UNIFIED SOIL CLASSIFICATION
INCLUDING IDENTIFICATION AND DESCRIPTION

FIELD IDENTIFICATION PROCEDURES (Excluding particles larger than 3 inches and basing fractions on estimated weights)				GROUP SYMBOLS	TYPICAL NAMES	INFORMATION REQUIRED FOR DESCRIBING SOILS
COARSE GRAINED SOILS — More than half of material is larger than No. 200 sieve size 12	GRAVELS — More than half of coarse fraction is larger than No. 4 sieve size (For visual classifications, the " size may be used as equivalent to the No. 4 sieve size)	CLEAN GRAVELS (Little or no fines)	Wide range in grain size and substantial amounts of all intermediate particle sizes.	GW	Well graded gravel's, gravel–sand mixtures; little or no fines	Give typical name; indicate approximate percentages of sand and gravel; max. size; angularity, surface condition, and hardness of the coarse grains; local or geologic name and other pertinent descriptive information, and symbol in parentheses.
			Predominantly one size or a range of sizes with some intermediate sizes missing.	GP	Poorly graded gravel's, gravel–sand mixtures; little or no fines	
		GRAVELS WITH FINES (Appreciable amount of fines)	Non–plastic fines (for identification procedures see ML below).	GM	Silty gravels, poorly graded gravel–sand–silt mixtures	For undisturbed soils add information on stratification, degree of compactness, cementation, moisture conditions and drainage characteristics.
			Plastic fines (for identification procedures see CL below).	GC	Clayey gravels, poorly graded gravel–sand–clay mixtures	
	SANDS — More than half of coarse fraction is smaller than No. 4 sieve size (For visual classifications, the " size may be used as equivalent to the No. 4 sieve size)	CLEAN SANDS (Little or no fines)	Wide range in grain sizes and substantial amounts of all intermediate particle sizes.	SW	Well graded sands, gravely sands; little or no fines	EXAMPLE: – Silty Sand, gravely; about 20% hard, angular gravel particles ½ – inch maximum size; rounded and subangular sand grains coarse to fine; about 15% non–plastic fines with low dry strength; well compacted and moist in place; alluvial sand; (SM).
			Predominantly one size or a range of sizes with some intermediate sizes missing.	SP	Poorly graded sands, gravely sands; little or no fines	
		SANDS WITH FINES (Appreciable amount of fines)	Non–plastic fines (for indentification procedures see ML below).	SM	Silty sands, poorly graded sand–silt mixtures	
			Plastic fines (for identification procedures see CL below).	SC	Clayey sands, poorly graded sand–clay mixtures	
FINE GRAINED SOILS — More than half of material is smaller than No. 200 sieve size (The No. 200 sieve size is about the smallest particle visible to the naked eye)	IDENTIFICATION PROCEDURES ON FRACTION SMALLER THAN No 40 SIEVE SIZE	DRY STRENGTH (Crushing Characteristics)	DILATANCY (Reaction to skaking)	TOUGHNESS (Consistency near Plastic Limit)			
	SILTS AND CLAYS — Liquid limit less than 50	None to slight	Quick to slow	None	ML	Inorganic silty and very fine sands, rock flour, silty or clayey fine sands with slight plasticity	Give typical name; degree and character of plasticity, amount and maximum size of coarse grains; color in wet condition, odor in any, local or geologic name, and other pertinent descriptive information; and symbol in parentheses.
		Medium to high	None to very slow	Medium	CL	Inorganic clays to low to medium plasticity, gravely clays, sandy clays, silty clays, lean clays	
		Slight to medium	Slow	Slight	OL	Organic silts and organic silt–clays of low plasticity	
	SILTS AND CLAYS — Liquid limit greater than 50	Slight to medium	Slow to none	Slight to medium	MH	Inorganic silts, micaceous or diatomaceous fine sandy or silty soils, elastic silts	For undisturbed soils add information on structure, stratification, consistency in undisturbed and remolded states. Moisture and drainage conditions.
		High to very high	None	High	CH	Inorganic clays of high plasticity, fat clays	
		Medium to high	None to very slow	Slight to medium	OH	Inorganic clays of medium to high plasticity	EXAMPLE: – Clayey Silt, brown; slightly plastic. small percentage of fine sand. numerous vertical root holes, firm and dry in place, loess, (ML).
HIGHLY ORGANIC SOILS	Readily identified by color, odor, spongy feel and frequently by fibrous texture.			PT	Peat and other highly organic soils	

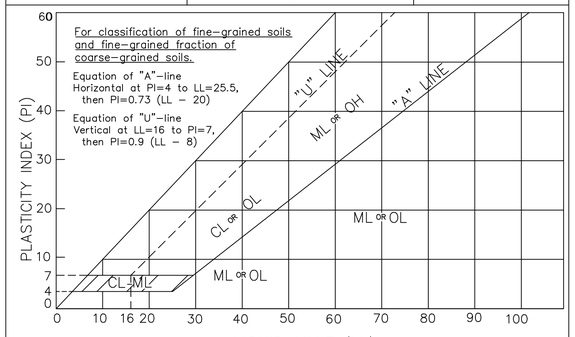
LABORATORY CLASSIFICATION CRITERIA

Use grain size curve identifying the fractions as given under field identification

Determine percentages of gravel and sand from grain size curve. Depending on percentage of fines (fraction smaller than No. 200 sieve size) coarse grained soils are classified as follows:

Less than 5%	GW, GP, SW, SP
More than 12%	GM, GC, SM, SC
5% to 12%	Bordering cases requiring use of dual symbols.

$C_V = \frac{D_{60}}{D_{10}}$ Greater than 4 $C_C = \frac{(D_{30})2}{D_{10}\ Dep}$ Between one and 3	
Not meeting all gradation requirements for GW	
Atterberg limits below "A" line or PI less than 4	Above "A" line with PI between 4 and 7 are borderline cases requiring use of dual symbols.
Atterberg limits above "A" line with PI greater than 7	
Cv = $\frac{D\ 60}{D\ 10}$ Greater than 6 Cc = $\frac{(D\ 30)2}{D\ 10\ Dep}$ Between one and 3	
Not meeting all gradation requirements for SW	
Afterberg limits below "A" line or PI less than 4	Above "A" line with PI between 4 and 7 are borderline cases requiring use of dual symbols.
Afterberg limits above "A" line with PI greater than 7	



FOR LABORATORY CLASSIFICATION OF FINE GRAINED SOILS

* Boundary classifications: – Soils processing characteristics of two groups are designated by combinations of group symbols for Example GW–GC, well graded gravel mixture with clay binder

* All sieve sizes on this chart are US standard.

ADOPTED BY – CORPS OF ENGINEERS AND BUREAU OF RECLAMATION 1952

FIELD IDENTIFICATION PROCEDURES FOR FINE GRAINED SOILS OR FRACTIONS

These procedures are to be performed on the minus No. 40 sieve size particles, in for field classification purposes, screening is not intended, simply remove by hand the coarse particles that interfere with the tests.

DILATANCY (Reaction to shaking)

After removing particles larger than No 40 sieve sieve, prepare a pat striking vigorously against the other of moist soil with a volume of about one–half cubic inch. Add enough water if necessary to make the soil soft but not sticky.

Place the pot in the open palm of one hand and shake horizontally, hand several times. A positive reaction consists of the appearance of water on the surface of the pot which changes to a livery consistency and becomes glossy. When the sample is squeezed between the fingers, the water and gloss disappear from the surface, the pot stiffens, and finally it cracks or crumbles. The rapidity of appearance of water during shaking and of its disappearance during squeezing assist in identifying the character of the times in a soil.

Very fine clean sands give the quickest and most distinct reaction whereas a plastic clay has no reaction inorganic silts, such as a typical rock flour, show a moderately quick reaction.

DRY STRENGTH (Crushing Characteristics)

After removing particles larger than No. 40 sieve size, mold a pot of soil to the consistency of putty, adding water if necessary. Allow the pot to dry completely by oven, sun, or air drying and then test its strength by breaking and crumbling between the fingers. This strength is a measure of the character and quantity of the colloidal fraction contained in the soil. The dry strength increases with increasing plasticity.

High dry strength is characteristic for clays of the CH group A typical inorganic silt possesses only very slight dry strength Silty fine sands and silts have about the same slight dry strength, but can be distinguished by the feel when powdering the dried specimen. Fine sand feels gritty whereas a typical silt has the smooth feel of flour.

Letter symbols in the logs, are group symbols of the Unified soil classification system based on field indent. Copies of Drawing No. 103–D–347, Unified Soil Classification, may be obtained on request office of Director of Design and Construction. Bureau of Reclamation, Denver, Colorado R0225.

TOUGHNESS (Consistency near plastic limit)

After removing particles larger than No. 40 sieve size, a specimen of soil about one–half inch cube in size is molded to the consistency of putty. If too dry, water must be added and if sticky, the specimen should be spread out in a thin layer and allowed to lose some moisture by evaporation. Then the specimen is rolled out by hand on a smooth surface or between the palms into a thread about one–eighth inch in diameter. The thread is then folded and rerolled repeatedly. During this manipulation, the moisture content is gradually reduced and the specimen stiffens, finally loses its plasticity, and crumbles when the plastic limit is reached.

After the thread crumbles, the pieces should be lumped together and a slight kneading action continued until the lump crumbles.

The tougher the thread near the plastic limit and the stiffer the lump when it finally crumbles, the more potent is the colloidal clay fraction in the soil weakness of the thread at the plastic limit and quick loss of coherence of the lump below the plastic limit indicate either inorganic clay of low plasticity, or materials such as kaolin – type clays and organic clays which occur below the A–line.

Highly organic clays have a very weak and spongy feel at the plastic limit.

103–D–347

REV NO		
1	2003– 12 –05 D – G.T.	REVISED PLASTICITY CHART. REDRAWN WITH AUTOCAD SOFTWARE.

DATE AND TIME PLOTTED 12–05–2003
PLOTTED BY Roy Dunbar

WEATHERING

FRESH (W1): Body of rock is not oxidized or discolored; fracture surfaces are not oxidized or discolored*; no separation of grain boundaries; no change of texture and no solutioning. Hammer rings when crystalline rocks are struck.

SLIGHTLY WEATHERED TO FRESH (W2):**

SLIGHTLY WEATHERED (W3): Discoloration or oxidation is limited to surface of, or short distance from fractures; some feldspar crystals are dull; fracture surfaces have minor to complete discoloration or oxidation; no visible separation of grain boundaries; texture preserved and minor leaching of soluble minerals may be present. Hammer rings when crystalline rocks are struck, body of rock is not weakened by weathering.

MODERATELY TO SLIGHTLY WEATHERED (W4):**

MODERATELY WEATHERED (W5): Discoloration or oxidation extends from fractures, usually throughout body of rock; ferromagnesian minerals are "rusty", feldspar crystals are "cloudy"; all fracture surfaces are discolored or oxidized; partial opening of grain boundaries visible; texture generally preserved, but soluble minerals may be mostly leached. Hammer does not ring when rock is struck, body of rock is slightly weakened.

INTENSELY TO MODERATELY WEATHERED (W6):**

INTENSELY WEATHERED (W7): Body of rock is discolored or oxidized throughout; all feldspars and ferromagnesian minerals are altered to clay to some extent. All fracture surfaces are discolored or oxidized, and friable; partial separation of grain boundaries, rock is friable; in situ disaggregation of granitics common in semi-arid regions; texture altered and leaching of soluble minerals may be complete. Rock has dull sound when struck with hammer; rock is weakened, usually can be broken with moderate to heavy manual pressure or by light hammer blow without reference to planes of weakness.

VERY INTENSELY WEATHERED (W8):**

DECOMPOSED (W9): Body of rock is discolored or oxidized throughout, but resistant minerals such as quartz may be unaltered; all feldspars and ferro-magnesian minerals are completely altered to clay; complete separation of grain boundaries (disaggregated), partial or complete remnant rock structure may be preserved, but resembles a soil.

NOTE: Weathering categories are established primarily for crystalline rocks and those with ferromagnesian minerals, weathering in various sedimentary rocks will not always fit the categories established – weathering categories may be modified for particular site conditions or alteration such as hydrothermal alteration. Where modified criteria are established, they should be identified and described.

* Characteristics of fracture surfaces do not include directional weathering along shears or faults and their associated fracture zones; for example a shear that carries weathering to great depths in a fresh rock mass would not require the whole rock mass to be classified as weathered.

** Combination descriptors are used when equal distribution of both weathering characteristics are present over significant intervals or where characteristics noted are "in between" the diagnostic characteristics.

DURABILITY INDEX

DURABILITY DESCRIPTOR	DESCRIPTIVE CRITERIA
DIØ	Rock specimen or exposure remains intact with no deleterious cracking after exposure longer than 1 year.
DI1	Rock specimen or exposure develops hairline cracking on surfaces within 1 month, but no disaggregation within 1 year of exposure.
DI2	Rock specimen or exposure develops hairline cracking on surfaces within 1 week, and/or disaggregation within 1 month of exposure.
DI3	Specimen or exposure may develop hairline cracks in 1 day and displays pronounced separation of bedding and/or disaggregation within 1 week of exposure.
DI4	Specimen or exposure displays pronounced cracking and disaggregation within 1 day (24 hours) of exposure. Generally ravels and degrades to small fragments.

COLOR

The Munsell color system (Geologic Society of America Rock Color Chart) should be used. This system defines wet color by its hue, value, and chroma. Color symbols used (i.e., 5 YR 5/6 may be included).

SEDIMENTARY AND PYROCLASTIC ROCK PARTICLE SIZES

Size in mm	Sedimentary Rounded, subrounded, subangular		Pyroclastic	
	Particle or fragment	Lithified product	Fragment	Lithified product
256	Boulder	Boulder conglomerate	Block[a] or Bomb[b]	Volcanic[a] breccia or Volcanic[b] agglomerate
64	Cobble	Cobble conglomerate		
4	Pebble	Pebble conglomerate	Lapilli	Lapillistone and Lapilli tuff
2	Granule	Granule conglomerate		
1	Very coarse sand Coarse sand	Sandstone (Very coarse, coarse, medium, fine, or very fine)	Coarse ash	Coarse tuff
0.5				
0.25	Medium sand			
0.125	Fine sand			
0.0625	Very fine sand			
0.00391	Silt	Siltstone/ Shale	Fine ash	Fine tuff
	Clay	Claystone Shale		

(a) Broken from previous igneous rock, block shaped (angular to subangular).
(b) Solidified from plastic material while in flight, rounded clasts.

IGNEOUS AND METAMORPHIC ROCK TEXTURE

TEXTURE DESCRIPTOR	AVERAGE GRAIN DIAMETER
VERY COARSE GRAINED OR PEGMATITIC	>10 mm [>3/8 in]
COARSE GRAINED	5–10 mm [3/16 –3/8 in]
MEDIUM GRAINED	1–5 mm [1/32 –3/16 in]
FINE GRAINED	0.1–1 mm [0.004 – 1/32 in]
APHANITIC (Cannot be seen with the unaided eye)	<0.1 mm [<0.004 in]

ADDITIONAL TEXTURAL ADJECTIVES

PIT (pitted) – pinhole to 0.03 ft [3/8 in] (<1 to 10 mm) openings.

VUG (vuggy) – Small openings (usually lined with crystals) ranging in diameter from 0.03 ft [3/8 in] to 0.33 ft [4 in] (10 to 100 mm).

CAVITY – An opening larger than 0.33 ft [4 in] (100 mm), size descriptions are required, and adjectives such as small, large, etc., may be used.

HONEYCOMBED – If numerous enough that only thin walls separate individual pits or vugs, this term further describes the preceding nomenclature to indicate cell-like form.

VESICLE (vesicular) – Small openings in volcanic rocks of variable shape and size formed by entrapped gas bubbles during solidification.

BEDDING FOLIATION OR FLOW TEXTURE

DESCRIPTORS	THICKNESS/SPACING
MASSIVE	Greater than 10 ft (>3 m)
VERY THICKLY (bedded, foliated or banded)	3 to 10 ft (1 to 3 m)
THICKLY	1 to 3 ft (300 mm to 1 m)
MODERATELY	0.3 to 1 ft (100 to 300 mm)
THINLY	0.1 to 0.3 ft (30 to 100 mm)
VERY THINLY	0.03 [3/8 in] to 0.1 ft (10 to 30 mm)
LAMINATED (Intensely foliated or banded)	Less than 0.03 ft [3/8 in] (<10 mm)

BEDROCK HARDNESS/STRENGTH

EXTREMELY HARD (H1): Core, fragment or exposure cannot be scratched with knife or sharp pick; can only be chipped with repeated heavy hammer blows.

VERY HARD (H2): Cannot be scratched with knife or sharp pick. Core or fragment breaks with repeated heavy hammer blows.

HARD (H3): Can be scratched with knife or sharp pick with difficulty (heavy pressure). Heavy hammer blow required to break specimen.

MODERATELY HARD (H4): Can be scratched with knife or sharp pick with light or moderate pressure. Core or fragment breaks with moderate hammer blow.

MODERATELY SOFT (H5): Can be grooved 1/16 inch (2 mm) deep by knife or sharp pick with moderate or heavy pressure. Core or fragment breaks with light hammer blow or heavy manual pressure.

SOFT (H6): Can be grooved or gouged easily by knife or sharp pick with light pressure, can be scratched with fingernail. Breaks with light to moderate manual pressure.

VERY SOFT (H7): Can be readily indented, grooved or gouged with fingernail, or carved with a knife. Breaks with light manual pressure.

Any bedrock unit softer than H7, Very Soft, is to be described using USBR 5005-86 (visual classification of soils) consistency characteristics.

REV NO		
1	3-8-00 D – P. M. R.	CONVERTED ORIGINAL DRAWING 40-D-6493 TO ACAD, CHANGED DWG. NO., MINOR REVISIONS.

ALWAYS THINK SAFETY

UNITED STATES
DEPARTMENT OF THE INTERIOR
BUREAU OF RECLAMATION

GEOLOGY FOR DESIGN & SPECIFICATIONS

STANDARD DESCRIPTORS AND DESCRIPTIVE CRITERIA FOR ROCK

GEOLOGY NOMENCLATURE COMMITTEE — CHECKED
DRAWN — TECH. APPROVAL
APPROVED — PEER REVIEWER

CADD SYSTEM	CADD FILENAME	DATE AND TIME PLOTTED
AutoCAD Rel. 12 c4 DENVER, COLORADO	40-D-7022.DWG MARCH 8, 2000	MAY 10, 2000 09:20

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DISCONTINUITY TERMINOLOGY

DISCONTINUITY – A collective term used for all structural breaks in geologic materials which usually are unhealed and have zero or low tensile strength. Discontinuities also may be healed and exhibit high tensile strength. Discontinuities comprise fractures (including joints), planes of weakness, shears/faults, and shear/fault zones. Contacts between various units also may be considered discontinuities.

FRACTURE – A term used to describe any natural break in geologic material excluding shears and shear zones. Additional fracture terminology is provided below.

SHEAR – A structural break where differential movement has taken place along a surface or zone of failure by shear; characterized by striations, slickensides, gouge, breccia, mylonite, or any combination of these. Often direction, amount of displacement, and continuity may not be known because of limited exposures or observations.

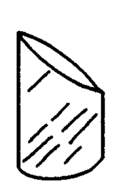
FAULT – A shear with significant continuity which can be correlated between observations; occurs over a significant portion of a given site, foundation area, or region; or is a segment of a fault or fault zone defined in the literature. The designation of a shear as a fault or fault zone is a site-specific determination.

SHEAR/FAULT ZONE – A shear that is expressed in relative terms of width. The zone may consist of gouge, breccia, or many related faults or shears together with fractured and crushed rock between the shears and faults, or any combination of these. In the literature many fault zones simply are referred to as faults.

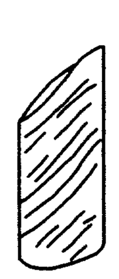
SHEAR-/FAULT-DISTURBED ZONE – An associated zone of fractures and/or folds adjacent to a shear or shear zone where the country rock has been subjected to only minor cataclastic action and may be mineralized. If adjacent to a fault or fault zone, the term is fault-disturbed zone. Occurrence, orientation, and areal extent of these phenomena depend upon depth of burial (pressure and temperature) during shearing, brittleness of materials, and the stress envelope.

FRACTURE TERMINOLOGY

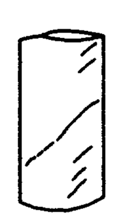
EXAMPLES SHOWN FOR CORE, BUT APPLICABLE TO ANY OBSERVATION



JOINT (JT) – A relatively planar fracture along which there has been little or no shearing displacement.



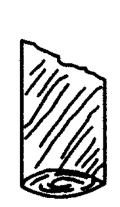
FOLIATION JOINT (FJ) OR BEDDING JOINT (BJ) – a relatively planar fracture which is parallel to foliation or bedding along which there has been little or no shearing displacement.



BEDDING PLANE SEPARATION – A separation along bedding after extraction or exposure due to stress relief or slaking.

INCIPIENT JOINT (IJ) OR INCIPIENT FRACTURE (IF) – A joint or fracture which does not continue through the specimen or at least is not seen with the naked eye. However, when the specimen is wetted, and then allowed to dry, the joint or fracture trace is evident. When core is broken, it breaks along an existing plane.

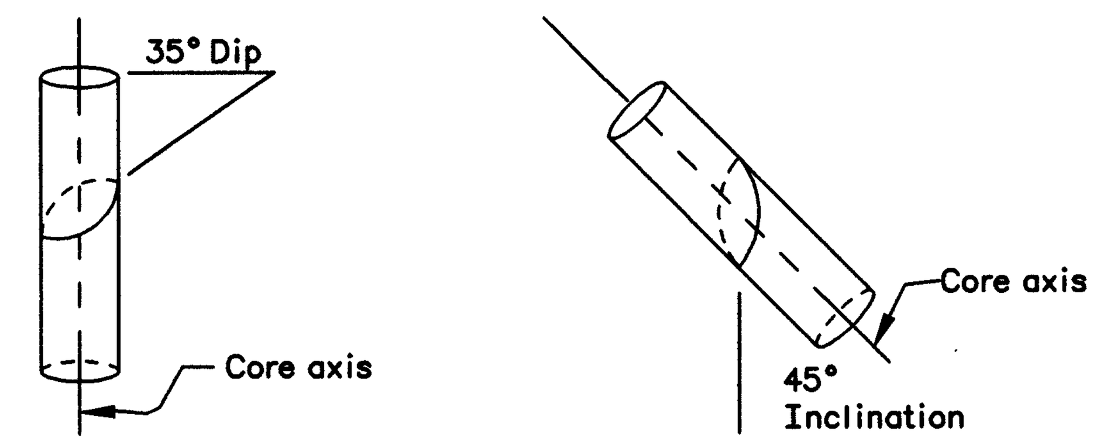
RANDOM FRACTURE (RF) – A natural break which does not belong to a joint set, and which exhibits a generally rough, very irregular, nonplanar surface.



MECHANICAL BREAK (MB) – A break due to drilling, blasting, or handling. Mechanical breaks parallel to bedding or foliation are called Bedding Breaks (BB) or Foliation Breaks (FB), respectively. Recognizing mechanical breaks may be difficult. The absence of oxidation, staining, or mineral fillings, and often a hackly or irregular surface are clues for recognition.

FRACTURE ZONE (FZ) – Numerous, very closely spaced intersecting fractures. Often fragmented core cannot be fitted together.

METHOD OF MEASURING DIP OF PLANAR DISCONTINUITIES, FOLIATION, AND BEDDING IN CORE



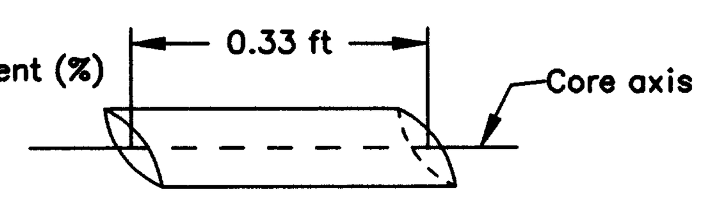
1. Vertical hole – true dip is measured and reported.
2. Angle hole – true dip usually not known; angle is measured from core axis and is called inclination.

ROCK QUALITY DESIGNATION (RQD)

EXAMPLE SHOWN FOR CORE, BUT APPLICABLE TO ANY LINEAR OBSERVATION

$$RQD = \frac{\text{Sum of length of solid core pieces > 0.33 ft [4 in] (100 mm) long}}{\text{Length of the run in feet (mm)}} \times 100$$

Expressed as percent (%)



FRACTURE FREQUENCY

FRACTURE FREQUENCY – The number of natural fractures occurring within a base length or core run. The number of fractures is divided by the length and is reported as fractures per foot or fractures per meter. Expressed as 3/m or 6/ft.

FRACTURE DENSITY

FRACTURE DENSITY – Based on the spacing of all natural fractures in an exposure or core recovery lengths in boreholes; excludes mechanical breaks, shears, and shear zones; however, shear-disturbed zones (fracturing outside the shear) are included. Descriptors for fracture density apply to all rock exposures such as tunnel walls, dozer trenches, outcrops, or foundation cut slopes and inverts, as well as boreholes. Descriptive criteria presented below are based on borehole cores where lengths are measured along the core axis. For other exposures the criterium is distance measured between fractures (size of blocks).

UNFRACTURED (FD0): No fractures.

VERY SLIGHTLY FRACTURED (FD1): Core recovered mostly in lengths greater than 3 feet (1 m).

SLIGHTLY TO VERY SLIGHTLY FRACTURED (FD2) *

SLIGHTLY FRACTURED (FD3): Core recovered mostly in lengths from 1 to 3 feet (300 to 1000 mm) with few scattered lengths less than 1 foot (300 mm) or greater than 3 feet (1000 mm).

MODERATELY TO SLIGHTLY FRACTURED (FD4) *

MODERATELY FRACTURED (FD5): Core recovered mostly in 0.3- to 1.0-foot (100- to 300-mm) lengths with most lengths about 0.6 foot (200 mm).

INTENSELY TO MODERATELY FRACTURED (FD6) *

INTENSELY FRACTURED (FD7): Lengths average from 0.1 to 0.3 foot (30 to 100 mm) with scattered fragmented intervals. Core recovered mostly in lengths less than 0.3 foot (100 mm).

VERY INTENSELY TO INTENSELY FRACTURED (FD8) *

VERY INTENSELY FRACTURED (FD9): Core recovered mostly as chips and fragments with a few scattered short core lengths.

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* Combinations of fracture densities (e.g., Very Intensely to Intensely Fractured or Moderately to Slightly Fractured) are used where equal distribution of both fracture density characteristics are present over a significant interval or exposure, or where characteristics are "in between" the descriptor definitions.

FRACTURE SPACING

JOINT SET, OR FRACTURE SPACING DESCRIPTOR	TRUE SPACING
EXTREMELY WIDELY SPACED (SP1)	Greater then 10 ft (>3 m)
VERY WIDELY SPACED (SP2)	3 to 10 ft (1 to 3 m)
WIDELY SPACED (SP3)	1 to 3 ft (300 mm to 1 m)
MODERATELY SPACED (SP4)	0.3 to 1 m (100 to 300 mm)
CLOSELY SPACED (SP5)	0.1 to 0.3 ft (30 to 100 mm)
VERY CLOSELY SPACED (SP6)	less than 0.1 ft (<30 mm)

FRACTURE CONTINUITY

CONTINUITY DESCRIPTOR	DISCONTINUITY LENGTH
DISCONTINUOUS (C1)	Less than 3 ft (<1 m)
SLIGHTLY CONTINUOUS (C2)	3 to 10 ft (1 to 3 m)
MODERATELY CONTINUOUS (C3)	10 to 30 ft (3 to 10 m)
HIGHLY CONTINUOUS (C4)	30 to 100 ft (10 to 30 m)
VERY CONTINUOUS (C5)	Greater than 100 ft (>30 m)

FRACTURE ENDS (JOINT SURVEYS)

FRACTURE ENDS DESCRIPTOR	DESCRIPTIVE CRITERIA
EØ	Zero ends leave the exposure (both ends can be seen).
E1	One end of the fracture terminates in the exposure (one end can be seen).
E2	Neither fracture end terminates in the exposure (neither end can be seen).

FRACTURE OPENNESS OR FILLING THICKNESS

FILLING THICKNESS DESCRIPTOR	THICKNESS/OPENNESS	OPENNESS DESCRIPTOR
CLEAN (TØ)	No film or coating.	
	No visible separation.	TIGHT (OØ)
VERY THIN (T1)	Less than 0.003 ft [1/32 in] (<1 mm).	SLIGHTLY OPEN (O1)
MODERATELY THIN (T2)	0.003 to 0.01 ft [1/32 to 1/8 in] (1 to 3 mm).	MODERATELY OPEN (O2)
THIN (T3)	0.01 to 0.03 ft [1/8 to 3/8 in] (3 to 10 mm).	OPEN (O3)
MODERATELY THICK (T4)	0.03 ft [3/8 in] to 0.1 ft (10 to 30 mm).	MODERATELY WIDE (O4)
THICK (T5)	Greater than 0.1 ft (>30 mm). Actual thickness or openings recorded.	WIDE (O5)

FRACTURE MOISTURE CONDITIONS

MOISTURE DESCRIPTOR	DESCRIPTIVE CRITERIA
M1	The fracture is dry. It is tight or filling (where present) is of sufficient density or composition to impede waterflow. Waterflow along the fracture does not appear possible.
M2	The fracture is dry with no evidence of previous waterflow. Waterflow appears possible.
M3	The fracture is dry, but shows evidence of waterflow such as staining, leaching and/or vegetation.
M4	The fracture or filling (where present) is damp, but no free water is present.
M5	The fracture shows seepage. It is wet with occasional drops of water.
M6	The fracture emits a continuous flow (estimate flow rate) under low pressure. Filling materials (where present) may show signs of leaching or piping.
M7	The fracture emits a continuous flow (estimate flow rate) under moderate to high pressure. Water is squirting and/or filling material (where present) may be substantially washed out.

FRACTURE ROUGHNESS

Refers to small-scale asperities of surfaces, not large-scale undulations or waviness.

STEPPED (R1): Near-normal steps and ridges occur on the fracture surface.
ROUGH (R2): Large, angular asperities can be seen.
MODERATELY ROUGH (R3): Asperities are clearly visible and fracture surface feels abrasive.
SLIGHTLY ROUGH (R4): Small asperities on the fracture surface are visible and can be felt.
SMOOTH (R5): No asperities, smooth to the touch.
POLISHED (R6): Extremely smooth and shiny.

FRACTURE SURFACE AND/OR FILLING ALTERATION AND HARDNESS

Descriptors for weathering or alteration of fracture surfaces and fracture fillings (excluding soil materials) are the same as those used for weathering and alteration of rock.

Descriptors for hardness/strength of fillings and/or fracture surfaces are the same as those presented for hardness of rock and consistency of soils.

DISCONTINUITY HEALING

TOTALLY HEALED (HL1) – All fragments bonded, discontinuity is completely healed or recemented to a degree at least as hard as surrounding rock.

MODERATELY HEALED (HL3) – Greater than 50 percent of fractured or sheared material, discontinuity surfaces or filling is healed or recemented; and/or strength of healing agent is less hard than surrounding rock.

PARTLY HEALED (HL5) – Less than 50 percent of fractured or sheared material, discontinuity surface or filling is healed or recemented.

NOT HEALED (HL6) – Discontinuity surface, fractured zone, sheared material or filling is not healed or recemented, rock fragments or filling (if present) held in place by their own angularity and/or cohesiveness.

SHEAR/FAULT DESCRIPTORS

SHEAR/FAULT GOUGE CONSISTENCY

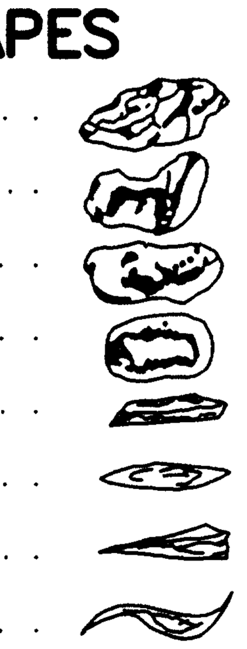
DESCRIPTOR	DESCRIPTIVE CRITERIA (Similar to consistency of soils)
VERY HARD	Gouge cannot be broken with finger pressure; cannot be indented with fingernail.
HARD	Gouge can be broken with firm finger pressure; can be indented with fingernail; cannot be indented with thumb.
FIRM	Gouge can be easily crumbled; can be indented with thumb 1 to 5 mm.
SOFT	Gouge can be easily molded; can be penetrated with thumb 5 to 25 mm.
VERY SOFT	Gouge can be penetrated with thumb more than 25 mm.

SHEAR/FAULT MOISTURE DESCRIPTORS

The apparent moisture content of gouge is described as WET (visible free water); MOIST (damp, but no visible water); and DRY (absence of moisture, dusty, dry to the touch). Moisture descriptors M1 through M7 may be used to describe the shear or shear zone.

BRECCIA SHAPES

Angular . . . .
Subangular. . . . .
Subrounded. . . . .
Rounded. . . . .
Platy . . . .
Lens-shaped. . . . .
Wedge-shaped. . . . .
Contorted. . . . .



REV NO		
1	3-8-00 D - P. M. R.	CONVERTED ORIGINAL DRAWING 40-D-6499 TO ACAD, CHANGED DWG. NO., MINOR REVISIONS.

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UNITED STATES
DEPARTMENT OF THE INTERIOR
BUREAU OF RECLAMATION

GEOLOGY FOR DESIGN & SPECIFICATIONS

STANDARD DESCRIPTORS AND DESCRIPTIVE CRITERIA FOR DISCONTINUITIES

GEOLOGY NOMENCLATURE COMMITTEE CHECKED [signature]
DRAWN [signature] TECH. APPROVAL [signature]
APPROVED [signature]
PEER REVIEWER

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DENVER, COLORADO | MARCH 8, 2000 | 40-D-7023

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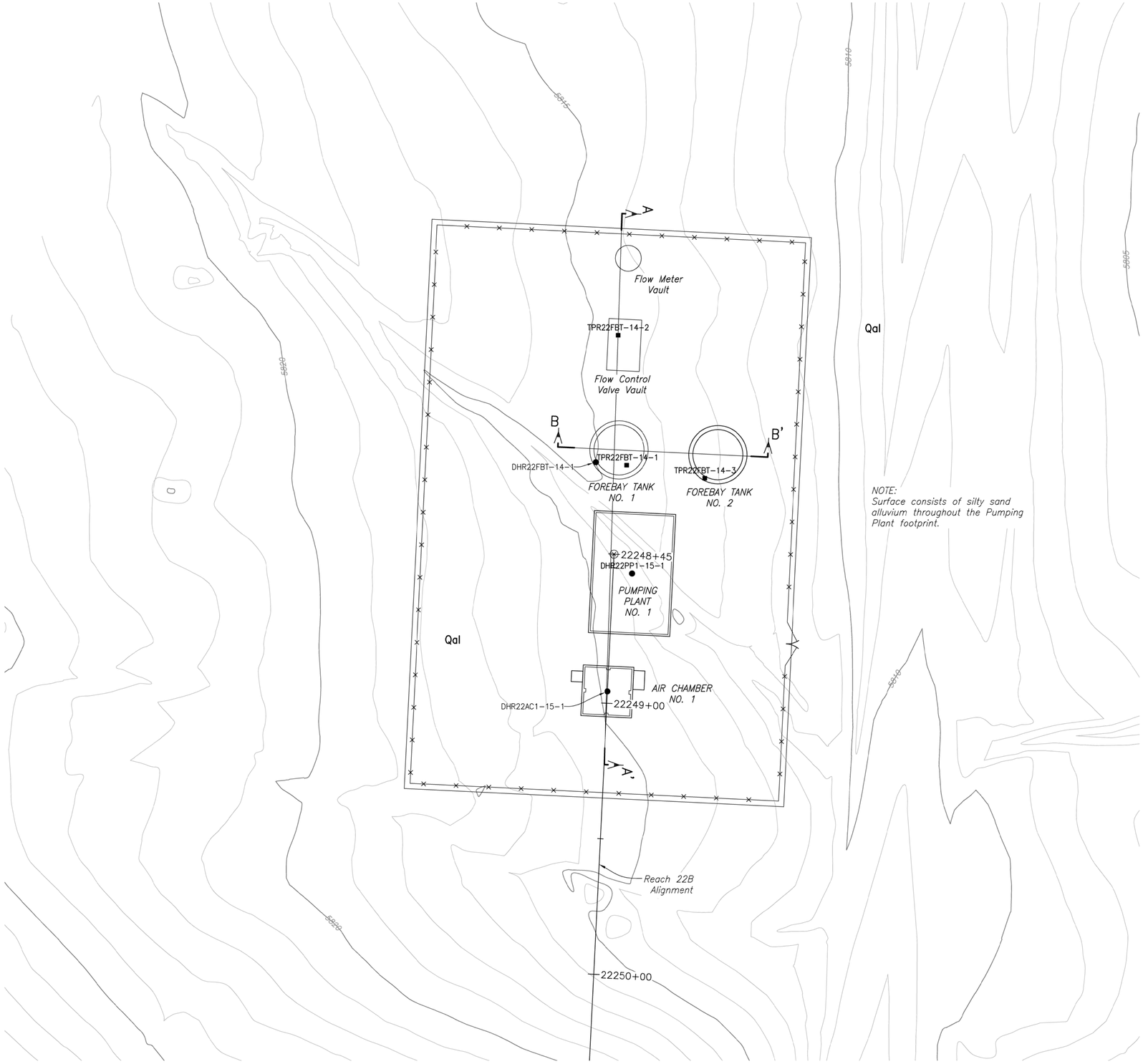
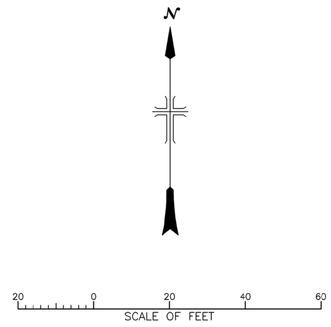


NOTE:
Surface consists of silty sand alluvium throughout the Pumping Plant footprint.



NOTES

Coordinates are in NAD83 state plane, New Mexico West Zone

For General Geologic Legend Explanation and Notes Drawing see 1695-529-942.

For Sections A-A' and B-B' see drawing number 1695-529-943.

RECLAMATION
Managing Water in the West

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BUREAU OF RECLAMATION

NAVAJO-GALLUP WATER SUPPLY PROJECT
NEW MEXICO

CUTTER LATERAL
REACH 22B
PUMPING PLANT NO. 1

SURFACE GEOLOGY AND LOCATION OF EXPLORATION

GEOLOGY
DRAWN
CHECKED
TECH. APPROVED
APPROVED
ADMINISTRATIVE APPROVAL

FARMINGTON, NEW MEXICO 2014-10-11

1695-529-935

SHEET 1 OF 1

DATE AND TIME PLOTTED
May 21, 2015 10:36
PLOTTED BY
DTHORNBURG

CADD SYSTEM
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CADD FILENAME
1695-529-935.dwg

NOTES

Coordinates are in NAD83 state plane, New Mexico West Zone

For General Geologic Legend Explanation and Notes Drawing see 1695-529-942.

For Section A-A' and B-B' see drawing number 1695-529-944.

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BUREAU OF RECLAMATION
NAVAJO-GALLUP WATER SUPPLY PROJECT
NEW MEXICO

CUTTER LATERAL
REACH 22B
PUMPING PLANT NO. 2
SURFACE GEOLOGY AND LOCATION OF EXPLORATION

GEOLOGY
DRAWN Thornburg
CHECKED
TECH. APPR.
APPROVED
ADMINISTRATIVE APPROVAL

FARMINGTON, NEW MEXICO 2014-10-12

1695-529-936
SHEET 1 OF 1

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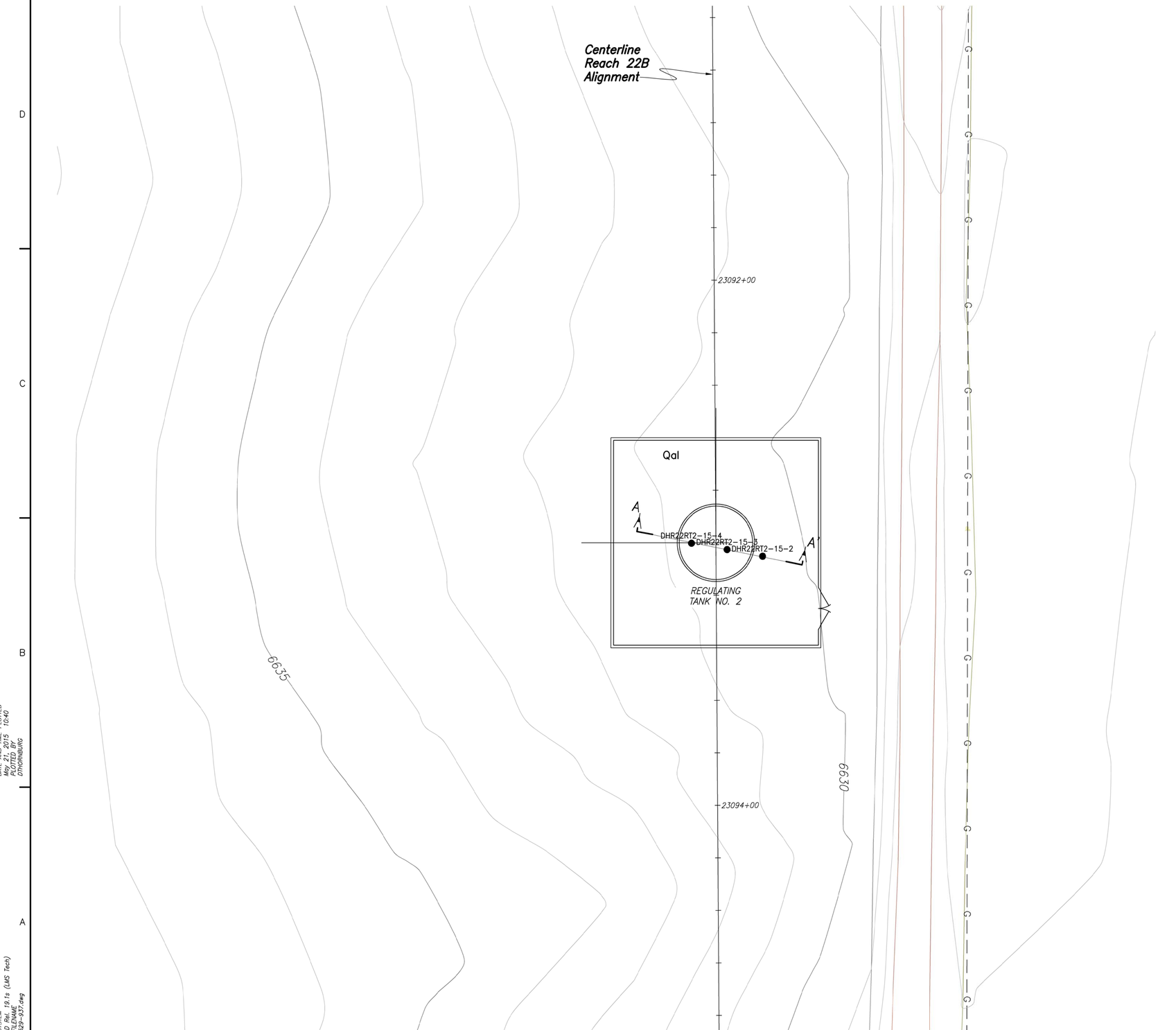

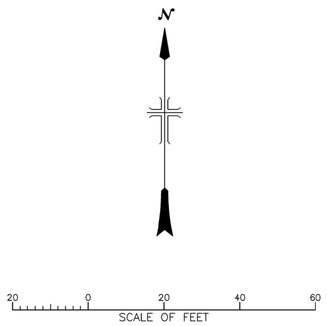

NOTES

Coordinates are in NAD83 state plane, New Mexico West Zone

For General Geologic Legend Explanation and Notes Drawing see 1695-529-942.

For Section A-A' see drawing number 1695-529-945.

RECLAMATION
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NAVAJO-GALLUP WATER SUPPLY PROJECT
NEW MEXICO

CUTTER LATERAL
REACH 22B
REGULATING TANK NO. 2
SURFACE GEOLOGY AND LOCATION OF EXPLORATION

GEOLOGY
DRAWN
CHECKED
TECH. APPR.
APPROVED
ADMINISTRATIVE APPROVAL

FARMINGTON, NEW MEXICO 2014-10-12

1695-529-937

SHEET 1 OF 1

DATE AND TIME PLOTTED
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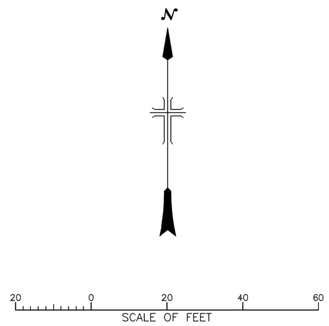

NOTES

Coordinates are in NAD83 state plane, New Mexico West Zone

For General Geologic Legend Explanation and Notes Drawing see 1695-529-942.

For Section A-A' see drawing number 1695-529-946.

For Sections B-B' and C-C' see drawing number 1695-529-948.

RECLAMATION
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BUREAU OF RECLAMATION

NAVAJO-GALLUP WATER SUPPLY PROJECT
NEW MEXICO

CUTTER LATERAL
REACH 22B

REGULATING TANKS 3A AND 3B
SURFACE GEOLOGY AND LOCATION OF EXPLORATION

GEOLOGY	
DRAWN	
CHECKED	
TECH. APPR.	
APPROVED	ADMINISTRATIVE APPROVAL

FARMINGTON, NEW MEXICO *2014-10-13*

1695-529-938

SHEET 1 OF 1

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May 21, 2015 10:43
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GENERAL GEOLOGIC LEGEND

STRATIGRAPHY

Quaternary Alluvium (Qal)

Consists of a variety of materials from clayey sand (SC), silty sand (SM), poorly graded sand with silt (SP–SM), to poorly graded sand (SP).

Tertiary Nacimiento Formation (Tn)

The Nacimiento Formation is found from the east side of Largo Canyon to the end of reach 22. Bedrock is often covered by a thin layer of Qal/Qsw.

Sandstone (SS), is fine to medium to fine to coarse, color transitions between brown,orange, grey, and yellow, soft (H6) to moderately hard (H4), Decomposed (W9), to slightly weathered (W3), thinly to moderately bedded, sporadic zones containing carbon inclusions and iron/manganese oxide staining, occasional conglomeratic zones with subrounded to subangular fine gravel and mud ripup clasts.

Siltstone (SLTSN), is grey to brown in color, very soft (H7) to moderately hard (H4), slightly weathered (W3) to intensely to moderately weathered (W6), thinly to moderately bedded, occasional gypsum veins.

Claystone (CLSTN), is dark grey, to brown in color, very soft (H7) to soft (H6), decomposed (W9) to intensely weathered (W7), moderately to thinly bedded, occasional carbon inclusions, gypsum and calcite veins, iron/manganese oxide staining.

GEOLOGIC EXPLANATION

DHR22B–14–25 ● *Drill hole location with year and identification number*

TPR22B–14–33 ■ *Test Pit location with year and Identification number*

CPT22B–14–38 ⊠ *Cone Penetrometer location with year and Identification number*

Qal / Tn — *Geologic Unit Contact*

— — Qal/Tn — — *Dashed where approximate*

— ? — Qal/Tn — ? — *Queried where inferred*

Drill hole or Test Pit on profile (dashed where projected)

TPR22B–14–127

0.0 SM

3.1 SP–SM

T.D. 14.0

GENERAL GEOLOGIC NOTES

Geologic standards and definitions used for rock quality and rock discontinuities are based on Bureau of Reclamation Engineering Geology Field Manual and drawing numbers 40–D–6493 and 40–D–6499.

The Unified Soil Classification System and descriptions are based on the USCS (Unified Soil Classification System) and Bureau of Reclamation procedures and guidelines as described in Geotechnical Branch Training Manuals Nos. 4, 5, 6, and Designations 5000 (laboratory classification) and USBR 5005 (visual classification). These procedures are similar to ASTM D2485–87 and D2487–88 respectively.

Interpretations shown on geologic profiles are based on Test Pit, Drill hole, outcrop, and field mapping data. Interpretations suggest general trends between data points and do not depict localized irregularities.

For the entire description of material, drilling or excavation method and conditions, exact locations of the hole, etc., see complete log.

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BUREAU OF RECLAMATION

NAVAJO GALLUP WATER SUPPLY PROJECT
NEW MEXICO

CUTTER LATERAL
REACH 22B

GENERAL GEOLOGIC LEGEND
EXPLANATION AND NOTES

GEOLOGY
DRAWN
CHECKED
TECH. APPR. — NAME – TITLE
APPROVED — ADMINISTRATIVE APPROVAL – FIELD DIVISION CHIEF

FARMINGTON, NEW MEXICO NOVEMBER 19, 2014

1695–529–942

SHEET 1 OF 1

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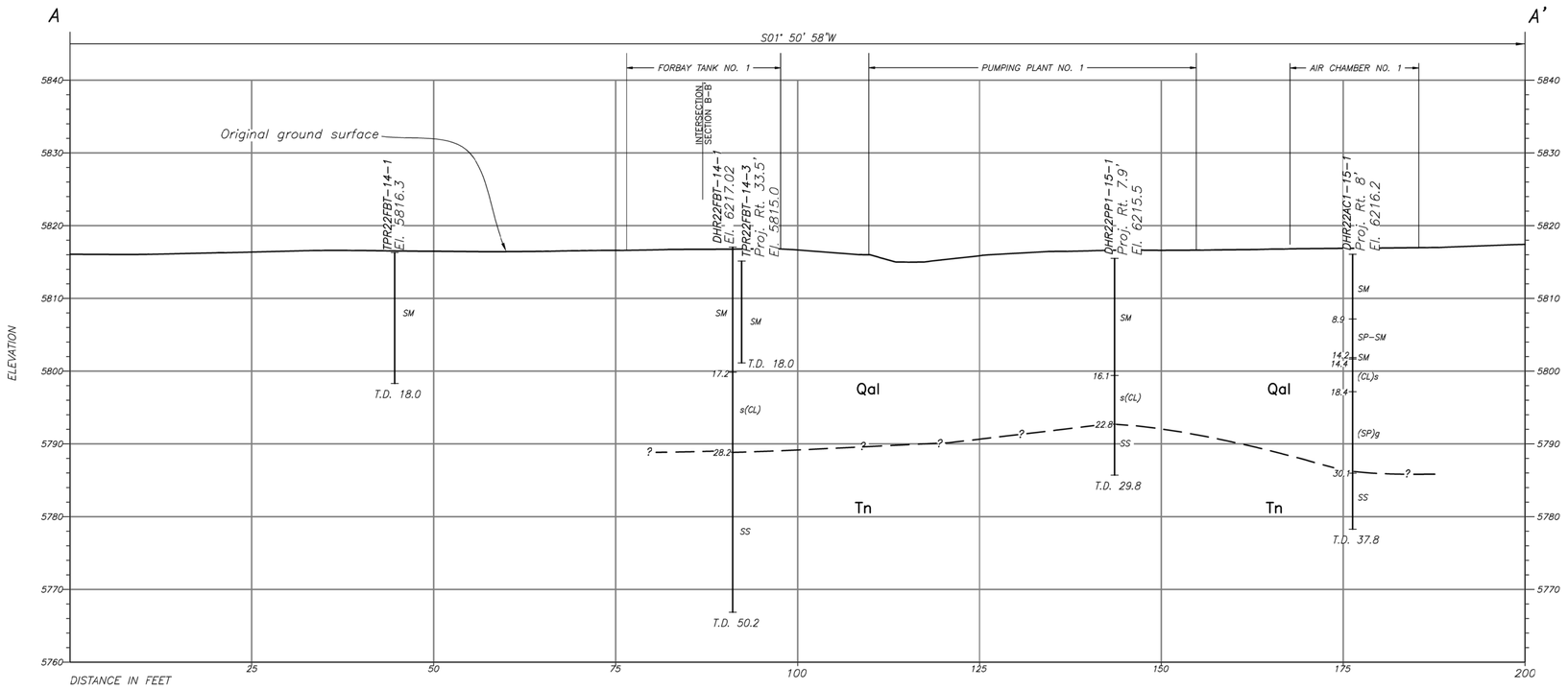
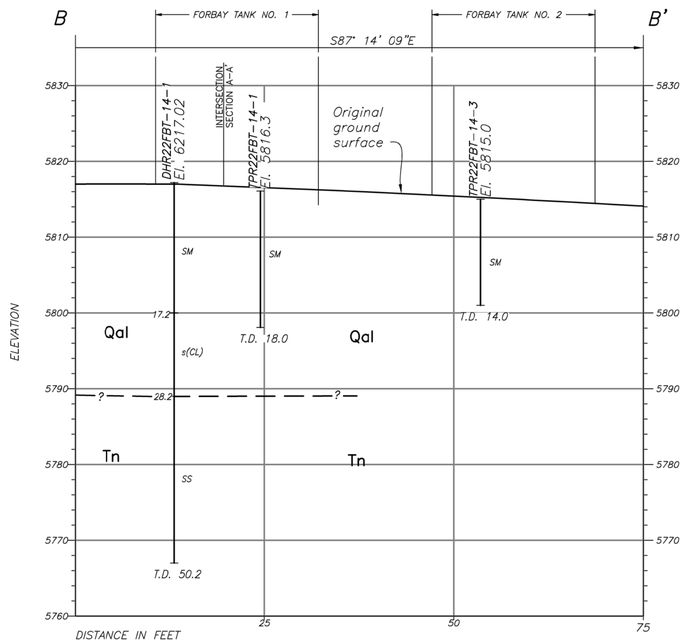


GEOLOGIC SECTION A–A'



GEOLOGIC SECTION B–B'

NOTES

Coordinates are in NAD83 state plane, New Mexico West Zone

For General Geologic Legend Explanation and Notes Drawing see 1695–529–942.

For Location of Sections A–A' and B–B' see drawing number 1695–529–935.

0 10' 20'

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NAVAJO – GALLUP WATER SUPPLY PROJECT
NEW MEXICO

CUTTER LATERAL

REACH 22B

GEOLOGY
DRAWN
CHECKED
TECH. APPR.
APPROVED
ADMINISTRATIVE APPROVAL

FARMINGTON, NEW MEXICO 2014–12–08

PUMPING PLANT NO. 1

GEOLOGIC SECTION A–A' AND B–B'

1695–529–943

SHEET 1

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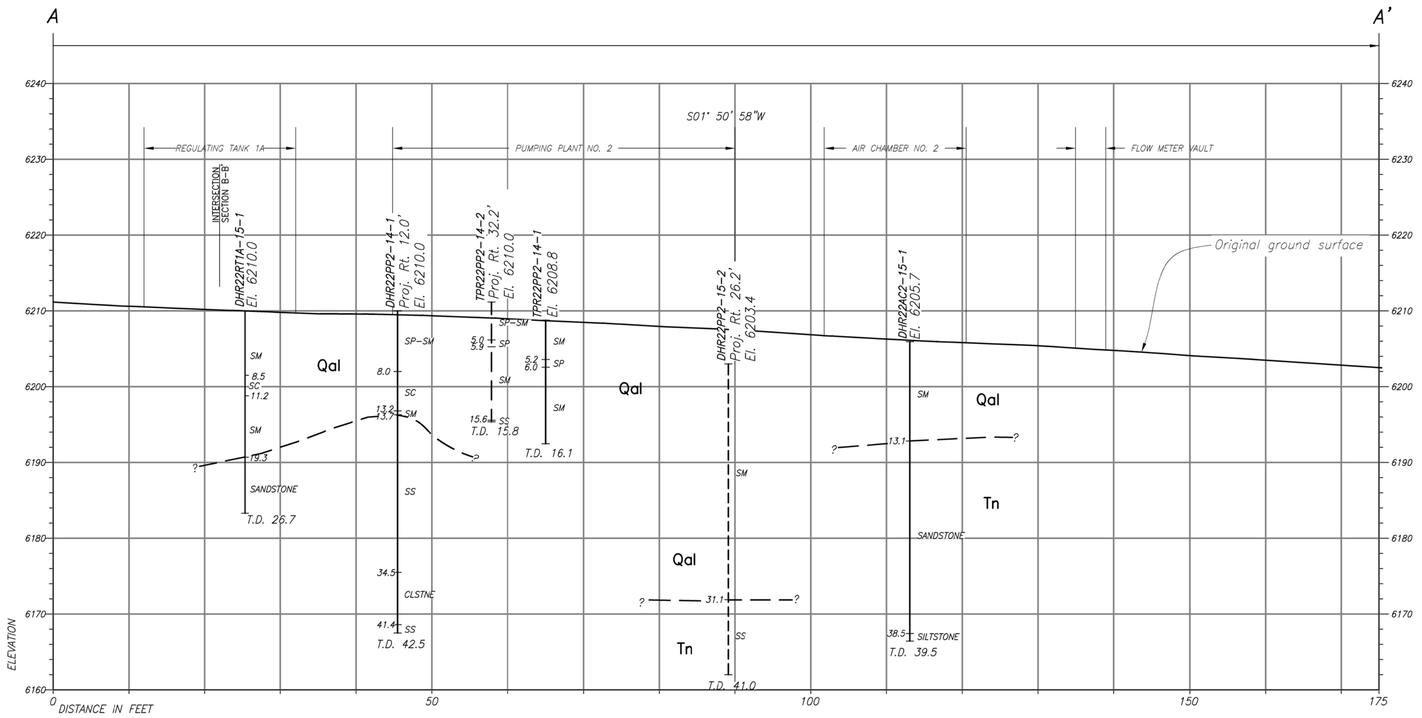
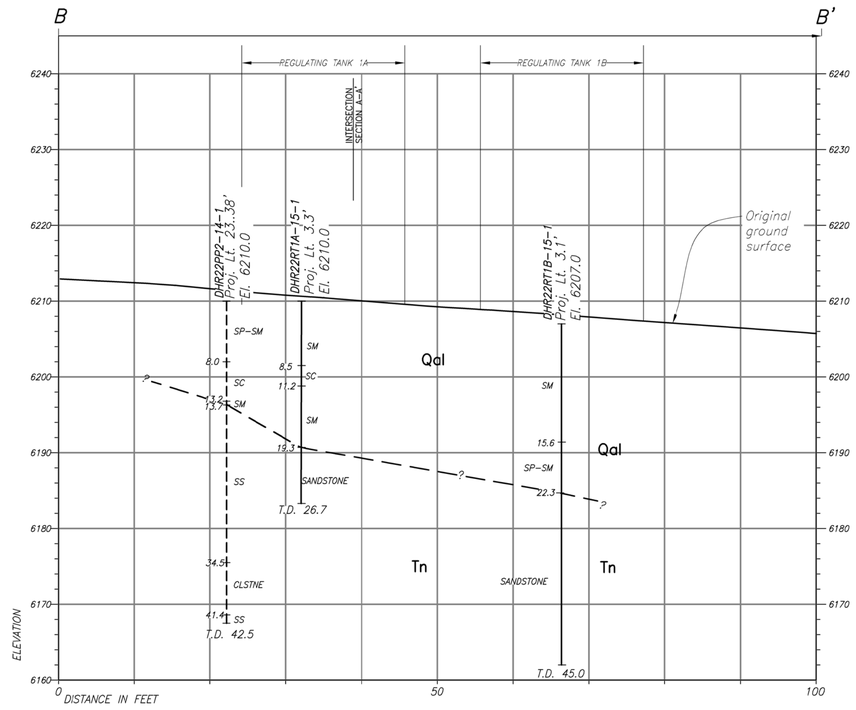


GEOLOGIC SECTION A–A'



GEOLOGIC SECTION B–B'

NOTES

Coordinates are in NAD83 state plane, New Mexico West Zone

For General Geologic Legend Explanation and Notes Drawing see 1695–529–942.

For Location of Section A–A' and B–B' see drawing number 1695–529–936.

0 10' 20'

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BUREAU OF RECLAMATION
NAVAJO – GALLUP WATER SUPPLY PROJECT
NEW MEXICO

CUTTER LATERAL

REACH 22B

GEOLOGY
DRAWN
CHECKED
TECH. APPR.
APPROVED
ADMIN APPROVAL –

FARMINGTON, NEW MEXICO 2014–12–08

PUMPING PLANT NO. 2

GEOLOGIC SECTIONS A–A' AND B–B'

1695–529–944

SHEET 1

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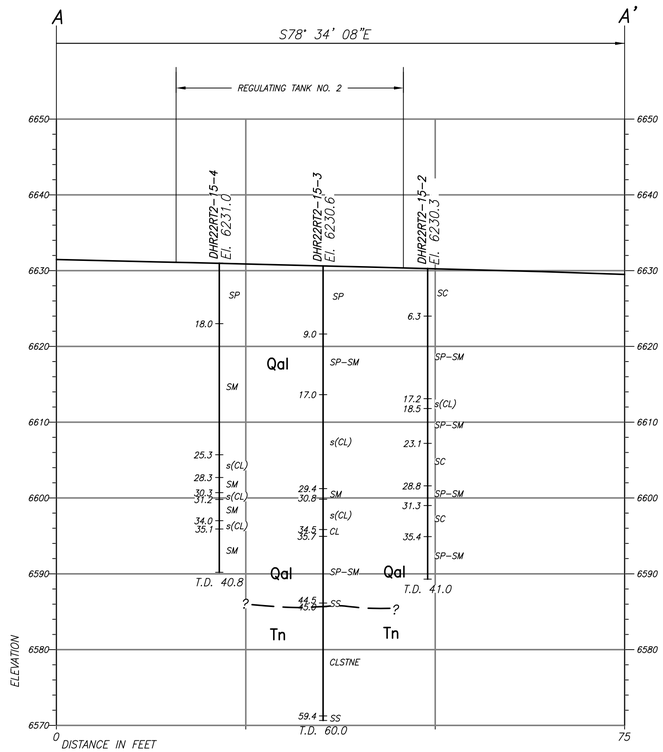

GEOLOGIC SECTION A–A'

NOTES

Coordinates are in NAD83 state plane, New Mexico West Zone

For General Geologic Legend Explanation and Notes Drawing see 1695–529–942.

For Location of Section A–A' see drawing number 1695–529–937.

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BUREAU OF RECLAMATION
NAVAJO – GALLUP WATER SUPPLY PROJECT
NEW MEXICO

CUTTER LATERAL

REACH 22B

GEOLOGY
DRAWN
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ADMIN. APPROVAL – TITLE

FARMINGTON, NEW MEXICO 2014–12–09

REGULATING TANK NO. 2

GEOLOGIC SECTION A–A'

1695–529–945

SHEET 1

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Not Plotted
PLOTTED BY
Not Plotted

CAD SYSTEM
AUTOCAD
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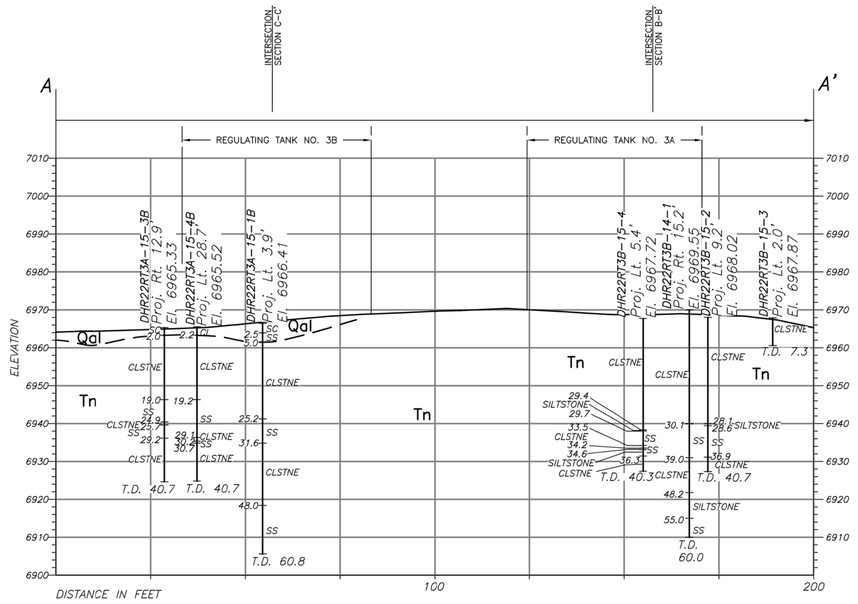
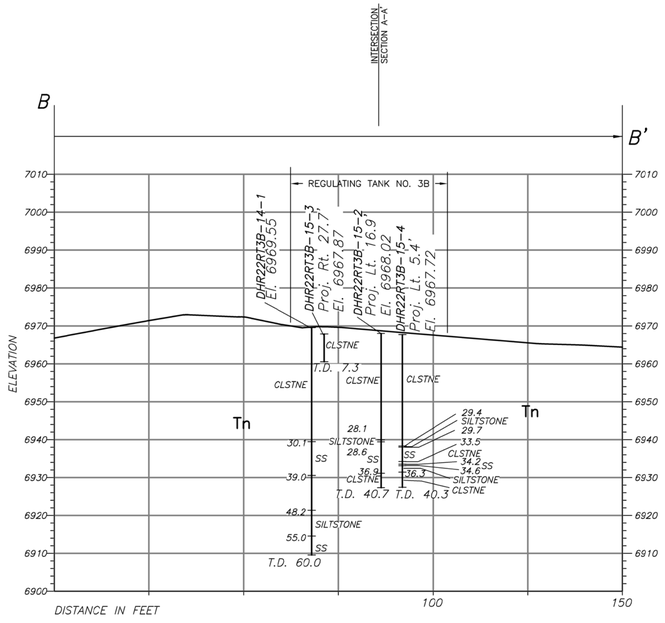
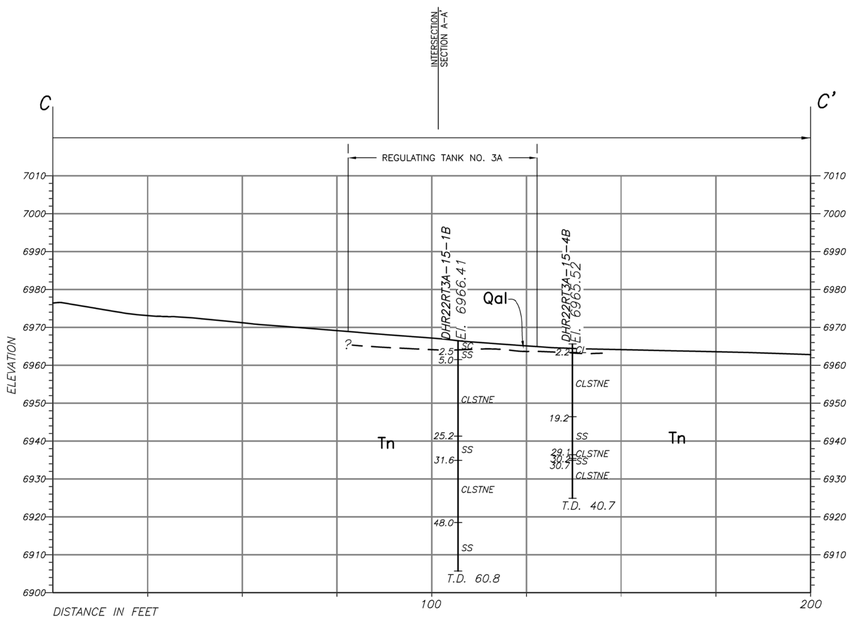


GEOLOGIC SECTION A–A'



GEOLOGIC SECTION B–B'



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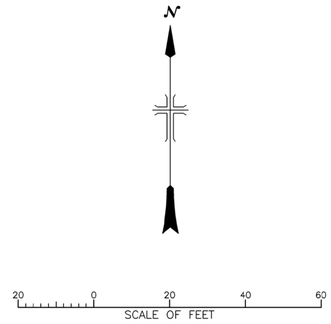

NOTES

Coordinates are in NAD83 state plane, New Mexico West Zone

For General Geologic Legend Explanation and Notes Drawing see 1695–529–942.

For location of Section A–A', B–B' AND C–C' see drawing number 1695–529–938.

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BUREAU OF RECLAMATION
NAVAJO GALLUP WATER SUPPLY PROJECT
NEW MEXICO

CUTTER LATERAL

REACH 22B

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FARMINGTON, NEW MEXICO 2015–04–09

REGULATING TANKS NO 3A AND 3B

GEOLOGIC SECTIONS A–A', B–B' AND C–C'

1695–529–946

SHEET 1

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MAY 21, 2015 11:02
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1695-529-946.DWG

GEOLOGIC LOG OF DRILL HOLE NO. DHR21-14-G

SHEET 1 OF 1

FEATURE: REACH 22 PIPELINE
LOCATION: WATER TREATMENT PLANT
BEGUN: 9/7/14 FINISHED: 9/7/14
DEPTH AND ELEVATION OF WATER LEVEL: WLNE
AND DATE MEASURED: 9/7/2014

PROJECT: NAVAJO GALLUP WATER SUPPLY PROJECT
COORDINATES: N 1,968,336.0 E 2,735,072.1
TOTAL DEPTH: 53.5
DEPTH TO BEDROCK: 28.3

STATE: NEW MEXICO
GROUND ELEVATION: 6631.6
ANGLE FROM HORIZONTAL: 90
HOLE LOGGED BY: J. GILBERT
REVIEWED BY:

NOTES

ALL MEASUREMENTS ARE FROM GROUND SURFACE AND ARE THE SAME AS THOSE USED BY THE DRILLER.

ALL MEASUREMENTS ARE REPORTED IN FEET EXCEPT WHERE NOTED.

DRILLED BY: U.C. REGION DRILL CREW; DRILLER; JEFF VAN AUSDALE, HELPERS; KYLE KILEBREW; DAVE NIELSON.

PURPOSE:
PRECONSTRUCTION SOIL AND BEDROCK FOUNDATION INVESTIGATIONS.

DRILL EQUIPMENT:
CME 85.

DRILL METHOD:
0- 53.5 FT 4 1/4" HSA AND DRY CORE SYSTEM WITH SPTs.
CASING RECORD:
NONE USED.

DRILLING MEDIUM:
NONE USED.

HOLE COMPLETION: HOLE BACKFILLED WITH CUTTINGS.

DEPTH	% CORE RECOVERY	LABORATORY DATA: % FINES	% SAND	% GRAVEL	LIQUID LIMIT	PLASTICITY INDEX	MOISTURE CONTENT	LABORATORY CLASSIFICATION	BLOWS / 0.5 FT	GEOLOGIC UNIT SYMBOL	VISUAL CLASSIFICATION / ELEVATION
											SM 6630.5
											SC 6630.1
5	68	17.1	82.9	0	NA	NP	3.0%	SM	5/9/11		
	80	88.5	88.5	11.5	0	46.3%	26.3%	12.5%	CL	8/14/18	(CL)s
10	100	38.3	38.3	61.7	0	24.7	10.9	6.2%	SC	11/21/21	6622.4
	32	31.3	31.3	68.7	0	NA	NP	3.9%	SM	8/11/12	
15	100	14.7	14.7	85.3	0	NA	NP	2.0%	SM	6/10/12	Qal
	32	11.7	11.7	78.2	10.1	NA	NP	1.9%	SP-SM	6/9/10	
20	50	14.9	14.9	80.1	5.0	NA	NP	2.5%	SM	9/12/14	SP-SM
	90	17.3	17.3	82.7	0	NA	NP	4.2%	SM	5/10/9	
25											6603.3
30	100	30.8	30.8	69.2	0	30.6%	10.8%	12.1%	SC	17/34/48	
	100	32.5	32.5	67.5	0	28.5%	9.6%	9.3%	SC	25/REFUSAL	
35	100										
40	100										Tn SS
45	100										
50	100										
											6578.1

BOTTOM OF HOLE

CLASSIFICATION AND PHYSICAL CONDITION

0.0 - 28.3 FT QUATERNARY ALLUVIUM (Qal)

0.0 - 1.1 FT: SILTY SAND (SM): ABOUT 80% FINE SAND, MAXIMUM SIZE, FINE SAND; ABOUT 20% FINES WITH NO PLASTICITY, RAPID DILATANCY, LOW DRY STRENGTH, DRY, TAN IN COLOR; STRONG REACTION WITH HCl.

1.1 - 1.5 FT CLAYEY SAND (SC): ABOUT 80% FINE SAND; ABOUT 20% FINES WITH LOW PLASTICITY, LOW TO MEDIUM DRY STENGTH, LOW TOUGHNESS AND SLOW DILATANCY; GREY TO ORANGE IN COLOR, DRY, NO REACTION WITH HCl.

1.5 - 9.2 FT LEAN CLAY WITH SAND (CL)s: ABOUT 80% FINES WITH MEDIUM TO HIGH PLASTICITY, MEDIUM TO HIGH DRY STRENGTH, NO DILATANCY AND MEDIUM TO HIGH TOUGHNESS; ABOUT 20% FINE SAND; MAXIUMUM SIZE, FINE SAND; DRY, TAN IN COLOR, NO REACTION WITH HCl.

9.2 - 28.3 FT POORLY GRADED SAND WITH SILT (SP-SM): ABOUT 90% FINE SAND; ABOUT 10% FINES WITH NO PLASTICITY, NO DRY STRENGTH, AND RAPID DILATANCY; DRY, LIGHT BROWN IN COLOR; NO REACTION WITH HCl.

28.3 - 53.5 FT TERTIARY NACIMIENTO FORMATION (TN)

28.3 - 53.5 FT SANDSTONE: FINE TO MEDIUM GRAINED, TAN IN COLOR, MODERATELY TO INTENSELY WEATHERED (W5-W7) MODERATELY SOFT (H5), THINLY BEDDED TO LAMINATED; NO REACTION WITH HCl.

ROCK APPEARS TO BE BROKEN DURING DRILLING AND IS RECOVERED MOSTLY AS ANGULAR FRAGMENTS FROM 1/2-INCH TO APPROXIMATELY 4- INCHES IN SIZE. MOST SURFACES ON THE FRAGMENTS APPEAR FRESHLY BROKEN. OCCASIONAL PLANAR SURFACES ARE STAINED WITH IRON OXIDE INDICATING SOME JOINTS AND FRACTURES EXISTING IN THE ROCK. ORIENTATION AND DENSITY OF THE JOINTS AND FRACTURES COULD NOT BE DETERMINED.

STRATIGRAPHY:
0.0 - 28.3 FT: QUATERNARY ALLUVIUM (Qal)
28.3 - 53.5 FT: TERTIARY NACIMIENTO FORMATION (Tn)
ABBREVIATIONS:
WLNE = WATER LEVEL NOT ENCOUNTERED
I.D. = INSIDE DIAMETER
BNE = BEDROCK NOT ENCOUNTERED
NE=NOT ENCOUNTERED
FT=FEET
HSA=HOLLOW STEM AUGER
CME=CENTRAL MINING EQUIPMENT
SPT=STANDARD PENETRATION TEST.

COMMENTS:

ALL ANGLES MEASURED FROM CORE AXIS AT ZERO DEGREES, UNLESS OTHERWISE NOTED.
THE DATA FOR THE CENTER COLUMN AND"CLASSIFICATION AND PHYSICAL CONDITIONS" COLUMN ARE BASED ON BUREAU OF RECLAMATION GEOLOGY FIELD MANUAL AND DRAWINGS TITLED FOR DESIGNS AND SPECIFICATIONS AS FOLLOWS- DRAWING NO. 40-D-6493. STANDARD DESCRIPTIONS AND DESCRIPTIVE CRITERIA FOR ROCK. DRAWING NO. 40-D-6499. STANDARD DESCRIPTORS AND DESCRIPTIVE CRITERIA FOR DISCONTINUITIES.

GEOLOGIC LOG OF DRILL HOLE NO. DHR22-25

SHEET 1 OF 1

FEATURE: REACH 22B
LOCATION: PIPELINE
BEGUN: 6/21/12 FINISHED: 6/21/12
DEPTH OF WATER LEVEL:
DATE MEASURED:

PROJECT: NAVAJO GALLUP WATER SUPPLY PROJECT
COORDINATES: N 2,047,328.8 E 2,750,275.1
TOTAL DEPTH: 23.9
DEPTH TO BEDROCK: 21.4

STATE: NEW MEXICO
GROUND ELEVATION: 5863.3
ANGLE FROM HORIZONTAL: 90
HOLE LOGGED BY: C. BEYER
REVIEWED BY:

NOTES

ALL MEASUREMENTS ARE FROM GROUND SURFACE AND ARE THE SAME AS THOSE USED BY THE DRILLER.

ALL MEASUREMENTS ARE REPORTED IN FEET EXCEPT WHERE NOTED.

DRILLED BY: U.C. REGION DRILL CREW; DRILLER; LENNY WASHBURN, HELPERS; BRENT TERRY, TYSON BEZANSON.

PURPOSE:
PRECONSTRUCTION SOIL AND BEDROCK FOUNDATION INVESTIGATIONS.

DRILL EQUIPMENT:
GUS PECH MODEL GP3000 ROTARY DRILL RIG.

DRILL METHOD:
0-23.9 FT 4 1/4" HSA AND DRY CORE SYSTEM WITH SPTs.

CASING RECORD:
NONE USED

DRILLING MEDIUM:
NONE USED

HOLE COMPLETION:
BACKFILLED WITH CUTTINGS.

DEPTH	% CORE RECOVERY	LABORATORY DATA: % FINES	% SAND	% GRAVEL	LIQUID LIMIT	PLASTICITY INDEX	MOISTURE CONTENT	LABORATORY CLASSIFICATION	BLOWS / 0.5 FT	GEOLOGIC UNIT SYMBOL	VISUAL CLASSIFICATION / ELEVATION
	20										SC
5											5858.3
	32	19.9	80.1	0	N/A	NP	1.9%	SM	4 6 8		
	24	25.9	74.1	0	N/A	NP	3%	SM	3 3 2		
10											SM
	76	25.9	74.1	0	N/A	NP	3.3%	SM	3 7 3	Qal	
	60	43.1	56.9	0	26.1	11.1	4.2%	SC	2 3 5		
15											5848.3
	64	43.1	56.9	0	26.2	9.2	3.7%	SC	2 4 4		SC
											5846.3
	72	38.4	59.9	1.7	22.9	3.7	3.8%	SM	3 4 4		SM
20											
	79	19.9	80.1	0	N/A	NP	2.8%	SM	3 4 5		5841.9
										TN	SANDSTONE
											5839.4

BOTTOM OF HOLE

CLASSIFICATION AND PHYSICAL CONDITION

0.0 - 21.4 FT: QUATERNARY ALLUVIUM (Qal):

0.0 - 5.0 FT: CLAYEY SAND (SC): ABOUT 60% FINE SAND, TRACE MEDIUM TO COARSE SAND; ABOUT 40% FINES WITH LOW TO MEDIUM PLASTICITY, NO DILATANCY, LOW DRY STRENGTH, LOW TOUGHNESS; DRY, BROWN TO GREY IN COLOR, MAXIMUM SIZE, COARSE SAND; ROOTS IN TOP 0.5 FT; NO REACTION WITH HCl.

5.0 - 15.0 FT: SILTY SAND (SM): ABOUT 75% FINE TO MEDIUM SAND; ABOUT 25% NONPLASTIC FINES, WITH RAPID DILATANCY, NO TOUGHNESS, AND NO DRY STRENGTH; DRY, TAN IN COLOR; NO REACTIION WITH HCl.

15.0 - 17.0 FT: CLAYEY SAND (SC): ABOUT 50% FINE SAND, WITH LENSES OF COARSE SAND ABOUT 0.2 FT THICK; AB0UT 50% MEDIUM PLASTIC FINES, WITH NO DILATANCY, LOW T0UGHNESS, LOW DRY STRENGTH; DRY, BROWN TO GREY IN COLOR; WEAK REACTION WITH HCl.

17.0 - 21.4 FT: SILTY SAND (SM): ABOUT 75% FINE TO MEDIUM SAND; ABOUT 25% NONPLASTIC FINES, WITH RAPID DILATANCY, NO TOUGHNESS, NO DRY STRENGTH; DRY, TAN IN COLOR; NO REACTIION WITH HCl.

21.4 - 23.9 FT: TERTIARY NACIMIENTO FORMATION (TN):

21.4 - 23.9 FT: SANDSTONE: FINE TO MEDIUM GRAINED, MODERATELY TO SLIGHTLY WEATHERED (W4), SOFT (H6), TAN IN COLOR, AUGER MET REFUSAL AT 23.9 FT.

STRATIGRAPHY:
0.0 - 21.4 FT. QUATERNARY ALLUVIUM (Qal)
21.4 - 23.9 FT. TERTIARY NACIMIENTO FORMATION (Tn)
ABBREVIATIONS:
WLNE = WATER LEVEL NOT ENCOUNTERED
I.D. = INSIDE DIAMETER.

COMMENTS:

GEOLOGIC LOG OF DRILL HOLE NO. DHR22-29

SHEET 1 OF 1

FEATURE: REACH 22B
LOCATION: PIPELINE
BEGUN: 6/22/12 FINISHED: 6/22/12
DEPTH OF WATER LEVEL:
DATE MEASURED:

PROJECT: NAVAJO GALLUP WATER SUPPLY PROJECT
COORDINATES: N 2,042,450.7 E 2,750,045.5
TOTAL DEPTH: 26.3
DEPTH TO BEDROCK: 7.8

STATE: NEW MEXICO
GROUND ELEVATION: 5905.9
ANGLE FROM HORIZONTAL: 90
HOLE LOGGED BY: C. BEYER
REVIEWED BY:

NOTES

ALL MEASUREMENTS ARE FROM GROUND SURFACE AND ARE THE SAME AS THOSE USED BY THE DRILLER.

ALL MEASUREMENTS ARE REPORTED IN FEET EXCEPT WHERE NOTED.

DRILLED BY:
U.C. REGION DRILL CREW;
DRILLER; LENNY WASHBURN,
HELPERS; BRENT TERRY,
TYSON BEZANSON.
PURPOSE:
PRECONSTRUCTION SOIL AND BEDROCK FOUNDATION INVESTIGATIONS.

DRILL EQUIPMENT:
GUS PECH MODEL GP3000 ROTARY DRILL RIG.

DRILL METHOD:
0 - 9.0 FT 4 1/4" HSA AND DRY CORE SYSTEM WITH SPTs.
9.0 - 26.3 FT HQ3 WIRELINE CORING SYSTEM WITH A 3' SPILT TUBE SAMPLER AND DIAMOND SURFACE-SET BIT.

CASING RECORD:
NONE USED

DRILLING MEDIUM:
NONE USED IN TOP 7.8 FT. WATER USED FROM 7.8 TO 26.3 FT.

HOLE COMPLETION:
BACKFILLED WITH CUTTINGS.

DEPTH	% CORE RECOVERY	LABORATORY DATA: % FINES	% SAND	% GRAVEL	LIQUID LIMIT	PLASTICITY INDEX	MOISTURE CONTENT	LABORATORY CLASSIFICATION	BLOWS / 0.5 FT	GEOLOGIC UNIT SYMBOL	VISUAL CLASSIFICATION / ELEVATION
5		63.7	28.6	7.7	32.7%	14.7	7.3	s(CL)	5 7 8	Qal	SM 5904.7
											SC 5898.1
		32.9	67.1	0	N/A	NP	4.5	SM	REFUSAL		SS 5896.6
											CLST 5896.2
10	100										SLTS 5895.2
15	80									TN	SS
20	97										
25	100										CLSTN 5879.6

BOTTOM OF HOLE

CLASSIFICATION AND PHYSICAL CONDITION

0.0 - 7.8 FT: QUATERNARY ALLUVIUM (Qal):

0 - 1.2 FT: SILTY SAND (SM): ABOUT 80% FINE SAND; ABOUT 20% NONPLASTIC FINES, WITH RAPID DILATANCY, NO TOUGHNESS, NO DRY STRENGTH; MAX SIZE, FINE SAND; DRY, TAN IN COLOR; ROOTS IN TOP 0.5 FT. STRONG REACTIION WITH HCl.

1.2 - 7.8 FT: CLAYEY SAND (SC): ABOUT 60% FINE SAND; ABOUT 40% FINES WITH LOW TO MEDIUM PLASTICITY, NO DILATANCY, LOW DRY STRENGTH, LOW TOUGHNESS; TRACE COARSE SAND AND FINE SUBROUNDED GRAVEL, MAXIMUM SIZE, 15MM; DRY, BROWN TO GREY IN COLOR, INTERMITTENT CALCITE NODULES; STRONG REACTION WITH HCl.

7.8 - 26.3 FT: TERTIARY NACIMIENTO FORMATION (TN):

7.8- 9.3 FT: SANDSTONE: FINE TO MEDIUM GRAINED, AUGER REFUSAL WAS MET AT 9.0 FT, WEATHERING AND HARDNESS UNKNOWN DUE TO SAMPLE DISINTEGRATION BY AUGER, SWITCHED TO CORING SYSTEM AND CONTINUED HOLE. FROM 9.0 TO 9.3 SANDSTONE WAS MODERATELY TO SLIGHTLY WEATHERED (W4), MODERATELY SOFT (H5), TAN IN COLOR, NO REACTION WITH HCl.

9.3 - 9.7 FT: CLAYSTONE: INTENSELY TO MODERATELY WEATHERED (W6), SOFT (H6) GREY IN COLOR, SAMPLE WASHED BY DRILL, NO REACTION WITH HCl.

9.7 - 10.7 FT: SILTSTONE: MODERATELY TO SLIGHTLY WEATHERED (W4), MODERATELY SOFT (H5), LIGHT GREY IN COLOR, NO REACTION WITH HCl.

10.7 TO 24.3 FT: SANDSTONE: FINE TO MEDIUM GRAINED, MODERATELY TO SLIGHTLY WEATHERED (W4), MODERATELY SOFT (H5), LIGHT GREY IN COLOR, DARK GREY SILTSTONE INTERBEDS 0.3 FT THICK, MODERATELY BEDDED, NO REACTION WITH HCl.

24.3 TO 26.3 FT: CLAYSTONE: DARK GREY IN COLOR, MODERATELY TO SLIGHTLY WEATHERED (W4), VERY SOFT (H7), FeOx STAINING ALONG TOP OF CLAYSTONE AT SANDSTONE CONTACT. NO REACTION WITH HCl.

STRATIGRAPHY:
0.0 - 7.8 FT. QUATERNARY ALLUVIUM (Qal)
7.8 - 26.3 FT. TERTIARY NACIMIENTO FORMATION (Tn)
ABBREVIATIONS:
WLNE = WATER LEVEL NOT ENCOUNTERED
I.D. = INSIDE DIAMETER BNE = BEDROCK NOT ENCOUNTERED.

COMMENTS:

ALL ANGLES MEASURED FROM CORE AXIS AT ZERO DEGREES, UNLESS OTHERWISE NOTED.
THE DATA FOR THE CENTER COLUMN AND"CLASSIFICATION AND PHYSICAL CONDITIONS" COLUMN ARE BASED ON BUREAU OF RECLAMATION GEOLOGY FIELD MANUAL AND DRAWINGS TITLED FOR DESIGNS AND SPECIFICATIONS AS FOLLOWS- DRAWING NO. 40-D-6493. STANDARD DESCRIPTIONS AND DESCRIPTIVE CRITERIA FOR ROCK. DRAWING NO. 40-D-6499. STANDARD DESCRIPTORS AND DESCRIPTIVE CRITERIA FOR DISCONTINUITIES.

GEOLOGIC LOG OF DRILL HOLE NO. DHR22-33

SHEET 1 OF 1

FEATURE: REACH 22B
LOCATION: PIPELINE
BEGUN: 6/23/12 FINISHED: 6/23/12
DEPTH OF WATER LEVEL:
DATE MEASURED:

PROJECT: NAVAJO GALLUP WATER SUPPLY PROJECT
COORDINATES: N 2,037,461.9 E 2,750,453.9
TOTAL DEPTH: 26.8
DEPTH TO BEDROCK: 5.0

STATE: NEW MEXICO
GROUND ELEVATION: 5931.8
ANGLE FROM HORIZONTAL: 90
HOLE LOGGED BY: C. BEYER
REVIEWED BY:

NOTES

ALL MEASUREMENTS ARE FROM GROUND SURFACE AND ARE THE SAME AS THOSE USED BY THE DRILLER.

ALL MEASUREMENTS ARE REPORTED IN FEET EXCEPT WHERE NOTED.

DRILLED BY: U.C. REGION DRILL CREW; DRILLER; LENNY WASHBURN, HELPERS; BRENT TERRY, TYSON BEZANSON.
PURPOSE:
PRECONSTRUCTION SOIL AND BEDROCK FOUNDATION INVESTIGATIONS.

DRILL EQUIPMENT:
GUS PECH MODEL GP3000 ROTARY DRILL RIG.

DRILL METHOD:
0 - 4.6 FT 4 1/4" HSA AND DRY CORE SYSTEM WITH SPTs.
4.6 - 26.8 FT HQ3 WIRELINE CORING SYSTEM WITH A 3' SPILT TUBE SAMPLER AND DIAMOND SURFACE-SET BIT.

CASING RECORD:
NONE USED.

DRILLING MEDIUM:
NONE USED FROM 0.0 TO 4.6 FT.
WATER FROM 5.0 TO 26.8 FT.

HOLE COMPLETION:
BACKFILLED WITH CUTTINGS.

DEPTH	% CORE RECOVERY	LABORATORY DATA: % FINES	% SAND	% GRAVEL	LIQUID LIMIT	PLASTICITY INDEX	MOISTURE CONTENT	LABORATORY CLASSIFICATION	BLOWS / 0.5 FT	GEOLOGIC UNIT SYMBOL	VISUAL CLASSIFICATION / ELEVATION
0		46.9	53.1	0	25.6%	5.4%	4.2%	SC-SM		Qal	SC
											5926.8
5	44	39.0	61.0	0	N/A	NP	7.6%	SM	9 18 REFUSAL	TN	
10	100										SS
15	50										
20	100										5911.3
											CONGL
											5907.6
25	90										SS
											5905.0

BOTTOM OF HOLE

CLASSIFICATION AND PHYSICAL CONDITION

0.0 - 5.0 FT: QUATERNARY ALLUVIUM (Qal):

0.0 - 5.0 FT: CLAYEY SAND (SC): ABOUT 70% FINE SAND; ABOUT 40% FINES WITH LOW TO MEDIUM PLASTICITY, NO DILATANCY, LOW DRY STRENGTH, LOW TOUGHNESS; DRY, TAN IN COLOR, INTERMITTENT CALCITE NODULES, ROOTS IN TOP 0.5 FT, STRONG REACTION WITH HCL.

5.0 - 26.8 FT: TERTIARY NACIMIENTO FORMATION (Tn):

5.0 - 8.8 FT: SANDSTONE: FINE TO MEDIUM GRAINED GREY IN COLOR, MODERATELY HARD (W4), SLIGHTLY WEATHERED TO FRESH (W2), INTERMITTENT TRACES OF COARSE SAND; GRAVEL-SIZED SUBROUNDED CHERT AND QUARTZITE CLASTS UP TO 15 mm IN DIAMETER; SUBANGULAR MUDSTONE RUP-UP CLASTS UP TO 15 mm IN DIAMETER.

8.8 - 20.5 FT: SANDSTONE: CHANGES FROM GREY TO BROWN IN COLOR AT 9.6 FT; MODERATELY HARD (W4), SLIGHTLY WEATHERED TO FRESH (W2), MODERATELY BEDDED, TRACE COARSE SAND, SUBANGULAR HEMATITE NODULES UP TO 70mm IN DIAMETER, IRON OXIDE STAINING AROUND MARGINS OF INCLUSIONS. SANDSTONE BECOMES MODERATELY SOFT (H5) AND SLIGHTLY WEATHERED (W3) AT 13.0 FT, CORE WASHED BY DRILL.

20.5 -24.2 FT: CONGLOMERATE: SUBROUNDED DARK GREY CLAYSTONE AND LIGHT GREY SILTSTONE CLASTS IN A LIGHT GREY FINE SANDSTONE TO SILTSTONE MATRIX, CLASTS ABOUT 10mm IN DIAMETER. SLIGHTLY WEATHERED TO FRESH (W2), MODERATELY HARD (H4) TO MODERATELY SOFT (H5), MODERATELY BEDDED, TRACE FeOx STAINING.

JOINT MEASUREMENTS:

DEPTH	INCL	R	W	O	T	HL	INFILLING
21.1	65	3			3	6	FeOx
21.9	65	3			3	6	FeOx
23.0	65	3			3	6	FeOx
23.6	65	3			3	6	FeOx

24.2 - 26.8 FT: SANDSTONE: FINE TO MEDIUM GRAINED BROWN TO GREY IN COLOR, MODERATELY SOFT (H5), SLIGHTLY WEATHERED TO FRESH (W2), LAMINATED, INTERMITTENT TRACES OF COARSE SAND, NO REACTION WITH HCl.

STRATIGRAPHY:
0.0 - 5.0 FT. QUATERNARY ALLUVIUM (Qal)
5.0 - 26.8 FT. TERTIARY NACIMIENTO FORMATION (Tn)
ABBREVIATIONS:
WLNE = WATER LEVEL NOT ENCOUNTERED
I.D. = INSIDE DIAMETER BNE = BEDROCK NOT ENCOUNTERED.

COMMENTS:

ALL ANGLES MEASURED FROM CORE AXIS AT ZERO DEGREES, UNLESS OTHERWISE NOTED.
THE DATA FOR THE CENTER COLUMN AND"CLASSIFICATION AND PHYSICAL CONDITIONS" COLUMN ARE BASED ON BUREAU OF RECLAMATION GEOLOGY FIELD MANUAL AND DRAWINGS TITLED FOR DESIGNS AND SPECIFICATIONS AS FOLLOWS- DRAWING NO. 40-D-6493, STANDARD DESCRIPTIONS AND DESCRIPTIVE CRITERIA FOR ROCK. DRAWING NO. 40-D-6499. STANDARD DESCRIPTORS AND DESCRIPTIVE CRITERIA FOR DISCONTINUITIES.

GEOLOGIC LOG OF DRILL HOLE NO. DHR22-53

SHEET 1 OF 1

FEATURE: REACH 22B
LOCATION: PIPELINE
BEGUN: 5/24/13 FINISHED: 5/25/13
DEPTH OF WATER LEVEL:
DATE MEASURED:

PROJECT: NAVAJO GALLUP WATER SUPPLY PROJECT
COORDINATES: N 2,013,482.2 E 2,750,318.5
TOTAL DEPTH: 25.0
DEPTH TO BEDROCK: 3.0

STATE: NEW MEXICO
GROUND ELEVATION: 6211.9
ANGLE FROM HORIZONTAL: 90
HOLE LOGGED BY: J. GILBERT
REVIEWED BY:

NOTES

ALL MEASUREMENTS ARE FROM GROUND SURFACE AND ARE THE SAME AS THOSE USED BY THE DRILLER.

ALL MEASUREMENTS ARE REPORTED IN FEET EXCEPT WHERE NOTED.

DRILLED BY: U.C. REGION DRILL CREW; DRILLER; LENNY WASHBURN, HELPERS; LARRY ZOLEMAN, DAVE NIELSEN.

PURPOSE:
PRECONSTRUCTION SOIL AND BEDROCK FOUNDATION INVESTIGATIONS.

DRILL EQUIPMENT:
CME 85

DRILL METHOD:
0- 13.3 FT 4 1/4" HSA AND DRY CORE SYSTEM WITH SPTs.
13.3 TO 25.0 FT HQ3 WIRELINE CORING SYSTEM WITH A 5' SPILT TUBE SAMPLER AND DIAMOND SURFACE- SET BIT.
CASING RECORD:
NONE USED

DRILLING MEDIUM:
WATER

DRILLER NOTES: MOVE RIG AND EQUIPMENT TO DRILL SITE. SPOT RIG ON HOLE AND RIG UP. TAKE SPT SAMPLES AT 2.5 FT. INTERVALS. CLEAN OUT BETWEEN SAMPLERS WITH A CME SPLIT SPOON SAMPLER.

HOLE COMPLETION:
BACKFILLED WITH AUGER CUTTINGS

DEPTH	% CORE RECOVERY	LABORATORY DATA: % FINES	% SAND	% GRAVEL	LIQUID LIMIT	PLASTICITY INDEX	MOISTURE CONTENT	LABORATORY CLASSIFICATION	BLOWS / 0.5 FT	GEOLOGIC UNIT SYMBOL	VISUAL CLASSIFICATION / ELEVATION
										Qal	SM 6208.9
		29.1	70.9	0	25.1	7.0	5.1	SC	15/17/16		
5		25.4	74.6	0	NA	NP	4.7	SM	23/REFUSAL		
									REFUSAL		
10		23.8	76.2	0	NA	NP	2.2	SM			
	0									Tn	SS
15											
	84%										
20											
	96%										
25											6186.9

BOTTOM OF HOLE

CLASSIFICATION AND PHYSICAL CONDITION

0.0 - 3.0 FT: QUATERNARY ALLUVIUM (Qal):

0.0-3.0 FT: SILTY SAND (SM): ABOUT 70% FINE SAND, ; ABOUT 30% FINES WITH RAPID DILATANCY, NO DRY STRENGTH; MAXIMUM SIZE, FINE SAND; MOIST, TAN IN COLOR; ROOTS AND ORGANIC MATERIAL IN TOP 0.5 FT, LOOSE; NO REACTION WITH HCl.

3.0-25.0 FT TERTIARY NACIMIENTO FORMATION (Tn)

3.0-25.0 FT: SANDSTONE: SANDSTONE: FINE TO COARSE GRAINED, TRANSITIONS BETWEEN GREY TO DARK GREY IN COLOR, SOFT (H6), VERY INTENSELY WEATHERED (W8) TO DECOMPOSED (W9) FROM 3.0 TO 13.3 FT, BECOMES MODERATELY SOFT (H5) AND MODERATELY WEATHERED (W5) FROM 13.3 TO 25.0 FT, NO REACTION WITH HCl, INTERMITTENT FeOx STAINING, ENCOUNTERED AUGER REFUSAL AT 13.3 FT AND SWITCHED TO CORING SETUP.

JOINT MEASUREMENTS:

DEPTH	INCL	R	W	O	T	HL	INFILLING
23.1	70	4		3	6		FeOx

STRATIGRAPHY:
0.0 - 3.0 FT. QUATERNARY ALLUVIUM (Qal)
3.0 - 25.0 FT. TERTIARY NACIMIENTO FORMATION (Tn)

ABBREVIATIONS:
WLNE = WATER LEVEL NOT ENCOUNTERED
I.D. = INSIDE DIAMETER BNE = BEDROCK NOT ENCOUNTERED.

COMMENTS:

ALL ANGLES MEASURED FROM CORE AXIS AT ZERO DEGREES, UNLESS OTHERWISE NOTED.
THE DATA FOR THE CENTER COLUMN AND"CLASSIFICATION AND PHYSICAL CONDITIONS" COLUMN ARE BASED ON BUREAU OF RECLAMATION GEOLOGY FIELD MANUAL AND DRAWINGS TITLED FOR DESIGNS AND SPECIFICATIONS AS FOLLOWS- DRAWING NO. 40-D-6493. STANDARD DESCRIPTIONS AND DESCRIPTIVE CRITERIA FOR ROCK. DRAWING NO. 40-D-6499. STANDARD DESCRIPTORS AND DESCRIPTIVE CRITERIA FOR DISCONTINUITIES.

GEOLOGIC LOG OF DRILL HOLE NO. DHR22-57

SHEET 1 OF 2

FEATURE: REACH 22B
LOCATION: PIPELINE
BEGUN: 4/13/12 FINISHED: 4/13/12
DEPTH OF WATER LEVEL:
DATE MEASURED:

PROJECT: NAVAJO GALLUP WATER SUPPLY PROJECT
COORDINATES: N 2,008,904.2 E 2,749,313.0
TOTAL DEPTH: 25.3
DEPTH TO BEDROCK: BNE

STATE: NEW MEXICO
GROUND ELEVATION: 6192.6
ANGLE FROM HORIZONTAL: 90
HOLE LOGGED BY: C. BEYER
REVIEWED BY:

NOTES

ALL MEASUREMENTS ARE FROM GROUND SURFACE AND ARE THE SAME AS THOSE USED BY THE DRILLER.

ALL MEASUREMENTS ARE REPORTED IN FEET EXCEPT WHERE NOTED.

DRILLED BY: P.N. REGION DRILL CREW; C. PETERSON DRILLER; SCRIVENER, CLINE, HELPERS.

PURPOSE:
PRECONSTRUCTION SOIL AND BEDROCK FOUNDATION INVESTIGATIONS.

DRILL EQUIPMENT:
CME MODEL 850 TRACK MOUNTED ROTARY DRILL RIG.

DRILL METHOD:
0-25.3 FT 4 1/4" HSA AND DRY CORE SYSTEM WITH SPTs.

CASING RECORD:
NONE USED

DRILLING MEDIUM:
NONE USED

HOLE COMPLETION:
BACKFILLED 0.0 TO 10.0 FEET WITH CUTTINGS,
10.0 TO 25.3 FEET WITH BENTONINTE.

DEPTH	% CORE RECOVERY	LABORATORY DATA: % FINES	% SAND	% GRAVEL	LIQUID LIMIT	PLASTICITY INDEX	MOISTURE CONTENT	LABORATORY CLASSIFICATION	BLOWS / 0.5 FT	GEOLOGIC UNIT SYMBOL	VISUAL CLASSIFICATION / ELEVATION
0	100									Qal	
5	92	33.1	66.9	0	N/A	NP	3.9	SM	4 5 5		
10	100	19.9	80.7	0	N/A	NP	2.4	SM	HAMMER SANK 4		SM
	100	8.2	91.8	0	N/A	NP	1.6	SP-SM	4 10 13		
15	100	9.2	80.8	0	N/A	NP	1.3	SP-SM	4 12 15		
	78	7.9	92.1	0	N/A	NP	1.5	SP-SM	8 14 7		
		65	15	0	36.3	19.8	16	(CL)s			6175.1 (CL)s 6174.4
20		5.1	91.9	3	N/A	NP	0.7	SP-SM			
	100	6.9	93.1	0	N/A	NP	1.3	SP-SM	8 17 23		(SP-SM)

CLASSIFICATION AND PHYSICAL CONDITION

0.0 - 25.0 FT: QUATERNARY ALLUVIUM (Qal):
0.0 - 17.5 FT: SILTY SAND SM: ABOUT 80% PREDOMINATELY FINE TO MEDIUM SAND, TRACE FINE SUBANGULAR GRAVEL; ABOUT 20% NONPLASTIC FINES, WITH RAPID DILATANCY, LOW DRY STRENGTH, AND LOW TOUGHNESS; DRY, BROWN TO GREY IN COLOR, MAXIMUM SIZE, 12 mm; ROOTS ON TOP 1.0 FT, INTERMITTENT CHARCOAL FRAGMENTS; INTERMITTENT CALCITE NODULES BELOW 5.3 FT; NO REACTION WITH HCl (STRONG REACTION WITH HCl ON CALCITE NODULES).

17.5 -18.2 FT: LEAN CLAY WITH SAND(CL)s: ABOUT 80% MEDIUM PLASTIC FINES, NO DILATANCY, MEDIUM DRY STRENGTH, MEDIUM TO HIGH TOUGHNESS, ABOUT 20% FINE SAND; DARK GREY IN COLOR, ORANGE FeOx STAINING; NO REACTION WITH HCl.

18.2 -25.3. FT: POORLY GRADED SAND WITH SILT (SP-SM): ABOUT 90% FINE TO MEDIUM SAND, TRACE COARSE SAND AND FINE GRAVEL; ABOUT 10% NONPLASTIC FINES, WITH RAPID DILATANCY, NO DRY STRENGTH, AND LOW TOUGHNESS; BROWN TO GREY IN COLOR, FeOx STAINING, MAXIMUM SIZE, 12 mm, NO REACTION WITH HCl.

STRATIGRAPHY: 0.0 - 25.3 ft. QUATERNARY ALLUVIUM (Qal)

ABBREVIATIONS: WLNE = WATER LEVEL NOT ENCOUNTERED I.D. = INSIDE DIAMETER BNE = BEDROCK NOT ENCOUNTERED.

COMMENTS:

ALL ANGLES MEASURED FROM CORE AXIS AT ZERO DEGREES, UNLESS OTHERWISE NOTED.
THE DATA FOR THE CENTER COLUMN AND"CLASSIFICATION AND PHYSICAL CONDITIONS" COLUMN ARE BASED ON BUREAU OF RECLAMATION GEOLOGY FIELD MANUAL AND DRAWINGS TITLED FOR DESIGNS AND SPECIFICATIONS AS FOLLOWS- DRAWING NO. 40-D-6493. STANDARD DESCRIPTIONS AND DESCRIPTIVE CRITERIA FOR ROCK. DRAWING NO. 40-D-6499. STANDARD DESCRIPTORS AND DESCRIPTIVE CRITERIA FOR DISCONTINUITIES.

GEOLOGIC LOG OF DRILL HOLE NO. DHR22-57

FEATURE: REACH 22B
LOCATION: PIPELINE
BEGUN: 4/13/12 FINISHED: 4/13/12
DEPTH OF WATER LEVEL:
DATE MEASURED:

PROJECT: NAVAJO GALLUP WATER SUPPLY PROJECT
COORDINATES: N 2,008,904.2 E 2,749,313.0
TOTAL DEPTH: 25.3
DEPTH TO BEDROCK: BNE

STATE: NEW MEXICO
GROUND ELEVATION: 6192.6
ANGLE FROM HORIZONTAL: 90
HOLE LOGGED BY: C. BEYER
REVIEWED BY:

NOTES	DEPTH	% CORE RECOVERY	LABORATORY DATA: % FINES	% SAND	% GRAVEL	LIQUID LIMIT	PLASTICITY INDEX	MOISTURE CONTENT	LABORATORY CLASSIFICATION	BLOWS / 0.5 FT	GEOLOGIC UNIT SYMBOL	VISUAL CLASSIFICATION / ELEVATION	CLASSIFICATION AND PHYSICAL CONDITION
												(SP-SM) 6167.3	

BOTTOM OF HOLE

GEOLOGIC LOG OF DRILL HOLE NO. DHR22-61

SHEET 1 OF 1

FEATURE: REACH 22B
LOCATION: PIPELINE
BEGUN: 4/14/12 FINISHED: 4/14/12
DEPTH OF WATER LEVEL:
DATE MEASURED:

PROJECT: NAVAJO GALLUP WATER SUPPLY PROJECT
COORDINATES: N 2,003,871.8 E 2,747,997.6
TOTAL DEPTH: 25.0
DEPTH TO BEDROCK: 21.7

STATE: NEW MEXICO
GROUND ELEVATION: 6187.8
ANGLE FROM HORIZONTAL: 90
HOLE LOGGED BY: C. BEYER
REVIEWED BY:

NOTES

ALL MEASUREMENTS ARE FROM GROUND SURFACE AND ARE THE SAME AS THOSE USED BY THE DRILLER.

ALL MEASUREMENTS ARE REPORTED IN FEET EXCEPT WHERE NOTED.

DRILLED BY: P.N. REGION DRILL CREW; C. PETERSON DRILLER; SCRIVENER, CLINE, HELPERS.

PURPOSE:
PRECONSTRUCTION SOIL AND BEDROCK FOUNDATION INVESTIGATIONS.

DRILL EQUIPMENT:
CME MODEL 850 TRACK MOUNTED ROTARY DRILL RIG.

DRILL METHOD:
0-25.0 FT 4 1/4" HSA AND DRY CORE SYSTEM WITH SPTs.

CASING RECORD:
NONE USED

DRILLING MEDIUM:
NONE USED

HOLE COMPLETION:
BACKFILLED FROM 0.0 TO 10.0 FEET WITH CUTTINGS.
FROM 10.0 TO 25.0 FEET WITH BENTONINTE.

DEPTH	% CORE RECOVERY	LABORATORY DATA: % FINES	% SAND	% GRAVEL	LIQUID LIMIT	PLASTICITY INDEX	MOISTURE CONTENT	LABORATORY CLASSIFICATION	BLOWS / 0.5 FT	GEOLOGIC UNIT SYMBOL	VISUAL CLASSIFICATION / ELEVATION
0	92									Qal	SM
5	100	51	49	0	23.7	6.9	4.3	s(CL-ML)	3, 4, 4		
									3		
	40	38.4	61.6	0	21.2	4.5	3.6	SC-SM	3, 5, 6		
10											6177.8
	100	15	85	0	N/A	NP	1.5	SM	3, 7, 9		
	100	6.5	93.5	0	N/A	NP	0.9	SP-SM	4, 7, 10		
15											SM
	86	16.3	83.7	0	N/A	NP	2.2	SM	7, 14, 18		
		18.6	77.3	4.1	N/A	NP	3.2	SM			
20											6167.8
	100								7, 11, 11		SM 6166.1
										Tn	CLST
25											6162.8

BOTTOM OF HOLE

CLASSIFICATION AND PHYSICAL CONDITION

0.0 - 21.7 FT: QUATERNARY ALLUVIUM (Qal):

0.0 - 10.0 FT: SILTY SAND SC: ABOUT 60% FINE SAND; ABOUT 40% FINES WITH LOW PLASTICITY, LOW TO MEDIUM DRY STRENGTH, LOW TOUGHNESS AND SLOW DILATANCY; MAXIMUM SIZE, FINE SAND; DRY, BROWN IN COLOR, ROOTS ON TOP 1.0 FT; NO REACTION WITH HCl.

10.0 -20.0 FT: SILTY SAND SM: ABOUT 80% FINE SAND; ABOUT 20% FINES WITH NO PLASTICITY, LOW DRY STRENGTH, AND RAPID DILATANCY; DRY, BROWN IN COLOR; NO REACTION WITH HCl.

20.0 -21.7 FT: SILTY SAND (SM): ABOUT 75% FINE TO MEDIUM SAND, ABOUT 20% NONPLASTIC FINES, WITH RAPID DILATANCY, AND NO DRY STRENGTH; ABOUT 5% FINE GRAVEL, MAXIMUM SIZE, 12 mm; NO REACTION WITH HCl.

21.7 - 25.0 FT: TERTIARY NACIMIENTO FORMATION (Tn):

CLAYSTONE: DECOMPOSED (W9) VERY SOFT (H7),
LEAN CLAY WITH SAND (CL)s: ABOUT 90% FINES WITH MEDIUM TO HIGH PLASTICITY; ABOUT 10% FINE SAND; DARK GREY WITH PURPLE SPOTS; INTERMITTENT CALCITE VEINS; STRONG REACTION WITH HCl.

STRATIGRAPHY:
0.0 - 21.7 ft. QUATERNARY ALLUVIUM (Qal)
21.7 - 25.0 FT: TERTIARY NACIMIENTO FORMATION (Tn)

ABBREVIATIONS:
WLNE = WATER LEVEL NOT ENCOUNTERED
I.D. = INSIDE DIAMETER BNE = BEDROCK NOT ENCOUNTERED.

COMMENTS:

ALL ANGLES MEASURED FROM CORE AXIS AT ZERO DEGREES, UNLESS OTHERWISE NOTED.
THE DATA FOR THE CENTER COLUMN AND"CLASSIFICATION AND PHYSICAL CONDITIONS" COLUMN ARE BASED ON BUREAU OF RECLAMATION GEOLOGY FIELD MANUAL AND DRAWINGS TITLED FOR DESIGNS AND SPECIFICATIONS AS FOLLOWS- DRAWING NO. 40-D-6493. STANDARD DESCRIPTIONS AND DESCRIPTIVE CRITERIA FOR ROCK. DRAWING NO. 40-D-6499. STANDARD DESCRIPTORS AND DESCRIPTIVE CRITERIA FOR DISCONTINUITIES.

GEOLOGIC LOG OF DRILL HOLE NO. DHR22-65

SHEET 1 OF 1

FEATURE: REACH 22B
LOCATION: 22792+13.21, 9.2'R
BEGUN: 4/15/12 FINISHED: 4/15/12
DEPTH OF WATER LEVEL:
DATE MEASURED:

PROJECT: NAVAJO GALLUP WATER SUPPLY PROJECT
COORDINATES: N 1,999,152.1 E 2,746,905.0
TOTAL DEPTH: 25.0
DEPTH TO BEDROCK: BNE

STATE: NEW MEXICO
GROUND ELEVATION: 6284.8
ANGLE FROM HORIZONTAL: 90
HOLE LOGGED BY: C. HALL
REVIEWED BY:

NOTES

ALL MEASUREMENTS ARE FROM GROUND SURFACE AND ARE THE SAME AS THOSE USED BY THE DRILLER.

ALL MEASUREMENTS ARE REPORTED IN FEET EXCEPT WHERE NOTED.

DRILLED BY: P.N. REGION DRILL CREW: C. PETERSON DRILLER; SCRIVENER, CLINE, HELPERS.

PURPOSE:
PRECONSTRUCTION SOIL AND BEDROCK FOUNDATION INVESTIGATIONS.

DRILL EQUIPMENT:
CME MODEL 850 TRACK MOUNTED ROTARY DRILL RIG.

DRILL METHOD:
0-25.0 FT 4 1/4" HSA AND DRY CORE SYSTEM WITH SPTs.

CASING RECORD:
NONE USED

DRILLING MEDIUM:
NONE USED

DRILLER NOTES:
SET UP AND BEGAN DRILLING WITH 4 1/4 HSA WITH DRY CORE SYSTEM. TOOK SPTs, DRILL RAN AT 1500 RPM WHEN USING AUTO HAMMER. GEOLOGIST TOOK BLOW COUNTS. COMPLETED HOLE, PULLED AUGERS, MOVED TO DHR22-69.

HOLE COMPLETION:
BACKFILLED WITH 4 BAGS SWELL PLUG AND RANDOM FILL.

DEPTH	% CORE RECOVERY	LABORATORY DATA: % FINES	% SAND	% GRAVEL	LIQUID LIMIT	PLASTICITY INDEX	MOISTURE CONTENT	LABORATORY CLASSIFICATION	BLOWS / 0.5 FT	GEOLOGIC UNIT SYMBOL	VISUAL CLASSIFICATION / ELEVATION
										Qal	SM
		23.9	76.1	0	N/A	NP	2.6	SM			6281.3
5	100	9.7	90.3	0	N/A	NP	1.7	SP-SM	1 2 1		SP-SM
	100	10.9	89.1	0	N/A	NP	2.1	SP-SM	4 9 15		
10	100	12.1	87.9	0	N/A	NP	2.1	SM	13 20 23		6272.9
		62.1	37.9	0	27.7	11.4	8.3	s(CL)			s(CL) 6272.2
	100	26.2	73.8	0	N/A	NP	3.8	SM	5 16 21		
15	100	21.1	78.9	0	N/A	NP	3.3	SM	7 13 5		SM
20	100	23.3	76.7	0	N/A	NP	2.2	SM	12 12 14		6259.8
25											

BOTTOM OF HOLE

CLASSIFICATION AND PHYSICAL CONDITION

0.0 - 25.0 FT.: QUATERNARY ALLUVIUM (Qal):
0.0 - 3.5 FT: SILTY SAND SM: ABOUT 70% PREDOMINATLY FINE SAND; ABOUT 30% NONPLASTIC FINES WITH RAPID DILATANCY, LOW DRY STRENGTH; MAXIMUM SIZE, MEDIUM SAND; NO REACTION WITH HCl.
DRY, BROWN TO GREY IN COLOR, FINE ROOTS ON TOP 1.0 FT.

3.5 -11.9 FT: POORLY GRADED SAND WITH SILT (SP-SM): ABOUT 90% FINE TO MEDIUM SAND; ABOUT 10% NONPLASTIC FINES, WITH RAPID DILATANCY, NO DRY STRENGTH; MAXIMUM SIZE, MEDIUM SAND; NO REACTION WITH HCl. DRY, TAN IN COLOR,

11.9 -12.6 FT: SANDY LEAN CLAY s(CL): ABOUT 65% MEDIUM PLASTIC FINES, NO DILATANCY, MEDIUM DRY STRENGTH, MEDIUM TO HIGH TOUGHNESS, ABOUT 35% PREDOMINATELY FINE SAND; MAXIMUM SIZE, MEDIUM SAND; REDDISH BROWN IN COLOR, DRY, NO REACTION WITH HCl.

12.6 - 25.0 FT: SILTY SAND SM: ABOUT 70% FINE TO COARSE, HARD, SUBROUNDED TO ANGULAR SAND; ABOUT 30% NONPLASTIC FINES WITH RAPID DILATANCY, LOW DRY STRENGTH; MAXIMUM SIZE, COARSE SAND; NO REACTION WITH HCl.
DRY, TAN WITH THIN DARK GREY LENSES.

STRATIGRAPHY:
0.0 - 25.0 ft. QUATERNARY ALLUVIUM (Qal)

ABBREVIATIONS:
WLNE = WATER LEVEL NOT ENCOUNTERED I.D. = INSIDE DIAMETER
BNE = BEDROCK NOT ENCOUNTERED.

COMMENTS:

ALL ANGLES MEASURED FROM CORE AXIS AT ZERO DEGREES, UNLESS OTHERWISE NOTED.
THE DATA FOR THE CENTER COLUMN AND"CLASSIFICATION AND PHYSICAL CONDITIONS" COLUMN ARE BASED ON BUREAU OF RECLAMATION GEOLOGY FIELD MANUAL AND DRAWINGS TITLED FOR DESIGNS AND SPECIFICATIONS AS FOLLOWS- DRAWING NO. 40-D-6493, STANDARD DESCRIPTIONS AND DESCRIPTIVE CRITERIA FOR ROCK. DRAWING NO. 40-D-6499. STANDARD DESCRIPTORS AND DESCRIPTIVE CRITERIA FOR DISCONTINUITIES.

GEOLOGIC LOG OF DRILL HOLE NO. DHR22-69

SHEET 1 OF 1

FEATURE: REACH 22B
LOCATION: PIPELINE
BEGUN: 4/16/12 FINISHED: 4/16/12
DEPTH OF WATER LEVEL:
DATE MEASURED:

PROJECT: NAVAJO GALLUP WATER SUPPLY PROJECT
COORDINATES: N 1,994,418.9 E 2,745,774.2
TOTAL DEPTH: 25.0
DEPTH TO BEDROCK: BNE

STATE: NEW MEXICO
GROUND ELEVATION: 6359.7
ANGLE FROM HORIZONTAL: 90
HOLE LOGGED BY: C. BEYER
REVIEWED BY:

NOTES

ALL MEASUREMENTS ARE FROM GROUND SURFACE AND ARE THE SAME AS THOSE USED BY THE DRILLER.

ALL MEASUREMENTS ARE REPORTED IN FEET EXCEPT WHERE NOTED.

DRILLED BY: P.N. REGION DRILL CREW; C. PETERSON DRILLER; SCRIVENER, CLINE, HELPERS.

PURPOSE:
PRECONSTRUCTION SOIL AND BEDROCK FOUNDATION INVESTIGATIONS.

DRILL EQUIPMENT:
CME MODEL 850 TRACK MOUNTED ROTARY DRILL RIG.

DRILL METHOD:
0-25.0 FT 4 1/4" HSA AND DRY CORE SYSTEM WITH SPTs.

CASING RECORD:
NONE USED

DRILLING MEDIUM:
NONE USED

HOLE COMPLETION:
BACKFILLED WITH 4 BAGS SWELL PLUG AND RANDOM FILL.

DEPTH	% CORE RECOVERY	LABORATORY DATA: % FINES	% SAND	% GRAVEL	LIQUID LIMIT	PLASTICITY INDEX	MOISTURE CONTENT	LABORATORY CLASSIFICATION	BLOWS / 0.5 FT	GEOLOGIC UNIT SYMBOL	VISUAL CLASSIFICATION / ELEVATION
0	100									Qal	
5	100	16.3	83.7	0	N/A	NP	2.4	SM	4 8 14		SM
	100	25.2	74.8	0	N/A	NP	2.7	SM	8 9 11		
10	100	40.1	58.5	1.4	N/A	NP	4.8	SM	4 8 11		
	100	58	40.6	1.4	31.1	15.7	7	s(CL)	10 16 15		6347.2 SC
15	100	48.9	46.9	4.3	27.6	12.4	5.8	SC	14 22 26		6344.7
	100	23.1	61.9	15	25.5	11.1	4.5	(SC)g			(SC)g
20	84	35.7	55.3	9	29.2	14.8	5.6	SC	16 26 30		
25											6334.7

BOTTOM OF HOLE

CLASSIFICATION AND PHYSICAL CONDITION

0.0 - 25.0 FT: QUATERNARY ALLUVIUM (Qal):

0.0 - 12.5 FT: SILTY SAND SM: ABOUT 70% FINE SAND; ABOUT 30% FINES WITH LOW TO MEDIUM PLASTICITY, RAPID DILATANCY, LOW DRY STRENGTH; MAXIMUM SIZE, FINE SAND; LOW TOUGHNESS, DRY, BROWN IN COLOR; NO REACTION WITH HCl.

12.5 - 15.0 FT: CLAYEY SAND SC: ABOUT 50% PREDOMINATELY FINE SAND, TRACE COARSE SAND AND FINE GRAVEL; ABOUT 50% FINES WITH LOW TO MEDIUM PLASTICITY, NO DILATANCY, LOW TO MEDIUM DRY STRENGTH; LOW TOUGHNESS; MAXIMUM SIZE, 25mm; DRY, BROWN IN COLOR; INTERMITTENT CALCITE NODULES; STRONG REACTION WITH HCl.

15.0 - 25.0 FT: CLAYEY SAND WITH GRAVEL (SC)g: ABOUT 45%PREDOMINATELY FINE SAND, TRACE COARSE SAND; ABOUT 40% FINES WITH LOW TO MEDIUM PLASTICITY, NO DILATANCY, LOW TO MEDIUM DRY STRENGTH, LOW TOUGHNESS, ABOUT 15% FINE GRAVEL, MAXIMUM SIZE, 25mm; DRY, BROWN IN COLOR; INTERMITTENT CALCITE NODULES; STRONG REACTION WITH HCl.

STRATIGRAPHY:
0.0 - 25.0 ft. QUATERNARY ALLUVIUM (Qal)

ABBREVIATIONS:
WLNE = WATER LEVEL NOT ENCOUNTERED
I.D. = INSIDE DIAMETER BNE = BEDROCK NOT ENCOUNTERED.

COMMENTS:

ALL ANGLES MEASURED FROM CORE AXIS AT ZERO DEGREES, UNLESS OTHERWISE NOTED.
THE DATA FOR THE CENTER COLUMN AND"CLASSIFICATION AND PHYSICAL CONDITIONS" COLUMN ARE BASED ON BUREAU OF RECLAMATION GEOLOGY FIELD MANUAL AND DRAWINGS TITLED FOR DESIGNS AND SPECIFICATIONS AS FOLLOWS- DRAWING NO. 40-D-6493. STANDARD DESCRIPTIONS AND DESCRIPTIVE CRITERIA FOR ROCK. DRAWING NO. 40-D-6499. STANDARD DESCRIPTORS AND DESCRIPTIVE CRITERIA FOR DISCONTINUITIES.

GEOLOGIC LOG OF DRILL HOLE NO. DHR22-74

SHEET 1 OF 1

FEATURE: REACH 22B
LOCATION: PIPELINE
BEGUN: 4/16/12 FINISHED: 4/17/12
DEPTH OF WATER LEVEL:
DATE MEASURED:

PROJECT: NAVAJO GALLUP WATER SUPPLY PROJECT
COORDINATES: N 1,989,099.5 E 2,742,900.5
TOTAL DEPTH: 24.0
DEPTH TO BEDROCK: 10

STATE: NEW MEXICO
GROUND ELEVATION: 6413.0
ANGLE FROM HORIZONTAL: 90
HOLE LOGGED BY: C. BEYER
REVIEWED BY:

NOTES

ALL MEASUREMENTS ARE FROM GROUND SURFACE AND ARE THE SAME AS THOSE USED BY THE DRILLER.

ALL MEASUREMENTS ARE REPORTED IN FEET EXCEPT WHERE NOTED.

DRILLED BY: P.N. REGION DRILL CREW; C. PETERSON DRILLER; SCRIVENER, CLINE, HELPERS.

PURPOSE:
PRECONSTRUCTION SOIL AND BEDROCK FOUNDATION INVESTIGATIONS.

DRILL EQUIPMENT:
CME MODEL 850 TRACK MOUNTED ROTARY DRILL RIG.

DRILL METHOD:
0-24.0 FT 4 1/4" HSA AND DRY CORE SYSTEM WITH SPTs.

CASING RECORD:
NONE USED

DRILLING MEDIUM:
NONE USED

HOLE COMPLETION:
BACKFILLED WITH 5 BAGS SWELL PLUG AND CUTTINGS.

DEPTH	% CORE RECOVERY	LABORATORY DATA: % FINES	% SAND	% GRAVEL	LIQUID LIMIT	PLASTICITY INDEX	MOISTURE CONTENT	LABORATORY CLASSIFICATION	BLOWS / 0.5 FT	GEOLOGIC UNIT SYMBOL	VISUAL CLASSIFICATION / ELEVATION
	96									Qal	SM
5	60	31.1	68.9	0	N/A	NP	3.8	SM	5 5 5		
	100	29.1	70.9	0	25.3	NP	6.4	SM	10 16 23		6403.0
10	100	30.7	69.3	0	28.3	11.4	6.3	SC	10 24 41	Tn	SS
	100	29.6	67.9	2.5	27.1	10.1	4.7	SC	16 REFUSAL		6398.0
15	74	47.6	52.4	0	34.5	12.8	10.5	SC	26 REFUSAL		CLST
20	82	57.8	42.2	0	35	18.8	9.4	s(CL)	23 REFUSAL		6389.0

BOTTOM OF HOLE

CLASSIFICATION AND PHYSICAL CONDITION

0.0 - 10.0 FT.: QUATERNARY ALLUVIUM (Qal):

0.0 - 10.0 FT: SILTY SAND SM: ABOUT 70% FINE SAND; ABOUT 30% FINES WITH NO PLASTICITY, RAPID DILATANCY, LOW DRY STRENGTH, LOW TOUGHNESS; MAXIMUM SIZE, FINE SAND, DRY, BROWN IN COLOR; ROOTS IN TOP 1.0 FT; NO REACTION WITH HCl IN TOP 6.5 FT, STRONG REACTION WITH HCl BELOW 6.5 FT.

10.0 - 24.0 FT: TERTIARY NACIMIENTO FORMATION (Tn):

10.0 - 15.0 FT: SANDSTONE: INTENSELY WEATHERED (W7) TO DECOMPOSED (W9) SOFT (H6) TO VERY SOFT (H7), MATERIAL VERY TIGHTLY PACKED IN SPT SAMPLER, TRACE FINE SUBROUNDED GRAVEL (ACTUAL ROCK WEATHERING AND HARDNESS APPROXIMATED DUE TO SAMPLE DISINTEGRATION FROM AUGER)

15.0 - 24.0 FT: CLAYSTONE: INTENSELY WEATHERED (W7) SOFT (H6) TO VERY SOFT (H7), GREY IN COLOR, NO REACTION WITH HCL; MATERIAL VERY TIGHTLY PACKED IN SPT SAMPLER, (ACTUAL ROCK WEATHERING AND HARDNES APPROXIMATED DUE TO SAMPLE DISINTEGRATION FROM AUGER).

STRATIGRAPHY:
0.0 - 10.0 FT: QUATERNARY ALLUVIUM (Qal)
10.0 - 24.0 FT: TERTIARY NACIMIENTO FORMATION (Tn)
ABBREVIATIONS:
WLNE = WATER LEVEL NOT ENCOUNTERED
I.D. = INSIDE DIAMETER BNE = BEDROCK NOT ENCOUNTERED.

COMMENTS:

ALL ANGLES MEASURED FROM CORE AXIS AT ZERO DEGREES, UNLESS OTHERWISE NOTED.
THE DATA FOR THE CENTER COLUMN AND"CLASSIFICATION AND PHYSICAL CONDITIONS" COLUMN ARE BASED ON BUREAU OF RECLAMATION GEOLOGY FIELD MANUAL AND DRAWINGS TITLED FOR DESIGNS AND SPECIFICATIONS AS FOLLOWS- DRAWING NO. 40-D-6493. STANDARD DESCRIPTIONS AND DESCRIPTIVE CRITERIA FOR ROCK. DRAWING NO. 40-D-6499. STANDARD DESCRIPTORS AND DESCRIPTIVE CRITERIA FOR DISCONTINUITIES.

GEOLOGIC LOG OF DRILL HOLE NO. DHR22-78

SHEET 1 OF 1

FEATURE: REACH 22B
LOCATION: PIPELINE
BEGUN: 6/24/12 FINISHED: 6/24/12
DEPTH OF WATER LEVEL:
DATE MEASURED:

PROJECT: NAVAJO GALLUP WATER SUPPLY PROJECT
COORDINATES: N 1,984,821.4 E 2,741,525.2
TOTAL DEPTH: 25.0
DEPTH TO BEDROCK: BNE

STATE: NEW MEXICO
GROUND ELEVATION: 6434.9
ANGLE FROM HORIZONTAL: 90
HOLE LOGGED BY: C. BEYER
REVIEWED BY:

NOTES

ALL MEASUREMENTS ARE FROM GROUND SURFACE AND ARE THE SAME AS THOSE USED BY THE DRILLER.

ALL MEASUREMENTS ARE REPORTED IN FEET EXCEPT WHERE NOTED.

DRILLED BY: U.C. REGION DRILL CREW; DRILLER; LENNY WASHBURN, HELPERS; BRENT TERRY, TYSON BEZANSON.
PURPOSE:
PRECONSTRUCTION SOIL AND BEDROCK FOUNDATION INVESTIGATIONS.

DRILL EQUIPMENT:
GUS PECH MODEL GP3000 ROTARY DRILL RIG.

DRILL METHOD:
0-25.0 FT 4 1/4" HSA AND DRY CORE SYSTEM WITH SPTs.

CASING RECORD:
NONE USED

DRILLING MEDIUM:
NONE USED

HOLE COMPLETION:
BACKFILLED WITH CUTTINGS.

DEPTH	% CORE RECOVERY	LABORATORY DATA: % FINES	% SAND	% GRAVEL	LIQUID LIMIT	PLASTICITY INDEX	MOISTURE CONTENT	LABORATORY CLASSIFICATION	BLOWS / 0.5 FT	GEOLOGIC UNIT SYMBOL	VISUAL CLASSIFICATION / ELEVATION
	90									Qal	
5									14		SM
	88	32.7	67.3	0	21.9%	8.4%	4.6%	SC	21		
									25		
	100	51.0	49.0	0	21.4%	3.8%	4.5%	s(ML)	21		
									31		
									29		
											6425.1
10		75.4	24.6	0	52.1%	30.3%	17.2%	(CH)s	4		(CL)s 6424.4
	96	44.4	55.6	0	25.6%	7.3%	5.6%	SC	15		SC 6423.9
									26		
									22		
	100	22.8	77.2	0	N/A	NP	2.7%	SM	REFUSAL		
15									14		
	100	68.5	31.5	0	N/A	NP	5.5%	s(ML)	24		
									24		
									12		SM
	100	40.4	59.6	0	N/A	NP	4.6%	SM	24		
									29		
20									12		
	100	34.4	65.6	0	N/A	NP	3.9%	SM	21		
									25		
25											6409.9

BOTTOM OF HOLE

CLASSIFICATION AND PHYSICAL CONDITION

0.0 - 25.0 FT.: QUATERNARY ALLUVIUM (Qal):

0.0 - 9.8 FT: SILTY SAND SM: ABOUT 80% FINE SAND; ABOUT 20% FINES WITH NO PLASTICITY, RAPID DILATANCY, LOW DRY STRENGTH, LOW TOUGHNESS; MAXIMUM SIZE, FINE SAND; DRY, BROWN IN COLOR; ROOTS IN TOP 0.5 FT, CLACITE NODULES AND CEMENT; STRONG REACTION WITH HCl.

9.8 - 10.5 FT: LEAN CLAY WITH SAND (CL)s: ABOUT 60% FINES WITH MEDIUM TO HIGH PLASTICITY, HIGH DRY STRENGTH, MEDIUM TOUGHNESS; ABOUT 40% FINE SAND, MAXIMUM SIZE, FINE SAND; DARK GREY IN COLOR; WEAK REACTION WITH HCl.

10.5 - 11.0 FT: CLAYEY SAND SC: ABOUT 50 % FINE SAND; ABOUT 50% MEDIUM PLASTIC FINES, WITH MEDIUM TOUGHNESS, AND MEDIUM DRY STRENGTH; NO REACTION WITH HCl.

11.0 - 25.0 FT: SILTY SAND SM: ABOUT 80% FINE SAND; ABOUT 20% FINES WITH NO PLASTICITY, RAPID DILATANCY, LOW DRY STRENGTH, LOW TOUGHNESS; MAXIMUM SIZE, FINE SAND; DRY, FeOx STAINING, ORANGE IN COLOR, CLACITE NODULES AND CEMENT; STRONG REACTION WITH HCl.

STRATIGRAPHY:
0.0 - 25.0 FT: QUATERNARY ALLUVIUM (Qal)

ABBREVIATIONS:
WLNE = WATER LEVEL NOT ENCOUNTERED
I.D. = INSIDE DIAMETER BNE = BEDROCK NOT ENCOUNTERED.

COMMENTS:

ALL ANGLES MEASURED FROM CORE AXIS AT ZERO DEGREES, UNLESS OTHERWISE NOTED.
THE DATA FOR THE CENTER COLUMN AND"CLASSIFICATION AND PHYSICAL CONDITIONS" COLUMN ARE BASED ON BUREAU OF RECLAMATION GEOLOGY FIELD MANUAL AND DRAWINGS TITLED FOR DESIGNS AND SPECIFICATIONS AS FOLLOWS- DRAWING NO. 40-D-6493. STANDARD DESCRIPTIONS AND DESCRIPTIVE CRITERIA FOR ROCK. DRAWING NO. 40-D-6499. STANDARD DESCRIPTORS AND DESCRIPTIVE CRITERIA FOR DISCONTINUITIES.

GEOLOGIC LOG OF DRILL HOLE NO. DHR22AC1-15-1

SHEET 1 OF 1

FEATURE: REACH 22B
LOCATION: AIR CHAMBER 1
BEGUN: 1/14/15 FINISHED: 1/15/15
DEPTH OF WATER LEVEL:
DATE MEASURED:

PROJECT: NAVAJO GALLUP WATER SUPPLY PROJECT
COORDINATES: N 2,052,633.1 E 2,752,135.6
TOTAL DEPTH: 37.8
DEPTH TO BEDROCK: 30.1

STATE: NEW MEXICO
GROUND ELEVATION: 5816.2
ANGLE FROM HORIZONTAL: 90
HOLE LOGGED BY: J. GILBERT
REVIEWED BY:

NOTES

ALL MEASUREMENTS ARE FROM GROUND SURFACE AND ARE THE SAME AS THOSE USED BY THE DRILLER.

ALL MEASUREMENTS ARE REPORTED IN FEET EXCEPT WHERE NOTED.

DRILLED BY: U.C. REGION DRILL CREW; DRILLER; JEFF VAN AUSDAL, HELPERS; KYLE KILLEBREW, JOE PROCTOR.

PURPOSE:
PRECONSTRUCTION SOIL AND BEDROCK FOUNDATION INVESTIGATIONS.

DRILL EQUIPMENT:
CME 850 TRACK MOUNTED DRILL RIG

DRILL METHOD:
0.0 - 30.1 FT 4 1/4" HSA AND DRY CORE SYSTEM WITH SPTs.
30.1 - 37.8 FT HQ3 WIRELINE CORING SYSTEM WITH A 3' SPLIT TUBE SAMPLER AND DIAMOND SURFACE-SET BIT.

CASING RECORD:
NONE USED

DRILLING MEDIUM:
0.0 - 30.1 FT, NONE USED
30.1 - 37.8 FT, WATER

HOLE COMPLETION:
BACKFILLED WITH DRILL CUTTINGS AND BENTONITE

OBSERVATION WELL INSTALLED BGS:
NONE USED

DEPTH	% CORE RECOVERY	LABORATORY DATA: % FINES	% SAND	% GRAVEL	LIQUID LIMIT	PLASTICITY INDEX	MOISTURE CONTENT	LABORATORY CLASSIFICATION	BLOWS / 0.5 FT	GEOLOGIC UNIT SYMBOL	VISUAL CLASSIFICATION / ELEVATION
5	84	21.7	78.3	0	NA	NP	2.5	SM	3/5/5	Qal	SM
	88	10.0	90.0	0	NA	NP	1.7	SP-SM	4/4/4		
10	100	9.6	90.4	0	NA	NP	1.6	SP-SM	2/3/4		5807.3
	88	37.1	62.9	0	23.4	7.1	5.3	SC	3/5/5		SP-SM
15	100	27.7	72.3	0	22.4	5.2	4.6	SC-SM	5/6/6		5802.9 SM 5801.6
	88	36.3	63.7	0	27.2	10.3	5.5	SC	5/8/10		(CL)s
20	96	37.5	62.5	0	26.9	9.3	5.8	SC	4/8/9		5797.3
25	0	19.7	79.7	0.6	NA	NP	5.3	SM	12/49/REFUSAL		(SP)g
30	11										5786.1
	91									Tn	SS
35	96										5778.4

BOTTOM OF HOLE

CLASSIFICATION AND PHYSICAL CONDITION

0.0 - 30.1 FT QUATERNARY ALLUVIUM (Qal)

0.0 to 8.9 FT SILTY SAND (SM): ABOUT 80% FINE SAND, MAXIMUM SIZE, FINE SAND; ABOUT 20% FINES WITH NO PLASTICITY, RAPID DILATANCY, LOW DRY STRENGTH, LOW TOUGHNESS; DRY, TAN IN COLOR; NO REACTION WITH HCl.

8.9 - 14.2 FT POORLY GRADED SAND WITH SILT (SP-SM): ABOUT 90% FINE SAND; ABOUT 10% FINES WITH NO PLASTICITY, NO DRY STRENGTH, RAPID DILATANCY; DRY, LIGHT BROWN IN COLOR; NO REACTION WITH HCl.

14.2 - 14.4 FT SILTY SAND (SM): ABOUT 80% FINE SAND, MAXIMUM SIZE, FINE SAND; ABOUT 20% FINES WITH NO PLASTICITY, RAPID DILATANCY, LOW DRY STRENGTH, LOW TOUGHNESS; DRY, TAN IN COLOR; NO REACTION WITH HCl.

14.4 - 18.9 FT LEAN CLAY WITH SAND (CL)s: ABOUT 70% MEDIUM PLASTIC FINES, NO DILATANCY, MEDIUM DRY STRENGTH, MEDIUM TO HIGH TOUGHNESS; ABOUT 30% FINE SAND; DARK BROWN IN COLOR; NO REACTION WITH HCl.

18.9 - 30.1 F POORLY GRADED SAND WITH GRAVEL (SP)g: ABOUT 75% FINE TO COARSE SAND; ABOUT 20% FINE TO COARSE GRAVEL, MAXIMUM SIZE 40mm; ABOUT 5% NONPLASTIC FINES WITH RAPID DILATANCY, AND NO DRY STRENGTH; NO RECTION WITH HCl.

30.1- 37.8 TERTIARY NACIMIENTO FORMATION (Tn)

30.1 - 31.8 FT SANDSTONE: DECOMPOSED (W9) AND DESCRIBED AS A SOIL: POORLY GRADED SAND (SP): ABOUT 90% FINE TO MEDIUM SAND; ABOUT 10% NONPLASTIC FINES WITH RAPID DILATANCY, NO DRY STRENGTH; NO REACTION WITH HCl.

31.8 - 37.8 FT SANDSTONE: FINE TO COARSE GRAINED, TAN IN COLOR MODERATELY WEATHERED (W5), MODERATELY HARD (H4); THINLY BEDDED TO LAMINATED; COAL INTERBED FROM 36.1 - 36.6 FT; NO REACTION WITH HCl.

STRATIGRAPHY:
0.0 - 30.1 FT: QUATERNARY ALLUVIUM (Qal)
30.1 - 37.8 FT: TERTIARY NACIMIENTO FORMATION (Tn)

ABBREVIATIONS:
WLNE = WATER LEVEL NOT ENCOUNTERED
I.D. = INSIDE DIAMETER.

COMMENTS:

ALL ANGLES MEASURED FROM CORE AXIS AT ZERO DEGREES, UNLESS OTHERWISE NOTED.
THE DATA FOR THE CENTER COLUMN AND"CLASSIFICATION AND PHYSICAL CONDITIONS" COLUMN ARE BASED ON BUREAU OF RECLAMATION GEOLOGY FIELD MANUAL AND DRAWINGS TITLED FOR DESIGNS AND SPECIFICATIONS AS FOLLOWS- DRAWING NO. 40-D-6493. STANDARD DESCRIPTIONS AND DESCRIPTIVE CRITERIA FOR ROCK. DRAWING NO. 40-D-6499. STANDARD DESCRIPTORS AND DESCRIPTIVE CRITERIA FOR DISCONTINUITIES.

GEOLOGIC LOG OF DRILL HOLE NO. DHR22AC2-15-1

SHEET 1 OF 1

FEATURE: REACH 22B
LOCATION: AIR CHAMBER 2
BEGUN: 1/16/15 FINISHED: 1/17/15
DEPTH OF WATER LEVEL:
DATE MEASURED:

PROJECT: NAVAJO GALLUP WATER SUPPLY PROJECT
COORDINATES: N 2,017,854.5 E 2,750,606.7
TOTAL DEPTH: 39.5
DEPTH TO BEDROCK: 13.1

STATE: NEW MEXICO
GROUND ELEVATION: 6203.4
ANGLE FROM HORIZONTAL: 90
HOLE LOGGED BY: J. GILBERT
REVIEWED BY:

NOTES

ALL MEASUREMENTS ARE FROM GROUND SURFACE AND ARE THE SAME AS THOSE USED BY THE **DRILLER**.

ALL MEASUREMENTS ARE REPORTED IN FEET EXCEPT WHERE NOTED.

DRILLED BY: U.C. REGION DRILL CREW; DRILLER; JEFF VAN AUSDAL, HELPERS; KYLE KILLEBREW, JOE PROCTOR.

PURPOSE:
PRECONSTRUCTION SOIL AND BEDROCK FOUNDATION INVESTIGATIONS.

DRILL EQUIPMENT:
CME 85

DRILL METHOD:
0.0 - 13.1 FT 4 1/4" HSA AND DRY CORE SYSTEM WITH SPTs.
13.1 - 39.5 FT HQ3 WIRELINE CORING SYSTEM WITH A 3' SPLIT TUBE SAMPLER AND DIAMOND SURFACE-SET BIT.

CASING RECORD:
NONE USED

DRILLING MEDIUM:
0.0 - 13.1 FT, NONE
13.1 - 39.5 FT, WATER

HOLE COMPLETION:
BACKFILLED WITH DRILL CUTTINGS

OBSERVATION WELL INSTALLED BGS:
NONE USED

DEPTH	% CORE RECOVERY	LABORATORY DATA: % FINES	% SAND	% GRAVEL	LIQUID LIMIT	PLASTICITY INDEX	MOISTURE CONTENT	LABORATORY CLASSIFICATION	BLOWS / 0.5 FT	GEOLOGIC UNIT SYMBOL	VISUAL CLASSIFICATION / ELEVATION
5	80	16.8	83.4	0	NA	NP	3.7	SM	9/11/12		
	100	73.2	26.8	0	25.9	6.9	5.4	(CL-ML)s	14/16/18	Qal	SM
10	100	33.5	66.5	0	NA	NP	3.1	SM	11/13/14		
	96	30.8	69.2	0	NA	NP	3.7	SM	8/13/13		6190.3
15	0	17.2	82.8	0	NA	NP	2.5	SM	8/6/6		
	0										
20											
	40										
25										Tn	SANDSTONE
	26										
30											
	28										
35											
	100										6164.9
											SILTSTONE 6163.9

BOTTOM OF HOLE

CLASSIFICATION AND PHYSICAL CONDITION

0.0 - 13.1 FT QUATERNARY ALLUVIUM (Qal)

0.0 to 13.1 FT SILTY SAND (SM): ABOUT 80% FINE SAND; ABOUT 20% FINES WITH NO PLASTICITY, RAPID DILATANCY, LOW DRY STRENGTH, LOW TOUGHNESS; MAXIMUM SIZE, FINE SAND; DRY, TAN IN COLOR; NO REACTION WITH HCl.

13.1 - 39.5 FT TERTIARY NACIMIENTO FORMATION (Tn)

13.1 - 38.5 FT SANDSTONE: FINE TO MEDIUM GRAINED, INTENSELY TO VERY INTENSELY WEATHERED (W7-W8) , SOFT (H6), WEAK REACTION WITH HCl.

38.5 - 39.5 FT SILTSTONE: FINE GRAINED, GREY IN COLOR, INTENSELY WEATHERED (W7), SOFT (H6); NO REACTION WITH HCl.

STRATIGRAPHY:
0.0 - 13.1 FT: QUATERNARY ALLUVIUM (Qal)
13.1 - 39.5 FT: TERTIARY NACIMIENTO FORMATION (Tn)

ABBREVIATIONS:
WLNE = WATER LEVEL NOT ENCOUNTERED
I.D. = INSIDE DIAMETER BNE = BEDROCK NOT ENCOUNTERED.

COMMENTS:

ALL ANGLES MEASURED FROM CORE AXIS AT ZERO DEGREES, UNLESS OTHERWISE NOTED.
THE DATA FOR THE CENTER COLUMN AND"CLASSIFICATION AND PHYSICAL CONDITIONS" COLUMN ARE BASED ON BUREAU OF RECLAMATION GEOLOGY FIELD MANUAL AND DRAWINGS TITLED FOR DESIGNS AND SPECIFICATIONS AS FOLLOWS- DRAWING NO. 40-D-6493. STANDARD DESCRIPTIONS AND DESCRIPTIVE CRITERIA FOR ROCK. DRAWING NO. 40-D-6499. STANDARD DESCRIPTORS AND DESCRIPTIVE CRITERIA FOR DISCONTINUITIES.

GEOLOGIC LOG OF DRILL HOLE NO. DHR22B-14-25

SHEET 1 OF 1

FEATURE: REACH 22B
LOCATION: PIPELINE
BEGUN: 8/24/14 FINISHED: 8/24/14
DEPTH OF WATER LEVEL:
DATE MEASURED:

PROJECT: NAVAJO GALLUP WATER SUPPLY PROJECT
COORDINATES: N 2,047,827.0 E 2,750,962.4
TOTAL DEPTH: 25.5
DEPTH TO BEDROCK: BNE

STATE: NEW MEXICO
GROUND ELEVATION: 5823.8
ANGLE FROM HORIZONTAL: 90
HOLE LOGGED BY: J. GILBERT
REVIEWED BY:

NOTES

ALL MEASUREMENTS ARE FROM GROUND SURFACE AND ARE THE SAME AS THOSE USED BY THE DRILLER.

ALL MEASUREMENTS ARE REPORTED IN FEET EXCEPT WHERE NOTED.

DRILLED BY: U.C. REGION DRILL CREW; DRILLER; JEFF VAN AUSDAL, HELPERS; KYLE KILEBREW, DAVE NIELSEN.

PURPOSE:
PRECONSTRUCTION SOIL AND BEDROCK FOUNDATION INVESTIGATIONS.

DRILL EQUIPMENT:
CME 85

DRILL METHOD:
0- 25.5 FT 4 1/4" HSA AND DRY CORE SYSTEM WITH SPTs.

CASING RECORD:
NONE USED

DRILLING MEDIUM:
NONE

HOLE COMPLETION:
BACKFILLED WITH CUTTINGS

DEPTH	% CORE RECOVERY	LABORATORY DATA: % FINES	% SAND	% GRAVEL	LIQUID LIMIT	PLASTICITY INDEX	MOISTURE CONTENT	LABORATORY CLASSIFICATION	BLOWS / 0.5 FT	GEOLOGIC UNIT SYMBOL	VISUAL CLASSIFICATION / ELEVATION
5	64	45.6	56.4	0	25.9	11.0	4.0	SC	4/4/2	Qal	
	100	39.4	60.6	0	24.3	7.0	6.7	SC-SM	6/5/4		
10	100	32	68	0	NA	NP	5.4	SM	3/5/6		SM
	100	36	64	0	25.2	7.0	5.7	SC-SM	5/7/9		
15	100	23.3	76.7	0	NA	NP	4.4	SM	8/8/7		
	100	22.3	76.7	0	NA	NP	4.9	SM	6/8/9		
20	100	22	78	0	NA	NP	5.5	SM	5/8/8		5802.9
25		84.1	15.9	0	41.1	21.3	17.6	(CL)s	9/18/21		CL 5798.3

BOTTOM OF HOLE

CLASSIFICATION AND PHYSICAL CONDITION

0.0 - 25.5 FT.: QUATERNARY ALLUVIUM (Qal):

0.0 - 20.9 FT SILTY SAND SM: ABOUT 80% FINE SAND; ABOUT 20% FINES WITH NO PLASTICITY, RAPID DILATANCY, LOW DRY STRENGTH; DRY, MAXIMUM SIZE, FINE SAND; TAN IN COLOR; STRONG REACTION WITH HCl.

20.9 - 25.5 FT LEAN CLAY (CL): ABOUT 85 % FINES WITH MEDIUM PLASTICITY, MEDIUM DRY STRENGTH, MEDIUM TOUGHNESS; ABOUT 15%, PREDOMINATELY FINE TO MEDIUM SAND; MAXIMUM SIZE, MEDIUM SAND; NO REACTION WITH HCl.

STRATIGRAPHY: 0.0 - 25.5 FT QUATERNARY ALLUVIUM (Qal).

ABBREVIATIONS WLNE = WATER LEVEL NOT ENCOUNTERED I.D. = INSIDE DIAMETER SS = SANDSTONE SLST = SILTSTONE CLSTNE = CLAYSTONE FeOx = IRON OXIDE MnOx = MANGANESE OXIDE

COMMENTS:

ALL ANGLES MEASURED FROM CORE AXIS AT ZERO DEGREES, UNLESS OTHERWISE NOTED.
THE DATA FOR THE CENTER COLUMN AND"CLASSIFICATION AND PHYSICAL CONDITIONS" COLUMN ARE BASED ON BUREAU OF RECLAMATION GEOLOGY FIELD MANUAL AND DRAWINGS TITLED FOR DESIGNS AND SPECIFICATIONS AS FOLLOWS- DRAWING NO. 40-D-6493, STANDARD DESCRIPTIONS AND DESCRIPTIVE CRITERIA FOR ROCK. DRAWING NO. 40-D-6499, STANDARD DESCRIPTORS AND DESCRIPTIVE CRITERIA FOR DISCONTINUITIES.

GEOLOGIC LOG OF DRILL HOLE NO. DHR22B-14-33B

SHEET 1 OF 1

FEATURE: REACH 22B
LOCATION: PIPELINE
BEGUN: 8/24/14 FINISHED: 8/24/14
DEPTH OF WATER LEVEL:
DATE MEASURED:

PROJECT: NAVAJO GALLUP WATER SUPPLY PROJECT
COORDINATES: N 2,037,116.7 E 2,750,759.7
TOTAL DEPTH: 25.0
DEPTH TO BEDROCK: BNE

STATE: NEW MEXICO
GROUND ELEVATION: 5911.1
ANGLE FROM HORIZONTAL: 90
HOLE LOGGED BY: J. GILBERT
REVIEWED BY:

NOTES

ALL MEASUREMENTS ARE FROM GROUND SURFACE AND ARE THE SAME AS THOSE USED BY THE DRILLER.

ALL MEASUREMENTS ARE REPORTED IN FEET EXCEPT WHERE NOTED.

DRILLED BY: U.C. REGION DRILL CREW; DRILLER; JEFF VAN AUSDAL, HELPERS; KYLE KILEBREW, DAVE NIELSEN.

PURPOSE:
PRECONSTRUCTION SOIL AND BEDROCK FOUNDATION INVESTIGATIONS.

DRILL EQUIPMENT:
CME 85

DRILL METHOD:
0- 25.0 FT 4 1/4" HSA AND DRY CORE SYSTEM WITH SPTs.

CASING RECORD:
NONE USED

DRILLING MEDIUM:
NONE

HOLE COMPLETION:
BACKFILLED WITH AUGER CUTTINGS

DEPTH	% CORE RECOVERY	LABORATORY DATA: % FINES	% SAND	% GRAVEL	LIQUID LIMIT	PLASTICITY INDEX	MOISTURE CONTENT	LABORATORY CLASSIFICATION	BLOWS / 0.5 FT	GEOLOGIC UNIT SYMBOL	VISUAL CLASSIFICATION / ELEVATION
										Qal	SM
5	100	36.4	63.6	0	22.6	6.4	3.9	SC-SM	2/2/2		
	68	31.7	68.3	0	NA	NP	3.8	SM	3/4/3		
10	60	21.1	78.9	0	NA	NP	2.7	SM	2/3/3		5900.9
	76	42.9	57.1	0	23.6	9.8	6.3	SC	3/4/6		SP-SM 5899.8
15	92	47.2	52.8	0	27.2	12.1	7.2	SC	4/4/3		
	100	59.3	40.7	0	28.4	13.7	9.6	s(CL)	3/4/5		SC
20	98	43.7	56.3	0	26.4	11.7	8.2	SC	3/4/6		
25		26.9	73.1	0	NA	NP	7.1	SM	10/33/18		5886.1

BOTTOM OF HOLE

CLASSIFICATION AND PHYSICAL CONDITION

0.0 - 25.0 FT.: QUATERNARY ALLUVIUM (Qal):

0.0 - 10.2 FT SILTY SAND SM: ABOUT 80% FINE SAND; ABOUT 20% FINES WITH NO PLASTICITY, RAPID DILATANCY, LOW DRY STRENGTH; MAXIMUM SIZE, FINE SAND; DRY, TAN IN COLOR; STRONG REACTION WITH HCl.

10.2 - 11.3 FT POORLY GRADED SAND WITH SILT (SP-SM): ABOUT 90% FINE TO MEDIUM SAND; ABOUT 10% NONPLASTIC FINES WITH RAPID DILATANCY AND NO DRY STRENGTH; TRACE COARSE SAND AND FINE GRAVEL MAXIMUM SIZE, 10MM; GREY, DRY, BECOMES MOIST BELOW 7.0 FT; NO REACTION WITH HCl.

11.3 - 25.0 FT CLAYEY SAND (SC): ABOUT 60% FINE SAND; ABOUT 40% FINES WITH MEDIUM PLASTICITY, MEDIUM TOUGHNESS, LOW TO MEDIUM DRY STRENGTH; MAXIMUM SIZE, FINE SAND; DARK GREY IN COLOR; NO REACTION WITH HCl.

STRATIGRAPHY: 0.0 - 25.0 FT QUATERNARY ALLUVIUM (Qal).

ABBREVIATIONS WLNE = WATER LEVEL NOT ENCOUNTERED I.D. = INSIDE DIAMETER SS = SANDSTONE SLST = SILTSTONE CLSTNE = CLAYSTONE FeOx = IRON OXIDE MnOx = MANGANESE OXIDE

COMMENTS:

ALL ANGLES MEASURED FROM CORE AXIS AT ZERO DEGREES, UNLESS OTHERWISE NOTED.
THE DATA FOR THE CENTER COLUMN AND"CLASSIFICATION AND PHYSICAL CONDITIONS" COLUMN ARE BASED ON BUREAU OF RECLAMATION GEOLOGY FIELD MANUAL AND DRAWINGS TITLED FOR DESIGNS AND SPECIFICATIONS AS FOLLOWS- DRAWING NO. 40-D-6493. STANDARD DESCRIPTIONS AND DESCRIPTIVE CRITERIA FOR ROCK. DRAWING NO. 40-D-6499. STANDARD DESCRIPTORS AND DESCRIPTIVE CRITERIA FOR DISCONTINUITIES.

GEOLOGIC LOG OF DRILL HOLE NO. DHR22B-14-41

SHEET 1 OF 1

FEATURE: REACH 22B
LOCATION: PIPELINE
BEGUN: 9/9/14 FINISHED: 9/9/14
DEPTH OF WATER LEVEL:
DATE MEASURED:

PROJECT: NAVAJO GALLUP WATER SUPPLY PROJECT
COORDINATES: N 2,027,647.0 E 2,750,126.8
TOTAL DEPTH: 24.5
DEPTH TO BEDROCK: 18.5

STATE: NEW MEXICO
GROUND ELEVATION: 5972.8
ANGLE FROM HORIZONTAL: 90
HOLE LOGGED BY: J. GILBERT
REVIEWED BY:

NOTES

ALL MEASUREMENTS ARE FROM GROUND SURFACE AND ARE THE SAME AS THOSE USED BY THE **DRILLER.**

ALL MEASUREMENTS ARE REPORTED IN FEET EXCEPT WHERE NOTED.

DRILLED BY: U.C. REGION DRILL CREW; DRILLER; JEFF VAN AUSDAL, HELPERS; KYLE KILEBREW, DAVE NIELSEN.

PURPOSE:
PRECONSTRUCTION SOIL AND BEDROCK FOUNDATION INVESTIGATIONS.

DRILL EQUIPMENT:
CME 85

DRILL METHOD:
0- 24.5 FT 4 1/4" HSA AND DRY CORE SYSTEM WITH SPTs.

CASING RECORD:
NONE USED

DRILLING MEDIUM:
NONE

HOLE COMPLETION:
BACKFILLED WITH DRILL CUTTINGS

DEPTH	% CORE RECOVERY	LABORATORY DATA: % FINES	% SAND	% GRAVEL	LIQUID LIMIT	PLASTICITY INDEX	MOISTURE CONTENT	LABORATORY CLASSIFICATION	BLOWS / 0.5 FT	GEOLOGIC UNIT SYMBOL	VISUAL CLASSIFICATION / ELEVATION
5	56	11.4	88.6	0	NA	NP	0.9%	SP-SM	2/3/4	Qal	SP
	48	8.3	91.7	0	NA	NP	0.7%	SP-SM	9/9/9		
10	68	11.8	88.2	0	NA	NP	1.1%	SP-SM	7/12/19		
	40	12.6	81.3	6.1	NA	NP	1.3%	SM	13/17/18		
15	80	12.8	87.2	0	NA	NP	1.6%	SM	4/9/12		
	60	17.5	82.5	0	NA	NP	2.4%	SM	8/9/10		
											5954.6
											SC 5954.3
20		72.1	27.9	0	34.9%	18.0%	10.3%	(CL)s	20/31/49		
	80									Tn	CLSTNE
		62.6	37.4	0	30.5%	10.4%	9.2%	s(CL)	25/REFUSAL		5948.3

BOTTOM OF HOLE

CLASSIFICATION AND PHYSICAL CONDITION

0.0 - 18.5 FT QUATERNARY ALLUVIUM (Qal)

0.0 - 18.2 FT: POORLY GRADED SAND (SP): ABOUT 95% PREDOMINATELY FINE SAND, ABOUT 5% NONPLASTIC FINES WITH RAPID DILATANCY, AND NO DRY STRENGTH; MAXIMUM SIZE, FINE SAND; NO REACTION WITH HCl.

18.2 - 18.5 CLAYEY SAND (SC): ABOUT 80% PREDOMINATELY FINE SAND; ABOUT 20% FINES WITH LOW PLASTICITY, LOW DRY STENGTH, LOW TOUGHNESS AND SLOW DILATANCY; TRACE FINE TO COARSE GRAVEL; MAXIMUM SIZE, 50MM; DARK BROWN IN COLOR, MOIST; NO REACTION WITH HCl.

18.5 - 24.5 FT TERTIARY NACIMIENTO FORMATION (TN)

18.5 - 24.5 FT CLAYSTONE: GREY TO DARK GREY IN COLOR, VERY INTENSLEY WEATHERED TO DECOMPOSED (W8-W9), VERY SOFT TO SOFT (H6-H7); WEAK REACTION WITH HCl.

STRATIGRAPHY:
0.0 - 18.5 FT: QUATERNARY ALLUVIUM (Qal)
18.5 - 24.5 FT: TERTIARY NACIMIENTO FORMATION (Tn)

ABBREVIATIONS:
WLNE = WATER LEVEL NOT ENCOUNTERED
I.D. = INSIDE DIAMETER BNE = BEDROCK NOT ENCOUNTERED.

COMMENTS:

ALL ANGLES MEASURED FROM CORE AXIS AT ZERO DEGREES, UNLESS OTHERWISE NOTED.
THE DATA FOR THE CENTER COLUMN AND"CLASSIFICATION AND PHYSICAL CONDITIONS" COLUMN ARE BASED ON BUREAU OF RECLAMATION GEOLOGY FIELD MANUAL AND DRAWINGS TITLED FOR DESIGNS AND SPECIFICATIONS AS FOLLOWS- DRAWING NO. 40-D-6493. STANDARD DESCRIPTIONS AND DESCRIPTIVE CRITERIA FOR ROCK. DRAWING NO. 40-D-6499. STANDARD DESCRIPTORS AND DESCRIPTIVE CRITERIA FOR DISCONTINUITIES.

GEOLOGIC LOG OF DRILL HOLE NO. DHR22B-14-50

SHEET 1 OF 1

FEATURE: REACH 22B
LOCATION: PIPELINE
BEGUN: 8/25/14 FINISHED: 8/25/14
DEPTH OF WATER LEVEL:
DATE MEASURED:

PROJECT: NAVAJO GALLUP WATER SUPPLY PROJECT
COORDINATES: N 2,016,957.4 E 2,750,693.9
TOTAL DEPTH: 24.0
DEPTH TO BEDROCK: 9.8

STATE: NEW MEXICO
GROUND ELEVATION: 6185.5
ANGLE FROM HORIZONTAL: 90
HOLE LOGGED BY: J. GILBERT
REVIEWED BY:

NOTES

ALL MEASUREMENTS ARE FROM GROUND SURFACE AND ARE THE SAME AS THOSE USED BY THE DRILLER.

ALL MEASUREMENTS ARE REPORTED IN FEET EXCEPT WHERE NOTED.

DRILLED BY: U.C. REGION DRILL CREW; DRILLER; JEFF VAN AUSDAL, HELPERS; KYLE KILEBREW, DAVE NIELSEN.

PURPOSE:
PRECONSTRUCTION SOIL AND BEDROCK FOUNDATION INVESTIGATIONS.

DRILL EQUIPMENT:
CME 85

DRILL METHOD:
0.0 - 10.5 FT 4 1/4" HSA AND DRY CORE SYSTEM WITH SPTs.
10.5 - 24.0 FT 4 1/4" HSA AND DRY CORE SYSTEM WITH NO SPTs

CASING RECORD:
NONE USED

DRILLING MEDIUM:
NONE

DEPTH	% CORE RECOVERY	LABORATORY DATA: % FINES	% SAND	% GRAVEL	LIQUID LIMIT	PLASTICITY INDEX	MOISTURE CONTENT	LABORATORY CLASSIFICATION	BLOWS / 0.5 FT	GEOLOGIC UNIT SYMBOL	VISUAL CLASSIFICATION / ELEVATION
											SM
5	100	17.4	82.6	0	NA	NP	3.5%	SM	4/11/16	Qal	6180.4
	100	43.8	56.2	0	38.0%	12.8%	7.1%	SC	12/17/21		SC
10	100	53.9	46.1	0	29.3%	12.6%	6.5%	s(CL)	13/50/REFUSAL		6175.7
	100										SS
											6171.5
15	100									Tn	CLSTN
											6170.1
20											SS
											6161.5

BOTTOM OF HOLE

CLASSIFICATION AND PHYSICAL CONDITION

0.0 - 9.8 FT.: QUATERNARY ALLUVIUM (Qal):

0.0 - 5.1 FT: SILTY SAND (SM): ABOUT 80% FINE SAND; ABOUT 20% FINES WITH NO PLASTICITY, RAPID DILATANCY, LOW DRY STRENGTH; MAXIMUM SIZE, FINE SAND; DRY, TAN IN COLOR; STRONG REACTION WITH HCl.

5.1 - 9.8 FT: CLAYEY SAND (SC): ABOUT 60% FINE SAND; ABOUT 40% FINES WITH LOW TO MEDIUM PLASTICITY, NO DILATANCY, LOW DRY STRENGTH, LOW TOUGHNESS; MAXIMUM SIZE, FINE SAND; DRY, TAN IN COLOR; STRONG REACTION WITH HCl.

9.8 -24.0 FT.: TERTIARY NACIMIENTO FORMATION (Tn):

9.8 - 14.0 FT SANDSTONE: FINE TO MEDIUM GRAINED, INTENSELEY WEATHERED TO DECOMPOSED (W7-W9), MODERATELY SOFT TO SOFT (H5-H6), LIGHT BROWN IN COLOR; NO REACTION WITH HCl.

14.0 - 15.4 FT CLAYSTONE: FINE GRAINED, INTENSELY WEATHERED TO DECOMPOSED (W7-W9), MODERATELY SOFT TO SOFT (H5-H6), GREY IN COLOR, SANDSTONE INTERBED FROM 20.0 TO 20.4 FEET; NO REACTION WITH HCl.

15.4 - 24.0 FT SANDSTONE: INTENSELY WEATHERED TO DECOMPOSED (W7-W9), MODERATELY SOFT TO SOFT (H5-H6), LIGHT GREY IN COLOR; NO REACTION WITH HCl.

STRATIGRAPHY:
0.0 - 9.8 FT QUATERNARY ALLUVIUM (Qal).
9.8 - 24.0 FT TERTIARY NACIMIENTO FORMATION (Tn)

ABBREVIATIONS WLNE = WATER LEVEL NOT ENCOUNTERED I.D. = INSIDE DIAMETER SS = SANDSTONE SLST = SILTSTONE CLSTNE = CLAYSTONE FeOx = IRON OXIDE MnOx = MANGANESE OXIDE

COMMENTS:

ALL ANGLES MEASURED FROM CORE AXIS AT ZERO DEGREES, UNLESS OTHERWISE NOTED.
THE DATA FOR THE CENTER COLUMN AND"CLASSIFICATION AND PHYSICAL CONDITIONS" COLUMN ARE BASED ON BUREAU OF RECLAMATION GEOLOGY FIELD MANUAL AND DRAWINGS TITLED FOR DESIGNS AND SPECIFICATIONS AS FOLLOWS- DRAWING NO. 40-D-6493. STANDARD DESCRIPTIONS AND DESCRIPTIVE CRITERIA FOR ROCK. DRAWING NO. 40-D-6499. STANDARD DESCRIPTORS AND DESCRIPTIVE CRITERIA FOR DISCONTINUITIES.

GEOLOGIC LOG OF DRILL HOLE NO. DHR22B-14-121

SHEET 1 OF 1

FEATURE: REACH 22B
LOCATION: PIPELINE
BEGUN: 8/21/14 FINISHED: 8/22/14
DEPTH OF WATER LEVEL:
DATE MEASURED:

PROJECT: NAVAJO GALLUP WATER SUPPLY PROJECT
COORDINATES: N 1,975,384.1 E 2,735,818.2
TOTAL DEPTH: 25.0
DEPTH TO BEDROCK: BNE

STATE: NEW MEXICO
GROUND ELEVATION: 6623.5
ANGLE FROM HORIZONTAL: 90
HOLE LOGGED BY: J. GILBERT
REVIEWED BY:

NOTES

ALL MEASUREMENTS ARE FROM GROUND SURFACE AND ARE THE SAME AS THOSE USED BY THE DRILLER.

ALL MEASUREMENTS ARE REPORTED IN FEET EXCEPT WHERE NOTED.

DRILLED BY: U.C. REGION DRILL CREW; DRILLER; JEFF VAN AUSDAL, HELPERS; KYLE KILEBREW, DAVE NIELSEN.

PURPOSE:
PRECONSTRUCTION SOIL AND BEDROCK FOUNDATION INVESTIGATIONS.

DRILL EQUIPMENT:
CME 85

DRILL METHOD:
0- 25.0 FT 4 1/4" HSA AND DRY CORE SYSTEM WITH SPTs.

CASING RECORD:
NONE USED

DRILLING MEDIUM:
NONE

HOLE COMPLETION:
BACKFILLED WITH AUGER CUTTINGS

DEPTH	% CORE RECOVERY	LABORATORY DATA: % FINES	% SAND	% GRAVEL	LIQUID LIMIT	PLASTICITY INDEX	MOISTURE CONTENT	LABORATORY CLASSIFICATION	BLOWS / 0.5 FT	GEOLOGIC UNIT SYMBOL	VISUAL CLASSIFICATION / ELEVATION
5	72	43.2	56.8	0	24.4	11.0	3.9	SC	3/5/7	Qal	SM
	52	18.7	81.3	0	NA	NP	1.7	SM	1/2/2		
10	72	55.7	44.3	0	26.5	12.3	5.4	s(CL)	2/4/5		6613.4
	56	47.9	52.1	0	26.7	11.8	5.0	SC	8/9/12		SC
15	60	54.1	45.9	0	29.2	14.8	5.7	s(CL)	8/10/15		
	100	59.4	40.6	0	31.2	14.8	2.64	s(CL)	12/14/15		
20	94	53.8	46.2	0	27.9	13.4	5.7	s(CL)	16/21/23		6603.4
											SM
25		47.1	52.9	0	28.2	14.8	4.7	SC	8/16/22		6598.5

BOTTOM OF HOLE

CLASSIFICATION AND PHYSICAL CONDITION

0.0 - 25.0 FT: QUATERNARY ALLUVIUM (Qal):

0.0-10.1 FT SILTY SAND (SM): ABOUT 70% FINE SAND; ABOUT 30% FINES WITH RAPID DILATANCY, NO DRY STRENGTH; MAXIMUM SIZE, FINE SAND; MOIST, TAN IN COLOR; ROOTS AND ORGANIC MATERIAL IN TOP 0.5 FT, LOOSE; NO REACTION WITH HCl.

10.1-20.1 FT CLAYEY SAND (SC): ABOUT 60% FINE SAND; ABOUT 40% FINES WITH MEDIUM PLASTICITY, LOW TO MEDIUM DRY STRENGTH; MEDIUM TOUGHNESS; MAXIMUM SIZE, FINE SAND; DARK GREY IN COLOR, ORGANIC MATERIAL PRESENT; NO REACTION WITH HCl.

20.1-25.0 FT SILTY SAND (SM): ABOUT 80% FINE SAND; ABOUT 20% FINES WITH RAPID DILATANCY, NO DRY STRENGTH; MAXIMUM SIZE, FINE SAND; MOIST, TAN IN COLOR, LOOSE; NO REACTION WITH HCl.

STRATIGRAPHY:
0.0 - 25.0 FT QUATERNARY ALLUVIUM (Qal).

ABBREVIATIONS WLNE = WATER LEVEL NOT ENCOUNTERED I.D. = INSIDE DIAMETER SS = SANDSTONE FeOx = IRON OXIDE

COMMENTS:

ALL ANGLES MEASURED FROM CORE AXIS AT ZERO DEGREES, UNLESS OTHERWISE NOTED.
THE DATA FOR THE CENTER COLUMN AND"CLASSIFICATION AND PHYSICAL CONDITIONS" COLUMN ARE BASED ON BUREAU OF RECLAMATION GEOLOGY FIELD MANUAL AND DRAWINGS TITLED FOR DESIGNS AND SPECIFICATIONS AS FOLLOWS- DRAWING NO. 40-D-6493. STANDARD DESCRIPTIONS AND DESCRIPTIVE CRITERIA FOR ROCK. DRAWING NO. 40-D-6499. STANDARD DESCRIPTORS AND DESCRIPTIVE CRITERIA FOR DISCONTINUITIES.

GEOLOGIC LOG OF DRILL HOLE NO. DHR22B-14-125

SHEET 1 OF 1

FEATURE: REACH 22B
LOCATION: PIPELINE
BEGUN: 8/22/14 FINISHED: 8/22/14
DEPTH OF WATER LEVEL:
DATE MEASURED:

PROJECT: NAVAJO GALLUP WATER SUPPLY PROJECT
COORDINATES: N 1,970,531.8 E 2,735,821.9
TOTAL DEPTH: 25.0
DEPTH TO BEDROCK: BNE

STATE: NEW MEXICO
GROUND ELEVATION: 6628.7
ANGLE FROM HORIZONTAL: 90
HOLE LOGGED BY: J. GILBERT
REVIEWED BY:

NOTES

ALL MEASUREMENTS ARE FROM GROUND SURFACE AND ARE THE SAME AS THOSE USED BY THE DRILLER.

ALL MEASUREMENTS ARE REPORTED IN FEET EXCEPT WHERE NOTED.

DRILLED BY: U.C. REGION DRILL CREW; DRILLER; JEFF VAN AUSDAL, HELPERS; KYLE KILEBREW, DAVE NIELSEN.

PURPOSE:
PRECONSTRUCTION SOIL AND BEDROCK FOUNDATION INVESTIGATIONS.

DRILL EQUIPMENT:
CME 85

DRILL METHOD:
0- 25.0 FT 4 1/4" HSA AND DRY CORE SYSTEM WITH SPTs.

CASING RECORD:
NONE USED

DRILLING MEDIUM:
NONE

HOLE COMPLETION:
BACKFILLED WITH AUGER CUTTINGS

DEPTH	% CORE RECOVERY	LABORATORY DATA: % FINES	% SAND	% GRAVEL	LIQUID LIMIT	PLASTICITY INDEX	MOISTURE CONTENT	LABORATORY CLASSIFICATION	BLOWS / 0.5 FT	GEOLOGIC UNIT SYMBOL	VISUAL CLASSIFICATION / ELEVATION
										Qal	SM
5	100	42.4	57.6	0	34.2	21.6	6.3	SC	7/3/4		
	100	21.5	78.5	0	NA	NP	3.2	SM	6/12/14		6622.1
10	100	43.5	56.5	0	26.3	14.1	6.2	SC	12/18/16		SC
	100	68.5	31.5	0	39.6	27.0	9.9	s(CL)	10/14/16		
15	100	76.1	23.9	0	40.4	28.1	10.4	(CL)s	7/12/6		6614.5
	100	56.7	43.3	0	34.0	22.0	8.8	s(CL)	10/17/22		
20	92	50.6	49.4	0	28.2	15.9	7.6	s(CL)	13/19/23		CL
											6605.5
		96.1	3.9	0	69.0	44.5	25.0	CH	4/8/15		s(CL) 6604.6
25											CH 6603.7

BOTTOM OF HOLE

CLASSIFICATION AND PHYSICAL CONDITION

0.0 - 25.0 FT.: QUATERNARY ALLUVIUM (Qal):

0.0 - 6.6 FT SILTY SAND (SM): ABOUT 80% FINE SAND; ABOUT 20% FINES WITH NO PLASTICITY, RAPID DILATANCY, LOW DRY STRENGTH; MAXIMUM SIZE, FINE SAND; DRY, TAN IN COLOR; STRONG REACTION WITH HCl.

6.6 - 14.2 FT CLAYEY SAND (SC): ABOUT 60% FINE SAND; ABOUT 40% FINES WITH LOW TO MEDIUM PLASTICITY, NO DILATANCY, LOW DRY STRENGTH; MAXIMUM SIZE, FINE SAND; LOW TOUGHNESS; DRY, TAN IN COLOR, INTERMITTENT CALCITE NODULES, ROOTS IN TOP 0.5 FT, STRONG REACTION WITH HCl.

14.2 - 23.2 FT LEAN CLAY (CL): ABOUT 85% MEDIUM PLASTIC FINES, NO DILATANCY, MEDIUM DRY STRENGTH, MEDIUM TO HIGH TOUGHNESS; ABOUT 15% FINE SAND; MAXIMUM SIZE, FINE SAND; DARK GREY IN COLOR; NO REACTION WITH HCl.

23.2 - 24.1 FT SANDY LEAN CLAY s(CL): ABOUT 80% FINES WITH MEDIUM PLASTICITY, NO DILATANCY, MEDIUM DRY STRENGTH, MEDIUM TO HIGH TOUGHNESS, ABOUT 20% FINE SAND; MAXIMUM SIZE, FINE SAND; DARK GREY IN COLOR; NO REACTION WITH HCl.

24.1 - 25.0 FT FAT CLAY (CH): ABOUT 95% HIGHLY PLASTIC FINES, HIGH TO VERY HIGH DRY STRENGTH, HIGH TOUGHNESS; ABOUT 5% FINE TO MEDIUM SAND; MAX SIZE, MEDIUM SAND; NO REACTION WITH HCl.

STRATIGRAPHY:
0.0 - 25.0 FT QUATERNARY ALLUVIUM (Qal).

ABBREVIATIONS WLNE = WATER LEVEL NOT ENCOUNTERED I.D. = INSIDE DIAMETER SS = SANDSTONE FeOx = IRON OXIDE

COMMENTS:

ALL ANGLES MEASURED FROM CORE AXIS AT ZERO DEGREES, UNLESS OTHERWISE NOTED.
THE DATA FOR THE CENTER COLUMN AND"CLASSIFICATION AND PHYSICAL CONDITIONS" COLUMN ARE BASED ON BUREAU OF RECLAMATION GEOLOGY FIELD MANUAL AND DRAWINGS TITLED FOR DESIGNS AND SPECIFICATIONS AS FOLLOWS- DRAWING NO. 40-D-6493. STANDARD DESCRIPTIONS AND DESCRIPTIVE CRITERIA FOR ROCK. DRAWING NO. 40-D-6499. STANDARD DESCRIPTORS AND DESCRIPTIVE CRITERIA FOR DISCONTINUITIES.

GEOLOGIC LOG OF DRILL HOLE NO. DHR22FBT-14-1

SHEET 1 OF 1

FEATURE: REACH 22B
LOCATION: FOREBAY TANK
BEGUN: 5/7/14 FINISHED: 5/7/14
DEPTH OF WATER LEVEL:
DATE MEASURED: 5/7/2014

PROJECT: NAVAJO GALLUP WATER SUPPLY PROJECT
COORDINATES: N 2,052,716.0 E 2,752,126.2
TOTAL DEPTH: 50.2
DEPTH TO BEDROCK: 28.2

STATE: NEW MEXICO
GROUND ELEVATION: 5816.9
ANGLE FROM HORIZONTAL: 90
HOLE LOGGED BY: J. GILBERT
REVIEWED BY:

NOTES

ALL MEASUREMENTS ARE FROM GROUND SURFACE AND ARE THE SAME AS THOSE USED BY THE DRILLER.

ALL MEASUREMENTS ARE REPORTED IN FEET EXCEPT WHERE NOTED.

DRILLED BY: U.C. REGION DRILL CREW; DRILLER; JEFF VAN AUSDAL, HELPERS; KYLE KILLEBREW, ROBBY ROBINSON.

PURPOSE:
PRECONSTRUCTION SOIL AND BEDROCK FOUNDATION INVESTIGATIONS.

DRILL EQUIPMENT:
CME 85

DRILL METHOD:
0.0 TO 28.2 FT 4 1/4" HSA AND DRY CORE SYSTEM WITH SPLIT SPOON SAMPLER. SPT SAMPLING TO 28.2 FEET. DISCONTINUED SPT SAMPLING DUE TO BEDROCK.
28.2 TO 50.2 FT HQ3 WIRELINE CORING SYSTEM WITH A 3' SPLIT TUBE SAMPLER AND DIAMOND SURFACE- SET BIT.

CASING RECORD:
NONE USED

DRILLING MEDIUM:
0.0 TO 28.2, NONE USED
28.2 TO 50.2 WATER

HOLE COMPLETION
GROUTED TO SURFACE

DEPTH	% CORE RECOVERY	LABORATORY DATA: % FINES	% SAND	% GRAVEL	LIQUID LIMIT	PLASTICITY INDEX	MOISTURE CONTENT	LABORATORY CLASSIFICATION	BLOWS / 0.5 FT	GEOLOGIC UNIT SYMBOL	VISUAL CLASSIFICATION / ELEVATION
5		34.4	65.6	0.0	NA	NP	3.0	SM	4/4/4	Qal	SM
		20.2	79.8	0.0	NA	NP	3.0	SM	2/3/2		
10		12.1	85.8	2.1	NA	NP	2.7	SM	2/3/2		
		13.4	86.6	0.0	NA	NP	3.2	SM	4/3/3		
15		20.5	75.6	3.9	NA	NP	4.3	SM	2/2/2		5799.7
		35.0	65.0	0.0	20.7	2.2	7.7	SM	3/2/2		
20											s(CL)
		38.5	61.5	0.0	23.5	9.6	5.0	SC	3/3/2		
25											5788.7
30	0	26.1	73.9	0.0	NA	NP	6.9	SM	REFUSAL	Tn	SANDSTONE
	40										
35	48										
40	8										
45	40										
50											5766.7

BOTTOM OF HOLE

CLASSIFICATION AND PHYSICAL CONDITION

0.0 - 28.2 FT QUATERNARY ALLUVIUM (Qal)

0.0 TO 17.2 FT SILTY SAND (SM): ABOUT 80% FINE SAND; ABOUT 20% FINES WITH NO PLASTICITY, RAPID DILATANCY, LOW DRY STRENGTH, LOW TOUGHNESS; MAXIMUM SIZE, FINE SAND, DRY, BROWN IN COLOR; ROOTS IN TOP 0.5 FT, LENSE OF POORLY GRADED SAND (SP) FROM 10.7 TO 11.0 FT; NO REACTION WITH HCL.

17.2 TO 28.2 FT SANDY LEAN CLAY s(CL): ABOUT 70% FINES WITH MEDIUM PLASTICITY, MEDIUM TO HIGH DRY STRENGTH, AND MEDIUM TO HIGH TOUGHNESS; ABOUT 30% FINE SAND, MAXIMUM SIZE; FINE SAND, BROWN IN COLOR; NO REACTION TO HCl.

28.2 - 50.2 FT TERTIARY NACIMIENTO FORMATION (TN)

28.2 TO 50.2 FT SANDSTONE: FINE GRAINED, BROWN IN COLOR, MODERATELY TO INTENSELY WEATHERED (W6) MODERATELY HARD (H4), THINLY BEDDED TO LAMINATED,TRACE OF SUBANGULAR GRAVEL, MAX SIZE 40 mm, CLAY INTERBED FROM 49.9 TO 50.2 FT; POOR CORE RECOVERY, NO REACTION WITH HCl.

STRATIGRAPHY: 0.0 - 28.2 FT QUATERNARY ALLUVIUM (Qal) 28.2 - 50.2 FT TERTIARY NACIMIENTO FORMATION (TN). ABBREVIATIONS: WLNE = WATER LEVEL NOT ENCOUNTERED I.D. = INSIDE DIAMETER BNE = BEDROCK NOT ENCOUNTERED.

COMMENTS:

ALL ANGLES MEASURED FROM CORE AXIS AT ZERO DEGREES, UNLESS OTHERWISE NOTED.
THE DATA FOR THE CENTER COLUMN AND"CLASSIFICATION AND PHYSICAL CONDITIONS" COLUMN ARE BASED ON BUREAU OF RECLAMATION GEOLOGY FIELD MANUAL AND DRAWINGS TITLED FOR DESIGNS AND SPECIFICATIONS AS FOLLOWS- DRAWING NO. 40-D-6493. STANDARD DESCRIPTIONS AND DESCRIPTIVE CRITERIA FOR ROCK. DRAWING NO. 40-D-6499. STANDARD DESCRIPTORS AND DESCRIPTIVE CRITERIA FOR DISCONTINUITIES.

GEOLOGIC LOG OF DRILL HOLE NO. DHR22PP1-15-1

SHEET 1 OF 2

FEATURE: REACH 22B
LOCATION: PUMPING PLANT 1
BEGUN: 1/15/15 FINISHED: 1/15/15
DEPTH OF WATER LEVEL:
DATE MEASURED:

PROJECT: NAVAJO GALLUP WATER SUPPLY PROJECT
COORDINATES: N 2,052,663.8 E 2,752,139.7
TOTAL DEPTH: 29.8
DEPTH TO BEDROCK: 22.8

STATE: NEW MEXICO
GROUND ELEVATION: 5815.5
ANGLE FROM HORIZONTAL: 90
HOLE LOGGED BY: J. GILBERT
REVIEWED BY:

NOTES

ALL MEASUREMENTS ARE FROM GROUND SURFACE AND ARE THE SAME AS THOSE USED BY THE DRILLER.

ALL MEASUREMENTS ARE REPORTED IN FEET EXCEPT WHERE NOTED.

DRILLED BY: U.C. REGION DRILL CREW; DRILLER; JEFF VAN AUSDAL, HELPERS; KYLE KILLEBREW, JOE PROCTOR.

PURPOSE:
PRECONSTRUCTION SOIL AND BEDROCK FOUNDATION INVESTIGATIONS.

DRILL EQUIPMENT:
CME 850 TRACK MOUNTED DRILL RIG

DRILL METHOD:
0.0 - 22.8 4 1/4 INCH HOLLOW STEM AUGER WIH SPT SAMPLER, REACHED AUGER REFUSAL AT 22.8 FT, SWITCHED TO CORING SETUP.
22.8 - 29.8 FT HQ3 WIRELINE CORING SYSTEM WITH A 3' SPLIT TUBE SAMPLER AND DIAMOND SURFACE-SET BIT.

CASING RECORD:
NONE USED

DRILLING MEDIUM:
0.0 - 22.8 FT, NONE
22.8 - 29.8 WATER

HOLE COMPLETION:
BACKFILLED WITH DRILL CUTTINGS

OBSERVATION WELL INSTALLED BGS:
NONE USED

DEPTH	% CORE RECOVERY	LABORATORY DATA: % FINES	% SAND	% GRAVEL	LIQUID LIMIT	PLASTICITY INDEX	MOISTURE CONTENT	LABORATORY CLASSIFICATION	BLOWS / 0.5 FT	GEOLOGIC UNIT SYMBOL	VISUAL CLASSIFICATION / ELEVATION
5		21.1	78.9	0	NA	NP	3.1	SM	3/4/4		
		21.0	79.0	0	NA	NP	2.4	SM	4/5/6		
10		38.3	61.7	0	NA	NP	4.3	SC-SM	4/4/5		SM
		21.9	74.1	4.0	NA	NP	2.8	SM	3/4/4	Qal	
15		19.3	80.7	0	NA	NP	2.9	SM	2/4/4		
		32.4	67.6	0	NA	NP	4.8	SM	3/4/5		5799.4
20		38.6	61.4	0	31.3	16.5	6.5	SC	3/6/6		s(CL)
											5792.7
25	0									Tn	SS
	100										5785.7

CLASSIFICATION AND PHYSICAL CONDITION

0.0 - 22.8 FT QUATERNARY ALLUVIUM (Qal)

0.0 - 16.1 FT SILTY SAND (SM): ABOUT 85% FINE SAND; ABOUT 15% NONPLASTIC FINES WITH RAPID DILATANCY, AND NO DRY STRENGTH; BROWN IN COLOR, NO REACTION WITH HCl.

16.1 -22.8 FT SANDY LEAN CLAY s(CL): ABOUT 85% FINES WITH MEDIUM PLASTICITY, MEDIUM DRY STRENGTH, AND MEDIUM TOUGHNESS; ABOUT 15% FINE SAND; STRONG REACTION WITH HCl, INTERMITTENT CALCITE NODULES, GREY IN COLOR.

22.8 - 29.8 FT TERTIARY NACIMIENTO FORMATION (TN)

22.8 TO 29.8 FT SANDSTONE: FINE TO MEDIUM GRAINED, SOFT (H6), MODERATELY TO INTENSELY WEATHERED (W6), TAN TO GREY IN COLOR, MODERATELY TO THINLY BEDDED, NO REACTION WITH HCl, OCCASIONAL CARBONACEOUS INCLUSIONS, FeOx AND MnOx STAINING, CORE SEPARATES ALONG BEDDING PLANES AND DESTROYED BY AUGER.

STRATIGRAPHY:
0.0 - 22.8 FT: QUATERNARY ALLUVIUM (Qal)
22.8 - 29.8 FT: TERTIARY NACIMIENTO FORMATION (Tn)
ABBREVIATIONS:
WLNE = WATER LEVEL NOT ENCOUNTERED
I.D. = INSIDE DIAMETER BNE = BEDROCK NOT ENCOUNTERED.

COMMENTS:

ALL ANGLES MEASURED FROM CORE AXIS AT ZERO DEGREES, UNLESS OTHERWISE NOTED.
THE DATA FOR THE CENTER COLUMN AND"CLASSIFICATION AND PHYSICAL CONDITIONS" COLUMN ARE BASED ON BUREAU OF RECLAMATION GEOLOGY FIELD MANUAL AND DRAWINGS TITLED FOR DESIGNS AND SPECIFICATIONS AS FOLLOWS- DRAWING NO. 40-D-6493. STANDARD DESCRIPTIONS AND DESCRIPTIVE CRITERIA FOR ROCK. DRAWING NO. 40-D-6499. STANDARD DESCRIPTORS AND DESCRIPTIVE CRITERIA FOR DISCONTINUITIES.

GEOLOGIC LOG OF DRILL HOLE NO. DHR22PP1-15-1

FEATURE: REACH 22B
LOCATION: PUMPING PLANT 1
BEGUN: 1/15/15 FINISHED: 1/15/15
DEPTH OF WATER LEVEL:
DATE MEASURED:

PROJECT: NAVAJO GALLUP WATER SUPPLY PROJECT
COORDINATES: N 2,052,663.8 E 2,752,139.7
TOTAL DEPTH: 29.8
DEPTH TO BEDROCK: 22.8

STATE: NEW MEXICO
GROUND ELEVATION: 5815.5
ANGLE FROM HORIZONTAL: 90
HOLE LOGGED BY: J. GILBERT
REVIEWED BY:

NOTES	DEPTH	% CORE RECOVERY	LABORATORY DATA						LABORATORY CLASSIFICATION	BLOWS / 0.5 FT	GEOLOGIC UNIT SYMBOL	VISUAL CLASSIFICATION / ELEVATION	CLASSIFICATION AND PHYSICAL CONDITION
			% FINES	% SAND	% GRAVEL	LIQUID LIMIT	PLASTICITY INDEX	MOISTURE CONTENT					

BOTTOM OF HOLE

GEOLOGIC LOG OF DRILL HOLE NO. DHR22PP2-14-1

SHEET 1 OF 1

FEATURE: REACH 22B
LOCATION: PUMPING PLANT 2
BEGUN: 9/10/14 FINISHED: 9/10/14
DEPTH OF WATER LEVEL:
DATE MEASURED:

PROJECT: NAVAJO GALLUP WATER SUPPLY PROJECT
COORDINATES: N 2,017,892.6 E 2,750,548.8
TOTAL DEPTH: 42.5
DEPTH TO BEDROCK: 13.7

STATE: NEW MEXICO
GROUND ELEVATION: 6210.0
ANGLE FROM HORIZONTAL: 90
HOLE LOGGED BY: J. GILBERT
REVIEWED BY:

NOTES

ALL MEASUREMENTS ARE FROM GROUND SURFACE AND ARE THE SAME AS THOSE USED BY THE DRILLER.

ALL MEASUREMENTS ARE REPORTED IN FEET EXCEPT WHERE NOTED.

DRILLED BY: U.C. REGION DRILL CREW; DRILLER; JEFF VAN AUSDAL, HELPERS; KYLE KILEBREW, DAVE NIELSEN.

PURPOSE:
PRECONSTRUCTION SOIL AND BEDROCK FOUNDATION INVESTIGATIONS.

DRILL EQUIPMENT:
CME 85

DRILL METHOD:
0- 15.0 FT 4 1/4" HSA AND DRY CORE SYSTEM WITH SPTs.
15.0 - 42.5 FT 4 1/4" HSA AND DRY CORE SYSTEM WITHOUT SPT's

CASING RECORD:
NONE USED

DRILLING MEDIUM:
NONE

HOLE COMPLETION:

BACKFILLED WITH AUGER CUTTINGS

DEPTH	% CORE RECOVERY	LABORATORY DATA: % FINES	% SAND	% GRAVEL	LIQUID LIMIT	PLASTICITY INDEX	MOISTURE CONTENT	LABORATORY CLASSIFICATION	BLOWS / 0.5 FT	GEOLOGIC UNIT SYMBOL	VISUAL CLASSIFICATION / ELEVATION
5	52	9.1	90.9	0	NA	NP	1.6%	SP-SM	3/6/6		SP-SM
	52	8.5	91.5	0	NA	NP	1.2%	SP-SM	3/4/13	Qal	
											6202.0
10	100	70.1	29.9	0	23.3%	5.5%	5.0%	(CL-ML)s	18/23/27		SC
	96	30.1	69.9	0	NA	NP	3.4%	SM	11/15/24		
											6196.8
											SM 6196.3
15	96	30.3	69.7	0	NA	NP	3.7%	SM	7/12/REFUSAL		
20	100										
25	100									Tn	SS
30	100										
35	100										6175.5
											CLSTNE
40	100										6168.6
											SS 6167.5

BOTTOM OF HOLE

CLASSIFICATION AND PHYSICAL CONDITION

0.0 - 13.7 FT QUATERNARY ALLUVIUM (Qal)

0.0 - 8.0 FT POORLY GRADED SAND WITH SILT (SP-SM): ABOUT 90% FINE SAND; ABOUT 10% FINES WITH NO PLASTICITY, RAPID DILATANCY, NO DRY STRENGTH; MAXIMUM SIZE, FINE SAND; DRY, LIGHT BROWN IN COLOR; NO REACTION WITH HCl.

8.0 - 13.2 FT CLAYEY SAND (SC): ABOUT 70% FINE SAND; ABOUT 30% FINES WITH LOW PLASTICITY, LOW TO MEDIUM DRY STRENGTH, LOW TOUGHNESS AND SLOW DILATANCY; GREY TO ORANGE IN COLOR, DRY, NO REACTION WITH HCl.

13.2 - 13.7 FT: SILTY SAND (SM): ABOUT 85% FINE SAND; ABOUT 15% FINES WITH NO PLASTICITY, RAPID DILATANCY, LOW DRY STRENGTH; MAXIMUM SIZE, FINE SAND; DRY, TAN IN COLOR; STRONG REACTION WITH HCl.

13.7 - 42.5 FT TERTIARY NACIMIENTO FORMATION (TN)

13.7 - 34.5 FT SANDSTONE: FINE TO MEDIUM GRAINED, TAN IN COLOR, MODERATELY TO INTENSELY WEATHERED (W6) MODERATELY HARD (H4), THINLY BEDDED TO LAMINATED; NO REACTION WITH HCl

34.5 - 41.4 FT CLAYSTONE: GREY TO DARK GREY IN COLOR, VERY INTENSELY WEATHERED TO DECOMPOSED (W8-W9) , SOFT TO VERY SOFT (H6-H7), WEAK REACTION WITH HCl.

41.4 - 42.5 FT SANDSTONE: FINE TO MEDIUM GRAINED, TAN IN COLOR, MODERATELY TO INTENSELY WEATHERED (W6) MODERATELY SOFT (H5), THINLY BEDDED TO LAMINATED; NO REACTION WITH HCl

STRATIGRAPHY:
0.0 - 13.7 FT: QUATERNARY ALLUVIUM (Qal)
13.7 - 42.5 FT: TERTIARY NACIMIENTO FORMATION (Tn)

ABBREVIATIONS:
WLNE = WATER LEVEL NOT ENCOUNTERED
I.D. = INSIDE DIAMETER BNE = BEDROCK NOT ENCOUNTERED.

COMMENTS:

ALL ANGLES MEASURED FROM CORE AXIS AT ZERO DEGREES, UNLESS OTHERWISE NOTED.
THE DATA FOR THE CENTER COLUMN AND"CLASSIFICATION AND PHYSICAL CONDITIONS" COLUMN ARE BASED ON BUREAU OF RECLAMATION GEOLOGY FIELD MANUAL AND DRAWINGS TITLED FOR DESIGNS AND SPECIFICATIONS AS FOLLOWS- DRAWING NO. 40-D-6493. STANDARD DESCRIPTIONS AND DESCRIPTIVE CRITERIA FOR ROCK. DRAWING NO. 40-D-6499. STANDARD DESCRIPTORS AND DESCRIPTIVE CRITERIA FOR DISCONTINUITIES.

GEOLOGIC LOG OF DRILL HOLE NO. DHR22PP2-15-2

SHEET 1 OF 1

FEATURE: REACH 22B
LOCATION: PUMPING PLANT 2
BEGUN: 1/17/15 FINISHED: 1/18/15
DEPTH OF WATER LEVEL:
DATE MEASURED:

PROJECT: NAVAJO GALLUP WATER SUPPLY PROJECT
COORDINATES: N 2,017,891.0 E 2,750,609.9
TOTAL DEPTH: 41.0
DEPTH TO BEDROCK: 31.1

STATE: NEW MEXICO
GROUND ELEVATION: 6203.4
ANGLE FROM HORIZONTAL: 90
HOLE LOGGED BY: J. GILBERT
REVIEWED BY:

NOTES

ALL MEASUREMENTS ARE FROM GROUND SURFACE AND ARE THE SAME AS THOSE USED BY THE DRILLER.

ALL MEASUREMENTS ARE REPORTED IN FEET EXCEPT WHERE NOTED.

DRILLED BY: U.C. REGION DRILL CREW; DRILLER; JEFF VAN AUSDAL, HELPERS; KYLE KILLEBREW, JOE PROCTOR.

PURPOSE:
PRECONSTRUCTION SOIL AND BEDROCK FOUNDATION INVESTIGATIONS.

DRILL EQUIPMENT:
CME 850 TRACK MOUNTED DRILL RIG

DRILL METHOD:
0.0 - 31.1 FT 4 1/4" HSA AND DRY CORE SYSTEM WITH SPTs.
31.1 - 41.0 FT HQ3 WIRELINE CORING SYSTEM WITH A 3' SPLIT TUBE SAMPLER AND DIAMOND SURFACE-SET BIT.

CASING RECORD:
NONE USED

DRILLING MEDIUM:
0.0 - 31.1 FT, NONE
31.1 - 41.0 FT WATER

HOLE COMPLETION:
BACKFILLED WITH DRILL CUTTINGS

DEPTH	% CORE RECOVERY	LABORATORY DATA: % FINES	% SAND	% GRAVEL	LIQUID LIMIT	PLASTICITY INDEX	MOISTURE CONTENT	LABORATORY CLASSIFICATION	BLOWS / 0.5 FT	GEOLOGIC UNIT SYMBOL	VISUAL CLASSIFICATION / ELEVATION
5	100	16.3	83.7	0	NA	NP	3.4	SM	2/10/15		
	100	13.9	86.1	0	NA	NP	2.3	SM	8/16/22		
10	100	46.3	53.7	0	22.2	4.8	5.8	SC-SM	17/22/26		
	100	17.0	83.0	0	NA	NP	2.1	SM	8/12/12		
15	100	30.5	69.5	0	NA	NP	3.4	SM	8/13/13	Qal	SM
	100	6.7	93.5	0	NA	NP	1.4	SP-SM	6/12/15		
20	100	8.5	91.5	0	NA	NP	2.2	SP-SM	10/16/19		
25	100	26.4	73.6	0	NA	NP	3.7	SM	14/16/15		
30	100	30.7	69.3	0	NA	NP	3.5	SM	6/14/19		6172.3
35										Tn	SS
40											6162.3

BOTTOM OF HOLE

CLASSIFICATION AND PHYSICAL CONDITION

0.0 - 31.1 FT QUATERNARY ALLUVIUM (Qal)

0.0 - 31.1 FT SILTY SAND (SM): ABOUT 80% FINE SAND, MAXIMUM SIZE, FINE SAND; ABOUT 20% FINES WITH NO PLASTICITY, RAPID DILATENCY, LOW DRY STRENGTH, LOW TOUGHNESS; DRY, TAN IN COLOR; NO REACTION WITH HCl.

31.1 - 41.0 FT TERTIARY NACIMIENTO FORMATION (Tn)

31.1 - 41.0 SANDSTONE: FINE TO MEDIUM GRAINED, TAN IN COLOR, INTENSELY TO VERY INTENSELY WEATHERED (W7-W8), VERY SOFT TO SOFT (H6), UNFRACTURED (FD0); NO REACTION WITH HCl.

STRATIGRAPHY:
0.0 - 31.1 FT: QUATERNARY ALLUVIUM (Qal)
31.1 - 41.0 FT: TERTIARY NACIMIENTO FORMATION (Tn)

ABBREVIATIONS:
WLNE = WATER LEVEL NOT ENCOUNTERED
I.D. = INSIDE DIAMETER BNE = BEDROCK NOT ENCOUNTERED.

COMMENTS:

ALL ANGLES MEASURED FROM CORE AXIS AT ZERO DEGREES, UNLESS OTHERWISE NOTED.
THE DATA FOR THE CENTER COLUMN AND"CLASSIFICATION AND PHYSICAL CONDITIONS" COLUMN ARE BASED ON BUREAU OF RECLAMATION GEOLOGY FIELD MANUAL AND DRAWINGS TITLED FOR DESIGNS AND SPECIFICATIONS AS FOLLOWS- DRAWING NO. 40-D-6493. STANDARD DESCRIPTIONS AND DESCRIPTIVE CRITERIA FOR ROCK. DRAWING NO. 40-D-6499. STANDARD DESCRIPTORS AND DESCRIPTIVE CRITERIA FOR DISCONTINUITIES.

GEOLOGIC LOG OF DRILL HOLE NO. DHR22RT1A-15-1

SHEET 1 OF 2

FEATURE: REACH 22B
LOCATION: REGULATING TANK 1A
BEGUN: 1/19/15 FINISHED: 1/20/15
DEPTH OF WATER LEVEL:
DATE MEASURED:

PROJECT: NAVAJO GALLUP WATER SUPPLY PROJECT
COORDINATES: N 2,017,913.8 E 2,750,541.4
TOTAL DEPTH: 26.7
DEPTH TO BEDROCK: 19.3

STATE: NEW MEXICO
GROUND ELEVATION: 6208.7
ANGLE FROM HORIZONTAL: 90
HOLE LOGGED BY: J. GILBERT
REVIEWED BY:

NOTES

ALL MEASUREMENTS ARE FROM GROUND SURFACE AND ARE THE SAME AS THOSE USED BY THE DRILLER.

ALL MEASUREMENTS ARE REPORTED IN FEET EXCEPT WHERE NOTED.

DRILLED BY: U.C. REGION DRILL CREW; DRILLER; JEFF VAN AUSDAL, HELPERS; KYLE KILLEBREW, JOE PROCTOR.

PURPOSE:
PRECONSTRUCTION SOIL AND BEDROCK FOUNDATION INVESTIGATIONS.

DRILL EQUIPMENT:
CME 850 TRACK MOUNTED DRILL RIG

DRILL METHOD:
0.0 - 19.3 FT 4 1/4 INCH HOLLOW STEM AUGER WIH SPT SAMPLER, REACHED AUGER REFUSAL AT 19.3 FT, SWITCHED TO CORING SETUP.
19.3 - 26.7 FT HQ3 WIRELINE CORING SYSTEM WITH A 3' SPLIT TUBE SAMPLER AND DIAMOND SURFACE-SET BIT.

CASING RECORD:
NONE USED

DRILLING MEDIUM:
0.0 - 19.3 FT, NONE
19.3 - 26.7 FT, WATER

HOLE COMPLETION:
BACKFILLED WITH DRILL CUTTINGS

OBSERVATION WELL INSTALLED BGS:
NONE USED

DEPTH	% CORE RECOVERY	LABORATORY DATA: % FINES	% SAND	% GRAVEL	LIQUID LIMIT	PLASTICITY INDEX	MOISTURE CONTENT	LABORATORY CLASSIFICATION	BLOWS / 0.5 FT	GEOLOGIC UNIT SYMBOL	VISUAL CLASSIFICATION / ELEVATION
										Qal	SM
		10.7	89.3	0	NA	NP	1.5	SP-SM	3/5/4		
5											
		10.8	89.2	0	NA	NP	1.6	SP-SM	2/4/7		
											6200.2
		55.7	44.3	0	NA	NP	6.7	s(CL-ML)	12/19/21		SC
10											6197.5
		29.1	70.9	0	NA	NP	3.5	SM	14/12/12		
		12.6	87.4	0	NA	NP	1.9	SM	7/11/12		
15											SM
		11.9	88.1	0	NA	NP	2.8	SP-SM	10/18/17		
		20.1	79.9	0	NA	NP	4.8	SM	12/26/REFUSAL		6189.4
20	71									Tn	SS
25											6182.0

CLASSIFICATION AND PHYSICAL CONDITION

0.0-19.3 FT QUATERNARY ALLUVIUM (Qal)

0.0-8.5 FT SILTY SAND (SM) : ABOUT 80% FINE SAND, MAXIMUM SIZE, FINE SAND; ABOUT 20%FINES WITH NO PLASTICITY, RAPID DILATENCY, LOW DRY STRENGTH, LOW TOUGHNESS; DRY, TAN IN COLOR; NO REACTION WITH HCl.

8.5 - 11.2 FT CLAYEY SAND (SC): ABOUT 80% PREDOMINATELY FINE SAND; ABOUT 20% FINES WITH LOW PLASTICITY, LOW DRY STENGTH, LOW TOUGHNESS AND SLOW DILATANCY; MAXUMUM SIZE, FINE SAND, DARK BROWN IN COLOR, MOIST; NO REACTION WITH HCl.

11.2 - 19.3 FT SILTY SAND (SM) : ABOUT 85% FINE SAND, MAXIMUM SIZE, FINE SAND; ABOUT 15%FINES WITH NO PLASTICITY, RAPID DILATENCY, LOW DRY STRENGTH, LOW TOUGHNESS; DRY, TAN IN COLOR; NO REACTION WITH HCl.

19.3 - 26.7 FT TERTIARY NACIMIENTO FORMATION (Tn)

19.3 - 26.7 FT SANDSTONE: FINE TO MEDIUM GRAINED, TAN IN COLOR, VERY INTENSELY WEATHERED TO DECOMPOSED (W8-W9), VERY SOFT TO SOFT (H7); NO REACTION WITH HCl.

COMMENTS:

ALL ANGLES MEASURED FROM CORE AXIS AT ZERO DEGREES, UNLESS OTHERWISE NOTED.
THE DATA FOR THE CENTER COLUMN AND"CLASSIFICATION AND PHYSICAL CONDITIONS" COLUMN ARE BASED ON BUREAU OF RECLAMATION GEOLOGY FIELD MANUAL AND DRAWINGS TITLED FOR DESIGNS AND SPECIFICATIONS AS FOLLOWS- DRAWING NO. 40-D-6493, STANDARD DESCRIPTIONS AND DESCRIPTIVE CRITERIA FOR ROCK. DRAWING NO. 40-D-6499. STANDARD DESCRIPTORS AND DESCRIPTIVE CRITERIA FOR DISCONTINUITIES.

GEOLOGIC LOG OF DRILL HOLE NO. DHR22RT1A-15-1

FEATURE: REACH 22B
LOCATION: REGULATING TANK 1A
BEGUN: 1/19/15 FINISHED: 1/20/15
DEPTH OF WATER LEVEL:
DATE MEASURED:

PROJECT: NAVAJO GALLUP WATER SUPPLY PROJECT
COORDINATES: N 2,017,913.8 E 2,750,541.4
TOTAL DEPTH: 26.7
DEPTH TO BEDROCK: 19.3

STATE: NEW MEXICO
GROUND ELEVATION: 6208.7
ANGLE FROM HORIZONTAL: 90
HOLE LOGGED BY: J. GILBERT
REVIEWED BY:

NOTES	DEPTH	% CORE RECOVERY	LABORATORY DATA						LABORATORY CLASSIFICATION	BLOWS / 0.5 FT	GEOLOGIC UNIT SYMBOL	VISUAL CLASSIFICATION / ELEVATION	CLASSIFICATION AND PHYSICAL CONDITION
			% FINES	% SAND	% GRAVEL	LIQUID LIMIT	PLASTICITY INDEX	MOISTURE CONTENT					
													BOTTOM OF HOLE

GEOLOGIC LOG OF DRILL HOLE NO. DHR22RT1B-15-1

SHEET 1 OF 1

FEATURE: REACH 22B
LOCATION: REGULATING TANK 1B
BEGUN: 1/18/15 FINISHED: 1/19/15
DEPTH OF WATER LEVEL:
DATE MEASURED:

PROJECT: NAVAJO GALLUP WATER SUPPLY PROJECT
COORDINATES: N 2,017,937.7 E 2,750,565.4
TOTAL DEPTH: 45.0
DEPTH TO BEDROCK: 22.3

STATE: NEW MEXICO
GROUND ELEVATION: 6206.0
ANGLE FROM HORIZONTAL: 90
HOLE LOGGED BY: J. GILBERT
REVIEWED BY:

NOTES

ALL MEASUREMENTS ARE FROM GROUND SURFACE AND ARE THE SAME AS THOSE USED BY THE DRILLER.

ALL MEASUREMENTS ARE REPORTED IN FEET EXCEPT WHERE NOTED.

DRILLED BY: U.C. REGION DRILL CREW; DRILLER; JEFF VAN AUSDAL, HELPERS; KYLE KILLEBREW, JOE PROCTOR.

PURPOSE:
PRECONSTRUCTION SOIL AND BEDROCK FOUNDATION INVESTIGATIONS.

DRILL EQUIPMENT:
CME 850 TRACK MOUNTED DRILL RIG

DRILL METHOD:
0.0 -19.3 FT 4 1/4 INCH HOLLOW STEM AUGER WIH SPT SAMPLER, REACHED AUGER REFUSAL AT 19.3 FT, SWITCHED TO CORING SETUP.
19.3 - 45.0 FT HQ3 WIRELINE CORING SYSTEM WITH A 3' SPLIT TUBE SAMPLER AND DIAMOND SURFACE-SET BIT.

CASING RECORD:
NONE USED

DRILLING MEDIUM:
0.0 - 23.1 FT, NONE
23.1 - 45.0 FT, WATER

HOLE COMPLETION:
BACKFILLED WITH DRILL CUTTINGS

OBSERVATION WELL INSTALLED BGS:
NONE USED

DEPTH	% CORE RECOVERY	LABORATORY DATA: % FINES	% SAND	% GRAVEL	LIQUID LIMIT	PLASTICITY INDEX	MOISTURE CONTENT	LABORATORY CLASSIFICATION	BLOWS / 0.5 FT	GEOLOGIC UNIT SYMBOL	VISUAL CLASSIFICATION / ELEVATION
		14.1	85.9	0	NA	NP	2.4	SM	3/5/5		
5											
		17.2	82.8	0	NA	NP	2.4	SM	5/13/23		
											SM
		48.7	51.3	0	NA	NP	4.6	SM	10/15/19		
10											
		46.8	53.2	0	22.4	5.2	5.0	SC-SM	11/21/22	Qal	
		16.7	83.3	0	NA	NP	2.3	SM	12/12/12		
15											6190.4
		4.6	95.4	0	NA	NP	NA	SP	6/11/14		
		5.5	94.5	0	NA	NP	1.2	SP-SM	6/13/18		SP-SM
20											
											6183.7
	21										
25											
	28										
30											
	4									Tn	SS
35											
	56										
	100										
40											
	80										
45											6161.0

BOTTOM OF HOLE

CLASSIFICATION AND PHYSICAL CONDITION

0.0-22.3 QUATERNARY ALLUVIUM (Qal)

0.0-15.6 FT SILTY SAND (SM) : ABOUT 80% FINE SAND, MAXIMUM SIZE, FINE SAND; ABOUT 20%FINES WITH NO PLASTICITY, RAPID DILATENCY, LOW DRY STRENGTH, LOW TOUGHNESS; DRY, TAN IN COLOR; NO REACTION WITH HCl.

15.6 - 22.3 FT POORLY GRADED SAND WITH SILT (SP-SM): ABOUT 90% FINE SAND; ABOUT 10% FINES WITH NO PLASTICITY, NO DRY STRENGTH, RAPID DILATENCY; DRY, LIGHT BROWN IN COLOR; NO REACTION WITH HCl.

22.3 - 45.0 TERTIARY NACIMIENTO FORMATION (Tn)

22.3 - 45.0 SANDSTONE: INTENSELEY WEATHERED (W8), VERY SOFT TO SOFT (H7), TAN IN COLOR; INTERBED OF CLAYSTONE/SILTSTONE FROM 36.1 - 38.3 FT, CLAYSTONE/SILSTONE IS THINLY BEDDED TO LAMINATED, VERY INTENSELY WEATHERED TO (W8), VERY SOFT TO SOFT (H6-H7); NO REACTION WITH HCl.

JOINT MEASUREMENTS:

DEPTH	INCL	R	M	T	HL	INFILLING
44.2	90	5	4	3		CL

STRATIGRAPHY:
0.0 - 22.3 FT: QUATERNARY ALLUVIUM (Qal)
22.3 - 45.0 FT: TERTIARY NACIMIENTO FORMATION (Tn)
ABBREVIATIONS:
WLNE = WATER LEVEL NOT ENCOUNTERED
I.D. = INSIDE DIAMETER BNE = BEDROCK NOT ENCOUNTERED.

COMMENTS:

ALL ANGLES MEASURED FROM CORE AXIS AT ZERO DEGREES, UNLESS OTHERWISE NOTED.
THE DATA FOR THE CENTER COLUMN AND"CLASSIFICATION AND PHYSICAL CONDITIONS" COLUMN ARE BASED ON BUREAU OF RECLAMATION GEOLOGY FIELD MANUAL AND DRAWINGS TITLED FOR DESIGNS AND SPECIFICATIONS AS FOLLOWS- DRAWING NO. 40-D-6493. STANDARD DESCRIPTIONS AND DESCRIPTIVE CRITERIA FOR ROCK. DRAWING NO. 40-D-6499. STANDARD DESCRIPTORS AND DESCRIPTIVE CRITERIA FOR DISCONTINUITIES.

GEOLOGIC LOG OF DRILL HOLE NO. DHR22RT2-15-2

SHEET 1 OF 1

FEATURE: REACH 22B
LOCATION: REGULATING TANK 2
BEGUN: 3/17/15 FINISHED: 3/17/15
DEPTH OF WATER LEVEL:
DATE MEASURED:

PROJECT: NAVAJO GALLUP WATER SUPPLY PROJECT
COORDINATES: N 1,973,663.1 E 2,735,826.9
TOTAL DEPTH: 41.0
DEPTH TO BEDROCK: BNE

STATE: NEW MEXICO
GROUND ELEVATION: 6630.3
ANGLE FROM HORIZONTAL: 90
HOLE LOGGED BY: J. GILBERT
REVIEWED BY:

NOTES

ALL MEASUREMENTS ARE FROM GROUND SURFACE AND ARE THE SAME AS THOSE USED BY THE DRILLER.

ALL MEASUREMENTS ARE REPORTED IN FEET EXCEPT WHERE NOTED.

DRILLED BY: U.C. REGION DRILL CREW; DRILLER; JEFF VAN AUSDAL, HELPERS; KYLE KILLEBREW, STEVE COCHRAN.

PURPOSE:
PRECONSTRUCTION SOIL AND BEDROCK FOUNDATION INVESTIGATIONS.

DRILL EQUIPMENT:
CME 850 TRACK MOUNTED DRILL RIG

DRILL METHOD:
0.0 - 41.0 4 1/4 INCH HOLLOW STEM AUGER WIH SPTs
CASING RECORD:
NONE USED

DRILLING MEDIUM:
0.0 - 41.0 FT NONE USED

HOLE COMPLETION:
BACKFILLED WITH DRILL BENTONITE.

DEPTH	% CORE RECOVERY	LABORATORY DATA: % FINES	% SAND	% GRAVEL	LIQUID LIMIT	PLASTICITY INDEX	MOISTURE CONTENT	LABORATORY CLASSIFICATION	BLOWS / 0.5 FT	GEOLOGIC UNIT SYMBOL	VISUAL CLASSIFICATION / ELEVATION
5	100	32.8	67.2	0	NA	NP	5.4	SM	5/15/17		SC
											6624.0
	72	15.8	84.2	0	NA	NP	2.1	SM	6/9/7		
10	68	22.1	77.9	0	NA	NP	2.6	SM	6/9/13		
	100	33.8	66.2	0	NA	NP	4.0	SM	9/12/14		SP-SM
15	100	16.6	83.4	0	NA	NP	2.3	SM	5/15/20		
											6613.1
	100	53.5	46.5	0	31.1	19.4	8.7	s(CL)	12/13/20		s(CL) 6611.8
20	100	32.8	67.2	0	20.4	3.8	4.7	SM	13/24/25	Qal	SP-SM
	96	35.6	64.4	0	20.4	6.6	4.5	SC-SM	18/28/27		6607.2
25	100	39.5	60.5	0	21.3	5.0	4.4	SC-SM	13/21/21		SC
											6601.5
30	100	43.3	56.7	0	21.7	5.1	4.7	SC-SM	12/21/27		SP-SM 6599.0
											SC
35	100	92.1	7.9	0	51.7	30.6	14.4	CH	7/16/23		6594.9
											SP-SM
40		37.6	62.4	0	20.1	5.1	4.7	SC-SM	7/16/17		6589.3

BOTTOM OF HOLE

CLASSIFICATION AND PHYSICAL CONDITION

0.0 - 41.0 FT QUATERNARY ALLUVIUM (Qal)

0.0 TO 6.3 FT CLAYEY SAND (SC): ABOUT 60% PREDOMINATELY FINE SAND; ABOUT 40% FINES WITH LOW PLASTICITY, LOW DRY STRENGTH, LOW TOUGHNESS AND SLOW DILATANCY; NO REACTION WITH HCl.

6.3 TO 17.2 FT POORLY GRADED SAND WITH SILT (SP-SM): ABOUT 90% PREDOMINATELY FINE SAND; ABOUT 10% FINES WITH NO PLASTICITY, NO DRY STRENGTH, AND RAPID DILATANCY; NO REACTION WITH HCL.

17.2 TO 18.5 FT SANDY LEAN CLAY s(CL): ABOUT 70% FINES WITH MEDIUM PLASTICITY, MEDIUM TO HIGH DRY STRENGTH, AND MEDIUM TO HIGH TOUGHNESS; ABOUT 30% FINE SAND; BROWN IN COLOR

18.5 TO 23.1 FT POORLY GRADED SAND WITH SILT (SP-SM): ABOUT 90% PREDOMINATELY FINE SAND; ABOUT 10% FINES WITH NO PLASTICITY, NO DRY STRENGTH, AND RAPID DILATANCY; NO REACTION WITH HCL.

23.1 TO 28.8 FT CLAYEY SAND (SC): ABOUT 60% PREDOMINATELY FINE SAND; ABOUT 40% FINES WITH LOW PLASTICITY, LOW DRY STRENGTH, LOW TOUGHNESS AND SLOW DILATANCY; NO REACTION WITH HCl.

28.8 TO 31.3 FT POORLY GRADED SAND WITH SILT (SP-SM): ABOUT 90% PREDOMINATELY FINE SAND; ABOUT 10% FINES WITH NO PLASTICITY, NO DRY STRENGTH, AND RAPID DILATANCY; NO REACTION WITH HCL.

31.3 TO 35.4 FT CLAYEY SAND (SC): ABOUT 60% PREDOMINATELY FINE SAND; ABOUT 40% FINES WITH LOW PLASTICITY, LOW DRY STRENGTH, LOW TOUGHNESS AND SLOW DILATANCY; NO REACTION WITH HCl.

35.4 TO 41.0 FT POORLY GRADED SAND WITH SILT (SP-SM): ABOUT 90% PREDOMINATELY FINE SAND; ABOUT 10% FINES WITH NO PLASTICITY, NO DRY STRENGTH, AND RAPID DILATANCY; NO REACTION WITH HCL.

STRATIGRAPHY:
0.0 - 41.0 FT: QUATERNARY ALLUVIUM (Qal)
ABBREVIATIONS:
WLNE = WATER LEVEL NOT ENCOUNTERED
I.D. = INSIDE DIAMETER BNE = BEDROCK NOT ENCOUNTERED.

COMMENTS:

ALL ANGLES MEASURED FROM CORE AXIS AT ZERO DEGREES, UNLESS OTHERWISE NOTED.
THE DATA FOR THE CENTER COLUMN AND"CLASSIFICATION AND PHYSICAL CONDITIONS" COLUMN ARE BASED ON BUREAU OF RECLAMATION GEOLOGY FIELD MANUAL AND DRAWINGS TITLED FOR DESIGNS AND SPECIFICATIONS AS FOLLOWS- DRAWING NO. 40-D-6493. STANDARD DESCRIPTIONS AND DESCRIPTIVE CRITERIA FOR ROCK. DRAWING NO. 40-D-6499. STANDARD DESCRIPTORS AND DESCRIPTIVE CRITERIA FOR DISCONTINUITIES.

GEOLOGIC LOG OF DRILL HOLE NO. DHR22RT2-15-3

SHEET 1 OF 2

FEATURE: REACH 22B
LOCATION: REGULATING TANK 2
BEGUN: 3/15/15 FINISHED: 3/15/15
DEPTH OF WATER LEVEL:
DATE MEASURED:

PROJECT: NAVAJO GALLUP WATER SUPPLY PROJECT
COORDINATES: N 1,973,665.6 E 2,735,813.4
TOTAL DEPTH: 60.0
DEPTH TO BEDROCK: 44.5

STATE: NEW MEXICO
GROUND ELEVATION: 6630.6
ANGLE FROM HORIZONTAL: 90
HOLE LOGGED BY: J. GILBERT
REVIEWED BY:

NOTES

ALL MEASUREMENTS ARE FROM GROUND SURFACE AND ARE THE SAME AS THOSE USED BY THE DRILLER.

ALL MEASUREMENTS ARE REPORTED IN FEET EXCEPT WHERE NOTED.

DRILLED BY: U.C. REGION DRILL CREW; DRILLER; JEFF VAN AUSDAL, HELPERS; KYLE KILLEBREW, STEVE COCHRAN.

PURPOSE:
PRECONSTRUCTION SOIL AND BEDROCK FOUNDATION INVESTIGATIONS.

DRILL EQUIPMENT:
CME 850 TRACK MOUNTED DRILL RIG

DRILL METHOD:
0.0 - 44.5 FT 4 1/4 INCH HOLLOW STEM AUGER WIH SPTs
44.5 - 60.0 FT HQ3 WIRELINE CORING SYSTEM WITH A 3' SPLIT TUBE SAMPLER AND DIAMOND SURFACE-SET BIT.

CASING RECORD:
NONE USED

DRILLING MEDIUM:
0.0 - 44.5 FT NONE USED
45.0 - 60.0 WATER

HOLE COMPLETION:
BACKFILLED WITH DRILL BENTONITE AND CUTTINGS.

DEPTH	% CORE RECOVERY	LABORATORY DATA: % FINES	% SAND	% GRAVEL	LIQUID LIMIT	PLASTICITY INDEX	MOISTURE CONTENT	LABORATORY CLASSIFICATION	BLOWS / 0.5 FT	GEOLOGIC UNIT SYMBOL	VISUAL CLASSIFICATION / ELEVATION
	PILOT									Qal	
5	100	20.8	79.2	0	NA	NP	3.4	SM	7/16/23		SP
	80	19.2	80.8	0	NA	NP	2.4	SM	4/6/7		6621.6
10	100	23.6	76.4	0	NA	NP	2.8	SM	5/9/11		SP-SM
	92	23.3	76.7	0	NA	NP	3.2	SM	10/15/15		6613.6
15	100	18.7	81.3	0	NA	NP	2.5	SM	5/11/12		s(CL) 6612.3
	100	57.8	42.2	0	31.5	12.6	9.1	s(CL)	11/18/22		SP-SM 6610.5
20	100	24.4	75.6	0	NA	NP	3.5	SM	8/23/25		
	96	35.8	64.2	0	18.8	2.6	4.1	SM	13/24/22		s(CL)
25	100	41.6	58.4	0	22.4	7.5	4.9	SC	14/29/28		6601.2
30	86	39.6	60.4	0	20.6	4.5	4.1	SC-SM	14/17/22		SM 6599.8
											s(CL) 6596.1
35	94	96.3	3.7	0	61.3	40.0	14.9	CH	10/16/33		CL 6594.9
40	100	17.3	77.4	5.3	16.9	0.5	2.2	SM	8/18/23		SP-SM
											6586.1
45	10								42/REFUSAL		SS 6585.6
50	100									Tn	CLST
55	90										6571.2
60											SS 6570.6

BOTTOM OF HOLE

CLASSIFICATION AND PHYSICAL CONDITION

0.0 - 44.5 FT QUATERNARY ALLUVIUM (Qal)

0.0 TO 9.0 FT POORLY GRADED SAND (SP): ABOUT 95% FINE SAND, TRACE MEDIUM SAND; ABOUT 5% NONPLASTIC FINES, WHTH RAPID DILATANCY, NO DRY STRENGTH AND NO TOUGHNESS; MAXIMUM SIZE, MEDIUM SAND, NO REACTION WITH HCL, OCCASIONAL CALCITE CEMENTED AREAS WITH STRONG REACTION WITH HCL.

9.0 TO 17.0 FT POORLY GRADED SAND WHTH SILT (SP-SM): ABOUT 90% FINE SAND, TRACE GRAVEL; ABOUT 10% FINES WITH NO PLASTICITY, NO DRY STRENGTH AND NO THOUGHNESS; MAXIMUM SIZE 20MM, NO REACTION WITHG HCL.

17.0 TO 29.4 FT SANDY LEAN CLAY s(CL): ABOUT 60% FINES WITH MEDIUM PLASTICITY, MEDIUM TO HIGH DRY STRENGTH, AND MEDIUM TOUGHNESS; ABOUT 40% FINE SAND; CALCITE VEINS AND CEMENT, STRONG REACTION WITH HCL, GREYISH BROWN IN COLOR, FIRM CONSISTANCY.

29.4 TO 30.8 FT SILTY SAND (SM):ABOUT 85% FINE SAND, TRACE MEDIUM SAND; ABOUT 15% NONPLASTIC FINES WITH RAPID DILATANCY, NO DRY STRENGTH AND NO TOUGHNESS; BROWN IN COLOR, MAXIMUM SIZE, MEDIUM SAND, NO REACTION WITH HCL.

30.8 TO 34.5 FT SANDY LEAN CLAY s(CL): ABOUT 60% FINES WITH MEDIUM PLASTICITY, MEDIUM TO HIGH DRY STRENGTH, AND MEDIUM TOUGHNESS; ABOUT 40% FINE SAND; STRONG REACTION WITH HCL.

34.5 TO 35.7 LEAN CLAY (CL): ABOUT 85% FINES WITH MEDIUM PLASTICITY, MEDIUM DRY STRENGTH, MEDIUM TOUGHNESS; ABOUT 15% FINE TO MEDIUM SAND; MAXIMUM SIZE, MEDIUM SAND; NO REACTION WITH HCL.

35.7 TO 44.5 FT POORLY GRADED SAND WITH SILT (SP-SM): ABOUT 90% FINE SAND; ABOUT 10% FINES WITH NO PLASTICITY, NO DRY STRENGTH, RAPID DILATENCY; NO REACTION WITH HCl.

44.5 - 60.0 FT TERTIARY NACIMIENTO FORMATION

44.5 TO 45.0 FT SANDSTONE: FINE TO MEDIUM GRAINED, TAN IN COLOR, VERY INTENSELY WEATHERED TO DECOMPOSED (W8-W9), VERY SOFT TO SOFT (H7); NO REACTION WITH HCl.

45.0 TO 59.4 FT CLAYSTONE: DARK GREY IN COLOR, FINE GRAINED, INTENSELY WEATHERED (W7), SOFT (H6); NO REACTION WITH HCl.

59.4 TO 60.0 SANDSTONE: FINE TO MEDIUM GRAINED, TAN IN COLOR, VERY INTENSELY WEATHERED TO DECOMPOSED (W8-W9), VERY SOFT TO SOFT (H7); NO REACTION WITH HCl.

COMMENTS:

ALL ANGLES MEASURED FROM CORE AXIS AT ZERO DEGREES, UNLESS OTHERWISE NOTED.
THE DATA FOR THE CENTER COLUMN AND"CLASSIFICATION AND PHYSICAL CONDITIONS" COLUMN ARE BASED ON BUREAU OF RECLAMATION GEOLOGY FIELD MANUAL AND DRAWINGS TITLED FOR DESIGNS AND SPECIFICATIONS AS FOLLOWS- DRAWING NO. 40-D-6493. STANDARD DESCRIPTIONS AND DESCRIPTIVE CRITERIA FOR ROCK. DRAWING NO. 40-D-6499. STANDARD DESCRIPTORS AND DESCRIPTIVE CRITERIA FOR DISCONTINUITIES.

GEOLOGIC LOG OF DRILL HOLE NO. DHR22RT2-15-3

FEATURE: REACH 22B
LOCATION: REGULATING TANK 2
BEGUN: 3/15/15 FINISHED: 3/15/15
DEPTH OF WATER LEVEL:
DATE MEASURED:

PROJECT: NAVAJO GALLUP WATER SUPPLY PROJECT
COORDINATES: N 1,973,665.6 E 2,735,813.4
TOTAL DEPTH: 60.0
DEPTH TO BEDROCK: 44.5

STATE: NEW MEXICO
GROUND ELEVATION: 6630.6
ANGLE FROM HORIZONTAL: 90
HOLE LOGGED BY: J. GILBERT
REVIEWED BY:

NOTES	DEPTH	% CORE RECOVERY	LABORATORY DATA						LABORATORY CLASSIFICATION	BLOWS / 0.5 FT	GEOLOGIC UNIT SYMBOL	VISUAL CLASSIFICATION / ELEVATION	CLASSIFICATION AND PHYSICAL CONDITION
			% FINES	% SAND	% GRAVEL	LIQUID LIMIT	PLASTICITY INDEX	MOISTURE CONTENT					

STRATIGRAPHY:
0.0 - 44.5 FT: QUATERNARY ALLUVIUM (Qal)
44.5 - 60.0 FT: TERTIARY NACIMIENTO FORMATION (Tn)
ABBREVIATIONS:
WLNE = WATER LEVEL NOT ENCOUNTERED
I.D. = INSIDE DIAMETER BNE = BEDROCK NOT ENCOUNTERED.

GEOLOGIC LOG OF DRILL HOLE NO. DHR22RT2-15-4

SHEET 1 OF 2

FEATURE: REACH 22B
LOCATION: REGULATING TANK 2
BEGUN: 3/15/15 FINISHED: 3/15/15
DEPTH OF WATER LEVEL:
DATE MEASURED:

PROJECT: NAVAJO GALLUP WATER SUPPLY PROJECT
COORDINATES: N 1,973,668.1 E 2,735,799.9
TOTAL DEPTH: 40.8
DEPTH TO BEDROCK: BNE

STATE: NEW MEXICO
GROUND ELEVATION: 6631.0
ANGLE FROM HORIZONTAL: 90
HOLE LOGGED BY: C. BEYER
REVIEWED BY:

NOTES

ALL MEASUREMENTS ARE FROM GROUND SURFACE AND ARE THE SAME AS THOSE USED BY THE DRILLER.

ALL MEASUREMENTS ARE REPORTED IN FEET EXCEPT WHERE NOTED.

DRILLED BY: U.C. REGION DRILL CREW; DRILLER; JEFF VAN AUSDAL, HELPERS; KYLE KILLEBREW, STEVE COCHRAN.

PURPOSE:
PRECONSTRUCTION SOIL AND BEDROCK FOUNDATION INVESTIGATIONS.

DRILL EQUIPMENT:
CME 850 TRACK MOUNTED DRILL RIG

DRILL METHOD:
0.0 - 40.8 4 1/4 INCH HOLLOW STEM AUGER WIH SPTs.

CASING RECORD:
NONE USED

DRILLING MEDIUM:
0.0 - 40.8 FT NONE USED

HOLE COMPLETION:
BACKFILLED WITH DRILL BENTONITE AND CUTTINGS.

DEPTH	% CORE RECOVERY	LABORATORY DATA: % FINES	% SAND	% GRAVEL	LIQUID LIMIT	PLASTICITY INDEX	MOISTURE CONTENT	LABORATORY CLASSIFICATION	BLOWS / 0.5 FT	GEOLOGIC UNIT SYMBOL	VISUAL CLASSIFICATION / ELEVATION
	PILOT									Qal	SP
5	100	13.2	86.8	0	NA	NP	2.6	SM	5/9/11		
									7/8/8		
	100	21.4	78.6	0	NA	NP	3.0	SM			6623.0
10	100	21.8	78.2	0	NA	NP	2.8	SM	7/10/9		
	100	36.3	63.7	0	NA	NP	4.4	SM	12/13/15		
15	100	18.4	81.6	0	NA	NP	2.4	SM	7/17/21		
	100	47.9	52.1	0	25.7	12.6	6.6	SC	13/24/31		SM
20	100	17.8	82.2	0	NA	NP	2.5	SM	11/19/23		
	100	27.0	73.0	0	NA	NP	3.7	SM	11/16/21		
25	100	37.3	62.7	0	20.2	2.6	4.8	SM	16/20/20		6605.7
											s(CL)
											6602.7
30	88	55.0	45.0	0	23.1	5.6	6.3	s(CL-ML)	12/19/22		SM
											6600.7
											s(CL) 6599.8
35	100	95.6	4.4	0	58.8	33.3	14.8	CH	12/17/20		SM
											6597.0
											s(CL) 6595.9
											SM
40		29.9	70.1	0	NA	NP	3.9	SM	13/17/17		6590.2

BOTTOM OF HOLE

CLASSIFICATION AND PHYSICAL CONDITION

0.0 - 40.8 FT QUATERNARY ALLUVIUM (Qal)

0.0 TO 8.0 FT POORLY GRADED SAND (SP): ABOUT 95% FINE SAND, TRACE MEDIUM SAND; ABOUT 5% NONPLASTIC FINES, WHTH RAPID DILATANCY, NO DRY STRENGTH AND NO TOUGHNESS; MAXIMUM SIZE, MEDIUM SAND, NO REACTION WITH HCL.

8.0 TO 25.3 FT SILTY SAND (SM): ABOUT 85% FINE SAND, TRACE MEDIUM TO COARSE SAND; ABOUT 15% NONPLASTIC FINES WITH RAPID DILATANCY, NO DRY STRENGTH AND NO TOUGHNESS; BROWN IN COLOR, MAXIMUM SIZE, COARSE SAND, NO REACTION WITH HCL; CALCITE CEMENTED ZONE BETWEEN 16.8 AND 17.5 FEET WITH STRONG REACTION WITH HCL.

25.3 TO 28.3 FT SANDY LEAN CLAY s(CL): ABOUT 60% FONES WITH MEDIUM PLASTICITY, MEDIUM TO HIGH DRY STRENGTH, AND MEDIUM TOUGHNESS; ABOUT 40% FINE SAND; CALCITE VEINS AND CEMENT, STRONG REACTION WITH HCL, GREYISH BROWN IN COLOR, FIRM CONSISTANCY.

28.3 TO 30.3 FT SILTY SAND (SM): ABOUT 85% FINE SAND, TRACE MEDIUM SAND; ABOUT 15% NONPLASTIC FINES WITH RAPID DILATANCY, NO DRY STRENGTH AND NO TOUGHNESS; BROWN IN COLOR, MAXIMUM SIZE, MEDIUM SAND, NO REACTION WITH HCL.

30.3 TO 31.2 FT SANDY LEAN CLAY s(CL): ABOUT 60% FONES WITH MEDIUM PLASTICITY, MEDIUM TO HIGH DRY STRENGTH, AND MEDIUM TOUGHNESS; ABOUT 40% FINE SAND; CALCITE VEINS AND CEMENT, STRONG REACTION WITH HCL, GREYISH BROWN IN COLOR, FIRM CONSISTANCY.

31.2 TO 34.0 FT SILTY SAND (SM): ABOUT 85% FINE SAND, TRACE MEDIUM SAND; ABOUT 15% NONPLASTIC FINES WITH RAPID DILATANCY, NO DRY STRENGTH AND NO TOUGHNESS; BROWN IN COLOR, MAXIMUM SIZE, MEDIUM SAND, NO REACTION WITH HCL.

34.0 TO 35.1 FT SANDY LEAN CLAY s(CL): ABOUT 60% FONES WITH MEDIUM PLASTICITY, MEDIUM TO HIGH DRY STRENGTH, AND MEDIUM TOUGHNESS; ABOUT 40% FINE SAND; CALCITE VEINS AND CEMENT, STRONG REACTION WITH HCL, GREYISH BROWN IN COLOR, FIRM CONSISTANCY.

35.1 TO 40.8 FT SILTY SAND (SM): ABOUT 85% FINE SAND, TRACE MEDIUM SAND; ABOUT 15% NONPLASTIC FINES WITH RAPID DILATANCY, NO DRY STRENGTH AND NO TOUGHNESS; BROWN IN COLOR, MAXIMUM SIZE, MEDIUM SAND, NO REACTION WITH HCL.

STRATIGRAPHY:
0.0 - 40.8 FT QUATERNARY ALLUVIUM (Qal)
ABBREVIATIONS:
WLNE = WATER LEVEL NOT ENCOUNTERED

COMMENTS:

ALL ANGLES MEASURED FROM CORE AXIS AT ZERO DEGREES, UNLESS OTHERWISE NOTED.
THE DATA FOR THE CENTER COLUMN AND"CLASSIFICATION AND PHYSICAL CONDITIONS" COLUMN ARE BASED ON BUREAU OF RECLAMATION GEOLOGY FIELD MANUAL AND DRAWINGS TITLED FOR DESIGNS AND SPECIFICATIONS AS FOLLOWS- DRAWING NO. 40-D-6493. STANDARD DESCRIPTIONS AND DESCRIPTIVE CRITERIA FOR ROCK. DRAWING NO. 40-D-6499. STANDARD DESCRIPTORS AND DESCRIPTIVE CRITERIA FOR DISCONTINUITIES.

GEOLOGIC LOG OF DRILL HOLE NO. DHR22RT2-15-4

FEATURE: REACH 22B
LOCATION: REGULATING TANK 2
BEGUN: 3/15/15 FINISHED: 3/15/15
DEPTH OF WATER LEVEL:
DATE MEASURED:

PROJECT: NAVAJO GALLUP WATER SUPPLY PROJECT
COORDINATES: N 1,973,668.1 E 2,735,799.9
TOTAL DEPTH: 40.8
DEPTH TO BEDROCK: BNE

STATE: NEW MEXICO
GROUND ELEVATION: 6631.0
ANGLE FROM HORIZONTAL: 90
HOLE LOGGED BY: C. BEYER
REVIEWED BY:

NOTES	DEPTH	% CORE RECOVERY	LABORATORY DATA						LABORATORY CLASSIFICATION	BLOWS / 0.5 FT	GEOLOGIC UNIT SYMBOL	VISUAL CLASSIFICATION / ELEVATION	CLASSIFICATION AND PHYSICAL CONDITION
			% FINES	% SAND	% GRAVEL	LIQUID LIMIT	PLASTICITY INDEX	MOISTURE CONTENT					

I.D. = INSIDE DIAMETER BNE = BEDROCK NOT ENCOUNTERED.

GEOLOGIC LOG OF DRILL HOLE NO. DHRT2-1 (OLD LOCATION)

SHEET 1 OF 2

FEATURE: REACH 22B
LOCATION: REGULATING TANK 2 (OLD LOCATION)
BEGUN: 8/23/14 FINISHED: 8/23/14
DEPTH OF WATER LEVEL:
DATE MEASURED:

PROJECT: NAVAJO GALLUP WATER SUPPLY PROJECT
COORDINATES: N 1,974,068.0 E 2,735,796.0
TOTAL DEPTH: 60.0
DEPTH TO BEDROCK: 49.2

STATE: NEW MEXICO
GROUND ELEVATION: 6629.3
ANGLE FROM HORIZONTAL: 90
HOLE LOGGED BY: C. BEYER
REVIEWED BY:

NOTES

ALL MEASUREMENTS ARE FROM GROUND SURFACE AND ARE THE SAME AS THOSE USED BY THE DRILLER.

ALL MEASUREMENTS ARE REPORTED IN FEET EXCEPT WHERE NOTED.

DRILLED BY: U.C. REGION DRILL CREW; DRILLER; JEFF VAN AUSDAL, HELPERS; RON TODHUNTER AND GREG LOTT.

PURPOSE:
PRECONSTRUCTION SOIL AND BEDROCK FOUNDATION INVESTIGATIONS.

DRILL EQUIPMENT:
CME 85

DRILL METHOD:
0.0 TO 60.0 FT 4 1/4" HSA AND DRY CORE SYSTEM WITH SPLIT SPOON SAMPLER. PILOT BIT FROM 0.0 TO 3.5 FEET. SPT SAMPLING AT 2.5 FOOT INTERVALS FROM 3.5 FEET TO 20.0 FEET, AND 5 FOOT INTERVALS FROM 20.0 FEET TO TO REFUSAL AT 54.3 FEET. ADVANCED HOLE TO A TOTAL DEPTH OF 60.0 FEET.

CASING RECORD:
NONE USED

DRILLING MEDIUM:
0.0 TO 60.0 NONE USED

HOLE COMPLETION
BACKFILLED HOLE WITH CUTTINGS.

DEPTH	% CORE RECOVERY	LABORATORY DATA: % FINES	% SAND	% GRAVEL	LIQUID LIMIT	PLASTICITY INDEX	MOISTURE CONTENT	LABORATORY CLASSIFICATION	BLOWS / 0.5 FT	GEOLOGIC UNIT SYMBOL	VISUAL CLASSIFICATION / ELEVATION
5	20	12	88	0	NA	NP	2.3	SP-SM	3/8/11	QaL	SP-SM
	100	14.8	85.2	0	NA	NP	2.4	SM	7/11/14		
10	48	28.2	61.8	0	28.3	14.8	4.8	SC	8/11/11		6620.3 SC
	84	36.3	63.7	0	23.1	8.5	4.8	SC	9/13/12		6617.4 SP-SM
15	100	35.1	64.9	0	NA	NP	2.8	SM	6/16/21		6614.5 SC
	80	57.6	42.4	0	25.7	13.8	8.9	s(CL)	10/15/19		
20	100	48.7	44.7	6.6	26.9	11.8	7	s(CL)	14/23/25		6608.6 SP-SM 6608.0 (CL)s 6607.7
25	100	53.7	46.3	0	27	13.1	6.3	s(CL)	11/20/20		SM
	88	19	80.4	0.6	NA	NP	2.4	SM	8/13/13		6601.1 SP-SM

CLASSIFICATION AND PHYSICAL CONDITION

0.0 - 49.2 FT QUATERNARY ALLUVIUM (Qal)

0.0 TO 9.0 FT POORLY GRADED SAND WITH SILT (SP-SM): ABOUT 90% FINE SAND; ABOUT 10% FINES WITH NO PLASTICITY, NO DRY STRENGTH, AND RAPID DILATANCY; NO REACTION WITH HCl, DRY, LIGHT BROWN IN COLOR, ROOTS IN TOP 2.0 FT.

9.0 TO 11.9 FT CLAYEY SAND (SC): ABOUT 85% FINE SAND; ABOUT 15% FINES WITH LOW PLASTICITY, LOW DRY STRENGTH, AND LOW TOUGHNESS; STRONG REACTION WITH HCl, BROWN IN COLOR.

11.9 TO 14.8 FT POORLY GRADED SAND WITH SILT (SP-SM): ABOUT 90% FINE SAND; ABOUT 10% FINES WITH NO PLASTICITY, NO DRY STRENGTH, AND RAPID DILATANCY; NO REACTION WITH HCl, DRY, LIGHT BROWN IN COLOR.

14.8 TO 20.7 FT CLAYEY SAND (SC): ABOUT 85% PREDOMINATELY FINE SAND, TRACE MEDIUM TO COARSE SAND GRAVEL AND COBBLES; ABOUT 15% FINES WITH LOW PLASTICITY, LOW DRY STRENGTH, AND LOW TOUGHNESS; MAXIMUM SIZE, 90 MM; STRONG REACTION WITH HCl, ROOT CASTS, BROWN IN COLOR. 90MM SANDSTONE FRAGMENT STUCK IN SPT SAMPLER BETWEEN 19.4 AND 19.7 FT.

20.7 TO 21.3 FT POORLY GRADED SAND WITH SILT (SP-SM): ABOUT 90% PREDOMINATELY FINE SAND, TRACE MEDIUM SAND; ABOUT 10% FINES WITH NO PLASTICITY, NO DRY STRENGTH, AND RAPID DILATANCY; MAXIMUM SIZE, MEDIUM SAND; NO REACTION WITH HCl, DRY, LIGHT BROWN IN COLOR.

21.3 TO 21.6 FT LEAN CLAY WITH SAND (CL)s: ABOUT 85% FINES WITH MEDIUM PLASTICITY, MEDIUM DRY STRENGTH, AND MEDIUM TOUGHNESS; ABOUT 15% FINE SAND; STRONG REACTION WITH HCl, INTERMITTENT CALCITE NODULES GREY IN COLOR.

21.6 TO 28.2 FT SILTY SAND (SM): ABOUT 85% FINE SAND; ABOUT 15% NONPLASTIC FINES WITH RAPID DILATANCY, AND NO DRY STRENGTH; BROWN IN COLOR, NO REACTION WITH HCl.

28.2 TO 30.3 FT POORLY GRADED SAND WITH SILT (SP-SM): ABOUT 90% PREDOMINATELY FINE SAND, TRACE MEDIUM SAND AND FINE GRAVEL; ABOUT 10% FINES WITH NO PLASTICITY, NO DRY STRENGTH, AND RAPID DILATANCY; MAXIMUM SIZE, 10MM; NO REACTION WITH HCL, DRY, LOOSE, LIGHT BROWN IN COLOR.

30.3 TO 30.6 FT LEAN CLAY WITH SAND (CL)s: ABOUT 85% FINES WITH MEDIUM PLASTICITY, MEDIUM DRY STRENGTH, AND MEDIUM TOUGHNESS; ABOUT 15% FINE SAND; STRONG REACTION WITH HCl, INTERMITTENT CALCITE NODULES GREY IN COLOR.

30.6 TO 34.4 FT POORLY GRADED SAND WITH SILT (SP-SM): ABOUT 90%

COMMENTS:

ALL ANGLES MEASURED FROM CORE AXIS AT ZERO DEGREES, UNLESS OTHERWISE NOTED.
THE DATA FOR THE CENTER COLUMN AND"CLASSIFICATION AND PHYSICAL CONDITIONS" COLUMN ARE BASED ON BUREAU OF RECLAMATION GEOLOGY FIELD MANUAL AND DRAWINGS TITLED FOR DESIGNS AND SPECIFICATIONS AS FOLLOWS- DRAWING NO. 40-D-6493. STANDARD DESCRIPTIONS AND DESCRIPTIVE CRITERIA FOR ROCK. DRAWING NO. 40-D-6499. STANDARD DESCRIPTORS AND DESCRIPTIVE CRITERIA FOR DISCONTINUITIES.

GEOLOGIC LOG OF DRILL HOLE NO. DHRT2-1 (OLD LOCATION)

SHEET 2 OF 2

FEATURE: REACH 22B
LOCATION: REGULATING TANK 2 (OLD LOCATION)
BEGUN: 8/23/14 FINISHED: 8/23/14
DEPTH OF WATER LEVEL:
DATE MEASURED:

PROJECT: NAVAJO GALLUP WATER SUPPLY PROJECT
COORDINATES: N 1,974,068.0 E 2,735,796.0
TOTAL DEPTH: 60.0
DEPTH TO BEDROCK: 49.2

STATE: NEW MEXICO
GROUND ELEVATION: 6629.3
ANGLE FROM HORIZONTAL: 90
HOLE LOGGED BY: C. BEYER
REVIEWED BY:

NOTES	DEPTH	% CORE RECOVERY	LABORATORY DATA: % FINES	% SAND	% GRAVEL	LIQUID LIMIT	PLASTICITY INDEX	MOISTURE CONTENT	LABORATORY CLASSIFICATION	BLOWS / 0.5 FT	GEOLOGIC UNIT SYMBOL	VISUAL CLASSIFICATION / ELEVATION	CLASSIFICATION AND PHYSICAL CONDITION
												6629.0	
												(CL)s 6598.7	PREDOMINATELY FINE SAND, TRACE MEDIUM SAND; ABOUT 10% FINES WITH NO PLASTICITY, NO DRY STRENGTH, AND RAPID DILATANCY; MAXIMUM SIZE, MEDIUM SAND; NO REACTION WITH HCL, DRY, LOOSE, LIGHT BROWN IN COLOR.
		88										SP-SM	
			23.9	76.1	0	NA	NP	2.7	SM	6/11/17			34.4 TO 35.1 FT LEAN CLAY WITH SAND (CL)s: ABOUT 85% FINES WITH MEDIUM PLASTICITY, MEDIUM DRY STRENGTH, AND MEDIUM TOUGHNESS; ABOUT 15% FINE SAND; DRY, STRONG REACTION WITH HCl, INTERMITTENT CALCITE NODULES GREY IN COLOR.
			79.3	20.7	0	47.4	31.2	12.4	(CL)s			6594.9	
	35											(CL)s 6594.2	
		92										SC	35.1 TO 37.8 FT CLAYEY SAND (SC): ABOUT 85% FINE SAND; ABOUT 15% FINES WITH LOW PLASTICITY, LOW DRY STRENGTH, AND LOW TOUGHNESS; DRY, STRONG REACTION WITH HCl, BROWN IN COLOR.
												6591.5	
												SS BOULDER	37.8 TO 39.5 FT SANDSTONE BOULDER: FINE TO MEDIUM GRAINED, SOFT (H6), MODERATELY TO INTENSELY WEATHERED (W6), TAN TO BROWN IN COLOR, NO REACTION WITH HCl. SAMPLE PULVERIZED BY AUGER AND SPT SAMPLER.
			19.4	80.6	0	NA	NP	2	SM	38/19/9		6589.8	
	40										QaL		
		72										SP	39.5 TO 43.5 POORLY GRADED SAND (SP): ABOUT 95% FINE TO MEDIUM SAND, TRACE COARSE SAND; ABOUT 5% FINES WITH NO PLASTICITY, AND NO DRY STRENGTH; NO REACTION WITH HCl LOOSELY CONSOLIDATED.
												6585.8	
			10.3	72.0	17.7	NA	NP	2.2	(SP-SM)g	5/4/9			43.5 TO 49.2 FT POORLY GRADED SAND WITH SILT AND GRAVEL (SP-SM)g: ABOUT 75% FINE TO MEDIUM SAND; ABOUT 15% FINE TO COARSE GRAVEL; ABOUT 10% NONPLASTIC FINES WITH RAPID DILATANCY AND NO DRY STRENGTH; MAXIMUM SIZE, 62MM; LOOSE CONSISTENCY; NO REACTION WITH HCl, BECOMES MOIST BELOW 48.5 FT.
	45												
		26										(SP-SM)g	
												6580.1	**49.2 - 60.0 FT TERTIARY NACIMIENTO FORMATION (TN)**
			14.9	69.1	16	NA	NP	3.3	SM	14/10/11			49.2 TO 60.0 FT SANDSTONE: FINE TO MEDIUM GRAINED, SOFT (H6), MODERATELY TO INTENSELY WEATHERED (W6), TAN TO GREY IN COLOR, MODERATELY TO THINLY BEDDED, NO REACTION WITH HCl, OCCASIONAL CARBONACEOUS INCLUSIONS, FeOx AND MnOx STAINING, CORE SEPARATES ALONG BEDDING PLANES AND DESTROYED BY AUGER.
	50												
		74											
			31.1	68.9	0	NA	NP	7.9	SM	26/50/REFUSAL			**STRATIGRAPHY:**
													0.0 - 49.2 FT: QUATERNARY ALLUVIUM (Qal)
											Tn		**49.2 - 60.0 FT: TERTIARY NACIMIENTO FORMATION (Tn)**
	55											SS	**ABBREVIATIONS:**
		84											**WLNE = WATER LEVEL NOT ENCOUNTERED**
													I.D. = INSIDE DIAMETER BNE = BEDROCK NOT ENCOUNTERED.
		100											
	60											6569.3	

BOTTOM OF HOLE

GEOLOGIC LOG OF DRILL HOLE NO. DHRT2-2 (OLD LOCATION)

SHEET 1 OF 2

FEATURE: REACH 22B
LOCATION: REGULATING TANK 2 (OLD LOCATION)
BEGUN: 1/21/15 FINISHED: 1/21/15
DEPTH OF WATER LEVEL:
DATE MEASURED:

PROJECT: NAVAJO GALLUP WATER SUPPLY PROJECT
COORDINATES: N 1,974,063.3 E 2,735,829.5
TOTAL DEPTH: 50.0
DEPTH TO BEDROCK: 46.2

STATE: NEW MEXICO
GROUND ELEVATION: 6628.4
ANGLE FROM HORIZONTAL: 90
HOLE LOGGED BY: J. GILBERT
REVIEWED BY:

NOTES

ALL MEASUREMENTS ARE FROM GROUND SURFACE AND ARE THE SAME AS THOSE USED BY THE DRILLER.

ALL MEASUREMENTS ARE REPORTED IN FEET EXCEPT WHERE NOTED.

DRILLED BY: U.C. REGION DRILL CREW; DRILLER; JEFF VAN AUSDAL, HELPERS; KYLE KILLEBREW, JOE PROCTOR.

PURPOSE:
PRECONSTRUCTION SOIL AND BEDROCK FOUNDATION INVESTIGATIONS.

DRILL EQUIPMENT:
CME 850 TRACK MOUNTED DRILL RIG

DRILL METHOD:
0.0 - 33.2 FT HOLLOW STEM AUGER
33.2 - 50.0 FT HQ3 WIRELINE CORING SYSTEM WITH A 3' SPLIT TUBE SAMPLER AND DIAMOND SURFACE-SET BIT.

CASING RECORD:
NONE USED

DRILLING MEDIUM:
0.0 - 33.2 FT, NONE USED
33.2 - 50.0 FT, WATER

HOLE COMPLETION:
BACKFILLED WITH DRILL CUTTINGS

DEPTH	% CORE RECOVERY	LABORATORY DATA: % FINES	% SAND	% GRAVEL	LIQUID LIMIT	PLASTICITY INDEX	MOISTURE CONTENT	LABORATORY CLASSIFICATION	BLOWS / 0.5 FT	GEOLOGIC UNIT SYMBOL	VISUAL CLASSIFICATION / ELEVATION
		17.0	83.0	0	NA	NP	2.2	SM	4/4/5		SM
5											
		12.2	87.8	0	NA	NP	2.9	SM	4/6/8		
											6620.2
		29.7	70.3	0	NA	NP	5.6	SM	16/21/16		SC
10											6617.7
		18.3	81.7	0	NA	NP	2.6	SM	9/13/17		SP-SM 6617.1
											SP
		17.0	83.0	0	NA	NP	2.5	SM	13/19/21		6614.3
15											
		45.2	53.9	0.9	22.2	5.2	5.8	SC-SM	15/15/15		
		63.5	36.5	0	31.4	14.4	7.9	s(CL)	11/18/19		SC
20											
											6605.2
		NA	NA	0	55.1	34.2	NA	CH	11/12/15	Qal	CH
25											6602.1
		21.5	78.5	0	NA	NP	2.9	SM			SC
											6600.2
									11/11/11		SP-SM
30											6598.0
									REFUSAL		
35											
											SP-SM
40											
	70										
45											6582.2
	100									Tn	SS
											6578.4

CLASSIFICATION AND PHYSICAL CONDITION

0.0-46.2 FT QUATERNARY ALLUVIUM (Qal)

0.0-8.2 FT SILTY SAND (SM) : ABOUT 80% FINE SAND, MAXIMUM SIZE, FINE SAND; ABOUT 20%FINES WITH NO PLASTICITY, RAPID DILATENCY, LOW DRY STRENGTH, LOW TOUGHNESS; DRY, TAN IN COLOR; NO REACTION WITH HCl.

8.2 - 10.7 FT CLAYEY SAND (SC): ABOUT 80% PREDOMINATELY FINE SAND; ABOUT 20% FINES WITH LOW PLASTICITY, LOW DRY STENGTH, LOW TOUGHNESS AND SLOW DILATANCY; MAXUMUM SIZE, FINE SAND, DARK BROWN IN COLOR, MOIST; NO REACTION WITH HCl.

10.7 TO 11.3 FT POORLY GRADED SAND WITH SILT (SP-SM): ABOUT 90% PREDOMINATELY FINE SAND, TRACE MEDIUM SAND AND FINE GRAVEL; ABOUT 10% FINES WITH NO PLASTICITY, NO DRY STRENGTH, AND RAPID DILATANCY; MAXIMUM SIZE, 10MM; NO REACTION WITH HCL, DRY, LOOSE, LIGHT BROWN IN COLOR.

11.3 - 14.1 FT POORLY GRADED SAND (SP): ABOUT 95% FINE TO MEDIUM SAND, TRACE COARSE SAND; ABOUT 5% FINES WITH NO PLASTICITY, AND NO DRY STRENGTH; NO REACTION WITH HCl LOOSELY CONSOLIDATED, BECOMES MOIST BELOW 48.5 FT.

14.1 - 23.2 FT CLAYEY SAND (SC): ABOUT 80% PREDOMINATELY FINE SAND; ABOUT 20% FINES WITH LOW PLASTICITY, LOW DRY STENGTH, LOW TOUGHNESS AND SLOW DILATANCY; MAXUMUM SIZE, FINE SAND, DARK BROWN IN COLOR, MOIST; NO REACTION WITH HCl.

23.2 - 26.3 FT FAT CLAY (CH): ABOUT 90% FINES WITH HIGH PLASTICITY, HIGH TO VERY HIGH DRY STRENGTH, HIGH TOUGHNESS; ABOUT 10% MEDIUM TO FINE SAND; MAXIMUM SIZE MEDIUM SAND; NO REACTIO WITH HCl.

26.3 - 28.2 FT CLAYEY SAND (SC): ABOUT 85% PREDOMINATELY FINE SAND; ABOUT 15% FINES WITH LOW PLASTICITY, LOW DRY STENGTH, LOW TOUGHNESS AND SLOW DILATANCY; MAXUMUM SIZE, FINE SAND, DARK BROWN IN COLOR, MOIST; NO REACTION WITH HCl.

28.2 - 46.2 FT POORLY GRADED SAND WITH SILT (SP-SM): ABOUT 90% PREDOMINATELY FINE SAND, TRACE OF GRAVEL; ABOUT 10% FINES WITH NO PLASTICITY, NO DRY STRENGTH, AND RAPID DILATANCY; MAXIMUM SIZE, 80MM; NO REACTION WITH HCL, DRY, LOOSE, LIGHT BROWN IN COLOR.

46.2 - 50.0 FT TERTIARY NACIMIENTO FORMATION (Tn)

46.2 - 50.0 FT SANDSTONE: INTENSELEY WEATHERED (W8), VERY SOFT TO SOFT (H7), TAN IN COLOR; , VERY INTENSELY WEATHERED TO DECOMPOSED (W8-W9), VERY SOFT TO SOFT (H7); NO REACTION WITH HCl.

COMMENTS:

ALL ANGLES MEASURED FROM CORE AXIS AT ZERO DEGREES, UNLESS OTHERWISE NOTED.
THE DATA FOR THE CENTER COLUMN AND"CLASSIFICATION AND PHYSICAL CONDITIONS" COLUMN ARE BASED ON BUREAU OF RECLAMATION GEOLOGY FIELD MANUAL AND DRAWINGS TITLED FOR DESIGNS AND SPECIFICATIONS AS FOLLOWS- DRAWING NO. 40-D-6493. STANDARD DESCRIPTIONS AND DESCRIPTIVE CRITERIA FOR ROCK. DRAWING NO. 40-D-6499. STANDARD DESCRIPTORS AND DESCRIPTIVE CRITERIA FOR DISCONTINUITIES.

GEOLOGIC LOG OF DRILL HOLE NO. DHRT2-2 (OLD LOCATION)

FEATURE: REACH 22B
LOCATION: REGULATING TANK 2 (OLD LOCATION)
BEGUN: 1/21/15 FINISHED: 1/21/15
DEPTH OF WATER LEVEL:
DATE MEASURED:

PROJECT: NAVAJO GALLUP WATER SUPPLY PROJECT
COORDINATES: N 1,974,063.3 E 2,735,829.5
TOTAL DEPTH: 50.0
DEPTH TO BEDROCK: 46.2

STATE: NEW MEXICO
GROUND ELEVATION: 6628.4
ANGLE FROM HORIZONTAL: 90
HOLE LOGGED BY: J. GILBERT
REVIEWED BY:

NOTES	DEPTH	% CORE RECOVERY	LABORATORY DATA						LABORATORY CLASSIFICATION	BLOWS / 0.5 FT	GEOLOGIC UNIT SYMBOL	VISUAL CLASSIFICATION / ELEVATION	CLASSIFICATION AND PHYSICAL CONDITION
			% FINES	% SAND	% GRAVEL	LIQUID LIMIT	PLASTICITY INDEX	MOISTURE CONTENT					
													BOTTOM OF HOLE

STRATIGRAPHY:
0.0 - 46.2 FT: QUATERNARY ALLUVIUM (Qal)
46.2 - 50.0 FT: TERTIARY NACIMIENTO FORMATION (Tn)

ABBREVIATIONS:
WLNE = WATER LEVEL NOT ENCOUNTERED
I.D. = INSIDE DIAMETER BNE = BEDROCK NOT ENCOUNTERED.

7-1336-A (1-86)
Bureau of Reclamation

LOG OF TEST PIT NO. TPR22-52

SHEET 1 OF 1

FEATURE: Reach 22B
LOCATION:
COORDINATES: N 2,014,701 E 2,750,460
APPROXIMATE DIMENSIONS: 6.0' x 14.5'
DEPTH TO WATER: NE DATE:

PROJECT: Navajo Gallup Water Supply Project
GROUND ELEVATION: 6210.566
METHOD OF EXPLORATION: CASE 680L BACKHOE
LOGGED BY: C. BEYER
DATE EXCAVATED: 5/22/2013

DEPTH	CLASSIFICATION GROUP SYMBOL	CLASSIFICATION AND DESCRIPTION OF MATERIAL (SEE USBR 5000, 5005)	% PLUS 3 in (BY VOLUME) 3 - 5 in	5 - 12 in	PLUS 12 in
1–14	SM (visual) SP-SM (lab classif)	0.0 TO 14.5 FT SILTY SAND: About 75% fine sand; about 25% nonplastic fines with rapid dilatancy, no to low dry strength; maximum size, fine sand; strong reaction with HCl. IN-PLACE CONDITION: red/brown, dry in top 1.5 ft, becomes moist below 4.5 ft, intermittent calcite nodules, roots in top 3 ft. IN-PLACE UNIT WEIGHT AND MOISTURE FROM 6.0 TO 6.8 ft. Total: 97.8 lbs. / cu ft., 1.8 %. (90.7% compaction) LAB TEST DATA: 89.9% sand, 10.1% fines, LL= NP, PI= NP, SPG= NA Maximum dry density= 107.8 lbs. / cu ft., optimum water content= 13.5% Laboratory classification is: POORLY GRADED SAND WITH SILT BAG SAMPLE TAKEN at 10.0 ft for corrosion testing (two 2 quart bags) GEOLOGIC INTERPRETATION: Quaternary Alluvium (Qal)			
7	In-Place Density taken at 6.0 ft.				
14	14.5 ft (6196.1)				

COMMENTS: SURFACE VEGETATED WITH SAGE BRUSH AND GRASS. DISCONTINUED DUE TO LIMIT OF EQUIPMENT.

7-1336-A (1-86)
Bureau of Reclamation

LOG OF TEST PIT NO. TPR22-54

SHEET 1 OF 1

FEATURE: Reach 22B
LOCATION:
COORDINATES: N 2,012,451 E 2,750,167
APPROXIMATE DIMENSIONS: 6.0' x 14.0'
DEPTH TO WATER: NE DATE:

PROJECT: Navajo Gallup Water Supply Project
GROUND ELEVATION: 6205.273
METHOD OF EXPLORATION: CASE 680L BACKHOE
LOGGED BY: C. BEYER
DATE EXCAVATED: 5/22/2013

DEPTH	CLASSIFICATION GROUP SYMBOL	CLASSIFICATION AND DESCRIPTION OF MATERIAL (SEE USBR 5000, 5005)	% PLUS 3 in (BY VOLUME) 3 - 5 in	5 - 12 in	PLUS 12 in
0	SM	0.0 TO 14.5 FT SILTY SAND: About 75% fine sand; about 25% nonplastic fines with rapid dilatancy, no to low dry strength; maximum size, fine sand; strong reaction with HCl.			
1		IN-PLACE CONDITION: Red/brown, dry, roots in top 3 ft.			
2					
3		IN-PLACE UNIT WEIGHT AND MOISTURE FROM 6.0 TO 6.8 ft. Total: 99.2 lbs. / cu ft., 2.5%.(90.2% compaction) LAB TEST DATA: 81.4% sand, 18.6% fines, LL= NP, PI= NP, SPG= NA Maximum dry density= 110.0 lbs. / cu ft., optimum water content= 11.4% Laboratory classification is: SILTY SAND			
4					
5		GEOLOGIC INTERPRETATION: Quaternary Alluvium (Qal)			
6					
7	In-Place Density taken at 6.0 ft.				
8					
9					
10					
11					
12					
13					
14					
	14.5 ft (6190.8)				

COMMENTS: SURFACE VEGETATED WITH SAGE BRUSH AND GRASS. DISCONTINUED DUE TO LIMIT OF EQUIPMENT.

7-1336-A (1-86)
Bureau of Reclamation

LOG OF TEST PIT NO. TPR22-55

SHEET 1 OF 1

FEATURE: Reach 22B
LOCATION:
COORDINATES: N 2,011,057 E 2,749,832
APPROXIMATE DIMENSIONS: 6.0' x 14.0'
DEPTH TO WATER: NE DATE:

PROJECT: Navajo Gallup Water Supply Project
GROUND ELEVATION: 6204.497
METHOD OF EXPLORATION: CASE 680L BACKHOE
LOGGED BY: C. BEYER
DATE EXCAVATED: 5/23/2013

DEPTH	CLASSIFICATION GROUP SYMBOL	CLASSIFICATION AND DESCRIPTION OF MATERIAL (SEE USBR 5000, 5005)	% PLUS 3 in (BY VOLUME) 3 - 5 in	5 - 12 in	PLUS 12 in
1–6	SM	0.0 TO 7.1 FT SILTY SAND: About 75% fine sand; about 25% nonplastic fines with rapid dilatancy, no to low dry strength; maximum size, fine sand; strong reaction with HCl. IN-PLACE CONDITION: Red/brown, dry, moist between 0.3 and 1.2 ft, roots in top 3.0 ft. IN-PLACE UNIT WEIGHT AND MOISTURE FROM 6.0 TO 6.8 ft. Total: 96.4 lbs. / cu ft., 2.8 %.(NA% compaction) LAB TEST DATA: 88.1% sand, 11.9% fines, LL=, PI= NP, SPG= Maximum dry density= 110.9 lbs. / cu ft., optimum water content= 11.0% Laboratory classification is: SILTY SAND			
3–5	In-Place Density taken at 6.0 ft.				
7	7.1 ft (6197.4)				
7–8	SC	GEOLOGIC INTERPRETATION: Quaternary Alluvium (Qal) 7.1 to 8.3 FT CLAYEY SAND: About 50% fine sand; about 50% fines with medium plasticity, medium dry strength, and medium toughness; strong reaction with HCl. IN-PLACE CONDITION: grey/brown, dry, calcite nodules, roots casts. IN-PLACE UNIT WEIGHT AND MOISTURE FROM 6.0 TO 6.8 ft. Total: NA lbs. / cu ft., 2.8 %.(NA% compaction) LAB TEST DATA: 44.4% sand, 55.6% fines, LL= 27.5, PI= 12.8 NP, SPG= NA Maximum dry density= NA lbs. / cu ft., optimum water content= NA% Laboratory classification is: SANDY LEAN CLAY			
8	8.3 ft (6196.2)				
8–14	SM	GEOLOGIC INTERPRETATION: Quaternary Alluvium (Qal) 8.3 to 14.0 FT SILTY SAND: About 75% fine sand; about 25% nonplastic fines with rapid dilatancy, no to low dry strength; maximum size, fine sand; strong reaction with HCl. IN-PLACE CONDITION: red/brown, dry. GEOLOGIC INTERPRETATION: Quaternary Alluvium (Qal)			
14	14.0 ft (6190.5)				

COMMENTS: SURFACE VEGETATED WITH SAGE BRUSH AND GRASS. DISCONTINUED DUE TO LIMIT OF EQUIPMENT.

7-1336-A (1-86)
Bureau of Reclamation

LOG OF TEST PIT NO. TPR22-56

SHEET 1 OF 1

FEATURE: Reach 22B
LOCATION:
COORDINATES: N 2,010,170 E 2,749,620
APPROXIMATE DIMENSIONS: 6.0' x 14.0'
DEPTH TO WATER: NE DATE:

PROJECT: Navajo Gallup Water Supply Project
GROUND ELEVATION: 6205.753
METHOD OF EXPLORATION: CASE 680L BACKHOE
LOGGED BY: C. BEYER
DATE EXCAVATED: 5/23/2013

DEPTH	CLASSIFICATION GROUP SYMBOL	CLASSIFICATION AND DESCRIPTION OF MATERIAL (SEE USBR 5000, 5005)	% PLUS 3 in (BY VOLUME) 3 - 5 in	5 - 12 in	PLUS 12 in
1–14	SM	0.0 TO 14.0 FT SILTY SAND: About 75% fine sand; about 25% nonplastic fines with rapid dilatancy, no dry strength; maximum size, fine sand; strong reaction with HCl. IN-PLACE CONDITION: red/brown, dry, calcite nodules and calcite cemented zones, roots in top 3.0 ft. IN-PLACE UNIT WEIGHT AND MOISTURE FROM 6.0 FT. Total: 97.7lbs. / cu ft., 2.7%.(94.1% relative compaction) LAB TEST DATA: 83.8% sand, 16.2% fines, LL= NP, PI=NP, SPG= NA Maximum dry density= 103.8 lbs. / cu ft., optimum water content= 14.4% Laboratory classification is: SILTY SAND GEOLOGIC INTERPRETATION: Quaternary Alluvium (Qal)			
7	In-Place Density taken at 6.0 ft.				
14	14.0 ft (6191.8)				

COMMENTS: SURFACE VEGETATED WITH SAGE BRUSH AND GRASS. DISCONTINUED DUE TO LIMIT OF EQUIPMENT.

7-1336-A (1-86)
Bureau of Reclamation

LOG OF TEST PIT NO. TPR22-58

SHEET 1 OF 1

FEATURE: Reach 22B
LOCATION: STATION 22710+04.61, 4.3' Left
COORDINATES: N 2,007,231 E 2,749,018
APPROXIMATE DIMENSIONS: 6.0' x 14.0'
DEPTH TO WATER: NE DATE: 8/1/2012

PROJECT: Navajo Gallup Water Supply Project
GROUND ELEVATION: 6137.9
METHOD OF EXPLORATION: CASE 580N BACKHOE
LOGGED BY: P. GARDNER
DATE EXCAVATED: 8/1/2012

DEPTH	CLASSIFICATION GROUP SYMBOL	CLASSIFICATION AND DESCRIPTION OF MATERIAL (SEE USBR 5000, 5005)	% PLUS 3 in (BY VOLUME) 3 - 5 in	5 - 12 in	PLUS 12 in
1	(SP-SM)	0.0 to 14.0 ft POORLY GRADED SAND WITH SILT: About 90% fine to medium sand; about 5% non-plastic fines, no dry strength, rapid dilatancy; about 5% fine to coarse, soft to hard, rounded to angular gravel; trace of hard, subangular to subrounded cobbles and boulders; maximum size, 400 mm; no reaction with HCl. IN-PLACE CONDITION: Gray to dark brown, surface dry becoming moist at 0.2 ft. IN-PLACE UNIT WEIGHT AND MOISTURE FROM 4.0 TO 4.5 ft. Total: 102.0 lbs. / cu ft., 5.6 %. (89.8% compaction) LAB TEST DATA: 88.8% sand, 8.3% fines, 2.8% gravel, LL= N/A, PI= N/P, SPG= 2.67 Maximum dry density= 113.5 lbs. / cu ft., optimum water content= 11.8% Laboratory classification is: POORLY GRADED SAND WITH SILT.	tr	tr	tr
6	In-Place Density taken at 4.0 ft. 50 lb sample taken at 4.0 ft.	GEOLOGIC INTERPRETATION: Quaternary Alluvium (Qal)			
14	14.0 ft (6123.9)				

COMMENTS: SURFACE FREE OF VEGETATION. TEST PIT PERFORMED IN ARROYO. EXCAVATION DISCONTINUED DUE TO LIMIT OF EQUIPMENT. TEST PIT SLOUGHING OCCURRED AFTER EXCAVATION TO 14.0 ft.

7-1336-A (1-86)
Bureau of Reclamation

LOG OF TEST PIT NO. TPR22-59

SHEET 1 OF 1

FEATURE: Reach 22B
LOCATION: STATION 22721+45.02, 4.2' Left
COORDINATES: N 2,006,175 E 2,748,670
APPROXIMATE DIMENSIONS: 6.0' x 13.0'
DEPTH TO WATER: NE DATE: 8/1/2012

PROJECT: Navajo Gallup Water Supply Project
GROUND ELEVATION: 6155.8
METHOD OF EXPLORATION: CASE 580N BACKHOE
LOGGED BY: P. GARDNER
DATE EXCAVATED: 8/1/2012

DEPTH	CLASSIFICATION GROUP SYMBOL	CLASSIFICATION AND DESCRIPTION OF MATERIAL (SEE USBR 5000, 5005)	% PLUS 3 in (BY VOLUME) 3 - 5 in	5 - 12 in	PLUS 12 in
1	SM	0.0 to 10.5 ft SILTY SAND: About 85% fine sand; about 15% non-plastic fines with no dry strength, rapid dilatancy; maximum size, fine sand; no reaction with HCl. IN-PLACE CONDITION: Dry, tan, roots present up to 8 ft. IN-PLACE UNIT WEIGHT AND MOISTURE FROM 4.0 TO 4.5 ft. Total: 93.9 lbs. / cu ft., 2.0%. (89.8% compaction) LAB TEST DATA: 81.6% sand, 18.4% fines, LL= N/A, PI= N/P, SPG= 2.62 Maximum dry density= 104.6lbs. / cu ft., optimum water content= 14.3% Laboratory classification is SILTY SAND			
5	In-Place Density taken at 4.0 ft. 50 lb sample taken at 4.0 ft.	GEOLOGIC INTERPRETATION: Quaternary Alluvium (Qal)			
10	10.5 ft (6145.3)				
11	SC	10.5 to 13.0 ft CLAYEY SAND: About 55% fine to medium sand; about 45% medium plastic fines with medium dry strength, no dilatancy, medium toughness; trace of 2-3 inch, fat clay clasts present; maximum size, medium sand; weak reaction with HCl. IN-PLACE CONDITION: Dry, light brown.			
13	13.0 ft (6142.8)	GEOLOGIC INTERPRETATION: Quaternary Alluvium (Qal)			

COMMENTS: SURFACE VEGETATION CONSISTS OF SAGE, GRASSES AND GREASEWOOD. TOP 1 ft OF THE SOUTHEAST CORNER OF TEST PIT CONTAINED DISTURBED, MISCELLANEOUS s(CL) WELL PAD FILL MATERIAL. HOLE TERMINATED DUE TO LIMIT OF EQUIPMENT.

7-1336-A (1-86)
Bureau of Reclamation

LOG OF TEST PIT NO. TPR22-60

SHEET 1 OF 1

FEATURE: Reach 22B
PROJECT: Navajo Gallup Water Supply Project
LOCATION: STATION 22734+16.50, 27.3' Left
GROUND ELEVATION: 6175.9
COORDINATES: N 2,004,935 E 2,748,391
METHOD OF EXPLORATION: CASE 580N BACKHOE
APPROXIMATE DIMENSIONS: 6.0' x 13.6'
LOGGED BY: P. GARDNER
DEPTH TO WATER: NE DATE: 8/1/2012
DATE EXCAVATED: 8/1/2012

DEPTH	CLASSIFICATION GROUP SYMBOL	CLASSIFICATION AND DESCRIPTION OF MATERIAL (SEE USBR 5000, 5005)	% PLUS 3 in (BY VOLUME) 3 - 5 in	5 - 12 in	PLUS 12 in
1 2 3	SP	0.0 to 3.0 ft POORLY GRADED SAND: About 95% fine to medium sand; about 5% non-plastic fines with no dry strength, rapid dilatancy; maximum size, medium sand; no reaction with HCl. IN-PLACE CONDITION: Light to dark brown, dry, weak cementation, roots in top 1.5 ft.			
3.0 ft (6172.9)		GEOLOGIC INTERPRETATION: Quaternary Alluvium (Qal)			
4 5 6 7	SM	3.0 to 13.6 ft SILTY SAND: About 80% fine to medium sand; about 20% non-plastic fines with no dry strength, rapid dilatancy; maximum size, medium sand; no reaction with HCl. IN-PLACE CONDITION: Light to dark brown, dry, weak cementation, thin lenses of SP pinching laterally throughout. IN-PLACE UNIT WEIGHT AND MOISTURE FROM 4.0 TO 4.5 ft. Total: 101.6 lbs. / cu ft., 2.4 %.(88.9% compaction) LAB TEST DATA: 87.7% sand, 12.3% fines, LL= N/A, PI= N/P, SPG= 2.66 Maximum dry density= 114.2 lbs. / cu ft., optimum water content= 11.5% Laboratory classification is SILTY SAND			
8 9 10 11 12 13	In-Place Density taken at 4.0 ft, 50 lb sample taken at 4.0 ft	GEOLOGIC INTERPRETATION: Quaternary Alluvium (Qal)			
13.6 ft (6162.3)					

COMMENTS: SURFACE VEGETATION CONSISTS OF SAGE, GRASSES AND GREASEWOOD. HOLE TERMINATED DUE TO LIMIT OF EQUIPMENT.

7-1336-A (1-86)
Bureau of Reclamation

LOG OF TEST PIT NO. TPR22-63

SHEET 1 OF 1

FEATURE: Reach 22B
LOCATION: STATION 22769+32.06, 3.4' Left
COORDINATES: N 2,001,527 E 2,747,534
APPROXIMATE DIMENSIONS: 6.0' x 13.0'
DEPTH TO WATER: NE DATE: 7/31/2012

PROJECT: Navajo Gallup Water Supply Project
GROUND ELEVATION: 6267.0
METHOD OF EXPLORATION: CASE 580N BACKHOE
LOGGED BY: P. GARDNER
DATE EXCAVATED: 7/31/2012

DEPTH	CLASSIFICATION GROUP SYMBOL	CLASSIFICATION AND DESCRIPTION OF MATERIAL (SEE USBR 5000, 5005)	% PLUS 3 in (BY VOLUME) 3 - 5 in	5 - 12 in	PLUS 12 in
1–5	SM	0.0 to 13.0 ft SILTY SAND: About 75% fine sand; about 25% non-plastic fines with no dry strength, rapid dilatancy; maximum size, medium sand; no reaction with HCl. IN-PLACE CONDITION: Brown, dry, calcium carbonate veins and nodules with root casts, roots present in upper 4 ft. IN-PLACE UNIT WEIGHT AND MOISTURE FROM 4.0 TO 4.5 ft. Total: 103.9 lbs. / cu ft., 2.9 %. (90.2% compaction) LAB TEST DATA: 78.9% sand, 21.1% fines, LL= N/A, PI= N/P, SPG= 2.7 Maximum dry density= 115.1lbs. / cu ft., optimum water content= 10.5% Laboratory classification is: SILTY SAND GEOLOGIC INTERPRETATION: Quaternary Alluvium (Qal)			
6–7	In-Place Density taken at 4.0 ft. 50 lb sample taken at 4.0 ft.				
8–12					
13	13.0 ft (6254.0)				

COMMENTS: SURFACE VEGETATION CONSISTS OF SAGE AND GRASS. HOLE TERMINATED DUE TO LIMIT OF EQUIPMENT.

7-1336-A (1-86)
Bureau of Reclamation

LOG OF TEST PIT NO. TPR22-64

SHEET 1 OF 1

FEATURE: Reach 22B
PROJECT: Navajo Gallup Water Supply Project
LOCATION: STATION 22783+10.59, 1.5' Right
GROUND ELEVATION: 6271.7
COORDINATES: N 2,000,196 E 2,747,191
METHOD OF EXPLORATION: CASE 580N BACKHOE
APPROXIMATE DIMENSIONS: 6.0' x 13.8'
LOGGED BY: P. GARDNER
DEPTH TO WATER: NE DATE: 7/31/2012
DATE EXCAVATED: 7/31/2012

DEPTH	CLASSIFICATION GROUP SYMBOL	CLASSIFICATION AND DESCRIPTION OF MATERIAL (SEE USBR 5000, 5005)	% PLUS 3 in (BY VOLUME) 3 - 5 in	5 - 12 in	PLUS 12 in
0	SM	0.0 to 4.0 ft SILTY SAND: About 75% fine to medium sand; about 25% non-plastic fines with medium dry strength, rapid dilatancy; maximum size, fine sand; strong reaction with HCl. IN-PLACE CONDITION: Light to dark brown, dry, trace of calcium carbonate nodules(small) and veins, roots in top 2.0 ft, root casts to 4.0 ft, weak cementation. GEOLOGIC INTERPRETATION: Quaternary Alluvium (Qal)			
4.0 ft (6267.7)					
4	SC (visual)	4.0 to 5.3 ft CLAYEY SAND: About 65% fine sand; about 35% low to medium plastic fines with high dry strength, no dilatancy, low toughness; maximum size, fine sand; strong reaction with HCl.			
5.3 ft (6266.4)					
6	SM	IN-PLACE CONDITION: Light brown, dry, blocky chunks, hard consistency, calcium carbonate veins. IN-PLACE UNIT WEIGHT AND MOISTURE FROM 4.0 TO 4.5 ft. Total: 97.0 lbs. / cu ft., 5.9 %.(86.3% compaction) LAB TEST DATA: 31.8% sand, 68.2% fines, LL= 27.7, PI= 10.9, SPG= 2.75 Maximum dry density= 112.4 lbs. / cu ft., optimum water content=14.8% Laboratory classification is SANDY LEAN CLAY			
9	In-Place Density taken at 5.5 ft 50 lb sample taken at 5.5 ft.	GEOLOGIC INTERPRETATION: Quaternary Alluvium (Qal) 5.3 to 13.8 ft SILTY SAND: About 85% fine sand; about 15% non-plastic fines with low dry strength, slow dilatancy; maximum size, fine sand; strong reaction with HCl. IN-PLACE CONDITION: Tan to yellowish brown, dry, weak cementation becoming more cemented with depth, calcium carbonate veins. IN-PLACE UNIT WEIGHT AND MOISTURE FROM 5.5 TO 6.0 ft. Total: 98.4 lbs. / cu ft., 3.1 %.(92.4% compaction) LAB TEST DATA: 79.5 % sand, 20.5% fines, LL= N/A, PI= N/P, SPG= 2.67 Maximum dry density= 106.4 lbs. / cu ft., optimum water content= 13.4% Laboratory classification is SILTY SAND			
13					
13.8 ft (6257.9)		GEOLOGIC INTERPRETATION: Quaternary Alluvium (Qal)			

COMMENTS: SURFACE VEGETATION CONSISTS OF SAGE AND GRASS. HOLE TERMINATED DUE TO LIMIT OF EQUIPMENT.

7-1336-A (1-86)
Bureau of Reclamation

LOG OF TEST PIT NO. TPR22-66

SHEET 1 OF 1

FEATURE: Reach 22B
LOCATION: STATION 22806+72.73, 0.8' Right
COORDINATES: N 1,997,932 E 2,746,519
APPROXIMATE DIMENSIONS: 6.0' x 12.8'
DEPTH TO WATER: NE DATE: 7/31/2012

PROJECT: Navajo Gallup Water Supply Project
GROUND ELEVATION: 6291.7
METHOD OF EXPLORATION: CASE 580N BACKHOE
LOGGED BY: P. GARDNER
DATE EXCAVATED: 7/31/2012

DEPTH	CLASSIFICATION GROUP SYMBOL	CLASSIFICATION AND DESCRIPTION OF MATERIAL (SEE USBR 5000, 5005)	% PLUS 3 in (BY VOLUME) 3 - 5 in	5 - 12 in	PLUS 12 in
1	SC	0.0 to 4.0 ft CLAYEY SAND: About 65% fine sand; about 35% medium plastic fines, high dry strength, no dilatancy, medium toughness; maximum size, fine sand; no reaction with HCl. IN-PLACE CONDITION: Brown, dry, trace of calcium carbonate veins and nodules, roots present in upper 1.5 ft., firm consistency. GEOLOGIC INTERPRETATION: Quaternary Alluvium (Qal)			
4	4.0 ft (6287.7)				
5	SM	4.0 to 9.0 ft SILTY SAND: About 80% predominantly fine sand; about 20% non-plastic fines, medium dry strength, rapid dilatancy; maximum size, medium sand; no reaction with HCl. IN-PLACE CONDITION: Light brown to tan, dry, calcium carbonate veins and nodules with root casts. Roots present in upper 4 ft. IN-PLACE UNIT WEIGHT AND MOISTURE FROM 4.0 TO 4.5 ft. Total: 101.8 lbs. / cu ft., 3.2 %.(91.8% compaction) LAB TEST DATA: 68.7% sand, 31.3% fines, LL= N/A, PI= N/P, SPG= 2.67 Maximum dry density= 110.9lbs. / cu ft., optimum water content= 13.0% Laboratory classification is SILTY SAND			
6	In-Place Density taken at 4.0 ft. 50 lb sample taken at 4.0 ft.				
9	9.0 ft (6282.7)	GEOLOGIC INTERPRETATION: Quaternary Alluvium (Qal)			
10	SC	9.0 to 12.8 ft CLAYEY SAND: About 60% predominantly fine sand; about 40% medium to high plastic fines, low to medium dry strength, no dilatancy, low toughness; maximum size, medium sand; strong reaction with HCl. IN-PLACE CONDITION: Tan to brown to gray, dry, calcium carbonate veins and nodules, roots present in upper 1.5 ft., iron oxide staining, clay lenses present. GEOLOGIC INTERPRETATION: Quaternary Alluvium (Qal)			
12	12.8 ft (6278.9)				

COMMENTS: SURFACE VEGETATED WITH SAGE AND GRASS. HOLE TERMINATED DUE TO LIMIT OF EQUIPMENT.

7-1336-A (1-86)
Bureau of Reclamation

LOG OF TEST PIT NO. TPR22-67

SHEET 1 OF 2

FEATURE: Reach 22B
PROJECT: Navajo Gallup Water Supply Project
LOCATION: STATION 22818+63.90, 16.9' Right
GROUND ELEVATION: 6314.9
COORDINATES: N 1,996,787 E 2,746,192
METHOD OF EXPLORATION: CASE 580N BACKHOE
APPROXIMATE DIMENSIONS: 6.0' x 13.5'
LOGGED BY: C. BEYER
DEPTH TO WATER: NE DATE: 7/30/2012
DATE EXCAVATED: 7/30/2012

DEPTH	CLASSIFICATION GROUP SYMBOL	CLASSIFICATION AND DESCRIPTION OF MATERIAL (SEE USBR 5000, 5005)	% PLUS 3 in (BY VOLUME) 3 - 5 in	5 - 12 in	PLUS 12 in
1–12	SM	0.0 to 12.0 ft SILTY SAND: About 75% fine sand; about 25% nonplastic fines with slow dilatancy, low dry strength, no toughness; maximum size, fine sand; strong reaction with HCl. IN-PLACE CONDITION: Brown to tan, dry, roots in top 1.5 ft, weakly to moderately cemented, recovered as 6 inch diameter clods. IN-PLACE UNIT WEIGHT AND MOISTURE FROM 4.0 TO 4.5 ft. Total: 104.0 lbs. / cu ft., 3.4 %.(92.6% compaction) LAB TEST DATA: 68.1% sand, 31.9 % fines, LL= N/A, PI= N/P, SPG= 2.68 Maximum dry density= 112.3lbs. / cu ft., optimum water content= 11.8% Laboratory classification is SILTY SAND GEOLOGIC INTERPRETATION: Quaternary Alluvium (Qal)			
5–6	In-Place Density taken at 4.0 ft. 50 lb sample taken at 4.0 ft.				
12	12.0 ft (6302.9)				
13	SP-SM 13.0 ft (6301.9) 13.5 ft (6301.4) SC	12.0 to 13.0 ft POORLY GRADED SAND WITH SILT: About 90% fine sand; about 10% nonplastic fines, rapid dilatancy, low dry strength, low toughness; maximum size, fine sand; no reaction with HCl IN-PLACE CONDITION: Yellowish-brown, dry moderately cemented. BAG SAMPLE FROM 12.0 TO 12.5 ft. LAB TEST DATA: 87.3% sand, 12.7% fines, LL= N/A, PI= N/P, SPG= 2.67 Laboratory classification is: SILTY SAND GEOLOGIC INTERPRETATION: Quaternary Alluvium (Qal) 13.0 to 13.5 ft CLAYEY SAND: About 50% fine sand; about 50% medium plastic fines, no dilatancy, medium dry strength, medium toughness; maximum size, fine sand; strong reaction with HCl. IN-PLACE CONDITION: Dark brown, dry, firm, lensed, intermittent calcite veins and nodules.			

COMMENTS: SURFACE VEGETATED WITH SAGE BRUSH AND GRASS. DISCONTINUED DUE TO LIMIT OF EQUIPMENT.

7-1336-A (1-86)
Bureau of Reclamation

LOG OF TEST PIT NO. TPR22-67

SHEET 2 OF 2

FEATURE: Reach 22B
PROJECT: Navajo Gallup Water Supply Project
LOCATION: STATION 22818+63.90, 16.9' Right
GROUND ELEVATION: 6314.9
COORDINATES: N 1,996,787 E 2,746,192
METHOD OF EXPLORATION: CASE 580N BACKHOE
APPROXIMATE DIMENSIONS: 6.0' x 13.5'
LOGGED BY: C. BEYER
DEPTH TO WATER: NE DATE: 7/30/2012
DATE EXCAVATED: 7/30/2012

DEPTH	CLASSIFICATION GROUP SYMBOL	CLASSIFICATION AND DESCRIPTION OF MATERIAL (SEE USBR 5000, 5005)	% PLUS 3 in (BY VOLUME)		
			3 - 5 in	5 - 12 in	PLUS 12 in
		GEOLOGIC INTERPRETATION: Quaternary Alluvium (Qal)			

COMMENTS:

7-1336-A (1-86)
Bureau of Reclamation

LOG OF TEST PIT NO. TPR22-68

SHEET 1 OF 2

FEATURE: Reach 22B
PROJECT: Navajo Gallup Water Supply Project
LOCATION: STATION 22828+24.22, 9.4' Right
GROUND ELEVATION: 6325.3
COORDINATES: N 1,995,831 E 2,746,098
METHOD OF EXPLORATION: CASE 580N BACKHOE
APPROXIMATE DIMENSIONS: 6.0' x 13.5'
LOGGED BY: C. BEYER
DEPTH TO WATER: NE DATE: 7/30/2012
DATE EXCAVATED: 7/30/2012

DEPTH	CLASSIFICATION GROUP SYMBOL	CLASSIFICATION AND DESCRIPTION OF MATERIAL (SEE USBR 5000, 5005)	% PLUS 3 in (BY VOLUME) 3 - 5 in	5 - 12 in	PLUS 12 in
1	s(CL)	0.0 to 2.0 ft SANDY LEAN CLAY: About 55% fines with medium to high plasticity, high toughness, medium to high dry strength; about 45% fine sand; maximum size, fine sand; no reaction with HCl. IN-PLACE CONDITION: Reddish brown, dry, intermittent calcite nodules. GEOLOGIC INTERPRETATION: Quaternary Alluvium (Qal)			
2	2.0 ft (6323.3)				
3	SM	2.0 to 9.2 ft SILTY SAND: About 80% fine sand; about 20% nonplastic fines with slow dilatancy, low dry strength; maximum size, fine sand; no reaction with HCl. IN-PLACE CONDITION: Brown, dry, becomes moist below 8.5 ft, weak cementation. IN-PLACE UNIT WEIGHT AND MOISTURE FROM 4.0 TO 4.5 ft. Total: 101.3 lbs. / cu ft., 3.2 %. (93.5% compaction) LAB TEST DATA: 73.8 % sand,26.1 % fines, LL= N/A, PI= N/P, SPG= 2.70 Maximum dry density= 108.3 lbs. / cu ft., optimum water content= 3.2% Laboratory classification is SILTY SAND GEOLOGIC INTERPRETATION: Quaternary Alluvium (Qal)			
4					
5	In-Place Density taken at 4.0 ft. 50 lb sample taken at 4.0 ft.				
6					
7					
8					
9	9.2 ft (6316.1)				

COMMENTS: SURFACE VEGETATED WITH SAGE BRUSH AND GRASS, TEST PIT GROUND SURFACE LOCATED IN A SLIGHT DEPRESSION WITH MORE THAN NORMAL LUSH VEGETATION. DISCONTINUED DUE TO LIMIT OF EQUIPMENT.

7-1336-A (1-86) Bureau of Reclamation	**LOG OF TEST PIT NO. TPR22-68**	SHEET 2 OF 2

FEATURE: Reach 22B
PROJECT: Navajo Gallup Water Supply Project
LOCATION: STATION 22828+24.22, 9.4' Right
GROUND ELEVATION: 6325.3
COORDINATES: N 1,995,831 E 2,746,098
METHOD OF EXPLORATION: CASE 580N BACKHOE
APPROXIMATE DIMENSIONS: 6.0' x 13.5'
LOGGED BY: C. BEYER
DEPTH TO WATER: NE DATE: 7/30/2012
DATE EXCAVATED: 7/30/2012

DEPTH	CLASSIFICATION GROUP SYMBOL	CLASSIFICATION AND DESCRIPTION OF MATERIAL (SEE USBR 5000, 5005)	% PLUS 3 in (BY VOLUME) 3 - 5 in	5 - 12 in	PLUS 12 in
	(CL)s	9.2 to 9.7 ft LEAN CLAY WITH SAND: About 75% fines with high plasticity, high toughness, high dry strength; About 35% fine sand; maximum size, fine sand, strong reaction with HCL.			
9.7 ft (6315.6)					
10	SC	IN-PLACE CONDITION: Dark grey, moist, firm, intermittent calcite veins and nodules.			
		BAG SAMPLE TAKEN FROM 9.2 TO 9.7 ft LAB TEST DATA: 25.1% sand, 74.9% fines, LL= 36.5, PI= 21.7, SPG= 2.73 Laboratory classification is LEAN CLAY WITH SAND			
11		GEOLOGIC INTERPRETATION: Quaternary Alluvium (Qal)			
		9.7 to 13.5 ft CLAYEY SAND: About 60% fine sand; about 40% fines with medium plasticity, no dilatancy, medium dry strength, medium toughness; maximum size, fine sand; no reaction with HCl, except on occasional small calcite nodules.			
12		IN-PLACE CONDITION: Grey, intermittent calcite nodules 5mm in diameter, moist.			
13					
13.5 ft (6311.8)		GEOLOGIC INTERPRETATION: Quaternary Alluvium (Qal)			

COMMENTS:

7-1336-A (1-86)
Bureau of Reclamation

LOG OF TEST PIT NO. TPR22-70

SHEET 1 OF 2

FEATURE: Reach 22B
PROJECT: Navajo Gallup Water Supply Project
LOCATION: STATION 22855+49.46, 8.5' Right
GROUND ELEVATION: 6370.2
COORDINATES: N 1,993,176 E 2,745,526
METHOD OF EXPLORATION: CASE 580N BACKHOE
APPROXIMATE DIMENSIONS: 6.0' x 13.3' x 15'
LOGGED BY: C. BEYER
DEPTH TO WATER: NE DATE: 7/30/2012
DATE EXCAVATED: 7/30/2012

DEPTH	CLASSIFICATION GROUP SYMBOL	CLASSIFICATION AND DESCRIPTION OF MATERIAL (SEE USBR 5000, 5005)	% PLUS 3 in (BY VOLUME) 3 - 5 in	5 - 12 in	PLUS 12 in
0	SM	0.0 to 0.9 ft SILTY SAND: About 70% fine sand; about 30% nonplastic fines with slow dilatancy, medium dry strength, no toughness; maximum size, fine sand; no reaction with HCl.			
0.9 ft (6369.3)	SM (visual) SP-SM (lab class)	IN-PLACE CONDITION: Reddish brown, dry, weak cementation, roots in top 1.0 ft.			
		GEOLOGIC INTERPRETATION: Quaternary Alluvium (Qal)			
		0.9 to 13.0 ft SILTY SAND: About 85% fine sand; about 15% nonplastic fines with slow dilatancy, medium dry strength, no toughness; maximum size, fine sand; no reaction with HCl, except in thin calcite cemented zone with a strong reaction with HCl.			
		IN-PLACE CONDITION: Reddish brown in color, dry, becomes moist below 11.0 ft, thin zones of calcite cement, weak cementation, roots in top 1.0 ft.			
		IN-PLACE UNIT WEIGHT AND MOISTURE FROM 4.0 TO 4.5 ft. Total: 96.8 lbs. / cu ft., 2.2 %.(93.6% compaction) LAB TEST DATA: 88.6% sand,11.4 % fines, LL= N/A, PI= N/P, SPG= 2.72 Maximum dry density= 103.4 lbs. / cu ft., optimum water content= 13.9% Laboratory classification is POORLY GRADED SAND WITH SILT			
	In-Place Density taken at 4.0 ft. 50 lb sample taken at 4.0 ft.				
		GEOLOGIC INTERPRETATION: Quaternary Alluvium (Qal)			
13.0 ft (6357.2)					

COMMENTS: SURFACE VEGETATED WITH SAGE BRUSH AND GRASS. DISCONTINUED DUE TO LIMIT OF EQUIPMENT.

7-1336-A (1-86)
Bureau of Reclamation

LOG OF TEST PIT NO. TPR22-70

SHEET 2 OF 2

FEATURE: Reach 22B
PROJECT: Navajo Gallup Water Supply Project
LOCATION: STATION 22855+49.46, 8.5' Right
GROUND ELEVATION: 6370.2
COORDINATES: N 1,993,176 E 2,745,526
METHOD OF EXPLORATION: CASE 580N BACKHOE
APPROXIMATE DIMENSIONS: 6.0' x 13.3' x 15'
LOGGED BY: C. BEYER
DEPTH TO WATER: NE DATE: 7/30/2012
DATE EXCAVATED: 7/30/2012

DEPTH	CLASSIFICATION GROUP SYMBOL	CLASSIFICATION AND DESCRIPTION OF MATERIAL (SEE USBR 5000, 5005)	% PLUS 3 in (BY VOLUME) 3 - 5 in	5 - 12 in	PLUS 12 in
13.3 ft (6356.9)	SC	13.0 to 13.3 ft CLAYEY SAND: About 65% fine sand; about 35% fines with medium plasticity, no dilatancy, medium dry strength, medium toughness; trace medium sand; maximum size, medium sand; strong reaction with HCl. IN-PLACE CONDITION: Brown, moist, root casts, moderately cemented, calcite cement, lensed. GEOLOGIC INTERPRETATION: Quaternary Alluvium (Qal)			

COMMENTS:

7-1336-A (1-86)
Bureau of Reclamation

LOG OF TEST PIT NO. TPR22-71

SHEET 1 OF 1

FEATURE: Reach 22B
PROJECT: Navajo Gallup Water Supply Project
LOCATION: STATION 22867+48.11, 1.7' Right
GROUND ELEVATION: 6395.2
COORDINATES: N 1,992,018 E 2,745,226
METHOD OF EXPLORATION: CASE 580N BACKHOE
APPROXIMATE DIMENSIONS: 6.0' x 10.3'
LOGGED BY: C. BEYER
DEPTH TO WATER: NE DATE: 7/30/2012
DATE EXCAVATED: 7/30/2012

DEPTH	CLASSIFICATION GROUP SYMBOL	CLASSIFICATION AND DESCRIPTION OF MATERIAL (SEE USBR 5000, 5005)	% PLUS 3 in (BY VOLUME) 3 - 5 in	5 - 12 in	PLUS 12 in
0	s(CL)	0.0 to 2.8 ft SANDY LEAN CLAY: About 60% fines with medium to high plasticity, high toughness, medium to high dry strength, no reaction with HCL; about 40% fine sand; maximum size, fine sand. IN-PLACE CONDITION: Brown, dry, roots in top 1.5 ft. GEOLOGIC INTERPRETATION: Quaternary Alluvium (Qal)			
2.8 ft (6392.4)	SM In-Place Density and 50 lb sample taken at 4.0 ft.	2.8 to 4.5 ft SILTY SAND: About 75% fine sand; about 25% nonplastic fines with slow dilatancy, medium dry strength, no toughness; maximum size, fine sand; no reaction with HCl. IN-PLACE CONDITION: Tan, dry, moderate cementation. IN-PLACE UNIT WEIGHT AND MOISTURE FROM 4.0 TO 4.5 ft. Total: 112.1lbs. / cu ft., 4.1 %.(95.2% compaction) LAB TEST DATA: 76.6% sand, 23.2% fines, LL= N/A, PI= N/P, SPG= 2.70 Maximum dry density= 117.8 lbs. / cu ft., optimum water content= 11.7% Laboratory classification is SILTY SAND GEOLOGIC INTERPRETATION: Quaternary Alluvium (Qal)			
4.5 ft (6390.7)	SANDSTONE	4.5 to 10.3 ft SANDSTONE: Fine to medium grained, soft (H6) to moderately soft (H5), moderately weathered (W5) to intensely to moderately weathered (W6), yellow to brown in color, FeOx staining, intermittent calcite cemented zones with strong reaction with HCl, No reaction with HCl outside calcite cemented zones. Occasional zones containing angular mud ripup clasts and heavy FeOx staining. GEOLOGIC INTERPRETATION: Tertiary Nacimiento Formation (Tn)			
10.3 ft (6384.9)					

COMMENTS: SURFACE VEGETATED WITH SAGE BRUSH AND GRASS. DISCONTINUED DUE TO REFUSAL ON BEDROCK.

7-1336-A (1-86)
Bureau of Reclamation

LOG OF TEST PIT NO. TPR22-72

SHEET 1 OF 1

FEATURE: Reach 22B
PROJECT: Navajo Gallup Water Supply Project
LOCATION: STATION 22878+45.53, 127.2' Left
GROUND ELEVATION: 6413.8
COORDINATES: N 1,991,167 E 2,744,521
METHOD OF EXPLORATION: CASE 580N BACKHOE
APPROXIMATE DIMENSIONS: 6.0' x 7.0'
LOGGED BY: C. BEYER
DEPTH TO WATER: NE DATE: 7/20/2012
DATE EXCAVATED: 7/20/2012

DEPTH	CLASSIFICATION GROUP SYMBOL	CLASSIFICATION AND DESCRIPTION OF MATERIAL (SEE USBR 5000, 5005)	% PLUS 3 in (BY VOLUME) 3 - 5 in	5 - 12 in	PLUS 12 in
1	SC	0.0 to 2.2 ft CLAYEY SAND: About 70% fine sand; about 30% fines with medium plasticity, no dilatancy, medium dry strength, medium toughness; maximum size, fine sand; weak reaction with HCl. IN-PLACE CONDITION: Tan, dry, roots in top 1.5 ft. GEOLOGIC INTERPRETATION: Quaternary Alluvium (Qal)			
2	2.2 ft (6411.6)				
3	SANDSTONE (visual) ML (lab class)	2.2 to 7.0 ft SANDSTONE: Fine to medium grained argillaceous sandstone, tan to yellow in color, decomposed (W9) to intensely weathered (W7); very soft (H7) to soft (H6); becomes moderately hard (H4) at 7.0 ft contains zones of white, argillaceous calcite cement, strong reaction with HCl. IN-PLACE UNIT WEIGHT AND MOISTURE FROM 4.0 TO 4.5 ft. Total: 93.8 lbs. / cu ft., 5.5%. (82.8 % compaction) LAB TEST DATA: 49.4% sand, 50.6 % fines, LL= N/A, PI= N/P, SPG= 2.7 Maximum dry density= 113.3 lbs. / cu ft., optimum water content= 13.7% Laboratory classification is SILT GEOLOGIC INTERPRETATION: Tertiary Nacimiento Formation (Tn)			
4					
5	In-Place Density taken at 4.0 ft. 50 lb sample taken at 4.0 ft.				
6					
7	7.0 ft (6406.8)				

COMMENTS: SURFACE VEGETATED WITH SAGE BRUSH AND GRASS. DISCONTINUED DUE TO REFUSAL ON BEDROCK.

7-1336-A (1-86)
Bureau of Reclamation

LOG OF TEST PIT NO. TPR22-73

SHEET 1 OF 1

FEATURE: Reach 22B
PROJECT: Navajo Gallup Water Supply Project
LOCATION: STATION 22890+16.05, 43.5' Left
GROUND ELEVATION: 6405.2
COORDINATES: N 1,990,420 E 2,743,617
METHOD OF EXPLORATION: CASE 580N BACKHOE
APPROXIMATE DIMENSIONS: 6.0' x 11.0' x 13.0'
LOGGED BY: C. BEYER
DEPTH TO WATER: NE DATE: 7/20/2012
DATE EXCAVATED: 7/20/2012

DEPTH	CLASSIFICATION GROUP SYMBOL	CLASSIFICATION AND DESCRIPTION OF MATERIAL (SEE USBR 5000, 5005)	% PLUS 3 in (BY VOLUME) 3 - 5 in	5 - 12 in	PLUS 12 in
1 2 3 4	SM In-Place Density taken at 4.3 ft. 50 lb sample taken at 4.3 ft. 4.3 ft (6400.9)	0.0 to 4.3 ft SILTY SAND: About 70% fine sand; about 30% nonplastic fines with rapid dilatancy, low dry strength, low toughness; maximum size, fine sand; strong reaction with HCl. IN-PLACE CONDITION: Brown, dry, roots in top 2.0 ft. IN-PLACE UNIT WEIGHT AND MOISTURE FROM 4.3 TO 4.8 ft. Total: 112.8 lbs. / cu ft., 2.4%.(99.4% compaction) LAB TEST DATA: 87.0% sand, 13% fines, LL=N/A, PI=N/P, SPG=2.68 Maximum dry density= 113.5 lbs. / cu ft., optimum water content= 12.5% Laboratory classification is SILTY SAND GEOLOGIC INTERPRETATION: Quaternary Alluvium (Qal)			
5 6 7 8 9 10 11	SANDSTONE 11.0 ft (6394.2)	4.3 to 11.0 ft SANDSTONE: Fine to medium grained sandstone, becoming predominately fine with depth, tan to yellow in color, decomposed (W9) to intensely weathered (W7), decreased weathering with depth; very soft (H7) to moderately soft (H5), increased hardness with depth; intermittent calcite cemented zones and FeOx staining, no reaction with HCL outside calcareous zones. Logged as a soil: POORLY GRADED SAND: About 95% fine sand; about 5% nonplastic fines with rapid dilatancy, low to no dry strength; maximum size, medium sand; strong reaction with HCl. GEOLOGIC INTERPRETATION: Tertiary Nacimiento Formation (Tn)			

COMMENTS: SURFACE VEGETATED WITH SAGE BRUSH AND GRASS. REACHED REFUSAL AT 11.0 FT.

7-1336-A (1-86)
Bureau of Reclamation

LOG OF TEST PIT NO. TPR22-76

SHEET 1 OF 1

FEATURE: Reach 22B
PROJECT: Navajo Gallup Water Supply Project
LOCATION: STATION 22930+89.09, 31.2' Right
GROUND ELEVATION: 6421.5
COORDINATES: N 1,986,707 E 2,742,103
METHOD OF EXPLORATION: CASE 580N BACKHOE
APPROXIMATE DIMENSIONS: 6.0' x 13.5' x 11.0'
LOGGED BY: C. BEYER
DEPTH TO WATER: NE DATE: 7/19/2012
DATE EXCAVATED: 7/19/2012

DEPTH	CLASSIFICATION GROUP SYMBOL	CLASSIFICATION AND DESCRIPTION OF MATERIAL (SEE USBR 5000, 5005)	% PLUS 3 in (BY VOLUME) 3 - 5 in	5 - 12 in	PLUS 12 in
1–2	SC 2.5 ft (6419.0)	0.0 to 2.5 ft CLAYEY SAND: About 55% fine sand; about 45% fines with medium plasticity, no dilatancy, medium dry strength, medium toughness; maximum size, fine sand; no reaction with HCl. IN-PLACE CONDITION: Reddish brown, dry, roots in top 1.5 ft. GEOLOGIC INTERPRETATION: Quaternary Alluvium (Qal)			
3–6	SM In-Place Density taken at 4.0 ft. 50 lb sample taken at 4.0 ft. 6.2 ft (6415.3)	2.5 to 6.2 ft SILTY SAND: About 85% fine sand; about 15% nonplastic fines with rapid dilatancy, low dry strength, low toughness; maximum size, fine sand; weak reaction with HCl. IN-PLACE CONDITION: Reddish brown, dry, intermittent calcite nodules. IN-PLACE UNIT WEIGHT AND MOISTURE FROM 4.0 TO 4.5 ft. Total: 104.8 lbs. / cu ft., 3.9 %.(89.9% compaction) LAB TEST DATA: 58.9% sand, 41.1% fines, LL= N/A, PI= N/P, SPG= 2.65 Maximum dry density= 116.6lbs. / cu ft., optimum water content= 11.5% Laboratory classification is SILTY SAND GEOLOGIC INTERPRETATION: Quaternary Alluvium (Qal)			
7–9	s(CL) 9.5 ft (6412.0)	6.2 to 9.5 ft SANDY LEAN CLAY: About 60% fines with medium to high plasticity, high toughness, medium to high dry strength, strong reaction with HCL; about 40% fine sand; maximum size, fine sand. IN-PLACE CONDITION: Reddish-brown, dry, intermittent calcite nodules. GEOLOGIC INTERPRETATION: Quaternary Alluvium (Qal)			
10–13	SP-SM (visual) SM (lab class) Bag sample taken from 12.0 to 13.0 ft. 13.5 ft (6408.0)	9.5 to 13.5 ft POORLY GRADED SAND WITH SILT: About 90% fine sand; about 10% nonplastic fines, with rapid dilatancy, low dry strength; maximum size, fine sand; no reaction with HCl. IN-PLACE CONDITION: Brown in color, calcite cemented zone in bottom 0.3 ft. BAG SAMPLE TAKEN FROM 12.0 TO 13.0 ft. LAB TEST DATA: 65.3% sand, 34.7% fines, LL= N/A, PI= N/P, SPG= 2.70 Laboratory classification is SILTY SAND GEOLOGIC INTERPRETATION: Quaternary Alluvium (Qal)			

COMMENTS: SURFACE VEGETATED WITH SAGE BRUSH AND GRASS. DISCONTINUED DUE TO LIMIT OF EQUIPMENT.

7-1336-A (1-86)
Bureau of Reclamation

LOG OF TEST PIT NO. TPR22-77

SHEET 1 OF 2

FEATURE: Reach 22B
PROJECT: Navajo Gallup Water Supply Project
LOCATION: STATION 22943+19.14, 14.6' Right
GROUND ELEVATION: 6433.6
COORDINATES: N 1,985,534 E 2,741,732
METHOD OF EXPLORATION: CASE 580N BACKHOE
APPROXIMATE DIMENSIONS: 6.0' x 13.5' x 12.0'
LOGGED BY: C. BEYER
DEPTH TO WATER: NE DATE: 7/19/2012
DATE EXCAVATED: 7/19/2012

DEPTH	CLASSIFICATION GROUP SYMBOL	CLASSIFICATION AND DESCRIPTION OF MATERIAL (SEE USBR 5000, 5005)	% PLUS 3 in (BY VOLUME) 3 - 5 in	5 - 12 in	PLUS 12 in
1 2 3	SM	0.0 to 3.3 ft SILTY SAND: About 65% fine sand; about 35% nonplastic fines with slow dilatancy, low dry strength; maximum size, fine sand; strong reaction with HCl. IN-PLACE CONDITION: Tan, roots in top 1.5 ft, dry. GEOLOGIC INTERPRETATION: Quaternary Alluvium (Qal)			
	3.3 ft (6430.3)				
4 5 6 7 8 9 10	(CL)s In-Place Density taken at 4.5 ft. 50 lb sample taken at 4.5 ft. Bag sample taken from 6.3 to 7.0 ft.	3.3 to 10.0 ft LEAN CLAY WITH SAND: About 80% fines with medium to high plasticity, no dilatancy, high toughness, medium to high dry strength; about 20% fine sand; maximum size, fine sand; strong reaction with HCl. lens of dark grey CL (LEAN CLAY) from 6.3 to 7.0 f, About 90% fines with high plasticity, high toughness, high dry strength; about 10% fine sand; strong reaction with HCl; bag sample taken. IN-PLACE CONDITION: Brown, dry, intermittent calcite nodules and veins. IN-PLACE UNIT WEIGHT AND MOISTURE FROM 4.0 TO 4.5 ft. Total: 93.3 lbs. / cu ft., 5.5%. (81.3% compaction) LAB TEST DATA: 29.1% sand, 70.9% fines, LL= 27.9, PI= 10.9, SPG= 2.69 Maximum dry density= 114.7lbs. / cu ft., optimum water content=13.4% Laboratory classification is LEAN CLAY WITH SAND BAG SAMPLE TAKEN FROM 6.3 TO 7.0 ft. LAB TEST DATA: 7% sand, 93% fines, LL= 54.4, PI= 35.5, SPG= 2.65 Laboratory classification is FAT CLAY GEOLOGIC INTERPRETATION: Quaternary Alluvium (Qal)			
	10.0 ft (6423.6)				

COMMENTS: SURFACE VEGETATED WITH SAGE BRUSH AND GRASS. DISCONTINUED DUE TO LIMIT OF EQUIPMENT.

7-1336-A (1-86)
Bureau of Reclamation

LOG OF TEST PIT NO. TPR22-77

SHEET 2 OF 2

FEATURE: Reach 22B
PROJECT: Navajo Gallup Water Supply Project
LOCATION: STATION 22943+19.14, 14.6' Right
GROUND ELEVATION: 6433.6
COORDINATES: N 1,985,534 E 2,741,732
METHOD OF EXPLORATION: CASE 580N BACKHOE
APPROXIMATE DIMENSIONS: 6.0' x 13.5' x 12.0'
LOGGED BY: C. BEYER
DEPTH TO WATER: NE DATE: 7/19/2012
DATE EXCAVATED: 7/19/2012

DEPTH	CLASSIFICATION GROUP SYMBOL	CLASSIFICATION AND DESCRIPTION OF MATERIAL (SEE USBR 5000, 5005)	% PLUS 3 in (BY VOLUME) 3 - 5 in	5 - 12 in	PLUS 12 in
	SANDSTONE	10.0 TO 13.5 FT SANDSTONE: Fine to medium grained argillaceous sandstone yellow to brown, becoming yellow to grey in color, decomposed (W9); very soft (H7); zones of white, non plastic calcite cement, strong reaction with HCl.			
11					
	Bag sample taken from 10.0 to 11.0 ft.	BAG SAMPLE TAKEN FROM 10.0 TO 11.0 ft. LAB TEST DATA: 86.5% sand, 13.5% fines, LL= N/A, PI= N/P, SPG= 2.68			
12		Laboratory classification is: SILTY SAND			
		GEOLOGIC INTERPRETATION: Tertiary Nacimiento Formation (Tn).			
13					
	13.5 ft (6420.1)				

COMMENTS:

7-1336-A (1-86)
Bureau of Reclamation

LOG OF TEST PIT NO. TPR22-79

SHEET 1 OF 1

FEATURE: Reach 22B
LOCATION: STATION 22960+39.43, 228.8' Right
COORDINATES: N 1,984,391 E 2,740,789
APPROXIMATE DIMENSIONS: 6.0' x 13.0' x 3.0'
DEPTH TO WATER: NE DATE: 7/19/2012

PROJECT: Navajo Gallup Water Supply Project
GROUND ELEVATION: 6448.4
METHOD OF EXPLORATION: CASE 580N BACKHOE
LOGGED BY: C. BEYER
DATE EXCAVATED: 7/19/2012

DEPTH	CLASSIFICATION GROUP SYMBOL	CLASSIFICATION AND DESCRIPTION OF MATERIAL (SEE USBR 5000, 5005)	% PLUS 3 in (BY VOLUME) 3 - 5 in	5 - 12 in	PLUS 12 in
1–12	SC (visual) CL-ML (lab class)	0.0 to 13.0 ft CLAYEY SAND: About 75% fine sand; about 25% fines with medium plasticity, no dilatancy, medium dry strength, medium toughness; maximum size, fine sand; no reaction with HCl in top 3.0 ft, weak reaction with HCl below 3.0 ft. IN-PLACE CONDITION: Reddish-brown, dry, roots in top 1.5 ft, intermittent calcite veins and nodules; highly calcite cemented zone from 8.7 to 9.5 ft. IN-PLACE UNIT WEIGHT AND MOISTURE FROM 4.0 TO 4.5 ft. Total: 97.7 lbs. / cu ft., 5.1%. (85.5% compaction) LAB TEST DATA: 32.0% sand, 68% fines, LL= 23.6, PI= 6.7, SPG= 2.69 Maximum dry density= 114.3 lbs. / cu ft., optimum water content= 12.7% Laboratory classification is SANDY SILTY CLAY GEOLOGIC INTERPRETATION: Quaternary Alluvium (Qal)			
6–7	In-Place Density taken at 4.0 ft. 50 lb sample taken at 4.0 ft.				
13	13.0 ft (6435.4)				

COMMENTS: SURFACE VEGETATED WITH SAGE BRUSH AND GRASS. DISCONTINUED DUE TO LIMIT OF EQUIPMENT.

7-1336-A (1-86)
Bureau of Reclamation

LOG OF TEST PIT NO. TPR22-80

SHEET 1 OF 1

FEATURE: Reach 22B
PROJECT: Navajo Gallup Water Supply Project
LOCATION: STATION 22971+37.02, 153.5' Right
GROUND ELEVATION: 6480.9
COORDINATES: N 1,983,863 E 2,739,824
METHOD OF EXPLORATION: CASE 580N BACKHOE
APPROXIMATE DIMENSIONS: 6.0' x 13.5' x 10.0'
LOGGED BY: C. BEYER
DEPTH TO WATER: NE DATE: 7/19/2012
DATE EXCAVATED: 7/19/2012

DEPTH	CLASSIFICATION GROUP SYMBOL	CLASSIFICATION AND DESCRIPTION OF MATERIAL (SEE USBR 5000, 5005)	% PLUS 3 in (BY VOLUME) 3 - 5 in	5 - 12 in	PLUS 12 in
1 2 3 4 5 6	SC (visual) (CL)s (lab class) In-Place Density taken at 4.0 ft. 50 lb sample taken at 4.0 ft. 6.0 ft (6474.9)	0.0 to 6.0 ft CLAYEY SAND: About 75% fine sand; about 25% fines with low plasticity, no dilatancy, medium dry strength, low toughness; maximum size, fine sand; strong reaction with HCl. IN-PLACE CONDITION: Reddish-brown, dry, roots in top 1.5 ft; intermittent calcite veins and nodules, well cemented. IN-PLACE UNIT WEIGHT AND MOISTURE FROM 4.0 TO 4.5 ft. Total: 92.7 lbs. / cu ft., 5.9%. (82.8% compaction) LAB TEST DATA: 23.7% sand, 76.3% fines, LL= 27.2, PI= 9.9, SPG= 2.67 Maximum dry density= 112.0 lbs. / cu ft., optimum water content= 14.5% Laboratory classification is LEAN CLAY WITH SAND GEOLOGIC INTERPRETATION: Quaternary Alluvium (Qal)			
7 8 9 10 11 12 13	SM 13.5 ft (6467.4)	6.0 to 13.5 ft SILTY SAND: About 80% fine sand; about 20% nonplastic fines with slow dilatancy, low dry strength, no toughness; maximum size, fine sand; strong reaction with HCl. IN-PLACE CONDITION: Reddish-brown, calcite veins and nodules below 11.0 ft, dry. GEOLOGIC INTERPRETATION: Quaternary Alluvium (Qal)			

COMMENTS: SURFACE VEGETATED WITH SAGE BRUSH AND GRASS. DISCONTINUED DUE TO LIMIT OF EQUIPMENT.

7-1336-A (1-86)
Bureau of Reclamation

LOG OF TEST PIT NO. TPR22B-14-22

SHEET 1 OF 1

FEATURE: Reach 22B
LOCATION: PIPELINE
COORDINATES: N 2,050,922 E 2,751,289
APPROXIMATE DIMENSIONS: 12'x14'x12.6'
DEPTH TO WATER: NE DATE: NA

PROJECT: Navajo Gallup Water Supply Project
GROUND ELEVATION: 5847.4
METHOD OF EXPLORATION: CASE 680L BACKHOE
LOGGED BY: P. GARDNER
DATE EXCAVATED: 9/22/2014

DEPTH	CLASSIFICATION GROUP SYMBOL	CLASSIFICATION AND DESCRIPTION OF MATERIAL (SEE USBR 5000, 5005)	% PLUS 3 in (BY VOLUME) 3 - 5 in	5 - 12 in	PLUS 12 in
1 2 3	SC	0.0 to 3.3 ft CLAYEY SAND: About 70% fine to coarse sand; about 30% fines with low plasticity, low dry strength, low toughness and no dilatancy; maximum size, coarse sand; no reaction with HCl. IN-PLACE CONDITION: Brown and dry, homogeneous and moderate cementation. Roots and root casts down to 2.3 feet. GEOLOGIC INTERPRETATION: Quaternary Alluvium (Qal)			
	3.3 ft (5844.1)				
4 5 6	SP-SM (visual) In-place density taken at 6.0 ft.	3.3 to 6.3 ft POORLY GRADED SAND WITH SILT: About 90% fine to coarse sand, coarse, hard sand; subangular; about 10% fines with no plasticity, medium dry strength and rapid dilatancy; trace of fine to coarse, hard, angular gravel; maximum size, 50mm; strong reaction with HCl. IN-PLACE CONDITION: Brown to tan, dry, lensed and strong cementation. Calcium carbonate stringers present. In-place density overlaps stratigraphic units.			
	6.3 ft (5841.1)				
7 8 9 10 11	CL	IN-PLACE UNIT WEIGHT AND MOISTURE FROM 6.0 ft. Total: 105.5 lbf/ft³ 7.0% (90% compaction) LAB TEST DATA: 49.8% sand, 49.8% fines, 0.4% gravel, LL= 24.1, PI= 10.8, SPG= 2.57 Maximum dry density= 117.2 lbf/ft³, optimum water content= 14.4% Laboratory classification is CLAYEY SAND GEOLOGIC INTERPRETATION: Quaternary Alluvium (Qal) 6.3 to 12.1 ft LEAN CLAY: About 90% fines with medium plasticity, high dry strength, medium toughness and no dilatancy; about 10% fine sand; maximum size, fine sand; strong reaction with HCl. IN-PLACE CONDITION: Gray and dry, homogeneous with a hard consistency. Hard to excavate and recovered in blocky 2 x 3 x 4 inch chunks. Calcium carbonate stringers throughout. GEOLOGIC INTERPRETATION: Quaternary Alluvium (Qal)			
12	12.1 ft (5835.3)				
	SHALE 12.6 ft (5834.8)	12.1 to 12.6 ft SHALE: Dark gray in color. Fine grained shale. Very soft (H7) and fresh (W1). Fissile and slickensided. No reaction with HCl. GEOLOGIC INTERPRETATION: Tertiary Nacimiento Formation (Tn)			

COMMENTS: SURFACE VEGETATION CONSISTS OF GRASSES. DISCONTINUED HOLE DUE TO REFUSAL ON BEDROCK.

7-1336-A (1-86)
Bureau of Reclamation

LOG OF TEST PIT NO. TPR22B-14-23

SHEET 1 OF 1

FEATURE: Reach 22B
LOCATION: PIPELINE
COORDINATES: N 2,050,287 E 2,751,105
APPROXIMATE DIMENSIONS: 12'x14'x10'
DEPTH TO WATER: NE DATE: NA

PROJECT: Navajo Gallup Water Supply Project
GROUND ELEVATION: 5838.3
METHOD OF EXPLORATION: CASE 680L BACKHOE
LOGGED BY: P. GARDNER
DATE EXCAVATED: 9/22/2014

DEPTH	CLASSIFICATION GROUP SYMBOL	CLASSIFICATION AND DESCRIPTION OF MATERIAL (SEE USBR 5000, 5005)	% PLUS 3 in (BY VOLUME) 3 - 5 in	5 - 12 in	PLUS 12 in
1	SM	0.0 to 6.8 ft SILTY SAND: About 70% fine to coarse, hard, subangular to subrounded sand; about 30% nonplastic fines with medium dry strength and rapid dilatancy; trace of hard, subangular to subrounded, gravel; maximum size, 75mm; no reaction with HCl. IN-PLACE CONDITION: Brown and dry, homogeneous and moderate cementation. Roots down to 4.0 feet. Easy excavation. IN-PLACE UNIT WEIGHT AND MOISTURE FROM 6.0 ft. Total: 105.2 lbf/ft³ 3.8% (91.5% compaction) LAB TEST DATA: 22.5% fines, 76.6% sand, 0.9% gravel, LL= NA, PI= NP, SPG= 2.54 Maximum dry density= 115.0 lbf/ft³, optimum water content= 13.3% Laboratory classification is SILTY SAND GEOLOGIC INTERPRETATION: Quaternary Alluvium (Qal)			
2					
3	In-place density taken at 6.0 ft.				
4					
5					
6					
6.8 ft (5831.5)					
7	SANDSTONE	6.8 to 10.0 ft SANDSTONE: Fine to medium grain sandstone. Light brown to dark brown, orange and white. Very soft (H7) and intensely weathered (W7). Hard to excavate and recovered in 2 x 3 x 6 inch chunks. Because of the soft nature of the sandstone, it may be classified as "POORLY GRADED SAND WITH SILT" that is strongly cemented using the Unified Soil Classification System. Weak reaction with HCl. GEOLOGIC INTERPRETATION: Tertiary Nacimiento Formation (Tn)			
8					
9					
10.0 ft (5828.3)					
10					

COMMENTS: SURFACE VEGETATION CONSISTS OF SAGE AND GRASSES. DISCONTINUED HOLE DUE TO REFUSAL ON BEDROCK.

7-1336-A (1-86)
Bureau of Reclamation

LOG OF TEST PIT NO. TPR22B-14-24

SHEET 1 OF 1

FEATURE: Reach 22B
LOCATION: PIPELINE
COORDINATES: N 2,049,059 E 2,751,049
APPROXIMATE DIMENSIONS: 12'x14'x16'
DEPTH TO WATER: NE DATE: NA

PROJECT: Navajo Gallup Water Supply Project
GROUND ELEVATION: 5837.5
METHOD OF EXPLORATION: CASE 680L BACKHOE
LOGGED BY: P. GARDNER
DATE EXCAVATED: 9/22/2014

DEPTH	CLASSIFICATION GROUP SYMBOL	CLASSIFICATION AND DESCRIPTION OF MATERIAL (SEE USBR 5000, 5005)	% PLUS 3 in (BY VOLUME) 3 - 5 in	5 - 12 in	PLUS 12 in
1	SM	0.0 to 4.2 ft SILTY SAND: About 75% predominantly fine sand; about 25% nonplastic fines with low dry strength and rapid dilatancy; maximum size, medium sand; weak reaction with HCl. IN-PLACE CONDITION: Brown and dry, lensed with POORLY GRADED SAND and strong cementation. Roots down to 4.2 feet. GEOLOGIC INTERPRETATION: Quaternary Alluvium (Qal)			
4	4.2 ft (5833.3)				
5	SP (visual) SP-SM (lab class)	4.2 to 9.0 ft POORLY GRADED SAND: About 95% fine to coarse, hard, subrounded sand; about 5% nonplastic fines with no dry strength and rapid dilatancy; trace of hard, subrounded gravel; maximum size, 50mm; no reaction to HCl. IN-PLACE CONDITION: Brown to tan, dry and weak cementation. Roots down to 4.2 feet. Easy excavation. IN-PLACE UNIT WEIGHT AND MOISTURE FROM 6.0 ft. Total: 101.8 lbf/ft³ 1.0% (91.2% relative compaction) LAB TEST DATA: 7.6% fines, 91.1% sand, 1.3% gravel, LL= NA, PI= NP, SPG= 2.39 Maximum dry density= 111.6 lbf/ft³, optimum water content= N/A% Laboratory classification is POORLY GRADED SAND WITH SILT GEOLOGIC INTERPRETATION: Quaternary Alluvium (Qal)			
7	In-place density taken at 6.0 ft.				
9	9.0 ft (5828.5)				
10	SM	9.0 to 16.0 ft SILTY SAND: About 85% fine to medium sand; about 15% nonplastic fines with low dry strength and rapid dilatancy; maximum size, medium sand; weak reaction to HCl. IN-PLACE CONDITION: Brown and dry, lensed with POORLY GRADED SAND and strong cementation. Two gallon bag corrosion sample taken at 10.0 ft. GEOLOGIC INTERPRETATION: Quaternary Alluvium (Qal)			
12	Corrosion sample taken at 10.0 ft.				
16	16.0 ft (5821.5)				

COMMENTS: SURFACE VEGETATION CONSISTS OF CACTI, GRASSES AND SCRUB BRUSH.
DISCONTINUED HOLE DUE TO THE LIMIT OF THE EQUIPMENT.

7-1336-A (1-86)
Bureau of Reclamation

LOG OF TEST PIT NO. TPR22B-14-26

SHEET 1 OF 1

FEATURE: Reach 22B
LOCATION: PIPELINE
COORDINATES: N 2,046,693 E 2,750,871
APPROXIMATE DIMENSIONS: 12'x14'x15'
DEPTH TO WATER: NE DATE: NA

PROJECT: Navajo Gallup Water Supply Project
GROUND ELEVATION: 5829.1
METHOD OF EXPLORATION: CASE 680L BACKHOE
LOGGED BY: P. GARDNER
DATE EXCAVATED: 9/23/2014

DEPTH	CLASSIFICATION GROUP SYMBOL	CLASSIFICATION AND DESCRIPTION OF MATERIAL (SEE USBR 5000, 5005)	% PLUS 3 in (BY VOLUME) 3 - 5 in	5 - 12 in	PLUS 12 in
1–12	SM	0.0 to 12.0 ft SILTY SAND: About 75% fine to coarse, subrounded sand; about 25% nonplastic fines with low dry strength and rapid dilatancy; trace of hard, subrounded, fine to coarse gravel; maximum size, 50mm; no reaction with HCl. IN-PLACE CONDITION: Brown to tan, dry, lensed with POORLY GRADED SAND, POORLY GRADED SAND WITH SILT 1 to 8 inches in width. Weak cementation. Roots down to 12.0 feet. Two gallon bag corrosion sample taken at 10.0 ft. IN-PLACE UNIT WEIGHT AND MOISTURE FROM 6.0 ft. Total: 95.4 lbf/ft³ 1.6% (88.7% relative compaction) LAB TEST DATA: 12.7% fines, 87.3% sand, 0.0% gravel, LL= NA, PI= NP, SPG= 2.62 Maximum dry density= 107.5 lbf/ft³. Laboratory classification is SILTY SAND GEOLOGIC INTERPRETATION: Quaternary Alluvium (Qal)			
5	In-place density taken at 6.0 ft. Corrosion sample taken at 10.0 ft.				
12	12.0 ft (5817.1)				
12–15	SP	12.0 to 15.0 ft POORLY GRADED SAND: About 95% fine to medium sand; about 5% nonplastic fines with no dry strength and rapid dilatancy; maximum size, medium sand; no reaction with HCl. IN-PLACE CONDITION: Tan, moist and homogeneous. GEOLOGIC INTERPRETATION: Quaternary Alluvium (Qal)			
15	15.0 ft (5814.1)				

COMMENTS: SURFACE VEGETATION CONSISTS OF GRASSES, GREASEWOOD AND JUNIPER. DISCONTINUED HOLE DUE TO THE LIMIT OF THE EQUIPMENT.

7-1336-A (1-86)
Bureau of Reclamation

LOG OF TEST PIT NO. TPR22B-14-27

SHEET 1 OF 1

FEATURE: Reach 22B
LOCATION: PIPELINE
COORDINATES: N 2,045,591 E 2,750,776
APPROXIMATE DIMENSIONS: 12'x14'x17'
DEPTH TO WATER: NE DATE: NA

PROJECT: Navajo Gallup Water Supply Project
GROUND ELEVATION: 5850.7
METHOD OF EXPLORATION: CASE 680L BACKHOE
LOGGED BY: P. GARDNER
DATE EXCAVATED: 9/23/2014

DEPTH	CLASSIFICATION GROUP SYMBOL	CLASSIFICATION AND DESCRIPTION OF MATERIAL (SEE USBR 5000, 5005)	% PLUS 3 in (BY VOLUME) 3 - 5 in	5 - 12 in	PLUS 12 in
1–15	SM	0.0 to 15.2 ft SILTY SAND: About 80% predominantly fine sand; about 20% nonplastic fines with low dry strength and rapid dilatancy; trace of coarse sand, hard, subrounded, fine to coarse gravel and cobbles; maximum size, 125mm; weak to strong reaction with HCl. IN-PLACE CONDITION: Brown and dry. Lens of POORLY GRADED SAND at 4.8 feet. Lens is 2 inches to 1 foot thick, is the length of the trench and contains coarse, hard, subrounded sand with a trace of gravel. Roots down to 8.0 ft. IN-PLACE UNIT WEIGHT AND MOISTURE FROM 6.0 ft. Total: 96.1 lbf/ft³ 3.6% (82.6% compaction) LAB TEST DATA: 27.8% fines, 71.9% sand, 0.3% gravel, LL= NA, PI= NP, SPG= 2.55 Maximum dry density= 116.3 lbf/ft³, optimum water content= 11.9% Laboratory classification is SILTY SAND GEOLOGIC INTERPRETATION: Quaternary Alluvium (Qal)	t		
7	In-place density taken at 6.0 ft.				
15	15.2 ft (5835.5)				
16	SM	15.2 to 17.0 ft SILTY SAND: About 65% fine to medium sand; about 35% nonplastic fines with medium dry strength and rapid dilatancy; maximum size, coarse sand; strong reaction with HCl.			
17	17.0 ft (5833.7)	IN-PLACE CONDITION: Brown,dry and homogeneous. Calcium carbonate nodules present. GEOLOGIC INTERPRETATION: Quaternary Alluvium (Qal)			

COMMENTS: SURFACE VEGETATION CONSISTS OF GRASSES AND GREASEWOOD. DISCONTINUED HOLE DUE TO THE LIMIT OF THE EQUIPMENT.

7-1336-A (1-86)
Bureau of Reclamation

LOG OF TEST PIT NO. TPR22B-14-28

SHEET 1 OF 1

FEATURE: Reach 22B
LOCATION: PIPELINE
COORDINATES: N 2,044,324 E 2,750,477
APPROXIMATE DIMENSIONS: 12'x14'x16'
DEPTH TO WATER: NE DATE: NA

PROJECT: Navajo Gallup Water Supply Project
GROUND ELEVATION: 5869.3
METHOD OF EXPLORATION: CASE 680L BACKHOE
LOGGED BY: P. GARDNER
DATE EXCAVATED: 9/23/2014

DEPTH	CLASSIFICATION GROUP SYMBOL	CLASSIFICATION AND DESCRIPTION OF MATERIAL (SEE USBR 5000, 5005)	% PLUS 3 in (BY VOLUME) 3 - 5 in	5 - 12 in	PLUS 12 in
1	SM	0.0 to 1.8 ft SILTY SAND: About 70% fine sand; about 30% nonplastic fines with medium dry strength and rapid dilatancy; maximum size, fine sand; no reaction with HCl.			
1.8 ft (5867.5)					
2	SM	IN-PLACE CONDITION: Light brown and dry. Moderate cementation and homogeneous. Roots down to 8.0 feet.			
3		GEOLOGIC INTERPRETATION: Quaternary Alluvium (Qal)			
4		1.8 to 4.2 ft SILTY SAND: About 85% fine to coarse sand; about 15% nonplastic fines with low dry strength and rapid dilatancy; trace of hard, subrounded, fine gravel; maximum size, 30mm; no reaction with HCl.			
4.2 ft (5865.1)					
5	SP (visual) SP-SM (lab class)	IN-PLACE CONDITION: Light brown, tan and dry. Moderately cemented. Lensed with POORLY GRADED SAND with Fine Gravel . Lenses are 2 to 3 inches thick and up to 2 feet long.			
6		GEOLOGIC INTERPRETATION: Quaternary Alluvium (Qal)			
7		4.2 to 16.0 ft POORLY GRADED SAND: About 95% fine to coarse, hard, angular to rounded sand; about 5% nonplastic fines with no dry strength and rapid dilatancy; trace of hard, angular, fine to coarse gravels; maximum size, 30mm; no reaction with HCl.			
8					
9		IN-PLACE CONDITION: Tan and dry and homogeneous.			
10	In-place density taken at 6.0 ft.	IN-PLACE UNIT WEIGHT AND MOISTURE FROM 6.0 ft. Total: 99.7 lbf/ft³ 0.6% (87.4% relative compaction) LAB TEST DATA: 11.2% fines, 88.7% sand, 0.1% gravel, LL= NA, PI= NP, SPG= 2.40 Maximum dry density= 114.1 lbf/ft³, optimum water content= N/A% Laboratory classification is POORLY GRADED SAND WITH SILT			
11					
12					
13		GEOLOGIC INTERPRETATION: Quaternary Alluvium (Qal)			
14					
15					
16					
16.0 ft (5853.3)					

COMMENTS: SURFACE VEGETATION CONSISTS OF SAGE, GRASSES AND JUNIPER. DISCONTINUED HOLE DUE TO THE LIMIT OF THE EQUIPMENT.

7-1336-A (1-86)
Bureau of Reclamation

LOG OF TEST PIT NO. TPR22B-14-30

SHEET 1 OF 1

FEATURE: Reach 22B
LOCATION: PIPELINE
COORDINATES: N 2,040,702 E 2,750,485
APPROXIMATE DIMENSIONS: 2'x12'x4'
DEPTH TO WATER: NE DATE: NA

PROJECT: Navajo Gallup Water Supply Project
GROUND ELEVATION: 5929.3
METHOD OF EXPLORATION: CASE 680L BACKHOE
LOGGED BY: P. GARDNER
DATE EXCAVATED: 9/23/2014

DEPTH	CLASSIFICATION GROUP SYMBOL	CLASSIFICATION AND DESCRIPTION OF MATERIAL (SEE USBR 5000, 5005)	% PLUS 3 in (BY VOLUME) 3 - 5 in	5 - 12 in	PLUS 12 in
1	SM	0.0 to 1.7 ft SILTY SAND: About 75% fine sand; about 25% nonplastic fines with low dry strength and rapid dilatancy; maximum size, fine sand; no reaction with HCl. IN-PLACE CONDITION: Brown, dry and homogeneous. GEOLOGIC INTERPRETATION: Quaternary Alluvium (Qal)			
	1.7 ft (5927.6)				
2	SANDSTONE	1.7 to 4.0 ft SANDSTONE: Fine to medium grained sandstone. Orange to brown to yellow in color. Intensely weathered (W7) and moderately soft (H5). No reaction with HCl. GEOLOGIC INTERPRETATION: Tertiary Nacimiento Formation (Tn)			
3					
	4.0 ft (5925.3)				
4					

COMMENTS: SURFACE VEGETATION CONSISTS OF SAGE, GRASSES, CEDAR AND GREASE WOOD. DISCONTINUED HOLE DUE TO REFUSAL ON BEDROCK.

7-1336-A (1-86)
Bureau of Reclamation

LOG OF TEST PIT NO. TPR22B-14-31

SHEET 1 OF 1

FEATURE: Reach 22B
LOCATION: PIPELINE
COORDINATES: N 2,039,933 E 2,750,598
APPROXIMATE DIMENSIONS: 8'x12'x6.6'
DEPTH TO WATER: NE DATE: NA

PROJECT: Navajo Gallup Water Supply Project
GROUND ELEVATION: 5913.5
METHOD OF EXPLORATION: CASE 680L BACKHOE
LOGGED BY: P. GARDNER
DATE EXCAVATED: 9/24/2014

DEPTH	CLASSIFICATION GROUP SYMBOL	CLASSIFICATION AND DESCRIPTION OF MATERIAL (SEE USBR 5000, 5005)	% PLUS 3 in (BY VOLUME) 3 - 5 in	5 - 12 in	PLUS 12 in
1	SP-SM	0.0 to 4.7 ft POORLY GRADED SAND WITH SILT: About 90% fine to medium sand; about 10% nonplastic fines with low dry strength and rapid dilatancy; trace of gravel; maximum size, 40mm; no reaction with HCl. IN-PLACE CONDITION: Brown and dry. Moderate cementation and lensed with LEAN CLAY 5 inch thick and 2 feet in length. Roots down to 4.0 feet. GEOLOGIC INTERPRETATION: Quaternary Alluvium (Qal)			
4.7 ft (5908.8)					
5	SP	4.7 to 5.8 ft POORLY GRADED SAND: About 95% fine to coarse, hard, angular to rounded sand; about 5% nonplastic fines with no dry strength and rapid dilatancy; trace of hard, subangular to rounded, fine to coarse gravels; maximum size, 50mm; no reaction with HCl. IN-PLACE CONDITION: Brown to tan with black. Dry and homogeneous. GEOLOGIC INTERPRETATION: Quaternary Alluvium (Qal)			
5.8 ft (5907.7)					
6	SANDSTONE	5.8 to 6.6 ft SANDSTONE: Fine to coarse grained sandstone. Light brown to brown and tan in color. Slightly weathered (W3) and moderately hard (H4). No reaction with HCl. GEOLOGIC INTERPRETATION: Tertiary Nacimiento Formation (Tn)			
6.6 ft (5906.9)					

COMMENTS: SURFACE VEGETATION CONSISTS OF GRASSES AND SAGE BRUSH. DISCONTINUED HOLE DUE TO REFUSAL ON BEDROCK.

7-1336-A (1-86)
Bureau of Reclamation

LOG OF TEST PIT NO. TPR22B-14-32

SHEET 1 OF 1

FEATURE: Reach 22B
LOCATION: PIPELINE
COORDINATES: N 2,038,358 E 2,750,754
APPROXIMATE DIMENSIONS: 6'x12'x6'
DEPTH TO WATER: NE DATE: NA

PROJECT: Navajo Gallup Water Supply Project
GROUND ELEVATION: 5919.9
METHOD OF EXPLORATION: CASE 680L BACKHOE
LOGGED BY: P. GARDNER
DATE EXCAVATED: 9/24/2014

DEPTH	CLASSIFICATION GROUP SYMBOL	CLASSIFICATION AND DESCRIPTION OF MATERIAL (SEE USBR 5000, 5005)	% PLUS 3 in (BY VOLUME) 3 - 5 in	5 - 12 in	PLUS 12 in
1	SP-SM	0.0 to 1.2 ft POORLY GRADED SAND WITH SILT: About 90% fine to coarse, hard, subangular to subrounded sand; about 10% nonplastic fines with low dry strength and rapid dilatancy; trace of soft, angular fine gravel; maximum size, 20mm; no reaction with HCl. IN-PLACE CONDITION: Brown and dry. Weak cementation and lensed with 1 inch wide and 12 inches in length SILTY SAND. Roots down to 6.0 feet.			
	1.2 ft (5918.7)				
2	SM	GEOLOGIC INTERPRETATION: Quaternary Alluvium (Qal) about 25% nonplastic fines with medium dry strength and slow dilatancy; weak reaction with HCl. IN-PLACE CONDITION: Brown, dry and homogeneous. Strong cementation. GEOLOGIC INTERPRETATION: Quaternary Alluvium (Qal)			
3	3.3 ft (5916.6)				
4	SANDSTONE	3.3 to 6.0 ft SANDSTONE: Fine grained sandstone. Gray with black specs and mica. Moderately weathered (W5) and soft (H6). No reaction with HCl. Recovered in 1 x 6 x 12 inch flat chunks. GEOLOGIC INTERPRETATION: Tertiary Nacimiento Formation (Tn)			
5					
6	6.0 ft (5913.9)				

COMMENTS: SURFACE VEGETATION CONSISTS OF GRASSES AND GREASE WOOD. DISCONTINUED HOLE DUE TO REFUSAL ON BEDROCK.

7-1336-A (1-86)
Bureau of Reclamation

LOG OF TEST PIT NO. TPR22B-14-34

SHEET 1 OF 1

FEATURE: Reach 22B
LOCATION: PIPELINE
COORDINATES: N 2,035,983 E 2,750,398
APPROXIMATE DIMENSIONS: 2'x10'x3'
DEPTH TO WATER: NE DATE: NA

PROJECT: Navajo Gallup Water Supply Project
GROUND ELEVATION: 5928.1
METHOD OF EXPLORATION: CASE 680L BACKHOE
LOGGED BY: P. GARDNER
DATE EXCAVATED: 9/24/2014

DEPTH	CLASSIFICATION GROUP SYMBOL	CLASSIFICATION AND DESCRIPTION OF MATERIAL (SEE USBR 5000, 5005)	% PLUS 3 in (BY VOLUME) 3 - 5 in	5 - 12 in	PLUS 12 in
1	SP-SM	0.0 to 1.3 ft POORLY GRADED SAND WITH SILT: About 90% fine to coarse, hard, subangular to subrounded sand; about 10% nonplastic fines with no dry strength and rapid dilatancy; trace of hard, subrounded, fine and coarse gravel; maximum size, 75mm; no reaction with HCl. IN-PLACE CONDITION: Brown and dry. Weak cementation and lensed with POORLY GRADED SAND. Roots down to 3.0 feet. GEOLOGIC INTERPRETATION: Quaternary Alluvium (Qal)			
1.3 ft (5926.8)					
2	SANDSTONE	1.3 to 3.0 ft SANDSTONE: Fine grained. gray with black specs and mica. Intensely weathered (W7) and soft (H6). No reaction with HCl. Recovered in 2 x 2 x 4 inch chunks. Roots recovered in sandstone through 3.0 feet. GEOLOGIC INTERPRETATION: Tertiary Nacimiento Formation (Tn)			
3.0 ft (5925.1)					
3					

COMMENTS: SURFACE VEGETATION CONSISTS OF GRASSES AND SAGE BRUSH. DISCONTINUED HOLE DUE TO REFUSAL ON BEDROCK.

7-1336-A (1-86)
Bureau of Reclamation

LOG OF TEST PIT NO. TPR22B-14-36

SHEET 1 OF 1

FEATURE: Reach 22B
LOCATION: PIPELINE
COORDINATES: N 2,033,668 E 2,749,696
APPROXIMATE DIMENSIONS: 12'x14'x16.5'
DEPTH TO WATER: NE DATE: NA

PROJECT: Navajo Gallup Water Supply Project
GROUND ELEVATION: 5939.0
METHOD OF EXPLORATION: CASE 680L BACKHOE
LOGGED BY: P. GARDNER
DATE EXCAVATED: 9/24/2014

DEPTH	CLASSIFICATION GROUP SYMBOL	CLASSIFICATION AND DESCRIPTION OF MATERIAL (SEE USBR 5000, 5005)	% PLUS 3 in (BY VOLUME) 3 - 5 in	5 - 12 in	PLUS 12 in
1–5	SP (visual) SP-SM (lab class)	0.0 to 6.2 ft POORLY GRADED SAND: About 95% fine to coarse, hard, subrounded sand; about 5% nonplastic fines with low dry strength and rapid dilatancy; trace of hard, subangular to subrounded, fine to coarse gravel; maximum size, 50mm; no reaction with HCl. IN-PLACE CONDITION: Tan and dry. Lensed with POORLY GRADED SAND, 1 inch in width and 3 feet in length, coarse . Weak cementation above 1.7 feet, strongly cemented below. Roots down to to 4.0 feet. Easy excavation. In-place density overlaps stratigraphic unit. IN-PLACE UNIT WEIGHT AND MOISTURE FROM 6.0 ft. Total: 98.6 lbf/ft³ 1.9% (88.9% relative compaction) LAB TEST DATA: 9.5% fines, 90.3% sand, 0.2% gravel, LL= NA, PI= NP, SPG= 2.41 Maximum dry density= 110.9 lbf/ft³, optimum water content= N/A% Laboratory classification is POORLY GRADED SAND WITH SILT GEOLOGIC INTERPRETATION: Quaternary Alluvium (Qal)			
In-place density taken at 6.0 ft.					
6	6.2 ft (5932.8)				
6–14	SP-SM	6.2 to 14.5 ft POORLY GRADED SAND WITH SILT: About 90% fine to medium sand; about 10% nonplastic fines with low dry strength and rapid dilatancy; trace of hard, subangular and subrounded, fine gravel; maximum size, 20mm; no reaction with HCl. IN-PLACE CONDITION: Brown to tan and dry, becoming moist below 10.2 feet. Strong cementation and lensed with POORLY GRADED SAND. GEOLOGIC INTERPRETATION: Quaternary Alluvium (Qal)			
14	14.5 ft (5924.5)				
14–16	SP	14.5 to 16.5 ft POORLY GRADED SAND: About 95% fine to coarse, subrounded sand; about 5% nonplastic fines with no dry strength and rapid dilatancy; trace of hard, angular to subrounded gravels; maximum size, 60mm; no reaction with HCl. IN-PLACE CONDITION: Tan and moist, becoming wet below 15.0 feet. Homogeneous. GEOLOGIC INTERPRETATION: Quaternary Alluvium (Qal)			
16	16.5 ft (5922.5)				

COMMENTS: SURFACE VEGETATION CONSISTS OF GRASSES AND GOLDEN ROD. DISCONTINUED HOLE DUE TO LIMIT OF EQUIPMENT.

7-1336-A (1-86)
Bureau of Reclamation

LOG OF TEST PIT NO. TPR22B-14-38

SHEET 1 OF 2

FEATURE: Reach 22B
LOCATION: PIPELINE
COORDINATES: N 2,031,213 E 2,749,670
APPROXIMATE DIMENSIONS: 12'x14'x16'
DEPTH TO WATER: NE DATE: NA

PROJECT: Navajo Gallup Water Supply Project
GROUND ELEVATION: 5950.2
METHOD OF EXPLORATION: CASE 680L BACKHOE
LOGGED BY: P. GARDNER
DATE EXCAVATED: 9/24/2014

DEPTH	CLASSIFICATION GROUP SYMBOL	CLASSIFICATION AND DESCRIPTION OF MATERIAL (SEE USBR 5000, 5005)	% PLUS 3 in (BY VOLUME) 3 - 5 in	5 - 12 in	PLUS 12 in
1	SC	0.0 to 1.4 ft CLAYEY SAND: About 75% fine to medium sand; about 25% fines with low plasticity, high dry strength, low toughness and slow dilatancy; no reaction with HCl.			
	1.4 ft (5948.8)				
2	SP-SM				
	2.4 ft (5947.8)	IN-PLACE CONDITION: Brown and dry, homogeneous and strong cementation. Roots down to 3 feet.			
3	SM				
4	(visual) In place density taken at 6.0 ft.	GEOLOGIC INTERPRETATION: Quaternary Alluvium (Qal)			
5		1.4 to 2.4 ft POORLY GRADED SAND WITH SILT: About 90% fine to medium sand; about 10% nonplastic fines with rapid dilatancy and no dry strength; trace of coarse sand; maximum size, coarse sand; no reaction with HCl.			
	6.2 ft (5944.0)				
6	s(CL)	IN-PLACE CONDITION: Tan and dry, homogeneous and weak cementation. Roots down to 3.0 feet.			
7					
8		GEOLOGIC INTERPRETATION: Quaternary Alluvium (Qal)			
9		2.4 to 6.2 ft SILTY SAND: About 80% fine to coarse sand; about 20% nonplastic fines with medium dry strength and rapid dilatancy; trace of hard, subangular to subrounded, fine gravel; maximum size, 20mm; no reaction with HCl.			
10					
11					
12					
	12.8 ft (5937.4)				
13	SP	IN-PLACE CONDITION: Brown, dry and homogeneous. Roots down to 3.0 feet. In-place density overlaps stratigraphic unit.			
14					
15		IN-PLACE UNIT WEIGHT AND MOISTURE FROM 6.0 ft. Total: 98.0 lbf/ft³ 4.5% (83.3% compaction) LAB TEST DATA: 52.8% fines, 46.6% sand, 0.6% gravel, LL= 21.4, PI= 4.9, SPG= 2.44 Maximum dry density= 117.7 lbf/ft³, optimum water content= 12.3% Laboratory classification is SILTY SANDY CLAY			
	16.0 ft (5934.2)				
16		GEOLOGIC INTERPRETATION: Quaternary Alluvium (Qal) 6.2 to 12.8 ft SANDY LEAN CLAY: About 55% fines with low plasticity, low toughness, high dry strength and no dilatancy; about 45% fine sand; maximum size, fine sand; strong reaction with HCl.			
		IN-PLACE CONDITION: Brown, dry and homogeneous.			
		GEOLOGIC INTERPRETATION: Quaternary Alluvium (Qal) 12.8 to 16.0 ft POORLY GRADED SAND: About 95% fine sand; about 5% nonplastic fines with rapid dilatancy and no dry strength; maximum size, fine sand; no reaction with HCl.			

COMMENTS: SURFACE VEGETATION CONSISTS OF GRASSES AND HEAVY SAGE BRUSH. DISCONTINUED HOLE DUE TO LIMIT OF EQUIPMENT.

7-1336-A (1-86)
Bureau of Reclamation

LOG OF TEST PIT NO. TPR22B-14-38

SHEET 2 OF 2

FEATURE: Reach 22B
LOCATION: PIPELINE
COORDINATES: N 2,031,213 E 2,749,670
APPROXIMATE DIMENSIONS: 12'x14'x16'
DEPTH TO WATER: NE DATE: NA

PROJECT: Navajo Gallup Water Supply Project
GROUND ELEVATION: 5950.2
METHOD OF EXPLORATION: CASE 680L BACKHOE
LOGGED BY: P. GARDNER
DATE EXCAVATED: 9/24/2014

DEPTH	CLASSIFICATION GROUP SYMBOL	CLASSIFICATION AND DESCRIPTION OF MATERIAL (SEE USBR 5000, 5005)	% PLUS 3 in (BY VOLUME) 3 - 5 in	5 - 12 in	PLUS 12 in
		IN-PLACE CONDITION: White, dry, homogeneous and loose. Easy excavation and sloughing below 12.8 feet. GEOLOGIC INTERPRETATION: Quaternary Alluvium (Qal)			

COMMENTS:

7-1336-A (1-86)
Bureau of Reclamation

LOG OF TEST PIT NO. TPR22B-14-39

SHEET 1 OF 1

FEATURE: Reach 22B
LOCATION: PIPELINE
COORDINATES: N 2,030,063 E 2,749,779
APPROXIMATE DIMENSIONS: 12'x14'x16'
DEPTH TO WATER: NE DATE: NA

PROJECT: Navajo Gallup Water Supply Project
GROUND ELEVATION: 5951.0
METHOD OF EXPLORATION: CASE 680L BACKHOE
LOGGED BY: P. GARDNER
DATE EXCAVATED: 9/25/2014

DEPTH	CLASSIFICATION GROUP SYMBOL	CLASSIFICATION AND DESCRIPTION OF MATERIAL (SEE USBR 5000, 5005)	% PLUS 3 in (BY VOLUME) 3 - 5 in	5 - 12 in	PLUS 12 in
1	s(CL)	0.0 to 1.3 ft SANDY LEAN CLAY: About 70% fines with low plasticity, low toughness, high dry strength and slow dilatancy; about 30% fine sand; maximum size, medium sand; strong reaction with HCl.			
	1.3 ft (5949.7)				
2	CL (visual) (CL)s (lab class)	IN-PLACE CONDITION: Brown to gray, dry and blocky. Firm consistency and lots of roots. Calcium carbonate stringers and nodules. Roots down to 6.0 feet.			
3		GEOLOGIC INTERPRETATION: Quaternary Alluvium (Qal)			
4		1.3 to 9.6 ft LEAN CLAY: About 90% fines with medium plasticity, medium toughness, high dry strength and no dilatancy; about 10% fine sand; maximum size, fine sand; strong reaction with HCl.			
5	In-place density taken at 6.0 ft.	IN-PLACE CONDITION: Brown, moist and homogeneous. Hard consistency. Calcium carbonate stringers and nodules. Roots down to 6.0 feet.			
6					
7		IN-PLACE UNIT WEIGHT AND MOISTURE FROM 6.0 ft.			
8		Total: 83.7 lbf/ft³ 14.3% (79.3% compaction)			
		LAB TEST DATA: 84.2% fines, 15.7% sand, 0.1% gravel, LL= 41.0, PI= 21.5, SPG= 2.37			
9		Maximum dry density= 105.6 lbf/ft³, optimum water content= 19.8%			
		Laboratory classification is LEAN CLAY WITH SAND			
	9.6 ft (5941.4)				
10	SM	GEOLOGIC INTERPRETATION: Quaternary Alluvium (Qal)			
		9.6 to 16.0 ft SILTY SAND: About 70% fine to medium sand; about 30% nonplastic fines with no dry strength and rapid dilatancy; maximum size, medium sand; no reaction with HCl.			
11					
12		IN-PLACE CONDITION: Reddish brown, moist and homogeneous. Weak cementation.			
	Corrosion sample taken at 10.0 ft.	Two gallon bag corrosion sample taken at 10.0 feet.			
13		GEOLOGIC INTERPRETATION: Quaternary Alluvium (Qal)			
14					
15					
	16.0 ft (5935.0)				
16					

COMMENTS: SURFACE VEGETATION CONSISTS OF GRASSES, HEAVY SAGE BRUSH, GREASEWOOD AND TAMARISK. DISCONTINUED HOLE DUE TO LIMIT OF EQUIPMENT.

7-1336-A (1-86)
Bureau of Reclamation

LOG OF TEST PIT NO. TPR22B-14-40

SHEET 1 OF 1

FEATURE: Reach 22B
LOCATION: PIPELINE
COORDINATES: N 2,028,911 E 2,749,941
APPROXIMATE DIMENSIONS: 12'x14'x16'
DEPTH TO WATER: NE DATE: NA

PROJECT: Navajo Gallup Water Supply Project
GROUND ELEVATION: 5969.9
METHOD OF EXPLORATION: CASE 680L BACKHOE
LOGGED BY: P. GARDNER
DATE EXCAVATED: 9/25/2014

DEPTH	CLASSIFICATION GROUP SYMBOL	CLASSIFICATION AND DESCRIPTION OF MATERIAL (SEE USBR 5000, 5005)	% PLUS 3 in (BY VOLUME) 3 - 5 in	5 - 12 in	PLUS 12 in
1	s(CL)	0.0 to 1.4 ft SANDY LEAN CLAY: About 60% fines with medium plasticity, medium toughness, high dry strength and no dilatancy; about 40% fine to medium sand; maximum size, medium sand; weak reaction with HCl.			
1.4 ft (5968.5)					
2	SM	IN-PLACE CONDITION: Brown, dry and homogeneous. Hard consistency and excavated in blocky chunks. Calcium carbonate stringers and nodules.			
3		GEOLOGIC INTERPRETATION: Quaternary Alluvium (Qal)			
4		1.4 to 16.0 ft SILTY SAND: About 75% fine to medium sand; about 25% nonplastic fines with low dry strength and rapid dilatancy; trace of hard, subrounded, fine gravel; maximum size, 20mm; weak reaction with HCl.			
5		IN-PLACE CONDITION: Light brown to tan, dry, lensed and stratified. Lenses of coarse POORLY GRADED SAND that vary from 2 to 6 inches in width and from 2 feet to the length of the trench. Weak cementation. Calcium carbonate stringers and nodules.			
6					
7		IN-PLACE UNIT WEIGHT AND MOISTURE FROM 6.0 ft. Total: 94.1 lbf/ft³ 2.7% (79.4% compaction) LAB TEST DATA: 26.5% fines, 73.2% sand, 0.3% gravel, LL= NA, PI= NP, SPG= 2.22 Maximum dry density= 118.5 lbf/ft³, optimum water content= 10.7% Laboratory classification is SILTY SAND			
8	In-place density taken at 6.0 ft.				
9		GEOLOGIC INTERPRETATION: Quaternary Alluvium (Qal)			
10					
11					
12					
13					
14					
15					
16					
16.0 ft (5953.9)					

COMMENTS: SURFACE VEGETATION CONSISTS OF GRASSES, SAGE BRUSH AND GREASE WOOD. DISCONTINUED HOLE DUE TO LIMIT OF EQUIPMENT.

7-1336-A (1-86)
Bureau of Reclamation

LOG OF TEST PIT NO. TPR22B-14-42

SHEET 1 OF 1

FEATURE: Reach 22B
PROJECT: Navajo Gallup Water Supply Project
LOCATION: PIPELINE
GROUND ELEVATION: 5997.0
COORDINATES: N 2,026,204 E 2,750,278
METHOD OF EXPLORATION: CASE 680L BACKHOE
APPROXIMATE DIMENSIONS: 12'x14'x17'
LOGGED BY: P. GARDNER
DEPTH TO WATER: NE DATE: NA
DATE EXCAVATED: 9/25/2014

DEPTH	CLASSIFICATION GROUP SYMBOL	CLASSIFICATION AND DESCRIPTION OF MATERIAL (SEE USBR 5000, 5005)	% PLUS 3 in (BY VOLUME) 3 - 5 in	5 - 12 in	PLUS 12 in
1	SM	0.0 to 6.3 ft SILTY SAND: About 75% fine to medium sand; about 25% nonplastic fines with medium dry strength and slow dilatancy; trace of hard, flat, fine to coarse gravel; maximum size, 30mm; no reaction with HCl.			
2					
3	In-place density taken at 6.0 ft.	IN-PLACE CONDITION: Brown, dry and lensed. Lenses and pockets of coarse POORLY GRADED SAND that are about 8 inches in width and up to 3 feet in length. Strong cementation. Roots down to 8.0 feet. In-place density overlaps stratigraphic units.			
4					
5		IN-PLACE UNIT WEIGHT AND MOISTURE FROM 6.0 ft. Total: 93.8 lbf/ft³ 3.6% (82.6% compaction) LAB TEST DATA: 30.2% fines, 69.8% sand, 0.0% gravel, LL= NA, PI= NP, SPG= 2.64			
6	6.3 ft (5990.7)	Maximum dry density= 113.6 lbf/ft³, optimum water content= 13.6% Laboratory classification is SILTY SAND			
7	SM	6.3 to 17.0 ft SILTY SAND: About 70% fine to medium sand; about 30% nonplastic fines with high dry strength and rapid dilatancy; maximum size, medium sand; no reaction with HCl.			
8					
9		IN-PLACE CONDITION: Brown, dry and lensed with POORLY GRADED SAND. Strong cementation. Roots down to 8.0 feet.			
10					
11		GEOLOGIC INTERPRETATION: Quaternary Alluvium (Qal)			
12					
13					
14					
15					
16					
17	17.0 ft (5980.0)				

COMMENTS: SURFACE VEGETATION CONSISTS OF GRASSES, SAGE BRUSH AND JUNIPER.
DISCONTINUED HOLE DUE TO LIMIT OF EQUIPMENT.

7-1336-A (1-86)
Bureau of Reclamation

LOG OF TEST PIT NO. TPR22B-14-43

SHEET 1 OF 1

FEATURE: Reach 22B
LOCATION: PIPELINE
COORDINATES: N 2,025,296 E 2,750,343
APPROXIMATE DIMENSIONS: 12'x15'x15.8'
DEPTH TO WATER: NE DATE: NA

PROJECT: Navajo Gallup Water Supply Project
GROUND ELEVATION: 6060.0
METHOD OF EXPLORATION: CASE 680L BACKHOE
LOGGED BY: J. GILBERT
DATE EXCAVATED: 10/16/2014

DEPTH	CLASSIFICATION GROUP SYMBOL	CLASSIFICATION AND DESCRIPTION OF MATERIAL (SEE USBR 5000, 5005)	% PLUS 3 in (BY VOLUME) 3 - 5 in	5 - 12 in	PLUS 12 in
1	SP-SM	0.0 to 6.7 ft POORLY GRADED SAND WITH SILT: About 90% fine to medium sand; about 10% nonplastic fines with low dry strength and rapid dilatancy; no reaction with HCl. IN-PLACE CONDITION: tan in color, dry. IN-PLACE UNIT WEIGHT AND MOISTURE FROM 6.0 ft. Total: 103.4 lbf/ft³ 2.0% (88.5% relative compaction) LAB TEST DATA: 6.9% fines, 86.9% sand, 6.2% gravel, LL= NA, PI= NP, SPG= 2.65 Maximum dry density= 116.9 lbf/ft³, optimum water content= N/A% Laboratory classification is POORLY GRADED SAND WITH SILT GEOLOGIC INTERPRETATION: Quaternary Alluvium (Qal)			
6	6.7 ft (6053.3)				
7	(SP-SM)g	6.7 to 9.9 ft POORLY GRADED SAND WITH SILT AND GRAVEL: About 70% fine to coarse sand; about 20% fine to coarse gravel, maximum size, 70mm; about 10% nonplastic fines with rapid dilatancy, and no dry strength; no reaction with HCl. IN-PLACE CONDITION: Unconsolidated subrounded to subangular gravels, dry.			
9	9.9 ft (6050.1)				
10	SP	GEOLOGIC INTERPRETATION: Quaternary Alluvium (Qal) 9.9 to 12.2 ft POORLY GRADED SAND: About 95% fine sand; about 5% nonplastic fines with rapid dilatancy and no dry strength; maximum size, fine sand; no reaction with HCl.			
12	12.2 ft (6047.8)	IN-PLACE CONDITION: Dry and homogeneous and no cementation, easy excavation.			
13	(SP)g	GEOLOGIC INTERPRETATION: Quaternary Alluvium (Qal) 12.2 to 15.8 ft POORLY GRADED SAND WITH GRAVEL: About 75% fine to coarse sand; about 20% fine to coarse gravel, maximum size, 80mm; about 5% nonplastic fines with rapid dilatancy, and no dry strength; no reaction with HCl.			
15	15.8 ft (6044.2)	IN-PLACE CONDITION: Subrounded to subangular gravels, dry. GEOLOGIC INTERPRETATION: Quaternary Alluvium (Qal)			

COMMENTS: SURFACE VEGETATION CONSISTS OF GRASSES, SAGE BRUSH. DISCONTINUED HOLE DUE TO LIMIT OF EQUIPMENT.

7-1336-A (1-86)
Bureau of Reclamation

LOG OF TEST PIT NO. TPR22B-14-44

SHEET 1 OF 1

FEATURE: Reach 22B
LOCATION: PIPELINE
COORDINATES: N 2,023,858 E 2,750,425
APPROXIMATE DIMENSIONS: 12'x15'x12'
DEPTH TO WATER: NE DATE: NA

PROJECT: Navajo Gallup Water Supply Project
GROUND ELEVATION: 6080.1
METHOD OF EXPLORATION: CASE680L BACKHOE
LOGGED BY: J. GILBERT
DATE EXCAVATED: 10/16/2014

DEPTH	CLASSIFICATION GROUP SYMBOL	CLASSIFICATION AND DESCRIPTION OF MATERIAL (SEE USBR 5000, 5005)	% PLUS 3 in (BY VOLUME) 3 - 5 in	5 - 12 in	PLUS 12 in
1	SM	0.0 to 5.2 ft SILTY SAND: About 85% fine to medium sand; about 15% nonplastic fines with medium dry strength and slow dilatancy; no reaction with HCl. IN-PLACE CONDITION: Brown, dry. GEOLOGIC INTERPRETATION: Quaternary Alluvium (Qal)			
5	5.2 ft (6074.9)				
6	SP-SM (visual) SP (lab classif)	5.2 to 12.0 ft POORLY GRADED SAND WITH SILT: About 90% fine to medium sand; about 10% nonplastic fines with low dry strength and rapid dilatancy; no reaction with HCl. IN-PLACE CONDITION: Brown to tan and dry, becoming slightly moist below 10.2 feet. IN-PLACE UNIT WEIGHT AND MOISTURE FROM 6.0 ft. Total: 100.2 lbf/ft³ 4.0% (94.2% relative compaction) LAB TEST DATA: 4.7% fines, 95.3% sand, 0.0% gravel, LL= NA, PI= NP, SPG= 2.63 Maximum dry density= 106.4 lbf/ft³, optimum water content= N/A% Laboratory classification is POORLY GRADED SAND GEOLOGIC INTERPRETATION: Quaternary Alluvium (Qal)			
12	12.0 ft (6068.1)				

COMMENTS: SURFACE VEGETATION CONSISTS SAGE BRUSH. DISCONTINUED HOLE DUE TO SLOUGHING STARTING AT 10.0 FEET.

7-1336-A (1-86)
Bureau of Reclamation

LOG OF TEST PIT NO. TPR22B-14-46

SHEET 1 OF 1

FEATURE: Reach 22B
LOCATION: PIPELINE
COORDINATES: N 2,021,692 E 2,750,396
APPROXIMATE DIMENSIONS: 12'x18'x14.7'
DEPTH TO WATER: NE DATE: NA

PROJECT: Navajo Gallup Water Supply Project
GROUND ELEVATION: 6092.6
METHOD OF EXPLORATION: CASE 580N BACKHOE
LOGGED BY: P. GARDNER
DATE EXCAVATED: 8/25/2014

DEPTH	CLASSIFICATION GROUP SYMBOL	CLASSIFICATION AND DESCRIPTION OF MATERIAL (SEE USBR 5000, 5005)	% PLUS 3 in (BY VOLUME) 3 - 5 in	5 - 12 in	PLUS 12 in
1	SM	0.0 to 4.0 ft SILTY SAND: About 80% fine sand; about 20% fines with no plasticity, low dry strength and slow dilatancy; maximum size, fine sand; no reaction to HCl.			
2		IN-PLACE CONDITION: Light brown and dry, loose consolidation. Calcium carbonate stringers and nodules below 3.6 feet. Roots in the upper 2.0 feet of excavation. Easy excavation.			
3					
4	4.0 ft (6088.6)	GEOLOGIC INTERPRETATION: Quaternary Alluvium (Qal)			
5	SP	4.0 to 8.8 ft POORLY GRADED SAND: About 95% predominantly fine sand; about 5% fines with no plasticity, no dry strength and rapid dilatancy; trace of gravel; maximum size, 25mm; no reaction to HCl.			
6	In-place density taken at 6.0 ft.	IN-PLACE CONDITION: Tan and dry, loose consolidation, trace of peat. Lenses of 2 x 10 inch medium to coarse POORLY GRADED SAND.			
7					
8		IN-PLACE UNIT WEIGHT AND MOISTURE FROM 6.0 ft. Total: 107.0 lbf/ft³ 1.1% (98.7% relative compaction) LAB TEST DATA: 3.9% fines, 94.4% sand, 1.7% gravel, LL= NA, PI= NP, SPG= 2.65 Maximum dry density= 108.4 lbf/ft³, optimum water content= NA% Laboratory classification is POORLY GRADED SAND			
9	8.8 ft (6083.8)				
10	SM	GEOLOGIC INTERPRETATION: Quaternary Alluvium (Qal) 8.8 to 13.7 ft SILTY SAND: About 80% fine sand; about 20% fines with no plasticity, low dry strength, slow dilatancy; maximum size, fine sand; no reaction to HCl.			
11	Corrosion sample taken at 10.0 ft.				
12					
13	13.7 ft (6078.9)	IN-PLACE CONDITION: Light brown and dry, loose consolidation. Two gallon bag corrosion sample taken at 10.0 feet.			
14	SANDSTONE 14.7 ft (6077.9)	GEOLOGIC INTERPRETATION: Quaternary Alluvium (Qal) 13.7 to 14.7 ft SANDSTONE: Fine to medium grained sandstone. Dark brown and brown to tan in color. Moderately to slightly weathered (W4) and very soft (H7), becoming moderately hard (H4) at 14.5 feet. Thinly bedded and recovered from backhoe generally in 2 x 12 x 12 inch pieces. Mica present. None to weak reaction with HCl.			
		GEOLOGIC INTERPRETATION: Tertiary Nacimiento Formation (Tn)			

COMMENTS: SURFACE VEGETATION CONSISTS OF GRASSES, SAGE BRUSH AND JUNIPER . DISCONTINUED HOLE DUE TO REFUSAL ON BEDROCK.

7-1336-A (1-86)
Bureau of Reclamation

LOG OF TEST PIT NO. TPR22B-14-47

SHEET 1 OF 1

FEATURE: Reach 22B
PROJECT: Navajo Gallup Water Supply Project
LOCATION: PIPELINE
GROUND ELEVATION: 6078.4
COORDINATES: N 2,020,522 E 2,750,401
METHOD OF EXPLORATION: CASE 580N BACKHOE
APPROXIMATE DIMENSIONS: 12'x17'x15.4'
LOGGED BY: P. GARDNER
DEPTH TO WATER: NE DATE: NA
DATE EXCAVATED: 8/25/2014

DEPTH	CLASSIFICATION GROUP SYMBOL	CLASSIFICATION AND DESCRIPTION OF MATERIAL (SEE USBR 5000, 5005)	% PLUS 3 in (BY VOLUME) 3 - 5 in	5 - 12 in	PLUS 12 in
1–15	SM (visual) SP-SM (lab class)	0.0 to 15.4 ft SILTY SAND: About 85% predominantly fine sand; about 15% fines with no plasticity, low dry strength and rapid dilatancy; trace of coarse sand, gravel and cobbles; cobbles are subrounded and hard; maximum size, 100mm; no reaction to HCl. IN-PLACE CONDITION: Brown to tan, dry, homogeneous. Roots in the upper 2.0 feet of excavation. Weak cementation and easy excavation. IN-PLACE UNIT WEIGHT AND MOISTURE FROM 6.0 ft. Total: 102.9 lbf/ft³ 1.9% (92.0% compaction) LAB TEST DATA: 12.0% fines, 87.8% sand, 0.2% gravel, LL= NA, PI= NP, SPG= 2.63 Maximum dry density= 111.9 lbf/ft³, optimum water content= 11.3% Laboratory classification is POORLY GRADED SAND WITH SILT GEOLOGIC INTERPRETATION: Quaternary Alluvium (Qal)	tr		
8	In-place density taken at 6.0 ft.				
15	15.4 ft (6063.0)				

COMMENTS: SURFACE VEGETATION CONSISTS OF GRASSES AND SAGE BRUSH. DISCONTINUED HOLE DUE TO LIMIT OF EQUIPMENT.

7-1336-A (1-86)
Bureau of Reclamation

LOG OF TEST PIT NO. TPR22B-14-48

SHEET 1 OF 1

FEATURE: Reach 22B
LOCATION: PIPELINE
COORDINATES: N 2,019,384 E 2,750,347
APPROXIMATE DIMENSIONS: 12'x17'x16.3'
DEPTH TO WATER: NE DATE: NA

PROJECT: Navajo Gallup Water Supply Project
GROUND ELEVATION: 6121.2
METHOD OF EXPLORATION: CASE 580N BACKHOE
LOGGED BY: P. GARDNER
DATE EXCAVATED: 8/26/2014

DEPTH	CLASSIFICATION GROUP SYMBOL	CLASSIFICATION AND DESCRIPTION OF MATERIAL (SEE USBR 5000, 5005)	% PLUS 3 in (BY VOLUME) 3 - 5 in	5 - 12 in	PLUS 12 in
1–16	SM	0.0 to 16.3 ft SILTY SAND: About 85% fine to coarse sand, subangular and hard; about 15% nonplastic fines with no dry strength and rapid dilatancy; trace of hard, angular to subrounded, fine to coarse gravels; trace of hard, angular cobbles; max size, 200mm; no reaction to HCl. IN-PLACE CONDITION: Brown to tan, moist, homogeneous except for a 2 x 3 foot long lens of POORLY GRADED SAND at depth of 3.2 feet. Easy excavation. IN-PLACE UNIT WEIGHT AND MOISTURE FROM 6.0 ft. Total: 100.3 lbf/ft³ 4.0% (87.4% compaction) LAB TEST DATA: 17.3% fines, 82.6% sand, 0.1% gravel, LL= NA, PI= NP, SPG= 2.61 Maximum dry density= 114.7 lbf/ft³, optimum water content= 10.0% Laboratory classification is SILTY SAND GEOLOGIC INTERPRETATION: Quaternary Alluvium (Qal)		tr	
8	In-place density taken at 6.0 ft.				
16	16.3 ft (6104.9)				

COMMENTS: SURFACE VEGETATION CONSISTS OF GRASSES AND SAGE BRUSH. DISCONTINUED HOLE DUE TO LIMIT OF EQUIPMENT.

7-1336-A (1-86)
Bureau of Reclamation

LOG OF TEST PIT NO. TPR22B-14-50

SHEET 1 OF 1

FEATURE: Reach 22B
LOCATION: PIPELINE
COORDINATES: N 2,016,957 E 2,750,694
APPROXIMATE DIMENSIONS: 6'x12'x6.8'
DEPTH TO WATER: NE DATE: NA

PROJECT: Navajo Gallup Water Supply Project
GROUND ELEVATION: 6185.5
METHOD OF EXPLORATION: CASE 680L BACKHOE
LOGGED BY: P. GARDNER
DATE EXCAVATED: 9/25/2014

DEPTH	CLASSIFICATION GROUP SYMBOL	CLASSIFICATION AND DESCRIPTION OF MATERIAL (SEE USBR 5000, 5005)	% PLUS 3 in (BY VOLUME) 3 - 5 in	5 - 12 in	PLUS 12 in
0	SM	0.0 to 3.0 ft SILTY SAND: About 75% predominantly fine sand; about 25% nonplastic fines with medium dry strength and rapid dilatancy; trace of hard, angular, medium to coarse sand; maximum size, coarse sand; strong reaction with HCl. IN-PLACE CONDITION: Reddish brown, dry and homogeneous. Strong cementation. Roots down to 6.8 feet. GEOLOGIC INTERPRETATION: Quaternary Alluvium (Qal)			
3.0 ft (6182.5)	SP-SM	3.0 to 6.0 ft POORLY GRADED SAND WITH SILT: About 90% predominantly fine sand; about 10% nonplastic fines with no dry strength and rapid dilatancy; trace of hard, subangular, medium to coarse sand; maximum size, coarse sand; no reaction with HCl. IN-PLACE CONDITION: Light brown and tan, dry and lensed with POORLY GRADED SAND. Weak cementation. Roots down to 6.8 feet. GEOLOGIC INTERPRETATION: Quaternary Alluvium (Qal)			
6.0 ft (6179.5)	SANDSTONE	6.0 to 6.8 ft SANDSTONE: Fine grained sandstone. Reddish brown in color. Intensely weathered (W7) and soft (H6). Joints contain calcium carbonate and roots. Excavated in 6 inch blocky chunks; strong reaction with HCl. GEOLOGIC INTERPRETATION: Tertiary Nacimiento Formation (Tn)			
6.8 ft (6178.7)					

COMMENTS: SURFACE VEGETATION CONSISTS OF GRASSES, SAGE BRUSH. DISCONTINUED HOLE DUE TO REFUSAL ON BEDROCK.

7-1336-A (1-86)
Bureau of Reclamation

LOG OF TEST PIT NO. TPR22B-14-51

SHEET 1 OF 2

FEATURE: Reach 22B
LOCATION: PIPELINE
COORDINATES: N 2,015,742 E 2,750,704
APPROXIMATE DIMENSIONS: 12'x17'x14.8'
DEPTH TO WATER: NE DATE: NA

PROJECT: Navajo Gallup Water Supply Project
GROUND ELEVATION: 6203.2
METHOD OF EXPLORATION: CASE 580N BACKHOE
LOGGED BY: P. GARDNER
DATE EXCAVATED: 8/27/2014

DEPTH	CLASSIFICATION GROUP SYMBOL	CLASSIFICATION AND DESCRIPTION OF MATERIAL (SEE USBR 5000, 5005)	% PLUS 3 in (BY VOLUME) 3 - 5 in	5 - 12 in	PLUS 12 in
1–7	SM (visual) SP-SM (lab class) In-place density taken at 6.0 ft. 7.5 ft (6195.7)	0.0 to 7.5 ft SILTY SAND: About 85% fine sand; about 15% nonplastic fines with no dry strength and rapid dilatancy; maximum size, fine sand; weak reaction with HCl. IN-PLACE CONDITION: Light brown, dry, homogeneous and moderately cemented. IN-PLACE UNIT WEIGHT AND MOISTURE FROM 6.0 ft. Total: 98.1 lbf/ft³ 2.0% (95.3% compaction) LAB TEST DATA: 91.1% sand, 8.9% fines, 0.0% gravel, LL= NA, PI= NP, SPG= 2.65 Maximum dry density= 102.9 lbf/ft³, optimum water content= 14.0% Laboratory classification is POORLY GRADED SAND WITH SILT GEOLOGIC INTERPRETATION: Quaternary Alluvium (Qal)			
8–12	SM 13.0 ft (6190.2)	7.5 to 13.0 ft SILTY SAND: About 75% fine to medium sand; about 25% nonplastic fines with high dry strength and slow dilatancy; maximum size, medium sand; strong reaction to HCl. IN-PLACE CONDITION: Brown, dry, homogeneous and strong cementation. Calcium carbonate stringers and root casts. Hard to excavate. Recovered in blocky chunks. GEOLOGIC INTERPRETATION: Quaternary Alluvium (Qal)			
13–14	SP-SM One sack sample taken at 14.0 ft. 14.8 ft (6188.4)	13.0 to 14.8 ft POORLY GRADED SAND WITH SILT: About 90% fine to coarse sand; about 10% nonplastic fines with no dry strength and rapid dilatancy; maximum size, coarse sand; no reaction with HCl. IN-PLACE CONDITION: Tan, dry and weak cementation.			

COMMENTS: SURFACE VEGETATION CONSISTS OF GRASSES, SAGE BRUSH AND JUNIPER.
DISCONTINUED HOLE DUE TO LIMIT OF EQUIPMENT.

7-1336-A (1-86)
Bureau of Reclamation

LOG OF TEST PIT NO. TPR22B-14-51

SHEET 2 OF 2

FEATURE: Reach 22B
LOCATION: PIPELINE
COORDINATES: N 2,015,742 E 2,750,704
APPROXIMATE DIMENSIONS: 12'x17'x14.8'
DEPTH TO WATER: NE DATE: NA

PROJECT: Navajo Gallup Water Supply Project
GROUND ELEVATION: 6203.2
METHOD OF EXPLORATION: CASE 580N BACKHOE
LOGGED BY: P. GARDNER
DATE EXCAVATED: 8/27/2014

DEPTH	CLASSIFICATION GROUP SYMBOL	CLASSIFICATION AND DESCRIPTION OF MATERIAL (SEE USBR 5000, 5005)	% PLUS 3 in (BY VOLUME) 3 - 5 in	5 - 12 in	PLUS 12 in
		One gallon sack sample TPR22-51 taken at 14.0 feet. Hole sloughed below 13.0 feet. LAB TEST DATA: 92.4% sand, 7.6% fines, 0.0% gravel, LL= NA, PI= NP, SPG= 2.63 Laboratory classification is POORLY GRADED SAND WITH SILT GEOLOGIC INTERPRETATION: Quaternary Alluvium (Qal)			

COMMENTS:

7-1336-A (1-86)
Bureau of Reclamation

LOG OF TEST PIT NO. TPR22B-14-52B

SHEET 1 OF 1

FEATURE: Reach 22B
LOCATION: PIPELINE
COORDINATES: N 2,014,592 E 2,750,610
APPROXIMATE DIMENSIONS: 12'x14'x16.2'
DEPTH TO WATER: NE DATE: NA

PROJECT: Navajo Gallup Water Supply Project
GROUND ELEVATION: 6202.7
METHOD OF EXPLORATION: CASE 580N BACKHOE
LOGGED BY: P. GARDNER
DATE EXCAVATED: 8/27/2014

DEPTH	CLASSIFICATION GROUP SYMBOL	CLASSIFICATION AND DESCRIPTION OF MATERIAL (SEE USBR 5000, 5005)	% PLUS 3 in (BY VOLUME) 3 - 5 in	5 - 12 in	PLUS 12 in
1–16	SM	0.0 to 16.2 ft SILTY SAND: About 85% predominantly fine sand; about 15% fines with no plasticity, medium dry strength and rapid dilatancy; maximum size, medium sand; none to strong reaction with HCl. IN-PLACE CONDITION: Brown and dry, moderately cemented. Trace of calcium carbonate nodules. Calcium carbonate stringers below 6.0 feet. Roots in the upper 1.5 feet. Two gallon bag corrosion sample taken at 10.0 feet. IN-PLACE UNIT WEIGHT AND MOISTURE FROM 6.0 ft. Total: 99.1 lbf/ft³ 3.8% (88.0% compaction) LAB TEST DATA: 67.5% sand, 32.5% fines, 0.0% gravel, L= NA, PI= NP, SPG= 2.66 Maximum dry density= 112.6 lbf/ft³, optimum water content= 12.0% Laboratory classification is SILTY SAND GEOLOGIC INTERPRETATION: Quaternary Alluvium (Qal)			
8	In-place density taken at 6.0 ft. Corrosion sample taken at 10.0 ft.				
16	16.2 ft (6186.5)				

COMMENTS: SURFACE VEGETATION CONSISTS OF SAGE BRUSH AND GRASSES. DISCONTINUED HOLE DUE TO LIMIT OF EQUIPMENT.

7-1336-A (1-86)
Bureau of Reclamation

LOG OF TEST PIT NO. TPR22B-14-54B

SHEET 1 OF 1

FEATURE: Reach 22B
LOCATION: PIPELINE
COORDINATES: N 2,012,009 E 2,750,210
APPROXIMATE DIMENSIONS: 14'x17'x14.9'
DEPTH TO WATER: NE DATE: NA

PROJECT: Navajo Gallup Water Supply Project
GROUND ELEVATION: 6181.5
METHOD OF EXPLORATION: CASE 580N BACKHOE
LOGGED BY: P. GARDNER
DATE EXCAVATED: 8/27/2014

DEPTH	CLASSIFICATION GROUP SYMBOL	CLASSIFICATION AND DESCRIPTION OF MATERIAL (SEE USBR 5000, 5005)	% PLUS 3 in (BY VOLUME) 3 - 5 in	5 - 12 in	PLUS 12 in
1 2 3 4 5	SM	0.0 to 5.8 ft SILTY SAND: About 80% fine to medium sand; about 20% fines with no plasticity, low dry strength and rapid dilatancy; trace of hard, subrounded coarse gravel; maximum size, 50mm; no reaction to HCl. IN-PLACE CONDITION: Brown and dry, moderately cemented and homogeneous. Calcium carbonate stringers and nodules. Roots and root casts throughout interval. GEOLOGIC INTERPRETATION: Quaternary Alluvium (Qal)			
5.8 ft (6175.7)					
6 7 8 9 10 11 12 13 14	SM In-place density taken at 6.0 ft.	5.8 to 14.9 ft SILTY SAND: About 75% fine to medium sand; about 25% fines with no plasticity, high dry strength and slow dilatancy; maximum size, medium sand; strong reaction to HCl. IN-PLACE CONDITION: Tan to brown, dry, moderately cemented. Calcium carbonate stringers and nodules. Root casts present. IN-PLACE UNIT WEIGHT AND MOISTURE FROM 6.0 ft. Total: 110.1 lbf/ft³ 3.6% (92.6% compaction) LAB TEST DATA: 70.8% sand, 28.3% fines, 0.9% gravel, LL= NA, PI= NP, SPG= 2.66 Maximum dry density= 118.9 lbf/ft³, optimum water content= 11.4% Laboratory classification is SILTY SAND GEOLOGIC INTERPRETATION: Quaternary Alluvium (Qal)			
14.9 ft (6166.6)					

COMMENTS: SURFACE VEGETATION CONSISTS OF GRASSES, SAGE BRUSH AND JUNIPER. DISCONTINUED HOLE DUE TO LIMIT OF EQUIPMENT.

7-1336-A (1-86)
Bureau of Reclamation

LOG OF TEST PIT NO. TPR22B-14-62

SHEET 1 OF 2

FEATURE: Reach 22B
LOCATION: PIPELINE
COORDINATES: N 2,002,708 E 2,747,827
APPROXIMATE DIMENSIONS: 12'x17'x12.2'
DEPTH TO WATER: NE DATE: NA

PROJECT: Navajo Gallup Water Supply Project
GROUND ELEVATION: 6232.0
METHOD OF EXPLORATION: CASE 580N BACKHOE
LOGGED BY: P. GARDNER
DATE EXCAVATED: 8/27/2014

DEPTH	CLASSIFICATION GROUP SYMBOL	CLASSIFICATION AND DESCRIPTION OF MATERIAL (SEE USBR 5000, 5005)	% PLUS 3 in (BY VOLUME) 3 - 5 in	5 - 12 in	PLUS 12 in
1	SM	0.0 to 2.4 ft SILTY SAND: About 75% fine to medium sand; about 25% nonplastic fines with low dry strength and rapid dilatancy; maximum size, medium sand; no reaction to HCl. IN-PLACE CONDITION: Brown and dry, homogeneous and weak cementation. Roots down to 1.5 feet. GEOLOGIC INTERPRETATION: Quaternary Alluvium (Qal)			
2	2.4 ft (6229.6)				
3	SM	2.4 to 11.6 ft SILTY SAND: About 85% fine to medium sand; about 15% nonplastic fines with low dry strength and rapid dilatancy; maximum size, medium sand; strong reaction to HCl. IN-PLACE CONDITION: Light gray and white, dry, homogeneous and moderately cemented. Large veins and nodules of calcium carbonate. Veins can be 12 inches long by 0.5 inches wide. IN-PLACE UNIT WEIGHT AND MOISTURE FROM 6.0 ft. Total: 98.7 lbf/ft³ 3.0% (88.5% compaction) LAB TEST DATA: 19.6% fines, 80.4% sand, 0.0% gravel, LL= NA, PI= NP, SPG= 2.61 Maximum dry density= 111.5 lbf/ft³, optimum water content= 13.3% Laboratory classification is SILTY SAND			
4					
5					
6	In-place density taken at 6.0 ft.	GEOLOGIC INTERPRETATION: Quaternary Alluvium (Qal)			
7					
8					
9					
10					

COMMENTS: SURFACE VEGETATION CONSISTS OF SAGE BRUSH AND GRASSES. DISCONTINUED HOLE DUE TO REFUSAL ON BEDROCK.

7-1336-A (1-86)
Bureau of Reclamation

LOG OF TEST PIT NO. TPR22B-14-62

SHEET 2 OF 2

FEATURE: Reach 22B
LOCATION: PIPELINE
COORDINATES: N 2,002,708 E 2,747,827
APPROXIMATE DIMENSIONS: 12'x17'x12.2'
DEPTH TO WATER: NE DATE: NA

PROJECT: Navajo Gallup Water Supply Project
GROUND ELEVATION: 6232.0
METHOD OF EXPLORATION: CASE 580N BACKHOE
LOGGED BY: P. GARDNER
DATE EXCAVATED: 8/27/2014

DEPTH	CLASSIFICATION GROUP SYMBOL	CLASSIFICATION AND DESCRIPTION OF MATERIAL (SEE USBR 5000, 5005)	% PLUS 3 in (BY VOLUME) 3 - 5 in	5 - 12 in	PLUS 12 in
11	In-place density taken at 6.0 ft.				
	11.6 ft (6220.4)				
	SHALE 12.0 ft (6220.0)	11.6 to 12.0 ft SHALE: Light gray to dark gray. Slightly weathered (W4) and soft (H6). Fissile and can have calcium carbonate veneer. Slakes rapidly in field test at natural moisture content. GEOLOGIC INTERPRETATION: Tertiary Nacimiento Formation (Tn)			
12	SANDSTONE 12.2 ft (6219.8)	12.0 to 12.2 ft SANDSTONE: Dark gray and fine grained. Hard (H3), difficult to break with a heavy hammer blow and slightly weathered (W4). Calcium carbonate veneer observed. GEOLOGIC INTERPRETATION: Tertiary Nacimiento Formation (Tn)			

COMMENTS:

7-1336-A (1-86)
Bureau of Reclamation

LOG OF TEST PIT NO. TPR22B-14-75

SHEET 1 OF 2

FEATURE: Reach 22B
LOCATION: PIPELINE
COORDINATES: N 1,987,945 E 2,742,547
APPROXIMATE DIMENSIONS: 13'x18'x17'
DEPTH TO WATER: NE DATE: NA

PROJECT: Navajo Gallup Water Supply Project
GROUND ELEVATION: 6408.7
METHOD OF EXPLORATION: CASE 580N BACKHOE
LOGGED BY: P. GARDNER
DATE EXCAVATED: 8/28/2014

DEPTH	CLASSIFICATION GROUP SYMBOL	CLASSIFICATION AND DESCRIPTION OF MATERIAL (SEE USBR 5000, 5005)	% PLUS 3 in (BY VOLUME) 3 - 5 in	5 - 12 in	PLUS 12 in
1–6	SM	0.0 to 6.2 ft SILTY SAND: About 85% predominantly fine sand; about 15% nonplastic fines with medium dry strength and rapid dilatancy; maximum size, medium sand; no reaction to HCl. IN-PLACE CONDITION: Brown and dry, homogeneous and moderate cementation. Roots down to 2.0 feet. IN-PLACE UNIT WEIGHT AND MOISTURE FROM 6.0 ft. Total: 104.5 lbf/ft³ 2.8% (102.2% compaction) LAB TEST DATA: 8.1% fines, 91.9% sand, 0.0% gravel, LL= NA, PI= NP, SPG= 2.63 Maximum dry density= 102.2 lbf/ft³, optimum water content= 9.4% Laboratory classification is POORLY GRADED SAND WITH SILT GEOLOGIC INTERPRETATION: Quaternary Alluvium (Qal)			
6.2 ft (6402.5)					
7–15	SP-SM In-place density taken at 6.0 ft.	6.2 to 15.0 ft POORLY GRADED SAND WITH SILT: About 90% predominantly fine sand; about 10% nonplastic fines with low dry strength and rapid dilatancy; maximum size, medium sand; no reaction to HCl. IN-PLACE CONDITION: Light brown to brown, dry, homogeneous and weak cementation. In-place density test may overlap soil horizons. IN-PLACE UNIT WEIGHT AND MOISTURE FROM 6.0 ft. Total: 104.5 lbf/ft³ 2.8% (102.3% compaction) LAB TEST DATA: 91.9% sand, 8.1% fines, 0.0% gravel, LL= NA, PI= NP, SPG= 2.63 Maximum dry density= 102.2 lbf/ft³, optimum water content= 9.4% Laboratory classification is POORLY GRADED SAND WITH SILT GEOLOGIC INTERPRETATION: Quaternary Alluvium (Qal)			
15.0 ft (6393.7)					
16–17	SANDSTONE	15.0 to 17.0 ft SANDSTONE: Fine to medium grained sandstone. Brown to red and white in color. Very soft (H7) and very intensely weathered (W8). Excavated material is very soft and can be described using the Unified Soil Classification System as "POORLY GRADED SAND" with very hard			
17.0 ft (6391.7)					

COMMENTS: SURFACE VEGETATION CONSISTS OF SAGE BRUSH AND GRASSES. DISCONTINUED HOLE DUE TO LIMIT OF EQUIPMENT.

7-1336-A (1-86)
Bureau of Reclamation

LOG OF TEST PIT NO. TPR22B-14-75

SHEET 2 OF 2

FEATURE: Reach 22B
LOCATION: PIPELINE
COORDINATES: N 1,987,945 E 2,742,547
APPROXIMATE DIMENSIONS: 13'x18'x17'
DEPTH TO WATER: NE DATE: NA

PROJECT: Navajo Gallup Water Supply Project
GROUND ELEVATION: 6408.7
METHOD OF EXPLORATION: CASE 580N BACKHOE
LOGGED BY: P. GARDNER
DATE EXCAVATED: 8/28/2014

DEPTH	CLASSIFICATION GROUP SYMBOL	CLASSIFICATION AND DESCRIPTION OF MATERIAL (SEE USBR 5000, 5005)	% PLUS 3 in (BY VOLUME) 3 - 5 in	5 - 12 in	PLUS 12 in
		consistency. Calcium carbonate stringer and iron oxide staining observed. Strong reaction with HCl. GEOLOGIC INTERPRETATION: Tertiary Nacimiento Formation (Tn)			

COMMENTS:

7-1336-A (1-86)
Bureau of Reclamation

LOG OF TEST PIT NO. TPR22B-14-79B

SHEET 1 OF 1

FEATURE: Reach 22B
LOCATION: PIPELINE
COORDINATES: N 1,983,933 E 2,740,342
APPROXIMATE DIMENSIONS: 10'x18'x16.3'
DEPTH TO WATER: NE DATE: NA

PROJECT: Navajo Gallup Water Supply Project
GROUND ELEVATION: 6460.2
METHOD OF EXPLORATION: CASE 580N BACKHOE
LOGGED BY: P. GARDNER
DATE EXCAVATED: 8/28/2014

DEPTH	CLASSIFICATION GROUP SYMBOL	CLASSIFICATION AND DESCRIPTION OF MATERIAL (SEE USBR 5000, 5005)	% PLUS 3 in (BY VOLUME) 3 - 5 in	5 - 12 in	PLUS 12 in
1–11	s(CL) (visual) (CL-ML)s (lab class) In-place density taken at 6.0 ft. Corrosion sample taken at 10.0 ft. 11.2 ft (6449.0)	0.0 to 11.2 ft SANDY LEAN CLAY: About 55% fines with medium plasticity, medium toughness, no dilatancy and high dry strength; about 45% fine sand; maximum size, fine sand; weak to strong reaction with HCl. IN-PLACE CONDITION: Reddish brown and dry. Homogeneous and very hard consistency. Calcium carbonate stringers present. Hard to excavate. Field dispersion test determined non-dispersive. Roots down to 2.8 feet. IN-PLACE UNIT WEIGHT AND MOISTURE FROM 6.0 ft. Total: 94.7 lbf/ft³ 5.9%. (84.2% compaction) LAB TEST DATA: 78.3% fines, 21.7% sand, 0.0% gravel, LL= 24.8, PI= 6.6, SPG= 2.66 Maximum dry density= 112.5 lbf/ft³, optimum water content= 13.8% Laboratory classification is SILTY CLAY WITH SAND GEOLOGIC INTERPRETATION: Quaternary Alluvium (Qal)			
12–16	SM 16.3 ft (6443.9)	11.2 to 16.3 ft SILTY SAND: About 80% fine sand; about 20% nonplastic fines with low dry strength and rapid dilatancy; maximum size, fine sand; weak reaction to HCl. IN-PLACE CONDITION: Light brown and dry, homogeneous and weak cementation. Calcium carbonate stringers present. GEOLOGIC INTERPRETATION: Quaternary Alluvium (Qal)			

COMMENTS: SURFACE VEGETATION CONSISTS OF SAGE BRUSH AND GRASSES. DISCONTINUED HOLE DUE TO LIMIT OF EQUIPMENT.

7-1336-A (1-86)
Bureau of Reclamation

LOG OF TEST PIT NO. TPR22B-14-114

SHEET 1 OF 1

FEATURE: Reach 22B
LOCATION: PIPELINE
COORDINATES: N 1,982,697 E 2,739,424
APPROXIMATE DIMENSIONS: 12'x18'x12.9'
DEPTH TO WATER: NE DATE: NA

PROJECT: Navajo Gallup Water Supply Project
GROUND ELEVATION: 6490.9
METHOD OF EXPLORATION: CASE 580N BACKHOE
LOGGED BY: P. GARDNER
DATE EXCAVATED: 8/28/2014

DEPTH	CLASSIFICATION GROUP SYMBOL	CLASSIFICATION AND DESCRIPTION OF MATERIAL (SEE USBR 5000, 5005)	% PLUS 3 in (BY VOLUME) 3 - 5 in	5 - 12 in	PLUS 12 in
1	SM	0.0 to 2.0 ft SILTY SAND: About 80% fine to medium sand; about 20% nonplastic fines with medium dry strength and slow dilatancy; maximum size, medium sand; no reaction to HCl. IN-PLACE CONDITION: Brown and dry, homogeneous and moderate cementation. Roots down to 2.8 feet.			
2	2.0 ft (6488.9) SC (visual) s(CL) (lab class)	GEOLOGIC INTERPRETATION: Quaternary Alluvium (Qal) 2.0 to 9.8 ft CLAYEY SAND: About 70% fine sand; about 30% fines with low plasticity, low toughness, no dilatancy and high dry strength; maximum size, fine sand; strong reaction with HCl. IN-PLACE CONDITION: Brown, dry and homogeneous. Hard consistency. Calcium carbonate stringers observed.			
3					
4					
5		IN-PLACE UNIT WEIGHT AND MOISTURE FROM 6.0 ft. Total: 89.5 lbf/ft³, 6.0%. (79.2% compaction) LAB TEST DATA: 69.6% fines, 30.4% sand, 0.0% gravel, LL= 26.9, PI= 8.9, SPG= 2.63 Maximum dry density= 113.0 lbf/ft³, optimum water content= 13.8% Laboratory classification is SANDY LEAN CLAY			
6	In-place density taken at 6.0 ft.				
7		GEOLOGIC INTERPRETATION: Quaternary Alluvium (Qal)			
8					
9	9.8 ft (6481.1)				
10	SANDSTONE	9.8 to 12.9 ft SANDSTONE: Brown, white, red to tan. Fine to medium grained sandstone. Very soft (H7) and may be classified as "POORLY GRADED SAND" using the Unified Soil Classification System. Very intensely weathered (W8) to decomposed (W9). Excavated in powder and 1 x 2 x 5 inch chunks. Iron oxide staining present. Strong reaction to HCl.			
11	Corrosion sample taken at 10.0 ft.				
12		Two gallon bag corrosion sample taken at 10.0 feet.			
	12.9 ft (6478.0)	GEOLOGIC INTERPRETATION: Tertiary Nacimiento Formation (Tn)			

COMMENTS: SURFACE VEGETATION CONSISTS OF SAGE BRUSH AND GRASSES. DISCONTINUED HOLE DUE TO REFUSAL ON BEDROCK.

7-1336-A (1-86)
Bureau of Reclamation

LOG OF TEST PIT NO. TPR22B-14-115

SHEET 1 OF 1

FEATURE: Reach 22B
PROJECT: Navajo Gallup Water Supply Project
LOCATION: PIPELINE
GROUND ELEVATION: 6502.8
COORDINATES: N 1,981,684 E 2,738,789
METHOD OF EXPLORATION: CASE 580N BACKHOE
APPROXIMATE DIMENSIONS: 10'x18'x10'
LOGGED BY: P. GARDNER
DEPTH TO WATER: NE DATE: NA
DATE EXCAVATED: 8/28/2014

DEPTH	CLASSIFICATION GROUP SYMBOL	CLASSIFICATION AND DESCRIPTION OF MATERIAL (SEE USBR 5000, 5005)	% PLUS 3 in (BY VOLUME) 3 - 5 in	5 - 12 in	PLUS 12 in
1–9	SM (visual) s(CL) (lab class) In-place density taken at 6.0 ft. 9.6 ft (6493.2)	0.0 to 9.6 ft SILTY SAND: About 70% fine sand; about 30% nonplastic fines with medium dry strength and slow dilatancy; maximum size, fine sand; strong reaction to HCl. IN-PLACE CONDITION: Brown and dry, homogeneous and strong cementation. Roots down to 3.0 feet. Calcium carbonate veins and nodules throughout interval. IN-PLACE UNIT WEIGHT AND MOISTURE FROM 6.0 ft. Total: 97.7 lbf/ft³ 5.6% (85.4% compaction) LAB TEST DATA: 50.7% fines, 49.3% sand, 0.0% gravel, LL= 24.4, PI= 7.1, SPG= 2.62 Maximum dry density= 114.4 lbf/ft³, optimum water content= 13.0% Laboratory classification is SANDY LEAN CLAY GEOLOGIC INTERPRETATION: Quaternary Alluvium (Qal)			
10	SANDSTONE 10.0 ft (6492.8)	9.6 to 10.0 ft SANDSTONE: Brown, gray, orange and white in color. Fine to coarse grained sandstone. Very soft (H7) and may be classified as "POORLY GRADED SAND" using the Unified Soil Classification System. Very intensely weathered (W8) to decomposed (W9). Excavated in powder and 1 x 2 x 5 inch chunks. Strong reaction to HCl. GEOLOGIC INTERPRETATION: Tertiary Nacimiento Formation (Tn)			

COMMENTS: SURFACE VEGETATION CONSISTS OF SAGE BRUSH AND GRASSES. DISCONTINUED HOLE DUE TO REFUSAL ON BEDROCK.

7-1336-A (1-86)
Bureau of Reclamation

LOG OF TEST PIT NO. TPR22B-14-116

SHEET 1 OF 2

FEATURE: Reach 22B
LOCATION: PIPELINE
COORDINATES: N 1,980,683 E 2,738,161
APPROXIMATE DIMENSIONS: 12'x18'x14.9'
DEPTH TO WATER: NE DATE: NA

PROJECT: Navajo Gallup Water Supply Project
GROUND ELEVATION: 6528.9
METHOD OF EXPLORATION: CASE 580N BACKHOE
LOGGED BY: P. GARDNER
DATE EXCAVATED: 8/29/2014

DEPTH	CLASSIFICATION GROUP SYMBOL	CLASSIFICATION AND DESCRIPTION OF MATERIAL (SEE USBR 5000, 5005)	% PLUS 3 in (BY VOLUME) 3 - 5 in	5 - 12 in	PLUS 12 in
1	SM/SC (visual) s(ML) (lab class)	0.0 to 14.2 ft SILTY SAND/ CLAYEY SAND: About 75% fine sand; about 25% fines with low plasticity, medium dry strength, slow dilatancy and low toughness; maximum size, fine sand; weak reaction to HCl. IN-PLACE CONDITION: Brown and dry, homogeneous and strong cementation. Roots down to 3.0 feet. Calcium carbonate stringers. IN-PLACE UNIT WEIGHT AND MOISTURE FROM 6.0 ft. Total: 94.8 lbf/ft³ 5.6% (84.7% compaction) LAB TEST DATA: 50.7% fines, 49.3% sand, 0.0% gravel, LL= 22.9, PI= 3.8, SPG= 2.66 Maximum dry density= 111.9 lbf/ft³, optimum water content= 14.5% Laboratory classification is SANDY SILT GEOLOGIC INTERPRETATION: Quaternary Alluvium (Qal)			
2					
3					
4					
5					
6					
7	In-place density taken at 6.0 ft.				
8					
9					
10					
11					
12					
13					
14	14.2 ft (6514.7)				
	SANDSTONE 14.9 ft (6514.0)	14.2 to 14.9 ft SANDSTONE: Brown, gray, orange and white in color. Fine to coarse grained sandstone. Very soft (H7) and may be classified as "POORLY GRADED SAND" using the Unified Soil Classification System. Very intensely weathered (W8) to decomposed (W9). Excavated in powder			

COMMENTS: SURFACE VEGETATION CONSISTS OF SAGE BRUSH AND GRASSES. DISCONTINUED HOLE DUE TO REFUSAL ON BEDROCK.

7-1336-A (1-86)
Bureau of Reclamation

LOG OF TEST PIT NO. TPR22B-14-116

SHEET 2 OF 2

FEATURE: Reach 22B
PROJECT: Navajo Gallup Water Supply Project
LOCATION: PIPELINE
GROUND ELEVATION: 6528.9
COORDINATES: N 1,980,683 E 2,738,161
METHOD OF EXPLORATION: CASE 580N BACKHOE
APPROXIMATE DIMENSIONS: 12'x18'x14.9'
LOGGED BY: P. GARDNER
DEPTH TO WATER: NE DATE: NA
DATE EXCAVATED: 8/29/2014

DEPTH	CLASSIFICATION GROUP SYMBOL	CLASSIFICATION AND DESCRIPTION OF MATERIAL (SEE USBR 5000, 5005)	% PLUS 3 in (BY VOLUME) 3 - 5 in	5 - 12 in	PLUS 12 in
		and 1 x 5 x 12 inch chunks. Strong reaction to HCl.			
		GEOLOGIC INTERPRETATION: Tertiary Nacimiento Formation (Tn)			

COMMENTS:

7-1336-A (1-86)
Bureau of Reclamation

LOG OF TEST PIT NO. TPR22B-14-118

SHEET 1 OF 1

FEATURE: Reach 22B
LOCATION: PIPELINE
COORDINATES: N 1,978,638 E 2,736,870
APPROXIMATE DIMENSIONS: 12'x14'x14.8'
DEPTH TO WATER: NE DATE: NA

PROJECT: Navajo Gallup Water Supply Project
GROUND ELEVATION: 6568.4
METHOD OF EXPLORATION: CASE 580N BACKHOE
LOGGED BY: P. GARDNER
DATE EXCAVATED: 8/29/2014

DEPTH	CLASSIFICATION GROUP SYMBOL	CLASSIFICATION AND DESCRIPTION OF MATERIAL (SEE USBR 5000, 5005)	% PLUS 3 in (BY VOLUME) 3 - 5 in	5 - 12 in	PLUS 12 in
1–14	SM (visual) s(ML) (lab class)	0.0 to 14.8 ft SILTY SAND: About 75% fine sand; about 25% nonplastic fines with low dry strength and rapid dilatancy; trace of hard, subrounded and elongated gravel; maximum size, 30mm; weak reaction to HCl. IN-PLACE CONDITION: Light brown and dry, homogeneous and strong cementation. Roots down to 3.0 feet. Calcium carbonate stringers and nodules. IN-PLACE UNIT WEIGHT AND MOISTURE FROM 6.0 ft. Total: 99.0 lbf/ft³ 5.0% (91.9% compaction) LAB TEST DATA: 50.4% fines, 49.6% sand, 0.0% gravel, LL= NA, PI= NP, SPG= 2.65 Maximum dry density= 107.7 lbf/ft³, optimum water content= 15.0% Laboratory classification is SANDY SILT GEOLOGIC INTERPRETATION: Quaternary Alluvium (Qal)			
7	In-place density taken at 6.0 ft.				
14	14.8 ft (6553.6)				

COMMENTS: SURFACE VEGETATION CONSISTS OF GRASSES AND SAGE BRUSH. DISCONTINUED HOLE DUE TO LIMIT OF EQUIPMENT.

7-1336-A (1-86)
Bureau of Reclamation

LOG OF TEST PIT NO. TPR22B-14-119

SHEET 1 OF 1

FEATURE: Reach 22B
LOCATION: PIPELINE
COORDINATES: N 1,977,644 E 2,736,212
APPROXIMATE DIMENSIONS: 12'x14'x13.8'
DEPTH TO WATER: NE DATE: NA

PROJECT: Navajo Gallup Water Supply Project
GROUND ELEVATION: 6592.0
METHOD OF EXPLORATION: CASE 580N BACKHOE
LOGGED BY: P. GARDNER
DATE EXCAVATED: 8/29/2014

DEPTH	CLASSIFICATION GROUP SYMBOL	CLASSIFICATION AND DESCRIPTION OF MATERIAL (SEE USBR 5000, 5005)	% PLUS 3 in (BY VOLUME) 3 - 5 in	5 - 12 in	PLUS 12 in
1 2 3 4 5 6	s(CL) In-place density taken at 6.0 ft. 6.5 ft (6585.5)	0.0 to 6.5 ft SANDY LEAN CLAY: About 70% fines with medium plasticity, high dry strength, medium toughness and no dilatancy; about 30% predominantly fine sand; trace of hard, fine gravel; maximum size, 10mm; strong reaction to HCl. IN-PLACE CONDITION: Gray and dry, homogeneous and very hard consistency. Roots down to 1.8 feet. Field crumb test determined non-dispersive. In-place density may overlap soil horizons. IN-PLACE UNIT WEIGHT AND MOISTURE FROM 6.0 ft. Total: 89.5 lbf/ft³ 6.6% (77.3% compaction) LAB TEST DATA: 64.4% fines, 35.6% sand, 0.0% gravel, LL= 25.9, PI= 11.8, SPG= 2.65 Maximum dry density= 115.8 lbf/ft³, optimum water content= 13.6% Laboratory classification is SANDY LEAN CLAY GEOLOGIC INTERPRETATION: Quaternary Alluvium (Qal)			
7 8 9 10	SC 10.2 ft (6581.8)	6.5 to 10.2 ft CLAYEY SAND: About 55% fine sand; about 45% fines with medium plasticity, high dry strength, medium toughness and no dilatancy; maximum size, fine sand; strong reaction with HCl. IN-PLACE CONDITION: Reddish brown and dry, homogeneous and strong cementation. GEOLOGIC INTERPRETATION: Quaternary Alluvium (Qal)			
11 12 13	SC 13.8 ft (6578.2)	10.2 to 13.8 ft CLAYEY SAND: About 55% fine to medium sand; about 45% fines with medium plasticity, medium dry strength, medium toughness and no dilatancy; maximum size, medium sand; strong reaction to HCl. IN-PLACE CONDITION: Gray in color, dry, homogeneous and strong cementation. Calcium carbonate stringers present. GEOLOGIC INTERPRETATION: Quaternary Alluvium (Qal)			

COMMENTS: SURFACE VEGETATION CONSISTS OF GRASSES WITH SPARSE SAGE BRUSH. DISCONTINUED HOLE DUE TO REFUSAL ON STIFF CLAY.

7-1336-A (1-86)
Bureau of Reclamation

LOG OF TEST PIT NO. TPR22B-14-120

SHEET 1 OF 1

FEATURE: Reach 22B
LOCATION: PIPELINE
COORDINATES: N 1,976,517 E 2,735,822
APPROXIMATE DIMENSIONS: 12'x14'x15.7'
DEPTH TO WATER: NE DATE: NA

PROJECT: Navajo Gallup Water Supply Project
GROUND ELEVATION: 6616.2
METHOD OF EXPLORATION: CASE 580N BACKHOE
LOGGED BY: P. GARDNER
DATE EXCAVATED: 8/29/2014

DEPTH	CLASSIFICATION GROUP SYMBOL	CLASSIFICATION AND DESCRIPTION OF MATERIAL (SEE USBR 5000, 5005)	% PLUS 3 in (BY VOLUME) 3 - 5 in	5 - 12 in	PLUS 12 in
1 2 3 4 5 6 7 8 9 10 11 12	s(CL) (visual) SM (lab class) In-place density taken at 6.0 ft. Corrosion sample taken at 10.0 ft. 12.2 ft (6604.0)	0.0 to 12.2 ft SANDY LEAN CLAY: About 55% fines with medium plasticity, high dry strength, medium toughness and no dilatancy; about 45% fine sand; maximum size, fine sand; strong reaction to HCl. IN-PLACE CONDITION: Gray to light brown, dry, homogeneous and very hard consistency. Roots down to 4.0 feet. Two gallon bag corrosion sample taken at 10.0 feet. IN-PLACE UNIT WEIGHT AND MOISTURE FROM 6.0 ft. Total: 94.4 lbf/ft³ 4.1% (80.3% compaction) LAB TEST DATA: 66.2% sand, 32.0% fines, 1.8% gravel, LL= 19.7, PI= 2.4, SPG= 2.64 Maximum dry density= 117.6 lbf/ft³, optimum water content= 11.5% Laboratory classification is SILTY SAND GEOLOGIC INTERPRETATION: Quaternary Alluvium (Qal)			
13 14 15	SC 15.7 ft (6600.5)	12.2 to 15.7 ft CLAYEY SAND: About 55% fine sand; about 45% fines with medium plasticity, high dry strength, medium toughness and no dilatancy; maximum size, fine sand; strong reaction to HCl. IN-PLACE CONDITION: Dark brown, dry, homogeneous and strong cementation. GEOLOGIC INTERPRETATION: Quaternary Alluvium (Qal)			

COMMENTS: SURFACE VEGETATION CONSISTS OF GRASSES WITH SPARSE SAGE BRUSH.
DISCONTINUED HOLE DUE TO LIMIT OF EQUIPMENT.

7-1336-A (1-86)
Bureau of Reclamation

LOG OF TEST PIT NO. TPR22B-14-123

SHEET 1 OF 1

FEATURE: Reach 22B
LOCATION: PIPELINE
COORDINATES: N 1,972,957 E 2,735,815
APPROXIMATE DIMENSIONS: 12'x14'x13.6'
DEPTH TO WATER: NE DATE: NA

PROJECT: Navajo Gallup Water Supply Project
GROUND ELEVATION: 6630.4
METHOD OF EXPLORATION: CASE 680N BACKHOE
LOGGED BY: P. GARDNER
DATE EXCAVATED: 9/26/2014

DEPTH	CLASSIFICATION GROUP SYMBOL	CLASSIFICATION AND DESCRIPTION OF MATERIAL (SEE USBR 5000, 5005)	% PLUS 3 in (BY VOLUME) 3 - 5 in	5 - 12 in	PLUS 12 in
1	CL (visual) s(CL) (lab class)	0.0 to 4.2 ft LEAN CLAY: About 90% fines with medium plasticity, high toughness, high dry strength and no dilatancy; about 10% fine sand; trace of angular, coarse sand; maximum size, coarse sand; strong reaction with HCl.			
2	One gallon bag sample taken at 2.0 ft.	IN-PLACE CONDITION: Grayish brown, dry and blocky. Very hard consistency and hard to excavate. Calcium carbonate stringers below 2.7 and above 4.2 feet. One gallon bag sample taken at 2.0 ft.			
3					
4	4.2 ft (6626.2)	LAB TEST DATA: 84.1% fines, 15.9% sand, 0.0% gravel, LL= 45.2, PI= 27.5, SPG= 2.69 Laboratory classification is LEAN CLAY WITH SAND GEOLOGIC INTERPRETATION: Quaternary Alluvium (Qal)			
5	SP-SM (visual) SM (lab class)	4.2 to 13.6 ft POORLY GRADED SAND WITH SILT: About 90% fine to medium sand; about 10% nonplastic fines with low dry strength and rapid dilatancy; trace of coarse sand, fine and coarse gravel; maximum size, 30mm; no reaction with HCl.			
6					
7		IN-PLACE CONDITION: Reddish brown and tan in color. Dry and homogeneous. Moderately cemented becoming strongly cemented below 12.0 feet and hard to excavate. Nodules containing fines 1 inch in diameter are found throughout the profile.			
8					
9	In-place density taken at 6.0 ft.	IN-PLACE UNIT WEIGHT AND MOISTURE FROM 6.0 ft. Total: 97.3 lbf/ft³ 3.6% (83.7% compaction) LAB TEST DATA: 25.9% fines, 74.1% sand, 0.0% gravel, LL= N/A, PI= N/P, SPG= 2.68 Maximum dry density= 116.2 lbf/ft³, optimum water content= 11.5% Laboratory classification is SILTY SAND			
10					
11		GEOLOGIC INTERPRETATION: Quaternary Alluvium (Qal)			
12					
13	13.6 ft (6616.8)				

COMMENTS: SURFACE VEGETATION CONSISTS OF SPARSE SAGE AND GRASSES. DISCONTINUED HOLE DUE TO REFUSAL ON WELL CEMENTED SOIL.

7-1336-A (1-86)
Bureau of Reclamation

LOG OF TEST PIT NO. TPR22B-14-124

SHEET 1 OF 1

FEATURE: Reach 22B
LOCATION: PIPELINE
COORDINATES: N 1,971,730 E 2,735,804
APPROXIMATE DIMENSIONS: 12'x14'x11.7'
DEPTH TO WATER: NE DATE: NA

PROJECT: Navajo Gallup Water Supply Project
GROUND ELEVATION: 6626.5
METHOD OF EXPLORATION: CASE 680N BACKHOE
LOGGED BY: J. GILBERT
DATE EXCAVATED: 10/15/2014

DEPTH	CLASSIFICATION GROUP SYMBOL	CLASSIFICATION AND DESCRIPTION OF MATERIAL (SEE USBR 5000, 5005)	% PLUS 3 in (BY VOLUME) 3 - 5 in	5 - 12 in	PLUS 12 in
1	SC (visual) SC-SM (lab class)	0.0 to 7.2 ft CLAYEY SAND: About 60% fine sand; about 40% fines with low plasticity, no dilatancy, medium dry strength, medium toughness; maximum size, fine sand; no reaction with HCl IN-PLACE CONDITION: Dry, dark brown in color, homogeneous, root casts present. IN-PLACE UNIT WEIGHT AND MOISTURE FROM 6.0 ft. Total: 96.8 lbf/ft³ 5.2% (81.7% compaction) LAB TEST DATA: 33.4% fines, 66.6% sand, 0.0% gravel, LL= 20.1, PI= 4.8, SPG= 2.64 Maximum dry density= 118.5 lbf/ft³, optimum water content= 11.6% Laboratory classification is SILTY CLAYEY SAND GEOLOGIC INTERPRETATION: Quaternary Alluvium (Qal)			
2					
3	In-place density taken at 6.0 ft, corrosion sample at 10.0 ft				
4					
5					
6					
7	7.2 ft (6619.3)				
8	SM	7.2 to 11.7 ft SILTY SAND: About 80% fine sand; about 20% nonplastic fines with rapid dilatancy, no dry strength; maximum size, fine sand; no reaction with HCl. IN-PLACE CONDITION: Tan in color, dry, homogeneous			
9					
10					
11					
	11.7 ft (6614.8)				

COMMENTS: SURFACE VEGETATION CONSISTS OF GRASSES, SAGE BRUSH. DISCONTINUED HOLE DUE TO LIMIT OF EQUIPMENT.

7-1336-A (1-86)
Bureau of Reclamation

LOG OF TEST PIT NO. TPR22B-14-126

SHEET 1 OF 1

FEATURE: Reach 22B
LOCATION: PIPELINE
COORDINATES: N 1,969,380 E 2,735,941
APPROXIMATE DIMENSIONS: 12'x14'x14.6'
DEPTH TO WATER: NE DATE: NA

PROJECT: Navajo Gallup Water Supply Project
GROUND ELEVATION: 6600.9
METHOD OF EXPLORATION: CASE 580N BACKHOE
LOGGED BY: J. GILBERT
DATE EXCAVATED: 10/15/2014

DEPTH	CLASSIFICATION GROUP SYMBOL	CLASSIFICATION AND DESCRIPTION OF MATERIAL (SEE USBR 5000, 5005)	% PLUS 3 in (BY VOLUME) 3 - 5 in	5 - 12 in	PLUS 12 in
1 2 3 4 5	SP-SM	0.0 to 5.5 ft POORLY GRADED SAND WITH SILT: About 90% fine to medium sand; about 10% nonplastic fines with low dry strength and rapid dilatancy; trace of coarse sand, fine and coarse gravel; maximum size, 30mm; no reaction with HCl. IN-PLACE CONDITION: Tan in color, homogeneous , dry.			
5.5 ft (6595.4)					
6 7 8 9 10 11 12 13 14	(SP-SM)g (visual) SP-SM (lab class) In-place density taken at 6.0 ft.	5.5 to 14.6 ft POORLY GRADED SAND WITH SILT AND GRAVEL: About 70% fine to coarse sand; about 20% fine to coarse gravel, maximum size, 60mm; about 10% nonplastic fines with rapid dilatancy, and no dry strength; no reaction with HCl. IN-PLACE CONDITION: unconsolidated subrounded to subangular gravel, dry. IN-PLACE UNIT WEIGHT AND MOISTURE FROM 6.0 ft. Total: 104.2 lbf/ft³ 2.7% (92.1% relative compaction) LAB TEST DATA: 11.7% fines, 82.3% sand, 6.0% gravel, LL= N/A, PI= NP, SPG= 2.43 Maximum dry density= 113.1 lbf/ft³, optimum water content= N/A% Laboratory classification is POORLY GRADED SAND WITH SILT GEOLOGIC INTERPRETATION: Quaternary Alluvium (Qal)			
14.6 ft (6586.3)					

COMMENTS: SURFACE VEGETATION CONSISTS OF SAGE BRUSH. DISCONTINUED HOLE DUE TO LIMIT OF EQUIPMENT.

7-1336-A (1-86)
Bureau of Reclamation

LOG OF TEST PIT NO. TPR22B-14-127

SHEET 1 OF 1

FEATURE: Reach 22B
LOCATION: PIPELINE
COORDINATES: N 1,968,417 E 2,735,558
APPROXIMATE DIMENSIONS: 6.0' x 10.0' x 14.0'
DEPTH TO WATER: NE DATE:

PROJECT: Navajo Gallup Water Supply Project
GROUND ELEVATION: 6618.9
METHOD OF EXPLORATION: CASE 580N BACKHOE
LOGGED BY: J. GILBERT
DATE EXCAVATED: 7/31/2014

DEPTH	CLASSIFICATION GROUP SYMBOL	CLASSIFICATION AND DESCRIPTION OF MATERIAL (SEE USBR 5000, 5005)	% PLUS 3 in (BY VOLUME) 3 - 5 in	5 - 12 in	PLUS 12 in
1	SM	0.0 to 3.1 ft SILTY SAND: About 80% fine sand; about 20% nonplastic fines with rapid dilatancy, no dry strength; no reaction with HCl. IN-PLACE CONDITION: Tan in color. GEOLOGIC INTERPRETATION: Quaternary Alluvium (Qal)			
3	3.1 ft (6615.8)				
4	SP-SM (visual) SM (lab class)	3.1 to 14.0 ft POORLY GRADED SAND WITH SILT: About 90% fine sand; about 10% nonplastic fines with slow dilatancy, low dry strength; maximum size, fine sand; no reaction with HCl. IN-PLACE CONDITION: tan in color IN-PLACE UNIT WEIGHT AND MOISTURE FROM 6.0 ft. Total: 108.3 lbs. / cu ft., 3.4%. (90.9% compaction) LAB TEST DATA: 79.3 % sand, 19.8 % fines, 0.9% gravels, LL= N/A, PI= NP, SPG= 2.68 Maximum dry density = 119.2 lbs. / cu ft., optimum water content = 11.7% Laboratory classification SILTY SAND GEOLOGIC INTERPRETATION: Quaternary Alluvium (Qal)			
8	In-place density taken at 6.0 ft.				
14	14.0 ft (6604.9)				

COMMENTS: SURFACE VEGETATED WITH SAGE BRUSH, DISCONTINUED AT 14.0 FEET DUE TO LIMIT OF EQUIPMENT.

7-1336-A (1-86)
Bureau of Reclamation

LOG OF TEST PIT NO. TPR22FBT-14-1

SHEET 1 OF 1

FEATURE: Reach 22B
LOCATION: FOREBAY TANK
COORDINATES: N 2,052,715 E 2,752,138
APPROXIMATE DIMENSIONS: 12'x14'x16'
DEPTH TO WATER: NE DATE: NA

PROJECT: Navajo Gallup Water Supply Project
GROUND ELEVATION: 5816.6
METHOD OF EXPLORATION: CASE 580N BACKHOE
LOGGED BY: P. GARDNER
DATE EXCAVATED: 5/7/2014

DEPTH	CLASSIFICATION GROUP SYMBOL	CLASSIFICATION AND DESCRIPTION OF MATERIAL (SEE USBR 5000, 5005)	% PLUS 3 in (BY VOLUME) 3 - 5 in	5 - 12 in	PLUS 12 in
0	SM (visual)	0.0 to 16.0 ft SILTY SAND: About 75% fine to medium sand; about 25% fines with no plasticity, no dry strength, rapid dilatancy; trace of fine to coarse, soft, weathered, round sandstone gravel; maximum size, 75mm; no reaction to HCl. IN-PLACE CONDITION: Tan and dry, loose consolidation, lenses of SP-SM 3 to 5 inches thick and 1 to 3 feet in length, iron oxide staining on gravel. IN-PLACE UNIT WEIGHT AND MOISTURE FROM 4.0 ft. Total: 94.0 lbf/ft³ 2.2% (84.2% compaction) LAB TEST DATA: 77.5% sand, 22.1% fines, 0.4% gravel, LL= NA, PI= NP, SPG= 2.64 Maximum dry density= 111.7 lbf/ft³, optimum water content= 13.6% Laboratory classification is SILTY SAND IN-PLACE UNIT WEIGHT AND MOISTURE FROM 8.0 ft. Total: 100.2 lbf/ft³ 2.8% (86.6% compaction) LAB TEST DATA: 81.7% sand, 15.9% fines, 2.4% gravel, LL= NA, PI= NP, SPG= 2.64 Maximum dry density= 115.7 lbf/ft³, optimum water content= 10.9% Laboratory classification is SILTY SAND GEOLOGIC INTERPRETATION: Quaternary Alluvium (Qal)			
1					
2					
3					
4	In-place density taken at 4.0 ft.				
5					
6					
7	In-place density taken at 8.0 ft.				
8					
9					
10					
11					
12					
13					
14					
15					
16	16.0 ft (5800.6)				

COMMENTS: SURFACE VEGETATION CONSISTS OF GRASSES AND FLOWERS. DISCONTINUED HOLE DUE TO THE LIMIT OF THE EQUIPMENT.

7-1336-A (1-86)
Bureau of Reclamation

LOG OF TEST PIT NO. TPR22FBT-14-2

SHEET 1 OF 1

FEATURE: Reach 22B
LOCATION: FOREBAY TANK
COORDINATES: N 2,052,763 E 2,752,135
APPROXIMATE DIMENSIONS: 12'x14'x18'
DEPTH TO WATER: NE DATE: NA

PROJECT: Navajo Gallup Water Supply Project
GROUND ELEVATION: 5816.3
METHOD OF EXPLORATION: CASE 580N BACKHOE
LOGGED BY: P. GARDNER
DATE EXCAVATED: 5/7/2014

DEPTH	CLASSIFICATION GROUP SYMBOL	CLASSIFICATION AND DESCRIPTION OF MATERIAL (SEE USBR 5000, 5005)	% PLUS 3 in (BY VOLUME) 3 - 5 in	5 - 12 in	PLUS 12 in
1	SM	0.0 to 4.2 ft SILTY SAND: About 80% fine to medium sand; about 20% fines with no plasticity, no dry strength, rapid dilatancy; trace of fine to coarse, soft, weathered, round gravel; max size 75mm; no reaction to HCl.			
2	In-place density taken at 4.0 ft.	IN-PLACE CONDITION: Tan and dry, loose consolidation, lenses of SP-SM 3 to 5 inches thick and 1 to 3 feet in length, iron oxide staining on gravel.			
3					
4	4.2 ft (5812.1)	IN-PLACE UNIT WEIGHT AND MOISTURE FROM 4.0 ft. Total: 98.4 lbf/ft³ 1.6% (88.2% compaction) LAB TEST DATA: 87.0% sand, 12.5% fines, 0.5% gravel, LL= NA, PI= NP, SPG= 2.61 Maximum dry density= 111.6 lbf/ft³, optimum water content= 12.7% Laboratory classification is SILTY SAND			
5	SM				
6					
7					
8		GEOLOGIC INTERPRETATION: Quaternary alluvium (Qal)			
9		SILTY SAND: About 75% fine to medium sand; about 25% fines with no plasticity, low dry strength, rapid dilatancy; trace of fine to coarse, soft, weathered, round to subrounded gravel; max size 75mm; no reaction to HCl.			
10					
11	In-place density taken at 8.0 ft.	IN-PLACE CONDITION: Tan and dry, loose consolidation, lenses of SP-SM 3 to 5 inches thick and 1 to 3 feet in length, iron oxide staining on gravel.			
12					
13		IN-PLACE UNIT WEIGHT AND MOISTURE FROM 8.0 ft. Total: 95.1 lbf/ft³ 2.8% (84.5% compaction) LAB TEST DATA: 78.6% sand, 21.0% fines, 0.4% gravel, LL= NA, PI= NP, SPG= 2.63 Maximum dry density= 112.5 lbf/ft³, optimum water content= 11.5% Laboratory classification is SILTY SAND			
14					
15					
16					
17					
18	18.0 ft (5798.3)				

COMMENTS: SURFACE VEGETATION CONSISTS OF GRASSES AND FLOWERS. DISCONTINUED HOLE DUE TO THE LIMIT OF THE EQUIPMENT.

7-1336-A (1-86)
Bureau of Reclamation

LOG OF TEST PIT NO. TPR22FBT-14-3

SHEET 1 OF 1

FEATURE: Reach 22B
LOCATION: FOREBAY TANK
COORDINATES: N 2,052,710 E 2,752,167
APPROXIMATE DIMENSIONS: 12'x14'x14'
DEPTH TO WATER: NE DATE: NA

PROJECT: Navajo Gallup Water Supply Project
GROUND ELEVATION: 5815.0
METHOD OF EXPLORATION: CASE 580N BACKHOE
LOGGED BY: P. GARDNER
DATE EXCAVATED: 5/7/2014

DEPTH	CLASSIFICATION GROUP SYMBOL	CLASSIFICATION AND DESCRIPTION OF MATERIAL (SEE USBR 5000, 5005)	% PLUS 3 in (BY VOLUME) 3 - 5 in	5 - 12 in	PLUS 12 in
1–14	SM	0.0 to 14.0 FT SILTY SAND: About 70% fine to medium sand; about 30% fines with no plasticity, low dry strength, rapid dilatancy; trace of fine to coarse, soft, weathered, round to subrounded gravel; maximum size, 75mm; no reaction to HCl. IN-PLACE CONDITION: Tan and dry, loose consolidation, lenses of SP-SM 3 to 5 inches thick and 1 to 3 feet in length, iron oxide staining on gravel. IN-PLACE UNIT WEIGHT AND MOISTURE FROM 4.0 ft. Total: 93.0 lbf/ft³ 2.9% (80.4% compaction) LAB TEST DATA: 72.5% sand, 26.9% fines, 0.6% gravel, LL= NA, PI= NP, SPG= 2.64 Maximum dry density= 115.7 lbf/ft³, optimum water content= 11.5% Laboratory classification is SILTY SAND IN-PLACE UNIT WEIGHT AND MOISTURE FROM 8.0 ft. Total: 92.2 lbf/ft³ 2.0% (86.6% compaction) LAB TEST DATA: 88.5% sand, 9.1% fines, 2.4% gravel, LL= NA, PI= NP, SPG= 2.63 Maximum dry density= 106.5 lbf/ft³, optimum water content= 5.2% Laboratory classification is POORLY GRADED SAND WITH SILT GEOLOGIC INTERPRETATION: Quaternary Alluvium (Qal)			
6	In-place density taken at 4.0 ft.				
7	In-place density taken at 8.0 ft.				
8	SP-SM (lab classification)				
14	14.0 ft (5801.0)				

COMMENTS: SURFACE VEGETATION CONSISTS OF GRASSES AND FLOWERS. DISCONTINUED HOLE DUE TO THE LIMIT OF THE EQUIPMENT.

7-1336-A (1-86)
Bureau of Reclamation

LOG OF TEST PIT NO. TPR22PP2-14-1

SHEET 1 OF 1

FEATURE: Reach 22B
LOCATION: PUMPING PLANT
COORDINATES: N 2,017,890 E 2,750,574
APPROXIMATE DIMENSIONS: 12'x17'x16.1'
DEPTH TO WATER: NE DATE: NA

PROJECT: Navajo Gallup Water Supply Project
GROUND ELEVATION: 6208.7
METHOD OF EXPLORATION: CASE 580N BACKHOE
LOGGED BY: P. GARDNER
DATE EXCAVATED: 8/26/2014

DEPTH	CLASSIFICATION GROUP SYMBOL	CLASSIFICATION AND DESCRIPTION OF MATERIAL (SEE USBR 5000, 5005)	% PLUS 3 in (BY VOLUME) 3 - 5 in	5 - 12 in	PLUS 12 in
1–5	SM	0.0 to 5.2 ft SILTY SAND: About 85% predominantly fine sand; about 15% non plastic fines with low dry strength and rapid dilatancy; maximum size, medium sand; no reaction to HCl. IN-PLACE CONDITION: Dark to light brown, dry, weak cementation and homogeneous. GEOLOGIC INTERPRETATION: Quaternary Alluvium (Qal)			
5.2 ft (6203.5)					
6.0 ft (6202.7)	SP SM	5.2 to 6.0 ft POORLY GRADED SAND: About 95% fine sand; about 5% fines with no plasticity, low dry strength and rapid dilatancy; maximum size, fine sand; no reaction to HCl. IN-PLACE CONDITION: Tan, dry, weak cementation and homogeneous. Roots in the upper 4.0 feet of excavation. GEOLOGIC INTERPRETATION: Quaternary Alluvium (Qal)			
6–16	In-place density taken at 6.0 ft.	6.0 to 16.1 ft SILTY SAND: About 75% fine sand; about 25% non plastic fines with high dry strength and rapid dilatancy; maximum size, fine sand; strong reaction to HCl. IN-PLACE CONDITION: Dark brown, dry and homogeneous. Moderately cemented. Calcium carbonate stringers and root casts present. Hard to excavate. IN-PLACE UNIT WEIGHT AND MOISTURE FROM 6.0 ft. Total: 102.4 lbf/ft³ 3.0% (88.4% compaction) LAB TEST DATA: 66.6% sand, 34.4% fines, 0.0% gravel, LL= NA, PI= NP, SPG= 2.64 Maximum dry density= 115.8 lbf/ft³, optimum water content= 12.0% Laboratory classification is SILTY SAND GEOLOGIC INTERPRETATION: Quaternary Alluvium (Qal)			
16.1 ft (6192.6)					

COMMENTS: SURFACE VEGETATION CONSISTS OF GRASSES, SAGE BRUSH AND JUNIPER. DISCONTINUED HOLE DUE TO LIMIT OF EQUIPMENT.

7-1336-A (1-86)
Bureau of Reclamation

LOG OF TEST PIT NO. TPR22PP2-14-2

SHEET 1 OF 1

FEATURE: Reach 22B
LOCATION: PUMPING PLANT
COORDINATES: N 2,017,870 E 2,750,543
APPROXIMATE DIMENSIONS: 12'x17'x15.8'
DEPTH TO WATER: NE DATE: NA

PROJECT: Navajo Gallup Water Supply Project
GROUND ELEVATION: 6211.1
METHOD OF EXPLORATION: CASE 580N BACKHOE
LOGGED BY: P. GARDNER
DATE EXCAVATED: 8/26/2014

DEPTH	CLASSIFICATION GROUP SYMBOL	CLASSIFICATION AND DESCRIPTION OF MATERIAL (SEE USBR 5000, 5005)	% PLUS 3 in (BY VOLUME) 3 - 5 in	5 - 12 in	PLUS 12 in
1–5	SP-SM	0.0 to 5.0 ft POORLY GRADED SAND WITH SILT: About 90% fine sand; about 10% non plastic fines with low dry strength and rapid dilatancy; maximum size, fine sand; no reaction to HCl. IN-PLACE CONDITION: Tan to brown, dry, weak cementation and homogeneous. Roots through 5.0 feet. GEOLOGIC INTERPRETATION: Quaternary Alluvium (Qal)			
5.0 ft (6206.1)					
5.9 ft (6205.2)	SP SM	5.0 to 5.9 ft POORLY GRADED SAND: About 95% fine sand; about 5% non plastic fines with low dry strength and rapid dilatancy; maximum size, fine sand; no reaction to HCl. IN-PLACE CONDITION: Tan, dry, weak cementation and homogeneous. GEOLOGIC INTERPRETATION: Quaternary Alluvium (Qal)			
6–15	In-place density taken at 6.0 ft.	5.9 to 15.6 ft SILTY SAND: About 75% fine sand; about 25% non plastic fines with high dry strength and rapid dilatancy; trace of hard, angular gravel; maximum size, 50mm; strong reaction to HCl. IN-PLACE CONDITION: Dark brown, dry, moderate cementation and homogeneous. Calcium carbonate stringers and root casts present. Hard to excavate. In-place density test may overlap stratigraphic units. IN-PLACE UNIT WEIGHT AND MOISTURE FROM 6.0 ft. Total: 106.6 lbf/ft³ 5.1% (92.8% compaction) LAB TEST DATA: 67.8% sand, 32.2% fines, 0.0% gravel, LL= NA, PI= NP, SPG= 2.66 Maximum dry density= 114.9 lbf/ft³, optimum water content= 13.2% Laboratory classification is SILTY SAND GEOLOGIC INTERPRETATION: Quaternary Alluvium (Qal)			
15.6 ft (6195.5)	SANDSTONE 15.8 ft (6195.3)	15.6 to 15.8 ft SANDSTONE: Fine to medium grained sandstone. Yellow to orange in color. Moderately weathered (W5) and soft (H6); No reaction to HCl. GEOLOGIC INTERPRETATION: Tertiary Nacimiento Formation (Tn)			

COMMENTS: SURFACE VEGETATION CONSISTS OF GRASSES, SAGE BRUSH AND JUNIPER. DISCONTINUED HOLE DUE TO REFUSAL ON BEDROCK.

7-1336-A (1-86)
Bureau of Reclamation

LOG OF TEST PIT NO. TPRT2-1

SHEET 1 OF 1

FEATURE: Reach 22B
LOCATION: OLD REGULATING TANK 2
COORDINATES: N 1,974,063 E 2,735,817
APPROXIMATE DIMENSIONS: 12'x14'x15.7'
DEPTH TO WATER: NE DATE: NA

PROJECT: Navajo Gallup Water Supply Project
GROUND ELEVATION: 6628.9
METHOD OF EXPLORATION: CASE 680L BACKHOE
LOGGED BY: P. GARDNER
DATE EXCAVATED: 9/26/2014

DEPTH	CLASSIFICATION GROUP SYMBOL	CLASSIFICATION AND DESCRIPTION OF MATERIAL (SEE USBR 5000, 5005)	% PLUS 3 in (BY VOLUME) 3 - 5 in	5 - 12 in	PLUS 12 in
1	SC	0.0 to 2.3 ft CLAYEY SAND: About 55% fine to medium sand; about 45% fines with low plasticity, low toughness and high dry strength; maximum size, medium sand; strong reaction with HCl.			
2	2.3 ft (6626.6)	IN-PLACE CONDITION: Grayish brown, dry, strong cementation and blocky. Roots down to 4.0 feet.			
3	SM (visual) SP-SM (lab class)	GEOLOGIC INTERPRETATION: Quaternary Alluvium (Qal) 2.3 to 8.8 ft SILTY SAND: About 85% fine sand; about 15% nonplastic fines with medium dry strength and rapid dilatancy; maximum size, fine sand; no reaction with HCl.			
4					
5	In-Place Density taken at 6.0 ft.	IN-PLACE CONDITION: Reddish brown, dry and homogeneous. Strong cementation. Easy excavation. Roots down to 4.0 feet.			
6		IN-PLACE UNIT WEIGHT AND MOISTURE FROM 6.0 ft. Total: 95.4 lbf/ft³ 3.2% (90% compaction) LAB TEST DATA: 10.6% fines, 88.4% sand, 0.0% gravel, LL= NA, PI= NP, SPG= 2.64 Maximum dry density= 106.0 lbf/ft³, optimum water content= 11.4% Laboratory classification is POORLY GRADED SAND WITH SILT.			
7					
8	8.8 ft (6620.1)				
9	s(CL)	GEOLOGIC INTERPRETATION: Quaternary Alluvium (Qal) 8.8 to 10.2 ft SANDY LEAN CLAY: About 55% fines with medium plasticity, medium toughness, high dry strength and no dilatancy; about 45% fine sand; maximum size, fine sand; strong reaction to HCl.			
10	10.2 ft (6618.7)				
11	SM	IN-PLACE CONDITION: Dark brown, dry and blocky. Very hard consistency. Calcium carbonate stringers and nodules.			
12		GEOLOGIC INTERPRETATION: Quaternary Alluvium (Qal) 10.2 to 15.7 ft SILTY SAND: About 85% fine sand; about 15% nonplastic fines with medium dry strength and rapid dilatancy; maximum size, fine sand; no reaction to HCl.			
13					
14		IN-PLACE CONDITION: Reddish brown, dry and lensed. Lensed with LEAN CLAY and medium to coarse POORLY GRADED SAND. Lenses average 1 inch thick and are of various lengths. Strong cementation. Easy excavation. Calcium carbonate in lenses.			
15	15.7 ft (6613.2)	GEOLOGIC INTERPRETATION: Quaternary Alluvium (Qal)			

COMMENTS: SURFACE VEGETATION CONSISTS OF GRASSES, SAGE BRUSH. DISCONTINUED HOLE DUE TO LIMIT OF EQUIPMENT.

7-1336-A (1-86)
Bureau of Reclamation

LOG OF TEST PIT NO. TPRT2-2

SHEET 1 OF 1

FEATURE: Reach 22B
LOCATION: OLD REGULATING TANK 2
COORDINATES: N 1,974,063 E 2,735,769
APPROXIMATE DIMENSIONS: 12'x14'x14.8'
DEPTH TO WATER: NE DATE: NA

PROJECT: Navajo Gallup Water Supply Project
GROUND ELEVATION: 6630.5
METHOD OF EXPLORATION: CASE 580N BACKHOE
LOGGED BY: J. GILBERT
DATE EXCAVATED: 10/15/2014

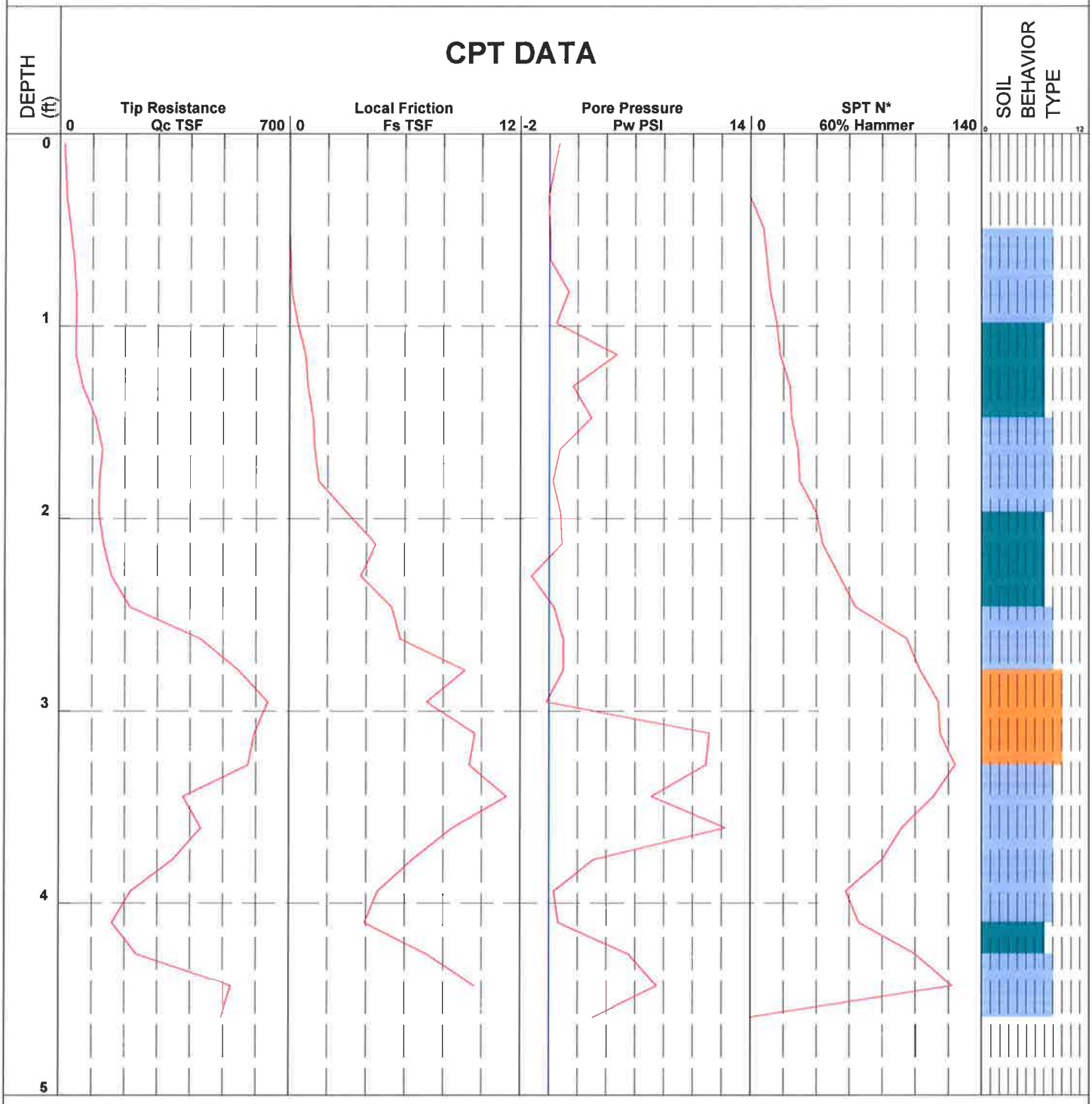
DEPTH	CLASSIFICATION GROUP SYMBOL	CLASSIFICATION AND DESCRIPTION OF MATERIAL (SEE USBR 5000, 5005)	% PLUS 3 in (BY VOLUME) 3 - 5 in	5 - 12 in	PLUS 12 in
1 2 3	s(CL)	0.0 to 3.4 ft SANDY LEAN CLAY: About 60% fines with medium to high plasticity, high toughness, medium to high dry strength, ; about 40% fine sand; maximum size, fine sand; strong reaction with HCl. IN-PLACE CONDITION: Brown in color, homogeneous GEOLOGIC INTERPRETATION: Quaternary Alluvium (Qal)			
3.4 ft (6627.1)					
4 5 6 7 8 9 10 11 12 13 14	SM (visual) SP-SM (lab class) In-Place Density taken at 6.0 ft, Corrosion sample taken at 10.0 ft.	3.4 to 14.8 ft SILTY SAND: About 80% fine to medium sand; about 20% fines with no plasticity, low dry strength, rapid dilatancy; no reaction to HCl. IN-PLACE CONDITION: Tan and dry IN-PLACE UNIT WEIGHT AND MOISTURE FROM 6.0 ft. Total: 100.6 lbf/ft³ 2.9% (96.1% relative compaction) LAB TEST DATA: 10.6% fines, 89.4% sand, 0.0% gravel, LL= NA, PI= NP, SPG= 2.63 Maximum dry density= 104.7 lbf/ft³, optimum water content= N/A% Laboratory classification is POORLY GRADED SAND WITH SILT GEOLOGIC INTERPRETATION: Quaternary Alluvium (Qal)			
14.8 ft (6615.7)					

COMMENTS: SURFACE VEGETATION CONSISTS OF GRASSES AND FLOWERS. DISCONTINUED HOLE DUE TO THE LIMIT OF THE EQUIPMENT.

BUREAU OF RECLAMATION

Hole #	CPT22B-14-6	Cone #	DSA0739	Date/Time	9/9/2014 8:45:44 AM
Project	NGWSP	Location	REACH 22B	Operator	L ROBINSON
Station		Offset		Elevation	
		Northing		Easting	

CPT DATA



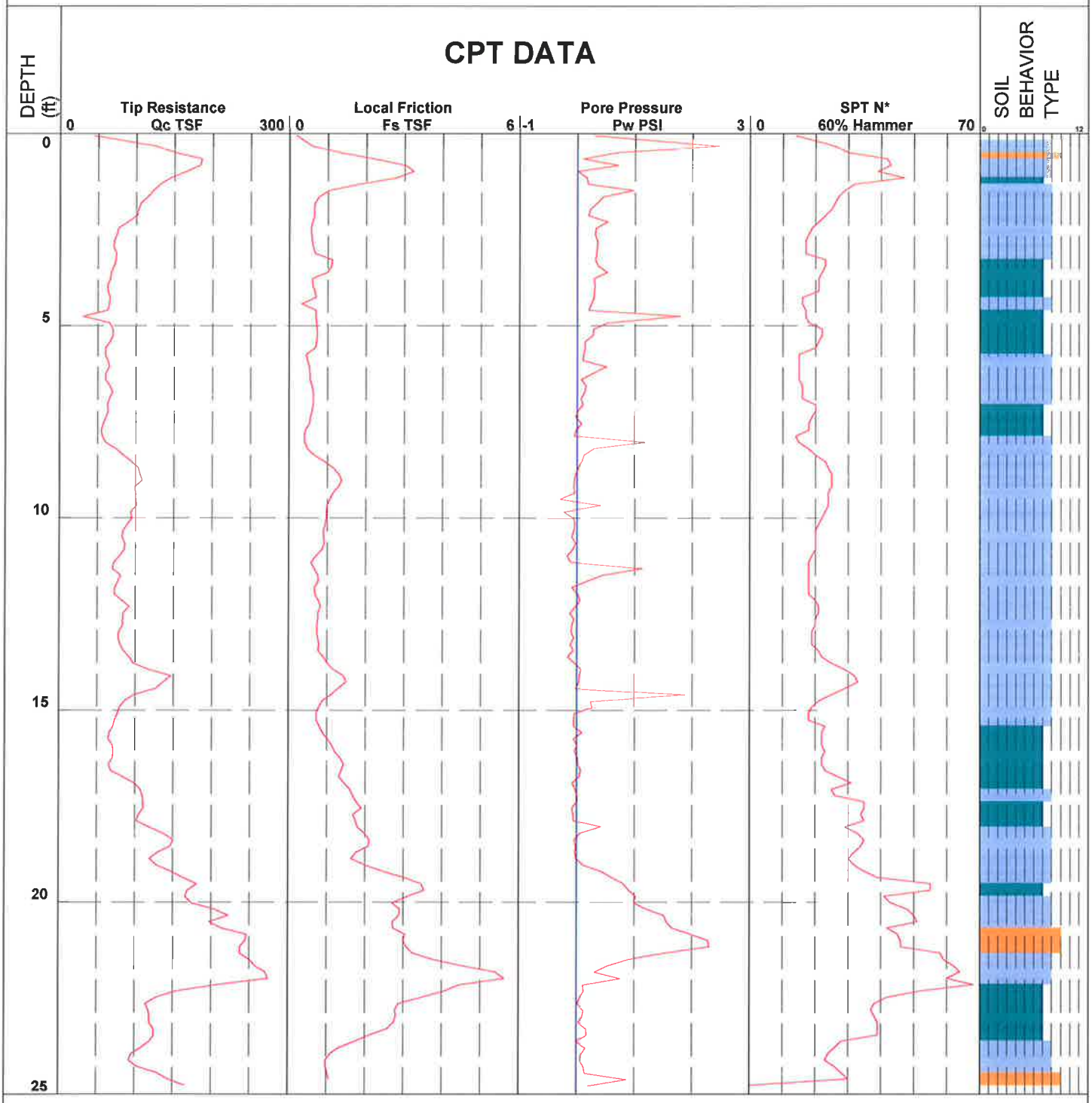
1 - sensitive fine grained
2 - organic material
3 - clay
4 - silty clay to clay
5 - clayey silt to silty clay
6 - sandy silt to clayey silt
7 - silty sand to sandy silt
8 - sand to silty sand
9 - sand
10 - gravelly sand to sand
11 - very stiff fine grained (*)
12 - sand to clayey sand (*)

Total Depth 4.8' Qc>600 Fs>11

BUREAU OF RECLAMATION

Hole #	CPT22B-14-7	Cone #	DSA0739	Date/Time	9/9/2014 9:52:54 AM
Project	NGWSP	Location	REACH 22B	Operator	L ROBINSON
Station		Offset		Elevation	
		Northing		Easting	

CPT DATA



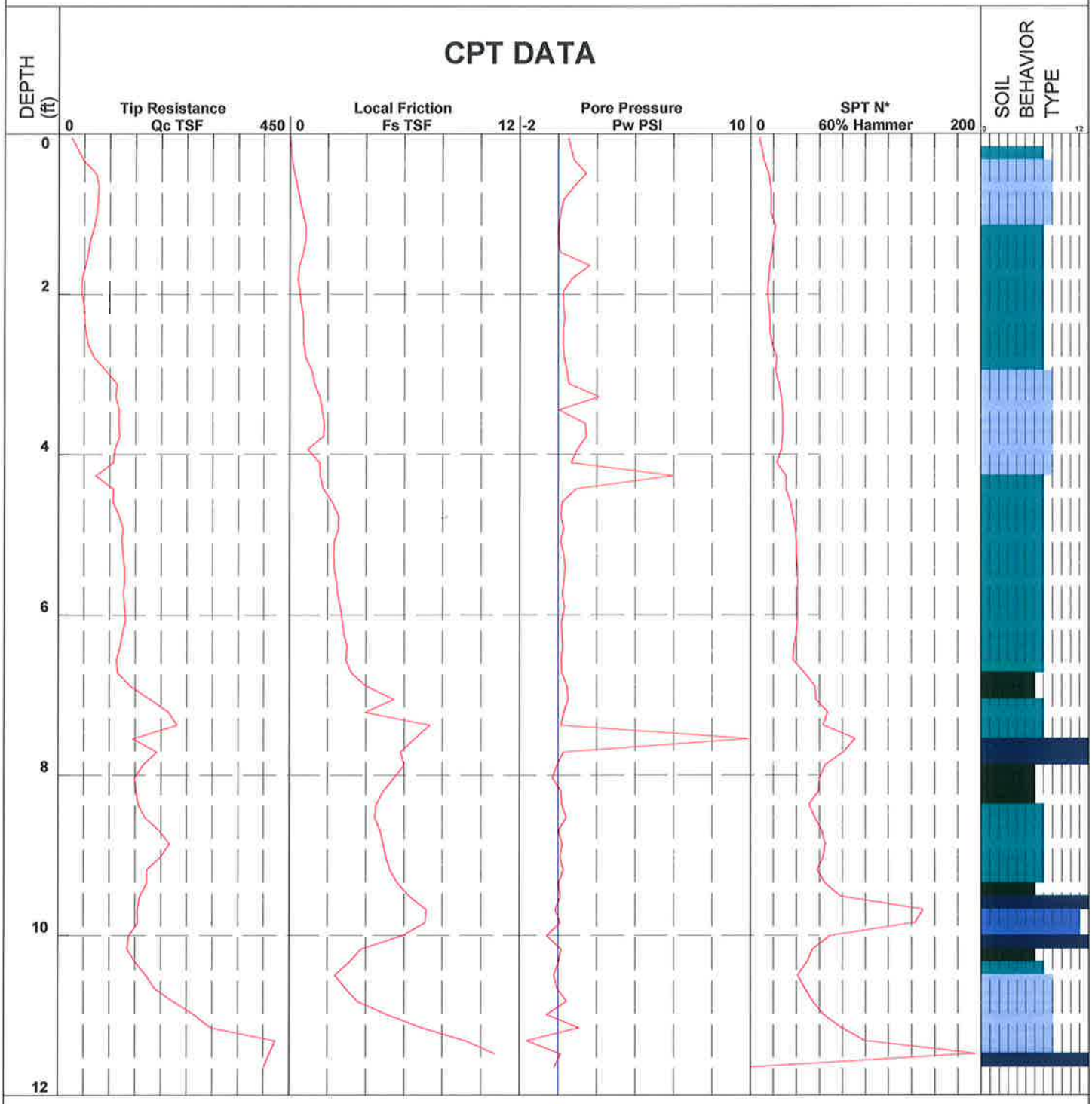
1 - sensitive fine grained
2 - organic material
3 - clay
4 - silty clay to clay
5 - clayey silt to silty clay
6 - sandy silt to clayey silt
7 - silty sand to sandy silt
8 - sand to silty sand
9 - sand
10 - gravelly sand to sand
11 - very stiff fine grained (*)
12 - sand to clayey sand (*)

Total Depth 25'

BUREAU OF RECLAMATION

Hole #	CPT22B-14-8	Cone #	DSA0739	Date/Time	9/9/2014 10:37:12 AM
Project	NGWSP	Location	REACH 22B	Operator	L ROBINSON
Station		Offset		Elevation	
		Northing		Easting	

CPT DATA



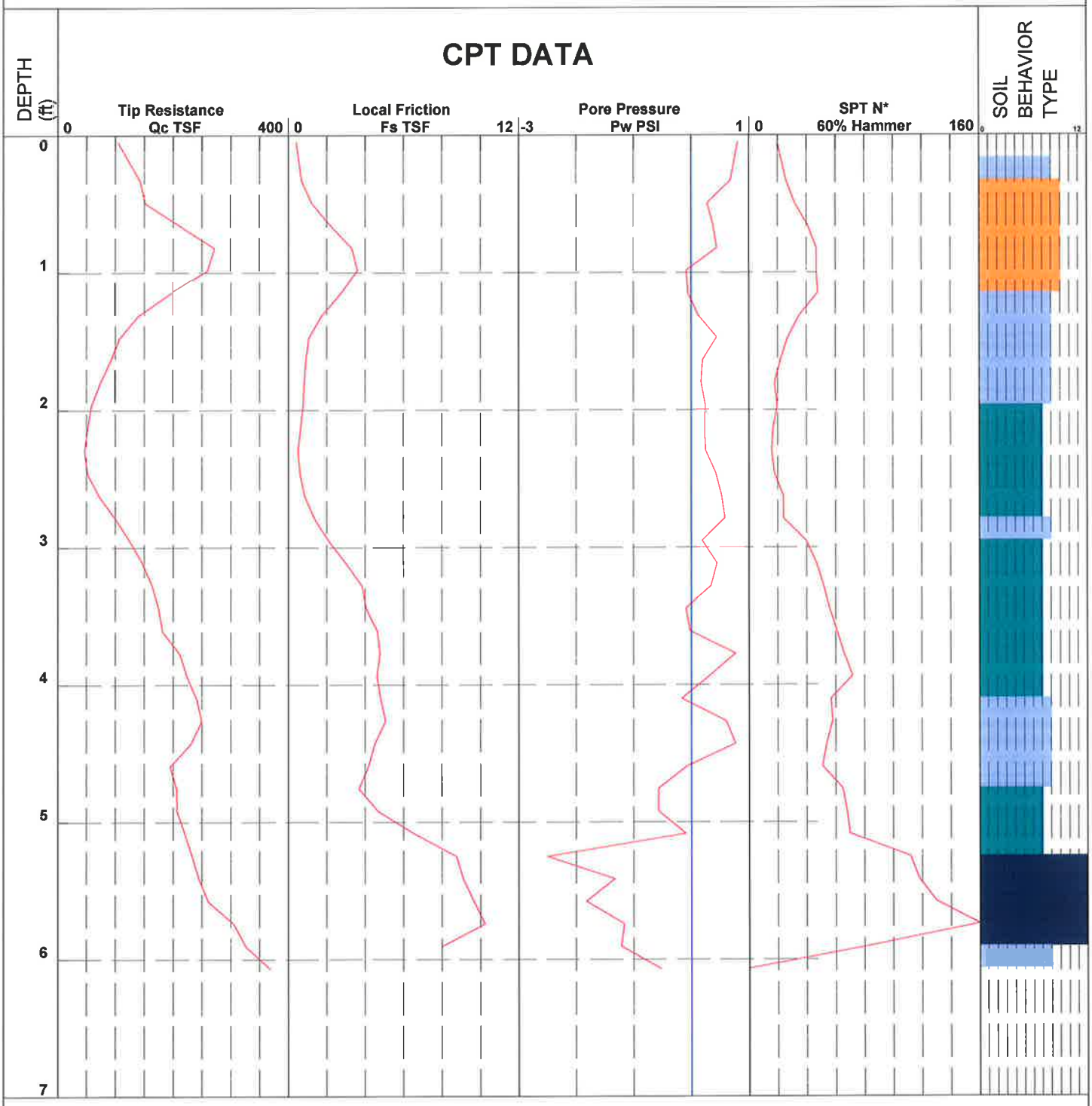
1 - sensitive fine grained	4 - silty clay to clay	7 - silty sand to sandy silt	10 - gravelly sand to sand
2 - organic material	5 - clayey silt to silty clay	8 - sand to silty sand	11 - very stiff fine grained (*)
3 - clay	6 - sandy silt to clayey silt	9 - sand	12 - sand to clayey sand (*)

Total Depth 11.9' Fs>11

BUREAU OF RECLAMATION

Hole #	CPT22B-14-9	Cone #	DSA0739	Date/Time	9/9/2014 11:11:20 AM
Project	NGWSP	Location	REACH 22B	Operator	L ROBINSON
Station		Offset		Elevation	
		Northing		Easting	

CPT DATA



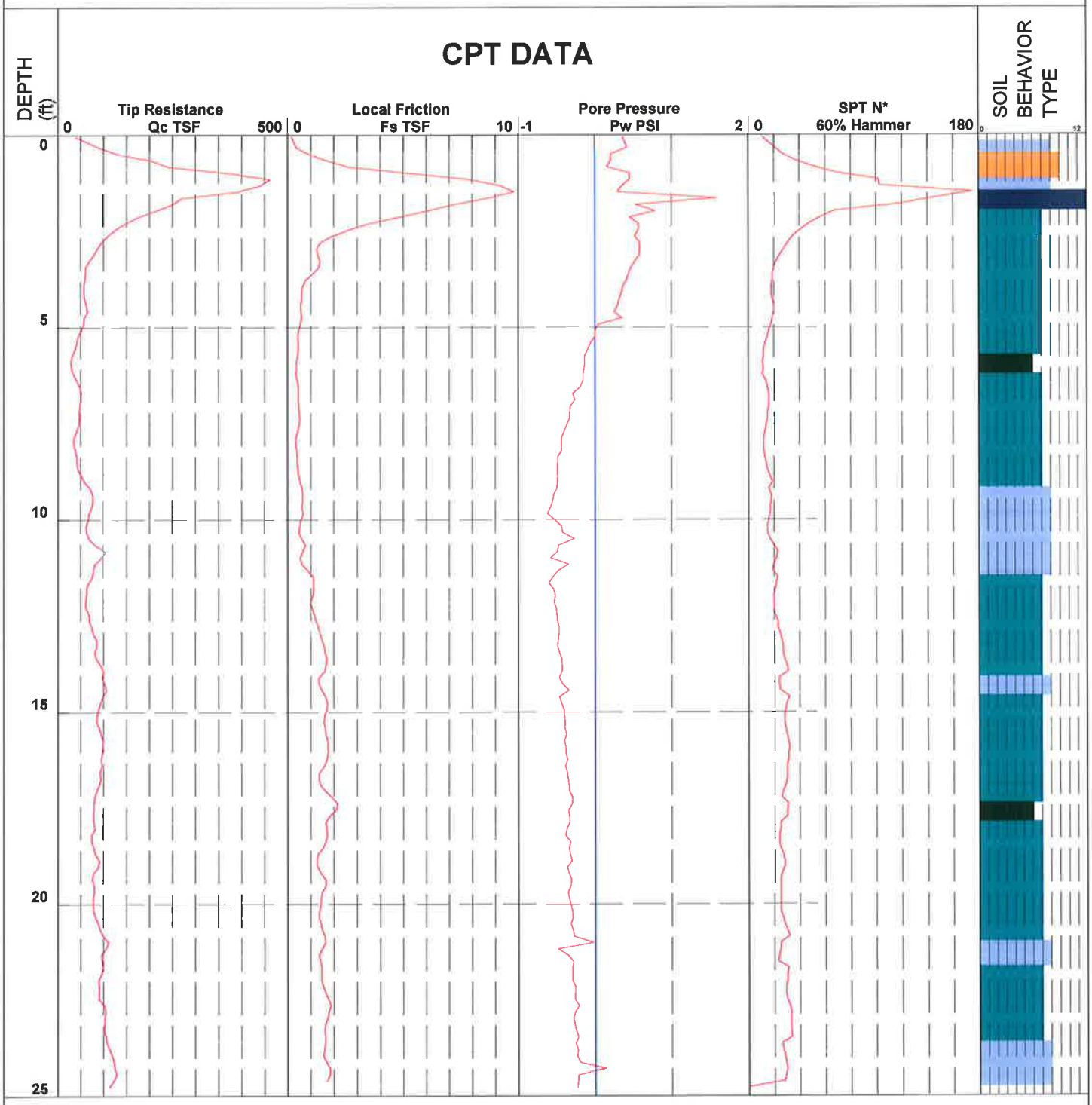
1 - sensitive fine grained	4 - silty clay to clay	7 - silty sand to sandy silt	10 - gravelly sand to sand
2 - organic material	5 - clayey silt to silty clay	8 - sand to silty sand	11 - very stiff fine grained (*)
3 - clay	6 - sandy silt to clayey silt	9 - sand	12 - sand to clayey sand (*)

Total Depth 6.2' Qc>600

BUREAU OF RECLAMATION

Hole #	CPT22B-14-10	Cone #	DSA0739	Date/Time	9/9/2014 12:03:34 PM
Project	NGWSP	Location	REACH 22B	Operator	L ROBINSON
Station		Offset		Elevation	
		Northing		Easting	

CPT DATA



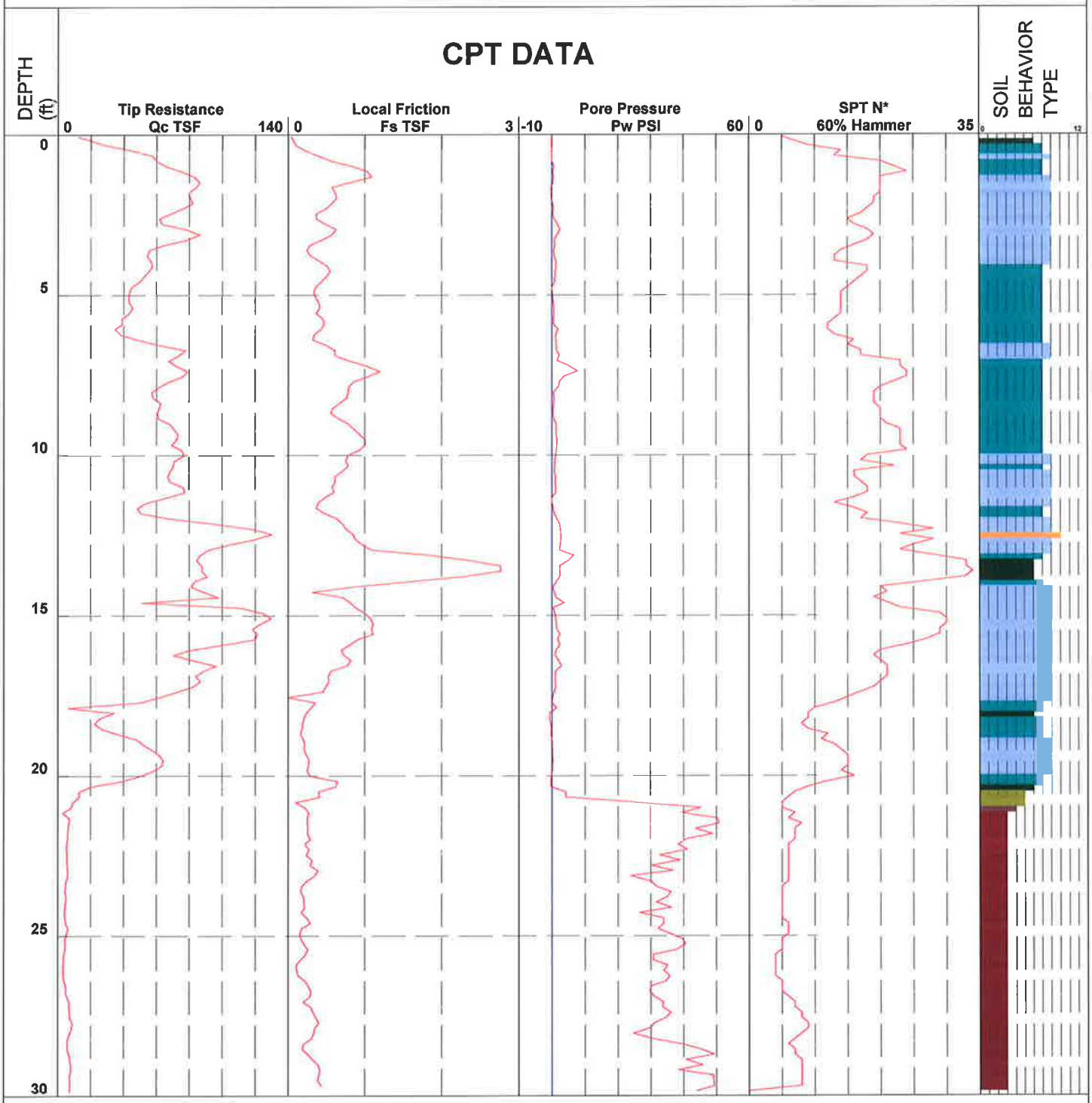
1 - sensitive fine grained	4 - silty clay to clay	7 - silty sand to sandy silt	10 - gravelly sand to sand
2 - organic material	5 - clayey silt to silty clay	8 - sand to silty sand	11 - very stiff fine grained (*)
3 - clay	6 - sandy silt to clayey silt	9 - sand	12 - sand to clayey sand (*)

Total Depth 25'

BUREAU OF RECLAMATION

Hole #	CPT22B-14-11	Cone #	DSA0739	Date/Time	10/15/2014 12:30:37 PM
Project	NGWSP	Location	REACH 22B	Operator	L ROBINSON
Station		Offset		Elevation	
		Northing		Easting	

CPT DATA



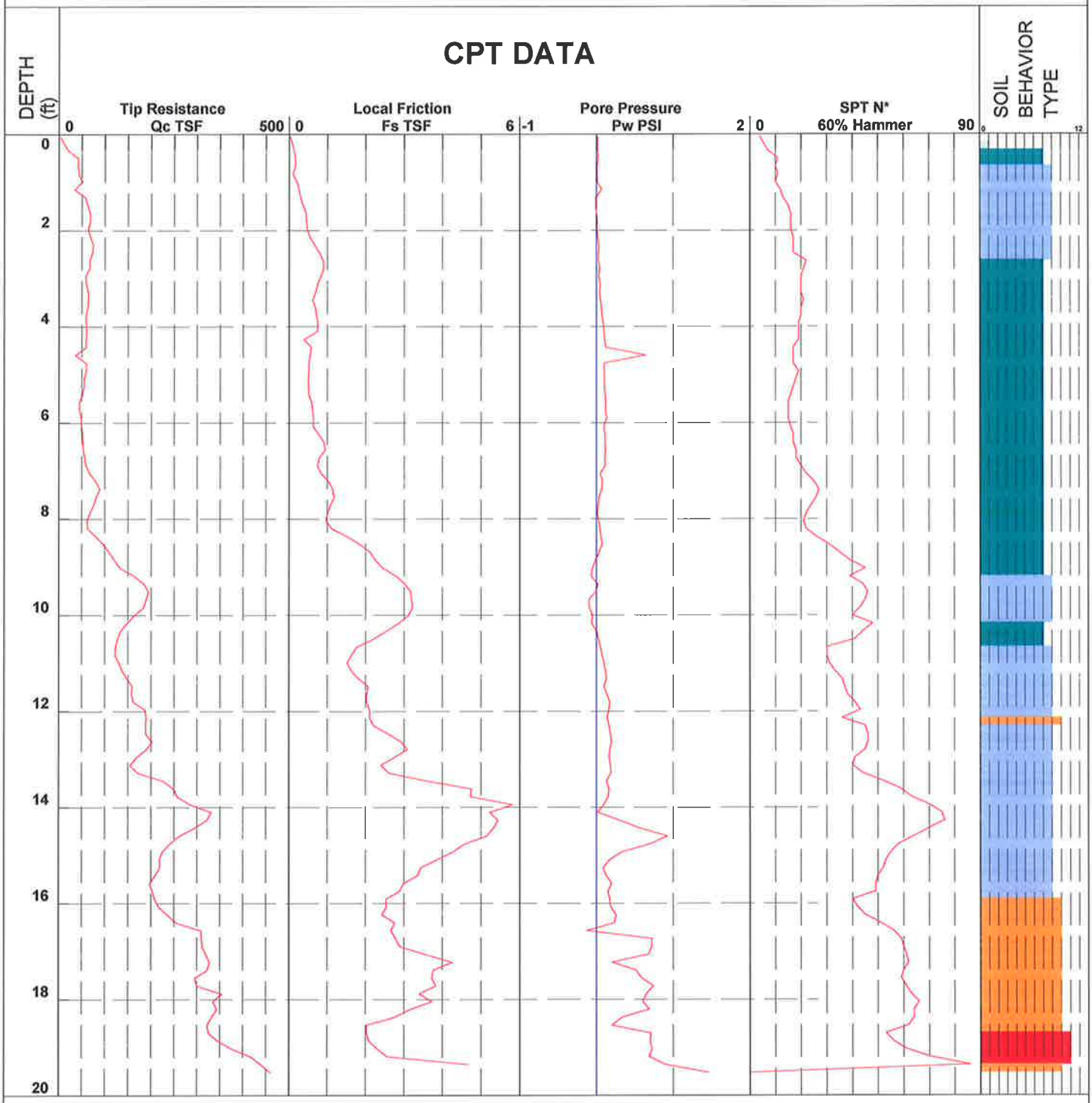
1 - sensitive fine grained
2 - organic material
3 - clay
4 - silty clay to clay
5 - clayey silt to silty clay
6 - sandy silt to clayey silt
7 - silty sand to sandy silt
8 - sand to silty sand
9 - sand
10 - gravelly sand to sand
11 - very stiff fine grained (*)
12 - sand to clayey sand (*)

Total Depth 30'

BUREAU OF RECLAMATION

Hole #	CPT22B-14-12	Cone #	DSA0739	Date/Time	9/5/2014 12:28:26 PM
Project	NGWSP	Location	REACH 22B	Operator	L ROBINSON
Station		Offset		Elevation	
		Northing		Easting	

CPT DATA



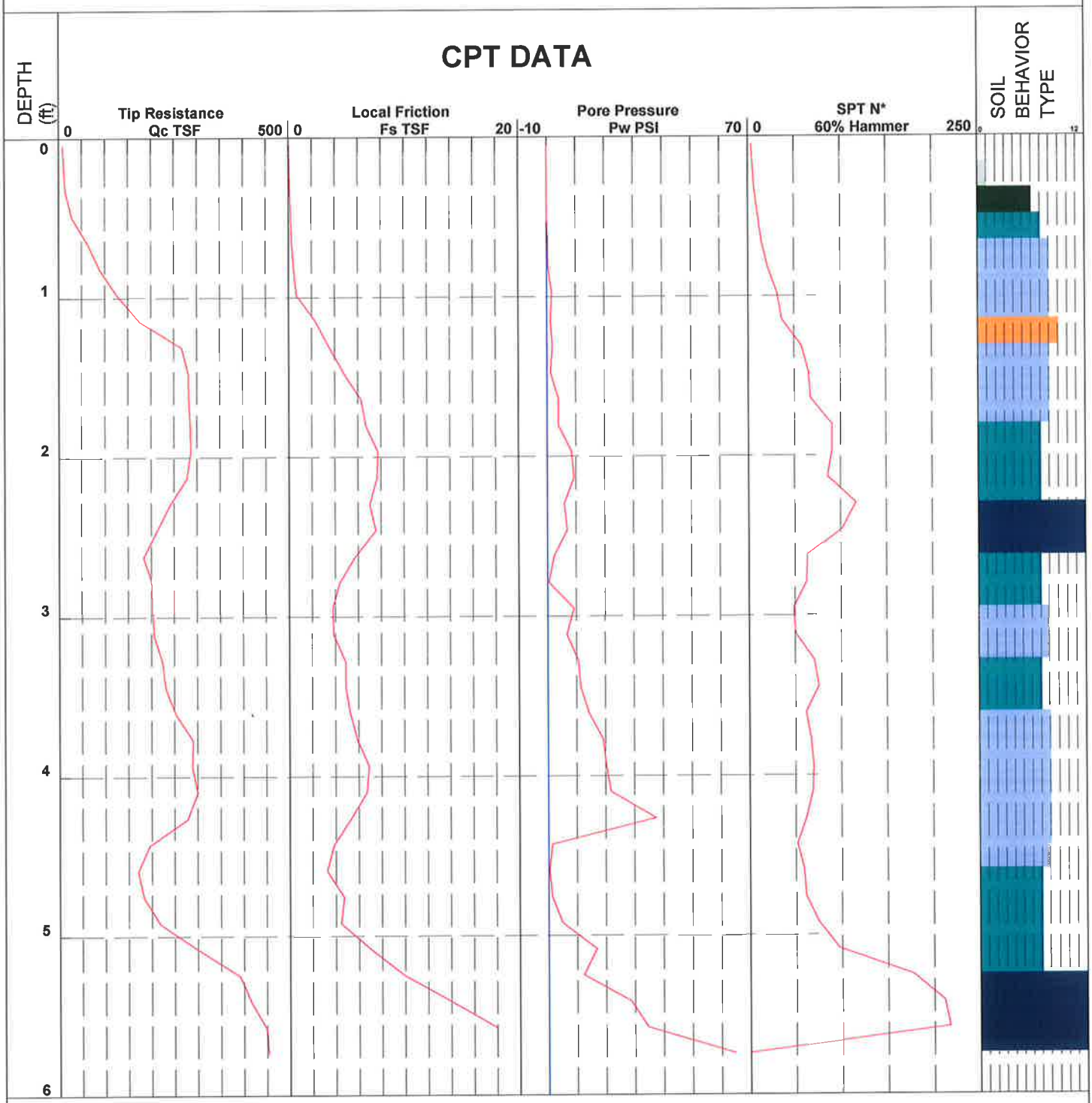
1 - sensitive fine grained	4 - silty clay to clay	7 - silty sand to sandy silt	10 - gravelly sand to sand
2 - organic material	5 - clayey silt to silty clay	8 - sand to silty sand	11 - very stiff fine grained (*)
3 - clay	6 - sandy silt to clayey silt	9 - sand	12 - sand to clayey sand (*)

Total Depth 19.7' Qc>750

BUREAU OF RECLAMATION

Hole #	CPT22B-14-13	Cone #	DSA0739	Date/Time	10/15/2014 10:29:41 AM
Project	NGWSP	Location	REACH 22B	Operator	L ROBINSON
Station		Offset		Elevation	
		Northing		Easting	

CPT DATA



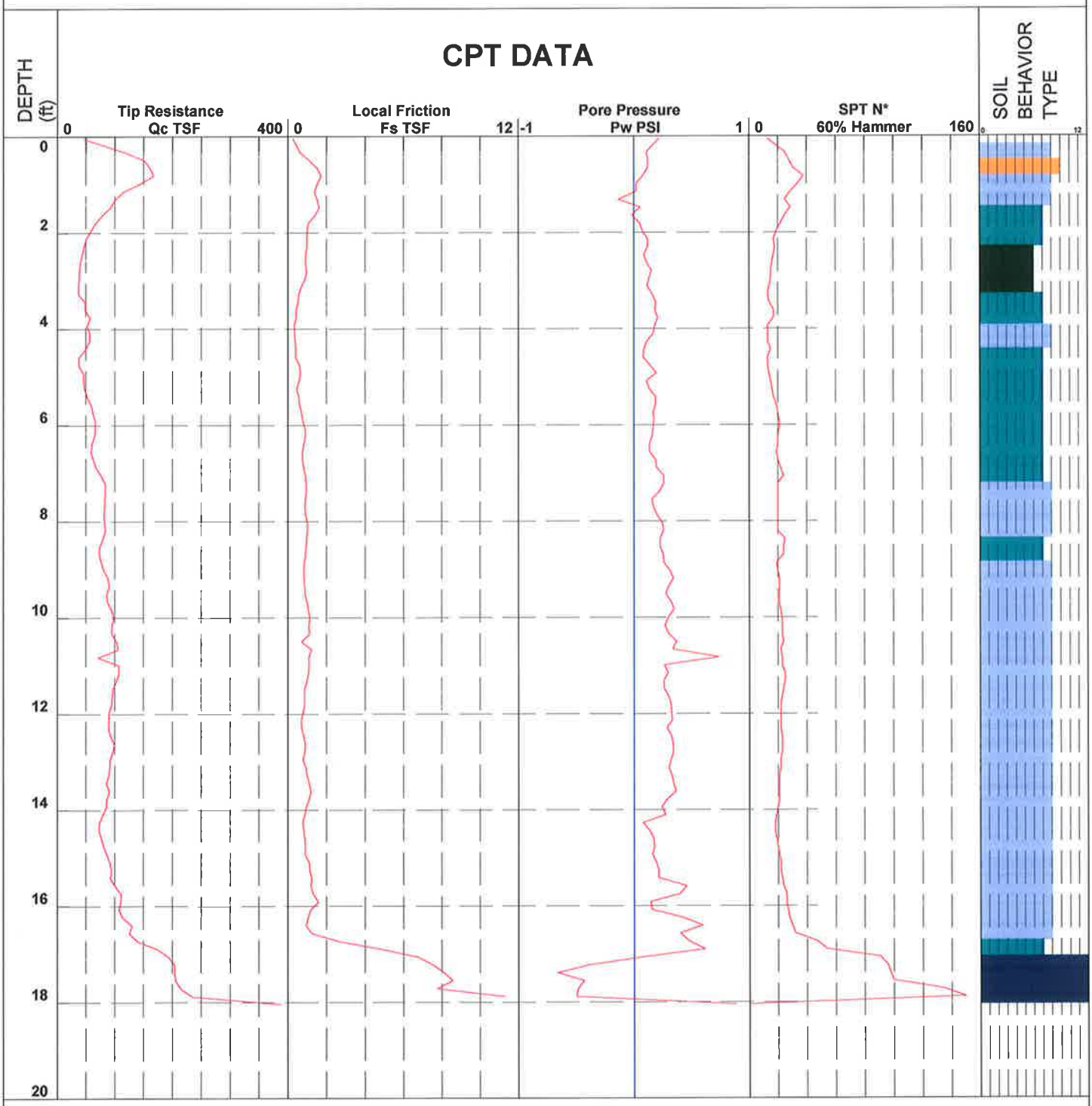
1 - sensitive fine grained
2 - organic material
3 - clay
4 - silty clay to clay
5 - clayey silt to silty clay
6 - sandy silt to clayey silt
7 - silty sand to sandy silt
8 - sand to silty sand
9 - sand
10 - gravelly sand to sand
11 - very stiff fine grained (*)
12 - sand to clayey sand (*)

Total Depth 5.9' Fs>13

BUREAU OF RECLAMATION

Hole #	CPT22B-14-14	Cone #	DSA0739	Date/Time	10/15/2014 11:12:28 AM
Project	NGWSP	Location	REACH 22B	Operator	L ROBINSON
Station		Offset		Elevation	
		Northing		Easting	

CPT DATA



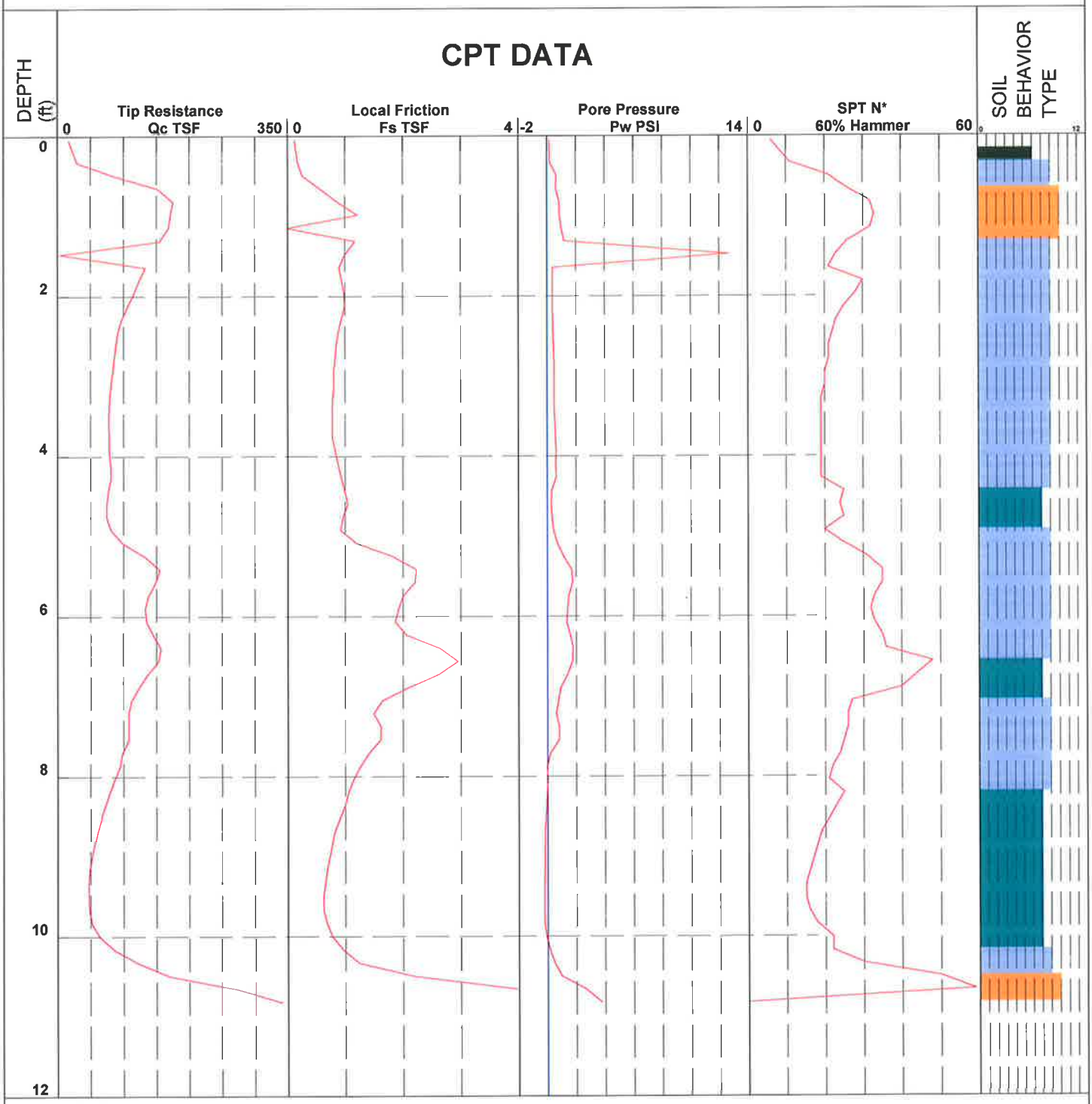
1 - sensitive fine grained
2 - organic material
3 - clay
4 - silty clay to clay
5 - clayey silt to silty clay
6 - sandy silt to clayey silt
7 - silty sand to sandy silt
8 - sand to silty sand
9 - sand
10 - gravelly sand to sand
11 - very stiff fine grained (*)
12 - sand to clayey sand (*)

Total Depth 18.2' Qc>650 Fs>11

BUREAU OF RECLAMATION

Hole #	CPT22B-14-15	Cone #	DSA0739	Date/Time	9/9/2014 1:12:28 PM
Project	NGWSP	Location	REACH 22B	Operator	L ROBINSON
Station		Offset		Elevation	
		Northing		Easting	

CPT DATA



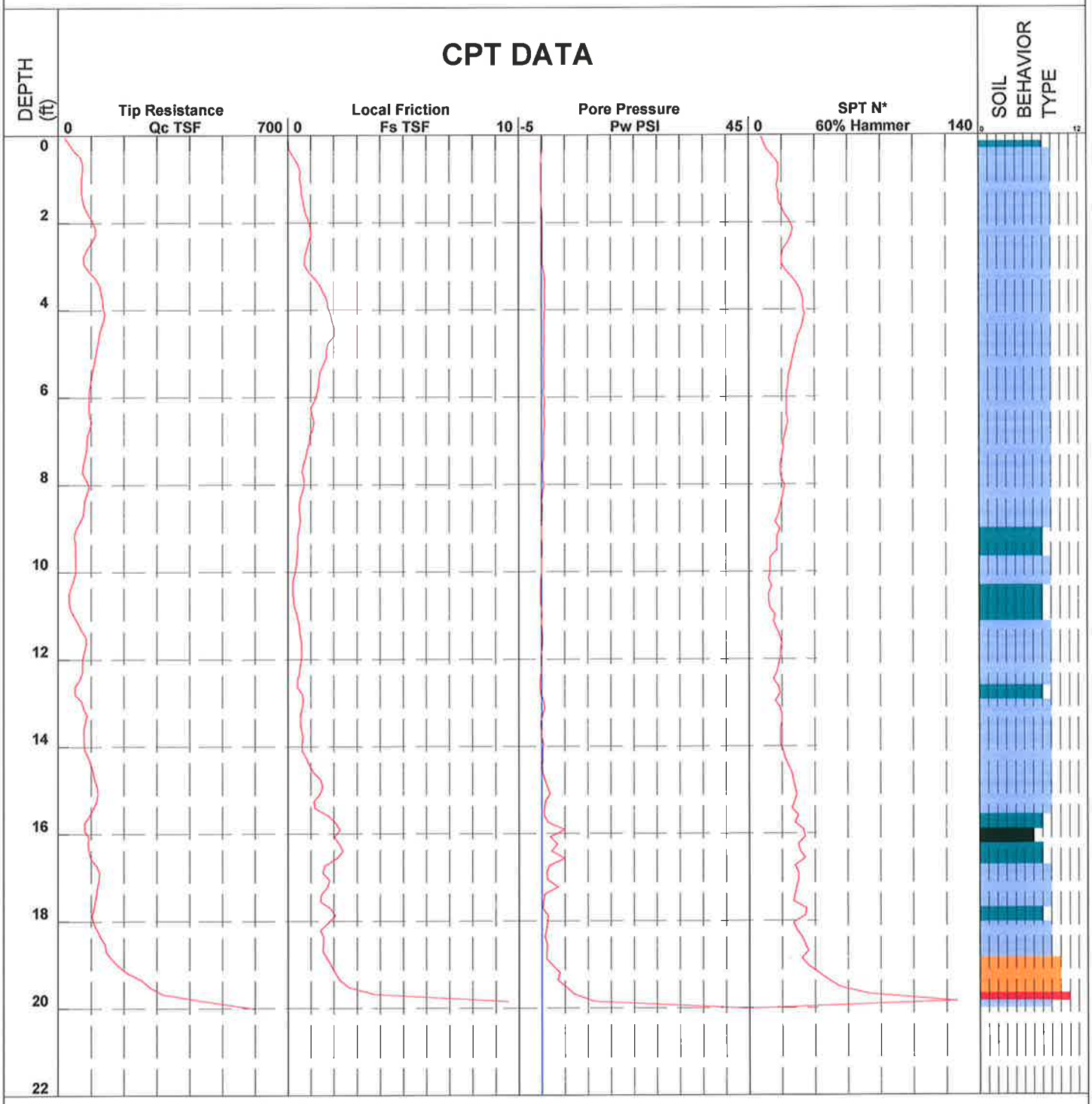
1 - sensitive fine grained
2 - organic material
3 - clay
4 - silty clay to clay
5 - clayey silt to silty clay
6 - sandy silt to clayey silt
7 - silty sand to sandy silt
8 - sand to silty sand
9 - sand
10 - gravelly sand to sand
11 - very stiff fine grained (*)
12 - sand to clayey sand (*)

Total Depth 11' Qc>700

BUREAU OF RECLAMATION

Hole #	CPT22B-14-16	Cone #	DSA0739	Date/Time	10/15/2014 1:28:09 PM
Project	NGWSP	Location	REACH 22B	Operator	L ROBINSON
Station		Offset		Elevation	
		Northing		Easting	

CPT DATA



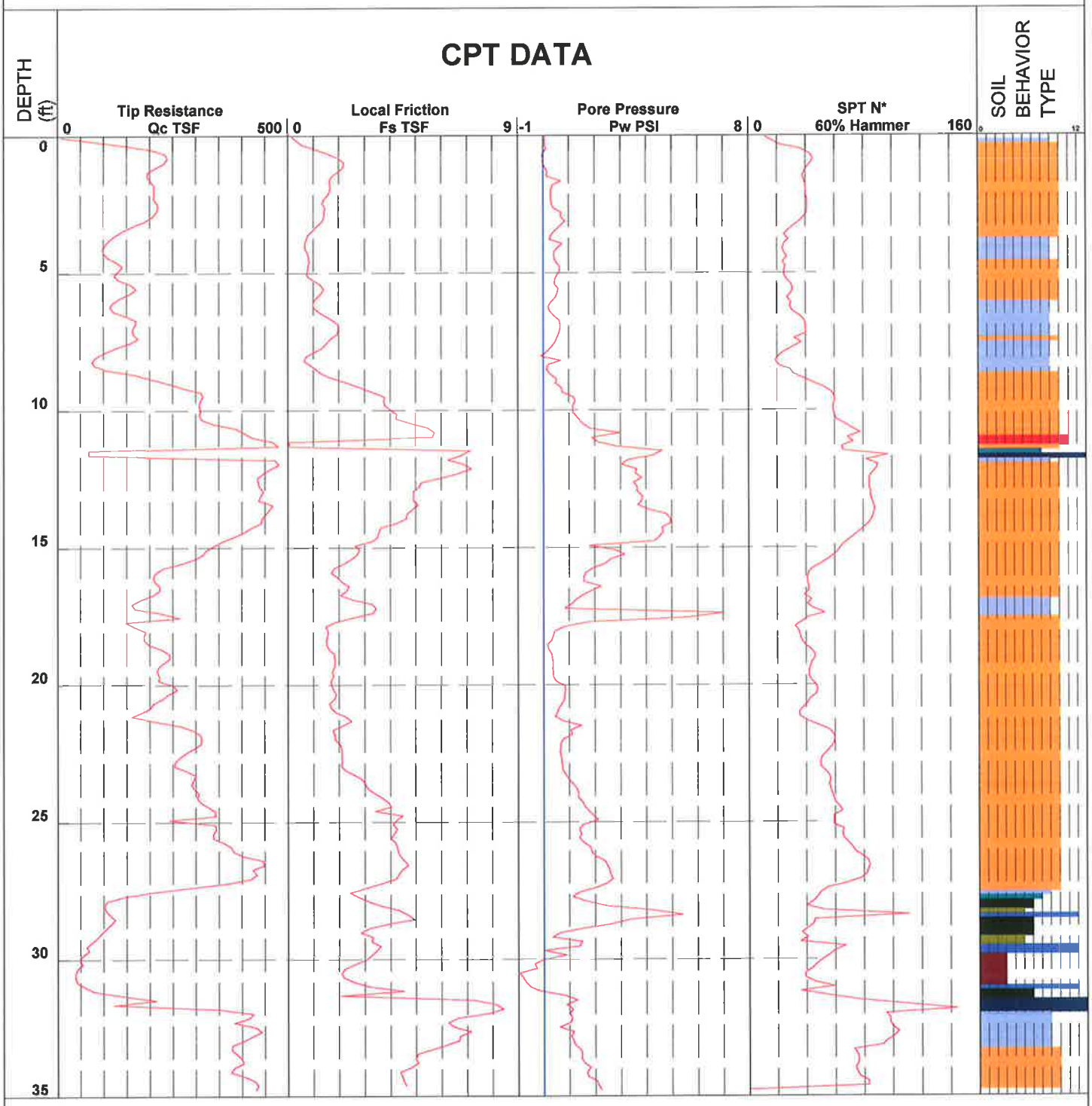
1 - sensitive fine grained	4 - silty clay to clay	7 - silty sand to sandy silt	10 - gravelly sand to sand
2 - organic material	5 - clayey silt to silty clay	8 - sand to silty sand	11 - very stiff fine grained (*)
3 - clay	6 - sandy silt to clayey silt	9 - sand	12 - sand to clayey sand (*)

Total Depth 20.2' Fs>11

BUREAU OF RECLAMATION

Hole #	CPT22B-14-17	Cone #	DSA0739	Date/Time	9/5/2014 1:54:10 PM
Project	NGWSP	Location	REACH 22B	Operator	L ROBINSON
Station		Offset		Elevation	
		Northing		Easting	

CPT DATA



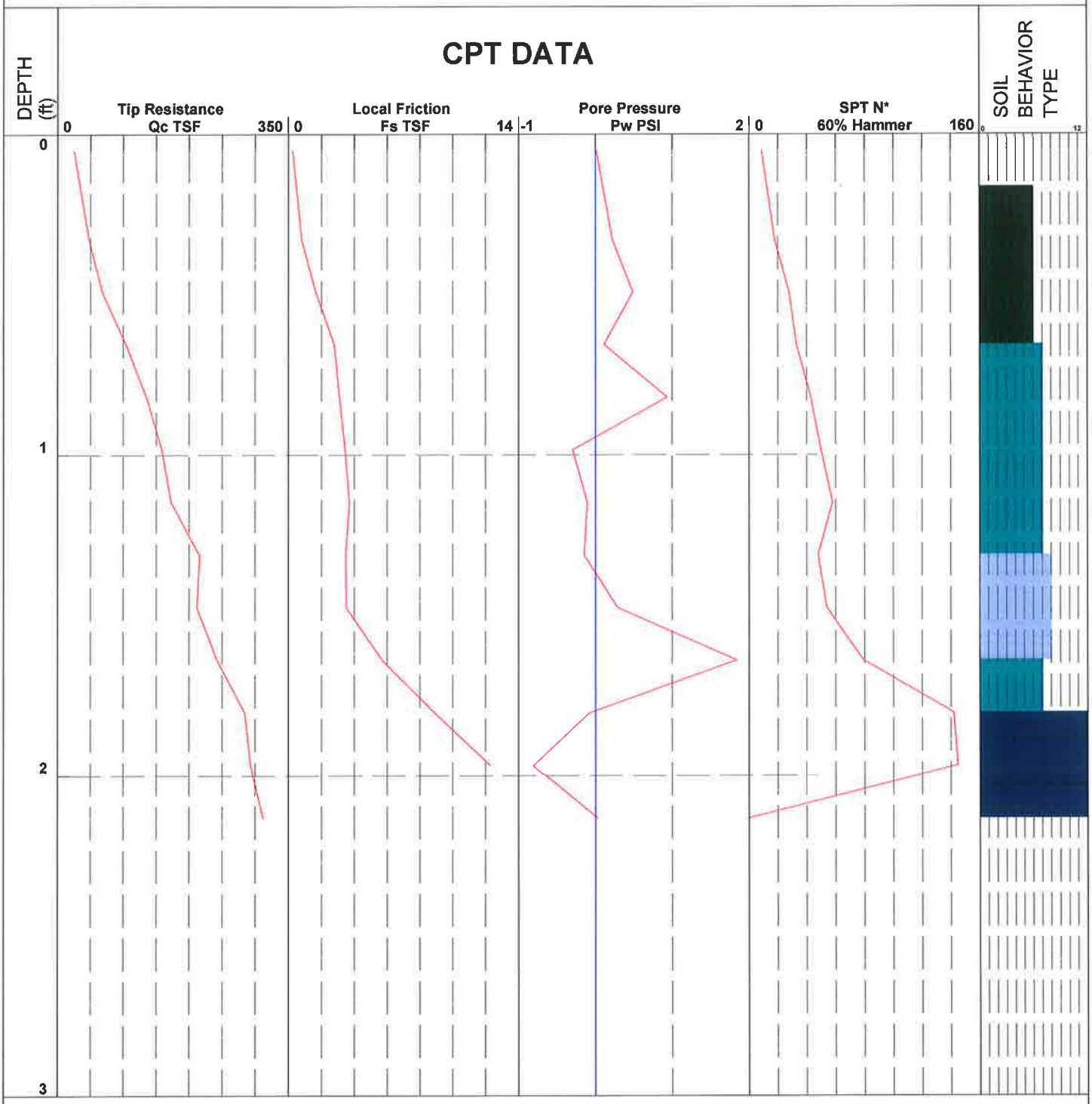
1 - sensitive fine grained
2 - organic material
3 - clay
4 - silty clay to clay
5 - clayey silt to silty clay
6 - sandy silt to clayey silt
7 - silty sand to sandy silt
8 - sand to silty sand
9 - sand
10 - gravelly sand to sand
11 - very stiff fine grained (*)
12 - sand to clayey sand (*)

Total Depth 34.9' Fs>9.5

BUREAU OF RECLAMATION

Hole #	CPT22B-14-18	Cone #	DSA0739	Date/Time	10/15/2014 2:16:54 PM
Project	NGWSP	Location	REACH 22B	Operator	L ROBINSON
Station		Offset		Elevation	
		Northing		Easting	

CPT DATA



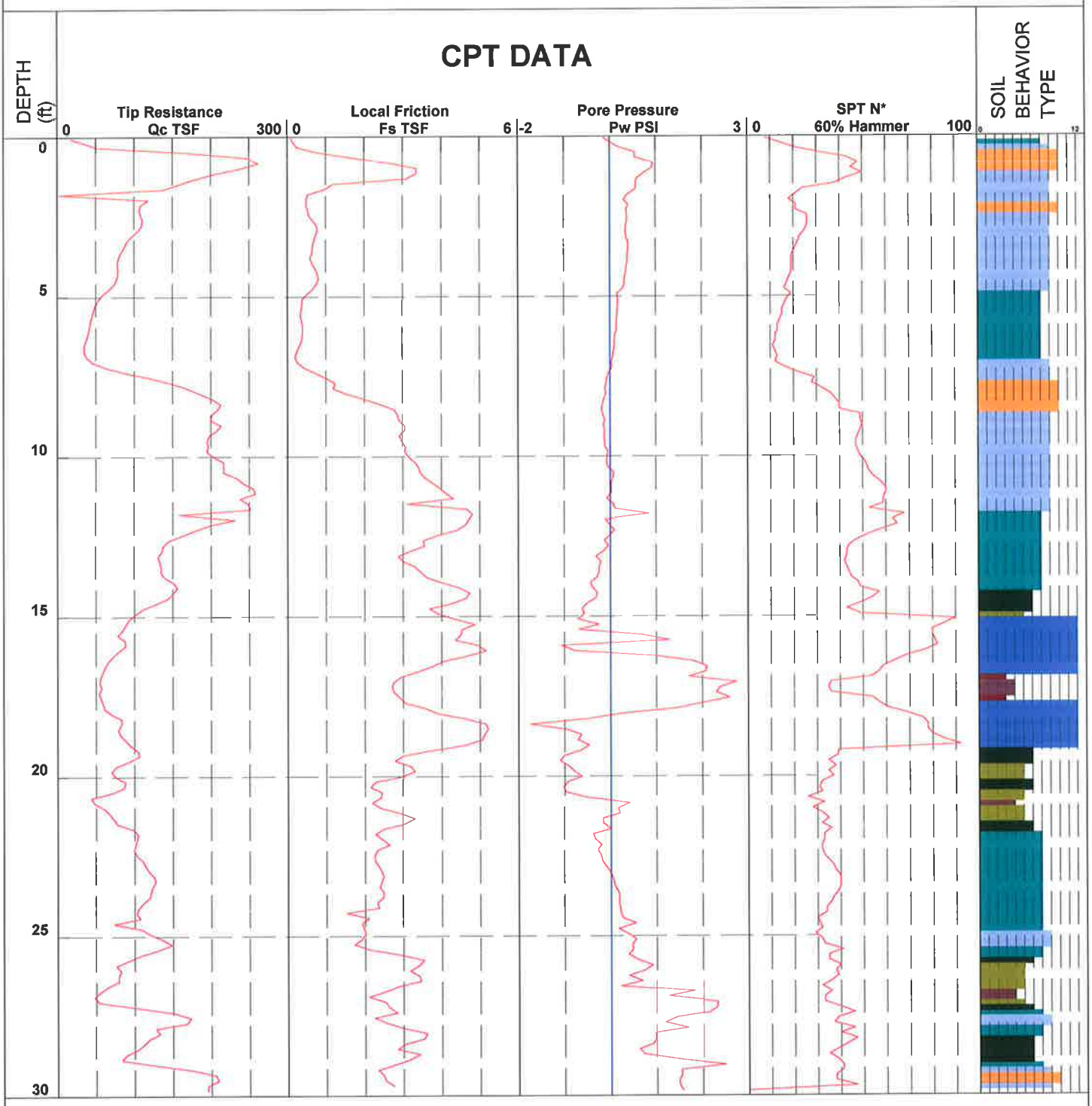
1 - sensitive fine grained
2 - organic material
3 - clay
4 - silty clay to clay
5 - clayey silt to silty clay
6 - sandy silt to clayey silt
7 - silty sand to sandy silt
8 - sand to silty sand
9 - sand
10 - gravelly sand to sand
11 - very stiff fine grained (*)
12 - sand to clayey sand (*)

Total Depth 2.4' Fs>13

BUREAU OF RECLAMATION

Hole #	CPT22B-14-19	Cone #	DSA0739	Date/Time	9/8/2014 9:33:45 AM
Project	NGWSP	Location	REACH 22B	Operator	L ROBINSON
Station		Offset		Elevation	
		Northing		Easting	

CPT DATA



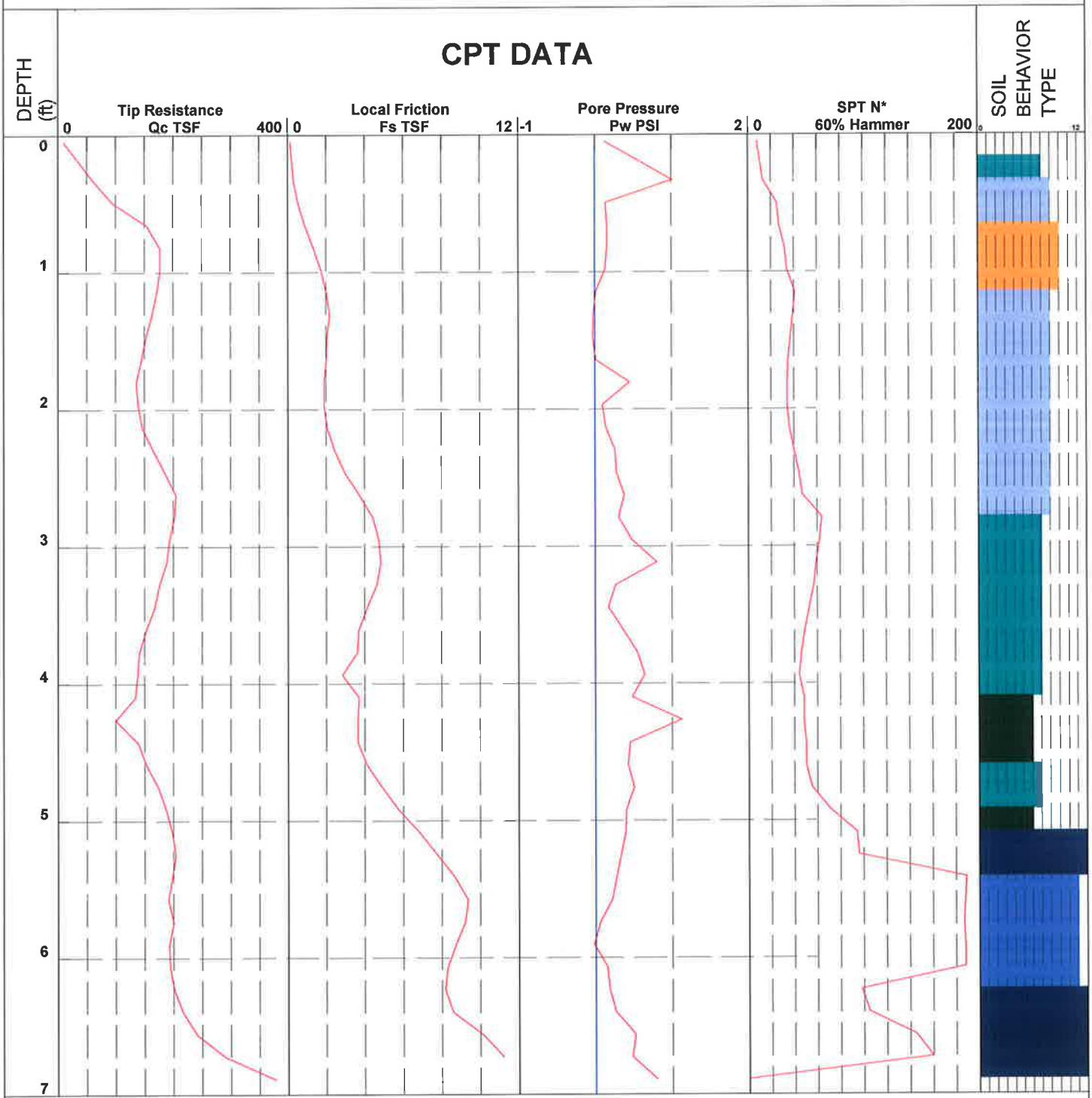
1 - sensitive fine grained
2 - organic material
3 - clay
4 - silty clay to clay
5 - clayey silt to silty clay
6 - sandy silt to clayey silt
7 - silty sand to sandy silt
8 - sand to silty sand
9 - sand
10 - gravelly sand to sand
11 - very stiff fine grained (*)
12 - sand to clayey sand (*)

Total Depth 30'

BUREAU OF RECLAMATION

Hole #	CPT22B-14-20	Cone #	DSA0739	Date/Time	10/15/2014 2:49:57 PM
Project	NGWSP	Location	REACH 22B	Operator	L ROBINSON
Station		Offset		Elevation	
		Northing		Easting	

CPT DATA



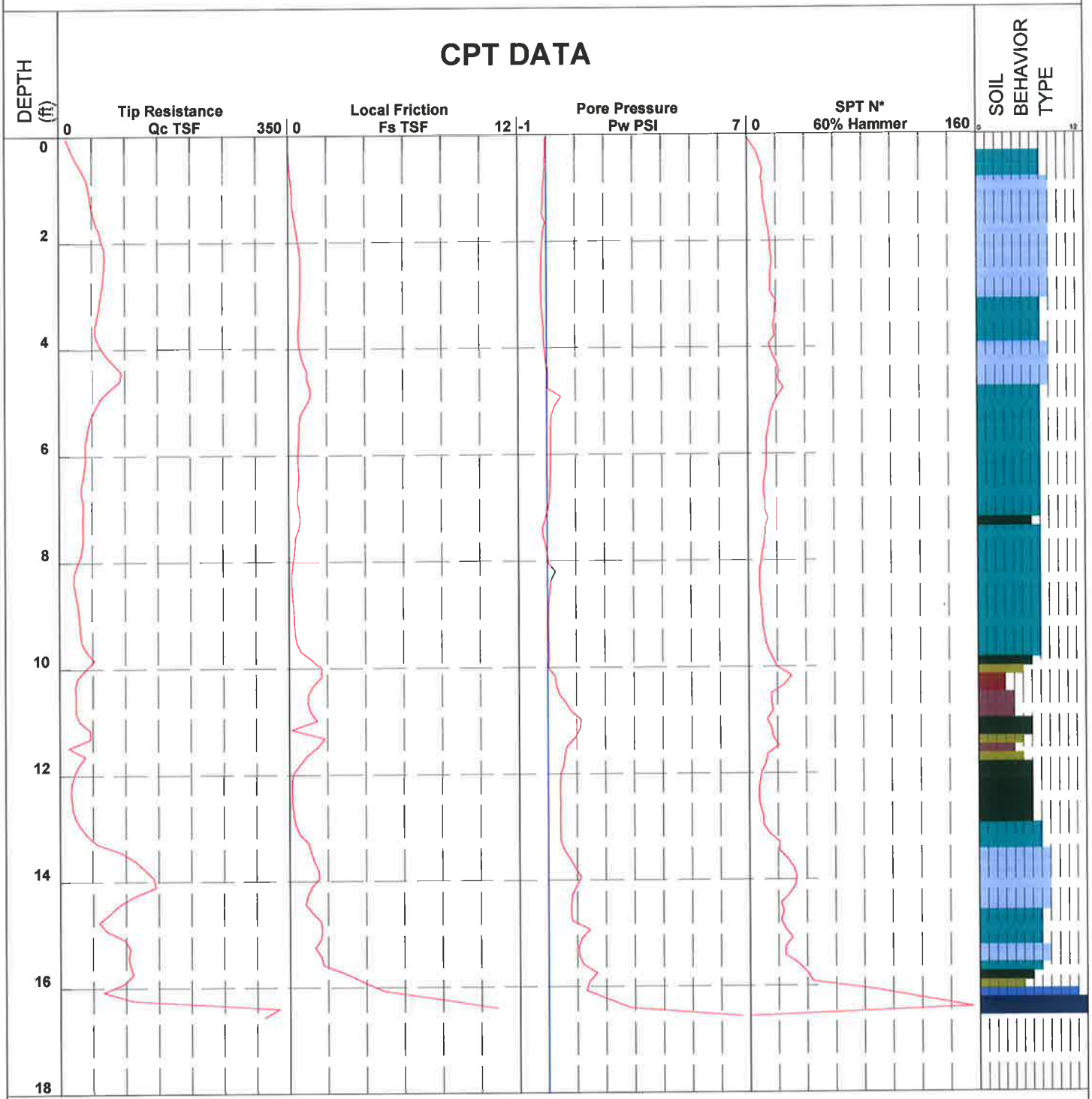
1 - sensitive fine grained
2 - organic material
3 - clay
4 - silty clay to clay
5 - clayey silt to silty clay
6 - sandy silt to clayey silt
7 - silty sand to sandy silt
8 - sand to silty sand
9 - sand
10 - gravelly sand to sand
11 - very stiff fine grained (*)
12 - sand to clayey sand (*)

Total Depth 7.1' Qc>400 Fs>11

BUREAU OF RECLAMATION

Hole #	CPT22B-14-21	Cone #	DSA0739	Date/Time	10/15/2014 3:20:40 PM
Project	NGWSP	Location	REACH 22B	Operator	L ROBINSON
Station		Offset		Elevation	
		Northing		Easting	

CPT DATA



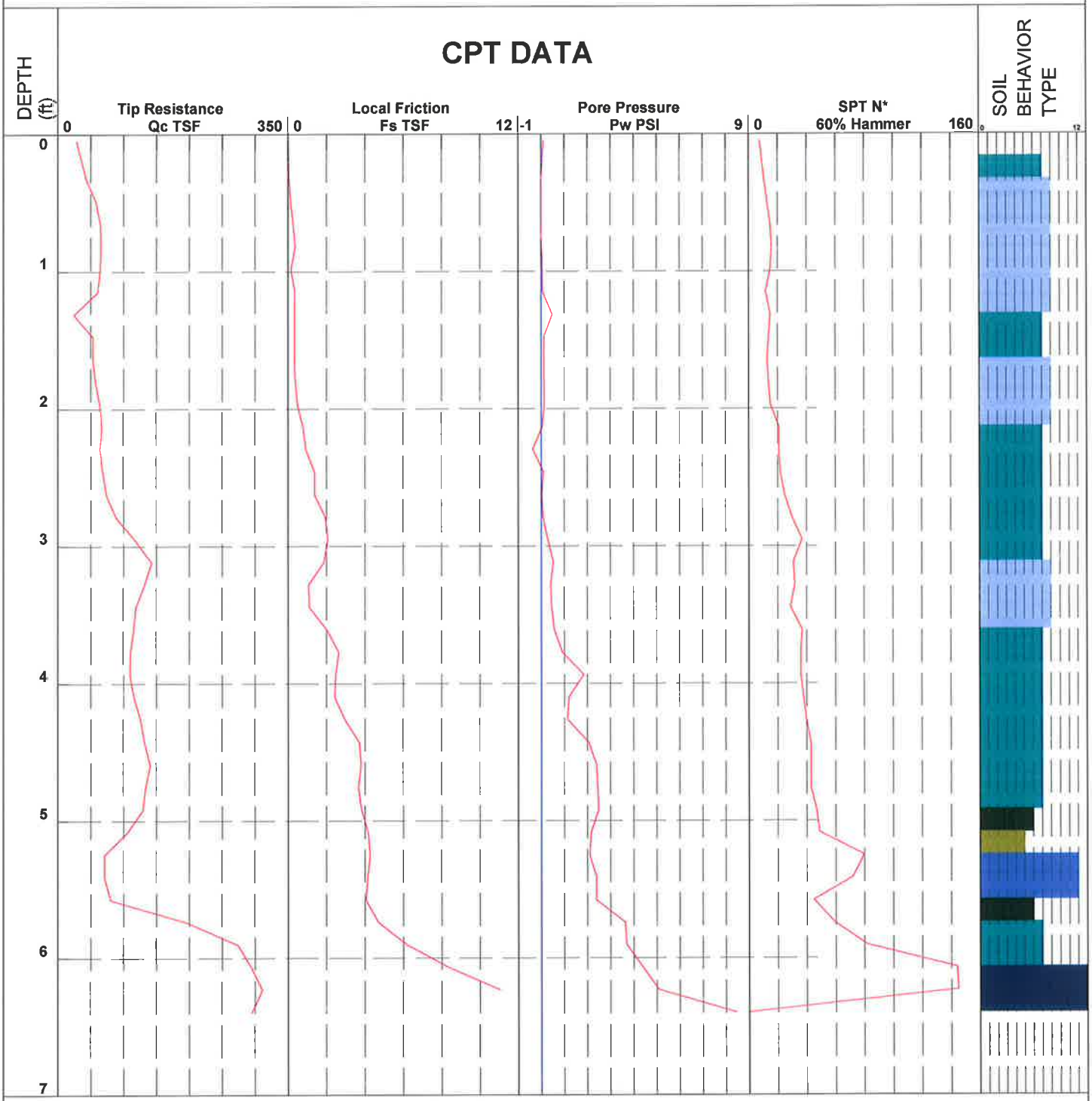
1 - sensitive fine grained	4 - silty clay to clay	7 - silty sand to sandy silt	10 - gravelly sand to sand
2 - organic material	5 - clayey silt to silty clay	8 - sand to silty sand	11 - very stiff fine grained (*)
3 - clay	6 - sandy silt to clayey silt	9 - sand	12 - sand to clayey sand (*)

Total Depth 16.8' Fs>12

BUREAU OF RECLAMATION

Hole #	CPT22B-14-22	Cone #	DSA0739	Date/Time	9/10/2014 11:24:46 AM
Project	NGWSP	Location	REACH 22B	Operator	L ROBINSON
Station		Offset		Elevation	
		Northing		Easting	

CPT DATA



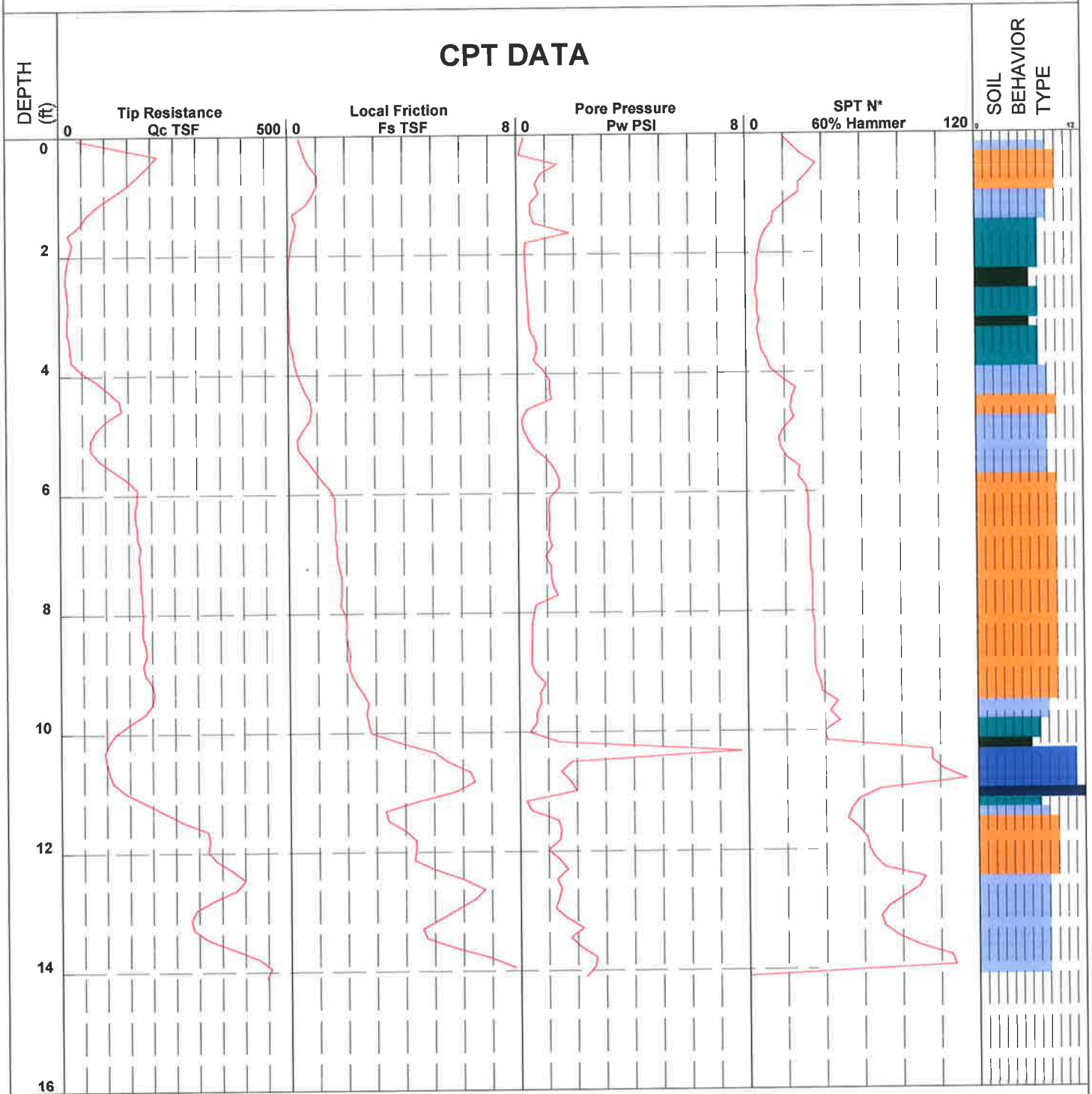
1 - sensitive fine grained	4 - silty clay to clay	7 - silty sand to sandy silt	10 - gravelly sand to sand
2 - organic material	5 - clayey silt to silty clay	8 - sand to silty sand	11 - very stiff fine grained (*)
3 - clay	6 - sandy silt to clayey silt	9 - sand	12 - sand to clayey sand (*)

Total Depth 6.6' Fs>12

BUREAU OF RECLAMATION

Hole #	CPT22B-14-24	Cone #	DSA0739	Date/Time	9/5/2014 10:32:51 AM
Project	NGWSP	Location	REACH 22B	Operator	L ROBINSON
Station		Offset		Elevation	
		Northing		Easting	

CPT DATA



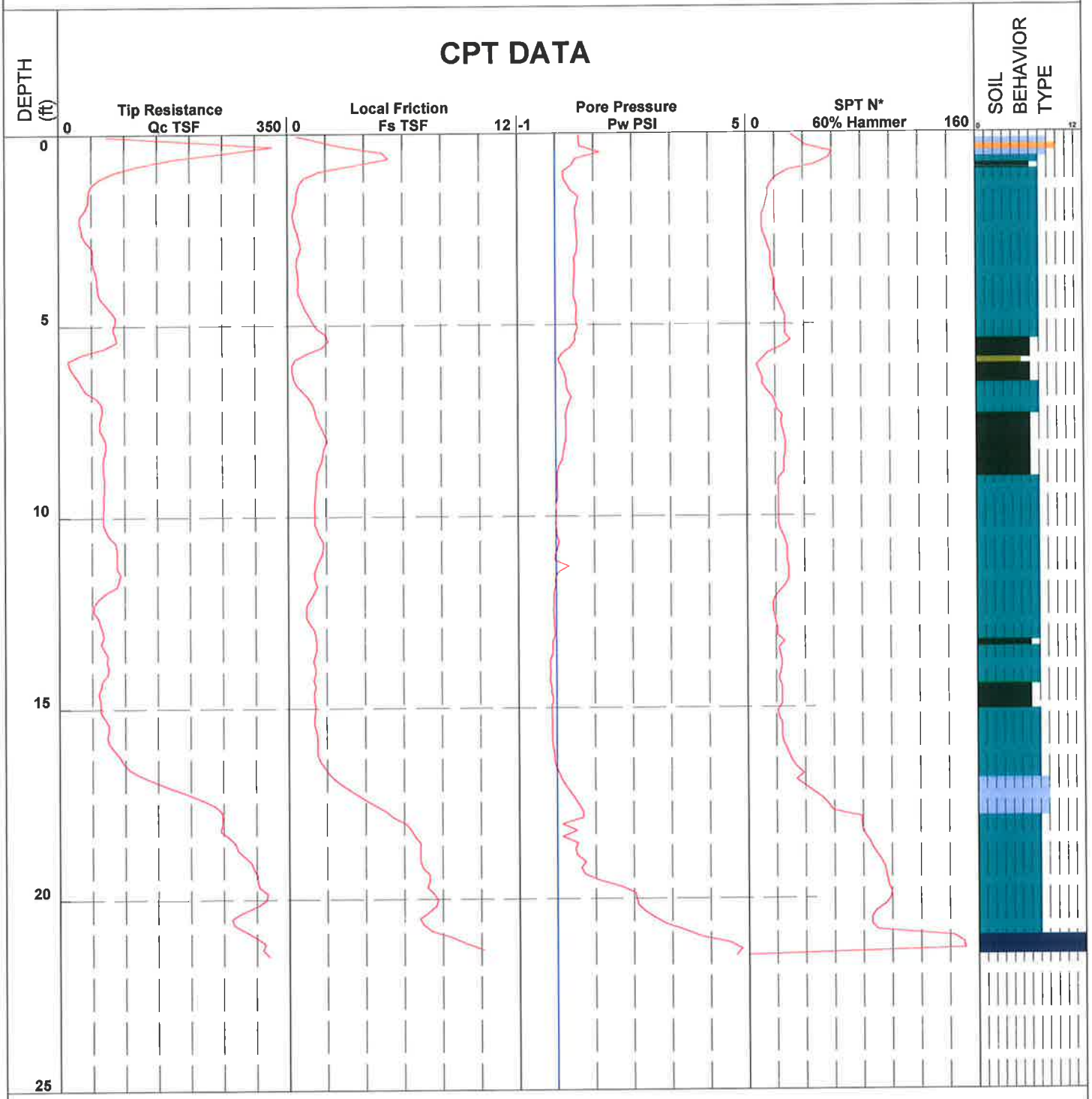
1 - sensitive fine grained
2 - organic material
3 - clay
4 - silty clay to clay
5 - clayey silt to silty clay
6 - sandy silt to clayey silt
7 - silty sand to sandy silt
8 - sand to silty sand
9 - sand
10 - gravelly sand to sand
11 - very stiff fine grained (*)
12 - sand to clayey sand (*)

Total Depth 14.3' Qc>400 Fs>8

BUREAU OF RECLAMATION

Hole #	CPT22B-14-25	Cone #	DSA0739	Date/Time	9/10/2014 12:45:13 PM
Project	NGWSP	Location	REACH 22B	Operator	L ROBINSON
Station		Offset		Elevation	
		Northing		Easting	

CPT DATA



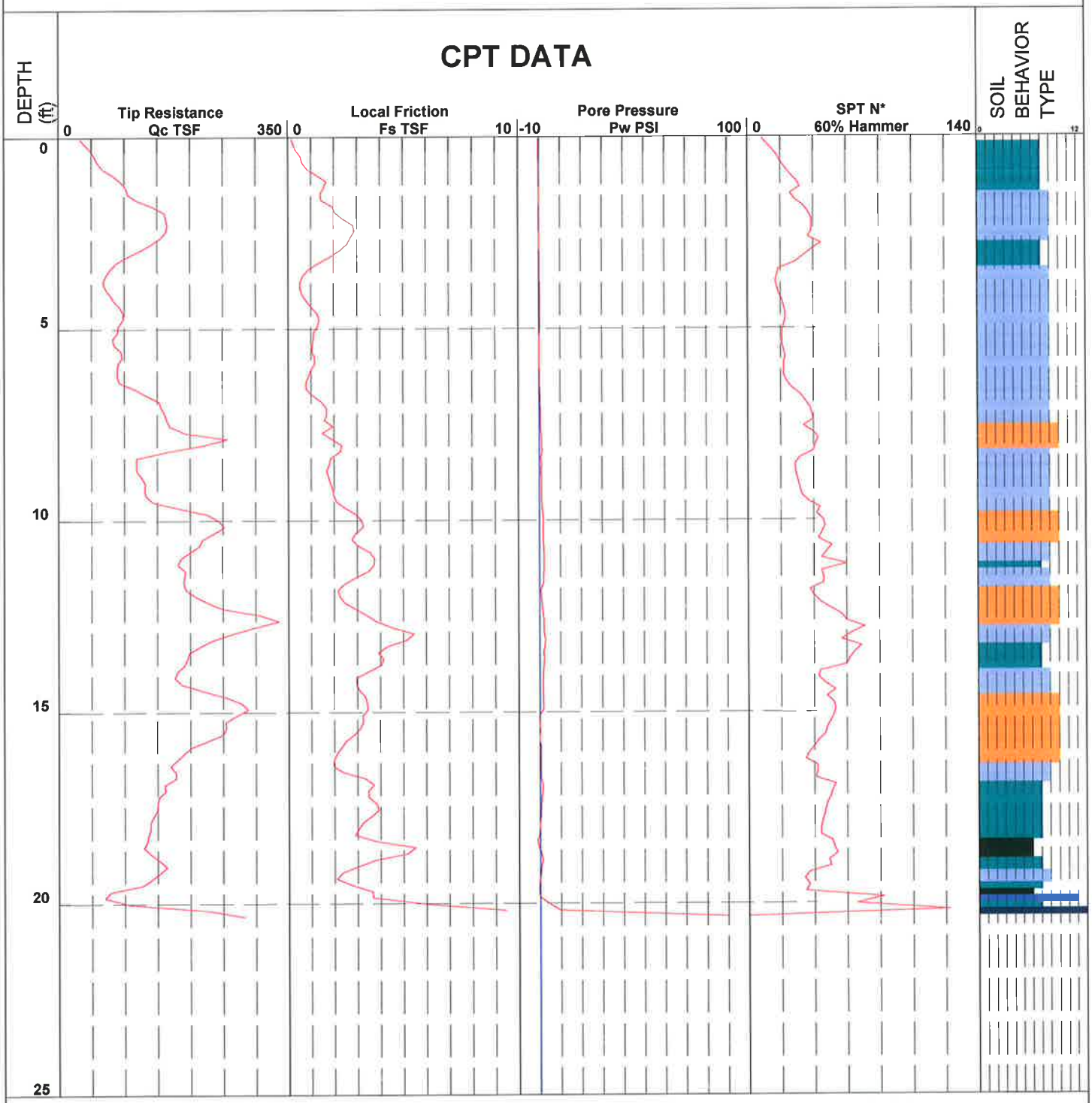
1 - sensitive fine grained
2 - organic material
3 - clay
4 - silty clay to clay
5 - clayey silt to silty clay
6 - sandy silt to clayey silt
7 - silty sand to sandy silt
8 - sand to silty sand
9 - sand
10 - gravelly sand to sand
11 - very stiff fine grained (*)
12 - sand to clayey sand (*)

Total Depth 21.8' Fs>11

BUREAU OF RECLAMATION

Hole #	CPT22B-14-37	Cone #	DSA0739	Date/Time	9/8/2014 10:58:08 AM
Project	NGWSP	Location	REACH 22B	Operator	L ROBINSON
Station		Offset		Elevation	
		Northing		Easting	

CPT DATA



1 - sensitive fine grained	4 - silty clay to clay	7 - silty sand to sandy silt	10 - gravelly sand to sand
2 - organic material	5 - clayey silt to silty clay	8 - sand to silty sand	11 - very stiff fine grained (*)
3 - clay	6 - sandy silt to clayey silt	9 - sand	12 - sand to clayey sand (*)

Total Depth 35' Fs>12

G143

SUMMARY OF PHYSICAL PROPERTIES TEST RESULTS

PROJECT: NAVAJO GALLUP WATER SUPPLY PROJECT **FEATURE:** REACH 21 WTP

Drill Hole Number: DHR21-14-G

IDENTIFICATION			PARTICLE SIZE FRACTIONS IN PERCENT						CONSISTENCY LIMITS			SPECIFIC GRAVITY						
			FINES															
TEST PIT NUMBER	DEPTH – feet	CLASSIFICATION SYMBOL	SMALLER THAN 0.005 mm	0.005 to 0.074 mm	SAND #200 (.074mm) to #4 (4.76mm)	GRAVEL #4 (4.76mm) to 3" (76.2mm)	COBBLES 3" (76.2mm) to 5" (127mm)	OVERSIZE Larger than 5" (127mm)	LIQUID LIMIT - %	PLASTICITY INDEX - %	SHRINKAGE LIMIT - %	SPECIFIC GRAVITY MINUS NO.4	SPECIFIC GRAVITY PLUS NO. 4 BULK	ABSORPTION - %	FILL WATER CONTENT % MINUS No. 4	FILL WATER CONTENT % PLUS No. 4		
SPT# 1	3.5 – 5.0	SM	10.0	7.1	82.9	0	0	0	NA	NP	-	2.63	-	-	3.0	-		
SPT# 2	6.0 – 7.5	CL	55.7	32.8	11.5	0	0	0	46.3	26.3	9.1	2.75	2.43	3.8	12.5	0		
SPT# 3	8.5 – 10.0	SC	27.9	10.4	61.7	0	0	0	24.7	10.9	-	2.67	-	-	6.2	-		
SPT# 4	11.0 – 12.5	SM	15.0	16.3	68.7	0	0	0	NA	NP	-	2.62	-	-	3.9	-		
SPT# 5	13.5 – 15.0	SM	9.0	5.7	85.3	0	0	0	NA	NP	-	2.64	-	-	2.0	-		
SPT# 6	16.0 -17.5	SP-SM	5.8	5.9	78.2	10.1	0	0	NA	NP	-	2.65	2.39	5.2	1.9	0		
SPT# 7	18.5 – 20.0	SM	7.5	7.4	80.1	5.0	0	0	NA	NP	-	2.67	2.38	6.5	2.5	0		
SPT# 8	23.5 – 25.0	SM	10.5	6.8	82.7	0	0	0	NA	NP	-	2.68	2.27	3.7	4.2	0		
SPT# 9	28.5 – 30.0	SC	19.1	11.7	69.2	0	0	0	30.6	10.8	-	2.68	-	-	12.1	-		
SPT# 10	33.5 – 34.5	SC	20.5	12.0	67.5	0	0	0	28.5	9.6	-	2.64	-	-	9.3	-		

G144

SUMMARY OF PHYSICAL PROPERTIES TEST RESULTS

PROJECT: NAVAJO GALLUP WATER SUPPLY PROJECT **FEATURE:** REACH 22 CUTTER LATERAL

IDENTIFICATION			PARTICLE SIZE FRACTIONS IN PERCENT						CONSISTENCY LIMITS			IN-PLACE DENSITY			
			FINES												
TEST PIT NUMBER	DEPTH – feet	CLASSIFICATION SYMBOL	SMALLER THAN 0.005 mm	0.005 to 0.074 mm	SAND #200 (.074mm) to #4 (4.76mm)	GRAVEL #4 (4.76mm) to 3" (76.2mm)	COBBLES 3" (76.2mm) to 5" (127mm)	OVERSIZE Larger than 5" (127mm)	LIQUID LIMIT - %	PLASTICITY INDEX - %	SHRINKAGE LIMIT - %	DRY DENSITY - PCF	FILL WATER CONTENT - %	SPECIFIC GRAVITY PLUS NO. 4	SPECIFIC GRAVITY MINUS NO.4
DHR22-25	5.0-6.5	SM	10.9	9.0	80.1	0.0	0.0	0.0	N/A	NP	-	-	1.9	-	2.64
DHR22-25	7.5-9.0	SM	13.8	12.1	74.1	0.0	0.0	0.0	N/A	NP	-	-	3.0	-	2.63
DHR22-25	10.0-11.5	SM	13.9	12.0	74.1	0.0	0.0	0.0	N/A	NP	-	-	3.3	-	2.64
DHR22-25	12.5-14.0	SC	18.2	24.9	56.9	0.0	0.0	0.0	26.1	11.1	-	-	4.2	-	N/A
DHR22-25	15.0-16.5	SC	18.9	24.2	56.9	0.0	0.0	0.0	26.2	9.2	-	-	3.7	-	2.71
DHR22-25	17.5-19.0	SM	17.6	20.8	59.9	1.7	0.0	0.0	22.9	3.7	-	-	3.8	-	2.61
DHR22-25	20.0-21.5	SM	10.3	9.6	80.1	0.0	0.0	0.0	N/A	NP	-	-	2.8	-	2.65
DHR22-29	5.0-6.5	$_s$(CL)	24.5	39.2	28.6	7.7	0.0	0.0	32.7	14.7	-	-	7.3	-	2.70
DHR22-29	7.5-8.0	SM	14.0	18.9	67.1	0.0	0.0	0.0	N/A	NP	-	-	4.5	-	2.68
DHR22-33	0.0-4.6	SC-SM	16.4	30.5	53.1	0.0	0.0	0.0	25.6	5.4	-	-	4.2	-	2.64
DHR22-33	5.0-6.2	SM	18.0	21.0	61.0	0.0	0.0	0.0	N/A	NP	-	-	7.6	-	2.61

NOTE: Numbers in parentheses are metric equivalents of numbers directly above.

**Denotes in-place density and 5-point curve.*

G145

SUMMARY OF PHYSICAL PROPERTIES TEST RESULTS

PROJECT: NAVAJO GALLUP WATER SUPPLY PROJECT **FEATURE:** REACH 22

IDENTIFICATION			PARTICLE SIZE FRACTIONS IN PERCENT						CONSISTENCY LIMITS			IN-PLACE DENSITY				COMPACTION TESTS				
			FINES																	
TEST PIT NUMBER	DEPTH – feet	CLASSIFICATION SYMBOL	SMALLER THAN 0.005 mm	0.005 to 0.074 mm	SAND #200 (.074mm) to #4 (4.76mm)	GRAVEL #4 (4.76mm) to 3" (76.2mm)	COBBLES 3" (76.2mm) to 5" (127mm)	OVERSIZE Larger than 5" (127mm)	LIQUID LIMIT - %	PLASTICITY INDEX - %	SHRINKAGE LIMIT - %	DRY DENSITY - PCF	FILL WATER CONTENT -%	SPECIFIC GRAVITY PLUS NO. 4	SPECIFIC GRAVITY MINUS NO.4	MAXIMUM DRY DENSITY - pcf	OPTIMUM WATER CONTENT - %	PENETRATION RESISTANCE psi	D-Value %	Relative Density %
DHR22-13-5	2.5 – 4.0	SC	11.8	12.2	74.5	1.5	0	0	23.6	9.4	--	--	7.3	2.53	2.65	--	--	--	--	
"	5.0 – 6.5	SC	23.9	19.8	56.3	0	0	0	21.5	7.4	--	--	5.3	--	2.68	--	--	--	--	
DHR22-53	2.5 – 4.0	SC	18.0	11.1	70.9	0	0	0	25.1	7.0	--	--	5.1	--	2.62	--	--	--	--	
	5.0 – 6.5	SM	14.4	11.0	74.6	0	0	0	N/P	N/P	--	--	4.7	--	2.67	--	--	--	--	
	10.0 – 11.5	SM	10.8	13.0	76.2	0	0	0	N/P	N/P	--	--	2.2	--	2.64	--	--	--	--	
DHR22-96	2.5 – 4.0	SM	7.5	7.2	85.3	0	0	0	N/P	N/P	--	--	1.8	--	2.62	--	--	--	--	
	5.0 – 6.5	SM	7.1	5.0	82.4	5.5	0	0	N/P	N/P	--	--	1.6	2.36	2.64	--	--	--	--	
	7.5 – 9.0	SM	17.5	21.2	61.3	0	0	0	N/P	N/P	--	--	4.0	--	2.64	--	--	--	--	
	10.0 – 11.5	SM	11.0	11.0	78.0	0	0	0	N/P	N/P	--	--	2.6	--	2.63	--	--	--	--	
	12.5 – 14.0	SM	8.5	4.5	87.0	0	0	0	N/P	N/P	--	--	2.1	--	2.64	--	--	--	--	
	15.0 – 16.5	SM	7.5	5.4	87.1	0	0	0	N/P	N/P	--	--	1.7	--	2.64	--	--	--	--	
	17.5 – 19.0	SM	8.0	5.7	86.3	0	0	0	N/P	N/P	--	--	1.8	--	2.61	--	--	--	--	
	25.0 -26.5	SM	15.4	13.1	71.5	0	0	0	19.0	2.7	--	--	3.5	--	2.62	--	--	--	--	

G146

SUMMARY OF PHYSICAL PROPERTIES TEST RESULTS

PROJECT: NAVAJO GALLUP WATER SUPPLY PROJECT **FEATURE:** REACH 22 CUTTER LATERAL

DHR22-57

IDENTIFICATION			PARTICLE SIZE FRACTIONS IN PERCENT						CONSISTENCY LIMITS			IN-PLACE DENSITY			
			FINES												
TEST PIT NUMBER	DEPTH – feet	CLASSIFICATION SYMBOL	SMALLER THAN 0.005 mm	0.005 to 0.074 mm	SAND #200 (.074mm) to #4 (4.76mm)	GRAVEL #4 (4.76mm) to 3" (76.2mm)	COBBLES 3" (76.2mm) to 5" (127mm)	OVERSIZE Larger than 5" (127mm)	LIQUID LIMIT - %	PLASTICITY INDEX - %	SHRINKAGE LIMIT - %	DRY DENSITY - PCF	FILL WATER CONTENT - %	SPECIFIC GRAVITY PLUS NO. 4	SPECIFIC GRAVITY MINUS NO.4
DHR22-57-1	5.3-6.8	SM	12.9	20.2	66.9	0.0	-	-	N/A	NP	-	-	3.9	-	2.68
DHR22-57-2	7.8-9.3	SM	8.0	11.3	80.7	0.0	-	-	N/A	NP	-	-	2.4	-	2.66
DHR22-57-3	10.3-11.8	SP-SM	4.5	3.7	91.8	0.0	-	-	N/A	NP	-	-	1.6	-	2.60
DHR22-57-4	12.8-14.3	SP-SM	4.9	4.3	90.8	0.0	-	-	N/A	NP	-	-	1.3	-	2.70
DHR22-57-5	15.3-16.8	SP-SM	5.5	2.4	92.1	0.0	-	-	N/A	NP	-	-	1.5	-	2.65
DHR22-57-7	17.3-18.2	$(CL)_s$	60.7	24.3	15.0	0.0	-	-	36.3	19.8	-	-	16.0	-	2.64
DHR22-57-8	18.2-20.3	SP-SM	3.3	1.8	91.9	3.0	0.0	-	N/A	NP	-	-	0.7	2.56	2.66
DHR22-57-9	20.3-21.8	SP-SM	5.2	1.7	93.1	0.0	-	-	N/A	NP	-	-	1.3	-	2.68

NOTE: Numbers in parentheses are metric equivalents of numbers directly above.

**Denotes in-place density and 5-point curve.*

G147

SUMMARY OF PHYSICAL PROPERTIES TEST RESULTS

PROJECT: NAVAJO GALLUP WATER SUPPLY PROJECT **FEATURE:** REACH 22 CUTTER LATERAL

DHR22-61

IDENTIFICATION			PARTICLE SIZE FRACTIONS IN PERCENT						CONSISTENCY LIMITS			IN-PLACE DENSITY			
			FINES												
TEST PIT NUMBER	DEPTH – feet	CLASSIFICATION SYMBOL	SMALLER THAN 0.005 mm	0.005 to 0.074 mm	SAND #200 (.074mm) to #4 (4.76mm)	GRAVEL #4 (4.76mm) to 3" (76.2mm)	COBBLES 3" (76.2mm) to 5" (127mm)	OVERSIZE Larger than 5" (127mm)	LIQUID LIMIT - %	PLASTICITY INDEX - %	SHRINKAGE LIMIT - %	DRY DENSITY - PCF	FILL WATER CONTENT - %	SPECIFIC GRAVITY PLUS NO. 4	SPECIFIC GRAVITY MINUS NO.4
DHR22-61-1	5.0-6.5	$_s$(CL-ML)	17.5	33.5	49.0	0.0	-	-	23.7	6.9	-	-	4.3	-	2.64
DHR22-61-2	7.5-9.0	SC-SM	15.5	22.9	61.6	0.0	-	-	21.2	4.5	-	-	3.6	-	2.66
DHR22-61-3	10.0-11.5	SM	7.0	8.0	85.0	0.0	-	-	N/A	NP	-	-	1.5	-	2.60
DHR22-61-4	12.5-14.0	SP-SM	3.4	3.1	93.5	0.0	-	-	N/A	NP	-	-	0.9	-	2.68
DHR22-61-5	15.0-16.5	SM	8.5	7.8	83.7	0.0	-	-	N/A	NP	-	-	2.2	-	2.66
DHR22-61-6	17.5-19.0	SM	9.6	9.0	77.3	4.1	0.0	-	N/A	NP	-	-	3.2	2.50	2.67

NOTE: Numbers in parentheses are metric equivalents of numbers directly above.
**Denotes in-place density and 5-point curve.*

G148

SUMMARY OF PHYSICAL PROPERTIES TEST RESULTS

PROJECT: NAVAJO GALLUP WATER SUPPLY PROJECT **FEATURE:** REACH 22 CUTTER LATERAL

DHR22-65

IDENTIFICATION			PARTICLE SIZE FRACTIONS IN PERCENT						CONSISTENCY LIMITS			IN-PLACE DENSITY			
			FINES												
TEST PIT NUMBER	DEPTH – feet	CLASSIFICATION SYMBOL	SMALLER THAN 0.005 mm	0.005 to 0.074 mm	SAND #200 (.074mm) to #4 (4.76mm)	GRAVEL #4 (4.76mm) to 3" (76.2mm)	COBBLES 3" (76.2mm) to 5" (127mm)	OVERSIZE Larger than 5" (127mm)	LIQUID LIMIT - %	PLASTICITY INDEX - %	SHRINKAGE LIMIT - %	DRY DENSITY - PCF	FILL WATER CONTENT - %	SPECIFIC GRAVITY PLUS NO. 4	SPECIFIC GRAVITY MINUS NO.4
DHR22-65-1	5.0-6.5	SP-SM	7.5	2.2	90.3	0.0	-	-	N/A	NP	-	-	1.7	-	2.72
DHR22-65-2	7.5-9.0	SP-SM	6.7	4.2	89.1	0.0	-	-	N/A	NP	-	-	2.1	-	2.63
DHR22-65-3	10.0-11.5	SM	5.8	6.3	87.9	0.0	-	-	N/A	NP	-	-	2.1	-	2.67
DHR22-65-4	12.5-14.0	SM	11.5	14.7	73.8	0.0	-	-	N/A	NP	-	-	3.8	-	2.68
DHR22-65-5	15.0-16.5	SM	11.6	9.5	78.9	0.0	-	-	N/A	NP	-	-	3.3	-	2.61
DHR22-65-6	20.0-21.5	SM	10.0	13.3	76.7	0.0	-	-	N/A	NP	-	-	2.2	-	2.68
DHR22-65	2.5-3.5	SM	10.4	13.5	76.1	0.0	-	-	N/A	NP	-	-	2.6	-	2.64
DHR22-65	11.9-12.5	$_s$(CL)	26.8	35.3	37.9	0.0	-	-	27.7	11.4	-	-	8.3	-	2.67

NOTE: Numbers in parentheses are metric equivalents of numbers directly above.

**Denotes in-place density and 5-point curve.*

G149

SUMMARY OF PHYSICAL PROPERTIES TEST RESULTS

PROJECT: NAVAJO GALLUP WATER SUPPLY PROJECT **FEATURE:** REACH 22 CUTTER LATERAL

DHR22-69

IDENTIFICATION			PARTICLE SIZE FRACTIONS IN PERCENT						CONSISTENCY LIMITS			IN-PLACE DENSITY			
			FINES												
TEST PIT NUMBER	DEPTH – feet	CLASSIFICATION SYMBOL	SMALLER THAN 0.005 mm	0.005 to 0.074 mm	SAND #200 (.074mm) to #4 (4.76mm)	GRAVEL #4 (4.76mm) to 3" (76.2mm)	COBBLES 3" (76.2mm) to 5" (127mm)	OVERSIZE Larger than 5" (127mm)	LIQUID LIMIT - %	PLASTICITY INDEX - %	SHRINKAGE LIMIT - %	DRY DENSITY - PCF	FILL WATER CONTENT -%	SPECIFIC GRAVITY PLUS NO. 4	SPECIFIC GRAVITY MINUS NO.4
DHR22-69-1	5.0-6.5	SM	7.8	8.5	83.7	0.0	-	-	N/A	NP	-	-	2.4	-	2.70
DHR22-69-2	7.5-9.0	SM	8.5	16.7	74.8	0.0	-	-	N/A	NP	-	-	2.7	-	2.71
DHR22-69-3	10.0-11.5	SM	13.8	26.3	58.5	1.4	0.0	-	N/A	NP	-	-	4.8	2.62	2.65
DHR22-69-4	12.5-14.0	$_s$(CL)	21.2	36.8	40.6	1.4	0.0	-	31.1	15.7	-	-	7.0	2.45	2.60
DHR22-69-5	15.0-16.5	SC	20.3	28.6	46.8	4.3	0.0	-	27.6	12.4	-	-	5.8	2.40	2.70
DHR22-69-6	17.0-20.0	$(SC)_g$	12.7	10.4	61.9	15.0	0.0	-	25.5	11.1	-	-	4.5	2.57	2.69
DHR22-69-7	20.0-21.5	SC	18.8	16.9	55.3	9.0	0.0	-	29.2	14.8	-	-	5.6	2.43	2.70

NOTE: Numbers in parentheses are metric equivalents of numbers directly above.
**Denotes in-place density and 5-point curve.*

G150

SUMMARY OF PHYSICAL PROPERTIES TEST RESULTS

PROJECT: NAVAJO GALLUP WATER SUPPLY PROJECT **FEATURE:** REACH 22 CUTTER LATERAL

DHR22-74

IDENTIFICATION			PARTICLE SIZE FRACTIONS IN PERCENT						CONSISTENCY LIMITS			IN-PLACE DENSITY			
			FINES												
TEST PIT NUMBER	DEPTH – feet	CLASSIFICATION SYMBOL	SMALLER THAN 0.005 mm	0.005 to 0.074 mm	SAND #200 (.074mm) to #4 (4.76mm)	GRAVEL #4 (4.76mm) to 3" (76.2mm)	COBBLES 3" (76.2mm) to 5" (127mm)	OVERSIZE Larger than 5" (127mm)	LIQUID LIMIT - %	PLASTICITY INDEX - %	SHRINKAGE LIMIT - %	DRY DENSITY - PCF	FILL WATER CONTENT -%	SPECIFIC GRAVITY PLUS NO. 4	SPECIFIC GRAVITY MINUS NO.4
DHR22-74-1	5.0-6.5	SM	11.9	19.2	68.9	0.0	-	-	N/A	NP	-	-	3.8	-	2.65
DHR22-74-2	7.5-9.0	SM	17.0	12.1	70.9	0.0	-	-	25.3	NP	-	-	6.4	-	2.67
DHR22-74-3	10.0-11.5	SC	18.0	12.7	69.3	0.0	-	-	28.3	11.4	-	-	6.3	-	2.73
DHR22-74-4	12.5-14.0	SC	17.5	12.1	67.9	2.5	0.0	-	27.1	10.1	-	-	4.7	2.54	2.74
DHR22-74-5	15.0-15.7	SC	16.7	30.9	52.4	0.0	-	-	34.5	12.8	-	-	10.5	-	2.65
DHR22-74-6	20.0-20.6	$_s$(CL)	28.6	29.2	42.2	0.0	-	-	35.0	18.8	-	-	9.4	-	2.74

NOTE: Numbers in parentheses are metric equivalents of numbers directly above.

**Denotes in-place density and 5-point curve.*

G151

SUMMARY OF PHYSICAL PROPERTIES TEST RESULTS

PROJECT: NAVAJO GALLUP WATER SUPPLY PROJECT **FEATURE:** REACH 22 CUTTER LATERAL

IDENTIFICATION			PARTICLE SIZE FRACTIONS IN PERCENT						CONSISTENCY LIMITS			IN-PLACE DENSITY			
			FINES												
TEST PIT NUMBER	DEPTH – feet	CLASSIFICATION SYMBOL	SMALLER THAN 0.005 mm	0.005 to 0.074 mm	SAND #200 (.074mm) to #4 (4.76mm)	GRAVEL #4 (4.76mm) to 3" (76.2mm)	COBBLES 3" (76.2mm) to 5" (127mm)	OVERSIZE Larger than 5" (127mm)	LIQUID LIMIT - %	PLASTICITY INDEX - %	SHRINKAGE LIMIT - %	DRY DENSITY - PCF	FILL WATER CONTENT - %	SPECIFIC GRAVITY PLUS NO. 4	SPECIFIC GRAVITY MINUS NO.4
DHR22-78	5.0-6.5	SC	25.0	7.7	67.3	0.0	0.0	0.0	21.9	8.4	-	-	4.6	-	2.66
DHR22-78	7.5-9.0	$_s$(ML)	19.3	31.7	49.0	0.0	0.0	0.0	21.4	3.8	-	-	4.5	-	2.67
DHR22-78	10.0-10.5	$(CH)_s$	58.2	17.2	24.6	0.0	0.0	0.0	52.1	30.3	8.1	-	17.2	-	2.69
DHR22-78	10.5-11.5	SC	21.4	23.0	55.6	0.0	0.0	0.0	25.6	7.3	-	-	5.6	-	2.78
DHR22-78	12.5-14.0	SM	12.8	10.0	77.2	0.0	0.0	0.0	N/A	NP	-	-	2.7	-	2.66
DHR22-78	15.0-16.5	$_s$(ML)	17.0	51.5	31.5	0.0	0.0	0.0	N/A	NP	-	-	5.5	-	2.61
DHR22-78	17.5-19.0	SM	16.3	24.1	59.6	0.0	0.0	0.0	N/A	NP	-	-	4.6	-	2.65
DHR22-78	20.0-21.5	SM	14.0	20.4	65.6	0.0	0.0	0.0	N/A	NP	-	-	3.9	-	2.60

NOTE: Numbers in parentheses are metric equivalents of numbers directly above.
**Denotes in-place density and 5-point curve.*

G152

SUMMARY OF PHYSICAL PROPERTIES TEST RESULTS

PROJECT: NAVAJO GALLUP WATER SUPPLY PROJECT **FEATURE:** REACH 22B

Drill Hole Number: DHR22AC1-15-1

IDENTIFICATION			PARTICLE SIZE FRACTIONS IN PERCENT						CONSISTENCY LIMITS			SPECIFIC GRAVITY				IN-PLACE DENSITY				
			FINES																	
TEST PIT NUMBER	DEPTH – feet	CLASSIFICATION SYMBOL	SMALLER THAN 0.005 mm	0.005 to 0.074 mm	SAND #200 (.074mm) to #4 (4.76mm)	GRAVEL #4 (4.76mm) to 3" (76.2mm)	COBBLES 3" (76.2mm) to 5" (127mm)	OVERSIZE Larger than 5" (127mm)	LIQUID LIMIT - %	PLASTICITY INDEX - %	SHRINKAGE LIMIT - %	SPECIFIC GRAVITY MINUS NO.4	SPECIFIC GRAVITY PLUS NO. 4 BULK	APPARENT	ABSORPTION - %	FILL WATER CONTENT % MINUS No. 4	FILL WATER CONTENT % PLUS No. 4			
SPT #1	3.5 – 5.0	SM	8.5	13.2	78.3	0	-	-	NA	NP	-	2.70	-	-	-	2.5	-			
SPT #2	6.0 – 7.5	SP-SM	4.9	5.1	90.0	0	-	-	NA	NP	-	2.62	-	-	-	1.7	-			
SPT #3	8.5 – 10.0	SP-SM	4.4	5.2	90.4	0	-	-	NA	NP	-	2.51	-	-	-	1.6	-			
SPT #4	11.0 – 12.5	SC	17.0	20.1	62.9	0	-	-	23.4	7.1	-	2.61	-	-	-	5.3	-			
SPT #5	13.5 – 15.0	SC-SM	14.6	13.1	72.3	0	-	-	22.4	5.2	-	2.62	-	-	-	4.6	-			
SPT #6	16.0 – 17.5	SC	16.6	19.7	63.7	0	-	-	27.2	10.3	-	2.72	-	-	-	5.5	-			
SPT #7	18.5 – 20.0	SC	16.3	21.2	62.5	0	-	-	26.9	9.3	-	2.66	-	-	-	5.8	-			
SPT #8	23.5 – 25.0	SM	9.6	10.1	79.7	0.6	-	-	NA	NP	-	2.67	2.48	-	1.3	5.3	1.2			

G153

SUMMARY OF PHYSICAL PROPERTIES TEST RESULTS

PROJECT: NAVAJO GALLUP WATER SUPPLY PROJECT **FEATURE:** REACH 22B

Drill Hole Number: DHR22AC2-15-1

IDENTIFICATION			PARTICLE SIZE FRACTIONS IN PERCENT						CONSISTENCY LIMITS			SPECIFIC GRAVITY				IN-PLACE DENSITY			
			FINES																
TEST PIT NUMBER	DEPTH – feet	CLASSIFICATION SYMBOL	SMALLER THAN 0.005 mm	0.005 to 0.074 mm	SAND #200 (.074mm) to #4 (4.76mm)	GRAVEL #4 (4.76mm) to 3" (76.2mm)	COBBLES 3" (76.2mm) to 5" (127mm)	OVERSIZE Larger than 5" (127mm)	LIQUID LIMIT - %	PLASTICITY INDEX - %	SHRINKAGE LIMIT - %	SPECIFIC GRAVITY MINUS NO.4	SPECIFIC GRAVITY PLUS NO. 4 BULK	APPARENT	ABSORPTION - %	FILL WATER CONTENT % MINUS No. 4	FILL WATER CONTENT % PLUS No. 4		
SPT #1	3.5 – 5.0	SM	9.4	7.2	83.4	0	-	-	NA	NP	-	2.66	-	-	-	3.7	-		
SPT #2	6.0 – 7.5	(CL-ML)s	16.8	56.4	26.8	0	-	-	25.9	6.9	-	2.64	-	-	-	5.4	-		
SPT #3	8.5 – 10.0	SM	11.0	22.5	66.5	0	-	-	NA	NP	-	2.64	-	-	-	3.1	-		
SPT #4	11.0 – 12.5	SM	12.2	18.6	69.2	0	-	-	NA	NP	-	2.64	-	-	-	3.7	-		
SPT #5	13.5 – 15.0	SM	8.9	8.3	82.8	0	-	-	NA	NP	-	2.62	-	-	-	2.5	-		

G154

SUMMARY OF PHYSICAL PROPERTIES TEST RESULTS

PROJECT: NAVAJO GALLUP WATER SUPPLY PROJECT **FEATURE:** REACH 22B

Drill Hole Number: DHR22B-14-25

IDENTIFICATION			PARTICLE SIZE FRACTIONS IN PERCENT						CONSISTENCY LIMITS			SPECIFIC GRAVITY				IN-PLACE DENSITY				
TEST PIT NUMBER (DHR22B-14-25)	DEPTH – feet	CLASSIFICATION SYMBOL	FINES: SMALLER THAN 0.005 mm	FINES: 0.005 to 0.074 mm	SAND #200 (.074mm) to #4 (4.76mm)	GRAVEL #4 (4.76mm) to 3" (76.2mm)	COBBLES 3" (76.2mm) to 5" (127mm)	OVERSIZE Larger than 5" (127mm)	LIQUID LIMIT - %	PLASTICITY INDEX - %	SHRINKAGE LIMIT - %	SPECIFIC GRAVITY MINUS NO.4	SPECIFIC GRAVITY PLUS NO. 4 BULK	APPARENT	ABSORPTION - %	FILL WATER CONTENT % MINUS No. 4	FILL WATER CONTENT % PLUS No. 4			
SPT# 1	4.0 – 5.5	SC	20.9	22.7	56.4	0	0	0	25.9	11.0	-	2.69	-	-	-	4.0	-			
SPT# 2	6.5 – 8.0	SC-SM	21.0	18.4	60.6	0	0	0	24.3	7.0	-	2.66	-	-	-	6.7	-			
SPT# 3	9.0 – 10.5	SM	16.9	15.1	68.0	0	0	0	NA	NP	-	2.69	-	-	-	5.4	-			
SPT# 4	11.5 – 13.0	SC-SM	20.3	15.7	64.0	0	0	0	25.2	7.0	-	2.69	-	-	-	5.7	-			
SPT# 5	14.0 – 15.5	SM	14.3	9.0	76.7	0	0	0	NA	NP	-	2.68	-	-	-	4.4	-			
SPT# 6	16.5 – 18.0	SM	13.3	9.0	77.7	0	0	0	21.6	3.0	-	2.64	-	-	-	4.9	-			
SPT# 7	19.0 – 20.5	SM	16.5	5.5	78.0	0	0	0	NA	NP	-	2.70	-	-	-	5.5	-			
SPT# 8	24.0 – 25.5	$(CL)_S$	35.9	48.2	15.9	0	0	0	41.1	21.3	12.0	2.73	-	-	-	17.6	-			

G155

SUMMARY OF PHYSICAL PROPERTIES TEST RESULTS

PROJECT: NAVAJO GALLUP WATER SUPPLY PROJECT **FEATURE:** REACH 22B

Drill Hole Number: DHR22B-14-33

IDENTIFICATION			PARTICLE SIZE FRACTIONS IN PERCENT						CONSISTENCY LIMITS			SPECIFIC GRAVITY				IN-PLACE DENSITY				
			FINES																	
TEST PIT NUMBER (DHR22B-14-33)	DEPTH – feet	CLASSIFICATION SYMBOL	SMALLER THAN 0.005 mm	0.005 to 0.074 mm	SAND #200 (.074mm) to #4 (4.76mm)	GRAVEL #4 (4.76mm) to 3" (76.2mm)	COBBLES 3" (76.2mm) to 5" (127mm)	OVERSIZE Larger than 5" (127mm)	LIQUID LIMIT - %	PLASTICITY INDEX - %	SHRINKAGE LIMIT - %	SPECIFIC GRAVITY MINUS NO.4	SPECIFIC GRAVITY PLUS NO. 4 BULK	APPARENT	ABSORPTION - %	FILL WATER CONTENT % MINUS No. 4	FILL WATER CONTENT % PLUS No. 4			
SPT# 1	3.5 – 5.0	SC-SM	16.6	19.8	63.6	0	0	0	22.6	6.4	-	2.66	-	-	-	3.9	-			
SPT# 2	6.0 – 7.5	SM	14.9	16.8	68.3	0	0	0	NA	NP	-	2.64	-	-	-	3.8	-			
SPT# 3	8.5 – 10.0	SM	10.5	10.6	78.9	0	0	0	NA	NP	-	2.65	-	-	-	2.7	-			
SPT# 4	11.0 – 12.5	SC	19.1	23.8	57.1	0	0	0	23.6	9.8	-	2.67	-	-	-	6.3	-			
SPT# 5	13.5 – 15.0	SC	22.4	24.8	52.8	0	0	0	27.2	12.1	-	2.68	-	-	-	7.2	-			
SPT# 6	16.0 – 17.5	s(CL)	26.0	33.3	40.7	0	0	0	28.4	13.7	-	2.73	-	-	-	9.6	-			
SPT# 7	18.5 – 20.0	SC	21.9	21.8	56.3	0	0	0	26.4	11.7	-	2.72	-	-	-	8.2	-			
SPT# 8	23.5 – 25.0	SM	4.5	22.4	73.1	0	0	0	NA	NP	-	2.71	-	-	-	7.1	-			

G156

SUMMARY OF PHYSICAL PROPERTIES TEST RESULTS

PROJECT: NAVAJO GALLUP WATER SUPPLY PROJECT **FEATURE:** REACH 22B

Drill Hole Number: DHR-22B-14-41

IDENTIFICATION			PARTICLE SIZE FRACTIONS IN PERCENT						CONSISTENCY LIMITS			SPECIFIC GRAVITY						
			FINES															
TEST PIT NUMBER	DEPTH – feet	CLASSIFICATION SYMBOL	SMALLER THAN 0.005 mm	0.005 to 0.074 mm	SAND #200 (.074mm) to #4 (4.76mm)	GRAVEL #4 (4.76mm) to 3" (76.2mm)	COBBLES 3" (76.2mm) to 5" (127mm)	OVERSIZE Larger than 5" (127mm)	LIQUID LIMIT - %	PLASTICITY INDEX - %	SHRINKAGE LIMIT - %	SPECIFIC GRAVITY MINUS NO.4	SPECIFIC GRAVITY PLUS NO. 4 BULK	ABSORPTION - %	FILL WATER CONTENT % MINUS No. 4	FILL WATER CONTENT % PLUS No. 4		
SPT# 1	3.5 – 5.0	SP-SM	5.0	6.4	88.6	0	0	0	NA	NP	-	2.63	-	-	0.9	-		
SPT# 2	6.0 – 7.5	SP-SM	4.0	4.3	91.7	0	0	0	NA	NP	-	2.64	-	-	0.7	-		
SPT# 3	8.5 – 10.0	SP-SM	6.0	5.8	88.2	0	0	0	NA	NP	-	2.66	-	-	1.1	-		
SPT# 4	11.0 – 12.5	SM	6.1	6.5	81.3	6.1	0	0	NA	NP	-	2.63	2.47	3.7	1.3	0		
SPT# 5	13.5 – 15.0	SM	6.0	6.8	87.2	0	0	0	NA	NP	-	2.65	-	-	1.6	-		
SPT# 6	16.0 -17.5	SM	8.5	9.0	82.5	0	0	0	NA	NP	-	2.67	-	-	2.4	-		
SPT# 7	18.5 – 20.0	(CL)s	29.8	42.3	27.9	0	0	0	34.9	18.0	-	2.67	-	-	10.3	-		
SPT# 8	23.5 – 25.0	s(CL)	23.9	38.7	37.4	0	0	0	30.5	10.4	-	2.66	-	-	9.2	-		

G157

SUMMARY OF PHYSICAL PROPERTIES TEST RESULTS

PROJECT: NAVAJO GALLUP WATER SUPPLY PROJECT **FEATURE:** REACH 22B

Drill Hole Number: DHR22B-14-50

IDENTIFICATION			PARTICLE SIZE FRACTIONS IN PERCENT						CONSISTENCY LIMITS			SPECIFIC GRAVITY				IN-PLACE DENSITY				
			FINES																	
TEST PIT NUMBER (DHR22B-14-50)	DEPTH – feet	CLASSIFICATION SYMBOL	SMALLER THAN 0.005 mm	0.005 to 0.074 mm	SAND #200 (.074mm) to #4 (4.76mm)	GRAVEL #4 (4.76mm) to 3" (76.2mm)	COBBLES 3" (76.2mm) to 5" (127mm)	OVERSIZE Larger than 5" (127mm)	LIQUID LIMIT - %	PLASTICITY INDEX - %	SHRINKAGE LIMIT - %	SPECIFIC GRAVITY MINUS NO.4	SPECIFIC GRAVITY PLUS NO. 4 BULK	APPARENT	ABSORPTION - %	FILL WATER CONTENT % MINUS No. 4	FILL WATER CONTENT % PLUS No. 4			
SPT# 1	4.0 – 5.5	SM	9.4	8.0	82.6	0	0	0	NA	NP	-	2.63	-	-	-	3.5	-			
SPT# 2	6.5 – 8.0	SC	22.9	20.9	56.2	0	0	0	38.0	21.6	-	2.67	-	-	-	7.1	-			
SPT# 3	9.0 – 10.5	s(CL)	21.0	32.9	46.1	0	0	0	29.3	12.8	-	2.65	-	-	-	6.7	-			

G158

SUMMARY OF PHYSICAL PROPERTIES TEST RESULTS

PROJECT: NAVAJO GALLUP WATER SUPPLY PROJECT **FEATURE:** REACH 22B

Drill Hole Number: DHR22B-14-121

IDENTIFICATION			PARTICLE SIZE FRACTIONS IN PERCENT						CONSISTENCY LIMITS			SPECIFIC GRAVITY				IN-PLACE DENSITY				
			FINES																	
TEST PIT NUMBER	DEPTH – feet	CLASSIFICATION SYMBOL	SMALLER THAN 0.005 mm	0.005 to 0.074 mm	SAND #200 (.074mm) to #4 (4.76mm)	GRAVEL #4 (4.76mm) to 3" (76.2mm)	COBBLES 3" (76.2mm) to 5" (127mm)	OVERSIZE Larger than 5" (127mm)	LIQUID LIMIT - %	PLASTICITY INDEX - %	SHRINKAGE LIMIT - %	SPECIFIC GRAVITY MINUS NO.4	SPECIFIC GRAVITY PLUS NO. 4 BULK	APPARENT	ABSORPTION - %	FILL WATER CONTENT % MINUS No. 4	FILL WATER CONTENT % PLUS No. 4			
SPT# 1	3.5 – 5.0	SC	19.8	23.4	56.8	-	-	-	24.4	11.0	-	2.65	-	-	-	3.9	-			
SPT# 2	6.0 – 7.5	SM	8.5	10.2	81.3	-	-	-	NA	NP	-	2.62	-	-	-	1.7	-			
SPT# 3	8.5 – 10.0	s(CL)	21.8	33.9	44.3	-	-	-	26.5	12.3	-	2.63	-	-	-	5.4	-			
SPT# 4	11.0 – 12.5	SC	20.9	27.0	52.1	-	-	-	26.7	11.8	14.2	2.67	-	-	-	5.0	-			
SPT# 5	13.5 – 15.0	s(CL)	28.0	26.1	45.9	-	-	-	29.2	14.8	-	2.65	-	-	-	5.7	-			
SPT# 6	16.0 – 17.5	s(CL)	31.8	27.6	40.6	-	-	-	31.2	16.6	-	2.64	-	-	-	7.0	-			
SPT# 7	18.5 – 20.0	s(CL)	27.8	26.0	46.2	-	-	-	27.9	13.4	-	2.64	-	-	-	5.7	-			
SPT# 8	23.5 – 25.0	SC	29.0	18.1	52.9	-	-	-	28.2	14.8	-	2.65	-	-	-	4.7	-			

G159

SUMMARY OF PHYSICAL PROPERTIES TEST RESULTS

PROJECT: NAVAJO GALLUP WATER SUPPLY PROJECT **FEATURE:** REACH 22B

Drill Hole Number: DHR22B-14-125

IDENTIFICATION			PARTICLE SIZE FRACTIONS IN PERCENT						CONSISTENCY LIMITS			SPECIFIC GRAVITY				IN-PLACE DENSITY				
			FINES																	
TEST PIT NUMBER (DHR22B-14-125)	DEPTH – feet	CLASSIFICATION SYMBOL	SMALLER THAN 0.005 mm	0.005 to 0.074 mm	SAND #200 (.074mm) to #4 (4.76mm)	GRAVEL #4 (4.76mm) to 3" (76.2mm)	COBBLES 3" (76.2mm) to 5" (127mm)	OVERSIZE Larger than 5" (127mm)	LIQUID LIMIT - %	PLASTICITY INDEX - %	SHRINKAGE LIMIT - %	SPECIFIC GRAVITY MINUS NO.4	SPECIFIC GRAVITY PLUS NO. 4 BULK	APPARENT	ABSORPTION - %	FILL WATER CONTENT % MINUS No. 4	FILL WATER CONTENT % PLUS No. 4			
SPT# 1	3.5 – 5.0	SC	31.0	11.4	57.6	0	0	0	34.2	21.6	-	2.61	-	-	-	6.3	-			
SPT# 2	6.0 – 7.5	SM	12.5	9.0	78.5	0	0	0	-	NP	-	2.66	-	-	-	3.2	-			
SPT# 3	8.5 – 10.0	SC	26.1	17.4	56.5	0	0	0	26.3	14.1	-	2.61	-	-	-	6.2	-			
SPT# 4	11.0 – 12.5	s(CL)	39.2	29.3	31.5	0	0	0	39.6	27.0	-	2.58	-	-	-	9.9	-			
SPT# 5	13.5 –15.0	$(CL)_S$	45.0	31.1	23.9	0	0	0	40.4	28.1	8.8	2.60	-	-	-	10.4	-			
SPT# 6	16.0 – 17.5	s(CL)	38.3	18.4	43.3	0	0	0	34.0	22.0	-	2.63	-	-	-	8.8	-			
SPT# 7	18.5 – 20.0	s(CL)	29.4	21.2	49.4	0	0	0	28.2	15.9	-	2.59	-	-	-	7.6	-			
SPT# 8	23.5 – 25.0	CH	74.6	21.5	3.9	0	0	0	69.0	44.5	8.3	2.56	-	-	-	25.0	-			

G160

SUMMARY OF PHYSICAL PROPERTIES TEST RESULTS

PROJECT: NAVAJO GALLUP WATER SUPPLY PROJECT **FEATURE:** REACH 22B

Drill Hole Number: DHR22PP1-15-1

IDENTIFICATION			PARTICLE SIZE FRACTIONS IN PERCENT						CONSISTENCY LIMITS			SPECIFIC GRAVITY				IN-PLACE DENSITY				
			FINES																	
TEST PIT NUMBER	DEPTH – feet	CLASSIFICATION SYMBOL	SMALLER THAN 0.005 mm	0.005 to 0.074 mm	SAND #200 (.074mm) to #4 (4.76mm)	GRAVEL #4 (4.76mm) to 3" (76.2mm)	COBBLES 3" (76.2mm) to 5" (127mm)	OVERSIZE Larger than 5" (127mm)	LIQUID LIMIT - %	PLASTICITY INDEX - %	SHRINKAGE LIMIT - %	SPECIFIC GRAVITY MINUS NO.4	SPECIFIC GRAVITY PLUS NO. 4 BULK	APPARENT	ABSORPTION - %	FILL WATER CONTENT % MINUS No. 4	FILL WATER CONTENT % PLUS No. 4			
SPT #1	3.5 – 5.0	SM	8.9	12.2	78.9	0	-	-	NA	NP	-	2.66	-	-	-	3.1	-			
SPT #2	6.0 – 7.5	SM	9.3	11.7	79.0	0	-	-	NA	NP	-	2.63	-	-	-	2.4	-			
SPT #3	8.5 – 10.0	SC-SM	15.0	23.3	61.7	0	-	-	22.8	4.2	-	2.61	-	-	-	4.3	-			
SPT #4	11.0 – 12.5	SM	8.6	13.3	74.1	4.0	-	-	NA	NP	-	2.69	2.34	-	6.5	2.8	2.8			
SPT #5	13.5 – 15.0	SM	9.0	10.3	80.7	0	-	-	NA	NP	-	2.63	-	-	-	2.9	-			
SPT #6	16.0 – 17.5	SM	16.2	16.2	67.6	0	-	-	NA	NP	-	2.62	-	-	-	4.8	-			
SPT #7	18.5 – 20.0	SC	19.1	19.5	61.4	0	-	-	31.3	16.5	-	2.67	-	-	-	6.5	-			

G161

SUMMARY OF PHYSICAL PROPERTIES TEST RESULTS

PROJECT: NAVAJO GALLUP WATER SUPPLY PROJECT **FEATURE:** REACH 22

Drill Hole Number: DHR-22-PP2A-14-1

IDENTIFICATION			PARTICLE SIZE FRACTIONS IN PERCENT						CONSISTENCY LIMITS			SPECIFIC GRAVITY					
			FINES														
TEST PIT NUMBER	DEPTH – feet	CLASSIFICATION SYMBOL	SMALLER THAN 0.005 mm	0.005 to 0.074 mm	SAND #200 (.074mm) to #4 (4.76mm)	GRAVEL #4 (4.76mm) to 3" (76.2mm)	COBBLES 3" (76.2mm) to 5" (127mm)	OVERSIZE Larger than 5" (127mm)	LIQUID LIMIT - %	PLASTICITY INDEX - %	SHRINKAGE LIMIT - %	SPECIFIC GRAVITY MINUS NO.4	SPECIFIC GRAVITY PLUS NO. 4 BULK	ABSORPTION - %	FILL WATER CONTENT % MINUS No. 4	FILL WATER CONTENT % PLUS No. 4	Total Moisture%
SPT#1	3.5 – 5.0	SP-SM	5.0	4.1	90.9	0	0	0	NA	NP	-	2.64	-	-	1.6	-	1.6
SPT#2	6.0 – 7.5	SP-SM	4.0	4.5	91.5	0	0	0	NA	NP	-	2.63	-	-	1.2	-	1.2
SPT#3	8.5 – 10.0	(CL-ML)s	23.6	46.5	29.9	0	0	0	23.3	5.5	-	2.68	-	-	5.0	-	5.0
SPT#4	11.0 – 12.5	SM	15.0	15.1	69.9	0	0	0	NA	NP	-	2.68	-	-	3.4	-	3.4
SPT#5	13.5 – 15.0	SM	16.5	13.8	69.7	0	0	0	NA	NP	-	2.65	-	-	3.7	-	3.7

G162

SUMMARY OF PHYSICAL PROPERTIES TEST RESULTS

PROJECT: NAVAJO GALLUP WATER SUPPLY PROJECT **FEATURE:** REACH 22B

Drill Hole Number: DHR22PP2-15-2

IDENTIFICATION			PARTICLE SIZE FRACTIONS IN PERCENT						CONSISTENCY LIMITS			SPECIFIC GRAVITY				IN-PLACE DENSITY				
			FINES																	
TEST PIT NUMBER	DEPTH – feet	CLASSIFICATION SYMBOL	SMALLER THAN 0.005 mm	0.005 to 0.074 mm	SAND #200 (.074mm) to #4 (4.76mm)	GRAVEL #4 (4.76mm) to 3" (76.2mm)	COBBLES 3" (76.2mm) to 5" (127mm)	OVERSIZE Larger than 5" (127mm)	LIQUID LIMIT - %	PLASTICITY INDEX - %	SHRINKAGE LIMIT - %	SPECIFIC GRAVITY MINUS NO.4	SPECIFIC GRAVITY PLUS NO. 4 BULK	APPARENT	ABSORPTION - %	FILL WATER CONTENT % MINUS No. 4	FILL WATER CONTENT % PLUS No. 4			
SPT # 1	4.2 – 5.7	SM	8.4	7.9	83.7	0	-	-	NA	NP	-	2.64	-	-	-	3.4	-			
SPT #2	6.7 – 8.2	SM	6.4	7.5	86.1	0	-	-	NA	NP	-	2.61	-	-	-	2.3	-			
SPT #3	9.2 – 10.7	SC-SM	18.4	27.9	53.7	0	-	-	22.2	4.8	-	2.61	-	-	-	5.8	-			
SPT #4	11.7 – 13.2	SM	6.9	10.1	83.0	0	-	-	NA	NP	-	2.65	-	-	-	2.1	-			
SPT #5	14.2 – 15.7	SM	9.5	21.0	69.5	0	-	-	NA	NP	-	2.64	-	-	-	3.4	-			
SPT #6	16.7 – 18.2	SP-SM	3.4	3.1	93.5	0	-	-	NA	NP	-	2.65	-	-	-	1.4	-			
SPT #7	19.2 – 20.7	SP-SM	5.4	3.1	91.5	0	-	-	NA	NP	-	2.66	-	-	-	2.2	-			
SPT #8	24.2 – 25.7	SM	10.9	15.5	73.6	0	-	-	NA	NP	-	2.62	-	-	-	3.7	-			
SPT #9	29.2 – 30.7	SM	11.0	19.7	69.3	0	-	-	NA	NP	-	2.63	-	-	-	3.5	-			

G163

SUMMARY OF PHYSICAL PROPERTIES TEST RESULTS

PROJECT: NAVAJO GALLUP WATER SUPPLY PROJECT **FEATURE:** REACH 22B

Drill Hole Number: DHR22RT1A-15-1

IDENTIFICATION			PARTICLE SIZE FRACTIONS IN PERCENT						CONSISTENCY LIMITS			SPECIFIC GRAVITY				IN-PLACE DENSITY				
			FINES																	
TEST PIT NUMBER (DHR22B-14-50)	DEPTH – feet	CLASSIFICATION SYMBOL	SMALLER THAN 0.005 mm	0.005 to 0.074 mm	SAND #200 (.074mm) to #4 (4.76mm)	GRAVEL #4 (4.76mm) to 3" (76.2mm)	COBBLES 3" (76.2mm) to 5" (127mm)	OVERSIZE Larger than 5" (127mm)	LIQUID LIMIT - %	PLASTICITY INDEX - %	SHRINKAGE LIMIT - %	SPECIFIC GRAVITY MINUS NO.4	SPECIFIC GRAVITY PLUS NO. 4 BULK	APPARENT	ABSORPTION - %	FILL WATER CONTENT % MINUS No. 4	FILL WATER CONTENT % PLUS No. 4			
SPT #1	3.0 – 4.5	SP-SM	4.4	6.3	89.3	0	-	-	NA	NP	-	2.66	-	-	-	1.5	-			
SPT #2	5.5 – 7.0	SP-SM	3.5	7.3	89.2	0	-	-	NA	NP	-	2.65	-	-	-	1.6	-			
SPT #3	8.0 – 9.5	s(CL-ML)	20.4	35.3	44.3	0	-	-	26.0	6.9	-	2.65	-	-	-	6.7	-			
SPT #4	10.5 – 12.0	SM	11.0	18.1	70.9	0	-	-	NA	NP	-	2.64	-	-	-	3.5	-			
SPT #5	13.0 – 14.5	SM	6.5	6.1	87.4	0	-	-	NA	NP	-	2.65	-	-	-	1.9	-			
SPT #6	15.5 – 17.0	SP-SM	6.3	5.6	88.1	0	-	-	NA	NP	-	2.65	-	-	-	2.8	-			
SPT #7	18.0 – 19.5	SM	13.0	7.1	79.9	0	-	-	NA	NP	-	2.65	-	-	-	4.8	-			

G164

SUMMARY OF PHYSICAL PROPERTIES TEST RESULTS

PROJECT: NAVAJO GALLUP WATER SUPPLY PROJECT **FEATURE:** REACH 22B

Drill Hole Number: DHR22RT1B-15-1

IDENTIFICATION			PARTICLE SIZE FRACTIONS IN PERCENT						CONSISTENCY LIMITS			SPECIFIC GRAVITY				IN-PLACE DENSITY				
			FINES																	
TEST PIT NUMBER	DEPTH – feet	CLASSIFICATION SYMBOL	SMALLER THAN 0.005 mm	0.005 to 0.074 mm	SAND #200 (.074mm) to #4 (4.76mm)	GRAVEL #4 (4.76mm) to 3" (76.2mm)	COBBLES 3" (76.2mm) to 5" (127mm)	OVERSIZE Larger than 5" (127mm)	LIQUID LIMIT - %	PLASTICITY INDEX - %	SHRINKAGE LIMIT - %	SPECIFIC GRAVITY MINUS NO.4	SPECIFIC GRAVITY PLUS NO. 4 BULK	APPARENT	ABSORPTION - %	FILL WATER CONTENT % MINUS No. 4	FILL WATER CONTENT % PLUS No. 4			
SPT #1	3.1 – 4.6	SM	4.4	9.7	85.9	0	-	-	NA	NP	-	2.63	-	-	-	2.4	-			
SPT #2	5.6 – 7.1	SM	7.5	9.7	82.8	0	-	-	NA	NP	-	2.67	-	-	-	2.4	-			
SPT #3	8.1 – 9.6	SM	15.4	33.3	51.3	0	-	-	NA	NP	-	2.62	-	-	-	4.6	-			
SPT #4	10.6 – 12.1	SC-SM	17.5	29.3	53.2	0	-	-	22.4	5.2	-	2.64	-	-	-	5.0	-			
SPT #5	13.1 – 14.6	SM	7.4	9.3	83.3	0	-	-	NA	NP	-	2.64	-	-	-	2.3	-			
SPT #6	15.6 – 17.1	SP	2.4	2.2	95.4	0	-	-	NA	NP	-	2.64	-	-	-	-	-			
SPT #7	18.1 – 19.6	SP-SM	3.4	2.1	94.5	0	-	-	NA	NP	-	2.63	-	-	-	1.2	-			

G165

SUMMARY OF PHYSICAL PROPERTIES TEST RESULTS

PROJECT: NAVAJO GALLUP WATER SUPPLY PROJECT **FEATURE:** REACH 22B

Drill Hole Number: DHR22RT2-15-2

IDENTIFICATION			PARTICLE SIZE FRACTIONS IN PERCENT						CONSISTENCY LIMITS			SPECIFIC GRAVITY				IN-PLACE DENSITY				
			FINES																	
TEST PIT NUMBER	DEPTH – feet	CLASSIFICATION SYMBOL	SMALLER THAN 0.005 mm	0.005 to 0.074 mm	SAND #200 (.074mm) to #4 (4.76mm)	GRAVEL #4 (4.76mm) to 3" (76.2mm)	COBBLES 3" (76.2mm) to 5" (127mm)	OVERSIZE Larger than 5" (127mm)	LIQUID LIMIT - %	PLASTICITY INDEX - %	SHRINKAGE LIMIT - %	SPECIFIC GRAVITY MINUS NO.4	SPECIFIC GRAVITY PLUS NO. 4 BULK	APPARENT	ABSORPTION - %	FILL WATER CONTENT % MINUS No. 4	FILL WATER CONTENT % PLUS No. 4			
SPT #1	3.2 – 4.7	SM	7.4	9.6	83.0	0	-	-	NA	NP	-	2.62	-	-	-	2.2	-			
SPT #2	5.7 – 7.2	SM	8.5	3.7	87.8	0	-	-	NA	NP	-	2.64	-	-	-	2.9	-			
SPT #3	8.2 – 9.7	SM	18.8	10.9	70.3	0	-	-	NA	NP	-	2.67	-	-	-	5.6	-			
SPT #4	10.7 – 12.2	SM	10.3	8.0	81.7	0	-	-	NA	NP	-	2.64	-	-	-	2.6	-			
SPT #5	13.2 – 14.7	SM	9.0	8.0	83.0	0	-	-	NA	NP	-	2.64	-	-	-	2.5	-			
SPT #6	15.7 – 17.2	SC-SM	25.8	19.4	53.9	0.9	-	-	22.2	5.2	-	2.64	2.42	-	4.3	5.8	1.6			
SPT #7	18.2 – 19.7	s(CL)	34.6	28.9	36.5	0	-	-	31.4	14.4	-	2.70	-	-	-	7.9	-			
SPT #8	23.2 – 24.7	CH							55.1	34.2	-									
SPT #9	25.7 – 27.2	SM	10.9	10.6	78.5	0	-	-	NA	NP	-	2.63	-	-	-	2.9	-			

G166

SUMMARY OF PHYSICAL PROPERTIES TEST RESULTS

PROJECT: NAVAJO GALLUP WATER SUPPLY PROJECT **FEATURE:** REACH 22B

Drill Hole Number: DHR22RT2-15-3

IDENTIFICATION			PARTICLE SIZE FRACTIONS IN PERCENT						CONSISTENCY LIMITS			SPECIFIC GRAVITY					
			FINES														
TEST PIT NUMBER	DEPTH – feet	CLASSIFICATION SYMBOL	SMALLER THAN 0.005 mm	0.005 to 0.074 mm	SAND #200 (.074mm) to #4 (4.76mm)	GRAVEL #4 (4.76mm) to 3" (76.2mm)	COBBLES 3" (76.2mm) to 5" (127mm)	OVERSIZE Larger than 5" (127mm)	LIQUID LIMIT - %	PLASTICITY INDEX - %	SHRINKAGE LIMIT - %	SPECIFIC GRAVITY MINUS NO.4	SPECIFIC GRAVITY PLUS NO. 4 BULK	ABSORPTION - %	FILL WATER CONTENT % MINUS No. 4	FILL WATER CONTENT % PLUS No. 4	
SPT # 1	4.5 – 6.0	SM	12.9	7.9	79.2	0	-	-	NA	NP	-	2.64	-	-	3.4	-	
SPT # 2	7.0 – 8.5	SM	10.9	8.3	80.8	0	-	-	NA	NP	-	2.64	-	-	2.4	-	
SPT # 3	9.5 – 11.0	SM	11.9	11.7	76.4	0	-	-	NA	NP	-	2.64	-	-	2.8	-	
SPT # 4	12.0 – 13.5	SM	13.9	9.4	76.7	0	-	-	NA	NP	-	2.65	-	-	3.2	-	
SPT # 5	14.5 – 16.0	SM	8.5	10.2	81.3	0	-	-	NA	NP	-	2.64	-	-	2.5	-	
SPT # 6	17.0 – 18.5	s(CL)	38.5	19.3	42.2	0	-	-	31.5	12.6	-	2.60	-	-	9.1	-	
SPT # 7	19.0 – 21.5	SM	11.9	12.5	75.6	0	-	-	NA	NP	-	2.65	-	-	3.5	-	
SPT # 8	22.0 – 23.5	SM	21.8	14.0	64.2	0	-	-	18.8	2.6	-	2.64	-	-	4.1	-	
SPT # 9	24.5 – 26.0	SC	18.4	23.2	58.4	0	-	-	22.4	7.5	-	2.67	-	-	4.9	-	
SPT # 10	29.5 – 31.0	SC-SM	17.4	22.2	60.4	0	-	-	20.6	4.5	-	2.65	-	-	4.1	-	
SPT # 11	34.5 – 36.0	CH	70.1	26.2	3.7	0	-	-	61.3	40.0	9.2	2.68	-	-	14.9	-	
SPT # 12	39.5 – 41.0	SM	8.5	8.8	77.4	5.3	-	-	16.9	0.5	-	2.61	2.38	5.5	2.2	2.0	

G167

SUMMARY OF PHYSICAL PROPERTIES TEST RESULTS

PROJECT: NAVAJO GALLUP WATER SUPPLY PROJECT **FEATURE:** REACH 22B

Drill Hole Number: DHR22RT2-15-4

IDENTIFICATION			PARTICLE SIZE FRACTIONS IN PERCENT						CONSISTENCY LIMITS			SPECIFIC GRAVITY					
			FINES														
TEST PIT NUMBER	DEPTH – feet	CLASSIFICATION SYMBOL	SMALLER THAN 0.005 mm	0.005 to 0.074 mm	SAND #200 (.074mm) to #4 (4.76mm)	GRAVEL #4 (4.76mm) to 3" (76.2mm)	COBBLES 3" (76.2mm) to 5" (127mm)	OVERSIZE Larger than 5" (127mm)	LIQUID LIMIT - %	PLASTICITY INDEX - %	SHRINKAGE LIMIT - %	SPECIFIC GRAVITY MINUS NO.4	SPECIFIC GRAVITY PLUS NO. 4 BULK	ABSORPTION - %	FILL WATER CONTENT % MINUS No. 4	FILL WATER CONTENT % PLUS No. 4	
SPT # 1	4.3 – 5.8	SM	8.9	4.3	86.8	0	-	-	NA	NP	-	2.62	-	-	2.6	-	
SPT # 2	6.8 – 8.3	SM	11.5	9.9	78.6	0	-	-	NA	NP	-	2.60	-	-	3.0	-	
SPT # 3	9.3 – 10.8	SM	11.3	10.5	78.2	0	-	-	NA	NP	-	2.65	-	-	2.8	-	
SPT # 4	11.8 – 13.3	SM	17.8	18.5	63.7	0	-	-	NA	NP	-	2.65	-	-	4.4	-	
SPT # 5	14.3 – 15.8	SM	8.5	9.9	81.6	0	-	-	NA	NP	-	2.63	-	-	2.4	-	
SPT # 6	16.8 – 18.3	SC	29.3	18.6	52.1	0	-	-	25.7	12.6	-	2.60	-	-	6.6	-	
SPT # 7	19.3 – 20.8	SM	8.0	9.8	82.2	0	-	-	NA	NP	-	2.65	-	-	2.5	-	
SPT # 8	21.8 – 23.3	SM	13.8	13.2	73.0	0	-	-	NA	NP	-	2.63	-	-	3.7	-	
SPT # 9	24.3 – 25.8	SM	20.0	17.3	62.7	0	-	-	20.2	2.6	-	2.65	-	-	4.8	-	
SPT # 10	29.3 – 30.8	s(CL-ML)	30.9	24.1	45.0	0	-	-	23.1	5.6	-	2.63	-	-	6.3	-	
SPT # 11	34.8 – 36.3	CH	69.9	25.7	4.4	0	-	-	58.8	33.3	9.8	2.70	-	-	14.8	-	
SPT # 12	39.3 – 40.8	SM	17.5	12.4	70.1	0	-	-	NA	NP	-	2.63	-	-	3.9	-	

G168

SUMMARY OF PHYSICAL PROPERTIES TEST RESULTS

PROJECT: NAVAJO GALLUP WATER SUPPLY PROJECT **FEATURE:** REACH 22B

Drill Hole Number: DHRT2-~~14~~-1

IDENTIFICATION			PARTICLE SIZE FRACTIONS IN PERCENT						CONSISTENCY LIMITS			SPECIFIC GRAVITY				IN-PLACE DENSITY				
			FINES																	
TEST PIT NUMBER	DEPTH – feet	CLASSIFICATION SYMBOL	SMALLER THAN 0.005 mm	0.005 to 0.074 mm	SAND #200 (.074mm) to #4 (4.76mm)	GRAVEL #4 (4.76mm) to 3" (76.2mm)	COBBLES 3" (76.2mm) to 5" (127mm)	OVERSIZE Larger than 5" (127mm)	LIQUID LIMIT - %	PLASTICITY INDEX - %	SHRINKAGE LIMIT - %	SPECIFIC GRAVITY MINUS NO.4	SPECIFIC GRAVITY PLUS NO. 4 BULK	APPARENT	ABSORPTION - %	FILL WATER CONTENT % MINUS No. 4	FILL WATER CONTENT % PLUS No. 4			
SPT# 1	3.5 – 5.0	SP-SM	8.7	3.3	88.0	0	0	0	NA	NP	-	2.63	-		-	2.3	-			
SPT# 2	6.0 – 7.5	SM	7.5	7.3	85.2	0	0	0	NA	NP	-	2.63	-		-	2.4	-			
SPT# 3	8.5 – 10.0	SC	16.0	22.2	61.8	0	0	0	28.3	14.8	-	2.64	-		-	4.8	-			
SPT# 4	11.0 – 12.5	SC	20.0	16.3	63.7	0	0	0	23.1	8.5	-	2.65	-		-	4.8	-			
SPT# 5	13.5 –15.0	SM	14.0	21.1	64.9	0	0	0	NA	NP	-	2.65	-		-	2.8	-			
SPT# 6	16.0 – 17.5	$_S$(CL)	31.8	25.8	42.4	0	0	0	25.7	13.8	-	2.56	-		-	8.9	-			
SPT# 7	18.5 – 20.0	$_S$(CL)	28.9	19.8	44.7	6.6	0	0	26.9	11.8	-	2.58	2.47		3.4	7.0	0			
SPT# 8	23.5 – 25.0	$_S$(CL)	33.0	20.7	46.3	0	0	0	27.0	13.1	-	2.69	-		-	6.3	-			
SPT# 9	28.5 - 30.0	SM	11.4	7.6	80.4	0.6	0	0	NA	NP	-	2.65	2.62		2.5	2.4	0			
SPT# 10A	33.5 – 34.4	SM	13.5	10.4	76.1	0	0	0	NA	NP	-	2.68	-		-	2.7	-			
SPT# 10B	34.4 – 35.0	(CL)$_S$	53.9	25.4	20.7	0	0	0	47.4	31.2	8.6	2.68	-		-	12.4	-			
SPT# 11	38.5 – 40.0	SM	8.0	11.4	80.6	0	0	0	NA	NP	-	2.61	-		-	2.0	-			
SPT# 12	43.5 – 45.0	(SP-SM)$_G$	5.7	4.6	72.0	17.7	0	0	NA	NP	-	2.65	2.39		6.2	2.2	0			
SPT# 13	48.5 – 50.0	SM	7.1	7.8	69.1	16.0	0	0	NA	NP	-	2.61	2.35		6.2	3.3	0			
SPT# 14	53.5 – 54.3	SM	14.5	16.6	68.9	0	0	0	NA	NP	-	2.64	-		-	7.9	-			

G169

SUMMARY OF PHYSICAL PROPERTIES TEST RESULTS

PROJECT: NAVAJO GALLUP WATER SUPPLY PROJECT **FEATURE:** REACH 22

IDENTIFICATION			PARTICLE SIZE FRACTIONS IN PERCENT						CONSISTENCY LIMITS			IN-PLACE DENSITY				COMPACTION TESTS				
			FINES																	
TEST PIT NUMBER	DEPTH – feet	CLASSIFICATION SYMBOL	SMALLER THAN 0.005 mm	0.005 to 0.074 mm	SAND #200 (.074mm) to #4 (4.76mm)	GRAVEL #4 (4.76mm) to 3" (76.2mm)	COBBLES 3" (76.2mm) to 5" (127mm)	OVERSIZE Larger than 5" (127mm)	LIQUID LIMIT - %	PLASTICITY INDEX - %	SHRINKAGE LIMIT - %	DRY DENSITY - PCF	FILL WATER CONTENT -%	SPECIFIC GRAVITY PLUS NO. 4	SPECIFIC GRAVITY MINUS NO.4	MAXIMUM DRY DENSITY - pcf	OPTIMUM WATER CONTENT - %	PENETRATION RESISTANCE psi	D-Value %	Relative Density %
TPR22-52	6.0	SP-SM	4.0	6.1	89.9	0	0	0	NP	NP	NA	97.8	1.8	--	2.63	107.8	13.5	590	90.7	
TPR22-54	6.0	SM	7.5	11.1	81.4	0	0	0	NP	NP	NA	99.2	2.5	--	2.65	110.0	11.4	420	90.2	
TPR22-55	6.0	SP-SM	7.0	4.9	88.1	0	0	0	NP	NP	NA	96.4	2.8	--	2.64	110.9	11.0	510	86.9	
TPR22-55	7.1-8.3	$_S$(CL)	21.3	34.3	44.4	0	0	0	27.5	12.8	NA	--	6.4	--	2.68	--	--	--	--	
TPR22-56	6.0	SM	7.5	8.7	83.8	0	0	0	NP	NP	NA	97.7	2.7	--	2.61	103.8	14.4	260	94.1	
TPR22-87	0.0-1.0	$_S$(CL)	26.6	35.6	37.8	0	0	0	29.3	14.0	NA	--	5.7	--	2.64	--	--	--	--	
TPR22-87	4.0-5.0	SM	12.8	9.9	75.6	1.7	0	0	NP	NP	NA	--	3.0	2.56	2.62	--	--	--	--	
TPR22-87	6.0	SM	14.4	15.3	69.6	0.7	0	0	NP	NP	NA	92.0	3.5	2.25	2.61	115.8	12.0	910	79.4	
TPR22-88	6.0	SM	14.0	15.2	70.8	0	0	0	NP	NP	NA	94.9	3.5	--	2.62	116.3	12.8	700	81.6	
TPR22-89	6.0	SM	18.1	23.3	58.6	0	0	0	NP	NP	NA	92.6	5.3	--	2.61	115.2	12.8	1059	80.4	

SUMMARY OF PHYSICAL PROPERTIES TEST RESULTS (Maximum Density by Proctor)

PROJECT: NAVAJO GALLUP WATER SUPPLY PROJECT **FEATURE:** REACH 22

G170

IDENTIFICATION			PARTICLE SIZE FRACTIONS IN PERCENT						CONSISTENCY LIMITS			IN-PLACE DENSITY				COMPACTION TESTS						
			FINES																			
Test Pit Number	DEPTH – feet	CLASSIFICATION SYMBOL	SMALLER THAN 0.005 mm	0.005 to 0.074 mm	SAND #200 (.074mm) to #4 (4.76mm)	GRAVEL #4 (4.76mm) to 3" (76.2mm)	COBBLES 3" (76.2mm) to 5" (127mm)	OVERSIZE Larger than 5" (127mm)	LIQUID LIMIT - %	PLASTICITY INDEX - %	SHRINKAGE LIMIT - %	DRY DENSITY - PCF	TOTAL FILL WATER CONTENT -%	SPECIFIC GRAVITY PLUS NO. 4	SPECIFIC GRAVITY MINUS NO.4	MAXIMUM DRY DENSITY - pcf	OPTIMUM WATER CONTENT - %	PENETRATION RESISTANCE psi	D-Value - %	DRY IN-PLACE MINUS #4 pcf	MINUS #4 MOISTURE	RELATIVE DENSITY
*TPR22-58	4.0	SP-SM	6.0	2.3	88.8	2.9	0	0	N/A	N/P	_	102.0	5.6	2.41	2.67	113.5	11.8	_	_	102.0	5.7	77.2
*TPR22-59	4.0	SM	7.0	11.4	81.6	0	0	0	N/A	N/P	_	93.9	2.0	_	2.62	104.6	14.3	215	89.8	93.9	2.0	_
*TPR22-60	4.0	SM	6.0	6.3	87.7	0	0	0	N/A	N/P	_	101.6	2.4	_	2.66	114.2	11.5	310	89.0	101.6	2.4	_
*TPR22-63	4.0	SM	9.3	11.8	78.9	0	0	0	N/A	N/P	_	103.9	2.9	_	2.70	115.1	10.5	400	90.3	103.9	2.9	_
*TPR22-64	4.0	s(CL)	24.0	44.2	31.8	0	0	0	27.7	10.9	_	97.0	5.9	_	2.75	112.4	14.8	890	86.3	97.0	5.9	_
*TPR22-64	5.5	SM	9.5	11.0	79.5	0	0	0	N/A	N/P	_	98.4	3.1	_	2.67	106.4	13.4	275	92.5	98.4	3.1	_
*TPR22-66	4.0	SM	11.9	19.4	68.7	0	0	0	N/A	N/P	_	101.8	3.2	_	2.67	110.9	13.0	520	91.8	101.8	3.2	_
*TPR22-67	4.0	SM	14.0	17.9	68.1	0	0	0	N/A	N/P	_	104.0	3.4	_	2.68	112.3	11.8	501	92.6	104.0	3.4	_
TPR22-67	12.0 - 12.5	SM	6.9	5.8	87.3	0	0	0	N/A	N/P	_	_	2.6	_	2.67	_	_	_	_	_	2.6	_
*TPR22-68	4.0	SM	10.0	16.2	73.8	0	0	0	N/A	N/P	_	101.3	3.2	_	2.70	108.3	12.9	400	93.5	101.3	3.2	_
TPR22-68	9.2-9.7	(CL)s	43.4	31.5	25.1	0	0	0	36.5	21.7	8.8	_	15.9	_	2.73	_	_	_	_	_	15.9	_
*TPR22-70	4.0	SP-SM	6.5	4.9	88.6	0	0	0	N/A	N/P	_	96.8	2.2	_	2.72	103.4	13.9	230	93.6	96.8	2.2	_
*TPR22-71	4.0	SM	14.5	8.7	76.6	0.2	0	0	N/A	N/P	_	112.1	4.1	2.47	2.70	117.8	11.7	900	95.2	112.1	4.1	_

NOTE: Numbers in parentheses are metric equivalents of numbers directly above.

**Denotes in-place density and 5-point curve.*

G171

SUMMARY OF PHYSICAL PROPERTIES TEST RESULTS (Maximum Density by Proctor)

PROJECT: **Navajo Gallup Water Supply Project** **FEATURE:** **Reach 22**

IDENTIFICATION			PARTICLE SIZE FRACTIONS IN PERCENT						CONSISTENCY LIMITS			IN-PLACE DENSITY				COMPACTION TESTS					
			FINES																		
Test Pit Number	DEPTH – feet	CLASSIFICATION SYMBOL	SMALLER THAN 0.005 mm	0.005 to 0.074 mm	SAND #200 (.074mm) to #4 (4.76mm)	GRAVEL #4 (4.76mm) to 3" (76.2mm)	COBBLES 3" (76.2mm) to 5" (127mm)	OVERSIZE Larger than 5" (127mm)	LIQUID LIMIT - %	PLASTICITY INDEX - %	SHRINKAGE LIMIT - %	DRY DENSITY - PCF	TOTAL FILL WATER CONTENT -%	SPECIFIC GRAVITY PLUS NO. 4	SPECIFIC GRAVITY MINUS NO.4	MAXIMUM DRY DENSITY - pcf	OPTIMUM WATER CONTENT - %	PENETRATION RESISTANCE psi	D-Value - %	DRY IN-PLACE MINUS #4 pcf	MINUS #4 MOISTURE
*TPR22-72	4.0	ML	15.8	34.8	49.4	0.0	0	0	N/A	NP	-	93.8	5.5	-	2.70	113.3	13.7	900	82.8	93.8	5.5
*TPR22-73	4.0	SM	7.9	5.1	87.0	0.0	0	0	N/A	NP	-	112.8	2.4	-	2.68	113.5	12.5	740	99.4	112.8	2.4
*TPR22-76	4.0	SM	16.0	25.1	58.9	0.0	0	0	N/A	NP	-	104.8	3.9	-	2.65	116.6	11.5	1180	89.9	104.8	3.9
TPR22-76	12.0-13.0	SM	12.9	21.8	65.3	0.0	0	0	N/A	NP	-	-	3.9	-	2.70	-	-	-	-	-	3.9
*TPR22-77	4.0	$(CL)_s$	20.8	50.1	29.1	0.0	0	0	27.9	10.9	-	93.3	5.5	-	2.69	114.7	13.4	930	81.3	93.3	5.5
TPR22-77	6.3-7.0	CH	58.7	34.3	7.0	0.0	0	0	54.4	35.5	10.4	-	15.5	-	2.65	-	-	-	-	-	15.5
TPR22-77	10.0-10.7	SM	10.0	3.5	86.5	0.0	0	0	N/A	NP	-	-	3.6	-	2.68	-	-	-	-	-	3.6
*TPR22-79	4.0	CL-ML	21.3	46.7	32.0	0.0	0	0	23.6	6.7	-	97.7	5.1	-	2.69	114.3	12.7	1180	85.5	97.7	5.1
*TPR22-80	4.0	$(CL)_s$	21.3	55.0	23.7	0.0	0	0	27.2	9.9	-	92.7	5.9	-	2.67	112.0	14.5	1050	82.8	92.7	5.9
TPR22-81	0.0-3.0	SC-SM	15.2	15.1	68.3	1.4	0	0	21.3	4.1	-	-	4.0	2.42	2.68	-	-	-	-	-	3.9
TPR22-81	3.0-4.0	$(SC-SM)_g$	7.4	5.3	58.5	28.8	0	0	21.2	5.2	-	-	3.4	2.41	2.63	-	-	-	-	-	3.9
TPR22-81	4.0-4.5	SM	13.8	13.8	71.7	0.7	0	0	18.7	NP	-	-	4.0	-	2.65	-	-	-	-	-	4.1
*TPR22-81	4.5	SM	12.7	16.5	69.0	1.8	0	0	23.8	NP	-	106.5	5.5	2.33	2.66	109.2	14.4	600	97.4	106.4	5.6
*TPR22-83	4.0	SC-SM	20.9	28.5	50.6	0	0	0	22.1	5.1	-	98.7	5.2	-	2.60	115.3	12.3	950	85.6	98.7	5.2

NOTE: Numbers in parentheses are metric equivalents of numbers directly above.

**Denotes in-place density and 5-point curve.*

G172

SUMMARY OF PHYSICAL PROPERTIES TEST RESULTS

PROJECT: NAVAJO GALLUP WATER SUPPLY PROJECT **FEATURE:** REACH 22B

IDENTIFICATION			PARTICLE SIZE FRACTIONS IN PERCENT						CONSISTENCY LIMITS			IN-PLACE DENSITY				COMPACTION TESTS				
			FINES																	
TEST PIT NUMBER	DEPTH – feet	CLASSIFICATION SYMBOL	SMALLER THAN 0.005 mm	0.005 to0.074 mm	SAND #200 (.074mm) to #4 (4.76mm)	GRAVEL #4 (4.76mm) to 3" (76.2mm)	COBBLES 3" (76.2mm) to 5" (127mm)	OVERSIZE Larger than 5" (127mm)	LIQUID LIMIT - %	PLASTICITY INDEX - %	SHRINKAGE LIMIT - %	DRY DENSITY - pcf	FILL WATER CONTENT - %	SPECIFIC GRAVITY PLUS No. 4	SPECIFIC GRAVITY MINUS No. 4	MAXIMUM DRY DENSITY - pcf	OPTIMUM WATER CONTENT - %	PENETRATION RESISTANCE - psi	D-VALUE - %	RELATIVE COMPACTION - %
*TPR22B-14-22	6.0	SC	17.9	31.9	49.8	0.4	0.0	0.0	24.1	10.8	-	105.5	7.0	2.57	2.67	117.2	14.4	280	90.0	-
*TPR22B-14-23	6.0	SM	13.3	9.2	76.6	0.9	0.0	0.0	NA	NP	-	105.2	3.8	2.50	2.67	115.0	13.3	850	91.5	-
*TPR22B-14-24	6.0	SP-SM	4.4	3.2	91.1	1.3	0.0	0.0	NA	NP	-	101.8	1.0	2.39	2.65	111.6	-	-	-	91.2
*TPR22B-14-26	6.0	SM	5.0	7.7	87.3	0.0	0.0	0.0	NA	NP	-	95.4	1.6	-	2.62	107.5	-	-	-	88.7
*TPR22B-14-27	6.0	SM	12.9	14.9	71.9	0.3	0.0	0.0	NA	NP	-	96.1	3.6	2.55	2.65	116.3	11.9	1281	82.6	-
*TPR22B-14-28	6.0	SP-SM	6.0	5.2	88.7	0.1	0.0	0.0	NA	NP	-	99.7	0.6	2.40	2.66	114.1	-	-	-	87.4
*TPR22B-14-36	6.0	SP-SM	0.0	9.5	90.3	0.2	0.0	0.0	NA	NP	-	98.6	1.9	2.41	2.61	110.9	-	-	-	88.9
*TPR22B-14-38	6.0	$_s$(CL-ML)	16.7	36.1	46.6	0.6	0.0	0.0	21.4	4.9	-	98.0	4.5	2.44	2.69	117.7	12.3	800	83.3	-
*TPR22B-14-39	6.0	$(CL)_s$	39.9	44.3	15.7	0.1	0.0	0.0	41.0	21.5	11.5	83.7	14.3	2.37	2.73	105.6	19.8	300	79.3	-
*TPR22B-14-40	6.0	SM	8.6	17.9	73.2	0.3	0.0	0.0	NA	NP	-	94.1	2.7	2.22	2.64	118.5	10.7	1050	79.4	-
*TPR22B-14-42	6.0	SM	14.0	16.2	69.8	0.0	0.0	0.0	NA	NP	-	93.8	3.6	-	2.64	113.6	13.6	430	82.6	-
*TPR22B-14-43	6.0	SP-SM	5.6	1.3	86.9	6.2	0.0	0.0	NA	NP	-	103.4	2.0	2.45	2.65	116.9	-	-	-	88.5
*TPR22B-14-44	6.0	SP	3.0	1.7	95.3	0.0	0.0	0.0	NA	NP	-	100.2	4.0	-	2.63	106.4	-	-	-	94.2
TPR22B-14-123	2.0	$(CL)_s$	68.9	15.2	15.9	0.0	0.0	0.0	45.2	27.5	8.8	-	10.9	-	2.69	-	-	-	-	-
*TPR22B-14-123	6.0	SM	12.6	13.3	74.1	0.0	0.0	0.0	NA	NP	-	97.3	3.6	-	2.68	116.2	11.5	480	83.7	-
*TPR22B-14-124	6.0	SC-SM	18.9	14.5	66.6	0.0	0.0	0.0	20.1	4.8	-	96.8	5.2	-	2.64	118.5	11.6	810	81.7	-
*TPR22B-14-126	6.0	SP-SM	6.1	5.6	82.3	6.0	0.0	0.0	NA	NP	-	104.2	2.7	2.43	2.65	113.1	-	-	-	92.1

** Denotes In-place density and 5-point curve*

G173

SUMMARY OF PHYSICAL PROPERTIES TEST RESULTS

PROJECT: NAVAJO GALLUP WATER SUPPLY PROJECT **FEATURE:** REACH 22

IDENTIFICATION			PARTICLE SIZE FRACTIONS IN PERCENT						CONSISTENCY LIMITS			IN-PLACE DENSITY				COMPACTION TESTS				
TEST PIT NUMBER	DEPTH – feet	CLASSIFICATION SYMBOL	FINES		SAND #200 (.074mm) to #4 (4.76mm)	GRAVEL #4 (4.76mm) to 3" (76.2mm)	COBBLES 3" (76.2mm) to 5" (127mm)	OVERSIZE Larger than 5" (127mm)	LIQUID LIMIT - %	PLASTICITY INDEX - %	SHRINKAGE LIMIT - %	DRY DENSITY - PCF	FILL WATER CONTENT -%	SPECIFIC GRAVITY PLUS NO. 4	SPECIFIC GRAVITY MINUS NO.4	MAXIMUM DRY DENSITY - pcf	OPTIMUM WATER CONTENT - %	PENETRATION RESISTANCE psi	D-Value %	% Relative Compaction
			SMALLER THAN 0.005 mm	0.005 to 0.074 mm																
TPR22-46	6.0	SP	2.0	1.9	94.4	1.7	0	0	-	NP	-	107.0	1.1	2.47	2.65	108.4	-	-	-	98.7
TPR22-47	6.0	SP-SM	4.9	7.1	87.8	0.2	0	0	-	NP	-	102.9	1.9	2.39	2.63	111.9	11.3	225	92.0	-
TPR22-48	6.0	SM	8.0	9.3	82.6	0.1	0	0	-	NP	-	100.3	4.0	2.44	2.61	114.7	10.0	430	87.4	-
TPR22-51	6.0	SP-SM	4.4	4.5	91.1	0	0	0	-	NP	-	98.1	2.0	-	2.65	102.9	14.0	61	95.3	-
TPR22-51	14.0	SP-SM	2.4	5.2	92.4	0	0	0	-	NP	-	-	1.2	-	2.63	NA	NA	NA	-	-
TPR22-52B	6.0	SM	10.6	21.9	67.5	0	0	0	-	NP	-	99.1	3.8	-	2.66	112.6	12.0	440	88.0	-
TPR22-54B	6.0	SM	11.4	16.9	70.8	0.9	0	0	-	NP	-	110.1	3.6	2.56	2.66	118.9	11.4	800	92.6	-
TPR22-62	6.0	SM	8.9	10.7	80.4	0	0	0	-	NP	-	98.7	3.0	-	2.61	111.5	13.3	440	88.5	-
TPR22-75	6.0	SP-SM	6.4	1.7	91.9	0	0	0	-	NP	-	104.5	2.8	-	2.63	102.2	9.4	150	102.3	-
TPR22-79B	6.0	CL-ML	18.9	59.4	21.7	0	0	0	24.8	6.6	-	94.7	5.9	-	2.66	112.5	13.8	1195	84.2	-
TPR22-114	6.0	s(CL)	19.2	50.4	30.4	0	0	0	26.9	8.9	-	89.5	6.0	-	2.63	113.0	13.8	1150	79.2	-
TPR22-115	6.0	s(CL)	20.1	30.6	49.3	0	0	0	24.4	7.1	-	97.7	5.6	-	2.62	114.4	13.0	1100	85.4	-
TPR22-116	6.0	ML	18.1	32.6	49.3	0	0	0	22.9	3.8	-	94.8	5.6	-	2.66	111.9	14.5	600	84.7	-
TPR22-118P	6.0	ML	15.4	35.0	49.6	0	0	0	-	NP	-	99.0	5.0	-	2.65	107.7	15.0	530	91.9	-
TPR22-119P	6.0	s(CL)	24.6	39.8	35.6	0	0	0	25.9	11.8	-	89.5	6.6	-	2.65	115.8	13.6	420	77.3	-
TPR22-120P	6.0	SM	16.1	15.9	66.2	1.8	0	0	19.7	2.4	-	94.4	4.1	2.28	2.64	117.6	11.5	1300	80.3	-

G174

SUMMARY OF PHYSICAL PROPERTIES TEST RESULTS

PROJECT: NAVAJO GALLUP WATER SUPPLY PROJECT **FEATURE:** REACH 22B

IDENTIFICATION			PARTICLE SIZE FRACTIONS IN PERCENT						CONSISTENCY LIMITS			IN-PLACE DENSITY				COMPACTION TESTS			
			FINES																
TEST PIT NUMBER	DEPTH – feet	CLASSIFICATION SYMBOL	SMALLER THAN 0.005 mm	0.005 to 0.074 mm	SAND #200 (.074mm) to #4 (4.76mm)	GRAVEL #4 (4.76mm) to 3" (76.2mm)	COBBLES 3" (76.2mm) to 5" (127mm)	OVERSIZE Larger than 5" (127mm)	LIQUID LIMIT - %	PLASTICITY INDEX - %	SHRINKAGE LIMIT - %	DRY DENSITY - PCF	FILL WATER CONTENT - %	SPECIFIC GRAVITY PLUS NO. 4	SPECIFIC GRAVITY MINUS NO.4	MAXIMUM DRY DENSITY - pcf	OPTIMUM WATER CONTENT - %	PENETRATION RESISTANCE psi	D-Value %
TPR22B-14-127	6.0	SM	13.8	6.0	79.3	0.9	0	0	NA	NP	-	108.3	3.4	2.33	2.68	119.2	11.7	1400	90.9
TPR22B-14-128	6.0	SP-SM	9.0	2.6	88.4	0	0	0	NA	NP	-	97.9	2.4	-	2.64	107.5	14.0	353	91.1
TPR22B-14-130	6.0	SP-SM	3.0	2.2	94.8	0	0	0	NA	NP	-	99.5	1.6	-	2.62	101.1	16.0	-	98.4
TPR22B-14-131	6.0	SM	11.0	6.2	82.8	0	0	0	NA	NP	-	100.7	3.0	-	2.67	110.3	13.4	-	91.3
TPR22B-14-132	6.0	SM	8.0	11.2	80.8	0	0	0	NA	NP	-	96.2	3.0	-	2.64	113.8	11.8	600	84.5
TPR22B-14-134	6.0	SC	26.7	12.3	61.0	0	0	0	25.0	9.7	-	108.1	6.5	-	2.66	115.7	12.8	520	93.4
TPR22B-14-135	6.0	SM	17.4	21.7	60.8	0.1	0	0	NA	NP	-	93.0	4.1	2.55	2.63	118.5	11.5	-	78.5
TPR22B-14-136	6.0	SM	8.0	6.5	85.5	0	0	0	NA	NP	-	97.7	2.4	-	2.64	107.1	13.1	433	91.2
TPR22B-14-138	6.0	SP-SM	6.5	2.6	90.9	0	0	0	NA	NP	-	100.7	2.4	-	2.65	107.2	12.0	-	93.9

NOTE: Numbers in parentheses are metric equivalents of numbers directly above.
**Denotes In-place density and 5-point curve.*