APPENDIX B

HYDROGEOLOGIC AND SOILS FACTORS INFLUENCING LEAKAGE POTENTIAL FROM THE CONCHAS-HUDSON CANAL SYSTEM, ARCH HURLEY CONSERVANCY DISTRICT, QUAY AND SAN MIGUEL COUNTIES, NEW MEXICO

by

John W. Hawley, Senior Hydrogeologist
New Mexico Water Resources Research Institute

and

John F. Kennedy, GIS Specialist/Hydrogeologist
New Mexico Water Resources Research Institute

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INTRODUCTION

The following discussion of geology and soils in the Arch Hurley Conservancy District (District) study area introduces the major landscape features (*landforms*) and surficial geologic units of the Conchas-Hudson Canal system between Conchas Reservoir in San Miguel County and the eastern part of the Tucumcari (irrigation) Project in Quay County. Emphasis is on hydrogeologic and soils factors that influence leakage from not only the *canal corridor* but also the complex network of laterals, ditches and field-drainage features that characterize irrigated parts of the District. Of particular importance is the historic role played by Project operations (since 1946) in recharge of the shallow-alluvial and bedrock (Entrada Sandstone) aquifer systems of the Tucumcari Metropolitan area. The latter topic was first addressed in detail by Trauger and Bushman (1964) and is only briefly covered here.

The geologic setting of the entire study area is the subject of a recent comprehensive review paper that was written specifically for a general audience by Adrian Hunt (Director, New Mexico Museum of Natural History and Science; 1998). Hydrogeologic characteristics of major stratigraphic units exposed or shallowly buried along the canal corridor are summarized in Table B1, which also includes a list of supporting references. Distribution patterns and leakage potential of surficial-geologic units and soils are summarized in Tables B2-B5 in Attachment B1 to this Appendix.

TABLE B1

MAJOR HYDROSTRATIGRAPHIC UNITS OF THE ARCH HURLEY CONSERVANCY DISTRICT, WITH EMPHASIS ON SURFICIAL DEPOSITS AND EXPOSED BEDROCK UNITS IN AND ADJACENT TO CANAL CORRIDORS* (Plate 4, References**)

TIME-ROCK CLASSES	HYDROSTRATIGRAPHIC UNITS AND LITHOSTRATIGRAPHIC CORRELATIVES
HOLOCENE/UPPER PLEISTOCENE	Canadian River alluvium (Qa component)
	*Alluvial deposits of tributary valley systems (Qa)
	Lacustrine and alluvial-colloidal sediments in local closed depressions (including Tucumcari Lake basin—Qa component)
	*Surficial eolian sediments (Qa component)
PLEISTOCENE	*Older alluvium of ancestral Canadian River and its major tributaries (Qoa and Qp components)
	Older lacustrine and alluvial-colloidal sediments in local closed depressions (primarily solution-subsidence; buried Qoa correlatives)
	Older eolian-cover sediments (Qe and Qoa components)
NEOGENE	High-level (Pliocene/upper Miocene) alluvial and eolian deposits of the ancestral Canadian River-valley system that are correlative with the Ogallala (Southern High Plains) aquifer system (To)
CRETACEOUS	Dakota Group-undivided (Kdg)—primarily marine clastic rocks, which include (in increasing age): Pajarito Shale, Mesa Rica Sandstone, and Tucumcari Shale
JURASSIC	*Upper and Middle Jurassic rocks-undivided (J)— Continental clastic rocks comprising three formations: *Morrison Fm (Jm)—mainly mudstone and sandstone *Summerville Fm—primarily sandstone *Entrada Sandstone (Je)—mainly of eolian origin *Middle Jurassic Summerville/Entrada sequence forms most of the San Rafael Gp mapping unit in the study area*

UPPER TRIASSIC	Chinle Group-undivided (>c)—Continental redbed-clastic rocks including five formations in the study area: *Redonda Fm (>r)—primarily interbedded mudstone and fine sandstone-siltstone *Bull Canyon Fm (>b)—mainly mudstone, with sandstone interbeds *Trujillo Fm (>b)—primarily fluvial sandstone, with mudstone interbeds *Garita Creek Fm (>g)— mainly mudstone, with sandstone interbeded (*Redonda to Garita Ck. sequence comprises the Upper Chinle Gp mapping unit*: >cu) Santa Rosa Fm (>s)—primarily fluvial sandstone
MIDDLE TRIASSIC	Moenkopi Formation—Mudstone, siltstone and limestone (non-marine) included either with basal Chinle Gp (>s) or uppermost Permian mapping units in the Canadian and Pecos Valley region (e.g. Quartermaster Fm and Artesia Gp)
PERMIAN	Upper and Middle Permian rocks-undivided—Primarily shallow-marine, dolomitic-carbonate and clastic rocks with common extensive evaporite zones, including anhydrite/gypsum and halite (NaCl). Major units beneath the study area include the Quartermaster Fm (Upper Permian), Artesia Gp, and San Andres Fm (Mid-Permian). *Note that widespread dissolution of buried Permian evaporite beds has caused differential subsidence of overlying rocks and unconsolidated deposits throughout the study area*

*Bedrock units and surficial deposits of the *Canal Corridor* (*cf* Tables AB2 to AB5)

**Major Source References:

General Geology, Geomorphology, and Geohydrology: Berkstresser and Mourant (1966), Dolliver (1984, 1985, 1991), Green and Jones (1997), Griggs and Hendrickson (1951), Hawley (1984, 1986, 2005), Hunt (1998), Hunt and Lucas (2001), Kelley and Trauger (1972), Lucas (1985), Lucas and Ullmer-Scholle (2001), NMBGMR (2003), Trauger (1972a), Trauger et al. 1972, TX-BEG (1983)

General Subsurface Geology, including Permian/Pennsylvanian rocks and Structure: Broadhead (1984), Broadhead and King (1988), Foster et al. (1972)

Triassic Stratigraphy: Hunt et al. (2001), Kelley (1972b), Lucas (1995), Lucas et al. (1985b)

Jurassic Stratigraphy: Lucas et al. (1985a)

Cretaceous Stratigraphy: Lucas et al. (2001)

District Area Geology, Geomorphology, and Hydrogeology: Dobrovolny and Townsend (1946), Dobrovolny et al. (1946), Hunt (2001b), Love (1985), Lucas et al. (2001), Trauger (1972b), Trauger and Bushman (1964)

District Area Water Issues: Hunt (2001a), Kunkler (1972), Mutz (1998), U.S. Bureau of Reclamation (1983), Wilson (1998), Wilson and Esparza (1998)

Primary sources of soils information are U.S. Soil Conservation Service (*now* Natural Resource Conservation Service-NRCS) Soil Survey and NMSU Agricultural Experiment Station reports on Quay and San Miguel Counties (Maker et al. 1971; Ross and Pease 1974; Hilley et al. 1981). Specific soil-survey map sheets (air-photo mosaic map base) and USGS topographic quadrangles (7.5 Minute Series) used in this study are identified in each cell of the last (see Remarks) column of Tables B2-B4. Published sources on surficial geology and hydrostratigraphy are itemized on Table B1.

PHYSIOGRAPHIC AND HYDROGEOLOGIC SETTING

Physiographic Setting

The study area is located in the Pecos-Canadian Valley Section of the southern Great Plains Physiographic Province (Dolliver 1984, 1985; Hawley 1986, 2005). This part of the upper Canadian River drainage basin (*Canadian Valley subsection*) is bounded of the northwest by the Raton Section (*Canadian Escarpment*) and on the south by the Southern High Plains Section (*Llano Estacado-Caprock Escarpment*). Conchas Dam and the upper Conchas Canal diversion structure (elevation about 4,155 feet) are located at the confluence of Canadian River and Conchas Creek. The Conchas headwaters are at the southern edge of the Las Vegas Plateau above the Canadian Escarpment and along a low-lying watershed divide with the northeastern Pecos River basin (northeast of the Town of Santa Rosa). Headwaters of the two major Canadian tributaries, Mora and Cimarrón Rivers, are in the southeasternmost part of the Southern Rocky Mountain Province, with peak elevations ranging from 12,000 to 13,000 feet.

Hydrogeologic Setting

Conchas Dam is sited in an inner-canyon reach that is cut into the Santa Rosa Sandstone (SS) Member at the base of the Upper Triassic-Chinle Group (Gp, Table B1); it is located at the upper end of a narrow river-valley segment (southeasternmost San Miguel County) that extends to the District's Tucumcari-Project irrigated area of western Quay County. Conchas Reservoir occupies the lower Conchas Creek Valley and a long reach of the Canadian Valley at elevations between 4,201 feet (Dam Spillway) and about 4,040 ft (canyon floor). This broad lowland area, with scattered tablelands (mesas and buttes) is eroded into a thick sequence of (non-marine) mudstones and interbedded sandstones of the middle and upper Chinle Gp (Table B1). The high Canadian Escarpment-Las Vegas Plateau region of the north is capped by resistant (marine) sandstones of the Dakota Gp (including the Mesa Rica Sandstone); escarpment slopes are carved on weaker mudstones, siltstones, and sandstones of Jurassic Age (non-marine Morrison Formation/Summerville Fm/ Entrada SS sequence), which are mantled by an extensive landslide deposits.

Mesa Rica (elevations 4,800-5,400 feet) is the major upland landscape feature of the upper Conchas Canal section, which extends about 39 miles from the Dam to the Tucumcari Project boundary at the San Miguel-Quay County Line. The Mesa is a large High Plains outlier capped by the Dakota Gp-Mesa Rica SS, and it marks the physiographic transition from the Las Vegas Plateau to the northwest and the Llano Estacado *subsection* of the Southern High Plains south of the Canadian Valley. Most of the canal corridor (elev. 4,155-4,100 feet), including three long tunnel reaches (Nos. 2-4, Tables 13D, E and G), is located at or near the base of the northern Mesa Rica

escarpment, which has a local relief of almost 1,000 feet. Most reaches in this critical area of potential canal leakage (Table 13 and Table 15) are excavated in relatively impermeable mudstones and interbedded sandstones of the uppermost Chile Group, and overlying sandstones and mudstones of the lower Morrison Formation and Summerville/ Entrada Sandstone sequence (Table B2). Landslide deposits are also a major escarpment-footslope component (Hilley et al. 1981; Soil Survey Sheets 45, 56, 57).

In the Quay County-Tucumcari Project section east of Mesa Rica (Tables B3 and B5), the middle to lower Conchas/Hudson Canal system crosses broad alluvial plains that are intermediate in elevation between the inner Canadian Valley/Canyon (Ute Lake) area to the north and the high Plateaus and Llano Estacado outliers to the south and west (e.g. Mesa Redonda, Tucumcari Mountain and Mesa Rica). These plains are extensively veneered with windblown deposits and *calcic* soils (Ross and Pease 1974; Soil Survey Sheets 6, 11, 12, 17, 18, 22, 25, 26), and this eolian/alluvial sedimentary sequence shallowly buries Chinle Group and Summerville/Entrada Sandstone units in much of the lower Conchas-Hudson Canal part of the Project (beyond the "Y," Tables B4 and B5).

In the immediate vicinity of Tucumcari (e.g. north of Tucumcari Mountain and east of Pajarito Creek) however, the alluvial-eolian veneer overlies as much as 350 feet of older alluvial and playa-lake deposits that fill several large closed depressions and buried valleys. The latter features appear to be primarily of solution-subsidence origin and are related to Late Cenozoic dissolution of thick evaporite units that originally formed much of the Permian bedrock sequence that underlies the Triassic section of the entire study area (Table B1; Trauger and Bushman 1964; Trauger 1972b; Gustavson and Finley 1985, Dolliver 1985; Love 1985; Gustavson 1986; McGookey et al. 1988, Hunt 1998; Hawley

2005). These thick depression/buried valley fills and contiguous parts of the Entrada Sandstone constitute the major aquifer system of Tucumcari municipal area. As emphasized in Part III, much of the recharge to this critical groundwater reservoir is from historic (post-1946) leakage associated with operation of the District's Tucumcari Project (e.g., Trauger and Bushman 1964, p. 10, 31, 33, 61-64, 74-76, 84-85, 90, 98, 102-107).

CONDITIONS THAT AFFECT LEAKAGE POTENTIAL

The study area's tectonic framework is characterized by regional-scale geologic structures with a gentle eastward dip (from the Rocky Mountains to the Great Plains) that are locally disrupted by broad basins and arches. Moreover, the very low slope of the main canal (0.0001 feet per foot) is significantly less than the regional structural dip in most places west of a major tectonic depression (*the Tucumcari basin*) that underlies much of the Project area near Tucumcari. As a result, the Conchas Canal starts near the base of the upper Chinle Gp (Garita Creek and Trujillo [SS] Mbrs) and ascends through the entire overlying Chinle (Redonda/Bull Canyon Mbr) stratigraphic sequence between the Reservoir and the outlet of Siphon 13 (mile 18.5, Table B2). Surficial geologic and soil conditions (Plates 3 and 4) along specific reaches with significant (moderate to high) leakage potential are summarized in Table B2 (*cf* Tables 13A-D and Table15). As noted in the Part IV-GIS discussion, these reaches are best identified with the color-infrared satellite imagery illustrated by Plate 2.

Between Siphon 13 and Tunnel 3 (mile 20.5) the canal is primarily excavated in the Entrada SS, Summerville Fm and basal part of the Morrison Fm. These Jurassic bedrock units are locally mantled with footslope alluvial and landslide deposits (Tables

B1 and B2). Between Tunnels 3 and 4 (mile 22.3-mile 27.3) the canal crosses a broad structural arch and is primarily excavated in mudstones and interbedded sandstones of the upper-most Triassic Redonda Fm, with a local cover of valley-fill alluvium in the Johnson Creek Valley (near Siphon 17). Reaches with significant leakage potential occur at many places in this part of the upper Conchas Canal (Tables B2, 13E-G, and 15; Plate 2).

The long section of the Conchas Canal between Tunnel 4 and Siphon 28 (mile 28.7 to mile 50), which includes the Bench Flumes and the western (irrigation) Project area, is primarily excavated in the Summerville/Entrada Sandstone and basal Morrison Formation sequence. The area is within the western Tucumcari (structural) basin; bedrock is locally covered with landslide blocks and thin alluvial-toeslope valley-fill deposits (Tables B2 and B3). Many reaches with significant leakage potential (Table 13G-L and Table15) also occur in this part of the (upper and middle) canal system, which crosses the lower valley of Pajarito Creek (Siphon 25) and part of the Entrada-aquifer recharge zone (Trauger and Bushman 1964, p. 72-74).

The entire Conchas-Hudson Canal system downstream from the Siphon 28 inlet (mile 50) is excavated in either the Redonda/Bull Canyon Formation sequence (upper-most Chinle Group) or a thin overlying upland cover of eolian and older alluvial deposits (Plate 4, Tables B1 and B3-B5). As originally documented by Trauger and Bushman (1964, p. 61-64, 74-76, 98, 102-105), canal leakage in a series of reaches between Siphons 28 and 30 (mile 50.5-mile 54.5; Tables 13L-N and Table15) appears to be a significant contributor to recharge of the thick alluvial aquifer system in the deep solution-subsidence basin complex of the central Tucumcari area (Town Well Field).

This same observation applies to the historic formation of a perennial surface-water body at Tucumcari Lake, which was formerly (pre-1946) the site of an ephemeral playa-lake (Trauger and Bushman 1964, p. 75, 82; Love 1985; Hunt 2001b). This shallow lake depression is outside (southeast of) the major area of solution subsidence; Dobrovolny and Townsend (1946) have suggested that it occupies a former stream valley (in upper Chinle bedrock) that was “dammed” by eastward drifting “eolian” sediments of Quaternary age (Table B1-Qe).

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APPENDIX B

ATTACHMENT B1

TABLES B2, B3, B4, AND B5

TABLE B2. CONCHAS CANAL SOILS/SURFACE GEOLOGY CHARACTERISTICS AND LEAKAGE POTENTIAL ARCH-HURLEY CONSERVATION DISTRICT—WESTERN CANAL SECTION, SAN MIGUEL COUNTY

Distance Down Canal in Feet	Major Structures on Canal	Major Soil Series & Relationship	Soils Code	General Soil Characteristics along Canal Route	General Characteristics of Surficial Geologic Units	Canal Leakage Potential; Major Controlling Factors	Soil Survey Sheet Number; Topographic Quadrangle; Remarks
4	Start of Canal at Outlet from Conchas Reservoir	Latom-Newkirk-Rock Outcrop	LN	poor top soil, loam to stony loam, shallow bedrock at 6 to 18 inches	thin foot slope alluvium, over Lower Chinle Gp siltstone, sandstone, and shale	includes 2,000-ft reach with high leakage potential, based on interpretation of Landsat Color IR imagery (9/2000); moderate permeability and piping hazard	San Miguel County Soil Survey Sheet 44; Conchas Dam; Sta 1; elev: 4,157.35ft
5,031	Releases Measured at USGS Gage	Latom-Newkirk-Rock Outcrop	LN	poor top soil, loam to stony loam, shallow bedrock at 6 to 18 inches	thin foot slope alluvium, over Lower Chinle Gp siltstone, sandstone, and shale; potential for landslide activity from here to Tunnel No. 1 Portal	moderate permeability and piping hazard	SM-SSS-44; Conchas Dam; Sta 152; elev: 4,156.89ft; Sta 178; elev: 4,157.49ft
5,101 (0.88 mi)	Tunnel No. 1, Upstream Portal	Latom-Newkirk-Rock Outcrop	LN	poor top soil, loam to stony loam, shallow bedrock at 6 to 18 inches	thin foot slope alluvium, over Lower Chinle Gp siltstone, sandstone, and shale	moderate permeability and piping hazard	SM-SSS-44; Conchas Dam
7,673 (1.37 mi)	Tunnel No. 1, Downstream Portal	Conchas-Latom	CK	fine salty loam to loam, moderately deep to shallow on bedrock	thin upland alluvium, on Lower Chinle Gp, Trujillo Sandstone	moderately well drained to well drained over fractured hard sandstone	SM-SSS-44; Conchas Dam; Sta 191; elev: 4,154.36ft
~11,320		Redona-Quay	RE	good to fair top soil, deep, fine loamy to loamy, with gravel lenses, calcareous	older upland alluvial and eolian deposits (up to 15 ft thick) on Chinle Gp	includes short (~300 ft) reach with moderate leakage potential in area of wasteway; moderate permeability and piping hazard	SM-SSS-44; Conchas Dam; Sta 1180; elev: 4,153.92ft

TABLE B2. CONCHAS CANAL SOILS/SURFACE GEOLOGY CHARACTERISTICS AND LEAKAGE POTENTIAL ARCH-HURLEY CONSERVATION DISTRICT—WESTERN CANAL SECTION, SAN MIGUEL COUNTY

Distance Down Canal in Feet	Major Structures on Canal	Major Soil Series & Relationship	Soils Code	General Soil Characteristics along Canal Route	General Characteristics of Surficial Geologic Units	Canal Leakage Potential; Major Controlling Factors	Soil Survey Sheet Number; Topographic Quadrangle; Remarks
15,321 (2.81 mi)	Siphon 1 Inlet	Badland	BA	poor top soil, very shallow to moderately deep on bedrock	valley-border erosion surfaces on Chinle Gp shale, siltstone, and sandstone	permeability and piping hazard highly variable	SM-SSS-44; Conchas Dam; Sta 1199; elev: 4,153.73ft
16,766 (3.10 mi)	Siphon 1 Outlet	Badland	BA	poor top soil, very shallow to moderately deep on bedrock	valley-border erosion surfaces on Chinle Gp shale, siltstone, and sandstone	short (<500 ft) reach with moderate to high leakage potential located about 500 ft downstream from Siphon 1 outlet; permeability and piping hazard highly variable	SM-SSS-44; Conchas Dam; Sta 1214; elev: 4,151.97ft
19,942 (3.69 mi)	Siphon 2 Inlet	Montoya-Tucumcari	MF	deep, fine textured calcareous sediments, very plastic	clayey fills of swales and depressions in upland-plain and valley-floor settings	large range in permeability and shrink-swell potential; form deep cracks when dry	SM-SSS-44; Conchas Dam; Sta 1245; elev: 4,151.66ft
20,599 (3.82 mi)	Siphon 2 Outlet	Montoya-Tucumcari	MF	deep, fine textured calcareous sediments, very plastic	clayey fills of swales and depressions in upland-plain and valley-floor settings	large range in permeability and shrink-swell potential; form deep cracks when dry	SM-SSS-44; Tenaja Mesa; Sta 1253; elev: 4,150.78ft
22,937	Culvert under Canal	Montoya-Tucumcari	MF	deep, fine textured calcareous sediments, very plastic	clayey fills of swales and depressions in upland-plain and valley-floor settings	large range in permeability and shrink-swell potential; form deep cracks when dry	SM-SSS-44; Tenaja Mesa

TABLE B2. CONCHAS CANAL SOILS/SURFACE GEOLOGY CHARACTERISTICS AND LEAKAGE POTENTIAL ARCH-HURLEY CONSERVATION DISTRICT—WESTERN CANAL SECTION, SAN MIGUEL COUNTY

Distance Down Canal in Feet	Major Structures on Canal	Major Soil Series & Relationship	Soils Code	General Soil Characteristics along Canal Route	General Characteristics of Surficial Geologic Units	Canal Leakage Potential; Major Controlling Factors	Soil Survey Sheet Number; Topographic Quadrangle; Remarks
23,335	Culvert under Canal	Montoya-Tucumcari	MF	deep, fine textured calcareous sediments, very plastic	clayey fills of swales and depressions in upland-plain and valley-floor settings	includes 3,000-ft reach with high leakage potential (see Remarks); large range in permeability and shrink-swell potential; form deep cracks when dry	SM-SSS-44; Tenaja Mesa; Start of area of proposed Lined Reach S-1 (USBOR 1983)
25,573 (4.75 mi)	Siphon 3 Inlet, Saladito Creek	Montoya-Tucumcari	MF	deep, fine textured calcareous sediments, very plastic	clayey fills of swales and depressions in upland-plain and valley-floor settings	large range in permeability and shrink-swell potential; form deep cracks when dry	SM-SSS-44; Tenaja Mesa; Sta 1300; elev: 4,150.29ft
25,805 (4.81 mi)	Siphon 3 Outlet	Conchas-Latom	CK	fine silty loam to loam, moderately deep to shallow on bedrock	thin upland alluvium, on Upper Chinle Gp sandstone	moderately well drained to well drained over fractured hard sandstone	SM-SSS-44; Tenaja Mesa; Sta 1303; elev: 4,149.8ft
~27,000 (26,400)	Canal Bends to North (Near Mile 5)	Conchas-Latom	CK	fine silty loam to loam, moderately deep to shallow on bedrock	thin upland alluvium, on Upper Chinle Gp sandstone	moderately well drained to well drained over fractured hard sandstone	SM-SSS-44; Tenaja Mesa; Sta 1310; elev: 4,149.72ft
~28,000	Enter Lowland Area (MF Soil Association)	Montoya-Tucumcari	MF	deep, fine textured calcareous sediments, very plastic	clayey fills of swales and depressions in upland-plain and valley-floor settings	includes 2,000-ft reach with high leakage potential; large range in permeability and shrink-swell potential; form deep cracks when dry	SM-SSS-44; Tenaja Mesa; includes proposed Lined Reach S-2

TABLE B2. CONCHAS CANAL SOILS/SURFACE GEOLOGY CHARACTERISTICS AND LEAKAGE POTENTIAL ARCH-HURLEY CONSERVATION DISTRICT—WESTERN CANAL SECTION, SAN MIGUEL COUNTY

Distance Down Canal in Feet	Major Structures on Canal	Major Soil Series & Relationship	Soils Code	General Soil Characteristics along Canal Route	General Characteristics of Surficial Geologic Units	Canal Leakage Potential; Major Controlling Factors	Soil Survey Sheet Number; Topographic Quadrangle; Remarks
~30,600	Leave Lowland Area (MF Soil Association)	Conchas-Latom	CK	fine silty loam to loam, moderately deep to shallow on bedrock	thin upland alluvium, on Upper Chinle Gp sandstone	moderately well drained to well drained over fractured hard sandstone	SM-SSS-44; Tenaja Mesa
33,645	Bridge over Canal	Redona-Quay	RE	good to fair top soil, deep, fine loamy to loamy, with gravel lenses, calcareous	older upland alluvial and eolian deposits (up to 15 ft thick) on Chinle Gp	central part of 3,000-ft reach with moderate to high leakage potential; moderate permeability, and piping hazard	SM-SSS-44; Tenaja Mesa
41,047 (7.68 mi)	Siphon 4 Inlet	Redona-Quay	RE	good to fair top soil, deep, fine loamy to loamy, with gravel lenses, calcareous	older upland alluvial and eolian deposits (up to 15 ft thick) on Chinle Gp	moderate permeability and piping hazard	SM-SSS-44; Tenaja Mesa; Sta 1453; elev: 4,148.28ft
41,212 (7.73 mi)	Siphon 4 Outlet	Redona-Quay	RE	good to fair top soil, deep, fine loamy to loamy, with gravel lenses, calcareous	older upland alluvial and eolian deposits (up to 15 ft thick) on Chinle Gp	start of ~2,000-ft reach with high leakage potential; moderate permeability and piping hazard	SM-SSS-44; Tenaja Mesa; Sta 1455; elev: 4,147.87ft; start of area of proposed Lined Reach S-3
44,905	Drainage Inlet to Canal	Conchas-Latom	CK	fine silty loam to loam, moderately deep to shallow on bedrock	thin upland alluvium, on Upper Chinle Gp sandstone	moderately well drained to well drained over fractured hard sandstone	SM-SSS-44; Tenaja Mesa

TABLE B2. CONCHAS CANAL SOILS/SURFACE GEOLOGY CHARACTERISTICS AND LEAKAGE POTENTIAL ARCH-HURLEY CONSERVATION DISTRICT—WESTERN CANAL SECTION, SAN MIGUEL COUNTY

Distance Down Canal in Feet	Major Structures on Canal	Major Soil Series & Relationship	Soils Code	General Soil Characteristics along Canal Route	General Characteristics of Surficial Geologic Units	Canal Leakage Potential; Major Controlling Factors	Soil Survey Sheet Number; Topographic Quadrangle; Remarks
46,951	Culvert under Canal	Redona-Quay	RE	good to fair top soil, deep, fine loamy to loamy, with gravel lenses, calcareous	older upland alluvial and eolian deposits (up to 15 ft thick) on Chinle Gp	about 2,000-ft up canal of 2,500-ft reach with moderate to high leakage potential (see Remarks); moderate permeability and piping hazard	SM-SSS-44; Tenaja Mesa; up canal from area of proposed Lined Reach S-4; includes wetland areas noted on SM-SSS-55
51,596	Culvert under Canal	Redona-Quay	RE	good to fair top soil, deep, fine loamy to loamy, with gravel lenses, calcareous	older upland alluvial and eolian deposits (up to 15 ft thick) on Chinle Gp	moderate permeability and piping hazard	SM-SSS-55; Tenaja Mesa; Sta 1570; elev: 4,146.69ft; down canal from area of proposed Lined Reach S-4
53,477 (10.03 mi)	Siphon 5 Inlet	Montoya-Tucumcari	MF	deep, fine textured calcareous sediments, very plastic	clayey fills of swales and depressions in upland-plain and valley-floor settings	large range in permeability and shrink-swell potential; form deep cracks when dry	SM-SSS-55; Tenaja Mesa; Sta 1574; elev: 4,146.65ft
53,700 (10.09 mi)	Siphon 5 Outlet	Montoya-Tucumcari	MF	deep, fine textured calcareous sediments, very plastic	clayey fills of swales and depressions in upland-plain and valley-floor settings	large range in permeability and shrink-swell potential; form deep cracks when dry	SM-SSS-55; Tenaja Mesa; Sta 1577; elev: 4,146.16ft
57,033 (10.71 mi)	Siphon 6 Inlet, W. Oso Creek	Latom-Newkirk-Rock Outcrop	LN	poor top soil, loam to stony loam, shallow bedrock at 6 to 18 inches	thin foot slope alluvium, over Upper Chinle Gp shale, siltstone, and sandstone	moderate permeability and piping hazard	SM-SSS-55; Tenaja Mesa; Sta 1608; elev: 4,145.83ft

TABLE B2. CONCHAS CANAL SOILS/SURFACE GEOLOGY CHARACTERISTICS AND LEAKAGE POTENTIAL ARCH-HURLEY CONSERVATION DISTRICT—WESTERN CANAL SECTION, SAN MIGUEL COUNTY

Distance Down Canal in Feet	Major Structures on Canal	Major Soil Series & Relationship	Soils Code	General Soil Characteristics along Canal Route	General Characteristics of Surficial Geologic Units	Canal Leakage Potential; Major Controlling Factors	Soil Survey Sheet Number; Topographic Quadrangle; Remarks
57164 (10.75 mi)	Siphon 6 Outlet	Latom-Newkirk-Rock Outcrop	LN	poor top soil, loam to stony loam, shallow bedrock at 6 to 18 inches	thin foot slope alluvium, over Upper Chinle Gp shale, siltstone, and sandstone	start of long canal reach (extending ~1,000 ft beyond outlet of Siphon 9; see Remarks) with moderate to high leakage potential; moderate permeability and piping hazard	SM-SSS-55; Tenaja Mesa; Sta 1610; elev: 4,145.42ft; up canal from area of proposed Lined Reach S-5
61319 (11.52 mi)	Siphon 7 Inlet, Oso Creek	Lacita-San Jose	LB	poor top soil, deep, fine silty to coarse loamy	younger valley-fill alluvium (up to 15 ft thick) over Upper Chinle Gp shale, siltstone, and sandstone	see above; large permeability range, moderate to high piping hazard	SM-SSS-55; Tenaja Mesa; Sta 1651; elev: 4,145.01ft; down canal from area of proposed Lined Reach S-5
61,512 (11.57 mi)	Siphon 7 Outlet	Lacita-San Jose	LB	poor top soil, deep, fine silty to coarse loamy	younger valley-fill alluvium (up to 15 ft thick) over Upper Chinle Gp shale, siltstone, and sandstone	see above; large permeability range, moderate to high piping hazard	SM-SSS-56; Monument Point; Sta 1654; elev: 4,144.51ft
63,343	Drainage Inlet to Canal	Lacita-San Jose	LB	poor top soil, deep, fine silty to coarse loamy	younger valley-fill alluvium (up to 15 ft thick) over Upper Chinle Gp shale, siltstone, and sandstone	see above; large permeability range, moderate to high piping hazard	SM-SSS-56; Monument Point; Sta 1692; elev: 4,144.12ft
65,431 (12.30 mi)	Siphon 8 Inlet, Corralitos Creek	Lacita-San Jose	LB	poor top soil, deep, fine silty to coarse loamy	younger valley-fill alluvium (up to 15 ft thick) over Upper Chinle Gp shale, siltstone, and sandstone	see above; large permeability range, moderate to high piping hazard	SM-SSS-56; Monument Point; Sta 1697; elev: 4,143.43ft
65,788 (12.39 mi)	Siphon 8 Outlet	Lacita-San Jose	LB	poor top soil, deep, fine silty to coarse loamy	younger valley-fill alluvium (up to 15 ft thick) over Upper Chinle Gp shale, siltstone, and sandstone	see above; large permeability range, moderate to high piping hazard	SM-SSS-56; Monument Point

TABLE B2. CONCHAS CANAL SOILS/SURFACE GEOLOGY CHARACTERISTICS AND LEAKAGE POTENTIAL ARCH-HURLEY CONSERVATION DISTRICT—WESTERN CANAL SECTION, SAN MIGUEL COUNTY

Distance Down Canal in Feet	Major Structures on Canal	Major Soil Series & Relationship	Soils Code	General Soil Characteristics along Canal Route	General Characteristics of Surficial Geologic Units	Canal Leakage Potential; Major Controlling Factors	Soil Survey Sheet Number; Topographic Quadrangle; Remarks
67,735 (12.74 mi)	Siphon 9 Inlet	Redona-Quay	RE	good to fair top soil, deep, fine loamy to loamy, with gravel lenses, calcareous	older upland alluvial and eolian deposits (up to 15 ft thick) on Chinle Gp	see above; moderate permeability, moderate piping hazard	SM-SSS-56; Monument Point; Sta 1708; elev: 4,143.24ft
67,987 (12.80 mi)	Siphon 9 Outlet	Lacita-San Jose	LB	poor top soil, deep, fine silty to coarse loamy	younger valley-fill alluvium (up to 15 ft thick) over Upper Chinle Gp shale, siltstone, and sandstone	see above: Siphon 6 outlet; large permeability range, moderate to high piping hazard	SM-SSS-56; Monument Point; Sta 1712; elev: 4,142.69ft
70,871 (13.33 mi)	Siphon 10 Inlet	Redona-Quay	RE	good to fair top soil, deep, fine loamy to loamy, with gravel lenses, calcareous	older upland alluvial and eolian deposits (up to 15 ft thick) on Chinle Gp	moderate permeability and piping hazard	SM-SSS-56; Monument Point; Sta 1740; elev: 4,142.41ft
71,281 (13.95 mi)	Siphon 10 Outlet	Montoya-Tucumcari	MF	clayey fills of swales and depressions in upland-plain and valley-floor settings	clayey fills of swales and depressions in upland-plain and valley-floor settings	start of 2,000-ft reach with moderate to high leakage potential; large range in permeability and shrink-swell potential; form deep cracks when dry	SM-SSS-56; Monument Point; Sta 1744; elev: 4,1441.73ft
76,849 (14.99 mi)	Siphon 11 Inlet, Comanchero Creek	Lacita-San Jose	LB	poor top soil, deep, fine silty to coarse loamy	younger valley-fill alluvium over Upper Chinle Gp shale, siltstone, and sandstone	large permeability range, moderate to high piping hazard	SM-SSS-56; Monument Point; Sta 1797; elev: 4,141.18ft

TABLE B2. CONCHAS CANAL SOILS/SURFACE GEOLOGY CHARACTERISTICS AND LEAKAGE POTENTIAL ARCH-HURLEY CONSERVATION DISTRICT—WESTERN CANAL SECTION, SAN MIGUEL COUNTY

Distance Down Canal in Feet	Major Structures on Canal	Major Soil Series & Relationship	Soils Code	General Soil Characteristics along Canal Route	General Characteristics of Surficial Geologic Units	Canal Leakage Potential; Major Controlling Factors	Soil Survey Sheet Number; Topographic Quadrangle; Remarks
77,044 (15.04 mi)	Siphon 11 Outlet	Lacita-San Jose	LB	poor top soil, deep, fine silty to coarse loamy	younger valley-fill alluvium over Upper Chinle Gp shale, siltstone, and sandstone	start of 3,000-ft canal reach (near Mile 15; see Remarks) with high to moderate leakage potential; large permeability range, moderate to high piping hazard	SM-SSS-56; Monument Point; Sta 1800; elev: 4,140.68ft; up canal from area of proposed Lined Reach S-6
79,418	Culvert under Canal	Redona-Quay	RE	good to fair top soil, deep, fine loamy to loamy, with gravel lenses, calcareous	older upland alluvial and eolian deposits (up to 15 ft thick) on Upper Chinle Gp shale, siltstone, and sandstone	see above; moderate permeability and piping hazard	SM-SSS-56; Monument Point; down canal from area of proposed Lined Reach S-6
80,094	Culvert under Canal	Redona-Quay	RE	good to fair top soil, deep, fine loamy to loamy, with gravel lenses, calcareous	older upland alluvial and eolian deposits (up to 15 ft thick) on Upper Chinle Gp shale, siltstone, and sandstone	see above; moderate permeability and piping hazard	SM-SSS-56; Monument Point
80,718	Culvert under Canal	Redona-Quay	RE	good to fair top soil, deep, fine loamy to loamy, with gravel lenses, calcareous	older upland alluvial and eolian deposits (up to 15 ft thick) on Upper Chinle Gp shale, siltstone, and sandstone	upstream from end of ~3,000-ft canal reach (see Remarks) with moderate to high leakage potential; moderate permeability, moderate piping hazard	SM-SSS-56; Monument Point
84,489 (16.4mi)	Siphon 12 Inlet	Latom-Newkirk-Rock Outcrop	LN	poor top soil, loam to stony loam, shallow bedrock at 6 to 18 inches	thin foot slope alluvium over Upper Chinle Gp shale, siltstone, and sandstone	moderate permeability and piping hazard	SM-SSS-56; Monument Point; Sta 1869; elev: 4,139.94ft

TABLE B2. CONCHAS CANAL SOILS/SURFACE GEOLOGY CHARACTERISTICS AND LEAKAGE POTENTIAL ARCH-HURLEY CONSERVATION DISTRICT—WESTERN CANAL SECTION, SAN MIGUEL COUNTY

Distance Down Canal in Feet	Major Structures on Canal	Major Soil Series & Relationship	Soils Code	General Soil Characteristics along Canal Route	General Characteristics of Surficial Geologic Units	Canal Leakage Potential; Major Controlling Factors	Soil Survey Sheet Number; Topographic Quadrangle; Remarks
84,819 (16.52 mi)	Siphon 12 Outlet	Ustorthent-Rock Outcrop Complex	UR	very shallow to deeper well-drained soils from area formations	very steep; landslide complexes on Mesa Rica escarpment; mostly Morrison Fm slide blocks over Entrada SS and Upper Chinle Gp	moderate permeability and piping hazard	SM-SSS-56; Monument Point; Sta 1876; elev: 4,139.31ft; canal on Upper Chinle Gp-uppermost Redonda Fm
85,151 (16.57 mi)	Tunnel No. 2 Entrance Portal	Ustorthent-Rock Outcrop Complex	UR	very shallow to deeper well-drained soils from area formations	very steep; landslide complexes on Mesa Rica escarpment; mostly Morrison Fm slide blocks over Entrada SS and Upper Chinle Gp	moderate permeability and piping hazard	SM-SSS-56; Monument Point; Sta 1869; elev: 4,139.94ft; tunnel portal in uppermost Redonda Fm of Chinle Gp
93,128 (18.09 mi, 95,515 ft)	Tunnel No. 2 Exit Portal	Ustorthent-Rock Outcrop Complex	UR	very shallow to deeper well-drained soils from area formations	very steep; landslide complexes on Mesa Rica escarpment; mostly Morrison Fm slide blocks over Entrada SS and Upper Chinle Gp	start of 2,500-ft reach with high leakage potential; permeability and piping hazard highly variable	SM-SSS-56; Monument Point; tunnel portal in basal Entrada SS and uppermost Redonda Fm of Chinle Gp
94,636 (18.36 mi)	Siphon 13 Inlet	Badland	BA	poor top soil, very shallow to moderately deep on bedrock	valley-border erosion surfaces on Upper Chinle Gp shale and siltstone	see above; permeability and piping hazard highly variable	SM-SSS-56; Monument Point; Sta 1970; elev: 4,132.07ft; siphon inlet in uppermost Redonda Fm of Chinle Gp

TABLE B2. CONCHAS CANAL SOILS/SURFACE GEOLOGY CHARACTERISTICS AND LEAKAGE POTENTIAL ARCH-HURLEY CONSERVATION DISTRICT—WESTERN CANAL SECTION, SAN MIGUEL COUNTY

Distance Down Canal in Feet	Major Structures on Canal	Major Soil Series & Relationship	Soils Code	General Soil Characteristics along Canal Route	General Characteristics of Surficial Geologic Units	Canal Leakage Potential; Major Controlling Factors	Soil Survey Sheet Number; Topographic Quadrangle; Remarks
95,223 (18.48 mi)	Siphon 13 Outlet	Badland	BA	poor top soil, very shallow to moderately deep on bedrock	valley-border erosion surfaces on Summerville Fm/Entrada sandstone sequence	near end of reach with high leakage potential (see above); permeability and piping hazard highly variable	SM-SSS-56; Monument Point; Sta 1976; elev: 4,131.15ft; outlet in basal Entrada SS and upstream from deep cut in Summerville Fm/Entrada sandstone sequence
98,863	Bridge over Canal	Redona-Quay	RE	good to fair top soil, deep, fine loamy to loamy, with gravel lenses, calcareous	older upland alluvial and eolian deposits (up to 15 ft thick) on Summerville Fm/Entrada sandstone sequence	start of long canal reach (including Mile 20; see Remarks) with high to moderate leakage potential; moderate permeability, moderate piping hazard	SM-SSS-45; Monument Point; Sta 11180; elev: 4,130.76ft; just down canal from area of proposed Lined Reach S-7
99,134	Drainage Inlet to Canal	Redona-Quay	RE	good to fair top soil, deep, fine loamy to loamy, with gravel lenses, calcareous	older upland alluvial and eolian deposits (up to 15 ft thick) on Summerville Fm/Entrada sandstone sequence	see above; moderate permeability and piping hazard	SM-SSS-45; Monument Point
101,743	Culvert under Canal	Redona-Quay	RE	good to fair top soil, deep, fine loamy to loamy, with gravel lenses, calcareous	older upland alluvial and eolian deposits (up to 15 ft thick) on Summerville Fm sandstone	see above; moderate permeability and piping hazard	SM-SSS-45; Monument Point

TABLE B2. CONCHAS CANAL SOILS/SURFACE GEOLOGY CHARACTERISTICS AND LEAKAGE POTENTIAL ARCH-HURLEY CONSERVATION DISTRICT—WESTERN CANAL SECTION, SAN MIGUEL COUNTY

Distance Down Canal in Feet	Major Structures on Canal	Major Soil Series & Relationship	Soils Code	General Soil Characteristics along Canal Route	General Characteristics of Surficial Geologic Units	Canal Leakage Potential; Major Controlling Factors	Soil Survey Sheet Number; Topographic Quadrangle; Remarks
103,168	Culvert under Canal	Latom-Newkirk-Rock Outcrop	LN	poor top soil, loam to stony loam, shallow bedrock at 6 to 18 inches	thin foot slope alluvium, over basal Morrison Fm/Summerville Fm mudstone and sandstone sequence	see above; moderate permeability and piping hazard	SM-SSS-45; Monument Point
104,868 (20.33 mi)	Siphon 14 Inlet, Alamosa Creek	Latom-Newkirk-Rock Outcrop	LN	poor top soil, loam to stony loam, shallow bedrock at 6 to 18 inches	thin foot slope alluvium, over basal Morrison Fm/Summerville Fm mudstone and sandstone sequence	near end of reach with high to moderate leakage potential (see above); moderate permeability and piping hazard	SM-SSS-56; Monument Point; Sta 11238; elev: 4,130.17ft; siphon beneath Alamosa Creek in Morrison Fm/Summerville Fm mudstone and sandstone sequence
105,428 (20.43 mi)	Siphon 14 Outlet	Latom-Newkirk-Rock Outcrop	LN	poor top soil, loam to stony loam, shallow bedrock at 6 to 18 inches	very steep; Mesa Rica SS-Morrison Fm landslide complex over Summerville Fm/Entrada sandstone sequence	moderate permeability and piping hazard	SM-SSS-56; Carpenter Mesa SW; Sta 11244; elev: 4,128.06ft
105,516 (20.45 mi)	Tunnel No. 3 Entrance Portal	Latom-Newkirk-Rock Outcrop	LN	poor top soil, loam to stony loam, shallow bedrock at 6 to 18 inches	very steep; Mesa Rica SS-Morrison Fm landslide complex over Summerville Fm/Entrada sandstone sequence	moderate permeability and piping hazard	SM-SSS-56; Carpenter Mesa SW; Sta 11245; elev: 4,127.99ft; tunnel portal in Mesa Rica SS-Morrison Fm landslide complex

TABLE B2. CONCHAS CANAL SOILS/SURFACE GEOLOGY CHARACTERISTICS AND LEAKAGE POTENTIAL ARCH-HURLEY CONSERVATION DISTRICT—WESTERN CANAL SECTION, SAN MIGUEL COUNTY

Distance Down Canal in Feet	Major Structures on Canal	Major Soil Series & Relationship	Soils Code	General Soil Characteristics along Canal Route	General Characteristics of Surficial Geologic Units	Canal Leakage Potential; Major Controlling Factors	Soil Survey Sheet Number; Topographic Quadrangle; Remarks
115,186 (22.30 mi)	Tunnel No. 3 Exit Portal	Latom-Newkirk-Rock Outcrop	LN	poor top soil, loam to stony loam, shallow bedrock at 6 to 18 inches	thin foot slope alluvium, over Upper Chinle Gp shale, siltstone, and sandstone	start of ~5-mi canal reach between Tunnels 3 and 4 (including Mile 25; see Remarks) with high leakage potential; moderate permeability and piping hazard	SM-SSS-56; Carpenter Mesa SW; Sta 11342; elev: 4,120.98ft; portal in upper Redonda Fm-Chinle Gp; just up canal from area of proposed Lined Reach S-8
116,946 (22.61 mi)	Siphon 15 Inlet	Latom-Newkirk-Rock Outcrop	LN	poor top soil, loam to stony loam, shallow bedrock at 6 to 18 inches	thin foot slope alluvium, over Upper Chinle Gp shale, siltstone, and sandstone	see above; moderate permeability and piping hazard	SM-SSS-56; Carpenter Mesa SW; down canal from area of proposed Lined Reach S-8
117,248 (22.68 mi)	Siphon 15 Outlet	Latom-Newkirk-Rock Outcrop	LN	poor top soil, loam to stony loam, shallow bedrock at 6 to 18 inches	thin foot slope alluvium, over Upper Chinle Gp shale, siltstone, and sandstone	see above; moderate permeability and piping hazard	SM-SSS-56; Carpenter Mesa SW; Sta 11361; elev: 4,120.22ft
118,363	Culvert under Canal	Latom-Newkirk-Rock Outcrop	LN	poor top soil, loam to stony loam, shallow bedrock at 6 to 18 inches	thin foot slope alluvium, over Upper Chinle Gp shale, siltstone, and sandstone	see above; moderate permeability and piping hazard	SM-SSS-56; Carpenter Mesa SW
120,205	Culvert under Canal	Latom-Newkirk-Rock Outcrop	LN	poor top soil, loam to stony loam, shallow bedrock at 6 to 18 inches	thin foot slope alluvium, over Upper Chinle Gp shale, siltstone, and sandstone	see above; moderate permeability and piping hazard	SM-SSS-56; Carpenter Mesa SW
121,983	Culvert under Canal	Latom-Newkirk-Rock Outcrop	LN	poor top soil, loam to stony loam, shallow bedrock at 6 to 18 inches	thin foot slope alluvium, over Upper Chinle Gp shale, siltstone, and sandstone	see above; moderate permeability and piping hazard	SM-SSS-56; Carpenter Mesa SW; up canal from area of proposed Lined Reach S-9

TABLE B2. CONCHAS CANAL SOILS/SURFACE GEOLOGY CHARACTERISTICS AND LEAKAGE POTENTIAL ARCH-HURLEY CONSERVATION DISTRICT—WESTERN CANAL SECTION, SAN MIGUEL COUNTY

Distance Down Canal in Feet	Major Structures on Canal	Major Soil Series & Relationship	Soils Code	General Soil Characteristics along Canal Route	General Characteristics of Surficial Geologic Units	Canal Leakage Potential; Major Controlling Factors	Soil Survey Sheet Number; Topographic Quadrangle; Remarks
124,923	Culvert under Canal	Canez-Ima	CA	fair top soil, deep to shallow, fine to coarse loamy, slight to medium plasticity	valley-fill alluvium associated with fans, low terraces, and floodplains, over Upper Chinle Gp	see above; moderate permeability, low to moderate piping hazard	SM-SSS-56; Carpenter Mesa SW; down canal from area of proposed Lined Reach S-9
126,157	Culvert under Canal	Latom-Newkirk-Rock Outcrop	LN	poor top soil, loam to stony loam, shallow bedrock at 6 to 18 inches	thin foot slope alluvium, over Upper Chinle Gp shale, siltstone, and sandstone	see above; moderate permeability and piping hazard	SM-SSS-56; Carpenter Mesa SW
128,257	Culvert under Canal	Latom-Newkirk-Rock Outcrop	LN	poor top soil, loam to stony loam, shallow bedrock at 6 to 18 inches	thin foot slope alluvium, over Upper Chinle Gp shale, siltstone, and sandstone	see above; moderate permeability and piping hazard	SM-SSS-56; Carpenter Mesa SW
131,248	Culvert under Canal (near Mile 25)	Latom-Newkirk-Rock Outcrop	LN	poor top soil, loam to stony loam, shallow bedrock at 6 to 18 inches	thin foot slope alluvium, over Upper Chinle Gp shale, siltstone, and sandstone	see above; moderate permeability and piping hazard	SM-SSS-56; Carpenter Mesa SW; down canal from Sta 11469; elev: 4,120.22ft; near "design site" of Siphon 16 (mi 24.72-76)
132,845	Siphon 17 Inlet, Johnson Creek	Latom-Newkirk-Rock Outcrop	LN	poor top soil, loam to stony loam, shallow bedrock at 6 to 18 inches	thin foot slope alluvium, over Upper Chinle Gp shale, siltstone, and sandstone	see above; moderate permeability and piping hazard	SM-SSS-56; Carpenter Mesa SW; Sta 11518; elev: 4,118.28ft
134,092 (25.62 mi)	Siphon 17 Outlet	Latom-Newkirk-Rock Outcrop	LN	poor top soil, loam to stony loam, shallow bedrock at 6 to 18 inches	thin foot slope alluvium, over Upper Chinle Gp shale, siltstone, and sandstone	see above; moderate permeability and piping hazard	SM-SSS-56; Carpenter Mesa SW; Sta 11531; elev: 4,116.58ft

TABLE B2. CONCHAS CANAL SOILS/SURFACE GEOLOGY CHARACTERISTICS AND LEAKAGE POTENTIAL ARCH-HURLEY CONSERVATION DISTRICT—WESTERN CANAL SECTION, SAN MIGUEL COUNTY

Distance Down Canal in Feet	Major Structures on Canal	Major Soil Series & Relationship	Soils Code	General Soil Characteristics along Canal Route	General Characteristics of Surficial Geologic Units	Canal Leakage Potential; Major Controlling Factors	Soil Survey Sheet Number; Topographic Quadrangle; Remarks
135,126 (25.88 mi)	Culvert under Canal	Redona-Quay	RE	good to fair top soil, deep, fine loamy to loamy, with gravel lenses, calcareous	older upland alluvial and eolian deposits (up to 15 ft thick) on Chinle Gp	see above; moderate permeability and piping hazard	SM-SSS-56; Carpenter Mesa SW
136,629	Culvert under Canal	Redona-Quay	RE	good to fair top soil, deep, fine loamy to loamy, with gravel lenses, calcareous	older upland alluvial and eolian deposits (up to 15 ft thick) on Chinle Gp	see above; moderate permeability and piping hazard	SM-SSS-56; Carpenter Mesa SW; up canal from area of proposed Lined Reach S-10
138,145	Culvert under Canal	Redona-Quay	RE	good to fair top soil, deep, fine loamy to loamy, with gravel lenses, calcareous	older upland alluvial and eolian deposits (up to 15 ft thick) on Chinle Gp	see above; moderate permeability and piping hazard	SM-SSS-56; Carpenter Mesa SW; down canal from area of proposed Lined Reach S-10
139,542	Culvert under Canal	Redona-Quay	RE	good to fair top soil, deep, fine loamy to loamy, with gravel lenses, calcareous	older upland alluvial and eolian deposits (up to 15 ft thick) on Chinle Gp	see above; moderate permeability and piping hazard	SM-SSS-56; Carpenter Mesa SW
140,952	Culvert under Canal	Canez-Ima	CA	fair top soil, deep to shallow, fine to coarse loamy, slight to medium plasticity	valley-fill alluvium associated with fans, low terraces, and floodplains, over Upper Chinle Gp	see above; moderate permeability, low to moderate piping hazard	SM-SSS-56; Carpenter Mesa SW

TABLE B2. CONCHAS CANAL SOILS/SURFACE GEOLOGY CHARACTERISTICS AND LEAKAGE POTENTIAL ARCH-HURLEY CONSERVATION DISTRICT—WESTERN CANAL SECTION, SAN MIGUEL COUNTY

Distance Down Canal in Feet	Major Structures on Canal	Major Soil Series & Relationship	Soils Code	General Soil Characteristics along Canal Route	General Characteristics of Surficial Geologic Units	Canal Leakage Potential; Major Controlling Factors	Soil Survey Sheet Number; Topographic Quadrangle; Remarks
141,760 (27.32 mi)	Tunnel No.4 Entrance Portal	Canez-Ima	CA	fair top soil, deep to shallow, fine to coarse loamy, slight to medium plasticity	valley-fill alluvium associated with fans, low terraces, and floodplains, over Upper Chinle Gp	end of 5-mi reach with high leakage potential (see above: 22.3 mi); moderate permeability, low to moderate piping hazard	SM-SSS-56; Carpenter Mesa SW; Sta 11607; up canal from portal, elev: 4,115.91ft; portal just below base of Entrada SS in uppermost Redonda Fm-Chinle Gp
148,913 (28.68 mi)	Tunnel No.4 Exit Portal	Latom-Newkirk-Rock Outcrop	LN	poor top soil, loam to stony loam, shallow bedrock at 6 to 18 inches	very steep; landslide complex on Mesa Rica escarpment; Morrison Fm-Entrada SS slide blocks over Redonda Fm-Chinle Gp	start of ~1.6-mi canal reach between Tunnel 4 and Siphon 18 inlet (see Remarks) with moderate to high leakage potential; slow to moderate permeability, medium to high piping hazard	SM-SSS-57; Carpenter Mesa SW; Sta 11679; down canal from portal, elev: 4,109.74ft; portal in west-tilted slide block of Summerville Fm/Entrada sandstones
149,832	Culvert under Canal	La Lande-Redona	LC	fair top soil, fine loamy, deep, medium plasticity	very steep; landslide complex on Mesa Rica escarpment; Morrison Fm-Entrada SS slide blocks over Redonda Fm-Chinle Gp	see above; slow to moderate permeability, medium to high piping hazard	SM-SSS-57; Carpenter Mesa SW
152,735	Culvert under Canal, Road Creek	La Lande-Redona	LC	fair top soil, fine loamy, deep, medium plasticity	foot slope-fan and valley-fill alluvium over basal Entrada SS and uppermost Redonda Fm-Chinle Gp	see above; slow to moderate permeability, medium to high piping hazard	SM-SSS-57; Carpenter Mesa SW

TABLE B2. CONCHAS CANAL SOILS/SURFACE GEOLOGY CHARACTERISTICS AND LEAKAGE POTENTIAL ARCH-HURLEY CONSERVATION DISTRICT—WESTERN CANAL SECTION, SAN MIGUEL COUNTY

Distance Down Canal in Feet	Major Structures on Canal	Major Soil Series & Relationship	Soils Code	General Soil Characteristics along Canal Route	General Characteristics of Surficial Geologic Units	Canal Leakage Potential; Major Controlling Factors	Soil Survey Sheet Number; Topographic Quadrangle; Remarks
153,497	Culvert under Canal	La Lande-Redona	LC	fair top soil, fine loamy, deep, medium plasticity	foot slope-fan and valley-fill alluvium over basal Entrada SS and uppermost Redonda Fm-Chinle Gp	see above; slow to moderate permeability, medium to high piping hazard	SM-SSS-57; Carpenter Mesa SW
157,233 (30.24 mi)	Siphon 18	Ustorthent-Rock Outcrop Complex	UR	very shallow to deeper well-drained soils local bedrock units	very steep; landslide complex on Mesa Rica escarpment; Morrison Fm slide blocks on Summerville Fm/Entrada sandstones	end of 1.6-mi reach with moderate to high leakage potential (see above: 28.68 mi); permeability and piping hazard highly variable	SM-SSS-57; Carpenter Mesa SW; Sta 11763; elev: 4,108.92ft
157,676 (30.33 mi)	Siphon 18 Outlet	Ustorthent-Rock Outcrop Complex	UR	very shallow to deeper well-drained soils local bedrock units	very steep; landslide complex on Mesa Rica escarpment; Morrison Fm slide blocks on Summerville Fm/Entrada sandstones	permeability and piping hazard highly variable	SM-SSS-57; Carpenter Mesa SW
157,676 to 158,267	Western Bench Flume	Ustorthent-Rock Outcrop Complex	UR	very shallow to deeper well-drained soils local bedrock units	very steep; landslide complex on Mesa Rica escarpment; Morrison Fm slide blocks on Summerville Fm/Entrada sandstones	permeability and piping hazard highly variable	SM-SSS-57; Carpenter Mesa SW; Sta 11776; elev: 4,107.98ft
160,803 to 162,372	Eastern Bench Flume	Latom-Rock Outcrop	LW*	poor top soil, shallow bedrock at 6 to 18 inches	very steep; landslide complex on Mesa Rica escarpment; Morrison Fm slide blocks on Summerville Fm/Entrada sandstones	permeability and piping hazard highly variable	SM-SSS-57 (soils mapped as LW in Quay County); Trinchera Creek; Sta 11775-6; elev: 4,107.79-60ft

TABLE B2. CONCHAS CANAL SOILS/SURFACE GEOLOGY CHARACTERISTICS AND LEAKAGE POTENTIAL ARCH-HURLEY CONSERVATION DISTRICT—WESTERN CANAL SECTION, SAN MIGUEL COUNTY

Distance Down Canal in Feet	Major Structures on Canal	Major Soil Series & Relationship	Soils Code	General Soil Characteristics along Canal Route	General Characteristics of Surficial Geologic Units	Canal Leakage Potential; Major Controlling Factors	Soil Survey Sheet Number; Topographic Quadrangle; Remarks
162,372 (31.19 mi)	San Miguel-Quay County Line	Latom-Rock Outcrop	LW*	poor top soil, shallow bedrock at 6 to 18 inches	very steep; landslide complex on Mesa Rica escarpment; Morrison Fm slide blocks on Summerville Fm/Entrada sandstones	permeability and piping hazard highly variable	SM-SSS-57 (soils mapped as UR in San Miguel County); Trinchera Creek; Sta 11812-3: elev: 4,107.27ft
162,500 (31.24 mi)	Siphon 19 Inlet	Latom-Rock Outcrop	LW	poor top soil, shallow bedrock at 6 to 18 inches	thin foot slope alluvium, over Entrada SS	permeability and piping hazard highly variable	SM-SSS-57; Trinchera Creek; Sta 11815; elev: 4,107.25ft
163,242 (31.40 mi)	Siphon 19 Outlet	Latom-Rock Outcrop	LW	poor top soil, shallow bedrock at 6 to 18 inches	thin foot slope alluvium, over Entrada SS	start of ~1.6-mi reach with high leakage potential; permeability and piping hazard highly variable	SM-SSS-57; Trinchera Creek; Sta 11823: elev: 4,106.1ft
167,012	Quay-San Miguel County Line	Latom-Rock Outcrop	LW	poor top soil, shallow bedrock at 6 to 18 inches	very steep; landslide complex on Mesa Rica escarpment; Morrison Fm slide blocks on Summerville Fm/Entrada sandstones	see above; permeability and piping hazard highly variable	SM-SSS-57; Trinchera Creek
168,564 (32.24 mi)	Siphon 20 Inlet	Badland	BA	poor top soil, very shallow to moderately deep on bedrock	very steep; landslide complex on Mesa Rica escarpment; Morrison Fm slide blocks on Summerville Fm/Entrada sandstones	end of 1.6-mi reach with high leakage potential (see above: 31.4 mi); permeability and piping hazard highly variable	SM-SSS-57; Liberty Mesa; Sta 12074; elev: 4,105.57ft

TABLE B2. CONCHAS CANAL SOILS/SURFACE GEOLOGY CHARACTERISTICS AND LEAKAGE POTENTIAL ARCH-HURLEY CONSERVATION DISTRICT—WESTERN CANAL SECTION, SAN MIGUEL COUNTY

Distance Down Canal in Feet	Major Structures on Canal	Major Soil Series & Relationship	Soils Code	General Soil Characteristics along Canal Route	General Characteristics of Surficial Geologic Units	Canal Leakage Potential; Major Controlling Factors	Soil Survey Sheet Number; Topographic Quadrangle; Remarks
168,844 (32.40 mi)	Siphon 20 Outlet	Badland	BA	poor top soil, very shallow to moderately deep on bedrock	very steep; landslide complex on Mesa Rica escarpment; Morrison Fm slide blocks on Summerville Fm/Entrada sandstones	permeability and piping hazard highly variable	SM-SSS-57; Liberty Mesa; Sta 12078; elev: 4,104.97ft
169,955	Culvert under Canal	Badland	BA	poor top soil, very shallow to moderately deep on bedrock	thin foot slope alluvium, over Entrada SS	permeability and piping hazard highly variable	SM-SSS-57; Liberty Mesa
171,901 (33.06 mi)	Siphon 21 Inlet	Badland	BA	poor top soil, very shallow to moderately deep on bedrock	thin foot slope alluvium, over Entrada SS	permeability and piping hazard highly variable	SM-SSS-57; Liberty Mesa; Sta 12115; elev: 4,104.65ft
172,293 (33.15 mi)	Siphon 21 Outlet	Badland	BA	poor top soil, very shallow to moderately deep on bedrock	toe of landslide complex on Mesa Rica escarpment; Morrison Fm slide blocks on Summerville Fm/Entrada sandstones	start of 3000-ft reach with moderate to low leakage potential; permeability and piping hazard highly variable	SM-SSS-57; Liberty Mesa; Sta 12115; elev: 4,104.65ft; up canal from area of proposed Lined Reach S-11
175,082 (33.66 mi)	Siphon 22 Inlet	Badland	BA	poor top soil, very shallow to moderately deep on bedrock	thin foot slope alluvium, over Entrada SS	see above; permeability and piping hazard highly variable	SM-SSS-57; Liberty Mesa; Sta 12147; elev: 4,103.74ft; down canal from area of proposed Lined Reach S-11
176,073 (33.87 mi)	Siphon 22 Outlet	Badland	BA	poor top soil, very shallow to moderately deep on bedrock	thin foot slope alluvium, over Entrada SS	start of ~1.3-mi reach with moderate to high leakage potential; permeability and piping hazard highly variable	SM-SSS-57; Liberty Mesa; Sta 12158; elev: 4,102.32ft

TABLE B2. CONCHAS CANAL SOILS/SURFACE GEOLOGY CHARACTERISTICS AND LEAKAGE POTENTIAL ARCH-HURLEY CONSERVATION DISTRICT—WESTERN CANAL SECTION, SAN MIGUEL COUNTY

Distance Down Canal in Feet	Major Structures on Canal	Major Soil Series & Relationship	Soils Code	General Soil Characteristics along Canal Route	General Characteristics of Surficial Geologic Units	Canal Leakage Potential; Major Controlling Factors	Soil Survey Sheet Number; Topographic Quadrangle; Remarks
179,078	Culvert under Canal	Canez-Ima	CA	fair top soil, deep to shallow, fine to coarse loamy, slight to medium plasticity	valley-fill alluvium associated with fans, low terraces, and floodplains, over Entrada SS	see above; moderate permeability, low to moderate piping hazard	SM-SSS-57; Liberty Mesa
182,871	NM 104 Bridge over Canal (up Canal from Mile 35)	Canez-Ima	CA	fair top soil, deep to shallow, fine to coarse loamy, slight to medium plasticity	valley-fill alluvium associated with fans, low terraces, and floodplains, over Entrada SS	end of ~1.3-mi reach with moderate to high leakage potential; upstream from reach with high leakage potential; moderate permeability, low to moderate piping hazard	SM-SSS-57; Trinchera Creek; up canal from area of proposed Lined Reach S-12
189,492 (36.38 mi)	Siphon 23 Inlet	Canez-Ima	CA	fair top soil, deep to shallow, fine to coarse loamy, slight to medium plasticity	valley-fill alluvium associated with fans, low terraces, and floodplains, over Entrada SS	see above; moderate permeability, low to moderate piping hazard	SM-SSS-57; Trinchera Creek; Sta 12299; elev: 4,100.99ft; down canal from area of proposed Lined Reach S-12
189,897 (36.47 mi)	Siphon 23 Outlet	Canez-Ima	CA	fair top soil, deep to shallow, fine to coarse loamy, slight to medium plasticity	valley-fill alluvium associated with fans, low terraces, and floodplains, over Entrada SS	see above; moderate permeability, low to moderate piping hazard	SM-SSS-57; Liberty Mesa; Sta 12304; elev: 4,100.32ft
192,818	Culvert under Canal	Canez-Ima	CA	fair top soil, deep to shallow, fine to coarse loamy, slight to medium plasticity	valley-fill alluvium associated with fans, low terraces, and floodplains, over Summerville Fm/Entrada sandstones	near end of ~1.5-mi reach with high leakage potential; moderate permeability, low to moderate piping hazard	SM-SSS-57; Liberty Mesa; about 1.5 miles up canal from area of proposed Lined Reach S-13

TABLE B2. CONCHAS CANAL SOILS/SURFACE GEOLOGY CHARACTERISTICS AND LEAKAGE POTENTIAL ARCH-HURLEY CONSERVATION DISTRICT—WESTERN CANAL SECTION, SAN MIGUEL COUNTY

Distance Down Canal in Feet	Major Structures on Canal	Major Soil Series & Relationship	Soils Code	General Soil Characteristics along Canal Route	General Characteristics of Surficial Geologic Units	Canal Leakage Potential; Major Controlling Factors	Soil Survey Sheet Number; Topographic Quadrangle; Remarks
205,077 (39.33 mi)	Bridge over Canal at Quay County Line	Canez-Ima	CA	fair top soil, deep to shallow, fine to coarse loamy, slight to medium plasticity	valley-fill alluvium associated with fans, low terraces, and floodplains, over Entrada SS	about 1,000-ft down canal from ~2,000-ft reach with high leakage potential (see Remarks); moderate permeability, low to moderate piping hazard	SM-SSS-57; Liberty Mesa; Sta 12458; elev: 4,098.81ft; down canal from area of proposed Lined Reach S-13 (USBOR 1983). AHCD Project lands

TABLE B3. CONCHAS CANAL SOILS/SURFACE GEOLOGY CHARACTERISTICS AND LEAKAGE POTENTIAL WESTERN ARCH-HURLEY CD PROJECT

Distance Down Canal in Feet	Major Structures on Canal	Major Soil Series and Associations	Soils Code	General Soil Characteristics along Canal Route	General Characteristics of Surficial Geologic Units	Canal Leakage Potential; Major Controlling Factors	Soil Survey Sheet Number; Topographic Quadrangle; Remarks
205,077 (39.33 mi; 207,657 ft)	Bridge over Canal at Quay County Line	Canez-Ima	CA	fair top soil, deep to shallow, fine to coarse loamy, slight to medium plasticity	valley-fill alluvium associated with fans, low terraces, and floodplains, over Entrada SS	start of long (~11,000-ft) reach with high leakage potential; based on interpretation of Landsat Color IR imagery (9/2000); moderate permeability, low to moderate piping hazard	SM-SSS-57; Liberty Mesa; Sta 12458; elev: 4,098.81ft; About 1 mi down canal from area of proposed Lined Reach S-13 (USBOR 1983). AHCD Project Bdry
206,941	Bell Lateral	Kinkead	Km	poor top soil, clay, high plasticity	alluvial fills of upland swales and depressions, over Entrada SS	see above; large range in permeability and shrink-swell potential; form deep cracks when dry	Tucumcari Area (Quay County) Soil Survey Sheet 6; Liberty Mesa
207,141	Culvert under Canal	Kinkead	Km	poor top soil, clay, high plasticity	alluvial fills of upland swales and depressions, over Entrada SS	see above; large range in permeability and shrink-swell potential; form deep cracks when dry	Q-SSS-6; Liberty Mesa
208,135	NM 104 Bridge over Canal	Kinkead	Km	poor top soil, clay, high plasticity	alluvial fills of upland swales and depressions, over Entrada SS	see above; large range in permeability and shrink-swell potential; form deep cracks when dry	Q-SSS-6; Liberty Mesa; Start of long proposed Lined Reach S-14 (USBOR 1983)
210,990 (211,200)	Roberts Lateral (near Mile 40)	Canez	Ce	fair top soil, deep to shallow, fine loamy, medium plasticity	upland and valley-fill alluvium associated with fans and terraces, over Entrada SS	in lower part of long reach with high leakage potential; moderate permeability, low to moderate piping hazard	Q-SSS-6; Liberty Mesa; In area of proposed Lined Reach S-14

TABLE B3. CONCHAS CANAL SOILS/SURFACE GEOLOGY CHARACTERISTICS AND LEAKAGE POTENTIAL WESTERN ARCH-HURLEY CD PROJECT

Distance Down Canal in Feet	Major Structures on Canal	Major Soil Series and Associations	Soils Code	General Soil Characteristics along Canal Route	General Characteristics of Surficial Geologic Units	Canal Leakage Potential; Major Controlling Factors	Soil Survey Sheet Number; Topographic Quadrangle; Remarks
218,474 (41.86 mi)	Siphon 24 Inlet	Canez	Ce	fair top soil, deep to shallow, fine loamy, medium plasticity	upland and valley-fill alluvium associated with fans and terraces, on Morrison/Summerville Fms over Entrada SS	moderate permeability, low to moderate piping hazard	Q-SSS-6; Liberty Mesa; Sta 12590; elev: 4,098.011ft; seepage area (Trauger)
219,053 (41.98 mi; 221,654 ft)	Siphon 24 Outlet	Canez	Ce	fair top soil, deep to shallow, fine loamy, medium plasticity	upland and valley-fill alluvium associated with fans and terraces, on Morrison/Summerville Fms over Entrada SS	moderate permeability, low to moderate piping hazard	Q-SSS-6; Liberty Mesa; Sta 12597; elev: 4,097.261ft
221,415	Liberty Lateral	Los Tanos	Lx	fair top soil, sandy loam, bedrock 18 to 42 inches	thin footslope alluvium, over mudstones and sandstones of the Morrison/Summerville Fms	near upper end of ~1.5-mi reach with high leakage potential; moderately rapid permeability	Q-SSS-12; Liberty Mesa
226,053	Coulter Lateral	Quay	Qg	fair top soil, deep, fine silty, calcareous, medium plasticity	older upland alluvial and eolian deposits (up to 20 ft thick) on mudstones and sandstones of the Morrison/Summerville Fms	see above; moderate permeability and piping hazard	Q-SSS-11; Liberty Mesa
228,202	Culvert under Canal	Los Tanos	Lx	fair top soil, sandy loam, bedrock 18 to 42 inches	thin footslope alluvium, over mudstones and sandstones of the Morrison/Summerville Fms	see above; moderately rapid permeability	Q-SSS-11; Liberty Mesa
229,415	Bridge over Canal	Los Tanos	Lx	fair top soil, sandy loam, bedrock 18 to 42 inches	thin footslope alluvium, over mudstones and sandstones of the Morrison/Summerville Fms	see above; moderately rapid permeability	Q-SSS-6; Liberty Mesa; Sta 12704; elev: 4,096.111ft

TABLE B3. CONCHAS CANAL SOILS/SURFACE GEOLOGY CHARACTERISTICS AND LEAKAGE POTENTIAL WESTERN ARCH-HURLEY CD PROJECT

Distance Down Canal in Feet	Major Structures on Canal	Major Soil Series and Associations	Soils Code	General Soil Characteristics along Canal Route	General Characteristics of Surficial Geologic Units	Canal Leakage Potential; Major Controlling Factors	Soil Survey Sheet Number; Topographic Quadrangle; Remarks
229,648	Culvert under Canal	Los Tanos	Lx	fair top soil, sandy loam, bedrock 18 to 42 inches	thin footslope alluvium, over mudstones and sandstones of the Morrison/Summerville Fms	near lower end of ~1.5-mi reach with high leakage potential; moderately rapid permeability	Q-SSS-11; Liberty Mesa
231,010 (44.22 mi)	Siphon 25 Inlet	Latom	Lt	poor top soil, shallow bedrock at 6 to 18 inches	thin footslope alluvium, over mudstones and sandstones of the Morrison/Summerville Fms	moderate permeability and piping hazard	Q-SSS-11; Liberty Mesa; enter tunnel beneath valley of Pajarito Creek
~232,500 to 234,000	Siphon 25 beneath Pajarito Creek	Minneosa	Mn	fair top soil, very deep loamy fine sand over fine-gravelly sand	sandy to loamy (Pajarito Creek) floodplain and coarser stream-channel deposits, over Entrada Fm	moderate to high permeability	Q-SSMS-11; Liberty Mesa; area of seepage and springs immediately downstream
235,606 (45.11 mi, 238,181)	Siphon 25 Outlet	Canez	Ce	fair top soil, deep to shallow, fine loamy, medium plasticity	upland and valley-fill alluvium associated with fans and terraces, over Morrison/Summerville Fms	many (long and short) reaches between Siphons 25 and 26 with apparent moderate to high leakage potential; moderate permeability, low to moderate piping hazard	Q-SSS-11; Liberty Mesa; exit tunnel beneath valley of Pajarito Creek
239,736	W. Gaynell Ave Bridge over Canal	La Lande	Lp	fair top soil, fine loamy, deep, medium plasticity	footslope-fan and valley-fill alluvium over mudstones and sandstones of the Morrison/Summerville Fms	see above; slow to moderate permeability, medium to high piping hazard	Q-SSS-11, 11i; Liberty Mesa

TABLE B3. CONCHAS CANAL SOILS/SURFACE GEOLOGY CHARACTERISTICS AND LEAKAGE POTENTIAL WESTERN ARCH-HURLEY CD PROJECT

Distance Down Canal in Feet	Major Structures on Canal	Major Soil Series and Associations	Soils Code	General Soil Characteristics along Canal Route	General Characteristics of Surficial Geologic Units	Canal Leakage Potential; Major Controlling Factors	Soil Survey Sheet Number; Topographic Quadrangle; Remarks
243,373	Culvert under Canal	Toyah	Th	good top soil, fine loamy, medium plasticity	footslope-fan and valley-fill alluvium over mudstones and sandstones of the Morrison/Summerville Fms	see above; moderate permeability, low to moderate piping hazard	Q-SSS-11i; Liberty Mesa; Start of area of proposed Lined Reach S-15
247,257	Culvert under Canal	Canez	Ce	fair top soil, deep to shallow, fine loamy, medium plasticity	footslope-fan and valley-fill alluvium over mudstones and sandstones of the Morrison/Summerville Fms	see above; moderate permeability, low to moderate piping hazard	Q-SSS-11i; Liberty Mesa
249,679	Bridge over Canal	Latom	Lt	poor top soil, loam to stony loam, shallow bedrock at 6 to 18 inches	thin footslope alluvium, over mudstones and sandstones of the Morrison/Summerville Fms	see above; moderate permeability and piping hazard	Q-SSS-11i; Liberty Mesa; Tunnel beneath Old US-66 and SPRR
251,757 (48.13 mi)	Siphon 26 Inlet (Bluewater Creek)	Latom	Lt	poor top soil, loam to stony loam, shallow bedrock at 6 to 18 inches	thin footslope alluvium, over mudstones and sandstones of the Morrison/Summerville Fms	see above (45.11 mi); moderate permeability and piping hazard	Q-SSS-11i; Liberty Mesa; Tunnel beneath Old US-66 and SPRR; Bluewater Creek Siphon
252,543 (48.30 mi)	Siphon 26 Outlet	Latom	Lt	poor top soil, loam to stony loam, shallow bedrock at 6 to 18 inches	thin footslope alluvium, over mudstones and sandstones of the Morrison/Summerville Fms	moderate permeability and piping hazard	Q-SSS-17; Liberty Mesa
256,138	Farm-road Bridge over Canal	Latom	Lt	poor top soil, loam to stony loam, shallow bedrock at 6 to 18 inches	thin footslope alluvium, over mudstones and sandstones of the Morrison/Summerville Fms	moderate permeability and piping hazard	Q-SSS-17; Liberty Mesa

TABLE B3. CONCHAS CANAL SOILS/SURFACE GEOLOGY CHARACTERISTICS AND LEAKAGE POTENTIAL WESTERN ARCH-HURLEY CD PROJECT

Distance Down Canal in Feet	Major Structures on Canal	Major Soil Series and Associations	Soils Code	General Soil Characteristics along Canal Route	General Characteristics of Surficial Geologic Units	Canal Leakage Potential; Major Controlling Factors	Soil Survey Sheet Number; Topographic Quadrangle; Remarks
256,758 (49.08 mi, 249,142 ft)	Siphon 27 Inlet	Quay	Qg	fair top soil, deep, fine silty, calcareous, medium plasticity	thin footslope alluvium, over mudstones and sandstones of the Morrison/Summerville Fms	moderate permeability and piping hazard	Q-SSS-17; Liberty Mesa
256,937 (49.11 mi)	Siphon 27 Outlet	Quay	Qg	fair top soil, deep, fine silty, calcareous, medium plasticity	thin footslope alluvium, over mudstones and sandstones of the Morrison/Summerville Fms	moderate permeability and piping hazard	Q-SSS-17; Liberty Mesa
257,644	Culvert under Canal	Quay	Qg	fair top soil, deep, fine silty, calcareous, medium plasticity	older upland alluvial and eolian deposits (up to 20 ft thick) on Morrison/Summerville Fms	near start of ~2,500-ft reach with moderate leakage potential; moderate permeability and piping hazard	Q-SSS-17; Liberty Mesa
260,819	Bridge over Canal	Quay	Qg	fair top soil, deep, fine silty, calcareous, medium plasticity	older upland alluvial and eolian deposits (up to 20 ft thick) on Entrada SS	moderate permeability and piping hazard	Q-SSS-17; Liberty Mesa
261,184	Lateral to North	Quay	Qf, Qg	fair top soil, deep, fine silty, calcareous, medium plasticity	older upland alluvial and eolian deposits (up to 20 ft thick) on Entrada SS	near start of long reach with apparent moderate to high leakage potential (including area of Siphon 28); moderate permeability and piping hazard	Q-SSS-17; Liberty Mesa
263,192 (50.35; 265,848 ft)	Siphon 28 Inlet (Smith Creek)	Quay	Qk	fair top soil, deep, fine silty, calcareous, medium plasticity	older upland alluvial and eolian deposits (up to 20 ft thick) on Chinle Gp	see above; moderate permeability and piping hazard	Q-SSS-17; Liberty Mesa; Smith Creek Siphon

TABLE B3. CONCHAS CANAL SOILS/SURFACE GEOLOGY CHARACTERISTICS AND LEAKAGE POTENTIAL WESTERN ARCH-HURLEY CD PROJECT

Distance Down Canal in Feet	Major Structures on Canal	Major Soil Series and Associations	Soils Code	General Soil Characteristics along Canal Route	General Characteristics of Surficial Geologic Units	Canal Leakage Potential; Major Controlling Factors	Soil Survey Sheet Number; Topographic Quadrangle; Remarks
263,833 (50.48 mi)	Siphon 28 Outlet	Quay	Qk	fair top soil, deep, fine silty, calcareous, medium plasticity	older upland alluvial and eolian deposits (up to 20 ft thick) on Chinle Gp	see above; moderate permeability and piping hazard	Q-SSS-17; Liberty Mesa
265,291	Bridge over Canal	Quay	Qf	fair top soil, deep, fine silty, calcareous, medium plasticity	older upland alluvial and eolian deposits (up to 20 ft thick) on Chinle Gp	see above; moderate permeability and piping hazard	Q-SSS-17; Liberty Mesa
265,784	Tucumcari Lateral to North	Quay	Qf	fair top soil, deep, fine silty, calcareous, medium plasticity	older upland alluvial and eolian deposits (up to 20 ft thick) on Chinle Gp	near end of long reach with apparent moderate to high leakage potential (including area of Siphon 28); moderate permeability and piping hazard	Q-SSS-17; Liberty Mesa
267,884	Bridge over Canal	Redona	Ro	good top soil, deep, loamy to fine silty, with gravelly zones	older upland alluvial and eolian deposits (up to 20 ft thick) on Chinle Gp	within reach with low to moderate leakage potential; moderate permeability and piping hazard	Q-SSS-17; Tucumcari
270,997	Bridge over Canal	Quay	Qf	fair top soil, deep, fine silty, calcareous, medium plasticity	older upland alluvial and eolian deposits (up to 20 ft thick) on Chinle Gp	within reach with low to moderate leakage potential; moderate permeability and piping hazard	Q-SSS-17; Tucumcari
272,416 (52.08 mi; 274,982 ft)	Tunnel No. 5 Upstream Portal	Redona	Rn	good top soil, deep, loamy to fine silty, with gravelly zones	older upland alluvial and eolian deposits (up to 20 ft thick) on Chinle Gp	at lower end of reach with low to moderate leakage potential; moderate permeability and piping hazard	Q-SSS-17; Tucumcari; Tunnel under south part of Tucumcari from Seventh to First Avenues

TABLE B3. CONCHAS CANAL SOILS/SURFACE GEOLOGY CHARACTERISTICS AND LEAKAGE POTENTIAL WESTERN ARCH-HURLEY CD PROJECT

Distance Down Canal in Feet	Major Structures on Canal	Major Soil Series and Associations	Soils Code	General Soil Characteristics along Canal Route	General Characteristics of Surficial Geologic Units	Canal Leakage Potential; Major Controlling Factors	Soil Survey Sheet Number; Topographic Quadrangle; Remarks
275,476 (52.67 mi)	Tunnel No. 5 Down-stream Portal	Quay	Qf	fair top soil, deep, fine silty, calcareous, medium plasticity	older upland alluvial and eolian deposits (up to 20 ft thick) on Chinle Gp	start of ~2-mi reach extending to Siphon 30 with moderate to high leakage potential; moderate permeability and piping hazard	Q-SSS-18; Tucumcari
277,644	Lateral to North	Canez	Ch	fair top soil, deep to shallow, fine loamy, medium plasticity	upland and valley-fill alluvium associated with fans and terraces, over Upper Chinle Gp	see above; moderate permeability, low to moderate piping hazard	Q-SSS-18; Tucumcari
~278,910	Culvert under Canal	Toyah	Th	good top soil, deep, fine loamy, medium plasticity	footslope-fan and valley-fill alluvium over Chinle Gp shale, siltstone, and sandstone	see above; moderate permeability, low to moderate piping hazard	Q-SSS-18; Tucumcari
280,373	I-40W Bridge over Conchas Canal	Lacita	Ld	poor top soil, deep, fine silty, medium plasticity	younger valley-fill alluvium over Upper Chinle Gp shale, siltstone, and sandstone	see above; slow to moderate permeability, moderate to high piping hazard	Q-SSS-18; Tucumcari
280,464	I-40E Bridge over Canal	Lacita	Ld	poor top soil, deep, fine silty, medium plasticity	younger valley-fill alluvium over Upper Chinle Gp shale, siltstone, and sandstone	see above; slow to moderate permeability, moderate to high piping hazard	Q-SSS-18; Tucumcari
280,989	Lateral to Tucumcari Lake	Lacita	Ld	poor top soil, deep, fine silty, medium plasticity	younger valley-fill alluvium over Upper Chinle Gp shale, siltstone, and sandstone	see above; slow to moderate permeability, moderate to high piping hazard	Q-SSS-18; Tucumcari

TABLE B3. CONCHAS CANAL SOILS/SURFACE GEOLOGY CHARACTERISTICS AND LEAKAGE POTENTIAL WESTERN ARCH-HURLEY CD PROJECT

Distance Down Canal in Feet	Major Structures on Canal	Major Soil Series and Associations	Soils Code	General Soil Characteristics along Canal Route	General Characteristics of Surficial Geologic Units	Canal Leakage Potential; Major Controlling Factors	Soil Survey Sheet Number; Topographic Quadrangle; Remarks
283,204	Siphon 29 Inlet	Lacita	Ld	poor top soil, deep, fine silty, medium plasticity	younger valley-fill alluvium over Upper Chinle Gp shale, siltstone, and sandstone	see above; slow to moderate permeability, moderate to high piping hazard	Q-SSS-18; Tucumcari
283,396	Siphon 29 Outlet	Lacita	Ld	poor top soil, deep, fine silty, medium plasticity	younger valley-fill alluvium over Upper Chinle Gp shale, siltstone, and sandstone	see above; slow to moderate permeability, moderate to high piping hazard	Q-SSS-18; Tucumcari
~285,400	Culverts under Canal	Lacita	Ld	poor top soil, deep, fine silty, medium plasticity	younger valley-fill alluvium over Upper Chinle Gp shale, siltstone, and sandstone	see above; slow to moderate permeability, moderate to high piping hazard	Q-SSS-18; Tucumcari; Includes area of proposed Lined Reach S-16
288,068	Siphon 30 Inlet	San Jon	Sa	poor top soil, severe erosion hazard, shale at 18 inches	thin footslope alluvium, over Upper Chinle Gp shale, siltstone, and sandstone	lower end of ~2-mi reach with moderate to high leakage potential; slow permeability, with bedrock at 18 to 42 inches limiting losses	Q-SSS-18; Tucumcari
~288,368 (290,400)	Siphon 30 Outlet (up Canal from Mile 55)	San Jon	Sa	poor top soil, severe erosion hazard, shale at 18 inches	thin footslope alluvium, over Upper Chinle Gp shale, siltstone, and sandstone	slow permeability, with bedrock at 18 to 42 inches limiting losses	Q-SSS-18; Tucumcari
292,816	Canal Splits at the "Y"	Quay	Qg	fair top soil, deep, fine silty, calcareous, medium plasticity	older upland alluvial and eolian deposits (up to 20 ft thick) on Chinle Gp	moderate permeability and piping hazard	Q-SSS-18; Tucumcari; Hudson Canal to northeast, and Conchos Canal to southeast; elevation ~4,090ft

TABLE B4. CONCHAS CANAL SOILS/SURFACE GEOLOGY CHARACTERISTICS AND LEAKAGE POTENTIAL SOUTHEASTERN ARCH-HURLEY CONSERVANCY DISTRICT IRRIGATION-PROJECT AREA

Distance Down Canal in Feet	Major Structures on Canal	Major Soil Series and Associations	Soils Code	General Soil Characteristics along Canal Route	General Characteristics of Surficial Geologic Units	Canal Leakage Potential; Major Controlling Factors	Soil Survey Sheet Number; Topographic Quadrangle; Remarks
292,816	Canal Splits at the "Y"	Quay	Qg	fair top soil, deep, fine silty, calcareous, medium plasticity	older upland alluvial and eolian deposits (up to 20 ft thick) on Chinle Gp	near upper end of 6,000-ft reach with high leakage potential; based on interpretation of Landsat Color IR imagery (9/2000); moderate permeability and piping hazard	Q-SSS-18; Tucumcari; Hudson Canal to northeast, and Conchos Canal to southeast; elev: ~4,090ft
297,723	Lateral, Drains to Hittson Creek	Quay	Qg	fair top soil, deep, fine silty, calcareous, medium plasticity	older upland alluvial and eolian deposits (up to 20 ft thick) on Chinle Gp	near lower end of 6,000-ft reach with high leakage potential; moderate permeability and piping hazard	Q-SSS-18; Tucumcari
299,753	Bridge	Quay	Qg	fair top soil, deep, fine silty, calcareous, medium plasticity	older upland alluvial and eolian deposits (up to 20 ft thick) on Chinle Gp	moderate permeability and piping hazard	Q-SSS-18; Tucumcari
306,973	Lateral	Quay, Montoya	Qg,Mr	deep, fine silty to clayey, calcareous, medium to high plasticity	upland alluvial and eolian deposits (up to 20 ft thick) on Chinle Gp	in upper part of ~1-mi reach with moderate leakage potential; large range in permeability and shrink-swell potential; form deep cracks when dry	Q-SSS-25i; Bulldog Mesa
308,120	Savage Lateral	Montoya	Mr	deep, fine textured, calcareous, medium to high plasticity	clayey fills of broad swales in upland-plain and valley-floor settings	in upper part of ~1-mi reach with moderate leakage potential; large range in permeability and shrink-swell potential; form deep cracks when dry	Q-SSS-25i; Bulldog Mesa

TABLE B4. CONCHAS CANAL SOILS/SURFACE GEOLOGY CHARACTERISTICS AND LEAKAGE POTENTIAL SOUTHEASTERN ARCH-HURLEY CONSERVANCY DISTRICT IRRIGATION-PROJECT AREA

Distance Down Canal in Feet	Major Structures on Canal	Major Soil Series and Associations	Soils Code	General Soil Characteristics along Canal Route	General Characteristics of Surficial Geologic Units	Canal Leakage Potential; Major Controlling Factors	Soil Survey Sheet Number; Topographic Quadrangle; Remarks
310,174	Siphon 31	Montoya	Mr	deep, fine textured, calcareous, medium to high plasticity	clayey fills of broad swales in upland-plain and valley-floor settings	in lower part of ~1-mi reach with moderate leakage potential; large range in permeability and shrink-swell potential; form deep cracks when dry	Q-SSS-22; Bulldog Mesa
314,266; 314,346	Lateral; Bridge	Redona	Ro	good top soil, deep, loamy to fine silty, with gravelly zones	older upland alluvial and eolian deposits (up to 20 ft thick) on Chinle Gp	in upper part of 0.5-mi reach with moderate leakage potential; moderate permeability and piping hazard	Q-SSS-22; Bulldog Mesa
320,204	Bridge and Lateral to Regulator Reservoir 2	Tucumcari	Tm	deep, heavy clay loam, calcareous, medium to high plasticity	fine-grained fills of broad swales on upland plains	up canal from and adjacent to areas of "artificial ponding" (see Remarks); large range in permeability and shrink-swell potential; form deep cracks when dry	Q-SSS-22, 25; Bulldog Mesa; Start of area of proposed Lined Reach S-17 (USBOR 1983)
324,979	Bridge	Quay	Qn	fair top soil, deep, fine silty, calcareous, medium plasticity	oilder upland alluvial and eolian deposits (up to 20 ft thick) on Chinle Gp	near upper end of reach with low leakage potential; moderate permeability, moderate piping hazard	Q-SSS-22, 25; Bulldog Mesa
328,174	Wharton Lateral	Ima	Im	poor top soil, sandy loam, deep, low plasticity	younger upland alluvial and eolian deposits (up to 10 ft thick) on Chinle Gp	see above; moderately rapid permeability	Q-SSS-22, 25; Bulldog Mesa

TABLE B4. CONCHAS CANAL SOILS/SURFACE GEOLOGY CHARACTERISTICS AND LEAKAGE POTENTIAL SOUTHEASTERN ARCH-HURLEY CONSERVANCY DISTRICT IRRIGATION-PROJECT AREA

Distance Down Canal in Feet	Major Structures on Canal	Major Soil Series and Associations	Soils Code	General Soil Characteristics along Canal Route	General Characteristics of Surficial Geologic Units	Canal Leakage Potential; Major Controlling Factors	Soil Survey Sheet Number; Topographic Quadrangle; Remarks
333,896	Siphon 32 Inlet	Latom	Lt	poor top soil, loam to stony loam, shallow bedrock at 6 to 18 inches	footslope alluvium, over Upper Chinle Gp shale, siltstone, and sandstone	near lower end of reach with low leakage potential; moderate to high permeability, moderate piping hazard	Q-SSS-25; Bulldog Mesa; enter tunnel beneath valley of Plaza Larga Creek
336,286	Siphon 32 Outlet	San Jon, La Lande	Sa, Ls	poor top soil, moderately deep to shallow, fine loamy to loamy, calcareous	footslope alluvium, over Upper Chinle Gp shale, siltstone, and sandstone	near upper end of reach with moderate leakage potential; moderate permeability and piping hazard	Q-SSS-25; Bulldog Mesa; exit tunnel beneath valley of Plaza Larga Creek
343,308	Siphon 33 Inlet	Latom	Lt	poor top soil, loam to stony loam, shallow bedrock at 6 to 18 inches	footslope alluvium, over Upper Chinle Gp shale, siltstone, and sandstone	in lower part of reach with moderate leakage potential; moderate to high permeability, moderate piping hazard	Q-SSS-25; Tucumcari SE
343,568	Siphon 33 Outlet	Latom	Lt	poor top soil, loam to stony loam, shallow bedrock at 6 to 18 inches	footslope alluvium, over Upper Chinle Gp shale, siltstone, and sandstone	in lower part of reach with moderate leakage potential; moderate to high permeability, moderate piping hazard	Q-SSS-25; Tucumcari SE
348,855	NM 88 Bridge	Quay	Qf	fair top soil, deep, fine silty, calcareous, medium plasticity	older upland alluvial and eolian deposits (up to 20 ft thick) on Chinle Gp	near upper end of reach with moderate to high leakage potential; moderate permeability and piping hazard	Q-SSS-25; Tucumcari SE
354,250	Siphon 34	Redona	Ro	good top soil, deep, loamy to fine silty, with gravelly zones	older alluvial valley fill (up to 20 ft thick) on Chinle Gp shale, siltstone, and sandstone	within reach with moderate to high leakage potential; moderate permeability and piping hazard	Q-SSS-26; Tucumcari SE

TABLE B4. CONCHAS CANAL SOILS/SURFACE GEOLOGY CHARACTERISTICS AND LEAKAGE POTENTIAL SOUTHEASTERN ARCH-HURLEY CONSERVANCY DISTRICT IRRIGATION-PROJECT AREA

Distance Down Canal in Feet	Major Structures on Canal	Major Soil Series and Associations	Soils Code	General Soil Characteristics along Canal Route	General Characteristics of Surficial Geologic Units	Canal Leakage Potential; Major Controlling Factors	Soil Survey Sheet Number; Topographic Quadrangle; Remarks
361,104	Lateral	Quay	Qg	fair top soil, deep, fine silty, calcareous, medium plasticity	older upland alluvial and eolian deposits (up to 20 ft thick) on Chinle Gp	within short reach with moderate to low leakage potential; moderate permeability and piping hazard	Q-SSS-26; Tucumcari SE
363,100	Conchas and Farrow Laterals at End of Main Canal	Canez	Ce	fair top soil, deep to shallow, fine loamy, medium plasticity	upland and valley-fill alluvium associated with fans and terraces, over Upper Chinle Gp	within reach with moderate to high leakage potential; moderate permeability, low to moderate piping hazard	Q-SSS-26; Tucumcari SE; elev: ~4,070ft

TABLE B5. HUDSON CANAL SOILS/SURFACE GEOLOGY CHARACTERISTICS AND LEAKAGE POTENTIAL NORTHEASTERN ARCH-HURLEY CONSERVANCY DISTRICT IRRIGATION-PROJECT AREA

Distance Down Canal in Feet	Major Structures on Canal	Major Soil Series and Associations	Soils Code	General Soil Characteristics along Canal Route	General Characteristics of Surficial Geologic Units	Canal Leakage Potential; Major Controlling Factors	Soil Survey Sheet Number; Topographic Quadrangle; Remarks
0.00 (292,816 ft Conchas Canal)	Canal splits at the "Y"	Quay	Qg	fair top soil, deep, fine silty, calcareous, medium plasticity	older upland alluvial and eolian deposits (up to 20 ft thick) on Chinle Gp	near upper end of long reach with high leakage potential; based on interpretation of Landsat Color IR imagery (9/2000); moderate permeability and piping hazard	Q-SSS-18; Tucumcari; Hudson Canal to northeast, elevation ~4,090ft
9,423	Bridge over Canal (I-40 and Tucumcari Blvd East)	Quay	Qg	fair top soil, deep, fine silty, calcareous, medium plasticity	older upland alluvial and eolian deposits (up to 20 ft thick) on Chinle Gp	near lower end of long reach with high leakage potential; moderate permeability and piping hazard	Q-SSS-18; Tucumcari
9,536	Siphon H1 Inlet	Quay	Qg	fair top soil, deep, fine silty, calcareous, medium plasticity	older upland alluvial and eolian deposits (up to 20 ft thick) on Chinle Gp	at lower end of long reach with high leakage potential; moderate permeability and piping hazard	Q-SSS-18; Tucumcari
9,627	I-40E Bridge over Siphon H1	Quay	Qg	fair top soil, deep, fine silty, calcareous, medium plasticity	older upland alluvial and eolian deposits (up to 20 ft thick) on Chinle Gp	moderate permeability, moderate piping hazard	Q-SSS-14; Tucumcari
9,745	I-40W Bridge over Siphon H1	Quay	Qg	fair to good top soil, deep, fine loamy to loamy, with gravel lenses, calcareous	older upland alluvial and eolian deposits (up to 20 ft thick) on Chinle Gp	moderate permeability, moderate piping hazard	Q-SSS-14; Tucumcari

TABLE B5. HUDSON CANAL SOILS/SURFACE GEOLOGY CHARACTERISTICS AND LEAKAGE POTENTIAL NORTHEASTERN ARCH-HURLEY CONSERVANCY DISTRICT IRRIGATION-PROJECT AREA

Distance Down Canal in Feet	Major Structures on Canal	Major Soil Series and Associations	Soils Code	General Soil Characteristics along Canal Route	General Characteristics of Surficial Geologic Units	Canal Leakage Potential; Major Controlling Factors	Soil Survey Sheet Number; Topographic Quadrangle; Remarks
14,015	Siphon H1 Outlet	Quay	Qg	fair top soil, deep, fine silty, calcareous, medium plasticity	older upland alluvial and eolian deposits (up to 20 ft thick) on Chinle Gp	at upper end of long reach with moderate to high leakage potential; moderate permeability and piping hazard	Q-SSS-14; Tucumcari
24,519	Lateral to south (Hittson Creek)	Quay, Redona	Qn, Ro	fair top soil, deep, fine silty, calcareous, medium plasticity	older upland alluvial and eolian deposits (up to 20 ft thick) on Chinle Gp	in lower part of reach with moderate to high leakage potential; moderate permeability and piping hazard	Q-SSS-14; Tucumcari
31,046	Bridge over Canal (Airport-Jones Road to south)	Montoya	Mr	deep, fine textured, calcareous, medium to high plasticity	clayey fills of broad swales in upland-plain and valley-floor settings	down canal from long reach with moderate to high leakage potential; large range in permeability and shrink-swell potential; form deep cracks when dry	Q-SSS-14; Lesbia
36,334	Felk Lateral (to southeast)	Quay, Ima	Qg, Im	deep, fine silty to coarse loamy, calcareous, medium to low plasticity	upland and footslope alluvial deposits (up to 10 ft thick) on Chinle Gp	near lower end of long reach with moderate to high leakage potential; moderate to high permeability, moderate piping hazard	Q-SSS-15; Lesbia
43,529	Lateral (to south)	Montoya, Lacita	Ms, Ld	deep, fine textured to silty, calcareous, medium to high plasticity	fine-grained fills of broad swales and valleys on upland plains over Upper Chinle Gp	near upper end of 4.5-mi reach with moderate leakage potential; large range in permeability and shrink-swell potential; form deep cracks when dry	Q-SSS-9; Lesbia

TABLE B5. HUDSON CANAL SOILS/SURFACE GEOLOGY CHARACTERISTICS AND LEAKAGE POTENTIAL NORTHEASTERN ARCH-HURLEY CONSERVANCY DISTRICT IRRIGATION-PROJECT AREA

Distance Down Canal in Feet	Major Structures on Canal	Major Soil Series and Associations	Soils Code	General Soil Characteristics along Canal Route	General Characteristics of Surficial Geologic Units	Canal Leakage Potential; Major Controlling Factors	Soil Survey Sheet Number; Topographic Quadrangle; Remarks
44,632	Bridge over Canal	La Lande	Lp	fair top soil, fine loamy, deep, medium plasticity	footslope-fan and valley-fill alluvium over Upper Chinle Gp shale, siltstone, and sandstone	near upper end of 4.5-mi reach with moderate leakage potential; slow to moderate permeability, piping hazard	Q-SSS-9; Lesbia
63,668	Bridge over Canal	Redona, Ima	Rn, Im	deep, loamy to fine silty and sandy, with gravelly zones and moderate to low plasticity	upland and footslope alluvial deposits (up to 10 ft thick) on Chinle Gp	near lower end of 4.5-mi reach with moderate leakage potential; moderate to high permeability, moderate piping hazard	Q-SSS-9,10; Lesbia; Start of proposed Lined Reach S-18 (USBOR. 1983)
65,013	Bugg Lateral (to south)	Redona	Rn	good top soil, deep, loamy to fine silty, with gravelly zones	older upland and alluvial valley fill (up to 20 ft thick) on Chinle Gp shale, siltstone, and sandstone	near lower end of 4.5-mi reach with moderate leakage potential; moderate to high permeability, moderate piping hazard	Q-SSS-10; Lesbia; End of proposed Lined Reach S-18 .
69,224	Bridge over Canal	Quay	Qg	fair top soil, deep, fine silty, calcareous, medium plasticity	older upland and footslope alluvial deposits (up to 10 ft thick) on Chinle Gp	at end of 4.5-mi reach with moderate leakage potential; moderate permeability and piping hazard	Q-SSS-10; Lesbia
73,798	Troutman Lateral (to east)	Los Tanos	Lx	fair top soil, sandy loam, bedrock 18 to 42 inches	thin footslope alluvium, over Upper Chinle Gp shale and siltstone	start of 2.5-mi reach with moderate leakage potential; moderate permeability and piping hazard	Q-SSS-10; Lesbia

TABLE B5. HUDSON CANAL SOILS/SURFACE GEOLOGY CHARACTERISTICS AND LEAKAGE POTENTIAL NORTHEASTERN ARCH-HURLEY CONSERVANCY DISTRICT IRRIGATION-PROJECT AREA

Distance Down Canal in Feet	Major Structures on Canal	Major Soil Series and Associations	Soils Code	General Soil Characteristics along Canal Route	General Characteristics of Surficial Geologic Units	Canal Leakage Potential; Major Controlling Factors	Soil Survey Sheet Number; Topographic Quadrangle; Remarks
77,923	Lateral (short to east-Revuelto Creek)	Redona	Rn	good top soil, deep, loamy to fine silty, with gravelly zones	older upland alluvial and eolian deposits (up to 20 ft thick) on Chinle Gp	in upper part of 2.5-mi reach with moderate leakage potential; moderate permeability and piping hazard	Q-SSS-10; Lesbia
87,396	Lateral (short to east-Revuelto Creekk)	Canez, Los Tanos	Ch, Lx	deep to very shallow, fine loamy to sandy, medium to low plasticity, over bedrock	alluvial fan, terrace, and thin footslope deposits, over Upper Chinle Gp	near lower end of 2.5-mi reach with moderate leakage potential; moderate to high permeability, low to moderate piping hazard	Q-SSS-4; San Jon NW
94,843	Hudson and "Mater" Laterals at End of Main Canal	Redona	Rd	good top soil, deep, loamy to fine silty, with gravelly zones	older upland alluvial and eolian deposits (up to 20 ft thick) on Chinle Gp	in area with moderate leakage potential; moderate permeability and piping hazard	Q-SSS-4; Logan South; elevation ~4,070ft