Hoderate wind and water erosion bay and, topsoil is fair (excess salt). 8 inch precipitation zone. Strinkowell potential is low, soil is slightly saline, high corrosion hazard to uncoated ateel. |
| 3.94.0 | Sd | Sheppard Hayquear-Shiprock: Deep, womethat excessively and vell drainod, lomay fine asnd, fine and, and fine annty loam soils formed on level to moderately sloping mease and plateane from allevial and oolimn materinle derived from andstons, ahale, and mixed cources. | Sheppard <br> Mayqueen <br> Shiprock | $\begin{aligned} & 60+ \\ & 60+ \\ & 60+ \end{aligned}$ | $\begin{aligned} & 5-8 \\ & 2-8 \\ & 0-8 \end{aligned}$ | $\begin{aligned} & >6 \\ & >6 \\ & >6 \end{aligned}$ | $\begin{aligned} & 7.9-8.4 \\ & 7.9-9.4 \\ & 7.48 .4 \end{aligned}$ | $\begin{aligned} & 2 \\ & 2 \\ & 2 \\ & 8 \end{aligned}$ | $\begin{aligned} & A \\ & B \end{aligned}$ | $2$ | $\begin{aligned} & .15 \\ & .24 \\ & .24 \end{aligned}$ | $\begin{aligned} & 5 \\ & 5 \end{aligned}$ | Moderate to high wind erosion bazard, low to moderate water erosion hazard, topeoil is poor to good, 8 inch precipitation mone. Shrink-well poter tial is low, high corrosion hazard to uncoated ateel. |
| 4.0-4.35 | Av/Ax | Ayplan: Deep, well drainod, sendy loen, fine sandy loesa, and loem soile formed on gently to moderately aloping meases and platean from alluvial and colian materials derived primarily from andstone and shele. | Avalon | $60+$ | 2-8 | > | 7.9-8.6 | 2-8 | B | 3 | 37 | 3 | Moderate wind and water erosion harard, topsoil is fair (excess ealt), 8 inch precipitation rone. Starinkovell potential is low, soil is slightly saline, high corrosion hazard to uncoated ateel. |
| 4.35-6.0 s | $\underset{\mathrm{sd} / \mathrm{So} /}{\substack{\text { sm }}}$ | Shiprock-Sherpard Hayques: Deep, someWhat excessively and vell drained, loanry fine sand, fine sand, fine aandy loan, and sandy losa soils formed on level to moderately sloping meses and platean frum alLuvial and eolim materials derived from asodetone, ahale, and mixad sources. | Shiprock <br> Sheppard <br> Mayqueen | $\begin{aligned} & 60+ \\ & 60+ \\ & 60+ \end{aligned}$ | $\begin{aligned} & 0-5 \\ & 5-8 \\ & 2-8 \end{aligned}$ | $\begin{aligned} & >6 \\ & >6 \\ & >6 \end{aligned}$ | $\begin{aligned} & 7.4-8.4 \\ & 7.9-8.4 \\ & 7.9-8.4 \end{aligned}$ | $\begin{aligned} & 8 \\ & 8 \\ & 8 \end{aligned}$ | $\begin{aligned} & B \\ & 1 \end{aligned}$ | $\begin{aligned} & 3 \\ & 2 \\ & 2 \end{aligned}$ | $\begin{aligned} & .24 \\ & .15 \\ & .24 \end{aligned}$ | $\begin{aligned} & 5 \\ & 5 \\ & 5 \end{aligned}$ | Moderate to high vind erosion bazard, lou to moderate water erosion hazard, topeoil is good to poor, 8 inch precipitation mone. Shrink-swell poter tial is low, high corrosion hazand to umosated ateel. |
| 6.0-6.25 | Ax | Avalon: Deep, vell drained, sendy loan, and lame soile formed on moderately sloping weans and plateaus from alluvial and colian materiala derived primarily from sandatone and ahale. | Avalon | $60+$ | 5-8 | 7 | 7.9-8.4 | 2-8 | B | 3 | 37 | 3 | Koderate wind and water erosion harard, coppoil is fair (excess aslt). 8 inch precipitation zone. Starinkavell potential is low, wil is - lightly ealine, high corrosion hazard to uncoated atcel. |
| 6.25-13.0 | $\underset{\text { Sol }}{\substack{\text { sol } \\ \text { So }}}$ | Shiprock-Sheppard-Hayqueen: Deep, what excestively and well drained, loany fine eand, fine aand, fine anndy loam, and eandy loem soils formod on level to moderately sloping mesas and plateans from alluvial and eolian materials derived from andetone, ahale, and aixed acources. | Shiprock <br> Sheppard <br> Mayqueen | $\begin{aligned} & 60+ \\ & 60+ \\ & 60+ \end{aligned}$ | $\begin{aligned} & 0-5 \\ & 5-8 \\ & 2-8 \end{aligned}$ | $\begin{aligned} & \lambda 6 \\ & \lambda_{6} \\ & \lambda 6 \end{aligned}$ | $\begin{aligned} & 7.48 .4 \\ & 7.9-8.4 \\ & 7.9-8.4 \end{aligned}$ | $\begin{aligned} & 2 \\ & 8 \\ & <2 \\ & <2 \end{aligned}$ | B | $\begin{aligned} & 3 \\ & 2 \\ & 2 \end{aligned}$ | $\begin{aligned} & .24 \\ & .15 \\ & .24 \end{aligned}$ | $\begin{aligned} & 5 \\ & 5 \\ & 5 \end{aligned}$ | Hoderate to high vind erosion hazard, low to moderate witer erosion harard, topsoil is good to poor, 8 inch precipitation 20ne. Shrink-well poter tial is low, high corrosion hazard to uncoated atoel. |
| 13.0-13.05 | De | Doak: Deep, vell drained, lamen, and clayey lomen soils formod on level and pearly level meane, platems, and tarraces from allurima derivod primarily from andstone and shale. | Doak | $60+$ | $0-1$ | $\chi$ | 7-8.4 | 8 | B | 5 | 37 | 5 | Low wind eroaion harard, woderate miter erosion hazard, topsoil is fair (too clayey), 8 inch precipitation zone. Shrink-avell potential is low to moderate, low wil atreigth, high corrosion hazard to uncoated ateel. |
| 13.05-13.10 | 0 m | Shiprock: Deep, well drained, fine sandy loea, and senty loens eoila formod on level and nearly level mease and platoas from alluvial and oolian miterisla derived primarily from andetone and abale. | Stiprock | $60+$ | 0-2 | $>$ | 7.4.8. | 0 | 1 | 3 | . 24 | 5 | Hoderate wind and veter crosion har and, good topeoil, 8 inch precipite tion rone. Shrink-suell potential is low, highly corrosive to unonated steel. |
| 13.10-13.15 | 5 Av | Ayalon: Deep, well drainod, aendy loan, and fine aendy lomeseils formod on gently sloping mease and plateme from alluvial and oolian materials derived primarily from andatone and shale. | Avaloa | $60+$ | 2-5 | > | 7.9-8.4 | 2-8 | B | 3 | 37 | 3 | Hoderate rind and water erosion har and, topeoil is fair (excess salt), 8 inch precipitation mone. Strinkwell potential is low, soil is slightly asline, high corrosion |

Table 2. Characieristics of the soils mentificd along mand water pipring bouis pl (coutimed)

Table 2. charactraistics of tie solis meatified alowg min hatir pipeline roite pl (contimed)

| Mileport | Map <br> Syubol | Soil Phase, Series, Associatipn, or Camplex and Description | Soil Phase or Series | Depth to Bedrock (inches) | Slope <br> ( $)^{2}$ | Depth to High Kater Table (feet) | Soil Reaction (pl) | Salinity (murhos) (0) | Hydrologic Grap | $\begin{aligned} & \mathrm{HECG} \\ & \text { Clasb } \end{aligned}$ | 'K' | 'T' | Couments |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| 15.45-16.8 | $B A$ | Badland: Moderately sloping to extrene ly steep, nonstony, barren shale uplands that are diasected by deep intemittent drainagewas and gullies. | Bedland | 0 | 5-80 | M | NM | N | NH | N | N | M | 8 inch precipitation zone. |
| 16.8-17.3 | $A Z$ | Avalon-Sheppard-Shiprock: Deep, well and sanewhat excessively drained, sandy loam, loam, loanry fine sand, fine amd, and fine sandy loam soils formed on level to moderately sloping mesas and plateaus from allurial and eolian materials derived primarily from amdstone and shale. | Avalon Sheppard Shiprock | $\begin{aligned} & 60+ \\ & 60+ \\ & 60+ \end{aligned}$ | $\begin{aligned} & 0-5 \\ & 3-8 \\ & 0-5 \end{aligned}$ | $\begin{aligned} & >6 \\ & >6 \\ & >6 \end{aligned}$ | $\begin{aligned} & 7.9-8.4 \\ & 7.9-8.4 \\ & 7.4-8.4 \end{aligned}$ | $\begin{aligned} & 2-8 \\ & <2 \\ & <2 \end{aligned}$ | $\begin{aligned} & \text { B } \\ & \text { A } \\ & \text { B } \end{aligned}$ | $\begin{aligned} & 3 \\ & 2 \\ & 3 \end{aligned}$ | $\begin{aligned} & .37 \\ & .15 \\ & .24 \end{aligned}$ | $\begin{aligned} & 3 \\ & 5 \\ & 5 \end{aligned}$ | Moderate to high vind erosion hazard, low to moderate water erosion hazard, topsoil is fair to good, 8 inch precipitation zone. Strrink-avell potertial is low, high corrosion hazard to uncoated steel. |
| 17.3-19.2 | H | Hier fanothiff-Uffens: Shallow to deep, well drained, sandy clay loam, clay loam, very fine sandy loan, and fine aandy loan soils formed on level to moderately sloping mesas and valleys from alluvium and residen derived primarily from shale and siltstone. | buerfano Muff Uffens | $\begin{gathered} 10-20 \\ 20-40 \\ 60+ \end{gathered}$ | $\begin{aligned} & 0-3 \\ & 0-8 \\ & 0-5 \end{aligned}$ | $\begin{aligned} & \geqslant 6 \\ & >6 \\ & >6 \end{aligned}$ | $\begin{aligned} & 7.9-9.0 \\ & 7.4-8.4 \\ & 7.4-8.4 \end{aligned}$ | $\begin{aligned} & 24 \\ & 2-4 \\ & 4-8 \end{aligned}$ | $\begin{aligned} & \mathrm{D} \\ & \mathrm{D} \\ & \mathrm{D} \end{aligned}$ | $\begin{aligned} & 4 \mathrm{~L} \\ & 3 \\ & 3 \end{aligned}$ | $\begin{aligned} & .32 \\ & .28 \\ & .20 \end{aligned}$ | $\begin{aligned} & 1 \\ & 3 \\ & 1 \end{aligned}$ | Hoderate wind and water erosion hazand, topsoil is poor due to shallowness and excess salt/sodium (huff portioo-area reclaim, 8 inch precip itstion zone. Shrink-swell potential is lov to moderate, exchangeable sodium content is $25-75 \%$, high cor |
| 19.2-22.7 | SC | Sheppard-therfano-rbtal: Deep and shallow, somenhat excessively and well drained, loamy fine sand, fine sand, sandy clay losan, clay loam, and clay soils formed on level to moderately sloping valley bottans, fans, mesas, and plateaus from eolian, allevial, and residual materials derived from sandstone, shale, and siltstone. | Sheppard Huerfano Notal | $\begin{gathered} 60+ \\ 10-20 \\ 60 \pm \end{gathered}$ | $\begin{aligned} & 2-8 \\ & 0-3 \\ & 0-2 \end{aligned}$ | $\begin{aligned} & >6 \\ & >6 \\ & >6 \end{aligned}$ | $\begin{aligned} & 7.9-8.4 \\ & 7.9-9.0 \\ & 7.9-9.0 \end{aligned}$ | $\begin{aligned} & <2 \\ & >4 \\ & 4-8 \end{aligned}$ | $\begin{aligned} & \text { A } \\ & \text { D } \\ & \text { D } \end{aligned}$ | $\begin{aligned} & 2 \\ & 4 \mathrm{~L} \\ & 4 \mathrm{~L} \end{aligned}$ | $\begin{aligned} & .15 \\ & .32 \\ & .32 \end{aligned}$ | $\begin{aligned} & 5 \\ & 1 \\ & 5 \end{aligned}$ | Moderate to high wind erosion hazard, low to moderate water erosion hazard, topsoil is fair to poor, 8 inch precipitation mone. Sharink-quell potertial is low to high, exchangeable sodium content ranges from 15-75\% for Hierfano-hbtal portion, high corrosion hazard to uncoated steel. |
| 22.7-22.8 | $D_{1}$ | Doak-Uffens: Deep, well drained, very fine sandy loan, sandy clay loam, fine sandy loam, and clay loan soils formed on level to gently sloping mesas and plateaus from alluviun derived primarily from sandstone and shale. | Daak Uffens | $\begin{aligned} & 60+ \\ & 60+ \end{aligned}$ | $\begin{aligned} & 0-3 \\ & 0-3 \end{aligned}$ | $\begin{aligned} & >6 \\ & >6 \end{aligned}$ | $\begin{aligned} & 7.4-8.4 \\ & 7.4-8.4 \end{aligned}$ | $\begin{aligned} & <2 \\ & 4-8 \end{aligned}$ | $\begin{aligned} & \text { B } \\ & \text { D } \end{aligned}$ | $\begin{aligned} & 3 \\ & 3 \end{aligned}$ | $\begin{aligned} & .37 \\ & .20 \end{aligned}$ | $5$ | Hoderate wind and water erosion hazard, topeoil is fair to poor (excess clay or salt/sodium), 8 inch precipitation rone. Strink-swell potential is low to moderate, high corrosion hazard to unooated steel. |
| 22.8-22.85 | SC | Sheppard-Hherfano-Notal: Deep and shallow, sonewhat excessively and well drained, loary fine sand, fine and, sandy clay lam, clay loan, and clay soils formed on level to moderately sloping valley bottons, fans, pesas, and plateaus from eolian, allurvial, and residual materials derived from sandstone, shale, and siltstone. | Sheppard Buerfano Notal | $\begin{gathered} 60+ \\ 10-20 \\ 60+ \end{gathered}$ | $\begin{aligned} & 2-8 \\ & 0-3 \\ & 0-2 \end{aligned}$ | $\begin{aligned} & >6 \\ & >6 \\ & >6 \end{aligned}$ | $\begin{aligned} & 7.9-8.4 \\ & 7.9-9.0 \\ & 7.9-9.0 \end{aligned}$ | $\begin{aligned} & <2 \\ & >4 \\ & 4-8 \end{aligned}$ | $\begin{aligned} & \mathbf{A} \\ & \mathrm{D} \\ & \mathrm{D} \end{aligned}$ | $\begin{aligned} & 2 \\ & 4 \mathrm{~L} \\ & 4 \mathrm{~L} \end{aligned}$ | $\begin{aligned} & .15 \\ & .32 \\ & .32 \end{aligned}$ | $\begin{aligned} & 5 \\ & 1 \\ & 5 \end{aligned}$ | Moderate to high vind erosion hazard, low to moderate water erosion hazard, toproil is fair to poor, 8 inch precipitation zone. Starink-quell potertial is low to high, exchangeable sodium content ranges from 15-75\% for Huerfano-Notal portion, high corrosion hazard to uncoated steel. |
| 22.85-22.9 | HII | Herfanothiff-Uffens: Shallow to deep, well drained, sandy clay loam, clay loam, very fine sandy loant, and fine sandy loan soils formed on level to moderately sloping mesas and valleys from alluvium and residam derived primarily from shale and siltstone. | Huerfano Muff Uffens | $\begin{gathered} 10-20 \\ 20-40 \\ 60+ \end{gathered}$ | $\begin{aligned} & 0-3 \\ & 0-8 \\ & 0-5 \end{aligned}$ | $\begin{aligned} & >6 \\ & >6 \\ & >6 \end{aligned}$ | $\begin{aligned} & 7.9-9.0 \\ & 7.4-8.4 \\ & 7.4-8.4 \end{aligned}$ | $\begin{aligned} & 24 \\ & 2-4 \\ & 4-8 \end{aligned}$ | $\begin{aligned} & \mathrm{D} \\ & \mathrm{D} \\ & \mathrm{D} \end{aligned}$ | $\begin{aligned} & 4 \mathrm{~L} \\ & 3 \\ & 3 \end{aligned}$ | $\begin{aligned} & .32 \\ & .28 \\ & .20 \end{aligned}$ | $\begin{aligned} & 1 \\ & 3 \\ & 1 \end{aligned}$ | Moderate wind and water erosion hazard, topsoil is poor due to shallowness and excess salt/sodium (Miff portior-area reclaim), 8 inch precipitation zone. Shrink-swell potential is low to moderate, exchangeable sodinm content is $25-75 \%$, high corrosion hazard to uncoated steel. |
| 22.9-22.95 | Du | Doak-Uffeng: Deep, well drained, very fine sandy loam, sandy clay loan, fine sandy loam, and clay loan soils formed on level to gently sloping mesas and plateans from alluvium derived primarily from sandstone and shale. | Doak Uffens | $\begin{aligned} & 60+ \\ & 60+ \end{aligned}$ | $\begin{aligned} & 0-3 \\ & 0-3 \end{aligned}$ | $\begin{aligned} & >6 \\ & >6 \end{aligned}$ | $\begin{aligned} & 7.4-8.4 \\ & 7.4-8.4 \end{aligned}$ | $\begin{aligned} & <2 \\ & 4-8 \end{aligned}$ | $\begin{aligned} & \text { B } \\ & \text { D } \end{aligned}$ | $\begin{aligned} & 3 \\ & 3 \end{aligned}$ | $\begin{aligned} & .37 \\ & .20 \end{aligned}$ | $\begin{aligned} & 5 \\ & 1 \end{aligned}$ | Hoderate wind and water erosion hazard, topsoil is fair to poor (exces6 clay or salt/aodium), 8 inch precipitation zone. Shrink-suell potential is low to moderate, high corrosion |



| Milepost | Map Syubol | Soil Phase, Series, Associatipn, or Complex and Description | Soil Phase or Series | Depth to Bedrock (inches) | Slope <br> (\%) | Depth to High Water Table (feet) | Soil Reaction (pH) | Salinity (umhos/ cm) | Bydrologic Grow | $\begin{gathered} \text { WBG } \\ \text { Class } \end{gathered}$ | 'K' | 'T' | Comments |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| 22.95-23.0 | Sd | Sheppard Hayqueen-Shiprock: Deep, somewhat excessively and well drained, loany fine sand, fine sand, and fine sandy loam soils fonsed on level to moderately sloping mesas and plateaus from allurvial and eolian materials derived from sandstone, shale, and mixed sources. | Shepperd Mayqueen Shiprock | $\begin{aligned} & 60+ \\ & 60+ \\ & 60+ \end{aligned}$ | $\begin{aligned} & 5-8 \\ & 2-8 \\ & 0-5 \end{aligned}$ | $\begin{aligned} & >6 \\ & >6 \\ & >6 \end{aligned}$ | $\begin{aligned} & 7.9-8.4 \\ & 7.9-8.4 \\ & 7.4-8.4 \end{aligned}$ | $\begin{aligned} & <2 \\ & <2 \\ & <2 \end{aligned}$ | $\begin{aligned} & \text { A } \\ & \text { B } \\ & \text { B } \end{aligned}$ | $\begin{aligned} & 2 \\ & 2 \\ & 3 \end{aligned}$ | $\begin{aligned} & .15 \\ & .24 \\ & .24 \end{aligned}$ | $\begin{aligned} & 5 \\ & 5 \\ & 5 \end{aligned}$ | Hoderate to high vind erosion hazard, low to moderate water erosion hazard, topsoil is poor to good, 8 inch precipitation zone. Strink-awell poterr tial is low, high corrosion hazard to uncoated steel. |
| 23.0-23.3 | $D_{1}$ | Doak-Uffens: Deep, well drained, very fine sandy loam, sandy clay loam, fine sandy loan, and clay loan soils formed on level to gently sloping mesas and plateaus from alluvium derived primarily frum sandstone and shale. | Doak Uffens | $\begin{aligned} & 60+ \\ & 60+ \end{aligned}$ | $\begin{aligned} & 0-3 \\ & 0-3 \end{aligned}$ | $\begin{aligned} & >6 \\ & >6 \end{aligned}$ | $\begin{aligned} & 7.4-8.4 \\ & 7.4-8.4 \end{aligned}$ | $\begin{aligned} & <2 \\ & 4-8 \end{aligned}$ | $\begin{aligned} & \mathrm{B} \\ & \mathrm{D} \end{aligned}$ | $\begin{aligned} & 3 \\ & 3 \end{aligned}$ | $\begin{aligned} & .37 \\ & .20 \end{aligned}$ | $\begin{aligned} & 5 \\ & 1 \end{aligned}$ | Hoderate wind and water erosion hazand, topsoil is fair to poor (excess clay or salt/sodium), 8 inch precipitstion zone. Strink-swell potential is low to moderate, high corrosion hazard to uncosted steel. |
| 23.3-23.4 | SC | Sheppard-Hierfano-Notal: Deep and shallow, sanewhat excessively and well drained, laany fine sand, fine sand, sandy clay loam, clay loam, and clay soils fomed on level to moderately sloping valley bottoms, fans, wesas, and plateaus from ealian, alluvial, and residual materials derived from sandstone, shale, and siltstone. | Sheppard Huerfano Notal | $\begin{gathered} 60+ \\ 10-20 \\ 60+ \end{gathered}$ | $\begin{aligned} & 2-8 \\ & 0-3 \\ & 0-2 \end{aligned}$ | $\begin{aligned} & >6 \\ & >6 \\ & >6 \end{aligned}$ | $\begin{aligned} & 7.9-8.4 \\ & 7.9-9.0 \\ & 7.9-9.0 \end{aligned}$ | $\begin{aligned} & 82 \\ & \times 4 \\ & 4-8 \end{aligned}$ | $\begin{aligned} & \mathrm{A} \\ & \mathrm{D} \\ & \mathrm{D} \end{aligned}$ | $\begin{aligned} & 2 \\ & 4 \mathrm{~L} \\ & 4 \mathrm{~L} \end{aligned}$ | $\begin{aligned} & .15 \\ & .32 \\ & .32 \end{aligned}$ | $\begin{aligned} & 5 \\ & 1 \\ & 5 \end{aligned}$ | Moderate to high wind erosion hazard, low to moderate water erosion hazard, topsoil is fair to poor, 8 inch precipitation zone. Shrink-surell potertial is low to high, exchangeable sodium content ranges from 15-75\% for hierfano-Abtsl portion, high corrosion hazard to uncoated steel. |
| 23.4-23.5 | HII | Herfanothiff-Uffens: Shallow to deep, well drained, sandy clay loam, clay loom, very fine sandy loan, and fine sandy loam soils formed on level to moderately sloping besas and valleys from alluvium and residana derived primarily from shale and siltstone. | Huerfano Muff <br> Uffens | $\begin{gathered} 10-20 \\ 20-40 \\ 60+ \end{gathered}$ | $\begin{aligned} & 0-3 \\ & 0-8 \\ & 0-5 \end{aligned}$ | $\begin{aligned} & >6 \\ & >6 \\ & >6 \end{aligned}$ | $\begin{aligned} & 7.9-9.0 \\ & 7.4-8.4 \\ & 7.4-8.4 \end{aligned}$ | $\begin{aligned} & >4 \\ & 2-4 \\ & 4-8 \end{aligned}$ | $\begin{aligned} & \mathrm{D} \\ & \mathrm{D} \\ & \mathrm{D} \end{aligned}$ | $\begin{aligned} & 4 \mathrm{~L} \\ & 3 \\ & 3 \end{aligned}$ | $\begin{aligned} & .32 \\ & .28 \\ & .20 \end{aligned}$ | $\begin{aligned} & 1 \\ & 3 \\ & 1 \end{aligned}$ | Hoderate vind and water erosion hazard, topsoil is poor due to shallow ness and excess salt/sodium (Muff portior-area reclaim), 8 inch precipitation zone. Sturink-owell potential is low to moderate, exchangeable sodium content is $25-75 \%$, high cor rosion hazard to uncoated steel. |
| 23.5-23.55 | Sd | Sheppard-Hayqueer-Shiprock: Deep, samewhat excessively and well drained, laany fine sand, fine sand, and fine sandy loam soils formed on level to moderately sloping mesas and plateaus from alluvial and eolian materisls derived from sandstone, shale, and mixed sources. | Sheppard Mayqueen Shiprock | $\begin{aligned} & 60+ \\ & 60+ \\ & 60+ \end{aligned}$ | $\begin{aligned} & 5-8 \\ & 2-8 \\ & 0-5 \end{aligned}$ | $\begin{aligned} & >6 \\ & >6 \\ & >6 \end{aligned}$ |  | $\begin{aligned} & <2 \\ & <2 \\ & <2 \end{aligned}$ | $\begin{aligned} & \mathrm{A} \\ & \mathrm{~B} \\ & \mathrm{~B} \end{aligned}$ | $\begin{aligned} & 2 \\ & 2 \\ & 3 \end{aligned}$ | $\begin{aligned} & .15 \\ & .24 \\ & .24 \end{aligned}$ | $\begin{aligned} & 5 \\ & 5 \\ & 5 \end{aligned}$ | Moderate to high wind erosion hazard, low to moderate water erosion hazard, topsoil is poor to good, 8 inch precipitation zone. Shrink-swell potertial is low, high corrosion hazard to uncoated steel. |
| 23.55-23.6 | Dı | Doak-Uffens: Deep, well drained, very fine sandy loam, sandy clay loan, fine sandy loam, and clay loan soils formed on level to gently sloping mesas and plateans from alluviur derived primarily from sandstone and shale. | Doak <br> Uffens | $\begin{aligned} & 60+ \\ & 60+ \end{aligned}$ | $\begin{aligned} & 0-3 \\ & 0-3 \end{aligned}$ | $\begin{aligned} & >6 \\ & >6 \end{aligned}$ | $\begin{aligned} & 7.4-8.4 \\ & 7.4-8.4 \end{aligned}$ | $\begin{aligned} & 8 \\ & 4-8 \end{aligned}$ | $\begin{aligned} & \mathrm{B} \\ & \mathrm{D} \end{aligned}$ | $\begin{aligned} & 3 \\ & 3 \end{aligned}$ | $\begin{aligned} & .37 \\ & .20 \end{aligned}$ | $\begin{aligned} & 5 \\ & 1 \end{aligned}$ | Koderate vind and water erosion hazard, topsoil is fair to poor (excess clay or salt/sodinm), 8 inch precipitstion mone. Shrink-swell potential is low to moderate, high corrosion hazard to uncoated steel. |
| 23.6-23.7 | Av | Avalon: Deep, well drained, sandy loan, and fire sandy loan soils formed on gently sloping mesas and plateaus from alluvial and eolian materials derived primarily from sandatone and shale. | Avalon | $60+$ | 2-5 | 76 | 7.9-8.4 | 2-8 | B | 3 | . 37 | 3 | Moderate wind and water erosion hazard, topsoil is fair (excess salt), 8 inch precipitation zone. Shrinksuell potential is low, eoil is slightly saline, high corrosion hazard to uncoated steel. |
| 23.7-23.8 | Sd | Sheppard-Hayqueer-Shiprock: Deep, scmewhat excessively and well drained, loany fine sand, fine sand, and fine sandy loem soils formed on level to moderately sloping mesas and platears from sllivial and | Sheppard Mayqueen Shiprock | $\begin{aligned} & 60+ \\ & 60+ \\ & 60+ \end{aligned}$ | $\begin{aligned} & 5-8 \\ & 2-8 \\ & 0-5 \end{aligned}$ | $\begin{aligned} & >6 \\ & >6 \\ & >6 \end{aligned}$ |  | $\begin{aligned} & <2 \\ & <2 \\ & <2 \end{aligned}$ | $\begin{aligned} & \text { A } \\ & \text { B } \\ & \text { B } \end{aligned}$ | $\begin{aligned} & 2 \\ & 2 \\ & 3 \end{aligned}$ | $\begin{aligned} & .15 \\ & .24 \\ & .24 \end{aligned}$ | $\begin{aligned} & 5 \\ & 5 \\ & 5 \end{aligned}$ | Moderate to high vind erosion hazard, low to moderate water erosion hazard, topsoil is poor to good, 8 inch precipitation zone. Shrink-swell potertial is low, high corrosion hazard to |

Table 2. characteristics of tir soins identified alowg min hater pipeing boitr pl (cont inued)

| Milepost | $\underset{\text { Syub }}{\substack{\text { sup } \\ \hline}}$ | Soil Phase, Series, Asocciation, or Complex and Description | Soil Phase or Series | Depth to Betrock (inches) | $\begin{aligned} & \text { Slope } \\ & (\text { I) } \end{aligned}$ | Depth to High Wate Table (feet) | $\underset{\substack{\text { Reaction } \\(\mathrm{pH})}}{\text { Soil }}$ (pH) | Salinity (umhor) am) | Hydrologic Group | $\underset{\substack{\text { KECG } \\ \text { Class }}}{ }$ | 'K' | 'T' | Caments |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| 23.8-23.85 | Av | Avalon: Deep, well drained, sandy loan, and fine sandy loam soils formed on gently sloping mesas and plateaus from alluvisl and eolian materials derived prinarily from sandstone and shale. | Avalon | $60+$ | 2-5 | > | 7.9-8.4 | 2-8 | B | 3 | 37 | 3 | Moderate wind and water erosion hazard, topsoil is fair (excess salt), 8 inch precipitation zone. Shrinksuell potential is low, will is slightly saline, high corrosion hazard to uncoated steel. |
| 23.85-23.95 | Sd | Sheppant-Msyqueer-Shiprock: Deep, sanewhat excessively and well drained, loany fine sand, fine sand, and fine sandy loam soils formed on level to moderately sloping mesas and plateaus fran allivisl and eolian materials derived from sandatone, shale, and mixed sources. | Sheppand <br> Mayqueen <br> Shiprock | $\begin{aligned} & 60 \\ & 60+ \\ & 60+ \end{aligned}$ | $\begin{aligned} & 5-8 \\ & 2-8 \\ & 0-5 \end{aligned}$ | $\begin{aligned} & >6 \\ & >6 \\ & >6 \end{aligned}$ | $\begin{aligned} & 7.9-8.4 \\ & 7.9-9.4 \\ & 7.4-8.4 \end{aligned}$ | $\begin{aligned} & <2 \\ & <2 \\ & <2 \end{aligned}$ | $\begin{aligned} & A \\ & B \\ & B \end{aligned}$ | $\begin{aligned} & 2 \\ & 2 \\ & 3 \end{aligned}$ | .15 .24 .24 | $\begin{aligned} & 5 \\ & 5 \\ & 5 \end{aligned}$ | Moderate to high wind erosion hazard, low to moderate water erosion hazard, topsoil is poor to good, 8 inch precipitation zone. Starink-awell poter tial is low, high corrosion hazard to uncoated steel. |
| 23.95-24.0 | Av | Avalon: Deep, well drained, sandy loam, and fine sandy loan soils formed on gently sloping mesas and plateaus from alluvial and eolian materials derived primarily from sandstone and shale. | Avalon | $60+$ | 2-5 | خ | 7.9-8.4 | 2-8 | B | 3 | . 37 | 3 | Hoderate wind and water erosion hazard, topsoil is fair (excess salt), 8 inch precipitstion zone. Strinkswell potential is low, soil is slightly aaline, high corrosion hazard to uncoated steel. |
| 24.0-24.9 | $\begin{gathered} \mathrm{Sd} / \mathrm{so} / \\ \mathrm{Sr} \end{gathered}$ | Sheppard-Shiprock-Hayqueen: Deep, sanewhat excessively and well drained, loany fine sand, fine sand, fine sandy loam, sandy loam, and sandy clay loan soils formed on level to moderately sloping meass and plateans from alluvial and eolian materials derived from samdstone, shale, and mixed sources. | Sheppard Shiprock Mayqueen | $\begin{aligned} & 60+ \\ & 60+ \\ & 60+ \end{aligned}$ | $\begin{aligned} & 5-8 \\ & 0-5 \\ & 2-8 \end{aligned}$ | $\begin{aligned} & \gamma 6 \\ & \gamma 6 \\ & \gamma 6 \end{aligned}$ | $\begin{aligned} & 7.9-8.4 \\ & 7.4-8.4 \\ & 7.9-8.4 \end{aligned}$ | $\begin{aligned} & >2 \\ & >2 \\ & >2 \end{aligned}$ | $\begin{aligned} & A \\ & B \end{aligned}$ | $\begin{aligned} & 2 \\ & 3 \\ & 2 \end{aligned}$ | $\begin{aligned} & .15 \\ & .24 \\ & .24 \end{aligned}$ | $\begin{aligned} & 5 \\ & 5 \\ & 5 \end{aligned}$ | High and moderate wind erosion hazand, low to moderate water erosion hazard, poor to good topsoil, 8 inch precipitation zone. Shrink-swell potential is low, high corrosion hazard to uncoated steel. |
| 24.9-25.0 | Av | Avalon: Deep, well drained, sandy loam, and fine sandy loam soils formed on gently sloping mesas and plateaus from alluvial and eolian materisls derived primarily from sandstone and shale. | Avalon | $60+$ | 2-5 | > | 7.9-8.4 | 2-8 | B | 3 | . 37 | 3 | Moderate wind and water erosion hazard, topsoil is fair (excess salt), 8 inch precipitation zone. Shrinkswell potential is low, soil is slightly saline, high corrosion hazard to uncoated steel. |
| 25.0-25.3 | Sr | Shiprock (variant): Deep, well drained, sandy lomm, fine sandy loam, and sandy clay loam soils formed on level to gently sloping mesas and plateaus frow alluvial and eolian materisls derived primarily from sandstone and shale. | Shiprock | $60+$ | 0-3 | 26 | 7.9-8.4 | < | в | 3 | . 24 | 5 | Moderate wind and water erosion haz and, good topsoil, 8 inch precipitation zone. Strink-owell potential is low, high corrosion hazard to uncoated steel. |
| 25.3-26.1 | Sd | Sheppard-Meyqueen-Shiprock: Deep, bonewhat excessively and well drained, loany fine sand, $f$ ine sand, and fine sandy loan soils formed on level to moderately sloping mesas and plateans from alluvial and eolian materials derived from sandstone, shale, and mixed sources. | Sheppard Mayqueen Shiprock | $\begin{aligned} & 60+ \\ & 60+ \\ & 60+ \end{aligned}$ | $\begin{aligned} & 5-8 \\ & 2-8 \\ & 0-5 \end{aligned}$ | $\begin{aligned} & >6 \\ & >6 \\ & >6 \end{aligned}$ | $\begin{aligned} & 7.9-8.4 \\ & 7.9-8.4 \\ & 7.4-8.4 \end{aligned}$ | $\begin{aligned} & <2 \\ & 2 \\ & <2 \end{aligned}$ |  | $2$ | $\begin{aligned} & .15 \\ & .24 \\ & .24 \end{aligned}$ | $\begin{aligned} & 5 \\ & 5 \\ & 5 \end{aligned}$ | Moderate to high wind erosion hazard, low to moderate water erosion hazard, topsoil is poor to good, 8 inch precipitation zone. Shrink-swell potertial is low, high corrosion hazard to uncoated steel. |
| 26.1-26.25 | Du | Doak-Uffens: Deep, well drained, very fine sandy loan, sandy clay loam, fine sandy loam, and clay loan soils formed on level to gently sloping mesas and plateans fron slluvinu derived primarily from bandstone and shale. | Doak Uffens | $\begin{aligned} & 60+ \\ & 60+ \end{aligned}$ | $\begin{aligned} & 0-3 \\ & 0-3 \end{aligned}$ | $\underset{\gamma}{>}$ | $\begin{aligned} & 7.4-8.4 \\ & 7.4-8.4 \end{aligned}$ | $\begin{aligned} & <2 \\ & 4-8 \end{aligned}$ | в | $3$ | $\begin{aligned} & .37 \\ & .20 \end{aligned}$ | $\begin{aligned} & 5 \\ & 1 \end{aligned}$ | Moderate wind and water erosion hazard, topsoil is fair to poor (excess clay or salt/sodium), 8 inch precipitation zone. Shrink-suell potential is low to moderate, high corrosion hazard to uncosted steel. |



| Milepost | Map Syubol | Soil Phase, Series, Association, or Complex and Description | Soil Phase or Series | Depth to Bedrock (inches) | Slope <br> (z) | Depth to High Water Table (feet) | Soil Reaction (p1) | Salinity (romios) cas) | Hydrologic Group | $\underset{\text { Clabs }}{\text { LEB }}$ | 'r' | ' ${ }^{\prime}$ ' | Comments |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| 26.25-28.4 | Sd/8o | Sheppard-Hayqueen-Shiprock: Deep, somwhat excessively and well drained, loany fine and, fine sand, and fine sandy loas soils formed an level to moderately sloping mesas and plateaus from alluvial and eolian materisls derived from sandstone, shale, and mixed scurces. | Sheppard Mayqueen Shiprock | $\begin{aligned} & 60+ \\ & 60+ \\ & 60+ \end{aligned}$ | $\begin{aligned} & 5-8 \\ & 2-8 \\ & 0-5 \end{aligned}$ | $\begin{aligned} & 26 \\ & 26 \\ & 26 \end{aligned}$ | $\begin{aligned} & 7.9-8.4 \\ & 7.9-8.4 \\ & 7.4-8.4 \end{aligned}$ | $\begin{aligned} & <2 \\ & <2 \\ & <2 \end{aligned}$ | $\begin{aligned} & \mathbf{A} \\ & \text { B } \\ & \text { B } \end{aligned}$ | $\begin{aligned} & 2 \\ & 2 \\ & 3 \end{aligned}$ | $\begin{aligned} & .15 \\ & .24 \\ & .24 \end{aligned}$ | $\begin{aligned} & 5 \\ & 5 \\ & 5 \end{aligned}$ | Moderate to high vind erosion hazard, low to moderate water erosion hazard, topeoil is poor to good, 8 inch precipitation mone. Starink-avell potential is low, high corrosion hazard to uncoated steel. |
| 28-4-28.85 | $s C$ | Sheppard-therfano-thotal: Deep and shallow, sonewhat excessively and well drained, loamy fine sand, fine sand, andy clay loam, clay loam, and clay soils formed an level to moderately sloping valley bottows, fans, mesas, and platesus fromeolian, allivial, and residual materials derived from aandstone, shale, and siltstone. | Sheppard Huerfano Hotal | $\begin{gathered} 60+ \\ 10-20 \\ 60+ \end{gathered}$ | $\begin{aligned} & 2-8 \\ & 0-3 \\ & 0-2 \end{aligned}$ | $\begin{aligned} & >6 \\ & >6 \\ & >6 \end{aligned}$ | $\begin{aligned} & 7.9-8.4 \\ & 7.9-9.0 \\ & 7.9-9.0 \end{aligned}$ | $\begin{aligned} & <2 \\ & >4 \\ & 4-8 \end{aligned}$ | $\begin{aligned} & A \\ & \mathrm{D} \\ & \mathrm{D} \end{aligned}$ | $\begin{aligned} & 2 \\ & 4 \mathrm{~L} \\ & 4 \mathrm{~L} \end{aligned}$ | $\begin{aligned} & .15 \\ & .32 \\ & .32 \end{aligned}$ | $\begin{aligned} & 5 \\ & 1 \\ & 5 \end{aligned}$ | Moderate to high vind erosica hazard, low to moderate water erosion hazard, topsoil is fair to poor, 8 inch precipitation zove. Sturink-awell poter tial is low to high, exchangesble sodium cantent ranges fran 15-75\% for Huerfano-Hotal portion, high corrosion hazard to uncoated ateel. |
| 28.85-29.15 | 5 Sd | Sheppard trayqueen-Shiprock: Deep, samewhat excessively and well drained, loamy fine sand, fine sand, and fine sandy loen soils formed on level to moderately sloping mesas and plateaus from alluvial and solisn materials derived from sandstons, ahale, and mixed sources. | Sheppard Mayqueea Shiprock | $\begin{aligned} & 60+ \\ & 60+ \\ & 60+ \end{aligned}$ | $\begin{aligned} & 5-8 \\ & 2-8 \\ & 0-5 \end{aligned}$ | $\begin{aligned} & 76 \\ & 76 \\ & 76 \end{aligned}$ | 7.9-8.4 <br> 7.9-8.4 <br> 7.4-8.4 | $\begin{aligned} & <2 \\ & <2 \\ & <2 \end{aligned}$ | $\begin{aligned} & \mathrm{A} \\ & \mathrm{~B} \\ & \mathrm{~B} \end{aligned}$ | $\begin{aligned} & 2 \\ & 2 \\ & 3 \end{aligned}$ | $\begin{aligned} & .15 \\ & .24 \\ & .24 \end{aligned}$ | $\begin{aligned} & 5 \\ & 5 \\ & 5 \end{aligned}$ | Moderate to high wind erosion hazard, low to moderate water erosion hazard, topeoil is poor to good, 8 inch precipitation zone. Sturink-avell potertial is low, high corrosion hazard to umcoated steel. |
| 29.15-29.35 | SC | Sheppard-Hierfano-Notal: Deep and shallow, somenhat excessively and well drainod, loany fine and, fine aand, andy clay loan, clay loam, and clay soils formed an level to moderately sloping valley bottors, fans, mesas, and platesus fromeolian, allivial, and residual materials derived from sandstone, shale, and siltstone. | Sheppard Huerfano Notal | $\begin{gathered} 60+ \\ 10-20 \\ 60+ \end{gathered}$ | $\begin{aligned} & 2-8 \\ & 0-3 \\ & 0-2 \end{aligned}$ | $\begin{aligned} & 76 \\ & 26 \\ & 76 \end{aligned}$ | $\begin{aligned} & 7.9-8.4 \\ & 7.9-9.0 \\ & 7.9-9.0 \end{aligned}$ | $\begin{aligned} & Q \\ & \times 4 \\ & 4-8 \end{aligned}$ | $\begin{aligned} & \mathrm{A} \\ & \mathrm{D} \\ & \mathrm{D} \end{aligned}$ | $\begin{aligned} & 2 \\ & 4 \mathrm{~L} \\ & 4 \mathrm{~L} \end{aligned}$ | $\begin{aligned} & .15 \\ & .32 \\ & .32 \end{aligned}$ | $\begin{aligned} & 5 \\ & 1 \\ & 5 \end{aligned}$ | Hoderate to high wind erosion hazard, low to moderate water erosion hazard, topooil is fair to poor, 8 inch precipitation zane. Sarink-avell potear tial is low to high, exchangeable oodium content ranges from 15-75\% for Huerfamo-total portion, high corrosion harard to uncoated steel. |
| 29.35-29.6 | Sd | Sheppard-Mayqueen-Shiprock: Deep, somewhat excessively and well drained, losmy fine and, fine aand, and fine sandy loan soil. formed on level to moderately sloping meses and plateaus from alluvial and eolian materials derived from andetona, shale, and mixed aources. | Sheppand Mayqueen Shiprock | $\begin{aligned} & 60+ \\ & 60+ \\ & 60+ \end{aligned}$ | $\begin{aligned} & 5-8 \\ & 2-8 \\ & 0-5 \end{aligned}$ | $\begin{aligned} & 76 \\ & 76 \\ & 76 \end{aligned}$ | $\begin{aligned} & 7.9-8.4 \\ & 7.9-8.4 \\ & 7.8-8.4 \end{aligned}$ | $\begin{aligned} & <2 \\ & <2 \\ & <2 \end{aligned}$ | $\begin{aligned} & \mathrm{A} \\ & \mathrm{~B} \\ & \mathrm{~B} \end{aligned}$ | $\begin{aligned} & 2 \\ & 2 \\ & 3 \end{aligned}$ | $\begin{aligned} & .15 \\ & .24 \\ & . .44 \end{aligned}$ | $\begin{aligned} & 5 \\ & 5 \\ & 5 \end{aligned}$ | Moderate to high wind erosion havard, low to moderate witer erosion hazard, topsoil is poor to good, 8 inch precipitation rone. Shrink-avell poter tial is low, high corrosion harard to uncoated ateel. |
| 29.6-30.8 | 9 | Sheppard-Huerfano-Notal: Deep and shallow, sconewhat excessively and well drained, loavy fine sand, fine sand, asndy clay lomas, clay loam, and clay soils formed on level to moderately sloping valley bottons, fans, mesas, and plateass fromeolian, alliwial, and residual materiala derived from andstone, shale, and siltatone. | Sheppard Buerfano Hotal | $\begin{gathered} 60+ \\ 10-20 \\ 60+ \end{gathered}$ | $\begin{aligned} & 2-8 \\ & 0-3 \\ & 0-2 \end{aligned}$ | $\begin{aligned} & >6 \\ & >6 \\ & >6 \end{aligned}$ | $\begin{aligned} & 7.9-8.4 \\ & 7.9-9.0 \\ & 7.9-9.0 \end{aligned}$ | $\begin{aligned} & 2 \\ & 24 \\ & 488 \end{aligned}$ | $\begin{aligned} & \mathbf{A} \\ & \mathrm{D} \\ & \mathrm{D} \end{aligned}$ | $\begin{aligned} & 2 \\ & 4 L \\ & 4 J \end{aligned}$ | $\begin{aligned} & .15 \\ & .32 \\ & .32 \end{aligned}$ | $\begin{aligned} & 5 \\ & 1 \\ & 5 \end{aligned}$ | Moderate to high wind erosion haxard, low to moderate water erosion hazard, topsoil is fair to poor, 8 inch precipitation mone. Shrink-awell poter tial is low to high, exchsngeable sodium content ramges from 15-75I for Huerfmo-Hotal portion, high corrosion hazard to uncoated steel. |
| 30.8-33.3 | B4 | Badland: Moderately sloping to extrenly steep, monstony, barren absle uplande that are dissected by deep intemittent drainageayza and galliea. | Radland | 0 | 5-80 | m | ma | M | M | M | B4 | 岰 | 8 inch precipitatioa mone. |

Table 2. charactraistics of tip sons mentified along mann hatre pipline ravir pl (contimed)

| Milepost | $\operatorname{Map}_{\text {Syutiol }}^{\text {man }}$ | Soil Phase, Seriea, Associstipa, or Cauplex and Description | Soil Phage or Series | Depth to Bedrock (inches) | $\begin{aligned} & \text { Slope } \\ & (\mathrm{I}) \end{aligned}$ | Depth to High hater Table (feet) | $\underset{\substack{\text { Reaction } \\(\mathrm{pH})}}{\text { Soil }}$ | $\begin{gathered} \text { Salinity y } \\ (\text { mimhos/ } \\ \text { cal }) \end{gathered}$ | $\begin{aligned} & \text { Hydro- } \\ & \text { logic } \\ & \text { Group } \end{aligned}$ | $\begin{gathered} \text { KBG } \\ \text { Class } \end{gathered}$ | 'R' | 'T' | Camments |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| 33.3-35.0 | S | Sheppard-therfano-ibtal: Deep and shallow, somentat excessively and well drained, loasiry fine sand, fine sand, sandy clay loam, clay loan, and clay soils formed oo level to moderately sloping valley bottons, fans, mesas, and plateass from eolian, alluvis1, and residual materials derived from | Sheppard <br> Bierfano <br> Notal | $\begin{gathered} 60+ \\ 10-20 \\ 60+ \end{gathered}$ | $\begin{aligned} & 2-8 \\ & 0-3 \\ & 0-2 \end{aligned}$ | $\begin{aligned} & \gamma 6 \\ & \gamma \\ & \gamma 6 \end{aligned}$ | $\begin{aligned} & 7.9-8.4 \\ & 7.99 .0 \\ & 7.9-9.0 \end{aligned}$ | $\begin{aligned} & 8 \\ & \times 4 \\ & 48 \end{aligned}$ | $\begin{aligned} & A \\ & D \end{aligned}$ | $\begin{aligned} & 2 \\ & 4 \mathrm{~L} \\ & 4 \mathrm{~L} \end{aligned}$ | $\begin{aligned} & .15 \\ & .32 \\ & .32 \end{aligned}$ | $\begin{aligned} & 5 \\ & 1 \\ & 5 \end{aligned}$ | Moderate to high wind erosion hazard, low to moderate water erosion hazard, topsoil is fair to poor, 8 inch precipitation zone. Shrink-owell potertisl is low to high, exchangeable sodim content ranges from 15-75\% for Huerfano-Notal portion, high corrosion hazard to uncoated steel. |
| 35.0-35.4 | BA | Radland: Moderately sloping to extrenely steep, nonstony, barren shale uplands that are dissected by deep internittent drainageays and gullies. | Badland | 0 | 5-80 | M | M | M | M | N | M | M | 8 inch precipitation zone. |
| 35.4-35.95 | SC | Sheppard-Hherfano-tibtal: Deep and shallow, samenthat excessively and well drained, loanry fine sand, fine sand, sandy clay loam, clay loam, and clay soils formed oa level to uoderately sloping valley bottcass, fans, mesas, and plateans from eolian, alluvisa, and residusl materiala derived from sandstone, shale, and siltstone. | Sheppard huerfano Notal | $\begin{gathered} 60+ \\ 10-20 \\ 60+ \end{gathered}$ | $\begin{aligned} & 2-8 \\ & 0-3 \\ & 0-2 \end{aligned}$ | $\begin{aligned} & >6 \\ & >6 \\ & >6 \end{aligned}$ | $\begin{aligned} & \text { 7.9-8.4 } \\ & \text { 7.9-9.0 } \\ & 7.9-9.0 \end{aligned}$ | $\begin{aligned} & <2 \\ & >4 \\ & 4-8 \end{aligned}$ | $\begin{aligned} & \text { A } \\ & \text { D } \end{aligned}$ | $\begin{aligned} & 2 \\ & 4 \mathrm{~L} \\ & 4 \mathrm{~L} \end{aligned}$ | $\begin{aligned} & .15 \\ & .32 \\ & .32 \end{aligned}$ | $\begin{aligned} & 5 \\ & 1 \\ & 5 \end{aligned}$ | Moderate to high vind erosion hazard, low to moderate water erosion hazard, topsoil is fair to poor, 8 inch precipitation zone. Strink-avell poter tisl is low to high, exchangeable sodium content ranges from 15-75\% for Huerfano-hotal portion, high corrosion hazard to uncoated steel. |
| 35.95-36.05 | ED | Riverwash-Dmeland: Deep, poorly to excessively drained, umstabilized sandy, silty, clayey, and gravelly alluvium occurring ou level and nearly level floodplains, strearbeds, and arroyos; and unstabilized eolian sand occurring on nearly level to steep mesas, plateaus, and major drainageways. | Riverwash <br> Dumeland | $\begin{aligned} & 60+ \\ & 60+ \end{aligned}$ | $\begin{aligned} & 0-2 \\ & 2-40 \end{aligned}$ | $\frac{0-2^{2}}{>6}$ | $\begin{aligned} & \mathrm{M} \\ & \mathrm{M} \end{aligned}$ | $\begin{aligned} & M \\ & M \end{aligned}$ | $\begin{aligned} & D \\ & \Delta \end{aligned}$ | ${ }_{1}^{\mathrm{M}}$ | $\begin{aligned} & \text { MM } \\ & .15 \end{aligned}$ | $\begin{aligned} & \mathrm{M} \\ & 5 \end{aligned}$ | Low and high (Dmeland portion) wind erosion hazard, high (Riverwash portion) and low water erosion hazard, poor topsoil, 6-10 inch precipitation rone. Riverwash portion is frequently flooded, and strink-awell potertial is low. |
| 36.05-36.6 | tab | TirleyPruitlant-Blancol: Deep, will drained, clay loam, loam, fine aundy loam, and sandy loan soils formed ou level to moderately steep alluvial fans, uland valley sideslopes, and mesas from mixed alluvium derived from sandstone and shale. | Tarley Fruitland Blancot | $\begin{aligned} & 60+ \\ & 60+ \\ & 60+ \end{aligned}$ | $\begin{aligned} & 0-5 \\ & 0-30 \\ & 0-5 \end{aligned}$ | $\begin{aligned} & \gamma 6 \\ & >6 \\ & \gamma 6 \end{aligned}$ | $\begin{aligned} & 7.4-9.0 \\ & 7.4-8.4 \\ & 7.9-9.0 \end{aligned}$ | $\begin{aligned} & 2-4 \\ & 4 \\ & 2-4 \end{aligned}$ | $\begin{aligned} & \text { B } \\ & \text { B } \\ & \text { B } \end{aligned}$ | $\begin{aligned} & 3,4 \mathrm{~L} \\ & 1,3,5 \\ & 3,5 \end{aligned}$ | $\begin{aligned} & .37 \\ & .28 \\ & .28 \end{aligned}$ | $5$ | Low to high (Fruitland portion) wind erosion hazard, woderate water erosion hazard, fair to good topsoil, 6-10 inch precipitation zone. These soils are mildly to strongly alkaline (calcareous), and shrink-avell potertisl is low to moderate. |
| 36.6-37.2 | SSH | Shiprock-Sheppand-fierfang: Deep to shallow, well to sanerhat excessively drained, fine sandy loam, fine sand, loany fine sand, sandy clay loen, sandy lomen, and clay loam soils. These soils formed ou nearly level to strongly sloping mesas, platesus, and upland valley bottans from sandy allivial and eolian materials derived from sandatone; and from allivium, residnan, and loess derived from shale and siltstone. | Shiprock <br> Sheppard <br> Huerfano | $\begin{gathered} 60+ \\ 60+ \\ 10-20 \end{gathered}$ | $\begin{aligned} & 0-8 \\ & \begin{array}{l} 1-12 \\ 0-3 \end{array} \end{aligned}$ | $\begin{aligned} & \gamma 6 \\ & >6 \\ & \gamma 6 \end{aligned}$ | $\begin{aligned} & 7.4-9.0 \\ & 7.4-8.4 \\ & 7.9-9.0 \end{aligned}$ | $\begin{aligned} & <4 \\ & <2 \\ & >4 \end{aligned}$ | $\begin{aligned} & \text { A } \\ & \text { D } \end{aligned}$ | $\begin{gathered} 2,3 \\ 1 \\ 3,4 \mathrm{~L} \end{gathered}$ | $\begin{aligned} & .24 \\ & .10 \\ & .32 \end{aligned}$ | $\begin{aligned} & 5 \\ & 5 \\ & 1 \end{aligned}$ | Moderate to high wind erosion hazard, moderate to low water erosion hazand, good to poor topeoil, 6-10 inch precipitation zone. These boils are mildly to atrongly alkaline (huerfano portion is sodium affected), and strink-swell potentisl is low to moderate. |
| 37.2-37.75 | TAB | Turley-Pritiand-Blancot: Deep, well drained, clay loam, loam, fine sandy loam, and sandy loan soils formed on level to moderately steep alluvisl fans, upland valley sideslopes, and mesas from mixed alluvium derived from sandstone and shale. | Turley Fruitland Blancot | $\begin{aligned} & 60+ \\ & 60+ \\ & 60+ \end{aligned}$ | $\begin{aligned} & 0-5 \\ & 0-30 \\ & 0-5 \end{aligned}$ | $\begin{aligned} & \gamma \\ & > \\ & >6 \end{aligned}$ | $\begin{aligned} & 7.4-9.0 \\ & 7.4-8.4 \\ & 7.9-9.0 \end{aligned}$ | $\begin{aligned} & 2-4 \\ & 4-4 \\ & 2-4 \end{aligned}$ |  | $\begin{aligned} & 3,4 \mathrm{~L} \\ & 1,3,5 \\ & 3,5 \end{aligned}$ | $\begin{aligned} & .37 \\ & .28 \\ & .28 \end{aligned}$ | 5 5 5 | Low to high (Pruitland portion) wind erosion hazard, moderate water erosion hazard, fair to good topsoil, $6-10$ inch precipitation zone. These boils are mildly to strongly alkaline (calcarecus), and shrink-swell poterr tial is low to moderate. |

Table 2. characteristics of the soms dentified aionc main hater pipeine raine p-1 (concluded)

| Milepost | $\begin{aligned} & \text { Mup } \\ & \text { Syubol } \end{aligned}$ | Soil Phase, Series, Associatign, or Complex and Deacription | Soil Phase or Series | Depth to Bedrock (inches) | $\begin{aligned} & \text { Slope } \\ & (\mathrm{I}) \end{aligned}$ | Depth to High Kat Table (feet) | $\begin{gathered} \text { Soil } \\ \text { Reaction } \\ (\mathrm{pH}) \end{gathered}$ | $\begin{gathered} \text { Salinity } \\ \text { (momos/ } \\ \text { cons } \end{gathered}$ | $\begin{aligned} & \text { y Eydro- } \\ & \text { logic } \\ & \text { Croup } \end{aligned}$ |  | 'R' | 'T' | Cament |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| 37.75-37.95 | 쬬 | Bedlant-Rock Outctop: Nonstony, woderately sloping to extrenely steep barren shale uplands that are dissected by deep intermittent drainageways and gullies; and barren sandstone exposures on moderately sloping to extremely steep ridges, benches, and escarpments. | Badland <br> Rock Outcrup | $\begin{aligned} & 0 \\ & 0 \end{aligned}$ | $\begin{aligned} & 5-80 \\ & 5-80 \end{aligned}$ | $\begin{aligned} & >6 \\ & >6 \end{aligned}$ | $\begin{aligned} & \mathrm{NA} \\ & \mathrm{Ma} \end{aligned}$ | $\begin{aligned} & \mathrm{M} \\ & \mathrm{M} \end{aligned}$ | $\begin{aligned} & \text { D } \\ & \text { D } \end{aligned}$ | $\begin{aligned} & \mathrm{M} \\ & \mathrm{M} \end{aligned}$ | $\begin{aligned} & \mathrm{M} \\ & \mathrm{M} \end{aligned}$ | $\begin{aligned} & \mathrm{M} \\ & \mathrm{M} \end{aligned}$ | Wind erosion hazard is low, Bedland portion is subceptible to water erosion, topsoil is generslly nonexistent (i.e., poor topsoil), 6-10 inch precipitation zone. Potential rumoff on Bedland portion is very rapid. |
| 37.95-38.3 | IAB | Murley-Pruitlant-Blancot: Deep, vell drained, clay loan, loam, fine sandy loan, and sandy loan soils formed on level to moderately steep alluvial fans, upland valley sideslopes, and mesas from mixed alluvium derived from sandstone and shale. | Turley Fruitland Blancot | $\begin{aligned} & 60+ \\ & 60+ \\ & 60+ \end{aligned}$ | $\begin{aligned} & 0-5 \\ & 0-30 \\ & 0-5 \end{aligned}$ | $\begin{aligned} & \gamma 6 \\ & \gamma 6 \\ & \gamma 6 \end{aligned}$ | $\begin{aligned} & 7.4-9.0 .0 \\ & 7.4-8.4 \\ & 7.9-9.0 \end{aligned}$ | $\begin{aligned} & 2-4 \\ & 4 \\ & 2-4 \end{aligned}$ | $\begin{aligned} & \text { B } \\ & \text { B } \\ & \text { B } \end{aligned}$ | $\begin{aligned} & 3,4 \mathrm{~L} \\ & 1,3,5 \\ & 3,5 \end{aligned}$ | $\begin{aligned} & .37 \\ & .28 \\ & .28 \end{aligned}$ | $\begin{aligned} & 5 \\ & 5 \\ & 5 \end{aligned}$ | Low to high (Pruitland portion) wind erosion hazard, uoderate water erosion hazard, fair to good topsoil, $6-10$ inch precipitation zone. These soils are mildly to strongly alkaline (calcareous), and ahrink-swell potertial is low to moderste. |
| 38.3-38.4 | SSH | Shiprock-Sheppard-hierfano: Deep to shallow, well to somentat excessively drained, fine sandy lomn, fine sand, loarry fine sand, sandy clay loam, sandy loam, and clay loan soils. These soils formed on nearly level to strongly sloping mesas, plateaus, and upland valley bottons fram sandy slluvial and eolian materials derived from sandstone; and fran allovium, resionum, and loeas derived from shale and siltstone. | Shiprock <br> Sheppard <br> Huerfano | $\begin{gathered} 60+ \\ 60+ \\ 10-20 \end{gathered}$ | $\begin{aligned} & 0-8 \\ & 1-12 \\ & 0-3 \end{aligned}$ | $\begin{aligned} & >6 \\ & >6 \\ & >6 \end{aligned}$ | $\begin{aligned} & 7.4-9.0 \\ & 7.4-8.4 \\ & 7.9-9.0 \end{aligned}$ | $\begin{aligned} & <4 \\ & <2 \\ & >4 \end{aligned}$ | $\begin{aligned} & B \\ & A \\ & \text { A } \end{aligned}$ | $\begin{aligned} & 2,3 \\ & 1 \\ & 3,4 \mathrm{~L} \end{aligned}$ | $\begin{aligned} & .24 \\ & .10 \\ & .3 \end{aligned}$ | $\begin{aligned} & 5 \\ & 5 \end{aligned}$ | Moderate to high wind erosion hazard, moderate to low water erosion hazard, good to poor topsoil, 6-10 inch precipitation zone. Theae soils are mildly to strongly alkaline (huerfano portion is sodium affected), and shrink-owell potential is low to moderate. |
| 38.4-39.2 | SC | Sheppard-fherfano-thotal: Deep and shallow, sanewhat excessively and well drained, loany fine sand, fine sand, sandy clay loam, clay loam, and clay soils fomed on level to moderately sloping valley bottans, fans, wesas, and plateas from eolian, alluvial, and residual materials derived from sandstone, shale, and siltstone. | Sheppard Auerfano Notal | $\begin{gathered} 60+ \\ 10-20 \\ 60+ \end{gathered}$ | $\begin{aligned} & \begin{array}{l} 2-8 \\ 0-3 \\ 0-2 \end{array} \end{aligned}$ | $\begin{aligned} & >6 \\ & >6 \\ & >6 \end{aligned}$ | $\begin{aligned} & 7.9-8.4 \\ & 7.9-9.0 \\ & 7.9-9.0 \end{aligned}$ | $\begin{aligned} & <2 \\ & >4 \\ & 4-8 \end{aligned}$ | $\begin{aligned} & \text { A } \\ & D \end{aligned}$ | $\begin{aligned} & 2 \\ & 4 \mathrm{~L} \\ & 4 \mathrm{~L} \end{aligned}$ | $\begin{aligned} & .15 \\ & .32 \\ & .32 \end{aligned}$ | $\begin{aligned} & 5 \\ & 1 \end{aligned}$ | Moderate to high wind erosion hazard, low to moderate water erosion hazard, topsoil is fair to poor, 8 inch precipitation zone. Shrink-swell potertial is low to high, exchangeable sodium content ranges from 15-75\% for bierfano-hbtal portion, high corrosion hazard to uncoated steel. |
| 39.2-39.55 | BA | Badland: Moderately sloping to extrenely steep, nonstony, barren shale uplands that are dissected by deep intermittent drainagemys and gullies. | Badland | 0 | 5-80 | N | M | N | M | M | N ${ }^{\text {a }}$ | N | 8 inch precipitation zone. |
| 39.55-39.7 | s | Steppard-therfan-Notal: Deep and shallow, somentat excessively and well drained, locaury fine sand, fine sand, sandy clay loam, clay loam, and clay soils fomed on level to moderately sloping valley bottons, fans, nesas, and platesus from eolian, alluvisl, and residual materials derived from sandstone, shale, and siltstone. | Sheppard Huerfano Notal | $\begin{gathered} 60+ \\ 10-20 \\ 60+ \end{gathered}$ | $\begin{aligned} & 2-8 \\ & 0-3 \\ & 0-2 \end{aligned}$ | $\begin{aligned} & >6 \\ & >6 \\ & >6 \end{aligned}$ | $\begin{aligned} & 7.9-8.4 \\ & 7.9-9.0 \\ & 7.9-9.0 \end{aligned}$ | $\begin{aligned} & <2 \\ & >4 \\ & 4-8 \end{aligned}$ | $\begin{aligned} & \text { A } \\ & \text { D } \end{aligned}$ | $\begin{aligned} & 2 \\ & 4 \mathrm{~L} \\ & 4 \mathrm{~L} \end{aligned}$ | $\begin{aligned} & .15 \\ & .32 \\ & .32 \end{aligned}$ | $\begin{aligned} & 5 \\ & 1 \end{aligned}$ | Moderate to high vind erosion hazard, low to moderate water erosion hazard, topsoil is fair to poor, 8 inch precipitation zone. Shrink-swell potertial is low to high, exchangeable bodisan content ranges from 15-75\% for Huerfano-total portion, high corrosion hazard to uncoated steel. |

soil erosion is primarily low to moderate. The soils identified along the proposed Pl pipeline route are mildly to strongly alkaline. Shrink-swell potential of the identified soils is primarily low to moderate, but the Notal soil has a high shrink-swell potential. These soils are currently used primarily for livestock grazing, wildife habitat, and to a lesser extent energy resource development. This pipeline route traverses the following undeveloped portions of NIIP: Block 6 (MP 4-7; 8-10) ; Block 7 (MP 7-8); Block 9 (MP 10-15); Block 11 (MP 23.5-25; 29-30.5) ; and Block 10 (MP 25-27.5). These areas have been determined to be irrigable.

Main Water Pipeline Alternative P2. Pipeline route P2 is within the San Juan River Valley Mesas and Plateaus portion of the Western Range and Irrigated Region (SCS 1978a). Annual precipitation along this route is usually about 8 inches. Thirty-one different soil phases, series, associations, or complexes were identified along this route. The identified soils are listed (by mileposts) and characterized in Table 3.

The soils identified along pipeline route $P 2$ are primarily deep and well to somewhat excessively drained. Surface textures range from fine sand to clay. These soils are forming in alluvial, eolian, and residual materials derived primarily from sandstone, shale, and siltstone on mesas, plateaus, hills, canyons, valleys, and alluvial fans. The terrain slopes range mainly from nearly level to moderately sloping, but areas of moderately steep Badland would be traversed near Horn Canyon (MP 4.4-5.35) and southwest of Gallegos Canyon (between MP 14.6-15.0). Approximately 5.0 miles of Badland (nonstony, barren shale) and Badland-Rock Outcrop would be traversed by this pipeline route. Topsoil availability along this pipeline route is limited due to generally shallow soil surface layers, and the majority of the existing topsoil is of fair to poor quality due to undesirable surface
Table 3. Charactyristics of the soils identified aiong min hatir plpeiine rouir p2

| Milepost | Map Syubol | Soil Phase, Series, Association, or Couplex and Description | Soil Phase or Seriea | Depth to Bedrock (inches) | Slope <br> ( Z ) | Depth to High Water Table (feet) | ```Soil Reaction (pH)``` | Salinity (muhos/ can) | Hydro- <br> logic <br> Group | $\begin{aligned} & \text { Weg } \\ & \text { Class } \end{aligned}$ | 'K' | 'T' | Comments |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| 0.000 .25 | Fy | Pruitland-Slickspots: Deep, well and poorly drained, aanty loan soils formed on level to gently sloping fans and valleys from alluvium derived primarily from sandstone and shale. Includes Slickspots areas which are strongly alkali affected, and are easily puddled and crusted. | Pruitland | $60+$ | 0-3 | خ | 7.4-8.4 | 4 | B | 3 | . 24 | 5 | Hoderate vind and water erosion hazard, topeoil is good (Slickspots areas are poor), 8 inch precipitation zane. Shrink-swell potential is 10 w . Slickspots areas contain 15-50\% exchangeable sodium (addition of gypsum reduces associated problens). |
| 0.25-0.30 | HA | Haplargido-Blackstor-Torriorthents: Shallow to deep, well to excessively drained, cobbly sandy laan, cobbly sandy clay losen, gravelly loam, gravelly clay laam, cobbly loam, and clay loan soils formed on moder ately sloping to steep terraces, mesas, and plateaus from alliving derived from mixed sources. | Haplargids <br> Blackston Torriorthents | $10-60+$ $60+$ $10-20$ | $\begin{aligned} & 8-50 \\ & 8-40 \\ & 8-50 \end{aligned}$ | $\begin{aligned} & M A \\ & >6 \\ & M \end{aligned}$ | $\begin{gathered} \mathrm{NA} \\ 7.9-8.4 \\ \mathrm{NA} \end{gathered}$ | N $2-4$ <br> NA | $\begin{aligned} & \mathrm{NA} \\ & \mathrm{~B} \\ & \mathrm{NA} \end{aligned}$ | $\begin{aligned} & \text { M } \\ & 5 \\ & \mathrm{NA} \end{aligned}$ | $\begin{aligned} & \mathrm{NA} \\ & .17 \\ & \mathrm{NH} \end{aligned}$ | NA 1 NA | Low vind erooion hazand, low to high weter erosion hazard, poor topsoil (area reclain), 9 inch precipitation zase. Shrink-svell potential is 10 w , high corrosion hazard to uncoated steel. |
| $0.30-0.75$ | $\mathrm{Ay} / \mathrm{Ax}$ | Avalon: Deep, well drained, lasm, and sandy lann soils formed on level to moderately sloping mesas and plateans from alluvial and eolian materials derived primarily from sandstone and shale. | Avalon | $60+$ | 0-8 | >6 | 7.9-8.4 | 2-8 | B | 4L,3 | $\begin{aligned} & .43, \\ & .37 \end{aligned}$ | 3 | Moderate wind erosion hazard, moderate to high water erosion hazard, fair topooil (excess salt), 8 inch precipitation zone. Shrink-owell potential is low, soil is slightly as line, high corrosion hazard to uncosted steel. |
| 0.75-0.95 | FX | Fruitland-Persayo-Sheppard: Deep and shallow, well to somertat excessively drained, santy loam, fine santy loan, clay loan, loany fine sand, and fine sand soils formad on moderately slopirg to moderstely steep hills, mesas, plateaus, fans, and breaks from allirvinm, resicinn, and eolisn materials derived from sandstone and shale. | Pruitland Persayo Sheppard | $\begin{gathered} 60+ \\ 10-20 \\ 60+ \end{gathered}$ | $\begin{aligned} & 5-30 \\ & 5-30 \\ & 5-30 \end{aligned}$ | $\begin{aligned} & >6 \\ & >6 \\ & >6 \end{aligned}$ | $\begin{aligned} & 7.4-8.4 \\ & 7.9-9.0 \\ & 7.9-8.4 \end{aligned}$ | $\begin{aligned} & <4 \\ & <8 \\ & <2 \end{aligned}$ | $\begin{aligned} & \mathrm{B} \\ & \mathrm{D} \\ & \mathrm{~A} \end{aligned}$ | $\begin{aligned} & 3 \\ & 4 \mathrm{~L} \\ & 2 \end{aligned}$ | $\begin{aligned} & .24 \\ & .37 \\ & .15 \end{aligned}$ | $\begin{aligned} & 5 \\ & 1 \\ & 5 \end{aligned}$ | Moderate to high wind erosion hazard, low to moderate water erosion hazard, topooil is poor (Persayo portior-area reclain), 8 inch precipitation zone. Strink-bwell potential is low to moderate, high corrosion hazard to urcoated steel. |
| 0.95-1.0 | HA | Haplargids-Blackstor-Torriorthents: Shallow to deep, well to excessively drained, cobbly sandy loam, cobbly sandy clay laan, gravelly loam, gravelly clay laan, cobbly loan, and clay loam soils fomed on moderstely sloping to steep terraces, mesas, and plateaus from alluvin derived from mixed sources. | Haplargids <br> Blackston Torriorthents | $\begin{gathered} 10-60+ \\ 60+ \\ 10-20 \end{gathered}$ | $\begin{aligned} & 8-50 \\ & 8-40 \\ & 8-50 \end{aligned}$ | $\begin{aligned} & N H \\ & >6 \\ & N A \end{aligned}$ | $\begin{gathered} \mathrm{N} \\ 7.9-8.4 \\ \mathrm{M} \end{gathered}$ | $\begin{aligned} & \mathrm{NH} \\ & 2-4 \\ & \mathrm{~N} \end{aligned}$ | $\begin{aligned} & \text { N } \\ & \text { B } \\ & \text { NA } \end{aligned}$ | $\begin{aligned} & \text { NA } \\ & 5 \\ & \text { NA } \end{aligned}$ | N <br> .17 <br> N | $\begin{aligned} & N A \\ & 1 \\ & N A \end{aligned}$ | Low wind erosion hazard, low to high water erosion hazard, poor topboil (area reclaim), 9 inch precipitation zone. Shrink-swell potential is low, high corrosion hazard to uncoated steel. |
| 1.0-1.25 | $\mathrm{Av} / \mathrm{Ax}$ | Avalon: Deep, well drained, sandy laan, fine sandy loam, and loan soils formed on gently to moderately sloping mesas and plateaus from alluvial and eolian materisla derived primarily fram aandatone and shale. | Avalca | $60+$ | 2-8 | 26 | 7.9-8.4 | 2-8 | B | 3 | . 37 | 3 | Hoderate wind and water erobion hazard, topsoil is fair (excess all), 8 inch precipitation zone. Strinkswell potential is low, soil is slightly asline, high corrosion hazard to uncoated steel. |
| 1.25-1.60 | $B A$ | Badland: Maderately sloping to extrenely steep, nonstony, barren shale uplands that are dissected by deep intermittent drainageways and gullies. | Badland | 0 | 5-80 | M | NH | NH | NA | NA | NA | NA | 8 inch precipitation zone. |
| 1.60-1.85 | $G Y$ | Gypaiorthids-Bedland-Sumble: Very shallow to deep, well to excessively drained, sandy loam, loany sand, and sand soils formed on moderately sloping to moderately steep hills, knolls, breaks, and valleys from materials derived from gypom and from alluwiun derived primarily from aandetane | Cypsiorthids Badland Stumble | $\begin{gathered} 16 \text { (ave.) } \\ 0 \\ 60+ \end{gathered}$ | $\begin{aligned} & 5-30 \\ & 5-30 \\ & 5-8 \end{aligned}$ | $\begin{aligned} & >6 \\ & >6 \\ & >6 \end{aligned}$ | $\begin{gathered} \mathrm{NA} \\ \mathrm{NA} \\ 7.9-8.4 \end{gathered}$ | NH <br> M <br> $<2$ | NA <br> NA <br> A | NA <br> N <br> 2 | NA <br> N .17 | $\begin{aligned} & \mathrm{N} \\ & \mathrm{M} \\ & 5 \end{aligned}$ | High wind erosion hazard, low to moderate water erosion hazard, poor topeoil, 8 inch precipitation zone. Shrink-8well potential is low, Sumble portion presents bigh corrosion hazard to uncosted steel. |





| Milepost | Map Syubol | Soil Phase, Series, Associatipn, or Complex and Description | Soil Phase or Series | Depth to Bedrock (inches) | Slope ( ${ }^{2}$ ) | Depth to High Water Table (feet) | Soil Reaction ( pH ) | Salinity (muhos/ ca) | Hydro- <br> logic <br> Gcoup | $\begin{aligned} & \text { VOG } \\ & \text { Class } \end{aligned}$ | ' ${ }^{\prime}$ | 'T' | Comments |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| 4.75-4.85 | Fs | Fruitland: Deep, well drained, sandy losm soils formed on gently sloping alluvial fans and in valleys from alluvium derived primarily from sondstone and ahale. | Pruitland | $60+$ | 2-5 | 76 | 7.4-8.4 | $<4$ | B | 3 | . 24 | 5 | Moderate wind and water exosion hazand, good topsoil, 8 inch precipitation some. Strink-owell potential is low, high corrosion hazard to umcoated steel. |
| 4.85-5.35 | B4 | Badland: Moderately sloping to extremely steep, noustony, barren shale uplands that are dissected by deep intemittent drainageway and gullies. | Badland | 0 | 5-80 | M | M | M | M | M | L4 | M | 8 inch precipitation sone. |
| 5.35-5.65 | KZ | Fruitland-Persayo-Sheppard: Deep and shallow, well to somerthat excessively drained, sandy loasn, fine sandy laam, clay lasm, loany fine sand, and fine sand soils formed on moderately sloping to moderately steep hills, weas, plateaus, fans, and breaks fros alluvism, residma, and colian materials derived from sandstoce and shele. | Pruitland Persayo Sheppard | $\begin{gathered} 60+ \\ 10-20 \\ 60+ \end{gathered}$ | $\begin{aligned} & 5-30 \\ & 5-30 \\ & 5-30 \end{aligned}$ | $\begin{aligned} & 76 \\ & 76 \\ & 76 \end{aligned}$ | $\begin{aligned} & 7.4-8.4 \\ & 7.9-9.0 \\ & 7.9-8.4 \end{aligned}$ | $\begin{aligned} & <4 \\ & <8 \\ & <2 \end{aligned}$ | $\begin{aligned} & \text { B } \\ & \text { D } \\ & \text { A } \end{aligned}$ | $\begin{aligned} & 3 \\ & 4 L \\ & 2 \end{aligned}$ | $\begin{aligned} & .24 \\ & .37 \\ & .15 \end{aligned}$ | $\begin{aligned} & 5 \\ & 1 \\ & 5 \end{aligned}$ | Moderate to high wind erosion hazand, low to moderate water erosion hazard, topeoil is poor (Persayo portion-area reclaim), 8 inch precipitation rane. Strink-awell potential is low to moderate, high corrosion hazard to urcoated steel. |
| 5.65-5.75 | Sd | Sheppard-Hayqueen-Shiprock: Deep, somewhat excessively and well drained, loany fine sand, fine and, and fine sandy laan soils formed on level to moderately sloping weas and plateaus from alluvial and eolian materials derived from andstone, shale, and mixed aources. | Sheppard Mayqueen Shiprock | $\begin{aligned} & 60+ \\ & 60+ \\ & 60+ \end{aligned}$ | $\begin{aligned} & 5-8 \\ & 2-8 \\ & 0-5 \end{aligned}$ | $\begin{aligned} & 76 \\ & 76 \\ & 76 \end{aligned}$ | $\begin{aligned} & 7.9-8.4 \\ & 7.9-8.4 \\ & 7.4-8.4 \end{aligned}$ | $\begin{aligned} & <2 \\ & <2 \\ & <2 \end{aligned}$ | $\begin{aligned} & \text { A } \\ & \text { B } \\ & \text { B } \end{aligned}$ | $\begin{aligned} & 2 \\ & 2 \\ & 3 \end{aligned}$ | $\begin{aligned} & .15 \\ & .24 \\ & .24 \end{aligned}$ | $\begin{aligned} & 5 \\ & 5 \\ & 5 \end{aligned}$ | Hoderate to high wind erosion hazard, low to moderate water erosion hazard, topesil is poor to good, 8 inch precipitation mone. Starink-awell poter tial is low, high corrosion hazard to uncoated steel. |
| 5.75-5.90 | 12 | Fruitland-Persayo-Sheppard: Deep and shallow, vell to somewhat excessively drained, sandy loam, fine sandy loem, clay laan, loany fine asnd, and fine aand soils formed on moderately sloping to moderately steep hills, meas, plateaus, fans, and breaks from alluviux, residum, and colian materials derived frow andstone and shale. | Fruitland Persayo Sheppard | $\begin{gathered} 60 t \\ 10-20 \\ 60 t \end{gathered}$ | $\begin{aligned} & 5-30 \\ & 5-30 \\ & 5-30 \end{aligned}$ | $\begin{aligned} & >6 \\ & >6 \\ & >6 \end{aligned}$ | $\begin{aligned} & 7.4-8.4 \\ & 7.9-9.0 \\ & 7.9-8.4 \end{aligned}$ | $\begin{aligned} & <4 \\ & <8 \\ & Q \end{aligned}$ | $\begin{aligned} & \text { B } \\ & \text { D } \\ & \mathbf{A} \end{aligned}$ | $\begin{aligned} & 3 \\ & 4 L \\ & 2 \end{aligned}$ | $\begin{aligned} & .24 \\ & .37 \\ & .15 \end{aligned}$ | $\begin{aligned} & 5 \\ & 1 \\ & 5 \end{aligned}$ | Hoderate to high wind erosion hazard, low to woderate water erosion hazard, topeoil is poor (Persayo portior-area reclaim), 8 inch precipitation mane. Strink-swell potential is low to moderate, high corrosion hazard to urcoated steel. |
| 5.96.9 | $80 / \mathrm{Sp} /$ 8d/9a | Shiprock-Sheppard-Yayqueen: Deep, comewhat excessively and well drained, loany fine and, fine and, fine sandy low, and sandy loam soils formed on level to moderately sloping mesas and plateaus from alluvial and colian materisls derived from sandstone, shale, and mixed sources. | Shiprock <br> Sheppard Mayquean | $\begin{aligned} & 60+ \\ & 60+ \\ & 60+ \end{aligned}$ | $\begin{aligned} & 0-5 \\ & 5-8 \\ & 2-8 \end{aligned}$ | $\begin{aligned} & >6 \\ & >6 \\ & >6 \end{aligned}$ | $\begin{aligned} & 7.4-8.4 \\ & 7.9-8.4 \\ & 7.9-8.4 \end{aligned}$ | $\begin{aligned} & <2 \\ & <2 \\ & <2 \end{aligned}$ | $\begin{aligned} & \mathbf{B} \\ & \mathbf{A} \\ & \mathbf{B} \end{aligned}$ | $\begin{aligned} & 3 \\ & 2 \\ & 2 \end{aligned}$ | $\begin{aligned} & .24 \\ & .15 \\ & .24 \end{aligned}$ | $\begin{aligned} & 5 \\ & 5 \\ & 5 \end{aligned}$ | Moderate to high wind erosion hazard, low to moderate water erosion hazand, topsoil is good to poor, 8 inch precipitation rone. Shrink-well potertial is low, high corrosion havard to uncoated steel. |
| 6.9-7.0 | D6 | Doak: Deep, well drained, loem, and clay loan soils formed on level to gently sloping mesas, plateaus, and terraces from alluviun derived primarily from amdatoce and shale. | Doek | $60+$ | 1-3 | 76 | 7.4-8.4 | $<2$ | B | 5 | . 37 | 5 | Low wind erosion havard, moderate water erosion hazard, topsoil is fair (too clayey), 8 inch precipitation zone. Shrink-well potential is low to moderate, low soil streagth, high corrosion hazard to uncoated ateel. |
| 7.0-7.45 | $\mathrm{Sd} / \mathrm{So} /$ 8m | Shiprock-Sheppard-Hayqueen: Deep, sowewhat excesaively and sell drained, loawy fine asad, fine and, fine sandy loan, and sandy los soils formed on level to moderately sloping meses and plateaus from alluvial and eolian materials derived from sandstone, shale, and mixed sources. | Shiprock <br> Sheppard Mayqueen | $\begin{aligned} & 60+ \\ & 60+ \\ & 60 t \end{aligned}$ | $\begin{aligned} & 0-5 \\ & 5-8 \\ & 2-8 \end{aligned}$ | $\begin{aligned} & >6 \\ & >6 \\ & >6 \end{aligned}$ | $\begin{aligned} & 7.4-8.4 \\ & 7.9-8.4 \\ & 7.9-8.4 \end{aligned}$ | $\begin{aligned} & Q \\ & <2 \\ & <2 \end{aligned}$ | $\begin{aligned} & \text { B } \\ & \mathbf{A} \\ & \mathbf{B} \end{aligned}$ | $\begin{aligned} & 3 \\ & 2 \\ & 2 \end{aligned}$ | $\begin{aligned} & .24 \\ & .15 \\ & .24 \end{aligned}$ | $\begin{aligned} & 5 \\ & 5 \\ & 5 \end{aligned}$ | Moderate to high wind erosion harard, low to moderate water erosion hazard, topsoil is good to poor, 8 inch precipitation mone. Shrink-awell poter tial is low, high corrosion harard to uncoated ateel. |
| 7.45-7.75 | Av | Ayslon: Deep, well drained, sandy loem, and fine sandy loam soils formed on gently sloping mesas and plateaus fros alluvial and eolian materials derived primarily <br> from aendatome and shalan- | Avalon | $60+$ | 2-5 | 26 | 7.9-8.4 | 2-8 | E | 3 | . 37 | 3 | Hoderate wind and vater erosion harand, topsoil is fair (excess aalt), 8 inch precipitation zone. Strinkswell potential is low, soil is slightly saline, high corrosion |


| Milepost $\begin{gathered}\text { Map } \\ \text { Syubol }\end{gathered}$ | Soil Phase, Series, Asoociatipa, or Caupler and Description | Soil Phase or Series | Depth to Bedrock (inches) | Slope (\%) | Depth to High Hater Table (feet) | Soil Reaction (pH) | Salinity (mukoa/ cin | Hydrologic Group | $\begin{gathered} \text { HBGG } \\ \text { Clase } \end{gathered}$ | ' ' | 'T' | Comments |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| $7.75-8.8 \quad \begin{gathered} \mathrm{Sd} / \mathrm{Sol} \\ \mathrm{Smo} \end{gathered}$ | Shiprock-Sheppard-Mayqueen: Deep, acmewhat excesaively and well drained, loany fine asand, fine sand, fine sandy loan, and sandy loan soils formed on level to moderately sloping mesas and plateans from alluvial and eolisn materiale derived from sandstons, shale, and mixed sources. | Shiprock Sheppard Hayqueen | $\begin{aligned} & 60+ \\ & 60+ \\ & 60+ \end{aligned}$ | $\begin{aligned} & 0-5 \\ & 5-8 \\ & 2-8 \end{aligned}$ | $\begin{aligned} & 26 \\ & 26 \\ & 26 \end{aligned}$ | 7.4-8.4 <br> 7.9-8.4 <br> 7.9-8.4 | $\begin{aligned} & 2 \\ & <2 \\ & <2 \end{aligned}$ | $\begin{aligned} & \text { B } \\ & \mathbf{A} \\ & \mathbf{B} \end{aligned}$ | $\begin{aligned} & 3 \\ & 2 \\ & 2 \end{aligned}$ | $\begin{aligned} & .24 \\ & .15 \\ & .24 \end{aligned}$ | $\begin{aligned} & 5 \\ & 5 \\ & 5 \end{aligned}$ | Moderate to high vind erosion hazard, low to moderate water erosion hazard, topsoil is good to poor, 8 inch precipitation zone. Shrink-avell potertial is low, high corrosion hazard to umcoated ateel. |
| 8.8-9.1 De | Doak: Deep, well drained, Loan, and clayey loen moils formed on level and nearly level meas, plateans, and terraces from alluvium derived primarily from sandstone and shale. | Doak | $60+$ | 0-1 | 76 | 7.8-8.4 | $<2$ | B | 5 | 37 | 5 | Low wind erosion hazard, woderate vater erosion hazard, topeoil is Eair (too clayey), 8 inch precipitstion zone. Shrink-avell potential is low to moderate, low soil strength, high corrosion hazard to uncoated steel. |
| $\begin{gathered} 9.1-9.95 \mathrm{Sd} / \mathrm{So} / \\ \mathrm{Su} \end{gathered}$ | Shiprock-Sheppard-Mayqueen: Deep, sone what eacessively and well drained, loeny fine sand, fine sand, fine sandy loam, and sandy loam woile fomed on level to moder ately sloping mesas and platesus from alluvial and colian materisla derived from sandstone, shale, and mixed sources. | Shiprock Sheppard Mayqueen | $\begin{aligned} & 60+ \\ & 60+ \\ & 60+ \end{aligned}$ | $\begin{aligned} & 0-5 \\ & 5-8 \\ & 2-8 \end{aligned}$ | $\begin{aligned} & >6 \\ & >6 \\ & >6 \end{aligned}$ | $\begin{aligned} & 7.4-8.4 \\ & 7.9-8.4 \\ & 7.9-8.4 \end{aligned}$ | $\begin{aligned} & <2 \\ & <2 \\ & <2 \end{aligned}$ | $\begin{aligned} & \text { B } \\ & \text { A } \\ & \text { B } \end{aligned}$ | $\begin{aligned} & 3 \\ & 2 \\ & 2 \end{aligned}$ | $\begin{aligned} & .24 \\ & .15 \\ & .24 \end{aligned}$ | $\begin{aligned} & 5 \\ & 5 \\ & 5 \end{aligned}$ | Hoderate to high vind erosion hazard, low to moderate uater erosion hazard, topsoil is good to poor, 8 inch precipitation zone. Starink-gwell potential is low, high corrosion hazard to umocated steel. |
| 9.95-10.1 Ma | Mayqueen: Deep, somenhat excessively drained, losauy fine aand, and loamy sand soils formed on level to moderately sloping mesas and platesus from allovial and eolian materisls derived primarily from andstone and shale. | Mayqueen | $60+$ | 0-8 | 26 | 7.9-8.4 | 0 | B | 2 | . 24 | 5 | High wind erosion harard, moderate water erosion hazard, poor topsoil, 8 inch precipitation zone. Shrinkowell potential is low, high corrosion hazard to umcoated steel. |
| $\begin{gathered} 10.1-13.3 \mathrm{sm} / \mathrm{Sd} / \\ \mathrm{So} \end{gathered}$ | Shiprock-Sheppard-Hayqueen: Deep, somewhat exceasively and well drained, lomay fine sand, fine sand, fine sandy losm, and sandy loam soils formed on level to moderately sloping mesas and plateaus from alluvial and eolian materials derived from sandstone, shale, and mixed sources. | Shiprock Sheppard Hayqueen | $\begin{aligned} & 60+ \\ & 60+ \\ & 60+ \end{aligned}$ | $\begin{aligned} & 0-5 \\ & 5-8 \\ & 2-8 \end{aligned}$ | $\begin{aligned} & 26 \\ & 26 \\ & 26 \end{aligned}$ | $\begin{aligned} & 7.4-8.4 \\ & 7.9-8.4 \\ & 7.9-8.4 \end{aligned}$ | $\begin{aligned} & Q \\ & <2 \\ & <2 \end{aligned}$ | $\begin{aligned} & \text { B } \\ & \text { A } \\ & \text { B } \end{aligned}$ | $\begin{aligned} & 3 \\ & 2 \\ & 2 \end{aligned}$ | $\begin{aligned} & .24 \\ & .15 \\ & .24 \end{aligned}$ | $\begin{aligned} & 5 \\ & 5 \\ & 5 \end{aligned}$ | Moderate to high vind erosion hazand, low to moderate water erosion hazand, topooil is good to poor, 8 inch precipitation rone. Starink-avell potential is low, high corrosion hazard to uncoated steel. |
| 13.3-13.45 DC | Doak: Deep, well drained, loem, and clay loam soils fomed on gently sloping measa, plateaus, and terraces from allivium derived primarily from aandatove and ahale. | Doak | $60+$ | 3-5 | 26 | 7-4-8.4 | 2 | B | 5 | 37 | 5 | Low vind erosion hazard, moderate vater erosion hazard, fair topsoil, 8 inch precipitation rone. Shrinkavell potential is low to moderate, high corrosion hazard to uncoated steel. |
| 13.45-13.55 82 | Sumble-8lickspots: Deep, somenthat excessively and poorly drained, loseny send, and sand soils formed on level to gently sloping valley sides and fans from allurvium derived primarily from andstone and ahale. Includes Slickspots arean wich are strangly alkali affected, and are easily puddled and crusted. | Stumble | $60+$ | 0-5 | 76 | 7.9-8.4 | 2 | 4 | 2 | . 17 | 5 | High wind erosion haxard, low water erosion hazard, poor topsoil, 8 inch precipitation zone. Shrink-ewell potentisl is low, Slickspote areas contain 25-75\% exchangeable aodiva, high corrosion hazard to uncoated ateel. |
| 13.55-13.60 8A | Riventagh: Deep, well to excessively drained, unatabilized sandy, silty, clayey, or gravelly aediment on level to gently sloping floodplaine, strembeds, riverbeds, and in arroyos. | Riverwash | $60+$ | 0-3 | M | M | M | M | \$ | 断 | M | Highly quaceptible to vater erosion and reworking, frequently flooded, 8 inch precipitation zone. |
| 13.6-13.8 Sd | Sheppard-Hayqueen-Chiprock: Deep, sowewhat excessively and well drained, loany fine sand, fine aand, and fine sandy lome soils formed on level to moderately sloping mesas and plateans from alluvial and eolian materisls derived from sandstone, | Sheppand Meyqueea Shiprock | $\begin{aligned} & 60+ \\ & 60+ \\ & 60+ \end{aligned}$ | $\begin{aligned} & 5-8 \\ & 2-8 \\ & 0-5 \end{aligned}$ | $\begin{aligned} & >6 \\ & >6 \\ & >6 \end{aligned}$ | $\begin{aligned} & 7.9-8.4 \\ & 7.9-8.4 \\ & 7.4-8.4 \end{aligned}$ | $\begin{aligned} & <2 \\ & <2 \\ & <2 \end{aligned}$ | $\begin{aligned} & 1 \\ & 8 \\ & 8 \end{aligned}$ | $\begin{aligned} & 2 \\ & 2 \\ & 3 \end{aligned}$ | $\begin{aligned} & .15 \\ & .24 \\ & .24 \end{aligned}$ | $\begin{aligned} & 5 \\ & 5 \\ & 5 \end{aligned}$ | Moderate to high vind erosion havard, low to moderate water eroaion hazard, topaoil is poor to good, 8 inch precipitation zone. Starink-awell potertial is low, high corrosion hazand to uncoated steel. |

Table 3. characteristics of the soils identified alang man hater pipeinine route P2 (contimed)

| Mileport | $\underset{\text { Syutiol }}{\text { Sup }}$ | Soil Phase, Series, Associatigu, or Camplex and Description | Soil Phase or Series | Depth to Bedrock (inches) | $\begin{gathered} \text { Slope } \\ (\mathrm{I}) \end{gathered}$ | Depth to High Water Table (feet) | $\underset{\substack{\text { Reaction } \\(\mathrm{pH})}}{\text { Soil }}$ | Sal inity (minos) cin) | $\begin{aligned} & \text { Hydro- } \\ & \text { logic } \\ & \text { Group } \end{aligned}$ | $\underset{C l a s s}{\mathrm{CWGG}}$ | 'K' | 'T' | Coments |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| 13.8-14.0 | SB | Sheppard-Badland: Deep, zanemhat excessively drained, loarry fine sand, and fine asnd soils fomed on moderately sloping to steep mesas, plateavs, and breaks from eolian materials derived fron mixed sources. Includes nonstory, barren shale areas oo uplands that are dissected by drainageways and gullies. | Sheppard Bedland | $\begin{gathered} 60+ \\ 0 \end{gathered}$ | $\begin{aligned} & 5-40 \\ & 5-40 \end{aligned}$ | $\begin{aligned} & >6 \\ & >6 \end{aligned}$ | 7.9-8.4 | $\begin{gathered} <2 \\ M \end{gathered}$ | $\begin{aligned} & \text { A } \\ & \mathrm{M} \end{aligned}$ | $\begin{gathered} 2 \\ \mathrm{M} \end{gathered}$ | ${ }_{\text {M }}^{\text {M }}$ | S M | High wind erosion hazard, low water erosion hazard, poor topsoil, 8 inch precipitation zone. Shrink-swell potential is low, high corrosion hazard to uncoated steel. |
| 14.0-14.15 | RA | Riverwash: Deep, well to excessively drained, unstabilized sandy, silty, clayey, or gravelly sediment on level to gently sloping floodplains, streambeds, riverbeds, and in arroyos. | Riverwab | $60+$ | 0-3 | N | M | N | M | M | N | M | Highly susceptible to water erosion and reworking, frequently flooded, 8 inch precipitation zone. |
| 14.15-14.25 | Ex | Fruitland-Persayo-Sheppard: Deep and shallow, well to sanewhat excessively drained, sandy loam, fine sandy loam, clay loam, lamy fine sand, and fine sand soils formed on moderately sloping to moderately steep hills, mesas, plateals, fans, and breaks from allirvim, residam, and eolian materials derived fram sandatone and shale. | Fruitland Persayo Sheppard | $\begin{gathered} 60+ \\ 10-20 \\ 60+ \end{gathered}$ | $\begin{aligned} & 5-30 \\ & 5-30 \\ & 5-30 \end{aligned}$ | $\begin{aligned} & >6 \\ & >6 \\ & >6 \end{aligned}$ | $\begin{aligned} & 7.4-8.4 \\ & 7.9-9.0 \\ & 7.9-8.4 \end{aligned}$ | $\begin{aligned} & <4 \\ & <8 \\ & <8 \end{aligned}$ | $\begin{aligned} & \mathrm{D} \\ & \mathrm{~A} \end{aligned}$ | $\begin{aligned} & 3 \\ & 4 \mathrm{~L} \\ & 2 \end{aligned}$ | $\begin{aligned} & .24 \\ & .37 \\ & .15 \end{aligned}$ | $5$ | Moderate to high wind erosion hazard, low to moderate water erosion hazard, topsoil is poor (Persayo portion-area reclaim), 8 inch precipitation zone. Starink-swell potential is low to moderate, high corrosion hazard to urcoated steel. |
| 14.25-14.5 | Iv | Turley-Slickspots: Deep, well drained, clay loan soils formed on level to gently sloping alluvial fans from alluvium derived from primarily from sandstone and shale. Includes Slickspots areas which are strongly alkali affected, and are slowly permeable and easily puddled. | Turley | $60+$ | 0-3 | $>6$ | 7.4-9.0 | 2-4 | B | 4 L | . 28 | 5 | Moderate wind and water erosion hazand, fair topsoil (Slickspots areas are poor), 8 inch precipitation zone. Shrink-swell potential is moderate, Slickspots conta in 25-75\% exchangeable sodium, high corrosion hazard to uncoated steel. |
| 14.5-14.6 | FX | Pruitland-Persayo-Sheppard: Deep and shallow, well to saneshat excessively drained, sandy loam, fine sandy loam, clay lown, loarry fine sand, and fine sand soils formed on moderately sloping to moderately steep hills, mesas, plateaus, fans, and breaks frou allivium, residom, and eolian materials derived fron sandstone and shale. | Pruitland <br> Perbayo <br> Sheppard | $\begin{gathered} 60+ \\ 10-20 \\ 60+ \end{gathered}$ | $\begin{aligned} & 5-30 \\ & 5-30 \\ & 5-30 \end{aligned}$ | $\begin{aligned} & >6 \\ & >6 \\ & >6 \end{aligned}$ | $\begin{aligned} & 7.4-8.4 \\ & 7.9 .9 .0 \\ & 7.9-8.4 \end{aligned}$ | $\begin{aligned} & <4 \\ & <8 \\ & <2 \end{aligned}$ | $\begin{aligned} & \text { B } \\ & \text { D } \\ & \text { A } \end{aligned}$ | $\begin{aligned} & 3 \\ & 4 \mathrm{~L} \\ & 2 \end{aligned}$ | $\begin{aligned} & .24 \\ & .37 \\ & .15 \end{aligned}$ | $\begin{aligned} & 5 \\ & 1 \\ & 5 \end{aligned}$ | Moderate to high wind erosion hazard, low to moderate water erosion hazard, topsoil is poor (Perbayo portior-area reclaim), 8 inch precipitation zone. Strink-swell potential is lou to moderate, high corrosion hazard to uncoated steel. |
| 14.6-15.0 | BA | Badland: Moderately sloping to extrenely steep, nonstany, barrea shale uplands that are dissected by deep intermittent drainageway and gullies. | Bodland | 0 | 5-80 | M | M | N | N | M | M | M | 8 inch precipitation zone. |
| 15.0-15.4 | Du | Doak-Uffens: Deep, well drained, very fine sandy loam, sandy clay loam, fine aandy loam, and clay loan soils formed on level to gently sloping mesas and plateans from alluvium derived primarily fran sandstone and shale. | Doak Uffens | $\begin{aligned} & 60+ \\ & 60+ \end{aligned}$ | $\begin{aligned} & 0-3 \\ & 0-3 \end{aligned}$ | $\begin{aligned} & >6 \\ & >6 \end{aligned}$ | $\begin{aligned} & 7.4-8.4 \\ & 7.4-8.4 \end{aligned}$ | $\stackrel{8}{4-8}$ | $\begin{aligned} & \text { B } \\ & \text { D } \end{aligned}$ | $\begin{aligned} & 3 \\ & 3 \end{aligned}$ | $\begin{aligned} & .37 \\ & .20 \end{aligned}$ | $\begin{aligned} & 5 \\ & 1 \end{aligned}$ | Moderate wind and water erosion hazard, topsoil is fair to poor (excess clay or salt/8odiun), 8 inch precipitation zone. Shrink-orell potential is low to moderate, high corrosion hazard to uncoated steel. |
| 15.4-15.6 | Sd | Sheppard-Mayqueen-Shiprock: Deep, sanewhat excessively and well drained, loamy fine sand, fine sand, and fine sandy loam soils formed on level to moderately sloping mesas and plateans from allivial and eolian materials derived from sandstone, shale, and mixed sources. | Sheppard Mayqueen Shiprock | $\begin{aligned} & 60+ \\ & 60+ \\ & 60+ \end{aligned}$ | $\begin{aligned} & 5-8 \\ & 2-8 \\ & 0-5 \end{aligned}$ | $\begin{aligned} & >6 \\ & >6 \\ & >6 \end{aligned}$ | $\begin{aligned} & 7.9-8.4 \\ & 7.9-8.4 \\ & 7.4-8.4 \end{aligned}$ | $\begin{aligned} & <2 \\ & <2 \\ & <2 \end{aligned}$ | $\hat{B}$ | $\begin{aligned} & 2 \\ & 2 \end{aligned}$ | $\begin{aligned} & .15 \\ & .24 \\ & .24 \end{aligned}$ | $\begin{aligned} & 5 \\ & 5 \\ & 5 \end{aligned}$ | Moderate to high wind erosion hazard, low to moderate water erosion hazard, topsoil is poor to good, 8 inch precipitation zone. Shrink-swell poter tial is low, high corrosion hazard to uncoated steel. |

Table 3. Characteristics or tie solls ideatified along main haita pipline moire p2 (contimud)

| Milepost | $\mathrm{Mmp}_{\text {Syubol }}^{\text {Syut }}$ | Soil Phase, Series, Associatipa, or Complex and Description | Soil Phase or Series | Depth to Bedrock (inches) | $\begin{gathered} \text { Slope } \\ (z) \end{gathered}$ | Depth to High Water Table (feet) | $\underset{\substack{\text { Reaction } \\(\mathrm{pB})}}{\text { Soil }}$ | Salinity (wuhos) an) | Hydrologic Grap |  | 'K' | 'T' | Comments |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| 15.6-15.7 | Du | Doak-Uffens: Deep, well drained, very fine sandy loam, sandy clay losm, fine sandy loam, and clay loam soils formed on level to gently sloping mesas and plateaus from alluvium derived primarily from sandstone and shale. | Doak Uffens | $\begin{aligned} & 60+ \\ & 60+ \end{aligned}$ | $\begin{aligned} & 0-3 \\ & 0-3 \end{aligned}$ | $\begin{aligned} & >6 \\ & >6 \end{aligned}$ | $\begin{aligned} & 7.4-8.4 \\ & 7.4-8.4 \end{aligned}$ | $\stackrel{8}{4-8}$ | $\begin{aligned} & \text { B } \\ & \text { D } \end{aligned}$ | $\begin{aligned} & 3 \\ & 3 \end{aligned}$ | .37 .20 | $5$ | Koderate wind and water erosion hazand, topsoil is fair to poor (excess clay or salt/aodium), 8 inch precipitation zone. Strink-swell potential is low to moderate, high corrosion hazard to uncoated steel. |
| 15.7-15.75 | Sd | Sheppard-Mayqueen-Shiprock: Deep, sanewhat excessively and well drained, loany fine sand, fine sand, and $f$ ine sandy loam soils formed on level to moderately sloping mesas and plateaus from allivial and eolian materials derived from sandstone, shale, and mixed sources. | Sheppard <br> Mayqueen <br> Shiprock | $\begin{aligned} & 60+ \\ & 60+ \\ & 60+ \end{aligned}$ | $\begin{aligned} & 5-8 \\ & 2-8 \\ & 0-5 \end{aligned}$ | $\begin{aligned} & >6 \\ & >6 \\ & >6 \end{aligned}$ | $\begin{aligned} & 7.9-8.4 \\ & 7.9-8.4 \\ & 7.4-8.4 \end{aligned}$ | $\begin{aligned} & <2 \\ & <2 \\ & <2 \end{aligned}$ | $\begin{aligned} & \text { A } \\ & \text { B } \\ & \text { B } \end{aligned}$ | $\begin{aligned} & 2 \\ & 2 \\ & 3 \end{aligned}$ | $\begin{aligned} & .15 \\ & .24 \\ & .24 \end{aligned}$ | $\begin{aligned} & 5 \\ & 5 \\ & 5 \end{aligned}$ | Moderate to high wind erosion hazard, low to moderate water erosion hazard, topsoil is poor to good, 8 inch precipitation mone. Shrink-swell potertial is low, high corrosion hazard to uncoated steel. |
| 15.75-15.8 | Du | Doak-Uffens: Deep, well drained, very fine sandy loan, sandy clay loxan, fine sandy loem, and clay loem soils formed on level to gently sloping mesas and plateaus from alluviun derived primarily frow sandstone and shale. | Doak Uffens | $\begin{aligned} & 60+ \\ & 60+ \end{aligned}$ | $\begin{aligned} & 0-3 \\ & 0-3 \end{aligned}$ | $\begin{aligned} & >6 \\ & >6 \end{aligned}$ | $\begin{aligned} & 7.4-8.4 \\ & 7.4-8.4 \end{aligned}$ | $\frac{8}{4-8}$ | $\begin{aligned} & \text { B } \\ & \text { D } \end{aligned}$ | $\begin{aligned} & 3 \\ & 3 \end{aligned}$ | .37 .20 | $\begin{aligned} & 5 \\ & 1 \end{aligned}$ | Moderate wind and water erosion hazard, topsoil is fair to poor (excess clay or salt/bodium, 8 inch precipitation zone. Shrink-awell potential is low to moderate, high corrosion hazard to uncoated steel. |
| 15.8-16.0 | Sd | Sheppard-Mayqueen-Shiprock: Deep, sanewhat excessively and well drained, Loany fine sand, fine sand, and fine sandy loam soils formed on level to moderately sloping mesas and plateaus from alluvial and eolian materials derived from sandstone, shale, and mixed scurces. | Sheppard <br> Mayqueen <br> Shiprock | $\begin{aligned} & 60+ \\ & 60+ \\ & 60+ \end{aligned}$ | $\begin{aligned} & 5-8 \\ & 2-8 \\ & 0-5 \end{aligned}$ | $\begin{aligned} & >6 \\ & >6 \\ & >6 \end{aligned}$ | $\begin{aligned} & 7.9-8.4 \\ & 7.9-9.4 \\ & 7.4-8.4 \end{aligned}$ | $\begin{aligned} & 2 \\ & <2 \\ & <2 \end{aligned}$ | A | $\begin{aligned} & 2 \\ & 2 \\ & 3 \end{aligned}$ | $\begin{aligned} & .15 \\ & .24 \\ & .24 \end{aligned}$ | $\begin{aligned} & 5 \\ & 5 \\ & 5 \end{aligned}$ | Moderate to high wind erosion hazard, low to moderate water erosion hazard, topsoil is poor to good, 8 inch precipitation zone. Shrink-swell poter tial is low, high corrosion hazard to uncoated steel. |
| 16.0-16.05 | Du | Doak-Uffens: Deep, well drained, very fine sandy loam, sandy clay loan, fine sandy loan, and clay loam soils forned on level to gently sloping mesas and platesus from alluvium derived primar ily from sandstone and shale. | Doak Uffens | $\begin{aligned} & 60+ \\ & 60+ \end{aligned}$ | $\begin{aligned} & 0-3 \\ & 0-3 \end{aligned}$ | $\begin{aligned} & >6 \\ & >6 \end{aligned}$ | $\begin{aligned} & 7.4-8.4 \\ & 7.4-8.4 \end{aligned}$ | $\stackrel{<2}{4-8}$ | $\begin{aligned} & \text { B } \\ & \text { D } \end{aligned}$ | $\begin{aligned} & 3 \\ & 3 \end{aligned}$ | $\begin{aligned} & .37 \\ & .20 \end{aligned}$ | $\begin{aligned} & 5 \\ & 1 \end{aligned}$ | Moderate wind and water erosion hazard, topsoil is fair to poor (excess clay or salt/godium), 8 inch precipitation zone. Shrink-owell potential is low to moderate, high corrosion hazard to uncoated ateel. |
| 16.05-16.55 | Sd | Sheppard Hayqueen-Shiprock: Deep, sanewhat excessively and well drained, loany fine sand, fine sand, and fine sandy loam soils formed on level to moderately sloping meesas and platears from alluvial and eol ian materials derived from andstone, shale, and mixed sources. | Sheppard <br> Mayqueen <br> Shiprock | $\begin{aligned} & 60+ \\ & 60+ \\ & 60+ \end{aligned}$ | $\begin{aligned} & 5-8 \\ & 2-8 \\ & 0-5 \end{aligned}$ | $\begin{aligned} & >6 \\ & >6 \\ & >6 \end{aligned}$ | $\begin{aligned} & 7.9-8.4 \\ & 7.9-9.4 \\ & 7.4-8.4 \end{aligned}$ | $\begin{aligned} & <2 \\ & <2 \\ & <2 \end{aligned}$ | $\begin{aligned} & A \\ & B \\ & B \end{aligned}$ | ${ }_{3}^{2}$ | $\begin{aligned} & .15 \\ & .24 \\ & .24 \end{aligned}$ | $\begin{aligned} & 5 \\ & 5 \end{aligned}$ | Moderate to high vind erosion hazard, low to moderste water erosion hazard, topsoil is poor to good, 8 inch precipitation zone. Shrink-swell poter tial is low, high corrosion hazard to uncoated steel. |
| 16.55-17.0 |  | Doak-Dffens: Deep, well drained, very fine sandy loan, sandy clay loam, fine sandy loam, and clay loam soils formed on level to gently sloping mesas and plateaus from alluviur derived primarily from sandstone and shale. | Doak Uffens | $\begin{aligned} & 60+ \\ & 60+ \end{aligned}$ | $\begin{aligned} & 0-3 \\ & 0-3 \end{aligned}$ | $\begin{aligned} & >6 \\ & >6 \end{aligned}$ | $\begin{aligned} & 7.4-8.4 \\ & 7.4-8.4 \end{aligned}$ | $\begin{aligned} & <2 \\ & 4-8 \end{aligned}$ | $\begin{aligned} & \text { B } \\ & \text { D } \end{aligned}$ | $\begin{aligned} & 3 \\ & 3 \end{aligned}$ | $\begin{aligned} & .37 \\ & .20 \end{aligned}$ | $\begin{aligned} & 5 \\ & 1 \end{aligned}$ | Moderate wind and water erosion hazand, topsoil is fair to poor (excess clay or salt/sodium), 8 inch precipitation zone. Shrink-owell potential is low to moderate, high corrosion hazard to umcoated steel. |
| 17.0-17.4 |  | Shiprock: Deep, well drained, fine andy loam, and aandy loan soils formed on level and nearly level mesas and plateaus from alluvial and eolian materiala derived primarily from andstone and shale. | Shiprock | $60+$ | 0-2 | 76 | 7.4-8.4 | $<2$ | B | 3 | . 24 | 5 | Moderate wind and water erosion hazard, good topsoil, 8 inch precipitation zone. Shrink-swell potential is low, highly corrosive to uncoated steel. |
| 17.4-17.55 | Du | Doak-Offens: Deep, well drained, very fine sandy loan, sandy clay loam, fine sandy loam, and clay loam soils formed on level to gently sloping mesas and plateaus frun alluviun derived primarily from sandstone and shale. | Daak Uffens | $\begin{aligned} & 60+ \\ & 60+ \end{aligned}$ | $\begin{aligned} & 0-3 \\ & 0-3 \end{aligned}$ | $\begin{aligned} & \gamma 6 \\ & \gamma \end{aligned}$ | $\begin{aligned} & 7.4-8.4 \\ & 7.4-8.4 \end{aligned}$ | $\stackrel{<2}{4-8}$ | $\begin{aligned} & B \\ & D \end{aligned}$ | $3$ | $\begin{aligned} & .37 \\ & .20 \end{aligned}$ | 5 | Moderate wind and water erosion hazand, topsoil is fair to poor (excess clay or salt/(zodium), 8 inch precipitation mane. Strink-awell potential is low to moderste, high corrosion |

Table 3. Characteristics of the soms mentified aiong mann hater pipline rocit P2 (contimed)

| Milepost S | Map Syubol | Soil Phase, Series, Associatipn, or Couplex and Description | Soil Phase or Series | Depth to Bedrock (inches) | Slope <br> (z) | Depth to High Water Table (feet) | Soil Reaction (pH) | Salinity (muhos) ca) | Hydrologic Group | $\begin{aligned} & \text { WEG } \\ & \text { Class } \end{aligned}$ | 'K' | 'T' | Camments |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| 17.55-18.05 | $5 \mathrm{Su} / \mathrm{Sd}$ | Shiprock-Sheppard Hayqueen: Deep, somewhat excessively and well drained, loany fine sand, fine sand, fine sandy loam, and sandy loam soils fomed on level to moderately sloping mesas and plateaus from alluvisl and eolian materials derived from sandstone, shale, and mixed sources. | Shiprock Sheppard Mayqueen | $\begin{aligned} & 60+ \\ & 60+ \\ & 60+ \end{aligned}$ | $\begin{aligned} & 0-5 \\ & 5-8 \\ & 2-8 \end{aligned}$ | $\begin{aligned} & >6 \\ & >6 \\ & >6 \end{aligned}$ | $\begin{aligned} & 7.4-8.4 \\ & 7.9-8.4 \\ & 7.9-8.4 \end{aligned}$ | $\begin{aligned} & <2 \\ & <2 \\ & <2 \end{aligned}$ | $\begin{aligned} & \text { B } \\ & \text { A } \\ & \text { B } \end{aligned}$ | $\begin{aligned} & 3 \\ & 2 \\ & 2 \end{aligned}$ | $\begin{aligned} & .24 \\ & .15 \\ & .24 \end{aligned}$ | $\begin{aligned} & 5 \\ & 5 \\ & 5 \end{aligned}$ | Moderate to high vind erosion hazard, low to moderate water erosion hazard, topeoil is good to poor, 8 inch precipitation zone. Strink-awell poterr tial is low, high corrosion hazard to uncoated steel. |
| 18.05-18.1 | FX | Fruitland-Persayo-Sheppard: Deep and shallow, well to sonesthat excessively drained, sandy loam, fine sandy loam, clay loan, loanty fine sand, and fine sand soils formed on moderately sloping to moderately steep hills, mesas, plateaus, fans, and breaks from alluvium, residiom, and eoliam materials derived from sandstone and shale. | Fruitland <br> Persayo <br> Sheppard | $\begin{gathered} 60+ \\ 10-20 \\ 60+ \end{gathered}$ | $\begin{aligned} & 5-30 \\ & 5-30 \\ & 5-30 \end{aligned}$ | $\begin{aligned} & >6 \\ & >6 \\ & >6 \end{aligned}$ | $\begin{aligned} & 7.4-8.4 \\ & 7.9-9.0 \\ & 7.9-8.4 \end{aligned}$ | $\begin{aligned} & <4 \\ & <8 \\ & <2 \end{aligned}$ | $\begin{aligned} & \text { B } \\ & \text { D } \\ & \text { A } \end{aligned}$ | $\begin{aligned} & 3 \\ & 4 \mathrm{~L} \\ & 2 \end{aligned}$ | $\begin{aligned} & .24 \\ & .37 \\ & .15 \end{aligned}$ | $\begin{aligned} & 5 \\ & 1 \\ & 5 \end{aligned}$ | Moderate to high wind erosion hazard, low to moderate water erosion hazard, topsoil is poor (Persayo portion-area reclaim), 8 inch precipitation zone. Strink-awell potential is low to moderate, high corrosion hazard to urcoated steel. |
| 18.1-18.2 | BB | Badland-Honierco-Rock Outcrop: Shallow, well drained, fine sandy loan, clay loam, and sandy clay loam soils fonmed on level to moderately sloping hills, ridges, and mesas frav alluvial and eolian materisls derived primarily from shale. Includes nonstony, barren shale areas on uplands that are dissected by deep interwittent drainageways and gullies, and barren sandstone outcrops on moderately sloping to steep ridges, benches, and escarpuenta. | Badland <br> Manierco Rock Outcrop | $\begin{gathered} 0 \\ 10-20 \\ 0 \end{gathered}$ | $\begin{aligned} & 5-30 \\ & 0-8 \\ & 5-30 \end{aligned}$ | $\begin{aligned} & >6 \\ & >6 \\ & >6 \end{aligned}$ | $\begin{gathered} N A \\ 7.4-8.4 \\ N \mathrm{M} \end{gathered}$ | $\begin{aligned} & N A \\ & <2 \\ & N \end{aligned}$ | $\begin{aligned} & \mathrm{N} \\ & \mathrm{D} \\ & \mathrm{~N} \end{aligned}$ | $\begin{aligned} & N M \\ & 3 \\ & M \end{aligned}$ | $\begin{aligned} & \mathrm{N} \\ & .24 \\ & \mathrm{~N} \end{aligned}$ | $\begin{aligned} & N A \\ & 1 \\ & N A \end{aligned}$ | Wind and water erosion hazard is moderate, poor topsoil, 8 inch precipitation zone. Shrink-swell potential is low to moderate, moderate corrosion hazard to uncoated steel. |
| 18.2-18.3 | RA | Riverwash: Deep, well to excessively drained, unstabilized aandy, silty, clayey, or gravelly sediment on level to gently sloping floodplains, streambeds, riverteds, and in arroyos. | Riverwash | $60+$ | 0-3 | N | NA | NA | N | N | NA | NA | Highly susceptible to water erosion and reworking, frequently flooded, 8 inch precipitation zone. |
| 18.3-18.45 | EX | Fruitland-Peraayo-Sheppard: Deep and shallow, well to sonerhat exceasively drained, sandy loan, fine sandy loam, clay loam, loamy fine sand, and fine sand soils fomed on moderately sloping to moderately steep hills, mesas, plateaus, fans, and breaks from alluvium, residum, and eolian materials derived from sandstone and shale. | Fruitland <br> Persayo <br> Sheppard | $\begin{gathered} 60+ \\ 10-20 \\ 60+ \end{gathered}$ | $\begin{aligned} & 5-30 \\ & 5-30 \\ & 5-30 \end{aligned}$ | $\begin{aligned} & >6 \\ & >6 \\ & >6 \end{aligned}$ | $\begin{aligned} & 7.4-8.4 \\ & 7.9-9.0 \\ & 7.9-8.4 \end{aligned}$ | $\begin{aligned} & <4 \\ & <8 \\ & <2 \end{aligned}$ | $\begin{aligned} & \text { B } \\ & \text { D } \\ & \text { A } \end{aligned}$ | $\begin{aligned} & 3 \\ & 4 \mathrm{~L} \\ & 2 \end{aligned}$ | $\begin{aligned} & .24 \\ & .37 \\ & .15 \end{aligned}$ | $\begin{aligned} & 5 \\ & 1 \\ & 5 \end{aligned}$ | Moderate to high wind erosion hazard, low to moderate water erosion hazard, topsoil is poor (Persayo portion-area reclaim), 8 inch precipitation zone. Strink-suell potential is low to moderate, high corrosion hazard to urcoated steel. |
| 18.45-18.65 | $\mathrm{Da}$ | Doak: Deep, well drained, loan, and clayey loan soils formed on level and nearly level mesas, plateaus, and terraces from alluvium derived primarily frau andstone and shale. | Doak | $60+$ | 0-1 | 76 | 7.4-8.4 | $<2$ | B | 5 | . 37 | 5 | Low wind erosion hazard, moderate water erosion hazard, topsoil is fair (too clayey), 8 inch precipitation zone. Sarink-swell potential is low to moderate, low soil strength, high corrosion hazard to umcoated steel. |
| 18.65-18.7 | So | Shiprock: Deep, well drained, fine sandy loan, and sandy loan soila formed on gertly sloping mesas and plateaus from aller vial and eolian materials derived primarily fran sandstone and shale. | Shiprock | $60+$ | 2-5 | 76 | 7.4-8.4 | $<2$ | B | 3 | . 24 | 5 | Moderate wind and water erosion hazard, good topsoil, 8 inch precipitation zone. Shrink-swell potential is low, high corrosion hazard to uncoated steel. |
| 18.7-18.9 |  | Huerfano Hiff-Uffens: Shallow to deep, well drained, sandy clay loam, clay loam, very fine sandy loam, and fine sandy loam soils formed on level to moderately sloping mesas and valleys from allivius and residnom derived primarily fram shale and | Hierfano Miff Uffens | $\begin{gathered} 10-20 \\ 20-40 \\ 60+ \end{gathered}$ | $\begin{aligned} & 0-3 \\ & 0-8 \\ & 0-5 \end{aligned}$ | $\begin{aligned} & >6 \\ & >6 \\ & >6 \end{aligned}$ | $\begin{aligned} & 7.9-9.0 \\ & 7.4-8.4 \\ & 7.4-8.4 \end{aligned}$ | $\begin{aligned} & x_{4} \\ & 2-4 \\ & 4-8 \end{aligned}$ | $\begin{aligned} & D \\ & D \\ & D \end{aligned}$ | $\begin{aligned} & 4 \mathrm{~L} \\ & 3 \\ & 3 \end{aligned}$ | $\begin{aligned} & .32 \\ & .28 \\ & .20 \end{aligned}$ | $\begin{aligned} & 1 \\ & 3 \\ & 1 \end{aligned}$ | Moderate wind and water erosion hazand, topsoil is poor due to shallowness and excess salt/sodium (Muff portior-area reclaim), 8 inch precipitation zone. Shrink-Ewell potential is loy to moderaremexchangeable |

Table 3. Cfuracteristics of the soins hientified along main hatre pipiline rovis p2 (contimued)

| Milepost | Map Syubol | Soil Phase, Series, Associstign, or Camplex and Description | Soil Phase or Series | Depth to Bedrock (inches) | Slope <br> ( Z ) | Depth to High Kater Table (feet) | Soil Reaction (pH) | Salinity (mohos/ (an) | Hydrologic Group | $\begin{aligned} & \text { WEG } \\ & \text { Class } \end{aligned}$ | 'K' | 'T' | Couments |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| 18.9-19.0 | So | Shiprock: Deep, well drained, fine sandy loam, and andy loan soils formed on gently sloping mesas and platesus from alluvial and eolian materials derived primarily from sandstone and shale. | Shiprock | $60+$ | 2-5 | 76 | 7.4-8.4 | $<2$ | B | 3 | . 24 | 5 | Moderate wind and water erosion hazard, good topeoil, 8 inch precipitation zone. Shrink-swell potential is low, high corrosion hazard to uncoated steel. |
| 19.0-19.2 | HJ | Huerfanothiff-Uffens: Shallow to deep, well drained, sandy clay loam, clay loam, very fine sandy loam, and fine sandy loan soils formed on level to moderately sloping mesas and valleys from allivium and residam derived primarily from shale and siltstone. | Huerfano <br> Muff <br> Uffens | $\begin{gathered} 10-20 \\ 20-40 \\ 60+ \end{gathered}$ | $\begin{aligned} & 0-3 \\ & 0-8 \\ & 0-5 \end{aligned}$ | $\begin{aligned} & 26 \\ & 26 \\ & 26 \end{aligned}$ | $\begin{aligned} & 7.9-9.0 \\ & 7.4-8.4 \\ & 7.4-8.4 \end{aligned}$ | $\begin{aligned} & >4 \\ & 2-4 \\ & 4-8 \end{aligned}$ | $\begin{aligned} & D \\ & D \\ & D \end{aligned}$ | $\begin{aligned} & 4 \mathrm{~L} \\ & 3 \\ & 3 \end{aligned}$ | $\begin{aligned} & .32 \\ & .28 \\ & .20 \end{aligned}$ | $\begin{aligned} & 1 \\ & 3 \\ & 1 \end{aligned}$ | Moderate wind and water erosion hazard, topsoil is poor due to shallowness and excess salt/sodium (Muff portion-area reclaim), 8 inch precipitation zone. Strink-swell potentisl is low to moderate, exchrageable sodium content is $25-75 \%$, high corrosion hazard to uncoated steel. |
| 19.2-19.3 | Sd | Sheppard-Hayqueen-Shiprock: Deep, вomewhat excessively and well drained, loamy fine sand, fine sand, and fine sandy loam soils formed on level to moderately sloping mesas and plateaus from allivial and eolian materials derived from sandstone, shale, and mixed sources. | Sheppard Mayqueen Shiprock | $\begin{aligned} & 60+ \\ & 60+ \end{aligned}$ $60+$ | $\begin{aligned} & 5-8 \\ & 2-8 \\ & 0-5 \end{aligned}$ | $\begin{aligned} & 26 \\ & 26 \\ & 26 \end{aligned}$ | $\begin{aligned} & 7.9-8.4 \\ & 7.9-8.4 \\ & 7.4-8.4 \end{aligned}$ | $\begin{aligned} & <2 \\ & <2 \\ & <2 \end{aligned}$ | $\begin{aligned} & \text { A } \\ & \text { B } \\ & \text { B } \end{aligned}$ | $\begin{aligned} & 2 \\ & 2 \\ & 3 \end{aligned}$ | $\begin{aligned} & .15 \\ & .24 \\ & .24 \end{aligned}$ | $\begin{aligned} & 5 \\ & 5 \\ & 5 \end{aligned}$ | Moderate to high wind erosion hazard, low to moderate water erosion hazard, topsoil is poor to good, 8 inch precipitation zone. Shrink-swell potential is low, high corrosion hazard to uncoated steel. |
| 19.3-19.7 | H0 | Huerfanothiff-Uffens: Shallow to deep, well drained, sandy clay loan, clay loan, very fine sandy loam, and fine sandy loam soils formed on level to moderately sloping mesas and valleys from alluvium and resicum derived primarily from shale and siltatone. | Huerfamo Muff Uffens | $\begin{gathered} 10-20 \\ 20-40 \\ 60+ \end{gathered}$ | $\begin{aligned} & 0-3 \\ & 0-8 \\ & 0-5 \end{aligned}$ | $\begin{aligned} & 76 \\ & 26 \\ & 26 \end{aligned}$ | $\begin{aligned} & 7.9-9.0 \\ & 7.4-8.4 \\ & 7.4-8.4 \end{aligned}$ | $\begin{aligned} & >4 \\ & 2-4 \\ & 4-8 \end{aligned}$ | $\begin{aligned} & \mathrm{D} \\ & \mathrm{D} \\ & \mathrm{D} \end{aligned}$ | $\begin{aligned} & 4 \mathrm{~L} \\ & 3 \\ & 3 \end{aligned}$ | $\begin{aligned} & .32 \\ & .28 \\ & .20 \end{aligned}$ | $\begin{aligned} & 1 \\ & 3 \\ & 1 \end{aligned}$ | Moderate wind and water erosion hat and, topsoil is poor due to shallowness and excess salt/sodium (Huff portion-area reclaim), 8 inch precipitation zone. Shrink-swell potential is low to moderate, exchangeable sodium content is $25-75 \%$, high corrosion hazard to uncoated steel. |
| 19.7-19.9 | So | Shiprock: Deep, well drained, fine sandy loam, and sandy loam soils formed on gently sloping mesas and plateaus from alluvial and eolian materials derived primarily fram sandstone and shale. | Shiprock | $60+$ | 2-5 | 76 | 7.4-8.4 | $<2$ | B | 3 | . 24 | 5 | Moderate wind and water erosion hazard, good topeoil, 8 inch precipitation zone. Shrink-swell potential is low, high corrosion hazard to uncasted steel. |
| 19.9-20.55 | Sd | Sheppard-Hayqueen-Shiprock: Deep, somewhat excessively and well drained, loany fine sand, fine sand, and fine sandy loam ooils formed on level to moderately sloping mesas and plateaus from alluvial and eolian materials derived from andstone, shale, and mixed sourcea. | Sheppard Mayqueen Shiprock | $\begin{aligned} & 60+ \\ & 60+ \\ & 60+ \end{aligned}$ | $\begin{aligned} & 5-8 \\ & 2-8 \\ & 0-5 \end{aligned}$ | $\begin{aligned} & >6 \\ & >6 \\ & >6 \end{aligned}$ | $\begin{aligned} & 7.9-8.4 \\ & 7.9-8.4 \\ & 7.4-8.4 \end{aligned}$ | $\begin{aligned} & <2 \\ & <2 \\ & <2 \end{aligned}$ | $\begin{aligned} & \text { A } \\ & \text { B } \\ & \text { B } \end{aligned}$ | $\begin{aligned} & 2 \\ & 2 \\ & 3 \end{aligned}$ | $\begin{aligned} & .15 \\ & .24 \\ & .24 \end{aligned}$ | $\begin{aligned} & 5 \\ & 5 \\ & 5 \end{aligned}$ | Moderate to high wind erosion hazard, low to moderate water erosion hazard, topsoil is poor to good, 8 inch precipitation zone. Sarink-owell potertial is low, high corrosion bazard to uncoated steel. |
| 20.55-20.6 | Da | Doak: Deep, well drained, loam, and clayey loan soils formed on level and nearly level messa, plateans, and terraces from alluvium derived primarily from andstone and shale. | Doak | $60+$ | 0-1 | 76 | 7.4-8.4 | $<2$ | B | 5 | . 37 | 5 | Low wind erosion hazard, moderate water erosion hazard, topsoil is fair (too clayey), 8 inch precipitation zone. Sturink-swell potential is low to moderate, low soil strength, high corrosion hazard to uncoated steel. |
| 20.6-20.7 | Sd | Sheppard Hayqueer-Shiprock: Deep, aconewhat excessively and well drained, loamy fine sand, fine sand, and fine sandy loam soils formed on level to moderately sloping mesas and plateaus fram alluvial and eolian materials derived fran sandstone. shale, and mixed saurces. | Sheppard Mayqueen Shiprock | $\begin{aligned} & 60+ \\ & 60+ \\ & 60+ \end{aligned}$ | $\begin{aligned} & 5-8 \\ & 2-8 \\ & 0-5 \end{aligned}$ | $\begin{aligned} & >6 \\ & >6 \\ & >6 \end{aligned}$ | $\begin{aligned} & 7.9-8.4 \\ & 7.9-8.4 \\ & 7.4-8.4 \end{aligned}$ | $\begin{aligned} & <2 \\ & <2 \\ & <2 \end{aligned}$ | $\begin{aligned} & \text { A } \\ & \text { B } \\ & \text { B } \end{aligned}$ | $\begin{aligned} & 2 \\ & 2 \\ & 3 \end{aligned}$ | $\begin{aligned} & .15 \\ & .24 \\ & .24 \end{aligned}$ | $\begin{aligned} & 5 \\ & 5 \\ & 5 \end{aligned}$ | Moderate to high wind erosion hazard, low to moderate water erosion hazard, topeoil is poor to good, 8 inch precipitation zone. Sturink-owell potertisl is low, high corrosion hazard to uncoated steel. |

Table 3. Charactiplistics of tie soils identifird aionc main hatir pipenine rait P2 (contimued)

| Milepost | $\stackrel{\text { Map }}{\text { Syabol }^{2}}$ | Soil Phase, Series, Asbociatipa, or Couplex and Description | Soil Phase or Series | Depth to Bedrock (inches) | $\underset{(\text { I })}{\substack{\text { Slope }}}$ | Depth to High Kater Table (feet) | $\begin{gathered} \text { reaction } \\ (\mathrm{pH}) \end{gathered}$ |  | Hydrologic Grap | $\underset{C l a s s}{{ }_{C l}^{\text {Liag }}}$ | 'K' | 'T' | Camments |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| 20.7-20.75 | $\mathrm{D}_{\mathrm{D}}$ | Doak: Deep, well drained, loam, and clayey loam soils formed on level and nearly level mesas, plateaus, and terracea from alluvium derived primarily froas sandstone and shale. | Doalk | $60+$ | 0-1 | 76 | 7.4-8.4 | <2 | B | 5 | 37 | 5 | Low wind erosion hazard, moderate water erosion hazard, topsoil is fair (too clayey), 8 inch precipitation zooe. Shrink-awell potential is low to moderate, low soil strength, high corrosion hazard to unoosted steel. |
| 20.75-26.0 | $\mathrm{Sd} / \mathrm{sol}$ <br> $S_{n}$ | Shiprock-Sheppand-Mayqueen: Deep, sanewhat excessively and well drained, loamy fine sand, fine sand, fine sandy loam, and sandy loam soils formed on level to moderately sloping mesas and plateans from alluvial and eolian materials derived from sandstone, shale, and mixed sources. | Shiprock <br> Sheppard <br> Mayqueen | $\begin{aligned} & 60+ \\ & 60+ \\ & 60+ \end{aligned}$ | $\begin{aligned} & 0-5 \\ & 5-8 \\ & 2-8 \end{aligned}$ | $\begin{aligned} & >6 \\ & >6 \\ & >6 \end{aligned}$ | $\begin{aligned} & 7.4-8.4 \\ & 7.9-8.4 \\ & 7.9-8.4 \end{aligned}$ | $\begin{aligned} & <2 \\ & <2 \\ & <2 \end{aligned}$ | $\begin{aligned} & \text { B } \\ & \text { A } \end{aligned}$ | $\begin{aligned} & 3 \\ & 2 \\ & 2 \end{aligned}$ | .24 .15 .24 | $5$ | Moderate to high vind erosion hazard, low to moderate water erosion hazard, topsoil is good to poor, 8 inch precipitation zone. Surink-wwell poter tial is low, high corrosion hazard to uncoated ateel. |
| 26.0-26.4 |  | Doak-Uffens: Deep, well drained, very fine sandy loam, sandy clay loam, fine sandy loam, and clay loan soils formed on level to gently sloping mesas and plateaus fran alluvium derived primarily from sandstone and shale. | Doak Uffens | $\begin{aligned} & 60+ \\ & 60+ \end{aligned}$ | $\begin{aligned} & 0-3 \\ & 0-3 \end{aligned}$ | $\begin{aligned} & >6 \\ & >6 \end{aligned}$ | $\begin{aligned} & 7.4-8.4 \\ & 7.4-8.4 \end{aligned}$ | $\begin{aligned} & <2 \\ & 4-8 \end{aligned}$ | $\begin{aligned} & \text { B } \\ & \text { D } \end{aligned}$ | $\begin{aligned} & 3 \\ & 3 \end{aligned}$ | .37 .20 | $\begin{aligned} & 5 \\ & 1 \end{aligned}$ | Hoderate wind and water erosion hazand, topsoil is fair to poor (excess clay or salt/bodium), 8 inch precipitation zone. Starink-suell potential is la to moderate, high corrosion hazard to ucaated steel. |
| 26.4-26.95 |  | Sheppard-Mayqueen-Shiprock: Deep, sanewhat excessively and well drained, loany fine sand, fine sand, and fine sandy loam soils formed on level to moderately sloping mesas and plateaus from allirvial and eolian materials derived from sandstone, shale, and mixed sources. | Sheppard <br> Mayqueen <br> Shiprock | $\begin{aligned} & 60+ \\ & 60+ \\ & 60+ \end{aligned}$ | $\begin{aligned} & 5-8 \\ & 2-8 \\ & 0-5 \end{aligned}$ | $\begin{aligned} & >6 \\ & >6 \\ & >6 \end{aligned}$ | $\begin{aligned} & 7.9-8.4 \\ & 7.9-8.4 \\ & 7.4-8.4 \end{aligned}$ | $\begin{aligned} & <2 \\ & <2 \\ & <2 \end{aligned}$ | $\begin{aligned} & \text { A } \\ & \text { B } \\ & \text { B } \end{aligned}$ | $3$ | .15 .24 .24 | $\begin{aligned} & 5 \\ & 5 \end{aligned}$ | Moderate to high wind erosion hazard, low to moderate water erosion hazard, topsoil is poor to good, 8 inch precipitation zone. Slurink-owell poter tial is low, high corrosion hazard to uncoated steel. |
| 26.95-27.4 |  | Doak-Uffens: Deep, well drained, very fine sandy loam, sandy clsy loan, fine sandy loam, and clay loam soils formed on level to gently sloping mesas and plateaus from alluvium derived primar ily from sandstone and shale. | Doak Uffens | $\begin{aligned} & 60+ \\ & 60+ \end{aligned}$ | $\begin{aligned} & 0-3 \\ & 0-3 \end{aligned}$ | $\begin{aligned} & >6 \\ & >6 \end{aligned}$ | $\begin{aligned} & 7.4-8.4 \\ & 7.4-8.4 \end{aligned}$ | $\begin{aligned} & <2 \\ & 4-8 \end{aligned}$ | $\begin{aligned} & \text { B } \\ & \text { D } \end{aligned}$ | $\begin{aligned} & 3 \\ & 3 \end{aligned}$ | .37 .20 | $5$ | Moderate wind and water erosion hazand, topsoil is fair to poor (excess clay or balt/sodiun), 8 inch precipitation zone. Strink-swell potential is low to moderate, high corrosion hazard to umooated steel. |
| 27.4-27.45 | Sd | Sheppard-Hayqueen-Shiprock: Deep, sonewhat excessively and well drained, losmy fine sand, fine sand, and fine sandy loam soils formed on level to moderately sloping mesas and plateans from alluvial and eolian materials derived from sandstone, shale, and mixed sources. | Sheppard <br> Mayqueen <br> Shiprock | $\begin{aligned} & 60+ \\ & 60+ \\ & 60+ \end{aligned}$ | $\begin{aligned} & 5-8 \\ & 2-8 \\ & 0-5 \end{aligned}$ | $\begin{aligned} & >6 \\ & >6 \\ & >6 \end{aligned}$ | $\begin{aligned} & \text { 7.9-8.44 } \\ & 7.9-8.4 \\ & 7.4-8.4 \end{aligned}$ | $\begin{aligned} & <2 \\ & <2 \\ & <2 \end{aligned}$ | $\begin{aligned} & A \\ & B \\ & B \end{aligned}$ | $3$ | .15 .24 .24 | $\begin{aligned} & 5 \\ & 5 \end{aligned}$ | Moderate to high wind erosion hazard, low to moderaté water erosion hazard, topsoil is poor to good, 8 inch precipitation zone. Starink-avell poter tial is low, high corrosion hazard to uncoated steel. |
| 27.45-27.9 |  | Doak-Ulffens: Deep, well drained, very fine andy loam, sandy clay loam, fine sandy loam, and clay loan soils formed on level to gently sloping mesas and plateaus from alluvium derived primar ily from andatone and shale. | Doak Uffens | $\begin{aligned} & 60+ \\ & 60+ \end{aligned}$ | $\begin{aligned} & 0-3 \\ & 0-3 \end{aligned}$ | $\begin{aligned} & >6 \\ & >6 \end{aligned}$ | $\begin{aligned} & 7.4-8.4 \\ & 7.4-8.4 \end{aligned}$ | $\begin{aligned} & <2 \\ & 4-8 \end{aligned}$ | $\begin{aligned} & \text { B } \\ & \text { D } \end{aligned}$ | $\begin{aligned} & 3 \\ & 3 \end{aligned}$ | .37 .20 | $\begin{aligned} & 5 \\ & 1 \end{aligned}$ | Moderate vind and water erosion hazand, topsoil is fair to poor (excess clay or salt/aodium), 8 inch precipitation zone. Strink-swell potential is low to moderate, high corrosion hazard to uncoated ateel. |
| 27.9-27.95 | Sd | Sheppard-Hayqueer-Shiprock: Deep, somewhat excessively and well drained, loamy fine sand, fine sand, and fine sandy loam soils formed on level to moderstely sloping nesas and plateaus from allivial and | Sheppand <br> Mayqueen Shiprock | $\begin{aligned} & 60+ \\ & 60+ \\ & 60+ \end{aligned}$ | $\begin{aligned} & 5-8 \\ & 2-8 \\ & 0-5 \end{aligned}$ | $\begin{aligned} & >6 \\ & >6 \\ & >6 \end{aligned}$ | $\begin{aligned} & \text { 7.9-8.4 } \\ & 7.9-8.4 \\ & 7.4-8.4 \end{aligned}$ | $\begin{aligned} & <2 \\ & <2 \\ & <2 \end{aligned}$ | $\stackrel{A}{B}$ | $\begin{aligned} & 2 \\ & 2 \end{aligned}$ | .15 .24 .24 | $5$ | Moderate to high wind erosion hazard, low to moderate water erosion hazard, topsoil is poor to good, 8 inch precipitation zone. Sarink-awell potertial is low, high corrosion hazard to |



| Milepoat ${ }^{\text {s }}$ | $\underset{\text { Myp }}{\text { Myubol }}$ | Soil Phase, Series, Associatipa, or Couplex and Description | Soil Phase or Seriee | Depth to Bedrock (inchen) | $\underset{(X)}{\text { slope }^{\text {H }}}$ | Depth to High Hater Table (feet) | $\begin{gathered} \text { Roaction } \\ (\mathrm{pHI}) \end{gathered}$ | Salinity (uxtoo/ ai) | $\begin{aligned} & \text { uydro- } \\ & \text { logic } \\ & \text { Group } \end{aligned}$ | $\begin{aligned} & \text { VRG } \\ & \text { Class } \end{aligned}$ | 'K' | 'T' | Coments |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| 27.95-28.05 | du | Doak-Iffens: Deep, well drained, very fine aandy loan, sandy clay loan, fine sandy lome and clay loam soils forved on level to gently sloping mesas and plateaus from allivium derived primarily from andetone and ahale. | Doak uffena | $\begin{aligned} & 60+ \\ & 60+ \end{aligned}$ | $\begin{aligned} & 0-3 \\ & 0-3 \end{aligned}$ | $\begin{aligned} & >6 \\ & >6 \end{aligned}$ | $\begin{aligned} & 7.4-8.4 \\ & 7.4-8.4 \end{aligned}$ | $\stackrel{8}{2}$ | $\begin{aligned} & \text { B } \\ & \text { D } \end{aligned}$ | $\begin{aligned} & 3 \\ & 3 \end{aligned}$ | $\begin{aligned} & .37 \\ & .20 \end{aligned}$ | $\begin{aligned} & 5 \\ & 1 \end{aligned}$ | Moderate wind and water erosion hat and, topeoil is fair to poor (excess clay or aalt/sodium), 8 inch precipitation zone. Starink-awell potential is low to moderate, high corrosion havard to uncoated ateel. |
| 28.05-30.6 S | So/sd | Shiprock-Sheppard Hayqueen: Deep, eovewhat excessively and vell drained, lowny fine sand, fixe sand, fine eandy loam, and candy loem soile formed on level to moderately sloping mesas and plateans from allivial and eolian materials derived from sandatone, ahale, and mixed nources. | Shiprock Sheppard Mayquean | $\begin{aligned} & 60+ \\ & 60+ \\ & 60+ \end{aligned}$ | $\begin{aligned} & 0-5 \\ & 5-8 \\ & 2-8 \end{aligned}$ | $\begin{aligned} & >6 \\ & >6 \\ & >6 \end{aligned}$ | $\begin{aligned} & 7.4-8.4 \\ & 7.9-8.4 \\ & 7.9-8.4 \end{aligned}$ | $\begin{aligned} & <2 \\ & <2 \\ & <2 \end{aligned}$ |  | $\begin{aligned} & 3 \\ & 2 \end{aligned}$ | $\begin{aligned} & .24 \\ & .15 \\ & .24 \end{aligned}$ | $\begin{aligned} & 5 \\ & 5 \\ & 5 \end{aligned}$ | Hoderate to high wind erosion hezard, low to moderate water erosion hazard, topeoil is good to poor, 8 inch precipitation zone. Shrink-avell poter tial is low, high corrosion hazard to uncoated ateel. |
| 30.6-30.9 | Du | Doak-Iffens: Deep, well drained, very fine sandy loea, sendy clay lomen, fine andy loam, and clay loam wils formed on level to gently sloping mesas and plateaus from alluvium derived primarily from andatone and ahale. | Doak Uffena | $\begin{aligned} & 60+ \\ & 60+ \end{aligned}$ | $\begin{aligned} & 0-3 \\ & 0-3 \end{aligned}$ | $\begin{aligned} & 76 \\ & 76 \end{aligned}$ | $\begin{aligned} & 7.4-8.4 \\ & 7.4-8.4 \end{aligned}$ | ${ }_{4}^{2}$ | $\begin{aligned} & \text { B } \\ & \text { D } \end{aligned}$ | $\begin{aligned} & 3 \\ & 3 \end{aligned}$ | $\begin{aligned} & .37 \\ & .20 \end{aligned}$ | $5$ | Hoderate wind and water erosion hazand, topeoil is fair to poor (excesa clay or att/sodium), 8 inch precipitation zone. Shrink-awell potential is low to moderate, high corrosion hazard to unooated ateel. |
| 30.9-31.3 | SC | Sheppand-Hherfamo-Hotal: Deep and aballow, eweshat ercessively and well drained, loamy fine sand, fine sand, eandy clay loan, clay loan, and clay soils formed on level to moderately sloping valley bottomes, fans, mesas, and plateaus from eolian, alluvisl, and residual materials derived from andstooe, shale, and siltatone. | Sheppard Muerfano Notal | $\begin{gathered} 60+ \\ 10-20 \\ 60+ \end{gathered}$ | $\begin{aligned} & 2-8 \\ & 0-3 \\ & 0-2 \end{aligned}$ | $\begin{aligned} & >6 \\ & >6 \\ & >6 \end{aligned}$ | $7.9-8.4$ $7.9-9.0$ <br> $7.9-9$ | $\begin{aligned} & <2 \\ & >4 \\ & 4-8 \end{aligned}$ | D | $\begin{aligned} & 2 \\ & 4 \mathrm{~L} \\ & 4 . \end{aligned}$ | $\begin{aligned} & .15 \\ & 32 \\ & 32 \end{aligned}$ | $\begin{aligned} & 5 \\ & 1 \\ & 5 \end{aligned}$ | Moderate to high vind erosion hazard, low to moderate water erosion hazard, topeoil is fair to poor, 8 inch precipitation zone. Shrink-avell potertial is low to high, exchangeable sodium content ranges from 15-75y for heerfano-kotal portion, high corrosion hazard to umcoated ateel. |
| 31.3-31.75 | 5 Sd | Sheppard-Kayqueen-Shiprock: Deep, acwewhat excessively and well drained, loany fine aand, fine sand, and fine sandy loem soils formed on level to moderately aloping meas and plateans from alluvial and eolian materials derived from semdstone, shale, and mixed scurcen. | Sheppard Mayqueen Shiprock | $\begin{aligned} & 60+ \\ & 60+ \\ & 60+ \end{aligned}$ | $\begin{aligned} & 5-8 \\ & 2-8 \\ & 0-5 \end{aligned}$ | $\begin{aligned} & 76 \\ & >6 \\ & \lambda 6 \end{aligned}$ | 7.9-8.4 <br> 7.9-8.4 <br> 7.4-8.4 | $\begin{aligned} & <2 \\ & <2 \\ & <2 \end{aligned}$ | $\wedge$ | $\begin{aligned} & 2 \\ & 2 \\ & 3 \end{aligned}$ | $\begin{aligned} & .15 \\ & .24 \\ & .24 \end{aligned}$ | $\begin{aligned} & 5 \\ & 5 \\ & 5 \end{aligned}$ | Moderate to high vind erosion hazard, low to moderate water erosion hazard, topsoil is poor to good, 8 inch precipitation zone. Shrink-avell potertial is low, high corrosion herard to uncoated ateel. |
| 31.75-31.8 | . 8 D2 | Dme Land: Deep, excessively drained, umatabilized eolian sand and fine asnd occuring an moderately aloping to steep menan, platems, and in major drainagemys. | Dume Lend | $60+$ | 5-25 | $\chi$ | m | 4 | M | 4 | M | m | High wind erosion hazard, low vater erosion hazard, poor topeoil (too eandy, excess fines), 8 inch precipitation zone. Shrink-avell potential is low. |
| 31.8-32.5 | Sd | Sheppand-Hayquesp-Shiprock: Deep, soceswhat excessively and vell drained, loeny fine sand, fine sand, and fine asndy loam ooils formed an level to moderately sloping mesas and platesus from allirvial and eolian materials derived from andstone, shale, and mixed scurces. | Sheppard Mayqueen Shiprock | $\begin{aligned} & 60+ \\ & 60+ \\ & 60+ \end{aligned}$ | $\begin{aligned} & 5-8 \\ & 2-8 \\ & 0-5 \end{aligned}$ | $\begin{aligned} & >6 \\ & >6 \\ & >6 \end{aligned}$ | $\begin{aligned} & 7.9-8.4 \\ & 7.9-9.4 \\ & 74-8.4 \end{aligned}$ | $\begin{aligned} & <2 \\ & <2 \\ & <2 \end{aligned}$ | A | 2 2 3 | $\begin{aligned} & .15 \\ & .24 \\ & .24 \end{aligned}$ | 5 5 5 | Moderate to high vind erosion harard, low to moderate water erosion hazard, topsoil is poor to good, 8 inch precipitation sone. Shrink-awell poter tial is low, high corrosion hasard to uncoated ateel. |
| 32.5-33.7 | 7 S | Sheppard-Huerfano-tibtal: Deep and shallow, ecmentat excesaively and vell drained, loeny fine sand, fine asnd, andy clay loen, clay loen, and clay coils fonned on level to moderately sloping valley bottome, fans, mesas, and platesus from eolien, alluvial. and reaidual materials derived from sandetone, shale, and siltstone. | Sheppard Hiverfeno Hotal | $\begin{gathered} 60+ \\ 10-20 \\ 60+ \end{gathered}$ | $\begin{aligned} & 2-8 \\ & 0-3 \\ & 0-2 \end{aligned}$ | $\begin{aligned} & 26 \\ & 26 \\ & 26 \end{aligned}$ | $\begin{aligned} & 7.9-8.4 \\ & 7.9-9.0 \\ & 7.9-9.0 \end{aligned}$ | $\begin{aligned} & 2 \\ & >4 \\ & 4-8 \end{aligned}$ | D | 2 4 4. | $\begin{aligned} & .15 \\ & .32 \\ & 32 \end{aligned}$ | 5 1 5 | Moderate to high vind erosion bazard, low to moderate water erosion hazard, topsoil is fair to poor, 8 inch precipitation rave. Sarink-avell poter tial is low to high, eachangeable oodinan content ranges from 15-75\% for Herfano-Notal portion, high corrosion hazard to uncoated steel. |



| Milepost | Map Syubol | Soil Phase, Series, Aosocistipa, or Couplex and Description | Soil Phase ar Series | Depth to Bedrock (inchea) | 8lope ( X ) | Depth to High Kater Table (feet) | $\begin{aligned} & \text { Soil } \\ & \text { Reaction } \\ & (\mathrm{pH}) \end{aligned}$ | 8alinity (muhos) ain | Hydrologic Group | $\begin{aligned} & \text { WEG } \\ & \text { Clasa } \end{aligned}$ | 'K' | 'T' | Couments |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| 33.7-36.2 | B | Badland: Moderately sloping to extremly steep, nonstony, barren shale uplands that are dissected by deep intermittent drainagewys and gullies. | Badland | 0 | 5-80 | s | M | M | M | M | M | M | 8 inch precipitation zone. |
| 36.2-37.9 | SC | Sheppand-hierfano-Hotal: Deep and shallow, qumerhat excessively and well drained, loany fine and, fine sund, sandy clay loem, clay loem, and clay soils formed on level to moderately sloping valley bottom, fans, mesas, and platesus from eoliam, allevial, and residual materials derived from andetoos, shale, and siltstone. | Sheppand Huerfano Notal | $\begin{gathered} 60+ \\ 10-20 \\ 60+ \end{gathered}$ | $\begin{aligned} & 2-8 \\ & 0-3 \\ & 0-2 \end{aligned}$ | $\begin{aligned} & 76 \\ & >6 \\ & >6 \end{aligned}$ | $\begin{aligned} & 7.9-8.4 \\ & 7.9-9.0 \\ & 7.9-9.0 \end{aligned}$ | $\begin{aligned} & <2 \\ & >4 \\ & 48 \end{aligned}$ | $\begin{aligned} & \mathbf{A} \\ & \mathbf{D} \\ & \mathrm{D} \end{aligned}$ | $\begin{aligned} & 2 \\ & 4 \mathrm{~L} \\ & 4 \mathrm{~L} . \end{aligned}$ | $\begin{aligned} & .15 \\ & .32 \\ & .32 \end{aligned}$ | $\begin{aligned} & 5 \\ & 1 \\ & 5 \end{aligned}$ | Moderate to high wind erosion hazard, low to moderate water erosion hazard, topeoil is fair to poor, 8 inch precipitation sone. Starink-awell potertial is low to high, exchangeable sodim coutent ranges from 15-75\% for Herfemo-ithtal portion, high corrosion hazand to umooated ateel. |
| 37.9-38.3 | B | Badland: Moderately sloping to extremely steep, nonstony, barrea shale uplande that are dissected by deep intemittent drainageway and gullies. | Badlend | 0 | 5-80 | su | n | M | M | M | M | m | 8 inch precipitation zone. |
| 38.3-38.85 | S | Sheppand-Hherfano-Nbtal: Deep and shallow, somewhat excessively and well drained, loany fine sand, fine sand, sandy clay loem, clay loem, and clay soils formed an level to moderately sloping valley bottoms, fans, mesas, and platean from eolian, allirvial, and residual materials derived from andatone, shale, and siltstone. | Sbeppand Huerfano Hotal | $\begin{gathered} 60+ \\ 10-20 \\ 60+ \end{gathered}$ | $\begin{aligned} & 2-8 \\ & 0-3 \\ & 0-2 \end{aligned}$ | $\begin{aligned} & >6 \\ & >6 \\ & >6 \end{aligned}$ | $\begin{aligned} & 7.9-8.4 \\ & 7.9-9.0 \\ & 7.9-9.0 \end{aligned}$ | $\begin{aligned} & <2 \\ & >4 \\ & 4-8 \end{aligned}$ | $\begin{aligned} & \text { A } \\ & \text { D } \\ & \text { D } \end{aligned}$ | $\begin{aligned} & 2 \\ & 4 \mathrm{~L} \\ & 4 \mathrm{~L} \end{aligned}$ | $\begin{aligned} & .15 \\ & .32 \\ & .32 \end{aligned}$ | $\begin{aligned} & 5 \\ & 1 \\ & 5 \end{aligned}$ | Moderate to high wind erosion hazard, low to moderate water erosion hazard, topsoil is fair to poor, 8 inch precipitation rave. Shrink-avell potential is low to high, exchangeable sodium content ranges from 15-75\% for Hierfano-hotal portion, high corrosion hazard to uncoated steel. |
| 38.85-38.95 | ED | Riverwast-Dumeland: Deep, poorly to excesaively drained, unstabilized aandy, silty, clayey, and gravelly alluvium occarring on level and nearly level floodplains, streabbeds, and arroyos; and unstabilized eolian sand occurring on nearly level to steep mease, plateaus, and wajor drainageways. | Riverwash <br> Dmeland | $\begin{aligned} & 60+ \\ & 60+ \end{aligned}$ | $\begin{aligned} & 0-2 \\ & 2-40 \end{aligned}$ | $\begin{aligned} & 0-2^{2} \\ & >6 \end{aligned}$ | $\begin{aligned} & M M \\ & M M \end{aligned}$ | $\begin{aligned} & \mathrm{MM} \\ & \mathrm{MM} \end{aligned}$ | $\begin{aligned} & \mathrm{D} \\ & \mathbf{A} \end{aligned}$ | $\begin{aligned} & \mathrm{MA} \\ & 1 \end{aligned}$ | $\begin{aligned} & \mathrm{kA} \\ & .15 \end{aligned}$ | ${ }_{5}^{\mathrm{IM}}$ | Low and high (Dumeland portion) vind erosion hazard, high (Riverwash portion) and low water erosion hazard, poor topsoil, 6-10 inch precipitation sone. Riverwash portion is frequently flooded, and abrink-avell potertial is low. |
| 38.95-39.5 | тав | Turley-Pruitland-Blancot: Deep, well drained, clay loam, loam, fine sandy loana, and andy loem eoils formed on level to moderately ateep alluvial fans, upland valley aideslopes, and mesas from mixed alliviin derived from sandatone and ahale. | Turley <br> Pruitland <br> Blancot | $\begin{aligned} & 60+ \\ & 60+ \\ & 60+ \end{aligned}$ | $\begin{aligned} & 0-5 \\ & 0-30 \\ & 0-5 \end{aligned}$ | $\begin{aligned} & >6 \\ & >6 \\ & >6 \end{aligned}$ | $\begin{aligned} & 7.4-9.0 \\ & 7.4-8.4 \\ & 7.9-9.0 \end{aligned}$ | $\begin{aligned} & 2-4 \\ & <4 \\ & 2-4 \end{aligned}$ | $\begin{aligned} & \mathrm{B} \\ & \mathrm{~B} \\ & \mathbf{B} \end{aligned}$ | $\begin{aligned} & 3,4 \mathrm{~L} \\ & 1,3,5 \\ & 3,5 \end{aligned}$ | $\begin{aligned} & .37 \\ & .28 \\ & . .28 \end{aligned}$ | $\begin{aligned} & 5 \\ & 5 \\ & 5 \end{aligned}$ | Low to high (Pruitland portion) wind erosion hazard, moderate water erosion hazard, fair to good topsoil, 6-10 inch precipitation zowe. These soils are mildly to atroogly alkaline (calcareous), and abrink-avell poteatial is low to moderate. |
| 39.5-40.1 | 8SE | Shiprock-Sheppard-Huerfape: Deep to shallow, well to somenhat exceasively drained, fine sandy loass, fine sand, loany fine sand, asndy clay loan, sandy loam, and clay lome soils. These eoils fomed an nearly level to atroogly sloping mesas, plateans, and upland valley bottome from aandy alluvial and colian materials derived from asndetone; and from alliviim, residum, and loess derived from shale and siltatone. | Shiprock Sheppard Huerfano | $\begin{gathered} 60+ \\ 60+ \\ 10-20 \end{gathered}$ | $\begin{aligned} & 0-8 \\ & 1-12 \\ & 0-3 \end{aligned}$ | $\begin{aligned} & 26 \\ & >6 \\ & 26 \end{aligned}$ | $\begin{aligned} & 7.4-9.0 \\ & 7.4-8.4 \\ & 7.9-9.0 \end{aligned}$ | $\begin{aligned} & <4 \\ & <2 \\ & >4 \end{aligned}$ | $\begin{aligned} & \text { B } \\ & \text { A } \\ & \text { D } \end{aligned}$ | $\begin{gathered} 2,3 \\ 1 \\ 3,42 \end{gathered}$ | $\begin{aligned} & .24 \\ & .10 \\ & .32 \end{aligned}$ | $\begin{aligned} & 5 \\ & 5 \\ & 1 \end{aligned}$ | Moderate to high wind erosion hazard, moderate to low water erosion hazard, good to poor topeoil, 6-10 inch precipitation zone. These soils are mildly to atroagly alkaline (Hierfano portion is sodium affected), and shrink-avell potential is low to moderate. |
| $40.1-40.65$ 0 | TAB | Thrley Truitland-Blancot: Deep, well drained, clay loen, loan, fine santy loam, and sandy loses soils formed on level to moderately steep alluvial fana, upland valley sideslopes, and messes from mixed all .rerived ndstoc pernle. | Durley <br> Yruitland <br> Blmant | $\begin{aligned} & 60+ \\ & 60+ \\ & 60+ \end{aligned}$ | $\begin{aligned} & 0-5 \\ & 0-30 \\ & 0-5 \end{aligned}$ | $\begin{aligned} & 26 \\ & 26 \\ & 26 \end{aligned}$ | $\begin{aligned} & 7.4-9.0 \\ & 7.4-8.4 \\ & 7.9-9.0 \end{aligned}$ | $\begin{aligned} & 2-4 \\ & <4 \\ & 2-4 \end{aligned}$ | $\begin{aligned} & \mathbf{B} \\ & \mathbf{B} \\ & \mathbf{B} \end{aligned}$ | $\begin{aligned} & 3,4 \mathrm{~L} \\ & 1,3,5 \\ & 3,5 \end{aligned}$ | $\begin{aligned} & .37 \\ & .28 \\ & .28 \end{aligned}$ | $\begin{aligned} & 5 \\ & 5 \\ & 5 \end{aligned}$ | Low to high (Pruitland portion) vind erosion haxard, moderate water erosion hazard, fair to good topeoil, 6-10 inch precipitation zone. These soila are mildly to atrongly alkaline (calcareous), and shrink-auell poten- |

Table 3. CHaractiristics of the sons meanified aionc main hater pipline rovie p2 (concluded)

| Milepost | Map Syubol | Soil Phase, Series, Associatign, or Camplex and Description | Soil Phase or Series | Depth to Bedrock (inches) | Slope <br> (\%) | Depth to High Water Table (feet) | Soil Reaction (pH) | Salinity (muhos/ cal | Hydrologic Group | $\begin{gathered} \text { WEG } \\ \text { Class } \end{gathered}$ | 'K' | 'T' | Conments |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| 40.65-40.85 | H2 | Badland-Rock Outcrop: Nonstory, moder ately sloping to extremely steep barren shale uplands that are dissected by deep intermittent drainageways and gullies; and barren andstone exposures on moderately sloping to extremely steep ridges, benches, and escarpwents. | Badland Rock Outcrop | $0$ | $\begin{aligned} & 5-80 \\ & 5-80 \end{aligned}$ | $\begin{aligned} & >6 \\ & >6 \end{aligned}$ | $\begin{aligned} & \mathrm{N} \\ & \mathrm{~N} \end{aligned}$ | $\begin{aligned} & N A \\ & N A \end{aligned}$ | $\begin{aligned} & \mathrm{D} \\ & \mathrm{D} \end{aligned}$ | $\begin{aligned} & N A \\ & N A \end{aligned}$ | $\begin{aligned} & N A \\ & N A \end{aligned}$ | $\begin{aligned} & \mathrm{NA} \\ & \mathrm{M} \end{aligned}$ | Wind erosion hazard is low, Bedland portion is susceptible to water erosion, topsoil is generally nonexistent (i.e., poor topsoil), 6-10 inch precipitation zone. Potential runoff on Bedland portion is very rapid. |
| 40.85-41.2 | TAB | TurleyPruitland-Blancot: Deep, well drained, clay loam, laam, fine sandy loam, and sandy loam soils formed on level to moderstely steep alluvial fans, upland valley sideslopes, and mesas from mixed alluvium derived from sandstone and shale. | Turley <br> Fruitland <br> Blancot | $\begin{aligned} & 60+ \\ & 60+ \\ & 60+ \end{aligned}$ | $\begin{aligned} & 0-5 \\ & 0-30 \\ & 0-5 \end{aligned}$ | $\begin{aligned} & >6 \\ & >6 \\ & >6 \end{aligned}$ | $\begin{aligned} & 7.49 .0 \\ & 7.4-8.4 \\ & 7.9-9.0 \end{aligned}$ | $\begin{aligned} & 2-4 \\ & <4 \\ & 2-4 \end{aligned}$ | $\begin{aligned} & \text { B } \\ & \text { B } \\ & \text { B } \end{aligned}$ | $\begin{aligned} & 3,4 \mathrm{~L} \\ & 1,3,5 \\ & 3,5 \end{aligned}$ | $\begin{aligned} & .37 \\ & .28 \\ & .28 \end{aligned}$ | $\begin{aligned} & 5 \\ & 5 \\ & 5 \end{aligned}$ | Low to high (Pruitland portion) wind erosion hazard, moderate water erosion hazard, fair to good topesil, 6-10 inch precipitation zone. These soils are mildly to strongly alkaline (calcarecus), and ahrink-owell potertial is low to moderate. |
| 41.2-41.3 | SSH | Shiprock-Sheppard fherfano: Deep to shallow, well to sanewhat excessively drained, fine sandy loam, fine sand, loanty fine asnd, sandy clay loan, sandy loan, and clay loan soils. These soils formed on nearly level to strongly sloping mesas, plateaus, and upland valley bottons from sandy alluvial and eolian materials derived from sandstone; and from alluvium, residum, and loess derived fram shale and siltstone. | Shiprock Sheppard Huerfano | $\begin{gathered} 60+ \\ 60+ \\ 10-20 \end{gathered}$ | $\begin{aligned} & 0-8 \\ & 1-12 \\ & 0-3 \end{aligned}$ | $\begin{aligned} & >6 \\ & >6 \\ & >6 \end{aligned}$ | $\begin{aligned} & 7.4-9.0 \\ & 7.4-8.4 \\ & 7.9-9.0 \end{aligned}$ | $\begin{aligned} & <4 \\ & <2 \\ & >4 \end{aligned}$ | $\begin{aligned} & \text { B } \\ & \text { A } \\ & \text { D } \end{aligned}$ | $\begin{gathered} 2,3 \\ 1 \\ 3,4 \mathrm{~L} \end{gathered}$ | $\begin{aligned} & .24 \\ & .10 \\ & .32 \end{aligned}$ | $\begin{aligned} & 5 \\ & 5 \\ & 1 \end{aligned}$ | Moderate to high wind erosion hazard, moderate to low water erosion hazard, good to poor topsoil, 6-10 inch precipitation zone. These soils are mildly to strongly alkaline (Huerfano portion is oodium affected), and slurink-swell potential is low to moderate. |
| 41.3-42.1 | SC | Sheppard-Hherfano-Notsl: Deep and shallow, sanewhat excessively and well drained, loary fine sand, fine aand, sandy clay loam, clay loam, and clay soils formed on level to moderately sloping valley bottoms, fans, wesas, and plateass from eolian, alluvial, and residual materials derived from sandstone, shale, and siltstone. | Sheppard Herfano Notal | $\begin{gathered} 60+ \\ 10-20 \\ 60+ \end{gathered}$ | $\begin{aligned} & 2-8 \\ & 0-3 \\ & 0-2 \end{aligned}$ | $\begin{aligned} & >6 \\ & >6 \\ & >6 \end{aligned}$ | $\begin{aligned} & 7.9-8.4 \\ & 7.9-9.0 \\ & 7.9-9.0 \end{aligned}$ | $\begin{aligned} & <2 \\ & >4 \\ & 4-8 \end{aligned}$ | $\begin{aligned} & \text { A } \\ & \text { D } \\ & \text { D } \end{aligned}$ | $\begin{aligned} & 2 \\ & 4 \mathrm{~L} \\ & 4 \mathrm{~L} \end{aligned}$ | $\begin{aligned} & .15 \\ & .32 \\ & .32 \end{aligned}$ | $\begin{aligned} & 5 \\ & 1 \\ & 5 \end{aligned}$ | Moderate to high wind erosion hazard, low to moderate water erosion hazard, topsoil is fair to poor, 8 inch precipitation zone. Shrink-swell poterr tial is low to high, exchangeable oodiun content ranges from 15-75\% for Huerfano-Notal portion, high corrosion hazard to uncoated steel. |
| 42.1-42.45 | BA | Badland: Moderately sloping to extrenely steep, noustony, barren shale uplands that are dissected by deep intemittent drainageways and gullies. | Bodland | 0 | 5-80 | M | N | NA | N | N | NA | N | 8 inch precipitation zone. |
| 42.45-42.6 | S | Sheppard-herfano-Notal: Deep and shallow, somewhat excessively and well drained, loarry fine sand, fine sand, sandy clay loan, clay loam, and clay soils formed on level to moderately sloping valley bottoms, fans, mesas, and plateans from eolian, allovial, and residual materials derived from sandstone, shale, and siltstone. | Sheppard Huerfano Notal | $\begin{gathered} 60+ \\ 10-20 \\ 60+ \end{gathered}$ | $\begin{aligned} & 2-8 \\ & 0-3 \\ & 0-2 \end{aligned}$ | $\begin{aligned} & >6 \\ & >6 \\ & >6 \end{aligned}$ | $\begin{aligned} & 7.9-8.4 \\ & 7.9-9.0 \\ & 7.9-9.0 \end{aligned}$ | $\begin{aligned} & <2 \\ & >4 \\ & 4-8 \end{aligned}$ | $\begin{aligned} & \text { A } \\ & \text { D } \\ & \text { D } \end{aligned}$ | $\begin{aligned} & 2 \\ & 4 \mathrm{~L} \\ & 4 \mathrm{~L} \end{aligned}$ | $\begin{aligned} & .15 \\ & .32 \\ & .32 \end{aligned}$ | $\begin{aligned} & 5 \\ & 1 \\ & 5 \end{aligned}$ | Moderate to high wind erosion hazand, low to moderate water erosion hazard, topsoil is fair to poor, 8 inch precipitation zone. Strink-swell poter tial is low to high, exchangeable sodium content ranges from 15-75\% for Huerfano-kbtal portion, high corrosion hazard to uncoated steel. |

NA = Not available or not applicable.
(1) U.S. Soil Conservation Service (SCS). 1980. Soil survey of San ran County, New Mexico, eastern part. (For Mileposts 0.0-38.85 and 41.3-42.6.)
textures (e.g., too sandy or clayey) or excess salt/sodium. The Blackston ( 0.3 mile ), Persayo ( 2.90 miles ), and Muff ( 0.8 mile ) soils traversed by the P2 route are difficult to reclaim if the topsoil is removed and not replaced. Susceptibility to wind-induced soil erosion ranges from low to high, but it is primarily moderate to high. Susceptibility to water-induced soil erosion is primarily low to moderate. The soils identified along this alternative main water pipeline route are mildly to strongly alkaline. Shrink-swell potential of the identified soils is primarily low to moderate, but the Notal soil has a high shrink-swell potential. These soils are currently used primarily for livestock grazing, wildife habitat, and to a lesser extent irrigated cropland and energy resource development. This pipeline route traverses developed portions of NIIP Block 4 (MP 5.5-13 and 15.5-18). Additionally, this pipeline route traverses the following undeveloped portions of NIIP Block 11: MP 18-19, 28-30, and 31.75-33. These undeveloped portions have been determined to be irrigable.

Main Water Pipeline Alternative P3. Alternative pipeline route P3 is also within the San Juan River Valley Mesas and Plateaus portion of the Western Range and Irrigated Region (SCS 1978a). Annual precipitation is usually about 8 inches along this route. Thirteen different soil phases, series, associations, or complexes were identified along P3. Table 4 lists (by mileposts) and characterizes the identified soils.

The soils identified along this alternative pipeline route are primarily deep and well to somewhat excessively drained. Surface textures range from fine sand to clay. These soils are forming in alluvial, eolian, and residual materials derived primarily from sandstone, shale, and siltstone on mesas, plateaus, hills, breaks, canyons, upland valleys, alluvial fans, intermittent drainageways,
Table 4. Characteristics af the sons mentifind aiong mann hatir pipeinit boite pu

| Milepost | Hap Syubol | Soil Phase, Series, Associatipa, or Couplex and Description | Soil Phase or Series | Depth to Bedrock (inches) | Slope (z) | Depth to High Kater Table (feet) | (pH) <br> Soil <br> Reaction | Salinity (muthos) cu) | Hydrologic Graup | $\begin{gathered} \text { WEGG } \\ \text { Class } \end{gathered}$ | 'R' | 'T' | Comments |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| 0.00 .25 | Py | Fruitland-Slickspots: Deep, well and poorly drained, sandy loem soils formed on level to gently sloping fans and valleys from alluviun derived primarily from sandstone and shale. Includes Slickspots areas which are strongly alksli affected, and are easily puddled and crusted. | Fruitland | $60+$ | 0-3 | 76 | 7.4-8.4 | 4 | B | 3 | . 24 | 5 | Moderate wind and water erosion harand, topsoil is good (Slickspots areas are poor), 8 inch precipitation zone. Starink-grell potential is low, Slickspots areas contain 15-50\% exchangeable acdim (addition of sypsom reduces associated problens). |
| $0.25-0.30$ | H | Baplargidg-Blackstor-Torriorthents: Shallow to deep, well to excessively drained. cobbly aandy loam, cobbly sandy clay loam, gravelly loam, gravelly clay loam, cobbly loam, and clay laan soils formed on moderately sloping to steep terraces, mesas, and plateans from alluvium derived from mixed sources. | Haplargids Blackston Torriorthents | $\begin{gathered} 10-60+ \\ 60+ \\ 10-20 \end{gathered}$ | $\begin{aligned} & 8-50 \\ & 8-40 \\ & 8-50 \end{aligned}$ | $\begin{aligned} & M \\ & >6 \\ & M \end{aligned}$ | $\stackrel{\mathrm{M}}{7.9-8.4} \underset{\mathrm{M}}{ }$ | $\begin{aligned} & \mathrm{M} \\ & 2-4 \\ & \mathrm{M} \end{aligned}$ | $\begin{aligned} & \mathbf{M} \\ & \mathbf{B} \\ & \mathbf{M} \end{aligned}$ | $\begin{aligned} & M \\ & 5 \\ & M M \end{aligned}$ | $\begin{aligned} & M A \\ & .17 \\ & N A \end{aligned}$ | $\begin{aligned} & M A \\ & 1 \\ & \mathbb{M} \end{aligned}$ | Low wind erosion hazard, low to high water erosion hazard, poor topsoil (area reclaim), 9 inch precipitation zone. Shrink-swell potential is low, high corrosion hazard to uncoated steel. |
| $0.30-0.75$ | Ay/Ax | Avalon: Deep, well drained, loam, and sandy loam soils formed on level to moderately sloping mesas and platerus from alluvial and colian materials derived primarily from aandstove and shale. | Avalon | $60+$ | 0-8 | $>6$ | 7.9-8.4 | 2-8 | B | 4L, 3 | $\begin{aligned} & .43 \\ & .37 \end{aligned}$ | 3 | Moderate wind erosion hazard, moderate to high water erosion hazard, fair topsoil (excess salt), 8 inch precipitation zone. Strink-swell potential is low, soil is slightly saline, high corrosion hazard to umosated steel. |
| 0.75-1.55 | FX | Pruitland-Persayo-Sheppard: Deep and shallow, well to somerhat excessively drained, sandy loam, fine sandy loam, clay loam, loany fine sand, and fine sand soils fomed on moderately sloping to moderately steep hills, mesas, plateaus, fans, and breaks from allovium, residion, and eolian materials derived from sandstone and shale. | Fruitland Persayo Sheppard | $\begin{gathered} 60+ \\ 10-20 \\ 60+ \end{gathered}$ | $\begin{aligned} & 5-30 \\ & 5-30 \\ & 5-30 \end{aligned}$ | $\begin{aligned} & >6 \\ & >6 \\ & >6 \end{aligned}$ | $\begin{aligned} & 7.4-8.4 \\ & 7.9-9.0 \\ & 7.9-8.4 \end{aligned}$ | $\begin{aligned} & <4 \\ & <8 \\ & <2 \end{aligned}$ | $\begin{aligned} & \text { B } \\ & \text { D } \\ & \text { A } \end{aligned}$ | $\begin{aligned} & 3 \\ & 4 \mathrm{~L} \\ & 2 \end{aligned}$ | $\begin{aligned} & .24 \\ & .37 \\ & .15 \end{aligned}$ | $\begin{aligned} & 5 \\ & 1 \\ & 5 \end{aligned}$ | Moderate to high wind erosion hazard, low to moderate water erosion hazard, topsoil is poor (Persayo portion-area reclaim), 8 inch precipitation zone. Shrink-swell potential is low to moderate, high corrosion hazard to urcoated ateel. |
| 1.55-1.70 | Sh | Shiprock: Deep, well drained, loany fine sand, fine sandy loam, and sandy loan soils formed on level and nearly level mesas and platecas from alluvial and eolian materials derived primarily from sandstove and shale. | Shiprock | $60+$ | 0-2 | $>6$ | 7.4-8.4 | $<2$ | B | 2 | . 15 | 5 | High wind erosion harard, low water erosion hazard, good topsoil, 8 inch precipitation zone. Shrink-avell potential is low, high corrosion hazard to uncoated steel. |
| 1.70-2.85 | FX | Fruitland Persayo-Sheppard: Deep and shallow, well to somenhat excessively drained, sandy loam, fine sandy loan, clay loan, loany fine sand, and fine sand soils forwed ou moderately sloping to moderately steep hills, mesas, plateaus, fans, and breaks from allivium, residoun, and colian materisls derived from sandstone and shale. | Fruitland <br> Peraayo <br> Sheppard | $\begin{gathered} 60+ \\ 10-20 \\ 60+ \end{gathered}$ | $\begin{aligned} & 5-30 \\ & 5-30 \\ & 5-30 \end{aligned}$ | $\begin{aligned} & >6 \\ & >6 \\ & >6 \end{aligned}$ | $\begin{aligned} & 7.4-8.4 \\ & 7.9-9.0 \\ & 7.9-8.4 \end{aligned}$ | $\begin{aligned} & <4 \\ & <8 \\ & <2 \end{aligned}$ | $\begin{aligned} & \text { B } \\ & \text { D } \\ & \text { A } \end{aligned}$ | $\begin{aligned} & 3 \\ & 4 \mathrm{~L} \\ & 2 \end{aligned}$ | $\begin{aligned} & .24 \\ & .37 \\ & .15 \end{aligned}$ | $\begin{aligned} & 5 \\ & 1 \\ & 5 \end{aligned}$ | Moderate to high vind erosion hazard, low to moderate water erosion hazard, topeoil is poor (Persayo portior-area reclaim), 8 inch precipitation rone. Strink-swell potential is low to moderate, high corrosion hazard to urcasted ateel. |
| 2.85-3.55 | DN | Doak-Avalon: Deep, well drained, loam. and clayey loan soils formed an level to gently sloping mesas, platems, and terraces from alluvial and eolian materials derived primarily from sandstooe and shale. | Doak <br> Avalon | $\begin{aligned} & 60+ \\ & 60+ \end{aligned}$ | $\begin{aligned} & 0-5 \\ & 3-5 \end{aligned}$ | $\begin{aligned} & >6 \\ & >6 \end{aligned}$ | $\begin{aligned} & 7.4-8.4 \\ & 7.9-8.4 \end{aligned}$ | $\begin{aligned} & >2 \\ & 2-8 \end{aligned}$ | $\begin{aligned} & \text { B } \\ & \text { B } \end{aligned}$ | $\begin{aligned} & 5 \\ & 4 \mathrm{~L} \end{aligned}$ | $\begin{aligned} & .37 \\ & .43 \end{aligned}$ | $\begin{aligned} & 5 \\ & 3 \end{aligned}$ | Low to moderate wind erosion hazard, moderate to high water erosion hazard, fair topsoil (excess clay/asit), 8 inch precipitation zone. Shrinksuell potential is low to moderate, bigh corrosion hazard to uncoated steel. |
| 3.55-7.0 | DS | Doak-Sheppard-Shiprock: Deep, well and sonenhat excessively drained, loan, clay loan, loamy fine sand, fine and, and fine sandy loam ooils fonmed an level to strongly sloping mesas, plateans, and terraces from alluvial and eolian materials derived from sandstone, shale, and mixed sources. | Doak <br> Sheppard <br> Shiprock | $\begin{aligned} & 60+ \\ & 60+ \\ & 60+ \end{aligned}$ | $\begin{aligned} & 0-5 \\ & 0-15 \\ & 0-15 \end{aligned}$ | $\begin{aligned} & >6 \\ & >6 \\ & >6 \end{aligned}$ | $\begin{aligned} & 7.4-8.4 \\ & 7.9-8.4 \\ & 7.4-8.4 \end{aligned}$ | $\begin{aligned} & <2 \\ & <2 \\ & <2 \end{aligned}$ | $\begin{aligned} & \text { B } \\ & \text { A } \\ & \text { B } \end{aligned}$ | $\begin{aligned} & 5 \\ & 2 \\ & 3 \end{aligned}$ | $\begin{aligned} & .37 \\ & .15 \\ & .24 \end{aligned}$ | $\begin{aligned} & 5 \\ & 5 \\ & 5 \end{aligned}$ | Low to high wind erosion hazard, low to moderate water erosion harard, fair to good topeoil, 8 inch precipitation zone. Shrink-swell potential is low to moderate, high corrosion hazard to uncoated steel. |



| Milepost | Hap Syatol | Soil Phase, Series, Associatipa, or Couplex and Deacription | Soil Phase or Series | Depth to Bedrock (inches) | Slope <br> (I) | Depth to High Water Table (feet) | Soil Reaction (pस) | Salinity (mmos) (a) | Hydrologic Grap | $\begin{gathered} \mathrm{W} 2 \mathrm{C} \\ \text { Class } \end{gathered}$ | 'K' | 'T' | Comments |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| 7.0-9.25 | FX | Pruitland-Persayo-Sheppard: Deep and shallow, well to samerhat excessively drained, sandy loan, fine sandy loan, clay loan, lowny fine sand, and fine sand soils fomed on moderately sloping to moderately steep hills, messe, plateaus, fans, and breaks frum allwium, residom, and eolian materials derived from sandstone and shale. | Pruitland <br> Persayo <br> Sheppard | $\begin{gathered} 60+ \\ 10-20 \\ 60+ \end{gathered}$ | $\begin{aligned} & 5-30 \\ & 5-30 \\ & 5-30 \end{aligned}$ | $\begin{aligned} & x \\ & >6 \\ & >6 \end{aligned}$ | $\begin{aligned} & 7.4-8.4 \\ & 7.9-9.0 \\ & 7.9-8.4 \end{aligned}$ | $\begin{aligned} & <4 \\ & <8 \\ & <2 \end{aligned}$ | $\begin{aligned} & \text { B } \\ & \text { D } \\ & \text { A } \end{aligned}$ | $\begin{aligned} & 3 \\ & 4 \mathrm{~L} \\ & 2 \end{aligned}$ | $\begin{aligned} & .24 \\ & .37 \\ & .15 \end{aligned}$ | $\begin{aligned} & 5 \\ & 1 \\ & 5 \end{aligned}$ | Moderate to high vind erosion hazard, low to moderste water erosion hazard, topsoil is poor (Perbayo portion-area reclaim), 8 inch precipitation zone. Strink-owell potential is low to maderate, high corrosion hazard to urcoated steel. |
| 9.25-9.9 | BA | Badland: Moderately sloping to extremely steep, nonstony, barren shale uplande that are dissected by deep internittent drainagenery and gullies. | Badland | 0 | 5-80 | N | M | N | M | NA | N | N | 8 inch precipitation zone. |
| 9.9-10.4 | BT | Blancot-Notal: Deep, well drained, laan, clay loam, silty clay loan, and clay soils fomed on level to gently sloping alluvial fans and upland valleys from alliwiwn derived primarily from asndstone and shale. | Blancot <br> Notal | $\begin{aligned} & 60+ \\ & 60+ \end{aligned}$ | $\begin{aligned} & 0-5 \\ & 0-2 \end{aligned}$ | $\begin{aligned} & >6 \\ & >6 \end{aligned}$ | $\begin{aligned} & 7.9-8.4 \\ & 7.9-9.0 \end{aligned}$ | $\begin{aligned} & <2 \\ & 4-8 \end{aligned}$ | $\begin{aligned} & \text { B } \\ & \text { D } \end{aligned}$ | $\begin{aligned} & 6 \\ & 4 \mathrm{~L} \end{aligned}$ | $\begin{aligned} & .32 \\ & .32 \end{aligned}$ | $\begin{aligned} & 5 \\ & 5 \end{aligned}$ | Low to moderate wind erosion hazard, moderate water erosion hazard, topsoil is fair to poor (too clayey), 8 inch precipitation zone. Strrinksuell potential is low to high, high corrosion hazard to uncoated steel. |
| 10.4-10.6 | BA | Badland: Moderately sloping to extrenely steep, nonstony, barren shale uplands that are dissected by deep intermittent drainagewys and gallies. | Badland | 0 | 5-80 | N | NM | N | N | N | N | N | 8 inch precipitation zone. |
| 10.6-10.85 | FA | Farb-Persayo-Rock Outcrop: Very shallow to shallow, excessively and well drained, fine sandy loam, sandy clay loam, clay loam and silty clay loam soils formed on gently sloping to moderately steep hills and breaks frox residinm derived from andstone and shale. Includes barren aandstane outcrops an strungly sloping to moderately steep benches, ridges, and breaks. | Farb <br> Perbayo <br> Rock Outcrop | $\begin{gathered} 5-20 \\ 10-20 \\ 0 \end{gathered}$ | $\begin{array}{r} 3-30 \\ 3-30 \\ 10-30 \end{array}$ | $\begin{aligned} & >6 \\ & >6 \\ & >6 \end{aligned}$ | $\begin{gathered} 7.48 .4 \\ 7.9-9.0 \\ \mathrm{NH} \end{gathered}$ | $\begin{aligned} & <2 \\ & <8 \\ & \mathrm{~N} \end{aligned}$ | $\begin{aligned} & \mathrm{D} \\ & \mathrm{D} \\ & \mathrm{~N} \end{aligned}$ | $\begin{aligned} & 3 \\ & 4 \mathrm{~L} \\ & \mathrm{~N} \end{aligned}$ | $\begin{aligned} & .32 \\ & .37 \\ & \mathrm{~N} \end{aligned}$ | $\begin{aligned} & 1 \\ & 1 \\ & \mathrm{~N} \end{aligned}$ | Moderate vind and water erosion haz ard, poor topsoil (Persayo portionarea reclaim), 8 inch precipitation zone. Shrink-8well potential is low to moderate, low to high corrosion hazard to uncoated steel. |
| 10.85-11.3 | BA | Bedland: Moderately sloping to extremely steep, nonstony, barren shale uplands that are dissected by deep intermittent drainagewys and gullies. | Badland | 0 | 5-80 | N | N | NA | N | N | N | NA | 8 inch precipitation zone. |
| 11.3-11.4 | RA | Rivenash: Deep, well to excessively drained, unstabilized sandy, silty, clayey, or gravelly sediment on level to gently sloping floodplains, streanbeds, riverbeds, and in arroyos. | Riverwash | $60+$ | 0-3 | N | M | N | N | N | M | N | Highly susceptible to water erosion and reworking, frequently flooded, 8 inch precipitation zone. |
| 11.4-12.05 | BA | Bedland: Moderately sloping to extrenely steep, nonstony, barren shale uplands that are dissected by deep intemittent drainagewery and gullies. | Bedland | 0 | 5-80 | N | N | N | N | N | N | NA | 8 inch precipitation zone. |
| 12.05-12.8 | DS | Doak-Sheppard-Shiprock: Deep, well and soneshat excessively drained, loan, clay loam, loany fine sand, fine sand, and fine sandy loan soils formed on level to strongly sloping messs, plateas, and terraces from alluvial and eolian materials derived from sandstone, shale, and mixed sources. | Doak <br> Sheppard <br> Shiprock | $\begin{aligned} & 60+ \\ & 60+ \\ & 60+ \end{aligned}$ | $\begin{aligned} & 0-5 \\ & 0-15 \\ & 0-15 \end{aligned}$ | $\begin{aligned} & >6 \\ & >6 \\ & >6 \end{aligned}$ | $\begin{aligned} & 7.4-8.4 \\ & 7.9-8.4 \\ & 7.4-8.4 \end{aligned}$ | $\begin{aligned} & <2 \\ & <2 \\ & <2 \end{aligned}$ | $\begin{aligned} & \text { B } \\ & \text { A } \\ & \text { B } \end{aligned}$ | $\begin{aligned} & 5 \\ & 2 \\ & 3 \end{aligned}$ | $\begin{aligned} & .37 \\ & .15 \\ & .24 \end{aligned}$ | $\begin{aligned} & 5 \\ & 5 \\ & 5 \end{aligned}$ | Low to high wind erosion hazard, low to moderate water erosion hazard, fair to good topooil, 8 inch precipitation zone. Shrink-swell potential is low to moderate, high corrosion hazard to uncoated steel. |




| Milepost | $\begin{aligned} & \text { Kep } \\ & \text { Syubol } \end{aligned}$ | Soil Phase, Series, Associatipa, or Couplex and Description | Soil Phase or Series | Depth to Bedrock (inches) | $\underset{(\mathrm{X})}{\mathrm{Slope}}$ | Depth to High Water Table (feet) | $\underset{\substack{\text { Reaction } \\(\mathrm{p} A)}}{\text { Soil }}$ | Salinity (umbos/ (an) | $\begin{aligned} & \text { Hydro- } \\ & \begin{array}{l} \text { logic } \\ \text { Group } \end{array} \end{aligned}$ | $\begin{gathered} \mathrm{HEC} \\ \text { Clase } \end{gathered}$ | 'K' | 'T' | Cauments |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| 13.15-13.7 | DS | Doak-Sheppard-Shiprock: Deep, well and saneshat excessively drained, loam, clay loam, loanty fine sand, fine sand, and fine sandy loam soils formed on level to strongly sloping mesas, platesus, and terraces from alluvial and eolian materials derived fron sandstone, shale, and mixed scurces. | Daak Sheppard Shiprock | $\begin{aligned} & 60+ \\ & 60+ \\ & 60+ \end{aligned}$ | $\begin{aligned} & 0-5 \\ & 0-15 \\ & 0-15 \end{aligned}$ | $\begin{aligned} & >6 \\ & >6 \\ & >6 \end{aligned}$ | $\begin{aligned} & 7.4-8.4 \\ & 7.9-9.4 \\ & 7.4-8.4 \end{aligned}$ | $\begin{aligned} & <2 \\ & <2 \\ & <2 \end{aligned}$ | B | $\begin{aligned} & 5 \\ & 2 \\ & 3 \end{aligned}$ | $\begin{aligned} & .37 \\ & .15 \\ & .24 \end{aligned}$ | $\begin{aligned} & 5 \\ & 5 \\ & 5 \end{aligned}$ | Low to high vind erosion hazard, low to moderate water erosion hazard, fair to good topeoil, 8 inch precipitation zone. Shrink-awell potential is low to moderate, high corrosion hazard to uncoated steel. |
| 13.7-16.0 | bA | Bedland: Moderately sloping to extremely steep, nonstony, barren shale uplands that are dissected by deep intermittent drainageways and gull ies. | Bedland | 0 | 5-80 | M | M | NA | N | N | N | M | 8 inch precipitation mane. |
| 16.0-20.9 | DS | Doak-Sheppard-Shiprock: Deep, well and sonewhat excessively drained, loam, clay loan, loasy fine sand, fine sand, and fine sandy loan soils formed on level to strongly sloping mesas, plateaus, and ter races from alluvial and eolian materials derived from sandstone, shale, and mixed sources. | Doak <br> Sheppard <br> Shiprock | $\begin{aligned} & 60+ \\ & 60+ \\ & 60+ \end{aligned}$ | $\begin{aligned} & 0-5 \\ & 0-15 \\ & 0-15 \end{aligned}$ | $\begin{aligned} & >6 \\ & >6 \\ & >6 \end{aligned}$ | $\begin{aligned} & 7.4-8.4 \\ & 7.9-8.4 \\ & 7.4-8.4 \end{aligned}$ | $\begin{aligned} & <2 \\ & <2 \\ & <2 \end{aligned}$ | $\begin{aligned} & \text { B } \\ & \text { A } \\ & \text { B } \end{aligned}$ | $3$ | $\begin{aligned} & .37 \\ & .15 \\ & .24 \end{aligned}$ | $\begin{aligned} & 5 \\ & 5 \\ & 5 \end{aligned}$ | Lov to high vind erosion hazand, low to moderate water erosion hazard, fair to good topsoil, 8 inch precipitation zone. Strink-swell potential is low to moderate, high corrosion hazard to uncoated steel. |
| 20.9-21.15 | BT | Blancot-ibtal: Deep, well drained, loam, clay loan, silty clay loam, and clay soil formed on level to gently sloping alluvisl fans and upland valleys from alluvium derived primarily from sandstone and shale. | Blancot Notal | $\begin{aligned} & 60+ \\ & 60+ \end{aligned}$ | $\begin{aligned} & 0-5 \\ & 0-2 \end{aligned}$ | $\begin{aligned} & >6 \\ & \gamma 6 \end{aligned}$ | $\begin{aligned} & 7.9-8.4 \\ & 7.9-9.0 \end{aligned}$ | $\stackrel{<2}{4-8}$ | $\begin{aligned} & \text { B } \\ & \text { D } \end{aligned}$ | $\begin{aligned} & 6 \\ & 4 \mathrm{~L} \end{aligned}$ | $\begin{aligned} & .32 \\ & .32 \end{aligned}$ | $\begin{aligned} & 5 \\ & 5 \end{aligned}$ | Low to moderate wind erosion hazard, moderate water erosion hazard, topsoil is fair to poor (too clayey), 8 inch precipitation mone. Strinkswell potential is low to high, high corrosion hazard to uncoated ateel. |
| 21.15-23.75 | ds | Doak-Steppard-Shiprock: Deep, well and sonerhat excess ively drained, loam, clay loan, loany fine sand, fine sand, and fine sandy loam soils formed on level to strongly sloping resas, plateaus, and ter races from alluvial and eolian materials derived from sandstone, shale, and mixed sources. | Doak <br> Sheppard <br> Shiprock | $\begin{aligned} & 60+ \\ & 60+ \\ & 60+ \end{aligned}$ | $\begin{aligned} & 0-5 \\ & 0-15 \\ & 0-15 \end{aligned}$ | $\begin{aligned} & >6 \\ & >6 \\ & >6 \end{aligned}$ | $\begin{aligned} & 7.4-8.4 \\ & 7.9-8.4 \\ & 7.4-8.4 \end{aligned}$ | $\begin{aligned} & <2 \\ & <2 \\ & <2 \end{aligned}$ | $\begin{aligned} & \text { B } \\ & \text { A } \\ & \text { B } \end{aligned}$ | $3$ | $\begin{aligned} & .37 \\ & .15 \\ & .24 \end{aligned}$ | $\begin{aligned} & 5 \\ & 5 \\ & 5 \end{aligned}$ | Low to high wind erosion harard, low to moderate vater erosion hazard, fair to good topeoil, B inch precipitation mone. Shrink-swell potential is low to moderate, high corrosion hazard to umcoated steel. |
| 23.75-23.8 | HX | Pruitland-Persayo-Sheppard: Deep and shallow, well to somestat excessively drained, sandy loan, fine sandy loam, clay loam, loany fine sand, and fine sand soils formed on moderately sloping to moderately steep hills, mesas, plateaus, fans, and breaks from alluvim, residum, and eolian materials derived from sandotoce and shale. | Pruitland <br> Persayo <br> Sheppard | $\begin{gathered} 60+ \\ 10-20 \\ 60+ \end{gathered}$ | $\begin{aligned} & 5-30 \\ & 5-30 \\ & 5-30 \end{aligned}$ | $\begin{aligned} & >6 \\ & >6 \\ & >6 \end{aligned}$ | $\begin{aligned} & 7.4-8.4 \\ & 7.9-9.0 \\ & 7.9-8.4 \end{aligned}$ | $\begin{aligned} & <4 \\ & <8 \\ & <2 \end{aligned}$ | $\begin{aligned} & \text { B } \\ & \text { D } \\ & \text { A } \end{aligned}$ | $\begin{aligned} & 3 \\ & 4 \mathrm{~L} \\ & 2 \end{aligned}$ | $\begin{aligned} & .24 \\ & .37 \\ & .15 \end{aligned}$ | $\begin{aligned} & 5 \\ & 1 \\ & 5 \end{aligned}$ | Moderate to high wind erosion hazard, low to moderate water erosion hazard, topsoil is poor (Persayo portior-area reclaim), 8 inch precipitation zone. Sturink-swell potential is low to moderate, high corrosion hazard to urcasted steel. |
| 23.8-24.9 | DS | Doak-Sheppard-Shiprock: Deep, well and sonewhat excessively drained, loam, clay loam, loarry fine sand, fine sand, and fine sandy loam soils formed on level to strongly sloping mesas, plateaus, and ter races from alluvial and eolian materials derived from sandstone, shale, and mixed sources. | Doak <br> Sheppard <br> Shiprock | $\begin{aligned} & 6+ \\ & 60+ \\ & 60+ \end{aligned}$ | $\begin{aligned} & 0-5 \\ & 0-15 \\ & 0-15 \end{aligned}$ | $\begin{aligned} & >6 \\ & >6 \\ & >6 \end{aligned}$ | $\begin{aligned} & 7.4-8.4 \\ & 7.9-9.4 \\ & 7.4-8.4 \end{aligned}$ | $\begin{aligned} & <2 \\ & <2 \\ & <2 \end{aligned}$ | $\begin{aligned} & \text { B } \\ & \text { A } \end{aligned}$ | $3$ | $\begin{aligned} & .37 \\ & .15 \\ & .24 \end{aligned}$ | $\begin{aligned} & 5 \\ & 5 \\ & 5 \end{aligned}$ | Low to high wind erosion hazard, low to moderate water erosion hazand, fair to good topsoil, 8 inch precipitation zone. Shrink-awell potential is low to moderate, high corrosion hazard to uncoated steel. |
| 24.9-25.45 | ex | Pruitland-Persayo-Sheppard: Deep and shallow, well to sanewhat excessively drained, sandy loam, fine samdy loam, clay loant, loary fine sand, and fine sand soils formed on moderately sloping to moderately steep hills, wesas, platearis, fans, and breaks fran alluvium, residam, and eolign waterials derived from sandstove and shale. | Fruitland Persayo Steppard | $\begin{gathered} 60+ \\ 10-20 \\ 60+ \end{gathered}$ | $\begin{aligned} & 5-30 \\ & 5-30 \\ & 5-30 \\ & 5-30 \end{aligned}$ | $\begin{aligned} & >6 \\ & >6 \\ & >6 \end{aligned}$ | $\begin{aligned} & 7.4-8.4 \\ & 7.9-9.0 \\ & 7.9-8.4 \end{aligned}$ | $\begin{aligned} & <4 \\ & <8 \\ & <2 \end{aligned}$ | $\begin{aligned} & \text { B } \\ & \text { D } \\ & \text { A } \end{aligned}$ | $\begin{aligned} & 3 \\ & 4 \mathrm{~L} \\ & 2 \end{aligned}$ | $\begin{aligned} & .24 \\ & .37 \\ & .15 \end{aligned}$ | $\begin{aligned} & 5 \\ & 1 \end{aligned}$ | Moderate to high wind erosion hazard, low to moderate water erosion hazard, topsoil is poor (Persayo portion-area reclaim), 8 inch precipitation zane. Strink-owell potential is low to moderate, high corrosion hazard to urcoated ateel. |

table 4. characteristics or the soils idemificd along minh hitra pipeine raite p3 (contimed)

| Mileport S | Map Syubol | Soil Phase, Series, Associatipa, or Complex and Description | Soil Phase or Series | Depth to Bedrock (inches) | Slope <br> (\%) | Depth to High Water Table (feet) | Soil Reaction (pH) | Salinity (minos/ ad | Hydrologic Grous | $\begin{aligned} & \mathrm{WOC} \\ & \text { Class } \end{aligned}$ | ' $\mathrm{K}^{\prime}$ | 'T' | Couments |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| 25.45-25.7 | DS | Doak-Sheppard-Shiprock: Deep, well and samerhat excessively drained, loan, clay loam, loanry fine sand, fine sand, and fine sandy loam soils formed an level to strongly sloping mesas, plateaus, and terraces from alluvial and eolizn materials derived from sandstone, shale, and mixed sources. | Doak <br> Sheppard Shiprock | $\begin{aligned} & 60+ \\ & 60+ \\ & 60+ \end{aligned}$ | $\begin{aligned} & 0-5 \\ & 0-15 \\ & 0-15 \end{aligned}$ | $\begin{aligned} & >6 \\ & >6 \\ & >6 \end{aligned}$ | $\begin{aligned} & 7.4-8.4 \\ & 7.9-8.4 \\ & 7.4-8.4 \end{aligned}$ | $\begin{aligned} & <2 \\ & <2 \\ & <2 \end{aligned}$ | $\begin{aligned} & \text { B } \\ & \text { A } \\ & \text { B } \end{aligned}$ | $\begin{aligned} & 5 \\ & 2 \\ & 3 \end{aligned}$ | $\begin{aligned} & .37 \\ & .15 \\ & .24 \end{aligned}$ | $\begin{aligned} & 5 \\ & 5 \\ & 5 \end{aligned}$ | Low to high wind erosion hazard, low to moderate water erosion hazard, fair to good topsoil, 8 inch precipitation zone. Shrink-swell potential is low to moderate, high corrosion hazard to uncoated ateel. |
| 25.7-26.05 | FX | Fruitland-Persayo-Sheppard: Deep and shallow, well to soneshat excessively drained, sandy loam, fine sandy loam, clay loan, loany fine sand, and fine sand soils formed on moderately sloping to moderately steep hills, mesas, plateals, fans, and breaks from alluvim, resionam, and eolian materials derived from sandstone and shale. | Fruitland Perssyo Sheppard | $\begin{gathered} 60+ \\ 10-20 \\ 60+ \end{gathered}$ | $\begin{aligned} & 5-30 \\ & 5-30 \\ & 5-30 \end{aligned}$ | $\begin{aligned} & >6 \\ & >6 \\ & >6 \end{aligned}$ | $\begin{aligned} & 7.4-8.4 \\ & 7.9-9.0 \\ & 7.9-8.4 \end{aligned}$ | $\begin{aligned} & <4 \\ & <8 \\ & <2 \end{aligned}$ | $\begin{aligned} & \text { B } \\ & \text { D } \\ & \text { A } \end{aligned}$ | $\begin{aligned} & 3 \\ & 4 \mathrm{~L} \\ & 2 \end{aligned}$ | $\begin{aligned} & .24 \\ & .37 \\ & .15 \end{aligned}$ | $\begin{aligned} & 5 \\ & 1 \\ & 5 \end{aligned}$ | Moderate to high wind erosion hazard, low to moderate water erosion hazard, topsoil is poor (Persayo portior-area rechaim), 8 inch precipitation zone. Shrink-swell potential is low to $\mathrm{mod}-$ erate, high corrosion hazard to urcosted steel. |
| 26.05-26.45 | 5 BT | Blancot-Notal: Deep, well drained, loam, clay loan, silty clay loan, and clay soils formed on level to gently sloping alluvial fans and upland valleys from allivium derived primarily from sandstone and shale. | Blancot <br> Notal | $\begin{aligned} & 60+ \\ & 60+ \end{aligned}$ | $\begin{aligned} & 0-5 \\ & 0-2 \end{aligned}$ | $\begin{aligned} & >6 \\ & >6 \end{aligned}$ | $\begin{aligned} & 7.9-8.4 \\ & 7.9-9.0 \end{aligned}$ | $\begin{aligned} & 4 \\ & 4-8 \end{aligned}$ | $\begin{aligned} & \text { B } \\ & \text { D } \end{aligned}$ | $\begin{aligned} & 6 \\ & 4 \mathrm{~L} \end{aligned}$ | $\begin{aligned} & .32 \\ & .32 \end{aligned}$ | $\begin{aligned} & 5 \\ & 5 \end{aligned}$ | Low to moderate wind erosion hazard, moderate water erosion hazard, topsoil is fair to poor (too clayey), 8 inch precipitation zone. Shrinksuell potential is low to high, high corrosion hazard to uncoated steel. |
| 26.45-28.15 | 5 DS | Doak-Sheppard-Shiprock: Deep, well and sconewhat excessively drained, loan, clay loan, loamy fine sand, fine sand, and fine sandy loem soils formed on level to strongly sloping mesas, platesus, and terraces from alluvial and eolian materials derived from sandstone, shale, and mixed sources. | Daak <br> Sheppand <br> Shiprock | $\begin{aligned} & 60+ \\ & 60+ \\ & 60+ \end{aligned}$ | $\begin{aligned} & 0-5 \\ & 0-15 \\ & 0-15 \end{aligned}$ | $\begin{aligned} & 26 \\ & 26 \\ & >6 \end{aligned}$ | $\begin{aligned} & 7.4-8.4 \\ & 7.9-8.4 \\ & 7.4-8.4 \end{aligned}$ | $\begin{aligned} & <2 \\ & <2 \\ & <2 \end{aligned}$ | $\begin{aligned} & \text { B } \\ & \text { A } \\ & \text { B } \end{aligned}$ | $\begin{aligned} & 5 \\ & 2 \\ & 3 \end{aligned}$ | $\begin{aligned} & .37 \\ & .15 \\ & .24 \end{aligned}$ | $\begin{aligned} & 5 \\ & 5 \\ & 5 \end{aligned}$ | Low to high wind erosion hazard, low to moderate vater erosion hazard, fair to good topsoil, 8 inch precipitation zone. Shrink-owell potential is low to moderate, high corrosion hazard to uncoated steel. |
| 28.15-28.25 | 5 FX | Fruitland-Persayo-Sheppard: Deep and shallow, well to somerhat excessively drained, sandy loan, fine sandy loam, clay loam, loamy fine sand, and fine sand soils fonved on moderately sloping to moderately steep hills, wessa, plateaus, fams, and breaks from allurium, residum, and eolian materials derived from sandatone and shale. | Fruitland Persayo Sheppard | $\begin{gathered} 60+ \\ 10-20 \\ 60+ \end{gathered}$ | $\begin{aligned} & 5-30 \\ & 5-30 \\ & 5-30 \end{aligned}$ | $\begin{aligned} & >6 \\ & >6 \\ & >6 \end{aligned}$ | $\begin{aligned} & 7.4-8.4 \\ & 7.9-9.0 \\ & 7.9-8.4 \end{aligned}$ | $\begin{aligned} & <4 \\ & <8 \\ & <2 \end{aligned}$ | $\begin{aligned} & \text { B } \\ & \text { D } \\ & \text { A } \end{aligned}$ | $\begin{aligned} & 3 \\ & 4 \mathrm{~L} \\ & 2 \end{aligned}$ | $\begin{aligned} & .24 \\ & .37 \\ & .15 \end{aligned}$ | $\begin{aligned} & 5 \\ & 1 \\ & 5 \end{aligned}$ | Moderate to high wind erosion hazard, low to moderate water erosion hazard, topooil is poor (Persayo portion-area reclaim), 8 inch precipitation zone. Strink-swell potential is low to moderate, high corrosion hazard to urcoated steel. |
| 28.25-28.28 | $8 \text { BI }$ | Blancot-Notal: Deep, well drained, loam, clay loan, silty clay loam, and clay soils formed on level to gently sloping alluvial fans and upland valleye from alluvium derived primarily from sandstone and shale. | Blancot <br> Notal | $\begin{aligned} & 60+ \\ & 60+ \end{aligned}$ | $\begin{aligned} & 0-5 \\ & 0-2 \end{aligned}$ | $\begin{aligned} & >6 \\ & >6 \end{aligned}$ | $\begin{aligned} & 7.9-8.4 \\ & 7.9-9.0 \end{aligned}$ | $\begin{aligned} & <2 \\ & 4-8 \end{aligned}$ | $\begin{aligned} & \text { B } \\ & \text { D } \end{aligned}$ | $\begin{aligned} & 6 \\ & 4 \mathrm{~L} \end{aligned}$ | $\begin{aligned} & .32 \\ & .32 \end{aligned}$ | $\begin{aligned} & 5 \\ & 5 \end{aligned}$ | Iow to moderate wind erosion hazard, moderate water erosion hazard, topsoil is fair to poor (too clayey), 8 inch precipitation zone. Strinkovell potential is low to high, high corrosion hazard to uncoated steel. |
| 28.28-28.4 | EX | Fruitland-Persayo-Sheppard: Deep and shallow, well to sonerhat excessively drained, sandy loan, fine sandy loam, clay loan, loamy fine sand, and fine sand soils formed on moderately sloping to moderately steep hills, messs, platesus, fans, and breaks from allivium, residum, and eolism materials derived from sandstone and shale. | Pruitland Perasyo Sheppard | $\begin{gathered} 60+ \\ 10-20 \\ 60+ \end{gathered}$ | $\begin{aligned} & 5-30 \\ & 5-30 \\ & 5-30 \end{aligned}$ | $\begin{aligned} & >6 \\ & >6 \\ & >6 \end{aligned}$ | $\begin{aligned} & 7.4-8.4 \\ & 7.9-9.0 \\ & 7.9-8.4 \end{aligned}$ | $\begin{aligned} & <4 \\ & <8 \\ & <2 \end{aligned}$ | $\begin{aligned} & \text { B } \\ & \text { D } \\ & \text { A } \end{aligned}$ | $\begin{aligned} & 3 \\ & 4 \mathrm{~L} \\ & 2 \end{aligned}$ | $\begin{aligned} & .24 \\ & .37 \\ & .15 \end{aligned}$ | $\begin{aligned} & 5 \\ & 1 \\ & 5 \end{aligned}$ | Moderate to high vind erosion hazard, low to moderate water erosion hazard, topsoil is poor (Persayo portiar-area reclaim), 8 inch precipitation zone. Strink-suell potential is low to moderate, high corrosion hazard to urcoated steel. |
| 28.4-28.6 | BT | Blancot-ibtal: Deep, well drained, loam, clay laam, silty clay loam, and clay soils formed on level to gently sloping alluvial fans and upland valleys from alluvium derived primarily from sandstone and shale. | Blancot <br> Notal | $\begin{aligned} & 60+ \\ & 60+ \end{aligned}$ | $\begin{aligned} & 0-5 \\ & 0-2 \end{aligned}$ | $\begin{aligned} & 76 \\ & >6 \end{aligned}$ | $\begin{aligned} & 7.9-8.4 \\ & 7.9-9.0 \end{aligned}$ | $\frac{8}{4-8}$ | $\begin{aligned} & \text { B } \\ & \text { D } \end{aligned}$ | $\begin{aligned} & 6 \\ & 4 \mathrm{~L} \end{aligned}$ | $\begin{aligned} & .32 \\ & .32 \end{aligned}$ | $\begin{aligned} & 5 \\ & 5 \end{aligned}$ | Low to moderate wind erosion hazard, moderate water erosion hazard, topsoil is fair to poor (too clayey), 8 inch precipitation zone. Shrinkavell potential is low to high, high |


| Milepost | $\operatorname{Mup}_{\text {Syubol }}$ | Soil Phase, Series, Associatipa, or Complex and Description | Soil Phase or Series | Depth to Bedrock (inches) | $\begin{aligned} & \text { Slope } \\ & (\mathrm{Z}) \end{aligned}$ | Depth to High Water Table (feet) | $\begin{gathered} \text { Soil } \\ \begin{array}{c} \text { Reaction } \\ (\mathrm{pH}) \end{array} \end{gathered}$ | $\underset{\substack{\text { Salinity } \\(\text { mimbos } \\ \mathrm{cm})}}{ }$ | Hydrologic Growp | $\begin{gathered} \text { Wig } \\ \text { Class } \end{gathered}$ | 'r' | 'T' | Coments |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| 28.6-28.7 | FX | Pruitland-Persayo-Sheppard: Deep and shallow, well to somerthat excessively drained, sandy loam, fine sandy loam, clay loam, loany fine sand, and fine sand soils formed on moderately sloping to moderately steep hills, mesas, plateaus, fans, and breaks from alluvium, residum, and eolian materials derived from sandstone and shale. | Pruitland <br> Perayo <br> Sheppard | $\begin{gathered} 60+ \\ 10-20 \\ 60+ \end{gathered}$ | $\begin{aligned} & 5-30 \\ & 5-30 \\ & 5-30 \end{aligned}$ | $\begin{aligned} & \gamma \\ & \gamma \\ & \gamma \end{aligned}$ | $\begin{aligned} & 7.4-8.4 \\ & 7.9-9.0 \\ & 7.9-8.4 \end{aligned}$ | $\begin{aligned} & <4 \\ & <8 \\ & <2 \end{aligned}$ | $\begin{aligned} & \mathrm{D} \\ & \mathrm{~A} \end{aligned}$ | $\begin{aligned} & 3 \\ & 4 \mathrm{~L} \\ & 2 \end{aligned}$ | $\begin{aligned} & .24 \\ & .37 \\ & .15 \end{aligned}$ | $1$ | Moderate to high wind erosion hazard, low to moderate water erosion hazard, topeoil is poor (Persayo portion-area reclaim), 8 inch precipitation zone. Stirink-suell potential is low to moderate, high corrosion hazard to urcoated steel. |
| 28.7-29.45 | ds | Doak-Sheppard-Shiprock: Deep, well and sonenhat excessively drained, loem, clay loam, loanty fine sand, fine sand, and fine sandy loam soils formed oa level to strongly sloping mesas, plateaus, and terraces from alluvial and eolimm materials derived from andstone, shale, and mixed sources. | Doak Sheppard Shiprock | $\begin{aligned} & 60+ \\ & 60+ \\ & 60+ \end{aligned}$ | $\begin{aligned} & 0-5 \\ & 0-15 \\ & 0-15 \end{aligned}$ | $\begin{aligned} & >6 \\ & > \\ & \gamma \end{aligned}$ | $\begin{aligned} & 7.4-8.4 \\ & 7.9-8.4 \\ & 7.4-8.4 \end{aligned}$ | $\begin{aligned} & <2 \\ & <2 \\ & <2 \end{aligned}$ |  | $\begin{aligned} & 5 \\ & 2 \\ & 3 \end{aligned}$ | $\begin{aligned} & .37 \\ & .15 \\ & .24 \end{aligned}$ | $\begin{aligned} & 5 \\ & 5 \end{aligned}$ | Low to high vind erosion hazard, low to moderate water erosion hazard, fair to good topeoil, 8 inch precipitation zone. Shrink-suell potential is low to moderate, high corrosion hazard to uncoated ateel. |
| 29.45-29.75 | 5 FX | Fruitland-Persavo-Sheppard: Deep and shallow, well to somentat excessively drained, sandy loam, fine sandy lamn, clay loan, loanyy fine send, and fine sand soils formed on moderately sloping to moderately steep hills, messe, plateaus, fans, and breaks from alluviun, residom, and eolian materials derived from sandstone and shale. | Pruitland Perasyo Sheppard | $\begin{gathered} 60+ \\ 10-20 \\ 60+ \end{gathered}$ | $\begin{aligned} & 5-30 \\ & 5-30 \\ & 5-30 \end{aligned}$ | $\begin{aligned} & \gamma \\ & > \\ & > \end{aligned}$ | $\begin{aligned} & 7.4-8.4 \\ & 7.9-9.0 \\ & 7.9-8.4 \end{aligned}$ | $\begin{aligned} & <4 \\ & <8 \\ & <2 \end{aligned}$ | $\begin{aligned} & \text { B } \\ & \text { D } \\ & \text { A } \end{aligned}$ | $\begin{aligned} & 3 \\ & 4 \mathrm{~L} \\ & 2 \end{aligned}$ | $\begin{aligned} & .24 \\ & .37 \\ & .15 \end{aligned}$ | $1$ | Hoderate to high vind erosion hazard, low to moderate water erosion hazard, topsoil is poor (Persayo portion-area reclaim), 8 inch precipitation zone. Strink-awell potential is low to moderate, high corrosion hazard to urcoasted steel. |
| 29.75-31.55 | DS | Doak-Sheppard-Shiprock: Deep, well and samedhat excessively drained, loam, clay loam, loany fine sund, fine sand, and fine sandy loam soils formed on level to strongly sloping mesas, plateass, and terraces from alluvial and eolian materisls derived from sandstone, shale, and mixed saurces. | Doak Sheppard Shiprock | $\begin{aligned} & 6+ \\ & 60+ \\ & 60+ \end{aligned}$ | $\begin{aligned} & 0-5 \\ & 0-15 \\ & 0-15 \end{aligned}$ | $\begin{aligned} & \gamma \\ & \gamma \\ & \gamma \end{aligned}$ | $\begin{aligned} & 7.4-8.4 \\ & 7.9-8.4 \\ & 7.4-8.4 \end{aligned}$ | $\begin{aligned} & <2 \\ & <2 \\ & <2 \end{aligned}$ | $\begin{aligned} & \text { B } \\ & \text { A } \end{aligned}$ | $\begin{aligned} & 5 \\ & 2 \\ & 3 \end{aligned}$ | $\begin{aligned} & .37 \\ & .15 \\ & .24 \end{aligned}$ | $5$ | Low to high wind erosion hazard, low to moderate water erosion hazard, fair to good topsoil, 8 inch precipitation mone. Shrink-swell potential is low to moderate, high corrosion hazard to uncoated steel. |
| 31.55-32.4 | HI | Fruitland-Perssyo-Sheppard: Deep and shallow, well to somestat excessively drained, sandy loan, fine sandy loasa, clay loan, loany fine sand, and fine sand soils fomed oo moderately sloping to moderately steep hills, mesas, plateaus, fans, and breaks from alluvium, residuon, and eolian materials derived from sandstone and shale. | Pruitland <br> Perasyo <br> Sheppard | $\begin{gathered} 60+ \\ 10-20 \\ 60+ \end{gathered}$ | $\begin{aligned} & 5-30 \\ & 5-30 \\ & 5-30 \\ & 5-30 \end{aligned}$ | $\begin{aligned} & \gamma \\ & \gamma \\ & \gamma \end{aligned}$ | $\begin{aligned} & 7.4-8.4 \\ & 7.9-9.0 \\ & 7.9-8.4 \end{aligned}$ | $\begin{aligned} & <4 \\ & <8 \\ & <8 \end{aligned}$ | $\begin{aligned} & \text { B } \\ & \text { D } \end{aligned}$ | $\begin{aligned} & 3 \\ & 4 \mathrm{~L} \\ & 2 \end{aligned}$ | $\begin{aligned} & .24 \\ & .37 \\ & .15 \end{aligned}$ | $5$ | Hoderate to high wind erosion hazard, low to moderate water erosion hazard, topsoil is poor (Persayo portion-area reclaim), 8 inch precipitation mone. Shrink-suell potential is low to moderate, high corrosion hazard to urcoated steel. |
| 32.4-32.65 | BT | Blancot-Nbtal: Deep, well drained, loan, clay loan, silty clay loan, and clay soila formed on level to gently sloping allivial fans and upland valleys from alluvium derived primarily from sandstome and shale. | $\begin{aligned} & \text { Blancot } \\ & \text { Notal } \end{aligned}$ | $\begin{aligned} & 60+ \\ & 60+ \end{aligned}$ | $\begin{aligned} & 0-5 \\ & 0-2 \end{aligned}$ | $\underset{\chi}{\nsucc}$ | $\begin{aligned} & 7.9-8.4 \\ & 7.9-9.0 \end{aligned}$ | $\begin{aligned} & <2 \\ & 4-8 \end{aligned}$ | $\begin{aligned} & \text { B } \\ & \text { D } \end{aligned}$ | $\begin{aligned} & 6 \\ & 4 \mathrm{~L} \end{aligned}$ | $\begin{aligned} & .32 \\ & .32 \end{aligned}$ | $\begin{aligned} & 5 \\ & 5 \end{aligned}$ | Low to moderate wind erosion hazard, moderate water erosion hazard, topsoil is fair to poor (too clayey), 8 inch precipitation zone. Strinkswell potential is low to high, high corrosion hazard to uncoated steel. |
| 32.65-33.0 | FX | Fruitland-Perssyo-Sheppard: Deep and shallow, well to sonerhat excessively drained, sandy loan, fine sandy loan, clay loan, loany fine sand, and fine sand soils formed on moderately sloping to moderately steep hills, wesas, platerais, fans, and breaks from alluvium, residum, and eolisn materials derived from sandstone and shale. | Pruitland <br> Perbayo <br> Sheppard | $\begin{gathered} 60+ \\ 10-20 \\ 60+ \end{gathered}$ | $\begin{aligned} & 5-30 \\ & 5-30 \\ & 5-30 \end{aligned}$ | $\begin{aligned} & \gamma \\ & > \\ & > \\ & >6 \end{aligned}$ | $\begin{aligned} & 7.4-8.4 \\ & 7.9-9.0 \\ & 7.9-8.4 \end{aligned}$ | $\begin{aligned} & <4 \\ & <8 \\ & <2 \end{aligned}$ | $\begin{aligned} & \text { B } \\ & \text { D } \\ & \text { A } \end{aligned}$ | $\begin{aligned} & 3 \\ & 4 \mathrm{~L} \\ & 2 \end{aligned}$ | $\begin{aligned} & .24 \\ & .37 \\ & .15 \end{aligned}$ | $5$ | Moderate to high wind erosion hazard, low to moderate water erosion hazard, topsoil is poor (Persayo portioo-ares reclaim), 8 inch precipitation zone. Shrink-suell potential is low to uoderate, high corrosion hazard to ur coated steel. |
| 33.0-33.3 | BT | Blancot-Notsl: Deep, well drained, loam, clay loam, silty clay loan, and clay soils formed on level to gently sloping alluvial fans and upland valleys from allivium derived primarily from sandatone and shale. | $\begin{aligned} & \text { Blancot } \\ & \text { Notal } \end{aligned}$ | $\begin{aligned} & 60+ \\ & 60+ \\ & \hline \end{aligned}$ | $\begin{aligned} & 0-5 \\ & 0-2 \end{aligned}$ | $\begin{aligned} & >6 \\ & >6 \end{aligned}$ | $\begin{aligned} & 7.9-8.4 \\ & 7.9-9.0 \end{aligned}$ | $\begin{aligned} & <2 \\ & 4-8 \end{aligned}$ | $\begin{aligned} & \text { B } \\ & \text { D } \end{aligned}$ | $\begin{aligned} & 6 \\ & 4 \mathrm{~L} \end{aligned}$ | $\begin{aligned} & 32 \\ & .32 \end{aligned}$ | $5$ | Low to moderate wind erosion hazard, moderate water erosion hazard, topsoil is fair to poor (too clayey), 8 inch precipitation zone. Shrinksuell potential is low to high, high corrosion hazard to uncoasted steel. |

Table 4. CHARACTERISTICS OF THE SOISS DENTIFIED AIONG MARN WATER PIPELINE ROOIB P3 (contimed)
Depth to soil solinity tedto

| Milepost | $\operatorname{Mup}_{\text {Syibol }}$ | Soil Phase, Series, Associatipa, or Complex and Description | Soil Phase or Series | Depth to Bedrock (inchea) | $\underset{(\mathcal{I})}{\substack{\text { Slope }}}$ | High Water Table (feet) | $\begin{aligned} & \text { Soil } \\ & \text { Reaction } \\ & (\mathrm{pH}) \end{aligned}$ | $\begin{gathered} \text { Salinity y y } \\ \substack{\text { (unthos/ } \\ \text { can }} \end{gathered}$ | Hydro logic Group | $\begin{gathered} \text { WeG } \\ \text { Clase } \end{gathered}$ | 'K' | 'T' | Commenta |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| 33.3-34.4 | DS | Daak-Sheppard-Shiprock: Deep, well and sonenhat excessively drained, loam, clay loan, loany fine and, fine and, and fine sandy loan soils formed on level to strongly sloping pesas, plateaus, and terraces from alluvial and eolian materials derived fron samdstone, shale, and mixed saurces. | Daak Sheppard Shiprock | $\begin{aligned} & 60+ \\ & 60+ \\ & 60+ \end{aligned}$ | $\begin{aligned} & 0-5 \\ & 0-15 \\ & 0-15 \end{aligned}$ | $\begin{aligned} & >6 \\ & >6 \\ & >6 \end{aligned}$ | $\begin{aligned} & 7.4-8.4 \\ & 7.9-8.4 \\ & 7.4-8.4 \end{aligned}$ | $\begin{aligned} & <2 \\ & <2 \\ & <2 \end{aligned}$ | $\begin{aligned} & \text { B } \\ & \text { A } \\ & \text { B } \end{aligned}$ | $\begin{aligned} & 5 \\ & 2 \\ & 3 \end{aligned}$ | $\begin{aligned} & .37 \\ & .15 \\ & .24 \end{aligned}$ | $\begin{aligned} & 5 \\ & 5 \\ & 5 \end{aligned}$ | Low to high wind erosion hazard, low to moderate water erosion hazard, fair to good topboil, 8 inch precipitation zone. Shrink-avell potential is low to moderate, high corrosion hazard to tmocated ateel. |
| 34.4-34.65 | BA | Bodland: Moderately sloping to extrenely steep, nonstony, barren shale uplands that are dissected by deep intermittent drainageway and gullies. | Badland | 0 | 5-80 | M | M | NA | N | NA | M | N | 8 inch precipitation move. |
| 34.65-35.95 | 5 DS | Doak-Sheppard-Shiprock: Deep, well and sonewhat excessively drained, loam, clay loam, loamy fine sand, fine sand, and fine sandy loan soils formed on level to strongly sloping mesas, platesus, and terraces from alluvial and eolian materials derived from andstone, shale, and mixed sources. | Doak Steeppard Shiprock | $\begin{aligned} & 60+ \\ & 60+ \\ & 60+ \end{aligned}$ | $\begin{aligned} & 0-5 \\ & 0-15 \\ & 0-15 \end{aligned}$ | $\begin{aligned} & >6 \\ & >6 \\ & >6 \end{aligned}$ | $\begin{aligned} & 7.4-8.4 \\ & 7.9-8.4 \\ & 7.4-8.4 \end{aligned}$ | $\begin{aligned} & <2 \\ & <2 \\ & <2 \end{aligned}$ | $\begin{aligned} & B \\ & \text { A } \\ & \text { B } \end{aligned}$ | $\begin{aligned} & 5 \\ & 2 \\ & 3 \end{aligned}$ | $\begin{aligned} & 37 \\ & .15 \\ & .24 \end{aligned}$ | $\begin{aligned} & 5 \\ & 5 \\ & 5 \end{aligned}$ | Low to high wind erosion hazard, low to moderate water erosion hazard, fair to good topeoil, 8 inch precipitation zone. Strinink-8well potential is low to moderate, high corrosion bazard to uncoated steel. |
| 35.95-36.15 | 5 FX | Fruitland-Persayo-Sheppard: Deep and shallow, well to someshat excessively drained, sandy loam, fine sandy loam, clay loam, loany fine sand, and fine sand soils formed on moderately sloping to moderately steep hills, mesas, plateaus, fans, and breaks fran alluvim, residnam, and eolim materials derived from sandstone and shale. | Fruitland Persayo Sheppard | $\begin{gathered} 60+ \\ 10-20 \\ 60+ \end{gathered}$ | $\begin{aligned} & 5-300 \\ & 5-30 \\ & 5-30 \\ & 50 \end{aligned}$ | $\begin{aligned} & >6 \\ & >6 \\ & >6 \end{aligned}$ | $\begin{aligned} & 7.4-8.4 \\ & 7.9-9.0 \\ & 7.9-8.4 \end{aligned}$ | $\begin{aligned} & <4 \\ & <8 \\ & <8 \end{aligned}$ | $\begin{aligned} & \text { B } \\ & \text { D } \\ & \text { A } \end{aligned}$ | $\begin{aligned} & 3 \\ & 4 \mathrm{~L} \\ & 2 \end{aligned}$ | $\begin{aligned} & .24 \\ & .37 \\ & .15 \end{aligned}$ | $\begin{aligned} & 5 \\ & 1 \\ & 5 \end{aligned}$ | Moderate to high wind erosion hazard, low to moderate water erosion hazard, topsoil is poor (Persayo portior-area reclaim), 8 inch precipitation zone. Shrink-owell potential is low to moderate, high corrosion hazard to urcoated ateel. |
| 36.15-36.45 | 5 Br | Blancot-Nbtal: Deep, well drained, loam, clay loam, silty clay loam, and clay soil formed ou level to gently sloping alluvial fans and upland valleys from alluvium derived primarily from sandstone and shale. | $\begin{aligned} & \text { Blancot } \\ & \text { Notal } \end{aligned}$ | $\begin{aligned} & 60+ \\ & 60+ \end{aligned}$ | $\begin{aligned} & 0-5 \\ & 0-2 \end{aligned}$ | $\underset{>6}{>6}$ | $\begin{aligned} & 7.9-8.4 \\ & 7.9-9.0 \end{aligned}$ | $\begin{aligned} & 8 \\ & 4-8 \end{aligned}$ | $\begin{aligned} & \text { B } \\ & \text { D } \end{aligned}$ | $\begin{aligned} & 6 \\ & 4 \mathrm{~L} \end{aligned}$ | $\begin{aligned} & .32 \\ & .32 \end{aligned}$ | $5$ | Low to moderate wind erosion hazard, moderate water erosion hazard, topsoil is fair to poor (too clayey), 8 inch precipitation zone. Strinkswell potential is low to high, high corrosion hazard to uncoated steel. |
| 36.45-37.5 | DS | Doak-Sheppard-Shiprock: Deep, well and socneshat excessively drained, loam, clay loam, loanty fine sand, fine sand, and fine sandy loan soils formed on level to strongly sloping neesas, plateaus, and terraces froa alluvial and eolimen materials derived from sandstone, shale, and mixed sources. | Doak Sheppard Shiprock | $\begin{aligned} & 60 \\ & 60+ \\ & 60+ \end{aligned}$ | $\begin{aligned} & 0-5 \\ & 0-15 \\ & 0-15 \end{aligned}$ | $\begin{aligned} & >6 \\ & >6 \\ & >6 \end{aligned}$ | $\begin{aligned} & 7.4-8.4 \\ & 7.9-8.4 \\ & 7.4-8.4 \end{aligned}$ | $\begin{aligned} & <2 \\ & <2 \\ & <2 \end{aligned}$ | $\begin{aligned} & \text { B } \\ & \text { A } \\ & \text { B } \end{aligned}$ | $\begin{aligned} & 5 \\ & 2 \\ & 3 \end{aligned}$ | $\begin{aligned} & .37 \\ & .15 \\ & .24 \end{aligned}$ | $\begin{aligned} & 5 \\ & 5 \end{aligned}$ | Low to high wind erosion hazard, low to moderate water erosico hazard, fair to good topsoil, 8 inch precipitation zone. Strink-awell potential is low to moderate, high corrosion hazard to umocated steel. |
| 37.5-38.3 | SC | Sheppard Hierfano-total: Deep and shallow, scoenhat excessively and well drained, loany fine sand, fine sand, sandy clay loam, clay loan, and clay ooils formed on level to moderately sloping valley bottans, fans, mesas, and plateans from eolian, alluvial, and residual materials derived from sandstone, shale, and siltstone. | Sheppard Buerfano Notal | $\begin{gathered} 60+ \\ 10-20 \\ 60+ \end{gathered}$ | $\begin{aligned} & 2-8 \\ & 0-3 \\ & 0-2 \end{aligned}$ | $\begin{aligned} & \gamma \\ & \gamma \\ & \gamma 6 \end{aligned}$ | $\begin{aligned} & 7.9-8.4 \\ & 7.9-9.0 \\ & 7.99 .0 \end{aligned}$ | $\begin{aligned} & <2 \\ & >4 \\ & 4-8 \end{aligned}$ | $\begin{aligned} & A \\ & D \\ & D \end{aligned}$ | $\begin{aligned} & 2 \\ & 4 \mathrm{~L} \\ & 4 \mathrm{~L} \end{aligned}$ | $\begin{aligned} & .15 \\ & .32 \\ & .32 \end{aligned}$ | $\begin{aligned} & 5 \\ & 1 \\ & 5 \end{aligned}$ | Moderate to high wind erosion hazard, low to moderate water erosion hazard, topsoil is fair to poor, 8 inch precipitation zone. Shrink-swell poterr tial is low to high, exchangeable sodium content ranges from 15-75\% for Huerfano-Nbtal portion, high corrosion hazard to uncoated steel. |
| 38.3-42.35 | Br | Blancot-Notal: Deep, well drained, loan, clay loan, silty clay loam, and clay soils formed on level to gently sloping alluvial fans and upland valleys from alluvium de- | Blancot Notal | $\begin{aligned} & 60+ \\ & 60+ \end{aligned}$ | $\begin{aligned} & 0-5 \\ & 0-2 \end{aligned}$ | $\begin{aligned} & >6 \\ & >6 \end{aligned}$ | $\begin{aligned} & 7.9-8.4 \\ & 7.9-9.0 \end{aligned}$ | ${ }_{4-8}^{<2}$ | в | $\begin{aligned} & 6 \\ & 4 \mathrm{~L} \end{aligned}$ | $\begin{aligned} & 323 \\ & .32 \end{aligned}$ | $\begin{aligned} & 5 \\ & 5 \end{aligned}$ | Low to moderate wind erosion hazard, moderate mater erosion hazard, topsoil is fair to poor (too clayey), <br> 8 inch precipitation zone. Strink- |

Table 4. Characieristics or the soils identified along mann hater pipeiine rouie p3 (concluded)

| Milepost | Map Symbol | Soil Phase, Series, Associatipn, or Complex and Description | Soil Phase or Series | Depth to Bedrock (inches) | Slope <br> (\%) | Depth to High Water Table (feet) | Soil Reaction ( pH ) | Salinity (mahos) cm) | Hydrologic Grolp | $\begin{aligned} & \text { WEG } \\ & \text { Class } \end{aligned}$ | 'K' | 'T' | Couments |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| 42.35-43.9 | SC | Sheppand-fherfano-Notal: Deep and shallow, sanewhat excessively and well drained, loarry fine sand, fine sand, sandy clay loam, clay loam, and clay soils formed on level to moderately sloping valley bottoms, fans, mesas, and platears from eolian, alluvial, and residual materials derived from sandstone, shale, and siltstone. | Sheppard Huerfano Notal | $\begin{gathered} 60+ \\ 10-20 \\ 60+ \end{gathered}$ | $\begin{aligned} & 2-8 \\ & 0-3 \\ & 0-2 \end{aligned}$ | $\begin{aligned} & >6 \\ & >6 \\ & >6 \end{aligned}$ | $\begin{aligned} & 7.9-8.4 \\ & 7.9-9.0 \\ & 7.9-9.0 \end{aligned}$ | $\begin{aligned} & <2 \\ & >4 \\ & 4-8 \end{aligned}$ | $\begin{aligned} & \text { A } \\ & \text { D } \\ & \text { D } \end{aligned}$ | $\begin{aligned} & 2 \\ & 4 \mathrm{~L} \\ & 4 \mathrm{~L} \end{aligned}$ | $\begin{aligned} & .15 \\ & .32 \\ & .32 \end{aligned}$ | $\begin{aligned} & 5 \\ & 1 \\ & 5 \end{aligned}$ | Moderate to high wind erosion hazard, low to moderate water erosion hazard, topsoil is fair to poor, 8 inch precipitation zone. Shrink-swell poterr tial is low to high, exchangeable sodiun content ranges from 15-75\% for Huerfano-Notal portion, high corrosion hazard to uncoated steel. |
| 43.9-44.7 | BT | Blancot-Notal: Deep, well drained, loam, clay loan, silty clay loan, and clay soils formed on level to gently sloping alluvial fans and upland valleys from alluvium derived primarily from sandstone and shale. | Blancot Notal | $\begin{aligned} & 60+ \\ & 60+ \end{aligned}$ | $\begin{aligned} & 0-5 \\ & 0-2 \end{aligned}$ | $\begin{aligned} & >6 \\ & >6 \end{aligned}$ | $\begin{aligned} & 7.9-8.4 \\ & 7.9-9.0 \end{aligned}$ | $\begin{aligned} & <2 \\ & 4-8 \end{aligned}$ | $\begin{aligned} & \text { B } \\ & \text { D } \end{aligned}$ | $\begin{aligned} & 6 \\ & 4 \mathrm{~L} \end{aligned}$ | $\begin{aligned} & .32 \\ & .32 \end{aligned}$ | $\begin{aligned} & 5 \\ & 5 \end{aligned}$ | Low to moderate wind erosion hazard, moderate water erosion hazard, topsoil is fair to poor (too clayey), 8 inch precipitation zone. Shrinkswell potential is low to high, high corrosion hazard to uncosted steel. |
| 44.7-45.1 | SC | Sheppand-Hierfano-Notal: Deep and shallow, somewhat excessively and well drained, loamy fine sand, fine sand, sandy clay loam, clay loam, and clay soils formed on level to moderately sloping valley bottows, fans, mesas, and plateaus from eolian, alluvial, and residual materials derived from sandstone, shale, and siltstone. | Sheppard Hierfano Notal | $\begin{gathered} 60+ \\ 10-20 \\ 60+ \end{gathered}$ | $\begin{aligned} & 2-8 \\ & 0-3 \\ & 0-2 \end{aligned}$ | $\begin{aligned} & >6 \\ & >6 \\ & >6 \end{aligned}$ | $\begin{aligned} & 7.9-8.4 \\ & 7.9-9.0 \\ & 7.9-9.0 \end{aligned}$ | $\begin{aligned} & <2 \\ & >4 \\ & 4-8 \end{aligned}$ | $\begin{aligned} & \text { A } \\ & \text { D } \\ & \text { D } \end{aligned}$ | $\begin{aligned} & 2 \\ & 4 \mathrm{~L} \\ & 4 \mathrm{~L} \end{aligned}$ | $\begin{aligned} & .15 \\ & .32 \\ & .32 \end{aligned}$ | $\begin{aligned} & 5 \\ & 1 \\ & 5 \end{aligned}$ | Moderate to high wind erosion hazand, low to moderate water erosion hazard, topsoil is fair to poor, 8 inch precipitation zone. Shrink-swell potential is low to high, exchangeable sodium content ranges from 15-75\% for Huerfano-Notal portion, high corrosion hazard to uncoated steel. |
| 45.1-45.85 | BA | Badland: Moderately sloping to extrenely steep, nonstony, barren shale uplands that are dissected by deep intermittent drainageways and gullies. | Bedland | 0 | 5-80 | NA | M | N | NA | NA | NA | NA | 8 inch precipitation zone. |
| 45.85-48.5 | SC | Sheppand-Huerfano-Notal: Deep and shallow, somewhat excessively and well drained, loamy fine sand, fine sand, sandy clay loam, clay loam, and clay soils formed on level to moderately sloping valley bottome, fans, mesas, and plateas from eolian, alluvial, and residual materisls derived from sandstone, shale, and siltstone. | Sheppard Huerfano Notal | $\begin{gathered} 60+ \\ 10-20 \end{gathered}$ $60+$ | $\begin{aligned} & 2-8 \\ & 0-3 \\ & 0-2 \end{aligned}$ | $\begin{aligned} & >6 \\ & >6 \\ & >6 \end{aligned}$ | $\begin{aligned} & 7.9-8.4 \\ & 7.9-9.0 \\ & 7.9-9.0 \end{aligned}$ | $\begin{aligned} & <2 \\ & >4 \\ & 4-8 \end{aligned}$ | $\begin{aligned} & \text { A } \\ & \text { D } \\ & \text { D } \end{aligned}$ | $\begin{aligned} & 2 \\ & 4 \mathrm{~L} \\ & 4 \mathrm{~L} \end{aligned}$ | $\begin{aligned} & .15 \\ & .32 \\ & .32 \end{aligned}$ | $\begin{aligned} & 5 \\ & 1 \\ & 5 \end{aligned}$ | Moderate to high wind erosion hazard, low to moderate water erosion hazard, topsoil is fair to poor, 8 inch precipitation zone. Shrink-swell poterr tial is low to high, exchangeable sodium content ranges fram 15-75\% for Huerfano-Notal portion, high corrosion hazard to uncoated steel. |

[^2]and gullies. The terrain slopes range mainly from nearly level to strongly sloping, but a strongly sloping to steep Badland area would be traversed near the southern end of Kutz Canyon (between MP 13.716.0). Approximately 5.6 miles of Badland (nonstony, barren shale) would be traversed by pipeline route P3. Topsoil availability along this alternative pipeline route is limited due to generally shallow surface layers, and the majority of the existing topsoil is of fair to poor quality due to undesirable surface textures (e.g., too sandy or clayey) or excess salt/sodium. The Blackston (MP 0.25-0.30) and Persayo (map units FX and FA in Table 4) soils identified along this route are difficult to reclaim if the topsoil is removed and not replaced. Susceptibility of the identified soils to wind-induced soil erosion ranges from low to high, but it is primarily moderate to high. Susceptibility to water-induced soil erosion is primarily low to moderate. The soils identified along this alternative pipeline route are mildly to strongly alkaline. Shrink-swell potential of the identified soils is primarily low to moderate, but the Notal soil has a high shrink-swell potential. These soils are currently used primarily for livestock grazing, wildlife habitat, and energy resource development.

Proposed Terminal Storage Reservoir (Rl). Three different soil associations (or land types) were identified at the proposed terminal storage reservoir site. Table 5 lists and characterizes the identified soils.

The soils identified at the Rl reservoir site are shallow to deep and well to somewhat excessively drained. Surface textures range from fine sand to clay loam. These soils are forming in alluvial, eolian, and residual materials derived primarily from shale, sandstone, and siltstone on a nearly level to moderately sloping mesa. More than 50 percent of the proposed reservoir site is Badland (nonstony, barren
Table 5. charactiristics of the soils mentified at the proposed terkinal storace reservoir

| Soil Association and Deacription ${ }^{1}$ | Approximate Acreage | $\begin{aligned} & \text { Soil } \\ & \text { Series } \end{aligned}$ | Depth to Bedrock (inches) | $\begin{aligned} & \text { Slope } \\ & (\underline{)} \text { ) } \end{aligned}$ | Depth to High hater Table (feet) | $\begin{gathered} \text { Soil } \\ \begin{array}{c} \text { Reaction } \\ (\mathrm{pH}) \end{array} \end{gathered}$ | $\begin{gathered} \text { Salinity } \\ \begin{array}{c} \text { (aumbos/ } \\ \text { an) } \end{array} \end{gathered}$ | $\begin{aligned} & \text { Hydro } \\ & \text { logic } \\ & \text { Group } \end{aligned}$ | $\begin{gathered} \mathrm{W} \in \mathrm{G} \\ \mathrm{Clases}^{2} \end{gathered}$ | 'K' | 'T' | Couments |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| Badland: Moderately sloping to extremely steep, nonstony, barren shale uplands that are dissected by deep intermittent drainageways and gullies. | 75 | Bedland | 0 | 5-80 | $\chi$ | м | M | D | NA | N | N4 | 8 inch precipitation zone, potential numoff is very rapid, slight limitations for arr benkments, dikes, and levees. |
| Sheppard-therfano-Notsl: Deep and shallow, someshat excessively and well drained, loany fine sand, fine aand, sandy clay lom, clay loam, and clay soils forned on level to moderately sloping valley bottons, fans, mesas, and plateaus from eolian, alluvial, and residual materials derived fran sandstone, shale, and siltatone. | ${ }^{35}$ | Sheppard Heerfano Notal | $\begin{gathered} 60+ \\ 10-20 \\ 60+ \end{gathered}$ | $\begin{aligned} & 2-8 \\ & 0-3 \\ & 0-2 \end{aligned}$ | $\begin{aligned} & >6 \\ & >6 \\ & >6 \end{aligned}$ | $\begin{aligned} & 7.9-8.4 \\ & 7.9-9.0 \\ & 7.9-9.0 \end{aligned}$ | $\begin{aligned} & <2 \\ & >4 \\ & 4-8 \end{aligned}$ |  | $\begin{aligned} & 2 \\ & 4 \mathrm{~L} \\ & 4 \mathrm{~L} \end{aligned}$ | $\begin{aligned} & .15 \\ & .32 \\ & .32 \end{aligned}$ | $\begin{aligned} & 5 \\ & 1 \\ & \frac{1}{2} \end{aligned}$ | Moderate to high wind erosion hazard, low to moderate water erosion hazard, topsoil is fair to poor, 8 inch precipitation zone. Shrink-swell potential is low to high, limitations for reservoirs, embankments, dikes, and levees are seepage and piping. |
| herfenothiff-Uffens: Shallow to deep, well drained, sandy clay loan, clay loan, very fine sandy loam, and $f$ ine sandy loam soils formed on level to moderately sloping mesas and valleys from alluvium and residum derived primarily fram shale and siltstone. | 35 | Heerfano <br> Muff <br> Uffens | $\begin{gathered} 10-20 \\ 20-40 \\ 60+ \end{gathered}$ | $\begin{aligned} & 0-3 \\ & 0-8 \\ & 0-5 \end{aligned}$ | $\begin{aligned} & >6 \\ & >6 \\ & >6 \end{aligned}$ | $\begin{aligned} & 7.9-9.0 \\ & 7.4-8.4 \\ & 7.4-8.4 \end{aligned}$ | $\begin{aligned} & >4 \\ & 2-4 \\ & 4-8 \end{aligned}$ |  | $\begin{aligned} & 4 \mathrm{~L} \\ & 3 \\ & 3 \end{aligned}$ | $\begin{aligned} & .32 \\ & .28 \\ & .20 \end{aligned}$ | $\begin{aligned} & 1 \\ & 3 \\ & 1 \end{aligned}$ | Moderate wind and water erosion hazard, topsoil is poor due to shallowness, excess salt/sodium (Muff portior-area reclaim), 8 inch precipitation zone. Shrink-swell potential is low to moderate, limitations for reservoirs are minimal, limitations for |
| (Total Acreage) | (145) |  |  |  |  |  |  |  |  |  |  |  |

[^3]shale). Topsoil availability at the site is limited due to shallow or nonexistent soil surface layers, and the majority of the existing topsoil is of fair to poor quality due to undesirable surface textures (e.g., too sandy or clayey) or excess salt/sodium. The Muff soil is difficult to reclaim if the topsoil is removed and not replaced. The identified soils are characterized by a moderate to high wind erosion hazard and a low to moderate water erosion hazard. These soils are mildly to strongly alkaline. Shrink-swell potential of the identified soils is primarily low to moderate, but the Notal soil has a high shrink-swell potential. The identified soils present slight to moderate limitations for reservoirs, embankments, dikes, and levees (e.g., shallowness, piping, and seepage). These soils are currently used primarily for llvestock grazing and wildife habitat.

Terminal Storage Reservoir Alternative (R2). Two different soil associations (SCS 1980) were identified at the alternative reservoir site. Map unit HU (Huerfano-Muff-Uffens) covers approximately 95 percent of the site, and map unit DN (Doak-Avalon) covers approximately 5 percent on the northern tip of the site.

The soils in map unit $H U$ are shallow to deep, while map unit DN consists of deep soils. All of these soils are well drained, and the surface textures range from very fine sandy loam to clay loam. These soils are forming primarily in alluvium and residuum derived from shale and siltstone on a gently to moderately sloping upland drainage sideslope. The Avalon portion of map unit DN is also forming in eolıan materials derived from sandstone and shale. Topsoil availability at the alternative reservoir site is limited due to generally shallow surface layers, and the majority of the existing topsoil is of poor to fair quality due to undesirable surface texture (too clayey) or excess salt/sodium. The Muff soil is difficult to reclaim if the topsoil is removed and not replaced. The identified
soils are characterized by a moderate wind erosion hazard, and a primarily moderate water erosion hazard. These soils are mildly to strongly alkaline. The Avalon soil is moderately to highly susceptible to water-induced soil erosion. Since the Avalon soil covers a very small portion of the site (less than 2 percent), no significant water erosion problems would be expected to occur. Shrinkswell potential of the identified soils is low to moderate. The soils identified at this alternative reservoir site present slight to moderate limitations for reservoirs, embankments, dikes, and levees (e.g., shallowness, low strength, piping, and seepage). These soils are currently used primarily for livestock grazing and wildife habitat.

## Transmission Lines

Proposed FC-A-P 500-kV Transmission Line Loop (T5). The corridor associated with this proposed transmission line loop falls within transmission corridor T4. See Table 9 (MP 0.0-5.0) for the applicable soils data.

First Proposed Transmission Corridor (T2). The first proposed transmission corridor is within the San Juan River Valley Mesas and Plateaus and the New Mexico and Arizona Plateaus and Mesas portions of the Western Range and Irrigated Region (SCS 1978a). Annual precipitation generally ranges from 6 to 17 inches along T2, but most of this corridor receives between 6 and 14 inches. Fourteen different soil associations were identified within this corridor. Table 6 lists (by mileposts) and characterizes the identified soils.

The soils identified within the transmission corridor $T 2$ are very shallow to deep, with surface textures ranging from gravelly loamy sand to clay. Permeability of these soils is very slow to rapid.


| Milepost | $\underset{\text { Syathol }}{\mathrm{Map}_{2}}$ | Soil Aseociation and Deacription | Soil Seriee | Depth to Bedrock (inchen) | $\underset{(\mathrm{I})}{\text { Slope }}$ | Coments |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| Sen suan Canty ${ }^{1}$ |  |  |  |  |  |  |
| 0.0-0.75 | 8 | Badland-Rock Outcrop-Hmierce: Shallow, well drained, fine sandy loan eoils formod on level to moderately sloping knolls, mesas, and platesus from alluvial and coliman moterials derived prinarily from sandstone and shale. Includes nonstouy, barren shale areas on moderately sloping to extrenely steep uplands that are dissected by deep intermittent drainageways and gullies; and barren asndstone outcrops on moderately sloping to extrewely steep cliffs, ridgea, breaks, and ledgea. | Hanierco | 10-20 | $0-8$ | Moderate wind and water erosion hazand, poor topeoil, $6-10$ inch precipitation zone. Shrink-avell potential is low to moderate, wild to moderately alkaline mils. |
| 0.75-4.25 | 6 | Sheppard Herfano-Nbtal: Deep to ahallow, well to comathat excessively drained, louny fine sand, asndy clay loen, and silty clay loem soils fonmed on level to steep mesas, plateens, valley bottona and fana from colian, alluvial, and residual materiala derived from sandstone, shale, and siltstone. | Sheppard Herfeno Autal | $\begin{gathered} 60+ \\ 10-20 \\ 60 \end{gathered}$ | $\begin{aligned} & 0-40 \\ & 0-3 \\ & 0-2 \end{aligned}$ | Moderate to high wind erosion hazard, low to moderate water erosion hazard, topsoil is poor to fair, 6-10 inch precipitation zone. Strink-swell potential is low to high, moderately to strougly alkaline soils. |
| 4.25-5.0 | 6/8 | Refer to Map Syatols - 6 and 8 (mileposte $0.75-4.25$ and $0.0-0.75$, respectively). |  |  |  |  |
| 5.0-5.75 | 6 | Sheppard-Herfeno-Hotal: Deep to shallov, well to comeshat excessively drained, loary fine sand, sandy clay loana, and silty clay loam soils formed oa level to steep resas, plateas, valley bottoma and fans from colian, alluvial, and residual materials derived from sandetone, shale, and siltstcuc. | Sheppard Huerfano Notel | $\begin{gathered} 60+ \\ 10-20 \\ 60 \end{gathered}$ | $\begin{aligned} & 0-40 \\ & 0-3 \\ & 0-2 \end{aligned}$ | Moderate to high vind erosion hazard, low to moderate water erosion hazard, topooil is poor to fair, 6-10 inch precipitation zone. Slurink-swell potential is low to high, moderately to strougly alkaline soils. |
| 5.75-8.75 | 6/8 | Befer to hap Syubols -6 and 8 (mileposts $0.75-4.25$ and 0.0-0.75, reapectively). |  |  |  |  |
| 8.75-10.0 | 6 | Sheppard therfano-total: Deep to shallow, well to somedhat excessively drained, loany fine send, sendy clay loan, and silty clay loan soile formod oa level to steep measa, plateana, valley bottowa and fana from oolian, alluvial, and residual materiale derived from candetoves, shale, and silcstone. | Sheppard Huerfano Hotal | $\begin{gathered} 60+ \\ 10-20 \\ 60 \end{gathered}$ | $\begin{aligned} & 0-40 \\ & 0-3 \\ & 0-2 \end{aligned}$ | Moderate to high wind erosion hazard, low to moderate water erosion hazard, topeoil is poor to fair, 6-10 inch precipitation zone. Shrink-swell potential is low to high, moderately to atrangly alksline wils. |
| 10.0-11.0 | 6/8 | Refer to Mep Symbols -6 and 8 (mileposts 0.75-4.25 and 0.0-0.75, reppectively). |  |  |  |  |
| 11.0-13.25 | 6 | Sheppard-Herfamo-Hotal: Deep to shallow, well to sowahat excess ively drained, losury fine aand, sandy chay loan, and silty clay loom noils formed oa level to steep mesas, plateaus, valley bottome and fave from eolian, alluvial, and residual materials derived from sandstone, shale, and siltatone. | Sheppard Huerfano Motal | $\begin{gathered} 60+ \\ 10-20 \\ 60 \end{gathered}$ | $\begin{aligned} & 0-40 \\ & 0-3 \\ & 0-2 \end{aligned}$ | Moderate to high vind erosion hazard, low to moderate water erosion hazard, topeoil is poor to fair, 6-10 inch precipitation zone. Strink-swell potential is low to high, moderately to atroogly alkaline soils. |
| 13.25-14.75 | 6/8 | Refer to Map Syabole - 6 and 8 (mileposte $0.75-4.25$ and 0.0-0.75, reepectively). |  |  |  |  |
| 14.75-17.25 | $6 / 5$ | Refeer to thep Syubols - 6 end 5 (eileposts 0.75-4.25 end 17.25-21.0, reapectively). |  |  |  |  |
| 17.25-21.0 | 5 | Blancot-Abral: Deep, well to comenhat excessively drained, loem and silty clay loam eoils fonmed on level to gently sloping fans, valley sides, and valley bottome from alluviwe derived primarily from andstone and shalo. | Blenoot <br> Hatal | $\begin{aligned} & 60 \\ & 60 \end{aligned}$ | $\begin{aligned} & 0-5 \\ & 0-2 \end{aligned}$ | Low to moderate wind erosion hazard, woderate water erosion hazard, topeoil is poor to fair, 6-10 inch precipitation zone. Shrink-awell potential is low to high, moderately to atrougly alkaline soils. |
| 21.0-22.0 | 5/6 | Refer to Map Syubole - 5 and 6 (mileposte 17.25-21.0 and 0.0-0.75, reapectively). |  |  |  |  |
| 22.0-23.25 | 6 | Steppardtherfano-thtal: Deep to ahallow, well to | Stepperd | $60+$ | 0-40 | Moderate to high vind erosion havard, low to moderate |



| Milepoat | $\operatorname{Map}_{\text {Syibol }}$ | Soil Aspociation and Description | Soil Series | Depth to Bedrock (inches) | $\begin{gathered} \text { Slope } \\ (X) \end{gathered}$ | Cowents |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| San Juan Combly ${ }^{1}$ (contimued) |  |  |  |  |  |  |
| 23.25-24.75 | 6/8 | Befer to Mep Syabole - 6 and 8 (mileposte $0.75-4.25$ and 0.0-0.75, reapectively). |  |  |  |  |
| 24.75-30.25 | 6 | Sheppard-Herfano-dotal: Deep to shallow, well to comenhat excessively drained, loany fine sand, sandy clay lomen, and silty clay loam mile formed on level to steep mesas, plateans, valley bottona and fans from eolian, allivial, and reaidual materials derived from andstone, ahale, and siltstone. | Sheppard Huerfano Notal | $\begin{gathered} 604 \\ 10-20 \\ 60 \end{gathered}$ | $\begin{aligned} & 0-40 \\ & 0-3 \\ & 0-2 \end{aligned}$ | Hoderate to high wind erosion hayard, lov to moderate whter erosion hazand, topeoil is poor to fair, 6-10 inch precipitation sone. Shrink-avell potential is low to high, moderately to strongly alkaline eoils. |
| 30.25-32.0 | 6/5 | Refer to hap Symols - 6 and 5 (mileposta $0.75-4.25$ and $17.25-21.0$, reapectively). |  |  |  |  |
| Mrxinley County ${ }^{2}$ |  |  |  |  |  |  |
| 32.0-35.0 | 14 | Persayo-Lohmiller: Very shallow to deep, silty clay loam, silt losm, and silty clay losm soils formed oa level to moderately steep broad valleys, uplends, eacarpuants, and breake from residuna and alluvime derived from shale and andotone. Includea barrea or nearly barrea ahale outcrop areas. | Persayo Lotmiller | $\begin{gathered} 6-20 \\ 60+ \end{gathered}$ | $\begin{aligned} & 5-25 \\ & 0-3 \end{aligned}$ | Moderate wind and water erosion hazand, topeoil is poor to fair, $10-17$ inch precipitation zone. Strink-awell potential is moderate, permeability is slow to very slow, calcareous. |
| 35.0-35.75 | 6 | Penistaja-Valent: Deep, fine sandy loem, very fine sandy loan, and loany fine sand wille formed on mearly level to gently sloping uplande, and upland ridgea from eolian, alluvisl, and residual materials derived primarily from sundstone and shale. Includes moderately steep to ateep sandstone and shale outcrops, and slickspots or alkali-affected areas. | Penistaja Valent | $\begin{aligned} & 60 \\ & 60+ \end{aligned}$ | $\begin{aligned} & 3-5 \\ & 1-5 \end{aligned}$ | Hoderate to high wind erosion havard, low to moderate water erosion havard, topeoil is fair to poor, 10-17 inch precipitation zone. Surink-avell potential is low to moderate, perweability is moderate to rapid, noncalcareous. |
| 35.75-38.5 | 6/14 | Refer to Map Syabole - 6 and 14 (mileposte 35.0-35.75 and 32.0-35.0, reapectively). |  |  |  |  |
| 38.5-40.0 | 6/14/13 | Refer to Mep Syubols -6,14, and 13 (mileposte 35.0-35.75; 32.0-35.0; and 45.5-46.25, reapectively). |  |  |  |  |
| 40.0-41.0 | 14 | Persapo-Lotmiller: Very shallow to deep, silty clay loam, silt loan, and silty chay loan eoils formed on level to moderately steep broed valleys, uplande, eacarppeats, and breake fron residum and slluvium derived from shale and sandstone. Includes berrea or nearly berreen shale outcrop areas. | Persayo Lobailler | $\begin{gathered} 6-20 \\ 60+ \end{gathered}$ | $\begin{aligned} & 5-25 \\ & 0-3 \end{aligned}$ | Moderate vind and weter erosion harard, topeoil is poor to fair, 10-17 inch precipitation mane. Strink-well potential is moderate, permeability is slow to very slow, calcarecus. |
| 41.0-42.75 | 14/13 | Refer to Map Symbols - 14 and 13 (mileposte 32.0-35.0 and 45.5-46.25, reapectively). |  |  |  |  |
| 42.75-45.5 | 14 | Persaso-Lotmiller: Very shallow to deep, silty clay lomen, silt loena, and silty clay losm soils formed an level to moderately steep broad valleys, uplands, eacarpments, and breake from residum and alluviua derived from shale and sandotrose. Includes barren or pearly barren shale outcrop areas. | Perayyo Lotailler | $\begin{gathered} 6-20 \\ 60+ \end{gathered}$ | $\begin{aligned} & 5-25 \\ & 0-3 \end{aligned}$ | Hoderate wind and water erosion harard, topeoil is poor to fair, 10-17 inch precipitation rone. Shrink-awell potential is modarate, permeability is slow to very slow, calcareas. |
| 45.5-46.25 | 13 | Hegerman-Traveasilla: Hoderately deep to very shallov, fine sandy loma, loam, and gravelly sandy loea soils formed on mearly level to moderately steep uplands, peas tope, valley bottowe, and flood plaina in residum derived from sandstone and in colian and alluvial mediments of mixed origin. Includes steap sandstone (and eame shale) outcrops. | Hageman <br> Traveseilla | $\begin{aligned} & 20-40 \\ & 4-20 \end{aligned}$ | $\begin{aligned} & 1-5 \\ & 3-25 \end{aligned}$ | Hoderate to high wind erosion hazard, woderate water erosion harard, topeoil is good to poor, 10-17 inch precipitation mone. Shrink-awell potential is low, perneability is moderate to rapid, noncalcareous to slightly calcareous. |
| 46.25-46.5 | 14 | Perpayo-Iohmiller: Very shallow to deep, silty clay lome, silt lome and ailty clay loan soils formed on level to moderately steep broad valleys, uplands, eacarpoents, and breaks from residum and alhovium derived from shale and andstone. Includea barren or nearly barren shale outerop areas. | Persayo Lobmiller | $\begin{gathered} 6-200+ \\ 60+ \end{gathered}$ | $\begin{aligned} & 5-25 \\ & 0-3 \end{aligned}$ | Hoderate wind and water erosion harard, topeoil is poor to fair, 10-17 inch precipitation zone. Shrink-avell potential is moderate, permeability is slow to very slow, calcareous. |



| Milepost | $\begin{aligned} & \text { Mep } \\ & \text { Syubol } \end{aligned}$ | Soil Associatioa and Description | Soil Series | Depth to Bedrock (inches) | $\begin{gathered} \text { Slope } \\ (2) \end{gathered}$ | Coments |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| Hexinley Comty ${ }^{2}$ (continued) |  |  |  |  |  |  |
| 46.5-47.75 | 13 | Heserman-Travessilla: Moderately deep to very uhallow, fine sandy loom, loan, and gravelly sandy loem soila formed on pearly level to moderately steep uplande, weas tops, valley bottome, and flood plaina in residum derived from sandetone and in colian and alluvial sediments of mixed origin. Includees steep sandetone (and rome ahale) outcrops. | Hageman <br> Travessille | $\begin{aligned} & 20-40 \\ & 4-20 \end{aligned}$ | $\begin{aligned} & 1-5 \\ & 3-25 \end{aligned}$ | Moderate to high wind erosion hazard, woderate water erosion hazard, topeoil is good to poor, 10-17 inch precipitstion rone. Shrink-awell potential is low, permeability is moderate to rapid, noncalcareaus to slightly calcareous. |
| 47.75-49.5 | 14/13 | Refer to Mop Syubole - 14 and 13 (mileposts 32.0-35.0 and | -46.25, repect | vely). |  |  |
| 49.5-52.0 | 14/15 | Befer to Map Syrbole - 14 and 15 (mileposta 32,0-35.0 and 59. | 0-53.5, respecti | ely). |  |  |
| 52.0-53.0 | 13/15 | Refer to Map Symbols - 13 med 15 (aileposts 45.5-46.25 and | -53.5, reapect | 1y). |  |  |
| 53.0-53.5 | 15 | Las lucas-hitle-Persayo: Deep to very shallow, loan, clay, silty clay loan, and silt loam soile formed an nearly level to moderately sloping alliwial fans, valley sideslopes, uplands, ridges, and knolls from alluvial and reaidual materials derived primarily from ahale. Includes interbedded shale and amdstone exposures on steep eacarpments and breaks. | Las Lucas Litle Perazo | $\begin{array}{r} 40-60 \\ 20-40 \\ 6-20 \end{array}$ | $\begin{aligned} & 3-5 \\ & 3-5 \\ & 1-9 \end{aligned}$ | Low to moderate wind erosion hazard, woderate to high water erosion hazard, topaoil is fair to poor, 7-10 inch precipitation rone. Shrink-avell potential is moderate to high, slow to very slow permeability, calcareous. |
| 53.5-55.75 | 15/14 | Refer to Mip Syubole - 15 and 14 (milepostas $53.0-53.5$ and 32.0 | - 35.0 , respecti |  |  |  |
| 55.75-57.5 | 15 | Las Lucas-Litle-Persayo: Deep to very shallow, Loen, clay, silty clay lom, and silt loan soils formed an nearly level to moderately sloping alluvial fans, valley sideslopes, uplands, ridges, and knolls from allur vial and residual materials derived primarily from shale. Includea intertedded shale and amdatone expoarrea as steep escarpments and breaks. | Les lucas Litle Persayo | $\begin{array}{r} 40-60 \\ 20-40 \\ 6-20 \end{array}$ | $\begin{aligned} & 3-5 \\ & 3-5 \\ & 1-9 \end{aligned}$ | Low to moderate vind erosion hazard, moderate to high water erosion hazard, topsoil is fair to poor, 7-10 inch precipitation zone. Shrink-swell potential is moderate to high, slow to very slow permeability, calcareous. |
| Sendoval County ${ }^{3}$ (Part 1) |  |  |  |  |  |  |
| 57.5-59.75 | 2 | Litle-Las lucas: Shallow to doep, well drained, lomen, clay loan, and silty clay lomem soils formed on level to moderately steep uplande and low hills from eolian materials and shale. | Litle <br> Las lucas | $\begin{aligned} & 14-24 \\ & 40-72+ \end{aligned}$ | $\begin{aligned} & 1-25 \\ & 0-9 \end{aligned}$ | Low vind erosion hazard, moderate to high witer erosion hazand, fair to good topaoil, 10-14 inch precipitation zane. Shrink-twell potential is moderate to high, mildly to moderately alkaline wils. |
| 59.75-63.5 | 2/6 | Refer to Hep Syubols - 2 and 6 (mileposte 57.5-59.75 and 63.5-74.75, respectively). |  |  |  |  |
| 63.5-74.75 | 6 | Traveasilla-Persayo: Very shallow to shallow, well drained, andy loen, loena, and silty clay loam woils fommed on gently sloping to moderately steep mesass and breake from materiala derived primarily from andatove and shale. | Travessille <br> Persayo | $\begin{aligned} & 6-16 \\ & 0-16 \end{aligned}$ | $\begin{aligned} & 3-25 \\ & 9-25 \end{aligned}$ | Hoderate vind and water erosion harard, poor to fair topsoil, 10-14 inch precipitation zone. Shrink-avell potential is low to high, moderately alkaline soils. |
| 74.75-75.5 | 2 | Litle-Laq Lucas: Shallow to deep, well drainod, Loen, clay loam, and silty clay loan soile formed on level to moderately steep uplende and low hills from eolian materials and shale. | Litle Las lucae | $\begin{aligned} & 14-24 \\ & 40-72+ \end{aligned}$ | $\begin{aligned} & 1-25 \\ & 0-9 \end{aligned}$ | Low wind erosion hazard, moderate to high water erosion hazard, fair to good topsoil, 10-14 inch precipitation zone. Surink-avell potential is moderate to high, mildly to moderately alkaline soils. |
| 75.5-76.25 | 1/2 | Refer to Map Syubols -1 and 2 (mileposts 76.25-76.5 and 57.5-59.75, respectively). |  |  |  |  |
| 76.25-76.5 | 1 | Christimpburg-Nayaio: Deep, somenhat poorly and poorly drained, silty clay, and clay eoils formed on level to gently sloping flood plaine and terraces fras alluviva. Includes Slickspots areas which are alkali-affected and susceptible to pudding. | Cluristianturg Nevajo | $\begin{aligned} & 60+ \\ & 60+ \end{aligned}$ | $\begin{aligned} & 0-3 \\ & 0-3 \end{aligned}$ | Low wind erosion hazard, moderate to high vater erosion hazard, topsoil is poor, 10-14 inch precipitation zone. Strink-swell potential is high, strongly alkaline soils. |



| Milepost | $\begin{aligned} & \text { Mep } \\ & \text { Syubol } \end{aligned}$ | Soil Association and Description | Soil Series | Depth to Bedrock (inches) | $\underset{(z)}{\text { Slope }}$ | Coments |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| Sandoral Comby ${ }^{4}$ (Part II) |  |  |  |  |  |  |
| 77.0-82.75 | 10 | Persayo-Mrlev-Badland: Very shallow to deep, ailty clay loan, and silt loam soils formed on level to moderately ateep uplands, ridges, valley bottonas, and valley sides from residum derived from shale and sandstone, and to a leseer extent from alluvisu. Includes moderately to very steep barrea ahale outcrops. | $\begin{aligned} & \text { Persayo } \\ & \text { Turley } \end{aligned}$ | $\begin{gathered} 6-18 \\ 60+ \end{gathered}$ | $\begin{aligned} & 5-25 \\ & 0-5 \end{aligned}$ | Moderate vind and water erosion hazard, topeoil is poor, 10-14 inch precipitation zone. Sturink-gwell potertial is moderate, permeability is slov, calcareous. |
| 82.75-88.75 | 10; | Befer to Map Symol - 10 (milepost 77.0-82.75). |  |  |  |  |
|  | 14 | Apache-Silver Rockland: Shallow to deep, atory loan, atory fine sandy loem, and loam soils formed on level to atrongly sloping old lave flowe and basaltic mesas from materials of volcanic or basic igneous origin. Includes basalt outcrope on moderately sloping to steep lave flow froate and sidea of besalt capped mesas. | Apeche 8ilver | $\underset{60}{10-20}$ | $\begin{aligned} & 0-10 \\ & 0-5 \end{aligned}$ | Low vind erosion hazard, woderate water erosion hazard, topeoil is poor to good, $10-14$ inch precipitation zone. Strink-avell poteatial is low to high, perneability is slow to moderate, calcareans and noncalcareous soils. |
| 83.75-86.75 | 11/14 | Refer to hap Syutola - 11 and 14 (mileposta $8.75-92.5$ and 82.75-83.75, reapectively). |  |  |  |  |
| 86.75-92.5 | 11 | Las Lucas-Litle Persarg: Deep to very shallow, clay, loan, silty clay loan, and silt lomen wits formed on nearly level to moderately sloping allivial fans, valley side alopes, uplands, ridges, and koolls from materials derived from veathered shale. Includes steep to very steep ahale and sandatone outcrops. | Las lucas Litle Persayo | $\begin{gathered} 40-60 \\ 20-40 \\ 6-18 \end{gathered}$ | $\begin{aligned} & 3-5 \\ & 3-5 \\ & 1-9 \end{aligned}$ | Low vind erosion hazard, moderate to high water erosion hazand, fair to poor topeoil, $10-14$ inch precipitation sone. Sturink-owell potentisl is moderate to high, permeability is slou to very slow, calcareous. |
| 92.5-94.25 | 11; | Refer to Hap Syubol - 11 (milepost $88.75-92.5$ ). |  |  |  |  |
|  | 13 | Traveasilla-Persayo-Lockland: Very aballow to shallow, sandy loan, ailty clay loam, and silt loan soils formed an gently sloping to moderately steep meaas, breaks, ridges, and knolls frou sandstone and shale. Includes interbedded sendstone and shale outcrops on moderately steep to extrenely steep eacarpmenta and breaks. | Travessille <br> Persayo | $\begin{aligned} & 8-20 \\ & 3-25 \end{aligned}$ | $\begin{aligned} & 3-25 \\ & 3-25 \end{aligned}$ | Hoderate wind and water erosion hazard, topsoil is poor 10-14 inch precipitation zone. Starink-avell potential is low to moderate, permeability is rapid to slow, slightly calcareous and calcareous wils. |
| \%4.25-98.25 | 11 | Las Lucas-Litle-Persayo: Deep to very shallow, clay, loan, silty clay loan, and silt lomeneils formad on nearly level to moderately aloping alluvial fana, valley side slopes, uplands, ridges, and knolls from materiala derived from weathered shale. Includea ateep to very steep abale and aenderona outcrope. | Las lucas Litle Persayo | $\begin{aligned} & 40-60 \\ & 20-40 \\ & 6-18 \end{aligned}$ | $\begin{aligned} & 3-5 \\ & 3-5 \\ & 1-9 \end{aligned}$ | Low wind erosion hazard, moderate to high water erosion hazand, fair to poor topsoil, 10-14 inch precipitation zone. Shrink-swell potential is moderate to high, permeability is slow to very slow, calcareous. |
| 98.25-99.5 | 7/11 | Refer to hap Symbie - 7 and 11 (milepostes 99.5-101.0 and $88.75-92.5$, reapectively). |  |  |  |  |
| 99.5-101.0 | 7 | Roush Broken Lend - Pisude: Shellow to moderately deep, gravelly fine sendy loem, fine sendy lome, gravelly aandy loam, and gravelly loamy aand soils formed on nearly level to moderately steep uplands dissected by nomerous intermittent drainages and arroyos as well as breaks, ridges, ad to a leaser eutent valley bottoma and flood plains. These soile are foruing primarily in unconeolidated allivium. | Aududo | 20-36 | 1-9 | Low wind erosion hazard, moderate water erosion haxard, topsoil is poor, $10-14$ inch precipitation mone. Sharinkswell potential is lou, permeability is rapid, calcarecus. |

curces:
10.8. Soil Conservation Service (gcs). 1979. Ceneral moil mp, San Jum County, New Herico, eastern part. Soil aurvey of San Juan County, bew Herico, eastern part.
2 . 1974. General mill map of Hxtinley Connty, Hew Kexico. New Herico State Univervity, Agricultural kperiment Station, Rearearch Report 262.
3 - 1967. General wil mep, Cabezon area, Sendoval County, Hew Herico. Soil aurvey, Caberso area, New Herioo. $=$
$\vdots$
$\vdots$
$\vdots$
$\vdots$
$\vdots$
$\vdots$
$\vdots$

These soils are forming primarily in alluvial, eolian, and residual materials derived from sandstone, shale, and siltstone, and to a lesser extent in materials of volcanic origin (e.g., basalt). These soils are forming primarily on gently to strongly sloping mesas, plateaus, hills, ridges, knolls, valleys, intermittent drainageways, and floodplains. This proposed transmission corridor traverses numerous intermittent drainages as well as Badland (nonstony, barren shale) and Rock Outcrop (barren sandstone and lava) areas. Topsoil availability within this proposed transmission corridor is limited due to generally shallow soil surface layers, and the majority of the existing topsoil is of fair to poor quality due to undesirable surface textures (e.g., too sandy or clayey) or excess salt/sodium. Susceptibility to wind-induced soil erosion ranges from low to high, and susceptibility to water-induced soil erosion also ranges from low to high. Most of the soils identified within this proposed transmission corridor are alkaline and/or calcareous. Shrink-swell potential of the identified soils ranges from low to high. These soils are used primarily for livestock grazing, wildlife habitat, and to a lesser extent energy resources development.

Second Proposed Transmission Corridor (Tl). The Tl transmission corridor is within the San Juan River Mesas and Plateaus and the New Mexico and Arizona Plateaus and Mesas portions of the Western Range and Irrigated Region (SCS 1978a). Annual precipitation generally ranges from 6 to 17 inches along this proposed transmission corridor, but most of this corridor receives between 6 and 14 inches. Eighteen different soil associations were identified within this proposed transmission corridor. Table 7 lists (by mileposts) and characterizes the identified soils.

The soils identified within the transmission corridor Tl are very shallow to deep, with surface textures ranging from gravelly loamy
Table 7. characitzistics of ties solis identified hithia ink secon pracosed transhission couridor (ti)

| Milepost | $\underset{\text { Syubbol }}{\text { Kup }}$ | Soil Aseociation end Description | Soil Series | Depth to Bedrock (inchea) | $\begin{gathered} \text { slope } \\ (\mathrm{X}) \end{gathered}$ | Coments |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| Sma Juan Camty ${ }^{1}$ |  |  |  |  |  |  |
| 0.00.5 | 8 | Bodland-Rock Outcroptonierco: Shallov, well drained, fine sandy loem soils formed on level to moderately sloping knolls, mesas, and platease from alluvial and colian uaterisls derived primarily from sandstone and shala. Includes nonstony, barren shale areas on moderately sloping to extremely steep uplands that are dissected by deep intermittent drainageway and gullies; and barren aandstove outcrope on moderately sloping to extremely steep cliffs, ridges, breaks, and ledges. | Haierco | 10-20 | 0-8 | Moderate vind and water erosion hazard, poor topeoil, 6-10 inch precipitation zone. Shrink-arell potential is low to moderate, mild to moderately alkaline eoils. |
| 0.5-11.5 | 6 | Sheppard-Hherfano-tibtal: Deep to shallow, well to comesthat excessively drained, looury fine sand, sendy clay loam, and silty clay loam soile formed oa level to ateep mease, platema, valley bottome and fans from eolian, alluvial, and residual materiale derivad frou sandstone, shale, and siltstone. | Sheppard Huerfamo Hotal | $\begin{gathered} 60+ \\ 10-20 \\ 60 \end{gathered}$ | $\begin{aligned} & 0-40 \\ & 0-3 \\ & 0-2 \end{aligned}$ | Moderate to high vind erosion harard, low to moderate weter erosion hazard, topeoil is poor to fair, $6-10$ inch precipitation zone. Strink-swell poteatisl is low to high, moderately to strangly alkaline eoils. |
| 11.5-13.25 | 3 | Shiprock-Sheppard-Doak: Deep, well to scmedhat exceesively drained, fine sandy loam, loany fine aand, and Loam soils formed on level to moderately steep misas, plateans, and terraces from alluvial and eolim materials derived frois sandstone, shale, and mixed sources. | Shiprock Sheppand Dook | $\begin{aligned} & 60 \\ & 60+ \\ & 60+ \end{aligned}$ | $\begin{aligned} & 0-8 \\ & 0-30 \\ & 0-5 \end{aligned}$ | Moderate to high vind erosion hazard, low to moderate water erosion hazard, topeoil is fair to good, 6 -10 inch precipitation zone. Sturink-well poteatial is low to moderate, sildly to moderately alkaline coils. |
| 13.25-15.5 | 3/8 | Refer to hap Syubole - 3 end 8 (mileposts $11.5-13.25$ and 0 | .5, reapectiv |  |  |  |
| 15.5-18.5 | 6 | Sheppard-Herfano-ibtal: Deep to shallow, well to someshat excessively drained, loasiry fine sand, sandy clay loam, and silty clay loan soils fomed on level to steep mease, plateans, valley bottowa and fans from colim, allivial, and residual materials derived from sandstone, shale, and siltstone. | Sheppard Herfano Notal | $\begin{gathered} 60+ \\ 10-20 \\ 60 \end{gathered}$ | $\begin{aligned} & 0-40 \\ & 0-3 \\ & 0-2 \end{aligned}$ | Moderate to high vind erosion hazard, low to moderate water erosion hazand, topeoil is poor to fair, 6-10 inch precipitation zone. Shrink-awell potential is low to high, moderately to stroagly alkaline wils. |
| 18.5-19.5 | 6; | Refer to hap Syubol - 6 (milepost 0.5-11.5). |  |  |  |  |
|  | 1 | Persayo-Pruitland-Sheppard: Very shallow to deep, well to excessively drained, clay loem, sandy loam, and loany fine sand soils formed on level to steep hills, breaks, valley sidea, fans, and platemes from alluvial, residual, and eolian materials derived from shale, sendstone, and mixed sources. | Persayo <br> Fruitland <br> Sheppand | $\begin{aligned} & 10-20 \\ & 60 \\ & 60+ \end{aligned}$ | $\begin{aligned} & 3-40 \\ & 0-30 \\ & 0-40 \end{aligned}$ | Hoderate to high vind erosion hazard, low to moderate water erosion hazard, topsoil is poor to fair, $6-10$ inch precipitation rone. Shrink-owell potential is low to moderate, mildly to atroagly alkeline wile. |
| 19.5-21.0 | 1 | Persayo-Fruitland-Sheppand: Very shallow to deep, well to excessively drained, clay loem, andy loan, and loany fine sand soils formed on level to steep hills, breake, valley sides, fans, and plateans from alhivial, residual, and colian materials derived from ahale, sendetone, and mixed sources. | Persayo <br> Pruitland <br> Sheppand | $\begin{aligned} & 10-20 \\ & 60 \\ & 60+ \end{aligned}$ | $\begin{aligned} & 3-40 \\ & 0-30 \\ & 0-40 \end{aligned}$ | Moderate to high vind erosion harard, low to moderate water erocion hazard, topeoil is poor to fair, 6-10 inch precipitation zone. Strink-owell potential is low to moderate, mildly to stroagly alkaline wile. |
| 21.0-22.25 | 5 | Blancot-Hotal: Deep, well to somedhat excessively drained, loan and oilty clay loom soils formed oa level to geatly sloping fans, valley sides, and valley bottone frou alluviue derived primarily from andotone and shale. | Blancot Hotal | $\begin{aligned} & 60 \\ & 60 \end{aligned}$ | $\begin{aligned} & 0-5 \\ & 0-2 \end{aligned}$ | Iow to moderate vind erosion haxard, moderate weter erosion hazard, topeoil is poor to fair, 6-10 inch precipitation zone. Shrink-avell potential is low to high, moderately to atrougly alkaline soils. |
| 22.25-22.75 | 5/1 | Refer to Map 9yubole - 5 and 1 (milepoate $21.0-22.25$ and 19.5 | -21.0, reepect |  |  |  |



| Hilepost | $\operatorname{Map}_{\text {Syutol }}$ | Soil Aenociation and Description | Soil Seriea | Depth to Bedrock (inches) | $\underset{(X)}{\text { Slope }}$ | Coments |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| Ssm Stan County ${ }^{1}$ (coorimed) |  |  |  |  |  |  |
| 22.75-23.5 | 5 | Blancot-ibtal; Deep, well to eomenhat exceasively drained, loam and silty clay loem soils formed oa level to geatly sloping fans, valley sidea, and valley bottone from alluvium derived prianrily from andstone and shale. | Blancot Sotal | $\begin{aligned} & 60 \\ & 60 \end{aligned}$ | $\begin{aligned} & 0-5 \\ & 0-2 \end{aligned}$ | Low to moderate vind erosion hatard, moderate veter ecrosion hazard, topeoil is poor to fair, 6-10 inch precipitation zoose. Strink-awell potential is low to high, moderately to strougly alkaline coils. |
| 23.5-25.5 | 1 | Peragyo-fruit land-Sheppand: Very shallow to deep, well to excessively drained, clay loan, aundy loan, and loany fine sand soils formed on level to steep hills, breaks, valley sides, fans, and platease froas allivial, residual, and colian materials derived frou ahale, sandstone, and mixod sources. | Persayo Pruitland Sheppand | $\begin{gathered} 10-20 \\ 60 \\ 60+ \end{gathered}$ | $\begin{aligned} & 3-40 \\ & 0-30 \\ & 0-40 \end{aligned}$ | Moderate to high vind erosion havard, low to moderate water erosion harand, topeoil is poor to fair, 6-10 inch precipitation rone. Strink-well potentisl is low to moderate, mildly to strougly alkaline woils. |
| 25.5-26.75 | 3/1 | Befer to thp Syabols - 3 and 1 (mileposta $11.5-13.25$ and 18.5-19.5, respectively). |  |  |  |  |
| 26.75-28.0 | 1 | Persayo Fruitland-Sheppard: Very ahallow to deep, well to excessively drained, clay loon, sendy loam, and loany fine and soils forwed oa level to steep hills, breaks, valley sides, fens, and plateaus from alluvial, reaidual, and eolian materisle derived frou chale, sandstone, and mixod sources. | Perasyo Pruitland Sheppand | $\begin{gathered} 10-20 \\ 60 \\ 60+ \end{gathered}$ | $\begin{aligned} & 3-40 \\ & 0-30 \\ & 0-40 \end{aligned}$ | Hoderate to high vind erosion hazard, low to moderate noter erosion hazard, topsoil is poor to fair, 6-10 inch precipitation zone. Slurink-well potential is low to moderate, mildly to stroagly alkaline soils. |
| 28.0-29.5 | 1/5 | Refer to Hap Syabole - 1 and 5 (mileposta 18.5-19.5 and 21.0-22.5, reapectively). |  |  |  |  |
| 29.5-30.0 | 1/3 | Befer to Hap Syubole -1 and 3 (mileposta 18.5-19.5 and 11.5-13.25, respectively). |  |  |  |  |
| 30.0-31.5 | 3 | Shiprock-Sheppard-Doak: Deep, well to acwewhat excessively drained, fine sandy loam, loamy fine aand, and loan soils formed on level to moderately steep mesas, platesus, and terraces from alluvial and eolian materisls derived from sandstone, shale, and mixed sources. | Shiprock <br> Sheppurd <br> Dock | $\begin{aligned} & 60 \\ & 60+ \\ & 60+ \end{aligned}$ | $\begin{aligned} & 0-8 \\ & 0-30 \\ & 0-5 \end{aligned}$ | Moderate to high wind erosion hazard, lov to moderate vater erosion hazard, topeoil is fair to good, $6-10$ inch precipitation zone. Shrink-awell potentisl is low to moderate, mildly to moderately alkaline woils. |
| 31.5-33.5 | 5 | Blancot-total: Deep, well to momenhat excessively drained, loem and silty clay loan woils formed oa level to gently sloping fans, valley sides, and valley bottowe frou alluvium derived primarily from andstone and shale. | Blancot Hotal | $\begin{aligned} & 60 \\ & 60 \end{aligned}$ | $\begin{aligned} & 0-5 \\ & 0-2 \end{aligned}$ | Low to moderate wind erosion hazard, moderate water erosion hazard, topsoil is poor to fair, 6-10 inch precipitation zone. Sirink-surell potential is low to high, woderately to atrougly alkaline soils. |
| Sandoval Countr ${ }^{2}$ (Part I) |  |  |  |  |  |  |
| 33.5-34.5 | 10 | Persavo-Aurley-Badland: Very shallow to deep, silty clay loas, and silt loean soils formod on level to moderately ateep uplande, ridges, valley bottoue, and valley sides froa residum derived froa ahale and aandotone, and to a leaser extent from alluvium. Includes moderately to very steep barrea shale outcrope. | $\begin{aligned} & \text { Persayo } \\ & \text { Turley } \end{aligned}$ | $\begin{gathered} 6-18 \\ 60+ \end{gathered}$ | $\begin{aligned} & 5-25 \\ & 0-5 \end{aligned}$ | Hoderate vind and water erosion havard, topeoil is poor, 10-14 inch precipitation rone. Shrink-amell potential is moderate, permeability is slow, calcareous. |
| 34.5-36.75 | 8 | Penistaja-Valent-Rockland: Deep, fine sandy loan, very fine aendy loem, and lowiry fine sand will formod oa nearly level to gently sloping uplande frou eolian and alluvial deposita end to a leaser extent from residual materials derived frow sendetone and other sedimentary rock. Includes moderately sloping to moderately steep outcrope of andstone and shale, and aseociated rough lande. | Penistaja Valeat | $\begin{aligned} & 60 \\ & 60+ \end{aligned}$ | $\begin{aligned} & 3-5 \\ & 1-5 \end{aligned}$ | Moderate to high wind erosion havard, low to moderate water erosion harard, topsoil is fair to poor, 10-14 inch precipitation zone. Strink-awell potential is low to moderate, permeability is moderate to rapid, noncalcareous. |



| Milepost | $\underset{\text { Syap }}{\text { Mab }}$ | Soil Aseociation and Description | Soil Seriea | Depth to Bedrock (inches) | $\underset{(\mathrm{I})}{\text { slope }}$ | Comenta |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| Sandoval Carnty ${ }^{2}$ (Part I) (continued) |  |  |  |  |  |  |
| 37.75-41.0 | 8 | Penistaja-Valent-Rockland: Deep, fine sendy loan, very fine sandy loan, and loerry fine sand soils formed on nearly level to gently sloping uplande from colian and alluvisl deposits and to a lesaer extent from residual materials derived from sendstooe and other sedimentary rocks. Includes moderately sloping to moderately steep outcropa of sandstone and abale, and sesociated rough lande. | Penistaja Valent | $\begin{aligned} & 60 \\ & 60+ \end{aligned}$ | $\begin{aligned} & 3-5 \\ & 1-5 \end{aligned}$ | Hoderate to high wind erosion hazard, low to moderate water erosion hazard, topsoil is fair to poor, 10-14 inch precipitation zone. Shrink-avell potential is low to moderate, permeability is moderate to rapid, noncalcarecus. |
| 41.0-45.5 | 10 | Persave-Murler-Bedland: Very shallow to deep, silty clay loan, and silt loan soils formed on level to moderately steep uplando, ridges, valley bottona, and valley sidea from residun derived from shale and sandstone, and to a lesser extent from alluviis. Includes moderately to very steep bearrea shale outcrops. | $\begin{aligned} & \text { Persaso } \\ & \text { Turley } \end{aligned}$ | $\begin{gathered} 6-18 \\ 60+ \end{gathered}$ | $\begin{aligned} & 5-25 \\ & 0-5 \end{aligned}$ | Moderate vind and weter erosion hazard, topeoil is poor, 10-14 inch precipitation zone. Shrink-well potential is moderate, permeability is slow, calcareous. |
| 45.5-46.75 | 10/8 | Refer to Mip Syubole - 10 and 8 (mileposta 33.5-34.5 and | 6.75, respec |  |  |  |
| 46.75-50.75 | 8 | Penistaja-Valent-Rockland: Deep, fine annty loan, very fine sandy loam, and loany fine sand soils formed on nearly level to gently sloping uplands fram eolian and alluvial deposits and to a leseer extent from residual materials derived from sandstone and other sedimentary rocks. Includes moderately sloping to moderately steep outcrope of sandstooe and shale, and associated rough lands. | Penistaja Valent | $\begin{aligned} & 60 \\ & 60+ \end{aligned}$ | $\begin{aligned} & 3-5 \\ & 1-5 \end{aligned}$ | Moderate to high wind erosion hazard, low to moderate water erosion hazard, topsoil is fair to poor, 10-14 inch precipitation sone. Shrink-awell potential is low to moderate, permeability is moderate to rapid, noncalcareous. |
| Hexinley Cantry ${ }^{3}$ |  |  |  |  |  |  |
| 50.75-56.5 | 6 | Penistaja-Valent: Deep, fine sandy loan, very fine sandy losan, and loany fine sand wils formod oa nearly level to geatly sloping uplands, and upland ridges from eolian, alluvial, and residual materiala derived primarily from andstone and shale. Includes moderately steep to steep sandstone and shale outcrops, and slickspote or alkali-affected arese. | Penistaja Valent | $\begin{aligned} & 60 \\ & 60+ \end{aligned}$ | $\begin{aligned} & 3-5 \\ & 1-5 \end{aligned}$ | Moderate to high wind erosion hazard, low to moderate water erosion hazard, topsoil is fair to poor, 10-17 inch precipitation zone. Starink-awell potential is low to moderate, perweability is moderate to rapid, noncalcareans. |
| 56.5-57.25 | 14 | Persavo-Lohmiller: Very ahallow to deep, silty clay loan, silt loan, and silty clay loam eoils formed oa level to moderately steep brood valleys, uplanda, eacarpents, and breaks from residum and alluvim derived from shale and sandatone. Includes berren or nearly barren shale outcrop areas. | Persayo Lotwiller | $\begin{gathered} 6-20 \\ 60+ \end{gathered}$ | $\begin{aligned} & 5-25 \\ & 0-3 \end{aligned}$ | Hoderate vind and water erosion hazard, topeoil is poor to fair, 10-17 inch precipitation zone. Sturink-well potential is moderate, permeability is slow to very slow, calcarecus. |
| Saudoval Cautse ${ }^{2,4}$ (Part II) |  |  |  |  |  |  |
| 57.25-64.75 | 3 | Penistaja-Berent-Sandstone Outcrop: Deep and moderately deep, well to excessively drained, fine aendy lom, and loarry fine and soils formed on level to moderately sloping uplands, mesas, and ridges from colian materials and to a lesser extent from alluvium. Includes strougly sloping to moderately steep sand atone outcrope and slickspots areas (alkali-affected). | Penistaja Berent | $\begin{gathered} 60+ \\ 36-60 \end{gathered}$ | $\begin{aligned} & 0-9 \\ & 0-9 \end{aligned}$ | Hoderate to high wind erosion hazard, woderate water erosion havard, topeoil is good to poor, 10-14 inch precipitation wone. Shrink-well potential is low to moderate, mildly to moderately alkaline coils. |
| 64.75-69.75 | 2 | Litle-las lucas: Shallow to deep, well drained, loan, clay loam, and silty clay lome soils forved on level to moderately steep uplande and low hills frou eolian materiala and shale. | Litle <br> Las Lucas | $\begin{aligned} & 14-24 \\ & 40-72+ \end{aligned}$ | $\begin{aligned} & 1-25 \\ & 0 \rightarrow 9 \end{aligned}$ | Low vind erosion hazard, moderate to high water erosion hazard, fair to good topasil, $10-14$ inch precipitation zone. Shrink-awell potential is moderate to high, mildly to moderately alkaline soils. |

table 7. churactiblistics ar the solls meantified hithin tir secon prcposed transaission corridor (ti) (contimed)

| Kilepost | $\underset{\text { Syabol }}{\text { Syat }}$ | Soil Association and Deacription | Soil Series | Depth to Bedrock (inches) | $\underset{(X)}{\text { Slope }}$ | Coments |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| Sandoval Camty ${ }^{2,4}$ (Part II) (contimed) |  |  |  |  |  |  |
| 69.75-79.75 | 6 | Travesailla-Perrasy: Very shallow to shallow, well drained, sandy loam, loan, and silty clay loam soils formed on gently sloping to moderately steep mesas and breaka from materials derived primarily from andstone and ahale. | Traveasilla <br> Perbayo | $\begin{aligned} & 6-16 \\ & 0-16 \end{aligned}$ | $\begin{aligned} & 3-25 \\ & 9-25 \end{aligned}$ | Hoderate wind and water erosion hazard, poor to fair topeoil, 10-14 inch precipitation zone. Sturink-awell potential is low to high, moderately alkaline eoils. |
| 79.75-80.5 | 2/6 | Refer to Map Syabole - 2 and 6 (mileposts $64.75-69.75$ and 69.75-79.75, respectively). |  |  |  |  |
| 80.5-81.0 | 1 | Clyistianburg-Nevaio: Deep, ecmeshat poorly and poorly drained, silty clay, and clay soils formed on level to gently sloping flood plaina and terraces from alluviza. Includea Slickspots areas which are alkali-affected and ausceptible to puddling. | $\begin{aligned} & \text { Cliriatianhurg } \\ & \text { Mevajo } \end{aligned}$ | $\begin{aligned} & 60+ \\ & 60+ \end{aligned}$ | $\begin{aligned} & 0-3 \\ & 0-3 \end{aligned}$ | Low wind erosion barard, moderate to high vater erosion hazard, topeoil is poor, $10-14$ inch precipitation zone. Strinik-avell poteotial is hich, atruogly alkaline soils. |
| $81.0-81.5$ | 11 | Las Lucas-Litle-Persayo: Deep to very shallow, clay, Loan, silty clay loan, and silt loan soils formed on nearly level to moderately sloping alluvial fans, valley side slopes, uplands, ridges, and knolls from materials. derived from weathered abale. Includes steep to very steep shale and sandstoce outcropa. | Las luces Litle Persayo | $\begin{gathered} 40-60 \\ 20-40 \\ 6-18 \end{gathered}$ | $\begin{aligned} & 3-5 \\ & 3-5 \\ & 1-9 \end{aligned}$ | Low vind erosion hazard, moderate to high water erosion hazard, fair to poor topeoil, 10-14 inch precipitation sone. Starink-awell potential is moderate to high, perneability is slow to very slow, calcareous. |
| 911.5-82.5 | 11/10 | Refer to Hap Syabole - 11 and 10 (milepoats $81.0-81.5$ and $33.5-34.5$, reppectively). |  |  |  |  |
| 82.5-85.0 | 10 | Persayo-Mirley-Badland: Very ahallow to deep, silty clay loan, and silt lowe soils fonned on level to moderately steep uplands, ridges, valley bottows, and valley sides from residum derived from shale and sandstone, and to a lesser extent from alluvive. Includes moder ately to very steep barren shale outcrops. | $\begin{aligned} & \text { Persayo } \\ & \text { Durley } \end{aligned}$ | $\begin{gathered} 6-18 \\ 60+ \end{gathered}$ | $\begin{aligned} & 5-25 \\ & 0-5 \end{aligned}$ | Hoderate wind and water erosion hazard, topsoil is poor 10-14 inch precipitation zone. Starink-wwell poteotial is moderate, permeability is slow, calcareous. |
| 85.0-86.0 | 10/11 | Refer to hap Syutole - 10 and 11 (mileposts 33.5-34.5 and 81.0-81.5, rempectively). |  |  |  |  |
| $88.0-91.0$ | 11 | Las Lucas-hitle-Persays: Deep to very shallow, clay, loem, silty clay loana, and silt loan soils fomed on nearly level to moderately sloping alluvial fans, valley side slopes, uplands, ridges, and knolls from waterisle derived from weathered shale. Includes steep to very steep shale and amodetone outcrope. | $\begin{aligned} & \text { Las Lucas } \\ & \text { Litle } \\ & \text { Perrayo } \end{aligned}$ | $\begin{array}{r} 40-60 \\ 20-40 \\ 6-18 \end{array}$ | $\begin{aligned} & 3-5 \\ & 3-5 \\ & 1-9 \end{aligned}$ | Low wind erosion hazard, moderate to high water erosion bayard, fair to poor topeoil, 10-14 inch precipitation mone. Shrink-avell potential is moderate to high, permeability is slow to very slow, calcareas. |
| 91.0-92.0 | 11/13 | Refer to Map Syubols - 11 and 13 (mileposts $81.0-81.5$ and $92.0-94.0$, reppectively). |  |  |  |  |
| 92.0-94.0 | 13 | Travessille-Persayo-Rockland: Very shallow to shallow, eandy loen, silty clay loan, and silt loam soile formed on gently sloping to moderately steep meaas, breaks, ridgea, and knolle from sandstone and shole. Includes intertedded sandstone and shale outcrope on moderately steep to extrensely steep eacarponents and breaks. | Travessilla <br> Pernayo | $\begin{aligned} & 8-20 \\ & 3-25 \end{aligned}$ | $\begin{aligned} & 3-25 \\ & 3-25 \end{aligned}$ | Moderate wind and water erosion hazard, topeoil is poor 10-14 inch precipitation rone. Starink-awell potential is low to moderate, permeability is rapid to slow, slightly calcareous and calcareous soils. |
| 94.0-96.25 | 13/11 | Befer to Map Syubole - 13 end 11 (mileposts $92.0-94.0$ and $81.0-81.5$, respectively). |  |  |  |  |
| 96.25-100.0 | 11 | Las Lucas-hitle-Persayo: Deep to very shallov, clay, loan, silty clay loam, and silt loam eoils formed an nearly level to moderately sloping alluvial fana, valley side slopes, uplande, ridges, and knolls from materials derived from weathered shale. Includes ateep to very steep abale and sandstane outcrops. | Las luces Litle Persayo | $\begin{aligned} & 40-60 \\ & 20-40 \\ & 6-18 \end{aligned}$ | $\begin{aligned} & 3-5 \\ & 3-5 \\ & 1-5 \end{aligned}$ | low wind erosion hazard, moderate to high water erosion hazard, fair to poor toppoil, 10-14 inch precipitation zone. Strink-awell potential is moderate to high, permesbility is slow to very slow, calcareous. |

Table 7. charactiristics of the soils mentified witin tie sbeond proposed transyission corbidor (ti) (concluded)

| Milepost | $\underset{\text { Map }}{\text { Sywbol }}$ | Soil Association and Description | Soil Series | Depth to Bedrock (inches) | $\begin{gathered} \text { Slope } \\ (\mathbf{Z}) \end{gathered}$ | Coment: |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| Sandoval County ${ }^{4}$ (Part II) (coutinued) |  |  |  |  |  |  |
| 100.0-102.75 | $11 ;$ | Refer to Map Syubol - 11 (milepost $81.0-81.5$ ). |  |  |  |  |
|  | 7 | Rough Broken Land-Bidudo: Shallow to moderately deep, gravelly fine sandy loam, fine sandy loam, gravelly sandy loam, and gravelly loany sand soils forwed on nearly level to moderately steep uplands dissected by mumerous intermittent drainages and arroyos as well as breaks, ridges, and to a lesser extent valley bottoms and flood plains. These soils are forming primarily in umconsolidated alluvium. | Bubudo | 20-36 | 1-9 | Low wind erosion hazard, moderate water erosion hazard, topsoil is poor, 10-14 inch precipitation zone. Shrinkowell potential is low, permeability is rapid, calcareous. |
| 102.75-104.25 | 7/5 | Befer to Map Syubols - 7 and 5 (mileposts 100.0-102.75 and 104.25-108.0, respectively). |  |  |  |  |
| 104.25-108.0 | 5 | Madurez-Caliza-Wink: Shallow to moderately deep, loamy fine sand, fine sandy loas, gravelly sandy loam, and very gravelly sandy loam soils formed on nearly level to moderately sloping uplands and ridges from unconoolidated allervium. | Madurez <br> Caliza <br> Wink | $\begin{aligned} & 20-36 \\ & 10-20 \\ & 20-36 \end{aligned}$ | $\begin{aligned} & 1-3 \\ & 1-9 \\ & 1-9 \end{aligned}$ | Moderate to high wind erosion hazard, low to moderate water erosion hazard, poor topsoil, 10-14 inch precipitatiou zone. Shrink-swell potential is low to moderate, permeability is moderate to rapid, noncalcareous and calcareous soils. |

[^4]sand to clay loam. Permeability of these soils is very slow to rapid. These soils are forming in alluvial, eolian, and residual materials derived primarily from sandstone, shale, and siltstone. These soils are forming primarily on gently sloping to strongly sloping mesas, plateaus, hills, ridges, knolls, valleys, intermittent drainageways, and floodplains. This proposed transmission corridor traverses numerous intermittent drainages, as well as Badland (nonstony, barren shale) and Rock Outcrop (barren sandstone) areas. Topsoil availability within this proposed transmission corridor is limited due to generally shallow soil surface layers, and the majority of the existing topsoil is of fair to poor quality due to undesirable surface textures (e.g., too sandy, clayey, or gravelly) or excess salt/sodium. Susceptibility to wind-induced soil erosion ranges from low to high, and susceptibility to water-induced soil erosion also ranges from low to high. Most of the soils identified within this proposed transmission corridor are alkaline and/or calcareous. Shrinkswell potential of the identified soils ranges from low to high. These soils are used primarily for livestock grazing, wildife habitat, and to a lesser extent energy resource development.

Transmission Corridor T3. Alternative transmission corridor T3 is within the San Juan River Valley Mesas and Plateaus and the New Mexico and Arizona Plateaus and Mesas portions of the Western Range and Irrigated Region (SCS 1978a). Annual precipitation generally ranges from 6 to 17 inches along this transmission corridor alternative. Seventeen different soil associations were identified within this corridor alternative. Table 8 lists (by mileposts) and characterizes the identified soils.

The soils identified within transmission corridor T3 are very shallow to deep, with surface textures ranging from loamy fine sand to clay. Permeability of these soils is very slow to rapid. These soils


| Milepost | $\begin{aligned} & \text { Mep } \\ & \text { Syubol } \end{aligned}$ | Soil Aesociation and Description | Soil Series | Depth to Bedrock (inchee) | $\underset{(X)}{\text { Slope }}$ | Comente |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| Sam Juan Coamtr ${ }^{1}$ |  |  |  |  |  |  |
| 0.0-0.75 | 8 | Bedland-Rock Outcrop-tonierco: Shallow, well drained, fine sandy lome noils formed on level to moderately sloping knolls, mesas, and plateaus from allivial and eolian materiale derived primarily from andatone and ahale. Includes nonstory, barren shale areas an moderately sloping to extremely steep uplands that are dissected by deep intermittent drainageways and gullies; and barren sendetone outcrope on moderately sloping to extranely steep cliffs, ridges, breako, and ledgee. | Monierco | 10-20 | 0-8 | Moderate wind and vater erosion hazard, poor topeoil, 6-10 inch precipitation zone. Strink-anell potential is low to moderate, mild to moderately alkeline coils. |
| 0.75-1.25 | 6 | Sheppard therfano-itital: Deep to ahallow, well to comenhat excessively drained, loany fine send, sendy clay loem, and silty clay loem soils formed an level to steep meas, plateass, valley bottome and fans from eolian, alluvial, and residual materials derived from sandstone, abale, and siltatone. | Sheppard Huertano Hotal | $\begin{gathered} 60+ \\ 10-20 \\ 60 \end{gathered}$ | $\begin{aligned} & 0-40 \\ & 0-3 \\ & 0-2 \end{aligned}$ | Moderate to high vind erosion hazard, low to moderate water erosion hazard, topeoil is poor to fair, $6-10$ inch precipitation zone. Sltrink-awell potential is low to bigh, moderately to atrongly alkaline woils. |
| 1.25-3.5 | 6; | Refer to hap Syubol -6 (milepost 0.75-1.25). |  |  |  |  |
|  | 3 | Shiprock-Sheppard-Doak: Deep, well to somenhat excessively drained, fine sandy loem, losury fine and, and loan eoils formed an level to moderately steep mesas, plateans, and terraces from alluvial and eolian mato rials derived from andstone, ahale, and mixed sources. | Shiprock Shepperd Doak | $\begin{aligned} & 60 \\ & 60+ \\ & 60+ \end{aligned}$ | $\begin{aligned} & 0-8 \\ & 0-30 \\ & 0-5 \end{aligned}$ | Hoderate to high vind erosion hasard, low to moderate meter erosion hazard, topeoil is fair to good, $6-10$ inch precipitation rone. starink-anell potentinl is low to moderate, mildly to moderately alkaline coile. |
| 3.5-4.0 | 6/8 | Refer to Mip Symole -6 and 8 (mileposte 0.75-1.25 and 0.0-0.75, reapectively). |  |  |  |  |
| 4.0-5.5 | 6 | Sheppard-Hierfano-Nbtal: Deep to shallow, well to scruedhat excesaively drained, loeny fine sand, asandy clay loam, and ailty clay loam soils formed on level to steep meses, plateans, valley bottome and fane from colian, alluvial, and residual material derived from sandstone, shale, and siltatone. | Sheppard Heerfano Hotal | $\begin{gathered} 60+ \\ 10-20 \\ 60 \end{gathered}$ | $\begin{aligned} & 0-40 \\ & 0-3 \\ & 0-2 \end{aligned}$ | Moderate to high vind erosion hasard, low to moderate water erosion hazard, topeoil is poor to fair, 6-10 inch precipitation zone. Strinink-avell potential is low to bigh, moderately to atroagly alkaline soils. |
| 5.5-6.0 | 8 | Badland-Rock Outcrop-Honierco: Shallow, well drained, fine sendy loam soils formed on level to moderately sloping knolls, mesas, and platean from allivial and eolian materials derived primarily from andstone and shale. Includes nonstony, barren shale areas an moderately sloping to extremely steep uplands that are dissected by deep intermittent drainagewaye and gullies; and barren sandstone outcrope on moderately sloping to extremely steep cliffs, ridges, breaks, and ledges. | Manierco | 10-20 | 0-8 | Hoderate vind and water erosion hazard, poor topeoil, $6-10$ inch precipitation zone. Starink-avell potential is low to moderate, wild to moderately alkaline soils. |
| 6.0-6.5 | 6/8 | Befer to hep Syubols -6 and 8 (mileposts $0.75-1.25$ and 0.0-0.75, respectively). |  |  |  |  |
| 6.5-17.25 | 6 | Sheppard-therfano-tibtal: Doep to shallov, well to scomedhat excessively drainod, loany fine asend, sendy clay loen, and silty clay loem soils formed on level to steep mesas, plateas, valley bottoma and fans from colian, alluvial, and residual materials derived from sandetone, shale, end siltatone. | Sheppard Bierfano Notal | $\begin{gathered} 60+ \\ 10-20 \\ 60 \end{gathered}$ | $\begin{aligned} & 0-40 \\ & 0-3 \\ & 0-2 \end{aligned}$ | Moderate to high vind erosion harard, low to moderate mater erosion hazard, topeoil is poor to fair, 6-10 inch precipitation sone. Starink-arell potential is low to high, moderately to atroogly alkaline wils. |



| Milepost |  | Soil Aecociation and Description | Soil Seriea | Depth to Bedrock (inches) | $\underset{(\mathbf{Z})}{\text { Slope }}$ | Coments |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| Haxinley Camty ${ }^{2}$ |  |  |  |  |  |  |
| 17.25-19.0 | 1/2 | Refer to Map Syubole - 1 and 2 (mileposta 19.0-24.0 and | 8.0). |  |  |  |
| 19.0-24.0 | 1 | Persavo-Camborthidg: Very shallow to moderately deep, silt loan, silty clay loan, and fine asidy loam soils formed on nearly level to straogly sloping uplands in residun derived primarily from sandstone. Includes steep to extremely steep andetone and interbedded shale outcrope. | Persayo Cenborthide | $\begin{array}{r} 6-20 \\ 20-36 \end{array}$ | $\begin{aligned} & 1-15 \\ & 1-8 \end{aligned}$ | Hoderate to high vind erosion hayand, moderate meter exosion hazard, poor topeoil, 10-17 inch precipitation zone. Shrink-arell potential is low to moderate, per meability is slow to moderate, calcarean. |
| 24.0-25.75 | 2 | Persayo-Billinge: Very shallow to deep, silty clay lom soils formed on level to strongly sloping uplands, alluvial fans, valley sides, and flood plains in residumand alluvium derived from ahale. | Perasyo Billinge | $\begin{gathered} 6-20 \\ 60+ \end{gathered}$ | $0-15$ | Hoderate wind erosion hazard, low to high vater erosion hazard, poor topeoil, $10-17$ inch precipitation zone. Sorink-well potential is moderate, permeability is very slow to slow, calcareous. |
| 25.75-27.25 | 1 | Persavo-Caporthids: Very ahallow to moderately deep, silt lom, silty clay loem, and fine sandy loem soils formed on nearly level to atrongly sloping uplands in residum derived primarily from sandstone. Includes steep to extremely steep sandetcone and interbedded shale outcrope. | $\begin{aligned} & \text { Persayo } \\ & \text { Cemborthide } \end{aligned}$ | $\begin{gathered} 6-20 \\ 20-36 \end{gathered}$ | $\begin{aligned} & 1-15 \\ & \hline 15 \end{aligned}$ | Moderate to high wind eroaion harard, moderate vater ecrosion hazard, poor topeoil, 10-17 inch precipitation zone. Surink-awell potential is low to moderate, permeability is slow to moderate, calcareous. |
| 27.25-28.0 | 2 | Persayo-Billinge: Very shallow to deep, silty clay loam soils formed an level to strongly sloping uplande, alluvial fans, valley sides, and flood plaine in residum and allervium derived from ahale. | Persayo Billing | $\begin{gathered} 6-20 \\ 60+ \\ \hline \end{gathered}$ | $\begin{aligned} & 0-15 \\ & 0-5 \end{aligned}$ | Hoderate vind erosion hazard, low to high water erosion hazard, poor topeoil, 10-17 inch precipitation zone. Starink-avell potential is moderate, permeability is very slow to slow, calcarecus. |
| 28.0-30.0 | 1 | Persayo-Camborthida: Very shallow to moderately deep, silt loen, silty clay lomen, and fine sandy loas soils formed on nearly level to strongly sloping uplands in residum derived primarily from eandstone. Includes steep to extremely steep sandatone and interbedded chale outcrope. | Persayo Centrorthide | $\begin{array}{r} 6-20 \\ 20-36 \end{array}$ | $\begin{aligned} & 1-15 \\ & 1-8 \end{aligned}$ | Moderate to high vind erosion hazand, moderate water erosion hazard, poor topeoil, 10-17 inch precipitation zone. Shrink-anell potential in low to moderate, per mesbility is slow to moderate, calcarecus. |
| 30.0-32.0 | 13 | Haseman-Travesailla: Moderately deep to very ahallow, fine sandy lomen, loan, and gravelly senty loam soils formed on nearly level to moderately steep uplands, meas tope, valley bottome, and flood plaine in residum derived from sandstone and in eolian and alluvial sediments of mired origin. Includes steep sandstone (and sone shale) outcrops. | Hegernon <br> Travessill | $\begin{aligned} & 20-40 \\ & 4-20 \end{aligned}$ | $\begin{aligned} & 1-5-5 \\ & 3-25 \end{aligned}$ | Hoderate to high vind erosion hazard, moderate mater exosion hazard, topeoil is good to poor, 10-17 inch precipitation sone. Starink-avell potential is low, permeability is moderate to rapid, noncalcareas to slightly calcareous. |
| 32.0-32.5 | 2 | Perasyo-Billings: Very shallow to deep, silty clay lome soils formed on level to strongly sloping uplands, alluvial fans, valley sides, and flood plains in resitum and alluvium derived from ahale. | Peramyo Billinge | $\begin{gathered} 6-20 \\ 60+ \end{gathered}$ | $0-15$ | Moderate vind erosion hazard, low to high mater exosion bazard, poor topeoil, 10-17 inch precipitation mone. Strink-well potential is moderate, permeability is very slow to slow, calcareaus. |
| 32.5-36.25 | 13 | Hogeman-Traveasilles: Moderately deep to very shallow, fine sandy loan, loem, and gravelly andy lom soils formed on nearly level to moderately steep uplande, tope, valley bottons, and flood plains in residuna derived from andstone and in eolimand alluvial sediments of mixed origin. Includes ateap sandetone (and somes ablele) outcrops. | Hagerman <br> Travessill | $\begin{aligned} & 20-40 \\ & 4-20 \end{aligned}$ | $\begin{aligned} & 1-5-25 \\ & 3 \end{aligned}$ | Hoderate to high vind erosion harard, moderate vater ecosion hazard, topeoil is good to poor, 10-17 inch precipitation anne. Shrink-avell potential is low, permeability is underate to rapid, noncalcareaus to elightly calcareaus. |
| 36.25-42.5 | 10; | Lobmiller Sam Mateo: Deep, clay loma, clay, silty clay loma, loem, and sandy loan soils formed oa level to gently sloping valley bottome, flood plains, and terraces from allwium derived primarily from andstove and abale. | Lobmiller Sen Meteo | $\begin{aligned} & 60+ \\ & 60+ \end{aligned}$ | $\begin{aligned} & 0-3 \\ & 0-3 \end{aligned}$ | Hoderate wind and water erooion hazard, topeoil is fair to good, 10-17 inch precipitation zane. Sharink-awell potential is low to high, penmeability is very slow to woderate, calcareous. |

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\text { Refer to Hap Symbol - } 13 \text { (mileqoest } 30.0-32.0 \text { ). }
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| Milepost | $\begin{aligned} & \text { Map } \\ & \text { Syabol } \end{aligned}$ | Soil Association and Description | Soil Series | Depth to Bedrock (inches) | $\begin{gathered} \text { Slope } \\ (\mathrm{z}) \end{gathered}$ | Caments |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| Mcxinley Commty ${ }^{2,4}$ (continued) |  |  |  |  |  |  |
| 42.5-47.5 | 13 | Hagerman-Travessilla: Moderately deep to very shallow, fine sandy loam, loam, and gravelly sandy loam soils formed on nearly level to moderately steep uplands, mess tops, valley bottoms, and flood plains in residum derived from sandstone and in eolian and alluvial sediments of mixed origin. Includes steep sandstone (and some shale) outcrops. | Hagerman <br> Travessilla | $\begin{aligned} & 20-40 \\ & 4-20 \end{aligned}$ | $\begin{aligned} & 1-5 \\ & 3-25 \end{aligned}$ | Moderate to high wind erosion hazard, moderate water erosion hazard, topsoil is good to poor, 10-17 inch precipitation zone. Shrink-owell potential is low, permeability is moderate to rapid, noncalcarecus to slightly calcareous. |
| 47.5-49.75 | 13; | Refer to Map Symbol-13 (milepost 30.0-32.0). |  |  |  |  |
|  | 18 | Rock Land-Travessilla: Very shallow to shallow, fine sandy loam, and gravelly sandy loam soils formed on moderately sloping to moderately steep upland areas and mesa tope from materials derived primarily from sandstone and shale. Includes sandstone (and other sedimentary rock) outcrops on steep to extremely steep mesa sideslopes, escarpments, and breaks. | Travessilla | $4-20$ | 5-30 | Moderate wind and water erosion hazard, poor topsoil, 10-17 inch precipitation zone. Shrink-swell potential is low, permeability is rapid, slightly calcareous. |
| 49.75-60.0 | 13 | Hagerman-Travesailla: Moderately deep to very shallow, fine sandy loam, loam, and gravelly sandy loam soils formed on nearly level to moderately steep uplands, mese tops, valley bottoms, and flood plains in residum derived from sandstone and in eolian and alluvial sediments of mixed origin. Includes steep sandstone (and some shale) outcrops. | Hageman <br> Travessilla | $\begin{aligned} & 20-40 \\ & 4-20 \end{aligned}$ | $\begin{aligned} & 1-5 \\ & 3-25 \end{aligned}$ | Moderate to high wind erosion hazard, moderate weter erosion hazard, topsoil is good to poor, 10-17 inch precipitation zone. Shrink-swell potential is low, permeability is moderate to rapid, noncalcareous to slightly calcarecus. |
| 60.0-61.5 | 13/16 | Refer to Map Symbols - 13 and 16 (mileposts $30.0-32.0$ and $61.5-66.25$, respectively). |  |  |  |  |
| 61.5-66.25 | 16 | Travessilla-Persayo: Very shallow to shallow, fine sandy loam, gravelly seandy loam, silty clay loam, and silt loam soils formed on gently sloping to moderately steep flood plains, alluvial fans, valley slopes, mesas, ridges, canyon walls, escarpments, and breaks from alluvium and residhum derived prinarily from sandstone and shale. Includes outcrops of interbedded sandstone and shale on steep escarpuents and breaks. | Travessilla <br> Persayo | ${ }_{6-20}^{4-20}$ | $\begin{aligned} & 3-25 \\ & 3-25 \end{aligned}$ | Moderate wind and water erosion hazard, poor topsoil, 10-17 inch precipitation zone. Shrink-swell potential is low to moderate, permeability is slow to rapid, slightly calcareous and calcareous soils. |
| Sendoval Comenty ${ }^{3,4}$ |  |  |  |  |  |  |
| 66.25-75.5 | 6 | Travessilla-Persayo: Very shallow to shallow, well drained, sandy loam, loam, and silty clay loam soils formed on gently sloping to moderately steep messa and breaks from materials derived primarily from sandstone and shale. | Travessilla <br> Persayo | $\begin{aligned} & 6-16 \\ & 0-16 \end{aligned}$ | $\begin{aligned} & 3-25 \\ & 9-25 \end{aligned}$ | Moderate wind and water erosion hazard, poor to fair topsoil, 10-14 inch precipitation zone. Shrink-awell potential is low to high, moderately alkaline soils. |
| 75.5-106.0 |  | Refer to Mileposts $70.5-101.0$ of First Proposed Transmission Corridor (T2) (Table 6). |  |  |  |  |

[^5]are forming primarily in eolian, alluvial, and residual materials derived mainly from sandstone and shale, and to a lesser extent siltstone. These soils are forming primarily on gently sloping to moderately sloping mesas, plateaus, valley bottoms, valley sideslopes, intermittent drainageways, floodplains, alluvial fans, and breaks. This transmission corridor alternative traverses numerous intermittent drainages, as well as sandstone and shale outcrop (Badland) areas. Topsoil availability within this alternative transmission corridor is limited due to generally shallow soil surface layers, and the majority of the existing topsoil is of poor to fair quality due to undesirable surface textures (e.g., too sandy, gravelly, or clayey) or excess salt/sodium. Susceptibility of these soils to wind-induced erosion ranges from low to high. Susceptibility to water-induced soil erosion ranges from low to high, but it is primarily moderate. The majority of the soils identified within this corridor are alkaline andor calcareous. Shrink-swell potential of the identified soils ranges from low to high. These soils are currently used primarily for livestock grazing and wildife habitat, and to a lesser extent energy resource development.

Transmission Corridor T4. Alternative transmission corridor T4 is within the San Juan River Valley Mesas and Plateaus, New Mexico and Arizona Plateaus and Mesas, and Arizona and New Mexico Mountains portions of the Western Range and Irrigated Region (SCS 1978a). Annual precipitation generally ranges from 6 to 17 inches along this route. Seventeen different soil associations were identified within this transmission corridor. Table 9 lists (by mileposts) and characterizes the identified soils.

The soils identified within transmission corridor $T 4$ are very shallow to deep, with surface textures ranging from loamy fine sand to clay. Permeability of these soils is very slow to rapid. These soils


| Milepoat | $\begin{aligned} & \text { Hep } \\ & \text { Syabol } \end{aligned}$ | Soil Aecocintion and Description | Soil Series | Depth to Bedrock (inches) | $\underset{(Z)}{\text { 8lope }}$ | Camente |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| San Suen Comat ${ }^{1}$ |  |  |  |  |  |  |
| 0.0-4.5 | 6/8 | Refer to Map Syabole -6 and 8 (mileporta 7.0-7.5 and 4.5-5.25, reapectively). |  |  |  |  |
| 4.5-5.25 | 8 | Badland-Rock Outcrop tonierco: Shallow, well drained, fine aendy loen eoile formed on level to moderately oloping knolls, mesas, and plateaus from alluvial and colim materials derived primarily from sandstone and shale. Includes nonstory, barren shale areas on moderately sloping to extremely steep uplands that are dissected by deep intermittent drainagesays and gullies; and barren sandstooe outcrops an moderately sloping to extremely steep cliffe, ridges, breaks, and ledgen. | Hosierco | 10-20 | $0-8$ | Hoderate wind and water erosion haserd, poor topeoil, 6-10 inch precipitation sone. Starink-well potential is low to moderate, wild to moderately alkeline coils. |
| 5.25-6.0 | 8; | Befer to Map Symol - 8 (milepost 4.5-5.25). |  |  |  |  |
|  | 3 | Shiprock-Sheppard-Doak: Deep, vell to ecmenhat exceosively drained, fine sandy loem, lommy fine aand, and lom roils formed on level to moderately steep measa, platesus, and terraces from allovial and colian matorisls derived from sendstome, abale, and mixed sources. | Shiprock Shepperd Doak | $\begin{aligned} & 60 \\ & 60+ \\ & 60+ \end{aligned}$ | $\begin{aligned} & 0-8 \\ & 0-30 \\ & 0-5 \end{aligned}$ | Moderate to high wind erosion hazard, low to moderate mater erosion harard, topeoil is fair to good, 6-10 inch precipitation sone. Slurink-avell potential is low to moderate, mildly to moderately alkaline soils. |
| 6.0-6.25 | 8 | Badland Rock Outcrop-tonierce: Shallov, well drained, fine sendy loam soils formed on level to moderately sloping loolla, mesas, and plateas from alhwial and eolian materials derived primarily from andstone and shale. Includes nonstony, barren ahale areas an moderately oloping to extremely steep uplande that are diseected by deep intermittent drainageways and gullies: and barren sandstone outcrope on moderately sloping to extremely ateep cliffa, ridges, breaks, and ledges. | Monierco | 10-20 | 0-8 | Moderate wind and water erosion hazard, poor topeoil, $6-10$ inch precipitation wose. Starink-arell potential is low to moderate, mild to moderately alkaline coils. |
| 6.25-7.0 | 8/6 | Refer to Map symbole - 8 and 6 (mileposts 4.5-5.25 and 7.0-7.5, reespectivaly). |  |  |  |  |
| 7.0-7.5 | 6 | Sheppand-Huerfano-Notal: Deep to shallow, well to sonewhat excessively drained, loemy fine send, sendy clay lomen, and silty clay lomeneils formed on level to steap meace, plateans, valley bottome and fane from eolian, allivial, and residual materialo derived from sandstone, ahale, and ailtatone. | Sheppard Huerfano Botal | $\begin{gathered} 60+ \\ 10-20 \\ 60 \end{gathered}$ | $\begin{aligned} & 0-40 \\ & 0-3 \\ & 0-2 \end{aligned}$ | Moderate to high vind erosion hamard, low to moderate meter erosion hazard, topeoil is poor to fair, 6-10 inch precipitation zane. Slarink-uell potential is low to high, moderately to atrougly alkaline eoils. |
| 7.5-8.0 | 6/8 | Refer to thep Syubols -6 and 8 (mileponts 7.0-7.5 and 4.5-5.25, respectively). |  |  |  |  |



| Milepost | $\underset{\text { Syabol }}{\text { Map }^{2}}$ | Soil Aseociation and Description | Soil Series | Depth to Bedrock (inches) | $\underset{(\mathrm{I})}{\text { 8lope }}$ | Comente |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| San fuan Compty ${ }^{1}$ (continued) |  |  |  |  |  |  |
| 8.0-14.5 | 8 | Bedland Rock Outcroo tonierco: Shallow, well drained, fine andy loan soils formed ou level to moderately sloping knolle, mesas, and plateans from alluvial and colim materials derived primarily from asdstone and shale. Includen nonstony, barren shale areas on moderately sloping to extremely steep uplende that are diseected by deep intermittent drainageways and gullies; and barren sandstone outcrope on moderately sloping to extremely steep cliffs, ridges, breaks, and ledges. | Monierco | 10-20 | 0-8 | Moderate wind and water erosion hazard, poor topeoil, 6-10 inch precipitation sane. Strink-mell potential is low to moderate, mild to moderately alkaline coils. |
| 14.5-20.25 | 6 | Sheppandtherfano-Notal: Deep to ahallow, vell to soneshat exceasively drained, loany fine send, semty clay lomen, and silty clay loem soils formed on level to steep mease, platease, valley bottomand fans from eolian, alluvial, and residual materiale derived from sandstoces, shale, and siltatove. | Sheppard Herfano Notal | $\begin{gathered} 60+ \\ 10-20 \\ 60 \end{gathered}$ | $\begin{aligned} & 0-40 \\ & 0-3 \\ & 0-2 \end{aligned}$ | Moderate to high vind erosion hazard, low to moderate meter erosion hasard, topeoil is poor to fair, 6-10 inch precipitation zone. Starink-anell potentinl is low to high, moderately to stroogly alkaline woile. |
| HCXinley Camty ${ }^{2}$ |  |  |  |  |  |  |
| 20.25-25.0 | 3; | Befer to hap syabol-3 (milepost 25,0-27.5). |  |  |  |  |
|  | 4 | Chipeta-Sheppard-Shiprock: Shallow to deep, silty clay, clay, loeny send, loeny fine aand, and fine and wile formed on level to atrongly sloping uplands, ridges, and valley sideslopes from alluvial, eolian, and residual materials derived primarily from ahale and sendstove. | Chipeta Sheppard Shiprock | $\begin{gathered} 10-20 \\ 60+ \\ 60+ \end{gathered}$ | $\begin{aligned} & 0-15 \\ & 1-9 \\ & 0-5 \end{aligned}$ | Low to high vind and water erosion hazand, topeoil is poor, 10-17 inch precipitation mone. Strink-avell potentinl is low to high, permeability is very slow to rapid, calcareowe end moxcalcareous soila. |
| 25.0-22.5 | 3 | Rock Lamd-Billinge: Very shallow to deep, silty clay loam, silt loan, silty clay, clay, sandy loem, and lonany fine send soile formod an nearly level to moderately steep ledges, benches, escarpmente valley bottome, and valley sidee from materisle derived from asndetone, shale, and other sedimentary rocks. Includes numerous steep to extremely steep outcrope of amendotone and abale. | Billinge | $60+$ | 0-5 | Low to moderate wind erosion havard, high witer erosion hazard, poor topeoil, 10-17 inch precipitation zoos. Sturink-awell potential is moderate, permeability is very slow to slow, calcareous. Some areas within the Billinge portion my contsin toxic mounte of soluble salts, abject to piping and severe gully erosion. |
| 27.5-29.0 | 1; | Persavo-Camborthide: Very ahallow to moderately deep, silt lome, silty clay looen, and fine aendy loem soils fornasd ou nearly level to atrongly sloping uplande in residun derived primarily from sendatone. Includes steep to extremely steeqp amdetooes and interbedded abale outcrope. | Persayo Cenborthide | $\begin{array}{r} 6-20 \\ 20-36 \end{array}$ | $\begin{aligned} & 1-15 \\ & 1-8 \end{aligned}$ | Moderate to high vind erosion hazand, moderate meter ercesion hazard, poor topeoil, 10-17 inch precipitation zone. Starink-anell potential is low to woderate, permeability is slow to moderate, calcarecus. |
|  | 13 | Befer to Hep Symbol-13 (mileqoet 35.75-36.75). |  |  |  |  |
| 29.0-33.5 | 10/13 | Befere to rap 8ymbole - 10 and 13 (mileposts 33.5-34.0 and | 5-36.75, reep | vely). |  |  |



| Milepost | $\stackrel{\text { Kup }}{\text { Syubol }}$ | Soil Aesocietion and Description | Soil Series | Depth to Bedrock (inches) | $\underset{(\mathrm{X})}{\text { 8lope }}$ | Camente |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| Mckinler Cantry ${ }^{2}$ (continued) |  |  |  |  |  |  |
| 33.5-34.0 | 10 | Lohmiller-San Mateo: Deep, clay lome, clay, silty clay lom, loem, and aandy lomeneils formed on level to gently sloping valley bottona, flood plains, and terraces from alluvile derived primarily from andstone and ablale. | Lobmiller Sen Mateo | $\begin{aligned} & 60+ \\ & 60+ \end{aligned}$ | $\begin{aligned} & 0-3 \\ & 0-3 \end{aligned}$ | Moderate vind and water erosion hazand, topeoil is fair to good, 10-17 inch precipitation mone. Strink-well potential is low to high, permesbility is very slow to moderate, calcareous. |
| 34.0-35.75 | 10/13 | Refer to Mtap Symbols - 10 and 13 (mileposto $33.5-34.0$ and $35.75-36.75$, reapectively). |  |  |  |  |
| 35.75-36.75 | 13 | Hagerman-Travesailla: Moderately deep to very shallow, fine aandy loam, loem, and gravelly sandy lom coile formed oa nearly level to moderately steep uplande, mesa tops, valley bottomes, and flood plaine in residum derived from asndatone and in colian and alluvial sedimente of mixed origin. Includes steap sendetone (and sowe shale) outcrops. | Higermen <br> Travessille | $\begin{aligned} & 20-40 \\ & 4-20 \end{aligned}$ | $\begin{aligned} & 1-5 \\ & 3-25 \end{aligned}$ | Hoderate to high wind erosion havard, moderate mater erosion havard, topeoil is good to poor, 10-17 inch precipitation 2000 . Sarink-avell potential is low, permeability is moderate to rapid, moncalcareous to slightly calcarecus. |
| 36.75-38.75 | 10/13 | Refer to Map Syabole - 10 and 13 (mileposte 33.5-34.0 and 35.75-36.75, reapectively). |  |  |  |  |
| 38.75-60.0 | 13 | Hagerman-Travessilla: Moderately deep to very shallow, fine sandy loan, lom, and gravelly andy lom coils formed oa nearly level to moderately steep uplands, mesa tops, valley bottoms, and flood plains in residum derived frum andstone and in colien and allevisl sediments of mixed origin. Includes steep sendetone (and sone shale) outcrope. | Hagernan <br> Travessille | $\begin{aligned} & 20-40 \\ & 4-20 \end{aligned}$ | $\begin{aligned} & 1-5 \\ & 3-25 \end{aligned}$ | Moderate to high vind erosion hazard, moderate vater exosion hazard, topeoil is good to poor, 10-17 inch precipitation zone. Sarink-avell potential is low, permeability is moderate to rapid, moncalcerreons to slightly calcareaus. |
| 60.0-68.5 | 18 | Rock Land-Travesailla: Very aballow to ahallow, fine eandy loem, and gravelly sendy lomen soils formed on moderately sloping to moderately steep upland areas and meas tope from materials derived prinarily from sandetone and shale. Includee amditone (and other sedimentary rock) outcrope on steep to extremely steep meas sidealopes, eccarpanents, and breakc. | Tavestille | 420 | 5-30 | Moderate wind and miter erosion havard, poor topeoil, 10-17 inch precipitation zone. Strink-arell potential is low, pemeability is rapid, slightly calcureas. |
| 68.5-68.75 | 15; | Las Lucas-Litle-Persayo: Deep to very shallow, loam, clay, silty clay loam, and silt loem eoils formed on nearly level to moderately sloping allivial fans, valley sidealopes, uplande, ridges, and knolls from allur vial and residual materiale derived primarily from ahale. Includea interbedded ahale and andatone exposures on steep escarpments and breaks. | Las Luces Litle Peresyo | $\begin{aligned} & 40-60 \\ & 20-40 \\ & 6-20 \end{aligned}$ | $\begin{aligned} & 3-5 \\ & 3-5 \\ & 1-9 \end{aligned}$ | Low to moderate wind erosion hazard, moderate to high mater erosion hazard, topsoil is fair to poor, 7-10 inch precipitation sone. Strink-awell potentinl is moderate to high, slow to very slow permeability, calcareous. |
|  | 18; | Refer to Hap Syutol - 18 (milepost 60.0-68.5). |  |  |  |  |



| Milepoat | $\underset{\text { Syatol }}{\substack{\text { Hep }}}$ | Soil Areociation and Deacription | Soil Serice | Depth to Bedrock (inchee) | $\underset{(X)}{\text { Blope }}$ | Caments |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| Hacinley Comty ${ }^{2}$ (continued) |  |  |  |  |  |  |
|  | 19 | Bock Land-Bond: Very shallow to dhallow, fine sendy loen, sandy loan, and gravelly sendy lome wils formed ou nearly level to moderately steep meass, ridges, eocarpuents, and breaks from residual materials derived primarily from amdetone, and to a leaser extent from eolien end alluvial materials of mixed origin. Includes nomeroun steep to eutremely steep outcrops of sandotoose and other aedimentary rocks. | Bood | 10-20 | 1-5 | Moderate wind and weter erosion hazand, poor topeoil, 10-17 inch precipitation mone. Starink-mell potential is low to moderate, permeability is slow to rapid, noncalcarecus. |
| 68.75-71.5 | 18/19 | Refer to Hep syabole - 18 and 19 (mileposts 60.0-68.5 and 68.5-68.75, reepectively). |  |  |  |  |
| 71.5-72.0 | 18 | Rock Land-Travesailla: Very shallow to shallow, fine sandy lomem, and gravelly emity lomen soile formed on moderately sloping to moderately ateep uplend aroes and mean tope from materials derived primarily from sandstoos and ahale. Includes sendstone (and othar sedimentary rock) outcrope on steep to extremely steep mose sideslopes, eecarpments, and breaks. | Travesoilla | 4-20 | 5-30 | Hoderate wind and mater erosion hazard, poor topeoil, 10-17 inch precipitation sone. Storink-avell potential is low, permeability is rapid, alightly calcereous. |
| 72.0-72.5 | 18/13 | Refer to Map Symble - 18 end 13 (mileposte $60.0-68.5$ end $35.75-36.75$, respectively). |  |  |  |  |
| 72.5-73.0 | 18 | Rock Land-Travesailla: Very aballow to ahallow, fine amidy loan, and gravelly sendy loem soils formed on moderately aloping to moderately ateep upland areas and mese tope from materiale derived primarily from asndatone and shale. Includes sendotione (and other sedimentary rock) outcropes on steep to extremely steep meek sideelopes, eccarprents, and breaks. | Travesailla | 4-20 | 5-30 | Hoderate wind and meter erosion hazard, poor topeoil, 10-17 inch precipitation rone. Starink-avell potential is low, permeability is rapid, slightly calcareous. |
| 73.0-75.0 | 10/18/19 | Refer to Mup Symble - 10, 18, and 19 (mileposte 33.5-34.0; 60.0-68.5; and 68.5-68.75, reapectively). |  |  |  |  |
| 75.0-75.5 | 10/18 | Refer to Mep gymble - 10 and 18 (mileposte 33.5-34.0 and 60.0-68.5, reppectivaly). |  |  |  |  |
| 75.5-76.0 | 23/15 | Refer to Mip symbole - 23 and 15 (mileposte 76.0-79.5 and 68.5-68.75, respectively). |  |  |  |  |
| 76.0-79.5 | 23 | Bock Land-Thunderpird: Shallow to moderately deep, atony clay loan, stony lomen, and loem soils formed on level to atrongly oloping mesas, ridge tops, eacarpments, and breake from materials manthered froa volcanic rocke (primarily basalt), and to a lesser extent from colim materiale of mixed origin. Includes mmerous ateep to extremely steep outcrope of baesit or occasionally eet imentary rocke. | Tumdertind | 20-40 | 0-10 | Low to moderate vind erosion bavard, moderate meter ecosion hazerd, poor topeoil, 10-17 inch precipitation zone. Skrink-avell potentinl is moderate to high, permeability is very slow, noncalcerreas. |
| 79.5-80.5 | 23/15 | Refer to Map 8yabole - 23 and 15 (rileposta $76.0-79.5$ end | -68.75, reepect | 1y). |  |  |



| Milepoat | $\begin{aligned} & \text { Hep } \\ & \text { Syubol } \end{aligned}$ | Soil Associstion and Description | Soil Series | Depth to Bedrock (iaches) | $\underset{(\mathrm{I})}{\text { Slope }}$ | Coments |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| Hexinley Canty ${ }^{2}$ (cootinued) |  |  |  |  |  |  |
| 80.5-9.0 | 23 | Rock Lend-Thmderbind: Shellow to moderately deep, stony clay lomen, stoury lomen, and lomen soile forcued on level to stroogly sloping meass, ridge topa, eacarpments, and breake from materiale weathered from volcanic rocke (primarily beaslt), and to a lesser extent froa solim materials of mixod origin. Includea numeroue steep to extremely steep outcrope of besalt or occasionally redimentary rocks. | Thundertion | $20-40$ | 0-10 | Low to moderate vind erosion hazurd, moderate meter erosion hazard, poor topeoil, 10-17 inch precipitation sone. Strink-awell potential is moderate to high, permability is very slow, noncalcarocus. |
| Cibola Countr ${ }^{3}$ |  |  |  |  |  |  |
| 96.0-100.0 | 14 | Bock Land-Thmorbind: Shallow to moderately deep, otory clay loman, stoxy loom, and silt loom soile formed on level to strougly sloping besalt capped mesan, lava flow, and volcanic hills from materisle derived primarily from besic volcanic rocke (basalt). Includen outcrope of basalt, amdetowe, and other sedimentary bedrocks con steep to very steep mess sides, eecarpmenta, levi flow froota, hills, and ridgee. | Thumertiod | 20-40 | 0-10 | Low vind erosion hazard, moderate meter erosion hazand, poor topeoil, 7-10 inch precipitation mone. Starinkmell potential is moderate to high, permeability is very slow to slow, poncalcarecus. |
| 100.0-102.25 | 15 | Litle-Clovio-Travesilla: Hoderately deep to very shallow, silty clay lom, clay, fine sendy lom, lom, atory emidy loun, and zandy lom soile formed on level to moderately steep uplands, meeas, hille, ridges, breaks, eacarpuente, and flood plaine from residum derived from aendatone and shale, and to a lesser extent from alluvial and eolian materisle of similar origin. | Litle <br> Clovis <br> Travessille | $\begin{array}{r} 20-40 \\ 20-40 \\ 8-20 \end{array}$ | $\begin{aligned} & 0-20 \\ & 0-10 \\ & 5-30 \end{aligned}$ | Low to moderate vind erosion hasard, moderate miter erosion hazard, poor to fair topeoil, 7-10 inch precipitation mone. Starink-arell potential is low to high, permeability is very slow to repid, calcarecus and moncalcareas eoils. |
| Sandoval Cantry ${ }^{4}$ |  |  |  |  |  |  |
| 102.25-103.25 | 11 | Las Lucas-Litle-Persayo: Deep to very ahallow, clay, lom, silty clay loom, and silt loom soils formed on moarly level to moderately sloping allivial fans, valley side slopes, uplands, ridges, and knolls from materials derived from weathered shale. Includee steap to very steep shale and asedstone outcrope. | Las Iucas Litle Perenyo | $\begin{aligned} & 40-60 \\ & 20-40 \\ & 6-18 \end{aligned}$ | $\begin{aligned} & 3-5 \\ & 3-5 \\ & 1-9 \end{aligned}$ | Low vind erosion hasind, moderate to high muter erosion hasard, fair to poor topeoil, $10-14$ inch precipitation mone. Strink-avell potential is moderate to high, permeability is slow to very slow, calcarecua. |
| 103.25-104.0 | 13 | Travegille-Persayo-Rockland: Very ahallow to aballow, ematy lomen, silty clay loan, and silt loom soils formed on gently sloping to moderately steep mesas, breaka, ridges, and knolls from aendetone and shale. Includen interbedded andstone and shale outcrops co moderately steep to extremely steep eeccarpments and breaks. | Tavessille <br> Persayo | $\begin{aligned} & 8-20 \\ & 3-25 \end{aligned}$ | $\begin{aligned} & 3-25 \\ & 3-25 \end{aligned}$ | Hoderate vind and meter erosion bazard, tupeoil is poor 10-14 inch precipitation zone. Sturink-awell poteatinl is low to moderate, permeability is rapid to slow, slightly calcareous and calcareous soils. |



| Milepost | $\operatorname{Map}_{\text {Syebol }}$ | Soil Aseociation and Deacription | Soil serice | Depth to Bedrock (inches) | $\underset{(x)}{\text { slope }}$ | Commen |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| Sandeval Contry ${ }^{4}$ (continued) |  |  |  |  |  |  |
| 104.0-105.0 | 11/13 | Refer to hap gyabole - 11 and 13 (mileposts 102.25-103.25 and 103.25-104.0, reqpectively). |  |  |  |  |
| 105.0-105.5 | 11 | Las Lucas-Litle-Persayo: Deep to very shallow, clay, loen, silty clay lom, and silt lomem wils formed on nearly level to moderately sloping allivial fens, valley side slopen, uplends, ridges, and knolle from materials derived from weathered abale. Includes steep to very steep abale and andstone outcrops. | Las lucas <br> Litle <br> Peramyo | $\begin{aligned} & 40-60 \\ & 20-40 \\ & 6-18 \end{aligned}$ | $\begin{aligned} & 3-5 \\ & 3-5 \\ & 1-9 \end{aligned}$ | Low vind erosion hazurd, moderate to high vater erooion hand, fair to poor topeoil, 10-14 inch precipitation sooe. Starink-well potential is moderate to high, permability is slow to very slov, calcareale. |
| 105.5-108.5 | 13 | Travesailla-Perrayo-Reckland: Very ahallow to ahallow, sendy lome, silty clay loom, and silt loem wils formed on gently sloping to moderately steep measa, breaks, ridgea, and knolls from sandotone and abale. Includen intertodded sandetone and ahale outcrope on moderately steep to extresely steep eecarpuaste and breake. | Travesaille <br> Persayo | $\begin{gathered} 8-20 \\ 3-25 \end{gathered}$ | $\begin{aligned} & 3-25 \\ & 3-25 \end{aligned}$ | Hoderate wind and meter erosion hamerd, topeoil is poor 10-14 inch precipitation zone. Sharink-avell potential is low to moderate, permeability is rapid to slow, slightly calcarean end calcarean soils. |
| 108.5-109.0 | 2/13 | Refer to Hep Symbole -2 and 13 (mileposte 109.0-111.5 and 109.25-104.0, reppectively). |  |  |  |  |
| 109.0-111.5 | 2 | Christianburg-isyaio: Deep, clay, silty clay loan, and sandy clay loam soils formod oa level to gently sloping valley bottoms, flood plaina, and tarcaces from alluvium derived primarily from ahale. | Ctristimburg Hevajo | $\begin{aligned} & 60+ \\ & 60+ \end{aligned}$ | $\begin{aligned} & 0-3 \\ & 0-3 \end{aligned}$ | Low wind erosion hazned, woderate to high witer erosion bazard, poor topeoil, $10-14$ inch precipitation rone. Shrink-awell potential is high, permeebility is very slow, calcareous. |
| 111.5-115.0 | 2/13 | Refer to Mep Syabole - 2 and 13 (mileposts 109.0-111.5 and 103.25-104.0, respectively). |  |  |  |  |
| 115.0-117.25 | 13 | Travesaill-Perrayo-Rockland: Very sballow to aballow, sendy lomen, silty clay loen, and silt loen wils formod ou gently sloping to moderately steep mesas, breaks, ridges, and knolls from anndetooe and shale. Includes interbedded asandstone and shale outcrope on moderately steep to extremely steep eacarpmento and breaks. | Travestille <br> Perayo | $\begin{aligned} & 8-20 \\ & 3-25 \end{aligned}$ | $\begin{aligned} & 3-25 \\ & 3-25 \end{aligned}$ | Moderate wind and water erosion hazard, topeoil is poor, 10-14 inch precipitation zone. Surink-well potential is low to moderate, permeability is repid to slov, slightly calcarecus and calcarecus soile. |
| 117.25-117.75 | 2 | Churistianburs-ievaio: Deep, clay, silty clay lomen, and sandy clay loem soils formed on level to gently sloping valley bottona, flood plains, and terraces from alluvium derived primarily from shale. | Christianturg Nevajo | $\begin{aligned} & 60+ \\ & 60+ \end{aligned}$ | $\begin{aligned} & 0-3 \\ & 0-3 \end{aligned}$ | Low vind erosion hazard, moderate to high mater erosion hazard, poor topeoil, $10-14$ inch precipitation some. Shrink-awell potential is high, permeability is very slov, calcareaus. |
| 117.75-118.25 | 2/13 | Refer to Map Symble - 2 and 13 (milepostes 109.0-111.5 and 100.25-104.0, respectively). |  |  |  |  |
| 118.25-118.5 | 13 | Travessilla-Persayo Rockland: Very shallow to shallow, asindy loam, silty clay loam, and silt loan soils formed on gently sloping to moderately steep mesas, breaks, ridges, and knolle from andstone and shale. Includea interbedded aandatone and shale outcropa on moderately ateep to extremely steep escarpments and breake. | Travessille <br> Peraayo | $\begin{aligned} & 8-20 \\ & 3-25 \end{aligned}$ | $\begin{aligned} & 3-25 \\ & 3-25 \end{aligned}$ | Moderate wind and mater erosion hazard, topeoil is poor, 10-14 inch precipitation sone. Starink-awell potential is low to moderate, permeability is rapid to slow, slightly calcareous and calcareous soils. |

Table 9. charactiristics ar the soils mentited htihin the 'p' trangission corridor aitirkutive (T4) (concluded)

| Milepost | $\underset{\text { Myabol }}{\text { Map }}$ | Soil Association and Description | Soil Series | Depth to Bedrock (inches) | $\underset{(\mathbf{( x )}}{\text { Slope }}$ | Camments |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| Sandoval County ${ }^{4}$ (continued) |  |  |  |  |  |  |
| 118.5-119.5 | 2/13 | Refer to Map Symbols - 2 and 13 (mileposts 109.0-111.5 and 103.25-104.0, respectively). |  |  |  |  |
| 119.5-120.25 | 2 | Christianburg-Navajo: Deep, clay, silty clay loam, and sandy clay loam soils formed on level to gently sloping valley bottoms, flood plains, and terraces from alluvium derived primarily from shale. | Christianburg Nava jo | $\begin{aligned} & 60+ \\ & 60+ \end{aligned}$ | $\begin{aligned} & 0-3 \\ & 0-3 \end{aligned}$ | Low wind erosion bazard, moderate to high water erosion hazard, poor topsoil, $10-14$ inch precipitation zone. Shrink-swell potential is high, permeability is very slow, calcareous. |
| 120.25-122.25 | 11 | Las Lucas-Litle-Persayo: Deep to very shallow, clay, loam, silty clay loam, and silt loam soils formed on nearly level to moderately sloping alluvial fans, valley side slopes, uplands, ridges, and knolls from materials derived from weathered shale. Includes steep to very steep shale and sandstone outcrops. | Las Lucas Litle Persayo | $\begin{gathered} 40-60 \\ 20-40 \\ 6-18 \end{gathered}$ | $\begin{aligned} & 3-5 \\ & 3-5 \\ & 1-9 \end{aligned}$ | Low wind erosion hazard, moderate to high water erosion hazard, fair to poor topeoil, $10-14$ inch precipitation zone. Shrink-swell potential is moderate to high, perneebility is slow to very slow, calcarecus. |
| 122.25-124.0 | 7 | Rough mroken Land-Entudo: Shallow to moderately deep, gravelly fine sandy loam, fine sandy loam, gravelly sandy loam, and gravelly loany sand soils formed on nearly level to moderately steep uplands dissected by momerous intermittent drainages and arroyos as well as breaks, ridges, and to a lesser extent valley bottoms and flood plains. These soils are forming primarily in unconsolidated alluvium. | Eabudo | 20-36 | 1-9 | Low wind erosion hazard, moderate water erosion hazard, topsoil is poor, $10-14$ inch precipitation zone. Shrinkswell potential is low, permeability is rapid, calcarecus. |

[^6]are forming primarily in alluvial, eolian, and residual materials derived from sandstone, shale, siltstone, and to a lesser extent volcanic rock (e.g., basalt). These soils are forming primarily on gently sloping to moderately sloping mesas, plateaus, ridges, knolls, canyons, valleys, intermittent drainageways, floodplains, and alluvial fans. Transmission corridor $T 4$ traverses numerous intermittent drainageways and numerous Rock Outcrop (sandstone, shale, and basalt) areas on strongly sloping to steep ridges, escarpments, and breaks. The main areas of steep terrain are in southern McKinley County (e.g., San Lucas Canyon area), southeastern McKinley County (between Canon de Marquez and Canon de Pedro Padilla), and in northeastern Cibola County (La Mesa del Canon Seco area). Topsoil availability within this alternative transmission corridor is limited due to generally shallow soil surface layers, and the majority of the existing topsoil is of poor to fair quality due to undesirable surface textures (e.g., too gravelly, stony, sandy, or clayey) or excess salt/sodium. Susceptibility of these soils to wind-induced erosion is primarily moderate to high, and susceptibility to water-induced soil erosion ranges from low to high. Approximately 50 percent of the soils identified within this transmission corridor are alkaline and/or calcareous. Shrink-swell potential of the identified soils ranges from low to high. These soils are currently used primarily for livestock grazing and wildife habitat, and to a lesser extent for energy resource development.

## PRIME AND UNIQUE FARMLANDS

## Proposed NMGS Site

Since the proposed NMGS could potentially take agricultural land out of production for the life of the project, the NMGS site was evaluated to determine whether it includes any Prime and/or Unique Farmland. The soil survey of San Juan County (SCS 1980) was used in
conjunction with the Prime Farmland list (soil mapping units) for San Juan County (SCS 1978b) for this evaluation. The soil types (BA and SC) present at the proposed NMGS site do not meet the criteria for Prime Farmland. Additionally, the proposed NMGS site does not contain any Unique or Statewide/Locally Important Farmland.

## Water Supply System

Proposed Main Water Pipeline (P1). The proposed intake/pumping plant and the three intermediate pump stations associated with this pipeline could potentially take agricultural land out of production for the life of the project, so these project component locations were evaluated for Prime Farmland potential.

The soil type (Wr) present at the proposed intake/pumping plant is potential Prime Farmland (SCS 1978 b and 1980). For this area to qualify as Prime Farmland it must be irrigated and used for cropland. This area is not used for cropland and is not irrigated, thus this area does not qualify as Prime Farmland. Additionally, this area contains no Unique or Statewide/Locally Important Farmlands. The soil types (FA, Ay, Sm, and Sd) present at the three intermediate pump station locations do not meet the criteria for Prime Farmland (SCS 1978b and 1980). The three intermediate pump station locations contain no Unique or Statewide/Locally Important Farmlands. Intermediate pump stations 2 and 3 are in an irrigable portion of the Navajo Indian Irrigation Project (NIIP) - Block 9, which is currently undeveloped (i.e., potential Statewide/Locally Important Farmland). Congress has cut off funding for NIIP indefinitely, thus it is very likely Block 9 will never be developed.

Main Water Pipeline Alternatives P2 and P3. The soil types (Fy, RA, and Fw) present at the intake/pumping plant locations associated with
these main water pipeline alternatives do not meet the criteria for Prime Farmland (SCS 1978b and 1980). The intake/pumping plant locations contain no Unique or Statewide/Locally Important Farmlands either.

The soil types (FX, BA, Sd, and DS) present at the intermediate pump station locations associated with these pipeline alternatives do not meet the criteria for Prime Farmland (SCS 1978b and 1980). These intermediate pump station locations also contain no Unique or Statewide/Locally Important Farmlands.

Proposed Terminal Storage Reservoir (RI). The soil types (BA, SC. and $H U$ ) present at the proposed reservoir location do not qualify as Prime Farmland (SCS 1978b and 1980). The proposed site contains no Unique or Statewide/Locally Important Farmlands.

Terminal Storage Reservoir Alternative (R2). The soil types (HU and DN) present at this alternative reservoir site do not qualify as Prime Farmland either (SCS 1978b and 1980). Additionally, the alternative reservoir site does not contain any Unique or Statewide/Locally Important Farmlands.

## Transmission Lines

The proposed and alternative transmission line corridors do not traverse any irrigated cropland, thus no Unique or Statewide/Locally Important Farmlands would be taken out of production by surface facilities associated with the transmission system.

Proposed FC-A-P $500-\mathrm{kV}$ Transmission Line Loop (T5). Transmission towers and substations associated with transmission lines could potentially take agricultural land out of production for the life of the project. Since tower locations are unknown at this time, the
entire transmission corridors were evaluated for the presence of potential Prime Farmland.

The soil types (SC, BA, and RA) present within the proposed FC-A-P $500-\mathrm{kV}$ transmission line loop corridor do not qualify as Prime Farmland (SCS 1978b and 1980).

First Proposed Transmission Line Corridor (T2). The soils present within the portion of this corridor in San Juan County do not meet the criteria for Prime Farmland. A Land Class For Irrigation (LCFI) of 1 qualifies as potential Prime Farmland (if irrigated), but the highest rating for the soils within this corridor segment is LCFI 2-3 (SCS 1973).

The soils present within the portion of this corridor in McKinley and Sandoval counties do not qualify as Prime Farmland (Fjefeth 1981, and Hacker 1981).

Second Proposed Transmission Line Corridor (Tl). The soils present within the portion of this corridor in San Juan County do not meet the criteria for Prime Farmland, because the highest LCFI rating is 2-3 (SCS 1973).

The soils present within the portion of this corridor in McKinley and Sandoval counties do not qualify as Prime Farmland (Fjefeth 1981, and Hacker 1981).

Transmission Line Corridor Alternative T3. The soils present within the portion of this corridor in San Juan County do not meet the criteria for Prime Farmland, because the highest LCFI rating is 4-6 (SCS 1973).

The soils present within the portion of this corridor in McKinley and Sandoval counties do not qualify as Prime Farmland (Fjefeth 1981, and Hacker 1981).

Transmission Line Corridor Alternative T4. The soils present within the portion of this corridor in San Juan County do not meet the criteria for Prime Farmland, because the highest LCFI rating is 6-2 (SCS 1973).

The soils present within the portion of this corridor in McKinley and Sandoval counties do not qualify as Prime Farmland (Fjefeth 1981, and Hacker 1981).

The soils present within the portion of this corridor in Cibola County do not meet the criteria for Prime Farmland, because the highest LCFI rating is 6-4-3 (SCS 1974).

## SOILS

## Proposed NMGS Site

Construction of the proposed NMGS would disturb approximately 2400 acres of soils and topography, significantly affecting the existing soils (see Table 10). The soils at the NMGS site would be taken out of production for the life of the project. Depending on the amount of grading and excavation necessary, existing soil profiles could be completely altered or destroyed during site preparation. Topsoil (or salvageable soil) removal, stockpiling, and redistribution would result in an intermixing of the native topsoils. Depending on the specific topsoil removal plan chosen (e.g., selective or nonselective by soil types, salvage depths), topsoil may also be salvaged and mixed with less desirable subsoils or bedrock. Alteration of the existing soil profiles, and mixing of topsoil or salvageable soil would alter the physical, chemical, and biological characteristics of the native soils. For example, physical features affected include surface textures, soil structure, permeability, and infiltration rates; chemical features include pH , sodium levels, macroand micronutrients; biological features include the type and quantity of soil microorganisms.

The primary goal of a reclamation plan is to ensure that lands disturbed during construction or operation are restored to a stable,
productive, and aesthetically acceptable condition. Although a detailed construction and reclamation plan is not yet available, the applicant has proposed several general mitigation measures and reclamation procedures that would be employed at the NMGS site.

During site preparation, the entire plant area would be step graded, but existing contours would be preserved to the maximum practical extent to avoid excessive cut-and-fill operations. During construction, erosion control would consist of drainage ditches across disturbed areas that would tie into the existing surface drainage features. Siltation control measures would include sedimentation ponds, sediment traps, and controlled drainage slopes. Topsoil would be removed and stockpiled by construction equipment prior to required excavations. The topsoil stockpiles would be shaped and graded for drainage and erosion control. The stockpiled topsoil would be redistributed on spoil-disposal and disturbed areas prior to revegetation. All disturbed nonroad areas (not covered with asphalt, concrete, or gravel) would be reseeded with native grasses.

The effects of unavoidable impacts to the soils resource as a result of constructing NMGS would include: (1) accelerated soil erosion due to wind and water; (2) decreased soil stability; (3) decreased soil diversity in chemical, physical, and topographic aspects; (4) decreased soil fertility and productivity; (5) decreased soil development; and (6) decreased quantity, quality, and diversity of vegetative cover.

The soils data for NMGS in the Affected Environment section (including Table 1) of this background report indicate that some of the sites may be difficult to reclaim due to adverse physical and chemical soil properties, such as: undesirable surface textures, absence of and/or restricted topsoil supply, high erosion
susceptibility, excess salts, and alkalinity. In addition, the low precipitation at the site could inhibit reclamation efforts. Selection of seed species specifically adapted to local soils and climate, as well as timing and methods of reseeding, are essential prerequisites for successful revegetation on problem soil areas (e.g., soils with excess salts, high alkalinity, droughtiness). Excess salts and alkalinity problems could increase in some areas if excavated materials, which in some cases are more toxic than the overlying topsoils, were placed on the surface. Shale is mildly to strongly alkaline and extremely difficult to vegetate, thus shale should not be mixed with topsoil or placed on the surface.

Potential soils reclamation problem areas at NMGS are listed in Table 10 by soil association and the specific indicators of potential reclamation problems. Table 10 also lists potential mitigation measures which, if implemented, would increase reclamation success at the site. The applicant's Proposed Action includes most of the measures.

## Water Supply System

Proposed Main Water Pipeline (P1). Construction of the proposed main water pipeline Pl (including intake pumping plant and intermediate pump stations) would directly disturb approximately 474 acres of soil and topography (see Table 10). Construction of staging and work areas at pump station sites and stream, road, and canal crossings would cause a small amount of additional disturbance. Soil surface disturbance, excavation (trenching operations), and removal of vegetative cover would increase the present soil erosion rates and soil instability. These increases would continue until denuded areas were revegetated. If a moderately intensive erosion control and reclamation program were implemented following construction, most of
Table 10. SUMMARY OF POIENITAL SOILS RECIAMATION PROBL LM AREASI

| Project Component | Map Unit or Soil Association ${ }^{2}$ | Approximate Milepost or Acreage | Indicators of Potential Reclamation Problens |  |  | Camments | Potential Mitigation Measures for Consideration |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
|  |  |  | High Wind High Water <br> Erosion Erosion <br> Susceptibility  <br> Susceptibility  | Area 5 Reclaim | $\text { Steep } 6$ Terrain |  |  |
| MSS |  |  |  |  |  |  |  |
|  | Shiprock-Sheppard-twerfano | 911 | X | - | - | Shiprock-Sheppard portion is highly susceptible to wind erosion. | A, B, D |
|  | Turley-Fruitland-Blancot | 882 | x | - | - | Fruitland portion may be highly susceptible to wind erosion. | A, B, D |
|  | Stumble-Notal-Huerfano | 439 | x | - | - | Stumble portion may be highly susceptible to wind erosion; Notal portion is highly susceptible to shrink-swell. | A, B, C, D |
|  | Riverwash-Dumeland | 114 | X X | - | - | Dumeland portion is highly susceptible to wind erosion; Riverwash portion is highly susceptible to water erosion. | A, B, C, D |
|  | Radland-Rock Outcrop | 54 | x | - | x | Badland areas ( $>15 \%$ slope) are highly susceptible to water erosion in excavated areas, if loose/broken up shale is left umprotected on the surface. | c |
|  |  | Totals ${ }^{8}$ | 2346 acres $\quad 168$ acres | 0 | 54 acres |  |  |
| Water Supply System |  |  |  |  |  |  |  |
| P1 | $\mathrm{HA} / \mathrm{BC}$ | 0.05-0.2 | - - | x | x | Adit/shaft area (i.e., precludes soils problems). |  |
|  | FA | $\begin{aligned} & 0.2-0.6,0.65-0.75 \\ & 0.85-1.95 \end{aligned}$ | - - | x | - | Persayo portion - area reclaim, shallow soils. | A, B, C, D |
|  | Ay | $0.6-0.65,0.75-0.85$ | X | - | - | This phase of the Avalon series is highly susceptible to water erosion. | A, B, C, D |
|  | EX | $\begin{aligned} & 1.95-2.7,2.85-3.05, \\ & 3.15-3.3 \end{aligned}$ | x | x | - | Sheppard portion is highly susceptible to wind erosion; Persayo portion - area reclaim | A, B, C, D |
|  | BC | 3.05-3.15 | - - | X | - | Persayo portion - area reclaim | $A, B, C, D$ |

Table 10. stamary of potenital soils reciamation probiem areas ${ }^{1}$ (contimued)

| Project Component | Map Unit or Soil Association ${ }^{2}$ | Approximate Milepost or Acreage | Indicators of Potential Reclamation Problems |  |  |  | Camments | Potential Mitigation Measures for Consideration |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
|  |  |  | $\begin{aligned} & \text { High Wind } \\ & \text { Erosion } \\ & \text { Susceptibility }{ }^{3} \end{aligned}$ | High Water Erosion Susceptibility ${ }^{4}$ | Area 5 Reclaim | Steep 6 Terrain |  |  |
| Water Supply System (continued) |  |  |  |  |  |  |  |  |
| P1 | Sd | 3.3-3.65, 3.9-4.0, <br> 4.35-6.0, 6.25-13.0, <br> 13.15-13.2, 13.25-13.6, <br> 13.7-14.1, 14.5-14.8, <br> 15.25-15.45, 22.95-23.0, <br> 23.5-23.55, 23.7-23.8, <br> 23.85-23.95, 24.0-24.9, <br> 25.3-26.1, 26.25-28.4, <br> 28.85-29.15, 29.35-29.6 | $x$ | - | - | - | Sheppard-Mayqueen portion is highly susceptible to wind erosion. | A, B, D |
|  | BA | 15.45-16.8 | - | x | - | X | Badland areas ( $>15 \%$ slope) are highly susceptible to water erosion in trenched areas. | c |
|  | AZ | 16.8-17.3 | x | - | - | - | Sheppard portion is highly susceptible to wind erosion. | A, B, D |
|  | HU | $\begin{aligned} & 17.3-19.2,22.85-22.9 \\ & 23.4-23.5 \end{aligned}$ | - | - | x | - | Muff portion - area reclaim. | A, B, C, D |
|  | SC | $\begin{aligned} & \text { 19.2-22.7, 22.8-22.85, } \\ & 23.3-23.4,28.4-28.85, \\ & 29.15-29.35,29.6-30.8, \\ & 33.3-35.0,35.4-35.95, \\ & 38.4-39.2,39.55-39.7 \end{aligned}$ | x | - | - | - | Sheppard portion is highly susceptible to wind erosion; Notal portion is highly susceptible to shrink-swell. | A, B, C, D |
|  | Riverwash-Dumeland | 35.95-36.05 | x | x | - | - | Dumeland portion is highly susceptible to wind erosion; Riverwash portion is highly susceptible to water erosion. | A, B, C, D |
|  | Turley-Fruitland-Blancot | $\begin{aligned} & 36.05-36.6,37.2-37.75, \\ & 37.95-38.3 \end{aligned}$ | X | - | - | - | Fruitland portion may be highly susceptible to wind erosion. | A, B, C, D |
|  | Shiprock-Sheppard-Huerfano | 36.6-37.2, 38.3-38.4 | x | - | - | - | Shiprock-Sheppard portion is highly susceptible to wind erosion. | A, B, C, D |
|  |  | Totals ${ }^{8}$ | 31.7 miles | 1.6 miles | 4.4 miles | 1.35 miles |  |  |

Table 10. SUMMARY of potential soils reciamation probilem areas ${ }^{1}$ (contimued)

Table 10. simmary of potential soils reciamation problem areas (continued)

| Project Component | Map Unit ar Soil Association ${ }^{2}$ | Approximate Milepost or Acreage | Indicators of Potential Reclamation Problens |  |  |  | Comments | Potential <br> Mitigation Measures for 7 Consideration |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
|  |  |  | $\begin{aligned} & \text { High Wind } \\ & \text { Erosion } \\ & \text { Susceptibility } \end{aligned}$ | High Water Erosion Susceptibility ${ }^{4}$ | Area Reclaim | Steep 6 Terrain |  |  |
| Water Supply System (continued) |  |  |  |  |  |  |  |  |
| P2 ${ }^{9}$ | Ma | 9.95-10.1 | X | - | - | - | Mayqueen is highly susceptible to wind erosion. | A, B, D |
|  | SB | 13.8-14.0 | X | - | - | - | Sheppard portion is highīy susceptible to wind erosion. | A, B, D |
|  | нU | $\begin{aligned} & 18.7-18.9,19.0-19.2, \\ & 19.3-19.7 \end{aligned}$ | - | - | - | x | Muff portion - area reclaim. | A, B, C, D |
|  | Sc | $\begin{aligned} & 30.9-31.3,32.5-33.1 \\ & 36.2-37.9,38.3-38.85, \\ & 41.3-42.1,42.45-42.6 \end{aligned}$ | X | - | - | - | Sheppard portion is highly susceptible to wind erosion; Notal portion is highly susceptible to shrink-swell. | A, B, C, D |
|  | Dz | 31.75-31.8 | x | - | - | - | Dumeland is highly susceptible to wind erosion. | A, B, D |
|  | Riverwash-Duneland | 38.85-38.95 | x | X | - | - | Dumeland portion is highly susceptible to wind erosion; Riverwash portion is highly susceptible to water erosion. | A, B, C, D |
|  | Turley-Fruitland-Blancot | $\begin{aligned} & 38.95-39.5,40.1-40.65, \\ & 40.85-41.2 \end{aligned}$ | , x | - | - | - | Fruitland portion may be highly susceptible to wind erosion. | A, B, D |
|  | Shiprock-Sheppard-Huerfano | 41.2-41.3 | x | - | - | - | Shiprock-Sheppard portion is highly susceptible to wind erosion. | A, B, D |
| P3 |  | Totals ${ }^{8}$ | 28.4 miles | 2.6 miles | 3.2 miles | 2.0 miles |  |  |
|  | HA | 0.25-0.3 | - | x | X | - | Haplargids-Torriorthents portion may be highly susceptible to water erosion; Blackston portion - area reclaim. | A, B, C, D |
|  | Ay | 0.3-0.75 | - | x | - | - | This phase of the Avalon series is highly susceptible to water erosion. | A, B, C, D |

C700AT.SX (PIM) - 5
Table 10. sImmary of poiential soil. reciamation probiem areas (continued)

| Project Component | Map Unit or Soil Association ${ }^{2}$ | Approximate Milepost or Acreage | Indicators of Potential Reclamation Problems |  |  |  | Camments | Potential <br> Mitigation <br> Measures for 7 <br> Consideration |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
|  |  |  | High Wind Erosion Susceptibility ${ }^{3}$ | High Water Erosion Susceptibility ${ }^{4}$ | $\underset{\text { Reclain }}{ }{ }^{\text {Area }}$ | Steep Terrain |  |  |
| Water Supply System (continued) |  |  |  |  |  |  |  |  |
| P3 | FX | 0.75-1.55, 1.7-2.85, 7.0-9.25, 24.9-25.45, 25.7-26.05, 28.15-28.25, 28.28-28.4, 28.6-28.7, 29.45-29.75, 31.55-32.4, 32.65-33.0, 35.95-36.15 | X | - | X | - | Sheppard portion is highly susceptible to wind erosion; Persayo portion - area reclaim. | A, B, C, D |
|  | Sh | 1.55-1.7 | X | - | - | - | This phase of the Shiprock series is highly susceptible to wind erosion. | A, B, D |
|  | DN | 2.85-3.55 | - | X | - | - | Avalon portion is highly susceptible to water erosion. | A, B, C, D |
|  | DS | $\begin{aligned} & 3.55-7.0,12.05-12.8, \\ & 13.15-13.7,16.0-20.9, \\ & 21.15-23.75,23.8-24.9 \\ & 25.45-25.7,26.45-28.15 \\ & 28.7-29.45,29.75-31.55, \\ & 33.3-34.4,34.65-35.95 \\ & 36.45-37.5 \end{aligned}$ | X | - | - | - | Sheppard portion is highly susceptible to wind erosion. | A, B, C, D |
|  | FA | 10.6-10.85 | - | - | X | - | Persayo portion - area reclaim, shallow soils. | , A,B,C,D |
|  | RA | 11.3-11.4 | - | X | - | - | Riverwash is highly susceptible to water erosion. | A |
|  | BA | 13.7-16.0 | - | X | - | X | Badland areas ( $>15 \%$ slope) are highly susceptible to water erosion in trenched areas. This area includes slopes of about 35\% (i.e., would require intensive stabilization measures). | C |
|  | SC | $\begin{aligned} & 37.5-38.3,42.35-43.9 \\ & 44.7-45.1,45.85-48.5 \end{aligned}$ | X | - | - | - | Sheppard portion is highly susceptible to wind erosion; Notal portion is highly susceptible to shrink-swell. | A, B, C, D |
|  |  | $\text { Totals }{ }^{8}$ | 33.97 miles | 3.6 miles 7 | 7.42 miles | 2.3 miles |  |  |

Table 10. SLImerary of potenital soils reciamation probibm areas ${ }^{1}$ (contimued)

| Project Component | Map Unit or Soil Association ${ }^{2}$ | Approximate Milepost or Acreage | Indicators of Potential Reclamation Problens |  |  |  | Corments | Potential <br> Mitigation <br> Measures for <br> Consideration |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
|  |  |  | High Wind Erosion Susceptibility ${ }^{3}$ | High water Erosion Susceptibility ${ }^{4}$ | Area Reclaim | $\begin{aligned} & \text { Steep } 6 \\ & \text { Terrain } \end{aligned}$ |  |  |
| Water Supply System (continued) |  |  |  |  |  |  |  |  |
| Proposed Teminal <br> Storage Reservoir | SC | 35 | X | - | X | - | Sheppard portion is highly susceptible to wind erosion; Muff portion - area reclaim, Notal portion is highly susceptible to shrink-swell. | A, B, C, D |
|  |  | Totals ${ }^{8}$ | 35 acres | 0 | 35 acres | 0 |  |  |
| Teminal Storage Reservoir Alternat | HU | 71 | - | - | x | - | Muff portion - area reclaim. | A, B, C, D |
|  | DN | 4 | - | X | - | - | Avalon portion is highly susceptible to water erosion. | $\mathrm{A}, \mathrm{B}, \mathrm{C}, \mathrm{D}$ |
|  |  | Totals ${ }^{8}$ | 0 | 4 acres | 71 acres | 0 |  |  |
| Transmission Line Corridors |  |  |  |  |  |  |  |  |
| TS | Sheppard therf ano-Notal/ Badland-Rock Outcrop-Monierco | 0.0-5.0 | X | - | - | - | Sheppard portion is highly susceptible to wind erosion; Notal portion is highly susceptible to shrink-swell. | $A, B, C, D$ |
|  |  | Totals ${ }^{8}$ | 5 miles | 0 | 0 | 0 |  |  |
| T2 | Sheppard-Huerfano-Notal | 0.75-17.25, 21.0-32.0 | x | - | - | - | Sheppard portion is highly susceptible to wind erosion; Notal portion is highly susceptible to shrink-swell. | A, B, C, D |
|  | Penistaja-Valent | 35.0-38.5 | x | - | - | - | Moderate to high wind erosion hazard. | A, B, D |
|  | Penistaja-Valent/ <br> Hageman-Travessilla | 38.5-40.0 | x | - | - | - | Moderate to high wind erosion hazard. | A, B, D |
|  | Hagermar-Travess illa | 45.5-46.25, 46.5-49.5 | x | - | - | - | Moderate to high wind erosion hazard. | A, B, D |
|  | Las Lucas-Litle-Persayo | $\begin{aligned} & 49.5-52.0,53.0-57.5, \\ & 83.75-99.5 \end{aligned}$ | - | x | - | - | Las Lucas portion is highly susceptible to water erosion. | A, B, C, D |
|  | Hagerman-Travessilla/ Las Lucas-Litle-Persayo | 52.0-53.0 | x | x | - | - | Low to high wind erosion hazard; las Lucas portion is highly susceptible to water erosion. | A, B, C, D |

C700AT.SX (PNM) - 7
Table 10. stamary of potienital soils reciamation frobiem areas ${ }^{1}$ (contimued)

| Project Component | Map Unit or Soil Association ${ }^{2}$ | Approximate <br> Milepost or Acreage | Indicators of Potential Reclamation Problems |  |  |  | Comments | Potential <br> Mitigation <br> Measures for 7 <br> Consideration |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
|  |  |  | High Wind Erosion Susceptibility ${ }^{3}$ | High Water Erosion Susceptibility | Area Reclaim 5 | Steep 6 Terrain |  |  |
| Transmission Line Corridors (continued) |  |  |  |  |  |  |  |  |
| T2 | Litle-las Lucas | $57.5-63.5,74.75-75.5$ | - | X | - | - | Las Lucas portion is highly susceptible to water erosion. | A, B, C, D |
|  | Christianburg-Navajo/ Litle-las Lucas | 75.5-76.25 | - | X | - | - | Navajo and Las Lucas are highly susceptible to water erosion. | A, B, C, D |
|  | Christianburg-Navajo | 76.25-77.0 | - | X | - | - | Navajo portion is highly susceptible to water erosion. | A, B, C, D |
|  |  | Totals ${ }^{8}$ | 37.3 miles | 32.0 miles | Unknown | 0 |  |  |
| Tl | Sheppard-Huerfano-Notal | 0.5-11.5, 15.5-18.5 | X | - | - | - | Sheppard portion is highly susceptible to wind erosion; Notal portion is highly susceptible to shrink-swell. | A, B, C, D |
|  | Shiprock-Sheppard-Doak | $11.5-15.5,30.0-31.5$ | X | - | - | - | Sheppard portion is highly susceptible to wind erosion. | A, B, D |
|  | Sheppard-Huerfano-Notal/ Persayo-Fruitland-Sheppard | 18.5-19.5 | X | - | - | - | Sheppard portion is highly susceptible to wind erosion. | A, B, C, D |
|  | Persayo-Fruitland-Sheppard | $\begin{aligned} & 19.5-21.0,22.25-22.75, \\ & 23.5-25.5,26.75-29.5 \end{aligned}$ | , X | - | - | - | Sheppard portion is highly susceptible to wind erosion. | A, B, C, D |
|  | Shiprock-Sheppard-Doak/ Persayo-Fruitland-Sheppard | 25.5-26.75, 29.5-30.0 | X | - | - | - | Sheppard portion is highly susceptible to wind erosion. | A, B, C, D |
|  | Penistaja-Valent-Rockland | $34.5-41.0,45.5-50.75$ | X | - | - | - | Moderate to high wind erosion hazard. | A, B, D |
|  | Penistaja-Valent | 50.75-56.5 | X | - | - | - | Moderate to high wind erosion hazard. | A, B, D |
|  | Penistaja-Berent-Sandstone Outcrop | 57.25-64.75 | X | - | - | - | Moderate to high wind erosion hazard. | A, B, D |
|  | Litle-Las Lucas | 64.75-69.75, 79.75-80.5 | 5 | X | - | - | Las Lucas portion is highly susceptible to water erosion. | A, B, C, D |
|  | Christianburg-Navajo | 80.5-81.0 | - | X | - | - | Navajo portion is highly susceptible to water erosion. | A, B, C, D |

Table 10. SUMMARY OF POIENIIAL. SOLLS RECIAMATION PROBLEM AREASI (contimued)

| Project Camponent | Map Unit or Soil Association ${ }^{2}$ | Approximate <br> Milepost <br> or Acreage | Indicators of Potential Reclamation Problens |  |  |  | Caments | Potential <br> Mitigation <br> Measures for <br> Consideration |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
|  |  |  | $\begin{aligned} & \text { High Wind } \\ & \text { Erosion } \\ & \text { Susceptibility } \end{aligned}$ | High hater Erosion Susceptibility ${ }^{4}$ | Area Reclaim | ${ }_{\text {Terrain }} 6$ |  |  |
| Transmission Line Corridors (continued) |  |  |  |  |  |  |  |  |
| T1 | Las Lucas-Litle-Persayo | $\begin{aligned} & 81.0-82.5,85.0-92.0, \\ & 94.0-102.75 \end{aligned}$ | - | X | - | - | Las Lucas portion is highly susceptible to water erosion. | A, B, C, D |
|  | Madurez-Caliza-Wink | 102.75-108.0 | x | - | - | - | Moderate to high wind erosion hazard. | A, B, D |
|  |  | Totals ${ }^{8}$ | 56.6 miles | 23.5 miles | Unknown | 0 |  |  |
| 73 | Sheppard-Huerfano-Notal | $\begin{aligned} & 0.75-1.25,3.5-5.5, \\ & 6.0-17.25 \end{aligned}$ | X | - | - | - | Sheppard portion is highly susceptible to water erosion; Notal portion is highly susceptible to shrink-swell. | A, B, C, D |
|  | Sheppard-Hwerfano-Notal/ Shiprock-Sheppard-Doak | 1.25-3.5 | x | - | - | - | Sheppard portion is highly susceptible to water erosion. | A, B, C, D |
|  | Persayo-Billings | $\begin{aligned} & 17.25-19.0,24.0-25.75 \\ & 27.25-28.0,32.0-32.5 \end{aligned}$ | - | X | - | - | Billings portion is highly susceptible to water erosion. | A, B, C, D |
|  | Hageman-Travessilla | 30.0-32.0, 32.5-61.5 | x | - | - | - | Moderate to high wind erosion hazard. | A, B, D |
|  | Litle-Las Lucas | 79.75-80.5 | - | x | - | - | Las Lucas portion is highly susceptible to water erosion. | A, B, C, D |
|  | Christianburg-Navajo/ Litle-Las Lucas | 80.5-81.25 | - | x | - | - | Navajo and Las Lucas are highly susceptible to water erosion. | A, B, C, D |
|  | Christianturg-Navajo | 81.25-82.0 | - | x | - | - | Navajo portion is highly susceptible to water erosion. | A, B, C, D |
|  | Las Lucas-Litle-Persayo | 88.75-104.5 | - | X | - | - | las Lucas portion is highly susceptible to water erosion. | A, B, C, D |
|  |  | Totals ${ }^{8}$ | 47.0 miles | 22.75 miles | Unknown | 0 |  |  |
| T4 | Sheppard-Huerfano-Notal | $\begin{aligned} & 0.0-4.5,6.25-8.0, \\ & 14.5-20.25 \end{aligned}$ | x | - | - | - | Sheppard portion is highly susceptible to wind erosion; Notal portion is highly susceptible to shrink-swell. | A, B, C, D |
|  | Shiprock-Sheppard-Doak | 5.25-6.0 | X | - | - | - | Sheppard portion is highly susceptible to wind erosion. | A, B, D |

Table 10. SUPMARY of rotential soins reciamation probizm areas ${ }^{1}$ (concluded)

| Project Component | Map Unit ar Soil Association ${ }^{2}$ | Approximate <br> Milepost <br> or Acreage | Indicators of Potential Reclamation Problems |  |  |  | Comments | Potential Mitigation Measures for, 7 Consideration |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
|  |  |  | High Wind Erosion sceptibility | High Water Erosion Susceptibility ${ }^{4}$ | Area 5 Reclaim | Steep 6 Terrain |  |  |
| Transmission Line Corridors (continued) |  |  |  |  |  |  |  |  |
| T4 | Rock Land-Bil lings/ Chipeta-Sheppard-Shiprock | 20.25-25.0 | X | X | - | - | Sheppard portion is highly susceptible to wind erosion; Billings and Chipeta are highly susceptible to water erosion. | A, B, C, D |
|  | Rock Land-Billings | 25.0-27.5 | - | X | - | - | Billings portion is highly susceptible to water erosion. | A, B, C, D |
|  | Hagerman-Travessilla | $\begin{aligned} & 27.5-33.5,34.0-60.0, \\ & 72.0-72.5 \end{aligned}$ | X | - | - | - | Moderate to high wind erosion hazard. | A, B, D |
|  | Las Lucas-Litle-Persayo | $\begin{aligned} & 68.5-68.75,75.5-76.0, \\ & 79.5-80.5,102.25-103.75 \\ & 104.0-105.5,120.25-122.25 \end{aligned}$ | 5 | X | - | - | Las Lucas portion is highly susceptible to water erosion. | A, B, C, D |
|  | Rock Land-Thumderbird | $\begin{aligned} & 76.0-77.5,78.0-81.0 \\ & 94.25-96.0,98.25-100.75 \end{aligned}$ | - | - | - | x | Sloping areas ( $>15 \%$ slope) may be highly susceptible to water erosion where graded and/or bladed. Thunderbind portion - moderate to high shrink-swell potential. | A, B, C, D |
|  | Christianburg-Navajo | $\begin{aligned} & 108.5-115.0,117.25-118.25 \\ & 118.5-120.25 \end{aligned}$ | $25, \quad-$ | X | - | - | Navajo portion is highly susceptible to water erosion. | A, B, C, D |
|  |  | Total ${ }^{8}$ | 50.0 miles | 23.25 miles | Unknown | 8.75 miles |  |  |

${ }^{1}$ Typically more than one soil series or association is present for a specific area along the linear project components. Since it is not known what specific soil series would be traversed in many areas, a conservative approach was used in coupiling this table. Undesirable soil characteristics are listed for whole soil associations, but the problem soil usually constitutes only a fraction of the whole association. It is very probable that many of the potential reclanation problems listed would not be encountered, because the problem soils would not be tion problem areas).
${ }^{2}$ Sources: Refer to Tables 1 through 9 in this tectmical report.
$3_{\text {Based on WEG }}$ classes where: Classes $5-8=1 \mathrm{ww}, 3-4 \mathrm{~L}=$ moderate, and $1-2=$ high.
${ }^{4}$ Based on K factor values where: $<.2=$ low, $.2-.39=$ moderate, and $\geq .4=$ high.
${ }^{5}$ Areas that are difficult to reclaim if soil is removed for construction or other purposes. Source: applicable SCS Form 5-Soil Interpretation Tables. Most of the soils data that are be considered as a potential mitigation measure for graded/bladed areas along transnission line RoWs.
${ }^{6}$ Source: USGS topographic maps ( $1: 24,000 ; 1: 62,500 ;$ and $1: 250,000$ scales). Criteria: $>15 \%$ slope.
${ }^{7} A=$ Mulch denuded areas or consider covering with jute fabric (primarily on dume areas) or riprap (drainages). $B=$ Topsoiling. $C=$ hater diversions (e.g., water bars). $D=$ Reseeding. ${ }^{8}$ Areas with multiple problens are listed and counted under each applicable potential problem (i.e., some areas counted more than once).
${ }^{9}$ Mileposts 5.5-13.0 and 15.5-18.0 of alternative main water pipeline P2 are developed portions of Block 4 - Navajo Indian Irrigation Project (NIP). The listed indicators of potential reclamation problens may not apply to these areas, because intensive corrective measures have been applied to these areas (e.g., addition of fertilizer, gypsum, sulphur, etc.). If

the disturbed rights-of-way (ROW) should recover within three to five years (i.e., the native grass cover would be reestablished). The soils data in the Affected Environment section (including Table 2) of this background report indicate that some areas would be difficult to reclaim due to adverse physical and chemical soil properties such as: undesirable surface textures, poor topsoil, high wind erosion susceptibility, excess salts, and alkalinity. In addition, the low precipitation in this area could inhibit the success of reclamation efforts. In some areas it may be necessary to reseed several times, and special erosion control practices might be needed to stabilize soils (e.g., in sandy or dune-type areas) prior to successful revegetation. Water bars and possible other water diversion techniques would be used on sloping areas to reduce water erosion and help maintain soil stability. Selection of seed species specifically adapted to local soils (and climates), as well as timing and methods of reseeding, are essential prerequisites for successful revegetation on problem soil areas.

Excess salts and alkalinity problems could increase in some areas if trenched materials, which in some cases (e.g., shale) are more toxic than the overlying topsoils, were mixed with the topsoil or placed on the surface.

The sandy soils that occur intermittently from MP 2.0 to the end of the proposed main water pipeline route (P1) are of special concern due to their high susceptibility to wind-induced soil erosion. Intensive mitigation measures may be required to stabilize the ROW in these areas and successful revegetation may be difficult to accomplish. Special construction methods in dune areas should include burying the pipeline deeply and minimizing vegetation disturbance.

Badland (nonstony, barren shale) areas are traversed by this proposed water pipeline route (refer to Table 2), and these areas are
virtually impossible to vegetate. In sloping Badland areas, water bars should be used to keep water from moving down and eroding materials out of the trench. Shrink-swell problems may be encountered in these Badland areas.

The Proposed Action calls for a second main water pipeline to be layed within the same ROW as the first pipeline, approximately five years after the first pipeline is laid. This would cause the same ROW to be disturbed again, just about the time it had recovered from the first disturbance. Conversations with local BLM personnel (Spears 1982) indicate that the ROW should be able to recover again, as long as it is reseeded again. Revegetation success would probably be lower after the second disturbance.

Mileposts for potential soils reclamation problem areas along this pipeline route are listed in Table 10 by map unit or soil association and the specific indicators of potential reclamation problems. Table 10 also lists potential mitigation measures which would increase reclamation success in these areas.

The proposed main water pipeline Pl (including intermediate pump stations 2 and 3) traverses Blocks 6, 7, 9, 11, and 10 of NIIP, all of which are currently undeveloped. Congress has cut off funding for NIIP, thus it is not known if (or when) the aforementioned undeveloped blocks will be developed. Mileposts of the areas determined to be irrigable within these undeveloped NIIP blocks are listed in the Affected Environment section. If proposed main water pipeline P1 were ultimately selected and these NIIP blocks were developed prior to construction of Pl , special construction and reclamation measures should be used in these areas. Special measures for maintaining productivity should include laying both pipes (initial and second pipeline) simultaneously and topsoiling. Assuming P1 was ultimately
the NIIP project should be reevaluated prior to construction. If NIIP funding had been restored and the aforementioned NIIP blocks were to be eventually developed, special construction and reclamation measures should be taken. Special construction and reclamation measures for these areas should include laying both pipes simultaneously, topsoiling, and reseeding, so that the potential productivity of these areas is not significantly reduced.

A monitoring program would be conducted over the life of the pipeline and would include visual identification of problem soil erosion areas and other areas not responding adequately to the revegetation program. Once identified, problem soil areas would undergo more intensive reclamation and mitigation in order to help ensure soil stability, structural integrity of the pipeline, renewed forage/crop production, and an aesthetically acceptable condition. The monitoring program would be conducted by BLM personnel or a reclamation specialist approved by the BLM. Identification of problem areas would also be conducted by the applicant during routine aerial patrols.

Indirect impacts to the soils resource could occur if construction of the pipeline ROW allows some previously inaccessible areas to be accessible to ORVs. The degree and areal extent of such disturbances are unknown, but would probably be limited to about 5 miles on either side of the ROW. Since this pipeline route generally follows State Highway 371, it would not provide very much new access to ORVs. General impacts to the soils resource which would result from increased ORV use are: soil compaction, reduced infiltration capacity, reduced vegetative cover, and increased erosion susceptibility. An effort should be made to limit ORV access along the pipeline ROW to reduce potential impacts to the ROW as well as surrounding areas.

Main Water Pipeline Alternative P2. Construction of main water pipeline alternative P2 (including intake pumping plant and intermediate pump stations) would directly disturb approximately 508 acres of soils and topography. Construction of staging and work areas at pump station sites and stream, road, and canal crossings would cause a small amount of additional disturbance.

The soils data presented in the Affected Environment section (including Table 3) of this background report indicate that the same impacts and reclamation problems discussed for the proposed main water pipeline route (Pl) would be encountered along this route. Some of the sandy soils that occur intermittently over the entire length of this route are also highly susceptible to wind-induced soil erosion. This alternative route also traverses Badland areas (refer to Table 3).

Mileposts for potential soils reclamation problem areas (and associated mitigation measures for consideration) along this alternative water pipeline route are presented in Table 10.

Main water pipeline alternative P 2 traverses developed portions of NIIP-Block 4 (MP 5.5-13 and 15.5-18). Intensive corrective measures (addition of fertilizer, gypsum, sulphur, etc.) have been applied to these areas in order to increase their productivity. If this alternative pipeline was ultimately selected, special construction and reclamation measures should be used in these areas. Special measures for maintaining productivity in these areas should include laying both pipes simultaneously and topsoiling. This alternative pipeline route also traverses undeveloped portions of NIIP-Block 11. These undeveloped portions (refer to Affected Environment section for applicable pipeline mileposts) have been determined to be irrigable. Congress has cut off funding for NIIP,
and it is not known if (or when) Block 11 will ever be developed. Refer to the proposed main water pipeline (P1) for a discussion of special construction and reclamation measures which could apply to P2 under two different potential NIIP development scenarios.

If this alternative main water pipeline route were ultimately selected, a second pipeline would be laid within the same ROW within five years after the initial pipeline was layed. The monitoring program discussed for the proposed main water pipeline (P1) applies to this alternative route as well.

Potential indirect impacts to the soils resource from increased ORV access are the same as discussed for proposed main water pipeline (P1).

Main Water Pipeline Alternative P3. Construction of main water pipeline alternative P3 (including intake pumping plant and intermediate pump stations) would disturb approximately 574 acres of soils and topography. A small amount of additional disturbance would occur during construction of staging and work areas at pump station sites and stream and road crossings.

The soils data presented in the Affected Environment section (including Table 4) of this background report indicate that the same impacts and reclamation problems discussed for the proposed main water pipeline route (P1) would be encountered along this route. Many of the sandy soils that recur over the entire length of this alternative pipeline route are highly susceptible to wind-induced soil erosion. This alternative route traverses approximately the same amount of Badland areas as the proposed route (P1) and (P2) alternative route, but the areas of steeper terrain near the southern end of the Kutz Canyon (approximately 35 percent slope) would require more intensive mitıgation to stabilize.

Mileposts for potential soils reclamation problem areas (and associated mitigation measures for consideration) along this alternative water pipeline route are presented in Table 10.

If this alternative main water pipeline were ultimately selected, a second pipeline would be layed within the same ROW with five years after the initial pipeline was layed. The monitoring program discussed for the proposed main water pipeline (Pl) applies to this alternative route as well.

Potential indirect impacts to the soils resource from increased ORV access are the same as discussed for proposed main water pipeline (P1).

## Proposed Terminal Storage Reservoir (R1). Construction and

 operation of the proposed terminal storage reservoir would take approximately 145 acres of soils out of production for the life of the project. Approximately 1.5 million cubic yards of material would be needed to construct an embankment (or dike) around 70 percent of the reservoir perimeter. Materials for construction of the embankment would be obtained from the reservoir area to the maximum practical extent, but the available soils data indicate that a significant volume of materials would have to be obtained from borrow areas outside the reservoir area. Over 50 percent of the proposed reservoir site is Badland (nonstony, barren shale), which can provide little if any materials suitable for embankment construction. The applicant's proposed erosion control and reclamation procedures for the reservoir and potential borrow areas are presented in Chapter 1 of the DEIS.Acreages of potential soils reclamation problem areas (and associated mitigation measures for consideration) at this proposed reservoir site are presented in Table 10. The applicant's Proposed Action includes these measures.

Terminal Storage Reservoir Alternative (R2). Construction and operation of the terminal storage reservoir alternative would take approximately 75 acres of soils out of production for the life of the project. Although the alternate reservoir site does not contain any Badland, the available soils data indicate that a large volume of borrow materials would be needed to construct an embankment for this reservoir as well. Additionally, the Muff soil ( 95 percent of site) is difficult to reclaim.


#### Abstract

Acreages of potential sites reclamation problem areas (and associated mitigation measures for consideration) at this alternative reservoir site are presented in Table 10. The applicant's Proposed Action includes these measures.


## Transmission Lines

Proposed FC-A-P 500-kV Transmission Line Loop (T5). Construction of the proposed FC-A-P loop would directly disturb a maximum of 194 acres (not including portions within the boundary of NMGS) of soils and topography. Soil surface disturbance, excavation (tower sites), and grading, blading, trampling, and removal of vegetative cover would increase present soil erosion rates and soil instability. These increases would continue until denuded areas were revegetated. Grading and clearing of vegetation would be performed only where necessary for equipment access or safety considerations. The major disturbance to the soils resource associated with construction of the transmission lines would result from the blading required for construction of the temporary construction access roads ( 14 feet wide) along the ROW. Access roads would be closed to public travel and restoration measures would be applied after construction was completed. All graded or bladed areas would be reseeded, and erosion control measures would be applied where necessary. Most of the
construction ROW would not be cleared of vegetation, graded, or bladed; thus impacts to the soils resource would generally be minor and short-term. The soils data presented in the Affected Environment section (including MP 0.0-5.0 of Table 9) of this background report indicate that some bladed/graded areas would be difficult to reclaim. The types of reclamation problems that would be encountered on graded/bladed areas are generally the same as those discussed for the proposed main water pipeline (Pl).

Mileposts for potential soils reclamation problem areas along this proposed transmission line are presented in Table 10. Table 10 also lists potential mitigation measures which, if implemented, would increase reclamation success. The applicant's Proposed Action includes many of these measures. Assuming that the measures would be moderately successful, most of these areas would recover within 3-5 years. Reclamation success on deeply graded/bladed areas could be enhanced by stockpiling topsoil on the side of construction access roads and replacing it during the restoration phase. The monitoring program discussed for the proposed main water pipeline (Pl) should also apply to this transmission line.

Potential indirect impacts to the soils resource from increased ORV access are the same as discussed for the proposed main water pipeline (Pl). The applicant's Proposed Action states that transmission line access roads would be closed to public travel. If access roads were effectively closed, indirect impacts from ORVs would not occur.

First Proposed Transmission Corridor (T2). Construction of the first proposed transmission line would directly disturb a maximum of 2594 acres (including construction access roads, Rio Puerco Station, and other associated facilities) of soils and topography. As with the
proposed FC-A-P loop, soil surface disturbance, excavation (tower sites), and grading, blading, trampling, and removal of vegetative cover would increase present soil erosion rates and soil instability. These increases would continue until denuded areas were revegetated. Blading required for construction of temporary access roads would constitute the major soils disturbance associated with construction of this transmission line. Clearing of vegetation, grading, and blading would be performed on a relatively small portion of the ROW, thus impacts to the soils resource would generally be minor and shortterm. Table 6 of this background report indicates that some bladed/graded areas would be difficult to reclaim. Potential reclamation problems (refer to Table 10), the applicant's proposed corrective measures, and anticipated recovery period are generally the same as discussed (or alluded to) for the proposed FC-A-P loop (T5). The monitoring program discussed for the proposed main water pipeline (P1) should also apply to this transmission line.

Potential indirect impacts to the soils resource from increased ORV access are the same are discussed for the proposed transmission line loop (T5).

Second Proposed Transmission Corridor (T1). A maximum of 2595 acres (including construction access roads, Rio Puerco Station, and other associated facilities) of soils and topography would be directly disturbed during construction of this alternative. Expected types and causes of direct and indirect soils impacts, potential reclamation problems (refer to Table 10) the applicant's proposed corrective measures, and anticipated recovery period are generally the same as discussed (or alluded to) for the proposed FC-A-P loop (T5). The monitoring program discussed for the proposed main water pipeline (P1) should also apply to this transmission line.

Transmission Corridor Alternative T3. Construction of the transmission line alternative T 3 would directly disturb a maximum of 2545 acres (including construction access roads, Rio Puerco Station, and other associated facilities) of soils and topography. Refer to the proposed FC-A-P loop (T5) discussion for expected types and causes of direct and indirect soils impacts, potential reclamation problems (refer to Table 10) the applicant's proposed corrective measures, and anticipated recovery period. The monitoring program discussed for the proposed main water pipeline (P1) should also apply to this transmission line alternative.

Transmission Corridor Alternative T4. A maximum of 3054 acres (including construction access roads, Rio Puerco Station, and other associated facilities) of soils and topography would be disturbed during construction of this alternative transmission line. Expected types and causes of direct and indirect soils impacts, potential reclamation problems (refer to Table 10) the applicant's proposed corrective measures, and anticipated recovery period are generally the same as discussed for the proposed FC-A-P loop (T5). This transmission corridor traverses areas of steeper terrain than the other corridor alternatives. The primary areas of concern are in southeastern McKinley County (between Canon de Marquez and Canon de Pedro Padilla [MP 94-96]), and in northeastern Cibola County (La Mesa del Canon Seco area [MP 98-101]). Terrain restrictions in these areas might necessitate placing a new transmission line directly adjacent to the existing transmission line that runs through these areas. The soil associations (Rock Land-Thunderbird and Little-ClovisTravessilla) in these steep areas are shallow to moderately deep (includes rock outcrops), and erosion susceptibility is low to moderate. If this alternative were ultimately selected, special care during construction and reclamation phases should be taken to protect the existing soils resource in the aforementioned steep areas. The monitoring program discussed for the proposed main water pipeline (Pl) should also apply to this transmission line.

## PRIME AND UNIQUE FARMLANDS


#### Abstract

The surface facilities associated with the Proposed Action and alternatives would not be located on Prime or Unique Farmlands, thus no long-term crop production losses on Prime or Unique Farmlands would occur. The intake/pumping plant associated with the proposed main water pipeline (P1) would take approximately 35 acres of potential (not irrigated and not used as cropland) Prime Farmland out of production for the life of the project. Proposed main water pipeline (P1) intermediate pumping stations 2 and 3 would preclude development of 2 acres of potential Statewide/Locally Important Farmland in Block 9 of NIIP. These potential impacts are not considered significant.


SPECIFIC MITIGATION MEASURES GENERATED BY THE IMPACT ASSESSMENT

Table 10 lists specific mitigation measures for consideration, as generated by the impact assessment. Mitigation measures for consideration are listed by project component, map unit of soil association, and mileposts (linear project components) or acreages. The types of mitigation measures proposed for consideration are: (1) mulching denuded areas or covering with jute fabric or riprap; (2) topsoiling; (3) water diversions; and (4) reseeding. These measures are listed (as applicable) for potential soils reclamation problem areas, where potentially significant impacts to the soils resource may occur if erosion control and reclamation measures are not implemented. The determination of potential soils reclamation problem areas was based on the following factors: (1) soils with high wind or water erosion susceptibility; (2) soils which are known to be difficult to reclaim; and (3) areas of steep terrain.

The available soils data which were used are not necessarily adequate to accurately predict all potential reclamation problem areas. Additionally, some of the areas listed in Table 10 would probably not be difficult to reclaim (i.e., determination based on available soils data and conservative approach).

In summary, Table 10 and the other soils data in this technical report should be used as a reference guide. BLM reclamation specialists will make an on-the-ground determination of appropriate

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erosion control and reclamation measures to be stipulated, prior to issuance of the ROW grant. In addition, BLM reclamation specialists will formulate a soils monitoring program for sensitive soils area.

Unavoidable adverse impacts to the soils resource resulting from construction of the Proposed Action or alternatives would include: (1) increases in soil erosion and soil instability on disturbed areas; and (2) decreases in short-term soil productivity. If a moderately intensive erosion control and reclamation program (including monitoring) were implemented following construction, increases in soil erosion and instability would generally be short-term impacts (e.g., 3-5 years).

RELATIONSHIPS BETWEEN THE SHORT-TERM USE OF THE AFFECTED ENVIRONMENT AND THE ENHANCEMENT OF LONG-TERM PRODUCTIVITY

Assuming the erosion control and reclamation measures implemented following construction on temporarily disturbed areas were moderately successful, impacts to the soils resource should not result in significant long-term productivity losses. Construction and operation of the surface facilities associated with the proposed project would result in long-term productivity losses at these locations.

IRREVERSIBLE AND IRRETRIEVABLE COMMITMENTS OF RESOURCES

Short-term increases in soil erosion due to construction of the proposed project would not cause temporarily disturbed areas to be irreversibly converted to other uses, and the viability of these areas should not be significantly diminished. The BLM monitoring program that would be conducted over the life of the project would include identification of problem soil erosion areas. Once identified, problem soil erosion areas would undergo more intensive reclamation and mitigation, thereby helping to ensure that irreversible and irretrievable commitments of the soils resource would not occur. Surface facility sites would be reclaimed upon project termination; thus these areas would not be permanently or irreversibly committed to other uses.

A comparison of the mitigation/reclamation potential for the main water pipeline alternatives is contained in Table 11. This comparison provides the primary basis for ranking the main water pipeline alteratives in the following order of preference: Pl--first; P2--second; and P3--third. Main water pipeline route P1 is also preferred over P2 because it would cause less disturbance ( 474 acres versus 508 acres during construction, including river intake and intermediate pump stations); Pl has better access for construction/maintenance (e.g., State Highway 371); and P1 would probably not impact any developed NIIP blocks. Main water pipeline route $P 3$ is ranked last because it would cause the most disturbance during construction ( 547 acres); and it traverses the most miles of steep terrain, area reclaim soils, and soils which are highly susceptible to wind and water erosion.

Table 11 also provides the primary basis for ranking the terminal storage reservoir alternatives in the following order of preference: proposed-first; alternative--second. The alternative reservoir site would be more difficult to reclaim ( 95 percent area reclaim soils), and it is located on an upland drainage sideslope which is undesirable from an erosion/reclamation standpoint.

The information in Table 11 also provides the primary basis for ranking the transmission line corridor route alternatives in the
Table 11. COMPARISON OF RECLAMATION POTENTIAL FOR ALTERNATIVES

| Criteria for Comparison | Main Water Pipeline Route Alternatives |  |  | Terminal <br> Storage Reservoirs |  | Transmission Line Corridor Alternatives |  |  |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
|  | P-1 | P-2 | P-3 | Proposed | Alternate | T-1 | T-2 | T-3 | T-4 |
| High susceptibility to wind-induced soil erosio | 31.7 mi | 28.4 mi | 34 mi | 35 ac . | -- | 56.6 mi | 37.3 mi | 47 mi | 50 mi |
| High susceptibility to water-induced soil erosi | 1.6 mi | 2.6 mi | 3.6 mi | -- | 4 ac . | 23.5 mi | 32 mi | 22.8 mi | 23.3 mi |
| Steep terrain ${ }^{\text {c }}$ | 1.4 mi | 2 mi | 2.3 mi | -- | -- | -- | -- | -- | 8.8 mi |
| Area reclaim ${ }^{\text {d }}$ | 4.4 mi | 3.2 mi | 7.4 mi | 35 ac. | 71 ac . | -- | -- | -- | -- |
| Potential for mitigation and successful reclamati | $\bmod$ | $\bmod$ | 1ow-mod | mod | 1ow | mod-high | mod-high | mod-high | low-mod |
| ${ }^{\text {a }}$ Based on WEG classes where: Classes $5-8=10 w ; 3-4 \mathrm{~L}=$ moderate; and $1-2=$ high. |  |  |  |  |  |  |  |  |  |
| $\mathrm{b}_{\text {Based }}$ on K factor values where: $<.2=10 w ; .2-.39=$ moderate; and $\geq .4=\mathrm{high}$. |  |  |  |  |  |  |  |  |  |
| ${ }^{\text {c }}$ Areas with terrain slope greater than 15 percent. |  |  |  |  |  |  |  |  |  |
| ${ }^{d}$ Area reclaim is an indicator of areas which would be difficult to reclaim. Transmission line corr are too general to use for identifying these areas. |  |  |  |  |  |  |  |  |  |
| ${ }^{\text {e }}$ Principle items considered in determination include relative topsoil suitability, terrain ruggedne success of standard BLM erosion control measures, and potential for successful revegetation. |  |  |  |  |  |  |  |  |  |

following order of preference: T3--first; T2/T1--second; and T4--third. Transmission line corridor alternative $T 3$ would cause the least amount of disturbance during construction ( 2545 acres), while T2 and T1 would cause about the same amount ( 2594 and 2595 acres, respectively). Transmission corridor alternative T4 would cause the most disturbance during construction (3054 acres), and it would traverse about 9 miles of steep terrain (i.e., potential reclamation problems).

## AFFECTED ENVIRONMENT

## SOILS

The possible new town site is within the San Juan River Valley Mesas and Plateaus portion of the Western Range and Irrigated Region (SCS 1978a). Annual precipitation at the site generally ranges from 6 to 10 inches. Two different soil associations were identified at the site. Table 1 lists and characterizes the identified soils. A map ( $1: 250,000$ scale) showing the soils identified at the possible new town site is available for review at the BLM New Mexico State Office in Santa Fe .

The soils identified at the possible new town site are shallow to deep, but are primarily deep. The surface textures of the soils identified at the site range from loamy fine sand to silty clay loam. These soils are well to somewhat excessively drained. The identified soils are forming in eolian, alluvial, and residual materials derived primarily from sandstone, shale, and siltstone. These soils are forming primarily on gently to strongly sloping mesas, plateaus, intermittent drainageways, terraces, and fans. Topsoil availability at the possible new town site is good, but the topsoil quality is primarily fair to poor. Susceptibility of these soils to wind-induced erosion is moderate to high, and susceptibility to water-induced soil erosion is low to moderate. The identified soils are mildly to strongly alkaline, and shrink-swell potential ranges from low to high.
Table 1. characteristics of the soils dentified at the possibie new town stte

${ }^{1}$ Source: U.S. Soil Conservation Service (SCS). 1979. General soil map, San Juan County, New Mexico, eastern part. Soil survey of San Juan County, New Mexico, eastern part.

These soils are currently used primarily for livestock grazing and wildife habitat.

## PRIME AND UNIQUE FARMLANDS

Since the possible new town could potentially take agricultural land out of production permanently, the new town site was evaluated to determine whether it includes any Prime or Unique Farmland. The soil types (DS, BT, SC, and FX) present at the possible new town site do not qualify as Prime Farmland (SCS 1978 b and 1980). Additionally, the site contains no Unique or Statewide/Locally Important Farmlands.

SOILS

Construction of the possible new town would directly disturb approximately 2400 acres of soils and topography, significantly affecting the existing soils. The entire possible new town site would probably be permanently changed from its preconstruction use (grazing and wildlife habitat) to an urban development.

Construction of utilities (e.g., water, gas, electrical power) and roads necessary for the possible new town would disturb an unknown amount of soils and topography. Additionally, an unknown amount of land in the vicinity of the possible new town could be adversely impacted by recreational pursuits (e.g., ORV use) of new town residents.

PRIME FARMLAND

Construction of the possible new town would not impact any Prime, Unique, or Statewide/Locally Important Farmlands.

Alluvium-Materials such as sand, silt, or clay, deposited on land by streams.

Area reclaim-An area which is difficult to reclaim if soil is removed for construction or other purposes. Revegetation and erosion control are extremely difficult.

Calcareous soil--Soil containing enough calcium carbonate (commonly combined with magnesium carbonate) to effervesce visibly when treated with cold, dilute hydrochloric acid.

Clay-As a soil separate, the mineral soil particles less than 0.002 millimeter in diameter. As a soil textural class, soil material that is 40 percent or more clay, less than 45 percent sand, and less than 40 percent silt.

Drainage class (natural)--Refers to the frequency and duration of periods of saturation or partial saturation during soil formation, as opposed to altered drainage, which is commonly a result of artificial drainage or irrigation but may be caused by the sudden deepening of channels or the blocking of drainage outlets. Seven classes of natural soil drainage are recognized:

- Excessively drained--Water is removed from the soil very rapidly. Excessively drained soils are commonly very coarse textured, rocky, or shallow. Some are steep. All are free of the mottling related to wetness.
- Somewhat excessively drained-- Water is removed from the soil rapidly. Many somewhat excessively drained soils are sandy and rapidly pervious. Some are shallow. Some are so steep that much of the water they receive is lost as runoff. All are free of the mottling related to wetness.
- Well drained--Water is removed from the soil readily, but not rapidly. It is available to plants throughout most of the growing season, and wetness does not inhibit growth of roots for significant periods during most growing seasons. Well-drained soils are commonly medium textured. They are mainly free of mottling.
- Moderately well drained--Water is removed from the soil somewhat slowly during some periods. Moderately welldrained soils are wet for only a short time during the growing season, but periodically for long enough that most mesophytic crops are affected. They commonly have a slowly pervious layer within or directly below the solum, or periodically receive high rainfall, or both.
- Somewhat poorly drained--Water is removed slowly enough that the soil is wet for significant periods during the growing season. Wetness markedly restricts the growth of mesophytic crops unless artificial drainage is provided. Somewhat poorly drained soils commonly have a slowly pervious layer, a high water table, additional water from
seepage, nearly continuous rainfall, or a combination of these.
- Poorly drained--Water is removed so slowly that the soil is saturated periodically during the growing season or remains wet for long periods. Free water is commonly at or near the surface for long enough during the growing season that most mesophytic crops cannot be grown unless the soil is artificially drained. The soil is not continuously saturated in layers directly below plow depth. Poor drainage results from a high water table, a slowly pervious layer within the profile, seepage, nearly continuous rainfall, or a combination of these.
- Very poorly drained--Water is removed from the soil so slowly that free water remains at or on the surface during most of the growing season. Unless the soil is artificially drained, most mesophytic crops cannot be grown. Very poorly drained soils are commonly level or depressed and are frequently ponded. Yet, where rainfall is high and nearly continuous, they can have moderate or high slope gradients.

Eolian soil material--Earthy parent material accumulated through wind action; commonly refers to sandy material in dunes or to loess in blankets on the surface.

Excess salts--Excess water-soluble salts in the soil that restrict the growth of most plants.

## Farmlands:

Prime--Land that has the best combination of physical and chemical characteristics for producing food, feed, forage, fiber, and
oilseed crops, and is also available for these uses (e.g., not urban built-up land). Numerous specific SCS criteria must be met for a soil to qualify as potential Prime Farmland. For a soil to qualify as Prime Farmland (in the NMGS project area in New Mexico) it must meet the specific criteria and be irrigated.

Unique--Land other than Prime Farmland that is used for the production of specific high value food and fiber crops. It has the special combination of soil quality, location, growing season, and moisture supply needed to economically produce sustained high quality and/or high yields of a specific crop when treated and managed according to acceptable farming methods.

Statewide/Locally Important--All irrigated cropland in New Mexico is considered to be Statewide/Locally Important.

Hydrologic soil groups-Refers to soils grouped according to their runoff-producing characteristics. The primary consideration is the inherent capacity of soil denuded of vegetation to permit infiltration. The slope and the kind of plant cover are not considered. Soils are assigned to four groups (A through D). In group A are soils having a high infiltration rate when thoroughly wet and having a low runoff potential. They are mainly deep, well drained, and sandy or gravelly. In group D, at the other extreme, are soils having a very slow infiltration rate and thus a high runoff potential. They have a claypan or clay layer at or near the surface, have a permanent high water table, or are shallow over nearly impervious bedrock or other material.

Loam--Soil material that is 7 to 27 percent clay particles, 28 to 50 percent silt particles, and less than 52 percent sand particles.

Permeability--The quality that enables the soil to transmit water or air, measured as the number of inches per hour that water moves downward through the saturated soil. Terms describing permeability are:

| Very slow | $<0.06$ inch/hour |
| :--- | :--- |
| Slow | 0.06 to 0.20 inch/hour |
| Moderately slow | 0.20 to 0.60 inch/hour |
| Moderate | 0.6 to 2.0 inches/hour |
| Moderately rapid | 2.0 to 6.0 inches/hour |
| Rapid | 6.0 to 20.0 inches/hour |
| Very rapid | 20.0 inches/hour |

Reaction, soil--A measure of acidity or alkalinity of a soil, expressed in pH values. A soil that tests to pH 7.0 is described as precisely neutral in reaction. The degree of acidity or alkalinity is expressed as:

| Extremely acidic | $<\mathrm{pH} 4.5$ |  |
| :--- | ---: | :--- |
| Very strongly acidic | pH 4.5 to 5.0 |  |
| Strongly acidic | pH 5.1 to 5.5 |  |
| Moderately acidic | pH 5.6 to 6.0 |  |
| Slightly acidic | pH 6.1 to 6.5 |  |
| Neutral | pH 6.6 to 7.3 |  |
| Mildly alkaline | pH 7.4 to 7.8 |  |
| Moderately alkaline | pH 7.9 to 8.4 |  |
| Strongly alkaline | pH 8.5 to 9.0 |  |
| Very strongly alkaline | $\geq \mathrm{pH} 9.1$ |  |

Residuum (residual soil material)--Unconsolidated, weathered, or partly weathered mineral material that accumulated as consolidated rock disintegrated in place.

Saline soil--A soil containing soluble salts in an amount that impairs growth of plants. A saline soil does not contain excess exchangeable sodium. Salinity ratings are based on the electrical conductivity of a saturated extract, as expressed in millimhos per centimeter (mmos $/ \mathrm{cm}$ ) at $25^{\circ} \mathrm{C}$. The degree of salinity is expressed as:

| None | $<2.0 \mathrm{mmhos} / \mathrm{cm}$ |
| :--- | :--- |
| Low | 2.0 to 4.0 mmhos $/ \mathrm{cm}$ |
| Moderate | 4.0 to 8.0 mmhos $/ \mathrm{cm}$ |
| High | 8.0 to 16.0 mmhos $/ \mathrm{cm}$ |
| Very high | $>16.0 \mathrm{mmhos} / \mathrm{cm}$ |

Sand--As a soil separate, individual rock or mineral fragments from 0.05 millimeter to 2.0 millimeters in diameter. Most sand grains consist of quartz. As a soil textural class, a soil that is 85 percent or more sand and not more than 10 percent clay.

Sandstone--Sedimentary rock containing dominantly sand-sized particles.

Shale--Sedimentary rock formed by the hardening of a clay deposit.

Shrink-swell potential--The potential of a given soil to shrink when dry and swell when wet. Shrink-swell is associated with clay soils. Shrinking and swelling can damage roads, dams, buildings, foundations, and other structures. It can also damage plant roots.

Silt--As a soil separate, individual mineral particles that range in diameter from the upper limit of clay ( 0.002 millimeter) to the lower limit of very fine sand ( 0.05 millimeter). As a soil
textural class, soil that is 80 percent or more silt and less than 12 percent clay.

Siltstone--Sedimentary rock made up of dominantly silt-sized particles.

Slick spot-A small area of soil having a puddled, crusted, or smooth surface and an excess of exchangeable sodium. The soil is generally silty or clayey, is slippery when wet, and is low in productivity.

Slope--The inclination of the land surface from the horizontal. Percentage of slope is the vertical distance divided by horizontal distance, then multiplied by 100. In the Soils Background Report the following slope classifications are used:

| Nearly level or level | 0 to $2 \%$ |
| :--- | :--- |
| Gently sloping | 2 to $5 \%$ |
| Moderately sloping | 5 to $9 \%$ |
| Strongly sloping | 9 to $15 \%$ |
| Moderately steep | 15 to $30 \%$ |
| Steep | 30 to $50 \%$ |
| Very steep | 50 to $75 \%$ |
| Extremely steep | $>75 \%$ |

Soil loss tolerance ("T" factor)--The " $T$ " value is the amount of soil (tons/acre) that can be lost in a year from a particular soil series, while the soil continues to support sustained longterm productivity.

Subsoil--Technically, the B horizon; roughly, the part of the solum below plow depth.

Topsoil--The upper part of the soil, which is the most favorable material for plant growth. It is ordinarily rich in organic matter, and technically it corresponds to the A horizon.

Water erosion susceptibility-Relative susceptibility of a given soil series to water-induced erosion. In this report, based on Soil Conservation Service K factors where: <0.2 = low; $0.2-0.39=$ moderate $;$ and $\geq 0.4=$ high.

Wind erosion susceptibility--Relative susceptibility of a given soil series to wind-induced erosion. In this report, based on Soil Conservation Service WEG classes where: Classes 5-8 = low; $3-4 \mathrm{~L}=$ moderate; and $1-2=$ high.

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[^1]:    $N A=$ Not available or not applicable.

[^2]:    $N A=$ Not available or not applicable.
    ${ }^{1}$ Source: U.S. Soil Conservation Service (SCS). 1980. Soil survey of San Juan County, New Mexico, eastern part.

[^3]:    $\mathrm{M}=$ Not available or not applicable.
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