RECLAMATION
Managing Water in the West

Geologic Data

EXPLORATORY DRILLING, Phase 1 Stage 1
Santee Sioux Water Supply Feasibility Study

Solicitation. 06SQ600125
Santee, Nebraska

U.S. Department of the Interior
Bureau of Reclamation
Nebraska-Kansas Area Office

April 2007

I. BACKGROUND

The Bureau of Reclamation (Reclamation) is conducting a Water Supply Feasibility Study for the Santee Sioux Nation. One of the water source options is to draw water from the Missouri River. Reclamation is considering installing a well in an alluvial layer that is hydraulically connected to the Missouri River.

II. Report Data

Three test holes existed along the Missouri River near Santee, NE prior to the Water Supply Feasibility Study (DH-1, DH-2 and TH-2). Their locations are shown on Figure 2. Data from these holes in included in the Design Data for Alternatives Screening, transmitted by letter on December 23, 2005.

Thiele Geotech Inc. of Omaha, NE was contracted to drill and sample three exploration holes in or near the alluvial deposits of the Missouri River at Santee, NE. The contractor successfully completed the first two holes (DH-3 and DH-4) in October 2006, but encountered material in the third hole (DH-5) which required drilling methods other than the specified wash-boring.

After reviewing the initial data, Reclamation decided to contract with Thiele Geotech to finish drilling hole DH-5 using hollow-stem augers and to drill test holes in two additional locations. After receiving Cultural & NEPA Clearance and with cooperative weather, Thiele Geotech remobilized in April, 2007 and completed DH-5 and drilled holes DH-6 and DH-7.

The drill logs, wash gradations, and photos are included in Tabs DH-3 through DH-7.

Recreation Area Site
(DH-6)

Boat Ramp Site
(DH-5)

Delta Site
(DH-4)

Gravel Surfaced

Unimproved Access

TH-2

Irrigation Well Site
(DH-7)

N

Santee

DH-1

DH-2

Access Trail
(Unsurfaced)

Santee Spur 54D
(Asphalt Surfaced)

Crazy Peak SIte
(DH-3)

Figure 2:
Exploratory Drilling Locations And Site Access

Santee Sioux Water Supply Feasibility Study

Legend

▲ Test Hole

April 16, 2007

0 0.125 0.25 0.5 0.75 1 Miles

Photo: 2003 FSA, Taken on 7-5-2003

DH-3

7-1337
(1-55)
BUREAU OF RECLAMATION

COPY

GEOLOGIC LOG OF DRILL HOLE

FEATURE Santee Water Supply PROJECT Spec. No. 065Q600125 STATE Nebraska

HOLE NO. DH-3 LOCATION NW¼, NW¼, NW¼, T33N R5W GROUND ELEVATION ~~122.0~~ 1220 ANGLE FROM VERTICAL 90°

BEGUN 10-29-06 FINISHED 10-30-06 COORDINATES N 551,825 E 2,570,023 DEPTH OF OVERBURDEN 37.0' TOTAL DEPTH 38.5' BEARING OF ANGLE HOLE

DEPTH OR ELEV. OF WATER TABLE Not Obtained HOLE LOGGED BY Cast FOREMAN

NOTES
On water table levels, water return, character of drilling etc.

Crazy Peak Site

Purpose:
Evaluate potential water supply source for Village of Santee

Driller:
Dave Mather of Thield Geotech of Omaha NE

Drill Rig:
CME-55

Drill Method:
Set 22.5' of 3¼" ID Hollow stem augers as surface casing. Drive samples taken at 10' intervals beginning at 9.1' using SPT sampler. 140 lb. CME auto-hammer used to advance sampler. Hole advanced 22.5-37.0' between drive samples with 3" roller bit.

Drill Fluid:
150 gallons of water with 1 pint of EZ-mud (anionic polymer).

Completion:
Hole backfilled with cuttings, top section contains mixture of bentonite.

Coordinates by GPS; elev. from USGS Quad Sheet.

TYPE AND SIZE OF HOLE: 3" wash bore

CORE RECOVERY (%)

PERCOLATION TESTS: DEPTH (FT.) FROM (P, Cs or Cm) / TO; LOSS IN (G.P.M.); PRESSURE (P.S.I.); LENGTH OF TEST (min)

S = Sample

ELEVATION

DEPTH

LOG — SAMPLES FOR TESTING

CLASSIFICATION AND PHYSICAL CONDITION

0-18± ' SANDY SILT, about 80% nonplastic fines and 20% very fine sand; grades sandier with depth; saturated below 4'; paper-thin bedding with organic streaks; grayish-brown. (ML)

18-37± ' SILTY SAND, about 60% very fine sand and 40% nonplastic fines grading to 80% very fine to fine sand and 20% nonplastic fines at bottom of interval; saturated; paperthin bedding with organic streaks; grayish brown. (SM)

NIOBRARA FORMATION

37-38.5 SHALEY CHALK, thinly bedded; lightly weathered; medium gray; can be cut with knife and crushed with high finger pressure.

EXPLANATION

CORE LOSS
CORE RECOVERY

Type of hole ..... D = Diamond, H = Haystellite, S = Shot, C = Churn
Hole sealed ..... P = Packer, Cm = Cemented, Cs = Bottom of casing
Approximate size of hole (X-series) ..... Ex = 1 ½", Ax = 1 ⅞", Bx = 2 ⅜", Nx = 3"
Approximate size of core (X-series) ..... Ex = ⅞", Ax = 1 ⅛", Bx = 1 ⅝", Nx = 2 ⅛"
Outside diameter of casing (X-series) ..... Ex = 1 13/16", Ax = 2 ¼", Bx = 2 ⅞", Nx = 3 ½"
Inside diameter of casing (X-series) ..... Ex = 1 ½", Ax = 1 29/32", Bx = 2 ⅜", Nx = 3"

ANGLE HOLE ☐
VERTICAL HOLE ☐

GPO 844140

HOLE NO. DH-3

Grand Island Testing Laboratories
Division of Benjamin & Associates, Inc.
SOIL - BITUMINOUS - CONCRETE TESTING SOIL INVESTIGATIONS ENVIRONMENTAL AUDITS
TELEPHONE (308) 382-8465 3550 WEST OLD HIGHWAY 30 P. O. BOX 339
FAX (308) 382-8467 GRAND ISLAND, NEBRASKA 68802

DATE: November 8, 2006 NAME OF PROJECT: Water Supply for the Village of Santee DH-3 LOCATION:

TYPE OF TESTS: WASH GRADATIONS FOR: Bureau of Reclamation-Nebraska/Kansas AO, 203 W. Second Street, Grand Island, NE 68801

MECHANICAL ANALYSIS OF MATERIAL

*WASH = W DRY = D			PERCENT RETAINED:															
SAMPLE DATE	SAMPLE NO.	*	1"	3/4"	1/2"	3/8"	4	8	10	12	16	20	30	40	50	80	100	200
	S-2 28.5-30.0	W	0	0	0	0	0	0	0	0.1	0.1	0.1	0.2	0.3	1.0	51.1	74.1	95.7
	S-1 37.5-38.5	W	0	0	0	0	0.9	4.9	5.9	7.0	9.4	11.4	13.3	16.3	17.6	21.9	24.4	34.1

Photo 1 – Santee Sioux Water Supply Feasibility Study – Exploratory Drilling
Crazy Peak site. View looking from right bank of Missouri River looking downstream (east) towards drill site.
Photo by: R. Schieffer 10/30/2006 Solicitation No. 06SQ600125

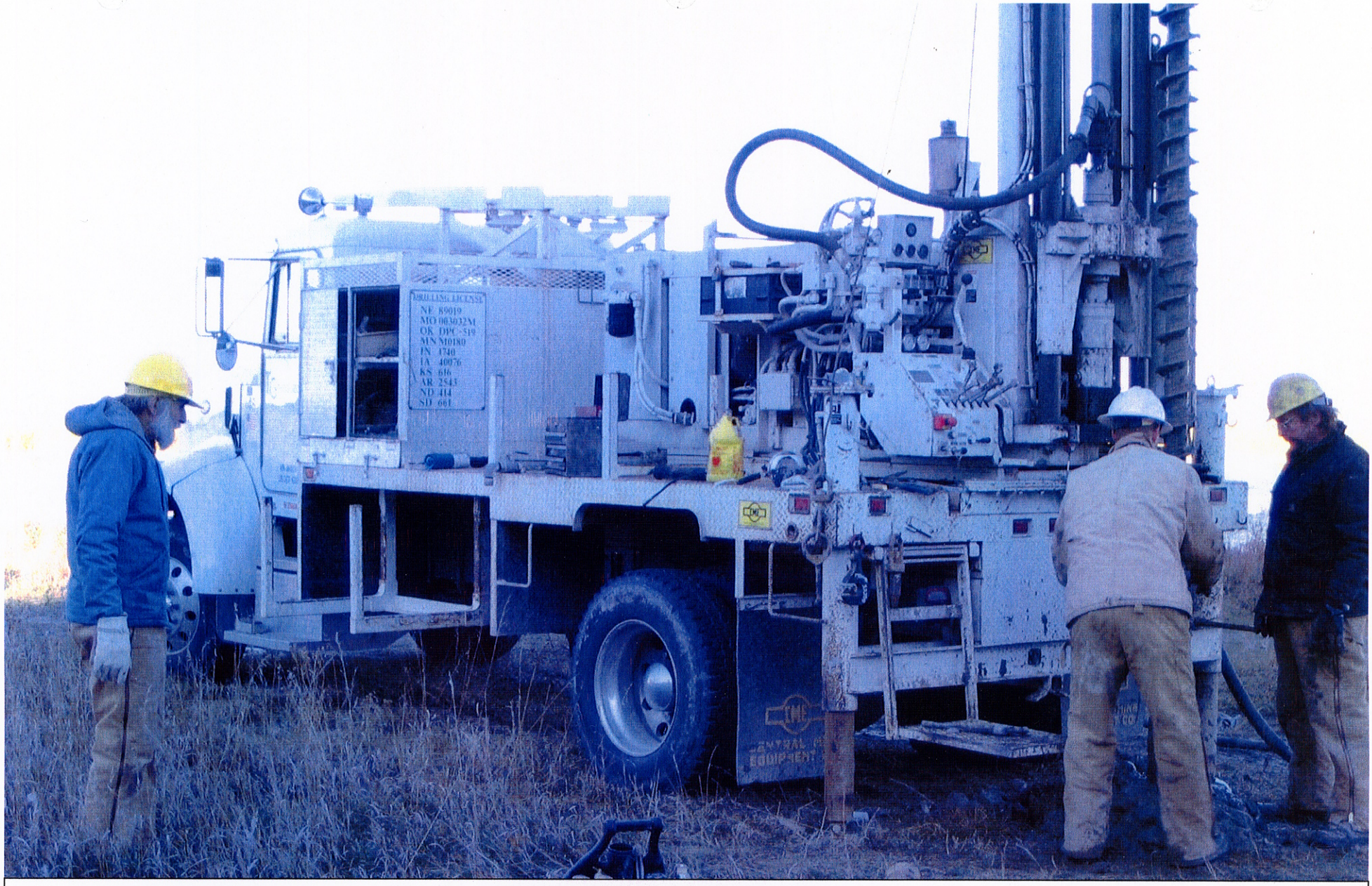
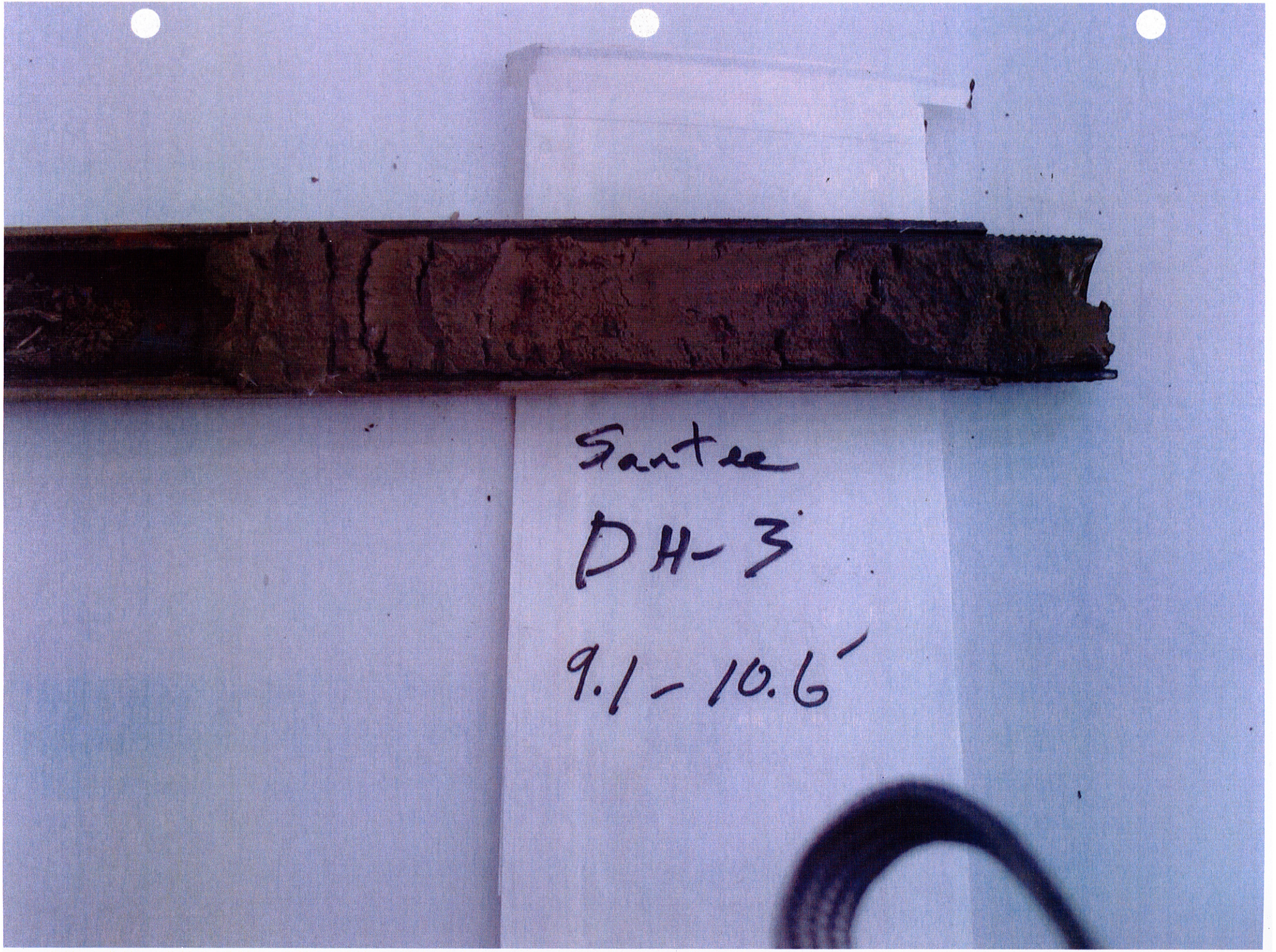
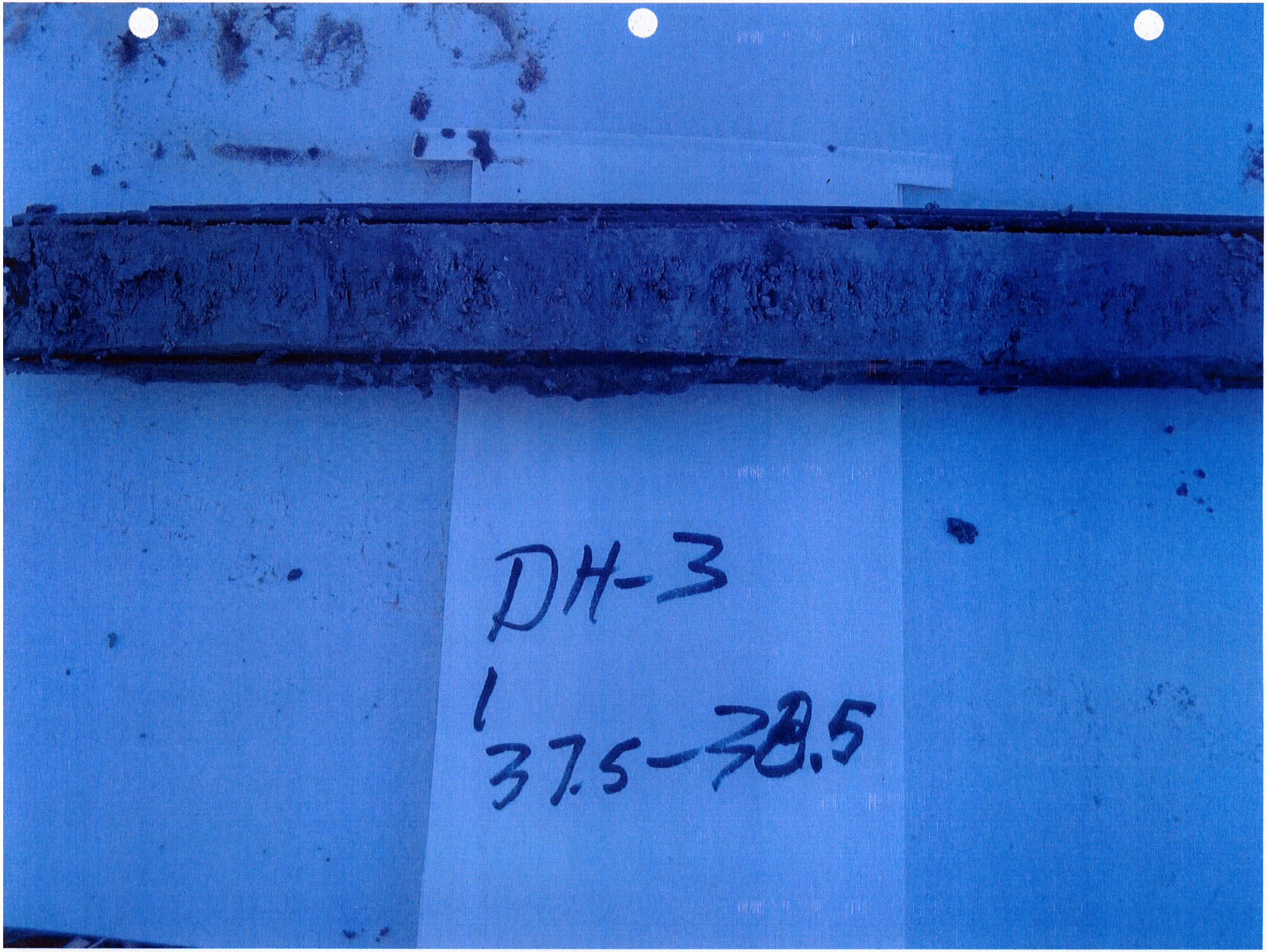


Photo 2 – Santee Sioux Water Supply Feasibility Study – Exploratory Drilling
Crazy Peak site. Contractor finished with hole and is removing the hollow-stem auger set casing. (CME-55 rig)
Photo by: R. Schieffer 10/30/2006 Solicitation No. 06SQ600125


Santee
DH-3
9.1-10.6'


Sentea
DH3
19.1 - 20.6


DH-3
28.5-30.0


DH-3
1
37.5-38.5

DH-4

GEOLOGIC LOG OF DRILL HOLE

FEATURE Santee Water Supply PROJECT Spec No. 06SQ600125 STATE Nebraska

HOLE NO. DH-4 LOCATION NE¼NW¼NW¼ T33N R5W 90°

COORDINATES N 557,381 E 2,575,894 GROUND ELEVATION ~~121.8~~ 1218 ANGLE FROM VERTICAL

BEGUN 10-30-06 FINISHED 10-30-06 DEPTH OF OVERBURDEN 64.7 TOTAL DEPTH 66.0 BEARING OF ANGLE HOLE

DEPTH OR ELEV. OF WATER TABLE Not Obtained HOLE LOGGED BY Cast FOREMAN

NOTES
On water table levels, water return, character of drilling etc.

Delta Site

Purpose:
Evaluate potential water supply source for Village of Santee

Driller:
Dave Mather of Thiele Geotech of Omaha NE

Drill Rig:
CME 55

Drill Method:
Set 22.5' of 3¼" ID Hollowstem augers as surface casing. Drive samples taken at 10" intervals beginning at 9.1' using SPT sampler. 140 lb. auto-hammer used to advance sampler. Hole advanced 22.5-65.0' with 3" roller bit between drive samples.

Drill Fluid:
200 gallons of water, 100 lbs of bentonite, and 1 quart of EZ-mud (anionic polymer).

Completion:
Backfilled hole with drill cuttings,

Coordinates by GPS; elev. taken from USGS Quad Sheet.

TYPE AND SIZE OF HOLE	CORE RECOVERY (%)	PERCOLATION TESTS: DEPTH (FT.) FROM (P, Cs or Cm)	PERCOLATION TESTS: DEPTH (FT.) TO	LOSS IN (G.P.M.)	PRESSURE (P.S.I.)	LENGTH OF TEST (min)	ELEVATION	DEPTH	LOG / SAMPLES FOR TESTING	CLASSIFICATION AND PHYSICAL CONDITION
	S		S=Sample					10		0-20+' SANDY SILT, about 65% no to low plasticity fines and 35% fine sand, b becomes sandier with depth; saturated below 4'; scattered 0.1 to 0.2' interbeds of silty sand and lean clay; random 1/4" pieces of chalk; some rust staining; grayish brown. (ML)
	S							20		20-40+' POORLY GRADED SAND with SILT, about 90% fine sand and 10% non-plastic fines; scattered medium to coarse sand grains; maximum size coarse sand; saturated; gray. (SP-SM)
	S							30		40-50+' POORLY GRADED SAND, about 95% fine to medium sand; maximum size coarse sand; scattered layers of silt and wood at 42+'; saturated; medium gray. (SP)
	S							40		50-64.7' POORLY GRADED SAND, about 95% fine sand and 5% nonplastic fines; scattered 0.1' seams of medium sand, trace of coarse, and silt; maximum size coarse sand, grayish brown; saturated. (SP)
	S							50		NIOBRARA FORMATION
	S							60		64.7-66.0' CHALK, lightly weathered; gray; separates into thin plates; can be cut with knife; requires high finger pressure to break fragments.
	S							64.7		
								66.0		
								70		
								80		
								90		

EXPLANATION

CORE LOSS
CORE RECOVERY

Type of hole ..... D=Diamond, H=Haystellite, S=Shot, C=Churn
Hole sealed ..... P=Packer, Cm=Cemented, Cs=Bottom of casing
Approximate size of hole (X-series) ..... Ex = 1 1/2", Ax = 1 7/8", Bx = 2 3/8", Nx = 3"
Approximate size of core (X-series) ..... Ex = 7/8", Ax = 1 1/8", Bx = 1 5/8", Nx = 2 1/8"
Outside diameter of casing (X-series) ..... Ex = 1 13/16", Ax = 2 1/4", Bx = 2 7/8", Nx = 3 1/2"
Inside diameter of casing (X-series) ..... Ex = 1 1/2", Ax = 1 29/32", Bx = 2 3/8", Nx = 3"

ANGLE HOLE ☐
VERTICAL HOLE ☐

GPO 844140

Grand Island Testing Laboratories

Division of Benjamin & Associates, Inc.

SOIL - BITUMINOUS - CONCRETE TESTING SOIL INVESTIGATIONS ENVIRONMENTAL AUDITS

TELEPHONE (308) 382-8465 3550 WEST OLD HIGHWAY 30 P. O. BOX 339

FAX (308) 382-8467 GRAND ISLAND, NEBRASKA 68802

DATE: November 8, 2006 NAME OF PROJECT: Water Supply for the Village of Santee DH-4 LOCATION: .....

TYPE OF TESTS: WASH GRADATIONS FOR: Bureau of Reclamation-Nebraska/Kansas AO, 203 W. Second Street, Grand Island, NE 68801

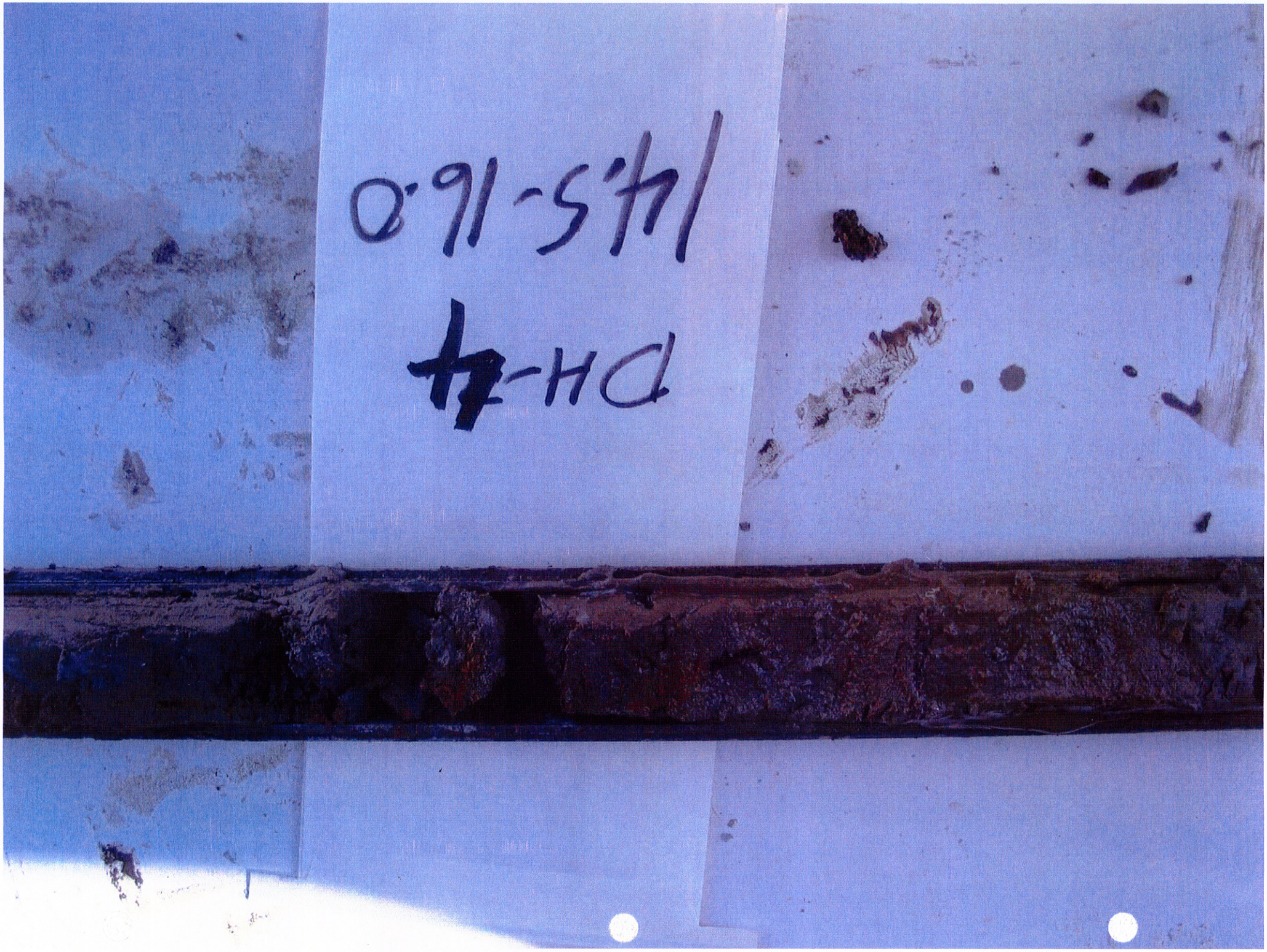
MECHANICAL ANALYSIS OF MATERIAL

*WASH = W DRY = D			PERCENT RETAINED:															
SAMPLE DATE	SAMPLE NO.	*	1"	3/4"	1/2"	3/8"	4	8	10	12	16	20	30	40	50	80	100	200
	S-3 23.0-24.5	W	0	0	0	0	0.3	0.8	0.9	1.0	1.2	1.4	1.5	5.7	10.1	35.2	52.6	83.6
	S-4 35.0-36.5	W	0	0	0	0	0	0	0	0	0	0.1	0.1	1.0	4.2	75.3	85.9	97.1
	S-5 45.0-46.0	W	0	0	0	0	1.0	4.5	5.6	7.6	12.6	18.8	33.7	66.1	75.8	87.4	91.9	98.4
	S-6 55.0-56.5	W	0	0	0	0	0	0.6	0.7	1.0	1.7	2.3	2.8	6.2	9.0	69.7	83.0	96.7

Photo 3 – Santee Sioux Water Supply Feasibility Study – Exploratory Drilling
Delta Site. Photo looking North-Northwest towards drill site. Site location is as far north as possible using a single axle drill rig. Notice cattails and swampy area directly behind the drill rig. (CME-55 rig)
Photo by: R. Schieffer 10/31/2006 Solicitation No. 06SQ600125

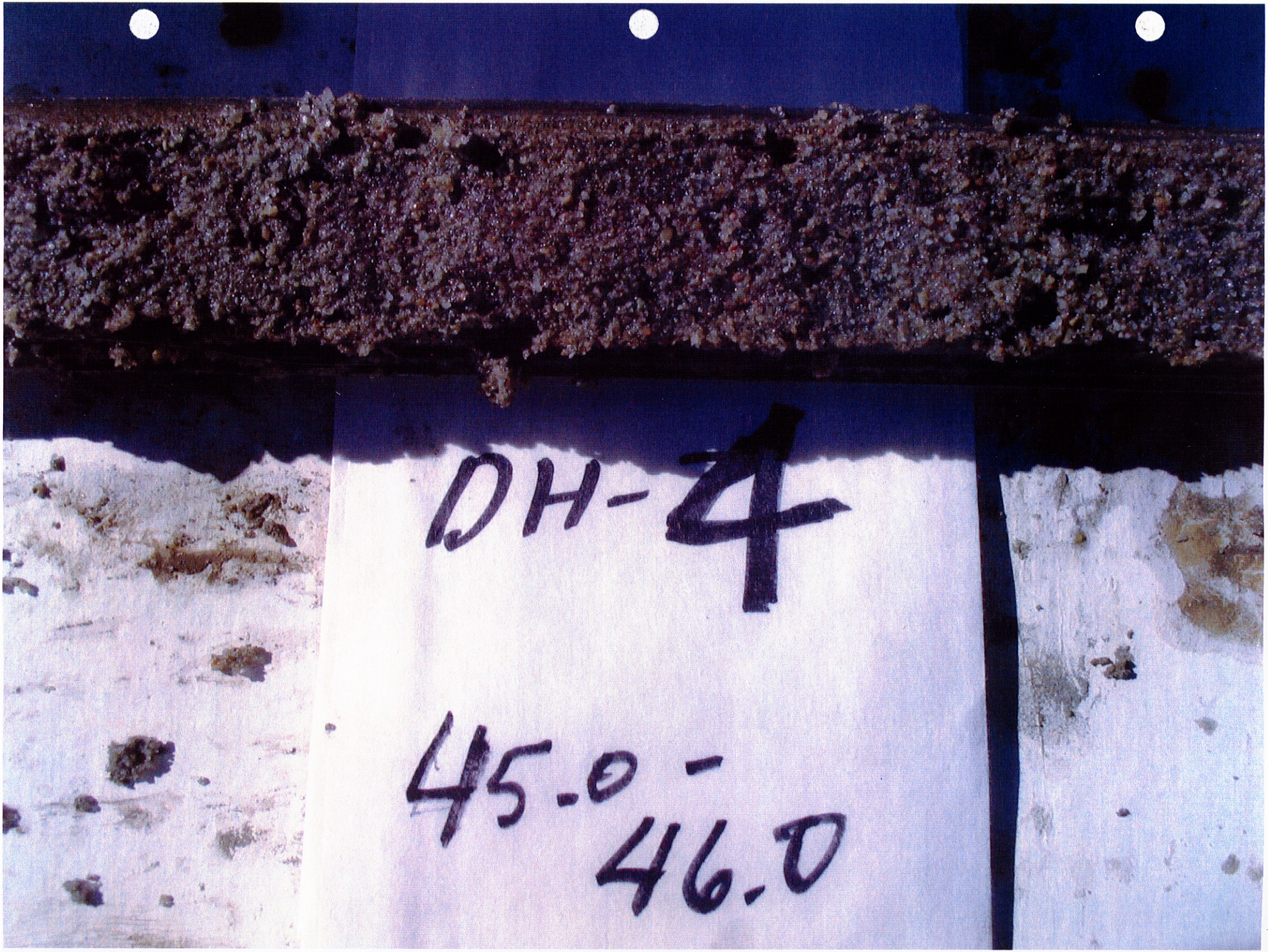
Photo 4 – Santee Sioux Water Supply Feasibility Study – Exploratory Drilling
Delta Site. Contractor advancing rotary bit. (CME-55 rig)
Photo by: R. Schieffer 10/31/2006 Solicitation No. 06SQ600125

DH-4
14.5-16.0


0.91-5'h1
4-HCl


DH-4
23°-24.5


DH-24
35.0~
36.5


DH-4
45.0-
46.0

DH-4

550 - 565


DH-4
650-66.0

DH-5

GEOLOGIC LOG OF DRILL HOLE

FEATURE Santee Water Supply PROJECT Spec. No. 06SQ600125 STATE Nebraska

HOLE NO. DH-5 LOCATION NE¼NE¼NE¼ Sec 13 T33N R5W GROUND ELEVATION 1218 ANGLE FROM VERTICAL 90°

COORDINATES

BEGUN 10-31-06 FINISHED 4-03-07 DEPTH OF OVERBURDEN 46+ TOTAL DEPTH 47.0 BEARING OF ANGLE HOLE

DEPTH OR ELEV. OF WATER TABLE Not Obtained HOLE LOGGED BY Cast FOREMAN

NOTES On water table levels, water return, character of drilling etc.

Boat Ramp Site

Purpose:
Evaluate potential water supply source for Village of Santee

Driller:
Dave Mather of Thiele Geotech of Omaha NE

Drill Rig:
CME-55

Drill Method:
Set 22.5'± of 3¼" ID hollow stem augers as surface casing. Drive samples taken at 10' intervals beginning at 23.5' using SPT sampler. 140 lb. auto-hammer used to advance sampler. Hole advanced 22.5-46' with 3" roller bit between drive samples.

Drill Fluid:
Water, bentonite, and EZ-mud (anionic polymer)

Completion:
Backfilled with drill cuttings.

Coordinates by GPS; elev. taken from USGS Quad Sheet.

TYPE AND SIZE OF HOLE	CORE RECOVERY (%)	PERCOLATION TESTS: DEPTH (FT.) FROM (P, Cs or Cm)	PERCOLATION TESTS: DEPTH (FT.) TO	LOSS IN (G.P.M.)	PRESSURE (P.S.I.)	LENGTH OF TEST (min)	ELEVATION	DEPTH	LOG: SAMPLES FOR TESTING	CLASSIFICATION AND PHYSICAL CONDITION
	SM							0		0-2+' COMPACTED EMBANKMENT, mixture of sand, gravel, and clay, max. size 1"
								10		2-10+' COMPACTED EMBANKMENT, LEAN CLAY, about 90% fines with low to medium plasticity and 10% fine sand; moist; quite firm; gray-black. (CL)
								20		10-21+' LEAN CLAY, about 90% fines with low plasticity and 10% fine sand; saturated; organic odor; soft; black (CL)
	S							21		21-41.5+' SILTY SAND grading to POORLY GRADED SAND, about 85-95% very fine to fine sand; saturated; scattered fragments of wood; loose; gray brown (SM to SP)
								30		
	S							40		41.5-46+' SILTY SAND and GRAVEL, about 50% fine gravel, 25% fine to coarse sand, and 25% no to low plasticity fines; max. size recovered 1½"; dense; rusty gray; obtained sample appeared impervious to very low permeability; (SM-CM)
	S							41.5		
	S							46		NIOBRARA FORMATION
								47		46+-47.0' CHALK, weathered to clay-like indistinct layering, bands of gray and yellow; moldable with fingers.
								50		Off-Set Hole Off-set 10 feet west on 4-03-07; advanced hole to 43' with 3¼" ID hollow-stem augers, sampled at 43' and advanced augers to 45', advanced roller bit to 46', drive sample 46-47'. Hole backfilled with auger cuttings.
								60		
								70		
								80		
								90		

EXPLANATION

CORE LOSS

CORE RECOVERY

Type of hole ..... D = Diamond, H = Haystellite, S = Shot, C = Churn

Hole sealed ..... P = Packer, Cm = Cemented, Cs = Bottom of casing

Approximate size of hole (X-series) ..... Ex = 1 ½", Ax = 1 ⅞", Bx = 2 ⅜", Nx = 3"

Approximate size of core (X-series) ..... Ex = ⅞", Ax = 1 ⅛", Bx = 1 ⅝", Nx = 2 ⅛"

Outside diameter of casing (X-series) ..... Ex = 1 13/16", Ax = 2 ¼", Bx = 2 ⅞", Nx = 3 ½"

Inside diameter of casing (X-series) ..... Ex = 1 ½", Ax = 1 29/32", Bx = 2 ⅜", Nx = 3"

ANGLE HOLE ☐

VERTICAL HOLE ☐

Grand Island Testing Laboratories

Division of Benjamin & Associates, Inc.

SOIL - BITUMINOUS - CONCRETE TESTING SOIL INVESTIGATIONS ENVIRONMENTAL AUDITS

TELEPHONE (308) 382-8465 3550 WEST OLD HIGHWAY 30 P. O. BOX 339

FAX (308) 382-8467 GRAND ISLAND, NEBRASKA 68802

DATE: November 8, 2006 NAME OF PROJECT: Water Supply for the Village of Santee DH-5 LOCATION: .....

TYPE OF TESTS: WASH GRADATIONS FOR: Bureau of Reclamation-Nebraska/Kansas AO, 203 W. Second Street, Grand Island, NE 68801

MECHANICAL ANALYSIS OF MATERIAL

*WASH = W DRY = D			PERCENT RETAINED:															
SAMPLE DATE	SAMPLE NO.	*	1"	3/4"	1/2"	3/8"	4	8	10	12	16	20	30	40	50	80	100	200
	S-7 23.5-25.0	W	0	0	0	0	0.5	0.9	0.9	1.0	1.2	1.3	1.4	4.6	9.5	30.2	39.1	82.5
	S-9 33.5-35.0	W	0	0	0	0	0.1	0.2	0.2	0.2	0.3	0.3	0.4	1.9	4.6	83.7	89.1	96.5
	S-8 43.5-45.0	W	0	15.1	21.7	30.4	41.5	49.7	50.8	51.9	54.1	55.6	57.2	60.7	63.1	78.7	83.4	91.7

Photo 5 – Santee Sioux Water Supply Feasibility Study – Exploratory Drilling
Looking North across the Boat Ramp Site to the South Dakota Bluffs. The Car is the approximate location of the test hole location.
Photo by: R. Schieffer 5/2006 Solicitation No. 06SQ600125


DH-5
23.5-25.0


DH-5
33.5-35.0


DH-5
43.5-45.0


DH-5
46.0-47.0

DH-6

GEOLOGIC LOG OF DRILL HOLE

FEATURE Santee Water Supply PROJECT Spec. No. 06SQ600125 STATE Nebraska

HOLE NO. DH-6 LOCATION See Notes COORDINATES GROUND ELEVATION 1238 ANGLE FROM VERTICAL 90°

BEGUN 4-03-07 FINISHED 4-04-07 DEPTH OF OVERBURDEN 82.5' TOTAL DEPTH 82.5' BEARING OF ANGLE HOLE

DEPTH OR ELEV. OF WATER TABLE Est 27' 4-03-07 HOLE LOGGED BY Cast FOREMAN

NOTES
On water table levels, water return, character of drilling etc.

Recreation Area-Site

Purpose:
Evaluate potential water supply source for Village of Santee

Driller:
Dave Mather of Thiele Geotech of Omaha NE

Drill Rig:
CME-55

Drill Method:
Advanced 3½" ID hollow stem augers 74.5'; 2" drive samples attempted at 29.5', 34.5', 35.5', 45', 48.5', 54.5', 59.5', 64.5', 69.5'*, 74.5', 79.5'* and 82.5'**
* = 1 gravel recovered
**= Refused
Drill fluid-water with polymer; 3' roller bit used 74.5-82.5'

Completion:
Hole backfilled with cuttings.

Elev. taken from USGS Quad Sheet.

Location:
1050' S and 1150' W of NE Corner Sec. 13, T33N, R5W

TYPE AND SIZE OF HOLE	CORE RECOVERY (%)	PERCOLATION TESTS: DEPTH (FT.) FROM (P, Cs or Cm)	PERCOLATION TESTS: DEPTH (FT.) TO	LOSS IN (G.P.M.)	PRESSURE (P.S.I.)	LENGTH OF TEST (min)	ELEVATION	DEPTH	LOG / SAMPLES FOR TESTING
	S							10	
	S							20	
	S							30	
	S							40	
	S							50	
	S							60	
	*							70	
	S							80	
	*							82.5	
	**							90	

CLASSIFICATION AND PHYSICAL CONDITION

0-10+' SILT, about 90% no to low plasticity fines and 10% fine sand; moist; light brown; topsoil 0-1.5' (ML)

10-27+' LEAN CLAY, about 90% fines with medium plasticity and 10% fine sand; scattered lime nodules and chalk fragments to ¼"; moist; brown with variations to brown-black; contains old soil horizons; minor rust streaking and lime spots. (CL)

27-55+' Alternating layers of SANDY SILT, SILTY SAND, and POORLY GRADED SAND, silts and silty sands predominate; layers are 0.3-0.8' thick; Sandy Silts are about 60% fines and 40% fine to coarse sand; silty sands are about 75% fine sand and 25% fines; poorly graded sands are about 95% fine to medium sand with trace of coarse sand and fine gravel; scattered fragments of chalk up to 3"; shades of brown; saturated. (SM, ML, and SP)

55-70+' SILTY GRAVEL, about 60% fine to coarse sand and gravel with 40% nonplastic fines; max. size recovered 2", shades of brown, dark gray, and yellow; saturated. (GM)

70-82.5' SILTY GRAVEL, about 85% fine to coarse sand and fine to coarse gravel and 15% fines; max. size recovered 2"; dark gray; saturated.

82.5' Bit refusal, a few chert shards recovered. Drilling action and shards interrupted as bedrock surface - Niobrara Fm.

EXPLANATION

CORE LOSS
CORE RECOVERY

Type of hole..... D=Diamond, H=Haystellite, S=Shot, C=Churn
Hole sealed..... P=Packer, Cm=Cemented, Cs=Bottom of casing
Approximate size of hole (X-series)..... Ex = 1½", Ax = 1⅞", Bx = 2⅜", Nx = 3"
Approximate size of core (X-series)..... Ex = ⅞", Ax = 1⅛", Bx = 1⅝", Nx = 2⅛"
Outside diameter of casing (X-series)..... Ex = 1 13/16", Ax = 2¼", Bx = 2⅞", Nx = 3½"
Inside diameter of casing (X-series)..... Ex = 1½", Ax = 1 29/32", Bx = 2⅜", Nx = 3"

ANGLE HOLE ☐
VERTICAL HOLE ☐

GPO 844140

Grand Island Testin Laboratories
Division of Benjamin & Associates, Inc.
SOIL - BITUMINOUS - CONCRETE TESTING SOIL INVESTIGATIONS ENVIRONM
TELEPHONE (308) 382-8465 3550 WEST OLD HIGHWAY 30 P.
FAX (308) 382-8467 GRAND ISLAND, NEBI

Post-it® Fax Note 7671 | Date 04-12-07 | pages ▶ 2
To Margo | From Lee Wagner
Co./Dept. | Co. GI Testing
Phone # | Phone # 382-8465
Fax # 389-4780 | Fax # 382-8467

DATE: April 11, 2007 NAME OF PROJECT: Water Supply for the Village of Santee DH-6 LOCATION:

TYPE OF TESTS: WASH GRADATIONS FOR: Bureau of Reclamation-Nebraska/Kansas AO, 203 W. Second Street, Grand Island, NE 68801

MECHANICAL ANALYSIS OF MATERIAL

*WASH = W DRY = D			PERCENT RETAINED:															
SAMPLE DATE	SAMPLE NO.	*	1"	3/4"	1/2"	3/8"	4	8	10	12	16	20	30	40	50	80	100	200
	S-7 29.5-31.0	W	5.2	12.5	19.6	25.4	37.8	50.7	53.2	56.6	62.2	66.3	68.4	71.0	71.9	73.9	74.9	77.8
	S-8 34.5-35.0	W	0	2.2	4.9	5.6	8.7	11.5	12.0	12.8	15.7	23.5	60.5	92.9	94.5	96.2	96.6	97.4
	S-9 35.5-36.0	W	0	0	0	0.5	1.3	2.4	2.5	2.6	2.8	3.0	3.9	6.1	7.3	14.7	21.1	42.9
	S-10 45.0-46.0	W	13.8	13.8	22.0	28.4	42.3	58.3	60.2	62.3	65.5	67.6	69.2	72.9	75.5	80.8	82.5	86.5
	S-11 48.5-50.0	W	10.5	10.5	16.8	23.7	43.3	57.6	59.6	62.0	65.7	68.6	71.3	76.5	78.4	81.6	82.7	85.6
	S-12 54.5-56.0	W	12.0	13.1	19.4	24.8	38.0	55.1	56.8	60.4	64.8	69.9	77.0	84.9	86.7	89.0	89.6	91.3
	S-13 59.5-61.0	W	4.6	17.5	27.5	33.3	41.5	50.4	51.6	53.1	55.3	57.8	62.4	69.5	72.6	78.5	80.4	84.8
	S-14 64.5-66.0	W	35.3	39.8	46.5	51.8	62.1	71.3	72.9	74.7	77.2	79.8	83.0	86.0	87.2	89.2	90.0	92.3
	S-15 74.5-76.0	W	13.5	16.5	27.0	38.8	56.0	67.7	68.9	70.3	72.7	74.6	76.5	79.0	80.7	87.1	89.4	92.9

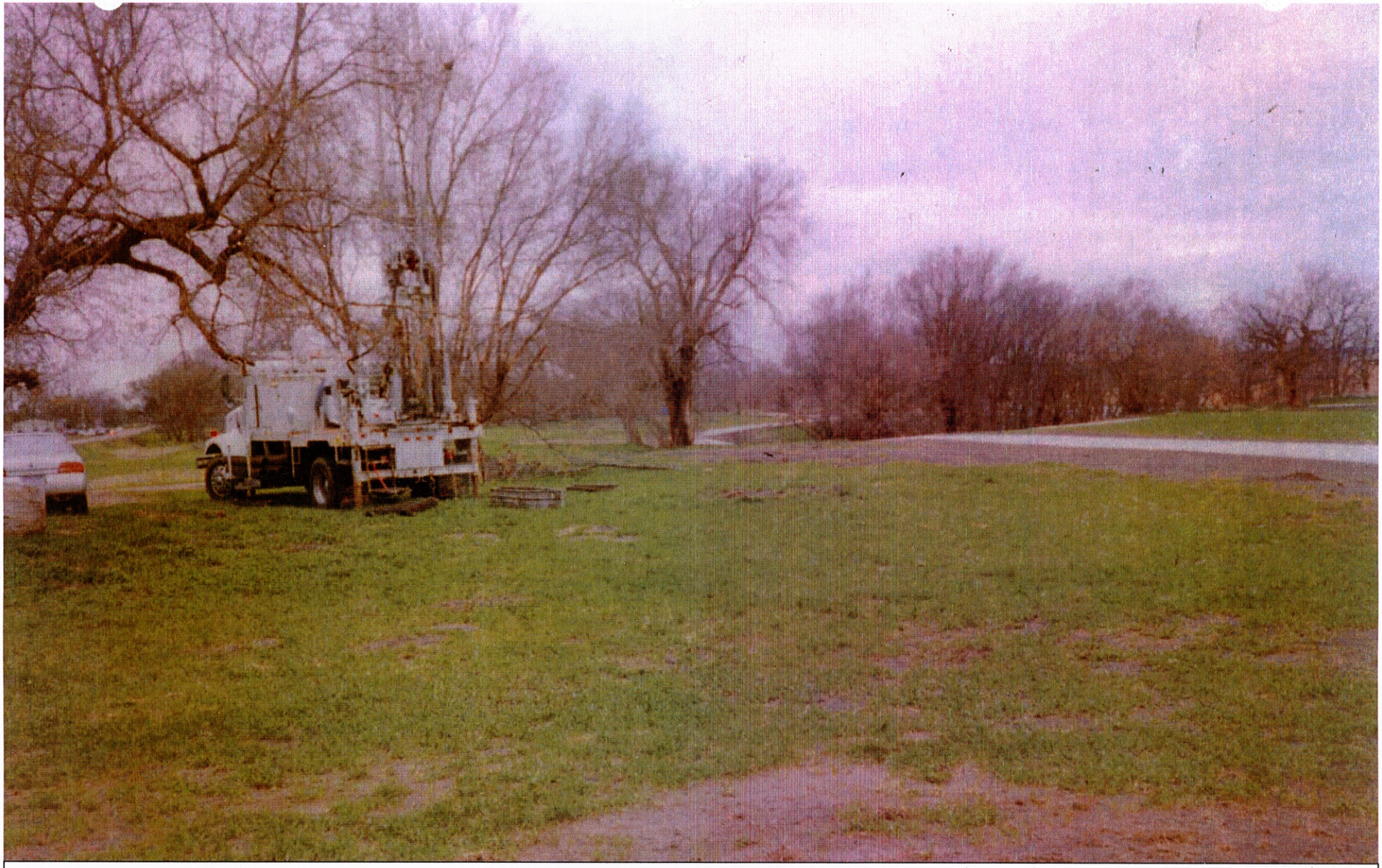


Photo 6 – Santee Sioux Water Supply Feasibility Study – Exploratory Drilling
Looking West at the Recreation Area Site. Notice the new walking trail to the right and the main East/West Road to the left.
Photo by: L. Cast 4/2007 Solicitation No. 06SQ600125


Santee
DH-6
29.5-31.0


Santee
DH-6
345-355
Santee
DH-6
355-360


Santee
DH-6
345-350
Santee
DH-6
355-360


Santee
DH-6
45-46'


Santa
DH-6
UR.5-50'


Santee
DH-6
54.5 -56


Santee
DH-6
59.5-61.0

Santa
DH-6


Santa
DH-6

DH-7

GEOLOGIC LOG OF DRILL HOLE

FEATURE Santee Water Supply PROJECT. STATE Nebraska

HOLE NO. DH-7 LOCATION See Notes GROUND ELEVATION 1280 39 ANGLE FROM VERTICAL

COORDINATES TOTAL

BEGUN 4-04-07 FINISHED 4-04-07 DEPTH OF OVERBURDEN 57.0' DEPTH 57.0' BEARING OF ANGLE HOLE

DEPTH OR ELEV. OF WATER TABLE 29' Est. HOLE LOGGED BY Cast FOREMAN.

NOTES
On water table levels, water return, character of drilling etc.

Irrigation Well Site

Purpose:
Evaluate potential water supply source for Village of Santee

Driller:
Dave Mather of Thiele Geotech of Omaha NE

Drill Rig:
CME-55

Drill Method:
Advanced 3½" ID hollow stem augers advanced to 57'; attempted roller bit at 57' with no advancement. 2" x 1.5' drive samples taken at 29.5', 34.5', 39.5', 44.5', 49.5', and 54.5'.

Completion:
Hole backfilled with cuttings.

Elev. taken from USGS Quad Sheet.

Location:
1600' S and 1650' W of NE Corner, Sec. 13, T33N, R5W

TYPE AND SIZE OF HOLE	CORE RECOVERY (%)	PERCOLATION TESTS: DEPTH (FT.) FROM (P, Cs or Cm)	PERCOLATION TESTS: DEPTH (FT.) TO	LOSS IN (G.P.M.)	PRESSURE (P.S.I.)	LENGTH OF TEST (min)	ELEVATION	DEPTH	LOG: SAMPLES FOR TESTING	CLASSIFICATION AND PHYSICAL CONDITION
								0		0-2+' LEAN CLAY, Topsoil, about 95% fines with low plasticity; max. size noted medium sand; moist; black; some organic material. (CL)
								10		2-17+' LEAN CLAY, about 90% fines with low plasticity and 10% fine sand; scattered lime nodules to 1/8"; tan; dry-moist. (CL)
								20		17-25+' LEAN CLAY with layers of gravel considerable drill chatter and short intervals of slow advancement; maximum size recovered 1½".
								30		25-33+' POORLY GRADED GRAVEL with SILT; about 60% fine gravel with some coarse grains; 30% fine to coarse sand, and 10% nonplastic fines; max. size recovered 1.5"; grains are subrounded to rounded; saturated at 29'; dark brown; (GM)
								40		33-37+' POORLY GRADED SAND, about 95% fine to medium sand with some coarse sand and fine gravel and 5% nonplastic fines; max. size recovered 3/4"; saturated; tan with black specks. (SP)
								50		37-54+' POORLY GRADED GRAVEL with SILT; about 60% fine to coarse gravel, 30% fine to coarse sand, and 10% nonplastic fines; max. size recovered 1"; particles are subrounded to rounded; saturated; dark grayish brown.
								60		54-57.0' SILTY SAND, about 85% fine to medium sand, predominately fine; trace of coarse sand and fine gravel, and 15% fines with no to low plasticity max. size recovered 1/2"; dark brown; saturated. (SM)
								70		57.0 Bit Refusal; drilling action interpreted as bedrock surface - Niobrara Formation.
								80		
								90		

EXPLANATION

CORE LOSS

CORE RECOVERY

Type of hole ..... D = Diamond, H = Haystellite, S = Shot, C = Churn

Hole sealed ..... P = Packer, Cm = Cemented, Cs = Bottom of casing

Approximate size of hole (X-series) ..... Ex = 1 1/2", Ax = 1 7/8", Bx = 2 3/8", Nx = 3"

Approximate size of core (X-series) ..... Ex = 7/8", Ax = 1 1/8", Bx = 1 5/8", Nx = 2 1/8"

Outside diameter of casing (X-series) ..... Ex = 1 13/16", Ax = 2 1/4", Bx = 2 7/8", Nx = 3 1/2"

Inside diameter of casing (X-series) ..... Ex = 1 1/2", Ax = 1 29/32", Bx = 2 3/8", Nx = 3"

ANGLE HOLE ☐

VERTICAL HOLE ☐

GPO 844140

Grand Island Testing Laboratories

Division of Benjamin & Associates, Inc.

SOIL - BITUMINOUS - CONCRETE TESTING SOIL INVESTIGATIONS ENVIRONMENTAL AUDITS

TELEPHONE (308) 382-8465 3550 WEST OLD HIGHWAY 30 P. O. BOX 339

FAX (308) 382-8467 GRAND ISLAND, NEBRASKA 68802

DATE: April 10, 2007 NAME OF PROJECT: Water Supply for the Village of Santee DH-7 LOCATION: .....

TYPE OF TESTS: WASH GRADATIONS FOR: Bureau of Reclamation-Nebraska/Kansas AO, 203 W. Second Street, Grand Island, NE 68801

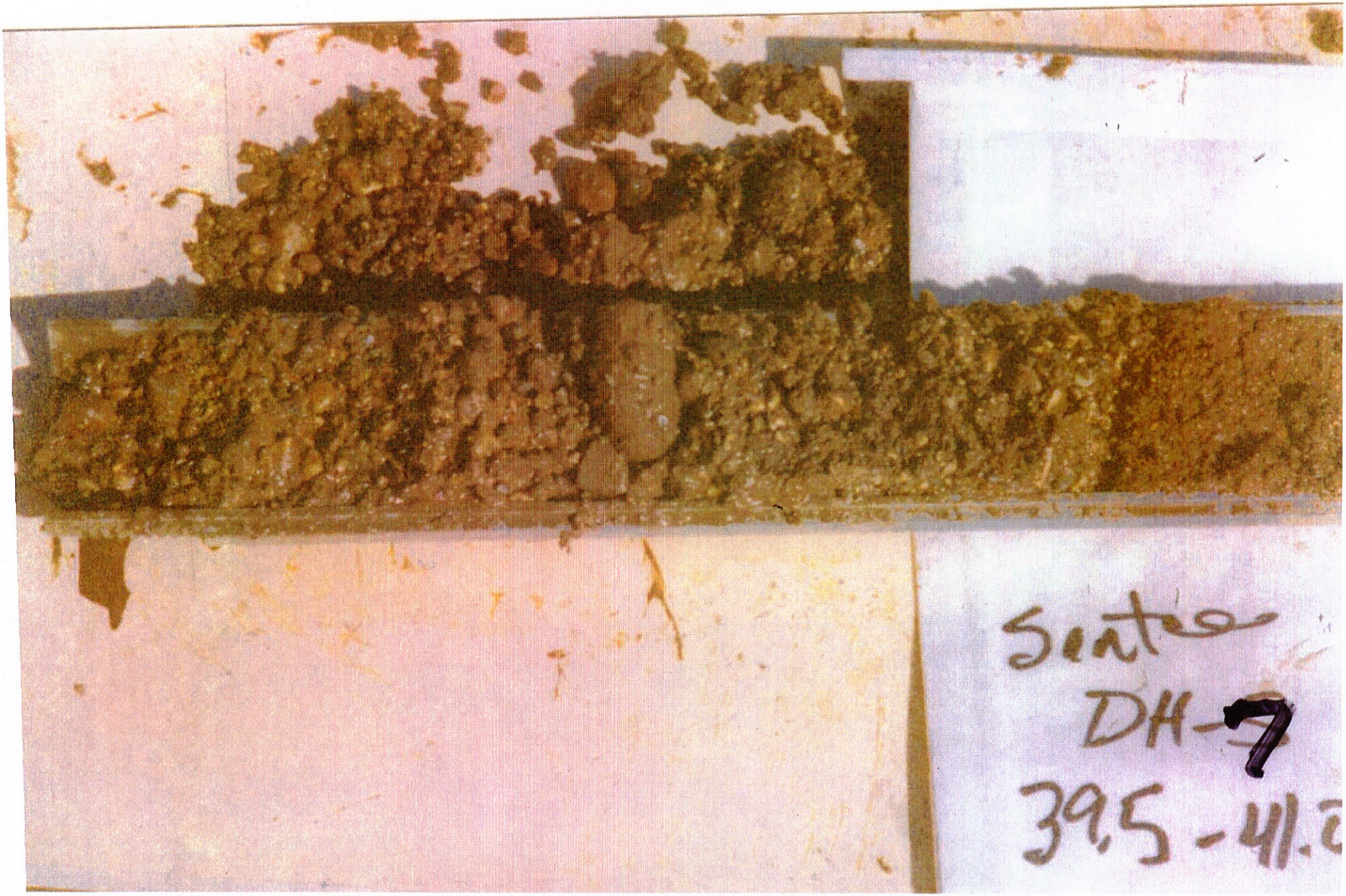
MECHANICAL ANALYSIS OF MATERIAL

*WASH = W DRY = D			PERCENT RETAINED:															
SAMPLE DATE	SAMPLE NO.	*	1"	3/4"	1/2"	3/8"	4	8	10	12	16	20	30	40	50	80	100	200
	S-1 29.5-31.0	W	13.1	15.5	25.7	35.2	53.0	66.9	69.0	71.2	74.7	78.0	82.5	87.1	89.1	92.4	93.2	94.9
	S-2 34.5-36.0	W	0	4.4	6.0	6.9	10.3	16.6	18.4	21.1	27.5	37.6	56.7	83.7	90.5	96.2	97.2	98.6
	S-3 39.5-41.0	W	0	1.8	7.4	16.4	45.2	70.7	74.1	77.2	81.1	83.9	86.8	89.8	91.3	94.8	95.4	96.9
	S-4 44.5-46.0	W	15.4	16.9	28.0	33.9	54.0	72.1	74.4	77.0	80.2	82.7	83.9	87.6	88.7	90.8	91.4	92.9
	S-5 49.5-51.0	W	16.3	18.0	22.3	26.2	36.0	46.7	49.2	53.7	59.6	66.7	73.5	82.6	85.2	88.6	89.4	91.4
	S-6 54.5-56.0	W	0	3.0	5.0	6.1	8.5	11.8	12.5	13.5	15.6	17.9	21.2	40.3	49.9	83.6	87.8	92.8

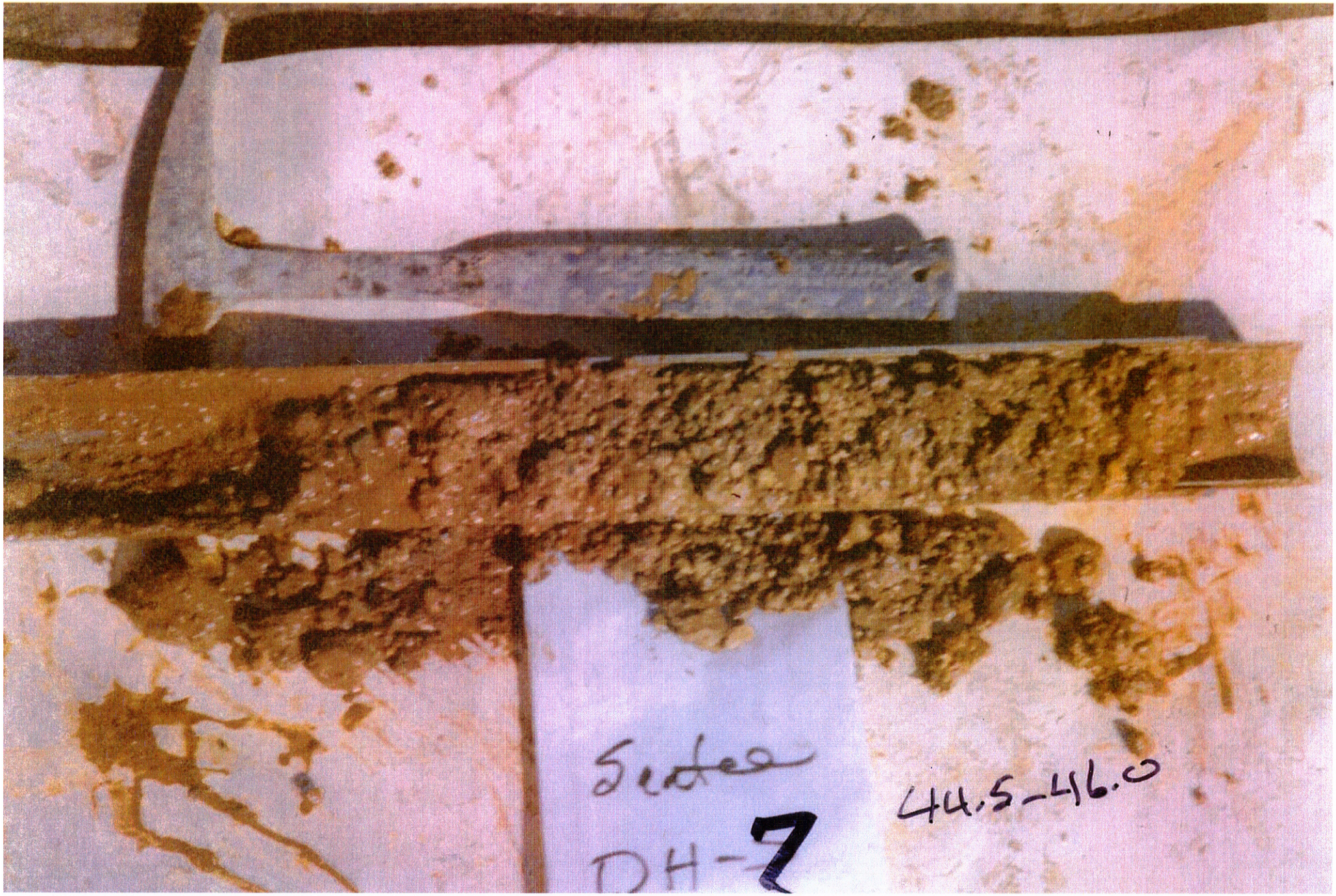
Photo 7 – Santee Sioux Water Supply Feasibility Study – Exploratory Drilling
Looking East at the Irrigation Well Site. The fenced-in area is a local storage unit.
Photo by: L. Cast 4/2007 Solicitation No. 06SQ600125

DH-07
Santa
2915-31

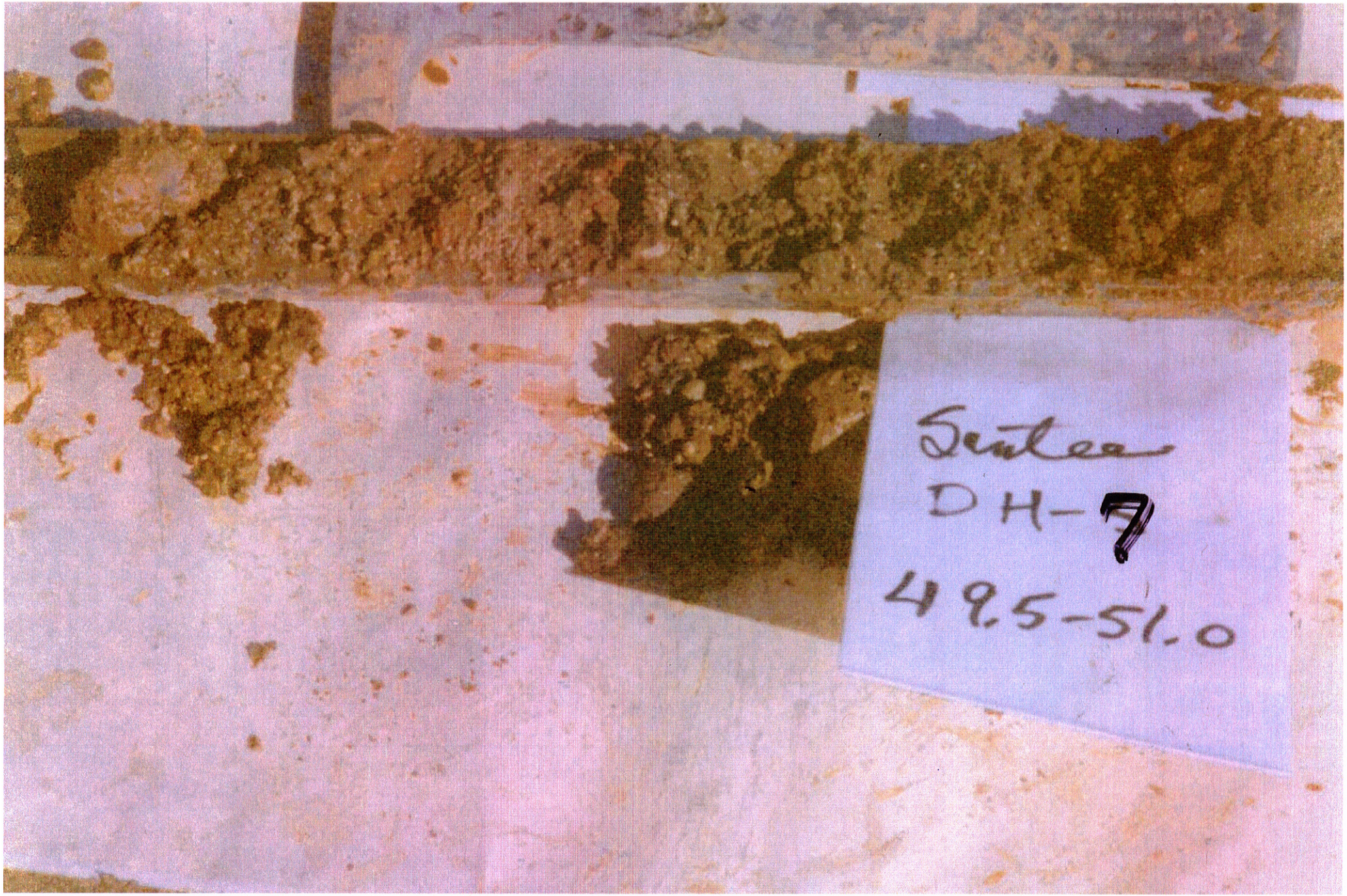

Santee
DH-7
34.5-36.0


Sinter
DH-7
39,5-41.

Sutter
DH-7
325-414


Sidee
DH-7
44.5-46.0


Sediment
DH-7
445-460


Surface
DH-7
49.5-51.0

Dented
DH-7
SU-5-45