NOTICE

All drawings located at the end of the document.

INFORMATION ONLY J.M. Stelmach

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21100-WP-OU-8.01
VOLUME II

EG&G

ROCKY FLATS

PHASE I RFI/RI WORK PLAN FOR OPERABLE UNIT 8 700 AREA

VOLUME II - APPENDICES

Rocky Flats Environmental Restoration Project

OCTOBER 1994

Reviewed for Classification/UCNI/OUO
By: Janet Nesheim, Derivative Classifier
DOE, EMCBC
Date: 11-04-08
Confirmed Unclassified, Not UCNI/Not OUO

A-OU08-000109

ROCKY FLATS INTERAGENCY AGREEMENT

JANUARY 22, 1991

Table 5: Preliminary RFI/RI Workplan for Previously Identified Inactive Sites

Operable Unit 8-700 Area

SITE NUMBER	SITE NAME	REQUIRED ACTION	REQUIRED COMPLETION/SUBMITTAL DATE
118.1 118.2	Multiple Solvent Spills West of Building 730 and in the South End of Building 776	1. Submit the results of the Aerial Radiological Measuring System (ARMS) survey which documented the elevated gamma-radiation exposure rates for sites 118.1 and 118.2. 2. Complete a real time soil gas analysis over the entire area of site 118.1 and 118.2 using 25 and 30 foot grid intervals, respectively. The soil gas analysis shall utilize a portable GC. The detection limits for the following compounds shall be proposed in the Workplan. The soil gas survey shall analyze for the volatiles 1,1,1 TCA, benzene, carbon tetrachloride, methylethyl ketone, dichloromethane, PCE, and TCE. The analysis shall note analytical peaks for compounds not calibrated for on the GC. Soil cores shall be taken at the location of the soil gas analysis on a random basis every 25 soil gas survey locations to verify the presence or non-presence of volatiles at the specific location. Transects of each site shall also be constructed longitudinally through each site. Four boreholes shall be constructed transecting site 118.1 and two boreholes shall be constructed to transect site 118.2. Prior to drilling each borehole, 2" soil surface scrapes shall be collected and analyzed for total plutonium, tritium, total uranium, gross alpha and gross beta. The soil boreholes shall be drilled three feet into weathered bedrock. Composite samples shall be taken from each two foot interval and shall be analyzed for HSL volatiles utilizing calibrated GC/MS.	1. Submit an RFI/RI Workplan in accordance with section VI. of the Statement of Work. Submit the Phase I RFI/RI Report in accordance with the schedules in Table 6 of the SOW. This RFI/RI Report will include all data collected as a result of and required by this preliminary workplan for this group of sites.

Table 5: Preliminary RFI/RI Workplan for Previously Identified Inactive Sites

SITE NUMBER	SITE NAME	REQUIRED ACTION	REQUIRED COMPLETION/SUBMITTAL DATE
123.1 123.2	Valve Vault 7 and West of Bldg. 707	1. Submit the report(s) documenting the radiometric survey conducted from 1975 - 1983. 2. Conduct a radiation survey using a G-M shielded pancake detector and side-shielded FIDLER of sites 123.1 and 123.2. The survey method shall be proposed within the Workplan for this OU. If "hotspots" are detected the grid must be tightened to locate the source of the radiation. 3. Conduct a soil sampling survey of the areas affected by site's 123.1 & 123.2. Four soil bores will be placed around each vault associated with site 123, and shall be drilled to a depth 10 feet below the bottom of each vault. Soil samples shall be composited to define each 2 foot interval of soil and analyzed for HSL volatiles. Soil samples shall also be composited to define six foot intervals, and will be analyzed for nitrates, flourides, beryllium, total uranium, total plutonium, gross alpha, and gross beta.	
125	Holding Tank closure plan submitted 9/89	1. Submit the report(s) documenting the radiometric survey conducted from 1975 - 1983. 2. Conduct a radiation survey using a G-M shielded pancake detector and side-shielded FIDLER of site 125. If the releases occurred after surfacing was in place, then the survey should be conducted without removing the surfacing. If the surfacing was placed after the spills occurred,	

Table 5: Preliminary RFI/RI Workplan for Previously Identified Inactive Sites

SITE NUMBER	SITE NAME	REQUIRED ACTION	REQUIRED COMPLETION/SUBMITTAL DATE
125 (cont'd)		then the top 2" of the soil surface shall be sampled and analyzed for radiation prior to drilling the boreholes. The survey shall be conducted using 10 foot grids and will cover all areas affected by site 125. If "hotspots" are detected, the grid must be tightened to locate the source of the radiation.	
		3. Conduct a soil sampling survey of the areas affected by sites 125. Soil bores will be placed around each tank associated with site 125 and will be drilled to a depth 10 feet below the bottom of each tank. The soil samples shall be composited to define each 2 foot interval and will be analyzed for HSL volatiles. In addition, the soils shall be composited to represent six foot intervals and shall be analyzed for nitrates, total americium, beryllium, total uranium, total plutonium, gross alpha and gross beta. In addition to the soil bores, surface scrapes 2 inches deep will be taken at the same location as the soil borings and analyzed for the same constituents as required for the soil boring composites. At least two of the boreholes shall be completed as down-gradient alluvial monitoring wells. The location and number of these wells shall be proposed in the RFI/RI Workplan to be submitted in accordance with section I.B.9. of the Statement of Work. These wells shall be sampled immediately upon completion and quarterly thereafter. Groundwater samples shall be analyzed for total nitrate, HSL volatiles, gross alpha, gross beta, total plutonium, total uranium, tritium and HSL metals.	
126.1 Out-of-Service Process 126.2 Waste Tanks		1. Determine and document the types of wastes stored in these tanks during use.	

Table 5: Preliminary RFI/RI Workplan for Previously Identified Inactive Sites

SITE NUMBER	SITE NAME	REQUIRED ACTION	REQUIRED COMPLETION/SUBMITTAL DATE
126 cont'd		2. Conduct a soil sampling survey of the areas affected by sites 126.1 and 126.2. One soil bore will be placed downgradient of each tank associated with site 126 and will be drilled to a depth 10 feet below the bottom of each tank. The soil samples shall be composited to define each 2 foot interval and will be analyzed for HSL volatiles. In addition, the soils shall be composited to represent six foot intervals and shall be analyzed for nitrates, total americium, beryllium, total uranium, total plutonium, gross alpha and gross beta. In addition to the soil bores, surface scrapes 2 inches deep will be taken at the same location as the soil borings and analyzed for the same constituents as required for the soil boring composites. The most downgradient borehole shall be completed as a downgradient alluvial monitoring well. The location of this well shall be proposed in the RFI/RI Workplan to be submitted in accordance with section I.B.9. of the Statement of Work. This well shall be sampled immediately upon completion and quarterly thereafter. Groundwater samples shall be analyzed for total nitrate, HSL volatiles, gross alpha, gross beta, total plutonium, total uranium, tritium and HSL metals. Initial results of the groundwater sampling and analysis shall be submitted with the PSC report for this group of sites.	
127	Low Level Radioactive Waste Leak	1. Conduct a radiation survey using a G-M shielded pancake detector and side-shielded FIDLER of site 127. The survey shall be conducted using 10 foot grids and will cover the entire area affected by site 127. If "hotspots" are detected, the grid must be tightened to locate the source of the radiation. If surfacing has been placed over the soils affected	

Table 5: Preliminary RFI/RI Workplan for Previously Identified Inactive Sites

SITE NUMBER	SITE NAME	REQUIRED ACTION	REQUIRED COMPLETION/SUBMITTAL DATE
127 cont'd		by releases from this site, 2" surface scrapes will be taken prior to constructing the required boreholes for this site. 2. Conduct a soil sampling survey of the areas affected by site 127. Place 5 soil borings 20 feet apart within the boundaries of the site. Collect a 2" surface scrape of the soils before constructing the soil borings. The surface scrape sample shall be analyzed for total plutonium, total uranium, gross alpha, gross beta, HSL metals and total nitrate. The soil borings will extend to 10 feet below the pipe invert carrying low level waste between 995 and 774 or three feet into weathered bedrock, whichever is greater. The soil samples will be composited to represent each 2 foot increment of depth and will be analyzed for total plutonium, total uranium, gross alpha, gross beta, and total nitrate.	
132	Radioactive Site #4 - 700	1. Conduct a soil sampling survey of the areas affected by site 132. Soil bores will be placed around each tank associated with site 132 and will be drilled to a depth 10 feet below the bottom of each tank or 3 feet into weathered bedrock, whichever is greater. The soil samples shall be composited to define each six foot interval and will be analyzed for total americium, total beryllium, total uranium, total plutonium, total alpha and total beta.	
135	Cooling Tower Blowdown	1. Verify the location of site 135 as either north or south of building 374. 2. Conduct a soil sampling survey of site 135 utilizing soil borings drilled to a depth of 6 feet. Borings will be	

Table 5: Preliminary RFI/RI Workplan for Previously Identified Inactive Sites

SITE NUMBER	SITE NAME	REQUIRED ACTION	REQUIRED COMPLETION/SUBMITTAL DATE
135 cont'd		placed on 50 foot centers. Samples will be composited to represent 2 foot intervals and will be analyzed for total chromium. A 2 inch surface scrape will be taken prior to drilling at each grid location and will be analyzed for total chromium.	
137	Cooling Tower Blowdown Building 774	1. Conduct a soil sampling survey of site 137 utilizing soil borings drilled six feet deep. Borings will be placed on 50 foot centers. Samples will be composited to represent 2 foot intervals and will be analyzed for total chromium. A 2 inch surface scrape will be taken prior to drilling at each grid location and will be analyzed for total chromium.	
138	Cooling Tower Blowdown Building 779	1. Conduct a soil sampling survey of site 138 utilizing soil borings drilled to a depth of 6 feet. Borings will be placed on 25 foot centers. Samples will be composited to represent 2 foot intervals and will be analyzed for total chromium. A 2" surface scrape will be taken prior to drilling at each grid location and will be analyzed for total chromium.	
139.1 139.2	Caustic/Acid Spills	1. Collect soil samples from the top six inches of soil at sites 139.1 and 139.2. These samples shall be taken from soils directly surrounding the source tanks and from soils affected by the sites. The soils affected by sites 139.1 and 139.2 will be sampled using 25 foot grids and shall be analyzed for sodium, potassium, and fluoride.	
144	Sewer Line Break	1. Submit the report(s) documenting the radiometric survey conducted from 1975 - 1983.	
		2. Conduct a radiation survey using a G-M	

Table 5: Preliminary RFI/RI Workplan for Previously Identified Inactive Sites

SITE NUMBER	SITE NAME	REQUIRED ACTION	REQUIRED COMPLETION/SUBMITTAL DATE
144 cont'd		shielded pancake detector and side-shielded FIDLER of the areas affected by site 144. The survey shall be conducted using 10 foot grids and will cover all areas affected by site 144 including the hillside referred to in the CEARP Phase I: Installation Assessment, Rocky Flats Plant. If "hotspots" are detected, the grid must be tightened to locate the source of the radiation.	
		3. Conduct a soil sampling survey of all areas affected by site 144 including the hillside 500 feet north, utilizing surface soil scrapings collected at "hotspot" locations identified through the radiation survey and prior to construction of each borehole. Two boreholes shall be located adjacent to the sewer line and shall be drilled to 5 feet below the invert of the pipe or three feet into weathered bedrock, whichever is deeper. Four boreholes shall be located on the affected hillside and shall be drilled three feet into weathered bedrock. The soil cores shall be composited to represent 2 feet of soil and analyzed for total plutonium, total americium, beryllium, total chromium, tritium, total nitrate, uranium 233/234, uranium 235, uranium 238, gross alpha, gross beta, HSL metals, and total sulfate.	
146.1 146.2 146.3 146.4 146.5 146.6	Concrete Process Waste Tanks	1. Submit the report(s) documenting the radiometric survey conducted from 1975 - 1983.	
		2. Verify the location of these tanks.	
		3. Conduct a radiation survey using a G-M shielded pancake detector and side-shielded FIDLER of the areas affected by site 146. The survey	

Table 5: Preliminary RFI/RI Workplan for Previously Identified Inactive Sites

SITE NUMBER	SITE NAME	REQUIRED ACTION	REQUIRED COMPLETION/SUBMITTAL DATE
146 cont'd		shall be conducted using 10 foot grids and will cover all areas affected by site 146 including the road and ground surfaces affected by the overflows of these tanks. If concrete or asphalt surfacing exists over affected soils, the surface soils will be sampled prior to constructing the required boreholes. If "hotspots" are detected, the grid must be tightened to locate the source of the radiation.	
		4. Conduct a soil sampling survey of all areas affected by site 146 including the areas affected by the tank overflows, utilizing surface soil scrapings to a depth of 2 inches and soil cores composited to represent each 2 feet of soil. The boreholes will be drilled to a depth of 10 feet below the tank inverts or to below the bottom of the building, whichever is required to assess the contamination of the soils related to this site. The location of six boreholes shall be proposed in the Workplan after verifying the location of these tanks. For three of the six boreholes, the core samples shall be composited to represent two foot intervals. These two foot composites shall be analyzed for HSL volatiles and HSL semi-volatiles. For all six boreholes the soils shall be composited to represent six foot intervals. The borehole composites and surface scrapes shall be analyzed for total plutonium, total americium, beryllium, total chromium, tritium, total nitrate, uranium 233/234, uranium 235, uranium 238, gross alpha, gross beta, total sodium, total sulfate and HSL metals.	
149	Effluent Pipe	1. Submit the report(s) documenting the radiometric survey conducted from 1975 - 1983 and any cleanup activities	

Table 5: Preliminary RFI/RI Workplan for Previously Identified Inactive Sites

SITE NUMBER	SITE NAME	REQUIRED ACTION	REQUIRED COMPLETION/SUBMITTAL DATE
149 cont'd		for this site. 2. Submit all soil survey information pertinent to this site aquired during the investigations of the solar ponds. 3. Conduct a radiation survey using a G-M shielded pancake detector and side-shielded FIDLER of the areas affected by site 149. The survey shall be conducted using 10 foot grids and will cover all areas affected by site 149 including the ground surfaces affected by the leakages of this line. If concrete or asphalt surfacing exists over affected soils, the surface soils shall be sampled prior to construcing the boreholes required for this site. If "hotspots" are detected, the grid must be tightened to locate the source of the radiation. 4. Conduct a soil sampling survey of the soils affected by site 149 utilizing cores drilled to a depth of 5 feet below the invert of the waste line(s) which resulted in the release at this site or three feet into weathered bedrock, whichever is greater. Eleven boreholes shall be located on 50' centers along the downgradient side of the effluent pipe. The soil core samples shall be composited to represent 2 feet of soil. The two foot composite core samples will be analyzed for HSL volatiles. The soil cores shall also be composited to represent six foot intervals. The six foot cores and the surface scrapes shall be analyzed for total plutonium, total americium, beryllium, total chromium, tritium, total nitrate, uranium 233/234, uranium 235, uranium 238, gross alpha, gross beta, and HSL metals.	

Table 5: Preliminary RFI/RI Workplan for Previously Identified Inactive Sites

SITE NUMBER	SITE NAME	REQUIRED ACTION	REQUIRED COMPLETION/SUBMITTAL DATE
150 150.1 150.2 150.3 150.4 150.5 150.6 150.7 150.8	Radioactive Liquid Leaks North of Bldg. 771, West of Bldg. 771, Between Bldgs. 771 and 774, East of Bldg. 750, West of Bldg. 707, South of Bldg. 779, South of Bldg. 776, Northeast of Bldg. 779	1. Submit the report(s) documenting the radiometric survey conducted from 1975 - 1983 and any cleanup activities for these sites. 2. Conduct a radiation survey using a G-M shielded pancake detector and side-shielded FIDLER of the areas affected by site 150. The survey shall be conducted using 25 foot grids and will cover all areas affected by site 150 including the ground surfaces affected by runon and spillage. If surfacing exists over affected soils, surface samples shall be taken prior to constructing the boreholes required for this site. If "hotspots" are detected, the grid must be tightened to locate the source of the radiation. 3. Conduct a soil sampling survey of all areas affected by site 150 utilizing surface soil scrapings to a depth of 2" and soil cores drilled three feet into weathered bedrock. Soil cores shall be composited to represent two foot intervals and shall be analyzed for HSL volatiles. Soil cores shall also be composited to represent six foot intervals. The six foot soil core composites and the 2" surface scrapes for all boreholes shall be analyzed for total plutonium, total americium, beryllium, total chromium, tritium, total nitrate, uranium 233/234, uranium 235, uranium 238, gross alpha, gross beta, total sodium, total sulfate and HSL metals. Nine boreholes constructed on 50' centers shall be located to transect site 150.1. Twenty boreholes constructed on 50' centers shall be located to transect site 150.2. Two rows of three boreholes shall be constructed to characterize site 150.3.	

Table 5: Preliminary RFI/RI Workplan for Previously Identified Inactive Sites

SITE NUMBER	SITE NAME	REQUIRED ACTION	REQUIRED COMPLETION/SUBMITTAL DATE
150 cont'd		Two rows of four boreholes shall be constructed to characterize site 150.4. Ten boreholes constructed on 75' centers shall be located to transect site 150.5. Two rows of four boreholes shall be constructed to characterize site 150.6. Ten boreholes constructed on 50' centers shall be located to transect site 150.7. Three boreholes constructed on 40' centers shall be located to transect site 150.8. The surface and core samples will also be collected from "hotspots" located during the radiometric survey.	
151	Fuel Oil Leak	1. Complete a real time soil gas analysis over the entire area of site 151 using 10 foot grid intervals. The soil gas analysis will utilize a portable GC. The detection limits for the following compounds shall be proposed in the Workplan. The soil gas survey will analyze for the volatiles benzene, toluene and xylene. The analysis will note analytical peaks for compounds not calibrated for on the GC. Four boreholes shall be constructed to characterize the soils on all sides of the fuel oil tank. The boreholes shall be drilled to a depth five feet below the bottom of the tank or three into weatered bedrock, whichever is deeper. Composite samples shall be taken from every 2 foot interval and analyzed for HSL volatiles utilizing calibrated GC/MS.	
159	Radioactive Site-Bldg. 559	1. Submit the report(s) documenting the radiometric survey conducted from 1975 - 1983 and any cleanup activities for this site. 2. Conduct a radiation survey using a G-M shielded pancake detector and side-shielded FIDLER of the areas affected by site 159. The survey shall be conducted using 10 foot grids and will cover all the areas affected by site 159.	

Table 5: Preliminary RFI/RI Workplan for Previously Identified Inactive Sites

SITE NUMBER	SITE NAME	REQUIRED ACTION	REQUIRED COMPLETION/SUBMITTAL DATE
159 cont'd		If "hotspots" are detected, the grid must be tightened to located the source of the radiation.	
		3. Conduct a soil sampling survey of the soils affected by site 159 utilizing cores drilled to a depth of 5 feet below the invert of the waste line(s) or three feet into weathered bedrock, whichever is deeper. Borehole core samples will be composited to represent 2 feet of soil. The two foot composites shall be analyzed for HSL volatiles. Borehole core samples shall also be composited to represent six foot intervals of soil. The 2" surface scrapes and the six foot composites shall be analyzed for total plutonium, total americium, beryllium, total chromium, tritium, total nitrate, uranium 233/234, uranium 235, uranium 238, gross alpha, gross beta, and HSL metals. Two inch surface scrapes shall be sampled prior to constructing all boreholes and where surfacing exists to prevent the radiation survey.	
163.1 163.2	Radioactive Sites #3: Wash Area and Buried Slab	1. Submit the report(s) documenting the radiometric survey conducted from 1975 - 1983 and any cleanup activities	
		2. Investigate and determine the nature of the soil/soil mounds north of 163.1 and east of 163.2 which are identified in the 1969 and 1971 aerial photographs.	
		3. Conduct a radiation survey using a G-M shielded pancake detector and side-shielded FIDLER of the areas affected by site 163.1. The survey shall be conducted using 25 foot grids and shall cover all areas affected by site 163.1. If surfacing exists over affected soils, the 2" surface samples shall be taken prior to construction of the required boreholes. If "hotspots"	

Table 5: Preliminary RFI/RI Workplan for Previously Identified Inactive Sites

SITE NUMBER	SITE NAME	REQUIRED ACTION	REQUIRED COMPLETION/SUBMITTAL DATE
163 cont'd		are detected, the grid must be tightened to locate the source of the radiation. 4. Conduct a soil sampling survey of all areas affected by site 163.1 utilizing surface soil scrapings to a depth of 2 inches and boreholes drilled four feet deep. The borehole soil cores shall be composited to represent each 2 foot interval of soil. The surface and core samples will be collected at locations indicated as radioactive after conducting the radioactive survey. The samples will be analyzed for total plutonium, total americium, uranium 233/234, uranium 235, uranium 238, gross alpha and gross beta.	
172	Central Avenue Waste Spill	1. Conduct a radiation survey using a G-M shielded pancake detector and side-shielded FIDLER of the areas affected by site 172. The survey shall be conducted along the Central avenue and 6th Street roadsides and all other roadsides utilized to transport the wastes from the 903 Pad Area to Bldg. 771. The survey shall also examine the surface water drainages next to the north and westbound lanes of the roads utilized. Both the roadside and surface water drainage surveys shall utilize 50 foot grid intervals. If "hotspots" are detected, the grid must be tightened to locate the source of the radiation. The survey shall utilize 5 foot grid intervals within 50 feet of stopping and unloading points. 2. Conduct a soil and asphalt sampling survey. Soil and asphalt sampling shall be conducted at locations indicated as radioactive during the radiometric survey and at stopping and unloading points along the route. The soil samples shall be analyzed for HSL metals	

Table 5: Preliminary RFI/RI Workplan for Previously Identified Inactive Sites

SITE NUMBER	SITE NAME	REQUIRED ACTION	REQUIRED COMPLETION/SUBMITTAL DATE
172 cont'd		carbon tetrachloride, bis(2-ethylhexyl) phthalate, total plutonium, uranium 233/234, uranium 235, uranium 238, beryllium, gross alpha and gross beta. The asphalt samples shall be taken at areas indicated as radioactive during the radiometric survey and on 5 foot grid intervals within 50 feet of stopping and unloading points along the route. These asphalt samples shall be analyzed for the same constituents as for the soil samples, with the exception of the carbon tetrachloride and bis(2-ethylhexyl) phthalate.	
173	Radioactive Site-900 Area	1. Submit information substantiating the characterization of this unit as a SWMU subject to HSWA corrective action.	
		2. Submit the results of the Aerial Radiological Measuring System (ARMS) survey which documented the elevated gamma-radiation exposure rates for site 173. Submit the results of the routine radiation surveys conducted in Bldg. 991.	
		3. Conduct radiation surveys using a G-M shielded pancake detector and a side-shielded FIDLER, device of all areas affected by site 173. The survey shall be conducted using 25 foot grid intervals and will cover all areas external to Bldg. 991. At radiation survey sites indicating radioactive contamination, soil samples, surfacing (i.e. asphalt or concrete) samples or surface wipes will be taken to determine the radioactive constituents responsible for the positive radiation reading. The type of sample taken will be dependent on whether the radiation survey site is located on the soil, or on surfacing. Soils shall be grab sampled. Asphalt, concrete and/or structural surfaces shall be wipe samples. All samples will be analyzed for total plutonium, total uranium,	

Table 5: Preliminary RFI/RI Workplan for Previously Identified Inactive Sites

SITE NUMBER	SITE NAME	REQUIRED ACTION	REQUIRED COMPLETION/SUBMITTAL DATE
73 cont'd		total americium, total cesium, total strontium, beryllium, tritium, gross alpha and gross beta.	
184	Bldg. 991 Steam Cleaning	1. Submit the report(s) documenting the radiometric survey(s) conducted which indicate that the radioactivity is not above background for this site. 2. Investigate the spillage identified as emanating from site 184 in the 8/6/71 aerial photograph. 3. Incorporate the investigation of site 184 into the radiometric investigation to be conducted at site 173.	
188	Acid Leak	1. Submit documentation describing the nature of the acid leak (i.e. describe whether the acid mixture is a waste acid, and whether it contained any other metals or dissolved constituents, etc.?). 2. Document any cleanup activity which took place at the time of the incident or after the incident to minimize environmental degradation.	

TABLE 6
FEDERAL FACILITY AGREEMENT AND CONSENT ORDER
MILESTONE SCHEDULE

OU 8
700 AREA

OU 8 700 AREA PHASE I RCRA FACILITY INVESTIGATION/
REMEDIAL INVESTIGATION (RFI/RI)

Submit Draft Phase I RFI/RI Work Plan	May 1, 1992
Submit Final Phase I RFI/RI Work Plan	September 28, 1992
Submit Draft Phase I RFI/RI Report	February 14, 1994
Submit Final Phase I RFI/RI Report	July 12, 1994

ATTACHMENT 4 - HAZARDOUS SUBSTANCE LIST

The materials listed below have been released at the Facility, or pose a threat of release to the environment at the Facility. This list is based on information gathered prior to the effective date of this Agreement and is subject to change dependent on the information gathered after the effective date of this Agreement.

Radionuclides:

- Plutonium 239, 240
- Americium 241
- Uranium 233, 234, 235, and 238
- Tritium
- Gross alpha
- Gross beta

Metals:

- Aluminum
- Beryllium
- Calcium
- Cadmium
- Cobalt
- Chromium
- Barium
- Lead
- Magnesium
- Selenium
- Sodium
- Silver
- Strontium
- Thallium
- Zinc
- Mercury
- Nickel
- Lithium

Inorganics:

- Sulfuric Acid
- Nitric Acid
- Hydrofluoric Acid
- Sodium Hydroxide
- Hydrochloric Acid
- Nitrate
- Sulfate
- Hydroxide

Volatile Organics:

1,1,2-Trichloroethylene
Chloroform
1,1,1-Trichloroethane
Carbon Tetrachloride
1,2-Dichloroethane
Acetone
Perchloroethane
Benzene
Toluene
Methylethyl Ketone Peroxide
Dichloromethane
Xylene
2-Butanone
Methylene Chloride
Methyl Ethyl Ketone

Semi-Volatile Organics:

bis(2-ethylhexyl)phthalate
ethylene glycol

Miscellaneous:

Diesel Fuel
Fuel Oil
Peroxide
Asbestos
Oil Sludge
Polyester Resin
Still Bottom Sands

COLORADO
DEPARTMENT
OF HEALTH

ROY ROMER
Governor

PATRICIA A. NOLAN, MD, MPH
Executive Director

Hazardous Materials and Waste Management Division
4210 East 11th Avenue
Denver, Colorado 80220-3716
(303) 331-4830 / FAX (303) 331-4401

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Ptarmigan Place, Denver
(303) 320-1529
First National Bank Building, Denver
(303) 355-6559
Grand Junction Office
(303) 248-7198
Pueblo Office
(719) 543-8441

April 21, 1992

RECEIVED
U.S.D.O.E.
R.F.O. - MAIL ROOM
1992 APR 27 A 8 22

Mr. Frazer Lockhart
U. S. Department of Energy
Rocky Flats Office
P.O. Box 928
Golden, Colorado 80402-0928

RE: Modification to Work in the IAG

Dear Mr. Lockhart,

Pursuant to Part 32, Paragraph 191 (Additional Work or Modification to Work) of the IAG, CDH and EPA hereby notify DOE that certain IHSSs included in several OUs, and the investigatory and remedial work associated with them, are now to be addressed as part of alternate OUs as follows:

IHSS 122:	From OU 13 to OU 9
IHSS 123.2:	From OU 8 to OU 9
IHSS 124:	From OU 10 to OU 9
IHSS 125:	From OU 8 to OU 9
IHSS 126:	From OU 8 to OU 9
IHSS 127:	From OU 8 to OU 9
IHSS 132:	From OU 8 to OU 9
IHSS 146:	From OU 8 to OU 9
IHSS 147.1:	From OU 12 to OU 9
IHSS 149:	From OU 8 to OU 9
IHSS 159:	From OU 8 to OU 9
IHSS 215:	From OU 15 to OU 9

Rationale: The above IHSSs all constitute part of the Original Process Waste Lines (OPWL) and will be investigated and remedied as such. These changes were recommended by DOE in the now-approved OU 9 Phase I RFI/RI Workplan. They need to be finalized as soon as possible so as not to impact the preparation of the RFI/RI Workplans for the OUs from which they are being moved.

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IHSS 156.2: From OU 14 to OU 6

Rationale: This change was recommended by DOE in the now-approved OU 6 Phase I RFI/RI Workplan because of the IHSS location along the Walnut Creek Drainage.

EPA and the Division consider these changes to be a modification to work associated with implementation of the IAG and are effective immediately. Although these changes were recommended by DOE, if you do not agree with any of these changes, you may invoke appropriate dispute-resolution procedures within 14 days. However, we would appreciate early notice of your disagreement so that an attempt can be made to resolve differences before dispute-resolution is invoked.

If you have any questions regarding these matters, please call Joe Schieffelin (CDH) at 331-4421.

Sincerely,

Joe Schieffelin for

Gary W. Baughman
Unit Leader, Hazardous Facilities Unit
Hazardous Materials and Waste Management Division

Martin Hestmark

Martin Hestmark
Manager
Rocky Flats Project
Environmental Protection Agency

cc: Daniel S. Miller, AGO
Barbara Barry, RFPU
Paul Bunge, EG&G
Peter Ornstein, EPA

OU8 IHSSs Researched and Discussed by Doty and Associates, 1992

IHSS No.	Doty and Associates Correspondence[1] Dates				
	April 9	April 10	April 11	April 14	Sept. 1
118.1			X	X	
118.2			X		
123.1			X		
123.2[2]			X		
125[2]	X				
126.1[2]			X		
126.2[2]			X		
127[2]		X			
132		X		X	
135		X			X
137		X			X
138		X			X
139.1	X				
139.2	X			X	
144			X	X	
146.1[2]	X				
146.2[2]	X				
146.3[2]	X				
146.4[2]	X				
146.5[2]	X				
146.6[2]	X				
149[2]		X			
150.1			X		
150.2		X			X

OU8 IHSSs Researched and Discussed by Doty and Associates (continued)

IHSS No.	Doty and Associates Correspondence[1] Dates				
	April 9	April 10	April 11	April 14	Sept. 1
150.3		X			X
150.4		X			X
150.5[2] [3]		X			X
150.6		X			X
150.7		X			X
150.8		X			X
151				X	
159[2]			X	X	
163.1		X			X
163.2			X		
172		X			
173		X			X
184		X			X
188		X			X

[1] 1992 Correspondence to Advanced Sciences Inc. for the purpose of delineating and updating information pertaining to specific IHSSs.
[2] IHSSs transferred from OU8 to OU9 by CDH letter dated April 21, 1992.
[3] IHSS 150.5 is the same as IHSS 123.2.

DOTY & ASSOCIATES
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9-1-92

September 1, 1992
1801-17

Mr. Jim Shaffer
Project Manager
Advanced Sciences, Inc.
405 Urban Street Suite 401
Lakewood, Colorado 80225

Subject: Descriptions for the Minor OU8 IHSSs

Dear Mr. Shaffer,

Enclosed please find descriptions of the remainder of the IHSSs for OU8 as requested. Included are descriptions for the following IHSSs: 135, 137, 138, 150.2, 150.3, 150.4, 150.5, 150.6, 150.7, 150.8, 163.1, 173, 184, and 188. It has become apparent through our research that some of these IHSSs had their boundaries slightly misplaced on previous maps. Several maps are attached which indicate the location where we believe these IHSSs should be placed. If we obtain more information for any of these IHSSs, we will prepare a supplementary document with that information and forward it to you. Please review these descriptions and do not hesitate to call if you have any questions or need additional details.

Sincerely,
DOTY & ASSOCIATES

Ann K. Sieben

Enclosures: as indicated

IHSS Number: 135
IHSS Name: Cooling Tower Blowdown

Date/Duration of Occurrence: 1980 to 1982

Description of Incident:

General Physical Setting

Building 373 is the cooling tower that serves Building 374 and was constructed in the mid 1970s. In 1979, because of a concern of tritium possibly being in the water, a proposal was made that overflows and drains from the cooling towers should be made to the sanitary sewer.[1] The cooling tower blowdown from this structure is currently piped into the sewage treatment plant. These cooling towers have had the ability since approximately 1981 to accept recondensed evaporator water from Building 374. Evaporator water is routinely sampled and analyzed and may be transferred to either the cooling towers or to the Building 443 boilers. The 1989 water balance indicated that 11.3 million gallons of recondensed Building 374 evaporator water went to the Building 443 boiler and 2 million gallons went to the Building 373 cooling towers. This water is combined with other plant raw water for the cooling tower makeup water.

A holding pond is located south of the cooling towers, across a paved drive, and currently serves as secondary containment for Tanks 808A and 808B. The holding pond was originally clay lined and was used to contain surface runoff from around Building 374. It was concreted in approximately 1986 for the purpose of serving as secondary containment for the two tanks, which were constructed in 1986, as well as containing surface runoff. A sluice gate is located at the northeast corner of the pond with a connecting culvert that directs water into a drainage toward North Walnut Creek.

Releases to the Environment

On June 12, 1981, the cooling tower was cleaned and the slurry portion was pumped into the holding pond. During the night, some of the water leaked through the dirt dike and gate valve and drained into Walnut Creek. Analyses of the cooling tower water and of Pond A-3 were conducted for phosphate, a compound added to cooling tower water as a rust inhibitor. The results indicated no detectable quantities of phosphate in either source.[2] In December 1981, a new valve was installed at the pond in response to the leak.[3]

Persons interviewed for the CEARP Phase 1 document indicated that cooling tower blowdown was released to the environment near Building 374 and may have contained chromates and algicides.[4] This cooling tower was constructed during the same timeframe that the RFP switched from chromates to inorganic phosphates as the additive in the cooling tower water for a rust inhibitor.

Radiometric Survey Results

The results of the Radiometric Survey, performed at the RFP during the late 1970s and early 1980s, indicate no extremely contaminated areas (stated to be 500,000 to 1,000,000 pCi/g)[5] around the Building 373 cooling tower.

IHSS Boundary

The 1981 event impacted the holding pond located to the south of the cooling towers. The IHSS boundary should be located around this holding pond and at the outlet of the culvert. No documentation was found specifically identifying the immediate environment around the cooling tower as being impacted by the cooling tower blowdown.

*** ** ***

Other IHSSs of Concern: IHSS 206 is a hazardous waste storage tank located at the northeast corner of Building 374. This tank has at times contained radioactive materials. No radioactively contaminated releases were identified as a result of this tank. The HRR narrative for this IHSS is attached.

IHSS 151 is an underground fuel storage tank located northwest of the cooling tower and is included in OU8. The narrative for this IHSS has previously been submitted.

References

[1] Crites, T.R., Rockwell International, 1979, "Environmental Sciences Weekly Highlights Week Ending October 19, 1979," October 19.
[2] Hornbacher, D.D., Rockwell International, 1981, "Environmental Analysis Weekly Highlights Week Ending June 19, 1981," June 19.
[3] Hornbacher, D.D., Rockwell International, 1981, "Environmental Analysis Weekly Highlights Week Ending December 4, 1981," December 4.
[4] RCRA 3004(u)

[5] Setlock, G.H., 1988, "Request for Detailed Report on Radiometric Survey," Internal Letter to Tom Greengard, August 19.

PAC REFERENCE NUMBER: 300-206

IHSS Reference Number: 206, Operable Unit 10

Unit Name: Inactive Hazardous Waste Tank D-836

Approximate Location: N750,500; E2,082,500

Date(s) of Operation or Occurrence

1975 - 1987[1]

Description of Operation or Occurrence

Tank D-836 was a 19,000 gallon, carbon steel tank used for hazardous waste storage. The tank had no secondary containment and was located on compacted soil. It has been identified as a portion of Unit #42 in the RCRA Part B Permit Application. Specifically it was identified as Unit #42.14.[1] The tank can be seen in a 1980 RFP photograph, situated at the northwest corner of Building 371 near Door 5.[2] Specifications for Tank D-836 can be found in the RCRA 3004(u) document.

A spill of condensate water occurred on February 18, 1980 when a line from the evaporator to the tank was disconnected.[3]

Physical/Chemical Description of Constituents Released

The tank was used to hold off-specification Building 374 Product Water, i.e., water too high in conductivity. The spill in 1980 was found to contain low concentrations of tritium.[3]

Responses to Operation or Occurrence

No documentation was found which detailed a response to this occurrence.

Fate of Constituents Released to Environment

This IHSS is being studied in accordance with the IAG schedule of OU10. The IAG activities will include site investigations, site characterizations, and possible site remediation. The Final Phase I RFI/RI Report is to be completed by January 30, 1995.

Comments

This unit is no longer to be closed under Interim Status. The 1988 Closure Plan has been superseded by the RFI/RI Report.

It is proposed that the location of IHSS 206 be moved to the area believed to be occupied by the tank. This area is different than the location indicated on the IAG map which had the site located north of Building 374.

Reference

[1] 1502735
[2] 1800342
[3] 1501223

IHSS Number: 137
IHSS Name: Cooling Tower Blowdown Buildings 712 and 713

Date/Duration of Occurrence: 1962 to Present

Description of Incident:

General Physical Setting

Buildings 712 and 713 are located adjacent to each other south of Building 774 and north of Building 777. Building 712, the westernmost of the two, was constructed in 1962 to service Buildings 776 and 777. Building 713 was constructed in 1966 for additional cooling tower capacity. During construction of Building 713, several laundry and process waste lines were rerouted to make room for the new building.[1] It is unknown if these underground pipes were removed or abandoned in place. The area around these cooling towers, especially immediately south of the buildings, is characterized with an abundance of aboveground and underground pipes and structures. The ground surface around the buildings is at an approximate elevation of 5982 feet. Process waste invert elevations in the area south of the buildings are as deep as approximately 5978 feet. Buildings 702 and 703 are the pumphouses for Buildings 712 and 713, respectively. The cooling tower sump for Building 712 is located between the cooling tower and the 702 Pumphouse.

Cooling Tower Operation

Cooling tower water is made up of filtered untreated raw water from the onsite raw water reservoir. Water is removed from the cooling tower system from blowdown and drift. Drift water is water that is released to the atmosphere and sprayed to the ground surrounding the tower. Water is periodically blowndown to maintain a specified range of total dissolved solids. A calculation done in the 1980 Environmental Impact Statement estimated that approximately 4,000 pounds of solids per year may be carried with the drift water and deposited on the surrounding soil. This value is a total from all of the cooling towers onsite. Due to the age and use of these cooling towers, it is estimated that the ground surrounding and between the cooling towers has been impacted by the cooling tower water from drift, blowdown, and leaks.[2] These cooling towers do not receive recondensed evaporator water from Building 374.

Chemicals were added to the cooling tower water for the prevention of biological growth, corrosion, scaling, and other effects that can foul heat-transfer surfaces and degrade performance. Prior to approximately 1976, chromates were added as a rust inhibitor.[3] After that time, the use of chromates was reduced plantwide due to pressure from EPA regarding the release of chromates to the environment. Sodium silicate has been used in cooling tower water as a corrosion inhibitor.[2]

Releases to the Environment

Interviewees for CEARP Phase 1 indicated that cooling tower blowdown south of Building 774 drained northward into North Walnut Creek.[4] These towers are located directly south of Building 774. The topography slopes gently to the north of the buildings for the first 100 feet or so and then slopes quite steeply to the north toward Building 774 and North Walnut Creek. Surface water collection pipes direct the water toward North Walnut Creek. The CEARP working notes attribute the blowdown to towers south of Building 774, which would logically refer to Buildings 712 and 713; however, it was stated as speculation in the CEARP final document that the interviewees probably referred to a specific incident occurring in 1976 near the Building 779 cooling tower (IHSS 138).[5] The reasoning behind this interpretation is not stated and it is unclear why one would assume this description would be attributed to the Building 779 cooling tower.

The cooling towers have been damaged by wind and rain and the west tower (Building 712) has been resided at least once in the past. It currently has open panel siding. Building 713 currently has open slat siding. The slat siding allows some water to spray out of the tower onto the surrounding ground surface. The ground immediately around the east side of Building 713 was puddled from the overspray on a site visit on August 20, 1992; Building 712 was not operational on that day and has not been operation for quite some time.

Prior to the early 1970s, it was routine for the cooling towers of Building 712 and 713 to blowdown effluent onto the soil outside the building. The blowdown water evaporated, infiltrated into the soil, or flowed into the storm water culverts and pipes and was directed to North Walnut Creek. Since approximately 1974, the blowdown has entered the sanitary sewer lines and is treated at the sewage treatment plant.

In September 1990, a leaking cooling tower behind Building 777 was checked by RCRA personnel. The cooling tower was reportedly releasing about 20 to 40 gallons per minute to the environment. It was unclear how long the leak had occurred prior to the RCRA response to the incident. The releases were caused by leaks from corroded sides of the cooling tower.

Previous Studies

In May 1973, a letter was sent to various operations managers from Environmental Control requesting information about cooling towers. The information sought included the type of tower, type of discharge, volume of discharge, disposition of discharge, and the amount, frequency, and type of chemical additives.[6] Responses to this request have not been found; however, in September 1973, a proposal was developed to connect all cooling tower blowdown to the sanitary sewers.[7] Details of the results of these studies have not been found; however, it is believed that since approximately 1974, the blowdown has been piped to the sanitary sewers.

In 1979, a project was implemented to upgrade cooling towers sitewide. The project included the collection of samples for determination of subsequent waste disposal as a result of demolition of some of the cooling towers. Buildings 712 and 713 were included in the study. Materials sampled included wood siding and soil samples. The results of the sampling indicated that none of the materials qualified as toxic or hazardous material based on EPA guidance and extraction tests. Therefore, material removed for the upgrades were disposed of in the onsite landfill. The analytical results are available.[3]

Radiometric Survey Results

The results of the Radiometric Survey, performed at the RFP during the late 1970s and early 1980s, indicate no extremely contaminated areas (stated to be 500,000 to 1,000,000 pCi/g)[8] around Buildings 712 and 713.

IHSS Boundary

As stated above, it is estimated from the age and use of the cooling towers that the area surrounding and between the cooling towers has been impacted by drift, blowdown, and leaks. Therefore, the IHSS boundary, as stated in the IAG and HRR, is proposed to be enlarged from the south end of the cooling towers only to the entire area surrounding and between the cooling towers. The potential area of impact is difficult to ascertain because no documentation has been found which delineates the effected area. For the purpose of initial investigation, it is suggested to include a zone approximately 10 feet beyond the foundation of Buildings 712 and 713. It is not possible to estimate the area of surface runoff that may have been caused in the past by drift, blowdown, or leaks, again, because no documentation has been found which identifies any paths other than to the north toward North Walnut Creek. It is suggested that the area of impact be adjusted toward the north if preliminary investigation indicates contamination to the proposed 10 foot boundary.

*** ** ***

Other IHSSs of Concern: IHSSs 127 and 149.2 are located in the area of the cooling towers. These IHSSs represent underground process waste pipe leaks and are scheduled to be investigated through the implementation of the OU9 RFI/RI workplan.

References

[1] RFP Engineering Drawing 14267-9 rev. A, Recommended January 19, 1966.

[2] US Department of Energy, 1980, "Final Environmental Impact Statement, Rocky Flats Plant Site," Vol. 1, pp 2-141, 3-8, April.

[3] Kriznar, A.L., Dow Chemical Company, 1979, "Authorization 309042 - Demolition and Disposal of Old Cooling Towers," Internal Letter to Distribution, Dow Chemical Company, May 11.

[4] CEARP Working Notes, page 5

[5] CEARP Phase 1, page V-32

[6] Hobbs, F.D., Dow Chemical Company, 1973, "Cooling Tower Information," Internal Letter to Operators, Dow Chemical Company, May 15.

[7] Hawes, R.W., Dow Chemical Company, 1973, "Cooling Towers - Proposed Connections to Sanitary Sewer," Internal Letter to G.J. Werkema, Dow Chemical Company, September 17.

[8] Setlock, G.H., 1988, "Request for Detailed Report on Radiometric Survey," Internal Letter to Tom Greengard, August 19.

IHSS Number: 138
IHSS Name: Cooling Tower Blowdown Building 779

Date/Duration of Occurrence: December 8, 1976 and December 8, 1990

Description of Incident: There has been a point of confusion concerning this IHSS because the event that occurred in 1976 predated the existence of the cooling towers to which the event was attributed in the past. This discussion is based on documentation, historical engineering drawings, and interviews with personnel involved with the events.

General Physical Setting

The original Building 779 cooling towers were built in 1964 when construction of Building 779 was completed. The original cooling towers were relatively small structures located south of the present Building 779 cooling towers. The present cooling towers, Buildings 784, 785, 786, and 787 were constructed in 1986. The original cooling towers were removed when those buildings were constructed. Building 783 is a pumphouse associated with the current towers and contains many of the ancillary piping. The area is marked by an abundance of aboveground and underground utilities and structures.

A discussion of general cooling tower development at the RFP is described in detail in the narrative for IHSS 137. The current Building 779 cooling towers are separated for different functions and different plumbing. Cooling Tower 1, which consists of four units, is the West Chiller Cooling Water System, and is labelled Building 786. The one unit of Cooling Tower 2 is Building 785 and is the Process Cooling Water System. Cooling Tower 3, Building 787, is the East Chiller Cooling Water (Glycol mix) System. Finally, Cooling Tower 4 consists of four units and is the Standby Cooling Water System, Building 784.[1]

Attached to this discussion is a design drawing from the original construction of Building 779. Prior to the construction of that building and its outbuildings, including the original cooling towers, a geotechnical study was performed to determine characteristics of the substratum. The core logs for six test borings are included on the attached drawing and provide information pertaining to soil characteristics.

Releases to the Environment

On December 8, 1976, a leak occurred in an underground line connected to the original cooling towers.[2] The leak discharged approximately 400 gallons of cooling tower effluent which were released into a storm sewer east of Building 779 and northwest of Building 727. At the time, it was stated that the spilled effluent drained toward Trench No. 6. Trench No. 6 was a part of the original surface water and shallow groundwater collection system north of the solar ponds.

The spilled effluent was analyzed at the time and was found to contain approximately 50 parts per million total chrome and 3,000 dpm/l gross alpha activity. In response to the spill, the leak was repaired. A FIDLER survey was conducted along the water course of the spill. No readings above background were observed. Additionally, soil samples were taken in the area and submitted for analysis.[2,3] The results of the soil samples are not known. Samples were also reportedly collected daily from Trench No. 6; however, the sample analyses are not known.

Engineering drawings show a forced storm drain immediately south of the original cooling towers which is northwest of Building 727 and east of Building 779. Currently, there is a concrete surface water diversion trough located in the area between the former location of the original cooling towers and Building 727. During construction activities in 1986 for the demolition of the original cooling towers and the construction of the present cooling towers, several underground utility lines were excavated. The storm drain was not rerouted; however, several other lines in the immediate area were rerouted. Because of all of the intrusive activities in the area, it is probable that the soil in the area of the release has been disturbed since the event occurred.

On December 8, 1990, Cooling Tower No. 2 discharged cooling tower water to the ground.[4] The event occurred when the sump filled and water backwashed into the cooling tower and spilled out of the fan on the east side of the structure. Cooling Tower No. 2 is Building 756. The spray from the backwash extended no more than 5 to 6 feet east of the building according to utilities personnel in Building 779.[5] The cooling tower water contained an additive called "Nalco 2826" an inorganic phosphate rust inhibitor. The manufacturer of Nalco 2826 was contacted after the event and assured the operators that the amount of Nalco released was not harmful to the environment.[5] An Occurrence Report was prepared after the incident, but the RCRA contingency plan was not implemented. The Occurrence Report indicated that a sample was taken for analysis; however, it is not stated if it was a soil or water sample. The results of the sample analysis are not known.

Previous Studies

Several geotechnical studies have occurred in conjunction with Building 779 and adjacent facilities and with the Solar Evaporation Ponds. The information gathered for those studies may be useful in identifying the subsurface conditions of the general area such as water table levels and soil types. These studies include: "Subsurface Investigation Planned Site for Building 79 U.S. Atomic Energy Commission Rocky Flats Facility, Boulder, Colorado" November 1962; "Geotechnical Services for Seismic Retrofit on Buildings 707, 779, and 776/777 at Rocky Flats Plant Jefferson County, Colorado" December 1986; and "Geological and Subsoil Investigations at Evaporating Ponds Dow Chemical Rocky Flats Plant near Denver, Colorado" October 22, 1970.

Radiometric Survey Results

The results of the Radiometric Survey, performed at the RFP during the late 1970s and early 1980s, indicate no extremely contaminated areas (stated to be 500,000 to 1,000,000 pCi/g)[7] around the area of these cooling towers.

IHSS Boundary

The IHSS boundary presented in the IAG was concluded to be too large and too far west of where the 1976 event occurred. The reidentification of the site in the HRR is considered to be adequate for the location of the pipe leak. The effluent spilled toward Trench No. 6, presumably through the storm water drains and channels. At the time, these were monitored for radioactivity and were considered to be uncontaminated. The exact route the spill took is not known at this time and therefore cannot be mapped with accuracy.

The location of the original cooling tower is evident in the field, identifiable by the unvegetated white gravelly material just to the south of the current cooling towers (Building 786). In addition, if it is chosen to pursue the 1990 incident, the location of that area can be defined as being along the east side of Building 785 (Tower 2) and extending six feet out from the building.

*** ** ***

Other IHSSs of Concern: The adjacent IHSS 101 is the Solar Evaporation Ponds which are currently under investigation as part of the OU4 Phase I RFI/RI implementation. IHSS 150.8 impacted some of the area adjacent to the cooling towers and is detailed in this submittal.

References

[1] RFP Engineering Drawing 28177-402, Original Issue: August 4, 1982; As Built: September 29, 1986.

[2] Werkema, M.V., Rockwell International, 1976, "Environmental Sciences Weekly Highlights Week Ending December 10, 1976," Internal Report to R.E. Yoder, Rockwell International, December 10.

[3] West, J.M., Rockwell International, 1976, "Environmental Analysis and Control Highlights Week Ending December 23, 1976," Internal Report to M.V. Werkema, December 23.

[4] Hornbacher, D.D., Rockwell International, 1976, "Environmental Analysis and Control Highlights Week Ending December 10, 1976," Internal Report to M.V. Werkema, December 10.

[5] Personal Communication with Lou LePore, RFP Stationary Operating Engineer Building 779, August 19, 1992.

[6] Jensen, J., EG&G Rocky Flats, 1990, Occurrence Report, December 8.

[7] Setlock, G.H., 1988, "Request for Detailed Report on Radiometric Survey," Internal Letter to Tom Greengard, August 19.

OU8 IHSS DESCRIPTION

IHSS Number: 150.2
IHSS Name: Radioactive Leak West of Building 771

Note: This IHSS also encompasses the area west of Building 776

Date/Duration of Occurrence: September 11, 1957; May 11, 1969

Description of Incident: The area west of Buildings 771 and 776 are contaminated as a result of the September 11, 1957 fire in Building 771 and the May 11, 1969 fire in Building 776/777.

1957

The west side of Building 771 was contaminated as a result of the 1957 fire. Although no documentation was found which details specific activities in the area, a review of documents pertaining to the fire indicates that the west side of Building 771 was used quite extensively during extinguishing activities, for purposes such as the staging of firefighting vehicles. The portion of the building that was most affected by the fire was Room 180, which is located in the southwest corner of Building 771; therefore, the west entrance provided good access for the firefighters. At the time of the fire, there was an access door on the west side of the building, and the area was paved[1]. Currently, there is a dock located at the access door.

No documentation was found which details contamination of the surrounding environment. One eyewitness report states, "I then went back in the front area of Building 71 with a Pee Wee and did some spot monitoring. I found the general level of contamination to be 100 to 500 counts per minute, except around the air-lock to the exclusion area, where the floor had been tracked up"[2]. (Note: A Pee Wee was the alpha probe used in the 1950s.) The front door of Building 771 is located on the north side of the building, however the levels may be an indication of the contamination levels in the general area. It is conjectured that the west side of Building 771 would have become more contaminated than the north side of the building, because it is believed that firefighting access was mostly through the west access door. No details of cleanup activities were found.

1969

In 1969, the west dock area of Building 776 was contaminated by tracking of contamination by firefighting personnel up to greater than 100,000 (cpm?)[3]. This was most likely an area just south of Door 6, in the northern half of the west side of the building, where surveys showed contamination of between 100 and 300 micrograms per square meter[4]. Documentation also indicates that the steps, dock, and ramp areas on the west side of Building 776 were contaminated to 6,000 cpm[5]. The contaminated area extended out from the building approximately 30 feet. Following the fire, rain transported the contamination into nearby soil, and oil and gravel were placed on the soil to stabilize the contamination[6].

The soil, oil, and gravel were removed on July 19, 1969[6]. Asphalt and dirt removed from the west side of the building contained 7 dpm/g, and was to be buried in the "Building 903 area"[7]. Contaminated asphalt from the 1969 fire was actually buried in a location east of Building 881,

at IHSS 130. Approximately 320 tons of soil and asphalt were removed from the west side of the building[8]. At least a portion of the sidewalk on the west side of Building 776 was also removed[9]. A new asphalt road had been constructed on top of the affected area by the end of July 1969[6].

In 1973, a survey was conducted on the asphalt road west of Building 776 to determine contamination levels prior to widening of the road. The maximum soil activity found was 70 dpm/g plutonium[10].

In January 1972, the soil at the southwest corner of Building 776 was considered to be contaminated[11]. The cause of the contamination was not stated.

In June 1972, the "west dock" became contaminated when a radioactively contaminated roller on a box was brought into the building. The area was decontaminated at the time of the incident[12]. No documentation providing further details of cleanup was found. It was not stated what building the "west dock" was connected to, but it is possible that is was the west dock of Building 776.

Radiometric Survey Results

The results of the Radiometric Survey, performed at the RFP during the late 1970s and early 1980s, indicate no extremely contaminated areas (stated to be 500,000 to 1,000,000 pCi/g)[13] around the west sides of Buildings 771 or 776.

IHSS Boundary

The boundary of this IHSS, as presented in the IAG, includes an area between the west sides of Buildings 771 and 776. No documentation was found which substantiates the inclusion of this area in this IHSS. The IHSS should include only the areas west of the buildings, and not the whole area extending from the middle of Building 771 to the south side of Building 776.

Other IHSSs of Concern: IHSSs 150.7 and 131 are areas south and north of Building 776/777, respectively, which were affected by the 1969 fire. The description for IHSS 150.7 is included in this submittal. The HRR PAC Description of IHSS 131, which is included in OU14, is attached.

References

[1] Epp, J., Former RFP Employee, 1992, Personal Communication, August 18.

[2] Pringle, J., Dow Company, 1957?, Personal Account of 1957 Fire Activities, Date Unknown.

[3] Author Unknown, Dow Company, 1969, Log Book, July 8.

[4] Lee, W.H., Dow Company, 1970, Letter and Map, March 23.

[5] Joshel, L.M., Dow Company, 1971, "Ad Hoc Review of Rocky Flats Waste Problems," Letter to F.E. Abbott, May 28.

[6] Owen, J.B., Dow Company, 1969, "Restricted Area, West Side of Building 776," July 25.

[7] Piltingsrud, C.W., Dow Company, 1969, "Status Report -- Health Physics -- August, 1969," Internal Letter to C.M. Love, Dow Company, September 12.

[8] Owen, J.B. and L.M. Steward, 1974, "A Historical Summation of Environmental Incidents Affecting Soils At or Near the U.S.AEC Rocky Flats Plant," Internal Report January 29.

[9] Author Unknown, Dow Company, 1971, Log Book, May 4.

[10] Gunning, R.R. and F.D. Hobbs, Dow Company, 1973, "Surface Contamination in Area of Building 776 Drive Asphalt Extension Project," Internal Report, August 15.

[11] Illsley, C.T., Dow Company, 1972, "Project RF 399051, Restoration of Production Facility," Letter to W.G. Graeper, January 28.

[12] Author Unknown, Dow Company, 1972, Log Book, June 20.

[13] Setlock, G.H., 1988, "Request for Detailed Report on Radiometric Survey," Internal Letter to Tom Greengard, August 19.

PAC REFERENCE NUMBER: 700-131

IHSS Reference Number: 131, Operable Unit 14

Unit Name: Radioactive Site - 700 Area Site #1

Approximate Location: N 751,500; E 2,084,000

Date(s) of Operation or Occurrence

June 1964[1] and May 1969[2,3]

Description of Operation or Occurrence

As a result of an explosion in Building 776 in June 1964, an area of approximately 1,500 square feet of soil at the exit of the gas bottle dock was contaminated with plutonium; some areas had activities greater than 200,000 dpm/67cm^2.[1] A later account states that 40 square feet of soil north of Building 776 was contaminated with plutonium due to the June 1964 explosion incident.[4] An area 20 by 100 feet on the west end of the north side of Building 776 was radioactively contaminated during the course of firefighting activity in May 1969 (PAC 700-150.2).[2] Tracking by personnel around Door 17 of the dock area resulted from use of the door as a major access to the building at the time of the May 1969 fire.[3]

Physical/Chemical Description of Constituents Released

Plutonium was released to the environment.[1,4]

Responses to Operation or Occurrence

In June 1964, following the removal of spots of high level soil contamination, a seal coat of oil and about two inches of gravel were placed over the contaminated soil.[1] The area around Door 17 was paved twice and in the fall of 1971 the asphalt was removed and placed in barrels.[3] In November 1971, the paving of a gravel-covered contaminated area north of Building 776 compressor shed was pending.[5,6]

Fate of Constituents Released to Environment

No documentation was found which detailed the fate of the constituents. This IHSS is being studied in accordance with the IAG schedule for OU14. However, the information developed on this unit for this study indicate that the location for IHSS 131 presented in the IAG is inaccurate. The IAG activities will include site investigations, site characterizations, and possible site remediation. The Final Phase I RFI/RI Report is to be completed by May 23, 1995.

Comments

No documentation was found which detailed the final disposition of the asphalt removed from the site. The removed material could have been buried in trenches or moved to a fill area to the west of Building 881 (PAC 900-130), as was contaminated material removed from the west side of Building 776.[7,8]

A french drain which may have provided a pathway for migration of contamination from this site is discussed as PAC 700-1100.

Based on information from documents reviewed for this study, it is proposed that the area of IHSS 131 defined in the IAG be enlarged to extend to the northwest corner of Building 776 (PAC 700-131).

References

[1] 1600181
[2] 1501091
[3] 1500842
[4] 1600269
[5] 1500425
[6] 1500551
[7] 1501097
[8] 1500563

Other References of Interest

1500423
1500456
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1500656
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OU8 IHSS DESCRIPTION

IHSS Number: 150.3
IHSS Name: Radioactive Leak Between Buildings 771 and 774

Date/Duration of Occurrence: 1971

Description of Incident: Contamination in the area between Buildings 771 and 774 is a result of leaks from process waste lines in the area.

The tunnel between Buildings 771 and 774 was built during construction of the buildings in 1952. The tunnel was originally built as an exhaust ventilation duct for Building 774[1], and contains process waste lines.

The interior of the tunnel is 3.4 feet square. It is constructed of 8-inch-thick removable concrete slabs with a copper water seal at the joints. The tunnel is approximately 175 feet in length and slopes evenly from the east side of Building 771, where the tunnel has an interior floor elevation of 5,963 feet, to the west side of Building 774, where the tunnel has an interior floor elevation of 5,939.66 feet. The tunnel has a periscope-type shape on the west end, where it raises sharply and enters Building 771 at an elevation of 5,974.7 feet[2]. The tunnel also "doglegs," running east/west on the west end of the tunnel, and then angling to the northeast on the east end of the tunnel. The land surface in the area of the tunnel has been modified as a result of construction activities over the years. When the tunnel was originally built, the ground surface to the north of the tunnel was relatively flat as compared to the present topography; currently, the ground surface slopes steeply to the north. As a result, the tunnel now is partially exposed at the ground surface. It should also be noted that there are overhead pipes in the 771/774 courtyard.

In August 1971, leaks of liquid into a Building 771 room, which was adjacent to the west end of the tunnel, were attributed to releases from the process west lines coming through the wall where the pipes entered the building[3]. Also in August 1971, contaminated soil was removed from beneath the tunnel[4], which was almost fully exposed on the north side at the time[5]. It is unknown if the soil removal was a response to the leaks into Building 771.

During construction activities in September 1971, the tunnel was exposed. The activities were in support of construction of the annex between Buildings 771 and 774. Three cracks in the tunnel were found to be contaminated, and were subsequently sealed. Eight drums of plutonium-contaminated soil, with approximately 24 dpm/g activity, were removed September 1971[6]. Cleanout and decontamination of the tunnel was completed by January 7, 1972. Repair of the cracks, as well as pipe replacement, were to be done at a later date. It was believed at the time that some contamination would remain in the concrete[7]. Samples of wastewater from the pipeline indicated activity of 1,000 pCi/l[8].

Radiometric Survey Results

The results of the Radiometric Survey, performed at the RFP during the late 1970s and early 1980s, indicate no extremely contaminated areas (stated to be 500,000 to 1,000,000 pCi/g)[9] around the Building 771/774 tunnel.

IHSS Boundary

The boundary of this IHSS, as presented in the IAG, includes a rectangular area against the west side of Building 774. The boundaries should instead include an area surrounding the tunnel, since contamination in the area is a result of leaks from the process waste lines contained in the tunnel.

Other IHSSs of Concern: IHSS 146 is located east of IHSS 150.3, and includes an area affected by process waste tanks which were south of the original Building 774. The description of IHSS 146 was included in a previous OU8 submittal.

References

[1] Owen, J.B., and L.M. Steward, Dow Company, 1974, "Environmental Inventory - A Historical Summation of Environmental Incidents Affecting Soils At or Near the U.S.AEC Rocky Flats Plant," Internal Report, January 29.

[2] Austin Company, 1952, As-Built Drawing RF-74-S4-B, "Concrete Tunnel - Concrete Storage Tanks," No Changes, Drawn and Approved June 27.

[3] Author Unknown, 1971a, Log Book Entry, August 12.

[4] Author Unknown, 1971b, Log Book Entry, August 13.

[5] EG&G, 1971, Rocky Flats Photo Negative Number 15422-02, July 23.

[6] Piltingsrud, C.W., Dow Company, 1971, "Status Report -- Health Physics -- August, 1971," Internal Letter to J.F. Willging, Dow Company, September 8.

[7] Putzier, E.A., Dow Company, 1972, "Status Report -- Health Physics Operations -- December, 1971," Internal Letter to J.F. Willging, Dow Company, January 7.

[8] Dow Chemical Company?, 1972, "Minutes of Information Exchange - Dow Chemical U.S.A., Rocky Flats Division and State of Colorado Department of Health," January 18.

[9] Setlock, G.H., 1988, "Request for Detailed Report on Radiometric Survey," Internal Letter to Tom Greengard, August 19.

OU8 IHSS DESCRIPTION

IHSS Number: 150.4
IHSS Name: Radioactive Leak East of Building 750

Note: This IHSS should be located west of Building 750.

Date/Duration of Occurrence: Early 1980s

Description of Incident: The area west of Building 750 is believed to have been contaminated due to decontamination activities in Building 776/777 following the 1969 fire and/or from "leaking manholes" in the area.

Building 750 is located south of the east side of Buildings 776/777 and 778, and east of Building 707.

CEARP interviewees recalled that decontamination equipment, such as trucks, was staged in the 750 Courtyard, and that manholes had "leaked" in the same area[1]. According to former RFP personnel, the area referred to as the 750 Courtyard was the area between Buildings 750 and 707, west of Building 750[2].

No documentation was found which confirmed the staging of decontamination equipment near Building 750. Present and former RFP employees did not recall the use of the area for such activities [2,3,4].

No documentation regarding "leaking" manholes was found; however, the leak described in the following discussion may be the incident to which the interviewees were referring.

During routine foundation drain and sump sampling in 1980 and 1981, elevated levels of total dissolved solids, conductivity, gross alpha and gross beta were found in a sump located south of Building 778[5] just outside Door 3, in an area that would be considered to be in the 750 Courtyard. These high levels were discovered during the week ending November 20, 1981[6]. Investigation into the high levels resulted in the finding of a leaking process waste line located above the sump. The leak was repaired. Specific isotopic analyses indicated 900 pCi/l uranium and no plutonium[5]. Whether the analyses were performed on soil or water was not specified. No documentation regarding soil removal or other cleanup activities was found.

This area may have also been affected by airborne contamination during the 1969 fire. Details of this contamination are included in the IHSS 150.7 description.

It is doubtful that decontamination vehicles were staged in the 750 Courtyard, because, to the knowledge of RFP personnel involved in cleanup after the fire, this area was not used for vehicle staging; however, if such activities did occur, it is unlikely that the environment was impacted, or that any residual contamination remains, because detailed documentation exists for the fire cleanup, and if contamination had been found, it is likely that it would have been recorded. Therefore, it is suggested that this IHSS include only the area around the process waste line leak.

Radiometric Survey Results

The results of the Radiometric Survey, performed at the RFP during the late 1970s and early 1980s, indicate no extremely contaminated areas (stated to be 500,000 to 1,000,000 pCi/g)[7] in the 750 Courtyard.

IHSS Boundary

The boundary of this IHSS, as presented in the IAG, includes the whole courtyard area. Because it is doubtful that firefighting vehicles were staged in this area and the process waste leak is the only incident which may have contributed to residual contamination, this IHSS should include only the area in which the process waste leak occurred.

Other IHSSs of Concern: IHSSs 150.7, 185 and 194 are in the vicinity of IHSS 150. IHSS 150.7 is an area south of Building 776/777 affected by the 1969 fire. The description for IHSS 150.7 is included in this submittal. IHSS 185 is an area which may have been affected by a solvent spill on the southeast dock of Building 707. IHSS 194 is an area affected by a steam condensate line break near Building 707. The HRR PAC Descriptions for IHSSs 185 and 194 are attached.

References

[1] Ferenbaugh, R., K. Rea, and L. Walker, 1985, "CEARP Phase I Interview Notes - Rocky Flats Plant," April 16.

[2] Rose, C., Retired RFP Employee, 1992, Personal Interview, August 14.

[3] Epp, J., Retired RFP Employee, 1992, Personal Interview, August 18.

[4] Hobbs, F., RFP Employee, 1992, Personal Interview, August 17.

[5] Hoffman, N.D., 1981, "Water Quality Data for Foundation Drains and Building Sumps from 1977 Through 1981 (Draft)," December 17.

[6] Hornbacher, D.D., 1981, "Environmental Analysis Weekly Highlights Week Ending November 20, 1981," Internal Letter to Crites, T.R., November 20.

[7] Setlock, G.H., 1988, "Request for Detailed Report on Radiometric Survey," Internal Letter to Tom Greengard, August 19.

PAC REFERENCE NUMBER: 700-185

IHSS Reference Number: 185, Operable Unit 16

Unit Name: Solvent Spill

Approximate Location: N750,000; E2,084,000

Date(s) of Operation or Occurrence

November 10, 1986[1,2,3]

Description of Operation or Occurrence

The fork of a forklift punctured a 55-gallon drum of trichloroethane on the southeast dock of Building 707, causing approximately 4 gallons of the solvent to leak onto the ground.[1,2,3]

Physical/Chemical Description of Constituents Released

The punctured drum contained trichloroethane.[1,2,3]

Responses to Operation or Occurrence

Four bags of absorbent were used to clean up the spill.[1,2,3] Material was cleaned up and placed in drums by the Fire Department and taken to Hazardous Storage.[3]

Fate of Constituents Released to Environment

No documentation was found which detailed the fate of the constituents. This IHSS is being studied in accordance with the IAG schedule for OU16, Low Priority Sites. The Final No Further Action Justification Document for OU16 is to be completed by July 30, 1992.

Comments

None.

References

[1] 1500856
[2] 1501053
[3] 1501825

Other References of Interest

1502735

PAC REFERENCE NUMBER: 700-194

IHSS Reference Number: 194, Operable Unit 16

Unit Name: Steam Condensate Leak - 700 Area

Approximate Location: N750,000; E2,084,000

Date(s) of Operation or Occurrence

September 26, 1979[1,2,3]

Description of Operation or Occurrence

A steam condensate line break occurred in the Building 707 area. The water from the line break flowed into the surface water drainage through Pond B-4 to Walnut Creek (PAC NE-142.5 - NE-142.9).[1,2,3]

Physical/Chemical Description of Constituents Released

The steam condensate contained tritium at approximately 1,000 pCi/l.[1,2,3]

Responses to Operation or Occurrence

On September 27, surface water drainage was diverted to Pond B-1 and the valve to Pond B-5 was closed.[1,2,3]

Fate of Constituents Released to Environment

Water samples from Pond B-4 ranged from less than or equal to 524 to approximately 926 pCi/l for tritium. Samples from Walnut Creek at Indiana showed 1,163 pCi/l for a 24 hour composite covering September 26, 1979 and approximately 700 pCi/l in a grab sample taken on September 27, 1979.[1,2]

This IHSS is being studied in accordance with the IAG schedule for OU16, Low Priority Sites. The Final No Further Action Justification Document for OU16 is to be completed by July 30, 1992.

Comments

None.

References

[1] 1501006
[2] 1501225
[3] 1600219

Other References of Interest

1502735

Other IHSSs of Concern: The descriptions for IHSS 150.7, which is located east of IHSSs 150.6 and 150.8 and IHSS 138 are included in this submittal.

References

[1] Hornbacher, D.D., Retired RFP Employee, 1992, Personal Communication, August 13.

[2] Authors Unknown, 1969, Two Log Book Entries, June 22.

[3] Setlock, G.H., 1988, "Request for Detailed Report on Radiometric Survey," Internal Letter to Tom Greengard, August 19.

OU8 IHSS DESCRIPTION

IHSS Number: 150.7
IHSS Name: Radioactive Leak South of Building 776

Date/Duration of Occurrence: 1969

Description of Incident: Contamination on the south side of Buildings 776 and 778 is a result of the 1969 fire in Building 776/777.

As a result of the May 11, 1969 fire in Building 776/777, outdoor areas surrounding the building were contaminated with plutonium due to extinguishing activities in the area and smoke. Areas north, west, and south of the building were contaminated. The area north of the building is included in IHSS 131, which pertains to contamination resulting from a 1964 explosion incident, as well as the 1969 fire. The area west of the building is included in IHSS 150.2, which pertains to contamination resulting from the 1957 and 1969 fires. The following discussion emphasizes contamination on the south side of Building 776/777 resulting from the 1969 fire.

Alpha direct survey techniques were used to delineate contaminated areas following the fire and during cleanup activities.[1] A detailed study of contamination resulting from the fire was completed by May 1971.[2]

Building 778, a laundry facility, is south of Building 776/777. The distance between the two buildings is approximately 35 feet, and the buildings are connected with enclosed walkways. Most of the outdoor contamination south of Building 776/777 resulting from the 1969 fire occurred between these buildings. Contamination was found on the ground south of Building 776/777, as well as on the ground south of Building 778, to the north wall of Building 707.[3] Contamination was detected in the soil approximately 200 feet from Building 776/777.[1] The walkway area between Buildings 776/777 and 778 was contaminated to 200,000 cpm direct and 5,000 cpm removable.[4]

Initially, soil in the area was covered with road oil and gravel.[2] The exact location of this soil is unknown. By December 1969, asphalt in the area and the covered soil had been removed from between the buildings and buried in a location east of Building 881.[5] This area is IHSS 130. The walkway between Buildings 776/777 and 778 was removed in October 1971.[4] No documentation was found which further details decontamination activities of the area between the buildings, nor was any documentation found which details cleanup of the area south of Building 778.

In 1972, the soil at the southwest corner of Building 776/777 was considered to be contaminated.[6] The levels and source of this contamination are unknown, and it is not known if it is related to the 1969 fire.

One reference indicated that Building 779 was also contaminated slightly, but whether the contamination occurred inside or outside the building was not stated.[1]

The area south of Building 778, which is included in IHSS 150.4, may also be contaminated due to other incidents. See the description for IHSS 150.4 for further details of contamination in the area.

Radiometric Survey Results

The results of the Radiometric Survey, performed at the RFP during the late 1970s and early 1980s, indicate no extremely contaminated areas (stated to be 500,000 to 1,000,000 pCi/g)[7] south of Building 776/777.

IHSS Boundary

The boundary of this IHSS, as presented in the IAG, includes the area between Buildings 776 and 778. Maps showing the area of contamination, produced during and after cleanup activities, indicate that the affected area extended to the north wall of Building 707. The boundaries of this IHSS now encompass the area indicated on the maps as being contaminated.

Other IHSSs of Concern: IHSS 118.2 is located south of Building 776, and is a result of solvent spills. IHSS 150.4 is located south of Building 778, and is a result of a process waste line leak. The description for IHSS 150.4 is included in this submittal.

References

[1] Author Unknown, 1970?, "Exposure Control During a Massive Decontamination."

[2] Joshel, L.M., 1971, "Ad Hoc Review of Rocky Flats Waste Problems," Letter to Abbott, F.E., May 28.

[3] Atomic Energy Commission?, 1971, "Rocky Flats Data Sheet - Fires," January 29.

[4] Author Unknown, 1971, Log Book Entry, October 1.

[5] Freiberg, K.J., 1969, "Health Physics Monthly Status Report - Operations Group Technical and Construction - November, 1969," Internal Letter to Putzier, E.A., December 12.

[6] Illsley, C.T., 1972, "Project RF 399051, Restoration of Production Facility," Letter to Graeper, W.G., January 28.

[7] Setlock, G.H., 1988, "Request for Detailed Report on Radiometric Survey," Internal Letter to Tom Greengard, August 19.

OU8 IHSS DESCRIPTION

IHSS Number: 163.1
IHSS Name: Radioactive Site - 700 Area Site #3 - Wash Area

Date/Duration of Occurrence: Unknown

Description of Incident: CEARP interviewees recalled that an area north of Building 774 was used for washing radioactively contaminated equipment and vehicles. Personnel would use nitric acid, soap, and water for the cleaning, and the solution would flow onto the ground.[1] A former RFP employee contacted during this OU8 study recalled that the cleaning of trucks occurred near the dock at the northeast corner of the building.[2]

It has always been an RFP policy that extreme care be exercised for the protection of the workers and of the environment. An event that would have released radioactively contaminated liquid onto the ground and allowed to runoff into the surrounding environment is not consistent with this policy. It was the purpose of the RFP Site Survey Group to monitor outdoor activities and events for the presence of radionuclides. Interviews were held with two retired Site Survey monitors who were with the RFP from the 1950s until the 1980s. These individuals would have been aware of radioactively contaminated vehicles and equipment being decontaminated outside of buildings. They could not recall any activity similar to this description having happened and could not believe that it could have without their knowledge. Furthermore, on occasion, when a vehicle became contaminated, it was either decontaminated at the location of the incident to reduce the potential for contamination spread or, if safe, it was taken to a suitable onsite location for decontamination. Building 774 may have been suitable for the decontamination of some equipment because of the accessibility of the docks. Decontamination of vehicles was performed by wiping the surfaces with kimwipes and then monitoring until the surface was clean. The vehicle was not cleaned by being hosed down. There was no resulting wash water which could penetrate the asphalt or soil. The area around the decontamination site was monitored afterward and cleaned up if contamination was detected.

Radiometric Survey Results

The results of the Radiometric Survey, performed at the RFP during the late 1970s and early 1980s, indicated no extremely contaminated areas (stated to be 500,000 to 1,000,000 pCi/g)[3] northeast of Building 774.

IHSS Boundary

The area adjacent to the east dock of Building 774 may have been used for the cleaning of noncontaminated materials but there is no evidence that it was used for the cleaning of radioactively contaminated vehicles. To allow radioactively contaminated wash water to flow into the environment would have been against the operating procedures that were employed at the RFP since its inception. The site has routinely been monitored prior to construction activities or other intrusive activities and with all of the construction and paving activities that have occurred, any residual radioactivity in this area would have been detected. The site-wide radiometric survey did not detect any extremely high levels of activity in the area. For these reasons, it is proposed to eliminate this IHSS from further remedial investigations.

Other IHSSs of Concern: IHSSs 139.1 and 149, which pertain to caustic releases and abandoned waste lines, respectively, are also located northeast of Building 774.

References

[1] Ferenbaugh, R., K. Rea, and L. Walker, 1985, "CEARP Phase I Interview Notes - Rocky Flats Plant," April 16.
[2] Maas, M., Retired RFP Employee, 1992, Personal Interview, August 18.
[3] Setlock, G.H., 1988, "Request for Detailed Report on Radiometric Survey," Internal Letter to Tom Greengard, August 19.

OU8 IHSS DESCRIPTION

IHSS Number: 173
IHSS Name: Radioactive Site - 900 Area

Date/Duration of Occurrence: Late 1950s, Early 1960s

Description of Incident: The "south dock" of Building 991 may have residual contamination resulting from loading/unloading and washing activities in the area. The vaults associated with Building 991 may also be contaminated due to storage activities and structural problems.

Building 991 was the first active building at the RFP and was used for storage and loading/unloading of finished products. According to former RFP employees, the "south dock" is actually located on the west side of Building 991,[1] and is referred to as "south" because it is located south of the tunnels to Buildings 996 through 999, to and from which loading/unloading operations were being conducted.

The south dock was used for loading and unloading assembly components into the vaults, Buildings 996 through 999. According to former RFP employees, the dock and courtyard were often washed down with water, which could seep into cracks and the edge of the asphalt.[1]

Cleaning of depleted uranium parts was conducted in the courtyard of Building 991, which is located on the west side of the building near the dock, in the late 1950s and early 1960s. Acetone and solvents were used for cleaning of parts and the spent cleaning solutions were stored in drums and removed for disposal. Spills and water could have drained into storm drains.[2] These washing activities were conducted along the north wall of the asphalted courtyard.[3]

The storage vaults and tunnels associated with Building 991, Buildings 996 through 999, are used for storing finished uranium, plutonium, and beryllium parts prior to offsite shipment. The finished product was not considered radioactive because the components were plated with nickel. The vaults have reportedly been subject to infiltration of groundwater.[4] The structural integrity of the vaults was compromised during construction of Building 771, due to heavy equipment driving over the area.[3] According to a recent newspaper article, water is entering the tunnels through fractures in the walls, ceiling, and floors. Materials being stored in the area will be removed as a safety precaution.[5]

Radiometric Survey Results

The results of the Radiometric Survey, performed at the RFP during the late 1970s and early 1980s, indicate no extremely contaminated areas (stated to be 500,000 to 1,000,000 pCi/g)[6] around the south dock of Building 991.

IHSS Boundary

The IAG boundary for this IHSS includes all of Building 991 and its surrounding areas. Contaminated areas underlying and surrounding the vaults and tunnels of Building 991, as well as the building itself, will be remediated as Under Building Contamination (UBC) 991 as indicated in the final Historical Release Report of June 1992; therefore, it is proposed that this

OU8 IHSS DESCRIPTION

IHSS Number: 184
IHSS Name: Building 991 Steam Cleaning Area

Date/Duration of Occurrence: Unknown

Description of Incident: An area southwest of Building 991, near Building 992, was used for the steam cleaning of equipment and drums. It was reported in CEARP Phase 1 that some of the equipment may have been radioactively contaminated. Steam cleaning of radioactively contaminated equipment may have been conducted in an area southwest of Building 991, near Building 992, the Guard Post. It was stated that the wash water was collected in a sump and then transferred to the process waste system.[1] No former or present RFP personnel were found which recalled the steam cleaning of radioactively contaminated materials in this area.

CEARP interviewees recalled that there was a small contaminated spot on the ground that was cleaned up. Approximately 3 feet were excavated during cleanup. It was stated that this occurred on the north side of Central Avenue, southwest of Building 991;[2] however, the exact location was not stated. Many spots of contamination had been detected in the past in soil along Central Avenue in this area due to the presence of the Mound, Trench No. 1, and Oil Burn Pit No. 2. It is unlikely that the 3 feet of contaminated soil was associated with the steam cleaning activities.

Radiometric Survey Results

The results of the Radiometric Survey, performed at the RFP during the late 1970s and early 1980s, indicate no extremely contaminated areas (stated to be 500,000 to 1,000,000 pCi/g)[3] southwest of Building 991.

IHSS Boundary

The boundary of this IHSS, as presented in the IAG, is around the Building 992 Guard Post. No documentation delineates the location of washing activities; however, the paved area between Building 992 and the south dock may have been used for steam cleaning. It is proposed to extend the boundaries to include the paved area and not the Guard Post.

Other IHSSs of Concern: IHSS 173 is near IHSS 184. The description for IHSS 173 is included in this submittal.

References

[1] U.S. Department of Energy, 1987, "Appendix 1, Resource Conservation and Recovery Act 3004(u) Waste Management Units," Revision No. 1, December 15.
[2] Ferenbaugh, R., K. Rea and L. Walker, 1985, "CEARP Phase I Interview Notes - Rocky Flats Plant," April 16.
[3] Setlock, G.H., 1988, "Request for Detailed Report on Radiometric Survey," Internal Letter to Tom Greengard, August 19.

OU8 IHSS DESCRIPTION

IHSS Number: 188
IHSS Name: Acid Leak

Date/Duration of Occurrence: 1983

Description of Incident: CEARP interviewees recalled an incident near the east gate of Building 374 in which a drum containing nitric acid and hydrochloric acid leaked. The area was unpaved at the time of the incident.[1]

No documentation regarding the incident or cleanup activities was found. The incident is not mentioned in the Summary of Events or Environmental Analysis Weekly Highlights for the 1983 timeframe nor were any event-specific reports found which detail the incident.

Employees who were in positions to have responded to such an incident do not recall this incident and state that they knew of no reason why a drum containing acids would have been in the area of Building 374.[2,3]

Radiometric Survey Results

The results of the Radiometric Survey, performed at the RFP during the late 1970s and early 1980s, indicate no extremely contaminated areas (stated to be 500,000 to 1,000,000 pCi/g)[4] around Building 334.

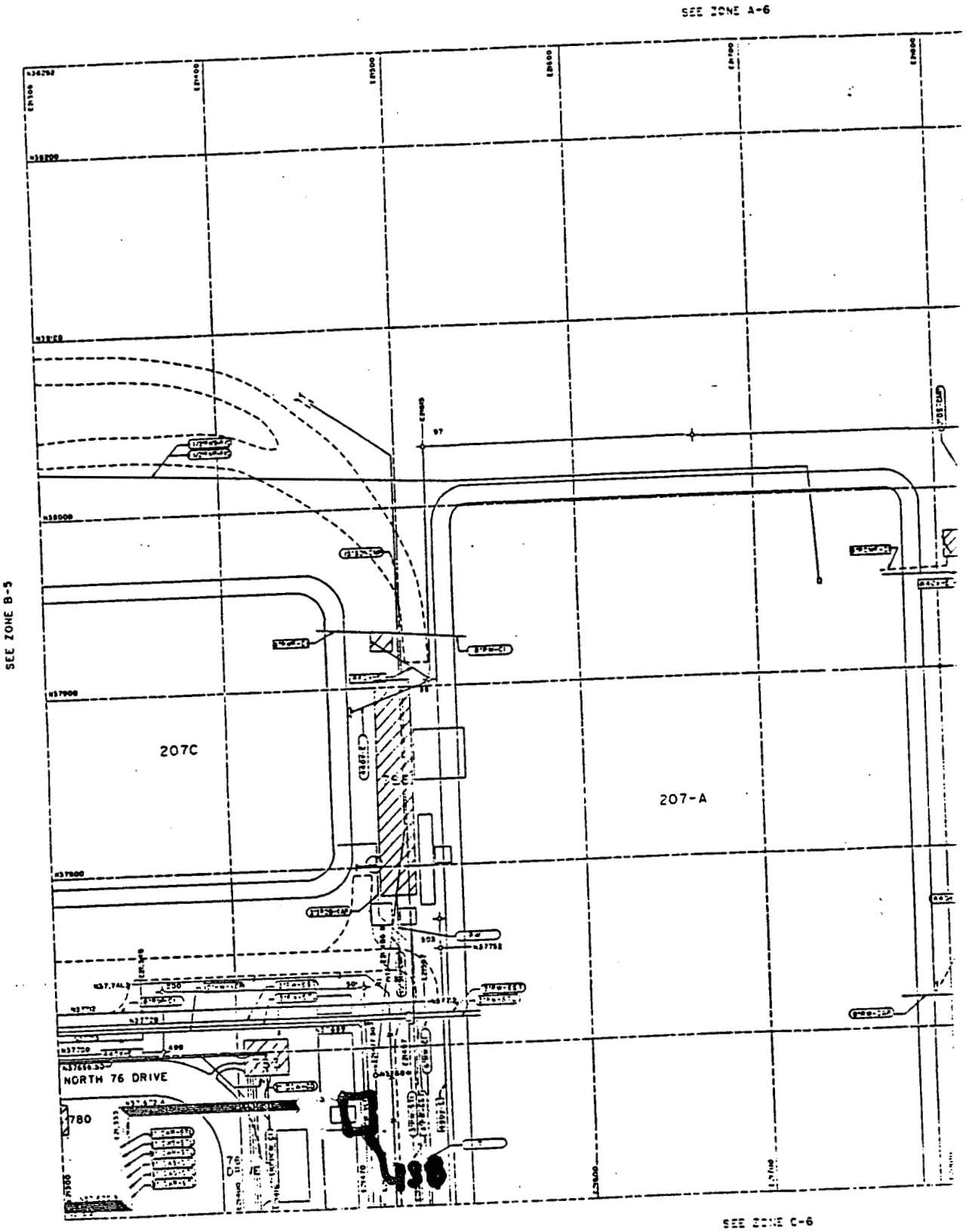
IHSS Boundary

Because no documentation was found which delineates the location of the incident, the existing IHSS boundaries could not be verified. The occurrence of this incident could not be confirmed so it is not unlikely that this incident ever occurred.

Other IHSSs of Concern: No other IHSSs have been identified in this area.

References

[1] U.S. Department of Energy, 1987, "Appendix 1, Resource Conservation and Recovery Act 3004(u) Waste Management Units," Revision No. 1, December 15.
[2] Hawes, R., Retired RFP Employee, 1992, Personal Interview, August 31.
[3] Hewitt, G., Retired RFP Employee, 1992, Personal Interview, August 21.
[4] Setlock, G.H., 1988, "Request for Detailed Report on Radiometric Survey," Internal Letter to Tom Greengard, August 19.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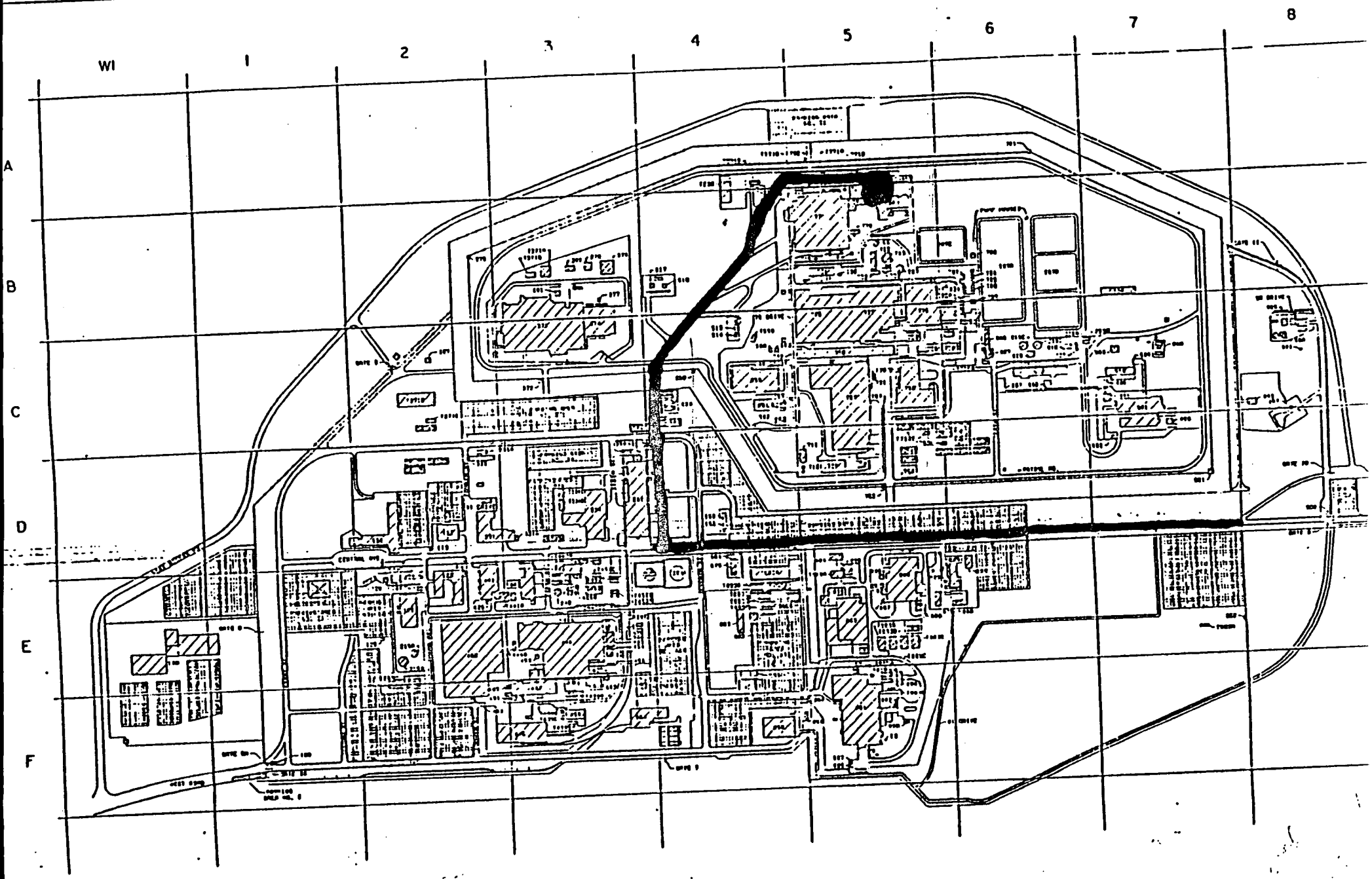

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April 14, 1992
1801-17

Mr. Jim Shaffer
Advanced Sciences, Inc.
405 Urban Street
Suite 401
Lakewood, CO 80228

Subject: OU8 Deliverable

Dear Mr. Shaffer:

Enclosed is a current description for IHSS 150.1 in OU8.

I am also providing supplemental information on IHSSs 118.1, 132, 139.2, 144, and 159. This additional information primarily presents more details regarding the depth and construction of tanks and pits. The exception to this is IHSS 139.2 in which we present information on a very similar potential area of concern in the immediate vicinity of IHSS 139.2. This other potential area of concern also involves acid, although the specific acid is nitric, not hydrofluoric. With regard to IHSS 151, the information in the HRR is accurate enough to use. I have included a computer disk with this information on it.

Please call if you have any questions or comments.

Sincerely,
DOTY & ASSOCIATES

Frank J. Blaha

Frank J. Blaha

OU13 IHSS DESCRIPTIONS
SUPPLEMENTAL INFORMATION

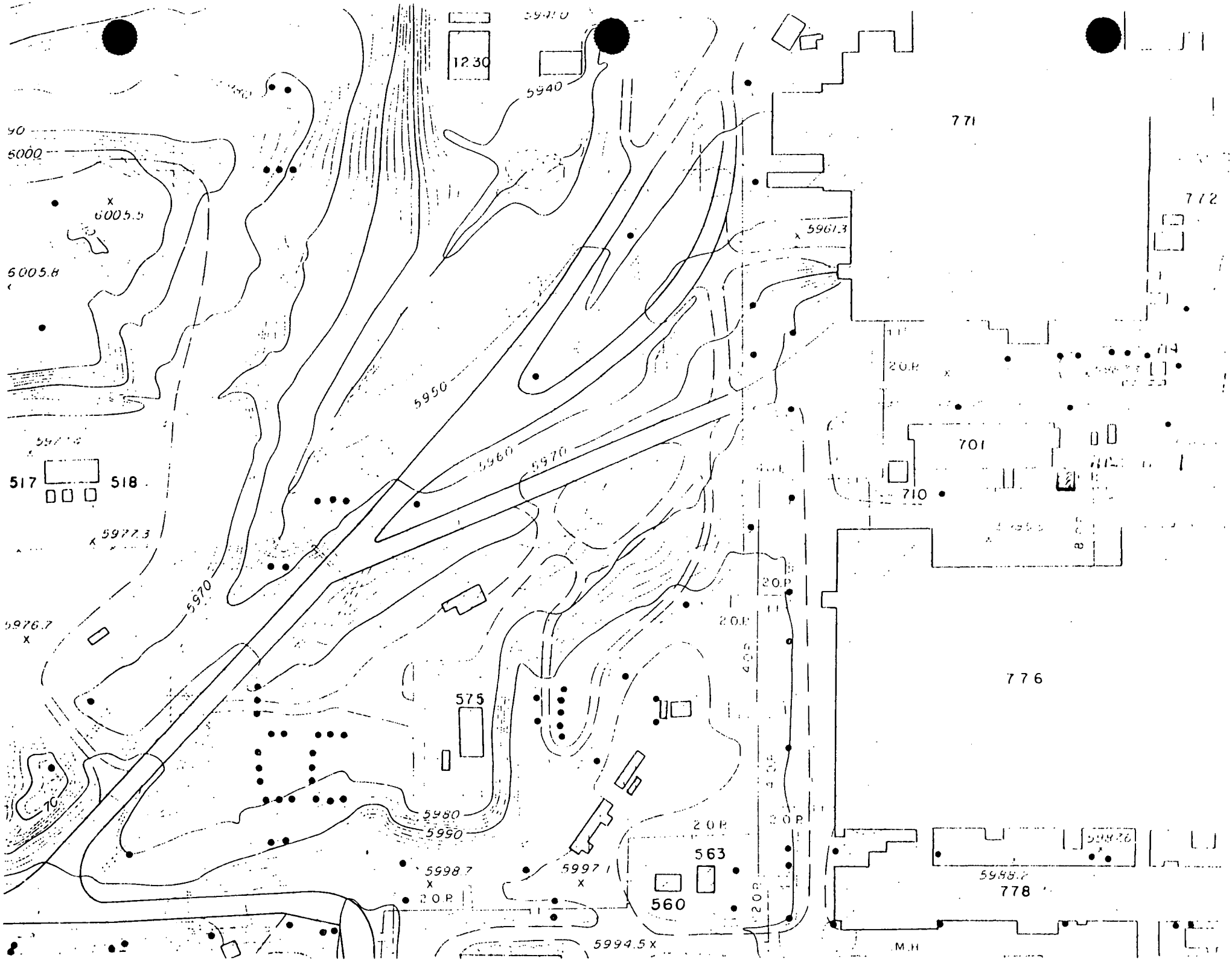
IHSS Number: 118.1

IHSS Name: Multiple Solvent Spills West End of Building 730

The steel carbon tetrachloride tank associated with this IHSS was removed in the early 1980s. Recently obtained drawings, including D-13491A, D-13492A, and D-13493A, provide dimensions and details of the tank which may be of importance when planning the environmental investigation of the area.

The length of the tank (north/south) was approximately 14 feet and the diameter of the tank was approximately 8 feet. The south end of the tank was enclosed in a concrete structure with which provided maintenance access and encased the piping. The dimensions of the concrete structure was approximately 6 feet by 12 feet in plan view and 12 feet deep. The wall thickness was approximately 0.75 feet. An 18 inch square sump pit located in the southwest corner at the bottom of the structure provided drainage. The bottom elevation of the interior of the structure was at 5976 feet and the top of the structure was at 5988 feet. The ground surface around the structure was approximately 1 foot below the top of the structure.

This structure encased only approximately 3 feet of the south end of the tank. The tank was supported by the concrete structure and a concrete footing approximately 3 feet wide located at the north end. It is unclear from the design drawings how deeply the north portion of the tank (that was not enclosed in the structure) was buried. The material which had surrounded the north portion of the tank is unknown.



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OU13 IHSS DESCRIPTIONS
SUPPLEMENTAL INFORMATION

IHSS Number: 139.2

IHSS Name: Hydrofluoric Acid Tank Area

There is a portable, refillable nitric acid dumpster located just north and west (approximately 25 feet) of the hydrofluoric acid storage area discussed in the IHSS 139.2 description. More precisely, the dumpster is located at the southeast corner of Building 771. It is possible that leaks and spills in the vicinity of the dumpster have impacted the environment, as well as those affects on the environment resulting from incidents at the hydrofluoric acid supply area. Low pH soils and groundwater in the area at the hydrofluoric acid tank may be due to releases of hydrofluoric acid, nitric acid, or both.

According to Supervisor Investigation Report #87-7-771.1 - Acid Spill, there was a release of approximately 35 gallons of 12 normal nitric acid at the dumpster on July 1, 1987. The cause was a leak in the supply hose. Neutralization was attempted by the use of potassium hydroxide flake and sodium bicarbonate. The following day, the soil was loosened and more sodium bicarbonate was added. An asphalt layer was discovered approximately 6 inches below the ground surface. The effected soil was removed, and new road mix was to be placed on the asphalt pad.

The dumpster involved supplies nitric acid to the Building 771 chemical makeup area. The acid is delivered to the 218 tank farm near Building 444 by an outside supplier. One of two available dumpsters is picked up at Building 771, taken to the bulk supply, and filled by Building 774 Chemical Operators. The dumpster is then returned to Building 771. This process occurred on a daily basis when Building 771 was operational as a plutonium recovery facility.

OU13 IHSS DESCRIPTIONS
SUPPLEMENTAL INFORMATION

IHSS Number: 144 (also pertains to IHSS 132)

IHSS Name: Sewer Line Break

Building 730 is the location of tanks discussed in IHSS 132 and 144. Recently obtained engineering drawings, specifically D-13493 and 28714-X51, provide additional information about these tanks.

The tanks are underground concrete tanks which are beneath a pumphouse. To gain access to the pumphouse, one must go through a ground-level doorway and descend 9.67 feet down stairs. At this level, one is essentially standing on the tanks, which have manhole covers.

Specific dimensions are as follows. The top of the pumphouse, which is slightly above the ground surface, is at an elevation of 5988.0 feet. The floor of the pumphouse, also the roof of the tanks, is at an elevation of 5978.33 feet. The base of the tanks are approximately 12 feet below the floor of the pumphouse, indicating an approximate base elevation of 5966.33 feet. The concrete surrounding the pumphouse and tanks is approximately 1 foot thick.

OU13 IHSS DESCRIPTIONS
SUPPLEMENTAL INFORMATION

IHSS Number: 159

IHSS Name: Radioactive Site - Building 559

Recently-obtained engineering drawings, specifically 39163-201 and 38551-206, provide additional information pertaining to the tanks located in Building 528.

The tanks are located in a "pit" which has a 16-inch thick concrete floor and 16-inch thick concrete walls. The base of the pit is at an elevation of 5,976.50 feet, while the ground surface in the area is at an elevation of 5,998.0 feet. The tanks stand on legs, approximately 3.125 feet high. Access to the tanks requires the use of stairs, which descend to the east. The sump, which is located on the east end of the pit, is 4 feet deep, 3.5 feet wide, and has 1-foot thick concrete walls.

OU8 IHSS DESCRIPTIONS

IHSS Number: 150.1
IHSS Name: Radioactive Leak North of Building 771

Date/Duration of Occurrence: 1957 - 1974

Description of Incident: Wastes from Building 771 and materials to be reprocessed in Building 771 were frequently handled and stored in the area north of the building. Building 770, north of Building 771, was built prior to 1964 and was used as a residue storage area in the past. Information for the development of the following discussion was gathered from the review of documents and historical engineering drawings as well as photographs and visual observation of the site. Several discrepancies were identified with the discussion in RCRA 3004(u).

General Physical Setting

The north side of Building 771 has been paved since 1952. The drive along the north side of the building served as the main access road to Buildings 771 and 774. Building 771 was one of the original buildings and has had several additions built onto it since it was first constructed. The building's main function has been plutonium recovery. Building 770 was constructed sometime prior to 1964 and has its main entrance on the west side. The west and north sides were initially paved. The south side of the building is now paved as well. A grass-lined ditch is beyond the east side of the building. The area north of Building 770 was altered during construction of the Protected Area (PA) and a road, although it is not known if any soil was removed. [illegible]

A small prefabricated building used for storage is located west of Building 770. This building was present in 1969 photographs and has been used for equipment storage. No documentation was found relating any incidents of contamination to this small building.

Incidents of Contamination

Through the course of the heavy use this area received, several unrelated incidents have occurred which impacted the area. Brief descriptions of these follow.

On September 11, 1957, the RFP's first major fire occurred in Building 771. A plenum was breached releasing an unknown amount of radioactivity around the building, particularly to the

north. The impact the airborne radioactivity may have had on the access road was not quantified; however, fire clean-up activities followed the incident.

From approximately 1962 until approximately 1968, a 5,000-gallon stainless steel tank was located approximately 30 feet north of Building 771. The tank was on 6-foot legs and was approximately 8 feet in diameter. Two overhead pipes from Room 114 in Building 771 connected to the tank; one of which was a vacuum vent to control transfer in and out of the other. The tank was used in the Filtrate Recovery Ion Exchange system which concentrated plutonium and americium for recovery. Americium concentrated on an ion exchange column and was transferred at a predetermined concentration to the tank. The resulting liquid contained in the tank was a nitrate solution high in americium with some plutonium.[1]

In approximately 1968, a pinhole leak developed in the tank and dripped onto the slab foundation. The tank was temporarily sealed to mitigate the leak until the tank could be emptied through the processing of the contained solution. Once emptied, the tank was taken out of service and remained in place until it was moved to the size-reduction facility in Building 776 sometime shortly after. Once size-reduced, the tank was disposed of as radioactive waste. When the tank was removed to the size-reduction facility, the concrete slab was decontaminated until the point where smear samples did not detect further removable radioactivity. Paint was applied to the concrete to secure the fixed radioactivity. The slab was moved to a ditch directly north of the area and buried (IHSS 163.2). The area was paved sometime prior to June 1969.

On June 11, 1968, during the removal of drums from the 903 Storage area, a drum leaked on the roadways as it was being transported to Building 774. The forklift carrying the leaking drum traveled across the access road north of Building 771. The area near Building 774 was contaminated at the time. The road in front of Building 771 was apparently not considered to be impacted by the incident. Further details of this incident are provided in the IHSS 172 description.

The paved area between Buildings 771 and 770 was used for the storage of residue in drums prior to processing in Building 771. A June 1969 photograph shows over one hundred drums stored in rows on the pavement. A fence parallel to Building 771 also encloses the west entrance to Building 770 and defines a storage area.[2] Drums were also stored in the courtyard south of Building 770 between the access road and the building. This location has since been altered because in the 1960s, there was a concrete embankment wall along the south and east sides of the courtyard and there is no embankment wall currently. Construction changes in this area are not clear. More information may be found regarding the physical alteration of the area. Drums

of waste from the 1969 fire in Building 776 were stored in the area for counting prior to shipment.[3]

Another specific incident of contamination occurred on November 16, 1970 when residue leaked out of a drum of filters as it was being transported from a storage area (triangle area east of the solar ponds) to Building 771 for processing. The ground area near the dock at Building 771 as well as the truck and cargo container the drum had come in contact with were all contaminated.[4] The leak was detected while in transit and the area was decontaminated.[5] It was noted in March 1971 that a significant increase in the number of "hot waste" drums were stored outside in the area north of Building 771. These drums contained residues for the Building 771 incinerator and the number of drums in storage was becoming problematic for the Health Physics Operations Group.[6]

On June 11, 1971, a leaking drum on the pavement caused the contamination of approximately 115 square feet of asphalt.[7] Soil and approximately 200 square feet of asphalt were removed for off-site disposal.[8] A recommendation was made to lease cargo carriers to protect the drums.[9] A waste drum was found to be leaking shortly after that on July 2, 1971 and was determined to contain nitric acid from non-line generated waste. A rainstorm spread the contamination affecting between 2,300 and 2,500 square feet of asphalt and gravel with levels of contamination ranging from 500 to 1,000,000 counts per minute plutonium. The incident prompted a request for additional cargo carriers and the use of Building 776 for storage.[10,11,12] It was subsequently determined that these incidents in June and July 1971 resulted in contamination of the area ranging from 100,000 to 300,000 dpm/100 cm^2 on the asphalt.[8]

In August 1972, a punctured scrap box stored inside Building 770 contaminated 3,600 square feet inside the building and 500 square feet outside. Levels of radioactivity ranged up to 200,000 dpm/cm^2. Removal of asphalt and soil for off-site disposal began immediately following the incident.[8] Finally, on September 15, 1972, a 55-gallon drum containing spent ion exchange resin residue leaked inside Building 770 onto the concrete floor. Contamination was tracked between Buildings 771 and 770 and covered 600 square feet including 50 drums and a forklift. Levels of contamination ranged from 5,000 to 100,000 counts per minute plutonium. The area was noted to be decontaminated but details of these activities were not found.[13]

The specific locations of these incidents were not recorded; however, the paved area north of Building 771 and west of Building 770 was used for storage in a structured manner since before 1969, and probably as early as 1964.[14] The storage area was bounded on the north by a fence which was parallel to Building 771 and jogged north to enclose the west entrance of Building

770. During the time of storage, the paved area still functioned as the access road for Buildings 771 and 774.

The material stored consisted primarily of residues which had a high plutonium content and were destined for plutonium recovery operations in Building 771. Materials were stored in drums on pallets or in cargo containers. No documentation was found which provided any hazardous waste characteristics which may have been associated with the plutonium residue. Decontamination activities conducted after specific incidents would have been focused on radioactive contamination. It is not unlikely that residual contamination from hazardous constituents may have remained.

Due to environmental concerns related to the clean-up activities at the 903 storage area and the triangle storage area, efforts were made sitewide in the early 1970s to move all radioactively contaminated materials to indoor storage. The Building 771 area was used for storage until approximately 1974 when Building 776 was used for such storage. Building 770 was then used for the storage of equipment and also a facility for equipment assembly prior to installation in other buildings.[1]

Radiometric Survey Results

The results of the Radiometric Survey, performed at the RFP during the late 1970s and early 1980s, indicate no extremely contaminated areas (stated to be 500,000 to 1,000,000 pCi/g)[15] north of Building 771.

*** ** ***

Air Considerations: No documentation was found identifying air monitoring in response to any release incidents.

Soil Consideration: Soil may have been exposed in the area directly around Building 770 and beneath the concrete foundation slab of the americium tank. These areas have subsequently been paved and were probably not monitored for hazardous constituent contamination. RFP procedures in 1972 required an alpha survey meter evaluation prior to excavation. Readings of greater than 250 cpm plutonium necessitated additional soil sample collection.[16] It is unknown if the preparation of soil for paving required the alpha survey. The soil beneath the pavement is compacted fill because the area had been a fairly steep hillside sloping to the north before the

area was developed. The thickness of the compacted fill material varies across the site and increases to the north.

Contamination from hazardous constituents which may have accompanied the radioactive contamination was not monitored. Contamination may exist beneath the pavement. The potential constituents, concentrations, and specific locations are unknown. Because contamination may have been in the area since at least 1968, the potential for migration and decomposition of the constituents exist.

Surface Water Considerations: Surface water on the pavement generally drains to the west. Prior to the mid 1960s, some surface runoff was able to drain into a strip of grass west of Building 770 between the access road and the Building 771 parking lot. The grass strip was reduced in width in the late 1960s and finally was paved entirely. The area immediately north of Building 770 has a grated collection channel which directs collected water to the east toward a small pond ("Bowman's Pond"). The water in the pond is collected in the Interceptor Trench Pump House system associated with the solar ponds.

Geologic Considerations: Several test wells were drilled in the area north of Building 771 in 1962 in preparation for the construction of an addition. One boring was located in the northeast corner of Building 771 and was drilled to a depth of 36 feet from an elevation of 5946 feet. Fill was to a depth of 1 foot, highly weathered claystone was to a depth of 15 feet and weathered claystone was to the bottom of hole. The water table was encountered at 6 feet although the date of the borings was not provided.

*** ** ***

Other IHSSs of Concern: IHSSs 146, 163.2, and 172 are all in close proximity to this IHSS. Descriptions of these are included in this OU8 workplan. IHSS 146 involved process waste and may have constituents similar in nature to IHSS 150.1. IHSS 163.2 is the buried concrete slab contaminated with americium from the 1968 incident. IHSS 172 involved a small amount of contaminated liquid that leaked onto the roadway in 1968.

Buildings 770 and 771 were proposed in the draft HRR to be designated as buildings suspected to have contamination underlying it due to the activities that occurred in the building.

References

[1] Personal Communication, Jack Weaver, RFP Employee, April 9, 1992.

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[3] Author Unknown, 1969, "Barrel Storage Area, Building 770 East," Attachment to Internal Authorization - Part III Justification, July 30.

[4] Locker, F.G., Jr., 1970, "Rocky Flats Division Executive Safety Committee Minutes," Internal Report, November 25.

[5] Irwin, K.W., 1971, "Report of Property Damage or Loss," Internal Report, January 5.

[6] Author Unknown, 1971, "Monthly Status Report - Health Physics Operations Group Buildings 771 and 774 - February 1971,", Internal Report to E.A. Putzier, March 9.

[7] Author Unknown, 1971, "Rocky Flats Division Executive Safety Committee Minutes," Internal Report, June 16.

[8] Owen, J.B. and L.M. Steward, 1973, "A Historical Summation of Environmental Incidents Affecting Soils at or near the U.S.AEC Rocky Flats Plant," October.

[9] Freiberg, K.J., 1971, "Health Physics Monthly Status Report - Operations Group Technical and Construction - June 1971," Internal Report, July 9.

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[11] Piltingsrud, C.W., "Status Report - Health Physics July 1971," Internal Report, August 10.

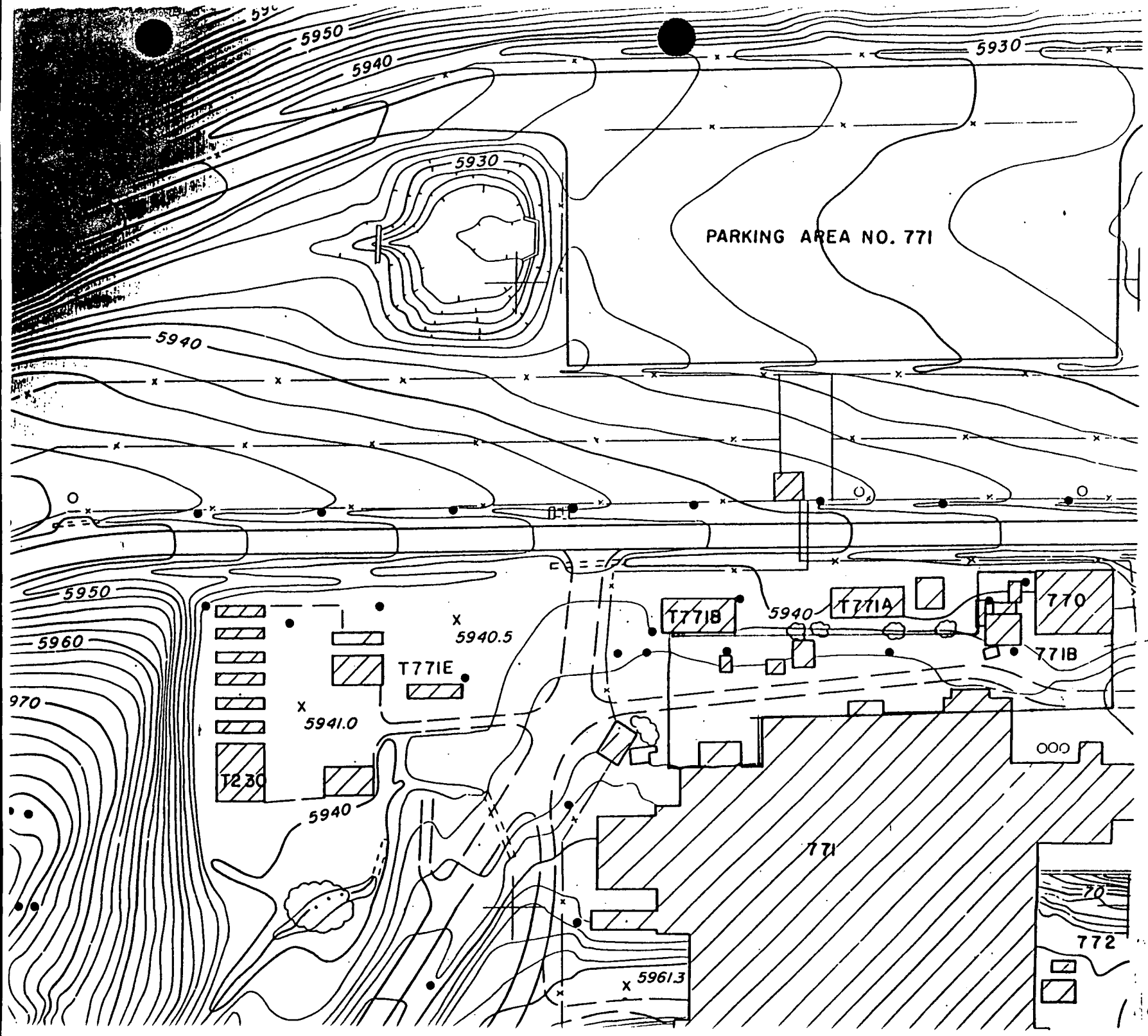
[12] Author Unknown, 1971, Monthly Status Report - Health Physics Operations Group, Buildings 771 and 774 - July 1971," Internal Report to E.A. Putzier, August 4.

[13] Ellis, C.W., 1972, ""Report of Property Damage or Loss," Internal Report, October 4.

[14] EPA Aerial Photograph, Frame No. VB BL 3-7, October 15, 1964.

[15] Setlock, G.H., 1988, "Request for Detailed Report on Radiometric Survey," Internal Letter to Tom Greengard, August 19.

[16] Bresson, J.F., 1972, "Policy on Soil Distribution at Rocky Flats," Internal Memorandum to File to R.L. Miller, AEC, April 3.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April 11, 1992
1801-17

Mr. Jim Shaffer
Advanced Sciences, Inc.
405 Urban Street
Suite 401
Lakewood, CO 80228

Subject: OU8 Deliverable

Dear Mr. Shaffer:

Enclosed are current descriptions for a number of IHSSs in OU8.

The specific IHSSs included in this submittal are 123.2, 126.1, 126.2, 144, 159, and 163.2. Having now completed IHSS 123.2, I can state that the facts as presented in the Historical Release Report (HRR) for IHSS 123.1 are accurate. The description of IHSS 123.1 from the HRR should now be used by ASI for your purposes. I have obtained a small amount of additional information on IHSSs 118.1 and 118.2, but this information has only served to verify that the locations and facts surrounding these two IHSSs as presented in the HRR are largely correct. I intend to visit the engineering department on Monday and try to obtain additional information that may be of use during our site investigation (such as elevation of the bottom of the tank for IHSS 118.1 and dimensions of the valve pit that served this tank) for these two IHSSs. The carbon tetrachloride tank associated with IHSS 118.2 is located within secondary containment in an area between Buildings 707 and 778 that is entirely paved. The tank is an aboveground 5,000 gallon tank apparently sitting on a concrete pad (the very base of the tank is sitting in water that is held by the secondary containment).

I have included a computer disk with the descriptions of the above IHSSs on it as well as the IHSS submittal of Thursday. With this submittal we have provided new, detailed descriptions of 15 of the IHSSs in OU8. We still owe you a write-up on IHSSs 150.1 and 151. We have reviewed the descriptions in the HRR of the remaining IHSSs in OU8 to ensure that there are no major inaccuracies in location or release information. Of these, some additional details were provided for IHSSs 132 and 150.3 in my letter of yesterday. Of the remaining IHSSs, the HRR description was essentially accurate.

Please call if you have any questions or comments.

Sincerely,
DOTY & ASSOCIATES

Frank J. Blaha

Frank J. Blaha

OU8 IHSS DESCRIPTIONS

IHSS Number: 123.2
IHSS Name: Valve Vault West of Building 707

Date/Duration of Occurrence: Particular occurrence in 1958, however, the Valve Vault was in use from 1952 to Late 1980s

Description of Incident: (The coordinate system used in this description is that of the Rocky Flats Utility Drawings.) The specific incident that has been described in IHSS 123.2 is that which involved a valve vault on the original process waste lines (OPWL). The OPWL were installed at various times from 1952 until approximately the mid 1970's, and were taken out of service during the period of the mid-1970's to the mid-1980's. The OPWL were originally laid out with the line from just west of Building 881 to Building 774 consisting of a 3-inch diameter saran-lined pipe encased in a 10-inch diameter vitrified clay pipe (VCP). This line extended in approximately a north-south alignment from approximately N35,450, E20,560 to a 45-degree elbow at approximately N36,910, E20,560. At this elbow the line extended to the northeast to approximately N37,340, E20,990 at which point another 45-degree elbow re-directed the waste to a north-south ending at Building 774. Flow in this line was by gravity from approximately N35,450 to the north.[1,2] The OPWL were typically abandoned in place.

This line was originally installed primarily with lampholes; no valve vault was present at the south 45-degree elbow.[1,2] These lampholes consist of a small structure that allows one to view the containment area between the primary containment (the 3-inch saran-lined steel pipe) and the secondary containment (the VCP).[3] These lampholes were too narrow for access to the pipe system and were not provided with rungs.[4] The intent of the lampholes was to allow for more efficient repair of the OPWL system should a leak develop by allowing some narrowing of the location of the leak.[3]

Substantial leaks occurred at the two 45-degree elbows on this line due to expansion of the steel pipe from thermally hot steam condensate discharges from Building 881.[4] The operation of the OPWL in this area involved the use of steam condensate to flush the OPWL line following the transfer of acidic or other corrosive waste.[5] Leaks of acidic process waste into the secondary containment pipe resulted in additional corrosion of the outside of the mild steel pipe. One bad leak occurred in December 1958 at the south 45-degree elbow when the pipe broke and process waste followed the containment pipe to the north 45-degree elbow and leaked into a ditch. Approximately 4,050 gallons of waste leaked in this incident (Building 881 had sent 2,700 gallons of laboratory waste and 2,700 gallons of laundry waste and only 1,350 gallons of waste were received in Building 774). The laboratory waste had a pH of 5.6, 0.51 milligrams per liter (mg/l) of enriched uranium (uranium 235), and 120 mg/l of nitrates; and the laundry waste had a pH of 9.4 and 0.51 mg/l of enriched uranium. The elbow was repaired.[4]

At some time after construction of the OPWL in this area a valve vault was installed at the location of the south 45-degree elbow (N36,910, E20,560).[6,7] This is the valve vault referred to as "the valve vault west of 707." The valve vaults consist of a larger, more elaborate structure than lampholes with rungs down to the pipe location allowing worker access to the pipes. This valve vault may have been installed due to the need to allow for repair of the 45-degree elbow. The diagonal line (from the south 45-degree elbow to the north 45-degree elbow) was abandoned in 1968 due to the construction of Building 707 over the line.[4] The alignment of the OPWL was modified so that from N36,910, E20,560 a three-inch diameter stainless steel line ran due north to N37,284, E20,560. At N37,059, E20,560 another valve vault was built to allow for process waste collection from Building 559 which became operative in 1968.[8,9] This valve vault could also be described as "west of 707," but this valve

vault is further north than the one at which the 45-degree elbow had been located, and was not in existence at the time of the leaks from the 45-degree elbows. From N37,284, E20,560 the new process waste line ran to the east and eventually to Building 774.[9] No documentation was found of any releases from the valve vault that was constructed at the location of the south 45-degree elbow.

*** ** ***

Air Considerations: No documentation was found identifying air monitoring in response to any release incidents.

Soil Considerations: It is possible that soils contaminated from problems experienced at the two 45-degree elbows contributed to soil contamination in the area of each elbow in addition to areas along the OPWL. Since the OPWL are sloped to allow for gravity drainage, the migration of waste along the backfill of the OPWL would probably have been from the south 45-degree elbow (N36,910, E20,560) to the north 45-degree elbow (N37,340, E20,990), a distance of approximately 630 feet. The approximate invert elevation of the OPWL at the south 45-degree elbow is 5,986.34 feet, while at the north 45-degree elbow the invert elevation is approximately 5,982.80.[1] Based on current topography these inverts should be approximately 5.5 feet deep and approximately 3.2 feet deep, respectively. Approximately 360 feet of the diagonal OPWL pipe is either buried beneath Buildings 707 and 778, or has been removed for the construction of Buildings 707 and 778.[7,9] It is possible that the remainder of the diagonal pipe could have been removed during construction activities related to Building 707, but this is considered unlikely.

A soil sample taken one foot south and one foot east of the valve pit for the south 45-degree elbow contained 45 mg/l of nitrate and 0.145 disintegrations per minute per gram of plutonium activity. This soil sample was taken at an approximate depth of four feet and is assumed to have been collected in 1976 for the study in which it was reported.[4] The reason for which the soil sample was analyzed for plutonium is unclear since the buildings upstream of this location on the OPWL were not plutonium processing buildings but were rather laboratories (Buildings 123 and 441) and uranium processing buildings (Buildings 444 and 881). Building 881 was converted in the mid-1960's to a stainless steel processing building. Major concentrations of plutonium should not have been expected in this line.

The Radiometric Survey, performed at the RFP during the late 1970s and early 19809s, indicated no extremely contaminated areas (stated to be 500,000 to 1,000,000 pCi/g) in the areas along the surveyed portions of the alignment of the original process waste lines involved in the 1958 incident.[10]

Surface Water Considerations: Surface water drainage in the vicinity of the north and south 45-degree elbows is currently to the east. The surface water drainage patterns at the south 45-degree elbow time of the 1958 spill is expected to have largely been the same as currently. However, the ditch near the north 45-degree elbow discussed in the description of the 1958 spill is assumed to have been associated with a road noticeable in a 1955 aerial photograph of Rocky Flats. Based on the original contours of the land in this area it is expected that flow in the ditch near the north 45-degree elbow would have been to the south.[11] Ultimate drainage from each of these areas in 1958 was to South Walnut Creek.

Geologic Considerations: It is probably that subsurface geotechnical investigations were conducted for Building 707 prior to its construction. Any record of these investigations have not yet been located. Monitoring wells located in the general vicinity of this IHSS are 23-86 and 24-86 as well as 180-89.

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Other IHSSs of Concern: This release involved the OPWL, and therefore the OPWL IHSS (IHSS 121) is of potential concern. It is possible that this IHSS should more properly be addressed by the OPWL IHSS.

Other IHSSs that may have impacted this IHSS include IHSSs 150.4, 150.7, and 159. These IHSSs are included in this OU.

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[1] The Austin Company, 1952, "Industrial Waste Plan & Profile, Bldg. 81 & 74," Drawing RF-207-104-C (Dow Drawing 5703-2), As-Built (Date Illegible), Designed May 17.

[2] The Austin Company, 1953, "Rocky Flats Plant, Industrial Waste Flow Diagram," Drawing RF-207-106-B (Dow Drawing 5703-2), As-Built, January 29.

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OU8 IHSS DESCRIPTIONS

IHSS Number: 126.1 & 126.2
IHSS Name: Westernmost and Easternmost Out-of-Service Process Waste Tanks

Date/Duration of Occurrence: 1953 to 1984 (period of operation of the tanks)

Description of Incident: Two out-of-service process waste tanks are located below Building 728. The tanks were built in 1952. Each reinforced concrete tank has a design capacity of 25,000 gallons and an approximate operating capacity of 20,000 gallons. The combined exterior tank dimensions are 33 feet 6 inches (east-west) by 23 feet 5 inches (north-south) and are 11 feet 8 inches high. The ceiling and wall thickness is 10 inches and the floor thickness is 1 foot. The tanks share the inner wall. The bottom elevation of the tanks' interior is at 5931 feet. The tanks were designed with a minimum cover of three feet of fill except for the area overlain by the building. The original design indicated that two pipes enter each tank from the south. The invert elevations of the pipes where they entered the tanks are 5939 and 5938 feet.[1] The volume of material that could remain in the tank below the level of the outlet pipe is unclear from the design drawings. The tanks had stored laundry water from the Building 771 laundry facility which ceased operations in the late 1950s. The tanks are sometimes referred to as laundry tanks.

The pumphouse (Building 728) is a concrete structure situated directly above the tanks with dimensions of 14 feet 10 inches (east-west) by 7 feet 10 inches (north-south) and is 7 feet 6 inches high. The south wall of the pumphouse is above the south wall of the tanks. It contains the manholes for access into the tanks and one sump pump for each tank as well as one sampling point into each tank. The pumphouse is partially underground so it does not appear as large as its dimensions indicate.[1]

At the time the tanks were constructed, an asphaltic concrete road existed between the tanks and Building 771. The ground surface directly north of Building 771 was at an elevation of 5949 feet. The ground sloped toward the road which was at an elevation of 5945 feet and then dropped off toward the north at a slope of four to one to the location of the tanks. The road was built over compacted fill. A drainage ditch beginning at the east end of the tanks between the tanks and the road directed surface runoff to the west.

In 1966, the original pipelines into the tanks were replaced with cast iron pipes.[2] The original lines were abandoned and they may still be in place. The cast iron pipes were either replaced or supplemented with fiberglass pipes in 1969.[3]

By 1969, the entire area north of Building 771 was covered with fill and pavement including the area around Building 728 and above the tanks. Traffic was then permitted over the area of the tanks, which were then beneath approximately ten feet of fill. No documentation was found indicating the condition of the tanks during their use.

Design of the process waste system replacement in Building 771 was completed in 1983.[4] Since 1984, the tanks have served as overflow for fire deluge water. The tanks reportedly fill with groundwater slowly and periodically the liquid is pumped into the process waste system. The tanks were pumped in 1990.[5] Water was noted in the tanks in 1992 and is assumed to be groundwater.[6]

No documents were found which identify any specific incidents of releases to the environment caused by these tanks. Liquid process waste typically contained nitrate, plutonium, uranium, and various other organic and inorganic constituents. In 1976, typically two transfers were made to the tanks per month.

Radiometric Survey Results

The results of the Radiometric Survey, conducted at the RFP during the late 1970s and early 1980s, indicate no extremely contaminated areas (stated to be 500,000 to 1,000,000 pCi/g) north of Building 771.[7]

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Air Considerations: No documentation was found which detailed specific air monitoring activities related to these tanks.

Soil Consideration: No documentation was found which described soil samples collected in the area around the tanks. The tanks are surrounded by fill material placed in 1953. The area to the south of the tanks was disturbed in 1966 and 1969 with the replacement or addition of process lines. Compaction of soil occurred above the tanks when area was paved in the late 1960s. Utility drawings indicate the number of underground pipelines present in the area of the tanks. There may be a number of other underground pipelines present in the area which are not shown on current utility drawings. In particular, many pipelines from the OPWL have been abandoned and may still be present. These pipelines represent both obstacles for intrusive investigations as well as pathways for migration. Migration pertains to the potential for contamination due to

these tanks to move to other areas and the potential for contamination from other sources to move toward these tanks.

Surface Water Considerations: The tanks are located underground and are currently covered with pavement. Runoff from the pavement is directed to the west. The tanks were not entirely covered with pavement until the late 1960s. Prior to that, the area above the tanks was covered with fill allowing surface drainage to infiltrate to the area around the tanks.

Geologic Considerations: A previous study of this IHSS indicated that groundwater seeps into the concrete tanks and is periodically pumped out. This indicates that the tanks are within the saturated zone of the soil. Historical soil borings from near Building 771 indicate that the area is fill material overlying weathered clay bedrock.[8] The depth to bedrock in the immediate area is not currently known.

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Other IHSSs of Concern: This IHSS is within the area of IHSS 150.1 which is included in OU8. IHSS 172, also included in OU8, is located directly south of Building 728. Descriptions of these IHSSs are included in the OU8 Workplan.

References

[1] RFP Engineering Drawing No. RF-71-S20, Approved August 4, 1952.

[2] RFP Engineering Drawing No. 2-80-14165-1, Revised August 1, 1966.

[3] Sunday, G., 1976, "Summary of the Status of the Existing Process Waste Lines," September 1.

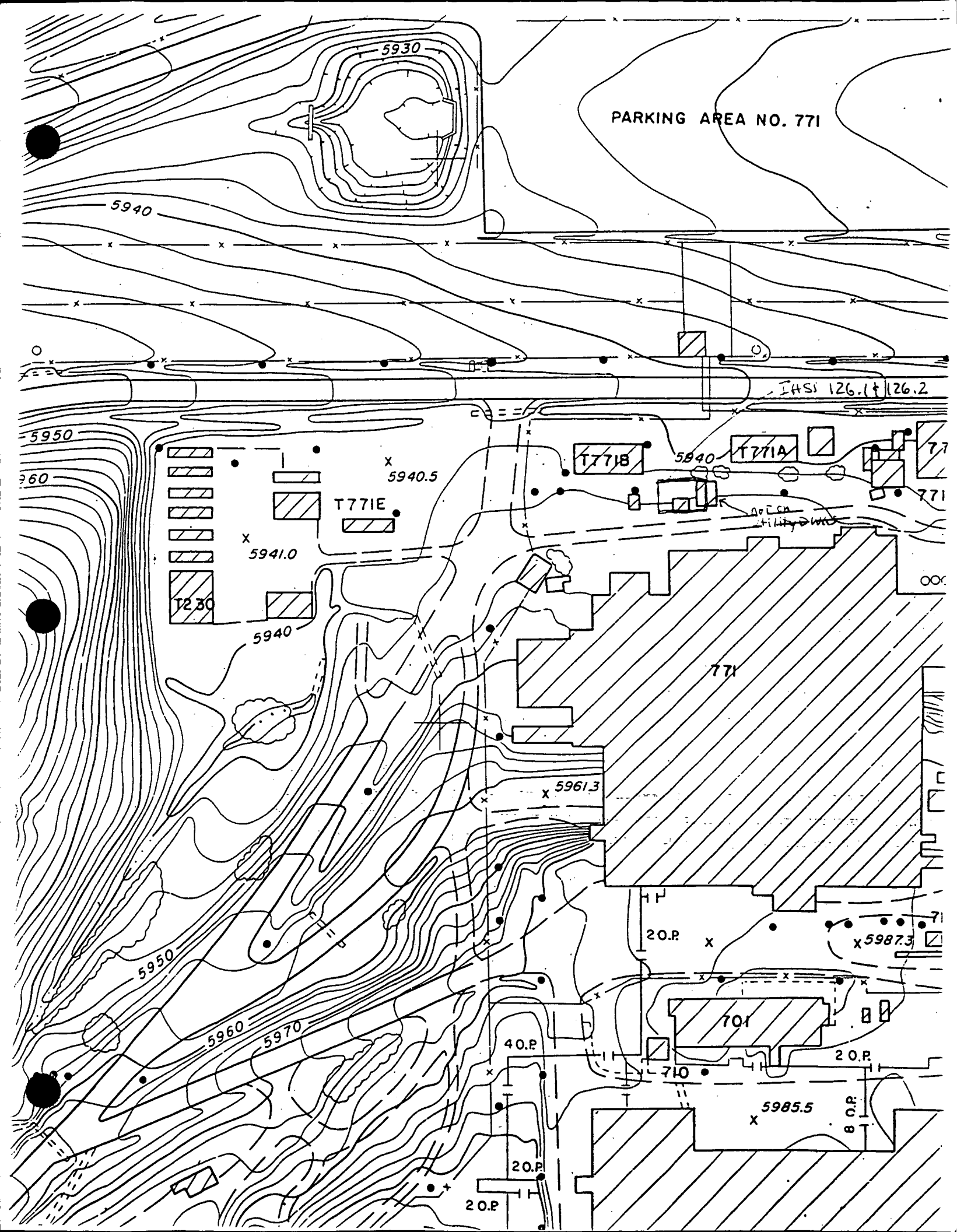
[4] RFP Engineering Drawing No. 26628-3, Approved January 4, 1983.

[5] EG&G, 1990, Draft Phase I RFI/RI Work Plan Operable Unit No. 5, July 23.

[6] Personal Communication, Jack Weaver, RFP Employee, April 9, 1992.

[7] Setlock, G.H., 1988, "Request for Detailed Report on Radiometric Survey," Internal Letter to Tom Greengard, August 19.

[8] RFP Engineering Drawing No. V-71774-10007, Approved August 6, 1962.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OU8 IHSS DESCRIPTIONS

IHSS Number: 144
IHSS Name: Sewer Line Break

Date/Duration of Occurrence: June 7 and 8, 1972

Description of Incident: There are four underground waste holding tanks located north of Building 776 and east of Building 701, in a small structure identified as Building 730. They are designated as Tanks 776 A through D. They were built in approximately 1956,[1] and were taken out of service in the 1980s. They are now used as plenum deluge tanks.[2] The tanks would, therefore, normally be dry.

The tanks are concrete, and have a 26-foot depth. They are non-inspectable. The capacity of Tanks 776 A and B is 22,500 gallons each, and the capacity of Tanks 776 C and D is 4,500 gallons each. The dimensions of 776 A and B are 25'x15'x10' each, and those of 776 C and D are 5'x15'x10' each.[1] Tanks 776 A and B are laundry waste holding tanks, and Tanks 776 C and D are process waste holding tanks. If tanks C and D overflowed, the excess liquid could drain into tanks A and B, and vice versa.[3] A site map is attached.

From approximately 1969 until 1973, laundry waste could be transferred through the sewer lines to the sanitary sewer system.[4] A pipe header at the tanks allowed alternatives of pumping the laundry water to the sanitary sewer system, the Solar Evaporation Ponds, or Building 774.[5]

On approximately June 1, 1972, a revision of a Building 776 radiography vault floor drain was completed. Apparently, previous transfers of laundry waste water from Tanks 776 A and B resulted in backflow into the vault. The revision to the floor drain, involving relocation of the drain pipe connection, would allow the waste to be transferred at higher pressures.[3]

On June 7 or 8, 1972, the increased pumping rate during a transfer of laundry waste water from Tanks 776A and B to Building 995 caused suspension of high level sediment in the tanks and pressurization of the sanitary waste line. The pressurization of the line caused a commode and sink in Building 701 to overflow, and a patch to rupture in the line east of the waste holding tanks.[3] Due to the overflow of the commode and sink, the toilet, sink and floor of Building 701, as well as the ground east of the building, were contaminated.[6] The patch which ruptured was apparently located between Buildings 777 and 779.[7] At the time of the incident, maintenance may have been cleaning out a clean out plug near Building 701, further increasing the potential impacts on the environment.[6]

Activities of samples taken from the toilet bowl in Building 701 were as high as 136,000 pCi/l on June 7 and 8. A sludge sample taken from a cleanout plug in the Building 701 sanitary sewer line contained only minimal radioactivity. Analysis of the sediments from the bottoms of Tanks 776 A, B and D indicated liquid phase activities of 68,000 pCi/l, 9,100 pCi/l, and 302,000 pCi/l, respectively.[3]

Interviewees for CEARP Phase I recalled a sewer line break between Buildings 779 and 777 which was discovered when contamination was found in a rest room.[7] It is believed that this is the same incident as the 1972 patch rupture as discussed above. The area between Buildings 777 and 779 consists of a paved alley which slopes to the south. The alley was paved in 1968.[8]

*** ** ***

Air Considerations: It is improbable that the release has a residual impact on the air. Air monitoring done on June 8, 1972 detected no count.[9]

Soil Considerations: The rupture in the line patch east of the tanks resulted in soil contamination. Approximately 50 drums of soil were removed.[3] A conflicting document states that 38 drums of soil were removed.[10] It is probable that residual soil contamination is present.

The contaminated soil around Building 701 was apparently removed also. As of June 8, 1972, 19 drums of soil had been removed. No soil count was detected at that time.[9]

The radiometric survey performed in the late 1970s and early 1980s indicated no extremely contaminated (500,000 to 1,000,000 pCi/g) areas at or near this IHSS.[11]

Surface Water Considerations: Following the 1972 pressurization incident, the Building 995 outfall and other downstream points were sampled daily. There was increased radioactivity in the 995 outfall. The highest sample concentration of total alpha-emitting radionuclides in the outfall was 417 pCi/l, on June 11, 1972.[3]

Geologic Considerations: It is possible that the laundry waste had an impact on the groundwater in the area. Wells #1986 and #2386, which were installed in 1986, and Well #09389, which was installed in 1989, are the only wells in the general vicinity of this IHSS.

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Other IHSSs in the Area: Other areas or incidents of concern in the immediate area of Tanks 776A and B and Building 701 are as follows.

- West of Building 730 Solvent Spill; IHSS 118.1:
  In the 1970s and early 1980s, releases of carbon tetrachloride occurred from the storage tank adjacent to the west end of Building 730. This IHSS is included in OU8, and the description is included in this work plan.

- Radioactive Site - 700 Area Site No. 4; IHSS 132:
  The tanks included in IHSS 144 are also identified in IHSS 132. A revised description of this IHSS will follow at a later date.

- Cooling Tower Blowdown Building 774; IHSS 137:
  This IHSS consists of a potentially impacted area resulting from possible releases of cooling tower water south of Building 774. Historical Release Report text from this IHSS is attached.

- French Drain North of Building 776/777; PAC 700-1100:
  The french drain discussed in this potential area of concern (PAC) may have been a pathway for groundwater and soil contamination. Historical Release Report text from this PAC is attached.

- Compressor Waste Oil Spill - Building 776; PAC 700-1107:
  This potential area of concern consists of a release of compressor waste oil which originated in a sump trench in the Compressor House. The spill occurred north of Building 776. Historical Release Report text pertaining to this PAC is attached.

References

[1] Sunday, 1976, "Survey of the Status of the Existing Process Waste Lines," September 1.
[2] Personal Communication, Ron Teel, RFP Employee, April 10, 1992.
[3] Werkema, 1972, "Investigation of Radioactivity Found in 701 Building Sanitary Sewer Backflow and in 995 Building Outfall, June 7-13, 1972," June 19.
[4] 3004(U)
[5] Personal Communication, Maury Maas, Former RFP Employee, April 10, 1992.
[6] Ellis, 1972, "Report of Property Damage or Loss," July 24.
[7] 1985, "CEARP Phase I Interview Notes," April 16.
[8] U.S. DOE, 1990, "Draft Phase I RFI/RI Work Plan, Operable Unit No. 5," July 23.
[9] 1972, Log Book of "Jim," June 8.
[10] Piltingsrud, 1972, "Status Report - Health Physics Input to Operations - June 1972," Internal Letter to J.F. Willging, July 10.
[11] Reischick R.V., 1984, "Radiometric Survey," Internal Letter to R. Hawes, July 5.

PAC REFERENCE NUMBER: 700-137

IHSS Reference Number: 137

Unit Name: Cooling Tower Blowdown Buildings 712 and 713
(IAG Name: Cooling Tower Blowdown Building 774)

Approximate Location: N750,750; E2,084,150

Date(s) of Operation or Occurrence

Late 1950s - Present.[1]

Description of Operation or Occurrence

Building 712 and Building 713 are both cooling tower facilities associated with Building 776.[1] Interviewees for CEARP mentioned a release of cooling tower water south of Building 774 that flowed north into Walnut Creek. It is speculated that they were recalling a release from the Building 779 cooling tower in December 1976.[2] The Building 779 cooling towers are covered in greater detail in PAC 700-138.

The Building 776 cooling towers blowdown water is treated in the wastewater treatment plant. It is thought the blowdown water drains from the cooling towers through underground pipes outside the south ends of the buildings.[1]

A leak in a cooling tower within the PA was reported to have occurred between August 20 and September 6, 1990. A memorandum was sent to utilities personnel expressing the need to fix the leaks caused by corroded metal sides.[3] Contact with the author of the document has verified that the leak came from either Building 712 or Building 713. The leak has been estimated at a flow rate between 5 and 20 gallons per minute. The duration of the leak is unknown but could have occurred over several months prior to reporting.[4]

Physical/Chemical Description of Constituents Released

The released water contained 50 mg/l total chromium.[2]

Responses to Operation or Occurrence

The release that occurred during the summer of 1990 was stopped after the memorandum was sent to utilities. No environmental cleanup occurred in response to this occurrence.[4]

Fate of Constituents Released to Environment

No documentation was found which detailed the fate of the constituents released to the environment. This IHSS is being studied in accordance with the IAG schedule for OU8. However, the information developed on this unit for this study indicates that the IHSS location presented in the IAG is inaccurate. The IAG activities will include site investigations, site characterizations, and possible site remediation. The Final Phase I RFI/RI Report is to be completed by July 12, 1994.

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PAC REFERENCE NUMBER: 700-1100

IHSS Reference Number: Not Applicable

Unit Name: French Drain North of Building 776/777

Approximate Location: N750,000; E2,084,000

Date(s) of Operation or Occurrence

Prior to 1963 - After 1971[1]

Description of Operation or Occurrence

A french drain which was in use from about 1963 until at least 1972 leads north from Door 17T of Building 776, crosses the alleyway, then heads eastward where its effluent leaches into the soil.[1] Radioactive contamination in the area of this site is the result of the June 1964 explosion incident in Building 776.[2] The area was again contaminated at the time of the May 1969 fire in Building 776 (PAC 700-131). This drain may have provided a pathway for the migration of radioactive contamination.[1] Another source indicated the french drain leads north from Door 14T of Building 776.

Physical/Chemical Description of Constituents Released

Plutonium contamination present in the area of this site as a result of the 1964 and 1969 incidents was possibly redistributed below the ground surface although no surface expression was noted.[2]

Responses to Operation or Occurrence

No documentation was found which detailed response to this occurrence.

Fate of Constituents Released to Environment

No documentation was found which detailed the fate of the constituents released to the environment.

Comments

The french drain could not be located on the RFP Utility Drawings.

The June 1964 explosion incident and the May 1969 fire, both in Building 776, are discussed as PAC 700-131.

References

[1] 1500842
[2] 1501191
[3] Personal Communication, Freiberg, K.J., Retired RFP Employee, December 6, 1991.
[4] 1601057
[3] 1501191

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PAC REFERENCE NUMBER: 700-1107

IHSS Reference Number: Not Applicable

Unit Name: Compressor Waste Oil Spill - Building 776

Approximate Location: N750,500; E2,084,000

Date(s) of Operation or Occurrence

June 10, 1986 and June 12, 1986

Description of Operation or Occurrence

On June 10, 1986, an open oil drum filled with water from the Building 776 Compressor House roof overflowed. One or two gallons of oil flowed onto the road and was carried past Building 776 by rainwater. The oil originated from a sump trench in the Compressor House.[1] On June 12, 1986, two to three gallons of compressor waste oil were spilled while transferring the oil from an overfilled drum. The spill occurred in the waste oil drum storage area north of Building 776 outside of Door 15T.[2]

Physical/Chemical Description of Constituents Released

Compressor House waste oil was released to the environment.[1,2]

Responses to Operation or Occurrence

In response to the June 10th incident, "Oil-Dry" was poured over the area to absorb the spilled oil. The compressor operator was instructed to have the "Oil-Dry" swept up, placed into a drum and disposed of in the Present Landfill (PAC NW-114).[1] No documentation was found which detailed the final disposition of the "Oil-Dry". Two bags of oil absorbent were used on the June 12th spill.[1] No documentation was found which further details responses to these occurrences.

Fate of Constituents Released to Environment

No documentation was found which detailed the fate of the constituents.

Comments

None.

References

[1] 1600548
[2] 1600550

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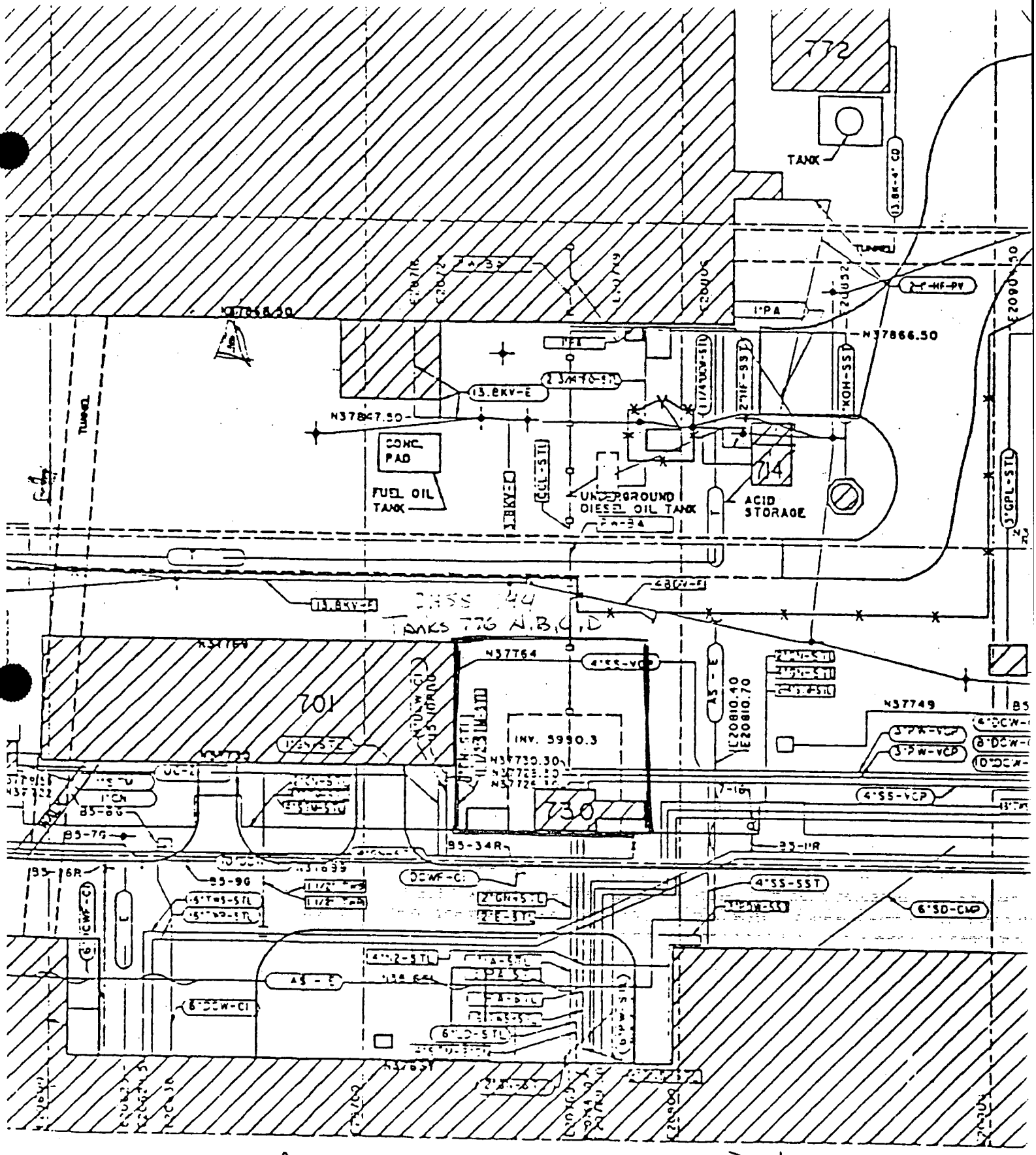

Also affected area between Bldgs 777 + 779.

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OU8 IHSS DESCRIPTIONS

IHSS Number: 159
IHSS Name: Radioactive Site - Building 559

Date/Duration of Occurrence: 1968 to 1971

Description of Incident: Occupation of Building 559, the Plutonium Analytical Laboratory, began in 1968. The original construction included the installation of underground, pyrex, process waste lines beneath and adjacent to Building 559. These glass lines broke due to settling and construction activities in the area.[1]

Building 559 is located north of Building 561, south of Building 566, west of Building 707 and east of the Protected Area (PA). IHSS 159, located on the east side of Building 559, is in an area of both paved and unpaved surfaces, which slopes to the east.[1] A site map is attached.

Process waste lines exit Building 559 in two different locations on the east side, connecting at a manhole just east of where the southernmost pipe leaves the building. From there a pipe carries the waste south to the process waste tank area, known as Building 528, or "the pit." Process waste from Building 561 also exits on the east side of the building, and is carried to Building 528.[2] Process waste exits Building 528 on the east side of the building.

Building 528 contains a total of three process waste holding tanks, including two 1,800-gallon, 7'x9' tanks and one 500-gallon, 3.5'x8' tank. The tanks are stainless steel, and have been in existence since approximately 1966.[3]

Some time prior to 1970, a break in the line was discovered between Building 559 and the pump house. Reportedly, several hundred feet of contaminated soil were removed as a result of the incident.[4] No further documentation was found regarding this pipe break.

In 1972, some time between March and May 1, the process waste line ruptured near the pit, resulting in soil contamination analyzed as containing 4,500 picoCuries per gram (pCi/g) of radioactivity at the waste holding tanks, and decreasing in activity from the tanks to the concrete pad and along the south side of Building 559.[5] The leak was discovered around May 1, 1972, when the total number of gallons of waste transferred to Building 774 was being tallied. It was then noticed that no waste had been pumped since March 22, 1972. It is estimated that approximately 4,000 gallons of waste had been released to the environment on the north side of the pit. Three breaks were found within an eight-foot area north of the pit.[6] Reportedly, the line from the building perimeter to the holding tanks was replaced with a 4-inch PVC pipe surrounded by a 6-inch stainless steel pipe.[7]

A leak in the southern section of the pipeline underlying Building 559 was also found at the same time in 1972 as the leaks discussed above. The leak was located 12 inches from the south wall and 32 feet west of the east end of the tunnel[6] (description follows). A bypass, of PVC pipe, was installed.[4] Liquid was found on the floor of an air circulation tunnel, which is approximately 4 feet north and parallel to the pipeline. Analysis of contamination found near the floor drain indicated 20,000 to 100,000 disintegrations per minute (dpm).[8]

Another release occurred around May, 1972. Reportedly, there was a release of contaminated liquid due to the failure of a 4-inch pyrex line leading from "the surge tank to Building 774."[9] It is unclear whether this incident involves the line exiting the east side of Building 528 or involves incident discussed below.

On May 2, 1977, flooding in the manhole where the two pipes leaving Building 559 join was discovered. Water samples indicated 7,000 picoCuries per liter (pCi/l) gross alpha on May 2, and 450 pCi/l gross alpha on May 3. Two sludge samples, collected on May 3, indicated 400 disintegrations per minute per gram (d/m/g) and 45,000 d/m/g.[10] The contamination was, at that time, thought to be due to residual groundwater contamination from the 1972 incident.[5] The water which had collected in the manhole was pumped to the process waste holding tanks.[10]

The manhole was observed from May 2 to May 19, and on May 19, water was found again in the manhole, as well as in the waste holding tank pit. It was determined that the leak was through the drip leg of the double-contained process waste line.[5] Approximately 4,600 gallons of water had leaked into the pit, causing the sump pumps to pump the water into the tanks, which subsequently overflowed.[10] The water contained gross alpha of 160,000 pCi/l.[5] Conflicting documentation states that alpha activity was in excess of 300,000 disintegrations per minute per liter (d/m/l).[11] It was concluded at that time that the process water supply line (between Buildings 559 and 561), the process line, and the shell of the process waste line were broken. The pit was decontaminated, and Building 559 ceased generation of process waste water. Water samples were taken, with analyses as follows:[5]

Date	Location	Concentration (gross alpha)
5/19/77	Process waste tank pit	160,000 pCi/l
5/20/77	Steam pit (E of where northernmost pipe exits Bldg. 559)	200 pCi/l
5/20/77	NE corner of Bldg. 561	<40 pCi/l
5/20/77	Footing drain manhole and sump between Bldgs. 559 and 561	900 pCi/l

By May 23, 1977, the concentration of gross alpha was less than 40 pCi/l at the steam pit and the northeast corner of Building 561, and 450 pCi/l at the footing drain manhole. Water was pumped from the footing drain manhole to the process waste holding tanks. No attempt was made to repair the broken line, since the new process waste lines were to be ready by the week of June 13, 1977. Process waste was to be hand-carried to the tanks. Cleanup of the soil was to be completed by the end of the calendar year.[5]

At the current time process waste exits Building 528 from the southeast corner and flows to Valve Vault 10. The pipes from Building 528 to Valve Vault 10 are a 2-inch and a 4-inch polyethylene pipe.[2]

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Air Considerations: An air sample was taken on May 3, 1977, following flooding of the manhole which contained gross alpha activity less than 0.01 picoCuries per cubic meter (pCi/m^3).[10] Air sampling was also done at the time of the May 19, 1977 flooding of the pit; however, the analyses were not documented.[5] It is possible that contaminated soils could have had an impact on the air. The majority of the area in which these releases took place is currently paved.

Soil Considerations: Following the pipeline leak underneath Building 559 in 1972, core samples indicated no measurable quantities of process waste contamination outside the building perimeter. Samples from underneath the pipeline, however, indicated activity of approximately 250 d/m/g.[4]

As of May 26, 1972, soil had been excavated from the pit to somewhere along the length between Buildings 559 and 561, and 82 barrels of soil had been removed. Soil counts at the time indicated 10,000 counts per minute (cpm) at a 7.5' depth at the pit, 750 cpm two feet north of the pit at 92" depth, 300 cpm ten feet north of the pit, 250 cpm 25 feet north of the pit, and 500 cpm 24 feet east of the concrete pad[6].

Following a leak near the waste storage tanks, approximately 80 drums of soil were removed. The soil waste excavated from over and around the pipeline, but not from underneath the pipeline. The strip of soil below the pipeline now lies under seven feet of fill dirt, and may contain up to 10,000 d/m/g. Reportedly, some minor surface contamination also remains (250-500 dpm), but is mostly covered by asphalt.[8] Documentation did not indicate whether the leak was north, west or east of Building 528, and it is unknown whether the preceding paragraph discusses the same soil removal activities.

An August, 1977 document states that removal of the contaminated soil from the flooding incident would be postponed until the fall of 1978.[12] An October, 1982 document indicates that the site had still not been cleaned up.[13]

The Radiometric Survey, performed at the RFP during the late 1970s and early 1980s, did not indicate any extremely contaminated areas (state to be 500,000 to 1,000,000 pCi/g)[14] around Buildings 528, 559, and 561.

Surface Water Considerations: Stormwater runoff in the area of Building 528 at the time of the releases and at the current time flows to the east. However, surface water impacts could be noted to the northwest of this release site due to the presence of footing drains in the area that may be influencing the migration of contaminants in the area. This footing drain is noted due north of Building 561. This footing drain flows to the west and combines with a 12-inch diameter corrugated metal stormwater pipe and daylights on the hillside southwest of Building 771 at approximately N37,414 and E19,961.[2] The drainage ditch southwest of Building 771 (presumably at the combined footing drain/stormwater outfall) was sampled at the time of the May, 1977 pit flooding. On May 20, 1977, the concentration of gross alpha was less than 40 pCi/l.[5]

Geologic Considerations: It is probable that the releases of process waste at this location impacted the groundwater. The presence of a footing drain in the vicinity of the releases related to this IHSS may impact groundwater flow, possibly causing a local gradient to cause contaminants related to the pipes and tanks near Building 528 to flow to the west. It appears that this footing drain is related to the underground tunnel that connects Building 559 and 561. The invert elevation of this footing drain and the elevation of the bottom of the tunnel are unknown at this time. The footing drain daylights at N37,414 and E19,961 as a 15-inch corrugated metal pipe.[2] Similarly, some migration of contaminants away from the Building 528 area could be taking place in the original process waste lines or in the backfill of the original process waste lines that once carried process waste from the Building 528 tanks due east to the original process waste line valve vault at approximately N37,059, E20,560.[15] The original process waste lines typically drained by gravity, so a slight gradient along these pipes should exist.[3] There are presently no monitoring wells in the immediate vicinity of this IHSS.

*** ** ***

Other IHSSs/PACs in the Area: There are no other sites of concern in the immediate area of the Building 559 radioactive site.

References

[1] Blaha, F., 1992, Site Visit to Building 528 Area, April 11.
[2] Rocky Flats Plant, 1990, "Site Utility Drawings," Drawing 15501-20-M, Sheet C-4, July 20.
[3] Sunday, G., 1976, "Survey of the Status of the Existing Process Waste Lines," Rockwell International, September 1.
[4] Owen & Steward, 1974, "A Historical Summation of Environmental Incidents Affecting Soils at or Near the USAEC Rocky Flats Plant," January 29.
[5] Werkema, M.V., 1977, "Building 559 Process Water and Ground Water Problems," Internal Letter to J.E. Dorr, May 23.
[6] Anderson, H.C., 1972, "Glass Waste Process Line - Building 559," May 26.[9] Walko, 1972, "Minutes of Rocky Flats Division Ecology Council, Meeting Held Thursday, May 4, 1972," May 5.
[7] Colston, B.W., 1973, "Buried Contaminated Lines and Buried Waste at Rocky Flats," October 3.
[8] Steward, L.M., 1973, "Areas of Concern at Rocky Flats: Soil Contamination and Related Incidents," June 29.
[9] Walko, E.J., 1972, "Minutes of Rocky Flats Division Ecology Council," Meeting Held Thursday, May 4, 1972.
[10] West, J.M., 1977, "Status of Building 559 Waste Line Inspection Pit Evaluation," Internal Letter to D.D. Hornbacher, May 20.
[11] Werkema, M.V., 1977, "Environmental Sciences Highlights - Week Ending May 20, 1977," May 20.
[12] Werkema, M.V., 1977, "Building 559 Ground Water Contamination," Internal Letter to J.E. Dorr, August 17.
[13] Unknown Author, 1982, Report discussing priority for removal of contamination, October 13.
[14] Setlock, G.H., 1988, "Request for Detailed Report on Radiometric Survey," Internal Letter to Tom Greengard, August 19.
[15] Rocky Flats Plant, 1990, "Site Utility Drawings," Drawing 15501-21-M, Sheet C-5, May 14.

OU8 IHSS DESCRIPTIONS

IHSS Number: 163.2
IHSS Name: Radioactive Site 700 Area, Site Number 3 - Buried Slab

Date/Duration of Occurrence: Approximately 1969 to Present

Description of Incident: Information for the development of the following discussion was gathered from the review of documents, historical drawings, and historical engineering drawings as well as interviews with Building 771 employees. The information identified for this OU workplan found inconsistencies with the discussion presented in RCRA 3004(u).

An americium-contaminated slab is buried in the area near Building T771A by the Perimeter Road. The slab is approximately 8 feet square and 10 inches thick. From approximately 1962 until approximately 1968, the slab served as a foundation for a 5,000-gallon stainless steel tank located approximately 30 feet north of Building 771. The tank was on 6-foot legs and was approximately 8 feet in diameter. Two overhead pipes from Room 114 in Building 771 connected to the tank; one of which was a vacuum vent to control transfer in and out of the other. The tank was used in the Filtrate Recovery Ion Exchange system which concentrated plutonium and americium for recovery. Americium concentrated on an ion exchange column and was transferred at a predetermined concentration to the tank. The resulting liquid contained in the tank was a nitrate solution high in americium with some plutonium.[1]

In approximately 1968, a pinhole leak developed in the tank and dripped onto the slab. The tank was temporarily sealed to mitigate the leak until the tank could be emptied through the processing of the contained solution. Once emptied, the tank was taken out of service and remained in place until it was taken to the size-reduction facility in Building 776 sometime shortly after. Once size-reduced, the tank was disposed of as radioactive waste. When the tank was removed to the size-reduction facility, the concrete slab was decontaminated until the point where smear samples did not detect further removable radioactivity. Paint was applied to the concrete to secure the fixed radioactivity. The slab was moved to a ditch directly north of the area and buried. The area was paved sometime prior to June 1969. In the mid 1970s, Building T771A, a prefabricated structure, was constructed in the same general area. None of the persons interviewed for this investigation recalled any subsequent excavation of the slab.[1,2] The slab lies underground near or beneath the east end of T771A at a probable depth of less than ten feet.

An environmental summary report from 1973 does not indicate the incident in the summary of environmental incidents impacting the soil at the RFP; however, the report does have a notation of the slab on a map of the area north of Building 771. The report indicates an area farther to the north of the where the slab is believed to be buried and states that it was later excavated and the contaminated portion cut away for off-site disposal.[3] This is not believed to be the case. The location indicated on the map cannot be accurate because it is in an area that was paved several years before the slab became contaminated. As stated above, there has been no verification that the slab was subsequently excavated.

Radiometric Survey Results

The results of the Radiometric Survey, conducted at the RFP during the late 1970s and early 1980s, indicate no extremely contaminated areas (stated to be 500,000 to 1,000,000 pCi/g)[3] north of Building 771.[4]

An Aerial Radiological Survey of the RFP conducted during July 1989 did not indicate anomalous concentrations of americium-241 in the area north of Building 771.[5] However, the survey was not structured to identify sources that occupied a small area (200 meters in diameter was the target size and less than 10 meters in diameter would not have been detected with confidence).

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Air Considerations: No documentation was found related to the monitoring of the air in the area where the slab was buried.

Soil Consideration: The 8 foot by 8 foot slab is probably still buried beneath the pavement near Building T771A. There was no mention of americium-contaminated soil being buried with the slab; however, because the slab had been located on soil, it is likely that some soil from beneath the slab was also deposited when the slab was pushed into the ditch. The slab had had all removable contamination removed and was then painted to seal the fixed contamination. Therefore, it is not likely that there is a significant amount of contaminated soil surrounding the slab. Other material of an unknown source was backfilled into the ditch prior to the area being graded and paved. Construction activities for the Protected Area (PA) occurred north of where this slab is thought to be buried and therefore would not have affected this IHSS.

Surface Water Considerations: The slab was placed in a ditch which was then backfilled. The ditch formerly directed surface drainage to the west into a tributary to North Walnut Creek. It is unknown how long the slab remained in the ditch before the area was paved.

Geologic Considerations: The area is on a steep hillside into the North Walnut Creek drainage. The Building 771 parking lot is over approximately 40 feet of fill material right in the drainage. Building 771 was built into the hillside with the roof of the two story building at ground level along the south wall. The location of the slab is in an area of varying depths of fill over weathered clay bedrock.[6]

*** ** ***

Other IHSSs of Concern: IHSS 163.2 is located in close proximity to IHSSs 150.1 and 172. Both of these IHSSs are included in OU8 and there descriptions are available as part of this workplan.

References

[1] Personal Communication, Jack Weaver, RFP Employee, April 9, 1992.

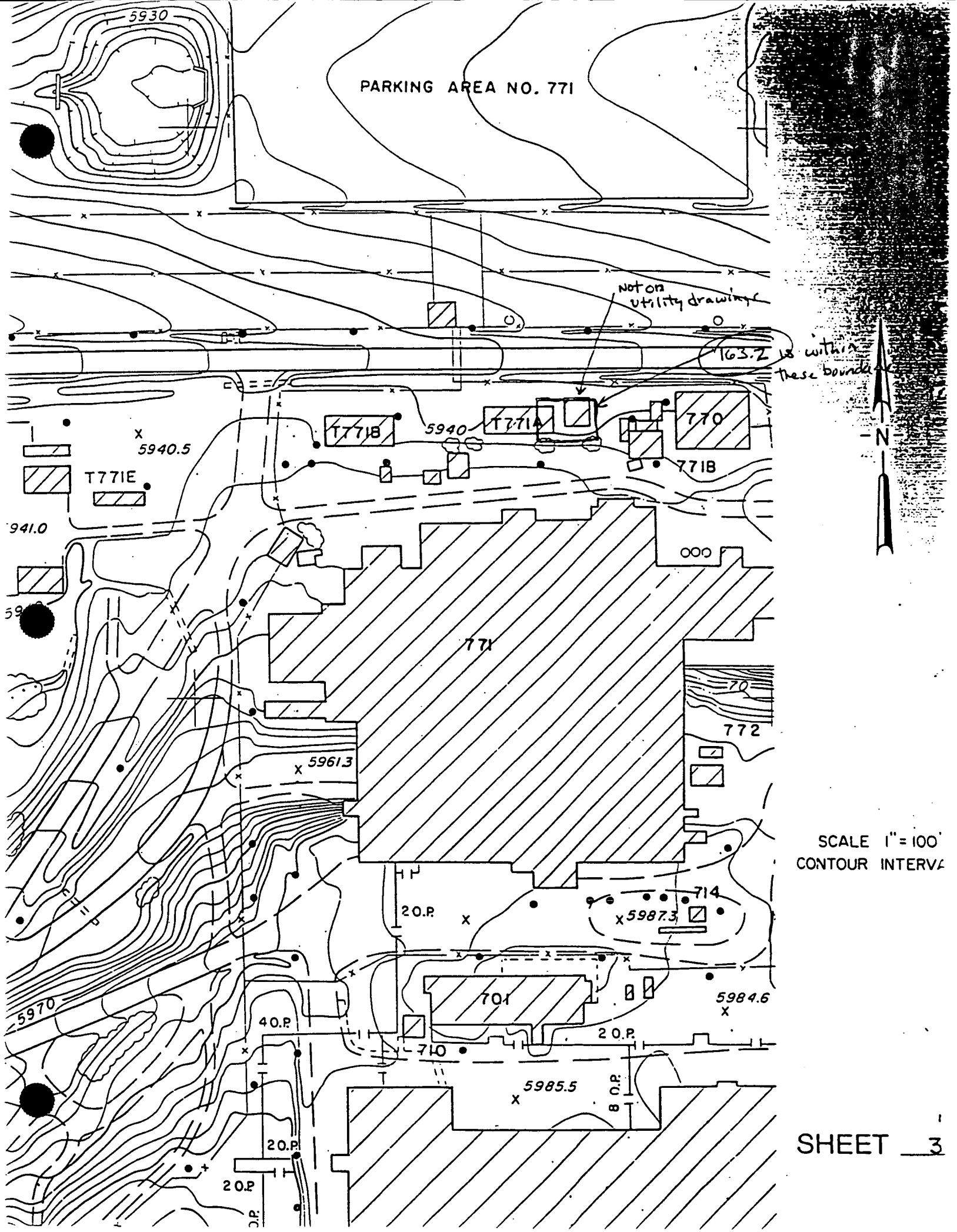
[2] Personal Communication, Carol Barker, RFP Employee, April 9, 1992.

[3] Owen, J.B. and L.M. Steward, 1973, "A Historical Summation of Environmental Incidents Affecting Soils at or near the AEC Rocky Flats Plant," October.

[4] Setlock, G.H., 1988, "Request for Detailed Report on Radiometric Survey," Internal Letter to Tom Greengard, August 19.

[5] Remote Sensing Laboratory, 1990, "An Aerial Radiological Survey of the USDOE's Rocky Flats Plant and Surrounding Area," May.

[6] RFP Engineering Drawing, RF-V71774-10007, Building 71 and 74 Addition Site and Grading Plan, Approved August 6, 1962.


5930
PARKING AREA NO. 771
Not on utility drawings
163.2 is within these bounds
T771B
5940
T771A
770
771B
5940.5
T771E
941.0
771
772
5961.3
714
5987.3
20.P.
701
5984.6
5970
40.P.
710
20.P.
5985.5
8 O.P.
20.P.
20.P.
N
SCALE 1" = 100'
CONTOUR INTERVA
SHEET 3

DOTY & ASSOCIATES
ENVIRONMENTAL, GROUND-WATER AND WASTE MANAGEMENT ENGINEERS

20011 GOLDEN GATE CANYON ROAD
SUITE 100
GOLDEN, COLORADO 80403-8125

TELEPHONE: (303) 279-9181
FAX: (303) 279-9186

April 10, 1992
1801-17

Mr. Jim Shaffer
Advanced Sciences, Inc.
405 Urban Street
Suite 401
Lakewood, CO 80228

Subject: OU8 Deliverable

Dear Mr. Shaffer:

As per your request of earlier today, I have reviewed the IHSS descriptions in the HRR for OU8.

We will provide you with detailed information on all of the IHSSs that we have identified as higher priority IHSSs. In many cases this information is considerably more detailed, or different, than that contained in the HRR. Therefore, I only reviewed the HRR descriptions for all of the lower priority IHSSs. For the lower priority IHSSs 127, 135, 137, 138, 149, 150.2, 150.4, 150.5, 150.6, 150.7, 150.8, 163.1, 172, 173, 184, and 188, ASI should use the information and locations presented in the HRR pending any significant changes we may uncover next week. I do not anticipate any significant changes to any of these IHSSs.

The location and general description of IHSS 132 as presented in the HRR is correct, but the HRR narrative description of activities at this location is somewhat confusing and incorrect. I would like to modify the HRR description of this IHSS and provide it to ASI for use in this work plan. In particular, this IHSS has no aboveground tanks associated with it. The four tanks associated with IHSS 132 are made of concrete with the sides poured against soils. The tanks are in a valve pit with the tops of the tanks approximately eight to ten feet below grade. The bottoms of the tanks would be about 15 to 25 feet below grade. The tops of the tanks serve as the floor of the valve pit.

The HRR narrative description of events related to IHSS 150.3 is correct, however, the location of the tunnel is wrong. I have attached to this letter a utility map with the tunnel highlighted on it. I have also provided a figure that gives

some additional detail on the tunnel. This tunnel slopes down from Building 771 to Building 774. This tunnel entered 774 on the south wall of 774 prior to the southward expansion of 774 in 1972. Now the tunnel enters 774 Building from the west wall of the building; the additions to Building 774 account for why some of the drawings appear so different with respect to the juxtaposition of the tunnel to Building 774. This tunnel had been under a couple of feet of soil when originally built, but due to major modifications of the hillside between 771 and 774 the top of the tunnel is exposed near 774, and is, I estimate, nowhere under more than approximately one foot of soil. The north edge of the tunnel is the point at which the slope of the hillside down to the 771/774 courtyard changes from quite steep to nearly vertical. I may revise the narrative description of this tunnel for your use, but for the time being the above information should be adequate to allow ASI to get on with characterization of any environmental impacts near this tunnel.

I trust that the above is adequate for your purposes, please call if you have any questions or comments.

Sincerely,
DOTY & ASSOCIATES

Frank J. Blaha

Frank J. Blaha

DOTY & ASSOCIATES
ENVIRONMENTAL, GROUND-WATER AND WASTE MANAGEMENT ENGINEERS

20011 GOLDEN GATE CANYON ROAD
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GOLDEN, COLORADO 80403-8125

TELEPHONE: (303) 279-9181
FAX: (303) 279-9186

April 9, 1992
1801-17

Mr. Jim Shaffer
Advanced Sciences, Inc.
405 Urban Street
Suite 401
Lakewood, CO 80228

Subject: OU8 Deliverable

Dear Mr. Shaffer:

Enclosed are draft descriptions of the present conditions at a number of the IHSSs in OU8. The IHSSs addressed in this submittal are 125, 139.1, 139.2, 146.1, 146.2, 146.3, 146.4, 146.5, and 146.6. I have not included a disk with this submission because you will receive more IHSS descriptions tomorrow at which time a disk will be included.

I trust that the attached descriptions are adequate for your use. Please call if you have any questions or comments.

Sincerely,
DOTY & ASSOCIATES

Frank J. Blaha

Frank J. Blaha

OU8 IHSS DESCRIPTIONS

IHSS Number: 125
IHSS Name: Concrete Process Waste Tanks

Date/Duration of Occurrence: 1953 - 1972

Description of Incident: An underground concrete process waste holding tank is located southeast of the original Building 774. IHSS 125 represents Tank 66, which is associated with Tank 67, directly south of Tank 66, (same size, construction, and age and share an internal wall). Tank 68 is a similar tank located 2 feet south of Tank 67 and built in 1958. Tanks 66, 67, and 68 are also identified in the IAG as IHSSs 124.2, 124.3, and 124.1, respectively, and are currently included in OU10. These tanks are also included in RCRA Unit 55 for which a closure plan was written in 1989. Information for the development of the following discussion was gathered from the review of documents and historical engineering drawings as well as photographs and visual observation of the site.

General Physical Setting

IHSS 125 is a 14,000-gallon reinforced concrete tank at the southeast corner of Building 774 and has a nominal capacity of 12,000 gallons. The tank was included in a 1953 engineering drawing but it is unclear when it was first placed into service. Liquid waste was transferred to or from the tank through pipes connected with the Building 774 treatment process. A manhole is located at the top of the tank. Four 3-inch diameter pipes enter Tank 66 from the north end of the west wall. Two inflow pipes enter 2 feet from the roof of the tank. One passes through Tank 66 and enters Tank 67. Two outlet pipes enter approximately 6 inches from the floor of the tank and one passes through into Tank 67. The elevation of the outlet pipe above the floor of Tank 66 allows approximately 1,000 gallons of liquid to remain in the tank.[1]

The walls of the tank are approximately 10 inches thick. The bottom elevation is approximately 5955 feet and the tank is approximately 8 feet high. The area occupied by the tank is 21.5 feet (east-west) by 11 feet (north-south). The floor of tank was at the same approximate height as the second floor of Building 774 and a short pipe tunnel connects the building with the tank. Ground elevation to the east of the tank is approximately 5962 feet.[1,2] The west side of Tanks 66 and 67 are 4 feet from the east sides of the concrete storage tanks (IHSS 146). A shed was constructed over Tanks 66 and 67 with bay doors at the east and west sides. The roof of the tanks serves as the floor to the shed.

The main function of Tanks 66 and 67 was to receive treated liquid decanted from the second-stage batch precipitation process in Building 774. According to personnel interviewed for the development of the closure plan, the tank floors were cleaned, sandblasted, and coated with eight coats of Amercoat No. 55 in 1956. Details regarding the processes that created waste that had been destined for the tanks are provided in the 1989 RCRA Closure Plan. These tanks were taken out of service in September 1989 because they did not meet the requirements for permitting standards.[3]

In 1962, a subsurface investigation of the area was done prior to the construction of an addition on the west side of Building 774. Several boreholes were drilled prior to the construction. Soil samples were obtained using both split spoon samplers and Shelby tubes.[4] The results of the laboratory analyses are unknown. A second engineering and geologic investigation of the area was done in 1970 prior to the construction of two additions to Building 774. Borehole logs written prior to the construction are attached.[5]

Approximately 4 feet of the north side of the tank was exposed above the ground surface in 1965 photographs. The ground sloped to the north approximately 25 feet to a loading dock on the east wall of Building 774. The ground elevation dropped approximately 12 feet in that distance.[5,6] In photographs from 1969 and from the 1970 engineering report prior to the construction of an addition to the building, it is clear that an addition to the building was constructed in the area between the loading dock and the tank extended to the east beyond the east side of Tank 66.[4,7]

Incidents of Contamination

Several references to contamination of the environment from the underground concrete tanks near Building 774 have been cited. These tanks are generally believed to be the 6 concrete waste tanks identified as IHSS 146.1 through 146.6, but the actual identification of the tanks is inconclusive.[8] These tanks are located only 4 feet west of the concrete tank known as Tank 66 and held liquid of similar waste characteristics.

One incident that is attributed specifically to Tank 66 occurred in July 1981 when the tank overflowed and spilled an estimated 3,300 gallons of process wastewater onto the ground and pavement east of the tanks.[9] Air samplers were promptly set up and a water sample was collected (location unknown). Direct and smear count surveys of the pavement were taken and no measurements above background (level unknown) were identified. The water sample analysis indicated about 40,000 dpm/l plutonium.[9] The pH of the sample was 12.0 and nitrate as nitrogen was 5.6×10^3 mg/l.[10]

Radiometric Survey Results

The results of the Radiometric Survey, performed at the RFP during the late 1970s and early 1980s, indicate no extremely contaminated areas (stated to be 500,000 to 1,000,000 pCi/g)[11] around Building 774 in the area of Tank 66.

*** ** ***

Air Considerations: No documentation was found identifying air monitoring in response to any release incidents. Air monitoring was performed following the 1981 overfill incident; however, monthly Health Physics Reports during the timeframe do not document specific air surveillance efforts.

Soil Consideration: Much of the soil surrounding the concrete tanks was disturbed during the construction of the addition (between 1965 and 1969) and paving of the area surrounding the tanks. Because of the steep slope in area, the bottom level of the tanks was near the level of the second floor of Building 774. Therefore, the soil beneath the tank is adjacent to the rooms on the first floor of the building.

Surface Water Considerations: Surface drainage from the hillside south of the building is toward the north. A roadway is located on the top of the slope. A footing drain which daylights north of the building between the western condensate receiving tank (Tank T-108) and Building 770 originates south of the building near the concrete tanks. The footing drain water has been sampled regularly in the past and in 1971, contamination detected in the water was attributed to the presence of the 6 concrete tanks west of Tank 66; however, due to the close proximity of the concrete tanks, the similarity in waste constituents contained, and the similarity in age and construction, the origin of the footing drain water contamination cannot definitively be identified as one set of tanks or the other. Surface water quality data from the footing drain is included in the RFEDS database.

Geologic Considerations: The subsurface investigations prepared in 1962 and 1970 identified borehole lithology in the area of Building 774. The logs from the 1970 study are attached. The surface geology south of the building has changed because of the construction of the addition and removal of contaminated soil. A number of wells are located to the north, south, and especially the east of Building 774, primarily due to the presence of the RCRA-regulated solar ponds.

*** ** ***

Other IHSSs of Concern: IHSS 125 and IHSS 124.1 through 124.3 are the concrete tanks located directly east of IHSS 146 tanks. These tanks held waste similar to the waste in the IHSS 125 tanks and operated during the same period. IHSS 146 is included in OU8. IHSS 124.1 through 124.3 is included in OU10 Other Outside Closures. The Draft Final RFI/RI Workplan was completed in November 1991.

IHSSs 139.1, 149, 127, and 150.3 are located in the immediate vicinity of Building 774 and are included in OU8. IHSS 139.1(N) is a sodium hydroxide tank and has had a number of leaks. IHSS 149 is the site of a former waste transfer pipe between Buildings 774 and the solar ponds. The characteristics of the potential waste contamination due to IHSS 149 is the same as from IHSS 146. IHSS 127 represents another pipeline leak of process waste from Building 774 to Building 995 (wastewater treatment plant) located southeast of Building 774. The waste was of the same characteristics as the IHSS 146 waste. IHSS 150.3 was a concrete vent tunnel between Building 774 and 771. The tunnel carried process waste pipelines into the concrete tanks of IHSS 146. The events that caused contamination of the soil occurred while the concrete tanks were being removed and the addition to Building 774 was being constructed. The source of contamination was the same process waste as contained in the concrete tanks.

IHSS 215 was a tank inside the building and is included in OU15. Tank T-40 held sludge from the treatment of liquid process waste. Although there were no documented releases to the environment identified, contamination caused by this tank may be identified through subsurface investigations. The HRR discussion of IHSS 215 is attached.

The solar evaporation ponds are located east of Building 774. The ponds have had a complex history of construction and use. The Final RFI/RI Workplan for OU4 Solar Evaporation Ponds was completed in February 1992. The solar ponds have been used in the past for the evaporation of process waste. The soil contamination attributed to the ponds has been characterized as primarily nitrates with elevated levels of radionuclides. The HRR narrative for the solar ponds details their construction and operation histories and is attached.

References

[1] RFP Engineering Drawing RF-74-656-B, Approved February 1953.

[2] RFP Engineering Drawing RF-74-S8B, Approved January 1953.

[3] Rockwell International, 1989, "RCRA Closure Plant Tanks T-40, T-66, T-67, T-68 Hazardous Waste Management Unit 55 for U.S.D.O.E. - Rocky Flats Plant Transuranic Mixed Waste," September 29.

[4] R.V. Lord and Associates, Inc., 1962, Subsurface Investigation Facilities Expansion, U.S. Atomic Energy Commission Rocky Flats Plant, Boulder, Colorado, Prepared for Associated Nucleonics, Inc. May.

[5] Woodward-Clevenger & Associates, Inc., 1970, Engineering & Geologic Investigation for Two Additions to Building No. 774 A.E.C. Rocky Flats Facility, Prepared for Stearns-Roger Corporation, August 26.

[6] RFP Photograph Negative Nos. 10829-08 & 10829-03, September 21, 1965.

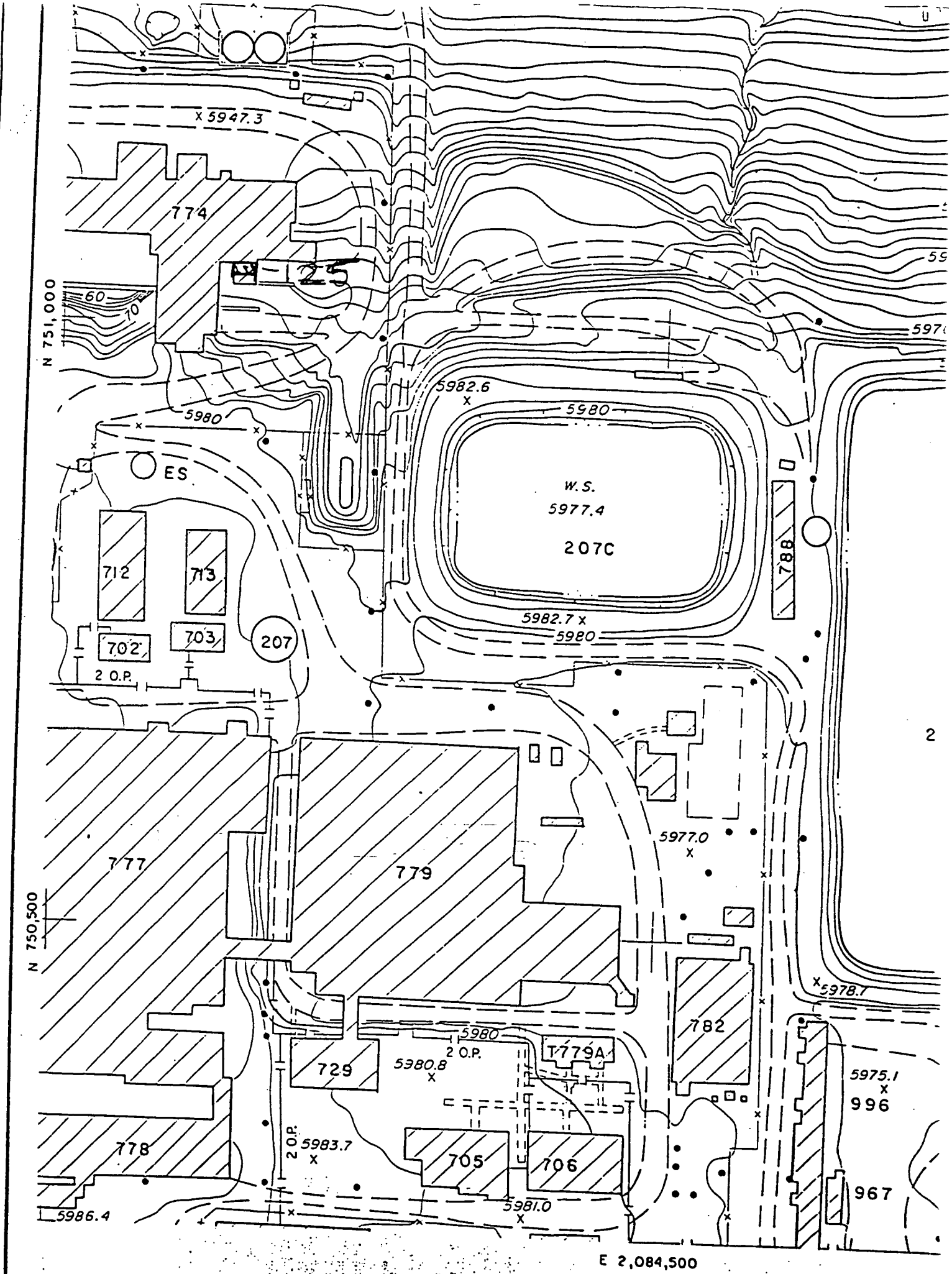
[7] RFP Photograph Negative No. 13677-03, June 9, 1969.

[8] Owen, J.B. and L.M. Steward, 1973, "A Historical Summation of Environmental Incidents Affecting Soils at or near the U.S.AEC Rocky Flats Plant," October.

[9] Hornbacher, D.D., 1981, "Environmental Analysis Weekly Highlights Week Ending July 17, 1989," July 17.

[10] Johnson, L.P., 1981, "774 Spill - Tank 66 Analytical Report," July 22.

[11] Setlock, G.H., 1988, "Request for Detailed Report on Radiometric Survey," Internal Letter to Tom Greengard, August 19.


5947.3
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60
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N 751,000
5982.6
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702
703
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2 O.P.
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5978.1
782
5980
2 O.P.
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E 2,084,500

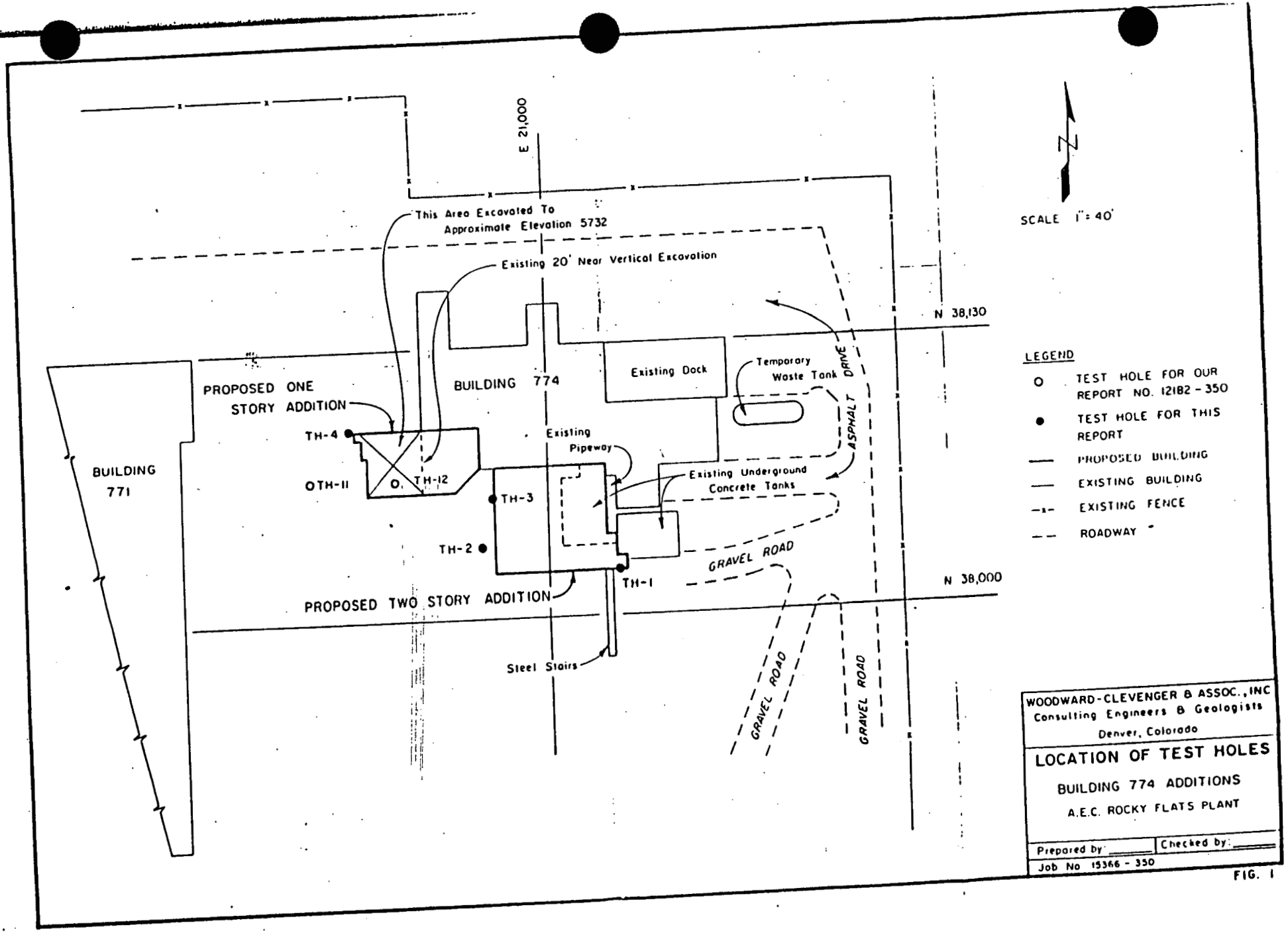
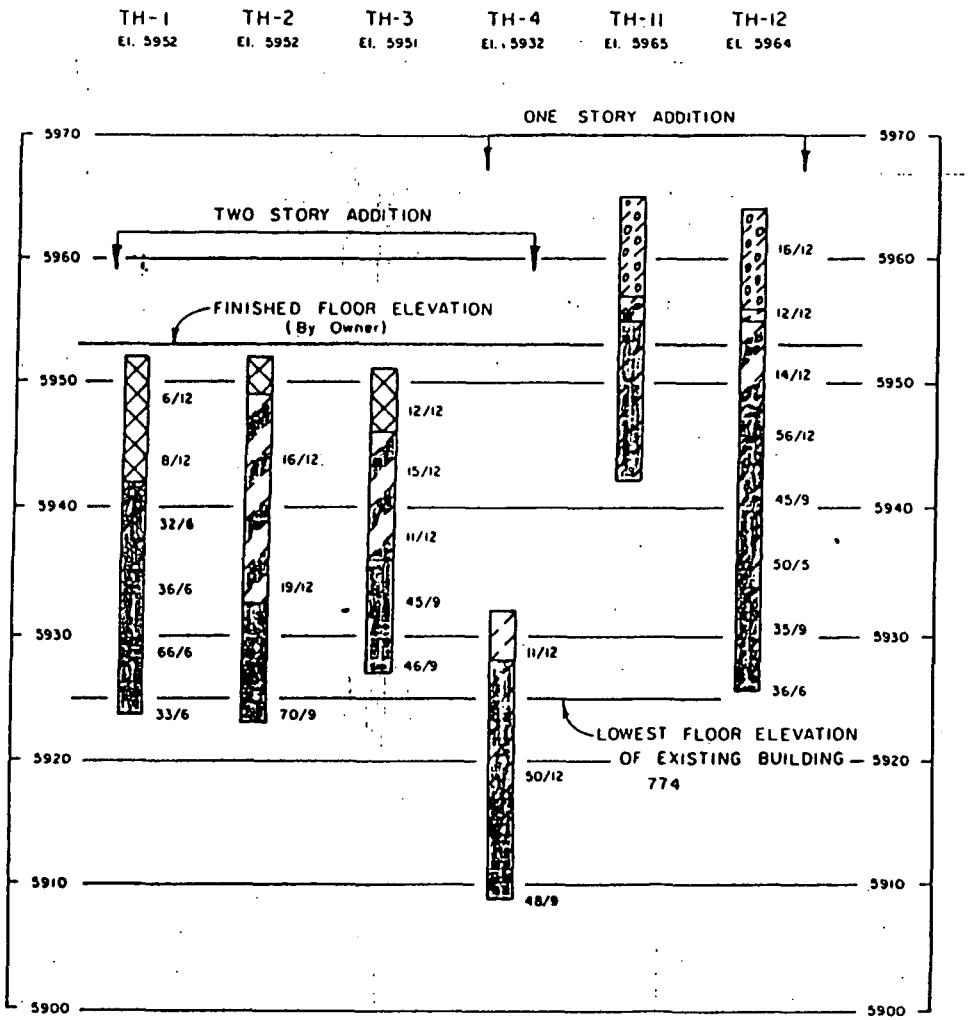

E 21,000
This Area Excavated To Approximate Elevation 5732
Existing 20' Near Vertical Excavation
N 38,130
N 38,000
SCALE 1" = 40'
BUILDING 771
PROPOSED ONE STORY ADDITION
BUILDING 774
Existing Dock
Temporary Waste Tank
ASPHALT DRIVE
TH-4
OTH-11
TH-12
TH-3
TH-2
TH-1
Existing Pipeway
Existing Underground Concrete Tanks
GRAVEL ROAD
PROPOSED TWO STORY ADDITION
Steel Stairs
GRAVEL ROAD
GRAVEL ROAD
LEGEND
TEST HOLE FOR OUR REPORT NO. 12182 - 350
TEST HOLE FOR THIS REPORT
PROPOSED BUILDING
EXISTING BUILDING
EXISTING FENCE
ROADWAY
WOODWARD-CLEVENGER & ASSOC., INC
Consulting Engineers & Geologists
Denver, Colorado
LOCATION OF TEST HOLES
BUILDING 774 ADDITIONS
A.E.C. ROCKY FLATS PLANT
Prepared by:
Checked by:
Job No 15366 - 350

FIG. 1



LEGEND

- MAN-MADE FILL, CLAY, MEDIUM STIFF TO STIFF, VERY SANDY, VERY GRAVELLY, CALCAREOUS, MOIST, BROWN.
- CLAY, STIFF, VERY SANDY, MOIST, TAN (CL).
- GRAVEL, MEDIUM DENSE, SLIGHTLY SANDY, SLIGHTLY CLAYEY, MOIST, BROWN (GC).
- CLAY, STIFF, SANDY, RUST AND TAN-MOTTLED, GRAY, MOIST (CL) (WEATHERED BEDROCK).
- CLAYSTONE, FIRM TO MEDIUM HARD, SILTY, SANDY, MOIST, TAN, RUST MOTTLED, GRAY (BEDROCK).
- CLAYSTONE, HARD, SILTY, SANDY, MOIST, TAN, RUST MOTTLED, GRAY (BEDROCK).
- 6/12 — INDICATES THAT 6 BLOWS OF A 140-POUND HAMMER FALLING 30 INCHES WERE REQUIRED TO DRIVE A 2-INCH DIAMETER SAMPLER 12 INCHES.

NOTES:

1. HOLES WERE DRILLED ON JULY 24, 1971 WITH A 4-INCH DIAMETER HELICAL AUGER POWERED BY A CENTRAL MINE EQUIPMENT (CME 55) DRILL RIG.
2. ELEVATIONS ARE APPROXIMATE AND REFER TO BENCH MARK SHOWN ON FIGURE 1.
3. NO FREE WATER WAS FOUND IN TEST HOLES AT TIME OF DRILLING.
4. DRILL LOGS IN THIS REPORT ARE SUBJECT TO LIMITATIONS, EXPLANATIONS AND CONCLUSIONS OF THIS REPORT.

WOODWARD-CLEVENGER & ASSOC., INC
Consulting Engineers & Geologists
Denver, Colorado

SUMMARY LOGS OF TEST HOLES

BUILDING 774 ADDITIONS

A.E.C. ROCKY FLATS PLANT

Prepared by: _____ Checked by: _____

Job No 15366-350

FIG. 2

[49] EG&G, "Solar Ponds Interceptor Trench System Groundwater Management Study, Rocky Flats Plant Site," Task 7 of the Zero-Offsite Water-Discharge Study, January 15, 1991.
[50] Hornbacher, D.D., "Environmental Analysis and Control Weekly Highlights, Week Ending September 3, 1976," September 3, 1976.
[51] Hornbacher, D.D., "Environmental Analysis and Control Weekly Highlights, Week Ending September 30, 1977," September 30, 1977.
[52] Hornbacher, D.D., "Environmental Analysis and Control Weekly Highlights, Week Ending June 3, 1977," June 3, 1977.
[53] Hornbacher, D.D., "Environmental Analysis and Control Weekly Highlights, Week Ending July 29, 1977," July 29, 1977.
[54] 1700788
[55] 1700797
[56] 1500299
[57] 1601054
[58] 1601037
[59] 1700158

Other References of Interest

1501868
1600668
1501867
1501866
1600671
1501863
1501879
1500418
1501861
1601044
1501859
1501858
1601040
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1500553
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DRAFT

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PAC REFERENCE NUMBER: 000-121

IHSS Number: 121

Unit Name: Original Process Waste Lines

Location: RFP Main Production Facility (Figure 000-5)

Date(s) of Operation or Occurrence

1952 - 1983 (approximate)

Description of Operation or Occurrence

Background Information

The Original Process Waste Lines (OPWL) are a network of tanks and underground pipelines constructed to transport and temporarily store aqueous chemical and radioactive process wastes from point of origin to on-site treatment and discharge points. The system handled process wastes from Building 123, Building 444, Building 707, Building 771, Building 776, Building 779, Building 865, Building 881, Building 883, and Building 889.[1] Minor amounts of waste from Building 122 and Building 441 were also handled.[2] These wastes were analyzed prior to transfer. Depending on the level of radioactivity and chemical composition, process wastes were routed to Building 774 for treatment, Pond B-2 (see PAC NE-142.6), or the Solar Evaporation Ponds (see PAC 000-101).[1] Process waste held in Pond B-2 was also pumped to Pond A-2 for storage during the mid-1970s.[3,4]

The OPWL was placed in service when the RFP began production activities in 1952.[1] Repairs and additions were made to the system through 1975.[2] The OPWL system was replaced beginning in 1975 by a doubly-contained, fully inspectable process waste system.[1] This new process waste system was completed in the summer of 1984.[5] Some tanks and pipelines from the OPWL were incorporated into the new process waste system and into the RFP exhaust plenum fire deluge system.[2]

As defined in the 1988 OPWL Closure Plan, the OPWL consists of approximately 35,000 feet of pipeline and 39 separate tank locations which house a total of 73 tanks. OPWL tanks and pipelines exist in RFP areas 100, 400, 500, 600, 700, 800, and 900, the Solar Evaporation Ponds, and the northeast buffer zone between the 900 Area and holding Pond B-2.[2]

Pipeline Network

OPWL pipelines vary in age, usage history, and construction.[1] The pipelines range from one to ten inches in diameter and are constructed of a variety of materials, including cast iron, stainless steel, vitrified clay, polyvinyl chloride, teflon, plastic and pyrex glass. They are buried in trenches averaging three feet wide and three to eight feet deep, and are bedded in sand and/or native soil backfill.[1,6] Approximately 13,000 feet of OPWL pipeline are located beneath buildings, and approximately 7,000 feet are beneath concrete or asphalt pavement. Roughly 13,000 feet, or more than half of the 22,000 feet not located beneath buildings, are located in areas highly congested with other active and inactive utility lines.[2]

Most OPWL pipelines which were not converted to the new process waste system are believed to have been abandoned in place. Pipelines beneath buildings were flushed with water until significant residues appeared to have been removed, then sealed at wall and floor penetrations with six to twelve inch plugs of "non-shrinking cement sealant". Small segments of pipelines within buildings (e.g., riser pipes) were removed.[2] The OPWL Closure Plan indicates that underground pipelines outside of buildings were abandoned in place without sealing

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References

[1] 1501869
[2] 1601043
[3] 1601042
[4] 1600369
[5] 1501860
[6] 1501865
[7] RFP Drawings, Dow Chemical, 1-3398-207, December 16, 1955.
[8] 1501852
[9] 1600408
[10] 1700206
[11] RFP Photograph, Negative 1935, September 19, 1956.
[12] RFP Photograph, Negative 1936, September 19, 1956.
[13] 1600395
[14] 1600652
[15] EPA Aerial Photograph Frame AIN-2N-88, July 2, 1955.
[16] RFP Photograph, Negative 1935-00, September 19, 1986.
[17] Ryan, E.S., "History Report - Waste Disposal Co-Ordination Group - August, 1959," September 9, 1959.
[18] 1600649
[18] 1600649
[19] 1600394
[20] 1600407
[21] Ryan, E.S., "History Report - Waste Disposal Co-Ordination Group - October, 1960," November 11, 1960.
[22] Ryan, E.S., "History Report - Waste Disposal Co-Ordination Group - December, 1960," January 9, 1961.
[23] Ryan, E.S., "History Report - Waste Disposal Co-Ordination Group - April, 1961," May 19, 1961.
[24] Ryan, E.S., "History Report - Waste Disposal Co-Ordination Group - July, 1961," August 18, 1961.
[25] Ryan, E.S., "History Report - Waste Disposal Co-Ordination Group - August, 1961," September 26, 1961.
[26] 1700205
[27] Ryan, E.S., "History Report - Process Waste Disposal Group - July, 1963," August 19, 1963.
[28] Ryan, E.S., "History Report - Process Waste Disposal Group - September, 1963," October 16, 1963.
[29] 1600154
[30] Ryan, E.S., "History Report - Process Waste Disposal Group - May, 1964," June 17, 1964.
[31] 1500565
[32] 1700785
[33] 1700798
[34] 1600399
[35] 1700204
[36] 1600040
[37] 1700198
[38] 1500413
[39] 1500296
[40] U.S. DOE, "Solar Evaporation Ponds Closure Plan," Rocky Flats Plant, July 1, 1988.
[41] Ryan, E.S., "History Report - Waste Disposal Co-Ordination Group - November, 1960," December 16, 1960.
[42] Ryan, E.S., "History Report - Waste Disposal Co-Ordination Group - January, 1961," February 15, 1961.
[43] 1600414
[44] Personal Communication, Maas, M., September 9, 1990.
[45] Dow Chemical Drawing 25573-1, "Nitrate Interceptor Trench Plan," June 9, 1975.
[46] 1500405
[47] Site Visit, December 17, 1991.
[48] 1500759

DRAFT

TABLE 000-1
SOLAR POND DESIGNATIONS AND STATUS

Current Designation	Original Designation	Date Completed	Date of Last Recorded Use	Current Status
Original Clay-Lined Solar Pond	Pond 2	October 1953[57]	March 1963	Regraded in 1970, soils from pond possibly incorporated into berms for 207C[40]
Not Applicable*	Pond 2 Auxiliary**	September 1955[2]	June 1960	Removed in 1962 or 1963[43]
Not Applicable*	Either Pond 2C or Pond 2D	August 1959[17]	June 1960	Regraded in 1970, soils from pond possibly incorporated into berms for 207C[40]
Solar Pond 207A	Pond 2A	August 1956[58]	August 1991	Dry
Solar Pond 207B (this solar pond consists of three cells, North, Center, and South)	Pond 2B (this pond consists of three cells, North, Center, and South)	May 1960[20]	Still in use	Water (primarily contaminated groundwater from the ITPH) being removed from pond cells[40]
Solar Pond 207C	Solar Pond 207C	December 1970[59]	Still in use	Contains process waste

* This pond could be confused with the original clay-lined solar pond since it was of earthen construction only.

** This pond was also known by one of the two following designations: Pond 2C or Pond 2D. This pond was originally unlined, but was provided with a clay liner in February 1957.[9]

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In 1988, two distinctly different sets of engineering drawings were found that pertained to the 207B solar pond re-design that occurred in the 1960 and 1961 time-frame. Briefly, the difference between these two sets of engineering drawings related to whether or not underdrains would be constructed beneath the 207B solar ponds. The set of drawings indicating underdrains beneath the 207B solar ponds were undated but numbered 1-8080-207. One of the drawings that had no underdrains beneath the 207B ponds is numbered 16887-1. Physical evidence observed in the field was inconclusive in determining which of the two re-designs were built. Therefore, in fall 1988 one of the manholes on the drainage tile was cleaned out to determine if laterals connected with the manhole from the west. The existence of such laterals would have indicated that underdrains were probably present under the 207B solar ponds. No such laterals were found connecting with the manhole. It is now understood that the 1960 Pond 207B re-design for which the bids were too high was the design for which underdrains were required. The 207B re-design that was built did not have underdrains beneath the 207B ponds, but did have a drainage tile immediately east of the 207B solar ponds. This drainage tile drained to the north, and was eventually (in the 1970s) collected by Sump 1 and pumped to 207B-North. The sequence of events regarding re-design of the 207B solar ponds can be traced in the monthly history reports of the Waste Group at the RFP.

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ITPH Overflow

The ITPH overflow of August 7, 1989 resulted in the filing of a RCRA Contingency Plan Implementation Report (Number 89-012).[32] In addition to the filing of this report, additional inspection and maintanence activities were to be implemented to prevent the reoccurrence of similar problems.

Valve Vault Flooding

The valve vault flooding of October 21, 1989 was related to the transfer of solar pond water to Building 374 for evaporation. The incident resulted in the filing of a RCRA Contingency Plan Implementation Report (Number 89-015). Solar pond water in this incident was entirely contained within the valve vaults with no environmental release. In addition to the report, piping repairs were made as well as piping upgrades.[54]

Piping of Contaminated Smowmelt

On March 10, 1990 it was discovered that approximately 1,440 gallons of domestic water and contaminated snowmelt was being pumped out of a containment berm to the nearby ground. In response to this incident a RCRA Contingency Plan Implementation Report (Number 90-002) was filed and controls over this type of activity were upgraded.[55]

Transfer of Water to 207A

For the March 1990 event involving transfer of water from the 207B solar ponds to the 207A solar pond, a RCRA Contingency Plan Implementation Report was filed (Number 90-003). Additionally, piping changes were made that allowed the transfer of water from the solar ponds to Building 374. The water transferred to 207A was to be evaporated in Building 374.[33]

Fate of Constituents Released to Environment

It is believed that most of the contaminants released from the solar ponds have contaminated soils and groundwater in the immediate vicinity of the solar ponds. It is known that in the past some of the contaminated groundwater and seepage reached North Walnut Creek and migrated offsite. However, this migration of contamination is believed to have largely been corrected first by the installation of the trenches and sumps and later by the installation of the ITPH system. Some older studies tried to estimate the inventory of nitrate contamination in the soils north and east of the solar ponds.[56] Extensive groundwater and soil sampling activities have been conducted since 1986 in order to better address the fate of contaminants released to the environment from the solar ponds. These sampling activities are discussed in the Solar Pond Closure Plans of July 1, 1988 and in the Solar Pond RFI/RI Work Plan.

The solar ponds will be studied in accordance with the IAG schedule for OU4. The IAG activities will include site investigations, site characterizations, and possible site remediation. The Final Phase I RFI/RI Report is to be completed by October 18, 1993.

Comments

A number of documents state that the routine use of the earthen solar ponds ceased upon completion of Pond 207A in 1956. This is not the case because the waste group's monthly reports clearly indicate routine discharges to Pond 2 (the original clay-lined solar pond) up to June 1960. An additional use of Pond 2 was made in March 1963.

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References

[1] 1500824
[2] 1501186
[3] 1600454
[4] 1501197
[5] 1501198
[6] 1600457
[7] 1600456
[8] 1501810
[9] 1501811
[10] 1501762

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PAC REFERENCE NUMBER: 700-215

IHSS Reference Number: 215

Unit Name: Tank T-40, Unit 55.13

Approximate Location: N 751,000; E 2,084,000

Date(s) of Operation or Occurrence

1963 - September 1989

Description of Operation or Occurrence

The concrete mixed waste storage tank adjacent to Room 103 of Building 771 was constructed in 1963. The roof of the tank serves as the floor of Room 203.[1]

Physical/Chemical Description of Constituents Released

The tank held sludge from second stage precipitation of liquid process waste from Building 771. Also stored was effluent from a silver recovery unit in Building 774.[1]

Responses to Operation or Occurrence

Use of Tank T-40 ceased when the tank was replaced in September, 1989.[1] No documentation was found which details releases from this unit.

Fate of Constituents Released to Environment

No documentation was found which detailed a release of constituents from the tank. An interim status closure plan was prepared for the tank and submitted to the CDH and EPA on September 29, 1989.[1] This IHSS is being studied in accordance with the IAG schedule for OU9 and OU15. The IAG activities will include site investigations, site characterizations, and possible site remediation. The Final Phase I RFI/RI Report for OU9 is to be completed by September 6, 1994. The Final Phase I RFI/RI Report for OU15 is to be completed by January 4, 1995.

Comments

None.

References

[1] Blaha, F.J., "Solid Waste Management Unit Descriptions", March 23, 1990.
[2] 1500755

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PAC REFERENCE NUMBER: 000-101

IHSS Reference Number: 101

Unit Name: Solar Evaporation Ponds

Approximate Location: N751,000; E2,085,000

Date(s) of Operation or Occurrence

The solar ponds have operated in varying configurations since December 1953 when waste was first sent to the original clay lined solar pond.[1] This original clay lined pond was supplemented and eventually replaced by other solar ponds. The first use of a solar pond typically began shortly after construction of the pond was completed. The dates of completion and last use of the various solar ponds are presented in Table 000-1.

Description of Operation or Occurrence

The solar ponds were used primarily for the disposal of low-level radioactive wastes contaminated with high concentrations of nitrate. Building 774, the process waste treatment plant, was designed primarily for the removal of radioactive contaminants and not the removal of nitrate. The solar ponds were also used for the disposal of other difficult to treat wastes. The design of the original solar pond is documented in Dow drawing 1-1454-207. It was estimated in late summer 1955 that Pond 2 would be incapable of holding the waste volumes expected to be generated through the winter months;[2] therefore, this pond was supplemented with an auxiliary pond in September 1955[3]. The auxiliary pond was built adjacent to the southeast corner of Pond 2. These two ponds shared a common corner with an overflow channel connecting the two ponds.[3] Water exceeding a certain level in Pond 2 would flow into Pond 2 Auxiliary.

Construction of the first lined pond (known at that time as Pond 2A, later designated Pond 207A) was prompted by the knowledge that nitrate contamination from the earthen ponds was moving off the RFP (on April 5, 1955 the effluent leaving the RFP boundary, at that time the cattle fence, contained 90 mg/l nitrate),[4] as well as the fact that Great Western Reservoir was going to be used as a human drinking water supply.[5] The first leakage of water from any of the solar ponds had been noted in June 1954 with the identification of a nitrate contaminated spring on the hillside north of the solar ponds.[6] The first lined pond was built of asphalt planking (asphalt impregnated wood approximately 1/2-inch thick[7]). This pond was constructed immediately to the east of the two earthen ponds. Dow Chemical drawing 1-3398-207 documents the relationship of the new lined pond with the pre-existing earthen ponds. All references in this document will henceforth use 207A to reference the first lined pond.

Following construction of the first lined pond (Pond 207A), the original pond and the auxiliary pond were allowed to dry. The original clay lined pond had some additional clay added to its east side to prevent leakage, and the auxiliary pond was fully lined with clay.[8] These ponds were returned to service shortly after these lining activities took place. The clay lined ponds were used routinely until June 1960.[9] After June 1960, routine use of the clay-lined ponds is not documented, although an additional release to Pond 2 was made in March 1963.[10] Photographs of Ponds 2, 2 Auxiliary, and 207A have been located which clearly show the three ponds and their physical relationship to each other.[11,12]

The next major change in operations at the solar ponds came with the creation of a third earthen pond in support of testing on oxidation of wastes. The third earthen cell was constructed in April 1959.[13] The existing references indicate that the three earthen cells were used in series and the effluent from these three

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ponds was discharged to the sanitary wastewater treatment plant.[13] These tests were carried out over a few months, the late summer and early fall of 1959, and were ultimately unsuccessful.[14] The third earthen cell was constructed immediately east of the existing Pond 2, immediately west of 207A, and immediately north of Pond 2 Auxiliary.[15,16] The designation of this new pond was either Pond 2C or 2D, with the existing Pond 2 Auxiliary receiving the remaining designation.[17] It appears that the Pond 2 Auxiliary designation was no longer used.

Construction of the 207B solar ponds began on November 11, 1959.[18] These ponds are immediately east of Pond 207A and consist of three separate cells (North, Center, and South). During December 1959 construction activities, seepage was identified in the west side of the excavation near the east side of Pond 207A. A "covered drainage ditch" (later references to this device use the term drainage tile, this discussion will also use drainage tile) was installed to collect the seepage water and release it to the hill just north of the ponds.[19] Dow Chemical drawing 1-6217-207 documents the design and configuration of the asphalt plank-lined 207B solar ponds. Construction of the 207B solar ponds was fully completed on June 16, 1960.[10] The first placement of waste in the 207B ponds occurred on May 31, 1960 into a fully completed cell.[20] Upon use of the fully completed 207B ponds, leaks were almost immediately identified and the ponds were removed from service. The leakage from the ponds was attributed to the reaction of acid wastes seeping beneath the asphalt planking and reacting with marl soil to produce carbon dioxide gas. This gas then caused the asphalt floor of the ponds to lift, rupturing the seams.[10] A new lining and design for the 207B ponds was designed and submitted for bids. The bids received in November 1960 were too high, and so the new pond configuration was redesigned and re-bids were requested for just the south portion of the 207B ponds.[21] Repair and re-lining of the 207B-South solar pond were completed on November 29, 1960. The 207B-South cell was returned to service in December 1960.[22] Work on repair of 207B-North and Center was started in April 1961.[23] This work included the construction of a drainage tile immediately east of the 207B ponds that drained to the north. Difficulty was encountered in laying the asphalt on the bottom of 207B-North. It was found necessary to remove the asphalt planking in order to lay the asphalt concrete on the bottom.[24] The repairs to 207B-Center and North were completed on August 17, 1961. Pond 207B Center was returned to service on August 25, 1961, and 207B-North was returned to service on August 28, 1961.[25]

Work related to the relining and redesign of Pond 207A began in April 1963 with the removal of liquids and salts so that the liner could be accessed.[26] As Pond 207A was emptied salts and sands remaining in the pond were drummed for removal from the ponds. Tests were conducted to determine whether the asphalt planking to be removed from the pond would be suitable for burning. It was found that the asphalt planking would not support combustion on its own.[27] Removal of the asphalt planking and Pond 207A subgrade preparation was completed in September 1963.[28] Disposal of the asphalt planking took place in the East Trenches (PAC NE-111.1 - NE-111.8). Relining and redesign of Pond 207A continued through November 18, 1963.[29] Wastes were again placed in Pond 207A on May 28, 1964.[30]

Solar Pond 207C was constructed in 1970 primarily to allow the transfer of water from other solar ponds so that they could be repaired.[31] The design of Pond 207C included a leak detection pipe placed immediately beneath the solar pond and running from south to north where it drains into a leak detection sump. Solar Pond 207C has remained in constant service since the beginning of its use.

In the mid-1980s activities for solar pond cleanout began. The first step in these activities was to construct a building (Building 788) in which the solar sludge and Portland cement could be mixed to create pondcrete. This building was constructed between solar ponds 207A and 207C. Solar pond sludge cleanout began in mid-1986. This activity along with the transfers of solar pond water to the Building 374 evaporator, have helped to remove both the sludges and the liquids form the solar ponds. At times however, problems with the cleanout effort have occurred. Examples of these problems include pondcrete that has not hardened properly and flooding of some of the valve vaults used to help transfer solar pond

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water to Building 374 for evaporation.

An event related to solar ponds on August 7, 1989, required the filing of a RCRA Contingency Plan Implementation Report (Report Number 89-012). This event consisted of an overflow of contaminated water from the Interceptor Trench Pump House (ITPH) wet well. This overflow occurred because the circuit breakers supplying electricity to the pump motors were both tripped.[32] Additional details concerning this incident can be found in the "Response" section of this Pac narrative.

A second event at the solar ponds took place from March 14, 1990 to March 16, 1990 which also required the filing of a RCRA Contingency Plan Implementation Report (Report Number 90-003). This event consisted of transfer of contaminated groundwater and precipitation from Pond 207B-North into Pond 207A. This transfer was made due to the lack of freeboard in Pond 207B-North which presented a potential for overflow of the pond. The transfer was made with permission from CDH.[33]

Physical/Chemical Description of Constituents Released

The RFP solar ponds are often referred to in historical documents as the "high nitrate ponds." The most common characteristic of the wastes released to the solar ponds was high concentrations of nitrate. The solar ponds typically had untreated process waste placed in them, but on occasion treated process waste was also placed in the ponds. The RFP process waste treatment plant was designed to remove radioactive contamination of process wastes (and also achieved some removal of metals), but it was not designed to remove nitrate. The monthly history reports from the RFP waste group detailed the originating building, quantity of water transferred, and activity present in the water released to the solar ponds. These history reports also stated which of the solar ponds received these waters. Only limited information was found on more detailed chemical analyses of the wastes released to the solar ponds. One of these references does provide a relatively complete characterization of Pond 207A waters from the fall of 1958.[34] The analyses available in this report cover activity of plutonium, activity of uranium, total solids, total nitrate, pH, specific gravity, aluminum, chromium (VI), fluoride, iron, magnesium, silicon dioxide, sulfate, total halides, and an extensive list of metals. There are also analytical results presented for a compound R_2O_3 which is described as "... the combined oxides denoted by R_2O_3 must include all those cations which are precipitated with ammonium hydroxide even in the presence of a large concentration of ammonium chloride."[34] Of particular note in this reference is the fact that the pH range reported was 0.87 to 0.97, with an average of 0.93. The pH reported for June of 1958 was 1.21.[34]

The monthly history reports of the waste group also mention when other materials were placed in the solar ponds or handled near the solar ponds. For instance, it is known that radioactively contaminated aluminum scrap was disposed in the solar ponds (see PAC 500-197),[35] as was alcohol for at least a short time in the 1950s.[36] Also, for a period of time, waste radiography solutions were drummed for disposal in the solar ponds;[37,38] and lithium scrap was sprayed with water for destruction of the lithium metal between the solar ponds.[39] For a period in late 1973 and early 1974, leachate collected from the RFP sanitary landfill was pumped to the solar ponds for disposal. It is also known that sewer sludge, cyanide wastes and acid wastes were disposed in the solar ponds for at least a portion of the time the solar ponds have been in use.[40] The handling of these materials was non-routine, and is not thought to have comprised a major portion of the waste materials placed in these ponds.

Data have also been generated from water collected from the drainage tile and from monitoring wells near the solar ponds. Interpretation of these data could also indicate some of the chemical constituents released by the solar ponds. A more detailed discussion of these response actions, and the types of data that are available, is given in the next section of this narrative.

In the more recent time frame, detailed analyses of solar pond water, solar pond sludge, and groundwater

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in the vicinity of the solar ponds have been conducted. The results of these analyses can be found in the RCRA closure plans for the solar ponds, the RFI/RI workplan for the solar ponds, and the groundwater monitoring reports that cover the solar ponds.

The volume of water that overflowed the ITPH wet well on August 7, 1989 was estimated at 50 to several hundred gallons. This water was analyzed and found to contain:

pH	7.3;
Total Dissolved Solids (TDS)	2.27 mg/l;
Gross Alpha	95 ± 38 pCi/l;
Nitrate	2,200 mg/l;
Chloride	114 mg/l;
Chloroform	3 micrograms per liter;
Carbon tetrachloride	3 micrograms per liter;
Trichloroethene	6 micrograms per liter; and
Tertrachloroethene	1 micrograms per liter.[32]

The water transferred in March 1990 from Pond 207B-North to Pond 207A consisted of contaminated groundwater and runoff.[33]

Responses to Operation or Occurrence

Relining and patching of the solar ponds are response activities to the possibility of leakage from the solar ponds. The relining and patching activities were conducted a number of times throughout the history of the solar ponds.[40]

After installation of the drainage tile (between Pond 207A and Pond 207B) in December 1960, analysis of the water flowing from that tile became a routine daily activity. The water was sampled on a daily basis for flow, temperature, total alpha activity, nitrate, and pH.[19] Typically, only gross alpha activity and flow rate were reported. Flow rates in the drainage tile were variable with flows of hundreds of gallons per hour not uncommon. The chemical characteristics of the water flowing out of the pipe also varied considerably, but at times the water had elevated levels of gross alpha activity (up to thousands of picocuries per liter). These analyses from samples of water from the drainage tile can indicate some of the chemical characteristics of the constituents released; however, the analytical parameters that were evaluated on water samples collected from the drainage tile are limited in scope. Similarly, the drainage tile immediately east of the 207B ponds installed in 1961 was also sampled for environmental analyses. The analytical data from this sampling was presented in the Solar Pond Closure Plan of 1988 under the title of Sump 1.[40]

During November 1960, six groundwater monitoring wells were installed near the 207B solar ponds.[41] The first chemical analysis of water collected from the groundwater sampling wells in January 1961 indicated that nitrate contamination was present in the groundwater in concentrations up to 800 mg/l.[42] Sampling of the six wells became a routine activity with data reported in the waste group's history reports. The analyses of water collected from these wells can indicate some of the chemical characteristics of constituents released from the solar ponds. Once again, however, the analytical parameters that were evaluated are limited in scope.

In addition to the activities discussed above, two sumps, six trenches, and french drains were constructed in the area north of the solar ponds to allow the return of contaminated groundwater to the solar ponds. These actions were largely prompted by the RFP policy to keep waters in the A-series drainage below the State Public Health Service limit for nitrates in drinking water (10 mg/l).

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Removal of Pond 2 Auxiliary

Pond 2 Auxiliary was removed in preparation for the construction of Building 779. Surveys of the pond 2 Auxiliary area soil indicated readings between 2,500 to 5,000 counts per minute (cpm). Clay samples of the pond had 75,000 d/m/kg which was described as 2-1/2 times soil background in the area. The proposed activity was to remove the clay lining to a depth of 6 inches. This material was to be disposed of by burial in dried sewage sludge trenches (PAC 900-109, PAC NE-110, PAC NE-111.1 - NE-111.8). The pond berms were to be leveled after removal of the clay liner.[43] No documentation confirming the fate of the soil has been found.

Removal of Pond 2 and Pond 2C or 2D

Pond 2 and the earthen pond immediately east of it (Pond 2C or 2D) was removed in preparation for construction of Pond 207C in 1970. The soils potentially impacted from operation of the two referenced earthen ponds were reworked and possibly were incorporated into the berm for Pond 207C.[40] No documentation has been found indicating that radiation surveys or soil removal and disposal operations were conducted.

Sumps and Trenches

The first two sumps were activated in April 1970. Sump Number 1 was installed at the north end of the drainage tile running along the east side of the 207B complex. Sump Number 1 returned water to 207B-North. Sump Number 2 was installed at the north end of the drainage tile located between solar ponds 207A and 207B. Water from this sump was returned to 207A. Trenches 1 and 2 were installed in October 1971, Trench 3 in September 1972, and Trenches 4 and 5 in April 1974.[44] Trench 6 was installed in July 1974. Trench 1 returned water to Sump 1. Trench 2 returned water to Sump 2. Trench 5 drained by gravity to Trench 4. Water from Trench 4 was pumped to Trench 3, and Trench 3 returned the water to Pond 207A. Trench 6 returned water directly to Pond 207A.[45] Figure 000-2 presents the final configuration of the sumps and trenches. These trenches and sumps were located where seepage and nitrate concentrations were greatest.[46]

The low end of the trenches and the sumps consisted of buried 55-gallon drums. Most of these drums were supplied with an electric pump and float system to automatically control the pumps. The trenches consisted of a shallow excavated trench backfilled with gravel to the soil surface. These trenches drained to the buried drums at the low end of the trenches. This design of the trenches allowed collection of both surface and subsurface flows.[47]

This trench system remained in operation until the early 1980s when it was replaced by a more extensive french drain system. The need for the more extensive french drain system was prompted by the construction of the Perimeter Security Zone (PSZ). The PSZ is now called the Protected Area (PA). Construction of the PSZ destroyed Trenches 3 and 6. The trenches and sumps that were not destroyed in PSZ-related construction were abandoned in-place by cutting their electrical power supply.[44]

Interceptor Trench Pump House System

The Interceptor Trench Pump House system was installed in 1980 and 1981 and is still in use. The pump station is identified by a number of names at the RFP, including: Main Sump, Main Nitrate Sump, Nitrate Sump, Solar Pond Sump, French Drain Sump, and others. In this report, the pump station and the french drain system will be referred to as the Interceptor Trench Pump House (ITPH). The ITPH system was designed primarily to collect subsurface water. Engineering drawings for the design of the ITPH system are the following Rockwell International drawings: 27550-033, 27550-040, 27550-050, 27550-200, 27550-201, and 27550-202. These drawings are as-built drawings. Records indicate that the ITPH system was built in April 1981.[48] Figure 000-3 presents the configuration of the ITPH system at that time. Although the ITPH system was much more extensive than the trench and sump system that it replaced, the ITPH system was extended shortly after construction of

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the original parts of the ITPH system.[40] It was this extension of the system that was referred to as the "Interceptor Trench."

The ITPH system was extended due to concerns over the existence of groundwater seeps immediately north of the solar ponds. The extension of the ITPH system consisted of a new french drain that paralleled the old Patrol Road. This extension of the ITPH system was designed and built with gravel backfill from the drain to the surface so that it would collect both groundwater and surface water flow. This extension also provided for the collection of footing drain flows from Building 771 and 774, through a 4-inch diameter polyvinyl chloride (PVC) pipe.[49] Engineering drawings for the design of the ITPH system extension are Rockwell International drawings: 26637-01 and 26637-02. These as-built drawings indicate that the ITPH system extension was built between February and June 1982. Figure 000-4 presents the configuration of the ITPH system following its extension with the Interceptor Trench.

This system collects groundwater and surface water runoff (from the area immediately north of the solar ponds and south of the new PSZ perimeter patrol road) which drains by gravity to a pump station located near North Walnut Creek. The pump station consists of a wet well and a duplex installation of self-priming pumps. The ITPH pumps the collected incoming water to Pond 207B-North. Water from this pond is transferred to other solar ponds or force evaporated in Building 374.[40] Some of the water from 207B-North was spray irrigated in the West Spray Field (PAC SW-168).

For the August 7, 1989, ITPH overflow, a RCRA Contingency Plan Implementation Report was filed (Number 89-012). Inspections of the ITPH wet well were also increased. The water remaining in the wet well was pumped to Solar Pond 207B-North.[32]

Solar Pond Clean-Out

Solar pond clean-out is a response action to the presence of waste materials in the solar ponds and the presence of contamination in nearby soils, groundwater, and surface water. Some solar pond clean-out activities were conducted to allow re-lining activities to take place, such as the re-lining of 207A in the early 1960s. However, in most clean-outs conducted earlier than those given below, the waste materials were immediately re-introduced upon completion of the re-lining activities or repairs.

From fall 1976 to fall 1977, the 207B solar ponds were cleaned and decommissioned with respect to use for storage of process wastewater.[50,51] This clean-out was done in support of the water recycle program being implemented by the RFP. All three cells of the 207B pond were cleaned, but only 207B-South was relined. This relining was done with a hypalon liner. During these clean-out and re-lining activities, soils to the south, east and between the solar ponds were also removed in order to better clean the area.[52,53] Process waste was not re-introduced to the ponds. Since the clean-out activities, these ponds have been used for reverse osmosis plant brine, treated sanitary sewage effluent, and contaminated groundwater collected by the ITPH system.[40]

The clean-out of process waste sludge in the 207A solar pond began in 1986 with the completion of Building 788 - a Pondcrete production building. The removal of the process waste and sludge from 207A was completed in 1988. In 1988 the final volume of sludge was removed from 207A and the final volume of water was transferred to the 207B solar ponds. The sludge was handled by combining the sludge with Portland cement, creating Pondcrete. The Pondcrete has been largely stored on plantsite since its generation, but some Pondcrete has been shipped offsite for disposal. In March 1990, contaminated groundwater transferred to the 207B solar ponds from the ITPH was placed in Pond 207A in order to prevent the over-topping of the 207B solar ponds. All of the water present in 207A was removed during 1991 and evaporated at the Building 374 forced evaporator.

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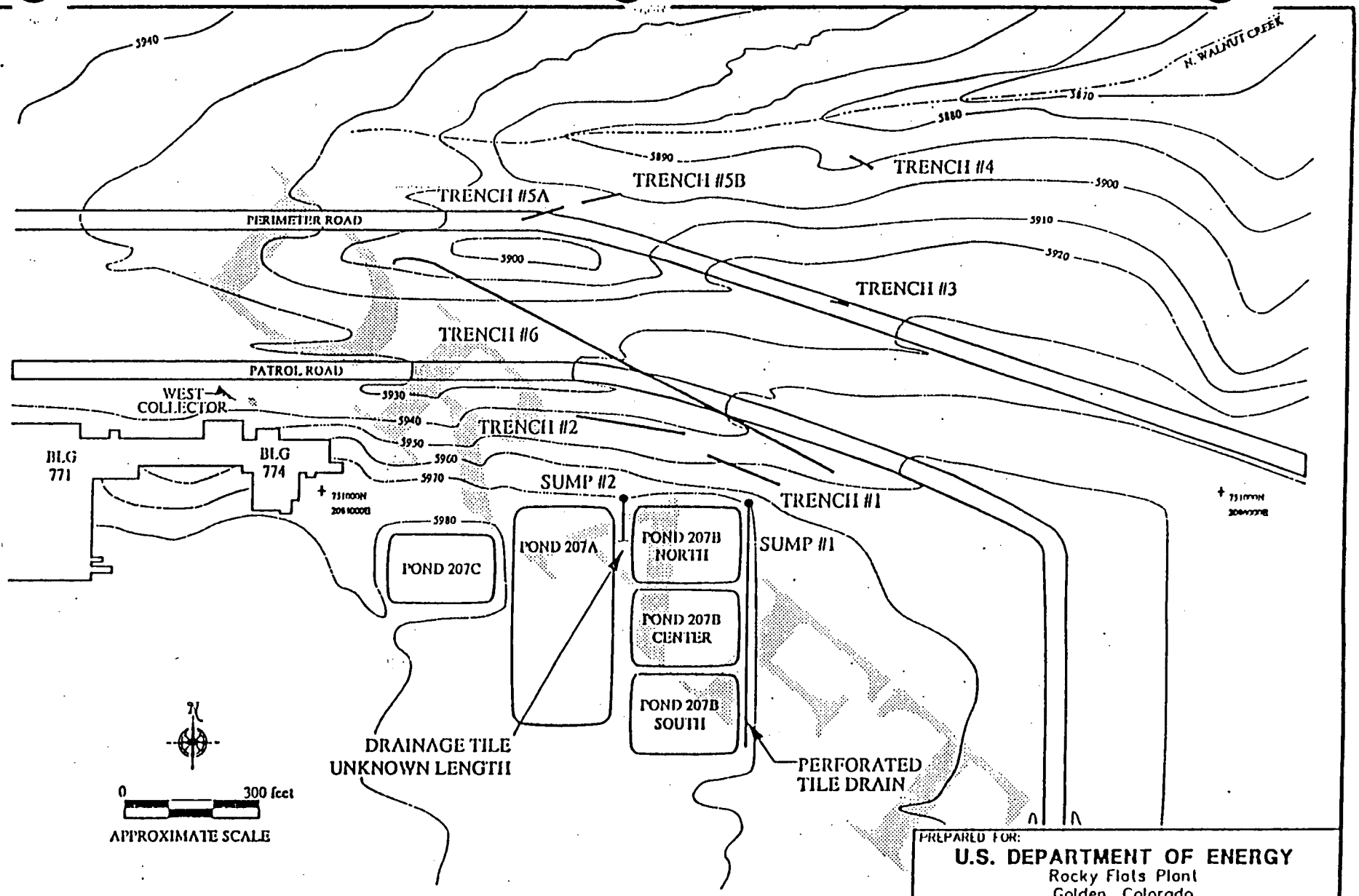

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Rocky Flats Plant
Golden, Colorado

FIGURE 000-2

TITLE:

TRENCHES AND SUMPS

DRAFT

PROJ. NO.	304944	DWG. NO.	304944-A84
DESIGN BY	A. VIRGIL	CHECKED	EJB
DRAWN BY	A. VIRGIL	APPROVED	
DATE	12/19/91	SCALE	AS SHOWN

REFERENCE: DRAWING PROVIDED BY DOTY & ASSOCIATES, FIGURE NO. 000-2, 12/17/91, PROJECT NO. 600-10.

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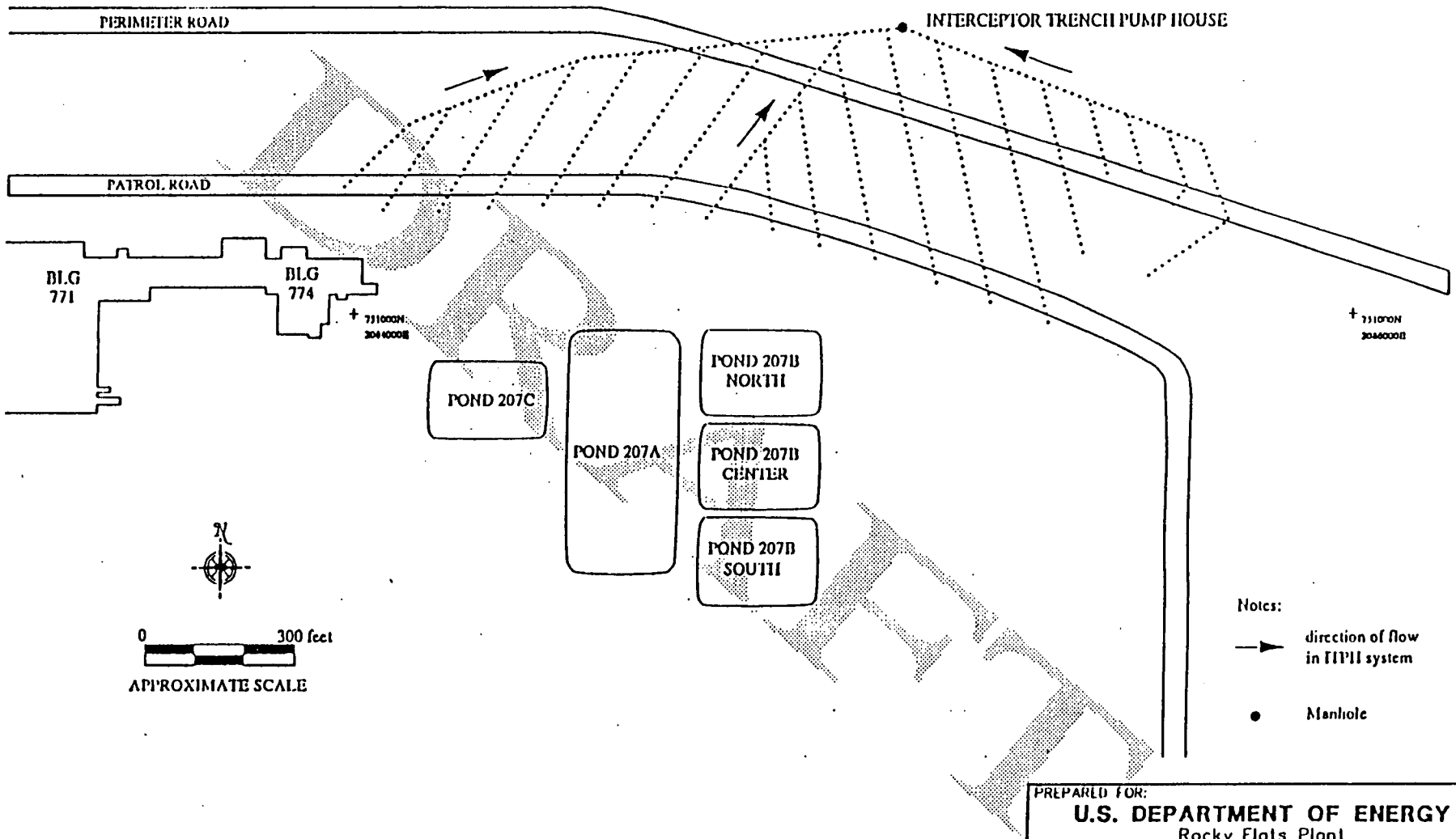
45144331 12/19/91 1:35pm CFH

APPROXIMATE LOCATION OF ITPH DRAIN SYSTEM



DRAFT

REFERENCE: DRAWING PROVIDED BY DOTY & ASSOCIATES, FIGURE NO. 000-3, 12/17/91, PROJECT NO. 506-10.

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Rocky Flats Plant
Golden, Colorado

FIGURE 000-3

TITLE:

INTERCEPTOR TRENCH PUMP HOUSE SYSTEM

DRAFT

PROJ. NO.	304944	DWG. NO.	304944-A85
DESIGN BY	A. VIRGIL	CHECKED	FJB
DRAWN BY	A. VIRGIL	APPROVED	
DATE	12/19/91	SCALE	AS SHOWN

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APPROXIMATE LOCATION OF FRENCH DRAIN SYSTEM

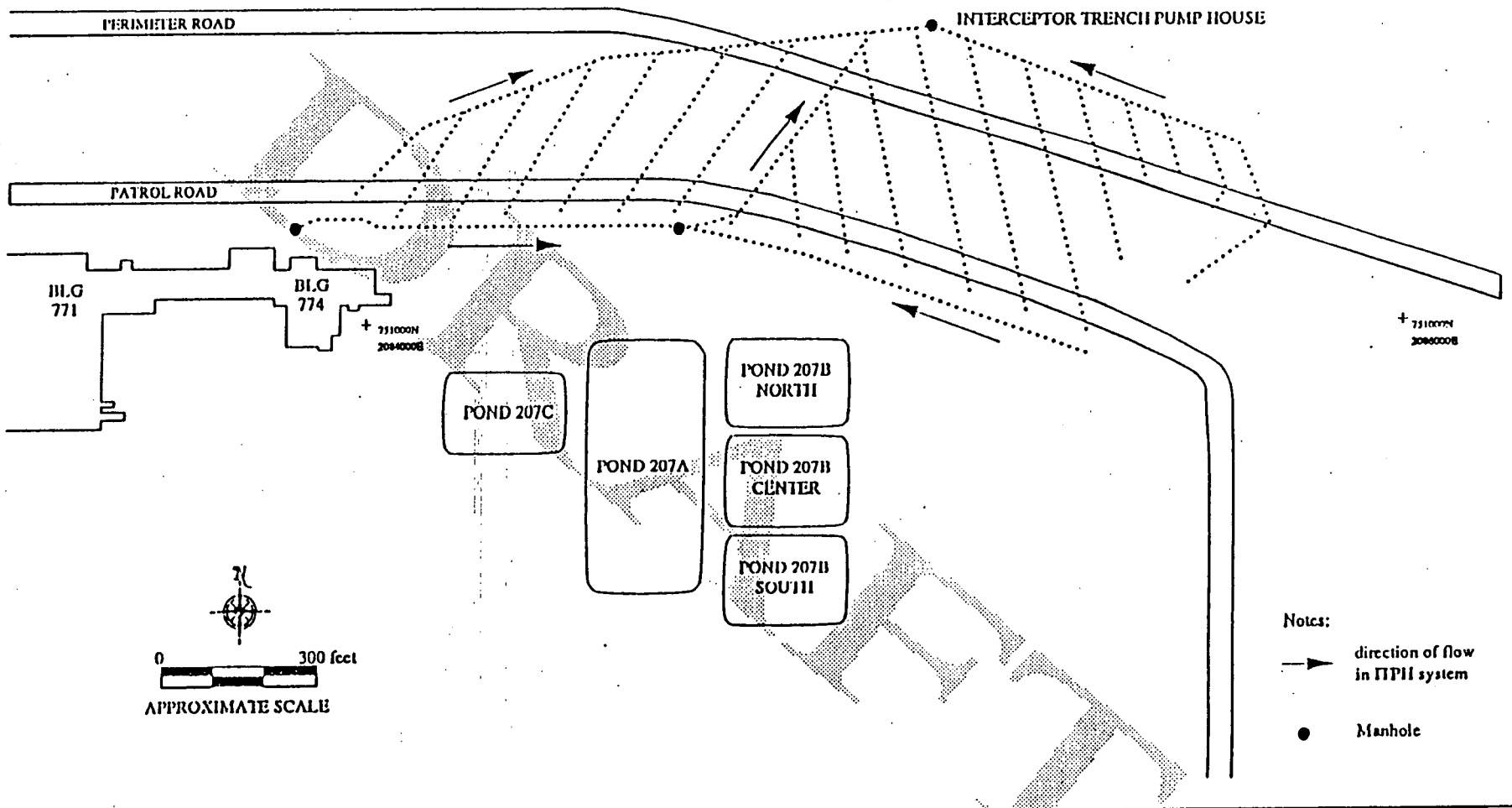

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FIGURE 000-4

TITLE:
INTERCEPTOR TRENCH PUMP HOUSE SYSTEM EXTENSION

DRAFT

PROJ. NO.	304944	DWG. NO.	304944-A86
DESIGN BY	A. VIRGIL	CHECKED	EJB
DRAWN BY	A. VIRGIL	APPROVED	
DATE	12/19/91	SCALE	AS SHOWN

REFERENCE: DRAWING PROVIDED BY DOTY & ASSOCIATES, FIGURE NO. 000-4, 12/17/91, PROJECT NO. 606-10.

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OU8 IHSS DESCRIPTIONS

IHSS Number: 139.1
IHSS Name: Hydroxide Tank Areas

Date/Duration of Occurrence: 1955(?) to Present

Description of Incident: Two caustic tanks, a 5,400-gallon potassium hydroxide (KOH) tank south of Building 771, and a 6,500-gallon sodium hydroxide (NaOH) tank north of Building 774, have been subject to spills and leaks in the past.

The KOH tank is located approximately 55 feet south and 35 feet east of the southeast corner of Building 771.[1] It was built some time between 1955 and 1964.[2] The tank is of welded construction, and appears to be in good condition presently. It is on a concrete base, which is also in good condition, and is surrounded by a small, eroded, earthen berm.[3] It has been suggested that this tank site be identified as IHSS 139.1(S).

The NaOH tank is located adjacent to the north side of Building 774. The tank was built some time between 1955 and 1964.[2] It is vertical and surrounded by insulation, which is in poor condition. Through the holes in the insulation, it is apparent that the sides of the tank are corroded, as is the base of the tank. The tank is surrounded by a corroded berm which is approximately 18 inches high.[3] It has been suggested that this tank, along with tanks described below, be identified as IHSS 139.1(N).

Two large tanks, which were once used as steam condensate tanks, are located approximately 80 feet north of the NaOH tank,[1] and at a lower elevation. These tanks were built some time between 1971 and 1978.[4] The westernmost tank receives overflow and contained liquid from the bermed area around the NaOH tank. The easternmost tank receives overflow from the westernmost tank. These two tanks, T-107 and T-108, have riveted construction. Currently, there is standing water around the tanks. The bottom of the tanks appear to be corroded, and there is rust on the tops and sides of the tanks.[3]

Documented incidents involving the caustic tanks are as follows.

During the week ending May 5, 1978, a spill occurred during the routine filling of a caustic tank near Building 771. Neither the specific tank nor the quantity spilled was documented. The spilled caustic was contained by a dike below the tank, and was not released to the environment.[5]

During March 1985, a pinhole leak was found in the piping from the NaOH tank at Building 774. The leak occurred inside the building, "and probably did not contribute to the caustic found on the ground in the pit surrounding the tank."[6] Apparently, the leak had seeped along the underground pipe to the outside of the building. The leak was repaired.[7] The "caustic found...in the pit" was attributed to a poor sampling technique which allowed the valve to dip on the ground. It was estimated that 80 to 100 gallons of caustic had spilled as a result of this method over the thirty-year history of the tank. The pit was to be cleaned out and lined in response to the problem.[6] No documentation was found detailing the cleaning or lining of the pit.

In May 1985, A small leak was found at the fitting of a thermocouple in the NaOH tank north of Building 774. The caustic had solidified at the fitting, and therefore had not run into the pit. The fitting was repaired.[7]

On June 22, 1987, there was an overflow of NaOH during delivery operations to the 6,000-gallon Building 774 caustic supply tank because of a faulty level indicator. (It is believed that this was actually the 6,500-gallon NaOH tank.) Approximately 100 gallons of caustic flowed into the bermed containment area of the tank and then drained to the caustic "catch" tank, T-108. Due to cracks in, and deterioration of, the concrete berm, caustic seeped onto the road. Tank T-108 was also found to be deteriorating, and showed signs of seepage. In response to the incident, the 1 to 2 gallons which had seeped onto the road was diluted with water and rinsed off the road. Work orders to repair the cracks in the berm were initiated, and the work was completed on June 24. A job order was submitted to replace the deteriorating catch tank, T-108. The liquid in T-108 was sampled and was to be subsequently pumped to the sanitary sewer system or Building 774. The level indicator on the caustic tank was repaired.[8]

On November 13, 1989, approximately 5 gallons of 12 molar KOH was spilled when a vendor was refilling the holding tank near Building 771. Apparently, the tank was overfilled and the extra liquid spilled into an earthen berm surrounding the tank. The KOH was absorbed with approximately 100 pounds of "oil dry," and the contaminated soil and "oil dry," a chemical absorbent, were placed in an 83-gallon salvage drum. Soil samples were taken, and pH analyses were performed. It was determined that all KOH-contaminated material had been removed. The area was backfilled with new gravel.[9] It is possible that the overflowing liquid infiltrated into the soil beneath Building 771.[10]

*** ** ***

Air Considerations: It is improbable that the caustic spills or leaks had an impact on the air.

Soil Considerations: It is improbable that the spills and leaks of caustic have a residual impact on the soils. Elements associated with the incidents, such as potassium, sodium, oxygen and hydrogen, are all naturally occurring, and would therefore not be indicative of the releases, except by way of concentration. The only incident which included soil removal as a response was the November 1989 overflow incident.

Surface Water Considerations: It is improbable that the incidents have a residual impact on the surface water in the area.

Geologic Considerations: It is improbable that the incidents have a residual impact on the groundwater in the area. Existing wells in the area include #19189, #18489 (in the north area), and #89389 (in the south area). They were constructed in 1989.

*** ** ***

Other IHSSs/PACs in the Area: Other areas or incidents of concern in the immediate area of the caustic tanks are as follows.

- Effluent Pipe; IHSS 149, PAC 700-149:
  A line used for transfer of wastes leaked solar pond water and process waste east of the NaOH tank and the old condensate tanks. Historical Release Report text pertaining to this site is attached.

- Radioactive Site - 700 Area Site #3 - Wash Area; IHSS 163.1, PAC 700-163.1:
  The area north of Building 774 may have been used for washing radioactively contaminated equipment. Historical Release Report text pertaining to this site is attached.

- 771/774 Footing Drain Pond; PAC 700-1108:
  Footing drains from Buildings 771 and 774 drain into a small pond northwest of the two condensate receiving tanks. Historical Release Report text pertaining to this site is attached.

- Hydrofluoric Acid Tank Area; IHSS 139.2, PAC 700-139.2:
  There is a storage shed containing cylinders of hydrofluoric acid northwest of the KOH tank. This IHSS is included in OU8, and the description is included in this work plan.

- Radioactive Leak Between Buildings 771 and 774; IHSS 150.3, PAC 700-150.3:
  Process waste leaks have occurred in a tunnel containing process waste lines between Buildings 771 and 774. Historical Release Report text pertaining to this site is attached.

References

[1] Site Utility Plans, D-15501-13-M, January 17, 1987.

[2] RFP Photographs, Frames VB-BL-33-7 (October 1964), and AIN-2N-88 (July 1955).

[3] Site Visit, F.J. Blaha, April 6, 1992.

[4] RFP Photographs, Frames VEQC-C-3-179 (1978) and VCUC-2-88 (August 1971).

[5] Hornbacher, 1978, "Environmental Analysis and Control Weekly Highlights - Week Ending May 5, 1978," Internal Letter to M.V. Werkema, May 5.

[6] Setlock, 1986, "Special Projects," from "Environmental Analysis and Control Weekly Highlights" from R.W. Hawes, April 19, 1985.

[7] Setlock, 1986, "Special Projects," from "Environmental Analysis and Control Weekly Highlights" from R.W. Hawes, May 2, 1985.

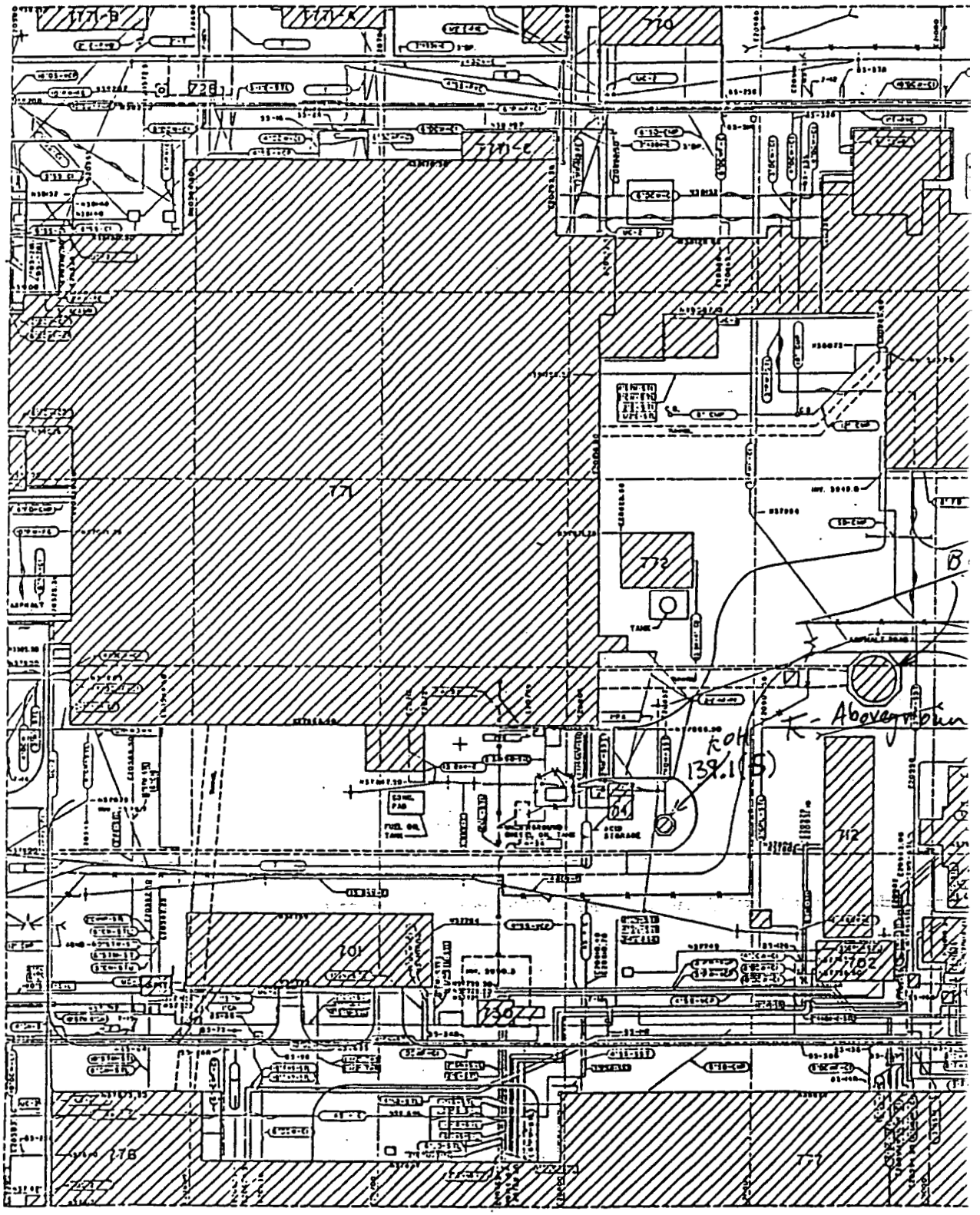
[8] Kissel, 1987, "Final SIR #87-6-774.1 - Caustic Spill," June 29.

[9] "RCRA Contingency Plan Implementation Report No. 89-020."

[10] "...3004(U)," December 15, 1987.

SEE ZONE A-5

SEE ZONE B-4



SEE ZONE C-5

40'
1" = 40'

PAC REFERENCE NUMBER: 700-149

IHSS Reference Number: 149

Unit Name: Effluent Pipe

Approximate Location: N751,000; E2,084,200

Date(s) of Operation or Occurrence

1972 - 1980[1]

Description of Operation or Occurrence

In 1972, two 1.5-inch PVC pipes were installed to transfer wastes between Building 774 and the 207 Solar Evaporation Ponds. These lines were abandoned in place in 1980 after the vapor compression evaporation Building 374 was constructed.[1]

Sometime during June or July of 1973, a contractor broke the plastic line that ran from the evaporation ponds to Building 774. Repairs were made and the water continued to be drawn to the ponds.[2]

In the late 1970s, a process waste line break southeast of Building 774 resulted in a release of liquid which flowed around to the front of the building.[1,3,4,5] Another, more detailed, document reports that on July 21, 1980, an eight year old process waste line was discovered leaking southeast of Building 774. Process waste water was observed seeping up in the soil on the south side of the road southeast of Building 774. The leaking process waste water flowed down slope and through a 30-foot culvert, along the east chain-link and under the fence at the corner. From this point, the liquid flowed under the unpaved access road into a boggy area, the 771/774 Footing Drain Pond, north of Building 774 (PAC 700-1108). The vegetation in the boggy area was damaged where the spilled liquid formed a pool. It was estimated that approximately 1,000 gallons had leaked from the process waste line.[6]

Physical/Chemical Description of Constituents Released

Low-level radioactive wastes containing caustics and acids were released to the environment.[1]

Analysis of the spilled water from the July 1980 incident showed 2,500 pCi/l total alpha activity, 4,000 pCi/l gross beta activity, and 10,000 mg/l nitrate and a pH of 12.[3]

Responses to Operation or Occurrence

The initial response to the July 1980 incident was to stop the flow through the waste line causing the leak to stop. When the soil dried, a FIDLER survey was conducted and verified that the flow did not go beyond the 771/774 Footing Drain Pond. On July 24, the broken waste line was excavated and the problem identified as a loose flange. Soil excavation began July 28, 1980, with radiation monitors checking the soil as it was excavated.[3]

Fate of Constituents Released to Environment

This IHSS is being studied in accordance with the IAG schedule for OU8. The IAG activities will include site investigations, site characterizations, and possible site remediation. The Final Phase I RFI/RI Report is to be completed by July 12, 1994.

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Comments

The Solar Evaporation Ponds are discussed as PAC 000-101. The Draft RFI/RI Work Plan for OU4 describes, in detail, past work on the solar ponds. Much of the area of IHSS 149 is covered by the area of monitoring and investigation for the Solar Evaporation Ponds. It has been proposed that the 700-149 be redefined as a 20 by 120 foot area encompassing the west end of the pipeline.[1]

The existing and currently proposed location boundaries for IHSS 149 do not include the area affected by the July 1980 process waste line leak. Although remedial action has been documented for the area affected by the July 1980 incident, it is proposed that this area be included within the boundaries of IHSS 149.

The stated diameters of the waste lines differ in the utility drawings (1.5 inches)[1] and the Report of Investigation of the 1980 incident (3 inches).[6]

This unit is part of the Original Process Waste Line (OPWL) system which is discussed as PAC 000-121.

References

[1] U.S. DOE, Draft Phase I RFI/RI Work Plan, Operable Unit No. 5, July 23, 1990.
[2] 1500920
[3] 1500755
[4] 1501999
[5] U.S. DOE, "Resource Conservation and Recovery Act Part B - Operating Permit, Rocky Flats Plant," Appendix I, RCRA 3004(u), December, 1987.
[6] 1600424

Other References of Interest

1500903
1500975
1500986
1501206
1501226
1600228
1700141

DRAFT

PAC REFERENCE NUMBER: 700-163.1

IHSS Reference Number: 163.1

Unit Name: Radioactive Site - 700 Area Site #3 - Wash Area

Approximate Location: N751,150; E2,084,250

Date(s) of Operation or Occurrence

Unknown.

Description of Operation or Occurrence

CEARP Phase 1 interviewees indicated the area north of Building 774 was used to wash radioactively contaminated equipment. The wash water flowed onto the ground.[1] Building 774 personnel did not recall this area ever being used to wash equipment.[2]

Aerial photos from 1971 and 1969 show two areas east of this IHSS that were covered with mounds of soil. RFP personnel interviewed for CEARP did not recall these mounds.[2]

The eastern half of the area depicted as IHSS 163.1 is mostly flat and paved. The area was repaved in 1987 or 1988.[2]

Physical/Chemical Description of Constituents Released

Wash water from radioactively contaminated equipment would be expected to have low levels of radionuclides and may also have contained various organic and inorganic compounds.

Responses to Operation or Occurrence

A sitewide radiometric survey was performed from 1977 through 1984. The purpose of the survey was to identify areas extremely contaminated with plutonium.[3]

Fate of Constituents Released to Environment

No radioactivity above background levels was indicated at this location by the radiological survey.[2,3]

This IHSS is being studied in accordance with the IAG schedule for OU8. The IAG activities will include site investigations, site characterizations, and possible site remediation. The Final Phase I RFI/RI Report is to be completed by July 12, 1994.

Comments

None.

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References

[1] 1501999
[2] U.S. DOE, Draft RFI/RI Work Plan, Operable Unit No. 5, July 23, 1990.
[3] Yoder, R.E., "Radiometric Soil Survey Completion", September 18, 1984.
[4] U.S. DOE, "Resource Conservation and Recovery Act Part B - Operating Permit, Rocky Flats Plant," Appendix 1, RCRA 3004(u), December, 1987.

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PAC REFERENCE NUMBER: 700-1108

IHSS Reference Number: Not Applicable

Unit Name: 771/774 Footing Drain Pond

Approximate Location: N751,000; E2,084,000

Date(s) of Operation or Occurrence

Late 1950s - Present

Description of Operation or Occurrence

Footing drain flows from Building 771 and Building 774 both daylight in the general location of a small pond north of Building 774.[1]

Footing drains north of Building 774 carry liquid from the drain tiles around the foundation of that building.[2,3] The Building 774 footing drain previously discharged to the north of Building 774 toward Walnut Creek.[3]

Six underground process waste storage tanks, in use since the late 1950s were removed from south of Building 774 in 1972 (PAC 700-146).[3,4] Physical failure of process waste storage tanks has been one of the major contributors of chemical and radioactive contamination to the soil around Building 774.[5] It is suspected that some minor leakage from these tanks has seeped to the building footing drain tiles.[3,5,6]

On July 21, 1980, an eight-year-old process waste line was discovered leaking southeast of Building 774. Process waste water was observed seeping up in the soil on the south side of the road southeast of Building 774. The leaking process waste water flowed down slope and through a 30-foot culvert, along the est chain-link fence, and under the fence at the corner. From this point, the liquid flowed under the unpaved access road into a boggy area north of Building 774. The vegetation in the boggy area was damaged where the spilled liquid formed a pool. It was estimated that approximately 1,000 gallons had leaked from the process waste line.[7]

There are two steel 8,000-gallon aboveground condensate receiving tanks located adjacent to the southeast of the Building 771/774 footing drain outfall. The two tanks are located on a concrete slab and have badly corroded bottoms. The tanks held "clean" condensate from an evaporative waste concentration system formerly used in Building 774. The condensate was tested for the absence of radioactive contamination and then released into a swampy area to below the tanks. The tanks have been out of service as condensate receiving tanks since approximately 1980. The western condensate tank presently receives overflow and precipitation runoff from the bermed area surrounding the sodium hydroxide tank (PAC 700-139.1(N)). The bermed area directs flow through a pipe and into the western condensate receiving tank.[4] One June 22, 1987, and again sometime around 1988, the sodium hydroxide tank north of Building 774 was overfilled.[4,8] In the June 1987 incident, approximately 100 gallons of the liquid caustic soda overflowed. The caustic spilled inside the bermed area beneath the tank drained to the caustic catch tank (western condensate receiving tank).[8]

Physical/Chemical Description of Constituents Released

A March 1971 report states that water coming from the footing drains was as high as 500 dpm/l gross alpha activity.[2,9] Water samples taken from the Building 774 footing drain in April 1971 indicated 400 dpm/l plutonium and 800 parts per million nitrate.[10]

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Analysis of the spilled water from the July 1980 incident showed 2,500 pCi/l total alpha activity, 4,000 pCi/l gross beta activity, 10,000 mg/l nitrate and a pH of 12.[3]

The western condensate receiving tank contained sodium hydroxide from the June 1987 overflow incident in which the caustic drained from the bermed area.[8]

Flow at the sump currently installed near the Building 771/774 footing drain outfall was estimated in September 1990. Measurements indicated the flow from this area to be on the order of 1.2 to 1.3 gpm. Between March 1988 and June 1990, water samples collected from the 771/774 Footing Drain Pond were analyzed and found to fall within the following ranges for the indicated analytes:

Nitrate/Nitrite	5.7 - 23.8 mg/l
Nitrate	76.7 - 105.4 mg/l
Gross Alpha Activity	0 - 83 pCi/l
Gross Beta Activity	7 - 46 pCi/l
Plutonium	0.01 - 0.24 pCi/l
Americium	0.0 - 0.23 pCi/l
pH	7.0 - 8.45.[1]

Responses to Operation or Occurrence

In approximately 1975, a control structure was installed at the Building 771/774 footing drain outfall pond which consisted of a wet-well with a submersible pump. The pump would remove water from the area of the pond and pump the water to Solar Evaporation Pond 207C. This wet-well was connected to the solar pond Interceptor Trench Pump House (ITPH) system when the ITPH system was installed in 1981 (see PAC 000-101). Water from this wet-well sump now flows by gravity to the ITPH where it is pumped to Solar Pond 207B-North.[1]

The initial response to the July 1980 incident was to stop the flow through the waste line causing the leak to stop. When the soil dried, a FIDLER survey was conducted to determine the extent of resulting contamination. On July 24, 1980, the broken waste line was excavated and the problem identified as a loose flange.[3]

In response to the June 1987 incident, Waste Operations Engineering submitted an Engineering Job Order to replace the deteriorating caustic catch tank T-108 (western condensate receiving tank). The accumulation of the rain water and caustic in the western condensate tank was sampled and it was determined to pump the solution to the sanitary sewer system or to Building 774 for processing, depending on the results of the sample analysis.[8]

Fate of Constituents Released to Environment

Following the July 1980 incident, a FIDLER survey was conducted and verified that the flow of process waste water did not extend beyond the boggy area to the north of Building 771.[3]

From approximately 1975 to 1981, water was pumped from the wet-well installed at the 771/774 Footing Drain Pond to Solar Pond 207C. Following the installation of the ITPH system, the water from the wet-well was collected by the ITPH system and discharged to Solar Pond 207B-North.[1]

Comments

The 771/774 Footing Drain Pond is also referred to as Bowman's Pond in some documents.

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References

[1] EG&G, Solar Pond Interceptor Trench System Groundwater Management Study, Rocky Flats Plant, January 8, 1991.
[2] 1600119
[3] 1500755
[4] U.S. DOE, Draft Phase I RFI/RI Work Plan, Operable Unit No. 5, July 23, 1990.
[5] 1601057
[6] 1500833
[7] 1600424
[8] 1501824
[9] 1501081
[10] 1500572

DRAFT

PAC REFERENCE NUMBER: 700-150.3

IHSS Reference Number: 150.3

Unit Name: Radioactive Site Between Buildings 771 and 774 (IAG Name: Radioactive Leak Between Buildings 771 and 774)

Approximate Location: N750,950; E2,084,000

Date(s) of Operation or Occurrence

August, September, and December 1971, Late 1970s or Early 1980s

Description of Operation or Occurrence

During excavation for construction between Building 771 and Building 774, in August 1971, a cement tunnel containing process waste lines was exposed. Three cracks in the concrete walls were found to be contaminated.[1]

In September 1971, construction excavation resulted in the exposure of the tunnel between Buildings 771 and 774. The tunnel contained process waste lines and at one time had been used as an exhaust ventilation duct for Building 774.[2]

In December 1971 (or possibly early January 1972), construction activities in this area resulted in a broken process waste line. Samples of the water showed an activity of about 1,000 pCi/l. Soil samples from the area were found to be only slightly contaminated.[3]

Personnel recall an incident in this area in the late 1970s or early 1980s. A flange in a line separated releasing an unspecified amount of aqueous process waste that reached the surface.[4]

Physical/Chemical Description of Constituents Released

The August 1971 incident resulted in the release of plutonium contamination to the soil.[1]

The September 1971 incident resulted in 24 disintegrations per minute per gram contamination of soil.[2]

The incident involving a wastewater line in December 1971 released wastewater with an activity of about 1000 pCi/l. This resulted in slightly contaminated soil.[3] It is not clear if this is process, laundry, or sanitary wastewater.

The leak resulting from the separated flange would have released liquid waste containing low-levels of radionuclides as well as nitrate and other chemical contaminants.[4]

Responses to Operation or Occurrence

The August 1971 incident resulted in the sealing of the cracks that were contaminated and the removal of eight drums of soil. The soil removal was completed prior to September 8, 1971, the date of the referenced document.[1]

The September 1971 incident also resulted in sealing of the cracks and removal of eight drums of soil. The soil was removed for off-site disposal in January 1972.[2]

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No response beyond soil and water sampling is mentioned regarding the wastewater line break in December 1971.

Personnel recalled that the area impacted by the leak from the loose flange was cleaned up.[4]

Fate of Constituents Released to Environment

No documents were found which detail the fate of the constituents released. This IHSS is being studied in accordance with the IAG schedule for OU8. The IAG activities will include site investigations, site characterizations, and possible site remediation. The Final Phase I RFI/RI Report is to be completed by July 12, 1994.

Comments

It is believed that the six underground process waste holding tanks at the present location of the south wing of Building 774 may have affected PAC 700-150.3.[4] These tanks were known to have leaked and overflowed. PAC 700-146 has more details on the history of these tanks.

References

[1] 1500544
[2] 1601057
[3] 1500922
[4] U.S. DOE, Draft Phase I RFI/RI Work Plan, Operable Unit No. 5, July 23, 1990.

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OU8 IHSS DESCRIPTIONS

IHSS Number: 139.2
IHSS Name: Hydrofluoric Acid Tank Area

Date/Duration of Occurrence: 1963 to Present

Description of Incident: Two horizontal, 1,300-pound hydrofluoric acid (HF) cylinders, each with a 1,200-pound capacity,[1] are located in Building 714, a small shed approximately 4 feet east and 29 feet south of the southeast corner of Building 771.[2] A site map is attached. The hydrofluoric acid is delivered to the RFP in portable cylinders, which are replaced when empty. No open transfer of the acid takes place.[3] The acid is piped to, and used in, Building 771.[1]

During the month of May 1971, there was a small vapor release from the HF connection outside Building 771.[4] No documentation was found which detailed a response to the release.

During the week ending August 13, 1976, a HF leak above Building 771 was repaired. Apparently, the hoses had collected small amounts of the acid which appeared when the line was pressurized.[5]

It should be noted that previous discussions of this IHSS indicate that the shed contains two 1,200-gallon aboveground hydrofluoric acid (HF) tanks. This, however, is not the case. The HF is contained in two 1,300-pound cylinders.

*** ** ***

Air Considerations: It is improbable that the acid releases have a residual impact on the air.

Soil Considerations: There was no documentation of events which may have impacted the soil.

Surface Water Considerations: It is improbable that the acid releases had an impact on the surface water.

Geologic Considerations: It is improbable that the acid releases had an impact on the groundwater. Well #89389 is near the site. The well was installed in 1989.

*** ** ***

Other IHSSs/PACs in the Area: Other areas or incidents of concern in the immediate area of the hydrofluoric acid storage shed are as follows.

- Radioactive Leak Between Buildings 771 and 774; IHSS 150.3, PAC 700-150.3: Process waste leaks have occurred in a tunnel containing process waste lines between Buildings 771 and 774. Historical Release Report text pertaining to this site is attached.

- Hydroxide Tank Area Spill; IHSS 139.2:
  There are two caustic tanks which have spilled and/or leaked in the past. They include a sodium hydroxide tank north of Building 774, and a potassium hydroxide tank south of Building 771, just southeast of the HF storage shed. This IHSS is included in OU8 and the IHSS description is included in this work plan.

References

[1] Personal Communication, F.J. Blaha, April 7, 1992.

[2] Site Utility Plans, D-15501-13-M, January 7, 1987.

[3] U.S. DOE, 1990, "Draft RFI/RI Work Plan, Operable Unit No. 5, July 23.

[4] Hammond, 1971, "Status Report - Industrial Hygiene and Bioassay - May, 1971," June 9.

[5] Putzier, 1976, "Highlights - Health Sciences and Industrial Safety - Week Ending August 13, 1976," August 13.

PAC REFERENCE NUMBER: 700-150.3

IHSS Reference Number: 150.3

Unit Name: Radioactive Site Between Buildings 771 and 774 (IAG Name: Radioactive Leak Between Buildings 771 and 774)

Approximate Location: N750,950; E2,084,000

Date(s) of Operation or Occurrence

August, September, and December 1971, Late 1970s or Early 1980s

Description of Operation or Occurrence

During excavation for construction between Building 771 and Building 774, in August 1971, a cement tunnel containing process waste lines was exposed. Three cracks in the concrete walls were found to be contaminated.[1]

In September 1971, construction excavation resulted in the exposure of the tunnel between Buildings 771 and 774. The tunnel contained process waste lines and at one time had been used as an exhaust ventilation duct for Building 774.[2]

In December 1971 (or possibly early January 1972), construction activities in this area resulted in a broken process waste line. Samples of the water showed an activity of about 1,000 pCi/l. Soil samples from the area were found to be only slightly contaminated.[3]

Personnel recall an incident in this area in the late 1970s or early 1980s. A flange in a line separated releasing an unspecified amount of aqueous process waste that reached the surface.[4]

Physical/Chemical Description of Constituents Released

The August 1971 incident resulted in the release of plutonium contamination to the soil.[1]

The September 1971 incident resulted in 24 disintegrations per minute per gram contamination of soil.[2]

The incident involving a wastewater line in December 1971 released wastewater with an activity of about 1000 pCi/l. This resulted in slightly contaminated soil.[3] It is not clear if this is process, laundry, or sanitary wastewater.

The leak resulting from the separated flange would have released liquid waste containing low-levels of radionuclides as well as nitrate and other chemical contaminants.[4]

Responses to Operation or Occurrence

The August 1971 incident resulted in the sealing of the cracks that were contaminated and the removal of eight drums of soil. The soil removal was completed prior to September 8, 1971, the date of the referenced document.[1]

The September 1971 incident also resulted in sealing of the cracks and removal of eight drums of soil. The soil was removed for off-site disposal in January 1972.[2]

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No response beyond soil and water sampling is mentioned regarding the wastewater line break in December 1971.

Personnel recalled that the area impacted by the leak from the loose flange was cleaned up.[4]

Fate of Constituents Released to Environment

No documents were found which detail the fate of the constituents released. This IHSS is being studied in accordance with the IAG schedule for OU8. The IAG activities will include site investigations, site characterizations, and possible site remediation. The Final Phase I RFI/RI Report is to be completed by July 12, 1994.

Comments

It is believed that the six underground process waste holding tanks at the present location of the south wing of Building 774 may have affected PAC 700-150.3.[4] These tanks were known to have leaked and overflowed. PAC 700-146 has more details on the history of these tanks.

References

[1] 1500544
[2] 1601057
[3] 1500922
[4] U.S. DOE, Draft Phase I RFI/RI Work Plan, Operable Unit No. 5, July 23, 1990.

DRAFT

OU8 IHSS DESCRIPTIONS

IHSS Number: 146.1 - 146.6
IHSS Name: Concrete Process Waste Tanks

Date/Duration of Occurrence: 1953 - 1972

Description of Incident: Six underground concrete process waste storage tanks were located south of the original Building 774. Building 774, a liquid waste processing facility, has been modified several times since its construction in 1952. During the construction of a south addition in 1972, the tanks were removed. Information for the development of the following discussion was gathered from the review of documents and historical engineering drawings as well as photographs and visual observation of the site. Several discrepancies were identified with the discussion in RCRA 3004(u).

General Physical Setting

IHSS 146 represents a six-chambered reinforced concrete structure south of Building 774. The chambers of the structure are referred to as Tanks 30, 31, 32, 33, 34W, and 34E. Tanks 30 and 33 have a 3,000-gallon capacity. The others have a 6,000-gallon capacity. The tanks were included in a 1952 engineering drawing but it is unclear when they were first placed into service. Liquid waste was transferred to or from the tanks through pipes connected with the original process waste lines (OPWL). Manholes were located at the top of each chamber. The walls of the tanks were approximately 10 inches thick. The bottom elevation was approximately 5955 feet and the tanks were 11'- 8" high. The area occupied by the tanks was 22.5 feet (east-west) by 32.5 feet (north-south). The floor of tanks were at the same approximate height as the second floor of Building 774. Ground elevation to the south of the tanks was approximately 5965 feet. The ground surface south of Building 774 slopes steeply to the north and levels out near the top of the tanks.[1,2]

Process waste would enter the tanks from the OPWL and be stored for processing in the liquid waste treatment system in Building 774. It is unknown whether the waste was stored before, during, or after treatment stages. Waste characteristics would include both plutonium and uranium radionuclide waste as well as all other constituents of process waste. The waste characteristics cannot be distinguished from specific building processes because Building 774 was the endline treatment facility for all liquid waste until Building 374 was constructed in 1973.

In 1962, a subsurface investigation of the area was done prior to the construction of an addition on the west side of Building 774. Several boreholes were drilled prior to the construction. Soil samples were obtained using both split spoon samplers and Shelby tubes.[3] The results of the laboratory analyses are unknown. A second engineering and geologic investigation of the area was done in 1970 prior to the construction of two additions to Building 774. The construction of one of the additions, a two story addition to the south, called for the removal of the concrete tanks. The addition, Room 241 of Building 774, houses four steel tanks which has replaced the function of the concrete tanks. The finished floor elevation is approximately 5958 feet. The area occupied by the addition is 55 feet by 64 feet. Borehole logs written prior to the construction are attached.[4]

Tanks 66, 67, and 68 (identified as IHSSs 124.1, 124.2, 124.3, and 125) were located adjacent to the east of the tanks of IHSS 146.1 through 146.6. Tanks 66, 67, and 68 were also concrete process waste holding tanks. These tanks were taken out of service in 1989.

Incidents of Contamination

Although it was generally believed that the presence of the concrete waste tanks had an impact on the environment, no documentation was found which detailed specific events. Two events were documented in 1973 involving infiltration of the process waste into the soil: In October 1956, the process waste tanks at Building 774 overflowed resulting in minor environmental infiltration. In August 1957, some of the tanks leaked, resulting in minor environmental infiltration with levels of up to 2,500 disintegrations per minute (dpm) per gram gross alpha.[5]

In April 1971, during review of the Building 774 construction design, it was noted that three drains flow into North Walnut Creek from the Building 774 vicinity. Samples from one of the drains, the Building 774 footing drain, indicated 400 dpm/l plutonium and 800 ppm nitrate. The concrete tanks were believed to be the source of the plutonium contamination. Corrective action was the scheduled removal of the tanks.[6]

Excavation for the Building 774 addition construction began in February 1972.[7] Contamination, resulting from the overflow of the tanks, was detected. At the time, the policy on waste disposal guidelines required soil samples in excess of 34 dpm/g plutonium activity be disposed of as contaminated waste. Radiometric monitoring procedures included an alpha survey meter evaluation of the site to be excavated. Readings in excess of 250 cpm required specific soil samples to be collected for further analysis. Soil contamination in the excavation was identified

as slightly below the 34 dpm/g limit and by April 1972, 101 barrels of contaminated soil was reportedly shipped to Idaho Falls. It was estimated that 30 to 40 more barrels would follow.[8]

Demolition of the concrete tanks began on May 8 1972.[9] A wet saw cutting method was used for the removal of the tanks.[7] The disposition of the concrete is unknown. Approximately 200 cubic yards of soil contaminated with up to 2,500 dpm/g plutonium from around the tanks were moved temporarily to an area north of Building 334. Another 60 cubic yards of soil contaminated with up to 250 dpm/g plutonium were moved to an area east of Building 881 and buried beneath approximately 3 feet of fill dirt.[10] The 60 yards of soil is now in an area identified as IHSS 130. In January 1973, 12 soil samples were taken from the 200 yards of soil piled near Building 334. The results from the analysis ranged from 2.8 to 704.2 dpm/g gross alpha with an average of 173 dpm/g. The values convert to a range of 1.3 to 316.9 pCi/g and 13 to 3,169 mCi/km^2.[11]

In February 1973, the soil pile was moved temporarily from the area north of Building 334 to the Triangle Area (IHSS 165) east of the solar ponds because it was in the way of Building 371 construction.[12] A series of soil samples collected from the pile on June 18, 1973, indicated levels of contamination with an average of 87 dpm/g. The soil was on plastic sheeting and had been treated with coherex, a soil stabilizing agent to reduce erosion. The soil was removed for landfill disposal on September 5, 1973.[10]

Radiometric Survey Results

The results of the Radiometric Survey, performed at the RFP during the late 1970s and early 1980s, indicate no extremely contaminated areas (stated to be 500,000 to 1,000,000 pCi/g)[13] around Building 774 in the area of the former location of the concrete tanks.

*** ** ***

Air Considerations: No documentation was found identifying air monitoring in response to any release incidents. Air monitoring may have been performed during the removal of the tanks because a reference states that close Health Physics surveillance was to be required during the Building 774 renovation. Monthly Health Physics Reports during the timeframe do not document specific air surveillance efforts.

Soil Consideration: Much of the soil surrounding the concrete tanks was removed during the construction of the addition and demolition of the tanks. At least 285 cubic yards of

contaminated soil was removed. At the time the tanks were removed, radiometric surveys operated off of an action limit of 250 dpm/g gross alpha (about one quarter of the scale of the instruments). For soil contamination measured below this limit, no further action was taken. It is not unlikely that soil contamination would be present in the area beneath the south addition of Building 774 below 250 cpm. Because of the steep slope in area, the bottom level of the tanks was near the level of the second floor of Building 774. Therefore, the soil beneath the tanks was adjacent to the rooms on the first floor of the building.

Surface Water Considerations: Surface drainage from the hillside south of the building is toward the north. A roadway is located on the top of the slope. Surface runoff is directed away from the building through footing drains which slope to the west around the building and pass under the building through a corrugated metal pipe. The footing drain daylights north of the building, between the western condensate receiving tank (Tank T-108) and Building 770. The footing drain water has been sampled regularly in the past and in 1971, contamination detected in the water was attributed to the presence of the concrete tanks. Surface water quality data from the footing drain is included in the RFEDS database.

Geologic Considerations: The subsurface investigations prepared in 1962 and 1970 identified borehole lithology in the area of Building 774. The logs from the 1970 study are attached. The surface geology south of the building has changed because of the construction of the addition and removal of contaminated soil. A number of wells are located to the north, south, and especially the east of Building 774, primarily due to the presence of the RCRA-regulated solar ponds.

*** ** ***

Other IHSSs/PACs of Concern: IHSS 125 and IHSS 124.1 through 124.3 are the concrete tanks located directly east of IHSS 146 tanks. These tanks held waste similar to the waste in the IHSS 146 tanks and operated during the same period. IHSS 125 is included in OU8. IHSS 124.1 through 124.3 is included in OU9 Original Process Waste Lines. The Final RFI/RI Workplan was completed in February 1992. The discussion of IHSS 124.1 through 124.3 from the HRR is attached.

IHSSs 139.1, 149, 127, and 150.3 are located in the immediate vicinity of Building 774 and are included in OU8. IHSS 139.1(N) is a sodium hydroxide tank and has had a number of leaks. IHSS 149 is the site of a former waste transfer pipe between Buildings 774 and the solar ponds. The characteristics of the potential waste contamination due to IHSS 149 is the same as from IHSS 146. IHSS 127 represents another pipeline leak of process waste from Building 774 to

Building 995 (wastewater treatment plant) located southeast of Building 774. The waste was of the same characteristics as the IHSS 146 waste. IHSS 150.3 was a concrete vent tunnel between Building 774 and 771. The tunnel carried process waste pipelines into the concrete tanks of IHSS 146. The events that caused contamination of the soil occurred while the concrete tanks were being removed and the addition to Building 774 was being constructed. The source of contamination was the same process waste as contained in the concrete tanks.

IHSS 215 was a tank inside the building and is included in OU15. Tank T-40 held sludge from the treatment of liquid process waste. Although there were no documented releases to the environment identified, contamination caused by this tank may be identified through subsurface investigations. The HRR discussion of IHSS 215 is attached.

The solar evaporation ponds are located east of Building 774. The ponds have had a complex history of construction and use. The ~~Draft~~ Final RFI/RI Workplan for OU4 Solar Evaporation Ponds was completed in February 1992. The solar ponds have been used in the past for the evaporation of process waste. The soil contamination attributed to the ponds has been characterized as primarily nitrates with elevated levels of radionuclides. The HRR narrative for the solar ponds details their construction and operation histories and is attached.

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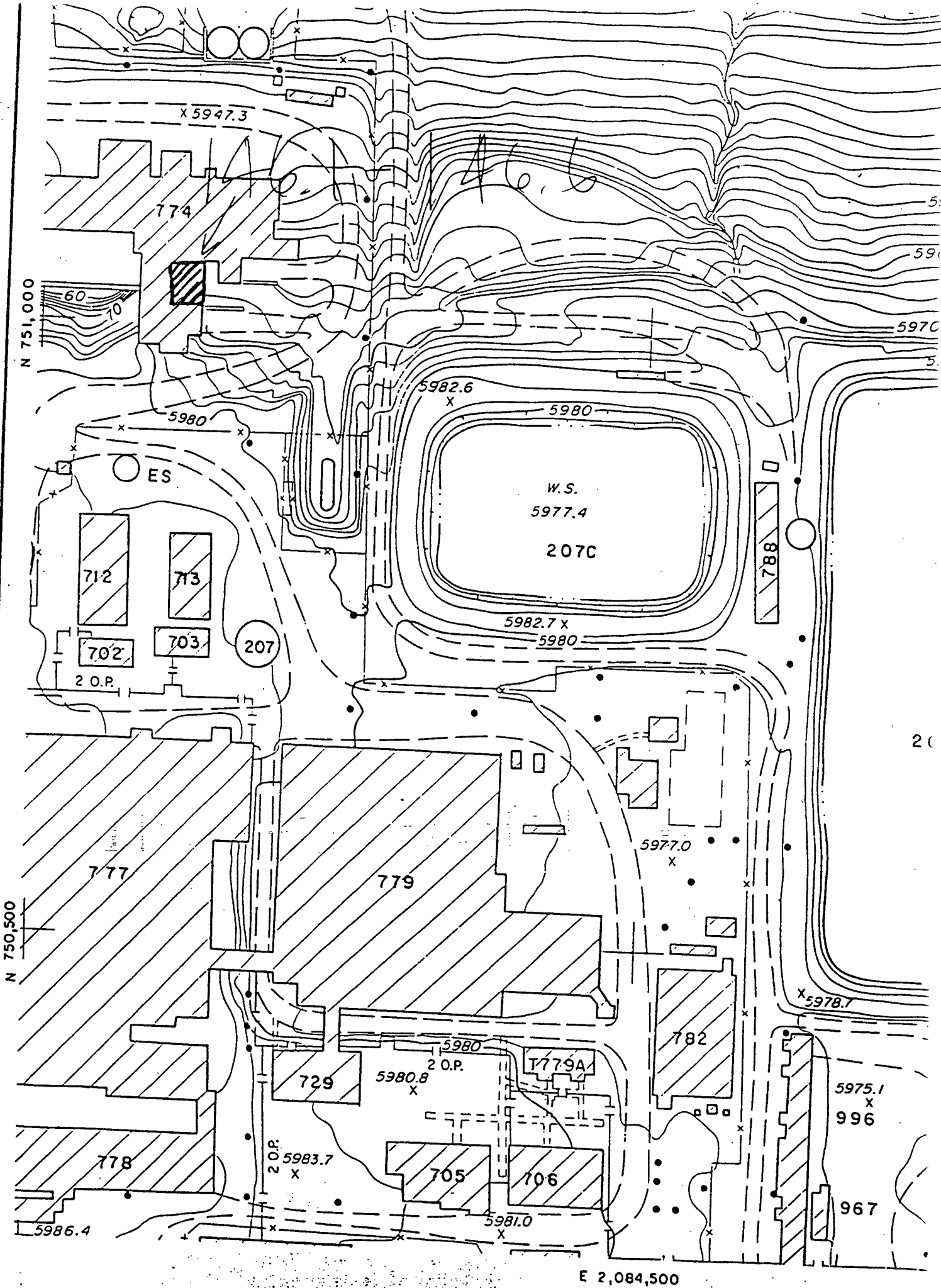
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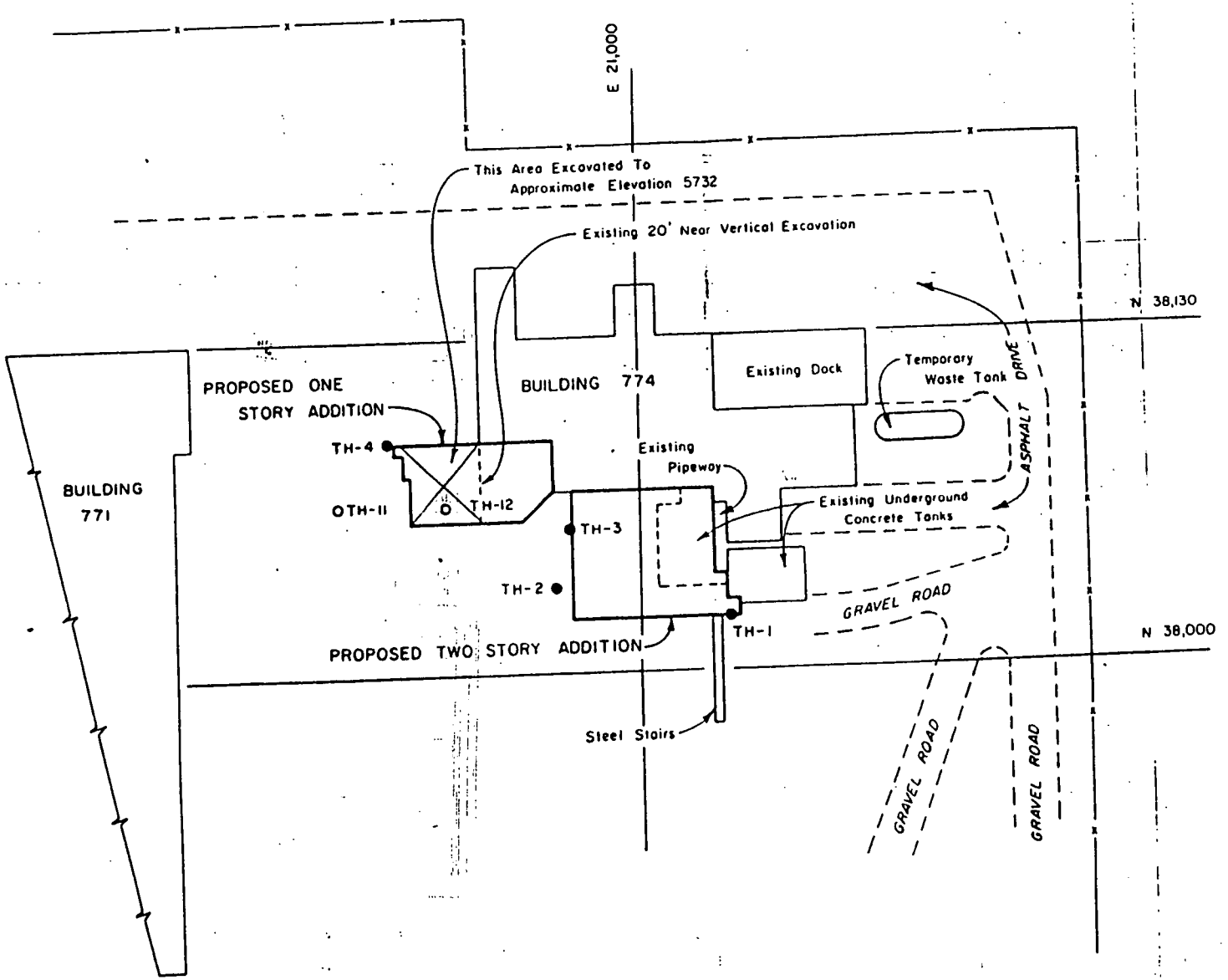


SCALE 1" = 40'

LEGEND

- O TEST HOLE FOR OUR REPORT NO. 12182 - 350
- ● TEST HOLE FOR THIS REPORT
- PROPOSED BUILDING
- EXISTING BUILDING
- EXISTING FENCE
- ROADWAY

WOODWARD-CLEVENGER & ASSOC., INC.
Consulting Engineers & Geologists
Denver, Colorado

LOCATION OF TEST HOLES

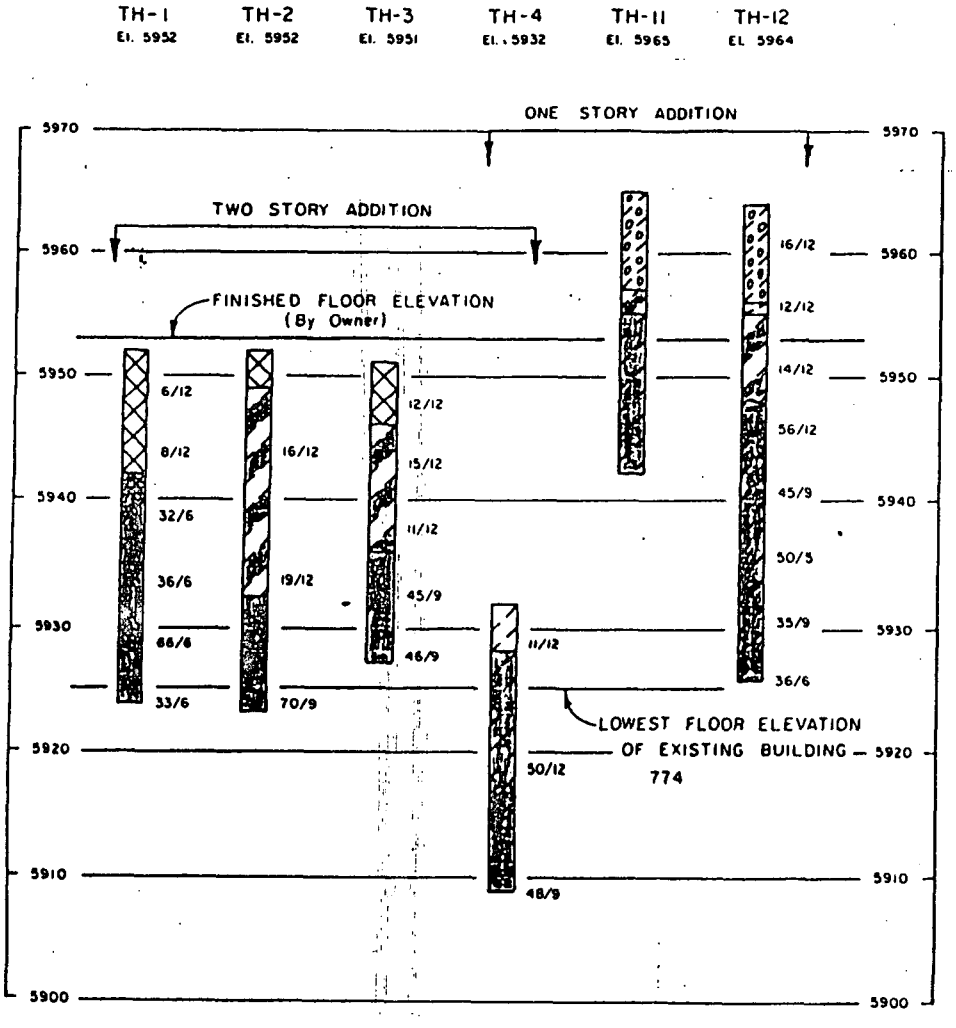
BUILDING 774 ADDITIONS

A.E.C. ROCKY FLATS PLANT

Prepared by: _____ Checked by: _____

Job No. 15366 - 350

FIG. 1



LEGEND

- MAN-MADE FILL, CLAY, MEDIUM STIFF TO STIFF, VERY SANDY, VERY GRAVELLY, CALCAREOUS, MOIST, BROWN.
- CLAY, STIFF, VERY SANDY, MOIST, TAN (CL).
- GRAVEL, MEDIUM DENSE, SLIGHTLY SANDY, SLIGHTLY CLAYEY, MOIST, BROWN (GC).
- CLAY, STIFF, SANDY, RUST AND TAN-MOTTLED, GRAY, MOIST (CL) (WEATHERED BEDROCK).
- CLAYSTONE, FIRM TO MEDIUM HARD, SILTY, SANDY, MOIST, TAN, RUST MOTTLED, GRAY (BEDROCK).
- CLAYSTONE, HARD, SILTY, SANDY, MOIST, TAN, RUST MOTTLED, GRAY (BEDROCK).
- 6/12 — INDICATES THAT 6 BLOWS OF A 140-POUND HAMMER FALLING 30 INCHES WERE REQUIRED TO DRIVE A 2-INCH DIAMETER SAMPLER 12 INCHES.

NOTES:

1. HOLES WERE DRILLED ON JULY 24, 1971 WITH A 4-INCH DIAMETER HELICAL AUGER POWERED BY A CENTRAL MINE EQUIPMENT (CME 55) DRILL RIG.
2. ELEVATIONS ARE APPROXIMATE AND REFER TO BENCH MARK SHOWN ON FIGURE 1.
3. NO FREE WATER WAS FOUND IN TEST HOLES AT TIME OF DRILLING.
4. DRILL LOGS IN THIS REPORT ARE SUBJECT TO LIMITATIONS, EXPLANATIONS AND CONCLUSIONS OF THIS REPORT.

WOODWARD-CLEVENGER & ASSOC., INC.
Consulting Engineers & Geologists
Denver, Colorado

SUMMARY LOGS OF TEST HOLES

BUILDING 774 ADDITIONS

A.E.C. ROCKY FLATS PLANT

Prepared by: _____ Checked by: _____

Job No. 15366-350

FIG. 2

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1501866
1600671
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1500418
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1601044
1501859
1501858
1601040
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PAC REFERENCE NUMBER: 000-121

IHSS Number: 121

Unit Name: Original Process Waste Lines

Location: RFP Main Production Facility (Figure 000-5)

Date(s) of Operation or Occurrence

1952 - 1983 (approximate)

Description of Operation or Occurrence

Background Information

The Original Process Waste Lines (OPWL) are a network of tanks and underground pipelines constructed to transport and temporarily store aqueous chemical and radioactive process wastes from point of origin to on-site treatment and discharge points. The system handled process wastes from Building 123, Building 444, Building 707, Building 771, Building 776, Building 779, Building 865, Building 881, Building 883, and Building 889.[1] Minor amounts of waste from Building 122 and Building 441 were also handled.[2] These wastes were analyzed prior to transfer. Depending on the level of radioactivity and chemical composition, process wastes were routed to Building 774 for treatment, Pond B-2 (see PAC NE-142.6), or the Solar Evaporation Ponds (see PAC 000-101).[1] Process waste held in Pond B-2 was also pumped to Pond A-2 for storage during the mid-1970s.[3,4]

The OPWL was placed in service when the RFP began production activities in 1952.[1] Repairs and additions were made to the system through 1975.[2] The OPWL system was replaced beginning in 1975 by a doubly-contained, fully inspectable process waste system.[1] This new process waste system was completed in the summer of 1984.[5] Some tanks and pipelines from the OPWL were incorporated into the new process waste system and into the RFP exhaust plenum fire deluge system.[2]

As defined in the 1988 OPWL Closure Plan, the OPWL consists of approximately 35,000 feet of pipeline and 39 separate tank locations which house a total of 73 tanks. OPWL tanks and pipelines exist in RFP areas 100, 400, 500, 600, 700, 800, and 900, the Solar Evaporation Ponds, and the northeast buffer zone between the 900 Area and holding Pond B-2.[2]

Pipeline Network

OPWL pipelines vary in age, usage history, and construction.[1] The pipelines range from one to ten inches in diameter and are constructed of a variety of materials, including cast iron, stainless steel, vitrified clay, polyvinyl chloride, teflon, plastic and pyrex glass. They are buried in trenches averaging three feet wide and three to eight feet deep, and are bedded in sand and/or native soil backfill.[1,6] Approximately 13,000 feet of OPWL pipeline are located beneath buildings, and approximately 7,000 feet are beneath concrete or asphalt pavement. Roughly 13,000 feet, or more than half of the 22,000 feet not located beneath buildings, are located in areas highly congested with other active and inactive utility lines.[2]

Most OPWL pipelines which were not converted to the new process waste system are believed to have been abandoned in place. Pipelines beneath buildings were flushed with water until significant residues appeared to have been removed, then sealed at wall and floor penetrations with six to twelve inch plugs of "non-shrinking cement sealant". Small segments of pipelines within buildings (e.g., riser pipes) were removed.[2] The OPWL Closure Plan indicates that underground pipelines outside of buildings were abandoned in place without sealing

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TABLE 000-1
SOLAR POND DESIGNATIONS AND STATUS

Current Designation	Original Designation	Date Completed	Date of Last Recorded Use	Current Status
Original Clay-Lined Solar Pond	Pond 2	October 1953[57]	March 1963	Regraded in 1970, soils from pond possibly incorporated into berms for 207C[40]
Not Applicable*	Pond 2 Auxiliary**	September 1955[2]	June 1960	Removed in 1962 or 1963[43]
Not Applicable*	Either Pond 2C or Pond 2D	August 1959[17]	June 1960	Regraded in 1970, soils from pond possibly incorporated into berms for 207C[40]
Solar Pond 207A	Pond 2A	August 1956[58]	August 1991	Dry
Solar Pond 207B (this solar pond consists of three cells, North, Center, and South)	Pond 2B (this pond consists of three cells, North, Center, and South)	May 1960[20]	Still in use	Water (primarily contaminated groundwater from the ITPH) being removed from pond cells[40]
Solar Pond 207C	Solar Pond 207C	December 1970[59]	Still in use	Contains process waste

* This pond could be confused with the original clay-lined solar pond since it was of earthen construction only.

** This pond was also known by one of the two following designations: Pond 2C or Pond 2D. This pond was originally unlined, but was provided with a clay liner in February 1957.[9]

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In 1988, two distinctly different sets of engineering drawings were found that pertained to the 207B solar pond re-design that occurred in the 1960 and 1961 time-frame. Briefly, the difference between these two sets of engineering drawings related to whether or not underdrains would be constructed beneath the 207B solar ponds. The set of drawings indicating underdrains beneath the 207B solar ponds were undated but numbered 1-8080-207. One of the drawings that had no underdrains beneath the 207B ponds is numbered 16887-1. Physical evidence observed in the field was inconclusive in determining which of the two re-designs were built. Therefore, in fall 1988 one of the manholes on the drainage tile was cleaned out to determine if laterals connected with the manhole from the west. The existence of such laterals would have indicated that underdrains were probably present under the 207B solar ponds. No such laterals were found connecting with the manhole. It is now understood that the 1960 Pond 207B re-design for which the bids were too high was the design for which underdrains were required. The 207B re-design that was built did not have underdrains beneath the 207B ponds, but did have a drainage tile immediately east of the 207B solar ponds. This drainage tile drained to the north, and was eventually (in the 1970s) collected by Sump 1 and pumped to 207B-North. The sequence of events regarding re-design of the 207B solar ponds can be traced in the monthly history reports of the Waste Group at the RFP.

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PAC REFERENCE NUMBER: 700-215

IHSS Reference Number: 215

Unit Name: Tank T-40, Unit 55.13

Approximate Location: N 751,000; E 2,084,000

Date(s) of Operation or Occurrence

1963 - September 1989

Description of Operation or Occurrence

The concrete mixed waste storage tank adjacent to Room 103 of Building 771 was constructed in 1963. The roof of the tank serves as the floor of Room 203.[1]

Physical/Chemical Description of Constituents Released

The tank held sludge from second stage precipitation of liquid process waste from Building 771. Also stored was effluent from a silver recovery unit in Building 774.[1]

Responses to Operation or Occurrence

Use of Tank T-40 ceased when the tank was replaced in September, 1989.[1] No documentation was found which details releases from this unit.

Fate of Constituents Released to Environment

No documentation was found which detailed a release of constituents from the tank. An interim status closure plan was prepared for the tank and submitted to the CDH and EPA on September 29, 1989.[1] This IHSS is being studied in accordance with the IAG schedule for OU9 and OU15. The IAG activities will include site investigations, site characterizations, and possible site remediation. The Final Phase I RFI/RI Report for OU9 is to be completed by September 6, 1994. The Final Phase I RFI/RI Report for OU15 is to be completed by January 4, 1995.

Comments

None.

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[1] Blaha, F.J., "Solid Waste Management Unit Descriptions", March 23, 1990.
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PAC REFERENCE NUMBER: 000-101

IHSS Reference Number: 101

Unit Name: Solar Evaporation Ponds

Approximate Location: N751,000; E2,085,000

Date(s) of Operation or Occurrence

The solar ponds have operated in varying configurations since December 1953 when waste was first sent to the original clay lined solar pond.[1] This original clay lined pond was supplemented and eventually replaced by other solar ponds. The first use of a solar pond typically began shortly after construction of the pond was completed. The dates of completion and last use of the various solar ponds are presented in Table 000-1.

Description of Operation or Occurrence

The solar ponds were used primarily for the disposal of low-level radioactive wastes contaminated with high concentrations of nitrate. Building 774, the process waste treatment plant, was designed primarily for the removal of radioactive contaminants and not the removal of nitrate. The solar ponds were also used for the disposal of other difficult to treat wastes. The design of the original solar pond is documented in Dow drawing 1-1454-207. It was estimated in late summer 1955 that Pond 2 would be incapable of holding the waste volumes expected to be generated through the winter months;[2] therefore, this pond was supplemented with an auxiliary pond in September 1955[3]. The auxiliary pond was built adjacent to the southeast corner of Pond 2. These two ponds shared a common corner with an overflow channel connecting the two ponds.[3] Water exceeding a certain level in Pond 2 would flow into Pond 2 Auxiliary.

Construction of the first lined pond (known at that time as Pond 2A, later designated Pond 207A) was prompted by the knowledge that nitrate contamination from the earthen ponds was moving off the RFP (on April 5, 1955 the effluent leaving the RFP boundary, at that time the cattle fence, contained 90 mg/l nitrate),[4] as well as the fact that Great Western Reservoir was going to be used as a human drinking water supply.[5] The first leakage of water from any of the solar ponds had been noted in June 1954 with the identification of a nitrate contaminated spring on the hillside north of the solar ponds.[6] The first lined pond was built of asphalt planking (asphalt impregnated wood approximately 1/2-inch thick[7]). This pond was constructed immediately to the east of the two earthen ponds. Dow Chemical drawing 1-3398-207 documents the relationship of the new lined pond with the pre-existing earthen ponds. All references in this document will henceforth use 207A to reference the first lined pond.

Following construction of the first lined pond (Pond 207A), the original pond and the auxiliary pond were allowed to dry. The original clay lined pond had some additional clay added to its east side to prevent leakage, and the auxiliary pond was fully lined with clay.[8] These ponds were returned to service shortly after these lining activities took place. The clay lined ponds were used routinely until June 1960.[9] After June 1960, routine use of the clay-lined ponds is not documented, although an additional release to Pond 2 was made in March 1963.[10] Photographs of Ponds 2, 2 Auxiliary, and 207A have been located which clearly show the three ponds and their physical relationship to each other.[11,12]

The next major change in operations at the solar ponds came with the creation of a third earthen pond in support of testing on oxidation of wastes. The third earthen cell was constructed in April 1959.[13] The existing references indicate that the three earthen cells were used in series and the effluent from these three

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ponds was discharged to the sanitary wastewater treatment plant.[13] These tests were carried out over a few months, the late summer and early fall of 1959, and were ultimately unsuccessful.[14] The third earthen cell was constructed immediately east of the existing Pond 2, immediately west of 207A, and immediately north of Pond 2 Auxiliary.[15,16] The designation of this new pond was either Pond 2C or 2D, with the existing Pond 2 Auxiliary receiving the remaining designation.[17] It appears that the Pond 2 Auxiliary designation was no longer used.

Construction of the 207B solar ponds began on November 11, 1959.[18] These ponds are immediately east of Pond 207A and consist of three separate cells (North, Center, and South). During December 1959 construction activities, seepage was identified in the west side of the excavation near the east side of Pond 207A. A "covered drainage ditch" (later references to this device use the term drainage tile, this discussion will also use drainage tile) was installed to collect the seepage water and release it to the hill just north of the ponds.[19] Dow Chemical drawing 1-6217-207 documents the design and configuration of the asphalt plank-lined 207B solar ponds. Construction of the 207B solar ponds was fully completed on June 16, 1960.[10] The first placement of waste in the 207B ponds occurred on May 31, 1960 into a fully completed cell.[20] Upon use of the fully completed 207B ponds, leaks were almost immediately identified and the ponds were removed from service. The leakage from the ponds was attributed to the reaction of acid wastes seeping beneath the asphalt planking and reacting with marl soil to produce carbon dioxide gas. This gas then caused the asphalt floor of the ponds to lift, rupturing the seams.[10] A new lining and design for the 207B ponds was designed and submitted for bids. The bids received in November 1960 were too high, and so the new pond configuration was redesigned and re-bids were requested for just the south portion of the 207B ponds.[21] Repair and re-lining of the 207B-South solar pond were completed on November 29, 1960. The 207B-South cell was returned to service in December 1960.[22] Work on repair of 207B-North and Center was started in April 1961.[23] This work included the construction of a drainage tile immediately east of the 207B ponds that drained to the north. Difficulty was encountered in laying the asphalt on the bottom of 207B-North. It was found necessary to remove the asphalt planking in order to lay the asphalt concrete on the bottom.[24] The repairs to 207B-Center and North were completed on August 17, 1961. Pond 207B Center was returned to service on August 25, 1961, and 207B-North was returned to service on August 28, 1961.[25]

Work related to the relining and redesign of Pond 207A began in April 1963 with the removal of liquids and salts so that the liner could be accessed.[26] As Pond 207A was emptied salts and sands remaining in the pond were drummed for removal from the ponds. Tests were conducted to determine whether the asphalt planking to be removed from the pond would be suitable for burning. It was found that the asphalt planking would not support combustion on its own.[27] Removal of the asphalt planking and Pond 207A subgrade preparation was completed in September 1963.[28] Disposal of the asphalt planking took place in the East Trenches (PAC NE-111.1 - NE-111.8). Relining and redesign of Pond 207A continued through November 18, 1963.[29] Wastes were again placed in Pond 207A on May 28, 1964.[30]

Solar Pond 207C was constructed in 1970 primarily to allow the transfer of water from other solar ponds so that they could be repaired.[31] The design of Pond 207C included a leak detection pipe placed immediately beneath the solar pond and running from south to north where it drains into a leak detection sump. Solar Pond 207C has remained in constant service since the beginning of its use.

In the mid-1980s activities for solar pond cleanout began. The first step in these activities was to construct a building (Building 788) in which the solar sludge and Portland cement could be mixed to create pondcrete. This building was constructed between solar ponds 207A and 207C. Solar pond sludge cleanout began in mid-1986. This activity along with the transfers of solar pond water to the Building 374 evaporator, have helped to remove both the sludges and the liquids form the solar ponds. At times however, problems with the cleanout effort have occurred. Examples of these problems include pondcrete that has not hardened properly and flooding of some of the valve vaults used to help transfer solar pond

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water to Building 374 for evaporation.

An event related to solar ponds on August 7, 1989, required the filing of a RCRA Contingency Plan Implementation Report (Report Number 89-012). This event consisted of an overflow of contaminated water from the Interceptor Trench Pump House (ITPH) wet well. This overflow occurred because the circuit breakers supplying electricity to the pump motors were both tripped.[32] Additional details concerning this incident can be found in the "Response" section of this Pac narrative.

A second event at the solar ponds took place from March 14, 1990 to March 16, 1990 which also required the filing of a RCRA Contingency Plan Implementation Report (Report Number 90-003). This event consisted of transfer of contaminated groundwater and precipitation from Pond 207B-North into Pond 207A. This transfer was made due to the lack of freeboard in Pond 207B-North which presented a potential for overflow of the pond. The transfer was made with permission from CDH.[33]

Physical/Chemical Description of Constituents Released

The RFP solar ponds are often referred to in historical documents as the "high nitrate ponds." The most common characteristic of the wastes released to the solar ponds was high concentrations of nitrate. The solar ponds typically had untreated process waste placed in them, but on occasion treated process waste was also placed in the ponds. The RFP process waste treatment plant was designed to remove radioactive contamination of process wastes (and also achieved some removal of metals), but it was not designed to remove nitrate. The monthly history reports from the RFP waste group detailed the originating building, quantity of water transferred, and activity present in the water released to the solar ponds. These history reports also stated which of the solar ponds received these waters. Only limited information was found on more detailed chemical analyses of the wastes released to the solar ponds. One of these references does provide a relatively complete characterization of Pond 207A waters from the fall of 1958.[34] The analyses available in this report cover activity of plutonium, activity of uranium, total solids, total nitrate, pH, specific gravity, aluminum, chromium (VI), fluoride, iron, magnesium, silicon dioxide, sulfate, total halides, and an extensive list of metals. There are also analytical results presented for a compound R_2O_3 which is described as "... the combined oxides denoted by R_2O_3 must include all those cations which are precipitated with ammonium hydroxide even in the presence of a large concentration of ammonium chloride."[34] Of particular note in this reference is the fact that the pH range reported was 0.87 to 0.97, with an average of 0.93. The pH reported for June of 1958 was 1.21.[34]

The monthly history reports of the waste group also mention when other materials were placed in the solar ponds or handled near the solar ponds. For instance, it is known that radioactively contaminated aluminum scrap was disposed in the solar ponds (see PAC 500-197),[35] as was alcohol for at least a short time in the 1950s.[36] Also, for a period of time, waste radiography solutions were drummed for disposal in the solar ponds;[37,38] and lithium scrap was sprayed with water for destruction of the lithium metal between the solar ponds.[39] For a period in late 1973 and early 1974, leachate collected from the RFP sanitary landfill was pumped to the solar ponds for disposal. It is also known that sewer sludge, cyanide wastes and acid wastes were disposed in the solar ponds for at least a portion of the time the solar ponds have been in use.[40] The handling of these materials was non-routine, and is not thought to have comprised a major portion of the waste materials placed in these ponds.

Data have also been generated from water collected from the drainage tile and from monitoring wells near the solar ponds. Interpretation of these data could also indicate some of the chemical constituents released by the solar ponds. A more detailed discussion of these response actions, and the types of data that are available, is given in the next section of this narrative.

In the more recent time frame, detailed analyses of solar pond water, solar pond sludge, and groundwater

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in the vicinity of the solar ponds have been conducted. The results of these analyses can be found in the RCRA closure plans for the solar ponds, the RFI/RI workplan for the solar ponds, and the groundwater monitoring reports that cover the solar ponds.

The volume of water that overflowed the ITPH wet well on August 7, 1989 was estimated at 50 to several hundred gallons. This water was analyzed and found to contain:

pH	7.3;
Total Dissolved Solids (TDS)	2.27 mg/l;
Gross Alpha	95 ± 38 pCi/l;
Nitrate	2,200 mg/l;
Chloride	114 mg/l;
Chloroform	3 micrograms per liter;
Carbon tetrachloride	3 micrograms per liter;
Trichloroethene	6 micrograms per liter; and
Tertrachloroethene	1 micrograms per liter.[32]

The water transferred in March 1990 from Pond 207B-North to Pond 207A consisted of contaminated groundwater and runoff.[33]

Responses to Operation or Occurrence

Relining and patching of the solar ponds are response activities to the possibility of leakage from the solar ponds. The relining and patching activities were conducted a number of times throughout the history of the solar ponds.[40]

After installation of the drainage tile (between Pond 207A and Pond 207B) in December 1960, analysis of the water flowing from that tile became a routine daily activity. The water was sampled on a daily basis for flow, temperature, total alpha activity, nitrate, and pH.[19] Typically, only gross alpha activity and flow rate were reported. Flow rates in the drainage tile were variable with flows of hundreds of gallons per hour not uncommon. The chemical characteristics of the water flowing out of the pipe also varied considerably, but at times the water had elevated levels of gross alpha activity (up to thousands of picocuries per liter). These analyses from samples of water from the drainage tile can indicate some of the chemical characteristics of the constituents released; however, the analytical parameters that were evaluated on water samples collected from the drainage tile are limited in scope. Similarly, the drainage tile immediately east of the 207B ponds installed in 1961 was also sampled for environmental analyses. The analytical data from this sampling was presented in the Solar Pond Closure Plan of 1988 under the title of Sump 1.[40]

During November 1960, six groundwater monitoring wells were installed near the 207B solar ponds.[41] The first chemical analysis of water collected from the groundwater sampling wells in January 1961 indicated that nitrate contamination was present in the groundwater in concentrations up to 800 mg/l.[42] Sampling of the six wells became a routine activity with data reported in the waste group's history reports. The analyses of water collected from these wells can indicate some of the chemical characteristics of constituents released from the solar ponds. Once again, however, the analytical parameters that were evaluated are limited in scope.

In addition to the activities discussed above, two sumps, six trenches, and french drains were constructed in the area north of the solar ponds to allow the return of contaminated groundwater to the solar ponds. These actions were largely prompted by the RFP policy to keep waters in the A-series drainage below the State Public Health Service limit for nitrates in drinking water (10 mg/l).

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Removal of Pond 2 Auxiliary

Pond 2 Auxiliary was removed in preparation for the construction of Building 779. Surveys of the pond 2 Auxiliary area soil indicated readings between 2,500 to 5,000 counts per minute (cpm). Clay samples of the pond had 75,000 d/m/kg which was described as 2-1/2 times soil background in the area. The proposed activity was to remove the clay lining to a depth of 6 inches. This material was to be disposed of by burial in dried sewage sludge trenches (PAC 900-109, PAC NE-110, PAC NE-111.1 - NE-111.8). The pond berms were to be leveled after removal of the clay liner.[43] No documentation confirming the fate of the soil has been found.

Removal of Pond 2 and Pond 2C or 2D

Pond 2 and the earthen pond immediately east of it (Pond 2C or 2D) was removed in preparation for construction of Pond 207C in 1970. The soils potentially impacted from operation of the two referenced earthen ponds were reworked and possibly were incorporated into the berm for Pond 207C.[40] No documentation has been found indicating that radiation surveys or soil removal and disposal operations were conducted.

Sumps and Trenches

The first two sumps were activated in April 1970. Sump Number 1 was installed at the north end of the drainage tile running along the east side of the 207B complex. Sump Number 1 returned water to 207B-North. Sump Number 2 was installed at the north end of the drainage tile located between solar ponds 207A and 207B. Water from this sump was returned to 207A. Trenches 1 and 2 were installed in October 1971, Trench 3 in September 1972, and Trenches 4 and 5 in April 1974.[44] Trench 6 was installed in July 1974. Trench 1 returned water to Sump 1. Trench 2 returned water to Sump 2. Trench 5 drained by gravity to Trench 4. Water from Trench 4 was pumped to Trench 3, and Trench 3 returned the water to Pond 207A. Trench 6 returned water directly to Pond 207A.[45] Figure 000-2 presents the final configuration of the sumps and trenches. These trenches and sumps were located where seepage and nitrate concentrations were greatest.[46]

The low end of the trenches and the sumps consisted of buried 55-gallon drums. Most of these drums were supplied with an electric pump and float system to automatically control the pumps. The trenches consisted of a shallow excavated trench backfilled with gravel to the soil surface. These trenches drained to the buried drums at the low end of the trenches. This design of the trenches allowed collection of both surface and subsurface flows.[47]

This trench system remained in operation until the early 1980s when it was replaced by a more extensive french drain system. The need for the more extensive french drain system was prompted by the construction of the Perimeter Security Zone (PSZ). The PSZ is now called the Protected Area (PA). Construction of the PSZ destroyed Trenches 3 and 6. The trenches and sumps that were not destroyed in PSZ-related construction were abandoned in-place by cutting their electrical power supply.[44]

Interceptor Trench Pump House System

The Interceptor Trench Pump House system was installed in 1980 and 1981 and is still in use. The pump station is identified by a number of names at the RFP, including: Main Sump, Main Nitrate Sump, Nitrate Sump, Solar Pond Sump, French Drain Sump, and others. In this report, the pump station and the french drain system will be referred to as the Interceptor Trench Pump House (ITPH). The ITPH system was designed primarily to collect subsurface water. Engineering drawings for the design of the ITPH system are the following Rockwell International drawings: 27550-033, 27550-040, 27550-050, 27550-200, 27550-201, and 27550-202. These drawings are as-built drawings. Records indicate that the ITPH system was built in April 1981.[48] Figure 000-3 presents the configuration of the ITPH system at that time. Although the ITPH system was much more extensive than the trench and sump system that it replaced, the ITPH system was extended shortly after construction of

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the original parts of the ITPH system.[40] It was this extension of the system that was referred to as the "Interceptor Trench."

The ITPH system was extended due to concerns over the existence of groundwater seeps immediately north of the solar ponds. The extension of the ITPH system consisted of a new french drain that paralleled the old Patrol Road. This extension of the ITPH system was designed and built with gravel backfill from the drain to the surface so that it would collect both groundwater and surface water flow. This extension also provided for the collection of footing drain flows from Building 771 and 774, through a 4-inch diameter polyvinyl chloride (PVC) pipe.[49] Engineering drawings for the design of the ITPH system extension are Rockwell International drawings: 26637-01 and 26637-02. These as-built drawings indicate that the ITPH system extension was built between February and June 1982. Figure 000-4 presents the configuration of the ITPH system following its extension with the Interceptor Trench.

This system collects groundwater and surface water runoff (from the area immediately north of the solar ponds and south of the new PSZ perimeter patrol road) which drains by gravity to a pump station located near North Walnut Creek. The pump station consists of a wet well and a duplex installation of self-priming pumps. The ITPH pumps the collected incoming water to Pond 207B-North. Water from this pond is transferred to other solar ponds or force evaporated in Building 374.[40] Some of the water from 207B-North was spray irrigated in the West Spray Field (PAC SW-168).

For the August 7, 1989, ITPH overflow, a RCRA Contingency Plan Implementation Report was filed (Number 89-012). Inspections of the ITPH wet well were also increased. The water remaining in the wet well was pumped to Solar Pond 207B-North.[32]

Solar Pond Clean-Out

Solar pond clean-out is a response action to the presence of waste materials in the solar ponds and the presence of contamination in nearby soils, groundwater, and surface water. Some solar pond clean-out activities were conducted to allow re-lining activities to take place, such as the re-lining of 207A in the early 1960s. However, in most clean-outs conducted earlier than those given below, the waste materials were immediately re-introduced upon completion of the re-lining activities or repairs.

From fall 1976 to fall 1977, the 207B solar ponds were cleaned and decommissioned with respect to use for storage of process wastewater.[50,51] This clean-out was done in support of the water recycle program being implemented by the RFP. All three cells of the 207B pond were cleaned, but only 207B-South was relined. This relining was done with a hypalon liner. During these clean-out and re-lining activities, soils to the south, east and between the solar ponds were also removed in order to better clean the area.[52,53] Process waste was not re-introduced to the ponds. Since the clean-out activities, these ponds have been used for reverse osmosis plant brine, treated sanitary sewage effluent, and contaminated groundwater collected by the ITPH system.[40]

The clean-out of process waste sludge in the 207A solar pond began in 1986 with the completion of Building 788 - a Pondcrete production building. The removal of the process waste and sludge from 207A was completed in 1988. In 1988 the final volume of sludge was removed from 207A and the final volume of water was transferred to the 207B solar ponds. The sludge was handled by combining the sludge with Portland cement, creating Pondcrete. The Pondcrete has been largely stored on plantsite since its generation, but some Pondcrete has been shipped offsite for disposal. In March 1990, contaminated groundwater transferred to the 207B solar ponds from the ITPH was placed in Pond 207A in order to prevent the over-topping of the 207B solar ponds. All of the water present in 207A was removed during 1991 and evaporated at the Building 374 forced evaporator.

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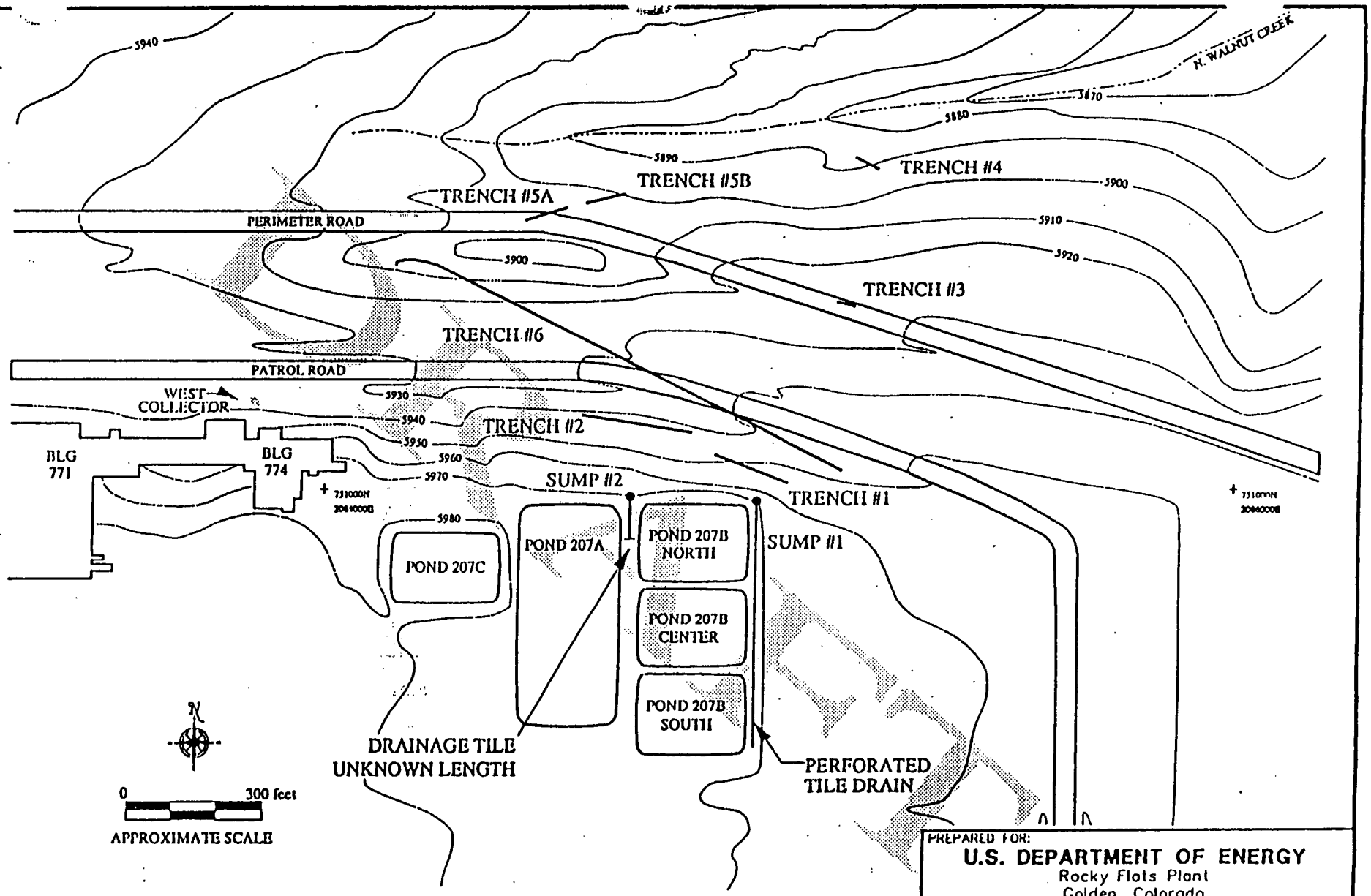

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Rocky Flats Plant
Golden, Colorado

FIGURE 000-2

TITLE:
TRENCHES AND SUMPS

DRAFT

PROJ. NO.	304944	DWG. NO.	304944-A84
DESIGN BY	A. VIRGIL	CHECKED	EJD
DRAWN BY	A. VIRGIL	APPROVED	
DATE	12/19/91	SCALE	AS SHOWN

REFERENCE: DRAWING PROVIDED BY DOTY & ASSOCIATES, FIGURE NO. 000-2, 12/17/91, PROJECT NO. 506-10.

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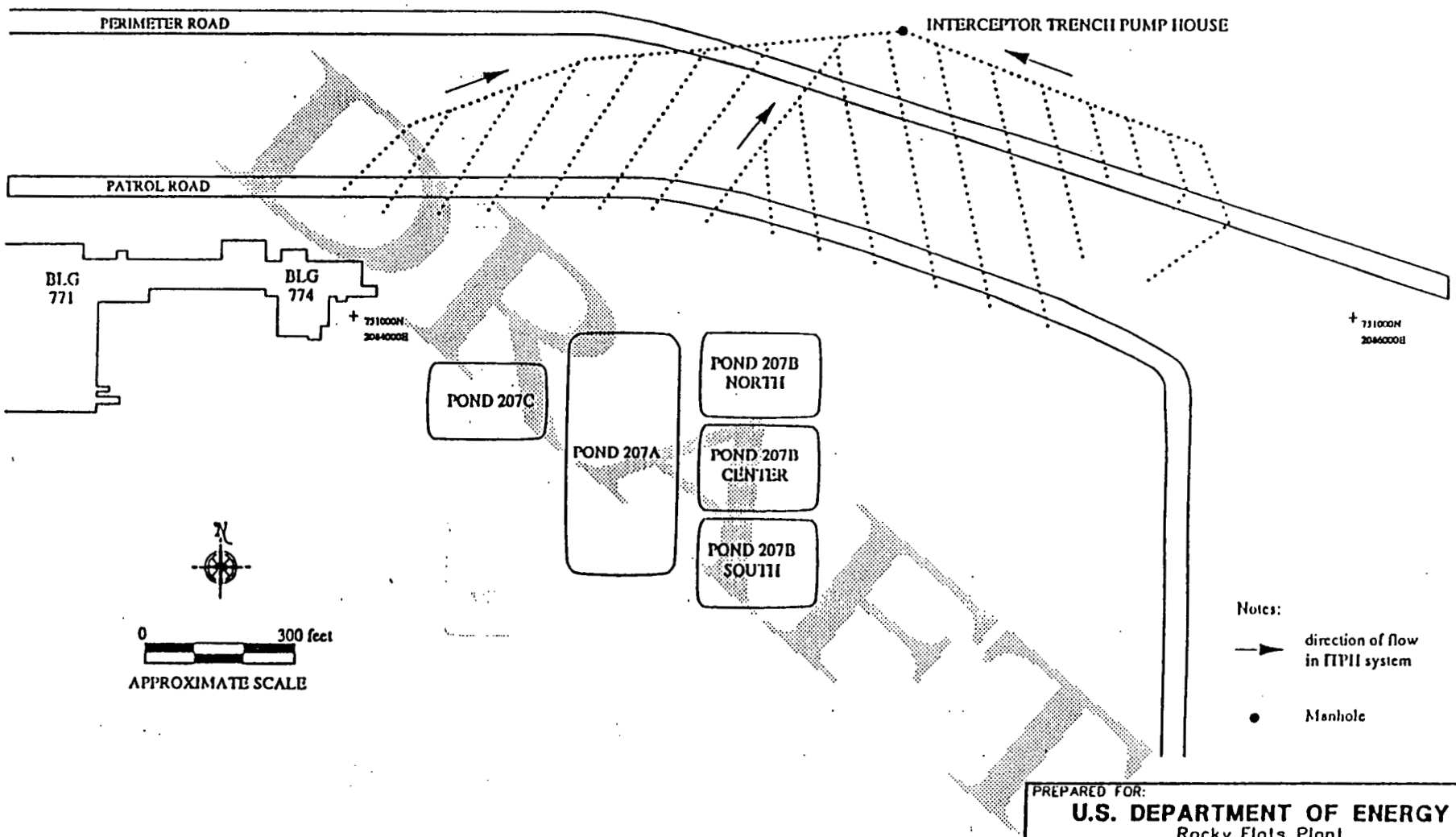
45144-31 12/19/91 1:35pm CAH

APPROXIMATE LOCATION OF ITPH DRAIN SYSTEM



REFERENCE: DRAWING PROVIDED BY DOTY & ASSOCIATES, FIGURE NO. 000-3, 12/17/91, PROJECT NO. 506-10.

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Rocky Flats Plant
Golden, Colorado

FIGURE 000-3

TITLE:
INTERCEPTOR TRENCH PUMP HOUSE SYSTEM

DRAFT

PROJ. NO.	304944	DWG. NO.	304944-A85
DESIGN BY	A. VIRGIL	CHECKED	FJB
DRAWN BY	A. VIRGIL	APPROVED	
DATE	12/19/91	SCALE	AS SHOWN

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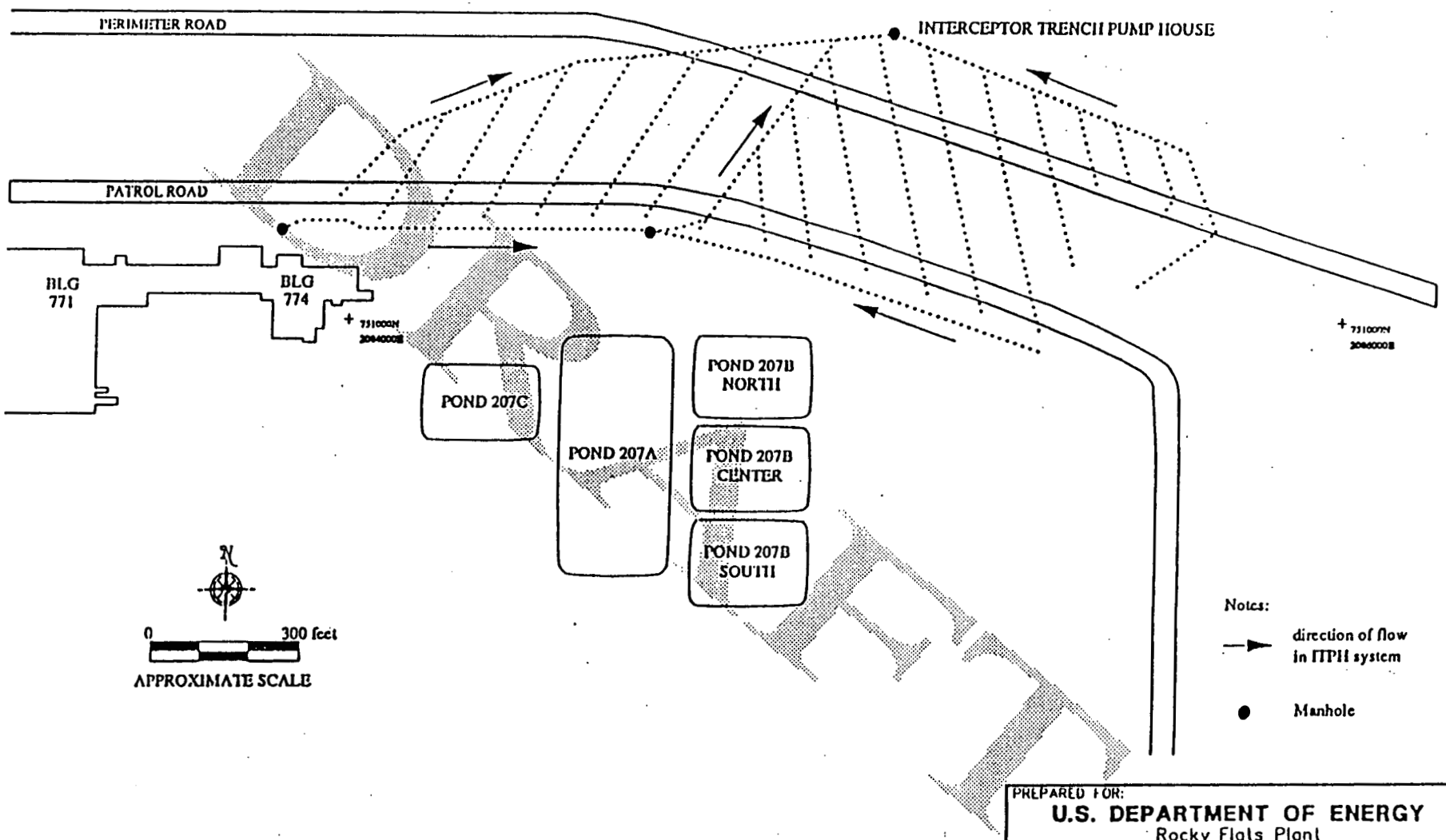
45146.35 12/19/91 1:40pm

APPROXIMATE LOCATION OF FRENCH DRAIN SYSTEM



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U.S. DEPARTMENT OF ENERGY
Rocky Flats Plant
Golden, Colorado

FIGURE 000-4

TITLE:
INTERCEPTOR TRENCH PUMP HOUSE SYSTEM EXTENSION

DRAFT

PROJ. NO.	304944	DWG. NO.	304944-A86
DESIGN BY	A. VIRGIL	CHECKED	EJB
DRAWN BY	A. VIRGIL	APPROVED	
DATE	12/19/91	SCALE	AS SHOWN

REFERENCE: DRAWING PROVIDED BY DOTY & ASSOCIATES, FIGURE NO. 000-4, 12/17/91, PROJECT NO. 606-10.

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APPENDIX C

Geologic Data for Wells and Boreholes Within and Surrounding OU8

Appendix C is subdivided into the following subsections:

C-1 This table lists information for selected wells and contains geographic coordinate elevation data for alluvium and bedrock intercepts.

The table includes well names, old well names, area at RFP, surveyed location, surface elevation TD, TD elevation, type of alluvium, thickness of alluvium, and elevation to top of bedrock.

C-2 This table contains information for selected wells and depicts sub-alluvial lithology and grain size analysis of the Ka ss # 1 of the Arapahoe Formation.

The table includes well names, old well names, sub-alluvial formation, sub-alluvial lithology, grain size, sample depth, Ka SS #1 elevation, thickness, grain size, and sample depth.

C-3 This table contains information for selected wells intercepting the Ka SS #2 and SS #3 of the Arapahoe Formation.

The table includes well names, old well names, Ka SS #2 and SS #3 elevation, thickness, grain size, and sample depth.

C-4 This table lists information for selected wells containing grain size analysis intercepting the Ka SS #4 and #5 of the Arapahoe Formation.

The table includes well names, old well names, Ka SS #4 and SS #5 elevation, thickness, grain size, and sample depth.

C-5 This table lists information for selected wells containing grain size and caliche analysis of the alluvium.

The table includes well names, old well names, alluvium type and depth, grain size analysis and sample depth, and caliche type and depth.

C-6 This table contains information for selected wells containing grain size analysis at selected sample depths.

The table includes well names, old well names, sub-alluvial formation, sub-alluvial lithology, grain size, sample depth, Ka SS #1 elevation, thickness, grain size, sample depth, bedding attitude, grain size percentages, and median grain diameter.

C-7 This table contains information of revised well and borehole coordinates drilled in 1986 and 1987 and screened well intervals.

The table includes a list of 96 wells from which the following data was obtained: location, surface elevation, T.O.C. elevation, TD elevation, type of alluvium, thickness of alluvium, elevation to top of bedrock, type of bedrock, and screened intervals.

C-8 This table lists information for all wells containing water level measurements and the date collected.

The table includes the well number, date the information was gathered, and the depth from top of casing.

C-9 This table lists information for selected wells containing the lithologic interpretation of the Ka SS #1 of the Arapahoe Formation.

The table includes the thickness of bedrock penetrated, presence of the KA SS #1, depth of top of lithology, thickness of lithology, and summary comments from lithologic logs.

APPENDIX C-1

GEOLOGIC DATA FOR WELLS AND BOREHOLES WITHIN AND SURROUNDING OU8 FROM GEOLOGICAL CHARACTERIZATION REPORT (EG&G, 1991a)

20-April-92

WELL NAME	OLD WELL NAME	AREA	RFP NORTH	RFP EAST	STATE NORTH	STATE EAST	SURFACE ELEVATION	TD.	TD. ELEVATION	TYPE ALLUVIUM	THICK ALLUVIUM	EL. TOP BEDROCK
0460	04-60	SOLAR POND	37593	22405			5962.00					
1986	19-86	SOLAR POND	37942	20195	750943	2083298	5931.22	16.5	5914.72	Qc	11.5	5919.72
2086	20-86		38110	21254	751112	2084358	5960.47	22	5938.47	Qc	12.5	5947.97
2086	20-86											
2086	20-86											
2186	21-86	PLANT NORTH	37948	21143	750911	2082503	5991.11	78	5913.11	Qrf	23.6	5967.51
2186	21-86	PLANT NORTH										
2186	21-86	PLANT NORTH										
2286	22-86	SOLAR POND	37735	21308	750737	2084412	5976.81	26	5950.81	Qd/Qrf	11	5965.81
2286	22-86	SOLAR POND										
2386	23-86	SOLAR POND	37355	21154	750357	2084259	5981.18	130.5	5850.68	Qd/Qrf	8.2	5972.98
2386	23-86	SOLAR POND										
2486	24-86	SOLAR POND	37355	21173	750357	2084277	5980.45	12	5968.45	Qd/Qrf	7.2	5973.25
2486	24-86	SOLAR POND										
2586	25-86	SOLAR POND	37426	21727	750428	2084831	5974.45	89.6	5884.85	Qd/Qrf	13	5961.45
2586	25-86	SOLAR POND										
2586A	25-86A						5974.45	98	5876.45		12.5	5961.95
2586A	25-86A											
2686	26-86	SOLAR POND	37426	21737	750428	2084841	5974.48	17	5957.48	Qd/Qrf	10.5	5963.98
2786	27-86	SOLAR POND	37794	22135	750796	2085239	5961.86	157	5804.86	Qd/Qrf	11	5950.86
2786	27-86	SOLAR POND										
2786	27-86	SOLAR POND										
2786	27-86	SOLAR POND										
2886	28-86	SOLAR POND	37816	22137	750818	2085241	5961.23	15.5	5945.73	Qd/Qrf	8.5	5952.73
2886	28-86	SOLAR POND								Qd/Qrf		
2986	29-86	SOLAR POND	37610	22584	750612	2085688	5958.26	22.5	5935.76		8.5	5949.76
2986	29-86	SOLAR POND										

APPENDIX C-1
GEOLOGIC DATA FOR WELLS AND BOREHOLES WITHIN AND SURROUNDING OU8 FROM GEOLOGICAL CHARACTERIZATION REPORT (EG&G, 1991a)

20-April-92

WELL NAME	OLD WELL NAME	AREA	RFP NORTH	RFP EAST	STATE NORTH	STATE EAST	SURFACE ELEVATION	TD.	TD. ELEVATION	TYPE ALLUVIUM	THICK ALLUVIUM	EL. TOP BEDROCK
2986	29-86	SOLAR POND										
3086	30-86	SOLAR POND	38092	22166	751094	2084924	5956.21	16	5940.21	Qd/Qrf	2.5	5953.71
3186	31-86	SOLAR POND	38094	21662	751068	2085269	5964.21	22	5942.21	Qd/Qrf	0.5	5963.71
3186	31-86	SOLAR POND										
3186	31-86	SOLAR POND										
3286	32-86	SOLAR POND	37654	21641	750638	2084423	5964.50	135	5829.5	Qd/Qrf	1	5963.5
3286	32-86	SOLAR POND										
3386	33-86	MOUND AREA	36961	21896	749963	2085000	5949.28	16.8	5932.48	Qc	6.8	5942.48
4486	44-86	PLANT WEST	36252	19131	749254	2082234	6019.93	33	5986.93	Qrf	25	5994.93
4486	44-86	PLANT WEST										
6186	61-86	881 HILLSIDE	36217	20609	749219	2083712	5999.31	18.5	5980.81	Qrf	11.5	5987.81
6186	61-86	881 HILLSIDE										
6186	61-86	881 HILLSIDE										
SP0187	SP01-87	Solar Ponds	37792	21209	750790	2084310	5982.70	30.2	5952.5	Qaf/Qrf	13.2	5969.5
SP0187	SP01-87	Solar Ponds										
SP0187	SP01-87	Solar Ponds										
SP0287	SP02-87	Solar Ponds	37980	21532	750970	2084640	5976.60	15	5961.6	Qaf/Qrf	10.5	5966.1
SP0387	SP03-87	Solar Ponds	37485	21532	750480	2084630	5978.70	19.7	5959	Qaf/Qrf	13	5965.7
SP0387	SP03-87	Solar Ponds										
SP0387	SP03-87	Solar Ponds										
SP0487	SP04-87	Solar Ponds	37561	21820	750560	2084920	5971.80	37	5934.8	Qd/Qrf	12	5959.8
SP0487	SP04-87	Solar Ponds										
SP0487	SP04-87	Solar Ponds										
SP0487	SP04-87	Solar Ponds										
SP0487	SP04-87	Solar Ponds										
SP0487	SP04-87	Solar Ponds										
SP0587	SP05-87	Solar Ponds	37865	21810	750870	2084910	5971.60	21.8	5949.8	Qd/Qrf	16.3	5955.3

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GEOLOGIC DATA FOR WELLS AND BOREHOLES WITHIN AND SURROUNDING OU8 FROM GEOLOGICAL CHARACTERIZATION REPORT (EG&G, 1991a)

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WELL NAME	OLD WELL NAME	AREA	RFP NORTH	RFP EAST	STATE NORTH	STATE EAST	SURFACE ELEVATION	TD.	TD. ELEVATION	TYPE ALLUVIUM	THICK ALLUVIUM	EL. TOP BEDROCK
SP0687	SP06-87	Solar Ponds	37900	22100	750900	2085200	5972.90	30.7	5942.2	Qaf/Qrf	18	5954.9
SP0687	SP06-87	Solar Ponds										
SP0687	SP06-87	Solar Ponds										
SP0687	SP06-87	Solar Ponds										
SP0687	SP06-87	Solar Ponds										
SP0787	SP07-87	Solar Ponds	37485	22100	750471	2085200	5973.60	31	5942.6	Qaf/Qrf	20.8	5952.8
SP0787	SP07-87	Solar Ponds										
SP0887	SP08-87	SOLAR POND	35786	15022	748749	2078136	6099.52			Qd/Qc		
0987	09-87/BH29-87	903 PAD	36081	22239	749068	2085348	5980.22	37.5	5942.72	Qrf	12.7	5967.52
0987	09-87/BH29-87	903 PAD										
0987	09-87/BH29-87	903 PAD										
0987	09-87/BH29-87	903 PAD										
1087	10-87	903 PAD	35960	22180	748947	2085289	5981.96	17	5964.96	Qrf	11.3	5970.66
1087	10-87	903 PAD										
SP1187	SP11-87	Solar Ponds	38590	21342	751585	2084450	5904.50	34	5870.5	Qd/Qc	21.5	5883
SP1187	SP11-87	Solar Ponds										
SP1187	SP11-87	Solar Ponds										
1587	15-87/BH30-87	903 PAD	36020	23140	749010	2086249	5970.89	27	5943.89	Qrf	21.85	5949.04
1587	15-87/BH30-87	903 PAD										
1687BR	16-87BR	903 PAD	36140	23140	749130	2086249	5969.06	174	5795.06	Qrf	22.2	5946.86
1687BR	16-87BR	903 PAD										
1687BR	16-87BR	903 PAD										
1687BR	16-87BR	903 PAD										
1987	19-87	MOUND AREA	36633	23065	749623	2086172	5967.98	16.1	5951.88	Qrf	10.8	5957.18
1987	19-87	MOUND AREA										
2087BR	20-87BR	MOUND AREA	36644	23048	749634	2086155	5968.10	126.2	5841.9	Qrf	11.8	5956.3
2087BR	20-87BR	MOUND AREA										

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GEOLOGIC DATA FOR WELLS AND BOREHOLES WITHIN AND SURROUNDING OU8 FROM GEOLOGICAL CHARACTERIZATION REPORT (EG&G, 1991a)

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WELL NAME	OLD WELL NAME	AREA	RFP NORTH	RFP EAST	STATE NORTH	STATE EAST	SURFACE ELEVATION	TD.	TD. ELEVATION	TYPE ALLUVIUM	THICK ALLUVIUM	EL. TOP BEDROCK
2087BR	20-87BR	MOUND AREA										
2187	21-87	MOUND AREA	36980	22694	749969	2085800	5927.58	17	5910.58	Qrf	8	5919.58
BH2287	BH22-87	903 Pad	35790	22536	748778	2085646	5978.50	27.2	5951.3	Qrf	22.2	5956.3
2287BR	22-87BR	MOUND AREA	36935	22716	749924	2085822	5930.70	111	5819.7	Qrf	12.8	5917.9
2287BR	22-87BR	MOUND AREA										
2287BR	22-87BR	MOUND AREA										
2287BR	22-87BR	MOUND AREA										
2387BR	23-87BR	MOUND AREA	36415	22803	749404	2085910	5972.34	45.3	5927.04	Qrf	15.25	5957.09
2387BR	23-87BR	MOUND AREA										
2387BR	23-87BR	MOUND AREA										
2387BR	23-87BR	MOUND AREA										
2387BR	23-87BR	MOUND AREA										
BH2487	BH24-87	903 Pad	35839	23081	748829	2086190	5953.60	12.3	5941.3	Qc	4.9	5948.7
BH2887	BH28-87	903 Pad	35803	23131	748794	2086241	5946.70	15	5931.7	Qc	5.9	5940.8
BH2987	BH29-87	903 Pad	36081	23140	749068	2085348	5980.22			Qrf		
BH3087	BH30-87	903 Pad	36020	N/A	749010	2086249	5970.89			Qrf		
BH3187	BH31-87	MOUND AREA	36499	22297	749486	2085405	5973.80	15.9	5957.9	Qrf	>15.9	5973.8
BH3187	BH31-87	MOUND AREA										
BH3187	BH31-87	MOUND AREA										
BH3287	BH32-87	MOUND AREA	36498	22421	749485	2085528	5971.70	20.5	5951.2	Qrf	7.7	5964
BH3287	BH32-87	MOUND AREA										
BH3387	BH33-87	MOUND AREA	36499	22659	749488	2085766	5967.90	20.8	5947.1	Qrf	9.2	5958.7
BH3387	BH33-87	MOUND AREA										
BH3387	BH33-87	MOUND AREA										
BH3487	BH34-87	MOUND AREA	36474	22786	749463	2085893	5971.40	24.7	5946.7	Qrf	16.7	5954.7
BH3487	BH34-87	MOUND AREA										
BH3487	BH34-87	MOUND AREA										

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WELL NAME	OLD WELL NAME	AREA	RFP NORTH	RFP EAST	STATE NORTH	STATE EAST	SURFACE ELEVATION	TD.	TD. ELEVATION	TYPE ALLUVIUM	THICK ALLUVIUM	EL. TOP BEDROCK
BH3487	BH34-87	MOUND AREA										
BH3587	BH35-87	MOUND AREA	36440	22962	749430	2086069	5970.50	20.3	5950.2	Qrf	14.3	5956.2
BH3587	BH35-87	MOUND AREA										
BH3587	BH35-87	MOUND AREA										
BH3687	BH36-87	MOUND AREA	36512	23042	749502	2086149	5969.40	26	5943.4	Qrf	20.6	5948.8
3787	37-87	SOLAR POND	37507	22120	750494	2085224	5967.03	13	5954.03	Qd/Qrf	8	5959.03
3787	37-87	SOLAR POND										
BH3787	BH37-87	EAST TRENCHES	36621	23021	749610	2086128	5968.80	28	5940.8	Qrf	14	5954.8
BH3787	BH37-87	EAST TRENCHES										
3887	38-87	SOLAR POND	37371	22021	750357	2085125	5971.79	15.2	5956.59	Qd/Qrf	7.8	5963.99
3887	38-87	SOLAR POND										
3987BR	39-87BR(SP08-87)	SOLAR POND								Qd/Qc		
3987BR	39-87BR(SP08-87)	SOLAR POND										
3987BR	39-87BR(SP08-87)	SOLAR POND	38094	22166	751080	2085269	5947.10	138	5809.1		3.5	5943.6
3987BR	39-87BR(SP08-87)	SOLAR POND										
5687	56-87/SP16-87	SOLAR POND	37654	21319	750638	2084423	5978.51	13.4	5965.11	Qd/Qrf	9.4	5969.11
P207389	SEP0189BR	SOLAR POND	37211	21363	750195	2084468	5981.02	23.3	5957.72	Qrf	7	5974.02
P207389	SEP0189BR	SOLAR POND										
P207389	SEP0189BR	SOLAR POND										
P207389	SEP0189BR	SOLAR POND										
P207489	SEP0289	SOLAR POND	37213	21376	750197	2084481	5980.71	10	5970.71	Qrf	6.5	5974.21
P207489	SEP0289	SOLAR POND										
P207589	SEP0389	SOLAR POND	37410	21739	750395	2084843	5974.06	29.1	5944.96	Qrf	9.5	5964.56
P207589	SEP0389	SOLAR POND										
P207589	SEP0389	SOLAR POND										
P207689	SEP0489	SOLAR POND	37411	22214	750398	2085318	5966.32	18.2	5948.12	Qrf	12.6	5953.72
P207689	SEP0489	SOLAR POND										

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WELL NAME	OLD WELL NAME	AREA	RFP NORTH	RFP EAST	STATE NORTH	STATE EAST	SURFACE ELEVATION	TD.	TD. ELEVATION	TYPE ALLUVIUM	THICK ALLUVIUM	EL. TOP BEDROCK
P207689	SEP0489	SOLAR POND										
P207689	SEP0489	SOLAR POND										
P207689	SEP0489	SOLAR POND										
P207789	SEP0589	SOLAR POND	37406	22239	750392	2085343	5965.88	32.3	5933.58	Qrf	12.9	5952.98
P207789	SEP0589	SOLAR POND										
P207789	SEP0589	SOLAR POND										
P207889	SEP0689	SOLAR POND	37684	22240	750671	2085343	5962.82	10.5	5952.32	Qrf	8.5	5954.32
P207889	SEP0689	SOLAR POND										
P207889	SEP0689	SOLAR POND										
P207989	SEP0789BR	SOLAR POND	37684	22226	750671	2085330	5963.09	26.2	5936.89	Qrf	5.8	5957.29
P207989	SEP0789BR	SOLAR POND										
P207989	SEP0789BR	SOLAR POND										
P207989	SEP0789BR	SOLAR POND										
B208789	SEP1589	SOLAR POND	38771	21350	751755	2084450	5907.10	14.4	5892.7	Qal	4.5	5902.6
B208789	SEP1589	SOLAR POND										
P208889	SEP1689BR	SOLAR POND	38100	22146	751086	2085249	5947.30	105.1	5842.2	Qc	5.5	5941.8
P208889	SEP1689BR	SOLAR POND										
P208889	SEP1689BR	SOLAR POND										
P208889	SEP1689BR	SOLAR POND										
P208889	SEP1689BR	SOLAR POND										
P208889	SEP1689BR	SOLAR POND										
P208889	SEP1689BR	SOLAR POND										
P208889	SEP1689BR	SOLAR POND										
P208989	SEP1789BR	SOLAR POND	38059	21736	751044	2084839	5962.53	28.6	5933.93	Qrf	3.5	5959.03
P208989	SEP1789BR	SOLAR POND										
P209089	SEP1889BR	SOLAR POND	37509	21807	750566	2084910	5972.16	31.5	5940.66	Qrf	11.5	5960.66
P209089	SEP1889BR	SOLAR POND										

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WELL NAME	OLD WELL NAME	AREA	RFP NORTH	RFP EAST	STATE NORTH	STATE EAST	SURFACE ELEVATION	TD.	TD. ELEVATION	TYPE ALLUVIUM	THICK ALLUVIUM	EL. TOP BEDROCK
P209089	SEP1889BR	SOLAR POND										
P209189	SEP1989BR	SOLAR POND	37779	21206	750762	2084309	5980.66	38.3	5942.36	Qrf	10.3	5970.36
P209189	SEP1989BR	SOLAR POND										
P209189	SEP1989BR	SOLAR POND										
P209189	SEP1989BR	SOLAR POND										
P209189	SEP1989BR	SOLAR POND										
P209289	SEP2089	SOLAR POND	37880	21036	750863	2084139	5981.59	17.8	5963.79	Qrf	13.8	5967.79
P209289	SEP2089	SOLAR POND										
P209289	SEP2089	SOLAR POND										
P209289	SEP2089	SOLAR POND										
P209389	SEP2189BR	SOLAR POND	37881	21026	750864	2084130	5981.47	34.2	5947.27	Qrf	13.8	5967.67
P209389	SEP2189BR	SOLAR POND										
P209389	SEP2189BR	SOLAR POND										
P209489	SEP2289BR	SOLAR POND	38007	21531	750991	2084634	5977.98	48	5929.98	Qrf	9	5968.98
P209489	SEP2289BR	SOLAR POND										
P209489	SEP2289BR	SOLAR POND										
P209589	SEP2389BR	SOLAR POND	38084	22184	751071	2085286	5948.17	30.3	5917.87	Qrf	4.1	5944.07
P209589	SEP2389BR	SOLAR POND										
P209589	SEP2389BR	SOLAR POND										
P209689	SEP2489BR	SOLAR POND	37591	22390	750533	2085514	5962.63	30.2	5932.43	Qrf	12.2	5950.43
P209689	SEP2489BR	SOLAR POND										
P209689	SEP2489BR	SOLAR POND										
P209789	SEP2589	SOLAR POND	37591	22377	750579	2085481	5962.63	17.5	5945.13	Qrf	12.2	5950.43
P209789	SEP2589	SOLAR POND										
P209789	SEP2589	SOLAR POND										
P209789	SEP2589	SOLAR POND										
P209889	SEP2689BR	SOLAR POND	38209	21882	751194	2084984	5940.28	23.9	5916.38	Qrf	3.9	5936.38

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GEOLOGIC DATA FOR WELLS AND BOREHOLES WITHIN AND SURROUNDING OU8 FROM GEOLOGICAL CHARACTERIZATION REPORT (EG&G, 1991a)

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WELL NAME	OLD WELL NAME	AREA	RFP NORTH	RFP EAST	STATE NORTH	STATE EAST	SURFACE ELEVATION	TD.	TD. ELEVATION	TYPE ALLUVIUM	THICK ALLUVIUM	EL. TOP BEDROCK
P209989	SEP2889	SOLAR POND	38581	21548	751565	2084649	5898.10	12	5886.1	Qc	7.6	5890.5
P210089	SEP2989BR	SOLAR POND	38579	21539	751564	2084639	5898.40	28	5870.4	Qc	7.2	5891.2
P210189	SEP3089BR	SOLAR POND	37768	21307	750751	2084411	5980.82	38.6	5942.22	Qrf	14.6	5966.22
P210189	SEP3089BR	SOLAR POND										
P210189	SEP3089BR	SOLAR POND										
P210189	SEP3089BR	SOLAR POND										
P210189	SEP3089BR	SOLAR POND										
P210289	SEP3189BR	SOLAR POND	37578	22119	750564	2085223	5967.03	26	5941.03	Qrf	6.6	5960.43
P210289	SEP3189BR	SOLAR POND										
P210289	SEP3189BR	SOLAR POND										
P210289	SEP3189BR	SOLAR POND										
P313489	PZ0589	PLANT	35934	19952	748913	2083062	6011.70	24	5987.7	Qrf	20.6	5991.1
P313489	PZ0589	PLANT										
P313489	PZ0589	PLANT										
P313489	PZ0589	PLANT										
P213689	PZ1089	PLANT	36478	20629	749460	2083736	5994.30	23	5971.3	Qrf	13	5981.3
P213689	PZ1089	PLANT										
P213689	PZ1089	PLANT										
P213689	PZ1089	PLANT										
P213689	PZ1089	PLANT										
P314089	PZ2389	PLANT	36480	20545	749461	2083653	5996.70	19	5977.7	Qrf	9.3	5987.4
P414189	PZ2489	PLANT	36080	19877	749059	2082986	6010.60	28	5982.6	Qrf	18	5992.6
P414189	PZ2489	PLANT										
P414189	PZ2489	PLANT										
P414189	PZ2489	PLANT										
P414189	PZ2489	PLANT										
P414189	PZ2489	PLANT										

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WELL NAME	OLD WELL NAME	AREA	RFP NORTH	RFP EAST	STATE NORTH	STATE EAST	SURFACE ELEVATION	TD.	TD. ELEVATION	TYPE ALLUVIUM	THICK ALLUVIUM	EL. TOP BEDROCK
P114689	PZ4289	PLANT	36964	19938	749943	2083044	6004.00	26	5978	Qrf	22	5982
P114789	PZ4389	PLANT	36962	19504	749940	2082610	6010.70	31	5979.7	Qrf	26	5984.7
P114789	PZ4389	PLANT										
P114789	PZ4389	PLANT										
P114789	PZ4389	PLANT										
P114789	PZ4389	PLANT										
P114889	PZ4489	PLANT	36950	19020	749926	2082127	6016.60	18	5998.6	Qrf	13.8	6002.8
P114889	PZ4489	PLANT										
P115489	PZ4989	PLANT	36531	19026	749507	2082135	6023.40	31	5992.4	Qrf	26	5997.4
P115489	PZ4989	PLANT										
P115489	PZ4989	PLANT										
P115489	PZ4989	PLANT										
P115589	PZ5089	PLANT	36573	19550	749551	2082658	6014.10	33.6	5980.5	Qrf	29	5985.1
P115589	PZ5089	PLANT										
P115589	PZ5089	PLANT										
P115589	PZ5089	PLANT										
P115589	PZ5089	PLANT										
P115589	PZ5089	PLANT										
P115589	PZ5089	PLANT										
P115589	PZ5089	PLANT										
P115589	PZ5089	PLANT										
P115589	PZ5089	PLANT										
P115589	PZ5089	PLANT										
P115589	PZ5089	PLANT										
P115689	PZ5189	PLANT	36553	19910	749532	2083019	6006.90	23.5	5983.4	Qrf	19.7	5987.2
P215789	PZ5289	PLANT	36490	20322	749470	2083430	6002.00	22	5980	Qrf	18	5984

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WELL NAME	OLD WELL NAME	AREA	RFP NORTH	RFP EAST	STATE NORTH	STATE EAST	SURFACE ELEVATION	TD.	TD. ELEVATION	TYPE ALLUVIUM	THICK ALLUVIUM	EL. TOP BEDROCK
P215789	PZ5289	PLANT										
P215789	PZ5289	PLANT										
P215789	PZ5289	PLANT										
P215789	PZ5289	PLANT										
P215789	PZ5289	PLANT										
P215789	PZ5289	PLANT										
P215789	PZ5289	PLANT										
P317989	OP0289	ORIGINAL PROCESS	35907	21163	748891	2084272	5990.90	16	5974.9	Qrf	6.4	5984.5
P317989	OP0289	ORIGINAL PROCESS										
P317989	OP0289	ORIGINAL PROCESS										
P218089	OP0389	ORIGINAL PROCESS	36958	20914	749941	2084020	5985.80	16	5969.8	Qrf	6	5979.8
P218289	OP0189	PLANT	35974	19544	748952	2082653	6016.9	33	5983.9	Qrf	23	5993.9
P218289	OP0189	PLANT										
P218289	OP0189	PLANT										
P218289	OP0189	PLANT										
P218289	OP0189	PLANT										
P218289	OP0189	PLANT										
P218389	PZ2789	PLANT	37843	22545	750831	2085648	5956.2	22	5934.2	Qrf	12	5944.2
P218389	PZ2789	PLANT										
P218489	BH7740589	PLANT	38144	21014	751127	2084117	5949.1	5	5944.1			
P219189	PZ1889	PLANT	38240	20908	751222	2084010	5941.2	21	5920.2	Qrf	11	5930.2
P219489	PZ1589	PLANT	37427	22547	750415	2085651	5959.5	32	5927.5	Qrf	22.4	5937.1
P219489	PZ1589	PLANT										
P219589	PZ1289	PLANT	37280	22432	750268	2085536	5963.8	16.7	5947.1	Qrf	17.2	5946.6
P320089	7089	PLANT	35818	20170	748799	2083280	6009.9	20.9	5989	Qrf	18.8	5991.1

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GEOLOGIC DATA FOR WELLS AND BOREHOLES WITHIN AND SURROUNDING OU8 FROM GEOLOGICAL CHARACTERIZATION REPORT (EG&G, 1991a)

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WELL NAME	OLD WELL NAME	SUB. ALLUV. FORMATION	SUB. ALLUV. LITHOLOGY	GRAIN SIZE (mm)	GRAIN SIZE DEPTH	Ka SS #1 Strat. Eqv. ELEVATION	Ka SS #1 Strat. Eqv. THICK.	Ka SS #1 GRAIN SIZE % > 200/230 SIEVE	Ka SS #1 GRAIN SIZE DEPTH
0460	04-60	Ka							
1986	19-86	Ka	CLYSTN						
2086	20-86	Ka	CLYSTN						
2086	20-86	Ka							
2086	20-86	Ka							
2186	21-86	Ka	CLYSTN						
2186	21-86	Ka							
2186	21-86	Ka							
2286	22-86	Ka	SS #1	0.009	10-12	5965.81	7	22	10-12
2286	22-86	Ka	SS #1	0.075	16-18	5965.81	7	50	16-18
2386	23-86	Ka	CLYSTN						
2386	23-86	Ka							
2486	24-86	Ka	CLYSTN						
2486	24-86	Ka							
2586	25-86	Ka	CLYSTN SANDY						
2586	25-86	Ka							
2586A	25-86A	Ka	CLYSTN						
2586A	25-86A	Ka							
2686	26-86	Ka	CLYSTN						
2786	27-86	Ka	CLYSTN						
2786	27-86	Ka							
2786	27-86	Ka							
2786	27-86	Ka							
2886	28-86	Ka	CLYSTN						
2886	28-86	Ka							
2986	29-86	Ka	CLYSTN			5945.76	10	26	12.5-14.5
2986	29-86	Ka				5945.76	10	63	17.5-22.5

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WELL NAME	OLD WELL NAME	SUB. ALLUV. FORMATION	SUB. ALLUV. LITHOLOGY	GRAIN SIZE (mm)	GRAIN SIZE DEPTH	Ka SS #1 Strat. Eqv. ELEVATION	Ka SS #1 Strat. Eqv. THICK.	Ka SS #1 GRAIN SIZE % > 200/230 SIEVE	Ka SS #1 GRAIN SIZE DEPTH
2986	29-86	Ka				5945.76	10	63	18
3086	30-86	Ka	CLYSTN						
3186	31-86	Ka	SS #1	0.022	2.5	5963.7	14.5	13	2-4
3186	31-86	Ka	SS #1	0.08	2-4	5963.7	14.5	54	13-14.5
3186	31-86	Ka	SS #1	N/A	13-14.5	5963.7	14.5	36.3	2.5
3286	32-86	Ka	SS #1	0.086	2-4	5963.5	8.3	58	2-4
3286	32-86	Ka							
3386	33-86	Ka	CLYSTN						
4486	44-86	Ka	CLYSTN						
4486	44-86	Ka							
6186	61-86	Ka	CLYSTN SILTY						
6186	61-86	Ka							
6186	61-86	Ka							
SP0187	SP01-87	Ka	SS #1	0.095	19	5969.5	17	61	19
SP0187	SP01-87	Ka	SS #1	EST. .045	28	5969.5	17	31	28
SP0187	SP01-87	Ka							
SP0287	SP02-87	Ka	SS #1	0.077	12	5966.1	4.6	51	12
SP0387	SP03-87	Ka	CLYSTN						
SP0387	SP03-87	Ka							
SP0387	SP03-87	Ka							
SP0487	SP04-87	Ka	CLYSTN						
SP0487	SP04-87	Ka							
SP0487	SP04-87	Ka							
SP0487	SP04-87	Ka							
SP0487	SP04-87	Ka							
SP0487	SP04-87	Ka							
SP0587	SP05-87	Ka	CLYSTN						

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GEOLOGIC DATA FOR WELLS AND BOREHOLES WITHIN AND SURROUNDING OU8 FROM GEOLOGICAL CHARACTERIZATION REPORT (EG&G, 1991a)

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WELL NAME	OLD WELL NAME	SUB. ALLUV. FORMATION	SUB. ALLUV. LITHOLOGY	GRAIN SIZE (mm)	GRAIN SIZE DEPTH	Ka SS #1 Strat. Eqv. ELEVATION	Ka SS #1 Strat. Eqv. THICK.	Ka SS #1 GRAIN SIZE % > 200/230 SIEVE	Ka SS #1 GRAIN SIZE DEPTH
SP0687	SP06-87	Ka	CLYSTN						
SP0687	SP06-87	Ka							
SP0687	SP06-87	Ka							
SP0687	SP06-87	Ka							
SP0687	SP06-87	Ka							
SP0787	SP07-87	Ka	CLYSTN						
SP0787	SP07-87	Ka							
SP0887	SP08-87	Ka							
0987	09-87/BH29-87	Ka	SS #1	0.1	17.5-19.5	5967.52	19.2	61	17.5-19.5
0987	09-87/BH29-87	Ka							
0987	09-87/BH29-87	Ka	SS #1	0.095	20-21.5	5967.52	19.2	59	20-21.5
0987	09-87/BH29-87	Ka	SS #1	0.095	31.5	5967.52	19.2	57	31.5
1087	10-87	Ka	SS #1	EST. .06	12	5970.66	6	38	12
1087	10-87	Ka							
SP1187	SP11-87	Ka	SS #2						
SP1187	SP11-87	Ka							
SP1187	SP11-87	Ka							
1587	15-87/BH30-87	Ka	CLYSTN SILTY						
1587	15-87/BH30-87	Ka							
1687BR	16-87BR	Ka	CLYSTN						
1687BR	16-87BR	Ka							
1687BR	16-87BR	Ka							
1687BR	16-87BR	Ka							
1987	19-87	Ka	CLYSTN SILTY						
1987	19-87	Ka							
2087BR	20-87BR	Ka	CLYSTN						
2087BR	20-87BR	Ka							

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WELL NAME	OLD WELL NAME	SUB. ALLUV. FORMATION	SUB. ALLUV. LITHOLOGY	GRAIN SIZE (mm)	GRAIN SIZE DEPTH	Ka SS #1 Strat. Eqv. ELEVATION	Ka SS #1 Strat. Eqv. THICK.	Ka SS #1 GRAIN SIZE % > 200/230 SIEVE	Ka SS #1 GRAIN SIZE DEPTH
2087BR	20-87BR	Ka							
2187	21-87	Ka	CLYSTN						
BH2287	BH22-87	Ka	CLYSTN						
2287BR	22-87BR	Ka	CLYSTN						
2287BR	22-87BR	Ka							
2287BR	22-87BR	Ka							
2287BR	22-87BR	Ka							
2387BR	23-87BR	Ka	SS #1	0.091	17-19	5957.1	17.5	60	17-19
2387BR	23-87BR	Ka	SS #1						
2387BR	23-87BR	Ka	SS #1	0.065	23-25	5971.1	17.5	45	23-25
2387BR	23-87BR	Ka	SS #1	0.17	25-27	5971.1	17.5	80	25-27
2387BR	23-87BR	Ka			35-35.5	5971.1	17.5	23	35-35.5
BH2487	BH24-87	Ka	SILTSTN CLAYEY						
BH2887	BH28-87	Ka	CLYSTN						
BH2987	BH29-87	Ka							
BH3087	BH30-87	Ka							
BH3187	BH31-87	Ka	SS #1 (*REMARKS)		9.05-9.75	5965.8	2.2	39	9.05-9.75
BH3187	BH31-87	Ka							
BH3187	BH31-87	Ka							
BH3287	BH32-87	Ka	SS #1	0.048	10.2-12.7	5964	6.9	41	10.2-12.7
BH3287	BH32-87	Ka	SS #1		11	5964	6.9	41	11
BH3387	BH33-87	Ka	SS #1	0.093	12.8-15.3	5956.9	4.3	56	12.8-15.3
BH3387	BH33-87	Ka		0.057	19 EST	5950.3	2	40	19 EST
BH3387	BH33-87					5947.6	0.5		
BH3487	BH34-87	Ka	SS #1		16.7-18.7	5954.7	8	23	16.7-18.7
BH3487	BH34-87	Ka	SS #1		20.7-22.7	5954.7	8	43	20.7-22.7
BH3487	BH34-87	Ka							

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WELL NAME	OLD WELL NAME	SUB. ALLUV. FORMATION	SUB. ALLUV. LITHOLOGY	GRAIN SIZE (mm)	GRAIN SIZE DEPTH	Ka SS #1 Strat. Eqv. ELEVATION	Ka SS #1 Strat. Eqv. THICK.	Ka SS #1 GRAIN SIZE % > 200/230 SIEVE	Ka SS #1 GRAIN SIZE DEPTH
BH3487	BH34-87	Ka							
BH3587	BH35-87	Ka	CLYSTN SANDY			5956.2	6	16	17
BH3587	BH35-87	Ka							
BH3587	BH35-87	Ka							
BH3687	BH36-87	Ka	CLYSTN						
3787	37-87	Ka	CLYSTN						
3787	37-87	Ka							
BH3787	BH37-87	Ka	CLYSTN SANDY			5947.1	6.3	12	23
BH3787	BH37-87	Ka							
3887	38-87	Ka	CLYSTN						
3887	38-87	Ka							
3987BR	39-87BR(SP08-87)	Ka							
3987BR	39-87BR(SP08-87)	Ka							
3987BR	39-87BR(SP08-87)	Ka	CLYSTN						
3987BR	39-87BR(SP08-87)								
5687	56-87/SP16-87	Ka	CLYSTN SILTY						
P207389	SEP0189BR	Ka	CLYSTN			5972.7	6.5		
P207389	SEP0189BR								
P207389	SEP0189BR								
P207389	SEP0189BR								
P207489	SEP0289	Ka	CLYSTN						
P207489	SEP0289								
P207589	SEP0389	Ka	CLYSTN SILTY						
P207589	SEP0389								
P207589	SEP0389								
P207689	SEP0489	Ka	CLYSTN SILTY						
P207689	SEP0489								

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WELL NAME	OLD WELL NAME	SUB. ALLUV. FORMATION	SUB. ALLUV. LITHOLOGY	GRAIN SIZE (mm)	GRAIN SIZE DEPTH	Ka SS #1 Strat. Eqv. ELEVATION	Ka SS #1 Strat. Eqv. THICK.	Ka SS #1 GRAIN SIZE % > 200/230 SIEVE	Ka SS #1 GRAIN SIZE DEPTH
P207689	SEP0489								
P207689	SEP0489								
P207689	SEP0489								
P207789	SEP0589	Ka	CLYSTN SILTY						
P207789	SEP0589								
P207789	SEP0589								
P207889	SEP0689	Ka	CLYSTN						
P207889	SEP0689								
P207889	SEP0689								
P207989	SEP0789BR	Ka	CLYSTN						
P207989	SEP0789BR								
P207989	SEP0789BR								
P207989	SEP0789BR								
B208789	SEP1589	Ka	CLYSTN						
B208789	SEP1589								
P208889	SEP1689BR	Ka	CLYSTN						
P208889	SEP1689BR								
P208889	SEP1689BR								
P208889	SEP1689BR								
P208889	SEP1689BR								
P208889	SEP1689BR								
P208889	SEP1689BR								
P208889	SEP1689BR								
P208989	SEP1789BR	Ka	CLYSTN SILTY						
P208989	SEP1789BR								
P209089	SEP1889BR	Ka	CLYSTN SILTY						
P209089	SEP1889BR								

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WELL NAME	OLD WELL NAME	SUB. ALLUV. FORMATION	SUB. ALLUV. LITHOLOGY	GRAIN SIZE (mm)	GRAIN SIZE DEPTH	Ka SS #1 Strat. Eqv. ELEVATION	Ka SS #1 Strat. Eqv. THICK.	Ka SS #1 GRAIN SIZE % > 200/230 SIEVE	Ka SS #1 GRAIN SIZE DEPTH
P209089	SEP1889BR								
P209189	SEP1989BR	Ka	SS #1			5970.4	23		
P209189	SEP1989BR								
P209189	SEP1989BR								
P209189	SEP1989BR								
P209189	SEP1989BR								
P209289	SEP2089	Ka	SS #1			5967.8	4+		
P209289	SEP2089								
P209289	SEP2089								
P209289	SEP2089								
P209389	SEP2189BR	Ka	SS #1			5967.7	14.2		
P209389	SEP2189BR								
P209389	SEP2189BR								
P209489	SEP2289BR	Ka	CLYSTN			5966	29		
P209489	SEP2289BR								
P209489	SEP2289BR								
P209589	SEP2389BR	Ka	CLYSTN SILTY						
P209589	SEP2389BR								
P209589	SEP2389BR								
P209689	SEP2489BR	Ka	CLYSTN SILTY						
P209689	SEP2489BR								
P209689	SEP2489BR								
P209789	SEP2589	Ka	CLYSTN SILTY						
P209789	SEP2589								
P209789	SEP2589								
P209789	SEP2589								
P209889	SEP2689BR	Ka	CLYSTN SILTY						

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WELL NAME	OLD WELL NAME	SUB. ALLUV. FORMATION	SUB. ALLUV. LITHOLOGY	GRAIN SIZE (mm)	GRAIN SIZE DEPTH	Ka SS #1 Strat. Eqv. ELEVATION	Ka SS #1 Strat. Eqv. THICK.	Ka SS #1 GRAIN SIZE % > 200/230 SIEVE	Ka SS #1 GRAIN SIZE DEPTH
P209989	SEP2889	Ka	CLYSTN SILTY						
P210089	SEP2989BR	Ka	CLYSTN SILTY						
P210189	SEP3089BR	Ka	SS SANDY CLAYEY			5966.2	16		
P210189	SEP3089BR								
P210189	SEP3089BR								
P210189	SEP3089BR								
P210189	SEP3089BR								
P210289	SEP3189BR	Ka	CLYSTN SILTY						
P210289	SEP3189BR								
P210289	SEP3189BR								
P210289	SEP3189BR								
P313489	PZ0589	Ka	CLYSTN						
P313489	PZ0589								
P313489	PZ0589								
P313489	PZ0589								
P213689	PZ1089	Ka	CLYSTN			5974.3	3+	46.5	20.7-20.9
P213689	PZ1089							58.3	21.6-21.7
P213689	PZ1089								
P213689	PZ1089								
P213689	PZ1089								
P314089	PZ2389	Ka	CLYSTN						
P414189	PZ2489	Ka	CLYSTN						
P414189	PZ2489								
P414189	PZ2489								
P414189	PZ2489								
P414189	PZ2489								
P414189	PZ2489								

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WELL NAME	OLD WELL NAME	SUB. ALLUV. FORMATION	SUB. ALLUV. LITHOLOGY	GRAIN SIZE (mm)	GRAIN SIZE DEPTH	Ka SS #1 Strat. Eqv. ELEVATION	Ka SS #1 Strat. Eqv. THICK.	Ka SS #1 GRAIN SIZE % > 200/230 SIEVE	Ka SS #1 GRAIN SIZE DEPTH
P114689	PZ4289	Ka	CLYSTN SANDY						
P114789	PZ4389	Ka	CLYSTN						
P114789	PZ4389								
P114789	PZ4389								
P114789	PZ4389								
P114789	PZ4389								
P114889	PZ4489	Ka	CLYSTN SANDY						
P114889	PZ4489								
P115489	PZ4989	Ka	CLYSTN						
P115489	PZ4989								
P115489	PZ4989								
P115489	PZ4989								
P115589	PZ5089	Ka	CLYSTN						
P115589	PZ5089								
P115589	PZ5089								
P115589	PZ5089								
P115589	PZ5089								
P115589	PZ5089								
P115589	PZ5089								
P115589	PZ5089								
P115589	PZ5089								
P115589	PZ5089								
P115589	PZ5089								
P115589	PZ5089								
P115689	PZ5189	Ka	CLYSTN						
P215789	PZ5289	Ka	CLYSTN						

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WELL NAME	OLD WELL NAME	SUB. ALLUV. FORMATION	SUB. ALLUV. LITHOLOGY	GRAIN SIZE (mm)	GRAIN SIZE DEPTH	Ka SS #1 Strat. Eqv. ELEVATION	Ka SS #1 Strat. Eqv. THICK.	Ka SS #1 GRAIN SIZE % > 200/230 SIEVE	Ka SS #1 GRAIN SIZE DEPTH
P215789	PZ5289								
P215789	PZ5289								
P215789	PZ5289								
P215789	PZ5289								
P215789	PZ5289								
P215789	PZ5289								
P215789	PZ5289								
P317989	OP0289	Ka	CLYSTN			5982.5	0.2		
P317989	OP0289								
P317989	OP0289								
P218089	OP0389	Ka	CLYSTN			5973.4	0.6		
P218289	OP0189	Ka	CLYSTN						
P218289	OP0189								
P218289	OP0189								
P218289	OP0189								
P218289	OP0189								
P218289	OP0189								
P218389	PZ2789	Ka	CLYSTN			5940.9	0.4		
P218389	PZ2789								
P218489	BH7740589								
P219189	PZ1889	Ka	CLYSTN						
P219489	PZ1589		CLYSTN						
P219489	PZ1589								
P219589	PZ1289		SS #1			5946.6	2		
P320089	7089		CLYSTN SILTY						

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GEOLOGIC DATA FOR WELLS AND BOREHOLES WITHIN AND SURROUNDING OU8 FROM GEOLOGICAL CHARACTERIZATION REPORT (EG&G, 1991a)

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WELL NAME	OLD WELL NAME	Ka SS #2 Strat. Eqv. ELEVATION	Ka SS #2 Strat. Eqv. THICK.	Ka SS #2 GRAIN SIZE % > 200/230 SIEVE	Ka SS #2 GRAIN SIZE DEPTH	Ka SS #3 Strat. Eqv. ELEVATION	Ka SS #3 Strat. Eqv. THICK.	Ka SS #3 GRAIN SIZE % > 200/230 SIEV	Ka SS #3 GRAIN SIZE DEPTH
0460	04-60								
1986	19-86								
2086	20-86								
2086	20-86								
2086	20-86								
2186	21-86	5960.1	1			5933	8	43	60
2186	21-86								
2186	21-86								
2286	22-86								
2286	22-86								
2386	23-86								
2386	23-86								
2486	24-86								
2486	24-86								
2586	25-86	5898.65	4.9	4	79.2-80.5				
2586	25-86								
2586A	25-86A	5905.5	4.3	71	72				
2586A	25-86A								
2686	26-86								
2786	27-86								
2786	27-86								
2786	27-86								
2786	27-86								
2886	28-86								
2886	28-86								
2986	29-86								
2986	29-86								

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GEOLOGIC DATA FOR WELLS AND BOREHOLES WITHIN AND SURROUNDING OU8 FROM GEOLOGICAL CHARACTERIZATION REPORT (EG&G, 1991a)

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WELL NAME	OLD WELL NAME	Ka SS #2 Strat. Eqv. ELEVATION	Ka SS #2 Strat. Eqv. THICK.	Ka SS #2 GRAIN SIZE % > 200/230 SIEVE	Ka SS #2 GRAIN SIZE DEPTH	Ka SS #3 Strat. Eqv. ELEVATION	Ka SS #3 Strat. Eqv. THICK.	Ka SS #3 GRAIN SIZE % > 200/230 SIEV	Ka SS #3 GRAIN SIZE DEPTH
2986	29-86								
3086	30-86								
3186	31-86								
3186	31-86								
3186	31-86								
3286	32-86					5872.46	5		
3286	32-86								
3386	33-86								
4486	44-86								
4486	44-86								
6186	61-86								
6186	61-86								
6186	61-86								
SP0187	SP01-87								
SP0187	SP01-87								
SP0187	SP01-87								
SP0287	SP02-87								
SP0387	SP03-87								
SP0387	SP03-87								
SP0387	SP03-87								
SP0487	SP04-87								
SP0487	SP04-87								
SP0487	SP04-87								
SP0487	SP04-87								
SP0487	SP04-87								
SP0487	SP04-87								
SP0587	SP05-87								

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WELL NAME	OLD WELL NAME	Ka SS #2 Strat. Eqv. ELEVATION	Ka SS #2 Strat. Eqv. THICK.	Ka SS #2 GRAIN SIZE % > 200/230 SIEVE	Ka SS #2 GRAIN SIZE DEPTH	Ka SS #3 Strat. Eqv. ELEVATION	Ka SS #3 Strat. Eqv. THICK.	Ka SS #3 GRAIN SIZE % > 200/230 SIEV	Ka SS #3 GRAIN SIZE DEPTH
SP0687	SP06-87								
SP0687	SP06-87								
SP0687	SP06-87								
SP0687	SP06-87								
SP0687	SP06-87								
SP0787	SP07-87								
SP0787	SP07-87								
SP0887	SP08-87								
0987	09-87/BH29-87								
0987	09-87/BH29-87								
0987	09-87/BH29-87								
0987	09-87/BH29-87								
1087	10-87								
1087	10-87								
SP1187	SP11-87	5883	10	6	23				
SP1187	SP11-87	5883	10	1	28				
SP1187	SP11-87								
1587	15-87/BH30-87								
1587	15-87/BH30-87								
1687BR	16-87BR					5868.56	16.5	57	102
1687BR	16-87BR								
1687BR	16-87BR								
1687BR	16-87BR								
1987	19-87								
1987	19-87								
2087BR	20-87BR					5860.8	9	30	112
2087BR	20-87BR								

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WELL NAME	OLD WELL NAME	Ka SS #2 Strat. Eqv. ELEVATION	Ka SS #2 Strat. Eqv. THICK.	Ka SS #2 GRAIN SIZE % > 200/230 SIEVE	Ka SS #2 GRAIN SIZE DEPTH	Ka SS #3 Strat. Eqv. ELEVATION	Ka SS #3 Strat. Eqv. THICK.	Ka SS #3 GRAIN SIZE % > 200/230 SIEV	Ka SS #3 GRAIN SIZE DEPTH
2087BR	20-87BR								
2187	21-87								
BH2287	BH22-87								
2287BR	22-87BR								
2287BR	22-87BR								
2287BR	22-87BR								
2287BR	22-87BR								
2387BR	23-87BR								
2387BR	23-87BR								
2387BR	23-87BR								
2387BR	23-87BR								
2387BR	23-87BR								
BH2487	BH24-87								
BH2887	BH28-87								
BH2987	BH29-87								
BH3087	BH30-87								
BH3187	BH31-87								
BH3187	BH31-87								
BH3187	BH31-87								
BH3287	BH32-87								
BH3287	BH32-87								
BH3387	BH33-87								
BH3387	BH33-87								
BH3387	BH33-87								
BH3487	BH34-87								
BH3487	BH34-87								
BH3487	BH34-87								

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GEOLOGIC DATA FOR WELLS AND BOREHOLES WITHIN AND SURROUNDING OU8 FROM GEOLOGICAL CHARACTERIZATION REPORT (EG&G, 1991a)

20-April-92

WELL NAME	OLD WELL NAME	Ka SS #2 Strat. Eqv. ELEVATION	Ka SS #2 Strat. Eqv. THICK.	Ka SS #2 GRAIN SIZE % > 200/230 SIEVE	Ka SS #2 GRAIN SIZE DEPTH	Ka SS #3 Strat. Eqv. ELEVATION	Ka SS #3 Strat. Eqv. THICK.	Ka SS #3 GRAIN SIZE % > 200/230 SIEV	Ka SS #3 GRAIN SIZE DEPTH
BH3487	BH34-87								
BH3587	BH35-87								
BH3587	BH35-87								
BH3587	BH35-87								
BH3687	BH36-87								
3787	37-87								
3787	37-87								
BH3787	BH37-87								
BH3787	BH37-87								
3887	38-87								
3887	38-87								
3987BR	39-87BR(SP08-87)								
3987BR	39-87BR(SP08-87)								
3987BR	39-87BR(SP08-87)								
3987BR	39-87BR(SP08-87)								
5687	56-87/SP16-87								
P207389	SEP0189BR								
P207389	SEP0189BR								
P207389	SEP0189BR								
P207389	SEP0189BR								
P207489	SEP0289								
P207489	SEP0289								
P207589	SEP0389								
P207589	SEP0389								
P207589	SEP0389								
P207689	SEP0489								
P207689	SEP0489								

APPENDIX C-3
GEOLOGIC DATA FOR WELLS AND BOREHOLES WITHIN AND SURROUNDING OU8 FROM GEOLOGICAL CHARACTERIZATION REPORT (EG&G, 1991a)

20-April-92

WELL NAME	OLD WELL NAME	Ka SS #2 Strat. Eqv. ELEVATION	Ka SS #2 Strat. Eqv. THICK.	Ka SS #2 GRAIN SIZE % > 200/230 SIEVE	Ka SS #2 GRAIN SIZE DEPTH	Ka SS #3 Strat. Eqv. ELEVATION	Ka SS #3 Strat. Eqv. THICK.	Ka SS #3 GRAIN SIZE % > 200/230 SIEV	Ka SS #3 GRAIN SIZE DEPTH
P207689	SEP0489								
P207689	SEP0489								
P207689	SEP0489								
P207789	SEP0589								
P207789	SEP0589								
P207789	SEP0589								
P207889	SEP0689								
P207889	SEP0689								
P207889	SEP0689								
P207989	SEP0789BR								
P207989	SEP0789BR								
P207989	SEP0789BR								
P207989	SEP0789BR								
B208789	SEP1589								
B208789	SEP1589								
P208889	SEP1689BR	5907.3	12.7						
P208889	SEP1689BR								
P208889	SEP1689BR								
P208889	SEP1689BR								
P208889	SEP1689BR								
P208889	SEP1689BR								
P208889	SEP1689BR								
P208889	SEP1689BR								
P208989	SEP1789BR								
P208989	SEP1789BR								
P209089	SEP1889BR								
P209089	SEP1889BR								

APPENDIX C-3

GEOLOGIC DATA FOR WELLS AND BOREHOLES WITHIN AND SURROUNDING OU8 FROM GEOLOGICAL CHARACTERIZATION REPORT (EG&G, 1991a)

20-April-92

WELL NAME	OLD WELL NAME	Ka SS #2 Strat. Eqv. ELEVATION	Ka SS #2 Strat. Eqv. THICK.	Ka SS #2 GRAIN SIZE % > 200/230 SIEVE	Ka SS #2 GRAIN SIZE DEPTH	Ka SS #3 Strat. Eqv. ELEVATION	Ka SS #3 Strat. Eqv. THICK.	Ka SS #3 GRAIN SIZE % > 200/230 SIEV	Ka SS #3 GRAIN SIZE DEPTH
P209089	SEP1889BR								
P209189	SEP1989BR								
P209189	SEP1989BR								
P209189	SEP1989BR								
P209189	SEP1989BR								
P209189	SEP1989BR								
P209289	SEP2089								
P209289	SEP2089								
P209289	SEP2089								
P209289	SEP2089								
P209389	SEP2189BR								
P209389	SEP2189BR								
P209389	SEP2189BR								
P209489	SEP2289BR								
P209489	SEP2289BR								
P209489	SEP2289BR								
P209589	SEP2389BR								
P209589	SEP2389BR								
P209589	SEP2389BR								
P209689	SEP2489BR								
P209689	SEP2489BR								
P209689	SEP2489BR								
P209789	SEP2589								
P209789	SEP2589								
P209789	SEP2589								
P209789	SEP2589								
P209889	SEP2689BR								

APPENDIX C-3

GEOLOGIC DATA FOR WELLS AND BOREHOLES WITHIN AND SURROUNDING OU8 FROM GEOLOGICAL CHARACTERIZATION REPORT (EG&G, 1991a)

20-April-92

WELL NAME	OLD WELL NAME	Ka SS #2 Strat. Eqv. ELEVATION	Ka SS #2 Strat. Eqv. THICK.	Ka SS #2 GRAIN SIZE % > 200/230 SIEVE	Ka SS #2 GRAIN SIZE DEPTH	Ka SS #3 Strat. Eqv. ELEVATION	Ka SS #3 Strat. Eqv. THICK.	Ka SS #3 GRAIN SIZE % > 200/230 SIEV	Ka SS #3 GRAIN SIZE DEPTH
P209989	SEP2889								
P210089	SEP2989BR								
P210189	SEP3089BR								
P210189	SEP3089BR								
P210189	SEP3089BR								
P210189	SEP3089BR								
P210189	SEP3089BR								
P210289	SEP3189BR								
P210289	SEP3189BR								
P210289	SEP3189BR								
P210289	SEP3189BR								
P313489	PZ0589								
P313489	PZ0589								
P313489	PZ0589								
P313489	PZ0589								
P213689	PZ1089								
P213689	PZ1089								
P213689	PZ1089								
P213689	PZ1089								
P213689	PZ1089								
P314089	PZ2389								
P414189	PZ2489								
P414189	PZ2489								
P414189	PZ2489								
P414189	PZ2489								
P414189	PZ2489								
P414189	PZ2489								

APPENDIX C-3

GEOLOGIC DATA FOR WELLS AND BOREHOLES WITHIN AND SURROUNDING OU8 FROM GEOLOGICAL CHARACTERIZATION REPORT (EG&G, 1991a)

20-April-92

WELL NAME	OLD WELL NAME	Ka SS #2 Strat. Eqv. ELEVATION	Ka SS #2 Strat. Eqv. THICK.	Ka SS #2 GRAIN SIZE % > 200/230 SIEVE	Ka SS #2 GRAIN SIZE DEPTH	Ka SS #3 Strat. Eqv. ELEVATION	Ka SS #3 Strat. Eqv. THICK.	Ka SS #3 GRAIN SIZE % > 200/230 SIEV	Ka SS #3 GRAIN SIZE DEPTH
P114689	PZ4289								
P114789	PZ4389								
P114789	PZ4389								
P114789	PZ4389								
P114789	PZ4389								
P114789	PZ4389								
P114889	PZ4489								
P114889	PZ4489								
P115489	PZ4989								
P115489	PZ4989								
P115489	PZ4989								
P115489	PZ4989								
P115589	PZ5089								
P115589	PZ5089								
P115589	PZ5089								
P115589	PZ5089								
P115589	PZ5089								
P115589	PZ5089								
P115589	PZ5089								
P115589	PZ5089								
P115589	PZ5089								
P115589	PZ5089								
P115589	PZ5089								
P115589	PZ5089								
P115589	PZ5089								
P115689	PZ5189								
P215789	PZ5289								

APPENDIX C-3
GEOLOGIC DATA FOR WELLS AND BOREHOLES WITHIN AND SURROUNDING OU8
FROM GEOLOGICAL CHARACTERIZATION REPORT (EG&G, 1991a)

20-April-92

WELL NAME	OLD WELL NAME	Ka SS #2 Strat. Eqv. ELEVATION	Ka SS #2 Strat. Eqv. THICK.	Ka SS #2 GRAIN SIZE % > 200/230 SIEVE	Ka SS #2 GRAIN SIZE DEPTH	Ka SS #3 Strat. Eqv. ELEVATION	Ka SS #3 Strat. Eqv. THICK.	Ka SS #3 GRAIN SIZE % > 200/230 SIEV	Ka SS #3 GRAIN SIZE DEPTH
P215789	PZ5289								
P215789	PZ5289								
P215789	PZ5289								
P215789	PZ5289								
P215789	PZ5289								
P215789	PZ5289								
P215789	PZ5289								
P317989	OP0289								
P317989	OP0289								
P317989	OP0289								
P218089	OP0389								
P218289	OP0189								
P218289	OP0189								
P218289	OP0189								
P218289	OP0189								
P218289	OP0189								
P218289	OP0189								
P218389	PZ2789								
P218389	PZ2789								
P218489	BH7740589								
P219189	PZ1889								
P219489	PZ1589								
P219489	PZ1589								
P219589	PZ1289								
P320089	7089								

APPENDIX C-4

GEOLOGIC DATA FOR WELLS AND BOREHOLES WITHIN AND SURROUNDING OU8 FROM GEOLOGICAL CHARACTERIZATION REPORT (EG&G, 1991a)

20-April-92

WELL NAME	OLD WELL NAME	Ka SS #4 Strat. Eqv. ELEVATION	Ka SS #4 Strat. Eqv. THICK.	Ka SS #4 GRAIN SIZE % > 200/230 SIEVE	Ka SS #4 GRAIN SIZE DEPTH	Ka SS #5 Strat. Eqv. ELEVATION	Ka SS #5 Strat. Eqv. THICK.	Ka SS #5 GRAIN SIZE % > 200/230 SIEVE	Ka SS #5 GRAIN SIZE DEPTH
0460	04-60								
1986	19-86								
2086	20-86								
2086	20-86								
2086	20-86								
2186	21-86								
2186	21-86								
2186	21-86								
2286	22-86								
2286	22-86								
2386	23-86	5867.88	2.6	24	114				
2386	23-86								
2486	24-86								
2486	24-86								
2586	25-86								
2586	25-86								
2586A	25-86A								
2586A	25-86A								
2686	26-86								
2786	27-86	5834.46	6.5	26	128.5				
2786	27-86								
2786	27-86								
2786	27-86								
2886	28-86								
2886	28-86								
2986	29-86								
2986	29-86								

APPENDIX C-4
GEOLOGIC DATA FOR WELLS AND BOREHOLES WITHIN AND SURROUNDING OU8 FROM GEOLOGICAL CHARACTERIZATION REPORT (EG&G, 1991a)

20-April-92

WELL NAME	OLD WELL NAME	Ka SS #4 Strat. Eqv. ELEVATION	Ka SS #4 Strat. Eqv. THICK.	Ka SS #4 GRAIN SIZE % > 200/230 SIEVE	Ka SS #4 GRAIN SIZE DEPTH	Ka SS #5 Strat. Eqv. ELEVATION	Ka SS #5 Strat. Eqv. THICK.	Ka SS #5 GRAIN SIZE % > 200/230 SIEVE	Ka SS #5 GRAIN SIZE DEPTH
2986	29-86								
3086	30-86								
3186	31-86								
3186	31-86								
3186	31-86								
3286	32-86	5849.3	10.5	23.8	120				
3286	32-86								
3386	33-86								
4486	44-86								
4486	44-86								
6186	61-86								
6186	61-86								
6186	61-86								
SP0187	SP01-87								
SP0187	SP01-87								
SP0187	SP01-87								
SP0287	SP02-87								
SP0387	SP03-87								
SP0387	SP03-87								
SP0387	SP03-87								
SP0487	SP04-87								
SP0487	SP04-87								
SP0487	SP04-87								
SP0487	SP04-87								
SP0487	SP04-87								
SP0487	SP04-87								
SP0587	SP05-87								

APPENDIX C-4

GEOLOGIC DATA FOR WELLS AND BOREHOLES WITHIN AND SURROUNDING OU8 FROM GEOLOGICAL CHARACTERIZATION REPORT (EG&G, 1991a)

20-April-92

WELL NAME	OLD WELL NAME	Ka SS #4 Strat. Eqv. ELEVATION	Ka SS #4 Strat. Eqv. THICK.	Ka SS #4 GRAIN SIZE % > 200/230 SIEVE	Ka SS #4 GRAIN SIZE DEPTH	Ka SS #5 Strat. Eqv. ELEVATION	Ka SS #5 Strat. Eqv. THICK.	Ka SS #5 GRAIN SIZE % > 200/230 SIEVE	Ka SS #5 GRAIN SIZE DEPTH
SP0687	SP06-87								
SP0687	SP06-87								
SP0687	SP06-87								
SP0687	SP06-87								
SP0687	SP06-87								
SP0787	SP07-87								
SP0787	SP07-87								
SP0887	SP08-87								
0987	09-87/BH29-87								
0987	09-87/BH29-87								
0987	09-87/BH29-87								
0987	09-87/BH29-87								
1087	10-87								
1087	10-87								
SP1187	SP11-87								
SP1187	SP11-87								
SP1187	SP11-87								
1587	15-87/BH30-87								
1587	15-87/BH30-87								
1687BR	16-87BR					5828.56	4	28	142
1687BR	16-87BR								
1687BR	16-87BR								
1687BR	16-87BR								
1987	19-87								
1987	19-87								
2087BR	20-87BR								
2087BR	20-87BR								

APPENDIX C-4
GEOLOGIC DATA FOR WELLS AND BOREHOLES WITHIN AND SURROUNDING OU8 FROM GEOLOGICAL CHARACTERIZATION REPORT (EG&G, 1991a)

20-April-92

WELL NAME	OLD WELL NAME	Ka SS #4 Strat. Eqv. ELEVATION	Ka SS #4 Strat. Eqv. THICK.	Ka SS #4 GRAIN SIZE % > 200/230 SIEVE	Ka SS #4 GRAIN SIZE DEPTH	Ka SS #5 Strat. Eqv. ELEVATION	Ka SS #5 Strat. Eqv. THICK.	Ka SS #5 GRAIN SIZE % > 200/230 SIEVE	Ka SS #5 GRAIN SIZE DEPTH
2087BR	20-87BR								
2187	21-87								
BH2287	BH22-87								
2287BR	22-87BR	5846.9	4			5834.7	5	44	82.5-84.5
2287BR	22-87BR								
2287BR	22-87BR								
2287BR	22-87BR								
2387BR	23-87BR								
2387BR	23-87BR								
2387BR	23-87BR								
2387BR	23-87BR								
2387BR	23-87BR								
BH2487	BH24-87								
BH2887	BH28-87								
BH2987	BH29-87								
BH3087	BH30-87								
BH3187	BH31-87								
BH3187	BH31-87								
BH3187	BH31-87								
BH3287	BH32-87								
BH3287	BH32-87								
BH3387	BH33-87								
BH3387	BH33-87								
BH3387	BH33-87								
BH3487	BH34-87								
BH3487	BH34-87								
BH3487	BH34-87								

APPENDIX C-4
GEOLOGIC DATA FOR WELLS AND BOREHOLES WITHIN AND SURROUNDING OU8 FROM GEOLOGICAL CHARACTERIZATION REPORT (EG&G, 1991a)

20-April-92

WELL NAME	OLD WELL NAME	Ka SS #4 Strat. Eqv. ELEVATION	Ka SS #4 Strat. Eqv. THICK.	Ka SS #4 GRAIN SIZE % > 200/230 SIEVE	Ka SS #4 GRAIN SIZE DEPTH	Ka SS #5 Strat. Eqv. ELEVATION	Ka SS #5 Strat. Eqv. THICK.	Ka SS #5 GRAIN SIZE % > 200/230 SIEVE	Ka SS #5 GRAIN SIZE DEPTH
BH3487	BH34-87								
BH3587	BH35-87								
BH3587	BH35-87								
BH3587	BH35-87								
BH3687	BH36-87								
3787	37-87								
3787	37-87								
BH3787	BH37-87								
BH3787	BH37-87								
3887	38-87								
3887	38-87								
3987BR	39-87BR(SP08-87)								
3987BR	39-87BR(SP08-87)								
3987BR	39-87BR(SP08-87)	5837.4	8		48	111			
3987BR	39-87BR(SP08-87)								
5687	56-87/SP16-87								
P207389	SEP0189BR								
P207389	SEP0189BR								
P207389	SEP0189BR								
P207389	SEP0189BR								
P207489	SEP0289								
P207489	SEP0289								
P207589	SEP0389								
P207589	SEP0389								
P207589	SEP0389								
P207689	SEP0489								
P207689	SEP0489								

APPENDIX C-4
GEOLOGIC DATA FOR WELLS AND BOREHOLES WITHIN AND SURROUNDING OU8 FROM GEOLOGICAL CHARACTERIZATION REPORT (EG&G, 1991a)

20-April-92

WELL NAME	OLD WELL NAME	Ka SS #4 Strat. Eqv. ELEVATION	Ka SS #4 Strat. Eqv. THICK.	Ka SS #4 GRAIN SIZE % > 200/230 SIEVE	Ka SS #4 GRAIN SIZE DEPTH	Ka SS #5 Strat. Eqv. ELEVATION	Ka SS #5 Strat. Eqv. THICK.	Ka SS #5 GRAIN SIZE % > 200/230 SIEVE	Ka SS #5 GRAIN SIZE DEPTH
P207689	SEP0489								
P207689	SEP0489								
P207689	SEP0489								
P207789	SEP0589								
P207789	SEP0589								
P207789	SEP0589								
P207889	SEP0689								
P207889	SEP0689								
P207889	SEP0689								
P207989	SEP0789BR								
P207989	SEP0789BR								
P207989	SEP0789BR								
P207989	SEP0789BR								
B208789	SEP1589								
B208789	SEP1589								
P208889	SEP1689BR								
P208889	SEP1689BR								
P208889	SEP1689BR								
P208889	SEP1689BR								
P208889	SEP1689BR								
P208889	SEP1689BR								
P208889	SEP1689BR								
P208889	SEP1689BR								
P208989	SEP1789BR								
P208989	SEP1789BR								
P209089	SEP1889BR								
P209089	SEP1889BR								

APPENDIX C-4
GEOLOGIC DATA FOR WELLS AND BOREHOLES WITHIN AND SURROUNDING OU8 FROM GEOLOGICAL CHARACTERIZATION REPORT (EG&G, 1991a)

20-April-92

WELL NAME	OLD WELL NAME	Ka SS #4 Strat. Eqv. ELEVATION	Ka SS #4 Strat. Eqv. THICK.	Ka SS #4 GRAIN SIZE % > 200/230 SIEVE	Ka SS #4 GRAIN SIZE DEPTH	Ka SS #5 Strat. Eqv. ELEVATION	Ka SS #5 Strat. Eqv. THICK.	Ka SS #5 GRAIN SIZE % > 200/230 SIEVE	Ka SS #5 GRAIN SIZE DEPTH
P209089	SEP1889BR								
P209189	SEP1989BR								
P209189	SEP1989BR								
P209189	SEP1989BR								
P209189	SEP1989BR								
P209189	SEP1989BR								
P209289	SEP2089								
P209289	SEP2089								
P209289	SEP2089								
P209289	SEP2089								
P209389	SEP2189BR								
P209389	SEP2189BR								
P209389	SEP2189BR								
P209489	SEP2289BR								
P209489	SEP2289BR								
P209489	SEP2289BR								
P209589	SEP2389BR								
P209589	SEP2389BR								
P209589	SEP2389BR								
P209689	SEP2489BR								
P209689	SEP2489BR								
P209689	SEP2489BR								
P209789	SEP2589								
P209789	SEP2589								
P209789	SEP2589								
P209789	SEP2589								
P209889	SEP2689BR								

APPENDIX C-4
GEOLOGIC DATA FOR WELLS AND BOREHOLES WITHIN AND SURROUNDING OU8 FROM GEOLOGICAL CHARACTERIZATION REPORT (EG&G, 1991a)

20-April-92

WELL NAME	OLD WELL NAME	Ka SS #4 Strat. Eqv. ELEVATION	Ka SS #4 Strat. Eqv. THICK.	Ka SS #4 GRAIN SIZE % > 200/230 SIEVE	Ka SS #4 GRAIN SIZE DEPTH	Ka SS #5 Strat. Eqv. ELEVATION	Ka SS #5 Strat. Eqv. THICK.	Ka SS #5 GRAIN SIZE % > 200/230 SIEVE	Ka SS #5 GRAIN SIZE DEPTH
P209989	SEP2889								
P210089	SEP2989BR								
P210189	SEP3089BR								
P210189	SEP3089BR								
P210189	SEP3089BR								
P210189	SEP3089BR								
P210189	SEP3089BR								
P210289	SEP3189BR								
P210289	SEP3189BR								
P210289	SEP3189BR								
P210289	SEP3189BR								
P313489	PZ0589								
P313489	PZ0589								
P313489	PZ0589								
P313489	PZ0589								
P213689	PZ1089								
P213689	PZ1089								
P213689	PZ1089								
P213689	PZ1089								
P213689	PZ1089								
P314089	PZ2389								
P414189	PZ2489								
P414189	PZ2489								
P414189	PZ2489								
P414189	PZ2489								
P414189	PZ2489								
P414189	PZ2489								

APPENDIX C-4
GEOLOGIC DATA FOR WELLS AND BOREHOLES WITHIN AND SURROUNDING OU8 FROM GEOLOGICAL CHARACTERIZATION REPORT (EG&G, 1991a)

20-April-92

WELL NAME	OLD WELL NAME	Ka SS #4 Strat. Eqv. ELEVATION	Ka SS #4 Strat. Eqv. THICK.	Ka SS #4 GRAIN SIZE % > 200/230 SIEVE	Ka SS #4 GRAIN SIZE DEPTH	Ka SS #5 Strat. Eqv. ELEVATION	Ka SS #5 Strat. Eqv. THICK.	Ka SS #5 GRAIN SIZE % > 200/230 SIEVE	Ka SS #5 GRAIN SIZE DEPTH
P114689	PZ4289								
P114789	PZ4389								
P114789	PZ4389								
P114789	PZ4389								
P114789	PZ4389								
P114789	PZ4389								
P114889	PZ4489								
P114889	PZ4489								
P115489	PZ4989								
P115489	PZ4989								
P115489	PZ4989								
P115489	PZ4989								
P115589	PZ5089								
P115589	PZ5089								
P115589	PZ5089								
P115589	PZ5089								
P115589	PZ5089								
P115589	PZ5089								
P115589	PZ5089								
P115589	PZ5089								
P115589	PZ5089								
P115589	PZ5089								
P115589	PZ5089								
P115589	PZ5089								
P115589	PZ5089								
P115689	PZ5189								
P215789	PZ5289								

APPENDIX C-4

GEOLOGIC DATA FOR WELLS AND BOREHOLES WITHIN AND SURROUNDING OU8 FROM GEOLOGICAL CHARACTERIZATION REPORT (EG&G, 1991a)

20-April-92

WELL NAME	OLD WELL NAME	Ka SS #4 Strat. Eqv. ELEVATION	Ka SS #4 Strat. Eqv. THICK.	Ka SS #4 GRAIN SIZE % > 200/230 SIEVE	Ka SS #4 GRAIN SIZE DEPTH	Ka SS #5 Strat. Eqv. ELEVATION	Ka SS #5 Strat. Eqv. THICK.	Ka SS #5 GRAIN SIZE % > 200/230 SIEVE	Ka SS #5 GRAIN SIZE DEPTH
P215789	PZ5289								
P215789	PZ5289								
P215789	PZ5289								
P215789	PZ5289								
P215789	PZ5289								
P215789	PZ5289								
P215789	PZ5289								
P317989	OP0289								
P317989	OP0289								
P317989	OP0289								
P218089	OP0389								
P218289	OP0189								
P218289	OP0189								
P218289	OP0189								
P218289	OP0189								
P218289	OP0189								
P218289	OP0189								
P218389	PZ2789								
P218389	PZ2789								
P218489	BH7740589								
P219189	PZ1889								
P219489	PZ1589								
P219489	PZ1589								
P219589	PZ1289								
P320089	7089								

APPENDIX C-5

GEOLOGIC DATA FOR WELLS AND BOREHOLES WITHIN AND SURROUNDING OU8 FROM GEOLOGICAL CHARACTERIZATION REPORT (EG&G, 1991a)

20-April-9

WELL NAME	OLD WELL NAME	Upper Laramie Sandstones ELEVATION	Upper Laramie Sandstones THICK.	Upper Laramie GRAIN SIZE % > 200/230 SIEVE	Upper Laramie GRAIN SIZE DEPTH	ALLUVIUM TYPE	ALLUVIUM RANGE	GRAIN SIZE % > 200/230 SIEVE	GRAIN SIZE DEPTH	CALICHE TYPE	CALICHE RANGE
0460	04-60										
1986	19-86									N	
2086	20-86					Gravel	1.5-6.5			SM	0-2
2086	20-86									SM	4-6.5
2086	20-86									SM	16-17.5
2186	21-86					Gravel	4-15			SM	62-65
2186	21-86										
2186	21-86										
2286	22-86					Gravel	0-11	22	10-12	AB	5-7
2286	22-86									TR	14-16
2386	23-86									TR	33-36
2386	23-86									TR	38-40
2486	24-86					Gravel	0-7.2			AB	2.5-5
2486	24-86									AB	7.2-10.6
2586	25-86					Gravel	0-7.5			AB	0-12
2586	25-86										
2586A	25-86A					Gravel	0-12.5			AB	0-22.5
2586A	25-86A										
2686	26-86					Gravel	0-10.5			AB	0-14
2786	27-86					Gravel	0-9.3			SM	0-2
2786	27-86									SM	8-11
2786	27-86									SM	25-28
2786	27-86									SM	70-73
2886	28-86					Gravel	0-8.5			AB	0-5.5
2886	28-86									TR	8.4-12.5
2986	29-86					Gravel	0-8			SM	8.5-14.5
2986	29-86										

APPENDIX C-5
GEOLOGIC DATA FOR WELLS AND BOREHOLES WITHIN AND SURROUNDING OU8 FROM GEOLOGICAL CHARACTERIZATION REPORT (EG&G, 1991a)

20-April-9:

WELL NAME	OLD WELL NAME	Upper Laramie Sandstones ELEVATION	Upper Laramie Sandstones THICK.	Upper Laramie GRAIN SIZE % > 200/230 SIEVE	Upper Laramie GRAIN SIZE DEPTH	ALLUVIUM TYPE	ALLUVIUM RANGE	GRAIN SIZE % > 200/230 SIEVE	GRAIN SIZE DEPTH	CALICHE TYPE	CALICHE RANGE
2986	29-86										
3086	30-86					Gravel	0-0.5			TR	0-5
3186	31-86					Gravel	0-0.5			TR	1-2
3186	31-86									TR	6.4-7
3186	31-86										
3286	32-86					Gravel	0-1			SM	0-27
3286	32-86										
3386	33-86					Gravel	0-7			AB	0-5
4486	44-86					Gravel	0-15.5			N	
4486	44-86					Sand	15.5-20				
6186	61-86					Gravel	0-2.5			AB	0-1.5
6186	61-86									AB	1.5-5
6186	61-86					Gravel	8.3-11.5	57	5.0-8.5	SM	5-8.5
SP0187	SP01-87					Gravel	0-13.2			SM	0-2
SP0187	SP01-87									AB	2-5
SP0187	SP01-87									TR	5-10
SP0287	SP02-87					Gravel	0-10.5			AB	7.6-15.1
SP0387	SP03-87					Gravel	0-12.8			AB	1-3.5
SP0387	SP03-87									SM	12.8-20.4
SP0387	SP03-87									AB	7.5-10.3
SP0487	SP04-87					Gravel	0-12			AB	0-2
SP0487	SP04-87									SM	4-5.8
SP0487	SP04-87									AB	7-8.7
SP0487	SP04-87									SM	12-17
SP0487	SP04-87									TR	17-22
SP0487	SP04-87									TR	29.5-32
SP0587	SP05-87					Gravel	0-16.3			AB	7-9.5

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GEOLOGIC DATA FOR WELLS AND BOREHOLES WITHIN AND SURROUNDING OU8 FROM GEOLOGICAL CHARACTERIZATION REPORT (EG&G, 1991a)

20-April-9

WELL NAME	OLD WELL NAME	Upper Laramie Sandstones ELEVATION	Upper Laramie Sandstones THICK.	Upper Laramie GRAIN SIZE % > 200/230 SIEVE	Upper Laramie GRAIN SIZE DEPTH	ALLUVIUM TYPE	ALLUVIUM RANGE	GRAIN SIZE % > 200/230 SIEVE	GRAIN SIZE DEPTH	CALICHE TYPE	CALICHE RANGE
SP0687	SP06-87					Gravel	0-18			AB	0-2
SP0687	SP06-87									SM	2-3.7
SP0687	SP06-87									TR	5-6.5
SP0687	SP06-87									AB	10.5-16.7
SP0687	SP06-87									TR	18-23
SP0787	SP07-87					Gravel	0-20.8			AB	0-10.5
SP0787	SP07-87									AB	13-20.8
SP0887	SP08-87										
0987	09-87/BH29-87					Gravel	0-12.7		76 9.5-11.5	N	
0987	09-87/BH29-87										
0987	09-87/BH29-87									N	
0987	09-87/BH29-87									N	
1087	10-87					Gravel	0-11.3			SM	5-17
1087	10-87										
SP1187	SP11-87									TR	3.5-6.3
SP1187	SP11-87									SM	6.3-9.3
SP1187	SP11-87									TR	9.3-21.5
1587	15-87/BH30-87					Gravel	0-20.5	47+47	20-21.5	AB	0-7
1587	15-87/BH30-87					Gravel-Sandy	20.5-21.85				
1687BR	16-87BR					Gravel-Sandy	17-20.5			SM	4-5
1687BR	16-87BR					Gravel	20.5-22.2			AB	5-7
1687BR	16-87BR									TR	7-8
1687BR	16-87BR									AB	48-52.2
1987	19-87					Gravel	0-10.8			AB	0-11.1
1987	19-87									SM	11.1-16.1
2087BR	20-87BR					Gravel	0-6.4			SM	0-10.8
2087BR	20-87BR					Gravel-Sandy	6.4-11.8			TR	13.8-20.8

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GEOLOGIC DATA FOR WELLS AND BOREHOLES WITHIN AND SURROUNDING OU8 FROM GEOLOGICAL CHARACTERIZATION REPORT (EG&G, 1991a)

20-April-9

WELL NAME	OLD WELL NAME	Upper Laramie Sandstones ELEVATION	Upper Laramie Sandstones THICK.	Upper Laramie GRAIN SIZE % > 200/230 SIEVE	Upper Laramie GRAIN SIZE DEPTH	ALLUVIUM TYPE	ALLUVIUM RANGE	GRAIN SIZE % > 200/230 SIEVE	GRAIN SIZE DEPTH	CALICHE TYPE	CALICHE RANGE
2087BR	20-87BR							82	8.8-10.8	TR	28.8-33.8
2187	21-87					Gravel	0-4.3			SM	0-13.5
BH2287	BH22-87					Gravel	0-22.2	82	7.2-8.8	AB	2-6.35
2287BR	22-87BR					Gravel	0-4.3			SM	0-4
2287BR	22-87BR									TR	4-16
2287BR	22-87BR									SM	18.2-20.2
2287BR	22-87BR									TR	41-45
2387BR	23-87BR					Gravel	0-15.25	77	13-14.7	AB	0-11
2387BR	23-87BR										
2387BR	23-87BR										
2387BR	23-87BR										
2387BR	23-87BR										
BH2487	BH24-87					Gravel	0-4.9			SM	7.5-10.75
BH2887	BH28-87					Gravel	0-5.9			SM	5.9-9
BH2987	BH29-87										
BH3087	BH30-87										
BH3187	BH31-87					Gravel	4-7.6			AB	0-7.6
BH3187	BH31-87									SM	10.1-17.8
BH3187	BH31-87									TR	17.8-20.3
BH3287	BH32-87					Gravel	0-7.7			AB	7.7-15.2
BH3287	BH32-87										
BH3387	BH33-87					Gravel	0-9.2			SM	0-2
BH3387	BH33-87									SM	9.2-17.8
BH3387	BH33-87										
BH3487	BH34-87					Gravel	0-4.5	79	4.0-6.0	SM	0-16.7
BH3487	BH34-87					Sand	4.5-14.7	51	12.7-14.7		
BH3487	BH34-87					Gravel	14.7-16.7				

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20-April-9

WELL NAME	OLD WELL NAME	Upper Laramie Sandstones ELEVATION	Upper Laramie Sandstones THICK.	Upper Laramie GRAIN SIZE % > 200/230 SIEVE	Upper Laramie GRAIN SIZE DEPTH	ALLUVIUM TYPE	ALLUVIUM RANGE	GRAIN SIZE % > 200/230 SIEVE	GRAIN SIZE DEPTH	CALICHE TYPE	CALICHE RANGE
BH3487	BH34-87										
BH3587	BH35-87					Gravel	0-14.3			AB	0-10.4
BH3587	BH35-87									TR	10.7-12.5
BH3587	BH35-87									SM	12.5-14.3
BH3687	BH36-87					Gravel	0-20.6			AB	0-4
3787	37-87					Gravel	0-8	82	7.0-9.5	SM	0-4
3787	37-87									AB	4-13
BH3787	BH37-87					Gravel	0-14	69	4.0-7.0	AB	0-11
BH3787	BH37-87										
3887	38-87					Gravel	0-7.8			AB	0-10.5
3887	38-87									TR	10.5-14
3987BR	39-87BR(SP08-87)					Gravel	0-3.5			TR	0-2
3987BR	39-87BR(SP08-87)									SM	3.5-6.5
3987BR	39-87BR(SP08-87)									TR	27-39
3987BR	39-87BR(SP08-87)										
5687	56-87/SP16-87					Gravel	0-9.4			SM	4-13.4
P207389	SEP0189BR					Sand	0.0-1.1			AB	6.3-8.3
P207389	SEP0189BR					Gravel	1.1-6.3			SM	8.3-11.3
P207389	SEP0189BR									SM	14.3-16.3
P207389	SEP0189BR									TR	16.3-20.3
P207489	SEP0289					Sand	0.0-0.9			TR	4.0-6.0
P207489	SEP0289					Gravel	0.9-6.5			AB	6.0-10.0
P207589	SEP0389					Gravel	0.0-8.1			AB	2.8-8.1
P207589	SEP0389					Sand	8.1-9.1			SM	7.5-12.1
P207589	SEP0389					Gravel	9.1-9.4			TR	12.1-16.1
P207689	SEP0489					Gravel	0.0-6.2			SM	0.8-2.2
P207689	SEP0489					Sand	6.2-8.2			AB	2.2-4.2

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GEOLOGIC DATA FOR WELLS AND BOREHOLES WITHIN AND SURROUNDING OU8 FROM GEOLOGICAL CHARACTERIZATION REPORT (EG&G, 1991a)

20-April-9

WELL NAME	OLD WELL NAME	Upper Laramie Sandstones ELEVATION	Upper Laramie Sandstones THICK.	Upper Laramie GRAIN SIZE % > 200/230 SIEVE	Upper Laramie GRAIN SIZE DEPTH	ALLUVIUM TYPE	ALLUVIUM RANGE	GRAIN SIZE % > 200/230 SIEVE	GRAIN SIZE DEPTH	CALICHE TYPE	CALICHE RANGE
P207689	SEP0489					Gravel	8.2-10.2			SM	6.2-7.2
P207689	SEP0489					Sand	10.2-12.6			AB	7.2-12.5
P207689	SEP0489									TR	12.5-15.3
P207789	SEP0589					Gravel	0.0-8.3			SM	2.3-10.3
P207789	SEP0589					Sand	8.3-10.3			AB	10.3-14.3
P207789	SEP0589									SM	14.3-18.3
P207889	SEP0689					Gravel	0.0-2.9			TR	0.0-3.0
P207889	SEP0689					Sand	2.9-4.5			AB	3.0-7.4
P207889	SEP0689					Gravel	4.5-5.5			SM	8.5-10.5
P207989	SEP0789BR					Gravel	0.0-4.7			SM	1.6-2.2
P207989	SEP0789BR					Sand	4.7-6.0			AB	2.2-3.4
P207989	SEP0789BR									AB	4.2-6.2
P207989	SEP0789BR									SM	6.2-12.2
B208789	SEP1589									TR	6.4-7.1
B208789	SEP1589									TR	12.4-14.1
P208889	SEP1689BR									TR	0.0-1.5
P208889	SEP1689BR									AB	1.5-2.0
P208889	SEP1689BR									SM	3.5-7.5
P208889	SEP1689BR										
P208889	SEP1689BR										
P208889	SEP1689BR										
P208889	SEP1689BR										
P208889	SEP1689BR										
P208989	SEP1789BR					Gravel	0.0-2.3			TR	4.6-7.2
P208989	SEP1789BR									AB	7.2-7.4
P209089	SEP1889BR					Gravel	0.5-1.0			TR	0.0-2.0
P209089	SEP1889BR					Gravel	2.2-9.5			AB	2.0-9.5

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GEOLOGIC DATA FOR WELLS AND BOREHOLES WITHIN AND SURROUNDING OU8 FROM GEOLOGICAL CHARACTERIZATION REPORT (EG&G, 1991a)

20-April-9

WELL NAME	OLD WELL NAME	Upper Laramie Sandstones ELEVATION	Upper Laramie Sandstones THICK.	Upper Laramie GRAIN SIZE % > 200/230 SIEVE	Upper Laramie GRAIN SIZE DEPTH	ALLUVIUM TYPE	ALLUVIUM RANGE	GRAIN SIZE % > 200/230 SIEVE	GRAIN SIZE DEPTH	CALICHE TYPE	CALICHE RANGE
P209089	SEP1889BR					Sand	9.5-10.0			TR	11.5-15.5
P209189	SEP1989BR					Gravel	0.0-4.3			TR	0.0-6.3
P209189	SEP1989BR					Sand	4.3-4.8			SM	6.3-9.5
P209189	SEP1989BR					Gravel	4.8-5.8				
P209189	SEP1989BR					Sand	5.8-6.3				
P209189	SEP1989BR					Gravel	6.3-10.3				
P209289	SEP2089					Gravel	0.0-5.8				
P209289	SEP2089					Sand	5.8-6.8				
P209289	SEP2089					Gravel	6.8-11.8				
P209289	SEP2089					Sand	11.8-13.8				
P209389	SEP2189BR					Gravel	0.0-10.0			TR	0.0-1.7
P209389	SEP2189BR					Sand	10.0-10.5			SM	2.2-9.8
P209389	SEP2189BR					Gravel	10.5-12.2			TR	10.0-11.8
P209489	SEP2289BR					Gravel	0.0-7.0			AB	6.0-12.0
P209489	SEP2289BR					Gravel	8.0-9.0			SM	12.0-18.0
P209489	SEP2289BR									TR	20.0-21.0
P209589	SEP2389BR					Gravel	1.5-2.0				
P209589	SEP2389BR					Sand	3.0-3.4				
P209589	SEP2389BR					Gravel	3.4-3.8				
P209689	SEP2489BR					Gravel	0.0-6.2			AB	2.2-5.6
P209689	SEP2489BR					Sand	6.2-12.2			TR	8.2-12.2
P209689	SEP2489BR									SM	12.2-14.2
P209789	SEP2589					Gravel	0.0-6.4			SM	2.2-8.2
P209789	SEP2589					Sand	6.4-7.1			TR	8.2-12.2
P209789	SEP2589					Gravel	7.1-7.5			SM	12.2-14.2
P209789	SEP2589					Sand	7.5-12.2			TR	14.2-15.2
P209889	SEP2689BR					Sand	2.3-3.9			TR	0.0-7.9

APPENDIX C-5
GEOLOGIC DATA FOR WELLS AND BOREHOLES WITHIN AND SURROUNDING OU8 FROM GEOLOGICAL CHARACTERIZATION REPORT (EG&G, 1991a)

20-April-9

WELL NAME	OLD WELL NAME	Upper Laramie Sandstones ELEVATION	Upper Laramie Sandstones THICK.	Upper Laramie GRAIN SIZE % > 200/230 SIEVE	Upper Laramie GRAIN SIZE DEPTH	ALLUVIUM TYPE	ALLUVIUM RANGE	GRAIN SIZE % > 200/230 SIEVE	GRAIN SIZE DEPTH	CALICHE TYPE	CALICHE RANGE
P209989	SEP2889									N	
P210089	SEP2989BR									N	
P210189	SEP3089BR					Gravel	0.0–4.6			TR	6.0–10.6
P210189	SEP3089BR					Sand	4.6–6.6				
P210189	SEP3089BR					Gravel	6.6–10.6				
P210189	SEP3089BR					Sand	10.6–12.6				
P210189	SEP3089BR					Gravel	12.6–14.6				
P210289	SEP3189BR					Gravel	0.0–6.0			TR	2.0–4.0
P210289	SEP3189BR					Sand	6.0–6.6			SM	4.0–6.6
P210289	SEP3189BR									AB	6.6–7.3
P210289	SEP3189BR									TR	7.3–18.0
P313489	PZ0589					Gravel	0.0–4.0			SM	0.0–4.0
P313489	PZ0589					Sand	4.0–10.0			TR	4.0–20.0
P313489	PZ0589					Gravel	10.0–12.8				
P313489	PZ0589					Sand	12.8–20.6				
P213689	PZ1089					Gravel	0.3–0.4	69.8	8.0–9.0	T	
P213689	PZ1089					Gravel	1.9–2.0				
P213689	PZ1089					Gravel	4.8–6.0				
P213689	PZ1089					Gravel	9.0–9.3				
P213689	PZ1089					Gravel	10.0–12.0				
P314089	PZ2389										
P414189	PZ2489					Gravel	0.0–2.0			TR	0.0–4.0
P414189	PZ2489					Sand	4.0–4.2			AB	4.0–4.5
P414189	PZ2489					Gravel	4.2–8.0			TR	4.5–14.0
P414189	PZ2489					Sand	8.0–12.5				
P414189	PZ2489					Gravel	12.5–14.0				
P414189	PZ2489					Sand	14.0–16.0				

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GEOLOGIC DATA FOR WELLS AND BOREHOLES WITHIN AND SURROUNDING OU8 FROM GEOLOGICAL CHARACTERIZATION REPORT (EG&G, 1991a)

20-April-9

WELL NAME	OLD WELL NAME	Upper Laramie Sandstones ELEVATION	Upper Laramie Sandstones THICK.	Upper Laramie GRAIN SIZE % > 200/230 SIEVE	Upper Laramie GRAIN SIZE DEPTH	ALLUVIUM TYPE	ALLUVIUM RANGE	GRAIN SIZE % > 200/230 SIEVE	GRAIN SIZE DEPTH	CALICHE TYPE	CALICHE RANGE
P114689	PZ4289										
P114789	PZ4389					Gravel	0.0-2.7			TR	0.0-2.0
P114789	PZ4389					Sand	2.7-8.0			TR	12.0-16.0
P114789	PZ4389					Gravel	8.0-13.0				
P114789	PZ4389					Sand	13.0-22.3				
P114789	PZ4389					Gravel	22.3-24.0				
P114889	PZ4489					Gravel	0.0-9.0			TR	0.0-4.0
P114889	PZ4489					Gravel	12.0-13.0			SM	5.0-14.0
P115489	PZ4989					Gravel	0.0-15.0			SM	0.0-4.0
P115489	PZ4989									AB	4.0-8.0
P115489	PZ4989									SM	8.0-12.5
P115489	PZ4989									AB	12.5-14.5
P115589	PZ5089					Sand	4.0-4.3			TR	4.0-5.0
P115589	PZ5089					Gravel	4.3-4.7			TR	12.0-16.0
P115589	PZ5089					Sand	4.7-5.6				
P115589	PZ5089					Gravel	5.6-6.0				
P115589	PZ5089					Sand	6.0-8.4				
P115589	PZ5089					Gravel	8.4-8.6				
P115589	PZ5089					Sand	8.6-12.5				
P115589	PZ5089					Gravel	12.5-13.2				
P115589	PZ5089					Sand	13.2-13.5				
P115589	PZ5089					Gravel	13.5-14.0				
P115589	PZ5089					Sand	14.0-15.5				
P115589	PZ5089					Gravel	15.5-16.0				
P115589	PZ5089					Sand	16.0-22.0				
P115689	PZ5189										
P215789	PZ5289					Gravel	0.0-2.0			TR	0.0-13.5

APPENDIX C-5
GEOLOGIC DATA FOR WELLS AND BOREHOLES WITHIN AND SURROUNDING OU8 FROM GEOLOGICAL CHARACTERIZATION REPORT (EG&G, 1991a)

WELL NAME	OLD WELL NAME	Upper Laramie Sandstones ELEVATION	Upper Laramie Sandstones THICK.	Upper Laramie GRAIN SIZE % > 200/230 SIEVE	Upper Laramie GRAIN SIZE DEPTH	ALLUVIUM TYPE	ALLUVIUM RANGE	GRAIN SIZE % > 200/230 SIEVE	GRAIN SIZE DEPTH	CALICHE TYPE	CALICHE RANGE
P215789	PZ5289					Sand	3.0-5.5				
P215789	PZ5289					Gravel	5.5-7.5				
P215789	PZ5289					Sand	7.5-8.5				
P215789	PZ5289					Gravel	8.5-9.5				
P215789	PZ5289					Sand	9.5-11.5				
P215789	PZ5289					Gravel	12.0-15.5				
P215789	PZ5289					Sand	15.5-18.0				
P317989	OP0289					Gravel	0.0-1.0				
P317989	OP0289					Sand	1.0-1.6				
P317989	OP0289					Gravel	1.6-5.2				
P218089	OP0389										
P218289	OP0189					Gravel	0.0-6.0			AB	6.0-8.0
P218289	OP0189					Sand	6.0-10.7				
P218289	OP0189					Gravel	10.7-11.2				
P218289	OP0189					Sand	12.0-14.0				
P218289	OP0189					Gravel	14.0-16.0				
P218289	OP0189					Sand	16.0-20.0				
P218389	PZ2789					Gravel	0.0-0.7			N	
P218389	PZ2789					Gravel	1.3-6.0				
P218489	BH7740589										
P219189	PZ1889										
P219489	PZ1589									SM	2.0-8.0
P219489	PZ1589									TR	8.0-10.0
P219589	PZ1289										
P320089	7089									SM	2.0-6.0

APPENDIX C-6

GEOLOGIC DATA FOR WELLS AND BOREHOLES WITHIN AND SURROUNDING OU8 FROM GEOLOGICAL CHARACTERIZATION REPORT (EG&G, 1991a)

20-April-92

WELL NAME	OLD WELL NAME	DIP ANGLE	DEPTH	REMARKS	SAMPLE DEPTH	SAMPLE % GRAVEL	SAMPLE % SAND	SAMPLE % < 200/230	SAMPLE % SILT	SAMPLE % CLAY	SAMPLE D 50
0460	04-60										
1986	19-86										
2086	20-86										
2086	20-86										
2086	20-86										
2186	21-86	3-16	60-65		37	0	5	95			
2186	21-86				47	0	6	94			
2186	21-86				60	0	43	57			
2286	22-86				10-12	0	22	78	33	45	0.009
2286	22-86				16-18	0	50	50			0.075
2386	23-86			MISSING LOG ABOVE 33'	106	0	2	98			
2386	23-86				114	0	24	76			
2486	24-86				7.2-8.8	2	17	81			
2486	24-86										
2586	25-86			BLK CLAYSTONE AT 5923-5919.5	75.8-77.6	0	9	91			
2586	25-86				79.2-80.5	0	4	96			
2586A	25-86A			BLK CLAYSTONE 5922-5915	72	0	71	29			
2586A	25-86A			EST ELEV SAME AS 25-86	75	0	24	76			
2686	26-86				9-11	35	42	23			1.7
2786	27-86				128.5	0	26	74			
2786	27-86				155	0	7	93			
2786	27-86										
2786	27-86										
2886	28-86										
2886	28-86										
2986	29-86			MINIMAL SS #1 THICKNESS	12.5-14.5	0	26	74			
2986	29-86				18	0	62.8	37.2			0.1

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GEOLOGIC DATA FOR WELLS AND BOREHOLES WITHIN AND SURROUNDING OU8 FROM GEOLOGICAL CHARACTERIZATION REPORT (EG&G, 1991a)

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WELL NAME	OLD WELL NAME	DIP ANGLE	DEPTH	REMARKS	SAMPLE DEPTH	SAMPLE % GRAVEL	SAMPLE % SAND	SAMPLE % < 200/230	SAMPLE % SILT	SAMPLE % CLAY	SAMPLE D 50
2986	29-86				17.5-22.5	0	63	37			0.1
3086	30-86										
3186	31-86				2.5	0	36.3	63.7			
3186	31-86				2.0-4.0	0	13	87	31	56	0.0026
3186	31-86				13.0-14.5	0	54	46	22	24	0.08
3286	32-86	0-1	95		2.0-4.0	0	58	42	15	27	0.086
3286	32-86				120	0	23.8	76.2			
3386	33-86										
4486	44-86										
4486	44-86										
6186	61-86										
6186	61-86				5.0-8.5	1	56	43	11	32	0.013
6186	61-86										
SP0187	SP01-87			SS #1 THICKNESS IS MINIMAL	19	0	61	39			0.095
SP0187	SP01-87										
SP0187	SP01-87				28	0	31	69			
SP0287	SP02-87			SS #1 THICKNESS IS MINIMAL	12	0	51	49			0.0775
SP0387	SP03-87										
SP0387	SP03-87										
SP0387	SP03-87										
SP0487	SP04-87										
SP0487	SP04-87										
SP0487	SP04-87										
SP0487	SP04-87										
SP0487	SP04-87										
SP0487	SP04-87										
SP0587	SP05-87										

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GEOLOGIC DATA FOR WELLS AND BOREHOLES WITHIN AND SURROUNDING OU8 FROM GEOLOGICAL CHARACTERIZATION REPORT (EG&G, 1991a)

WELL NAME	OLD WELL NAME	DIP ANGLE	DEPTH	REMARKS	SAMPLE DEPTH	SAMPLE % GRAVEL	SAMPLE % SAND	SAMPLE % < 200/230	SAMPLE % SILT	SAMPLE % CLAY	SAMPLE D 50
SP0687	SP06-87										
SP0687	SP06-87										
SP0687	SP06-87										
SP0687	SP06-87										
SP0687	SP06-87										
SP0787	SP07-87										
SP0787	SP07-87										
SP0887	SP08-87										
0987	09-87/BH29-87				9.5-11.5	7	69	24			0.7
0987	09-87/BH29-87				17.5-19.5	0	61	39			0.1
0987	09-87/BH29-87				20.0-21.5	0	59	41	25	16	0.095
0987	09-87/BH29-87				31.5	9	48	43			0.095
1087	10-87			SS #1 THICKNESS IS MINIMAL	9.0-10.5	27	59	14			0.95
1087	10-87				12	1	37	62			
SP1187	SP11-87			MINIMAL Ka SS #2 THICKNESS	23	0	6	94			
SP1187	SP11-87										
SP1187	SP11-87				28	0	1	99			
1587	15-87/BH30-87				20.0-21.5	47	47	6			4.2
1587	15-87/BH30-87										
1687BR	16-87BR	4	120.3	BLK CLAY 5919-5912	102	0	57	43			0.085
1687BR	16-87BR				122	0	28	72			
1687BR	16-87BR	1	69.7		142	0	28	72			
1687BR	16-87BR				155	0	48	52			0.074
1987	19-87										
1987	19-87										
2087BR	20-87BR				8.8-10.8	40	42	18			2.1
2087BR	20-87BR										

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WELL NAME	OLD WELL NAME	DIP ANGLE	DEPTH	REMARKS	SAMPLE DEPTH	SAMPLE % GRAVEL	SAMPLE % SAND	SAMPLE % < 200/230	SAMPLE % SILT	SAMPLE % CLAY	SAMPLE D 50
2087BR	20-87BR				112	0	30	70			
2187	21-87										
BH2287	BH22-87				7.2-8.8	46	36	18			3.6
2287BR	22-87BR				45.1-49.5	0	30	70			
2287BR	22-87BR										
2287BR	22-87BR										
2287BR	22-87BR				82.5-84.5	0	44	56			
2387BR	23-87BR				13.0-14.7	58	31	11			7
2387BR	23-87BR				17-19	0	60	40			0.091
2387BR	23-87BR				23-25	0	45	55	29	26	0.065
2387BR	23-87BR				25-27	0	80	20			0.17
2387BR	23-87BR				35-35.5	1	22	77			
BH2487	BH24-87										
BH2887	BH28-87										
BH2987	BH29-87				9.5-11.5	7	69	24			
BH3087	BH30-87										
BH3187	BH31-87			MAY BE BEDROCK	9.05-9.75	16	23	61			
BH3187	BH31-87										
BH3187	BH31-87										
BH3287	BH32-87				10.2-12.7	2	41	57	24	33	0.048
BH3287	BH32-87				11	2	40	58			
BH3387	BH33-87				12.8-15.3	1	56	43			0.092
BH3387	BH33-87			SS #1 THICKNESS IS MINIMAL	19	0	40	60			
BH3387	BH33-87										
BH3487	BH34-87			SS #1 THICKNESS IS MINIMAL	4.0-6.7	48	31	21			4
BH3487	BH34-87				12.7-14.7	4	47	49	14	35	0.082
BH3487	BH34-87				16.7-18.7	0	23	77			

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GEOLOGIC DATA FOR WELLS AND BOREHOLES WITHIN AND SURROUNDING OU8 FROM GEOLOGICAL CHARACTERIZATION REPORT (EG&G, 1991a)

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WELL NAME	OLD WELL NAME	DIP ANGLE	DEPTH	REMARKS	SAMPLE DEPTH	SAMPLE % GRAVEL	SAMPLE % SAND	SAMPLE % < 200/230	SAMPLE % SILT	SAMPLE % CLAY	SAMPLE D 50
BH3487	BH34-87				20.7-22.7	0	43	57			
BH3587	BH35-87			SS #1 THICKNESS IS MINIMAL	17	0	16	84			
BH3587	BH35-87										
BH3587	BH35-87										
BH3687	BH36-87										
3787	37-87				7.0-9.5	41	41	18			2.5
3787	37-87										
BH3787	BH37-87			SS #1 THICKNESS IS MINIMAL	4.0-7.0	31	38	31	10	21	0.91
BH3787	BH37-87				23	0	12.1	87.9	28	60	0.002
3887	38-87										
3887	38-87										
3987BR	39-87BR(SP08-87)				21.5	0	2	98	31	67	
3987BR	39-87BR(SP08-87)				111	0	48	52			0.072
3987BR	39-87BR(SP08-87)			ALL SILTS AND SS; BLK CLAY 37'-41.5'	127	0	11	89			
3987BR	39-87BR(SP08-87)				132	0	15	85			
5687	56-87/SP16-87										
P207389	SEP0189BR										
P207389	SEP0189BR										
P207389	SEP0189BR										
P207389	SEP0189BR										
P207489	SEP0289										
P207489	SEP0289										
P207589	SEP0389										
P207589	SEP0389										
P207589	SEP0389										
P207689	SEP0489										
P207689	SEP0489										

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GEOLOGIC DATA FOR WELLS AND BOREHOLES WITHIN AND SURROUNDING OU8 FROM GEOLOGICAL CHARACTERIZATION REPORT (EG&G, 1991a)

WELL NAME	OLD WELL NAME	DIP ANGLE	DEPTH	REMARKS	SAMPLE DEPTH	SAMPLE % GRAVEL	SAMPLE % SAND	SAMPLE % < 200/230	SAMPLE % SILT	SAMPLE % CLAY	SAMPLE D 50
P207689	SEP0489										
P207689	SEP0489										
P207689	SEP0489										
P207789	SEP0589										
P207789	SEP0589										
P207789	SEP0589										
P207889	SEP0689										
P207889	SEP0689										
P207889	SEP0689										
P207989	SEP0789BR										
P207989	SEP0789BR										
P207989	SEP0789BR										
P207989	SEP0789BR										
B208789	SEP1589										
B208789	SEP1589										
P208889	SEP1689BR				6.5-6.7	0	20	80	55	25	0.032
P208889	SEP1689BR				14.8-15.0	0	6	94	41	53	0.003
P208889	SEP1689BR				44.5-44.7	0	16	84	(50)	(34)	(.019)
P208889	SEP1689BR				48.4-48.6	0	19	81	(50)	(31)	(.02)
P208889	SEP1689BR				82.1-82.3	0	3	97	(30)	(67)	(.001)
P208889	SEP1689BR				91.3-91.5	0	4	96			
P208889	SEP1689BR				93.8-93.9	0	4	96			
P208889	SEP1689BR				104.0-104.5	0	1	99	40	59	0.002
P208989	SEP1789BR				16.1-16.2	0	33	67	39	28	0.04
P208989	SEP1789BR				17.9-18.1	0	41	59	(33)	(26)	
P209089	SEP1889BR										
P209089	SEP1889BR										

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GEOLOGIC DATA FOR WELLS AND BOREHOLES WITHIN AND SURROUNDING OU8 FROM GEOLOGICAL CHARACTERIZATION REPORT (EG&G, 1991a)

WELL NAME	OLD WELL NAME	DIP ANGLE	DEPTH	REMARKS	SAMPLE DEPTH	SAMPLE % GRAVEL	SAMPLE % SAND	SAMPLE % < 200/230	SAMPLE % SILT	SAMPLE % CLAY	SAMPLE D 50
P209089	SEP1889BR										
P209189	SEP1989BR										
P209189	SEP1989BR										
P209189	SEP1989BR										
P209189	SEP1989BR										
P209189	SEP1989BR										
P209289	SEP2089										
P209289	SEP2089										
P209289	SEP2089										
P209289	SEP2089										
P209389	SEP2189BR										
P209389	SEP2189BR										
P209389	SEP2189BR										
P209489	SEP2289BR										
P209489	SEP2289BR										
P209489	SEP2289BR										
P209589	SEP2389BR										
P209589	SEP2389BR										
P209589	SEP2389BR										
P209689	SEP2489BR										
P209689	SEP2489BR										
P209689	SEP2489BR										
P209789	SEP2589										
P209789	SEP2589										
P209789	SEP2589										
P209789	SEP2589										
P209889	SEP2689BR										

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GEOLOGIC DATA FOR WELLS AND BOREHOLES WITHIN AND SURROUNDING OU8 FROM GEOLOGICAL CHARACTERIZATION REPORT (EG&G, 1991a)

WELL NAME	OLD WELL NAME	DIP ANGLE	DEPTH	REMARKS	SAMPLE DEPTH	SAMPLE % GRAVEL	SAMPLE % SAND	SAMPLE % < 200/230	SAMPLE % SILT	SAMPLE % CLAY	SAMPLE D 50
P209989	SEP2889										
P210089	SEP2989BR										
P210189	SEP3089BR										
P210189	SEP3089BR										
P210189	SEP3089BR										
P210189	SEP3089BR										
P210189	SEP3089BR										
P210289	SEP3189BR										
P210289	SEP3189BR										
P210289	SEP3189BR										
P210289	SEP3189BR										
P313489	PZ0589										
P313489	PZ0589										
P313489	PZ0589										
P313489	PZ0589										
P213689	PZ1089				8.0–9.0	33.6	36.2	30.2	12	18.2	0.85
P213689	PZ1089				20.7–20.9	0	46.5	53.5	33.7	19.8	0.06
P213689	PZ1089				21.6–21.7	0	58.3	41.7	25	16.7	0.85
P213689	PZ1089										
P213689	PZ1089										
P314089	PZ2389										
P414189	PZ2489										
P414189	PZ2489										
P414189	PZ2489										
P414189	PZ2489										
P414189	PZ2489										
P414189	PZ2489										

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GEOLOGIC DATA FOR WELLS AND BOREHOLES WITHIN AND SURROUNDING OU8 FROM GEOLOGICAL CHARACTERIZATION REPORT (EG&G, 1991a)

WELL NAME	OLD WELL NAME	DIP ANGLE	DEPTH	REMARKS	SAMPLE DEPTH	SAMPLE % GRAVEL	SAMPLE % SAND	SAMPLE % < 200/230	SAMPLE % SILT	SAMPLE % CLAY	SAMPLE D 50
P114689	PZ4289										
P114789	PZ4389										
P114789	PZ4389										
P114789	PZ4389										
P114789	PZ4389										
P114789	PZ4389										
P114889	PZ4489										
P114889	PZ4489										
P115489	PZ4989										
P115489	PZ4989										
P115489	PZ4989										
P115489	PZ4989										
P115589	PZ5089										
P115589	PZ5089										
P115589	PZ5089										
P115589	PZ5089										
P115589	PZ5089										
P115589	PZ5089										
P115589	PZ5089										
P115589	PZ5089										
P115589	PZ5089										
P115589	PZ5089										
P115589	PZ5089										
P115589	PZ5089										
P115689	PZ5189										
P215789	PZ5289										

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GEOLOGIC DATA FOR WELLS AND BOREHOLES WITHIN AND SURROUNDING OU8 FROM GEOLOGICAL CHARACTERIZATION REPORT (EG&G, 1991a)

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WELL NAME	OLD WELL NAME	DIP ANGLE	DEPTH	REMARKS	SAMPLE DEPTH	SAMPLE % GRAVEL	SAMPLE % SAND	SAMPLE % < 200/230	SAMPLE % SILT	SAMPLE % CLAY	SAMPLE D 50
P215789	PZ5289										
P215789	PZ5289										
P215789	PZ5289										
P215789	PZ5289										
P215789	PZ5289										
P215789	PZ5289										
P215789	PZ5289										
P317989	OP0289										
P317989	OP0289										
P317989	OP0289										
P218089	OP0389										
P218289	OP0189										
P218289	OP0189										
P218289	OP0189										
P218289	OP0189										
P218289	OP0189										
P218289	OP0189										
P218389	PZ2789										
P218389	PZ2789										
P218489	BH7740589										
P219189	PZ1889										
P219489	PZ1589										
P219489	PZ1589										
P219589	PZ1289										
P320089	7089										

APPENDIX C-7

List of Wells and Boreholes at Operable Unit 08 Area
Rocky Flats Plant

	Well No.	State North	State East	Surface Elevation	T.O.C. Elevation	TD	TD Elevation	Type Alluvium	Thick All.+Fill	El. Top Bedrock	Upper Bedrock	Open Interval
1	460	***	***	5962	***	***	***	***	***	***	***	***
2	987BR	749068	2085347	5980.22	5981.22	37.5	5,942.72	Qrf	12.70	5,967.52	***	***
3	1087	748945	2085289	5981.95	5983.52	17	5,964.95	Qrf	11.30	5,970.65	Silty Sandstone	3.5 - 12.1
4	1587	749010	2086248	5971.27	5972.79	27	5,944.27	Qrf	21.85	5,949.42	Silty Claystone	5.00 - 22.53
5	1687BR	749129	2086248	5969.49	5970.79	174	5,795.49	Qc	22.20	5,947.29	Claystone	99.50-125.50
6	1986	750,893	2,083,296	5,943.08	5,943.86	16.5	5,926.58	Qc	11.50	5,931.58	Claystone	2.5 - 12.5
7	1987	749623	2086172	5967.98	5969.91	16.1	5,951.88	Qrf	10.80	5,957.18	Silty Claystone	3.00 - 12.15
8	2086	751112	2084358	5960.47	***	22	5,938.47	Qc	12.50	5,947.97	Clayey Sandstone	3.00 - 11.00
9	2087BR	749634	2086154	5968.66	5970.77	126.2	5,842.46	Qrf	11.80	5,956.86	Silty Claystone	105.96-116.56
10	2186	750,854	2,082,500	6,004.76	6005.96	78.0	5,926.76	Qrf	23.60	5,981.16	Sandy Claystone	35.00 - 67.24
11	2187	749968	2085799	5928.43	5929.69	17	5,911.43	Qrf	8.00	5,920.43	Claystone	3.00-11.00
12	2286	750718	2084410	5978.77	5979.55	266	5,712.77	Qrf	11.00	5,967.77	Sandstone	2.50 - 11.40
13	2287BR	749923	2085821	5931.18	5932.8	111	5,820.18	Qrf	12.80	5,918.38	Claystone	80.37 - 89.00
14	2386	750338	2084258	5982.46	5982.46	130.5	5,851.96	Qrf	8.20	5,974.26	Claystone	112.0 - 117.5
15	2387	749404	2085910	5972.79	5974.49	45.3	5,927.49	Qrf	15.25	5,957.54	Sandy Claystone	16.25 - 37.85
16	2486	750338	2084276	5982.45	5983.56	12	5,970.45	Qrf	7.20	5,975.25	Claystone	2.50 - 7.70
17	2586	750411	2084830	5975.24	5977.76	89.6	5,885.64	Qrf	13.00	5,962.24	Caliche	66.10 - 83.60
18	2686	750411	2084841	5975.42	5977.17	17	5,958.42	Qrf	10.50	5,964.92	Claystone	3.1 - 12.20
19	2786	750780	2085237	5962.89	5963.88	157	5,805.89	Qrf	11.00	5,951.89	Claystone	127.0 - 135.7
20	2886	750802	2085239	5962.38	5964.38	15.5	5,946.88	Qrf	8.50	5,953.88	Claystone	2.7 - 9.7
21	2986	750598	2085687	5959.58	5960.68	22.5	5,937.08	Qrf	8.50	5,951.08	Claystone	2.5 - 9.1
22	3086	751078	2084921	5957.42	5958.39	16	5,941.42	Qrf	2.50	5,954.92	Claystone	2.20 - 15.10
23	3186	751050	2084763	5964.98	5967.05	22	5,942.98	Qrf	0.50	5,964.48	Sandstone	2.40 - 18.30
24	3286	751050	2084742	5966.08	5967.92	135	5,831.08	Qrf	1.00	5,965.08	Sandstone	114.0 - 126.0
25	3386	749950	2085002	5951.4	5952.42	16.8	5,934.60	Qc	6.80	5,944.60	Claystone	2.50 - 7.50
26	3787	750493	2085223	5967.52	5968.99	15.2	5,952.32	Qrf	8.00	5,959.52	Claystone	3.00 -9.75
27	3887	705395	2085094	5972.15	5973.9	15.2	5,956.95	Qrf	7.80	5,964.35	Silty Claystone	3.00 - 9.75
28	3987BR	751080	2085268	5946.95	5948.42	138	5,808.95	0-5.2' Fill	3.50	5,943.45	Claystone	109.2 - 117.65
29	4386	749404	2085868	5972.91	5974.46	22	5,950.91	Qrf	17.00	5,955.91	Sandstone	3.00 - 16.80
30	4486	749,254	2,082,234	6,019.93	6,021.96	33.0	5,986.93	Qrf	25.00	5,994.93	Silty Claystone	2.50 - 25.60
31	5687	750,638	2084422	5978.39	5979.77	13.4	5964.99	Qrf	9.4	5968.99	Silty Claystone	3.00 - 10.20
32	6186	749,198	2,083,717	5,999.47	6,000.76	18.5	5,980.81	Qrf	11.50	5,987.97	Silty Claystone	4.0 - 12.5
33	BH22-87	748778	2085646	5978.5	**	27.2	5,951.30	Qrf	22.20	5,956.30	Claystone	
34	BH24-87	748829	2086190	5953.6	**	12.3	5,941.30	Qc	4.90	5,948.70	Claystone	
35	BH28-87	748794	2086241	5946.7	**	15	5,931.70	Qc	5.90	5,940.80	Claystone	

APPENDIX C-7

List of Wells and Boreholes at Operable Unit 08 Area
Rocky Flats Plant

	Well No.	State North	State East	Surface Elevation	T.O.C. Elevation	TD	TD Elevation	Type Alluvium	Thick All.+Fill	El. Top Bedrock	Upper Bedrock	Open Interval
36	BH29-87	749068	2085348	5980.22	***	***	5,980.22	Qrf	***	5,980.22	Silty Claystone	
37	BH31-87	749486	2085405	5973.8	**	15.9	5,957.90	Qrf	15.90	5,957.90	Silty Sandstone	
38	BH32-87	749485	2085405	5971.7	**	20.5	5,951.20	Qrf	7.70	5,964.00	Sandstone	
39	BH33-87	749488	2085766	5967.9	5969.78	20.8	5,947.10	Qrf	9.20	5,958.70	Claystone	15.00 - 20.00
40	BH34-87	749463	2085893	5971.4	**	24.7	5,946.70	Qrf	16.70	5,954.70	Silty Sandstone	
41	BH35-87	749430	2086069	5970.5	**	20.3	5,950.20	Qrf	14.30	5,956.20	Sandy Claystone	
42	BH36-87	749502	2086149	5969.4	**	26	5,943.40	Qrf	20.60	5,948.80	Claystone	
43	BH37-87	749610	2086128	5968.8	**	28	5,940.80	Qrf	14.00	5,954.80	Claystone	
44	B208789	751755	2084450	5907.1	5909.03	14.4	5,892.70	Qal	4.50	5,902.60	Caliche	2.88 - 10.93
45	P114089	749,461	2,083,653	5,996.70	5,998.49	19.0	5,977.70	Qrf	9.30	5,987.40	Claystone	21.1 - 27.60
46	P114789	749,940	2,082,610	6,010.70	6,012.40	31.0	5,979.70	Qrf	26.00	5,984.70	Claystone	21.81 - 26.23
47	P114889	749,926	2,082,127	6,016.60	6,018.26	18.0	5,998.60	Qrf	13.80	6,002.80	Claystone	8.66 - 15.55
48	P115489	749,507	2,082,135	6,023.40	6,025.10	31.0	5,992.40	Qrf	26.00	5,997.40	Claystone	20.70 - 27.75
49	P115589	749,551	2,082,658	6,014.10	6,015.77	33.6	5,980.50	Qrf	29.00	5,985.10	Claystone	24.05 - 30.90
50	P115689	749,532	2,083,019	6,006.90	6,008.71	23.5	5,983.40	Qrf	19.70	5,987.20	Claystone	14.9 - 21.31
51	P207389	750195	2084468	5981.02	5982.77	23.3	5,957.72	Qrf	7.00	5,974.02	Claystone	9.35 - 16.40
52	P207489	750197	2084481	5980.71	5982.64	10	5,970.71	Qrf	6.50	5,974.21	Claystone	2.25 - 8.60
53	P207589	750395	2084843	5974.06	5975.96	29.1	5,944.96	Qrf	9.50	5,964.56	Silty Claystone	13.4 - 25.10
54	P207689	750398	2085318	5966.32	5967.88	18.2	5,948.12	Qrf	12.60	5,953.72	Silty Claystone	3.00 - 14.36
55	P207789	750392	2085343	5965.88	5967.75	32.3	5,933.58	Qrf	12.90	5,952.98	Silty Claystone	16.9 - 28.63
56	P207889	750671	2085343	5962.82	5964.9	10.5	5,952.32	Qrf	8.50	5,954.32	Claystone	2.5 - 8.95
57	P207989	750671	2085330	5963.09	5965.17	26.2	5,936.89	Qrf	5.80	5,957.29	Claystone	10.0 - 21.73
58	P208889	751086	2085249	5947.3	5949.25	105.1	5,842.20	Qc	5.50	5,941.80	Siltstone	86.75 - 99.60
59	P208989	751044	2084839	5962.53	5964.56	28.6	5,933.93	Qrf	3.50	5,959.03	Claystone	14.4 - 26.12
60	P209089	750,566	2084910	5972.16	5974.25	31.5	5,940.66	Qrf	11.50	5,960.66	Silty Claystone	15.5 - 27.21
61	P209189	750762	2084309	5980.66	5982.21	38.3	5,942.36	Qrf	10.30	5,970.36	Sandstone	12.3 - 36.08
62	P209289	750863	2,084,139	5,981.59	5,983.42	17.8	5,963.79	Qrf	13.80	5,967.79	Sandstone	7.40 - 13.40
63	P209389	750864	2,084,130	5,981.47	5,983.39	34.2	5,947.27	Qrf	13.80	5,967.67	Sandstone	15.85 - 30.10
64	P209489	750991	2084634	5977.98	5980.1	48	5,929.98	Qrf	9.00	5,968.98	Claystone	14.40 - 37.00
65	P209589	751071	2085286	5948.17	5950.04	30.3	5,917.87	Qrf	4.10	5,944.07	Silty Claystone	8.07 - 19.77
66	P209689	750533	2085514	5962.63	5964.43	30.2	5,932.43	Qrf	12.20	5,950.43	Sandy Claystone	16.2 - 27.93
67	P209789	750579	2085481	5962.63	5964.75	17.5	5,945.13	Qrf	12.20	5,950.43	Silty Claystone	2.5 - 13.75
68	P209889	751194	2084984	5940.28	5942.4	23.9	5,916.38	Qrf	3.90	5,936.38	Silty Claystone	7.90 - 19.63
69	P209989	751565	2084649	5898.1	5900.4	12	5,886.10	Qc	7.70	5,890.40	Silty Claystone	2.50 - 9.58
70	P210089	751564	2084639	5898.4	5900.4	28	5,870.40	Qc	7.20	5,891.20	Silty Claystone	11.2 - 22.93

APPENDIX C-7

List of Wells and Boreholes at Operable Unit 08 Area
Rocky Flats Plant

	Well No.	State North	State East	Surface Elevation	T.O.C. Elevation	TD	TD Elevation	Type Alluvium	Thick All.+Fill	El. Top Bedrock	Upper Bedrock	Open Interval
71	P210189	750,752	2084410	5980.82	5982.4	38.6	5,942.22	Qrf	14.60	5,966.22	Clayey Siltstone	19.4 - 37.13
72	P210289	750564	2085223	5967.03	5969.19	26	5,941.03	Qrf	6.60	5,960.43	Silty Claystone	10.57 - 22.27
73	P213689	749,460	2,083,736	5,994.30	5,996.04	23.0	5,971.30	Qrf	13.00	5,981.30	Claystone	8.10 - 14.80
74	P214689	749,943	2,083,044	6,004.00	6,005.76	26.0	5,978.00	Qrf	22.00	5,982.00	Silty Claystone	16.55 - 23.85
75	P215789	749,470	2,083,430	6,002.00	6,003.66	22.0	5,980.00	Qrf	18.00	5,984.00	Claystone	13.00 - 19.69
76	P218089	749,941	2,084,020	5,985.80	5,987.55	16.0	5,969.80	Qrf	6.00	5,979.80	Claystone	2.5 - 8.69
77	P418289	748,952	2,082,653	6,016.90	6,018.20	33.0	5,983.90	Qrf	23.00	5,993.90	Claystone	8.2 - 26.7
78	P218389	750831	2085648	5956.2	5958.45	22	5,934.20	Qrf	12.00	5,944.20	Claystone	7.00 - 14.00
79	P218489	751,127	2,084,117	5,949.10	*	5.0	5,944.10	0-5 Fill	*	*	*	*
80	P219189	751,222	2,084,010	5,941.20	5,943.15	21.0	5,920.20	Qrf	11.00	5,930.20	Claystone	6.00 - 12.9
81	P219489	750415	2085651	5959.5	5961.15	32	5,927.50	Qrf	22.40	5,937.10	Claystone	17.30 - 24.55
82	P219589	750268	2085536	5963.8	5965.7	16.7	5,947.10	Qrf	17.20	5,946.60	Sandstone	20.10 - 27.25
83	P313489	748,913	2,083,062	6,011.70	6,013.58	24.0	5,987.70	Qrf	20.60	5,991.10	Claystone	15.00- 22.37
84	P317989	748,891	2,084,272	5,990.90	5,992.84	16.0	5,974.90	Qrf	6.40	5,984.50	Claystone	2.5 - 9.0
85	P320089	748,799	2,083,280	6,009.90	6,011.87	20.9	5,989.00	Qrf	18.80	5,991.10	Silty Claystone	13.00 - 20.08
86	P414189	749,059	2,082,986	6,010.60	6,012.18	28.0	5,982.60	Qrf	18.00	5,992.60	Claystone	13.0 - 20.00
87	SP01-87	750790	2084310	5982.7	**	30.2	5,952.50	Qaf/Qrf	13.20	5,969.50	Sandstone	
88	SP02-87	750970	2084640	5976.6	**	15	5,961.60	Qaf/Qrf	10.50	5,966.10	Sandstone	
89	SP03-87	750480	2084630	5978.7	**	19.7	5,959.00	Qaf/Qrf	13.00	5,965.70	Claystone	
90	SP04-87	750560	2084920	5971.8	**	37	5,934.80	Qrf	12.00	5,959.80	Claystone	
91	SP05-87	750870	2084910	5971.6	**	21.8	5,949.80	Qrf	16.30	5,955.30	Claystone	
92	SP06-87	750900	2085200	5972.9	**	30.7	5,942.20	Qaf/Qrf	18.00	5,954.90	Claystone	
93	SP07-87	750471	2085200	5973.6	**	31	5,942.60	Qaf/Qrf	20.80	5,952.80	Claystone	
94	SP08-87	748749	2078136	6099.52	***	***	6,099.52	Qd/Qc	***	6,099.52	Claystone	
95	SP11-87	751585	2084450	5904.5	**	34	5,870.50	Qc	21.50	5,883.00	Silty Claystone	
96	SP16-87	*	*	*	*	*	*	*	*	*	Silty Claystone	

Notes:

*** - No data reported ** - Borehole plugged * - Borehole abandoned due to obstruction in subsurface

ND - Not determined TOC - Top of Casing TD - Total depth drilled in feet

Alluvium Types: Qrf - Quaternary Rocky Flats; Qc - Quaternary Colluvium; Qal - Quaternary Alluvium

Blank Open Interval indicates borehole not completed as a well.

APPENDIX C-8

Water Level Measurements of Wells In and Near OU8

Well No.	Depth from T.O.C.	DATE
460	8	01-Feb-82
460	2	01-May-82
460	4	01-Aug-82
460	5	01-Dec-82
460	2	01-Jun-83
460	4.5	10-Aug-83
460	5	01-Sep-83
460	6	01-Nov-83
460	2	01-May-84
460	4	01-Jun-84
460	4	01-Mar-85
460	6.31	27-Mar-85
460	5.5	01-Jul-85
460	7.8	28-Aug-86
460	8.01	29-Aug-86
460	8.05	02-Sep-86
460	8.29	03-Sep-86
460	7.25	01-Jan-87
460	8.94	01-Feb-87
460	1.67	19-Mar-87
460	1.54	08-May-87
460	2.9	08-Jul-87
460	6.2	10-Sep-87
460	7.3	21-Oct-87
460	7.5	09-Nov-87
460	7.4	22-Dec-87
460	7.4	27-Jan-88
460	6.4	29-Feb-88
460	5.8	21-Mar-88
460	4.6	18-Apr-88
460	4.9	17-May-88
460	4.4	15-Jun-88
460	4.1	15-Jul-88
460	4.7	18-Aug-88
460	5.2	15-Sep-88
460	6	22-Oct-88
460	7	15-Nov-88
460	7.4	15-Dec-88

Well No.	Depth from T.O.C.	DATE
460	7.5	15-Jan-89
460	6	24-Feb-89
460	4.9	31-Mar-89
460	5	27-Apr-89
460	3.2	26-May-89
460	4.5	30-Jun-89
460	5.4	28-Jul-89
460	5.4	30-Aug-89
460	6.31	15-Nov-89
460	7.59	17-Jan-90
460	0.7	15-Mar-90
460	3.11	30-Apr-90
460	3.54	11-May-90
460	4.92	10-Jul-90
460	6.57	20-Aug-90
460	6.34	03-Oct-90
460	6.85	01-Nov-90
460	7.84	08-Jan-91
460	6.9	24-Apr-91
460	4.6	10-Jun-91
460	5.29	03-Jul-91
460	5.14	05-Aug-91
460	6.86	01-Oct-91
460	7.04	07-Oct-91
460	6.38	07-Jan-92
460	6.8	20-Jan-92
460	6.8	20-Jan-92
460	2.6	02-Apr-92
987	15.77	13-Apr-90
987	17.16	08-Jun-90
987	17.85	12-Jul-90
987	18.8	17-Sep-90
987	18.86	02-Oct-90
987	19.78	12-Dec-90
987	20.2	03-Jan-91
987	20.75	07-Mar-91
987	20.98	02-Apr-91
987	19.85	15-May-91

Well No.	Depth from T.O.C.	DATE
987	18.25	05-Jul-91
987	18.24	16-Aug-91
987	19.33	04-Oct-91
987	18.83	16-Dec-91
987	19.57	05-Feb-92
987	19.39	06-Mar-92
987	14.83	07-Apr-92
1087	-1	04-Aug-87
1087	13.2	09-Nov-87
1087	12.85	01-Dec-87
1087	13	21-Dec-87
1087	11.1	11-Jan-88
1087	12.9	29-Feb-88
1087	13	21-Mar-88
1087	13.1	18-Apr-88
1087	13.2	16-May-88
1087	13.4	15-Jun-88
1087	13.6	15-Jul-88
1087	13.6	18-Aug-88
1087	13.6	15-Sep-88
1087	-1	22-Oct-88
1087	-1	15-Nov-88
1087	13.6	15-Dec-88
1087	13.3	15-Jan-89
1087	12.1	14-Feb-89
1087	13	27-Apr-89
1087	13	28-May-89
1087	13.2	30-Jun-89
1087	13.55	21-Jul-89
1087	-1	25-Aug-89
1087	13.4	08-Dec-89
1087	12.98	19-Jan-90
1087	11.18	08-Mar-90
1087	13.14	13-Apr-90
1087	13.05	05-Jun-90
1087	13.56	12-Jul-90
1087	13.22	14-Aug-90
1087	13.17	17-Sep-90

APPENDIX C-8

Water Level Measurements of Wells In and Near OU8

Well No.	Depth from T.O.C.	DATE
1087	12.45	25-Sep-90
1087	12.94	02-Oct-90
1087	11.32	09-Nov-90
1087	13.08	10-Dec-90
1087	13.08	12-Dec-90
1087	13.62	03-Jan-91
1087 DRY		14-Mar-91
1087 DRY		02-Apr-91
1087	11.93	07-May-91
1087	17.86	11-Jun-91
1087	13.05	05-Jul-91
1087	12.89	08-Aug-91
1087	13.02	26-Aug-91
1087	13.6	05-Sep-91
1087	13.99	04-Oct-91
1087 DRY		04-Oct-91
1087	11.29	08-Nov-91
1087	12.96	05-Feb-92
1087 DRY		05-Mar-92
1087	13.05	07-Apr-92
1587	20.8	29-Sep-87
1587	20.4	11-Nov-87
1587	20.55	01-Dec-87
1587	20.1	21-Dec-87
1587	22.3	11-Jan-88
1587	20.2	29-Feb-88
1587	20	21-Mar-88
1587	19.6	18-Apr-88
1587	20.2	16-May-88
1587	19.2	15-Jun-88
1587	20.7	15-Jul-88
1587	21.1	18-Aug-88
1587	22	15-Sep-88
1587	22.6	22-Oct-88
1587	22.8	15-Nov-88
1587	22.8	15-Dec-88
1587	22.4	15-Jan-89
1587	21.6	14-Feb-89

Well No.	Depth from T.O.C.	DATE
1587	19.7	27-Mar-89
1587	19.8	27-Apr-89
1587	20.1	25-May-89
1587	16.7	30-Jun-89
1587	8.3	21-Jul-89
1587	19.78	25-Aug-89
1587	20.03	12-Sep-89
1587	22.1	04-Dec-89
1587	23.31	15-Jan-90
1587	22.59	23-Jan-90
1587	13.98	16-Apr-90
1587	19.32	25-Jun-90
1587	19.99	12-Jul-90
1587	20	09-Aug-90
1587	21.09	17-Sep-90
1587	21.1	18-Sep-90
1587	21.13	03-Oct-90
1587	21.65	08-Nov-90
1587	20.98	27-Nov-90
1587	21.39	04-Dec-90
1587	22.84	07-Jan-91
1587	23.72	10-Jan-91
1587	22.53	15-Apr-91
1587	20.83	03-May-91
1587	14.06	10-Jun-91
1587	17.31	03-Jul-91
1587	19.19	01-Aug-91
1587	19.58	03-Sep-91
1587	19.58	04-Sep-91
1587	20.87	01-Oct-91
1587	21.8	01-Nov-91
1587	19.24	18-Dec-91
1587	20.26	06-Jan-92
1587	20.88	03-Feb-92
1587	21.59	24-Feb-92
1587	21.93	03-Mar-92
1587	21.92	05-Mar-92
1587	12.97	06-Apr-92

Well No.	Depth from T.O.C.	DATE
1687	104.3	29-Sep-87
1687	85.2	11-Nov-87
1687	85.47	01-Dec-87
1687	85	21-Dec-87
1687	79.5	11-Jan-88
1687	76.4	29-Feb-88
1687	86.4	21-Mar-88
1687	79.5	18-Apr-88
1687	87.2	16-May-88
1687	79.6	15-Jun-88
1687	77.6	15-Jul-88
1687	81.3	15-Sep-88
1687	79.1	22-Oct-88
1687	91.9	15-Nov-88
1687	86.6	15-Dec-88
1687	78.4	15-Jan-89
1687	90.8	14-Feb-89
1687	80.8	27-Mar-89
1687	78.3	27-Apr-89
1687	78	26-May-89
1687	80.9	30-Jun-89
1687	78.48	21-Jul-89
1687	78.18	25-Aug-89
1687	94.72	16-Apr-90
1687	80.13	26-Jun-90
1687	101.34	12-Jul-90
1687	81.12	18-Sep-90
1687	102.14	03-Oct-90
1687	82.5	27-Nov-90
1687	88.8	07-Jan-91
1687	88.5	08-Jan-91
1687	80.93	15-Apr-91
1687	81.78	03-Jul-91
1687	77.83	04-Sep-91
1687	82.96	01-Oct-91
1687	81.01	20-Nov-91
1687	86.6	06-Jan-92
1687	79.8	24-Feb-92

APPENDIX C-8

Water Level Measurements of Wells In and Near OU8

Well No.	Depth from T.O.C.	DATE
1687	86.46	06-Apr-92
1986	3.95	16-Sep-86
1986	3.98	17-Sep-86
1986	4.02	18-Sep-86
1986	3.83	13-Oct-86
1986	3.37	26-Nov-86
1986	3.25	01-Jan-87
1986	2.9	25-Feb-87
1986	2.75	26-Mar-87
1986	2.75	08-May-87
1986	3.2	03-Jun-87
1986	3.2	08-Jul-87
1986	4.5	04-Aug-87
1986	3.6	10-Aug-87
1986	3.4	03-Sep-87
1986	3.5	14-Sep-87
1986	3.1	28-Oct-87
1986	3.1	09-Nov-87
1986	3.1	17-Nov-87
1986	3.3	22-Dec-87
1986	2.6	01-Feb-88
1986	2.9	29-Feb-88
1986	2.9	21-Mar-88
1986	2.8	18-Apr-88
1986	3.3	16-May-88
1986	3.5	15-Jun-88
1986	3.4	15-Jul-88
1986	3.4	18-Aug-88
1986	3.5	15-Sep-88
1986	3.4	22-Oct-88
1986	3.1	15-Nov-88
1986	2.9	15-Dec-88
1986	2.9	15-Jan-89
1986	2.5	24-Feb-89
1986	2.2	31-Mar-89
1986	3.1	27-Apr-89
1986	2.6	25-May-89
1986	3.4	30-Jun-89

Well No.	Depth from T.O.C.	DATE
1986	3.58	28-Jul-89
1986	3.57	30-Aug-89
1986	3.07	12-Sep-89
1986	2.98	03-Nov-89
1986	2.96	18-Jan-90
1986	2.81	12-Feb-90
1986	2.41	25-Apr-90
1986	2.85	09-May-90
1986	3.19	11-Jul-90
1986	3.15	25-Jul-90
1986	3.35	15-Aug-90
1986	3.53	04-Sep-90
1986	3.28	03-Oct-90
1986	3.24	18-Oct-90
1986	3.12	02-Nov-90
1986	2.98	04-Jan-91
1986	2.16	03-Jun-91
1986	2.16	03-Jun-91
1986	2.67	03-Jul-91
1986	3.06	31-Jul-91
1986	2.89	05-Aug-91
1986	3.01	04-Sep-91
1986	3.01	01-Oct-91
1986	3.15	02-Oct-91
1986	2.84	04-Nov-91
1986	2.57	03-Dec-91
1986	2.71	07-Jan-92
1986	2.55	30-Jan-92
1986	2.68	06-Feb-92
1986	2.78	02-Mar-92
1986	2.34	02-Apr-92
1986	2.53	08-Apr-92
1987	7.8	09-Nov-87
1987	11.77	01-Dec-87
1987	7.5	21-Dec-87
1987	13.3	11-Jan-88
1987	12.6	29-Feb-88
1987	12.7	21-Mar-88

Well No.	Depth from T.O.C.	DATE
1987	12.6	18-Apr-88
1987	12.7	16-May-88
1987	11.8	15-Jun-88
1987	12.8	15-Jul-88
1987	13.4	18-Aug-88
1987	12.5	15-Sep-88
1987	-1	22-Oct-88
1987	13.6	15-Nov-88
1987	-1	15-Dec-88
1987	-1	15-Jan-89
1987	-1	24-Feb-89
1987	-1	31-Mar-89
1987	-1	27-Apr-89
1987	-1	26-May-89
1987	12.1	30-Jun-89
1987	12.9	28-Jul-89
1987	-1	30-Aug-89
1987	-1	12-Sep-89
1987	-1	04-Dec-89
1987	-1	15-Jan-90
1987	13.54	12-Apr-90
1987	12.41	22-May-90
1987	12.98	10-Jul-90
1987	13.25	25-Jul-90
1987 DRY		01-Oct-90
1987 DRY		07-Nov-90
1987 DRY		02-Jan-91
1987 DRY		02-Jan-91
1987 DRY		02-Apr-91
1987	11.19	02-Jul-91
1987	12.85	14-Aug-91
1987	13.93	04-Oct-91
1987 DRY		04-Oct-91
1987 DRY		03-Jan-92
1987	6.94	06-Apr-92
2087	108.5	29-Sep-87
2087	112.5	09-Nov-87
2087	108.91	01-Dec-87

APPENDIX C-8

Water Level Measurements of Wells In and Near OU8

Well No.	Depth from T.O.C.	DATE
2087	112.2	21-Dec-87
2087	101.6	11-Jan-88
2087	98	29-Feb-88
2087	113.7	21-Mar-88
2087	108.5	18-Apr-88
2087	115.3	16-May-88
2087	109.9	15-Jun-88
2087	105.5	15-Jul-88
2087	103.7	18-Aug-88
2087	106.9	15-Sep-88
2087	104.7	22-Oct-88
2087	113.4	15-Nov-88
2087	111.1	15-Dec-88
2087	103.8	15-Jan-89
2087	112	24-Feb-89
2087	106.9	31-Mar-89
2087	104.1	27-Apr-89
2087	103.6	25-May-89
2087	105.5	30-Jun-89
2087	102.7	28-Jul-89
2087	101.67	30-Aug-89
2087	108.28	12-Apr-90
2087	103.95	22-May-90
2087	108.89	10-Jul-90
2087	106.85	27-Jul-90
2087	107.58	01-Oct-90
2087	103.62	08-Nov-90
2087	108.53	02-Jan-91
2087	101.02	18-Mar-91
2087	114.79	02-Apr-91
2087	108.86	09-May-91
2087	108.86	09-May-91
2087	109.78	02-Jul-91
2087	104.69	14-Aug-91
2087	109.58	04-Oct-91
2087	102.75	05-Dec-91
2087	112.31	03-Jan-92
2087	105.54	24-Feb-92

Well No.	Depth from T.O.C.	DATE
2087	110.49	06-Apr-92
2186	-1	29-Aug-86
2186	49.23	19-Nov-86
2186	45.5	20-Nov-86
2186	44.01	21-Nov-86
2186	38.79	24-Nov-86
2186	41.26	25-Nov-86
2186	32.79	01-Jan-87
2186	32.6	25-Feb-87
2186	32.58	25-Mar-87
2186	32.4	08-May-87
2186	32.47	03-Jun-87
2186	33	08-Jul-87
2186	32.5	04-Aug-87
2186	33	03-Sep-87
2186	33.1	14-Sep-87
2186	33.3	06-Oct-87
2186	33.3	09-Nov-87
2186	33.3	17-Nov-87
2186	33.1	22-Dec-87
2186	33.1	01-Feb-88
2186	32.9	29-Feb-88
2186	32.9	21-Mar-88
2186	32.9	18-Apr-88
2186	32.9	17-May-88
2186	33.1	15-Jun-88
2186	33.3	15-Jul-88
2186	33.3	18-Aug-88
2186	33.9	15-Sep-88
2186	33.7	22-Oct-88
2186	34.7	15-Nov-88
2186	33.7	15-Dec-88
2186	33.1	15-Jan-89
2186	32.9	24-Feb-89
2186	33	31-Mar-89
2186	32.8	27-Apr-89
2186	32.8	26-May-89
2186	32.9	30-Jun-89

Well No.	Depth from T.O.C.	DATE
2186	32.85	28-Jul-89
2186	32.99	30-Aug-89
2186	33.54	12-Sep-89
2186	32.9	07-Nov-89
2186	32.69	18-Jan-90
2186	32.36	28-Feb-90
2186	32.27	25-Apr-90
2186	32.18	11-May-90
2186	32.48	11-Jul-90
2186	32.56	02-Aug-90
2186	32.88	02-Oct-90
2186	32.81	06-Nov-90
2186	32.86	04-Jan-91
2186	32.91	03-Jun-91
2186	33.2	03-Jul-91
2186	33.21	08-Aug-91
2186	33.36	01-Oct-91
2186	33.35	15-Oct-91
2186	32.92	07-Jan-92
2186	32.72	28-Jan-92
2186	32.67	02-Apr-92
2187	7.3	12-Nov-87
2187	-1	01-Dec-87
2187	7.2	22-Dec-87
2187	7.4	27-Jan-88
2187	7.1	29-Feb-88
2187	8.4	21-Mar-88
2187	7.8	18-Apr-88
2187	8.8	17-May-88
2187	9.7	15-Jun-88
2187	8.5	15-Jul-88
2187	8	18-Aug-88
2187	7.9	15-Sep-88
2187	7.6	22-Oct-88
2187	9.5	15-Nov-88
2187	9.4	15-Dec-88
2187	9.2	15-Jan-89
2187	8.6	24-Feb-89

APPENDIX C-8

Water Level Measurements of Wells In and Near OU8

Well No.	Depth from T.O.C.	DATE
2187	9	31-Mar-89
2187	5.6	27-Apr-89
2187	5.4	25-May-89
2187	6.4	30-Jun-89
2187	6.11	28-Jul-89
2187	5.94	30-Aug-89
2187	8.01	11-Sep-89
2187	7.05	10-Nov-89
2187	10.35	17-Jan-90
2187	9.69	06-Feb-90
2187	8.33	24-Apr-90
2187	7.5	18-May-90
2187	8.69	10-Jul-90
2187	6.42	05-Sep-90
2187	10.29	01-Oct-90
2187	8.96	11-Dec-90
2187	10.95	04-Jan-91
2187	7.93	23-Apr-91
2187	8.97	10-Jun-91
2187	10.27	03-Jul-91
2187	8.52	05-Aug-91
2187	8.7	01-Oct-91
2187	8.41	16-Oct-91
2187	9.71	08-Jan-92
2187	9.56	15-Jan-92
2187	9.08	26-Feb-92
2187	10.24	02-Apr-92
2286	8.38	12-Sep-86
2286	8.52	13-Sep-86
2286	8.25	15-Sep-86
2286	8.22	16-Sep-86
2286	8.28	17-Sep-86
2286	8.22	19-Sep-86
2286	7.22	13-Oct-86
2286	7.35	26-Nov-86
2286	8.5	01-Jan-87
2286	7.29	25-Feb-87
2286	6.17	24-Mar-87

Well No.	Depth from T.O.C.	DATE
2286	5.71	08-May-87
2286	6.8	03-Jun-87
2286	6.25	08-Jul-87
2286	6.8	04-Aug-87
2286	5.6	27-Aug-87
2286	5.9	03-Sep-87
2286	8	21-Oct-87
2286	8.4	09-Nov-87
2286	8	21-Dec-87
2286	6.6	11-Jan-88
2286	7.3	29-Feb-88
2286	7.2	21-Mar-88
2286	6.7	18-Apr-88
2286	7	17-May-88
2286	6.7	15-Jun-88
2286	7	15-Jul-88
2286	7.7	18-Aug-88
2286	7.7	15-Sep-88
2286	8.1	22-Oct-88
2286	9.4	15-Nov-88
2286	9.5	15-Dec-88
2286	9.6	15-Jan-89
2286	8.2	24-Feb-89
2286	7.6	31-Mar-89
2286	7.5	27-Apr-89
2286	5.9	25-May-89
2286	7.3	30-Jun-89
2286	8.22	28-Jul-89
2286	7.04	30-Aug-89
2286	6.62	11-Sep-89
2286	8.33	06-Nov-89
2286	10.26	17-Jan-90
2286	10.54	16-Feb-90
2286	7.34	25-Apr-90
2286	7.6	09-May-90
2286	8.86	11-Jul-90
2286	7.87	27-Jul-90
2286	8.37	02-Oct-90

Well No.	Depth from T.O.C.	DATE
2286	8.66	12-Oct-90
2286	10.61	04-Jan-91
2286	10.75	07-Jan-91
2286	7.6	29-May-91
2286	8.21	03-Jul-91
2286	8.52	30-Jul-91
2286	9.75	01-Oct-91
2286	9.74	03-Oct-91
2286	9.79	07-Jan-92
2286	9.98	09-Jan-92
2286	7.12	02-Apr-92
2287BR	80.8	11-Sep-89
2287BR	80.45	10-Nov-89
2287BR	78.7	17-Jan-90
2287BR	80.3	08-Feb-90
2386	107.75	01-Oct-86
2386	91.79	17-Nov-86
2386	113.25	18-Nov-86
2386	115.61	19-Nov-86
2386	113.22	25-Nov-86
2386	93.92	01-Jan-87
2386	79.25	25-Feb-87
2386	73	18-Mar-87
2386	104.38	08-May-87
2386	94.02	03-Jun-87
2386	113.05	08-Jul-87
2386	98.6	04-Aug-87
2386	87.8	03-Sep-87
2386	87.8	23-Sep-87
2386	95.1	28-Oct-87
2386	94.9	09-Nov-87
2386	94.5	21-Dec-87
2386	95	29-Feb-88
2386	89.7	21-Mar-88
2386	104.9	18-Apr-88
2386	93.6	17-May-88
2386	103.6	15-Jun-88
2386	93	15-Jul-88

APPENDIX C-8

Water Level Measurements of Wells In and Near OU8

Well No.	Depth from T.O.C.	DATE
2386	88.5	18-Aug-88
2386	105.9	15-Sep-88
2386	98.1	22-Oct-88
2386	26.1	15-Nov-88
2386	105	15-Dec-88
2386	79.5	24-Feb-89
2386	78.1	31-Mar-89
2386	89.1	27-Apr-89
2386	55.67	12-Sep-89
2386	47.2	06-Nov-89
2386	91.42	17-Jan-90
2386	71.81	22-Mar-90
2386	102.96	25-Apr-90
2386	91.55	25-May-90
2386	97.17	11-Jul-90
2386	85.45	13-Aug-90
2386	95.27	02-Oct-90
2386	80.73	14-Nov-90
2386	93.82	04-Jan-91
2386	62.56	24-Apr-91
2386	101.51	30-May-91
2386	103.44	03-Jul-91
2386	92.27	31-Jul-91
2386	91.22	01-Oct-91
2386	89.08	07-Oct-91
2386	79.5	13-Jan-92
2386	83.93	02-Apr-92
2387	17.7	29-Sep-87
2387	18.4	09-Nov-87
2387	16.1	01-Dec-87
2387	18.1	21-Dec-87
2387	18.2	11-Jan-88
2387	16.5	29-Feb-88
2387	16.4	21-Mar-88
2387	15.5	18-Apr-88
2387	16.6	16-May-88
2387	16.6	15-Jun-88
2387	14.7	15-Jul-88

Well No.	Depth from T.O.C.	DATE
2387	18	18-Aug-88
2387	17.9	15-Sep-88
2387	18.9	22-Oct-88
2387	19.6	15-Nov-88
2387	19.7	15-Dec-88
2387	19.3	15-Jan-89
2387	16.5	24-Feb-89
2387	17	27-Mar-89
2387	17.1	27-Apr-89
2387	17.1	25-May-89
2387	15.4	30-Jun-89
2387	17.85	28-Jul-89
2387	17.37	30-Aug-89
2387	12.17	12-Apr-90
2387	15.52	01-Jun-90
2387	17.63	10-Jul-90
2387	33.68	13-Aug-90
2387	17.9	01-Oct-90
2387	17.62	09-Nov-90
2387	19.26	02-Jan-91
2387	18.96	08-Mar-91
2387	19.23	02-Apr-91
2387	17.41	19-Apr-91
2387	15.28	02-Jul-91
2387	15.22	19-Aug-91
2387	18.53	04-Oct-91
2387	15.56	23-Nov-91
2387	17.13	03-Jan-92
2387	19.73	28-Feb-92
2387	11.25	06-Apr-92
2486	-1	16-Sep-86
2486	-1	13-Oct-86
2486	-1	26-Nov-86
2486	-1	01-Jan-87
2486	-1	25-Feb-87
2486	-1	18-Mar-87
2486	-1	08-May-87
2486	-1	03-Jun-87

Well No.	Depth from T.O.C.	DATE
2486	8.65	08-Jul-87
2486	-1	04-Aug-87
2486	-1	03-Sep-87
2486	-1	24-Sep-87
2486	-1	28-Oct-87
2486	-1	09-Nov-87
2486	-1	21-Dec-87
2486	-1	11-Jan-88
2486	-1	29-Feb-88
2486	-1	21-Mar-88
2486	8.7	18-Apr-88
2486	8.2	15-Jun-88
2486	-1	15-Jul-88
2486	8.7	18-Aug-88
2486	8.7	15-Sep-88
2486	-1	22-Oct-88
2486	-1	15-Nov-88
2486	8.7	15-Dec-88
2486	8.4	15-Jan-89
2486	-1	24-Feb-89
2486	-1	31-Mar-89
2486	-1	27-Apr-89
2486	8.7	26-May-89
2486	-1	30-Jun-89
2486	-1	28-Jul-89
2486	-1	30-Aug-89
2486	8.58	11-Sep-89
2486	-1	06-Nov-89
2486	-1	17-Jan-90
2486	8.55	25-Apr-90
2486 DRY		20-May-90
2486 DRY		11-Jul-90
2486 DRY		10-Aug-90
2486 DRY		22-Aug-90
2486 DRY		05-Sep-90
2486 DRY		02-Oct-90
2486 DRY		01-Nov-90
2486 DRY		02-Nov-90

APPENDIX C-8

Water Level Measurements of Wells In and Near OU8

Well No.	Depth from T.O.C.	DATE
2486	**.**	04-Jan-91
2486	DRY	24-Apr-91
2486	7.36	07-Jun-91
2486	7.51	11-Jun-91
2486	DRY	03-Jul-91
2486	DRY	02-Aug-91
2486	DRY	04-Sep-91
2486	9.11	01-Oct-91
2486	DRY	01-Oct-91
2486	DRY	04-Nov-91
2486	7.54	03-Dec-91
2486	DRY	07-Jan-92
2486	8.65	06-Feb-92
2486	DRY	02-Mar-92
2486	7.55	02-Apr-92
2586	71.05	30-Sep-86
2586	77.93	01-Oct-86
2586	71.42	13-Oct-86
2586	76.73	21-Oct-86
2586	74.59	28-Oct-86
2586	74.24	05-Nov-86
2586	78.65	06-Nov-86
2586	79.52	07-Nov-86
2586	71.94	26-Nov-86
2586	31.83	01-Jan-87
2586	23.92	25-Feb-87
2586	21.75	18-Mar-87
2586	35.38	08-May-87
2586	27.25	03-Jun-87
2586	71.7	08-Jul-87
2586	24.7	04-Aug-87
2586	32.6	27-Aug-87
2586	31.4	03-Sep-87
2586	28.6	09-Nov-87
2586	28.4	21-Dec-87
2586	21	11-Jan-88
2586	34.6	29-Feb-88
2586	27.8	21-Mar-88

Well No.	Depth from T.O.C.	DATE
2586	40.7	18-Apr-88
2586	28.6	17-May-88
2586	45.2	15-Jun-88
2586	31	15-Jul-88
2586	27.3	18-Aug-88
2586	58.1	15-Sep-88
2586	41.6	22-Oct-88
2586	27.8	15-Nov-88
2586	72.6	15-Dec-88
2586	34.5	15-Jan-89
2586	27.6	24-Feb-89
2586	25.9	31-Mar-89
2586	35.9	27-Apr-89
2586	29.4	26-May-89
2586	41.5	30-Jun-89
2586	30.31	28-Jul-89
2586	25.15	30-Aug-89
2586	67.23	11-Sep-89
2586	35.52	08-Nov-89
2586	30.75	17-Jan-90
2586	24.4	22-Feb-90
2586	35	24-Apr-90
2586	26.87	25-May-90
2586	41.52	10-Jul-90
2586	26.16	28-Aug-90
2586	48.15	01-Oct-90
2586	42.19	10-Oct-90
2586	28.18	04-Jan-91
2586	27.76	07-Jan-91
2586	22.58	10-Jun-91
2586	60.32	03-Jul-91
2586	44.22	23-Jul-91
2586	32.77	01-Oct-91
2586	29.38	15-Oct-91
2586	28.74	07-Jan-92
2586	26.25	22-Jan-92
2586	26.25	22-Jan-92
2586	30.43	03-Apr-92

Well No.	Depth from T.O.C.	DATE
2786	111.22	30-Sep-86
2786	130.6	01-Oct-86
2786	130.48	13-Oct-86
2786	129.41	17-Oct-86
2786	127.5	21-Oct-86
2786	124.17	28-Oct-86
2786	123.1	05-Nov-86
2786	131.6	07-Nov-86
2786	115.94	26-Nov-86
2786	78.71	01-Jan-87
2786	99.04	25-Feb-87
2786	61.25	19-Mar-87
2786	107.04	08-May-87
2786	88.22	03-Jun-87
2786	115.15	08-Jul-87
2786	92.4	04-Aug-87
2786	74.5	03-Sep-87
2786	67.6	22-Sep-87
2786	100.7	21-Oct-87
2786	87.1	09-Nov-87
2786	70.1	22-Dec-87
2786	82.8	27-Jan-88
2786	70.5	29-Feb-88
2786	64.4	21-Mar-88
2786	99.3	18-Apr-88
2786	79.4	17-May-88
2786	.95	15-Jun-88
2786	77.1	15-Jul-88
2786	71.8	18-Aug-88
2786	109.6	15-Sep-88
2786	91.5	22-Oct-88
2786	73.9	15-Nov-88
2786	123.5	15-Dec-88
2786	84.8	15-Jan-89
2786	74	24-Feb-89
2786	70.6	31-Mar-89
2786	85.2	27-Apr-89
2786	75.9	26-May-89

APPENDIX C-8

Water Level Measurements of Wells In and Near OU8

Well No.	Depth from T.O.C.	DATE
2786	90.5	30-Jun-89
2786	76.4	28-Jul-89
2786	67.29	30-Aug-89
2786	63.44	11-Sep-89
2786	85.42	30-Oct-89
2786	81.82	17-Jan-90
2786	71.11	13-Feb-90
2786	79.2	24-Apr-90
2786	126.5	14-May-90
2786	86.08	10-Jul-90
2786	75.43	03-Aug-90
2786	83.56	01-Oct-90
2786	67.61	13-Nov-90
2786	87.91	04-Jan-91
2786	57.35	24-Apr-91
2786	94.65	10-Jun-91
2786	110.92	03-Jul-91
2786	95.12	23-Jul-91
2786	80.12	01-Oct-91
2786	77.16	08-Oct-91
2786	71.77	07-Jan-92
2786	66.31	27-Jan-92
2786	80.62	02-Apr-92
2886	10.54	12-Sep-86
2886	10.67	13-Sep-86
2886	10.36	15-Sep-86
2886	10.78	16-Sep-86
2886	10.8	17-Sep-86
2886	10.63	18-Sep-86
2886	9.1	13-Oct-86
2886	8.51	26-Nov-86
2886	8.79	01-Jan-87
2886	7	25-Feb-87
2886	3.25	19-Mar-87
2886	4.38	08-May-87
2886	5.73	03-Jun-87
2886	5.65	08-Jul-87
2886	7.4	04-Aug-87

Well No.	Depth from T.O.C.	DATE
2886	8	03-Sep-87
2886	8.9	21-Oct-87
2886	8.7	09-Nov-87
2886	8.7	22-Dec-87
2886	5.8	27-Jan-88
2886	5.6	29-Feb-88
2886	5.8	21-Mar-88
2886	5.7	18-Apr-88
2886	6.3	17-May-88
2886	6.1	15-Jun-88
2886	6.2	15-Jul-88
2886	6.5	18-Aug-88
2886	6.8	15-Sep-88
2886	7.5	22-Oct-88
2886	8.4	15-Nov-88
2886	8.5	15-Dec-88
2886	8.8	15-Jan-89
2886	7.9	24-Feb-89
2886	7.9	31-Mar-89
2886	7.3	27-Apr-89
2886	6.2	26-May-89
2886	6	30-Jun-89
2886	7.03	28-Jul-89
2886	7.13	30-Aug-89
2886	5.42	11-Sep-89
2886	7.2	30-Oct-89
2886	8.5	17-Jan-90
2886	8.75	13-Feb-90
2886	4.9	24-Apr-90
2886	5.7	15-May-90
2886	6.78	10-Jul-90
2886	6.84	03-Aug-90
2886	7.14	10-Aug-90
2886	7.61	05-Sep-90
2886	8.06	01-Oct-90
2886	8.61	02-Nov-90
2886	7.51	13-Nov-90
2886	8.99	04-Jan-91

Well No.	Depth from T.O.C.	DATE
2886	8.43	23-Apr-91
2886	5.99	07-Jun-91
2886	6.13	10-Jun-91
2886	6.98	03-Jul-91
2886	7.38	23-Jul-91
2886	7.48	02-Aug-91
2886	7.95	04-Sep-91
2886	8.48	01-Oct-91
2886	8.65	09-Oct-91
2886	8.95	01-Nov-91
2886	7.45	03-Dec-91
2886	8.11	07-Jan-92
2886	8.34	27-Jan-92
2886	8.46	06-Feb-92
2886	8.9	02-Mar-92
2886	4.75	02-Apr-92
2986	-1	12-Sep-86
2986	-1	24-Sep-86
2986	-1	13-Oct-86
2986	-1	26-Nov-86
2986	-1	01-Jan-87
2986	-1	25-Feb-87
2986	-1	19-Mar-87
2986	8.85	08-May-87
2986	9.82	03-Jun-87
2986	-1	08-Jul-87
2986	-1	04-Aug-87
2986	-1	03-Sep-87
2986	-1	21-Oct-87
2986	-1	09-Nov-87
2986	-1	22-Dec-87
2986	-1	27-Jan-88
2986	-1	29-Feb-88
2986	-1	21-Mar-88
2986	-1	18-Apr-88
2986	8.3	15-Jun-88
2986	10.2	15-Jul-88
2986	-1	18-Aug-88

APPENDIX C-8

Water Level Measurements of Wells In and Near OU8

Well No.	Depth from T.O.C.	DATE
2986	10.2	15-Sep-88
2986	-1	22-Oct-88
2986	-1	15-Nov-88
2986	-1	15-Dec-88
2986	-1	15-Jan-89
2986	-1	24-Feb-89
2986	-1	31-Mar-89
2986	10.2	27-Apr-89
2986	10.1	26-May-89
2986	10	30-Jun-89
2986	-1	28-Jul-89
2986	-1	30-Aug-89
2986	-1	11-Sep-89
2986	-1	30-Oct-89
2986	-1	17-Jan-90
2986	7.65	24-Apr-90
2986	8.82	16-May-90
2986	DRY	10-Jul-90
2986	DRY	02-Aug-90
2986	DRY	10-Aug-90
2986	DRY	05-Sep-90
2986	DRY	01-Oct-90
2986	DRY	19-Oct-90
2986	DRY	02-Nov-90
2986	DRY	04-Jan-91
2986	DRY	04-Jan-91
2986	8.96	07-Jun-91
2986	9.05	10-Jun-91
2986	DRY	03-Jul-91
2986	DRY	02-Aug-91
2986	DRY	04-Sep-91
2986	10.6	01-Oct-91
2986	DRY	01-Oct-91
2986	DRY	04-Nov-91
2986	DRY	03-Dec-91
2986	DRY	07-Jan-92
2986	DRY	06-Feb-92
2986	DRY	02-Mar-92

Well No.	Depth from T.O.C.	DATE
2986	7.43	02-Apr-92
3086	12.33	12-Sep-86
3086	11.94	13-Sep-86
3086	8.67	15-Sep-86
3086	9.67	16-Sep-86
3086	8.87	17-Sep-86
3086	8.66	18-Sep-86
3086	8.14	19-Sep-86
3086	5.07	13-Oct-86
3086	6.21	26-Nov-86
3086	9.33	01-Jan-87
3086	5.9	25-Feb-87
3086	4.58	23-Mar-87
3086	4.79	08-May-87
3086	5.62	03-Jun-87
3086	5.7	08-Jul-87
3086	6.5	04-Aug-87
3086	6.1	03-Sep-87
3086	6.1	23-Sep-87
3086	6.4	21-Oct-87
3086	6.5	09-Nov-87
3086	6.5	17-Nov-87
3086	6.4	22-Dec-87
3086	5.9	01-Feb-88
3086	5.1	29-Feb-88
3086	5	21-Mar-88
3086	4.9	18-Apr-88
3086	5.3	15-Jun-88
3086	5.8	15-Jul-88
3086	5.9	18-Aug-88
3086	5.7	15-Sep-88
3086	5.6	22-Oct-88
3086	5.8	15-Nov-88
3086	5.4	15-Dec-88
3086	6.2	15-Jan-89
3086	5.5	24-Feb-89
3086	4.1	31-Mar-89
3086	4.4	27-Apr-89

Well No.	Depth from T.O.C.	DATE
3086	4.4	26-May-89
3086	4.5	30-Jun-89
3086	5.35	28-Jul-89
3086	5.45	30-Aug-89
3086	5.29	12-Sep-89
3086	5.47	08-Nov-89
3086	5.6	17-Jan-90
3086	5.53	07-Feb-90
3086	4.58	25-Apr-90
3086	5.01	31-May-90
3086	5.65	10-Jul-90
3086	5.42	14-Aug-90
3086	6.17	02-Oct-90
3086	5.61	04-Jan-91
3086	5.35	29-Apr-91
3086	3.95	29-May-91
3086	4.93	05-Jul-91
3086	5.85	06-Aug-91
3086	4.85	01-Oct-91
3086	6.73	10-Oct-91
3086	6.07	07-Jan-92
3086	5.78	28-Jan-92
3086	3.93	02-Apr-92
3186	-1	12-Sep-86
3186	-1	13-Oct-86
3186	-1	09-Nov-86
3186	-1	26-Nov-86
3186	-1	01-Jan-87
3186	-1	25-Feb-87
3186	-1	23-Mar-87
3186	-1	08-May-87
3186	-1	03-Jun-87
3186	-1	08-Jul-87
3186	-1	04-Aug-87
3186	-1	03-Sep-87
3186	-1	24-Sep-87
3186	-1	21-Oct-87
3186	-1	09-Nov-87

APPENDIX C-8

Water Level Measurements of Wells In and Near OU8

Well No.	Depth from T.O.C.	DATE
3186	-1	22-Dec-87
3186	-1	01-Feb-88
3186	-1	29-Feb-88
3186	-1	21-Mar-88
3186	-1	18-Apr-88
3186	16.9	15-Jun-88
3186	-1	15-Jul-88
3186	-1	18-Aug-88
3186	-1	15-Sep-88
3186	-1	22-Oct-88
3186	-1	15-Nov-88
3186	-1	15-Dec-88
3186	-1	15-Jan-89
3186	-1	24-Feb-89
3186	-1	31-Mar-89
3186	-1	27-Apr-89
3186	19.4	26-May-89
3186	-1	30-Jun-89
3186	-1	28-Jul-89
3186	-1	30-Aug-89
3186	-1	12-Sep-89
3186	-1	14-Nov-89
3186	-1	17-Jan-90
3186	DRY	25-Apr-90
3186	DRY	07-May-90
3186	DRY	10-Jul-90
3186	DRY	25-Jul-90
3186	DRY	02-Oct-90
3186	DRY	25-Oct-90
3186	DRY	04-Jan-91
3186	DRY	04-Jan-91
3186	DRY	11-Jun-91
3186	DRY	03-Jul-91
3186	19.7	01-Oct-91
3186	DRY	01-Oct-91
3186	DRY	08-Jan-92
3186	DRY	02-Apr-92
3286	54	22-Sep-86

Well No.	Depth from T.O.C.	DATE
3286	66.34	13-Oct-86
3286	103.5	17-Oct-86
3286	101.52	21-Oct-86
3286	89.67	28-Oct-86
3286	89.2	04-Nov-86
3286	112.6	05-Nov-86
3286	119.77	06-Nov-86
3286	115.89	07-Nov-86
3286	72.32	26-Nov-86
3286	54.92	01-Jan-87
3286	53.77	25-Feb-87
3286	53.33	23-Mar-87
3286	110	24-Mar-87
3286	64.33	08-May-87
3286	55.74	03-Jun-87
3286	82.1	08-Jul-87
3286	57	04-Aug-87
3286	54.4	03-Sep-87
3286	58.3	21-Oct-87
3286	54.4	09-Nov-87
3286	54.4	17-Nov-87
3286	54.1	22-Dec-87
3286	54.8	01-Feb-88
3286	54	29-Feb-88
3286	54.7	21-Mar-88
3286	57.2	18-Apr-88
3286	55.7	15-Jun-88
3286	54.3	15-Jul-88
3286	53.8	18-Aug-88
3286	61.7	15-Sep-88
3286	55.8	22-Oct-88
3286	54.1	15-Nov-88
3286	74.5	15-Dec-88
3286	54.5	15-Jan-89
3286	53.7	24-Feb-89
3286	53.5	31-Mar-89
3286	54.7	27-Apr-89
3286	53.8	26-May-89

Well No.	Depth from T.O.C.	DATE
3286	59.5	30-Jun-89
3286	54.25	28-Jul-89
3286	53.6	30-Aug-89
3286	53.5	12-Sep-89
3286	54.65	14-Nov-89
3286	54.14	17-Jan-90
3286	53.16	12-Mar-90
3286	55.51	25-Apr-90
3286	65.51	10-Jul-90
3286	53.93	31-Aug-90
3286	58.42	02-Oct-90
3286	55.1	23-Oct-90
3286	54.3	04-Jan-91
3286	53.03	25-Apr-91
3286	57.55	30-May-91
3286	59.06	03-Jul-91
3286	54.71	06-Aug-91
3286	55.43	01-Oct-91
3286	54.9	14-Oct-91
3286	54.12	08-Jan-92
3286	53.43	03-Mar-92
3286	59.09	02-Apr-92
3286	53.12	21-Jun-92
3386	-1	12-Sep-86
3386	-1	13-Oct-86
3386	-1	26-Nov-86
3386	-1	01-Jan-87
3386	-1	25-Feb-87
3386	-1	24-Mar-87
3386	-1	08-May-87
3386	-1	03-Jun-87
3386	-1	08-Jul-87
3386	-1	04-Aug-87
3386	-1	03-Sep-87
3386	-1	24-Sep-87
3386	-1	21-Oct-87
3386	-1	09-Nov-87
3386	-1	01-Dec-87

APPENDIX C-8

Water Level Measurements of Wells In and Near OU8

Well No.	Depth from T.O.C.	DATE
3386	-1	21-Dec-87
3386	-1	11-Jan-88
3386	-1	29-Feb-88
3386	-1	21-Mar-88
3386	-1	18-Apr-88
3386	-1	15-Jun-88
3386	8.5	15-Jul-88
3386	-1	18-Aug-88
3386	-1	15-Sep-88
3386	-1	22-Oct-88
3386	-1	15-Nov-88
3386	-1	15-Dec-88
3386	-1	15-Jan-89
3386	-1	24-Feb-89
3386	-1	31-Mar-89
3386	-1	27-Apr-89
3386	-1	25-May-89
3386	-1	30-Jun-89
3386	-1	28-Jul-89
3386	-1	30-Aug-89
3386	-1	12-Sep-89
3386	-1	16-Nov-89
3386	-1	17-Jan-90
3386	6.64	24-Apr-90
3386	7.08	17-May-90
3386	8.29	11-Jul-90
3386	DRY	03-Aug-90
3386	DRY	01-Oct-90
3386	DRY	07-Nov-90
3386	DRY	04-Jan-91
3386	DRY	04-Jan-91
3386	6.15	11-Jun-91
3386	8.1	03-Jul-91
3386	DRY	05-Aug-91
3386	9.2	01-Oct-91
3386	DRY	01-Oct-91
3386	DRY	05-Mar-92
3386	5.97	02-Apr-92
3887	9.95	16-Nov-89

Well No.	Depth from T.O.C.	DATE
3787	6.9	12-Nov-87
3787	6.6	22-Dec-87
3787	6.8	27-Jan-88
3787	6.3	29-Feb-88
3787	7	21-Mar-88
3787	6.6	18-Apr-88
3787	7	17-May-88
3787	6.7	15-Jun-88
3787	9.3	15-Jun-88
3787	6.5	15-Jul-88
3787	6.7	18-Aug-88
3787	7	15-Sep-88
3787	7.5	22-Oct-88
3787	8.4	15-Nov-88
3787	8.6	15-Dec-88
3787	8.8	15-Jan-89
3787	7.8	24-Feb-89
3787	7.8	31-Mar-89
3787	6.9	27-Apr-89
3787	6.2	26-May-89
3787	6.5	30-Jun-89
3787	7.09	28-Jul-89
3787	7.1	30-Aug-89
3787	6.33	11-Sep-89
3787	8	20-Nov-89
3787	8.98	17-Jan-90
3787	6.21	05-Mar-90
3787	5.96	24-Apr-90
3787	6.08	02-May-90
3787	6.87	10-Jul-90
3787	7.4	10-Aug-90
3787	7.42	21-Aug-90
3787	7.72	05-Sep-90
3787	8.13	01-Oct-90
3787	8.5	16-Oct-90
3787	8.67	02-Nov-90
3787	9.3	04-Jan-91
3787	6.53	03-Jun-91
3987BR	85.7	26-May-89

Well No.	Depth from T.O.C.	DATE
3787	6.53	04-Jun-91
3787	6.92	19-Jun-91
3787	7.2	03-Jul-91
3787	7.49	30-Jul-91
3787	8.59	02-Aug-91
3787	7.9	04-Sep-91
3787	8.74	01-Oct-91
3787	8.94	09-Oct-91
3787	9.44	01-Nov-91
3787	7.5	03-Dec-91
3787	8.01	07-Jan-92
3787	8.35	22-Jan-92
3787	8.43	06-Feb-92
3787	8.96	26-Feb-92
3787	9.15	02-Mar-92
3787	5.92	02-Apr-92
3887	8.3	12-Nov-87
3887	8.2	21-Dec-87
3887	-1	27-Jan-88
3887	-1	29-Feb-88
3887	-1	21-Mar-88
3887	-1	18-Apr-88
3887	-1	17-May-88
3887	9.7	15-Jul-88
3887	9.7	18-Aug-88
3887	9.4	15-Sep-88
3887	9.8	22-Oct-88
3887	10.4	15-Nov-88
3887	10.6	15-Dec-88
3887	10.6	15-Jan-89
3887	10.6	24-Feb-89
3887	10.6	31-Mar-89
3887	10.6	27-Apr-89
3887	9.3	26-May-89
3887	8.9	30-Jun-89
3887	9.46	28-Jul-89
3887	9.55	30-Aug-89
3887	9.65	11-Sep-89
4386	17.5	27-Mar-89

APPENDIX C-8

Water Level Measurements of Wells In and Near OU8

Well No.	Depth from T.O.C.	DATE
3887	10.8	17-Jan-90
3887	10.95	23-Feb-90
3887	8.72	24-Apr-90
3887	9.22	23-May-90
3887	9.67	10-Jul-90
3887	9.93	23-Aug-90
3887	10.34	04-Oct-90
3887	10.55	08-Nov-90
3887	10.8	04-Jan-91
3887	11.02	24-Apr-91
3887	9.18	04-Jun-91
3887	9.54	03-Jul-91
3887	10.02	30-Jul-91
3887	11.41	01-Oct-91
3887	11.78	10-Oct-91
3887	10.17	07-Jan-92
3887	10.4	21-Jan-92
3887	10.4	21-Jan-92
3887	8.47	03-Apr-92
3987BR	23.9	12-Nov-87
3987BR	23.6	22-Dec-87
3987BR	40.2	01-Feb-88
3987BR	46.6	29-Feb-88
3987BR	108.6	21-Mar-88
3987BR	86	18-Apr-88
3987BR	86.5	16-May-88
3987BR	101.6	15-Jun-88
3987BR	99.1	15-Jul-88
3987BR	86.8	18-Aug-88
3987BR	102.5	15-Sep-88
3987BR	95	22-Oct-88
3987BR	83.9	15-Nov-88
3987BR	109.8	15-Dec-88
3987BR	89.9	15-Jan-89
3987BR	83.2	24-Feb-89
3987BR	82	31-Mar-89
3987BR	91.6	27-Apr-89

Well No.	Depth from T.O.C.	DATE
3987BR	94.3	30-Jun-89
3987BR	85.55	28-Jul-89
3987BR	78.9	30-Aug-89
3987BR	110.45	12-Sep-89
3987BR	82.37	20-Nov-89
3987BR	92.6	17-Jan-90
3987BR	91.6	30-Jan-90
4386	-1	10-Oct-86
4386	-1	13-Oct-86
4386	16.76	26-Nov-86
4386	18.33	01-Jan-87
4386	16.75	01-Feb-87
4386	15.42	11-Mar-87
4386	13.1	08-May-87
4386	14.87	02-Jun-87
4386	14.2	07-Jul-87
4386	16.1	27-Jul-87
4386	16.8	04-Aug-87
4386	16.5	01-Sep-87
4386	18	29-Sep-87
4386	18.3	03-Nov-87
4386	16.75	01-Dec-87
4386	-1	21-Dec-87
4386	-1	11-Jan-88
4386	17.1	29-Feb-88
4386	16.9	21-Mar-88
4386	16.2	18-Apr-88
4386	17	16-May-88
4386	17	15-Jun-88
4386	18.1	15-Jul-88
4386	18.2	18-Aug-88
4386	18.2	15-Sep-88
4386	-1	22-Oct-88
4386	-1	15-Nov-88
4386	-1	15-Dec-88
4386	-1	15-Jan-89
4386	18.4	14-Feb-89

Well No.	Depth from T.O.C.	DATE
4386	17.5	27-Apr-89
4386	17.8	28-May-89
4386	16	30-Jun-89
4386	18.11	21-Jul-89
4386	17.47	30-Aug-89
4386	17.83	12-Sep-89
4386	-1	06-Dec-89
4386	-1	15-Jan-90
4386	13.45	12-Apr-90
4386	16.02	05-Jun-90
4386	17.92	10-Jul-90
4386	17.38	09-Aug-90
4386	DRY	13-Aug-90
4386	18.23	10-Sep-90
4386	18.19	01-Oct-90
4386	18.41	11-Oct-90
4386	DRY	06-Nov-90
4386	18.36	07-Dec-90
4386	DRY	02-Jan-91
4386	DRY	02-Jan-91
4386	DRY	02-Apr-91
4386	16.21	07-May-91
4386	13.85	11-Jun-91
4386	15.99	02-Jul-91
4386	17.25	06-Aug-91
4386	15.98	19-Aug-91
4386	17.35	04-Sep-91
4386	18.73	04-Oct-91
4386	DRY	04-Oct-91
4386	DRY	08-Nov-91
4386	15.75	03-Dec-91
4386	17.51	03-Jan-92
4386		03-Feb-92
4386	DRY	03-Mar-92
4386	DRY	05-Mar-92
4386	12.9	08-Apr-92
4486	5.8	10-Nov-86

APPENDIX C-8

Water Level Measurements of Wells In and Near OU8

Well No.	Depth from T.O.C.	DATE
4486	6.62	13-Nov-86
4486	8.5	01-Jan-87
4486	9.08	08-May-87
4486	6.89	02-Jun-87
4486	6.15	08-Jul-87
4486	8.7	04-Aug-87
4486	9.6	21-Aug-87
4486	9.1	01-Sep-87
4486	10.7	29-Sep-87
4486	11.6	02-Nov-87
4486	11.6	11-Nov-87
4486	12	21-Dec-87
4486	12	11-Jan-88
4486	6.7	29-Feb-88
4486	6.5	21-Mar-88
4486	6.2	18-Apr-88
4486	6.9	16-May-88
4486	7.3	15-Jun-88
4486	7.7	15-Jul-88
4486	8	18-Aug-88
4486	7.2	15-Sep-88
4486	11.8	22-Oct-88
4486	9.1	15-Nov-88
4486	14.5	15-Dec-88
4486	8.4	15-Jan-89
4486	6.8	17-Feb-89
4486	6.8	27-Mar-89
4486	6.8	27-Apr-89
4486	6.2	19-May-89
4486	6.4	29-Jun-89
4486	7.8	14-Jul-89
4486	7.87	25-Aug-89
4486	5.85	13-Sep-89
4486	13.87	06-Dec-89
4486	12.97	16-Jan-90
4486	5.6	23-Mar-90
4486	5.98	12-Apr-90
4486	7.72	14-Jun-90
4486	6.68	10-Jul-90
4486	6.91	15-Aug-90
4486	7.15	27-Aug-90
4486	7.64	14-Sep-90
4486	7.32	04-Oct-90
4486	7.33	05-Nov-90
4486	8.1	07-Dec-90
4486	8.22	11-Dec-90
4486	14.43	03-Jan-91
4486	7.61	18-Mar-91
4486	7.27	02-Apr-91
4486	5.69	06-May-91
4486	5.87	07-Jun-91
4486	6.67	20-Jun-91
4486	7.65	05-Jul-91
4486	6.1	08-Aug-91
4486	6.38	14-Aug-91
4486	7.87	03-Sep-91
4486	8.87	04-Oct-91
4486	8.51	04-Nov-91
4486	7.68	08-Nov-91
4486	6.44	07-Dec-91
4486	8.61	09-Jan-92
4486	8.23	03-Feb-92
4486	8.24	05-Feb-92
4486	6.8	05-Mar-92
4486	6.25	06-Apr-92
5687	6.7	29-Feb-88
5687	7.8	21-Mar-88
5687	6.7	18-Apr-88
5687	6.2	17-May-88
5687	6.4	15-Jun-88
5687	6.4	15-Jul-88
5687	6.5	18-Aug-88
5687	7.8	15-Sep-88
5687	7.7	22-Oct-88
5687	8.1	15-Nov-88
5687	8.2	15-Dec-88
5687	8.4	15-Jan-89
5687	7.8	24-Feb-89
5687	7.6	31-Mar-89
5687	7	27-Apr-89
5687	6.5	26-May-89
5687	6.4	30-Jun-89
5687	6.88	28-Jul-89
5687	6.41	30-Aug-89
5687	7.53	11-Sep-89
5687	8.2	20-Nov-89
5687	9.21	17-Jan-90
5687	9.1	15-Feb-90
5687	6.82	25-Apr-90
5687	6.72	10-May-90
5687	7.84	11-Jul-90
5687	7.49	31-Jul-90
5687	9.32	10-Aug-90
5687	8.11	05-Sep-90
5687	7.8	02-Oct-90
5687	8.01	22-Oct-90
5687	9.68	02-Nov-90
5687	8.98	04-Jan-91
5687	9.7	08-Jan-91
5687	7.52	29-May-91
5687	9.32	07-Jun-91
5687	7.46	03-Jul-91
5687	7.45	23-Jul-91
5687	9.39	02-Aug-91
5687	7.44	04-Sep-91
5687	7.94	01-Oct-91
5687	7.97	03-Oct-91
5687	9.23	04-Nov-91
5687	8.18	03-Dec-91
5687	8.24	07-Jan-92
5687	8.31	09-Jan-92
5687	9.23	06-Feb-92
5687	9.08	02-Mar-92
5687	7.08	02-Apr-92

APPENDIX C-8

Water Level Measurements of Wells In and Near OU8

Well No.	Depth from T.O.C.	DATE
5687	6.93	06-Apr-92
6186	10.5	12-Dec-86
6186	10.93	15-Dec-86
6186	10.13	01-Jan-87
6186	8.33	10-Mar-87
6186	9.04	08-May-87
6186	-1	03-Jun-87
6186	10.85	24-Jun-87
6186	9.8	08-Jul-87
6186	10.2	06-Aug-87
6186	9.3	25-Aug-87
6186	9.9	01-Sep-87
6186	9.1	28-Oct-87
6186	8.8	02-Nov-87
6186	9.1	21-Dec-87
6186	9.3	11-Jan-88
6186	10.82	04-Feb-88
6186	9.9	29-Feb-88
6186	9.9	21-Mar-88
6186	9.4	18-Apr-88
6186	10	16-May-88
6186	10.1	15-Jun-88
6186	8.5	15-Jul-88
6186	10.2	18-Aug-88
6186	10	15-Sep-88
6186	10.5	22-Oct-88
6186	10	15-Nov-88
6186	10.4	15-Dec-88
6186	10.4	15-Jan-89
6186	6.9	17-Feb-89
6186	9.9	27-Mar-89
6186	10.9	27-Apr-89
6186	8.5	19-May-89
6186	10	29-Jun-89
6186	10.18	21-Jul-89
6186	9.43	25-Aug-89
6186	9.05	14-Sep-89
6186	10.3	06-Dec-89

Well No.	Depth from T.O.C.	DATE
6186	10.35	18-Jan-90
6186	7.75	23-Mar-90
6186	9.14	26-Apr-90
6186	9.82	18-May-90
6186	9.78	11-Jul-90
6186	9.82	03-Aug-90
6186	9.89	15-Aug-90
6186	9.86	07-Sep-90
6186	9.84	03-Oct-90
6186	10.28	02-Nov-90
6186	10.37	13-Dec-90
6186	10.86	04-Jan-91
6186	9.98	12-Jun-91
6186	9.92	03-Jul-91
6186	9.53	05-Aug-91
6186	9.33	07-Aug-91
6186	10.2	05-Sep-91
6186	9.9	02-Oct-91
6186	10.3	17-Oct-91
6186	9.49	04-Nov-91
6186	9.32	03-Dec-91
6186	10.29	07-Jan-92
6186	9.75	21-Jan-92
6186	9.75	21-Jan-92
6186	10.27	06-Feb-92
6186	10.49	02-Mar-92
6186	8.88	06-Apr-92
P114789	10.66	15-Jan-90
P114789	8.13	25-Apr-90
P114789	9	12-Jul-90
P114789	9.6	09-Aug-90
P114789	9.59	10-Sep-90
P114789	9.87	03-Oct-90
P114789	9.52	05-Nov-90
P114789	10.3	04-Dec-90
P114789	11.51	03-Jan-91
P114789	10.23	02-Apr-91
P114789	8.61	01-May-91

Well No.	Depth from T.O.C.	DATE
P114789	7.87	07-Jun-91
P114789	9.48	02-Jul-91
P114789	7.64	08-Aug-91
P114789	9.63	04-Sep-91
P114789	9.67	04-Oct-91
P114789	9.13	04-Nov-91
P114789	7.86	02-Dec-91
P114789	9.44	02-Jan-92
P114789	9.3	03-Feb-92
P114789	10.01	02-Mar-92
P114789	7.35	01-Apr-92
P114889	10.04	19-Jan-90
P114889	7.33	25-Apr-90
P114889	5.78	11-Jul-90
P114889	5.6	09-Aug-90
P114889	5.62	10-Sep-90
P114889	5.71	03-Oct-90
P114889	6.35	05-Nov-90
P114889	6.98	04-Dec-90
P114889	7.53	03-Jan-91
P114889	7.35	02-Apr-91
P114889	6.83	01-May-91
P114889	5.84	11-Jun-91
P114889	5.44	02-Jul-91
P114889	5.18	08-Aug-91
P114889	5.22	04-Sep-91
P114889	5.57	04-Oct-91
P114889	6.13	04-Nov-91
P114889	6.56	02-Dec-91
P114889	6.93	02-Jan-92
P114889	7.17	03-Feb-92
P114889	7.04	02-Mar-92
P114889	6.62	01-Apr-92
P115489	11.97	15-Jan-90
P115489	9.47	12-Jul-90
P115489	9.7	09-Aug-90
P115489	10.23	11-Sep-90
P115489	10.87	04-Oct-90

APPENDIX C-8

Water Level Measurements of Wells In and Near OU8

Well No.	Depth from T.O.C.	DATE
5687	6.93	06-Apr-92
6186	10.5	12-Dec-86
6186	10.93	15-Dec-86
6186	10.13	01-Jan-87
6186	8.33	10-Mar-87
6186	9.04	08-May-87
6186	-1	03-Jun-87
6186	10.85	24-Jun-87
6186	9.8	08-Jul-87
6186	10.2	06-Aug-87
6186	9.3	25-Aug-87
6186	9.9	01-Sep-87
6186	9.1	28-Oct-87
6186	8.8	02-Nov-87
6186	9.1	21-Dec-87
6186	9.3	11-Jan-88
6186	10.82	04-Feb-88
6186	9.9	29-Feb-88
6186	9.9	21-Mar-88
6186	9.4	18-Apr-88
6186	10	16-May-88
6186	10.1	15-Jun-88
6186	8.5	15-Jul-88
6186	10.2	18-Aug-88
6186	10	15-Sep-88
6186	10.5	22-Oct-88
6186	10	15-Nov-88
6186	10.4	15-Dec-88
6186	10.4	15-Jan-89
6186	6.9	17-Feb-89
6186	9.9	27-Mar-89
6186	10.9	27-Apr-89
6186	8.5	19-May-89
6186	10	29-Jun-89
6186	10.18	21-Jul-89
6186	9.43	25-Aug-89
6186	9.05	14-Sep-89
6186	10.3	06-Dec-89

Well No.	Depth from T.O.C.	DATE
6186	10.35	18-Jan-90
6186	7.75	23-Mar-90
6186	9.14	26-Apr-90
6186	9.82	18-May-90
6186	9.78	11-Jul-90
6186	9.82	03-Aug-90
6186	9.89	15-Aug-90
6186	9.86	07-Sep-90
6186	9.84	03-Oct-90
6186	10.28	02-Nov-90
6186	10.37	13-Dec-90
6186	10.86	04-Jan-91
6186	9.98	12-Jun-91
6186	9.92	03-Jul-91
6186	9.53	05-Aug-91
6186	9.33	07-Aug-91
6186	10.2	05-Sep-91
6186	9.9	02-Oct-91
6186	10.3	17-Oct-91
6186	9.49	04-Nov-91
6186	9.32	03-Dec-91
6186	10.29	07-Jan-92
6186	9.75	21-Jan-92
6186	9.75	21-Jan-92
6186	10.27	06-Feb-92
6186	10.49	02-Mar-92
6186	8.88	06-Apr-92
P114789	10.66	15-Jan-90
P114789	8.13	25-Apr-90
P114789	9	12-Jul-90
P114789	9.6	09-Aug-90
P114789	9.59	10-Sep-90
P114789	9.87	03-Oct-90
P114789	9.52	05-Nov-90
P114789	10.3	04-Dec-90
P114789	11.51	03-Jan-91
P114789	10.23	02-Apr-91
P114789	8.61	01-May-91

Well No.	Depth from T.O.C.	DATE
P114789	7.87	07-Jun-91
P114789	9.48	02-Jul-91
P114789	7.64	08-Aug-91
P114789	9.63	04-Sep-91
P114789	9.67	04-Oct-91
P114789	9.13	04-Nov-91
P114789	7.86	02-Dec-91
P114789	9.44	02-Jan-92
P114789	9.3	03-Feb-92
P114789	10.01	02-Mar-92
P114789	7.35	01-Apr-92
P114889	10.04	19-Jan-90
P114889	7.33	25-Apr-90
P114889	5.78	11-Jul-90
P114889	5.6	09-Aug-90
P114889	5.62	10-Sep-90
P114889	5.71	03-Oct-90
P114889	6.35	05-Nov-90
P114889	6.98	04-Dec-90
P114889	7.53	03-Jan-91
P114889	7.35	02-Apr-91
P114889	6.83	01-May-91
P114889	5.84	11-Jun-91
P114889	5.44	02-Jul-91
P114889	5.18	08-Aug-91
P114889	5.22	04-Sep-91
P114889	5.57	04-Oct-91
P114889	6.13	04-Nov-91
P114889	6.56	02-Dec-91
P114889	6.93	02-Jan-92
P114889	7.17	03-Feb-92
P114889	7.04	02-Mar-92
P114889	6.62	01-Apr-92
P115489	11.97	15-Jan-90
P115489	9.47	12-Jul-90
P115489	9.7	09-Aug-90
P115489	10.23	11-Sep-90
P115489	10.87	04-Oct-90

APPENDIX C-8

Water Level Measurements of Wells In and Near OU8

Well No.	Depth from T.O.C.	DATE
P115489	11.22	05-Nov-90
P115489	11.54	05-Dec-90
P115489	13.46	03-Jan-91
P115489	12.51	02-Apr-91
P115489	10.46	02-May-91
P115489	8.9	11-Jun-91
P115489	10.74	08-Jul-91
P115489	9.57	08-Aug-91
P115489	10.21	04-Sep-91
P115489	11.56	04-Oct-91
P115489	11.58	05-Nov-91
P115489	10.07	02-Dec-91
P115489	11.11	03-Jan-92
P115489	10.97	03-Feb-92
P115489	11.87	02-Mar-92
P115489	8.47	01-Apr-92
P115589	7.73	09-Jan-90
P115589	8.34	15-Jan-90
P115589	5.63	12-Jul-90
P115589	6.39	09-Aug-90
P115589	6.86	11-Sep-90
P115589	7.4	04-Oct-90
P115589	7.3	05-Nov-90
P115589	7.94	05-Dec-90
P115589	10	03-Jan-91
P115589	9.01	02-Apr-91
P115589	5.76	02-May-91
P115589	4.55	11-Jun-91
P115589	6.82	05-Jul-91
P115589	4.82	08-Aug-91
P115589	7.33	04-Sep-91
P115589	7.84	04-Oct-91
P115589	6.7	04-Nov-91
P115589	4.77	02-Dec-91
P115589	7.11	03-Jan-92
P115589	7.25	03-Feb-92
P115589	8.6	02-Mar-92
P115589	4.35	01-Apr-92

Well No.	Depth from T.O.C.	DATE
P115689	8.7	15-Sep-89
P115689	12.55	15-Jan-90
P115689	9.37	12-Jul-90
P115689	10.26	10-Aug-90
P115689	10.79	10-Sep-90
P115689	11.56	04-Oct-90
P115689	11.53	05-Nov-90
P115689	12.2	04-Dec-90
P115689	14.21	03-Jan-91
P115689	13.29	02-Apr-91
P115689	9.81	02-May-91
P115689	7.61	11-Jun-91
P115689	10.35	05-Jul-91
P115689	8.85	08-Aug-91
P115689	11.49	04-Sep-91
P115689	12.82	04-Oct-91
P115689	12.35	04-Nov-91
P115689	9.42	04-Dec-91
P115689	11.57	09-Jan-92
P115689	11.18	03-Feb-92
P115689	12.36	02-Mar-92
P115689	7.53	01-Apr-92
P207389	6.66	11-Sep-89
P207389	7.14	21-Sep-89
P207389	7.83	17-Jan-90
P207389	5.94	14-Mar-90
P207389	6.65	26-Apr-90
P207389	6.83	05-Jun-90
P207389	6.97	11-Jul-90
P207389	7.54	21-Aug-90
P207389	8.49	17-Dec-90
P207389	8.85	04-Jan-91
P207389	8.15	25-Mar-91
P207389	6.65	30-May-91
P207389	7.36	03-Jul-91
P207389	7.16	06-Aug-91
P207389	6.81	02-Oct-91
P207389	6.81	23-Oct-91

Well No.	Depth from T.O.C.	DATE
P207389	6.99	08-Jan-92
P207389	6.68	03-Mar-92
P207389	6.48	03-Apr-92
P207489	7.28	11-Sep-89
P207489	7.13	20-Sep-89
P207489	7.63	17-Jan-90
P207489	6	14-Mar-90
P207489	6.66	26-Apr-90
P207489	6.94	01-Jun-90
P207489	7.29	11-Jul-90
P207489	7.6	10-Aug-90
P207489	7.63	14-Aug-90
P207489	7.99	05-Sep-90
P207489	7.85	02-Nov-90
P207489	8.28	17-Dec-90
P207489	8.86	04-Jan-91
P207489	8.07	30-Apr-91
P207489	6.68	30-May-91
P207489	6.68	30-May-91
P207489	7.58	03-Jul-91
P207489	7.56	06-Aug-91
P207489	7.15	04-Sep-91
P207489	7.02	02-Oct-91
P207489	8.73	23-Oct-91
P207489	7.17	04-Nov-91
P207489	6.73	03-Dec-91
P207489	7.17	08-Jan-92
P207489	6.72	06-Feb-92
P207489	6.76	03-Mar-92
P207489	6.3	03-Apr-92
P207589	24.67	11-Sep-89
P207589	24.87	21-Sep-89
P207589	25.74	17-Jan-90
P207589	23.42	05-Mar-90
P207589	25.96	24-Apr-90
P207589	25.83	03-May-90
P207589	25.76	10-Jul-90
P207589	25.66	19-Jul-90

APPENDIX C-8

Water Level Measurements of Wells In and Near OU8

Well No.	Depth from T.O.C.	DATE
P207589	25.49	01-Oct-90
P207589	26.77	17-Dec-90
P207589	26.5	04-Jan-91
P207589	25.57	25-Mar-91
P207589	25.85	10-Jun-91
P207589	26.59	03-Jul-91
P207589	26.23	24-Jul-91
P207589	25.78	01-Oct-91
P207589	25.62	15-Oct-91
P207589	25.58	07-Jan-92
P207589	25.38	28-Jan-92
P207589	25.77	03-Apr-92
P207689	7.71	17-Jul-89
P207689	7.57	11-Sep-89
P207689	7.11	14-Sep-89
P207689	8.49	17-Jan-90
P207689	8.35	31-Jan-90
P207689	6.82	24-Apr-90
P207689	6.94	30-Apr-90
P207689	7.68	10-Jul-90
P207689	8.18	01-Oct-90
P207689	8.42	15-Oct-90
P207689	8.74	04-Jan-91
P207689	8.69	25-Mar-91
P207689	7.52	31-May-91
P207689	7.82	03-Jul-91
P207689	8.06	02-Aug-91
P207689	8.69	01-Oct-91
P207689	8.94	09-Oct-91
P207689	8.24	07-Jan-92
P207689	8.18	15-Jan-92
P207689	6.85	02-Apr-92
P207789	29.45	11-Sep-89
P207789	29.41	14-Sep-89
P207789	28.64	17-Jan-90
P207789	28.53	01-Feb-90
P207789	29.34	24-Apr-90
P207789	29.2	08-May-90
P207789	29.53	10-Jul-90
P207789	29.04	21-Aug-90
P207789	29.47	01-Oct-90
P207789	28.58	11-Dec-90
P207789	29.94	04-Jan-91
P207789	29.14	24-Apr-91
P207789	29.91	05-Jun-91
P207789	30.17	03-Jul-91
P207789	29.63	05-Aug-91
P207789	29.58	01-Oct-91
P207789	29.46	09-Oct-91
P207789	29.15	07-Jan-92
P207789	29	21-Jan-92
P207789	29	21-Jan-92
P207789	29.36	02-Apr-92
P207889	5.12	11-Sep-89
P207889	4.95	15-Sep-89
P207889	7.17	17-Jan-90
P207889	7.22	01-Feb-90
P207889	4.75	01-May-90
P207889	4.75	02-May-90
P207889	5.74	10-Jul-90
P207889	5.94	19-Jul-90
P207889	6.79	01-Oct-90
P207889	6.88	10-Oct-90
P207889	7.32	04-Jan-91
P207889	8.66	25-Mar-91
P207889	5.32	10-Jun-91
P207889	6.87	03-Jul-91
P207889	6.09	24-Jul-91
P207889	7.43	01-Oct-91
P207889	7.57	08-Oct-91
P207889	6.19	07-Jan-92
P207889	6.25	21-Jan-92
P207889	6.25	21-Jan-92
P207889	4.25	02-Apr-92
P207889	4.74	07-Apr-92
P207989	17.12	11-Sep-89
P207989	16.94	14-Sep-89
P207989	17.08	17-Jan-90
P207989	16.46	01-Feb-90
P207989	18.45	01-May-90
P207989	18.45	02-May-90
P207989	18.19	10-Jul-90
P207989	15.59	28-Aug-90
P207989	20.49	01-Oct-90
P207989	16.35	12-Dec-90
P207989	21.78	04-Jan-91
P207989	17.65	25-Mar-91
P207989	18.88	05-Jun-91
P207989	21.35	03-Jul-91
P207989	19.86	24-Jul-91
P207989	18.5	01-Oct-91
P207989	18.14	08-Oct-91
P207989	17.51	07-Jan-92
P207989	15.18	05-Mar-92
P207989	21.03	02-Apr-92
P207989	20.71	06-Apr-92
P208989	14.91	12-Sep-89
P208989	14.64	28-Sep-89
P208989	16.61	17-Jan-90
P208989	16.45	09-Mar-90
P208989	14.34	25-Apr-90
P208989	15.01	08-May-90
P208989	16.34	10-Jul-90
P208989	16.1	31-Jul-90
P208989	16.63	02-Oct-90
P208989	16.75	16-Oct-90
P208989	17.05	04-Jan-91
P208989	17.37	25-Mar-91
P208989	14.74	30-May-91
P208989	15.54	03-Jul-91
P208989	16.27	08-Aug-91
P208989	17.02	01-Oct-91
P208989	17.1	09-Oct-91
P208989	16.92	08-Jan-92

APPENDIX C-8

Water Level Measurements of Wells In and Near OU8

Well No.	Depth from T.O.C.	DATE
P208989	17.05	29-Jan-92
P208989	12.16	02-Apr-92
P209089	25.03	12-Sep-89
P209089	24.79	26-Sep-89
P209089	24.95	17-Jan-90
P209089	27.04	24-Apr-90
P209089	26.62	08-May-90
P209089	26.35	10-Jul-90
P209089	25.57	31-Jul-90
P209089	25.83	01-Oct-90
P209089	25.25	15-Oct-90
P209089	25.02	04-Jan-91
P209089	22.55	25-Mar-91
P209089	25.63	12-Jun-91
P209089	27.76	03-Jul-91
P209089	26.54	01-Aug-91
P209089	25.82	07-Oct-91
P209089	28.2	23-Oct-91
P209089	25.23	07-Jan-92
P209089	23	18-Mar-92
P209089	28.03	03-Apr-92
P209189	7.71	12-Sep-89
P209189	10.5	27-Sep-89
P209189	14.18	17-Jan-90
P209189	10.16	25-Apr-90
P209189	10.32	01-Jun-90
P209189	10.9	10-Jul-90
P209189	10.74	31-Aug-90
P209189	10.81	02-Oct-90
P209189	10.7	08-Nov-90
P209189	14.35	04-Jan-91
P209189	14.33	22-Mar-91
P209189	10.26	05-Jun-91
P209189	11.38	03-Jul-91
P209189	11.1	24-Jul-91
P209189	12.81	01-Oct-91
P209189	13.24	09-Oct-91
P209189	13.32	07-Jan-92

Well No.	Depth from T.O.C.	DATE
P209189	14.62	02-Mar-92
P209189	10.18	02-Apr-92
P209289	14.67	12-Sep-89
P209289	-1	25-Sep-89
P209289	-1	17-Jan-90
P209289	14.66	25-Apr-90
P209289	14.68	30-May-90
P209289	DRY	11-Jul-90
P209289	14.65	13-Aug-90
P209289	14.65	15-Aug-90
P209289	14.38	05-Sep-90
P209289	14.24	02-Oct-90
P209289	DRY	24-Oct-90
P209289	14.66	02-Nov-90
P209289	14.69	04-Jan-91
P209289	14.71	25-Mar-91
P209289	14.1	29-May-91
P209289	15.43	29-May-91
P209289	14.68	03-Jul-91
P209289	14.69	23-Jul-91
P209289	DRY	02-Aug-91
P209289	14.67	04-Sep-91
P209289	14.64	01-Oct-91
P209289	14.66	03-Oct-91
P209289	14.46	04-Nov-91
P209289	14.24	03-Dec-91
P209289	14.69	07-Jan-92
P209289	14.71	13-Jan-92
P209289	DRY	15-Jan-92
P209289	DRY	06-Feb-92
P209289	14.67	26-Feb-92
P209289	DRY	02-Mar-92
P209289	13.73	02-Apr-92
P209389	17.62	12-Sep-89
P209389	17.16	18-Sep-89
P209389	19.56	17-Jan-90
P209389	16.25	16-Mar-90
P209389	17.98	25-Apr-90

Well No.	Depth from T.O.C.	DATE
P209389	20.88	31-May-90
P209389	18.5	11-Jul-90
P209389	17.54	23-Aug-90
P209389	17.31	02-Oct-90
P209389	18.64	25-Oct-90
P209389	19.9	04-Jan-91
P209389	19.55	25-Mar-91
P209389	17.56	30-May-91
P209389	19.23	03-Jul-91
P209389	19.65	23-Jul-91
P209389	19.4	01-Oct-91
P209389	18.69	07-Oct-91
P209389	19.15	07-Jan-92
P209389	19.46	22-Jan-92
P209389	18.91	26-Feb-92
P209389	17.15	02-Apr-92
P209489	28.53	12-Sep-89
P209489	28.55	20-Sep-89
P209489	-1	17-Jan-90
P209489	27.87	25-Apr-90
P209489	28.52	31-May-90
P209489	28.68	10-Jul-90
P209489	28.58	15-Aug-90
P209489	28.65	02-Oct-90
P209489	28.88	25-Oct-90
P209489	29.35	04-Jan-91
P209489	29.95	25-Mar-91
P209489	28.58	03-Jul-91
P209489	29.58	01-Aug-91
P209489	29.01	01-Oct-91
P209489	29.32	15-Oct-91
P209489	29.41	07-Jan-92
P209489	29.6	29-Jan-92
P209489	26.5	02-Apr-92
P209589	16.68	12-Sep-89
P209589	16.59	19-Sep-89
P209589	17.99	17-Jan-90
P209589	17.62	30-Jan-90

APPENDIX C-8

Water Level Measurements of Wells In and Near OU8

Well No.	Depth from T.O.C.	DATE
P209589	17.9	25-Apr-90
P209589	16.55	24-May-90
P209589	19.02	10-Jul-90
P209589	20.78	28-Aug-90
P209589	19.79	02-Oct-90
P209589	18.49	06-Nov-90
P209589	19.27	04-Jan-91
P209589	17.58	25-Mar-91
P209589	18.74	05-Jun-91
P209589	19.99	03-Jul-91
P209589	18.7	31-Jul-91
P209589	18.73	01-Oct-91
P209589	18.78	03-Oct-91
P209589	18.63	07-Jan-92
P209589	18.54	09-Jan-92
P209589	18.36	02-Apr-92
P209689	26.47	13-Sep-89
P209689	28.19	17-Jan-90
P209689	27.6	15-Mar-90
P209689	29.11	25-Apr-90
P209689	28.99	30-Apr-90
P209689	28.63	10-Jul-90
P209689	28.49	19-Jul-90
P209689	28.41	01-Oct-90
P209689	28.4	02-Oct-90
P209689	28.3	10-Oct-90
P209689	28.02	04-Jan-91
P209689	28	07-Jan-91
P209689	28.44	25-Mar-91
P209689	28.98	04-Jun-91
P209689	27.15	12-Jun-91
P209689	29.28	03-Jul-91
P209689	28.81	31-Jul-91
P209689	28.58	01-Oct-91
P209689	28.19	07-Jan-92
P209689	28.02	21-Jan-92
P209689	28.02	21-Jan-92
P209689	28.45	02-Apr-92

Well No.	Depth from T.O.C.	DATE
P209789	5.18	13-Sep-89
P209789	8.82	17-Jan-90
P209789	3.34	15-Mar-90
P209789	5.07	25-Apr-90
P209789	5.53	04-May-90
P209789	7.11	10-Jul-90
P209789	6.65	24-Jul-90
P209789	8.42	01-Oct-90
P209789	8.85	19-Oct-90
P209789	9.92	04-Jan-91
P209789	10.36	22-Mar-91
P209789	6.59	07-Jun-91
P209789	7.42	03-Jul-91
P209789	7.59	01-Aug-91
P209789	9	01-Oct-91
P209789	9.41	11-Oct-91
P209789	8.42	07-Jan-92
P209789	8.89	20-Jan-92
P209789	8.89	20-Jan-92
P209789	4.7	02-Apr-92
P209889	4.68	12-Sep-89
P209889	5.22	26-Sep-89
P209889	5.15	17-Jan-90
P209889	4.52	09-Mar-90
P209889	4.43	25-Apr-90
P209889	4.5	23-May-90
P209889	5.06	10-Jul-90
P209889	5	22-Aug-90
P209889	4.98	02-Oct-90
P209889	5.15	29-Oct-90
P209889	5.46	04-Jan-91
P209889	5.02	25-Mar-91
P209889	4	04-Jun-91
P209889	4.51	03-Jul-91
P209889	4.47	06-Aug-91
P209889	5.25	01-Oct-91
P209889	5.34	14-Oct-91
P209889	5.01	07-Jan-92

Well No.	Depth from T.O.C.	DATE
P209889	5.21	22-Jan-92
P209889	5.3	27-Feb-92
P209889	4.49	02-Apr-92
P209989	-1	31-Aug-89
P209989	-1	11-Sep-89
P209989	-1	17-Jan-90
P209989	DRY	11-Apr-90
P209989	DRY	11-May-90
P209989	DRY	10-Jul-90
P209989	DRY	24-Jul-90
P209989	DRY	07-Aug-90
P209989	DRY	11-Sep-90
P209989	DRY	03-Oct-90
P209989	DRY	10-Oct-90
P209989	DRY	07-Nov-90
P209989	DRY	06-Dec-90
P209989	DRY	01-Apr-91
P209989	DRY	06-May-91
P209989	10.32	07-Jun-91
P209989	10.69	02-Jul-91
P209989	10.72	08-Jul-91
P209989	DRY	07-Aug-91
P209989	DRY	05-Sep-91
P209989	11.89	01-Oct-91
P209989	DRY	01-Oct-91
P209989	DRY	05-Nov-91
P209989	DRY	04-Dec-91
P209989	DRY	03-Jan-92
P209989	DRY	03-Feb-92
P209989	DRY	03-Mar-92
P209989	10.29	02-Apr-92
P210089	18.38	05-Sep-89
P210089	23.79	12-Sep-89
P210089	18.69	17-Jan-90
P210089	18.83	27-Feb-90
P210089	18.83	27-Feb-90
P210089	20.8	11-Apr-90
P210089	18.72	05-Jun-90

APPENDIX C-8

Water Level Measurements of Wells In and Near OU8

Well No.	Depth from T.O.C.	DATE
P210089	20.71	10-Jul-90
P210089	18.74	15-Aug-90
P210089	19.54	03-Oct-90
P210089	18.6	25-Oct-90
P210089	19.42	02-Jan-91
P210089	19.06	21-Jan-91
P210089	19.89	01-Apr-91
P210089	19.39	18-Apr-91
P210089	19.1	02-Jul-91
P210089	18.8	08-Jul-91
P210089	18.34	01-Oct-91
P210089	18.23	08-Oct-91
P210089	5.92	03-Jan-92
P210089	18.8	09-Jan-92
P210089	19.21	02-Apr-92
P210089	19.09	07-Apr-92
P210189	11.76	11-Sep-89
P210189	11.57	28-Sep-89
P210189	14.83	17-Jan-90
P210189	12.06	25-Apr-90
P210189	12.73	08-Jun-90
P210189	13.36	10-Jul-90
P210189	12.43	17-Aug-90
P210189	12.63	02-Oct-90
P210189	13.35	09-Nov-90
P210189	15.05	04-Jan-91
P210189	15.08	04-Jan-91
P210189	15.39	25-Mar-91
P210189	12.38	29-May-91
P210189	12.85	03-Jul-91
P210189	12.81	05-Aug-91
P210189	14.18	01-Oct-91
P210189	14.4	14-Oct-91
P210189	14.26	07-Jan-92
P210189	14.74	20-Jan-92
P210189	14.74	20-Jan-92
P210189	11.97	02-Apr-92
P210289	17.13	11-Sep-89
P214689	9.53	02-Dec-91

Well No.	Depth from T.O.C.	DATE
P210289	16.77	15-Sep-89
P210289	18.27	17-Jan-90
P210289	15.75	05-Mar-90
P210289	19.68	24-Apr-90
P210289	19.05	02-May-90
P210289	17.68	10-Jul-90
P210289	16.17	26-Jul-90
P210289	17.66	01-Oct-90
P210289	13.35	11-Dec-90
P210289	22.36	04-Jan-91
P210289	17.51	25-Mar-91
P210289	18.32	04-Jun-91
P210289	21.27	03-Jul-91
P210289	19.48	23-Jul-91
P210289	17.9	01-Oct-91
P210289		02-Apr-92
P213689	9.24	07-Oct-89
P213689	12.21	15-Jan-90
P213689	8.47	25-Apr-90
P213689	8.62	14-Aug-90
P213689	8.65	10-Sep-90
P213689	8.76	04-Oct-90
P213689	9.06	05-Nov-90
P213689	9.28	04-Dec-90
P213689	10.03	03-Jan-91
P213689	9.59	02-Apr-91
P213689	9.16	01-May-91
P213689	8.49	07-Jun-91
P213689	8.58	02-Jul-91
P213689	8.52	08-Aug-91
P213689	8.82	05-Sep-91
P213689	9.5	04-Nov-91
P213689	8.88	02-Dec-91
P213689	9.26	02-Jan-92
P213689	9.28	03-Feb-92
P213689	9.42	03-Mar-92
P213689	8.54	01-Apr-92
P214089	11.31	15-Jan-90
P218089	9.68	03-Jul-91

Well No.	Depth from T.O.C.	DATE
P214089	8.53	25-Apr-90
P214089	10.25	12-Jul-90
P214089	10.93	14-Aug-90
P214089	11.36	10-Sep-90
P214089	11.8	04-Oct-90
P214089	12.26	05-Nov-90
P214089	12.76	04-Dec-90
P214089	DRY	03-Jan-91
P214089	11.74	02-Apr-91
P214089	11.56	01-May-91
P214089	9.67	07-Jun-91
P214089	9.53	02-Jul-91
P214089	9.3	08-Aug-91
P214089	9.53	05-Sep-91
P214089	9.79	07-Oct-91
P214089	9.87	04-Nov-91
P214089	8.34	02-Dec-91
P214089	9	02-Jan-92
P214089	9.34	03-Feb-92
P214089	9.68	03-Mar-92
P214089	8.18	01-Apr-92
P214689	12.32	15-Jan-90
P214689	DRY	25-Apr-90
P214689	10.17	12-Jul-90
P214689	10.5	10-Aug-90
P214689	11.14	10-Sep-90
P214689	11.6	03-Oct-90
P214689	11.65	05-Nov-90
P214689	11.71	04-Dec-90
P214689	13.83	03-Jan-91
P214689	13.38	02-Apr-91
P214689	10.53	01-May-91
P214689	8.49	07-Jun-91
P214689	10.4	02-Jul-91
P214689	9.85	08-Aug-91
P214689	11.35	05-Sep-91
P214689	12.83	07-Oct-91
P214689	12.9	04-Nov-91
P219489	21.62	01-Oct-90

APPENDIX C-8

Water Level Measurements of Wells In and Near OU8

Well No.	Depth from T.O.C.	DATE
P214689	11.09	02-Jan-92
P214689	11.23	03-Feb-92
P214689	12.41	03-Mar-92
P214689	8.28	01-Apr-92
P215789	15.68	15-Jan-90
P215789	15.18	10-Aug-90
P215789	15.25	10-Sep-90
P215789	15.38	03-Oct-90
P215789	15.34	05-Nov-90
P215789	15.62	05-Dec-90
P215789	16.16	03-Jan-91
P215789	16.16	02-Apr-91
P215789	15.06	01-May-91
P215789	13.83	07-Jun-91
P215789	15.33	02-Jul-91
P215789	14.28	08-Aug-91
P215789	15.52	05-Sep-91
P215789	15.82	07-Oct-91
P215789	15.7	04-Nov-91
P215789	14.4	04-Dec-91
P215789	15.38	02-Jan-92
P215789	15.44	03-Feb-92
P215789	15.95	03-Mar-92
P215789	13.87	01-Apr-92
P218089	9.14	17-Jan-89
P218089	8.3	01-Dec-89
P218089	9.14	17-Jan-90
P218089	8.52	14-Feb-90
P218089	5.45	25-Apr-90
P218089	5.82	31-May-90
P218089	9.74	11-Jul-90
P218089	8.82	13-Aug-90
P218089	9.57	03-Oct-90
P218089	9.51	22-Oct-90
P218089	DRY	04-Jan-91
P218089	DRY	04-Jan-91
P218089	6.29	11-Jun-91

Well No.	Depth from T.O.C.	DATE
P218089	9.1	08-Aug-91
P218089	9.64	22-Aug-91
P218089	10.09	07-Oct-91
P218089	10.05	16-Oct-91
P218089	5.92	08-Jan-92
P218089	5.95	15-Jan-92
P218089	8.22	26-Feb-92
P218089	5.16	02-Apr-92
P218389	9.5	24-Apr-90
P218389	12.63	11-Jul-90
P218389	12.86	10-Aug-90
P218389	13.53	05-Sep-90
P218389	14.02	01-Oct-90
P218389	14.44	02-Nov-90
P218389	14.73	04-Jan-91
P218389	10.55	07-Jun-91
P218389	12.58	03-Jul-91
P218389	12.23	05-Aug-91
P218389	13.48	04-Sep-91
P218389	15.74	01-Oct-91
P218389	14.43	04-Nov-91
P218389	12.48	03-Dec-91
P218389	14.18	07-Jan-92
P218389	14.52	06-Feb-92
P218389	14.76	02-Mar-92
P218389	8.83	02-Apr-92
P219189	-1	17-Jan-90
P219189	14.2	25-Apr-90
P219189	12.86	11-Jul-90
P219189	12.05	03-Oct-90
P219189	12.9	04-Jan-91
P219189	10.55	03-Jul-91
P219189	10.05	08-Jan-92
P219189	9.77	02-Apr-92
P219489	-1	19-Jan-90
P219489	24.34	25-Apr-90
P219489	22.99	11-Jul-90

Well No.	Depth from T.O.C.	DATE
P219489	20.43	04-Jan-91
P219489	16.93	03-Jul-91
P219489	15.74	01-Oct-91
P219489	14.88	07-Jan-92
P219489	14.48	02-Apr-92
P219589	-1	17-Jan-90
P219589	DRY	24-Apr-90
P219589	DRY	11-Jul-90
P219589	27.41	01-Oct-90
P219589	26.65	04-Jan-91
P219589	25.61	03-Jul-91
P219589	24.93	01-Oct-91
P219589	24.35	07-Jan-92
P219589	23.94	02-Apr-92
P220089	9.66	16-Apr-90
P220089	12.48	07-Jun-90
P220089	13.15	12-Jul-90
P220089	14.12	24-Sep-90
P220089	14.58	04-Oct-90
P220089	14.3	30-Nov-90
P220089	15.64	04-Jan-91
P220089	15.32	19-Mar-91
P220089	15.41	02-Apr-91
P220089	9.84	12-Jun-91
P220089	12.15	05-Jul-91
P220089	11.99	13-Aug-91
P220089	14.71	04-Oct-91
P220089	15.5	22-Oct-91
P220089	14.13	09-Jan-92
P220089	14.25	04-Feb-92
P220089	10.19	06-Apr-92
P313489	15.46	16-Jan-90
P313489	10.85	25-Apr-90
P313489	13.76	09-Aug-90
P313489	14.62	11-Sep-90
P313489	14.43	05-Nov-90
P313489	14.9	04-Dec-90

APPENDIX C-8

Water Level Measurements of Wells In and Near OU8

Well No.	Depth from T.O.C.	DATE
P313489	15.79	02-Apr-91
P313489	12.88	02-May-91
P313489	10.17	07-Jun-91
P313489	DRY	05-Jul-91
P313489	12.49	08-Aug-91
P313489	14.07	03-Sep-91
P313489	15.13	07-Oct-91
P313489	15.12	05-Nov-91
P313489	12.23	02-Dec-91
P313489	14.6	03-Feb-92
P313489	15.51	03-Mar-92
P313489	9.36	01-Apr-92
P317989	8.2	04-Dec-89
P317989	7.69	18-Jan-90
P317989	5.07	23-Mar-90
P317989	5.15	26-Apr-90
P317989	5.98	22-May-90
P317989	6.41	11-Jul-90
P317989	5.85	15-Aug-90
P317989	6	23-Aug-90
P317989	9.64	07-Sep-90
P317989	8.92	03-Oct-90
P317989	8.53	02-Nov-90
P317989	9.87	04-Jan-91
P317989	7.45	25-Mar-91
P317989	4.33	12-Jun-91
P317989	8.43	03-Jul-91
P317989	7.32	05-Aug-91
P317989	7.22	07-Aug-91
P317989	8.72	03-Sep-91
P317989	8.39	02-Oct-91
P317989	8.31	17-Oct-91
P317989	9.9	04-Nov-91
P317989	6.66	03-Dec-91
P317989	6.2	07-Jan-92
P317989	6.22	21-Jan-92
P317989	6.22	21-Jan-92
P317989	9.33	06-Feb-92

Well No.	Depth from T.O.C.	DATE
P317989	8.14	02-Mar-92
P317989	3.88	06-Apr-92
P414189	8.52	12-Jul-90
P414189	8.25	15-Aug-90
P414189	9.22	11-Sep-90
P414189	9.01	04-Oct-90
P414189	9.4	05-Nov-90
P414189	8.76	04-Dec-90
P414189	10.42	03-Jan-91
P414189	9.65	05-Apr-91
P414189	8.18	02-May-91
P414189	5.67	07-Jun-91
P414189	7.56	05-Jul-91
P414189	8.23	08-Aug-91
P414189	8.37	03-Sep-91
P414189	10.22	07-Oct-91
P414189	10.6	05-Nov-91
P414189	7.35	02-Dec-91
P414189	8.04	02-Jan-92
P414189	8.07	03-Feb-92
P414189	8.82	03-Mar-92
P414189	4.88	01-Apr-92
P418289	9.7	07-Oct-89
P418289	10.49	14-Dec-89
P418289	10.25	16-Jan-90
P418289	5.12	22-Mar-90
P418289	5.32	11-Apr-90
P418289	7.38	19-May-90
P418289	7.25	12-Jul-90
P418289	8.78	11-Sep-90
P418289	9.21	04-Oct-90
P418289	8.09	19-Nov-90
P418289	11.53	03-Jan-91
P418289	10.57	19-Mar-91
P418289	7.38	18-Jun-91
P418289	8.93	05-Jul-91
P418289	7.24	16-Aug-91
P418289	8.6	11-Nov-91

Well No.	Depth from T.O.C.	DATE
P418289	9.83	09-Jan-92
P418289	9.35	05-Feb-92
P418289	6.31	06-Apr-92

Note: -1 indicates dry well

APPENDIX C-9

Geological Lithologies of Selected Wells and Boreholes Located Within and Adjacent to Operable Unit 8

Well No.	Within OU8	Elevation Top of Bedrock	Amount of Bedrock Penetrated (Feet)	(1) Presence of No. 1 Sandstone	Fining Upward Sequences	(2) Lithology from Top Bedrock to TD	Depth of Top of Lithology (Feet)	Thickness of Lithology (Feet)	(3) Comments from Lithologic Logs
10-87		5,970.65	6.7	No.1 SS	?	Silty Claystone	11.3	5.7+	Very weathered, fine to very fine, some carbonate mineralization, and black mineralization
BH-31-87	Yes	5,957.90		No. 1 SS		Silty Sandstone	7.6	2.2	Highly weathered, slightly friable, vfg
						No Sample	9.8	0.3	
				*May be bedrock		Claystone	10.1	5.9	Some caliche and silt, tr. fine sand, localized iron staining
BH 32-87	Yes	5,964.00	12.8	No. 1 SS	?	Sandstone	7.7	7.7	Silty, fg to vfg, calcareous mineralization as possible fracture fills, limonite staining, highly weathered
						Sandy Siltstone	14.7	14.7	Gradational contact, highly weathered, fg, calc. mineralization
						No Sample	15.2	15.2	
						Sandy Siltstone	15.5	15.5	Same as above, no calc. mineralization
BH 34-87		5,954.70	8.0	No. 1 SS	?	Silty Sandstone	16.7	8.0+	Gradational contact, highly weathered, highly friable, vfg, well sorted, iron-staining, possible Mg. staining.
20-86	Yes	5,938.47	9.5	Absent	?	Clayey Sandstone	12.5	.05	Sub-angular to sub-rounded, well sorted, sand is vfg - fg; abundant iron-staining
						No Sample	13.0	1.7	
						Silty Claystone	14.7	5.7	Highly weathered, mod.-poorly friable with abundant carb, Fe staining, tr sand at top of interval
22-86	Yes	5,967.77	255.	?	Coarsening Upward.	Sandstone	10.5	3.5	vfg, some Fe staining, well sorted
						Silty Claystone	14.0	10+	Some Fe staining, tr. calcite, carb. material
31-86	Yes	5,964.48	21.5	No. 1 SS	?	Sandstone	0.5	11.5	Highly weathered, mod. friable, vfg, well sorted, calcareous fracture fill
						No Sample	12.0	1.0	
						Sandstone	13.0	2.0	Same as above, abundant Fe staining
						Siltstone	15.0	1.2	Highly weathered, mod. friable; trace vfg sand
						Silty Claystone	16.2	0.8	Gradational contact, highly weathered, slightly friable, Fe staining locally on fractures.
						Silty Sandstone	17.0	17.9	Highly weathered, abundant Fe staining
						Siltstone	17.9	4.1+	Highly weathered, slightly friable, tr. vfg sand, tr. clay, no water encountered while drilling
32-86	Yes	5,965.08	134	No. 1 SS	?	Sandstone	1.0	8.3	Well sorted, silt to vfg sand, grading to moderate to highly weathere Moderate to highly, thinly stratified
						Clayey Siltstone	9.3	7.7	Moderately weathered, moderately friable, some Fe staining, some carb. in fracture (90 degrees), some vfg sand

APPENDIX C-9

Geological Lithologies of Selected Wells and Boreholes Located Within and Adjacent to Operable Unit 8

Well No.	Within OU8	Elevation Top of Bedrock	Amount of Bedrock Penetrated (Feet)	(1) Presence of No. 1 Sandstone	Fining Upward Sequences	(2) Lithology from Top Bedrock to TD	Depth of Top of Lithology (Feet)	Thickness of Lithology (Feet)	(3) Comments from Lithologic Logs
32-86 (Continued)						Silty Claystone	17.0	10+	Moderately weathered, slightly friable, Fe in fractures trace carbon and CaCO3, small silt lenses.
43-86	Yes	5,955.91	5.0	No. 1 SS		Sandstone	17.0	1.0	Vfg, trace silt, highly weathered, moderately friable
					Variable	Silty Sandstone	18.0	2.8	Highly weathered, moderately friable
						Sandstone	20.8	1.2	Highly weathered, slightly to moderately friable, vfg well sorted, rounded to well-rounded
P209189	Yes	5,970.36	28.0	No. 1 SS		Sandstone	10.2	7.0	Fg grading to mg (fining upward), well sorted, subangular to sub-rounded, scattered lignite
				No. 1 SS	Yes	Silty Claystone	17.0	1.0	Vfg sand - 20%
						Sandstone	18.2	1.6	Interbedded with silty claystone, fg and vfg, well-sorted, sub-angular to angular
				No. 1 SS	Yes	Silty Claystone	19.8	0.5	Vfg sand - 20%
					Yes	Silty Sandstone	20.3	1.0	Vfg, well-sorted, sub-angular to angular 80% sand
						Sandstone	21.3	5.0	Some clay, wet
				No. 1 SS		Sandstone interbedded w/Claystone	26.3	2.0	Fg sand, wet, increasing clay content with depth
						Claystone interbedded w/Sandstone	28.3	2.0	Vfg sand, wet, 15% sand, 85% clay
				No. 1 SS		Clayey Siltstone	30.3	2.0	Vfg sand, wet, 15% sand, 85% clay
						Sandy Claystone	33.3	1.0	Interbedded with sandy silty claystone, fg, well-sorted, Subangular, moist, 20% sand, 80% clay
						Silty Claystone	34.3	3.0+	Dry
P209289	Yes	5,967.79	4.0	No. 1 SS	Coarsening Upward	Sandstone	13.2	2.0	Damp to moist
						Claystone	15.2	2.0+	Interbedded with sandstone, vfg to fg, sub-rounded to rounded, moist
P209389	Yes	5,967.67	20.4	No. 1 SS	Coarsening Upward	Sandstone	13.8	4.4	Fg, well-sorted, subangular to angular, damp. 65% sand
						Silty Sandstone	18.2	10.2	Fg, well-sorted, subangular to sub-rounded, damp. 65% sand
						Claystone	28.4	6.0	Dry
						Silty Claystone	23.0	6.4	Weathered, iron staining, decreasing silt content with depth
						Claystone	29.4	3.6+	

Notes:
(1) Presence of No. 1 Sandstone is based on the Geological Characterization Report, Appendix A (EG&G, 1991a)
(2) Lithology is based well logs found in the Geological Characterization Report, Appendix G (EG&G, 1991a)
(3) Addtional well data is located in Table 2.1.

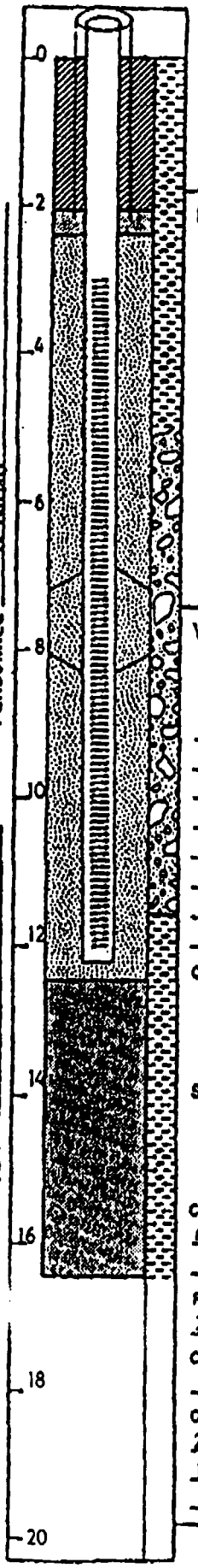
Valley Fill

WELL 19-86

WELL CONSTRUCTION SUMMARY

LOCATION or COORDS:

ELEVATION: GROUND LEVEL 5946'
TOP OF CASING 5947.25'



PROJECT 106906222 Rocky Flats Plant
PERSONNEL T. Murphy
LOCATION Golden, CO

DRILLING SUMMARY:

TOTAL DEPTH Well: 12.25' Hole: 16.50'
BOREHOLE DIAMETER 7½"

DRILLER Boyles Brothers Drilling Co.
15865 W. 5th Avenue
Golden, CO (Dave Jarvie)
RIG Mobile B-57
BIT(S) TS

DRILLING FLUID None

SURFACE CASING 5" x 4' steel w/ locking cap

WELL DESIGN:

BASIS: GEOLOGIC LOG X GEOPHYSICAL LOG

CASING STRING(S): C=CASING S=SCREEN

0.0'	3.00'	C1			
3.00'	12.25'	S1			

CASING: C1 2" I.D. Sch. 5 type 316 stainless steel, threaded and flush jointed.

SCREEN: S1 2" I.D. Sch. 5 type 316 stainless steel, threaded and flush jointed. 0.010" wire wrap screen 0.25' welded bottom cap.

CENTRALIZERS Type 304 stainless steel
6.88' - 8.13'

FILTER MATERIAL 32-42 silica sand
2.50' - 12.50'

CEMENT Portland Type I
0.00' - 2.10'

OTHER 3/8" bentonite pellets
2.10' - 2.50'
12.50' - 16.50'

CONSTRUCTION TIME LOG:

TASK	START DATE 1986	START TIME	FINISH DATE 1986	FINISH TIME
DRILLING:				
7½" auger	9/11	0907	9/11	1051
GEOPHYS. LOGGING:	—	—	—	—
CASING:				
2" stainless	9/11	1150	9/11	1155
FILTER PLACEMENT	9/11	1155	9/11	1336
CEMENTING:	9/11	1450	9/11	1455
DEVELOPMENT:	9/16	1340	9/17	1435
OTHER:				
Bentonite	9/11	1340	9/11	1342
	9/11	1145	9/11	1150

WELL DEVELOPMENT

See Well Development Summary Sheet.

COMMENTS:

Water encountered at 7.5' during drilling.

Top of stainless steel casing: 1.25'

Project: Rocky Flats Plant

LOG OF BORING NO. 19-86

Date Drilled 9/11/86

Coordinates

Boring Method Hollow Stem Auger

Ground Surface Elevation 5946

Elev. (feet)	Depth (feet)	Sample Type	Graphic Log	Material Description	Penetration Resistance (Blows/Inch) 20 40	Water Content (%) 20 40	Other Tests
	0			VALLEY FILL ALLUVIUM 0-4.5'-Sample. Recovered 3.8/4.5'=84%. 0-1.7'. CLAY: dusky brown (5YR 2/2); gravelly; poorly sorted; angular; unconsolidated; dry. 1.7-4.5'. CLAY: olive gray (5Y 3/2); some granite and quartzite pebbles; poorly sorted; firm; damp.			
	5			4.5-6.5'-Sample. Recovered 1.3/2.0'=65%. GRAVEL: dark yellowish brown (10 YR 2/2) to olive gray (5Y 3/2); some sand, silt and clay; poorly sorted; subrounded; unconsolidated; moist to wet. 6.5-11.5'-Sample. Recovered 1.0/5.0'=20%. GRAVEL: Same as above; grayish black (N 2) from 7.5-8.0'; wet.			
	10			ARAPAHOE FORMATION 11.5-16.5'-Sample. Recovered 5.0/5.0'=100%. CLAYSTONE: pale olive (10Y 6/2) to light olive gray (10Y 5/2); silty; consolidated; wet.			
	15			TOTAL DEPTH: 16.5'			
	20						

Remarks Logged by: T. Murphy

Checked by:

Project No. 106P06222

Hydro-Search, Inc.

STATE PLANE COORDINATE:		TOTAL DEPTH (FT): 16.5	GROUND ELEVATION (FT)	5931.22	PROJECT NUMBER:	667 11
NORTH:	750943	AREA: SOLAR POND	CASING DIAMETER (IN):	2 ID	GEOLOGIST	DCB
EAST:	2083298	LOCATOR NUMBER: K10	BOREHOLE DIAMETER (IN)	7 5	DATE DRILLED	09/11/86

REMARKS: Hollow Stem Auger.

LOG OF BORING NUMBER: 19-86

CHEMICAL SAMPLE DEPTH
GRADATIONAL SAMPLE D

SAMPLE NUMBER	SAMPLE GRAIN SIZE (0% – 50% – 100%)	PERCENT RECOVERY (0% – 100%)	RECOVERY/INTERVAL	DATUM (FT)	DEPTH (FT)	WELL OR PIEZOMETER CONSTRUCTION	LITHOLOGY	UNIFIED SOILS CLASSIFICATION OR ROCK TYPE	DESCRIPTION
			0 /10	5931	0				NO SAMPLE:
				5930	1				
				5929	2				
				5928	3				
				5927	4				
				5926	5				
				5925	6				
				5924	7	09/11/86			
				5923	8				
				5922	9				

STATE PLANE COORDINATE:	TOTAL DEPTH (FT): 16.5	GROUND ELEVATION (FT):	5931.22	PROJECT NUMBER:	667.11
NORTH: 750943	AREA: SOLAR POND	CASING DIAMETER (IN):	2 ID	GEOLOGIST:	DCB
EAST: 2083298	LOCATOR NUMBER: K10	BOREHOLE DIAMETER (IN):	7 5	DATE DRILLED:	09/11/86
REMARKS: Hollow Stem Auger.					

LOG OF BORING NUMBER: 19-86

CHEMICAL SAMPLE DEPTH / GRADATIONAL SAMPLE DEPTH	SAMPLE NUMBER	SAMPLE GRADI SIZE (0% 50% 100%)	PERCENT RECOVERY (0% 100%)	RECOVERY/INTERVAL	DATUM (FT)	DEPTH (FT)	WELL OR PIEZOMETER CONSTRUCTION	LITHOLOGY	UNIFIED SOILS CLASSIFICATION OR ROCK TYPE	DESCRIPTION
				0 /3.7	5921	10			NO SAMPLE:	
					5920	11				
					5919	12				
					5918	13				
				1.3 /1.3	5917	14			CLAYSTONE:	Light gray (N7), bedding not apparent, slightly friable, well weathered localized iron stains and dark calcareous fracture filing at approx. 14.5 ft., slight silt component
				1.5 /1.5	5916	15			CLAYSTONE:	Same as above.
					5915	16				
					5914	17				
					5913	18				
					5912	19				

LOG OF BORING NO. 19-86

PAGE 1 OF 1

GEOLOGIST(S): DCB
DATE: 8/21/89

PROJECT NO: 667-11-22

TOP/BOTTOM OF CORE IN BOX	TOP/BOTTOM OF INTERVAL	FEET OF CORE IN INTERVAL IN BOX	SAMPLE NUMBER	FRACTURE ANGLE	BEDDING ANGLE	GRAIN SIZE DISTRIBUTION	USCS SYMBOL	DEPTH IN FEET	LITHOLOGIC LOG	LITHOLOGIC DESCRIPTION
								13		
13.7	13.7					>50% clay		14		claystone, light gray (N7), bedding not apparent, slightly friable, with localized iron stains and dark mineralization (possible mn oxides) calcareous fracture filling at ~14.5 ft. slight silt component
	to									
	15.0							15		
	15.0									
	to									
16.5	16.5							16		
								17		Bottom of Box 2 of 2 at 16.5 ft.

NOTES: General USCS is modified for this log as follows:
Material amounts are estimated by % volume instead of % weight.
(1) Badly broken core, accurate footage measurements not possible.
(2) Core breaks cannot be matched, accurate footage measurements not possible.

Box 2 of 2 has no match w/ Box 1 of 2. Box 2 of 2 contains unmarked core possibly from box 1 of 2.

ROCKY FLATS PLANT

FIGURE NO.

Project: Rocky Flats Plant	LOG OF BORING NO. 20-86

Date Drilled 9/4/86 **Coordinates**

Boring Method Hollow Stem Auger **Ground Surface Elevation** 5962

Elev. (feet)	Depth (feet)	Sample Type	Graphic Log	Material Description	Penetration Resistance (Blows/Inch) 20 40	Water Content (%) 20 40	Other Tests
	0			ARTIFICIAL FILL 0-2.0'-Sample. Recovered 1.7/2.0'=85%. SAND: grayish orange (10YR 7/4) to dark yellowish orange (10YR 6/6) fine- to coarse grained sand; some granitic pebbles and cobbles; fragments of medium gray (N 5) claystone; no apparent bedding; poorly sorted; unconsolidated; dry.			
	5			2.0-4.0'-Sample. Recovered 2.0/2.0'=100%. GRAVEL: dark yellowish orange (10YR 6/6) granite and quartzite pebbles and cobbles; some very fine-grained sand; slightly calcareous; no bedding evident; poorly sorted; unconsolidated; dry. 4.0-6.5'-Sample. Recovered 0.3/2.5'=12%. GRAVEL: dark yellowish orange (10YR 6/6) granitic pebbles and cobbles; some fine-grained sand; poorly sorted; unconsolidated; dry.			
	10			6.5-7.5'-Sample. Recovered 0/1.0'=0%. BOULDER: drilled out large quartzite boulder. 7.5-12.5'-Sample. Recovered 0.1/5.0'=2%. 7.5-10.0'-Cuttings. CEMENT RUBBLE; dry.			
	15			ARAPAHOE FORMATION 12.5-17.5'-Sample. Recovered 5.0/5.0'=100%. 12.5-14.8'. CLAYSTONE: dark yellowish orange (10YR 6/6); silty; damp.			
	20						

Remarks Logged by: T. Murphy Checked by: JAP

Project No. 106P06222	Hydro-Search, Inc.	Page 1 of 2

Project: Rocky Flats Plant	LOG OF BORING NO. 20-86

Date Drilled 9/4/86 **Coordinates**

Boring Method Hollow Stem Auger **Ground Surface Elevation** 5962

Elev. (feet)	Depth (feet)	Sample Type	Graphic Log	Material Description	Penetration Resistance (Blows/inch) 20 40	Water Content (%) 20 40	Other Tests
	20			14.8-17.5'. CLAYSTONE: greenish gray (5GY 6/1) to dark gray (N 3); some black (N 1) organic fragments; interbedded sand layers consisting of medium to fine-grained sand and silty sand. well sorted; damp.			
				17.5-22.5'-Sample. Recovered 4.5/4.5'=100%. CLAYSTONE: medium brownish gray (5YR 4/4) to olive gray (5Y 4/1); silty; firm; damp.			
	25						
				TOTAL DEPTH: 22.5'			
	30						
	35						
	40						

Remarks Logged by: T. Murphy Checked by:

Project No. 106P06222

Hydro-Search, Inc.

LOG OF BORING NO. 20-86

GEOLOGIST(S): [illegible]
DATE: 9/5/89

PROJECT NO: 667-11.22

TOP/BOTTOM OF CORE IN BOX	TOP/BOTTOM OF INTERVAL	FEET OF CORE IN INTERVAL IN BOX	SAMPLE NUMBER	FRACTURE ANGLE	BEDDING ANGLE	GRAIN SIZE DISTRIBUTION	USCS SYMBOL	DEPTH IN FEET	LITHOLOGIC LOG	LITHOLOGIC DESCRIPTION
0.0 ↓	0.0-2.0	(1) 1.7				55% CLAY 40% SAND 10% GRAVEL		1, 2		GRAVELLY, SANDY CLAY, grayish orange (10 YR 7/4), mod- high plast., Sand is VFG-FG, max gravel size ≅ 7cm, some silt, some iron staining as mottles, some calc material, some roots
	2.0-4.0	Ø						3, 4		NO SAMPLE - a sample block is in the interval w/ only v. course gravel - ~~not~~ questionable representation of interval.
	4.0-6.5	(1) 0.5				60 ~~[illegible]~~% GRAVEL 25 ~~[illegible]~~% CLAY 15 ~~[illegible]~~% SAND		5, 6		SANDY CLAYEY GRAVEL, matrix color is grayish orange (10 YR 7/4) ~~grading to~~ moderate yellowish brown (10 YR 5/4), angular-subangular, mod- poorly graded max size ≅ 6 cm, Sand is FG-MG, some calc material
	6.5-7.5	Ø.						7		NO SAMPLE
	7.5-12.5	(1) 0.2						8, 9	CONCRETE	CONCRETE

NOTES: General USCS is modified for this log as follows:
Material amounts are estimated by % volume instead of % weight.
(1) Badly broken core, accurate footage measurements not possible.
(2) Core breaks cannot be matched, accurate footage measurements not possible.

ROCKY FLATS PLANT

FIGURE NO.

LOG OF BORING NO. 20-86

GEOLOGIST(S): [illegible]
DATE: ~~8~~ 9/5/89

PROJECT NO: 667-11.22

TOP/BOTTOM OF CORE IN BOX	TOP/BOTTOM OF INTERVAL	FEET OF CORE IN INTERVAL IN BOX	SAMPLE NUMBER	FRACTURE ANGLE	BEDDING ANGLE	GRAIN SIZE DISTRIBUTION	USCS SYMBOL	DEPTH IN FEET	LITHOLOGIC LOG	LITHOLOGIC DESCRIPTION
								11	CONCRETE	See previous page
								12		
	12.5-13.0	CBS (1)				60% SAND 40% CLAY				CLAYEY SAND, dark yellowish orange, sub-angular - subrounded, poorly graded, sand to VFG-FG abundant iron staining as mottles
Box 1 of 2	13.0-14.7	∅						13		
								14		NO SAMPLE
	14.7-16.1	(2) 1.5				30% SILT 70% CLAY		15		SILTY CLAYSTONE, yellowish gray (5 Y 8/1) at top grading to pale yellowish brown (10 YR 6/2), apparent massive bedding, slightly weathered, mod - poorly friable, abundant carb material at base of interval (trace of carb material at top), some iron staining as mottles, top of interval shows sharp contact with sand (FG-MG), trace of sand at top of interval
↑ 16.1								16		
16.1	16.1-17.5	(2) 1.2		80°				17		Same as above (base of interval): fracture at ≈80° filled w/ calc. material
Box 2 of 2	17.5-19.0	ND (2) 1.4						18		Same as above: no apparent fractures
	19.0-20.4	ND 1.4						19		Same as above: light olive gray (5 Y 6/1) some carb material

NOTES: General USCS is modified for this log as follows:
Material amounts are estimated by % volume instead of % weight.
(1) Badly broken core, accurate footage measurements not possible.
(2) Core breaks cannot be matched, accurate footage measurements not possible.

ROCKY FLATS PLANT

FIGURE NO.

LOG OF BORING NO. 20-86

GEOLOGIST(S): [illegible]
DATE: 9/5/89

PROJECT NO: 667-11.22

TOP/BOTTOM OF CORE IN BOX	TOP/BOTTOM OF INTERVAL	FEET OF CORE IN INTERVAL IN BOX	SAMPLE NUMBER	FRACTURE ANGLE	BEDDING ANGLE	GRAIN SIZE DISTRIBUTION	USCS SYMBOL	DEPTH IN FEET	LITHOLOGIC LOG	LITHOLOGIC DESCRIPTION
										See previous page
Box 2 of 2	20.4 - 22.0							21		No Sample
↑ 22.0								22		
End of Boxes								23		
								24		
								25		
								26		
								27		
								28		
								29		

NOTES: General USCS is modified for this log as follows:
Material amounts are estimated by % volume instead of % weight.
(1) Badly broken core, accurate footage measurements not possible.
(2) Core breaks cannot be matched, accurate footage measurements not possible.

ROCKY FLATS PLANT

FIGURE NO.

STATE PLANE COORDINATE:	TOTAL DEPTH (FT) 22	GROUND ELEVATION (FT)	5960.97	PROJECT NUMBER:	667 11
NORTH: 751112	AREA: SOLAR POND	CASING DIAMETER (IN)	2 ID	GEOLOGIST:	DAT
EAST: 2084958	LOCATOR NUMBER: L11	BOREHOLE DIAMETER (IN):	7 25	DATE DRILLED	09/04/86
REMARKS: Hollow Stem Auger					

LOG OF BORING NUMBER: 20-86

CHEMICAL SAMPLE DEPTH
GRADATIONAL SAMPLE DEPTH
SAMPLE NUMBER

SAMPLE GRAIN SIZE	PERCENT RECOVERY	RECOVERY/INTERVAL	DATUM (FT)	DEPTH (FT)	WELL OR PIEZOMETER CONSTRUCTION	LITHOLOGY	UNIFIED SOILS CLASSIFICATION OR ROCK TYPE	DESCRIPTION
CL 50%	100% CR 100%	1.7/2	5960, 5959	0, 1, 2			CH	Gravelly Sandy Clay - grayish orange (10YR 7/4), mod. - high plast., sand is VFG -FG, max. gravel size = 7 cm., some silt, some iron staining as mottles, some calc. material, some roots
		0/2	5958, 5957	3, 4			NO SAMPLE	No Sample - a sample block is in the interval with only v coarse gravel, questionable representation of interval
		0.5/2.5	5956, 5955, 5954	5, 6			GC	Sandy Clayey Gravel - matrix color is grayish orange (10YR 7/4) grading to moderate yellowish brown (10YR 5/4), angular to sub-angular, mod. to poorly graded, max size = 6 cm., sand is FG to MG, some calc. material.
		0/1	5953, 5952, 5951	7, 8, 9			NO SAMPLE	
							CONCRETE	Concrete

STATE PLANE COORDINATE:	TOTAL DEPTH (FT): 22	GROUND ELEVATION (FT):	5960.47	PROJECT NUMBER:	667 11
NORTH: 751112	AREA: SOLAR POND	CASING DIAMETER (IN):	2 ID	GEOLOGIST:	DAT
EAST: 2084358	LOCATOR NUMBER: L11	BOREHOLE DIAMETER (IN):	7 25	DATE DRILLED:	09/04/86
REMARKS: Hollow Stem Auger					

LOG OF BORING NUMBER: 20-86

CHEMICAL SAMPLE DEPTH
GRADATIONAL SAMPLE
SAMPLE NUMBER

SAMPLE GRAIN SIZE	PERCENT RECOVERY	RECOVERY/INTERVAL	DATUM (FT)	DEPTH (FT)	WELL OR PIEZOMETER CONSTRUCTION	LITHOLOGY	UNIFIED SOILS CLASSIFICATION OR ROCK TYPE	DESCRIPTION
CL 50% 100%	0% 100%	0.2/5	5950	10				
			5949	11				
			5948	12				
		0.85/0.5					CLAYEY SANDSTONE	Top of Bedrock Dark yellowish orange, sub-angular to sub-rounded, poorly graded, sand is VFG - FG, abundant iron staining as mottles.
			5947	13				NO SAMPLE
		0/1.7	5946	14				
		1.5/1.4	5945	15			SILTY CLAYSTONE	Yellowish gray (5Y 8/1) at top grading to pale yellowish brown (10YR 6/2), apparent massive bedding, highly weathered, mod. - poorly friable, abundant carb. material at base of interval (trace of carb. material at top), some iron staining as mottles, top of interval shows sharp contact with sand (FG - MG), trace of sand at top of interval
		1.2/1.4	5944	16			SILTY CLAYSTONE	Same as above (base of interval): fracture at approx. 80 degrees filled with calc. material
		1.4/1.5	5943	17			SILTY CLAYSTONE	Same as above: no apparent fractures.
		1.4/1.4	5942	18				
			5941	19			SILTY CLAYSTONE	Same as above: light olive gray (5Y 6/1), some carb. material.

STATE PLANE COORDINATE		TOTAL DEPTH (FT): 22	GROUND ELEVATION (FT)	5960.47	PROJECT NUMBER	667 11	LOG OF BORING NUMBER:
NORTH:	751112	AREA: SOLAR POND	CASING DIAMETER (IN)	2 ID	GEOLOGIST:	DAT	20-86
EAST:	2084058	LOCATOR NUMBER: L11	BOREHOLE DIAMETER (IN):	7 25	DATE DRILLED:	09/04/86	
REMARKS: Hollow Stem Auger							

CHEMICAL SAMPLE DEPTH
GRADATIONAL SAMPLE DEPTH
SAMPLE NUMBER

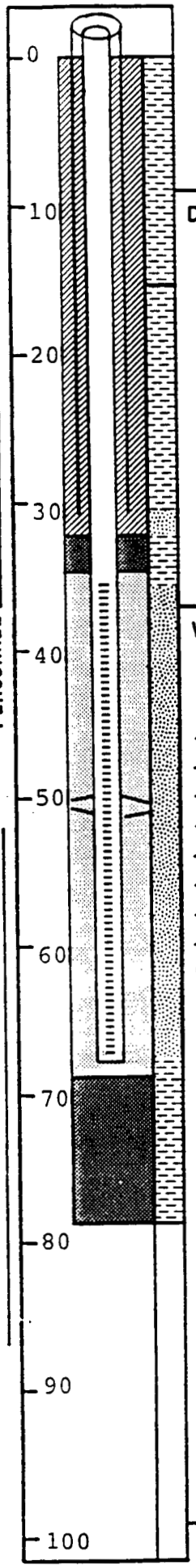
SAMPLE GRAIN SIZE	PERCENT RECOVERY	RECOVERY/ INTERVAL	DATUM(FT)	DEPTH(FT)	WELL OR PIEZOMETER CONSTRUCTION	LITHOLOGY	UNIFIED SOILS CLASSIFICATION OR ROCK TYPE	DESCRIPTION
0% 50% 100%	0% 100%							
			5940	20				NO SAMPLE
		0 /2.1	5939	21				
			5938	22				
			5937	23				
			5936	24				
			5935	25				
			5934	26				
			5933	27				
			5932	28				
			5931	29				

WELL 21-86

WELL CONSTRUCTION SUMMARY

LOCATION or COORDS: N 37909.8 E 19399.1

ELEVATION: GROUND LEVEL 5991.11'
TOP OF CASING 5993.21'



LOCATION Rocky Flats Plant
PERSONNEL L. Pivonka
PROJECT 106P06222

DRILLING SUMMARY:

TOTAL DEPTH Well: 67.25' Hole: 78.00'
BOREHOLE DIAMETER 0.00' - 30.50': 7¼"
30.50' - 78.00': 4 3/4"
DRILLER Boyles Brothers Drilling Co.
15865 W. 5th Avenue
Golden, CO (Jim Horn)
RIG Mobile B-57
BIT(S) 0.00' - 30.50': Blade bit
30.50' - 78.00': Coring bit
DRILLING FLUID None
SURFACE CASING 5" x 31.53' steel w/ locking cap

WELL DESIGN:

BASIS: GEOLOGIC LOG X GEOPHYSICAL LOG ___

CASING STRING(S): C=CASING S=SCREEN

0.00'	29.93'	C1			
0.00'	35.00'	C2			
35.00'	67.24'	S1			

CASING: C1 5" I.D. steel surface casing
C2 2" I.D. Sch. 5 type 316 stainless steel, threaded and flush jointed

SCREEN: S1 2" I.D. Sch. 5 type 316 stainless steel, threaded and flush jointed, 0.010" wire wrapped screen, 0.25' welded bottom cap

CENTRALIZERS Type 304 stainless steel
49.84' - 51.06'

FILTER MATERIAL 32-42 silica sand
34.00' - 68.00'

CEMENT Portland Type I
0.00' - 32.00'

OTHER 3/8" bentonite pellets
32.00' - 34.00'
68.00' - 78.00'

CONSTRUCTION TIME LOG:

TASK	START DATE 1986	START TIME	FINISH DATE 1986	FINISH TIME
DRILLING:				
7¼" auger	11/10	1105	11/11	1414
NC Core	11/13	1400	11/14	1150
Reaming	11/17	1445	11/18	0943
GEOPHYS. LOGGING:	—	—	—	—
CASING:				
5" steel	11/11	1416	11/11	1453
2" stainless	11/18	1053	11/18	0943
FILTER PLACEMENT:	11/18	1047	11/18	1144
CEMENTING:	11/18	1253	11/18	1315
DEVELOPMENT:	11/19	0920	11/25	0945
OTHER:				
Bentonite	11/18	1144	11/18	1151
	11/18	1037	11/18	1047
Packer Testing	11/17	1125	11/17	1426

WELL DEVELOPMENT

See Well Development Summary Sheet.

COMMENTS:

No water encountered during drilling.

Top of stainless steel casing: 2.10'

Project:	Rocky Flats Plant	LOG OF BORING NO.	21-86
Date Drilled	11/10/86 - 11/14/86	Coordinates	N 37909.8 E 19399.1
Boring Method	Hollow Stem Auger/NC Core	Ground Surface Elevation	5991.11'

Elev. (feet)	Depth (feet)	Sample Type	Graphic Log	Material Description	Penetration Resistance (Blows/Foot) 20 40	Water Content (%) 20 40	Other Tests
	0			ROCKY FLATS ALLUVIUM			
				0.0-4.0'-Sample. Recovered 0.0/4.0'=0%. CLAY: moderate brown (5YR 4/4); abundant sand; fine to coarse gravels and small cobbles; moist.			
	5			4.0-8.0'-Sample. Recovered 0.8/4.0'=20%. CLAY: moderate brown (5YR 4/4) to light brown (5YR 5/6); fine to medium-grained sand; some medium to coarse gravel; trace of small cobbles; moist.			
	10			8.0-10.5'-Sample. Recovered 0.7/2.5'=28%. CLAY: same as above with some dusky yellowish brown (10YR 2/2) top soil; disturbed; moist.			
				10.5-13.0'-Sample. Recovered 0.8/2.5'=32%. CLAY: moderate brown (5YR 4/4); sand, gravel and small cobbles; moist.			
	15			13.0-15.0'-Sample. Recovered 0.7/2.0'=35%. CLAY: same as above; moist.			
				ARAPAHOE FORMATION			
				15.0-20.5'-Sample. Recovered 4.5/5.5'=82%. CLAYSTONE: dark yellowish orange (10YR 6/6); micaceous clay with trace of fine gravel and some sand-rich intervals; moist.			
	20						

Remarks Logged by: L. Pivonka Checked by: AWP

Project No. 106P06222

Hydro-Search, Inc.

Project:	Rocky Flats Plant	LOG OF BORING NO.	21-86
Date Drilled	11/10/86 - 11/14/86	Coordinates N 37909.8	E 19399.1
oring Method	Hollow Stem Auger/NC Core	Ground Surface Elevation	5991.11'

Elev. (feet)	Depth (feet)	Sample Type	Graphic Log	Material Description	Penetration Resistance (Blows/Foot) 20 40	Water Content (%) 20 40	Other Tests
	20			20.5-23.0'-Sample. Recovered 2.5/2.5'=100%. CLAYSTONE: dark yellowish orange (10YR 6/6); light olive gray (5Y 6/1); greasy; micaceous; trace of fine-grained sand; moist.			
				23.0-25.5'-Sample. Recovered 2.0/2.5=80%. CLAYSTONE: same as above except trace of rounded coarse white sandstone gravel and rounded quartzite gravel; moist.			
	25			25.5'-28.0'-Sample. Recovered 2.1/2.5'=84%. CLAYSTONE: dark yellowish orange (10YR 6/6) to light olive gray (5Y 6/1); greasy claystone with trace of some fine sand intermixed clay; moist.			
	30			28.0-30.5'-Sample. Recovered 2.1/2.5'=84% CLAYSTONE: same as above; damp.			
				30.5-32.5'-Sample. Recovered 2.0/2.0'=100%. SANDSTONE: light olive gray (5Y 6/1); dark yellowish orange (10YR 6/6); some clay and trance of MnO partings; moist.			
	35			32.5-35.0'-Sample. Recovered 2.5/2.5'=100%. CLAYSTONE: dark yellowish orange (10YR 6/6) to light olive gray (5Y 6/1); some fine-grained sand; interbedded; 30% sand; moist.			
	40			35.0-40.0'-Sample. Recovered 5.0/5.0'=100%. SANDSTONE: dark yellowish orange (10YR 6/6) to light olive gray (5Y 6/1); clay bearing fine-grained; varying amounts of clay up to 30%; wet.			

Remarks Logged by: L. Pivonka Checked by: [signature]

Project No. 106P06222

Hydro-Search, Inc.

Project:	Rocky Flats Plant	LOG OF BORING NO.	21-86
Date Drilled	11/10/86 - 11/14/86	Coordinates	N 37909.8 E 19399.1
Boring Method	Hollow Stem Auger/NC Core	Ground Surface Elevation	5991.11'

Elev. (feet)	Depth (feet)	Sample Type	Graphic Log	Material Description	Penetration Resistance (Blows/Foot) 20 40	Water Content (%) 20 40	Other Tests
	40			40.0-45.0'-Sample. Recovered 5.0/5.0'=100%. SANDSTONE: medium dark gray (N 4/0); clay-rich; up to 35% clay; fine-grained, moist to wet.			
	45			45.0-50.0'-Sample. Recovered 5.0/5.0'=100% SANDSTONE: same as above but less clay (≤ 20%); trace of organic carbon fossils; moist to wet.			
	50			50.0-55.0'-Sample. Recovered 4.2/5.0'=84%. SANDSTONE: medium dark gray (N 4/0); fine-grained; 15% clay/silt content; trace charcoal wood fossils; moist to wet			
	55			55.0-60.0'-Sample. Recovered 5.0/5.0'=100%. SANDSTONE: same as above but more clay-rich (20-30%); moist to wet.			
	60						

Remarks Logged by: L. Pivonka Checked by:

Project No. 106P06222

Hydro-Search, Inc.

Project:	Rocky Flats Plant	LOG OF BORING NO.	21-86
Date Drilled	11/10/86 - 11/14/86	Coordinates	N 37909.8 E 19399.1
Boring Method	Hollow Stem Auger/NC Core	Ground Surface Elevation	5991.11'

Elev. (feet)	Depth (feet)	Sample Type	Graphic Log	Material Description	Penetration Resistance (Blows/Foot) 20 40	Water Content (%) 20 40	Other Tests
	60			60.0-65.0'-Sample. Recovered 5.0/5.0'=100%. SANDSTONE: medium dark gray (N 4/0); fine-grained with clay interlaminae; some $CaCO_3$ in the lower 3.0'; moist to wet.			
	65			65.0-67.0'-Sample. Recovered 2.0/2.0'=100%. SANDSTONE: medium dark gray (N 4/0); fine-grained; increasing clay content downward to 50%; clay at bottom (moist to wet).			
				67.0-69.5'-Sample. Recovered 2.5/2.5'=100%. CLAYSTONE: medium dark gray (N 4/0); fine-grained sandstone interlaminae; some leaf fossils and trace grayish orange (10YR 7/4) mottles; moist to wet.			
	70			69.5-73.0'-Sample. Recovered 3.5/3.5'=100%. SANDY CLAYSTONE: medium dark gray (N 4/0); up to 50% fine-grained sand intermixed; moist.			
	75			73.0-78.0'-Sample. Recovered 5.0/5.0'=100%. CLAYSTONE: medium dark gray (N 4/0); some fine-grained sand; trace grayish orange (10YR 7/4) mottles; moist.			
				TOTAL DEPTH: 78.0'			
	80						

Remarks

Logged by: L. Pivonka

Checked by:

Project No. 106P06222

Hydro-Search, Inc.

LOG OF BORING NO. 21-86

PAGE 1 OF 8

GEOLOGIST(S): DCB
DATE: 8/15/89

PROJECT NO: 667-1122

TOP/BOTTOM OF CORE IN BOX	TOP/BOTTOM OF INTERVAL	FEET OF CORE IN INTERVAL IN BOX	SAMPLE NUMBER	FRACTURE ANGLE	BEDDING ANGLE	GRAIN SIZE DISTRIBUTION	USCS SYMBOL	DEPTH IN FEET	LITHOLOGIC LOG	LITHOLOGIC DESCRIPTION
0.0 ↓	0.0 to 4.0	0						1, 2, 3, 4		~~Gravelly Sandy Clay, light brown (5YR 5/6), low plasticity~~ DCB No Sample
Bot	4.0 to 8.0	(1) .7				~~75~~ ~50% clay	CL	5, 6, 7, 8		Gravelly Sandy Clay, light brown (5YR 5/6), low plasticity.
	8.0 to 10.5	(1) .8						9		

NOTES: General USCS is modified for this log as follows:
Material amounts are estimated by % volume instead of % weight.
(1) Badly broken core, accurate footage measurements not possible.
(2) Core breaks cannot be matched, accurate footage measurements not possible.

ROCKY FLATS PLANT

FIGURE NO.

LOG OF BORING NO. 21-86

GEOLOGIST(S): DCB
DATE: 8/15/89

PROJECT NO: 667-1122

TOP/BOTTOM OF CORE IN BOX	TOP/BOTTOM OF INTERVAL	FEET OF CORE IN INTERVAL IN BOX	SAMPLE NUMBER	FRACTURE ANGLE	BEDDING ANGLE	GRAIN SIZE DISTRIBUTION	USCS SYMBOL	DEPTH IN FEET	LITHOLOGIC LOG	LITHOLOGIC DESCRIPTION
	8.0 to 10.5	(1) .8				~50% clay	CL			As above
	10.5 to 13.0	(1) .7						11, 12, 13		
	13.0 to 15.0	(1) .8						14, 15		
Box 7	15.0 to 15.5	(1) .2								Sandy Clay, very light gray (N8), mottled dark yellowish orange (10 YR 6/6), low to moderate plasticity, some silt, sand is disseminated throughout the majority of this interval with short intervals (< 0.1 ft) of sand occurring locally.
Box 8	15.5 to 18.0	(1) 1.9						16, 17, 18		
	18.0 to 20.5	ND						19		

NOTES: General USCS is modified for this log as follows:
Material amounts are estimated by % volume instead of % weight.
(1) Badly broken core, accurate footage measurements not possible.
(2) Core breaks cannot be matched, accurate footage measurements not possible.

LOG OF BORING NO. 21-86

GEOLOGIST(S): DCB
DATE: 8/15/89

PROJECT NO: 667-1122

TOP/BOTTOM OF CORE IN BOX	TOP/BOTTOM OF INTERVAL	FEET OF CORE IN INTERVAL IN BOX	SAMPLE NUMBER	FRACTURE ANGLE	BEDDING ANGLE	GRAIN SIZE DISTRIBUTION	USCS SYMBOL	DEPTH IN FEET	LITHOLOGIC LOG	LITHOLOGIC DESCRIPTION
	18.0 to 20.5	ND				>50% clay	CL			As above
Bot 21.8	20.5 to 21.8	ND				>50% clay	~~CL~~ DCB	21		Interval grades to claystone. Claystone, very light gray (N8) to dark yellowish orange (10 YR 6/6) - iron staining, bedding not apparent, highly weathered, slightly friable, local occurrences of dark mineralization (possibly manganese oxide), slight silt fraction.
21.8	21.8 to 23.0	ND						22		
	23.0 to 25.5	ND						23, 24, 25		As above with a few subangular to subrounded gravel from ~22.7 to 23.6 ft.
Bot 25.5	25.5 to 28.0	ND						26, 27, 28		
	28.0 to 30.5	ND				>50% clay		29		Silty claystone, grayish orange (10 YR 7/4), thinly laminated, moderately friable, local iron staining and dark mineralization.

NOTES: General: USCS is modified for this log as follows:
Material amounts are estimated by % volume instead of % weight.
(1) Badly broken core, accurate footage measurements not possible.
(2) Core breaks cannot be matched, accurate footage measurements not possible.

ROCKY FLATS PLANT

FIGURE NO.

LOG OF BORING NO. 21-86

GEOLOGIST(S): DCB
DATE: 8/15/89

PROJECT NO: 667-1122

TOP/BOTTOM OF CORE IN BOX	TOP/BOTTOM OF INTERVAL	FEET OF CORE IN INTERVAL IN BOX	SAMPLE NUMBER	FRACTURE ANGLE	BEDDING ANGLE	GRAIN SIZE DISTRIBUTION	USCS SYMBOL	DEPTH IN FEET	LITHOLOGIC LOG	LITHOLOGIC DESCRIPTION
Box 2 of 7	28.0 to 30.5	N/D				>50 clay				As above
	30.5	N/D				>50 sand		31		Interval grades to silty sandstone at ~31 ft. Silty sandstone, very light gray (N8) to grayish orange (10 YR 7/4), bedding appears to be horizontal (based on core breaks), well weathered, slightly friable, local iron staining and dark mineralization (mg oxides?) occurs on partings.
32.5	32.5					>50 clay		32		
32.5	32.5 to 35.0	N/D		85° at ~33.5'				33, 34		Interval grades to silty claystone. Silty claystone, grayish orange (10 YR 7/4), bedding not apparent, well weathered, slightly friable, dark mineralization occurs on a fracture face at ~33.5', abundant iron staining from ~36 ft to 37 ft.
	35.0 to 40.0	N/D						35, 36, 37, 38, 39		Interval grades to claystone. Claystone, medium light gray (N6), bedding appears to be horizontal (based on core breaks) weathered, slightly friable, significant silt fraction, localized occurances of dark mineralization, probably carbonaceous.

NOTES: General: USCS is modified for this log as follows:
Material amounts are estimated by % volume instead of % weight.
(1) Badly broken core, accurate footage measurements not possible.
(2) Core breaks cannot be matched, accurate footage measurements not possible.

ROCKY FLATS PLANT

FIGURE NO.

LOG OF BORING NO. 21-86

GEOLOGIST(S): DCD
DATE: 8/15/89

PROJECT NO: 667-11.22

TOP/BOTTOM OF CORE IN BOX	TOP/BOTTOM OF INTERVAL	FEET OF CORE IN INTERVAL IN BOX	SAMPLE NUMBER	FRACTURE ANGLE	BEDDING ANGLE	GRAIN SIZE DISTRIBUTION	USCS SYMBOL	DEPTH IN FEET	LITHOLOGIC LOG	LITHOLOGIC DESCRIPTION
Bot 3.4 ft 41.0	40.0 to 41.0	ND				>50% clay				As above
41.0 Bot 4 ft	41.0 to 45.0	ND						41, 42, 43, 44		
	45.0 to 50.0	ND				>50% clay		45, 46, 47, 48, 49		Silty Claystone medium light gray (N6), thin ~horizontally bedded to bedding not apparent, slightly friable, occasional intervals of v. fine sand (typically c.2 ft thick), silt ~~and~~ occurs disseminated throughout clay and as interfingering laminae. At about 47 ft bedding on slabbed surface exhibits 10° dip.

NOTES: General USCS is modified for this log as follows:
Material amounts are estimated by % volume instead of % weight.
(1) Badly broken core, accurate footage measurements not possible.
(2) Core breaks cannot be matched, accurate footage measurements not possible.

ROCKY FLATS PLANT

FIGURE NO.

LOG OF BORING NO. 21-86

GEOLOGIST(S): DCB
DATE: 8/15/89

PROJECT NO: 667-1122

TOP/BOTTOM OF CORE IN BOX	TOP/BOTTOM OF INTERVAL	FEET OF CORE IN INTERVAL IN BOX	SAMPLE NUMBER	FRACTURE ANGLE	BEDDING ANGLE	GRAIN SIZE DISTRIBUTION	USCS SYMBOL	DEPTH IN FEET	LITHOLOGIC LOG	LITHOLOGIC DESCRIPTION
Box 4 of 7 50.5	50.0 to 50.5					>50% clay				As above
50.5	50.5							51		
Box 5 of 7	to 55	ND				~~DCB~~ ~~sand~~ 90% sand 10% fines		52		Interval grades to silty sandstone at ~51.5. Silty sandstone, very light gray (N8), thin wavy bedding, slightly friable, very fine grained, well sorted.
								53		Interval grades to siltstone at ~52 ft. Siltstone, very light gray (N8), bedding not apparent, slightly friable.
								54		
	55 to 60	ND			3-5°			55		
								56		
								57		Interval grades to silty claystone at ~57 ft. Silty Claystone, light gray (N7), bedding is thin with slight dip to bedding not apparent, moderate to slight weathering, slightly friable, silt is disseminated throughout clay and as interfingering laminae, slight vfg sand fraction as beds <.1 ft. and disseminated locally.
								58		
								59		

NOTES: General: USCS is modified for this log as follows:
Material amounts are estimated by % volume instead of % weight.
(1) Badly broken core, accurate footage measurements not possible.
(2) Core breaks cannot be matched, accurate footage measurements not possible.

ROCKY FLATS PLANT

FIGURE NO.

LOG OF BORING NO. 21-89

GEOLOGIST(S): DCB
DATE: 8/15/89

PROJECT NO: 667-1122

TOP/BOTTOM OF CORE IN BOX	TOP/BOTTOM OF INTERVAL	FEET OF CORE IN INTERVAL IN BOX	SAMPLE NUMBER	FRACTURE ANGLE	BEDDING ANGLE	GRAIN SIZE DISTRIBUTION	USCS SYMBOL	DEPTH IN FEET	LITHOLOGIC LOG	LITHOLOGIC DESCRIPTION
Box 5 of 7 60.5	60.0 to 60.5					>50% clay				As above with abundant sand.
60.5 ↓	60.5					>50% clay				At 60.5 silty clay stone unconformably overlies a clay stone. The unconformity is not borne out by the sequence at the top of the next box.
					~10°	>50% clay		61		Silty Claystone, light gray (N7) bedding is thin <2 mm with slight dip to, not apparent, weathered, slight to moderate bedding friability, some vfg sand, silt and sand are discontinuous within the claystone and occur in discrete intervals.
					~10°	>50% silt.		62		
	to	NO						63		
								64		Interbedded siltstone and claystone. Siltstone, light gray (N7) to med. dark gray (N4) thin bedded <2 mm w/slight dip, slightly weathered, slightly friable, clay defines bedding planes, significant fraction of vfg sand, carbonaceous mineralization occurs on bedding planes.
	65.0							65		
Box 6 of 7	65.0 to 67.0	NO				>50% clay		66		Interval grades to claystone at ~66 ft. Claystone medium gray (N5) bedding slightly weathered, slightly friable, appears localized iron staining, some carbonaceous mineralization occurs on partings, moderate silt fraction
Box 7 of 7	67.0 to 69.5	NO						67		
								68		
								69		
69.5 ↑	69.5									
69.5 ↓ 72.0	69.5 to 72.0	NO								

NOTES: General USCS is modified for this log as follows:
Material amounts are estimated by % volume instead of % weight.
(1) Badly broken core, accurate footage measurements not possible.
(2) Core breaks cannot be matched, accurate footage measurements not possible.

NOTE! MISHAP OCCURRED, BOX WAS DROPPED AND SCRAMBLED AFTER IT WAS LOGGED. CORE WAS REPLACED IN BOX ON BASIS OF LOG DESCRIPTION.

ROCKY FLATS PLANT

FIGURE NO.

LOG OF BORING NO. 21-86

GEOLOGIST(S): DCB
DATE: 8/16/89

PROJECT NO: 667-11.22

TOP/BOTTOM OF CORE IN BOX	TOP/BOTTOM OF INTERVAL	FEET OF CORE IN INTERVAL IN BOX	SAMPLE NUMBER	FRACTURE ANGLE	BEDDING ANGLE	GRAIN SIZE DISTRIBUTION	USCS SYMBOL	DEPTH IN FEET	LITHOLOGIC LOG	LITHOLOGIC DESCRIPTION
	69.5 to 73.0	XID			<5°	>50% clay; ~50% silt; ~50% clay; >50% clay		71, 72, 73		As Above As above with increase in silt fraction ~70.5 to ~71.2 ft. silt/clay define bedding - <2mm thick. Claystone as above (reference interval 66 to 70.5 ft Slickensides at ~72.6 ft. ~22° attitude.
Box 7 of 7	73.0 to 78.0	NID			~5°	~50% clay; ~50% silt		74, 75, 76, 77, 78		Interbedded silt and claystone Silty Claystone, light gray (N7), med. brown gray (N4), thin bedded <2mm, slight dip, slightly weathered, slightly friable, localized iron staining.
78.0	78.0									Bottom of Box 7 of 7 at 78.0 ft.

NOTES: General USCS is modified for this log as follows:
Material amounts are estimated by % volume instead of % weight.
(1) Badly broken core, accurate footage measurements not possible.
(2) Core breaks cannot be matched, accurate footage measurements not possible.

ROCKY FLATS PLANT

FIGURE NO.

STATE PLANE COORDINATE:	TOTAL DEPTH (FT): 78	GROUND ELEVATION (FT)	5991.11	PROJECT NUMBER:	667.11	LOG OF BORING NUMBER:
NORTH: 750911	AREA: PLANT NORTH	CASING DIAMETER (IN):	2 ID	GEOLOGIST:	DCB	21-86
EAST: 2082503	LOCATOR NUMBER: J10	BOREHOLE DIAMETER (IN):	7 25	DATE DRILLED:	11/14/86	

REMARKS: Hollow Stem Auger/NC Core.

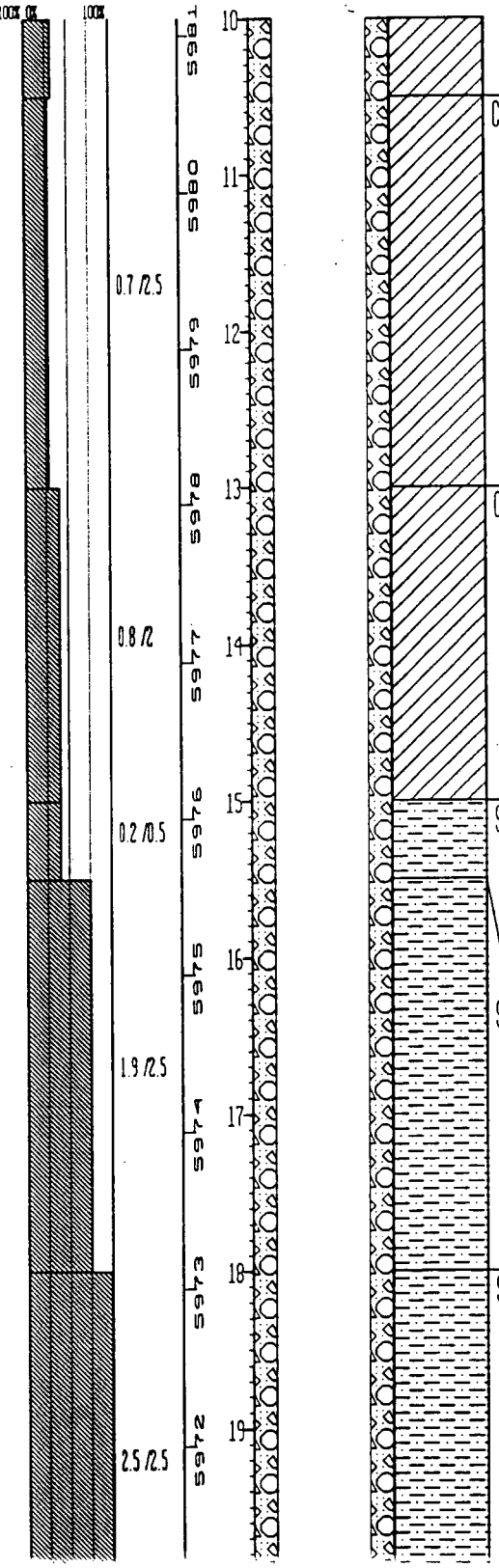
CHEMICAL SAMPLE DEPTH / GRADATIONAL SAMPLE DEPTH	SAMPLE NUMBER	SAMPLE GRAIN SIZE (0% 50% 100%)	PERCENT RECOVERY (0% 100%)	RECOVERY/INTERVAL	DATUM (FT)	DEPTH (FT)	WELL OR PIEZOMETER CONSTRUCTION	LITHOLOGY	UNIFIED SOILS CLASSIFICATION OR ROCK TYPE	DESCRIPTION
					5991	0				NO SAMPLE:
					5990	1				
				0/4	5989	2				
					5988	3				
					5987	4			CL	GRAVELLY SANDY CLAY - light brown (5YR 5/6), low plasticity.
					5986	5				
				0.7/4	5985	6				
					5984	7				
					5983	8			CL:	Same as above.
				0.8/2.5	5982	9				

STATE PLANE COORDINATE:	TOTAL DEPTH (FT): 78	GROUND ELEVATION (FT): 5991.11	PROJECT NUMBER: 667.11	LOG OF BORING NUMBER:
NORTH: 750911	AREA: PLANT NORTH	CASING DIAMETER (IN): 2 ID	GEOLOGIST: DCB	21-86
EAST: 2082503	LOCATOR NUMBER: J10	BOREHOLE DIAMETER (IN): 7.25	DATE DRILLED: 11/14/86	

REMARKS: Hollow Stem Auger/NC Core.

CHEMICAL SAMPLE DEP
GRADATIONAL SAMPLE
SAMPLE NUMBER

SAMPLE GRAIN SIZE (0% 50% 100%) | PERCENT RECOVERY (0% 100%) | RECOVERY/INTERVAL | DATUM (FT) | DEPTH (FT) | WELL OR PIEZOMETER CONSTRUCTION | LITHOLOGY | UNIFIED SOILS CLASSIFICATION OR ROCK TYPE | DESCRIPTION

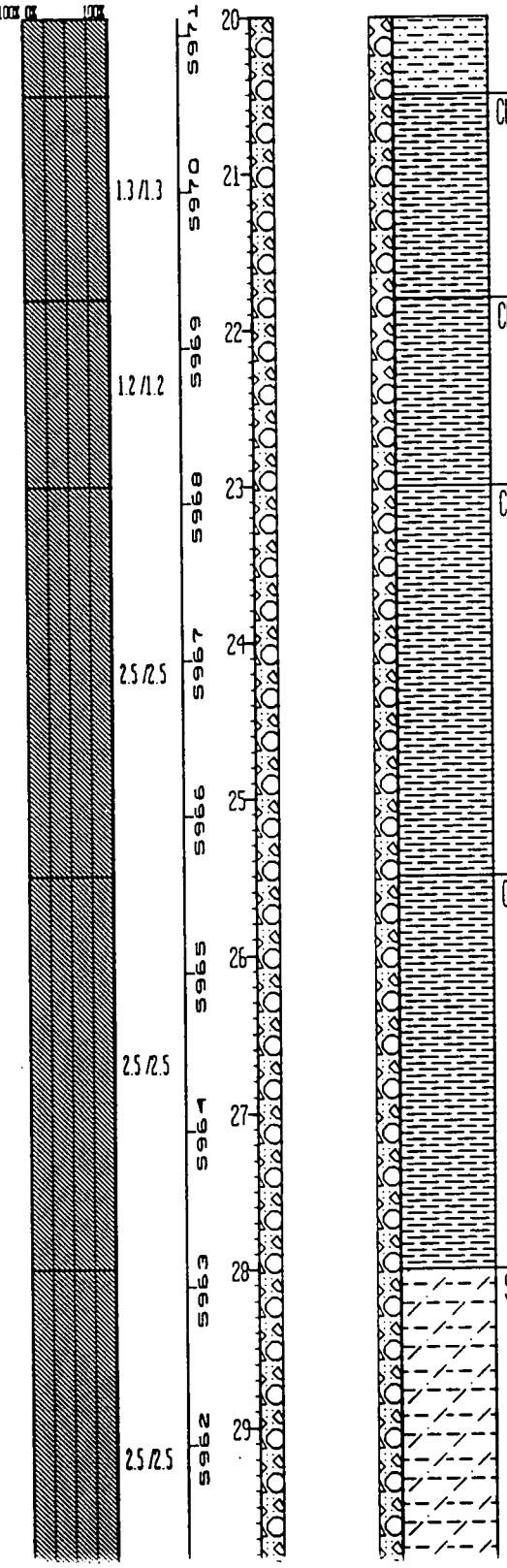


CL:	Same as above.
CL:	Same as above.
SANDY CLAYSTONE:	Top of Bedrock Very light gray (N8), mottled dark yellowish orange (10YR 6/6), low to moderate plasticity, some silt, sand is disseminated throughout the majority of this interval with short intervals (<0.1 ft.) of sand occuring locally.
SANDY CLAYSTONE:	Same as above.
SANDY CLAYSTONE:	Same as above.

STATE PLANE COORDINATE:		TOTAL DEPTH (FT): 78	GROUND ELEVATION (FT):	5991.11	PROJECT NUMBER:	667.11	LOG OF BORING NUMBER:
NORTH:	750911	AREA: PLANT NORTH	CASING DIAMETER (IN):	2 ID	GEOLOGIST:	DCB	21-86
EAST:	2082503	LOCATOR NUMBER: J10	BOREHOLE DIAMETER (IN):	7 25	DATE DRILLED:	11/14/86	

REMARKS: Hollow Stem Auger/NC Core.

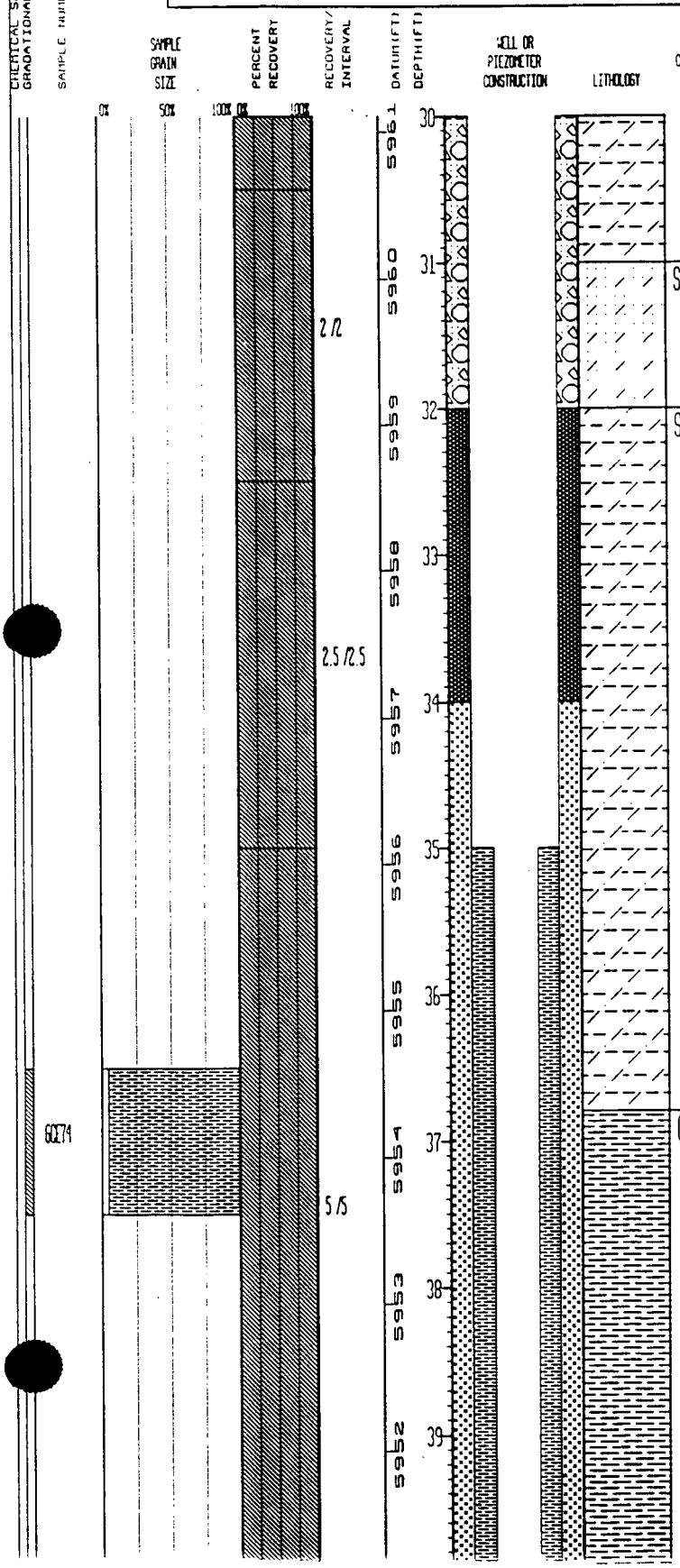
CHEMICAL SAMPLE DEPTH
GRADATIONAL SAMPLE DEPTH
SAMPLE NUMBER
SAMPLE GRAIN SIZE (0% 50% 100%)
PERCENT RECOVERY (0% 100%)
RECOVERY/INTERVAL
DATUM (FT)
DEPTH (FT)
WELL OR PIEZOMETER CONSTRUCTION
LITHOLOGY
UNIFIED SOILS CLASSIFICATION OR ROCK TYPE
DESCRIPTION



Recovery/Interval	Datum (ft)	Depth (ft)	Unified Soils Classification or Rock Type	Description
	5971	20		
1.3/1.3	5970	21	CLAYSTONE:	Interval grades to claystone. Very light gray (N8) to dark yellowish orange (10YR 6/6), iron staining, bedding not apparent, highly weathered, slightly friable, local occurences of dark mineralization (possibly a Mg oxide), slight silt fraction.
1.2/1.2	5969	22	CLAYSTONE:	As above with a few sub-angular to sub-rounded gravel from approx. 22.7 to 23.6 ft.
	5968	23	CLAYSTONE:	Same as above.
2.5/2.5	5967	24		
	5966	25		
			CLAYSTONE:	Same as above.
	5965	26		
2.5/2.5	5964	27		
	5963	28	SILTY CLAYSTONE:	Grayish orange (10YR 7/4), bedding not apparent, highly weathered, moderately friable, local iron staining and dark mineralization.
2.5/2.5	5962	29		

STATE PLANE COORDINATE:		TOTAL DEPTH (FT): 78	GROUND ELEVATION (FT):	5991.11	PROJECT NUMBER:	667.11	LOG OF BORING NUMBER:
NORTH:	750911	AREA: PLANT NORTH	CASING DIAMETER (IN):	2 ID	GEOLOGIST:	DCB	21-86
EAST:	2082503	LOCATOR NUMBER: J10	BOREHOLE DIAMETER (IN):	7.25	DATE DRILLED:	11/14/86	

REMARKS: Hollow Stem Auger/NC Core.



UNIFIED SOILS CLASSIFICATION OR ROCK TYPE	DESCRIPTION
SILTY SANDSTONE:	Interval grades to silty sandstone at approx. 31 ft. Very light gray (N8) to grayish orange (10YR 7/4), bedding appears to be horizontal (based on core breaks), well weathered, slightly friable, local iron staining and dark mineralization (Mg oxides?) occurs on partings.
SILTY CLAYSTONE:	Interval grades to silty claystone. Grayish orange (10YR 7/4), bedding not apparent, well weathered, slightly friable, dark mineralization occurs on a fracture face at approx. 33.5 ft., abundant iron staining from approx. 36 to 37 ft.
CLAYSTONE:	Interval grades to Claystone. Medium light gray (N6), bedding appears to be horizontal (based on core breaks), weathered, slightly friable, significant silt fraction, localized occurences of dark mineralization, probably carbonaceous.

STATE PLANE COORDINATE:	TOTAL DEPTH (FT): 78	GROUND ELEVATION (FT): 5991.11	PROJECT NUMBER: 667.11	LOG OF BORING NUMBER:
NORTH: 750911	AREA: PLANT NORTH	CASING DIAMETER (IN): 2 ID	GEOLOGIST: DCB	21-86
EAST: 2082503	LOCATOR NUMBER: J10	BOREHOLE DIAMETER (IN): 7 25	DATE DRILLED: 11/14/86	

REMARKS: Hollow Stem Auger/NC Core.

CHEMICAL SAMPLE DEPTH / GRADATIONAL SAMPLE DEPTH	SAMPLE NUMBER	SAMPLE GRAIN SIZE (0% 50% 100%)	PERCENT RECOVERY (0% 100%)	RECOVERY/INTERVAL	DATUM (FT)	DEPTH (FT)	WELL OR PIEZOMETER CONSTRUCTION	LITHOLOGY	UNIFIED SOILS CLASSIFICATION OR ROCK TYPE	DESCRIPTION
				1/1	5951	40				SILTY CLAYSTONE: As above.
					5950	41				SILTY CLAYSTONE: As above.
					5949	42				
				4/4	5948	43				
					5947	44				
					5946	45				SILTY CLAYSTONE: Medium light gray (N6), thin, approx. horizontal bedded to bedding not apparent, slightly friable, occasional intervals of v. fine sand (typically < 0.2 ft. thick), silt occurs disseminated throughout clay and as interfingering laminae. At about 47 ft. bedding on slabbed surface exhibits 10° degree dip.
					5945	46				
	6072				5944	47				
				5/5	5943	48				
					5942	49				

STATE PLANE COORDINATE:	TOTAL DEPTH (FT): 78	GROUND ELEVATION (FT): 5991.11	PROJECT NUMBER: 667.11	LOG OF BORING NUMBER:
NORTH: 750911	AREA: PLANT NORTH	CASING DIAMETER (IN): 2 ID	GEOLOGIST: DCB	21-86
EAST: 2082503	LOCATOR NUMBER: J10	BOREHOLE DIAMETER (IN): 7 25	DATE DRILLED: 11/14/86	

REMARKS: Hollow Stem Auger/NC Core.

CHEMICAL SAMPLE DEPTH
GRADATIONAL SAMPLE
SAMPLE NUMBER

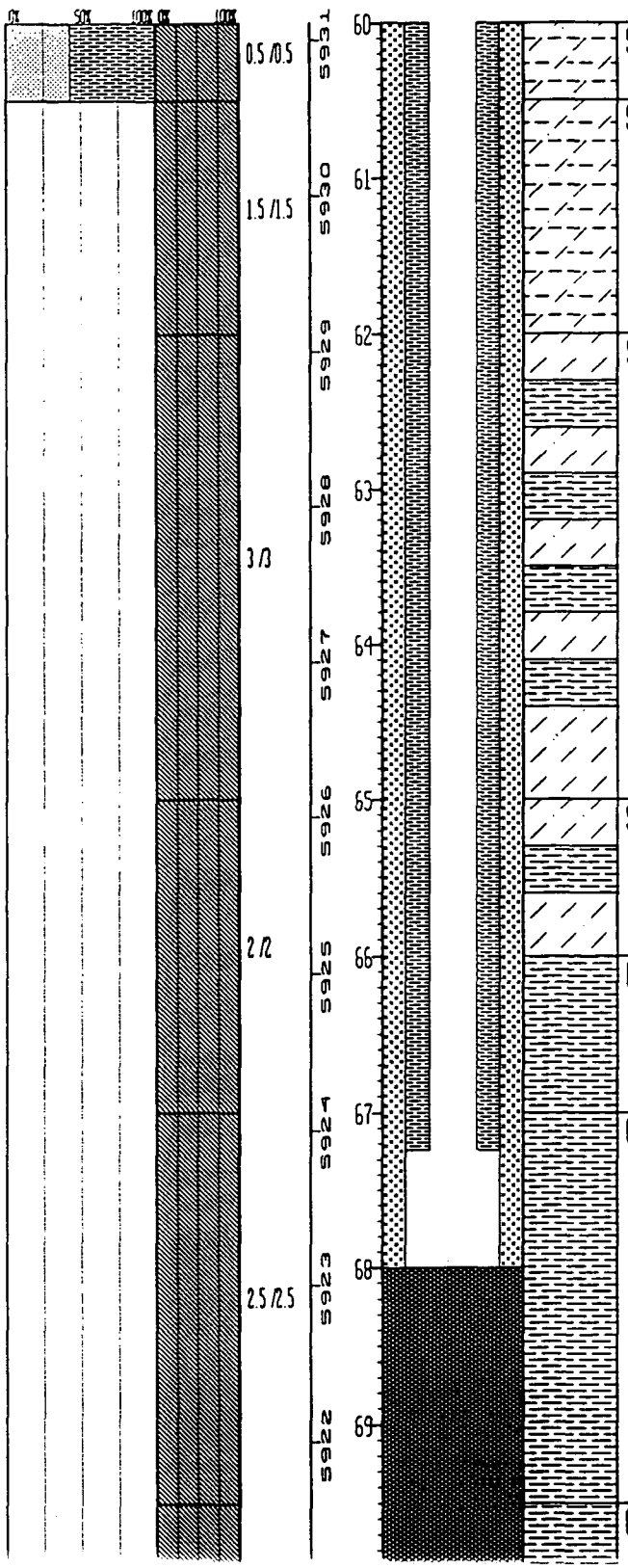
SAMPLE GRAIN SIZE	PERCENT RECOVERY	RECOVERY/INTERVAL	DATUM (FT)	DEPTH (FT)	WELL OR PIEZOMETER CONSTRUCTION	LITHOLOGY	UNIFIED SOILS CLASSIFICATION OR ROCK TYPE	DESCRIPTION
CL 50%	100% 0% 100%	0.5/0.5	5991	50			SILTY CLAYSTONE:	As above.
		1/1	5990	51			SILTY CLAYSTONE:	As above.
							SILTY SANDSTONE:	Interval grades to silty sandstone, very light gray (N8), thin wavy bedding, slightly friable, very fine grained, well sorted.
			5989	52			SILTSTONE:	Very light gray (N8), bedding not apparent, slightly friable.
		3.5/3.5	5988	53				
			5987	54				
			5986	55			SILTSTONE:	Same as above.
			5985	56				
			5984	57			SILTY CLAYSTONE:	Light gray (N7), bedding is thin with slight dip to bedding not apparent, moderate to slight weathering, slightly friable, silt is disseminated throughout clay and as interfingering laminae, slight VFG sand fraction as beds <0.1 ft. and disseminated locally.
		5/5	5983	58				
			5982	59				

STATE PLANE COORDINATE:		TOTAL DEPTH (FT): 78	GROUND ELEVATION (FT):	5991.11	PROJECT NUMBER:	667.11	LOG OF BORING NUMBER:
NORTH:	750911	AREA: PLANT NORTH	CASING DIAMETER (IN):	2 ID	GEOLOGIST:	DCB	21-86
EAST:	2082503	LOCATOR NUMBER: J10	BOREHOLE DIAMETER (IN):	7.25	DATE DRILLED:	11/14/86	

REMARKS: Hollow Stem Auger/NC Core.

CRITICAL SAMPLE DEPTH
GRADATIONAL SAMPLE DEPTH
SAMPLE NUMBER
SAMPLE GRAIN SIZE
PERCENT RECOVERY
RECOVERY/INTERVAL
DATUM (FT)
DEPTH (FT)
WELL OR PIEZOMETER CONSTRUCTION
LITHOLOGY
UNIFIED SOILS CLASSIFICATION OR ROCK TYPE
DESCRIPTION

6273

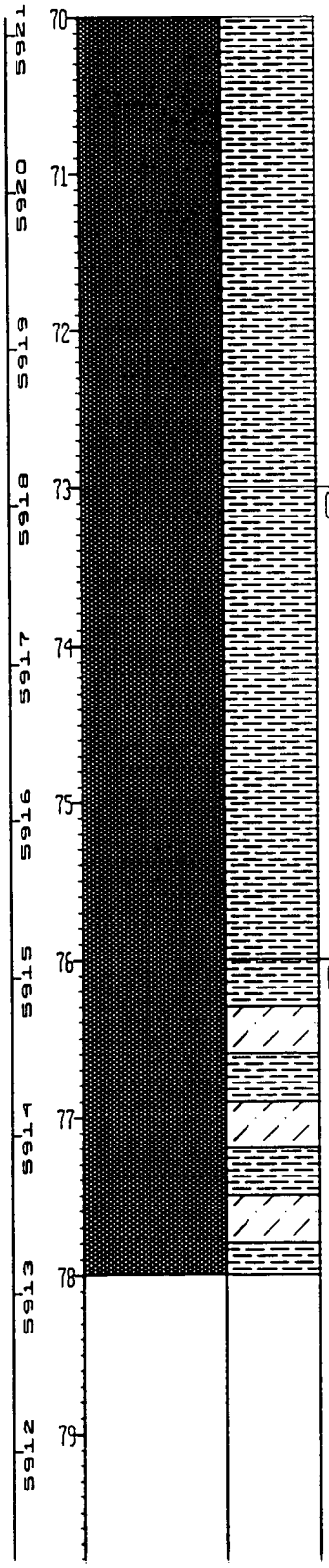


UNIFIED SOILS CLASSIFICATION OR ROCK TYPE	DESCRIPTION
SILTY CLAYSTONE:	As above with abundant VFG sand.
SILTY CLAYSTONE:	At 60.5 ft. silty, sandy claystone unconformably overlies a claystone. The unconformity is not borne out by the sequence at the top of the next box. Silty claystone, light gray (N7), bedding is thin <2 cm. with slight dip to not apparent, weathered, slight to moderate friability, some VFG sand, silt and sand core disseminated within the claystone and occur as discreet intervals.
SILTSTONE:	Interbedded siltstone and claystone. Siltstone, light gray (N7) to med. dark gray (N4), thin bedded < 2 mm., with slight dip, slightly weathered, slightly friable, clay defines bedding planes, significant fraction of VFG sand, carbonaceous mineralization occurs on bedding planes.
SILTSTONE:	Same as above.
CLAYSTONE:	Medium gray (N5), bedding not apparent, slightly weathered, slightly friable, localized iron staining, some carbonaceous mineralization occurs on partings, moderate silt fraction.
CLAYSTONE:	As above.
CLAYSTONE:	As above with increase in silt fraction from approx. 70.5 to 71.2 ft. silt/clay define bedding <2 mm. thick. Slickensides at approx. 72.6 ft

STATE PLANE COORDINATE:	TOTAL DEPTH (FT): 78	GROUND ELEVATION (FT): 5991.11	PROJECT NUMBER: 667.11	LOG OF BORING NUMBER:
NORTH: 750911	AREA: PLANT NORTH	CASING DIAMETER (IN): 2 ID	GEOLOGIST: DCB	21-86
EAST: 2082503	LOCATOR NUMBER: J10	BOREHOLE DIAMETER (IN): 7.25	DATE DRILLED: 11/14/86	

REMARKS: Hollow Stem Auger/NC Core.

CHEMICAL SAMPLE DEPTH
GRADATIONAL SAMPLE D
SAMPLE NUMBER
SAMPLE GRAIN SIZE (0% 50% 100%)
PERCENT RECOVERY (0% 100%)
RECOVERY/INTERVAL
DATUM (FT)
DEPTH (FT)
WELL OR PIEZOMETER CONSTRUCTION
LITHOLOGY



UNIFIED SOILS CLASSIFICATION OR ROCK TYPE	DESCRIPTION
	approx 22 degrees attitude.
CLAYSTONE:	Same as above.
CLAYSTONE:	Interbedded siltstone and claystone. Silty claystone, light gray (N7) med. dark gray (N4), thin bedded <2 mm., slight dip, slightly weathered, slightly friable, localized iron staining. Note: No water encountered during drilling.

INDEX OF DATA

Boring No.: 22-86

Completed as well? Yes

Data in File

X Log of Borehole

X Well Construction Summaries

____ Well Development Summaries

X Hydraulic Conductivity Test Data and Results

____ Packer Test Data and Results

X Water Level Data

X Saturated Thickness Hydrographs

Project: Rocky Flats Plant

LOG OF BORING NO. 22-86

Date Drilled 9/8/86

Boring Method Hollow Stem Auger

Coordinates N 37734.9 E 21307.7

Ground Surface Elevation 5976.81

Elev. (feet)	Depth (feet)	Sample Type	Graphic Log	Material Description	Penetration Resistance (Blows/inch) 20 40	Water Content (%) 20 40	Other Tests
	10			10.0-12.0'-Sample. Recovered 2.0/2.0'=100%. 10.0-11.0'. GRAVEL: Same as above; wet.			
				ARAPAHOE FORMATION 11.0-12.0'. SANDSTONE: medium light gray (N 6); medium to fine-grained silty sand with some clay; few dark yellowish orange (10YR 6/6) iron staining; moderately sorted; firm; moist.			
	12.5			12.0-14.0'-Sample. Recovered 2.0/2.0'=100%. SANDSTONE: medium light gray (N 6); medium to fine-grained sand and silty sand; increased iron staining; clayey layers at 12.9 and 13.4'; well sorted; firm; moist.			
	15			14.0-16.0'-Sample. Recovered 2.0/2.0'=100%. SANDSTONE: medium light gray (N 6); medium to fine-grained sand and silty sandstone with interbedded claystone; increase in clay content; slightly calcareous fractures at 14.4'; moderately sorted; firm; moist.			
	17.5			16.0-18.0'-Sample. Recovered 2.0/2.0'=100%. SANDSTONE: medium light gray (N 6) interbedded sandstone and claystone; increase in dark yellowish orange iron staining (10YR 6/6); increase in clay content; moderately sorted; firm; moist.			
				18.0-19.0'-Sample. Recovered 1.0/1.0'=100%. CLAYSTONE: greenish gray (5GY 6/1) to medium light gray (N 6); with interbedded fine-grained, silty, clayey sand; firm; moist.			
	20						

Remarks Logged by: T. Murphy

Checked by: [illegible]

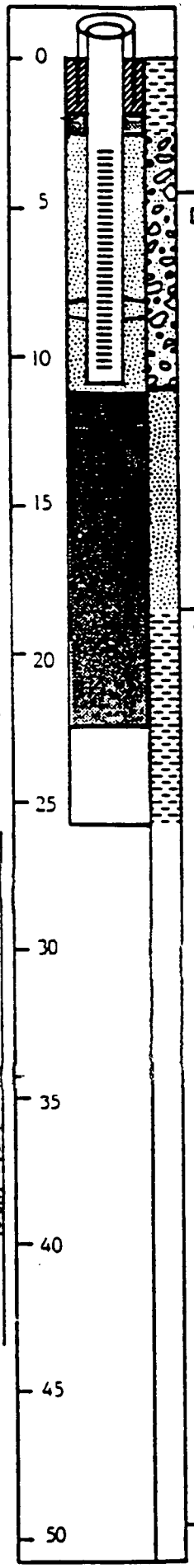
Project No.

WELL 22-86

WELL CONSTRUCTION SUMMARY

LOCATION or COORDS: N 37734.9 E 21307.7

ELEVATION: GROUND LEVEL 5976.81'
TOP OF CASING 5978.05'



LOCATION Golden, CO
PERSONNEL T. Murphy
PROJECT 106R06222 Rocky Flats Plant

DRILLING SUMMARY:

TOTAL DEPTH Well: 11.20' Hole: 26.00'
BOREHOLE DIAMETER 7½"

DRILLER Boyles Brothers Drilling Co.
15865 W. 5th Avenue
Golden, CO (Dave Jarvie)
RIG Mobile B-57
BIT(S) T5

DRILLING FLUID None

SURFACE CASING 5" x 4' steel w/ locking cap

WELL DESIGN:

BASIS: GEOLOGIC LOG X GEOPHYSICAL LOG ___

CASING STRING(S): C=CASING S=SCREEN

0.00'	-	3.20'	C1		
3.20'	-	11.20'	S1		

CASING: C1 2" I.D. Sch. 5 type 316 stainless steel, threaded and flush jointed.

SCREEN: S1 2" I.D. Sch. 5 type 316 stainless steel, threaded and flush jointed. 0.010" wire wrap screen 0.25' welded bottom cap.

CENTRALIZERS Type 304 stainless steel
6.10' - 7.35'

FILTER MATERIAL 32-42 silica sand
2.50' - 11.40'

CEMENT Portland Type I
0.00' - 2.00'

OTHER 3/8" bentonite pellets
2.00' - 2.50'
11.40' - 22.60'

CONSTRUCTION TIME LOG:

TASK	START DATE 1986	START TIME	FINISH DATE 1986	FINISH TIME
DRILLING:				
7½" auger	9/8	1000	9/8	162
GEOPHYS. LOGGING:	—	—	—	—
CASING:				
2" stainless	9/8	1734	9/8	17
FILTER PLACEMENT:	9/8	1738	9/8	17
CEMENTING:	9/8	1748	9/8	18
DEVELOPMENT:	9/12	1620	9/19	1
OTHER:				
Bentonite	9/8	1742	9/8	17
	9/8	1723	9/8	17

WELL DEVELOPMENT

See Well Development Summary Sheet.

COMMENTS:

Water encountered at 10.5' during drill.

Top of stainless steel casing: 1.24'

Cave from TD to 22.60'

12:01:59.68 BAIL DOWN - RECOVERY ANALYSIS FOR WELL 22-86 FRI 06-20-198

RAW DATA

WELL # 22-86

WELL DIAMETER= 7.25 INCHES
CASING DIAMETER= 2.00 INCHES
VOLUME OF WATER= .64 GALLONS *
LENGTH OF AQUIFER TESTED= 3.93 FEET
VALUE OF H0= 3.93 FEET
STATIC WATER LEVEL= 7.27 FEET
LENGTH OF SCREEN= 8.00 FEET
WATER TABLE TO BOTTOM OF WELL= 3.93 FEET

*Bailed well dry in 6 min.; 6.4 gal. = volume in casing & screen.

SLUG TEST DATA:

TIME	WATER LEVEL (FEET)	TIME SINCE TEST BEGAN (MINUTES)
0. 8.30	10.46	8.50
0. 9. 0	10.39	9.00
0. 9.30	10.17	9.50
0.10. 0	10.11	10.00
0.10.30	10.07	10.50
0.11. 0	9.93	11.00
0.11.30	9.81	11.50
0.12. 0	9.72	12.00
0.12.30	9.64	12.50
0.13. 0	9.52	13.00
0.14. 0	9.35	14.00
0.15. 0	9.17	15.00
0.16. 0	8.98	16.00
0.17. 0	8.85	17.00
0.18. 0	8.74	18.00
0.19. 0	8.49	19.00
0.20. 0	8.37	20.00
0.21. 0	8.20	21.00
0.22. 0	8.10	22.00
0.23. 0	8.02	23.00
0.24. 0	7.93	24.00
0.30. 0	7.92	30.00
0.40. 0	7.91	40.00
0.49. 0	7.85	49.00
0.54. 0	7.82	54.00
0.59. 0	7.80	59.00
1. 4. 0	7.78	64.00
1. 9. 0	7.74	69.00
1.21. 0	7.71	81.00
1.34. 0	7.69	94.00
1.44. 0	7.66	104.00
1.54. 0	7.63	114.00
2. 5. 0	7.61	125.00
2.14. 0	7.58	134.00
2.24. 0	7.54	144.00

12:02:08.46 BAIL DOWN - RECOVERY ANALYSIS FOR WELL 22-86 FRI 06-10-19

WELL # 22-86

PERMEABILITY BASED ON COOPER, BREDEHOEFT, AND PAPADOPULOS METHOD

PERMEABILITY=8.98E-04/ MATCH TIME (IN MINUTES)
STORAGE COEF= 7.61E-02* ALPHA
COMPUTER CALCULATES
ALPHA=1.00E-05 MATCH TIME= 7.5
PERMEABILITY= 1.20E-04 CM/SEC
STORAGE COEF=7.61E-07
CORRELATION NUMBER= 1.00

PERMEABILITY BASED ON REGRESSION FIT OF HEAD RATIO DATA

HVORSLEV PERMEABILITY=1.15E-03 / LAG TIME
BOUWER PERMEABILTY=1.00E-03 * -SLOPE

COMPUTER CALCULATES
PERMEABILITY VARIES MORE THAN 20% DEPENDING ON THEEQUAT

FOR X ON Y: HVORSLEV PERMEABILITY=5.38E-05 CM/SEC
BOUWER PERMEABILITY=7.43E-06CM/SEC
FOR Y ON X: HVORSLEV PERMEABILITY=4.32E-05 CM/SEC
BOUWER PERMEABILITY=9.94E-06 CM/SEC
AVERAGE HVORSLEV PERMEABILITY=4.79E-05 CM/SEC
AVERAGE BOUWER PERMEABILITY=8.69E-06 CM/SEC
REGRESSION STATISTICS
X ON Y
INTERCEPT= -.27
SLOPE=-7.40E-03
Y ON X
INTERCEPT= -.17
SLOPE=-9.90E-03
CORRELATION COEFFICIENT= -.86
CALCULATIONS INDICATE THAT A VALUE OF 6.72 FEET FOR HO
OR A VALUE OF 1.529 INCHES FOR EFFECTIVE CASING DIA.
MAY YIELD BETTER RESULTS

PERMEABILITY BASED ON REGRESSION FIT OF DATA - FERRIS & KNOWLES M

PERMEABILITY=8.79E-04 / SLOPE
PERMEABILITY=3.09E-05 CM/SEC
REGRESSION STATISTICS
X ON Y
INTERCEPT= -.03
SLOPE= 2.79E+01
Y ON X
INTERCEPT= -.08
SLOPE= 2.90E+01

AQUIFER TEST DATA

WELL 22-86
PUMPING or OBSERVATION W
PUMPING or RECOVERY DATA
PAGE 1 OF 2

TYPE OF AQUIFER TEST Rail down recovery
HOW Q MEASURED N/A (bailed)
HOW W.L.'s MEASURED [illegible]
RAD./DIST. OF/FROM PUMPING WELL 3
MEAS. POINT FOR W.L.'s [illegible]
ELEVATION OF MEAS. POINT [illegible]

DEPTH OF PUMP/AIRPIPE
PUMP ON: date 9/26 time
PUMP OFF: date time
DURATION OF AQUIFER TEST 136 min.

LOCATION Rocky Flats Plant, Golden, CO
PERSONNEL J. Pearce M. Bergman
PROJECT 106P06222

TIME t = 0858:00 at t' = 0					WATER LEVEL DATA STATIC WATER LEVEL 5+3.52'					DISCHARGE		RECORDED BY	COMMENTS
DAY	CLOCK TIME	t	t'		READING	CONVERSIONS & CORRECTIONS	WATER LEVEL	s or s'		READING	Q		
1	0845				5+3.52	-1.25'/sv	7.27						static
1	0852	0											Begin bailing
1	0856	6							5'	~3.25			Bailed dry
0858	0858	8	0		10+1.78	"	10.53	-0.07	-3.26			JP	Begin recovery 0858:0
1	:30		:30		10+1.71	"	10.46	-0.07	-3.19				
1	0859		1:00		10+1.64	"	10.39	-0.22	-3.12				
1	:30		1:30		10+1.47	"	10.17	-0.06	-2.90				
1	0900		2:00		10+1.36	"	10.11	-0.04	-2.84				
1	:30		[illegible]		10+1.32	"	10.07	-0.14	-2.80				
1	0901		[illegible]		10+1.18	"	9.93	-0.12	-2.66				
1	:30		[illegible]		10+1.06	"	9.81	-0.09	-2.54				
1	[illegible]		[illegible]		10+0.97	"	9.72	-0.08	-2.45				
1	:30		[illegible]		10+0.89	"	9.64	-0.12	-2.37				
1	0903		5:00		10+0.77	"	9.52	-0.17	-2.25				
1	0904		6:00		10+0.60	"	9.35	-0.18	-2.08				
1	0905		7:00		10+0.42	"	9.17	-0.19	-1.90				
1	0906		8:00		10+0.23	"	8.98	-0.13	-1.71				
1	[illegible]		9:00		10+0.10	"	8.85	-0.11	-1.58				
1	0908		10:00		5+4.99	"	8.74	-0.25	-1.47				
1	0909		11:00		5+4.74	"	8.49	-0.12	-1.22				
1	0910		12:00		5+4.62	"	8.37	-0.17	-1.10				
1	0911		[illegible]		5+4.45	"	8.20	-0.10	-0.93				
1	0912		[illegible]		5+4.35	"	8.10	-0.08	-0.83				
1	0913		[illegible]		5+4.27	"	8.02	-0.09	-0.75				
1	0914		15:00		5+4.18	"	7.93	-0.00	-0.66				
1	0916		18:00		5+4.18	"	7.93	-0.00	-0.66				
1	0918		[illegible]		5+4.18	"	7.93	-0.01	-0.66				
1	0920		[illegible]		5+4.17	"	7.92	-0.00	-0.65				
1	0922		[illegible]		5+4.17	"	7.92	-0.00	-0.65				
1	0924		25:00		5+4.17	"	7.92	0.00	-0.65				
1	0926		[illegible]		5+4.17	"	7.92	0.00	-0.65				
1	0928		[illegible]		5+4.17	"	7.92	-0.01	-0.65				
1	0930		[illegible]		5+4.16	"	7.91	+0.01	-0.64				
1	0932		[illegible]		5+4.17	"	7.92	0.00	-0.65				
1	0934		[illegible]		5+4.17	"	7.92	-0.07	-0.65				
1	0937		[illegible]		5+4.10	"	7.85	-0.03	-0.58				
1	0944		46:00		5+4.07	"	7.82	-0.02	-0.55				
1	0949		[illegible]		5+4.05	"	7.80	-0.02	-0.53				
1	0954		56:00		5+4.03	"	7.78	-0.04	-0.51				
1	0959		61:00		5+3.99	"	7.74	0.00	-0.47				
1	1005	[illegible]	61:00		5+3.99	-1.25 sv	7.74	-0.03	-0.47			JP	Gain 1 min.

ROCKY FLATS SOLAR PONDS

WATER LEVEL SUMMARY

WELL NUMBER	DATE	GROUND SURFACE ELEVATION	TOP OF CASING ELEVATION	STICK UP	DEPTH OF SI BASE	WATER DEPTH BELOW TOC	WATER SURFACE ELEVATION
2286	09/12/86	5976.81	5978.05	1.24	11.20	8.38	5969.67
	09/13/86					8.52	5969.53
	09/15/86					8.25	5969.80
	09/16/86					8.22	5969.83
	09/17/86					8.28	5969.77
	09/19/86					8.22	5969.83
	10/13/86					7.22	5970.83
	11/26/86					7.35	5970.70
	01/01/87					8.50	5969.55
	02/25/87					7.29	5970.76
	03/24/87					6.17	5971.88
	05/08/87					5.71	5972.34
	06/03/87					6.80	5971.25
	07/08/87					6.25	5971.80
	08/04/87					6.80	5971.25
	08/27/87					5.60	5972.45
	09/03/87					5.90	5972.15
	10/21/87					8.00	5970.05
	11/09/87					8.40	5969.65
	12/21/87					8.00	5970.05
	01/11/88					6.60	5971.45
	02/29/88					7.30	5970.75
	03/21/88					7.20	5970.85
	04/18/88					6.70	5971.35

LOG OF BORING NO. 22-86

GEOLOGIST(S): UAA
DATE: 8/16/89

PROJECT NO: 667-1122

TOP/BOTTOM OF CORE IN BOX	TOP/BOTTOM OF INTERVAL	FEET OF CORE IN INTERVAL IN BOX	SAMPLE NUMBER	FRACTURE ANGLE	BEDDING ANGLE	GRAIN SIZE DISTRIBUTION	USCS SYMBOL	DEPTH IN FEET	LITHOLOGIC LOG	LITHOLOGIC DESCRIPTION
0.0	0.0					Gravel >50%	GC	1, 2, 3		Clayey gravel. No preferr. color for gravel. Angular to sub rounded. Mod. well graded. Granules to 4cm. Clay matrix dk yellowish brown (10yr 4/2). Est. plast. Low to mod. Some silt + v.f.g. sand.
	UA ~~1.35~~	1.25								
	3.0	.4				Gravel >50%				Same as above. Color change in matrix to moderate yellowish brown (10yr 5/4).
	3.4	* .2				Gravel 100%		4, 5		* Markers indicate a sample was removed here. Gravel Grayish orange pink (10R 8/2). Looks like a ground up single rock.
	5.0	1.25				GC → Gravel >50%, ← Calche ~25%		6, 7		Sandy Gravel. Med. lt. gray (N6) Angular. Mod. to well graded to 5.5 cm. Sandy calche matrix. Sand v.f.g. to coarse.
	7.0	.35				CL → Clay >40%, ← Sand >30%, Gravel <30%		8, 9		Sandy clay. Grayish orange (10yr 7/4). Plast. Low. Sand v.f.g. to v. coarse. Some gravel to 3cm.
	10.0									

NOTES: General USCS is modified for this log as follows:
Material amounts are estimated by % volume instead of % weight.
(1) Badly broken core, accurate footage measurements not possible.
(2) Core breaks cannot be matched, accurate footage measurements not possible.

ROCKY FLATS PLANT

FIGURE NO.

LOG OF BORING NO. 22-86

GEOLOGIST(S): LAA
DATE: 8/16/89

PROJECT NO: 667-1122

TOP/BOTTOM OF CORE IN BOX	TOP/BOTTOM OF INTERVAL	FEET OF CORE IN INTERVAL IN BOX	SAMPLE NUMBER	FRACTURE ANGLE	BEDDING ANGLE	GRAIN SIZE DISTRIBUTION	USCS SYMBOL	DEPTH IN FEET	LITHOLOGIC LOG	LITHOLOGIC DESCRIPTION
↑ Box 1 of 3	10.0	1.85				Sand >50%	GC	11		Top 6 in. Clayey Sand + gravel Gravel predom. Mod gray (1PS). Well graded (granules to 5 cm.) Subangular to sub rounded Sand v.f.g. to granules. (well graded) Some silt. Bottom of interval: Sand. Very Pale orange. (10yr 8/2). v.f.g. Some iron staining. Well sorted
	12.0							12		
		.25*				Sand >50%	GC	13		*Marker indicates sample was removed here. Same as above.
14.0	14.0							14		
Box 2 of 3		1.85				Clay >50%	CL	15		Silty Clay. Very pale orange to dk yellowish orange (10yr 8/2 to 6/6). Mod. to high plast. Some iron staining. Trace Calcite, carbonaceous material.
	16.0							16		~~Same as above~~ LAA Silty Claystone Very pale orange to dk yellowish orange. (10y 8/2 to 6/6). Mod. weathered, ~~high plasticity~~ v.f.g. Slightly to mod. Friable. Bedding not evident. Some v.f.g. Sand. Some iron staining Trace Carb. material.
		1.80				Clay >50%		17		
	18.0							18		
		1.10				Clay >50%				Same as above
	19.0							19		
	19.7	.65				Clay >50%				Same as above.
	↓									See next page for descript. of this interval.

NOTES: General USCS is modified for this log as follows:
Material amounts are estimated by % volume instead of % weight.
(1) Badly broken core, accurate footage measurements not possible.
(2) Core breaks cannot be matched, accurate footage measurements not possible.

ROCKY FLATS PLANT

FIGURE NO.

LOG OF BORING NO. 22-86

GEOLOGIST(S): UAA
DATE: 8/16/89
PROJECT NO:

TOP/BOTTOM OF CORE IN BOX	TOP/BOTTOM OF INTERVAL	FEET OF CORE IN INTERVAL IN BOX	SAMPLE NUMBER	FRACTURE ANGLE	BEDDING ANGLE	GRAIN SIZE DISTRIBUTION	USCS SYMBOL	DEPTH IN FEET	LITHOLOGIC LOG	LITHOLOGIC DESCRIPTION
Box 2 of 3	19.7 – 21.0	(1) 1.25				Clay >50%		21		Silty Claystone. Very [illegible] to [illegible] orange (10yr 8/2 to 10yr 7/4). Mod [illegible]. Slightly to mod. friable. Some iron [illegible]. Some black carb. material. Some v.f.g. sand.
Box 2 of 3	21.0 – 23.0	(1) 1.65				Clay >50%		22, 23		Same as above
Box 3 of 3	23.0 – 24.0	1.1						24		Same as above — Begin Box 3
Box 3 of 3	24.0 – 26.0	0				Clay >50%		25, 26	X	No Sample
								27, 28, 29		Bottom of Boxes

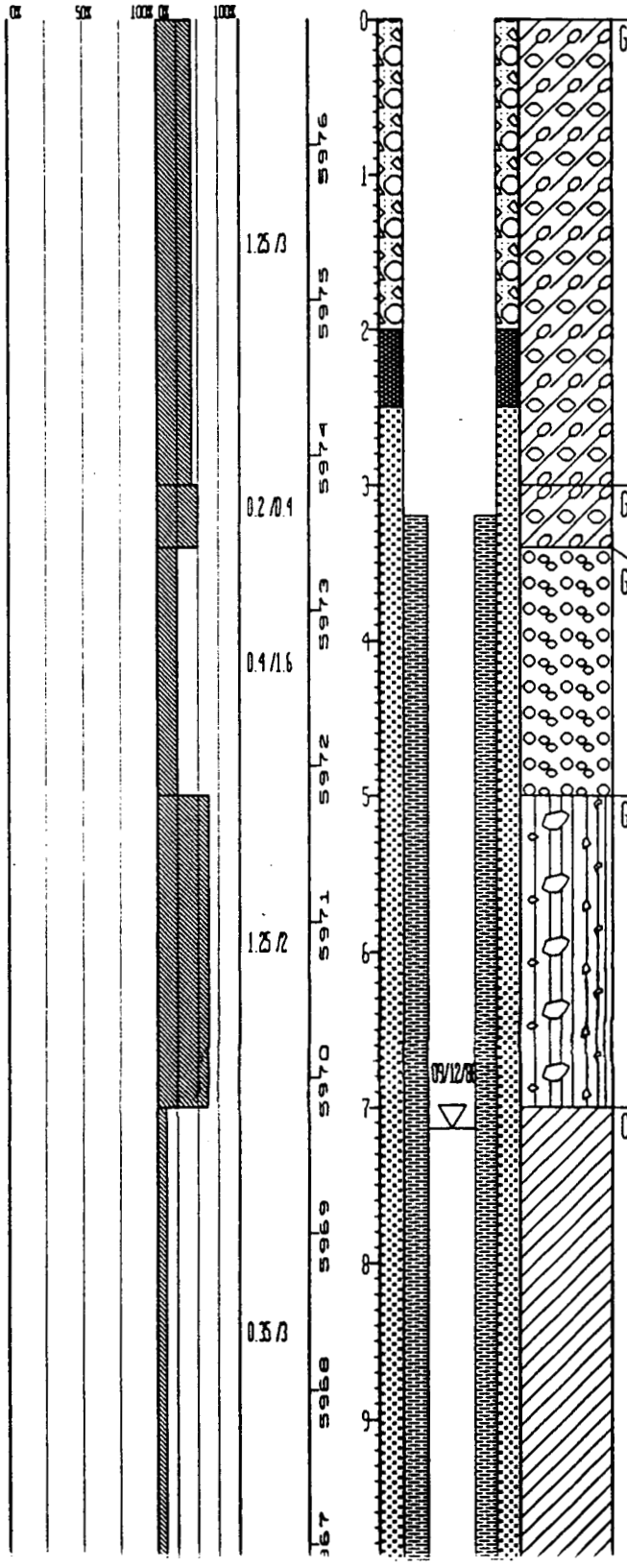
NOTES: General USCS is modified for this log as follows:
Material amounts are estimated by % volume instead of % weight.
(1) Badly broken core, accurate footage measurements not possible.
(2) Core breaks cannot be matched, accurate footage measurements not possible.

ROCKY FLATS PLANT

FIGURE NO.

STATE PLANE COORDINATE:	TOTAL DEPTH (FT): 26	GROUND ELEVATION (FT): 5976.81	PROJECT NUMBER: 667.11	LOG OF BORING NUMBER:
NORTH: 750737	AREA: SOLAR POND	CASING DIAMETER (IN): 2 ID	GEOLOGIST: LMA	22-86
EAST: 2084412	LOCATOR NUMBER: L10	BOREHOLE DIAMETER (IN): 7.25	DATE DRILLED: 09/08/86	
REMARKS: Hollow Stem Auger.				

CHEMICAL SAMPLE DEPTH
GRADATIONAL SAMPLE D
SAMPLE NUMBER
SAMPLE GRAIN SIZE (0% 50% 100%)
PERCENT RECOVERY (0% 100%)
RECOVERY/INTERVAL
DATUM (FT)
DEPTH (FT)
WELL OR PIEZOMETER CONSTRUCTION
LITHOLOGY
UNIFIED SOILS CLASSIFICATION OR ROCK TYPE
DESCRIPTION



UNIFIED SOILS CLASSIFICATION OR ROCK TYPE	DESCRIPTION
GC:	Clayey Gravel - no predom. color for gravel, angular to subrounded, mod. well graded, granules to 4 cm. Clay matrix dk. yellowish brown (10YR 4/2), est. plast. low to mod., some silt and VFG sand.
GC:	Same as above. Color change in matrix to moderate yellowish brown (10YR 5/4).
GW:	Markers indicate a sample was removed here. GRAVEL - grayish orange pink (10R 8/2) Looks like ground up single rock
GM:	SANDY GRAVEL - med. lt. gray (N6), angular, mod. to well graded to 5.5 cm., sandy caliche matrix, sand VFG to coarse.
CL:	SANDY CLAY - grayish orange (10YR 7/4), plast. low, sand VFG to V coarse, some gravel to 3 cm.

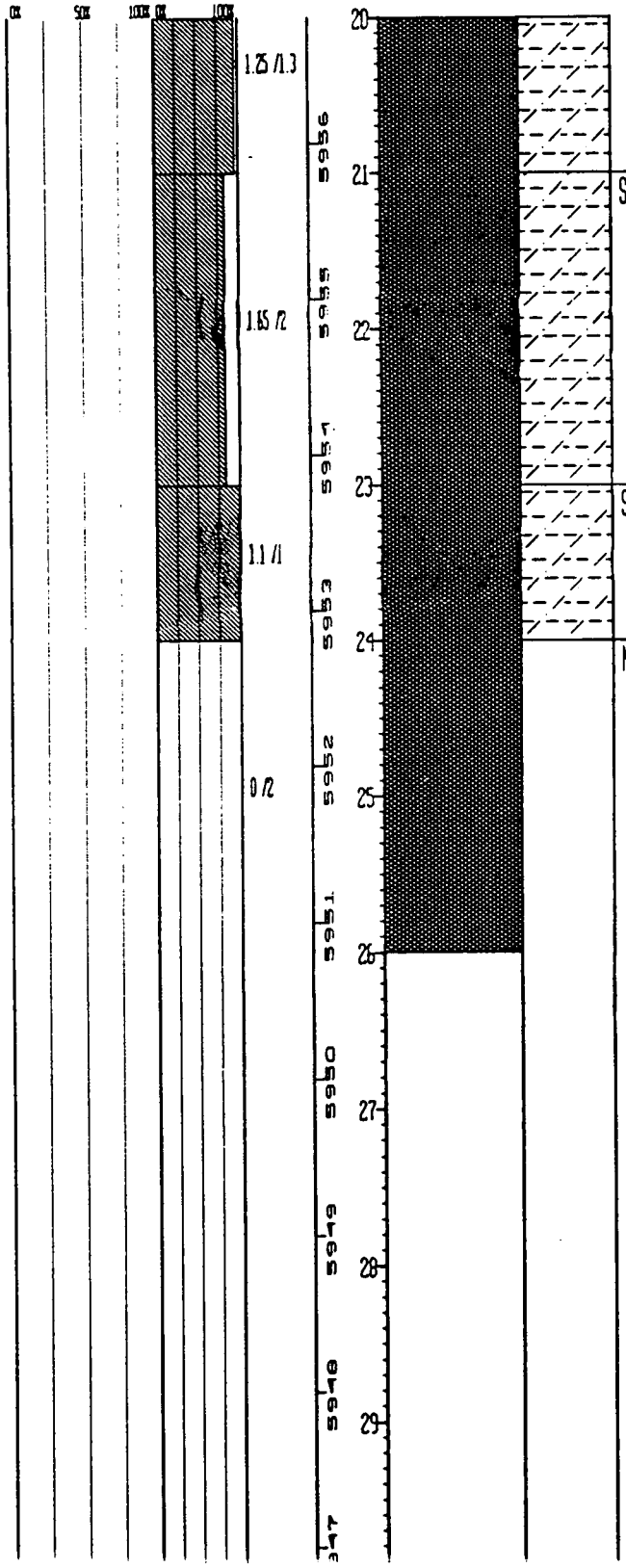
STATE PLANE COORDINATE:	TOTAL DEPTH (FT): 26	GROUND ELEVATION (FT): 5976.81	PROJECT NUMBER: 667.11	LOG OF BORING NUMBER:
NORTH: 750737	AREA: SOLAR POND	CASING DIAMETER (IN): 2 ID	GEOLOGIST: LAA	22-86
EAST: 2084412	LOCATOR NUMBER: L10	BOREHOLE DIAMETER (IN): 7.25	DATE DRILLED: 09/08/86	
REMARKS: Hollow Stem Auger.				

CHEMICAL SAMPLE DEPTH / GRADATIONAL SAMPLE DEPTH	SAMPLE NUMBER	SAMPLE GRADI SIZE	PERCENT RECOVERY	RECOVERY/ INTERVAL	DATUM (FT)	DEPTH (FT)	WELL OR PIEZOMETER CONSTRUCTION	LITHOLOGY	UNIFIED SOILS CLASSIFICATION OR ROCK TYPE	DESCRIPTION
						10	09/08/86		GC:	Clayey Sand and Gravel - gravel predom med. gray (N5), well graded granules to 5 cm., subangular to subrounded. Sand VFG to granules (well graded), some silt.
	LA18			1.85 /2	5966	11			SANDSTONE:	Top of Bedrock Very pale orange (10YR 8/2), VFG, some iron staining, well sorted.
					5965				SANDSTONE:	Very pale orange (10YR 8/2), VFG, some iron staining, well sorted.
				0.25 /2	5964	12			SANDSTONE:	Marker indicates sample was removed here. Same as above.
					5963	13				
				1.85 /2	5962	14			SILTY CLAYSTONE:	Very pale orange to dk. yellowish orange (10YR 8/2 to 6/6), mod. to high plast., some iron staining, trace calcite, carbonaceous material.
					5961	15				
						16			SILTY CLAYSTONE:	Very pale orange to dk. yellowish orange (10YR 8/2 to 6/6), mod. weathered, slightly to mod. friable, bedding not evident, some VFG sand, some iron staining, trace carb. material.
	DO31			1.8 /2	5960	17				
					5959	18			SILTY CLAYSTONE:	Same as above.
				1.1 /1	5958	19			SILTY CLAYSTONE:	Same as above.
				0.65 /0.7	57				SILTY CLAYSTONE:	Very pale orange to dk. yellowish orange (10YR 8/2 to 10YR 7/4), mod

STATE PLANE COORDINATE:	TOTAL DEPTH (FT): 26	GROUND ELEVATION (FT):	5976.81	PROJECT NUMBER:	667.11
NORTH: 750737	AREA: SOLAR POND	CASING DIAMETER (IN):	2 ID	GEOLOGIST:	LAA
EAST: 2084412	LOCATOR NUMBER: L10	BOREHOLE DIAMETER (IN):	7.25	DATE DRILLED:	09/08/86
REMARKS: Hollow Stem Auger.					

LOG OF BORING NUMBER: 22-86

CHEMICAL SAMPLE DEPTH
GRADATIONAL SAMPLE DEPTH
SAMPLE NUMBER
SAMPLE GRAIN SIZE
PERCENT RECOVERY
RECOVERY/INTERVAL
DATUM (FT)
DEPTH (FT)
WELL OR PIEZOMETER CONSTRUCTION
LITHOLOGY
UNIFIED SOILS CLASSIFICATION OR ROCK TYPE
DESCRIPTION



weathered, slightly to mod. friable, some iron staining, some black carb. material, some VFG sand.

SILTY CLAYSTONE: Same as above.

SILTY CLAYSTONE: Same as above.

NO SAMPLE:

INDEX OF DATA

Boring No.: 23-86

Completed as well? Yes

Data in File

X Log of Borehole

X Well Construction Summaries

____ Well Development Summaries

X Hydraulic Conductivity Test Data and Results

X Packer Test Data and Results

X Water Level Data

X Saturated Thickness Hydrographs

Project: Rocky Flats Plant

LOG OF BORING NO. 23-86

Date Drilled 9/11/86, 9/19/86, 9/22/86, 9/23/86 **Coordinates** N 37355.0 E 21154.4

Boring Method Hollow Stem Auger/NC core **Ground Surface Elevation** 5981.18

Elev. (feet)	Depth (feet)	Sample Type	Graphic Log	Material Description	Penetration Resistance (Blows/inch) 20 40	Water Content (%) 20 40	Other Tests
	0			ARTIFICIAL FILL			
				0-2.5'-Sample. Recovered 1.5/2.5'=60%. Pale GRAVEL: reddish brown (10R 5/4) to light olive gray (5Y 5/2) sand, silt and pebbles; some quartzite cobbles; calcareous; poorly sorted; angular; unconsolidated; dry.			
				2.5-5.0'-Sample. Recovered 1.2/2.5'=48%. GRAVEL: yellowish gray (5Y 8/4) sand, silt and pebbles; calcareous; poorly sorted; angular; damp.			
	5			5.0-7.0'-Sample. Recovered 0.7/2.0'=35%. GRAVEL: pale olive (10Y 6/2) granite and quartzite pebbles; some sand; trace clay and silt; calcareous; poorly sorted; compacted; damp.			
				7.0-9.5'-Sample. Recovered 1.7/2.5'=68%.			
	10			7.0-8.2'. GRAVEL: Same as above; damp.			
				ARAPAHOE FORMATION			
				8.2-9.5'. CLAYSTONE: pale olive (10Y 6/2); silty; calcite along fractures at 8.5', 9.0', and 9.5'; some dark yellowish orange (10YR 6/6) staining; firm; damp.			
				9.5-12.0'-Sample. Recovered 2.5/2.5'=100%. CLAYSTONE: yellowish gray to greenish gray (5Y 7/2 to 5GY 6/1); sandy and silty in upper 1.5' increasing in clay content with depth; some dark yellowish orange (10YR 6/6) iron staining; ironstone at 10.5'; calcareous layers at 9.5' and 10.7'; firm; damp.			
	15						
	20						

Remarks Logged by: T. Murphy Checked by:

Project No.

Project: Rocky Flats Plant

LOG OF BORING NO. 23-86

Date Drilled 9/11/86, 9/19/86, 9/22/86, 9/23/86 **Coordinates** N 37355.0 E 21154.4

Boring Method Hollow Stem Auger/NC core **Ground Surface Elevation** 5981.18

Elev. (feet)	Depth (feet)	Sample Type	Graphic Log	Material Description	Penetration Resistance (Blows/inch) 20 40	Water Content (%) 20 40	Other Tests
	20			12.0-17.0'-Sample. Recovered 5.0/5.0'=100%. CLAYSTONE: light olive gray (5Y 5/2) to olive gray (5Y 3/2); silty; calcareous layer at 13.5'; firm; damp.			
				17.0-22.0'-Sample. Recovered 5.0/5.0'=100%. CLAYSTONE: light olive gray (5Y 5/2); silty; trace calcite at 18.1'; trace dark yellowish orange (10YR 6/6) iron staining; firm; damp.			
	25			22.0-27.0'-Sample. Recovered 5.0/5.0'=100%. CLAYSTONE: light olive gray to olive gray (5Y 5/2 to 5Y 3/2); silty; some dark yellowish orange (10YR 6/6) iron staining; some black organic fragments; firm; damp.			
				27.0-32.0'-Sample. Recovered 5.0/5.0'=100%. CLAYSTONE: medium dark gray (N 4); silty; firm; damp.			
	30			33.0-38.0'-Sample. Recovered 5.0/5.0'=100%. RQD 4.9/5.0'=98%. CLAYSTONE: dusky yellow (5Y 6/4) to light olive gray (5Y 5/2) to medium light gray (N 5); trace silt; some organic fragments; dark yellowish orange (10YR 6/6) mottling in light olive gray areas; no apparent fractures; moderately soft to firm; damp.			
	35			38.0-40.9'-Sample. Recovered 2.0/2.9'=69%. RQD 2.0/2.0'=100%. CLAYSTONE: medium light gray (N 5); iron staining at 39.0'; subvertical fracture with iron staining from 39.0' to 39.8'; core has a mottled appearence with yellowish gray (5Y 8/1) stains throughout; firm to moderately soft; damp.			
	40						

Remarks Logged by: T. Murphy Checked by: [illegible]

Project No.

Hydro-Search, Inc.

Project: Rocky Flats Plant

LOG OF BORING NO. 23-86

Date Drilled 9/11/86, 9/19/86, 9/22/86, 9/23/86 **Coordinates** N 37355.0 E 21154.4

Boring Method. Hollow Stem Auger/NC core **Ground Surface Elevation** 5981.18

Elev. (feet)	Depth (feet)	Sample Type	Graphic Log	Material Description	Penetration Resistance (Blows/inch) 20 40	Water Content (%) 20 40	Other Tests
	40			40.9-45.9'-Sample. Recovered 2.8/5.0'=56%. RQD 1.6/2.8'=57%. CLAYSTONE: olive gray (5Y 4/1); trace silt; some organic fragments; vertical limonite filled fracture from 40.9' to 42.5'; horizontal limonite filled fracture at 41.9'; firm to moderately soft; damp.			
	45			45.9-50.9'-Sample. Recovered 4.8/5.0=96%. RQD 4.2/4.8'=86%. 45.9'-50.2'. CLAYSTONE: medium (N 5) to medium dark gray (N 4). Highly fractured interval with limonite along fracture planes (2 mm wide) from 48.3' to 49.6'; top 4.0' of core has abundant organics (wood fragments); firm; damp.			
	50			50.2'-50.9'. CLAYSTONE: dusky yellow (5Y 6/4).			
				50.9-55.9'-Sample. Recovered 4.0/5.0'=80%. RQD 2.6/4.0'=65%. 50.9'-51.5'. CLAYSTONE: light olive gray (5Y 5/2); heavy limonite along fracture planes. 51.5'-52.6'. CLAYSTONE: medium dark gray (N 4) claystone with interbedded dusky yellow (5Y 6/4) → clayey siltstone. 52.6'-55.9'. CLAYSTONE: medium dark gray (N 4); silty; occasional subvertical fracture with limonite stain (up to 0.7' long); firm; damp.			
	55			55.9-60.9'-Sample. Recovered 3.8/4.6'=83%. RQD 2.5/3.8'=66%. CLAYSTONE: olive gray (5Y 3/2) to medium dark gray (N 4); silty; trace iron staining at top of core; firm; damp.			
	60						

Remarks Logged by: T. Murphy Checked by:

Project No. Hydro-Search Inc.

Project: Rocky Flats Plant

LOG OF BORING NO. 23-86

Date Drilled 9/11/86, 9/19/86, 9/22/86, 9/23/86 **Coordinates** N 37355.0 E 21154.4

Boring Method · Hollow Stem Auger/NC core **Ground Surface Elevation** 5981.18

Elev. (feet)	Depth (feet)	Sample Type	Graphic Log	Material Description	Penetration Resistance (Blows/inch) 20 40	Water Content (%) 20 40	Other Tests
	60			60.9-65.5'-Sample. Recovered 4.6/4.6'=100%. RQD 4.3/4.6'=93%. SILTSTONE: dark gray (N 3) grading downward into dark greenish gray (5GY 4/1) clayey siltstone; some organic wood fragments; firm; damp.			
	65			65.5-70.5'-Sample. Recovered 5.0/5.0'=100%. RQD 3.7/5.0'=74%. SILTSTONE: dark greenish gray (5GY 4/1); clayey; trace very fine-grained sand; dark gray (N 3) clayey siltstone from 68.5 to 70.5'; calcareous layer at 66.5 with slight dark yellowish orange (10YR 6/6) iron stains; firm; damp.			
	70			70.5-75.5'-Sample. Recovered 2.5/5.0'=50%. RQD 0.0/2.5'=0%. CLAYSTONE: dark greenish gray (5GY 4/1); silty; trace very fine-grained sand; highly fractured; some organic fragments in vertical fractures; crumbly; damp.			
	75			75.5-80.5'-Sample. Recovered 4.8/5.0'=96%. RQD 2.3/4.8'=48%. SILTSTONE: dark greenish gray (5GY 4/1); some clay and very fine-grained sand; few organics; very pale orange (10YR 8/2) calcareous clay layer at 77.5'; firm; damp.			
	80						

Remarks Logged by: T. Murphy Checked by:

Project No.

Hydro-Search Inc

Project: Rocky Flats Plant

LOG OF BORING NO. 23-86

Date Drilled 9/11/86, 9/19/86, 9/22/86, 9/23/86 **Coordinates** N 37355.0 E 21154.4

Boring Method · Hollow Stem Auger/NC core **Ground Surface Elevation** 5931.18

Elev. (feet)	Depth (feet)	Sample Type	Graphic Log	Material Description	Penetration Resistance (Blows/inch) 20 40	Water Content (%) 20 40	Other Tests
	80			80.5-85.5'-Sample. Recovered 4.6/5.0'=92%. RQD 2.7/4.6'=59%. SILTSTONE: dark gray (N 3) to dark greenish gray (5GY 4/1); interbedded 0.1' to 0.3' beds of sandy siltstone; convoluted bedding in places; occasional clayey siltstone; firm; damp.			
	85			85.5-90.5'-Sample. Recovered 5.0/5.0'=100%. RQD 1.4/5.0'=28%. SILTSTONE: dark gray (N 3) to dark greenish gray (5GY 4/1); interbedded sandy siltstone beds (0.5' thick; occasional clayey siltstone layers; organics throughout; calcareous concretions from 87.8' to 88.4'; firm; damp.			
	90			90.5-95.5'-Sample. Recovered 5.0/5.0'=100%. RQD 1.2/5.0'=24%. SILTSTONE: dark gray (N 3); interbedded sandy siltstone and clayey siltstone beds; sand is very fine-grained; vertical fracture from 92.5'-95.5' due to drilling; crumbly; firm; damp.			
	95			95.5-100.5'-Sample. Recovered 4.8/5.0'=96%. RQD 3.8/5.0'=76%. SILTSTONE: dark gray (N 3); trace very fine-grained sand throughout; some organics; laminated; light olive gray (5Y 6/1) mottling around organic fragments; firm; damp.			
	100						

Remarks Logged by: T. Murphy Checked by:

Project No. Hydro-Search Inc.

Project: Rocky Flats Plant

LOG OF BORING NO. 23-86

Date Drilled 9/11/86, 9/19/86, 9/22/86, 9/23/86 **Coordinates** N 37355.0 E 21154.4

Boring Method Hollow Stem Auger/NC core **Ground Surface Elevation** 5981.18

Elev. (feet)	Depth (feet)	Sample Type	Graphic Log	Material Description	Penetration Resistance (Blows/inch) 20 40	Water Content (%) 20 40	Other Tests
	100			100.5-105.5'-Sample. Recovered 5.0/5.0'=100%. RQD 2.1/5.0'=42%. SILTSTONE: dark gray (N 3); sandy; interbedded silty sandstone beds at 102.6' and 103.8' (approximately 0.4' thick). Sandstone layers consist of medium gray (N 5) very fine-grained, silty sand; moderately sorted; convoluted bedding characteristic of interbedded siltstone and sandstone layers; some calcareous concretions in sandy siltstone layers; abundant organics; firm to hard; damp.			
	105			105.5-110.5'-Sample. Recovered 3.2/5.0'=64%. RQD 1.9/3.2'=59%. SANDSTONE: dark gray (N 3); very fine-grained; silty; clayey; lower 1.2' of core is clayey siltstone; soft to firm; damp.			
	110			110.5-116.5'-Sample. Recovered 4.6/5.0'=92%. RQD 3.6/4.6'=78%. 110.5'-113.3'. SILTSTONE: dark gray (N 3); clayey; increasing sand content through interval.			
				113.3'-115.5'. SANDSTONE: medium gray (N 5); fine to very fine-grained; occasional clay-filled vertical fracture; moderately sorted; firm; damp. 115.5-120.5'-Sample. Recovered 5.0/5.0'=100%. RQD 4.0/5.0'=80%. 115.5'-116.5'. SANDSTONE: medium gray (N 5); fine to very fine-grained; moderately sorted; firm; damp. Gradational change to siltstone at 116.5'.			
	115			116.5-120.5'. SILTSTONE: dark gray (N 3); very fine-grained; sandy; some clay; well sorted; organic fragments in subvertical fractures and horizontal layers; subvertical fractures have slickensides; fractures are 1.0' to 1.5' apart.			
	120						

Remarks Logged by: T. Murphy Checked by: [illegible]

Project No. Hydro-Search Inc.

Project: Rocky Flats Plant

LOG OF BORING NO. 23-86

Date Drilled 9/11/86, 9/19/86, 9/22/86, 9/23/86 **Coordinates** N 37355.0 E 21154.4

Boring Method. Hollow Stem Auger/NC core **Ground Surface Elevation** 5981.18

Elev. (feet)	Depth (feet)	Sample Type	Graphic Log	Material Description	Penetration Resistance (Blows/inch) 20 40	Water Content (%) 20 40	Other Tests
	120			120.5-125.5'-Sample. Recovered 5.0/5.0'=100%. RQD 3.9/5.0'=78%. SILTSTONE: dark gray (N 3) to medium gray (N 5); clayey; with interbedded sandy siltstone; sand is fine to very fine-grained; moderately sorted; some organic fragments; slickensides along fracture planes.			
	125			125.5-130.5'-Sample. Recovered 4.8/5.0'=96%. RQD 4.2/4.8'=88%. SILTSTONE: dark gray (N 3) to medium gray (N 5); clayey; with occasional interbedded sandy siltstone; occasional light brown (5YR 6/4) calcareous concretions; moderately sorted; firm; damp.			
	130			TOTAL DEPTH: 130.5'			
	135						
	140						

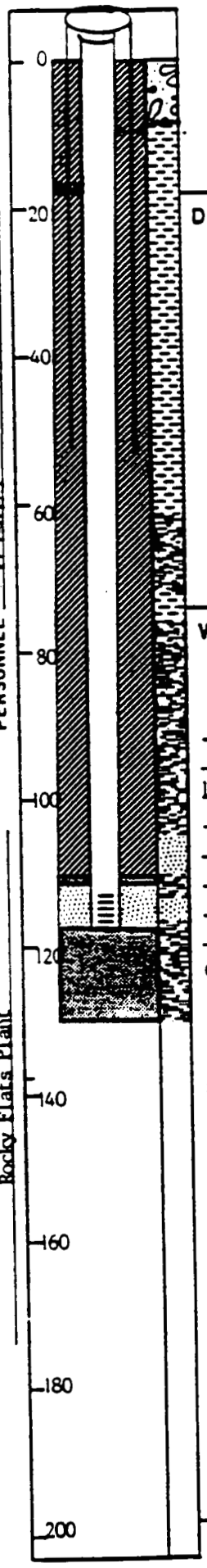
Remarks Logged by: T. Murphy Checked by:

Project No. 106P06222

Hydro-Search, Inc.

WELL 23-86

WELL CONSTRUCTION SUMMARY



LOCATION Golden, CO

PERSONNEL T. Murphy

PROJECT 106R06222 Rocky Flats Plant

LOCATION or COORDS: N 37355.0 E 21154.4

ELEVATION: GROUND LEVEL 5981.18'
TOP OF CASING 5981.91'

DRILLING SUMMARY:

TOTAL DEPTH Well: 117.00' Hole: 130.50'

BOREHOLE DIAMETER 0.00' - 32.00': 7½"
32.00' - 130.50': 5 5/8"

DRILLER Boyles Brothers Drilling Co.
15865 W. 5th Avenue, Golden, CO
(Dave Jarvie)

RIG Mobile B-57

BIT(S) 0.00' - 32.00': T5
32.00' - 130.50': Carbide bit

DRILLING FLUID 0.00' - 32.00': None
32.00' - 130.50': air/water mist

SURFACE CASING 5" x 32.50' steel w/ locking cap

WELL DESIGN:

BASIS: GEOLOGIC LOG X GEOPHYSICAL LOG ___

CASING STRING(S): C=CASING S=SCREEN

0.00'	32.00'	C1			
0.00'	113.25'	C2			
113.00'	117.25'	S1			

CASING: C1 5" I.D. steel surface casing
C2 2" I.D. Sch. 5 type 316 stainless steel, threaded and flush jointed.

SCREEN: S1 2" I.D. Sch 5 type 316 stainless steel, threaded and flush jointed, 0.010" wire wrap screen, 0.25' welded bottom cap.

CENTRALIZERS None (see comments)

FILTER MATERIAL 32-42 silica sand
112.00' - 117.50'

CEMENT Portland Type I
0.00' - 111.00'

OTHER 3/8" bentonite pellets
111.00' - 112.00'
117.50' - 130.50'

CONSTRUCTION TIME LOG:

TASK	START DATE	START TIME	FINISH DATE	FINISH TIME
DRILLING:	1986		1986	
7½" auger	9/11	1500	9/11	18
NC core	9/19	1000	9/23	15
Reaming	9/26	1217	9/26	15
GEOPHYS. LOGGING:	—	—	—	—
CASING:				
5" steel	9/12	1000	9/12	11
2" stainless	9/26	1637	9/26	16
FILTER PLACEMENT:	9/26	1738	9/26	20
CEMENTING:	9/27	0830	9/27	10
DEVELOPMENT:	10/1	1200	10/1	1
OTHER:				
Bentonite	9/26	2021	9/26	2
	9/26	1542	9/26	1
Packer testing	9/23	1500	9/26	1
Cementing 5" steel	9/12	1130	9/12	1

WELL DEVELOPMENT

See Well Development Summary Sheet.

COMMENTS:

No water encountered during drilling.

Top of stainless steel casing: 0.73'

Built well in NC rod; no centralizers

Protective casing and stainless steel casing were bent and had to be cut. top of stainless steel casing: 0.08'.

LOG OF BORING NO. 23-86

PAGE 1 OF 2

GEOLOGIST(S): DCB
DATE: 8/30/89

PROJECT NO: 667-11-22

TOP/BOTTOM OF CORE IN BOX	TOP/BOTTOM OF INTERVAL	FEET OF CORE IN INTERVAL IN BOX	SAMPLE NUMBER	FRACTURE ANGLE	BEDDING ANGLE	GRAIN SIZE DISTRIBUTION	USCS SYMBOL	DEPTH IN FEET	LITHOLOGIC LOG	LITHOLOGIC DESCRIPTION
					DCB	~~>50% clay~~		11, 12		Box 1 of 4 not in trailer, box 4 of 4 not in trailer. DCB
12.6 ↓	12.6 to 14.0	ND		40°		>50% clay		13, 14		Clay stone, light gray (N7), bedding not apparent, slightly weathered, slightly friable, caliche occurs as fracture filling, local iron staining, slight silt fraction.
Box 2 of 4	14.0 to 16.0	ND		60°				15, 16		claystone as above with iron staining on fractures and moderate amount of mg oxide mineralization.
	16.0 to 17.0	ND		90° ↓				17		
	17.0 to 17.3	ND								
	17.3 to 19.0	ND		18°				18, 19		
	19.0 to 20.8	ND								

NOTES: General USCS is modified for this log as follows:
Material amounts are estimated by % volume instead of % weight.
(1) Badly broken core, accurate footage measurements not possible.
(2) Core breaks cannot be matched, accurate footage measurements not possible.

ROCKY FLATS PLANT

FIGURE NO.

LOG OF BORING NO. 23-86

GEOLOGIST(S): DCB
DATE: 8/30/89

PROJECT NO: 667-11.22

TOP/BOTTOM OF CORE IN BOX	TOP/BOTTOM OF INTERVAL	FEET OF CORE IN INTERVAL IN BOX	SAMPLE NUMBER	FRACTURE ANGLE	BEDDING ANGLE	GRAIN SIZE DISTRIBUTION	USCS SYMBOL	DEPTH IN FEET	LITHOLOGIC LOG	LITHOLOGIC DESCRIPTION
Box 3 of 4 20.8	19.0 to 20.8	ND				>50% Clay				Claystone as above
20.8	20.8 to 22.0	ND						21		
	22.0 to 23.8	ND						22		Slickensides at ~21.9 ft. Attitudes 50° and 60°, iron staining and possible mn oxides on surface. Carbonaceous mineralization (low grade coal) at ~22.8 ft.
	23.8 to 25.5	ND						23		
	25.5 to 27.0	ND						24		
	27.0 to 28.6	ND						25		Slickensides at ~25 ft. Attitude ~45°
28.6	28.6							26		
								27		
								28		Slickensides at 28.2 ft, attitude 30°. Slickensides at 28.6 ft, attitude ~30°.
								29		Bottom of Box 3 of 4 at 28.6 ft. Box 4 of 4 not in trailer.

NOTES: General USCS is modified for this log as follows:
Material amounts are estimated by % volume instead of % weight.
(1) Badly broken core, accurate footage measurements not possible.
(2) Core breaks cannot be matched, accurate footage measurements not possible.

ROCKY FLATS PLANT

FIGURE NO.

LOG OF BORING NO. 23-86

GEOLOGIST(S): DCB
DATE: 8/17/89

PROJECT NO: 667-11.22

TOP/BOTTOM OF CORE IN BOX	TOP/BOTTOM OF INTERVAL	FEET OF CORE IN INTERVAL IN BOX	SAMPLE NUMBER	FRACTURE ANGLE	BEDDING ANGLE	GRAIN SIZE DISTRIBUTION	USCS SYMBOL	DEPTH IN FEET	LITHOLOGIC LOG	LITHOLOGIC DESCRIPTION
								31 32 33		No Sample
33.0 Box 10	33.0 to 34.8					250% clay		34		Claystone light gray (N7) to yellowish gray (5Y 8/1), bedding not apparent, well weathered, slightly friable, slight silt fraction, some depth mineralization - probably carbonaceous, occasional iron stains and calcareous bodies < 1mm in diam.
	34.8 to 36.6							35 36		
	36.6 to 38.0							37		As above slabbed section exhibits multiple very fine healed fractures.
	38.0 to 40.9			25° 90°		250% clay		38 39		Claystone light gray (N7), bedding not apparent, weathered, slightly friable, vertical fractures and ~25° fractures with iron staining, slightly calcareous in places.

NOTES: General: USCS is modified for this log as follows:
Material amounts are estimated by % volume instead of % weight.
(1) Badly broken core, accurate footage measurements not possible.
(2) Core breaks cannot be matched, accurate footage measurements not possible.
Box starts at 33.0 ft.

ROCKY FLATS PLANT

FIGURE NO.

LOG OF BORING NO. 23-86

GEOLOGIST(S): DCB
DATE: 8/17/89

PROJECT NO: 667-11.22

TOP/BOTTOM OF CORE IN BOX	TOP/BOTTOM OF INTERVAL	FEET OF CORE IN INTERVAL IN BOX	SAMPLE NUMBER	FRACTURE ANGLE	BEDDING ANGLE	GRAIN SIZE DISTRIBUTION	USCS SYMBOL	DEPTH IN FEET	LITHOLOGIC LOG	LITHOLOGIC DESCRIPTION
Box 1 of 10	38.0 to 40.9					>50% dry				
	40.9 to 43.0							41, 42, 43		As above, exterior of core has a knotty appearance. From 42.7 to 43.2 ft. DCB ~~[illegible]~~ of interval DCB ~~[illegible]~~ is highly weathered.
43.0	43.0 to 45.9	(1) 1.0						44, 45		
Box 2 of 10	45.9 to 46.9	ND						46		Claystone, medium light gray (N6) to very light gray (N8), bedding not apparent, possible soft sediment deformation or bioturbation, well weathered, moderately friable, abundant carbonaceous mineralization, some iron staining.
	46.9 to 48.2	ND						47, 48		
	48.2 to 50.1	ND		90°				49		Claystone, medium gray (N6), bedding not apparent, well weathered, slightly friable abundant iron staining on bedding plane partings and fractures, slickensides at ~49.6 ft.

NOTES: General: USCS is modified for this log as follows:
Material amounts are estimated by % volume instead of % weight.
(1) Badly broken core, accurate footage measurements not possible.
(2) Core breaks cannot be matched, accurate footage measurements not possible.

ROCKY FLATS PLANT

FIGURE NO.

LOG OF BORING NO. 23-89

GEOLOGIST(S): DCB
DATE: 8/17/89

PROJECT NO: 667-11.22

TOP/BOTTOM OF CORE IN BOX	TOP/BOTTOM OF INTERVAL	FEET OF CORE IN INTERVAL IN BOX	SAMPLE NUMBER	FRACTURE ANGLE	BEDDING ANGLE	GRAIN SIZE DISTRIBUTION	USCS SYMBOL	DEPTH IN FEET	LITHOLOGIC LOG	LITHOLOGIC DESCRIPTION
Bot 20 ↑ 54.4	50.1 to 51.7	ND				>50% clay		51		As above, slickensides at ~50.1 to 50.4
	51.7 to 54.4	ND						52, 53, 54		slickensides at ~52.5 ft.
54.4 ↓ Bot 10	54.4 to 55.9	ND						55		Clay stone, light olive gray (5Y 6/1), bedding not apparent, weathered, slightly friable, trace of silt, slickensides at ~55.4 ft, slight amount of iron staining.
	55.9 to 57.3	0						56, 57		No Sample
	57.3 to 58.9	ND				>50% clay		58		Clay stone, light gray (N7) to medium dark gray (N4), bedding not apparent, well weathered, slight to moderate friability, moderate silt fraction, slight iron staining and carbonaceous mineralization.
	58.9 to 60.9	ND						59		

NOTES: General USCS is modified for this log as follows:
Material amounts are estimated by % volume instead of % weight.
(1) Badly broken core, accurate footage measurements not possible.
(2) Core breaks cannot be matched, accurate footage measurements not possible.

ROCKY FLATS PLANT

FIGURE NO.

LOG OF BORING NO. 23-88

GEOLOGIST(S): DCB
DATE: 8/17/89

PROJECT NO: 667-11-23

TOP/BOTTOM OF CORE IN BOX	TOP/BOTTOM OF INTERVAL	FEET OF CORE IN INTERVAL IN BOX	SAMPLE NUMBER	FRACTURE ANGLE	BEDDING ANGLE	GRAIN SIZE DISTRIBUTION	USCS SYMBOL	DEPTH IN FEET	LITHOLOGIC LOG	LITHOLOGIC DESCRIPTION
	58.9 to 60.9	ND								As above
Box 3 of 10	60.9 to 62.7	ND				>50% silt		61, 62		Clayey Siltstone, light gray (N7), bedding not apparent (massive?), slightly friable, ~~[illegible]~~ iron stain at ~62 ft with possible carbonaceous mineralization. Interval grades to a silty Claystone at 62.7 ft as above, iron stains absent.
Box 4 of 10	62.7 to 64.5	ND						63, 64		
64.5	64.5 to 66.0	ND						65		Interval grades to siltstone at ~ Siltstone, light gray (N7), bedding not apparent (massive?), slightly friable, slight clay fraction, slight amount of carbonaceous mineralization.
Box 4 of 10	66.0 to 67.7	ND						66, 67		
	67.7 to 69.3	ND				>50% clay		68, 69		Slickenside at ~68.5
	69.3 to 70.5	ND								Interval grades to Claystone at ~68.5 Claystone, dark gray (N3), bedding not apparent, weathered, slight to moderate friability, slight amount of iron staining, moderate silt fraction

NOTES: General USCS is modified for this log as follows:
Material amounts are estimated by % volume instead of % weight.
(1) Badly broken core, accurate footage measurements not possible.
(2) Core breaks cannot be matched, accurate footage measurements not possible.

LOG OF BORING NO. 23-86

GEOLOGIST(S): DCB
DATE: 8/17/89

PROJECT NO: 667-11.22

TOP/BOTTOM OF CORE IN BOX	TOP/BOTTOM OF INTERVAL	FEET OF CORE IN INTERVAL IN BOX	SAMPLE NUMBER	FRACTURE ANGLE	BEDDING ANGLE	GRAIN SIZE DISTRIBUTION	USCS SYMBOL	DEPTH IN FEET	LITHOLOGIC LOG	LITHOLOGIC DESCRIPTION
Box 4 of 10	69.5 to 70.5	ND				75% clay				some carbonaceous mineraloids slickensides @ ~69.8 ft.
	70.5 to							71		
		(1)						72		
		2.0						73		
								74		
75.5	75.5							75		
75.5 ↓ Box 5 of 5	75.5 to	ND						76		
	77.4							77		Slickensides at ~77.0 ft
	77.4 to	ND						78		As above with an increase in the silt fraction from ~77.4 to 80.5 and color grades to light gray (N7)
	79.4							79		
	79.4 to 80.5	ND								

NOTES: General USCS is modified for this log as follows:
Material amounts are estimated by % volume instead of % weight.
(1) Badly broken core, accurate footage measurements not possible.
(2) Core breaks cannot be matched, accurate footage measurements not possible.

ROCKY FLATS PLANT

FIGURE NO.

LOG OF BORING NO. 23-86

GEOLOGIST(S): DCB
DATE: 8/17/89 18

PROJECT NO: 667-11.22

TOP/BOTTOM OF CORE IN BOX	TOP/BOTTOM OF INTERVAL	FEET OF CORE IN INTERVAL IN BOX	SAMPLE NUMBER	FRACTURE ANGLE	BEDDING ANGLE	GRAIN SIZE DISTRIBUTION	USCS SYMBOL	DEPTH IN FEET	LITHOLOGIC LOG	LITHOLOGIC DESCRIPTION
Bot 5 of 10	79.4 to 80.5	ND								
	80.5 to 81.0	ND				~50% clay		81		Claystone, light olive gray (5Y6/1), bedding not apparent, slightly friable, occasional iron staining, moderate silt fraction.
	81.0 to 83.3	ND						82, 83		
	83.3 to 85.5	ND		40°				84, 85		DCB Claystone - As above - slickenside at ~ 85.2 with 40° attitude.
8/17/89 ↑ 85.5	85.5 to 87.4	ND						86, 87		DCB Claystone As above - slickensides are absent. Irregular body of v+g sand at ~85.9 ft.
8/18/89 ↓ Bot 6 of 10	87.4 to 89.2	ND						88, 89		
	89.2 to 90.5	ND								DCB Claystone As above with irregular body of v+g sand at ~ 89.5.

Eva 8/

DCB misspl. desc

NOTES: General USCS is modified for this log as follows:
Material amounts are estimated by % volume instead of % weight.
(1) Badly broken core, accurate footage measurements not possible.
(2) Core breaks cannot be matched, accurate footage measurements not possible.

ROCKY FLATS PLANT

FIGURE NO.

LOG OF BORING NO. 23-86

GEOLOGIST(S): DCB
DATE: 8/17/89 ~~DCD~~

PROJECT NO: 66741.2

TOP/BOTTOM OF CORE IN BOX	TOP/BOTTOM OF INTERVAL	FEET OF CORE IN INTERVAL IN BOX	SAMPLE NUMBER	FRACTURE ANGLE	BEDDING ANGLE	GRAIN SIZE DISTRIBUTION	USCS SYMBOL	DEPTH IN FEET	LITHOLOGIC LOG	LITHOLOGIC DESCRIPTION
Box 6 of 10	89.2 to 90.5	ND				>50% clay				Claystone DCB As above with moderate amount of vfg sand at ~90.6 ft.
	90.5 to 91.3	ND						91		
	91.3 to 93.6	ND						92 93		
	93.6 to 95.5	ND						94 95		
95.5	95.5 to 97.4	ND		30°				96 97		Claystone as above, vfg sand is absent, occasional iron staining and carbonaceous mineralization, mineralized body at ~96 ft - some white bladed to fibr xtals (gypsum?) underlain by gray granular mass, Fe oxide and possible mg oxide stains surround mineral body.
Box 7 of 10	97.4 to 99.3	ND		30°				98 99		Fractures with faint slickensides at ~97 ft. and 99.1 ft.
	99.3 to 100.5	ND								

NOTES: General USCS is modified for this log as follows:
Material amounts are estimated by % volume instead of % weight.
(1) Badly broken core, accurate footage measurements not possible.
(2) Core breaks cannot be matched, accurate footage measurements not possible.

ROCKY FLATS PLANT

FIGURE NO.

LOG OF BORING NO. 23-86

GEOLOGIST(S): DCB
DATE: 8/18/89

PROJECT NO: 667-11.22

TOP/BOTTOM OF CORE IN BOX	TOP/BOTTOM OF INTERVAL	FEET OF CORE IN INTERVAL IN BOX	SAMPLE NUMBER	FRACTURE ANGLE	BEDDING ANGLE	GRAIN SIZE DISTRIBUTION	USCS SYMBOL	DEPTH IN FEET	LITHOLOGIC LOG	LITHOLOGIC DESCRIPTION
Box 7 of 10	99.3 to 100.5	ND				>50% clay				Claystone, light olive gray (5Y 6/1), bedding not apparent, slightly friable, slight to moderate silt fraction, occasional iron staining and carbonaceous mineralization.
	100.5 to 102.3							101, 102		- Lense of fg sand at ~102 ft. ~2 mm in thickness.
	102.3 to 103.6					>50% silt		103		Interval grades to Clayey siltstone at ~102.5 ft. Clayey siltstone, light olive gray (5Y 6/1), bedding is not apparent, slightly friable, slight fraction of vfg sand locally, occasional iron staining and carbonaceous mineralization.
	103.6 to 105.5					>50% clay		104, 105		DCB ~~Clayey siltstone is [illegible]~~ Increase in clay fraction below 105 ft.
105.5	105.5 to 107.5	ND						106, 107		Silty Claystone, light olive gray (5Y 6/1), bedding not apparent, weathered, slightly to moderately friable, occasional iron stains and carbonaceous mineralization,
Box 8 of 10	107.5 to 109.9	0						108, 109		No Sample
	109.9-110.5	ND				>50% clay				see Next Page

NOTES: General: USCS is modified for this log as follows:
Material amounts are estimated by % volume instead of % weight.
(1) Badly broken core, accurate footage measurements not possible.
(2) Core breaks cannot be matched, accurate footage measurements not possible.

ROCKY FLATS PLANT

FIGURE NO.

LOG OF BORING NO. 23-86

GEOLOGIST(S): DCB
DATE: 8/18/87

PROJECT NO: 667-11-22

TOP/BOTTOM OF CORE IN BOX	TOP/BOTTOM OF INTERVAL	FEET OF CORE IN INTERVAL IN BOX	SAMPLE NUMBER	FRACTURE ANGLE	BEDDING ANGLE	GRAIN SIZE DISTRIBUTION	USCS SYMBOL	DEPTH IN FEET	LITHOLOGIC LOG	LITHOLOGIC DESCRIPTION
	109.9 to 110.5	ND				>50% clay				Claystone, light olive gray (5Y 6/1), bedding not apparent, slightly weathered, slightly friable occasional carbonaceous mineralization, slight silt fraction, color varies to medium dark gray (N5).
	110.5 to 111.6	ND						111		
	111.6 to 113.4	ND						112		
								113		
Box 8 of 10	113.4 to 115.5	ND				>50% silt		114		Interval grades to siltstone at ~113.7. Siltstone light gray (N7), bedding not apparent, slightly friable occasional carbonaceous mineralization
								115		
	115.5 to 115.9	(1) .2				>50% clay		116		Interval grades to silty Claystone. Silty Claystone light gray (N7) to medium gray (N5), bedding exhibits extensive disturbance and soft sediment deformation, weathered, slightly friable, carbonaceous mineralization occurs on partings.
	115.9 to 117.8	ND						117		
117.8	117.8 to 119.4	ND						118		Thin stringers of coal < 2mm which appear to crosscut bedding!
								119		
	119.4 to 120.5	ND								

NOTES: General USCS is modified for this log as follows:
Material amounts are estimated by % volume instead of % weight.
(1) Badly broken core, accurate footage measurements not possible.
(2) Core breaks cannot be matched, accurate footage measurements not possible.

LOG OF BORING NO. 23-86

GEOLOGIST(S): DCB
DATE: 8/18/89

PROJECT NO: 667-11-22

TOP/BOTTOM OF CORE IN BOX	TOP/BOTTOM OF INTERVAL	FEET OF CORE IN INTERVAL IN BOX	SAMPLE NUMBER	FRACTURE ANGLE	BEDDING ANGLE	GRAIN SIZE DISTRIBUTION	USCS SYMBOL	DEPTH IN FEET	LITHOLOGIC LOG	LITHOLOGIC DESCRIPTION
Box 9 of 10	119.9 to 120.5	ND				75% Clay				As above - Silty Clay Loam
	120.5 to 121.1	ND						121		
	121.1 to 122.9	ND						122		slickensides at ~122.7
	122.9 to 124.9	ND			~10°			123, 124		Bedding appears to have slight dip (based on core breaks)
	124.9 to 125.5							125		
126.3	125.5 to 126.3							126		
126.3	126.3 to 127.8							127		
Box 10 of 10	127.8 to 129.5							128, 129		
	129.5 to 130.5							130.0, 130.5		

NOTES: General: USCS is modified for this log as follows:
Material amounts are estimated by % volume instead of % weight.
(1) Badly broken core, accurate footage measurements not possible.
(2) Core breaks cannot be matched, accurate footage measurements not possible.

Bottom of Box 10 of 10 at 130.5 ft.

ROCKY FLATS PLANT

FIGURE NO.

STATE PLANE COORDINATE:	TOTAL DEPTH (FT): 130.5	GROUND ELEVATION (FT):	5981.18	PROJECT NUMBER:	667.11	LOG OF BORING NUMBER:
NORTH: 751057	AREA: SOLAR POND	CASING DIAMETER (IN):	2 ID	GEOLOGIST:	DCB	23-86
EAST: 2084259	LOCATOR NUMBER: L10	BOREHOLE DIAMETER (IN):	7 25	DATE DRILLED:	09/23/86	

REMARKS: Hollow Stem Auger/NC Core. Built well in NC rod: no centralizers used.

CRITICAL SAMPLE DEPTH / GRADATIONAL SAMPLE DEPTH	SAMPLE NUMBER	SAMPLE GRADIN SIZE (0% 50% 100%)	PERCENT RECOVERY (0% 100%)	RECOVERY/ INTERVAL	DATUM (FT)	DEPTH (FT)	WELL OR PIEZOMETER CONSTRUCTION	LITHOLOGY	UNIFIED SOILS CLASSIFICATION OR ROCK TYPE	DESCRIPTION
					5985	0				NO SAMPLE:
					5980	1				
					5975	2				
					5970	3				
					5965	4				
					5960	5				
				0 /12.6	5955	6				
					5950	7				
					5945	8				
					5940	9				Top of Bedrock.

STATE PLANE COORDINATE:		TOTAL DEPTH (FT): 130.5	GROUND ELEVATION (FT): 5981.18	PROJECT NUMBER: 667.11	LOG OF BORING NUMBER:
NORTH:	750357	AREA: SOLAR POND	CASING DIAMETER (IN): 2 ID	GEOLOGIST: DCB	23-86
EAST:	2084259	LOCATOR NUMBER: L10	BOREHOLE DIAMETER (IN): 7.25	DATE DRILLED: 09/23/86	

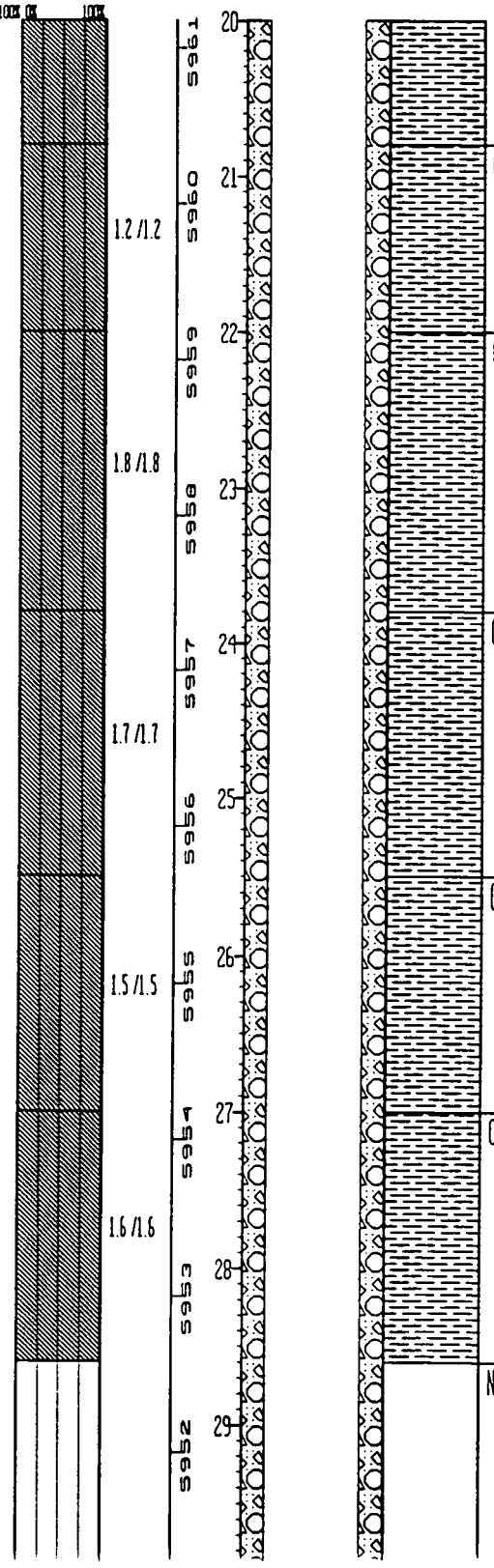
REMARKS: Hollow Stem Auger/NC Core. Built well in NC rod: no centralizers used.

CHEMICAL SAMPLE DE GRADATIONAL SAMPLE	SAMPLE NUMBER	SAMPLE GRAIN SIZE (0% 50% 100%)	PERCENT RECOVERY (0% 100%)	RECOVERY/ INTERVAL	DATUM (FT)	DEPTH (FT)	WELL OR PIEZOMETER CONSTRUCTION	LITHOLOGY	UNIFIED SOILS CLASSIFICATION OR ROCK TYPE	DESCRIPTION
					5971	10			NO SAMPLE	
					5970	11				
					5969	12				
				1.4/1.4	5968	13			CLAYSTONE	Light gray (N7) bedding not apparent, slightly weathered, slightly friable, caliche occurs as fracture filling, local iron staining, slight silt fraction.
					5967	14			CLAYSTONE	As above with iron staining on fractures and moderate amount of Mg oxide mineralization.
				2/2	5966	15				
					5965	16			CLAYSTONE	As above.
				1/1						
				0.3/0.29	5964	17			CLAYSTONE	As above.
									CLAYSTONE	As above.
				1.7/1.7	5963	18				
					5962	19			CLAYSTONE	As above.
				1.2/1.2						

STATE PLANE COORDINATE:		TOTAL DEPTH (FT): 130.5	GROUND ELEVATION (FT):	5981.18	PROJECT NUMBER:	557.11	LOG OF BORING NUMBER:
NORTH:	750357	AREA: SOLAR POND	CASING DIAMETER (IN):	2 ID	GEOLOGIST:	DCB	23-86
EAST:	2084259	LOCATOR NUMBER: L10	BOREHOLE DIAMETER (IN):	7 25	DATE DRILLED:	09/23/86	

REMARKS: Hollow Stem Auger/NC Core. Built well in NC rod: no centralizers used.

CHEMICAL SAMPLE DEPTH
GRADATIONAL SAMPLE DEPTH
SAMPLE NUMBER
SAMPLE GRADN SIZE (0% 50% 100%)
PERCENT RECOVERY (0% 100%)
RECOVERY/INTERVAL
DATUM (FT)
DEPTH (FT)
WELL OR PIEZOMETER CONSTRUCTION
LITHOLOGY



UNIFIED SOILS CLASSIFICATION OR ROCK TYPE	DESCRIPTION
CLAYSTONE	As above. Slickensides at approx. 21.9 ft., attitudes 50 degrees and 60 degrees, iron staining and possible Mg oxides on surface.
CLAYSTONE	Same as above, carbonaceous mineralization (low grade coal) at approx. 22.8 ft.
CLAYSTONE	Same as above, slickensides at approx. 25 ft.
CLAYSTONE	Same as above.
CLAYSTONE	Same as above, slickensides at 28.2 ft and 28.6 ft. attitudes approx. 30 degrees.
NO SAMPLE	

STATE PLANE COORDINATE:	TOTAL DEPTH (FT): 130.5	GROUND ELEVATION (FT):	5981.18	PROJECT NUMBER:	667.11	LOG OF BORING NUMBER:
NORTH: 750357	AREA: SOLAR POND	CASING DIAMETER (IN):	2 ID	GEOLOGIST:	DCB	23-86
EAST: 2084259	LOCATOR NUMBER: L10	BOREHOLE DIAMETER (IN):	7 25	DATE DRILLED:	09/23/86	

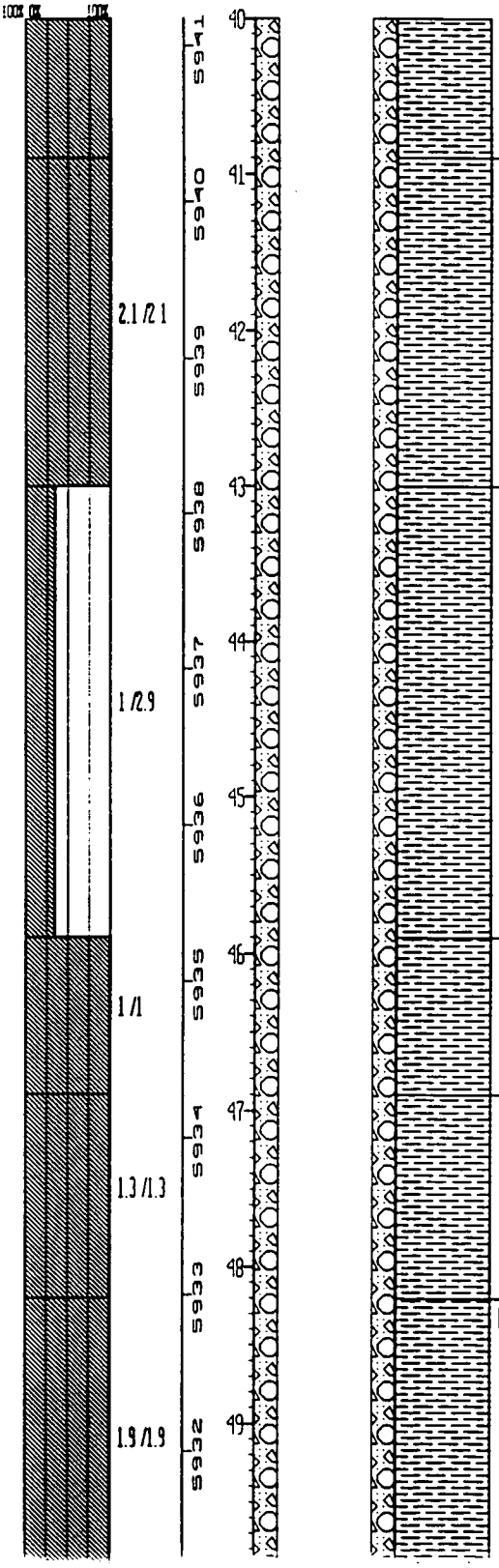
REMARKS: Hollow Stem Auger/NC Core. Built well in NC rod: no centralizers used.

CHEMICAL SAMPLE DEPTH / GRADATIONAL SAMPLE	SAMPLE NUMBER	SAMPLE GRAIN SIZE (0% 50% 100%)	PERCENT RECOVERY (0% 100%)	RECOVERY/INTERVAL	DATUM (FT)	DEPTH (FT)	WELL OR PIEZOMETER CONSTRUCTION	LITHOLOGY	UNIFIED SOILS CLASSIFICATION OR ROCK TYPE	DESCRIPTION
				0/4.4	5951	30				
					5950	31				
					5949	32				
					5948	33			CLAYSTONE	Light gray (N7) to yellowish gray (5Y 8/1), bedding not apparent, well weathered, slightly friable, slight silt fraction, some dark mineralization, probably carbonaceous, occasional iron stains and calcareous bodies <1 mm. in diam.
				1.8/1.8	5947	34				
					5946	35			CLAYSTONE	As above.
				1.8/1.8	5945	36				
					5944	37			CLAYSTONE	As above, slabbed section exhibits multiple very fine healed fractures.
				1.4/1.4	5943	38			CLAYSTONE	Light gray (N7), bedding not apparent, weathered, slightly friable, vertical fractures and approx. 25 degree fractures with iron staining, slightly calcareous in places.
				2.9/2.9	5942	39				

STATE PLANE COORDINATE:	TOTAL DEPTH (FT): 130.5	GROUND ELEVATION (FT):	5981.18	PROJECT NUMBER:	667.11	LOG OF BORING NUMBER:
NORTH: 750357	AREA: SOLAR POND	CASING DIAMETER (IN):	2 ID	GEOLOGIST:	DCB	23-86
EAST: 2084259	LOCATOR NUMBER: L10	BOREHOLE DIAMETER (IN):	7.25	DATE DRILLED:	09/23/86	

REMARKS: Hollow Stem Auger/NC Core. Built well in NC rod: no centralizers used.

CHEMICAL SAMPLE DEPTH
GRADATIONAL SAMPLE DEPTH
SAMPLE NUMBER
SAMPLE GRAIN SIZE (0% 50% 100%)
PERCENT RECOVERY (100% 0% 100%)
RECOVERY/INTERVAL
DATUM (FT)
DEPTH (FT)
WELL OR PIEZOMETER CONSTRUCTION
LITHOLOGY



UNIFIED SOILS CLASSIFICATION OR ROCK TYPE	DESCRIPTION
CLAYSTONE	As above, exterior of core has a knotty appearance. From 42.7 to 43.2 ft interval is highly weathered.
CLAYSTONE	Same as above.
CLAYSTONE	Medium light gray (N6) to very light gray (N8), bedding not apparent, possible soft sediment deformation or bioturbation, well weathered, moderately friable, abundant carbonaceous mineralization, some iron staining.
CLAYSTONE	Same as above.
CLAYSTONE	Medium gray (N6), bedding not apparent, well weathered, slightly friable, abundant iron staining on bedding plane partings and fractures, slickensides at approx. 49.6 ft.

STATE PLANE COORDINATE:		TOTAL DEPTH (FT): 130.5	GROUND ELEVATION (FT):	5981.18	PROJECT NUMBER:	667.11	LOG OF BORING NUMBER:
NORTH:	750357	AREA: SOLAR POND	CASING DIAMETER (IN):	2.10	GEOLOGIST:	DCB	23-86
EAST:	2084259	LOCATOR NUMBER: L10	BOREHOLE DIAMETER (IN):	7.25	DATE DRILLED:	09/23/86	

REMARKS: Hollow Stem Auger/NC Core. Built well in NC rod: no centralizers used.

CHEMICAL SAMPLE DEPTH / GRADATIONAL SAMPLE	SAMPLE NUMBER	SAMPLE GRAIN SIZE	PERCENT RECOVERY	RECOVERY/INTERVAL	DATUM (FT)	DEPTH (FT)	WELL OR PIEZOMETER CONSTRUCTION	LITHOLOGY	UNIFIED SOILS CLASSIFICATION OR ROCK TYPE	DESCRIPTION
				1.6/1.6	5931 5930	50 51			CLAYSTONE	As above, slickensides at approx. 50.1 to 50.4 ft.
				2.7/2.7	5929 5928	52 53			CLAYSTONE	As above, slickensides at approx. 52.5 ft.
				1.5/1.5	5927 5926	54 55			CLAYSTONE	Light olive gray (5Y 6/1), bedding not apparent, weathered, slightly friable, trace of silt, slickensides at approx. 55.4 ft., slight amount of iron staining.
				0/1.4	5925 5924	56 57			NO SAMPLE	
				1.6/1.6	5923 5922	58 59			CLAYSTONE	Light gray (N7) to medium dark gray (N4), bedding not apparent, well weathered, slight to moderate friability, moderate silt fraction, slight iron staining and carbonaceous mineralization.
									CLAYSTONE	As above.

STATE PLANE COORDINATE:		TOTAL DEPTH (FT): 130.5	GROUND ELEVATION (FT):	5981.18	PROJECT NUMBER:	667.11	LOG OF BORING NUMBER:
NORTH:	750357	AREA: SOLAR POND	CASING DIAMETER (IN):	2 ID	GEOLOGIST:	DCB	23-86
EAST:	2084259	LOCATOR NUMBER: L10	BOREHOLE DIAMETER (IN):	7.25	DATE DRILLED:	09/23/86	

REMARKS: Hollow Stem Auger/NC Core. Built well in NC rod: no centralizers used.

CHEMICAL SAMPLE DEPTH
GRADATIONAL SAMPLE DEPTH
SAMPLE NUMBER
SAMPLE GRAIN SIZE (0% 50% 100%)
PERCENT RECOVERY (0% 100%)
RECOVERY/INTERVAL
DATUM (FT)
DEPTH (FT)
WELL OR PIEZOMETER CONSTRUCTION
LITHOLOGY

RECOVERY/INTERVAL	UNIFIED SOILS CLASSIFICATION OR ROCK TYPE	DESCRIPTION
	CLAYEY SILTSTONE	Light gray (N7), bedding not apparent (massive?), slightly friable, iron stain at approx. 62 ft. with possible carbonaceous mineralization.
1.8/1.8		
1.8/1.8	SILTY CLAYSTONE	Interval grades to a silty claystone at 62.7 ft. as above, iron stains absent.
1.5/1.5	SILTSTONE	Light gray (N7), bedding not apparent (massive?), slightly friable, slight clay fraction, slight amount of carbonaceous mineralization.
1.7/1.7	SILTSTONE	As above.
1.6/1.6	SILTSTONE	As above.
	CLAYSTONE	Dark gray (N3), bedding not apparent, weathered, slight to moderate friability, slight amount of iron staining, moderate silt fraction, slickensides at approx. 68.5 ft.
	CLAYSTONE	As above, some carbonaceous mineralization, slickensides at approx. 69.8 ft.

DATUM (FT): 5921, 5920, 5919, 5918, 5917, 5916, 5915, 5914, 5913, 5912
DEPTH (FT): 60, 61, 62, 63, 64, 65, 66, 67, 68, 69

STATE PLANE COORDINATE:		TOTAL DEPTH (FT): 130.5	GROUND ELEVATION (FT):	5981.18	PROJECT NUMBER:	667.11	LOG OF BORING NUMBER:
NORTH:	750357	AREA: SOLAR POND	CASING DIAMETER (IN):	2 ID	GEOLOGIST:	DCB	23-86
EAST:	2084259	LOCATOR NUMBER: L10	BOREHOLE DIAMETER (IN):	7.25	DATE DRILLED:	09/23/86	

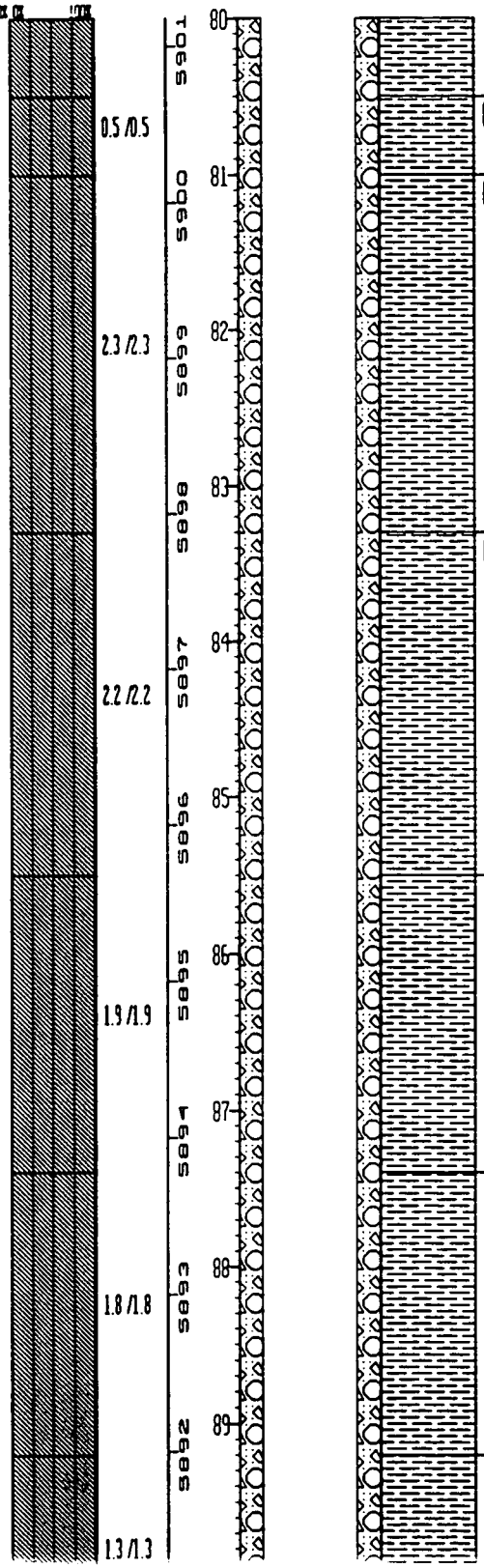
REMARKS: Hollow Stem Auger/NC Core. Built well in NC rod: no centralizers used.

CHEMICAL SAMPLE DEPTH / GRADATIONAL SAMPLE	SAMPLE NUMBER	SAMPLE GRAIN SIZE (0% 50% 100%)	PERCENT RECOVERY (0% 100%)	RECOVERY/INTERVAL	DATUM (FT)	DEPTH (FT)	WELL OR PIEZOMETER CONSTRUCTION	LITHOLOGY	UNIFIED SOILS CLASSIFICATION OR ROCK TYPE	DESCRIPTION
					5911	70			CLAYSTONE	As above.
					5910	71				
					5909	72				
				2.5	5908	73				
					5907	74				
					5906	75				
									CLAYSTONE	As above, slickensides at approx. 77.0 ft.
				1.9/1.9	5905	76				
					5904	77				
									CLAYSTONE	As above with an increase in the silt fraction from approx. 77.4 ft. to 80.5 ft. and color grades to light gray (N7).
				2.2	5903	78				
					5902	79			CLAYSTONE	As above.

STATE PLANE COORDINATE:	TOTAL DEPTH (FT): 130.5	GROUND ELEVATION (FT): 5981.18	PROJECT NUMBER: 667.11	LOG OF BORING NUMBER:
NORTH: 750357	AREA: SOLAR POND	CASING DIAMETER (IN): 2 ID	GEOLOGIST: DCB	23-86
EAST: 2084259	LOCATOR NUMBER: L10	BOREHOLE DIAMETER (IN): 7 25	DATE DRILLED: 09/23/86	

REMARKS: Hollow Stem Auger/NC Core. Built well in NC rod: no centralizers used.

CHEMICAL SAMPLE DEPTH
GRADATIONAL SAMPLE DEPTH
SAMPLE NUMBER
SAMPLE GRAIN SIZE (0% 50% 100%)
PERCENT RECOVERY (0% 100%)
RECOVERY/INTERVAL
DATUM (FT)
DEPTH (FT)
WELL OR PIEZOMETER CONSTRUCTION
LITHOLOGY

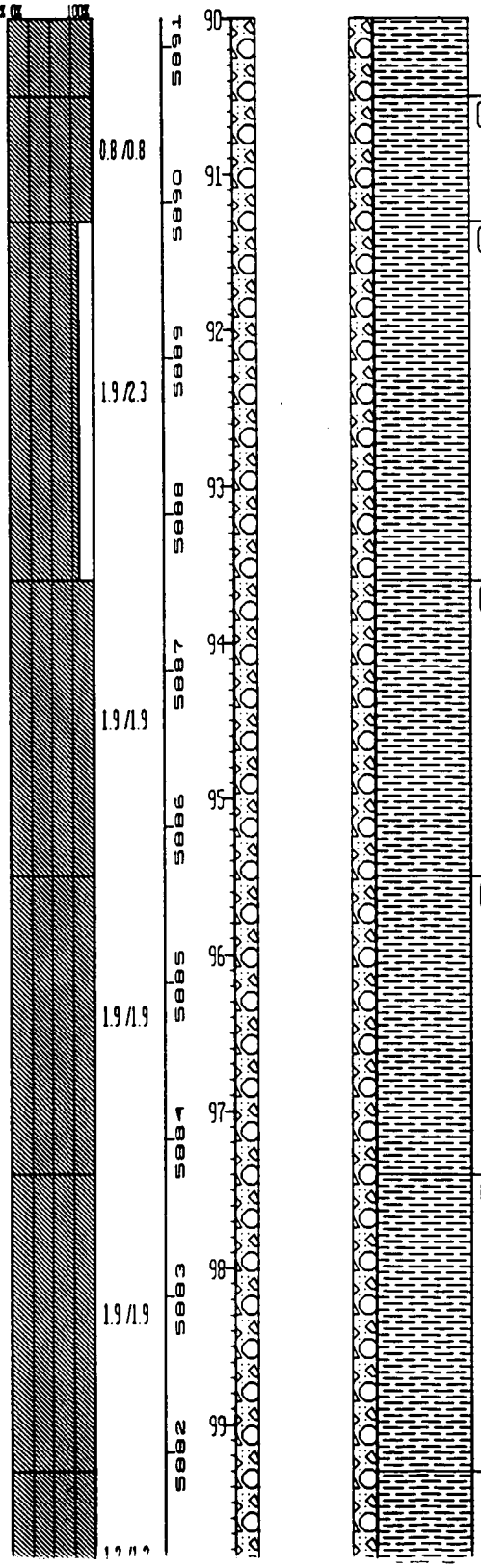


UNIFIED SOILS CLASSIFICATION OR ROCK TYPE	DESCRIPTION
CLAYSTONE	Light olive gray (5Y 6/1), bedding not apparent, slightly friable, occasional iron staining, moderate silt fraction.
CLAYSTONE	As above.
CLAYSTONE	As above. Slickensides at approx. 85.2 ft. with 40 degree attitude.
CLAYSTONE	As above, slickensides are absent. Irregular body of VFG sand at approx. 85.9 ft.
CLAYSTONE	As above.
CLAYSTONE	As above with irregular body of VFG sand at approx. 89.5 ft.

STATE PLANE COORDINATE:		TOTAL DEPTH (FT): 130.5	GROUND ELEVATION (FT):	5981.18	PROJECT NUMBER:	667.11	LOG OF BORING NUMBER:
NORTH:	750357	AREA: SOLAR POND	CASING DIAMETER (IN):	2 ID	GEOLOGIST:	DCB	23-86
EAST:	2084259	LOCATOR NUMBER: L10	BOREHOLE DIAMETER (IN):	7.25	DATE DRILLED:	09/23/86	

REMARKS: Hollow Stem Auger/NC Core. Built well in NC rod: no centralizers used.

CHEMICAL SAMPLE OR GRADATIONAL SAMPLE | SAMPLE NUMBER | SAMPLE GRAIN SIZE (0% 50% 100%) | PERCENT RECOVERY (0% 100%) | RECOVERY/INTERVAL | DATUM (FT) | DEPTH (FT) | WELL OR PIEZOMETER CONSTRUCTION | LITHOLOGY | UNIFIED SOILS CLASSIFICATION OR ROCK TYPE | DESCRIPTION



UNIFIED SOILS CLASSIFICATION OR ROCK TYPE	DESCRIPTION
CLAYSTONE	As above with moderate amount of VFG sand at approx. 90.6 ft.
CLAYSTONE	As above.
CLAYSTONE	As above.
CLAYSTONE	As above, VFG sand is absent, occasional iron staining and carbonaceous mineralization, mineralized body at approx. 96 ft., some white bladed to fibrous crystals (gypsum?) underlain by gray granular mass, Fe oxide and possible Mg oxide stains surround mineral body. Fractures with faint slickensides at approx. 97 ft. and 99.1 ft.
CLAYSTONE	As above.
CLAYSTONE	Light olive gray (5Y 6/1), bedding not apparent, slightly friable, slight to moderate silt fraction, occasional iron staining and carbonaceous mineralization

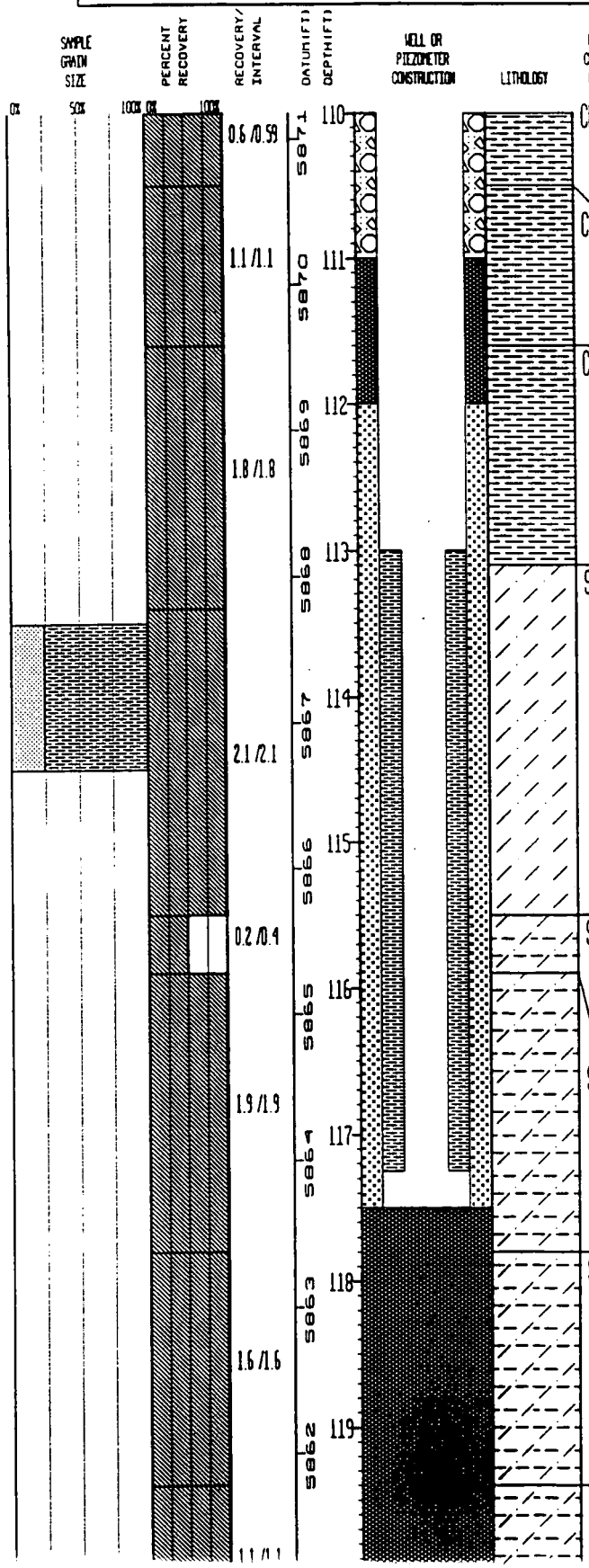
STATE PLANE COORDINATE:		TOTAL DEPTH (FT): 130.5	GROUND ELEVATION (FT):	5981.18	PROJECT NUMBER:	667.11	LOG OF BORING NUMBER:
NORTH:	750357	AREA: SOLAR POND	CASING DIAMETER (IN):	2 ID	GEOLOGIST:	DCB	23-86
EAST:	2084259	LOCATOR NUMBER: L10	BOREHOLE DIAMETER (IN):	7.25	DATE DRILLED:	09/23/86	

REMARKS: Hollow Stem Auger/NC Core. Built well in NC rod: no centralizers used.

CHEMICAL SAMPLE DEPTH / GRADATIONAL SAMPLE DEPTH	SAMPLE NUMBER	SAMPLE GRADN SIZE (0% 50% 100%)	PERCENT RECOVERY (0% 100%)	RECOVERY/INTERVAL	DATUM (FT)	DEPTH (FT)	WELL OR PIEZOMETER CONSTRUCTION	LITHOLOGY	UNIFIED SOILS CLASSIFICATION OR ROCK TYPE	DESCRIPTION
					5981	100				
				1.8 /1.8	5980	101			CLAYSTONE	As above, lense of FG sand at approx. 102 ft. approx. 2 mm. in thickness.
					5979	102				
				1.3 /1.3	5978	103			CLAYEY SILTSTONE	Interval grades to clayey siltstone at approx. 102.5 ft. Light olive gray (5Y 6/1), bedding is not apparent, slightly friable, slight fraction of VFG sand locally, occasional iron staining and carbonaceous mineralization.
				1.9 /1.9	5977	104			CLAYEY SILTSTONE	As above, increase in clay fraction below 105 ft.
					5976	105				
	0075			2 /2	5975	106			SILTY CLAYSTONE	Light olive gray (5Y 6/1), bedding not apparent, weathered, slightly to moderately friable, occasional iron stains and carbonaceous mineralization.
					5974	107				
				0 /2.4	5973	108			NO SAMPLE	
					5972	109				

STATE PLANE COORDINATE:		TOTAL DEPTH (FT): 130.5	GROUND ELEVATION (FT):	5981.18	PROJECT NUMBER:	667.11	LOG OF BORING NUMBER:
NORTH:	750357	AREA: SOLAR POND	CASING DIAMETER (IN):	2 ID	GEOLOGIST:	DCB	23-86
EAST:	2084259	LOCATOR NUMBER: L10	BOREHOLE DIAMETER (IN):	7.25	DATE DRILLED:	09/23/86	

REMARKS: Hollow Stem Auger/NC Core. Built well in NC rod: no centralizers used.

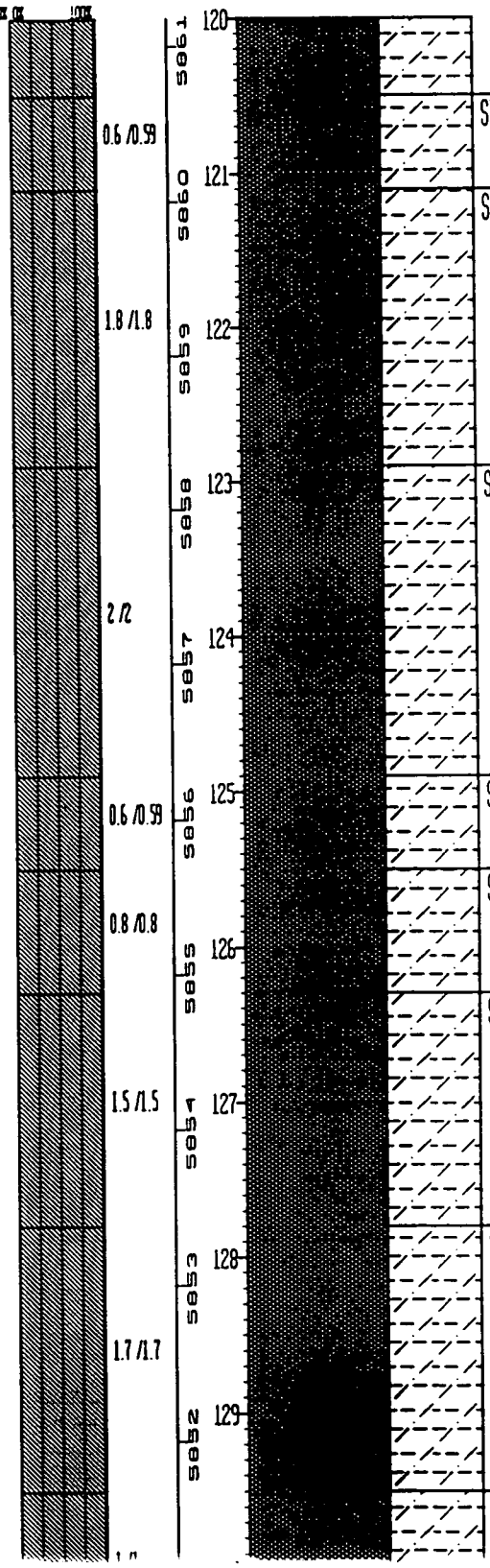


UNIFIED SOILS CLASSIFICATION OR ROCK TYPE	DESCRIPTION
CLAYSTONE	Light olive gray (5Y 6/1), bedding not apparent, slightly weathered, slightly friable, occasional carbonaceous mineralization, slight silt fraction, color varies to medium dark gray (N5).
CLAYSTONE	Same as above.
CLAYSTONE	Same as above.
SILTSTONE	Light gray (N7), bedding not apparent, slightly friable, occasional carbonaceous mineralizations.
SILTY CLAYSTONE	Interval grades to silty claystone. Light gray (N7) to medium gray (N5), bedding exhibits extensive bioturbation and soft sediment deformation, weathered, slightly friable, carbonaceous mineralization occurs on partings.
SILTY CLAYSTONE	As above.
SILTY CLAYSTONE	As above, thin stringers of coal <2 mm. which appear to cross out bedding.
SILTY CLAYSTONE	As above.

STATE PLANE COORDINATE:	TOTAL DEPTH (FT): 130.5	GROUND ELEVATION (FT): 5981.18	PROJECT NUMBER: 667.11	LOG OF BORING NUMBER:
NORTH: 750357	AREA: SOLAR POND	CASING DIAMETER (IN): 2 ID	GEOLOGIST: DCB	23-86
EAST: 2084259	LOCATOR NUMBER: L10	BOREHOLE DIAMETER (IN): 7 25	DATE DRILLED: 09/23/86	

REMARKS: Hollow Stem Auger/NC Core. Built well in NC rod: no centralizers used.

CRITICAL SAMPLE DEPTH
GRADATIONAL SAMPLE DEPTH
SAMPLE NUMBER
SAMPLE GRAIN SIZE (0% 50% 100%)
PERCENT RECOVERY (0% 100%)
RECOVERY/INTERVAL
DATUM (FT)
DEPTH (FT)
WELL OR PIEZOMETER CONSTRUCTION
LITHOLOGY
UNIFIED SOILS CLASSIFICATION OR ROCK TYPE
DESCRIPTION



SILTY CLAYSTONE As above.

SILTY CLAYSTONE As above, slickensides at approx. 122.7 ft.

SILTY CLAYSTONE As above, bedding appears to have slight dip (based on core breaks).

SILTY CLAYSTONE As above.

SILTY CLAYSTONE As above.

SILTY CLAYSTONE As above.

SILTY CLAYSTONE As above.

SILTY CLAYSTONE As above.

STATE PLANE COORDINATE:		TOTAL DEPTH (FT): 130.5	GROUND ELEVATION (FT):	5981.18	PROJECT NUMBER:	667.11	LOG OF BORING NUMBER:
NORTH:	750357	AREA: SOLAR POND	CASING DIAMETER (IN):	2 ID	GEOLOGIST:	DCB	23-86
EAST:	2084259	LOCATOR NUMBER: L10	BOREHOLE DIAMETER (IN):	7.25	DATE DRILLED:	09/23/86	

REMARKS: Hollow Stem Auger/NC Core. Built well in NC rod: no centralizers used.

CHEMICAL SAMPLE / GRADATIONAL SAMPLE	SAMPLE NUMBER	SAMPLE GRAIN SIZE	PERCENT RECOVERY	RECOVERY/INTERVAL	DATUM (FT)	DEPTH (FT)	WELL OR PIEZOMETER CONSTRUCTION	LITHOLOGY	UNIFIED SOILS CLASSIFICATION OR ROCK TYPE	DESCRIPTION
0%		50%	100% 0% 100%	1/1	5951	130				NOTE: No water encountered while drilling.
					5950	131				
					5949	132				
					5948	133				
					5947	134				
					5946	135				
					5945	136				
					5944	137				
					5943	138				
					5942	139				

INDEX OF DATA

Boring No.: 24-86

Completed as well? Yes

Data in File

X Log of Borehole

X Well Construction Summaries

____ Well Development Summaries

____ Hydraulic Conductivity Test Data and Results

____ Packer Test Data and Results

X Water Level Data

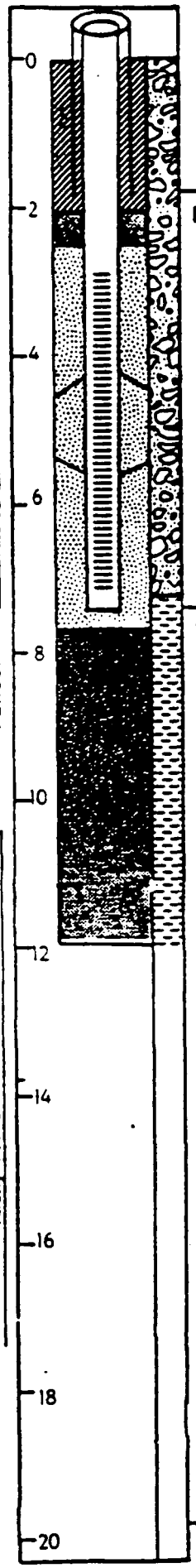
X Saturated Thickness Hydrographs

WELL 24-86

WELL CONSTRUCTION SUMMARY

LOCATION or COORDS: N 37354.8 E 21172.8

ELEVATION: GROUND LEVEL 5980.45'
TOP OF CASING 5982.07'



LOCATION Golden, CO
PERSONNEL T. Murphy
PROJECT 106P06222 Rocky Flats Plant

DRILLING SUMMARY:

TOTAL DEPTH Well: 7.45' Hole: 12.00'
BOREHOLE DIAMETER 7¼"

DRILLER Boyles Brothers Drilling Co.
15865 W. 5th Avenue
Golden, CO (Dave Jarvie)
RIG Mobile B-57
BIT(S) TS

DRILLING FLUID None

SURFACE CASING 5" x 4' steel w/ locking cap

WELL DESIGN:

BASIS: GEOLOGIC LOG X GEOPHYSICAL LOG ___

CASING STRING(S): C=CASING S=SCREEN

0.00'	-	2.95'	C1		
2.95'	-	7.45'	S1		

CASING: C1 2" I.D. Sch. 5 type 316 stainless steel, threaded and flush jointed.

SCREEN: S1 2" I.D. Sch. 5 type 316 stainless steel, threaded and flush jointed. 0.010" wire wrap screen 0.25' welded bottom cap.

CENTRALIZERS Type 304 stainless steel
4.34' - 5.59'

FILTER MATERIAL 32-42 silica sand
2.50' - 7.70'

CEMENT Portland Type I
0.00' - 2.00'

OTHER 3/8" bentonite pellets
2.00' - 2.50'
7.70' - 11.90'

CONSTRUCTION TIME LOG:

TASK	START DATE 1986	START TIME	FINISH DATE 1986	FINISH TI
DRILLING:				
7¼" auger	9/12	1320	9/12	140
GEOPHYS. LOGGING:	—	—	—	—
CASING:				
2" stainless	9/12	1525	9/12	15
FILTER PLACEMENT:	9/12	1526	9/12	15
CEMENTING:	9/12	1532	9/12	15
DEVELOPMENT:	9/16	1650	9/16	16
OTHER:				
Bentonite	9/12	1530	9/12	15
	9/12	1520	9/12	15

WELL DEVELOPMENT

See Well Development Summary Sheet.

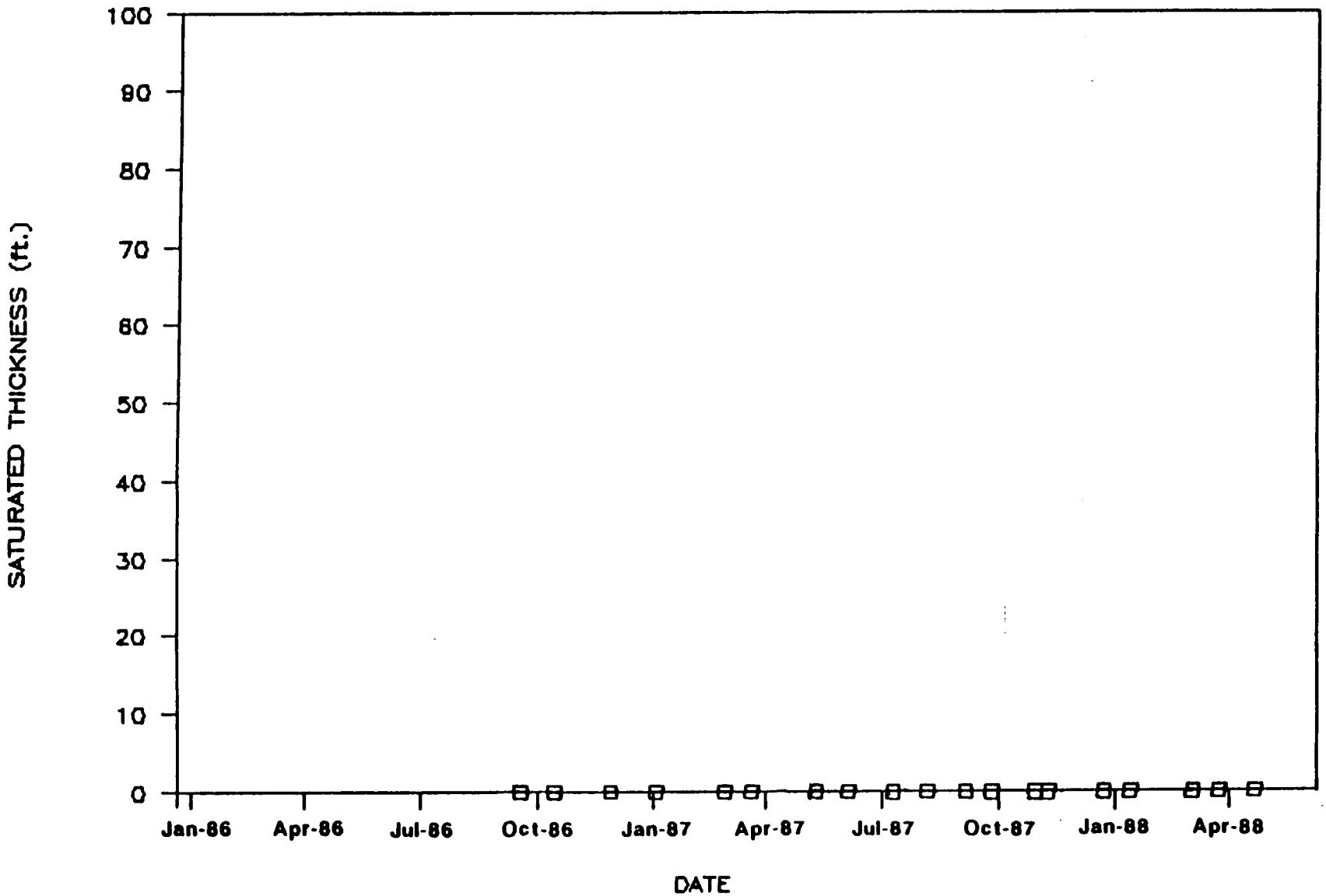
COMMENTS:

No water encountered during drilling.

Top of stainless steel casing: 1.62'

Cave from TD to 11.90'

SATURATED THICKNESS IN WELL # 24-86 (SP)



LOG OF BORING NO. 24-86

GEOLOGIST(S): DCB
DATE: 8/14/89

PROJECT NO: 667-1122

TOP/BOTTOM OF CORE IN BOX	TOP/BOTTOM OF INTERVAL	FEET OF CORE IN INTERVAL IN BOX	SAMPLE NUMBER	FRACTURE ANGLE	BEDDING ANGLE	GRAIN SIZE DISTRIBUTION	USCS SYMBOL	DEPTH IN FEET	LITHOLOGIC LOG	LITHOLOGIC DESCRIPTION
0.0 ↓ Box 1 of 1	0.0 to 2.5	ND				>50% Gravel	GC	1, 2		Clayey Gravel, light gray (N7), matrix is pale yellowish brown (10 YR 6/2) to pale brown (5 YR 5/2), angular to subrounded, poorly graded, max size 7cm, some silt and a trace of vfg sand.
	2.5 to 5.0	(1) .8					CL	3, 4, 5		Caliche and gravel, white (N9),
	5.0 to 7.0	0						6, 7		No Sample
	7.0 to 7.2	ND				>50% Clay	CL			Gravelly Sandy Clay, light gray (N7) mottled dark yellowish orange (10 YR 6/6), low to moderate plasticity, max gravel size is 5cm, sand is vfg to cg.
	7.2 to 8.8	ND				>50% Clay		8		Clay stone, bedding not apparent, highly weathered, slightly to moderately friable, caliche as fracture filling, localized carbonaceous mineralization and iron staining.
	8.8 to 10.6	ND						9		

NOTES: General USCS is modified for this log as follows:
Material amounts are estimated by % volume instead of % weight.
(1) Badly broken core, accurate footage measurements not possible.
(2) Core breaks cannot be matched, accurate footage measurements not possible.

ROCKY FLATS PLANT

FIGURE NO.

LOG OF BORING NO. 24-86

GEOLOGIST(S): DCB
DATE: 8/14/89

PROJECT NO: 667-1122

TOP/BOTTOM OF CORE IN BOX	TOP/BOTTOM OF INTERVAL	FEET OF CORE IN INTERVAL IN BOX	SAMPLE NUMBER	FRACTURE ANGLE	BEDDING ANGLE	GRAIN SIZE DISTRIBUTION	USCS SYMBOL	DEPTH IN FEET	LITHOLOGIC LOG	LITHOLOGIC DESCRIPTION
	8.8 to 10.6	ND				Clay >50%				As above
Box 1 of 1 @ 12.0	10.6 to 12.0	ND						11		
								12		Bottom of box 1 of 1 at 12.0 ft.

NOTES: General: USCS is modified for this log as follows:
Material amounts are estimated by % volume instead of % weight.
(1) Badly broken core, accurate footage measurements not possible.
(2) Core breaks cannot be matched, accurate footage measurements not possible.

ROCKY FLATS PLANT

FIGURE NO.

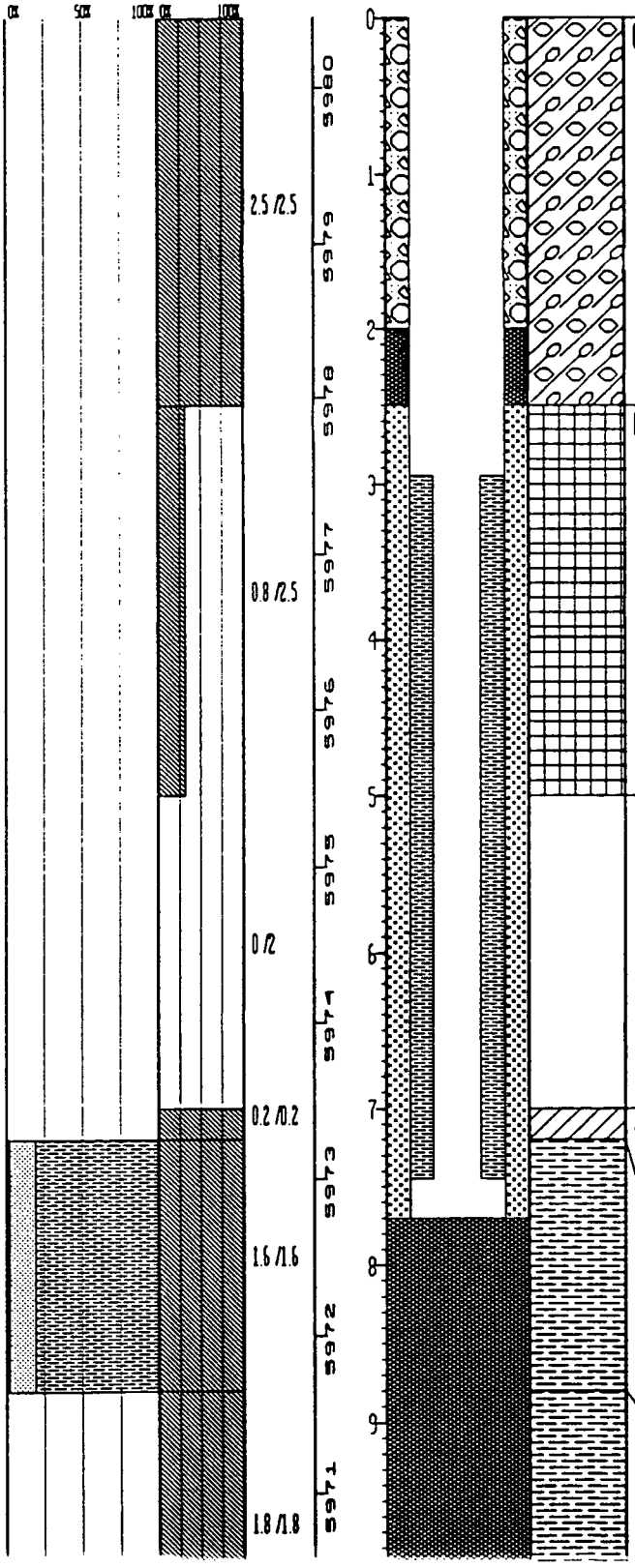
STATE PLANE COORDINATE:	TOTAL DEPTH (FT): 12	GROUND ELEVATION (FT):	5980.45	PROJECT NUMBER:	667.11	LOG OF BORING NUMBER:
NORTH: 750357	AREA: SOLAR POND	CASING DIAMETER (IN):	2 ID	GEOLOGIST:	DCB	24-86
EAST: 2084277	LOCATOR NUMBER: L10	BOREHOLE DIAMETER (IN):	7.25	DATE DRILLED:	09/12/86	

REMARKS: Hollow Stem Auger. Cave from TD to 11.9

CHEMICAL SAMPLE DEPTH
GRADATIONAL SAMPLE DEPTH

SAMPLE NUMBER

SAMPLE GRAIN SIZE (0% 50% 100%) | PERCENT RECOVERY (0% 100%) | RECOVERY/INTERVAL | DATUM (FT) | DEPTH (FT) | WELL OR PIEZOMETER CONSTRUCTION | LITHOLOGY | UNIFIED SOILS CLASSIFICATION OR ROCK TYPE | DESCRIPTION



GC:	Clayey Gravel - light gray (N7), matrix is pale yellowish brown (10YR 6/2) to pale brown (5YR 5/2), angular to sub-rounded, poorly graded, max. size 7 cm., some silt and trace of VFG sand.
CALICHE:	Caliche and Gravel - white (N9).
NO SAMPLE:	
CL:	GRAVELLY SANDY CLAY - light gray (N7) mottled dark yellowish orange (10YR 6/6), low to moderate plasticity, max. gravel size is 5 cm., sand is VFG to CG.
CLAYSTONE:	Top of Bedrock Light gray (N7) to mottled dark yellowish orange (10YR 6/6), bedding not apparent, highly weathered, slightly to moderately friable, caliche as fracture filling, localized carbonaceous mineralization and iron staining.
CLAYSTONE:	Same as above.

D3828

STATE PLANE COORDINATE:	TOTAL DEPTH (FT): 12	GROUND ELEVATION (FT):	5980.45	PROJECT NUMBER:	667.11	LOG OF BORING NUMBER:
NORTH: 750357	AREA: SOLAR POND	CASING DIAMETER (IN):	2 ID	GEOLOGIST:	DCB	24-86
EAST: 2084277	LOCATOR NUMBER: L10	BOREHOLE DIAMETER (IN):	7.25	DATE DRILLED:	09/12/86	

REMARKS: Hollow Stem Auger. Cave from TD to 11.9

CHEMICAL SAMPLE OR GRADATIONAL SAMPLE	SAMPLE NUMBER	SAMPLE GRAIN SIZE	PERCENT RECOVERY	RECOVERY/INTERVAL	DATUM(FT)	DEPTH(FT)	WELL OR PIEZOMETER CONSTRUCTION	LITHOLOGY	UNIFIED SOILS CLASSIFICATION OR ROCK TYPE	DESCRIPTION
		0% 50%	100% 0% 100%	1.4/1.4	5970 5969 5968 5967 5966 5965 5964 5963 5962 5961	10 11 12 13 14 15 16 17 18 19			CLAYSTONE:	Same as above. NOTE: No water encountered while drilling.

INDEX OF DATA

Boring No.: 25-86

Completed as well? Yes

Data in File

X Log of Borehole

X Well Construction Summaries

____ Well Development Summaries

X Hydraulic Conductivity Test Data and Results

X Packer Test Data and Results

X Water Level Data

X Saturated Thickness Hydrographs

Project: Rocky Flats Plant

LOG OF BORING NO. 25-86

Date Drilled 9/13/86 - 9/17/86

Boring Method NC Core

Coordinates N 37426.3 E 21726.5

Ground Surface Elevation 5974.45

Elev. (feet)	Depth (feet)	Sample Type	Graphic Log	Material Description	Penetration Resistance (Blows/ Inch) 20 40	Water Content (%) 20 40	Other Tests
	0			**ARTIFICIAL FILL** 0-2.0'-Cuttings. GRAVEL: granite and quartzite pebbles and large cobbles; dry. 2.0-9.0'-Cuttings. GRAVEL: pale yellowish brown (10YR 6/2); clayey; some silt and sand; 50% fines; dry to slightly damp.			
	5			9.0-11.0'-Cuttings. CLAY: gray orange (10YR 7/4); sandy and silty; caliche stringers; 1-2% quartzite pebbles; damp. 11.0-13.0'-Cuttings. CLAY: gray orange (10YR 7/2); gravelly; silty; 20% quartzite pebbles; caliche stringers; damp. 13.0-17.0'-Cuttings. CLAY: Same as above; light olive brown (5Y 5/6); damp.			
	10						
	15			**ARAPAHOE FORMATION** 17.0-19.5'-Cuttings. CLAYSTONE: moderate yellowish brown (10YR 5/4); sub-plastic; damp. 19.5-20.0'-Cuttings. CLAYSTONE: grayish brown (5YR 3/2); plastic; moist.			
	20						

Remarks Logged by: T. Gulliver & T. Murphy

Checked by:

Project No.

Project:	Rocky Flats Plant	LOG OF BORING NO.	25-86
Date Drilled	9/13/86 - 9/17/86	Coordinates	N 37426.3 E 21726.5
Boring Method	NC Core	Ground Surface Elevation	5974.45

Elev. (feet)	Depth (feet)	Sample Type	Graphic Log	Material Description	Penetration Resistance (Blows/inch) 20 40	Water Content (%) 20 40	Other Tests
	20			20.0-22.0'-Cuttings. CLAYSTONE: light grayish brown (5YR 6/1); firm; damp.			
				22.0-37.0'-Cuttings. CLAYSTONE: light grayish brown (5YR 6/1); silty; very wet (cored with water).			
	25						
	30						
	35						
				37.0-41.6'-Sample. Recovered 0.0/4.6'=0%.			
	40						

Remarks Logged by: T. Gulliver & T. Murphy Checked by: JLP

Project No.

Project:	Rocky Flats Plant	LOG OF BORING NO.	25-86

Date Drilled 9/13/86 - 9/17/86 **Coordinates** N 37426.3 E 21726.5

Boring Method NC Core **Ground Surface Elevation** 5974.45

Elev. (feet)	Depth (feet)	Sample Type	Graphic Log	Material Description	Penetration Resistance (Blows/inch) 20 40	Water Content (%) 20 40	Other Tests
	40						
	45			41.6-46.6'-Sample. Recovered 5.0/5.0'=100%. RQD 3.0/5.0'=60%. CLAYSTONE: light olive gray (5Y 5/2) to olive gray (5Y 3/2); light brown to dark yellowish orange (10YR 6/6) iron staining; trace silt; ironstone; altered claystone concretions from 46.0-46.6'; firm; damp.			
	50			46.6-51.6'-Sample. Recovered 5.0/5.0'=100%. RQD 3.6/5.0'=72%. CLAYSTONE: light brown (10YR 6/6) grading to medium dark gray (N 4); ironstone from 46.6-47.0'; heavy iron staining at 48.0'; high angle fractures with calcite along fracture planes; firm; moist.			
	55			51.6-56.6'-Sample. Recovered 5.0/5.0'=100%. RQD 4.3/5.0'=86%. CLAYSTONE: grayish black (N 2) to dark gray (N 3); occasional dark yellowish orange (10YR 6/6) iron staining; some coaly layers and fragments; firm; damp.			
	60			56.6-61.6'-Sample. Recoverd 5.5/5.0'=100%. RQD 3.5/5.0'=57%. CLAYSTONE: grayish black (N 2); silty; organic wood fragments; fractures due to drilling; firm; damp.			

Remarks Logged by: T. Gulliver & T. Murphy Checked by:

Project No.

Project:	Rocky Flats Plant	LOG OF BORING NO.	25-86
Date Drilled	9/13/86 - 9/17/86	Coordinates	N 37426.3 E 21726.5
Boring Method	NC Core	Ground Surface Elevation	5974.45

Elev. (feet)	Depth (feet)	Sample Type	Graphic Log	Material Description	Penetration Resistance (Blows/inch) 20 40	Water Content (%) 20 40	Other Tests
	60						
				61.6-66.6'-Sample. Recovered 4.0/5.0'=80%. RQD 3.4/4.0'=92%. CLAYSTONE: light olive gray (5Y 5/2); silty; occasional very fine-grained sandstone laminations at 63.5'; calcareous at 63.0'; hard; dry to damp.			
	65						
				66.6-71.6'-Sample. Recovered 5.0/5.0'=100%. RQD 5.0/5.0'=100%. CLAYSTONE: grayish black (N 3); thin interbedded silty claystone and clayey siltstone; highly fractured with numerous subvertical slickensides; crumbly to firm; damp.			
	70						
				71.6-74.0'-Sample. Recovered 0.0/2.4'=0%.			
				74.0-79.0'-Sample. Recovered 5.0/5.0'=100%. RQD 4.2/5.0'=85%. SANDSTONE: dark greenish gray (5GY 4/1); very fine-grained; silty; some clay; laminations of siltstone; convoluted bedding; moderately sorted; firm; damp.			
	75						
				79.0-81.1'-Sample. Recovered 2.1/2.1'=100%. RQD 1.3/2.1'=62%. SANDSTONE: Same as above; damp.			
	80						

Remarks Logged by: T. Gulliver & T. Murphy Checked by:

Project No.

Project: Rocky Flats Plant

LOG OF BORING NO. 25-86

Date Drilled 9/13/86 - 9/17/86

Boring Method NC Core

Coordinates N 37426.3 E 21726.5

Ground Surface Elevation 5974.45

Elev. (feet)	Depth (feet)	Sample Type	Graphic Log	Material Description	Penetration Resistance (Blows/inch) 20 40	Water Content (%) 20 40	Other Tests
	80			81.1-82.6'-Sample. Recovered 1.3/1.5'=87%. RQD 0.6/1.3'=46%. SANDSTONE: Same as above; some black coal lenses; firm; damp.			
	85			82.6-85.6'-Sample. Recovered 3.0/3.2'=94%. RQD 1.3/3.0'=43%. SILTSTONE: grayish black (N 3); alternating laminations of very fine-grained sandy siltstone and clayey siltstone; very fine coaly lenses; thinly bedded; some convoluted bedding; firm; dry to damp.			
				85.5-89.8'-Sample. Recovered 2.4/4.2'=57%. RQD 0.0/2.4'=0%. SILTSTONE: Same as above; dry to damp.			
	90			TOTAL DEPTH: 89.8'			
	95						
	100						

Remarks Logged by: T. Gulliver & T. Murphy

Checked by:

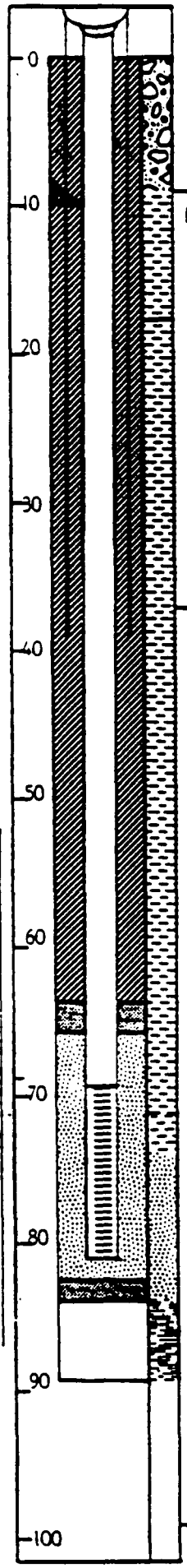
Project No.

WELL 25-86

WELL CONSTRUCTION SUMMARY

LOCATION or COORDS: N 37426.3 E 21726.5

ELEVATION: GROUND LEVEL 5974.45'
TOP OF CASING 5976.55'



PROJECT 106106222 Rocky Flats Plant
PERSONNEL T. Murphy
LOCATION Golden, CO

DRILLING SUMMARY:

TOTAL DEPTH Well: 82.00' Hole: 89.80'

BOREHOLE DIAMETER 0.00' - 38.50': 7½"
38.50' - 89.80': 3 3/4"

DRILLER Bovles Brothers Drilling Co.
15865 W. 5th Avenue
Golden, CO (Dave Jarvie)

RIG Mobile B-57

BIT(S) 0.00' - 38.56': Blade bit; 38.56' - 89.80': Carbide bit

DRILLING FLUID 0.00' - 38.50': None; 38.50' - 89.80': air/water mist

SURFACE CASING 5" x 41' steel w/ locking cap

WELL DESIGN:

BASIS: GEOLOGIC LOG X GEOPHYSICAL LOG ___

CASING STRING(S): C=CASING S=SCREEN

0.00'	38.50'	C1			
0.00'	59.90'	C2			
59.90'	82.00'	S1			

CASING: C1 5" I.D. steel surface casing
C2 2" I.D. Sch. 5 type 316 stainless steel, threaded and flush jointed.

SCREEN: S1 2" I.D. Sch. 5 type 316 stainless steel, threaded and flush jointed, 0.010" wire wrap screen, 0.25' welded bottom cap.

CENTRALIZERS None (see comments)

FILTER MATERIAL 32-42 silica sand
66.10' - 83.60'

CEMENT Portland Type I
0.00' - 64.00'

OTHER 3/8" bentonite pellets
64.00' - 66.10'
83.60' - 84.60'

CONSTRUCTION TIME LOG:

TASK	START DATE 1986	START TIME	FINISH DATE 1986	FINISH TI
DRILLING:				
7½" auger	8/26	1401	8/27	133
NC core	9/13	1400	9/16	170
Reaming	9/17	1030	9/17	131
GEOPHYS. LOGGING:	—	—	—	—
CASING:				
5" steel	8/27	1353	8/27	142
2" stainless	9/17	1537	9/17	154
FILTER PLACEMENT:	9/17	1526	9/17	180
CEMENTING:	9/18	0904	9/18	10
DEVELOPMENT:	9/30	1430	10/1	094
OTHER:				
Bentonite	9/17	1805	9/17	18
	9/17	1505	9/17	15
Cementing 5" steel	8/27	1540	8/27	16

WELL DEVELOPMENT

See Well Development Summary Sheet

COMMENTS:

No water encountered during drilling.

Top of stainless steel casing: 2.10'

Cave from TD to 84.60'

ROCKY FLATS SOLAR PONDS

WATER LEVEL SUMMARY

WELL NUMBER	DATE	GROUND SURFACE ELEVATION	TOP OF CASING ELEVATION	STICK UP	DEPTH OF SI BASE	WATER DEPTH BELOW TOC	WATER SURFACE ELEVATION
2586	09/30/86	5974.45	5976.55	2.10	82.00	71.05	5905.50
	10/01/86					77.93	5898.62
	10/13/86					71.42	5905.13
	10/21/86					76.73	5899.82
	10/28/86					74.59	5901.96
	11/05/86					74.24	5902.31
	11/06/86					78.65	5897.90
	11/07/86					79.52	5897.03
	11/26/86					71.94	5904.61
	01/01/87					31.83	5944.72
	02/25/87					23.92	5952.63
	03/18/87					21.75	5954.80
	05/08/87					35.38	5941.17
	06/03/87					27.25	5949.30
	07/08/87					71.70	5904.85
	08/04/87					24.70	5951.85
	08/27/87					32.60	5943.95
	09/03/87					31.40	5945.15
	11/09/87					28.60	5947.95
	12/21/87					28.40	5948.15
	01/11/88					21.00	5955.55
	02/29/88					34.60	5941.95
	03/21/88					27.80	5948.75
	04/18/88					40.70	5935.85

LOG OF BORING NO. 25-86

GEOLOGIST(S): [illegible]
DATE: 8/26/89

PROJECT NO: 6067-1122

TOP/BOTTOM OF CORE IN BOX	TOP/BOTTOM OF INTERVAL	FEET OF CORE IN INTERVAL IN BOX	SAMPLE NUMBER	FRACTURE ANGLE	BEDDING ANGLE	GRAIN SIZE DISTRIBUTION	USCS SYMBOL	DEPTH IN FEET	LITHOLOGIC LOG	LITHOLOGIC DESCRIPTION
0.C ↓	0.0 -2.5	(1) 1.4					SC	1, 2		TOP 3 IN: SANDY GRAVEL, moderate orange pink (5 YR 8/4), subangular - angular, mod.-well graded, max size = 5cm, sand to VFG - MG. GRAVELLY CLAYEY SAND, pale yellowish brown (10 YR 6/2), angular - subangular, mod graded, sand to FG-CG, max gravel size = 4cm, matrix is calcareous, some calcite, bottom of interval has possible black tar
	2.5 -5.0	(1) 0.4					GW	3, 4		CALCAREOUS GRAVEL, very pale orange (10 YR 8/2), angular - subangular, mod grading, max size = 8cm, some possible iron staining, some MG-FS sand, trace of clay
Box 1 of 5	5.0- 7.0	(1) 0.5					GW	5, 6		same as above
	7.0 -9.5	(2) 1.35						7, 8, 9		TOP 4 IN: same as above. TOP 4 IN - 12 IN OF INTERVAL: CALACHE, WHITE (N9), trace of gravel, trace of iron modules. BOTTOM OF INTERVAL: VFG SANDY CLAYSTONE, very light gray (N8), bedding, well weathered, mod fissiles, some iron staining as modules, trace of calc. material, trace of MG staining, trace of iron concretions. Sharp contact w/ above calichen. TOP 4 IN: same as above, seamy [illegible]
	9.5 -11.3	(2) 1.5								

NOTES: General USCS is modified for this log as follows:
Material amounts are estimated by % volume instead of % weight.
(1) Badly broken core, accurate footage measurements not possible.
(2) Core breaks cannot be matched, accurate footage measurements not possible.

ROCKY FLATS PLANT

FIGURE NO.

LOG OF BORING NO. 25-86

GEOLOGIST(S): LAJ
DATE: 8/26/89

PROJECT NO: 667-1122

TOP/BOTTOM OF CORE IN BOX	TOP/BOTTOM OF INTERVAL	FEET OF CORE IN INTERVAL IN BOX	SAMPLE NUMBER	FRACTURE ANGLE	BEDDING ANGLE	GRAIN SIZE DISTRIBUTION	USCS SYMBOL	DEPTH IN FEET	LITHOLOGIC LOG	LITHOLOGIC DESCRIPTION
Box 1 of 5								11		~~Top 6 in of the~~ Bottom of interval: Claystone, very light gray (N8), non-apparent bedding, ~~Some iron~~ well weathered, most friable, Some iron staining as mottles, some silt, trace of Mn staining, trace of calcite at ≈ 10.5 FT.
	11.3-12.6	(1) 1.9								Same as above: ~~calcite~~ calcite material, some abundant micro fractures
↑ 12.6		(2) 0.6						12		Same as above
Box 2 of 5 Begins at ~~50.3~~ 41.6	in same hole							13		See page 3 — Box ~~2~~ 1 of 5 of same hole begins at ~~50.3~~ 41.6 FT
								14		
								15		
								16		
								17		
								18		
								19		

NOTES: General: USCS is modified for this log as follows:
Material amounts are estimated by % volume instead of % weight.
(1) Badly broken core, accurate footage measurements not possible.
(2) Core breaks cannot be matched, accurate footage measurements not possible.

ROCKY FLATS PLANT

FIGURE NO.

LOG OF BORING NO. 25-86

GEOLOGIST(S): [illegible]
DATE: 8/29/89

PROJECT NO: 667-1122

TOP/BOTTOM OF CORE IN BOX	TOP/BOTTOM OF INTERVAL	FEET OF CORE IN INTERVAL IN BOX	SAMPLE NUMBER	FRACTURE ANGLE	BEDDING ANGLE	GRAIN SIZE DISTRIBUTION	USCS SYMBOL	DEPTH IN FEET	LITHOLOGIC LOG	LITHOLOGIC DESCRIPTION
								41		See page 2 - there is a box 1 of 5 that is from 0.0 - 12.6 of same hole
41.6 ↓	41.6 - 43.7	(2) 1.5						42, 43		CLAYSTONE, light gray (N7), non apparent bedding, well weathered, mod-poorly friable, some iron staining as mottles increasing at base of interval, trace of silt
	43.7 - 45.0	(2) 1.6						44		Same as above: some silt, trace iron staining NOTE: core is covered w/ iron stained mud
	45.0 - ~~47.0~~ 46.6	(2) ~~1.2~~ 1.2		50-80°				45, 46		Top of interval: same as above, fracture at 50-80° Bottom 3" of interval: same as above light brown (5 YR 5/4), abundant iron as staining and concretions, flaky texture
	46.6 - 47.0	0.3						47		Same as above
	47.0 - 49.0	(2) 1.65						48		Same as above: consolidated texture Base of interval: same as above, yellowish gray (5 Y 8/1), iron staining as mottles
	49.0 - 50.3	(2) 1.4						49		Same as above: fractures at 45°, 60°, 70° - shown, slickensided, iron staining along fracture faces

Box 1 of 5

NOTES: General USCS is modified for this log as follows:
Material amounts are estimated by % volume instead of % weight.
(1) Badly broken core, accurate footage measurements not possible.
(2) Core breaks cannot be matched, accurate footage measurements not possible.

ROCKY FLATS PLANT

FIGURE NO.

LOG OF BORING NO. 25-86

GEOLOGIST(S): DAY
DATE: 8/26/89

PROJECT NO: 667-1122

TOP/BOTTOM OF CORE IN BOX	TOP/BOTTOM OF INTERVAL	FEET OF CORE IN INTERVAL IN BOX	SAMPLE NUMBER	FRACTURE ANGLE	BEDDING ANGLE	GRAIN SIZE DISTRIBUTION	USCS SYMBOL	DEPTH IN FEET	LITHOLOGIC LOG	LITHOLOGIC DESCRIPTION
50.3										See previous page
50.3 ↓	50.3 - 51.6			70°				51		CLAYSTONE, light olive gray (5 Y 6/1), massive ~~[illegible]~~ Bedding, well weathered, mod friable, some iron staining as mottles, 70°, 60° fracture base of interval has some fractures, trace of silt
	51.6 - 53.4							52		Same as above: brownish gray (5 YR 4/1), trace of carb. material
								53		
	53.4 - 55.1							54		Same as above:
								55		
	55.1 - 56.6			50°				56		Same as above: some carb. material, coal seam (2 L-4 mm) (horizontal), fracture at 50°
	56.6 - 59.0							57		Same as above: Very highly weathered
								58		
↑ 59.0								59		
59.0 ↓	59.0 ~~[illegible]~~ 61.6	(2) 1.5								Same as above: olive gray (5 Y 4/1),

NOTES: General USCS is modified for this log as follows:
Material amounts are estimated by % volume instead of % weight.
(1) Badly broken core, accurate footage measurements not possible.
(2) Core breaks cannot be matched, accurate footage measurements not possible.

ROCKY FLATS PLANT

FIGURE NO.

LOG OF BORING NO. 25-86

PAGE ~~4~~ 5 OF ~~6~~ 7

GEOLOGIST(S): [illegible]
DATE: 8/26/89

PROJECT NO: 667-1122

TOP/BOTTOM OF CORE IN BOX	TOP/BOTTOM OF INTERVAL	FEET OF CORE IN INTERVAL IN BOX	SAMPLE NUMBER	FRACTURE ANGLE	BEDDING ANGLE	GRAIN SIZE DISTRIBUTION	USCS SYMBOL	DEPTH IN FEET	LITHOLOGIC LOG	LITHOLOGIC DESCRIPTION
Box 3 of 5	(59.0 ~~61.6~~ ~~69.1~~							61		
	61.6-64.6	(2) 1.7				30% SILT 70% CLAY		62, 63, 64		SILTY CLAYSTONE, light olive gray (5 Y 6/1), massive bedding w/ some horizontal laminae, highly weathered, mod-poorly friable, some carb material, trace of iron staining as mottles, possible vertical fracturing
	64.6-66.6	(2) 1.8				40% SILT 60% CLAY		65, 66		Same as above: higher silt fraction
	66.6-69.1	(2) 1.7				20% SILT 80% CLAY		67, 68, 69		Same as above: lower silt fraction
	69.1-71.6	(2) 1.6								SANDY CLAYSTONE (or possibly CLAY), moderate yellowish brown (10 YR 5/4), bedding non-apparent, highly weathered, mod friable, sand is FG-CG, some gravel (max size = 7 cm), trace of calc material. NOTE: This interval seems to be out of place compared to above CLAYSTONES.

NOTES: General: USCS is modified for this log as follows:
Material amounts are estimated by % volume instead of % weight.
(1) Badly broken core, accurate footage measurements not possible.
(2) Core breaks cannot be matched, accurate footage measurements not possible.

ROCKY FLATS PLANT

FIGURE NO.

LOG OF BORING NO. 25-~~06~~

PAGE 5/6 OF 6/7

GEOLOGIST(S): [illegible]
DATE: 8/28/89

PROJECT NO: 6667-1122

TOP/BOTTOM OF CORE IN BOX	TOP/BOTTOM OF INTERVAL	FEET OF CORE IN INTERVAL IN BOX	SAMPLE NUMBER	FRACTURE ANGLE	BEDDING ANGLE	GRAIN SIZE DISTRIBUTION	USCS SYMBOL	DEPTH IN FEET	LITHOLOGIC LOG	LITHOLOGIC DESCRIPTION
↑ 71.6								71		See previous page NO SAMPLE
71.6 ↓	71.6 - 74.0	∅						72 73 74		CLAYSTONE, olive gray (5 Y 4/1), apparent massive bedding, slightly weathered, mod-poorly friable, some silt, trace of carb material.
Box 4 of 5	74.0 - 75.8	(2) 1.75				30% SILT 70% CLAY		75		SILTY CLAYSTONE, light olive gray (5 Y 6/1), massive bedding, slightly weathered, mod-poorly friable, ~~some~~ trace of carb material
	75.8 - 77.6	(2) 1.90				30% ~~CLAY~~ SILT 70% CLAY ~~45% SILT~~ ~~55% CLAY~~		76 77		~~Same~~ as above; trace of iron staining as mottles, increased silt fraction at base of interval
	77.6 - 79.2	(2) 1.85				45% SILT 55% CLAY 30% SILT 70% CLAY		78 79		~~Same~~ as above; decreased silt fraction at base of interval
	79.2 - 80.5	(2) 1.55				45% SILT 55% CLAY				~~Brownish gray (5 YR 4/1)~~ ~~Same as above; some carb. material~~

NOTES: General USCS is modified for this log as follows:
Material amounts are estimated by % volume instead of % weight.
(1) Badly broken core, accurate footage measurements not possible.
(2) Core breaks cannot be matched, accurate footage measurements not possible.

ROCKY FLATS PLANT

FIGURE NO.

LOG OF BORING NO. 25-86

PAGE ~~6~~ 7 OF ~~6~~ 7

GEOLOGIST(S): [illegible]
DATE: 8/24/89

PROJECT NO: 667-1122

TOP/BOTTOM OF CORE IN BOX	TOP/BOTTOM OF INTERVAL	FEET OF CORE IN INTERVAL IN BOX	SAMPLE NUMBER	FRACTURE ANGLE	BEDDING ANGLE	GRAIN SIZE DISTRIBUTION	USCS SYMBOL	DEPTH IN FEET	LITHOLOGIC LOG	LITHOLOGIC DESCRIPTION
						30% ~~clay~~ SILT 70% CLAY				See previous page
Box 4 of 5	80.5 -81.1	(2) 0.55								CLAYSTONE, light olive gray (5 Y 6/1), mon. apparent bedding, well weathered, mod-poorly friable, some carb material
	81.1 -82.6	(2) 1.25						81		Same as above: abundant carb. material, some iron staining as mottles.
↑ 82.6								82		
84.4 ↓	82.6 -84.4	(2) 1.8						83		~~Top 6 cm~~: CARBONACEOUS CLAYSTONE, olive black (5 Y 2/1), laminar bedding ∠ ≈ 15°, well weathered, mod friable, some coal beds ≈ 1mm - 5mm, some silt
								84		
	84.4 -85.6	(2) 1.3						85		Same as above: olive gray (5 Y 4/1) Trace of iron staining as mottles
Box 5 of 5	85.6 -86.0	(2) 0.4								Same as above: less carb. material ~~and increased silt at base of interval~~
	86.0 -89.6	(2) 1.7						86		Same as above: increased silt at base of interval
								87		
								88		
↑ 89.5								89		
END OF BOXES										

NOTES: General: USCS is modified for this log as follows:
Material amounts are estimated by % volume instead of % weight.
(1) Badly broken core, accurate footage measurements not possible.
(2) Core breaks cannot be matched, accurate footage measurements not possible.

ROCKY FLATS PLANT

FIGURE NO.

LOG OF BORING NO. 25-86

PAGE 1 OF 1

GEOLOGIST(S): UAA
DATE: 8/24/89

PROJECT NO: 667-1122

TOP/BOTTOM OF CORE IN BOX	TOP/BOTTOM OF INTERVAL	FEET OF CORE IN INTERVAL IN BOX	SAMPLE NUMBER	FRACTURE ANGLE	BEDDING ANGLE	GRAIN SIZE DISTRIBUTION	USCS SYMBOL	DEPTH IN FEET	LITHOLOGIC LOG	LITHOLOGIC DESCRIPTION
0.0	0.0 – 1.5					Gravel ≈40% Clay >25%	GC	1		Clayey Gravel No predom. color to gravel. Angular to Subrounded. Mod. well graded. Max. size 4cm. Matrix very pale orange to grayish orange. (10yr 8/2 to 7/4). Est. plast. Mod. Some sand, v.f.g. to v.c.g. Some silt. Some $CaCO_3$.
	2.0							2		No Sample
	3.2					Clay ≈25% Gravel ≈40%	GC	3		Clayey Gravel ~~Mod~~. No predom. color. Sub angular to subrounded. Mod to well graded. Max size 4cm. Matrix dusky brown (5yr 2/2). Est. plast. mod. Some silt. Trace sand (v.f.g.). Trace $CaCO_3$ in matrix.
Box 1 of 1	4.5							4		No Sample
	7.5					Clay >50%	CL	5, 6, 7		Sandy Clay and Caliche. White to Dk. yellowish orange (10yr 6/6). Est. plast. low. Sand v.f.g. to v.c.g. well graded. Sub rounded. Abundant $CaCO_3$ Some gravel (to 3cm.) Angular to sub angular. Some silt
7.5								8, 9		Bottom of Box.

NOTES: General USCS is modified for this log as follows:
Material amounts are estimated by % volume instead of % weight.
(1) Badly broken core, accurate footage measurements not possible.
(2) Core breaks cannot be matched, accurate footage measurements not possible.

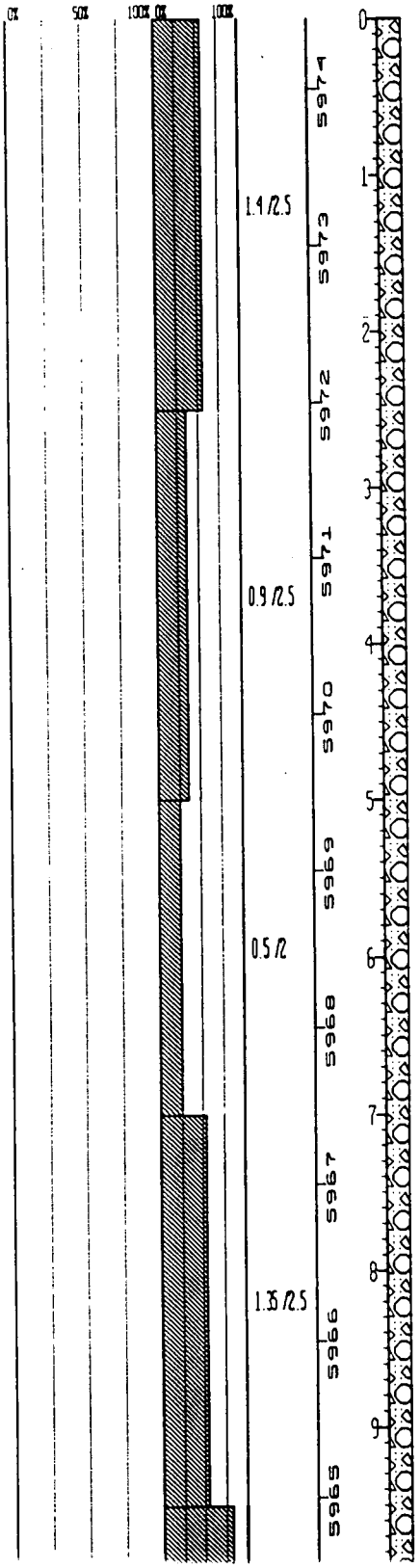
ROCKY FLATS PLANT

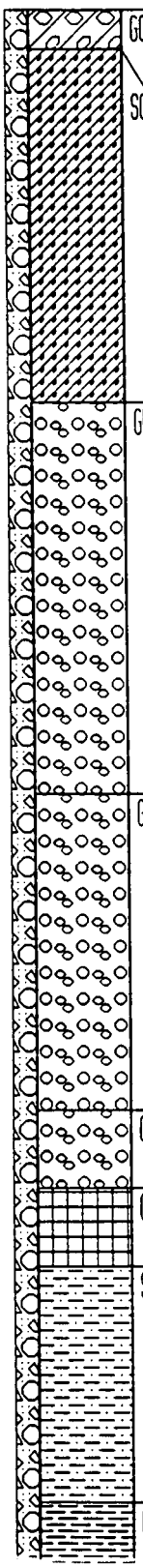
FIGURE NO.

STATE PLANE COORDINATE:		TOTAL DEPTH (FT): 89.6	GROUND ELEVATION (FT):	5974.45	PROJECT NUMBER:	667.11	LOG OF BORING NUMBER:
NORTH:	750428	AREA: SOLAR POND	CASING DIAMETER (IN):	2 ID	GEOLOGIST:	DAT	25-86
EAST:	2084831	LOCATOR NUMBER: L10	BOREHOLE DIAMETER (IN):	7.25	DATE DRILLED:	09/17/86	

REMARKS: NC Core. Cave from 10 to 84.60 ft.

CHEMICAL SAMPLE DI
GRADATIONAL SAMPL
SAMPLE NUMBER
SAMPLE GRAIN SIZE (0% 50% 100%)
PERCENT RECOVERY (0% 100%)
RECOVERY/INTERVAL
DATUM (FT)
DEPTH (FT)
WELL OR PIEZOMETER CONSTRUCTION
LITHOLOGY
UNIFIED SOILS CLASSIFICATION OR ROCK TYPE
DESCRIPTION



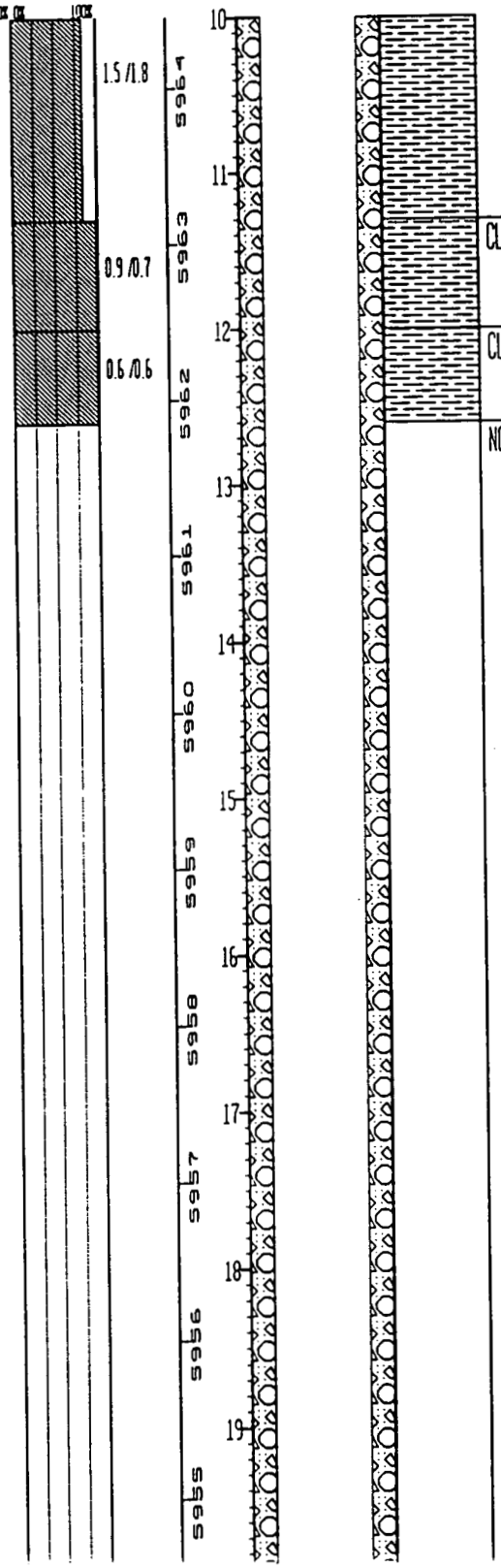


GC:	SANDY GRAVEL - moderate orange pink (5YR 8/4), sub-angular to angular, mod. to well graded, max. size = 5 cm., sand is VFG - MG.
SC:	Gravelly Clayey Sand - pale yellowish brown (10YR 6/2), angular to sub-angular, mod. graded, sand is FG - CG, max. gravel size = 4 cm., matrix is calcareous, some calcite, bottom of interval has possible black tar.
GW:	CALCAREOUS GRAVEL - very pale orange (10YR 8/2), angular to sub-angular, mod. grading, max. size = 8 cm., some possible iron staining, some MG - FG sand, trace of clay.
GW:	Same as above.
GW:	Same as above.
CALICHE:	Top of Bedrock White (N9), trace of gravel, trace of iron nodules.
SANDY CLAYSTONE:	VFG Sandy Claystone, very light gray (N8), non-apparent bedding, well weathered, mod. friable, some iron staining as mottles, trace of calc. material, trace of Mg staining, trace of iron concretions, sharp contact with above caliche.
CLAYSTONE:	Top 6 in.: same as above. Bottom of interval: Claystone, very light gray (N8), non-apparent bedding, well weathered, mod. friable, some iron

STATE PLANE COORDINATE:		TOTAL DEPTH (FT): 89.6	GROUND ELEVATION (FT):	5974.45	PROJECT NUMBER:	667.11	LOG OF BORING NUMBER:
NORTH:	750428	AREA: SOLAR POND	CASING DIAMETER (IN):	2 ID	GEOLOGIST:	DAT	25-86
EAST:	2084831	LOCATOR NUMBER: L10	BOREHOLE DIAMETER (IN):	7 25	DATE DRILLED:	09/17/86	

REMARKS: NC Core. Cove from 10 to 84.60 ft.

CHEMICAL SAMPLE DEPTH
GRADATIONAL SAMPLE DEPTH
SAMPLE NUMBER
SAMPLE GRAIN SIZE (0% 50% 100%)
PERCENT RECOVERY (0% 100%)
RECOVERY/INTERVAL
DATUM (FT)
DEPTH (FT)
WELL OR PIEZOMETER CONSTRUCTION
LITHOLOGY



UNIFIED SOILS CLASSIFICATION OR ROCK TYPE	DESCRIPTION
	staining as mottles, some silt, trace of Mg staining trace of calcite at approx. ~10.5 ft.
CLAYSTONE:	Same as above: some calc. material, abundant micro fractures.
CLAYSTONE:	Same as above.
NO SAMPLE:	

STATE PLANE COORDINATE:	TOTAL DEPTH (FT): 89.6	GROUND ELEVATION (FT):	5974.45	PROJECT NUMBER:	667.11
NORTH: 750428	AREA: SOLAR POND	CASING DIAMETER (IN):	2 ID	GEOLOGIST:	DAT
EAST: 2084831	LOCATOR NUMBER: L10	BOREHOLE DIAMETER (IN):	7.25	DATE DRILLED:	09/17/86

REMARKS: NC Core. Cove from TD to 84.60 ft.

LOG OF BORING NUMBER: 25-86

CHEMICAL SAMPLE DEPTH / GRADATIONAL SAMPLE	SAMPLE NUMBER	SAMPLE GRAIN SIZE	PERCENT RECOVERY	RECOVERY/ INTERVAL	DATUM (FT)	DEPTH (FT)	WELL OR PIEZOMETER CONSTRUCTION	LITHOLOGY	UNIFIED SOILS CLASSIFICATION OR ROCK TYPE	DESCRIPTION
0%		50% 100%	0% 100%		5954	20				NO SAMPLE:
					5953	21				
					5952	22				
					5951	23				
					5950	24				
					5949	25				
					5948	26				
				0 /29	5947	27				
					5946	28				
					5945	29				

STATE PLANE COORDINATE:		TOTAL DEPTH (FT): 89.6	GROUND ELEVATION (FT):	5974.45	PROJECT NUMBER:	667.11	LOG OF BORING NUMBER:
NORTH:	750428	AREA: SOLAR POND	CASING DIAMETER (IN):	2 ID	GEOLOGIST:	DAT	25-86
EAST:	2084831	LOCATOR NUMBER: L10	BOREHOLE DIAMETER (IN):	7 25	DATE DRILLED:	09/17/86	

REMARKS: NC Core. Cave from TD to 84.60 ft.

CHEMICAL SAMPLE DEPTH / GRADATIONAL SAMPLE DEPTH	SAMPLE NUMBER	SAMPLE GRAIN SIZE (0% 50% 100%)	PERCENT RECOVERY (0% 100%)	RECOVERY/INTERVAL	DATUM (FT)	DEPTH (FT)	WELL OR PIEZOMETER CONSTRUCTION	LITHOLOGY	UNIFIED SOILS CLASSIFICATION OR ROCK TYPE	DESCRIPTION
					5944	30				NO SAMPLE:
					5943	31				
					5942	32				
					5941	33				
					5940	34				
					5939	35				
					5938	36				
					5937	37				
					5936	38				
					5935	39				

STATE PLANE COORDINATE:		TOTAL DEPTH (FT): 89.6	GROUND ELEVATION (FT):	5374.45	PROJECT NUMBER:	667.11	LOG OF BORING NUMBER:
NORTH:	750428	AREA: SOLAR POND	CASING DIAMETER (IN):	2 ID	GEOLOGIST:	DAT	25-86
EAST:	2084831	LOCATOR NUMBER: L10	BOREHOLE DIAMETER (IN):	7.25	DATE DRILLED:	09/17/86	

REMARKS: NC Core. Cave from TD to 84.60 ft.

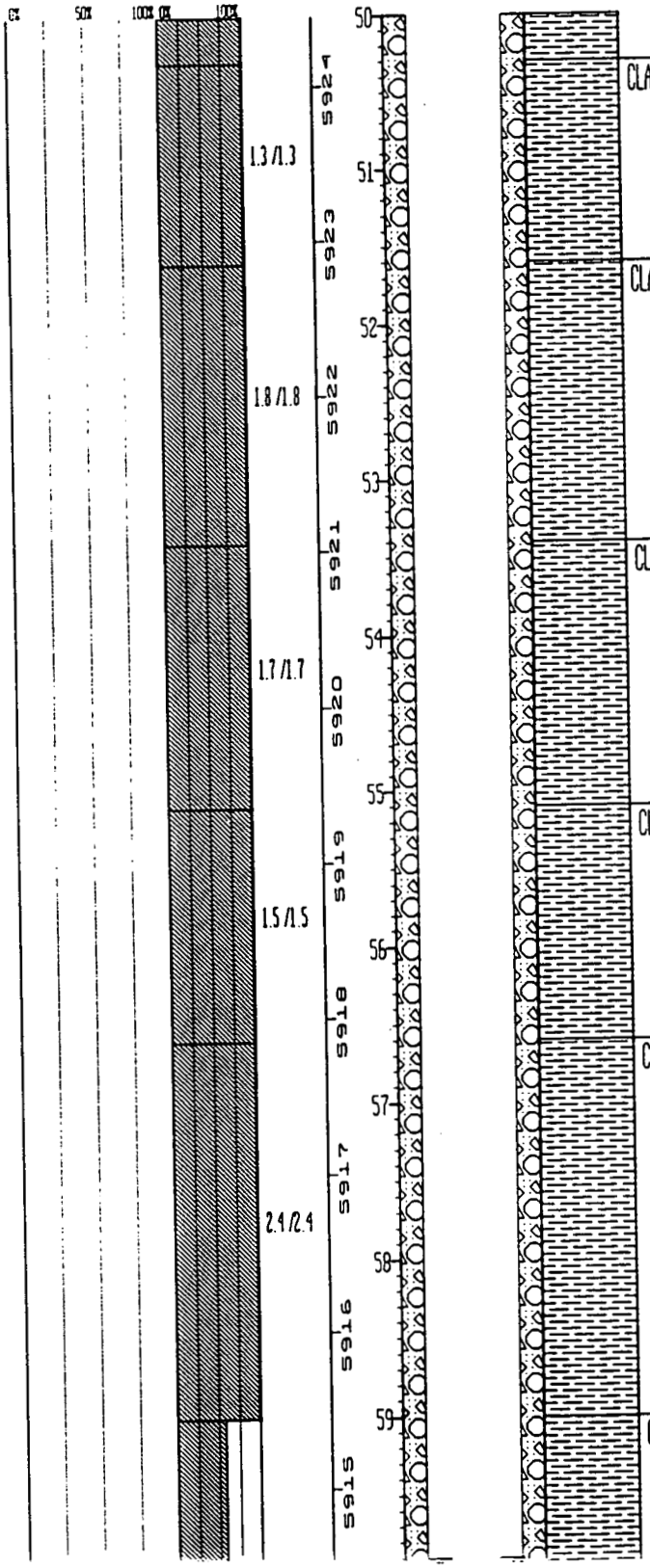
CHEMICAL SAMPLE DEPTH / GRADATIONAL SAMPLE	SAMPLE NUMBER	SAMPLE GRAIN SIZE (0% 50% 100%)	PERCENT RECOVERY (0% 100%)	RECOVERY / INTERVAL	DATUM (FT)	DEPTH (FT)	WELL OR PIEZOMETER CONSTRUCTION	LITHOLOGY	UNIFIED SOILS CLASSIFICATION OR ROCK TYPE	DESCRIPTION
					5934	40			NO SAMPLE:	
					5933	41				
				1.5 /2.1	5932	42			CLAYSTONE:	Light gray (N7), non apparent bedding, well weathered. mod. - poorly friable, some iron staining as mottles increasing at base of interval, trace of silt.
					5931	43				
				1.6 /1.3	5930	44			CLAYSTONE:	Same as above: some silt, trace iron staining. NOTE: core is covered with iron stained mud.
				1.2 /1.6	5929	45			CLAYSTONE:	Top of interval: same as above, fracture at 50 - 80 degrees. Bottom 3 in. of interval: same as above, light brown (5YR 5/6), abundant iron as staining and concretions, floury texture.
				0.3 /0.4	5928	46			CLAYSTONE:	Same as above.
				1.65 /2	5927	47			CLAYSTONE:	Same as above: consolidated texture. Base of interval: same as above, yellowish gray (5Y 8/1), iron staining as mottles.
				1.4 /1.3	5926	48			CLAYSTONE:	Same as above: fractures at 45, 60, 70 degrees showing slickensides, iron staining along fracture faces.
					5925	49				

STATE PLANE COORDINATE:	TOTAL DEPTH (FT): 89.6	GROUND ELEVATION (FT):	5974.45	PROJECT NUMBER:	567.11
NORTH: 750428	AREA: SOLAR POND	CASING DIAMETER (IN):	2 ID	GEOLOGIST:	DAT
EAST: 2084831	LOCATOR NUMBER: L10	BOREHOLE DIAMETER (IN):	7 25	DATE DRILLED:	09/17/86

REMARKS: NC Core. Cave from 10 to 84.60 ft.

LOG OF BORING NUMBER: 25-86

CRITICAL SAMPLE DEPTH
GRADATIONAL SAMPLE DEPTH
SAMPLE NUMBER
SAMPLE GRAIN SIZE
PERCENT RECOVERY
RECOVERY/INTERVAL
DATUM (FT)
DEPTH (FT)
WELL OR PIEZOMETER CONSTRUCTION
LITHOLOGY
UNIFIED SOILS CLASSIFICATION OR ROCK TYPE
DESCRIPTION



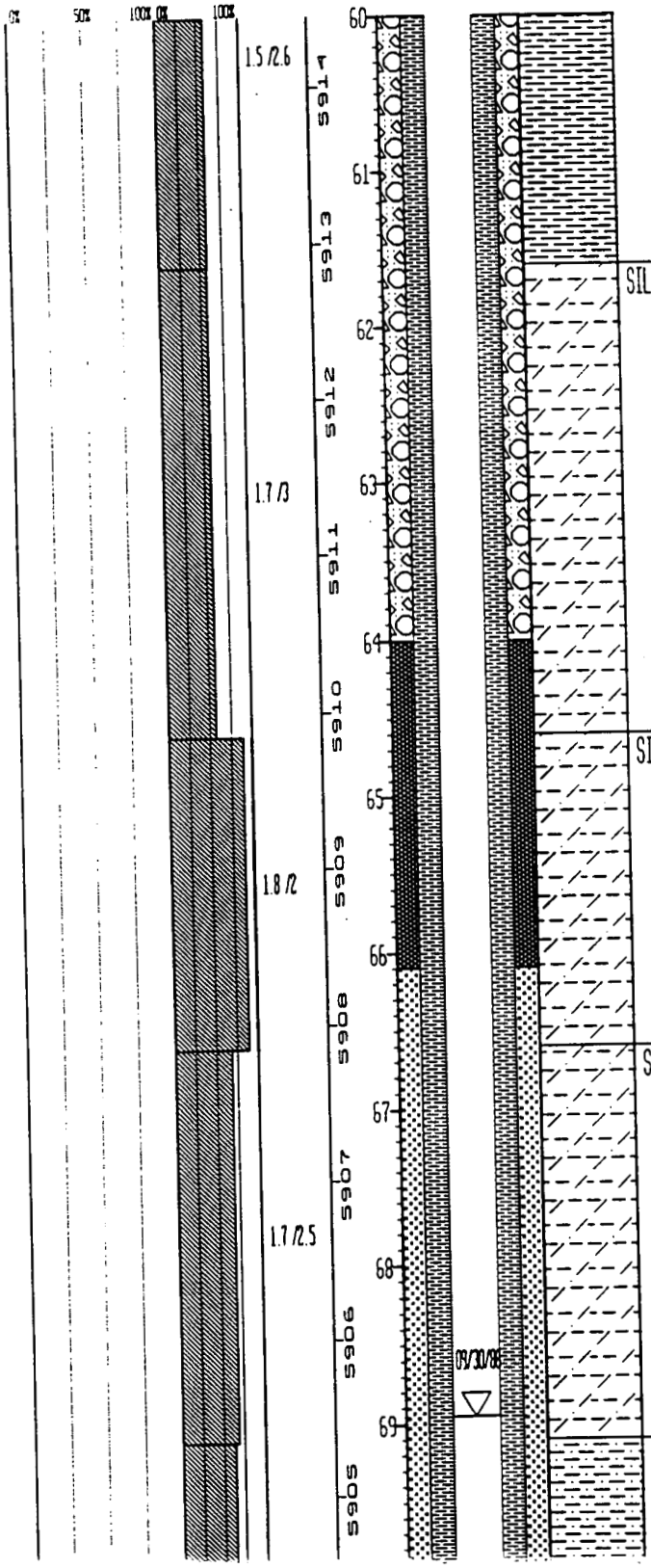
CLAYSTONE:	Light olive gray (5Y 6/1), massive bedding, well weathered, mod. friable, some iron staining as mottles, 60, 70 degree fracture, base of interval has some fractures, trace of silt.
CLAYSTONE:	Same as above: brownish gray (5YR 4/1), trace of carb. material.
CLAYSTONE:	Same as above.
CLAYSTONE:	Same as above: some carb. material, coal seam (approx. 2 - 4 mm.), (horizontal), fracture at 50 degrees.
CLAYSTONE:	Same as above: very highly weathered.
CLAYSTONE:	Same as above: olive gray (5Y 4/1).

STATE PLANE COORDINATE:	TOTAL DEPTH (FT): 89.6	GROUND ELEVATION (FT):	5974.45	PROJECT NUMBER:	667.11
NORTH: 750428	AREA: SOLAR POND	CASING DIAMETER (IN):	2 ID	GEOLOGIST:	DAT
EAST: 2084831	LOCATOR NUMBER: L10	BOREHOLE DIAMETER (IN):	7.25	DATE DRILLED:	09/17/86

LOG OF BORING NUMBER: **25-86**

REMARKS: NC Core. Cave from TD to 84.60 ft.

CHEMICAL SAMPLE DEPTH | GRADATIONAL SAMPLE DEPTH | SAMPLE NUMBER | SAMPLE GRAIN SIZE (0% 50% 100%) | PERCENT RECOVERY (0% 100%) | RECOVERY/INTERVAL | DATUM (FT) | DEPTH (FT) | WELL OR PIEZOMETER CONSTRUCTION | LITHOLOGY | UNIFIED SOILS CLASSIFICATION OR ROCK TYPE | DESCRIPTION



SILTY CLAYSTONE: Light olive gray (5Y 6/1), massive bedding with some horizontal laminar bedding, highly weathered, mod. to poorly friable, some carb. material, trace of iron staining as mottles, possible vertical fracturing.

SILTY CLAYSTONE: Same as above: higher silt fraction.

SILTY CLAYSTONE: Same as above: lower silt content.

SANDY CLAYSTONE: (Or possible clay), moderate yellowish brown (10YR 5/4), bedding non-apparent, highly weathered, mod. friable, sand is FG-CG, some gravel, max. size = 7 cm., trace of calc. material. NOTE: This interval seems to be out of place compared to above claystones.

STATE PLANE COORDINATE:
NORTH: 750428
EAST: 2084831

TOTAL DEPTH (FT): 89.6
AREA: SOLAR POND
LOCATOR NUMBER: L10

GROUND ELEVATION (FT): 5974.45
CASING DIAMETER (IN): 2 ID
BOREHOLE DIAMETER (IN): 7 25

PROJECT NUMBER: 667.11
GEOLOGIST: GAT
DATE DRILLED: 09/17/86

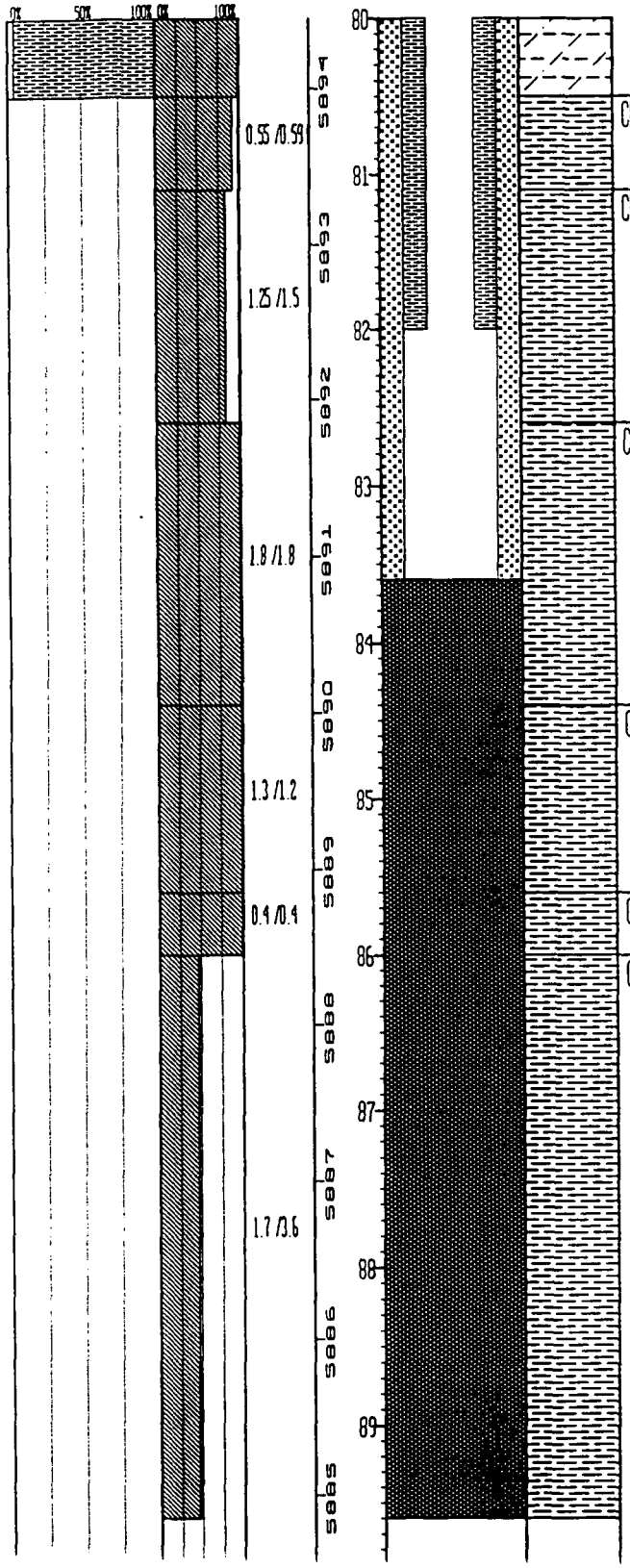
LOG OF BORING NUMBER: 25-86

REMARKS: NC Core. Cave from TD to 84.60 ft.

CHEMICAL SAMPLE DEPTH / GRADATIONAL SAMPLE DEPTH	SAMPLE NUMBER	SAMPLE GRAIN SIZE (0% 50% 100%)	PERCENT RECOVERY (0% 100%)	RECOVERY/INTERVAL	DATUM (FT)	DEPTH (FT)	WELL OR PIEZOMETER CONSTRUCTION	LITHOLOGY	UNIFIED SOILS CLASSIFICATION OR ROCK TYPE	DESCRIPTION
				1.6 /2.5	5904	70				
					5903	71				
									NO SAMPLE:	
				0 /2.4	5902	72				
					5901	73				
						74	10/21/86		CLAYSTONE:	Olive gray (5Y 4/1), apparent massive bedding, highly weathered, mod. - poorly friable, some silt, trace of carb. material.
				1.75 /1.8	5900	75				
					5899		10/01/86			
						76			SILTY CLAYSTONE:	Light olive gray (5Y 6/1), massive bedding, highly weathered, mod. to poorly friable, trace of carb. material.
	0929			1.9 /1.8	5898	77				
					5897				SILTY CLAYSTONE:	Same as above: trace of iron staining as mottles, increased silt fraction at base of interval.
				1.85 /1.6	5896	78				
						79			SILTY CLAYSTONE:	Same as above: decreased silt fraction at base of interval.
	0932			1.55 /1.3	5895					

STATE PLANE COORDINATE:		TOTAL DEPTH (FT): 89.6		GROUND ELEVATION (FT):	5974.46	PROJECT NUMBER:	667.11	LOG OF BORING NUMBER:	
NORTH:	750428	AREA: SOLAR POND		CASING DIAMETER (IN):	2 10	GEOLOGIST:	DAT		25-86
EAST:	2084831	LOCATOR NUMBER:	L10	BOREHOLE DIAMETER (IN):	7 25	DATE DRILLED:	09/17/86		

REMARKS: NC Core. Cave from 10 to 84.60 ft.



UNIFIED SOILS CLASSIFICATION OR ROCK TYPE	DESCRIPTION
CLAYSTONE:	Light olive gray (5Y 6/1), non - apparent bedding, well weathered, mod. - poorly friable, some carb. material.
CLAYSTONE:	Same as above: abundant carb. material, some iron staining as mottles.
CLAYSTONE:	Carbonaceous, olive black (5Y 2/1), laminar bedding at approx. 15 degrees, well weathered, mod. friable, some coal beds approx. 1 mm. - 5 mm., some silt.
CLAYSTONE:	Same as above: olive gray (5Y 4/1), trace of iron staining as mottles.
CLAYSTONE:	Same as above: less carb. material.
CLAYSTONE:	Same as above: increased silt at base of interval.

Note: No water encountered during drilling.

LOG OF BORING NO. 25A-86

GEOLOGIST(S): DCB
DATE: 8/24/86

PROJECT NO: 667-11.22

TOP/BOTTOM OF CORE IN BOX	TOP/BOTTOM OF INTERVAL	FEET OF CORE IN INTERVAL IN BOX	SAMPLE NUMBER	FRACTURE ANGLE	BEDDING ANGLE	GRAIN SIZE DISTRIBUTION	USCS SYMBOL	DEPTH IN FEET	LITHOLOGIC LOG	LITHOLOGIC DESCRIPTION
										Core Begins at 1.0 ft.
1.0 ↓ Bot 1 of 2	1.0 to 3.0	(1) 1.0				>50% Gravel	GC	1, 2		Gravel, dominantly very light gray (N8) to white (N9), matrix is pale yellowish brown (10 YR 6/2) subangular to subrounded, moderately graded, max. size 7cm., some clay, calcareous.
	3.0 to 5.0	<.1					GP	3, 4		One small cobble with calcareous rind.
	5.0 to 6.0	<.1					GP	5		One large gravel with calcareous rind.
	6.0 to 8.5	.3						6, 7, 8		Four medium to large Gravel. Gravel white (N9) to medium gray (N5), subangular, poorly graded max size 6cm, silty clay coat on gravel is calcareous.
	9.5 to 10.5	0						9		No Sample

NOTES: General: USCS is modified for this log as follows:
Material amounts are estimated by % volume instead of % weight.
(1) Badly broken core, accurate footage measurements not possible.
(2) Core breaks cannot be matched, accurate footage measurements not possible.

ROCKY FLATS PLANT

FIGURE NO.

LOG OF BORING NO. 25A-86

GEOLOGIST(S): DCB
DATE: 11/29/89

PROJECT NO: 667-11.2

TOP/BOTTOM OF CORE IN BOX	TOP/BOTTOM OF INTERVAL	FEET OF CORE IN INTERVAL IN BOX	SAMPLE NUMBER	FRACTURE ANGLE	BEDDING ANGLE	GRAIN SIZE DISTRIBUTION	USCS SYMBOL	DEPTH IN FEET	LITHOLOGIC LOG	LITHOLOGIC DESCRIPTION
	8.5 to 10.5	0								No Sample
Box 1 of 2	10.5 to 12.5	(1) .4				>50% clay	CL	11, 12		Clay and Caliche, yellowish gray (5Y 8/1) and white (N9) respect. moderate plasticity, one med. size gravel at base of interval.
	12.5 to 14.5	(1) .4						13, 14		Claystone, light gray (N7), bedding not apparent, highly weathered, slightly friable, local iron staining, trace amount of mn oxide mineralization and an isolated body of caliche ~ 1cm × 2cm at ~ ft.
	14.5 to 16.5	ND						15, 16		
	16.5 to 18.5	ND						17, 18		
18.5 ↓ Box 2 of 2	18.5 to 20.5	ND						19		

NOTES: General USCS is modified for this log as follows:
Material amounts are estimated by % volume instead of % weight.
(1) Badly broken core, accurate footage measurements not possible.
(2) Core breaks cannot be matched, accurate footage measurements not possible.

ROCKY FLATS PLANT

FIGURE NO.

LOG OF BORING NO. 25A-86

GEOLOGIST(S): DCB
DATE: 8/24/89

PROJECT NO: 667-11-22

TOP/BOTTOM OF CORE IN BOX	TOP/BOTTOM OF INTERVAL	FEET OF CORE IN INTERVAL IN BOX	SAMPLE NUMBER	FRACTURE ANGLE	BEDDING ANGLE	GRAIN SIZE DISTRIBUTION	USCS SYMBOL	DEPTH IN FEET	LITHOLOGIC LOG	LITHOLOGIC DESCRIPTION
	19.0 to 20.5	ND				> soil Clay				Clay & Gravel As above
	20.5 to 22.5	(1) .7						21, 22, 23		

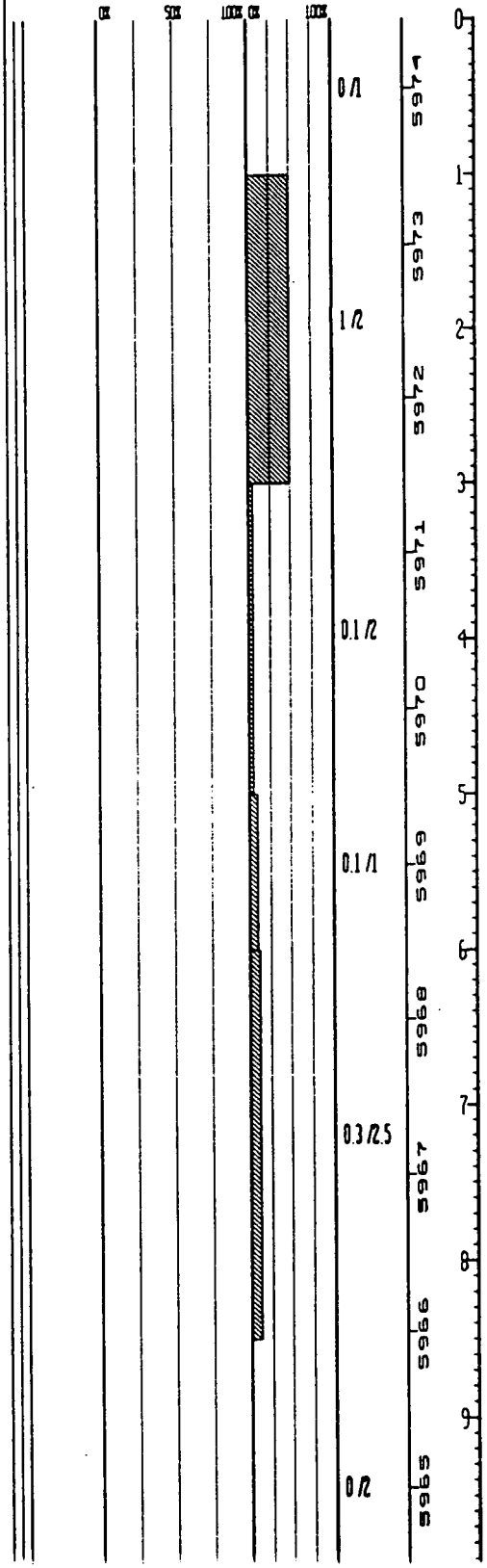
NOTES: General USCS is modified for this log as follows:
Material amounts are estimated by % volume instead of % weight.
(1) Badly broken core, accurate footage measurements not possible.
(2) Core breaks cannot be matched, accurate footage measurements not possible.

ROCKY FLATS PLANT

FIGURE NO.

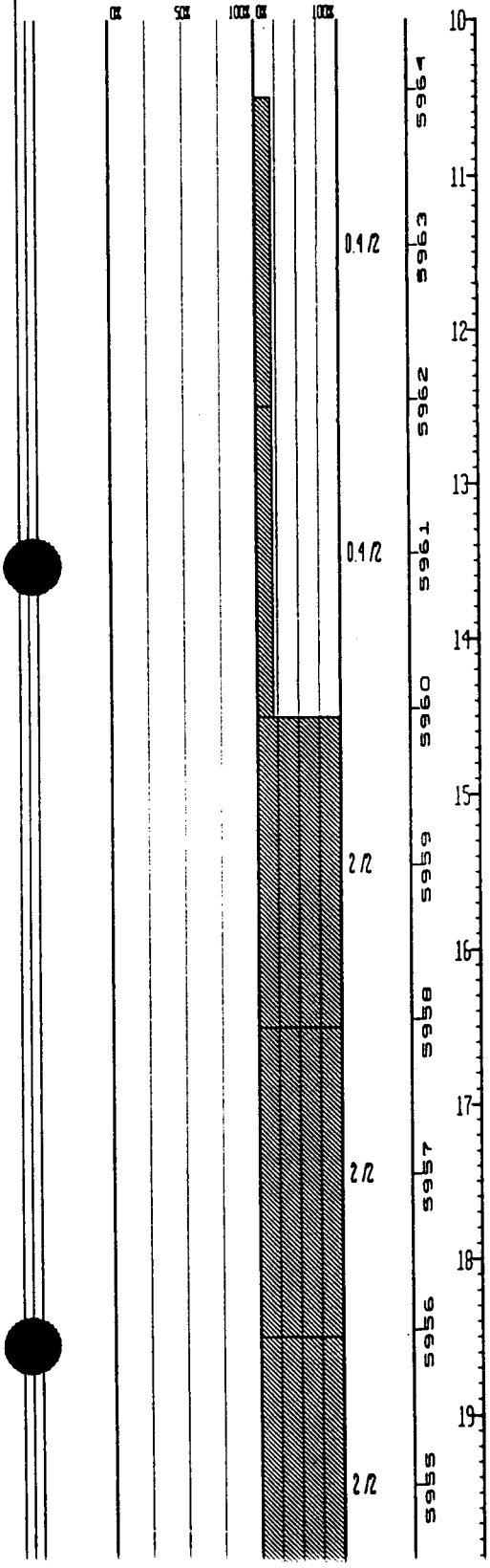
STATE PLANE COORDINATE:	TOTAL DEPTH (FT): 98	GROUND ELEVATION (FT): 5974.46	PROJECT NUMBER: 667.11	LOG OF BORING NUMBER:
NORTH: 0	AREA: 0	CASING DIAMETER (IN): 0	GEOLOGIST: DCB	25-86A
EAST: 0	LOCATOR NUMBER: 0	BOREHOLE DIAMETER (IN): 0	DATE DRILLED: UNK	
REMARKS:				

CHEMICAL SAMPLE DEPTH
GRADATIONAL SAMPLE DEPTH
SAMPLE NUMBER
SAMPLE GRAIN SIZE
PERCENT RECOVERY
RECOVERY/INTERVAL
DATUM (FT)
DEPTH (FT)
WELL OR PIEZOMETER CONSTRUCTION
LITHOLOGY
UNIFIED SOILS CLASSIFICATION OR ROCK TYPE
DESCRIPTION



	NO SAMPLE:	
	GC:	GRAVEL - dominantly very light gray (N8) to white (N9), matrix is pale yellowish brown (10YR 6/2), sub-angular to sub-rounded, moderately graded, max. size 7 cm., some clay, calcareous.
	GP:	One small cobble with calcareous rind.
	GP:	One large gravel with calcareous rind.
	GP:	Four medium to large gravels, white (N9) to medium gray (N5), sub-angular, poorly graded, max. size 6 cm., silty clay coating on gravel is calcareous.
	NO SAMPLE:	

STATE PLANE COORDINATE:	TOTAL DEPTH (FT): 98	GROUND ELEVATION (FT): 5974.45	PROJECT NUMBER: 667.11	LOG OF BORING NUMBER:
NORTH: 0	AREA: 0	CASING DIAMETER (IN): 0	GEOLOGIST: DCB	25-86A
EAST: 0	LOCATOR NUMBER: 0	BOREHOLE DIAMETER (IN): 0	DATE DRILLED: UNK	
REMARKS:				



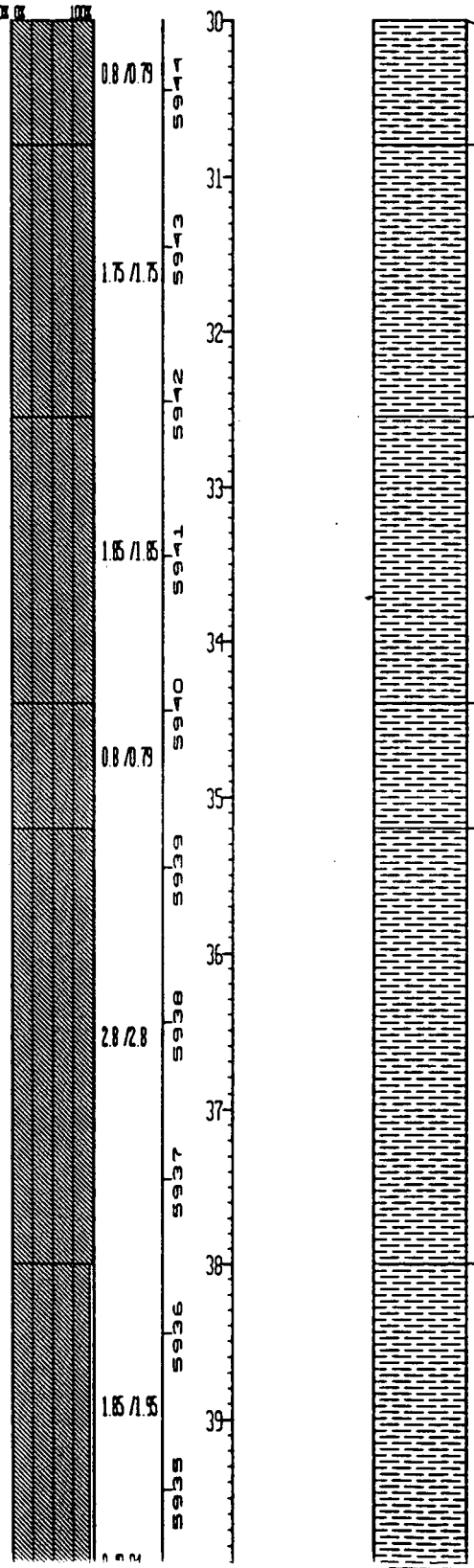
LITHOLOGY	UNIFIED SOILS CLASSIFICATION OR ROCK TYPE	DESCRIPTION
	CL:	Clay and Caliche - yellowish gray (5Y 8/1) and white (N9) respectively, moderate plasticity, one med. size gravel at base of interval.
	CLAYSTONE:	Top of Bedrock Light gray (N7), bedding not apparent, highly weathered, slightly friable, local iron staining, slight amount of Mg oxide mineralization.
	CLAYSTONE:	Same as above, an isolated body of caliche approx. 1 cm. x 2 cm. at approx. 16.0 ft.
	CLAYSTONE:	Same as above.
	CLAYSTONE:	Same as above.

STATE PLANE COORDINATE:	TOTAL DEPTH (FT): 98	GROUND ELEVATION (FT): 5974.45	PROJECT NUMBER: 667.11	LOG OF BORING NUMBER:
NORTH: 0	AREA: 0	CASING DIAMETER (IN): 0	GEOLOGIST: DCB	25-86
EAST: 0	LOCATOR NUMBER: 0	BOREHOLE DIAMETER (IN): 0	DATE DRILLED: UNK	
REMARKS:				

CRITICAL SAMPLE DEPTH / GRADATIONAL SAMPLE DEPTH	SAMPLE NUMBER	SAMPLE GRADI SIZE	PERCENT RECOVERY	RECOVERY/ INTERVAL	DATUM (FT)	DEPTH (FT)	WELL OR PIEZOMETER CONSTRUCTION	LITHOLOGY	UNIFIED SOILS CLASSIFICATION OR ROCK TYPE	DESCRIPTION
					5954	20				
				0.7 /2	5953	21			CLAYSTONE:	Same as above.
					5952	22				
				0.6 /0.6	5951	23			CLAYSTONE:	This interval overlaps with previous interval. This interval is recorded from 21.3' to 23.10'. Light gray (N7), bedding not apparent, moderately weathered, slightly friable, localized iron staining and carbonaceous mineralization.
				1.9 /1.9	5950	24			CLAYSTONE:	As above with color change to grayish orange (10YR 7/4) and light (N7), carb. minerals absent, iron stains locally and on fractures.
					5949	25			CLAYSTONE	As above, interval grades to light gray (N7), iron staining on fractures, occasional carb. mineralization.
				2.85 /2.85	5948	26				
					5947	27				
				1.97 /1.97	5946	28			CLAYSTONE:	As above. Two irregular bodies of calcareous mineralization occur at approx. 29.6 ft.
				0.9 /0.18	5945	29				

STATE PLANE COORDINATE:		TOTAL DEPTH (FT): 98	GROUND ELEVATION (FT):	5974.45	PROJECT NUMBER:	667.11	LOG OF BORING NUMBER:
NORTH:	0	AREA: 0	CASING DIAMETER (IN):	0	GEOLOGIST:	DCB	25-86A
EAST:	0	LOCATOR NUMBER: 0	BOREHOLE DIAMETER (IN):	0	DATE DRILLED:	UNK	
REMARKS:							

CHEMICAL SAMPLE DEPTH
GRADATIONAL SAMPLE DEPTH
SAMPLE NUMBER
SAMPLE GRAIN SIZE
PERCENT RECOVERY
RECOVERY/INTERVAL
DATUM (FT)
DEPTH (FT)
WELL OR PIEZOMETER CONSTRUCTION
LITHOLOGY
UNIFIED SOILS CLASSIFICATION OR ROCK TYPE
DESCRIPTION

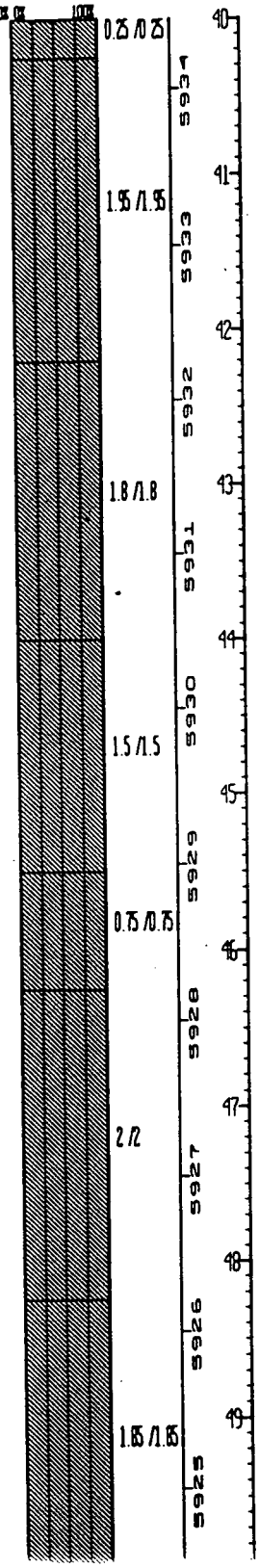


CLAYSTONE:	As above.
CLAYSTONE:	As above, calcareous mineralization is absent.
CLAYSTONE:	As above, slickensides with iron staining at approx. 31.4 ft., approx. 60 degrees attitude.
CLAYSTONE:	As above.
CLAYSTONE:	As above, irregular calcareous body at 34.8 ft.
CLAYSTONE:	As above.
CLAYSTONE:	As above.

STATE PLANE COORDINATE:	TOTAL DEPTH (FT): 98	GROUND ELEVATION (FT): 5974.45	PROJECT NUMBER: 667.11	LOG OF BORING NUMBER:
NORTH: 0	AREA: 0	CASING DIAMETER (IN): 0	GEOLOGIST: DCB	25-86A
EAST: 0	LOCATOR NUMBER: 0	BOREHOLE DIAMETER (IN): 0	DATE DRILLED: UNK	

REMARKS:

CHEMICAL SAMPLE DEPTH
GRAVITIONAL SAMPLE DEPTH
SAMPLE NUMBER
SAMPLE GRAIN SIZE (0% 50% 100%)
PERCENT RECOVERY (0% 100%)
RECOVERY/INTERVAL
DATUM (FT)
DEPTH (FT)
WELL OR PIEZOMETER CONSTRUCTION
LITHOLOGY



UNIFIED SOILS CLASSIFICATION OR ROCK TYPE	DESCRIPTION
NO SAMPLE:	
CLAYSTONE:	Light gray (N7), bedding not apparent, slightly weathered, slightly friable, iron staining on fractures and locally.
CLAYSTONE:	As above.
CLAYSTONE:	As above.
CLAYSTONE:	As above.
CLAYSTONE:	As above.
CLAYSTONE:	As above.
CLAYSTONE:	Medium dark gray (N4), bedding not apparent, slightly weathered, slightly friable, local carbonaceous mineralization and iron staining typically on fractures, slickenside at approx. 48.6 ft. with approx. 40 degree attitude.

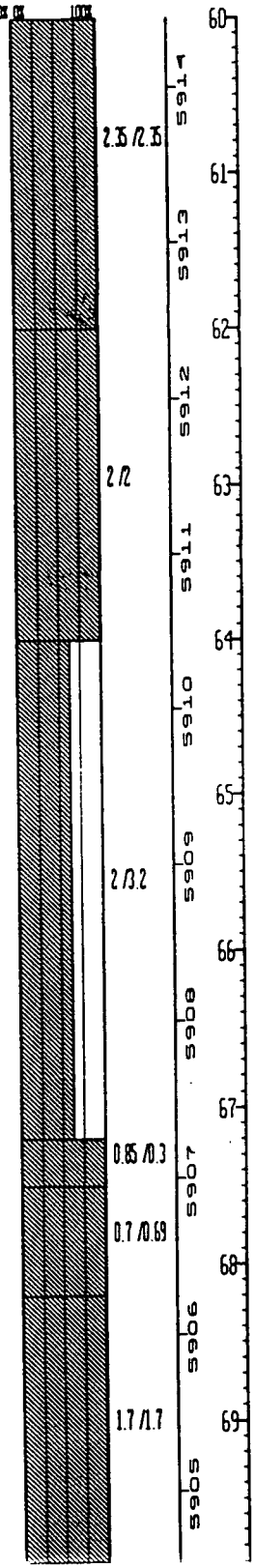
STATE PLANE COORDINATE:	TOTAL DEPTH (FT): 98	GROUND ELEVATION (FT): 5974.45	PROJECT NUMBER: 667.11	LOG OF BORING NUMBER:
NORTH: 0	AREA: 0	CASING DIAMETER (IN): 0	GEOLOGIST: DCB	25-86A
EAST: 0	LOCATOR NUMBER: 0	BOREHOLE DIAMETER (IN): 0	DATE DRILLED: UNK	
REMARKS:				

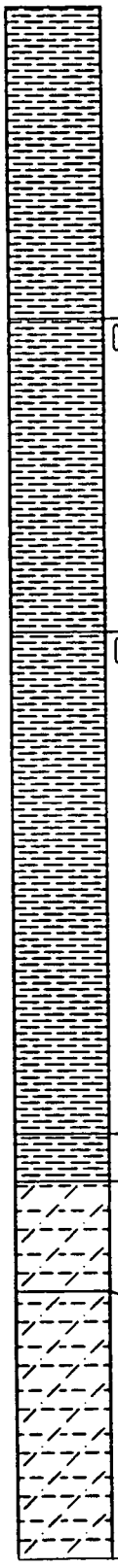
CHEMICAL SAMPLE DEPTH / GRADATIONAL SAMPLE DEPTH	SAMPLE NUMBER	SAMPLE GRAIN SIZE	PERCENT RECOVERY	RECOVERY/INTERVAL	DATUM (FT)	DEPTH (FT)	WELL OR PIEZOMETER CONSTRUCTION	LITHOLOGY	UNIFIED SOILS CLASSIFICATION OR ROCK TYPE	DESCRIPTION
			100%	0.7/0.9	5924	50			CLAYSTONE:	As above.
				1/1	5923	51			CLAYSTONE:	As above.
				1.95/1.95	5922	52			CLAYSTONE:	As above, slickensides at approx. 53 ft., curvilinear surface.
				2.35/2.35	5921	53			CLAYSTONE:	As above.
				0/0.2	5920	54			NO SAMPLE:	
				1.3/1.3	5919	55			CLAYSTONE:	Medium light gray (N6), weathered, bedding not apparent to thin (<2 mm.) with some soft sediment deformation, slightly friable, slight silt fraction occurs as discontinuous beds, local iron staining and carbonaceous mineralization.
				1.85/1.85	5918	56			CLAYSTONE:	As above.
					5917	57				
					5916	58				
					5915	59			CLAYSTONE:	Medium light gray (N6), bedding not apparent, slightly friable, occasional

STATE PLANE COORDINATE:	TOTAL DEPTH (FT): 98	GROUND ELEVATION (FT): 5974.45	PROJECT NUMBER: 667.11	LOG OF BORING NUMBER:
NORTH: 0	AREA: 0	CASING DIAMETER (IN): 0	GEOLOGIST: DCB	25-86A
EAST: 0	LOCATOR NUMBER: 0	BOREHOLE DIAMETER (IN): 0	DATE DRILLED: UNK	

REMARKS:

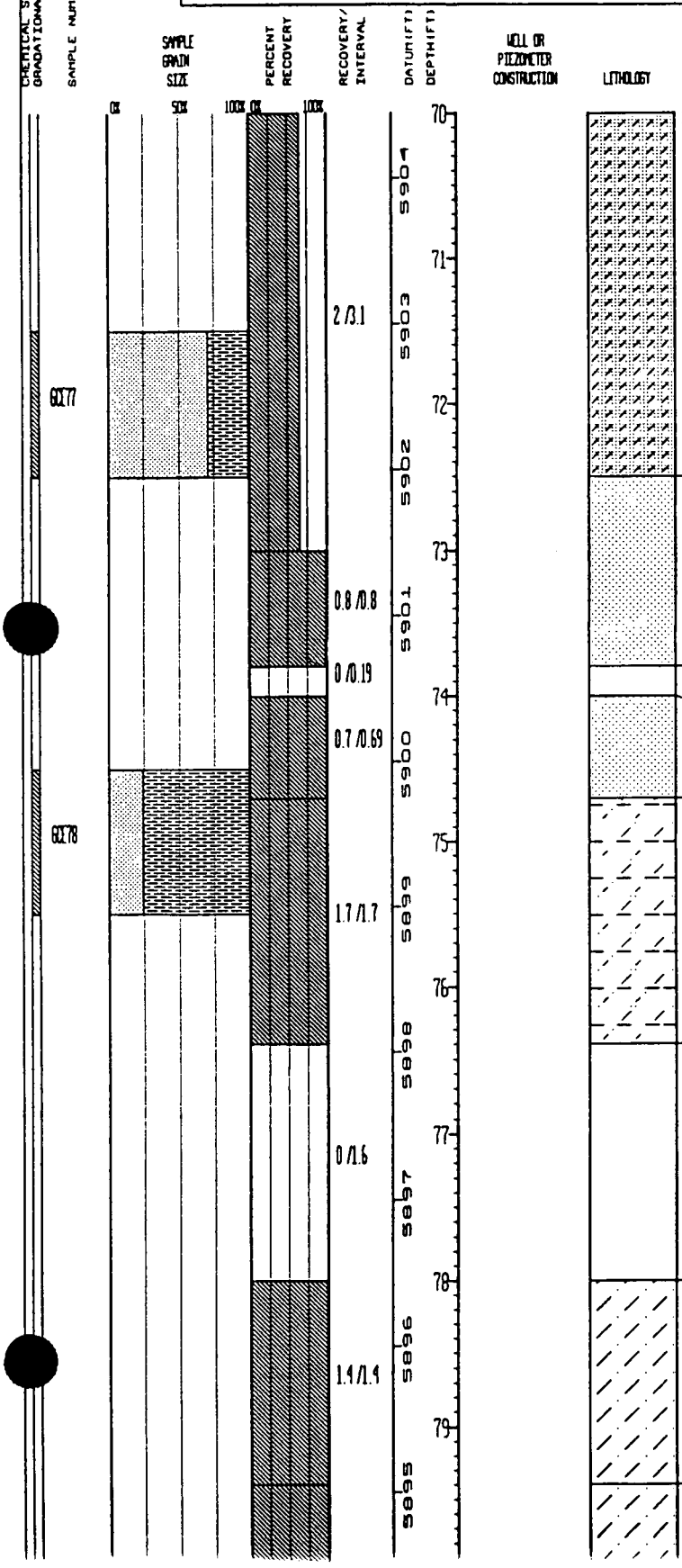
CHEMICAL SAMPLE DEPTH
GRADATIONAL SAMPLE DEPTH
SAMPLE NUMBER
SAMPLE GRAIN SIZE (0% 50% 100%)
PERCENT RECOVERY (0% 100%)
RECOVERY/INTERVAL
DATUM (FT)
DEPTH (FT)
WELL OR PIEZOMETER CONSTRUCTION





UNIFIED SOILS CLASSIFICATION OR ROCK TYPE	DESCRIPTION
	iron stain and carbonaceous mineralization, slight to moderate silt fraction.
CLAYSTONE:	Same as above.
CLAYSTONE:	Same as above, slickensides at approx. 66.8 ft., attitude approx. 60 degrees.
CLAYSTONE:	As above.
SILTY CLAYSTONE:	Interval grades to silty claystone below 67.5 ft., light gray (N7), bedding not apparent, slightly friable, slight to moderate VFG sand fraction.
SILTY CLAYSTONE:	As above.

STATE PLANE COORDINATE:		TOTAL DEPTH (FT): 98	GROUND ELEVATION (FT):	5974.45	PROJECT NUMBER:	667.11	LOG OF BORING NUMBER:
NORTH:	0	AREA: 0	CASING DIAMETER (IN):	0	GEOLOGIST:	DCB	25-86A
EAST:	0	LOCATOR NUMBER: 0	BOREHOLE DIAMETER (IN):	0	DATE DRILLED:	UNK	
REMARKS:							



UNIFIED SOILS CLASSIFICATION OR ROCK TYPE	DESCRIPTION
SANDY SILTSTONE:	Interval grades to sandy siltstone below 69.7 ft., light gray (N7), bedding not apparent to thin (<2 mm.), soft sed. deformation with moderate dip, slightly friable, increase in sand component with depth.
SANDSTONE:	Light gray (N7), thin bedded (<2 mm.), slight dip, slightly friable, moderate silt component.
NO SAMPLE:	
SANDSTONE:	As above.
CLAYEY SILTSTONE:	Interval grades to Clayey Siltstone, light gray (N7) to medium light gray (N6), bedding not apparent, slightly friable, localized carbonaceous mineralization, slight VFG sand fraction.
NO SAMPLE:	
SILTSTONE:	Light gray (N7) to medium light gray (N6), thin bedded (<2 mm.) interfingering clay laminae, bedding is distorted, possible soft sediment deformation or bioturbation, some carbonaceous mineralization and possible Mg oxides, slight VFG sand fraction
SILTSTONE:	As above.

STATE PLANE COORDINATE:		TOTAL DEPTH (FT): 98	GROUND ELEVATION (FT):	5974.45	PROJECT NUMBER:	667.11	LOG OF BORING NUMBER:
NORTH:	0	AREA: 0	CASING DIAMETER (IN):	0	GEOLOGIST:	DCB	25-86A
EAST:	0	LOCATOR NUMBER: 0	BOREHOLE DIAMETER (IN):	0	DATE DRILLED:	UNK	
REMARKS:							

CHEMICAL SAMPLE DEPTH / GRADATIONAL SAMPLE DEPTH	SAMPLE NUMBER	SAMPLE GRAIN SIZE	PERCENT RECOVERY	RECOVERY/ INTERVAL	DATUM (FT)	DEPTH (FT)	WELL OR PIEZOMETER CONSTRUCTION	LITHOLOGY	UNIFIED SOILS CLASSIFICATION OR ROCK TYPE	DESCRIPTION
				1.8 /1.8	5894	80				
					5893	81			CLAYSTONE:	Medium dark gray (N4), bedding not apparent, slightly friable, abundant carbonaceous mineralization (discontinuous coal beds), slight to moderate silt fraction, slight VFG sand fraction.
				1.8 /1.8	5892	82				
					5891	83			CLAYSTONE:	Light gray (N7), bedding not apparent, slightly friable, localized carbonaceous mineralization, moderate silt fraction.
				1.65 /1.65	5890	84				
					5889	85			CLAYSTONE:	As above.
				2.05 /2.05	5888	86				
					5887	87			CLAYSTONE:	As above.
				1.3 /1.3	5886	88			CLAYSTONE:	As above. Bedding becomes apparent from 88.0 to 89.5 ft., thin bedded (<2 mm.), slight dip, interbedded silt and clay, which exhibit soft sed. deformation.
				2 /2	5885	89				

STATE PLANE COORDINATE:	TOTAL DEPTH (FT): 98	GROUND ELEVATION (FT): 5974.45	PROJECT NUMBER: 667.11	LOG OF BORING NUMBER:
NORTH: 0	AREA: 0	CASING DIAMETER (IN): 0	GEOLOGIST: DCB	25-86A
EAST: 0	LOCATOR NUMBER: 0	BOREHOLE DIAMETER (IN): 0	DATE DRILLED: UNK	

REMARKS:

CHEMICAL SAMPLE OR GRADATIONAL SAMPLE	SAMPLE NUMBER	SAMPLE GRAIN SIZE (0% – 50%)	PERCENT RECOVERY (100% OR – 100%)	RECOVERY/INTERVAL	DATUM (FT)	DEPTH (FT)	WELL OR PIEZOMETER CONSTRUCTION	LITHOLOGY	UNIFIED SOILS CLASSIFICATION OR ROCK TYPE	DESCRIPTION
				1.8/1.8	5984	90			CLAYSTONE	As above, bedding apparent at approx. 90.6 ft. <2 mm. thick, steeply dipping, may be result of soft sed. deformation.
				1.2/1.2	5983	91			CLAYSTONE	As above.
				2.3/2.3	5982	92			CLAYSTONE	As above.
				1.7/1.7	5981	93			CLAYSTONE	As above.
				1/1	5980	94			CLAYSTONE	As above.
					5979	95			CLAYSTONE	As above.
					5978	96			CLAYSTONE	As above.
					5977	97			CLAYSTONE	As above.
					5976	98				
					5975	99				

LOG OF BORING NO. 26-82

DATES DRILLED:
ELEVATION:
GEOLOGIST(S): DCB
DATE: 7/25/89
CHECKED BY:
DATE:

PROJECT NO: 667-11.22

TOP/BOTTOM OF CORE IN BOX	TOP/BOTTOM OF CORE IN RUN (IN FACTS)	SAMPLE NUMBER	FEET OF CORE IN BOX (IN FACTS)	USCS SYMBOL ~~FEET OF CORE IN RUN~~	FRACTURES PER FOOT	FRACTURE ANGLE	BEDDING ANGLE	GRAIN SIZE DISTRIBUTION	DEPTH IN FEET	LITHOLOGIC LOG	LITHOLOGIC DESCRIPTION
0.0 ↓ Box 1 of 2	0.0 to 1.5		(1) .85	GP				>50% Gravel	1		Gravel, medium gray (N6) and very light gray (N8), angular to subangular, moderately graded, max. size, 6 cm, some caliche, silt and trace of clay.
	1.5 to 4.5		(1) .8						2, 3, 4		
	4.5 to 7.0		(1) 1.85	DCB ~~SP~~					5, 6		Caliche, white (N9), friable, trace of gravel. Sand, stone grayish orange (10 YR 7/4), DCB ~~subangular to rounded~~, bedding not apparent, highly weathered, moderately friable, very fine to fine grained, poor to moderate sorting, significant amount of caliche, trace of silt and gravel.
	7.0 to 9.0		0						7, 8		No Sample
	9.0 to 11.0		ND	GP				>50% Gravel	9		Gravel, medium light gray (N6), subangular to subrounded, poorly graded, max. size 6 cm, some caliche and sand.

NOTES: General: The USCS is modified for this log as follows: Material amounts are estimated by percent volume instead of percent weight.
(1) Badly broken core, accurate footage measurement not possible.
(2) Core breaks cannot be matched, accurate footage measurement not possible.

ROCKY FLATS PLANT

FIGURE NO.

Background 50-150 cpm

LOG OF BORING NO. 26-86

DATES DRILLED:
ELEVATION:
GEOLOGIST(S): DCB
DATE: 7/25/89
CHECKED BY: DATE:

PROJECT NO: 667-11.22

TOP/BOTTOM OF CORE IN BOX	TOP/BOTTOM OF CORE IN ROW (IN FEET)	SAMPLE NUMBER	FEET OF CORE (IN BOX)	USCS SYMBOL	FRACTURES PER FOOT	FRACTURE ANGLE	BEDDING ANGLE	GRAIN SIZE DISTRIBUTION	DEPTH IN FEET	LITHOLOGIC LOG	LITHOLOGIC DESCRIPTION
	9.0 to 11.0		ND	GP							See previous page.
15 of 2 DCB 14.0	11.0 to 12.0		(2) 1.3					750 clay	11		Clay, slone mottled yellowish gray (5 Y 8/1) and grayish orange (10 YR 7/4), bedding not apparent, highly weathered moderately friable, calcareous, caliche occurs as isolated bodies within rock, localized iron staining and possible mg oxide mineralization.
	12.0 to 14.0		(1) 1.6						12, 13, 14		

NOTES: General: The USCS is modified for this log as follows: Material amounts are estimated by percent volume instead of percent weight.
(1) Badly broken core, accurate footage measurement not possible.
(2) Core breaks cannot be matched, accurate footage measurement not possible.

ROCKY FLATS PLANT

FIGURE NO.

Background 50-150 cpm

LOG OF BORING NO. 26-86

PAGE 1 OF 1

GEOLOGIST(S): DCB
DATE: 8/30/89

PROJECT NO: 667-1122

TOP/BOTTOM OF CORE IN BOX	TOP/BOTTOM OF INTERVAL	FEET OF CORE IN INTERVAL IN BOX	SAMPLE NUMBER	FRACTURE ANGLE	BEDDING ANGLE	GRAIN SIZE DISTRIBUTION	USCS SYMBOL	DEPTH IN FEET	LITHOLOGIC LOG	LITHOLOGIC DESCRIPTION
								11		Box 26-86 1 of 2 not in trailer.
								12		
								13		
	14.0 to 15.8	N/D				>50% clay		14 15		Claystone, very light gray (N8), bedding not apparent, moderately weathered, slightly friable, trace of silt, local iron staining, slight mg oxide mineralization.
	15.8 to 17.0	N/D						16 17		
								18		Bottom of Box 2 of 2 at 17.0 ft.
								19		

NOTES: General USCS is modified for this log as follows:
Material amounts are estimated by % volume instead of % weight.
(1) Badly broken core, accurate footage measurements not possible.
(2) Core breaks cannot be matched, accurate footage measurements not possible.

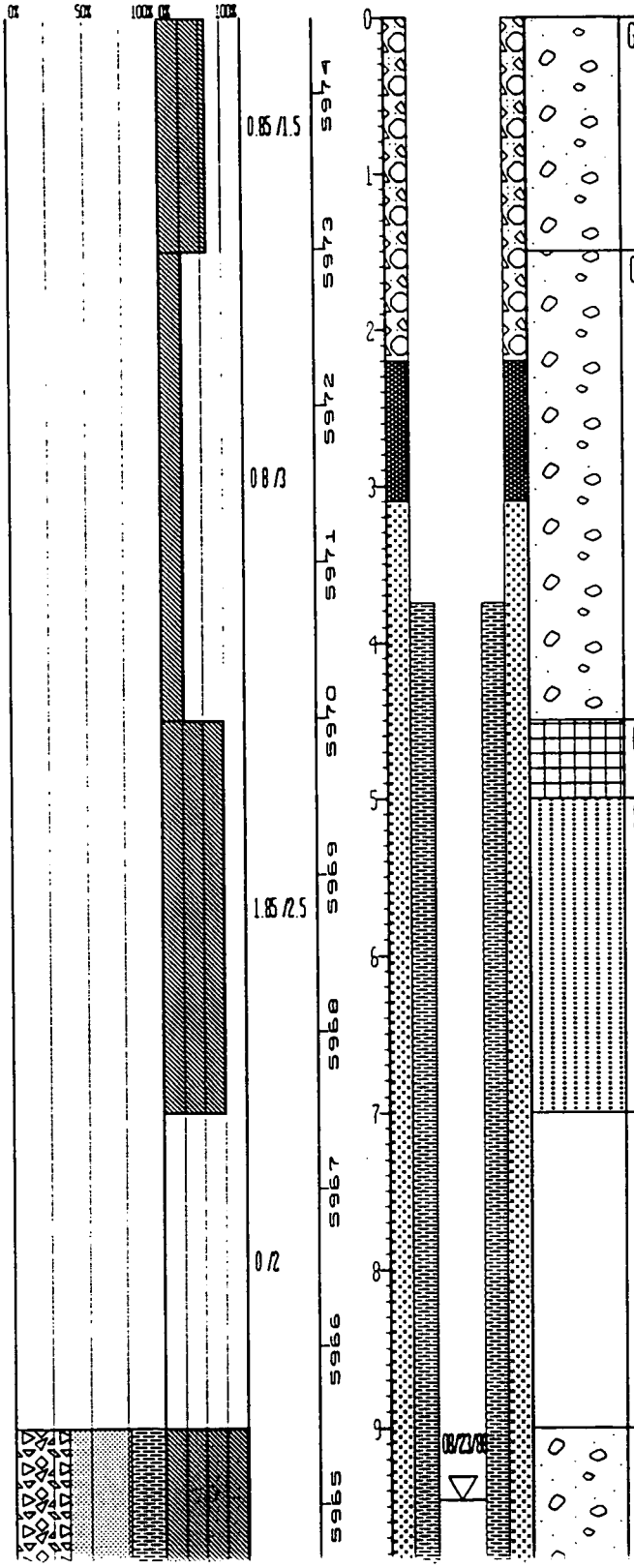
ROCKY FLATS PLANT

FIGURE NO.

STATE PLANE COORDINATE:		TOTAL DEPTH (FT): 17	GROUND ELEVATION (FT):	5974.48	PROJECT NUMBER:	667.11	LOG OF BORING NUMBER:
NORTH:	750428	AREA: SOLAR POND	CASING DIAMETER (IN):	2 ID	GEOLOGIST:	DCB	26-86
EAST:	2084841	LOCATOR NUMBER: L10	BOREHOLE DIAMETER (IN):	7 25	DATE DRILLED:	08/22/86	

REMARKS: Hollow Stem Auger. Cave from TD to 15.50'.

CHEMICAL SAMPLE DEPTH
GRADATIONAL SAMPLE DEPTH
SAMPLE NUMBER
SAMPLE GRAIN SIZE (0% 50% 100%)
PERCENT RECOVERY (0% 100%)
RECOVERY/INTERVAL
DATUM (FT)
DEPTH (FT)
WELL OR PIEZOMETER CONSTRUCTION
LITHOLOGY



UNIFIED SOILS CLASSIFICATION OR ROCK TYPE	DESCRIPTION
GP:	GRAVEL - medium gray (N6) and very light gray (N8), angular to sub-angular, moderately graded, max. size 6 cm., some caliche, silt and trace of clay.
GP:	Same as above.
CALICHE:	White (N9), friable, trace of gravel.
SP:	Grayish orange (10YR 7/4), bedding not apparent, highly weathered, moderately friable, very fine to fine grained, poor to moderate sorting, significant amount of caliche, trace of silt and gravel.
NO SAMPLE:	
GP:	GRAVEL - medium light gray (N6), sub-angular to sub-rounded, poorly graded, max. size 6 cm., some caliche and sand.

STATE PLANE COORDINATE:		TOTAL DEPTH (FT): 17	GROUND ELEVATION (FT):	5974.48	PROJECT NUMBER:	667 11	LOG OF BORING NUMBER:
NORTH:	750428	AREA: SOLAR POND	CASING DIAMETER (IN):	2 ID	GEOLOGIST:	DCB	26-86
EAST:	2084841	LOCATOR NUMBER: L10	BOREHOLE DIAMETER (IN):	7 25	DATE DRILLED:	08/22/86	

REMARKS: Hollow Stem Auger. Cave from TD to 15.50'.

CHEMICAL SAMPLE OR GRADATIONAL SAMPLE	SAMPLE NUMBER	SAMPLE GRADIN SIZE	PERCENT RECOVERY	RECOVERY/ INTERVAL	DATUM (FT)	DEPTH (FT)	WELL OR PIEZOMETER CONSTRUCTION	LITHOLOGY	UNIFIED SOILS CLASSIFICATION OR ROCK TYPE	DESCRIPTION
	6029	0% 50% 100%	0% 100%	2 /2	5964	10			CLAYSTONE:	Top of Bedrock Mottled yellowish gray (5Y 8/1) and grayish orange (10YR 7/4), bedding not apparent, highly weathered, moderately friable, calcareous, caliche occurs as isolated bodies within rock, localized iron staining and possible Mg oxide mineralization.
				1.3 /1	5963	11				
					5962	12			CLAYSTONE:	As above.
				1.6 /2	5961	13				
					5960	14			CLAYSTONE:	Very light gray (N8), bedding not apparent, moderately weathered, slightly friable, trace of silt, local iron staining, slight Mg oxide mineralization.
				1.8 /1.8	5959	15				
				1.2 /1.2	5958	16			CLAYSTONE:	Same as above.
					5957	17				
					5956	18				
					5955	19				

INDEX OF DATA

Boring No.: 27-86

Completed as well? Yes

Data in File

X Log of Borehole

X Well Construction Summaries

____ Well Development Summaries

X Hydraulic Conductivity Test Data and Results

X Packer Test Data and Results

X Water Level Data

X Saturated Thickness Hydrographs

Project: Rocky Flats Plant

LOG OF BORING NO. 27-86

Date Drilled 8/29/86 and 9/12/86 to 9/18/86 **Coordinates** N 37794.1 E 22134.9

Boring Method Hollow Stem Auger/NC Core **Ground Surface Elevation** 5961.86

Elev. (feet)	Depth (feet)	Sample Type	Graphic Log	Material Description	Penetration Resistance (Blows/inch) 20 40	Water Content (%) 20 40	Other Tests
	0			**ARTIFICIAL FILL**			
				0-2.0'-Sample. Recovered 1.0/2.0'=50%. GRAVEL: dusky brown (5YR 2/2) granite and quartzite coarse sand, pebbles and cobbles; some fine-grained sand; silty; slightly calcareous; poorly sorted; subangular; unconsolidated; dry.			
				2.0-4.0'-Sample. Recovered 0.9/2.0'=45%. GRAVEL: Same as above; calcareous; horizontal bedding; poorly sorted; unconsolidated; dry.			
	5			4.0-7.0'-Sample. Recovered 3.0/3.0'=100%. GRAVEL: very pale orange (10YR 6/2) to grayish orange (10YR 7/4) pebbles; grades downward into yellowish orange (10YR 6/6) coarse-grained sand; trace silt and clay; noncalcareous; poorly sorted; subangular; damp.		▼	
	10			7.0-8.0'-Sample. Recovered 0.0/1.0'=0%.			
				8.0-12.0'-Sample. Recovered 4.0/4.0'=100%.			
				8.0-9.2'. GRAVEL: very pale orange (10YR 6/2) to grayish orange (10YR 7/4) pebbles with dark yellowish orange (10YR 6/6) coarse-grained sand; gravel layer at bottom; poorly sorted; unconsolidated; wet.			
	15			**ARAPAHOE FORMATION**			
				9.2-12.0'. CLAYSTONE: pale olive (10Y 4/2) to grayish olive (10Y 4/2) with dark yellowish orange (10YR 6/6) mottling; silty; coarse-grained sandstone stringer at 9.8'; firm; weathered; damp.			
	20						

Remarks Logged by: T. Murphy & J. Bergman

Checked by: [illegible]

Project No. 106P06222

Hydro-Search, Inc.

Project: Rocky Flats Plant

LOG OF BORING NO. 27-86

Date Drilled 8/29/86 and 9/12/86 to 9/18/86 **Coordinates** N 37794.1 E 22134.9

Boring Method Hollow Stem Auger NC Core **Ground Surface Elevation** 5961.86

Elev. (feet)	Depth (feet)	Sample Type	Graphic Log	Material Description	Penetration Resistance (Blows/inch) 20 40	Water Content (%) 20 40	Other Tests
	20			12.0-17.0'-Sample. Recovered 5.0/5.0'=100%. CLAYSTONE: light gray (N 7) to medium gray (N 5) with dark yellowish orange (10YR 6/6) mottling. At 15.5' grades into medium dark gray (N 4) claystone; unweathered; damp to wet.			
				17.0-22.0'-Sample. Recovered 5.0/5.0'=100%.			
	25			17.0-19.6'. CLAYSTONE: light gray (N 7) to medium gray (N 5) with dark yellowish orange (10YR 6/6) mottles; firm; damp.			
				19.6-22.0'. CLAYSTONE: pale olive (10YR 6/2) claystone with slight dark yellowish orange (10YR 6/6) mottling along fractures; some ironstone in fractures; firm; damp.			
				23.0-28.5'-Sample. Recovered 3.5/5.0'=69%. RQD 2.9/3.5=87%.			
	30			CLAYSTONE: dark yellowish orange (10YR 6/6); sandy; grades downward into a dusky yellow (5Y 6/4) sandy claystone; several patches of white very fine-grained sand; consolidated; dry.			
				28.5-33.5'-Sample. Recovered 2.0/5.0'=40%. RQD 1.5/2.0'=75%.			
	35			CLAYSTONE: light gray (N 7) and pale yellowish brown (10YR 6/2); white caliche at 31.5' (0.25" thick); strong reaction strongly with HCL; consolidated; dry.			
				33.5-38.5'-Sample. Recovered 2.1/5.0'=42%. RQD 2.1/2.1'=100%. CLAYSTONE: dark yellowish orange (10YR 6/6) with moderate yellowish brown (10YR 5/4) limonite stains; grades downward into a pale yellowish brown (10YR 6/2) slightly sandy claystone; consolidated; dry.			
	40						

Remarks Logged by: T. Murphy & J. Bergman Checked by: [illegible]

Project No. 106P06222

Hydro-Search, Inc.

Project: Rocky Flats Plant

LOG OF BORING NO. 27-86

Date Drilled 8/29/86 and 9/12/86 to 9/18/86 **Coordinates** N 37794.1 E 22134.9

Boring Method Hollow Stem Auger/NC Core **Ground Surface Elevation** 5961.86

Elev. (feet)	Depth (feet)	Sample Type	Graphic Log	Material Description	Penetration Resistance (Blows/inch) 20 40	Water Content (%) 20 40	Other Tests
	40			38.5-43.5'-Sample. Recovered 3.6/5.0'=73%. RQD 3.6/3.6'=100%. CLAYSTONE: light olive gray (5Y 5/2); some fine to very fine-grained sand; dark yellowish orange (10YR 6/6) mottling; black organic fragments; few caliche stringers; consolidated; dry.			
	45			43.5-47.5'-Sample. Recovered 1.6/4.0'=40%. RQD 0.8/1.6'=50%. CLAYSTONE: yellowish brown (10YR 2/2) with some moderate yellowish orange (10YR 6/6) mottling; sandy; few black organic fragments; consolidated; damp.			
	50			47.5-52.5'-Sample. Recovered 5.0/5.0'=100%. RQD 5.0/5.0'=100%. CLAYSTONE: olive gray (5Y 3/2); no mottling; homogenous; consolidated; dry.			
				52.5-57.5'-Sample. Recovered 3.5/5.0'=70%. RQD 2.5/3.5'=71%. CLAYSTONE: Same as above; dry.			
	55			57.5-62.5'-Sample. Recovered 5.0/5.0'=100%. RQD 5.0/5.0'=100%. CLAYSTONE: olive gray (5Y 3/2) with moderate yellowish brown (10YR 5/4) mottling; at 59.0' and 59.5' hit a thin layer 0.3' and 0.1' thick, respectively, of moderate yellowish brown (10YR 5/4) siltstone nodules; very fine-grained; dry.			
	60						

Remarks Logged by: T. Murphy & J. Bergman

Checked by:

Project No. 106P06222

Hydro-Search, Inc.

Project: Rocky Flats Plant

LOG OF BORING NO. 27-86

Date Drilled 8/29/86 and 9/12/86 to 9/18/86 **Coordinates** N 37794.1 E 22134.9

Boring Method Hollow Stem Auger/NC Core **Ground Surface Elevation** 5961.86

Elev. (feet)	Depth (feet)	Sample Type	Graphic Log	Material Description	Penetration Resistance (Blows/inch) 20 40	Water Content (%) 20 40	Other Tests
	60						
				62.5-67.5'-Sample. Recovered 5.0/5.0'=100%. RQD 5.0/5.0'=100%. CLAYSTONE: olive gray (5Y 3/2); sandy; several moderate yellowish brown (10YR 5/4) siltstone nodules at 66.4', 66.9' and 67.0'; each layer is less than .05' wide; consolidated; moist.			
	65						
				67.5-72.5'-Sample. Recovered 5.0/5.0'=100%. RQD 5.0/5.0'=100%. CLAYSTONE: olive gray (5Y 3/2); sandy; moderate yellowish brown (10YR 5/4) siltstone nodules; consolidated; moist.			
	70						
				72.5-77.5'-Sample. Recovered 4.4/5.0'=88%. RQD 4.4/4.4'=100%. CLAYSTONE: olive gray (5Y 3/2); sandy; layer of moderate yellowish brown (10YR 5/4) siltstone nodules 73.8'; consolidated; moist.			
	75						
				77.5-82.5'-Sample. Recovered 4.5/5.0=90%. RQD 4.5/4.5'=100%. CLAYSTONE: olive gray (5Y 3/2); sandy; black organic fragments; consolidated; damp.			
	80						

Remarks Logged by: T. Murphy & J. Bergman Checked by:

Project No. 106P06222

Hydro-Search, Inc.

Project: Rocky Flats Plant

LOG OF BORING NO. 27-86

Date Drilled 8/29/86 and 9/12/86 to 9/18/86 **Coordinates** N 37794.1 E 22134.9

Boring Method Hollow Stem Auger/NC Core **Ground Surface Elevation** 5961.86

Elev. (feet)	Depth (feet)	Sample Type	Graphic Log	Material Description	Penetration Resistance (Blows/inch) 20 40	Water Content (%) 20 40	Other Tests
	80						
				82.5-87.5'-Sample. Recovered 5.0/5.5'=91%. RQD 5.0/5.0'=100%. CLAYSTONE: Same as above; damp.			
	85			87.5-92.5'-Sample. Recovered 5.0/5.0'=100%. RQD 5.0/5.0'=100%. CLAYSTONE: olive gray (5Y 3/2); moderate yellowish brown (10YR 5/4) siltstone nodules 91.8'; black organic fragments; consolidated; damp.			
	90						
				92.5-97.5'-Sample. Recovered 3.2/5.0'=64%. RQD 3.0/3.2'=94%. CLAYSTONE: olive gray (5Y 3/2); black organic fragments; consolidated; dry.			
	95						
				97.5-102.5'-Sample. Recovered 5.0/5.0'=100%. RQD 2.5/5.0'=50%. SILTSTONE: olive gray (5Y 3/2); very fine-grained; slightly sandy; black organic fragments; laminated; homogeneous; consolidated; dry.			
	100						

Remarks Logged by: T. Murphy & J. Bergman Checked by:

Project No. 106P06222

Hydro-Search, Inc.

Project: Rocky Flats Plant

LOG OF BORING NO. 27-86

Date Drilled 8/29/86 and 9/12/86 to 9/18/86 **Coordinates** N 37794.1 E 22134.9

Boring Method Hollow Stem Auger/NC Core **Ground Surface Elevation** 5961.86

Elev. (feet)	Depth (feet)	Sample Type	Graphic Log	Material Description	Penetration Resistance (Blows/inch) 20 40	Water Content (%) 20 40	Other Tests
	100						
				102.5-107.5-Sample. Recovered 3.8/5.0'=76%. RQD 3.0/3.8=79%. SILTSTONE: Same as above; dry.			
	105			107.5-110.5'-Sample. Recovered 3.0/3.0'=100%. RQD 3.0/3.0'100%. SILTSTONE: Same as above; dry.			
	110			110.5-113.5'-Sample. Recovered 0.25/3.0'=8%. RQD 0.0/0.25'=0%. SILTSTONE: Same as above; dry.			
				113.0-117.0'-Sample. Recovered 2.2/4.0'=55%. RQD 0.1/2.2'=5%. CLAYSTONE: Olive gray (5Y 3/2); silty; some very fine-grained sand; black organic fragments; homogenous; consolidated; damp.			
	115						
				117.0-122.0'-Sample. Recovered 3.5/5.0'=70%. RQD 2.7/3.5'=77%. CLAYSTONE: olive gray (5Y 3/2); silty; few organics; homogenous; damp.			
	120						

Remarks Logged by: T. Murphy & J. Bergman Checked by:

Project No. 106P06222

Hydro-Search, Inc.

Project: Rocky Flats Plant

LOG OF BORING NO. 27-86

Date Drilled 8/29/86 and 9/12/86 to 9/18/86 **Coordinates** N 37794.1 E 22134.9

Boring Method Hollow Stem Auger/NC Core **Ground Surface Elevation** 5961.86

Elev. (feet)	Depth (feet)	Sample Type	Graphic Log	Material Description	Penetration Resistance (Blows/inch) 20 40	Water Content (%) 20 40	Other Tests
	120			122.0-127.0'-Sample. Recovered 5.0/5.0'=100%. RQD 5.0/5.0' 100%. CLAYSTONE: olive gray (5Y 3/2); silty; some very fine-grained sand; few organic fragments; homogenous; hard; dry.			
				127.0-132.0'-Sample. Recovered 5.0/5.0'=100%. RQD 5.0/5.0'= 100%.			
	125			127.0-129.0'. CLAYSTONE: olive gray (5Y 3/2); sandy; black organic fragments; homogeneous; consolidated; dry.			
				129.0-132.0'. SANDSTONE: clay grades into light gray (N 7) sandstone; silty; very fine-grained; thin clay laminae; few organics; well sorted; rounded; consolidated; dry.		▽	
	130			132.0-137.0'-Sample. Recovered 3.5/5.0'=70%. RQD 2.3/3.5=66%. 132.0-133.9'. SANDSTONE: light gray (N 7); silty; very fine-grained; very thin clay laminae; well sorted; rounded; consolidated; dry.			
	135			133.9-137.0. CLAYSTONE: grades into olive gray (5Y 3/2) claystone; silty and sandy; laminations in sandy intervals; no organics; consolidated; dry.			
				137.0-142.0'-Sample. Recovered 3.2/5.0'=64%. RQD 2.2/3.2'=69%. CLAYSTONE: olive gray (5Y 3/2); light brown (5YR 6/4) mottling; no organics; homogenous; slightly damp.			
	140						

Remarks Logged by: T. Murphy & J. Bergman Checked by:

Project No. 106P06222

Hydro-Search, Inc.

Project: Rocky Flats Plant

LOG OF BORING NO. 27-86

Date Drilled 8/29/86 and 9/12/86 to 9/18/86 **Coordinates** N 37794.1 E 22134.9

Boring Method Hollow Stem Auger/NC Core **Ground Surface Elevation** 5961.86

Elev. (feet)	Depth (feet)	Sample Type	Graphic Log	Material Description	Penetration Resistance (Blows/inch) 20 40	Water Content (%) 20 40	Other Tests
	140						
				142.0-147.0'-Sample. Recovered 5.0/5.0'=100%. RQD 3.8/5.0'=76%. CLAYSTONE: olive gray (5Y 3/2); silty; some very fine-grained sand; grades downward into very fine-grained gray (N 7) sandstone; silty; few organics; laminated; well sorted; rounded; consolidated; dry.			
	145						
				147.0-152.0'-Sample. Recovered 5.0/5.0'=100%. RQD 5.0/5.0'100%. CLAYSTONE: olive gray (5Y 3/2) silty claystone and pale olive (10Y 6/2) very fine-grained silty sandstone; sandstone layers are less than 0.1' thick; well sorted; few organics; 2 dusky yellow (5Y 6/4) siltstone pockets at 148.0'; sample exhibits increased clay content with depth; consolidated; hard; slightly damp.			
	150						
				152.0-157.0'-Sample. Recovered 3.1/5.0'=62%. RQD 0.8/3.1'=26%. CLAYSTONE: alternating bands of olive gray (5Y 3/2) claystone and very fine-grained gray (N 7) silty sandstone; grades downward into olive gray (5Y 3/2) silty claystone; pale yellowish brown (10YR 6/2) siltstone nodule at 155.0'; consolidated; slightly damp.			
	155						
				TOTAL DEPTH: 157.0'			
	160						

Remarks Logged by: T. Murphy & J. Bergman Checked by:

Project No. 106P06222

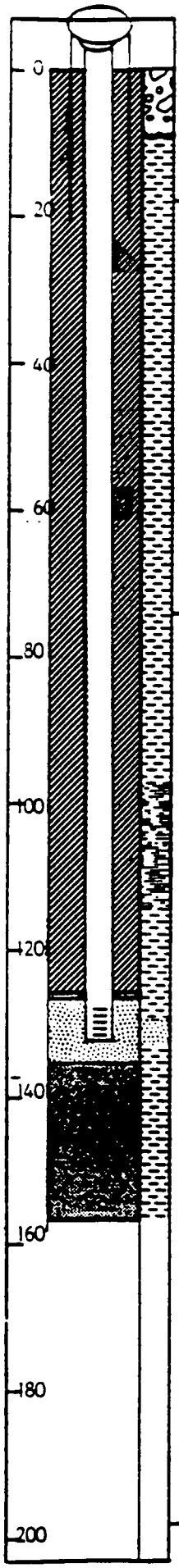
Hydro-Search, Inc.

WELL 37-86

WELL CONSTRUCTION SUMMARY

LOCATION or COORDS: N 37794.1 E 22134.9

ELEVATION: GROUND LEVEL 5961.86'
TOP OF CASING 5963.26'



LOCATION Golden, CO
PERSONNEL T. Murphy/J. Bergman
PROJECT 106P06222 Rocky Flats Plant

DRILLING SUMMARY:

TOTAL DEPTH Well: 133.00' Hole: 157.00'

BOREHOLE DIAMETER 0.00' - 22.00': 7½"
22.00' - 157.00': 5 5/8"

DRILLER Boyles Brothers Drilling Co.
15865 W. 5th Avenue, Golden, CO
(Dave Jarvie, Robert Roach)

RIG 0.00' - 22.00': Mobile B-57; 22.00' - 157.00': Failing

BIT(S) 0.00' - 22.00': T5; 22.00' - 157.00': coring bit; stone bit, tricone

DRILLING FLUID 0.00' - 22.00': none; 22.00' - 157.00': air/water mist

SURFACE CASING 5" x 22.6' steel w/ locking cap

WELL DESIGN:

BASIS: GEOLOGIC LOG X GEOPHYSICAL LOG ___

CASING STRING(S): C=CASING S=SCREEN

0.00'	21.00'	C1			
0.00'	128.50'	C2			
128.50'	133.00'	S1			

CASING: C1 5" I.D. steel surface casing
C2 2" I.D. Sch. 5 type 316 stainless steel, threaded and flush jointed.

SCREEN: S1 2" I.D. Sch. 5 type 316 stainless steel, threaded and flush jointed, 0.010" wire wrap screen, 0.25' welded bottom cap.

CENTRALIZERS None

FILTER MATERIAL 32-42 silica sand
127.50' - 135.70'

CEMENT Portland Type I
0.00' - 126.50'

OTHER 3/8" bentonite pellets
126.50' - 127.00'
135.75' - 157.00'

CONSTRUCTION TIME LOG:

TASK	START DATE 1986	START TIME	FINISH DATE 1986	FINISH TIME
DRILLING:				
7½" auger	8/29	0935	8/29	1200
NC core	9/11	1545	9/17	1615
Reaming	9/19	0905	9/19	0945
GEOPHYS. LOGGING:	—	—	—	—
CASING:				
5" steel	8/29	1300	8/29	1330
2" stainless	9/22	1110	9/22	1135
FILTER PLACEMENT:	9/22	1140	9/22	1150
CEMENTING:	9/23	1820	9/24	0920
DEVELOPMENT:	9/30	1215	10/1	0912
OTHER:				
Bentonite	9/22	1520	9/22	1620
	9/19	1625	9/19	[illegible]
Packer testing				
Cementing 5" steel	8/29	1330	8/29	1400

WELL DEVELOPMENT

See Well Development Summary Sheet.

COMMENTS:

Water encountered at 8.0' during drilling.

Top of stainless steel casing: 1.40'

LOG OF BORING NO. 27-86

GEOLOGIST(S): MA
DATE: 8/21/89

PROJECT NO: 667-1122

TOP/BOTTOM OF CORE IN BOX	TOP/BOTTOM OF INTERVAL	FEET OF CORE IN INTERVAL IN BOX	SAMPLE NUMBER	FRACTURE ANGLE	BEDDING ANGLE	GRAIN SIZE DISTRIBUTION	USCS SYMBOL	DEPTH IN FEET	LITHOLOGIC LOG	LITHOLOGIC DESCRIPTION
Box 1 of 3	0.0 – 2.0	.9 (1)				Gravel >50%, Clay ≈30%	GC	1, 2		Clayey gravel. Med. gray (N5). Angular to sub-rounded. Well graded. Granules to 6.5 cm. Matrix sandy clay. Mod. brown (5yr 3/4). Some sand. v.f.g. to v.c.g. Some $CaCO_3$.
	2.0 – 4.0	.75 (1)				Gravel 75%, Clay ≈30%, Silt + Sand ≈30%	GC	3, 4		Same as above. Silty clay matrix, some sand.
	4.0 – 5.7	1.8 (1)				Gravel ≈50%, Caliche ≈35%	GC	5		Gravel in Caliche Matrix. Gravel as above. Matrix very pale orange to white (10yr 8/2 to N9). Some silt and sand.
	5.7 – 7.0	.11 *				Gravel >75%		6, 7		* This interval consists only of a few pieces of sandy, clayey gravel. Not enough sample to characterize interval.
	7.0 – 8.0	0						8		No Sample
	8.0 – 8.8	.4 (1)				Gravel >80%	GC			Gravel. Med. dk. gray (N4). Angular to sub rounded. Poorly graded. Max. size ≈5 cm. Some sand + clay.
	8.8 – 10.8 ↓	1.7 (2)				Clay ≈75%	CL	9		Clay. Very lt. gray (N8) to Grayish orange (10yr 7/4). Est. plast. Mod. to high. Some gravel. Granules to ≈3cm. Angular to sub rounded. Thin caliche area (≈2cm). Trace sand + silt.

NOTES: General USCS is modified for this log as follows:
Material amounts are estimated by % volume instead of % weight.
(1) Badly broken core, accurate footage measurements not possible.
(2) Core breaks cannot be matched, accurate footage measurements not possible.

ROCKY FLATS PLANT

FIGURE NO.

LOG OF BORING NO. 27-86

GEOLOGIST(S): CAA
DATE: 8/21/89

PROJECT NO: 667-1122

TOP/BOTTOM OF CORE IN BOX	TOP/BOTTOM OF INTERVAL	FEET OF CORE IN INTERVAL IN BOX	SAMPLE NUMBER	FRACTURE ANGLE	BEDDING ANGLE	GRAIN SIZE DISTRIBUTION	USCS SYMBOL	DEPTH IN FEET	LITHOLOGIC LOG	LITHOLOGIC DESCRIPTION
Box 1 of 3	8.8 ↑ 10.8									See previous page for description of this interval.
12.0	10.8 12.0	1.4 (2)				Clay >80%	CL	11		Clay. Very pale orange (10yr 8/2) to grayish orange (10yr 7/4). Est. Plast. mod. to high. Trace iron staining. Trace white noncalcareous mineralization (maybe slightly weathered claystone).
12.0	12.0 13.8	*						12, 13		* Sample only consists of a few fragments of material (probably same as above). Not enough to characterize. Begin Box 2.
	13.8 15.8	1.7 (2)		60°		Clay >80%		14, 15		Claystone. Pinkish gray (5yr 8/1) to dark yellowish orange (10yr 6/6). Mod. to highly friable, mod. friable. Bedding not evident. Trace carb. material.
	15.8 17.0	1.1				Clay >80%		16		Same as above. Color change to very pale orange to pale yellowish brown (10yr 8/2 to 6/2). Some carb. material. Trace iron staining.
Box 2 of 3	17.0 17.4	.35				Clay >80%		17		Same as above. Trace silt.
	17.4 19.0	1.5 (2)				Clay >80%		18		Same as above, some iron staining, trace carb. material.
20.5	19.0 20.5 ↓	1.6 (2)				Clay >60%		19		Silty claystone, same as above, some carb. material.

NOTES: General USCS is modified for this log as follows:
Material amounts are estimated by % volume instead of % weight.
(1) Badly broken core, accurate footage measurements not possible.
(2) Core breaks cannot be matched, accurate footage measurements not possible.

ROCKY FLATS PLANT

FIGURE NO.

LOG OF BORING NO. 27-86

GEOLOGIST(S): LAA
DATE: 8/21/89

PROJECT NO: 667-1122

TOP/BOTTOM OF CORE IN BOX	TOP/BOTTOM OF INTERVAL	FEET OF CORE IN INTERVAL IN BOX	SAMPLE NUMBER	FRACTURE ANGLE	BEDDING ANGLE	GRAIN SIZE DISTRIBUTION	USCS SYMBOL	DEPTH IN FEET	LITHOLOGIC LOG	LITHOLOGIC DESCRIPTION
	20.5									See previous page for description.
20.5 Box 3 of 3 22.0	22.0	.4(1)				Clay >50%		21 22		Silty Claystone. Very pale orange (10yr 8/2) to grayish orange (10yr 7/4). Highly weathered mod fr. able. Bedding not evident.
								23 24 25		Bottom of Boxes

NOTES: General: USCS is modified for this log as follows:
Material amounts are estimated by % volume instead of % weight.
(1) Badly broken core, accurate footage measurements not possible.
(2) Core breaks cannot be matched, accurate footage measurements not possible.

ROCKY FLATS PLANT

FIGURE NO.

LOG OF BORING NO. 27-86

GEOLOGIST(S): UAA
DATE: 8/24/89

PROJECT NO: 6067-1122

TOP/BOTTOM OF CORE IN BOX	TOP/BOTTOM OF INTERVAL	FEET OF CORE IN INTERVAL IN BOX	SAMPLE NUMBER	FRACTURE ANGLE	BEDDING ANGLE	GRAIN SIZE DISTRIBUTION	USCS SYMBOL	DEPTH IN FEET	LITHOLOGIC LOG	LITHOLOGIC DESCRIPTION
								21		
								22		
								23		
								24		
25.05								25		Beginning of Boxes
25.05	25.05	2.9(1)				Clay 770% Silt ≈25%		26		Silty Claystone very pale orange to dk. yellowish orange (10yr 8/2 to 6/6). Mod. weathered, slightly friable. Some iron staining, carb. material in fractures. Bedding not evident ~~Clay~~ UA Trace $CaCO_3$.
								27		
								28		
	28.5									
	31.5↓	0						29		No Sample

Box 1 of 8

NOTES: General: USCS is modified for this log as follows:
Material amounts are estimated by % volume instead of % weight.
(1) Badly broken core, accurate footage measurements not possible.
(2) Core breaks cannot be matched, accurate footage measurements not possible.

ROCKY FLATS PLANT

FIGURE NO.

LOG OF BORING NO. 27-86

GEOLOGIST(S): LAA
DATE: 8/24/89
PROJECT NO:

TOP/BOTTOM OF CORE IN BOX	TOP/BOTTOM OF INTERVAL	FEET OF CORE IN INTERVAL IN BOX	SAMPLE NUMBER	FRACTURE ANGLE	BEDDING ANGLE	GRAIN SIZE DISTRIBUTION	USCS SYMBOL	DEPTH IN FEET	LITHOLOGIC LOG	LITHOLOGIC DESCRIPTION
Box 1 of 8	31.5	0						31		
	33.5	1.9 (1)	SL			Clay >70%		32, 33		Claystone. Grayish orange to lt. brownish gray (10yr 7/4) to (5y 6/1). mod. weathered, mod friable massive bedding, some iron staining in fractures. Trace carb material
	36.4	0						34, 35, 36		No Sample.
	38.5	1.55 (1)	SL			Clay >60% Silt ~30%		37, 38		Silty Claystone. Very lt. gray (N8) to Dk. yellowish orange (10yr 6/6). Mod weathered, slightly to mod. friable. Bedding appears horizontal but slightly disturbed. Trace carb. material + iron staining.
Box 2 of 8	39.85							39		No Sample.

NOTES: General USCS is modified for this log as follows:
Material amounts are estimated by % volume instead of % weight.
(1) Badly broken core, accurate footage measurements not possible.
(2) Core breaks cannot be matched, accurate footage measurements not possible.

ROCKY FLATS PLANT

FIGURE NO.

LOG OF BORING NO. 27-86

GEOLOGIST(S): UTT

DATE: 8/24/87

PROJECT NO: 667-1122

TOP/BOTTOM OF CORE IN BOX	TOP/BOTTOM OF INTERVAL	FEET OF CORE IN INTERVAL IN BOX	SAMPLE NUMBER	FRACTURE ANGLE	BEDDING ANGLE	GRAIN SIZE DISTRIBUTION	USCS SYMBOL	DEPTH IN FEET	LITHOLOGIC LOG	LITHOLOGIC DESCRIPTION
Box 2 of 8	39.85 / 43.5	3.7(1)		45°		Clay >50%		41, 42, 43		Silty Claystone. Lt. brownish gray (5yr 6/1). Mod weathered. Mod. to slightly friable. Bedding not evident. Trace $CaCO_3$, carb. material. Trace carb. material.
	43.5 / 46.0	0						44, 45, 46		No Sample
47.5	46.0 / 47.5	1.4(1)				Clay >50%		47		Same as above. Some iron staining, some carb. material.
Box 3 of 8	47.5 / 49.3	1.85(1)				Clay >50%		48, 49		Same as above
	49.3 / 51.0↓	1.85								See next page for description.

NOTES: General USCS is modified for this log as follows:
Material amounts are estimated by % volume instead of % weight.
(1) Badly broken core, accurate footage measurements not possible.
(2) Core breaks cannot be matched, accurate footage measurements not possible.

ROCKY FLATS PLANT

FIGURE NO.

LOG OF BORING NO. 27-86

GEOLOGIST(S): UAA
DATE: 8/24/89
PROJECT NO: 667-1141

TOP/BOTTOM OF CORE IN BOX	TOP/BOTTOM OF INTERVAL	FEET OF CORE IN INTERVAL IN BOX	SAMPLE NUMBER	FRACTURE ANGLE	BEDDING ANGLE	GRAIN SIZE DISTRIBUTION	USCS SYMBOL	DEPTH IN FEET	LITHOLOGIC LOG	LITHOLOGIC DESCRIPTION
Box 3 of 8	49.3↑ – 51.0		SL	40°		Clay >70%		51		Silty Claystone. Brownish gray (5yr 4/1). Mod. weathered. Slightly to mod. friable. Bedding appears massive. Some possible slickensides on fractures.
	51.0 – 52.5	1.5(1)				Clay >70%		52		Same as above. Trace carb. material.
	52.5 – 54.0	0						53, 54		No Sample.
	54.0 – 55.7	1.7(1)				Clay >50%		55		Same as above.
Box 4 of 8	55.7 – 57.5	1.8(1)				Clay >50%		56, 57		Same as above. Some carb. material. Begin New Box ↓
	57.5 – 58.3	0						58		No Sample
	58.3 – 62.5↓	4.0(1)				Clay >50%		59		Same as above. Some Mod. yellowish brown (10yr 5/4) discoloration in matrix and small siltstone pebbles (rounded) in matrix.

NOTES: General USCS is modified for this log as follows:
Material amounts are estimated by % volume instead of % weight.
(1) Badly broken core, accurate footage measurements not possible.
(2) Core breaks cannot be matched, accurate footage measurements not possible.

LOG OF BORING NO. 27-86

GEOLOGIST(S): LAA
DATE: 8/~~23~~ 24/89

PROJECT NO: 667 (122

TOP/BOTTOM OF CORE IN BOX	TOP/BOTTOM OF INTERVAL	FEET OF CORE IN INTERVAL IN BOX	SAMPLE NUMBER	FRACTURE ANGLE	BEDDING ANGLE	GRAIN SIZE DISTRIBUTION	USCS SYMBOL	DEPTH IN FEET	LITHOLOGIC LOG	LITHOLOGIC DESCRIPTION
	58.3↑							61, 62		See previous page for description.
*Box 4 of 8	62.5	3.0 (2)		55°		Clay 750%		63, 64, 65		Silty Claystone Lt. Olive gray (5y 6/1). Moderately weathered. Mod. to highly friable. Bedding not evident. Some carb. material. Trace iron staining ~~carb~~ w/ unknown white mineralization in fractures.
65.5	65.5	2.0 (2)				Clay 750%		66, 67		Silty Claystone. Brownish gray (5yr 4/1). Mod. Weathered, slightly to mod. friable. Bedding appears horizontal. Some carb. material. Some grayish orange (10yr 7/4) discoloration. Some very thin (threadlike) layers v.f.g. sand. Begin Nave ↓
Box 5 of 8	67.5	1.6 (2)	SL			Clay 750%		68, 69		Same as above.
	69.1	1.7 (2)				Clay 750%				Same as above. More common v.f.g. sand layers
	70.9↓									

NOTES: General: USCS is modified for this log as follows:
Material amounts are estimated by % volume instead of % weight.
(1) Badly broken core, accurate footage measurements not possible.
(2) Core breaks cannot be matched, accurate footage measurements not possible.

ROCKY FLATS PLANT

FIGURE NO.

* Had to erase to correct diagram.

LOG OF BORING NO. 27-86

PAGE ~~5~~ 6 OF 15

GEOLOGIST(S): [illegible]
DATE: 5/24/89

PROJECT NO: 667-1122

TOP/BOTTOM OF CORE IN BOX	TOP/BOTTOM OF INTERVAL	FEET OF CORE IN INTERVAL IN BOX	SAMPLE NUMBER	FRACTURE ANGLE	BEDDING ANGLE	GRAIN SIZE DISTRIBUTION	USCS SYMBOL	DEPTH IN FEET	LITHOLOGIC LOG	LITHOLOGIC DESCRIPTION
Box 5 of 8	70.9									See previous page for description
	72.5	1.9 (2)				Clay >50%		71, 72		Silty Claystone. Brownish gray (5yr 4/1). Mod. weathered, mod friable. Bedding not evident. Trace carb. material. Some $CaCO_3$. Some lt brown (5yr 5/6) discoloration
	73.2	0 (2) ~~1.8~~ 1.4						73		No sample
	75.0	1.8 (2)				Clay >50%		74, 75		Same as above. No $CaCO_3$ or discoloration.
Box 6 of 8	77.5	2.9 (1)				Clay >50%		75, 76, 77		Silty claystone Lt. olive gray (5y 6/1). Mod. Weathered. Mod friable. Bedding appears horizontal, uneven. Some carb. material, trace iron staining.
	78.0	0						78		No Sample
	78.3	.4			≈10°	Silt >50%				Clayey siltstone. Yellowish gray (5y 8/1). Slightly weathered. Slightly friable. Slightly tilted uneven bedding. Some v.f.g. sand.
	80.2	1.85				Silt >50%		79		Same as above. Trace carb. material.

NOTES: General USCS is modified for this log as follows:
Material amounts are estimated by % volume instead of % weight.
(1) Badly broken core, accurate footage measurements not possible.
(2) Core breaks cannot be matched, accurate footage measurements not possible.

ROCKY FLATS PLANT

FIGURE NO.

LOG OF BORING NO. 27-86

PAGE 6 OF 15

GEOLOGIST(S): LAA

DATE: 8/29/89

PROJECT NO: 167-1122

TOP/BOTTOM OF CORE IN BOX	TOP/BOTTOM OF INTERVAL	FEET OF CORE IN INTERVAL IN BOX	SAMPLE NUMBER	FRACTURE ANGLE	BEDDING ANGLE	GRAIN SIZE DISTRIBUTION	USCS SYMBOL	DEPTH IN FEET	LITHOLOGIC LOG	LITHOLOGIC DESCRIPTION
	80.2									See previous page for description
Box 6 of 8	82.0	1.8 (1)		≈20°		Silt >50%		81		Clayey Siltstone. Lt. olive gray (5y 6/1). Slightly weathered. Slightly friable. Bedding possibly due to soft sed. Deform. Some v.f.g. sand. Some carb. material.
	82.5	.4				Silt >50%		82		Same as above
83.5	83.5	.9 (1)				Clay >50%		83		Silty Claystone. Brownish gray (5yr 4/1). Mod. weathered, mod. friable. Bedding not evident. Trace carb material.
	85.0	1.8 (1)				Clay >50%		84		Same as above. Highly weathered, highly friable. Box Begins
	86.8	1.8 (1)				Clay >60%		85, 86		Same as above. Mod. weathered, mod. friable
Box 7 of 8	87.5	.6				Clay >60%		87		Same as above.
	88.3	.6 (1)				Clay >70%		88		Same as above.
	90.0	1.6 (1)				Clay >70%		89		Claystone. Same as above, less silt.

NOTES: General USCS is modified for this log as follows:
Material amounts are estimated by % volume instead of % weight.
(1) Badly broken core, accurate footage measurements not possible.
(2) Core breaks cannot be matched, accurate footage measurements not possible.

ROCKY FLATS PLANT

FIGURE NO.

LOG OF BORING NO. 27.86

GEOLOGIST(S): UAA
DATE: 8/24/89

PROJECT NO: 667-1122

TOP/BOTTOM OF CORE IN BOX	TOP/BOTTOM OF INTERVAL	FEET OF CORE IN INTERVAL IN BOX	SAMPLE NUMBER	FRACTURE ANGLE	BEDDING ANGLE	GRAIN SIZE DISTRIBUTION	USCS SYMBOL	DEPTH IN FEET	LITHOLOGIC LOG	LITHOLOGIC DESCRIPTION
91.5	90.0 / 91.5	1.7 (1)				Clay 70%		91		Claystone. Brownish gray (5yr 4/1). Mod. weathered, mod. friable. Bedding appears massive. Trace Carb. material, trace silt.
	92.5					Clay 70%		92		Same as above. Possible slickensides.
	94.3							93, 94		
Box 8 of 15	96.3					Clay 70%		95, 96		Same as above
						Clay 70%		97		Same as above. Some carb. material.
								98, 99		

NOTES: General: USCS is modified for this log as follows:
Material amounts are estimated by % volume instead of % weight.
(1) Badly broken core, accurate footage measurements not possible.
(2) Core breaks cannot be matched, accurate footage measurements not possible.

ROCKY FLATS PLANT

FIGURE NO.

LOG OF BORING NO. 27-86

GEOLOGIST(S): UAA
DATE: 8/24/89

PROJECT NO: 627-1122

TOP/BOTTOM OF CORE IN BOX	TOP/BOTTOM OF INTERVAL	FEET OF CORE IN INTERVAL IN BOX	SAMPLE NUMBER	FRACTURE ANGLE	BEDDING ANGLE	GRAIN SIZE DISTRIBUTION	USCS SYMBOL	DEPTH IN FEET	LITHOLOGIC LOG	LITHOLOGIC DESCRIPTION
								91		
								92		
								93		
								94		
								95		
95.8	95.8	1.7 (1)				Clay ~5%		96		Silty Claystone. Lt. olive gray. (5Y 6/1). Slightly to mod. weathered. Slightly Friable. Bedding uneven horizontal. Some very thin (<1 mm) layers silt + v.f.g. sand. Some carb. material. ↓
	97.5							97		
		1.7 (2)				Clay ~5%		98		Same as above.
box 9	99.5							99		
	↓ 101.5									See next page for description.

NOTES: General USCS is modified for this log as follows:
Material amounts are estimated by % volume instead of % weight.
(1) Badly broken core, accurate footage measurements not possible.
(2) Core breaks cannot be matched, accurate footage measurements not possible.

ROCKY FLATS PLANT

FIGURE NO.

LOG OF BORING NO. 27-86

GEOLOGIST(S): LAA
DATE: 8/24/89

PROJECT NO: 6677-1122

TOP/BOTTOM OF CORE IN BOX	TOP/BOTTOM OF INTERVAL	FEET OF CORE IN INTERVAL IN BOX	SAMPLE NUMBER	FRACTURE ANGLE	BEDDING ANGLE	GRAIN SIZE DISTRIBUTION	USCS SYMBOL	DEPTH IN FEET	LITHOLOGIC LOG	LITHOLOGIC DESCRIPTION
Box 9	99.5 ↑ – 101.5	1.8				Clay ≈50%		101		Silty Claystone. Lt. olive gray to olive gray. (5y 6/1 to 4/1). Slightly weathered. Slightly friable. Bedding in thin layers. Uneven horizontal. Some silt in thin layers (<1 mm) and v.f.g. sand. Trace carb. material.
	101.5 – 102.5	.75				"		102		Same as above.
	102.5 – 103.7	0						103		No Sample.
	103.7 – 104.6	.75 (2)				Clay ≈50%		104		Same as above
	104.6 – 106.5	.85				Clay ≈50%		105, 106		Same as above.
Box 10	106.5 – 107.5	1.0 (2)						107		Same as above
	107.5 – 108.2	.75 (2)	SL		40°-50°			108		Same as above. Bedding to tilt.
	108.2 – 110.0	1.7 (2)						109		Same as above. Bedding does not appear to be tilted. Some carb material.

NOTES: General: USCS is modified for this log as follows:
Material amounts are estimated by % volume instead of % weight.
(1) Badly broken core, accurate footage measurements not possible.
(2) Core breaks cannot be matched, accurate footage measurements not possible.

ROCKY FLATS PLANT

FIGURE NO.

LOG OF BORING NO. 27-86

GEOLOGIST(S): VAA
DATE: 8/24/89

PROJECT NO: 667-1122

TOP/BOTTOM OF CORE IN BOX	TOP/BOTTOM OF INTERVAL	FEET OF CORE IN INTERVAL IN BOX	SAMPLE NUMBER	FRACTURE ANGLE	BEDDING ANGLE	GRAIN SIZE DISTRIBUTION	USCS SYMBOL	DEPTH IN FEET	LITHOLOGIC LOG	LITHOLOGIC DESCRIPTION
Box 10	100.0 110.5	.7(1)					Clay >50%			Silty Claystone. Lt. olive gray to brownish gray. (5y6/1 to 5y4/1). Slightly weathered. Slightly friable. Distorted layered bedding layers very thin (some less than 1 mm). Some v.f.g. sand [illegible] carbs.
	114.8	0						111 112 113 114		No Sample
	117.0	* 1.8(2)		90°			Clay >50% Clay >80%	115 116 117		Same as above, grades to claystone toward bottom. Some slickensides in vertical fractures in claystone.
	118.5	0						118		No Sample
119.5	119.5	(2) 1.8					Clay >50%	119		Silty Claystone. Lt. olive gray to olive gray (5y6/1 to 4/1). Slightly weathered, slightly friable. Bedding not evident. Trace carb. material.
Bot 11	120									

Begin New Box ↓

NOTES: General: USCS is modified for this log as follows:
Material amounts are estimated by % volume instead of % weight.
(1) Badly broken core, accurate footage measurements not possible.
(2) Core breaks cannot be matched, accurate footage measurements not possible.

ROCKY FLATS PLANT

FIGURE NO.

* Had to erase to correct diagram

LOG OF BORING NO. 27-86

GEOLOGIST(S): LAA
DATE: 8/25/89

PROJECT NO: 667-1122

TOP/BOTTOM OF CORE IN BOX	TOP/BOTTOM OF INTERVAL	FEET OF CORE IN INTERVAL IN BOX	SAMPLE NUMBER	FRACTURE ANGLE	BEDDING ANGLE	GRAIN SIZE DISTRIBUTION	USCS SYMBOL	DEPTH IN FEET	LITHOLOGIC LOG	LITHOLOGIC DESCRIPTION
120.0	120.0 * 122.0	(2) 1.6					Clay >80%	121		Claystone. Olive gray (5y 4/1). Slightly weathered, slightly friable. Bedding appears massive. Trace carb. material. Some possible slickensides in fractures.
	124.0	(2) 1.7	SL				Clay >50%	122, 123		Silty Claystone. Lt. Olive gray (5y 6/1). Slightly weathered, slightly friable. Massive bedding. Trace carb material.
	126.0	(2) 1.75					Clay >60%	124, 125		Same as above, less silty
	127.0	(2) 1.25					Clay >50%	126		Same as above more silty
	127.4	.35(2)					Clay >50%	127		Same as above.
129.5	129.5	(2) 1.65					Clay >50%	128, 129		Sandy Claystone. Brownish gray (5yr 4/1). Slightly weathered, slightly friable. Massive bedding. Some carb material. Sand v.fg. well sorted.
	130.0	.3(2)				Clay >50%				Same as above. Very thin coal layer ≈ 1mm.

Begin New Box ↓

NOTES: General: USCS is modified for this log as follows:
Material amounts are estimated by % volume instead of % weight.
(1) Badly broken core, accurate footage measurements not possible.
(2) Core breaks cannot be matched, accurate footage measurements not possible.

ROCKY FLATS PLANT

FIGURE NO.

* Had to erase to correct diagram

LOG OF BORING NO. 27-86

GEOLOGIST(S): UAA
DATE: 8/24/89

PROJECT NO: 667-1122

TOP/BOTTOM OF CORE IN BOX	TOP/BOTTOM OF INTERVAL	FEET OF CORE IN INTERVAL IN BOX	SAMPLE NUMBER	FRACTURE ANGLE	BEDDING ANGLE	GRAIN SIZE DISTRIBUTION	USCS SYMBOL	DEPTH IN FEET	LITHOLOGIC LOG	LITHOLOGIC DESCRIPTION
Box 12 5	130.0 – 131.2					Silt >50%		131		Clayey Siltstone. Pinkish gray to Lt. olive gray (5yr 8/1 to 5y 6/1). Slightly weathered, slightly friable. Bedding disturbed, probably from soft sed. deformation. Some carb. material at top. Some v.f.g. sand, especially at top. Traces/pace yellowish orange (10yr 8/6 silt?).
	131.2 – 132.0				40°	Silt >50% Sand ≈30%		132		Sandy Siltstone. Pinkish gray (5yr 8/1). Mod. weathered, mod. friable. Tilted, layered bedding ≈1 in thick layers. Sand v.f.g. Some clay.
	132.0 – 133.5	0						133		No Sample.
	133.5 – 134.3					Silt >50% Sand ≈30%		134		Same as above, grading to [illegible] Claystone.
	134.3 – 136.2					Clay >50%		135, 136		Silty Claystone. Olive gray (5y 4/1). Slightly weathered, slightly friable. Bedding not evident. Some small bodies of silt (≈1 in. in dia.).
	136.2 – 137.0					Clay >50% Silt ≈40%		137		Same as above with some siltier layers UA
	137.0 – 138.8	0						138		No Sample
	138.8 – 139.8					Clay >50%		139		Silty Claystone as above.

NOTES: General USCS is modified for this log as follows:
Material amounts are estimated by % volume instead of % weight.
(1) Badly broken core, accurate footage measurements not possible.
(2) Core breaks cannot be matched, accurate footage measurements not possible.

LOG OF BORING NO. 27-86

GEOLOGIST(S): CAA
DATE: 3/25/89

PROJECT NO: 607-122

TOP/BOTTOM OF CORE IN BOX	TOP/BOTTOM OF INTERVAL	FEET OF CORE IN INTERVAL IN BOX	SAMPLE NUMBER	FRACTURE ANGLE	BEDDING ANGLE	GRAIN SIZE DISTRIBUTION	USCS SYMBOL	DEPTH IN FEET	LITHOLOGIC LOG	LITHOLOGIC DESCRIPTION
	139.5	(1) 1.7					Clay >50%	141		Silty Claystone. Lt. olive gray (5y 6/1). Slightly weathered, slightly friable, massive bedding.
141.5	141.5									
	142.0	.45	SL				Clay >50%	142		Same as above.
	143.5	(1) 1.3					Clay >50%	143		Same as above. Uneven layered bedding, some carb. material.
	145.2	1.55					Clay >50%	144 145		Same as above, some silt layers, very thin (<1mm.) Trace spotty iron staining.
	147.0	(2) 1.85			≈25°		Clay >50%	146 147		Same as above, interbedded in very fine layers w/v.f.g. sandstone. (layers <1 mm) Trace carb. material.
Box 13	149.0	(2) 1.8					Clay >50%	148 149		Same as above. Some grayish orange (10yr 7/4) discolored silt in some areas
	150.8	(2) 1.8					Clay >50%			Same as above.

NOTES: General USCS is modified for this log as follows:
Material amounts are estimated by % volume instead of % weight.
(1) Badly broken core, accurate footage measurements not possible.
(2) Core breaks cannot be matched, accurate footage measurements not possible.

ROCKY FLATS PLANT

FIGURE NO.

LOG OF BORING NO. 27-86

GEOLOGIST(S): [illegible]
DATE: 8/25/91

PROJECT NO: 007-1122

TOP/BOTTOM OF CORE IN BOX	TOP/BOTTOM OF INTERVAL	FEET OF CORE IN INTERVAL IN BOX	SAMPLE NUMBER	FRACTURE ANGLE	BEDDING ANGLE	GRAIN SIZE DISTRIBUTION	USCS SYMBOL	DEPTH IN FEET	LITHOLOGIC LOG	LITHOLOGIC DESCRIPTION
150.8	150.8 ↑					Clay 50%				See previous page for description of this interval.
Box 14	152.0	(2) 1.2				Clay 50%		151		Silty Claystone. Brownish gray to pinkish gray (5yr 6/1 to 8/1). Slightly weathered, slightly friable. Bedding in thin laminations predominantly horizontal. Some silt in brown layers 2-3mm. Some (brown? (5yr 5/4)) discoloration. Some carbonate coat
	153.8	0						152 153		No Sample
	154.3	.3(1)				Clay 25%		154		Same as above.
	156.3	(1) 1.85	SL			Sandy 25%		155 156		~~Same as above. Also has mod. brown to very dusky red coloring. Probably due to a high iron content. Bedding has well defined silt layers [illegible]. Bedding is distorted. Not been layered [illegible] probably from~~ LA
	157.0	(2) .6				Clay 75%		157		Silty Claystone. Lt. brownish gray (5yr 6/1). Slightly weathered, slightly ~~weathered~~ friable. Massive bedding. Trace carbs.
										Bottom of Boxes
								158 159		Sandstone. Brownish gray (5yr 4/1) to mod. yellowish brown to very dusky red (10yr 5/4 to 10R 2/2). Slightly weathered, slightly to non-friable. Bedding had been layered but is distorted probably from tectonic activity or slumping. Contains healed fractures. Trace carbs. Some silt. Sand v.f.g.

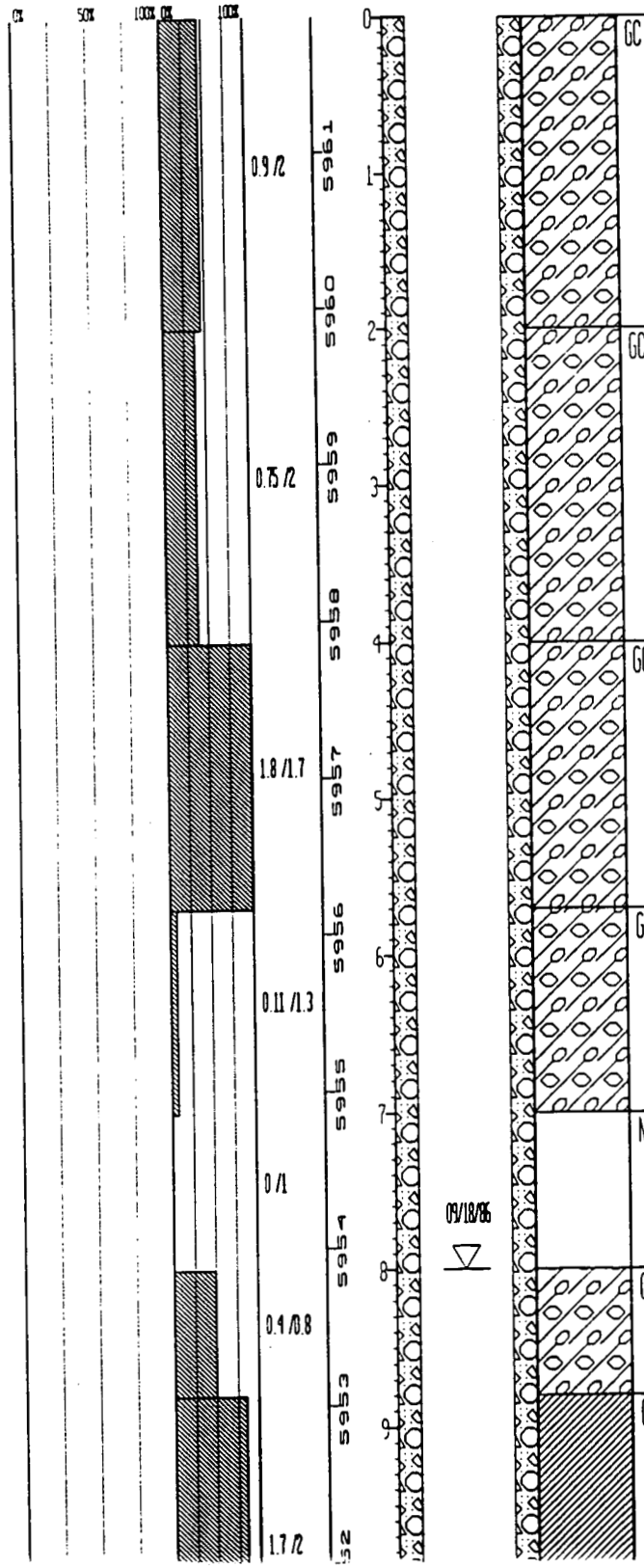
NOTES: General USCS is modified for this log as follows:
Material amounts are estimated by % volume instead of % weight.
(1) Badly broken core, accurate footage measurements not possible.
(2) Core breaks cannot be matched, accurate footage measurements not possible.

ROCKY FLATS PLANT

FIGURE NO.

STATE PLANE COORDINATE:		TOTAL DEPTH (FT): 157	GROUND ELEVATION (FT):	5961.86	PROJECT NUMBER:	667.11	LOG OF BORING NUMBER:
NORTH:	750796	AREA: SOLAR POND	CASING DIAMETER (IN):	2 ID	GEOLOGIST:	LAA	27-86
EAST:	2085239	LOCATOR NUMBER: M10	BOREHOLE DIAMETER (IN):	7.25	DATE DRILLED:	09/18/86	

REMARKS: Hollow Stem Auger/NC Core.



UNIFIED SOILS CLASSIFICATION OR ROCK TYPE	DESCRIPTION
GC:	Clayey Gravel - med. gray (N5), angular to sub-rounded, well graded, granules to 6.5 cm. Matrix sandy clay, mod. brown (5YR 3/4), some sand VFG to VCG, some CaCO3.
GC:	Same as above, silty clay matrix, some sand.
GC:	GRAVEL in Caliche Matrix - gravel as above. Matrix very pale orange to white (10YR 8/2 to N9), some silt and sand.
GC:	This interval consists of only a few pieces of sandy clayey gravel. Not enough sample to characterize interval.
NO SAMPLE:	
GC:	GRAVEL - med. dk. gray (N4), angular to sub-rounded, poorly graded, max. size approx. 5 cm., some sand and clay.
CH:	Clay - very lt. gray (N8) to grayish orange (10YR 7/4), est. plast. mod. to high, some gravel, granules to approx. 3 cm., angular to sub-rounded, thin caliche area (approx. 2 cm.), trace sand and silt.

STATE PLANE COORDINATE:	TOTAL DEPTH (FT): 157	GROUND ELEVATION (FT):	5961.86	PROJECT NUMBER:	667.11
NORTH: 750796	AREA: SOLAR POND	CASING DIAMETER (IN):	2 ID	GEOLOGIST:	LAA
EAST: 2085239	LOCATOR NUMBER: M10	BOREHOLE DIAMETER (IN):	7 25	DATE DRILLED:	09/18/86

LOG OF BORING NUMBER: 27-86

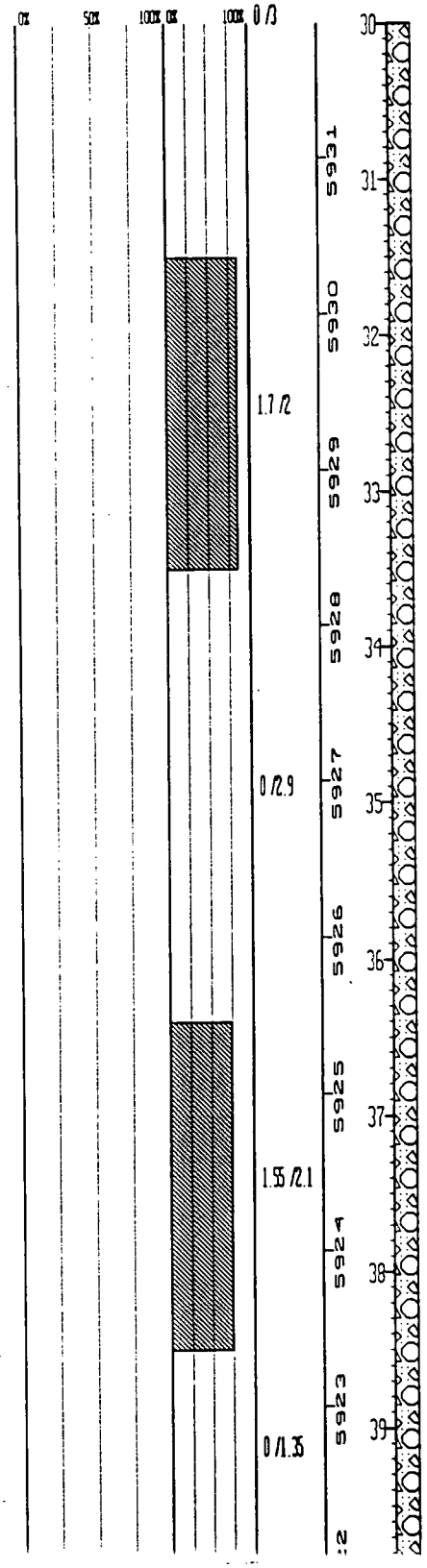
REMARKS: Hollow Stem Auger/NC Core.

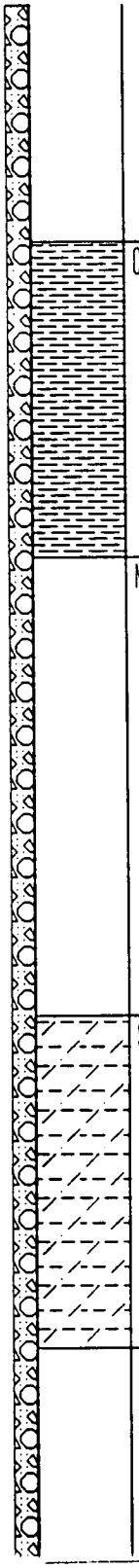
CHEMICAL SAMPLE DEPTH / GRADATIONAL SAMPLE DEPTH	SAMPLE NUMBER	SAMPLE GRAIN SIZE (0% 50% 100%)	PERCENT RECOVERY (100% OR 100%)	RECOVERY/INTERVAL	DATUM (FT)	DEPTH (FT)	WELL OR PIEZOMETER CONSTRUCTION	LITHOLOGY	UNIFIED SOILS CLASSIFICATION OR ROCK TYPE	DESCRIPTION
				0.4/1.5	5941	20–21			SILTY CLAYSTONE	Very pale orange (10YR 8/2) to grayish orange (10YR 7/4), highly weathered, mod. friable, bedding not evident.
					5940	22			NO SAMPLE	
				0/3.05	5939	23				
					5938	24				
					5937	25			SILTY CLAYSTONE	Very pale orange to dk. yellowish orange (10YR 8/2 to 6/6), mod. weathered, slightly friable, some iron staining, carb. material in fractures, bedding not evident, trace CaCO3.
				2.9/3.45	5936	26				
					5935	27				
					5934	28				
					5933	29			NO SAMPLE	
					32					

STATE PLANE COORDINATE:	TOTAL DEPTH (FT): 157	GROUND ELEVATION (FT): 5961.86	PROJECT NUMBER: 667.11	LOG OF BORING NUMBER:
NORTH: 750796	AREA: SOLAR POND	CASING DIAMETER (IN): 2 ID	GEOLOGIST: LAA	27-86
EAST: 2085239	LOCATOR NUMBER: M10	BOREHOLE DIAMETER (IN): 7 25	DATE DRILLED: 09/18/86	

REMARKS: Hollow Stem Auger/NC Core.

CHEMICAL SAMPLE DEPTH
GRADATIONAL SAMPLE D
SAMPLE NUMBER
SAMPLE GRAIN SIZE (0% 50% 100%)
PERCENT RECOVERY (0% 100%)
RECOVERY/INTERVAL
DATUM (FT)
DEPTH (FT)
WELL OR PIEZOMETER CONSTRUCTION
LITHOLOGY
UNIFIED SOILS CLASSIFICATION OR ROCK TYPE
DESCRIPTION



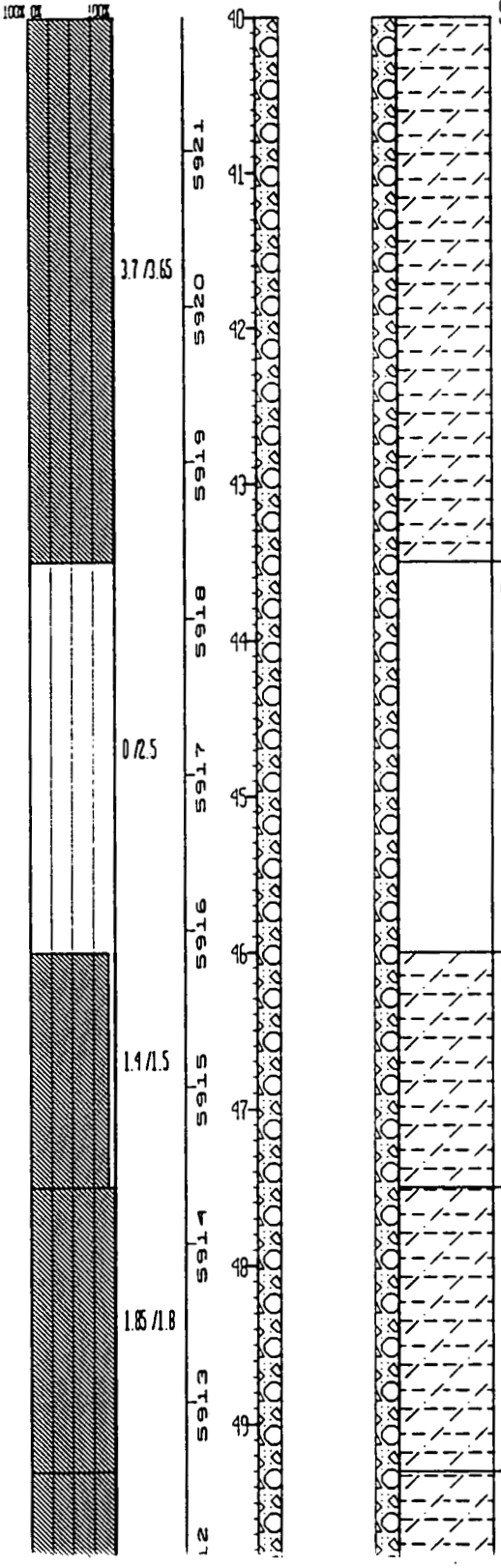


UNIFIED SOILS CLASSIFICATION OR ROCK TYPE	DESCRIPTION
CLAYSTONE:	Grayish orange to lt. brownish gray (10YR 7/4) to (5Y 6/1), mod. weathered, mod. friable, massive bedding, some silt, iron staining in fractures, trace carb. material.
NO SAMPLE:	
SILTY CLAYSTONE:	Very light gray (N8) to dk. yellowish orange (10YR 6/6), mod. weathered, slightly to mod. friable, bedding appears horizontal, but slightly distorted, trace carb. material and iron staining.
NO SAMPLE:	

STATE PLANE COORDINATE:		TOTAL DEPTH (FT): 157	GROUND ELEVATION (FT):	5961.86	PROJECT NUMBER:	667.11	LOG OF BORING NUMBER:
NORTH:	750796	AREA: SOLAR POND	CASING DIAMETER (IN):	2 ID	GEOLOGIST:	LAA	27-86
EAST:	2085239	LOCATOR NUMBER: M10	BOREHOLE DIAMETER (IN):	7 25	DATE DRILLED:	09/18/86	

REMARKS: Hollow Stem Auger/NC Core.

CHEMICAL SAMPLE DEPTH
GRADATIONAL SAMPLE DEPTH
SAMPLE NUMBER
SAMPLE GRAIN SIZE (0% 50% 100%)
PERCENT RECOVERY (0% 100%)
RECOVERY/INTERVAL
DATUM (FT)
DEPTH (FT)
WELL OR PIEZOMETER CONSTRUCTION
LITHOLOGY
UNIFIED SOILS CLASSIFICATION OR ROCK TYPE
DESCRIPTION



SILTY CLAYSTONE: Lt. brownish gray (5YR 6/1), mod. weathered, mod. to slightly friable, bedding not evident, trace CaCO3, carb. material.

NO SAMPLE:

SILTY CLAYSTONE: Same as above, some iron staining, some carb. material.

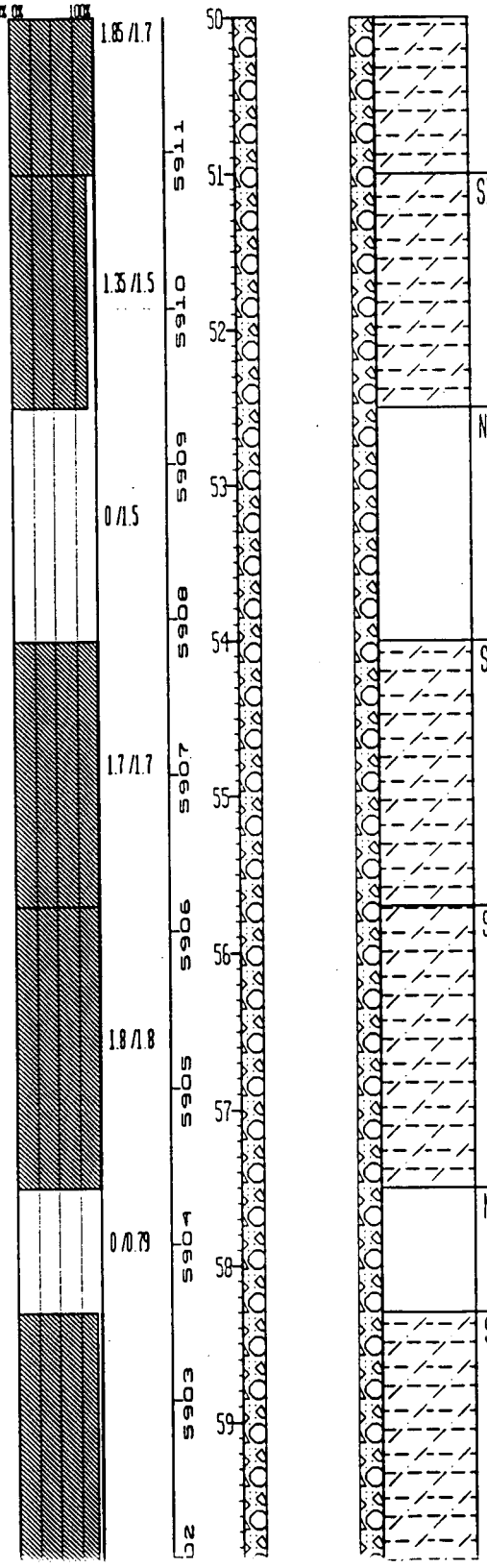
SILTY CLAYSTONE: Same as above.

SILTY CLAYSTONE: Brownish gray (5YR 4/1), mod. weathered, slightly to mod. friable, bedding appears massive, some possible slickensides on fractures.

STATE PLANE COORDINATE:	TOTAL DEPTH (FT): 157	GROUND ELEVATION (FT):	5961.86	PROJECT NUMBER:	567.11	LOG OF BORING NUMBER:	
NORTH: 750796	AREA: SOLAR POND	CASING DIAMETER (IN):	2 ID	GEOLOGIST:	LAA		27-86
EAST: 2085239	LOCATOR NUMBER: M10	BOREHOLE DIAMETER (IN):	7.25	DATE DRILLED:	09/18/86		
REMARKS: Hollow Stem Auger/NC Core.							

CHEMICAL SAMPLE DEPTH
GRADATIONAL SAMPLE
SAMPLE NUMBER

SAMPLE GRAIN SIZE (0% 50% 100%) | PERCENT RECOVERY (0% 100%) | RECOVERY/INTERVAL | DATUM (FT) | DEPTH (FT) | WELL OR PIEZOMETER CONSTRUCTION | LITHOLOGY | UNIFIED SOILS CLASSIFICATION OR ROCK TYPE | DESCRIPTION



SILTY CLAYSTONE: Same as above, trace carb. material.

NO SAMPLE:

SILTY CLAYSTONE: Same as above.

SILTY CLAYSTONE: Same as above, some carb. material.

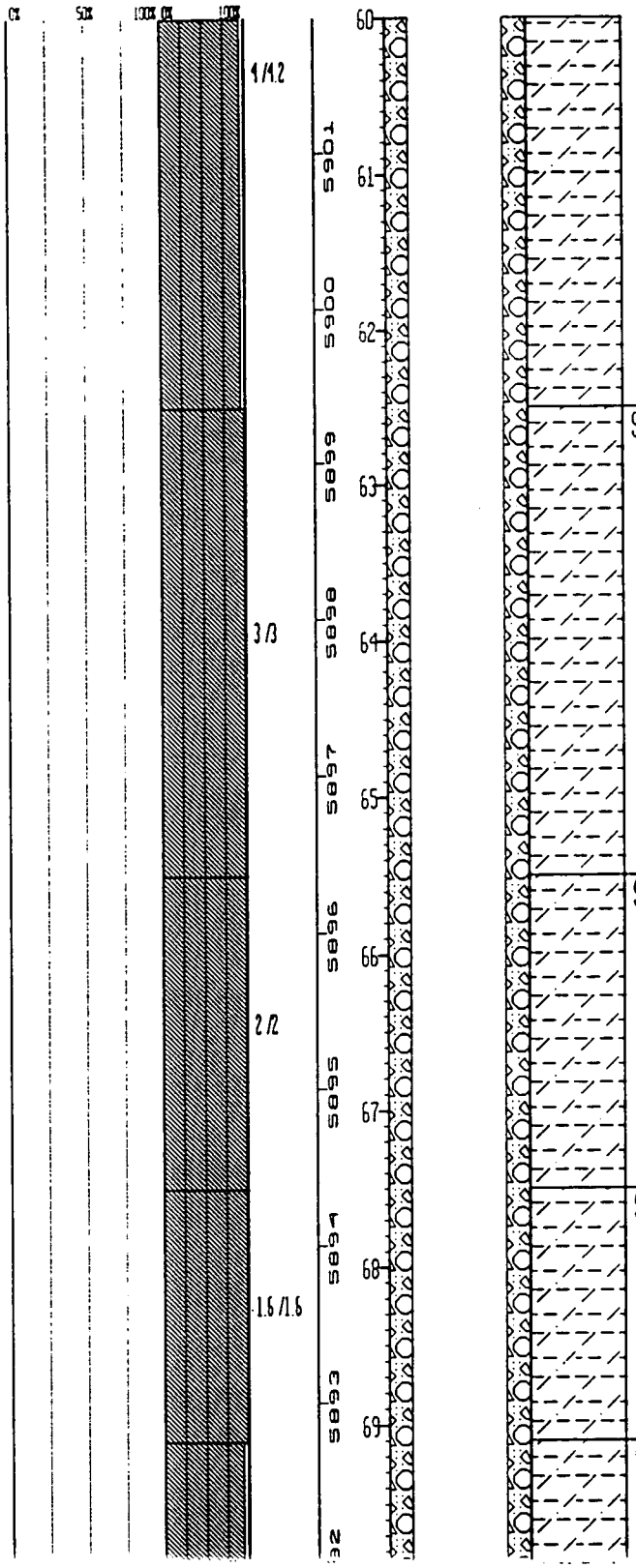
NO SAMPLE:

SILTY CLAYSTONE: Same as above. Some mod. yellowish brown (10YR 5/4) discoloration in matrix and small siltstone pebbles (rounded) in matrix.

STATE PLANE COORDINATE:		TOTAL DEPTH (FT): 157	GROUND ELEVATION (FT):	5961.86	PROJECT NUMBER:	667.11	LOG OF BORING NUMBER:
NORTH:	750796	AREA: SOLAR POND	CASING DIAMETER (IN):	2 ID	GEOLOGIST:	LAA	27-86
EAST:	2085239	LOCATOR NUMBER: M10	BOREHOLE DIAMETER (IN):	7 25	DATE DRILLED:	09/18/86	

REMARKS: Hollow Stem Auger/NC Core.

CHEMICAL SAMPLE DEPTH
GRADATIONAL SAMPLE DEPTH
SAMPLE NUMBER
SAMPLE GRAIN SIZE
PERCENT RECOVERY
RECOVERY/INTERVAL
DATUM (FT)
DEPTH (FT)
WELL OR PIEZOMETER CONSTRUCTION
LITHOLOGY
UNIFIED SOILS CLASSIFICATION OR ROCK TYPE
DESCRIPTION



SILTY CLAYSTONE: Lt. olive gray (5Y 6/1), moderately weathered, mod. to highly friable, bedding not evident, some carb. material, trace iron staining, unknown white mineralization in fractures.

SILTY CLAYSTONE: Brownish gray (5YR 4/1), mod. weathered, slightly to mod. friable, bedding appears horizontal, some carb. material, some grayish orange (10YR 7/4) discoloration, some very thin (threadlike) layers VFG sand.

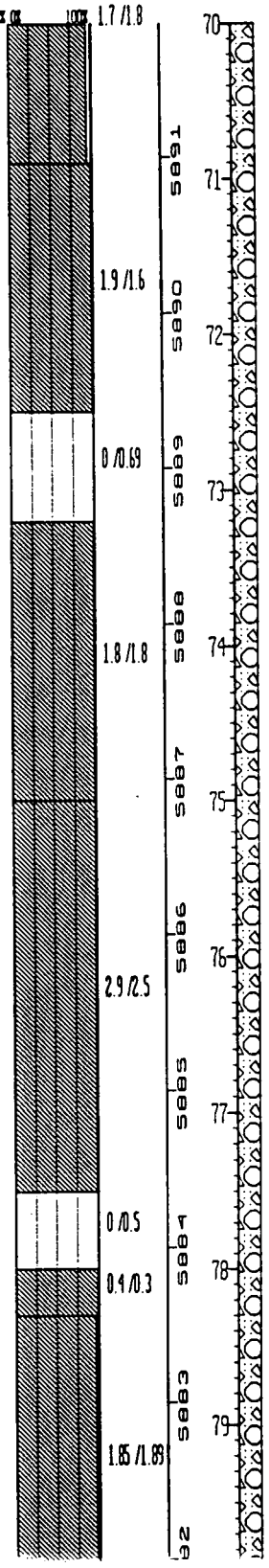
SILTY CLAYSTONE: Same as above.

SILTY CLAYSTONE: Same as above, more common VFG sand layers.

STATE PLANE COORDINATE:	TOTAL DEPTH (FT): 157	GROUND ELEVATION (FT): 5961.86	PROJECT NUMBER: 667.11	LOG OF BORING NUMBER:
NORTH: 750796	AREA: SOLAR POND	CASING DIAMETER (IN): 2 ID	GEOLOGIST: LAA	27-86
EAST: 2085239	LOCATOR NUMBER: M10	BOREHOLE DIAMETER (IN): 7.25	DATE DRILLED: 09/18/86	

REMARKS: Hollow Stem Auger/NC Core.

CRITICAL SAMPLE DEPTH
GRADATIONAL SAMPLE
SAMPLE NUMBER
SAMPLE GRAIN SIZE (0% 50% 100%)
PERCENT RECOVERY (0% 100%)
RECOVERY/INTERVAL
DATUM (FT)
DEPTH (FT)
WELL OR PIEZOMETER CONSTRUCTION
LITHOLOGY



UNIFIED SOILS CLASSIFICATION OR ROCK TYPE	DESCRIPTION
SILTY CLAYSTONE	Brownish gray (5YR 4/1), mod. weathered, mod. friable, bedding not evident, some CaCO3, trace carb. material, some CaCO3, some lt. brown (5YR 5/6) discoloration.
NO SAMPLE	
SILTY CLAYSTONE	Same as above, no CaCO3 or discoloration.
SILTY CLAYSTONE	Lt. olive gray (5Y 6/1), mod. weathered, mod. friable, bedding appears horizontal, uneven, some carb. material, trace iron staining.
NO SAMPLE	
CLAYEY SILTSTONE	Yellowish gray (5Y 8/1), slightly weathered, slightly friable, slightly tilted uneven bedding, some VFG sand.
CLAYEY SILTSTONE	Same as above, trace carb. material.

STATE PLANE COORDINATE:	TOTAL DEPTH (FT): 157	GROUND ELEVATION (FT): 5961.86	PROJECT NUMBER: 667.11	LOG OF BORING NUMBER:
NORTH: 750796	AREA: SOLAR POND	CASING DIAMETER (IN): 2 ID	GEOLOGIST: LAA	27-86
EAST: 2085239	LOCATOR NUMBER: M10	BOREHOLE DIAMETER (IN): 7 25	DATE DRILLED: 09/18/86	

REMARKS: Hollow Stem Auger/NC Core.

CRITICAL SAMPLE DEPTH
GRADATIONAL SAMPLE DEPTH
SAMPLE NUMBER

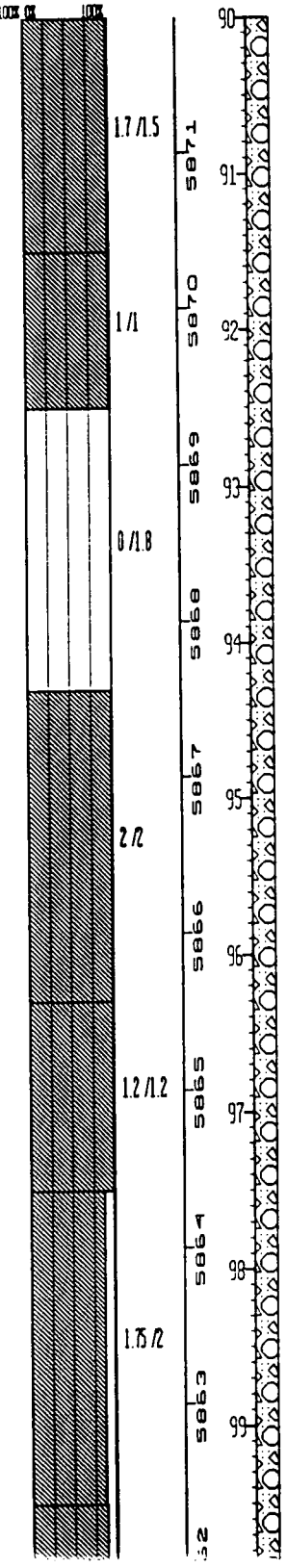
SAMPLE GRAIN SIZE	PERCENT RECOVERY	RECOVERY/INTERVAL	DATUM (FT)	DEPTH (FT)	WELL OR PIEZOMETER CONSTRUCTION	LITHOLOGY	UNIFIED SOILS CLASSIFICATION OR ROCK TYPE	DESCRIPTION
		1.8 /1.8	5881	80–81			CLAYEY SILTSTONE	Lt. olive gray (5Y 6/1), slightly weathered, slightly friable, distorted bedding possibly due to soft sed. deform., some VFG sand, some carb. material.
		0.4 /0.5	5880	82			CLAYEY SILTSTONE	Same as above.
		0.9 /1	5879	83			SILTY CLAYSTONE	Brownish gray (5YR 4/1), mod. weathered, mod. friable, bedding not evident, trace carb. material.
		1.8 /1.5	5878	84			SILTY CLAYSTONE	Same as above, highly weathered, highly friable.
		1.8 /1.8	5877	85–86			SILTY CLAYSTONE	Same as above, mod. weathered, mod. friable..
		0.6 /0.69	5876	87			SILTY CLAYSTONE	Same as above.
		0.6 /0.8	5875	88			SILTY CLAYSTONE	Same as above.
		1.6 /1.7	5874	89			CLAYSTONE	Same as above, less silt.
			5873	90				

STATE PLANE COORDINATE:	TOTAL DEPTH (FT): 157	GROUND ELEVATION (FT): 5961.86	PROJECT NUMBER: 667.11	LOG OF BORING NUMBER:
NORTH: 750796	AREA: SOLAR POND	CASING DIAMETER (IN): 2 ID	GEOLOGIST: LAA	27-86
EAST: 2085239	LOCATOR NUMBER: M10	BOREHOLE DIAMETER (IN): 7.25	DATE DRILLED: 09/18/86	

REMARKS: Hollow Stem Auger/NC Core.

CRITICAL SAMPLE DEPTH
GRADATIONAL SAMPLE
SAMPLE NUMBER

SAMPLE GRAIN SIZE (0% 50% 100%) | PERCENT RECOVERY (0% 100%) | RECOVERY/INTERVAL | DATUM (FT) | DEPTH (FT) | WELL OR PIEZOMETER CONSTRUCTION | LITHOLOGY | UNIFIED SOILS CLASSIFICATION OR ROCK TYPE | DESCRIPTION



UNIFIED SOILS CLASSIFICATION OR ROCK TYPE	DESCRIPTION
CLAYSTONE:	Brownish gray (5YR 4/1), mod. weathered, mod. friable, bedding appears massive, trace carb. material, trace silt.
CLAYSTONE:	Same as above, possible slickensides.
NO SAMPLE:	
CLAYSTONE:	Same as above.
CLAYSTONE:	Same as above. These intervals overlap with first interval in next box (95.8 ft. to 97.5 ft.), described as silty claystone as below.
SILTY CLAYSTONE:	Lt. olive gray (5Y 6/1), slightly to mod. weathered, slightly friable, bedding uneven horizontal, some very thin (<1 mm) layers silt and VFG sand, some carb. material.
SILTY CLAYSTONE:	Lt. olive gray to olive gray (5Y 6/1) to 4/1), slightly weathered, slightly friable, bedding in thin layers, uneven horizontal, some silt in

STATE PLANE COORDINATE:	TOTAL DEPTH (FT): 157	GROUND ELEVATION (FT): 5961.86	PROJECT NUMBER: 667.11	LOG OF BORING NUMBER:
NORTH: 750796	AREA: SOLAR POND	CASING DIAMETER (IN): 2 ID	GEOLOGIST: LAA	27-86
EAST: 2085239	LOCATOR NUMBER: M10	BOREHOLE DIAMETER (IN): 7.25	DATE DRILLED: 09/18/86	

REMARKS: Hollow Stem Auger/NC Core.

CHEMICAL SAMPLE DEPTH
GRADATIONAL SAMPLE DEPTH
SAMPLE NUMBER
SAMPLE GRAIN SIZE (0% 50% 100%)
PERCENT RECOVERY (100% OR 100%)

RECOVERY/INTERVAL	DATUM (FT)	DEPTH (FT)	WELL OR PIEZOMETER CONSTRUCTION	LITHOLOGY	UNIFIED SOILS CLASSIFICATION OR ROCK TYPE	DESCRIPTION
1.8 /2	5961	100				thin layers (<1 mm) and VFG sand, trace carb. material.
0.75 /1	5960	101				SILTY CLAYSTONE: Same as above.
0 /1.2	5959	102				NO SAMPLE:
0.75 /0.9	5958	103				SILTY CLAYSTONE: Same as above.
0.85 /1.9	5957	104				SILTY CLAYSTONE: Same as above.
1 /1	5956	105				SILTY CLAYSTONE: Same as above.
0.75 /0.69	5955	106				SILTY CLAYSTONE: Same as above.
1.7 /1.8	5954	107				SILTY CLAYSTONE: Same as above, bedding slightly tilted.
	5953	108				SILTY CLAYSTONE: Same as above, bedding does not appear to be tilted, some carb. material.
	52	109				

STATE PLANE COORDINATE:		TOTAL DEPTH (FT): 157	GROUND ELEVATION (FT):	5961.86	PROJECT NUMBER:	667.11	LOG OF BORING NUMBER:
NORTH:	750796	AREA: SOLAR POND	CASING DIAMETER (IN):	2 ID	GEOLOGIST:	LAA	27-86
EAST:	2085239	LOCATOR NUMBER: M10	BOREHOLE DIAMETER (IN):	7 25	DATE DRILLED:	09/18/86	

REMARKS: Hollow Stem Auger/NC Core.

CHEMICAL SAMPLE DEPTH / GRADATIONAL SAMPLE DEPTH	SAMPLE NUMBER	SAMPLE GRAIN SIZE (0% 50% 100%)	PERCENT RECOVERY (0% 100%)	RECOVERY/INTERVAL	DATUM (FT)	DEPTH (FT)	WELL OR PIEZOMETER CONSTRUCTION	LITHOLOGY	UNIFIED SOILS CLASSIFICATION OR ROCK TYPE	DESCRIPTION
				0.7 /0.5		110				SILTY CLAYSTONE: Lt. olive gray to brownish gray (5Y 6/1) to (5YR 4/1), slightly weathered, slightly friable, distorted layered bedding, layers very thin (some less than 1 mm.), some VFG sand, trace coarse.
					5851	111				NO SAMPLE:
					5850	112				
				0 /4.3	5849	113				
					5848	114				
					5847	115				SILTY CLAYSTONE: Same as above, grades to claystone toward bottom, some slickensides in vertical features in claystone.
				1.8 /2.2	5846	116				
					5845	117				NO SAMPLE:
				0 /1.5	5844	118				
				1.8 /1	5843	119				SILTY CLAYSTONE: Lt. olive gray to olive gray (5Y 6/1 to 4/1), slightly weathered, slightly friable, bedding not evident, trace carb. material.
				0 /0.5	42					NO SAMPLE:

STATE PLANE COORDINATE:		TOTAL DEPTH (FT): 157	GROUND ELEVATION (FT):	5961.86	PROJECT NUMBER:	667.11	LOG OF BORING NUMBER:
NORTH:	750796	AREA: SOLAR POND	CASING DIAMETER (IN):	2 ID	GEOLOGIST:	LAA	27-86
EAST:	2085239	LOCATOR NUMBER: M10	BOREHOLE DIAMETER (IN):	7.25	DATE DRILLED:	09/18/86	

REMARKS: Hollow Stem Auger/NC Core.

CHEMICAL SAMPLE DEPTH / GRADATIONAL SAMPLE DEPTH	SAMPLE NUMBER	SAMPLE GRAIN SIZE	PERCENT RECOVERY	RECOVERY/INTERVAL	DATUM (FT)	DEPTH (FT)	WELL OR PIEZOMETER CONSTRUCTION	LITHOLOGY	UNIFIED SOILS CLASSIFICATION OR ROCK TYPE	DESCRIPTION
				1.6/2	5841	120, 121			CLAYSTONE:	Olive gray (5Y 4/1), slightly weathered, slightly friable, bedding appears massive, trace carb. material, some possible slickensides in fractures.
				1.7/2	5840, 5839	122, 123			SILTY CLAYSTONE:	Lt. olive gray (5Y 6/1), slightly weathered, slightly friable, massive bedding, trace carb. material.
				1.75/2	5838, 5837	124, 125			SILTY CLAYSTONE:	Same as above, less silty.
				1.25/1	5836	126			SILTY CLAYSTONE:	Same as above, more silty.
				0.35/0.4	5835	127			SILTY CLAYSTONE:	Same as above.
	6079			1.65/2.1	5834, 5833	128, 129			SANDY CLAYSTONE:	Brownish gray (5YR 4/1), slightly weathered, slightly friable, massive bedding, some carb. material, sand VFG, well sorted.
				0.3/0.5	32				SANDY CLAYSTONE:	Same as above, very thin coal layer approx. 1 mm.

STATE PLANE COORDINATE:		TOTAL DEPTH (FT): 157	GROUND ELEVATION (FT):	5961.86	PROJECT NUMBER:	667.11	LOG OF BORING NUMBER:
NORTH:	750796	AREA: SOLAR POND	CASING DIAMETER (IN):	2 ID	GEOLOGIST:	LAA	27-86
EAST:	2085239	LOCATOR NUMBER: M10	BOREHOLE DIAMETER (IN):	7.25	DATE DRILLED:	09/18/86	

REMARKS: Hollow Stem Auger/NC Core.

CHEMICAL SAMPLE DEPTH
GRADATIONAL SAMPLE
SAMPLE NUMBER

SAMPLE GRAIN SIZE	PERCENT RECOVERY	RECOVERY/INTERVAL	DATUM (FT)	DEPTH (FT)	WELL OR PIEZOMETER CONSTRUCTION	LITHOLOGY	UNIFIED SOILS CLASSIFICATION OR ROCK TYPE	DESCRIPTION
0% 50% 100%	0% 100%	1.2/1.2	5831	130			CLAYEY SILTSTONE	Pinkish gray to lt. olive gray (5YR 8/1 to 5Y 6/1), slightly weathered, slightly friable, bedding distorted, probably from soft sed. deformation, some carb. material at top, some VFG sand especially at top, traces of pale yellowish orange (10YR 8/6) silt.
		0.8/0.8	5830	131			SANDY SILTSTONE	Pinkish gray (5YR 8/1), mod. weathered, mod. friable, tilted, layered bedding approx. 1 in. thick layers, sand VFG, some clay.
		0/1.5	5829	132			NO SAMPLE	
		0.8/0.8	5828	133			SANDY SILTSTONE	Same as above, grading to silty claystone.
		1.9/1.89	5827	134			SILTY CLAYSTONE	Olive gray (5Y 4/1), slightly weathered, slightly friable, bedding not evident, some small bodies of silt (approx. 1 in. in diam.).
		0.8/0.8	5826	135			SILTY CLAYSTONE	Same as above, with some siltier layers.
		0/1.8	5825	136			NO SAMPLE	
		1/1	5824	137			SILTY CLAYSTONE	Same as above.
			5823	138			SILTY CLAYSTONE	Lt. olive gray (5Y 6/1), slightly weathered, slightly friable, massive
			22	139				

STATE PLANE COORDINATE:	TOTAL DEPTH (FT): 157	GROUND ELEVATION (FT):	5561.86	PROJECT NUMBER:	667.11	LOG OF BORING NUMBER:	
NORTH: 750796	AREA: SOLAR POND	CASING DIAMETER (IN):	2 ID	GEOLOGIST:	LAA		27-86
EAST: 2085239	LOCATOR NUMBER: M10	BOREHOLE DIAMETER (IN):	7 25	DATE DRILLED:	09/18/86		

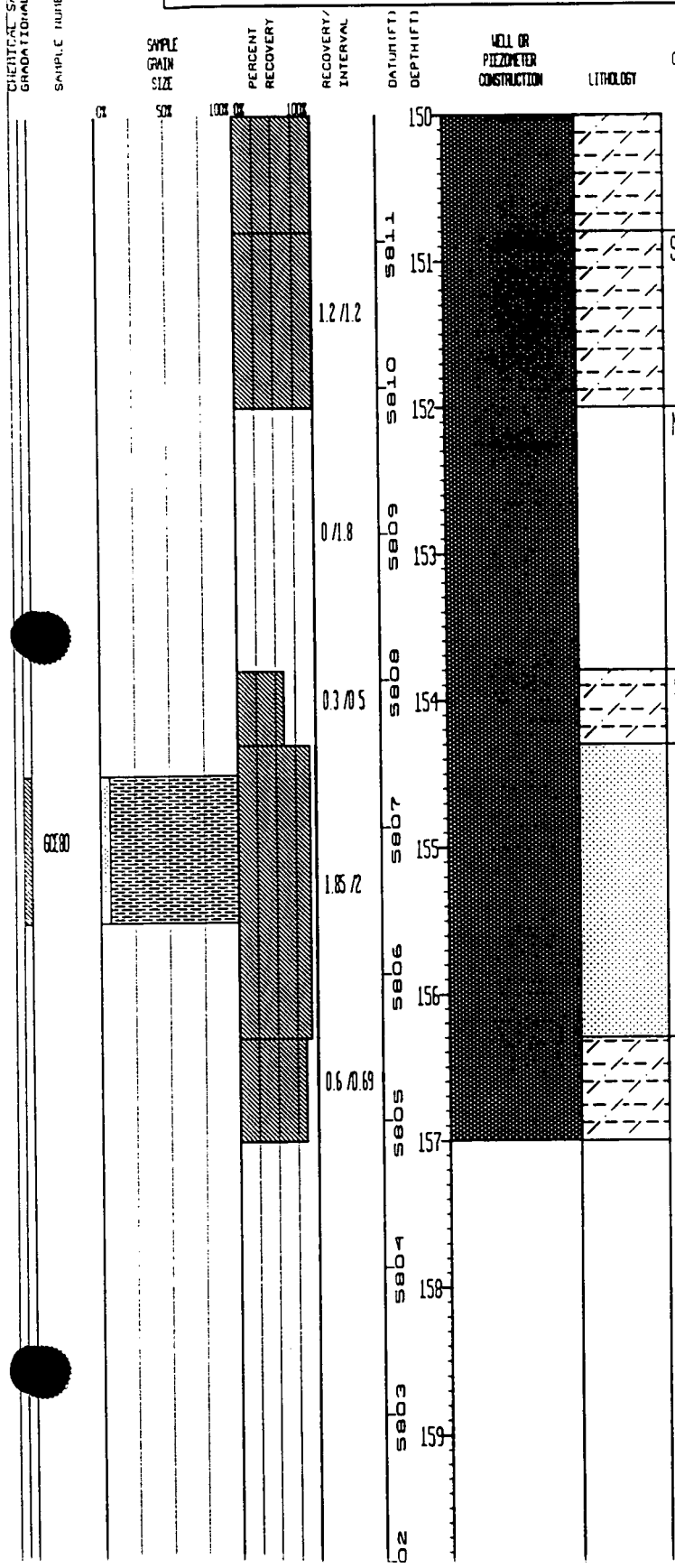
REMARKS: Hollow Stem Auger/NC Core.

CHEMICAL SAMPLE DEPTH
GRADATIONAL SAMPLE DEPTH
SAMPLE NUMBER

SAMPLE GRADN SIZE	PERCENT RECOVERY	RECOVERY/INTERVAL	DATUM (FT)	DEPTH (FT)	WELL OR PIEZOMETER CONSTRUCTION	LITHOLOGY	UNIFIED SOILS CLASSIFICATION OR ROCK TYPE	DESCRIPTION
		1.7 /1.7	5621	140–141			SILTY CLAYSTONE	Lt. olive gray (5Y 6/1), slightly weathered, slightly friab[illegible]ssive bedding.
		0.45 /0.5	5620	142			SILTY CLAYSTONE	Same as above.
		1.3 /1.5	5619	143			SILTY CLAYSTONE	Same as above, uneven layered bedding, some carb. material.
		1.55 /1.7	5618	144			SILTY CLAYSTONE	Same as above, some silt layers, very thin (<1 mm.), trace spotty ir[illegible] staining.
		1.85 /1.8	5617	145			SILTY CLAYSTONE	Same as above, interbedded in very fine layers with VFG sandstone (layers <1 mm.), trace carb. material.
		1.9 /2	5616	146			SILTY CLAYSTONE	Same as above. Some grayish orange (10YR 7/4) discolored silt in some areas.
			5615	147			SILTY CLAYSTONE	Same as above.
			5614	148				
			5613	149				

STATE PLANE COORDINATE:	TOTAL DEPTH (FT): 157	GROUND ELEVATION (FT): 5961.86	PROJECT NUMBER: 667.11	LOG OF BORING NUMBER:
NORTH: 750796	AREA: SOLAR POND	CASING DIAMETER (IN): 2 ID	GEOLOGIST: LAA	27-86
EAST: 2085239	LOCATOR NUMBER: M10	BOREHOLE DIAMETER (IN): 7.25	DATE DRILLED: 09/18/86	

REMARKS: Hollow Stem Auger/NC Core.



UNIFIED SOILS CLASSIFICATION OR ROCK TYPE	DESCRIPTION
SILTY CLAYSTONE:	Brownish gray to pinkish gray (5YR 6/1 to 8/1), slightly weathered, slightly friable, bedding in thin layers, predominantly horizontal, some silt in thin layers <1 mm., some lt. brown (5YR 5/6) discoloration, some carb. material.
NO SAMPLE:	
SILTY CLAYSTONE:	Same as above.
SANDSTONE:	Brownish gray (5YR 4/1) to mod. yellowish brown to dusky red (10YR 5/4 to 10R 2/2), slightly to non-friable, bedding had been layered but is distorted probably from tectonic activity or slumping, contains healed fractures, trace carbs, some silt, sand VFG.
SILTY CLAYSTONE:	Lt. brownish gray (5YR 6/1), slightly weathered, slightly friable, massive bedding, trace carbs.

INDEX OF DATA

Boring No.: 28-86

Completed as well? Yes

Data in File

X Log of Borehole

X Well Construction Summaries

____ Well Development Summaries

X Hydraulic Conductivity Test Data and Results

____ Packer Test Data and Results

X Water Level Data

X Saturated Thickness Hydrographs

Project: Rocky Flats Plant

LOG OF BORING NO. 28-86

Date Drilled 8/28/86

Boring Method Hollow Stem Auger

Coordinates

Ground Surface Elevation 5964

Elev. (feet)	Depth (feet)	Sample Type	Graphic Log	Material Description	Penetration Resistance (Blows/inch) 20 40	Water Content (%) 20 40	Other Tests
	0			ARTIFICIAL FILL 0-1.0'-Sample. Recovered 0.8/1.0'=80%. GRAVEL: grayish orange pink (5YR 7/2) to very pale orange (10YR 8/2) granite, quartzite and sandstone pebbles; sandy; silty, calcareous; poorly sorted; subangular to subrounded; unconsolidated; dry.			
	2			1.0-2.0'-Sample. Recovered 0.0/1.0'=0%. 2.0-4.0'-Sample. Recovered 1.5/2.0'=75%. GRAVEL: Same as above; trace silt and very light gray (N 8) sand; grayish orange (10YR 7/4) gravel layer from 3.5-4.0'; calcareous; poorly sorted; unconsolidated; dry.			
	4			4.0-5.5'-Sample. Recovered 1.5/1.5'=100%. GRAVEL: Same as above; trace silt and very light gray (N 8) sand; white (N 9) fine silt layer at 4.9'; calcareous; dusky yellow green (5GY 5/2) fine-grained sand and silt layer from 5.4-5.5'; moderately sorted; unconsolidated; dry.			
	6			5.5-8.0'-Sample. Recovered 0.0/2.5'=0%.		▽	
	8						

Remarks Logged by: T. Murphy

Checked by: _____

Project No. 106P06222

Hydro-Search, Inc.

Project: Rocky Flats Plant

LOG OF BORING NO. 28-86

Date Drilled 8/28/86

Boring Method Hollow Stem Auger

Coordinates

Ground Surface Elevation 5964

Elev. (feet)	Depth (feet)	Sample Type	Graphic Log	Material Description	Penetration Resistance (Blows/inch) 20 40	Water Content (%) 20 40	Other Tests
	8			8.0-12.5'-Sample. Recovered 4.5/4.5'=100%.			
				8.0-8.4'. GRAVEL: Same as above; trace silt and very light gray (N 8) sand; poorly sorted; subangular to subrounded; unconsolidated; dry.			
				ARAPAHOE FORMATION			
	10			8.4-12.5'. CLAYSTONE: pale olive (10YR 6/2) with dark yellowish orange (10YR 6/6) mottling; trace silt; thin coarse sand lense at 9.1-9.2'; slightly calcareous; weathered; damp.			
	12			12.5-15.5'-Sample. Recovered 3.0/3.0'=100%. CLAYSTONE: pale olive (10YR 6/2) with dark yellowish orange (10YR 6/6) mottles; trace silt; weathered; grades downward into brownish gray (5YR 4/1) claystone; damp.			
	14						
	16			TOTAL DEPTH: 15.5'			

Remarks Logged by: T. Murphy

Checked by: _____

Project No. 106P06222

Hydro-Search, Inc.

LOG OF BORING NO. 28-86

GEOLOGIST(S): DCB
DATE: 2/24/89

PROJECT NO: 667-11.22

TOP/BOTTOM OF CORE IN BOX	TOP/BOTTOM OF INTERVAL	FEET OF CORE IN INTERVAL IN BOX	SAMPLE NUMBER	FRACTURE ANGLE	BEDDING ANGLE	GRAIN SIZE DISTRIBUTION	USCS SYMBOL	DEPTH IN FEET	LITHOLOGIC LOG	LITHOLOGIC DESCRIPTION
0.0	0.0 to 1.0	(1) .7				~50% Clay ~50% Gravel	CL			Gravelly Clay, moderate brown (5 YR 3/4) low to moderate plasticity, some silt and sand, abundant caliche precipitate dispersed throughout clay
	1.0 to 2.0	0						2		No Sample
	2.0 to 3.0	(1) .5				>50% Gravel	GC	3		Clayey Gravel, light gray (N7) matrix is moderate brown (5 YR 3/4), OCB angular to subangular, poorly graded, max. size 5.5cm, some sand and silt. Below 3.0 ft. interval contains abundant caliche, disseminated in clay matrix and as rind on the gravel
	3.0 to 4.0	ND						4		
	4.0 to 4.4	ND								
	4.4 to 6.5	(1) 1.3						5, 6		
	6.5 to 8.0	0						7, 8		No Sample
	8.0 to 9.3	1.6				>50% Gravel >50% Clay	GP	9		Two small cobbles, medium gray (N5), OCB subrounded, max size 7cm. Claystone, light gray (N7), bedding not apparent, highly weathered, slightly friable, local iron staining, body of caliche at ~8.8 ft. Color varies to yellowish gray (5 Y 7/2)
	9.3 to 11.0	ND								

Box 1 of 2

NOTES: General USCS is modified for this log as follows:
Material amounts are estimated by % volume instead of % weight.
(1) Badly broken core, accurate footage measurements not possible.
(2) Core breaks cannot be matched, accurate footage measurements not possible.

ROCKY FLATS PLANT

FIGURE NO.

LOG OF BORING NO. 28-89

GEOLOGIST(S): DCB
DATE: 8/24/89

PROJECT NO: 667-11.2

TOP/BOTTOM OF CORE IN BOX	TOP/BOTTOM OF INTERVAL	FEET OF CORE IN INTERVAL IN BOX	SAMPLE NUMBER	FRACTURE ANGLE	BEDDING ANGLE	GRAIN SIZE DISTRIBUTION	USCS SYMBOL	DEPTH IN FEET	LITHOLOGIC LOG	LITHOLOGIC DESCRIPTION
10.0 to 11.0	7.3 to 11.0	ND				>50% Clay		11		Clay Shale As Above
	11.0 to 12.5	ND						12		
	12.5 to 14.0	(1) 1.5						13		
	14.0 to 14.8	ND						14		
	14.8 to 15.5	ND						15		
								16		Bottom of Box 2 of 2 at 15.5 ft.

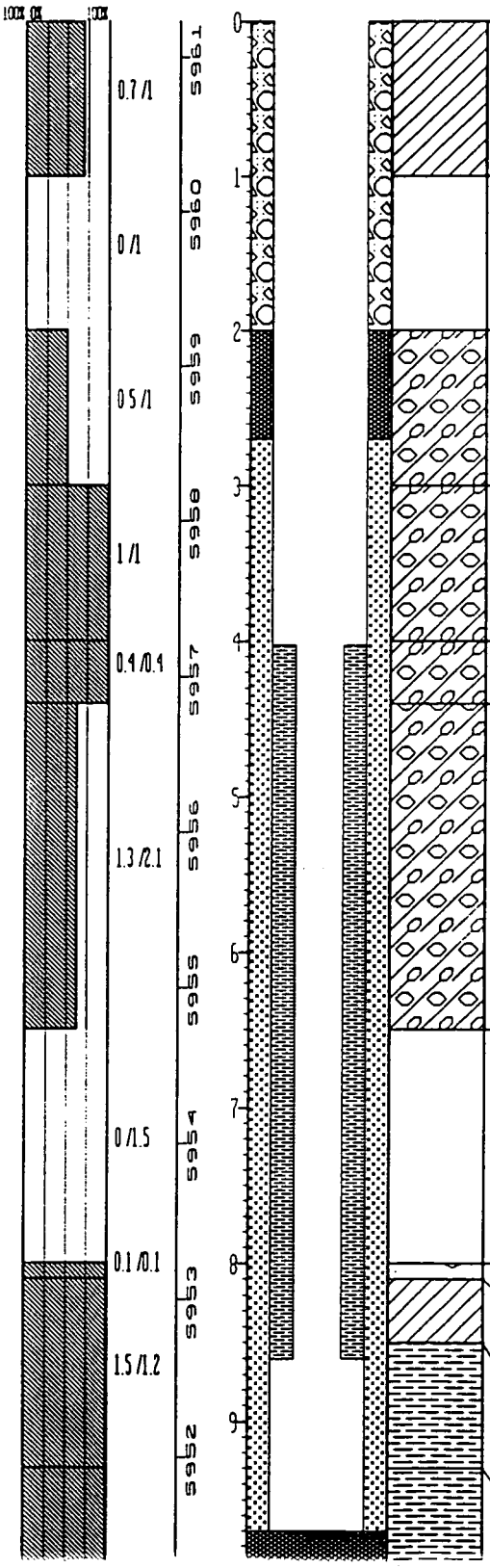
NOTES: General: USCS is modified for this log as follows:
Material amounts are estimated by % volume instead of % weight.
(1) Badly broken core, accurate footage measurements not possible.
(2) Core breaks cannot be matched, accurate footage measurements not possible.

ROCKY FLATS PLANT

FIGURE NO.

STATE PLANE COORDINATE:	TOTAL DEPTH (FT): 15.5	GROUND ELEVATION (FT): 5961.23	PROJECT NUMBER: 667.11	LOG OF BORING NUMBER:
NORTH: 750818	AREA: SOLAR POND	CASING DIAMETER (IN): 2 ID	GEOLOGIST: DCB	28-86
EAST: 2085241	LOCATOR NUMBER: N10	BOREHOLE DIAMETER (IN): 7 25	DATE DRILLED: 08/28/86	
REMARKS: Hollow Stem Auger.				

CHEMICAL SAMPLE DEPTH
GRADATIONAL SAMPLE DEPTH
SAMPLE NUMBER
SAMPLE GRAIN SIZE
PERCENT RECOVERY
RECOVERY/INTERVAL
DATUM (FT)
DEPTH (FT)
WELL OR PIEZOMETER CONSTRUCTION
LITHOLOGY
UNIFIED SOILS CLASSIFICATION OR ROCK TYPE
DESCRIPTION

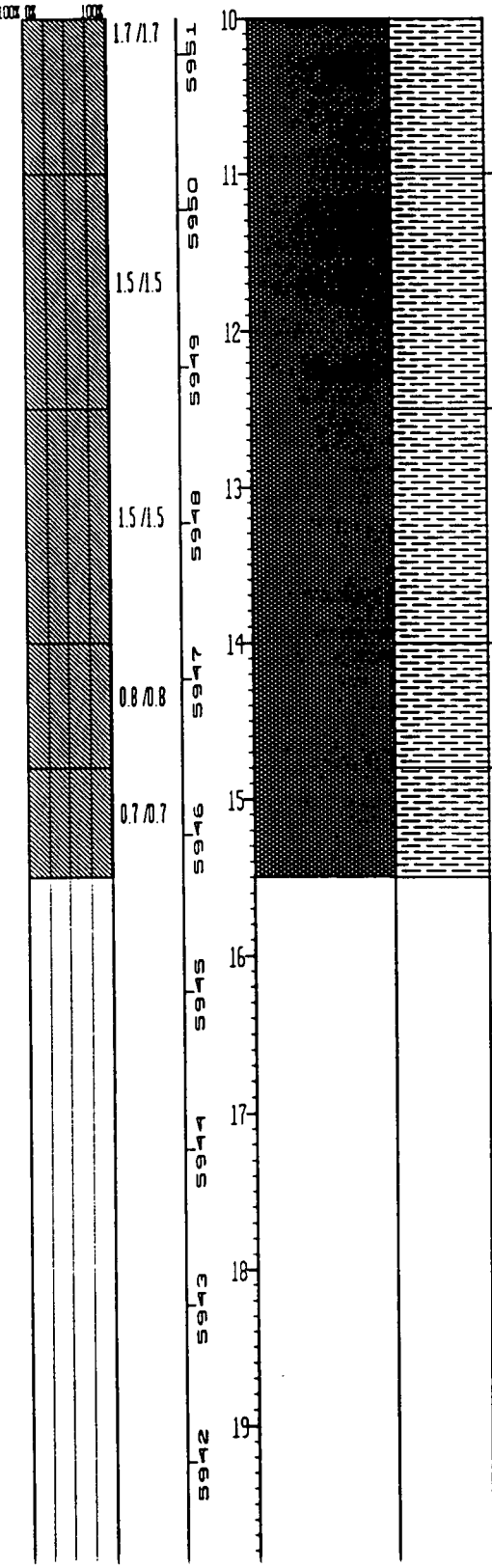


UNIFIED SOILS CLASSIFICATION OR ROCK TYPE	DESCRIPTION
CL:	GRAVELLY CLAY, moderate brown (5 YR 3/4), low to moderate plasticity, some silt and sand, abundant caliche precipitate dispersed throughout clay.
NO SAMPLE:	
GC:	Clayey Gravel, light gray (N7) matrix is moderate brown (5 YR 3/4), angular to sub-angular, poorly graded, max. size 5.5 cm, some sand and silt.
GC:	Same as above; interval contains abundant caliche disseminated in clay matrix and as a rind on the gravel.
GC:	Same as above.
GC:	Same as above.
NO SAMPLE:	
GP:	Two small cobbles, med. gray (N5), sub-rounded, max. size 7 cm.
CL:	Clay, light gray (N7), bedding not apparent, highly weathered, slightly friable, localized iron staining.
CLAYSTONE:	Top of Bedrock Light gray (N7), bedding not apparent, highly weathered, slightly friable, localized iron staining, body of caliche at approx. 8.8 ft.
CLAYSTONE:	Light gray (N7), bedding not apparent, highly weathered, slightly friable, localized iron staining, color varies to yellowish gray (5 Y 7/2)

STATE PLANE COORDINATE:		TOTAL DEPTH (FT): 15.5	GROUND ELEVATION (FT):	5961.23	PROJECT NUMBER:	667.11	LOG OF BORING NUMBER:
NORTH:	750818	AREA: SOLAR POND	CASING DIAMETER (IN):	2 ID	GEOLOGIST:	DCB	28-86
EAST:	2085241	LOCATOR NUMBER: M10	BOREHOLE DIAMETER (IN):	7 25	DATE DRILLED:	08/28/86	

REMARKS: Hollow Stem Auger.

CHEMICAL SAMPLE DEPT
GRADATIONAL SAMPLE D
SAMPLE NUMBER
SAMPLE GRAIN SIZE 0% 50% 100%
PERCENT RECOVERY 0% 100%
RECOVERY/INTERVAL
DATUM (FT)
DEPTH (FT)
WELL OR PIEZOMETER CONSTRUCTION
LITHOLOGY
UNIFIED SOILS CLASSIFICATION OR ROCK TYPE
DESCRIPTION



UNIFIED SOILS CLASSIFICATION OR ROCK TYPE	DESCRIPTION
CLAYSTONE:	Same as above.
CLAYSTONE:	Same as above.
CLAYSTONE:	Same as above.
CLAYSTONE:	Same as above.

Project: Rocky Flats Plant

LOG OF BORING NO. 29-86

Date Drilled 9/9/86

Boring Method Hollow Stem Auger

Coordinates

Ground Surface Elevation 5957

Elev. (feet)	Depth (feet)	Sample Type	Graphic Log	Material Description	Penetration Resistance (Blows/inch) 20 40	Water Content (%) 20 40	Other Tests
	0			ROCKY FLATS ALLUVIUM 0.0-2.0'-Sample. Recovered 0.5/2.0'=25%. GRAVEL: grayish brown (5YR 3/2) to dusky brown (5YR 2/2) granite and quartzite pebbles and cobbles; sand and silt matrix; bimodal sorting; subangular; unconsolidated; loose; damp.			
	5			2.0-3.6'-Sample. Recovered 1.6/1.6'=100%. GRAVEL: moderate brown (5YR 4/4) granite and quartzite pebbles and cobbles; sandy; some silt; poorly sorted; subangular; well packed; damp.			
				3.6-6.5'-Sample. Recovered 0.0/3.0'=0%. Cuttings. GRAVEL: light brown (5YR 5/6) granite and quartzite pebbles and cobbles; unconsolidated; dry.			
	10			6.5-7.5'-Sample. GRAVEL: light brown (5YR 6/4) granitic pebbles and cobbles; medium to coarse sand; poorly sorted; angular; unconsolidated; dry to damp.			
				7.5-12.5'-Sample. Recovered 4.3/5.0'=86%. 7.5-8.7'. CLAY: olive gray (5Y 3/2) and grayish brown (9YR 2/2); gravelly; some sand and silt: caliche stringers; soft; moist.			
	15			ARAPAHOE FORMATION 8.7-12.5'. CLAYSTONE: yellowish gray (5Y 7/2) to dusky yellow (5Y 6/4); silty; weathered; firm; moist.			
	20						

Remarks Logged by: T. Murphy

Checked by: [illegible]

Project No. 106P06222

Hydro-Search, Inc.

Project: Rocky Flats Plant

LOG OF BORING NO. 29-86

Date Drilled 9/9/86

Boring Method Hollow Stem Auger

Coordinates

Ground Surface Elevation 5957

Elev. (feet)	Depth (feet)	Sample Type	Graphic Log	Material Description	Penetration Resistance (Blows/Inch) 20 40	Water Content (%) 20 40	Other Tests
	20			12.5-17.5'-Sample. Recovered 5.0/5.0'=100%. CLAYSTONE: pale olive (10Y 6/2) with dark yellowish orange (10YR 6/6) mottling; fine-grained to coarse-grained sand stringers; occasional calcite in fractures (dark yellowish orange 10YR 6/6); 50% sand and 50% claystone; firm; moist.			
	25			17.5-22.5'-Sample. Recovered 2.0/5.0'=40%. SANDSTONE: dark yellowish orange (10YR 6/6) and light gray (N 7); silty; some clay; moist; soft.			
				22.5-25.5'. Lost core.			
				TOTAL DEPTH: 25.5'			
	30						
	35						
	40						

Remarks Logged by: T. Murphy

Checked by: [illegible]

Project No. 106P06222

Hydro-Search, Inc.

LOG OF BORING NO. 29-86

GEOLOGIST(S): DCB
DATE: 8/16/89

PROJECT NO: 667-11.22

TOP/BOTTOM OF CORE IN BOX	TOP/BOTTOM OF INTERVAL	FEET OF CORE IN INTERVAL IN BOX	SAMPLE NUMBER	FRACTURE ANGLE	BEDDING ANGLE	GRAIN SIZE DISTRIBUTION	USCS SYMBOL	DEPTH IN FEET	LITHOLOGIC LOG	LITHOLOGIC DESCRIPTION
0.0 ↓	0.0 to 2.0	(1) .7				>50% Gravel	GW	1, 2		Gravel, dominantly very light gray (N8), subangular well graded, max. size 5.5 cm, trace of clay-grayish brown (5 YR 3/2), some plant debris and ~~x~~ silt.
	2.0 to 2.5	ND				>50% Gravel	GC			Clayey gravel, light gray N7, clay matrix is grayish brown (5 YR 3/2), angular poorly graded, max size is 6.5 cm, some silt.
	2.5 to 3.6	ND				>50% Clay	CL	3		Gravelly Clay, moderate brown (5 YR 4/4), low plasticity, some silt and vfg sand.
Bot 1 of 2	3.6 to 6.5	0						4, 5, 6		No Sample
	6.5 to 7.5	ND				>50% Clay	CL	7		Silty Gravelly Clay, moderate yellowish brown (10 YR 5/4) moderately high plasticity, some gravel
	7.5 to 9.5	(1) 1.6						8, 9		Clay, moderate yellowish brown (10 YR 5/4), moderately high plasticity, some silt and gravel.
	9.5 to 11.0	ND								Clay, grayish orange (10 YR 7/4), moderate plasticity, some silt, ~~[illegible]~~ DCB bodies of caliche and stringers of sand, silt content increases with depth.

NOTES: General USCS is modified for this log as follows:
Material amounts are estimated by % volume instead of % weight.
(1) Badly broken core, accurate footage measurements not possible.
(2) Core breaks cannot be matched, accurate footage measurements not possible.

ROCKY FLATS PLANT

FIGURE NO.

LOG OF BORING NO. 29-86

GEOLOGIST(S): DCB
DATE: 2/16/89

PROJECT NO: 667-11.22

TOP/BOTTOM OF CORE IN BOX	TOP/BOTTOM OF INTERVAL	FEET OF CORE IN INTERVAL IN BOX	SAMPLE NUMBER	FRACTURE ANGLE	BEDDING ANGLE	GRAIN SIZE DISTRIBUTION	USCS SYMBOL	DEPTH IN FEET	LITHOLOGIC LOG	LITHOLOGIC DESCRIPTION
Box 1 of 2 ^ 11.0	9.5 to 11.0	ND				>50% clay	CL	11		As above
11.0 ↓	11.0 to 12.5	ND						12		
Box 2 of 2	12.5 to 14.5	ND				>50% silt		13, 14		Sandy siltstone, dark yellowish orange (10 YR 6/6), to very light gray (N8), bedding not apparent, moderately friable, irregular body of caliche at ~14.3 ft; sand is vfg.
	14.5 to 16.0	ND						15		
	16.0 to 17.5	ND						16, 17		
	17.5 to 22.5	(1) 1.5						18, 19		

NOTES: General: USCS is modified for this log as follows:
Material amounts are estimated by % volume instead of % weight.
(1) Badly broken core, accurate footage measurements not possible.
(2) Core breaks cannot be matched, accurate footage measurements not possible.

ROCKY FLATS PLANT

FIGURE NO.

LOG OF BORING NO. 29-86

GEOLOGIST(S): DCB
DATE: 8/16/89

PROJECT NO: 667-1122

TOP/BOTTOM OF CORE IN BOX	TOP/BOTTOM OF INTERVAL	FEET OF CORE IN INTERVAL IN BOX	SAMPLE NUMBER	FRACTURE ANGLE	BEDDING ANGLE	GRAIN SIZE DISTRIBUTION	USCS SYMBOL	DEPTH IN FEET	LITHOLOGIC LOG	LITHOLOGIC DESCRIPTION
Box 2 of 2	17.5 to 22.5	(1) 1.5						21		As above
								22		weathered Fe oxide cementation at 22.5 ft.
								23		Bottom of Box 2 of 2 at 22.5 ft.

NOTES: General USCS is modified for this log as follows:
Material amounts are estimated by % volume instead of % weight.
(1) Badly broken core, accurate footage measurements not possible.
(2) Core breaks cannot be matched, accurate footage measurements not possible.

ROCKY FLATS PLANT

FIGURE NO.

STATE PLANE COORDINATE:
NORTH: 750612
EAST: 2085688

TOTAL DEPTH (FT): 22.5
AREA: SOLAR POND
LOCATOR NUMBER: M10

GROUND ELEVATION (FT): 5958.26
CASING DIAMETER (IN): 2
BOREHOLE DIAMETER (IN): 7.25

PROJECT NUMBER: 667.11
GEOLOGIST: DCB
DATE DRILLED: 09/09/86

LOG OF BORING NUMBER: 29-86

REMARKS: Hollow Stem Auger.

CHEMICAL SAMPLE DEPTH / GRADATIONAL SAMPLE DEPTH	SAMPLE NUMBER	SAMPLE GRADI SIZE	PERCENT RECOVERY	RECOVERY/ INTERVAL	DATUM (FT)	DEPTH (FT)	WELL OR PIEZOMETER CONSTRUCTION	LITHOLOGY	UNIFIED SOILS CLASSIFICATION OR ROCK TYPE	DESCRIPTION
				0.7 /2	5958	0			GW:	GRAVEL, dominantly very light gray (N8), sub-angular, well graded, max. size 5.5 cm., trace of clay - grayish brown (5 YR 3/2), some plant debris and silt.
				0.5 /0.5	5957	1			GC:	Clayey Gravel, light gray N7, clay matrix is grayish brown (5 YR 3/2), angular, poorly graded, max. size is 6.5 cm., some silt.
				1.1 /1.1	5956	2			CL:	GRAVELLY CLAY, moderate brown (5 YR 4/4), low plasticity, some silt and VFG sand.
				0 /2.9	5955	3			NO SAMPLE:	
				1 /1	5954	4			CH:	Silty Gravelly Clay, moderate yellowish brown (10 YR 5/4), moderately high plasticity, some gravel.
				0.8 /1	5953	5			CH:	Clay, moderate yellowish brown (10 YR 5/4), moderately high plasticity, some silt and gravel.
				0.8 /1	5952	6			CLAYSTONE:	Top of Bedrock Grayish orange (10 YR 7/4), moderate plasticity, some silt, bodies of caliche and stringers of same, silt content increases with depth.
					5951	7			CLAYSTONE:	Same as above.
					5950	8				
					5949	9				

STATE PLANE COORDINATE:	TOTAL DEPTH (FT): 22.5	GROUND ELEVATION (FT): 5958.26	PROJECT NUMBER: 667.11	LOG OF BORING NUMBER:
NORTH: 750612	AREA: SOLAR POND	CASING DIAMETER (IN): 2	GEOLOGIST: DCB	29-86
EAST: 2085688	LOCATOR NUMBER: M10	BOREHOLE DIAMETER (IN): 7.25	DATE DRILLED: 09/09/86	
REMARKS: Hollow Stem Auger.				

CHEMICAL SAMPLE DEPTH / GRADATIONAL SAMPLE DEPTH	SAMPLE NUMBER	SAMPLE GRAIN SIZE (0% 50% 100%)	PERCENT RECOVERY (0% 100%)	RECOVERY/INTERVAL	DATUM (FT)	DEPTH (FT)	WELL OR PIEZOMETER CONSTRUCTION	LITHOLOGY	UNIFIED SOILS CLASSIFICATION OR ROCK TYPE	DESCRIPTION
				1.5/1.5	5948	10				
				1.5/1.5	5947	11			CLAYSTONE:	Same as above.
				1.5/1.5	5946	12				
	18			2/2	5945	13			SANDY SILTSTONE:	Dark yellowish orange (10 YR 6/6), to very light gray (N8), bedding not apparent, moderately friable, irregular body of caliche at approx. 14.3 ft., sand is VFG.
					5944	14				
				1.5/1.5	5943	15			SANDY SILTSTONE:	Dark yellowish orange (10 YR 6/6), to very light gray (N8), bedding not apparent, moderately friable, sand is VFG.
				1.5/1.5	5942	16			SANDY SILTSTONE:	Same as above.
					5941	17				
	GX-200				5940	18			SANDY SILTSTONE:	Same as above, with weathered Fe-oxide concretion at 22.5 ft.
					5939	19				

STATE PLANE COORDINATE:	TOTAL DEPTH (FT): 22.5	GROUND ELEVATION (FT):	5958.26	PROJECT NUMBER:	667.11
NORTH: 750612	AREA: SOLAR POND	CASING DIAMETER (IN):	2	GEOLOGIST:	DCB
EAST: 2085688	LOCATOR NUMBER: M10	BOREHOLE DIAMETER (IN):	7 25	DATE DRILLED:	09/09/86

REMARKS: Hollow Stem Auger.

LOG OF BORING NUMBER: 29-86

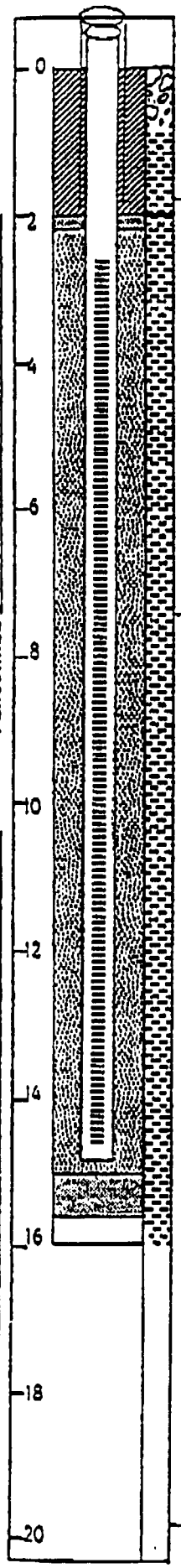
CHEMICAL SAMPLE DEPTH	GRADATIONAL SAMPLE DEPTH	SAMPLE NUMBER	SAMPLE GRAIN SIZE	PERCENT RECOVERY	RECOVERY/ INTERVAL	DATUM (FT)	DEPTH (FT)	WELL OR PIEZOMETER CONSTRUCTION	LITHOLOGY	UNIFIED SOILS CLASSIFICATION OR ROCK TYPE	DESCRIPTION
		008-19	0% 50% 100%	0% 100%	1.5/5	5938	20				
						5937	21				
						5936	22				
						5935	23				
						5934	24				
						5933	25				
						5932	26				
						5931	27				
						5930	28				
						5929	29				

WELL 30-86

WELL CONSTRUCTION SUMMARY

LOCATION or COORDS: _____

ELEVATION: GROUND LEVEL 5955'
TOP OF CASING 5956.50'



LOCATION Golden, CO
PERSONNEL T. Murphy
PROJECT 106X06222 Rocky Flats Plant

DRILLING SUMMARY:

TOTAL DEPTH Well: 14.93' Hole: 16.00'
BOREHOLE DIAMETER 7¼"

DRILLER Bovles Brothers Drilling Co.
15865 W. 5th Avenue
Golden, CO (Dave Jarvie)

RIG Mobile B-57
BIT(S) Blade bit

DRILLING FLUID None

SURFACE CASING 5" x 4' steel w/ locking cap

WELL DESIGN:

BASIS: GEOLOGIC LOG X GEOPHYSICAL LOG ___

CASING STRING(S): C=CASING S=SCREEN

0.00'	2.48'	C1			
2.48'	14.93'	S1			

CASING: C1 2" I.D. Sch. 5 type 316 stainless steel, threaded and flush jointed.

SCREEN: S1 2" I.D. Sch. 5 type 316 stainless steel, threaded and flush jointed, 0.010" wire wrap screen 0.25' welded bottom cap.

CENTRALIZERS Type 304 stainless steel

FILTER MATERIAL 32-42 silica sand
2.20' - 15.10'

CEMENT Portland Type I
0.00' - 2.00'

OTHER 3/8" bentonite pellets
2.00' - 2.20'
15.10' - 15.60'

CONSTRUCTION TIME LOG:

TASK	START DATE 1986	START TIME	FINISH DATE 1986	FINISH TIME
DRILLING:				
7¼" auger	9/6	1200	9/6	1430
GEOPHYS. LOGGING:	—	—	—	—
CASING:				
2" stainless	9/6	1630	9/6	1635
FILTER PLACEMENT:	9/6	1635	9/6	1650
CEMENTING:	9/6	1650	9/6	1700
DEVELOPMENT:	9/12	1010	9/19	1030
OTHER:				
Bentonite	9/6	1641	9/6	1642
	9/6	1625	9/6	1630

WELL DEVELOPMENT

See Well Development Summary Sheet.

COMMENTS:

No water encountered during drilling.

Top of stainless steel casing: 1.50'

Cave from TD to 15.60'

Project: Rocky Flats Plant

LOG OF BORING NO. 30-86

Date Drilled 9/6/86

Boring Method Hollow Stem Auger

Coordinates

Ground Surface Elevation 5955

Elev. (feet)	Depth (feet)	Sample Type	Graphic Log	Material Description	Penetration Resistance (Blows/Inch) 20 40	Water Content (%) 20 40	Other Tests
	0			ARTIFICIAL FILL 0.0-2.0'-Sample. Recovered 1.2/2.0'=60%. 0.0-0.8'. GRAVEL: granite and quartzite pebbles; sandy; silty; poorly sorted; wet.			
				0.8-2.0'. CLAYSTONE: dusky brown (5Y 2/2) and olive gray (5Y 3/2); silty; moist to wet.			
	5			ARAPAHOE FORMATION 2.0-4.0'-Sample. Recovered 2.0/2.0'=100%. CLAYSTONE: light olive gray (5Y 5/2); some dark yellowish orange (10YR 6/6) iron staining; slightly calcareous; silty; firm; moist.			
				4.0-6.0'-Sample. Recovered 2.0/2.0'=100%. CLAYSTONE: light olive gray (5Y 5/2); some dark yellowish orange (10YR 6/6) iron staining; fragments of calcite; some light olive gray (5Y 5/2) fine-grained sand; soft to moderately firm; moist.			
	10			6.0-11.0'-Sample. Recovered 5.0/5.0'=100%. CLAYSTONE: light olive gray (5Y 5/2); some dark yellowish orange (10YR 6/6) iron stains; calcite concretion at 6.3'; firm; damp.			
	15			11.0-16.0'-Sample. Recovered 5.0/5.0'=100%. CLAYSTONE: olive gray (5Y 3/2) to olive brown (5Y 4/4); firm; damp.			
				TOTAL DEPTH: 16.0'			
	20						

Remarks Logged by: T. Murphy

Checked by: [illegible]

Project No. 106P06222

Hydro-Search, Inc.

LOG OF BORING NO. 30-86

PAGE / OF

GEOLOGIST(S): DCB
DATE: 8/23/89

PROJECT NO: 667-11.22

TOP/BOTTOM OF CORE IN BOX	TOP/BOTTOM OF INTERVAL	FEET OF CORE IN INTERVAL IN BOX	SAMPLE NUMBER	FRACTURE ANGLE	BEDDING ANGLE	GRAIN SIZE DISTRIBUTION	USCS SYMBOL	DEPTH IN FEET	LITHOLOGIC LOG	LITHOLOGIC DESCRIPTION
0.0 ↓	0.0 to 2.0	(1) 1.5				>50% Clay	CL	1, 2		Clay, light brownish gray (5 YR 4/1), grades to very light gray (N8), moderate to low plasticity, calcareous, sand roots and gravel in upper 1.5 ft., some silt in upper 2.0 ft.
	2.0 to 4.0	0.0 (2) 1.7						3, 4		Interval graded to highly weath or incompletely indurated claystone. Claystone, very light gray (N8), bedding not apparent, highly weathered, slightly friable, occasional iron stains and bodies of caliche
	4.0 to 6.0	ND						5, 6		
	6.0 to 8.0	ND						7, 8		
	8.0 to 10.0	ND						9		slight amount of mn oxide mineralization below 8.0 ft and iron stains occur on fractures, rock is more competent.
↑ 10.0										

NOTES: General USCS is modified for this log as follows:
Material amounts are estimated by % volume instead of % weight.
(1) Badly broken core, accurate footage measurements not possible.
(2) Core breaks cannot be matched, accurate footage measurements not possible.

ROCKY FLATS PLANT

FIGURE NO.

DCB

LOG OF BORING NO. 30-86

GEOLOGIST(S): DCB
DATE: 8/2~~3~~4/89

PROJECT NO: 667-11.22

TOP/BOTTOM OF CORE IN BOX	TOP/BOTTOM OF INTERVAL	FEET OF CORE IN INTERVAL IN BOX	SAMPLE NUMBER	FRACTURE ANGLE	BEDDING ANGLE	GRAIN SIZE DISTRIBUTION	USCS SYMBOL	DEPTH IN FEET	LITHOLOGIC LOG	LITHOLOGIC DESCRIPTION
10.0 ↓	10.0 to 11.0	ND						11		Claystone, very light gray (N8), bedding not apparently highly weathered, slightly friable, iron staining locally and on partings, mg oxide mineralization occurs locally, slight silt fraction.
	11.0 to 12.0	ND						12		
Box 2 of 2	12.0 to 14.0	(2) 1.5						13		
	14.0 to 16.0	ND						14		
↑ 16.0								15		
								16		Bottom of Box 2 of 2 at 16.0 ft.
								17		

NOTES: General: USCS is modified for this log as follows:
Material amounts are estimated by % volume instead of % weight.
(1) Badly broken core, accurate footage measurements not possible.
(2) Core breaks cannot be matched, accurate footage measurements not possible.

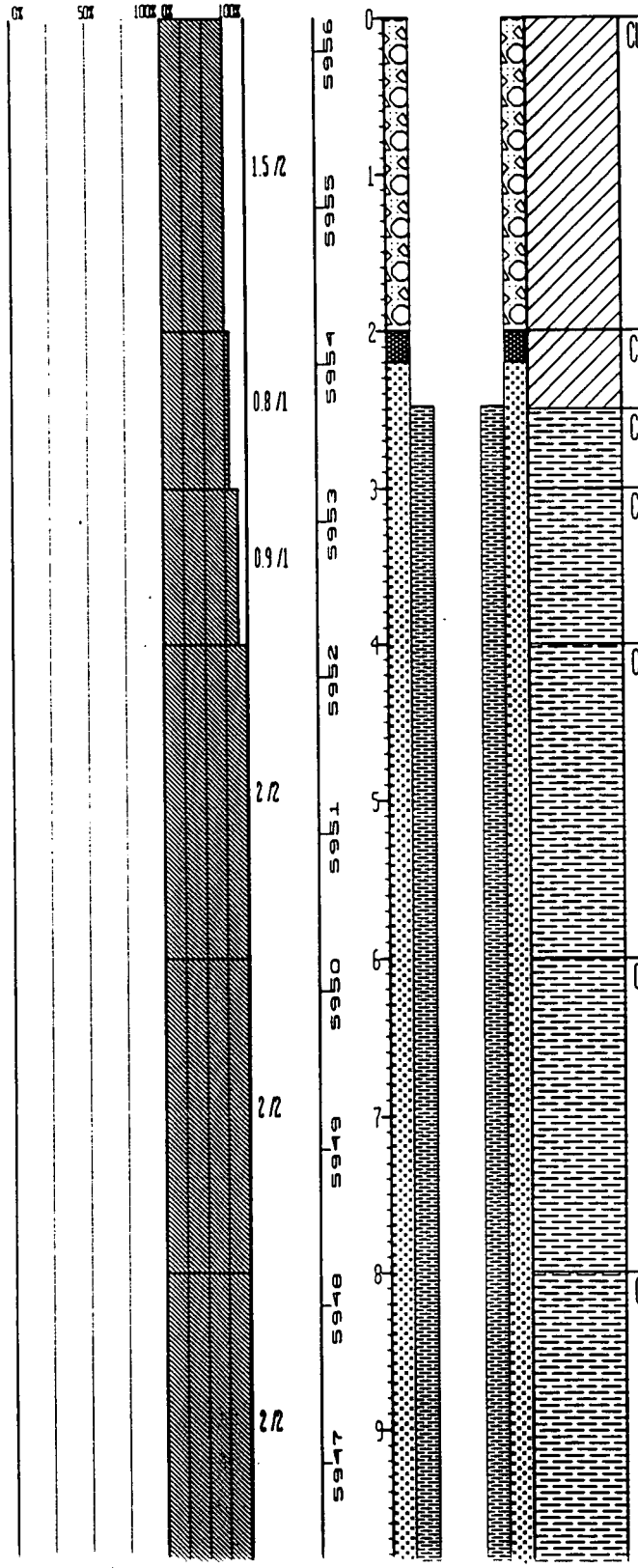
ROCKY FLATS PLANT

FIGURE NO.

STATE PLANE COORDINATE:		TOTAL DEPTH (FT): 16	GROUND ELEVATION (FT):	5956.21	PROJECT NUMBER:	667.11	LOG OF BORING NUMBER:
NORTH:	751094	AREA: SOLAR POND	CASING DIAMETER (IN):	2 ID	GEOLOGIST:	DCB	30-86
EAST:	2084924	LOCATOR NUMBER: L11	BOREHOLE DIAMETER (IN):	7.5	DATE DRILLED:	09/06/86	

REMARKS: Hollow Stem Auger. Cave from TD to 15.60'.

CHEMICAL SAMPLE DEPTH
GRADATIONAL SAMPLE DE
SAMPLE NUMBER



UNIFIED SOILS CLASSIFICATION OR ROCK TYPE	DESCRIPTION
CL:	CLAY, light brownish gray (5 YR 4/1), grades to very light gray (N8), moderate to low plasticity, calcareous, some roots and gravel in upper 1.5 ft., some silt in upper 2.0 ft.
CL:	Same as above.
CLAYSTONE:	Top of Bedrock Same as above.
CLAYSTONE:	Interval grades to highly weathered or incompletely indurated Claystone.
CLAYSTONE:	Very light gray (N8), bedding not apparent, highly weathered, slightly friable, occasional iron stains and bodies of caliche.
CLAYSTONE:	Same as above.
CLAYSTONE:	Same as above, with slight amount of Mg-oxide mineralization below 8.0 feet and iron stains occur on fractures, rock is more competent.

STATE PLANE COORDINATE:	TOTAL DEPTH (FT): 16	GROUND ELEVATION (FT):	5956.21	PROJECT NUMBER:	567.11	LOG OF BORING NUMBER:	
NORTH: 751094	AREA: SOLAR POND	CASING DIAMETER (IN):	2 ID	GEOLOGIST:	DCB	30-86	
EAST: 2084924	LOCATOR NUMBER: L11	BOREHOLE DIAMETER (IN):	7 5	DATE DRILLED:	09/06/86		

REMARKS: Hollow Stem Auger. Cave from TD to 15.60'.

CHEMICAL SAMPLE DEPTH	GRADATIONAL SAMPLE DEPTH	SAMPLE NUMBER	SAMPLE GRADI SIZE	PERCENT RECOVERY	RECOVERY/ INTERVAL	DATUM (FT)	DEPTH (FT)	WELL OR PIEZOMETER CONSTRUCTION	LITHOLOGY	UNIFIED SOILS CLASSIFICATION OR ROCK TYPE	DESCRIPTION
			0% 50%	100% 0% 100%	1/1	5946	10			CLAYSTONE:	Very light gray, (N8), bedding not apparent, highly weathered, slightly friable, iron staining locally and on partings, Mg oxide mineralization occurs locally, slight silt fraction.
					1/1	5945	11			CLAYSTONE:	Same as above.
					1.5/2	5944	12			CLAYSTONE:	Same as above.
					2/2	5943	13				
						5942	14			CLAYSTONE:	Same as above. NOTE: No water encountered while drilling.
						5941	15				
						5940	16				
						5939	17				
						5938	18				
						5937	19				

INDEX OF DATA

Boring No.: 31-86

Completed as well? Yes

Data in File

X Log of Borehole

X Well Construction Summaries

____ Well Development Summaries

____ Hydraulic Conductivity Test Data and Results

____ Packer Test Data and Results

X Water Level Data

X Saturated Thickness Hydrographs

Project: Rocky Flats Plant

LOG OF BORING NO. 31-86

Date Drilled 9/2/86

Coordinates N38066.2 E 21661.8

Boring Method Hollow Stem Auger

Ground Surface Elevation 5964.21'

Elev. (feet)	Depth (feet)	Sample Type	Graphic Log	Material Description	Penetration Resistance (Blows/inch) 20 40	Water Content (%) 20 40	Other Tests
	0			ARTIFICIAL FILL			
				0-2.0'-Sample. Recovered 2.0/2.0'=100%. 0-0.9': SILTY GRAVEL: grayish brown (5YR 2/2) very fine-grained sand, silt and gravel; few roots; poorly sorted; angular; unconsolidated; dry.			
	5			ARAPAHOE FORMATION			
				0.9-2.0': SAND: light gray (N 8/0) to dusky brown (5YR 3/2) medium to fine-grained; some clayey sand; moderately sorted; firm; apparent bedding from variation in clay fraction; alternating layers of sand and clayey sand; dark yellow stain (10YR 6/6) increase in sand and silt percent from 1.5-2.0'; firm; damp.			
	10						
				2.0-4.0'-Sample. Recovered 1.2/2.0'=60%. SAND: light gray (N 8/0) to grayish orange (10YR 4/4); medium-grained sand, some clay and silt; dark yellowish orange (10YR 6/6) mottles; calcareous sand from 3.0-3.5'; firm; damp.			
	15						
				4.0-7.0'-Sample. Recovered 3.0/3.0'=100%. SAND: grayish orange (10YR 7/4); silty and clayey sand at 4.9 and 6.2'; calcareous fracture at 6.8'; medium to fine-grained; quartz predominates; soft; damp.			
	20						

Remarks Logged by: T. Murphy

Checked by:

Project No. 106P06222

Hydro-Search, Inc.

Project: Rocky Flats Plant	LOG OF BORING NO. 31-86
Date Drilled 9/2/86	Coordinates N 38066.2 E 21661.8
Boring Method Hollow Stem Auger	Ground Surface Elevation 5063.21'

Elev. (feet)	Depth (feet)	Sample Type	Graphic Log	Material Description	Penetration Resistance (Blows/inch) 20 40	Water Content (%) 20 40	Other Tests
	20						
				7.0-12.0'-Sample. Recovered 5.0/5.0'=100%. SAND: grayish orange (10YR 7/4); medium to fine-grained; moderately clean; some silt; slight color variation to pale olive (10YR 6/2) with depth; soft; damp.			
	25						
				12.0-17.0'-Sample. Recovered 4.0/5.0'=80%. 12.0-14.9': SAND: pale olive (10YR 6/2) to grayish orange (10YR 7/4); medium to fine-grained; moderately clean; some silt; soft; damp.			
	30			14.9-16.5': CLAYSTONE: grayish olive (10Y 9/2); dark yellowish orange (10YR 6/6) mottles; occasional thin sand layers at 14.8 and 15.8'; slightly calcareous; firm; damp.			
				16.5-17.0': CLAYSTONE: dark olive gray (5Y 3/2); silty; black wood fragments; firm; damp.			
	35			17.0-22.0'-Sample. Recovered 5.0/5.0'=100%. 17.2-17.7': CLAYSTONE: dark olive gray (5Y 3/2); silty; black wood fragments; firm; damp.			
				17.7-20.0': SAND: pale olive (10Y 6/2); yellowish orange (10YR 6/6) mottles; some fine-grained sand; occasional sand lenses 0.2' thick; silty; firm; damp.			
	40						

Remarks Logged by: T. Murphy Checked by:

Project No. 106P06222	Hydro-Search, Inc.	Page 2 of 3

Project: Rocky Flats Plant

LOG OF BORING NO. 31-86

Date Drilled 9/2/86

Coordinates N 38066.2 E 21661.8

Boring Method Hollow Stem Auger

Ground Surface Elevation 5864.21'

Elev. (feet)	Depth (feet)	Sample Type	Graphic Log	Material Description	Penetration Resistance (Blows/inch) 20 40	Water Content (%) 20 40	Other Tests
	40			20.0-20.9': CLAYSTONE: moderate yellowish brown (10YR 5/4) to dark yellowish orange (10YR 6/6); dark yellowish orange (10YR 6/6) stains; firm; damp.			
				20.9-22.0': CLAYSTONE: moderate yellowish brown (10YR 5/4) to dark yellowish orange (10YR 6/6); dark yellowish orange (10YR 6/6) stains; ironstone; firm; damp.			
	45						
				TOTAL DEPTH: 22.0'			
	50						
	55						
	60						

Remarks Logged by: T. Murphy

Checked by: [illegible]

Project No. 106P06222

Hydro-Search, Inc.

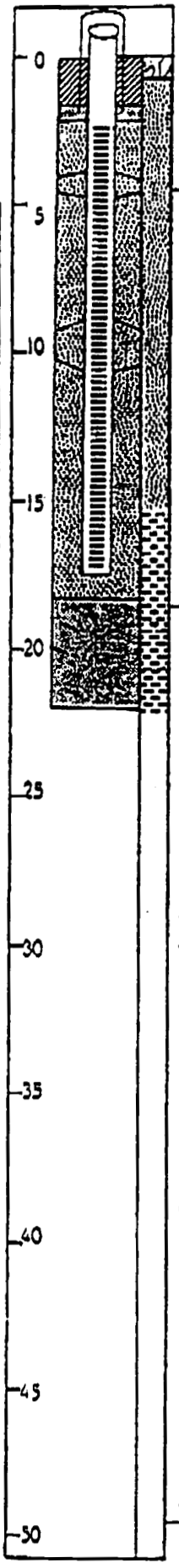
Weathered Bedrock

WELL 31-86

WELL CONSTRUCTION SUMMARY

LOCATION or COORDS:

ELEVATION: GROUND LEVEL 5964'
TOP OF CASING 5966.50'



LOCATION Golden, CO
PERSONNEL T. Murphy
PROJECT 10MX0222 - Rocky Flats Plant

DRILLING SUMMARY:

TOTAL DEPTH Well: 17.32' Hole: 22.00'
BOREHOLE DIAMETER 7¼"

DRILLER Bovles Brothers Drilling Co.
15865 W. 5th Avenue, Golden, CO
Dave Jarvie
RIG Mobile B-57
BIT(S) T-5

DRILLING FLUID None

SURFACE CASING 5" x 5' steel w/ locking cap

WELL DESIGN:

BASIS: GEOLOGIC LOG X GEOPHYSICAL LOG

CASING STRING(S): C=CASING S=SCREEN

0.00'	2.46'	C1	
2.46' -	17.32'	S1	

CASING: C1 2" I.D., Sch. 5 Type 316 stainless steel, threaded and flush jointed.

SCREEN: S1 2" I.D., Sch. 5 Type 316 stainless steel, threaded and flush jointed, 0.010" wire wrap screen, 0.25' welded bottom cap.

CENTRALIZERS Type 304 stainless steel
4.00' - 5.00'; 9.00' - 10.80'

FILTER MATERIAL 32-42 silica sand
2.40' - 18.30'

CEMENT Portland Type I
0.00' - 1.80'

OTHER 3/8" bentonite pellets
1.80' - 2.40'
18.30' - 22.00'

CONSTRUCTION TIME LOG:

TASK	START DATE 1986	START TIME	FINISH DATE 1986	FINISH TIME
DRILLING:				
7¼" auger	9/2	1100	9/2	1255
GEOPHYS. LOGGING:	—	—	—	—
CASING:				
2" stainless	9/2	1445	9/2	1450
FILTER PLACEMENT:	9/2	1503	9/2	1510
CEMENTING:	9/2	1515	9/2	1530
DEVELOPMENT:	9/12	1240	9/12	1240
OTHER:				
Bentonite	9/2	1510	9/2	1515
	9/2	1430	9/2	1445

WELL DEVELOPMENT

See Well Development Summary Sheet.

COMMENTS:

No water encountered during drilling.

Top of stainless steel casing: 2.50'

LOG OF BORING NO. 31-86

GEOLOGIST(S): DCC
DATE: 8/24/89

PROJECT NO: 667-11.22

TOP/BOTTOM OF CORE IN BOX	TOP/BOTTOM OF INTERVAL	FEET OF CORE IN INTERVAL IN BOX	SAMPLE NUMBER	FRACTURE ANGLE	BEDDING ANGLE	GRAIN SIZE DISTRIBUTION	USCS SYMBOL	DEPTH IN FEET	LITHOLOGIC LOG	LITHOLOGIC DESCRIPTION
0.0	0.0 to 2.0	ND				>50% clay; >85% vfg sand; 45% fines	CL	1		Silty Clay, pale yellowish brown (10 YR 6/2), low to moderate plasticity, trace of roots and gravel
	2.0 to 4.0	1.1						2, 3		Sandstone, very light gray (N8) to grayish orange (10 YR 7/4), bedding not apparent to apparent soft sediment deformation, highly weathered, moderately friable, very fine grained, well sorted, calcareous fracture fillings.
	4.0 to 4.4	ND						4		
Bot 1 of 3	4.4 to 6.4	ND						5		
	6.4 to 7.0	.55		35°				6, 7		
	7.0 to 8.0	ND						8		
	8.0 to 10.0	ND						9		

NOTES: General USCS is modified for this log as follows:
Material amounts are estimated by % volume instead of % weight.
(1) Badly broken core, accurate footage measurements not possible.
(2) Core breaks cannot be matched, accurate footage measurements not possible.

ROCKY FLATS PLANT

FIGURE NO.

LOG OF BORING NO. 31-86

GEOLOGIST(S): DCE
DATE: 8/24/89

PROJECT NO: 667-11.22

TOP/BOTTOM OF CORE IN BOX	TOP/BOTTOM OF INTERVAL	FEET OF CORE IN INTERVAL IN BOX	SAMPLE NUMBER	FRACTURE ANGLE	BEDDING ANGLE	GRAIN SIZE DISTRIBUTION	USCS SYMBOL	DEPTH IN FEET	LITHOLOGIC LOG	LITHOLOGIC DESCRIPTION
10.0 ↓	10.0 to 12.0	ND				>85% v.f. sand ~15% fines		11		Sandstone as above, calcareous fracture fillings are absent.
	12.0 to 13.0	0						12	X	No Sample
	13.0 to 14.5	ND	DC23-9		25°	>85% v.f. sand ~15% fines		13, 14		Sandstone as above (refer interval 0.4 to 12.0 ft), bedding apparent at ~14.3 ft. slight dip, structures not discernable, abundant iron staining.
Set 2	14.5 to 16.3	ND				>50% silt		15, 16		Interval grades to siltstone. Siltstone, grayish orange (10 YR 7/4), bedding not apparent, highly weathered, moderately friable, slight v.f. sand component.
	16.3 to 17.0	ND		~90°		>50% clay		17		Interval grades to silty claystone at ~16.2 ft. Silty claystone, light gray (N7), bedding not apparent, well weathered, slightly friable, iron staining locally bad on fractures.
Set 3	17.0 to 17.7	ND				>80% v.f. sand ~20% silt				
	17.7 to 19.5	ND				>50% silt		18, 19		Interval becomes silty sandstone at ~17.0 ft. Silty sandstone, dark yellowish orange (10 YR 6/6), bedding not apparent, highly weathered, moderately friable, abundant iron stains.
↑ 19.5	19.5									
19.5 ↓ Box 30	19.5 to 21.0	ND								Siltstone, very light gray (N8), bedding

NOTES: General USCS is modified for this log as follows:
Material amounts are estimated by % volume instead of % weight.
(1) Badly broken core, accurate footage measurements not possible.
(2) Core breaks cannot be matched, accurate footage measurements not possible.

ROCKY FLATS PLANT

FIGURE NO.

LOG OF BORING NO. 31-86

GEOLOGIST(S): DCB
DATE: 8/24/89

PROJECT NO: 667-11.22

TOP/BOTTOM OF CORE IN BOX	TOP/BOTTOM OF INTERVAL	FEET OF CORE IN INTERVAL IN BOX	SAMPLE NUMBER	FRACTURE ANGLE	BEDDING ANGLE	GRAIN SIZE DISTRIBUTION	USCS SYMBOL	DEPTH IN FEET	LITHOLOGIC LOG	LITHOLOGIC DESCRIPTION (cont'd from previous page)
Box 3	19.5 to 21.0	ND				>50% S.H.				not apparent, well weathered, slightly friable, slight vfg sand component, possible mg oxide mineralization, local iron staining, abundant iron staining below 19.5 ft., slight clay fraction
	21.0							21		
Box 1	21.0 to 22.0	ND								
22.0	22.0							22		Bottom of B ox 3 of 3 at 22.0 ft.
								23		

NOTES: General: USCS is modified for this log as follows:
Material amounts are estimated by % volume instead of % weight.
(1) Badly broken core, accurate footage measurements not possible.
(2) Core breaks cannot be matched, accurate footage measurements not possible.

ROCKY FLATS PLANT

FIGURE NO.

STATE PLANE COORDINATE:	TOTAL DEPTH (FT): 22	GROUND ELEVATION (FT):	5964.21	PROJECT NUMBER:	667.11	LOG OF BORING NUMBER:
NORTH: 751068	AREA: SOLAR POND	CASING DIAMETER (IN):	0	GEOLOGIST:	DCB	31-86
EAST: 2084766	LOCATOR NUMBER: M11	BOREHOLE DIAMETER (IN):	0	DATE DRILLED:	09/02/86	
REMARKS: Hollow Stem Auger.						

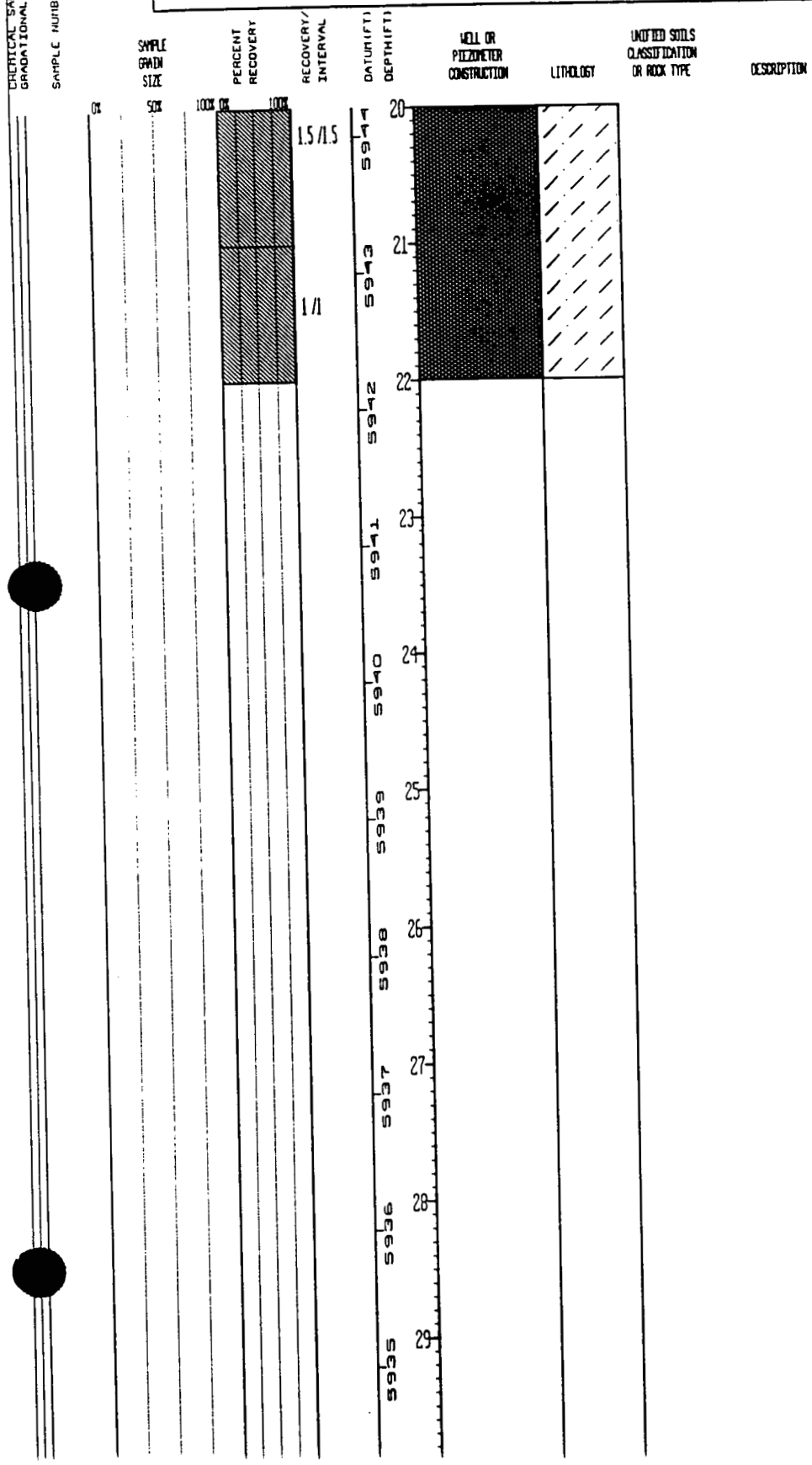
CHEMICAL SAMPLE DEPTH / GRADATIONAL SAMPLE DEPTH	SAMPLE NUMBER	SAMPLE GRAIN SIZE (0% 50% 100%)	PERCENT RECOVERY (0% 100%)	RECOVERY/INTERVAL	DATUM (FT)	DEPTH (FT)	WELL OR PIEZOMETER CONSTRUCTION	LITHOLOGY	UNIFIED SOILS CLASSIFICATION OR ROCK TYPE	DESCRIPTION
					5964	0			CL:	SILTY CLAY, pale yellowish brown (10 YR 6/2), low to moderate plasticity, trace of roots and gravel.
				2/2	5963	1			SANDSTONE:	Top of Bedrock Very light gray (N8) to grayish orange (10 YR 7/4), bedding not apparent to apparent, soft sediment deformation, highly weathered, moderately friable, very fine grained, well sorted, calcareous fracture fillings.
					5962	2				
	DCB 13			1.1/2	5961	3				
				0.9/0.9	5960	4			SANDSTONE:	Same as above.
				2/2	5959	5			SANDSTONE:	Same as above.
					5958	6				
				0.55/0.6					SANDSTONE:	Same as above.
				1/1	5957	7			SANDSTONE:	Same as above.
					5956	8			SANDSTONE:	Same as above.
				2/2	5955	9				

STATE PLANE COORDINATE:	TOTAL DEPTH (FT): 22	GROUND ELEVATION (FT): 5964.21	PROJECT NUMBER: 667.11	LOG OF BORING NUMBER:
NORTH: 751068	AREA: SOLAR POND	CASING DIAMETER (IN): 0	GEOLOGIST: DCB	31-86
EAST: 2084766	LOCATOR NUMBER: M11	BOREHOLE DIAMETER (IN): 0	DATE DRILLED: 09/02/86	

REMARKS: Hollow Stem Auger.

CRITICAL SAMPLE DEPTH / GRADATIONAL SAMPLE DEPTH	SAMPLE NUMBER	SAMPLE GRAIN SIZE (0% 50% 100%)	PERCENT RECOVERY (0% 100%)	RECOVERY/INTERVAL	DATUM (FT)	DEPTH (FT)	WELL OR PIEZOMETER CONSTRUCTION	LITHOLOGY	UNIFIED SOILS CLASSIFICATION OR ROCK TYPE	DESCRIPTION
				2.2	5954	10			SANDSTONE:	As above, calcareous fracture fillings are absent.
				0/1	5953	11			NO SAMPLE:	
	008 9			1.5/1.5	5952	12			SANDSTONE:	Same as above, (reference interval 0.4 ft. to 12.0 ft). Bedding apparent at approx. 14.3 ft., slight dip structures not discernable, abundant iron staining.
				0.5/0.5	5951	13			SANDSTONE:	Same as above.
				1.3/1.3	5950	14			SILTSTONE:	Interval grades to Siltstone, grayish orange (10 YR 7/4), bedding not apparent, highly weathered, moderately friable, slight VFG sand component.
				0.7/0.7	5949	15			SILTY CLAYSTONE:	Interval grades to Silty Claystone at approx. 16.2 ft., light grey (N7), bedding not apparent, well weathered, slightly friable, iron staining locally and on fractures.
				0.7/0.7	5948	16			SILTY SANDSTONE:	Dark yellowish orange (10 YR 6/6), bedding not apparent, highly weathered, moderately friable, abundant iron stains.
				1.8/1.8	5947	17			SILTSTONE:	Very light gray (N8), bedding not apparent, well weathered, slightly friable, slight VFG sand component, possible Mg-oxide mineralization, local iron staining, abundant iron staining below 19.5 ft., slight clay fraction.
					5946	18				NOTE: No water encountered while drilling.
					5945	19				

STATE PLANE COORDINATE:	TOTAL DEPTH (FT): 22	GROUND ELEVATION (FT): 5964.21	PROJECT NUMBER: 667.11	LOG OF BORING NUMBER:
NORTH: 751068	AREA: SOLAR POND	CASING DIAMETER (IN): 0	GEOLOGIST: DCB	31-86
EAST: 2084766	LOCATOR NUMBER: M11	BOREHOLE DIAMETER (IN): 0	DATE DRILLED: 09/02/86	
REMARKS: Hollow Stem Auger.				



INDEX OF DATA

Boring No.: 32-86

Completed as well? Yes

Data in File

X Log of Borehole

X Well Construction Summaries

____ Well Development Summaries

X Hydraulic Conductivity Test Data and Results

X Packer Test Data and Results

X Water Level Data

X Saturated Thickness Hydrographs

Project: Rocky Flats Plant

LOG OF BORING NO. [illegible]-86

Date Drilled 9/3/86, 9/22/86-9/25/86 **Coordinates** N 38065.7 E 21640.7

Boring Method Hollow Stem Auger/NX Core **Ground Surface Elevation** [illegible]

Elev. (feet)	Depth (feet)	Sample Type	Graphic Log	Material Description	Penetration Resistance (Blows/inch) 20 40	Water Content (%) 20 40	Other Tests
				ARTIFICIAL FILL			
				0-2.0'-Sample. Recovered 2.0/2.0'=100%.			
				0-0.8': TOP SOIL: dark yellowish brown (10YR 4/2); unconsolidated; dry.			
				ARAPAHOE FORMATION			
	5			0.8-2.0': SANDSTONE: light gray (N 7); medium to fine-grained; mostly fine-grained sand and silt; slightly calcareous; massive; no apparent bedding; well sorted; firm; dry.			
				2.0-4.0'-Sample. Recovered 2.0/2.0'=100%. SANDSTONE: light gray (N 7); dark yellowish orange (10YR 6/6) stains; increase in silt content; soft; well sorted; dry.			
	10			4.0-7.0'-Sample. Recovered 3.0/3.0'=100%. SANDSTONE: light gray (N 7) with dark yellowish orange (10YR 6/6) mottling; increased clay and silt at 4.8' to 6.3'; bedding 0.05' thick; apparent bedding from variations in staining; leaf imprints; very slightly calcareous along fractures; soft; damp.			
	15			7.0-12.0'-Sample. Recovered 5.0/5.0'=100%. SANDSTONE: medium light gray (N 6) to medium dark gray (N 4); fine to very fine-grained; silty with some clay; dark yellowish orange (10YR 6/6) stains; clayey sand layers alternate with sand layers 0.5-0.8' thick; soft; damp.			
	20						

Remarks Logged by: T. Murphy & J. Bergman Checked by: [illegible]

Project No. 106P06222

Hydro-Search, Inc.

Project: Rocky Flats Plant

LOG OF BORING NO. 32-89

Date Drilled 9/3/86, 9/22/86-9/25/86 **Coordinates** N 38065.7 E 21640.7

Boring Method Hollow Stem Auger/NC Core **Ground Surface Elevation** 5964.46'

Elev. (feet)	Depth (feet)	Sample Type	Graphic Log	Material Description	Penetration Resistance (Blows/inch) 20 40	Water Content (%) 20 40	Other Tests
	20			12.0-17.0'-Sample. Recovered 5.0/5.0'=100%. 12.0-16.5': SANDSTONE: medium light gray (N 6) to medium dark gray (N 4); fine to very fine-grained; silty with some clay; dark yellowish orange (10YR 6/6) stains; soft; damp. 16.5-17.0': CLAYSTONE: medium gray (N 5) to dark gray (N 2) and pale olive (10YR 6/2); black wood fragments; amount of clay and thickness of beds increase with depth; firm; damp.			
	25			17.0-22.0'-Sample. Recovered 5.0/5.0'=100%. CLAYSTONE: grayish olive (10Y 4/2) to medium gray (N 5); dark yellowish orange (10YR 6/6) mottles; calcareous thin sand lenses at 18.0 and 18.5'; lenses are 0.01-0.02' thick; firm; damp.			
	30			22.0-27.0'-Sample. Recovered 5.0/5.0'=100%. CLAYSTONE: grayish olive (10Y 4/2) to medium gray (N 5); dark yellowish orange (10YR 6/6) mottles; firm; damp.			
				25.0-31.0'-Sample. Recovered 0.0/6.0'=0%.			
	35			31.0-36.0'-Sample. Recovered 2.8/5.0'=56%. RQD=1.7/2.8'=12%. CLAYSTONE: pale yellowish brown (10YR 6/2) clay and silty clay; abundant moderate yellowish brown (10YR 5/4) mottles; very well sorted; few organics; consolidated; damp.			
	40			36.0-41.5'-Sample. Recovered 0.0/5.5'=0%.			

Remarks Logged by: T. Murphy & J. Bergman Checked by:

Project No. 106P06222

Hydro-Search, Inc.

Project: Rocky Flats Plant

LOG OF BORING NO. 32-86

Date Drilled 9/3/86, 9/22/86 - 9/25/86 **Coordinates** N 38065.7 E 21640.7

Boring Method Hollow Stem Auger/NC Core **Ground Surface Elevation** 5969.46'

Elev. (feet)	Depth (feet)	Sample Type	Graphic Log	Material Description	Penetration Resistance (Blows/inch) 20 40	Water Content (%) 20 40	Other Tests
	45			41.5-47.0'-Sample. Recovered 2.0/5.5'=36%. RQD=0.3/2.0'=17%. CLAYSTONE: olive gray (5Y 3/2); abundant dark yellowish orange (10YR 6/6) limonite stains predominantly along vertical fractures; consolidated; very well sorted; moist.			
	50			47.0-52.0'-Sample. Recovered 3.7/5.0'=74%. RQD=2.0/3.7'=54%. CLAYSTONE: light olive gray (5Y 5/2); abundant dark yellowish orange (10YR 6/6) and dusky red (5R 3/2) iron staining along fractures; some organics; very well sorted; consolidated; moist.			
	55			52.0-57.0'-Sample. Recovered 4.0/5.0'=80%. RQD=3.5/4.0'=88%. CLAYSTONE: olive gray (5Y 3/2); abundant dark yellowish orange (10YR 6/6) stains; few dusky red (5R 3/2) stains; few organics; very well sorted; consolidated; slightly damp.			
	60			57.0-62.0'-Sample. Recovered 4.3/5.0'=86%. RQD= 3.2/4.3'=75%. CLAYSTONE: olive gray (5Y 3/2); some black organic fragments; few wood fragments; some moderate yellowish brown siltstone; very well sorted; consolidated; firm; damp.			

Remarks Logged by: T. Murphy & J. Bergman Checked by:

Project No. 106P06222

Hydro-Search, Inc.

Project: Rocky Flats Plant

LOG OF BORING NO. 32-86

Date Drilled 9/3/86, 9/22/86 - 9/25/86 **Coordinates** N 38065.7 E 21640.7

Boring Method Hollow Stem Auger/NC Core **Ground Surface Elevation** 5964.26'

Elev. (feet)	Depth (feet)	Sample Type	Graphic Log	Material Description	Penetration Resistance (Blows/inch) 20 40	Water Content (%) 20 40	Other Tests
	60			62.0-67.0'-Sample. Recovered 5.0/5.0'=100%. RQD=4.0/5.0'=80%. CLAYSTONE: olive gray (5Y 3/2); few yellowish orange mottles (10YR 5/4); no organics; very well sorted; consolidated; damp.			
	65			67.0-72.0'-Sample. Recovered 0.6/5.0'=12%. RQD=0.0/0.6'=0%. CLAYSTONE: olive gray (5Y 3/2); few moderate yellowish brown (10YR 5/4) mottles; well sorted; consolidated; no organics; homogenous; damp.			
	70			72.0-77.0'-Sample. Recovered 2.5/5.0'=50%. RQD=0.6/2.5'=24%. CLAYSTONE: olive gray (5Y 3/2); very well sorted; consolidated; homogenous; several black organic fragments; slightly damp.			
	75			78.0-83.0'-Sample. Recovered 3.0/5.0'=60%. RQD=2.2/3.0'=73%. CLAYSTONE: olive gray (5Y 3/2); moderate yellowish brown (10YR 5/4) siltstone nodules; well sorted; consolidated; homogenous; no organics; moist.			
	80						

Remarks Logged by: T. Murphy & J. Bergman Checked by:

Project No. 106P06222

Hydro-Search, Inc.

Project: Rocky Flats Plant

LOG OF BORING NO. 32-86

Date Drilled 9/3/86, 9/22/86 - 9/25/86 **Coordinates** N 38065.7 E 21640.7

Boring Method Hollow Stem Auger/NX Core **Ground Surface Elevation** 5980.6'

Elev. (feet)	Depth (feet)	Sample Type	Graphic Log	Material Description	Penetration Resistance (Blows/Inch) 20 40	Water Content (%) 20 40	Other Tests
	80			83.0-87.0'-Sample. Recovered 3.0/4.0'=75%. RQD=1.4/3.0'=47%. CLAYSTONE: olive gray (5Y 3/2); common moderate yellowish brown (10YR 5/4) mottles and siltstone nodules; well sorted; consolidated; homogenous; moist.			
	85			87.0-92.0'-Sample. Recovered 3.8/5.0'=76%. RQD=0.0/3.8'=0%. CLAYSTONE: olive gray (5Y 3/2); interbedded gray (N 7) sandy and silty clay; very fine-grained; well sorted; consolidated; nicely laminated 0.7'thick; moist.			
	90			92.0-97.0'-Sample. Recovered. 2/5.0'=64%. RQD=2.9/3.2'=91%. SILTY SANDSTONE: light gray (N 7) interbedded with olive gray (5Y 3/2) silty clay; very fine-grained; very well sorted; rounded; consolidated; dry.			
	95			97.0-103.0'-Sample. Recovered 3.6/6.0'=60%. RQD=1.3/3.6=36%. CLAYSTONE: olive gray (5Y 3/2) clay and silty clay; very fine-grained; little sand; few moderate yellowish brown mottles (10YR 5/4); very well sorted; consolidated; slightly damp.			
	100						

Remarks Logged by: T. Murphy & J. Bergman Checked by: [illegible]

Project No. 106P06222

Hydro-Search, Inc.

Project: Rocky Flats Plant

LOG OF BORING NO. 32-86

Date Drilled 9/3/86, 9/22/86 - 9/25/86 **Coordinates** N 33065.7 E 21640.7

Boring Method Hollow Stem Auger/NC Core **Ground Surface Elevation** [illegible]

Elev. (feet)	Depth (feet)	Sample Type	Graphic Log	Material Description	Penetration Resistance (Blows/inch) 20 40	Water Content (%) 20 40	Other Tests
	100						
				103.0-107.0'-Sample. Recovered 2.3/4.0'=58%. RQD=0.0/2.3'=0%. CLAYSTONE: olive gray (5Y 3/2) clay and silty clay; some very fine-grained sand; very well sorted; rounded; slightly damp.			
	105						
				107.0-112.0'-Sample. Recovered 2.3/5.0'=46%. RQD=1.1/2.3'=48%. CLAYSTONE: olive gray (5Y 3/2) clay and silty clay; very well sorted; consolidated; slightly damp.			
				112.0-117.0'-Sample. Recovered 4.2/5.0'=83%. RQD=2.8/4.2'=67%. 112.8-115.2': CLAYSTONE: olive gray (5Y 3/2) clay and silty clay; abundant yellowish brown (10YR 5/4) pebble and gravel-sized nodules; angular; moderately sorted; dry. 115.2-117': SAND: light gray (N 7/0); very fine-grained; gradational contact; very well sorted; rounded; consolidated; dry.			
	110						
	115						
				117.0-122.0'-Sample. Recovered 2.2/5.0'=44%. RQD=0.5/2.2'=23%. SAND: light gray (N 7/0); very fine-grained and silty sand; very well sorted; rounded; consolidated; lower 1.0' becomes laminated with alternating layers of olive gray (5Y 3/2) clay and gray (N 7) very fine-grained sand; dry.			
	120						

Remarks Logged by: T. Murphy & J. Bergman Checked by: [illegible]

Project No. 106P06222

Hydro-Search, Inc.

Project: Rocky Flats Plant

LOG OF BORING NO. 32-86

Date Drilled 9/3/86, 9/22/86 - 9/25/86 **Coordinates** N 38065.7 E 21640.7

Boring Method Hollow Stem Auger/NC Core **Ground Surface Elevation** 6041.26'

Elev. (feet)	Depth (feet)	Sample Type	Graphic Log	Material Description	Penetration Resistance (Blows/inch) 20 40	Water Content (%) 20 40	Other Tests
	120			122.0-127.0'-Sample. Recovered 4.2/5.0'=84%. RQD=4.0/4.2'=95%. SILTY SAND: light gray (N 7/0); fine and very fine-grained sand and silty sand; thinly laminated with alternating layers of olive gray (5Y 3/2) clay and light gray (N 7) sand; well sorted; consolidated; rounded; dry.			
	125			127.0-132.0'-Sample. Recovered 2.0/5.0'=40%. RQD=0.8/2.0'=40%. CLAYSTONE: olive gray (5Y 3/2) clay and silty clay; one moderate yellowish brown (10YR 5/4) siltstone layer at 131.0' 0.02'wide; very well sorted; consolidated; rounded; dry.			
	130			132.0-135.0'-Sample. Recovered 1.5/3.0'=50%. RQD=0.0/3.0'=0%. CLAYSTONE: olive gray (5Y 3/2); no mottles; well sorted; consolidated; homogenous; dry.			
	135			TOTAL DEPTH: 135.0'			
	140						

Remarks Logged by: T. Murphy & J. Bergman Checked by:

Project No. 106P06222

Hydro-Search, Inc.

LOG OF BORING NO. 32-86

GEOLOGIST(S): LAA
DATE: 8/21/89

PROJECT NO: 667-1122

TOP/BOTTOM OF CORE IN BOX	TOP/BOTTOM OF INTERVAL	FEET OF CORE IN INTERVAL IN BOX	SAMPLE NUMBER	FRACTURE ANGLE	BEDDING ANGLE	GRAIN SIZE DISTRIBUTION	USCS SYMBOL	DEPTH IN FEET	LITHOLOGIC LOG	LITHOLOGIC DESCRIPTION
0.0	0.0	1.6(1)				Clay ≈45% Gravel ≈30% Sand ≈100%	CL / Sp	1		Gravelly Sandy Clay. Pale yellowish brown (10yr 6/2). Sub plast. mod. Angular to Sub angular. Poorly graded. Max. Size Gravel 3.5cm. Some root material. Grades to v.f.g. sand. Very lt. gray to white (N8-N9). Some very thin $CaCO_3$ stringers. Sand well sorted silt to v.f.g. sand.
	2.0	1.75(1) LAA #10 #11				Sand >90%	Sp	2, 3		Sand as above; also has dk. yellowish orange (10yr 6/6). Coloring.
	4.0	1.85(1)				Sand >85%	Sp	4, 5		Sand as above some $CaCO_3$ in matrix. Some black carb. material.
Box 1 of 4	6.0	1.7(1)				Sand >85%		6, 7		Sandstone, Pinkish gray (5yr 8/1) to dk. yellowish orange (10yr 6/6). Mod. to highly weathered. Mod. to highly friable. Bedding thin layered (≈1-2mm). Tilted ≈ 25%. Some carb. material, iron staining. Some $CaCO_3$ in small fractures. Trace clay
	7.5	1.85(1)			~~20°~~	Sand >85%		8, 9		Same as above
9.3	9.3	1.65(1)		90°	20°	Silt >50%				Clayey siltstone. Very pale orange to dk. yellowish orange (10yr 8/2 to 10yr 6/6). Mod. weathered, mod. friable. Tilted layered bedding. Some iron staining, some (continued on next page).
	10.5↓									

NOTES: General USCS is modified for this log as follows:
Material amounts are estimated by % volume instead of % weight.
(1) Badly broken core, accurate footage measurements not possible.
(2) Core breaks cannot be matched, accurate footage measurements not possible.

ROCKY FLATS PLANT

FIGURE NO.

LOG OF BORING NO. 32-86

GEOLOGIST(S): LAA
DATE: 8/21/89
PROJECT NO: 667-1122

TOP/BOTTOM OF CORE IN BOX	TOP/BOTTOM OF INTERVAL	FEET OF CORE IN INTERVAL IN BOX	SAMPLE NUMBER	FRACTURE ANGLE	BEDDING ANGLE	GRAIN SIZE DISTRIBUTION	USCS SYMBOL	DEPTH IN FEET	LITHOLOGIC LOG	LITHOLOGIC DESCRIPTION
Box 2 of 4	10.5									(Cont. from previous page) Carb. material in fractures. Some v.f.g. sand.
	12.0	1.5(1)			20°	Silt >50%		11, 12		Clayey Siltstone. Very lt. gray to dk. yellowish orange (N8) to (10yr 6/6). Mod. weathered, mod. friable, layered tilted bedding. Some carb. material in fractures. Some $CaCO_3$ some iron staining. Some v.f.g. sand.
	13.8	1.75(1)				Silt >50%		13		Same as above. Bedding closer to horizontal.
	15.4	1.7(1)				Silt >50%		14, 15		Same as above. Slightly weathered. Slightly friable. Bedding not evident.
	17.0	1.7(1)				Silt >50%		16		Same as above.
Box 3 of 4	18.8	1.7(2) 1.7(2)				Clay >50%		17, 18		Silty Claystone. yellowish gray (5y 8/1) to dk. yellowish orange (10yr 6/6) mod. weathered, slightly friable. Bedding not evident. Some iron staining in fractures. Trace Carb. material and $CaCO_3$.
	20.0	1.6(2)				Clay >50%		19		Same as above. Some pure silt areas. Some very heavily iron stained areas.

NOTES: General USCS is modified for this log as follows:
Material amounts are estimated by % volume instead of % weight.
(1) Badly broken core, accurate footage measurements not possible.
(2) Core breaks cannot be matched, accurate footage measurements not possible.

ROCKY FLATS PLANT

FIGURE NO.

LOG OF BORING NO. 32-86

GEOLOGIST(S): LAA
DATE: 8/21/89

PROJECT NO: 6267-1122

TOP/BOTTOM OF CORE IN BOX	TOP/BOTTOM OF INTERVAL	FEET OF CORE IN INTERVAL IN BOX	SAMPLE NUMBER	FRACTURE ANGLE	BEDDING ANGLE	GRAIN SIZE DISTRIBUTION	USCS SYMBOL	DEPTH IN FEET	LITHOLOGIC LOG	LITHOLOGIC DESCRIPTION
Box 3 of 4	20.0	(1) 1.8				Clay >50%		21		Silty Claystone. Lt. Olive gray (5y6/1) to dk. yellowish orange (10yr 6/6.). Mod. weathered. Slightly formed. Friable. Some iron staining + Carb. material. Some $CaCO_3$ in areas. Some small areas of pure silt. (Not in layers).
	22.0							22		
	23.9	(1) 1.8				Clay >50%		23		Same as above
								24		
	25.5	(1) 1.7				Clay >50%		25		Same as above
Box 4 of 4	27.0	1.6 (1)				Clay >50%		26		Same as above.
								27		Bottom of Boxes
								28		
								29		

NOTES: General USCS is modified for this log as follows:
Material amounts are estimated by % volume instead of % weight.
(1) Badly broken core, accurate footage measurements not possible.
(2) Core breaks cannot be matched, accurate footage measurements not possible.

ROCKY FLATS PLANT

FIGURE NO.

LOG OF BORING NO. 32-86

GEOLOGIST(S): DCB
DATE: 8/24/89

PROJECT NO: 667-11.22

TOP/BOTTOM OF CORE IN BOX	TOP/BOTTOM OF INTERVAL	FEET OF CORE IN INTERVAL IN BOX	SAMPLE NUMBER	FRACTURE ANGLE	BEDDING ANGLE	GRAIN SIZE DISTRIBUTION	USCS SYMBOL	DEPTH IN FEET	LITHOLOGIC LOG	LITHOLOGIC DESCRIPTION
										No Core above 31 ft.
31.0	31.0 to 33.2	NO				>50% clay		31, 32, 33		Claystone light gray (N7), bedding not apparent weathers slightly friable, iron staining on fractures, occasional carbonaceous mineralization.
	33.2 to 36.0	1.0 (1)						34, 35, 36		
	36.0 to 45.0	0						37, 38, 39		No Sample

NOTES: General USCS is modified for this log as follows:
Material amounts are estimated by % volume instead of % weight.
(1) Badly broken core, accurate footage measurements not possible.
(2) Core breaks cannot be matched, accurate footage measurements not possible.

ROCKY FLATS PLANT

FIGURE NO.

LOG OF BORING NO. 32-86

GEOLOGIST(S): DCB
DATE: 8/24/89

PROJECT NO: 667-11.22

TOP/BOTTOM OF CORE IN BOX	TOP/BOTTOM OF INTERVAL	FEET OF CORE IN INTERVAL IN BOX	SAMPLE NUMBER	FRACTURE ANGLE	BEDDING ANGLE	GRAIN SIZE DISTRIBUTION	USCS SYMBOL	DEPTH IN FEET	LITHOLOGIC LOG	LITHOLOGIC DESCRIPTION
Box 7	36.0 to 45.0	0						41, 42, 43, 44, 45		No Sample
	45.0 to 45.5	ND				>50' clay		45		Claystone, light gray (N7), bedding not apparent, weathered, slightly friable, iron staining on fractures.
	45.5 to 47.0	(1) 1.0						46, 47		
	47.0 to 48.3	0						48		No Sample
	48.3 to 49.0	ND		90°		>50' clay		49		Claystone, as above (reference interval 45 to 47 ft.)
	49.0 to 51.0	ND								

NOTES: General USCS is modified for this log as follows:
Material amounts are estimated by % volume instead of % weight.
(1) Badly broken core, accurate footage measurements not possible.
(2) Core breaks cannot be matched, accurate footage measurements not possible.

ROCKY FLATS PLANT

FIGURE NO.

LOG OF BORING NO. 32-86

GEOLOGIST(S): D CB
DATE: 8/24/89

PROJECT NO: 667-11.22

TOP/BOTTOM OF CORE IN BOX	TOP/BOTTOM OF INTERVAL	FEET OF CORE IN INTERVAL IN BOX	SAMPLE NUMBER	FRACTURE ANGLE	BEDDING ANGLE	GRAIN SIZE DISTRIBUTION	USCS SYMBOL	DEPTH IN FEET	LITHOLOGIC LOG	LITHOLOGIC DESCRIPTION
1 of 3	49.0 to 51.0	ND				>50% clay				Claystone, as above (reference interval 45 to 47 ft.)
	51.0 to 52.0			90°				51		
								52		
52.0 to 53.0	0							53		No Sample
53.0 ↓	53.0 to 54.7	ND		80°		>50% clay		54		Claystone as above (reference interval 45 to 47 ft.) bedding not apparent to thin (<2mm) with slight dip, slight silt fraction occurs as individual strata w/in interval
2 of 3	54.7 to 56.5	ND		80°	10°			55		
								56		
	56.5 to 57.0	(2) ND						57		
	57.0 to 57.7	0								No Sample
3 of 3	57.7 to 59.2	ND			5°	>50% clay		58		Claystone, medium gray (N6), bedding not apparent to thin (<2mm) slight dip, weathered, slightly friable, slight silt fraction, iron staining occurs locally.
								59		
	59.2 to 61.0									

NOTES: General USCS is modified for this log as follows:
Material amounts are estimated by % volume instead of % weight.
(1) Badly broken core, accurate footage measurements not possible.
(2) Core breaks cannot be matched, accurate footage measurements not possible.

ROCKY FLATS PLANT

FIGURE NO.

LOG OF BORING NO. 32-86

GEOLOGIST(S): DCB
DATE: 8/24/89

PROJECT NO: 667-11-22

TOP/BOTTOM OF CORE IN BOX	TOP/BOTTOM OF INTERVAL	FEET OF CORE IN INTERVAL IN BOX	SAMPLE NUMBER	FRACTURE ANGLE	BEDDING ANGLE	GRAIN SIZE DISTRIBUTION	USCS SYMBOL	DEPTH IN FEET	LITHOLOGIC LOG	LITHOLOGIC DESCRIPTION
Box 2 of 7	59.2 to 61.0	ND			>50% Clay					Claystone as above slickensides at — 60.6 ft. curvilinear surface.
	61.0 to 62.0	ND						61		
	62.0 to 62.8	ND						62		
62.8	62.8 to 65.0	ND						63		claystone (as above). Bedding not apparent and amount iron staining diminishes below 62.8 ft, silt fraction is disseminated throughout.
								64		
								65		
Box 3 of 7	65.0 to 67.0	ND						66		
								67		
Box 4 of 7	67.0 to 71.5	0						68		No Sample
								69		

NOTES: General USCS is modified for this log as follows:
Material amounts are estimated by % volume instead of % weight.
(1) Badly broken core, accurate footage measurements not possible.
(2) Core breaks cannot be matched, accurate footage measurements not possible.

ROCKY FLATS PLANT

FIGURE NO.

LOG OF BORING NO. 32-86

GEOLOGIST(S): DCB
DATE: 8/24/89

PROJECT NO: 667-11.22

TOP/BOTTOM OF CORE IN BOX	TOP/BOTTOM OF INTERVAL	FEET OF CORE IN INTERVAL IN BOX	SAMPLE NUMBER	FRACTURE ANGLE	BEDDING ANGLE	GRAIN SIZE DISTRIBUTION	USCS SYMBOL	DEPTH IN FEET	LITHOLOGIC LOG	LITHOLOGIC DESCRIPTION
	67.0 to 71.5	0						71		No Sample
Box 3 of 7	71.5 to 72.0	ND						72		Claystone, dark gray (N3), bedding may be horizontal based on appearance of core breaks, weathered, slightly friable, carbonaceous, occasional bodies of coal.
	72.0 to 74.5	(1) .3						73		
	74.5 to 75.5	(1) .7						74		Claystone, medium gray (N5), bedding not apparent, weathered, slightly friable, moderate amount of carb. mineralization, slight silt fraction.
	75.5 to 77.0	ND						75		
								76		slickensides at ~76.8 ft 55° to ~90°
								77		
	77.0 to 80.0	0						78		No Sample
								79		

NOTES: General USCS is modified for this log as follows:
Material amounts are estimated by % volume instead of % weight.
(1) Badly broken core, accurate footage measurements not possible.
(2) Core breaks cannot be matched, accurate footage measurements not possible.

ROCKY FLATS PLANT

FIGURE NO.

LOG OF BORING NO. 22-86

GEOLOGIST(S): DCB
DATE: 8/24/89

PROJECT NO: 667-11

TOP/BOTTOM OF CORE IN BOX	TOP/BOTTOM OF INTERVAL	FEET OF CORE IN INTERVAL IN BOX	SAMPLE NUMBER	FRACTURE ANGLE	BEDDING ANGLE	GRAIN SIZE DISTRIBUTION	USCS SYMBOL	DEPTH IN FEET	LITHOLOGIC LOG	LITHOLOGIC DESCRIPTION
Box 3 of 7	80.0 to 80.4	.2 (1)				>50% Clay				Claystone as above (reference interval 72.0 to 77.0 ft.)
	80.4 to 82.0	ND						81		slickensides at ~83.0 ft., curvilinear surface.
82.0	82.0 to 83.0	ND						82		
	83.0 to 84.0	0						83		No Sample
	84.0 to 84.7	(1) .55				>50% clay		84		Claystone as above (reference interval 72.0 to 77.0 ft.
	84.7 to 87.0	ND						85		
								86		Slickensides at ~ 86.0 ft. ~ 80°
	87.0 to 88.2	0						87		No Sample
	88.2 to 90.3	ND				>50% Clay		88		Silty Claystone, light gray (N7) thin (<2 mm) horizontal bedding slightly friable, moderate amount of carb. mineralization
								89		

NOTES: General USCS is modified for this log as follows:
Material amounts are estimated by % volume instead of % weight.
(1) Badly broken core, accurate footage measurements not possible.
(2) Core breaks cannot be matched, accurate footage measurements not possible.

ROCKY FLATS PLANT

FIGURE NO.

LOG OF BORING NO. 32-86

GEOLOGIST(S): DCB
DATE: 8/25/89

PROJECT NO: 667-11.22

TOP/BOTTOM OF CORE IN BOX	TOP/BOTTOM OF INTERVAL	FEET OF CORE IN INTERVAL IN BOX	SAMPLE NUMBER	FRACTURE ANGLE	BEDDING ANGLE	GRAIN SIZE DISTRIBUTION	USCS SYMBOL	DEPTH IN FEET	LITHOLOGIC LOG	LITHOLOGIC DESCRIPTION
Box 4 of 7	85.2 to 90.3	ND				>50% Clay				
	90.3 to 92.0	ND						91		silty claystone as above bedding exhibits soft sediment deformation, and silt fraction increases.
	92.0 to 93.8	0						92, 93		
	93.8 to 95.5	ND			~5°	~50% clay ~50% silt		94, 95		
Box 5 of 7	95.5 to 97.0	ND						96, 97		Interbedded siltstone and claystone very light gray (N8) to medium dark gray (N4), respectively, thin bedded (<2 cm and less), slight dip, slightly friable.
	97.0 to 99.4	0				DCS		98, 99		No Sample
	99.4 to 99.7	.25 (1)			~5°	>50% clay				Claystone medium light gray (N6), thin bedded (<2 cm), slight dip,
	99.7 to 101.5	ND								

NOTES: General USCS is modified for this log as follows:
Material amounts are estimated by % volume instead of % weight.
(1) Badly broken core, accurate footage measurements not possible.
(2) Core breaks cannot be matched, accurate footage measurements not possible.

ROCKY FLATS PLANT

FIGURE NO.

LOG OF BORING NO. 32-86

GEOLOGIST(S): DCB
DATE: 8/25/86

PROJECT NO: 667-11.22

TOP/BOTTOM OF CORE IN BOX	TOP/BOTTOM OF INTERVAL	FEET OF CORE IN INTERVAL IN BOX	SAMPLE NUMBER	FRACTURE ANGLE	BEDDING ANGLE	GRAIN SIZE DISTRIBUTION	USCS SYMBOL	DEPTH IN FEET	LITHOLOGIC LOG	LITHOLOGIC DESCRIPTION
Box 5 of 7	99.7 to 101.5	ND				>50' clay		101		(cont'd. from previous page), slightly friable, inte-bedded siltstone occurs throughout interval, carb. mineralization occurs on partings.
	101.5 to 103.0	ND						102, 103		
	103.0 to 104.7	0						104		No Sample
	104.7 to 105.0	ND						105		Claystone as above (reference interval 99.7 to 101.5 ft).
	105.0 to 107.0	ND						106, 107		
	107.0 to 109.7	0						108, 109		No Sample
	109.7 to 110.0	ND								Claystone, medium gray (N5), bedding

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Material amounts are estimated by % volume instead of % weight.
(1) Badly broken core, accurate footage measurements not possible.
(2) Core breaks cannot be matched, accurate footage measurements not possible.

ROCKY FLATS PLANT

FIGURE NO.

LOG OF BORING NO. 32-86

GEOLOGIST(S): DCB
DATE: 2/25/89

PROJECT NO: 667-11.22

TOP/BOTTOM OF CORE IN BOX	TOP/BOTTOM OF INTERVAL	FEET OF CORE IN INTERVAL IN BOX	SAMPLE NUMBER	FRACTURE ANGLE	BEDDING ANGLE	GRAIN SIZE DISTRIBUTION	USCS SYMBOL	DEPTH IN FEET	LITHOLOGIC LOG	LITHOLOGIC DESCRIPTION
Box 5 of 7	109.7 to 112.0					>50% clay		111		(cont'd. from previous page), not apparent, slightly friable, moderate silt component. Slickensides occur at ~111.0 ft, attitude of ~28°.
112.0	112.0 to 112.85	0						112		No Sample
112.85	112.85 to 115.0	N/D				>50% clay		113, 114, 115		Claystone as above (reference interval 109.7 to 112.0), Slickensides at ~113.3 ft., badly broken, attitude cannot be accurately measured. Interval grades to a carbonaceous clay at ~114.8 and the color changes to dark gray (N3
Box 6 of 7	115.0 to 115.2	N/D								
	115.2 to 117.0	N/D				~85% vfg ~15% silt		116, 117		Interval grades to sandstone, bioturbated, slightly friable, vfg, well sorted, slight to moderate silt fraction.
	117.0 to 119.8	0						118, 119		No Sample
	119.8 to 121.0	N/D								sandstone as above (reference interval

NOTES: General USCS is modified for this log as follows:
Material amounts are estimated by % volume instead of % weight.
(1) Badly broken core, accurate footage measurements not possible.
(2) Core breaks cannot be matched, accurate footage measurements not possible.

ROCKY FLATS PLANT

FIGURE NO.

LOG OF BORING NO. 32-86

GEOLOGIST(S): DCB
DATE: 8/25/86

PROJECT NO: 667-11.22

TOP/BOTTOM OF CORE IN BOX	TOP/BOTTOM OF INTERVAL	FEET OF CORE IN INTERVAL IN BOX	SAMPLE NUMBER	FRACTURE ANGLE	BEDDING ANGLE	GRAIN SIZE DISTRIBUTION	USCS SYMBOL	DEPTH IN FEET	LITHOLOGIC LOG	LITHOLOGIC DESCRIPTION
Box 6 of 7	119.8 to 121.1	ND				Sand vfg ~85% ~15% silt		121		(cont'd from previous page) 115.2 to 117.0.
	DCB 121.1 to 122.0									Influx of silt below DCB ~ 121 ft. bedding is thin (<2mm) and exhibits soft sediment deformation.
	122.0 to 122.8	0						122		No Sample
	122.8 to 124.7	(2) .8				vfg sand ~80% fines ~20%		123, 124		Silty Sandstone, very light gray (N8) to med. dark gray (N4), thin bedded (≤ 2mm) interbedded clay/silt and sand exhibit soft sed. deformation, dewatering (Cl DCB) structures, slumps, slightly friable vfg sand, vertical burrows occasional iron stains.
	124.7 to 126.3	ND						125, 126		Silty Claystone, medium gray (N5), bedding not apparent, slightly friable, occasional iron stains, carb mineralization on partings
126.3	126.3 to 127.0	1.7			20°	~60% silt ~30% clay ~10% vfg sand		127		Interbedded siltstone and claystone and vfg sandstone, light gray (N7) to med. light gray (N6), bedding is typically ≤ 2mm, moderate dip, slightly friable, local iron staining
Box 7 of 7	127.0 to 130.0	0						128, 129		No Sample

NOTES: General USCS is modified for this log as follows:
Material amounts are estimated by % volume instead of % weight.
(1) Badly broken core, accurate footage measurements not possible.
(2) Core breaks cannot be matched, accurate footage measurements not possible.

ROCKY FLATS PLANT

FIGURE NO.

LOG OF BORING NO. 32-86

GEOLOGIST(S): DCB
DATE: 8/25/89

PROJECT NO: 667-1122

TOP/BOTTOM OF CORE IN BOX	TOP/BOTTOM OF INTERVAL	FEET OF CORE IN INTERVAL IN BOX	SAMPLE NUMBER	FRACTURE ANGLE	BEDDING ANGLE	GRAIN SIZE DISTRIBUTION	USCS SYMBOL	DEPTH IN FEET	LITHOLOGIC LOG	LITHOLOGIC DESCRIPTION
2 of 2	130.0 to 132.0	ND				>50% clay		131		Claystone, med. dark gray (N4) bedding not apparent, slightly friable, moderate silt fraction, carb. mineralization on partings, occasional iron stains, silt fraction increases with depth.
	132.0 to 133.5	0						132, 133		No Sample
1 of 2	133.5 to 135.0	ND				>50% clay		134, 135		Claystone as above (reference interval 130.0 to 132.0)
								136		Bottom of Box 7 of 7 at 135.0 ft.

NOTES: General USCS is modified for this log as follows:
Material amounts are estimated by % volume instead of % weight.
(1) Badly broken core, accurate footage measurements not possible.
(2) Core breaks cannot be matched, accurate footage measurements not possible.

ROCKY FLATS PLANT

FIGURE NO.

STATE PLANE COORDINATE:		TOTAL DEPTH (FT): 135	GROUND ELEVATION (FT):	5964.46	PROJECT NUMBER:	667.11	LOG OF BORING NUMBER:
NORTH:	751068	AREA: SOLAR POND	CASING DIAMETER (IN):	2 ID	GEOLOGIST:	LAA/DCB	32-86
EAST:	2084745	LOCATOR NUMBER: L10	BOREHOLE DIAMETER (IN):	7 1/4	DATE DRILLED:	09/25/86	
REMARKS:	Hollow Stem Auger/NC Core.						

CHEMICAL SAMPLE DEPTH / GRADATIONAL SAMPLE	SAMPLE NUMBER	SAMPLE GRAIN SIZE (0% 50% 100%)	PERCENT RECOVERY (0% 100%)	RECOVERY/INTERVAL	DATUM (FT)	DEPTH (FT)	WELL OR PIEZOMETER CONSTRUCTION	LITHOLOGY	UNIFIED SOILS CLASSIFICATION OR ROCK TYPE	DESCRIPTION
				1/1	5964	0			CL:	SANDY GRAVELLY CLAY, pale yellowish brown (10 YR 6/2). Est. plast. mod. Gravel angular to sub-angular. Poorly graded. Max size 3.5 cm. Some root material.
				0.6/1	5963	1			SANDSTONE:	Top of Bedrock Very light gray to white (N 8-N 9). Some very thin CaCO3 stringers. Sand well sorted, silt to VFG sand.
	LAA11			1.75/2	5962	2			SANDSTONE	As above, also has dark yellowish orange (10 YR 6/6) coloring.
				1.85/2	5961	3			SANDSTONE:	As above, some CaCO3 in matrix. Some black carb. material.
				1.7/1.5	5960	4			SANDSTONE:	Pinkish gray (5 YR 8/1) to dark yellowish orange (10 YR 6/6). Mod. to highly weathered. Mod. to highly friable. Bedding thin layered (approx. 1-2 mm). Tilted approx. 25 degrees. Some carb. material, iron staining. Some CaCO3 in small fractures. Trace clay.
				1.85/1.8	5959	5			SANDSTONE:	Same as above.
				1.55/1.2	5958	6			CLAYEY SILTSTONE:	Very pale orange to dark yellowish orange (10 YR 8/2 to 10 YR 6/6). Mod. weathered, mod. friable. Tilted layered bedding. Some iron staining, some carb. material in fractures. Some VFG sand. Fracture angle = 90
					5957	7				
					5956	8				
					5955	9				

STATE PLANE COORDINATE:	TOTAL DEPTH (FT): 135	GROUND ELEVATION (FT): 5964.46	PROJECT NUMBER: 667.11	LOG OF BORING NUMBER:
NORTH: 751068	AREA: SOLAR POND	CASING DIAMETER (IN): 2.10	GEOLOGIST: LAA/DCB	32-86
EAST: 2084745	LOCATOR NUMBER: L10	BOREHOLE DIAMETER (IN): 7 1/4	DATE DRILLED: 09/25/86	

REMARKS: Hollow Stem Auger/NC Core.

CHEMICAL SAMPLE DEPTH
GRADATIONAL SAMPLE DEPTH
SAMPLE NUMBER

SAMPLE GRAIN SIZE	PERCENT RECOVERY	RECOVERY/INTERVAL	DATUM (FT)	DEPTH (FT)	WELL OR PIEZOMETER CONSTRUCTION	LITHOLOGY	UNIFIED SOILS CLASSIFICATION OR ROCK TYPE	DESCRIPTION
								degrees. Bedding angle = 20 degrees.
		1.5/1.5	5954, 5953	10, 11			CLAYEY SILTSTONE	Very light gray to dark yellowish orange (N 8 to 10 YR 6/6). Mod. weathered, mod. friable. Layered tilted bedding, (20 degrees). Some carb. material in fractures. Some CaCO3. Some iron staining. Some VFG sand.
		1.75/1.8	5952, 5951	12, 13			CLAYEY SILTSTONE	Same as above. Bedding closer to horizontal.
		1.7/1.6	5950	14, 15			CLAYEY SILTSTONE	Same as above. Slightly weathered, slightly friable. Bedding not evident.
		1.7/1.6	5949, 5948	16			CLAYEY SILTSTONE	Same as above.
		1.7/1.8	5947, 5946	17, 18			SILTY CLAYSTONE	Yellowish gray (5 Y 8/1) to dark yellowish orange (10 YR 6/6). Mod. weathered, slightly friable. Bedding not evident. Some iron staining in fractures. Trace carb. material and CaCO3.
		1.6/1.2	5945	19			SILTY CLAYSTONE	Same as above. Some pure silt areas. Some very heavily iron stained areas.

STATE PLANE COORDINATE:		TOTAL DEPTH (FT): 135	GROUND ELEVATION (FT):	5964.46	PROJECT NUMBER:	567.11	LOG OF BORING NUMBER:
NORTH:	751068	AREA: SOLAR POND	CASING DIAMETER (IN):	2 ID	GEOLOGIST:	LAA/DCB	32-86
EAST:	2084745	LOCATOR NUMBER: L10	BOREHOLE DIAMETER (IN):	7 1/4	DATE DRILLED:	09/25/86	

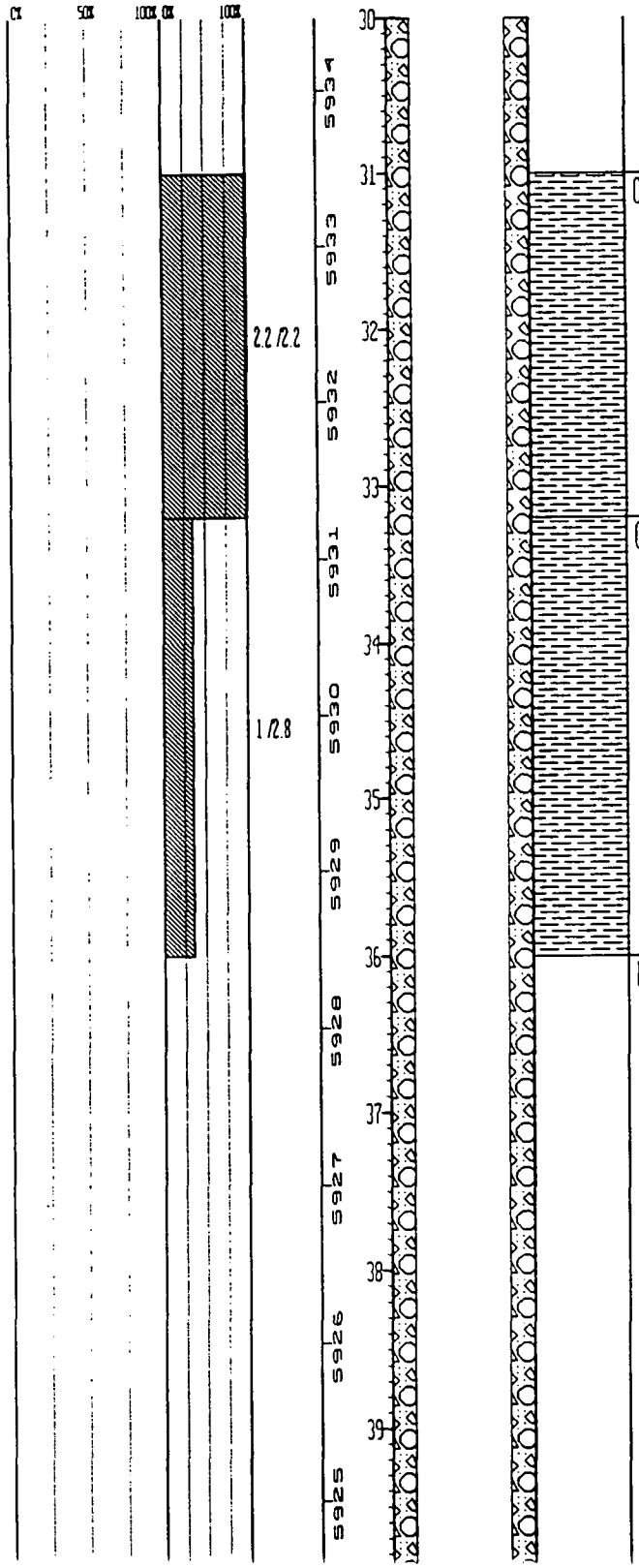
REMARKS: Hollow Stem Auger/NC Core.

CHEMICAL SAMPLE DEPTH / GRADATIONAL SAMPLE	SAMPLE NUMBER	SAMPLE GRAIN SIZE (0% 50% 100%)	PERCENT RECOVERY (0% 100%)	RECOVERY/INTERVAL	DATUM (FT)	DEPTH (FT)	WELL OR PIEZOMETER CONSTRUCTION	LITHOLOGY	UNIFIED SOILS CLASSIFICATION OR ROCK TYPE	DESCRIPTION
				1.8/2	5944	20			SILTY CLAYSTONE	Light olive gray (5 Y 6/1) to dark yellowish orange (10 YR 6/6). Mod. weathered. Slightly to mod. friable. Some iron staining and carb. material. Some CaCO3 in areas. Some small areas of pure silt (not in layers).
					5943	21				
				1.8/1.9	5942	22			SILTY CLAYSTONE	Same as above.
					5941	23				
				1.7/1.6	5940	24			SILTY CLAYSTONE	Same as above.
					5939	25				
				1.6/1.5	5938	26			SILTY CLAYSTONE	Same as above.
					5937	27			NO SAMPLE	
				0/4	5936	28				
					5935	29				

STATE PLANE COORDINATE:		TOTAL DEPTH (FT): 135	GROUND ELEVATION (FT)	5964.46	PROJECT NUMBER:	667.11	LOG OF BORING NUMBER:
NORTH:	751068	AREA: SOLAR POND	CASING DIAMETER (IN):	2 10	GEOLOGIST:	LAA/DCB	32-86
EAST:	2084745	LOCATOR NUMBER: L10	BOREHOLE DIAMETER (IN):	7 1/4	DATE DRILLED:	09/25/86	

REMARKS: Hollow Stem Auger/NC Core.

CHEMICAL SAMPLE DEPTH
GRADATIONAL SAMPLE DEPTH
SAMPLE NUMBER
SAMPLE GRAIN SIZE (CL 50% 100%)
PERCENT RECOVERY (0% 100%)
RECOVERY/INTERVAL
DATUM (FT)
DEPTH (FT)
WELL OR PIEZOMETER CONSTRUCTION
LITHOLOGY
UNIFIED SOILS CLASSIFICATION OR ROCK TYPE
DESCRIPTION



UNIFIED SOILS CLASSIFICATION OR ROCK TYPE	DESCRIPTION
CLAYSTONE:	Light gray (N 7), bedding not apparent, weathered, slightly friable, iron staining on fractures, occasional carbonaceous mineralization.
CLAYSTONE:	Same as above.
NO SAMPLE:	

STATE PLANE COORDINATE:		TOTAL DEPTH (FT): 135	GROUND ELEVATION (FT):	5964.46	PROJECT NUMBER:	667.11	LOG OF BORING NUMBER:
NORTH:	751068	AREA: SOLAR POND	CASING DIAMETER (IN):	2 ID	GEOLOGIST:	LAA/DCB	32-86
EAST:	2084745	LOCATOR NUMBER: L10	BOREHOLE DIAMETER (IN):	7 1/4	DATE DRILLED:	09/25/86	

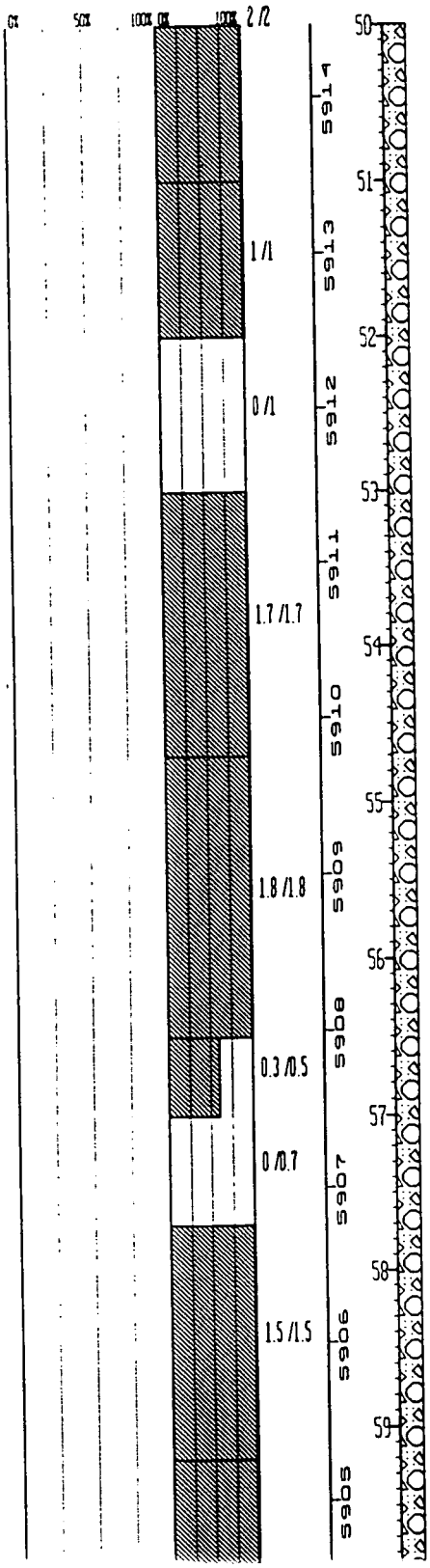
REMARKS: Hollow Stem Auger/NC Core.

CHEMICAL SAMPLE DEPTH / GRADATIONAL SAMPLE	SAMPLE NUMBER	SAMPLE GRAIN SIZE (0% 50% 100%)	PERCENT RECOVERY (0% 100%)	RECOVERY/INTERVAL	DATUM (FT)	DEPTH (FT)	WELL OR PIEZOMETER CONSTRUCTION	LITHOLOGY	UNIFIED SOILS CLASSIFICATION OR ROCK TYPE	DESCRIPTION
				0/9	5924	40				
					5923	41				
					5922	42				
					5921	43				
					5920	44				
				0.5/0.5	5919	45			CLAYSTONE:	Light gray (N 7), bedding not apparent, weathered, slightly friable, iron staining on fractures.
				1/1.5	5918	46			CLAYSTONE:	Same as above.
				0/1.3	5917	47			NO SAMPLE:	
				0.7/0.7	5916	48			CLAYSTONE:	Same as 45.0 to 47.0 ft. Fracture angle = 90 degrees.
					5915	49			CLAYSTONE:	Same as above.

STATE PLANE COORDINATE:		TOTAL DEPTH (FT): 135	GROUND ELEVATION (FT):	5964.46	PROJECT NUMBER:	667.11	LOG OF BORING NUMBER:
NORTH:	751068	AREA: SOLAR POND	CASING DIAMETER (IN):	2 ID	GEOLOGIST:	LAA/DCB	32-86
EAST:	2084746	LOCATOR NUMBER: L10	BOREHOLE DIAMETER (IN):	7 1/4	DATE DRILLED:	09/25/86	

REMARKS: Hollow Stem Auger/NC Core.

CHEMICAL SAMPLE DEPTH
GRADATIONAL SAMPLE DEPTH
SAMPLE NUMBER
SAMPLE GRAIN SIZE
PERCENT RECOVERY
RECOVERY/INTERVAL
DATUM (FT)
DEPTH (FT)
WELL OR PIEZOMETER CONSTRUCTION
LITHOLOGY
UNIFIED SOILS CLASSIFICATION OR ROCK TYPE
DESCRIPTION



CLAYSTONE:	Same as above.
NO SAMPLE:	
CLAYSTONE:	Same as 45.0 to 47.0 ft. Bedding not apparent to thin (< 2 mm) with slight dip, slight silt fraction occurs as individual strata w/in interval. Fracture angle = 90 degrees
CLAYSTONE:	Same as above. Fracture angle = 80 degrees, bedding angle = 10 degrees.
CLAYSTONE:	Same as above.
NO SAMPLE:	
CLAYSTONE:	Medium gray (N 6), bedding not apparent to thin (< 2 mm) slight dip, weathered, slightly friable, slight silt fraction, iron staining occurs locally. Bedding angle approx. 5 degrees.
CLAYSTONE:	Same as above. Slickensides at approx. 60.6 ft., curvilinear surface.

STATE PLANE COORDINATE:	TOTAL DEPTH (FT): 135	GROUND ELEVATION (FT):	5964.46	PROJECT NUMBER:	667.11	LOG OF BORING NUMBER:
NORTH: 751068	AREA: SOLAR POND	CASING DIAMETER (IN):	2 ID	GEOLOGIST:	LAA/DCB	32-86
EAST: 2084745	LOCATOR NUMBER: L10	BOREHOLE DIAMETER (IN):	7 1/4	DATE DRILLED:	09/25/86	

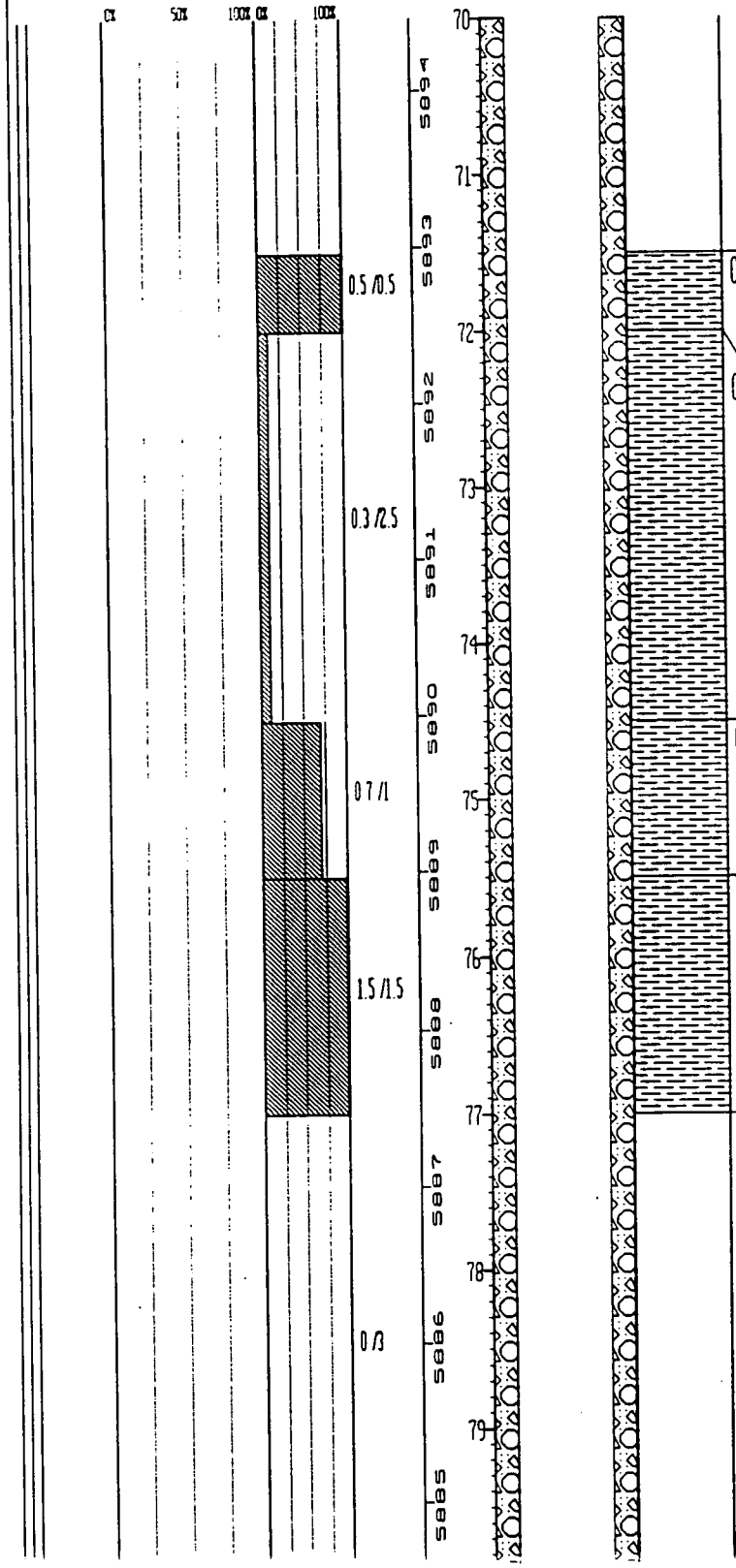
REMARKS: Hollow Stem Auger/NC Core.

CHEMICAL SAMPLE DEPTH / GRADATIONAL SAMPLE	SAMPLE NUMBER	SAMPLE GRAIN SIZE	PERCENT RECOVERY	RECOVERY/INTERVAL	DATUM (FT)	DEPTH (FT)	WELL OR PIEZOMETER CONSTRUCTION	LITHOLOGY	UNIFIED SOILS CLASSIFICATION OR ROCK TYPE	DESCRIPTION
			100%	1.8/1.8	5964	60				
				1/1	5963	61			CLAYSTONE:	Same as above.
				0.8/0.73	5962	62			CLAYSTONE:	Same as above. Bedding not apparent and amount of iron staining diminishes below 62.8 ft., silt fraction is disseminated throughout.
				2.2/2.2	5961	63	10/13/86 ▽		CLAYSTONE:	Same as above.
					5960	64				
				2/2	5959	65			CLAYSTONE:	Same as above.
					5958	66				
					5957	67			NO SAMPLE:	
					5956	68				
				0/4.5	5955	69				

STATE PLANE COORDINATE:		TOTAL DEPTH (FT): 135	GROUND ELEVATION (FT):	5964.46	PROJECT NUMBER:	667.11	LOG OF BORING NUMBER:
NORTH:	751068	AREA: SOLAR POND	CASING DIAMETER (IN):	2 ID	GEOLOGIST:	LAA/DCB	32-86
EAST:	2084745	LOCATOR NUMBER: L10	BOREHOLE DIAMETER (IN):	7 1/4	DATE DRILLED:	09/25/86	

REMARKS: Hollow Stem Auger/NC Core.

CHEMICAL SAMPLE DEPTH
GRADATIONAL SAMPLE DEPTH
SAMPLE NUMBER
SAMPLE GRAIN SIZE (0% 50% 100%)
PERCENT RECOVERY (0% 100%)
RECOVERY/INTERVAL
DATUM (FT)
DEPTH (FT)
WELL OR PIEZOMETER CONSTRUCTION
LITHOLOGY
UNIFIED SOILS CLASSIFICATION OR ROCK TYPE
DESCRIPTION

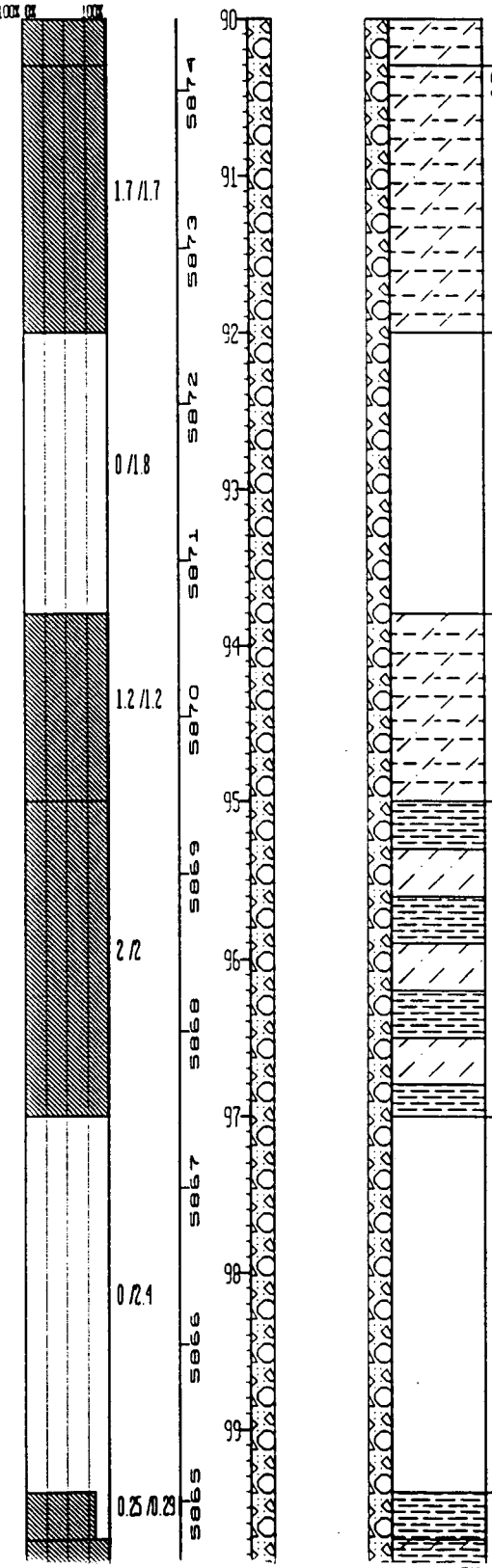


UNIFIED SOILS CLASSIFICATION OR ROCK TYPE	DESCRIPTION
CLAYSTONE:	Dark gray (N 3), bedding may be horizontal based on appearance of core breaks. Weathered, slightly friable, carbonaceous, occasional bodies of coal.
CLAYSTONE:	Medium gray (N 5), bedding not apparent, weathered, slightly friable, moderate amount of carb. mineralization, slight silt fraction.
CLAYSTONE:	Same as above.
CLAYSTONE:	Same as above. Slickensides at 76.8 ft., 55 to 90 degrees.
NO SAMPLE:	

STATE PLANE COORDINATE:		TOTAL DEPTH (FT): 135	GROUND ELEVATION (FT):	5964.46	PROJECT NUMBER:	667.11	LOG OF BORING NUMBER:
NORTH:	751068	AREA: SOLAR POND	CASING DIAMETER (IN):	2 ID	GEOLOGIST:	LAA/DCB	32-86
EAST:	2084745	LOCATOR NUMBER: L10	BOREHOLE DIAMETER (IN):	7 1/4	DATE DRILLED:	09/25/86	

REMARKS: Hollow Stem Auger/NC Core.

CHEMICAL SAMPLE DEP
GRADATIONAL SAMPLE
SAMPLE NUMBER
SAMPLE GRAIN SIZE 0% 50% 100%
PERCENT RECOVERY 0% 100%
RECOVERY/INTERVAL
DATUM (FT)
DEPTH (FT)
WELL OR PIEZOMETER CONSTRUCTION
LITHOLOGY
UNIFIED SOILS CLASSIFICATION OR ROCK TYPE
DESCRIPTION



SILTY CLAYSTONE: Same as above, bedding exhibits soft sediment deformation, and silt fraction increases.

NO SAMPLE:

SILTY CLAYSTONE: Same as above.

CLAYSTONE: Interbedded siltstone and claystone, very light gray (N 8) to medium dark gray (N 4), respectively thin bedded (approx. 2 mm and less), slight dip, slightly friable.

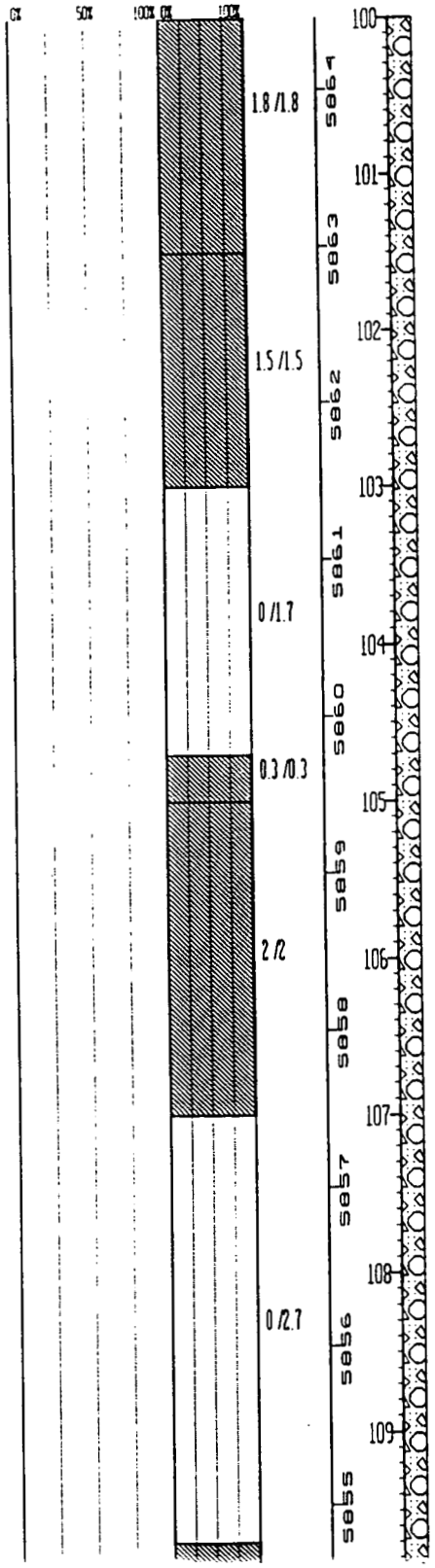
NO SAMPLE:

CLAYSTONE: Medium light gray (N 6), thin bedded (< 2 mm), slight dip, slightly friable, interbedded siltstone occurs throughout interval, carb.

STATE PLANE COORDINATE:		TOTAL DEPTH (FT): 135	GROUND ELEVATION (FT):	5964.46	PROJECT NUMBER:	667.11	LOG OF BORING NUMBER:
NORTH:	751068	AREA: SOLAR POND	CASING DIAMETER (IN):	2 ID	GEOLOGIST:	LAA/DCB	32-86
EAST:	2084745	LOCATOR NUMBER: L10	BOREHOLE DIAMETER (IN):	7 1/4	DATE DRILLED:	09/25/86	

REMARKS: Hollow Stem Auger/NC Core.

CHEMICAL SAMPLE DEPTH
GRADATIONAL SAMPLE DEPTH
SAMPLE NUMBER
SAMPLE GRAIN SIZE
PERCENT RECOVERY
RECOVERY/INTERVAL
DATUM (FT)
DEPTH (FT)
WELL OR PIEZOMETER CONSTRUCTION
LITHOLOGY
UNIFIED SOILS CLASSIFICATION OR ROCK TYPE
DESCRIPTION



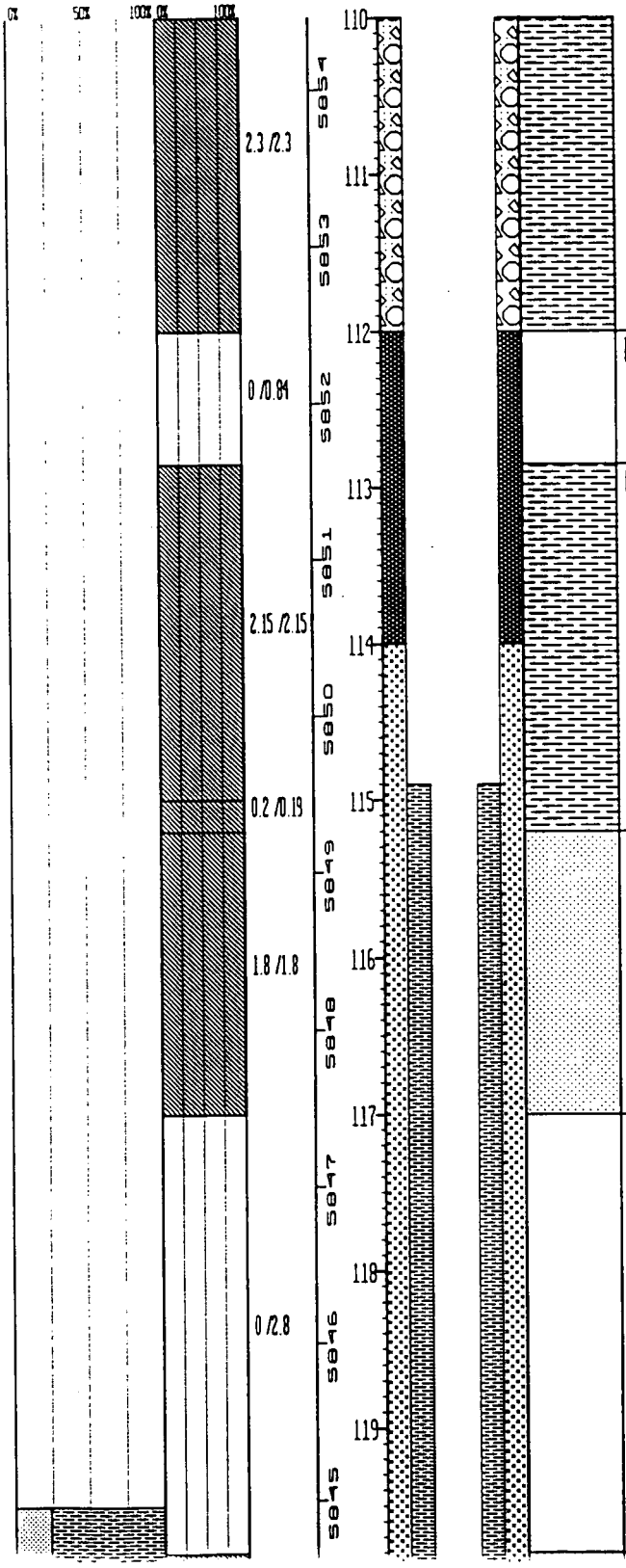
UNIFIED SOILS CLASSIFICATION OR ROCK TYPE	DESCRIPTION
CLAYSTONE:	Same as above.
NO SAMPLE:	
CLAYSTONE:	Same as 99.7 to 101.5 ft.
CLAYSTONE:	Same as above.
NO SAMPLE:	
CLAYSTONE:	Medium gray (N 5), bedding not apparent, slightly friable, moderate silt

STATE PLANE COORDINATE:	TOTAL DEPTH (FT): 135	GROUND ELEVATION (FT):	5964.46	PROJECT NUMBER:	667.11	LOG OF BORING NUMBER:
NORTH: 751068	AREA: SOLAR POND	CASING DIAMETER (IN):	2 ID	GEOLOGIST:	LAA/DCB	32-86
EAST: 2084745	LOCATOR NUMBER: L10	BOREHOLE DIAMETER (IN):	7 1/4	DATE DRILLED:	09/25/86	

REMARKS: Hollow Stem Auger/NC Core.

CHEMICAL SAMPLE DEPTH
GRADATIONAL SAMPLE
SAMPLE NUMBER

SAMPLE GRAIN SIZE (0% 50% 100%) | PERCENT RECOVERY (0% 100%) | RECOVERY/INTERVAL | DATUM (FT) | DEPTH (FT) | WELL OR PIEZOMETER CONSTRUCTION | LITHOLOGY

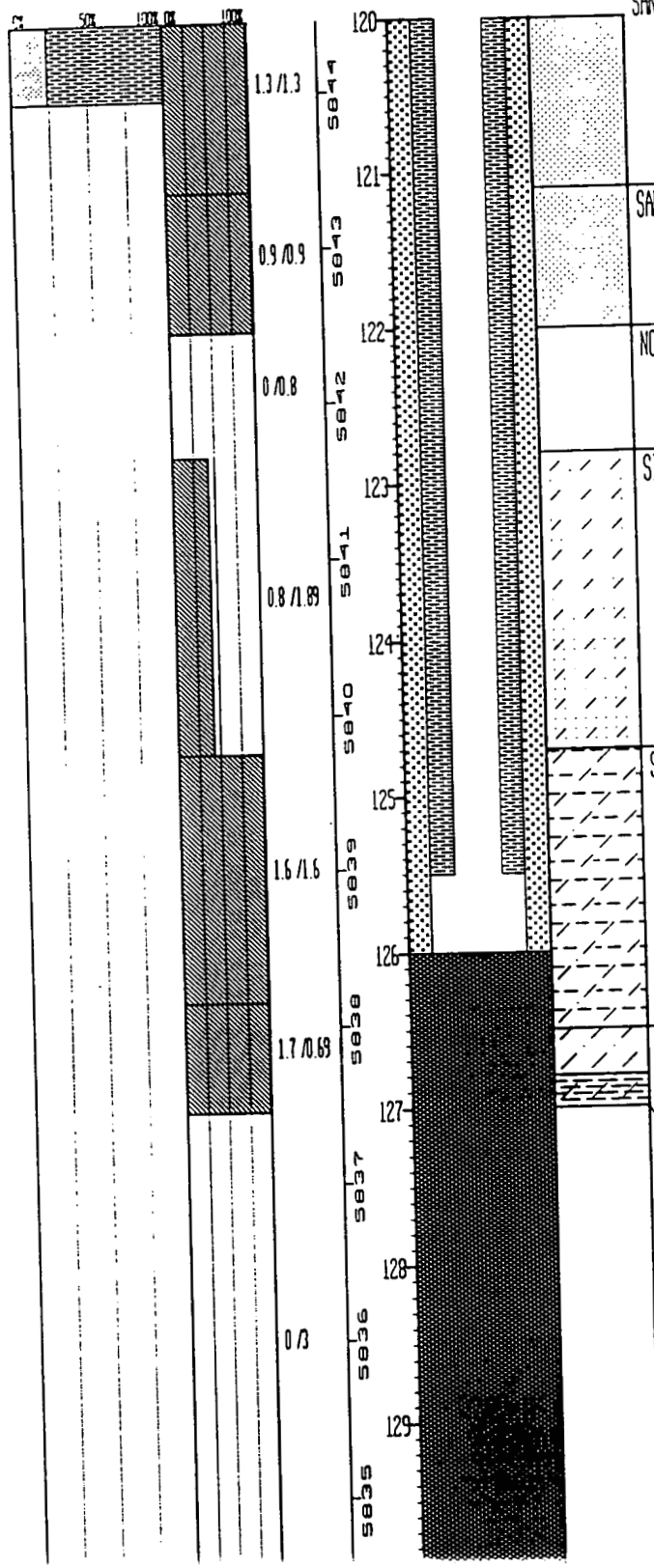


UNIFIED SOILS CLASSIFICATION OR ROCK TYPE	DESCRIPTION
	component. Slickensides occur at approx. 111.0 ft., attitude of approx. 28 degrees.
NO SAMPLE:	
CLAYSTONE:	Same as 109.7 to 112.0 ft. Slickensides at 113.3 ft., badly broken, attitude cannot be accurately measured. Interval grades to a Carbonaceous Claystone at approx. 114.8 ft. and the color changes to dark gray (N 3).
SANDSTONE:	Bioturbated, slightly friable, VFG, well sorted, slight to moderate silt fraction.
NO SAMPLE:	

STATE PLANE COORDINATE:	TOTAL DEPTH (FT): 135	GROUND ELEVATION (FT):	5964.46	PROJECT NUMBER:	557.11	LOG OF BORING NUMBER:	
NORTH: 751068	AREA: SOLAR POND	CASING DIAMETER (IN):	2 ID	GEOLOGIST:	LAA/DCB		32-86
EAST: 2084745	LOCATOR NUMBER: L10	BOREHOLE DIAMETER (IN):	7 1/4	DATE DRILLED:	09/25/86		

REMARKS: Hollow Stem Auger/NC Core.

CHEMICAL SAMPLE DEPTH
GRADATIONAL SAMPLE DEPTH
SAMPLE NUMBER
SAMPLE GRAIN SIZE
PERCENT RECOVERY
RECOVERY/INTERVAL
DATUM (FT)
DEPTH (FT)
WELL OR PIEZOMETER CONSTRUCTION
LITHOLOGY



UNIFIED SOILS CLASSIFICATION OR ROCK TYPE	DESCRIPTION
SANDSTONE:	Same as 115.2 to 117.0 ft.
SANDSTONE:	Same as above. Influx of silt approx. 121 ft., bedding is thin (< 2 mm) and exhibits soft sediment deformation.
NO SAMPLE:	
SILTY SANDSTONE:	Very light gray (N 8) to med. dark gray (N 4), thin bedded (< or = 2 mm), interbedded clay/silt and sand exhibit soft sed. deformation, dewatering structures, slumps, slightly friable, VFG sand, vertical burrows, occasional iron stains.
SILTY CLAYSTONE:	Medium gray (N 5), bedding not apparent, slightly friable, occasional iron stains, carb. mineralization on partings.
SILTSTONE:	Interbedded Siltstone and Claystone and VFG Sandstone, light gray (N 7) to med. light gray (N 6), bedding is typically < or = 2 mm, moderate dip, slightly friable, local iron staining. Bedding angle = 20 degrees.
NO SAMPLE:	

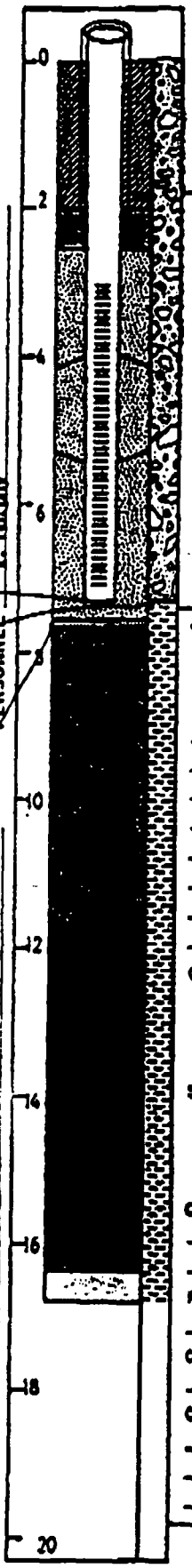
STATE PLANE COORDINATE:	TOTAL DEPTH (FT): 135	GROUND ELEVATION (FT): 5964.46	PROJECT NUMBER: 667.11	LOG OF BORING NUMBER:
NORTH: 751068	AREA: SOLAR POND	CASING DIAMETER (IN): 2 ID	GEOLOGIST: LAA/DCB	32-86
EAST: 2084745	LOCATOR NUMBER: L10	BOREHOLE DIAMETER (IN): 7 1/4	DATE DRILLED: 09/25/86	

REMARKS: Hollow Stem Auger/NC Core.

CRITICAL SAMPLE DEPTH / GRADATIONAL SAMPLE	SAMPLE NUMBER	SAMPLE GRAIN SIZE	PERCENT RECOVERY	RECOVERY/INTERVAL	DATUM (FT)	DEPTH (FT)	WELL OR PIEZOMETER CONSTRUCTION	LITHOLOGY	UNIFIED SOILS CLASSIFICATION OR ROCK TYPE	DESCRIPTION
		0% 50% 100%	0% 100%	2/2	5934 5933	130 131			CLAYSTONE:	Med. dark gray (N 4), bedding not apparent, slightly friable, moderate silt fraction, carb. mineralization on partings, occasional iron stains, silt fraction increases with depth.
				0/1.5	5932 5931	132 133			NO SAMPLE	
				1.5/1.5	5930 5929 5928 5927 5926 5925	134 135 136 137 138 139			CLAYSTONE:	Same as above.

WELL 33-86

WELL CONSTRUCTION SUMMARY



LOCATION Golden, CO

PERSONNEL T. Murphy

PROJECT 106P06222 Rocky Flats Plant

TD = 7.34'

QVF 7.0' Ka

7.5'

LOCATION or COORDS:

ELEVATION: GROUND LEVEL 5954'

TOP OF CASING 5955.49'

DRILLING SUMMARY:

TOTAL DEPTH Well: 7.34' Hole: 16.80'

BOREHOLE DIAMETER 7¼"

DRILLER Boyles Brothers Drilling Co.
15865 W. 5th Avenue
Golden, CO (Dave Jarvie)

RIG Mobile B-57

BIT(S) T5

DRILLING FLUID None

SURFACE CASING 5" x 4' steel w/ locking cap

WELL DESIGN:

BASIS: GEOLOGIC LOG ___ GEOPHYSICAL LOG ___

CASING STRING(S): C=CASING S=SCREEN

0.00'	2.99'	C1
2.99'	7.34'	S1

CASING: C1 2" I.D. Sch. 5 type 316 stainless steel, threaded and flush jointed.

SCREEN: S1 2" I.D. Sch. 5 type 316 stainless steel, threaded and flush jointed. 0.010" wire wrap screen. 0.25' welded bottom cap.

CENTRALIZERS Type 304 stainless steel
4.07' - 5.32'

FILTER MATERIAL 32-42 silica sand
2.50' - 7.50'

CEMENT Portland Type I
0.00' - 2.00'

OTHER 3/8" Bentonite Pellets
2.00' - 2.50'
7.50' - 16.40'

CONSTRUCTION TIME LOG:

TASK	START DATE 1986	START TIME	FINISH DATE 1986	FINISH TIME
DRILLING:				
7¼" auger	9/10	1055	9/10	1130
GEOPHYS. LOGGING:	—	—	—	—
CASING:				
2" stainless	9/10	1310	9/10	1317
FILTER PLACEMENT:	9/10	1302	9/10	1305
CEMENTING:	9/10	1331	9/10	1335
DEVELOPMENT:	9/12	1530	9/12	1530
OTHER:				
Bentonite	9/10	1305	9/10	1310
	9/10	1250	9/10	1255

WELL DEVELOPMENT

See Well Development Summary Sheet.

COMMENTS:

No water encountered during drilling.

Top of stainless steel casing: 1.49'

Cave from TD to 16.40'

HYDRO-SEARCH RENO-DENVER CONSULTING HYDROLOGISTS-GEOLOGIST

INDEX OF DATA

Boring No.: 33-86

Completed as well? Yes

Data in File

X Log of Borehole

X Well Construction Summaries

____ Well Development Summaries

____ Hydraulic Conductivity Test Data and Results

____ Packer Test Data and Results

X Water Level Data

____ Saturated Thickness Hydrographs

Project: Rocky Flats Plant

LOG OF BORING NO. 33-86

Date Drilled 9/10/86 **Coordinates** N 36960.9 E 21896.5

Boring Method Hollow Stem Auger **Ground Surface Elevation** 5049.28'

Elev. (feet)	Depth (feet)	Sample Type	Graphic Log	Material Description	Penetration Resistance (Blows/inch) 20 40	Water Content (%) 20 40	Other Tests
	0			ROCKY FLATS ALLUVIUM			
				0-4.8'-Sample. Recovered 3.1/4.8'= 65%. GRAVEL: light olive gray (5Y 5/2)to olive gray (5Y 3/2); clayey silt and sand matrix; quartzite pebbles; poorly sorted; subangular; crumbles; dry.			
	5						
				4.8-6.8'-Sample. Recovered 2.0/2.0'=100%. GRAVEL: light olive gray (5Y 5/2); clayey sand matrix; quartzite cobbles and gravel clasts; angular to subangular; moderate sorting; loose; dry.			
	10						
				ARAPAHOE FORMATION			
				6.8-11.8'-Sample. Recovered 5.0/5.0'=100%. 6.8-7.0': GRAVEL: light olive gray (5Y 5/2); clayey sand matrix; quartzite cobbles and gravel clasts; angular to subangular; moderate sorting; loose; dry.			
	15						
				7.0-11.8': CLAYSTONE: grayish yellow green (5GY 7/2) to grayish olive green (5GY 3/2) with olive gray (5Y 3/2) to greenish gray (5GY 6/1) and dark yellowish orange (10YR 6/6) stains; well sorted; consolidated; fractured; firm; damp.			
	20						

Remarks Logged by: T. Murphy Checked by:

Project No. 106P06222

Hydro-Search, Inc.

Project: Rocky Flats Plant

LOG OF BORING NO. 33-86

Date Drilled 9/10/86 **Coordinates** N 36960.9 E 21896.5

Boring Method Hollow Stem Auger **Ground Surface Elevation** 5949.28'

Elev. (feet)	Depth (feet)	Sample Type	Graphic Log	Material Description	Penetration Resistance (Blows/inch) 20 40	Water Content (%) 20 40	Other Tests
	20						
	25						
	30			11.8-16.8'-Sample. Recovered 5.0/5.0'=100%. RQD 5.0/5.0'=100%. CLAYSTONE: grayish yellow green (5GY 7/2) to grayish olive green (5GY 3/2) with olive gray (5Y 3/2) to greenish gray (5GY 6/1) and dark yellowish orange (10YR 6/6) stains; well sorted; consolidated; fractured; firm; damp.			
	35			TOTAL DEPTH: 16.8'			
	40						

Remarks Logged by: T. Murphy Checked by:

Project No. 106P06222

Hydro-Search, Inc.

LOG OF BORING NO. 33-86

GEOLOGIST(S): DCB
DATE: 8/23/89

PROJECT NO: 667-11.2

TOP/BOTTOM OF CORE IN BOX	TOP/BOTTOM OF INTERVAL	FEET OF CORE IN INTERVAL IN BOX	SAMPLE NUMBER	FRACTURE ANGLE	BEDDING ANGLE	GRAIN SIZE DISTRIBUTION	USCS SYMBOL	DEPTH IN FEET	LITHOLOGIC LOG	LITHOLOGIC DESCRIPTION
0.0	0.0 to 1.7	ND				~50% Gravel ~50% clay	GC	1		Clayey Gravel, dominantly light gray (N7), clay matrix is light brownish gray (5 YR 6/1), subangular to subrounded, poorly graded, some roots, matrix is calcareous.
	1.7 to 4.8	(2) 1.3				>50% clay	CL	2, 3, 4		Gravelly Clay, pale yellowish brown (10 YR 6/2), low to moderate plasticity, some silt, calcareous. Color grades to dusky brown (5 YR 2/2), from 4.6 ft to ~6.0 ft.
	4.8 to 6.8	(2) 1.4				>50% Gravel	GC	5, 6		Clayey Gravel, dominantly light gray (N7), clay matrix is pale brown (5 YR 5/2), subangular, poorly graded, max. size ~2.5 cm.
	6.8 to 8.4	ND				>50% clay	CL	7, 8		Clay, moderate yellowish brown (10 YR 5/4), moderately low plasticity, trace of silt.
	8.4 to 10.1	ND				>50% clay		9		Interval grades to claystone. Claystone mottled yellowish brown (10 YR 5/4) to light gray (N7), bedding not apparent, highly weathered.

NOTES: General: USCS is modified for this log as follows:
Material amounts are estimated by % volume instead of % weight.
(1) Badly broken core, accurate footage measurements not possible.
(2) Core breaks cannot be matched, accurate footage measurements not possible.

ROCKY FLATS PLANT

FIGURE NO.

LOG OF BORING NO. 33-86

GEOLOGIST(S): DCB
DATE: 8/23/89

PROJECT NO: 667-11-22

TOP/BOTTOM OF CORE IN BOX	TOP/BOTTOM OF INTERVAL	FEET OF CORE IN INTERVAL IN BOX	SAMPLE NUMBER	FRACTURE ANGLE	BEDDING ANGLE	GRAIN SIZE DISTRIBUTION	USCS SYMBOL	DEPTH IN FEET	LITHOLOGIC LOG	LITHOLOGIC DESCRIPTION
10.1	10.1 to 11.8	ND						11		(cont'd. from page 1), slightly friable local iron staining.
	11.8 to 13.7	ND						12, 13		claystone as above with abund. soft iron staining from ~ 11.8 ft to 13.6 ft.
	13.7 to 15.5	ND						14, 15		slickenside at ~ 14.8 ft., 45°.
	15.5 to 16.8	ND						16		some carbonaceous mineralization at ~ 16.6 ft.
								17, 18, 19		Bottom of Box 2 of 2 at 16.8 ft.

NOTES: General USCS is modified for this log as follows:
Material amounts are estimated by % volume instead of % weight.
(1) Badly broken core, accurate footage measurements not possible.
(2) Core breaks cannot be matched, accurate footage measurements not possible.

ROCKY FLATS PLANT

FIGURE NO.

STATE PLANE COORDINATE:	TOTAL DEPTH (FT): 16.8	GROUND ELEVATION (FT): 5949.28	PROJECT NUMBER: 667.11	LOG OF BORING NUMBER:
NORTH: 749963	AREA: MOUND AREA	CASING DIAMETER (IN): 0	GEOLOGIST: DCB	33-86
EAST: 2085000	LOCATOR NUMBER: M9	BOREHOLE DIAMETER (IN): 0	DATE DRILLED: 09/10/86	

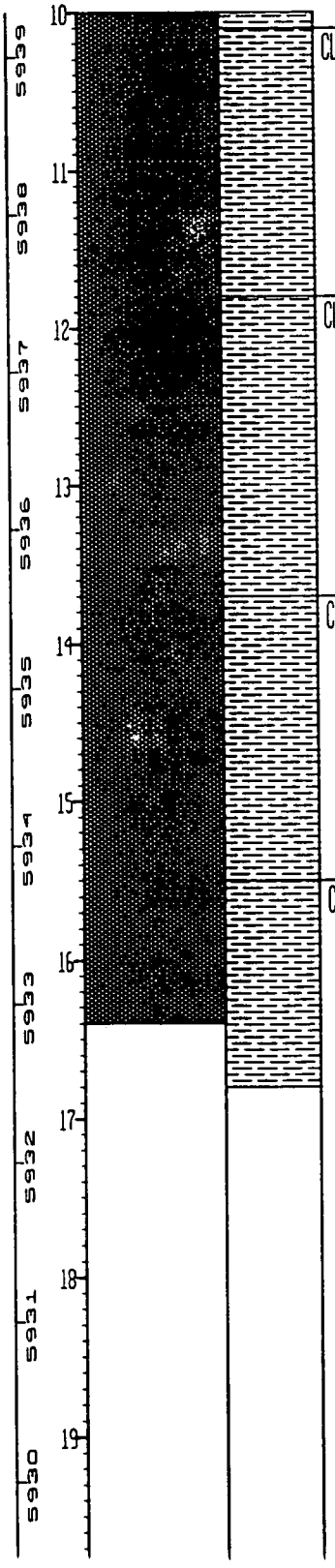
REMARKS: Hollow Stem Auger.

CHEMICAL SAMPLE DEP
GRADATIONAL SAMPLE D
SAMPLE NUMBER

SAMPLE GRAIN SIZE	PERCENT RECOVERY	RECOVERY/INTERVAL	DATUM (FT)	DEPTH (FT)	WELL OR PIEZOMETER CONSTRUCTION	LITHOLOGY	UNIFIED SOILS CLASSIFICATION OR ROCK TYPE	DESCRIPTION
0% 50%	100% 0% 100%	1.7/1.7	5949	0			GC:	Clayey Gravel, dominantly light gray (N7), clay matrix is light brownish gray (5YR 6/1), sub-angular to sub-rounded, poorly graded, max. size 6 cm, some roots, matrix is calcareous.
			5948	1				
			5947	2			CL:	GRAVELLY CLAY, pale yellowish brown (10YR 6/2), low to moderate plasticity, some silt, calcareous, color grades to dusky brown (5YR 2/2), from approx. 4.6 ft to approx. 6.0 ft.
		1.3/3.1	5946	3				
			5945	4				
			5944	5			GC:	Clayey Gravel, dominantly light gray (N7), clay matrix is pale brown (5YR 5/2), sub-angular, poorly graded, max. size approx. 2.5 cm.
		1.9/2	5943	6				
			5942	7			CLAYSTONE:	Top of Bedrock Moderate yellowish brown (10YR 5/4), moderately low plasticity, trace of silt.
		1.6/1.6	5941	8				
		1.7/1.7	5940	9			CLAYSTONE:	Mottled yellowish brown (10YR 5/4) to light gray (N7), bedding not apparent, highly weathered, slightly friable, local iron staining.

STATE PLANE COORDINATE:		TOTAL DEPTH (FT): 16.8	GROUND ELEVATION (FT):	5949.28	PROJECT NUMBER:	667.11	LOG OF BORING NUMBER:
NORTH:	749963	AREA: MOUND AREA	CASING DIAMETER (IN):	0	GEOLOGIST:	DCB	33-86
EAST:	2085000	LOCATOR NUMBER: M9	BOREHOLE DIAMETER (IN):	0	DATE DRILLED:	09/10/86	
REMARKS:	Hollow Stem Auger.						

CHEMICAL SAMPLE DEPTH
GRADATIONAL SAMPLE DEPTH
SAMPLE NUMBER
SAMPLE GRAIN SIZE (0% 50% 100%)
PERCENT RECOVERY (0% 100%)
RECOVERY/INTERVAL
DATUM (FT)
DEPTH (FT)
WELL OR PIEZOMETER CONSTRUCTION
LITHOLOGY
UNIFIED SOILS CLASSIFICATION OR ROCK TYPE
DESCRIPTION



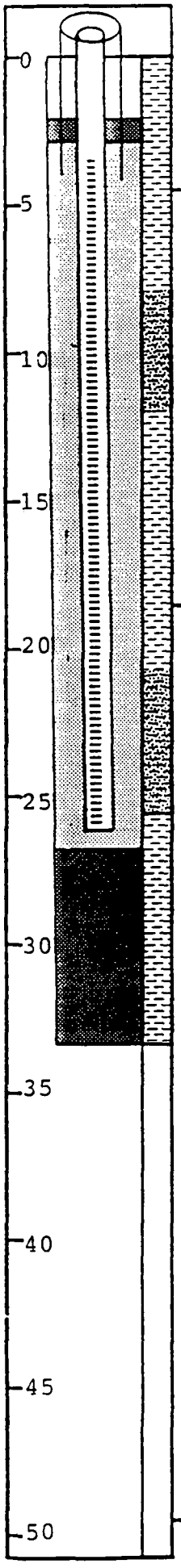
CLAYSTONE:	Same as above.
CLAYSTONE:	As above with abundant iron staining from approx. 11.8 ft. to 13.6 ft.
CLAYSTONE:	As above with slickensides at approx 14.8 ft., attitude 45 degrees.
CLAYSTONE:	As above with some carbonaceous mineralization at approx 16.6 ft.

WELL 44-86

WELL CONSTRUCTION SUMMARY

LOCATION or COORDS: N 36252.4 E 19130.5

ELEVATION: GROUND LEVEL 6021.96'
TOP OF CASING 6019.93'



LOCATION Rocky Flats Plant
PERSONNEL L. Pivonka
PROJECT 106R06222

DRILLING SUMMARY:

TOTAL DEPTH Well: 26.25' Hole: 33.00'
BOREHOLE DIAMETER 7¼"

DRILLER Boyles Brothers Drilling Co.
15865 W. 5th Avenue
Golden, CO (Roger Sharp)

RIG Mobile B-57
BIT(S) Blade bit

DRILLING FLUID None

SURFACE CASING 5" x 4' steel w/ locking cap

WELL DESIGN:

BASIS: GEOLOGIC LOG X GEOPHYSICAL LOG ___

CASING STRING(S): C=CASING S=SCREEN

0.00'	3.00'	C1	
3.23'	26.25'	S1	

CASING: C1 5" I.D. steel surface casing
C2 2" I.D. Sch. 5 type 316 stainless steel, threaded and flush jointed.

SCREEN: S1 2" I.D. Sch. 5 type 316 stainless steel, threaded and flush jointed, 0.010" wire wrapped screen, 0.25' welded bottom cap.

CENTRALIZERS (See Comments)

FILTER MATERIAL 32-42 silica sand
2.50' - 26.60'

CEMENT Portland Type I
0.00' - 2.00'

OTHER 3/8" bentonite pellets
2.00' - 2.50'
26.60' - 33.00'

CONSTRUCTION TIME LOG:

TASK	START DATE 1986	START TIME	FINISH DATE 1986	FINISH TIME
DRILLING:				
7¼" auger	11/6	0923	11/6	1234
GEOPHYS. LOGGING:	—	—	—	—
CASING:				
2" stainless	11/6	1600	11/6	1610
FILTER PLACEMENT:	11/6	1551	11/7	0824
CEMENTING:	11/7	0826	11/7	0856
DEVELOPMENT:	11/10	1500	11/13	1300
OTHER:				
Bentonite	11/7	0824	11/7	0826
	11/6	1520	11/6	1551

WELL DEVELOPMENT

See Well Development Summary Sheet.

COMMENTS:

No water encountered during drilling.

Top of stainless steel casing: 3.03'

Well was built through 4" casing. No centralizers used.

Project:	Rocky Flats Plant	LOG OF BORING NO.	44-86

Date Drilled 11/6/86 — Coordinates N 36252.4 E 19130.5

Boring Method Hollow Stem Auger — Ground Surface Elevation 6019.93'

Elev. (feet)	Depth (feet)	Sample Type	Graphic Log	Material Description	Penetration Resistance (Blows/Foot) 20 40	Water Content (%) 20 40	Other Tests
	0			ROCKY FLATS ALLUVIUM			
				0.0-1.4'-Sample. Recovered 0.8/1.4=57%. TOP SOIL: moderate brown (5YR 4/4); silty clay; abundant fine to coarse-grained gravel and small cobbles; moist.			
				1.4-5.0'-Sample. Recovered 0.8/3.6'=22%. CLAY: same as above; moist.			
	5			5.0-8.0'-Sample. Recovered 0.9/3.0'=30%. CLAY: same as above; wet.			
				8.0-10.5'-Sample. Recovered 1.1/2.5'=44%. SANDY CLAY dark yellowish brown (10YR 4/2); silty; gravel and small cobbles; wet.			
	10			10.5-12.0'-Sample. Recovered 0.8/1.5'=53%. SANDY CLAY: same as above with some FeO stains; wet.			
				12.0-15.5'- No sample recovered. Cuttings indicate cobbles; clay; silt; very wet.			
	15			15.5-18.0'-Sample. Recovered 2.5/2.5'=100%. SILTY CLAY: light brown (5YR 6/6); abundant FeO stains and mottling; wet.			
				18.0-20.5'-Sample. Recovered 2.5/2.5'=100%. CLAY: light brown (5YR 6/6); silty, sandy micaceous clay, abundant FeO; wet.			
	20						

Remarks — Logged by: L. Pivonka — Checked by: [illegible]

Project No. 106P06222 — Hydro-Search, Inc. —

Project: Rocky Flats Plant

LOG OF BORING NO. 44-86

Date Drilled 11/6/86

Boring Method Hollow Stem Auger

Coordinates N 36252.4 E 19130.5

Ground Surface Elevation 6019.93'

Elev. (feet)	Depth (feet)	Sample Type	Graphic Log	Material Description	Penetration Resistance (Blows/Foot) 20 40	Water Content (%) 20 40	Other Tests
	20			20.5-23.0'-Sample. Recovered 2.5/2.5'=100%. SANDY CLAY: light brown (5YR 5/6); micaceous; trace medium-grained gray quartzite gravel; mottled; wet.			
				23.0-25.5'-Sample. Recovered 2.5/2.5'=100%. SANDY CLAY: same as above; wet.			
	25			ARAPAHOE FORMATION			
				25.5-30.5'-Sample. Recovered 4.3/5.0=86%. CLAYSTONE: light olive gray (5Y 6/1); blocky, greasy; abundant FeO mottles; moist to wet.			
	30			30.5-33.0'-Sample. Recovered 1.2/2.5'=48%. CLAYSTONE: same as above; moist to wet.			
				TOTAL DEPTH: 33.0'			
	35						
	40						

Remarks

Logged by: L. Pivonka

Checked by:

Project No. 106P06222

Hydro-Search, Inc.

LOG OF BORING NO. 44-86

DATES DRILLED:
ELEVATION:
GEOLOGIST(S): LAA
DATE:
CHECKED BY:
DATE: 7/25/89

PROJECT NO: 667-11.22

TOP/BOTTOM OF CORE IN BOX	TOP/BOTTOM OF CORE IN ROCK (INTACTED)	SAMPLE NUMBER	FEET OF CORE (INTACTED)	USCS SYMBOL ~~FEET OF CORE IN RUN~~	FRACTURES PER FOOT	FRACTURE ANGLE	BEDDING ANGLE	GRAIN SIZE DISTRIBUTION	DEPTH IN FEET	LITHOLOGIC LOG	LITHOLOGIC DESCRIPTION
0.0 ↓	0.0 to 1.4		.75 (1)	GC				Gravel >50%	1		Gravel in sandy silty clay matrix very broad range of colors in gravel. None predominant. Angular to sub-rounded well graded. Maximum size visible - 6.5 cm. Clay matrix - moderate brown.
	1.40 to 5.0		.80 (1)	GC				"	2, 3, 4		Same as above
Box 1 of 3	5.0 to 8.0		.9 (1)	GC				"	5, 6, 7		Same as above. Sample more pulverized. (Matrix broken up)
	8.0 to 10.5		1.3	GC				"	8, 9		Same as above except color change in matrix to moderate yellowish brown. (10yr 5/4)

NOTES: General: The USCS is modified for this log as follows: Material amounts are estimated by percent volume instead of percent weight.
(1) Badly broken core, accurate footage measurement not possible.
(2) Core breaks cannot be matched, accurate footage measurement not possible.

ROCKY FLATS PLANT

FIGURE NO.

LOG OF BORING NO. 44-86

DATES DRILLED:
ELEVATION:
GEOLOGIST(S): LAA
DATE:
CHECKED BY:
DATE: 7/25/89

USCS symbol

PROJECT NO: 667-11.22

TOP/BOTTOM OF CORE IN BOX	TOP/BOTTOM OF CORE IN RUN (INTERVAL)	SAMPLE NUMBER	FEET OF CORE IN BOX (INTERVAL)	~~FEET OF CORE IN RUN~~	FRACTURES PER FOOT	FRACTURE ANGLE	BEDDING ANGLE	GRAIN SIZE DISTRIBUTION	DEPTH IN FEET	LITHOLOGIC LOG	LITHOLOGIC DESCRIPTION
Box 1 of 3	↑ 10.5										
	10.5 to 12.0		.8	GC				Gravel >50%	11		Gravel in sandy silty clay matrix. Gravel predominantly mat. dark gray. Subangular to subrounded. Matrix moderate yellowish brown with well graded sand.
	12.0 to 15.5		0						12, 13, 14, 15		No Sample
	15.5 to 16.5		1.6	CL				Clay >50%	16		Silty clay. Dark yellowish orange. (10yr 6/6) Moderate plasticity. Some gravel (to 1.5cm) some iron staining. ~~Trace~~ Some sand
↑ 18.0	16.5 to 18.0		N.D.	ML &					17		Clayey silt ~~stone~~. dark yellowish orange (10yr 6/6) to very pale orange (10yr 8/2) to yellowish gray (5y 8/1). Trace carbonaceous material. Trace iron staining
New box ↓ 18.0 ↓ Box 2 of 3	18.0 to 20.5		2.8	ML				Silt >50%	18, 19		Clayey silt ~~stone~~. Dark yellowish orange (10yr 6/6). Some well sorted fine grained sand throughout ~~Some~~ Trace carbonaceous materials. New Box ↓

NOTES: General: The USCS is modified for this log as follows: Material amounts are estimated by percent volume instead of percent weight.
(1) Badly broken core, accurate footage measurement not possible.
(2) Core breaks cannot be matched, accurate footage measurement not possible.

ROCKY FLATS PLANT

FIGURE NO.

LOG OF BORING NO. 44-86

DATES DRILLED:
ELEVATION:
GEOLOGIST(S): UAA
DATE:
CHECKED BY: DATE: 7/25/89

PROJECT NO: 667-11.22

TOP/BOTTOM OF CORE IN BOX	TOP/BOTTOM OF CORE IN FEET	SAMPLE NUMBER	FEET OF CORE RECOVERED	USCS SYMBOL	FRACTURES PER FOOT / FRACTURE ANGLE	BEDDING ANGLE	GRAIN SIZE DISTRIBUTION	DEPTH IN FEET	LITHOLOGIC LOG	LITHOLOGIC DESCRIPTION
	20.5									
Box 2 of 3	20.5 to 23.0		2.8 (1)	SW w/fines			Sand 50% Clay 50%	21, 22		Clayey sand. Dark yellowish orange to very pale orange (10yr 6/6 to 10yr 8/2). well graded. Very fine grained to coarse grained. Trace very coarse grained. Subangular to subrounded. Sufficient clay cement to create moderate to high plasticity.
	23.0 to 25.5	2	2.5 (1)	GW w/fines			Gravel 20% Sand 50% Clay 30%	23, 24, 25		Clayey sand and gravel. Light brown to very pale orange (5yr 5/6 to 10yr 7/4) Gravel angular to subrounded sand subangular to subrounded. Well graded fine sand to granular fine gravel to pebbles. Max. size 2.5 cm. Sufficient clay to create low plasticity. Increased clay content towards gravel content at bottom of interval.
	25.5 to 26.5		1.4 (1)	CH			Clay > 50%	26		Silty clay. Dark yellowish orange (10yr 6/6) to yellowish gray (5y 8/1). High plasticity trace sand (Possibly highly weathered claystone) Slightly friable to friable
new box	26.5 to 28.0	SL	1.8	CH				27, 28		SAME AS ABOVE. Trace carbonaceous material.
	28.0 to 30.5		1.7	CH			Clay > 50%	29		Silty clay. Yellowish gray (5y 7/2). High plasticity. Trace sand & trace white mineralization (unidentified). Does not react with dilute HCl. * Possibly highly weathered claystone. Slightly friable. Horizontal to convoluted bedding

NOTES: General: The USCS is modified for this log as follows: Material amounts are estimated by percent volume instead of percent weight.
(1) Badly broken core, accurate footage measurement not possible.
(2) Core breaks cannot be matched, accurate footage measurement not possible.

ROCKY FLATS PLANT

FIGURE NO.

LOG OF BORING NO. 44-86

DATES DRILLED:
ELEVATION:
GEOLOGIST(S): WAH
DATE:
CHECKED BY:
DATE: 7/26/89

USCS SYMBOL

PROJECT NO: 667-11.22

TOP/BOTTOM OF CORE IN BOX	TOP/BOTTOM OF CORE IN RUN (INTERVAL)	SAMPLE NUMBER	FEET OF CORE IN BOX (INTERVAL)	~~FEET OF CORE IN RUN~~	FRACTURES PER FOOT	FRACTURE ANGLE	BEDDING ANGLE	GRAIN SIZE DISTRIBUTION	DEPTH IN FEET	LITHOLOGIC LOG	LITHOLOGIC DESCRIPTION
	↑ 30.5										
Box 3 of 3 ↑ 33.0	30.5 ↓ ↑ 33.0	SA	1.1 (1)	CH				Clay >50%	31 32 33		Silty clay, possibly highly weathered claystone. Yellowish gray (5y 7/2). High plasticity. Trace sand No HCl reaction. If claystone slightly friable Horizontal to convoluted bedding
											Total Depth of Boxes

NOTES: General: The USCS is modified for this log as follows: Material amounts are estimated by percent volume instead of percent weight.
(1) Badly broken core, accurate footage measurement not possible.
(2) Core breaks cannot be matched, accurate footage measurement not possible.

ROCKY FLATS PLANT

FIGURE NO.

STATE PLANE COORDINATE	TOTAL DEPTH (FT): 33	GROUND ELEVATION (FT): 6019.93	PROJECT NUMBER: 667.11	LOG OF BORING NUMBER:
NORTH: 749254	AREA: PLANT WEST	CASING DIAMETER (IN): 2 ID	GEOLOGIST: LAA	44-86
EAST: 2082234	LOCATOR NUMBER: J9	BOREHOLE DIAMETER (IN): 7.25	DATE DRILLED: 11/06/86	

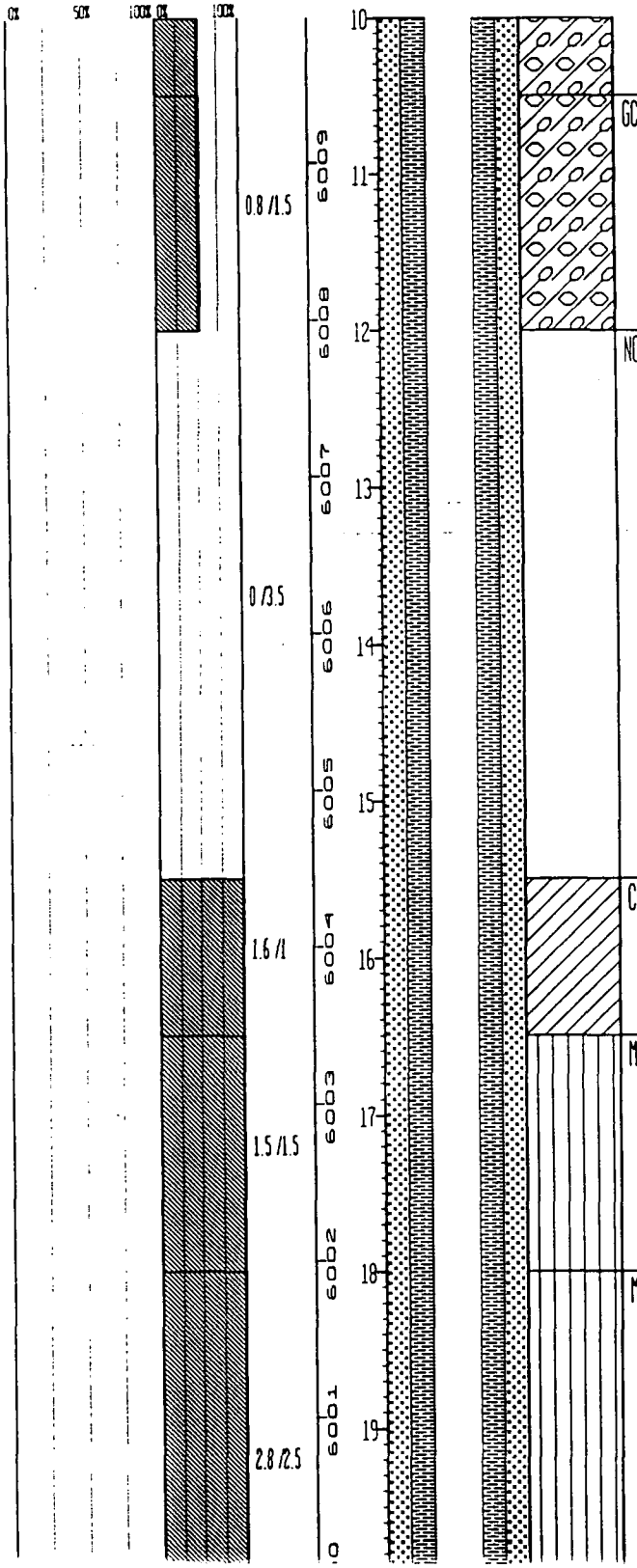
REMARKS: Hollow Stem Auger. Top of stainless steel casing: 3.03'. Well was built through 4" casing. No centralizers used.

CHEMICAL SAMPLE DEPTH / GRADATIONAL SAMPLE DEPTH	SAMPLE NUMBER	SAMPLE GRAIN SIZE (0% 50% 100%)	PERCENT RECOVERY (0% 100%)	RECOVERY/INTERVAL	DATUM (FT)	DEPTH (FT)	WELL OR PIEZOMETER CONSTRUCTION	LITHOLOGY	UNIFIED SOILS CLASSIFICATION OR ROCK TYPE	DESCRIPTION
				0.75/1.4	6019	0–1			GC	GRAVEL, in sandy silty clay matrix - very broad range of colors in gravel, none predominant, angular to sub-rounded, well graded, maximum size visible 6.5 cm., clay matrix is moderate brown.
				0.8/3.6	6018, 6017, 6016	1–4			GC	Same as above.
				0.9/3	6015, 6014, 6013	4–7			GC	Same as above, sample more pulverized (matrix broken up).
				1.3/2.5	6012, 6011	7–9			GC	Same as above except color change in matrix to moderate yellowish brown (10YR 5/4).

STATE PLANE COORDINATE:	TOTAL DEPTH (FT): 33	GROUND ELEVATION (FT): 6019.93	PROJECT NUMBER: 667.11	LOG OF BORING NUMBER:
NORTH: 749254	AREA: PLANT WEST	CASING DIAMETER (IN): 2 ID	GEOLOGIST: LAA	44-86
EAST: 2082234	LOCATOR NUMBER: J9	BOREHOLE DIAMETER (IN): 7 25	DATE DRILLED: 11/06/86	

REMARKS: Hollow Stem Auger. Top of stainless steel casing: 3 03'. Well was built through 4" casing. No centralizers used.

CHEMICAL SAMPLE DEPTH
GRADATIONAL SAMPLE DEPTH
SAMPLE NUMBER
SAMPLE GRAIN SIZE (0% 50%)
PERCENT RECOVERY (100% 0% 100%)
RECOVERY/INTERVAL
DATUM (FT)
DEPTH (FT)
WELL OR PIEZOMETER CONSTRUCTION
LITHOLOGY



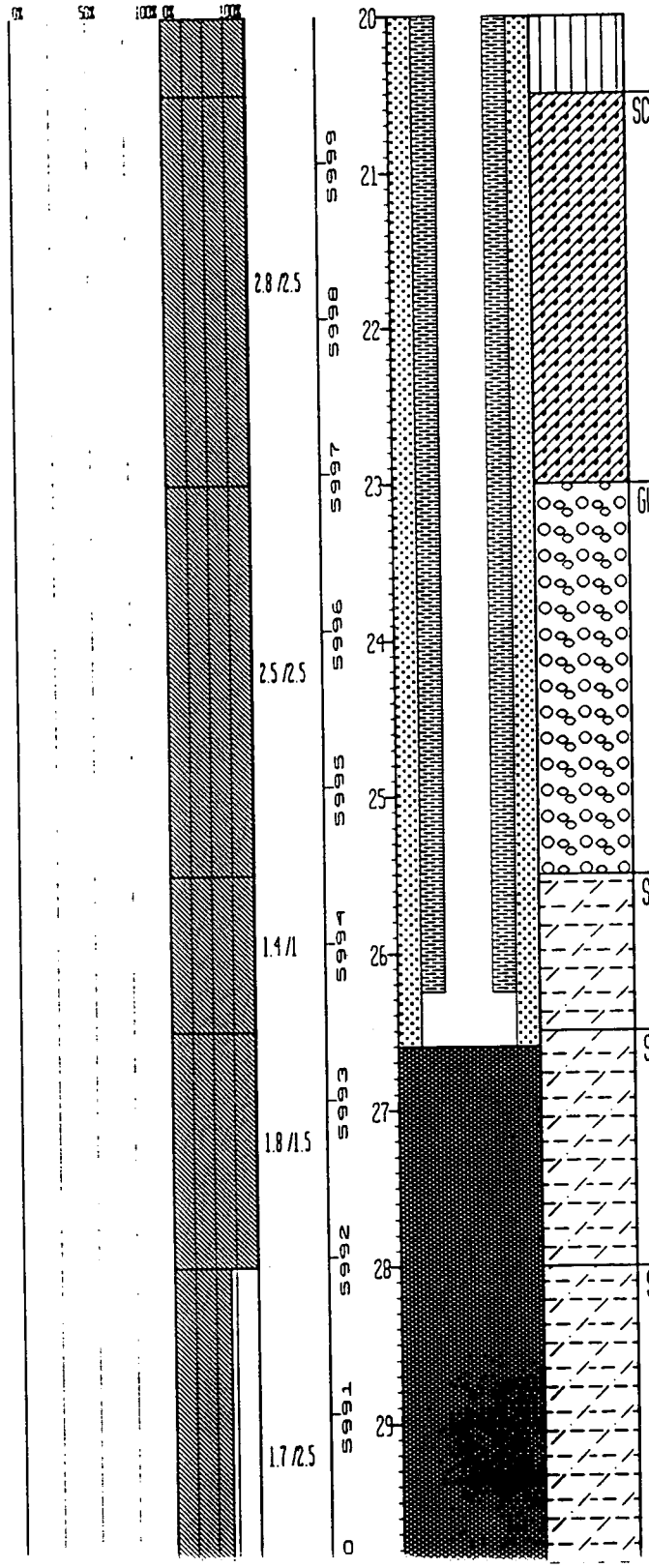
UNIFIED SOILS CLASSIFICATION OR ROCK TYPE	DESCRIPTION
GC:	GRAVEL in sandy silty clay matrix - gravel predominantly med. dark gray, sub-angular to sub-rounded, matrix moderate yellowish brown with well graded sand.
NO SAMPLE:	
CL:	SILTY CLAY - dark yellowish orange (10YR 6/6), moderate plasticity, some gravel (to 1.5 cm.), some iron staining, some sand.
ML:	Clayey Silt - dark yellowish orange (10YR 6/6) to very pale orange (10YR 8/2) to yellowish gray (5Y 8/1), trace carbonaceous material, trace iron staining.
ML:	Clayey Silt - dark yellowish orange (10YR 6/6), some well sorted fine grained sand throughout, trace carbonaceous materials.

STATE PLANE COORDINATE:		TOTAL DEPTH (FT): 33	GROUND ELEVATION (FT):	6019.93	PROJECT NUMBER:	667.11	LOG OF BORING NUMBER:
NORTH:	749254	AREA: PLANT WEST	CASING DIAMETER (IN):	2 ID	GEOLOGIST:	LAA	44-86
EAST:	2082234	LOCATOR NUMBER: J9	BOREHOLE DIAMETER (IN):	7 25	DATE DRILLED:	11/06/86	

REMARKS: Hollow Stem Auger. Top of stainless steel casing: 3.03'. Well was built through 4" casing. No centralizers used.

CHEMICAL SAMPLE DEPTH
GRADATIONAL SAMPLE DEPTH
SAMPLE NUMBER

SAMPLE GRAIN SIZE | PERCENT RECOVERY | RECOVERY/INTERVAL | DATUM (FT) | DEPTH (FT) | WELL OR PIEZOMETER CONSTRUCTION | LITHOLOGY | UNIFIED SOILS CLASSIFICATION OR ROCK TYPE | DESCRIPTION



UNIFIED SOILS CLASSIFICATION OR ROCK TYPE	DESCRIPTION
SC:	Clayey Sand - dark yellowish orange to very pale orange (10YR 6/6 to 10YR 8/2), well graded, very fine grained to coarse grained, trace of very coarse grained, sub-angular to sub-rounded, sufficient clay content to create moderate to high plasticity.
GW:	Clayey Sand and Gravel - light brown to very pale orange (5YR 5/6 to 10YR 7/4), gravel angular to sub-rounded, sand sub-angular to sub-rounded, wel graded, fine sand to granules, fine gravel to pebbles, max. size 2 sufficient clay to create low plasticity, increased clay content, decreased gravel content at bottom of interval.
SILTY CLAYSTONE:	Top of Bedrock. Dark yellowish orange (10YR 6/6) to yellowish gray (5Y 8/1), high plasticity, trace sand. (Possibly highly weathered claystone) slightly friable to friable.
SILTY CLAYSTONE:	Same as above, trace of carbonaceous material.
SILTY CLAYSTONE:	Yellowish gray (5Y 7/2), high plasticity, trace sand, trace white mineralization (unidentified), does not react with dilute HCl. Possibly highly weathered claystone, slightly friable, horizontal to conva bedding.

STATE PLANE COORDINATE:		TOTAL DEPTH (FT): 33	GROUND ELEVATION (FT):	6019.93	PROJECT NUMBER:	667.11	LOG OF BORING NUMBER:
NORTH:	749254	AREA: PLANT WEST	CASING DIAMETER (IN):	2 ID	GEOLOGIST:	LAA	44-86
EAST:	2082234	LOCATOR NUMBER: J9	BOREHOLE DIAMETER (IN):	7.25	DATE DRILLED:	11/06/86	

REMARKS: Hollow Stem Auger. Top of stainless steel casing: 3.03'. Well was built through 4" casing. No centralizersused.

CHEMICAL SAMPLE DEPTH
GRADATIONAL SAMPLE D
SAMPLE NUMBER

SAMPLE GRAIN SIZE	PERCENT RECOVERY	RECOVERY/INTERVAL	DATUM (FT)	DEPTH (FT)	WELL OR PIEZOMETER CONSTRUCTION	LITHOLOGY	UNIFIED SOILS CLASSIFICATION OR ROCK TYPE	DESCRIPTION
0% 50% 100%	0% 100%	1.1/2.5	5989 5988 5987 5986 5985 5984 5983 5982 5981	30 31 32 33 34 35 36 37 38 39				SILTY CLAYSTONE: Possibly highly weathered claystone, yellowish gray (5Y 7/2), high plasticity, trace sand, no HCl reaction. If claystone, slightly friable, horizontal to convoluted bedding.

NOTE: No water encountered during drilling.

Project:	Rocky Flats Plant	LOG OF BORING NO. 61-86
Date Drilled	11/19/86	Coordinates N 36217.4 E 20608.7
Boring Method	Hollow Stem Auger	Ground Surface Elevation 5999.31'

Elev. (feet)	Depth (feet)	Sample Type	Graphic Log	Material Description	Penetration Resistance (Blows/Foot) 20 40	Water Content (%) 20 40	Other Tests
	0			ROCKY FLATS ALLUVIUM 0.0-2.5'-Sample. Recovered 2.0/2.5'=80%. TOP SOIL: dark yellowish brown (10YR 4/2); silty; clay-rich; abundant small cobbles and coarse gravel; disturbed; moist.			
	5			ARAPAHOE FORMATION 2.5-5.0'-Sample. Recoverd 2.2/2.5'=88%. CLAYSTONE: yellowish gray (5Y 8/1); white (N 9/0) greasy clay with abundant $CaCO_3$ occuring throughout; some medium-grained sand in lower 1.0'; FeO stained; moist.			
	10			5.0-11.5'-Sample. Recovered 4.0/6.5=62%. CLAYSTONE: yellowish gray (5Y 8/1); dark yellowish brown (10YR 4/2) clays, silts, sands, gravels, and small cobbles; top soil; moist; wet at 8.0' with heavy FeO stains.			
	15			11.5-13.5'-Sample. Recovered 2.0/2.0'=100%. CLAYSTONE: dark yellowish orange (10 YR 6/6); greasy; undisturbed; blocky; moist. 13.5-18.5'-Sample. Recovered 4.0/5.0'=80%. CLAYSTONE: dark yellowish orange (10YR 6/6); light olive gray (5Y 6/1); blocky; greasy; bedded; moist.			
	20			TOTAL DEPTH: 18.5'			

Remarks Logged by: L. Pivonka Checked by:

Project No. 106P06222

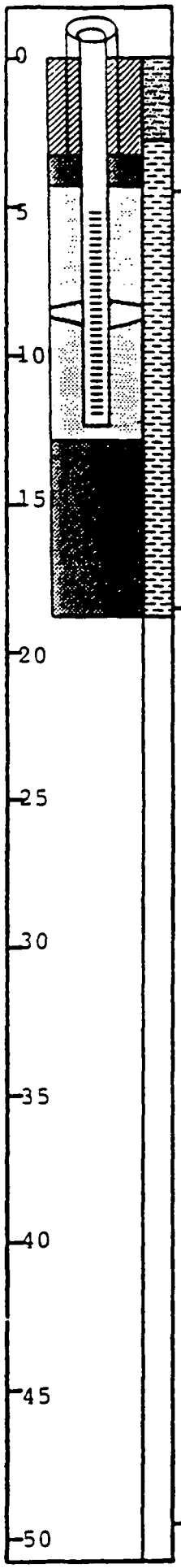
Hydro-Search, Inc.

WELL 61-86

WELL CONSTRUCTION SUMMARY

LOCATION or COORDS: N 36217.5 E 20608.7

ELEVATION: GROUND LEVEL 5999.31'
TOP OF CASING 6000.76'



LOCATION Rocky Flats Plant
PERSONNEL L. Piyonka
PROJECT 106R06222

DRILLING SUMMARY:

TOTAL DEPTH Well: 12.25' Hole: 18.50'
BOREHOLE DIAMETER 7¼"

DRILLER Boyles Brothers Drilling Co.
15865 W. 5th Avenue
Golden, CO (Jim Horn)
RIG Mobile B-57
BIT(S) Blade bit

DRILLING FLUID None

SURFACE CASING 5" x 4' steel w/ locking cap

WELL DESIGN:

BASIS: GEOLOGIC LOG X GEOPHYSICAL LOG ___

CASING STRING(S): C=CASING S=SCREEN

0.00'	5.00'	C1	
5.00'	12.00'	S1	

CASING: C1 2" I.D. Sch. 5 type 316 stainless steel, threaded and flush jointed.

SCREEN: S1 2" I.D. Sch. 5 type 316 stainless steel, threaded and flush jointed, 0.010" wire wrapped screen, 0.25' welded bottom cap.

CENTRALIZERS Type 304 stainless steel
7.84' - 9.01'

FILTER MATERIAL 32-42 silica sand
4.00' - 12.50'

CEMENT Portland Type I
0.00' - 3.00'

OTHER 3/8" bentonite pellets
3.00' - 4.00'
12.50' - 18.50'

CONSTRUCTION TIME LOG:

TASK	START DATE 1986	START TIME	FINISH DATE 1986	FINISH TIME
DRILLING:				
7¼" auger	11/19	1157	11/19	124
GEOPHYS. LOGGING:	—	—	—	—
CASING:				
2" stainless	11/19	1429	11/19	143
FILTER PLACEMENT:	11/19	1427	11/19	143
CEMENTING:	11/19	1436	11/19	144
DEVELOPMENT:				
OTHER:				
Bentonite	11/19	1435	11/19	14
	11/19	1425	11/19	14

WELL DEVELOPMENT

See Well Development Summary Sheet.

COMMENTS:

Water encountered at 8.50' during drilli

Top of stainless steel casing: 1.45'

LOG OF BORING No. 61-86

DATE DRILLED: 11/19/86 **EQUIPMENT:** Mobile B-57

DESCRIPTION: HSA **ELEVATION:** 5967.0

SAMPLE NO. / SAMPLE TYPE	BLOWS PER 6 INCHES	SPT. N	INCHES DRIVEN / INCHES RECOVERED	NUMBER OF RINGS	DEPTH IN FEET	WELL OR PIEZOMETER CONSTRUCTION	GRAPHIC LOG	TESTS
			2.5 / 2.0		1, 2			Clayey silty gravel, dark yellowish brown (10YR 4/2). Abundant small cobbles. Moist.
			2.5 / 2.2		3, 4			Caliche, yellowish gray (5y 8/1) to white (N9) some sand, abundant CaCO3
			6.5 / 4.0		5, 6, 7, 8, 9, 10, 11			Clayey, silty, sandy, gravel and pebbles. Dark yellowish brown (10yr 5/2) Caliche also interlayered. Heavy Fe2 stain, 8.5'-11.5'. Moist.
			? / ?		12, 13			Claystone, Dark yellowish orange (10yr 6/6) moderate to high plasticity. undisturbed, moist.
			5.0 / 4.0		14, 15, 16, 17, 18, 19			Silty claystone, dark yellowish orange (10yr 6/6) to light olive gray (5y 6/1) Friable. Moist.

3/10/87

5/8/87

1/87

6/24/87

DRILLING CONTRACTOR

DRILLER

BY

DATE

CHK'D BY

THIS SUMMARY APPLIES ONLY AT THE LOCATION OF THIS BORING AND AT THE TIME OF DRILLING. SUBSURFACE CONDITIONS MAY DIFFER AT OTHER LOCATIONS AND MAY CHANGE AT THIS LOCATION WITH THE PASSAGE OF TIME. THE DATA PRESENTED IS A SIMPLIFICATION OF ACTUAL CONDITIONS ENCOUNTERED

PROJECT NO

LOG OF BORING NO. 61-86

GEOLOGIST(S): LAA
DATE: 8/15/90

PROJECT NO: 667-1122

TOP/BOTTOM OF CORE IN BOX	TOP/BOTTOM OF INTERVAL	FEET OF CORE IN INTERVAL IN BOX	SAMPLE NUMBER	FRACTURE ANGLE	BEDDING ANGLE	GRAIN SIZE DISTRIBUTION	USCS SYMBOL	DEPTH IN FEET	LITHOLOGIC LOG	LITHOLOGIC DESCRIPTION
0.0	0.0 – 2.5	(1) 1.9				Sand 50% Gravel 50%	GW	1, 2		Sand + gravel. Pale yellowish brown (10yr6/2) to Lt. olive gray (5y 6/1). Sand v.f.g. to granules well graded Subangular to sub-rounded Gravel angular to subangular. Max size ≈ 3cm. Some silt. Some asphalt. Calcitic ~~Some~~ trace grass + roots @ surface Becomes gravelly Caliche toward bottom. Gravel larger to 6cm
	2.5 – 5.0	(1) 2.1				Caliche 50% Clay + sand 50%	CL	3, 4, 5		Caliche wh + e(N9) and sandy clay yellowish gray (5y 8/1). Plasticity (est.) low to mod. Sand med grained to v.c.g. Some iron staining.
Box 1 of 2	5.0 – 8.5	(1) 2.3	LAA #6			Sand >50%	SC	6, 7, 8		Clayey sand yellowish gray (5y 8/1) to olive gray (5y 4/1) to dk. yellowish orange (10yr6/6). Sand F.g. to v.c.g. Sub. angular to rounded Mod. well sorted. Some gravel. To 2cm Sub rounded Traces of asphalt Some areas calcitic
	8.5 to 11.5	(1) 1.4				Gravel >50% Clay ≥25%	GC	9		Sandy Clayey Gravel. No predom gravel color. Angular to sub rounded. Mod. to well sorted max size 5.5cm. Sand f. to c. grained Clay dk. yellowish orange 10yr 6/6.

NOTES: General: USCS is modified for this log as follows:
Material amounts are estimated by % volume instead of % weight.
(1) Badly broken core, accurate footage measurements not possible.
(2) Core breaks cannot be matched, accurate footage measurements not possible.

ROCKY FLATS PLANT

FIGURE NO.

LOG OF BORING NO. 61-86

GEOLOGIST(S): LAP
DATE: 8/15/89

PROJECT NO: 667.1122

TOP/BOTTOM OF CORE IN BOX	TOP/BOTTOM OF INTERVAL	FEET OF CORE IN INTERVAL IN BOX	SAMPLE NUMBER	FRACTURE ANGLE	BEDDING ANGLE	GRAIN SIZE DISTRIBUTION	USCS SYMBOL	DEPTH IN FEET	LITHOLOGIC LOG	LITHOLOGIC DESCRIPTION
Box 1 of 2	11.5						GC	11		~~Silty Clay. Grayish orange (10yr 7/4) to yellowish gray (5y 8/1).~~ LA See previous page for description.
13.5	13.5	1.4(1)				Clay >60%	CL	12 13		Silty Clay Grayish orange (10yr 7/4) to yellowish gray (5y 8/1) Est plasticity mod. to high Trace sand v.f.g. to coarse.
Box 2 of 2	13.5 18.5	3.4(1)				Clay >70%		14 15 16 17 18		Silty Claystone. Grayish orange (10yr 7/4) to yellowish gray (5y 8/1). Highly weathered Mod. Friable. Bedding not evident some iron staining and [illegible] material. Beg. Bo
								19		

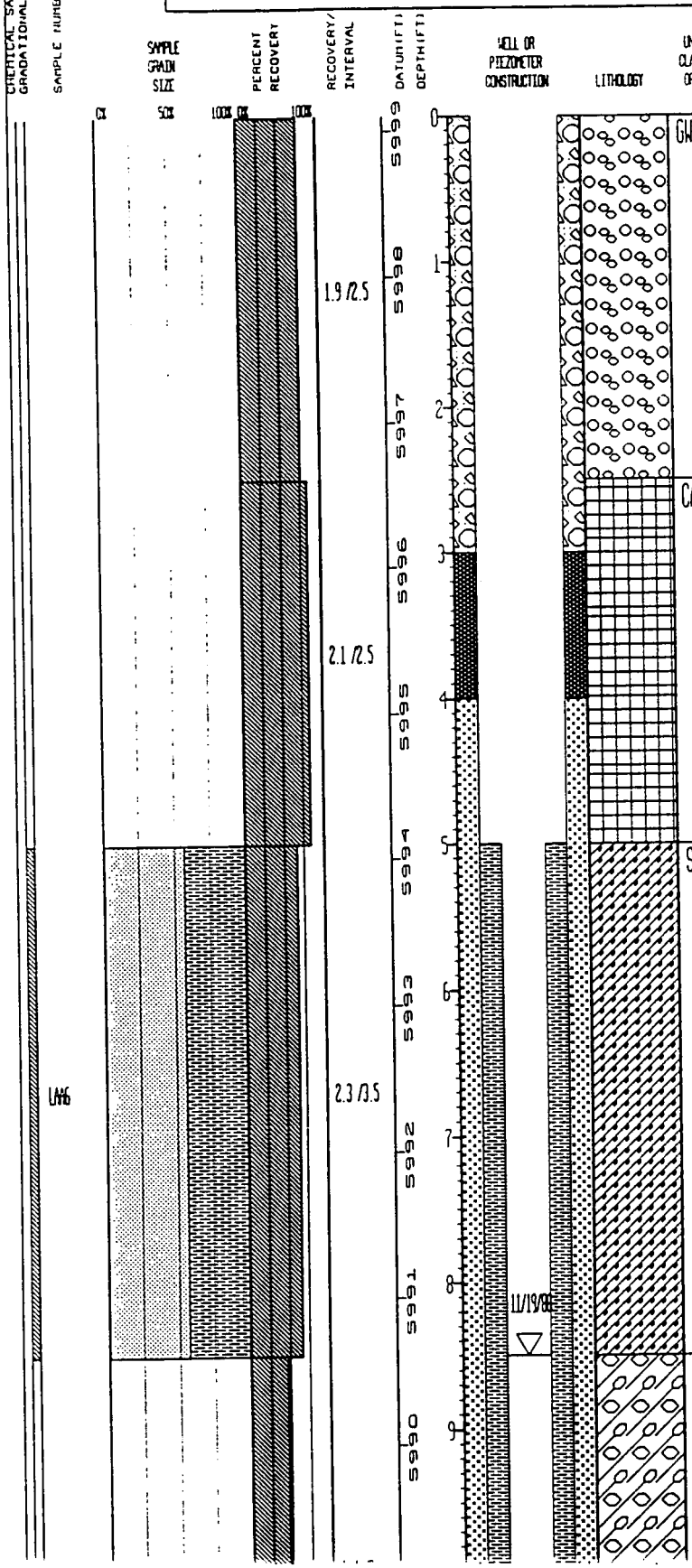
NOTES: General: USCS is modified for this log as follows:
Material amounts are estimated by % volume instead of % weight.
(1) Badly broken core, accurate footage measurements not possible.
(2) Core breaks cannot be matched, accurate footage measurements not possible.

ROCKY FLATS PLANT

FIGURE NO.

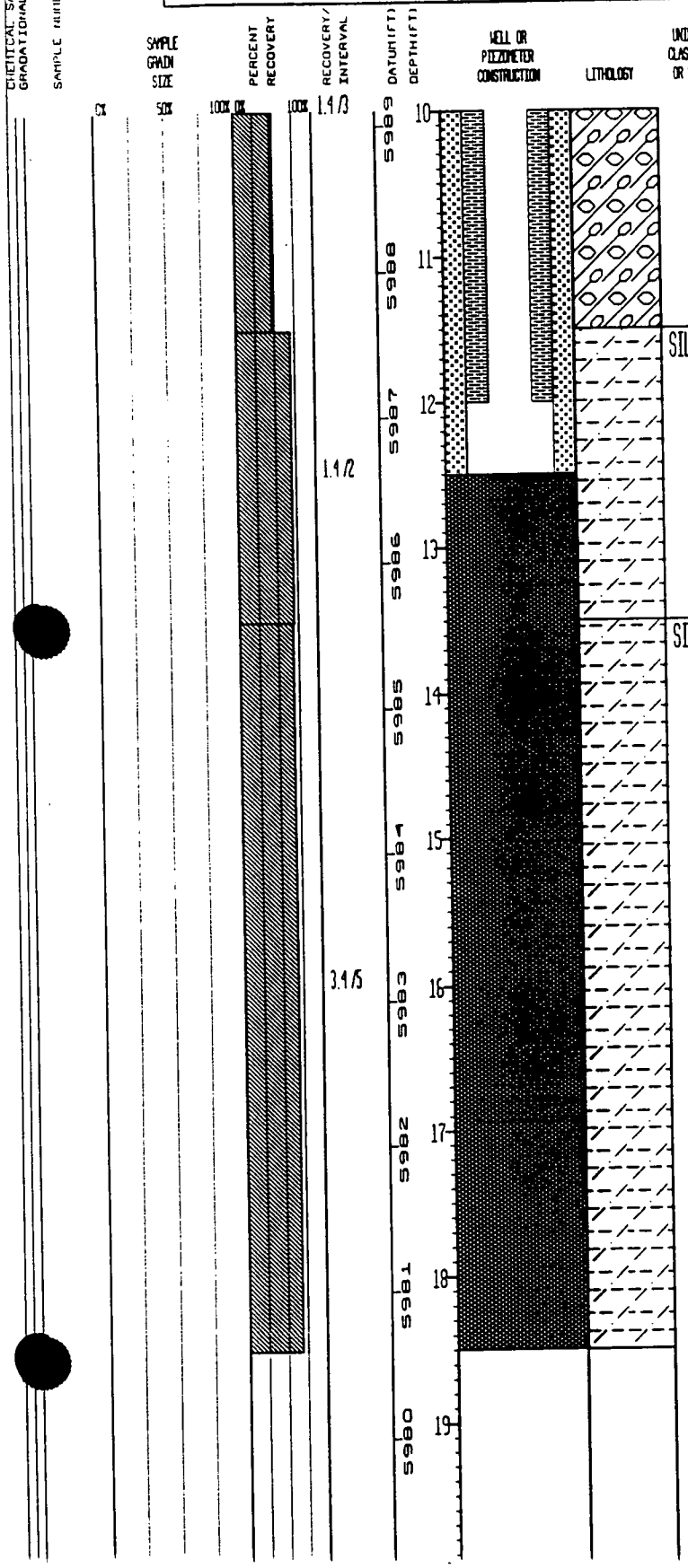
STATE PLANE COORDINATE:		TOTAL DEPTH (FT): 18.5	GROUND ELEVATION (FT):	5999.1	PROJECT NUMBER:	667.11	LOG OF BORING NUMBER:
NORTH:	749198	AREA: 881 HILLSIDE	CASING DIAMETER (IN):	2 ID	GEOLOGIST:	LAA	61-86
EAST:	2083717	LOCATOR NUMBER: K9	BOREHOLE DIAMETER (IN):	7.25	DATE DRILLED:	11/19/86	

REMARKS: Hollow Stem Auger.



UNIFIED SOILS CLASSIFICATION OR ROCK TYPE	DESCRIPTION
GW:	SAND AND GRAVEL - pale yellowish brown (10YR 6/2) to lt. olive gray (5Y 6/1), sand VFG to granules, well graded, sub-angular to sub-rounded. Gravel angular to sub-angular, max. size approx. 3 cm., some silt, some asphalt, calcitic, trace grass and roots at surface, becomes gravelly caliche toward bottom, gravel larger to 6 cm.
CALICHE:	White (N9) and sandy clay, yellowish gray (5Y 8/1), plasticity (est.) low to mod., some sand med. grained to VCG, some iron staining.
SC:	Clayey Sand - yellowish gray (5Y 8/1) to olive gray (5Y 4/1) to dk. yellowish orange (10YR 6/6), sand FG to VCG, sub-angular to rounded, mod. well sorted, some gravel to 2 cm., sub-rounded, traces of asphalt, some areas calcitic.
GC:	Sandy Clayey Gravel - no predom. gravel color, angular to sub-ro[illegible] mod. to well sorted, max. size 5.5 cm., sand F to C grained, clay [illegible] yellowish orange (10YR 6/6).

STATE PLANE COORDINATE:		TOTAL DEPTH (FT): 18.5	GROUND ELEVATION (FT):	5999.1	PROJECT NUMBER:	667.11	LOG OF BORING NUMBER:
NORTH:	749198	AREA: 881 HILLSIDE	CASING DIAMETER (IN):	2 ID	GEOLOGIST:	LAA	61-86
EAST:	2083717	LOCATOR NUMBER: K9	BOREHOLE DIAMETER (IN):	7.25	DATE DRILLED:	11/19/86	
REMARKS:	Hollow Stem Auger.						



SILTY CLAYSTONE: Top of Bedrock.
Grayish orange (10YR 7/4 to yellowish gray (5YR 8/1), est. plasticity mod. to high, trace sand VFG to coarse.

SILTY CLAYSTONE: Grayish orange (10YR 7/4) to yellowish gray (5Y 8/1), highly weathered, mod. friable, bedding not evident, some iron staining and carbonaceous material.

INDEX OF DATA

Boring No.: SP01-87

Completed as well? No

Data in File

X Log of Borehole

____ Well Construction Summaries

____ Well Development Summaries

____ Hydraulic Conductivity Test Data and Results

____ Packer Test Data and Results

____ Water Level Data

____ Saturated Thickness Hydrographs

LOG OF BOREHOLE

Location Rocky Flats Plant; Solar Ponds Area
Coordinates * N 37792 E 21209
Total Depth 30.2'

Borehole/Well No. SP01-87
Ground Surface Elevation *5982.7'
Water Level Encountered 15.2'
Static

Drilling Company Boyles Bros.
Date Drilled October 27-28, 1987
Drilling Method Hollow Stem Auger
Logged By J. Bacchus
Geologist

Driller R. Sharp
Helper T. Merritt
Drilling Fluid None
Checked By
Site Manager

CEARP Manager

Comments Borehole backfilled with Portland Type I Cement.
*Coordinates and elevation estimated from topographic map.

Depth Feet	Graphic Log	Sample Type	Lithologic Description	Samples Collected or Other Tests Performed
0			**ARTIFICIAL FILL/DISTURBED**	
			0.0-2.0' SAMPLE. Recovered 1.2/2.0' = 60%. 0-0.6': SAND: moderate yellowish brown (10 YR 5/4); silt and clay, asphalt; slight HCl reaction. 0.6-1.2': CLAY: moderate yellowish brown (10 YR 5/4); dense; large pebbles; caliche; dry.	HNu Background=0.8 OVA Background=1.0 Ludlum Background=0.0
			2.0-4.0' SAMPLE. Recovered 2.0/2.0' = 100%. CLAY: dense; large angular clasts of igneous origin; reacts with HCl; slightly moist.	No Ludlum readings above background
5			4.0-5.0' SAMPLE. Recovered 1.2/1.0' = 120%. 4.0-4.1': CLAY: same as above. 4.1-4.35': layer of asphalt 4.35-5.0': CLAY: same as layer above except one large chunk of redwood; appears to be a stake.	0.0-1.2': Field Screen Reading: HNu=0.4(0.4); OVA=1.2(0.6). 0.0-1.2': Field Screen Sample: SP018700FS. 4.0-5.0': Reading on Core: HNu=1.4; OVA=1.2. 4.0-5.0': Direct Hit Sample: SP018704DH.
10			5.0-8.0' SAMPLE. Recovered 1.3/3.0' = 43%. 5.0-7.7': CLAY: moderate yellowish brown (10 YR 5/4) with some spots of dark yellowish orange (10 YR 6/6); sandy; silty; pebbly; clasts are subangular to highly angular; dry. 7.7-8.0': CLAY: moderate reddish brown (10 YR 4/6); some coarse sand; slightly moist.	5.0-6.3': Reading on Core: HNu=3.4; OVA=1.2. 5.0-6.3': Direct Hit Sample: SP018705DH.
			8.0-10.5' SAMPLE. Recovered 2.0/2.5' = 80%. 8.0-9.1': CLAY: same as above. 9.1-10.0': SAND: moderate yellowish brown (10 YR 5/4) to dark yellowish orange (10 YR 6/6); no HCl reaction; very poorly sorted; size ranges from clay to pebbles; clasts are very angular; dry.	8.0-10.0': Readings on Core: HNu=3.4; OVA=1.2. 10.5': Readings in Breathing Zone: HNu=0.6; OVA=2.5.
15			10.5-12.7' SAMPLE. Recovered 1.65/2.5' = 66%. SAND: same as above; contains some subrounded small cobbles; dry.	10.5-12.2': Readings on Core: HNu=1.0; OVA=2.8. 10.5-12.2': Direct Hit/Upper Contact Sample SP 018711DH.
			12.7-15.2' SAMPLE. Recovered 1.2/2.5' = 48%. 12.7-13.2': SAND: moderate reddish brown (10 YR 4/6); conglomeratic sand; poorly sorted; silt; clay and large pebbles angular to subrounded; sand; slight HCl reaction; dry.	12.7-13.9': Readings on Core: HNu=1.0; OVA=2.8.
20				

LOG OF BOREHOLE

Location Rocky Flats Plant; Solar Ponds Area
Borehole/Well No. SP01-87(cont'd.)
Coordinates _____
Ground Surface Elevation _____
Total Depth _____
Water Level Encountered _____
Static _____
Drilling Company _____
Driller _____
Date Drilled _____
Helper _____
Drilling Method _____
Drilling Fluid _____
Logged By _____ Geologist
Checked By _____ Site Manager
_____ CEARP Manager
Comments _____

Depth Feet	Graphic Log	Sample Type	Lithologic Description	Samples Collected / Other Tests Perform
20			**ARAPAHOE FORMATION**	
			13.2-13.9': SANDSTONE: yellowish gray (5 Y 7/2); clean; mottled oxidation; dark yellowish orange (10 YR 6/6); well sorted, small amount of clay; slightly moist.	12.7-14.9': Direct Hit/Contact Sample: SP018713DH.
			15.2-17.7' SAMPLE. Recovered 1.5/2.5' = 60%. SANDSTONE: moderate yellowish brown (10 YR 5/4) to yellowish gray (5 Y 7/2); claystone soaked except last 0.15 ft where it is wet to moist.	15.2-16.7': Readings on Core: HNu=2.1; OVA=10.0.
				15.2-16.7': Bedrock Sample: SP018716BR.
25			17.7-20.2' SAMPLE. Recovered 2.35/2.5' = 94%. 17.7-17.9': CLAYSTONE: light olive gray (5 Y 5/2); very fissile; no sand; moist. 17.9-18.9': SANDSTONE: alternating bands of yellowish gray (5 Y 7/2) and dark yellowish orange (10 YR 6/6); coarse-grained; subrounded; moist to dry. 18.9-20.05': SANDSTONE: yellowish gray (5 Y 7/2); highly stained with dark yellowish orange (10 YR 6/6); fractures; well consolidated; fine to coarse-grained; no HCl reaction; moist.	20.2-22.3': Readings on Core: HNu=2.3; OVA=1.8.
				20.2-22.3': Direct Hit Sample: SP018721DH.
				22.7-24.8': Readings on Core: HNu=0.2; OVA=4.3.
				22.7-24.8': Direct Hit Sample: SP018723DH.
30			20.2-22.7' SAMPLE. Recovered 2.1/2.5' = 84%. SANDSTONE: same as above.	25.2-27.6': Readings on Core: HNu = 0.3; OVA = 0.6.
			22.7-25.2' SAMPLE. Recovered 2.1/2.5' = 84%. SANDSTONE: dark yellowish orange (10 YR 6/6) and yellowish gray (5 Y 7/2); fine-grained; well consolidated; slightly moist.	27.7-30.2': Readings on Core: HNu = 0.3; OVA = 0.6.
35			25.2-27.7' SAMPLE. Recovered 2.4/2.5' = 96%. 25.2-25.9': CLAYSTONE: dark yellowish orange (10 YR 6/6) and yellowish gray (5 Y 7/2); sand; dry. 25.9-27.6': SANDSTONE: dark yellowish orange (10 YR 6/6) and yellowish gray (5 Y 7/2); coarse-grained; dry.	
			27.7-30.2' SAMPLE. Recovered 2.65/2.5' = 120%. SANDSTONE: same as above except sand is finer-grained.	
			TOTAL DEPTH: 30.2'.	

LOG OF BORING NO. SPD187

DATES DRILLED:
ELEVATION:
GEOLOGIST(S): DAT
DATE:
CHECKED BY:
USCS Symbol
DATE: 3/8/89

PROJECT NO: 667-11.22

Top Depth of Box	Depth Interval	Sample Number	Recovery (ft)	USCS Symbol	Fracture Freq	Fracture Angle	Bedding Angle	Other Structure	Depth Scale	Sample Type	LITHOLOGIC DESCRIPTION (SAMPLE DESC)
0.0 ↓	0.0 - 1		(1) 0.5	GP							SANDY GRAVEL, MODERATE YELLOWISH BROWN (10 YR 5/4), ANGULAR, SUBROUNDED, MOD GRADING, MAX SIZE = 2 cm, SOME SILT, SOME ROOTS SOME ASPHALT, SOME CALCAREOUS MATERIAL
	1.0 - 2.0		∅						1		NO SAMPLE
	2.0 - 4.0		(1) 1.5	GC					2 3		SANDY GRAVELY CLAY, GREYISH ORANGE (10 YR 7/4), MOD-HIGH PLASTICITY, SOME SILT, MAX GRAVEL SIZE = 4 cm, ~~CARBONACEOUS~~ CALCAREOUS MATERIAL
	4.0-5.0		0.45	GC					4		SAME AS ABOVE, MODERATE Y[illegible] BROWN (10 YR 5/4), GRAVEL CO[illegible] INCREASED, LO AMT OF ASPALT, PART OF FENCE POST
Box 1 of 3	5.0-6.3		0.55	GC					5 6		SAME AS ABOVE, MODERATE ~~BROWNISH ORANGE~~ YELLOWISH BROWN (10 YR 5/4), HIGH PLAST, ~~NO ASPHALT~~ SOME SILT, NO ASPHALT OR POST, SLIGHTLY ~~CARBONACEOUS~~ CALCAREOUS AND SAME AS ABOVE, MODERATE REDDISH BROWN (10 R 4/6), SMALLER AMOUNT OF GRAVEL, NO CARBONACEOUS MATERIAL
	6.3 - 8.0		∅						7 8		NO SAMPLE
	8.0 - 10.0		(1) 0.9	GC					9		SAME AS ABOVE

NOTES: General: The USCS is modified for this log as follows: Material amounts are estimated by percent volume instead of percent weight.
(1) Badly broken core, accurate footage measurement not possible.
(2) Core breaks cannot be matched, accurate footage measurement not possible.

ROCKY FLATS PLANT

FIGURE NO.

LOG OF BORING NO. SPO 187

DATES DRILLED:
ELEVATION:
GEOLOGIST(S): DAT
DATE:
CHECKED BY:

USCS symbol
DATE: 3/8/92

PROJECT NO: 667-11.22

TOP/BOTTOM OF CORE IN BOX	TOP/BOTTOM OF CORE IN BOX (FT. BELOW)	SAMPLE NUMBER	FEET OF CORE	USCS SYMBOL	FRACTURES PER FOOT	FRACTURE ANGLE	BEDDING ANGLE	GRAIN SIZE DISTRIBUTION	DEPTH IN FEET	LITHOLOGIC LOG	LITHOLOGIC DESCRIPTION
Box 1 of 3	10.0-10.5		Ø						Erased at 10		NO SAMPLE
	10.5-12.7		(1) 0.55	GC					11, 12		SANDY GRAVELLY CLAY, MODERATE YELLOWISH BROWN (10 YR 5/4), MOD PLAST, SOME SILT, MAX SIZE GRAVEL = 55cm,
13.9	12.7-13.9		(1) 0.35	MH					13		CLAYEY SILT, VERY LIGHT GREY (N8), IRON STAINING, TRACE OF GRAVEL
NO SAMPLE									14, 15, 16, 17		NO SAMPLE
17.7 Box 2 of 3	17.7-20.05		(1) 1.6	MH					18, 19		VFG-FG SANDY SILT, DARK YELLOWISH ORANGE (10 YR 6/6), SOME CLAY

NOTES: General: The USCS is modified for this log as follows: Material amounts are estimated by percent volume instead of percent weight.
(1) Badly broken core, accurate footage measurement not possible.
(2) Core breaks cannot be matched, accurate footage measurement not possible.

ROCKY FLATS PLANT

FIGURE NO.

LOG OF BORING NO. SP0187

DATES DRILLED:
ELEVATION:
GEOLOGIST(S): DAT
DATE:
CHECKED BY:

USCS symbol

DATE: 9/9/87

PROJECT NO: 667-11.2

TOP/BOTTOM OF CORE IN BOX	TOP/BOTTOM OF CORE IN FEET	SAMPLE NUMBER	FEET OF CORE	USCS SYMBOL	FRACTURES PER FOOT	FRACTURE ANGLE	BEDDING ANGLE	GRAIN SIZE DISTRIBUTION	DEPTH IN FEET	LITHOLOGIC LOG	LITHOLOGIC DESCRIPTION
Box 2 of 3	20.05-20.2										NO SAMPLE
	20.2 -22.3		(1) 1.7	MH					21, 22		SILT, VERY LIGHT GREY (N8). SOME VFG-FG SAND. EXTENSIVE IRON STAINING, TRACE OF CARB MATERIAL
	22.3 -22.7		Ø								NO SAMPLE
	22.7 -24.4		(1) 1.25	MH					23, 24		SAME AS ABOVE; SOME CLAY
	24.4 -25.2		Ø						25		NO SAMPLE
	25.2 -27.6		(1) 1.75	MH					26, 27		SAME AS ABOVE; INCREASING AMOUNTS OF VFG-MG SAND.
	27.6-27.7		Ø								NO SAMPLE
27.7 ↓ Box 3 of 3	27.7-30.2	~~(1)~~ ~~1.6~~	(1) 1.6	MH					28, 29		SAME AS ABOVE; INCREASED AMOUNTS OF CLAY

NOTES: General: The USCS is modified for this log as follows: material amounts are estimated by percent volume instead of percent weight.
(1) Badly broken core, accurate footage measurement not possible.
(2) Core breaks cannot be matched, accurate footage measurement not possible.

ROCKY FLATS PLANT

FIGURE NO.

LOG OF BORING NO. SPO 157

DATES DRILLED:
ELEVATION:
GEOLOGIST(S): DAT
DATE:
CHECKED BY:

USCS symbol

DATE: 9/8/89

PROJECT NO: 667-11.22

TOP/BOTTOM OF CORE IN BOX	TOP/BOTTOM OF CORE IN BOX (FT)	SAMPLE NUMBER	FEET OF CORE	FEET OF CORE	FRACTURES PER FOOT	FRACTURE ANGLE	BEDDING ANGLE	GRAIN SIZE DISTRIBUTION	DEPTH IN FEET	LITHOLOGIC LOG	LITHOLOGIC DESCRIPTION
30.2	27.7 – 30.2										SILT, VERY LIGHT GREEN (NB); SOME VFG-MG SAND EXTENSIVE IRON STAINING. SOME CLAY, TRACE OF CARB
END OF BOXES											

NOTES: General: The USCS is modified for this log as follows: Material amounts are estimated by percent volume instead of percent weight.
(1) Badly broken core, accurate footage measurement not possible.
(2) Core breaks cannot be matched, accurate footage measurement not possible.

ROCKY FLATS PLANT

FIGURE NO.

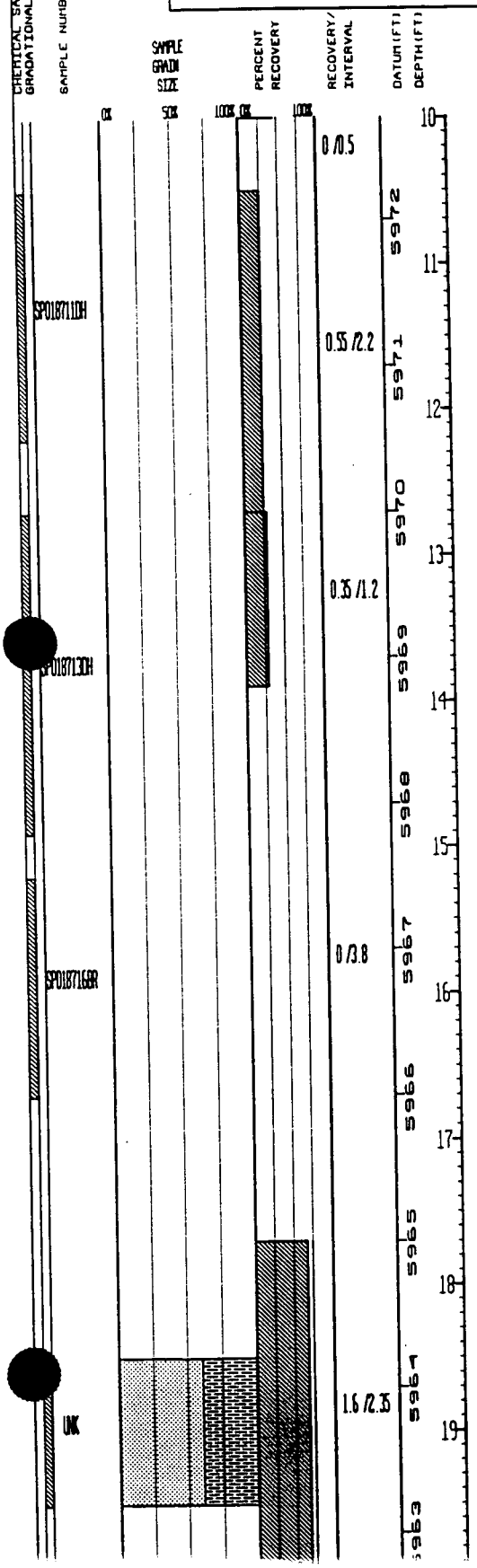
STATE PLANE COORDINATE:		TOTAL DEPTH (FT): 30.2	GROUND ELEVATION (FT):	5982.7	PROJECT NUMBER:	667.11	LOG OF BORING NUMBER:
NORTH:	750790	AREA: SOLAR PONDS	CASING DIAMETER (IN):	0	GEOLOGIST:	DAT	SP01-07
EAST:	2084310	LOCATOR NUMBER: L10	BOREHOLE DIAMETER (IN):	0	DATE DRILLED:	10/28/87	

REMARKS: Hollow stem auger. Borehole backfilled with Portland Type I Cement. Coordinates and elevation estimated from topo. map.

CHEMICAL SAMPLE DEPTH / GRADATIONAL SAMPLE DEPTH	SAMPLE NUMBER	SAMPLE GRAIN SIZE (0% 50% 100%)	PERCENT RECOVERY (0% 100%)	RECOVERY/INTERVAL	DATUM (FT)	DEPTH (FT)	WELL OR PIEZOMETER CONSTRUCTION	LITHOLOGY	UNIFIED SOILS CLASSIFICATION OR ROCK TYPE	DESCRIPTION
	SP018700FS			0.5/1	5982	0			GP:	SANDY GRAVEL - moderate yellowish brown (10YR 5/4), angular to subrounded, mod. grading, max. size = 4 cm., some silt, some roots, some asphalt, some calcareous material.
				0/1	5981	1			NO SAMPLE:	
				1.5/2	5980	2			CL:	SANDY GRAVELLY CLAY - grayish orange (10YR 7/4), mod. to high plasticity, some silt, max. gravel size = 4 cm., calcareous material.
					5979	3				
	SP018704DH			0.45/1	5978	4			CL:	Same as above, moderate yellowish brown (10YR 5/4), gravel content increased, lg. amount of asphalt, part of fence post.
	SP018705DH			0.55/1.3	5977	5			CL:	Top of interval, same as above, moderate yellowish brown (10YR 5/4), high plast., some silt, no asphalt, calcareous. Bottom of interval, moderate reddish brown (10R 4/6), smaller amount of gravel, no carbonaceous material.
				0/1.7	5976	6			NO SAMPLE:	
				0.9/2	5975	7			CL:	Same as above.
					5974	8				
					5973	9				

STATE PLANE COORDINATE:		TOTAL DEPTH (FT): 30.2	GROUND ELEVATION (FT):	5982.7	PROJECT NUMBER:	667.11	LOG OF BORING NUMBER:
NORTH:	750790	AREA: SOLAR PONDS	CASING DIAMETER (IN):	0	GEOLOGIST:	DAT	SP01-87
EAST:	2084310	LOCATOR NUMBER: L10	BOREHOLE DIAMETER (IN):	0	DATE DRILLED:	10/28/87	

REMARKS: Hollow stem auger. Borehole backfilled with Portland Type I Cement. Coordinates and elevation estimated from topo. map.



NO SAMPLE:

CL: SANDY GRAVELLY CLAY - moderate yellowish brown (10YR 5/4), mod. plast., some silt, max. size gravel = 5.5 cm.

MH: Clayey Silt - very light gray (N8), iron staining, trace of gravel.

NO SAMPLE:

SM: SM per sieve analysis at 18.5' to 19.5'
Per field log: mh - Sandy Silt - VFG-FG, dark yellowish orange (10YR 6/6), some clay.

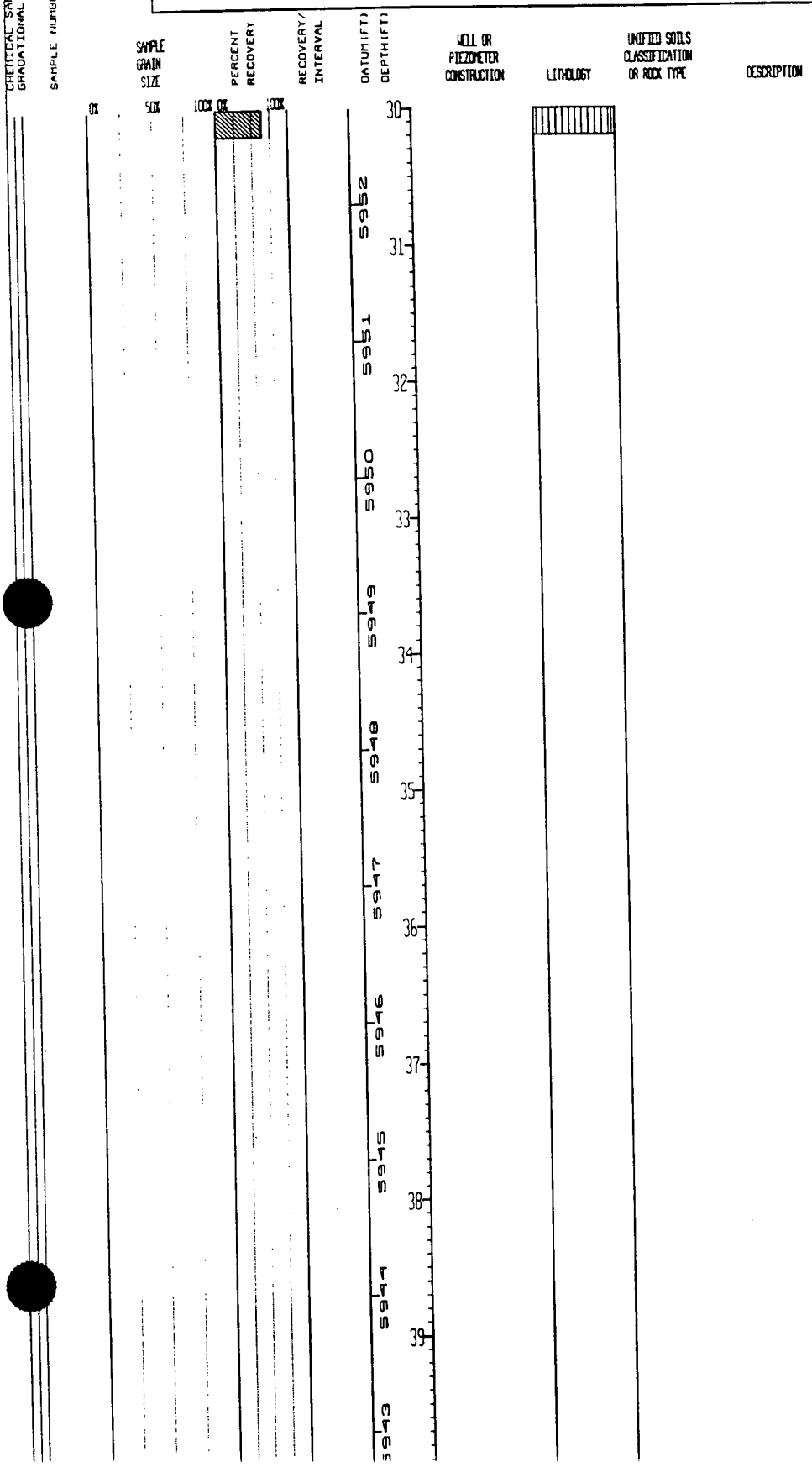
STATE PLANE COORDINATE:		TOTAL DEPTH (FT): 30.2	GROUND ELEVATION (FT):	5982.7	PROJECT NUMBER:	667.11	LOG OF BORING NUMBER:
NORTH:	750790	AREA: SOLAR PONDS	CASING DIAMETER (IN):	0	GEOLOGIST:	DAT	SP01-0[illegible]
EAST:	2083010	LOCATOR NUMBER: L10	BOREHOLE DIAMETER (IN):	0	DATE DRILLED:	10/28/87	

REMARKS: Hollow stem auger. Borehole backfilled with Portland Type I Cement. Coordinates and elevation estimated from topo. map.

CHEMICAL SAMPLE DEPTH / GRADATIONAL SAMPLE DEPTH	SAMPLE NUMBER	SAMPLE GRAIN SIZE (0% 50% 100%)	PERCENT RECOVERY (0% 100%)	RECOVERY/INTERVAL	DATUM (FT)	DEPTH (FT)	WELL OR PIEZOMETER CONSTRUCTION	LITHOLOGY	UNIFIED SOILS CLASSIFICATION OR ROCK TYPE	DESCRIPTION
				0 /0.15		20			NO SAMPLE:	
					5962				MH:	SILT - very light gray (N8), some VFG-FG sand, extensive iron staining, trace of carb. material.
	SP01872LDH			1.7 /2.1		21				
					5961	22				
				0 /0.4	5960				NO SAMPLE:	
						23			MH:	Same as above, some clay.
				1.25 /1.7	5959					
	SP01872ZDH					24				
				0 /0.8	5958				NO SAMPLE:	
						25			MH:	Same as above, increasing amounts of VFG-MG sand.
					5957	26				
				1.75 /2.4	5956					
						27				
				0 /0.1	5955				NO SAMPLE:	
	UNK					28			MH:	SILT - very light gray (N8), some VFG-MG sand, extensive iron staining, some clay, trace of carb.
					5954					
				1.6 /2.5		29				
					5953					

STATE PLANE COORDINATE:		TOTAL DEPTH (FT): 30.2	GROUND ELEVATION (FT):	5982.7	PROJECT NUMBER:	667.11	LOG OF BORING NUMBER:
NORTH:	750790	AREA: SOLAR PONDS	CASING DIAMETER (IN):	0	GEOLOGIST:	DAT	SP01-87
EAST:	2084310	LOCATOR NUMBER: L10	BOREHOLE DIAMETER (IN):	0	DATE DRILLED:	10/28/87	

REMARKS: Hollow stem auger. Borehole backfilled with Portland Type I Cement. Coordinates and elevation estimated from topo. map.



INDEX OF DATA

Boring No.: SP02-87

Completed as well? No

Data in File

X Log of Borehole

____ Well Construction Summaries

____ Well Development Summaries

____ Hydraulic Conductivity Test Data and Results

____ Packer Test Data and Results

____ Water Level Data

____ Saturated Thickness Hydrographs

LOG OF BOREHOLE

Location Rocky Flats Plant; Solar Ponds Area
Coordinates * N 37980 E 21532
Total Depth 15.1'

Borehole/Well No. SP02-87
Ground Surface Elevation *5976.6'
Water Level Encountered None
Static

Drilling Company Boyles Bros.
Date Drilled October 29, 1987
Drilling Method Hollow Stem Auger
Logged By J. Bacchus
Geologist

Driller R. Sharp
Helper T. Merritt
Drilling Fluid None
Checked By
Site Manager

CERAP Manager

Comments Borehole backfilled with Portland Type I Cement.
*Coordinates and elevation estimated from topographic map.

Depth Feet	Graphic Log	Sample Type	Lithologic Description	Samples Collected or Other Tests Performed
0			**ARTIFICIAL FILL/DISTURBED**	
			0-2.0' SAMPLE. Recovered 2.0/2.0' = 100%. CLAY: grayish brown (5 YR 3.2); sand, silt and gravel; clasts are angular; no roots; well indurated; dry.	HNu Background=0.9 OVA Background = 0.5-5.0 Ludlum Background = 0.0 No readings above background
			2.0-4.0' SAMPLE. Recovered 1.7/2.0' = 81%. CLAY: grayish brown (5 YR 3/2); poorly sorted, with sand silt and gravel; no reaction with HCl; dry.	
5			4.0-7.0' SAMPLE. Recovered 1.7/3.0' = 53%. CLAY: same as above.	
			Total depth measured at 7.6'. Readjust depth.	
			7.6-10.1' SAMPLE. Recovered 2.7/2.5' = 108%. 7.6-7.85': CLAY: same as above. 7.85-9.0': CALICHE: very pale orange (10 YR 8/2), reacts violently with HCl; silt size; dry. 9.0-10.1': CLAY: pale yellowish orange (10 YR 8/6); caliche; reacts violently with HCl; some angular pebbles; sand and silt; dry.	0.0-10.1': Composite Sample: SP02870008. (VOAs taken at 7.6-10.1). 7.6-10.1': Upper Contact Sample: SP028708UC. 10.1-12.6': Contact Sample: SP028711CT. 12.6-15.1': Bedrock sample: SP028713BR.
10			**ARAPAHOE FORMATION**	
			10.1-12.6' SAMPLE. Recovered 2.6/2.5' = 104%. SANDSTONE: yellowish gray (5 Y 7/2) with bands of light yellowish orange; fine to coarse-grained sand; caliche; coal; turns green with contact with HCl; dry.	
15			12.6-15 .1' SAMPLE. Recovered 2.7/2.5 = 108%. SANDSTONE: same as above except mottled with light yellowish orange; the sand is coarser; slightly moist near the bottom.	
			TOTAL DEPTH: 15.1'.	
20				

LOG OF BORING NO. SP02-87

DATES DRILLED:
ELEVATION:
GEOLOGIST(S): TSO
DATE:
CHECKED BY:

USCS symbol

DATE: 8/8/89

PROJECT NO: 667-11.22

TOP/BOTTOM OF CORE IN BOX	TOP/BOTTOM OF CORE IN TOP (FT/FT)	SAMPLE NUMBER	FEET OF CORE	USCS SYMBOL	FRACTURES PER FOOT	FRACTURE ANGLE	BEDDING ANGLE	GRAIN SIZE DISTRIBUTION	DEPTH IN FEET	LITHOLOGIC LOG	LITHOLOGIC DESCRIPTION
0.0 ↓	0.0 TO 2.0		1.7 (1)	GC					1		Clayey gravel - matrix color is brownish gray (5YR 4/1), angular to subrounded, mod. ~~sort~~ grading, max size = 7cm, some sand
	2.0 TO 3.7		1.75 (1)	GC					2, 3		same as above
	3.7-4.0		0	—					4		No Sample
	4.0 TO 5.7		1.8 (1)	GC					5		Same as above
	5.7 TO 7.0		0	—					6		No Sample
	7.0 TO 7.6		0	—					7		
	7.6 TO 10.1		1.8 (1)	—					8, 9		Cliche - white (N9) to yellowish gray (5Y 8/1), some sand, trace of gravel
↑ 10.1											

BOX 1 of 2

NOTES: General: The USCS is modified for this log as follows: Material amounts are estimated by percent volume instead of percent weight.
(1) Badly broken core, accurate footage measurement not possible.
(2) Core breaks cannot be matched, accurate footage measurement not possible.

ROCKY FLATS PLANT

FIGURE NO.

LOG OF BORING NO. SP02-87

DATES DRILLED:
ELEVATION:
GEOLOGIST(S): TSD
DATE:
CHECKED BY:

USCS symbol

DATE: 8/8/89

PROJECT NO: 667-11.22

TOP/BOTTOM OF CORE IN BOX	TOP/BOTTOM OF CORE IN PIPE	SAMPLE NUMBER	FEET OF CORE	[illegible]	FRACTURES PER FOOT	FRACTURE ANGLE	DECIDING ANGLE	GRAIN SIZE DISTRIBUTION	DEPTH IN FEET	LITHOLOGIC LOG	LITHOLOGIC DESCRIPTION
10.1 ↓	10.1 TO 12.6		ND						11, 12		Same as above (cliche) grading into a V.F.G. to F.G. sandstone mottled lt. greenish gray (5GY 8/1) & DK. yellowish orange (10YR 6/6) bedding is nonapparent, highly weathered, mod to highly friable trace of organic staining, + $CaCO_3$.
BOX 2 of 2	12.6 TO 15.1		ND						13, 14, 15		same as above w/ an increase in $CaCO_3$ at the bottom of the interval.
↑ 15.1											Bottom of Boxes
									16, 17, 18, 19		

NOTES: General: The USCS is modified for this log as follows: Material amounts are estimated by percent volume instead of percent weight.
(1) Badly broken core, accurate footage measurement not possible.
(2) Core breaks cannot be matched, accurate footage measurement not possible.

ASI

ROCKY FLATS PLANT

FIGURE NO.

STATE PLANE COORDINATE:		TOTAL DEPTH (FT): 15.1	GROUND ELEVATION (FT):	5976.6	PROJECT NUMBER:	667.11	LOG OF BORING NUMBER:
NORTH:	750970	AREA: SOLAR PONDS	CASING DIAMETER (IN):	0	GEOLOGIST:	TSD	SP02-87
EAST:	2084640	LOCATOR NUMBER: L10	BOREHOLE DIAMETER (IN):	0	DATE DRILLED:	10/29/87	

REMARKS: Hollow stem auger. Borehole backfilled w/ Portland Type I cement. Coordinates and elevation estimated from topographic map.

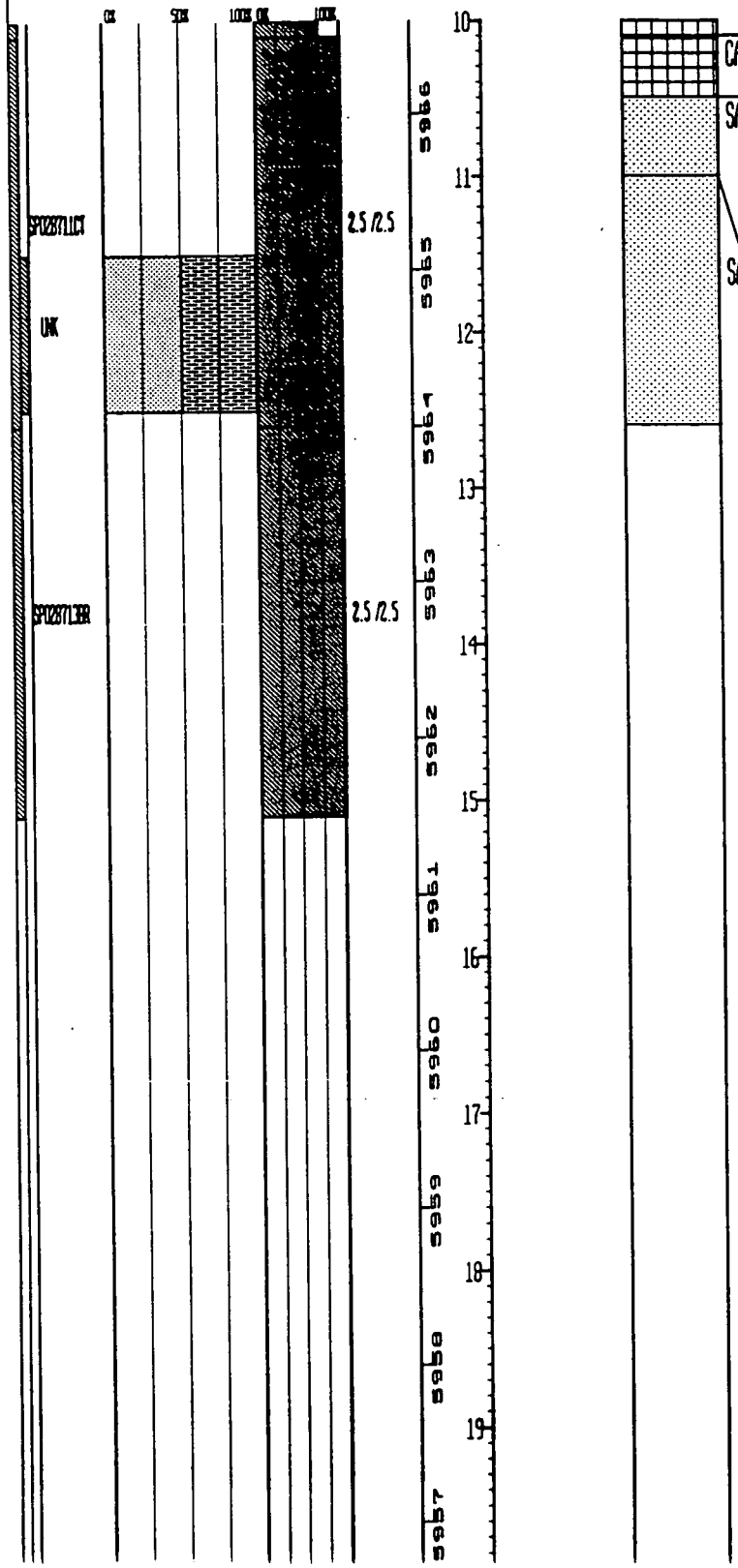
CHEMICAL SAMPLE DEPTH / GRADATIONAL SAMPLE	SAMPLE NUMBER	SAMPLE GRAIN SIZE	PERCENT RECOVERY	RECOVERY/INTERVAL	DATUM (FT)	DEPTH (FT)	WELL OR PIEZOMETER CONSTRUCTION	LITHOLOGY	UNIFIED SOILS CLASSIFICATION OR ROCK TYPE	DESCRIPTION
				1.7/2	5965	0–1			GC:	Clayey Gravel - matrix color is brownish gray (5YR 4/1), angular to sub-rounded, mod. grading, max. size = 7 cm., some sand.
				1.75/1.7	5965	2–3			GC:	Same as above.
				0/0.3	5965	3–4			NO SAMPLE:	
	SP02870008			1.8/1.7	5965	4–5			GC:	Same as above.
				0/1.3	5965	5–6			NO SAMPLE:	
				0/0.6	5965	6–7			NO SAMPLE:	
	SP02870010C			1.8/2.5	5965	7–8			CALICHE:	White (N9) to yellowish gray (5Y 8/1), some sand, trace of gravel.

STATE PLANE COORDINATE:	TOTAL DEPTH (FT): 15.1	GROUND ELEVATION (FT):	5976.6	PROJECT NUMBER:	667.11
NORTH: 750970	AREA: SOLAR PONDS	CASING DIAMETER (IN):	0	GEOLOGIST:	TSD
EAST: 2084640	LOCATOR NUMBER: L10	BOREHOLE DIAMETER (IN):	0	DATE DRILLED:	10/29/87

LOG OF BORING NUMBER: SP02-07

REMARKS: Hollow stem auger. Borehole backfilled w/ Portland Type I cement. Coordinates and elevation estimated from topographic map.

CHEMICAL SAMPLE DEPTH / GRADATIONAL SAMPLE DEPTH | SAMPLE NUMBER | SAMPLE GRAIN SIZE (0% 50% 100%) | PERCENT RECOVERY (0% 100%) | RECOVERY/INTERVAL | DATUM (FT) | DEPTH (FT) | WELL OR PIEZOMETER CONSTRUCTION | LITHOLOGY | UNIFIED SOILS CLASSIFICATION OR ROCK TYPE | DESCRIPTION



UNIFIED SOILS CLASSIFICATION OR ROCK TYPE	DESCRIPTION
CALICHE:	Same as above.
SANDSTONE:	Top of Bedrock Grading into VFG to FG sandstone, mottled lt. greenish gray (5GY 8/1) and dk. yellowish orange (10YR 6/6), weathered, mod. to highly friable, trace of organic staining and CaCO3.
SANDSTONE:	Same as above, with an increase in CaCO3 at the bottom of the interval. NOTE: No water encountered while drilling.

INDEX OF DATA

Boring No.: SP03-87

Completed as well? No

Data in File

X Log of Borehole

____ Well Construction Summaries

____ Well Development Summaries

____ Hydraulic Conductivity Test Data and Results

____ Packer Test Data and Results

____ Water Level Data

____ Saturated Thickness Hydrographs

LOG OF BOREHOLE

Location Rocky Flats Plant; Solar Ponds Area
Coordinates * N 37485 E 21532
Total Depth 20.4'

Borehole/Well No. SP03-87
Ground Surface Elevation *5978.7'
Water Level Encountered 12.8'
Static

Drilling Company Boyles Bros.
Date Drilled October 21 and 26, 1987
Drilling Method Hollow Stem Auger
Logged By J. Bacchus
Geologist

Driller R. Sharp
Helper T. Merritt
Drilling Fluid None
Checked By
Site Manager

CEARP Manager

Comments Borehole backfilled with Portland Type I Cement.
*Coordinates and elevation estimated from topographic map.

Depth Feet	Graphic Log	Sample Type	Lithologic Description	Samples Collected & Other Tests Performed
0			**ARTIFICIAL FILL/DISTURBED** 0-2.0' SAMPLE. Recovered 1.75/2.0' = 86%. SOIL: dark yellowish brown (10 YR 4/2); roots in the upper 0.4 ft; sizes range from clay to small cobbles; clasts are very angular and not oriented in any order; very poorly sorted; dry. **ROCKY FLATS ALLUVIUM** 2.0-4.0' SAMPLE. Recovered 1.5/2.0' = 75%. 2.0-3.1': CLAY: same as above. 3.1-3.5': CLAY: same as above except much more clay; grayish black (N 2/0); moist. 4.0-5.0' SAMPLE. Recovered 0.6/1.0' = 60%. CLAY: same as above except a large quartzite cobble. 5.0-8.0' SAMPLE. Recovered 1.85/3.0' = 62%. 5.0-5.7': CLAY: dusky red (5 R 3/4); some sand, pebbles to 2.5" diameter; clasts range from rounded to angular; moist. 5.7-6.85': SAND: moderate yellowish brown (10 YR 5/4); small cobbles and clay clasts range from rounded to angular; no HCl reaction. 8.0-10.5' SAMPLE. Recovered 1.1/2.5' = 44%. SAND: moderate yellowish brown (10 YR 5/4); mottled with very pale orange (10 YR 8/2); silty sand; large quartzite clasts that are subrounded to angular; high amount of caliche; very poorly sorted, dry. 10.5-12.8' SAMPLE. Recovered 1.3/2.5' = 52%. SAND: moderate yellowish brown (10 YR 5/4); poorly sorted; quartzite clasts that range in size from small cobbles to large pebbles; some silt; very little clay; no HCl reaction.	HNu Background=0.6 OVA Background = 0.0 Ludlum Background = 0.0 2.0-3.5': Reading on Core: HNu=2.0; OVA=20. 2.0-3.5': Direct Hit Sample: SP038702DH. 4.0': Reading in Augers: HNu=4; OVA=39. 4.0-4.6': Field Screen Sample: SP038703FS (VOAs only). 10.3-11.6': Readings on Core: HNu=0.3; OVA=3.6. 10.3-11.6': Direct Hit/Upper Contact Sample: SP038711DH. 12.8-14.4': Readings on Core: HNu=0.3; OVA=2.6.
5				
10				
15				
20				

LOG OF BOREHOLE

Location: Rocky Flats Plant; Solar Ponds Area

Borehole/Well No.: SP03-87(cont'd.)

Coordinates: _____

Ground Surface Elevation: _____

Total Depth: _____

Water Level Encountered: _____

Static: _____

Drilling Company: _____

Driller: _____

Date Drilled: _____

Helper: _____

Drilling Method: _____

Drilling Fluid: _____

Logged By: _____ Geologist

Checked By: _____ Site Manager

_____ CEARP Manager

Comments: _____

Depth Feet	Graphic Log	Sample Type	Lithologic Description	Samples Collected or Other Tests Perform.
20			12.8-15.2' SAMPLE. Recovered 1.6/2.5' = 64%. 12.8-13.2': GRAVEL: moderate yellowish brown (10 YR 5/4); very poorly sorted; clasts are highly angular; clay, silt and sand; saturated; encountered water table at the top of the run. ARAPAHOE FORMATION 13.2-14.4':CLAYSTONE: light olive gray (5 YR 3/2); mottled light brown (5 YR 5/6); dense; pockets of caliche; semi-moist to dry 15.2-17.7' SAMPLE. Recovered 1.7/2.5' = 68%. CLAYSTONE: same as above except getting sandy near the bottom of the run. Total depth with plopper 17.9'. Adjust depth. 17.9-20.4' SAMPLE. Recovered 1.8/2.5' = 72%. 17.9-18.0': CLAYSTONE: light olive gray (5 Y 5/2); stained light brown (5 YR 5/6); dense; no HCl reaction; moist to wet. 18.0-19.7': SILTSTONE: dark yellowish orange (10 YR 6/6); some coarse-grained sand clasts; pockets of caliche; dry. TOTAL DEPTH: 20.4'.	12.8-14.4': Contact Sample: SP038713CT. 15.2-16.9': Readings on Core: HNU=0.4; OVA=5.2. 15.2-16.9': Bedrock Sample: SP038716BR. 17.9-19.7': Readings on Core: HNU=0.3; OVA=2.6.
25				
30				
35				

LOG OF BORING NO. [illegible]

DATES DRILLED:
ELEVATION:
GEOLOGIST(S): [illegible]
DATE: [illegible]
CHECKED BY:
DATE:

PROJECT NO: 667-11.22

TOP/BOTTOM OF CORE IN BOX	TOP/BOTTOM OF CORE IN ROW (IN FEET)	SAMPLE NUMBER	FEET OF CORE IN BOX	USCS SYMBOL	FRACTURES PER FOOT	FRACTURE ANGLE	BEDDING ANGLE	GRAIN SIZE DISTRIBUTION	DEPTH IN FEET	LITHOLOGIC LOG	LITHOLOGIC DESCRIPTION
0.0	0.0 – 1.5		ND	GC				[illegible]	1		[illegible]
	[illegible] – 2.0		0 ~~ND~~ ACB	X				X	2	X	No Sample
	[illegible]		[illegible]	GC				>50% gravel	4		As above (reference interval 0.0 to 1.0) [illegible] max. gravel size 7cm.
	[illegible] – 6.0		ND						5		Gravel [illegible] (N[illegible]) [illegible] very light [illegible] angular to subrounded, poorly graded, max. size 5cm [illegible]
	6.0 – 7.5		0	X				X	7	X	No Sample
	7.5 – 8.6		(1) .6	GP				>50% gravel	8		[illegible] light gray (N[illegible]) to medium light gray (N[illegible]), subrounded, poorly graded, [illegible] size 7cm, caliche [illegible] occurs [illegible] gravel.
	8.6 – 10.0		(1) .3						9		At [illegible] the caliche [illegible] is absent, otherwise [illegible] with [illegible]

NOTES: General: The USCS is modified for this log as follows: Material amounts are estimated by percent volume instead of percent weight.
(1) Badly broken core, accurate footage measurement not possible.
(2) Core breaks cannot be matched, accurate footage measurement not possible.

ROCKY FLATS PLANT

FIGURE NO.

LOG OF BORING NO. SP0387

DATES DRILLED:
ELEVATION:
GEOLOGIST(S): [illegible]
DATE: 8/1/[illegible]
CHECKED BY:
DATE:

USCS symbol

PROJECT NO: 667-11.22

TOP/BOTTOM OF CORE IN BOX	TOP/BOTTOM OF CORE IN ROCK (IN FEET)	SAMPLE NUMBER	FEET OF CORE IN BOX	FEET OF CORE IN ROCK	FRACTURES PER FOOT	FRACTURE ANGLE	BEDDING ANGLE	GRAIN SIZE DISTRIBUTION	DEPTH IN FEET	LITHOLOGIC LOG	LITHOLOGIC DESCRIPTION
[illegible]	[illegible]		.3	GP				>50% gravel		0.0	As above
									11 12		No Sample
12.2	12.8 to 14.4			CL				>50% clay	13 14		Clay, yellowish gray (5 Y 8/1), high plasticity some silt, trace of gravel above 13.0 ft. localized carbonate mineralization
	14.4 to 15.2								15		No Sample
	15.2 to 16.9			CL				>50% clay	16		As above (reference interval ~~12~~ 13.0 to 14.4 ft)
	16.9 to 17.9								17		No Sample
	17.9 to 19.7			CL				>50% clay	18 19		As above (reference interval 13.0 to 14.4 ft.) with gradational color change to dark yellowish orange (10 YR 6/6)
	[illegible]										No Sample - 20.4 Bottom of Box 2/ at 19.7 Ister Block run 20.4

20.4

NOTES: General: The USCS is modified for this log as follows: Material amounts are estimated by percent volume instead of percent weight.
(1) Badly broken core, accurate footage measurement not possible.
(2) Core breaks cannot be matched, accurate footage measurement not possible.

ROCKY FLATS PLANT

FIGURE NO.

STATE PLANE COORDINATE:		TOTAL DEPTH (FT): 20.4	GROUND ELEVATION (FT):	5978.7	PROJECT NUMBER:	667.11	LOG OF BORING NUMBER:
NORTH:	750480	AREA: SOLAR PONDS	CASING DIAMETER (IN):	0	GEOLOGIST:	DCB	SP03-[redacted]
EAST:	2084630	LOCATOR NUMBER: L10	BOREHOLE DIAMETER (IN):	0	DATE DRILLED:	10/26/87	

REMARKS: Hollow stem auger. Borehole backfilled with Portland Type I cement. Coordinates and elevation estimated from topographic map.

CHEMICAL SAMPLE DEPTH / GRADATIONAL SAMPLE DEPTH	SAMPLE NUMBER	SAMPLE GRADI SIZE	PERCENT RECOVERY	RECOVERY/ INTERVAL	DATUM (FT)	DEPTH (FT)	WELL OR PIEZOMETER CONSTRUCTION	LITHOLOGY	UNIFIED SOILS CLASSIFICATION OR ROCK TYPE	DESCRIPTION
				1.5/1.5	5978	0			GC:	GRAVEL - medium light gray (N6), angular to sub-angular, well graded, max. size 5 cm., some clay, trace of sand and roots. At 1 ft. caliche replaces clay matrix.
				0/1.5	5977	1			NO SAMPLE:	
	SP03R02H			0.6/0.6	5976	2			GC:	As above (reference interval 0 to 1.0), no root fragments, max. gravel size 7 cm.
				0.4/0.4	5975	3			GC:	GRAVEL - white (N9) to very light gray (N8), angular to sub-rounded, poorly graded, max. size 5 cm., some clay, clay is dark reddish brown (10R 3/4), with trace of sand and silt.
	SP03R03S			1/2.3	5974	4			GC:	Same as above.
				0/1.2	5973	5			NO SAMPLE:	
				0.6/1.1	5972	6			GP:	GRAVEL - very light gray (N8) to medium light gray (N6), sub-rounded, poorly graded, max. size 7 cm., caliche rind occurs around gravel.
				0.3/1.7	5971	7			GP:	At 8.6 ft. the caliche rind is absent, otherwise as above with so[redacted].
					5970	8				
					5969	9				

STATE PLANE COORDINATE:		TOTAL DEPTH (FT): 20.4	GROUND ELEVATION (FT):	5978.7	PROJECT NUMBER:	667.11	LOG OF BORING NUMBER:
NORTH:	750480	AREA: SOLAR PONDS	CASING DIAMETER (IN):	0	GEOLOGIST:	DCB	SP03-87
EAST:	2084630	LOCATOR NUMBER: L10	BOREHOLE DIAMETER (IN):	0	DATE DRILLED:	10/26/87	

REMARKS: Hollow stem auger. Borehole backfilled with Portland Type I cement. Coordinates and elevation estimated from topographic map.

CHEMICAL SAMPLE DEP / GRADATIONAL SAMPLE | SAMPLE NUMBER | SAMPLE GRAIN SIZE (0% 50% 100%) | PERCENT RECOVERY (0% 100%) | RECOVERY/INTERVAL | DATUM (FT) | DEPTH (FT) | WELL OR PIEZOMETER CONSTRUCTION | LITHOLOGY | UNIFIED SOILS CLASSIFICATION OR ROCK TYPE | DESCRIPTION

Sample Number	Recovery/Interval	Depth (ft)	Well or Piezometer Construction	Unified Soils Classification or Rock Type	Description
SP03871 10H	0/2.5	10–12.5	10/26/87	NO SAMPLE:	
		12.5–13		CH:	Clay - yellowish gray (5Y 8/1), high plasticity, some silt, trace of gravel above 13.0 ft., localized carbonate mineralization.
03871 3CT	1.6/1.6	13–14.5		CLAYSTONE:	Top of Bedrock Yellowish gray (5Y 8/1), high plasticity, some silt, trace of gravel above 13.0 ft., localized carbonate mineralization.
	0/0.8	14.5–15		NO SAMPLE:	
SP03871 6BR	1.7/1.7	15–16.5		CLAYSTONE:	As above (reference interval 13.0 to 14.4 ft.)
	0/1	16.5–17		NO SAMPLE:	
	1.8/1.8	17–18.5		CLAYSTONE:	As above (reference interval 13.0 to 14.4 ft.) with gradational color change to dark yellowish orange (10YR 6/6).
		18.5–19		NO SAMPLE:	

Depth scale: 10, 11, 12, 13, 14, 15, 16, 17, 18, 19

Datum (ft): 5968, 5967, 5966, 5965, 5964, 5963, 5962, 5961, 5960, 5959

STATE PLANE COORDINATE:	TOTAL DEPTH (FT): 20.4	GROUND ELEVATION (FT):	5978.7	PROJECT NUMBER:	667.11
NORTH: 750480	AREA: SOLAR PONDS	CASING DIAMETER (IN):	0	GEOLOGIST:	DCB
EAST: 2084630	LOCATOR NUMBER: L10	BOREHOLE DIAMETER (IN):	0	DATE DRILLED:	10/26/87

LOG OF BOR

REMARKS: Hollow stem auger. Borehole backfilled with Portland Type I cement. Coordinates and elevation estimated from topographic map.

CHEMICAL SAMPLE DEPTH / GRADATIONAL SAMPLE DEPTH	SAMPLE NUMBER	SAMPLE GRAIN SIZE	PERCENT RECOVERY	RECOVERY/INTERVAL	DATUM (FT)	DEPTH (FT)	WELL OR PIEZOMETER CONSTRUCTION	LITHOLOGY	UNIFIED SOILS CLASSIFICATION OR ROCK TYPE	DESCRIPTION
		0% 50% 100%	0% 100%	0 /0.69	5958 5957 5956 5955 5954 5953 5952 5951 5950 5949	20 21 22 23 24 25 26 27 28 29 30				

INDEX OF DATA

Boring No.: SP04-87

Completed as well? No

Data in File

X Log of Borehole

____ Well Construction Summaries

____ Well Development Summaries

____ Hydraulic Conductivity Test Data and Results

____ Packer Test Data and Results

____ Water Level Data

____ Saturated Thickness Hydrographs

LOG OF BOREHOLE

Location Rocky Flats Plant; Solar Ponds Area
Coordinates * N 37561 E 21820
Total Depth 37.0'

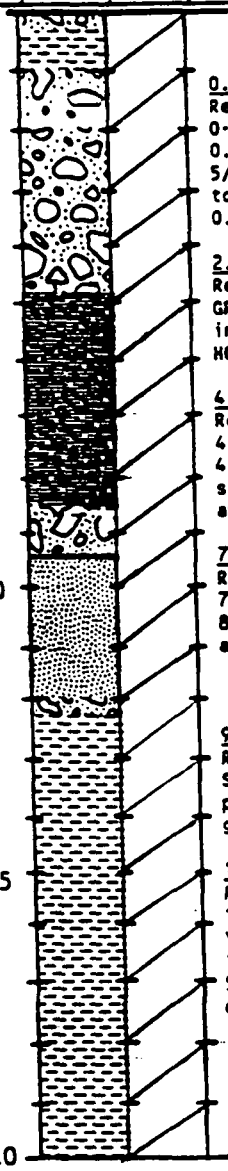
Borehole/Well No. SP04-87
Ground Surface Elevation *5971.8'
Water Level Encountered 12.0'
Static

Drilling Company Boyles Bros.
Date Drilled October 30 and November 3 and 4, 1987
Drilling Method Hollow Stem Auger
Logged By J. Bacchus
Geologist

Driller R. Sharp
Helper T. Merritt
Drilling Fluid None
Checked By
Site Manager

CEARP Manager

Comments Borehole backfilled with Portland Type I Cement.
*Coordinates and elevation estimated from topographic map.

Depth Feet	Graphic Log	Sample Type	Lithologic Description	Samples Collected or Other Tests Performed
0			**ARTIFICIAL FILL/DISTURBED** 0.0-2.0' SAMPLE. Recovered 1.2/2.0' = 60%. 0-0.0.3': PEBBLE: large. 0.3-0.9': CLAY: moderate yellowish brown (10 YR 5/4); sand; silt and pebbles; clasts are angular to subrounded; slight reaction to HCl; moist. 0.9-1.2': IGNEOUS ROCK: some fractures. 2.0-4.0' SAMPLE. Recovered 1.7/2.0' = 85%. GRAVEL: dusky brown (5 YR 2/2); cobbles to 4 inches in diameter, held together with clay; no HCl reaction; moist. 4.0-7.0' SAMPLE. Recovered 1.8/3.0' = 60%. 4.0-4.8': GRAVEL: same as above. 4.8-5.8': CALICHE; very pale orange (10 YR 8/2); silt; small angular cobbles similar to the clasts above; dry. 7.0-9.5' SAMPLE. Recovered 1.7/2.5' = 68%. 7.0-8.3': CALICHE: same as above. 8.3-8.7': GRAVEL: with caliche, similar to caliche above; dry; spotted with moist areas. **ARAPAHOE FORMATION** 9.5-12.0' SAMPLE. Recovered 0.6/2.5' = 24%. SANDSTONE: yellowish gray (5 Y 7/2; contains small pebbles; grains are rounded to subrounded; coarse-grained; some clay; very moist. 12.0-14.5' SAMPLE. Recovered 2.9/2.5' = 116%. 12.0-12.2': GRAVEL: moderate yellowish brown (10 YR 5/4); come clay and sand; wet. 12.2-14.5': CLAYSTONE: light olive gray (5 YR 5/2); mottled with dark yellowish orange (10 YR 6/6); moist.	HNu Background = 0.4-0.5 OVA Background = 0.6-3.6 No Ludlum readings taken 2.0-3.7': Readings on Core: HNu = 15; OVA = 0.4. 2.0-3.7': Direct Hit Sample: SP048702DH. 4.0-5.8': Reading on Core: HNu=400; OVA=0.2. 4.0-5.8': Direct Hit Sample: SP048704DH. 4.0-5.8': Duplicate Sample: SP0487004D. 7.0': Readings in Breathing Zone: HNu=1.2; OVA=1.0. 7.0-9.5': Readings on Core: HNu=750; OVA=0.2. 7.0-8.7': Direct Hit/Upper Contact Sample: SP048707DH. 10.5': Readings in Breathing Zone: HNu=0.6; OVA=2.5. 9.5-11.1': Readings on Core: HNu=20; OVA=7.8. 9.5-11.1': Direct Hit/Contact Sample: SP048710DH (VOAs only). 12.0-14.5': Readings on Core: HNu=85; OVA=3.3. 12.0-14.5': Direct Hit/Water Table/Bedrock Sample: SP048712DH.
5				
10				
15				
20				

LOG OF BOREHOLE

Location: Rocky Flats Plant; Solar Ponds Area
Borehole/Well No.: SP04-87(cont'd.)
Coordinates: _____
Ground Surface Elevation: _____
Total Depth: _____
Water Level Encountered: _____
Static: _____
Drilling Company: _____
Driller: _____
Date Drilled: _____
Helper: _____
Drilling Method: _____
Drilling Fluid: _____
Logged By: _____ Geologist
Checked By: _____ Site Manager
_____ CEARP Manager
Comments: _____

Depth Feet	Graphic Log	Sample Type	Lithologic Description	Samples Collected or Other Tests Performe
20 25 30 35 40			14.5-17.0' SAMPLE. Recovered 2.7/2.5' = 108%. 14.5-15.1': CLAYSTONE: light olive gray (5 Y 5/2) stained with dark yellowish orange (10 YR 6/6); blocky structure, concretions of caliche; moist. 15.1-17.0': Same as above; wet. 17.0-19.5' SAMPLE. Recovered 2.6/2.5' = 104%. 17.0-17.2': CLAYSTONE: same as above. 17.2-18.3': CLAYSTONE: dark yellowish orange (10 YR 6/6); slightly moist. 18.3-19.5': CLAYSTONE: olive gray (5 Y 3/2) mottled with dark yellowish orange (10 YR 6/6); very slightly moist. 19.5-22.0' SAMPLE. Recovered 2.6/2.5' = 104%. CLAYSTONE: same as above. 22.0-24.5' SAMPLE. Recovered 2.5/2.5' = 100%. CLAYSTONE: same as above except a little more sand. 24.5-27.0' SAMPLE. Recovered 2.5/2.5' = 100%. 24.5-25.0': CLAYSTONE: same as above except less sand, more consolidated and dry. 25.0-27.0': CLAYSTONE: olive gray (5 Y 2/2); some coal; slightly sandy; dry. 27.0-29.5' SAMPLE. Recovered 2.5/2.5' = 100%. CLAYSTONE: same as above except layers of oxidation from 0.2 to 0.4 ft in thickness; dark yellowish orange (10 YR 6/6); grades from pure claystone at the top to very sandy claystone at the bottom; pockets of caliche in unweathered areas; dry. 29.5-32.0' SAMPLE. Recovered 2.7/2.5' = 108%. CLAYSTONE: same as above except much more sandy; dry.	14.5-17.0': Readings on Core: HNu=1.0; OVA=2.8. 14.5-17.0': Field Screen Reading: HNu=650(0.5); OVA=3.6(32). 14.5-17.0': Field Screen Sample: SP048715FS 17.0-19.5': Readings on Core: HNu=45; OVA=3.2. 17.0-19.5': Direct Hit Sample: SP048717DH. 19.5-22.0': Readings on Core: HNu=60; OVA=3.0. 19.5-22.0': Direct Hit Sample: SP048720DH. 22.0-24.5': Readings on Core: HNu = 450; OVA = 30. 22.0-24.5': Direct Hit Sample: SP048722DH. 24.5-27.0': Readings on Core: HNu=45; OVA=3.0. 24.5-27.0': Direct Hit Sample: SP048725DH. 27.0-29.5': Readings on Core: HNu=4.0; OVA=5.8. 27.0-29.5': Direct Hit Sample: SP048727DH. 29.5-32.0': Readings on Core: HNu=0.0; OVA=5.4. 29.5-32.0': Direct Hit Sample: SP048730DH.

LOG OF BOREHOLE

Location Rocky Flats Plant; Solar Ponds Area

Borehole/Well No. SP04-87 (cont'd.)

Coordinates

Ground Surface Elevation

Total Depth

Water Level Encountered

Static

Drilling Company

Driller

Date Drilled

Helper

Drilling Method

Drilling Fluid

Logged By

Geologist

Checked By

Site Manager

CEARP Manager

Comments

Depth Feet	Graphic Log	Sample Type	Lithologic Description	Samples Collected or Other Tests Performed
			32.0-34.5' SAMPLE. Recovered 2.7/2.5' = 108%. CLAYSTONE: dark yellowish orange (10 YR 6/6) mottled with grayish orange pink (5 YR 7/2); very thin seams of coal; no HCl reaction; weathered; slightly moist. 34.5-37.0' SAMPLE. Recovered 2.5/2.5' = 100%. CLAYSTONE: olive gray (5 Y 3/2) mottled with dark yellowish orange (10 YR 6/6); sandy; contains some coal; dry. TOTAL DEPTH: 37.0'.	32.0-34.5': Readings on Core: HNu=0.2; OVA=1.8. 32.0-34.5': Direct Hit Sample: SP0487320N. 34.5-37.0': Readings on Core: HNu=0.0; OVA=0.5. 34.5-37.0': Field Screen Readings HNu=0(0.0); OVA=0.8(0.8).

LOG OF BORING NO. SP04-87

DATES DRILLED:
ELEVATION:
GEOLOGIST(S): UFA
DATE:
CHECKED BY:

USCS symbol

DATE: 8/9/89

PROJECT NO: 667-11.22

TOP/BOTTOM OF CORE IN BOX	TOP/BOTTOM OF CORE IN FEET	SAMPLE NUMBER	FEET OF CORE	USCS symbol	FRACTURES PER FOOT	FRACTURE ANGLE	BEDDING ANGLE	GRAIN SIZE DISTRIBUTION	DEPTH IN FEET	LITHOLOGIC LOG	LITHOLOGIC DESCRIPTION
SP04 Box 1 of 4	0.0 – 1.6		.8 (1)	GC				Gravel >60%	1		Gravel. Lt gray (N7). Mostly subrounded to ~~well rounded~~ artificial surface gravel - Max size ≈ 1.5cm. Some angular to subangular. Poorly sorted. Max size 6 cm. Matrix calcareous sandy clay. Est. plast.: Low to mod. Sand fine to coarse, some silt.
	1.6 – 2.2		0						2		No Sample
	2.2 – 3.7		.85 (1)	GC				Gravel >50%	3		Clayey gravel. Gravel med. gray (N5) predominantly. Angular. Mod. to well graded. Matrix: dk. yellowish brown (10yr 4/2). Est. plast. mod. to high. Some fine sand. Mod. sorting.
	3.7 – 4.0		0						4		No Sample
	4.0 – 5.8		1.1 (1)	GW				Gravel >80%	5		Gravel med. Lt. gray. (N6). Angular to subangular. Mod. graded. 6.5 cm. Very little matrix. Silty very calcareous clay. Some caliche rinds on gravel.
	5.8 – 7.0		0						6		No Sample
	7.0 – 8.7		1.0 (1)	GC				Gravel >60%	7, 8		Gravel, as above. More caliche matrix which also has some biotite.
	8.7 – 9.5		0 ~~.5~~						9		No Sample
	9.5 – 10.1		.5 (1)	GW				Gravel >80%			Gravel as above. Very little matrix. Sandy clay.

NOTES: General: The USCS is modified for this log as follows: Material amounts are estimated by percent volume instead of percent weight.
(1) Badly broken core, accurate footage measurement not possible.
(2) Core breaks cannot be matched, accurate footage measurement not possible.

ROCKY FLATS PLANT

FIGURE NO.

LOG OF BORING NO. SP04-87

DATES DRILLED:
ELEVATION:
GEOLOGIST(S): UAA
DATE:
CHECKED BY:

USCS symbol

DATE: 8/9/89

PROJECT NO: 667-11.22

Top/Bottom of Core in Box	Top/Bottom of Core in Box (Depth)	Sample Number	Feet of Core (Inches)	Feet of Core (Inches)	Fractures per Foot	Fracture Angle	Bedding Angle	Grain Size Distribution	Depth in Feet	Lithologic Log	Lithologic Description
Box 1 of 4	11.0 – 12.0		0						11 – 12		No Sample
	12.0 – 14.5		2.9(1)	CL				Clay >80%	12 – 14		Clay, yellowish gray (5y 8/1) to dk. yellowish orange (10yr 6/6) Est. plast. mod. to high. Trace CaCO3 Becomes slightly silty + slightly more calcareous toward bottom. Trace sand in lenses, trace gravel.
Box 2 of 4	14.5 – 17.0		2.5(1)	CL				Clay >80%	15 – 17		Clay - same as above Slightly more CaCO3
	17.0 to 22.0		3.6(1)	CL				Clay >80%	17 – 19		Clay - same as above. Silty in some small intervals. Trace carbs.

NOTES: General: The USCS is modified for this log as follows: Material amounts are estimated by percent volume instead of percent weight.
(1) Badly broken core, accurate footage measurement not possible.
(2) Core breaks cannot be matched, accurate footage measurement not possible.

ROCKY FLATS PLANT

FIGURE NO.

LOG OF BORING NO. SP04-87

DATES DRILLED:
ELEVATION:
GEOLOGIST(S): LAA
DATE:
CHECKED BY:

USCS symbol

DATE: 8/9/89

PROJECT NO: 667-11.22

Depth (ft)	Depth (ft)	Sample Number	Feet of Core	Feet of Core	Fractures per Foot	Fractures Angle	Bedding Angle	Drilling Date	Depth in Feet	Lithologic Log	Lithologic Description
	17.0 to 22.0								21		Clay - See previous page for description
22.0	22.0								22		Claystone Clay. Dk. yellowish orange (10yr 6/6) to Lt. brownish gray. Mottled. Est. plasticity mod. to high. Some iron staining. Trace carb. material.
	24.5		1.65(1)	CL				Clay >80%	23, 24		
	27.0		1.8(1)					Clay >80%	25, 26		Claystone. Lt. brownish gray (5yr 6/1). Probable horizontal thin bedding ≈ 2cm layers. Iron staining + carb. material common. Highly weathered, moderately friable. Trace sand.
	29.5		1.7(1)					Clay 75% Silt >10%	27, 28, 29		Silty claystone. Yellowish gray (5y 8/1), to grayish orange (10yr 7/4). Mod. weathered, slightly to mod. friable.

Box 3 of 4

NOTES: General: The USCS is modified for this log as follows: Material amounts are estimated by percent volume instead of percent weight.
(1) Badly broken core, accurate footage measurement not possible.
(2) Core breaks cannot be matched, accurate footage measurement not possible.

ROCKY FLATS PLANT

FIGURE NO.

LOG OF BORING NO. SP04-87

DATES DRILLED:
ELEVATION:
GEOLOGIST(S): LAA
DATE:
CHECKED BY:

DATE: 8/9/89

PROJECT NO: 667-11.2

Top of Core (in feet)	Top of Core (in feet)	Sample Number	Feet of Core (in feet)	USCS symbol	Fractures per foot	Fracture Angle	Bedding Angle	Clay Size	Depth in Feet	Lithologic Log	LITHOLOGIC DESCRIPTION
32.0	32.0	SL	1.85 (1)					Clay >50% Silt >10%	31		Silty Claystone yellowish gray (5y8/1) to grayish orange (10yr 7/4). Mod. weathered slightly to mod. friable. Trace carb. material. Trace $CaCO_3$ in areas
32.0									32		
			1.8 (1)					Clay >50% Silt >10%	33		Silty Claystone as above. Highly weathered mod friable. Bedding Not evident. Carb. material common leaf prints visible at top of section.
	34.5								34		
37.0	37.0		1.8 (1)					Clay >50% Silt >10%	35		Silty Claystone. Very pale orange (10yr 8/2) to pale yellowish brown (10yr 6/2) Color actually near lies between these two (10yr 7/2). Possible horizontal bedding Highly weathered Mod. to highly friable
									36		
									37		Bottom of Boxes
									38		
									39		

Box 4 of 4

NOTES: General: The USCS is modified for this log as follows: Material amounts are estimated by percent volume instead of percent weight.
(1) Badly broken core, accurate footage measurement not possible.
(2) Core breaks cannot be matched, accurate footage measurement not possible.

ROCKY FLATS PLANT

FIGURE NO.

STATE PLANE COORDINATE:		TOTAL DEPTH (FT): 37	GROUND ELEVATION (FT):	5971.8	PROJECT NUMBER:	667.11	LOG OF BORING NUMBER:
NORTH:	750560	AREA: SOLAR PONDS	CASING DIAMETER (IN):	0	GEOLOGIST:	LAA	SP04-87
EAST:	2084920	LOCATOR NUMBER: L10	BOREHOLE DIAMETER (IN):	0	DATE DRILLED:	11/04/87	

REMARKS: Hollow stem auger. Borehole backfilled with Portland Type I cement.
Coords. & elevation estimated from topographic map.

CHEMICAL SAMPLE DEPTH / GRADATIONAL SAMPLE D	SAMPLE NUMBER	SAMPLE GRAIN SIZE	PERCENT RECOVERY	RECOVERY/INTERVAL	DATUM (FT)	DEPTH (FT)	WELL OR PIEZOMETER CONSTRUCTION	LITHOLOGY	UNIFIED SOILS CLASSIFICATION OR ROCK TYPE	DESCRIPTION
				0.8 /1.6	5971	0–1			GC:	GRAVEL - Lt. gray (N7), mostly sub-rounded artificial surface gravel, max. size approx. 1.5 cm., some angular to sub-angular, poorly sorted, max. size 6 cm., matrix calcareous sandy clay, est. plast. low to mod., sand fine to coarse, some silt.
				0 /0.4	5970	1–2			NO SAMPLE:	
	SP04870020H			0.85 /1.7	5969	2–3			GC:	Clayey Gravel - gravel med. gray (N5), predominantly angular, mod. to well graded, matrix dk. yellowish brown (10YR 4/2), est. plast., mod. to high, some fine sand, mod. sorting.
				0 /0.3	5968	3–4			NO SAMPLE:	
	SP04870030H			1.1 /1.8	5967	4–5			GW:	GRAVEL - med. lt. gray (N6), angular to sub-angular, mod. graded, 6.5 cm., very little matrix, silty, very calcareous clay, some caliche rinds on gravel.
				0 /1.2	5966	5–6			NO SAMPLE:	
	SP04870070H			1 /1.7	5965	6–7			GC:	GRAVEL - as above, more caliche matrix which also has some biotite.
				0 /0.8	5964	7–8			NO SAMPLE:	
				0.5 /0.6	5963	8–9			GW:	GRAVEL - as above, very little matrix, sandy clay.

STATE PLANE COORDINATE:	TOTAL DEPTH (FT): 37	GROUND ELEVATION (FT):	5971.8	PROJECT NUMBER:	667.11
NORTH: 750560	AREA: SOLAR PONDS	CASING DIAMETER (IN):	0	GEOLOGIST:	LAA
EAST: 2084920	LOCATOR NUMBER: L10	BOREHOLE DIAMETER (IN):	0	DATE DRILLED:	11/04/87

LOG OF BORING NUMBER: SP04-87

REMARKS: Hollow stem auger. Borehole backfilled with Portland Type I cement.
Coords. & elevation estimated from topographic map.

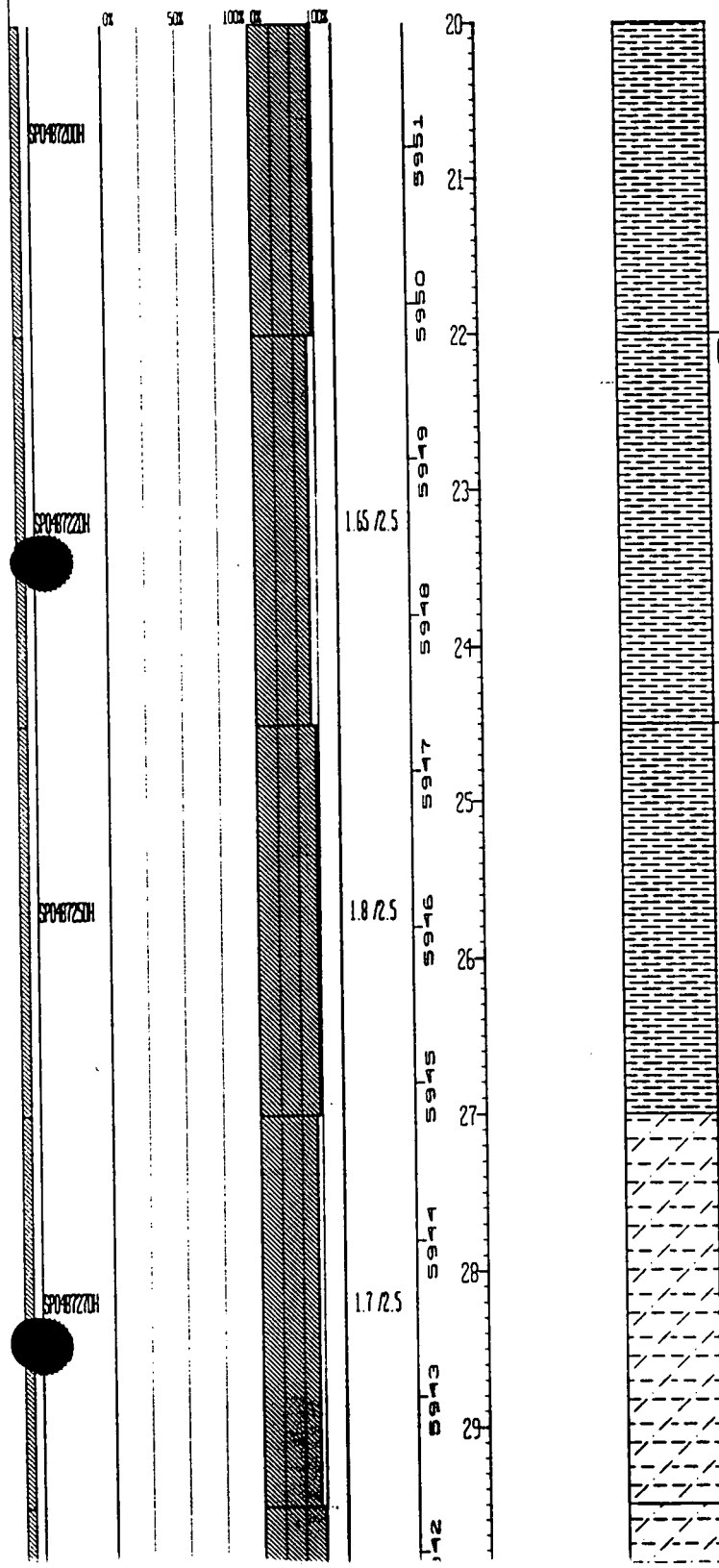
CHEMICAL SAMPLE DEPTH / GRADATIONAL SAMPLE DEPTH	SAMPLE NUMBER	SAMPLE GRAIN SIZE	PERCENT RECOVERY	RECOVERY/INTERVAL	DATUM (FT)	DEPTH (FT)	WELL OR PIEZOMETER CONSTRUCTION	LITHOLOGY	UNIFIED SOILS CLASSIFICATION OR ROCK TYPE	DESCRIPTION
	SP0487100H			0/1.9	5961	10–11			NO SAMPLE:	
					5960	11–12	11/04/87 ▽			
	SP0487120H			2.9/2.5	5959, 5958	12–14			CLAYSTONE:	Top of Bedrock Yellowish gray (5Y 8/1) to dk. yellowish orange (10YR 6/6), est. plast. mod. to high, trace CaCO3, becomes slightly silty and slightly more calcareous toward bottom, trace of sand in lenses, trace of gravel.
	SP0487195S			2.5/2.5	5957, 5956	15–16			CLAYSTONE:	Same as above, slightly more CaCO3.
	SP0487170H			3.6/5	5955, 5954, 5953, 5952	17–19			CLAYSTONE:	Same as above, silty in some small intervals, trace carb.

STATE PLANE COORDINATE:		TOTAL DEPTH (FT): 37	GROUND ELEVATION (FT):	5971.8	PROJECT NUMBER:	667.11	LOG OF BORING NUMBER:
NORTH:	750560	AREA: SOLAR PONDS	CASING DIAMETER (IN):	0	GEOLOGIST:	LAA	SP04-87
EAST:	2084920	LOCATOR NUMBER: L10	BOREHOLE DIAMETER (IN):	0	DATE DRILLED:	11/04/87	

REMARKS: Hollow stem auger. Borehole backfilled with Portland Type I cement.
Coords. & elevation estimated from topographic map.

CHEMICAL SAMPLE DEPTH / GRADATIONAL SAMPLE DEPTH

SAMPLE NUMBER | SAMPLE GRAIN SIZE (0% 50% 100%) | PERCENT RECOVERY (0% 100%) | RECOVERY/INTERVAL | DATUM (FT) | DEPTH (FT) | WELL OR PIEZOMETER CONSTRUCTION | LITHOLOGY | UNIFIED SOILS CLASSIFICATION OR ROCK TYPE | DESCRIPTION



Unified Soils Classification or Rock Type	Description
CLAYSTONE:	Dk. yellowish orange (10YR 6/6) to lt. brownish gray, mottled, est. plasticity mod. to high, some iron staining, trace carb. material.
CLAYSTONE:	Lt. brownish gray (5YR 6/1), probable horizontal thin bedding approx. 2 cm. layers, iron staining and carb. material common, highly weathered, moderately friable, trace sand.
SILTY CLAYSTONE:	Yellowish gray (5Y 8/1) to grayish orange (10YR 7/4), mod. weathered, slightly to mod. friable.
SILTY CLAYSTONE:	Yellowish gray (5Y 8/1) to grayish orange (10YR 7/4), mod. weathered, slightly to mod. friable, trace carb. material, trace CaCO3 in areas.

STATE PLANE COORDINATE:	TOTAL DEPTH (FT): 37	GROUND ELEVATION (FT): 5971.8	PROJECT NUMBER: 667.11	LOG OF BORING NUMBER:
NORTH: 750560	AREA: SOLAR PONDS	CASING DIAMETER (IN): 0	GEOLOGIST: LAA	SP04-87
EAST: 2084920	LOCATOR NUMBER: L10	BOREHOLE DIAMETER (IN): 0	DATE DRILLED: 11/04/87	

REMARKS: Hollow stem auger. Borehole backfilled with Portland Type I cement.
Coords. & elevation estimated from topographic map.

CHEMICAL SAMPLE DEPTH / GRADATIONAL SAMPLE DEPTH	SAMPLE NUMBER	SAMPLE GRAIN SIZE (0% 50% 100%)	PERCENT RECOVERY (0% 100%)	RECOVERY/INTERVAL	DATUM (FT)	DEPTH (FT)	WELL OR PIEZOMETER CONSTRUCTION	LITHOLOGY	UNIFIED SOILS CLASSIFICATION OR ROCK TYPE	DESCRIPTION
	SP0487301H			1.85 /2.5	5941	30, 31				
					5940	32				SILTY CLAYSTONE: As above, highly weathered, mod. friable, bedding not evident. carb. material common, leaf prints visible at top of section.
					5939	33				
	SP0487321H			1.8 /2.5	5938	34				
					5937	35				SILTY CLAYSTONE: Very pale orange (10YR 8/2) to pale yellowish brown (10YR 6/2), color actually lies between these two (10YR 7/2), possible near horizontal bedding, highly weathered, mod. to highly friable.
				1.8 /2.5	5936	36				
					5935	37				
					5934	38				
					5933	39				
					5932					

INDEX OF DATA

Boring No.: SP05-87

Completed as well? No

Data in File

X Log of Borehole

____ Well Construction Summaries

____ Well Development Summaries

____ Hydraulic Conductivity Test Data and Results

____ Packer Test Data and Results

____ Water Level Data

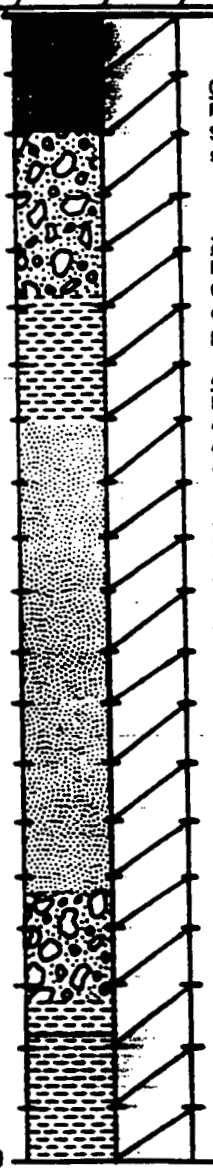
____ Saturated Thickness Hydrographs

LOG OF BOREHOLE

Location: Rocky Flats Plant; Solar Ponds Area
Borehole/Well No.: SP05-87
Coordinates: *N 37865 E 21810
Ground Surface Elevation: *5971.6'
Total Depth: 21.8'
Water Level Encountered: 15.3'
Static:

Drilling Company: Boyles Bros.
Driller: R. Sharp
Date Drilled: November 5 and 6, 1987
Helper: T. Merritt; S. Bradfield
Drilling Method: Hollow Stem Auger
Drilling Fluid: None
Logged By: J. Bacchus, Geologist
Checked By: Site Manager; CEARP Manager

Comments: Borehole backfilled with Portland Type I Cement.
*Coordinates and elevation estimated from topographic map.

Depth Feet	Graphic Log	Sample Type	Lithologic Description	Samples Collected or Other Tests Performed
0			**TOPSOIL** 0.0-2.0' SAMPLE. Recovered 0.4/2.0' = 20%. SOIL: moderate yellowish brown (10 YR 5/4); roots; sand; clay; silt; dry. **ARTIFICIAL FILL/DISTURBED** 2.0-4.0' SAMPLE. Recovered 1.3/2.0' = 65%. GRAVEL: dusky yellowish brown (10 YR 2/2) small cobbles; pebbles; sand, silt, and clay; angular particles; wet to moist. 4.0-7.0' SAMPLE. Recovered 1.6/3.0' = 53%. 4.0-4.7': GRAVEL: same as above. 4.7-7.0': CLAY: dark reddish brown (10 R 3/4); some sand and small angular cobbles; dense; dry. 7.0-9.5' SAMPLE. Recovered 1.3/2.5' = 52%. SAND: very pale orange (10 YR 8/2) and dark yellowish orange (10 YR 6/6); sand, silt, and cobbles; high amount of caliche; poorly sorted; dry. 9.5-12.0' SAMPLE. Recovered 1.1/2.5' = 44%. SAND: same as above except slightly moist near the bottom. Total depth of borehole measured 12.8'; adjust depth. 12.8-15.3' SAMPLE. Recovered 1.6/2.5' = 64%. SAND: light olive gray (5 Y 5/2); small cobbles; pebbles; silt; clay clasts are angular; slight HCl reaction; wet on top 0.3 ft; moist in the rest of the run. 15.3-17.3' SAMPLE. Recovered 2.0/2.0' = 100%. 15.3-16.3': GRAVEL: same as above except less sand; strong HCl reaction; very wet.	NNu Background=1.2 OVA Background=0.8 No Ludlum readings taken 0.0-0.4': Readings on Core: NNu = 1.0; OVA = 1.2. 0.0-0.4': Direct Hit Sample: SP058700DH (VOAs and Rads only). 2.0-3.3': Reading on Core: NNu=0.8; OVA=11. 2.0-3.3': Direct Hit Sample: SP058702DH. 4.0-5.6': Readings on Core: NNu=0.8; OVA=4.8. 4.0-5.6': Direct Hit Sample: SP058704DH. 7.0-8.3': Readings on Core: NNu=9; OVA=7.8. 7.0-8.3': Direct Hit Sample: SP058707DH. 9.5-10.6': Readings on Core: NNu=3.0; OVA=4.8. 9.5-10.6': Direct Hit Sample: SP058710DH. 12.8-14.4': Readings on Core: NNu=2.2; OVA=2.8. 12.8-14.4': Direct Hit Sample: SP058712DH. 15.3-17.3': Readings on Core: NNu=1.8; OVA=3.8. 15.3-17.3': Direct Hit Sample: SP058716DH.
5				
10				
15				
20				

LOG OF BOREHOLE

Location Rocky Flats Plant; Solar Ponds Area

Borehole/Well No. SP05-87(cont'd.)

Coordinates

Ground Surface Elevation

Total Depth

Water Level Encountered

Static

Drilling Company

Driller

Date Drilled

Helper

Drilling Method

Drilling Fluid

Logged By

Geologist

Checked By

Site Manager

CEARP Manager

Comments

Depth Feet	Graphic Log	Sample Type	Lithologic Description	Samples Collected or Other Tests Performed
20			**ARAPAHOE FORMATION** 17.8-19.8' SAMPLE. Recovered 2.2/2.0' = 110%. CLAYSTONE: dusky yellow (5 Y 6/4) to light olive gray (5 Y 5/2) mottled with dark yellowish orange (10 YR 6/6); blocky structure; no HCl reaction; moist to wet. 19.8-21.8' SAMPLE. Recovered 2.2/2.0' = 110%. CLAYSTONE: Same as above except small pockets of caliche; moist. TOTAL DEPTH: 21.8'.	17.8-19.8': Field Screen Readings: HNu=0.0(0.0); OVA=0.4(0.4). 19.8-21.8': Field Screen Readings: HNu=0.0(0.0); OVA=0.4(0.4).
25				
30				
35				
40				

LOG OF BORING NO. SP0587

DATES DRILLED:
ELEVATION:
GEOLOGIST(S):
DATE:
CHECKED BY: DATE:

PROJECT NO: 667-11.22

TOP/BOTTOM OF CORE IN BOX	TOP/BOTTOM OF CORE IN ROW (FT/INCHES)	SAMPLE NUMBER	FEET OF CORE	USCS symbol	FRACTURES PER FOOT	FRACTURE ANGLE	BEDDING ANGLE	GRAIN SIZE DISTRIBUTION	DEPTH IN FEET	LITHOLOGIC LOG	LITHOLOGIC DESCRIPTION
	[illegible]								1		No Sample
	[illegible]		.8	GP				[illegible]			[illegible] max size = 7cm, some clay trace of [illegible]
	3.3 40 4.5		[illegible]								[illegible] (10 & 3/4), trace of sand
	[illegible]		[illegible]						5		No Sample
	[illegible]		0								
	[illegible]		[illegible]	GC				[illegible]			~~[illegible]~~ Gravel, [illegible] (N7), sub-[illegible] max size 7cm, [illegible] occurs on gravel
	[illegible]		.4								

NOTES: General: The USCS is modified for this log as follows: Material amounts are estimated by percent volume instead of percent weight.
(1) Badly broken core, accurate footage measurement not possible.
(2) Core breaks cannot be matched, accurate footage measurement not possible.

ROCKY FLATS PLANT

FIGURE NO:

LOG OF BORING NO. SP0587

DATES DRILLED:
ELEVATION:
GEOLOGIST(S):
DATE:
CHECKED BY: DATE:

PROJECT NO: 667-11.22

TOP/BOTTOM OF CORE IN BOX	TOP/BOTTOM OF CORE (ELEVATION)	SAMPLE NUMBER	FEET OF CORE RECOVERED	USCS SYMBOL	FRACTURES PER FOOT	FRACTURE ANGLE	BEDDING ANGLE	GRAIN SIZE DISTRIBUTION	DEPTH IN FEET	LITHOLOGIC LOG	LITHOLOGIC DESCRIPTION
											[illegible]
									11		[illegible]
									12		
									13		[illegible]
			0						14		
			0					>50%	15		Clay, yellowish gray [illegible]
			N/D						16		
				CL					17		
			N/D						18		
									19		[illegible]

NOTES: General: The USCS is modified for this log as follows: Material amounts are estimated by percent volume instead of percent weight.
(1) Badly broken core, accurate footage measurement not possible.
(2) Core breaks cannot be matched, accurate footage measurement not possible.

ROCKY FLATS PLANT

FIGURE NO.

LOG OF BORING NO. SP0587

DATES DRILLED:
ELEVATION:
GEOLOGIST(S):
DATE:
CHECKED BY:

USCS symbol

DATE:

PROJECT NO: 667-11.22

TOP/BOTTOM OF CORE IN BOX	TOP/BOTTOM OF CORE IN FRONT (IN FRACTURE)	SAMPLE NUMBER	FEET OF CORE IN BOX	~~FEET OF CORE IN FRONT~~	FRACTURES PER FOOT	FRACTURE ANGLE	BEDDING ANGLE	GRAIN SIZE DISTRIBUTION	DEPTH IN FEET	LITHOLOGIC LOG	LITHOLOGIC DESCRIPTION
								>50% clay			As above
											Bottom of Box 11 [illegible]

NOTES: General: The USCS is modified for this log as follows: Material amounts are estimated by percent volume instead of percent weight.
(1) Badly broken core, accurate footage measurement not possible.
(2) Core breaks cannot be matched, accurate footage measurement not possible.

ROCKY FLATS PLANT

FIGURE NO:

STATE PLANE COORDINATE:	TOTAL DEPTH (FT): 21.8	GROUND ELEVATION (FT): 5971.6	PROJECT NUMBER: 667.11	LOG OF BORING NUMBER:
NORTH: 750870	AREA: SOLAR PONDS	CASING DIAMETER (IN): 0	GEOLOGIST: DCB	SP05-87
EAST: 2084910	LOCATOR NUMBER: L10	BOREHOLE DIAMETER (IN): 0	DATE DRILLED: 11/06/87	

REMARKS: Hollow Stem Auger. Borehole backfilled with Portland Type I cement.
Coords. and elev. estimated from topo. map.

CHEMICAL SAMPLE DEPTH / GRADATIONAL SAMPLE	SAMPLE NUMBER	SAMPLE GRAIN SIZE (0% 50% 100%)	PERCENT RECOVERY (0% 100%)	RECOVERY/INTERVAL	DATUM (FT)	DEPTH (FT)	WELL OR PIEZOMETER CONSTRUCTION	LITHOLOGY	UNIFIED SOILS CLASSIFICATION OR ROCK TYPE	DESCRIPTION
	SP0587000H			0/2	5971	0			NO SAMPLE:	
					5970	1				
	SP0587020H			0.8/1.3	5969	2			GP:	GRAVEL - light gray (N7), angular to sub-rounded, well graded, max. size 7 cm., some clay, trace of root fragments.
				0.7/0.7	5968	3			GP:	As above, at 3.3 ft. clay fraction increases and clay changes from medium dark gray (N4) to dark reddish brown (10R 3/4), trace of sand.
	SP0587040H			0/1.6	5967	4			NO SAMPLE:	
					5966	5				
				0/1.4	5965	6			NO SAMPLE:	
	SP0587070H			0.5/2.5	5964	7			GC:	GRAVEL - light gray (N7), sub-angular, poorly graded, max. size 7 cm., caliche rind occurs on gravel.
					5963	8				
					5962	9			GC:	As above.
						10				

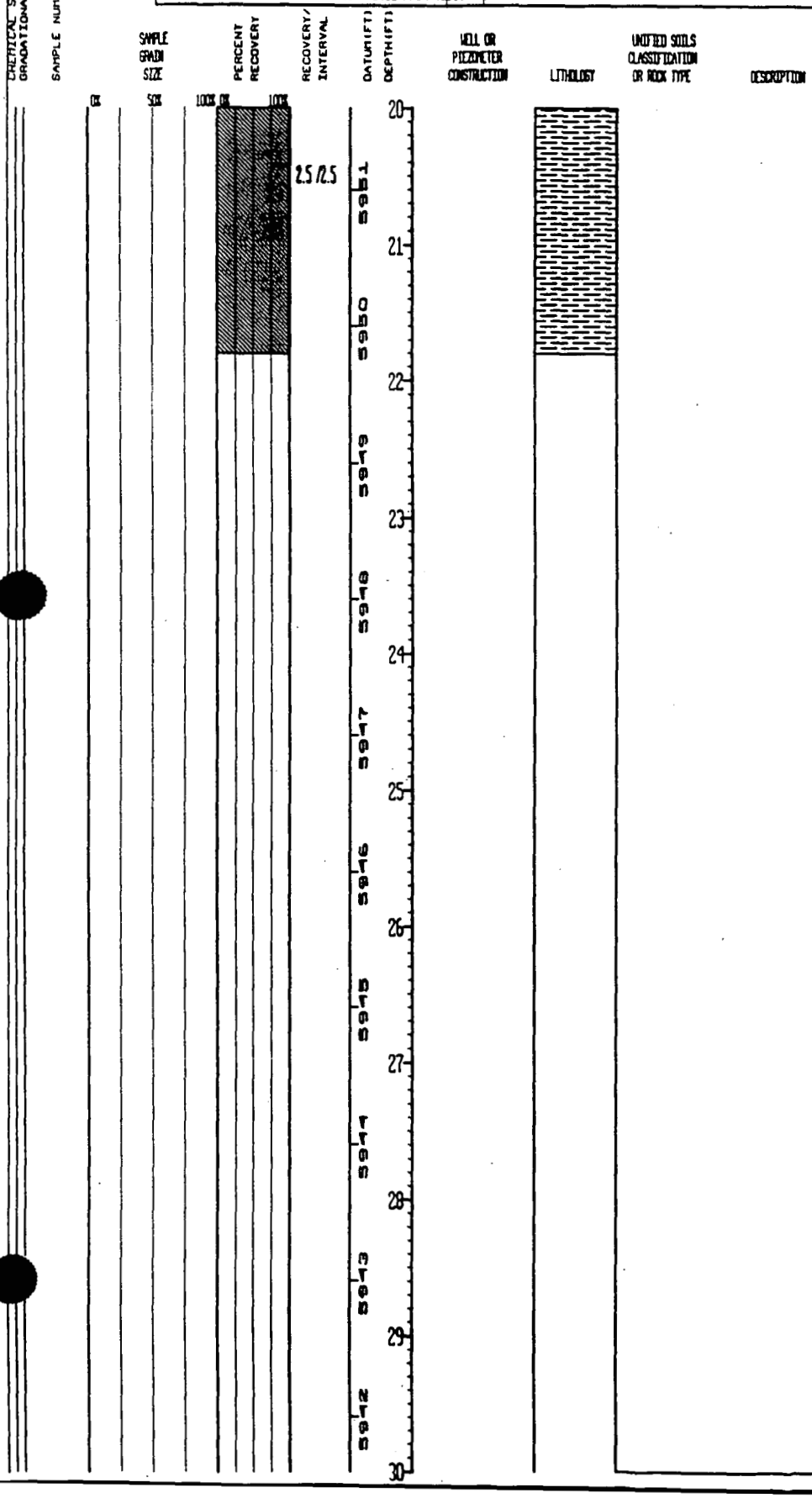
STATE PLANE COORDINATE:		TOTAL DEPTH (FT): 21.8	GROUND ELEVATION (FT):	5971.6	PROJECT NUMBER:	667.11	LOG OF BORING NUMBER:
NORTH:	750870	AREA: SOLAR PONDS	CASING DIAMETER (IN):	0	GEOLOGIST:	DCB	SP05-[illegible]
EAST:	2084910	LOCATOR NUMBER: L10	BOREHOLE DIAMETER (IN):	0	DATE DRILLED:	11/06/87	

REMARKS: Hollow Stem Auger. Borehole backfilled with Portland Type I cement.
Coords. and elev. estimated from topo. map.

CHEMICAL SAMPLE DEPTH / GRADATIONAL SAMPLE DEPTH	SAMPLE NUMBER	SAMPLE GRADN SIZE	PERCENT RECOVERY	RECOVERY/INTERVAL	DATUM (FT)	DEPTH (FT)	WELL OR PIEZOMETER CONSTRUCTION	LITHOLOGY	UNIFIED SOILS CLASSIFICATION OR ROCK TYPE	DESCRIPTION
	SP05871001H		100%	0.4/1.1	5961	10				
				0.3/1.4	5960	11			GC:	SILTY GRAVEL - light gray (N7), sub-rounded to sub-angular, poorly graded, max. size 6.5 cm., silt component is very pale orange (10YR 8/2), trace of sand.
				0/1.6	5959	12			NO SAMPLE:	
	SP05871201H			0/0.9	5958	13			NO SAMPLE:	
				0/0.8	5957	14			NO SAMPLE:	
					5956	15	11/06/87 ▽		CH:	Clay - yellowish gray (5Y 7/2), high plasticity, trace of silt.
	SP05871601H			2/2	5955	16			CLAYSTONE:	Top of Bedrock Yellowish gray (5Y 7/2), high plasticity, trace of silt.
				2/2	5954	17			CLAYSTONE:	As above.
					5953	18				
					5952	19			CLAYSTONE:	As above with color change to grayish orange (10YR 7/4) at 19.3 ft. through 21.8 ft.
						20				

STATE PLANE COORDINATE:		TOTAL DEPTH (FT): 21.8	GROUND ELEVATION (FT):	5971.6	PROJECT NUMBER:	667.11	LOG OF BORING NUMBER:
NORTH:	750870	AREA: SOLAR PONDS	CASING DIAMETER (IN):	0	GEOLOGIST:	DCB	SP05-87
EAST:	2084910	LOCATOR NUMBER: L10	BOREHOLE DIAMETER (IN):	0	DATE DRILLED:	11/06/87	

REMARKS: Hollow Stem Auger. Borehole backfilled with Portland Type I cement.
Coords. and elev. estimated from topo. map.



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Boring No.: SP06-87

Completed as well? No

Data in File

X Log of Borehole

____ Well Construction Summaries

____ Well Development Summaries

____ Hydraulic Conductivity Test Data and Results

____ Packer Test Data and Results

____ Water Level Data

____ Saturated Thickness Hydrographs

LOG OF BOREHOLE

Location Rocky Flats Plant; Solar Ponds Area
Coordinates * N 37900 E 22100
Total Depth 30.7'

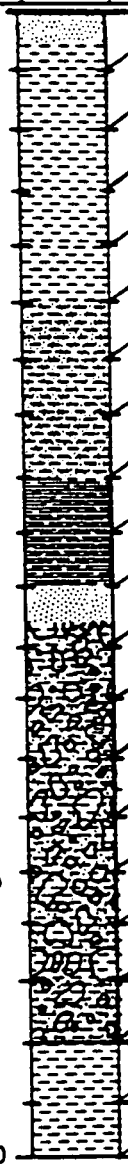
Borehole/Well No. SP06-87
Ground Surface Elevation *5972.9'
Water Level Encountered None
Static

Drilling Company Boyles Bros.
Date Drilled November 18 and 19, 1987
Drilling Method Hollow Stem Auger
Logged By J. Bacchus
Geologist

Driller R. Sharp
Helper T. Merritt
Drilling Fluid None
Checked By
Site Manager

CEARP Manager

Comments Borehole backfilled with Portland Type I Cement.
*Coordinates and elevation estimated from topographic map.

Depth Feet	Graphic Log	Sample Type	Lithologic Description	Samples Collected or Other Tests Performed
0			**ARTIFICIAL FILL/DISTURBED** 0.0-2.0' SAMPLE. Recovered 0.7/2.0' = 35%. 0.0-0.4': SOIL: dark yellowish brown (10 YR 4/2); sandy; grass and roots; wet to moist. 0.4-0.7': CLAY: moderate yellowish brown (10 YR 5/4) mottled with very pale orange (10 YR 8/2); caliche; sand; small angular cobbles; moist. 2.0-4.0' SAMPLE. Recovered 1.7/2.0' = 85%. CLAY: same as above, except slightly larger clasts; moist. 4.0-5.0' SAMPLE. Recovered 0.0/1.0' = 0%. QUARTZITE: angular block. 5.0-8.0' SAMPLE. Recovered 1.5/3.0' = 50%. CLAYEY SAND: dark yellowish orange (10 YR 6/6); large angular pebbles; slight HCl reaction; dry. 8.0-10.5' SAMPLE. Recovered 2.4/2.5' = 96%. 8.0-10.0': SOIL: dusky brown (5 YR 2/2); roots; clay, sand, silt, and small angular cobbles; dry. 10.0-10.4': SAND: pale yellowish brown (10 YR 6/2); contains clay and silt; small angular cobbles; no HCl reaction; dry. 10.5-13.0' SAMPLE. Recovered 1.9/2.5' = 76%. CALICHE: very pale orange (10 YR 8/2); sand, silt, clay, small cobbles and pebbles; clasts are angular; dry to slightly moist. 13.0-15.5' SAMPLE. Recovered 1.3/2.5' = 52%. CALICHE: same as above except the sample is coarser at the bottom. 15.5-18.0' SAMPLE. Recovered 1.2/2.5' = 48%. CALICHE: same as above but not as coarse; more small angular cobbles; slightly moist.	HNu Background=0.7 OVA Background=0.8 Ludlum Background=0.0 0.0-0.7': Readings on Core: HNu = 0.2; OVA = 0.7. 0.0-0.7': Field Screen Readings: HNu=0.4(0.3); OVA=0.6(0.6). 2.0-3.7': Readings on Core: HNu=0.6; OVA=0.7. 2.0-3.7': Field Screen Readings: HNu=400(45); OVA=0.8(0.6). 2.0-3.7': Field Screen Sample: SP068702FS. 5.0-6.5': Readings on Core: HNu=0.4; OVA=0.8. 5.0-6.5': Field Screen Readings: HNu=0.4(0.4); OVA=0.0(0.0). 8.0-10.4': Readings on Core: HNu=0.0; OVA=1.7. 8.0-10.4': Direct Hit Sample: SP068708DH. 10.5-12.4': Readings on Core: HNu=5.0; OVA=1.9; Ludlum=1. 10.5-12.4': Direct Hit Sample: SP068711DH. 13.0-14.3': Readings on Core: HNu=1.2; OVA=20.0; Ludlum=1. 13.0-14.3': Direct Hit Sample: SP068713DH.
5				
10				
15				
20				

LOG OF BOREHOLE

Location Rocky Flats Plant: Solar Ponds Area

Borehole/Well No. SP06-87(cont'd.)

Coordinates

Ground Surface Elevation

Total Depth

Water Level Encountered

Static

Drilling Company

Driller

Date Drilled

Helper

Drilling Method

Drilling Fluid

Logged By

Geologist

Checked By

Site Manager

CEARP Manager

Comments

Depth Feet	Graphic Log	Sample Type	Lithologic Description	Samples Collected or Other Tests Performed
20 25 30 35 40			**ARAPAHOE FORMATION** 18.0-20.5' SAMPLE. Recovered 5.0/2.5' = 200%. CLAYSTONE: light olive gray (5 Y 5/2) mottled with dark yellowish orange (10 YR 6/6); some sand near the bottom of the run; pockets of caliche; moist. 20.5-23.0' SAMPLE. Recovered 3.3/2.5' = 132%. 20.5-21.0': SANDSTONE: dark yellowish orange (10 Y 6/6) mottled with very pale orange (10 YR 8/2); grains are well rounded; high amount of caliche; well rounded pebbles; dry. 21.0-23.0': CLAYSTONE: light olive gray (5 Y 6/2) mottled with dark yellowish orange (10 YR 6/6); pockets of sand; no caliche; slightly moist to dry. Total depth of borehole measured 23.2'; adjust depth. 23.2-25.7' SAMPLE. Recovered 2.5/2.5' = 100%. CLAYSTONE: same as above. 25.7-28.2' SAMPLE. Recovered 2.8/2.5' = 112%. CLAYSTONE: olive gray (5 Y 3/2); slightly weathered; contains sand near the top of the run; dry. 28.2-30.7' SAMPLE. Recovered 3.0/2.5' = 120%. CLAYSTONE: olive gray (5 Y 3/2); mottled with light brown (5 YR 5/6); slightly sandy; blocky structure; dry. TOTAL DEPTH: 30.7'	15.5-17.7': Readings on Core: HNu=1.0; OVA=3.0. 15.5-17.7': Direct Hit Sample: SP068716DH. 18.0-20.5': Readings on Core: HNu=0.0; OVA=2.3. 18.0-20.5': Direct Hit Sample: SP068718DH. 20.5-23.0': Readings on Core: HNu=0.0; OVA=2.0. 20.5-23.0': Direct Hit Sample: SP068721DH. 23.2-25.7': Readings on core: HNu = 2.2; OVA = 7.4. 23.2-25.7': Direct hit sample: SP068724DH. 25.7-28.2': Readings on core: HNu = 1.0; OVA = 6.4. 25.7-28.2': Direct hit sample: SP068726DH. 28.2-30.7': Readings on core: HNu = 1.0; OVA = 1.8; Ludlum = 5. 28.2-30.7': Field screen readings: HNu = 1.0(1.0); OVA = 1.4(1.4).

LOG OF BORING NO. SPO687

GEOLOGIST(S): [illegible]
DATE: 8/11/89

PROJECT NO: 6667-11.22

TOP/BOTTOM OF CORE IN BOX	TOP/BOTTOM OF INTERVAL	FEET OF CORE IN INTERVAL IN BOX	SAMPLE NUMBER	FRACTURE ANGLE	BEDDING ANGLE	GRAIN SIZE DISTRIBUTION	USCS SYMBOL	DEPTH IN FEET	LITHOLOGIC LOG	LITHOLOGIC DESCRIPTION
Box 1 of 3	0.0 -1.7	(1) 1.1					CL	1		CALCAREOUS GRAVELEY CLAY, MODERATE YELLOWISH BROWN (10 YR 5/4), MOD PLAST., SOME SAND MAX GRAVEL SIZE = 3 cm. BOTTOM 3 IN: SANDY GRAVEL, DARK YELLOWISH BROWN (10 YR 4/2), ANGULAR-SUBANGULAR, MOD GRADED, MAX SIZE = 2.5 cm, SOME ~~SAND~~ ROOTS (NOTE: CORE IS POSSIBLY UPSIDE-DOWN IN BOX)
	1.7-2.0	Ø								NO SAMPLE
	2.0 -3.7	(1) 0.5					CL	2, 3		GRAVELEY SANDY (VFG-MG) CLAY, GREYISH ORANGE (10 YR 7/4), MOD PLAST. MAX GRAVEL SIZE = 7.5 cm, SOME ~~CARB~~ CALCAREOUS MATERIAL
	3.7-4.0	Ø								NO SAMPLE
	4.0 -5.0	Ø						4, 5		NO SAMPLE
	5.0 -6.5	(1) .65					~~GM~~ GC	6		SANDY GRAVEL, MODERATE YELLOWISH BROWN (10 YR 5/4), ANGULAR-SUBANGULAR, MOD-WELL GRADED, MAX SIZE = 6.5 cm SOME CLAY, SLIGHTLY CALCAREOUS
	6.5-8.0	Ø						7, 8		NO SAMPLE
	8.0 -9.5	(1) 1.3					GC	9		SAME AS ABOVE: DUSKY YELLOWISH BROWN (10 YR 2/2), MAX SIZE = 6.0 cm, NOT CALCAREOUS
	9.5 -10.5	Ø								NO SAMPLE

NOTES: General USCS is modified for this log as follows:
Material amounts are estimated by % volume instead of % weight.
(1) Badly broken core, accurate footage measurements not possible.
(2) Core breaks cannot be matched, accurate footage measurements not possible.

ROCKY FLATS PLANT

FIGURE NO.

LOG OF BORING NO. SP0687

GEOLOGIST(S): AMY
DATE: 8/11/89

PROJECT NO:

TOP/BOTTOM OF CORE IN BOX	TOP/BOTTOM OF INTERVAL	FEET OF CORE IN INTERVAL IN BOX	SAMPLE NUMBER	FRACTURE ANGLE	BEDDING ANGLE	GRAIN SIZE DISTRIBUTION	USCS SYMBOL	DEPTH IN FEET	LITHOLOGIC LOG	LITHOLOGIC DESCRIPTION
	9.5 -10.5									NO SAMPLE
BOX 1 OF 3	10.5 -12.9	(1) .8					GC	11, 12		CALCAREOUS SANDY GRAVEL, GREYISH ORANGE (10 YR 7/4) MATRIX COLOR; ANGULAR-SUBANGULAR, MAX SIZE = 4.5 cm, MOD-WELL GRADED, SOME CLAY
13.0	12.9-13.0							13		NO SAMPLE
DISCREPENCY BETWEEN BOXES		Ø						14, 15		NO SAMPLE
15.5	15.5 - 16.7	(1) 0.3					GC	16		SAME AS ABOVE
BOX 2 OF 3	15.5 -18.0	Ø						17, 18		NO SAMPLE
	18.0 -20.5	(1) 4.6		LARGE FRACTURE @ 40° VARIOUS DIRECTIONS			CL	19		TOP 2.5 FT - CALCAREOUS CLAY, YELLOWISH GREY (5 Y 8/1), MOD PLAST., SOME IRON STAINING AS MOTTLES, SOME CALCITE IN FRACTURES AND IN MATRIX, SLIGHTLY CALCAREOUS BOTTOM 1.5 FT: SAME AS ABOVE, YELLOWISH ORANGE (10 YR 7/4), SOME FG-MG SAND

NOTES: General USCS is modified for this log as follows:
Material amounts are estimated by % volume instead of % weight.
(1) Badly broken core, accurate footage measurements not possible.
(2) Core breaks cannot be matched, accurate footage measurements not possible.

ROCKY FLATS PLANT

FIGURE NO.

LOG OF BORING NO. SP0667

GEOLOGIST(S): [illegible]
DATE: 8/1/89

PROJECT NO:

TOP/BOTTOM OF CORE IN BOX	TOP/BOTTOM OF INTERVAL	FEET OF CORE IN INTERVAL IN BOX	SAMPLE NUMBER	FRACTURE ANGLE	BEDDING ANGLE	GRAIN SIZE DISTRIBUTION	USCS SYMBOL	DEPTH IN FEET	LITHOLOGIC LOG	LITHOLOGIC DESCRIPTION
										SEE PREVIOUS PAGE
Box 2 of 3	20.5 -23.0	(1) 3.0					CL	21, 22		CLAY, LIGHT GREY (N7) AND GREYISH ORANGE (10 YR 7/4), MOD PLAST., SOME SAND, SOME CALCITE AS MOTTLES.
23.0 DISCREPANCY								23		NO SAMPLE
23.2	23.2 -25.7						CL	24, 25		SAME AS ABOVE; NO CALCITE, NO SAND, TRACE OF SILT
Box 3 of 3	25.7 -28.2						CL	26, 27, 28		SAME AS ABOVE: LIGHT OLIVE GREY (5 Y 6/1) AND BROWNISH GREY (5 YR 4/1)
	28.2 -30.7						CL	29		SAME AS ABOVE: LIGHT OLIVE GREY (5 Y 6/1), DARK YELLOWISH ORANGE (10 YR 6/6),

NOTES: General USCS is modified for this log as follows:
Material amounts are estimated by % volume instead of % weight.
(1) Badly broken core, accurate footage measurements not possible.
(2) Core breaks cannot be matched, accurate footage measurements not possible.

ROCKY FLATS PLANT

FIGURE NO.

LOG OF BORING NO.

GEOLOGIST(S):
DATE:

PROJECT NO:

TOP/BOTTOM OF CORE IN BOX	TOP/BOTTOM OF INTERVAL	FEET OF CORE IN INTERVAL IN BOX	SAMPLE NUMBER	FRACTURE ANGLE	BEDDING ANGLE	GRAIN SIZE DISTRIBUTION	USCS SYMBOL	DEPTH IN FEET	LITHOLOGIC LOG	LITHOLOGIC DESCRIPTION
Bot 5 of 5 → 30.7	28.2 -30.7									SEE PREVIOUS PAGE
END OF BOXES								31		
								32		
								33		
								34		
								35		
								36		
								37		
								38		
								39		

NOTES: General USCS is modified for this log as follows:
Material amounts are estimated by % volume instead of % weight.
(1) Badly broken core, accurate footage measurements not possible.
(2) Core breaks cannot be matched, accurate footage measurements not possible.

ROCKY FLATS PLANT

FIGURE NO.

STATE PLANE COORDINATE:		TOTAL DEPTH (FT): 30.7	GROUND ELEVATION (FT):	5972.9	PROJECT NUMBER:	667.11	LOG OF BORING NUMBER:
NORTH:	750900	AREA: SOLAR PONDS	CASING DIAMETER (IN):	0	GEOLOGIST:	DAT	SP06-87
EAST:	2085200	LOCATOR NUMBER: M10	BOREHOLE DIAMETER (IN):	0	DATE DRILLED:	11/19/87	

REMARKS: Hollow Stem Auger. BH backfilled w/ Portland Type I cement. Coordinates and elevation estimated from topographic map.

CHEMICAL SAMPLE DEPTH / GRADATIONAL SAMPLE DEPTH	SAMPLE NUMBER	SAMPLE GRAIN SIZE (0% 50% 100%)	PERCENT RECOVERY (0% 100%)	RECOVERY/INTERVAL	DATUM (FT)	DEPTH (FT)	WELL OR PIEZOMETER CONSTRUCTION	LITHOLOGY	UNIFIED SOILS CLASSIFICATION OR ROCK TYPE	DESCRIPTION
				1.1 /1.7	5972	0–1			CL:	CALCAREOUS GRAVELLY CLAY - moderate yellowish brown (10YR 5/4), mod. plast., some sand, max. gravel size = 3 cm.
				0 /0.3	5971	2			GC:	SANDY GRAVEL - dark yellowish brown (10YR 4/2), angular - sub-angular, mod. graded, max. size = 2.5 cm., some roots. Note: core is possibly upside down in box.
									NO SAMPLE:	
	SP06870205			0.5 /1.7	5970	3			CL:	GRAVELLY SANDY CLAY - (VFG -MG), grayish orange (10YR 7/4), mod. plast., max. gravel size = 7.5 cm., some calcareous material.
				0 /0.3	5969	4			NO SAMPLE:	
				0 /1	5968	5			NO SAMPLE:	
				0.65 /1.5	5967	6			GC:	SANDY GRAVEL - moderate yellowish brown (10YR 5/4), angular to sub-angular, mod. to well graded, max. size = 6.5 cm., some clay, slightly calcareous.
				0 /1.5	5966	7			NO SAMPLE:	
				1.3 /1.5	5965	8–9			GC:	Same as above: dusky yellowish brown (10YR 2/2), max. size = 6.0 cm., not calcareous.
	SP06870808				5963				NO SAMPLE:	

STATE PLANE COORDINATE:		TOTAL DEPTH (FT): 30.7	GROUND ELEVATION (FT):	5972.9	PROJECT NUMBER:	667.11	LOG OF BORING NUMBER:
NORTH:	750900	AREA: SOLAR PONDS	CASING DIAMETER (IN):	0	GEOLOGIST:	DAT	SP06-87
EAST:	2085200	LOCATOR NUMBER: M10	BOREHOLE DIAMETER (IN):	0	DATE DRILLED:	11/19/87	

REMARKS: Hollow Stem Auger. BH backfilled w/ Portland Type I cement. Coordinates and elevation estimated from topographic map.

CHEMICAL SAMPLE DEPTH / GRADATIONAL SAMPLE	SAMPLE NUMBER	SAMPLE GRAIN SIZE (0% 50% 100%)	PERCENT RECOVERY (0% 100%)	RECOVERY/INTERVAL	DATUM (FT)	DEPTH (FT)	WELL OR PIEZOMETER CONSTRUCTION	LITHOLOGY	UNIFIED SOILS CLASSIFICATION OR ROCK TYPE	DESCRIPTION
				0/1		10				
					5962	11			GC:	CALCAREOUS SANDY GRAVEL - matrix color grayish orange (10YR 7/4), angular to sub-angular, max. size = 4.5 cm., mod. - well graded, some clay.
	SP06871110H			0.8/2.4	5961	12				
				0/0.1	5960	13			NO SAMPLE:	
	13H								NO SAMPLE:	
				0/2.5	5959	14				
					5958	15				
				0.3/1.2	5957	16			GC:	Same as above.
	SP06871610H									
				0/1.3	5956	17			NO SAMPLE:	
					5955	18			CLAYSTONE:	Top of Bedrock Top 2.5 ft. - yellowish gray (5Y 8/1), mod. plast., some iron staining as mottles, some calcite in fractures and as mottles, claystone matrix is slightly calcareous. Bottom 1.5 ft.: Same as above, grayish orange (10YR 7/4), some FG-MG sandstone.
	SP06871810H			1.6/2.5	5954	19				

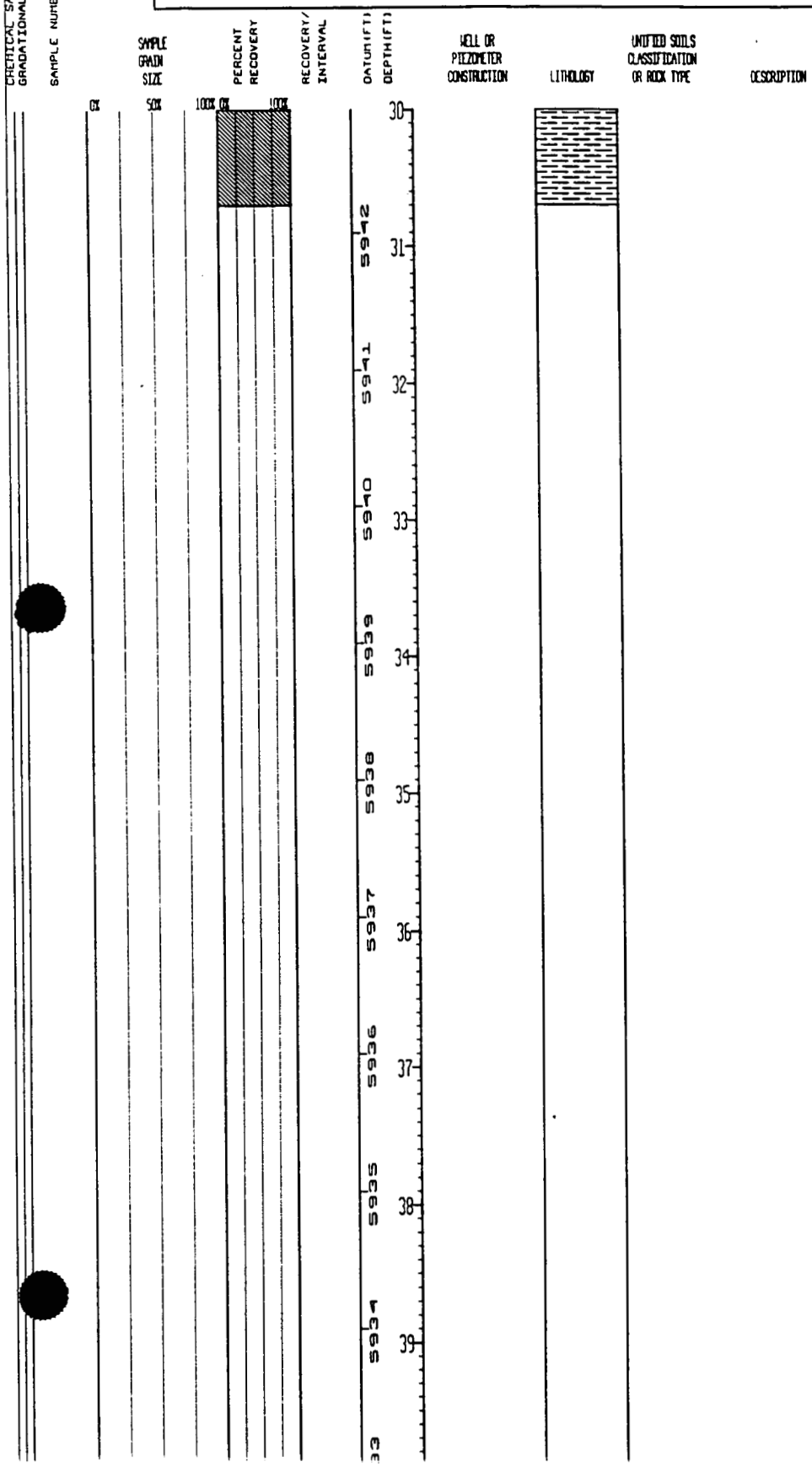
STATE PLANE COORDINATE:		TOTAL DEPTH (FT): 30.7	GROUND ELEVATION (FT):	5972.9	PROJECT NUMBER:	667.11	LOG OF BORING NUMBER:
NORTH:	750900	AREA: SOLAR PONDS	CASING DIAMETER (IN):	0	GEOLOGIST:	DAT	SP06-87
EAST:	2085200	LOCATOR NUMBER: M10	BOREHOLE DIAMETER (IN):	0	DATE DRILLED:	11/19/87	

REMARKS: Hollow Stem Auger. BH backfilled w/ Portland Type I cement. Coordinates and elevation estimated from topographic map.

CHEMICAL SAMPLE DEPTH / GRADATIONAL SAMPLE DEPTH	SAMPLE NUMBER	SAMPLE GRAIN SIZE (0% 50% 100%)	PERCENT RECOVERY (0% 100%)	RECOVERY/INTERVAL	DATUM (FT)	DEPTH (FT)	WELL OR PIEZOMETER CONSTRUCTION	LITHOLOGY	UNIFIED SOILS CLASSIFICATION OR ROCK TYPE	DESCRIPTION
						20				
					5952	21			CLAYSTONE:	Light gray (N7) and grayish orange (10YR 7/4), mod. plast., some sandstone, some calcite as mottles.
	SP06872101H			3/2.5	5951	22				
				0/0.2	5950	23			NO SAMPLE:	
					5949	24			CLAYSTONE:	Same as above, no calcite, no sandstone, trace of siltstone.
	SP06872401H			2.5/2.5	5948	25				
					5947	26			CLAYSTONE:	Same as above, light olive gray (5Y 6/1) and brownish gray (5YR 4/1).
	SP06872601H			2.5/2.5	5946	27				
					5945	28				
					5944	29			CLAYSTONE:	Same as above, light olive gray (5Y 6/1), dark yellowish orange (10YR 6/6). NOTE: No water encountered while drilling.
				2.5/2.5	43					

STATE PLANE COORDINATE:		TOTAL DEPTH (FT): 30.7	GROUND ELEVATION (FT):	5972.9	PROJECT NUMBER:	667.11	LOG OF BORING NUMBER:
NORTH:	750900	AREA: SOLAR PONDS	CASING DIAMETER (IN):	0	GEOLOGIST:	DAT	SP06-87
EAST:	2085200	LOCATOR NUMBER: M10	BOREHOLE DIAMETER (IN):	0	DATE DRILLED:	11/19/87	

REMARKS: Hollow Stem Auger. BH backfilled w/ Portland Type I cement. Coordinates and elevation estimated from topographic map.



INDEX OF DATA

Boring No.: SP07-87

Completed as well? No

Data in File

X Log of Borehole

____ Well Construction Summaries

____ Well-Development Summaries

____ Hydraulic Conductivity Test Data and Results

____ Packer Test Data and Results

____ Water Level Data

____ Saturated Thickness Hydrographs

LOG OF BOREHOLE

Location: Rocky Flats Plant; Solar Ponds Area
Coordinates: * N 37485 E 22100
Total Depth: 31.0'

Borehole/Well No.: SP07-87
Ground Surface Elevation: *5973.6'
Water Level Encountered: 18.0'
Static:

Drilling Company: Boyles Bros.
Date Drilled: November 12 and 13, 1987
Drilling Method: Hollow Stem Auger
Logged By: J. Bacchus
Geologist

Driller: R. Sharp
Helper: T. Merritt
Drilling Fluid: None
Checked By:
Site Manager

CERP Manager

Comments: Borehole backfilled with Portland Type I Cement.
*Coordinates and elevation estimated from topographic map.

Depth Feet	Graphic Log	Sample Type	Lithologic Description	Samples Collected Other Tests Perform
0			**ARTIFICIAL FILL/DISTURBED** 0.0-2.0' SAMPLE. Recovered 1.8/2.0' = 90%. CLAY: moderate yellowish brown (10 YR 5/4); small angular cobbles; pebbles; sand and silt; green grass and roots; caliche; moist. 2.0-4.0' SAMPLE. Recovered 1.8/2.0' = 90%. 2.0-2.2': CLAY: same as above. **ROCKY FLATS ALLUVIUM** 2.2-2.5': GRAVEL: dark reddish brown (10 R 3/4); clasts are very angular quartzite; clay in between clasts; very sticky; moist. 2.5-3.8': CLAY: moderate brown (5 YR 4/4); pebbles; sand and silt; dry. 4.0-5.0' SAMPLE. Recovered 1.2/1.0' = 120%. CLAY: same as above except much larger clasts; dry. 5.0-8.0' SAMPLE. Recovered 1.3/3.0' = 43%. 5.0-5.8': CLAY: Same as above. 5.8-6.3': CLAY: dusky yellowish brown (10 YR 2/2) at the top grading to dark yellowish orange (10 YR 6/6) at the bottom; gravel, sand and silt; pockets of caliche; slightly moist to dry. 8.0-10.5' SAMPLE. Recovered 2.3/2.5' = 92%. 8.0-8.5': CLAY: same as above. 8.5-10.3': CLAY: dusky brown (5 YR 2/2); roots; caliche; cobbles; sand; pebbles; silt; moist. 10.5-13.0' SAMPLE. Recovered 1.7/2.5' = 68%. 10.5-11.3': CLAY: same as above except slightly more wet. 11.3-12.2': SILT: pale yellowish brown (10 YR 6/2); clasts of angular pebbles and coarse-grained sand; no HCl reaction; dry.	HNu Background = 0.0-0.8. OVA Background = 0.0-0.6. Ludlum Background = 0.0. 0.0-1.8': Readings on core: HNu = 0.1; OVA = 6.0. 0.0-1.8': Direct hit sample: SP0787000H. 2.0-3.8': Readings on core: HNu = 4.0; OVA = 11. 2.0-3.8': Direct hit sample: SP078702DH. 4.0-5.0': Readings on core: HNu = 0.8; OVA = 0.0. 4.0-5.0': Field screen readings: HNu = 0.5(0.5); OVA = 0.6(0.5). 5.0-6.3': Readings on core: HNu = 0.6; OVA = 0.0. 5.0-6.3': Field screen readings: HNu = 0.5(0.5); OVA = 0.4(0.4). 8.0-10.3': Readings on core: HNu = 0.5; OVA = 0.8. 8.0-10.3': Field screen readings: HNu = 0.3(2.2); OVA = 6.8(3.2) 8.0-10.3': Field [illegible] sample: SP078708[illegible] 10.5-12.2': Readings on core: HNu = 1.0; OVA = 24. 10.5-12.2': Direct hit sample: SP0787110H.
5				
10				
15				
20				

LOG OF BOREHOLE

Location Rocky Flats Plant: Solar Ponds Area

Borehole/Well No. SP07-87(cont'd.)

Coordinates

Ground Surface Elevation

Total Depth

Water Level Encountered

Static

Drilling Company

Driller

Date Drilled

Helper

Drilling Method

Drilling Fluid

Logged By

Geologist

Checked By

Site Manager

CERP Manager

Comments

Depth Feet	Graphic Log	Sample Type	Lithologic Description	Samples Collected or Other Tests Performe
20			13.0-15.5' SAMPLE. Recovered 1.8/2.5' = 72%. 13.0-13.8': SILT: same as above. 13.8-14.8': CLAY: mottled dark greenish yellow (10 Y 6/6) and grayish olive (10 Y 4/2); sand; silt; pebbles and small cobbles; moist.	13.0-14.8': Readings on core: HNu = 0.4; OVA = 30.
				13.0-14.8': Direct hit sample: SP0787130H.
			15.5-18.0' SAMPLE. Recovered 1.2/2.5' = 48%. SAND: grayish orange (10 YR 7/4); coarse; clay; large angular pebbles; high amount of caliche; moist.	15.5-16.7': Readings on core: HNu = 1.0; OVA = 11.
25				15.5-16.7': Direct hit sample: SP0787160H.
			18.0-20.5' SAMPLE. Recovered 1.3/2.5' = 52%. SAND: Same as above but more coarse; wet.	18.0-19.3': Readings on core: HNu = 0.6; OVA = 11.
				18.0-19.3': Water table sample: SP078718WT.
			20.5-23.0' SAMPLE. Recovered 3.8/2.5' = 155%. 20.5-21.3': SAND: same as above.	20.5-23.0': Readings on core: HNu = 1020; OVA = 2.0.
			ARAPAHOE FORMATION	
30			21.3-23.0': CLAYSTONE: light olive gray (5 Y 5/2) mottled with pale yellowish orange (10 YR 8/6); dense; moist.	20.5-23.0': Contact sample: SP078721CT.
			23.0-26.0' SAMPLE. Recovered 5.0/3.0' = 167%. CLAYSTONE: same as above.	23.0-26.0': Readings on core: HNu = 95; OVA = 5.2.
				23.0-26.0': Bedrock sample: SP0787238R.
			26.0-28.5' SAMPLE. Recovered 3.0/2.5' = 120%. 26.0-27.2': CLAYSTONE: same as above. 27.2-28.5': CLAYSTONE: olive gray (5 Y 3/2); mottled with light brown (5 YR 5/6); dense; dry.	26.0-28.5': Readings on core: HNu = 0.4; OVA = 4.0; Ludlum = 2.
35				26.0-28.5': Direct hit sample: SP0787260H.
			28.5-31.0' SAMPLE. Recovered 3.3/2.5' = 132%. CLAYSTONE: same as above.	28.5-31.0': Readings on core: HNu = 0.6; OVA = 0.2; Ludlum = 1.
			TOTAL DEPTH: 31.0'	28.5-31.0': Field screen readings: HNu = 140(140); OVA = 0.5(0.4).
40				

LOG OF BORING NO. SP0787

GEOLOGIST(S): DCB
DATE: 8/10/89

PROJECT NO: 667-1122

TOP/BOTTOM OF CORE IN BOX	TOP/BOTTOM OF INTERVAL	FEET OF CORE IN INTERVAL IN BOX	SAMPLE NUMBER	FRACTURE ANGLE	BEDDING ANGLE	GRAIN SIZE DISTRIBUTION	USCS SYMBOL	DEPTH IN FEET	LITHOLOGIC LOG	LITHOLOGIC DESCRIPTION
0.0	0.0 to 1.8	(1) .6				>50% Gravel	GC	1		Clayey Gravel, light gray (N7), clay matrix is moderate yellowish brown (10 YR 5/4), angular to sub angular, poorly graded, max. size 5 cm., some plant debris in upper .5 ft., calcareous minerals disseminated throughout matrix, some silt
	1.8 to 2.0	0						2		No Sample
	2.0 to 3.8	(1) .4				>50% Gravel	GC	3		As above (reference interval 0.0 to 1.8 ft), without plant debris.
	3.8 to 4.0	0						4		No Sample
	4.0 to 5.0	(1) .4				>50% Gravel	GC	5		As above (reference interval 0.0 to 1.8), without plant debris, increase in calcareous mineralization. Localized bodies of caliche occur in the matrix. Clay matrix grades to med. dark gray (N4).
	5.0 to 6.0	ND						6		
	6.0 to 8.0	0						7		No Sample
	8.0 to 10.5	(1) 1.6				>50% Gravel	GC	8 9		Clayey Gravel, very light gray (N8), clay matrix is medium dark gray (N4), angular to subangular, poorly graded, max. size ~5 cm., caliche rind on gravel, local bodies of caliche and calcareous mineralization disseminated in clay matrix, trace of silt.

NOTES: General USCS is modified for this log as follows:
Material amounts are estimated by % volume instead of % weight.
(1) Badly broken core, accurate footage measurements not possible.
(2) Core breaks cannot be matched, accurate footage measurements not possible.

ROCKY FLATS PLANT

FIGURE NO.

LOG OF BORING NO. SP0787

GEOLOGIST(S): DCB
DATE: 8/10/89

PROJECT NO: 667-1122

TOP/BOTTOM OF CORE IN BOX	TOP/BOTTOM OF INTERVAL	FEET OF CORE IN INTERVAL IN BOX	SAMPLE NUMBER	FRACTURE ANGLE	BEDDING ANGLE	GRAIN SIZE DISTRIBUTION	USCS SYMBOL	DEPTH IN FEET	LITHOLOGIC LOG	LITHOLOGIC DESCRIPTION
1 of 3	8.0 to 10.5	(1) 1.6				>50% Gravel	GC			As above
	10.8 to 11.3	(1) .5				>50% Gravel		11		Gravel, very light gray (N8), poorly sorted, angular to subangular, max size 6cm, some clay, trace of sand and silt.
Box 1 of 3	11.3 to 13.0	0						12		No Sample (sample jars are used in this interval).
13.0	13.0 to 14.8	(1) .9				>50% Gravel	GC	13 14		Clayey Gravel, light gray (N 8), clay matrix is moderate, yellowish brown (10 YR 5/4), angular to sub angular, poorly graded, max size 4cm, calcareous mineralization disseminated throughout the clay fraction, caliche occurs in local bodies, [illegible]
Box 2 of 3	14.8 to 15.5	~~0~~ 0						15		No Sample
	15.5 to 16.6	(1) .5				>50% Gravel	GC	16		As above (reference interval 13.0 to 14.8), with increase in the sand fraction.
	16.6 to 18.0	0						17		No Sample
	18.0 to 19.2	(1) .5						18 19		Silty, Sandy Gravel, grayish brown (5 YR 3/2), matrix is grayish orange (10 YR 7/4), poorly graded, angular to subrounded, max size 3.5 cm, some clay, clacareous.
	19.2 to 20.5	0								No Sample

NOTES: General: USCS is modified for this log as follows:
Material amounts are estimated by % volume instead of % weight.
(1) Badly broken core, accurate footage measurements not possible.
(2) Core breaks cannot be matched, accurate footage measurements not possible.

ROCKY FLATS PLANT

FIGURE NO.

LOG OF BORING NO. SP 07 87

GEOLOGIST(S): DCB
DATE: 8/11/89

PROJECT NO: 667-1122

TOP/BOTTOM OF CORE IN BOX	TOP/BOTTOM OF INTERVAL	FEET OF CORE IN INTERVAL IN BOX	SAMPLE NUMBER	FRACTURE ANGLE	BEDDING ANGLE	GRAIN SIZE DISTRIBUTION	USCS SYMBOL	DEPTH IN FEET	LITHOLOGIC LOG	LITHOLOGIC DESCRIPTION
	19.3	0							X	No Sample
	20.5					750% Gravel	GC			Interval from 20.5 to 20.8 is as above (reference interval 18.0 to 19.3).
	20.5 to 23.0	ND				>50% Clay	CL	21, 22, 23		Interval grades to Clay at ~20.8 ft. Clay, mottled very light gray (N8) to dark yellowish orange (10 YR 6/6), high plasticity, trace of silt, probably highly weathered claystone.
Box 2 of 3	23.0 to 26.0	ND				>50% Clay		24, 25, 26		Claystone, very light gray (N8) to dark yellowish orange (10 YR 6/6), bedding not apparent (massive?), highly weathered, moderately to highly friable, localized iron staining. Contact with clay above is gradational, placement of contact is subjective.
see Notes 25.0	26.0 to 28.5							27, 28		
Box 3 of 3	28.5 to 31.0							29		As above at 28.5 ft. the interval becomes light gray (N7)

NOTES: General USCS is modified for this log as follows:
Material amounts are estimated by % volume instead of % weight.
(1) Badly broken core, accurate footage measurements not possible.
(2) Core breaks cannot be matched, accurate footage measurements not possible.

Interval 25.0 to 26.0 ft. occurs in both boxes 2/3 + 3/3

ROCKY FLATS PLANT

FIGURE NO.

LOG OF BORING NO. SP0787

GEOLOGIST(S): DCB
DATE: 8/11/89

PROJECT NO: 667-1122

TOP/BOTTOM OF CORE IN BOX	TOP/BOTTOM OF INTERVAL	FEET OF CORE IN INTERVAL IN BOX	SAMPLE NUMBER	FRACTURE ANGLE	BEDDING ANGLE	GRAIN SIZE DISTRIBUTION	USCS SYMBOL	DEPTH IN FEET	LITHOLOGIC LOG	LITHOLOGIC DESCRIPTION
Box #3 of 3 31-0						>50% clay				As above
								31		Bottom of Box 3 of 3 at 31 ft. DCB
								32		

NOTES: General USCS is modified for this log as follows:
Material amounts are estimated by % volume instead of % weight.
(1) Badly broken core, accurate footage measurements not possible.
(2) Core breaks cannot be matched, accurate footage measurements not possible.

ROCKY FLATS PLANT

FIGURE NO.

STATE PLANE COORDINATE:		TOTAL DEPTH (FT): 31	GROUND ELEVATION (FT): 5973.6	PROJECT NUMBER: 667.11	LOG OF BORING NUMBER:
NORTH:	750471	AREA: SOLAR PONDS	CASING DIAMETER (IN): 0	GEOLOGIST: DCB	SP07-87
EAST:	2085200	LOCATOR NUMBER: M10	BOREHOLE DIAMETER (IN): 0	DATE DRILLED: 11/13/87	

REMARKS: Hollow Stem Auger. Borehole backfilled with Portland Type I cement. Coordinates and elevation estimated from topographic map.

CHEMICAL SAMPLE DEPTH / GRADATIONAL SAMPLE DEPTH	SAMPLE NUMBER	SAMPLE GRAIN SIZE (0% 50% 100%)	PERCENT RECOVERY (0% 100%)	RECOVERY/INTERVAL	DATUM (FT)	DEPTH (FT)	WELL OR PIEZOMETER CONSTRUCTION	LITHOLOGY	UNIFIED SOILS CLASSIFICATION OR ROCK TYPE	DESCRIPTION
	SP0787001H			0.6/1.8	5973	0			GC:	Clayey Gravel - light gray (N7), clay matrix is moderate yellowish brown (10YR 5/4), angular to sub-angular, poorly graded, max. size 5 cm., some plant debris in upper 0.15 ft., calcareous minerals disseminated throughout matrix, some silt and sand.
				0/0.2	5972	1			NO SAMPLE:	
	SP0787002H			0.4/1.8	5971	2			GC:	As above, without plant debris.
				0/0.2	5970	3			NO SAMPLE:	
				0.4/1	5969	4			GC:	As above (reference interval 0 to 1.8), without plant debris, increase in calcareous mineralization, localized bodies of caliche occur in the matrix. Clay matrix grades to med. dark gray (N4).
				1/1	5968	5			GC:	As above.
				0/2	5967	6			NO SAMPLE:	
					5966	7				
					5965	8				
	SP0787003S			1.6/2.5	5964	9			GC:	Clayey Gravel - very light gray (N8), clay matrix is medium dark gray (N4), angular to sub-angular, poorly graded, max. size approx. 5 cm., caliche rind on gravel, local bodies of caliche and calcareous minerali[illegible] disseminated in clay matrix, trace of sand and silt.
						10				

STATE PLANE COORDINATE:		TOTAL DEPTH (FT): 31	GROUND ELEVATION (FT):	5973.6	PROJECT NUMBER:	667.11	LOG OF BORING NUMBER:
NORTH:	750471	AREA: SOLAR PONDS	CASING DIAMETER (IN):	0	GEOLOGIST:	DCB	SP07-87
EAST:	2085200	LOCATOR NUMBER: M10	BOREHOLE DIAMETER (IN):	0	DATE DRILLED:	11/13/87	

REMARKS: Hollow Stem Auger. Borehole backfilled with Portland Type I cement. Coordinates and elevation estimated from topographic map.

CHEMICAL SAMPLE OR GRADATIONAL SAMPLE	SAMPLE NUMBER	SAMPLE GRAIN SIZE (0% 50% 100%)	PERCENT RECOVERY (0% 100%)	RECOVERY/INTERVAL	DATUM (FT)	DEPTH (FT)	WELL OR PIEZOMETER CONSTRUCTION	LITHOLOGY	UNIFIED SOILS CLASSIFICATION OR ROCK TYPE	DESCRIPTION
				0.5 /0.8	5963	10–11			GC:	GRAVEL - very light gray (N8), poorly sorted, angular to sub-angular, max. size 6 cm., some clay, trace of sand and silt.
	SP0787110H			0 /1.7	5962, 5961	11–12			NO SAMPLE:	NO SAMPLE (sample jars are found in this interval.)
	SP0787130H			0.9 /1.8	5960, 5959	13–14			GC:	Clayey Gravel - light gray (N8), clay matrix is moderate yellowish brown (10YR 5/4), angular to sub-angular, poorly graded, max. size 4 cm., calcareous mineralization disseminated throughout the clay fraction, calich occurs in local bodies, some silt and sand.
				0 /0.7	5959	14–15			NO SAMPLE:	
	SP0787160H			0.5 /1.1	5958, 5957	15–16			GC:	As above (reference interval 13.0 to 14.8), with an increase in the sand fraction.
				0 /1.4	5957, 5956	16–17			NO SAMPLE:	
	SP0787180H			0.5 /1.3	5956, 5955	17–18	11/13/87 ▽		GM:	SILTY SANDY GRAVEL - grayish brown (5YR 3/2), matrix is grayish orange (10YR 7/4), poorly graded, angular to sub-rounded, max. size 3.5 cm., some clay, calcareous.
				0 /1.2	5955, 5954	18–20			NO SAMPLE:	

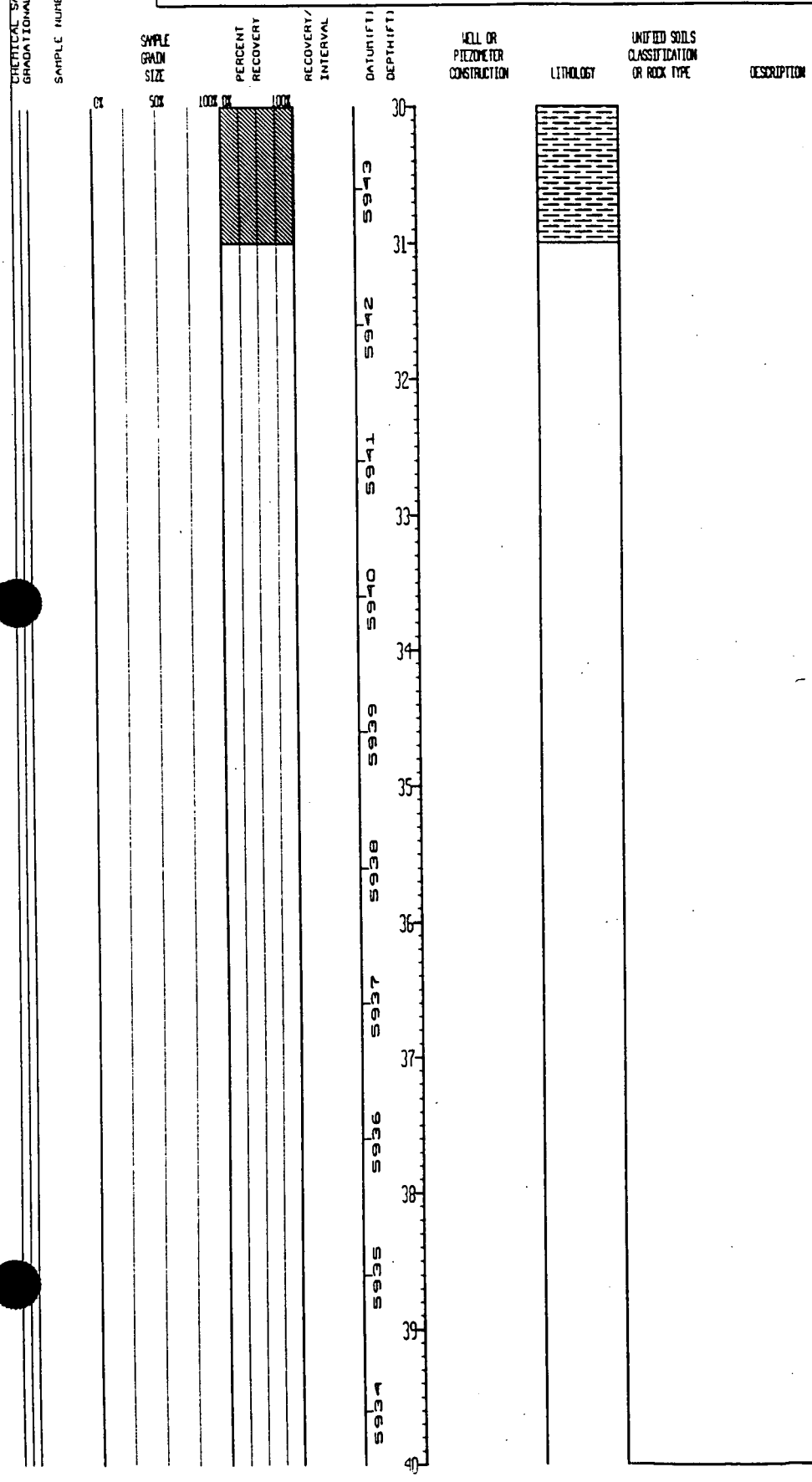
STATE PLANE COORDINATE:	TOTAL DEPTH (FT): 31	GROUND ELEVATION (FT): 5973.6	PROJECT NUMBER: 667.11	LOG OF BORING NUMBER:
NORTH: 750471	AREA: SOLAR PONDS	CASING DIAMETER (IN): 0	GEOLOGIST: DCB	SP07-07
EAST: 2085200	LOCATOR NUMBER: M10	BOREHOLE DIAMETER (IN): 0	DATE DRILLED: 11/13/87	

REMARKS: Hollow Stem Auger. Borehole backfilled with Portland Type I cement. Coordinates and elevation estimated from topographic map.

CHEMICAL SAMPLE DEPTH / GRADATIONAL SAMPLE DEPTH	SAMPLE NUMBER	SAMPLE GRAIN SIZE (0% 50% 100%)	PERCENT RECOVERY (0% 100%)	RECOVERY/INTERVAL	DATUM (FT)	DEPTH (FT)	WELL OR PIEZOMETER CONSTRUCTION	LITHOLOGY	UNIFIED SOILS CLASSIFICATION OR ROCK TYPE	DESCRIPTION
					5953	20			GM:	As above (reference interval 18 to 19.3 ft.).
	SP078721CT			2.5/2.5	5952	21			CLAYSTONE:	Top of Bedrock Mottled very light gray (N8) to dark yellowish orange (10YR 6/6), high plasticity, trace of silt, probably highly weathered claystone.
					5951	22				
	SP078723BR			3/3	5950	23			CLAYSTONE:	Very light gray (N8) to dark yellowish orange (10YR 6/6), bedding not apparent (massive?), highly weathered, moderately to highly friable, localized iron staining. Contact with clay above is gradational, placement of contact is subjective.
					5949	24				
					5948	25				
	SP078726DH			2.5/2.5	5947	26			CLAYSTONE:	As above.
					5946	27				
					5945	28			CLAYSTONE:	As above, at 28.5 ft. the interval becomes light gray (N7).
				2.5/2.5	5944	29				
						30				

STATE PLANE COORDINATE:		TOTAL DEPTH (FT): 31	GROUND ELEVATION (FT):	5973.6	PROJECT NUMBER:	667.11	LOG OF BORING NUMBER:
NORTH:	750471	AREA: SOLAR PONDS	CASING DIAMETER (IN):	0	GEOLOGIST:	DCB	SP07-87
EAST:	2085200	LOCATOR NUMBER: M10	BOREHOLE DIAMETER (IN):	0	DATE DRILLED:	11/13/87	

REMARKS: Hollow Stem Auger. Borehole backfilled with Portland Type I cement. Coordinates and elevation estimated from topographic map.



INDEX OF DATA

Boring No.: 10-87

Completed as well? Yes

Data in File

X Log of Borehole

X Well Construction Summaries

____ Well Development Summaries

____ Hydraulic Conductivity Test Data and Results

____ Packer Test Data and Results

X Water Level Data

WELL COMPLETION INFORMATION

Location Rocky Flats Plant; 903 Pad Area

Well No. 10-87

Coordinates N 35959.99 E 22180.04

Elevation: Ground Surface 5981.96'

Top of Casing 5983.53'

Total Depth: Well 12.00'

Borehole 17.00'

Formation of Completion Rocky Flats Alluvium

Casing Material Sch 5, type 316 TFJ stainless steel

Casing Diameter 2" ID

Screen Material: 0.010" wire wrap, type 316 TFJ stainless steel

Surface Casing Diameter 5" ID

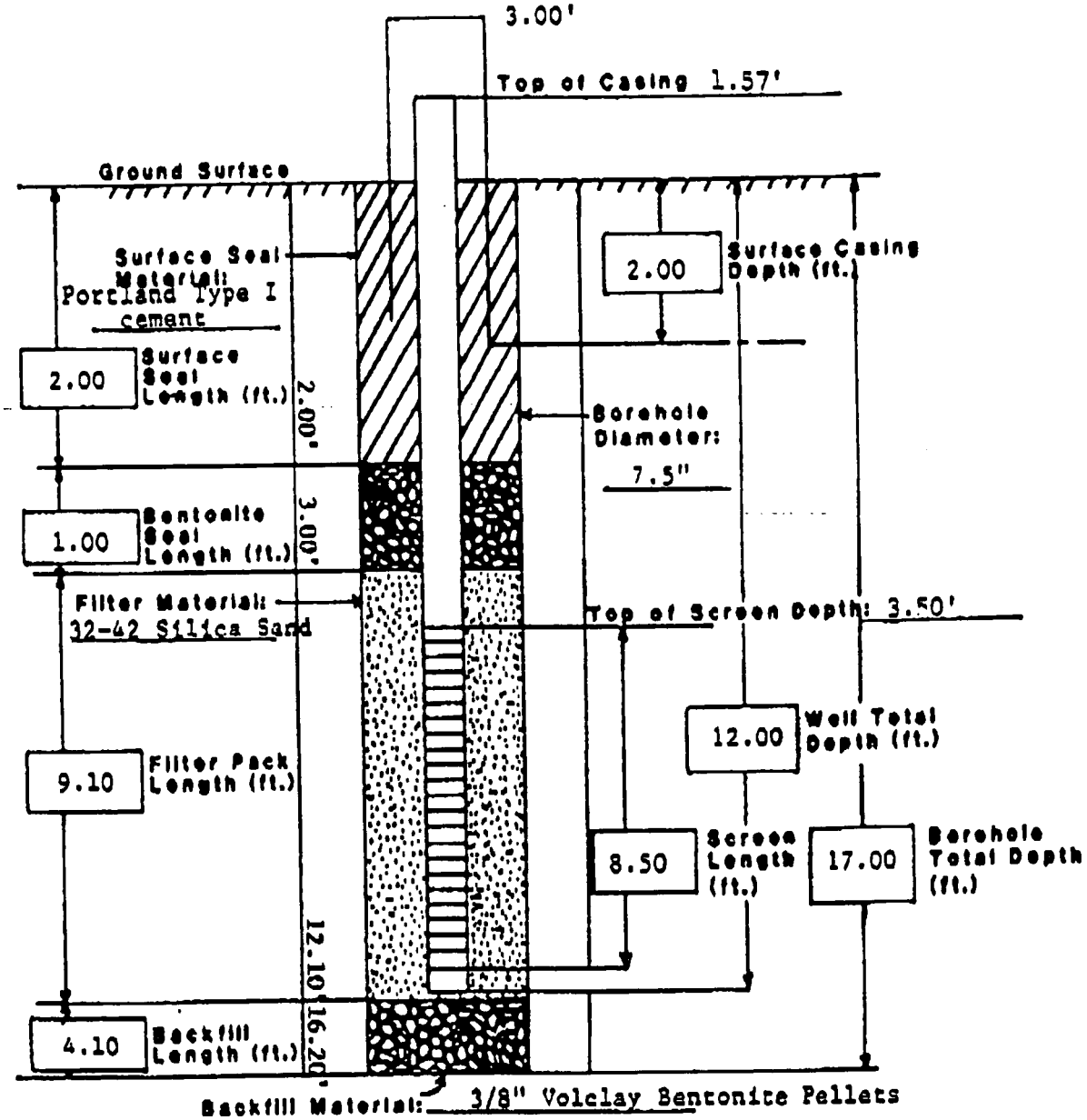
Date Installed June 15, 1987

Approved By [signature] Site Manager

Installed By C.J. Wood Geologist

[signature] ER/ARP Manager

Comments Centralizer at 7.35 to 8.50'



LOG OF BORING NO. 10-87

DATES DRILLED:
ELEVATION:
GEOLOGIST(S): TSD/DCB
DATE: 7/18/89
CHECKED BY:
DATE: 7/19/89

USCS symbol

PROJECT NO: 667-11.22

TOP/BOTTOM OF CORE IN BOX	TOP/BOTTOM OF CORE IN RUN (INTERVAL)	SAMPLE NUMBER	FEET OF CORE IN BOX (INTERVAL)	FEET OF CORE IN RUN	FRACTURES PER FOOT	FRACTURE ANGLE	BEDDING ANGLE	GRAIN SIZE DISTRIBUTION	DEPTH IN FEET	LITHOLOGIC LOG	LITHOLOGIC DESCRIPTION
0.0	0.0 to 1.0		.93					5.5cm to 2mm 70% VCG to MG 10% Fines [illegible]	1		Gravel, light gray (N7) and grayish orange pink (10 R 8/2), angular to subrounded, low to high sphericity, poorly graded, some clay, grayish brown (5 YR 3/2), trace of roots.
	1.0 to 2.0		0						2		No Sample
	2.0 to 2.6		.63				2cm	2cm-2mm =60% VCG = 15% Fines=25%			Gravel-Grayish pink (5R 8/2) to light brownish gray (5YR 6/1) angular to subangular, sphericity [illegible]
Box 10 of 2	2.6							5.5cm-2.0mm			
	5.0		0					FG=30% <FG =10%	4		No Sample
	5.0 to 7.0		1.82						5 6		Sandy Gravel - light gray (N7) angular to subrounded, low to high sphericity, moderately graded, some calcarious mineralization.
	7.0 to 9.0		1.85					[illegible] 10%	8		Same as above with [illegible] occuring approximately 8.4 ft to [illegible]
13	9.0 to 10.5		1.53						9		Same as above including clay fraction.

NOTES: General: The USCS is modified for this log as follows: Material amounts are estimated by percent volume instead of percent weight.
(1) Badly broken core, accurate footage measurement not possible.
(2) Core breaks cannot be matched, accurate footage measurement not possible.

ROCKY FLATS PLANT

FIGURE NO.

LOG OF BORING NO. 10-87

DATES DRILLED:
ELEVATION:
GEOLOGIST(S): TSD/DCB
DATE: 7/18/89
CHECKED BY: DATE:

PROJECT NO: 667-11.22

TOP/BOTTOM OF CORE IN BOX	TOP/BOTTOM OF CORE IN RUN (in/BOX)	SAMPLE NUMBER	FEET OF CORE IN BOX (in/BOX)	USCS symbol ~~FEET OF CORE IN RUN~~	FRACTURES PER FOOT	FRACTURE ANGLE	BEDDING ANGLE	GRAIN SIZE DISTRIBUTION	DEPTH IN FEET	LITHOLOGIC LOG	LITHOLOGIC DESCRIPTION
	9.0 to 10.5		1.53								
			0						11		No Sample
Box 1 of 2 ↑ 13.0	11.0 to 13.0		1.85						12		Same as above to 11.3 ft. At 11.3 ft. very weathered fine to very fine silty sandstone - white (N9) & dark yellowish orange (10YR (6/6) stained) some calcarious [illegible] lation & black (carbonaceous) [illegible] bedding 3-4 mm thick.
13.0 ↓	13.0 TO 15.0		1.7 (2)						14		Same as above
Box 2/2 ↑ 12.0	15.0 TO 17.0		1.75 (2)						15 16		Same as above with decre[illegible] amounts of staining & calcario[illegible] mineralization with depth. Note: Interval blocks [illegible] 17' appear to be reversed [illegible]
									18		
									19		

NOTES: General: The USCS is modified for this log as follows: Material amounts are estimated by percent volume instead of percent weight.
(1) Badly broken core, accurate footage measurement not possible.
(2) Core breaks cannot be matched, accurate footage measurement not possible.

ROCKY FLATS PLANT

FIGURE NO.

LOG OF BORING NO. 10-87

GEOLOGIST(S): TSD/DCB
DATE: 7/18/89

PROJECT NO: 667-11.22

TOP/BOTTOM OF CORE IN BOX	TOP/BOTTOM OF INTERVAL	FEET OF CORE IN INTERVAL IN BOX	SAMPLE NUMBER	FRACTURE ANGLE	BEDDING ANGLE	GRAIN SIZE DISTRIBUTION	USCS SYMBOL	DEPTH IN FEET	LITHOLOGIC LOG	LITHOLOGIC DESCRIPTION
0.0 ↓	0.0 To 1.0	0.93				5.5cm to 2mm 70% VCG to FG 10% Fines 20%		1		Gravel, light gray (N7) and grayish orange pink (10 R 8/2), angular to subrounded, low to high sphericity, poorly graded, some clay, grayish brown (5 YR 3/2), trace of roots.
	1.0 To 2.0	0						2		No Sample
	2.0									[redacted]
box 1 of 2	2.6 to 5.0	0				5cm to 2mm =60% VCG to FG=30% LFG =10%		3 4		[redacted] silt, + sand. No Sample
	5.0 to 7.0	1.82						5 6		Sandy Gravel - light gray angular to subrounded, low [redacted]
	7.0 to 9.0	1.85				6cm to 2mm =60% VCG to FG=30% LFG= 10%		7 8		[redacted] 8.4 FT to 9.0 FT.
	9.0 to 10.5	1.53						9		Same as above including clay fraction.

NOTES: General: USCS is modified for this log as follows:
Material amounts are estimated by % volume instead of % weight.
(1) Badly broken core, accurate footage measurements not possible.
(2) Core breaks cannot be matched, accurate footage measurements not possible.

This log has been recopied to include correct graphic lithologic log. CKF

ROCKY FLATS PLANT

FIGURE NO.

LOG OF BORING NO. 10-87

GEOLOGIST(S): TSD/DCB
DATE: 7/18/89

PROJECT NO: 667-11.22

TOP/BOTTOM OF CORE IN BOX	TOP/BOTTOM OF INTERVAL	FEET OF CORE IN INTERVAL IN BOX	SAMPLE NUMBER	FRACTURE ANGLE	BEDDING ANGLE	GRAIN SIZE DISTRIBUTION	USCS SYMBOL	DEPTH IN FEET	LITHOLOGIC LOG	LITHOLOGIC DESCRIPTION
	9.0 to 10.5	1.55								
		0						11		No Sample
Box 1 of 2	11.0 to 12.0	1.85						12		Same as above to 11.3 Ft. At 11.3 Ft very weathered fine to very fine silty sandstone-white (NA) + stained dark yellowish orange [illegible]
13.0										
13.0 ↓	13.0 to 15.0	1.7 (2)						13 14		Same As Above
Box 2/2	15.0 to 17.0	1.75 (2)						15 16		Same as above with decreasing amounts of staining + calcareous mineralization with depth. Note: interval blocks for 15' to 17' appear to be reversed based on [illegible]
								18 19		

NOTES: General USCS is modified for this log as follows:
Material amounts are estimated by % volume instead of % weight.
(1) Badly broken core, accurate footage measurements not possible.
(2) Core breaks cannot be matched, accurate footage measurements not possible.

ROCKY FLATS PLANT

FIGURE NO.

LOG OF BOREHOLE

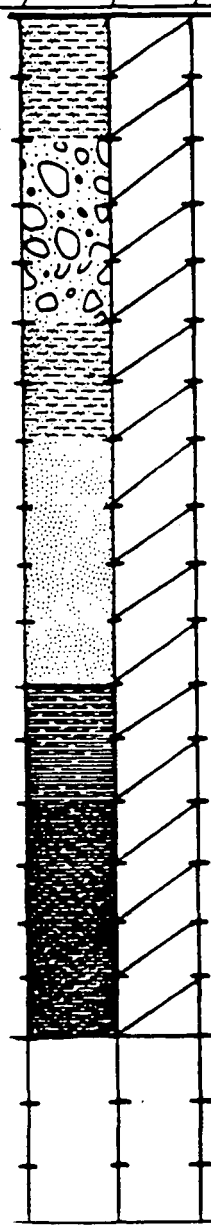
Location: Rocky Flats Plant; 903 Pad Area
Coordinates: N 35959.99 E 22180.04
Total Depth: 17.00'

Borehole/Well No.: 10-87
Ground Surface Elevation: 5981.96'
Water Level Encountered: None
Static: 5970.68'

Drilling Company: Boyles Bros
Date Drilled: June 15, 1987
Drilling Method: Hollow Stem Auger
Logged By: C. J. Wood
Geologist

Driller: D. Jarvie
Helper: K. Parker
Drilling Fluid: None
Checked By: J. S. Pascha
Site Manager
Brent Lewis
CEARP Manager

Comments:

Depth Feet	Graphic Log	Sample Type	Lithologic Description	Samples Collected or Other Tests Performed
0			**ROCKY FLATS ALLUVIUM** 0.0-2.0' SAMPLE. Recovered 1.0/2.0' = 50%. SANDY CLAY: moderate brown (5 YR 4/4); numerous quartzite pebbles and cobbles; some roots; dry. 2.0-4.0' SAMPLE. Recovered 0.6/2.0' = 30%. GRAVELS: quartzite pebbles and cobbles; dry. 4.0-5.0' SAMPLE. No recovery. Lost core. 5.0-7.0' SAMPLE. Recovered 2.0/2.0' = 100%. SANDY CLAY: light olive gray (5 Y 6/1) to moderate reddish orange (10 R 6/6); highly weathered; calcite throughout; numerous quartzite pebbles and cobbles; unconsolidated; damp. 7.0-9.0' SAMPLE. Recovered 2.0/2.0' = 100%. SAND: light gray (N 7/0) to moderate reddish orange (10 R 6/6); with some clay; numerous quartzite pebbles subangular to subrounded; caliche throughout; damp to dry.	HNu Background=0.0 OVA Background=0.0 Ludlum Background = 0.0 No readings over background.
5				
10				
15				
20				

LOG OF BOREHOLE

Location: Rocky Flats Plant; 903 Pad Area
Coordinates: N 33059.99 E 22180.04
Total Depth: 17.00'

Borehole Well No.: 10-97
Ground Surface Elevation: 5981.96'
Water Level Encountered: None
Static: 5970.68'

Drilling Company: Boyles Bros
Date Drilled: June 15, 1987
Drilling Method: Hollow Stem Auger
Logged By: C. J. Wood
Geologist

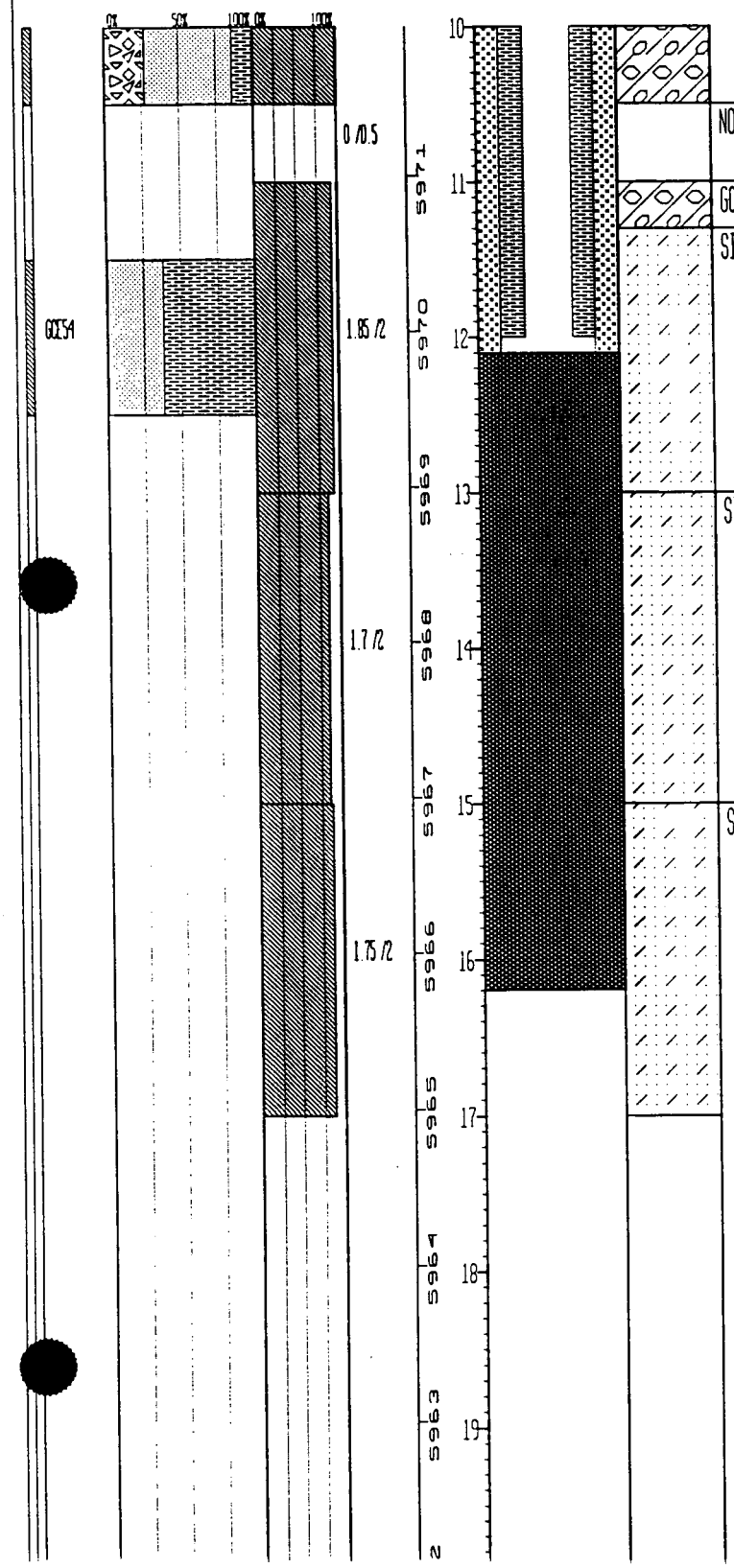
Driller: D. Jarvie
Helper: K. Parker
Drilling Fluid: None
Checked By: J. Paschke
Site Manager

CEARP Manager

Comments

Depth Feet	Graphic Log	Sample Type	Lithologic Description	Samples Collected or Other Tests Performed
			9.0-11.0' SAMPLE. Recovered 1.5/2.0' = 75%. 9.0-10.5': SAND: moderate reddish orange (10 R 6/6); weathered; numerous quartzite pebbles; medium to coarse grained; trace caliche; damp.	
			ARAPAHOE FORMATION	
			11.0-13.0' SAMPLE. Recovered 2.0/2.0' = 100%. SILTY CLAYSTONE: moderate reddish orange (10 R 6/6); iron staining; light gray (N 7/0) in areas; damp to dry.	
			13.0-15.0' SAMPLE. Recovered 2.0/2.0' = 100%. SANDY-SILTY CLAYSTONE: moderate reddish orange (10 R 6/6); iron staining; light gray areas (N 7/0); damp.	
			15.0-17.0' SAMPLE. Recovered 2.0/2.0' = 100%. SANDY-SILTY CLAYSTONE: light gray (N 7/0) to moderate reddish orange (10 R 6/6); trace calcite; dry to damp.	
			TOTAL DEPTH: 17.00'	

STATE PLANE COORDINATE:	TOTAL DEPTH (FT): 17	GROUND ELEVATION (FT): 5981.96	PROJECT NUMBER: 667.11	LOG OF BORING NUMBER:
NORTH: 748947	AREA: 903 PAD	CASING DIAMETER (IN): 2 ID	GEOLOGIST: TSD/DCB	10-87
EAST: 2085289	LOCATOR NUMBER: M8	BOREHOLE DIAMETER (IN): 7.5	DATE DRILLED: 06/15/87	
REMARKS: Hollow Stem Auger.				



UNIFIED SOILS CLASSIFICATION OR ROCK TYPE	DESCRIPTION
NO SAMPLE:	
GC:	Same as above.
SILTY SANDSTONE:	Top of Bedrock Very weathered, fine to very fine, white (N9) and dark yellowish orange (10YR 6/6), some calcareous mineralization and black (carbonaceous?) mineralization, some horizontal bedding 3 - <1 mm. thick.
SILTY SANDSTONE:	Same as above.
SILTY SANDSTONE:	Same as above with decreasing amounts of staining and calcareous mineralization with depth. NOTE: Interval blocks from 15' to 17' appear to be reversed based on color gradation between 15' - 17' int. and 13' to 15' interval. NOTE: No water encountered while drilling.

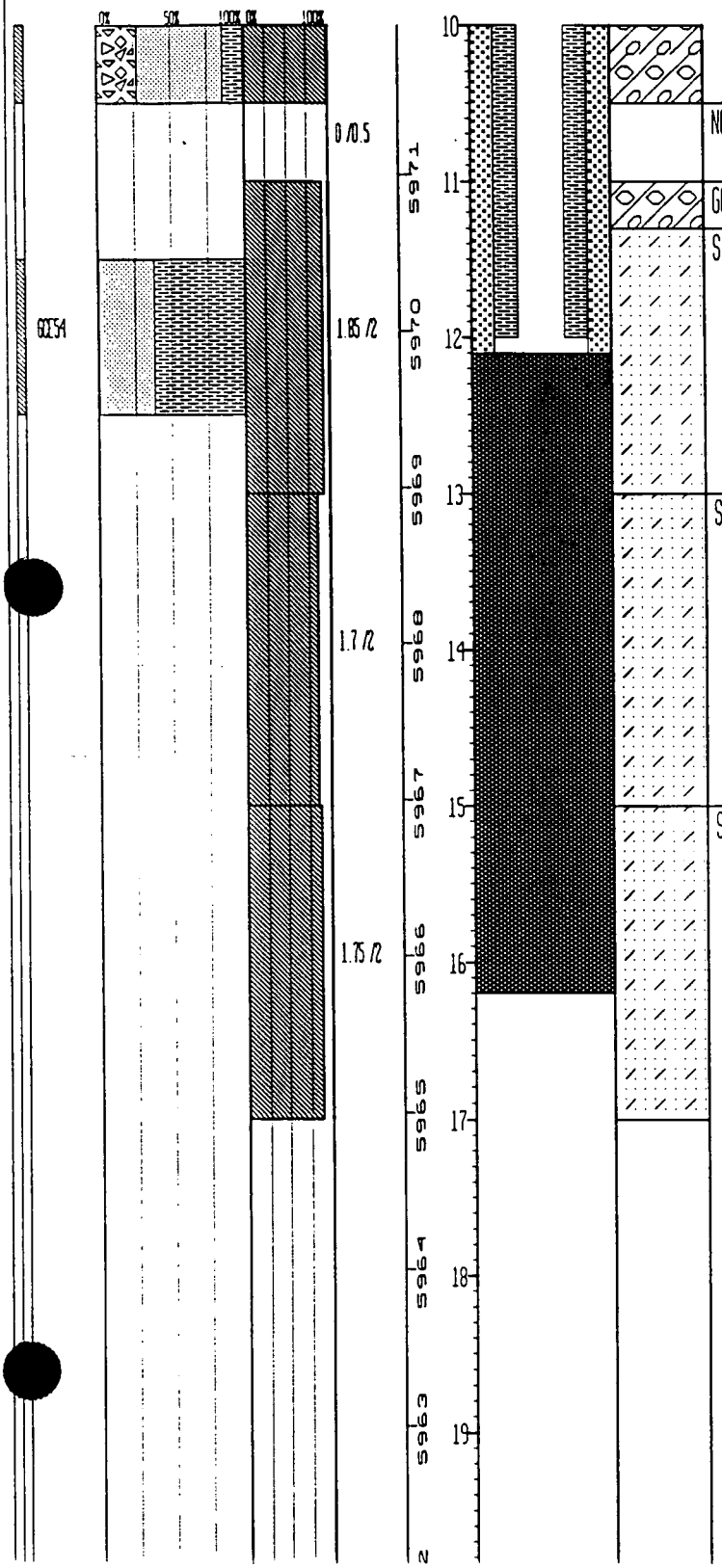
STATE PLANE COORDINATE:	TOTAL DEPTH (FT): 17	GROUND ELEVATION (FT): 5981.96	PROJECT NUMBER: 567 11	LOG OF BORING NUMBER:
NORTH: 748947	AREA: 903 PAD	CASING DIAMETER (IN): 2 ID	GEOLOGIST: TSD/DCB	10-87
EAST: 2085289	LOCATOR NUMBER: M8	BOREHOLE DIAMETER (IN): 7.5	DATE DRILLED: 06/15/87	

REMARKS: Hollow Stem Auger.

CHEMICAL SAMPLE DEPTH / GRADATIONAL SAMPLE DEPTH	SAMPLE NUMBER	SAMPLE GRAIN SIZE (0% 50% 100%)	PERCENT RECOVERY (0% 100%)	RECOVERY/INTERVAL	DATUM (FT)	DEPTH (FT)	WELL OR PIEZOMETER CONSTRUCTION	LITHOLOGY	UNIFIED SOILS CLASSIFICATION OR ROCK TYPE	DESCRIPTION
				0 /0.5	5971	10			NO SAMPLE:	
						11			GC:	Same as above.
	6054			1.85 /2	5970	12			SILTY SANDSTONE:	Top of Bedrock Very weathered, fine to very fine, white (N9) and dark yellowish orange (10YR 6/6), some calcareous mineralization and black (carbonaceous?) mineralization, some horizontal bedding 3 - <1 mm. thick.
				1.7 /2	5969	13			SILTY SANDSTONE:	Same as above.
				1.75 /2	5968	14				
					5967	15			SILTY SANDSTONE:	Same as above with decreasing amounts of staining and calcareous mineralization with depth. NOTE: Interval blocks from 15' to 17' appear to be reversed based on color gradation between 15' - 17' int. and 13' to 15' interval. NOTE: No water encountered while drilling.
					5966	16				
					5965	17				
					5964	18				
					5963	19				

STATE PLANE COORDINATE:		TOTAL DEPTH (FT): 17	GROUND ELEVATION (FT):	5981.96	PROJECT NUMBER:	667 11	LOG OF BORING NUMBER:
NORTH:	748947	AREA: 903 PAD	CASING DIAMETER (IN):	2 ID	GEOLOGIST:	FSD/DCB	10-87
EAST:	2085289	LOCATOR NUMBER: M8	BOREHOLE DIAMETER (IN):	7.5	DATE DRILLED:	06/15/87	
REMARKS: Hollow Stem Auger.							

CHEMICAL SAMPLE OR GRADATIONAL SAMPLE | SAMPLE NUMBER | SAMPLE GRAIN SIZE (0% 50% 100%) | PERCENT RECOVERY (0% 100%) | RECOVERY/INTERVAL | DATUM (FT) | DEPTH (FT) | WELL OR PIEZOMETER CONSTRUCTION | LITHOLOGY | UNIFIED SOILS CLASSIFICATION OR ROCK TYPE | DESCRIPTION



NO SAMPLE:

GC: Same as above.

SILTY SANDSTONE: Top of Bedrock
Very weathered, fine to very fine, white (N9) and dark yellowish orange (10YR 6/6), some calcareous mineralization and black (carbonaceous?) mineralization, some horizontal bedding 3 - <1 mm. thick.

SILTY SANDSTONE: Same as above.

SILTY SANDSTONE: Same as above with decreasing amounts of staining and calcareous mineralization with depth. NOTE: Interval blocks from 15' to 17' appear to be reversed based on color gradation between 15' - 17' int. and 13' to 15' interval.

NOTE: No water encountered while drilling.

STATE PLANE COORDINATE:	TOTAL DEPTH (FT): 17	GROUND ELEVATION (FT):	5981.96	PROJECT NUMBER:	667.11
NORTH: 748947	AREA: 903 PAD	CASING DIAMETER (IN):	2 ID	GEOLOGIST:	TSD/DCB
EAST: 2085289	LOCATOR NUMBER: M8	BOREHOLE DIAMETER (IN):	7.5	DATE DRILLED:	06/15/87

REMARKS: Hollow Stem Auger.

LOG OF BORING NUMBER: 10-87

CHEMICAL SAMPLE DEPTH / GRADATIONAL SAMPLE DEPTH	SAMPLE NUMBER	SAMPLE GRAIN SIZE (0% 50% 100%)	PERCENT RECOVERY (0% 100%)	RECOVERY/INTERVAL	DATUM (FT)	DEPTH (FT)	WELL OR PIEZOMETER CONSTRUCTION	LITHOLOGY	UNIFIED SOILS CLASSIFICATION OR ROCK TYPE	DESCRIPTION
				0 /0.5	5971	10				NO SAMPLE:
						11			GC:	Same as above.
	60154			1.85 /2	5970	12			SILTY SANDSTONE:	Top of Bedrock Very weathered, fine to very fine, white (N9) and dark yellowish orange (10YR 6/6), some calcareous mineralization and black (carbonaceous?) mineralization, some horizontal bedding 3 - <1 mm. thick.
					5969	13			SILTY SANDSTONE:	Same as above.
				1.7 /2	5968	14				
					5967	15			SILTY SANDSTONE:	Same as above with decreasing amounts of staining and calcareous mineralization with depth. NOTE: Interval blocks from 15' to 17' appear to be reversed based on color gradation between 15' - 17' int. and 13' to 15' interval. NOTE: No water encountered while drilling.
				1.75 /2	5966	16				
					5965	17				
					5964	18				
					5963	19				

STATE PLANE COORDINATE:	TOTAL DEPTH (FT): 17	GROUND ELEVATION (FT): 5981.96	PROJECT NUMBER: 667.11	LOG OF BORING NUMBER:
NORTH: 749947	AREA: 903 PAD	CASING DIAMETER (IN): 2 ID	GEOLOGIST: TSD/DCB	10-87
EAST: 2085289	LOCATOR NUMBER: M8	BOREHOLE DIAMETER (IN): 7.5	DATE DRILLED: 06/15/87	

REMARKS: Hollow Stem Auger.

CRITICAL SAMPLE DEPTH / GRADATIONAL SAMPLE	SAMPLE NUMBER	SAMPLE GRAIN SIZE (0% 50% 100%)	PERCENT RECOVERY (0% 100%)	RECOVERY/INTERVAL	DATUM (FT)	DEPTH (FT)	WELL OR PIEZOMETER CONSTRUCTION	LITHOLOGY	UNIFIED SOILS CLASSIFICATION OR ROCK TYPE	DESCRIPTION
				0 /0.5	5971	11			NO SAMPLE:	
									GC:	Same as above.
	60154			1.85 /2	5970	12			SILTY SANDSTONE:	Top of Bedrock Very weathered, fine to very fine, white (N9) and dark yellowish orange (10YR 6/6), some calcareous mineralization and black (carbonaceous?) mineralization, some horizontal bedding 3 - <1 mm. thick.
				1.7 /2	5969	13			SILTY SANDSTONE:	Same as above.
				1.75 /2	5968	14			SILTY SANDSTONE:	Same as above with decreasing amounts of staining and calcareous mineralization with depth. NOTE: Interval blocks from 15' to 17' appear to be reversed based on color gradation between 15' - 17' int. and 13' to 15' interval. NOTE: No water encountered while drilling.
					5967	15				
					5966	16				
					5965	17				
					5964	18				
					5963	19				

INDEX OF DATA

Boring No.: SP11-87

Completed as well? No

Data in File

X Log of Borehole

____ Well Construction Summaries

____ Well Development Summaries

____ Hydraulic Conductivity Test Data and Results

____ Packer Test Data and Results

____ Water Level Data

____ Saturated Thickness Hydrographs

LOG OF BOREHOLE

Location Rocky Flats Plant; Solar Ponds Area
Coordinates * N 38590 E 21342
Total Depth 34.0'

Borehole/Well No. SP11-87
Ground Surface Elevation *5904.5'
Water Level Encountered None
Static

Drilling Company Boyles Bros.
Date Drilled November 3-5, 1987
Drilling Method Hollow Stem Auger
Logged By R. Trear
Geologist

Driller T. High
Helper B. Keeney
Drilling Fluid None
Checked By
Site Manager

CEARP Manager

Comments Borehole backfilled with Portland Type I Cement.
*Coordinates and elevation estimated from topographic map.

Depth Feet	Graphic Log	Sample Type	Lithologic Description	Samples Collected o Other Tests Perform
0			**ARTIFICIAL FILL/DISTURBED**	
			0.0-1.5' SAMPLE. Recovered 1.5/1.5' = 100%. 0.0-0.3': SANDY CLAY: dusky brown (5 Y 2/2); low plastic; roots; fill; light moist. 0.3-1.5': CLAY: dark yellowish orange (10 YR 6/6); fine-grained sand with gravel to 3.2 mm; subrounded and rounded; low plastic; sandy; gravel; moderately oxide stained; light moist.	0.0-1.5': Field screen reading: HNu = 0.0(0.0); OVA = 0.0(0.0).
5			1.5-3.5' SAMPLE. Recovered 2.0/2.0' = 100%. CLAY: mixed brown and severely oxide stained; much noted claystone fragments and some sandstone particles; fine-grained sand; weakly cemented; fill; moist.	1.5-3.5': Field screen reading: HNu = 0.0(0.0); OVA = 0.0(0.0).
				3.5-6.3': Field screen reading: HNu = 0.0(0.0); OVA = 0.0(0.0).
				0.0-8.5': Composite sample: SP11870008.
			3.5-6.3' SAMPLE. Recovered 3.2/2.8' = 114%. SANDY CLAYSTONE: mixed oxide stained brown; gravel; weakly cemented; low plastic; 1.75 mm fragment of asphalt noted at approximately 5.5'.	6.3-8.5': Field screen readings: HNu = 0.0(0.0); OVA = 0.0(0.0).
10			6.3-8.8' SAMPLE. Recovered 2.2/2.5' = 88%. CLAY: oxide stained brown to light gray and dark brown; claystone fragments; sandy to very sandy; fine-grained; weakly cemented; massive; very moist.	8.8-11.3': Readings on core: HNu = 0; OVA = 13.5.
				8.8-11.3': Direct hit sample: SP118708DH.
			8.8-11.5' SAMPLE. Recovered 2.5/2.7' = 93%. CLAY: brown to dusky brown (5 YR 2/2); claystone fragments; very much clay; few roots noted; slightly sandy; small and medium size scattered gravel; weakly cemented; low to medium plastic lenses; very moist.	11.5-14.0': Readings on core: HNu = 0; OVA = 95.
15				11.5-14.0': Direct hit sample: SP118711DH.
			11.5-14.0' SAMPLE. Recovered 2.5/2.5' = 100%. CLAY: dark gray (N 4/0) to dark gray (N 3/0); claystone fragments and clay with occasional gravel; varying gravel, rounded (1.75-2.50 mm); medium plastic; moderately to weakly cemented; moist to very moist at bottom.	
20				

LOG OF BOREHOLE

Location Rocky Flats Plant; Solar Ponds Area

Borehole/Well No. SP11-87(cont'd.)

Coordinates

Ground Surface Elevation

Total Depth

Water Level Encountered

Static

Drilling Company

Driller

Date Drilled

Helper

Drilling Method

Drilling Fluid

Logged By

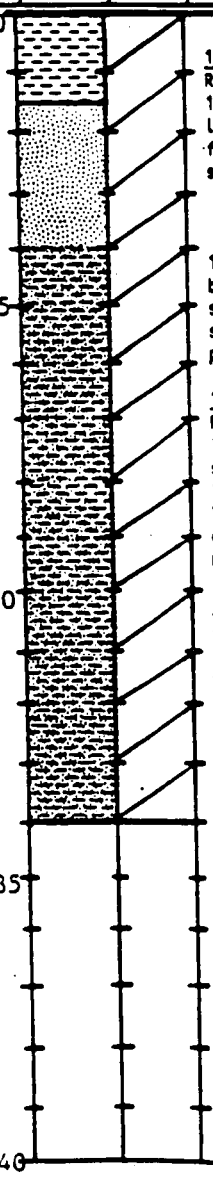
Geologist

Checked By

Site Manager

CEARP Manager

Comments

Depth Feet	Graphic Log	Sample Type	Lithologic Description	Samples Collected & Other Tests Perform
20 25 30 35 40			14.0-16.5' SAMPLE. Recovered 1.1/2.5' = 44%. 14.0-14.5': CLAY: medium dark gray (N 4/0) to light gray (N 7/0) with some brown; claystone fragments; scattered gravel; slightly oxide stained; weakly cemented; highly plastic; moist. COLLUVIUM 14.5-15.1': CLAY: grayish black (N 2/0) to brownish black (5 YR 2/2); scattered gravel; subrounded and subangular to 2.75 mm; slightly sandy; fine-grained; slightly organic; low plastic; moist. 16.5-19.0' SAMPLE. Recovered 1.3/2.5' = 52%. 16.5-17.0': CLAY: brownish black (5 YR 2/2); scattered gravel; same as above. 17.0-17.8': CLAY: moderate yellowish brown (10 YR 5/4) to grayish brown (5 YR 3/2); moderately cemented; medium plastic; slightly sandy and moist. 19.0-21.5' SAMPLE. Recovered 0.5/2.5' = 20%. CLAY: mixed brown and gray; medium plastic; moderately cemented; slightly sandy; very fine-grained; little scattered gravel; moist. ARAPAHOE FORMATION 21.5-24.0' SAMPLE. Recovered 2.5/2.5' = 100%. SANDSTONE: medium light gray (N 6/0) to medium dark gray (N 4/0); moderately oxide stained brown; low plastic; fine-grained sand (3.0-2.5 Ø); poorly sorted; somewhat blocky and moist. 24.0-26.5' SAMPLE. Recovered 2.5/2.5' = 100%. CLAYEY SANDSTONE: noted lignite fragments; gray as noted above; slightly to moderately oxide stained streaks; blocky; massive; low plastic; weakly cemented; fine-grained sand; moist.	14.0-15.1': Readings on core: HNu = 0; OVA = 95. 14.0-15.1': Direct hit sample: SP1187140H. 16.5-17.8': Readings on core: HNu = 0; OVA = 76. 16.5-17.8': Direct hit sample: SP1187160H. 19.0-19.5': Readings on core: HNu = 0; OVA = 310. 19.0-19.5': Direct hit/upper contact sample: SP1187190H. 21.5': Readings in augers: HNu = 0; OVA = 210. 21.5-24.0': Readings on core: HNu = 1.5; OVA = 98. 21.5-24.0': Direct hit/contact sample: SP1187210H. 24.0-26.5': Readings on core: HNu = 0; OVA = 58. 24.0-26.5': Direct hit/bedrock sample: SP1187240H.

LOG OF BOREHOLE

Location Rocky Flats Plant; Solar Ponds Area

Borehole/Well No. SP11-87 (cont'd.)

Coordinates _____

Ground Surface Elevation _____

Total Depth _____

Water Level Encountered _____

Static _____

Drilling Company _____

Driller _____

Date Drilled _____

Helper _____

Drilling Method _____

Drilling Fluid _____

Logged By _____ Geologist

Checked By _____ Site Manager

_____ CEARP Manager

Comments _____

Depth Feet	Graphic Log	Sample Type	Lithologic Description	Samples Collected o Other Tests Perform
			26.5-29.0' SAMPLE. Recovered 2.5/2.5' = 100%. CLAYEY SANDSTONE: medium dark gray (N 4/0) to dark gray (N 3/0); severely oxide stained brown streaks; low plastic; massive; somewhat blocky; moist. 29.0-31.5' SAMPLE. Recovered 2.5/2.5' = 100%. CLAYEY SANDSTONE: medium dark gray (N 4/0) with slight oxide staining; lignite particles scattered about; fine-grained sand (3.0-2.5 ϕ); low plastic; massive; weakly to moderately cemented; moist. 31.5-34.0' SAMPLE. Recovered 2.5/2.5' = 100%. SANDSTONE/CLAYSTONE INTERBEDDED: dark gray (N 3/0) varying to medium gray (N 5/0) with slight to moderate oxide stained lenses of light brown (5 YR 5/6); fine-grained sand (3.0-2.5 ϕ); massive claystone; low to medium plastic; blocky; poorly sorted sand; moist to light moist at bottom. TOTAL DEPTH: 34.0'	26.5-29.0': Readings on core: HNu = 0; OVA = 38. 26.5-29.0': Direct hi sample: SP1187260H. 29.0': Readings in augers: HNu = 0; OVA = 220. 29.0-31.5': Direct hit sample: SP1187290H. 29.0-31.5': Readings in core: HNu = 0; OVA = 11.5. 31.5-34.0': Field screen readings: HNu = 0(0); OVA = 0(0).

LOG OF BORING NO. SP11-87

GEOLOGIST(S): LAA
DATE: 5/10/89

PROJECT NO: 6607-1122

TOP/BOTTOM OF CORE IN BOX	TOP/BOTTOM OF INTERVAL	FEET OF CORE IN INTERVAL IN BOX	SAMPLE NUMBER	FRACTURE ANGLE	BEDDING ANGLE	GRAIN SIZE DISTRIBUTION	USCS SYMBOL	DEPTH IN FEET	LITHOLOGIC LOG	LITHOLOGIC DESCRIPTION
0 0 ↓	0.0 to 1.5	.6 (1)				Clay 75%	CL	1		Clay. Dusky yellow (5y 6/4). Slightly silty, trace sand. Est. plasticity med to high. Surficial grass + root material present.
	1.5 to 3.5	1.1 (1)				Clay 75%	CL	2, 3		Silty clay. yellowish gray (5y 8/1) to grayish orange (10yr 7/4) mottled. Est. plasticity slightly calcareous. Trace surficial root material.
	3.5 to 6.3	2.6 (1)				Clay 75%	CL	4, 5, 6		Same as above. Some gravel. Few lg. pieces (to 8cm.). Subrounded. Trace carb. material. Very slightly calcareous.
Box 1 of 3	6.3 to 8.3	2.5 (1)				Clay 75%	CL	7, 8		Sandy Gravelly Clay. Yellowish gray to dk yellowish orange. (10yr 6/6). Mottled. Est. plast. moderate. Some Calcareous + carb. material. Sand - v.f.g. to coarse. Gravel to 4cm.
↑ 9.3	8.3 to 9.3					Clay 75%	CL	9		Same as above
9.3 ↓	9.3 to 9.5									See next page for description.

NOTES: General USCS is modified for this log as follows:
Material amounts are estimated by % volume instead of % weight.
(1) Badly broken core, accurate footage measurements not possible.
(2) Core breaks cannot be matched, accurate footage measurements not possible.

ROCKY FLATS PLANT

FIGURE NO.

LOG OF BORING NO. SP-11-87

GEOLOGIST(S): LAA
DATE: 8/10/87

PROJECT NO: 667-1122

TOP/BOTTOM OF CORE IN BOX	TOP/BOTTOM OF INTERVAL	FEET OF CORE IN INTERVAL IN BOX	SAMPLE NUMBER	FRACTURE ANGLE	BEDDING ANGLE	GRAIN SIZE DISTRIBUTION	USCS SYMBOL	DEPTH IN FEET	LITHOLOGIC LOG	LITHOLOGIC DESCRIPTION
Box 2 of 3	9.3 to 11.5	1.0(1)				Clay >50%	~~Clay~~ CL	11		Silty clay ~~stone~~ Dk. yellowish brown. (10yr 4/2). ~~Highly fractured. Mod. to highly friable. Bedding not evident.~~ Some gravel to ≈ 2cm. Some sand v.f.g. to coarse. Slightly calcitic. Heterogeneous.
	11.5 – 14.0	2.6(1)				Clay >50%	CL	12, 13, 14		Same as above. Gravel fine to ≈ 3cm.
	14.0 – 16.5	.6(1)				Clay >50%	CL	15, 16		Same as above. Lg. some cobbles of gravel (≈ 5cm) Subangular.
	16.5 – 19.0	.8(1)				Clay >50%	CL	17, 18, 19		Same as above.
	19.0	0								

NOTES: General USCS is modified for this log as follows:
Material amounts are estimated by % volume instead of % weight.
(1) Badly broken core, accurate footage measurements not possible.
(2) Core breaks cannot be matched, accurate footage measurements not possible.

ROCKY FLATS PLANT

FIGURE NO.

LOG OF BORING NO. SP11-87

GEOLOGIST(S): LAG
DATE: 8/10/89

PROJECT NO: 6-7-122

TOP/BOTTOM OF CORE IN BOX	TOP/BOTTOM OF INTERVAL	FEET OF CORE IN INTERVAL IN BOX	SAMPLE NUMBER	FRACTURE ANGLE	BEDDING ANGLE	GRAIN SIZE DISTRIBUTION	USCS SYMBOL	DEPTH IN FEET	LITHOLOGIC LOG	LITHOLOGIC DESCRIPTION
Box 2 of 3	21.5	0						21		
	24.0	21(1)					Clay >50%	22, 23, 24		Silty claystone. Pale yellowish brown. (10yr 6/2) Highly weathered. Moderately friable Bedding not evident. Some carbonaceous material present Some iron staining
	24.6	.6(1)					Clay >50%			Same as above.
Box 3 of 3	26.5	1.5(1)					Clay >50%	25, 26		Silty Claystone. Pale brown. (5y 5/2) Highly weathered. Mod. Friable Bedding not evident but has turbated appearance on slab
	29.0	1.5(1)					Clay >50%	27, 28, 29		Same as above
	29.0 to 31.5									See next pg for description.

NOTES: General: USCS is modified for this log as follows:
Material amounts are estimated by % volume instead of % weight.
(1) Badly broken core, accurate footage measurements not possible.
(2) Core breaks cannot be matched, accurate footage measurements not possible.

ROCKY FLATS PLANT

FIGURE NO.

LOG OF BORING NO. SP11-87

GEOLOGIST(S): UAA
DATE: 8/10/89

PROJECT NO: 667-1122

TOP/BOTTOM OF CORE IN BOX	TOP/BOTTOM OF INTERVAL	FEET OF CORE IN INTERVAL IN BOX	SAMPLE NUMBER	FRACTURE ANGLE	BEDDING ANGLE	GRAIN SIZE DISTRIBUTION	USCS SYMBOL	DEPTH IN FEET	LITHOLOGIC LOG	LITHOLOGIC DESCRIPTION
	29.0	(1) 2.0				Clay >50%		31		Silty Claystone. Lt. olive gray (5y 6/1) to grayish orange (10yr 7/4). Highly weathered, Mod friable. Pillowy bedding.
	31.5							32		Same as above. Trace iron staining. Some carbonaceous material.
		2.6 (1)				Clay >50%		33		
	34.0							34		
								35		Bottom of Boxes
								36		
								37		
								38		
								39		

NOTES: General USCS is modified for this log as follows:
Material amounts are estimated by % volume instead of % weight.
(1) Badly broken core, accurate footage measurements not possible.
(2) Core breaks cannot be matched, accurate footage measurements not possible.

ROCKY FLATS PLANT

FIGURE NO.

STATE PLANE COORDINATE:	TOTAL DEPTH (FT): 34	GROUND ELEVATION (FT): 5904.5	PROJECT NUMBER: 667.11	LOG OF BORING NUMBER:
NORTH: 751585	AREA: SOLAR PONDS	CASING DIAMETER (IN): 0	GEOLOGIST: LAA	SP11-87
EAST: 2084450	LOCATOR NUMBER: L11	BOREHOLE DIAMETER (IN): 0	DATE DRILLED: 11/05/87	

REMARKS: Hollow Stem Auger. BH backfill with Portland Type I Cement. Coordinates and elevation estimated from topographic map.

CHEMICAL SAMPLE ID / GRADATIONAL SAMPLE ID	SAMPLE NUMBER	SAMPLE GRAIN SIZE (0% 50% 100%)	PERCENT RECOVERY (0% 100%)	RECOVERY/INTERVAL	DATUM (FT)	DEPTH (FT)	WELL OR PIEZOMETER CONSTRUCTION	LITHOLOGY	UNIFIED SOILS CLASSIFICATION OR ROCK TYPE	DESCRIPTION
				0.6 /1.5	5904	0			CH:	Clay - dusky yellow (5Y 6/4), slightly silty, trace sand, est. plasticity mod. to high, surficial grass and root material present.
				1.1 /2	5903	1			CL:	SILTY CLAY - yellowish gray (5Y 8/1) to grayish orange (10YR 7/4), mottled, slightly calcitic, trace surficial root material.
	SP11870008			2.6 /2.8	5902	2			CL:	Same as above, some gravel, few lg. pieces (to 8 cm.), sub-rounded, trace carb. material, very slightly calcareous.
				2.5 /2.5	5901	3			CL:	SANDY GRAVELLY CLAY - yellowish gray to dk. yellowish orange (10YR 6/6), mottled, est. plast. moderate, some calcareous and carb. material, sand VFG to coarse, gravel to 4 cm.
				0.5 /0.5	5900	4			CL:	Same as above.
					5899	5			CL:	SILTY CLAY - dk. yellowish brown (10YR 4/2), mod. plasticity, some gravel to approx. 2 cm., some sand VFG to coarse, slightly calcitic, heterogenous.
					5898	6				
					5897	7				
					5896	8				
					5895	9				
						10				

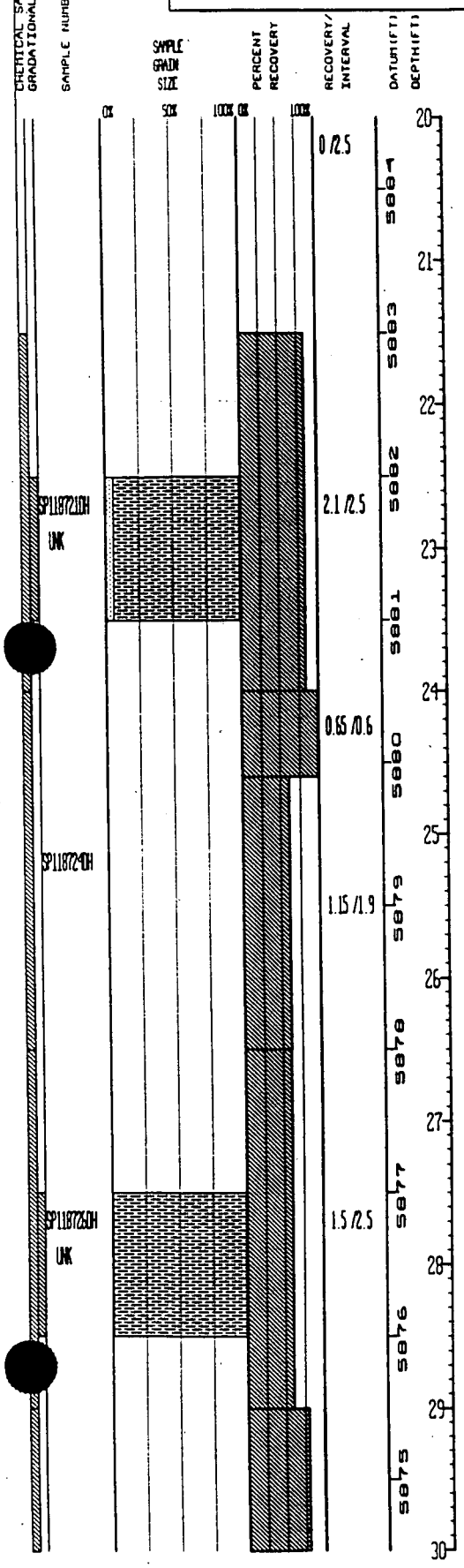
STATE PLANE COORDINATE:		TOTAL DEPTH (FT): 34	GROUND ELEVATION (FT):	5904.5	PROJECT NUMBER:	667.11	LOG OF BORING NUMBER:
NORTH:	751585	AREA: SOLAR PONDS	CASING DIAMETER (IN):	0	GEOLOGIST:	LAA	SP11-07
EAST:	2084450	LOCATOR NUMBER: L11	BOREHOLE DIAMETER (IN):	0	DATE DRILLED:	11/05/87	

REMARKS: Hollow Stem Auger. BH backfill with Portland Type I Cement. Coordinates and elevation estimated from topographic map.

CHEMICAL SAMPLE DEPTH / GRADATIONAL SAMPLE DEPTH / SAMPLE NUMBER	SAMPLE GRAIN SIZE	PERCENT RECOVERY	RECOVERY/INTERVAL	DATUM (FT)	DEPTH (FT)	WELL OR PIEZOMETER CONSTRUCTION	LITHOLOGY	UNIFIED SOILS CLASSIFICATION OR ROCK TYPE	DESCRIPTION
SP11870BOH	0% 50% 100%	0% 100%	1/2.2	5894	10				
				5893	11			CL:	Same as above, gravel fine to approx. 3 cm.
SP11871LOH			2.6/2.5	5892	12				
				5891	13				
SP11871-0H			0.6/2.5	5890	14			CL:	Same as above, some lg. cobbles of gravel (approx. 5 cm.), sub-angular.
				5889	15				
SP11871-5OH			0.8/2.5	5888	16			CL:	Same as above.
				5887	17				
SP11871-9OH				5886	18				
				5885	19			NO SAMPLE:	
					20				

STATE PLANE COORDINATE:		TOTAL DEPTH (FT): 34	GROUND ELEVATION (FT):	5904.5	PROJECT NUMBER:	667.11	LOG OF BORING NUMBER:
NORTH:	751585	AREA: SOLAR PONDS	CASING DIAMETER (IN):	0	GEOLOGIST:	LAA	SP11-87
EAST:	2084450	LOCATOR NUMBER: L11	BOREHOLE DIAMETER (IN):	0	DATE DRILLED:	11/05/87	

REMARKS: Hollow Stem Auger. BH backfill with Portland Type I Cement. Coordinates and elevation estimated from topographic map.



SILTY CLAYSTONE:	Top of Bedrock. Pale yellowish brown (10YR 6/2), highly weathered, moderately friable, bedding not evident, some carbonaceous material present, some iron staining.
SILTY CLAYSTONE:	Same as above.
SILTY CLAYSTONE:	Pale brown (5YR 5/2), highly weathered, mod. friable, bedding not evident but has turbated appearance on slab.
SILTY CLAYSTONE:	Same as above.
SILTY CLAYSTONE:	Lt. olive gray (5Y 6/1) to grayish orange (10YR 7/4), highly weathered, mod. friable, pillowy bedding.

STATE PLANE COORDINATE:		TOTAL DEPTH (FT): 34	GROUND ELEVATION (FT):	5904.5	PROJECT NUMBER:	667.11	LOG OF BORING NUMBER:
NORTH:	751585	AREA: SOLAR PONDS	CASING DIAMETER (IN):	0	GEOLOGIST:	LAA	SP11-07
EAST:	2084450	LOCATOR NUMBER: L11	BOREHOLE DIAMETER (IN):	0	DATE DRILLED:	11/05/87	

REMARKS: Hollow Stem Auger. BH backfill with Portland Type I Cement. Coordinates and elevation estimated from topographic map.

CHEMICAL SAMPLE DEPTH / GRADATIONAL SAMPLE DEPTH	SAMPLE NUMBER	SAMPLE GRAIN SIZE (0% 50% 100%)	PERCENT RECOVERY (0% 100%)	RECOVERY/INTERVAL	DATUM (FT)	DEPTH (FT)	WELL OR PIEZOMETER CONSTRUCTION	LITHOLOGY	UNIFIED SOILS CLASSIFICATION OR ROCK TYPE	DESCRIPTION
	SP11872SDH			2/2.5	5874	30				
					5873	31				
				2.6/2.5	5872	32				SILTY CLAYSTONE: Same as above, trace iron staining, some carbonaceous material. NOTE: No water encountered while drilling.
					5871	33				
					5870	34				
					5869	35				
					5868	36				
					5867	37				
					5866	38				
					5865	39				
						40				

INDEX OF DATA

Boring No.: 15-87/BH30-87

Completed as well? Yes

Data in File

x Log of Borehole

x Well Construction Summaries

____ Well Development Summaries

____ Hydraulic Conductivity Test Data and Results

____ Packer Test Data and Results

x Water Level Data

WELL COMPLETION INFORMATION

Location Rocky Flats Plant: 903 Pad Area

Well No. 15-87/BH30-87

Coordinates N 36020.14 E 23139.88

Elevation: Ground Surface 5970.89'

Total Depth: Well 22.53'

Top of Casing 5972.99'

Borehole 27.05'

Formation of Completion Rocky Flats Alluvium

Casing Material Sch 5, type 316 TFJ stainless steel

Casing Diameter 2" ID

Screen Material 0.010" wire wrap, type 316 TFJ stainless steel

Surface Casing Diameter 5" ID

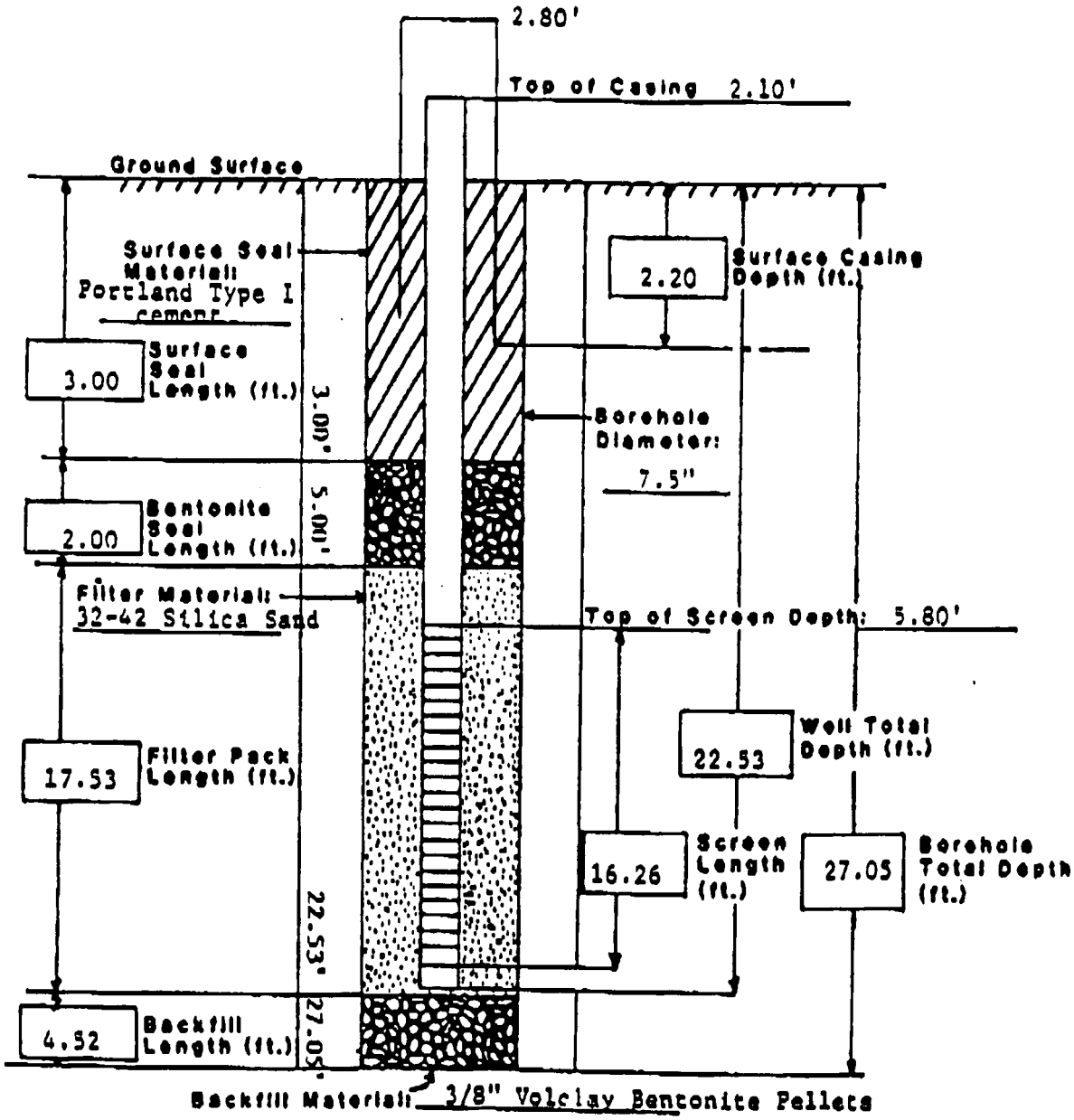
Date Installed June 17, 1987

Approved By [signature]
Site Manager

Installed By K.D. Holliway
Geologist

[signature]
CERAP Manager

Comments Water encountered in a sandy gravel at 20.0'. Water level in well 6/17/87 = 22.9'.



LOG OF BOREHOLE

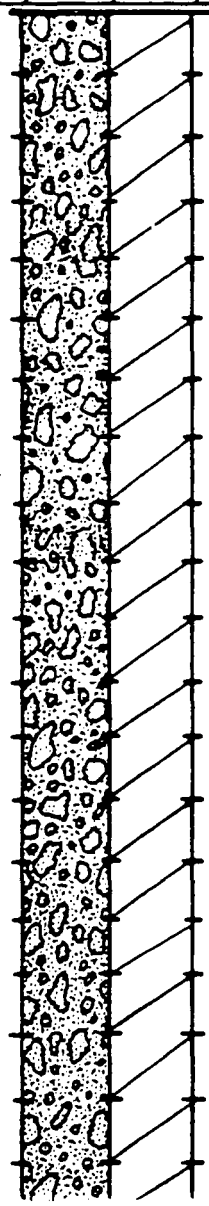
Location: Rocky Flats Plant: 903 Pad Area
Coordinates: N 36020.14 E 23139.88
Total Depth: 27.00'

Borehole/Well No.: 15-87/BH30-87
Ground Surface Elevation: 5970.89'
Water Level Encountered: 20.00'
Static: 5952.44' (12/01/87)

Drilling Company: Bovles Bros
Date Drilled: June 16, 1987
Drilling Method: Hollow Stem Auger
Logged By: K.D. Holliway
Geologist

Driller: R. Sharp
Helper: T. Merritt
Drilling Fluid: None
Checked By: [signature]
Site Manager
[signature]
CEARP Manager

Comments: Sample BH308720WT doubles as sample BH308722CT due to insufficient recovery for two samples.

Depth Feet	Graphic Log	Sample Type	Lithologic Description	Samples Collected or Other Tests Performed
0			**ROCKY FLATS ALLUVIUM** 0.0-2.0' SAMPLE. Recovered 1.1/2.0' = 55%. SANDY GRAVEL: dark yellowish brown (10 YR 4/2); quartzite pebbles and cobbles; trace clay; fine-grained sand (2.0-3.5 phi); poorly sorted; roots and grasses; dry. 2.0-3.4' SAMPLE. Recovered 1.4/1.4' = 100%. SANDY GRAVEL: moderate orange pink (5 YR 8/4); quartzite cobbles and pebbles; trace clay; fine-grained sand (2.0-1.0 phi); dry. 3.4-4.0'. No recovery. Drilled with center bit. 4.0-7.0' SAMPLE. Recovered 1.2/3.0' = 40%. SANDY GRAVEL: light brown (5 YR 5/6); quartzite cobbles and pebbles; trace clay; fine-grained sand (2.5-1.5 phi); some caliche; very pale orange (10 YR 8/2); damp to dry. 7.0-8.5' SAMPLE. Recovered 1.15/1.5' = 77%. SANDY GRAVEL: light brown (5 YR 5/6); quartzite cobbles and pebbles; trace clay; fine-grained sand (2.5-1.5 phi); dry. 8.5-9.0'. No recovery. Drilled with center bit.	HNu Background=0.2 OVA Background=0.0 No Ludlum readings. 0.0-9.0': Composite sample: BH30870010. 5.0': Field screen readings: HNu = 5.0-15.0; OVA = 0.1. 9.0-10.35': Waste sample: BH308710WS. 10.0': Field screen readings: HNu = 5.0-15.0; OVA = 0.1. 11.5-17.15': Composite sample: BH30871020. 15.0': Field screen readings: HNu = 10.0; OVA = 0.1. 20.0': Field screen readings: HNu = 2.0; OVA = 0.2.
5				
10				
15				
20				

LOG OF BOREHOLE

Location Rocky Flats Plant: 903 Pad Area
Coordinates N 36020.14 E 23139.88
Total Depth 27.00'

Borehole/Well No. 15-87/BH30-87
Ground Surface Elevation 5970.89'
Water Level Encountered 20.00'
Static 5952.44' (12/01/87)

Drilling Company Boyles Bros
Date Drilled June 16, 1987
Drilling Method Hollow Stem Auger
Logged By K.D. Holliway
Geologist

Driller R. Sharp
Helper T. Merritt
Drilling Fluid None
Checked By J. Pacelle
Site Manager

CEARP Manager

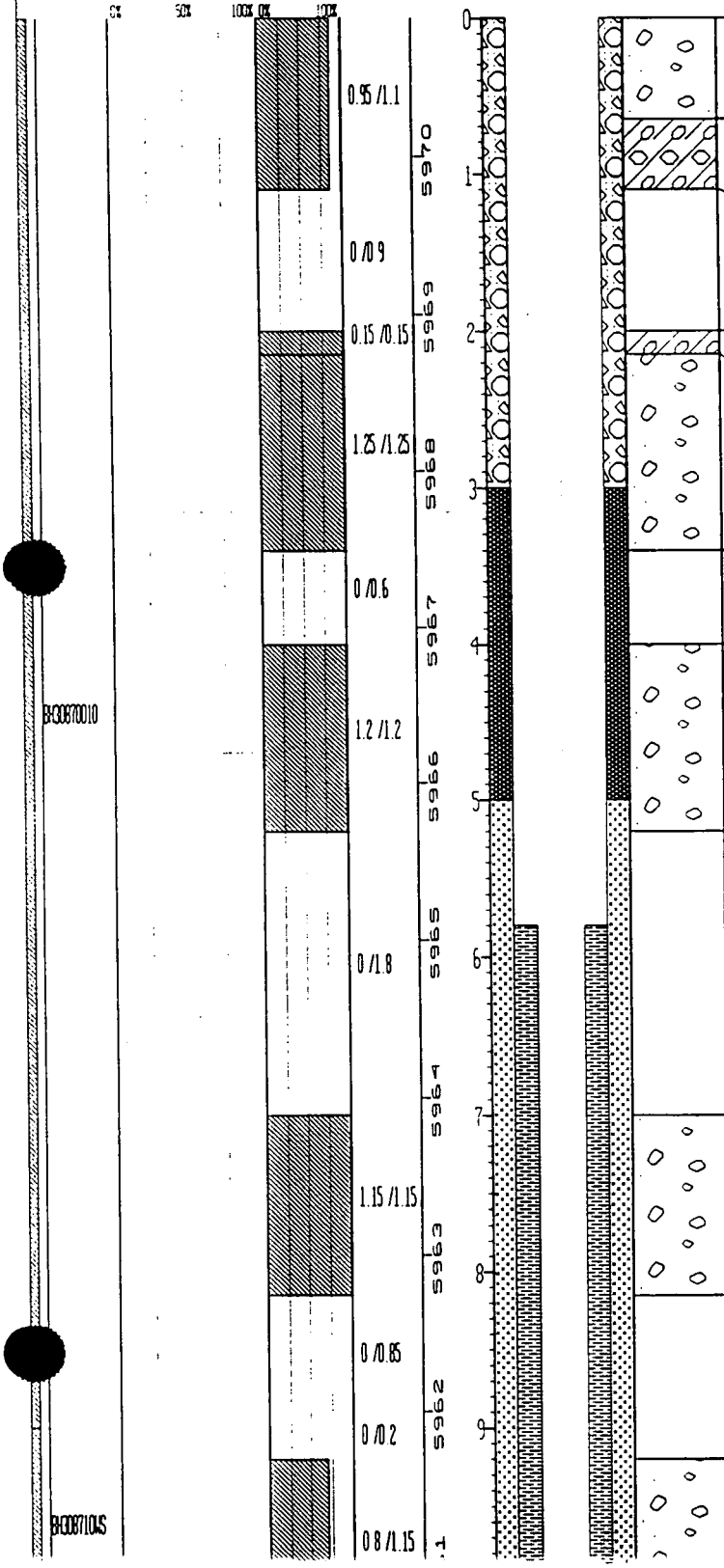
Comments Sample BH308720WT doubles as sample BH308722CT due to insufficient recovery for two samples.

Depth Feet	Graphic Log	Sample Type	Lithologic Description	Samples Collected or Other Tests Performed
20			9.0-11.5' SAMPLE. Recovered 1.35/2.5' = 54%. SANDY GRAVEL: same as above; dry.	20.0-20.8': Water table sample: BH308720WT.
			11.5-14.0' SAMPLE. Recovered 1.2/2.5' = 48%. SANDY GRAVEL: same as above; damp.	
25			14.0-16.0' SAMPLE. Recovered 0.7/2.0' = 35%. SANDY GRAVEL: same as above; damp.	24.5-25.2': Bedrock sample: BH308725BR.
			16.0-20.0' SAMPLE. Recovered 1.15/4.0' = 29%. SANDY GRAVEL: light brown (5 YR 5/6) to grayish orange (10 YR 7/4) in sand zone 16.80-17.10'; coarse to fine-grained sand (0.5-3.0 phi); well sorted; damp to moist.	
30			20.0-22.0' SAMPLE. Recovered 2.5/2.0' = 125%. GRAVEL: light brown (5 YR 5/6); some sand; quartzite cobbles and pebbles; wet.	
			ARAPAHOE FORMATION	
			22.0-24.5' SAMPLE. Recovered 2.2/2.5' = 88%. CLAYSTONE: light olive gray (5 Y 5/2); moderate reddish orange (10 R 6/6); iron stained patches; damp to moist.	
			24.5-27.0' SAMPLE. Recovered 2.65/2.5' = 106%. CLAYSTONE: same as above; damp to moist.	

STATE PLANE COORDINATE:		TOTAL DEPTH (FT): 27.05	GROUND ELEVATION (FT)	5970.89	PROJECT NUMBER:	667.11	LOG OF BORING NUMBER:
NORTH:	749010	AREA: 903 PAD	CASING DIAMETER (IN)	2 ID	GEOLOGIST:	DCB/GCE	15-87
EAST:	2086249	LOCATOR NUMBER: N9	BOREHOLE DIAMETER (IN)	7.5	DATE DRILLED:	06/16/87	

REMARKS: Hollow Stem Auger. Sample BH308720WT doubles as sample BH308722CT due to insufficient recovery for two samples

CHEMICAL SAMPLE DEPTH / GRADATIONAL SAMPLE / SAMPLE NUMBER / SAMPLE GRAIN SIZE / PERCENT RECOVERY / RECOVERY/INTERVAL / DATUM (FT) / DEPTH (FT) / WELL OR PIEZOMETER CONSTRUCTION / LITHOLOGY / UNIFIED SOILS CLASSIFICATION OR ROCK TYPE / DESCRIPTION



UNIFIED SOILS CLASSIFICATION OR ROCK TYPE	DESCRIPTION
GP:	GRAVEL - black (N1) to white (N9), sub-angular to rounded, poorly graded, some sand and silt, plant detritus at top of interval
GC:	Clayey Gravel, very light gray (N8), angular, poorly graded, some silt, clay fraction (5YR 3/2).
NO SAMPLE	
GC:	As above. Lower portion of interval.
GP:	Gravel in Caliche Matrix - light gray (N7), angular, poorly graded, caliche matrix is very pale orange (10YR 8/2).
NO SAMPLE	
GP:	As above, interval 2.15 to 3.4, with increase in max. gravel size to 7 cm
NO SAMPLE	
GP:	SANDY GRAVEL - medium light gray (N6), angular to sub-angular, poor to moderate grading, some clay.
NO SAMPLE	
NO SAMPLE	
GP:	GRAVEL - med. gray (N5), sub-angular to sub-rounded, poorly graded.

STATE PLANE COORDINATE		TOTAL DEPTH (FT): 27 05	GROUND ELEVATION (FT)	5970 89	PROJECT NUMBER	667 11	LOG OF BORING NUMBER
NORTH:	749010	AREA: 903 PAD	CASING DIAMETER (IN)	2 ID	GEOLOGIST	DCB/GCE	15-87
EAST:	2086249	LOCATOR NUMBER: N9	BOREHOLE DIAMETER (IN):	7 5	DATE DRILLED	06/16/87	

REMARKS: Hollow Stem Auger. Sample BH008720WT doubles as sample BH008722CT due to insufficient recovery for two samples

CHEMICAL SAMPLE DEPTH / GRADATIONAL SAMPLE DEPTH	SAMPLE NUMBER	SAMPLE GRAIN SIZE (0% 50% 100%)	PERCENT RECOVERY (0% 100%)	RECOVERY/INTERVAL	DATUM (FT)	DEPTH (FT)	WELL OR PIEZOMETER CONSTRUCTION	LITHOLOGY	UNIFIED SOILS CLASSIFICATION OR ROCK TYPE	DESCRIPTION
						10				
				0 /1.15	5960	11				NO SAMPLE
				0 85 /1.2	5959	12			GW:	SANDY GRAVEL - medium light gray (N6), sub-angular to sub-rounded, well graded, trace of silt
				0 /1.3	5958	13				NO SAMPLE
	BH008710D			0 4 /0 7	5957	14			GP:	GRAVEL - light gray (N7), angular to sub-rounded, moderately graded, trace of sand and silt
				0 /1.3	5956	15				NO SAMPLE
				0 85 /1.15	5955	16			GP:	Same as above (reference interval 14 0 to 14 7)
				0 /2.85	5954	17				NO SAMPLE
					5953	18				
					5952	19				
							06/16/87			

STATE PLANE COORDINATE		TOTAL DEPTH (FT) 27 05	GROUND ELEVATION (FT)	5970 89	PROJECT NUMBER:	667 11	LOG OF BORING NUMBER
NORTH:	749010	AREA: 903 PAD	CASING DIAMETER (IN)	2 ID	GEOLOGIST:	DCB/GCE	15-87
EAST:	2086249	LOCATOR NUMBER: N9	BOREHOLE DIAMETER (IN)	7 5	DATE DRILLED	06/16/87	

REMARKS: Hollow Stem Auger. Sample BH308720WT doubles as sample BH308722CT due to insufficient recovery for two samples

CHEMICAL SAMPLE DEPTH / GRADATIONAL SAMPLE DEPTH	SAMPLE NUMBER	SAMPLE GRAIN SIZE	PERCENT RECOVERY	RECOVERY/ INTERVAL	DATUM (FT)	DEPTH (FT)	WELL OR PIEZOMETER CONSTRUCTION	LITHOLOGY	UNIFIED SOILS CLASSIFICATION OR ROCK TYPE	DESCRIPTION
	BH308720WT 60221			0.85 /1.5	5950	20, 21			GW:	SANDY GRAVEL - medium gray (N5), sub-angular to sub-rounded, well graded, trace of silt
				1.2 /1	5949	22			SILTY CLAYSTONE:	Top of Bedrock Interval changes gradational to a silty claystone, very light gray (N8), moderate plasticity, trace of fine sandstone
				1.4 /2.2	5948, 5947	23, 24			SILTY CLAYSTONE:	As above, mottled coloring, pale yellowish orange (10YR 8/6) and very light gray (N8)
	BH308725BR			1.65 /2.35	5946, 5945, 5944, 5943, 5942	25, 26, 27, 28, 29			SILTY CLAYSTONE:	As above.

LOG OF BOREHOLE

Location: Rocky Flats Plant; 903 Pad Area
Coordinates: N 36139.59 E 23140.49
Total Depth: 174.00'

Borehole/Well No.: 16-87BR
Ground Surface Elevation: 5969.06'
Water Level Encountered: 20.0'
Static: 5885.51' (12/01/87)

Drilling Company: Boyles Bros
Date Drilled: June 17-18, 1987; July 6-8, 1987
Drilling Method: Hollow Stem Auger; Rotary Core
Logged By: C.J. Wood; J.B. Bergman
Geologist

Driller: N. Wheeler; P. Bushkovski
Helper: D. Jarvie ; K. Parker
Drilling Fluid: None
Checked By: Site Manager
CEARP Manager

Comments: Surface casing set to 49.17' by Craig Wood on June 18, 1987.

Depth Feet	Graphic Log	Sample Type	Lithologic Description	Samples Collected or Other Tests Performed
0			**ROCKY FLATS ALLUVIUM**	
			0.0-2.0' SAMPLE. Recovered 2.0/2.0' = 100%. SANDY GRAVELS: pale yellowish brown (10 YR 6/2); quartzite pebbles and cobbles; subrounded to subangular; some rock in upper 0.5'; dry.	HNu Background=0.0 OVA Background=0.0 No readings over background.
5			2.0-4.0' SAMPLE. Recovered 1.64/2.0' = 82%. SAND AND GRAVEL: moderate brown (5 YR 4/4); some sandy clay; quartzite pebbles and cobbles; subrounded to subangular; dry.	HNu Background= 0.2-0.8. No OVA readings. No readings over background.
10			4.0-6.0' SAMPLE. Recovered 0.95/2.0' = 47%. SANDY GRAVEL: moderate brown (5 YR 4/4); grades into caliche; dry.	
			6.0-7.0' SAMPLE. Recovered 1.45/1.0' = 145%. SAND AND CLAY: yellowish gray (5 Y 7/2) to moderate brown (5 Y 4/4); some quartzite cobbles; coarse sand; some caliche; damp.	
15			7.0-9.0' SAMPLE. Recovered 0.9/2.0' = 45%. SANDY GRAVEL: light brown (5 YR 6/4); quartzite pebbles and cobbles; subrounded to subangular; dry.	
20				

LOG OF BOREHOLE

Location: Rocky Flats Plant; 903 Pad Area
Coordinates: N 36139.59 E 23140.49
Total Depth: 174.00'

Borehole/Well No.: 16-87BR
Ground Surface Elevation: 5969.06'
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Drilling Method: Hollow Stem Auger; Rotary Core
Logged By: C.J. Wood; J.B. Berman
Geologist

Driller: N. Wheeler; P. Bushkovski
Helper: D. Jarvie; K. Parker
Drilling Fluid: None
Checked By: [signature]
Site Manager

CEARP Manager

Comments: Surface casing set to 49.17' by Craig Wood on June 18, 1987.

Depth Feet	Graphic Log	Sample Type	Lithologic Description	Samples Collected or Other Tests Performed
20			**9.0-11.0' SAMPLE.** Recovered 1.75/2.0' = 87%. SANDY GRAVEL TO SANDY CLAY: gravels moderate brown (5 YR 4/4); sand light brown (5 YR 5/6) to dark greenish gray (5 GY 4/1); iron staining streaks moderate reddish orange (10 R 6/6); trace of caliche; weathered; dry.	
25			**11.0-13.0' SAMPLE.** Recovered 2.0/2.0' = 100%. SAND: moderate reddish orange (10 R 6/6); some quartzite pebbles; trace caliche; coarse sand; weathered; damp.	
30			**13.0-15.0' SAMPLE.** Recovered 2.0/2.0' = 100%. SANDY GRAVELS: dark yellowish orange (10 YR 6/6) to grayish green (10 GY 5/2); quartzite pebbles and cobbles; damp to dry.	
35			**15.0-17.0' SAMPLE.** Recovered 2.0/2.0' = 100%. SANDY GRAVELS: moderate reddish orange (10 R 6/6); highly weathered; numerous quartzite pebbles; trace caliche; damp.	
40			**17.0-19.0' SAMPLE.** Recovered 1.7/2.0' = 85%. SAND: moderate reddish orange (10 R 6/6); weathered; numerous quartzite pebbles; damp.	

LOG OF BOREHOLE

Location: Rocky Flats Plant; 903 Pad Area
Coordinates: N 36139.59 E 23140.49
Total Depth: 174.00'

Borehole/Well No.: 16-87BR
Ground Surface Elevation: 5969.06'
Water Level Encountered: 20.0'
Static: 5885.51' (12/01/87)

Drilling Company: Boyles Bros
Date Drilled: June 17-18, 1987; July 6-8, 1987
Drilling Method: Hollow Stem Auger; Rotary Core
Logged By: C.J. Wood; J.B. Bergman
Geologist

Driller: N. Wheeler; P. Bushkovski
Helper: D. Jarvie; K. Parker
Drilling Fluid: None
Checked By: [signature]
Site Manager

CEARP Manager

Comments: Surface casing set to 49.17' by Craig Wood on June 18, 1987.

Depth Feet	Graphic Log	Sample Type	Lithologic Description	Samples Collected or Other Tests Performed
40			19.0-21.0' SAMPLE. Recovered 1.7/2.0' = 85%. SANDY GRAVEL: moderate brown (5 YR 4/4); quartzite pebbles and cobbles; wet.	
			21.0-23.0' SAMPLE. Recovered 1.6/2.0' = 80%. 21.0-21.9': SANDY GRAVEL: same as above; wet.	
45			**ARAPAHOE FORMATION**	
			21.9-22.6': CLAY: olive gray (5 Y 3/2); dry.	48.41-58.06': Packer Test Interval #23, aborted test.
			23.0-24.0' SAMPLE. Recovered 0.9/1.0' = 90%. CLAY: medium light gray (N 6/0); iron staining moderate reddish orange (10 R 6/6); wet.	
50			24.0-26.0' SAMPLE. Recovered 2.0/2.0' = 100%. CLAY: medium light gray (N 6/0) to olive gray (5 Y 3/2); moderate reddish orange (10 R 6/6); iron staining to dark reddish brown (10 R 4/6); highly weathered; damp to wet.	
55			26.0-28.0' SAMPLE. Recovered 2.0/2.0' = 100%. CLAY: olive gray (5 Y 3/2); iron staining moderate reddish orange (10 R 6/6); slightly weathered; damp.	55.90-65.55': Packer Test Interval #22. 57.90-67.55': Packer Test Interval #21, failed on 2/3 pressure test.
60				

LOG OF BOREHOLE

Location: Rocky Flats Plant; 903 Pad Area
Coordinates: N 36139.59 E 23140.49
Total Depth: 174.00'

Borehole/Well No.: 16-87BR
Ground Surface Elevation: 5969.06'
Water Level Encountered: 20.0'
Static: 5885.51' (12/01/87)

Drilling Company: Boyles Bros
Date Drilled: June 17-18, 1987; July 6-8, 1987
Drilling Method: Hollow Stem Auger; Rotary Core
Logged By: C.J. Wood; J.B. Bergman
Geologist

Driller: N. Wheeler; P. Bushkovski
Helper: D. Jarvie; K. Parker
Drilling Fluid: None
Checked By: [signature]
Site Manager

CEARP Manager

Comments: Surface casing set to 49.17' by Craig Wood on June 18, 1987.

Depth Feet	Graphic Log	Sample Type	Lithologic Description	Samples Collected or Other Tests Performed
60			28.0-29.0' SAMPLE. Recovered 1.4/1.0' = 140%. CLAY: olive gray (5 Y 3/2); iron staining moderate reddish orange (10 R 6/6); weathered; damp.	
65			29.0-30.0' SAMPLE. Recovered 1.35/1.0' = 135%. CLAY: moderate olive brown (5 Y 4/4) to olive gray (5 Y 3/2); some iron staining moderate reddish orange (10 R 6/6); damp.	
70			30.0-32.0' SAMPLE. Recovered 2.0/2.0' = 100%. CLAY: moderate reddish orange (10 R 6/6) to dark reddish brown (10 R 3/4); upper foot olive gray (5 Y 3/2), moderate reddish orange (10 R 6/6) with iron staining throughout; some dusky yellow areas (5 Y 6/4); highly weathered; wet.	67.55-77.20': Packer Test Interval #20. 69.55-79.20': Packer Test Interval #19, aborted test.
75			32.0-34.0' SAMPLE. Recovered 2.0/2.0' = 100%. CLAY: olive gray (5 Y 3/2); iron staining moderate reddish orange (10 R 6/6); weathered; wet.	
			34.0-36.0' SAMPLE. Recovered 2.0/2.0' = 100%. CLAY: same as above; wet.	
80			36.0-38.0' SAMPLE. Recovered 2.0/2.0' = 100%. CLAY: same as above; wet.	79.05-88.70': Packer Test Interval #18.

LOG OF BOREHOLE

Location: Rocky Flats Plant; 903 Pad Area
Coordinates: N 36139.59 E 23140.49
Total Depth: 174.00'

Borehole Well No.: 16-87BR
Ground Surface Elevation: 5969.06'
Water Level Encountered: 20.0'
Static: 5885.51' (12/01/87)

Drilling Company: Boyles Bros
Date Drilled: June 17-18, 1987 ; July 6-8, 1987
Drilling Method: Hollow Stem Auger ; Rotary Core
Logged By: C.J. Wood ; J.B. Bergman
Geologist

Driller: N. Wheeler ; P. Bushkovski
Helper: D. Jarvie ; K. Parker
Drilling Fluid: None
Checked By: [signature]
Site Manager

CEARP Manager

Comments: Surface casing set to 49.17' by Craig Wood on June 18, 1987.

Depth Feet	Graphic Log	Sample Type	Lithologic Description	Samples Collected or Other Tests Performed
80			38.0-40.0' SAMPLE. Recovered 2.0/2.0' = 100%. CLAY: light olive gray (5 Y 5/2); moderate reddish orange (10 R 6/6) iron staining; weathered; wet.	
			40.0-42.0' SAMPLE. Recovered 2.0/2.0' = 100%. CLAY: light olive gray (5 Y 5/2) with some olive gray (5 Y 3/2) streaks; some moderate reddish orange (10 R 6/6) iron staining; weathered; wet.	
85			42.0-44.0' SAMPLE. Recovered 2.1/2.0' = 105%. CLAY: same as above; wet.	88.70-98.35': Packer Test Interval #17.
90			44.0': Unweathered/weathered bedrock contact.	90.70-100.35': Packer Test Interval #16, aborted test.
			44.0-46.0' SAMPLE. Recovered 2.0/2.0' = 100%. CLAYSTONE: brownish black (5 YR 2/1); unweathered.	
95			46.0-48.0' SAMPLE. Recovered 2.0/2.0' = 100%. CLAYSTONE: same as above.	
			48.0-50.0' SAMPLE. Recovered 2.0/2.0' = 100%. CLAYSTONE: same as above.	
100				

LOG OF BOREHOLE

Location: Rocky Flats Plant; 903 Pad Area
Coordinates: N 36139.59 E 23140.49
Total Depth: 174.00'

Borehole/Well No.: 16-87BP
Ground Surface Elevation: 5969.06'
Water Level Encountered: 20.0'
Static: 5885.51' (12/01/87)

Drilling Company: Boyles Bros
Date Drilled: June 17-18, 1987; July 6-8, 1987
Drilling Method: Hollow Stem Auger; Rotary Core
Logged By: C.J. Wood; J.B. Bergman
Geologist

Driller: N. Wheeler; P. Bushkovski
Helper: D. Jarvie; K. Parker
Drilling Fluid: None
Checked By: A. Paschke
Site Manager

CEARP Manager

Comments: Surface casing set to 49.17' by Craig Wood on June 18, 1987.

Depth Feet	Graphic Log	Sample Type	Lithologic Description	Samples Collected or Other Tests Performed
100			48.0-51.5' SAMPLE. Recovered 2.2/3.5' = 63%. RQD = 1.4/2.2' = 64%. 48.0-49.4': CEMENT. 49.4-50.2': CLAYSTONE: olive gray (5 Y 3/2); trace moderate yellowish brown (10 YR 5/4) mottles; homogenous; consolidated; no sand; wet.	100.50-110.15': Packer Test Interval #15.
105			51.5-55.5' SAMPLE. Recovered 4.0/4.0' = 100%. RQD = 3.25/4.0' = 81%. CLAYSTONE: grayish black (N 2/0); abundant lignite stringers from 50.5-51.5'; organic rich; some sand; very fine-grained sand; dense; consolidated; dry.	109.72-119.37': Packer Test Interval #14.
110			55.5-60.0' SAMPLE. Recovered 4.5/4.5' = 100%. RQD = 3.2/4.5' = 71%. CLAYSTONE: olive gray (5 Y 3/2); trace sand bottom 0.5'; dense; homogenous; moist.	
115			60.0-65.0' SAMPLE. Recovered 1.6/5.0' = 32%. RQD = 0.5/1.6' = 31%. CLAYSTONE: olive gray (5 Y 3/2); some very fine-grained silty sand; trace organics; dense; homogenous; moist.	
120			65.0-68.0' SAMPLE. Recovered 2.95/3.0' = 98%. RQD = 2.0/2.95' = 68%. SANDY CLAYSTONE: olive gray (5 Y 3/2); trace organic fragments; sandstone at 66.1-67.1'; very fine-grained; silty; moist to dry.	119.37-129.02': Packer Test Interval #13.

LOG OF BOREHOLE

Location: Rocky Flats Plant; 903 Pad Area
Coordinates: N 36139.59 E 23140.49
Total Depth: 174.00'

Borehole Well No.: 16-87BR
Ground Surface Elevation: 5969.06'
Water Level Encountered: 20.0'
Static: 5885.51' (12/01/87)

Drilling Company: Boyles Bros
Date Drilled: June 17-18, 1987; July 6-8, 1987
Drilling Method: Hollow Stem Auger; Rotary Core
Logged By: C.J. Wood; J.B. Bergman
Geologist

Driller: N. Wheeler; P. Bushkovski
Helper: D. Jarvie; K. Parker
Drilling Fluid: None
Checked By: A.L. Parker
Site Manager

CEARP Manager

Comments: Surface casing set to 49.17' by Craig Wood on June 18, 1987.

Depth Feet	Graphic Log	Sample Type	Lithologic Description	Samples Collected or Other Tests Performed
120			68.0-72.0' SAMPLE. Recovered 3.0/4.0' = 75%. RQD = 3.0/3.0' = 100%. CLAYSTONE: olive gray (5 Y 3/2); abundant organics; consolidated; moist.	
			72.0-76.0' SAMPLE. Recovered 4.5/4.0' = 113%. RQD = 3.5/4.0' = 88%. CLAYSTONE: olive gray (5 Y 3/2); abundant organics; dense; moist. Last 1.0' grade to dusky green (5 G 3/2) claystone with no organics; silty; moist to dry.	
125				
			76.0-80.0' SAMPLE. Recovered 3.2/4.0' = 80%. RQD = 1.85/3.2' = 58%. 76.0-76.4: CLAYSTONE; olive gray (5 Y 3/2); silty; organic rich; dense; moist. 76.4-77.2: SANDSTONE/CLAYSTONE: olive gray (5 Y 3/2) and light olive gray (5 Y 5/2); interbedded medium-grained sandstone; rounded; sorted; moist. 77.2-78.6': SANDSTONE olive gray (5 Y 3/2); well sorted; rounded; medium to fine-grained; salt & pepper texture; abundant organics; moist. 78.6-79.2': SANDSTONE same as above but more clay; damp to dry.	129.02-138.67': Packer Test Interval #12. 131.02-140.67': Packer Test Interval #11; packers not sealing; aborted. 132.94-142.59': Packer Test Interval #10; failed test. 134.94-144.59': Packer Test Interval #9; failed test. 136.94-146.59': Packer Test Interval #8, aborted test.
130				
135				
			80.0-84.0' SAMPLE. Recovered 4.0/4.0' = 100%. RQD = 3.5/4.0' = 88%. CLAYSTONE: olive gray (5 Y 3/2); consolidated; organic rich; homogenous; damp.	
140				

LOG OF BOREHOLE

Location: Rocky Flats Plant; 903 Pad Area
Coordinates: N 36139.59 E 23140.49
Total Depth: 174.00'

Borehole Well No.: 16-87BR
Ground Surface Elevation: 5969.06'
Water Level Encountered: 20.0'
Static: 5885.51' (12/01/87)

Drilling Company: Boyles Bros
Date Drilled: June 17-18, 1987 ; July 6-8, 1987
Drilling Method: Hollow Stem Auger ; Rotary Core
Logged By: C.J. Wood ; J.B. Bergman
Geologist

Driller: N. Wheeler ; P. Bushkovski
Helper: D. Jarvie ; K. Parker
Drilling Fluid: None
Checked By: [signature]
Site Manager

CEARP Manager

Comments: Surface casing set to 49.17' by Craig Wood on June 18, 1987.

Depth Feet	Graphic Log	Sample Type	Lithologic Description	Samples Collected or Other Tests Performed
140			84.0-88.0' SAMPLE. Recovered 4.0/4.0' = 100%. RQD = 4.0/4.0' = 100%. 84.0-87.7': CLAYSTONE: same as above with some lignite stringers and trace sand; moist. 87.7-88.0': SANDSTONE: olive gray (5 Y 3/2); very fine-grained; silty; common organic fragments; moist.	140.21-149.86': Packer Test Interval #7; aborted test. 142.21-151.86': Packer Test Interval #6; aborted test.
145			88.0-92.0' SAMPLE. Recovered 4.0/4.0' = 100%. RQD = 3.2/4.0' = 80%. CLAYSTONE: olive gray (5 Y 3/2); consolidated; homogenous; trace organics; sandy top 3"; moist.	144.71-154.36': Packer Test Interval #5; aborted test. 146.71-156.36': Packer Test Interval #4; aborted test.
150			92.0-96.5' SAMPLE. Recovered 4.5/4.5' = 100%. RQD = 4.0/4.5' = 89%. CLAYSTONE: same as above; moist to wet; with moderate yellowish brown (10 YR 5/4) siltstone nodule at 94.0-94.5'; <1" wide; dry.	149.35-159.0': Packer Test Interval #3; aborted test. 151.35-161.0': Packer Test Interval #2; aborted test.
155			96.5-100.5' SAMPLE. Recovered 3.3/4.0' = 83%. RQD = 0/4.0' = 0%. 96.5-98.0': CLAYSTONE: olive gray (5 Y 3/2); two siltstone nodules, moderate yellowish brown (10 YR 5/4), approximate 1/4" diameter; elliptical; dry to moist. 98.0-99.8': SANDY CLAYSTONE: olive gray (5 Y 3/2); very fine-grained sand; well sorted; silty; moist.	155.0-163.30': Packer Test Interval #1; failed test.
160				

LOG OF BOREHOLE

Location: Rocky Flats Plant; 903 Pad Area
Coordinates: N 36139.59 E 23140.49
Total Depth: 174.00'

Borehole Well No.: 16-87BP
Ground Surface Elevation: 5969.06'
Water Level Encountered: 20.0'
Static: 5885.51' (12/01/87)

Drilling Company: Boyles Bros
Driller: N. Wheeler ; P. Bushkovski
Date Drilled: June 17-18, 1987 ; July 6-8, 1987
Helper: D. Jarvie ; K. Parker
Drilling Method: Hollow Stem Auger ; Rotary Core
Drilling Fluid: None
Logged By: C.J. Wood ; J.B. Bergman
Geologist
Checked By: [signature]
Site Manager

CEARP Manager

Comments: Surface casing set to 49.17' by Craig Wood on June 18, 1987.

Depth Feet	Graphic Log	Sample Type	Lithologic Description	Samples Collected or Other Tests Performed
160				
			100.5-105.0' SAMPLE. Recovered 4.0/4.5' = 89%. RQD = 4.0/4.0' = 100%. SANDSTONE: medium gray (N 5/0); silica cement; fine to medium-grained; sorted; rounded; two light brownish gray (5 YR 6/1) siltstone nodules at 102.9' and 104.2'; clayey in top 6"; salt & pepper look; moist.	
165				
			105.0-109.0' SAMPLE. Recovered 4.3/4.0' = 108%. RQD = 3.8/4.3' = 88%. SANDSTONE: same as above with several clay stringers; very dense; rock hard sandstone at 108.1 to 109'; very fine-grained; calcareous cement; reacts strongly with HCl; moist to dry.	
170				
			109.0-113.0' SAMPLE. Recovered 3.3/4.0' = 83%. RQD = 1.2/3.3' = 36%. 109.0-109.5': SANDSTONE: medium gray (N 5/0); rock hard; very dense; very fine-grained; calcareous cement; damp. 109.5-112.3': CLAYEY SANDSTONE: medium gray (N 5/0); very fine-grained; rounded; well sorted; increased clay with depth; moist to damp.	
175				

LOG OF BOREHOLE

Location: Rocky Flats Plant; 903 Pad Area
Coordinates: N 36139.59 E 33140.49
Total Depth: 174.00'

Borehole/Well No.: 16-87BP
Ground Surface Elevation: 5969.36'
Water Level Encountered: 20.0'
Static: 5885.51' (12/01/87)

Drilling Company: Boyles Bros
Date Drilled: June 17-18, 1987; July 6-8, 1987
Drilling Method: Hollow Stem Auger; Rotary Core
Logged By: C.J. Wood; J.B. Berman
Geologist

Driller: N. Wheeler; P. Bushkovski
Helper: D. Jarvie; K. Parker
Drilling Fluid: None
Checked By: A. Paoelke
Site Manager

CEARP Manager

Comments: Surface casing set to 49.17' by Craig Wood on June 18, 1987.

Depth Feet	Graphic Log	Sample Type	Lithologic Description	Samples Collected or Other Tests Performed
			117.0-121.0' SAMPLE. Recovered 5.0/4.0' = 125%. RQD = 5.0/5.0' = 100%. 117.0-118.0': CLAYEY SANDSTONE AND SANDY CLAYSTONE: same as above with more clay; dense; moist. 118.0-121.0': SANDY CLAYSTONE: medium gray (N 5/0); fine-grained sand; rounded; well sorted; light brownish gray (5 YR 6/1) siltstone nodule at 120.7'; moist.	
			121.0-125.0' SAMPLE. Recovered 3.7/4.0' = 93%. RQD = 3.7/3.7' = 100%. INTERBEDDED SANDSTONE/ CLAYSTONE: medium gray (N 5/0); very fine-grained; silty, clayey sandstone; interbedded clay laminations; sandstone is rounded; dense; sorted; 10° dip on fracture; cross-bedded; moist.	
			125.0-129.0' SAMPLE. Recovered 3.8/4.0' = 95%. RQD = 3.8/3.8' = 100%. INTERBEDDED SANDSTONE/ CLAYSTONE: same as above; sandstone beds 1-2" thick; clay beds 1-2" thick; some light brownish gray (5 YR 6/1) siltstone nodules 1" diameter; damp.	
			129.0-133.0' SAMPLE. Recovered 3.0/4.0' = 75%. RQD = 3.0/3.0' = 100%. INTERBEDDED SANDSTONE/ CLAYSTONE: same as above with clay layers 0.8 to 1.0' thick.	

LOG OF BOREHOLE

Location: Rocky Flats Plant; 903 Pad Area
Borehole/Well No.: 16-87BR
Coordinates: N 36139.59 E 23140.49
Ground Surface Elevation: 5969.06'
Total Depth: 174.00'
Water Level Encountered: 20.0'
Static: 5885.51' (12/01/87)

Drilling Company: Boyles Bros
Driller: N. Wheeler ; P. Bushkovski
Date Drilled: June 17-18, 1987 ; July 6-8, 1987
Helper: D. Jarvie ; K. Parker
Drilling Method: Hollow Stem Auger ; Rotary Core
Drilling Fluid: None
Logged By: C.J. Wood ; J.B. Bergman
Geologist
Checked By: [signature]
Site Manager

CEARP Manager

Comments: Surface casing set to 49.17' by Craig Wood on June 18, 1987.

Depth Feet	Graphic Log	Sample Type	Lithologic Description	Samples Collected or Other Tests Performed
			133.0-137.0' SAMPLE. Recovered 5.0/4.0' = 125%. RQD = 5.0/5.0' = 100%. SANDSTONE/SANDY CLAYSTONE: medium gray (N 5/0); very fine-grained; well sorted; rounded; dense; horizontal fractures; moist to wet.	
			137.0-141.0' SAMPLE. Recovered 4.0/4.0' = 100%. RQD = 4.0/4.0' = 100%. SANDSTONE/SANDY CLAYSTONE:same as above with medium to fine-grained sand; damp.	
			141.0-145.0' SAMPLE. Recovered 3.9/4.0' = 98%. RQD = 3.7/3.9' = 95%. SANDSTONE: medium gray (N 5/0); fine to medium-grained sand; well sorted; rounded; silica cement; organic fragment in shoe; damp.	
			145.0-149.0' SAMPLE. Recovered 3.2/4.0' = 80%. RQD = 2.8/3.2' = 88%. SANDSTONE/CLAYSTONE INTERBEDDED: medium gray (N 5/0); clay layers 1"; sand layers 3-6"; silty, clayey sandstone; dense; consolidated; moist to wet.	

LOG OF BOREHOLE

Location: Rocky Flats Plant; 903 Pad Area
Coordinates: N 36139.59 E 23140.49
Total Depth: 174.00'

Borehole/Well No.: 16-87BR
Ground Surface Elevation: 5969.36'
Water Level Encountered: 20.0'
Static: 5885.51' (12/01/87)

Drilling Company: Boyles Bros
Date Drilled: June 17-18, 1987; July 6-8, 1987
Drilling Method: Hollow Stem Auger; Rotary Core
Logged By: C.J. Wood ; J.B. Bergman
Geologist

Driller: N. Wheeler ; P. Bushkovski
Helper: D. Jarvie ; K. Parker
Drilling Fluid: None
Checked By: [signature]
Site Manager

CEARP Manager

Comments: Surface casing set to 49.17' by Craig Wood on June 18, 1987.

Depth Feet	Graphic Log	Sample Type	Lithologic Description	Samples Collected or Other Tests Performed
			149.0-153.0' SAMPLE. Recovered 4.9/4.0' = 123%. RQD = 4.9/4.9' = 100%. 149.0-149.6': CLAYEY SANDSTONE: medium gray (N 5/0); very fine-grained; silty; rounded; damp. 149.6-153.0': CLAYSTONE: olive gray (5 Y 3/2); no sand; some organic fragments; consolidated; moist.	
			153.0-157.0' SAMPLE. Recovered 4.0/4.0' = 100%. RQD = 4.0/4.0' = 100%. SANDSTONE/CLAYSTONE INTERBEDDED: medium gray (N 5/0); very fine-grained sand; rounded; cross-bedded; wet; claystone layers 1"; sandstone layers 1"; dense; homogenous; few organics; moist.	
			157.0-161.0' SAMPLE. Recovered 3.7/4.0' = 93%. RQD = 3.2/3.7' = 86%. SANDSTONE: medium gray (N 5/0); some clay lenses 1/4" to 4" wide; cross-bedded; fine to very fine-grained; well sorted; rounded; salt & pepper; very dense calcareous cemented sandstone at 157.3-157.6'; moist to wet.	

LOG OF BOREHOLE

Location: Rocky Flats Plant; 903 Pad Area
Coordinates: N 36139.59 E 23140.49
Total Depth: 174.00'

Borehole/Well No.: 16-87BR
Ground Surface Elevation: 5969.06'
Water Level Encountered: 20.0'
Static: 5885.51' (12/01/87)

Drilling Company: Boyles Bros
Date Drilled: June 17-18, 1987 ; July 6-8, 1987
Drilling Method: Hollow Stem Auger; Rotary Core
Logged By: C.J. Wood ; J.B. Bergman
Geologist

Driller: N. Wheeler; P. Bushkovski
Helper: D. Jarvie ; K. Parker
Drilling Fluid: None
Checked By: [signature]
Site Manager

CEARP Manager

Comments: Surface casing set to 49.17' by Craig Wood on June 18, 1987.

Depth Feet	Graphic Log	Sample Type	Lithologic Description	Samples Collected or Other Tests Performed
			161.0-165.0' SAMPLE. Recovered 2.9/4.0' = 73%. RQD = 2.3/2.9' = 79%. 161.0-161.9': SANDSTONE: medium light gray (N 6/0); very fine-grained; calcareous cement; very dense; strongly reacts with HCl; damp to dry. 161.9-163.0': SANDSTONE: medium gray (N 5/0); very fine-grained; few clay laminae; silty; rounded; cross-bedded; well sorted; moist to wet. 163.0-163.3': CLAYSTONE: olive gray (5 Y 3/2); trace sand; dense; homogenous; trace organics; moist to wet.	
			165.0-169.5' SAMPLE. Recovered 5.0/4.5' = 111%. RQD = 5.0/5.0' = 100%. CLAYSTONE: olive gray (5 Y 3/2); consolidated; homogenous; no sand; trace organics; wet.	
			169.5-174.0' SAMPLE. Recovered 5.1/5.0' = 102%. RQD = 5.1/5.1' = 100%. CLAYSTONE: same as above; wet.	
			TOTAL DEPTH: 174.0'	

WELL COMPLETION INFORMATION

Location: Rocky Flats Plant; 903 Pad Area

Well No.: 16-87BR

Coordinates: N 36139.59 E 23140.49

Elevation: Ground Surface 5969.06'

Top of Casing 5970.98'

Total Depth: Well 125.24'

Borehole 174.00'

Formation of Completion: Arapahoe Formation

Casing Material: Sch 5, type 316 TFJ stainless steel

Casing Diameter: 2" ID

Screen Material: 0.010" wire wrap, type 316 TFJ stainless steel

Surface Casing Diameter: 5" ID

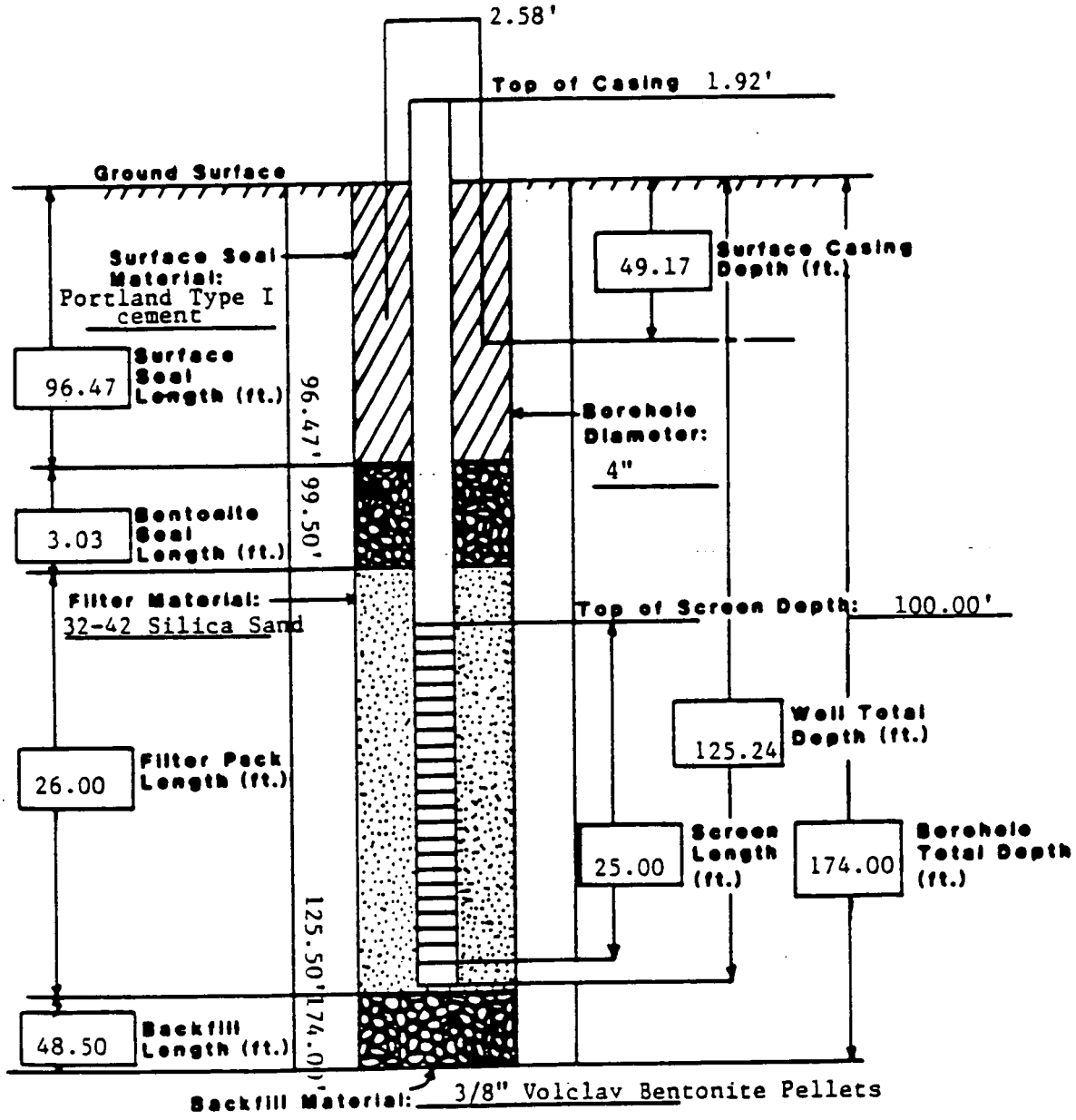
Date Installed: July 14-16, 1987

Approved By: [signature] Site Manager

Installed By: J.B. Bergman Geologist

[signature] CEARP Manager

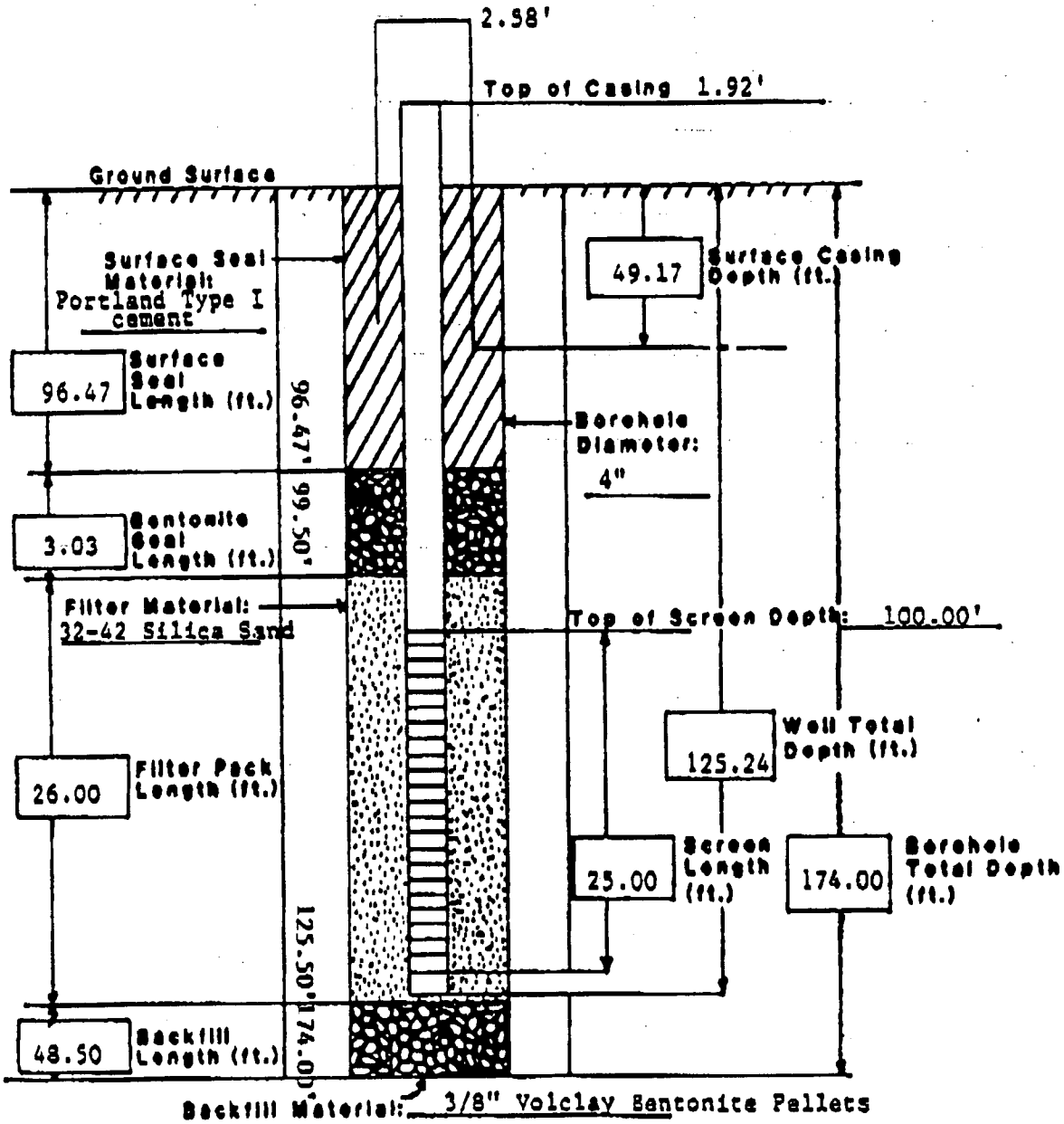
Comments: Surface casing set to 49.17' by C.J. Wood on June 18, 1987.



WELL COMPLETION INFORMATION

Location: Rocky Flats Plant; 903 Pad Area
Well No.: 16-87BR
Coordinates: N 36139.59 E 23140.49
Elevation: Ground Surface 5969.06'
Top of Casing 5970.98'
Total Depth: Well 125.24'
Borehole 174.00'
Formation of Completion: Arapahoe Formation
Casing Material: Sch 5, type 316 TFJ stainless steel
Casing Diameter: 2" ID
Screen Material: 0.010" wire wrap, type 316 TFJ stainless steel
Surface Casing Diameter: 5" ID
Date Installed: July 14-16, 1987
Approved By: [signature] Site Manager
Installed By: J.B. Berman Geologist
[signature] CEARP Manager

Comments: Surface casing set to 49.17' by C.J. Wood on June 18, 1987.



LOG OF BORING NO. 16-37 BR

GEOLOGIST(S): [illegible]
DATE: 3/29/89
PROJECT NO: 1167-1122

TOP/BOTTOM OF CORE IN BOX	TOP/BOTTOM OF INTERVAL	FEET OF CORE IN INTERVAL IN BOX	SAMPLE NUMBER	FRACTURE ANGLE	BEDDING ANGLE	GRAIN SIZE DISTRIBUTION	USCS SYMBOL	DEPTH IN FEET	LITHOLOGIC LOG	LITHOLOGIC DESCRIPTION
0.0	0.0	(1) 1.85				Gravel >50%	GM	1		Silty ~~Gravel~~ Sandy Gravel. Predom. med gray (N5) Angular to rounded. well graded, granules to 6cm. Sand med to coarse grained. Mod. well graded. Some rock material, some clay.
	2.0							2		
	3.64	(1) 1.8				Gravel >50%	GM	3		Same as above.
	4.0	0						4		No Sample
	4.95	(1) 1.6				Gravel >50%	GM SC	5		Gravel as above. Max size 6cm. Silty Clay matrix. Est. plast. low to mod. Gray orange to white. (10yr 7/1) to (N9), Some Caliche
		(1) 1.85				Clay >50%	SC	6		Sandy clay and caliche, lt. brown (5yr 5/6) to white (N9). Est. plast. low. Sand v.f.g. to coarse. ~~weight~~ well graded.
Box 10 of 6	7.0							7		
	7.9	(1) .5				Gravel ≈40% Sand ≈40%	GM			Silty gravel + sand. Gravel lt. gray (N7) to lt. olive gray (5y 6/1). Angular to sub rounded. Sand v.f.g. to granules well graded. Gravel mod. graded. Trace $CaCO_3$.
	9.0	0						8 9		No Sample
10.75	10.75	(1) 1.3				Gravel >60%	GW			Gravel. No predom. color. Angular to sub rounded. well graded. Granules to 3cm. Some sand, well graded. v.f.g. to granules. Trace silt + clay.

NOTES: General USCS is modified for this log as follows:
Material amounts are estimated by % volume instead of % weight.
(1) Badly broken core, accurate footage measurements not possible.
(2) Core breaks cannot be matched, accurate footage measurements not possible.

ROCKY FLATS PLANT

FIGURE NO.

LOG OF BORING NO. 16-87 BR

GEOLOGIST(S): LAA
DATE: 8/29/89

PROJECT NO: 1267-1122

TOP/BOTTOM OF CORE IN BOX	TOP/BOTTOM OF INTERVAL	FEET OF CORE IN INTERVAL IN BOX	SAMPLE NUMBER	FRACTURE ANGLE	BEDDING ANGLE	GRAIN SIZE DISTRIBUTION	USCS SYMBOL	DEPTH IN FEET	LITHOLOGIC LOG	LITHOLOGIC DESCRIPTION
10.75	10.75									See previous page for description of this interval.
10.75								11		This box is missing.
								12		
								13		
								14		
								15		
								16		
								17		
								18		
								19		
20.0										

Box 2 of 6

Begin New Box

Begin New Box

NOTES: General USCS is modified for this log as follows:
Material amounts are estimated by % volume instead of % weight.
(1) Badly broken core, accurate footage measurements not possible.
(2) Core breaks cannot be matched, accurate footage measurements not possible.

ROCKY FLATS PLANT

FIGURE NO.

LOG OF BORING NO. 16-87BR

GEOLOGIST(S): DCB
DATE: 8/29/89

PROJECT NO: 667-1122

TOP/BOTTOM OF CORE IN BOX	TOP/BOTTOM OF INTERVAL	FEET OF CORE IN INTERVAL IN BOX	SAMPLE NUMBER	FRACTURE ANGLE	BEDDING ANGLE	GRAIN SIZE DISTRIBUTION	USCS SYMBOL	DEPTH IN FEET	LITHOLOGIC LOG	LITHOLOGIC DESCRIPTION
20.0	20.0 to 22.6	(1) 2				>50% gravel	GC	21, 22		Sandy Gravel, medium light gray (N6), matrix is light brown (5YR 6/4), subangular to subrounded, moderately graded, max. size 4 cm., some clay.
						>50% clay				Claystone, very light gray (N8), bedding not apparent, highly weathered, slightly friable, occasional iron stain.
	22.6 to 23.0	0						23		No Sample
	23.0 to 23.9	ND	1			>50% clay				Claystone as above (reference interval 22.3 to 22.6 ft).
6	23.9 to 26.0	ND						24, 25		
M	26.0 to 28.0	ND						26, 27		Claystone as above, color grades to grayish orange (10YR 7/4) ~26 to ~27 ft.
	28.0 to 29.4	ND				>50% clay		28, 29		Silty Claystone, pinkish gray (5YR 8/1), bedding not apparent, highly weathered, slightly friable, moderate silt fracture, local iron staining.

NOTES: General USCS is modified for this log as follows:
Material amounts are estimated by % volume instead of % weight.
(1) Badly broken core, accurate footage measurements not possible.
(2) Core breaks cannot be matched, accurate footage measurements not possible.

ROCKY FLATS PLANT

FIGURE NO.

LOG OF BORING NO. 16-87 BR

GEOLOGIST(S): UAA
DATE: 8/29/89

PROJECT NO: 667-1122

TOP/BOTTOM OF CORE IN BOX	TOP/BOTTOM OF INTERVAL	FEET OF CORE IN INTERVAL IN BOX	SAMPLE NUMBER	FRACTURE ANGLE	BEDDING ANGLE	GRAIN SIZE DISTRIBUTION	USCS SYMBOL	DEPTH IN FEET	LITHOLOGIC LOG	LITHOLOGIC DESCRIPTION
30.0	30.0 – 31.35	1.6 (1)				Clay >50%		31		Silty Claystone. Very pale orange (10yr 8/2) Bedding not evident. Highly weathered, mod. friable. Some iron staining. Becomes mod. yellowish brown (10yr 5/4). Toward bottom of interval.
	31.35 – 32.0	0								No Sample.
	32.0 – 34.0	1.8 (1)				Clay >50%		32, 33, 34		Same as above. Has heavy ironization and abundant black mineralization near top of interval.
	34.0 – 36.0	1.85 (1)				Clay >50%		34, 35, 36		Silty Claystone. Very lt gray to grayish orange (10yr 7/4 to N8). Highly weathered, mod. friable, Bedding not evident. Some iron staining.
	36.0 – 38.0	1.75 (1)				Clay >50%		36, 37, 38		Same as above.
	38.0 – 40.0	1.75 (1)				Clay >50%		38, 39		Same as above.
40.0	40.0									

Box 4 of 6

NOTES: General: USCS is modified for this log as follows:
Material amounts are estimated by % volume instead of % weight.
(1) Badly broken core, accurate footage measurements not possible.
(2) Core breaks cannot be matched, accurate footage measurements not possible.

ROCKY FLATS PLANT

FIGURE NO.

LOG OF BORING NO. 16-37 BR

GEOLOGIST(S): UAA
DATE: 3/24/89

PROJECT NO: 16671122

TOP/BOTTOM OF CORE IN BOX	TOP/BOTTOM OF INTERVAL	FEET OF CORE IN INTERVAL IN BOX	SAMPLE NUMBER	FRACTURE ANGLE	BEDDING ANGLE	GRAIN SIZE DISTRIBUTION	USCS SYMBOL	DEPTH IN FEET	LITHOLOGIC LOG	LITHOLOGIC DESCRIPTION
								38		
* 38.0 Box 5 of 6	38.0 40.0	1.8 (1)				Clay >50%		39		Silty claystone. Pale yellowish (10YR 6/2). Highly weathered. Slightly friable. Bedding not evident. Some iron staining.

NOTES: General USCS is modified for this log as follows:
Material amounts are estimated by % volume instead of % weight.
(1) Badly broken core, accurate footage measurements not possible.
(2) Core breaks cannot be matched, accurate footage measurements not possible.

ROCKY FLATS PLANT

FIGURE NO.

* This interval overlaps with Box 4. Started new page.

LOG OF BORING NO. 16-37 BR

GEOLOGIST(S): LAA
DATE: 3/29/89

PROJECT NO: 607-1122

TOP/BOTTOM OF CORE IN BOX	TOP/BOTTOM OF INTERVAL	FEET OF CORE IN INTERVAL IN BOX	SAMPLE NUMBER	FRACTURE ANGLE	BEDDING ANGLE	GRAIN SIZE DISTRIBUTION	USCS SYMBOL	DEPTH IN FEET	LITHOLOGIC LOG	LITHOLOGIC DESCRIPTION
	40.0	(1) 1.7				Clay >50%		41		Silty Claystone Grayish orange (10yr 7/4 to 5yr 6/2). Highly weathered, mod friable Bedding not evident. Some iron staining.
	42.0							42		
		(1) 1.8				Clay >50%		43		SAME AS ABOVE w/ color change to light brownish gray (5YR 6/1)
	44.0							44		
		(1) 1.75				CLAY 75%		45		SAME AS ABOVE w/ color chg to medium dk gray (N4). SOME CARB. MATERIAL & NO IRON STAINING
Box 5 of 6	46.0							46		
		(1) 1.85				CLAY 75%		47		SAME AS ABOVE
48.0	48.0							48		
Box 6 of 6		1.8 (1)				CLAY 75%		49		SAME AS ABOVE; SOME IRON STAINING
	50.0									

NOTES: General USCS is modified for this log as follows:
Material amounts are estimated by % volume instead of % weight.
(1) Badly broken core, accurate footage measurements not possible.
(2) Core breaks cannot be matched, accurate footage measurements not possible.

ROCKY FLATS PLANT

FIGURE NO.

LOG OF BORING NO.

PAGE OF

DATES DRILLED:
ELEVATION:
GEOLOGIST(S):
DATE:
CHECKED BY:

USCS symbol

DATE:

PROJECT NO: 667-11.22

TOP/BOTTOM OF CORE IN BOX	TOP/BOTTOM OF CORE IN ROTARY (FLUSH)	SAMPLE NUMBER	FEET OF CORE	FEET OF CORE	FRACTURES PER FOOT	FRACTURE ANGLE	BEDDING ANGLE	GRAIN SIZE DISTRIBUTION	DEPTH IN FEET	LITHOLOGIC LOG	LITHOLOGIC DESCRIPTION
											[illegible]
X	To		ND						49		Caliche, white (N9), slightly friable. At 50 ft. interval grades to Claystone, light [illegible] bedding not apparent (massive), weathered, slightly to moderately friable, localized iron staining [illegible]
	[illegible]							[illegible]	50		
	[illegible]			0					51		No Sample
	[illegible]								52		
	52.5 to 55.5		ND					>50% Clay	53		Claystone medium dark gray (N4) bedding not apparent (massive), weathered, slightly friable, localized iron [illegible] and carbonaceous mineralization, occasional small bodies or lenses of coal <2.5mm thick. Slickensides occur at ~60.3 curvilinear surface - angle not applicable.
									54		
									55		
	55.5								56		

NOTES: General: The USCS is modified for this log as follows: Material amounts are estimated by percent volume instead of percent weight.
(1) Badly broken core, accurate footage measurement not possible.
(2) Core breaks cannot be matched, accurate footage measurement not possible.

ROCKY FLATS PLANT

FIGURE NO.

LOG OF BORING NO.

PAGE 2 OF 2

DATES DRILLED:
ELEVATION:
GEOLOGIST(S):
DATE:
CHECKED BY: DATE:

PROJECT NO: 667-11.22

TOP/BOTTOM OF CORE IN BOX	TOP/BOTTOM OF CORE IN ROW	SAMPLE NUMBER	FEET OF CORE	USCS SYMBOL	FRACTURES PER FOOT / FRACTURE ANGLE	BEDDING ANGLE	GRAIN SIZE DISTRIBUTION	DEPTH IN FEET	LITHOLOGIC LOG	LITHOLOGIC DESCRIPTION
							50%			As above
								58		[illegible] light gray (N7), bedding not apparent (massive?) weathered, moderately friable.
1			ND							
Box								59		
60.0	60.0									
60.0	60.0							60		
			ND							
	61.6				NA/55°			61		Fracture at ~ 61.4 ft. with carbonaceous mineralization
	61.6							62		
	to									
			(2) 2.8					63		
								64		
Box 2 of B								65		
								66		

NOTES: General: The USCS is modified for this log as follows: Material amounts are estimated by percent volume instead of percent weight.
(1) Badly broken core, accurate footage measurement not possible.
(2) Core breaks cannot be matched, accurate footage measurement not possible.

ROCKY FLATS PLANT

FIGURE NO.

LOG OF BORING NO. [illegible]

PAGE [illegible] OF [illegible]

DATES DRILLED:
ELEVATION:
GEOLOGIST(S): [illegible]
DATE:
CHECKED BY:

USCS symbol

DATE:

PROJECT NO: 667-11.22

TOP/BOTTOM OF CORE IN BOX	TOP/BOTTOM OF CORE IN FOOT	SAMPLE NUMBER	FEET OF CORE	FRACTURES PER FOOT	FRACTURE ANGLE	BEDDING ANGLE	GRAIN SIZE DISTRIBUTION	DEPTH IN FEET	LITHOLOGIC LOG	LITHOLOGIC DESCRIPTION
	[illegible] 67.95		2.0				>50% clay	68		As above
										NO SAMPLE
	68.0 to 71.0		ND				>50% clay	69, 70, 71		As above (reference interval 61.6 to 67.95), bedding may [illegible] core [illegible] appears wavy; weathering prevents better description, possible sulfur flower on DCB bedding planes.
	71.0 to 72.0		(1) 1.1					72		
2d 13 Box	72.0 to 74.0		ND					74		
74.0	74.0 to [illegible]							75, 76		slickenside at ~ 75 DCB ft. 60° angle, Coal body ~1.5cm in thickness also occurs at this depth and [illegible]. At 75 ft. interval grades to silty Cl yellowish gray (5 Y 7/2) bedding not apparent (massive?)
Box	[illegible]									

NOTES: General: The USCS is modified for this log as follows: Material amounts are estimated by percent volume instead of percent weight.
(1) Badly broken core, accurate footage measurement not possible.
(2) Core breaks cannot be matched, accurate footage measurement not possible.

ROCKY FLATS PLANT

FIGURE NO.

LOG OF BORING NO. [illegible]

DATES DRILLED:
ELEVATION:
GEOLOGIST(S): [illegible]
DATE: [illegible]
CHECKED BY:
DATE:

USCS symbol

PROJECT NO: 667-11.22

TOP/BOTTOM OF CORE IN BOX	TOP/BOTTOM OF CORE IN ROCK (FEET)	SAMPLE NUMBER	FEET OF CORE	FEET OF CORE	FRACTURES PER FOOT	FRACTURE ANGLE	BEDDING ANGLE	GRAIN SIZE DISTRIBUTION	DEPTH IN FEET	LITHOLOGIC LOG	LITHOLOGIC DESCRIPTION
13	[illegible]							750 Clay	78		[illegible] interbedded Claystone and Siltstone, medium gray (N5) [illegible] gray (N7) respectively, [illegible] interfingering very fine sandstone occurs occasionally in this interval, weathered, moderately friable, carbonaceous. Interval grades [illegible] Siltstone, lightest gray (N7), bedding [illegible]
Box	79.2	DCB							79		
	79.2 to DCB 80.0		0	DCB					80		No Sample
	80.0 to		ND					750 Clay	81		Claystone, medium light gray (N6), bedding not apparent (massive?) weathered slightly friable, slight silt fraction and occasional short intervals of silt.
									82		
									83		
84.0	84.0								84		
84.0	84.0 to		ND						85		
Box 4 of 13	88.0								86		

NOTES: General: The USCS is modified for this log as follows: Material amounts are estimated by percent volume instead of percent weight.
(1) Badly broken core, accurate footage measurement not possible.
(2) Core breaks cannot be matched, accurate footage measurement not possible.

ROCKY FLATS PLANT

FIGURE NO.

LOG OF BORING NO. [illegible] CR

PAGE [illegible] OF [illegible]

DATES DRILLED:
ELEVATION:
GEOLOGIST(S): [illegible]
DATE: [illegible]
CHECKED BY:

DATE:

PROJECT NO: 667-11.22

TOP/BOTTOM OF CORE IN BOX	TOP/BOTTOM OF CORE IN FOOT	SAMPLE NUMBER	FEET OF CORE	~~FEET OF CORE IN FOOT~~ (USCS symbol)	FRACTURES PER FOOT	FRACTURE ANGLE	DRILLING ANGLE	GRAIN SIZE DISTRIBUTION	DEPTH IN FEET	LITHOLOGIC LOG	LITHOLOGIC DESCRIPTION
	84.0 to 88.0		ND					>50% clay	88		As above
	88.0 to 92.0		ND						90, 91, 92		
Box 4 of 13	92.0 to 92.5		ND								
92.5	92.5 to 96.5		ND						94, 95, 96		
Box 5 of 13	96.5 to [illegible]		ND								

NOTES: General: The USCS is modified for this log as follows: Material amounts are estimated by percent volume instead of percent weight.
(1) Badly broken core, accurate footage measurement not possible.
(2) Core breaks cannot be matched, accurate footage measurement not possible.

ROCKY FLATS PLANT

FIGURE NO.

LOG OF BORING NO. [illegible]

PAGE [illegible] OF [illegible]

DATES DRILLED:
ELEVATION:
GEOLOGIST(S):
DATE: [illegible]
CHECKED BY:
DATE:

USCS symbol

PROJECT NO: 667-11.22

TOP/BOTTOM OF CORE IN BOX	TOP/BOTTOM OF CORE IN BOX (FT)	SAMPLE NUMBER	FEET OF CORE	FEET OF CORE	FRACTURES PER FOOT	FRACTURE ANGLE	BEDDING ANGLE	GRAIN SIZE DISTRIBUTION	DEPTH IN FEET	LITHOLOGIC LOG	LITHOLOGIC DESCRIPTION
	96.5 to 99.0		ND				0 to 10°	>50% clay, >50% silt	98		As above, interval grades to siltstone below 98 ft. Siltstone very light gray (N8), thin bedded <1mm, horizontal to 10° dip, weathered, slightly friable.
Box 5 of 6 B	99.0 to 100.5		X	0					100	X	No Sample
Box 5 of 6 B, Box 6 of 6 B, 101.7	100.5 to 101.7		ND				~~0~~ 0 to 10°	>50% silt	101		Siltstone very light gray (N8) thin bedded <1mm, horizontal to 10° dip, weathered, slightly friable, slight sand [illegible] very fine grained, inter[illegible]
Box 6 of 6 B	101.7 to 105.0		ND						102, 104		
	105.0 to 109.0		ND						105, 106		As above with abundant very fine grained sand from 105.0 to 105.4.

NOTES: General: The USCS is modified for this log as follows: Material amounts are estimated by percent volume instead of percent weight.
(1) Badly broken core, accurate footage measurement not possible.
(2) Core breaks cannot be matched, accurate footage measurement not possible.

ROCKY FLATS PLANT

FIGURE NO.

Interval blocks read 101.7, box reads 100.7. Core measurement [illegible]

LOG OF BORING NO. 16-87 CR

DATES DRILLED:
ELEVATION:
GEOLOGIST(S): DCB
DATE: 8/7/87
CHECKED BY:
DATE:

USCS symbol

PROJECT NO: 667-11.22

TOP/BOTTOM OF CORE IN BOX	TOP/BOTTOM OF CORE IN PLATE	SAMPLE NUMBER	FEET OF CORE	FEET OF PLATE	FRACTURES PER FOOT	FRACTURE ANGLE	DESIGNS ANGLE	GRAIN SIZE DISTRIBUTION	DEPTH IN FEET	LITHOLOGIC LOG	LITHOLOGIC DESCRIPTION
	105.0					DCB	10	250 silt			As above
	to		ND						108		
	109.0										
	101.0										
6 of 13	to		ND						110		
Box									111		
									112		
112.3	112.3										
			ND	∅							No Sample
113.8	113.0										
									114		
	to		ND	∅ DCB	DCB				115		
7 of 13											
Box									116		
	117.0										

NOTES: General: The USCS is modified for this log as follows: Material amounts are estimated by percent volume instead of percent weight.
(1) Badly broken core, accurate footage measurement not possible.
(2) Core breaks cannot be matched, accurate footage measurement not possible.

ROCKY FLATS PLANT

FIGURE NO.

LOG OF BORING NO. 6-87 CR

DATES DRILLED:
ELEVATION:
GEOLOGIST(S): D-C
DATE: 8/7/89
CHECKED BY:
DATE:

USCS symbol

PROJECT NO: 667-11.22

TOP/BOTTOM OF CORE IN BOX	TOP/BOTTOM OF CORE IN FEET	SAMPLE NUMBER	FEET OF CORE	FEET OF CORE	FRACTURES PER FOOT	FRACTURE ANGLE	BEDDING ANGLE	GRAIN SIZE DISTRIBUTION	DEPTH IN FEET	LITHOLOGIC LOG	LITHOLOGIC DESCRIPTION
	117.0						10°	>50% silt			
									118		
B	to		ND						119		
Box									120		
↑	121.0								121		As above, .75 ft. slabbed, bedding is dominant [illegible] deformed through biot turbation otherwise roughly horizontal thin bedded < 2.5 mm interbedded silts sand and clay, small scale [illegible]
121.5	121.0 to 121.5		ND								
121.5	121.5								122		
↓	to		ND								
Box									124		
	124.7										
	124.7		0						125		No Sample
Box	125 to						10°	>50% silt			Siltstone, light gray (N7), laminated bedding with some wavy bedding, weathered, slightly friable.
			ND					>50% clay	126		Interval grades to Claystone at ~125.6. Claystone, olive gray (5Y 4/1), bedding ~10° based
	129										

NOTES: General: The USCS is modified for this log as follows: Material amounts are estimated by percent volume instead of percent weight.
(1) Badly broken core, accurate footage measurement not possible.
(2) Core breaks cannot be matched, accurate footage measurement not possible.

ROCKY FLATS PLANT

FIGURE NO.

LOG OF BORING NO. 16-87 DK

DATES DRILLED:
ELEVATION:
GEOLOGIST(S):
DATE:
CHECKED BY:
DATE:

PROJECT NO: 667-11.22

TOP/BOTTOM OF CORE IN BOX	TOP/BOTTOM OF CORE IN FEET	SAMPLE NUMBER	FEET OF CORE	USCS SYMBOL	FRACTURES PER FOOT	FRACTURE ANGLE	BEDDING ANGLE	GRAIN SIZE DISTRIBUTION	DEPTH IN FEET	LITHOLOGIC LOG	LITHOLOGIC DESCRIPTION
	125 to 129		N(1)				10°	>50 Clay	128, 129		cont'd from previous page), on core breaks, weathered slightly friable, carbonaceous mineralization occurs locally fossil leaf at ~126 ft. short intervals of siltstone occasionally
80 Box	129 to 132.5		(2) 2.2						130, 131, 132		
132.5	132.5										
137.5	132.5 to 133		ND								
9 Box	133 to 137		ND				10°	>50	134, 135, 136		[illegible] gradual [illegible] (U7) thin bedded [illegible] slightly [illegible] occasionally interbedded with claystone.

NOTES: General: The USCS is modified for this log as follows: Material amounts are estimated by percent volume instead of percent weight.
(1) Badly broken core, accurate footage measurement not possible.
(2) Core breaks cannot be matched, accurate footage measurement not possible.

ROCKY FLATS PLANT

FIGURE NO:

LOG OF BORING NO. [illegible]

DATES DRILLED:
ELEVATION:
GEOLOGIST(S): [illegible]
DATE: 3/[illegible]
CHECKED BY:
DATE:

USCS symbol

PROJECT NO: 667-11.22

TOP/BOTTOM OF CORE IN BOX	TOP/BOTTOM OF CORE IN ROCK	SAMPLE NUMBER	FEET OF CORE	FEET OF CORE	FRACTURES PER FOOT	FRACTURE ANGLE	BEDDING ANGLE	GRAIN SIZE DISTRIBUTION	DEPTH IN FEET	LITHOLOGIC LOG	LITHOLOGIC DESCRIPTION
	137.0						10°	>50% silt			As above with increasing very fine sand fraction. Interval grades to sandstone by ~140.5 ft. Sandstone light gray (N7), thin bedded, weathered [illegible] grained, abundant silt.
13 9:4 Box	to		ND						138		
									139		
									140		
141.0								>50% sand	141		
141.0	141.0										
									142		
	to		ND						143		
10 of 13 Box								>50% silt	144		Interval grades to siltstone [illegible] light gray (N7), thin [illegible] <2.5 mm, weathered, slightly [illegible] slight clay and vfg sand fraction
	144.9										
	144.0		0						145		NO SAMPLE
	145.0						30° 10°	>[illegible] mg sand <30% FG sand >50% silt			Sandstone light gray (N7), thin bedded <2 mm, weathered, slightly friable, medium to fine grained, moderately sorted, subrounded to rounded. Interval grades to siltstone at ~145.4 ft. Siltstone light gray (N7)
	to		ND						146		
	147.2										

NOTES: General: The USCS is modified for this log as follows: Material amounts are estimated by percent volume instead of percent weight.
(1) Badly broken core, accurate footage measurement not possible.
(2) Core breaks cannot be matched, accurate footage measurement not possible.

ROCKY FLATS PLANT

FIGURE NO.

LOG OF BORING NO. 16-87 BR

DATES DRILLED:
ELEVATION:
GEOLOGIST(S): [illegible]
DATE: 8/3/89
CHECKED BY:
DATE:

PROJECT NO: 667-11.22

TOP/BOTTOM OF CORE IN BOX	TOP/BOTTOM OF CORE IN FEET (INTERVAL)	SAMPLE NUMBER	FEET OF CORE (INTERVAL)	FEET OF CORE (INTERVAL)	FRACTURES PER FOOT	FRACTURE ANGLE	BEDDING ANGLE	GRAIN SIZE DISTRIBUTION	DEPTH IN FEET	LITHOLOGIC LOG	LITHOLOGIC DESCRIPTION
	145.0 to 148.2		ND				~~[illegible]~~ DCB	>50% clay	148		(cont'd from previous page) thin bedded, <2.5 mm, convolute, [illegible] possible bioturbations, bad [illegible], weathered, slightly friable. Interval grades to ~~clay~~ silty clay stone at 147.0 ft. Claystone, light gray (N7), bedding
8/2/89	148.2 to 149.0		0						149	X	No Sample
Box	[illegible] to 151.0		ND					clay	150		[illegible] occur at ~150.0 ft. ~70° angle, slight to moderate silt fraction
151.0	151.0 to 153.0		ND						151		
2/8/89	153.0 to 157.0		ND				30°		152		[illegible] (N7), thin [illegible] mineralization along [illegible] at approximately 155 ft.
									155		
									156		

NOTES: General: The USCS is modified for this log as follows: Material amounts are estimated by percent volume instead of percent weight.
(1) Badly broken core, accurate footage measurement not possible.
(2) Core breaks cannot be matched, accurate footage measurement not possible.

ROCKY FLATS PLANT

FIGURE NO.

LOG OF BORING NO. [illegible] BR

DATES DRILLED:
ELEVATION:
GEOLOGIST(S): [illegible]
DATE: [illegible]
CHECKED BY:
DATE:

PROJECT NO: 667-11.22

Interval	Interval	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	Angle	USCS symbol	Depth (ft)	Graphic log	LITHOLOGIC DESCRIPTION
Box 13	157.3 to		ND				~~30~~ 35°	>50 silt	158, 159		As above with increase in sand fraction below 157.3 ft. Sandy siltstone.
159.9	159.9										
159.9 ↓	159.9 to 161.0		ND				30°	~50 silt ~50 clay	160		Interbedded siltstone and claystone at 160 ft. ~~as above~~ reference intervals above.
	161.0 to		ND				50°	>50 silt	161, 162		Grades to siltstone at 161 ft. Siltstone, light gray (N7), thin bedded, <2mm [illegible], slightly weathered, slightly [illegible] ized carbonaceous [illegible]. Grades to claystone at 162.3 ft. Claystone, medium gray (N5), bedding not apparent [illegible] weathered moderately [illegible]
								>50 clay	163		
Box	163.0 to 165.0		0						164, 165	X	No sample
	165.0 to 169		ND					>50 clay	166		As above (reference interval 162.3 to 163.3 ft.)

NOTES: General: The USCS is modified for this log as follows: material amounts are estimated by percent volume instead of percent weight.
(1) Badly broken core, accurate footage measurement not possible.
(2) Core breaks cannot be matched, accurate footage measurement not possible.

LOG OF BORING NO. [illegible] BR

DATES DRILLED:
ELEVATION:
GEOLOGIST(S): [illegible]
DATE: [illegible]
CHECKED BY:
DATE:

USCS symbol

PROJECT NO: 667-11.22

TOP/BOTTOM OF CORE IN BOX	TOP/BOTTOM OF CORE IN FOOT	SAMPLE NUMBER	FEET OF CORE	FEET OF CORE	FRACTURES PER FOOT	FRACTURE ANGLE	BEDDING ANGLE	GRAIN SIZE DISTRIBUTION	DEPTH IN FEET	LITHOLOGIC LOG	LITHOLOGIC DESCRIPTION
	165.0							250+ clay			As above
									168		
12 Box	to		ND								
									169		
[illegible]	[illegible]										
169.5	169.5										
									170		
									171		
13 of 13 Box	to										
									172		
									173		
[illegible]	[illegible]										[illegible]
174.0	174.0								174		[illegible] (N7) [illegible]
											Bottom of Box. 13/13 [illegible]
									175		

NOTES: General: The USCS is modified for this log as follows: Material amounts are estimated by percent volume instead of percent weight.
(1) Badly broken core, accurate footage measurement not possible.
(2) Core breaks cannot be matched, accurate footage measurement not possible.

ROCKY FLATS PLANT

FIGURE NO.

STATE PLANE COORDINATE:		TOTAL DEPTH (FT): 174	GROUND ELEVATION (FT):	5969.06	PROJECT NUMBER:	667.11	LOG OF BORING NUMBER:
NORTH:	749130	AREA: 903 PAD	CASING DIAMETER (IN):	2 ID	GEOLOGIST:	LAA/DCB	16-87BR
EAST:	2086249	LOCATOR NUMBER: N9	BOREHOLE DIAMETER (IN):	4	DATE DRILLED:	07/08/87	

REMARKS: Hollow stem auger, Rotary core. Surface casing set to 49.17' by Craig Wood, June 18, 1987.

CHEMICAL SAMPLE / GRADATIONAL SAMPLE / SAMPLE NUMBER

SAMPLE GRAIN SIZE: 0% 50% 100%

PERCENT RECOVERY: 0% 100%

RECOVERY/INTERVAL: 1.85/2; 1.8/1.64; 0/0.36; 1.6/0.95; 1.85/2.05; 0.5/0.9; 0/1.1; 1.3/1.75

DATUM (FT): 5969, 5968, 5967, 5966, 5965, 5964, 5963, 5962, 5961, 5960

DEPTH (FT): 0, 1, 2, 3, 4, 5, 6, 7, 8, 9, 10

WELL OR PIEZOMETER CONSTRUCTION

LITHOLOGY

UNIFIED SOILS CLASSIFICATION OR ROCK TYPE	DESCRIPTION
GM:	SILTY SANDY GRAVEL - predom. med. gray (N5), angular to rounded, well graded, granules to 6 cm., sand med. to coarse grained, mod. well graded, some root material, some clay.
GM:	Same as above.
NO SAMPLE:	
GM:	GRAVEL - as above, max. size 6 cm., silty clay matrix est. plast. low to mod., grayish orange to white (10YR 7/4) to (N9), some caliche.
SC:	Sandy Clay & Caliche - lt. brown (5YR 5/6) to white (N9), est. plast. low, sand VFG to coarse, well graded.
GM:	Silty Gravel & Sand - gravel lt. gray (N7) to lt. olive gray (5Y 6/1), angular to sub-rounded, sand VFG to granules, well graded, gravel mod. graded, trace CaCO3.
NO SAMPLE:	
GW:	GRAVEL - no predom. color, angular to sub-rounded, well graded, granules to 3 cm., some sand, well graded, VFG to granules, trace silt and clay.

STATE PLANE COORDINATE:	TOTAL DEPTH (FT): 174	GROUND ELEVATION (FT):	5969.06	PROJECT NUMBER:	567 11
NORTH: 749130	AREA: 903 PAD	CASING DIAMETER (IN):	2 ID	GEOLOGIST:	LAA/DCB
EAST: 2086249	LOCATOR NUMBER: N9	BOREHOLE DIAMETER (IN):	4	DATE DRILLED:	07/08/87

LOG OF BORING NUMBER: 16-87BB

REMARKS: Hollow stem auger, Rotary core. Surface casing set to 49.17' by Craig Wood, June 18, 1987.

CHEMICAL SAMPLE DEPTH / GRADATIONAL SAMPLE DEPTH	SAMPLE NUMBER	SAMPLE GRAIN SIZE (0% 50% 100%)	PERCENT RECOVERY (0% 100%)	RECOVERY/INTERVAL	DATUM (FT)	DEPTH (FT)	WELL OR PIEZOMETER CONSTRUCTION	LITHOLOGY	UNIFIED SOILS CLASSIFICATION OR ROCK TYPE	DESCRIPTION
					5959	10				
					5958	11			NO SAMPLE:	
					5957	12				
					5956	13				
					5955	14				
				0/9.25	5954	15				
					5953	16				
					5952	17				
					5951	18				
					5950	19				
						20	06/18/87			

STATE PLANE COORDINATE:		TOTAL DEPTH (FT): 174	GROUND ELEVATION (FT):	5969.06	PROJECT NUMBER:	567.11	LOG OF BORING NUMBER:
NORTH:	749130	AREA: 903 PAD	CASING DIAMETER (IN):	2 ID	GEOLOGIST:	LAA/DCB	16-87BR
EAST:	2086249	LOCATOR NUMBER: N9	BOREHOLE DIAMETER (IN):	4	DATE DRILLED:	07/08/87	

REMARKS: Hollow stem auger, Rotary core. Surface casing set to 49.17' by Craig Wood, June 18, 1987.

CHEMICAL SAMPLE
GRADATIONAL SAMPLE
SAMPLE NUMBER
SAMPLE GRAIN SIZE (0% 50% 100%)
PERCENT RECOVERY (100% 100%)
RECOVERY/INTERVAL: 2.7/2.6; 0.7/0.4; 0.9/0.9; 2.1/2.1; 2.7/2; 1.4/1.4; 0.7/0.6
DATUM (FT): 5969, 5968, 5967, 5966, 5965, 5964, 5963, 5962, 5961, 5960
DEPTH (FT): 20, 21, 22, 23, 24, 25, 26, 27, 28, 29, 30
WELL OR PIEZOMETER CONSTRUCTION
LITHOLOGY

UNIFIED SOILS CLASSIFICATION OR ROCK TYPE	DESCRIPTION
GC:	SANDY GRAVEL - medium light gray (N6), matrix is light brown (5YR 6/4), sub-angular to sub-rounded, moderately graded, max. size 4 cm., some clay.
CLAYSTONE:	Top of Bedrock Very light gray (N8), bedding not apparent, highly weathered, slightly friable, occasional iron stains.
NO SAMPLE:	
CLAYSTONE:	As above (reference interval 22.3 to 22.6 ft.)
CLAYSTONE:	As above.
CLAYSTONE:	As above, color grades to grayish orange (10YR 7/4) approx. 26 to 27 ft. with increase in iron staining.
SILTY CLAYSTONE:	Pinkish gray (5YR 8/1), bedding not apparent, highly weathered, slightly friable, moderate silt fraction, local iron staining.
NO SAMPLE:	

STATE PLANE COORDINATE:		TOTAL DEPTH (FT): 174	GROUND ELEVATION (FT):	5959.06	PROJECT NUMBER:	567.11	LOG OF BORING NUMBER:
NORTH:	749130	AREA: 903 PAD	CASING DIAMETER (IN):	2 ID	GEOLOGIST:	LAA/DCB	16-87DR
EAST:	2086249	LOCATOR NUMBER: N9	BOREHOLE DIAMETER (IN):	4	DATE DRILLED:	07/08/87	

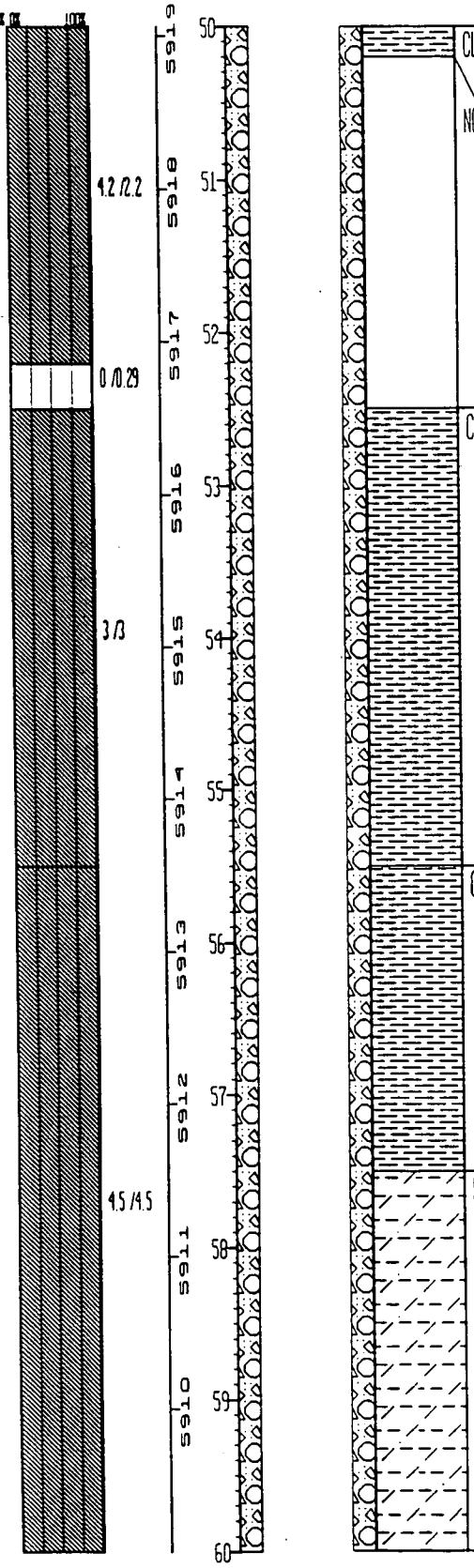
REMARKS: Hollow stem auger, Rotary core. Surface casing set to 49.17' by Craig Wood, June 18, 1987.

CRITICAL SAMPLE DEPTH / GRADATIONAL SAMPLE DEPTH	SAMPLE NUMBER	SAMPLE GRAIN SIZE (0% 50% 100%)	PERCENT RECOVERY (0% 100%)	RECOVERY/INTERVAL	DATUM (FT)	DEPTH (FT)	WELL OR PIEZOMETER CONSTRUCTION	LITHOLOGY	UNIFIED SOILS CLASSIFICATION OR ROCK TYPE	DESCRIPTION
				1.6 /1.35	5939	30			SILTY CLAYSTONE	Very pale orange (10YR 8/2), bedding not evident, highly weathered, mod. friable, some iron staining, becomes mod. yellowish brown (10YR 5/4) toward bottom of interval.
				0 /0.65	5938	31			NO SAMPLE	
				1.8 /2	5937	32			SILTY CLAYSTONE	Same as above, heavy ironization and abundant black mineralization near top of interval.
				1.85 /2	5936	33			SILTY CLAYSTONE	Very lt. gray to grayish orange (10YR 7/4 to N8), highly weathered, mod. friable, bedding not evident, some iron staining.
				1.75 /2	5935	34			SILTY CLAYSTONE	Same as above.
				1.75 /2	5934	35			SILTY CLAYSTONE	Same as above.
					5933	36				
					5932	37				
					5931	38				
					5930	39				
						40				

STATE PLANE COORDINATE		TOTAL DEPTH (FT): 174	GROUND ELEVATION (FT): 5569.06	PROJECT NUMBER: 667.11	LOG OF BORING NUMBER:
NORTH:	749130	AREA: 903 PAD	CASING DIAMETER (IN): 2 ID	GEOLOGIST: LAA/DCB	16-87BR
EAST:	2086249	LOCATOR NUMBER: N9	BOREHOLE DIAMETER (IN): 4	DATE DRILLED: 07/08/87	

REMARKS: Hollow stem auger, Rotary core. Surface casing set to 49.17' by Craig Wood, June 18, 1987.

CHEMICAL SAMPLE DEPTH
GRADATIONAL SAMPLE DEPTH
SAMPLE NUMBER
SAMPLE GRAIN SIZE (0% 50% 100%)
PERCENT RECOVERY (0% 100%)
RECOVERY/INTERVAL
DATUM (FT)
DEPTH (FT)
WELL OR PIEZOMETER CONSTRUCTION
LITHOLOGY
UNIFIED SOILS CLASSIFICATION OR ROCK TYPE
DESCRIPTION

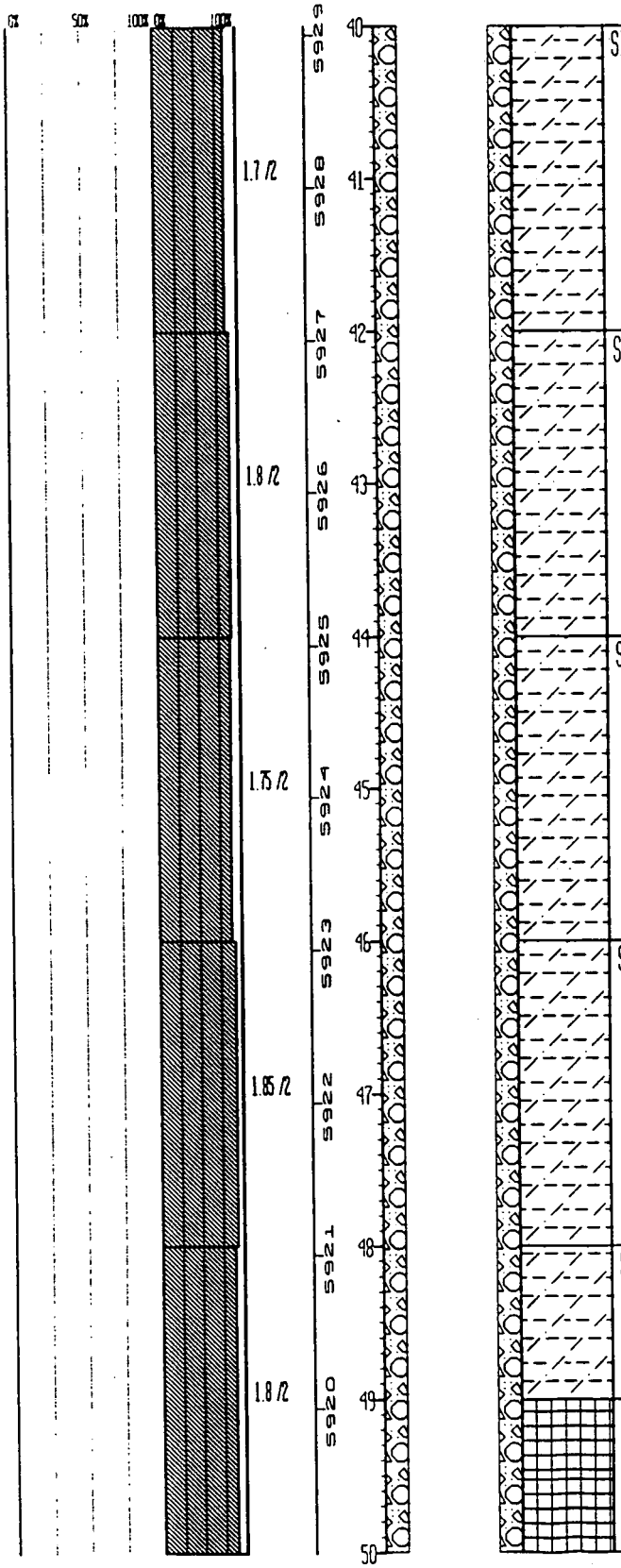


UNIFIED SOILS CLASSIFICATION OR ROCK TYPE	DESCRIPTION
CLAYSTONE:	Light gray (N7), bedding not apparent (massive?), weathered, slightly to moderately friable, localized iron staining.
NO SAMPLE:	
CLAYSTONE:	Medium dark gray (N4), bedding not apparent (massive?), weathered, slightly friable, localized iron staining, and carbonaceous mineralization, occasional small bodies or lenses of coal <2.5 mm. thick.
CLAYSTONE:	Same as above.
SILTY CLAYSTONE:	Light gray (N7), bedding not apparent (massive?), weathered, moderately friable.

STATE PLANE COORDINATE:		TOTAL DEPTH (FT) 174	GROUND ELEVATION (FT):	5969.06	PROJECT NUMBER:	667 11	LOG OF BORING NUMBER:
NORTH:	749130	AREA: 903 PAD	CASING DIAMETER (IN)	2 ID	GEOLOGIST:	LAA/DCB	16-87BR
EAST:	2086249	LOCATOR NUMBER: N9	BOREHOLE DIAMETER (IN):	4	DATE DRILLED:	07/08/87	

REMARKS: Hollow stem auger, Rotary core. Surface casing set to 49 17' by Craig Wood, June 18, 1987.

CHEMICAL SAMPLE DEPTH
GRADATIONAL SAMPLE DEPTH
SAMPLE NUMBER
SAMPLE GRAIN SIZE
PERCENT RECOVERY
RECOVERY/INTERVAL
DATUM (FT)
DEPTH (FT)
WELL OR PIEZOMETER CONSTRUCTION
LITHOLOGY
UNIFIED SOILS CLASSIFICATION OR ROCK TYPE
DESCRIPTION



SILTY CLAYSTONE: Grayish orange (10YR 7/4 to 10YR 6/2), highly weathered, mod. friable, bedding not evident, some iron staining.

SILTY CLAYSTONE: Same as above with color change to light brownish gray (5YR 6/1).

SILTY CLAYSTONE: Same as above with color change to medium dk. gray (N4), some carb. material, no iron staining.

SILTY CLAYSTONE: Same as above.

SILTY CLAYSTONE: Same as above, some iron staining.

CALICHE: White (N9), slightly friable.

STATE PLANE COORDINATE:		TOTAL DEPTH (FT): 174	GROUND ELEVATION (FT):	5969.06	PROJECT NUMBER:	667.11	LOG OF BORING NUMBER:
NORTH:	749130	AREA: 903 PAD	CASING DIAMETER (IN):	2 ID	GEOLOGIST:	LAA/DCB	16-87BR
EAST:	2086249	LOCATOR NUMBER: N9	BOREHOLE DIAMETER (IN):	4	DATE DRILLED:	07/08/87	

REMARKS: Hollow stem auger, Rotary core. Surface casing set to 49.17' by Craig Wood, June 18, 1987.

CHEMICAL SAMPLE
GRADATIONAL SAMPLE
SAMPLE NUMBER

SAMPLE GRAIN SIZE: 0% 50% 100%

PERCENT RECOVERY: 100% OK 100%

RECOVERY/INTERVAL: 1.6/1.6; 2.8/6.35; 0/0.05; 3/3

DATUM (FT): 5969, 5968, 5967, 5966, 5965, 5964, 5963, 5962, 5961, 5960

DEPTH (FT): 60, 61, 62, 63, 64, 65, 66, 67, 68, 69, 70

WELL OR PIEZOMETER CONSTRUCTION

LITHOLOGY

UNIFIED SOILS CLASSIFICATION OR ROCK TYPE / DESCRIPTION

SILTY CLAYSTONE: Same as above. Slickensides occur at approx. 60.3 ft., curvilinear, surface angle not applicable. Fracture at 61.4 ft. with carbonaceous mineralization.

SILTY CLAYSTONE: As above.

NO SAMPLE:

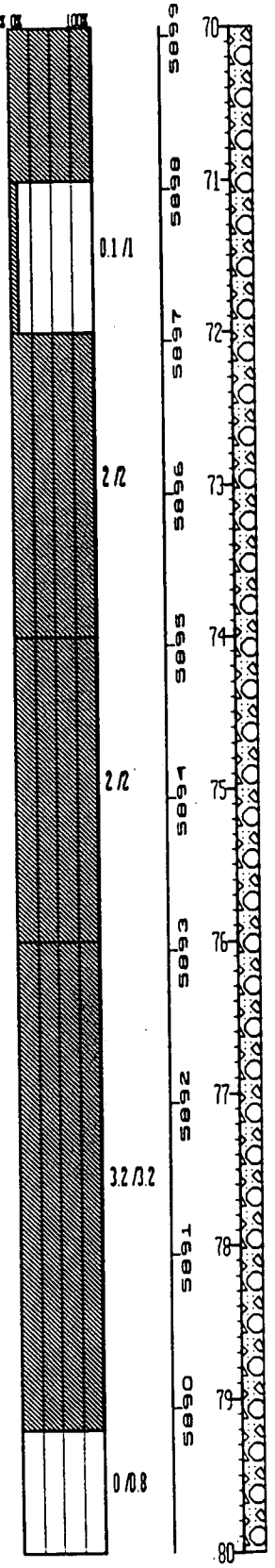
SILTY CLAYSTONE: As above (reference interval 61.6 to 67.95 ft.), bedding may be horizontal based on core breakage, appears wavy, weathering prevents better description, possible sulfur flower on bedding planes.

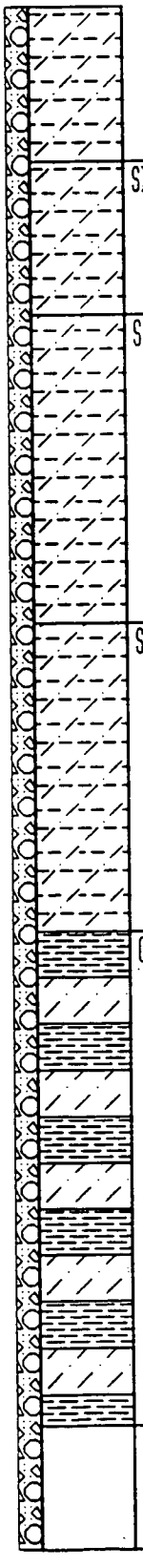
STATE PLANE COORDINATE:	TOTAL DEPTH (FT): 174	GROUND ELEVATION (FT):	5969.06	PROJECT NUMBER:	567 11
NORTH: 749130	AREA: 903 PAD	CASING DIAMETER (IN):	2 ID	GEOLOGIST:	LAA/DCB
EAST: 2086249	LOCATOR NUMBER: N9	BOREHOLE DIAMETER (IN):	4	DATE DRILLED:	07/08/87

LOG OF BORING NUMBER: 16-87DD

REMARKS: Hollow stem auger, Rotary core. Surface casing set to 49.17' by Craig Wood, June 18, 1987.

CHEMICAL SAMPLE DEPTH
GRADATIONAL SAMPLE DEPTH
SAMPLE NUMBER
SAMPLE GRAIN SIZE (0% 50% 100%)
PERCENT RECOVERY (100% OR 100%)
RECOVERY/INTERVAL
DATUM (FT)
DEPTH (FT)
WELL OR PIEZOMETER CONSTRUCTION
LITHOLOGY
UNIFIED SOILS CLASSIFICATION OR ROCK TYPE
DESCRIPTION





SILTY CLAYSTONE: As above.

SILTY CLAYSTONE: As above.

SILTY CLAYSTONE: As above. Slickenside at 75 ft. 60 degree angle, coal body approx. 1.5 cm. in thickness also occurs at this depth and angle. At 75 ft. interval grades to silty claystone, yellowish gray (5Y 7/2), bedding not apparent (massive?).

CLAYSTONE: At 76 ft. interval grades to interbedded claystone and siltstone, medium gray (N5) and light gray (N7) respectively, bedding is horizontal, interfingering very fine sandstone occurs occasionally in this interval, weathered, moderately friable, carbonaceous. Interval grades to siltstone, light gray (N7), bedding not apparent (massive?), weathered, mod. friable.

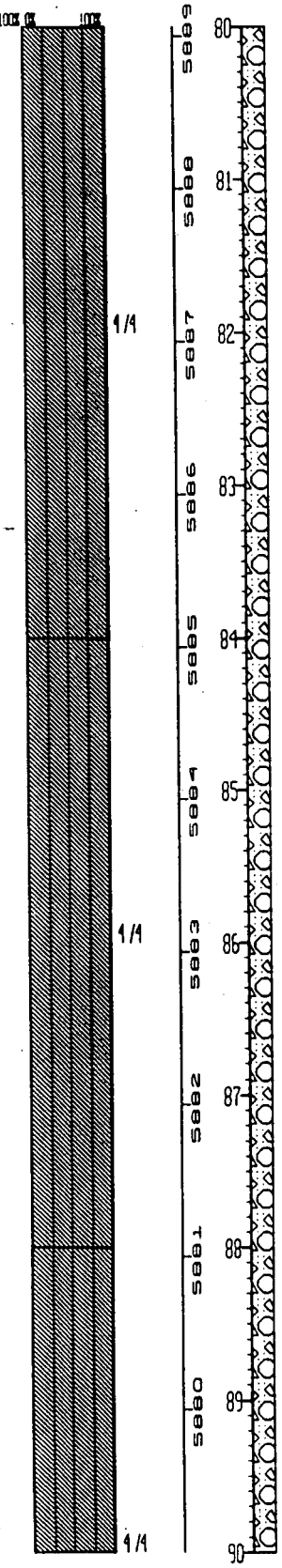
NO SAMPLE:

STATE PLANE COORDINATE:		TOTAL DEPTH (FT) 174	GROUND ELEVATION (FT): 5969.06	PROJECT NUMBER: 667.11	LOG OF BORING NUMBER:
NORTH:	749130	AREA: 903 PAD	CASING DIAMETER (IN): 2 ID	GEOLOGIST: LAA/DCB	16-87BR
EAST:	2086249	LOCATOR NUMBER: N9	BOREHOLE DIAMETER (IN): 4	DATE DRILLED: 07/08/87	

REMARKS: Hollow stem auger, Rotary core. Surface casing set to 49.17' by Craig Wood, June 18, 1987.

CHEMICAL SAMPLE
GRADATIONAL SAMPLE
SAMPLE NUMBER

SAMPLE GRAIN SIZE (0% 50% 100%) | PERCENT RECOVERY (0% 100%) | RECOVERY/INTERVAL | DATUM (FT) | DEPTH (FT) | WELL OR PIEZOMETER CONSTRUCTION | LITHOLOGY | UNIFIED SOILS CLASSIFICATION OR ROCK TYPE | DESCRIPTION

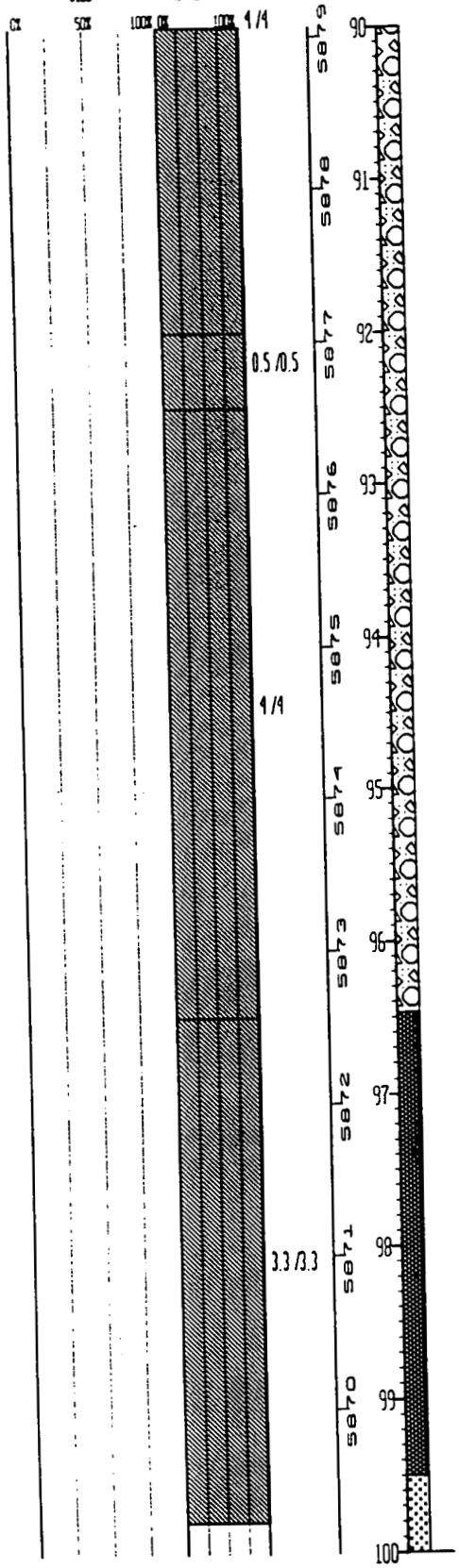


UNIFIED SOILS CLASSIFICATION OR ROCK TYPE	DESCRIPTION
CLAYSTONE:	Medium light gray (N6), bedding not apparent (massive?), weathered, slightly friable, slight silt fraction and occasional short intervals of silt.
CLAYSTONE:	Same as above.
CLAYSTONE:	As above.

STATE PLANE COORDINATE:		TOTAL DEPTH (FT) 174	GROUND ELEVATION (FT):	5969.06	PROJECT NUMBER:	667 11	LOG OF BORING NUMBER:
NORTH:	749130	AREA: 903 PAD	CASING DIAMETER (IN):	2 ID	GEOLOGIST:	LAA/DCB	16-87DR
EAST:	2086249	LOCATOR NUMBER: N9	BOREHOLE DIAMETER (IN):	4	DATE DRILLED:	07/08/87	

REMARKS: Hollow stem auger, Rotary core. Surface casing set to 49 17' by Craig Wood, June 18, 1987.

CHEMICAL SAMPLE DEPTH
GRADATIONAL SAMPLE DEPTH
SAMPLE NUMBER
SAMPLE GRAIN SIZE
PERCENT RECOVERY
RECOVERY/INTERVAL
DATUM (FT)
DEPTH (FT)
WELL OR PIEZOMETER CONSTRUCTION
LITHOLOGY
UNIFIED SOILS CLASSIFICATION OR ROCK TYPE
DESCRIPTION



UNIFIED SOILS CLASSIFICATION OR ROCK TYPE	DESCRIPTION
CLAYSTONE:	As above.
CLAYSTONE:	As above.
CLAYSTONE:	As above.
SILTSTONE:	Interval grades to siltstone below 98 ft., very light gray (N8), thin bedded <1" mm., Horizontal to 10 degree dip, weathered, slightly friable.

STATE PLANE COORDINATE:		TOTAL DEPTH (FT): 174	GROUND ELEVATION (FT):	5969.06	PROJECT NUMBER:	667.11	LOG OF BORING NUMBER:
NORTH:	749130	AREA: 903 PAD	CASING DIAMETER (IN):	2 ID	GEOLOGIST:	LAA/DCB	16-87BR
EAST:	2086249	LOCATOR NUMBER: N9	BOREHOLE DIAMETER (IN):	4	DATE DRILLED:	07/08/87	

REMARKS: Hollow stem auger, Rotary core. Surface casing set to 49.17' by Craig Wood, June 18, 1987.

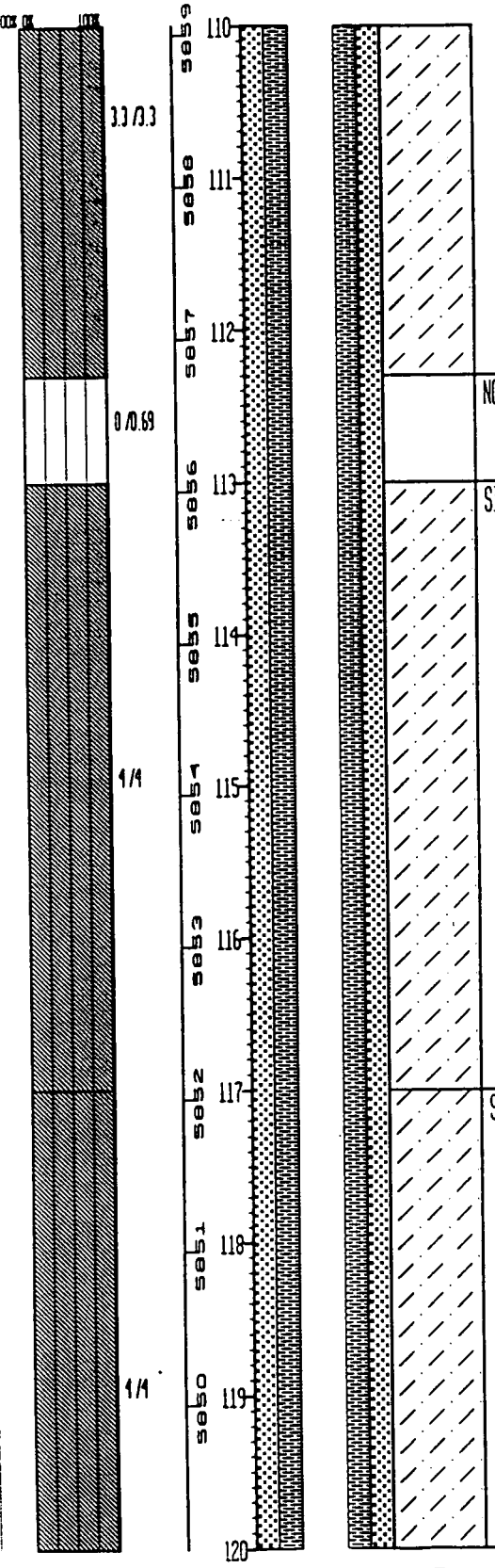
CHEMICAL SAMPLE / GRADATIONAL SAMPLE	SAMPLE NUMBER	SAMPLE GRAIN SIZE (0% 50% 100%)	PERCENT RECOVERY (0% 100%)	RECOVERY/INTERVAL	DATUM (FT)	DEPTH (FT)	WELL OR PIEZOMETER CONSTRUCTION	LITHOLOGY	UNIFIED SOILS CLASSIFICATION OR ROCK TYPE	DESCRIPTION
				0 /0.69	5969	100			NO SAMPLE:	
				1.2 /1.2	5968	101			SILTSTONE:	Very light gray (N8), thin bedded <1 mm, horizontal to 10 degree dip, weathered, slightly friable, slight sand fraction very fine grained, interbedded.
	60X64			3.3 /3.3	5967	102			SILTSTONE:	As above.
					5966	103				
					5965	104				
					5964	105			SILTSTONE:	As above with abundant very fine grained sand from 105.0 to 105.4 ft.
					5963	106				
				4 /4	5962	107				
					5961	108				
					5960	109			SILTSTONE:	As above.
						110				

STATE PLANE COORDINATE:	TOTAL DEPTH (FT): 174	GROUND ELEVATION (FT):	5969.06	PROJECT NUMBER:	667.11
NORTH: 749130	AREA: 903 PAD	CASING DIAMETER (IN):	2 ID	GEOLOGIST:	LAA/DCB
EAST: 2086249	LOCATOR NUMBER: N9	BOREHOLE DIAMETER (IN):	4	DATE DRILLED:	07/08/87

LOG OF BORING NUMBER: 16-87DR

REMARKS: Hollow stem auger, Rotary core. Surface casing set to 49.17' by Craig Wood, June 18, 1987.

CHEMICAL SAMPLE DEPTH
GRADATIONAL SAMPLE DEPTH
SAMPLE NUMBER
SAMPLE GRAIN SIZE (0% 50% 100%)
PERCENT RECOVERY (0% 100%)
RECOVERY/INTERVAL
DATUM (FT)
DEPTH (FT)
WELL OR PIEZOMETER CONSTRUCTION
LITHOLOGY
UNIFIED SOILS CLASSIFICATION OR ROCK TYPE
DESCRIPTION



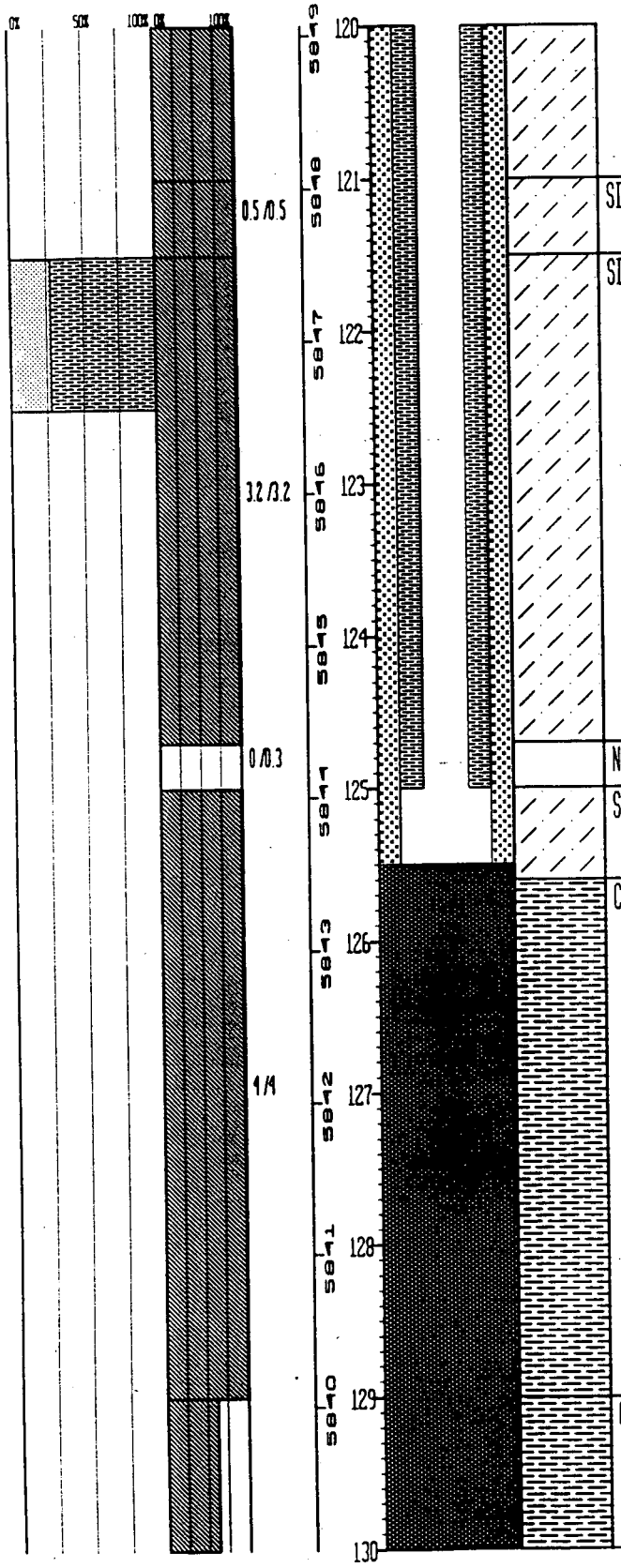
NO SAMPLE:

SILTSTONE: As above.

SILTSTONE: As above, 0.75 ft. slabbed, bedding is dominantly deformed through bioturbation otherwise roughly horizontal, thin bedded < 2.5 m., interbedded siltstone, sandstone and claystone, small scale offsets in bedding.

STATE PLANE COORDINATE:		TOTAL DEPTH (FT): 174	GROUND ELEVATION (FT): 5969.06	PROJECT NUMBER: 667 11	LOG OF BORING NUMBER:
NORTH:	749130	AREA: 903 PAD	CASING DIAMETER (IN): 2 ID	GEOLOGIST: LAA/DCB	16-87BR
EAST:	2086249	LOCATOR NUMBER: N9	BOREHOLE DIAMETER (IN): 4	DATE DRILLED: 07/08/87	

REMARKS: Hollow stem auger, Rotary core. Surface casing set to 49.17' by Craig Wood, June 18, 1987.

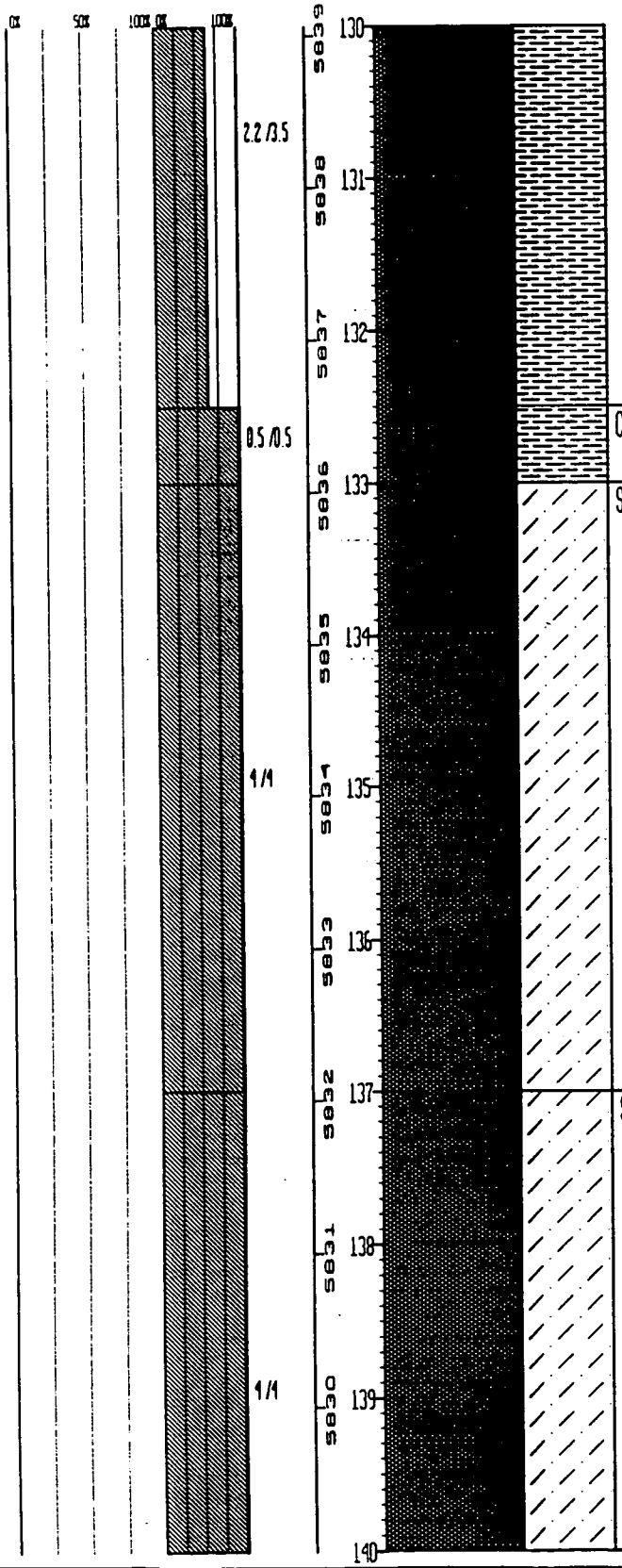


UNIFIED SOILS CLASSIFICATION OR ROCK TYPE	DESCRIPTION
SILTSTONE:	As above.
SILTSTONE:	As above.
NO SAMPLE:	
SILTSTONE:	Light gray (N7), laminar bedding with some wavy bedding, weathered, slightly friable.
CLAYSTONE:	Interval grades to claystone at approx. 125.6 ft., olive gray (5Y 4/1), bedding approx. 10 degrees based on core breaks, weathered, slightly friable, carbonaceous mineralization occurs locally, fossil leaf at approx. 126 ft., short intervals of siltstone occur occasionally.
CLAYSTONE:	As above.

STATE PLANE COORDINATE:		TOTAL DEPTH (FT): 174	GROUND ELEVATION (FT):	5969.06	PROJECT NUMBER:	667.11	LOG OF BORING NUMBER:
NORTH:	749130	AREA: 903 PAD	CASING DIAMETER (IN):	2 ID	GEOLOGIST:	LAA/DCB	16-87DR
EAST:	2086249	LOCATOR NUMBER: N9	BOREHOLE DIAMETER (IN):	4	DATE DRILLED:	07/08/87	

REMARKS: Hollow stem auger, Rotary core. Surface casing set to 49.17' by Craig Wood, June 18, 1987.

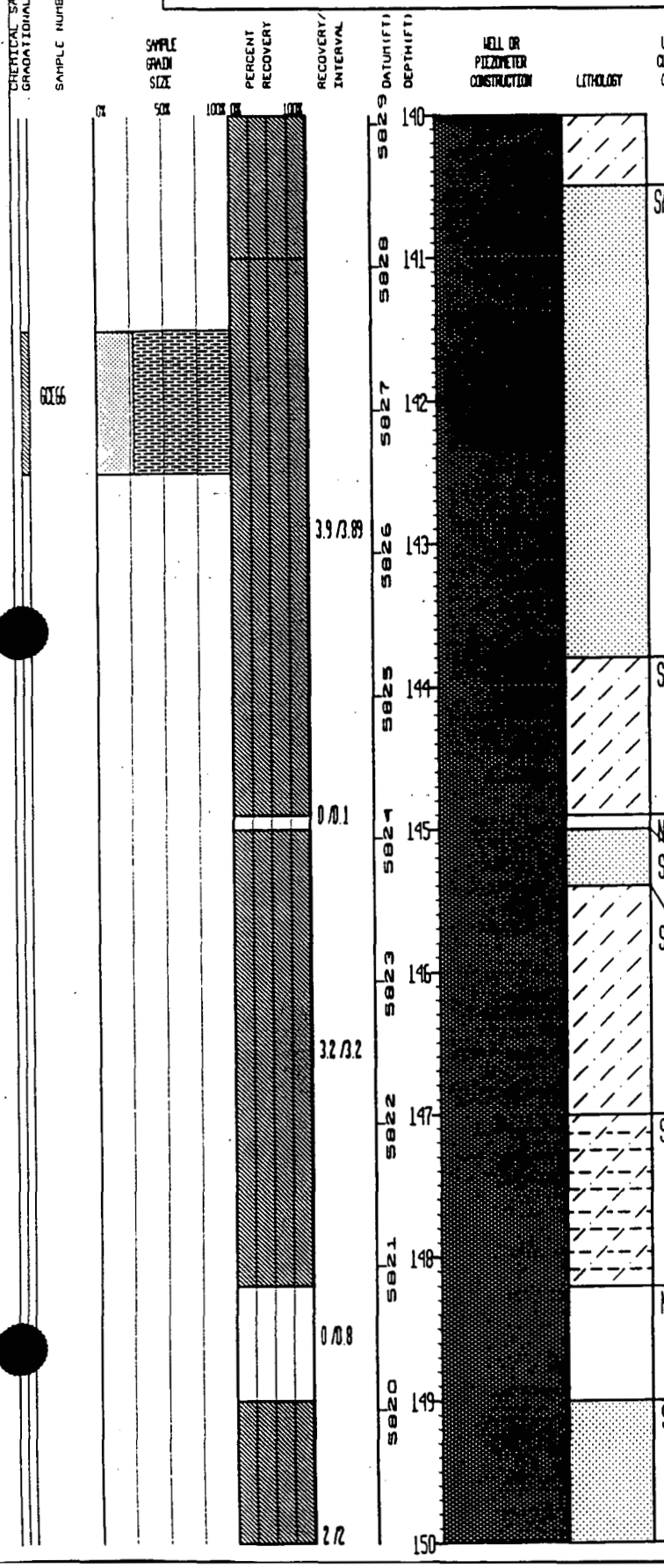
CHEMICAL SAMPLE DEPTH | GRADATIONAL SAMPLE DEPTH | SAMPLE NUMBER | SAMPLE GRAIN SIZE (0% 50% 100%) | PERCENT RECOVERY (0% 100%) | RECOVERY/INTERVAL | DATUM (FT) | DEPTH (FT) | WELL OR PIEZOMETER CONSTRUCTION | LITHOLOGY | UNIFIED SOILS CLASSIFICATION OR ROCK TYPE | DESCRIPTION



CLAYSTONE:	As above.
SILTSTONE:	Interval grades to siltstone at 132.9 ft., light gray (N7), thin bedded, weathered, slightly friable, occasionally interbedded with claystone.
SILTSTONE:	As above with increasing very fine sand fraction.

STATE PLANE COORDINATE:		TOTAL DEPTH (FT): 174	GROUND ELEVATION (FT):	5969.06	PROJECT NUMBER:	667.11	LOG OF BORING NUMBER:
NORTH:	749130	AREA: 903 PAD	CASING DIAMETER (IN):	2 ID	GEOLOGIST:	LAA/DCB	16-87BR
EAST:	2086249	LOCATOR NUMBER: N9	BOREHOLE DIAMETER (IN):	4	DATE DRILLED:	07/08/87	

REMARKS: Hollow stem auger, Rotary core. Surface casing set to 49.17' by Craig Wood, June 18, 1987.



SANDSTONE:	Interval grades to sandstone by approx. 140.5 ft., light gray (N7), thin bedded, weathered, slightly friable, very fine grained, abundant silt.
SILTSTONE:	Interval grades to siltstone at approx. 143.8 ft., light gray (N7), thin bedded <2.5 mm., weathered, slightly friable, slight clay and VFG sand fraction.
NO SAMPLE:	
SANDSTONE:	Light gray (N7), thin bedded <2 mm., weathered, slightly friable, medium to fine gained, moderately sorted, sub-rounded to rounded.
SILTSTONE:	Interval grades to siltstone at approx. 145.4 ft., light gray (N7), thin bedded <2.5 mm., convolute bedding possible, bioturbation load casts visible in slab, weathered, slightly friable.
SILTY CLAYSTONE:	Interval grades to silty claystone at 147.0 ft. Light gray (N7) to med. gray (N5), bedding not apparent, weathered, slightly friable.
NO SAMPLE:	
SANDSTONE:	As above, (reference interval 147.0 ft. to 148.2 ft.), slickensides occur at approx. 150 ft. approx. 70 degree angle, slight to moderate silt fraction.

STATE PLANE COORDINATE:		TOTAL DEPTH (FT): 174	GROUND ELEVATION (FT):	5959.06	PROJECT NUMBER:	667.11	LOG OF BORING NUMBER:
NORTH:	749130	AREA: 903 PAD	CASING DIAMETER (IN):	2 ID	GEOLOGIST:	LAA/DCB	16-87DD
EAST:	2086249	LOCATOR NUMBER: N9	BOREHOLE DIAMETER (IN):	4	DATE DRILLED:	07/08/87	

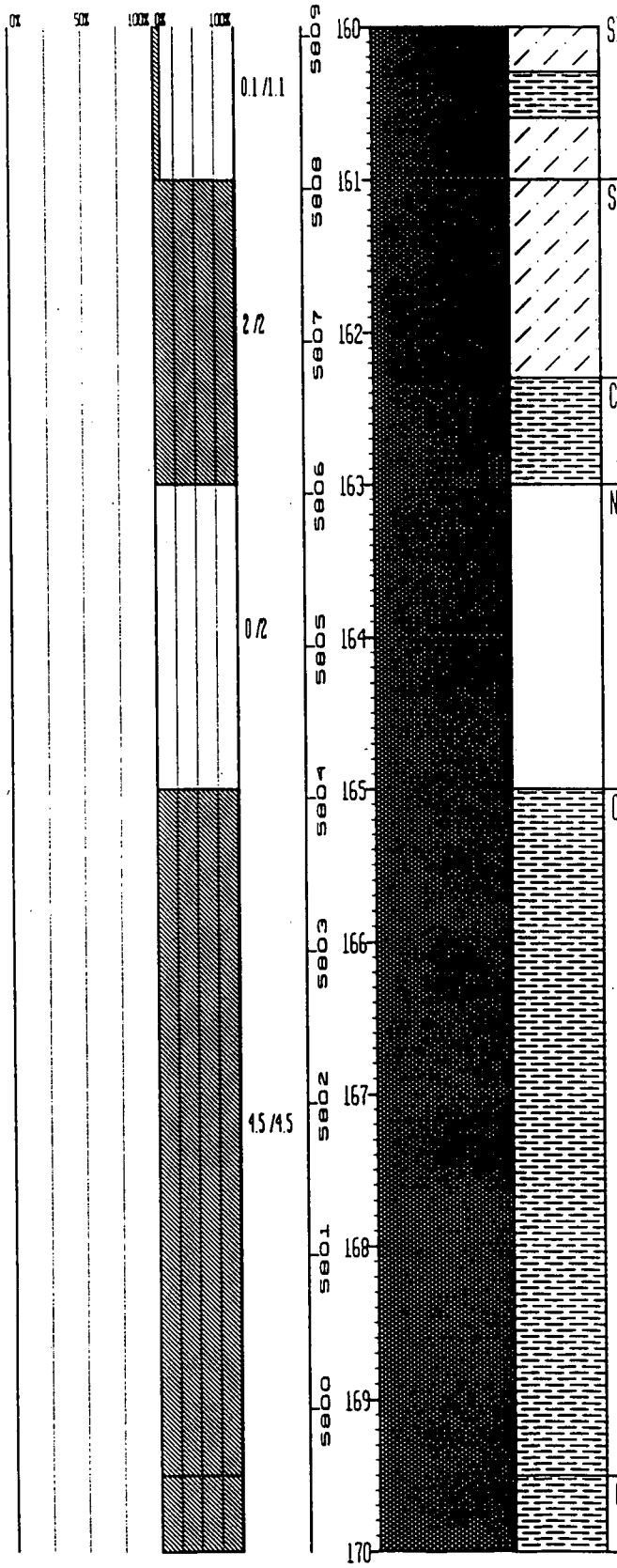
REMARKS: Hollow stem auger, Rotary core. Surface casing set to 49.17' by Craig Wood, June 18, 1987.

CHEMICAL SAMPLE DEPTH / GRADATIONAL SAMPLE DEPTH	SAMPLE NUMBER	SAMPLE GRADI SIZE (0% 50% 100%)	PERCENT RECOVERY (0% 100%)	RECOVERY/INTERVAL	DATUM (FT)	DEPTH (FT)	WELL OR PIEZOMETER CONSTRUCTION	LITHOLOGY	UNIFIED SOILS CLASSIFICATION OR ROCK TYPE	DESCRIPTION
				2/2	5919	150				
					5918	151			SANDSTONE:	As above.
				2/2	5917	152				
					5916	153			SILTSTONE:	Interval grades to siltsone, light gray (N7), thin bedded, wavy, weathered, slightly friable, slight clay fraction, carbonaceous mineralization along bedding plane parting at approximately 155 ft.
					5915	154				
	80167			4/4	5914	155				
					5913	156				
					5912	157			SILTSTONE:	As above with increase in sand fraction below 157.3 ft. sandy siltstone.
				2.9/2.89	5911	158				
					5910	159				
						160				

STATE PLANE COORDINATE:	TOTAL DEPTH (FT): 174	GROUND ELEVATION (FT): 5969.06	PROJECT NUMBER: 667.11	LOG OF BORING NUMBER:
NORTH: 749130	AREA: 903 PAD	CASING DIAMETER (IN): 2 ID	GEOLOGIST: LAA/DCB	16-87BR
EAST: 2086249	LOCATOR NUMBER: N9	BOREHOLE DIAMETER (IN): 4	DATE DRILLED: 07/08/87	

REMARKS: Hollow stem auger, Rotary core. Surface casing set to 49.17' by Craig Wood, June 18, 1987.

CHEMICAL SAMPLE
GRADATIONAL SAMPLE
SAMPLE NUMBER
SAMPLE GRAIN SIZE (0% 50% 100%)
PERCENT RECOVERY (0% 100%)
RECOVERY/INTERVAL
DATUM (FT)
DEPTH (FT)
WELL OR PIEZOMETER CONSTRUCTION
LITHOLOGY



UNIFIED SOILS CLASSIFICATION OR ROCK TYPE	DESCRIPTION
SILTSTONE:	Interbedded siltstones and claystones at 160 ft., reference intervals above. Grades to siltstone at 161 ft.
SILTSTONE:	Light gray (N7), thin bedded <2 mm., slightly weathered, slightly friable, localized carbonaceous mineralization.
CLAYSTONE:	Grades to claystone, medium gray (N5), bedding not apparent (massive?), weathered, moderately friable, slight silt fraction.
NO SAMPLE:	
CLAYSTONE:	As above (reference interval 162.3 to 163.3ft.)
CLAYSTONE:	As above.

STATE PLANE COORDINATE:		TOTAL DEPTH (FT): 174	GROUND ELEVATION (FT):	5969.06	PROJECT NUMBER:	557.11	LOG OF BORING NUMBER:
NORTH:	749130	AREA: 903 PAD	CASING DIAMETER (IN):	2 ID	GEOLOGIST:	LAA/DCB	16-87[illegible]
EAST:	2086249	LOCATOR NUMBER: N9	BOREHOLE DIAMETER (IN):	4	DATE DRILLED:	07/08/87	

REMARKS: Hollow stem auger, Rotary core. Surface casing set to 49.17' by Craig Wood, June 18, 1987.

CHEMICAL SAMPLE DEPTH / GRADATIONAL SAMPLE DEPTH	SAMPLE NUMBER	SAMPLE GRAIN SIZE (0% 50% 100%)	PERCENT RECOVERY (0% 100%)	RECOVERY/INTERVAL	DATUM (FT)	DEPTH (FT)	WELL OR PIEZOMETER CONSTRUCTION	LITHOLOGY	UNIFIED SOILS CLASSIFICATION OR ROCK TYPE	DESCRIPTION
				4.5/4.5	5799	170				
					5798	171				
					5797	172				
					5796	173				
					5795	174				SILTY CLAYSTONE: Interval grades to silty claystone, Light gray (N7), bedding not apparent (massive?), weathered, slightly friable.
					5794	175				
					5793	176				
					5792	177				
					5791	178				
					5790	179				
						180				

INDEX OF DATA

Boring No.: 19-87

Completed as well? Yes

Data in File

x Log of Borehole

x Well Construction Summaries

____ Well Development Summaries

____ Hydraulic Conductivity Test Data and Results

____ Packer Test Data and Results

x Water Level Data

LOG OF BOREHOLE

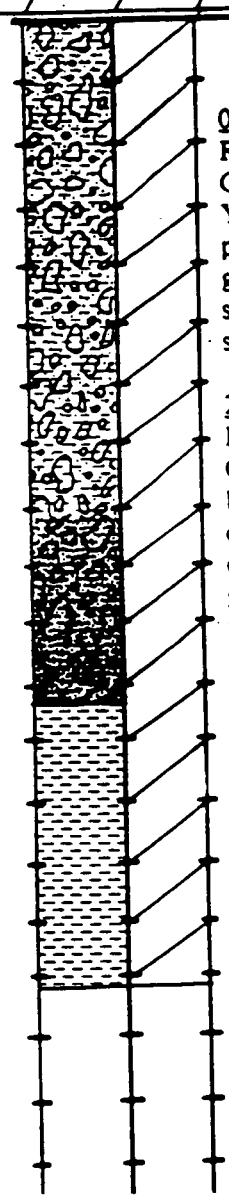
Location: Rocky Flats Plant; Mound Area
Coordinates: N 36633.42 E 23064.85
Total Depth: 16.10'

Borehole/Well No.: 19-87
Ground Surface Elevation: 5967.98'
Water Level Encountered: None
Static: 5958.07' (12/01/87)

Drilling Company: Boyles Bros
Date Drilled: August 5, 1987
Drilling Method: Hollow Stem Auger
Logged By: J.B. Bergman, Geologist

Driller: T. Merritt
Helper: J. Duncan
Drilling Fluid: None
Checked By: [signature], Site Manager
Brent Lewis, CEARP Manager

Comments:

Depth Feet	Graphic Log	Sample Type	Lithologic Description	Samples Collected or Other Tests Performed
0			**ROCKY FLATS ALLUVIUM** 0.0-2.0' SAMPLE. Recovered 1.4/2.0' = 70%. CLAY AND GRAVEL: grayish brown (5 YR 3/2); abundant gray quartzite cobbles, pebbles and gravels; some roots and grasses; poorly sorted; unconsolidated; some caliche-reacts strongly with HCl; slightly damp. 2.0-4.0' SAMPLE. Recovered 1.9/2.0' = 95%. CLAY AND GRAVEL: pale yellowish brown (10 YR 6/2); clay, abundant caliche-strongly reacts with HCl; abundant quartzite pebbles and cobbles; angular; poorly sorted; unconsolidated; dry to slightly damp. 4.0-5.3' SAMPLE. Recovered 1.9/1.3' = 146%. CLAY AND GRAVEL: same as above with some moderate brown (5 YR 3/4) clay patches; dry. 5.3-6.0' SAMPLE. Recovered 0.7/0.7 = 100%. CLAY AND GRAVEL: same as above; dry. 6.0-8.1' SAMPLE. No recovery. Drilled with center bit.	HNu Background=0.4 OVA Background=0.0 No Ludlum readings taken. 2.0-4.0': Readings on core: HNu = 0.2-2.0; OVA = 0.0 4.0-5.3': Readings on core: HNu = 1-100; OVA = 0.0 8.1-11.1': Readings on core: HNu=0.4-1.2; OVA=0.0-2.0 14.1-16.1': Readings on core: HNu=2; OVA=1.2
5				
10				
15				

LOG OF BOREHOLE

Location: Rocky Flats Plant; Mound Area
Coordinates: N 36633.42 E 23064.85
Total Depth: 16.10'

Borehole/Well No.: 19-87
Ground Surface Elevation: 5967.98'
Water Level Encountered: None
Static: 5958.07' (12/01/87)

Drilling Company: Boyles Bros
Date Drilled: August 5, 1987
Drilling Method: Hollow Stem Auger
Logged By: J.B. Bergman, Geologist

Driller: T. Merritt
Helper: J. Duncan
Drilling Fluid: None
Checked By: [signature], Site Manager

CEARP Manager

Comments

Depth Feet	Graphic Log	Sample Type	Lithologic Description	Samples Collected or Other Tests Performed
			8.1-11.1' SAMPLE. Recovered 3.0/3.0' = 100%. SANDY CLAY AND GRAVEL: moderate brown (5 YR 3/4) and light brown (5 YR 5/6); sandy clay matrix with abundant quartzite gravels; poorly sorted; very fine-grained; unconsolidated; dry.	
			11.1-14.1' SAMPLE. Recovered 3.0/3.0' = 100%. 11.1-11.4': CLAY: olive gray (5 Y 3/2); abundant caliche-reacts strongly with HCl; trace moderate yellowish brown (10 YR 5/4) clay patches; trace angular pebbles and gravels; dry.	
			ARAPAHOE FORMATION	
			11.4-14.1': CLAYSTONE: olive gray (5 Y 3/2); some moderate brown (10 YR 5/4) mottles; abundant $CaCO_3$ concretions; white-reacts strongly with HCl; some black organics; dry.	
			14.1-16.1' SAMPLE. Recovered 2.0/2.0' = 100%. CLAYSTONE: same as above; dry.	
			TOTAL DEPTH: 16.10'	

WELL COMPLETION INFORMATION

Location: Rocky Flats Plant; Mound Area

Well No.: 19-87

Coordinates: N 36633.42 E 23064.85

Elevation: Ground Surface 5967.98'

Total Depth: Well 11.89'

Top of Casing 5969.84'

Borehole 16.05'

Formation of Completion: Rocky Flats Alluvium

Casing Material: Sch 5, type 316 TFJ stainless steel

Casing Diameter: 2" ID

Screen Material: 0.010" wire wrap, type 316 TFJ stainless steel

Surface Casing Diameter: 5" ID

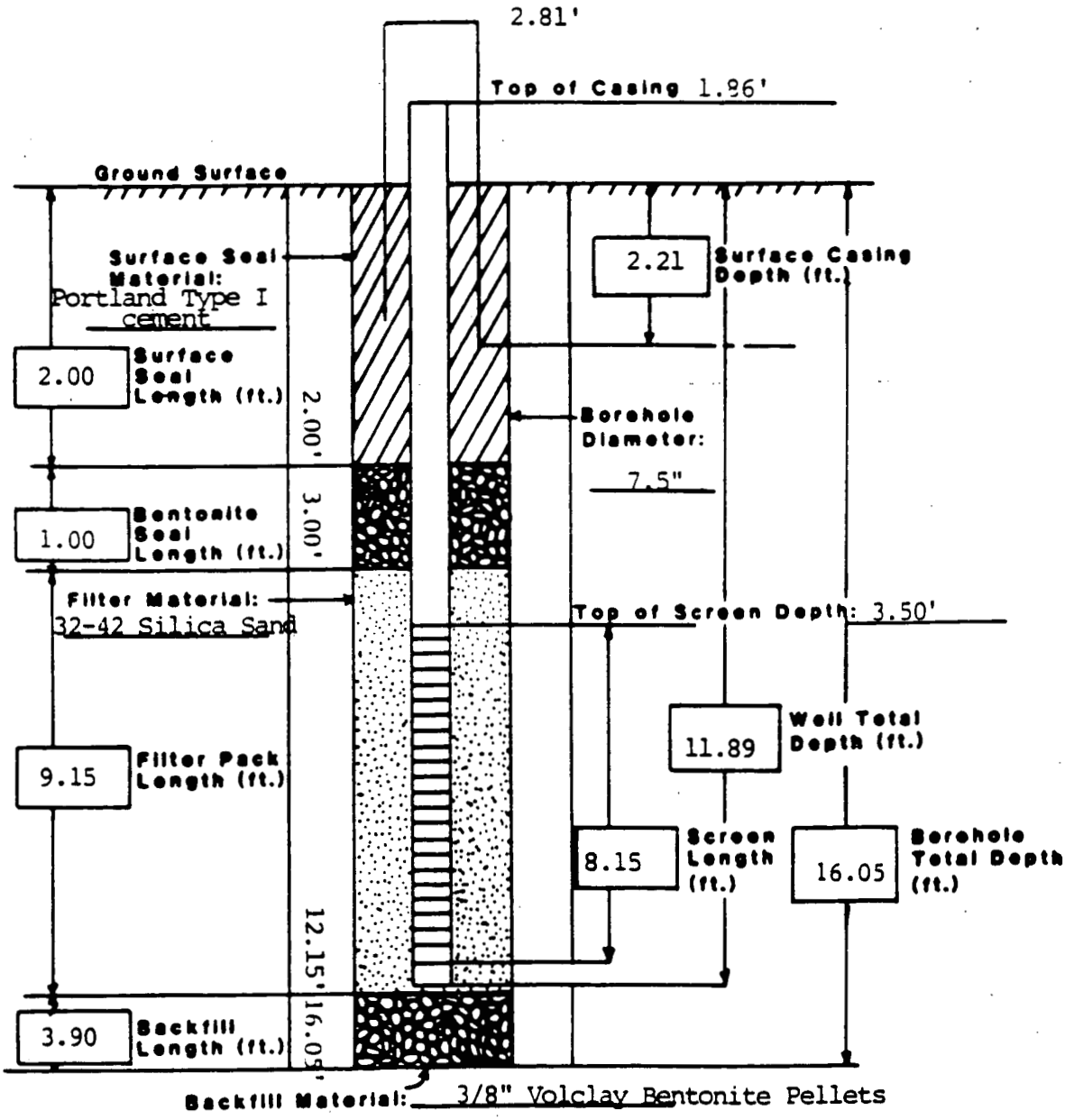
Date Installed: Aug. 6, 1987

Approved By: Site Manager

Installed By: J.B. Bergman, Geologist

CERRP Manager

Comments



LOG OF BORING NO. 14-87

DATES DRILLED:
ELEVATION:
GEOLOGIST(S): UAA
DATE:
CHECKED BY:

USCS symbol

DATE: 8/7/89

PROJECT NO: 667-11.22

TOP/BOTTOM OF CORE IN DEPTH	TOP/BOTTOM OF CORE IN DEPTH	SAMPLE NUMBER	FEET OF CORE	FEET OF CORE	FRACTURES PER FOOT	FRACTURE ANGLE	BEDDING ANGLE	GRAIN SIZE DISTRIBUTION	DEPTH IN FEET	LITHOLOGIC LOG	LITHOLOGIC DESCRIPTION
0.0 ↓	0.0 – 1.4		1.2 (1)	GC				Gravel ≈50% ≈Clay 50%	1		Clayey gravel. Gravel Med. gray to med. dark gray. (N5 to N4) Angular to sub angular. Mod. grading. Max. size 6cm. Matrix mod. brown (5yr 3/4). Silty clay. Low plasticity. Some sand. Some surficial roots + grass. Matrix calcareous
	1.4 – 2.0		0						2		No Sample
	2.0 – 3.9		2.2 (1)	GC				Caliche >50% Gravel ≈30%	3		Gravelly caliche white (N9) very [illegible] (10yr 8/2) to dark yellowish orange (10yr [illegible]) Mod. plasticity. Sandy. Gravel angular to subrounded. Max. size 3cm. Mod. grading. Short interval (≈ 3 in) Clayey v. coarse grained sand. Lt. brown (5yr 5/6). Well sorted. Subrounded. Calcite stringers (Near top)
	3.9 – 4.0		0						4		
	4.0 – 5.3		1.7 (1)	GC				Caliche 40% Clay 20% Gravel ≈35%	5		Same as above. More clay. No sand interval.
	5.3 – 6.0		.65 (1)	GC				Gravel ≥50%	6		Clayey Gravel. Predom. Med. gray (N5). Angular to sub rounded. Mod. grading. Max size 6cm. Matrix sandy clay mod. brown (5yr 4/4) Sand fine to [illegible]
	6.0 – 8.1		0						7 – 8		No Sample
↑ 11.1	8.1 to 11.1		2.9 (1)	GC				Gravel ≥30 Clay ≥30 Caliche ≥30	9		Same as above. Lg. amount of caliche present.

Box 1 of 2

NOTES: General: The USCS is modified for this log as follows: Material amounts are estimated by percent volume instead of percent weight.
(1) Badly broken core, accurate footage measurement not possible.
(2) Core breaks cannot be matched, accurate footage measurement not possible.

ROCKY FLATS PLANT

FIGURE NO.

LOG OF BORING NO. 19-87

DATES DRILLED:
ELEVATION:
GEOLOGIST(S): LAA
DATE:
CHECKED BY:

USCS symbol

DATE: 8/7/89

PROJECT NO: 667-11.22

TOP/BOTTOM OF CORE IN BOX	TOP/BOTTOM OF CORE IN FOOT (FOR FRACTURE)	SAMPLE NUMBER	FEET OF CORE (INCHES)	FEET OF CORE	FRACTURES PER FOOT	FRACTURE ANGLE	BEDDING ANGLE	GRAIN SIZE DISTRIBUTION	DEPTH IN FEET	LITHOLOGIC LOG	LITHOLOGIC DESCRIPTION
	8.1 to 11.1								11		See description on previous page.
11.1	11.1		3.0 (2)	CL				Clay >50% Silt ≈30%	12, 13, 14		Silty clay: yellowish gray to dark yellowish orange (5y 8/1 to 10yr 6/6.) Mod. plasticity. Some carb. material. Some caliche [illegible]
Boxes 2 of 2	14.1		2.9 (1)(2) LA	CL				Clay >50% Silt ≈48%	15, 16		Same as above
16.1	16.1								17, 18, 19		Bottom of Boxes

NOTES: General: The USCS is modified for this log as follows: Material amounts are estimated by percent volume instead of percent weight.
(1) Badly broken core, accurate footage measurement not possible.
(2) Core breaks cannot be matched, accurate footage measurement not possible.

ROCKY FLATS PLANT

FIGURE NO.

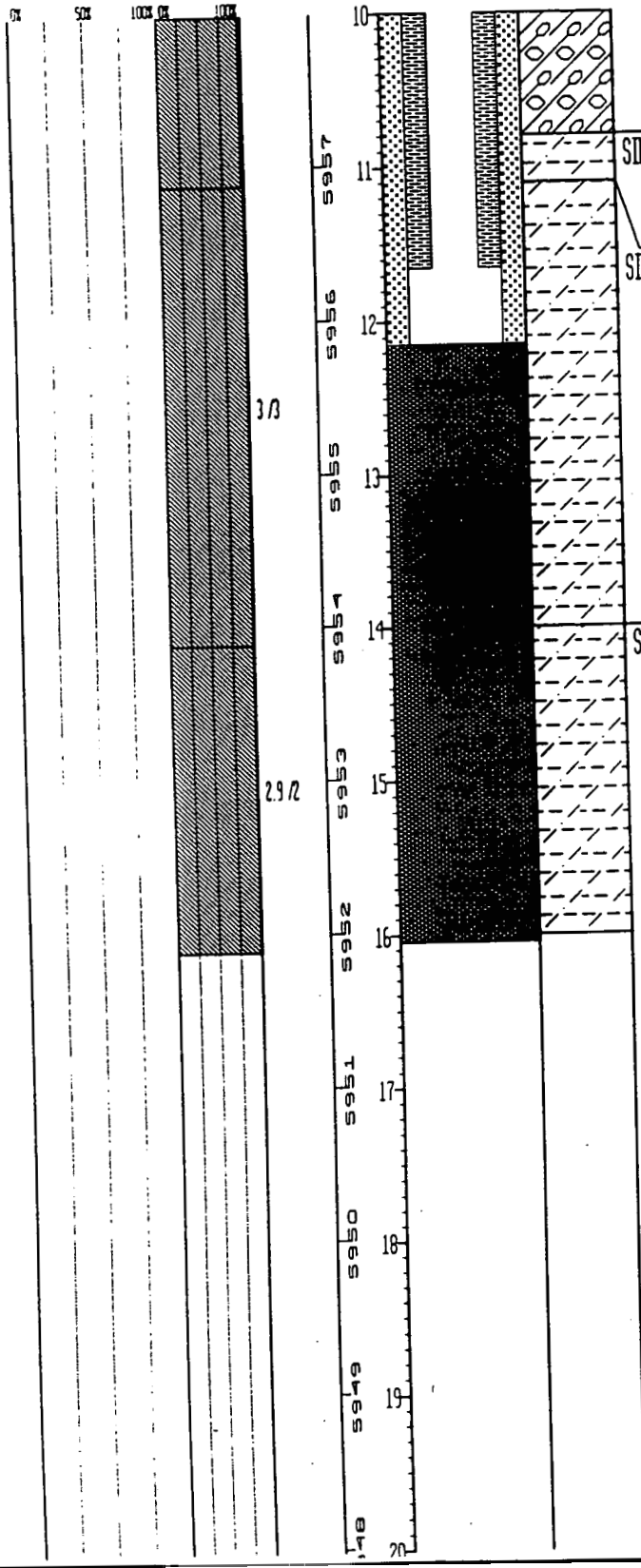
STATE PLANE COORDINATE:	TOTAL DEPTH (FT): 16.1	GROUND ELEVATION (FT): 5967.98	PROJECT NUMBER: 667.11	LOG OF BORING NUMBER:
NORTH: 749623	AREA: MOUND AREA	CASING DIAMETER (IN): 2 ID	GEOLOGIST: LAA	19-87
EAST: 2086172	LOCATOR NUMBER: N9	BOREHOLE DIAMETER (IN): 7.5	DATE DRILLED: 08/05/87	
REMARKS: Hollow stem auger.				

CHEMICAL SAMPLE
GRADATIONAL SAMPLE
SAMPLE NUMBER

SAMPLE GRAIN SIZE	PERCENT RECOVERY	RECOVERY/INTERVAL	DATUM (FT)	DEPTH (FT)	WELL OR PIEZOMETER CONSTRUCTION	LITHOLOGY	UNIFIED SOILS CLASSIFICATION OR ROCK TYPE	DESCRIPTION
		1.2/1.4	5967	0–1			GC:	Clayey Gravel - gravel med. gray to med. dark gray (N5 to N4), angular to sub-angular, mod. grading, max. size 6 cm., matrix med. brown (5YR 3/4), silty clay, low plasticity, some sand, some surficial roots and grass, matrix calcareous.
		0/0.6	5966	1–2			NO SAMPLE:	
		2.2/1.9	5965	2–3			GC:	Gravelly Caliche - white (N9), very pale orange (10YR 8/2) to dark yellowish orange (10YR 6/6), mod. plasticity, sandy gravel angular to sub-rounded, max. size 3 cm., mod. grading, short interval (approx. 0.3 in.) clayey v. coarse grained sand, lt. brown (5YR 5/6), well sorted, sub-rounded, calcite stringers (near top.)
		0/0.09	5964	3–4			NO SAMPLE:	
		1.7/1.3	5963	4–5			GC:	Same as above, more clay, no sand interval.
		0.65/0.7	5962	5–6			GC:	Clayey Gravel - predom. med. gray (N5), angular to sub-rounded, well graded, max. size 6 cm., matrix sandy clay med. brown (5YR 4/4), sand fine to granules, calcitic.
		0/2.1	5961–5960	6–8			NO SAMPLE:	
		2.9/3	5959–5958	8–10	12/01/87		GC:	Same as above, lg. amount of caliche present.

STATE PLANE COORDINATE:	TOTAL DEPTH (FT) 16.1	GROUND ELEVATION (FT): 5967.98	PROJECT NUMBER: 667.11	LOG OF BORING NUMBER:	
NORTH: 749623	AREA: MOUND AREA	CASING DIAMETER (IN): 2 ID	GEOLOGIST: LAA	19-87	
EAST: 2086172	LOCATOR NUMBER: N9	BOREHOLE DIAMETER (IN): 7.5	DATE DRILLED: 08/05/87		
REMARKS: Hollow stem auger.					

CHEMICAL SAMPLE DEPTH
GRADATIONAL SAMPLE DEPTH
SAMPLE NUMBER
SAMPLE GRAIN SIZE (0% 50% 100%)
PERCENT RECOVERY (0% 100%)
RECOVERY/INTERVAL
DATUM (FT)
DEPTH (FT)
WELL OR PIEZOMETER CONSTRUCTION
LITHOLOGY
UNIFIED SOILS CLASSIFICATION OR ROCK TYPE
DESCRIPTION



SILTY CLAYSTONE: Top of Bedrock
Yellowish gray to dark yellowish orange (5Y 8/1 to 10YR 6/6), mod. plasticity, some carb. material, some caliche in areas.

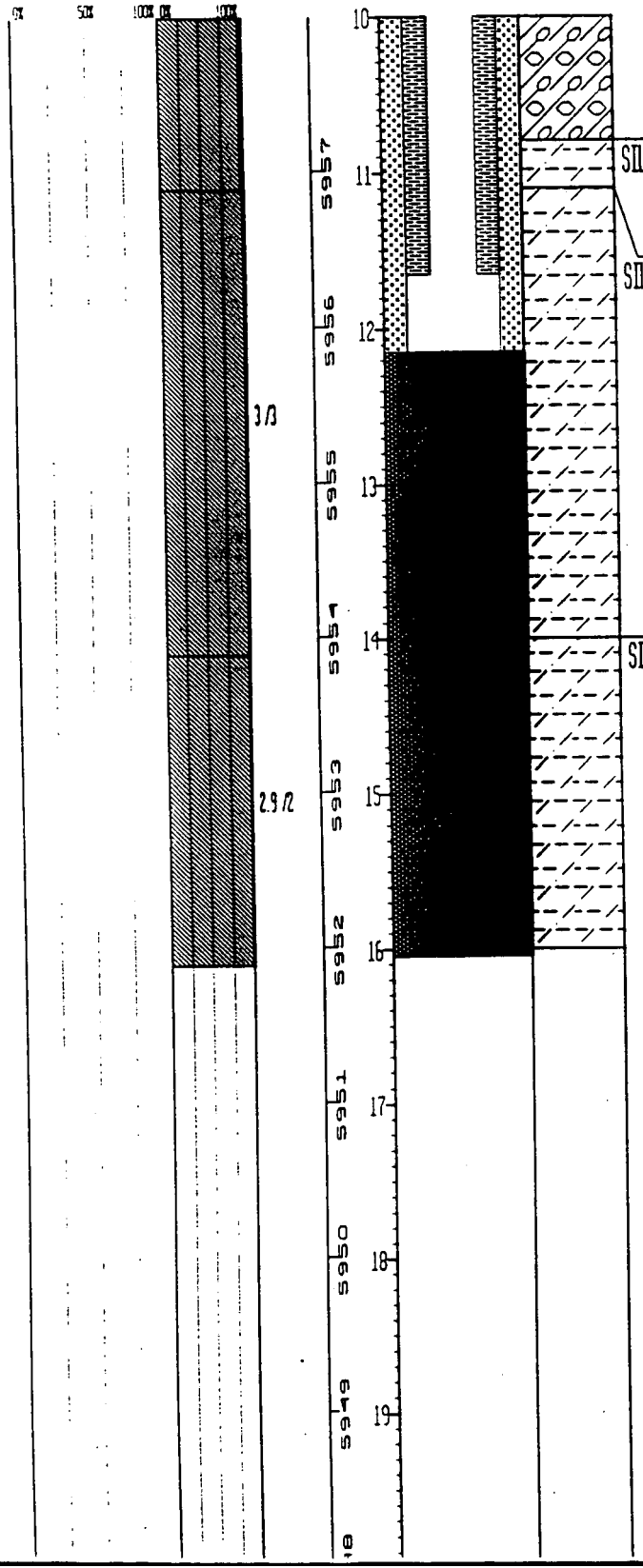
SILTY CLAYSTONE: Same as above.

SILTY CLAYSTONE: Same as above.

STATE PLANE COORDINATE:	TOTAL DEPTH (FT): 16.1	GROUND ELEVATION (FT):	5967.98	PROJECT NUMBER:	667 11
NORTH: 749623	AREA: MOUND AREA	CASING DIAMETER (IN):	2 ID	GEOLOGIST:	LAA
EAST: 2086172	LOCATOR NUMBER: N9	BOREHOLE DIAMETER (IN):	7.5	DATE DRILLED:	08/05/87
REMARKS: Hollow stem auger.					

LOG OF BORING NUMBER: 19-87

CHEMICAL SAMPLE DEPTH
GRADATIONAL SAMPLE
SAMPLE NUMBER
SAMPLE GRAIN SIZE
PERCENT RECOVERY
RECOVERY/INTERVAL
DATUM (FT)
DEPTH (FT)
WELL OR PIEZOMETER CONSTRUCTION
LITHOLOGY
UNIFIED SOILS CLASSIFICATION OR ROCK TYPE
DESCRIPTION



SILTY CLAYSTONE: Top of Bedrock
Yellowish gray to dark yellowish orange (5Y 8/1 to 10YR 6/6), mod. plasticity, some carb. material, some caliche in areas.

SILTY CLAYSTONE: Same as above.

SILTY CLAYSTONE: Same as above.

LOG OF BOREHOLE

Location Rocky Flats Plant; Mound Area
Coordinates N 36644.48 E 23048.42
Total Depth 127.00'

Borehole/Well No. 20-87BP
Ground Surface Elevation 5968.10'
Water Level Encountered None
Static 5861.19' (12/01/87)

Drilling Company Boyles Bros
Date Drilled July 30-31 and Aug. 3, 1987
Drilling Method Hollow Stem Auger; Rotary Core
Logged By J.B. Bergman; K.D. Holliway
Geologist

Driller T. Merritt; P. Bushkovski
Helper T. High; J. Duncan; K. Parker
Drilling Fluid 0 - 51.70': None
51.70' - 127.0': Water
Checked By
Site Manager
Brent Lewis
CEARP Manager

Comments Surface casing set to 51.64' by J.B. Bergman on August 4, 1987.

Depth Feet	Graphic Log	Sample Type	Lithologic Description	Samples Collected or Other Tests Performed
0			**ROCKY FLATS ALLUVIUM**	HNu Background = 0.2-0.4; OVA Background = 0.0; Ludlum Background = 0.0
			0.0-2.0' SAMPLE. Recovered 1.85/2.0' = 93%. GRAVEL: gray and pink quartzite in a moderate brown (5 YR 3/4) sand matrix; abundant roots and grasses in top 2"; unconsolidated; unsorted; dry.	
5			2.0-4.0' SAMPLE. Recovered 2.0/2.0' = 100%. SAND AND GRAVEL: grayish orange (10 YR 7/4); ~30% clay; light brown (5 YR 5/6); abundant caliche; dry.	
			4.0-6.4' SAMPLE. Recovered 2.4/2.4' = 100%. GRAVEL: moderate yellowish brown (10 YR 5/4) matrix of clay; abundant caliche; unsorted; unconsolidated; angular; moist.	
10			6.4-8.8' SAMPLE. LOST CORE. Drilled with center bit to get through boulders.	
			8.8-10.8' SAMPLE. Recovered 1.3/2.0' = 65%. SAND AND GRAVEL: moderate yellowish brown (10 YR 5/4) sand matrix with abundant quartzite pebbles and gravels; unconsolidated; unsorted; angular to subrounded; very fine-grained sand; moist.	
15				18.8': Readings on core: HNu = 15.0 OVA = 12.0
			10.8-13.8' SAMPLE. Recovered 3.5/3.0' = 117%. 10.8-11.8': SAND AND GRAVEL: same as above; moist.	
20				

LOG OF BOREHOLE

Location Rocky Flats Plant: Mound Area
Coordinates N 36644.48 E 23048.42
Total Depth 127.00'

Borehole/Well No. 20-87BR
Ground Surface Elevation 5968.10'
Water Level Encountered None
Static 5861.19' (12/01/87)

Drilling Company Boyles Bros
Date Drilled July 30-31 and Aug. 3, 1987
Drilling Method Hollow Stem Auger; Rotary Core
Logged By J.B. Bergman; K.D. Holliway
Geologist

Driller T. Merritt; P. Bushkovski
Helper T. High; J. Duncan; K. Parker
Drilling Fluid 0 - 51.70': None
51.70' - 127.0': Water
Checked By
Site Manager

CEARP Manager

Comments Surface casing set to 51.64' by J.B. Bergman on August 4, 1987.

Depth Feet	Graphic Log	Sample Type	Lithologic Description	Samples Collected or Other Tests Performed
20			**ARAPAHOE FORMATION**	20.8-23.8': Readings on core: HNu = 2.0 OVA = 0.0
			11.8-13.8': CLAYSTONE: medium gray (N 5/0) with abundant moderate yellowish brown (10 YR 5/4) mottles; abundant black organic fragments; abundant caliche-reacts strongly with HCl; trace white very fine-grained sand; well sorted; moist.	23.8-25.8': Readings on core: HNu = 15.0 OVA = 3.0
25			13.8-15.8' SAMPLE. Recovered 2.0/2.0' = 100%. SANDY CLAYSTONE: moderate yellowish brown (10 YR 5/4); very fine-grained, light gray (N 6/0) sand and moderate yellowish brown (10 YR 5/4) sand; some caliche; some black organic fragments; well sorted; rounded; moist.	
30			15.8-18.8' SAMPLE. Recovered 3.2/3.0' = 107%. CLAYSTONE: same as above; slightly moist.	
			18.8-20.8' SAMPLE. Recovered 2.0/2.0' = 100%. CLAYSTONE: same as above; moist.	34.70': Reading in well head: HNU = 20-30; OVA = 9.0
35			20.8-23.8' SAMPLE. Recovered 3.0/3.0' = 100%. CLAYSTONE: olive gray (5 Y 3/2) with abundant moderate yellowish brown (10 YR 5/4) mottles; some organics; some caliche; trace light gray (N 6/0) sand; very fine-grained; rounded; moist.	34.7-36.7': Readings on core: HNu = 2.0 OVA = 1.8
40				

LOG OF BOREHOLE

Location: Rocky Flats Plant: Mound Area
Coordinates: N 36644.48 E 23048.42
Total Depth: 127.00'

Borehole/Well No.: 20-87BR
Ground Surface Elevation: 5968.10'
Water Level Encountered: None
Static: 5861.19' (12/01/87)

Drilling Company: Boyles Bros
Date Drilled: July 30-31 and Aug. 3, 1987
Drilling Method: Hollow Stem Auger; Rotary Core
Logged By: J.B. Bergman; K.D. Holliway
Geologist

Driller: T. Merritt; P. Bushkovski
Helper: T. High; J. Duncan; K. Parker
Drilling Fluid: 0 - 51.70': None
51.70' - 127.0': Water
Checked By: _____
Site Manager

CEARP Manager

Comments: Surface casing set to 51.64' by J.B. Bergman on August 4, 1987.

Depth Feet	Graphic Log	Sample Type	Lithologic Description	Samples Collected or Other Tests Performed
40			23.8-25.8' SAMPLE. Recovered 2.0/2.0' = 100%. SANDY CLAYSTONE: same as above with slight increase in sand content; moist.	
			25.8-28.8' SAMPLE. Recovered 3.0/3.0' = 100%. SANDY CLAYSTONE: same as above; moist.	
45			28.8-30.8' SAMPLE. Recovered 2.0/2.0' = 100%. CLAYSTONE: olive gray (5 Y 3/2) with abundant moderate yellowish brown (10 YR 5/4) mottles; abundant light brown (5 YR 5/6) FeO nodules; trace light gray (N 6/0) sandstone, very fine-grained; rounded; moist.	
50			30.8-33.8' SAMPLE. Recovered 3.0/3.0' = 100%. CLAYSTONE: same as above; moist.	No HNu, OVA, or Ludlum readings taken below 50.0'.
			33.8-34.7' SAMPLE. No sample. Adjust depth after taking a TD of borehole.	53.90-63.55': Packer Test Interval #10.
55			34.7-36.7' SAMPLE. Recovered 2.0/2.0' = 100%. CLAYSTONE: olive gray (5 Y 3/2) with abundant light brown (5 YR 5/6) stains; wet at top 4"-probably slough; homogenous; dense; weathered; trace very fine-grained sand; dry.	55.90-65.55': Packer Test Interval #9.
60				65.55-75.20': Packer Test Interval #8.

LOG OF BOREHOLE

Location Rocky Flats Plant: Mound Area
Coordinates N 36644.48 E 23048.42
Total Depth 127.00'

Borehole/Well No. 20-97BR
Ground Surface Elevation 5968.10'
Water Level Encountered None
Static 5861.19' (12/01/87)

Drilling Company Boyles Bros
Date Drilled July 30-31 and Aug. 3, 1987
Drilling Method Hollow Stem Auger; Rotary Core
Logged By J.B. Bergman; K.D. Holliway
Geologist

Driller T. Merritt; P. Bushkovski
Helper T. High; J. Duncan; K. Parker
Drilling Fluid 0 - 51.70': None
51.70' - 127.0': Water
Checked By
Site Manager

CEARP Manager

Comments Surface casing set to 51.64' by J.B. Bergman on August 4, 1987.

Depth Feet	Graphic Log	Sample Type	Lithologic Description	Samples Collected or Other Tests Performed
60			36.7-39.7' SAMPLE. Recovered 3.5/2.0' = 88%. CLAYSTONE: olive gray (5 Y 3/2); some moderate yellowish brown (10 YR 5/4) stains; slightly weathered; homogenous; dense; abundant FeO nodules; some organic fragments; slightly moist.	
65			39.7-41.7' SAMPLE. Recovered 2.1/2.0' = 105%. CLAYSTONE: same as above; slightly moist.	
			41.7-44.7' SAMPLE. Recovered 1.7/3.0' = 85%. CLAYSTONE: same as above; dry.	
70			44.7-46.7' SAMPLE. Recovered 2.0/2.0' = 100%. CLAYSTONE: olive gray (5 Y 3/2); some dark yellowish orange (10 YR 6/6) stains; friable; homogenous; some vertical fractures; dry.	
			46.7-49.7' SAMPLE. Recovered 3.7/3.0' = 123%. CLAYSTONE: same as above; unweathered/weathered contact at 46.7'; dry.	
75			49.7-51.7' SAMPLE. Recovered 3.5/2.0' = 175%. CLAYSTONE: same as above; unweathered; dry.	75.20-84.85': Packer Test Interval #7.
				77.20-86.85': Packer Test Interval #6.
80				

LOG OF BOREHOLE

Location Rocky Flats Plant; Mound Area
Coordinates N 36644.48 E 23048.42
Total Depth 127.00'

Borehole/Well No. 20-87BR
Ground Surface Elevation 5968.10'
Water Level Encountered None
Static 5861.19' (12/01/87)

Drilling Company Bovles Bros
Date Drilled July 30-31 and Aug. 3, 1987
Drilling Method Hollow Stem Auger; Rotary Core
Logged By J.B. Bergman; K.D. Holliway
Geologist

Driller T. Merritt; P. Bushkovski
Helper T. High; J. Duncan; K. Parker
Drilling Fluid 0 - 51.70': None
51.70' - 127.0': Water
Checked By
Site Manager

CEARP Manager

Comments Surface casing set to 51.64' by J.B. Bergman on August 4, 1987.

Depth Feet	Graphic Log	Sample Type	Lithologic Description	Samples Collected or Other Tests Performed
80			50.0-54.0' SAMPLE. Recovered 2.0/4.0' = 50%. RQD = 1.1/2.0' = 55%. CLAYSTONE: olive black (5 Y 2/1); unweathered; damp.	
85			54.0-58.0' SAMPLE. Recovered 5.0/4.0' = 125%. RQD = 4.45/5.0' = 89%. CLAYSTONE: olive black (5 Y 2/1); some silt; unweathered; damp.	86.86-96.50': Packer Test Interval #5.
90			58.0-62.0' SAMPLE. Recovered 4.0/4.0' = 100%. RQD = 4.00/4.0' = 100%. 58.0-60.0': CLAYSTONE: dark gray; some silt; some very fine-grained sand; damp. 60.0-62.0': SANDY CLAYSTONE: light gray; some clay; some silt; some very fine-grained sand; fairly well sorted; subrounded; trace fossils (plant stems and leaves); dry.	
95			62.0-66.0' SAMPLE. Recovered 3.95/4.0' = 98.8%. RQD = 2.70/3.95' = 68.35%. SANDY CLAYSTONE: olive black (5 Y 2/1); sand is 3.0-3.5 phi to very fine-grained; subrounded; some silt; some clay; trace fossils (plant stems and leaves); damp to dry.	96.50-106.15': Packer Test Interval #4.
100				

LOG OF BOREHOLE

Location: Rocky Flats Plant; Mound Area
Coordinates: N 36644.48 E 23048.42
Total Depth: 127.00'

Borehole/Well No.: 20-87BR
Ground Surface Elevation: 5968.10'
Water Level Encountered: None
Static: 5861.19' (12/01/87)

Drilling Company: Boyles Bros
Date Drilled: July 30-31 and Aug. 3, 1987
Drilling Method: Hollow Stem Auger; Rotary Core
Logged By: J.B. Bergman; K.D. Holliway
Geologist

Driller: T. Merritt; P. Bushkovski
Helper: T. High; J. Duncan; K. Parker
Drilling Fluid: 0 - 51.70': None
51.70' - 127.0': Water
Checked By: _____
Site Manager

CEARP Manager

Comments: Surface casing set to 51.64' by J.B. Bergman on August 4, 1987.

Depth Feet	Graphic Log	Sample Type	Lithologic Description	Samples Collected or Other Tests Performed
100			66.0-70.0' SAMPLE. Recovered 3.7/4.0' = 92.5%. RQD = 2.91/3.7' = 78.6%. SANDY CLAYSTONE: same as above; very light gray (N 8/0) to grayish black (N 2/0); presence of vertical lamination planes of sand; very fine-grained to 3.0-3.5 phi, starting at 67.1'; damp to dry.	
105			70.0-74.0' SAMPLE. Recovered 5.2/4.0' = 130%. RQD = 4.8/5.2' = 92.3%. SANDY CLAYSTONE: same as above; vertical lamination planes fade out at 70.5' but reappear at 71.6'-72.8'; damp to dry.	106.15-115.80': Packer Test Interval #2. 107.20-116.85': Packer Test Interval #3.
110			74.0-78.0' SAMPLE. Recovered 4.0/4.0' = 100%. RQD = 3.0/4.0' = 60.5%. SANDY CLAYSTONE: same as above; damp to dry.	
115			78.0-79.5' SAMPLE. Recovered 0.5/1.5' = 33.3%. RQD = 0.5/0.5' = 100%. SILTY CLAYSTONE: dark gray (N 3/0) to light gray (N 7/0); some clay; some silt; some sand 3.5-2.5 phi to very fine-grained; mottled; indurated; dry.	114.42-124.07': Packer Test Interval #1.
120			79.5-82.0' SAMPLE. Recovered 3.5/2.5' = 140%. RQD = 2.42/3.5' = 69.1%. SILTY CLAYSTONE: dark gray (N 3/0) to olive black (5 Y 2/1); some clay; some silt; some sand; occasional small seams of coal; damp.	

LOG OF BOREHOLE

Location: Rocky Flats Plant; Mound Area
Coordinates: N 36644.48 E 23048.42
Total Depth: 127.00'

Borehole/Well No.: 20-87BR
Ground Surface Elevation: 5868.10'
Water Level Encountered: None
Static: 5861.19' (12/01/87)

Drilling Company: Boyles Bros
Date Drilled: July 30-31 and Aug. 3, 1987
Drilling Method: Hollow Stem Auger; Rotary Core
Logged By: J.B. Bergman; K.D. Holliway
Geologist

Driller: T. Merritt; P. Bushkovski
Helper: T. High; J. Duncan; K. Parker
Drilling Fluid: 0 - 51.70': None
51.70' - 127.0': Water
Checked By: _____
Site Manager

CEARP Manager

Comments: Surface casing set to 51.64' by J.B. Bergman on August 4, 1987.

Depth Feet	Graphic Log	Sample Type	Lithologic Description	Samples Collected or Other Tests Performed
120			82.0-84.5' SAMPLE. Recovered 2.15/2.5' = 86%. RQD = 1.48/2.15 = 68.8%. SILTY CLAYSTONE: same as above except less sand; damp.	
			84.5-88.0' SAMPLE. Recovered 3.1/3.5' = 88.6%. RQD = 2.68/3.1' = 86.5%. SILTY CLAYSTONE: same as above; except more sand in lenses; damp to dry.	
125			88.0-92.0' SAMPLE. Recovered 4.0/4.0' = 100%. RQD = 3.76/4.0' = 94%. SILTY CLAYSTONE: same as above; damp.	
130			92.0-96.0' SAMPLE. Recovered 1.65/4.0' = 41.25%. RQD = 1.65/1.65' = 100%. SILTY CLAYSTONE: same as above; dry.	
			96.0-99.0' SAMPLE. Recovered 3.4/3.0' = 113%. RQD = 2.5/3.4' = 73.5%. SILTY CLAYSTONE: same as above; dry.	
			99.0-102.0' SAMPLE. Recovered 2.7/3.0' = 90%. RQD = 1.38/2.7' = 53%. SILTY CLAYSTONE: same as above; dry.	

LOG OF BOREHOLE

Location: Rocky Flats Plant; Mound Area
Coordinates: N 36644.48 E 23048.42
Total Depth: 127.00'

Borehole/Well No.: 20-87BR
Ground Surface Elevation: 5968.10'
Water Level Encountered: None
Static: 5861.19' (12/01/87)

Drilling Company: Boyles Bros
Date Drilled: July 30-31 and Aug. 3, 1987
Drilling Method: Hollow Stem Auger; Rotary Core
Logged By: J.B. Bergman; K.D. Holliway
Geologist

Driller: T. Merritt; P. Bushkovski
Helper: T. High; J. Duncan; K. Parker
Drilling Fluid: 0 - 51.70': None
51.70' - 127.0': Water
Checked By:
Site Manager

CEARP Manager

Comments: Surface casing set to 51.64' by J.B. Bergman on August 4, 1987.

Depth Feet	Graphic Log	Sample Type	Lithologic Description	Samples Collected or Other Tests Performed
			102.0-105.0' SAMPLE. Recovered 5.0/3.0' = 167%. RQD = 3.8/5.0' = 76%. SILTY CLAYSTONE: greenish black (5 GY 2/1); some clay; some silt; some sand lenses; thin sand lamination; recovered 2.0' of silty clay core from previous run; dry.	
			105.0-109.0' SAMPLE. Recovered 4.0/4.0' = 100%. RQD = 4.0/4.0' = 100%. 105-107.25': CLAYSTONE, SANDSTONE AND SILTSTONE: same as above; dry. 107.25'-109.0': CLAYEY SANDSTONE: olive black (5 Y 2/1); sand well sorted; subangular; 2.5-1.5 phi; clay in pockets; more prominent 108.75-109.0; moist.	
			109.0-113.0' SAMPLE. Recovered 4.0/4.0' = 100%. RQD = 4.0/4.0' = 100%. CLAYEY SANDSTONE: same as above; except finer grained 3.0-3.5 phi; well cemented; damp.	
			113.0-117.0' SAMPLE. Recovered 4.0/4.0' = 100%. RQD = 4.0/4.0' = 100%. 113.0-115.8': CLAYEY SANDSTONE: light gray (N 7/0); sand 3.0-3.5 phi; subangular; well cemented; moist. 115.8-117.0': SANDY CLAYSTONE: medium gray (5 N/0); some clay; some sand; some silt; blocky; moist.	

LOG OF BOREHOLE

Location Rocky Flats Plant: Mound Area
Coordinates N 36644.48 E 23048.42
Total Depth 127.00'

Borehole/Well No. 20-87BR
Ground Surface Elevation 5968.10'
Water Level Encountered None
Static 5861.19' (12/01/87)

Drilling Company Boyles Bros
Date Drilled July 30-31 and Aug. 3, 1987
Drilling Method Hollow Stem Auger; Rotary Core
Logged By J.B. Bergman; K.D. Holliway
Geologist

Driller T. Merritt; P. Bushkovski
Helper T. High; J. Duncan; K. Parker
Drilling Fluid 0 - 51.70': None
51.70' - 127.0': Water
Checked By
Site Manager

CEARP Manager

Comments Surface casing set to 51.64' by J.B. Bergman on August 4, 1987.

Depth Feet	Graphic Log	Sample Type	Lithologic Description	Samples Collected or Other Tests Performed
			117.0-121.0' SAMPLE. Recovered 3.6/4.0' = 90%. RQD = 2.5/3.6' = 77.7%. 117-118.5': CLAYSTONE: medium gray (5 N/0); blocky; moderately cemented; moist. 118.5-119.5': CLAYEY SANDSTONE: light gray (N 7/0); moderate cementation; slightly moist. 119.5-121.0': CLAYSTONE: medium gray (5 N/0); sand fine-grained; moist.	
			121.0-125.0' SAMPLE. Recovered 1.5/4.0' = 37.5%. RQD = 1.2/1.5' = 80%. CLAYSTONE: same as above; massive; moist.	
			125.0-127.0' SAMPLE. Recovered 3.8/2.0' = 190%. RQD = 2.5/3.8' = 66%. CLAYSTONE: same as above; recovered 1.8' of claystone; same description from previous core run; moist.	
			TOTAL DEPTH: 127.00'	

WELL COMPLETION INFORMATION

Location: Rocky Flats Plant; Mound Area

Well No.: 20-87BR

Coordinates: N 36644.48 E 23048.42

Elevation: Ground Surface 5968.10'

Total Depth: Well 116.36'

Top of Casing 5970.10'

Borehole 126.20'

Formation of Completion: Arapahoe Formation

Casing Material: Sch 5, type 316 TFJ stainless steel

Casing Diameter: 2" ID

Screen Material: 0.010" wire wrap, type 316 TFJ stainless steel

Surface Casing Diameter: 5" ID

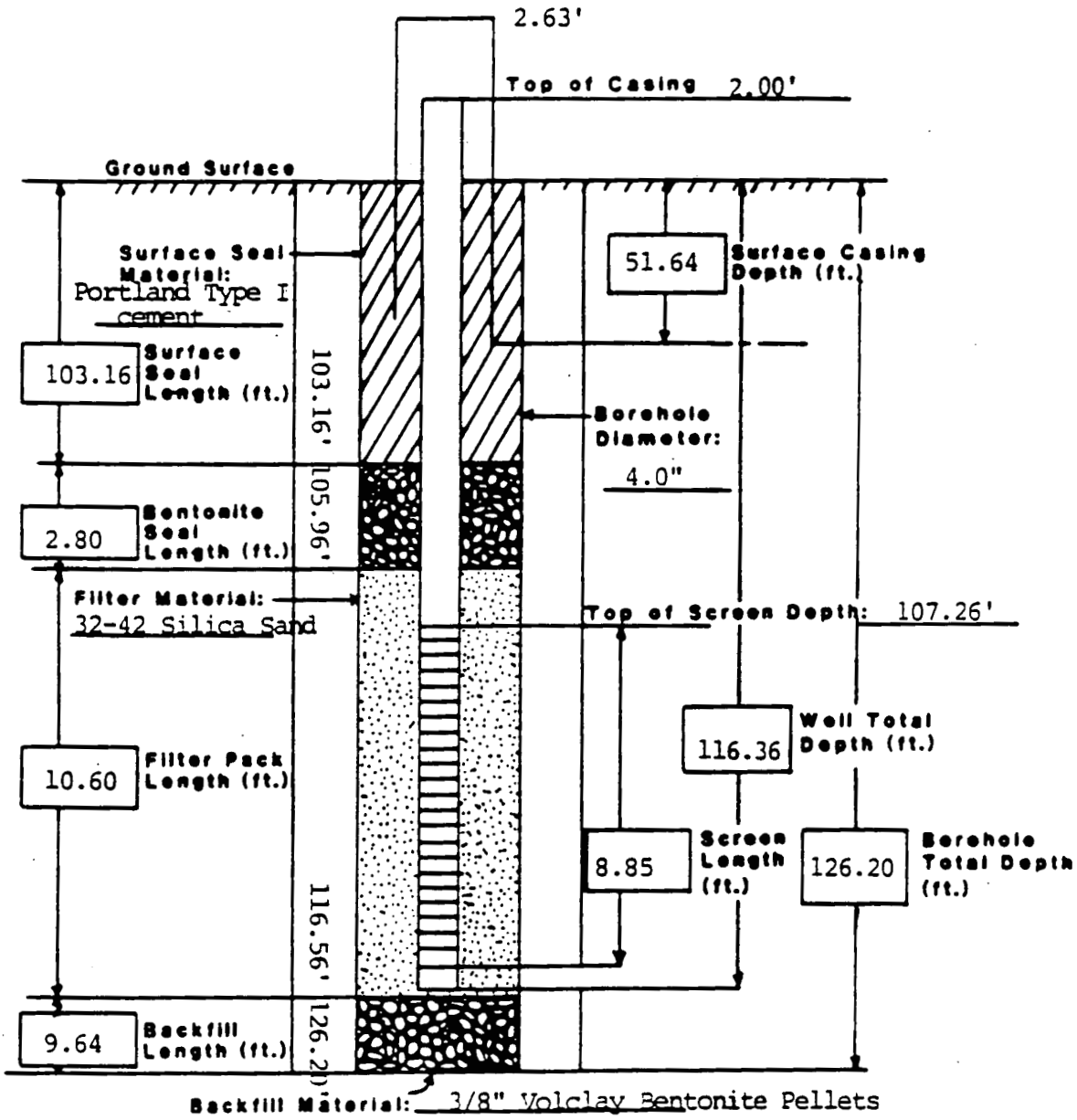
Date Installed: Aug 12, 1987

Approved By: Site Manager

Installed By: K.D. Holliway, Geologist

CEARP Manager

Comments: Surface casing set to 51.64' by J.B. Bergman on August 4, 1987.



LOG OF BORING NO. 20-87BR

PAGE 1 OF

DATES DRILLED:
ELEVATION:
GEOLOGIST(S): TSD
DATE:
CHECKED BY:

DATE: 8/8/89

PROJECT NO: 667-11.22

TOP/BOTTOM OF CORE IN BOX	TOP/BOTTOM OF CORE IN FEET	SAMPLE NUMBER	FEET OF CORE	USCS symbol	FRACTURES PER FOOT	FRACTURE ANGLE	DECIDING ANGLE	DRAIN SIZE DISTRIBUTION	DEPTH IN FEET	LITHOLOGIC LOG	LITHOLOGIC DESCRIPTION
50.0 ↓	50.0 TO 52.0		1.55 (2)						51		Silty Claystone-lt. gray (N7), massive bedding, well weathered, mod. friability, trace of carb. material & iron staining as mottles.
	52.0 TO 54.0		0						52 53		NO SAMPLE
	54.0 TO 55.5		ND						54 55		same as above
	55.5 TO 56.5		(2)								same as above
BOX 1 of 1	56.5 TO 58.0		ND						57 58		same as above
↑ 59.25	58.0 TO 59.75		ND						59		same as above
59.75 ↓											

NOTES: General: The USCS is modified for this log as follows: Material amounts are estimated by percent volume instead of percent weight.
(1) Badly broken core, accurate footage measurement not possible.
(2) Core breaks cannot be matched, accurate footage measurement not possible.

ROCKY FLATS PLANT

FIGURE NO.

LOG OF BORING NO. 20-87BR

DATES DRILLED:
ELEVATION:
GEOLOGIST(S): TSD
DATE:
CHECKED BY:

DATE: 8/8/89

PROJECT NO: 667-11.22

TOP/BOTTOM OF CORE IN BOX	TOP/BOTTOM OF CORE IN FEET	SAMPLE NUMBER	FEET OF CORE	USCS SYMBOL	FRACTURES PER FOOT	FRACTURE ANGLE	BEDDING ANGLE	GRAIN SIZE DISTRIBUTION	DEPTH IN FEET	LITHOLOGIC LOG	LITHOLOGIC DESCRIPTION
Box 2 of 9	59.75 TO 61.45		ND						61		Siltstone - lt. gray (N7); massive bedding; st. weathered, slightly friab. Some carb. material & clay, becoming clayey at bottom 0.5 ft of interval
	61.45 TO 63.1		[illegible]						62		Silty claystone - olive gray (5Y 4/1) massive to wavey bedding; weathered slightly friable, v. f.g. sand & silt [illegible]
	63.1 TO 64.9		ND						63, 64		Same as above; trace of iron staining as mottles
	64.9 TO 65.95		ND						65		Same as above; some carb. material & iron staining.
	[illegible]		[illegible]						66		[illegible]
↑ 68.0	66.25 TO 68.0		ND						67		Same as above
68.0 ↓ Box 3 of 9	68.0 TO 69.7		ND						68, 69		Silty claystone - olive gray (5Y 4/1) to very lt. gray (N8), well weathered, v.f.g. sand & silt laminae are bedded vertically, mod. friable, some carb. material & iron staining as mottles.
	69.7-72.0		0								No sample

NOTES: General: The USCS is modified for this log as follows: Material amounts are estimated by percent volume instead of percent weight.
(1) Badly broken core, accurate footage measurement not possible.
(2) Core breaks cannot be matched, accurate footage measurement not possible.

ROCKY FLATS PLANT

FIGURE NO.

LOG OF BORING NO. 20-87BR

DATES DRILLED:
ELEVATION:
GEOLOGIST(S): TSD/[illegible]
DATE: [illegible]
CHECKED BY:

USCS symbol

DATE: 8/8/89

PROJECT NO: 667-11.22

TOP/BOTTOM OF CORE IN BOX	TOP/BOTTOM OF CORE IN FEET (FT. BELOW)	SAMPLE NUMBER	FEET OF CORE (MODIFIED)	FEET OF CORE	FRACTURES PER FOOT	FRACTURE ANGLE	BEDDING ANGLE	GRAIN SIZE DISTRIBUTION	DEPTH IN FEET	LITHOLOGIC LOG	LITHOLOGIC DESCRIPTION
BOX 3 of 9	70.0 TO 71.6		ND						71		Silty Claystone - olive gray (5Y 4/1) to very lt. gray (N8), v. f.g. sand & silt laminae are bedded vertically to nearly vertical, mod. friable, trace of carb. material + iron staining as mottles.
	71.6 TO 72.8		(2)						72		Same as above
	72.8 TO 74.0		1.5 (2)						73		Same as above; vertical laminae is no longer present. (massive bedding?) silt occures in pockets
	74.0 TO 75.6		ND						74		Same as above; lt. olive gray (5Y 6/1), interval becomes carb. at the bottom. of [illegible]
↑ 75.6									75		
75.6 ↓	75.6 TO 77.3		ND					>50% clay	76		
									77		
BOX 4 of 9	77.3 TO 78.5		ND					>50% clay	78		
	78.5 TO 79.5		0.8 (2)					>50% clay	79		
	79.5 - 80.85		ND					>50% clay			

8/8/89 TSD

8/9/89 OCB

NOTES: General: The USCS is modified for this log as follows: Material amounts are estimated by percent volume instead of percent weight.
(1) Badly broken core, accurate footage measurement not possible.
(2) Core breaks cannot be matched, accurate footage measurement not possible.

ROCKY FLATS PLANT

FIGURE NO.

LOG OF BORING NO. 20-87CR

PAGE 4 OF

DATES DRILLED:
ELEVATION:
GEOLOGIST(S): TSD/[illegible]
DATE: 2/2-[illegible]/89
CHECKED BY:

DATE: 8/8/89

PROJECT NO: 667-11.22

Top/Bottom of Core in Box	Top/Bottom of Core (Elevation)	Sample Number	Feet of Core (Depth)	Feet of Core (Depth)	Fractures per Foot	Fracture Angle	Bedding Angle	Grain Size Distribution	Depth in Feet	Lithologic Log	Lithologic Description
Box 4 of 9	79.5 to 80.85		ND					>50% Clay			
	80.85 to 82.85		(2) 1.7			40°		>50% Clay	81, 82		As above with slickenside at 81.5 ft., 40° angle and decrease in carbonate [illegible]
	82.85 to 84.5		(2) 1.45					>50% Clay	83, 84		
84.5 ↓	84.5 to 86.4		ND					>50% Clay	85, 86		
Box 5 of 9	86.4 to 87.6		ND						87		
	87.6 to 88.0			0					88		No Sample
	88.0 to 88.4		ND								
	88.4 to 90.2		ND						89		

NOTES: General: The USCS is modified for this log as follows: Material amounts are estimated by percent volume instead of percent weight.
(1) Badly broken core, accurate footage measurement not possible.
(2) Core breaks cannot be matched, accurate footage measurement not possible.

ROCKY FLATS PLANT

FIGURE NO.

[illegible] interval blocks for 82.0 ft + 78.0 are [illegible] at place [illegible] the end of the box.

LOG OF BORING NO. 20-87 BK

PAGE 5 OF

DATES DRILLED:
ELEVATION:
GEOLOGIST(S): [illegible]
DATE:
CHECKED BY:

USCS symbol

DATE:

PROJECT NO: 667-11.22

TOP/BOTTOM OF CORE IN BOX	TOP/BOTTOM OF CORE IN BOX (FT)	SAMPLE NUMBER	FEET OF CORE	FEET OF CORE	FRACTURES PER FOOT	FRACTURE ANGLE	DRILLING ANGLE	DRILLING DISTRIBUTION	DEPTH IN FEET	LITHOLOGIC LOG	LITHOLOGIC DESCRIPTION
	[illegible]		ND					>50 Clear			As above
	90.2 to 92.0		ND						91		
Bot 5 of 2	92.0 to 93.65		ND						92		Increase in silt [illegible]
93.65	93.65								93		
93.65	93.65 to 96.0		0						94 95		No Sample
	96.0 to 97.4		ND					dry	96 97		[illegible] moderately [illegible] carbonaceous [illegible] disseminated [illegible]
	97.4 to 99.0		ND						98 99		
	99.0 to 100.7		ND								

Erasure 4/9/87 KB

NOTES: General: The USCS is modified for this log as follows: Material amounts are estimated by percent volume instead of percent weight.
(1) Badly broken core, accurate footage measurement not possible.
(2) Core breaks cannot be matched, accurate footage measurement not possible.

ROCKY FLATS PLANT

FIGURE NO.

LOG OF BORING NO. 20-[illegible]

PAGE [illegible] OF

DATES DRILLED:
ELEVATION:
GEOLOGIST(S): DCL
DATE: [illegible]
CHECKED BY:
DATE:

PROJECT NO: 667-[illegible]

Top/Bottom of Core in Box	Top/Bottom of Core in Interval	Sample Number	Feet of Core	USCS Symbol	Fractures per Foot	Fractures Angle	Bedding Angle	Drum Size Distribution	Depth in Feet	Lithologic Log	LITHOLOGIC DESCRIPTION
	[illegible] to 100.7		ND					>50" Clm			As above
101.7	100.7 to 101.7		ND						101		
[illegible]			0						102		SLUFF
102	102.0 to 103.75							>50" Clm	103		As above (reference interval: 96.0 to 101.7 ft), with localized iron staining below 103 ft., bedding [illegible]
[illegible]	[illegible] to 105.0								104		
Box	105.0 to 105.5		ND						105		
	105.5 to 107.3								106		
	107.3 to 108.7								107		
	108.7 to 109.0								108		
	109.0 to 110.3								109		

NOTES: General: The USCS is modified for this log as follows: Material amounts are estimated by percent volume instead of percent weight.
(1) Badly broken core, accurate footage measurement not possible.
(2) Core breaks cannot be matched, accurate footage measurement not possible.

ROCKY FLATS PLANT

FIGURE NO.

LOG OF BORING NO. 20-87 BR

PAGE 7 OF

DATES DRILLED:
ELEVATION:
GEOLOGIST(S): DCC
DATE: [illegible]
CHECKED BY:
DATE:

USCS symbol

PROJECT NO: 667-11.2

Top/Bottom of Core in Box	Top/Bottom of Core in Box (Depth)	Sample Number	Foot of Core (Depth)	Fractures per Foot	Fractures Angle	Bedding Angle	Drilling Size Distortion	Depth in Feet	Lithologic Log	LITHOLOGIC DESCRIPTION
[illegible]	[illegible]		ND				250			As above
110.2	110.2 to 112.0		ND					111		
	112.0 to 113.0		ND					112		
	113.0 to 113.8		ND					113		
Box 8 of 9	to 115.4		ND					114		
	115.4 to 117.0		ND		45° slick			115		Slickenside occurs at ~115.8 ft. ~45°
	117.0							116		
								117		As above with decrease in [illegible] silt fraction [illegible]
			ND							[illegible]
118.8	118.8 to 121		ND					119		

NOTES: General: The USCS is modified for this log as follows: Material amounts are estimated by percent volume instead of percent weight.
(1) Badly broken core, accurate footage measurement not possible.
(2) Core breaks cannot be matched, accurate footage measurement not possible.

ROCKY FLATS PLANT

FIGURE NO.

LOG OF BORING NO. [illegible]

DATES DRILLED:
ELEVATION:
GEOLOGIST(S): [illegible]
DATE:
CHECKED BY:
DATE:

USCS symbol

PROJECT NO: 667-11.[illegible]

TOP DIMENSION OF CORE IN BOX	TOP DIMENSION OF CORE IN FEET	SAMPLE NUMBER	FEET OF CORE	FEET OF CORE	FRACTURES PER FOOT	FRACTURE ANGLE	BEDDING ANGLE	GRAIN SIZE DISTRIBUTION	DEPTH IN FEET	LITHOLOGIC LOG	LITHOLOGIC DESCRIPTION
	113.5 to 121		ND					>50 Clay	121		As above
	121 to 122.5		ND						122		
	122.5 to 122.8		ND								
	122.8								123		
Box #9									124		
	124.6										
	124.6 to 126.2		ND						125		
126.2	126.2								126		
									127		Bottom of Box 9 at 126.2 ft.

NOTES: General: The USCS is modified for this log as follows: Material amounts are estimated by percent volume instead of percent weight.
(1) Badly broken core, accurate footage measurement not possible.
(2) Core breaks cannot be matched, accurate footage measurement not possible.

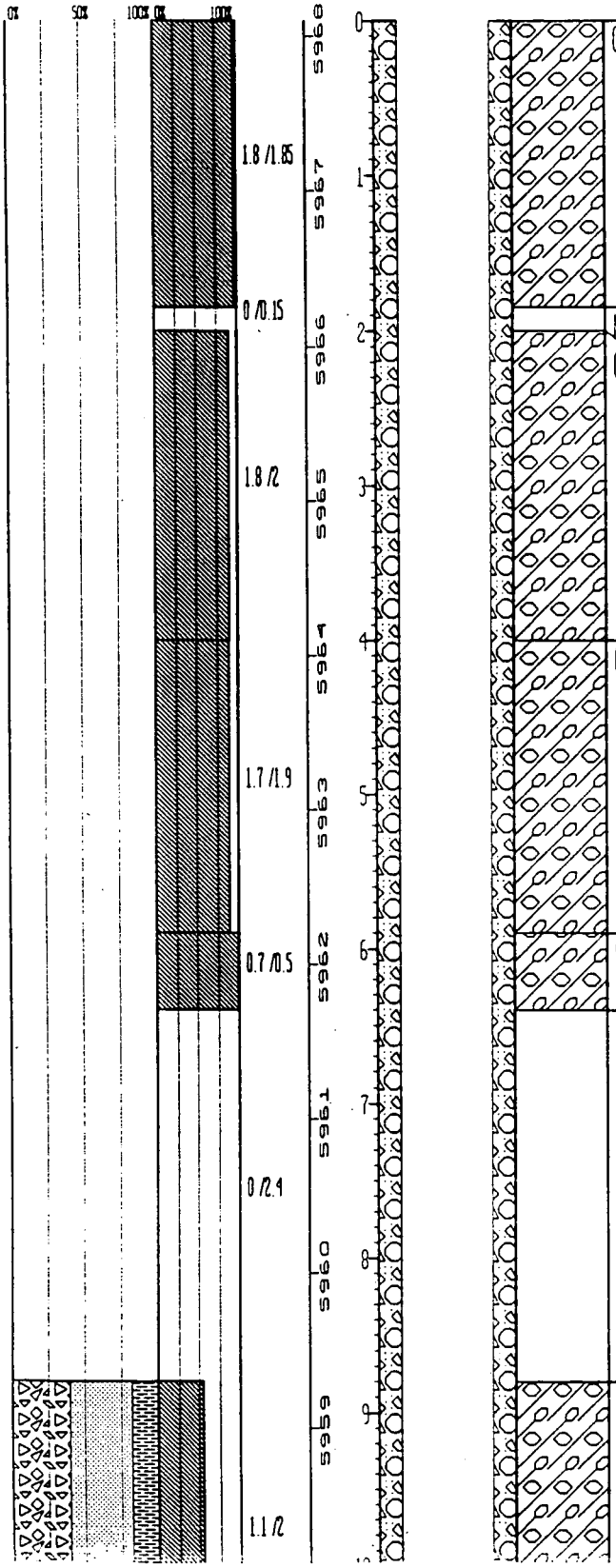
ROCKY FLATS PLANT

FIGURE NO.

STATE PLANE COORDINATE:		TOTAL DEPTH (FT): 126.2	GROUND ELEVATION (FT):	5968.1	PROJECT NUMBER:	667.11	LOG OF BORING NUMBER:
NORTH:	749634	AREA: MOUND AREA	CASING DIAMETER (IN):	2 ID	GEOLOGIST:	LAA/TSD/DCB	20-87BR
EAST:	2086155	LOCATOR NUMBER: N9	BOREHOLE DIAMETER (IN):	4.0	DATE DRILLED:	08/03/87	

REMARKS: Hollow stem auger; Rotary core. Surface casing to 51.64' by J.B.Bergman, Aug. 4, 1987.

CHEMICAL SAMPLE DEPTH
GRADATIONAL SAMPLE DEPTH
SAMPLE NUMBER
SAMPLE GRAIN SIZE (0% 50% 100%)
PERCENT RECOVERY (0% 100%)
RECOVERY/INTERVAL
DATUM (FT)
DEPTH (FT)
WELL OR PIEZOMETER CONSTRUCTION
LITHOLOGY



UNIFIED SOILS CLASSIFICATION OR ROCK TYPE	DESCRIPTION
GC:	Clayey Gravel - light gray (N7), predominant gravel color: Angular to sub-rounded, moderately well graded, max. size: 5 cm. Clay matrix: brownish gray (5YR 4/1), some sand, and silt, some surficial roots, some $CaCO_3$, grades to caliche matrix, less gravel at bottom of interval.
NO SAMPLE:	
GC:	Gravel In Caliche Matrix - medium gray (N5), angular to sub-angular, well graded, max. size 9.5 cm., some sand in caliche matrix, grades to some clay in caliche matrix toward bottom, light brown (5YR 5/6).
GC:	Same as above.
GC:	Same as above, less caliche, $CaCO_3$, more brown clay matrix.
NO SAMPLE:	
GC:	GRAVEL - very pale orange (10YR 8/2) to light gray (N7), angular to sub-rounded, well graded, max. size 4.5 cm. Sandy clay matrix, light brown (5YR 5/6), matrix approx. 30% coarse sand, some $CaCO_3$ still present.

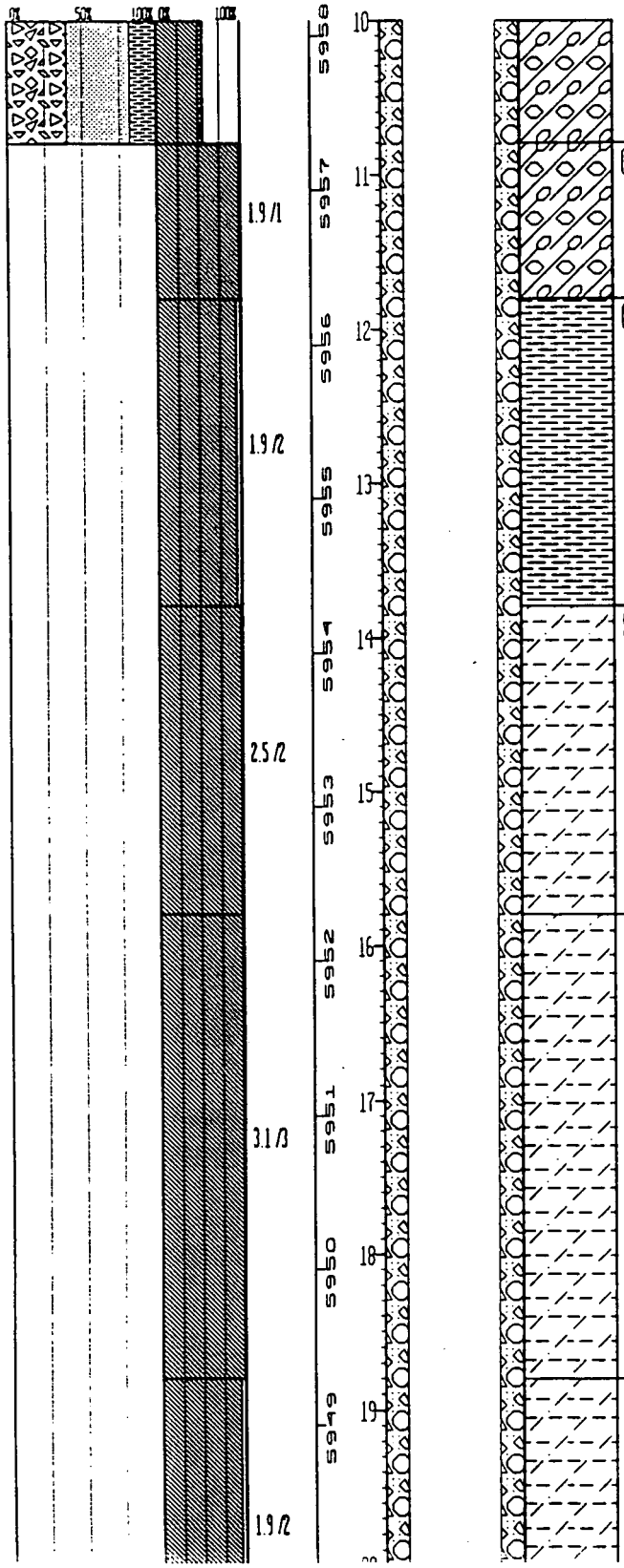
GX9

STATE PLANE COORDINATE:	TOTAL DEPTH (FT): 126.2	GROUND ELEVATION (FT):	5968.1	PROJECT NUMBER:	667.11
NORTH: 749634	AREA: MOUND AREA	CASING DIAMETER (IN):	2 ID	GEOLOGIST:	LAA/TSD/DCB
EAST: 2086155	LOCATOR NUMBER: N9	BOREHOLE DIAMETER (IN):	4 0	DATE DRILLED:	08/03/87

LOG OF BORING NUMBER: 20-87BR

REMARKS: Hollow stem auger; Rotary core. Surface casing to 51.64' by J.B.Bergman, Aug. 4, 1987.

CHEMICAL SAMPLE DEPTH
GRADATIONAL SAMPLE DEPTH
SAMPLE NUMBER



UNIFIED SOILS CLASSIFICATION OR ROCK TYPE	DESCRIPTION
GC:	Same as above, no CaCO3 seems to be present.
CLAYSTONE:	Top of Bedrock Dark yellowish orange (10YR 6/6) to light brown (5YR 5/6), mod. to high plasticity, horizontal bedding with some carbonaceous material, some gravel, becoming silty, very pale orange (10YR 8/2) toward bottom of interval.
SILTY CLAYSTONE:	Very pale orange to dark yellowish orange (10YR 8/2 to 10YR 6/6), moderate to high plasticity, bedding appears horizontal, some areas of matrix appear to be iron stained, trace carbonaceous material.
SILTY CLAYSTONE:	Same as above.
SILTY CLAYSTONE:	Same as above, silt content fluctuates 10% either way.

STATE PLANE COORDINATE:	TOTAL DEPTH (FT): 126.2	GROUND ELEVATION (FT)	5968.1	PROJECT NUMBER:	567.11
NORTH: 749634	AREA: MOUND AREA	CASING DIAMETER (IN):	2.10	GEOLOGIST:	LAA/TSD/DCB
EAST: 2086155	LOCATOR NUMBER: N9	BOREHOLE DIAMETER (IN):	4.0	DATE DRILLED:	08/03/87

LOG OF BORING NUMBER: **20-87BR**

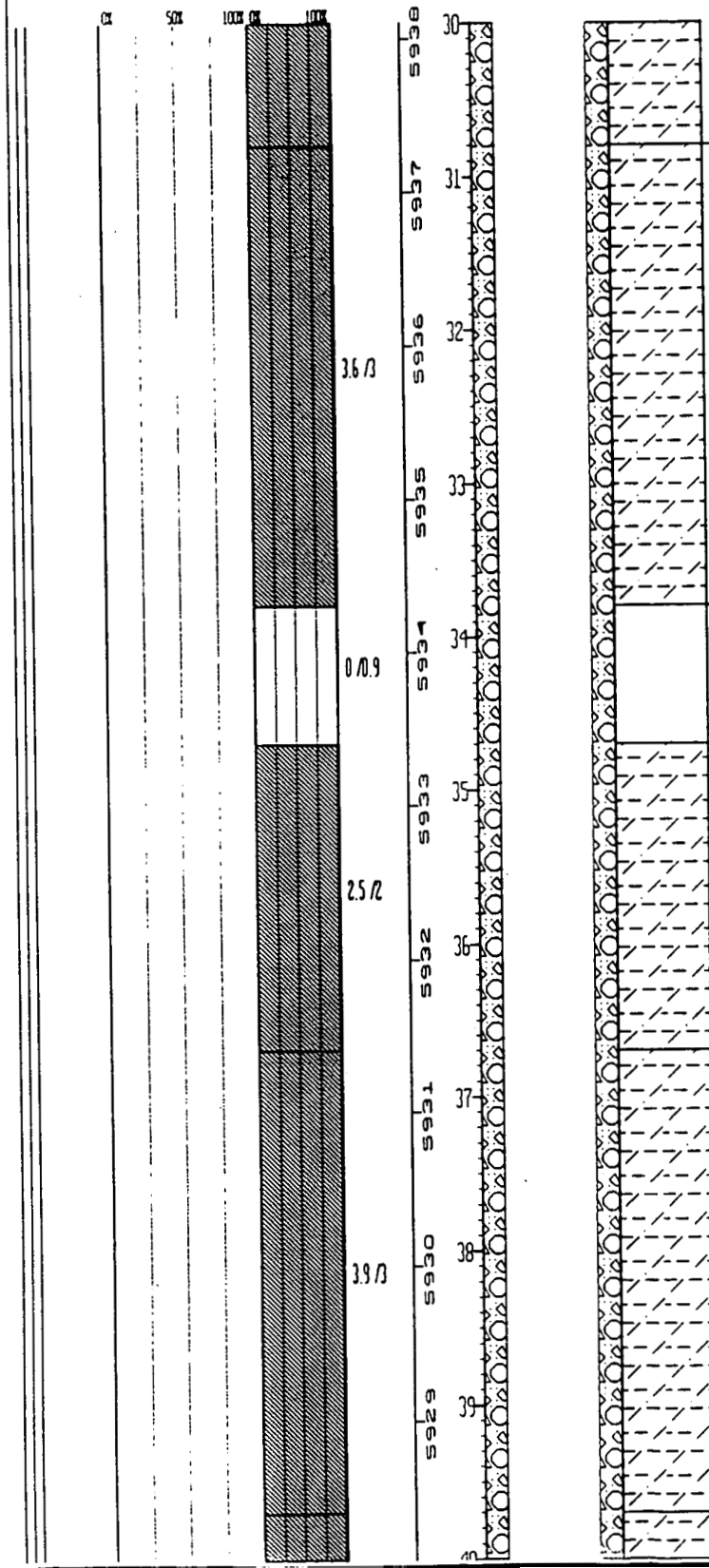
REMARKS: Hollow stem auger; Rotary core. Surface casing to 51.64' by J.B.Bergman, Aug. 4, 1987.

CHEMICAL SAMPLE DEPTH / GRADATIONAL SAMPLE DEPTH	SAMPLE NUMBER	SAMPLE GRADN SIZE	PERCENT RECOVERY	RECOVERY/INTERVAL	DATUM (FT)	DEPTH (FT)	WELL OR PIEZOMETER CONSTRUCTION	LITHOLOGY	UNIFIED SOILS CLASSIFICATION OR ROCK TYPE	DESCRIPTION
		0% 50%	100% 0% 100%	3.3/3	5948	20				
					5947	21			SILTY CLAYSTONE	Very pale orange to light brown (10YR 8/2 to 5YR 5/6), moderate plasticity, iron staining vertical in fractures, some carbonaceous material. Trace gravel, silt content fluctuates throughout interval by 30%, some areas 70% silt (one area approx. 2 in. long.)
					5946	22				
					5945	23				
				2.4/2	5944	24			SILTY CLAYSTONE	Same as above.
					5943	25				
				3.3/3	5942	26			SILTY CLAYSTONE	Same as above.
					5941	27				
					5940	28				
				2.3/2	5939	29			SILTY CLAYSTONE	Grayish orange to dark yellowish brown (10YR 7/4 to 6/6), moderately high plast., some carbonaceous material, some vertical fractures, 2' hollow geode like nodules approx. 1" (iron rich), trace CaCO3.
						30				

STATE PLANE COORDINATE:	TOTAL DEPTH (FT): 126.2	GROUND ELEVATION (FT): 5968.1	PROJECT NUMBER: 667.11	LOG OF BORING NUMBER:	
NORTH: 749634	AREA: MOUND AREA	CASING DIAMETER (IN): 2 ID	GEOLOGIST: LAA/TSD/DCB	20-87BR	
EAST: 2086155	LOCATOR NUMBER: N9	BOREHOLE DIAMETER (IN): 4 0	DATE DRILLED: 08/03/87		

REMARKS: Hollow stem auger; Rotary core. Surface casing to 51.64' by J.B.Bergman, Aug. 4, 1987.

CHEMICAL SAMPLE DEPTH / GRADATIONAL SAMPLE DEPTH | SAMPLE NUMBER | SAMPLE GRAIN SIZE (0% 50% 100%) | PERCENT RECOVERY (0% 100%) | RECOVERY/INTERVAL | DATUM (FT) | DEPTH (FT) | WELL OR PIEZOMETER CONSTRUCTION | LITHOLOGY | UNIFIED SOILS CLASSIFICATION OR ROCK TYPE | DESCRIPTION



SILTY CLAYSTONE: Same as above, some pale yellowish brown (10YR 6/2) toward bottom, CaCO3 stringers present, iron staining, did not see any nodules.

NO SAMPLE:

SILTY CLAYSTONE: Dark yellowish orange to very light gray (10YR 8/2 to N8), moderate to high plasticity, becoming siltier at bottom.

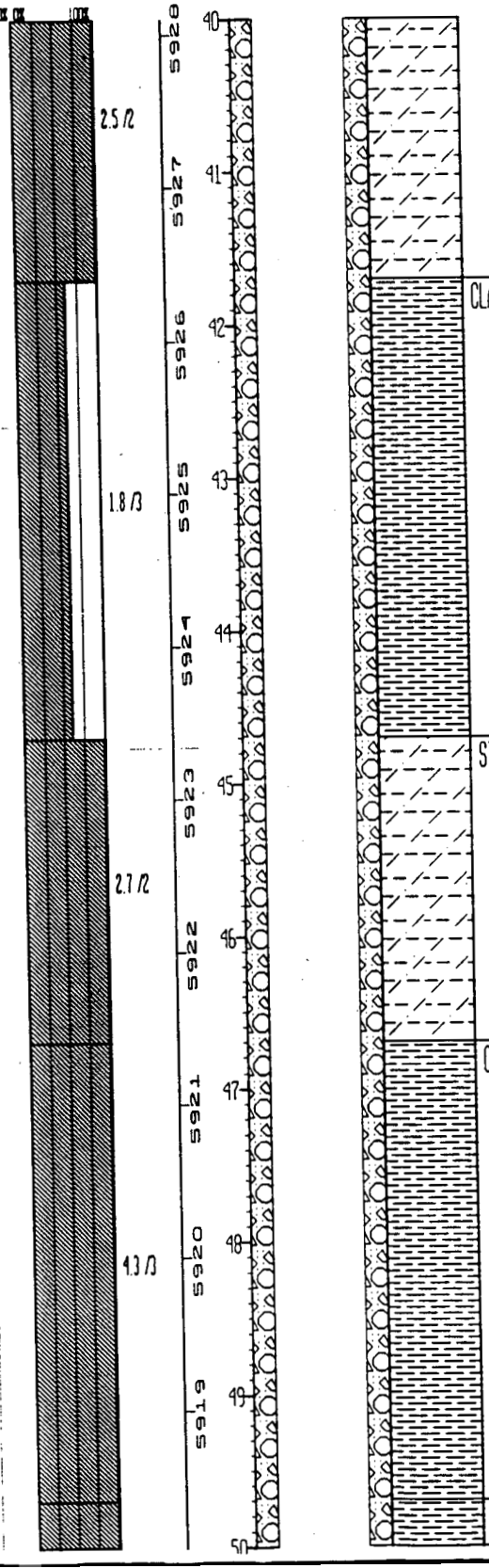
SILTY CLAYSTONE: Dark yellowish orange (10YR 6/6) yellowish gray (5Y 7/2), some iron staining, trace gravel, becoming less silty and light brownish gray (5YR 6/1) toward bottom of interval.

SILTY CLAYSTONE: Dark yellowish orange to yellowish gray (10YR 6/6 to 5Y 7/2), iron

STATE PLANE COORDINATE	TOTAL DEPTH (FT): 126.2	GROUND ELEVATION (FT)	5968.1	PROJECT NUMBER:	567.11	LOG OF BORING NUMBER:
NORTH: 749634	AREA: MOUND AREA	CASING DIAMETER (IN):	2 ID	GEOLOGIST:	LAA/TSD/DCB	20-87BR
EAST: 2086155	LOCATOR NUMBER: N9	BOREHOLE DIAMETER (IN):	4 0	DATE DRILLED:	08/03/87	

REMARKS: Hollow stem auger; Rotary core. Surface casing to 51.64' by J.B.Bergman, Aug. 4, 1987.

CHEMICAL SAMPLE DEPTH
GRADATIONAL SAMPLE DEPTH
SAMPLE NUMBER
SAMPLE GRAIN SIZE (0% 50% 100%)
PERCENT RECOVERY (0% 100%)
RECOVERY/INTERVAL
DATUM (FT)
DEPTH (FT)
WELL OR PIEZOMETER CONSTRUCTION
LITHOLOGY



UNIFIED SOILS CLASSIFICATION OR ROCK TYPE	DESCRIPTION
	staining in some vertical fractures, silt content fluctuates by 10%.
CLAYSTONE:	Dusky yellow (5Y 6/4) to light brownish gray (5YR 6/1), highly weathered, slightly to moderately friable, some silt, some iron staining.
SILTY CLAYSTONE:	Brownish gray (5YR 4/1) to grayish orange (10YR 7/4), highly weathered, moderately friable, vertical heavily iron stained fracture bottom 1.7 ft.
CLAYSTONE:	Same as above, silt content fluctuates approx. 20% upward toward bottom of interval.
CLAYSTONE:	Light olive gray to olive gray (5Y 6/1 to 5Y 4/1), highly weathered,

STATE PLANE COORDINATE:		TOTAL DEPTH (FT): 126.2	GROUND ELEVATION (FT):	5968.1	PROJECT NUMBER:	667 11	LOG OF BORING NUMBER:
NORTH:	749634	AREA: MOUND AREA	CASING DIAMETER (IN):	2 10	GEOLOGIST:	LAA/TSD/DCB	20-87BR
EAST:	2086155	LOCATOR NUMBER: N9	BOREHOLE DIAMETER (IN):	4 0	DATE DRILLED:	08/03/87	

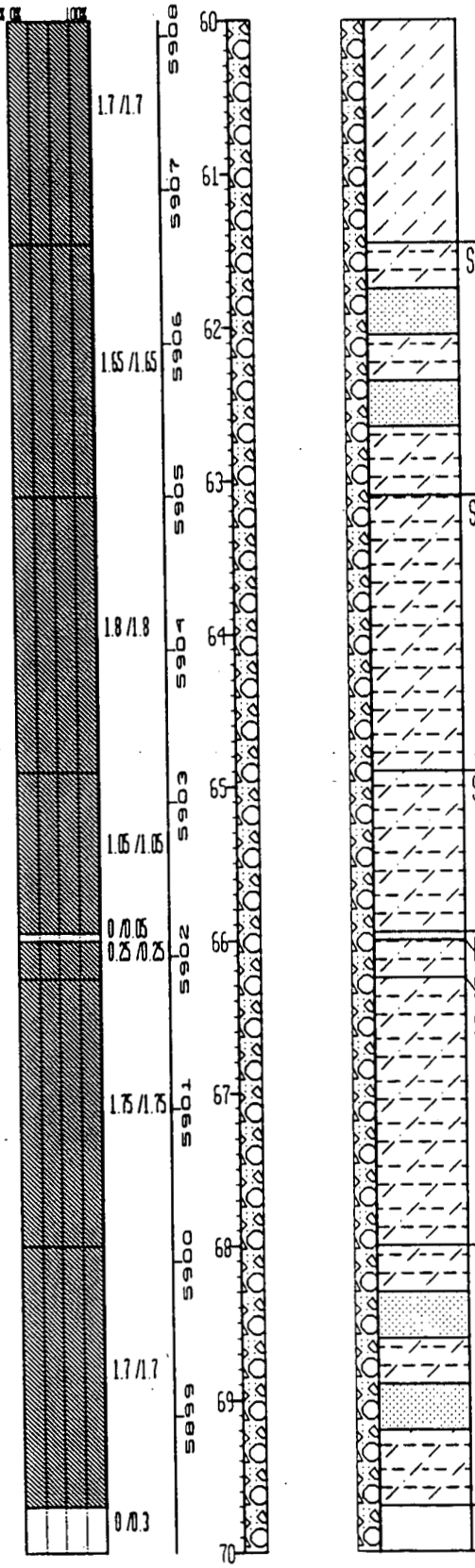
REMARKS: Hollow stem auger; Rotary core. Surface casing to 51.64' by J.B.Bergman, Aug. 4, 1987.

CHEMICAL SAMPLE DEPTH / GRADATIONAL SAMPLE DEPTH	SAMPLE NUMBER	SAMPLE GRAIN SIZE	PERCENT RECOVERY	RECOVERY/INTERVAL	DATUM (FT)	DEPTH (FT)	WELL OR PIEZOMETER CONSTRUCTION	LITHOLOGY	UNIFIED SOILS CLASSIFICATION OR ROCK TYPE	DESCRIPTION
		0% 50% 100%	0% 100%	3/2.3	5918 5917	50 51				highly friable, slightly silty, weathered somewhat horizontally, possibly due to bedding. NOTE: intervals overlap, this box ends at 51.7 ft., next box begins at 50 ft. First interval in this box goes from 50.0 to 52.0 ft. and is logged as silty claystone, same description as below, interval 54 to 55.5 ft.
				0/2	5916 5915	52 53				NO SAMPLE:
				1.5/1.5	5914 5913	54 55				SILTY CLAYSTONE: Lt. gray (N7), massive bedding, well weathered, mod. friability, trace of carb. material and iron staining as mottles.
				1.6/1	5912	56				SILTY CLAYSTONE: Same as above.
				1.5/1.5	5911	57				SILTY CLAYSTONE: Same as above.
				1.75/1.75	5910 5909	58 59				SILTY CLAYSTONE: Same as above.
						60				SILTSTONE: Light gray (N7), massive bedding, weathered, slightly friable, some

STATE PLANE COORDINATE:		TOTAL DEPTH (FT): 126.2	GROUND ELEVATION (FT): 5968.1	PROJECT NUMBER: 567.11	LOG OF BORING NUMBER:
NORTH:	749634	AREA: MOUND AREA	CASING DIAMETER (IN): 2 ID	GEOLOGIST: LAA/TSD/DCB	20-87BR
EAST:	2086155	LOCATOR NUMBER: N9	BOREHOLE DIAMETER (IN): 4 0	DATE DRILLED: 08/03/87	

REMARKS: Hollow stem auger; Rotary core. Surface casing to 51.64' by J.B.Bergman, Aug. 4, 1987.

CRITICAL SAMPLE DEPTH
GRADATIONAL SAMPLE DEPTH
SAMPLE NUMBER
SAMPLE GRAIN SIZE (0% 50% 100%)
PERCENT RECOVERY (0% 100%)
RECOVERY/INTERVAL
DATUM (FT)
DEPTH (FT)
WELL OR PIEZOMETER CONSTRUCTION
LITHOLOGY

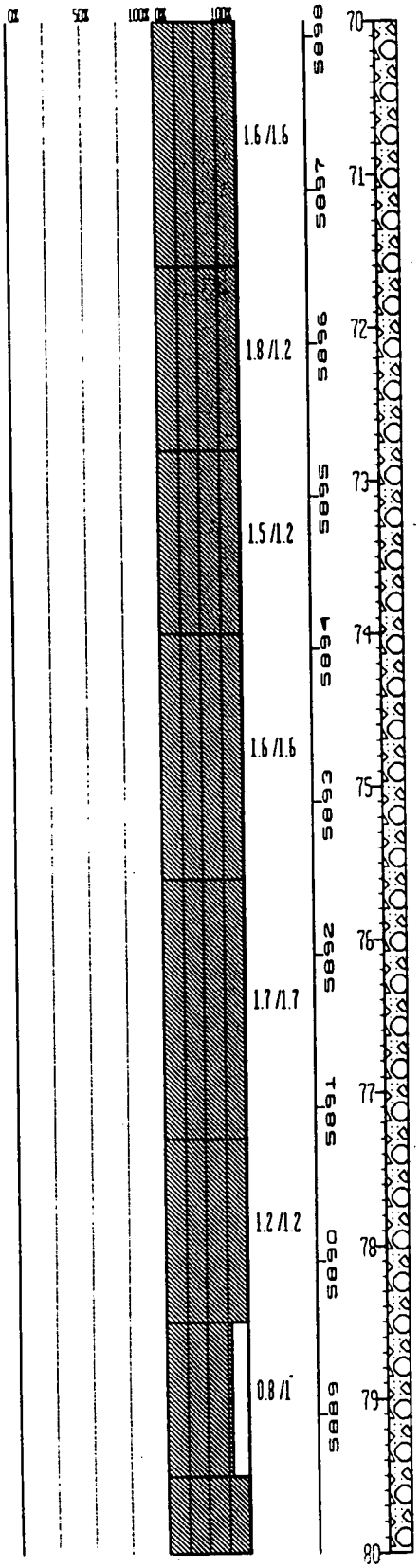


UNIFIED SOILS CLASSIFICATION OR ROCK TYPE	DESCRIPTION
	carb. material and clay, becoming clayier at bottom 0.5 ft. of interval.
SILTY CLAYSTONE	Olive gray (5Y 4/1), massive to wavy bedding, weathered, slightly friable, VFG sand and silt are interbedded throughout, trace of carb. material.
SILTY CLAYSTONE	Same as above, trace of iron staining as mottles.
SILTY CLAYSTONE	Same as above, some carb. material and iron staining.
NO SAMPLE	
SILTY CLAYSTONE	Same as above.
SILTY CLAYSTONE	Same as above.
SILTY CLAYSTONE	Olive gray (5Y 4/1) to very lt. gray (N8), well weathered, VFG sand and silt laminae are bedded vertically, mod. friable, some carb. material and iron staining as mottles.
NO SAMPLE	

STATE PLANE COORDINATE:		TOTAL DEPTH (FT) 126.2	GROUND ELEVATION (FT): 5968.1	PROJECT NUMBER: 667.11	LOG OF BORING NUMBER:
NORTH:	749634	AREA: MOUND AREA	CASING DIAMETER (IN): 2 ID	GEOLOGIST: LAA/TSD/DCB	20-87B
EAST:	2086155	LOCATOR NUMBER: N9	BOREHOLE DIAMETER (IN): 4 0	DATE DRILLED: 08/03/87	

REMARKS: Hollow stem auger; Rotary core. Surface casing to 51.64' by J.B.Bergman, Aug. 4, 1987.

CHEMICAL SAMPLE DEPTH
GRADATIONAL SAMPLE DEPTH
SAMPLE NUMBER
SAMPLE GRADN SIZE
PERCENT RECOVERY
RECOVERY/INTERVAL
DATUM(FT)
DEPTH(FT)
WELL OR PIEZOMETER CONSTRUCTION
LITHOLOGY
UNIFIED SOILS CLASSIFICATION OR ROCK TYPE
DESCRIPTION



SILTY CLAYSTONE: Olive gray (5Y 4/1) to very lt. gray (N8), VFG sandstone and silt laminae are bedded vertically to nearly vertical, mod. friable, trace of carb. material and iron staining as mottles.

SILTY CLAYSTONE: Same as above.

SILTY CLAYSTONE: Same as above, vertical laminae is no longer present, (massive bedding?), silt occurs in pockets.

SILTY CLAYSTONE: Same as above, lt. olive gray (5Y 6/1), interval becomes more carb. at the bottom.

SILTY CLAYSTONE: Same as above.

SILTY CLAYSTONE: Same as above.

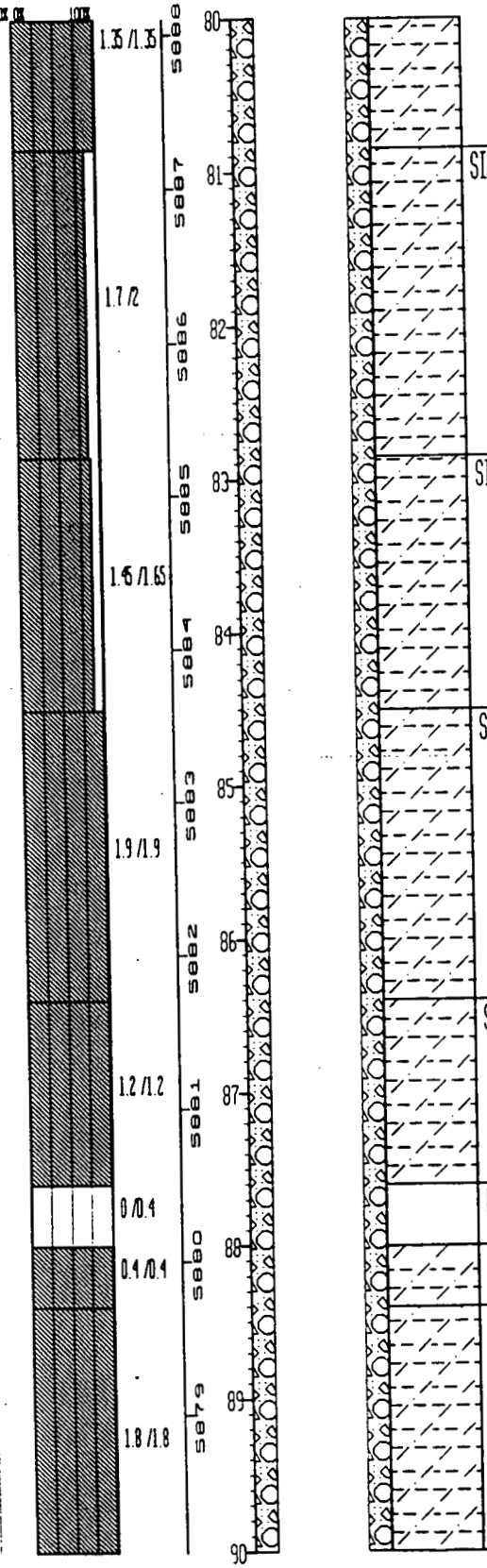
SILTY CLAYSTONE: Same as above.

SILTY CLAYSTONE: Same as above.

STATE PLANE COORDINATE:	TOTAL DEPTH (FT) 126.2	GROUND ELEVATION (FT) 5968.1	PROJECT NUMBER: 557.11	LOG OF BORING NUMBER:	
NORTH: 749634	AREA: MOUND AREA	CASING DIAMETER (IN): 2 ID	GEOLOGIST: LAA/TSD/DCB	20-87BR	
EAST: 2086155	LOCATOR NUMBER: N9	BOREHOLE DIAMETER (IN): 4.0	DATE DRILLED: 08/03/87		

REMARKS: Hollow stem auger; Rotary core. Surface casing to 51.64' by J.B.Bergman, Aug. 4, 1987.

CHEMICAL SAMPLE DEPTH
GRADATIONAL SAMPLE DEPTH
SAMPLE NUMBER
SAMPLE GRAIN SIZE (0% 50% 100%)
PERCENT RECOVERY (0% 100%)
RECOVERY/INTERVAL
DATUM (FT)
DEPTH (FT)
WELL OR PIEZOMETER CONSTRUCTION
LITHOLOGY
UNIFIED SOILS CLASSIFICATION OR ROCK TYPE
DESCRIPTION



SILTY CLAYSTONE:	As above, with slickensides at 81.5 ft, 40 degree angle and decrease in carbonaceous mineralization.
SILTY CLAYSTONE:	Same as above.
SILTY CLAYSTONE:	Same as above.
SILTY CLAYSTONE:	
NO SAMPLE:	Same as above.
SILTY CLAYSTONE:	Same as above.
SILTY CLAYSTONE:	Same as above.

STATE PLANE COORDINATE:
NORTH: 749634
EAST: 2086155

TOTAL DEPTH (FT): 126.2
AREA: MOUND AREA
LOCATOR NUMBER: N9

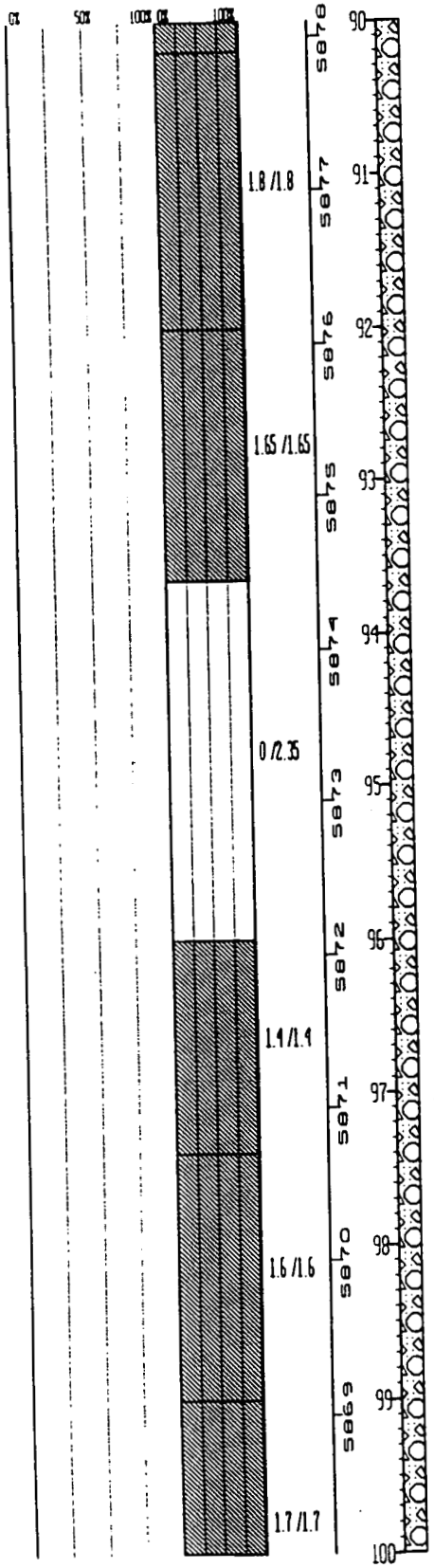
GROUND ELEVATION (FT): 5968.1
CASING DIAMETER (IN): 2 ID
BOREHOLE DIAMETER (IN): 4 0

PROJECT NUMBER: 557.11
GEOLOGIST: LAA/TSD/DCB
DATE DRILLED: 08/03/87

LOG OF BORING NUMBER: 20-87BR

REMARKS: Hollow stem auger; Rotary core. Surface casing to 51.64' by J.B.Bergman, Aug. 4, 1987.

CHEMICAL SAMPLE DEPTH
GRADATIONAL SAMPLE DEPTH
SAMPLE NUMBER
SAMPLE GRAIN SIZE (0% 50% 100%)
PERCENT RECOVERY (0% 100%)
RECOVERY/INTERVAL
DATUM (FT)
DEPTH (FT)
WELL OR PIEZOMETER CONSTRUCTION
LITHOLOGY
UNIFIED SOILS CLASSIFICATION OR ROCK TYPE
DESCRIPTION



SILTY CLAYSTONE: Same as above, increase in silt fraction below 92.0 ft.

SILTY CLAYSTONE:

NO SAMPLE: Light gray (N7), bioturbated / soft sediment deformation?, well weathered, moderately friable, some carbonaceous mineralization disseminated throughout.

SILTY CLAYSTONE: Same as above.

SILTY CLAYSTONE: Same as above.

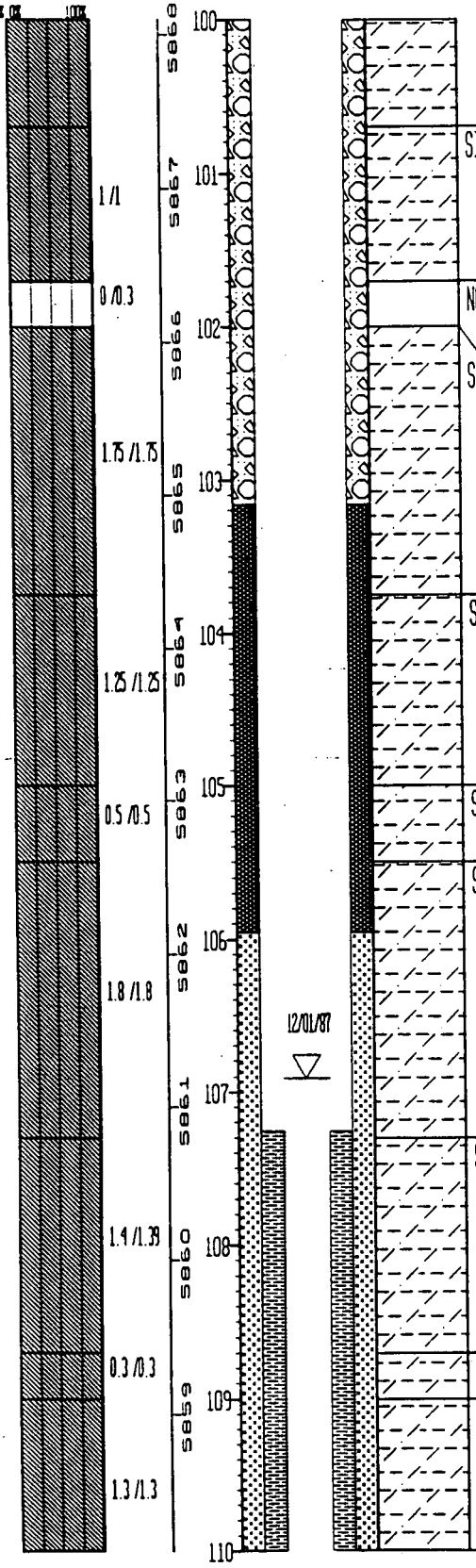
SILTY CLAYSTONE: Same as above

STATE PLANE COORDINATE:		TOTAL DEPTH (FT): 126.2	GROUND ELEVATION (FT): 5968.1	PROJECT NUMBER: 667 11	LOG OF BORING NUMBER:
NORTH:	749634	AREA: MOUND AREA	CASING DIAMETER (IN): 2 ID	GEOLOGIST: LAA/TSD/DCB	20-87BR
EAST:	2086155	LOCATOR NUMBER: N9	BOREHOLE DIAMETER (IN): 4 0	DATE DRILLED: 08/03/87	

REMARKS: Hollow stem auger; Rotary core. Surface casing to 51.64' by J.B.Bergman, Aug. 4, 1987.

CHEMICAL SAMPLE
GRADATIONAL SAMPLE
SAMPLE NUMBER

SAMPLE GRAIN SIZE (0% 50% 100%) | PERCENT RECOVERY (0% 100%) | RECOVERY/INTERVAL | DATUM (FT) | DEPTH (FT) | WELL OR PIEZOMETER CONSTRUCTION | LITHOLOGY | UNIFIED SOILS CLASSIFICATION OR ROCK TYPE | DESCRIPTION



SILTY CLAYSTONE: SLUFF

NO SAMPLE: As above (reference interval 96.0 to 101.7 ft.), with localized iron staining below 103 ft., bedding not apparent.

SILTY CLAYSTONE: As above.

SILTY CLAYSTONE: As above.

SILTY CLAYSTONE: As above.

SILTY CLAYSTONE: As above.

SILTY CLAYSTONE: As above.

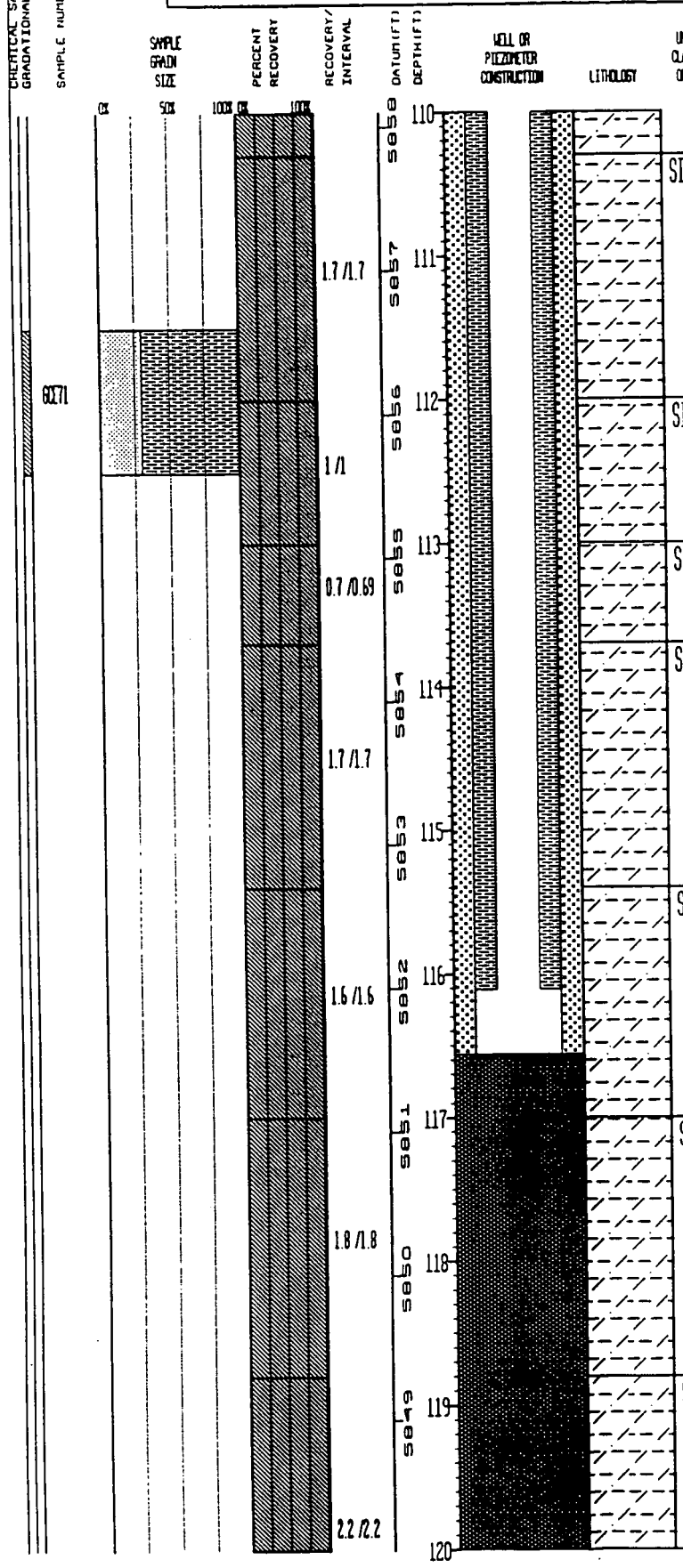
SILTY CLAYSTONE: As above.

SILTY CLAYSTONE: As above.

STATE PLANE COORDINATE:	TOTAL DEPTH (FT): 126.2	GROUND ELEVATION (FT):	5968.1	PROJECT NUMBER:	567 11
NORTH: 749634	AREA: MOUND AREA	CASING DIAMETER (IN):	2 ID	GEOLOGIST:	LAA/TSD/DCB
EAST: 2086155	LOCATOR NUMBER: M9	BOREHOLE DIAMETER (IN):	4.0	DATE DRILLED:	08/03/87

LOG OF BORING NUMBER: 20-87B

REMARKS: Hollow stem auger; Rotary core. Surface casing to 51.64' by J.B.Bergson, Aug. 4, 1987.

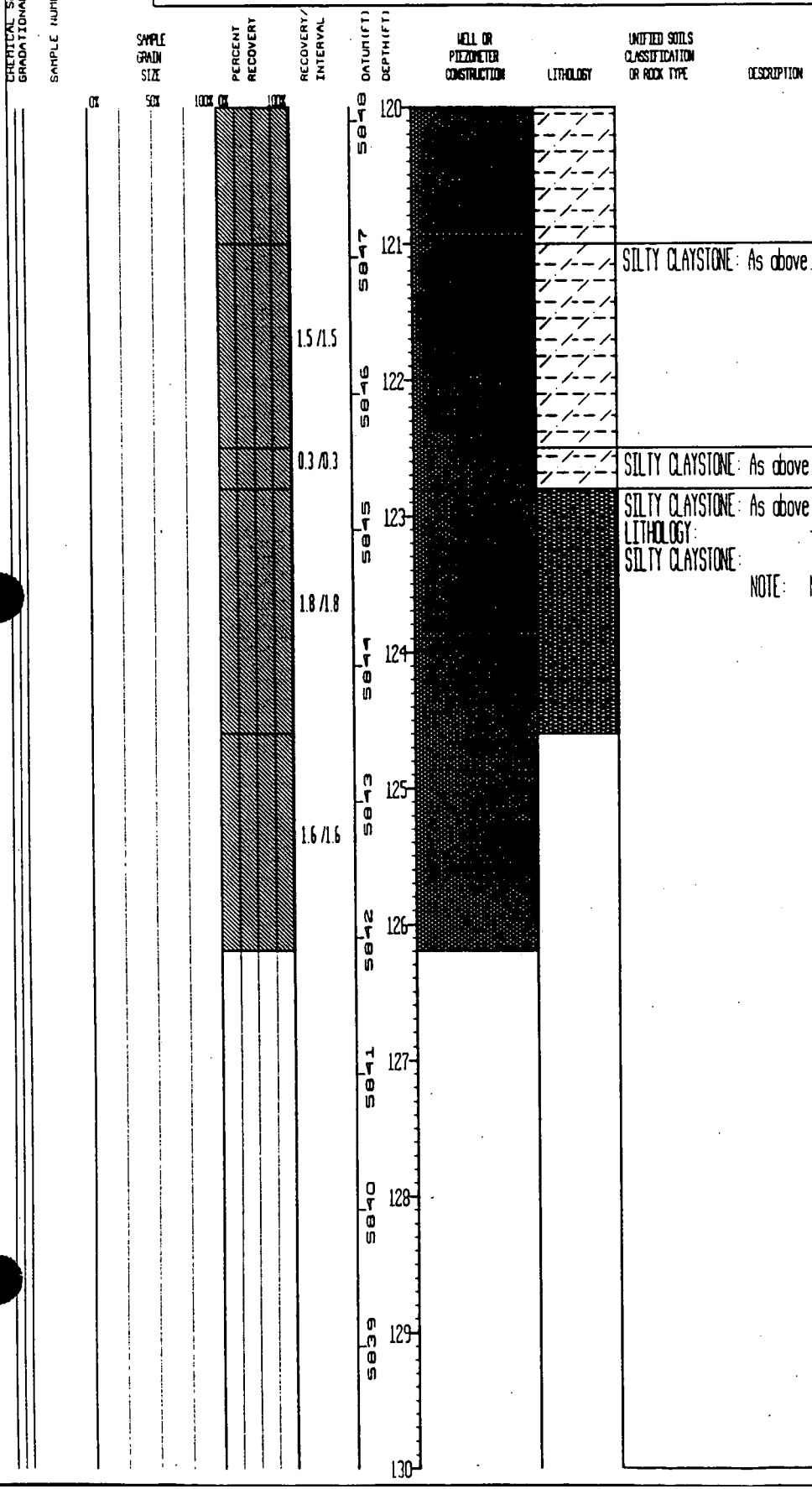


UNIFIED SOILS CLASSIFICATION OR ROCK TYPE	DESCRIPTION
SILTY CLAYSTONE	As above.
SILTY CLAYSTONE	As above.
SILTY CLAYSTONE	As above.
SILTY CLAYSTONE	As above, slickenside occurs at approx. 115.8 ft. approx. 45 degrees.
SILTY CLAYSTONE	As above with decrease in silt fraction from approx. 117 to 118 ft. Slickenside occurs at approx. 118.2 ft. vertical orientation.
SILTY CLAYSTONE	As above.
SILTY CLAYSTONE	As above.

STATE PLANE COORDINATE:	TOTAL DEPTH (FT): 126.2	GROUND ELEVATION (FT):	5968.1	PROJECT NUMBER:	667.11
NORTH: 749634	AREA: MOUND AREA	CASING DIAMETER (IN):	2 ID	GEOLOGIST:	LAA/TSD/DCB
EAST: 2086155	LOCATOR NUMBER: N9	BOREHOLE DIAMETER (IN):	4.0	DATE DRILLED:	08/03/87

LOG OF BORING NUMBER: 20-87BR

REMARKS: Hollow stem auger; Rotary core. Surface casing to 51.64' by J.B.Bergman, Aug. 4, 1987.



SILTY CLAYSTONE: As above.

SILTY CLAYSTONE: As above.

SILTY CLAYSTONE: As above.

LITHOLOGY: -124.6 -126.2 -124.6

SILTY CLAYSTONE:

NOTE: No water encountered during drilling.

INDEX OF DATA

Boring No.: 21-87

Completed as well? Yes

Data in File

X Log of Borehole

X Well Construction Summaries

X Well Development Summaries

____ Hydraulic Conductivity Test Data and Results

____ Packer Test Data and Results

X Water Level Data

____ Saturated Thickness Hydrographs

LOG OF BOREHOLE

Location: Rocky Flats Plant: Mound Area
Coordinates: N 36980.21 E 22693.84
Total Depth: 17.00'

Borehole/Well No.: 21-87
Ground Surface Elevation: 5927.58'
Water Level Encountered: 7.0'
Static: Dry

Drilling Company: Boyles Bros
Date Drilled: October 16, 1987
Drilling Method: Hollow Stem Auger
Logged By: K. D. Holliway
Geologist

Driller: R. Sharp
Helper: T. Merritt
Drilling Fluid: None
Checked By: _____
Site Manager

_____
CEARP Manager

Comments: _____

Depth Feet	Graphic Log	Sample Type	Lithologic Description	Samples Collected or Other Tests Performed
			9.5-12.0' SAMPLE. Recovered 2.5/2.5' = 100%. 9.5-10.4': SANDY CLAY: light olive gray (5 Y 5/2); occasional subrounded to rounded quartzite pebbles; very fine-grained sand; trace caliche; damp to moist.	
			ARAPAHOE FORMATION	
			10.4-12.0': SANDY CLAYSTONE: light olive gray (5 Y 5/2) to medium gray (N 5/0) with dark yellowish orange (10 YR 6/6) iron staining; very fine-grained sand; trace caliche; damp to moist.	
			12.0-14.5' SAMPLE. Recovered 2.5/2.5' = 100%. CLAYSTONE: same as above; damp to moist.	
			14.5-17.0' SAMPLE. Recovered 2.3/2.5' = 92%. CLAYSTONE: olive gray (5 Y 4/1) with trace dark yellowish orange (10 YR 6/6) iron staining; some very fine-grained sand more than above; trace caliche; damp to moist.	
			TOTAL DEPTH: 17.00'	

Well No.: 21-87

WELL DEVELOPMENT SUMMARY SHEET

DATE	TIME	METHOD	VOLUME	APPEARANCE	COMMENTS
12/1/87	---	Pumping	-----	Sandy	Water level 7.63' after pumping

LOG OF BORING NO. 21-87

GEOLOGIST(S): DCB
DATE: 8/11/89

PROJECT NO: 667-1122

TOP/BOTTOM OF CORE IN BOX	TOP/BOTTOM OF INTERVAL	FEET OF CORE IN INTERVAL IN BOX	SAMPLE NUMBER	FRACTURE ANGLE	BEDDING ANGLE	GRAIN SIZE DISTRIBUTION	USCS SYMBOL	DEPTH IN FEET	LITHOLOGIC LOG	LITHOLOGIC DESCRIPTION
0.0 ↓	0.0 to 1.9					>50% Gravel	GC	1		Clayey Gravel, light gray (N7), clay matrix is medium light gray (N6), angular to subangular, poorly graded, max. size 5 cm, some plant debris in upper .15 ft., some silt, trace of sand, calcareous mineralization disseminated throughout clay mat.
	1.9 to 2.0	0								NO SAMPLE
	2.0 to 3.0					>50% Gravel	GC	2		As above (reference interval 0.0 to 1.9 ft), clay matrix is med. dark gray (N4).
	3.0 to 4.3	0						3		No Sample
	4.0 to 4.3					>50% Gravel	GC	4		As above (reference interval 0.0 to 1.9 ft.).
	4.3 to 7.0	0						5, 6, 7		No Sample
	7.0 to 7.3	ND				>50% Clay	CL	7		Clay, light gray (N7), low to moderate plasticity, some gravel from 7.0 to 7.4 ft, trace of calcareous mineralization.
	7.3 to 8.9	ND				>50% Clay		8		Claystone, light gray (N7) to med. dark gray (N4), bedding not apparent, highly weathered, highly triable, some iron staining, local DCB carbonaceous ~~[illegible]~~ mineralization.
	8.9 to 9.5	ND						9		
	9.5 to 10.6	ND				>50% Clay	CL			Clay, light olive gray (5Y 5/2), moderately high plasticity, localized calcareous

Box 1 of 2 DCB

NOTES: General USCS is modified for this log as follows:
Material amounts are estimated by % volume instead of % weight.
(1) Badly broken core, accurate footage measurements not possible.
(2) Core breaks cannot be matched, accurate footage measurements not possible.

ROCKY FLATS PLANT

FIGURE NO.

LOG OF BORING NO. 21-87

GEOLOGIST(S): DCB
DATE: 8/11/89

PROJECT NO: 667-1122

TOP/BOTTOM OF CORE IN BOX	TOP/BOTTOM OF INTERVAL	FEET OF CORE IN INTERVAL IN BOX	SAMPLE NUMBER	FRACTURE ANGLE	BEDDING ANGLE	GRAIN SIZE DISTRIBUTION	USCS SYMBOL	DEPTH IN FEET	LITHOLOGIC LOG	LITHOLOGIC DESCRIPTION
DCB 1 of 2	9.5 to 10.6	ND				>50% clay	CL			bodies.
Box ↑ 12.0	10.6 to 12.0	ND						11		
12.0 ↓	12.0 to 14.5	ND						12, 13		
Box 2 of 2	14.5 to 17.0	ND						14, 15, 16, 17		Claystone, medium light gray (N6), bedding not apparent (massive?), highly weathered, moderately friable, iron staining occurs on fracture surfaces, localized carbonaceous mineralization.
								17, 18, 19		Bottom ~~of Hole~~ DCB Box 2 of 2 ~~at~~ 17.0 ft.

NOTES: General USCS is modified for this log as follows:
Material amounts are estimated by % volume instead of % weight.
(1) Badly broken core, accurate footage measurements not possible.
(2) Core breaks cannot be matched, accurate footage measurements not possible.

ROCKY FLATS PLANT

FIGURE NO.

STATE PLANE COORDINATE:	TOTAL DEPTH (FT): 17	GROUND ELEVATION (FT): 5927.58	PROJECT NUMBER: 667.11	LOG OF BORING NUMBER:
NORTH: 749969	AREA: MOUND AREA	CASING DIAMETER (IN): 2 ID	GEOLOGIST: DCB	21-87
EAST: 2085800	LOCATOR NUMBER: M9	BOREHOLE DIAMETER (IN): 7 5	DATE DRILLED: 10/16/87	

REMARKS: Hollow stem auger.

CHEMICAL SAMPLE DEPTH
GRADATIONAL SAMPLE DEPTH
SAMPLE NUMBER
SAMPLE GRAIN SIZE (0% 50% 100%)
PERCENT RECOVERY (0% 100%)
RECOVERY/INTERVAL
DATUM (FT)
DEPTH (FT)
WELL OR PIEZOMETER CONSTRUCTION
LITHOLOGY

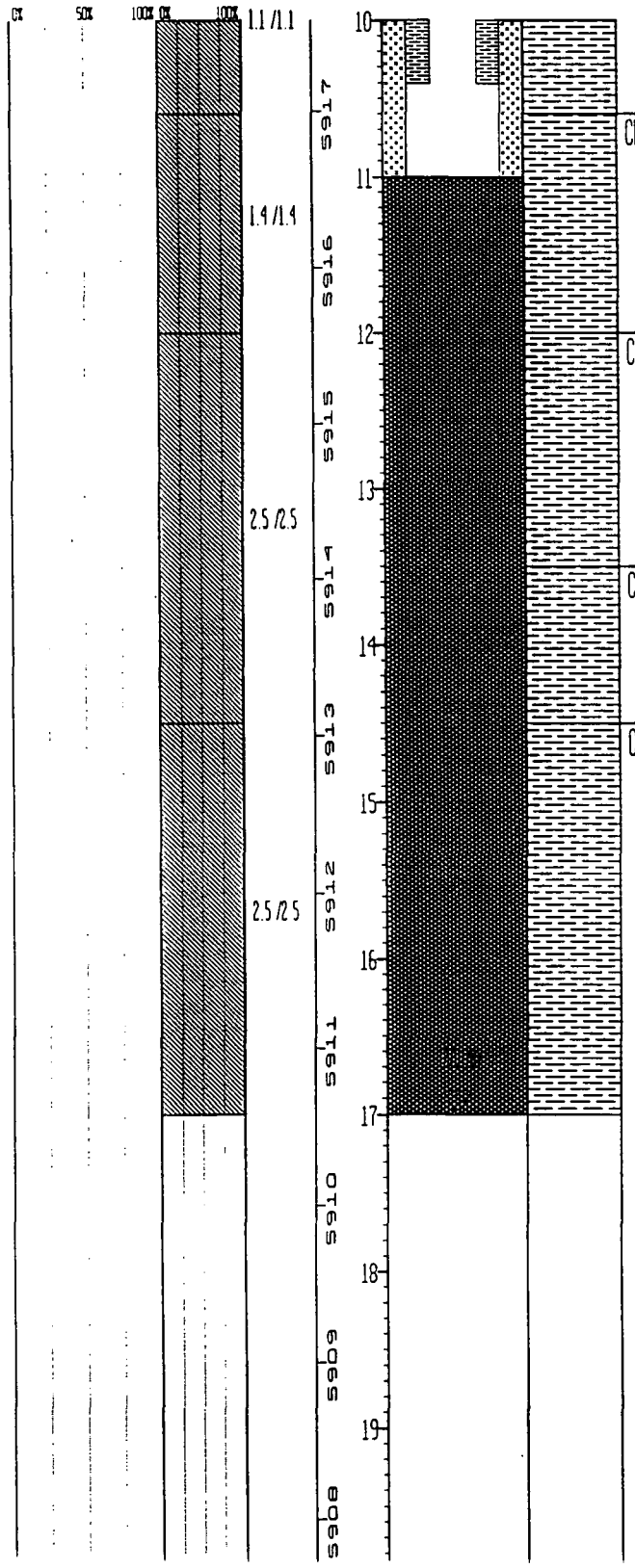
RECOVERY/INTERVAL	DATUM (FT)	UNIFIED SOILS CLASSIFICATION OR ROCK TYPE	DESCRIPTION
1.9 /1.9	5927	GC:	Clayey Gravel - light gray (N7), clay matrix is medium light gray (N6), angular to sub-angular, poorly graded, max. size 5 cm., some plant debris in upper 0.15 ft., some silt, trace of sand, calcareous mineralization disseminated throughout clay matrix.
0 /0.1	5926	NO SAMPLE	
1 /1	5925	GC	As above (reference interval 0.0 to 1.9 ft.), clay matrix is med. dark gray (N4)
0 /1	5924	NO SAMPLE:	
0.3 /0.3		GC:	As above (reference interval 0 to 1.9 ft).
0 /2.7	5923 5922 5921	NO SAMPLE	
0.3 /0.3	5920	CL:	CLAY - light gray (N7), low to moderate plasticity, some gravel from 7.0 to approx. 7.4 ft., trace of calcareous mineralization.
1.6 /1.6	5919	CL:	CLAY - light gray (N7) to medium dark gray (N4), bedding not apparent, highly weathered, highly friable, some iron staining, local carbonaceous mineralization.
		CLAYSTONE:	Top of Bedrock Same as above.
0.6 /0.6	5918	CLAYSTONE:	Same as above.
		CLAYSTONE:	Light olive gray (5Y 5/2), moderately high plasticity, localized calcareous bodies

DEPTH (FT): 0, 1, 2, 3, 4, 5, 6, 7, 8, 9

WELL OR PIEZOMETER CONSTRUCTION: 11/12/87; 10/16/87

STATE PLANE COORDINATE:	TOTAL DEPTH (FT): 17	GROUND ELEVATION (FT): 5927.58	PROJECT NUMBER: 667.11	LOG OF BORING NUMBER:
NORTH: 749969	AREA: MOUND AREA	CASING DIAMETER (IN): 2 ID	GEOLOGIST: DCB	21-87
EAST: 2085800	LOCATOR NUMBER: M9	BOREHOLE DIAMETER (IN): 7.5	DATE DRILLED: 10/16/87	
REMARKS: Hollow stem auger.				

CHEMICAL SAMPLE DEPTH
GRADATIONAL SAMPLE
SAMPLE NUMBER
SAMPLE GRAIN SIZE
PERCENT RECOVERY
RECOVERY/INTERVAL
DATUM (FT)
DEPTH (FT)
WELL OR PIEZOMETER CONSTRUCTION
LITHOLOGY
UNIFIED SOILS CLASSIFICATION OR ROCK TYPE
DESCRIPTION



UNIFIED SOILS CLASSIFICATION OR ROCK TYPE	DESCRIPTION
CLAYSTONE:	Same as above.
CLAYSTONE:	Same as above.
CLAYSTONE:	Medium light gray (N6), bedding not apparent (massive?), highly weathered, moderately friable, iron staining occurs on fracture surfaces, localized carbonaceous mineralization.
CLAYSTONE:	As above.

INDEX OF DATA

Boring No.: 22-87BR

Completed as well? Yes

Data in File

X Log of Borehole

X Well Construction Summaries

X Well Development Summaries

____ Hydraulic Conductivity Test Data and Results

X Packer Test Data and Results

X Water Level Data

____ Saturated Thickness Hydrographs

LOG OF BOREHOLE

Location: Rocky Flats Plant; Mound Area
Coordinates: N 36934.99 E 22715.72
Total Depth: 110.40'

Borehole/Well No.: 22-87BR
Ground Surface Elevation: 5930.70'
Water Level Encountered: 12.2'
Static: 5852.04' (12/01/87)

Drilling Company: Boyles Bros
Date Drilled: Sept 30 & Oct 7-8, 1987
Drilling Method: Hollow Stem Auger; Rotary Core
Logged By: K.D. Holliway; J.B. Berman
Geologist

Driller: R. Sharp
Helper: T. Merritt
Drilling Fluid: 0.0 - 45.1' None; 45.1' - 110.4' Water
Checked By: _____
Site Manager

_____
CEARP Manager

Comments: Surface casing set to 43.59' by K.D. Holliway on October 2, 1987

Depth Feet	Graphic Log	Sample Type	Lithologic Description	Samples Collected or Other Tests Performed
20			10.2-12.2' SAMPLE. Recovered 2.0/2.0' = 100%. CLAY: light olive gray (5 Y 5/2); some very fine-grained sand stained dark yellowish orange (10 YR 6/6); subrounded quartzite cobbles; some iron staining; trace caliche; damp.	12.2-26.5': No readings above background on the core.
25			12.2-14.2' SAMPLE. Recovered 2.0/2.0' = 100%. 12.2-12.8': SANDY CLAY: same as above; moist to wet.	26.5-27.5': Readings on core: HNu = Background; OVA = 1.6.
			ARAPAHOE FORMATION	
			12.8-14.2': SANDY CLAYSTONE: same as above except no quartzite cobbles; moist to wet.	28.5-29.5': Readings on core: HNu = 2.0; OVA = 1.0.
30			14.2-16.2' SAMPLE. Recovered 2.0/2.0' = 100%. CLAYSTONE: light olive gray (5 Y 5/2); some very fine-grained sand; some dusky yellow (5 Y 6/4); trace caliche; damp to moist.	
35			16.2-18.2' SAMPLE: Recovered 2.0/2.0' = 100%. CLAYSTONE: olive gray (5 Y 4/1); occasional dark yellowish orange (10 YR 6/6) iron staining; trace very fine-grained sand; trace caliche; damp.	
			18.2-20.2' SAMPLE. Recovered 2.0/2.0' = 100%. CLAYSTONE: same as above; damp.	

LOG OF BOREHOLE

Location: Rocky Flats Plant; Mound Area
Coordinates: N 36934.99 E 22715.72
Total Depth: 110.40'

Borehole. Well No.: 22-87BR
Ground Surface Elevation: 5930.70'
Water Level Encountered: 12.2'
Static: 5852.04' (12/01/87)

Drilling Company: Boyles Bros
Date Drilled: Sept 30 & Oct 7-8, 1987
Drilling Method: Hollow Stem Auger; Rotary Core
Logged By: K.D. Holliway; J.B. Berman
Geologist

Driller: R. Sharp
Helper: T. Merritt
Drilling Fluid: 0.0 - 45.1' None; 45.1' - 110.4' Water
Checked By: _____
Site Manager

_____
CEARP Manager

Comments: Surface casing set to 43.59' by K.D. Holliway on October 2, 1987

Depth Feet	Graphic Log	Sample Type	Lithologic Description	Samples Collected or Other Tests Performed
60			27.5-28.5' SAMPLE. Recovered 1.5/1.0' = 150%. CLAYSTONE: same as above; damp to moist.	62.20-71.85': Packer Test Interval #5.
			28.5-29.5' SAMPLE. Recovered 1.5/1.0' = 150%. CLAYSTONE: same as above except more iron staining; damp.	
65			29.5-30.5' SAMPLE. Recovered 1.5/1.0' = 150%. CLAYSTONE: same as above; trace organics; damp.	
			30.5-31.5' SAMPLE. Recovered 1.5/1.0' = 150%. SANDY CLAYSTONE: light olive gray (5 Y 5/2) with dark yellowish orange (10 YR 6/6) iron staining and grayish orange (10 YR 7/4) very fine-grained interbedded sands; occasional limonite nodules; some silt; some organics; dry.	71.85-81.50': Packer Test Interval #4.
70			31.5-32.5' SAMPLE. Recovered 1.0/1.0' = 100%. SANDY CLAYSTONE: olive black (5 Y 2/1) to light olive gray (5 Y 5/2); limonite nodules and iron staining moderate brown (5 YR 4/4); very fine-grained interbedded sands, grayish orange (10 YR 7/4); some silt; trace organics; dry.	
75				
80				

LOG OF BOREHOLE

Location: Rocky Flats Plant; Mound Area
Coordinates: N 36934.99 E 22715.72
Total Depth: 110.40'

Borehole, Well No.: 22-87BR
Ground Surface Elevation: 5930.70'
Water Level Encountered: 12.2'
Static: 5852.04' (12/01/87)

Drilling Company: Boyles Bros
Date Drilled: Sept 30 & Oct 7-8, 1987
Drilling Method: Hollow Stem Auger; Rotary Core
Logged By: K.D. Holliway; J.B. Berman
Geologist

Driller: R. Sharp
Helper: T. Merritt
Drilling Fluid: 0.0 - 45.1' None; 45.1' - 110.4' Water
Checked By: _____
Site Manager

_____
CEARP Manager

Comments: Surface casing set to 43.59' by K.D. Holliway on October 2, 1987

Depth Feet	Graphic Log	Sample Type	Lithologic Description	Samples Collected or Other Tests Performed
100			37.5-38.5' SAMPLE. Recovered 1.0/1.0' = 100%. CLAYSTONE: same as above with more sands; dry.	
			38.5-39.5' SAMPLE. Recovered 1.3/1.0' = 130%. CLAYSTONE: olive black (5 Y 2/1) to dark gray (N 3/0); some very fine-grained sand with moderate yellowish brown (10 YR 5/4) staining; some silt; some organics; dry.	
105			39.5-40.5' SAMPLE. Recovered 1.2/1.0' = 120%. CLAYSTONE: same as above with less sands and less iron staining; dry.	
110			40.5-41.5' SAMPLE. Recovered 1.2/1.0' = 120%. CLAYSTONE: olive black (5 Y 2/1) to dark gray (N 3/0); very fine-grained calcareous sand in fractures with moderate yellowish brown (10 YR 5/4) staining; at 41.2' band of caliche (or calcareous sand) reacts strongly with HCl; some organics; dry.	
115			41.5-42.5' SAMPLE. Recovered 1.5/1.0' = 150%. CLAYSTONE: same as above; dry.	
			42.5-43.5' SAMPLE. Recovered 1.4/1.0' = 140%. CLAYSTONE: same as above; dry.	

LOG OF BOREHOLE

Location: Rocky Flats Plant; Mound Area
Coordinates: N 36934.99 E 22715.72
Total Depth: 110.40'

Borehole, Well No.: 22-87BR
Ground Surface Elevation: 5930.70'
Water Level Encountered: 12.2'
Static: 5852.04' (12/01/87)

Drilling Company: Boyles Bros
Date Drilled: Sept 30 & Oct 7-8, 1987
Drilling Method: Hollow Stem Auger; Rotary Core
Logged By: K.D. Holliway; J.B. Bergman
Geologist

Driller: R. Sharp
Helper: T. Merritt
Drilling Fluid: 0.0 - 45.1' None; 45.1' - 110.4' Water
Checked By: _____
Site Manager

CEARP Manager

Comments: Surface casing set to 43.59' by K.D. Holliway on October 2, 1987

Depth Feet	Graphic Log	Sample Type	Lithologic Description	Samples Collected or Other Tests Performed
			60.5-64.5' SAMPLE. Recovered 3.6/4.0' = 90%. RQD = 3.6/3.6' = 100%. CLAYSTONE: dark gray (N 3/0); dense; consolidated; homogenous; some carbonaceous debris; sandy from 60.9-61.4'; moist to wet.	
			64.5-68.5' SAMPLE. Recovered 3.3/4.0' = 83%. RQD = 2.1/3.3' = 64%. 64.5-66.6': CLAYSTONE: same as above. 66.6-67.8': MUDSTONE: brownish gray (5 YR 4/1); very fine-grained; "sulphur-like" smell when HCl is added; abundant carbonaceous fragments; fragments strongly react with HCl; cement only slightly reacts when powdered; very hard and dense; dry.	
			68.5-72.5' SAMPLE. Recovered 4.0/4.0' = 100%. RQD = 3.7/4.0' = 93%. CLAYSTONE: brownish black (5 YR 2/1); trace very fine-grained sand; abundant organic fragments; moist to wet.	
			72.5-76.5' SAMPLE. Recovered 3.7/4.0' = 93%. RQD = 3.7/3.7' = 100%. CLAYSTONE: same as above; no sand; fractures at 76.0' and 76.3' (~45°); moist to wet.	

LOG OF BOREHOLE

Location: Rocky Flats Plant; Mound Area
Coordinates: N 36934.99 E 22715.72
Total Depth: 110.40'

Borehole. Well No.: 22-87BR
Ground Surface Elevation: 5930.70'
Water Level Encountered: 12.2'
Static: 5852.04' (12/01/87)

Drilling Company: Boyles Bros
Date Drilled: Sept 30 & Oct 7-8, 1987
Drilling Method: Hollow Stem Auger; Rotary Core
Logged By: K.D. Holliway; J.B. Berman
Geologist

Driller: R. Sharp
Helper: T. Merritt
Drilling Fluid: 0.0 - 45.1' None; 45.1' - 110.4' Water
Checked By: _____
Site Manager

CEARP Manager

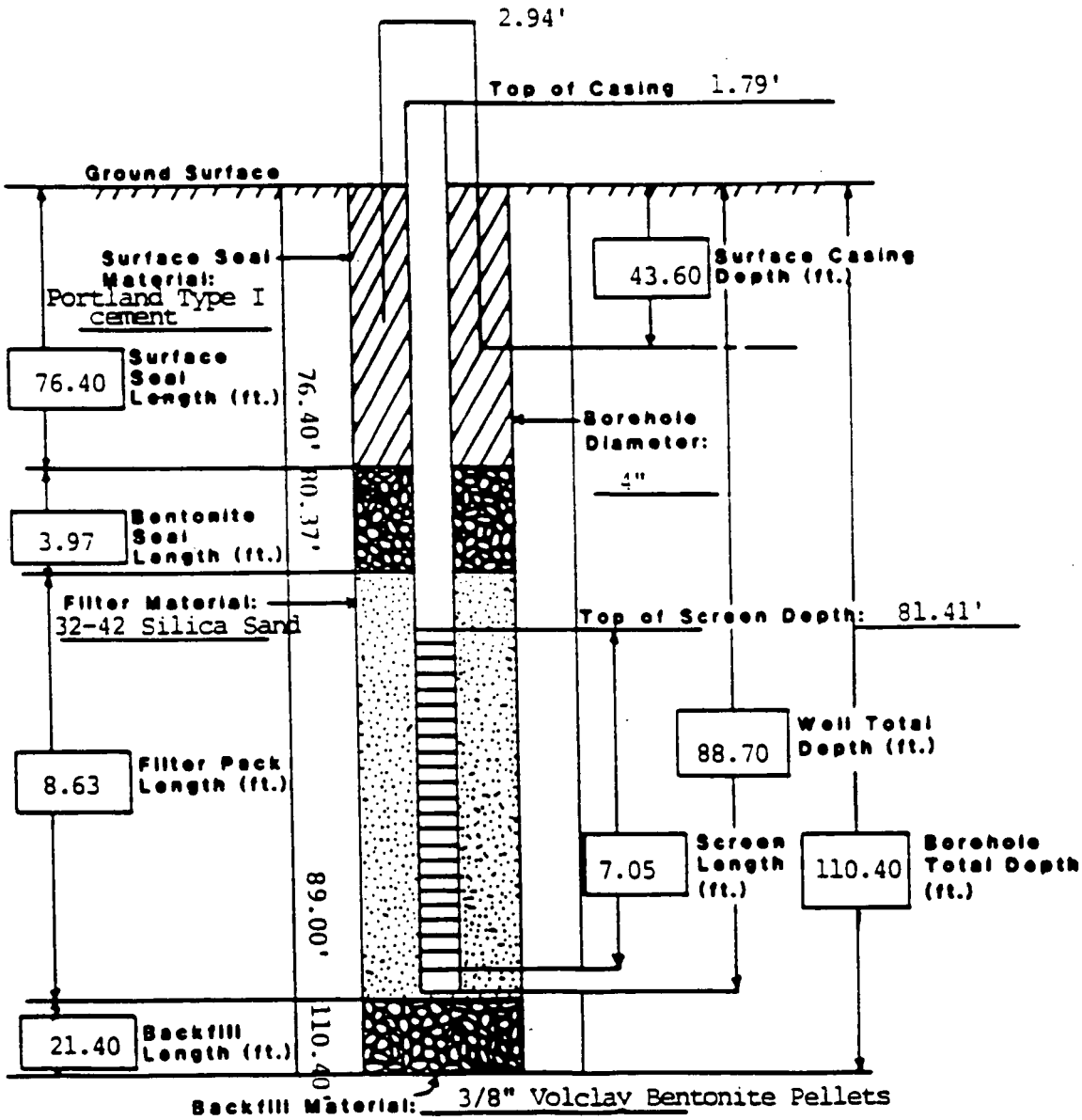
Comments: Surface casing set to 43.59' by K.D. Holliway on October 2, 1987

Depth Feet	Graphic Log	Sample Type	Lithologic Description	Samples Collected or Other Tests Performed
			86.5-90.5' SAMPLE. Recovered 2.6/4.0' = 65%. RQD = 1.3/2.6' = 50%. 86.5-87.1': SANDSTONE: medium light gray (N 6/0); fine to medium-grained; rounded; well sorted; calcareous cement; very dense and consolidated; dry. 87.1-88.5': INTERBEDDED SANDSTONE AND CLAYSTONE: sandstone layers medium gray (N 5/0); 0.5" to 2" thick; claystone layers medium dark gray (N 4/0); consolidated; moist. 88.5-89.1': CLAYSTONE: medium dark gray (N 4/0) with some very thin (<0.5') sandstone layers; same sand as above; moist.	
			90.5-95.0' SAMPLE. Recovered 4.0/4.5' = 89%. RQD = 3.3/4.0' = 83%. INTERBEDDED SANDSTONE/ CLAYSTONE: medium light gray (N 6/0) sandstone and medium dark gray (N 4/0) claystone; sandstone layers .05 to 1' thick; claystone layers 0.2-0.5' thick; decrease sandstone content with depth; crossbedded sands; moist to wet.	

WELL COMPLETION INFORMATION

Location: Rocky Flats Plant; Mound Area
Well No.: 22-87BR
Coordinates: N 36934.99 E 22715.72
Elevation: Ground Surface: 5930.70'
Total Depth: Well: 88.70'
Top of Casing: 5932.49'
Borehole: 110.40'
Formation of Completion: Arapahoe Formation
Casing Material: Sch 5, type 316 TFJ stainless steel
Casing Diameter: 2" ID
Screen Material: 0.010" wire wrap, type 316 TFJ stainless steel
Surface Casing Diameter: 5" ID
Date Installed: Oct. 10, 1987
Approved By: _____ Site Manager
Installed By: K. D. Holliway, Geologist
_____ CEARP Manager

Comments: Surface casing set to 43.60' by K. D. Holliway October 9, 1987



PACKER TEST DATA SHEET

Job No.: 2029-17-02

Location: Rocky Flats Plant; Mound Area

Well No.: 22-87BR

Borehole Diameter: 0.333'

Acrylic Tube Diameter: 0.1663'

Static Water Level: 78.66'

Date of Water Level: 12/1/87

Page 1 of 2

Comments: Test interval #5 failed on 2/3 pressure test and second 1/3 pressure test due to water gain in acrylic tube and test intervals #6 and 7 failed on second 1/3 pressure test.

Test Interval No.	Top of Test Interval	Bottom of Test Interval	Test Length (minutes)	Gage Pressure	Gage Height	Avg. H_2O Height	Gage Height +Avg. H_2O Height	Δh	Date of Test	Lithology	Geologist
1	92.35	102.00	15	0	7.50	3.45	10.95	0.88	10/09/87	Kass	JBB
			15	18.5	7.50	N/A	7.50	1.66	10/09/87	Kass	JBB
			15	0	7.50	2.70	10.20	0.59	10/09/87	Kass	JBB
2	82.70	92.35	15	0	7.50	2.12	9.62	2.93	10/09/87	Kass	JBB
			15	16.5	7.50	N/A	7.50	3.88	10/09/87	Kass	JBB
			15	0	7.50	2.95	10.45	2.56	10/09/87	Kass	JBB
3	81.50	91.15	15	0	7.50	3.62	11.12	2.67	10/09/87	Kass	JBB
			15	16.05	7.50	N/A	7.50	4.43	10/09/87	Kass	JBB
			15	0	7.50	1.94	9.44	1.90	10/09/87	Kass	JBB
4	71.85	81.50	15	0	7.50	4.38	11.88	0.03	10/09/87	KCL	JBB
			15	13.5	7.50	N/A	7.50	0.15	10/09/87	KCL	JBB
			15	0	7.50	5.37	12.87	0.00	10/09/87	KCL	JBB
5	62.20	71.85	15	0	6.70	4.91	11.61	0.01	10/12/87	KCL	KDH
			15	11.8	6.70	N/A	6.70	-0.03	10/12/87	KCL	KDH
			15	0	6.70	4.41	11.11	-0.37	10/12/87	KCL	KDH
6	52.55	62.20	15	0	6.70	5.35	12.05	0.05	10/12/87	KCL	KDH
			15	9.5	6.70	N/A	6.70	0.12	10/12/87	KCL	KDH
			15	0	6.70	1.52	8.22	-0.11	10/12/87	KCL	KDH

PACKER TEST ANALYSIS
WELL NO. 22-87BR
ROCKY FLATS PLANT; MOUND AREA JOB NO. 2029-17-02
DATE TESTED: 10/12/87 BY: K.D. HOLLIWAY
TEST INTERVAL (FEET BELOW G.S.): 45.60 - 52.55
MATERIAL TESTED: ARAPAHOE CLAYSTONE
DEPTH TO WATER (FEET BELOW G.S.): 78.66

$$K = \frac{Q}{2(PI)(L)(H)} LN\left(\frac{L}{R}\right)$$

1ST P1/3 TEST

Q = INJECTION RATE = .00008688 (FEET3/MIN)
L = LENGTH OF TEST INTERVAL = 6.95 FEET
TEST INTERVAL IS ABOVE WATER TABLE
HEAD = DEPTH OF CENTER OF INTERVAL + GAGE HEIGHT
+ GAGE PRESSURE (IN FEET)
= 49.07 + 11.15 + .00 * 2.31 = 60.22
R = BOREHOLE RADIUS = .17 FEET

K = HYDRAULIC CONDUCTIVITY = .0000001233 FT/MIN
K = .00000006 CM/SEC

P2/3 TEST

Q = INJECTION RATE = .00021721 (FEET3/MIN)
L = LENGTH OF TEST INTERVAL = 6.95 FEET
TEST INTERVAL IS ABOVE WATER TABLE
HEAD = DEPTH OF CENTER OF INTERVAL + GAGE HEIGHT
+ GAGE PRESSURE (IN FEET)
= 49.07 + 6.70 + 8.00 * 2.31 = 74.25
R = BOREHOLE RADIUS = .17 FEET

K = HYDRAULIC CONDUCTIVITY = .0000002500 FT/MIN
K = .00000013 CM/SEC

2ND P1/3 TEST

TEST ABORTED

PACKER TEST ANALYSIS
WELL NO. 22-87BR
ROCKY FLATS PLANT; MOUND AREA JOB NO. 2029-17-02
DATE TESTED: 10/12/87 BY: K.D. HOLLIWAY
TEST INTERVAL (FEET BELOW G.S.): 62.20 - 71.85
MATERIAL TESTED: ARAPAHOE CLAYSTONE
DEPTH TO WATER (FEET BELOW G.S.): 78.66

$$K = \frac{Q}{2(PI)(L)(H)} LN\left(\frac{L}{R}\right)$$

1ST P1/3 TEST

Q = INJECTION RATE = .00001448 (FEET3/MIN)
L = LENGTH OF TEST INTERVAL = 9.65 FEET
TEST INTERVAL IS ABOVE WATER TABLE
HEAD = DEPTH OF CENTER OF INTERVAL + GAGE HEIGHT
+ GAGE PRESSURE (IN FEET)
= 67.03 + 11.61 + .00 * 2.31 = 78.64
R = BOREHOLE RADIUS = .17 FEET

K = HYDRAULIC CONDUCTIVITY = .0000000123 FT/MIN
K = .00000001 CM/SEC

P2/3 TEST
TEST ABORTED

2ND P1/3 TEST
TEST ABORTED

PACKER TEST ANALYSIS
WELL NO. 22-87BR
ROCKY FLATS PLANT; MOUND AREA JOB NO. 2029-17-02
DATE TESTED: 10/09/87 BY: J.B. BERGMAN
TEST INTERVAL (FEET BELOW G.S.): 81.50 - 91.15
MATERIAL TESTED: ARAPAHOE SANDSTONE
DEPTH TO WATER (FEET BELOW G.S.): 78.66

$$K = \frac{Q}{2(PI)(L)(H)} LN\left(\frac{L}{R}\right)$$

1ST P1/3 TEST

Q = INJECTION RATE = .00386629 (FEET3/MIN)
L = LENGTH OF TEST INTERVAL = 9.65 FEET
TEST INTERVAL IS BELOW WATER TABLE
HEAD = DEPTH TO WATER + GAGE HEIGHT
+ GAGE PRESSURE (IN FEET)
= 78.66 + 11.12 + .00 * 2.31 = 89.78
R = BOREHOLE RADIUS = .17 FEET

K = HYDRAULIC CONDUCTIVITY = .00000288 FT/MIN
K = .00000146 CM/SEC

P2/3 TEST

Q = INJECTION RATE = .00641485 (FEET3/MIN)
L = LENGTH OF TEST INTERVAL = 9.65 FEET
TEST INTERVAL IS BELOW WATER TABLE
HEAD = DEPTH TO WATER + GAGE HEIGHT
+ GAGE PRESSURE (IN FEET)
= 78.66 + 7.50 + 16.05 * 2.31 = 123.24
R = BOREHOLE RADIUS = .17 FEET

K = HYDRAULIC CONDUCTIVITY = .00000349 FT/MIN
K = .00000177 CM/SEC

2ND P1/3 TEST

Q = INJECTION RATE = .00275129 (FEET3/MIN)
L = LENGTH OF TEST INTERVAL = 9.65 FEET
TEST INTERVAL IS BELOW WATER TABLE
HEAD = DEPTH TO WATER + GAGE HEIGHT
+ GAGE PRESSURE (IN FEET)
= 78.66 + 9.44 + .00 * 2.31 = 88.10
R = BOREHOLE RADIUS = .17 FEET

K = HYDRAULIC CONDUCTIVITY = .00000209 FT/MIN
K = .00000106 CM/SEC

PACKER TEST ANALYSIS
WELL NO. 22-87BR
ROCKY FLATS PLANT; MOUND AREA JOB NO. 2029-17-02
DATE TESTED: 10/09/87 BY: J.B. BERGMAN
TEST INTERVAL (FEET BELOW G.S.): 92.35 - 102.00
MATERIAL TESTED: ARAPAHOE SANDSTONE
DEPTH TO WATER (FEET BELOW G.S.): 78.66

$$K = \frac{Q}{2(PI)(L)(H)} LN\left(\frac{L}{R}\right)$$

1ST P1/3 TEST

Q = INJECTION RATE = .00127428 (FEET3/MIN)
L = LENGTH OF TEST INTERVAL = 9.65 FEET
TEST INTERVAL IS BELOW WATER TABLE
HEAD = DEPTH TO WATER + GAGE HEIGHT
+ GAGE PRESSURE (IN FEET)
= 78.66 + 10.95 + .00 • 2.31 = 89.61
R = BOREHOLE RADIUS = .17 FEET

K = HYDRAULIC CONDUCTIVITY = .00000095 FT/MIN
K = .00000048 CM/SEC

P2/3 TEST

Q = INJECTION RATE = .00240376 (FEET3/MIN)
L = LENGTH OF TEST INTERVAL = 9.65 FEET
TEST INTERVAL IS BELOW WATER TABLE
HEAD = DEPTH TO WATER + GAGE HEIGHT
+ GAGE PRESSURE (IN FEET)
= 78.66 + 7.50 + 18.50 • 2.31 = 128.90
R = BOREHOLE RADIUS = .17 FEET

K = HYDRAULIC CONDUCTIVITY = .00000125 FT/MIN
K = .00000063 CM/SEC

2ND P1/3 TEST

Q = INJECTION RATE = .00085435 (FEET3/MIN)
L = LENGTH OF TEST INTERVAL = 9.65 FEET
TEST INTERVAL IS BELOW WATER TABLE
HEAD = DEPTH TO WATER + GAGE HEIGHT
+ GAGE PRESSURE (IN FEET)
= 78.66 + 10.20 + .00 • 2.31 = 88.86
R = BOREHOLE RADIUS = .17 FEET

K = HYDRAULIC CONDUCTIVITY = .00000064 FT/MIN
K = .00000033 CM/SEC

LOG OF BORING NO. 22-87 BR

DATES DRILLED:
ELEVATION:
GEOLOGIST(S): UAA
DATE:
CHECKED BY:

USCS symbol

DATE: 8/3/87

PROJECT NO: 667-11.22

TOP/BOTTOM OF CORE IN BOX	TOP/BOTTOM OF CORE IN FOOT (PLACED)	SAMPLE NUMBER	FEET OF CORE (INCHES)	FEET OF CORE IN FOOT	FRACTURES PER FOOT	FRACTURE ANGLE	BEDDING ANGLE	GRAIN SIZE DISTRIBUTION	DEPTH IN FEET	LITHOLOGIC LOG	LITHOLOGIC DESCRIPTION
0.0 ↓	0.0 to 2.0		1.85(1)	GC				Grav. >50%	1, 2		Sandy, Clayey Gravel. Matrix color. Moderate yellowish brown (10yr 5/4). Gravel subangular to subrounded. Mod. well graded. Sand. Clay matrix. Low plasticity. Sand med. grained primarily. Becoming less gravelly toward bottom. Color darker + more mottled (Dark yellowish brown (10yr 4/2). Calcific.
	2.0 to 3.5		1.5(1)	GC					3		Same as above.
	3.5 to 4.0		0						4		No Sample
Box 1 of 7	4.0 to 6.0		1.75(1)	CL				Clay >50%	5, 6		Gravelly clay. Pale brown (5yr 5/2). Est. mod. high plasticity. Some sand. Trace calcite. Gravel subrounded small to very large. Max. size 7 cm. Some moderate yellow (5y 7/6) mottling toward bottom.
	6.0 to 7.4		1.6(1)	CL				Clay >50% "	7		Clay. Dark yellowish brown (10yr 4/2) to dark yellowish orange. Slightly silty. Trace gravel. Slightly calcitic. Est. plast. Mod. to high. Trace very ferrous material mineralized (about 1 in x .10 in plate
	7.4 to 8.0		.6(2)	CL				"	8		Same as above
↑ 9.0	8.0 to 9.0		.9(1)	CL					9		Same as above with some color change in areas to Grayish brown (5yr 3/2). These darker areas have traces of root material and organics very small.
9.0 ↓	9.0 to 10.2		1.6(1)	CL				Clay >50% Silt >10%			Silty Clay. Yellowish gray (5y 8/1) to Dk. yellowish orange 10yr 6/6. Traces of the darker grayish brown (5y 3/2) clay from above. Trace small rounded gravel. Slightly calcitic. Est. plast-Mod.

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(1) Badly broken core, accurate footage measurement not possible.
(2) Core breaks cannot be matched, accurate footage measurement not possible.

ROCKY FLATS PLANT

FIGURE NO.

LOG OF BORING NO. 22-87

DATES DRILLED:
ELEVATION:
GEOLOGIST(S): UAA
DATE:
CHECKED BY:

DATE: 5/3/89

PROJECT NO: 667-11.22

TOP/BOTTOM OF CORE IN BOX	TOP/BOTTOM OF CORE IN FOOT (FEET)	SAMPLE NUMBER	FEET OF CORE	USCS SYMBOL	FRACTURES PER FOOT	FRACTURE ANGLE	BEDDING ANGLE	GRAIN SIZE DISTRIBUTION	DEPTH IN FEET	LITHOLOGIC LOG	LITHOLOGIC DESCRIPTION
Box 2 of 7	10.2 to 11.8	~~1.8~~	1.8 (1)	CL				Clay >50%, Sand >10%	11		Same as above
	12.2		.3 (2)	CL					12		Same as above.
	12.2 to 13.2		~~.3~~ (2) 1.4	CL					13		Same as above. Some subrounded lg. gravel - max. 6.5cm.
	13.2 to 14.2		~~1.4~~ 1.1	CL					14		Same as above but without gravel
	14.2 to 15.0		~~1.1~~ .7	CL					15		Same as above, higher ~~more~~ silt content. larger areas of dark yellowish orange coloring.
16.2	15.0 to 16.2		1.6	CL					16		Same as above. Siltier at top of interval. Less silt toward bottom.
16.2 Box 3 of 7	16.2 to 17.6		1.75	CL				Clay >80%	17		Clay. Lt. brownish gray (5yr 4/1) Est. plasticity moderate. Slightly silty in some areas. Trace root material. Begin Box
	17.6 to 18.2		.75	CL					18		Clay. Same as above. Some dk. yellowish orange 10yr 6/6 mottling.
	18.2 to 19.0		1.0	CL					19		Clay. Same as above. Some calcareous nodules
	19.0 to 20.2		1.7	CL							Clay. Same as above some calcareous nodules. Claystone at very bottom of interval.

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ROCKY FLATS PLANT

FIGURE NO.

LOG OF BORING NO. 22-87

DATES DRILLED:
ELEVATION:
GEOLOGIST(S): UAA
DATE:
CHECKED BY:

USCS symbol

DATE: 8/3/89

PROJECT NO: 667-11.22

TOP/BOTTOM OF CORE IN BOX	TOP/BOTTOM OF CORE IN FOOT	SAMPLE NUMBER	FEET OF CORE	FEET OF CORE	FRACTURES PER FOOT	FRACTURE ANGLE	BEDDING ANGLE	GRAIN SIZE DISTRIBUTION	DEPTH IN FEET	LITHOLOGIC LOG	LITHOLOGIC DESCRIPTION
Box 3 of 7	20.2 to 22.0		1.8 ~~1.85~~ ~~1.4~~ UA					Clay >80% ↓	21		Claystone. Lt. olive gray (5y 6/1). Massive bedding. Highly weathered. Moderately friable. ~~Some~~ Silt. Some Dark yellowish orange (10yr 6/6) mottling.
	22.0							↓	22		Same as ~~able~~ UA above
	22.0 22.2		.4					↓			No Sample
	22.2 to 24.0		1.2					↓	23		Same as above some areas slightly siltier.
	24.0		1.6					Clay >80%	24		Claystone. Lt. olive gray (5y 6/1). Possible horizontal bedding. Highly weathered. Moderately friable. Silty in areas.
Box 4 of 7	25.5		1.6					Clay >80% ↓	25		Same as above
	26.5		1.55					↓	26		Same as above Some ironstaining Some fractures w/mineralization.
	27.5		1.45					↓	27		Same as above. More mottled.
	27.7		.4					↓			Same as above
	28.5		1.7						28		Same as above.
28.5 Box 5 of 7	29.5		1.65					Clay >70% Silt ≥10%	29		Silty claystone. Light olive gray (5y 5/2) to Dk yellowish orange. (10yr 6/6). Horizontal bedding. Highly to extremely weathered moderately to highly friable.
	29.5 to 30.5		1.5								Same as above

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ROCKY FLATS PLANT

FIGURE NO.

LOG OF BORING NO. 22-87 BR

DATES DRILLED:
ELEVATION:
GEOLOGIST(S): UAA
DATE:
CHECKED BY:
DATE: 8/3/89
PROJECT NO: 667-11.22

Box	Top Depth of Core in Box	Top Depth of Core in Hole	Sample Number	Percent Recovery	USCS Symbol	Percent Fracture	Fracture Angle	Core Angle	Clay Silt Sand Percentage	Depth in Feet	Graphic Log	LITHOLOGIC DESCRIPTION
Box 5 of 7		30.5		✓					Clay >50% >80% Silt >10%			Silty claystone. Same as above.
		30.9		.4						31		
		31.5		1.4								
		31.8		9.5					↓			
		32.5		.9 .85						32		Same as above appears less weathered possibly due to more massively bedded intervals. Some areas of very heavy iron staining.
		33.0		.85								
		33.5		.85					↓	33		
	34.0	34.0		1.0						34		Same as above, heavily weathered again. Some black carbonaceous material.
Box 6 of 7		34.5		.8					Clay >85% Silt >10%			Silty claystone. Yellowish gray (5Y 7/2) ~~Massive bedding~~. Highly weathered. Heated fractures. Iron stain. Some carbonaceous material.
		35.0		1.0						35		Same as above
		35.5		.9					↓			Same as above.
		35.8		.9						36		Same as above
		36.5		1.0					↓			Silty claystone, olive gray (5Y 4/1). Bedding not apparent. Weathered. Slightly friable. Trace sand.
		37.5		1.1						37		Silty claystone. Yellowish gray (5Y 7/2). Bedding not apparent. Highly weathered. Heated fractures. Some iron staining. Some carbonaceous material
		38.5		2.1					↓	38		
		39.5		1.75					Clay >80% Silt >10%	39		Silty claystone. Brownish gray (5YR 4/1) to grayish orange (10YR 7/4). Layered bedding. Probably horizontal. Highly weathered moderately friable. Common black carbonaceous material, usually between layers.
				1.75								

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ROCKY FLATS PLANT

FIGURE NO.

LOG OF BORING NO. 22-87 BR

DATES DRILLED:
ELEVATION:
GEOLOGIST(S): LAA
DATE:
CHECKED BY:

USCS symbol

DATE: 8/3/87

PROJECT NO: 667-11.22

TOP/BOTTOM OF CORE IN BOX	TOP/BOTTOM OF CORE IN FEET	SAMPLE NUMBER	FOOT OF CORE	FOOT OF RUN	FRACTURES PER FOOT	FRACTURE ANGLE	BEDDING ANGLE	GRAIN SIZE DISTRIBUTION	DEPTH IN FEET	LITHOLOGIC LOG	LITHOLOGIC DESCRIPTION
Box 7 of 7	40.5										
	41.5	1	1.6					Clay >80% Silt ≥10%	41		Silty Claystone. Brownish gray (5yr 4/1) to grayish orange (10yr 7/4). Layered Bedding probably horizontal. Highly weathered moderately friable. Common black carbonaceous material, usually between layers
	42.5		1.9					↓	42		Same as above
43.5	43.5		1.7 +9					↓	43		Same as above
									44		Bottom of Boxes
									45		
									46		
									47		
									48		
									49		

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ROCKY FLATS PLANT

FIGURE NO.

PAGE OF

LOG OF BORING NO. 22-87 BR

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PROJECT NO: 667-11.22

TOP/BOTTOM OF CORE IN BOX	TOP/BOTTOM OF CORE IN ROW (INTERVAL)	SAMPLE NUMBER	FEET OF CORE (INTERVAL)	~~FEET OF CORE IN ROW~~	FRACTURES PER FOOT	FRACTURE ANGLE	BEDDING ANGLE	GRAIN SIZE DISTRIBUTION	DEPTH IN FEET	LITHOLOGIC LOG	LITHOLOGIC DESCRIPTION
									41		
41.1	41.1 to 45.1		0.4 (1)					Clay 80% Silt 20%	42, 43, 44, 45		Claystone: Olive gray (5y4/1). Massive bedding. Begin Box ↓ Weathering moderate. Slightly friable. Some silt. Trace carbonaceous material. Some iron staining in horizontal and vertical fractures. Trace $CaCO_3$ (very weak HCL reaction.)
	45.1 to 49.45	SL	3.8 (1)					Silt 90% Clay 10%	46, 47, 48, 49		Siltstone. Yellowish gray to light olive gray. (5y8/4) to (5y6/1). Moderately weathered. Slightly friable. Massive bedding. Some iron staining. Some clay. Grades back into claystone (as 41.1 to 45.1 above) Slickensides present in fractures.
	49.45 ↓										

Box 4 of 10

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ROCKY FLATS PLANT

FIGURE NO.

LOG OF BORING NO. 22-87 BR

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DATES DRILLED:
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PROJECT NO: 667-11.22

TOP/BOTTOM OF CORE IN BOX	TOP/BOTTOM OF CORE IN FEET	SAMPLE NUMBER	FEET OF CORE RECOVERED	RQD	FRACTURES PER FOOT	FRACTURE ANGLE	BEDDING ANGLE	GRAIN SIZE DISTRIBUTION	DEPTH IN FEET	LITHOLOGIC LOG	LITHOLOGIC DESCRIPTION
Box 4 of 10	49.45 to 52.5	SL	2.5 UA; 2.2 (1)			90° + 40° from Vert.			51, 52		Claystone. Light brownish gray to brownish gray (5yr 6/1 to 5yr 4/1). Massive bedding. Slightly friable. Some silt. Trace carbonaceous material. Some slickensides visible in fractures. Trace iron staining.
	52.5 to 54.5	SL	1.9 (2)						53, 54		Same as above.
54.5 ↓ Box 5 of 10	54.5 to 56.5	SL.	1.9					Clay 80% Silt 20%	55, 56		Claystone. Light Olive gray (5y 6/1). Massive bedding. Weathered, slightly friable. Some silt. Some carbonaceous material. Some iron staining. Begin 5
	56.5 to 60.5		3.7 (2)			20° from Vert.			57, 58, 59		Same as above. Slightly more friable. Some slickensides visible in fractures. Grades to darker (Olive gray 5y 4/1) to Olive black (5y 2/1) Claystone. More weathered. Moderately friable. Weathered in platey layers. Some carbonaceous material. ~~Some~~ Trace very fine grained sand. Becoming more carbonaceous. Trace coal.

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ROCKY FLATS PLANT

FIGURE NO.

LOG OF BORING NO. 22-87 BR

PAGE OF

DATES DRILLED:
ELEVATION:
GEOLOGIST(S): AA
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USCS symbol

DATE: 7/28/89

PROJECT NO: 667-11.22

TOP/BOTTOM OF CORE IN BOX	TOP/BOTTOM OF CORE IN ROW (IN FEET)	SAMPLE NUMBER	FEET OF CORE (INCHES)	FEET OF CORE IN RUN	FRACTURES PER FOOT	FRACTURE ANGLE	BEDDING ANGLE	GRAIN SIZE DISTRIBUTION	DEPTH IN FEET	LITHOLOGIC LOG	LITHOLOGIC DESCRIPTION
Box 5 of 10 ↑ 64.5	↑ 60.5 / 60.5 to 64.5		3.6 (2)						61, 62, 63, 64		Claystone. Olive gray to olive black (5y 4/1) to (5y 2/1). Massive bedding. Highly weathered. Moderately friable. Weathered in thin platey layers 1-2 mm. Some areas of abundant carbonaceous material. Silty in upper 1 ft. of interval. Trace iron staining.
64.5 ↓ Box 6 of 10	64.5 to 68.5	SL	3.1 (2)			10° off vert.			65, 66, 67, 68		Claystone. Olive gray (5y 4/1). Massive bedding. Moderately weathered. Slightly friable. As above in to 1 in. of interval ~~less~~ Some carbonaceous material. Not as abundant as above. Trace ~~some~~ iron staining. Begin 6. Becomes very hard, non-friable at bottom of interval. Very ~~stained~~ stained on outside of core. Healed fracture (carbon)
	68.5 to 70.5		2.35 (2)			60° off vert.			69		Claystone. Olive gray (5y 4/1) massive bedding. Mod weathering. Slightly friable. Abundant carbonaceous material. Slickensides present in fracture

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ROCKY FLATS PLANT

FIGURE NO.

LOG OF BORING NO. 22-87 BR

PAGE OF

DATES DRILLED:
ELEVATION:
GEOLOGIST(S): UAA
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USCS symbol

DATE: 7/28/89

PROJECT NO: 667-11.22

TOP/BOTTOM OF CORE IN BOX	TOP/BOTTOM OF CORE IN RUN (in feet)	SAMPLE NUMBER	FEET OF CORE IN BOX	FEET OF CORE IN RUN	FRACTURES PER FOOT	FRACTURE ANGLE	BEDDING ANGLE	GRAIN SIZE DISTRIBUTION	DEPTH IN FEET	LITHOLOGIC LOG	LITHOLOGIC DESCRIPTION
Box 6 of 10	70.5 to 72.5		1.85 (1) UA ~~2.35~~						71, 72		Claystone. As above interval. Vertical fracture w/slickensides
	72.5 to 74.5		1.85 (1)						73, 74		As above
74.5 ↓ Box 7 of 10	74.5 to 76.5		1.7 (2)			25° from vert.			75, 76		Claystone. Light olive gray to olive gray (5y 4/1-2/1) Massive bedding. Moderate weathering. Slightly friable. Some carbonaceous material. Some slickensides in fractures. Begin 7 ↓
	76.5 to 78.5		3.7 (1)						77, 78		Same as above except highly weathered. Friable. Olive gray to olive black (5y 2/1) to (5y 4/1). No slick's. visible
	78.5 to 80.5		1.85 (1)						79		Same as above. Slightly less weathered. Less friable. More carbonaceous material.

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ROCKY FLATS PLANT

FIGURE NO.

LOG OF BORING NO. 22-87 BR

PAGE OF

DATES DRILLED:
ELEVATION:
GEOLOGIST(S): LAA
DATE:
CHECKED BY:

USCS symbol

DATE: 7/28/89

PROJECT NO: 667-11.22

TOP/BOTTOM OF CORE IN BOX	TOP/BOTTOM OF CORE IN ROW (interval)	SAMPLE NUMBER	FEET OF CORE IN BOX (interval)	FEET OF CORE IN ROW	FRACTURES PER FOOT	FRACTURE ANGLE	BEDDING ANGLE	GRAIN SIZE DISTRIBUTION	DEPTH IN FEET	LITHOLOGIC LOG	LITHOLOGIC DESCRIPTION
Box 7 of 10	80.5							Silt 20% Clay 30%	81		Silty claystone Brownish gray to olive gray (5y 4/1 to 5y 4/1). Moderately weathered Slightly friable. Abundant carbonaceous material.
	80.5 to 81.5	SL	.85								
	81.5 to 82.5	SL	.90					Silt 40% Clay 60%	82		
82.5	82.5	SL	1.8(1)				20°		83		Silty claystone. Same as above but with less carbonaceous material. Grades to Siltstone. Light olive gray. (5y 6/1). Weathered Slightly friable. Very thin parallel bedding. Grades to very fine sandstone Color - some weathered. ~~Slo~~ Moderately Friable well sorted. With thin layers of claystone (1 in. thick.)
	84.5								84		
Box 8 of 10	84.5		2.0(2)				20°		85		Top .7 ft. Interbedded Siltstones, claystones + very fine grained sandstones. Light olive gray (5y 6/1) to Olive gray. (5y 4/1). S.S. + Siltstn. layers ≈ 1 in thick. Claystn. .5 in. thick. Possible bad casts in clay layers. SS layers, well sorted weathered. Moderately Friable Lower portion: Fine grained silty sandstones as above
	86.5								86		1st. ≈ .5 ft. Sandstone. light olive gray. Moderately weathered. Slightly to non friable. Fine to med. grained well sorted. Calcareous cement ~~Grades through~~ rest of interval interbedded to claystone siltstone + sandstone Horizontal bedding. Sharp contacts. Some possible cross bedding.
	86.5 to 88.6	SL	1.8(2)						87		
									88		
	88.6 to 90.5		.6(2)						89		Claystone. Olive gray (5y 4/1). Slightly weathered Slightly friable. Trace iron staining.

Begin 8 ↓

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ROCKY FLATS PLANT

FIGURE NO.

LOG OF BORING NO. 22-87 BR

PAGE OF

DATES DRILLED:
ELEVATION:
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DATE: 7/28/89

PROJECT NO: 667-11.22

TOP/BOTTOM OF CORE IN BOX	TOP/BOTTOM OF CORE IN ROW (interval)	SAMPLE NUMBER	FEET OF CORE (INCHES)	FEET OF CORE IN ROW	FRACTURES PER FOOT	FRACTURE ANGLE	BEDDING ANGLE	GRAIN SIZE DISTRIBUTION	DEPTH IN FEET	LITHOLOGIC LOG	LITHOLOGIC DESCRIPTION
Box 8 of 10	90.5										
	90.5 to 93.3		2.75 (2)						91, 92, 93		Claystone. Olive gray (5y 4/1) Slightly weathered to weathered in places. Bedding angle changed abrubtly to ≈ 50° off horizontal. At very btm of interval sharp contact with med grnd. ss. (contact at 53°). Some possible load casts in Claystone. Very thin (1-2 mm) Coal seam visible
93.3 ↓	93.3 to 94.5		.9 (1)						94		Claystone. brownish gray (5yr 4/1). Massive bedding over interval. Slightly weathered slightly friable. Begin ↓
Box 9 of 10	95.0		0						95		No Sample
	95.0 to 99.0		4.3 (1) ~~.9 (1)~~ UA						96, 97, 98, 99		Same as above interbedded lenticularly with med. grained silty sandstone. Same color. Horizontal thin layers from 1-2 mm to 8 cm thick. Also some siltstone layers.
	99.0 ↓ to 101.0		1.8 (1)								Same as above.

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ROCKY FLATS PLANT

FIGURE NO.

LOG OF BORING NO. 22-87 BR

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DATES DRILLED:
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USCS SYMBOL

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TOP/BOTTOM OF CORE IN BOX	TOP/BOTTOM OF CORE IN ROW (IN FEET/ft)	SAMPLE NUMBER	FEET OF CORE (INCHES)	FEET OF CORE IN ROW	FRACTURES PER FOOT	FRACTURE ANGLE	BEDDING ANGLE	GRAIN SIZE DISTRIBUTION	DEPTH IN FEET	LITHOLOGIC LOG	LITHOLOGIC DESCRIPTION
Box 9 of 10	101.0								101		
	101.0 to 102.0		1.8(1)						102		No Sample
	102.0 to 104.0	SL	1.8(1)			50°			103, 104		Claystone: Brownish gray (5y 4/1). Massive bedding. Moderately weathered. Slightly friable. Abundant black carbonaceous material. Silty. Some fractures
104.0 ↓ Box 10 of 10	104.0 to 107.0		3.5(1)						105, 106, 107		Claystone. Light olive gray (5y 6/1). Massive bedding. Highly weathered. Slightly to moderately friable. Some carbonaceous material. Begin Box ↓
	107.0 to 111.0		2.3(1)						108, 109		Same as above. More weathered. Highly friable.

NOTES: General: The USCS is modified for this log as follows: Material amounts are estimated by percent volume instead of percent weight.
(1) Badly broken core, accurate footage measurement not possible.
(2) Core breaks cannot be matched, accurate footage measurement not possible.

ROCKY FLATS PLANT

FIGURE NO.

PAGE OF

LOG OF BORING NO. 22-87 BR

DATES DRILLED:
ELEVATION:
GEOLOGIST(S): LAH
DATE:
CHECKED BY:

USCS symbol

DATE: 7/28/89

PROJECT NO: 667-11.22

TOP/BOTTOM OF CORE IN BOX	TOP/BOTTOM OF CORE IN ROW (INTERVAL)	SAMPLE NUMBER	FEET OF CORE IN BOX (INTERVAL)	FEET OF CORE IN RUN	FRACTURES PER FOOT	FRACTURE ANGLE	BEDDING ANGLE	GRAIN SIZE DISTRIBUTION	DEPTH IN FEET	LITHOLOGIC LOG	LITHOLOGIC DESCRIPTION
↑ 111.0	↑ 111.0			CL					111		See previous page
									112		Bottom of Boxes
									113		

NOTES: General: The USCS is modified for this log as follows: Material amounts are estimated by percent volume instead of percent weight.
(1) Badly broken core, accurate footage measurement not possible.
(2) Core breaks cannot be matched, accurate footage measurement not possible.

ROCKY FLATS PLANT

FIGURE NO.

STATE PLANE COORDINATE:	TOTAL DEPTH (FT): 111	GROUND ELEVATION (FT):	5930.7	PROJECT NUMBER:	667.11	LOG OF BORING NUMBER:
NORTH: 749924	AREA: MOUND AREA	CASING DIAMETER (IN):	2 ID	GEOLOGIST:	LAA	22-87BR
EAST: 2095822	LOCATOR NUMBER: M9	BOREHOLE DIAMETER (IN):	4	DATE DRILLED:	10/08/87	

REMARKS: Hollow Stem Auger, Rotary Core. Surface casing set to 43.59' by K.D. Holliway on October 2, 1987.

CHEMICAL SAMPLE DEPTH / GRADATIONAL SAMPLE DEPTH	SAMPLE NUMBER	SAMPLE GRADI SIZE	PERCENT RECOVERY	RECOVERY/ INTERVAL	DATUM (FT)	DEPTH (FT)	WELL OR PIEZOMETER CONSTRUCTION	LITHOLOGY	UNIFIED SOILS CLASSIFICATION OR ROCK TYPE	DESCRIPTION
		GR / SAN	LOSS GR / LOSS	1.85/2	5930	0			GC:	Sandy Clayey Gravel - matrix color, moderate yellowish brown (10YR 5/4). Gravel sub-angular to sub-rounded, mod. well graded, max. size 3.5 cm. Sandy clay matrix, low plasticity. Sand med. grained primarily, becoming less gravelly toward bottom. Color darker and more mottled, (dark yellowish brown (10YR 4/2)), calcitic.
				1.5/1.5	5929	1			GC:	Same as above.
				0/0.5	5928	2			NO SAMPLE:	
				1.75/2	5927	3			CH:	Gravelly Clay - pale brown (5YR 5/2), est. mod. high plasticity, some sand, trace calcite, gravel sub-rounded, small to very large, max. size 7 cm., some moderate yellow (5Y 7/6) mottling toward bottom.
				1.6/1.4	5926	4			CH:	Clay - dark yellowish brown (10YR 4/2) to dark yellowish orange. Slightly silty, trace gravel, slightly calcitic, est. plast. mod. - high, trace very ferrous material mineralized (about 1 in. x 10 in. plate).
				0.6/0.6	5925	5			CH:	Same as above.
				0.9/1	5924	6			CH:	Same as above with some color change in areas to grayish brown (5YR 3/2). These darker areas have traces of root material and organics, very small.
				1.6/1.2	5923	7			CL:	SILTY CLAY - yellowish gray (5Y 8/1) to dk yellowish orange (10YR 6/6). Trace of the darker grayish brown (5YR 3/2) clay from above. Trace small rounded gravel, slightly calcitic, est. plast. mod.

STATE PLANE COORDINATE:	TOTAL DEPTH (FT): 111	GROUND ELEVATION (FT):	5930.7	PROJECT NUMBER:	667.11	LOG OF BORING NUMBER:	
NORTH: 749924	AREA: MOUND AREA	CASING DIAMETER (IN):	2 ID	GEOLOGIST:	LAA		22-87BR
EAST: 2085822	LOCATOR NUMBER: M9	BOREHOLE DIAMETER (IN):	4	DATE DRILLED:	10/08/87		

REMARKS: Hollow Stem Auger, Rotary Core. Surface casing set to 43.59' by K.D. Holliway on October 2, 1987.

CHEMICAL SAMPLE DEPTH / GRADATIONAL SAMPLE DEPTH	SAMPLE NUMBER	SAMPLE GRAIN SIZE	PERCENT RECOVERY	RECOVERY/ INTERVAL	DATUM (FT)	DEPTH (FT)	WELL OR PIEZOMETER CONSTRUCTION	LITHOLOGY	UNIFIED SOILS CLASSIFICATION OR ROCK TYPE	DESCRIPTION
				1.8/1.6	5920	10			CL:	Same as above.
				0.3/0.4	5919	11	10/08/87 ▽		CL:	Same as above.
				1.4/1	5918	12			CL:	Same as above, some sub-rounded lg. gravel - max. 6.5 cm.
				1.1/1	5917	13			CLAYSTONE:	Top of Bedrock Same as above, but without gravel.
				0.7/0.8	5916	14			CLAYSTONE:	Same as above, but without gravel.
				1.6/1.2	5915	15			CLAYSTONE:	Same as above, higher silt content, larger areas of dark yellowish orange coloring.
				1.75/1.4	5914	16			CLAYSTONE:	Same as above, siltier at top of interval, less silt toward bottom.
				0.75/0.6	5913	17			CLAYSTONE:	Lt. brownish gray (5YR 4/1), est. plasticity moderate, slightly silty in some areas, trace root material.
				1/0.79	5912	18			CLAYSTONE:	Same as above, some dk. yellowish orange (10YR 6/6) mottling.
				1.7/1.2	5911	19			CLAYSTONE:	Same as above, some calcareous nodules.
									CLAYSTONE:	Same as above, some calcareous nodules. Claystone at very bottom of interval.

STATE PLANE COORDINATE:	TOTAL DEPTH (FT): 111	GROUND ELEVATION (FT): 5930.7	PROJECT NUMBER: 667.11	LOG OF BORING NUMBER:
NORTH: 749924	AREA: MOUND AREA	CASING DIAMETER (IN): 2 ID	GEOLOGIST: LAA	22-87BR
EAST: 2085822	LOCATOR NUMBER: M9	BOREHOLE DIAMETER (IN): 4	DATE DRILLED: 10/08/87	

REMARKS: Hollow Stem Auger, Rotary Core. Surface casing set to 43.59' by K.D. Holliway on October 2, 1987.

CHEMICAL SAMPLE DEPTH / GRADATIONAL SAMPLE DEPTH	SAMPLE NUMBER	SAMPLE GRAIN SIZE	PERCENT RECOVERY	RECOVERY/INTERVAL	DATUM (FT)	DEPTH (FT)	WELL OR PIEZOMETER CONSTRUCTION	LITHOLOGY	UNIFIED SOILS CLASSIFICATION OR ROCK TYPE	DESCRIPTION
				1.8/1.8	5910	20–21			CLAYSTONE:	Lt. olive gray (5Y 6/1), massive bedding, highly weathered, moderately friable, some silt, some dark yellowish orange (10YR 6/6) mottling.
				0.1/0.2	5909	22			CLAYSTONE:	Same as above.
				0/0.29					NO SAMPLE:	
				1.2/1	5908	23			CLAYSTONE:	Same as above, some areas slightly siltier.
				1.6/1	5907	24			CLAYSTONE:	Lt. olive gray (5Y 6/1), possible horizontal bedding, highly weathered, moderately friable, silty in areas.
				1.6/1	5906	25			CLAYSTONE:	Same as above.
				1.55/1	5905	26			CLAYSTONE:	Same as above, some iron staining, some fractures with mineralization.
				1.65/1	5904	27			CLAYSTONE:	Same as above, more mottled.
				0.1/0.2	5903				CLAYSTONE:	Same as above.
				1.7/0.79		28			CLAYSTONE:	Same as above.
				1.55/1	5902	29			SILTY CLAYSTONE:	Light olive gray (5Y 5/2) to dk. yellowish orange (10YR 6/6), horizontal bedding, highly to extremely weathered, moderately to highly friable.
					5901				SILTY CLAYSTONE:	Same as above.

STATE PLANE COORDINATE:
NORTH: 749924
EAST: 2085822

TOTAL DEPTH (FT): 111
AREA: MOUND AREA
LOCATOR NUMBER: M9

GROUND ELEVATION (FT): 5930.7
CASING DIAMETER (IN): 2 ID
BOREHOLE DIAMETER (IN): 4

PROJECT NUMBER: 667.11
GEOLOGIST: LAA
DATE DRILLED: 10/08/87

LOG OF BORING NUMBER: 22-87BR

REMARKS: Hollow Stem Auger, Rotary Core. Surface casing set to 43.59' by K.D. Holliway on October 2, 1987.

CHEMICAL SAMPLE DEPTH
GRADATIONAL SAMPLE
SAMPLE NUMBER
SAMPLE GRADIN SIZE
PERCENT RECOVERY
RECOVERY/INTERVAL
DATUM (FT)
DEPTH (FT)
WELL OR PIEZOMETER CONSTRUCTION
LITHOLOGY
UNIFIED SOILS CLASSIFICATION OR ROCK TYPE
DESCRIPTION

0% 50% 100% 0% 100%

RECOVERY/INTERVAL	DATUM (FT)	DEPTH (FT)	DESCRIPTION
1.5/1		30	
0.1/0.1	5900		SILTY CLAYSTONE: Same as above.
1.1/0.6		31	SILTY CLAYSTONE: Same as above.
0.5/0.29	5899		SILTY CLAYSTONE: Same as above.
0.9/0.7		32	SILTY CLAYSTONE: Same as above, appears less weathered, possibly due to more massively bedded interval. Some areas of very heavy iron staining.
0.65/0.5	5898		SILTY CLAYSTONE: Same as above.
0.65/0.5		33	SILTY CLAYSTONE: Same as above.
1/0.5	5897		SILTY CLAYSTONE: Same as above, heavily weathered, some black carbonaceous material.
0.8/0.5		34	SILTY CLAYSTONE: Yellowish gray (5Y 7/2), highly weathered, healed fractures (with iron staining) some carbonaceous material.
1/0.5	5896		SILTY CLAYSTONE: Same as above.
0.9/0.5		35	SILTY CLAYSTONE: Same as above.
0.9/0.29	5895		SILTY CLAYSTONE: Same as above.
1/0.7		36	SILTY CLAYSTONE: Same as above.
1.1/1	5894	37	SILTY CLAYSTONE: Olive gray (5Y 4/1), bedding not apparent, mod. weathered, slightly friable, trace sand.
2.1/1	5893	38	SILTY CLAYSTONE: Yellowish gray (5Y 7/2), bedding not apparent, highly weathered, healed fractures, some iron staining, some carbonaceous material.
1.75/1	5892	39	SILTY CLAYSTONE: Brownish gray (5YR 4/1) to grayish orange (10YR 7/4), layered bedding, probably horizontal, highly weathered, moderately friable, common black carbonaceous material, usually between layers.
	5891		SILTY CLAYSTONE: Same as above.

STATE PLANE COORDINATE:	TOTAL DEPTH (FT): 111	GROUND ELEVATION (FT): 5930.7	PROJECT NUMBER: 667.11	LOG OF BORING NUMBER:
NORTH: 749924	AREA: MOUND AREA	CASING DIAMETER (IN): 2 ID	GEOLOGIST: LAA	22-87BR
EAST: 2085822	LOCATOR NUMBER: M9	BOREHOLE DIAMETER (IN): 4	DATE DRILLED: 10/08/87	

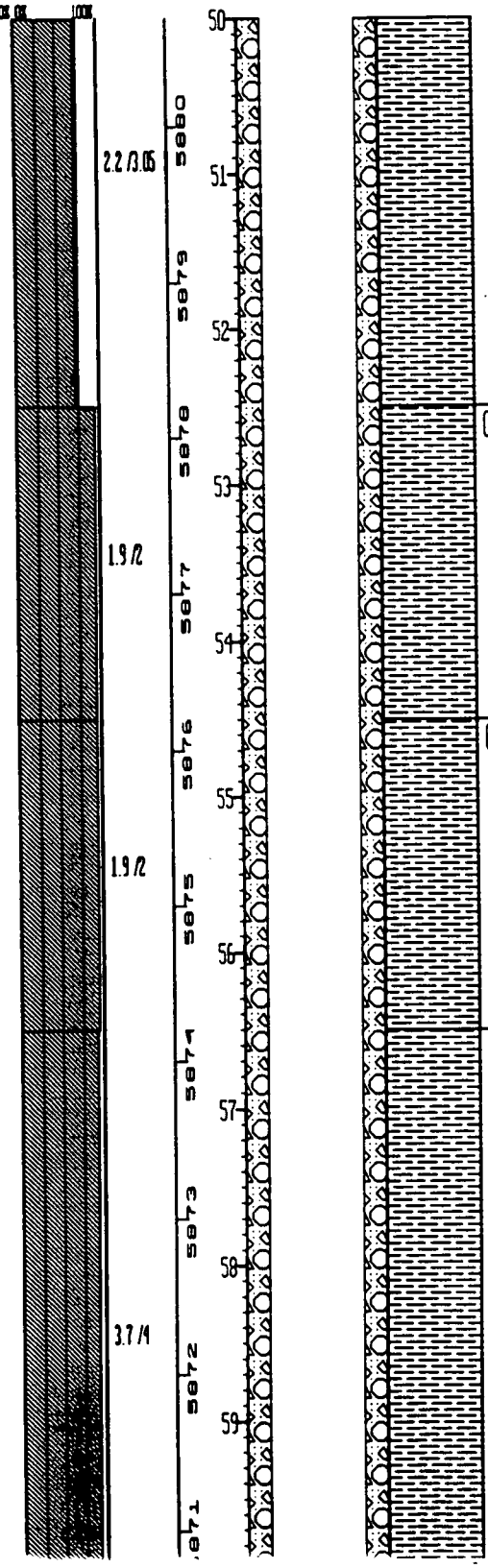
REMARKS: Hollow Stem Auger, Rotary Core. Surface casing set to 43.59' by K.D. Holliway on October 2, 1987.

CHEMICAL SAMPLE DEPTH / GRADATIONAL SAMPLE DEPTH	SAMPLE NUMBER	SAMPLE GRAIN SIZE (0% 50% 100%)	PERCENT RECOVERY (0% 100%)	RECOVERY/INTERVAL	DATUM (FT)	DEPTH (FT)	WELL OR PIEZOMETER CONSTRUCTION	LITHOLOGY	UNIFIED SOILS CLASSIFICATION OR ROCK TYPE	DESCRIPTION
				1.75/1		40				
				1.6/1	5890	41			SILTY CLAYSTONE:	Same as above.
				1.9/1	5889	42			SILTY CLAYSTONE:	Same as above.
				1.7/1	5888	43			SILTY CLAYSTONE:	Same as above.
				0.4/1.6	5887	44			CLAYSTONE:	Olive gray (5Y 4/1), massive bedding, weathering moderate, slightly friable, some silt, trace of carbonaceous material, some iron staining in horizontal and vertical fractures, trace $CaCO_3$ (very weak HCl reaction).
					5886	45				
				3.8/4.35	5885	46			SILTSTONE:	Yellowish gray to light olive gray (5Y 8/1) to 5Y 6/1). Moderately weathered, slightly friable, massive bedding, some iron staining, some clay.
	00822				5884	47				
					5883	48			CLAYSTONE:	Grades back into claystone (as 41.1 to 45.1 above), slickenslides present in fractures.
					5882	49	11/12/87			
					81				CLAYSTONE:	Light brownish gray to brownish gray (5YR 6/1 to 5YR 4/1), massive

STATE PLANE COORDINATE:		TOTAL DEPTH (FT): 111	GROUND ELEVATION (FT):	5930.7	PROJECT NUMBER:	667.11	LOG OF BORING NUMBER:
NORTH:	749924	AREA: MOUND AREA	CASING DIAMETER (IN):	2 ID	GEOLOGIST:	LAA	22-87BR
EAST:	2085822	LOCATOR NUMBER: M9	BOREHOLE DIAMETER (IN):	4	DATE DRILLED:	10/08/87	

REMARKS: Hollow Stem Auger, Rotary Core. Surface casing set to 43.59' by K.D. Holliway on October 2, 1987.

CHEMICAL SAMPLE DEP
GRADATIONAL SAMPLE
SAMPLE NUMBER
SAMPLE GRAIN SIZE 0% 50% 100%
PERCENT RECOVERY 0% 100%
RECOVERY/INTERVAL
DATUM (FT)
DEPTH (FT)
WELL OR PIEZOMETER CONSTRUCTION
LITHOLOGY
UNIFIED SOILS CLASSIFICATION OR ROCK TYPE
DESCRIPTION



slickensides visible in fractures, trace iron staining.

CLAYSTONE: Same as above.

CLAYSTONE: Light olive gray (5Y 6/1), massive bedding, weathered, slightly friable, some silt, some carbonaceous material, some iron staining.

CLAYSTONE: Same as above, slightly more friable, some slickenslides visible in fractures. Grades to darker olive gray (5Y 4/1) to olive black (5Y 2/1) claystone more weathered, moderately friable, weathered in platey layers, some carbonaceous material, trace very fine grained sand. Becoming more carbonaceous, trace coal.

STATE PLANE COORDINATE:	TOTAL DEPTH (FT): 111	GROUND ELEVATION (FT): 5930.7	PROJECT NUMBER: 667.11	LOG OF BORING NUMBER:
NORTH: 749924	AREA: MOUND AREA	CASING DIAMETER (IN): 2 ID	GEOLOGIST: LAA	22-87BR
EAST: 2085822	LOCATOR NUMBER: M9	BOREHOLE DIAMETER (IN): 4	DATE DRILLED: 10/08/87	

REMARKS: Hollow Stem Auger, Rotary Core. Surface casing set to 43.59' by K.D. Holliway on October 2, 1987.

CHEMICAL SAMPLE DEPTH / GRADATIONAL SAMPLE DEPTH	SAMPLE NUMBER	SAMPLE GRAIN SIZE	PERCENT RECOVERY	RECOVERY/INTERVAL	DATUM (FT)	DEPTH (FT)	WELL OR PIEZOMETER CONSTRUCTION	LITHOLOGY	UNIFIED SOILS CLASSIFICATION OR ROCK TYPE	DESCRIPTION
						60				
					5870	61			CLAYSTONE:	Olive gray to olive black (5Y 4/1) to (5Y 2/1), massive bedding, highly weathered, moderately friable, weathered in thin platey layers 1-2 mm. Some areas of abundant carbonaceous material, silty in upper 1 ft. of interval, trace iron staining.
					5869	62				
				3.6/4	5868	63				
					5867	64				
					5866	65			CLAYSTONE:	Olive gray (5Y 4/1), massive bedding, moderately weathered, slightly friable. As above in top 1 in. of interval, some carbonaceous material, not as abundant as above, trace of iron staining. Becomes very hard, non-friable at bottom of interval, very stained on outside of core, healed fracture (carbon).
					5865	66				
				3.1/4	5864	67				
					5863	68				
					5862	69			CLAYSTONE:	Olive gray (5Y 4/1), massive bedding, mod. weathering, slightly fri[illegible] abundant carbonaceous material, slickensides present in fractures.
				2.3/2	5861					

STATE PLANE COORDINATE:	TOTAL DEPTH (FT): 111	GROUND ELEVATION (FT): 5930.7	PROJECT NUMBER: 667.11	LOG OF BORING NUMBER:
NORTH: 749924	AREA: MOUND AREA	CASING DIAMETER (IN): 2 ID	GEOLOGIST: LAA	22-87BR
EAST: 2085822	LOCATOR NUMBER: M9	BOREHOLE DIAMETER (IN): 4	DATE DRILLED: 10/08/87	

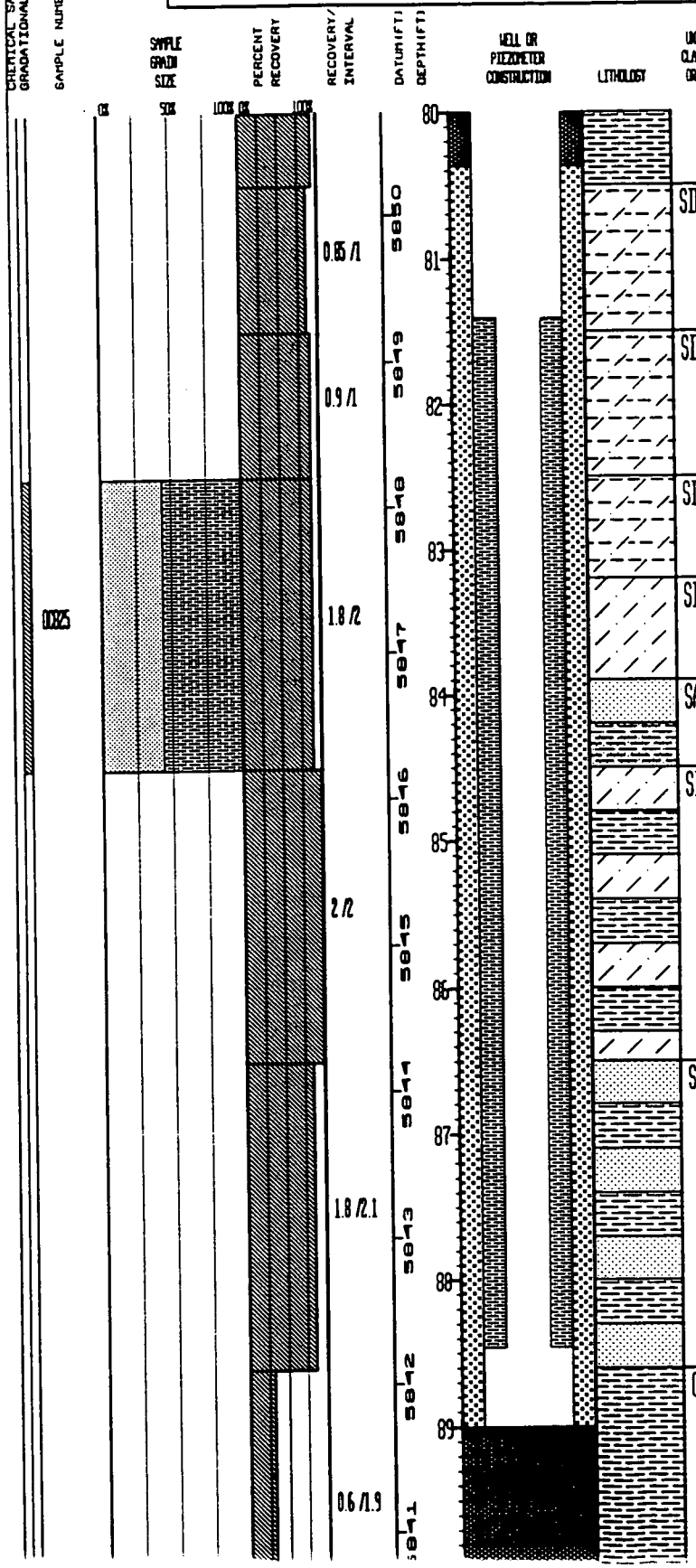
REMARKS: Hollow Stem Auger, Rotary Core. Surface casing set to 43.59' by K.D. Holliway on October 2, 1987.

CHEMICAL SAMPLE DEPTH / GRADATIONAL SAMPLE	SAMPLE NUMBER	SAMPLE GRADE SIZE	PERCENT RECOVERY	RECOVERY/INTERVAL	DATUM (FT)	DEPTH (FT)	WELL OR PIEZOMETER CONSTRUCTION	LITHOLOGY	UNIFIED SOILS CLASSIFICATION OR ROCK TYPE	DESCRIPTION
				1.85 ft	5860	70, 71			CLAYSTONE:	As above interval, vertical fracture with slickensides.
				1.85 ft	5859	72			CLAYSTONE:	As above.
				1.85 ft	5858	73				
				1.7 ft	5857	74			CLAYSTONE:	Light olive gray to olive gray (5Y 4/1 - 2/1), massive bedding, moderate weathering, slightly friable, some carbonaceous material, some slickensides in fractures.
				3.7 ft	5856	75				
					5855	76			CLAYSTONE:	Same as above, except highly weathered, friable. Olive gray to olive black (5Y 2/1) to (5Y 4/1).
					5854	77				
					5853	78	12/01/87 ▽			
				1.85 ft	5852	79			CLAYSTONE:	Same as above, slightly less weathered, less friable, more carbonaceous material.
					5851					

STATE PLANE COORDINATE:	TOTAL DEPTH (FT): 111	GROUND ELEVATION (FT):	5930.7	PROJECT NUMBER:	667.11
NORTH: 749924	AREA: MOUND AREA	CASING DIAMETER (IN):	2 ID	GEOLOGIST:	LAA
EAST: 2085822	LOCATOR NUMBER: M9	BOREHOLE DIAMETER (IN):	4	DATE DRILLED:	10/08/87

LOG OF BORING NUMBER: 22-87B

REMARKS: Hollow Stem Auger, Rotary Core. Surface casing set to 43.59' by K.D. Holliway on October 2, 1987.

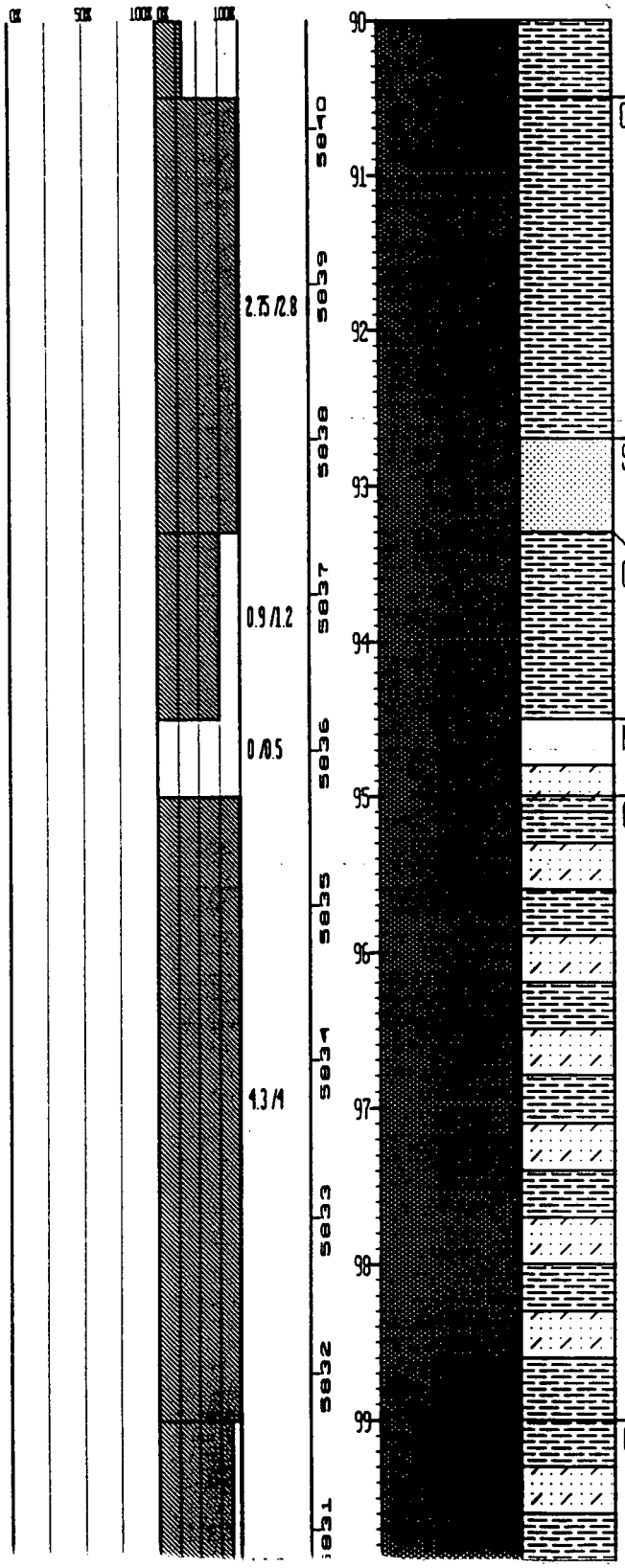


UNIFIED SOILS CLASSIFICATION OR ROCK TYPE	DESCRIPTION
SILTY CLAYSTONE:	Brownish gray to olive gray (5YR 4/1 to 5Y 4/1), moderately weathered, slightly friable, abundant carbonaceous material.
SILTY CLAYSTONE:	As above.
SILTY CLAYSTONE:	Same as above but with less carbonaceous material.
SILTSTONE:	Grades to siltstone, light olive gray (5Y 6/1), weathered, slightly friable, very thin parallel bedding.
SANDSTONE:	Grades to very fine sandstone color - some weathered, moderately friable, well sorted, with thin layers of claystone (1in. thick.)
SILTSTONE:	Top 0.7 ft. interbedded siltstones, claystones and very fine grained sandstones. Light olive gray (5Y 6/1) to olive gray (5Y 4/1). S.S. and siltstn. layers approx. 1 in. thick. Claystn. 0.5 in. thick, possible load casts in clay layers. S.S. layers well sorted, weathered, moderately friable.
SANDSTONE:	Fine grained silty sandstones as above, first .5 ft. sandstone, light olive gray, moderately weathered, slightly to nonfriable, fine to med. grained, well sorted, calcareous cement. Rest of interval interbedded claystone, siltstone and sandstone, horizontal bedding, sharp contacts, some possible cross bedding.
CLAYSTONE:	Olive gray (5Y 4/1), slightly weathered, slightly friable, trace iron staining.

STATE PLANE COORDINATE:		TOTAL DEPTH (FT): 111	GROUND ELEVATION (FT):	5930.7	PROJECT NUMBER:	667.11	LOG OF BORING NUMBER:
NORTH:	749924	AREA: MOUND AREA	CASING DIAMETER (IN):	2 ID	GEOLOGIST:	LAA	22-87BR
EAST:	2085822	LOCATOR NUMBER: M9	BOREHOLE DIAMETER (IN):	4	DATE DRILLED:	10/08/87	

REMARKS: Hollow Stem Auger, Rotary Core. Surface casing set to 43.59' by K.D. Holliway on October 2, 1987.

CHEMICAL SAMPLE DEPTH
GRADATIONAL SAMPLE
SAMPLE NUMBER
SAMPLE GRAIN SIZE
PERCENT RECOVERY
RECOVERY/INTERVAL
DATUM (FT)
DEPTH (FT)
WELL OR PIEZOMETER CONSTRUCTION
LITHOLOGY
UNIFIED SOILS CLASSIFICATION OR ROCK TYPE
DESCRIPTION



UNIFIED SOILS CLASSIFICATION OR ROCK TYPE	DESCRIPTION
CLAYSTONE:	Olive gray (5Y 4/1) slightly weathered to weathered in places, bedding angle changed abrubtly to approx. 50 degrees off horizontal.
SANDSTONE:	Sharp contact with med. grained SS (contact at 53 degrees). Some possible load casts in claystone, very thin (1-2 mm.) coal seam visible.
CLAYSTONE:	Brownish gray (5YR 4/1), massive bedding over interval, slightly weathered, slightly friable.
NO SAMPLE:	
CLAYSTONE:	Same as above, interbedded lenticularly with med. grained silty sandstone, same color, horizontal thin layers from 1-2 mm. to 8 cm. thick, also some siltstone layers.
CLAYSTONE:	Same as above.

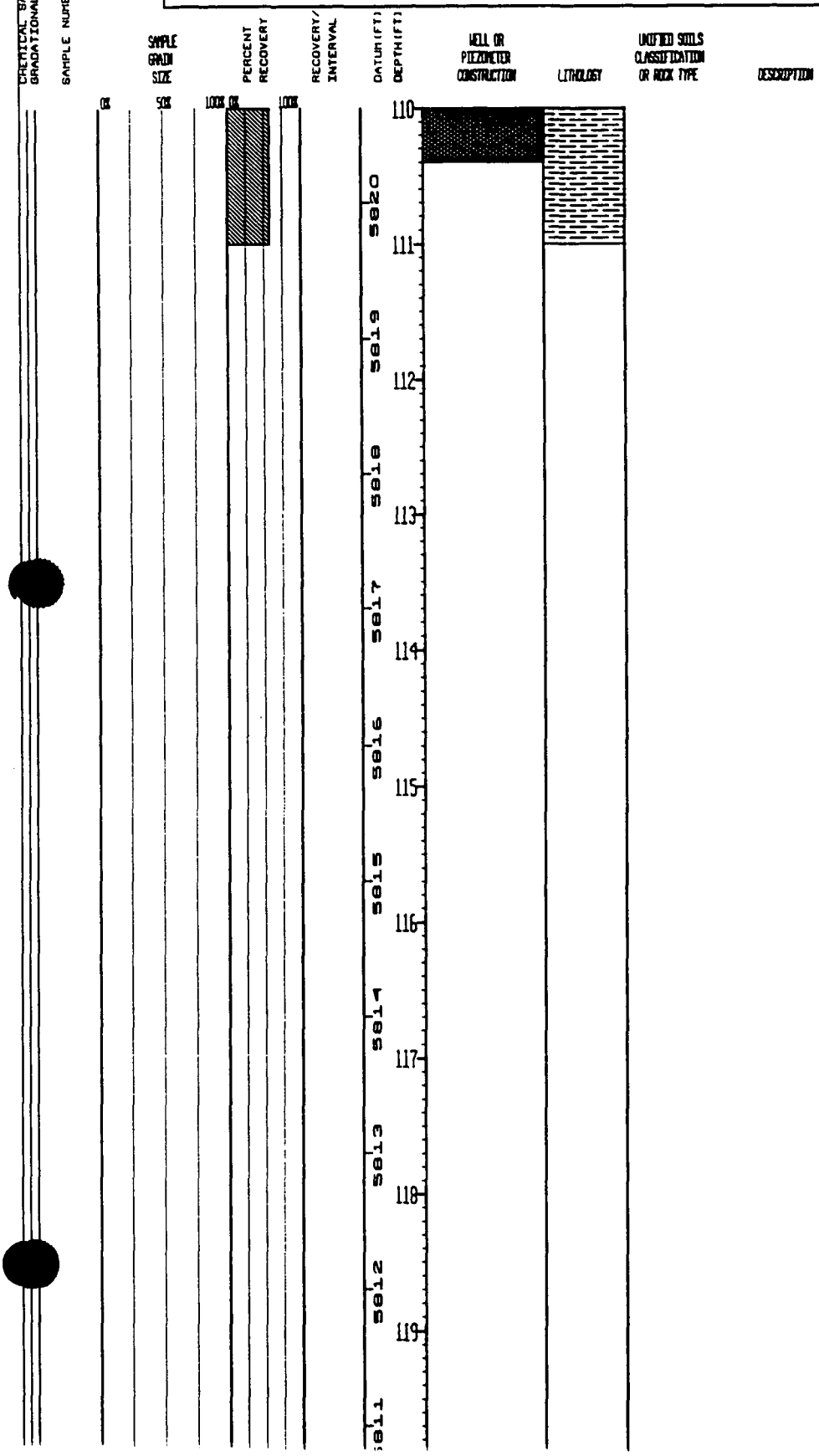
STATE PLANE COORDINATE:		TOTAL DEPTH (FT): 111	GROUND ELEVATION (FT):	5930.7	PROJECT NUMBER:	667.11	LOG OF BORING NUMBER:
NORTH:	749924	AREA: MOUND AREA	CASING DIAMETER (IN):	2 ID	GEOLOGIST:	LAA	22-87DR
EAST:	2085822	LOCATOR NUMBER: M9	BOREHOLE DIAMETER (IN):	4	DATE DRILLED:	10/08/87	

REMARKS: Hollow Stem Auger, Rotary Core. Surface casing set to 93.59' by K.D. Holliway on October 2, 1987.

CHEMICAL SAMPLE DEPTH / GRADATIONAL SAMPLE DEPTH	SAMPLE NUMBER	SAMPLE GRAIN SIZE	PERCENT RECOVERY	RECOVERY/INTERVAL	DATUM (FT)	DEPTH (FT)	WELL OR PIEZOMETER CONSTRUCTION	LITHOLOGY	UNIFIED SOILS CLASSIFICATION OR ROCK TYPE	DESCRIPTION
				1.8/2	5930	100				
				0/1	5929	101			NO SAMPLE:	
				1.8/2	5928	102			CLAYSTONE:	Brownish gray (5Y 4/1), massive bedding, moderately weathered, slightly friable, abundant black carbonaceous material, silty, some fractures.
				3.5/3	5927	103				
					5926	104			CLAYSTONE:	Light olive gray (5Y 6/1), massive bedding, highly weathered, slightly to moderately friable, some carbonaceous material.
					5925	105				
					5924	106				
					5923	107			CLAYSTONE:	Same as above, more weathered, highly friable.
				2.3/4	5922	108				
					5921	109				

STATE PLANE COORDINATE:		TOTAL DEPTH (FT): 111	GROUND ELEVATION (FT):	5930.7	PROJECT NUMBER:	667.11	LOG OF BORING NUMBER:
NORTH:	749924	AREA: MOUND AREA	CASING DIAMETER (IN):	2 ID	GEOLOGIST:	LAA	22-87BR
EAST:	2085822	LOCATOR NUMBER: M9	BOREHOLE DIAMETER (IN):	4	DATE DRILLED:	10/08/87	

REMARKS: Hollow Stem Auger, Rotary Core. Surface casing set to 43.59' by K.D. Holliway on October 2, 1987.



INDEX OF DATA

Boring No.: BH22-87

Completed as well? No

Data in File

x Log of Borehole

____ Well Construction Summaries

____ Well Development Summaries

____ Hydraulic Conductivity Test Data and Results

____ Packer Test Data and Results

____ Water Level Data

LOG OF BOREHOLE

Location: Rocky Flats Plant; 903 Pad Area
Coordinates: N 35789.86 E 22535.86
Total Depth: 27.20'

Borehole/Well No.: BH22-87
Ground Surface Elevation: 5978.50'
Water Level Encountered: 19.70'
Static: None

Drilling Company: Boyles Bros
Date Drilled: July 9, 1987
Drilling Method: Hollow Stem Auger
Logged By: K.D. Holliway
Geologist

Driller: R. Sharp
Helper: T. Merritt
Drilling Fluid: None
Checked By: [signature]
Site Manager
[signature]
CE[illegible]

Comments: Borehole backfilled with Portland Type I cement. Sample BH22[illegible] triples as samples BH228719WT and BH228720WS.

Depth Feet	Graphic Log	Sample Type	Lithologic Description	Samples Collected or Other Tests Performed
0			**ROCKY FLATS ALLUVIUM**	HNu Background=0.2 OVA Background=1.0 Ludlum Background =15.0. Beta/Gamma Background=0.06.
5			0.0-2.2' SAMPLE. Recovered 1.1/2.2' = 50%. CLAYEY SAND AND GRAVEL: pale yellowish brown (10 YR 6/2) to moderate yellowish brown (10 YR 5/4); quartzite cobbles subangular; sand fine-grained; occasional oxidized zones; unconsolidated poorly sorted; dry to slightly damp.	0.0-9.3': Composite sample: BH22870009. 0.0-9.3': Composite duplicate sample: BH22870009D.
			2.2-4.2' SAMPLE. Recovered 1.65/2.0' = 83%. CLAYEY SAND AND GRAVEL: same as above; damp.	5.0': Field screen readings: HNu = 1.0 13.0; OVA = 1.0.
10			4.2-7.2' SAMPLE. Recovered 2.15/3.0' = 72%. CLAYEY SAND AND GRAVEL: same as above; damp.	9.7-10.6': Waste sample: BH228710WS.
			7.2-9.7' SAMPLE. Recovered 2.1/2.5' = 84%. CLAYEY SAND AND GRAVEL: same as above; damp to dry.	10.0': Field screen readings: HNu = 250 peak; OVA = 1.0. 10.6-18.4': Composite sample: BH22871018.
15			9.7-12.2' SAMPLE. Recovered 2.25/2.5' = 90%. 9.7 - 11.95': SAND AND GRAVEL: same as above; dry. 11.95 - 12.2': Drilled with center bit.	12.2-14.7': Reading on core: HNu = 5.0-50.0. 14.7-16.0': Reading on core: HNu = 1.0-12.0.
20			12.2-14.7' SAMPLE. Recovered 1.6/2.5' = 64%. SAND AND GRAVEL: same as above; dry.	15.0': Field screen readings: HNu = 65 peak; OVA = 1.0.

LOG OF BOREHOLE

Location: Rocky Flats Plant; 903 Pad Area
Coordinates: N 35789.86 E 22535.86
Total Depth: 27.20'

Borehole/Well No.: BH22-87
Ground Surface Elevation: 5978.50'
Water Level Encountered: 19.70'
Static: None

Drilling Company: Boyles Bros
Date Drilled: July 9, 1987
Drilling Method: Hollow Stem Auger
Logged By: K.D. Holliway
Geologist

Driller: R. Sharp
Helper: T. Merritt
Drilling Fluid: None
Checked By: [signature]
Site Manager

CEARP Manager

Comments: Borehole backfilled with Portland Type I cement. Sample BH228720CT triples as samples BH228719WT and BH228720WS.

Depth Feet	Graphic Log	Sample Type	Lithologic Description	Samples Collected or Other Tests Performed
20			14.7-17.2' SAMPLE. Recovered 1.75/2.5' = 70%. SAND AND GRAVEL: same as above; dry.	18.4-20.6': Contact sample: BH228720CT.
			17.2-19.7' SAMPLE. Recovered 1.6/2.5' = 64%. SAND AND GRAVEL: same as above; damp.	20.0': Field screen readings: HNu = 50 peak; OVA = 1.0.
25			19.7-22.2' SAMPLE. Recovered 1.0/2.5' = 40%. 19.7-20.6': SAND AND GRAVEL: same as above; wet.	22.2-22.35': Bedrock sample: BH228722BR.
			ARAPAHOE FORMATION	
30			20.6-20.7': CLAYSTONE: light olive gray (5 Y 6/1); mottled; moist.	
			22.2-24.7' SAMPLE. Recovered 2.5/2.5' = 100%. CLAYSTONE: light olive gray (5 Y 6/1) to dusky yellow (5 Y 6/4); some iron staining, dark yellowish orange (10 YR 6/6); damp to dry.	
			24.7-27.2' SAMPLE. Recovered 2.5/2.5' = 100%. CLAYSTONE: pale olive (10 Y 6/2) to light olive brown (5 Y 5/6); iron staining dark yellowish orange (10 YR 6/6); indurated; damp.	
			TOTAL DEPTH: 27.20'	

LOG OF BORING NO. BH 22-87

GEOLOGIST(S): DCB
DATE: 8/14/89

PROJECT NO: 667-1122

TOP/BOTTOM OF CORE IN BOX	TOP/BOTTOM OF INTERVAL	FEET OF CORE IN INTERVAL IN BOX	SAMPLE NUMBER	FRACTURE ANGLE	BEDDING ANGLE	GRAIN SIZE DISTRIBUTION	USCS SYMBOL	DEPTH IN FEET	LITHOLOGIC LOG	LITHOLOGIC DESCRIPTION
0.0 ↓	0.0 to 1.1					>50% Gravel	GC	1		Clayey Gravel, light gray (N7), clay matrix is dark yellowish brown (10 YR 4/2), subrounded moderately graded, max. size 5 cm, some roots and plant debris, some silt, trace of sand
	1.1 to 2.2	0						2		No Sample
	2.2 to 3.6					>50% Gravel	GM			Silty Gravel, light gray (N7), angular, poorly graded, max. size 3 cm., some clay and calcareous mineralization
	2.6 to 3.85					>50% Clay		3		Below 2.6 ft. interval is Sandy Gravelly Caliche, white (N9), max. gravel size is 4 cm.
	3.85 to 4.2	0						4		No Sample
Box 1 of 3	4.2 to 5.95					>50% ~~Extra~~ Clay		5		Sandy Gravelly Caliche, white (N9), some clay, max. gravel size is 7 cm.
	5.95 to 6.35					~~>50%~~ Clay	CL	6		Sandy gravelly Clay, grayish orange (10 YR 7/4), low plasticity, calcareous mineralization
	6.35 to 7.2	0						7		No Sample
	7.2 to 8.8					>50% Gravel	GC	8		Sandy Gravel, medium dark gray (N4), matrix is light brown (5 YR 5/6), angular to subangular, moderately graded, max size 4 cm., some clay and silt.
	8.8 to 9.3							9		
	9.3 to 9.7	0								No Sample
	9.7 to 10.15	0								No Sample

NOTES: General: USCS is modified for this log as follows:
Material amounts are estimated by % volume instead of % weight.
(1) Badly broken core, accurate footage measurements not possible.
(2) Core breaks cannot be matched, accurate footage measurements not possible.

ROCKY FLATS PLANT

FIGURE NO.

LOG OF BORING NO. DH 22-86

GEOLOGIST(S): DCB
DATE: 8/14/89

PROJECT NO: 667-122

TOP/BOTTOM OF CORE IN BOX	TOP/BOTTOM OF INTERVAL	FEET OF CORE IN INTERVAL IN BOX	SAMPLE NUMBER	FRACTURE ANGLE	BEDDING ANGLE	GRAIN SIZE DISTRIBUTION	USCS SYMBOL	DEPTH IN FEET	LITHOLOGIC LOG	LITHOLOGIC DESCRIPTION
Box 143 ↑ 10.6	9.7 to 10.6	0								No Sample
10.6 ↓	10.6 to 11.95	ND				>50% Gravel	GC	11		As above (reference interval 7.2 to 89.3 ft.).
	11.95 to 12.[illegible]	0						12		No Sample
	12.[illegible] to 13.8	ND				>50% Gravel	GC	13		As above (reference interval 7.2 to 9.3 ft.), max. gravel size 6 cm with increase in overall size of gravel.
	13.8 to 14.7	0						14		No Sample
	14.7 to 16.45	ND				>50% Gravel	GC	15, 16		As above (reference interval 7.2 to 9.3 ft.), gravel is ~~not~~ as coarse as interval 12.2 to 13.8.
	16.45 to 17.2	0						17		No Sample
	17.2 to 18.8	ND				>50% Gravel	GC	18		As above (reference interval 7.2 to 9.3).
	18.8 to 19.7	0						19		No Sample
	19.7 to 20.7	.3(1)				>50% Clay				Clay stone, light gray (N7), bedding not apparent, slight (uncalibrated)

NOTES: General: USCS is modified for this log as follows:
Material amounts are estimated by % volume instead of % weight.
(1) Badly broken core, accurate footage measurements not possible.
(2) Core breaks cannot be matched, accurate footage measurements not possible.

ROCKY FLATS PLANT

FIGURE NO.

LOG OF BORING NO: BH 22-87

GEOLOGIST(S): DCB
DATE: 8/14/89

PROJECT NO: 667-1122

TOP/BOTTOM OF CORE IN BOX	TOP/BOTTOM OF INTERVAL	FEET OF CORE IN INTERVAL IN BOX	SAMPLE NUMBER	FRACTURE ANGLE	BEDDING ANGLE	GRAIN SIZE DISTRIBUTION	USCS SYMBOL	DEPTH IN FEET	LITHOLOGIC LOG	LITHOLOGIC DESCRIPTION
	19.7 to 20.7	(1) .3				>50' clay				moderately friable, possible mg oxides (exhibits dendritic morphology), 1 cobble, trace sand + gravel
2 of 3	20.7 to 22.2	0						21, 22	X	No Sample
Box ↑ 23.7	22.2 to 23.7	(1) .35						23		As above (reference interval 19.7 to 20.7 ft.), cobble, sand and gravel are absent, local iron staining
23.7 ↓	23.7 to 24.7	(1) 2.6						24		As above with ~~color change~~ DCB ~~to~~ ~~opaque~~ dark mineralization occurs locally but lacking a dendritic morphology.
3 of 3	24.7 to 26.0	ND						25		
Box ↑ 27.2	26.0 to 27.2	ND						26, 27		Abundant iron staining at 26.5
								28, 29		Bottom of Box 3 of 3 at 27.2 ft

NOTES: General USCS is modified for this log as follows:
Material amounts are estimated by % volume instead of % weight.
(1) Badly broken core, accurate footage measurements not possible.
(2) Core breaks cannot be matched, accurate footage measurements not possible.

ROCKY FLATS PLANT

FIGURE NO.

STATE PLANE COORDINATE:		TOTAL DEPTH (FT) 27.2	GROUND ELEVATION (FT): 5978.5	PROJECT NUMBER: 667.11	LOG OF BORING NUMBER:
NORTH:	748778	AREA: 903 PAD	CASING DIAMETER (IN): 0	GEOLOGIST: DCB	BH22-87
EAST:	2085646	LOCATOR NUMBER: M8	BOREHOLE DIAMETER (IN): 0	DATE DRILLED: 07/09/87	

REMARKS: Hollow Stem Auger. BH backfilled w/ Portland Type I cement. Sample BH228720CT triples as samples BH228719WT and BH228872DWS.

CHEMICAL SAMPLE DEPTH / GRADATIONAL SAMPLE	SAMPLE NUMBER	SAMPLE GRAIN SIZE (0% 50% 100%)	PERCENT RECOVERY (0% 100%)	RECOVERY/INTERVAL	DATUM (FT)	DEPTH (FT)	WELL OR PIEZOMETER CONSTRUCTION	LITHOLOGY	UNIFIED SOILS CLASSIFICATION OR ROCK TYPE	DESCRIPTION
				1.1/1.1	5978	0			GC	Clayey Gravel - light gray (N7), clay matrix is dark yellowish brown (10YR 4/2), sub-rounded, moderately graded, max. size 5 cm., some roots and plant debris, some silt, trace of sand.
				0/1.1	5977	1			NO SAMPLE	
				0.4/0.4	5976	2			GM	SILTY GRAVEL - light gray (N7), angular, poorly graded, max. size 3 cm., some clay and calcareous mineralization.
				1.25/1.25	5975	3			CALICHE	Below 2.6 ft interval is SANDY GRAVELLY CALICHE, white (N9), max. gravel size is 4 cm.
				0/0.35	5974	4			NO SAMPLE	
	BH228700D3			1.75/1.75	5973	5			CALICHE	Sandy, gravelly, white (N9), some clay, max. gravel size is 7 cm.
				0.4/0.4	5972	6			CL	SANDY GRAVELLY CLAY - grayish orange (10YR 7/4), low plasticity, calcareous mineralization
				0/0.85		7			NO SAMPLE	
	0036			1.6/1.6	5970	8			GC	SANDY GRAVEL - medium dark gray (N4), matrix is light brown (5YR 5/6), angular to sub-angular, moderately graded, max. size 4 cm., some clay and silt.
				0.5/0.5		9			GC	Same as above.
				0/0.4	5969				NO SAMPLE	
									NO SAMPLE	

STATE PLANE COORDINATE:	TOTAL DEPTH (FT): 27.2	GROUND ELEVATION (FT): 5978.5	PROJECT NUMBER: 667.11	LOG OF BORING NUMBER:
NORTH: 748778	AREA: 903 PAD	CASING DIAMETER (IN): 0	GEOLOGIST: DCB	BH22-[redacted]
EAST: 2085646	LOCATOR NUMBER: 118	BOREHOLE DIAMETER (IN): 0	DATE DRILLED: 07/09/87	

REMARKS: Hollow Stem Auger. BH backfilled w/ Portland Type I cement. Sample BH228720CT triples as samples BH228719WT and BH228720WS.

CRITICAL SAMPLE DEPTH / GRADATIONAL SAMPLE DEPTH	SAMPLE NUMBER	SAMPLE GRAIN SIZE (0% 50% 100%)	PERCENT RECOVERY (0% 100%)	RECOVERY/INTERVAL	DATUM (FT)	DEPTH (FT)	WELL OR PIEZOMETER CONSTRUCTION	LITHOLOGY	UNIFIED SOILS CLASSIFICATION OR ROCK TYPE	DESCRIPTION
	BH228710US			0/0.9	5968	10				
				1.35/1.35	5967	11			GC:	As above (reference interval 7.2 to 9.3ft.).
				0/0.25		12			NO SAMPLE	
				1.6/1.6	5966 5965	13			GC:	As above (reference interval 7.2 to 9.3 ft.), max. gravel size 6 cm with increase in overall size of gravel.
	BH228710DS			0/0.9	5964	14			NO SAMPLE	
				1.75/1.75	5963	15			GC:	As above (reference interval 7.2 to 9.3 ft.), gravel is not as coarse as interval 12.2 to 13.8.
				0/0.75	5962	16			NO SAMPLE	
				1.6/1.6	5961 5960	17			GC:	As above (reference interval 7.2 to 9.3 ft.)
	BH228720CT			0/0.9	5959	18	07/09/87 ▽		NO SAMPLE.	
						19			CL	CLAY - Light gray (N7), bedding not apparent, highly weathered, moderatel
						20				

STATE PLANE COORDINATE:		TOTAL DEPTH (FT): 27.2	GROUND ELEVATION (FT):	5978.5	PROJECT NUMBER:	667.11	LOG OF BORING NUMBER:
NORTH:	748778	AREA: 903 PAD	CASING DIAMETER (IN):	0	GEOLOGIST:	DCB	BH22-87
EAST:	2085646	LOCATOR NUMBER: M8	BOREHOLE DIAMETER (IN):	0	DATE DRILLED:	07/09/87	

REMARKS: Hollow Stem Auger. BH backfilled w/ Portland Type I cement. Sample BH228720CT triples as samples BH228719WT and BH228720WS.

CHEMICAL SAMPLE OR GRADATIONAL SAMPLE	SAMPLE NUMBER	SAMPLE GRAIN SIZE (0% 50% 100%)	PERCENT RECOVERY (0% 100%)	RECOVERY/INTERVAL	DATUM (FT)	DEPTH (FT)	WELL OR PIEZOMETER CONSTRUCTION	LITHOLOGY	UNIFIED SOILS CLASSIFICATION OR ROCK TYPE	DESCRIPTION
				0.3/1	5958	20				friable, possible Mg oxides (exhibits dendritic morphology), 1 cobble, trace sand and gravel.
				0/1.5	5957	21, 22			NO SAMPLE:	
	BH228722BR			0.35/1.5	5956, 5955	22, 23			CLAYSTONE	Top of Bedrock. As above (reference interval 19.7 to 20.7 ft), cobble, sand and gravel are absent, local iron staining.
				2.6/1	5954	24			CLAYSTONE:	As above.
				1.3/1.3	5953	25			CLAYSTONE:	As above with dark mineralization occurring locally but lacking dendritic morphology.
				1.2/1.2	5952, 5951, 5950, 5949	26, 27, 28, 29, 30			CLAYSTONE:	As above, abundant iron staining at 26.5 ft.

WELL COMPLETION INFORMATION

Location: Rocky Flats Plant; Mound Area

Well No. 23-87BR

Coordinates: N 36415.15 E 22802.78

Elevation: Ground Surface 5972.34'

Total Depth: Well 37.85'

Top of Casing 5974.49'

Borehole 45.30'

Formation of Completion: Arapahoe Formation

Casing Material: Sch 5, type 316 TFJ stainless steel

Casing Diameter: 2" ID

Screen Material: 0.010" wire wrap, type 316 TFJ stainless steel

Surface Casing Diameter: 5" ID

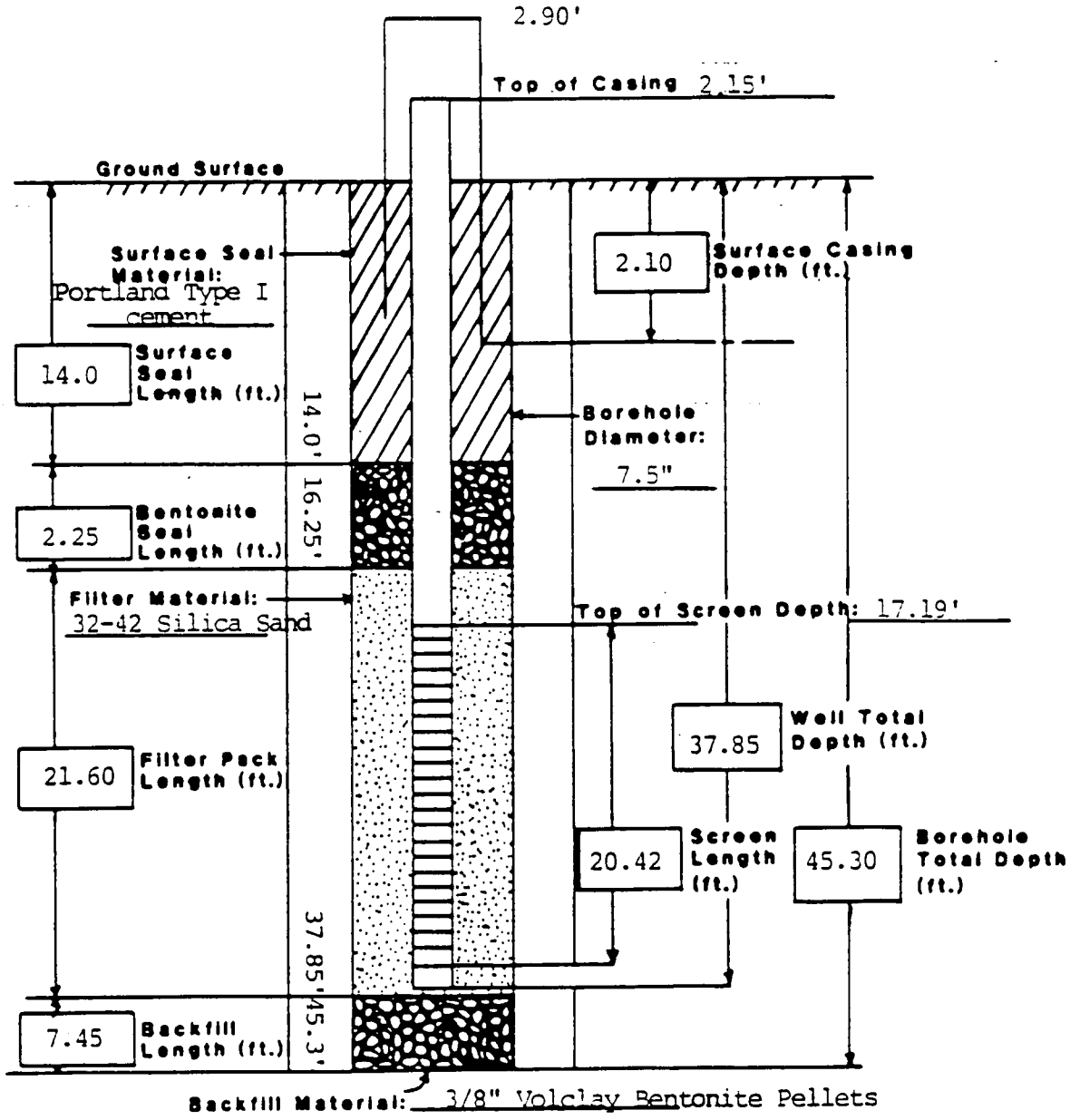
Date Installed: July 24, 1987

Approved By: Site Manager

Installed By: K.D. Holliway, Geologist

CERP Manager

Comments



LOG OF BOREHOLE

Location Rocky Flats Plant: Mound Area
Coordinates N 36415.15 E 22802.78
Total Depth 45.30'

Borehole/Well No. 22-87BB
Ground Surface Elevation 5972.34'
Water Level Encountered 19.0'
Static 5958.39' (12/01/87)

Drilling Company Boyles Bros
Date Drilled July 17-21, 1987
Drilling Method Hollow Stem Auger
Logged By S. Rogal; K.D. Holliway
Geologist

Driller D. Jarvie
Helper J. Duncan
Drilling Fluid None
Checked By [signature]
Site Manager
[signature]
CEARP Manager

Comments

Depth Feet	Graphic Log	Sample Type	Lithologic Description	Samples Collected or Other Tests Performed
0			**ROCKY FLATS ALLUVIUM**	HNu Background=2.0 OVA Background=3.0 Ludlum Background = 0.0
			0.0-2.0' SAMPLE. Recovered 1.5/2.0' = 75%. 0-1.0': SAND: dusky brown (5 YR 2/2); fine-grained; some grass; dry. 1.0-1.5': SILTY SAND: dusky yellow (5 Y 6/4); some gravel; dry.	0-2.0': No readings over background on core.
5			2.0-4.0' SAMPLE. Recovered 1.4/2.0' = 70%. SAND: dusky yellow (5 Y 6/4); fine-grained; some gravel and cobbles; iron discoloration; dry.	2.0-4.0': Readings on core: HNu = 3.0; OVA = 5.0.
			4.0-5.0' SAMPLE. Recovered 0.9/1.0' = 90%. GRAVEL AND SAND: same as above; dry.	4.0-5.0': Readings on core: HNu = 5.0; OVA = 7.0.
10			5.0-7.0' SAMPLE. Recovered 0.4/2.0' = 20%. GRAVEL AND SAND: light olive brown (5 Y 5/6); trace silt; dry.	5.0-7.0': Readings on core: HNu = 5.0; OVA = 6.0.
			7.0-9.0' SAMPLE. Recovered 1.7/2.0' = 85%. GRAVEL AND SAND: same as above; dry.	7.0-9.0': Readings on core: HNu = 2.0; OVA = 5.0.
15			9.0-11.0' SAMPLE. Recovered 0.6/2.0' = 30%. GRAVEL AND SAND: same as above; dry.	9.0-11.0': No readings over background on core.

LOG OF BOREHOLE

Location Rocky Flats Plant: Mound Area
Coordinates N 36415.15 E 22802.73
Total Depth 45.30'

Borehole/Well No. 23-8788
Ground Surface Elevation 5972.34'
Water Level Encountered 19.0'
Static 5958.39' (12/01/87)

Drilling Company Boyles Bros
Date Drilled July 17-21, 1987
Drilling Method Hollow Stem Auger
Logged By S. Rogal; K.D. Holliway
Geologist

Driller D. Jarvie
Helper J. Duncan
Drilling Fluid None
Checked By
Site Manager

CEARP Manager

Comments

Depth Feet	Graphic Log	Sample Type	Lithologic Description	Samples Collected or Other Tests Performed
20			11.0-13.0' SAMPLE. Recovered 0.43/2.0=20%. GRAVEL AND SILT: moderate reddish brown (10 R 4/6); trace fine-grained sand; cobble stuck in shoe of barrel; damp.	11.0-13.0': Readings on core: HNu = 5.0; OVA = 4.0.
			13.0-15.0' SAMPLE. Recovered 1.7/2.0' = 85%. GRAVEL AND SILT: same as above with iron and limonite staining; damp.	13.0-15.0': Readings on core: HNu = 3.0; OVA = 5.0.
25			15.0-17.0' SAMPLE. Recovered 1.98/2.0' = 99%. 15.0-15.25': GRAVEL AND SILT: same as above; damp.	15.0-17.0': Readings on core: HNu = 2.0; OVA = 5.0.
			ARAPAHOE FORMATION	17.0-19.0': Readings on core: HNu = 5.0; OVA = 5.0.
30			15.25-17.0': SANDSTONE: dusky yellow (5 Y 6/4); fine-grained; well sorted; iron staining; weathered; damp.	19.0-21.0': Readings on core: HNu = 3.0; OVA = 5.0.
			17.0-19.0' SAMPLE. Recovered 2.0/2.0' = 100%. SANDSTONE: same as above; moist.	21.0-23.0': Readings on core: HNu = 3.0; OVA = 5.0.
35			19.0-21.0' SAMPLE. Recovered 2.0/2.0' = 100%. SANDSTONE: same as above; wet.	23.0-25.0': Readings on core: HNu = 3.0; OVA = 5.0.
			21.0-23.0' SAMPLE. Recovered 2.0/2.0' = 100%. SANDSTONE: same as above; moist.	25.0-27.0': Readings on core: HNu = 3.0; OVA = 5.0.

LOG OF BOREHOLE

Location Rocky Flats Plant; Mound Area
Coordinates N 26415.15 E 22802.73
Total Depth 45.30'

Borehole/Well No. 23-87BR
Ground Surface Elevation 5972.34'
Water Level Encountered 19.0'
Static 5958.39' (12/01/87)

Drilling Company Boyles Bros
Date Drilled July 17-21, 1987
Drilling Method Hollow Stem Auger
Logged By S. Rogal; K.D. Holliway
Geologist

Driller D. Jarvie
Helper J. Duncan
Drilling Fluid None
Checked By
Site Manager

CEARP Manager

Comments

Depth Feet	Graphic Log	Sample Type	Lithologic Description	Samples Collected or Other Tests Performed
40			23.0-25.0' SAMPLE. Recovered 2.0/2.0' = 100%. SANDSTONE: olive gray (5 Y 3/2); mottled; weathered; wet.	27.0-29.0': Readings on core: HNu = 3.0; OVA = 5.0.
			25.0-27.0' SAMPLE. Recovered 2.0/2.0' = 100%. SANDSTONE: same as above; wet at 25.6'.	29.0-31.0': Readings on core: HNu = 3.0; OVA = 5.0.
45			27.0-29.0' SAMPLE. Recovered 1.9/2.0' = 100%. SANDSTONE: same as above; wet.	31.0-33.0': Readings on core: HNu = 3.0; OVA = 5.0.
			29.0-31.0' SAMPLE. Recovered 2.0/2.0' = 100%. SANDSTONE: olive gray (5 Y 3/2); trace silt; mottled; weathered; from 29.0-30.3' damp; 30.3-31' wet.	
50			31.0-33.0' SAMPLE. Recovered 2.0/2.0' = 100%. SANDSTONE: same as above with 1/2" gray clay lenses at 31.8', 32.3', 32.8'; moist.	
			31.4-33.4' SAMPLE. Recovered 2.0/2.0' = 100%. SANDSTONE: dark yellowish orange (10 YR 6/6) to dusky yellow (5 Y 6/4); 3.5-4.0 phi sand, well sorted; interbedded sand, light olive gray (5 Y 6/1), 3.0-2.5 phi; fairly well sorted; wet to moist.	
			33.4-35.0' SAMPLE. No recovery. Drilled with center bit.	

LOG OF BOREHOLE

Location Rocky Flats Plant: Mound Area
Coordinates N 36415.15 E 22802.73
Total Depth 45.30'

Borehole/Well No. 23-87BR
Ground Surface Elevation 5972.34'
Water Level Encountered 19.0'
Static 5958.39' (12/01/87)

Drilling Company Boyles Bros
Date Drilled July 17-21, 1987
Drilling Method Hollow Stem Auger
Logged By S. Rogal; K.D. Holliway
Geologist

Driller D. Jarvie
Helper J. Duncan
Drilling Fluid None
Checked By
Site Manager

CEARP Manager

Comments

Depth Feet	Graphic Log	Sample Type	Lithologic Description	Samples Collected or Other Tests Performed
			35.0-36.0' SAMPLE. Recovered 1.0/1.0' = 100%. SANDSTONE: dark yellowish orange (10 YR 6/6) to dusky yellow (5 Y 6/4); sand 3.5-4.0 phi, well sorted; trace clay; wet.	
			36.0-37.0' SAMPLE. Recovered 1.0/1.0' = 100%. SANDSTONE: same as above; wet.	
			37.0-38.0' SAMPLE. Recovered 1.0/1.0' = 100%. CLAYEY SANDSTONE: olive gray (5 Y 4/1); sand 3.5-4.0 phi; some silt; some clay; unweathered; moist.	
			38.0-39.3' SAMPLE. Recovered 1.3/1.3' = 100%. CLAYEY SANDSTONE: same as above; moist.	
			39.3-40.3' SAMPLE. Recovered 1.0/1.0' = 100%. SILTSTONE: olive gray (5 Y 4/1) to olive gray (5 Y 3/2); some clay; some 3.5-4.0 phi sand; unweathered; moist.	
			40.3-41.3' SAMPLE. Recovered 1.0/1.0' = 100%. 40.3-40.8': CLAYSTONE: olive gray (5 Y 4/1) trace silt; trace 3.5-4.0 phi sand; unweathered; slightly moist to damp. 40.8-41.3': SILTSTONE: olive gray (5 Y 4/1); some very fine-grained sand; some clay; unweathered; damp to dry.	

LOG OF BOREHOLE

Location Rocky Flats Plant: Mound Area
Coordinates N 36415.15 E 22802.73
Total Depth 45.30'

Borehole/Well No. 23-87BB
Ground Surface Elevation 5972.34'
Water Level Encountered 19.0'
Static 5958.39' (12/01/87)

Drilling Company Boyles Bros
Date Drilled July 17-21, 1987
Drilling Method Hollow Stem Auger
Logged By S. Rogal; K.D. Holliway
Geologist

Driller D. Jarvie
Helper J. Duncan
Drilling Fluid None
Checked By
Site Manager

CEARP Manager

Comments

Depth Feet	Graphic Log	Sample Type	Lithologic Description	Samples Collected or Other Tests Performed
			41.3-42.3' SAMPLE. Recovered 0/1.0' = 0%. SILTSTONE: same as above; dry.	
			42.3-43.3' SAMPLE. Recovered 1.0/1.0' = 100%. SILTSTONE: same as above; trace very fine-grained sand; dry.	
			43.3-44.3' SAMPLE. Recovered 1.0/1.0' = 100%. SILTSTONE: same as above; dry.	
			44.3-45.3' SAMPLE. Recovered 1.0/1.0' = 100%. SILTSTONE: same as above except more sand; dry.	
			TOTAL DEPTH: 45.30'	

LOG OF BORING NO. 23-87 BR

PAGE 1 OF 1

GEOLOGIST(S): LAS

DATE: 8/30/89

PROJECT NO: 667-1122

TOP/BOTTOM OF CORE IN BOX	TOP/BOTTOM OF INTERVAL	FEET OF CORE IN INTERVAL IN BOX	SAMPLE NUMBER	FRACTURE ANGLE	BEDDING ANGLE	GRAIN SIZE DISTRIBUTION	USCS SYMBOL	DEPTH IN FEET	LITHOLOGIC LOG	LITHOLOGIC DESCRIPTION
0.0 ↓	0.0 -1.5	ND 1.6				60% GRAVEL 25% SAND 15% CLAY		1		TOP 1 FT: CLAY SANDY GRAVEL, dark yellowish brown (10 YR 4/2), angular-subangular, mod grading, max size = 5 cm, abundant calc material. Bottom of interval: CALICHE, moderate orange pink (5 YR 8/4), some gravel & sand, broken up core.
	1.5-2.0	Ø						2		NO SAMPLE
	2.0 -3.4	ND 1.5				70% GRAVEL 30% CALC.		3		CALCAREOUS GRAVEL, moderate orange pink (5 YR 8/4), angular-subangular, mod grading, max size = 5 cm, some sand
	3.4-4.9	(1) 1.3				60% GRAVEL 20% CALC 20% CLAY		4		Same as above, max size = 7 cm, bottom of interval is dark yellowish orange (10 YR 6/4), some clay
Box 1 of 4	4.9-5.4	Ø						5		NO SAMPLES
	5.4 -6.0	(1) 0.9				Same as above				Same as above: some clay
	6.0 -7.0	(1) Ø						6 7		
↑ 8.7	7.0 -8.7	ND 1.6						8		Same as above.
END OF BOXES								9		

NOTES: General USCS is modified for this log as follows:
Material amounts are estimated by % volume instead of % weight.
(1) Badly broken core, accurate footage measurements not possible.
(2) Core breaks cannot be matched, accurate footage measurements not possible.

ROCKY FLATS PLANT

FIGURE NO.

LOG OF BORING NO. 23-87 BE

(Box 2 of 4 only)

GEOLOGIST(S): [illegible]

DATE: ~~8/E~~ 9/1/89

PROJECT NO: 6[illegible]7-1122

TOP/BOTTOM OF CORE IN BOX	TOP/BOTTOM OF INTERVAL	FEET OF CORE IN INTERVAL IN BOX	SAMPLE NUMBER	FRACTURE ANGLE	BEDDING ANGLE	GRAIN SIZE DISTRIBUTION	USCS SYMBOL	DEPTH IN FEET	LITHOLOGIC LOG	LITHOLOGIC DESCRIPTION
								1		
								2		
								3		
								4		
								5		
								6		
								7		
								8		
								9		
9.0	9.0 - 9.0	1.1				60% SAND 40% GRAVEL			0 0 0 0	GRAVELLEY SAND, matrix color is moderate orange [illegible] (5 YR 3/4), [illegible] - sub-[illegible], mod [illegible], max [illegible] = [illegible] cm; sand is FG-CG; some c [illegible]
[illegible]	9.0 - [illegible]	~~1.0~~								HC [illegible]

NOTES: General USCS is modified for this log as follows:
Material amounts are estimated by % volume instead of % weight.
(1) Badly broken core, accurate footage measurements not possible.
(2) Core breaks cannot be matched, accurate footage measurements not possible.

ROCKY FLATS PLANT

FIGURE NO.

LOG OF BORING NO. 23-87 BR

GEOLOGIST(S): [illegible]
DATE: 9/1/89

PROJECT NO: [illegible]-1122

TOP/BOTTOM OF CORE IN BOX	TOP/BOTTOM OF INTERVAL	FEET OF CORE IN INTERVAL IN BOX	SAMPLE NUMBER	FRACTURE ANGLE	BEDDING ANGLE	GRAIN SIZE DISTRIBUTION	USCS SYMBOL	DEPTH IN FEET	LITHOLOGIC LOG	LITHOLOGIC DESCRIPTION
Box 2 of 4		Ø								NO SAMPLE
	11.0-11.45	1.0				100% [illegible]		11		Gravel, matrix color is light brown (5 YR 5/6), angular - subangular, max size = 6 cm (artificial), some sand, some clay
	11.45-13.0	Ø						12		NO SAMPLE
	13.0-14.7	1.8						13, 14		Sandy [illegible], matrix color light brown (5 YR 5/6), subangular - subrounded, mod - well graded, max size = 6 cm, some clay as matter
	14.7-15.0	Ø						15		NO SAMPLE
	15.0-17.0	1.9				60% CLAY 40% SAND		16		VFS-FS SANDY CLAYSTONE, non-apparent bedding, well weathered, mod-highly friable, some iron staining as mottles, some silt, trace of Mg staining
	17.0-19.0	1.9				55% CLAY 45% SAND		17, 18		Same as above: increased sand fraction, floury texture
19.0								19		
NO OTHER BOXES FOUND										

NOTES: General: USCS is modified for this log as follows:
Material amounts are estimated by % volume instead of % weight.
(1) Badly broken core, accurate footage measurements not possible.
(2) Core breaks cannot be matched, accurate footage measurements not possible.

ROCKY FLATS PLANT

FIGURE NO.

LOG OF BORING NO. 23-87 BR PAGE 1 OF 2

GEOLOGIST(S): DCB
DATE: 9/1/89

PROJECT NO: 667-11.22

Erasures 9/1/89, LCB corrected interval error

TOP/BOTTOM OF CORE IN BOX	TOP/BOTTOM OF INTERVAL	FEET OF CORE IN INTERVAL IN BOX	SAMPLE NUMBER	FRACTURE ANGLE	BEDDING ANGLE	GRAIN SIZE DISTRIBUTION	USCS SYMBOL	DEPTH IN FEET	LITHOLOGIC LOG	LITHOLOGIC DESCRIPTION
								21		Core Begins at
								22		~24.0 Ft.
								23		
24.0								24		
24.0 ↓	24.0					70% vfg sand ~30% silt		25		silty sand strong grayish orange (10 YR 7/4), to v. light gray (N8), bedding not apparent to thin bedded (≤ 4mm), highly weathered, moderately friable, very fine grained, moderately sorted
		(1)						26		
Box 4	to	2.0						27		
								28		
								29		
	31.0									

NOTES: General: USCS is modified for this log as follows:
Material amounts are estimated by % volume instead of % weight.
(1) Badly broken core, accurate footage measurements not possible.
(2) Core breaks cannot be matched, accurate footage measurements not possible.

ROCKY FLATS PLANT

FIGURE NO.

LOG OF BORING NO. 23-87 BR

GEOLOGIST(S): DCB
DATE: 8/1/89

PROJECT NO: 667-11.22

TOP/BOTTOM OF CORE IN BOX	TOP/BOTTOM OF INTERVAL	FEET OF CORE IN INTERVAL IN BOX	SAMPLE NUMBER	FRACTURE ANGLE	BEDDING ANGLE	GRAIN SIZE DISTRIBUTION	USCS SYMBOL	DEPTH IN FEET	LITHOLOGIC LOG	LITHOLOGIC DESCRIPTION
	24.0 to 31.0	(1) 2.0								Silty Sandstone as above
4/ Box ↑ 33.0	31.0 to 33.0	ND						31 32 33 34		Silty Sandstone as above with thin beds of silty claystone at ~ 32.8 ft. Bottom of Box 4/ at 33 ft.

NOTES: General: USCS is modified for this log as follows:
Material amounts are estimated by % volume instead of % weight.
(1) Badly broken core, accurate footage measurements not possible.
(2) Core breaks cannot be matched, accurate footage measurements not possible.

ROCKY FLATS PLANT

FIGURE NO.

LOG OF BORING NO. 22-87 BR

PAGE 1 OF

DATES DRILLED:
ELEVATION:
GEOLOGIST(S): [illegible]
DATE: 7/2[illegible]/87
CHECKED BY:
DATE:

PROJECT NO: 667-11.22

TOP/BOTTOM OF CORE IN BOX	TOP/BOTTOM OF CORE IN ROW (IN FACTORY)	SAMPLE NUMBER	FEET OF CORE IN BOX (INCHES)	USCS SYMBOL / FEET OF CORE IN ROW	FRACTURES PER FOOT / FRACTURE ANGLE	BEDDING ANGLE	GRAIN SIZE DISTRIBUTION	DEPTH IN FEET	LITHOLOGIC LOG	LITHOLOGIC DESCRIPTION
[illegible]	[illegible] 40 [illegible]	GS	ND				[illegible]	31 32 33		[illegible] yellowish [illegible] bedding [illegible] not apparently highly weathered, slightly friable, localized [illegible] trace of [illegible] sand. At 32.5 [illegible] white (N9) are [illegible] 10° and are less than [illegible]
	33.4 40 35.0		O					34 35		NO Sample
	35.0 [illegible]		.8				[illegible]			As above [illegible] from 31.4 to 33.4) with [illegible]
	[illegible]		ND							
	[illegible]		ND							
	[illegible]		ND							
	[illegible] 40 32.5		ND				>50 clay			Clay [illegible] (N5), [illegible] not apparently [illegible] weathered, moderately friable, [illegible]
	38.0 [illegible]		ND					38 39		
[illegible]	[illegible]		[illegible]							

NOTES: General: The USCS is modified for this log as follows: Material amounts are estimated by percent volume instead of percent weight.
(1) Badly broken core, accurate footage measurement not possible.
(2) Core breaks cannot be matched, accurate footage measurement not possible.

ROCKY FLATS PLANT

FIGURE NO.

LOG OF BORING NO. [illegible] 23-87 BR

DATES DRILLED:
ELEVATION:
GEOLOGIST(S): [illegible]
DATE: 7/28/89
CHECKED BY:
DATE:

PROJECT NO: 667-11.22

TOP/BOTTOM OF CORE IN BOX	TOP/BOTTOM OF CORE IN ROW (INCHES)	SAMPLE NUMBER	FEET OF CORE (INCHES)	FEET OF CORE IN RUN	FRACTURES PER FOOT	FRACTURE ANGLE	BEDDING ANGLE	GRAIN SIZE DISTRIBUTION	DEPTH IN FEET	LITHOLOGIC LOG	LITHOLOGIC DESCRIPTION
	[illegible]		21.0					>50			[illegible]
	40.0 [illegible]		ND								
	[illegible]		ND								[illegible]
	[illegible]		ND								
	[illegible]		ND								
	[illegible]										[illegible]

NOTES: General: The USCS is modified for this log as follows: Material amounts are estimated by percent volume instead of percent weight.
(1) Badly broken core, accurate footage measurement not possible.
(2) Core breaks cannot be matched, accurate footage measurement not possible.

ROCKY FLATS PLANT

FIGURE NO.

STATE PLANE COORDINATE:	TOTAL DEPTH (FT) 45.3	GROUND ELEVATION (FT)	5972.34	PROJECT NUMBER	667 11	LOG OF BORING NUMBER:
NORTH: 749404	AREA: MOUND AREA	CASING DIAMETER (IN):	2 ID	GEOLOGIST:	DAT/DCB	23-87BR
EAST: 2085910	LOCATOR NUMBER: M9	BOREHOLE DIAMETER (IN):	7 5	DATE DRILLED:	07/21/87	

REMARKS: Hollow stem auger

CHEMICAL SAMPLE DEPTH
GRADATIONAL SAMPLE DEPTH
SAMPLE NUMBER
SAMPLE GRAIN SIZE (0% 50% 100% OR 100%)
PERCENT RECOVERY
RECOVERY/INTERVAL
DATUM (FT)
DEPTH (FT)
WELL OR PIEZOMETER CONSTRUCTION
LITHOLOGY

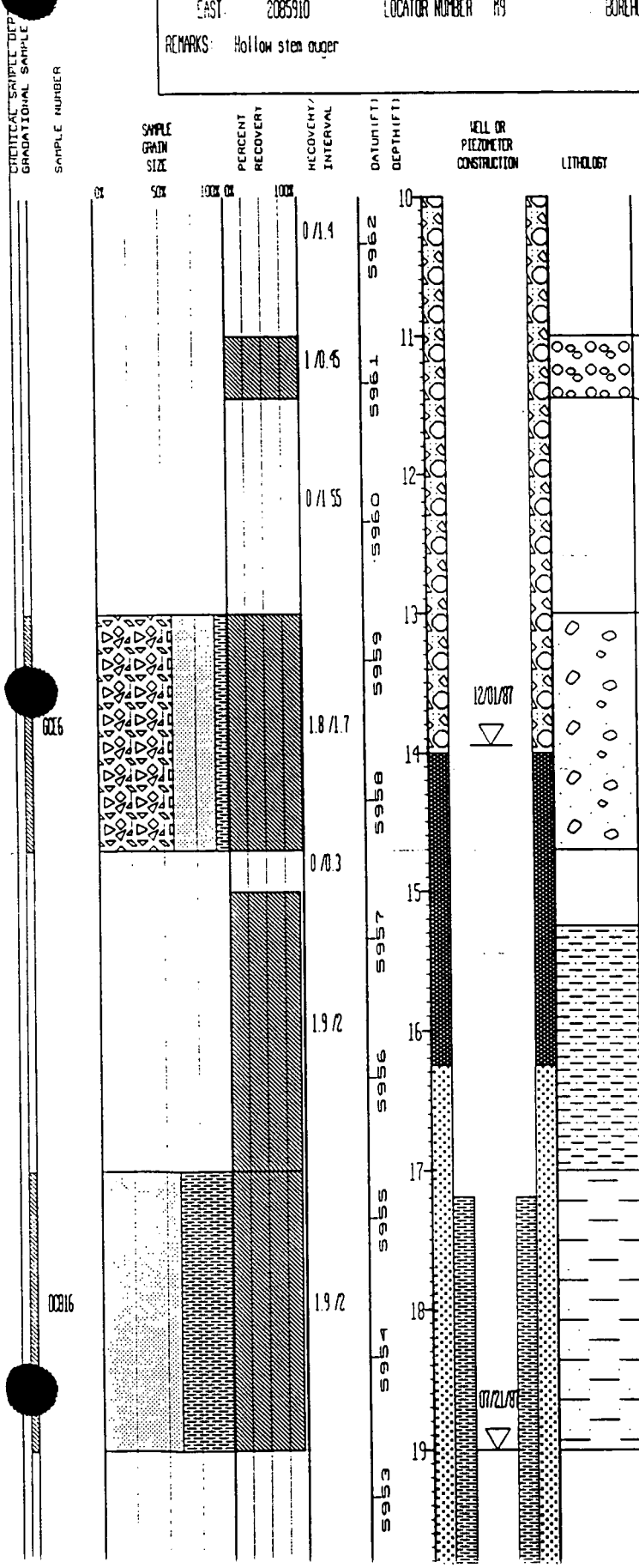
RECOVERY/INTERVAL	DATUM (FT)	UNIFIED SOILS CLASSIFICATION OR ROCK TYPE	DESCRIPTION
1.6/1.5	5972	GP	Top 1 ft · Clayey Sandy Gravel - dark yellowish brown (10YR 4/2), angular to sub-angular, mod. grading, max. size = 5 cm, abundant calc. material
0/0.5	5971	CALICHE	Moderate orange pink (5YR 8/4), some gravel and sand, broken-up texture.
		NO SAMPLE	
1.5/1.4	5970	GP	CALCAREOUS GRAVEL - moderate orange pink (5YR 8/4), angular to sub-angular, mod. grading, max size = 5 cm, some sand
1.3/1.5	5969	GP	Same as above max size = 7 cm, bottom of interval is dark yellowi[illegible] orange (10YR 6/6), some clay
0/0.5	5968	NO SAMPLE	
0.9/0.6	5967	GP:	Same as above· some clay
0/1	5966	NO SAMPLE	
1.6/1.7	5965	GP:	Same as above
0/0.3	5964	NO SAMPLE	
1.1/0.6	5963	SW:	GRAVELLY SAND - matrix color is moderate orange pink (5YR 8/4), angular to sub-angular, mod. grading, max gravel size = 6 cm., sand is FG - CG, some clay, calcareous

STATE PLANE COORDINATE	TOTAL DEPTH (FT) 45.3	GROUND ELEVATION (FT)	[illegible]	PROJECT NUMBER	[illegible]
NORTH: 749404	AREA: MOUND AREA	CASING DIAMETER (IN)	[illegible]	GEOLOGIST	[illegible]
EAST: 2085910	LOCATOR NUMBER M9	BOREHOLE DIAMETER (IN)	[illegible]	DATE DRILLED	07/21/87

REMARKS: Hollow stem auger

LOG OF BORING NUMBER

23-87BR



UNIFIED SOILS CLASSIFICATION OR ROCK TYPE	DESCRIPTION
GW:	GRAVEL - matrix color is light brown (5YR 5/6), angular to sub-angular, max. size = 6 cm. (artificial), some sand, some clay.
NO SAMPLE:	
GP	SANDY GRAVEL - matrix color is light brown (5YR 5/6), sub-angular to sub-rounded, mod. - well graded, max size = 6 cm, some clay as mottles
NO SAMPLE:	
SANDY CLAYSTONE:	Top of Bedrock VFG - FG, non-apparent bedding, well weathered, mod. to highly friable, some iron staining as mottles, some silt, trace of Mg. staining.
CLAYEY SANDSTONE	Clayey Sandstone per sieve analysis 17'-19' Per field log Sandy Claystone - Same as above increased sand fraction floury texture
NO SAMPLE:	NO SAMPLE found between boxes.

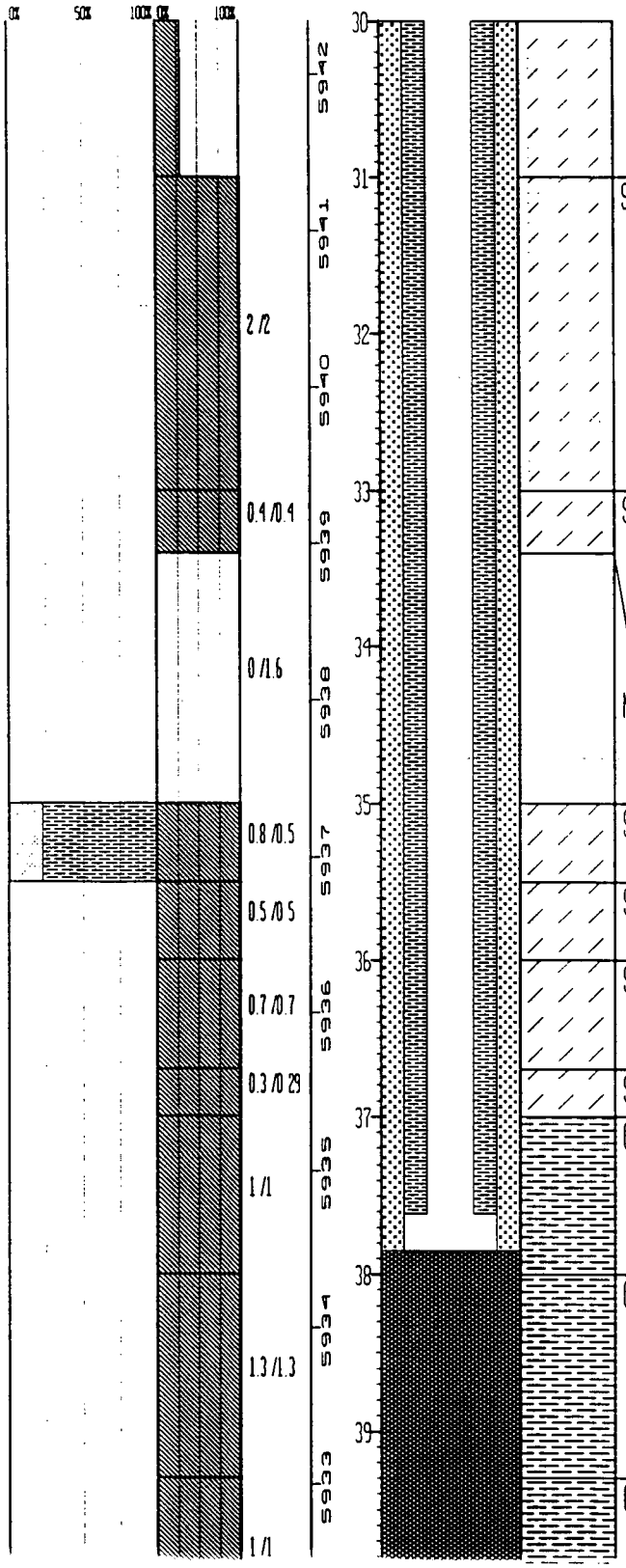
STATE PLANE COORDINATE		TOTAL DEPTH (FT) 45.3	GROUND ELEVATION (FT) 5972.34	PROJECT NUMBER: 667 11	LOG OF BORING NUMBER
NORTH:	749404	AREA: MOUND AREA	CASING DIAMETER (IN) 2 ID	GEOLOGIST DAT/DCB	23-87BR
EAST:	2085910	LOCATOR NUMBER: M9	BOREHOLE DIAMETER (IN) 7 5	DATE DRILLED 07/21/87	

REMARKS: Hollow stem auger.

CHEMICAL SAMPLE DEPTH / GRADATIONAL SAMPLE DEPTH	SAMPLE NUMBER	SAMPLE GRADN SIZE (0% 50% 100%)	PERCENT RECOVERY (0% 100%)	RECOVERY/INTERVAL	DATUM (FT)	DEPTH (FT)	WELL OR PIEZOMETER CONSTRUCTION	LITHOLOGY	UNIFIED SOILS CLASSIFICATION OR ROCK TYPE	DESCRIPTION
				0/5	5952	20				
					5951	21				
					5950	22				
					5949	23				
	0045				5948	24				SILTY SANDSTONE: Grayish orange (10YR 7/4), to very light gray (N8), bedding not apparent to thin bedded (<4 mm.), highly weathered, moderately friable, very fine grained, moderately sorted.
					5947	25				
	0026				5946	26				
				2/7	5945	27				
					5944	28				
					5943	29				

STATE PLANE COORDINATE	TOTAL DEPTH (FT): 45.3	GROUND ELEVATION (FT)	5972.34	PROJECT NUMBER:	667 11	LOG OF BORING NUMBER
NORTH: 749404	AREA: MOUND AREA	CASING DIAMETER (IN):	2 ID	GEOLOGIST	DAT/DCB	23-87BR
EAST: 2085910	LOCATOR NUMBER: M9	BOREHOLE DIAMETER (IN):	7 5	DATE DRILLED:	07/21/87	

REMARKS: Hollow stem auger.



UNIFIED SOILS CLASSIFICATION OR ROCK TYPE	DESCRIPTION
SILTY SANDSTONE	As above, with thin beds of silty claystone at approx. 32.8 ft
SILTSTONE	Interval is actually logged as 31.4 to 33.4 ft, overlaps with previous interval. Siltstone, dark yellowish orange (10YR 6/6), bedding not apparent, highly weathered, slightly friable, localized iron staining, trace of fine sand. At 32.5 ft (est depth) strata of siltstone, white (N9) are bedded at 10 degrees and are less than 1 mm thick
NO SAMPLE	
SILTSTONE	As above (reference interval from 31 44 to 33 4), with irregular lenses of the white siltstone
SILTSTONE	As above.
SILTSTONE	As above.
SILTSTONE	As above
CLAYSTONE	Medium gray (N5), bedding not apparent, highly weathered, moderately friable, localized iron staining
CLAYSTONE	As above.
CLAYSTONE	As above.

STATE PLANE COORDINATE:		TOTAL DEPTH (FT) 45.3	GROUND ELEVATION (FT)	5972.34	PROJECT NUMBER:	667 11	LOG OF BORING NUMBER:
NORTH:	749404	AREA: MOUND AREA	CASING DIAMETER (IN):	2 ID	GEOLOGIST	DAT/DCB	23-87BR
EAST:	2085910	LOCATOR NUMBER: M9	BOREHOLE DIAMETER (IN):	7 5	DATE DRILLED	07/21/87	

REMARKS: Hollow stem auger

CHEMICAL SAMPLE DEPTH / GRADATIONAL SAMPLE DEPTH	SAMPLE NUMBER	SAMPLE GRAIN SIZE	PERCENT RECOVERY	RECOVERY/INTERVAL	DATUM (FT)	DEPTH (FT)	WELL OR PIEZOMETER CONSTRUCTION	LITHOLOGY	UNIFIED SOILS CLASSIFICATION OR ROCK TYPE	DESCRIPTION
		0% 50% 100%	0% 100%							
				2/2	5932	40			CLAYSTONE:	As above.
					5931	41				
					5930	42			CLAYSTONE	Olive gray (5Y 4/1), bedding appears flaggy with approx 10 degree dip based on core breaks, weathered, moderately friable, localized iron staining and carbonaceous mineralization
				1/1	5929	43			CLAYSTONE:	As above.
				1/1	5928	44			CLAYSTONE:	As above.
				1/1	5927	45				
					5926	46				
					5925	47				
					5924	48				
					5923	49				

INDEX OF DATA

Boring No.: BH24-87

Completed as well? No

Data in File

X Log of Borehole

____ Well Construction Summaries

____ Well Development Summaries

____ Hydraulic Conductivity Test Data and Results

____ Packer Test Data and Results

____ Water Level Data

LOG OF BOREHOLE

Location: Rocky Flats Plant; 903 Pad Area
Coordinates: N 35839.2 E 23080.97
Total Depth: 12.60'

Borehole/Well No.: BH24-87
Ground Surface Elevation: 5953.60'
Water Level Encountered: None
Static: N/A

Drilling Company: Boyles Bros
Date Drilled: July 8, 1987
Drilling Method: Hollow Stem Auger
Logged By: K.D. Holliway
Geologist

Driller: R. Sharp
Helper: T. Merritt
Drilling Fluid: None
Checked By: [signature] Site Manager
[signature] CEARP Manager

Comments: Borehole backfilled with Portland Type I cement.

Depth Feet	Graphic Log	Sample Type	Lithologic Description	Samples Collected or Other Tests Performed
0			**COLLUVIUM**	HNu Background=0.2 OVA Background=1.0 Ludlum Background =10.0 Beta/Gamma Background=0.
5			0.0-2.0' SAMPLE. Recovered 1.7/2.0' = 85%. CLAYEY SAND: moderate brown (5 YR 3/4); quartzite cobbles; subangular to broken; sand medium (1.0-0.5 phi) and very fine-grained; subrounded; fairly well sorted; grass and roots to 0.4'; damp.	0.0-2.43': Composite sample: BH24870002.
			2.0-4.0' SAMPLE. Recovered 1.3/2.0' = 65%. CLAYEY SAND: moderate brown (5 YR 3/4) and dark yellowish brown (10 YR 4/2); quartzite cobbles subrounded and subangular; fairly well sorted; damp.	2.43-4.85': Contact sample: BH248705CT.
10			4.0-7.5' SAMPLE. Recovered 0.9/3.5' = 26%. 4.0-4.85': SANDY GRAVEL: light brown (5 YR 5/6); quartzite subangular to subrounded; coarse to fine-grained sand (0.5-0.0 phi some, 1.5-1.0 phi some, 2.5-2.0 phi trace); subangular; poorly sorted; moist to wet.	4.9': Field screen readings: HNu = 8.8; OVA = 1.0. 8.3-8.9': Bedrock sample: BH248708BR. 10.0': Field screen readings: HNu = 5.0; OVA = 1.2.
15			**ARAPAHOE FORMATION** 4.85-4.90': CLAYSTONE: dusky yellow (5 Y 6/4); damp.	10.0-10.9': Waste sample: BH248710WS.

LOG OF BOREHOLE

Location: Rocky Flats Plant; 903 Pad Area
Coordinates: N 35839.2 E 23080.97
Total Depth: 12.60'

Borehole/Well No.: BH24-87
Ground Surface Elevation: 5953.60'
Water Level Encountered: None
Static: N/A

Drilling Company: Boyles Bros
Date Drilled: July 8, 1987
Drilling Method: Hollow Stem Auger
Logged By: K.D. Holliway
Geologist

Driller: R. Sharp
Helper: T. Merritt
Drilling Fluid: None
Checked By: [signature]
Site Manager

CEARP Manager

Comments: Borehole backfilled with Portland Type I cement.

Depth Feet	Graphic Log	Sample Type	Lithologic Description	Samples Collected or Other Tests Performed
			7.5-10.0' SAMPLE. Recovered 2.5/2.5' = 100%. CLAYSTONE: light olive gray (5 Y 6/1) and dusky yellow (5 Y 6/4); some iron staining dark yellowish orange (10 YR 6/6); iron nodules at 9.85' dusky yellowish brown (10 YR 2/2); trace caliche; damp to moist.	
			10.0-12.6' SAMPLE. Recovered 2.6/2.6' = 100%. CLAYSTONE: yellowish gray (5 Y 7/2) and dusky yellow (5 Y 6/4); some iron staining dark yellowish orange (10 YR 6/6); some iron nodules dusky yellowish brown (10 YR 2/2); some caliche; damp.	
			TOTAL DEPTH: 12.60'	

LOG OF BORING NO. BH 24-87

GEOLOGIST(S): DCB
DATE: 8/14/89

PROJECT NO: 667-1122

TOP/BOTTOM OF CORE IN BOX	TOP/BOTTOM OF INTERVAL	FEET OF CORE IN INTERVAL IN BOX	SAMPLE NUMBER	FRACTURE ANGLE	BEDDING ANGLE	GRAIN SIZE DISTRIBUTION	USCS SYMBOL	DEPTH IN FEET	LITHOLOGIC LOG	LITHOLOGIC DESCRIPTION
0.0 ↓ Box 1 of 2	0.0 to 1.7	(1) 1.0				>50% Gravel	GC	1		Clayey Gravel, light gray (N7), clay is dusky brown (5YR 2/2), subangular to subrounded, poorly graded, max. size 6 cm, some roots and plant debris, some silt.
	1.7 to 2.0	0						2		No Sample
	2.0 to 3.3	(1) .7				>50% Gravel	GC	3		As above (reference interval 0.0 to 1.7 ft.).
	3.3 to 4.0	0						4		No Sample
	4.0 to 4.9	ND				>50% Gravel	GC			Gravel, med. light gray (N6), subangular to subrounded, poorly graded, max. size 7cm, some sand and silty clay at the base of this interval.
	4.9 to 7.5	0						5, 6, 7		No Sample
	7.5 to 7.8	ND				>50% clay		8		Clay Stone, very pale orange (10 YR 8/2), bedding not apparent, highly weathered, moderately friable, iron staining on fractures and as nodules, calcareous mineralized on fractures and dark mineralized on fractures and possible bedding plane partings.
	7.8 to 9.4	ND						9		
	9.4 to 10.0	ND								

NOTES: General USCS is modified for this log as follows:
Material amounts are estimated by % volume instead of % weight.
(1) Badly broken core, accurate footage measurements not possible.
(2) Core breaks cannot be matched, accurate footage measurements not possible.

ROCKY FLATS PLANT

FIGURE NO.

LOG OF BORING NO. BH 24-87

GEOLOGIST(S): DCB
DATE: 8/14/89

PROJECT NO: 667-1122

TOP/BOTTOM OF CORE IN BOX	TOP/BOTTOM OF INTERVAL	FEET OF CORE IN INTERVAL IN BOX	SAMPLE NUMBER	FRACTURE ANGLE	BEDDING ANGLE	GRAIN SIZE DISTRIBUTION	USCS SYMBOL	DEPTH IN FEET	LITHOLOGIC LOG	LITHOLOGIC DESCRIPTION
10.75	10.0 to 10.75	0								No Sample
10.75 ↓ Box 2 of 2 ↑ 12.3	10.75 to 12.3					75% clay		11, 12		As above (reference interval 7.5 to 10.0 ft.), without calcareous mineralization.
								13, 14, 15, 16		Bottom of Box 2 of 2 at 12.3 ft

NOTES: General USCS is modified for this log as follows:
Material amounts are estimated by % volume instead of % weight.
(1) Badly broken core, accurate footage measurements not possible.
(2) Core breaks cannot be matched, accurate footage measurements not possible.

ROCKY FLATS PLANT

FIGURE NO.

STATE PLANE COORDINATE:		TOTAL DEPTH (FT): 12.3	GROUND ELEVATION (FT):	5953.6	PROJECT NUMBER:	667.11	LOG OF BORING NUMBER:
NORTH:	748829	AREA: 903 PAD	CASING DIAMETER (IN):	0	GEOLOGIST:	DCB	BH24-07
EAST:	2086190	LOCATOR NUMBER: N8	BOREHOLE DIAMETER (IN):	0	DATE DRILLED:	07/08/87	

REMARKS: Hollow Stem Auger. Borehole backfilled with Portland Type I cement.

CHEMICAL SAMPLE DEPTH / GRADATIONAL SAMPLE DEPTH	SAMPLE NUMBER	SAMPLE GRAIN SIZE (0% – 50% – 100%)	PERCENT RECOVERY (0% – 100%)	RECOVERY/INTERVAL	DATUM (FT)	DEPTH (FT)	WELL OR PIEZOMETER CONSTRUCTION	LITHOLOGY	UNIFIED SOILS CLASSIFICATION OR ROCK TYPE	DESCRIPTION
	BH24870002			1/1.7	5953	0			GC:	Clayey Gravel - light gray (N7), clay is dusky brown (5YR 2/2), sub-angular to sub-rounded, poorly graded, max. size = 6 cm., some roots and plant debris, some silt.
				0/0.3	5952	1			NO SAMPLE:	
				0.7/1.3	5951	2			GC:	As above.
	BH24870507			0/0.7	5950	3			NO SAMPLE:	
				0.9/0.9	5949	4			GC:	GRAVEL - med. light gray (N6), sub-angular to sub-rounded, poorly graded, max. size 7 cm., some sand and silty clay at the base of this interval.
				0/2.6	5948	5			NO SAMPLE:	Top of Bedrock.
				0.3/0.3	5947	6			CLAYSTONE:	Very pale orange (10YR 8/2), bedding not apparent, highly weathered, moderately friable, iron staining or fractures as mottling, calcareous mineralization on fractures and dark mineralization on fractures and on possible bedding plane partings.
	BH24870888			1.6/1.6	5946	7			CLAYSTONE:	As above.
				0.6/0.6	5945	8			CLAYSTONE:	As above.

STATE PLANE COORDINATE:		TOTAL DEPTH (FT): 12.3	GROUND ELEVATION (FT):	5953.6	PROJECT NUMBER:	667.11	LOG OF BORING NUMBER:
NORTH:	748829	AREA: 903 PAD	CASING DIAMETER (IN):	0	GEOLOGIST:	DCB	BH24-87
EAST:	2086190	LOCATOR NUMBER: N8	BOREHOLE DIAMETER (IN):	0	DATE DRILLED:	07/08/87	

REMARKS: Hollow Stem Auger. Borehole backfilled with Portland Type I cement.

CHEMICAL SAMPLE DEPTH / GRADATIONAL SAMPLE DEPTH	SAMPLE NUMBER	SAMPLE GRAIN SIZE (0% 50% 100%)	PERCENT RECOVERY (0% 100%)	RECOVERY/INTERVAL	DATUM (FT)	DEPTH (FT)	WELL OR PIEZOMETER CONSTRUCTION	LITHOLOGY	UNIFIED SOILS CLASSIFICATION OR ROCK TYPE	DESCRIPTION
	BH24-87T10.5			0 /0.75	5943	10			NO SAMPLE:	
				1.55 /1.55	5942	11			CLAYSTONE:	As above (reference interval 7.5 to 10 ft.) without calcareous mineralization. NOTE: No water encountered while drilling.
					5941	12				
					5940	13				
					5939	14				
					5938	15				
					5937	16				
					5936	17				
					5935	18				
					5934	19				

LOG OF BOREHOLE

Location Rocky Flats Plant; 903 Pad Area
Coordinates N 35803.33 E 23131.28
Total Depth 15.00'

Borehole/Well No. BH28-87
Ground Surface Elevation 5946.70'
Water Level Encountered 0.0
Static N/A

Drilling Company Boyles Bros
Date Drilled July 13, 1987
Drilling Method Hollow Stem Auger
Logged By K. D. Holliway
Geologist

Driller T. Merritt
Helper J. Duncan
Drilling Fluid None
Checked By [signature]
Site Manager
[signature]
CERP Manager

Comments Borehole backfilled with Portland Type I cement

Depth Feet	Graphic Log	Sample Type	Lithologic Description	Samples Collected or Other Tests Performed
0			**COLLUVIUM**	HNu Background=0.4 OVA Background=1.0 Alpha=0.0
			0.0-2.0' SAMPLE. Recovered 0.9/2.0' = 45%. CLAYEY SAND: dusky brown (5 YR 2/2); occasional quartzite cobbles; sub-rounded; grass and organics; wet.	0.0-0.9': Water table sample: BH288700WT.
5			2.0-4.0' SAMPLE. Recovered 1.90/2.0' = 95%. CLAYEY SAND: same as above; wet.	0.9-3.75': Composite sample: BH28870104.
			4.0-7.0' SAMPLE. Recovered 3.0/3.0' = 100%. 4.0-5.9': CLAYEY SAND: same as above; wet.	3.75-4.85': Waste sample: BH288705WS.
10			**ARAPAHOE FORMATION**	5.0': Field screen readings: HNu = 260; OVA = 1.0.
			5.9-7.0': CLAYSTONE: light olive gray (5 Y 6/1) to light olive brown (5 Y 5/6); some iron staining dark yellowish orange (10 YR 6/6); moist.	4.85-5.90': Contact sample: BH288706CT.
			7.0-11.0' SAMPLE. Recovered 2.0/4.0' = 50%. CLAYSTONE: same as above; moist.	9.0': Field screen readings: HNu = 15.0; OVA = 1.0.
15			11.0-15.0' SAMPLE. Recovered 1.0/4.0' = 25%. CLAYSTONE: light olive gray (5 Y 6/1); and iron staining dark yellowish orange (10 YR 6/6); trace caliche; many iron nodules, blackish red (5 R 2/2) and light brown (5 YR 5/6); moist.	8.80-9.0' and 11.0-12.0': Bedrock sample: BH288709BR.
			TOTAL DEPTH: 15.00'	

LOG OF BORING NO. CH 28-27

GEOLOGIST(S): DCB
DATE: 8/15/89

PROJECT NO:

TOP/BOTTOM OF CORE IN BOX	TOP/BOTTOM OF INTERVAL	FEET OF CORE IN INTERVAL IN BOX	SAMPLE NUMBER	FRACTURE ANGLE	BEDDING ANGLE	GRAIN SIZE DISTRIBUTION	USCS SYMBOL	DEPTH IN FEET	LITHOLOGIC LOG	LITHOLOGIC DESCRIPTION
0.0 ↓	0.0 to 0.9	0								No Sample
	0.9 to 2.0	0						1		No Sample
	2.0 to 2.5					>80% clay	CL	2		silty Clay, grayish black (N2), moderate plasticity trace of gravel, to some gravel - gravel fraction increases in abundance with depth.
	2.5 to 3.9							3		
	3.9 to 4.0	0						4		NO SAMPLE
Box 1 of 1	4.0 to 5.9	0						5		No Sample
	5.9 to 7.0					>80% clay		6		Clay, very light gray (N8) with mottled iron staining, dark yellowish orange (10YR 6/6), highly weathered slightly to moderately friable, trace occurrence of calcareous mineralization as small bodies < 1mm.
	7.0 to 9.0							7		
								8		
↑ 9.0	9.0							9		Bottom of Box 1 of 1 at 9.0 ft.

NOTES: General USCS is modified for this log as follows:
Material amounts are estimated by % volume instead of % weight.
(1) Badly broken core, accurate footage measurements not possible.
(2) Core breaks cannot be matched, accurate footage measurements not possible.

ROCKY FLATS PLANT

FIGURE NO.

STATE PLANE COORDINATE:		TOTAL DEPTH (FT): 15	GROUND ELEVATION (FT):	5946.7	PROJECT NUMBER:	667.11	LOG OF BORING NUMBER:
NORTH:	748794	AREA: 903 PAD	CASING DIAMETER (IN):	0	GEOLOGIST:	DCB	BH28-87
EAST:	2086241	LOCATOR NUMBER: N8	BOREHOLE DIAMETER (IN):	0	DATE DRILLED:	07/13/87	

REMARKS: Hollow Stem Auger. Borehole backfilled w/ Portland Type I cement.

CHEMICAL SAMPLE	GRADATIONAL SAMPLE	SAMPLE NUMBER	SAMPLE GRAIN SIZE (0% 50% 100%)	PERCENT RECOVERY (0% 100%)	RECOVERY/INTERVAL	DATUM (FT)	DEPTH (FT)	WELL OR PIEZOMETER CONSTRUCTION	LITHOLOGY	UNIFIED SOILS CLASSIFICATION OR ROCK TYPE	DESCRIPTION
		BH28870047			0/0.9	5946	0			NO SAMPLE:	
					0/1.1	5945	1			NO SAMPLE:	
		BH28870104			0.5/0.5	5944	2			CL:	Silty Clay - grayish black (N2), moderate plasticity, trace of gravel, to some gravel - gravel fraction increases in abundance with depth.
					1.4/1.4	5943	3			CL:	Same as above.
					0/0.09		4			NO SAMPLE:	
		BH28870545								NO SAMPLE:	
					0/1.9	5942	5				
		BH28870607				5941					
					1.1/1.1	5940	6			CLAYSTONE:	Top of Bedrock Very light gray (N8) with mottled iron staining, dark yellowish orange (10YR 6/6), highly weathered, slightly to moderately friable, localized occurrence of calcareous mineralization as small bodies <1 mm.
					2/2	5939	7			CLAYSTONE:	Same as above.
		BH28870988				5938	8				
						5937	9			NO SAMPLE:	Note: No water encountered during drilling.

STATE PLANE COORDINATE:	TOTAL DEPTH (FT): 15	GROUND ELEVATION (FT): 5946.7	PROJECT NUMBER: 667.11	LOG OF BORING NUMBER:
NORTH: 748794	AREA: 903 PAD	CASING DIAMETER (IN): 0	GEOLOGIST: DCB	BH28-[redacted]
EAST: 2086241	LOCATOR NUMBER: N8	BOREHOLE DIAMETER (IN): 0	DATE DRILLED: 07/13/87	

REMARKS: Hollow Stem Auger. Borehole backfilled w/ Portland Type I cement.

CHEMICAL SAMPLE DEPTH / GRADATIONAL SAMPLE DEPTH	SAMPLE NUMBER	SAMPLE GRAIN SIZE (0% 50% 100%)	PERCENT RECOVERY (0% 100%)	RECOVERY/ INTERVAL	DATUM (FT)	DEPTH (FT)	WELL OR PIEZOMETER CONSTRUCTION	LITHOLOGY	UNIFIED SOILS CLASSIFICATION OR ROCK TYPE	DESCRIPTION
	BH28870988			0/6	5936	10				
					5935	11				
					5934	12				
					5933	13				
					5932	14				
					5931	15				
					5930	16				
					5929	17				
					5928	18				
					5927	19				

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Boring No.: BH31-87

Completed as well? No

Data in File

x Log of Borehole

____ Well Construction Summaries

____ Well Development Summaries

____ Hydraulic Conductivity Test Data and Results

____ Packer Test Data and Results

____ Water Level Data

LOG OF BOREHOLE

Location Rocky Flats Plant; Mound Area
Coordinates N 36498.76 E 22297.23
Total Depth 22.85'

Borehole/Well No. BH31-87
Ground Surface Elevation 5973.80'
Water Level Encountered None
Static N/A

Drilling Company Boyles Bros
Date Drilled August 4, 1987
Drilling Method Hollow Stem Auger
Logged By K. D. Holliway
Geologist

Driller R. Sharp
Helper J. Duncan
Drilling Fluid None
Checked By [signature]
Site Manager
[signature]
CERCLA Manager

Comments Borehole backfilled with Portland Type I cement

Depth Feet	Graphic Log	Sample Type	Lithologic Description	Samples Collected or Other Tests Performed
0			**ROCKY FLATS ALLUVIUM**	HNu Background=0.2 OVA Background=0.3 No Ludlum readings taken.
			0.0-2.0' SAMPLE. Recovered 1.3/2.0' = 65%. SAND AND CLAY: dark yellowish brown (10 YR 4/2); some quartzite gravel-broken to subangular; very fine-grained sand to 2.0-2.5 phi; poorly sorted; subrounded; iron staining-dark yellowish orange (10 YR 6/6); damp.	0.0-11.7': Composite sample: BH31870013.
5			2.0-4.0' SAMPLE. Recovered 2.0/2.0' = 100%. SAND AND CLAY: dark yellowish brown (10 YR 4/2) to light olive gray (5 Y 6/1); some quartzite gravel, subangular to subrounded; some sand very fine-grained to 2.5-2.0 phi; poorly sorted; subrounded; some clay; damp.	0.0-11.7': Duplicate composite sample: BH31870013D. 5.0': Field screen readings: HNu = 0.2; OVA = 0.3.
10			4.0-7.6' SAMPLE. Recovered 3.6/3.6' = 100%. SAND AND CLAY: dark yellowish brown (10 YR 4/2) to moderate yellowish brown (10 YR 5/4) with some light olive gray (5 Y 5/2) and dark reddish brown (10 R 3/4) at 4.0-6.0'; some iron staining dark yellowish orange (10 YR 6/6); some caliche; some quartzite gravel subangular to angular; some clay; sand 2.0-3.0 phi, fairly well sorted; subrounded to subangular; damp.	10.0': Field screen readings: HNu = 0.2'; OVA = 0.3. 11.7-12.6': Contact sample: BH318713CT. 15.0': Field screen readings: HNu = 0.2; OVA = 0.3. 15.7-22.85': Bedrock sample: BH318716BR.
15				
20				

LOG OF BOREHOLE

Location Rocky Flats Plant; Mound Area
Coordinates N 36498.76 E 22297.23
Total Depth 22.85'

Borehole/Well No. BH31-87
Ground Surface Elevation 5973.80'
Water Level Encountered None
Static N/A

Drilling Company Boyles Bros
Date Drilled August 4, 1987
Drilling Method Hollow Stem Auger
Logged By K. D. Holliway
Geologist

Driller R. Sharp
Helper J. Duncan
Drilling Fluid None
Checked By [signature]
Site Manager

CEARP Manager

Comments Borehole backfilled with Portland Type I cement

Depth Feet	Graphic Log	Sample Type	Lithologic Description	Samples Collected or Other Tests Performed
20			7.6-10.1' SAMPLE. Recovered 2.15/2.5' = 84%. SAND AND CLAY: moderate yellowish brown (10 YR 5/4) and dark yellowish orange (10 YR 6/6) to light brown (5 YR 4/4) iron staining; sand 3.0-2.0 phi, fairly well sorted; subrounded to subangular; some caliche; damp.	20.0': Field screen readings: HNu = 0.2; OVA = 0.3.
25			10.1-12.6' SAMPLE. Recovered 2.5/2.5' = 100%. SAND AND CLAY: light olive gray (5 Y 6/1) to moderate yellowish brown (10 YR 5/4) with some dark yellowish orange (10 YR 6/6) iron staining; some subangular quartzite gravel; sand 3.5-4.0 phi, fairly well sorted, subrounded to subangular; some clay; some caliche; damp.	
			12.6-15.1' SAMPLE. Recovered 2.5/2.5' = 100%. 12.6-12.7': SAND AND CLAY: same as above; damp.	
			ARAPAHOE FORMATION	
			12.7-15.1': CLAYSTONE: light olive gray (5 Y 6/1) to (5 Y 5/2); with some dark yellowish orange (10 YR 6/6) iron staining; some sand very fine-grained in lenses; damp.	

LOG OF BOREHOLE

Location Rocky Flats Plant; Mound Area
Coordinates N 36498.76 E 22297.23
Total Depth 22.85'

Borehole/Well No. BH31-87
Ground Surface Elevation 5973.80'
Water Level Encountered None
Static N/A

Drilling Company Boyles Bros
Date Drilled August 4, 1987
Drilling Method Hollow Stem Auger
Logged By K. D. Holliway
Geologist

Driller R. Sharp
Helper J. Duncan
Drilling Fluid None
Checked By [signature]
Site Manager

CEARP Manager

Comments Borehole backfilled with Portland Type I cement

Depth Feet	Graphic Log	Sample Type	Lithologic Description	Samples Collected or Other Tests Performed
			15.1-17.8' SAMPLE. Recovered 0.8/2.7' = 30%. CLAYSTONE: light olive gray (5 Y 5/2) with some light brown (5 YR 5/6) iron staining; some caliche; damp.	
			17.8-20.3' SAMPLE. Recovered 0.7/2.5' = 28%. SANDY CLAYSTONE: moderate yellowish brown (10 YR 5/4) with dark yellowish orange (10 YR 6/6) iron staining; sand very fine-grained, fairly well sorted; trace caliche; damp.	
			20.3-22.85' SAMPLE. Recovered 0.8/2.55' = 31.3%. SANDY CLAYSTONE: light olive gray (5 Y 5/2) with dark yellowish orange (10 YR 6/6) iron staining; some very fine-grained sand.	
			TOTAL DEPTH: 22.85'	

LOG OF BORING NO. CH 21-87

DATES DRILLED:
ELEVATION:
GEOLOGIST(S): DCB
DATE: 7/26/89
CHECKED BY:
DATE:

PROJECT NO: 667-11.22

TOP/BOTTOM OF CORE IN BOX	TOP/BOTTOM OF CORE IN RUN (in feet)	SAMPLE NUMBER	FEET OF CORE RECOVERED (in feet)	USCS symbol	FEET OF CORE IN RUN	FRACTURES PER FOOT	FRACTURE ANGLE	BEDDING ANGLE	GRAIN SIZE DISTRIBUTION	DEPTH IN FEET	LITHOLOGIC LOG	LITHOLOGIC DESCRIPTION
0.0	0.0 to 1.3		(1) 1.0	CL					35% gravel 25% clay sand 40% clay	1		Gravelly Sandy Clay, grayish orange (10 YR 7/4), low plasticity, root ~~[illegible]~~ OK >CB and wood fragments in upper 1.3 ft, some silt. A Gradational change occurs below 1.3 ft. - Silty Clay, light gray (N7), moderate plasticity, locally calcareous, some fine sand, trace of root fragments, localized iron staining
	1.3 to 2.0		0						>50% clay		SCB	
	2.0 to 2.4		ND							2		
	2.4 to 4.0		(1) 1.6							3		
N	4.0 to 6.2		(1) 1.5						>50% gravel >40% clay	4		~~Gravelly (SCB) Clayey Gravel, weighted calcareous pulk, very light gray~~ Gravelly Clay, moderate reddish orange (10 R 6/6), moderate plasticity, abundant sand and caliche
Bot										5		
	6.2 to 7.6		(1) 1.6							6		At 6.2 ft. a gradational change occurs. Gravelly Clay, grayish orange (10 YR 7/4), moderate plasticity, decrease in gravel, sand and caliche fraction
										7		
	7.6 to 9.05		(1) 1.4							8		Below 7.6 ft. a gradational change occurs - Silty Sandstone, very light gray (N8) and grayish orange (10 YR 7/4), bedding not apparent, highly weathered, slightly friable, very fine grained
9.05	9.05									9		
9.05	9.05 to 9.75		(1) .5									
	9.75 to 10.1		0									

NOTES: General: The USCS is modified for this log as follows: Material amounts are estimated by percent volume instead of percent weight.
(1) Badly broken core, accurate footage measurement not possible.
(2) Core breaks cannot be matched, accurate footage measurement not possible.

ROCKY FLATS PLANT

FIGURE NO.

15.

NO. BH 21-87

DATES DRILL
ELEVATION:
GEOLOGIST(S
DATE: 7/26/
CHECKED BY:

PROJECT NO: 667-11.22

TOP/BOTTOM OF CORE IN BOX	TOP/BOTTOM OF CORE IN FOOT INTERVAL			USCS LOG	LITHOLOGIC DESCRIPTION
	10.1 to 11.0				A gradational change occurs below 10.1 ft. — Clay, yellowish gray (5 Y 8/1), mottled grayish orange (10 YR 7/4), moderate plasticity, some caliche and silt trace of fine sand, localized iron staining.
	11.0 to 12.6	(1) .7	CL		As Above — Two 5 cm size gravel occur at the base of the interval from 11.0 to 12.6
Box 2 of 2	12.6 to 14.2	ND			
	14.2 to 15.1	ND			
↑ 15.9	15.1 to 15.9	(1) .45			Bottom of Box 2 of 2 at 15.9.

Note this box is marked 9.05 to 22.85 on its exterior. Core only runs from 9.05 to 15.9.

NOTES: General: The USCS is modified for this log as follows: Material amounts are estimated by percent volume instead of percent weight.
(1) Badly broken core, accurate footage measurement not possible.
(2) Core breaks cannot be matched, accurate footage measurement not possible.

ROCKY FLATS PLANT

FIGURE NO.

STATE PLANE COORDINATE:	TOTAL DEPTH (FT): 22.9	GROUND ELEVATION (FT): 5973.8	PROJECT NUMBER: 667.11	LOG OF BORING NUMBER:
NORTH: 749486	AREA: MOUND AREA	CASING DIAMETER (IN): 0	GEOLOGIST: DCB	BH31-87
EAST: 2085405	LOCATOR NUMBER: M9	BOREHOLE DIAMETER (IN): 0	DATE DRILLED: 08/04/87	

REMARKS: Hollow Stem Auger. Borehole backfilled with Portland Type I cement.

CRITICAL SAMPLE DEPTH	GRADATIONAL SAMPLE	SAMPLE NUMBER	SAMPLE GRAIN SIZE (0% 50% 100%)	PERCENT RECOVERY (0% 100%)	RECOVERY/INTERVAL	DATUM (FT)	DEPTH (FT)	WELL OR PIEZOMETER CONSTRUCTION	LITHOLOGY	UNIFIED SOILS CLASSIFICATION OR ROCK TYPE	DESCRIPTION
					1/1.3	5973	0–1			CL:	GRAVELLY, SANDY CLAY - grayish orange (10YR 7/4), low plasticity, roots and wood fragments in upper 1.3 ft., some silt, locally calcareous.
					0/0.7	5972	1–2			NO SAMPLE:	
					0.4/0.4	5971	2–3			CL:	A gradational change occurs below 1.3 ft - SILTY CLAY, light gray (N7), moderate plasticity, locally calcareous, some fine sand, trace of root fragments, localized iron staining.
					1.6/1.6	5970	3–4			CL:	Same as above.
		BH01870013			1.5/2.2	5969	4–5			CL:	GRAVELLY CLAY - moderate reddish orange (10R 6/6), moderate plasticity, abundant sand and caliche.
					1.6/1.4	5968	5–6			CL:	At 6.2 ft. a gradational change occurs. - GRAVELLY CLAY, grayish orange (10YR 7/4), moderate plasticity, decrease in gravel, sand and caliche fraction.
					1.4/1.6	5967	7–8			SILTY SANDSTONE:	Top of Bedrock Very light gray (N8) and grayish orange (10YR 7/4), bedding not apparent, highly weathered, slightly friable, very fine grained.
		0030			0.5/0.7	5966	8–9			SILTY SANDSTONE:	Same as above.
						5965	9–10			NO SAMPLE:	

STATE PLANE COORDINATE:		TOTAL DEPTH (FT): 22.9	GROUND ELEVATION (FT):	5973.8	PROJECT NUMBER:	667.11	LOG OF BORING NUMBER:
NORTH:	749486	AREA: MOUND AREA	CASING DIAMETER (IN):	0	GEOLOGIST:	DCB	BH31-[illegible]
EAST:	2085405	LOCATOR NUMBER: M9	BOREHOLE DIAMETER (IN):	0	DATE DRILLED:	08/04/87	

REMARKS: Hollow Stem Auger. Borehole backfilled with Portland Type I cement.

CHEMICAL SAMPLE DEPTH / GRADATIONAL SAMPLE DEPTH

SAMPLE NUMBER: BH31871 3CI; BH31871 6BR

SAMPLE GRAIN SIZE: 0% 50% 100%

PERCENT RECOVERY: 0% 100%

RECOVERY/INTERVAL: 0.9 /0.9; 0.7 /1.6; 1.6 /1.6; 0.9 /0.9; 0.45 /0.79; 0 /7

DATUM (FT): 5963, 5962, 5961, 5960, 5959, 5958, 5957, 5956, 5955, 54

DEPTH (FT): 10, 11, 12, 13, 14, 15, 16, 17, 18, 19

WELL OR PIEZOMETER CONSTRUCTION

LITHOLOGY

UNIFIED SOILS CLASSIFICATION OR ROCK TYPE	DESCRIPTION
CLAYSTONE:	Yellowish gray (5Y 8/1), mottled grayish orange (10YR 7/4), moderate plasticity, some caliche and silt, trace of fine sand, localized iron staining.
CLAYSTONE:	As above - two 5 cm. size gravel occur at the base of the interval from 11.0 to 12.6.
CLAYSTONE:	As above.
CLAYSTONE:	As above.
CLAYSTONE:	As above.
NO SAMPLE:	NO SAMPLE - ASI only found core boxes to 15.9 ft. Weston logs go to 22.9 ft.

STATE PLANE COORDINATE:	TOTAL DEPTH (FT): 22.9	GROUND ELEVATION (FT):	5973.8	PROJECT NUMBER:	667.11
NORTH: 749486	AREA: MOUND AREA	CASING DIAMETER (IN):	0	GEOLOGIST:	DCB
EAST: 2085405	LOCATOR NUMBER: M9	BOREHOLE DIAMETER (IN):	0	DATE DRILLED:	08/04/87

REMARKS: Hollow Stem Auger. Borehole backfilled with Portland Type I cement.

LOG OF BORING NUMBER: BH31-87

CHEMICAL SAMPLE DEP	GRADATIONAL SAMPLE	SAMPLE NUMBER	SAMPLE GRAIN SIZE (0% 50% 100%)	PERCENT RECOVERY (0% 100%)	RECOVERY/ INTERVAL	DATUM (FT)	DEPTH (FT)	WELL OR PIEZOMETER CONSTRUCTION	LITHOLOGY	UNIFIED SOILS CLASSIFICATION OR ROCK TYPE	DESCRIPTION
						5953	20			NO SAMPLE:	NO SAMPLE
						5952	21				Note: No water encountered during drilling.
						5951	22				
						5950	23				
						5949	24				
						5948	25				
						5947	26				
						5946	27				
						5945	28				
						5944	29				

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Boring No.: BH32-87

Completed as well? No

Data in File

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____ Well Development Summaries

____ Hydraulic Conductivity Test Data and Results

____ Packer Test Data and Results

____ Water Level Data

LOG OF BOREHOLE

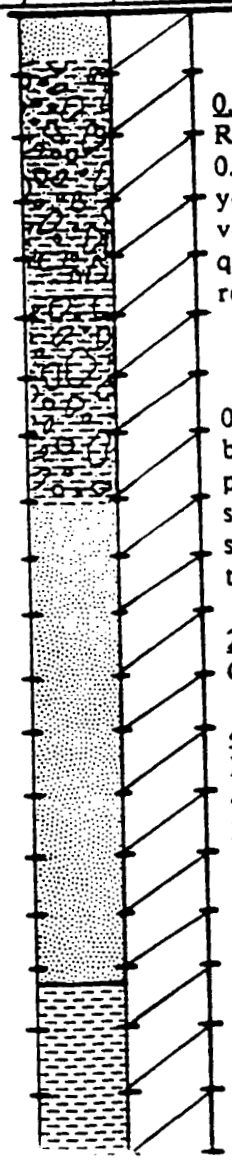
Location: Rocky Flats Plant; Mound Area
Coordinates: N 36497.67 E 22420.92
Total Depth: 20.50'

Borehole/Well No.: BH32-87
Ground Surface Elevation: 5971.70'
Water Level Encountered: 20'
Static: N/A

Drilling Company: Boyles Bros
Date Drilled: August 3, 1987
Drilling Method: Hollow Stem Auger
Logged By: L. A. Gregory-Frost, Geologist

Driller: R. Sharp
Helper: J. Duncan
Drilling Fluid: None
Checked By: [signature], Site Manager; [signature], CEARP Manager

Comments: Borehole backfilled with Portland Type I cement

Depth Feet	Graphic Log	Sample Type	Lithologic Description	Samples Collected or Other Tests Performed
0			**TOPSOIL** 0.0-2.0' SAMPLE. Recovered 1.8/2.0' = 90%. 0.0-0.85': SANDY TOPSOIL: moderate yellowish brown (10 YR 5/4); silty; sandy; very fine-grained; rounded; abundant quartzite pebbles; subangular; grasses; roots; calcareous; unconsolidated; dry. **ROCKY FLATS ALLUVIUM** 0.85-2.0': CLAYEY GRAVEL: grayish brown (5 YR 3/2); quartzite and granite pebbles and cobbles; up to 0.25' diameter; subangular to angular; calcareous; ironstone nodules; slightly sandy; consolidated to unconsolidated; dry. 2.0-4.0' SAMPLE. No recovery. Gravel as in 0.85-2.0' in cuttings. 4.0-7.7' SAMPLE. Recovered 1.4/3.7' = 38%. 4.0-4.6': CLAYEY GRAVEL: same as 0.85-2.0'; moderate yellowish brown (10 YR 5/4); unconsolidated; dry. 4.6-4.8': CALICHE: pinkish gray (5 YR 8/1); broken up; dry. 4.8-5.4': CLAYEY GRAVEL: same as 0.85-2.0'; moderate yellowish brown (10 YR 5/4); unconsolidated; dry.	HNu Background=0.4 OVA Background=0.2 No Ludlum readings taken. 0.0-8.0': Composite sample: BH32870008. 8.0-15.0': Composite sample: BH32870815. 8.0-15.0': Duplicate composite sample: BH3287815D. 10.0': Field screen readings: HNu = 0.4; OVA = 0.2. 15.0': Field screen readings: HNu = 0.4; OVA = 0.2. 15.1-16.2': Contact sample: BH328716CT. 17.2-18.0': Bedrock sample: BH328718BR.
5				
10				
15				

LOG OF BOREHOLE

Location: Rocky Flats Plant; Mound Area
Coordinates: N 36497.67 E 22420.92
Total Depth: 20.50'

Borehole/Well No.: BH32-87
Ground Surface Elevation: 5971.70'
Water Level Encountered: 20'
Static: N/A

Drilling Company: Boyles Bros
Date Drilled: August 3, 1987
Drilling Method: Hollow Stem Auger
Logged By: L. A. Gregory-Frost, Geologist

Driller: R. Sharp
Helper: J. Duncan
Drilling Fluid: None
Checked By: [signature], Site Manager

CEARP Manager

Comments: Borehole backfilled with Portland Type I cement

Depth Feet	Graphic Log	Sample Type	Lithologic Description	Samples Collected or Other Tests Performed
20			7.7-10.2' SAMPLE. Recovered 2.9/2.5' = 116%. 7.7-8.1': CLAYEY GRAVEL: same as 0.85-2.0'. 8.1-10.2': SAND: moderate yellowish brown (10 YR 5/4); very fine to fine-grained sand grading into fine to medium-grained sand at base; subangular; well sorted; slightly clayey with occasional very clayey zones; occasional caliche deposits; rare quartzite pebbles; consolidated; dry.	
25			10.2-12.7' SAMPLE. Recovered 2.9/2.5' = 116%. SAND: moderate yellowish brown (10 YR 5/4); fine to medium-grained; subangular; well sorted; interbedded slightly clayey unconsolidated zones with occasional very clayey calcareous zones; occasional caliche deposits; rare quartzite pebbles; dry.	
			12.7-15.2' SAMPLE. Recovered 2.9/2.5' = 116%. SAND: same as 10.2-12.7'; dry.	
			15.5-18.0' SAMPLE. Recovered 3.0/2.5' = 120%. 15.5-16.2': SAND: same as 10.2-12.7'; no pebbles; damp.	

LOG OF BOREHOLE

Location: Rocky Flats Plant; Mound Area
Coordinates: N 36497.67 E 22420.92
Total Depth: 20.50'

Borehole/Well No.: BH32-87
Ground Surface Elevation: 5971.70'
Water Level Encountered: 20'
Static: N/A

Drilling Company: Boyles Bros
Date Drilled: August 3, 1987
Drilling Method: Hollow Stem Auger
Logged By: L. A. Gregory-Frost, Geologist

Driller: R. Sharp
Helper: J. Duncan
Drilling Fluid: None
Checked By: [signature], Site Manager

CEARP Manager

Comments: Borehole backfilled with Portland Type I cement

Depth Feet	Graphic Log	Sample Type	Lithologic Description	Samples Collected or Other Tests Performed
			ARAPAHOE FORMATION	
			16.2-18.0': CLAYSTONE: moderate yellowish brown (10 YR 5/4) and light olive gray (5 Y 5/2); abundant very fine-grained sandy and silty layers; abundant carbonaceous debris; consolidated; weathered; damp.	
			18.0-20.5' SAMPLE. Recovered 2.5/2.5' = 100%. CLAYSTONE: same as 18.0-20.5'; fining upward; moist to saturated.	
			TOTAL DEPTH: 20.50'	

LOG OF BORING NO. BH 32-87

DATES DRILLED:
ELEVATION:
GEOLOGIST(S): TSD
DATE:
CHECKED BY: DATE: 7/17/89

USCS symbol

PROJECT NO:

TOP/BOTTOM OF CORE IN BOX	TOP/BOTTOM OF CORE IN ~~RUN~~ interval	SAMPLE NUMBER	FEET OF CORE IN ~~RUN~~ interval	~~FEET OF CORE IN RUN~~	FRACTURES PER FOOT	FRACTURE ANGLE	BEDDING ANGLE	GRAIN SIZE DISTRIBUTION	DEPTH IN FEET	LITHOLOGIC LOG	LITHOLOGIC DESCRIPTION
0.0 ↓	0.0 TO 2.0		1.23 (1)	GW				5 cm TO ~~(max)~~ 3.0 = 5% 3.0-1.0 cm = 55% <1.0 cm = 40%	1		Gravel light gray (N7) to med-gray (N5) angular to sub angular low to high sphericity, 5cm is max size, moderately graded, some sand & silt, trace of roots,
	2.0 TO 4.0		0						2, 3		No Sample
Box 1 of 2	4.0 TO 7.7		0.75 (1)	GW/GP				3.5 cm TO 1.2 cm = ~~5%~~ 10% <1.2 cm ~~95%~~ 90%	4, 5, 6, 7		Sandy gravel very light gray (N8) angular to subrounded, low to moderate ~~ty~~ sphericity moderately graded, some silty clay. trace of organics
	7.7 TO 10.2		1.73 (1)	NA					8, 9		Silty fine to very fine sandstone mottled very light gray (N8) & dark yellowish orange (10YR 6/6) Calcarious mineralization ~~in~~ as possible fracture fills, limonite staining, (well weathered / incompletely indurated ?)

NOTES:

ROCKY FLATS PLANT

FIGURE NO.

LOG OF BORING NO. BH32-87

DATES DRILLED:
ELEVATION:
GEOLOGIST(S):
DATE:
CHECKED BY: DATE:

PROJECT NO:

TOP/BOTTOM OF CORE IN BOX	TOP/BOTTOM OF CORE IN RUN	SAMPLE NUMBER	FEET OF CORE IN BOX	FEET OF CORE IN RUN	FRACTURES PER FOOT / FRACTURE ANGLE	BEDDING ANGLE	GRAIN SIZE DISTRIBUTION	DEPTH IN FEET	LITHOLOGIC LOG	LITHOLOGIC DESCRIPTION
BOX 1 of 2	10.2 TO 12.7		2.9 (1)					11, 12		Same as above
	12.7 TO ?		0.85					13		Same as above
	? TO 15.2		1.9 (1)					14, 15		Grades to a highly weathered fine sandy siltstone very pale orange (10YR 10/2), calcarious mineralization
BOX 2 of 2	15.2 TO 15.5		0							NO SAMPLE
	15.5 TO 18.0		1.9 (1)					16, 17		Same as above mottled dark yellowish orange (10YR 6/6) & very pale orange (10YR 10/2) NO calcarious mineralization.
	18.0 TO 20.5		1.87 (1)					18, 19		Same as above

NOTES:

ROCKY FLATS PLANT

FIGURE NO.

STATE PLANE COORDINATE:		TOTAL DEPTH (FT): 20.5	GROUND ELEVATION (FT):	5971.7	PROJECT NUMBER:	667.11	LOG OF BORING NUMBER:
NORTH:	749485	AREA: MOUND AREA	CASING DIAMETER (IN):	0	GEOLOGIST:	TSD	BH32-87
EAST:	2085528	LOCATOR NUMBER: M9	BOREHOLE DIAMETER (IN):	0	DATE DRILLED:	08/03/87	

REMARKS: Hollow Stem Auger. BH backfilled w/ Portland Type I cement.

CHEMICAL SAMPLE OR GRADATIONAL SAMPLE	SAMPLE NUMBER	SAMPLE GRAIN SIZE (0% – 50% – 100%)	PERCENT RECOVERY (0% – 100%)	RECOVERY/INTERVAL	DATUM (FT)	DEPTH (FT)	WELL OR PIEZOMETER CONSTRUCTION	LITHOLOGY	UNIFIED SOILS CLASSIFICATION OR ROCK TYPE	DESCRIPTION
				1.23/2	5971, 5970	0, 1, 2			GW:	GRAVEL - light gray (N7) to medium gray (N5), angular to sub-angular, low to high sphericity, 5 cm. is max. size, moderately graded, some sand and silt, trace of roots.
				0/2	5969, 5968	2, 3			NO SAMPLE:	
	BH32870008			0.75/3.7	5968, 5967, 5966, 5965, 5964	4, 5, 6, 7			GP:	SANDY GRAVEL - very light gray (N8), angular to sub-rounded, low to moderate sphericity, moderately graded, some silty clay, trace of organics.
				1.73/2.5	5964, 5963, 5962	8, 9			SANDSTONE:	Top of Bedrock Silty, fine to very fine, mottled very light gray (N8) and dark yellowish orange (10YR 6/6), calcareous mineralization as possible fracture fills, limonite staining, (well weathered/incompletely indurated?).

STATE PLANE COORDINATE:	TOTAL DEPTH (FT): 20.5	GROUND ELEVATION (FT): 5971.7	PROJECT NUMBER: 667.11	LOG OF BORING NUMBER:
NORTH: 749485	AREA: MOUND AREA	CASING DIAMETER (IN): 0	GEOLOGIST: TSD	BH32-[redacted]
EAST: 2085528	LOCATOR NUMBER: M9	BOREHOLE DIAMETER (IN): 0	DATE DRILLED: 08/03/87	

REMARKS: Hollow Stem Auger. BH backfilled w/ Portland Type I cement.

CHEMICAL SAMPLE DEPTH / GRADATIONAL SAMPLE DEPTH	SAMPLE NUMBER	SAMPLE GRAIN SIZE (0% 50% 100%)	PERCENT RECOVERY (0% 100%)	RECOVERY/INTERVAL	DATUM (FT)	DEPTH (FT)	WELL OR PIEZOMETER CONSTRUCTION	LITHOLOGY	UNIFIED SOILS CLASSIFICATION OR ROCK TYPE	DESCRIPTION
						10			SANDSTONE:	Same as above.
	60222			2.9 /2.5	5961	11				
	BH02870815				5960	12				
					5959	13			SANDSTONE:	Same as above.
				2.85 /2.5	5958	14				
					5957	15			SANDY SILTSTONE:	Grades to a highly weathered fine sandy siltstone, very pale orange (10YR 10/2), calcareous mineralization.
				0 /0.3					NO SAMPLE:	
	BH02871507				5956	16			SANDY SILTSTONE:	Same as above, mottled dark yellowish orange (10YR 6/6) and very pale orange (10YR 10/2), no calcareous mineralization.
				1.9 /2.5	5955	17				
	BH02871908R				5954	18			SANDY SILTSTONE:	Same as above.
				1.87 /2.5	5953	19				
					5952	20	08/03/87 ▽			

STATE PLANE COORDINATE:	TOTAL DEPTH (FT): 20.5	GROUND ELEVATION (FT):	5971.7	PROJECT NUMBER:	667.11
NORTH: 749485	AREA: MOUND AREA	CASING DIAMETER (IN):	0	GEOLOGIST:	TSO
EAST: 2085528	LOCATOR NUMBER: M9	BOREHOLE DIAMETER (IN):	0	DATE DRILLED:	08/03/87

REMARKS: Hollow Stem Auger. BH backfilled w/ Portland Type I cement.

LOG OF BORING NUMBER: BH32-87

CHEMICAL SAMPLE DE
GRADATIONAL SAMPLE
SAMPLE NUMBER

SAMPLE GRAIN SIZE: 0% 50% 100%

PERCENT RECOVERY: 0% 100%

RECOVERY/INTERVAL

DATUM (FT): 5951, 5950, 5949, 5948, 5947, 5946, 5945, 5944, 5943, 5942

DEPTH (FT): 20, 21, 22, 23, 24, 25, 26, 27, 28, 29

WELL OR PIEZOMETER CONSTRUCTION

LITHOLOGY

UNIFIED SOILS CLASSIFICATION OR ROCK TYPE

DESCRIPTION

LOG OF BOREHOLE

Location Rocky Flats Plant: Mound Area
Coordinates N 36499.27 E 22658.54
Total Depth 20.80'

Borehole/Well No. BH33-87
Ground Surface Elevation 5967.90'
Water Level Encountered 20.0'
Static N/A

Drilling Company Boyles Bros
Date Drilled July 30, 1987
Drilling Method Hollow Stem Auger
Logged By L. A. Gregory-Frost
Geologist

Driller R. Sharp
Helper J. Duncan
Drilling Fluid None
Checked By [signature]
Site Manager
[signature]
CERP Manager

Comments Borehole backfilled with Portland Type I cement.

Depth Feet	Graphic Log	Sample Type	Lithologic Description	Samples Collected or Other Tests Performed
0			**TOPSOIL** 0.0-2.0' SAMPLE. Recovered 2.0/2.0' = 100%. 0.0-0.7': TOPSOIL: dark yellowish brown (10 YR 4/2); clayey sand; fine-grained; rounded; abundant caliche deposits; abundant quartzite pebbles; roots; grasses; unconsolidated; dry.	HNu Background=0.0 OVA Background=0.0 Ludlum Background = 0.0. No readings over background.
5			**ROCKY FLATS ALLUVIUM** 0.7-1.0': CALICHE: pinkish gray (5 YR 8/1); soft; chalky; dry. 1.0-2.0': CLAY: moderate yellowish brown (10 YR 5/4); fine to medium-grained sandy; rounded to subangular; abundant quartzite pebbles; subangular to angular; caliche deposits; consolidated; calcareous; dry to damp.	0.0-0.4': Composite sample: BH33870004. 5.0': Field screen readings: HNu = Background; OVA = Background.
10			2.0-4.0' SAMPLE. Recovered 2.2/2.0' = 110%. CLAY: moderate yellowish brown (5 Y 4/4); fine to medium-grained sandy; rounded; silty; occasional quartzite pebbles; calcareous; consolidated; dry.	7.8-14.7': Composite sample: BH33870815. 7.8-14.7': Duplicate composite sample: BH3387815D.
15			4.0-7.8' SAMPLE. No recovery.	10.0': Field screen readings: HNu = Background; OVA = Background. 14.7-15.9': Contact sample: BH338716CT.
20				

LOG OF BOREHOLE

Location Rocky Flats Plant: Mound Area
Coordinates N 36499.27 E 22658.54
Total Depth 20.80'

Borehole/Well No. BH33-87
Ground Surface Elevation 5967.90'
Water Level Encountered 20.0'
Static N/A

Drilling Company Boyles Bros
Date Drilled July 30, 1987
Drilling Method Hollow Stem Auger
Logged By L. A. Gregory-Frost
Geologist

Driller R. Sharp
Helper J. Duncan
Drilling Fluid None
Checked By [signature]
Site Manager

CEARP Manager

Comments Borehole backfilled with Portland Type I cement.

Depth Feet	Graphic Log	Sample Type	Lithologic Description	Samples Collected or Other Tests Performed
20			7.8-10.3' SAMPLE. Recovered 2.5/2.5' = 100%. 7.8-8.3': CLAY: moderate yellowish brown (10 YR 5/4) and moderate olive brown (5 YR 4/4); caliche deposits; carbonaceous debris; calcareous; consolidated; dry. 8.3-9.1': SAND: moderate yellowish brown (10 YR 5/4); coarse-grained; well sorted; well rounded; carbonaceous debris; loose grains; unconsolidated; dry to moist. 9.1-9.95': CLAY: moderate yellowish brown (10 YR 5/4) and moderate olive brown (5 YR 4/4); caliche deposits; carbonaceous debris; calcareous; dry. 9.95-10.3': SAND: moderate yellowish brown (10 YR 5/4); coarse-grained; well sorted; well rounded; carbonaceous debris; loose grains; unconsolidated; damp to moist.	15.0': Field screen readings: HNu = Background; OVA = Background. 18.9-19.8': Bedrock sample: BH338719BR. 19.5-20.8': Water table sample: BH338720WT.
25			10.3-12.8' SAMPLE. Recovered 2.5/2.5' = 100%. 10.3-10.5': CLAY: moderate yellowish brown (10 YR 5/4) and moderate olive brown (5 YR 4/4); caliche deposits; carbonaceous debris; calcareous; consolidated; moist. 10.5-12.5': SAND: moderate yellowish brown (10 YR 5/4); fine-grained; well sorted; well rounded; unconsolidated; loose grains; moist. 12.5-12.8': CLAY: moderate yellowish brown (10 YR 5/4) and moderate olive brown (5 YR 4/4); caliche deposits; carbonaceous debris; calcareous; consolidated; moist.	

LOG OF BOREHOLE

Location: Rocky Flats Plant: Mound Area
Coordinates: N 36499.27 E 22658.54
Total Depth: 20.80'

Borehole/Well No.: BH33-87
Ground Surface Elevation: 5967.90'
Water Level Encountered: 20.0'
Static: N/A

Drilling Company: Boyles Bros
Date Drilled: July 30, 1987
Drilling Method: Hollow Stem Auger
Logged By: L. A. Gregory-Frost
Geologist

Driller: R. Sharp
Helper: J. Duncan
Drilling Fluid: None
Checked By: [signature]
Site Manager

CEARP Manager

Comments: Borehole backfilled with Portland Type I cement.

Depth Feet	Graphic Log	Sample Type	Lithologic Description	Samples Collected or Other Tests Performed
			12.8-15.3' SAMPLE. Recovered 2.5/2.5' = 100%. SAND: moderate yellowish brown (10 YR 5/4) with light gray (N 8/0); fine to medium-grained; well rounded; well sorted; alternating clayey consolidated zones with unconsolidated non clayey zones; moist.	
			15.3-17.8' SAMPLE. Recovered 2.5/2.5' = 100%. 15.3-15.9': SAND: moderate yellowish brown (10 YR 5/4); medium to coarse-grained; poorly sorted; subangular; ironstone nodules; quartzite pebbles; caliche deposits; clayey at top; carbonaceous debris; unconsolidated; moist.	
			ARAPAHOE FORMATION	
			15.9-17.2': CLAYSTONE: moderate yellowish brown (10 YR 5/4) and medium gray (N 5/0); slightly silty; weathered; moist. 17.2-17.8': SANDSTONE: moderate yellowish brown (10 YR 5/4); fine to medium-grained; rounded; well sorted; unconsolidated-loose grains; moist.	

LOG OF BOREHOLE

Location: Rocky Flats Plant: Mound Area
Coordinates: N 36499.27 E 22658.54
Total Depth: 20.80'

Borehole/Well No.: BH33-87
Ground Surface Elevation: 5967.90'
Water Level Encountered: 20.0'
Static: N/A

Drilling Company: Boyles Bros
Date Drilled: July 30, 1987
Drilling Method: Hollow Stem Auger
Logged By: L. A. Gregory-Frost, Geologist

Driller: R. Sharp
Helper: J. Duncan
Drilling Fluid: None
Checked By: [signature], Site Manager

CEARP Manager

Comments: Borehole backfilled with Portland Type I cement.

Depth Feet	Graphic Log	Sample Type	Lithologic Description	Samples Collected or Other Tests Performed
			17.8-20.3' SAMPLE. Recovered 2.5/2.5' = 100%. 17.8-19.2': SANDSTONE: same as 17.2-17.8'. 19.2-20.3': SANDSTONE/CLAYSTONE: interbedded 0.3' layers of sandstone; moderate yellowish brown (10 YR 5/4); fine to coarse-grained; poorly sorted; ironstone nodules; unconsolidated; moist with claystone; moderate yellowish brown (10 YR 5/4); slightly silty; consolidated; weathered; moist.	
			20.3-20.8' SAMPLE. Recovered 0.5/0.5' = 100%. SANDSTONE: moderate yellowish brown (10 YR 5/4); coarse-grained; well rounded; well sorted; unconsolidated; saturated.	
			TOTAL DEPTH: 20.80'	

LOG OF BORING NO. BH 33-87

DATES DRILLED:
ELEVATION:
GEOLOGIST(S): DCB/GCE
DATE: 7/19/89
CHECKED BY:
DATE:

USCS symbol

PROJECT NO: 667-11.22

TOP/BOTTOM OF CORE IN BOX	TOP/BOTTOM OF CORE IN RUN (interval)	SAMPLE NUMBER	FEET OF CORE IN BOX (interval)	FEET OF CORE IN RUN	FRACTURES PER FOOT	FRACTURE ANGLE	BEDDING ANGLE	GRAIN SIZE DISTRIBUTION	DEPTH IN FEET	LITHOLOGIC LOG	LITHOLOGIC DESCRIPTION
0.0 ↓ Box 1 of 2	0.0 to 2.0		(1) 1.5'	GP				4.5 cm to .2 cm 40% VCG to MG 15% FG 25% FINES 20%	1		SANDY SILTY GRAVEL, MED DARK GREY (N4), SUBANG-SUBROUNDED, POORLY GRADED GRAVEL, SOME CARBONATE MINERALIZATION IN FINE GRAINED FRACTION
	2.0 to 4.0		(1) 2.2'	CL				6 cm to 2 cm 10% VCG-FG 35% FINES 55%	2, 3		SILTY SANDY CLAY, LIGHT OLIVE GRAY (5Y) 6/1, LOW TO MODERATE PLASTICITY, SOME GRAVEL
			0					30-2 cm 10	4, 5, 6, 7		
	7.8 to 10.3		(1) 2.2	SP				30-2 cm 10% VCG-CG 5% MG-FG 85%	8, 9		SAND, DARK YELLOWISH ORANGE (10YR) 6/6, SUBROUNDED - WELL ROUNDED, POORLY GRADED, SOME GRAVEL AT APPROX 9.2 ft THIS INTERVAL (STONE) GRADES TO A CLAY & STONE CLAY, VERY PALE ORANGE 10YR 8/2, MOTTLED DARK YELLOWISH ORANGE 10YR 6/6 (con't)

NOTES: General: The USCS is modified for this log as follows: Material amounts are estimated by percent volume instead of percent weight.
(1) Badly broken core, accurate footage measurement not possible.
(2) Core breaks cannot be matched, accurate footage measurement not possible.

ROCKY FLATS PLANT

FIGURE NO.

LOG OF BORING NO.

DATES DRILLED:
ELEVATION:
GEOLOGIST(S): DCB/GCE
DATE: 1/19/89
CHECKED BY:
DATE:

BH-33-87

USCS SYMBOL

PROJECT NO: 667-11.22

TOP/BOTTOM OF CORE IN BOX	TOP/BOTTOM OF CORE IN RUN (INTERVAL)	SAMPLE NUMBER	FEET OF CORE IN BOX (INTERVAL)	~~FEET OF CORE IN RUN~~	FRACTURES PER FOOT	FRACTURE ANGLE	BEDDING ANGLE	GRAIN SIZE DISTRIBUTION	DEPTH IN FEET	LITHOLOGIC LOG	LITHOLOGIC DESCRIPTION
	7.8 to 10.3 cont'd		cont'd			30°			10.3		(cont'd) SAND LENSES 1.5 cm to < 1 cm THICK, IRON OXIDE STAINS ON BEDDING PLANES AND FRACTURES SOME CARBONATE MINERALIZATION
											As above, fractures not apparent
Box 1 of 2	~~10.3~~ to 12.8		(1) 2.0'					FG = 100%	11 12		FINE GRAINED SANDSTONE, YELLOWISH GRAY (5Y 8/1) AND DARK YELLOWISH ORANGE (10 YR 6/6), SUBROUNDED TO ROUNDED, POORLY GRADED, interval is heavily weathered, SOME CALCEREOUS MINERALIZATION.
~~12.8~~ Box 2 of 2 (12.8)	12.8 to ~~17.8~~ 15.3		2.3' (1) ~~4.8'~~						13 14 15		SAME AS ABOVE
↓	15.3 to 17.8		(1) 1.65'						16 17		HEAVILY WEATHERED CLAYSTONE, MOTTLED DARK YELLOWISH ORANGE (10 YR 6/6) & LIGHT GRAY (N7), IRON STAINING AND BLACK CARBONACEOUS MINERALIZATION APPARENT AT CORE BREAKS, FINE TO MEDIUM GREY SANDSTONE OCCURS IN LAST .2 FT OF THIS INTERVAL.
	17.8 to 20.3		(1) 2.0'						18 19		SANDSTONE, HEAVILY WEATHERED, MOTTLED VERY LIGHT GREY (N8) TO DARK YELLOWISH ORANGE (10YR 6/6), CLAYSTONE LENS 1 cm THICK, ~~[illegible]~~ LINEAR CARBONACEOUS MINERALIZATION APPARENT ON BEDDING PLANES, POSSIBLY PLANT REMAINS. LOWER .4 ft GRADES TO CLAYSTONE, HEAVILY WEATHERED, dark yellowish orange (10 YR 6/6), carbonaceous mineralization occurs throughout

NOTES: General: The USCS is modified for this log as follows: Material amounts are estimated by percent volume instead of percent weight.
(1) Badly broken core, accurate footage measurement not possible.
(2) Core breaks cannot be matched, accurate footage measurement not possible.

ROCKY FLATS PLANT

FIGURE NO.

LOG OF BORING NO.

DATES DRILLED:
ELEVATION:
GEOLOGIST(S): DCB/GCE
DATE: 7/19/89
CHECKED BY:

BH 33-87

USCS SYMBOL

DATE:

PROJECT NO: 667-11.22

TOP/BOTTOM OF CORE IN BOX	TOP/BOTTOM OF CORE IN RUN (INTERVAL)	SAMPLE NUMBER	FEET OF CORE IN BOX (INTERVAL)	FEET OF CORE IN RUN	FRACTURES PER FOOT	FRACTURE ANGLE	BEDDING ANGLE	GRAIN SIZE DISTRIBUTION	DEPTH IN FEET	LITHOLOGIC LOG	LITHOLOGIC DESCRIPTION
20.8	17.8-20.3 cont		(1) cont								STONE SEE PAGE 2
↓			(1) <10'					FG-VFG 80% CLAY/20%			SAND, PALE YELLOWISH ORANGE (10YR 8/6) SUBANGULAR TO SUBROUNDED, POORLY GRADED, SOME CLAY (20%)
(20.8)									21.0		BOTTOM OF BOX (20.8)

NOTE: SAMPLE JARS FROM 5, 10, 15 ft OCCUR IN THE INTERVAL FROM 17.8 - 20.3 ft.

NOTES: General: The USCS is modified for this log as follows: Material amounts are estimated by percent volume instead of percent weight.
(1) Badly broken core, accurate footage measurement not possible.
(2) Core breaks cannot be matched, accurate footage measurement not possible.

ROCKY FLATS PLANT

FIGURE NO.

STATE PLANE COORDINATE:		TOTAL DEPTH (FT): 20.8	GROUND ELEVATION (FT):	5967.9	PROJECT NUMBER:	667.11	LOG OF BORING NUMBER:
NORTH:	749488	AREA: MOUND AREA	CASING DIAMETER (IN):	0	GEOLOGIST:	DCB/GCE	BH33-[illegible]
EAST:	2085766	LOCATOR NUMBER: M9	BOREHOLE DIAMETER (IN):	0	DATE DRILLED:	07/30/87	

REMARKS: Hollow Stem Auger. BH backfilled w/ Portland Type I cement.

CRITICAL SAMPLE DEPTH / GRADATIONAL SAMPLE DEPTH	SAMPLE NUMBER	SAMPLE GRAIN SIZE	PERCENT RECOVERY	RECOVERY/INTERVAL	DATUM (FT)	DEPTH (FT)	WELL OR PIEZOMETER CONSTRUCTION	LITHOLOGY	UNIFIED SOILS CLASSIFICATION OR ROCK TYPE	DESCRIPTION
	BH03870004	50%	100% 0% 100%	1.5/2	5967	0–1			GP:	SANDY SILTY GRAVEL - med. dark gray (N4), sub-angular to sub-rounded, poorly graded gravel, some carbonate mineralization in fine grained fraction.
				2.2/2	5966, 5965, 5964	2–4			CL	SILTY SANDY CLAY - light olive gray (5Y 6/1), low to moderate plasticity, some gravel.
				0/3.8	5963, 5962, 5961	5–7			NO SAMPLE	
				2.2/2.5	5960, 5959	8–9			SP:	SAND - dark yellowish (10YR 6/6), sub-rounded to well rounded, poorly graded, some gravel.
									CLAYSTONE:	Top of Bedrock Grades to a claystone, very pale orange (10YR 8/2) mottled dark yellowish orange (10YR 6/6) sand lenses 1.5 cm. to <1 mm. thick, iron oxide stains

STATE PLANE COORDINATE:		TOTAL DEPTH (FT): 20.8	GROUND ELEVATION (FT):	5967.9	PROJECT NUMBER:	667.11	LOG OF BORING NUMBER:
NORTH:	749488	AREA: MOUND AREA	CASING DIAMETER (IN):	0	GEOLOGIST:	DCB/GCE	BH33-87
EAST:	2085766	LOCATOR NUMBER: M9	BOREHOLE DIAMETER (IN):	0	DATE DRILLED:	07/30/87	

REMARKS: Hollow Stem Auger. BH backfilled w/ Portland Type I cement.

CRITICAL SAMPLE DEPTH / GRADATIONAL SAMPLE	SAMPLE NUMBER	SAMPLE GRAIN SIZE	PERCENT RECOVERY	RECOVERY/INTERVAL	DATUM (FT)	DEPTH (FT)	WELL OR PIEZOMETER CONSTRUCTION	LITHOLOGY	UNIFIED SOILS CLASSIFICATION OR ROCK TYPE	DESCRIPTION
						10				
									CLAYSTONE:	Same as above, fractures not apparent.
	BH0387081S			2/2.5	5957	11			SANDSTONE:	Fine grained, yellowish gray (5Y 8/1) and dark yellowish orange (10YR 6/6), sub-rounded to rounded, poorly graded, interval is heavily weathered, some calcareous mineralization.
					5956	12				
					5955	13			SANDSTONE:	Same as above
	GC15			2.3/2.5	5954	14				
					5953	15				
	BH0387160T								CLAYSTONE:	Heavily weathered, mottled dark yellowish orange (10YR 6/6) to light gray (N7), iron staining and black carbonaceous mineralization apparent at core breaks, fine to medium gray sandstone occurs in last 0.2 ft. of this interval.
					5952	16				
				1.65/2.5	5951	17				
					5950	18			SANDSTONE	Heavily weathered, mottled very light gray (N8) to dark yellowish orange (10YR 6/6) Claystone lense 1 cm. thick, linear carbonaceous mineralization apparent on bedding planes, possibly plant remains.
	UNK			2/2.5	5949	19				
	BH0387198R					20	07/30/87		CLAYSTONE:	Grades to claystone, heavily weathered, dark yellowish orange (10YR 6/6),

STATE PLANE COORDINATE:	TOTAL DEPTH (FT): 20.8	GROUND ELEVATION (FT):	5967.9	PROJECT NUMBER:	667.11
NORTH: 749488	AREA: MOUND AREA	CASING DIAMETER (IN):	0	GEOLOGIST:	DCB/GCE
EAST: 2085766	LOCATOR NUMBER: M9	BOREHOLE DIAMETER (IN):	0	DATE DRILLED:	07/30/87

LOG OF BORING NUMBER: BH33-07

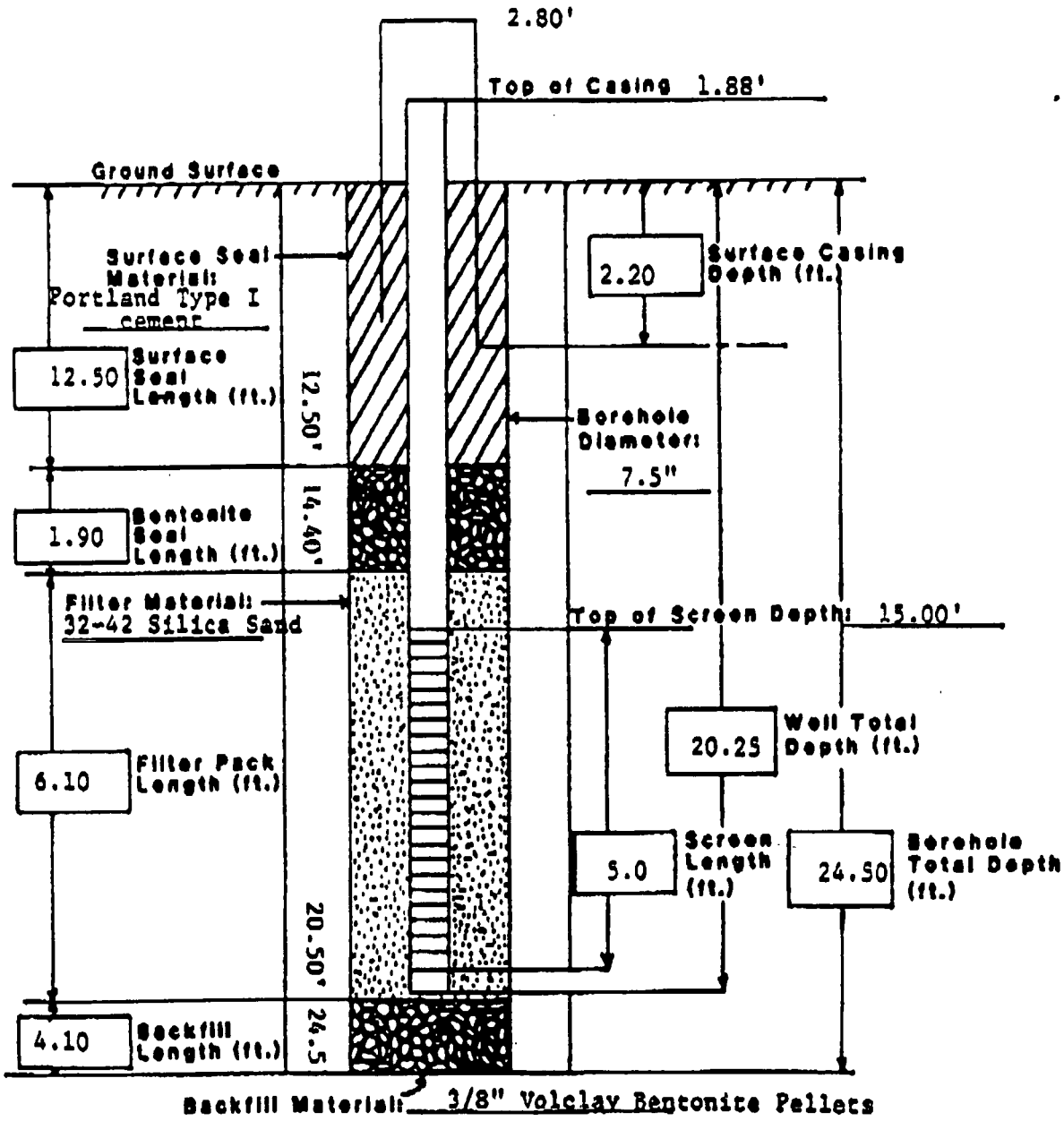
REMARKS: Hollow Stem Auger. BH backfilled w/ Portland Type I cement.

CHEMICAL SAMPLE DEPTH / GRADATIONAL SAMPLE DEPTH	SAMPLE NUMBER	SAMPLE GRAIN SIZE	PERCENT RECOVERY	RECOVERY/INTERVAL	DATUM (FT)	DEPTH (FT)	WELL OR PIEZOMETER CONSTRUCTION	LITHOLOGY	UNIFIED SOILS CLASSIFICATION OR ROCK TYPE	DESCRIPTION
										carbonaceous mineralization throughout.
	BH33872OWT	0% 50% 100%	0% 100%	0.5 /0.5		20			SANDSTONE:	Pale yellowish orange (10YR 8/6), sub-angular to sub-rounded, poorly graded, some clay (20%).
					5947	21				
					5946	22				
					5945	23				
					5944	24				
					5943	25				
					5942	26				
					5941	27				
					5940	28				
					5939	29				
					18					

WELL COMPLETION INFORMATION

Location Rocky Flats Plant: East Trenches Area
Well No. 33-87/BH56-87
Coordinates N 36859.07 E 24815.13
Elevation: Ground Surface 5945.27'
Total Depth: Well 20.25'
Top of Casing 5947.15'
Borehole 24.50'
Formation of Completion Rocky Flats Alluvium
Casing Material Sch 5, type 316 TFJ stainless steel
Casing Diameter 2" ID
Screen Material 0.010" wire wrap, type 316 TFJ stainless steel
Surface Casing Diameter 5" ID
Date installed Sept.11, 1987
Approved By [signature]
Site Manager
Installed By K.D. Holliway
Geologist
[signature]
CERAP Manager

Comments



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Boring No.: BH34-87

Completed as well? No

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____ Well Construction Summaries

____ Well Development Summaries

____ Hydraulic Conductivity Test Data and Results

____ Packer Test Data and Results

____ Water Level Data

LOG OF BOREHOLE

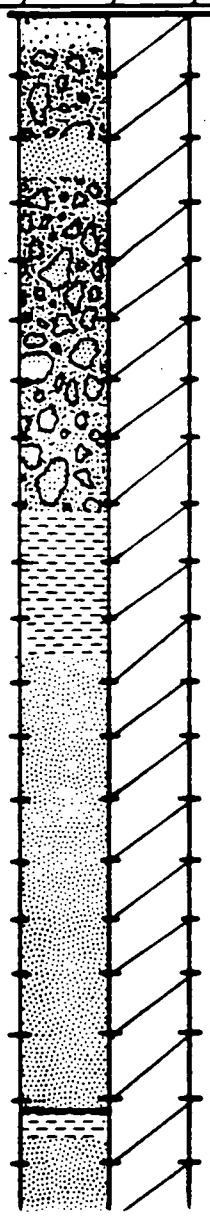
Location Rocky Flats Plant; Mound Area
Coordinates N 36473.68 E 22785.69
Total Depth 22.70'

Borehole/Well No. BH34-87
Ground Surface Elevation 5971.40'
Water Level Encountered 20'
Static N/A

Drilling Company Boyles Bros
Date Drilled July 29, 1987
Drilling Method Hollow Stem Auger
Logged By L.A. Gregory-Frost
Geologist

Driller R. Sharp
Helper J. Duncan
Drilling Fluid None
Checked By [signature]
Site Manager
[signature]
CERCLA Manager

Comments Borehole backfilled with Portland Type I cement.

Depth Feet	Graphic Log	Sample Type	Lithologic Description	Samples Collected or Other Tests Performed
0			**TOPSOIL** 0.0-2.0' SAMPLE. Recovered 1.4/2.0' = 70%. 0.0-0.6': TOPSOIL: dusky brown (5 YR 2/2); fine to medium-grained sand; moderately sorted; abundant quartzite and granite pebbles; subangular; up to 0.2' diameter; grasses; unconsolidated; dry. **ROCKY FLATS ALLUVIUM** 0.6-2.0': SANDY GRAVEL: moderate yellowish brown (10 YR 5/4); abundant quartzite and granite pebbles and cobbles; subangular to angular; medium to coarse-grained sand; subangular; well sorted; unconsolidated; dry. 2.0-4.0' SAMPLE. Recovered 1.6/2.0' = 80%. 2.0-2.6': SAND: dark yellowish brown (10 YR 4/2); very fine-grained sand; well rounded; well sorted; clayey; silty; unconsolidated; dry. 2.6-4.0': SANDY GRAVEL: moderate yellowish brown (10 YR 3/4); abundant quartzite and granite pebbles and cobbles; subangular to angular; medium to coarse-grained sand; subangular; well sorted; unconsolidated; dry.	HNu Background=0.2 OVA Background=0.0 Ludlum Background = 0.0. 0.0-8.0': Composite sample: BH34870008. 5.0': Field screen readings: HNu = Background; OVA = Background. 6.6-8.0': Perched water sample: BH348708CL. 8.0-14.7': Composite sample: BH34870815. 8.0-14.7': Duplicate composite sample: BH3487815D. HNu Background=0.6 10': Field screen readings: HNu = 0.8; OVA = 0.2.
5				
10				
15				
20				

LOG OF BOREHOLE

Location Rocky Flats Plant; Mound Area
Coordinates N 36473.68 E 22785.69
Total Depth 22.70'

Borehole/Well No. BH34-87
Ground Surface Elevation 5971.40'
Water Level Encountered 20'
Static N/A

Drilling Company Boyles Bros
Date Drilled July 29, 1987
Drilling Method Hollow Stem Auger
Logged By L.A. Gregory-Frost
Geologist

Driller R. Sharp
Helper J. Duncan
Drilling Fluid None
Checked By [signature]
Site Manager

CEARP Manager

Comments Borehole backfilled with Portland Type I cement.

Depth Feet	Graphic Log	Sample Type	Lithologic Description	Samples Collected or Other Tests Performed
20			4.0-4.7' SAMPLE. Recovered 0.9/0.7' = 128%. SANDY GRAVEL: same as 2.6-4.0'; light brown (5 YR 6/4); becomes clayey and consolidated at base; dry.	10.7-12.7': Readings on core: HNu = 1.0; OVA = Background.
			4.7-6.7' SAMPLE. Recovered 1.8/2.0' = 90%. SANDY GRAVEL: same as above (2.6-4.0').	12.7-14.7': Readings on core: HNu = Background; OVA = 2.3.
25			6.7-8.7' SAMPLE. Recovered 1.8/2.0' = 90%. 6.7-8.1': SANDY GRAVEL: same as 2.6-4.0'; moderate yellowish brown (10 YR 5/4). 8.1-8.7': CLAY: moderate yellowish brown (10 YR 5/4); very fine to fine-grained sandy; rounded to subangular; silty; consolidated; moist.	14.7-16.3': Waste sample: BH348715WS.
			8.7-10.7' SAMPLE. Recovered 2.1/2.0' = 105%. CLAY: same as above (8.1-8.7').	15.0': Field screen readings: HNu = 7; OVA = 2.9.
			10.7-12.7' SAMPLE. Recovered 2.0/2.0' = 100%. SAND: moderate yellowish brown (10 YR 5/4); fine-grained; rounded; well sorted; clayey; rare quartzite pebbles; consolidated; moist.	17.0-18.0': Contact sample: BH348718CT.
				18.0': HNu Background=1.2
				18.7-20.7': Field screen readings: HNu = 1.5; OVA = 2.0.
				21.0-22.1': Bedrock sample: BH348721BR.

LOG OF BOREHOLE

Location: Rocky Flats Plant; Mound Area
Coordinates: N 36473.68 E 22785.69
Total Depth: 22.70'

Borehole/Well No.: BH34-87
Ground Surface Elevation: 5971.40'
Water Level Encountered: 20'
Static: N/A

Drilling Company: Boyles Bros
Date Drilled: July 29, 1987
Drilling Method: Hollow Stem Auger
Logged By: L.A. Gregory-Frost
Geologist

Driller: R. Sharp
Helper: J. Duncan
Drilling Fluid: None
Checked By: [signature]
Site Manager

CEARP Manager

Comments: Borehole backfilled with Portland Type I cement.

Depth Feet	Graphic Log	Sample Type	Lithologic Description	Samples Collected or Other Tests Performed
			12.7-14.7' SAMPLE. Recovered 1.9/2.0' = 95%. SAND: moderate yellowish brown (10 YR 5/4); medium to very coarse-grained; well rounded; well sorted; rare quartzite and granite pebbles; subangular; slightly clayey; moist.	
			14.7-16.7' SAMPLE. Recovered 1.6/2.0' = 80%. SAND: same as above (12.7-14.7'); abundant quartzite and granite pebbles and cobbles.	
			16.7-18.7' SAMPLE. Recovered 2.0/2.0' = 100%. 16.7-18.1': SAND: same as above (12.7-14.7'); no pebbles from 17.4-18.1'.	
			ARAPAHOE FORMATION	
			18.1-18.7': CLAYSTONE: moderate yellowish brown (10 YR 5/4); very sandy; very fine to fine-grained; consolidated; weathered; moist.	
			18.7-20.7' SAMPLE. Recovered 1.8/2.0' = 90%. SANDSTONE: moderate yellowish brown (10 YR 5/4); fine to medium-grained; rounded; well sorted; clayey; weathered; moist.	

LOG OF BOREHOLE

Location: Rocky Flats Plant; Mound Area
Coordinates: N 36473.68 E 22785.69
Total Depth: 22.70'

Borehole/Well No.: BH34-87
Ground Surface Elevation: 5971.40'
Water Level Encountered: 20'
Static: N/A

Drilling Company: Boyles Bros.
Date Drilled: July 29, 1987
Drilling Method: Hollow Stem Auger
Logged By: L.A. Gregory-Frost
Geologist

Driller: R. Sharp
Helper: J. Duncan
Drilling Fluid: None
Checked By: [signature]
Site Manager

CEARP Manager

Comments: Borehole backfilled with Portland Type I cement.

Depth Feet	Graphic Log	Sample Type	Lithologic Description	Samples Collected or Other Tests Performed
			20.7-22.7' SAMPLE. Recovered 2.0/2.0' = 100%. SANDSTONE: moderate yellowish brown (10 YR 5/4) with light gray (N 7/0) well sorted coarse-grained sand lenses, rounded; fine to medium-grained; rounded; well sorted; slightly clayey; weathered; moist.	
			TOTAL DEPTH: 22.70'	

LOG OF BORING NO. BH 34-87

DATES DRILLED:
ELEVATION:
GEOLOGIST(S): DCB
DATE: 7/26/89
CHECKED BY: DATE:

PROJECT NO: 667-11.22

TOP/BOTTOM OF CORE IN BOX	TOP/BOTTOM OF CORE IN RUN (INTERVAL)	SAMPLE NUMBER	FEET OF CORE RECOVERED / FEET OF CORE IN RUN	USCS SYMBOL	FRACTURES PER FOOT / FRACTURE ANGLE	BEDDING ANGLE	GRAIN SIZE DISTRIBUTION	DEPTH IN FEET	LITHOLOGIC LOG	LITHOLOGIC DESCRIPTION
0.0	0.0 to 2.0		(1) 1.1				>50% Gravel	1		Gravel, medium light gray (N6), angular to subrounded, moderately graded, max. size 6 cm. some caliche, sand and silt, trace of clay, plant debris occurs in upper .2 ft. of interval.
Box 1 of 5	2.0 to 4.0		(1) 1.3	GP				2, 3		
	4.0 to 4.7		ND					4		As above, with an increase in the clay and caliche fraction ~~in the~~ the interval from 4.0 to 4.7
	4.7 to 6.7		(1) .25					5, 6		
	6.7 to 8.7		(1) .5					7, 8		
	8.7 to 10.7		(1) 1.7	SM				9		Silty Sand, grayish orange pink (5YR 7/2), subangular to rounded, poorly graded, very fine to fine grained, localized carbonate mineralization.

NOTES: General: The USCS is modified for this log as follows: Material amounts are estimated by percent volume instead of percent weight.
(1) Badly broken core, accurate footage measurement not possible.
(2) Core breaks cannot be matched, accurate footage measurement not possible.

ROCKY FLATS PLANT

FIGURE NO.

LOG OF BORING NO. BH 34-87

DATES DRILLED:
ELEVATION:
GEOLOGIST(S): DCB
DATE: 7/26/89
CHECKED BY: DATE:

PROJECT NO: 667-11.22

TOP/BOTTOM OF CORE IN BOX	TOP/BOTTOM OF CORE IN RUN (INTERVAL)	SAMPLE NUMBER	FEET OF CORE (INTERVAL)	USCS SYMBOL ~~FEET OF CORE IN RUN~~	FRACTURES PER FOOT	FRACTURE ANGLE	BEDDING ANGLE	GRAIN SIZE DISTRIBUTION	DEPTH IN FEET	LITHOLOGIC LOG	LITHOLOGIC DESCRIPTION
Box 1 of 3 / 10.7	8.7 to 10.7		(1) 1.7								see previous page
10.7	10.7 to 12.7	GS	ND						11, 12		
Box 2 of 3	12.7 to 14.7		ND		SM				13, 14		
	14.7 to 16.7		(1) .45						15, 16		As above with some gravel, ~~subang~~ DCB variegated pink, gray, grayish white, subangular, poorly graded in interval from 14.7 ft to 16.7 ft.
	16.7 to 18.7		(1) 1.0						17, 18		~~Si~~ DCB A gradational change occurs at approximately 16.7 ft. Silty Sandstone, very light gray (N8) to yellowish gray (5Y 8/1), bedding is <1mm to 2mm thick, appears to have slumped during coring but is probably horizontal, highly weathered, highly friable,
	18.7 to 20.7		ND						19		

NOTES: General: The USCS is modified for this log as follows: Material amounts are estimated by percent volume instead of percent weight.
(1) Badly broken core, accurate footage measurement not possible.
(2) Core breaks cannot be matched, accurate footage measurement not possible.

ROCKY FLATS PLANT

FIGURE NO.

LOG OF BORING NO. DH 34-87

DATES DRILLED:
ELEVATION:
GEOLOGIST(S): DCB
DATE: 7/25/89
CHECKED BY: DATE:

USCS SYMBOL

PROJECT NO: 667-11.22

TOP/BOTTOM OF CORE IN BOX	TOP/BOTTOM OF CORE IN RUN (INTERVAL)	SAMPLE NUMBER	FEET OF CORE (INCHES)	~~FEET OF CORE IN RUN~~	FRACTURES PER FOOT	FRACTURE ANGLE	BEDDING ANGLE	GRAIN SIZE DISTRIBUTION	DEPTH IN FEET	LITHOLOGIC LOG	LITHOLOGIC DESCRIPTION
Box 2 of 3 ↑ 20.7	18.7 to 20.7		ND						20		(cont'd from previous page), very fine grained, well sorted clay is present in sufficient amount to give a ground sample low plasticity, iron staining and possible mg oxides occur along bedding planes.
	20.7 to 22.7		(1) .8						21, 22		
Box 3 of 3 ↑ 24.7	22.7 to 24.7		ND						23, 24		
									25		Bottom of Box 3 of 3 at 24.7 ft.

NOTES: General: The USCS is modified for this log as follows: Material amounts are estimated by percent volume instead of percent weight.
(1) Badly broken core, accurate footage measurement not possible.
(2) Core breaks cannot be matched, accurate footage measurement not possible.

ROCKY FLATS PLANT

FIGURE NO.

STATE PLANE COORDINATE:		TOTAL DEPTH (FT): 24.7	GROUND ELEVATION (FT)	5971.4	PROJECT NUMBER:	667.11	LOG OF BORING NUMBER:
NORTH:	749463	AREA: MOUND AREA	CASING DIAMETER (IN):	0	GEOLOGIST:	DCB	BH34-87
EAST:	2085893	LOCATOR NUMBER: M9	BOREHOLE DIAMETER (IN):	0	DATE DRILLED:	07/29/87	

REMARKS: Hollow Stem Auger. BH backfilled w/ Portland Type I cement.

CHEMICAL SAMPLE DEPTH / GRADATIONAL SAMPLE / SAMPLE NUMBER	SAMPLE GRAIN SIZE (0% 50% 100%)	PERCENT RECOVERY (0% 100%)	RECOVERY/INTERVAL	DATUM (FT)	DEPTH (FT)	WELL OR PIEZOMETER CONSTRUCTION	LITHOLOGY	UNIFIED SOILS CLASSIFICATION OR ROCK TYPE	DESCRIPTION
			1.1 /2	5971	0			GP:	GRAVEL - medium light gray (N6), angular to sub-rounded, moderately graded, max. size 6 cm., some caliche, sand and silt, trace of clay, plant debris occurs in upper 2 ft. of interval.
			1.3 /2	5970	1			GP	As above
B0487008			0.7 /0.7	5969	2			GP	As above, with an increase in the clay and caliche fraction in this interval.
60.12			0.25 /2	5968	3			GP	As above.
B0487080			0.5 /2	5967	4			GP:	As above.
			1.7 /2	5966	5			SM:	SILTY SAND - grayish orange pink (5YR 7/2), sub-angular to rounded, poorly graded, very fine to fine grained, localized carbonate mineralization.
				5965	6				
				5964	7				
				5963	8				
				5962	9				

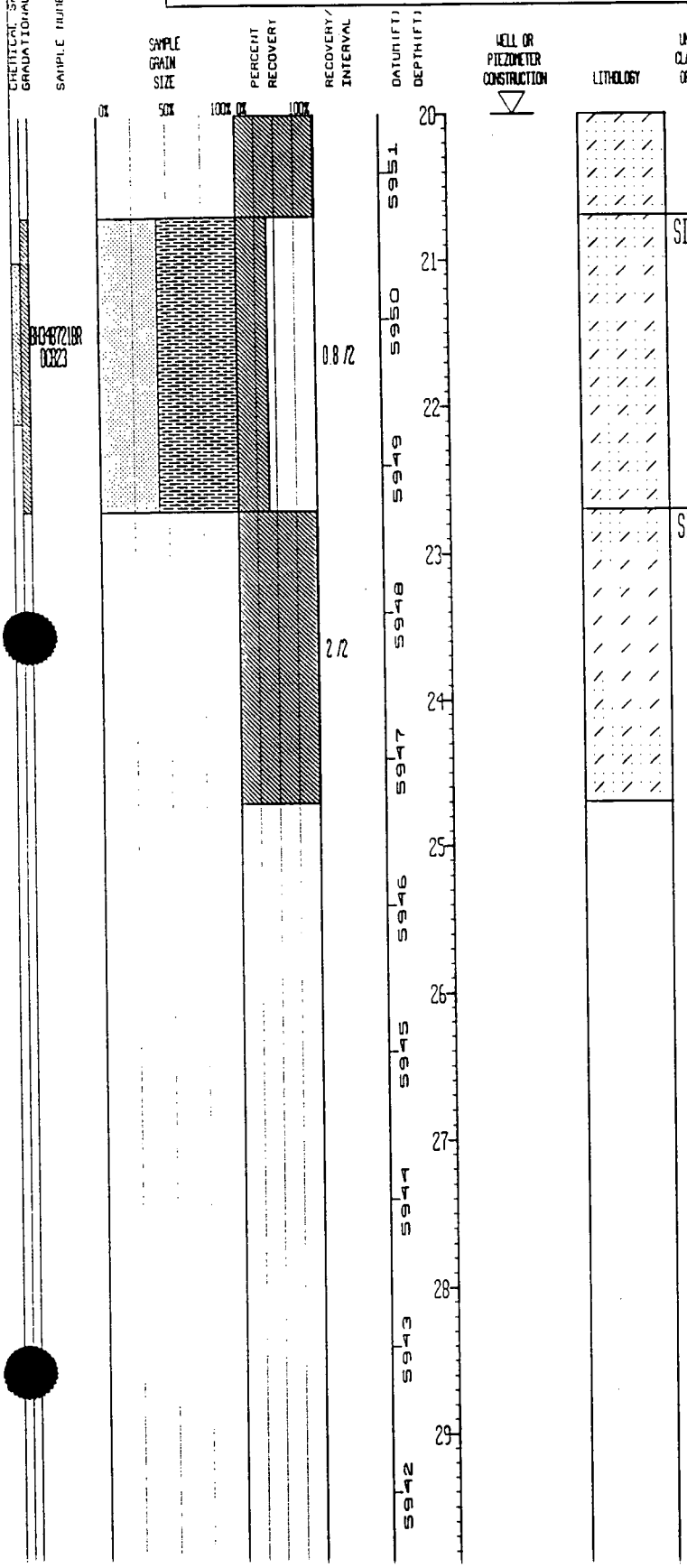
STATE PLANE COORDINATE:		TOTAL DEPTH (FT): 24.7	GROUND ELEVATION (FT):	5971.4	PROJECT NUMBER:	667.11	LOG OF BORING NUMBER:
NORTH:	749463	AREA: MOUND AREA	CASING DIAMETER (IN):	0	GEOLOGIST:	DCB	BH34-87
EAST:	2085893	LOCATOR NUMBER: M9	BOREHOLE DIAMETER (IN):	0	DATE DRILLED:	07/29/87	

REMARKS: Hollow Stem Auger. BH backfilled w/ Portland Type I cement.

CRITICAL SAMPLE DEPTH / GRADATIONAL SAMPLE DEPTH	SAMPLE NUMBER	SAMPLE GRAIN SIZE (0% 50% 100%)	PERCENT RECOVERY (0% 100%)	RECOVERY/INTERVAL	DATUM (FT)	DEPTH (FT)	WELL OR PIEZOMETER CONSTRUCTION	LITHOLOGY	UNIFIED SOILS CLASSIFICATION OR ROCK TYPE	DESCRIPTION
					5961	10				
	BH0870815			2 ft	5960	11			SM:	As above.
					5959	12				
	GCC10			2 ft	5958	13			SM	As above
					5957	14				
	BH0871515			0.5 ft	5956	15			SM:	As above with some gravel, variegated pink, gray, grayish white, sub-angular, poorly graded.
					5955	16				
	BH0871801 0324			1 ft	5954	17			SILTY SANDSTONE:	Top of Bedrock A gradational change occurs at approximately 16.7 ft. Silty sandstone, very light gray (N8) to yellowish gray (5Y 8/1), bedding is <1 mm. to 2 mm. thick, appears to have slumped during coring but is probably horizontal, highly weathered, highly friable, very fine grained, well sorted, clay is present in sufficient amount to give a ground sample low plasticity, iron staining and possible Mg oxides occur along bedding planes.
					5953	18				
				2 ft	5952	19	07/29/87		SILTY SANDSTONE:	Same as above.

STATE PLANE COORDINATE:		TOTAL DEPTH (FT): 24.7	GROUND ELEVATION (FT):	5971.4	PROJECT NUMBER:	667.11	LOG OF BORING NUMBER:
NORTH:	749463	AREA: MOUND AREA	CASING DIAMETER (IN):	0	GEOLOGIST:	DCB	BH34-87
EAST:	2085893	LOCATOR NUMBER: M9	BOREHOLE DIAMETER (IN):	0	DATE DRILLED:	07/29/87	

REMARKS: Hollow Stem Auger. BH backfilled w/ Portland Type I cement.



SILTY SANDSTONE: Same as above.

SILTY SANDSTONE: Same as above.

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Boring No.: BH35-87

Completed as well? No

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____ Well Development Summaries

____ Hydraulic Conductivity Test Data and Results

____ Packer Test Data and Results

____ Water Level Data

LOG OF BOREHOLE

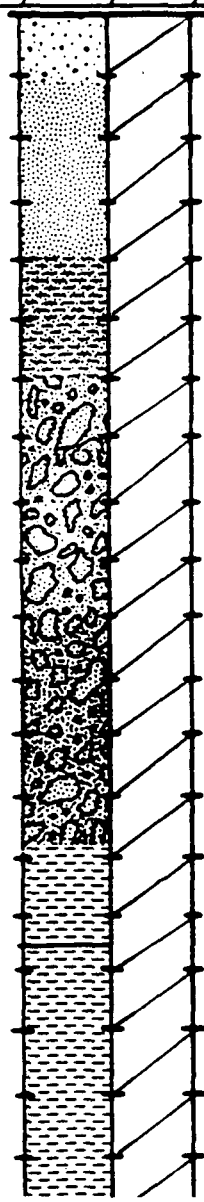
Location: Rocky Flats Plant; Mound Area
Coordinates: N 36440.4 E 22961.7
Total Depth: 20.50'

Borehole/Well No.: BH35-87
Ground Surface Elevation: 5970.50'
Water Level Encountered: None
Static: N/A

Drilling Company: Boyles Brcs
Date Drilled: July 27-28, 1987
Drilling Method: Hollow Stem Auger
Logged By: K. Holliway; L. A. Gregory-Frost
Geologist

Driller: R. Sharp
Helper: J. Duncan
Drilling Fluid: None
Checked By: [signature] Site Manager
[signature] CERP Manager

Comments: Borehole backfilled with Portland Type I cement

Depth Feet	Graphic Log	Sample Type	Lithologic Description	Samples Collected or Other Tests Performed
0			**TOPSOIL** 0.0-2.0' SAMPLE. Recovered 1.2/2.0' = 60%. 0.0-1.2': TOPSOIL: grayish brown (5 YR 3/2); very fine-grained sandy; subangular; moderately sorted; quartzite cobbles up to 0.25' diameter; subangular; trace clay; dry.	HNu Background=0.2 OVA Background=2.0 Ludlum Background = 0.0. 0.0-2.0': Readings on core: HNu = 0.3; OVA = 2.0.
5			**ROCKY FLATS ALLUVIUM** 2.0-4.0' SAMPLE. Recovered 1.9/2.0' = 95%. SAND: very pale orange (10 YR 8/2) to pale yellowish brown (10 YR 6/2) becoming very pale orange (10 YR 8/2) to grayish orange (10 YR 7/4) at 2.7'; very fine-grained; moderately sorted; subangular; dry.	5.0': Field screen readings: HNu = Background; OVA = Background. 0.0-12.3': Composite sample: BH35870012.
10			4.0-6.0' SAMPLE. Recovered 1.0/2.0' = 50%. 4.0-5.0': CLAYEY SAND: very pale orange (10 YR 8/2) to light brown (5 YR 5/6); very fine to coarse-grained; poorly sorted; quartzite cobbles up to 0.2' diameter; subangular to angular; damp.	0.0-12.3': Duplicate composite sample: BH35870012D. 10.0': Field screen readings: HNu = Background; OVA = Background.
15			6.0-7.4' SAMPLE. Recovered 1.4/1.4' = 100%. SANDY GRAVEL: moderate yellowish brown (10 YR 4/2); quartzite cobbles; subangular to angular; up to 0.25' diameter; very fine to very coarse-grained sand; poorly sorted; some clay; slightly consolidated; dry.	12.0-15.0': Composite sample: BH35871215.
20				

LOG OF BOREHOLE

Location: Rocky Flats Plant; Mound Area
Coordinates: N 36440.4 E 22961.7
Total Depth: 20.50'

Borehole/Well No.: BH35-87
Ground Surface Elevation: 5970.50'
Water Level Encountered: None
Static: N/A

Drilling Company: Boyles Bros
Date Drilled: July 27-28, 1987
Drilling Method: Hollow Stem Auger
Logged By: K. Holliway; L. A. Gregory-Frost, Geologist

Driller: R. Sharp
Helper: J. Duncan
Drilling Fluid: None
Checked By: [signature], Site Manager

CEARP Manager

Comments: Borehole backfilled with Portland Type I cement

Depth Feet	Graphic Log	Sample Type	Lithologic Description	Samples Collected or Other Tests Performed
20			8.3-10.3' SAMPLE. Recovered 1.9/2.0' = 95%. SANDY GRAVEL: moderate yellowish brown (10 YR 5/4); quartzite cobbles up to 0.2' diameter; subangular to subrounded; fine to very coarse-grained sand; subangular to subrounded; poorly sorted; some clay; slightly consolidated; damp.	14.1-15.4': Contact and waste sample: BH358715CT.
25			10.3-12.3' SAMPLE. Recovered 1.5/2.0' = 75%. SANDY GRAVEL: same as above (8.3-10.3').	15.0': Field screen readings: HNu = 1200; OVA not functioning.
			12.5-14.5' SAMPLE. Recovered 1.8/2.0' = 90%. 12.5-13.8': SANDY GRAVEL: same as 8.3-10.3'; moderate yellowish brown (10 YR 5/4) and grayish brown (5 YR 3/2); clay streaks; unconsolidated; dry. 13.8-14.5': CLAY: moderate yellowish brown (10 YR 5/4); very fine-grained sandy; silty; occasional quartzite pebbles; consolidated; damp.	18.4-19.45': Bedrock sample: BH358718BR.
			14.5-16.5' SAMPLE. Recovered 1.9/2.0' = 90%. 14.5-15.6': CLAY: same as above (13.8-14.5').	
			ARAPAHOE FORMATION	
			15.6-16.5': CLAYSTONE: moderate yellowish brown (10 YR 5/4); silty; trace very fine-grained sand; light olive gray (5 Y 6/1) lenses; weathered; damp to moist.	

LOG OF BOREHOLE

Location: Rocky Flats Plant; Mound Area
Coordinates: N 36440.4 E 22961.7
Total Depth: 20.50'

Borehole/Well No.: BH35-87
Ground Surface Elevation: 5970.50'
Water Level Encountered: None
Static: N/A

Drilling Company: Boyles Brcs
Date Drilled: July 27-28, 1987
Drilling Method: Hollow Stem Auger
Logged By: K. Holliway; L. A. Gregory-Frost
Geologist

Driller: R. Sharp
Helper: J. Duncan
Drilling Fluid: None
Checked By: [signature]
Site Manager

CEARP Manager

Comments: Borehole backfilled with Portland Type I cement

Depth Feet	Graphic Log	Sample Type	Lithologic Description	Samples Collected or Other Tests Performed
			16.5-18.5' SAMPLE. Recovered 2.0/2.0' = 100%. CLAYSTONE: same as above (15.6-16.5').	
			18.5-20.5' SAMPLE. Recovered 2.0/2.0' = 100%. CLAYSTONE: same as above (15.6-16.5').	
			TOTAL DEPTH: 20.50'	

LOG OF BORING NO. BH 35-87

GEOLOGIST(S): [illegible]
DATE: 8/30/89

PROJECT NO: 6671/22

TOP/BOTTOM OF CORE IN BOX	TOP/BOTTOM OF INTERVAL	FEET OF CORE IN INTERVAL IN BOX	SAMPLE NUMBER	FRACTURE ANGLE	BEDDING ANGLE	GRAIN SIZE DISTRIBUTION	USCS SYMBOL	DEPTH IN FEET	LITHOLOGIC LOG	LITHOLOGIC DESCRIPTION
0.0	0.0-1.2	0.8				70% GRAVEL 30% CLAY	GC	1		CLAYEY GRAVEL, top of interval matrix color w dusky yellowish brown (10 YR 2/2) bottom w light brownish gray (5 YR 6/1), sub angular - subrounded, max size = 1 cm, bottom is highly calc
	1.2-2.0	∅								NO SAMPLE
	2.0-2.7	0.3				60% GRAVEL 40% CLAY	GC	2		Same as above
	2.7-3.9	0.9				60% GRAVEL 40% CALC MATERIAL	GC	3		CALCAREOUS GRAVEL, matrix color w pinkish gray (5 YR 8/1), angular - sub angular mod-well graded, max size = 5 cm, some sand
	3.9-4.0									NO SAMPLE
	4.0-4.35	0.2				60% GRAVEL 40% CALC	GC	4		Same as above
	4.35-5.0	0.7				SAME AS ABOVE	GC			Same as above: moderate orange pink (5 YR 8/4), max size = 7 cm
	5.0-6.0	∅						5		NO SAMPLE
	6.0-6.8	0.5				50% GRAVEL 30% CALC 20% CLAY	GC	6		Same as above
	6.8-7.4	0.7				SAME	GC	7		Same as above: some clay
	7.4-8.3	0.8						8		NO SAMPLE
	8.3-9.2	0.7				SAME	GC	9		Same as above
	9.2-10.2	0.4				SAME	GC			Same as above: pale yellowish orange (10 YR 8/6)

Box 1 of 3

NOTES: General USCS is modified for this log as follows:
Material amounts are estimated by % volume instead of % weight.
(1) Badly broken core, accurate footage measurements not possible.
(2) Core breaks cannot be matched, accurate footage measurements not possible.

ROCKY FLATS PLANT

FIGURE NO.

LOG OF BORING NO. BH 35-87

GEOLOGIST(S): DAJ
DATE: 8/30/89

PROJECT NO: 667-1122

TOP/BOTTOM OF CORE IN BOX	TOP/BOTTOM OF INTERVAL	FEET OF CORE IN INTERVAL IN BOX	SAMPLE NUMBER	FRACTURE ANGLE	BEDDING ANGLE	GRAIN SIZE DISTRIBUTION	USCS SYMBOL	DEPTH IN FEET	LITHOLOGIC LOG	LITHOLOGIC DESCRIPTION
↑ 10.5	10.2-10.3	0.4				[illegible]	GC		0.5	CALCAREOUS GRAVEL, matrix color is pale yellowish orange (10 YR 8/6), angular, subangular, mod-well graded, [illegible] clay.
	10.3-10.5	0.5					GC		0.5	Same above
					50% GRAVEL 30% CALC 20% CLAY			11		BOXES. 2 & 3 OF 4 ARE NOT FOUND (could be the same as a box marked 2 OF 4, same bore hole
								12		
								13		
								14		
								15		
								16		
								17		
								18		
								19		

NOTES: General: USCS is modified for this log as follows:
Material amounts are estimated by % volume instead of % weight.
(1) Badly broken core, accurate footage measurements not possible.
(2) Core breaks cannot be matched, accurate footage measurements not possible.

ROCKY FLATS PLANT

FIGURE NO.

LOG OF BORING NO. BH 35-87(??)

GEOLOGIST(S): [illegible]
DATE: 8/30/89

PROJECT NO: 667-1122

TOP/BOTTOM OF CORE IN BOX	TOP/BOTTOM OF INTERVAL	FEET OF CORE IN INTERVAL IN BOX	SAMPLE NUMBER	FRACTURE ANGLE	BEDDING ANGLE	GRAIN SIZE DISTRIBUTION	USCS SYMBOL	DEPTH IN FEET	LITHOLOGIC LOG	LITHOLOGIC DESCRIPTION
										Box 1 of 4 is missing?
10.7 ↓ Box 2 of 4	10.7 -12.5					80% GRAVEL 20% CLAY	GC	11, 12		CLAYEY GRAVEL, grayish orange (10 YR 7/4) grading to pale yellowish brown (10 YR 6/2) angular - subangular, max size = 7 cm some FG - MG sand, slightly calc.
	12.5 -14.3					60% GRAVEL 40% CLAY	GC	13, 14		Same as above: increased calc material and FG sand at base of interval. average gravel size is smaller (≈3 cm) than above interval
	14.3-16.3					30% SAND 70% CLAY		15, 16		SANDY CLAYSTONE, very light gray (N8) and dark yell (10 YR 6/6) from apparent bedding, highly weathered mod friable, abundant iron staining, some Mg staining, sand is VFG-FG
	16.3-18.3					30% SAND 70% CLAY		17, 18		Same as above: trace of Mg staining
	18.3-20.3					30% SAND 70% CLAY		19		Same as above

NOTES: General USCS is modified for this log as follows:
Material amounts are estimated by % volume instead of % weight.
(1) Badly broken core, accurate footage measurements not possible.
(2) Core breaks cannot be matched, accurate footage measurements not possible.

ROCKY FLATS PLANT

FIGURE NO.

LOG OF BORING NO. BH 35-57 (77) PAGE 2 OF 2

GEOLOGIST(S): [illegible]
DATE: 8/30/89

PROJECT NO: 667-1122

TOP/BOTTOM OF CORE IN BOX	TOP/BOTTOM OF INTERVAL	FEET OF CORE IN INTERVAL IN BOX	SAMPLE NUMBER	FRACTURE ANGLE	BEDDING ANGLE	GRAIN SIZE DISTRIBUTION	USCS SYMBOL	DEPTH IN FEET	LITHOLOGIC LOG	LITHOLOGIC DESCRIPTION
20.3										See previous page
END OF BORES								21		Boxes 3 + 4 of 4 are missing
								22		
								23		
								24		
								25		
								26		
								27		
								28		
								29		

NOTES: General USCS is modified for this log as follows:
Material amounts are estimated by % volume instead of % weight.
(1) Badly broken core, accurate footage measurements not possible.
(2) Core breaks cannot be matched, accurate footage measurements not possible.

ROCKY FLATS PLANT

FIGURE NO.

STATE PLANE COORDINATE		TOTAL DEPTH (FT) 20 3	GROUND ELEVATION (FT)	5970 5	PROJECT NUMBER:	567 11	LOG OF BORING NUMBER:
NORTH:	7-19430	AREA: MOUND AREA	CASING DIAMETER (IN)	0	GEOLOGIST	GAT	BH35-87
EAST:	2086069	LOCATOR NUMBER: N9	BOREHOLE DIAMETER (IN)	0	DATE DRILLED:	07/28/87	

REMARKS: Hollow Stem Auger. Borehole backfilled with Portland Type I cement

CHEMICAL SAMPLE NO. / GRADATIONAL SAMPLE	SAMPLE NUMBER	SAMPLE GRAIN SIZE (0% 50% 100%)	PERCENT RECOVERY (0% 100%)	RECOVERY / INTERVAL	DATUM (FT)	DEPTH (FT)	WELL OR PIEZOMETER CONSTRUCTION	LITHOLOGY	UNIFIED SOILS CLASSIFICATION OR ROCK TYPE	DESCRIPTION
				0.8 /1.2	5970	0			GC	Clayey Gravel - top of interval matrix color is dusky yellowish brown (10YR 2/2), bottom is light brownish gray (5YR 6/1), sub-angular to sub-rounded, max. size = 7 cm., bottom is highly calc.
				0 /0.8	5969	1			NO SAMPLE	
				0.3 /0.7	5968	2			GC	Same as above
				0.9 /1.2	5967	3			GC	CALCAREOUS GRAVEL - matrix color is pinkish gray (5YR 8/1), angular to sub-angular, mod. - well graded, max. size = 5 cm., some sand.
				0 /0.09		4			NO SAMPLE	
				0.2 /0.35					GC	Same as above
				0.7 /0.65	5966				GC	Same as above: moderate orange pink (5YR 8/4), max. size = 7 cm
				0 /1	5965	5			NO SAMPLE	
	BH35870012			0.5 /0.8	5964	6			GC	Same as above.
				0.7 /0.6	5963	7			GC	Same as above: some clay.
				0 /0.9		8			NO SAMPLE	
				0.7 /0.9	5962	9			GC	Same as above.
				0.9 /1	5961	10			GC	Same as above: Pale yellowish orange (10YR 8/6).

STATE PLANE COORDINATE		TOTAL DEPTH (FT) 20.3	GROUND ELEVATION (FT) 5970.5	PROJECT NUMBER 567.11	LOG OF BORING NUMBER
NORTH: 719430		AREA: MOUND AREA	CASING DIAMETER (IN) 0	GEOLOGIST: DAT	BH35-[redacted]
EAST: 2086069		LOCATOR NUMBER: N9	BOREHOLE DIAMETER (IN): 0	DATE DRILLED: 07/28/87	

REMARKS: Hollow Stem Auger. Borehole backfilled with Portland Type I cement

CRITICAL SAMPLE DEPTH / GRADATIONAL SAMPLE DEPTH	SAMPLE NUMBER	SAMPLE GRAIN SIZE (0% 50% 100%)	PERCENT RECOVERY (0% 100%)	RECOVERY / INTERVAL	DATUM (FT)	DEPTH (FT)	WELL OR PIEZOMETER CONSTRUCTION	LITHOLOGY	UNIFIED SOILS CLASSIFICATION OR ROCK TYPE	DESCRIPTION
				0.1/0.1		10			GC	CALCAREOUS GRAVEL - matrix color is pale yellowish orange (10YR 8/6), angular to sub-angular, mod. - well graded, max. size = 5 cm., some sand, trace of clay.
				0.5/0.2	5960					
				0/0.2						
						11			GC	Same as above
									NO SAMPLE	
				0.8/11.3	5959				GC	Clayey Gravel - grayish orange (10YR 7/4) grading to pale yellowish brown (10YR 6/2), angular to sub-angular, max size = 7 cm., some FG-MG sand, slightly calc.
						12				
					5958				GC	Same as above: increased calc. material and FG sand at base of interval. Average gravel size is smaller than above interval (approx. 3 cm.).
	BH35871215			1.8/1.8	5957	13				
						14			SANDY CLAYSTONE	Top of Bedrock Very light gray (N8) and dark yellowish orange (6YR 6/6), non-apparent bedding, highly weathered, mod friable, abundant iron staining, some Mg staining, sand is VFG - FG.
	BH35871SC1				5956					
				2/2	5955	15				
						16			SANDY CLAYSTONE	Same as above: trace of Mg staining.
	UNK				5954					
				2/2	5953	17				
						18			SANDY CLAYSTONE	Same as above.
	BH35871BBR				5952					
				2/2	5951	19				
						20				

STATE PLANE COORDINATE		TOTAL DEPTH (FT) 20.3	GROUND ELEVATION (FT)	5970.5	PROJECT NUMBER:	367.11	LOG OF BORING NUMBER:
NORTH:	749430	AREA: MOUND AREA	CASING DIAMETER (IN):	0	GEOLOGIST:	DAT	BH35-87
EAST:	2086069	LOCATOR NUMBER: N9	BOREHOLE DIAMETER (IN):	0	DATE DRILLED:	07/28/87	

REMARKS Hollow Stem Auger. Borehole backfilled with Portland Type I cement

CHEMICAL SAMPLE / GRADATIONAL SAMPLE DEPTH	SAMPLE NUMBER	SAMPLE GRAIN SIZE (0% 50% 100%)	PERCENT RECOVERY (0% 100%)	RECOVERY/ INTERVAL	DATUM (FT)	DEPTH (FT)	WELL OR PIEZOMETER CONSTRUCTION	LITHOLOGY	UNIFIED SOILS CLASSIFICATION OR ROCK TYPE	DESCRIPTION
				0/0.2	5950	20			NO SAMPLE:	NOTE: No water encountered while drilling.
					5949	21				
					5948	22				
					5947	23				
					5946	24				
					5945	25				
					5944	26				
					5943	27				
					5942	28				
					5941	29				
						30				

INDEX OF DATA

Boring No.: BH36-87

Completed as well? No

Data in File

x Log of Borehole

____ Well Construction Summaries

____ Well Development Summaries

____ Hydraulic Conductivity Test Data and Results

____ Packer Test Data and Results

____ Water Level Data

LOG OF BOREHOLE

Location: Rocky Flats Plant: Mound Area
Coordinates: N 36512.16 E 23042.08
Total Depth: 26.00'

Borehole/Well No.: BH36-87
Ground Surface Elevation: 5969.40'
Water Level Encountered: None
Static: N/A

Drilling Company: Boyles Bros
Date Drilled: July 20, 1987
Drilling Method: Hollow Stem Auger
Logged By: J. B. Bergman, Geologist

Driller: T. High
Helper: J. Duncan
Drilling Fluid: None
Checked By: [signature], Site Manager
[signature], CERP Manager

Comments: Borehole backfilled with Portland Type I cement

Depth Feet	Graphic Log	Sample Type	Lithologic Description	Samples Collected or Other Tests Performed
0			**ROCKY FLATS ALLUVIUM**	HNu Background=0.8 OVA Background=10.8 Ludlum Background=0.0
			0.0-2.0' SAMPLE. Recovered 1.3/2.0' = 65%. GRAVEL AND COBBLES: moderate yellowish brown (10 YR 5/4); clay matrix; gray quartzite cobbles and pebbles; unsorted; unconsolidated; abundant caliche; abundant roots and grasses; slightly moist.	
5				0.0-5.0': Composite sample: BH36870005.
			2.0-4.0' SAMPLE. Recovered 2.0/2.0' = 100%. GRAVEL AND COBBLES: same as above; no vegetation; more caliche; granite pebbles; slightly moist.	0.0-5.0': Duplicate composite sample: BH36870005D.
			4.0-6.0' SAMPLE. Recovered 1.3/2.0' = 65%. GRAVEL AND COBBLES: same as above; slightly moist.	4.6-5.5': Waste sample: BH368705WS.
10				5.0': Field screen readings: HNu = 1.2; OVA = 10.8.
			6.0-8.0' SAMPLE. Recovered 0.6/2.0' = 30%. GRAVEL: moderate yellowish brown (10 YR 5/4); clay matrix; quartzite and granite gravel; subangular; poorly sorted; unconsolidated; slightly moist.	5.0-15.0': Composite sample: BH36870515.
15			8.0-10.0' SAMPLE. No recovery.	10.0': Field screen readings: HNu = 0.8; OVA = 10.8.
			10.0-12.0' SAMPLE. Recovered 0.6/2.0' = 30%. CLAY: moderate yellowish brown (10 YR 5/4); occasional quartzite and granite gravel; subangular; poorly sorted; unconsolidated; slightly moist.	15.0': Field screen readings: HNu = 0.8; OVA = 10.8.

LOG OF BOREHOLE

Location: Rocky Flats Plant: Mound Area
Coordinates: N 36512.16 E 23042.08
Total Depth: 26.00'

Borehole/Well No.: BH36-87
Ground Surface Elevation: 5969.40'
Water Level Encountered: None
Static: N/A

Drilling Company: Boyles Bros
Date Drilled: July 20, 1987
Drilling Method: Hollow Stem Auger
Logged By: J. B. Bergman
Geologist

Driller: T. High
Helper: J. Duncan
Drilling Fluid: None
Checked By: [signature]
Site Manager

CEARP Manager

Comments: Borehole backfilled with Portland Type I cement

Depth Feet	Graphic Log	Sample Type	Lithologic Description	Samples Collected or Other Tests Performed
20			12.0-15.0' SAMPLE. Recovered 0.65/3.0' = 20%. CLAY: light brown (5 YR 5/6); ribbons slightly; occasional gravels of quartzite; poorly sorted to well sorted; consolidated; moist.	17.7-20.4': Contact sample: BH368720CT.
			No sample from 15.0-16.20'.	20.0': Field screen readings: HNu = 0.8; OVA = 10.8.
25			16.2-19.2' SAMPLE. Recovered 1.5/3.0' = 50%. CLAY: moderate yellowish brown (10 YR 5/4); abundant quartzite pebbles; trace gravels; trace caliche; some light brown (5 YR 5/6) clay patches; dry.	23.4-24.5': Bedrock sample: BH368723BR.
			19.2-21.2' SAMPLE. Recovered 1.8/2.0' = 90%. 19.2-20.4': CLAY: same as above; dry.	25.0': Field screen readings: HNu = 0.8; OVA = 10.8.
30			**ARAPAHOE FORMATION**	
			20.4-21.0': CLAYSTONE: light olive gray (5 Y 5/2); abundant moderate yellowish brown (10 YR 5/4) mottles; consolidated; weathered; dry.	
			21.0-23.0' SAMPLE. Recovered 1.2/2.0' = 60%. CLAYSTONE: olive gray (5 Y 5/2); trace dark yellowish orange (10 YR 6/6) mottles; homogenous; unconsolidated; homogenous; dry.	

LOG OF BOREHOLE

Location: Rocky Flats Plant: Mound Area
Coordinates: N 36512.16 E 23042.08
Total Depth: 26.00'

Borehole, Well No.: BH36-87
Ground Surface Elevation: 5969.40'
Water Level Encountered: None
Static: N/A

Drilling Company: Boyles Bros
Date Drilled: July 20, 1987
Drilling Method: Hollow Stem Auger
Logged By: J. B. Bergman
Geologist

Driller: T. High
Helper: J. Duncan
Drilling Fluid: None
Checked By: [signature]
Site Manager

CEARP Manager

Comments: Borehole backfilled with Portland Type I cement

Depth Feet	Graphic Log	Sample Type	Lithologic Description	Samples Collected or Other Tests Performed
			23.0-26.0' SAMPLE. Recovered 3.0/3.0' = 100%. CLAYSTONE: same as above; some pale green (10 G 6/2) mottles; moist at 23.3-23.5'.	
			TOTAL DEPTH: 26.00'	

LOG OF BORING NO. BH 36-87

DATES DRILLED:
ELEVATION:
GEOLOGIST(S): DCB
DATE: 8/2/89
CHECKED BY:
DATE:

USCS symbol

PROJECT NO: 667-11.22

TOP/BOTTOM OF CORE IN DEG	TOP/BOTTOM OF CORE IN FEET	SAMPLE NUMBER	FEET OF CORE	FEET OF CORE	FRACTURES PER FOOT	FRACTURE ANGLE	BEDDING ANGLE	GRAIN SIZE DISTRIBUTION	DEPTH IN FEET	LITHOLOGIC LOG	LITHOLOGIC DESCRIPTION
0.0 ↓	0.0 to 1.3		(1) .6	CL				>50% Clay	1		Gravelly Clay, DCB pale yellowish brown (10 YR 6/2), low plasticity, abundant carbonate mineralization, some plant debris, caliche rind occurs on gravel.
	1.3 to 2.0		0	X					2	X	No Sample
10	2.0 to 4.0		(1) 1.3	CL				>50% Clay; Caliche	3		As above (reference interval 0.0 to 1.3), Clay component decreases below 3 ft. and is replaced by caliche
	4.0 to 5.3		0	X					4, 5	X	No Sample
	5.3 to 6.0		0	X						X	No Sample
	6.0 to 6.6		(1) .35	GC				>50% Gravel	6		Clayey Gravel, medium gray (N5), clay matrix is gray, 3b orange (10 YR 7/4), angular, poorly graded, max size 5.5 cm, some silt.
	6.6 to 10.0		0						7, 8, 9	X	No Sample

NOTES: General: The USCS is modified for this log as follows: Material amounts are estimated by percent volume instead of percent weight.
Badly broken core, accurate footage measurement not possible.
Core breaks cannot be matched, accurate footage measurement not possible.

ROCKY FLATS PLANT

FIGURE NO.

LOG OF BORING NO. BH 36-87

DATES DRILLED:
ELEVATION:
GEOLOGIST(S): DCB
DATE: 8/2/87
CHECKED BY:

USCS Symbol
DATE:

PROJECT NO: 667-11.22

TOP/BOTTOM OF CORE IN BOX	TOP/BOTTOM OF CORE IN FEET	SAMPLE NUMBER	FEET OF CORE RECOVERED	USCS SYMBOL	FRACTURES PER FOOT	FRACTURE ANGLE	BEDDING ANGLE	GRAIN SIZE DISTRIBUTION	DEPTH IN FEET	LITHOLOGIC LOG	LITHOLOGIC DESCRIPTION
	10.5 to 10.6		0								No Sample
	10.6 to 12.0		0						11, 12		No Sample
	12.0 to 12.65		0								No Sample
	12.65 to 16.2		0						13, 14, 15, 16		No Sample
	16.2 to 17.7		(1) .8	GC				>50% Gravel	17		Clayey Gravel, maximum size (US), clay matrix is grayish orange (10 YR 7/4), angular to subrounded, poorly sorted, max. size 4 cm.
	17.7 to 19.2		0						18, 19		No Sample
	19.2 to 20.4		(1) .5	GC				>50% Gravel			As above (reference interval 16.2 to 17.7 ft). max gravel size is 2.5 cm.

NOTES: General: The USCS is modified for this log as follows: Material amounts are estimated by percent volume instead of percent weight.
(1) Badly broken core, accurate footage measurement not possible.
(2) Core breaks cannot be matched, accurate footage measurement not possible.

ROCKY FLATS PLANT

FIGURE NO.

LOG OF BORING NO. 36-87

DATES DRILLED:
ELEVATION:
GEOLOGIST(S): DCB
DATE: 8/2/89
CHECKED BY:
DATE:

USCS symbol

PROJECT NO: 667-11.22

TOP/BOTTOM OF CORE IN BOX	TOP/BOTTOM OF CORE IN ROW (FT. BLOCK)	SAMPLE NUMBER	FEET OF CORE IN BOX	FEET OF CORE IN ROW	FRACTURES PER FOOT	FRACTURE ANGLE	BEDDING ANGLE	GRAIN SIZE DISTRIBUTION	DEPTH IN FEET	LITHOLOGIC LOG	LITHOLOGIC DESCRIPTION
Box 2 of 2 / 20.4	19.2 to 20.4		.5	GC				>50% sand			As above
20.4	20.4 to 21.0		ND	CL				>50% clay	21		As above upper 0.2 ft. of interval, grades to Clay. Clay, light olive gray (5Y6/1), high plasticity, localized iron [illegible]
	21.0 to 22.2		(1) .9						22		
	22.2 to 23.0		0						23		No Sample
	23.0 to 24.5		(1) .6	CL				>50% clay	24		As above (reference interval 20.6 to 22.2 ft.).
26.0	24.5 to 26.0		ND						25		
									26		[illegible] box 2 of 2 at 26.0 ft.
									27		

NOTES: General: The USCS is modified for this log as follows: Material amounts are estimated by percent volume instead of percent weight.
(1) Badly broken core, accurate footage measurement not possible.
(2) Core breaks cannot be matched, accurate footage measurement not possible.

ROCKY FLATS PLANT

FIGURE NO.

STATE PLANE COORDINATE:	TOTAL DEPTH (FT) 26	GROUND ELEVATION (FT)	5969.4	PROJECT NUMBER:	557 11	LOG OF BORING NUMBER:
NORTH: 749502	AREA: MOUND AREA	CASING DIAMETER (IN):	0	GEOLOGIST:	DCB	BH36-07
EAST: 2086149	LOCATOR NUMBER: N9	BOREHOLE DIAMETER (IN)	0	DATE DRILLED:	07/20/87	

REMARKS: Hollow Stem Auger. BH backfilled w/ Portland Type I cement

CHEMICAL SAMPLE DEPTH / GRADATIONAL SAMPLE DEPTH	SAMPLE NUMBER	SAMPLE GRAIN SIZE (0% 50% 100%)	PERCENT RECOVERY (0% 100%)	RECOVERY/INTERVAL	DATUM (FT)	DEPTH (FT)	WELL OR PIEZOMETER CONSTRUCTION	LITHOLOGY	UNIFIED SOILS CLASSIFICATION OR ROCK TYPE	DESCRIPTION
				0.6 /1.3	5969	0			CL	GRAVELLY CLAY - pale yellowish brown (10YR 6/2), low plasticity, abundant carbonate mineralization, some plant debris, caliche find occurs in gravel
				0 /0.7	5968	1			NO SAMPLE	
	BH36870005			1.3 /2	5967	2			CL	As above (reference interval 0.0 to 1.31), clay component decreases below 3 ft and is replaced by caliche
					5966	3				
				0 /1.3	5965	4			NO SAMPLE	
	BH36870015AS			0 /0.7	5964	5			NO SAMPLE	
				0.35 /0.6	5963	6			GC	Clayey Gravel - medium gray (N5), clay matrix is grayish orange (10YR 7/4), angular, poorly graded, max. size 5.5 cm., some silt
					5962	7			NO SAMPLE	
				0 /3.4	5961	8				
					5960	9				

STATE PLANE COORDINATE:	TOTAL DEPTH (FT) 26	GROUND ELEVATION (FT)	5969.4	PROJECT NUMBER:	667 11
NORTH: 749502	AREA: MOUND AREA	CASING DIAMETER (IN):	0	GEOLOGIST:	DCB
EAST: 2086149	LOCATOR NUMBER: N9	BOREHOLE DIAMETER (IN):	0	DATE DRILLED:	07/20/87

LOG OF BORING NUMBER: BH36-87

REMARKS: Hollow Stem Auger. BH backfilled w/ Portland Type I cement

CHEMICAL SAMPLE	GRADATIONAL SAMPLE	SAMPLE NUMBER	SAMPLE GRAIN SIZE	PERCENT RECOVERY	RECOVERY/ INTERVAL	DATUM (FT)	DEPTH (FT)	WELL OR PIEZOMETER CONSTRUCTION	LITHOLOGY	UNIFIED SOILS CLASSIFICATION OR ROCK TYPE	DESCRIPTION
		BH36870515			0 /0.6	5959	10			NO SAMPLE	
					0 /1.4	5958	11			NO SAMPLE	
					0 /0.65	5957	12			NO SAMPLE	
					0 /3.55	5956	13			NO SAMPLE	
						5955	14				
						5954	15				
					0.8 /1.5	5953	16			GC	Clayey Gravel - medium gray (N5), clay matrix is grayish orange (10YR 7/4), angular to sub-rounded, poorly sorted, max. size 4 cm.
					0 /1.5	5952	17			NO SAMPLE	
		BH36870001			0.5 /1.2	5951	18			GC	As above (reference interval 16.2 to 17.7 ft.), max. gravel size is 2.5 cm.
						5950	19				

STATE PLANE COORDINATE:		TOTAL DEPTH (FT): 26	GROUND ELEVATION (FT):	5969.4	PROJECT NUMBER:	667.11	LOG OF BORING NUMBER:
NORTH:	749502	AREA: MOUND AREA	CASING DIAMETER (IN):	0	GEOLOGIST:	DCB	BH36-07
EAST:	2086149	LOCATOR NUMBER: N9	BOREHOLE DIAMETER (IN):	0	DATE DRILLED:	07/20/87	

REMARKS: Hollow Stem Auger. BH backfilled w/ Portland Type I cement.

CHEMICAL SAMPLE DEPTH / GRADATIONAL SAMPLE DEPTH	SAMPLE NUMBER	SAMPLE GRAIN SIZE (0% 50% 100%)	PERCENT RECOVERY (0% 100%)	RECOVERY/INTERVAL	DATUM (FT)	DEPTH (FT)	WELL OR PIEZOMETER CONSTRUCTION	LITHOLOGY	UNIFIED SOILS CLASSIFICATION OR ROCK TYPE	DESCRIPTION
				0.6 /0.6	5949	20			CLAYSTONE:	Top of Bedrock Grades to claystone.
				0.9 /1.2	5948	21			CLAYSTONE:	Light olive gray (5Y 6/1), high plasticity, localized iron staining.
				0 /0.79	5947	22			NO SAMPLE:	
	BH06872338			0.6 /1.5	5946	23			CLAYSTONE:	As above (reference interval 20.6 to 22.2 ft.)
				1.5 /1.5	5945	24			CLAYSTONE:	As above. NOTE: No water encountered while drilling.
					5944	25				
					5943	26				
					5942	27				
					5941	28				
					5940	29				

INDEX OF DATA

Boring No.: 37-87

Completed as well? Yes

Data in File

X Log of Borehole

X Well Construction Summaries

X Well Development Summaries

____ Hydraulic Conductivity Test Data and Results

____ Packer Test Data and Results

X Water Level Data

X Saturated Thickness Hydrographs

LOG OF BOREHOLE

Location: Rocky Flats Plant; Solar Pond Area
Coordinates: N 37507.14 E 22119.81
Total Depth: 13.0'

Borehole/Well No.: 37-87
Ground Surface Elevation: 5967.03'
Water Level Encountered: None
Static:

Drilling Company: Boyles Bros.
Date Drilled: October 26, 1987
Drilling Method: Hollow Stem Auger
Logged By: R. Treat, Geologist

Driller: T. High
Helper: B. Keeney
Drilling Fluid: None
Checked By: Site Manager
CEARP Manager

Comments:

Depth Feet	Graphic Log	Sample Type	Lithologic Description	Samples Collected or Other Tests Performed
0			**ARTIFICIAL FILL/DISTURBED**	
			0.0-2.0' SAMPLE Recovered 1.11/2.0' = 70%. GRAVEL AND SAND: moderate brown (5 YR 3/4) to grayish brown (5 YR 3/2); medium and coarse sand with small gravel (0.55 mm to 2.25 mm); subangular; angular and few subrounded; weakly cemented; light; moist.	HNu background=0.6. OVA background = 2.6. Ludlum background = 0.0. 2.0-3.7': Readings in augers: HNu = 0.2; OVA = 3.2.
5			2.0-4.0' SAMPLE Recovered 1.7/2.0' = 85%. 2.0-2.7': GRAVEL AND SAND: same as above.	
			ROCKY FLATS ALLUVIUM	
10			2.7-3.7': CLAYEY GRAVEL: reddish brown; weakly to moderately cemented; poorly sorted; angular and subangular gravels; few rounded; slightly calcareous; light moist.	
			4.0-7.0' SAMPLE. Recovered 0.8/3.0' = 27%. CLAYEY GRAVEL: same as above.	
15			7.0-9.5' SAMPLE. Recovered 2.5/2.5' = 100%. 7.0-8.5': SAND AND GRAVEL: light brown (5 YR 5/6) to a moderate brown (5 YR 4/4) sand; well-sorted and range (2.0-1.5 mm) to 0.5-0.0 Ø with gravel 0.25 mm to 1.5 mm and scattered large size; medium dense; weakly cemented; moist.	
20				

LOG OF BOREHOLE

Location: Rocky Flats Plant; Solar Pond Area
Coordinates: N 37507.14 E 22119.81
Total Depth: 13.0'

Borehole/Well No.: 37-87 (cont'd.)
Ground Surface Elevation: 5967.03'
Water Level Encountered: None
Static:

Drilling Company: Boyles Bros.
Date Drilled: October 26, 1987
Drilling Method: Hollow Stem Auger
Logged By: R. Treat
Geologist

Driller: T. High
Helper: B. Keeney
Drilling Fluid: None
Checked By:
Site Manager

CEARP Manager

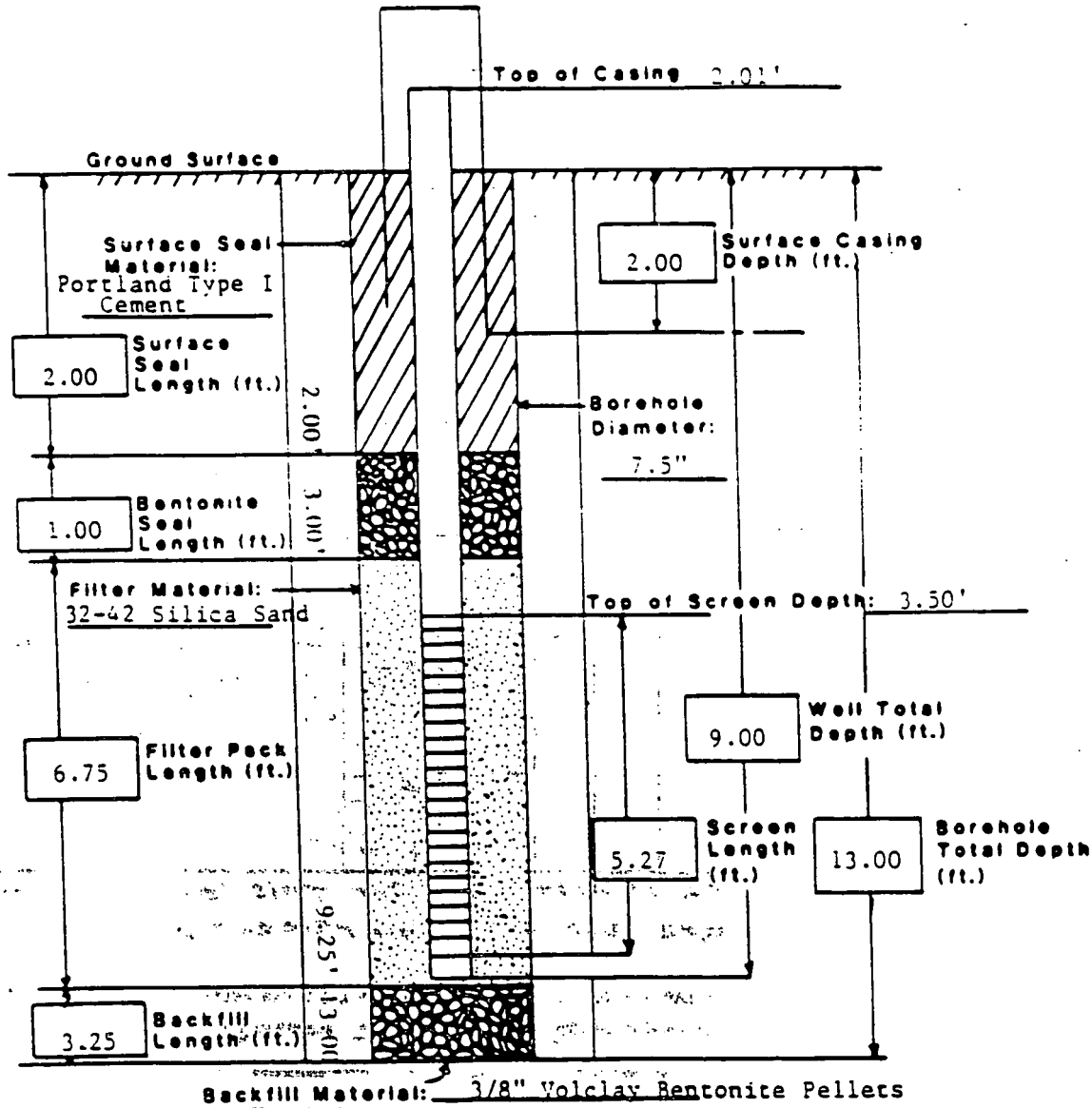
Comments:

Depth Feet	Graphic Log	Sample Type	Lithologic Description	Samples Collected or Other Tests Performed
0			**ARAPAHOE FORMATION**	
			8.5-9.5' CLAYSTONE: light gray (N 7/0) medium plastic, very calcareous in upper 12" to slightly calcareous; streaked and highly effervescess with HCl; massive; blocky; weathered; moist.	
5			9.5-13.0' SAMPLE. Recovered 3.5/3.5' = 100%. CLAYSTONE: light gray (N 7/0) to varying brownish gray; slightly oxide stained; blocky; massive; highly to moderately plastic; weathered; moist.	
			TOTAL DEPTH: 13.0'	
10				
15				
20				

WELL COMPLETION INFORMATION

Location: Rocky Flats Plant: Solar Ponds Area
Well No. 37-87
Coordinates N 37507.14 E 22119.81
Elevation: Ground Surface 5967.03'
Total Depth: Well 9.0'
Top of Casing 5969.02'
Borehole 13.0'
Formation of Completion Rocky Flats Alluvium
Casing Material Sch 5, Type 316, TFJ Stainless Steel
Casing Diameter 2" ID
Screen Material 0.010" wire wrap, Type 316, TFJ Stainless Steel
Surface Casing Diameter 5" ID
Date Installed October 27, 1987
Approved By
Installed By R. Treat
Geologist
Site Manager
CEARP Manager

Comments



LOG OF BORING NO. 37-87

DATES DRILLED:
ELEVATION:
GEOLOGIST(S): DCB
DATE: 8/1/89
CHECKED BY:

DATE:

PROJECT NO: 667-11.22

TOP/BOTTOM OF CORE IN BOX	TOP/BOTTOM OF CORE IN ROCK (FT/BLOW)	SAMPLE NUMBER	FEET OF CORE (INCHES)	USCS SYMBOL	FRACTURES PER FOOT	FRACTURE ANGLE	BEDDING ANGLE	GRAIN SIZE DISTRIBUTION	DEPTH IN FEET	LITHOLOGIC LOG	LITHOLOGIC DESCRIPTION
0.0	0.0 to 2.0		(1) 1.3					>50% Gravel	1, 2		Gravel, very light gray (N8), to medium light gray (N6), angular to subrounded, poorly graded to moderately graded, max size 5 cm, some clay, brownish gray (5 [illegible] 4/1), clay matrix has [illegible] component. [illegible] to moderate reddish brown (10 R 4/6) with [illegible] below 2.0 ft.
	2.0 to 4.0		ND						3, 4		[illegible] clay matrix is coupled with [illegible] below 4.0 ft.
	4.0 to 7.0		(1) 1.0						5, 6, 7		
	7.0 to [illegible]		ND					>50%	8, 9		Clay / Caliche - very light gray (N8), [illegible]
	[illegible]		ND								

NOTES: General: The USCS is modified for this log as follows: Material amounts are estimated by percent volume instead of percent weight.
(1) Badly broken core, accurate footage measurement not possible.
(2) Core breaks cannot be matched, accurate footage measurement not possible.

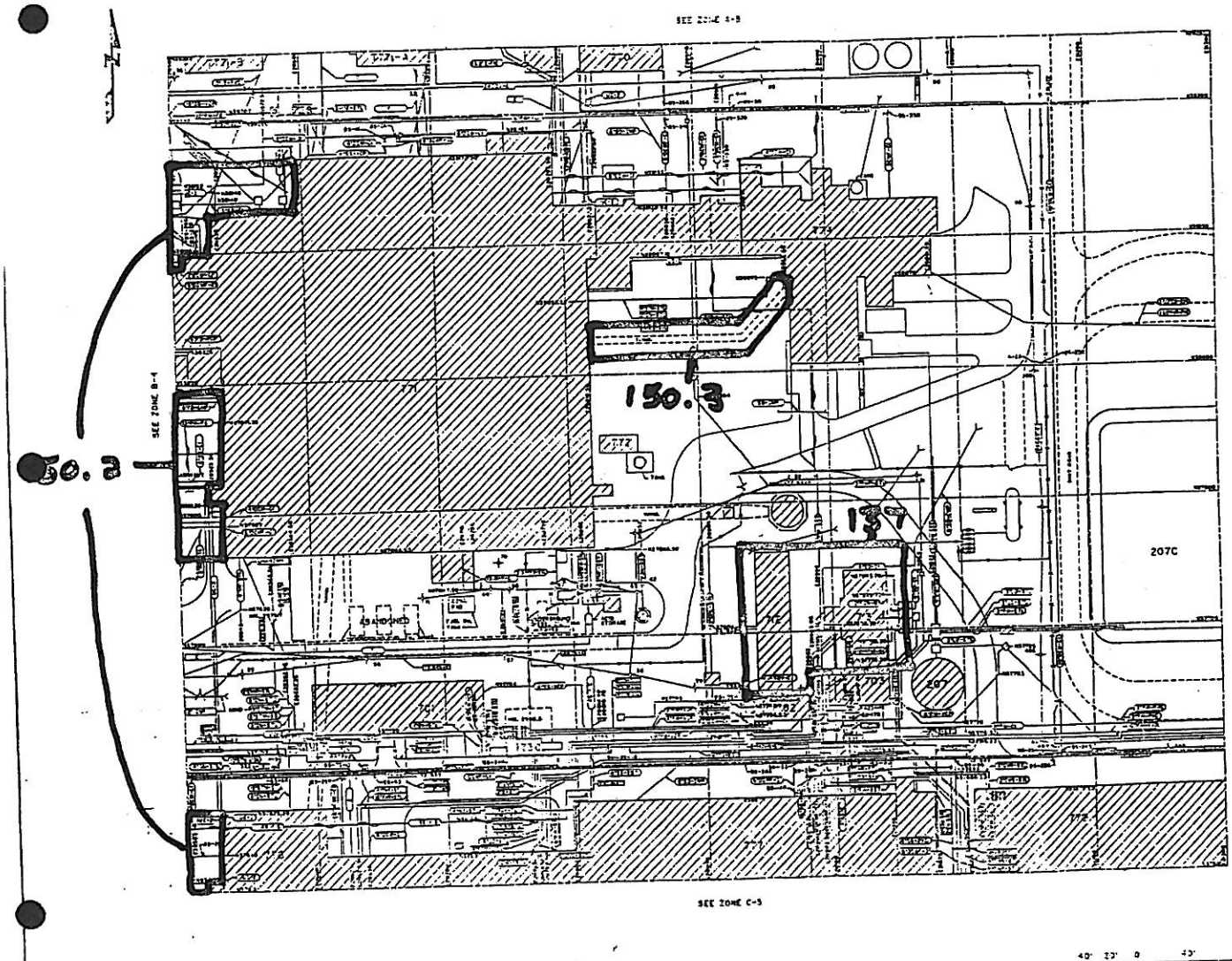
ROCKY FLATS PLANT

FIGURE NO.

STATE PLANE COORDINATE:		TOTAL DEPTH (FT): 13	GROUND ELEVATION (FT):	5967.03.	PROJECT NUMBER:	667.11	LOG OF BORING NUMBER:
NORTH:	750494	AREA: SOLAR POND	CASING DIAMETER (IN):	2 ID	GEOLOGIST:	DCB	37-87
EAST:	2085224	LOCATOR NUMBER: N10	BOREHOLE DIAMETER (IN):	7.5	DATE DRILLED:	10/26/87	

REMARKS: Hollow Stem Auger.

CHEMICAL SAMPLE DEPTH / GRADATIONAL SAMPLE DEPTH	SAMPLE NUMBER	SAMPLE GRAIN SIZE	PERCENT RECOVERY	RECOVERY/INTERVAL	DATUM (FT)	DEPTH (FT)	WELL OR PIEZOMETER CONSTRUCTION	LITHOLOGY	UNIFIED SOILS CLASSIFICATION OR ROCK TYPE	DESCRIPTION
		0% 50%	100% 0% 100%	2/2	5957	10				
					5956	11				
				1.5/1.5	5955	12			CLAYSTONE:	Yellowish gray (5Y 7/2), high plasticity, localized carbonate mineralization. NOTE: No water encountered while drilling
					5954	13				
					5953	14				
					5952	15				
					5951	16				
					5950	17				
					5949	18				
					5948	19				
						20				



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NUCLEAR INFORMATION

Reviewing J.A. Nesheim
Official: EMCBC Classin Office
Date: 11-04-08

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P	CONTROLLED DRAWING	1-17-87	
N	UPDATED	7-4-88	
A	ORIGINAL ISSUE		

U.S. DEPARTMENT OF ENERGY
ROCKY FLATS AREA OFFICE
Rockwell International
ROCKY FLATS PLANT
GOLDEN, COLORADO 80402-0464

SITE UTILITY PLANS

D 15501-13 P B-5

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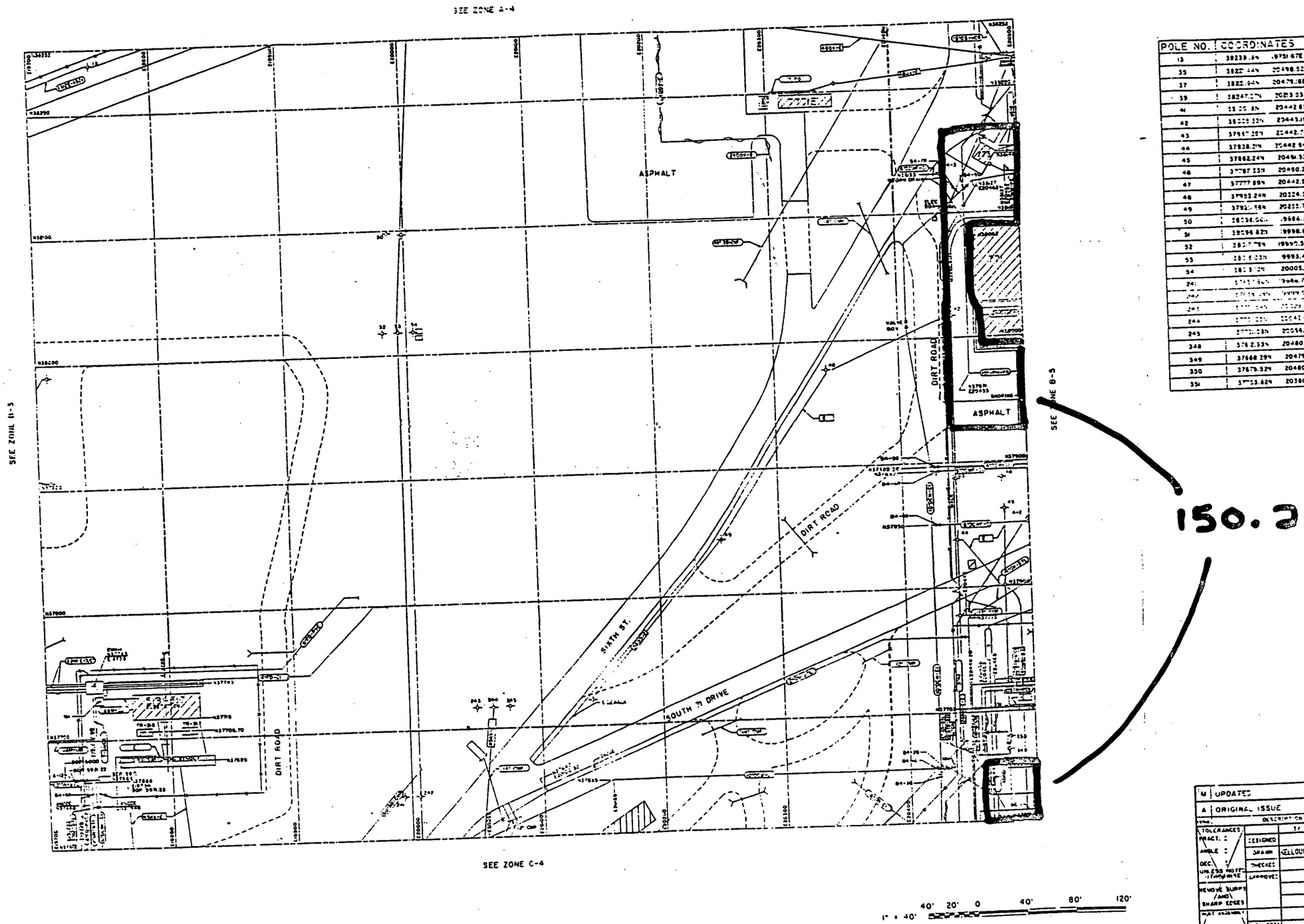

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35	3822[illegible] 20498.52E		
37	3822.94N 20479.18E		
39	38247.[illegible] 20213.53E		
41	[illegible] 20442.69E		
42	[illegible] 20443.19E		
43	37[illegible] 20442.74E		
44	37838.[illegible] 20442.94E		
45	37862.24N 20491.53E		
46	37787.33N 20490.29E		
47	37777.89N 20442.54E		
48	37953.24N 20324.32E		
49	3792[illegible] 20255.73E		
50	[illegible] 19986.38E		
51	38096.82N 19998.83E		
52	[illegible] 19990.52E		
53	[illegible] 19993.42E		
54	[illegible] 20005.75E		
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242	[illegible]		
243	[illegible]		
244	[illegible]		
245	[illegible] 20056.07E		
348	3762.93N 20480.33E		
349	37668.29N 20479.63E		
350	37679.52N 20480.91E		
351	37[illegible]3.82N 20380.17E		

M	UPDATED	7-1-86	450031
A	ORIGINAL ISSUE		

U.S. DEPARTMENT OF ENERGY
ROCKY FLATS AREA OFFICE GOLDEN COLORADO

Rockwell International
ROCKY FLATS PLANT
GOLDEN COLORADO 80402-0464

SITE UTILITY PLANS

SIZE D | DRAWING NUMBER 15501-12 | ISSUE M | SHEET B of 4

SCALE 1" = 40'-0"

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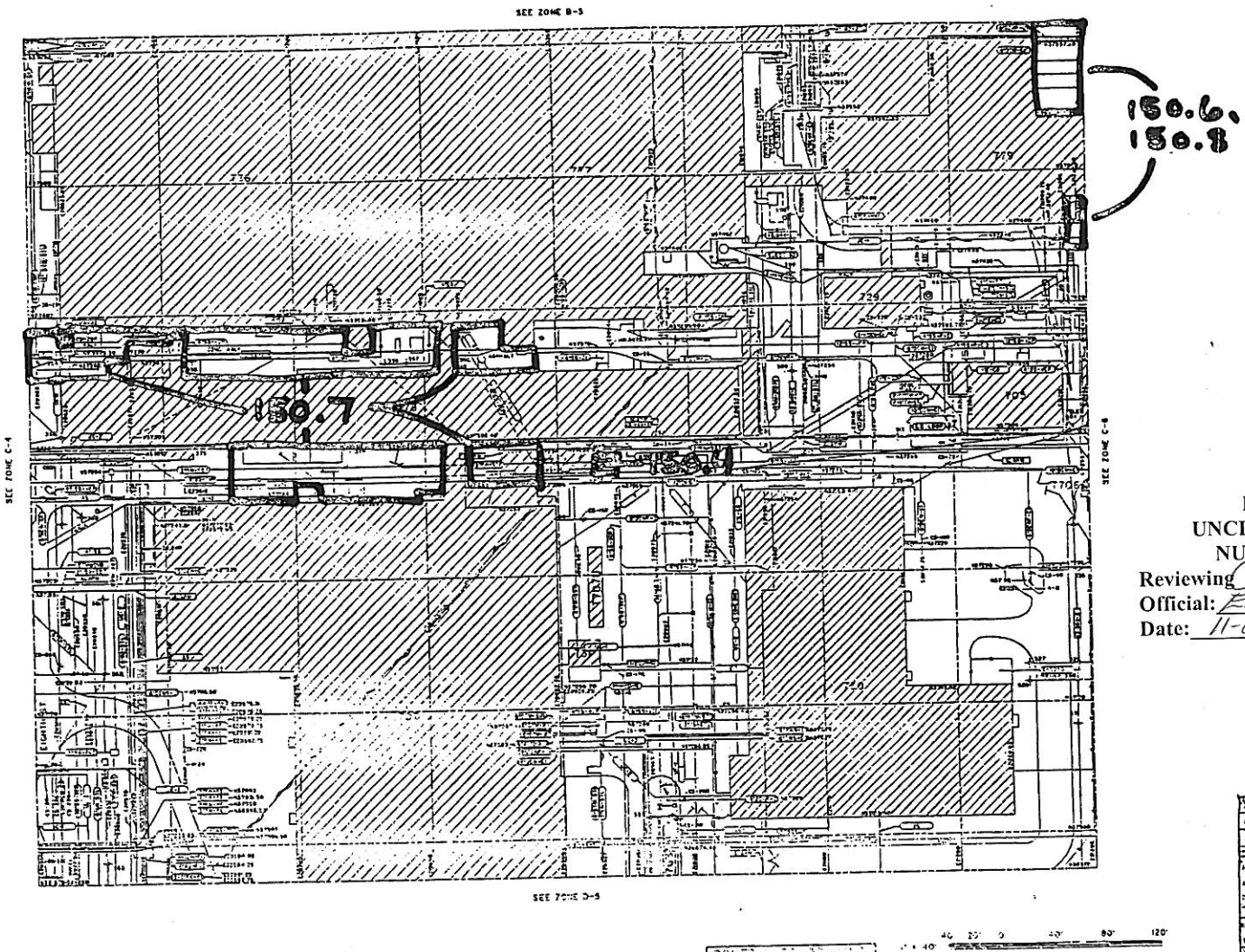
V2.U.KJK.B.4



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UNCLASSIFIED CONTROLLED
NUCLEAR INFORMATION

Reviewing J A Nesheim
Official: EMCBC Classin Office
Date: 11-04-08

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L	CONTROLLED DRAWING		470601
K	UPDATED	7-1-86	45002
A	ORIGINAL ISSUE		

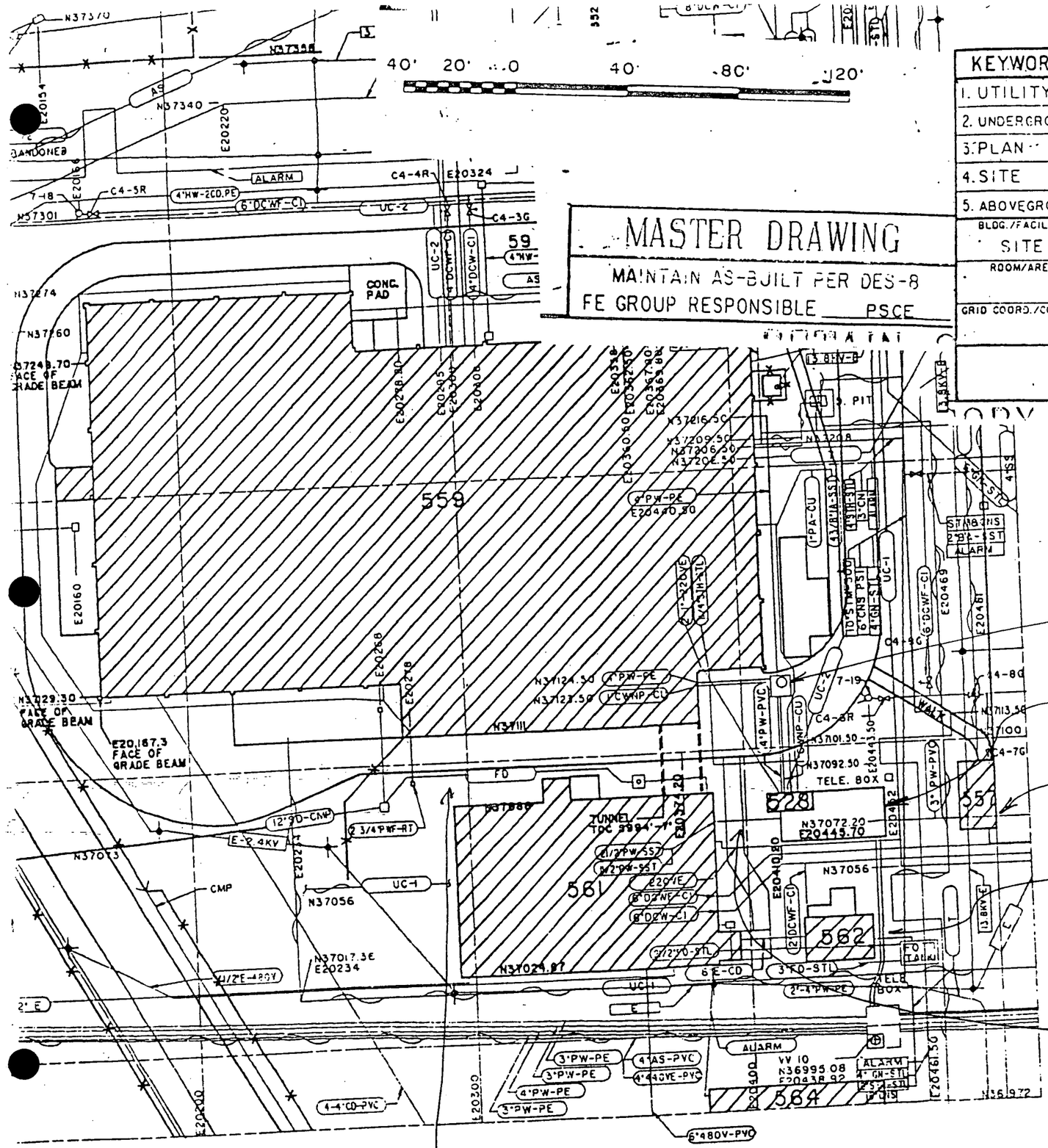
U.S. DEPARTMENT OF ENERGY
ROCKY FLATS AREA OFFICE GOLDEN, COLORADO

Rockwell International
ROCKY FLATS PLANT
GOLDEN, COLORADO 80402-0464

SITE UTILITY PLANS

D 15501-21 L C 5

CONTROLLED DRAWING RETAIN COPY COMPUTER GENERATED NO MANUAL CHANGES ALLOWED



MASTER DRAWING

MAINTAIN AS-BUILT PER DES-8

FE GROUP RESPONSIBLE PSCE

KEYWORDS								
1. UTILITY	R	ADDED MASTER STAMP	7/20/90	–	LCB	QU		CB 900458
2. UNDERGROUND	P	CONTROLLED DRAWING	1-17-87	–	WC	–	RKJ	DLG 470601
3. PLAN	ISSUE	DESCRIPTION	DATE	RFP			DOE	CLASS JOB NO.
4. SITE								
5. ABOVEGROUND								

		BY	DATE
TOLERANCES PRACT. ± ANGLE ± DEC. ± UNLESS NOTED OTHERWISE	DESIGNED	—	—
	DRAWN	KELLOUGH	7-20-83
	CHECKED	—	—
	APPROVED	TERKUN	6-17-86
REMOVE BURRS AND SHARP EDGES			
NEXT ASSEMBLY			
	SUBMITTED		
SCALE 1"=40'-0"	APPROVED RFP		
	APPROVED DOE		

BLDG./FACILITY: SITE

ROOM/AREA

GRID COORD./COL NO.

U.S. DEPARTMENT OF ENERGY

ROCKY FLATS OFFICE GOLDEN, COLORADO

Rocky Flats Plant

GOLDEN, COLORADO

SITE UTILITY PLANS

SIZE	DRAWING NUMBER	ISSUE	SHEET
D	15501-20-M	R	C OF 4

Manhole at which Process waste flows From 559 Combine prior to reaching Building 528.

Building 528.

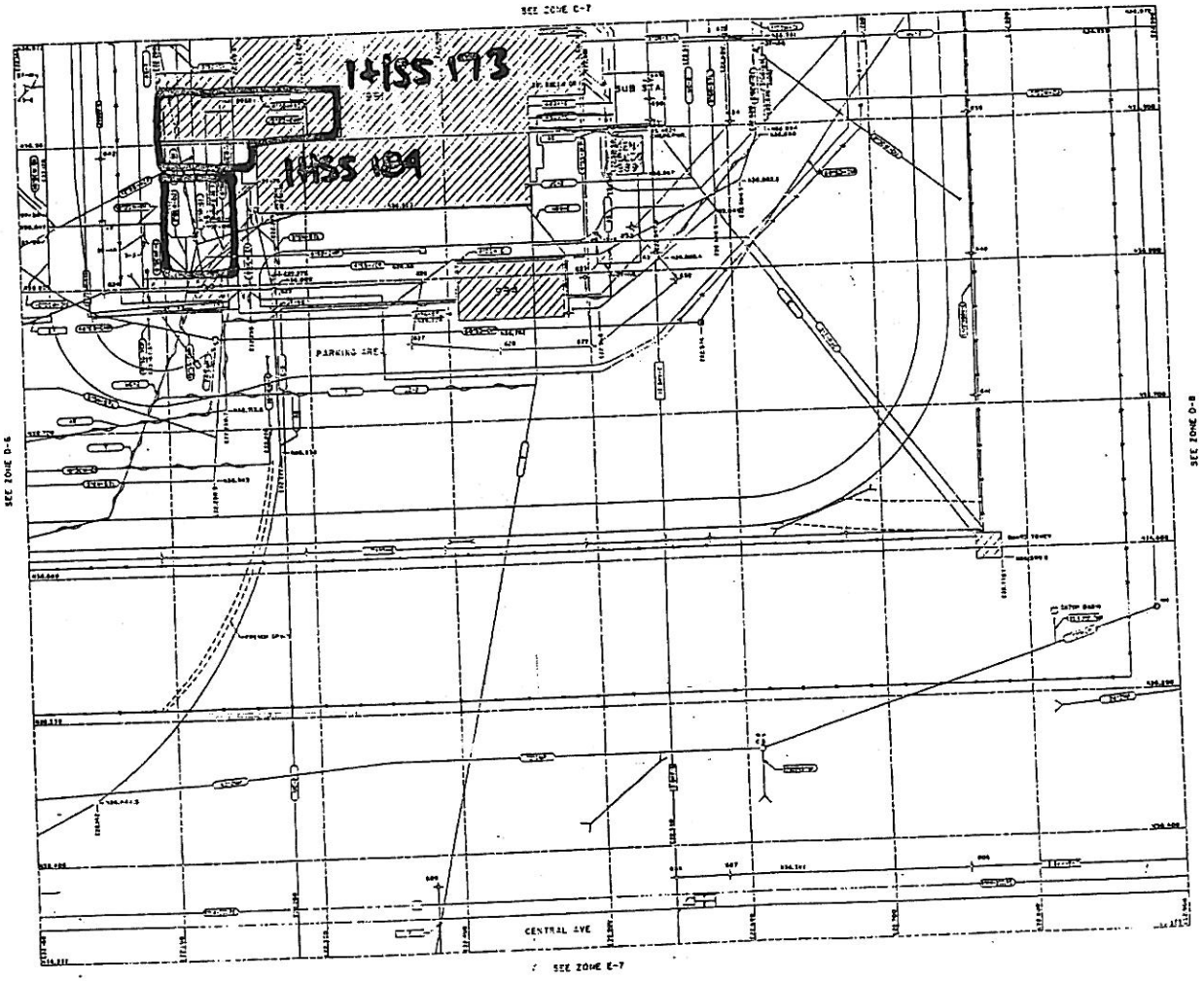
Old, currently Abandoned Line to Original Process Waste Lines.

In use lines for transfer of Process Waste to Valve Vault 10.

Process Waste line to 528 From 561.

Footing Drain

KEYWORDS			
1. UTILITY	R	ADDED MASTER STAMP	7/2
2. UNDERGROUND	P	CONTROLLED DRAWING	
	ISSUE	DESCRIPTION	
	TOLERANCES	BY	DATE



DOES NOT CONTAIN UNCLASSIFIED CONTROLLED NUCLEAR INFORMATION

Reviewing Official: J A Nesheim EMCBC Classification Officer

Date: 11-04-08

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K	UPDATED-OLD DWG NO. 15501-31	7-1-86	
A	ORIGINAL ISSUE		

U.S. DEPARTMENT OF ENERGY
ROCKY FLATS AREA OFFICE GOLDEN, COLORADO

Rockwell International
ROCKY FLATS PLANT
GOLDEN, COLORADO 80402-0464

SITE UTILITY PLANS

SIZE D | DRAWING NUMBER 15501-32 | K | D-7

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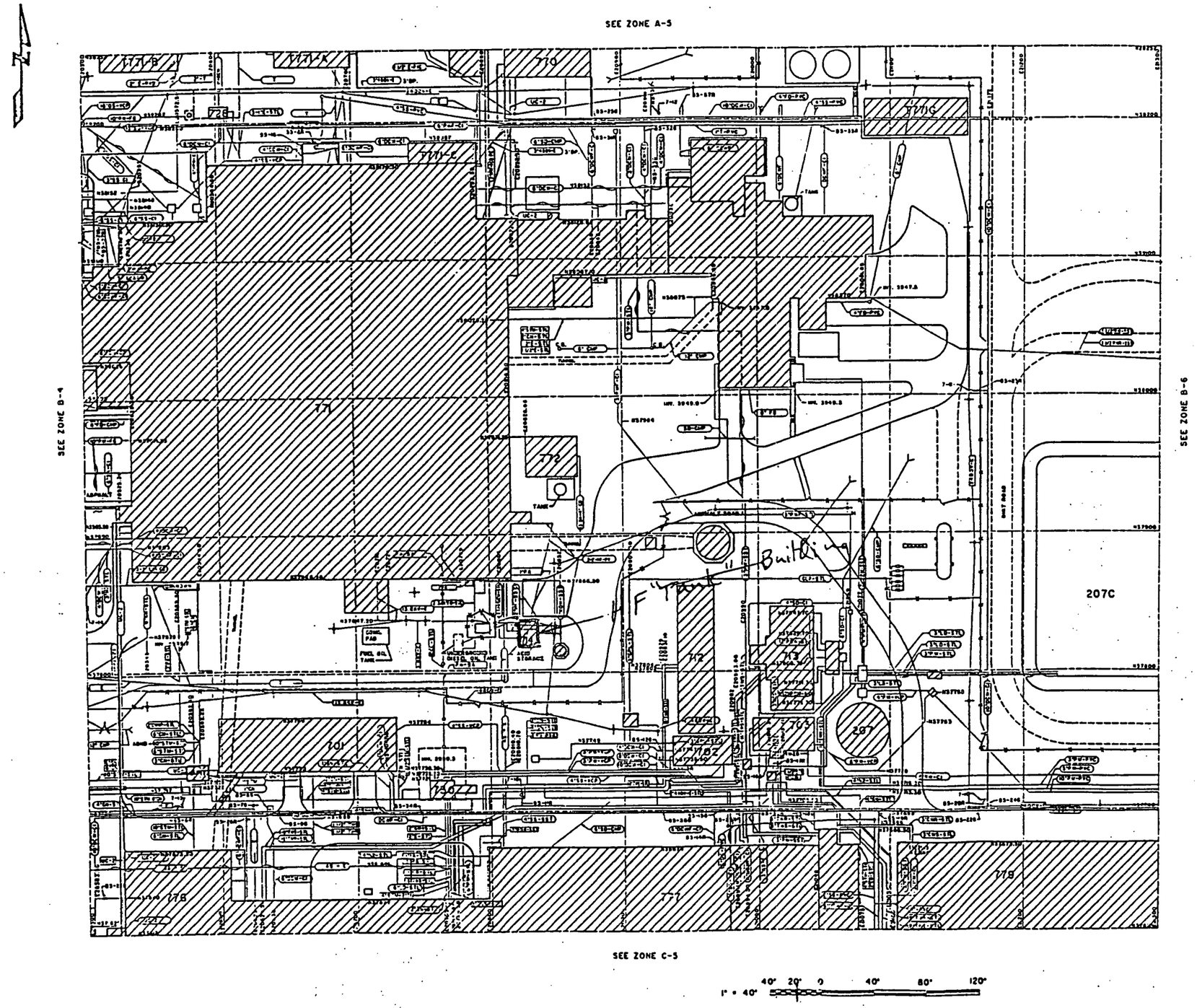

PART	QUAN	DESCRIPTION	MATERIAL

R	ADDED MASTER STAMP	7/29/90	—	KM	OU		900458
P	CONTROLLED DRAWING	1-17-87	—	WC	—	RKJ	DLG 470601
	DESCRIPTION	DATE		REP		DUE	CLASS JOB NO

KEYWORDS
1. UTILITY
2. UNDERGROUND
3. PLAN
4. SITE
5. ABOVEGROUND

SITE

TOLERANCES: FRACT. ± ANGLE ± DEC. ± UNLESS NOTED OTHERWISE

	BY	DATE
DESIGNED	—	—
DRAWN	KELLOUGH	7-20-83
CHECKED	—	—
APPROVED	V. TERKUN	6-27-86

SUBMITTED

SCALE: 1"=40'-0"

U.S. DEPARTMENT OF ENERGY
ROCKY FLATS OFFICE GOLDEN, COLORADO

Rocky Flats Plant
GOLDEN, COLORADO

SITE UTILITY PLANS

SIZE D | DRAWING NUMBER 15501-13-M | ISSUE R | SHEET B-5

MASTER DRAWING
MAINTAIN AS-BUILT PER DES-8
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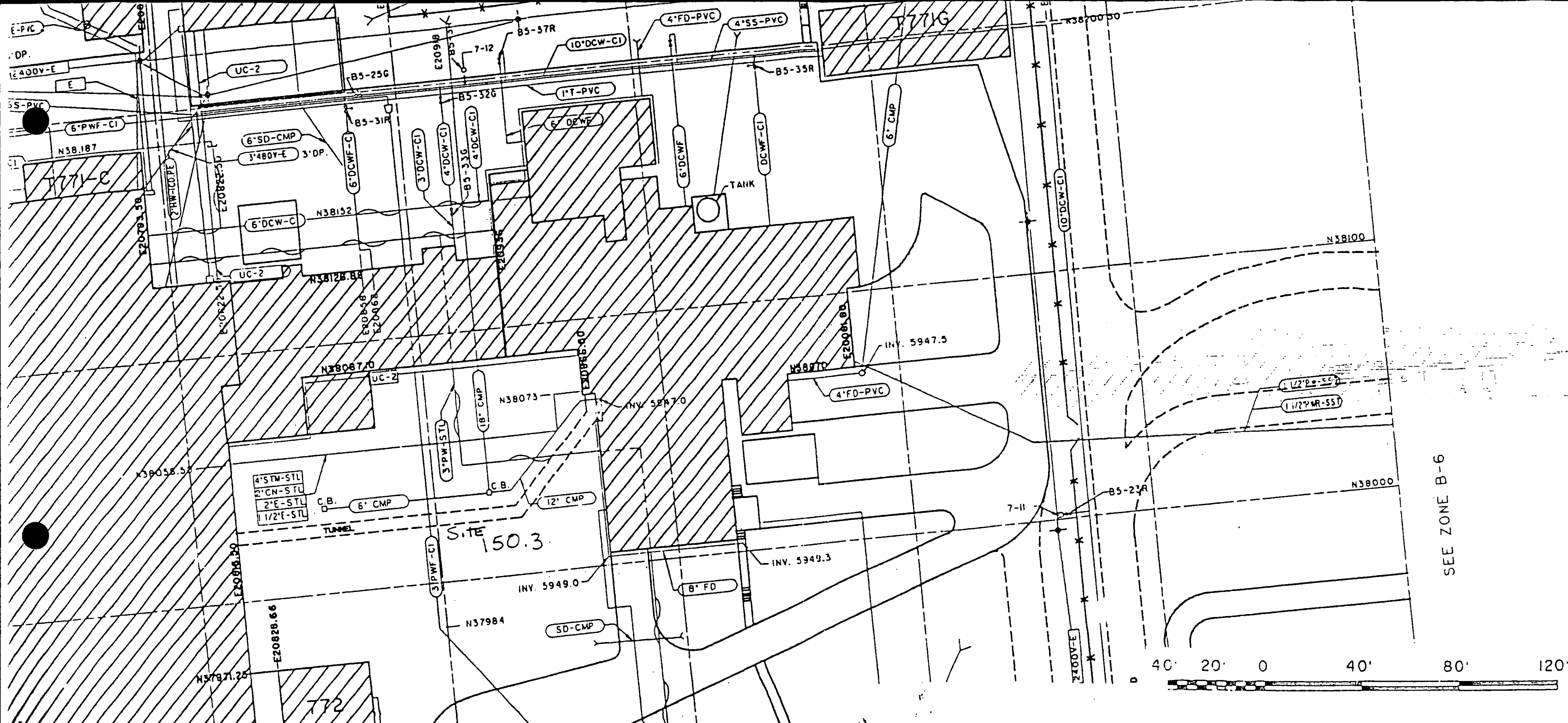


R	ADDED MASTER STAMP	7/20/90	—	KM	OU			CP	900458
P	CONTROLLED DRAWING	1-17-87	—	WC	—	RKJ		DLG	470601
ISSUE	DESCRIPTION	DATE		RFP			DOE	CLASS	JOB NO.

TOLERANCES		BY	DATE
FRACT. ±	DESIGNED	—	—
ANGLE ±	DRAWN	KELLOUGH	7-20-83
DEC. ±	CHECKED	—	—
UNLESS NOTED OTHERWISE	APPROVED	V. TERKUN	6-27-86
REMOVE BURRS AND SHARP EDGES			
NEXT ASSEMBLY	SUBMITTED		
SCALE 1"=40'-0"	APPROVED RFP		
	APPROVED DOE		

U.S. DEPARTMENT OF ENERGY
ROCKY FLATS OFFICE GOLDEN, COLORADO

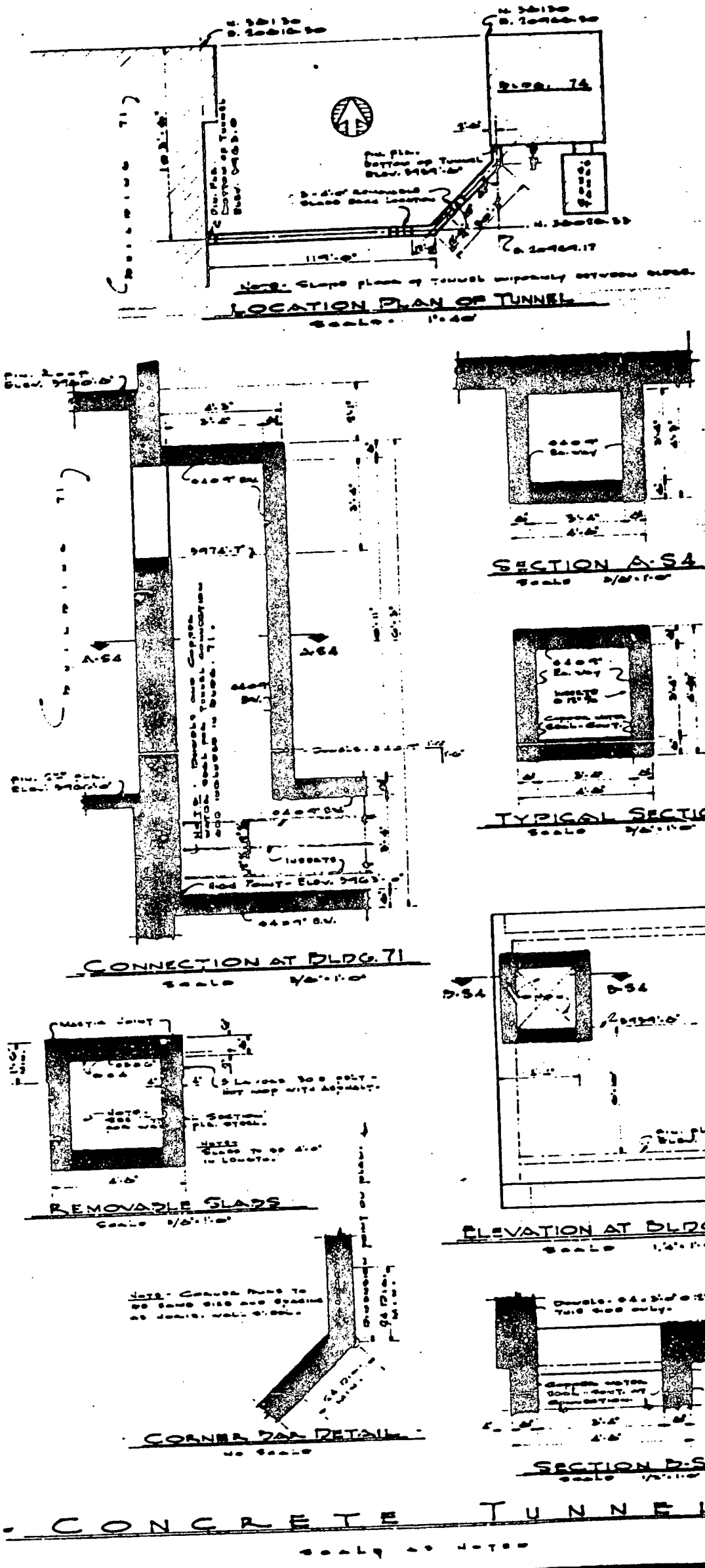
Rocky Flats Plant
GOLDEN, COLORADO

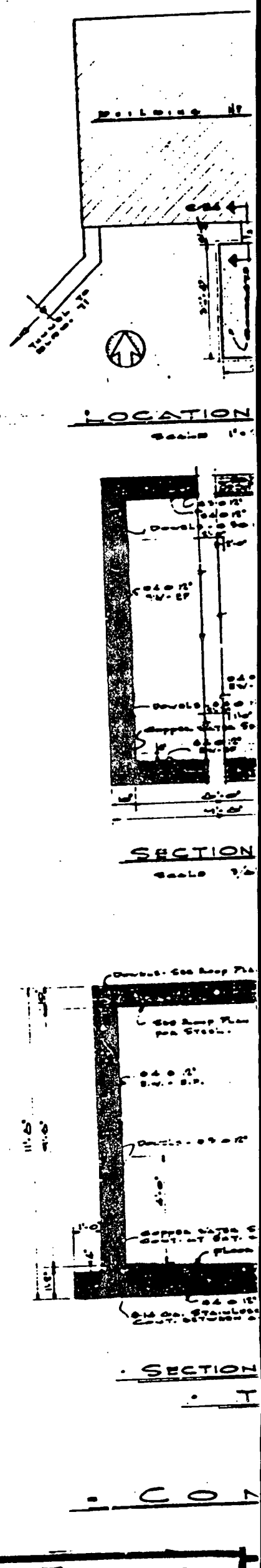
SITE UTILITY PLANS

SIZE	DRAWING NUMBER	ISSUE	SHEET
D	11501-13-M	R	B-5

E Elec | D Detectir | M Mech | I Inst | B Building | C Civil | U Utilities | P Piping | W Fire Pro | L Layouts | F Flow D | S Stds

OFFICIAL USE ONLY





CHANGE ORDER NO.	REVISION						

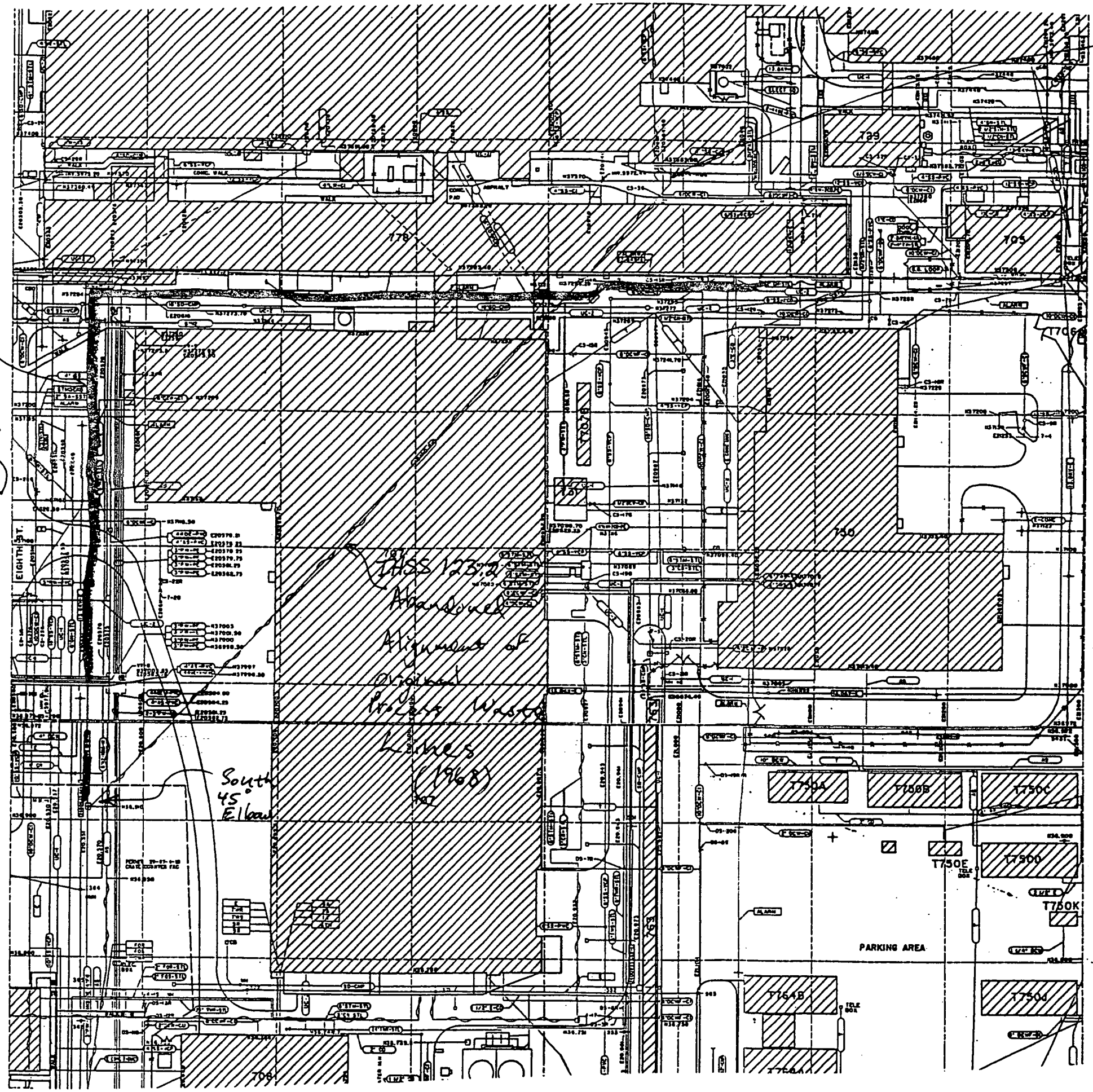
U. S. ATOMIC ENERGY COMMISSION
SANTA FE OPERATIONS OFFICE
LOS ALAMOS NEW MEXICO
ROCKY FLATS PLANT

CONCRETE TUNNEL -
CONC. STORAGE TANKS -

DATE 6/27/52 SCALE AS NOTED
DRAWN CHECKED
R F - 74-S4 D

FOR INFORMATION ONLY

"Newer" Alignment of Original Process Waste Lines (Also Currently Abandoned) (Not Part of IHSS (23.2)



KEYWORDS							
1. UTILITY	M	ADDED MASTER STAMP	5-14-90	– LCB	OU LJM		900458
2. UNDERGROUND	L	CONTROLLED DRAWING	1-17-87	– WC	– RKJ	DLG	470601
3. PLAN			DATE	RFP		DOE CLASS	JOB NO.
4. SITE							
5. ABOVEGROUND							
SUBFACILITY: SITE							
ROOM/AREA							
GRID COORD./COL. NO.							

		BY	DATE
DESIGNED		—	—
DRAWN		KELLOUGH	7-20-83
CHECKED		—	—
APPROVED		TERKUN	6-17-86
SUBMITTED			
APPROVED RFP			
APPROVED DOE			

TOLERANCES: FRACT. ±; ANGLE ±; DEC. ±; UNLESS NOTED OTHERWISE; REMOVE BURRS AND SHARP EDGES; HEAT ASSEMBLY

SCALE: 1"=40'-0"

U.S. DEPARTMENT OF ENERGY
ROCKY FLATS OFFICE GOLDEN, COLORADO

Rocky Flats Plant
GOLDEN, COLORADO

SITE UTILITY PLANS

SIZE	DRAWING NUMBER	ISSUE	SHEET
D	15501-21-M	M	C of 5

COPY COMPUTER GENERATED
NO MANUAL CHANGES ALLOWED R.MST104.U.KJK.C.5

KEYWORDS							
1. SITE	M	ADDED MASTER STAMP	7/20/90	– MLN	OU		900458
2. UTILITIES	L	UPDATED-OLD DWG. NO. 15501-29	7-1-86	– BSP	– VT	DLG	450031
3. ABOVEGROUND			DATE	RFP		DOE CLASS	JOB NO.
4. UNDERGROUND							
5.							
SUBFACILITY: SITE							
ROOM/AREA							
GRID COORD./COL. NO.							

		BY	DATE
DESIGNED		—	—
DRAWN		KELLOUGH	7-20-83
CHECKED		—	—
APPROVED		TERKUN	6-27-86
SUBMITTED			
APPROVED RFP			
APPROVED DOE			

TOLERANCES: FRACT. ±; ANGLE ±; DEC. ±; UNLESS NOTED OTHERWISE; REMOVE BURRS AND SHARP EDGES; HEAT ASSEMBLY

SCALE: 1"=40'-0"

U.S. DEPARTMENT OF ENERGY
ROCKY FLATS OFFICE GOLDEN, COLORADO

Rocky Flats Plant
GOLDEN, COLORADO

SITE UTILITY PLANS

SIZE	DRAWING NUMBER	ISSUE	SHEET
D	15501-30-M	M	D of 5

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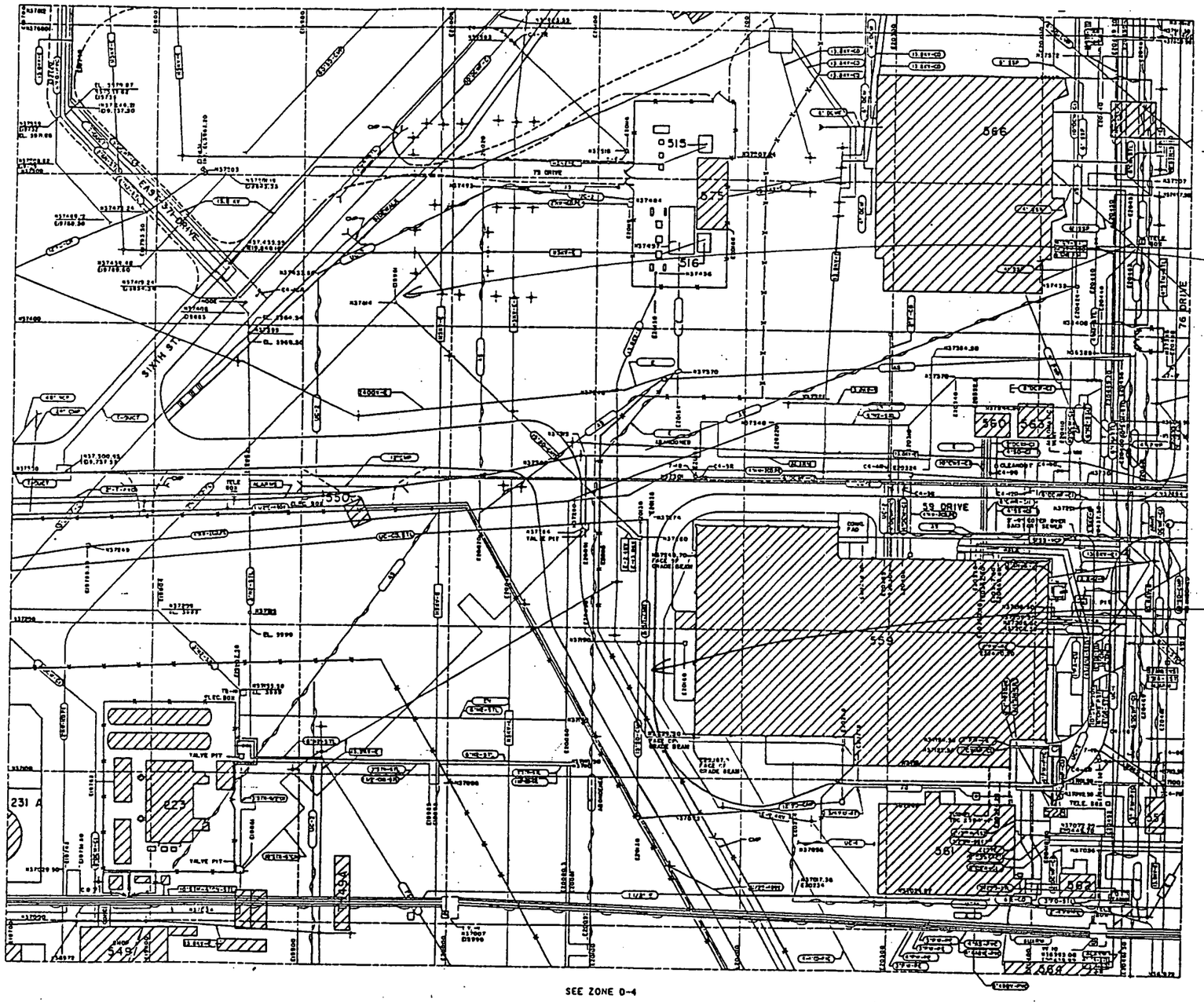
40' 20' 0 40' 80' 120'



Outfall of Footing Drain/ Stormwater

Flow route of Footing Drain and Stormwater.

40' 20' 0 40' 80' 120'

R	ADDED MASTER STAMP	7/20/90	—	LCB	OU		CA	900458
P	CONTROLLED DRAWING	1-17-87	—	WC	—	RKJ	DLG	470601

KEYWORDS
1. UTILITY
2. UNDERGROUND
3. PLAN
4. SITE
5. ABOVEGROUND

SIZE | DESCRIPTION | DATE | RFP | DOE | CLASS | JOB NO.

TOLERANCES: FRACT. ± ANGLE ± DEC. ± UNLESS NOTED OTHERWISE. REMOVE BURRS AND SHARP EDGES. NEXT ASSEMBLY

	BY	DATE
DESIGNED	—	—
DRAWN	KELLOUGH	7-20-83
CHECKED	—	—
APPROVED	TERKUN	6-17-86

SUBMITTED / APPROVED RFP / APPROVED DOE

SCALE 1"=40'-0"

U.S. DEPARTMENT OF ENERGY
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GOLDEN, COLORADO

SITE UTILITY PLANS

SIZE D | DRAWING NUMBER 15501-20-M | ISSUE R | SHEET C of 4

MASTER DRAWING
MAINTAIN AS-BUILT PER DES-8
FE GROUP RESPONSIBLE PSCE

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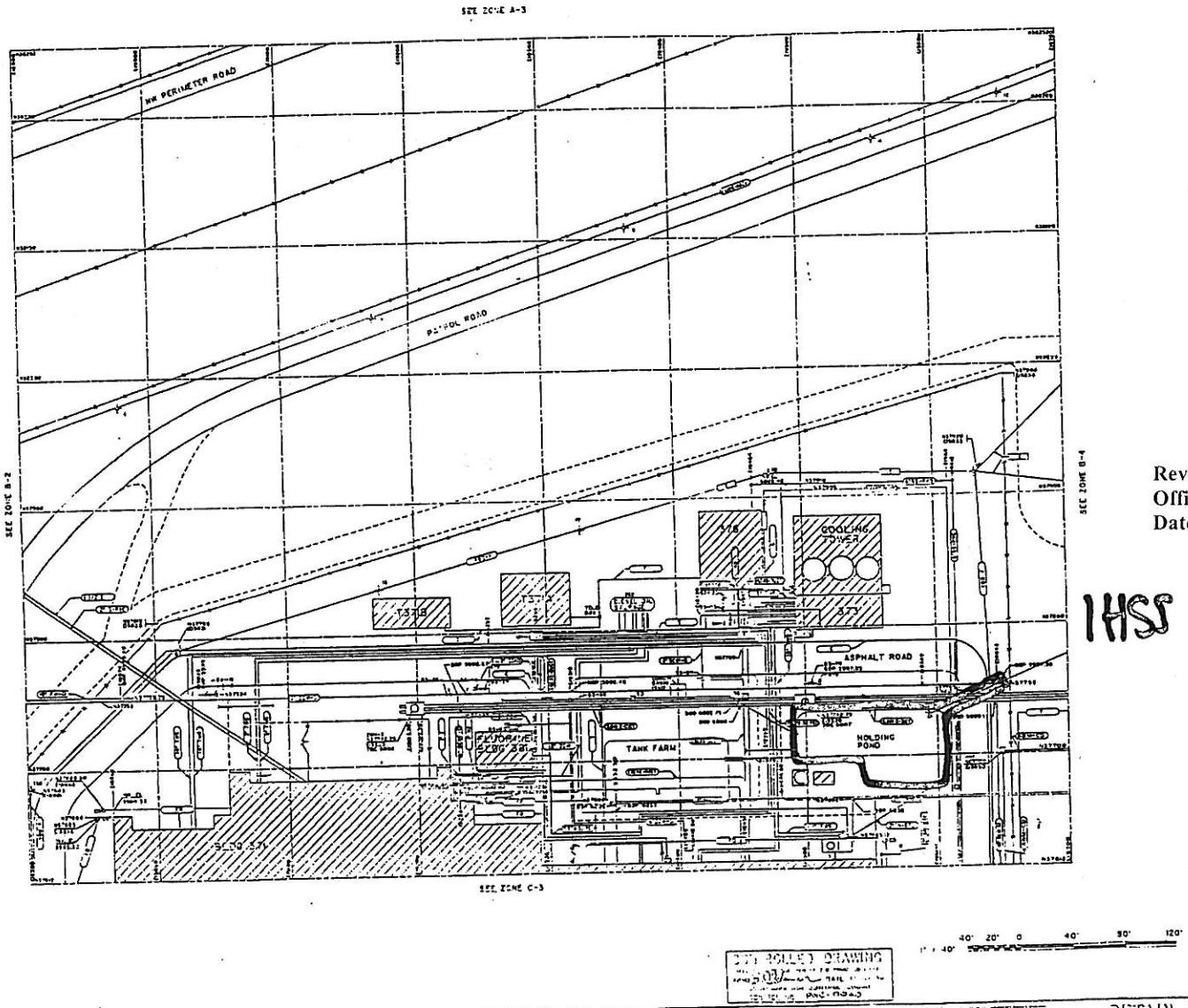
R.MST104.U.KJK.C.4



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NUCLEAR INFORMATION
Reviewing J.A. Nesheim
Official: EMCBC Classin Office
Date: 11-04-08

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G	CONTROLLED DRAWING		
F	UPDATED	7-1-86	
A	ORIGINAL ISSUE		

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GOLDEN, COLORADO 80402-2464

SITE UTILITY PLANS

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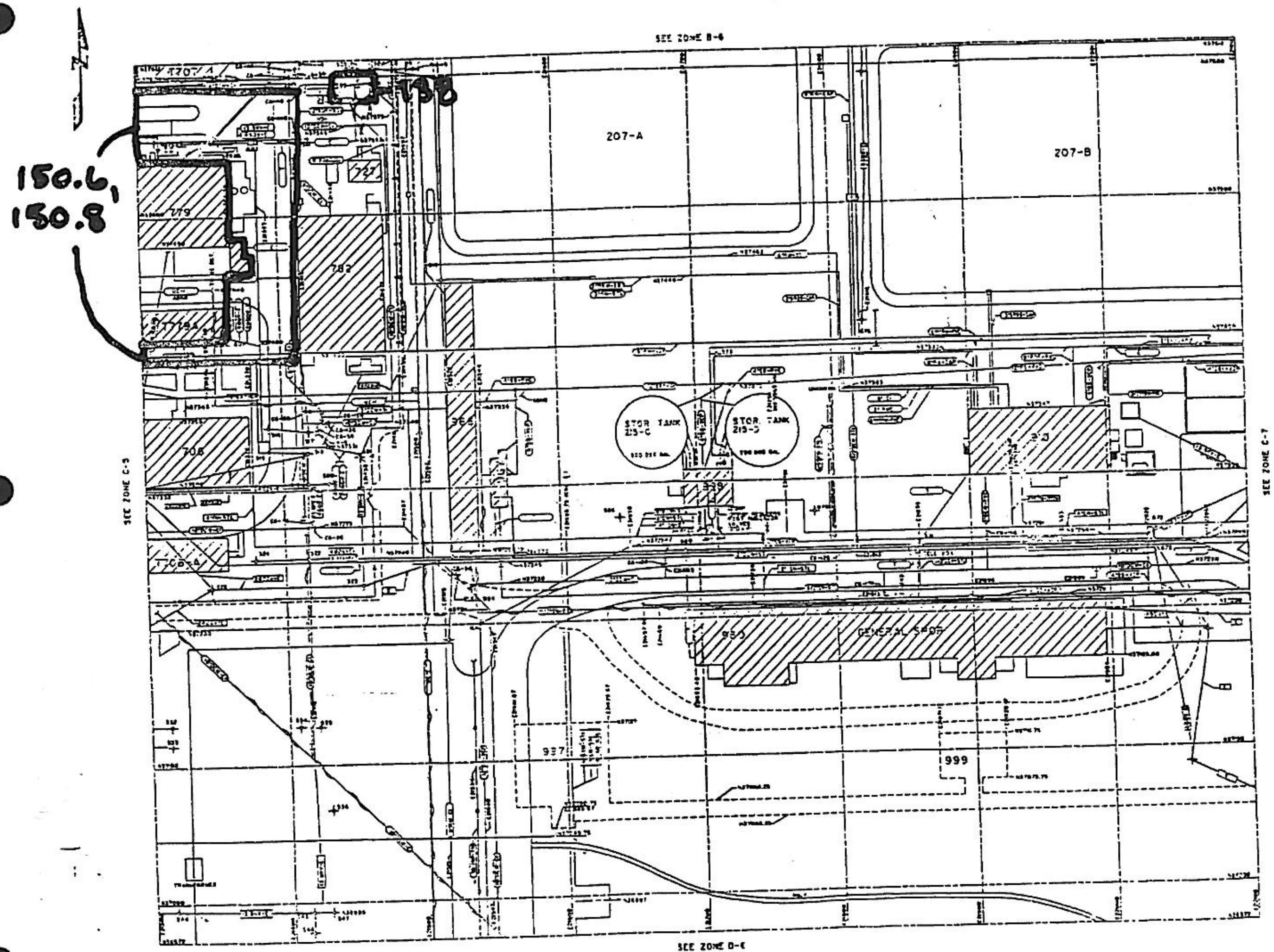

DOES NOT CONTAIN
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NUCLEAR INFORMATION
Reviewing Official: D. A. Hoskeim, RMCBC Classification Office
Date: 11-04-08

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1" = 40'

40' 20' 0 40' 80' 120'

CONTROLLED DRAWING
CONTROL NO. PAC-6050

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SITE UTILITY PLANS

A	CONTROLLED DRAWING	
L	UPDATED	7-1-88
A	ORIGINAL ISSUE	

SCALE 1" = 40'-0"

D15501-22 | M | C-6

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