NOTICE

All drawings located at the end of the document.

DRAFT

PHASE I RFI/RI WORK PLAN

ROCKY FLATS PLANT SITE
700 AREA
OPERABLE UNIT 8

U.S. DEPARTMENT OF ENERGY
ENVIRONMENTAL RESTORATION PROGRAM
ROCKY FLATS PLANT
GOLDEN, COLORADO

VOLUME II OF II

MAY 1, 1992

ADMIN RECORD

A-OU08-000014

REVIEWED FOR CLASSIFICATION/UCNI
By [signature] 1059 UNU
Date 5/12/92

EG&G ROCKY FLATS

INTEROFFICE CORRESPONDENCE

DATE: March 6, 1992

TO: P. L. Fuller, Remediation Programs Division, Bldg. T130B, X5744

FROM: R. B. Hoffman, Classification Office, T893B, X4598 SLC for RBH

SUBJECT: CLASSIFICATION EXEMPTION WAIVER FOR REMEDIATION PROGRAMS DIVISION (RPD) DOCUMENTS

Your request for exemption from classiification/UCNI review of Remediation Programs Division (RPD) documents as proposed in your letter of March 5, 1992 has been considered.

Based upon a substantial historical perspective, we have concluded that the reporting activities in which your Division of the Environmental Management Department is involved are unclassified and UCNI-free in nature and content.

All reporting activities for those Operable Units (OUs) one thru sixteen, except, Operable Unit 15 - Inside Building Closures, can be considered as exempt from further classification/UCNI review by the Classification Office. This waiver includes internal, as well as, external letters, work plans, reports, interim measures, RCRA facilities investigations, interim remedial actions, site characterization studies, human health risk assessments, environmental evaluations and assessments, comparative analyses, and other environmental and administrative documentation, as outlined in your letter. At this time sufficient knowledge of the type of information which OU 15 will comprise has not been established and until this can be acertained, classification review will be necessary.

In general, should RPD documents begin to differ in scope and context from past practice, it will become mandatory that you contact this office to ensure that this classification review waiver be justified and correct.

Should you require any further information or have any questions regarding this matter, please feel free to contact me or Karl Dallarosa (X3792) at any time.

kld

cc:
P. S. Bunge
J. E. Evered
W. A. Hunt

ROCKY FLATS INTERAGENCY AGREEMENT

JANUARY 22, 1991

ADMIN RECORD

REVIEWED FOR CLASSIFICATION/UCNI
By
Date 5/12/92

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 Action 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
173 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

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 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

OU8 IHSS DESCRIPTIONS

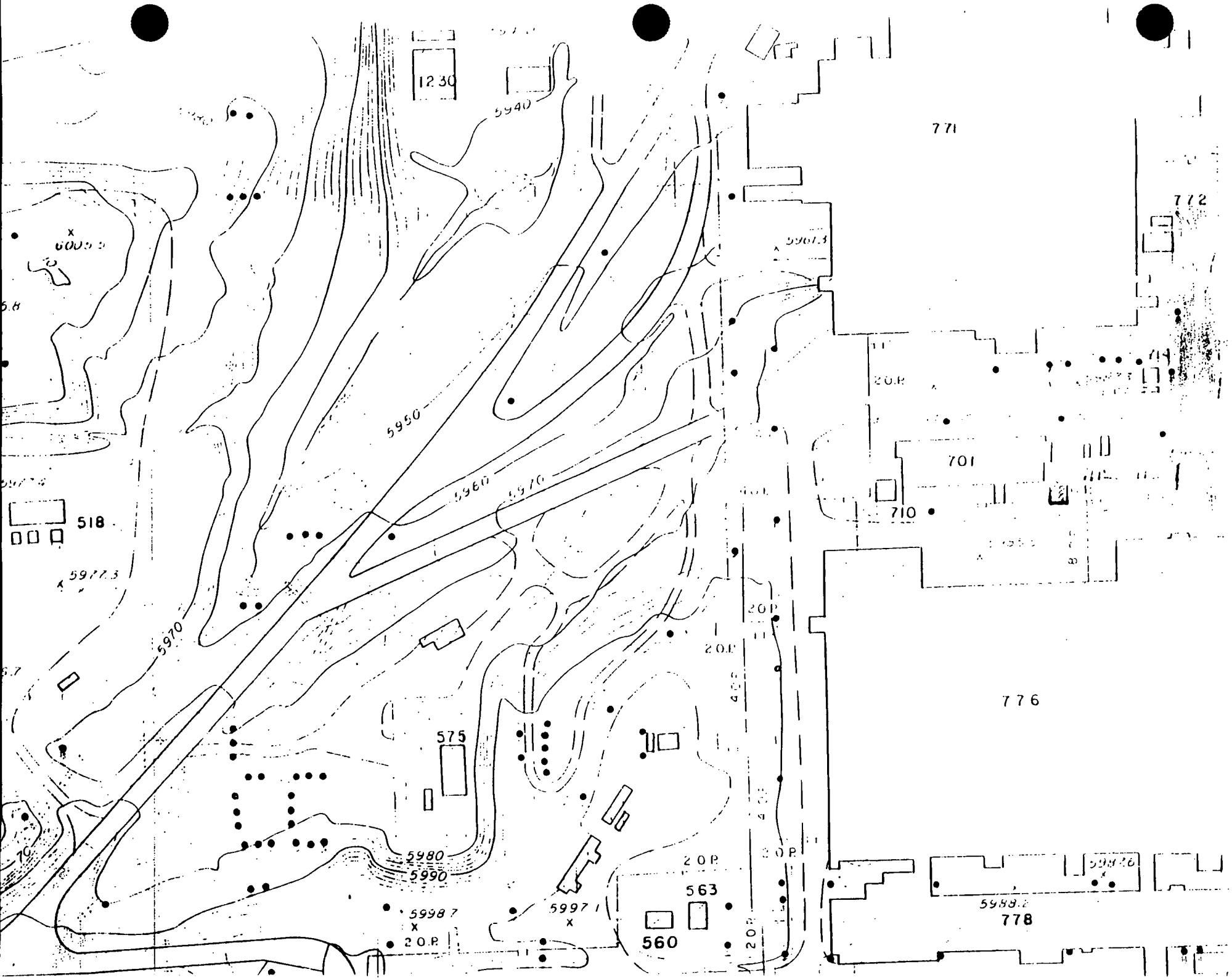
IHSS Number: 118.1

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.



1230
5940
771
772
5961.3
5950
5960
5970
518
5977.3
5970
701
710
776
575
5980
5990
5998.7
5997.1
563
560
778
5988.2

OU8 IHSS DESCRIPTIONS

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.

OU8 IHSS DESCRIPTIONS

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.

OU8 IHSS DESCRIPTIONS

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.

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.

[2] RFP Photograph Negative No. 13676-03 June 5, 1969.

[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.

[10] Irwin, K.W., 1971, "Report of Property Damage or Loss," Internal Report, July 27.

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

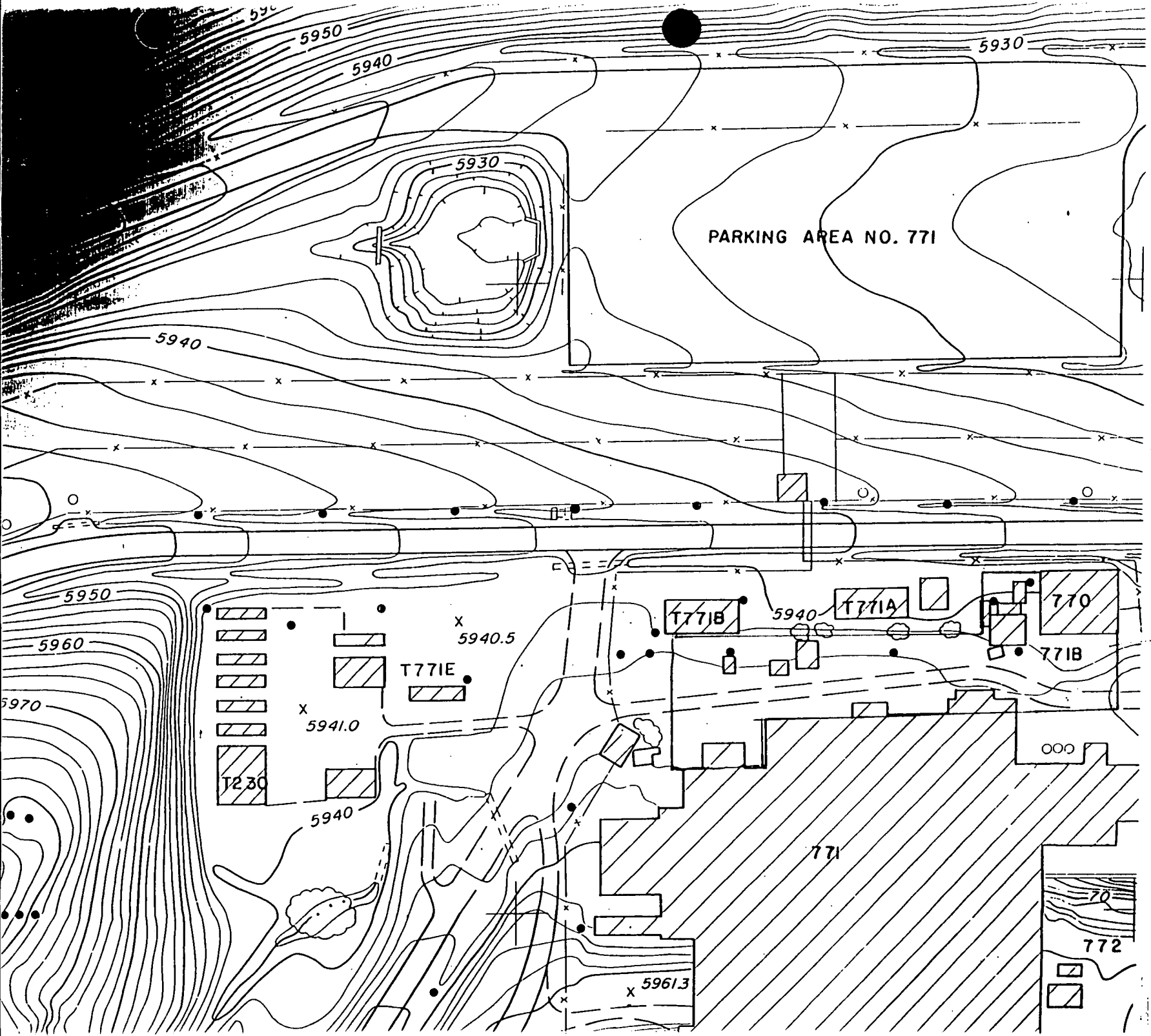
[12] Author Unknown, 1971, Monthly Status Report - Health Physics Operations Group, Buildings 771 and 774 - July 1971," Internal Report to E.A. Putzier, August 4.

[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.

References

[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.

[3] Maas, M., 1992, Retired Former Rocky Flats Plant Liquid Waste Operations Employee, Personal Communication, April 10.

[4] Sunday, G., 1976, "Survey of the Status of the Existing Process Waste Lines," Rockwell International, September 1.

[5] Maas, M., 1991, Retired Former Rocky Flats Plant Liquid Waste Operations Employee, Personal Communication, November 25.

[6] Blaha, F., 1992, Site Visit to Original Process Waste Lines West of Building 707, April 7.

[7] Rocky Flats Plant, 1990, "Site Utility Drawings," Drawing 15501-30-M, Sheet D-5, July 20.

[8] ChemRisk, 1992, "Task 3/4, Draft Report, Rocky Flats History," February.

[9] Rocky Flats Plant, 1990, "Site Utility Drawings," Drawing 15501-30-M, Sheet C-5, July 20.

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

[11] EPA, 1988, "U.S.DOE Rocky Flats Plant Aerial Photograph, 1955," EPA Environmental Monitoring Systems Laboratory - Las Vegas, PIC No. 88760, Frame No. AIN-2N-88, July 2, 1955.

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.

*** ** ***

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.

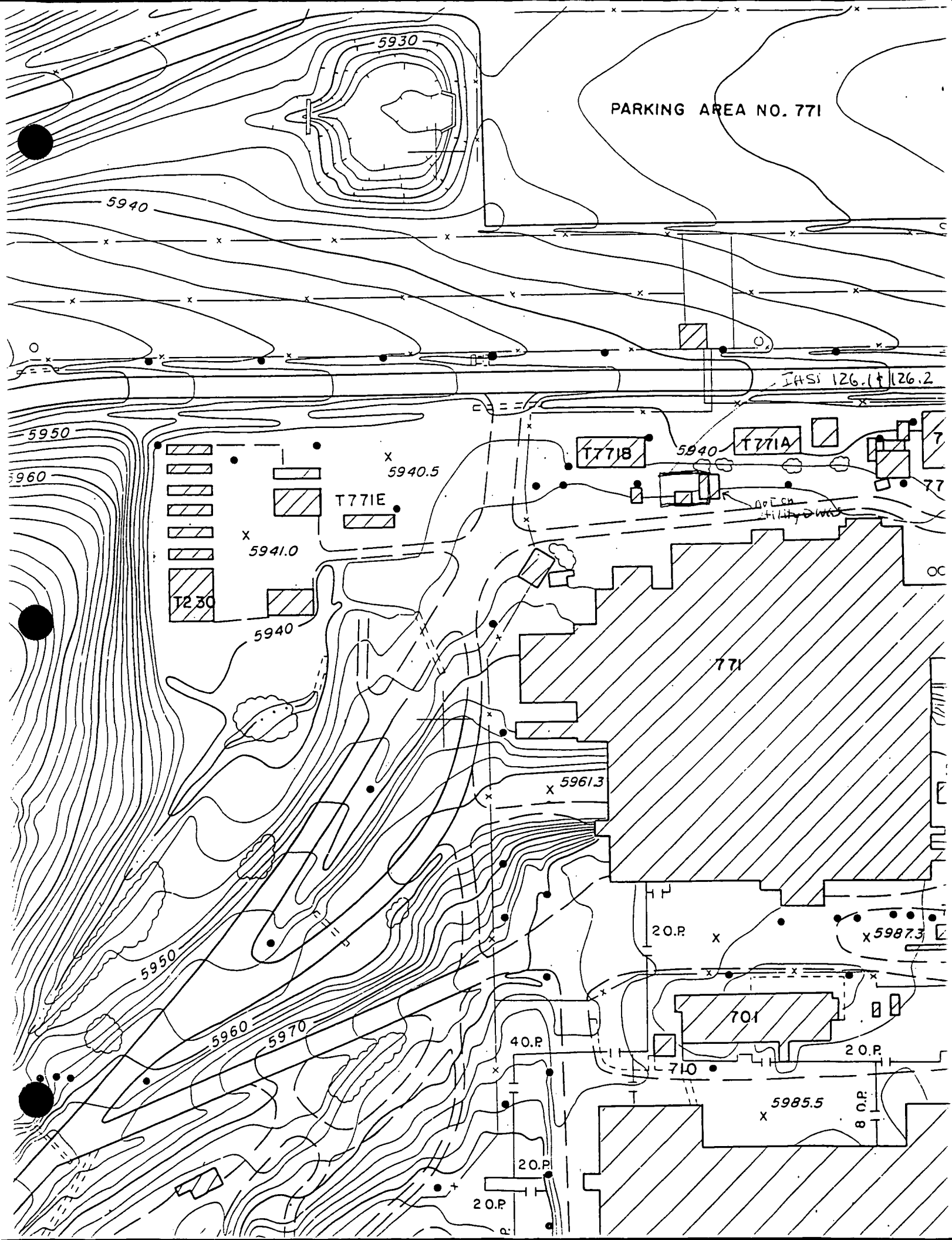
[4] RFP Engineering Drawing No. 26628-3, Approved January 4, 1983.

[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.

*** ** ***

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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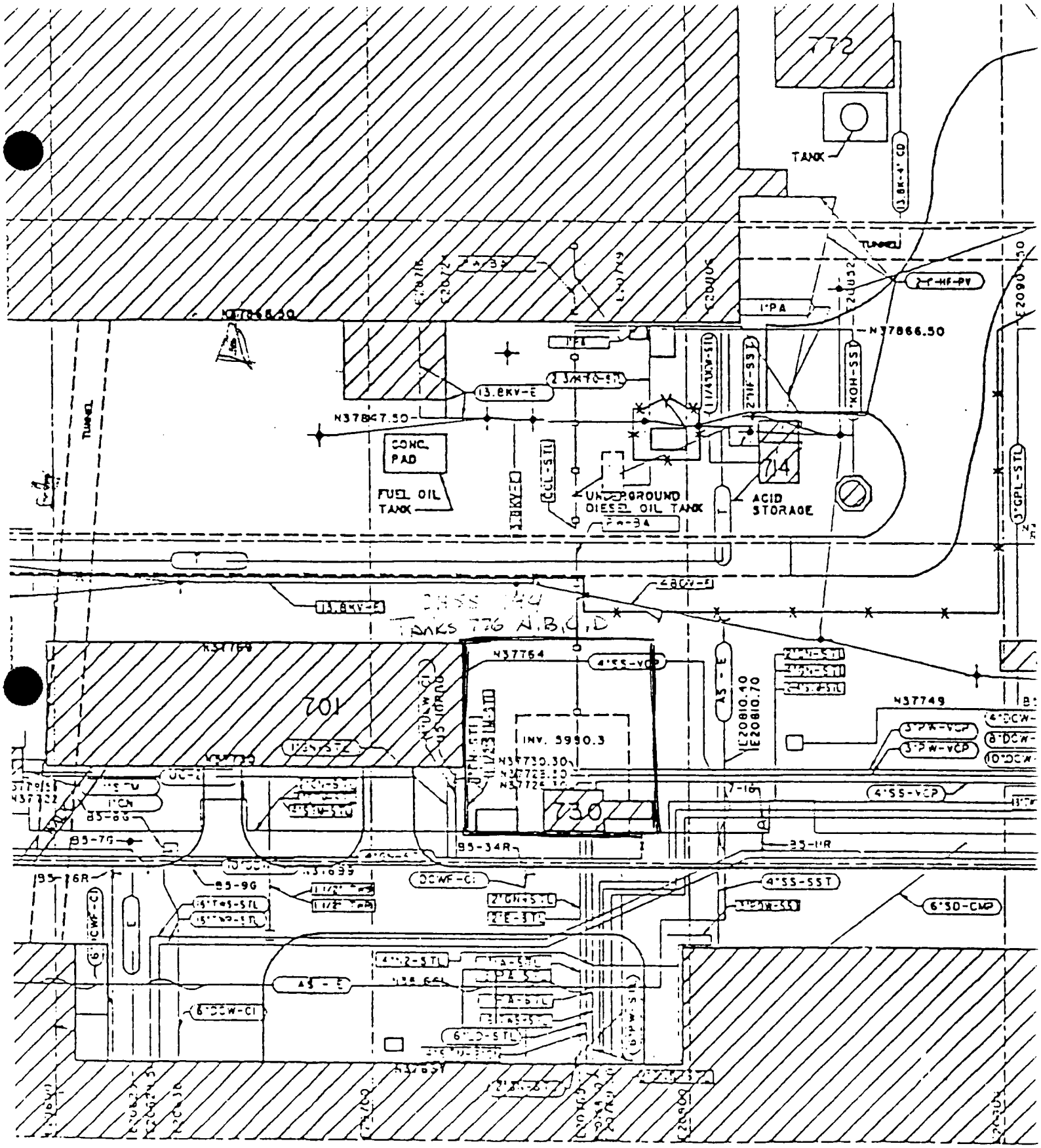

Also affected area between Bldgs 777 + 779

SEE Z

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.

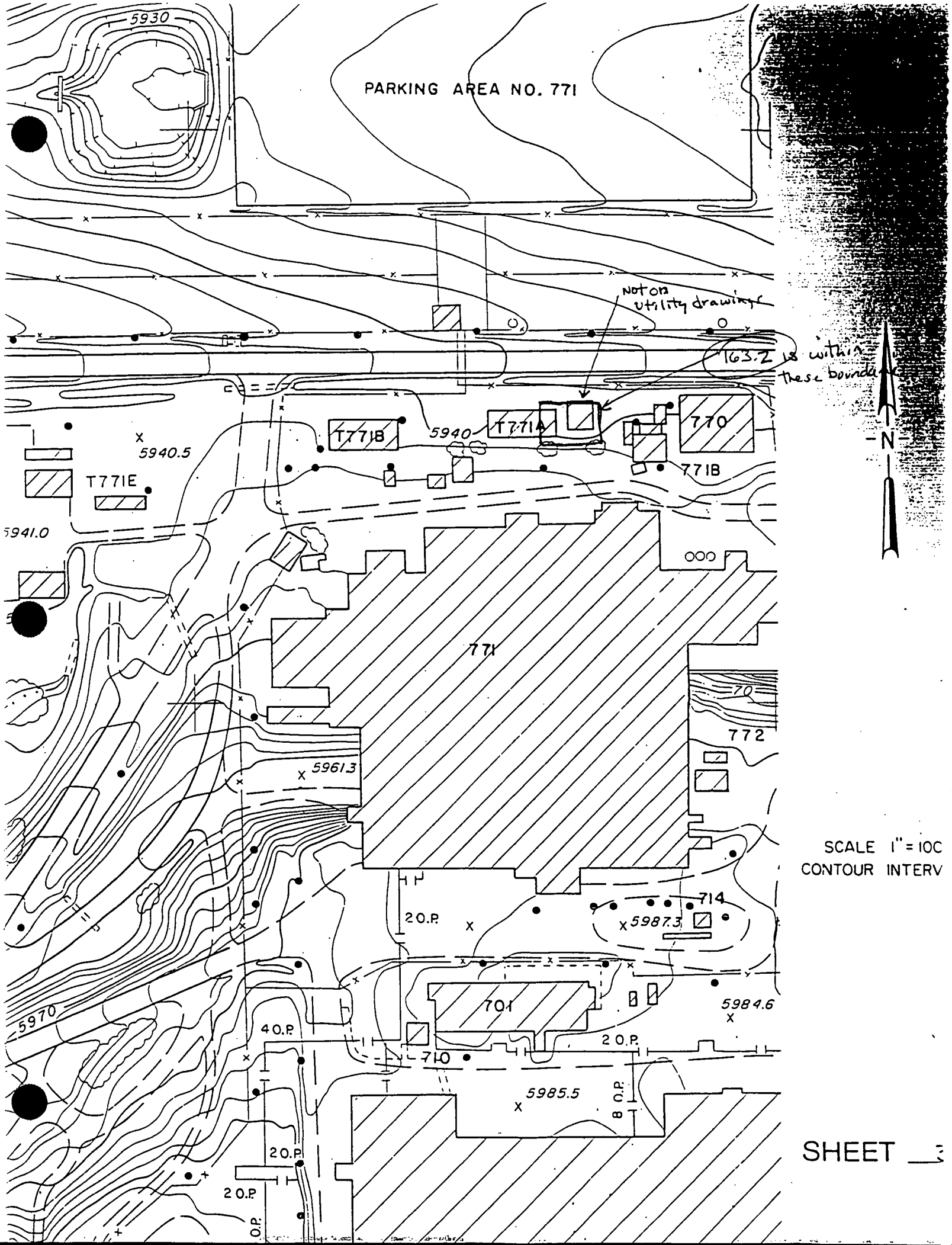
[2] Personal Communication, Carol Barker, RFP Employee, April 9, 1992.

[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 boundaries
T771B
5940
T771A
770
771B
5940.5
T771E
5941.0
771
70
772
5961.3
714
20.P.
5987.3
701
5984.6
5970
40.P.
20.P.
710
5985.5
8 O.P.
20.P.
20.P.
O.P.
N
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CONTOUR INTERV
SHEET

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

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TELEPHONE: (303) 279-9181
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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.

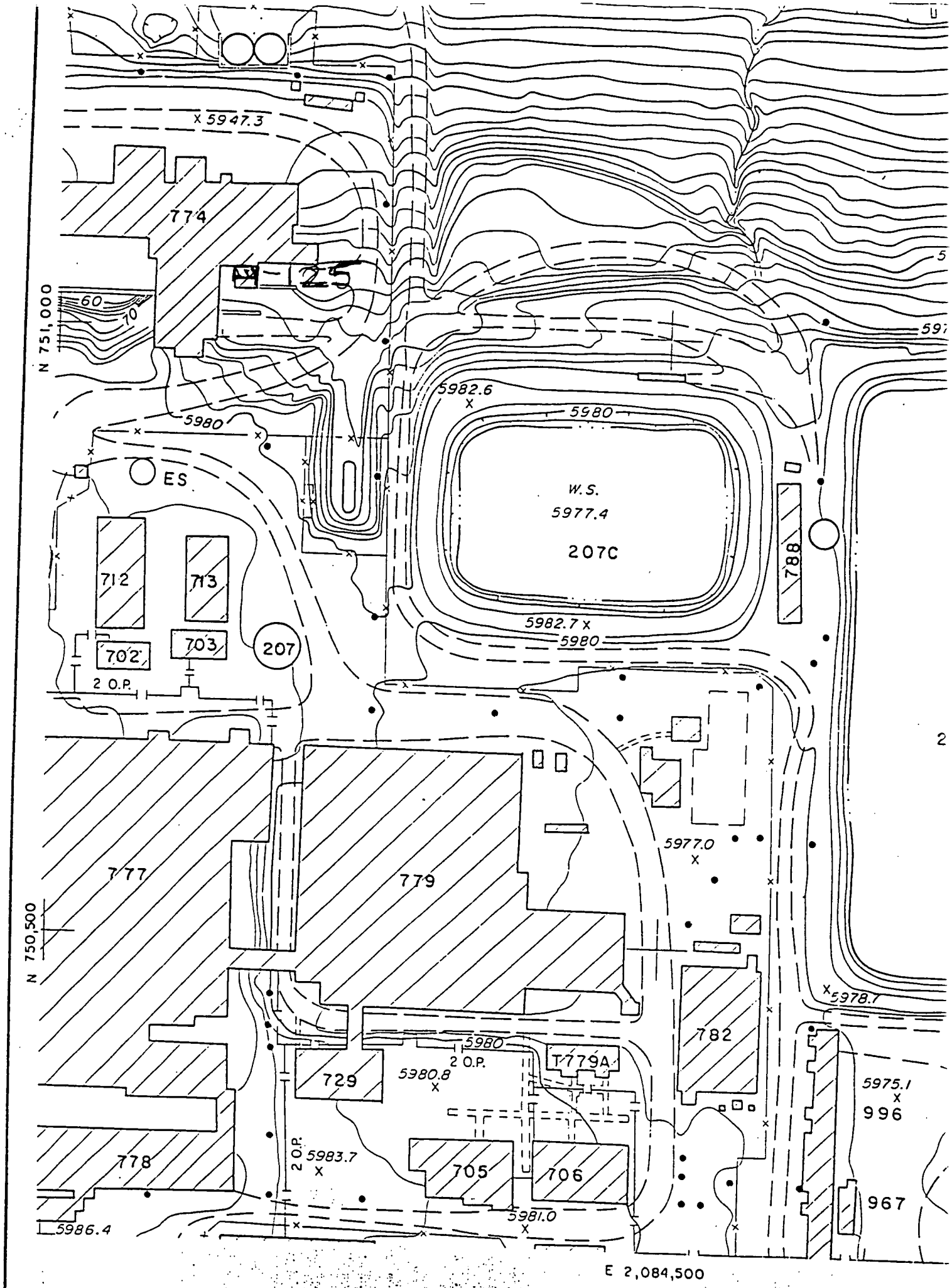
[7] RFP Photograph Negative No. 13677-03, June 9, 1969.

[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.


X 5947.3
774
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N 751,000
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5982.6
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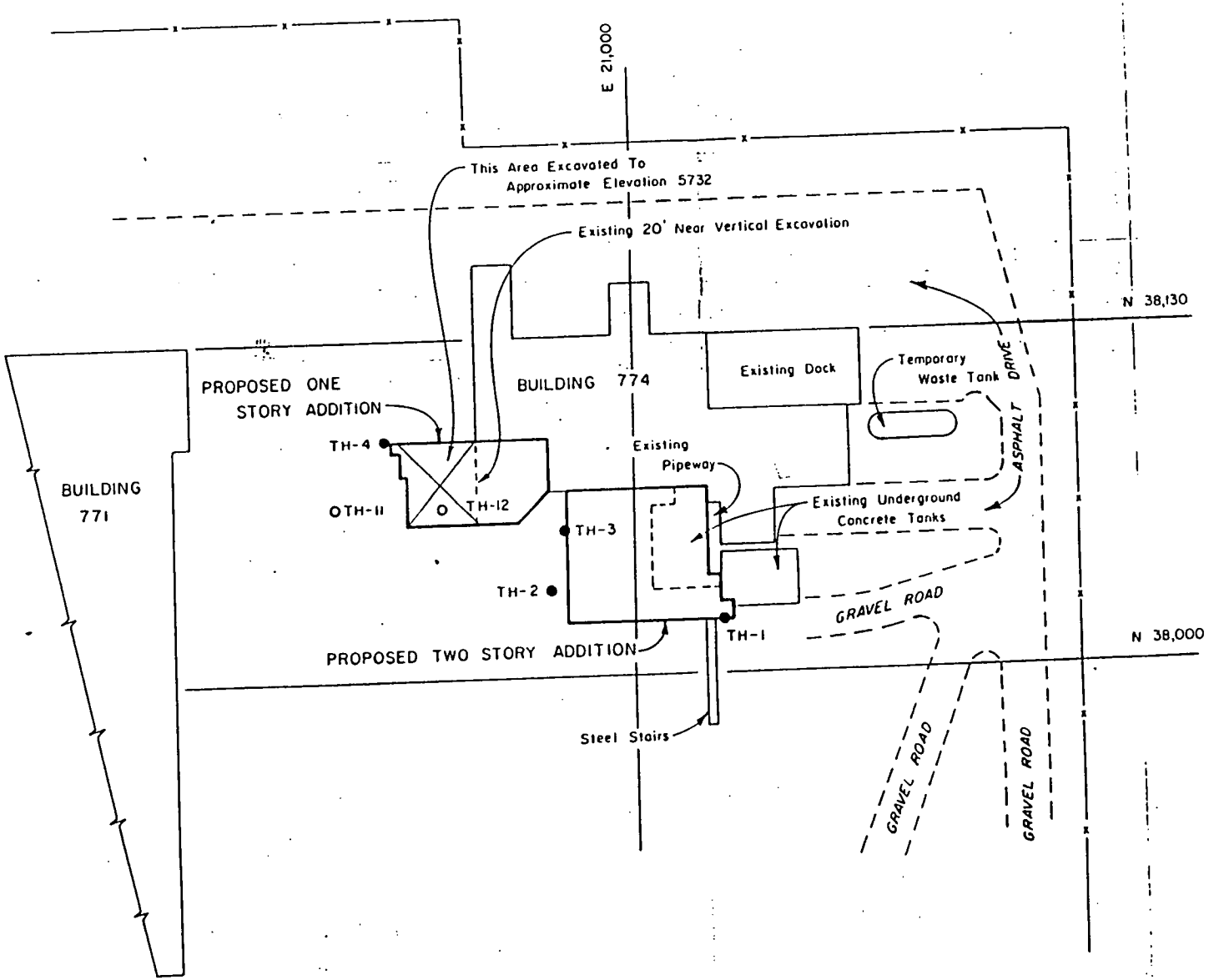


SCALE 1" = 40'

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

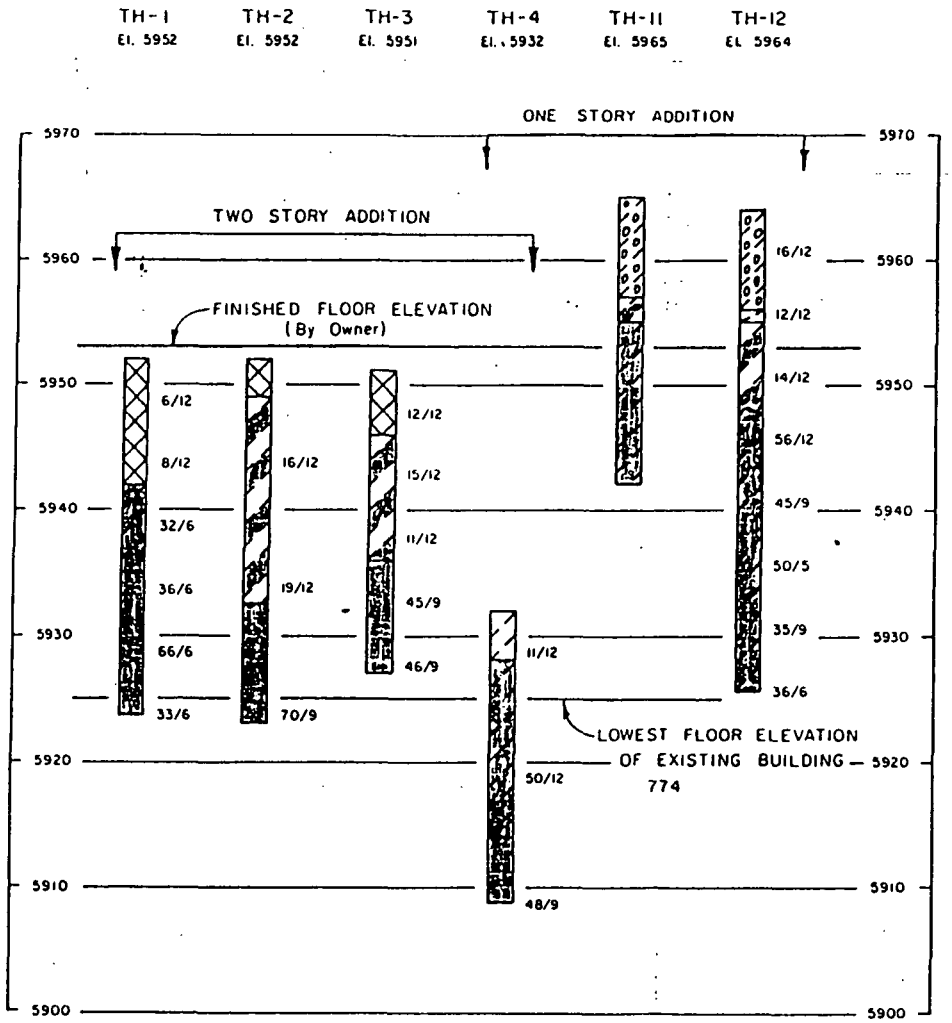
BUILDING 774 ADDITIONS

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

[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
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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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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

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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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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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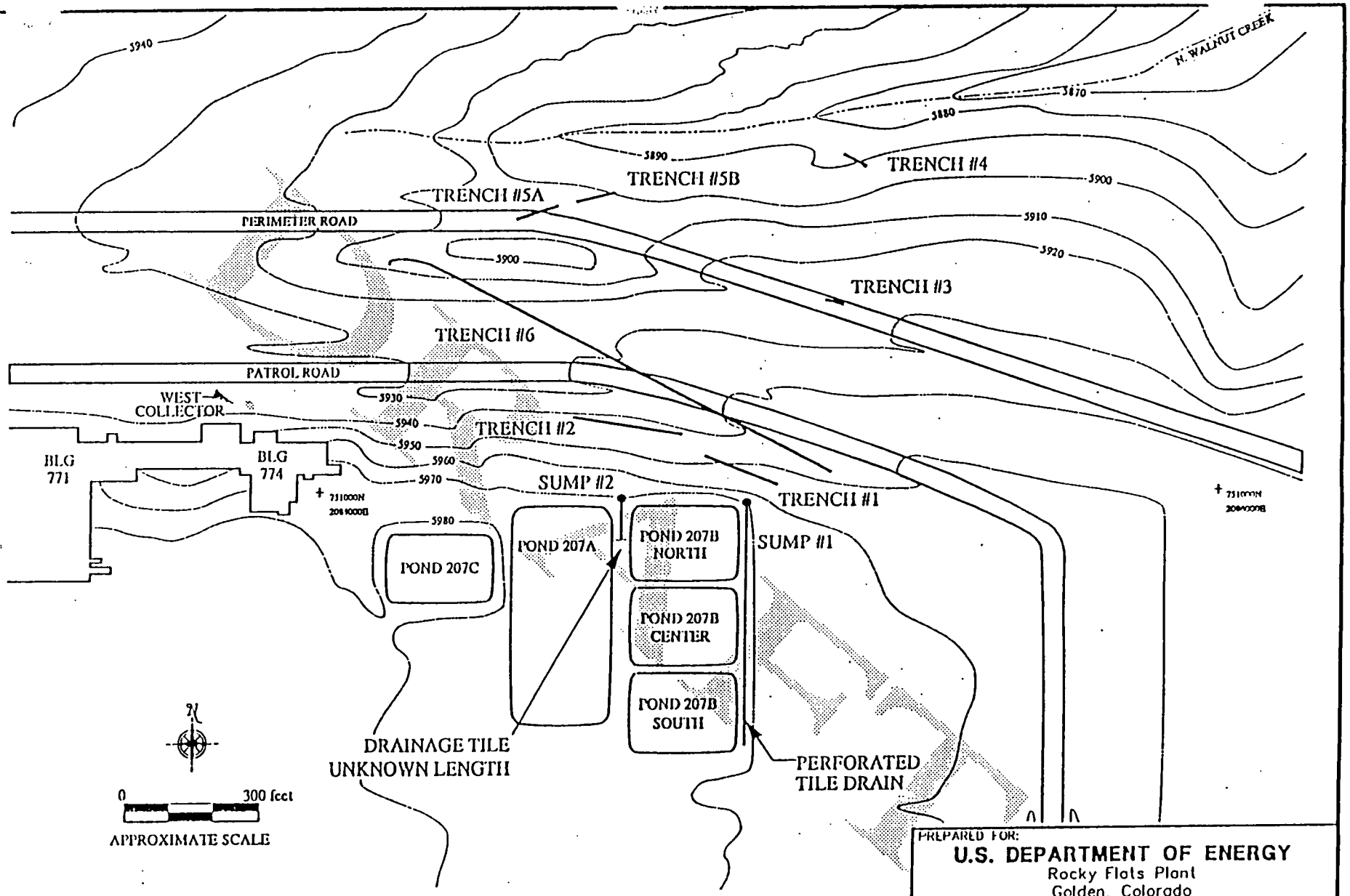


REFERENCE: DRAWING PROVIDED BY DOTY & ASSOCIATES, FIGURE NO. 000-2, 12/17/91, PROJECT NO. 600-10.

PREPARED FOR:

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

FIGURE 000-2

TITLE:

TRENCHES AND SUMPS

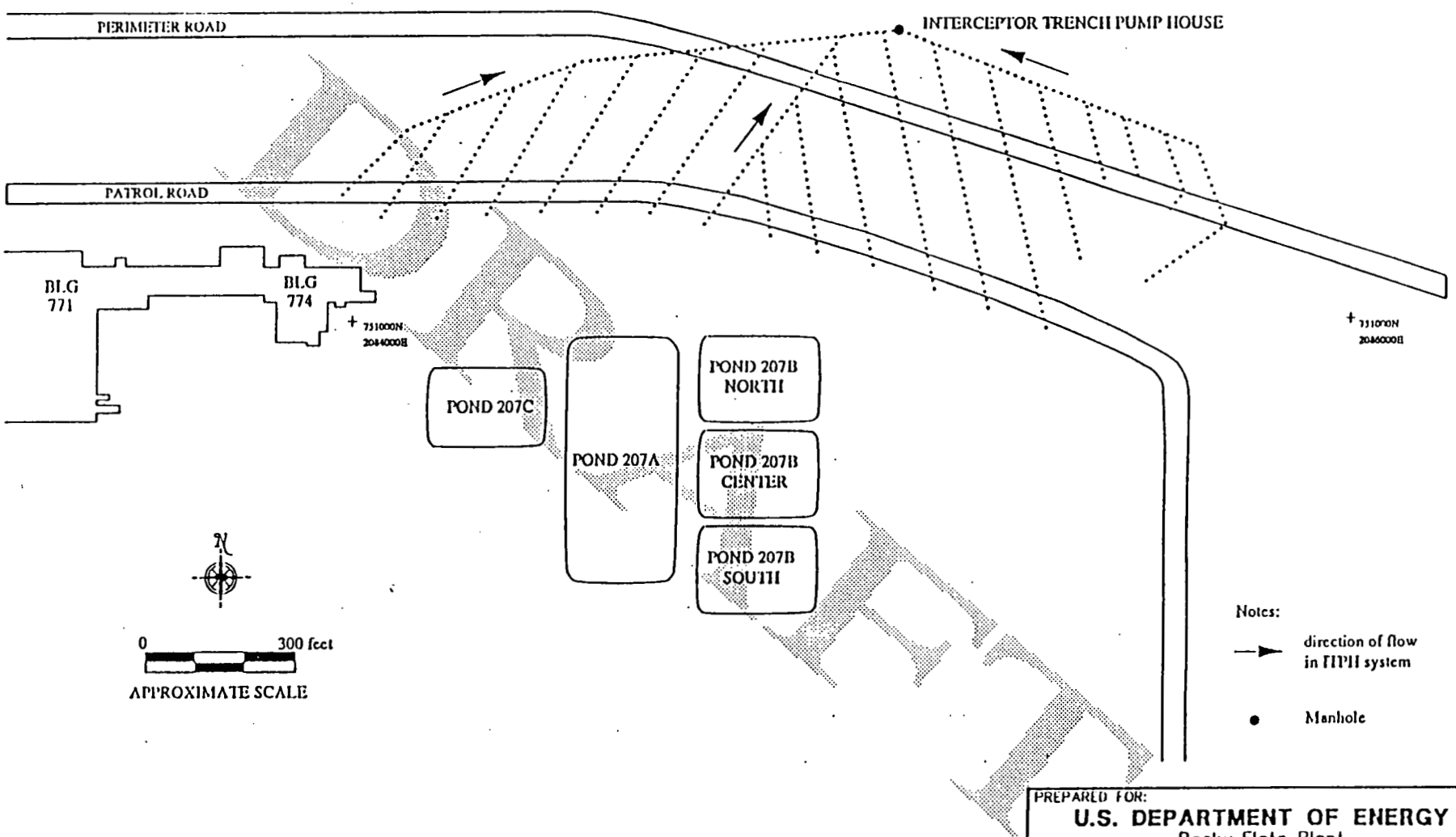
DRAFT

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

Printed on Recycled Paper

4914231 12/19/91 1:35pm CAK

APPROXIMATE LOCATION OF ITPH DRAIN SYSTEM



REFERENCE: DRAWING PROVIDED BY DOTY & ASSOCIATES, FIGURE NO. 000-3, 12/17/91, PROJECT NO. 606-10.

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

FIGURE 000-3

TITLE:
INTERCEPTOR TRENCH PUMP HOUSE SYSTEM

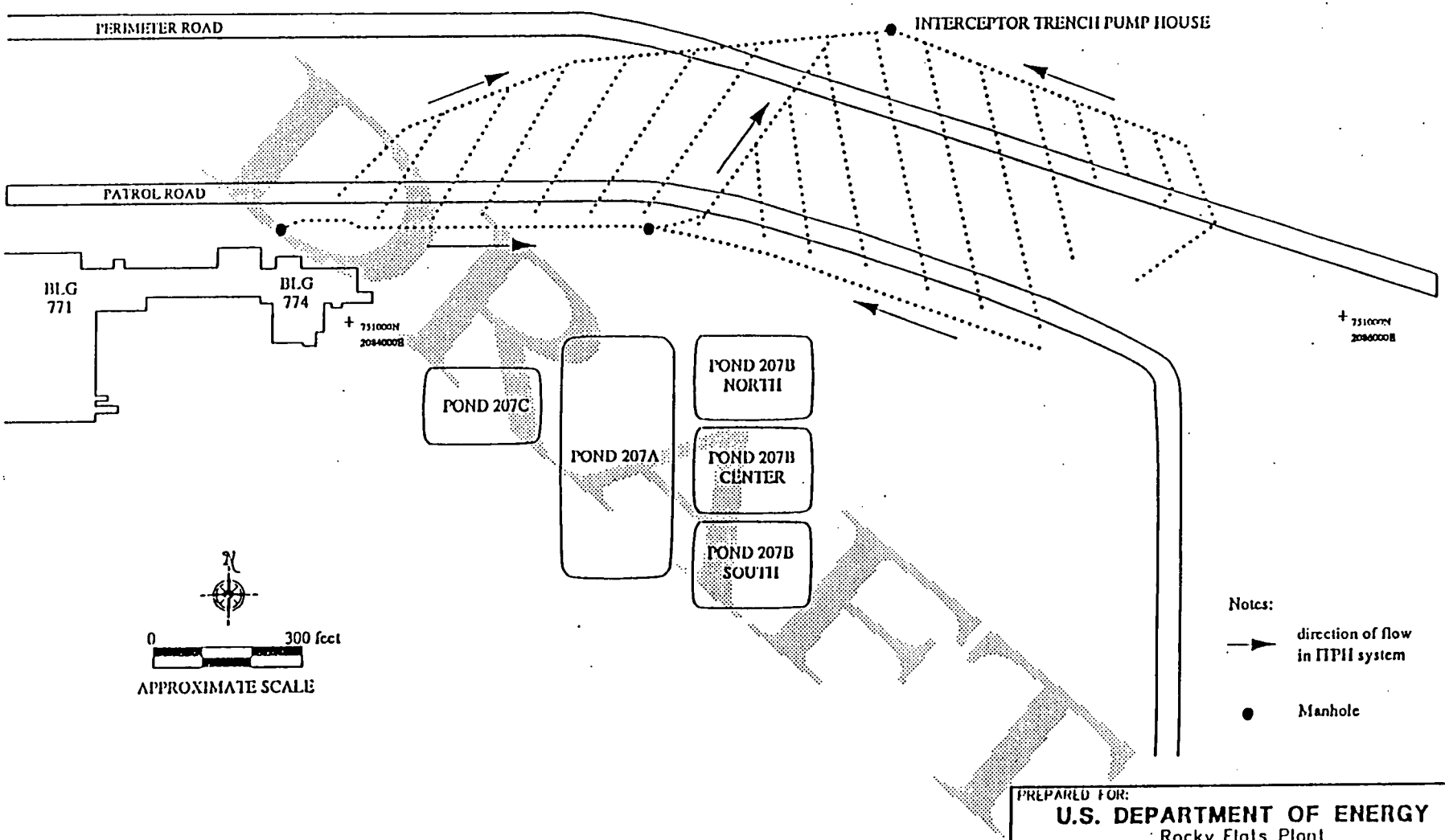
DRAFT

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

Printed on Recycled Paper

45144235 12/19/91 1:40pm CAH

APPROXIMATE LOCATION OF FRENCH DRAIN SYSTEM



REFERENCE: DRAWING PROVIDED BY DOTY & ASSOCIATES.
FIGURE NO. 000-4, 12/17/91, PROJECT NO. 506-10.

PREPARED FOR:
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	FJB
DRAWN BY	A. VIRGIL	APPROVED	
DATE	12/19/91	SCALE	AS SHOWN

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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.

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

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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.

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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 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-S4-8, Approved June 1952.

[2] RFP Engineering Drawing 1-5392-74, Drawn January 1958.

[3] 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.

[4] 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.

[5] 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.

[6] Freiberg, K.J., 1971, "Health Physics Monthly Status Report - Operations Group Technical and Construction - April 1971," May 1.

[7] Freiberg, K.J., 1972, "Health Physics Monthly Status Report - Operations Group Technical and Construction - February 1972," March 3.

[8] Bresson, J.F., 1972, "Policy on Soil Distribution at Rocky Flats," Memorandum to File, April 3.

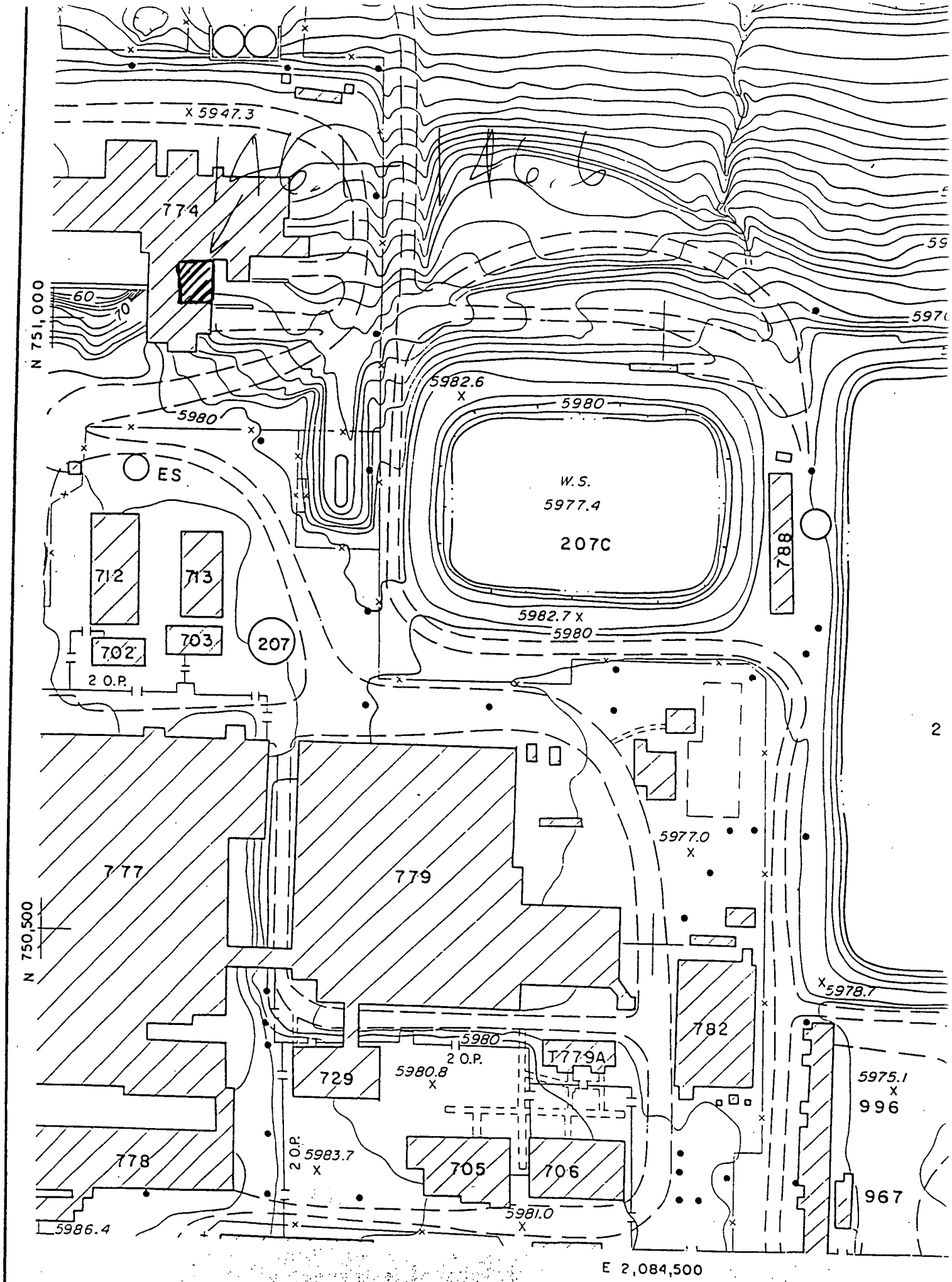
[9] Freiberg, K.J., 1972, "Health Physics Monthly Status Report - Operations Group Technical and Construction - May 1972," June 2.

[10] Steward, L.M., 1973, "Areas of Concern at Rocky Flats: Soil Contamination and Related Incidents, Part I: Plutonium," June 29.

[11] Illsley, C.T., 1973, "Soil Samples from Building 774 Excavation," Internal Report to M.A. Thompson, January 30.

[12] Author Unknown, 1973, "Rocky Flats Division Ecology Council Minutes of Meeting Held February 28, 1973," March 1.

[13] Setlock, G.H., 1988, "Request for Detailed Report on Radiometric Survey," Internal Letter to Tom Greengard, August 19.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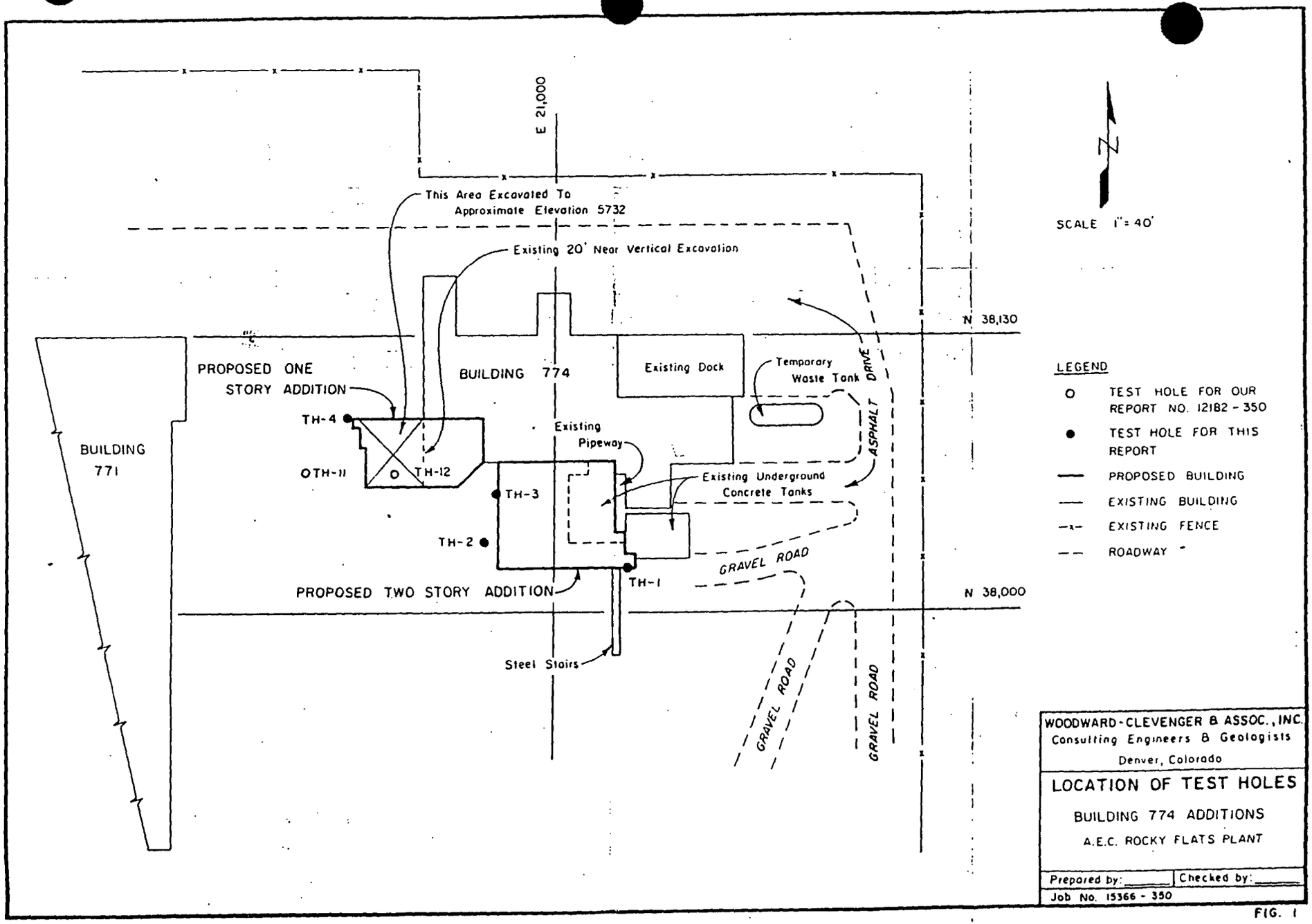
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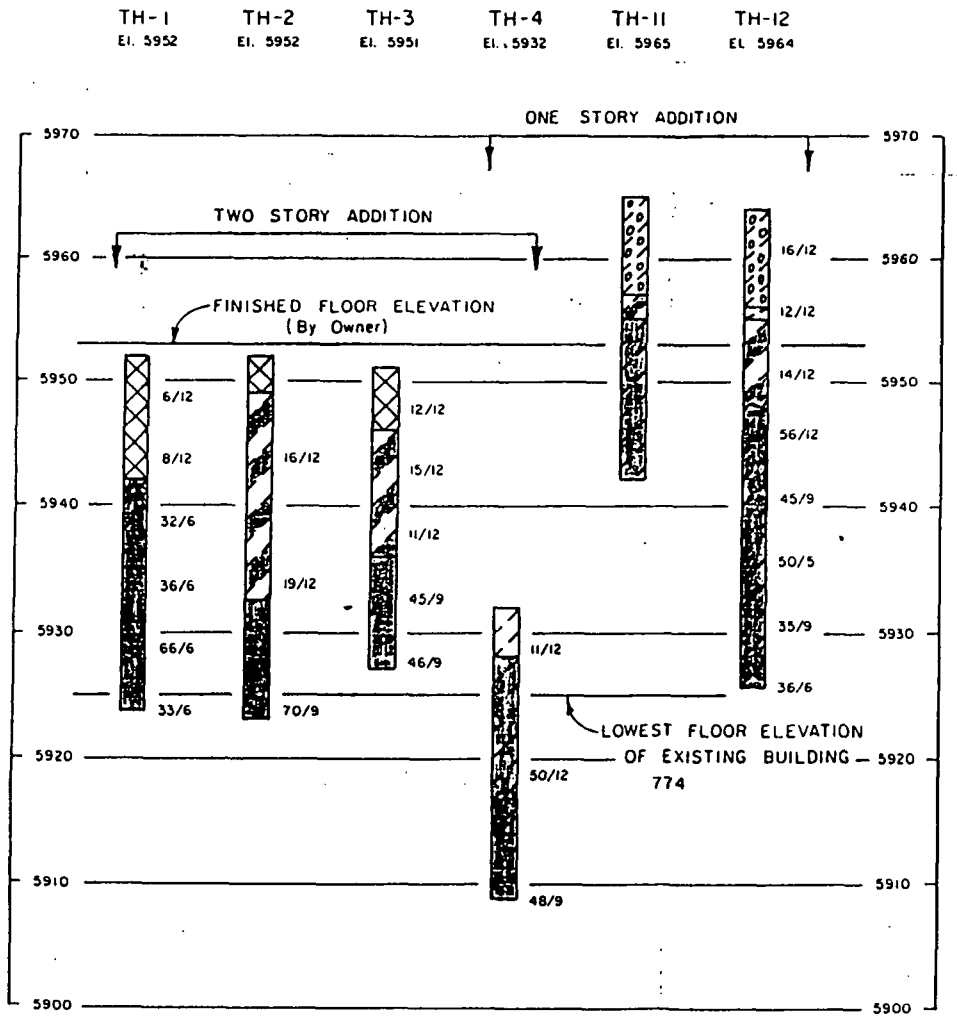
This Area Excavated To Approximate Elevation 5732
Existing 20' Near Vertical Excavation
N 38,130
N 38,000
PROPOSED ONE STORY ADDITION
BUILDING 774
Existing Dock
Temporary Waste Tank
ASPHALT DRIVE
BUILDING 771
TH-4
OTH-11
TH-12
Existing Pipeway
Existing Underground Concrete Tanks
TH-3
TH-2
TH-1
GRAVEL ROAD
PROPOSED TWO STORY ADDITION
Steel Stairs
GRAVEL ROAD
GRAVEL ROAD
SCALE 1" = 40'
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

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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[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
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1601040
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1500641
1500579
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1500863
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1501719
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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

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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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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

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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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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

DRAFT

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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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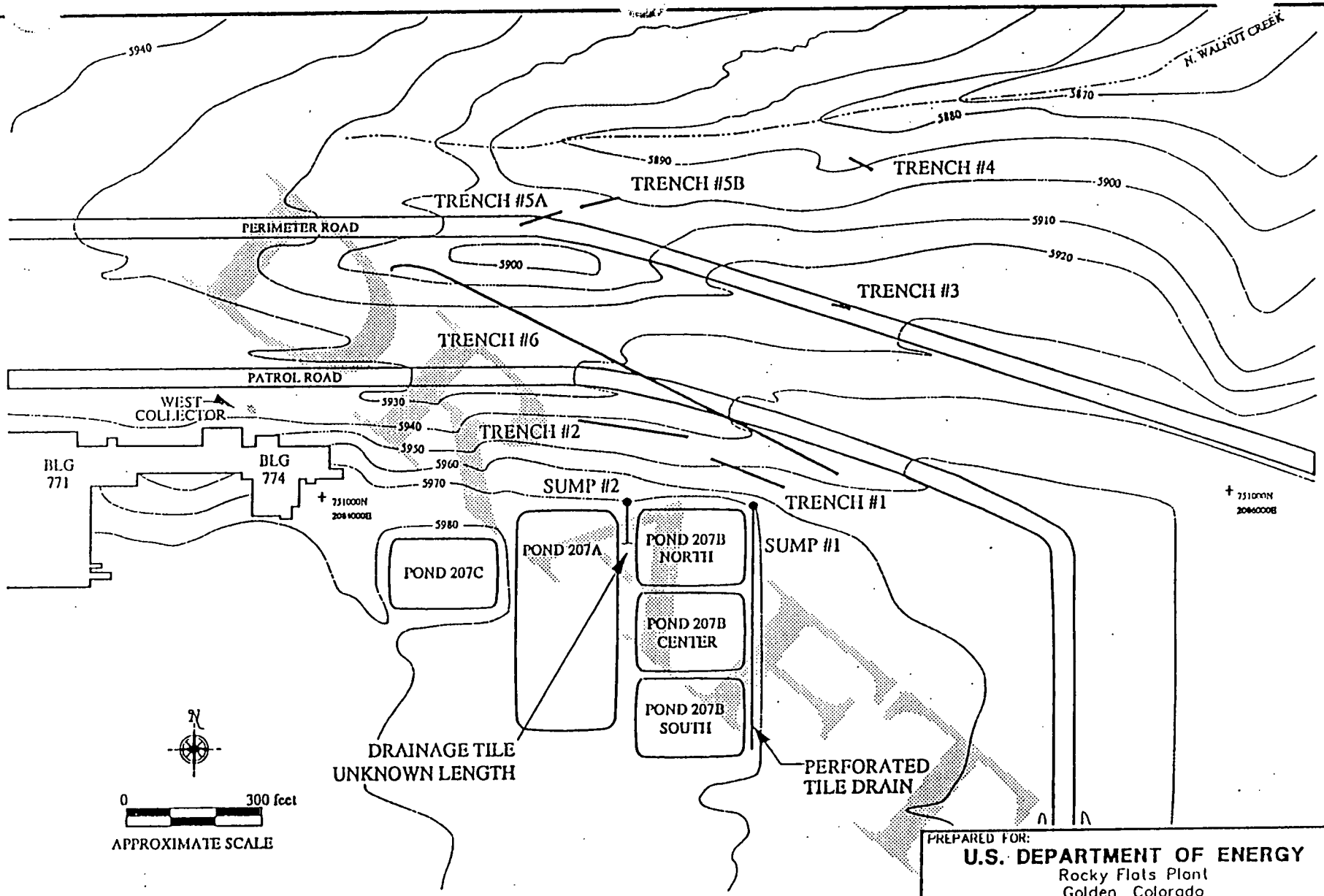

REFERENCE: DRAWING PROVIDED BY DOTY & ASSOCIATES, FIGURE NO. 000-2, 12/17/91, PROJECT NO. 606-10.

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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	FJB
DRAWN BY	A. VIRGIL	APPROVED	
DATE	12/19/91	SCALE	AS SHOWN

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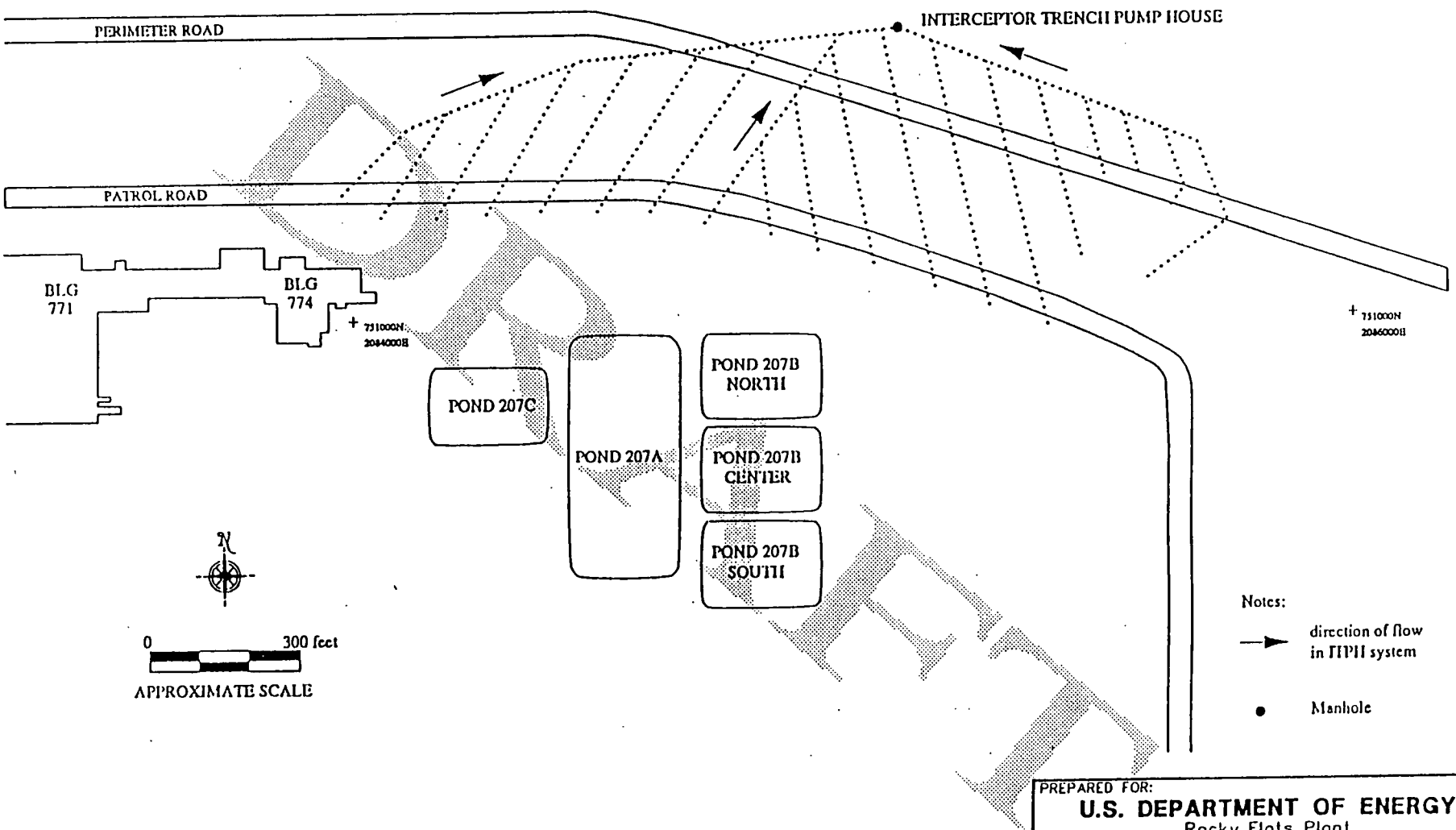
APPROXIMATE LOCATION OF ITPH DRAIN SYSTEM



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U.S. DEPARTMENT OF ENERGY
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

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

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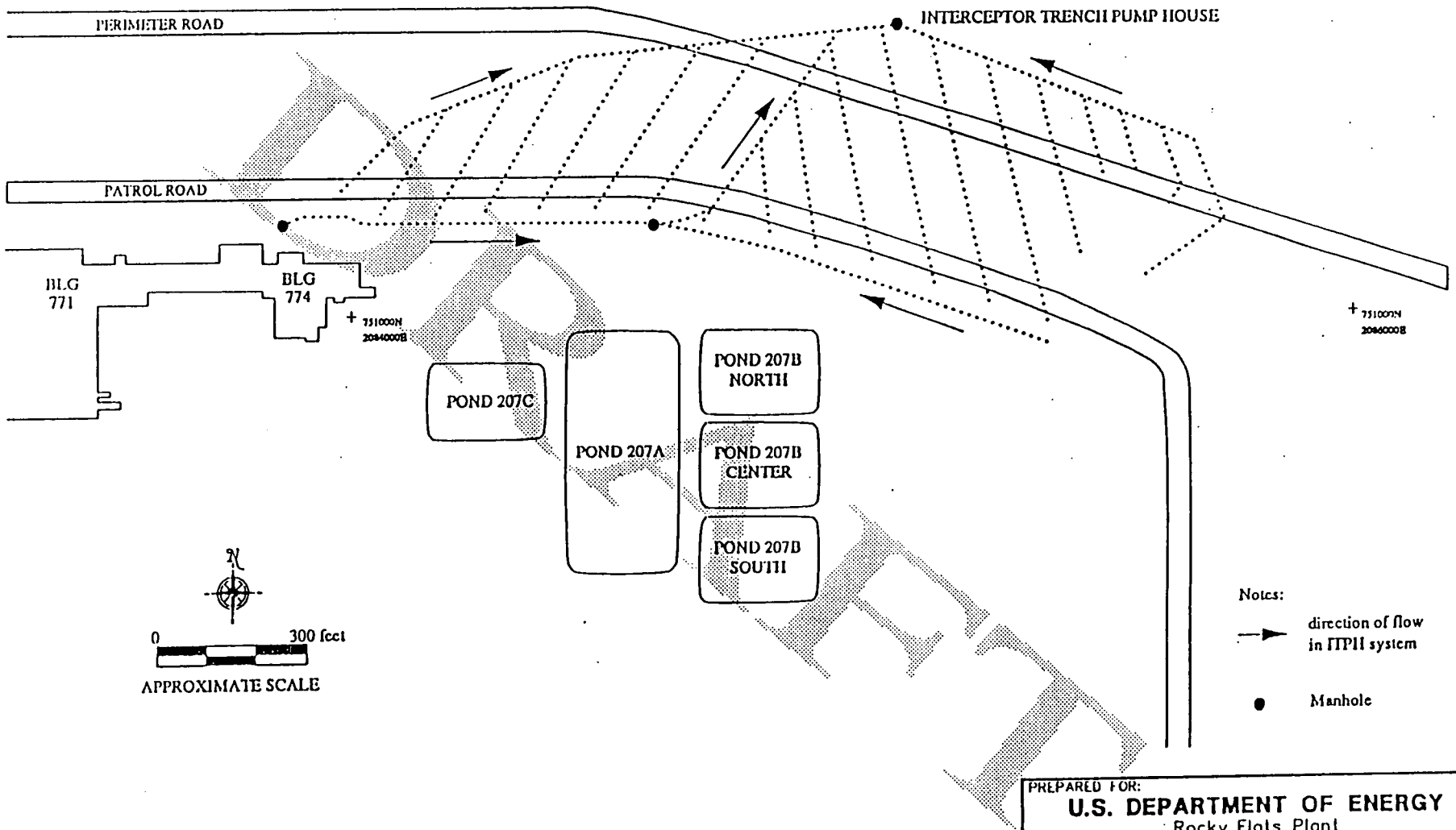
APPROXIMATE LOCATION OF FRENCH DRAIN SYSTEM



REFERENCE: DRAWING PROVIDED BY DOTY & ASSOCIATES, FIGURE NO. 000-4, 12/17/91, PROJECT NO. 506-10.

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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

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APPENDIX C
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
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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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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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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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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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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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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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								
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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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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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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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								

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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
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								

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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
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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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								

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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
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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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								

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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								

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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								

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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								

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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								

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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								

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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								

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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								

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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								

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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								

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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								

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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										

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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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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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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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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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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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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

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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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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

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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

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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
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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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										

APPENDIX C
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										

APPENDIX C
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
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			

APPENDIX C
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
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										

APPENDIX C
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										

APPENDIX C
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										

APPENDIX C
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										

APPENDIX C
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										

APPENDIX C
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
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										

STATE PLANE COORDINATE:		TOTAL DEPTH (FT): 16.5	GROUND ELEVATION (FT):	5931.22	PROJECT NUMBER:	667.11	LOG OF BORING NUMBER:
NORTH:	750943	AREA: SOLAR POND	CASING DIAMETER (IN):	2 ID	GEOLOGIST:	DCB	19-86
EAST:	2083298	LOCATOR NUMBER: K10	BOREHOLE DIAMETER (IN):	7 5	DATE DRILLED:	09/11/86	

REMARKS: Hollow Stem Auger.

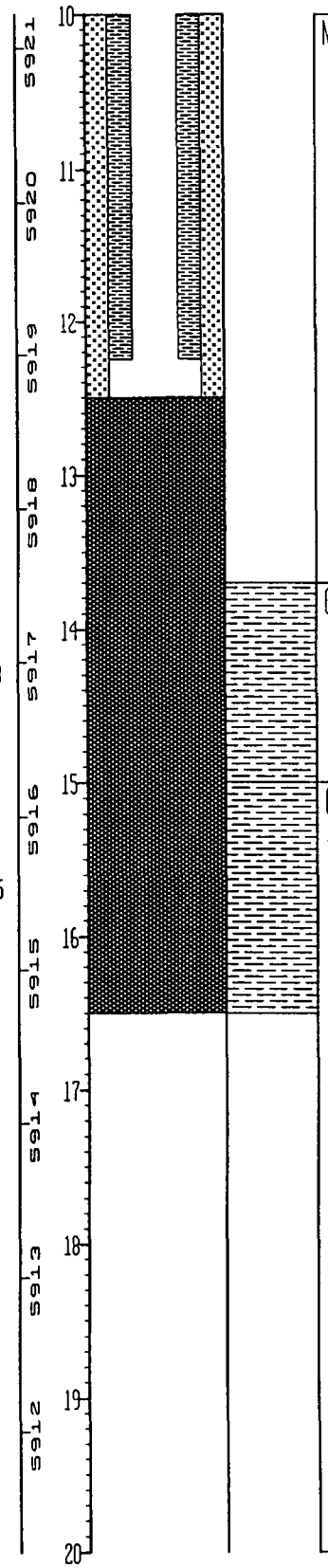
CHEMICAL SAMPLE DEPTH / GRADATIONAL SAMPLE DEPTH	SAMPLE NUMBER	SAMPLE GRAIN SIZE	PERCENT RECOVERY	RECOVERY/ INTERVAL	DATUM (FT)	DEPTH (FT)	WELL OR PIEZOMETER CONSTRUCTION	LITHOLOGY	UNIFIED SOILS CLASSIFICATION OR ROCK TYPE	DESCRIPTION
		0% 50% 100%	0% 100%	0 /10	5931 5930 5929 5928 5927 5926 5925 5924 5923 5922	0 1 2 3 4 5 6 7 8 9 10	09/11/86			NO SAMPLE:

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 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 friable, well weathered localized iron stains and dark calcareous fracture filing at approx. 14.5 ft., slight silt component.
CLAYSTONE:	Same as above.

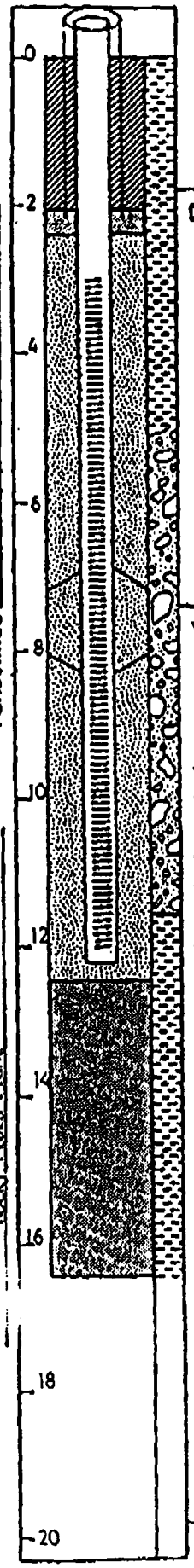
Valley Fill

WELL 19-86

WELL CONSTRUCTION SUMMARY

LOCATION or COORDS:

ELEVATION: GROUND LEVEL 5946'
TOP OF CASING 5947.25'



PROJECT 106PO6222 Rocky Flats Plant

LOCATION Golden, CO

PERSONNEL T. Murphy

DRILLING SUMMARY:

TOTAL DEPTH Well: 12.25' Hole: 16.50'

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

0.0'	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:				
7¼" 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.

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 to 15.0					>50% clay		14		claystone, light gray (N7), bedding not apparent, slightly friable, well localized iron stains, and dark mineralization (possible mg oxides), calcareous fracture filing at ~14.5 ft. slight silt component
Box 2 of 2 DCB	15.0 to 16.5							15		
16.5	16.5							16		
~~Box~~ DCB								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 mate eg Box 1 of 2. Box 2 of 2 contains unmarked core possibly from box 1 of 2.

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
				0/4	5991	0			NO SAMPLE:	
					5990	1				
					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				
						10				

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

RECOVERY/INTERVAL	UNIFIED SOILS CLASSIFICATION OR ROCK TYPE	DESCRIPTION
0.7 /2.5	CL:	Same as above.
0.8 /2	CL:	Same as above.
0.2 /0.5	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.
1.9 /2.5	SANDY CLAYSTONE:	Same as above.
2.5 /2.5	SANDY CLAYSTONE:	Same as above.

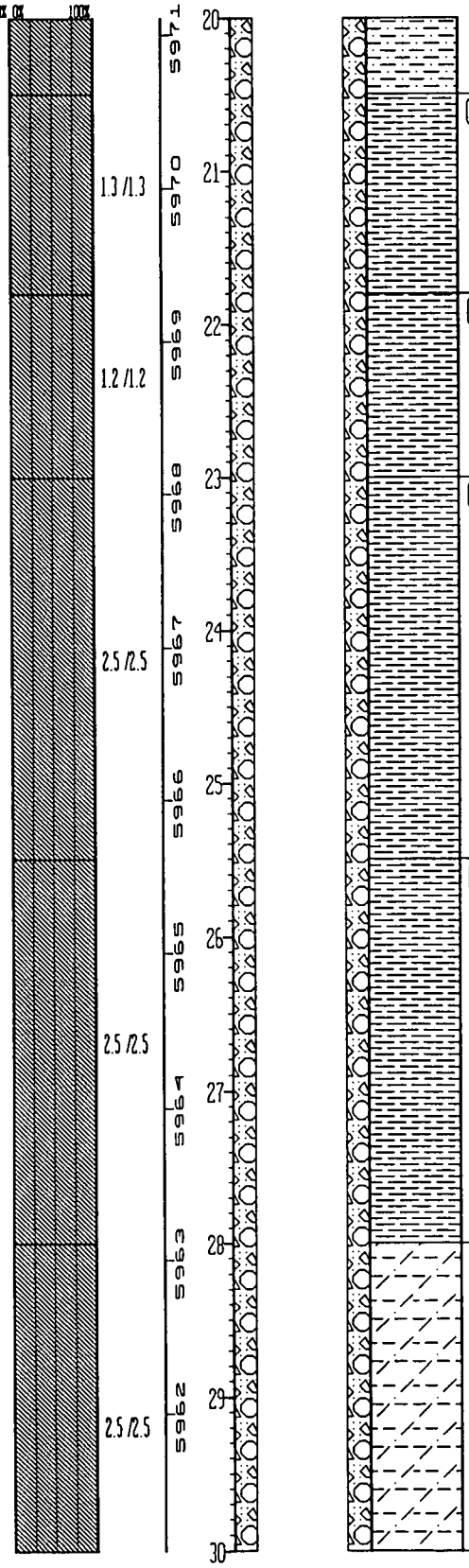
DATUM (FT): 5981, 5980, 5979, 5978, 5977, 5976, 5975, 5974, 5973, 5972

DEPTH (FT): 10, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20

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	

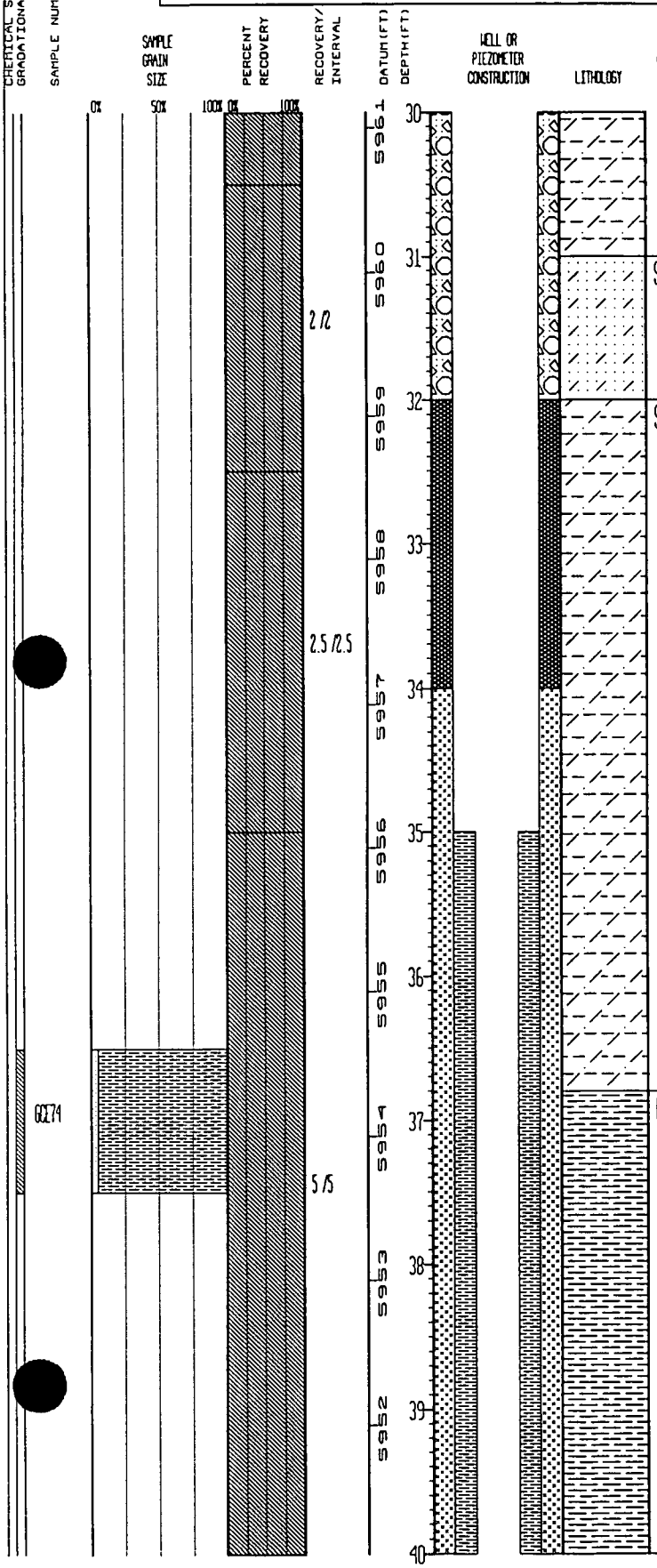
REMARKS: Hollow Stem Auger/NC Core.

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



UNIFIED SOILS CLASSIFICATION OR ROCK TYPE	DESCRIPTION
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.
CLAYSTONE:	As above with a few sub-angular to sub-rounded gravel from approx. 22.7 to 23.6 ft.
CLAYSTONE:	Same as above.
CLAYSTONE:	Same as above.
SILTY CLAYSTONE:	Grayish orange (10YR 7/4), bedding not apparent, highly weathered, moderately friable, local iron staining and dark mineralization.

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			5/5	5944	47				
					5943	48				
					5942	49				
						50				

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.

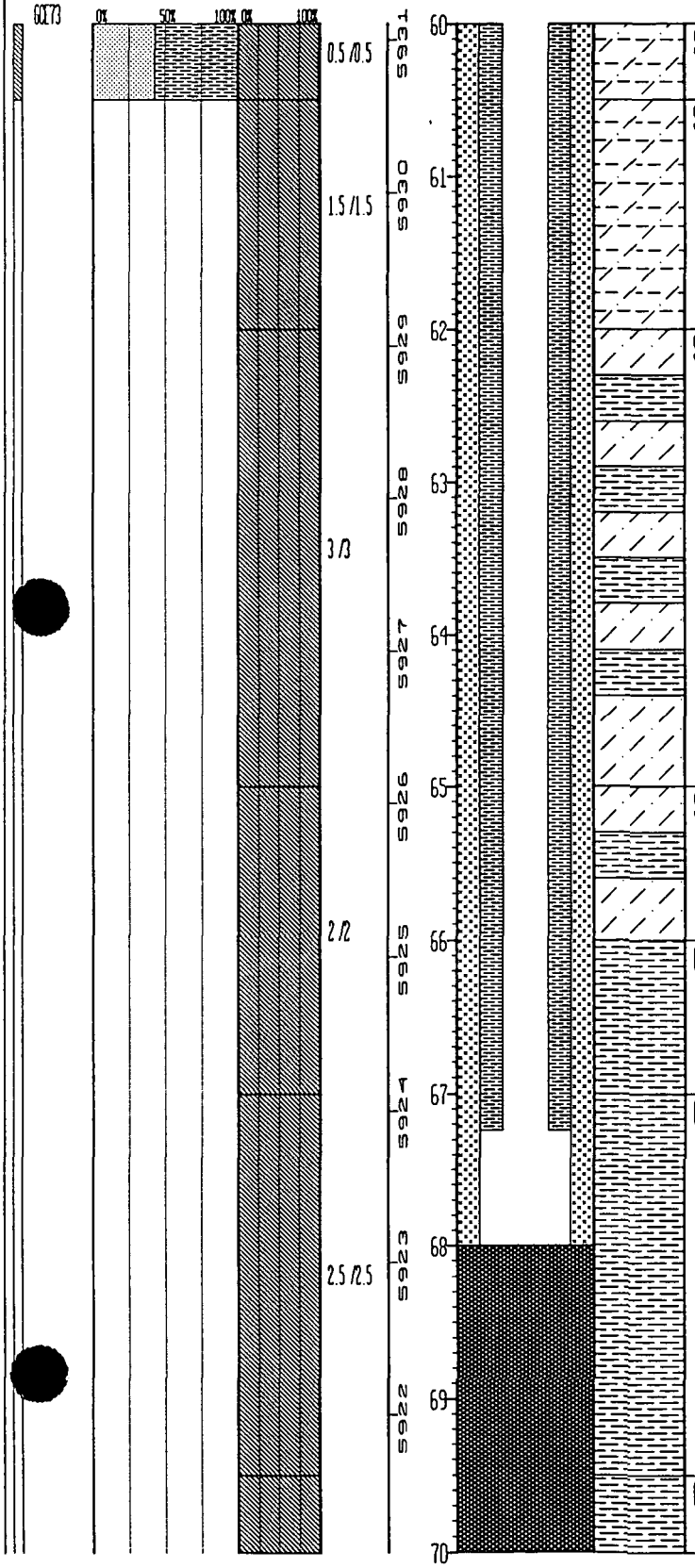
CHEMICAL SAMPLE DEPTH / GRADATIONAL SAMPLE DEPTH	SAMPLE NUMBER	SAMPLE GRAIN SIZE	PERCENT RECOVERY	RECOVERY/INTERVAL	DATUM (FT)	DEPTH (FT)	WELL OR PIEZOMETER CONSTRUCTION	LITHOLOGY	UNIFIED SOILS CLASSIFICATION OR ROCK TYPE	DESCRIPTION
		0% 50% 100%	0% 100%	0.5/0.5	5941	50			SILTY CLAYSTONE:	As above.
				1/1	5940	51			SILTY CLAYSTONE:	As above.
					5939	52			SILTY SANDSTONE:	Interval grades to silty sandstone, very light gray (N8), thin wavy bedding, slightly friable, very fine grained, well sorted.
				3.5/3.5	5938	53			SILTSTONE:	Very light gray (N8), bedding not apparent, slightly friable.
					5937	54				
					5936	55			SILTSTONE:	Same as above.
					5935	56				
				5/5	5934	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.
					5933	58				
					5932	59				
						60				

0073

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
PERCENT RECOVERY
RECOVERY/INTERVAL
DATUM (FT)
DEPTH (FT)
WELL OR PIEZOMETER CONSTRUCTION
LITHOLOGY
UNIFIED SOILS CLASSIFICATION OR ROCK TYPE
DESCRIPTION

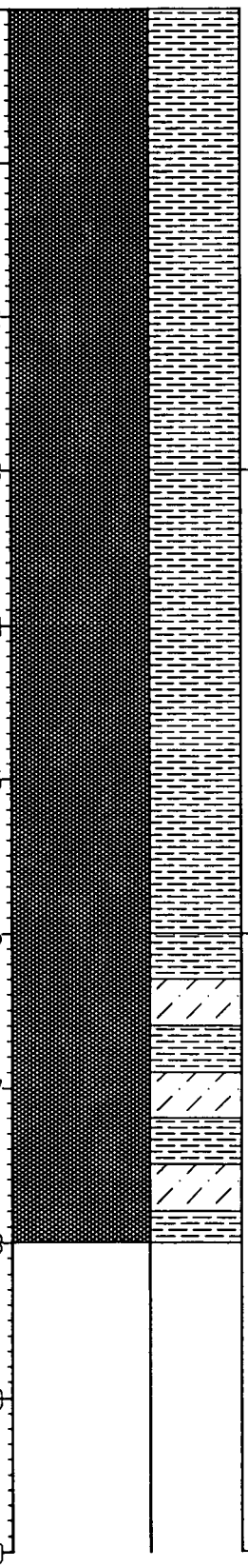


SILTY CLAYSTONE:	As above with abundant VFG sand.
SILTY CLAYSTONE:	At 60.5 ft. silty, sandy claystone unconformably overlies a claystone. The unconformity is not borne out by the sequence at the top of the next box. Silty claystone, light gray (N7), bedding is thin <2 cm. with slight dip to not apparent, 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 DEPTH
SAMPLE NUMBER
SAMPLE GRAIN SIZE (0% 50%)
PERCENT RECOVERY (100% 0% 100%)
RECOVERY/INTERVAL: 3.5/3.5; 3/3; 2/2
DATUM (FT): 5921, 5920, 5919, 5918, 5917, 5916, 5915, 5914, 5913, 5912
DEPTH (FT): 70, 71, 72, 73, 74, 75, 76, 77, 78, 79, 80



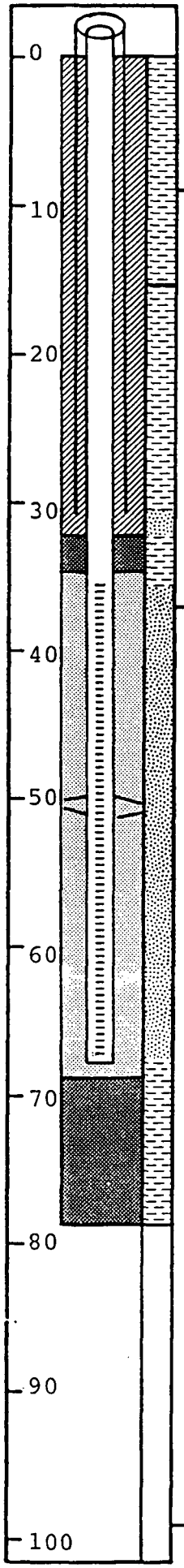
UNIFIED SOILS CLASSIFICATION OR ROCK TYPE	DESCRIPTION
	approx 22 degrees attitude.
CLAYSTONE:	Same as above.
CLAYSTONE:	Interbedded siltstone and claystone. Silty claystone, light gray (N7) med. dark gray (N4), thin bedded <2 mm., slight dip, slightly weathered, slightly friable, localized iron staining. Note: No water encountered during drilling.

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 106PO6222

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: AJP

Project No. 106P06222	Hydro-Search, Inc.	Page 1 of 4

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.			
				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.			
	40						

Remarks Logged by: L. Pivonka Checked by: [illegible]

Project No. 106P06222 | Hydro-Search, Inc. | Page 2 of 4

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

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 ↓ 1st	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				>5 ~soil 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: 8/15/87

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
	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		
10 of 7	15.0 to 15.5	(1) .2						15		
30	15.5 to 18.0	(1) 1.9						16, 17		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 occuring locally.
	18.0 to 20.5	ND						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. 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
Box 1 of 7 ↑ 21.8	20.5 to 21.8	ND				>50% clay	~~CL~~ DCB	21		Interval grades to claystone. claystone, DCB 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 a mg oxide), slight silt fraction.
21.8 ↓	21.8 to 23.0	ND						22		
	23.0 to 25.5	ND						23		As above with ~~[illegible]~~ DCB a few subangular to subrounded gravel from ~22.7 to 23.6 ft.
Box 2 of 7	25.5 to 28.0	ND						24		
								25		
								26		
								27		
								28		
	28.0 to 30.5	ND				>50% clay		29		silty claystone, grayish orange (10 YR 7/4), bedding not apparent, highly weathered, 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
2 of 7	28.0 to 30.5	N/D				>50% clay				As above
Box	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		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.
								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.

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 41.0	40.0 to 41.0	ND				>50% clay				As above
41.0 ↓	41.0 to 45.0	ND						41, 42, 43, 44, 45		
Bot 45.0	45.0 to 50.0	ND				>50% clay		46, 47, 48, 49		Silty Claystone medium light gray (N6), thin horizontally to bedding not apparent, slightly friable, occasional intervals of fine sand (typically c.2 ft thick), silt and clay 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		
	to	ND				~~DCB 50% 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.
Box 5 of 7								53		Interval grades to siltstone at ~52 ft. Siltstone, very light gray (N8), bedding not apparent, slightly friable.
								54		
	55							55		
	55 to							56		
		ND			3-5°			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		
	60									

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 silty sand.
60.5 ↓	60.5					>50% clay				At 60.5 silty clay stone unconformably overlies a claystone. The unconformity is not borne out by the sequence at the top of the next box.
					~10°	>50% clay		61		
								62		Siltstone, light gray (N7), bedding is thin <2mm with slight dip to, not apparent, weathered, slight to moderate friability, some vfg sand, silt and sand are disseminated within the claystone and occur in discrete intervals.
					~10°	>50% silt.				
	to	ND						63		
								64		Interbedded siltstone and claystone. Siltstone, light gray (N7) to med. dark gray (N4), thin bedded <2mm 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	ND				>50% clay		66		Interval grades to claystone at ~66 ft. Claystone medium gray (N5) bedding not apparent, slightly weathered, slightly friable, localized iron staining, some carbonaceous mineralization occurs on partings, moderate silt fraction
	67.0							67		
Box 7 of 7	67.0									
	to	ND						68		
								69		
↑ 69.5	69.5									
69.5 ↓ Box 7 of 7	69.5 to 73.0	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.

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	NID			<5°	>50% clay; ~50% silt; ~50% clay; >50% clay		71, 72, 73		As Above. As above with increase in silt fraction from ~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° altitude.
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. dark 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.
								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.

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	

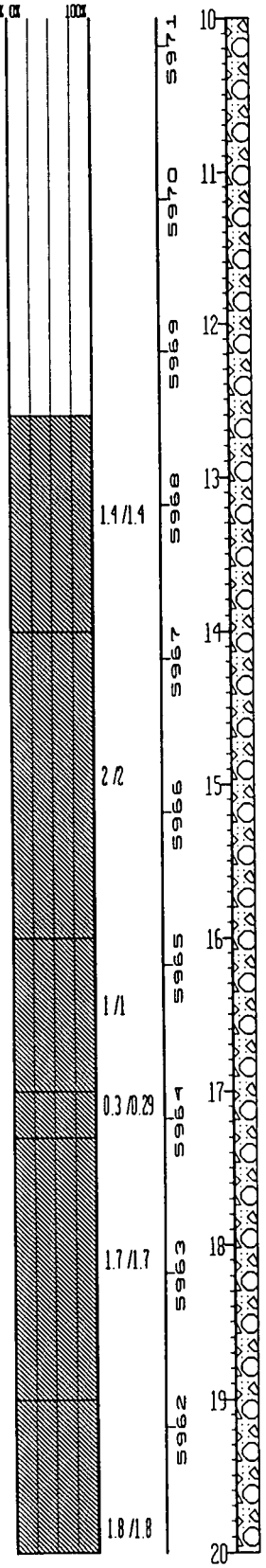
REMARKS: Hollow Stem Auger/NC Core. Built well in NC rod: no centralizers used.

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
				0 /12.6	5981	0				NO SAMPLE:
					5980	1				
					5979	2				
					5978	3				
					5977	4				
					5976	5				
					5975	6				
					5974	7				
					5973	8				Top of Bedrock.
					5972	9				
						10				

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

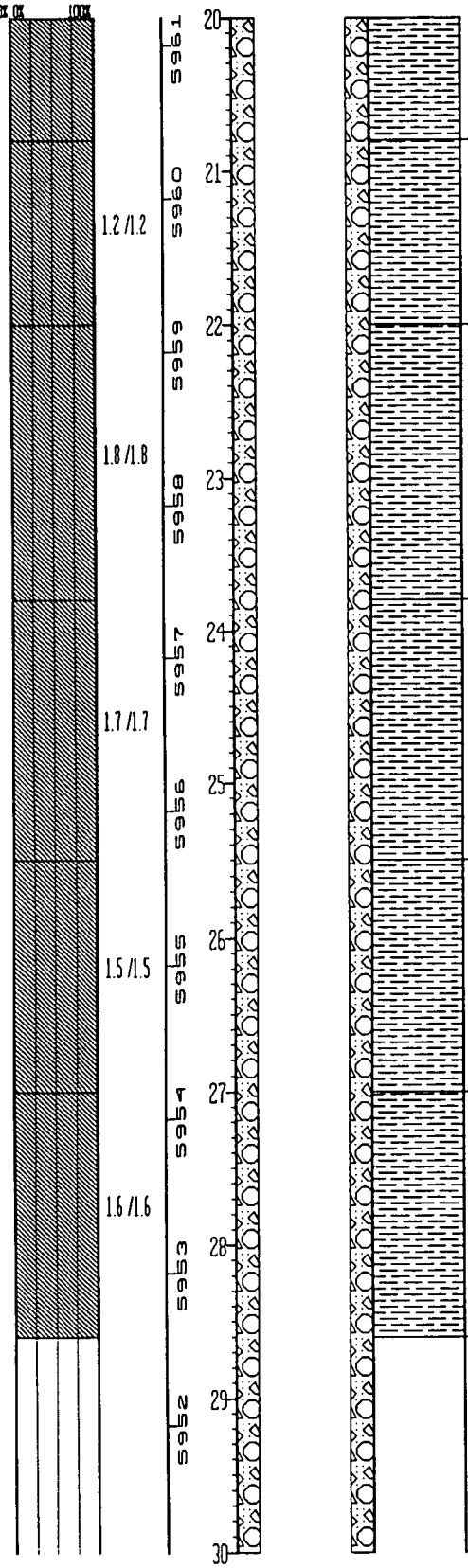


UNIFIED SOILS CLASSIFICATION OR ROCK TYPE	DESCRIPTION
NO SAMPLE	
CLAYSTONE	Light gray (N7) bedding not apparent, slightly weathered, slightly friable, caliche occurs as fracture filling, local iron staining, slight silt fraction.
CLAYSTONE	As above with iron staining on fractures and moderate amount of Mg oxide mineralization.
CLAYSTONE	As above.
CLAYSTONE	As above.
CLAYSTONE	As above.
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

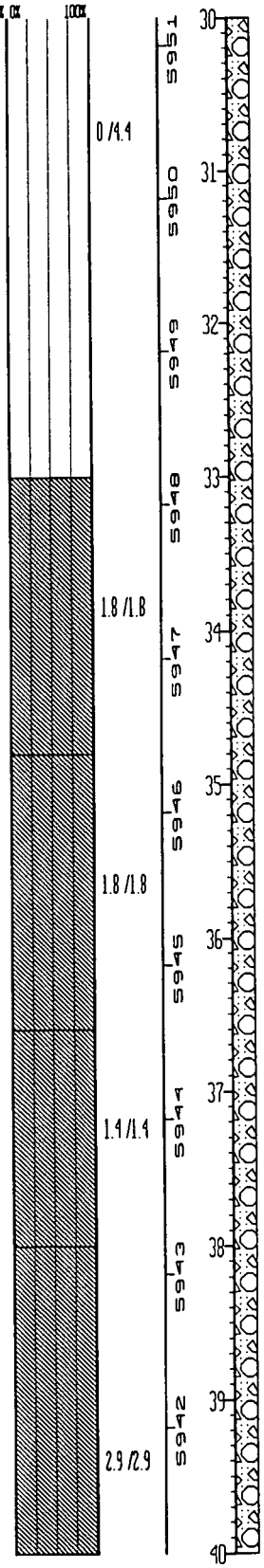


UNIFIED SOILS CLASSIFICATION OR ROCK TYPE	DESCRIPTION
CLAYSTONE	As above. Slickensides at approx. 21.9 ft., attitudes 50 degrees and 60 degrees, iron staining and possible Mg oxides on surface.
CLAYSTONE	Same as above, carbonaceous mineralization (low grade coal) at approx. 22.8 ft.
CLAYSTONE	Same as 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 DEPTH
SAMPLE NUMBER
SAMPLE GRAIN SIZE (0% 50% 100%)
PERCENT RECOVERY (0% 100%)
RECOVERY/INTERVAL
DATUM (FT)
DEPTH (FT)
WELL OR PIEZOMETER CONSTRUCTION
LITHOLOGY

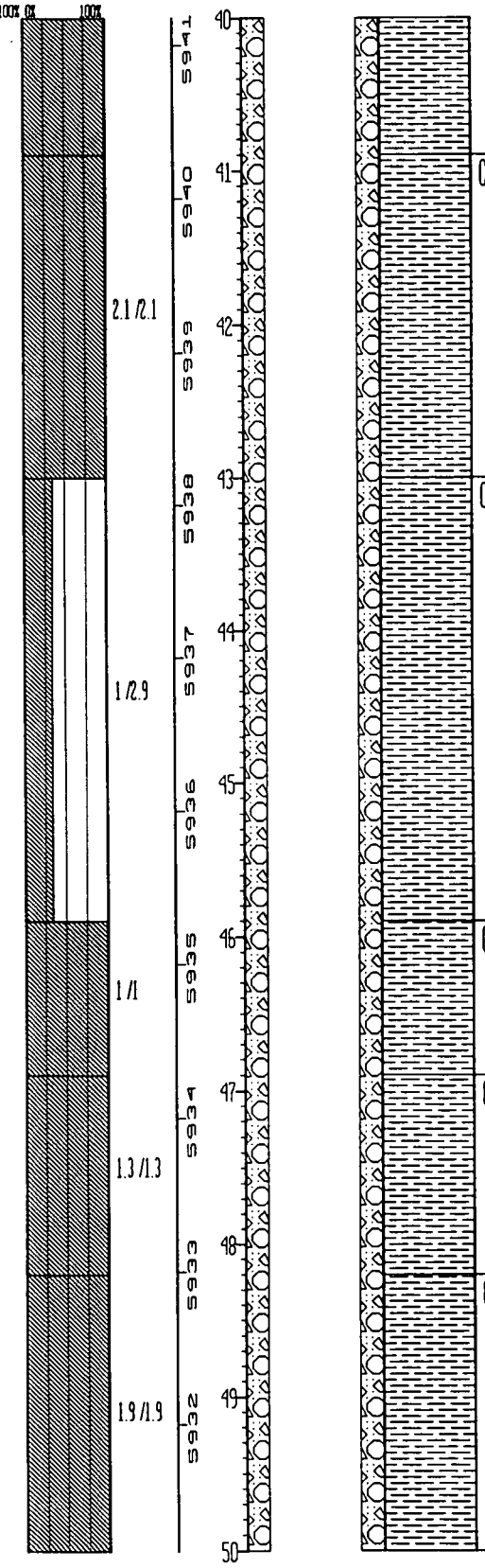


UNIFIED SOILS CLASSIFICATION OR ROCK TYPE	DESCRIPTION
CLAYSTONE	Light gray (N7) to yellowish gray (5Y 8/1), bedding not apparent, well weathered, slightly friable, slight silt fraction, some dark mineralization, probably carbonaceous, occasional iron stains and calcareous bodies <1 mm. in diam.
CLAYSTONE	As above.
CLAYSTONE	As above, slabbed section exhibits multiple very fine healed fractures.
CLAYSTONE	Light gray (N7), bedding not apparent, weathered, slightly friable, vertical fractures and approx. 25 degree fractures with iron staining, slightly calcareous in places.

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

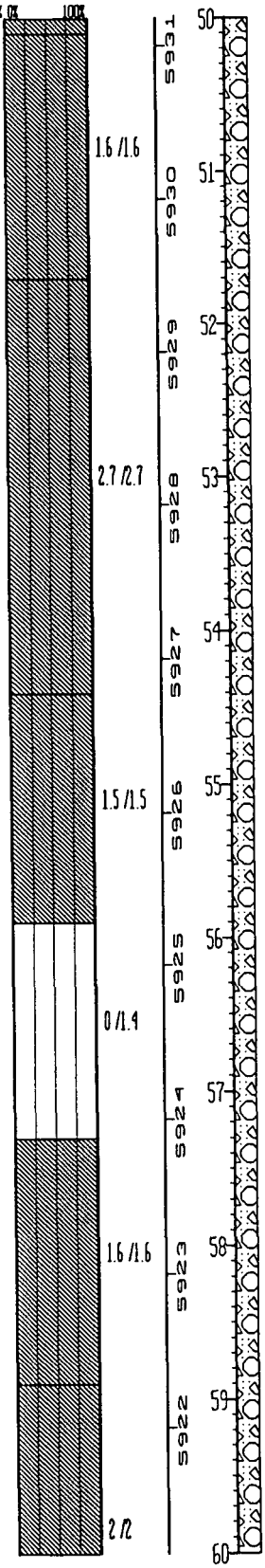


UNIFIED SOILS CLASSIFICATION OR ROCK TYPE	DESCRIPTION
CLAYSTONE	As above, exterior of core has a knotty appearance. From 42.7 to 43.2 ft. interval is highly weathered.
CLAYSTONE	Same as above.
CLAYSTONE	Medium light gray (N6) to very light gray (N8), bedding not apparent, possible soft sediment deformation 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 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

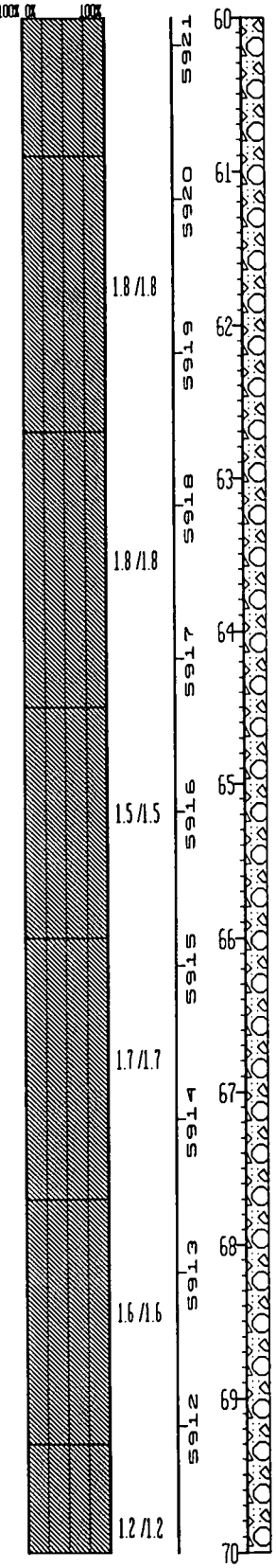


UNIFIED SOILS CLASSIFICATION OR ROCK TYPE	DESCRIPTION
CLAYSTONE	As above, slickensides at approx. 50.1 to 50.4 ft.
CLAYSTONE	As above, slickensides at approx. 52.5 ft.
CLAYSTONE	Light olive gray (5Y 6/1), bedding not apparent, weathered, slightly friable, trace of silt, slickensides at approx. 55.4 ft., slight amount of iron staining.
NO SAMPLE	
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

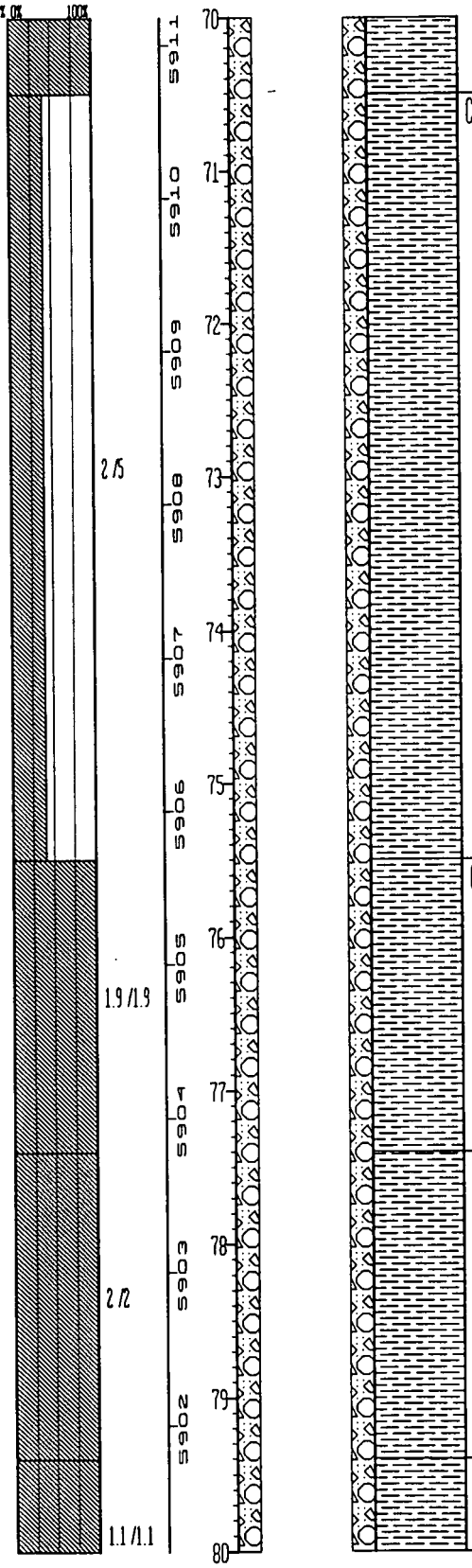


UNIFIED SOILS CLASSIFICATION OR ROCK TYPE	DESCRIPTION
CLAYEY SILTSTONE	Light gray (N7), bedding not apparent (massive?), slightly friable, iron stain at approx. 62 ft. with possible carbonaceous mineralization.
SILTY CLAYSTONE	Interval grades to a silty claystone at 62.7 ft. as above, iron stains absent.
SILTSTONE	Light gray (N7), bedding not apparent (massive?), slightly friable, slight clay fraction, slight amount of carbonaceous mineralization.
SILTSTONE	As above.
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.

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

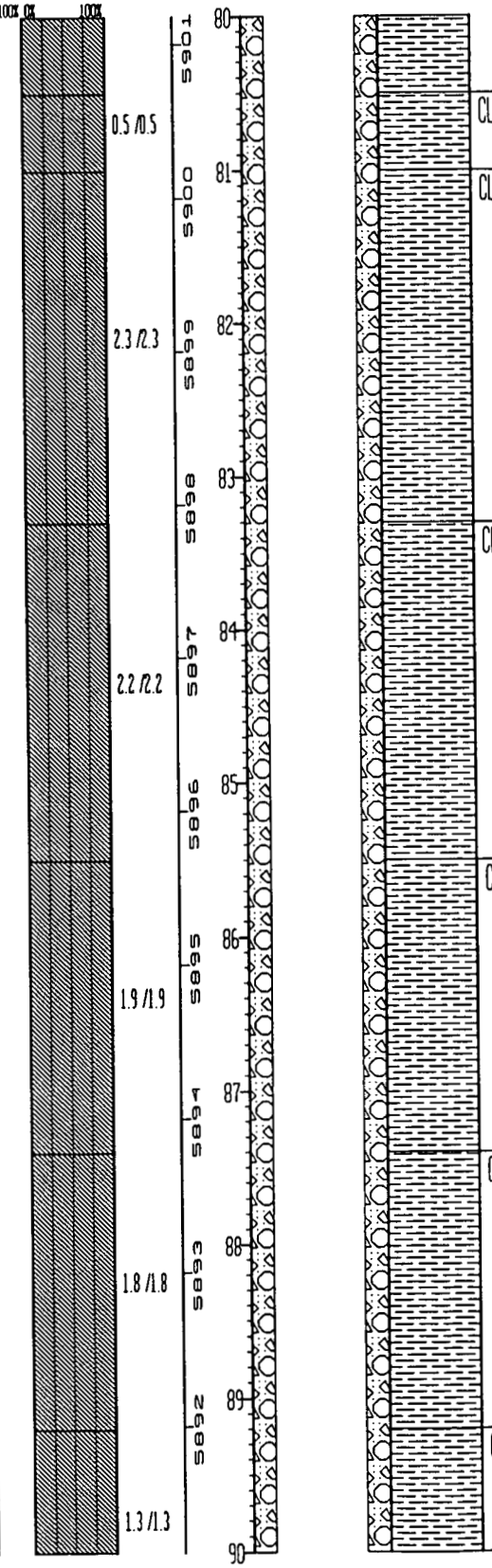


UNIFIED SOILS CLASSIFICATION OR ROCK TYPE	DESCRIPTION
CLAYSTONE	As above.
CLAYSTONE	As above, slickensides at approx. 77.0 ft.
CLAYSTONE	As above with an increase in the silt fraction from approx. 77.4 ft. to 80.5 ft. and color grades to light gray (N7).
CLAYSTONE	As above.

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

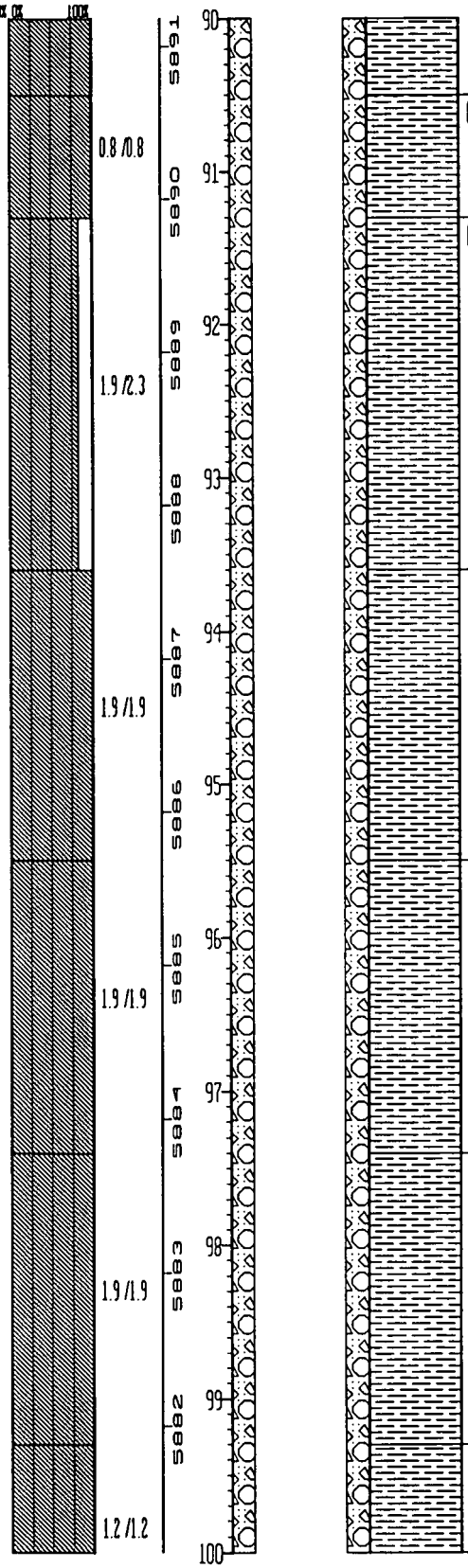


UNIFIED SOILS CLASSIFICATION OR ROCK TYPE	DESCRIPTION
CLAYSTONE	Light olive gray (5Y 6/1), bedding not apparent, slightly friable, occasional iron staining, moderate silt fraction.
CLAYSTONE	As above.
CLAYSTONE	As above. Slickensides at approx. 85.2 ft. with 40 degree attitude.
CLAYSTONE	As above, slickensides 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.

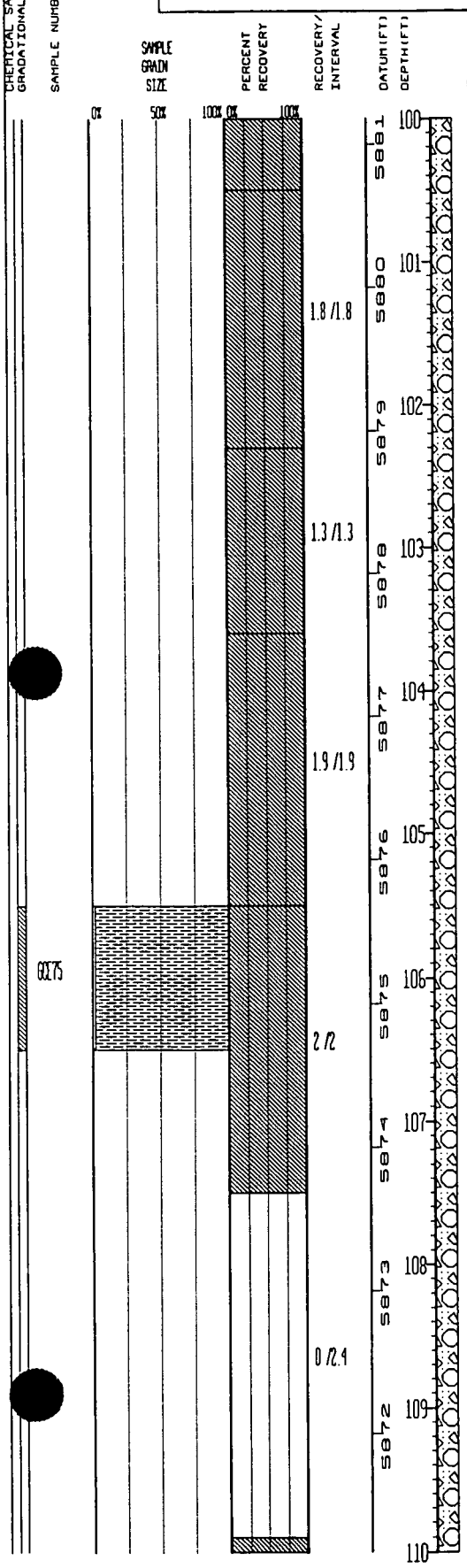
CHEMICAL SAMPLE DEPTH
GRADATIONAL SAMPLE DEPTH
SAMPLE NUMBER
SAMPLE GRAIN SIZE (0% 50% 100%)
PERCENT RECOVERY (0% 100%)
RECOVERY/INTERVAL
DATUM (FT)
DEPTH (FT)
WELL OR PIEZOMETER CONSTRUCTION
LITHOLOGY



UNIFIED SOILS CLASSIFICATION OR ROCK TYPE	DESCRIPTION
CLAYSTONE	As above 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	

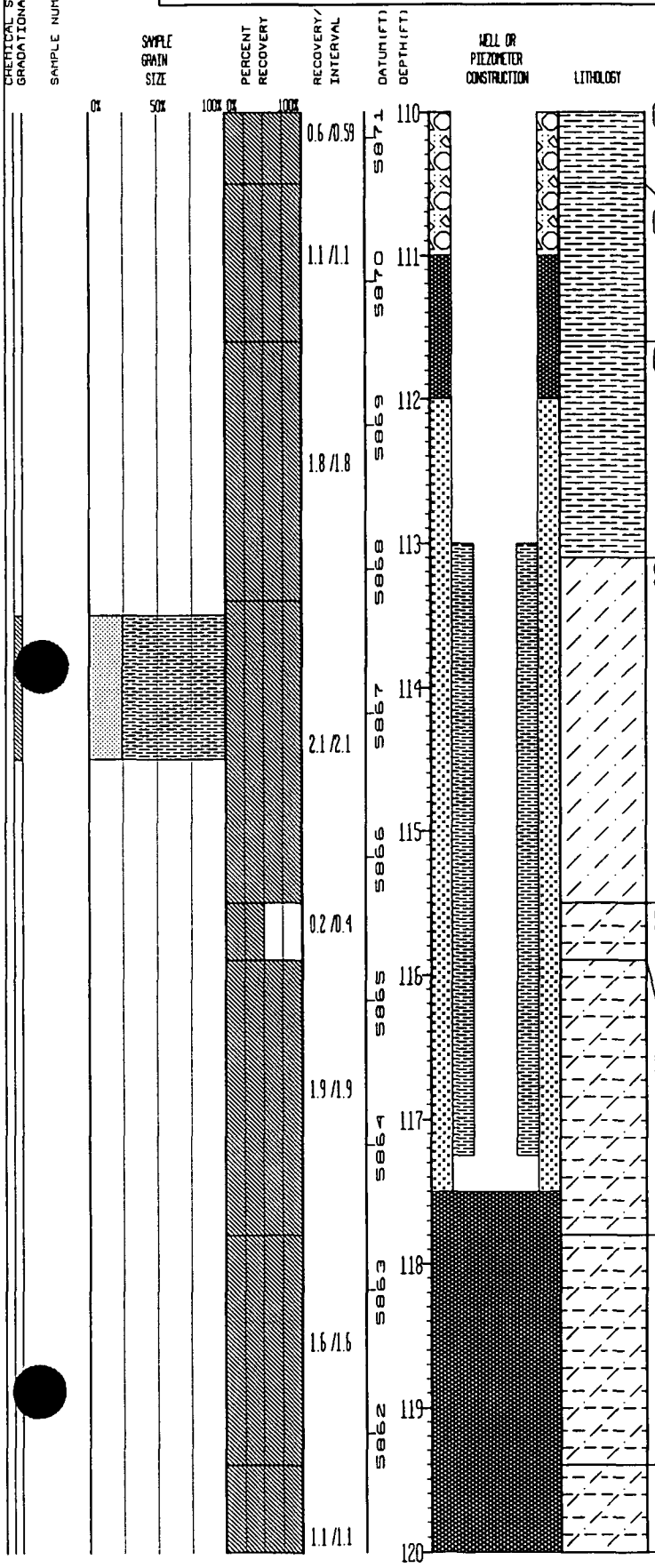
REMARKS: Hollow Stem Auger/NC Core. Built well in NC rod: no centralizers used.



UNIFIED SOILS CLASSIFICATION OR ROCK TYPE	DESCRIPTION
CLAYSTONE	As above, lense of FG sand at approx. 102 ft. approx. 2 mm. in thickness.
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.
CLAYEY SILTSTONE	As above, increase in clay fraction below 105 ft.
SILTY CLAYSTONE	Light olive gray (5Y 6/1), bedding not apparent, weathered, slightly to moderately friable, occasional iron stains and carbonaceous mineralization.
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.



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.

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)	DEPTH (FT)	UNIFIED SOILS CLASSIFICATION OR ROCK TYPE	DESCRIPTION
	5861	120		
0.6 /0.59			SILTY CLAYSTONE	As above.
	5860	121		
1.8 /1.8	5859	122	SILTY CLAYSTONE	As above, slickensides at approx. 122.7 ft.
	5858	123	SILTY CLAYSTONE	As above, bedding appears to have slight dip (based on core breaks).
2 /2	5857	124		
0.6 /0.59	5856	125	SILTY CLAYSTONE	As above.
0.8 /0.8	5855	126	SILTY CLAYSTONE	As above.
1.5 /1.5	5854	127	SILTY CLAYSTONE	As above.
1.7 /1.7	5853	128	SILTY CLAYSTONE	As above.
	5852	129		
1 /1		130	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 DEPTH
GRADATIONAL SAMPLE DEPTH
SAMPLE NUMBER
SAMPLE GRAIN SIZE (0% 50% 100%)
PERCENT RECOVERY (0% 100%)
RECOVERY/INTERVAL: 1/1
DATUM (FT)
DEPTH (FT): 130, 131, 132, 133, 134, 135, 136, 137, 138, 139, 140
WELL OR PIEZOMETER CONSTRUCTION
LITHOLOGY
UNIFIED SOILS CLASSIFICATION OR ROCK TYPE
DESCRIPTION

NOTE: No water encountered while drilling.

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. 5.0-7.0'-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%. 7.0-8.2'. GRAVEL: Same as above; damp.			
	5						
	10			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: [illegible]

Project No. 106P06222

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
	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. 106P06222

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. 106P06222

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: [illegible]

Project No. 106P06222

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. 106P06222

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. 106P06222

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						

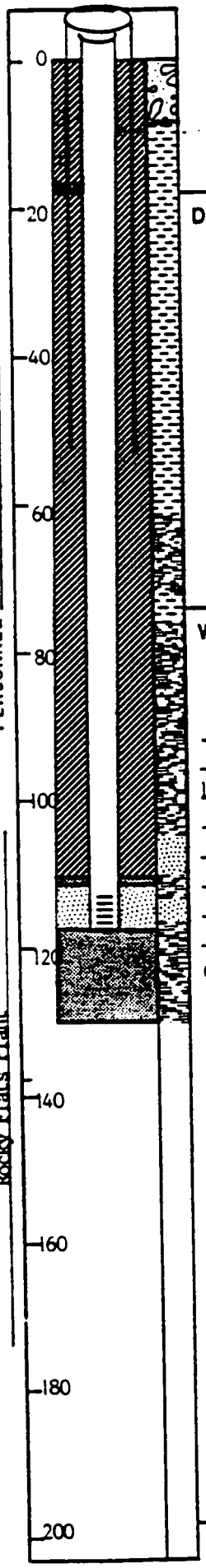
Remarks Logged by: T. Murphy Checked by:

Project No. 106P06222

Hydro-Search, Inc.

WELL 23-86

WELL CONSTRUCTION SUMMARY



LOCATION Golden, CO

PERSONNEL T. Murphy

PROJECT 106P06222 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': 7¼"
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	
7¼" auger	9/11	1500	9/11	1800
NC core	9/19	1000	9/23	1500
Reaming	9/26	1217	9/26	1541
GEOPHYS. LOGGING:	—	—	—	—
CASING:				
5" steel	9/12	1000	9/12	1115
2" stainless	9/26	1637	9/26	1650
FILTER PLACEMENT:	9/26	1738	9/26	2021
CEMENTING:	9/27	0830	9/27	1037
DEVELOPMENT:	10/1	1200	10/1	1200
OTHER:				
Bentonite	9/26	2021	9/26	2130
	9/26	1542	9/26	1545
Packer testing	9/23	1500	9/26	1217
Cementing 5" steel	9/12	1130	9/12	1225

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 use

Protective casing and stainless steel casing were bent and had to be cut. New top of stainless steel casing: 0.08'.

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
					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.
	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								

Box 2 of 4

Erasures 8/30/89, pc corrected interval marker error

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 2 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, attitudes 50° and 60°, iron staining and possible mg oxides on surface. Carbonaceous mineralization (low grade coal at ~22.8 ft.
	23.8 to 25.5	ND						23		
	23.8 to 25.5	ND						24		
	25.5 to 27.0	ND						25		Slickensides at ~25 ft. attitude ~~at~~ DCB ~45°
	27.0 to 28.6	ND						26		
↑ 28.6	27.0 to 28.6	ND						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		No Sample
33.0 ↓	33.0 to 34.8					>50% clay		33, 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		
Box to 10	36.6 to 38.0							37		As above slabbed section exhibits multiple very fine healed fractures.
	38.0 to 40.9			25° 90°		>50% 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				
Box 1 of 10	40.9 to 43.0							41, 42		As above, exterior of core has a knotty appearance. From 42.7 to 43.0 ft. of interval DCB is highly weathered.
43.0 ↓	43.0 to 45.9	(1) 1.0						43, 44, 45		
Box 2 of 10	45.9 to 46.9	ND						46		Claystone, medium light gray (NG) to very light gray (N8), bedding not apparent, possible soft sediment deformation or bioturbation, well weathered, moderately friable, abundant carbonaceous mineralization, some iron staining.
Box 2 of 10	46.9 to 48.2	ND						47, 48		
	48.2 to 50.1	ND		90°				49		Claystone, medium gray (NG), bedding not apparent, well weathered, slightly friable, abundant iron staining on bedding plane partings and fractures, streaks on sides 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 2nd 10	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	54.4 to 55.9	ND						55		Claystone, light olive gray (5Y6/1), bedding not apparent, weathered, slightly friable, trace of silt, slickensides at ~55.4 ft. slight amount of iron staining.
Bot 3rd 10	55.9 to 57.3	O						56, 57		No Sample
	57.3 to 58.9	ND				>50% clay		58		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.
	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. 23-86

GEOLOGIST(S): OCB
DATE: 8/17/87

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
Box 3 of 10	58.9 to 60.9	ND								As above
	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 carbaceous mineralization.
	62.7 to 64.5	ND						63, 64		Interval grades to a silty Claystone at 62.7 ft as above, iron stains absent.
Box 4 of 10	64.5 to 66.0	ND						65, 66		Interval grades to siltstone at ~65 ft. Siltstone, light gray (N7), bedding not apparent (massive?), slightly friable, slight clay fraction, slight amount of carbaceous mineralization.
	66.0 to 67.7	ND						67		
	67.7 to 69.3	ND				>50% clay		68, 69		Slickenside at ~68.5. Interval grades to Claystone at ~68.5 ft. Claystone, dark gray (N3), bedding not apparent, weathered, slight to moderate friability, slight amount of iron staining, moderate silt fraction
	69.3 to 70.5	ND								

OCB

OCB

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
	69.5 to 70.5	ND				750% clay				some carbonaceous mineralization, slickensides at ~69.8 ft.
	70.5 to							71		
Box 4 of 10		(1) 2.0						72		
								73		
								74		
75.5	75.5							75		
75.5 ↓	75.5 to	ND						76		
Box 5 of 5	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.

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		Claystone - DCB As above - slickenside at ~ 85.2 with 40° attitude.
85.5	85.5 to 87.4	ND						86, 87		Claystone DCB As above - slickensides are absent. Irregular body of vfg sand at ~85.9 ft.
Bot 6 of 10	87.4 to 89.2	ND						88, 89		
	89.2 to 90.5	ND								Claystone DCB As above with irregular body of vfg sand at ~ 89.5.

Erasures 8/18/89 DCB corrected misplaced 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. 23-86

GEOLOGIST(S): DCB
DATE: 8/17/89 DCB

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 fibrous xtals (gypsum?) underlain by gray granular mass, Fe oxide and possible mg oxide stains surround mineral body. Fractures with faint slickensides at ~97 ft. and 99.1 ft.
Box 7 of 10	97.4 to 99.3	ND		30°				98 99		
	99.3 to 100.5	ND								

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(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. ~2mm 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							104, 105		DCB ~~Clayey siltstone is clearly~~ Increase in clay fraction below 105 ft.
105.5	105.5 to 107.5	ND				>50% clay		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

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(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		
	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 mineralizations
								115		
Box 8 of 10	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 distortions 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.

ROCKY FLATS PLANT

FIGURE NO.

LOG OF BORING NO. 23-86

GEOLOGIST(S): DCB
DATE: 8/18/87

PROJECT NO: 6607-11-22

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/Clay
	120.5 to 121.1	ND								
	121.1 to 122.9	ND						121, 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		
	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.

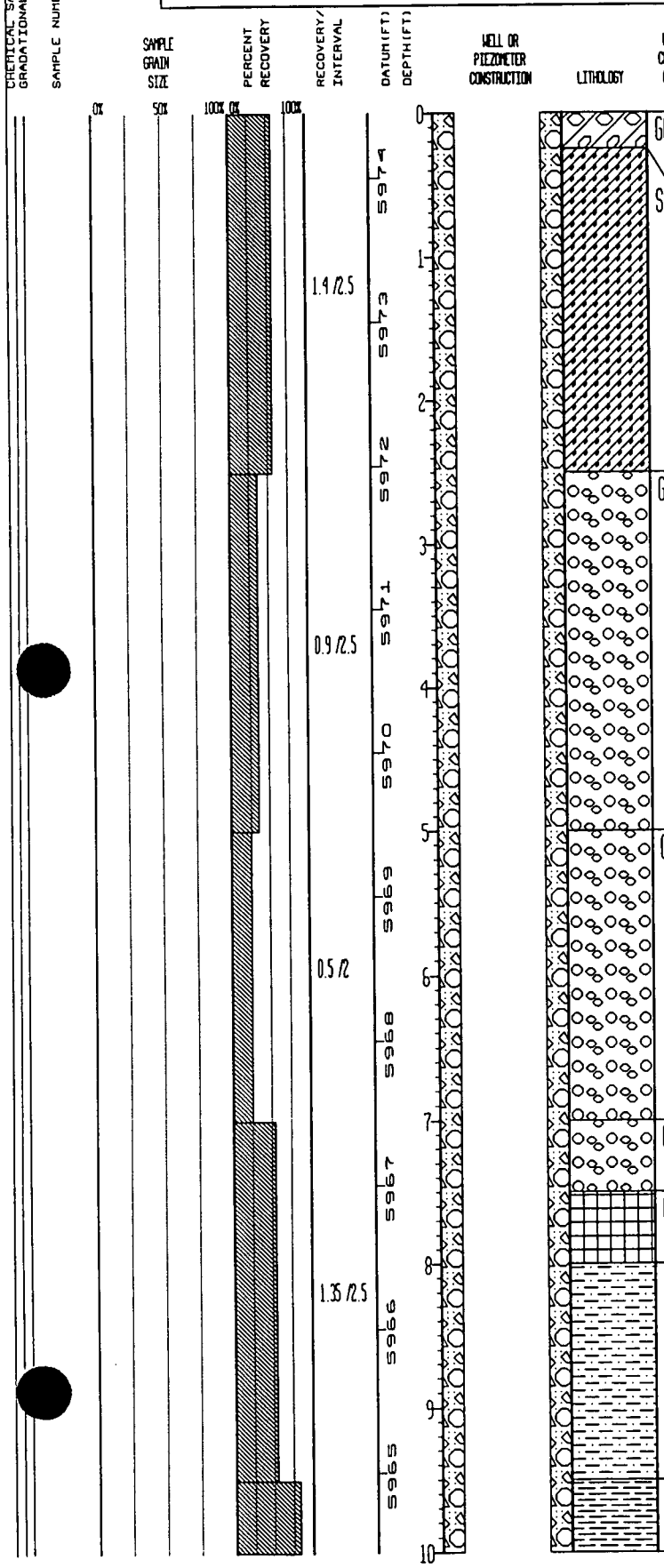
Bottom of Box 10 of 10 at 130.5 ft.

ROCKY FLATS PLANT

FIGURE NO.

STATE PLANE COORDINATE:		TOTAL DEPTH (FT): 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.



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. 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
				1.5/1.8	5964	10				staining as mottles, some silt, trace of Mg staining, trace of calcite at approx. 10.5 ft.
				0.9/0.7	5963	11			CLAYSTONE:	Same as above: some calc. material, abundant micro fractures.
				0.6/0.6	5962	12			CLAYSTONE:	Same as above.
					5961	13			NO SAMPLE:	
					5960	14				
					5959	15				
					5958	16				
					5957	17				
					5956	18				
					5955	19				
						20				

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 TD to 84.60 ft.

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%	0/29	5954 5953 5952 5951 5950 5949 5948 5947 5946 5945	20 21 22 23 24 25 26 27 28 29 30				NO SAMPLE:

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	

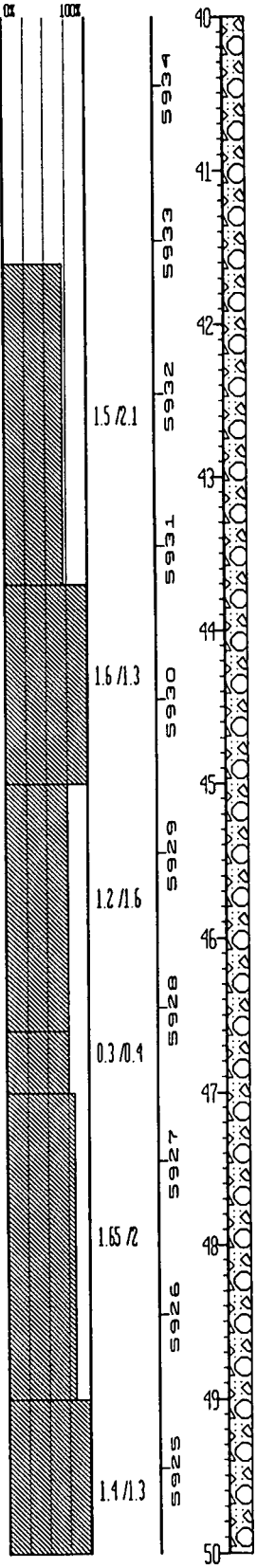
REMARKS: NC Core. Cave from TD to 84.60 ft.

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				
						40				

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

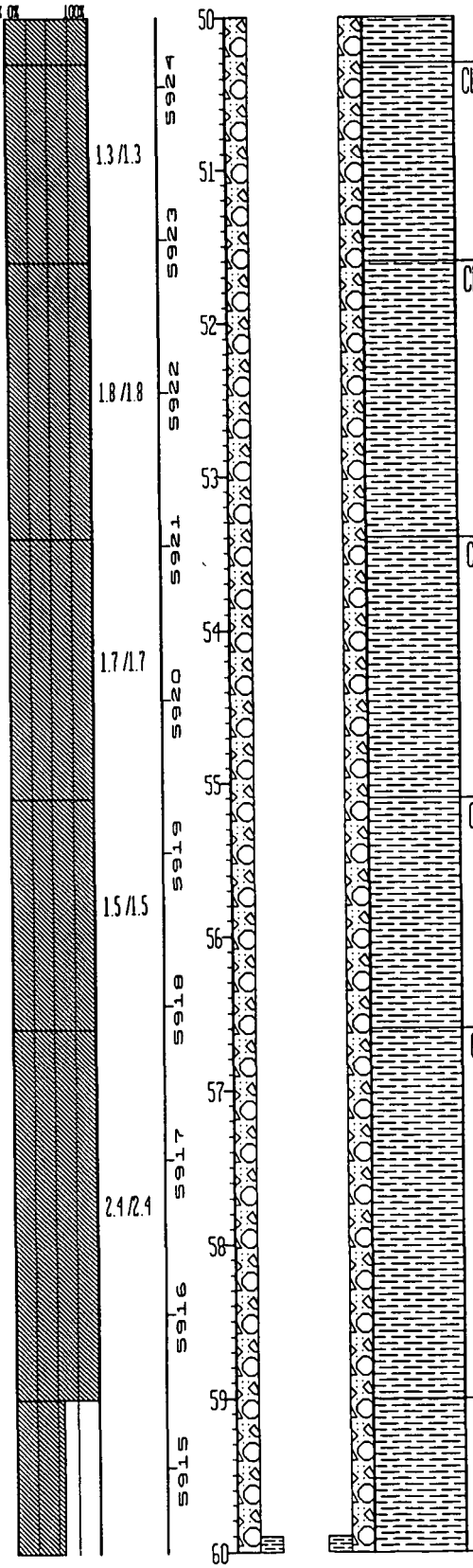


UNIFIED SOILS CLASSIFICATION OR ROCK TYPE	DESCRIPTION
NO SAMPLE:	
CLAYSTONE:	Light gray (N7), non apparent bedding, well weathered, mod. - poorly friable, some iron staining as mottles increasing at base of interval, trace of silt.
CLAYSTONE:	Same as above: some silt, trace iron staining. NOTE: core is covered with iron stained mud.
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.
CLAYSTONE:	Same as above.
CLAYSTONE:	Same as above: consolidated texture. Base of interval: same as above, yellowish gray (5Y 8/1), iron staining as mottles.
CLAYSTONE:	Same as above: fractures at 45, 60, 70 degrees showing slickensides, iron staining along fracture faces.

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

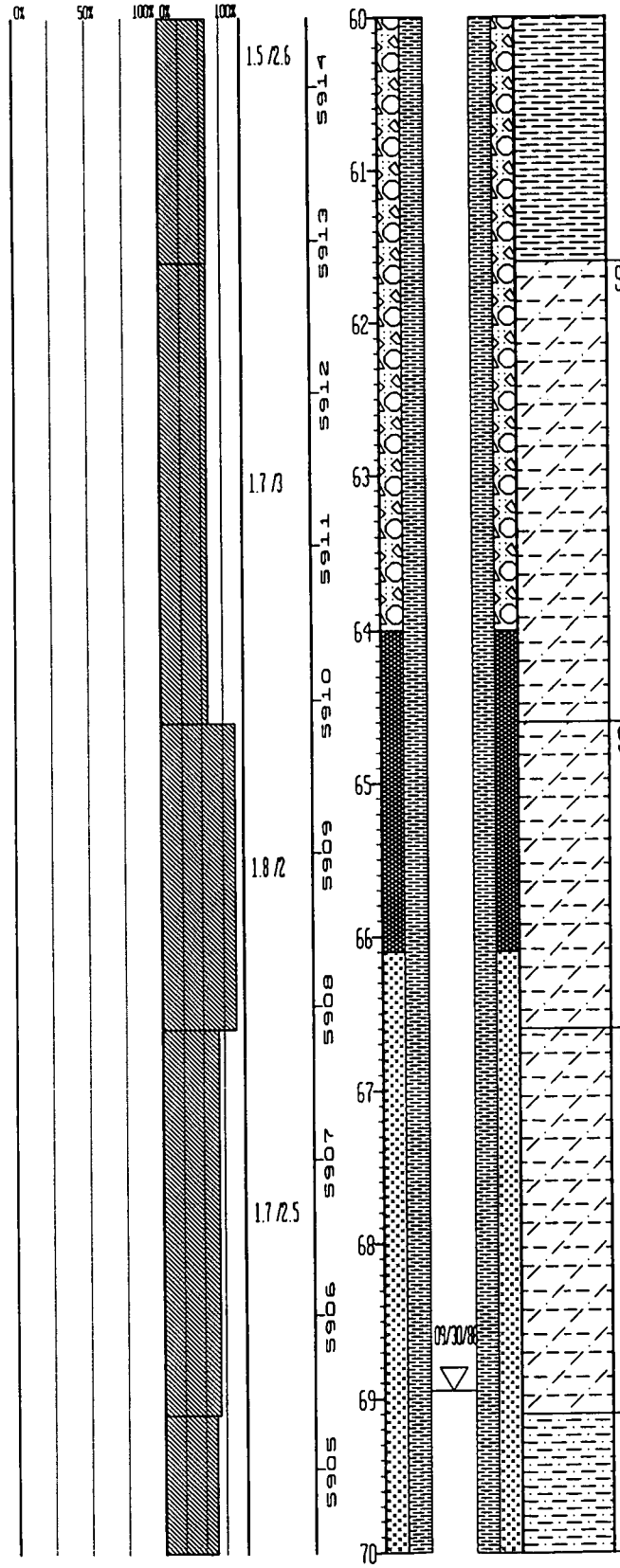


CLAYSTONE:	Light olive gray (5Y 6/1), massive bedding, well weathered, mod. friable, some iron staining as mottles, 60,70 degree fracture, base of interval has some fractures, trace of silt.
CLAYSTONE:	Same as above: brownish gray (5YR 4/1), trace of carb. material.
CLAYSTONE:	Same as above.
CLAYSTONE:	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	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 TD to 84.60 ft.

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: 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.

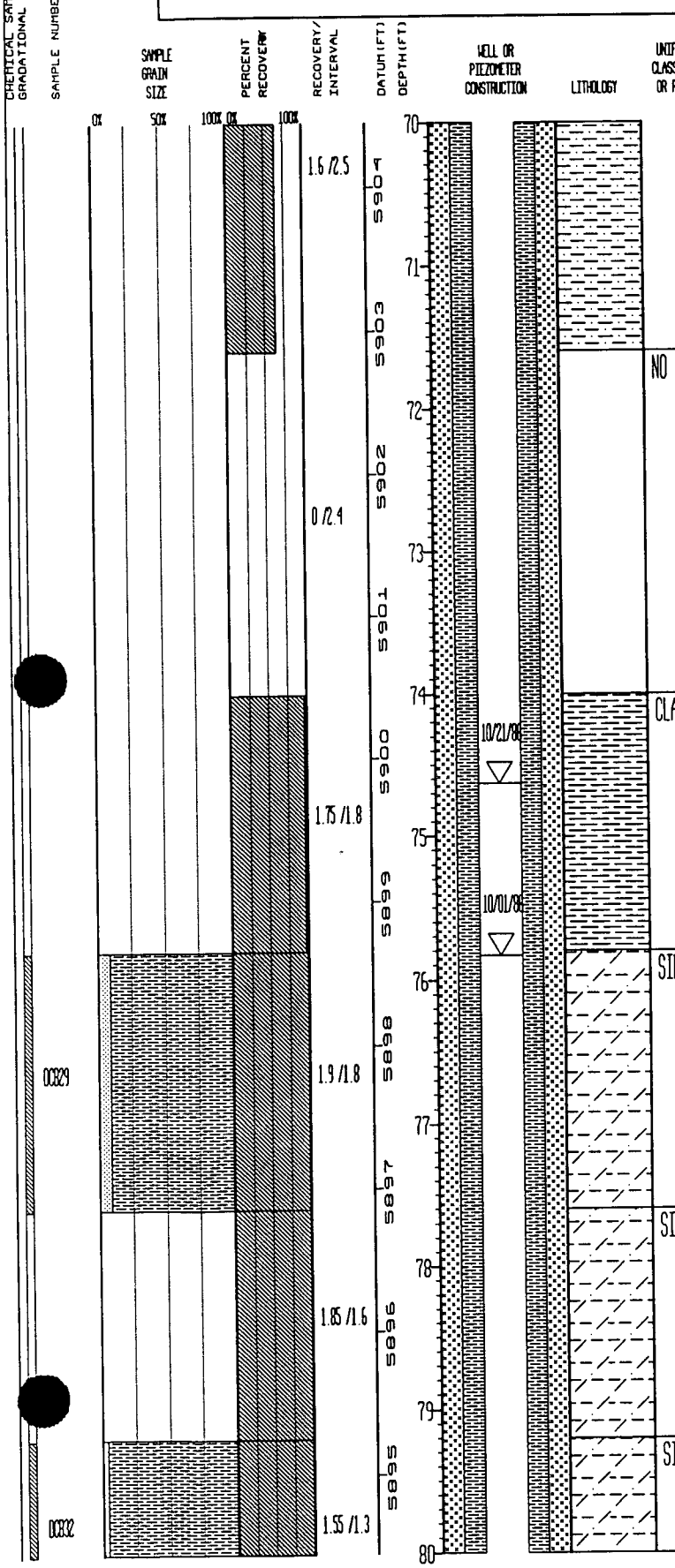
SILTY CLAYSTONE: Same as above: higher silt fraction.

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:	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 70 to 84.60 ft.



NO SAMPLE:

CLAYSTONE: Olive gray (5Y 4/1), apparent massive bedding, highly weathered, mod. - poorly friable, some silt, trace of carb. material.

SILTY CLAYSTONE: Light olive gray (5Y 6/1), massive bedding, highly weathered, mod. to poorly friable, trace of carb. material.

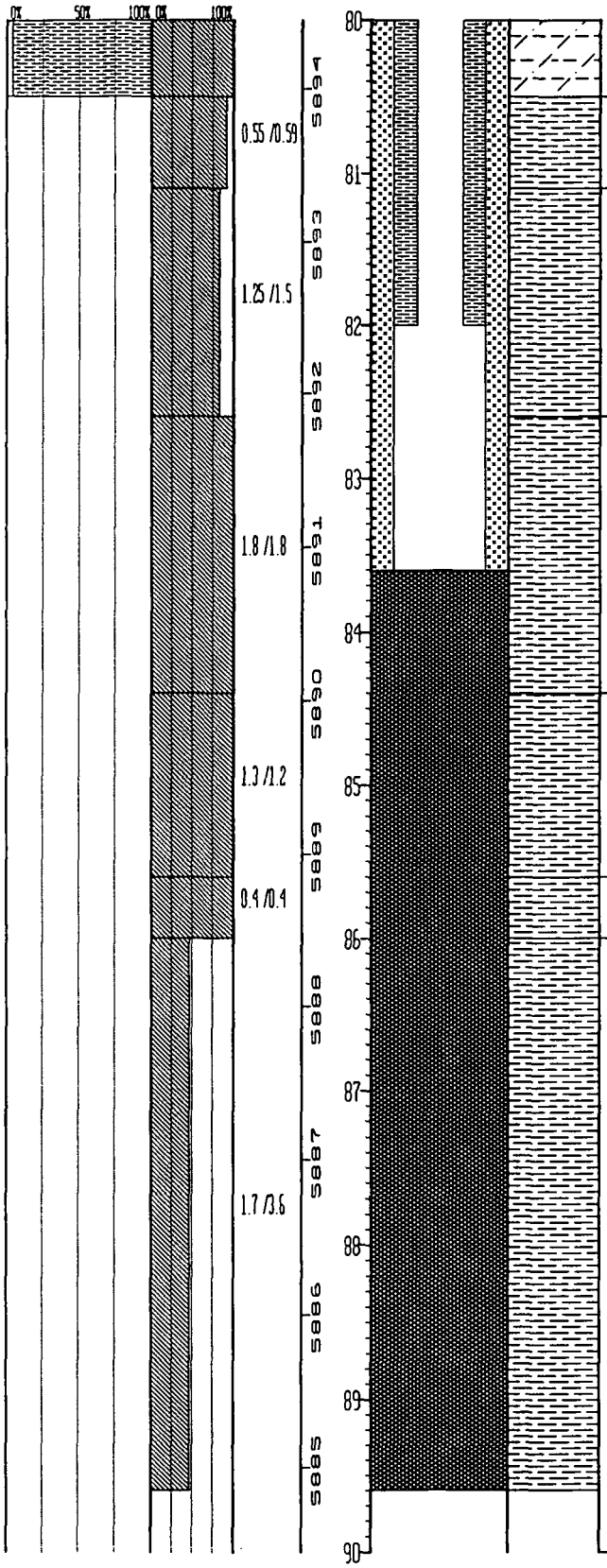
SILTY CLAYSTONE: Same as above: trace of iron staining as mottles, increased silt fraction at base of interval.

SILTY CLAYSTONE: Same as above: decreased silt fraction at base of interval.

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 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

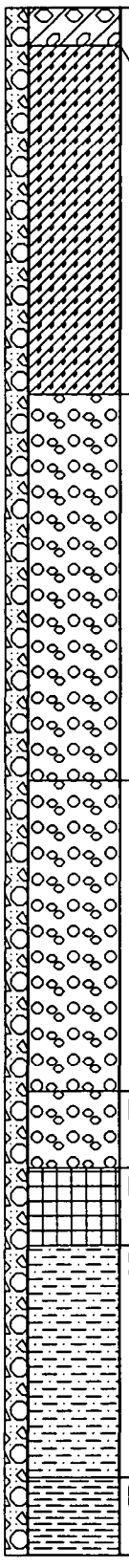


UNIFIED SOILS CLASSIFICATION OR ROCK TYPE	DESCRIPTION
CLAYSTONE:	Light olive gray (5Y 6/1), non - apparent bedding, well weathered, mod. - poorly friable, some carb. material.
CLAYSTONE:	Same as above: abundant carb. material, some iron staining as mottles.
CLAYSTONE:	Carbonaceous, olive black (5Y 2/1), 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.

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



RECOVERY/INTERVAL	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.
1.4/2.5	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.
0.9/2.5	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.
0.5/2	GW:	Same as above.
	GW:	Same as above.
	CALICHE:	Top of Bedrock White (N9), trace of gravel, trace of iron nodules.
1.35/2.5	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. 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
				1.5/1.8	5964	10				staining as mottles, some silt, trace of Mg staining, trace of calcite at approx. 10.5 ft.
				0.9/0.7	5963	11			CLAYSTONE:	Same as above: some calc. material, abundant micro fractures.
				0.6/0.6	5962	12			CLAYSTONE:	Same as above.
					5961	13			NO SAMPLE:	
					5960	14				
					5959	15				
					5958	16				
					5957	17				
					5956	18				
					5955	19				
						20				

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: DAT
DATE DRILLED: 09/17/86

LOG OF BORING NUMBER:

25-86

REMARKS: NC Core. Cove from TD to 84.60 ft.

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%	0/29	5954 5953 5952 5951 5950 5949 5948 5947 5946 5945	20 21 22 23 24 25 26 27 28 29 30				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 10	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.

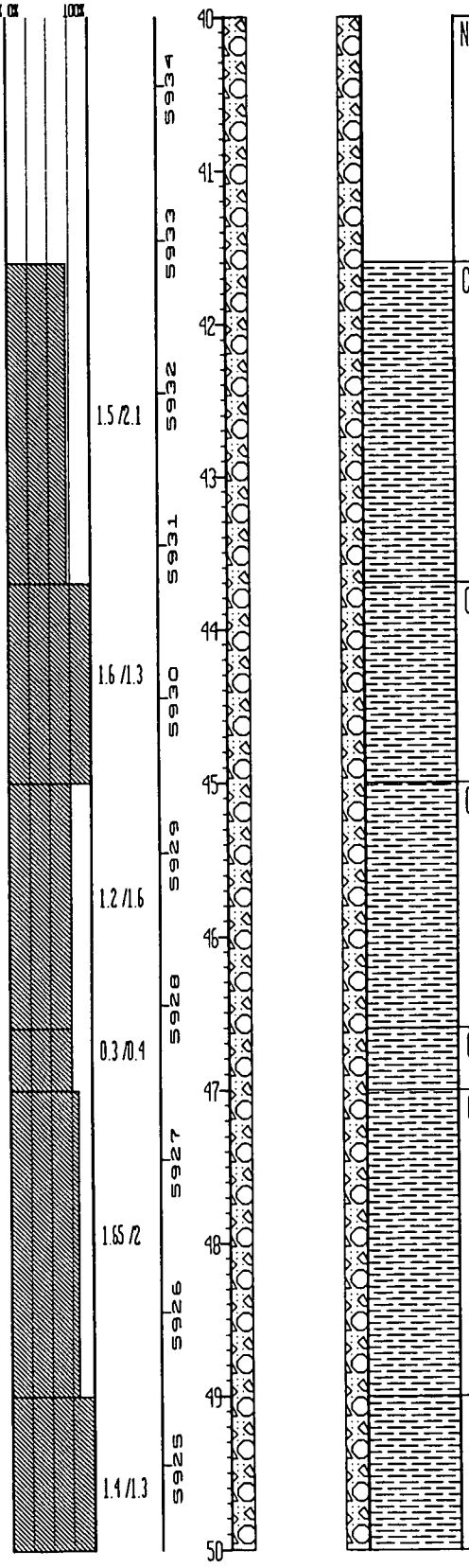
LOG OF BORING NUMBER: 25-86

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				
							40				

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
NO SAMPLE:	
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.
CLAYSTONE:	Same as above: some silt, trace iron staining. NOTE: core is covered with iron stained mud.
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.
CLAYSTONE:	Same as above.
CLAYSTONE:	Same as above: consolidated texture. Base of interval: same as above, yellowish gray (5Y 8/1), iron staining as mottles.
CLAYSTONE:	Same as above: fractures at 45, 60, 70 degrees showing slickensides, iron staining along fracture faces.

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	

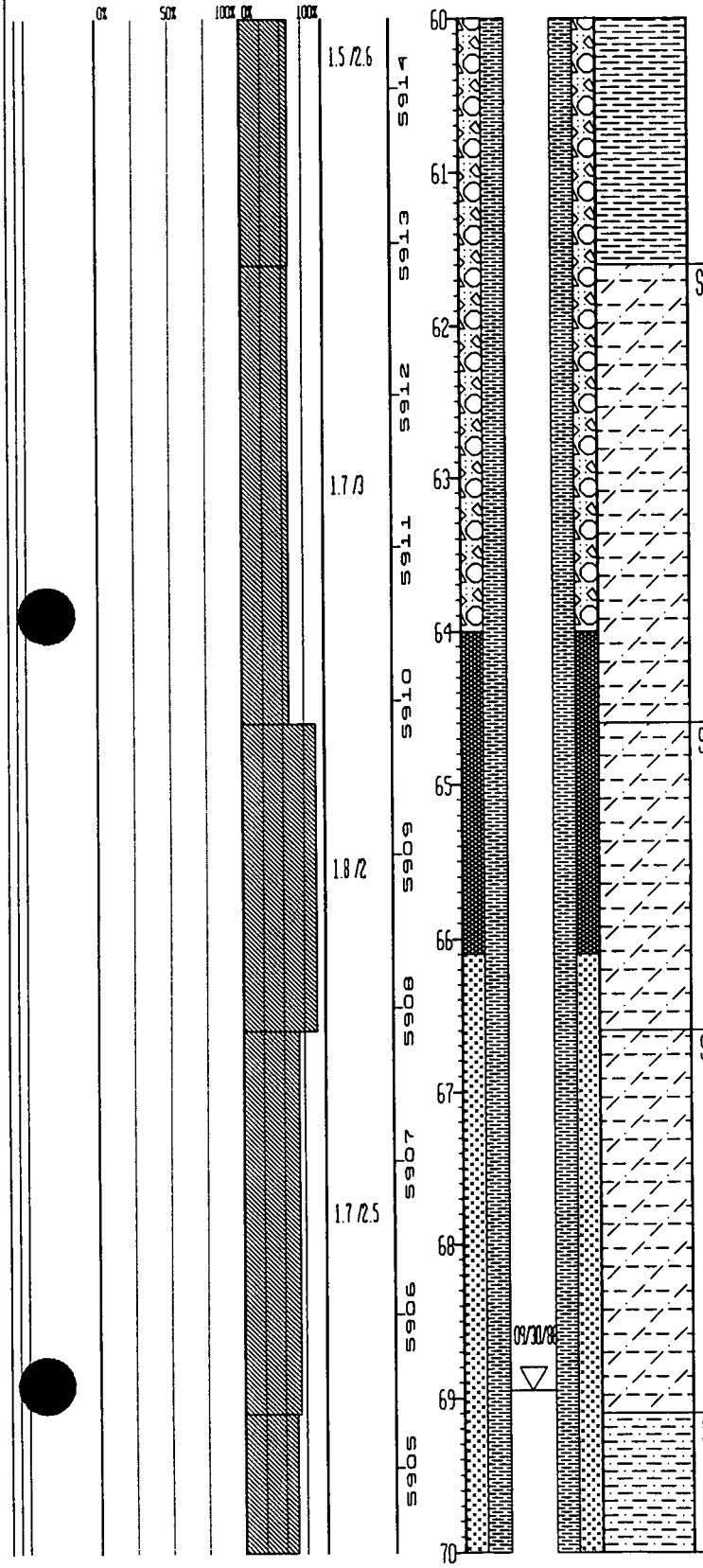
REMARKS: NC Core. Cave from TD to 84.60 ft.

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
				1.3/1.3	5924	50			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.
				1.8/1.8	5923	51			CLAYSTONE:	Same as above: brownish gray (5YR 4/1), trace of carb. material.
				1.7/1.7	5922	52			CLAYSTONE:	Same as above.
				1.5/1.5	5921	53			CLAYSTONE:	Same as above: some carb. material, coal seam (approx. 2 - 4 mm.), (horizontal), fracture at 50 degrees.
				2.4/2.4	5920	54			CLAYSTONE:	Same as above: very highly weathered.
					5919	55			CLAYSTONE:	Same as above: olive gray (5Y 4/1).
					5918	56				
					5917	57				
					5916	58				
					5915	59				
						60				

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 TD to 84.60 ft.

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



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.

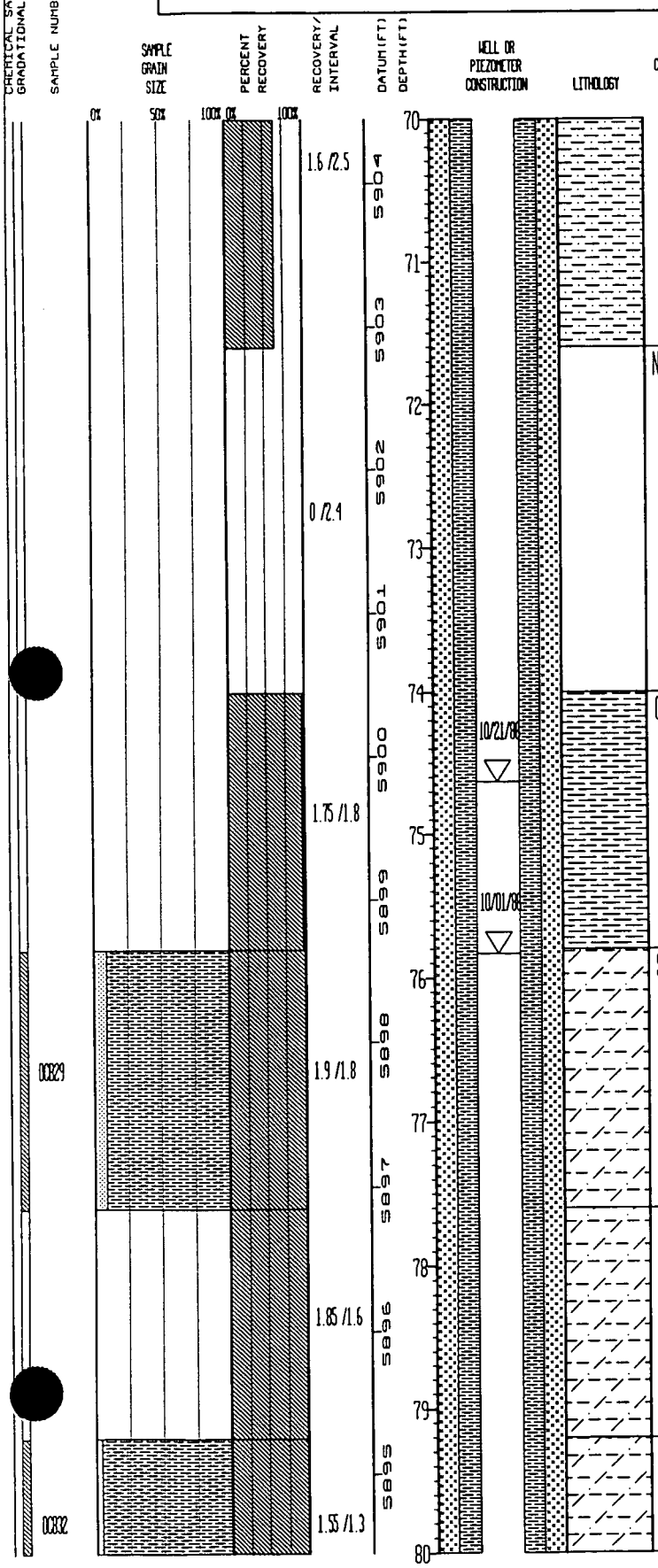
SILTY CLAYSTONE: Same as above: higher silt fraction.

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:		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.



NO SAMPLE:

CLAYSTONE: Olive gray (5Y 4/1), apparent massive bedding, highly weathered, mod. - poorly friable, some silt, trace of carb. material.

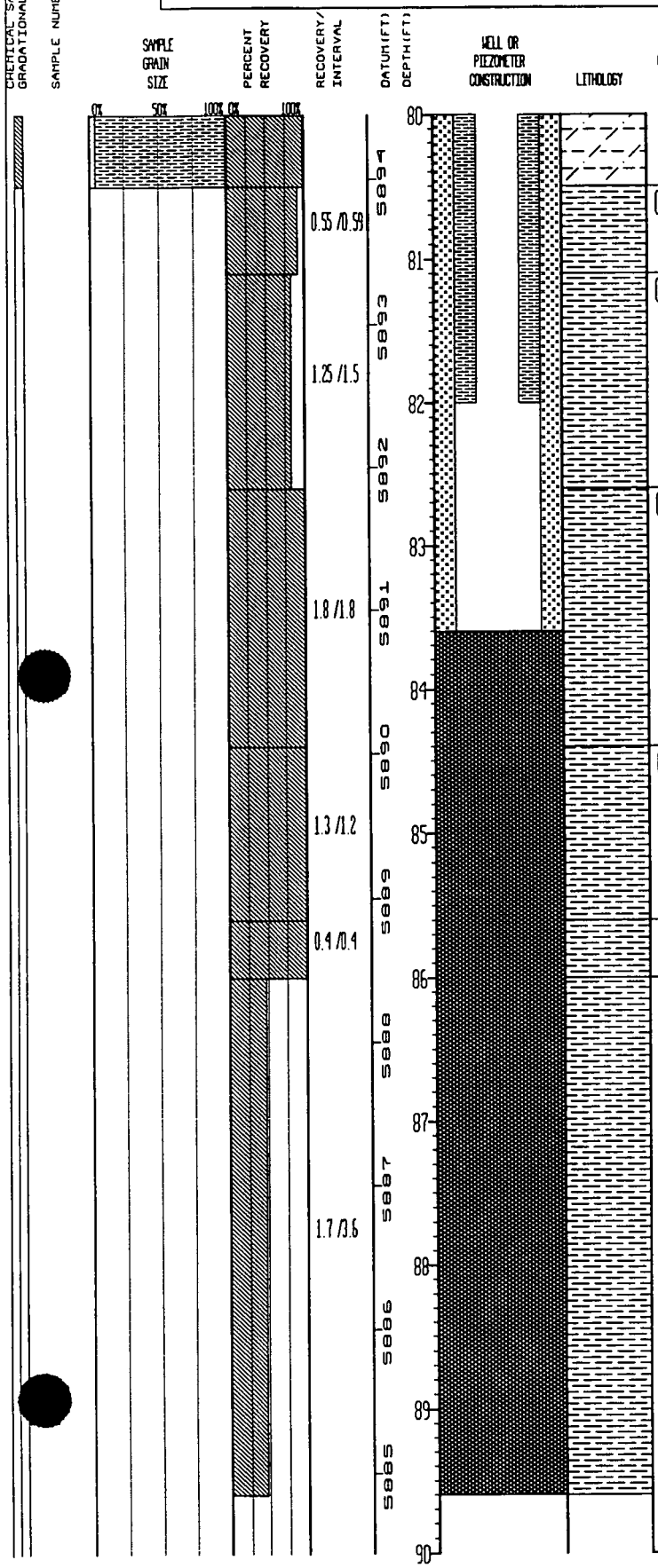
SILTY CLAYSTONE: Light olive gray (5Y 6/1), massive bedding, highly weathered, mod. to poorly friable, trace of carb. material.

SILTY CLAYSTONE: Same as above: trace of iron staining as mottles, increased silt fraction at base of interval.

SILTY CLAYSTONE: Same as above: decreased silt fraction at base of interval.

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.



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. 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
0.0 ↓	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 is VFG - MG GRAVELLY CLAYEY SAND, pale yellowish brown (10 YR 6/2), angular - subangular, mod graded, sand is FG-CG, max gravel size = 4cm, matrix is calcareous, some calcite, bottom of interval has possible black tar
	2.5 -5.0	(1) 0.9					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-FG 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 ~~3~~ 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), ~~[illegible]~~ non-apparent bedding, well weathered, mod friable, some iron staining as mottles, ~~some~~ trace of calc. material, trace of Mg staining, trace of iron concretions,
	9.5 -11.3	(2) 1.5								Sharp contact w/ above caliche ~~[illegible]~~ TOP 6 IN: Same as above, 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. 25-86

GEOLOGIST(S): DAJ
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 Cm of m~~ Bottom of interval: Claystone, very light gray (N8), non-apparent bedding, ~~Some iron~~ well weathered, mod friable, Some iron staining as mottles, some silt, trace of Mg staining, trace of calcite at ~~2~~ 10.5 FT.
	11.3-12.0 -~~12.6~~	(2) 0.9								Same as above: ~~calcite~~ some calc material, abundant micro fractures
↑ 12.6		~~1.5~~ (2) 0.6						12		Same as above
Box ~~2~~ 1 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): DAY
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 grey (N7), iron 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 3.4 of interval: same as above light brown (5 YR 5/6), abundant iron as staining and concretions, flowy texture
	46.6 - 47.0	0.3								Same as above
	47.0 - 49.0	(2) 1.65						47, 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° - showing slickensides, 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), ~~[illegible]~~ massive Dab 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 (≈2-4 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

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
Box 3 of 5	59.0 61.6 ~~60.7~~							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 laminar bedding~~, 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 mar-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-~~86~~

PAGE ~~5~~ 6 OF ~~6~~ 7

GEOLOGIST(S): [illegible]
DATE: 8/2~~8~~/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	
↑ 71.6								71		See previous page NO SAMPLE	
71.6 ↓	71.6 - 74.0	∅						72 73		CLAYSTONE, olive gray (5 Y 4/1), apparent massive bedding, highly weathered, mod-poorly friable, some silt, trace of carb material.	ERASER [illegible]
Box 4 of 5	74.0 - 75.8	(2) 1.75				30% SILT 70% CLAY		74 75		SILTY CLAYSTONE, light olive gray (5 Y 6/1), massive bedding, highly weathered, mod-poorly friable, ~~some~~ trace of carb material	ERASER [illegible]
	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	ERASER [illegible]
	77.6 - 79.2	(2) 1.85				45% SILT 55% CLAY 30% SILT 70% CLAY		78		Same as above; decreased silt fraction at base of interval	ERASER [illegible]
	79.2 - 80.5	(2) 1.55				45% SILT 55% CLAY		79		~~Same as above~~ ~~brownish~~ gray (5 YR 4/1) ~~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. 25-86

PAGE ~~6~~ 7 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
						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), non 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 8mm~~: 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): LAA
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. 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
								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.

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
	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. 106P06222

Hydro-Search, Inc.

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: HLP

Project No. 106P06222

Hydro-Search, Inc.

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. 106P06222

Hydro-Search, Inc.

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						
	80			79.0-81.1'-Sample. Recovered 2.1/2.1'=100%. RQD 1.3/2.1'=62%. SANDSTONE: Same as above; damp.			

Remarks Logged by: T. Gulliver & T. Murphy Checked by: [illegible]

Project No. 106P06222

Hydro-Search, Inc.

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
	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:

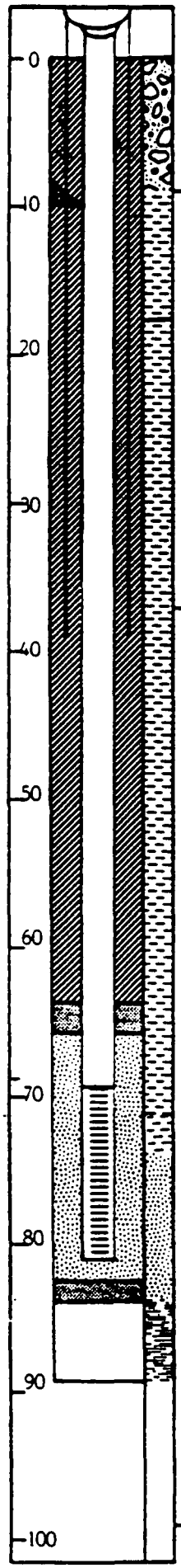
Project No.	Hydro-Search, Inc.	Page 5 of 5
106P06222		

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 Boyles 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 TIME
DRILLING:				
7½" auger	8/26	1401	8/27	1330
NC core	9/13	1400	9/16	1700
Reaming	9/17	1030	9/17	1315
GEOPHYS. LOGGING:	—	—	—	—
CASING:				
5" steel	8/27	1353	8/27	1421
2" stainless	9/17	1537	9/17	1545
FILTER PLACEMENT:	9/17	1526	9/17	1804
CEMENTING:	9/18	0904	9/18	1010
DEVELOPMENT:	9/30	1430	10/1	0945
OTHER:				
Bentonite	9/17	1805	9/17	1816
	9/17	1505	9/17	1506
Cementing 5" steel	8/27	1540	8/27	1606

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

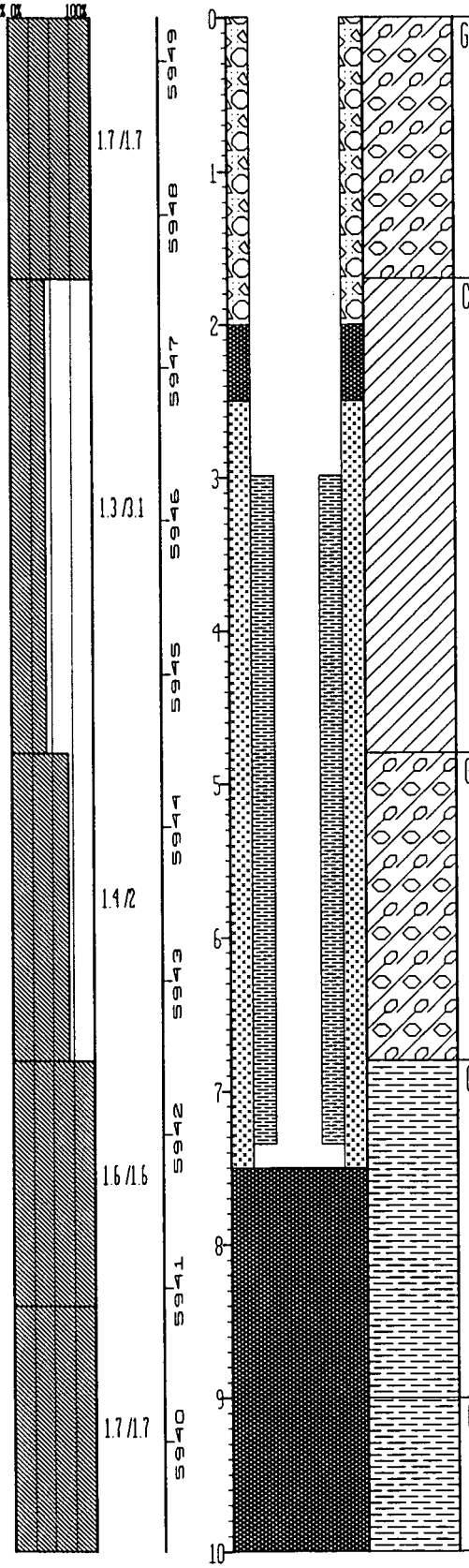
WATER LEVEL SUMMARY

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

STATE PLANE COORDINATE:	TOTAL DEPTH (FT): 16.8	GROUND ELEVATION (FT):	5949.28	PROJECT NUMBER:	667.11
NORTH: 749963	AREA: MOUND AREA	CASING DIAMETER (IN):	0	GEOLOGIST:	DCB
EAST: 2085000	LOCATOR NUMBER: M9	BOREHOLE DIAMETER (IN):	0	DATE DRILLED:	09/10/86
REMARKS: Hollow Stem Auger.					

LOG OF BORING NUMBER: 33-86

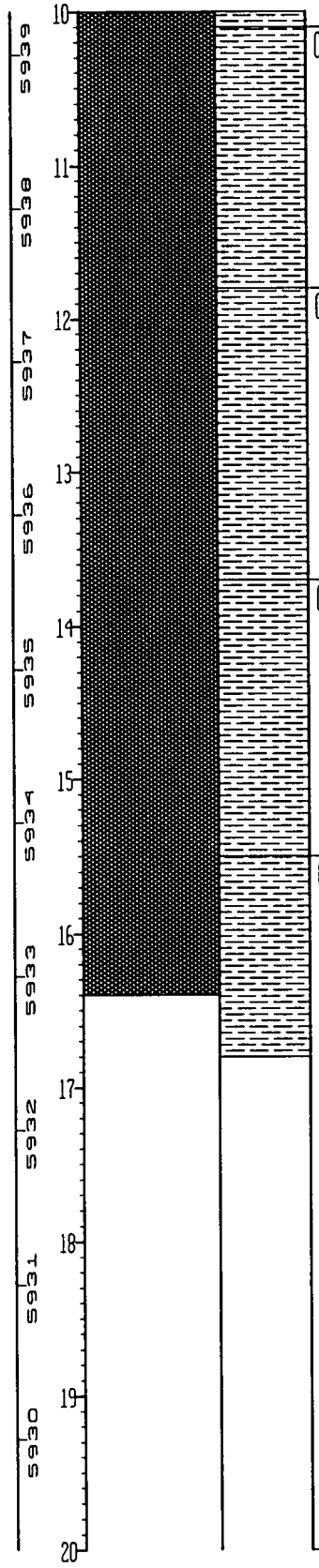
CHEMICAL SAMPLE DEPTH
GRADATIONAL SAMPLE DEPTH
SAMPLE NUMBER
SAMPLE GRAIN SIZE (0% 50% 100%)
PERCENT RECOVERY (0% 100%)
RECOVERY/INTERVAL
DATUM (FT)
DEPTH (FT)
WELL OR PIEZOMETER CONSTRUCTION
LITHOLOGY



UNIFIED SOILS CLASSIFICATION OR ROCK TYPE	DESCRIPTION
GC:	Clayey Gravel, 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.
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.
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.
CLAYSTONE:	Top of Bedrock Moderate yellowish brown (10YR 5/4), moderately low plasticity, trace of silt.
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



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.

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
0.0	0.0 to 1.7	ND				>50% Gravel, <50% clay	GC			Clayey Gravel, dominantly light gray (N7), clay matrix is light brownish gray (5 YR 6/1), subangular to subrounded, poorly graded, max. size 6cm, some roots, matrix is calcareous.
	1.7 to 4.8	(2) 1.3				>50% clay	CL	1, 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. DCB
	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 ~2.5cm.
	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								(cont'd. from page 1), slightly friable, local iron staining.
10.1 ↓	10.1 to 11.8	ND						11		
	11.8 to 13.7	ND						12		claystone as above with abund. iron staining from ~ 11.8 ft to 13.6 ft.
								13		
	13.7 to 15.5	ND						14		
								15		slickenside at ~ 14.8 ft., attitude 45°.
	15.5 to 16.8	ND						16		Some carbonaceous mineralization at ~ 16.6 ft.
								17		Bottom of Box 2 of 2 at 16.8 ft.
								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

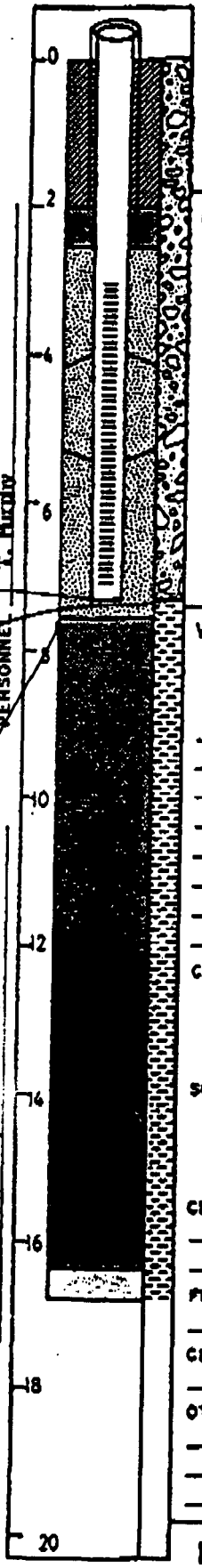
FIGURE NO.

WELL 33-86

WELL CONSTRUCTION SUMMARY

LOCATION or COORDS:

ELEVATION: GROUND LEVEL 5954'
TOP OF CASING 5955.49'



PROJECT 106R06222 Rocky Flats Plant
LOCATION Golden, CO
PERSONNEL T. Murphy

TD = 7.34'
Qrf
Ka
7.5'

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) TS

DRILLING FLUID None

SURFACE CASING 5" x 4' steel w/ locking C&D

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'

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: [illegible]

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.

STATE PLANE COORDINATE:	TOTAL DEPTH (FT): 18.5	GROUND ELEVATION (FT):	5999.1	PROJECT NUMBER:	667.11
NORTH: 749198	AREA: 881 HILLSIDE	CASING DIAMETER (IN):	2 ID	GEOLOGIST:	LAA
EAST: 2083717	LOCATOR NUMBER: K9	BOREHOLE DIAMETER (IN):	7.25	DATE DRILLED:	11/19/86
REMARKS: Hollow Stem Auger.					

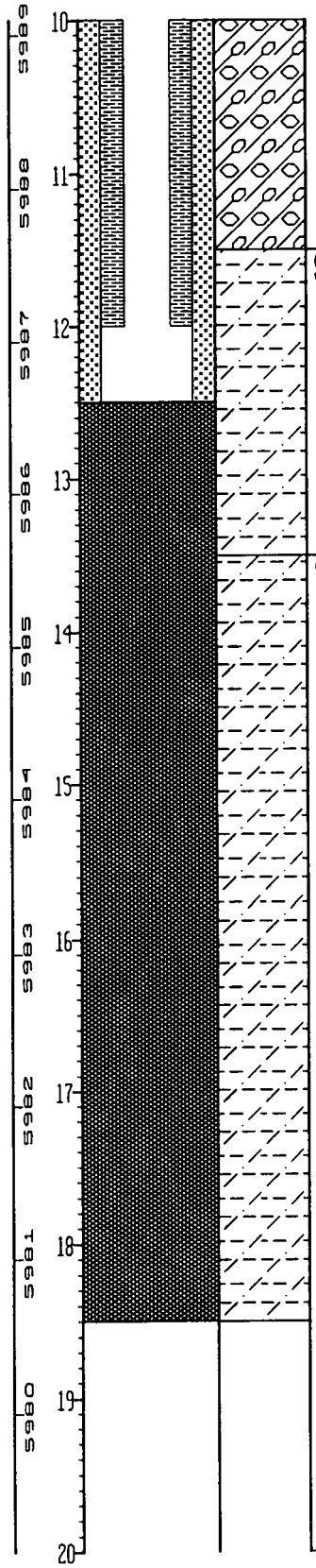
LOG OF BORING NUMBER: 61-86

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
				1.9 /2.5	5999 5998 5997	0 1 2			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.
				2.1 /2.5	5996 5995	3 4			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.
	LA46			2.3 /3.5	5994 5993 5992 5991	5 6 7 8	11/19/86		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.
				1.4 /3	5990	9 10			GC:	Sandy Clayey Gravel - no predom. gravel color, angular to sub-rounded, mod. to well sorted, max. size 5.5 cm., sand F to C grained, clay dk. 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.

CHEMICAL SAMPLE DEPTH
GRADATIONAL SAMPLE DEPTH
SAMPLE NUMBER
SAMPLE GRAIN SIZE (0% 50% 100%)
PERCENT RECOVERY (0% 100%)
RECOVERY/INTERVAL: 1.4/3; 1.4/2; 3.4/5
DATUM (FT): 5989, 5988, 5987, 5986, 5985, 5984, 5983, 5982, 5981, 5980
DEPTH (FT): 10, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20
WELL OR PIEZOMETER CONSTRUCTION
LITHOLOGY
UNIFIED SOILS CLASSIFICATION OR ROCK TYPE
DESCRIPTION



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.

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:

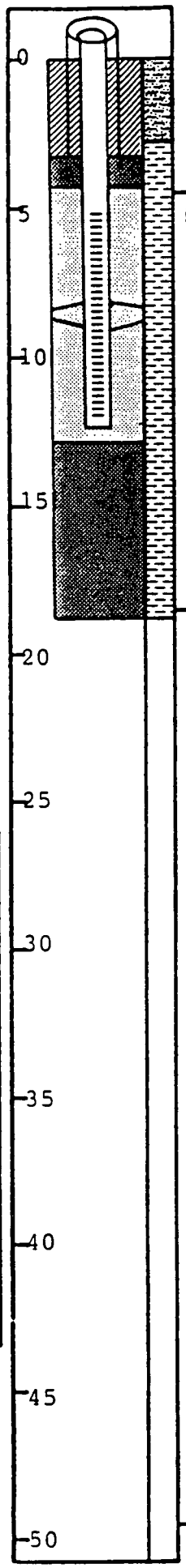
Project No. 106P06222	Hydro-Search, Inc.	Page 1 of 1

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. Pivonka
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	1247
GEOPHYS. LOGGING:	—	—	—	—
CASING:				
2" stainless	11/19	1429	11/19	1431
FILTER PLACEMENT:	11/19	1427	11/19	1435
CEMENTING:	11/19	1436	11/19	1447
DEVELOPMENT:				
OTHER:				
Bentonite	11/19	1435	11/19	1436
	11/19	1425	11/19	1427

WELL DEVELOPMENT

See Well Development Summary Sheet.

COMMENTS:

Water encountered at 8.50' during drilling.

Top of stainless steel casing: 1.45'

HYDRO-SEARCH RENO•DENVER CONSULTING HYDROLOGISTS-GEOLOGISTS

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 $CaCO_3$	
			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 interbedded. Heavy FeO_2 stains 8.5'-11.5'. Moist. 3/10/87; 5/8/87; 1/87; 6/24/87	
			?/?		12, 13			Claystone, Dark yellowish orange (10YR 6/6) moderate to high plasticity. Undisturbed, moist.	
			5.0/4.0		14, 15, 16, 17, 18			Silty claystone, dark yellowish orange (10YR 6/6) to Light olive Gray (5Y 6/1) Friable. Moist.	
					19				

DRILLING CONTRACTOR _____ DRILLER _____

CHK'D BY _____ DATE _____

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

DRAWING NO

LOG OF BORING NO. 61-86

GEOLOGIST(S): LAA
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	(1) 1.9				Sand 50% Gravel 50%	GW	1, 2		Sand + gravel. Pale yellowish brown (10yr 6/2) 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 ≈ 2cm. Some silt. Some asphalt. Calcitic ~~Some~~ trace grass + roots @ surface. Becomes gravelly Caliche toward ~~bottom~~. Gravel ~~[illegible]~~ larger to 6cm
	2.5									
		(1) 2.1				Caliche 50% Clay + sand 50%	CL	3, 4, 5		Caliche white (N9) and sandy clay yellowish gray (5y 8/1). Plasticity (est.) low to mod. Sand mod grained to v.c.g. Some iron staining.
	5.0									
Box 1 of 2		(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 (10yr 6/6). 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): LAT
DATE: 8/15/89

PROJECT NO: 1667-1122

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).~~ LAT 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 >60%		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 bituminous material.
								19		

Begin Box 2

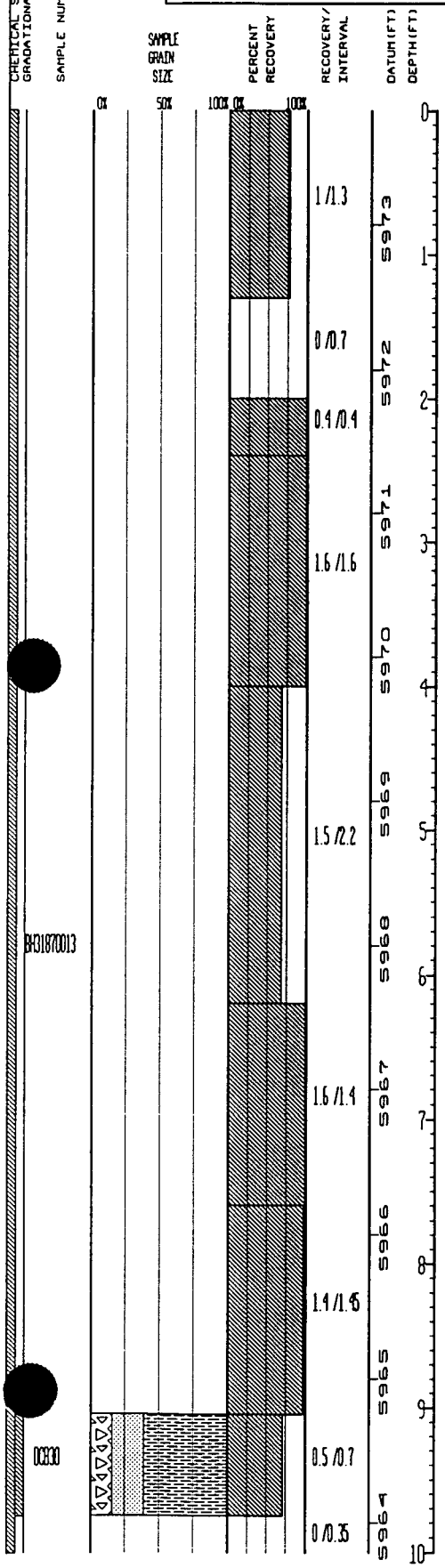
NOTES: General USCS is modified for this log as follows:
Material amounts are estimated by % volume instead of % weight.
(1) Badly broken core, accurate footage measurements not possible.
(2) Core breaks cannot be matched, accurate footage measurements not possible.

ROCKY FLATS PLANT

FIGURE NO.

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.



WELL OR PIEZOMETER CONSTRUCTION

LITHOLOGY	UNIFIED SOILS CLASSIFICATION OR ROCK TYPE	DESCRIPTION
	CL:	GRAVELLY, SANDY CLAY - grayish orange (10YR 7/4), low plasticity, roots and wood fragments in upper 1.3 ft., some silt, locally calcareous.
	NO SAMPLE:	
	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.
	CL:	Same as above.
	CL:	GRAVELLY CLAY - moderate reddish orange (10R 6/6), moderate plasticity, abundant sand and caliche.
	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.
	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.
	SILTY SANDSTONE:	Same as above.
	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	BH31-87
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.

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
				0.9 /0.9	5963	10–11			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.
	BH31871CCT			0.7 /1.6	5962	11–12			CLAYSTONE:	As above - two 5 cm. size gravel occur at the base of the interval from 11.0 to 12.6.
				1.6 /1.6	5961	12–13			CLAYSTONE:	As above.
				0.9 /0.9	5960	13–14			CLAYSTONE:	As above.
				0.45 /0.73	5959	14–15			CLAYSTONE:	As above.
					5958	15–16			NO SAMPLE:	NO SAMPLE - ASI only found core boxes to 15.9 ft. Weston logs go to 22.9 ft.
					5957	16–17				
					5956	17–18				
					5955	18–19				
	BH31871GGR			0 /1	5954	19–20				

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.

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				NO SAMPLE: NO SAMPLE Note: No water encountered during drilling.
					5952	21				
					5951	22				
					5950	23				
					5949	24				
					5948	25				
					5947	26				
					5946	27				
					5945	28				
					5944	29				
						30				

LOG OF BORING NO. DH 31-87

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 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
0.0	0.0 to 1.3		(1) 1.0	CL					35% gravel 25% sand 40% clay	1		Gravely Sandy Clay, grayish orange (10 YR 7/4), low plasticity, root ~~fragments~~ OK DCB and wood fragments in upper 1.3 ft, some silt, locally calcareous. 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		DCB	
	2.0 to 2.4		ND							2		
	2.4 to 4.0		(1) 1.6							3		
Box 1 of 2	4.0 to 6.2		(1) 1.5						~~>50% Gravel~~ DCB >40% clay	4 5		~~Gravel (DCB) Clayey Gravel, weighted coloration, pink, very light gray, gray~~ Gravelly Clay, moderate reddish orange (10 R 6/6), moderate plasticity, abundant sand and caliche
	6.2 to 7.6		(1) 1.6							6 7		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
9.05	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, ~~friable~~, slightly friable, very fine grained
9.05	9.05 to 9.75		(1) .5							9		
	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.

Need PSI
15.9' to 22'

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 ROW (interval)				LITHOLOGIC 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		
Box 2 of 2	12.6 to 14.2		ND			As Above — Two 5 cm size gravel occur at the base of the interval from 11.0 to 12.6
	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.

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]
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=0.2 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				0.0-11.7': Duplicate composite sample: BH31870013D.
			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.	5.0': Field screen readings: HNu = 0.2; OVA = 0.3.
10				10.0': Field screen readings: HNu = 0.2'; OVA = 0.3.
			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.	11.7-12.6': Contact sample: BH318713CT.
15				15.0': Field screen readings: HNu = 0.2; OVA = 0.3.
				15.7-22.85': Bedrock sample: BH318716BR.
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 A. Pasella
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'	

STATE PLANE COORDINATE:		TOTAL DEPTH (FT): 31.0	GROUND ELEVATION (FT):	6010.70	PROJECT NUMBER:	PZ43-89	LOG OF BORING NUMBER:
NORTH:	749940	AREA: PLANT	CASING DIAMETER (IN):	2-3/8 O.D.	GEOLOGIST:	TAL	P114789
EAST:	2082610	LOCATOR NUMBER: J9	BOREHOLE DIAMETER (IN):	7.25	DATE DRILLED:	09/28/89	

REMARKS: Hollow Stem Auger. Weston Log.

DRAFT

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
				2.00 /2.00	6010	0–1			SC:	Gravelly Clayey Sand - mod. brown (5 YR 3/4), non-stratified. Some 1 cm. to 6 cm. quartzose gravel. F.g. to c.g. sand, sub-rounded to sub-angular. Stiff, low plasticity, dry.
	PZ43890013				6009	1–2			CL:	Gravelly Sandy Clay - same as above, med. plasticity.
				1.10 /2.00	6008	2–3			SC:	Gravelly Clayey Sand - same as above.
					6007	3–4				
	PZ43890307			0.80 /2.00	6006	4–5			CL:	Gravelly Sandy Clay - same as above. Mod. brown (5 YR 3/4), non-stratified. 1 cm. to 3 cm. quartzose gravels. Plastic, moist. Interval from 4.5' to 4.8' wet.
					6005	5–6				
				2.00 /2.00	6004	6–7			SC:	Gravelly Clayey Sand - same as above (reference interval 0.0' to 2.0'). Light brown (5 YR 5/6), low plasticity, damp.
					6003	7–8				
	PZ43890711				6002	8–9	01/15/90		SC:	Clayey Gravelly Sand - same as above.
				1.00 /2.00	6001	9–10			ML:	Gravelly Sandy Silt - light brown (5 YR 5/6), non-stratified. Some 1 cm. to 3 cm. quartzose gravels. Trace to some f.g. to c.g. sand. Trace clay, stiff, non-plastic, dry.
									NO SAMPLE:	NO SAMPLE.

STATE PLANE COORDINATE:		TOTAL DEPTH (FT): 31.0	GROUND ELEVATION (FT):	6010.70	PROJECT NUMBER:	PZ43-89	LOG OF BORING NUMBER:
NORTH:	749940	AREA: PLANT	CASING DIAMETER (IN):	2-3/8 O.D.	GEOLOGIST:	TAL	P114789
EAST:	2082610	LOCATOR NUMBER: J9	BOREHOLE DIAMETER (IN):	7.25	DATE DRILLED:	09/28/89	

REMARKS: Hollow Stem Auger. Weston Log.

DRAFT

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
				0.00 /2.00	6000	10				
					5999	11				
	PZ43891115			2.00 /2.00	5998	12			CL:	Sandy Clay - pale yellowish brown (10 YR 6/2), non-stratified. Trace to some sand, f.g. to c.g., quartzose, sub-rounded to sub-angular. Med. plasticity, firm, damp.
	PZ43891214					13			SC:	Gravelly Clayey Sand - same as above (reference interval 8.0' to 8.7').
					5997	14			SC:	Gravelly Clayey Sand - same as above.
									CL:	Sandy Clay - same as above (reference interval 12.0' to 13.1').
				2.00 /2.00	5996	15			SC:	Gravelly Clayey Sand - same as above (reference interval 14.0' to 14.3') with grayish orange (10 YR 7/4), iron staining.
					5995				CL:	Gravelly Sandy Clay - same as above (reference interval 4.0' to 6.0').
						16			CL:	Gravelly Sandy Clay - same as above with trace to some iron stained silt.
	PZ43891519			2.00 /2.00	5994	17				
					5993		09/28/89			
						18			CL:	Gravelly Sandy Clay - same as above (reference interval 16.0' to 18.0').
				2.00 /2.00	5992	19			SC:	Gravelly Clayey Sand - same as above (reference interval 14.6' to 15.5').
					5991	20				

STATE PLANE COORDINATE:	TOTAL DEPTH (FT): 31.0	GROUND ELEVATION (FT):	6010.70	PROJECT NUMBER:	PZ43-89
NORTH: 749940	AREA: PLANT	CASING DIAMETER (IN):	2-3/8 O.D.	GEOLOGIST:	TAL
EAST: 2082610	LOCATOR NUMBER: J9	BOREHOLE DIAMETER (IN):	7.25	DATE DRILLED:	09/28/89

REMARKS: Hollow Stem Auger. Weston Log.

LOG OF BORING NUMBER: P114789

DRAFT

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
	PZ43891922			2.00 /2.00	5990	20			SC:	Gravelly Clayey Sand - same as above, wet.
					5989	21			CL:	Gravelly Sandy Clay - occasionally grading to m.g. to c.g. sub-angular to sub-rounded quartzose sand, damp to moist.
	PZ43892226			0.50 /2.00	5988	22			CL:	Gravelly Sandy Clay - pale yellowish brown (10 YR 6/2), non-stratified. Some f.g. to c.g. sand, quartzose, sub-rounded to sub-angular. Med. plasticity, wet.
					5987	23				
				0.00 /2.00	5986	24			NO SAMPLE:	Driller indicated contact while drilling at 26.0'.
					5985	25				
				0.00 /1.00	5984	26			NO SAMPLE:	Top of Bedrock NO SAMPLE.
				0.70 /1.00	5983	27			CLAYSTONE:	Pale yellowish brown (10 YR 6/2). Non-stratified, trace sitly, plastic, wet.
				0.30 /1.00	5982	28			CLAYSTONE:	Same as above.
	631			0.00 /1.00	5981	29			NO SAMPLE:	NO SAMPLE.
						30				

STATE PLANE COORDINATE:		TOTAL DEPTH (FT): 31.0	GROUND ELEVATION (FT):	6010.70	PROJECT NUMBER:	PZ43-89	LOG OF BORING NUMBER:
NORTH:	749940	AREA: PLANT	CASING DIAMETER (IN):	2-3/8 O.D.	GEOLOGIST:	TAL	P114789
EAST:	2082610	LOCATOR NUMBER: J9	BOREHOLE DIAMETER (IN):	7.25	DATE DRILLED:	09/28/89	

REMARKS: Hollow Stem Auger. Weston Log.

DRAFT

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
				1.00 /1.00	5980	30			CLAYSTONE:	Same as above (reference interval 28.0' to 29.0'), with pale yellowish orange (10 YR 8/6) mottling.
					5979	31				TD = 31.0'
					5978	32				
					5977	33				
					5976	34				
					5975	35				
					5974	36				
					5973	37				
					5972	38				
					5971	39				
						40				

PZ4389

WELL COMPLETION INFORMATION

QA By/Date Janell B Bryman / 10-3-89

Location Rocky Flats Plant

Well No. P114789

Coordinates N 36962.24 E 19503.82 (RFP)

Elevation: Ground Surface 6010.7'

Total Depth: Well 27.70'

Top of Casing 6012.40'

Borehole 31.0'

Formation of Completion Rocky Flats Alluvium

Casing Material Schedule 40 PVC

Casing Diameter 2 3/8" O.D.

Screen Material Schedule 40 10-slotted PVC

Surface Casing Diameter 5 5/8" O.D.

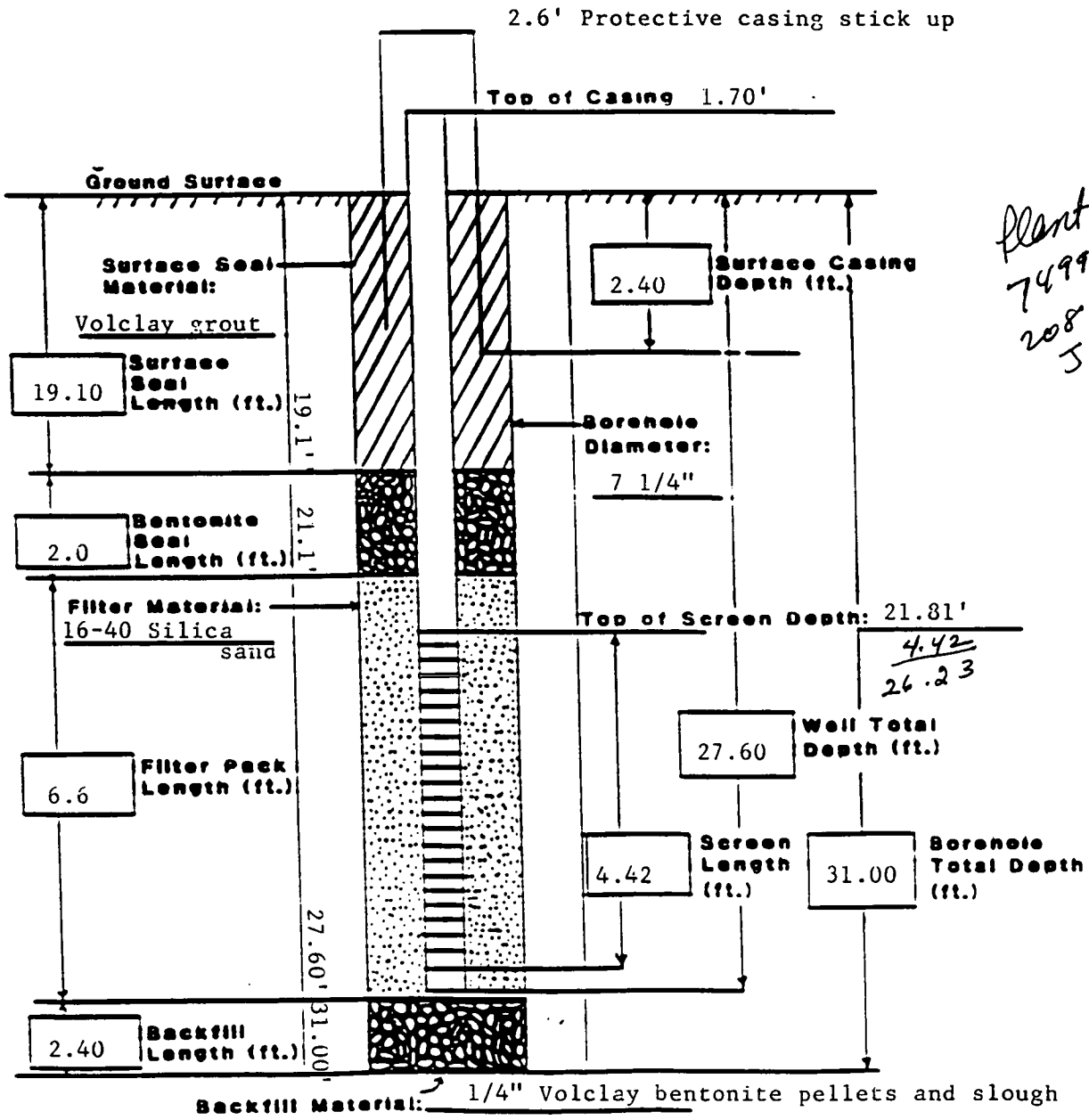
Date Installed 09/28/1989

Approved By J.B. Bryman
Site Manager

Installed By T.A. Lutherer
Geologist

CEARP Manager

Comments Set stainless steel centralizer from 27.58' to 26.36' below ground surface.



Plant
749940
2082610
J9

LOG OF BOREHOLE

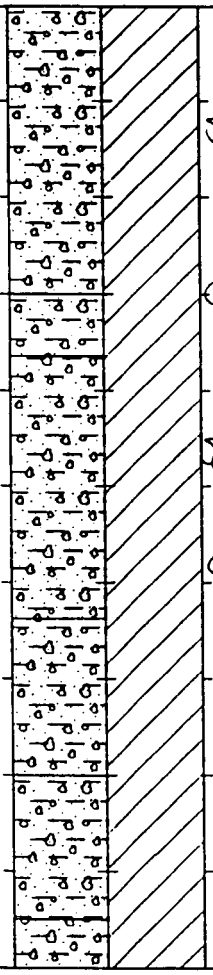
QA BY/DATE J.B. Burman 10-12-90
LOCATION Rocky Flats Plant
COORDINATES N36,962.24 E19,503.82 (RFP)
TOTAL DEPTH 31.0'

DRILLING COMPANY Boyles Brothers
DATE DRILLED September 28, 1989
DRILLING METHOD Hollow Stem Auger
LOGGED BY T.A. Lutherer
GEOLOGIST

BOREHOLE/WELL NO. P114789
GROUND SURFACE ELEVATION 6010.7'
WATER LEVEL ENCOUNTERED 18.0'
STATIC 8.96' (01/15/90)
DRILLER T. Merritt HELPER K. Parker
DRILLING FLUID None
CHECKED BY J.B. Burman
SITE MANAGER

CEARP MANAGER

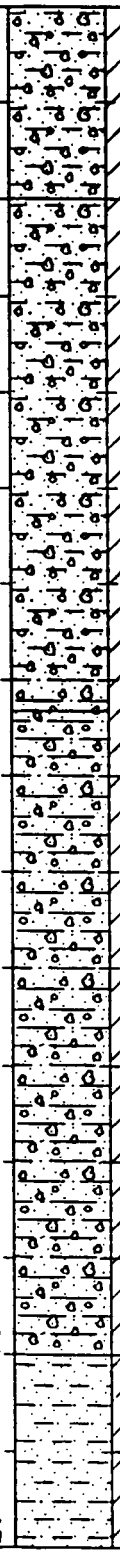
COMMENTS

DEPTH (FT)	GRAPHIC LOG	SAMPLE TYPE	LITHOLOGIC DESCRIPTION	SAMPLES COLLECTED OR OTHER TESTS PERFORMED
0 1 2 3 4 5			**ARTIFICIAL FILL** 0.0-2.0' SAMPLE. Recovered 2.0/2.0' = 100%. 0.0-1.5': GRAVELLY CLAYEY SAND: moderate brown (5 YR 3/4); nonstratified; some 1 to 6 cm quartzose gravel; fine- to coarse-grained sand; subrounded to subangular; stiff; low plasticity; dry. ROCKY FLATS ALLUVIUM 1.5-2.0': GRAVELLY SANDY CLAY: same as 0.0-2.0'; medium plasticity. 2.0-4.0' SAMPLE. Recovered 1.1/2.0' = 55%. GRAVELLY CLAYEY SAND: same as 0.0 to 2.0'. 4.0-6.0' SAMPLE. Recovered 0.8/2.0' = 40%. GRAVELLY SANDY CLAY: same as 2.0 to 4.0'; moderate brown (5 YR 3/4); nonstratified; 1 to 3 cm quartzose gravels; plastic; moist; 4.5 to 4.8' wet.	HNu Background: 0.0 OVA Background: 0.0 All readings on cuttings, in breathing zone, on core, and in augers: 0.0; unless otherwise noted below. TRIP BLANK SAMPLE TB0928898 0.0-2.0' SAMPLE (VOAs only) PZ43890002 0.0-3.0' SAMPLE PZ43890003 2.0-3.1' SAMPLE (VOAs only) PZ43890204 3.0-7.0' SAMPLE PZ43890307 4.0-4.8' SAMPLE (VOAs only) PZ43890406

PZ4389a.pj

WELL NO. P114789

LOG OF BOREHOLE

DEPTH (FT)	GRAPHIC LOG	SAMPLE TYPE	LITHOLOGIC DESCRIPTION	SAMPLES COLLECTED OR OTHER TESTS PERFORMED
5 6 7 8 9 10 11 12 13			**6.0-8.0' SAMPLE.** Recovered 2.0/2.0' = 100%. GRAVELLY CLAYEY SAND: same as 0.0-2.0'; light brown (5 YR 5/6); low plasticity; damp. **8.0-10.0' SAMPLE.** Recovered 1.0/2.0' = 50%. 8.0-8.7': CLAYEY GRAVELLY SAND: same as above. 8.7-9.0': GRAVELLY SANDY SILT: light brown (5 YR 5/6); nonstratified; some 1-3 cm quartzose gravels; trace to some fine- to coarse-grained sand; trace clay; stiff; nonplastic; dry. **10.0-12.0' SAMPLE.** Recovered 0.0/2.0' = 0%. **12.0-14.0' SAMPLE.** Recovered 2.0/2.0' = 100%. 12.0-13.1': SANDY CLAY; pale yellowish brown (10 YR 6/2); nonstratified; trace to some sand, fine- to coarse-grained, quartzose; subround to subangular; medium plasticity; firm; damp. 13.1-14.0': GRAVELLY CLAYEY SAND: same as 8.0-8.7'.	**7.0-10.0' SAMPLE** PZ43890711 **6.0-8.0' SAMPLE** (VOAs only) PZ43890608 **8.0-9.0' SAMPLE** (VOAs only) PZ43890810 **11.0-14.6' SAMPLE** PZ43891115 **12.0-14.0' SAMPLE** PZ43891214 ▼ 8.96'

PZ43890.pj

WELL NO. P114789

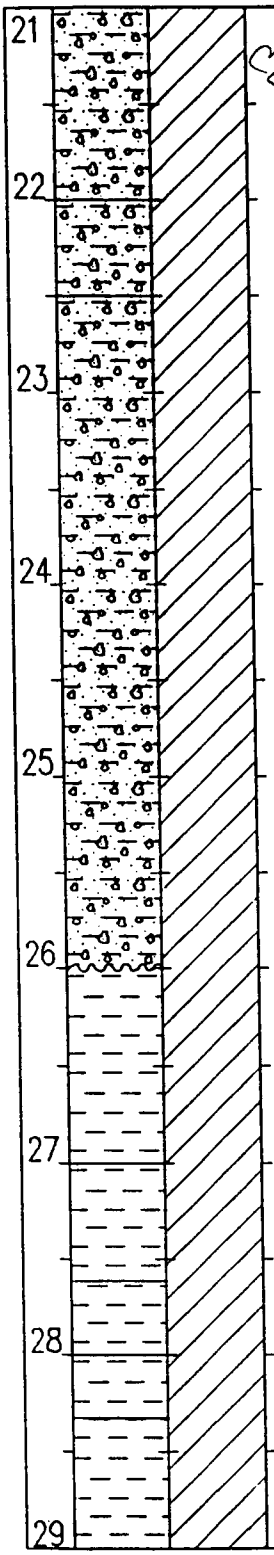
LOG OF BOREHOLE

DEPTH (FT)	GRAPHIC LOG	SAMPLE TYPE	LITHOLOGIC DESCRIPTION	SAMPLES COLLECTED OR OTHER TESTS PERFORMED
13			**14.0-16.0' SAMPLE.** Recovered 2.0/2.0' = 100%. 14.0-14.3': GRAVELLY CLAYEY SAND: same as 13.1-14.0'. 14.3-14.6': SANDY CLAY: same as 12.0 to 13.1'. 14.6-15.5': GRAVELLY CLAYEY SAND: same as 14.0-14.3' with grayish orange (10 YR 7/4); iron staining. 15.5-16.0': GRAVELLY SANDY CLAY: same as 4.0-6.0'.	**14.0-16.0'** SAMPLE (VOAs only) PZ43891416 **15.0-18.9'** SAMPLE PZ43891519
14			**16.0-18.0' SAMPLE.** Recovered 2.0/2.0' = 100%. GRAVELLY SANDY CLAY: same as 15.5-16.0' with trace to some iron stained silt.	**16.0-18.0'** SAMPLE (VOAs only) PZ43891618
15			**18.0-20.0' SAMPLE.** Recovered 2.0/2.0' = 100%. 18.0-18.9': GRAVELLY SANDY CLAY: same as 16.0-18.0'. 18.9-20.0': GRAVELLY CLAYEY SAND: same as 14.6-15.5'.	
16			**20.0-22.0' SAMPLE.** Recovered 2.0/2.0' = 100%. 20.0-20.9': GRAVELLY CLAYEY SAND: same as 18.9-20.0'; wet. 20.9-22.0': GRAVELLY SANDY CLAY: occasionally grading to medium- to coarse-grained subangular to subrounded quartzose sand; damp to moist.	**18.0-20.0'** SAMPLE (VOAs only) PZ43891820 **20.0-22.0'** SAMPLE (VOAs only) PZ43892022
17				
18				18.0'
19				
20				
21				

PZ4389c.pj

WELL NO. P114789

LOG OF BOREHOLE

DEPTH (FT)	GRAPHIC LOG	SAMPLE TYPE	LITHOLOGIC DESCRIPTION	SAMPLES COLLECTED OR OTHER TESTS PERFORMED
21			**22.0-24.0' SAMPLE.** Recovered 0.5/2.0' = 25%. GRAVELLY SANDY CLAY: pale yellowish brown (10 YR 6/2); nonstratified; some fine- to coarse-grained sand; quartzose; subround to subangular; medium plasticity; wet.	18.9-22.0' SAMPLE PZ43891922 22.0-22.5' SAMPLE (VOAs only) PZ43892224 22.0-22.5' SAMPLE PZ43892226
22			**24.0-26.0' SAMPLE.** Recovered 0.0/2.0' = 0%. Driller indicated contact while drilling at 26.0'.	
23			**LARAMIE/ARAPHOE FORMATION** **26.0-27.0' SAMPLE.** Recovered 0.0/1.0' = 0%.	
24			**27.0-28.0' SAMPLE.** Recovered 0.7/2.0' = 35%. CLAYSTONE: pale yellowish brown (10 YR 6/2); nonstratified, trace silty, plastic; wet.	27.0-27.7' SAMPLE (VOAs only) PZ4389728 28.0-28.3' SAMPLE (VOAs only) PZ47892829
25			**28.0-29.0' SAMPLE.** Recovered 0.3/2.0' = 15%. CLAYSTONE: same as 27.0-28.0'.	
26				
27				
28				
29				

PZ4389dpj

WELL NO. P114789

LOG OF BOREHOLE

DEPTH (FT)	GRAPHIC LOG	SAMPLE TYPE	LITHOLOGIC DESCRIPTION	SAMPLES COLLECTED OR OTHER TESTS PERFORMED
29			Note: 29.0-30.0': Drilled with center bit. No sample taken.	27.0-31.0' SAMPLE PZ43892631
			30.0-31.0' SAMPLE. Recovered 1.0/1.0' = 100%. CLAYSTONE: same as 28.0-29.0' with pale yellowish orange (10 YR 8/6); mottling.	30.0-31.0' SAMPLE (VOAs only) PZ43893031
30				
			TOTAL DEPTH = 31.0'	
31				
32				
33				
34				
35				
36				
37				

PZ4389e.pl

STATE PLANE COORDINATE:	TOTAL DEPTH (FT): 18.0	GROUND ELEVATION (FT):	6016.60	PROJECT NUMBER:	P244-89	LOG OF BORING NUMBER:
NORTH: 749926	AREA: PLANT	CASING DIAMETER (IN):	2-3/8 O.D.	GEOLOGIST:	WAH	P114889
EAST: 2082127	LOCATOR NUMBER: J9	BOREHOLE DIAMETER (IN):	7.25	DATE DRILLED:	09/22/89	

REMARKS: Hollow Stem Auger. Weston Log.

DRAFT

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%						SM:	Gravelly Silty Sand - mod. brown (5 YR 4/4). F.g. to c.g. sand. Gravel granite, quartzose, 2 cm. to 3 cm. Stiff, moist.
				1.60 /2.00	6016	0			GW:	Gravel - med. gray (N 5/0). 2 cm. to 5 cm. angular (fractured cobble).
	P24890003				6015	1			ML:	Gravelly Clayey Silt - dark yellowish brown (10 YR 4/2). Some f.g. to c.g. sand, poorly sorted, well rounded to sub-angular. Gravel quartzose, 2 cm. to 4 cm. Stiff, damp.
						2			NO SAMPLE:	NO SAMPLE.
					6014				ML:	Gravelly Clayey Silt - same as above. Dark greenish gray (5 GY 4/1).
				1.70 /2.00		3			GP:	Gravel - quartzite (gp-gw?)
					6013				SW:	Gravelly Sand - mod. brown (5 YR 4/4). Some silt, f.g. to c.g. sand, poorly sorted. Gravel quartzite, 2 cm. to 5 cm. Very stiff, dry.
						4			NO SAMPLE:	NO SAMPLE.
	P24890006			0.00 /1.00	6012				NO SAMPLE:	NO SAMPLE.
				1.00 /1.00	6011	5			ML:	Gravelly Sandy Silt - dark yellowish brown (10 YR 4/2), poorly sorted. Gravel 0.2 cm. to 4.0 cm., angular to sub-rounded, quartzose. F.g. to c.g. sand. Very stiff, dry.
					6010	6			GM:	Sandy Silty Gravel - light brown (5 YR 5/6). Trace clay. Gravel quartzose, 2 cm. to 6 cm., angular to sub-angular. F.g. to c.g. sand. Very stiff, dry.
	P24890608			1.30 /2.00	6009	7				
						8	01/18/90 ▽		NO SAMPLE:	NO SAMPLE.
				0.00 /1.00	6008					
						9			GM:	Sandy Silty Gravel - same as above (reference interval 6.0' to 8.0').
				2.00 /2.00	6007	10				

STATE PLANE COORDINATE:		TOTAL DEPTH (FT): 18.0	GROUND ELEVATION (FT):	6016.60	PROJECT NUMBER:	P244-89	LOG OF BORING NUMBER:
NORTH:	749926	AREA: PLANT	CASING DIAMETER (IN):	2-3/8 O.D.	GEOLOGIST:	WAH	P114889
EAST:	2082127	LOCATOR NUMBER: J9	BOREHOLE DIAMETER (IN):	7.25	DATE DRILLED:	09/22/89	

REMARKS: Hollow Stem Auger. Weston Log.

DRAFT

CHEMICAL SAMPLE DEPTH / GRADATIONAL SAMPLE DEPTH	SAMPLE NUMBER	RECOVERY/INTERVAL	DEPTH (FT)	UNIFIED SOILS CLASSIFICATION OR ROCK TYPE	DESCRIPTION
		2.00 /2.00	10		
	P244891913	0.00 /1.00	11	NO SAMPLE:	NO SAMPLE.
		1.90 /2.00	12	GM:	Sandy Silty Gravel - same as above (reference interval 9.0' to 11.0').
			13	GC:	Clay and Gravel - olive gray (5 Y 4/1). Some f.g. to c.g. sand, quartz sand and feldspar. Very stiff, dry.
				CL:	Clay - mod. brown (5 YR 4/4) to med. gray (N 5/0). Trace f.g. to c.g. sand, quartz sand and feldspar. Very stiff, dry.
			14	CLAYSTONE:	Top of Bedrock. Same as above - f.g. sand only.
		2.00 /2.00	15	SANDY CLAYSTONE:	Mod. brown (5 YR 4/4) and med. gray (N 5/0). Clay rolls to 1/16 in. dry, 1/32 in. wet. Color banding, brown and gray, reflects weathering. F.g. sand, stiff, dry.
	P244891318		16	SANDY CLAYSTONE:	Same as above.
		2.00 /2.00	17		
			18	:	TD = 18.0'
			19		
			20		

SAMPLE GRAIN SIZE: 0% - 50% 100%

PERCENT RECOVERY: 0% 100%

DATUM (FT): 6006, 6005, 6004, 6003, 6002, 6001, 6000, 5999, 5998, 5997

WELL OR PIEZOMETER CONSTRUCTION

LITHOLOGY

PZ4489

WELL COMPLETION INFORMATION

QA By/Date J.B. Suyman 10-2-89

Location Rocky Flats Plant

Well No. P114889

Coordinates N 36950.06 E 19020.34 (RFP)

Elevation: Ground Surface 6016.6'

Total Depth: Well 15.55'

Top of Casing 6018.26'

Borehole 18.0'

Formation of Completion Rocky Flats Alluvium

Casing Material Schedule 40 PVC

Casing Diameter 2 3/8" O.D.

Screen Material Schedule 40 10-slotted PVC

Surface Casing Diameter 5 5/8" O.D.

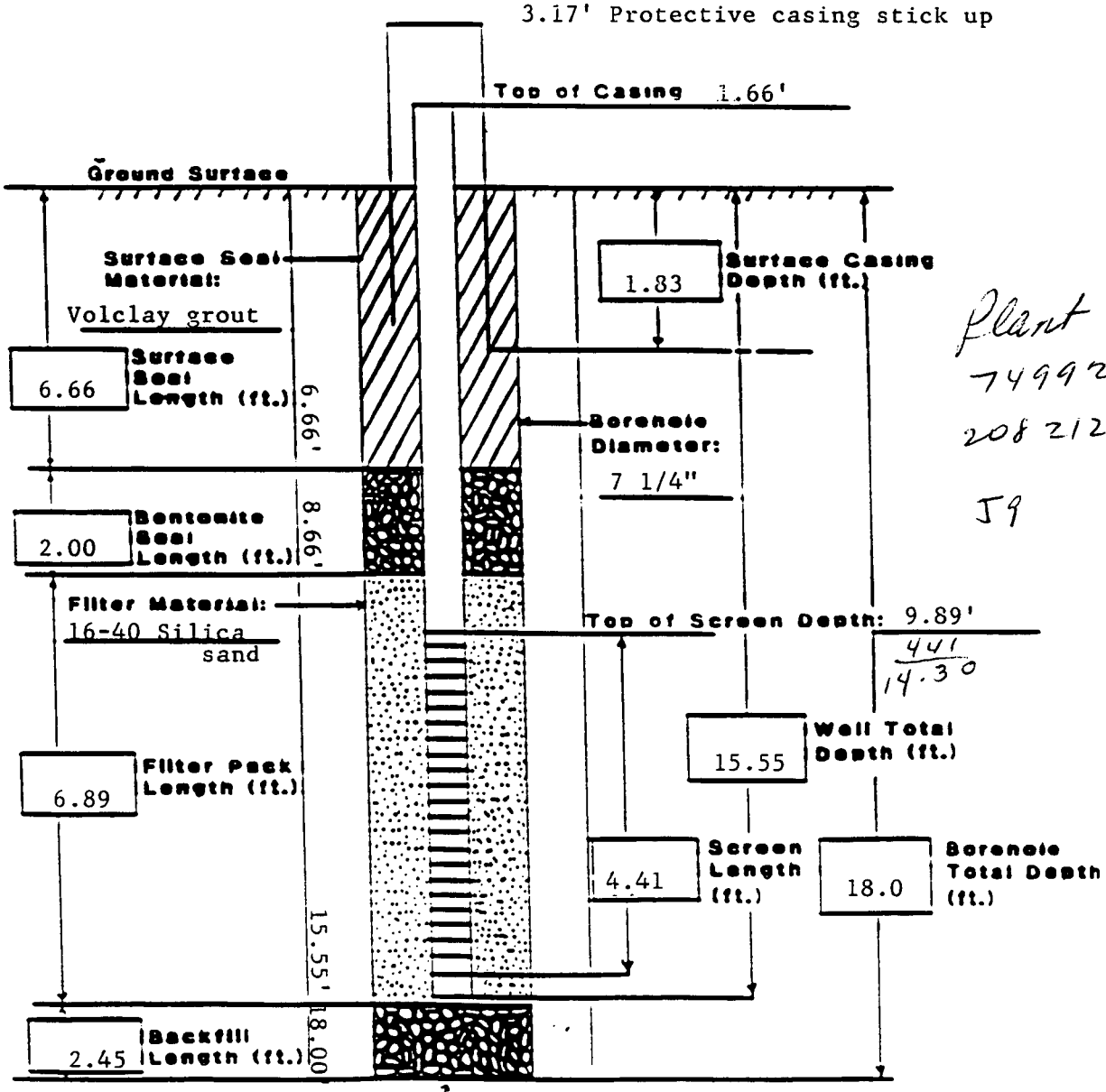
Date Installed 09/22/1989

Approved By James Suyman
Site Manager

Installed By W.W. Hurlburt
Geologist

CEARP Manager

Comments Set stainless steel centralizer from 15.53' to 14.40' below ground surface.



Plant
749926
2082127
J9

Backfill Material: 1/4" Volclay bentonite pellets and slough

LOG OF BOREHOLE

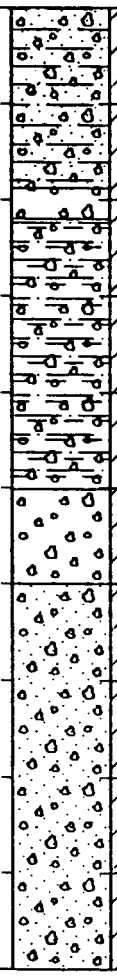
QA BY/DATE J.B. Bergman 3-26-90
LOCATION Rocky Flats Plant
COORDINATES N36,950.06 E19,020.34 (RFP)
TOTAL DEPTH 18.0'

DRILLING COMPANY Boyles Brothers
DATE DRILLED September 22, 1989
DRILLING METHOD Hollow Stem Auger
LOGGED BY W.W. Hurlburt
GEOLOGIST

BOREHOLE/WELL NO. P114889
GROUND SURFACE ELEVATION 6016.6'
WATER LEVEL ENCOUNTERED None
STATIC 8.41' (01/18/90)
DRILLER D. Styles HELPER A. Boday
DRILLING FLUID None
CHECKED BY J.B. Bergman
SITE MANAGER

CEARP MANAGER

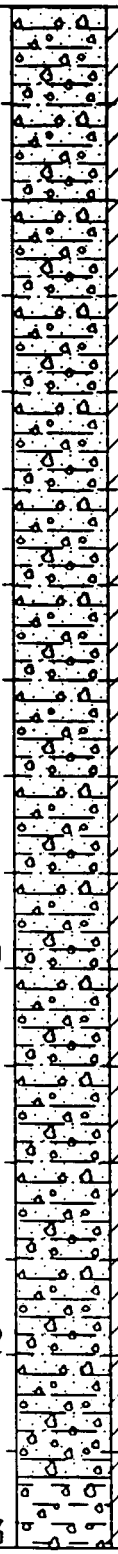
COMMENTS

DEPTH (FT)	GRAPHIC LOG	SAMPLE TYPE	LITHOLOGIC DESCRIPTION	SAMPLES COLLECTED OR OTHER TESTS PERFORMED
0 1 2 3 4 5			**ARTIFICIAL FILL** 0.0-2.0' SAMPLE. Recovered 1.6/2.0' = 80%. 0.0-0.9': GRAVELLY SILTY SAND: moderate brown (5 YR 4/4); fine- to coarse-grained sand; gravel - granite; quartzose; 2-3 cm; stiff; moist. 0.9-1.1': GRAVEL: medium gray (N 5/0); 2-5 cm angular (fractured cobble). 1.1-1.6': GRAVELLY CLAYEY SILT: dark yellowish brown (10 YR 4/2); some fine- to coarse-grained sand; poorly sorted; well rounded to subangular; gravel-quartzose; 2-4 cm; stiff; damp. 2.0-4.0' SAMPLE. Recovered 1.7/2.0' = 85%. 2.0-2.5': GRAVELLY CLAYEY SILT: same as above; dark greenish gray (5 GY 4/1). 2.5-3.0': GRAVEL: quartzite. (gp-gw?) **ROCKY FLATS ALLUVIUM** 3.0-3.7': GRAVELLY SAND: moderate brown (5 YR 4/4); some silt; fine- to coarse-grained sand; poorly sorted; gravel quartzite; 2-5 cm; very stiff; dry. Note: 4.0-5.0': Drilled with center bit. No sample taken.	HNu Background: 0.0 OVA Background: 0.0 All readings on cuttings, in breathing zone, on core, and in augers: 0.0 unless otherwise noted. TRIP BLANK SAMPLE TB092289B 0.0-1.6' SAMPLE (VOAs only) PZ44890002 0.0-3.0' SAMPLE PZ44890003 2.0-3.7' SAMPLE (VOAs only) PZ44890204 3.0-6.0' SAMPLE PZ44890306

PZ4489A

WELL NO. P114889

LOG OF BOREHOLE

DEPTH (FT)	GRAPHIC LOG	SAMPLE TYPE	LITHOLOGIC DESCRIPTION	SAMPLES COLLECTED OR OTHER TESTS PERFORMED
5 6 7 8 9 10 11 12 13			**5.0-6.0' SAMPLE.** Recovered 1.0/1.0' = 100%. GM GRAVELLY SANDY SILT: dark yellowish brown (10 YR 4/2); poorly sorted; gravel 0.2-4.0 cm, angular to subrounded, quartzose; fine- to coarse-grained sand; very stiff; dry. **6.0-8.0' SAMPLE.** Recovered 1.3/2.0' = 65%. GM SANDY SILTY GRAVEL: light brown (5 YR 5/6); trace clay; gravel - quartzose, 2-6 cm, angular to subangular, fine- to coarse-grained sand; very stiff; dry. Note: 8.0-9.0': Drilled with center bit. No sample taken. **9.0-11.0' SAMPLE.** Recovered 2.0/2.0' = 100%. GM SANDY SILTY GRAVEL: same as above. Note: 11.0-12.0': Drilled with center bit. No sample taken. **12.0-14.0' SAMPLE.** Recovered 1.9/2.0' = 95%. GM 12.0-12.6': SANDY SILTY GRAVEL: same as above. GC 12.6-13.2': CLAY AND GRAVEL: olive gray (5 Y 4/1); some fine- to coarse-grained sand; quartz sand and feldspar; very stiff; dry. CL 13.2-13.8': CLAY: moderate brown (5 YR 4/4) to medium gray (N 5/0); trace fine- to coarse grained sand; quartz sand and feldspar; very stiff; dry. **ARAPAHOE/LARAMIE FORMATION** 13.8-13.9': CLAYSTONE: same as above; fine-grained sand only.	**5.0':** Reading on Core: HNu: 45.0 **5.0-6.0'** SAMPLE (VOAs only) PZ44890506 **6.0':** Reading on Core: HNu: 3.0 **6.0-7.3'** SAMPLE (VOAs only) PZ44890608 **6.0-8.0'** SAMPLE PZ44890608 **9.0-11.0':** Reading on Core: HNu: 90.0 ▼ 8.41' **9.0':** Reading in Augers: 3.0 Reading in Breathing Zone: 0.8 **9.0-11.0'** SAMPLE (VOAs only) PZ44890911 PZ44890911D **9.0-13.8'** SAMPLE PZ44890913 PZ44890913D **12.0-13.9'** SAMPLE (VOAs only) PZ44891214 **13.8-18.0'** SAMPLE PZ44891318

WELL NO. P114889

LOG OF BOREHOLE

DEPTH (FT)	GRAPHIC LOG	SAMPLE TYPE	LITHOLOGIC DESCRIPTION	SAMPLES COLLECTED OR OTHER TESTS PERFORMED
13			**14.0-16.0' SAMPLE.** Recovered 2.0/2.0' = 100%. SANDY CLAYSTONE: moderate brown (5 YR 4/4) and medium gray (N 5/0); clay rolls to 1/16" dry, 1/32" wet; color banding - brown and gray, reflects weathering; fine-grained sand; stiff; dry.	**14.0-16.0'** SAMPLE (VOAs only) PZ44891416
14			**16.0-18.0' SAMPLE.** Recovered 2.0/2.0' = 100%. SANDY CLAYSTONE: same as above.	**16.0-18.0'** SAMPLE (VOAs only) PZ44891618
15			**TOTAL DEPTH = 18.0'**	**FIELD BLANK** SAMPLE FBPZ44890018
16				
17				
18				
19				
20				
21				

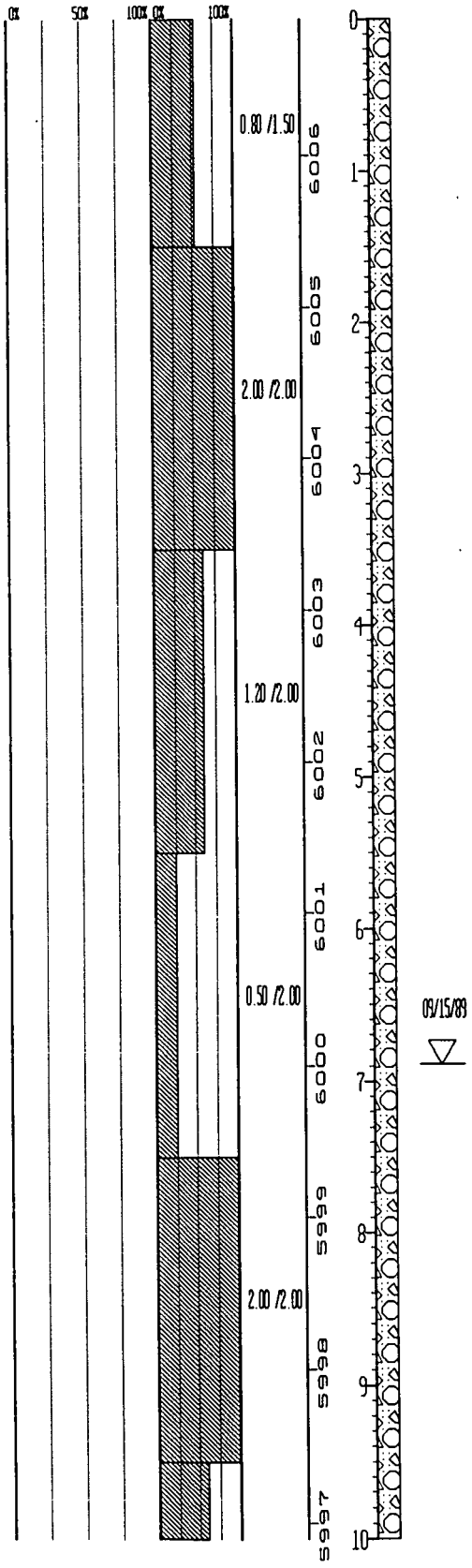
PZ4489c.pj

STATE PLANE COORDINATE:		TOTAL DEPTH (FT): 23.5	GROUND ELEVATION (FT):	6006.90	PROJECT NUMBER:	PZ51-89	LOG OF BORING NUMBER:
NORTH:	749532	AREA: PLANT	CASING DIAMETER (IN):	2-3/8 O.D.	GEOLOGIST:	SPC	P115689
EAST:	2083019	LOCATOR NUMBER: K9	BOREHOLE DIAMETER (IN):	7.25	DATE DRILLED:	07/10/89	

REMARKS: Hollow Stem Auger. Weston Log.

DRAFT

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



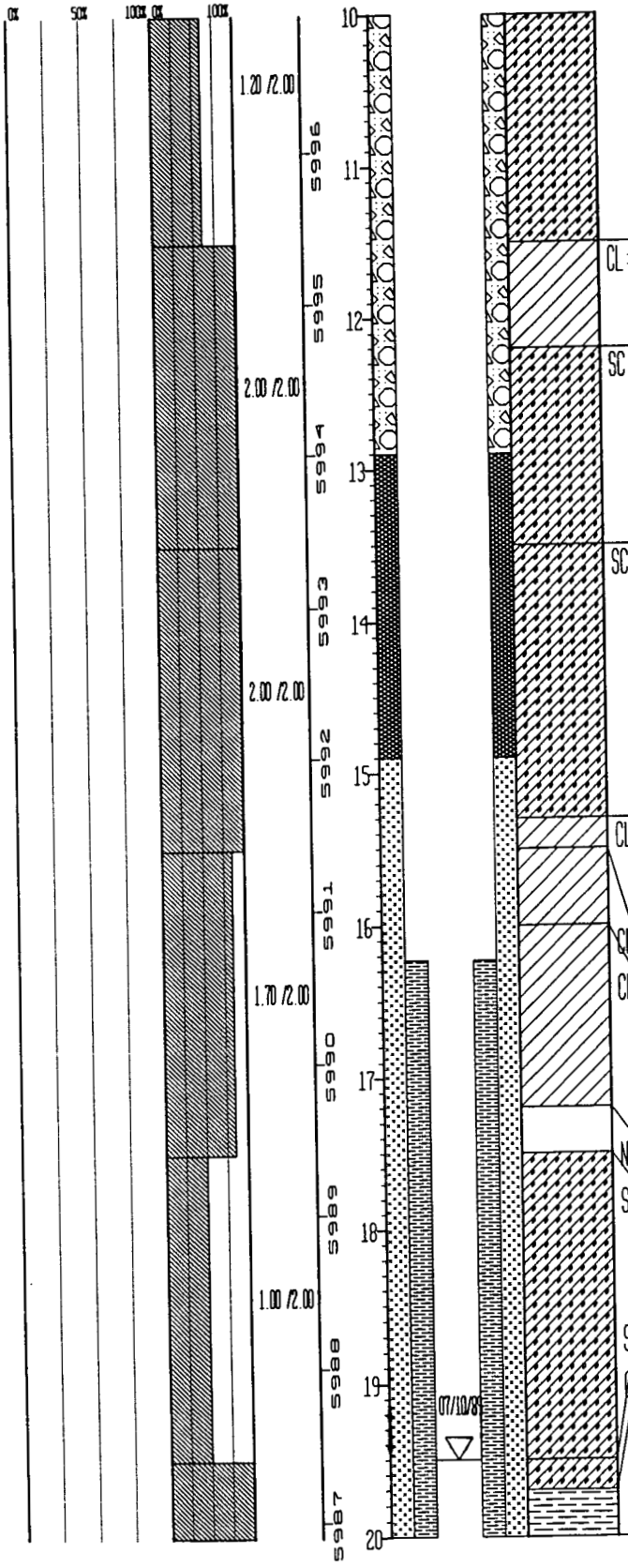
SC:	Gravelly Clayey Sand - mod. brown (5 R 3/4). F.g. to v.c.g. sand, 1 cm. to 6 cm. gravel. trace cobbles, non-stratified, poorly sorted, sub-angular, quartzose. Mod. consol., dense, moist to slightly moist.
SC:	Gravelly Clayey Sand - same as above.
CL:	Gravelly Sandy Clay - mod. reddish brown (10 R 4/6) to dark reddish brown (10 R 3/4). F.g. to v.c.g. sand, up to 2 cm. gravels. Non-stratified, mod. consol., stiff, med. plastic, moist.
SC:	Gravelly Clayey Sand - dark yellowish orange (10 YR 6/6). F.g. to v.c.g. sand, up to 2 cm. gravels, non-stratified, poor sorting, sub-angular, quartzose. Dense, iron oxide staining, moist.
NO SAMPLE:	NO SAMPLE.
SC:	Gravelly Clayey Sand - same as above (reference interval 3.0' to 3.5'). 1 cm. to 4 cm. gravels, low plastic.
SC:	Gravelly Clayey Sand - same as above. Dark yellowish orange (10 YR 6/6), to light brown (5 YR 5/6), to yellowish gray (5 Y 7/2). 1 cm. to 6 cm. gravel, calcareous.
SC:	Gravelly Clayey Sand - same as above.
SC:	Gravelly Clayey Sand - same as above. Light brown (5 YR 5/6), to dark yellowish orange (10 YR 6/6), to dusky yellow (5 Y 6/4), laminated.

STATE PLANE COORDINATE:	TOTAL DEPTH (FT): 23.5	GROUND ELEVATION (FT):	6006.90	PROJECT NUMBER:	P251-89	LOG OF BORING NUMBER:
NORTH: 749532	AREA: PLANT	CASING DIAMETER (IN):	2-3/8 O.D.	GEOLOGIST:	SPC	P115689
EAST: 2083019	LOCATOR NUMBER: K9	BOREHOLE DIAMETER (IN):	7.25	DATE DRILLED:	07/10/89	

REMARKS: Hollow Stem Auger. Weston Log.

DRAFT

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
CL:	Sandy Clay - yellowish gray (5 Y 7/2) to dusky yellow (5 Y 6/4). Trace gravels, non-stratified, mod. consol., stiff, med. plastic, slightly calcareous, moist.
SC:	Gravelly Clayey Sand - varicolored, pale reddish brown (10 R 5/4), to dark yellowish orange (10 YR 6/6), to light brown (5 YR 5/6) to dusky yellow (5 Y 6/4). F.g. to v.c.g sand. 1 cm. to 6 cm. gravels, poor sorting, sub-angular, quartzose. Laminated by color and clay content, dense, mod. consol., low plastic, iron oxide staining, moist.
SC:	Clayey Sand - light brown (5 YR 5/6), to yellowish gray (5 Y 7/2), to grayish orange pink (5 YR 7/2), mottled. M.g. to c.g. sand, mod. sorting, sub-angular, quartzose. Dense, mod. consol., low to med. plastic. Some Claystone pieces, iron oxide staining, moist.
CL:	Gravelly Sandy Clay - light brown (5 YR 5/6). F.g. to v.c.g. sand. 1 cm. to 3 cm. gravels. Mod. consol., very stiff, low plastic, moist.
CL:	Gravelly Sandy Clay - same as above, abundt. iron oxide.
CL:	Sandy Clay - light brown (5 YR 5/6) to grayish orange pink (5 YR 7/2), to light olive gray (5 Y 6/1), varicolored, mottled to lenticular inclusions. F.g. to m.g. sand. Trace gravel, mod. consol., very stiff, med. plastic, iron oxide, moist.
NO SAMPLE:	NO SAMPLE.
SC:	Gravelly Clayey Sand - light brown (5 YR 5/6), m.g. to c.g. sand. 1 cm. to 4 cm. gravels, mod. sorting, sub-angular, quartzose. Non-stratified, mod. consol., dense, low plastic, moist to very moist.
SC:	Gravelly Slightly Clayey Sand - same as above, wet.
CLAYSTONE:	Top of Bedrock. Dark yellowish orange (10 YR 6/6), to mod. yellowish brown (10 YR 5/4) to med. light gray (N 6/0). Blocky, laminated by color, weathered, well consol., med. to high plastic, manganese oxide and iron oxide staining, moist.

STATE PLANE COORDINATE:	TOTAL DEPTH (FT): 23.5	GROUND ELEVATION (FT):	6006.90	PROJECT NUMBER:	PZ51-89	LOG OF BORING NUMBER:
NORTH: 749532	AREA: PLANT	CASING DIAMETER (IN):	2-3/8 O.D.	GEOLOGIST:	SPC	P115689
EAST: 2083019	LOCATOR NUMBER: K9	BOREHOLE DIAMETER (IN):	7.25	DATE DRILLED:	07/10/89	

REMARKS: Hollow Stem Auger. Weston Log.

DRAFT

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
				2.00 /2.00	5986	20, 21				
				2.00 /2.00	5985, 5984	22, 23			CLAYSTONE:	Same as above - med. light gray (N 6/0) to dusky yellow (5 Y 6/4) to dark yellowish orange (10 YR 6/6).
					5983, 5982, 5981, 5980, 5979, 5978, 5977	24, 25, 26, 27, 28, 29, 30				TD = 23.5'

PZ5189

WELL COMPLETION INFORMATION

QA By/Date Jarrell Burman 17-19-89

Location Rocky Flats Plant

Well No. P115689

Coordinates N 36552.86 E 19911.10 (RFP)

Elevation: Ground Surface 6006.9'

Total Depth: Well 21.31'

Top of Casing 6008.71'

Borehole 23.5'

Formation of Completion Rocky Flats Alluvium

Casing Material Schedule 40 PVC

Casing Diameter 2 3/8" O.D.

Screen Material Schedule 40 10-slotted PVC

Surface Casing Diameter 5 5/8" O.D.

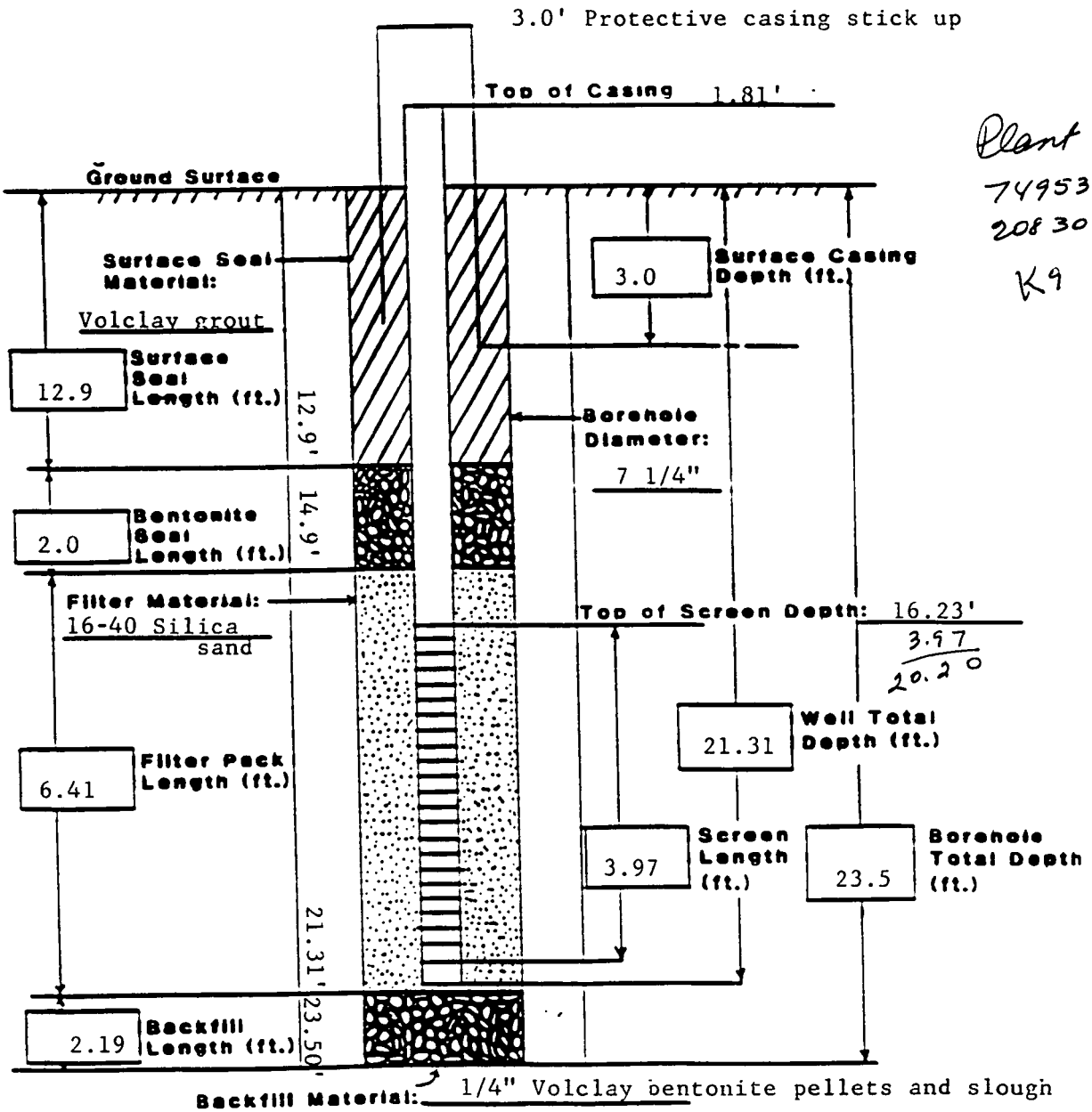
Date Installed 07/11/1989

Approved By Jarrell Burman
Site Manager

Installed By S.P. Carpenter
Geologist

CEARP Manager

Comments Set stainless steel centralizer from 21.31' to 20.22' below ground surface.



Plant
749532
2083019
K9

LOG OF BOREHOLE

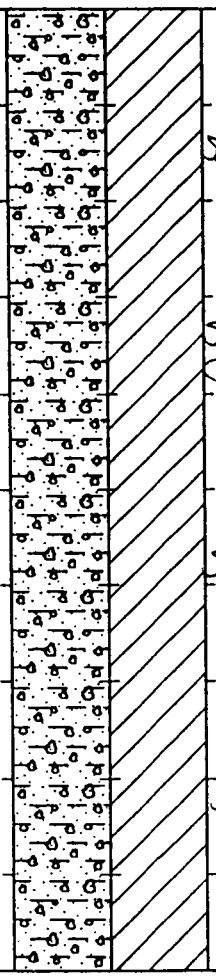
QA BY/DATE J.B. Burman 12-12-90
LOCATION Rocky Flats Plant
COORDINATES N36,552.86 E19,911.10 (RFP)
TOTAL DEPTH 23.5'

DRILLING COMPANY Boyles Brothers
DATE DRILLED July 10, 1989
DRILLING METHOD Hollow Stem Auger
LOGGED BY S.P. Carpenter
GEOLOGIST

BOREHOLE/WELL NO. P115689
GROUND SURFACE ELEVATION 6006.9'
WATER LEVEL ENCOUNTERED 19.5'
STATIC 6.89' (09/15/89)
DRILLER K. Parker HELPER T. Merritt
DRILLING FLUID None
CHECKED BY J.B Burman
SITE MANAGER

CEARP MANAGER

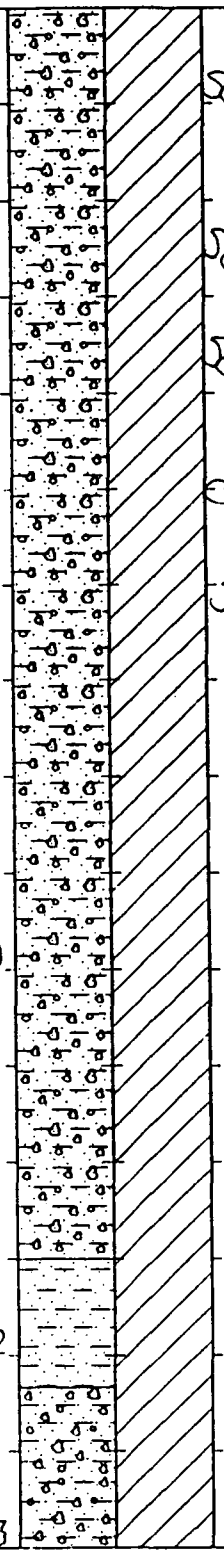
COMMENTS

DEPTH (FT)	GRAPHIC LOG	SAMPLE TYPE	LITHOLOGIC DESCRIPTION	SAMPLES COLLECTED OR OTHER TESTS PERFORMED
0 1 2 3 4 5			**ARTIFICIAL FILL** 0.0-1.5' SAMPLE. Recovered 0.8/1.5' = 53%. GRAVELLY CLAYEY SAND: moderate brown (5 R 3/4); fine- to very coarse-grained sand; 1 to 6 cm gravel; trace cobbles; nonstratified; poorly sorted; subangular; quartzose; moderately consolidated; dense; moist to slightly moist. 1.5-3.5' SAMPLE. Recovered 2.0/2.0' = 100%. 1.5-2.2': GRAVELLY CLAYEY SAND: same as above. 2.2-3.0': GRAVELLY SANDY CLAY: moderate reddish brown (10 R 4/6) to dark reddish brown (10 R 3/4); fine- to very coarse-grained sand; up to 2 cm gravels; nonstratified; moderately consolidated; stiff; medium plastic; moist. **ROCKY FLATS ALLUVIUM** 3.0-3.5': GRAVELLY CLAYEY SAND: dark yellowish orange (10 YR 6/6); fine- to very coarse-grained sand; up to 2 cm gravels; nonstratified; poor sorting;subangular; quartzose; dense; iron oxide staining; moist. 3.5-4.3': Drilled with center bit. No sample taken. 4.3-5.5' SAMPLE. Recovered 1.2/1.2' = 100%. GRAVELLY CLAYEY SAND: same as above; 1 to 4 cm gravels; low plastic.	HNu Background: 0.0 All readings on core, in breathing zone, and in augers: 0.0; unless otherwise noted below.

15689A

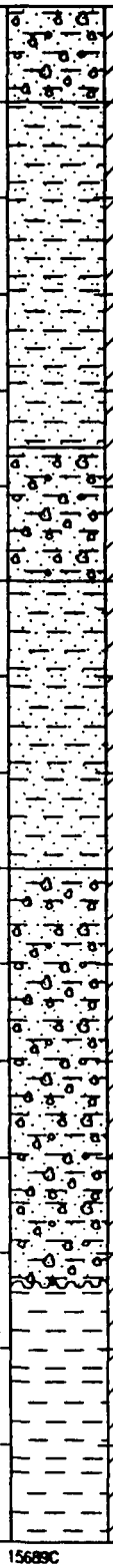
WELL NO. P115689B

LOG OF BOREHOLE

DEPTH (FT)	GRAPHIC LOG	SAMPLE TYPE	LITHOLOGIC DESCRIPTION	SAMPLES COLLECTED OR OTHER TESTS PERFORMED
5 6 7 8 9 10 11 12 13			**5.5-7.5' SAMPLE.** Recovered 0.5/2.0' = 25%. GRAVELLY CLAYEY SAND: same as above, dark yellowish orange (10 YR 6/6), to light brown (5 YR 5/6), to yellowish gray (5 Y 7/2); 1 to 6 cm gravels; calcareous. **7.5-9.5' SAMPLE.** Recovered 2.0/2.0' = 100%. GRAVELLY CLAYEY SAND; same as above. **9.5-11.5' SAMPLE.** Recovered 1.2/2.0' = 60%. GRAVELLY CLAYEY SAND: same as above; light brown (5 YR 5/6), to dark yellowish orange (10 YR 6/6), to dusky yellow (5 Y 6/4); laminated. **11.5-13.5' SAMPLE.** Recovered 2.0/2.0' = 100%. 11.5-12.2': SANDY CLAY: yellowish gray (5 Y 7/2) to dusky yellow (5 Y 6/4); trace gravels; nonstratified; moderately consolidated; stiff; medium plastic; slightly calcareous; moist. 12.2-13.5': GRAVELLY CLAYEY SAND: varicolored; pale reddish brown (10 R 5/4), to dark yellowish orange (10 YR 6/6), to light brown (5 YR 5/6) to dusky yellow (5 Y 6/4); fine- to very coarse-grained sand; 1 to 6 cm gravels; poor sorting; subangular; quartzose laminated by color and clay content; dense; moderately consolidated, low plastic; iron oxide stain; moist.	▼ 6.89'

WELL NO. P115689

LOG OF BOREHOLE

DEPTH (FT)	GRAPHIC LOG	SAMPLE TYPE	LITHOLOGIC DESCRIPTION	SAMPLES COLLECTED OR OTHER TESTS PERFORMED
13 14 15 16 17 18 19 20 21			<u>13.5-15.5' SAMPLE.</u> Recovered 2.0/2.0' = 100%. 13.5-15.3': CLAYEY SAND: light brown (5 YR 5/6), to yellowish gray (5 Y 7/2), to grayish orange pink (5 YR 7/2); mottled; medium- to coarse-grained sand; moderate sorting; subangular; quartzose; dense; moderately consolidated; low to medium plastic; some claystone pieces; iron oxide stain; moist. 15.3-15.5': GRAVELLY SANDY CLAY: light brown (5 YR 5/6); fine- to very coarse-grained sand; 1 to 3 cm gravels; moderately consolidated; very stiff; low plastic ; moist. <u>15.5-17.5' SAMPLE.</u> Recovered 1.7/2.0' = 85%. 15.5-16.0': GRAVELLY SANDY CLAY: same as above; abundant iron oxide. 16.0-17.2': SANDY CLAY: light brown (5 YR 5/6) to grayish orange pink (5 YR 7/2), to light olive gray (5 Y 6/1) varicolored; mottled to lenticular inclusions; fine- to medium-grained sand; trace gravel; moderately consolidated; very stiff; medium plastic; iron oxide, moist. <u>17.5-19.5' SAMPLE.</u> Recovered 1.0/2.0' = 50%. GRAVELLY CLAYEY SAND: light brown (5 YR 5/6); medium to coarse ground sand; 1 to 4 cm gravels; moderate sorting; subangular; quartzose; nonstratified; moderately consolidated; dense; low plastic; moist to very moist. <u>19.5-21.5' SAMPLE.</u> Recovered 2.0/2.0' = 100%. 19.5-19.7': GRAVELLY SLIGHTLY CLAYEY SAND: same as above; wet. <u>ARAPAHOE/LARAMIE FORMATION</u> 19.7-21.5': CLAYSTONE: dark yellowish orange (10 YR 6/6), to moderate yellowish brown (10 YR 5/4) to medium light gray (N 6/0); blocky; laminated by color; weathered; well consolidated; medium to high plastic; manganese oxide and iron oxide stainings; moist.	▽ 19.5'

15689C

WELL NO. P115689

LOG OF BOREHOLE

DEPTH (FT)	GRAPHIC LOG	SAMPLE TYPE	LITHOLOGIC DESCRIPTION	SAMPLES COLLECTED OR OTHER TESTS PERFORMED
21			**21.5-23.5' SAMPLES.** Recovered 2.0/2.0' = 100%. CLAYSTONE: same as above; medium light gray (N 6/0) to dusky yellow (5 Y 6/4) to dark yellowish orange (10 YR 6/6).	
22				
			TOTAL DEPTH: 23.5'	
23				
24				
25				
26				
27				
28				
29				

156890

STATE PLANE COORDINATE:		TOTAL DEPTH (FT): 29.1	GROUND ELEVATION (FT):	5974.06	PROJECT NUMBER:	SEP03-89BR	LOG OF BORING NUMBER:
NORTH:	750395	AREA: SOLAR POND	CASING DIAMETER (IN):	4.5 O.D.	GEOLOGIST:	KEM	P207589
EAST:	2084843	LOCATOR NUMBER: L10	BOREHOLE DIAMETER (IN):	7.25	DATE DRILLED:	05/18/89	

REMARKS: Hollow Stem Auger. Weston Log.

DRAFT

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
				2.10 /2.10	5974	0			CL:	Sandy Gravelly Clay - grayish orange (10 YR 7/4) to dusky brown (5 YR 2/2). C.g. to f.g. sand. Coarse to fine gravel, quartzite to 3 cm., broken. Loose to firm, no to low plasticity, damp.
	SEP03BBR0003				5973	1				
					5972	2			GC:	Sandy Clayey Gravel - mod. yellowish brown (10 YR 5/4) to very pale orange (10 YR 8/2). C.g. to f.g. sand. Coarse to fine gravel, quartzite, sub-rounded, some broken to 3 cm.. Loose, non-plastic, light HCl reaction (slightly calcareous), damp.
				1.70 /2.00	5971	3				
					5970	4			CL:	Gravelly Sandy Clay - very pale orange (10 YR 8/2). C.g. to f.g. sand, quartz. Some HCl reaction (mod. calcareous). Coarse to fine gravel, quartzite to 3 cm., sub-rounded. Loose to firm, no to low plasticity, damp.
				1.30 /2.00	5969	5				
	SEP03BBR0305				5968	6			CL:	Gravelly Sandy Clay - same as above. Yellowish gray (5 Y 8/1). Wet at shoe.
				1.40 /2.00	5967	7				
					5966	8	05/18/89 ▽		CL:	Gravelly Sandy Clay - same as above, wet.
				1.60 /2.00	5965	9			SILTY CLAYSTONE:	Top of Bedrock at 9.5'. Light olive gray (5 Y 6/1), mottled dusky yellow (5 Y 6/1). Stiff, consol., high plasticity.
						10			NO SAMPLE:	NO SAMPLE

STATE PLANE COORDINATE:		TOTAL DEPTH (FT): 29.1	GROUND ELEVATION (FT):	5974.06	PROJECT NUMBER:	SEP03-89BR	LOG OF BORING NUMBER:
NORTH:	750395	AREA: SOLAR POND	CASING DIAMETER (IN):	4.5 O.D.	GEOLOGIST:	KEM	P207589
EAST:	2084843	LOCATOR NUMBER: L10	BOREHOLE DIAMETER (IN):	7.25	DATE DRILLED:	05/18/89	

REMARKS: Hollow Stem Auger. Weston Log.

DRAFT

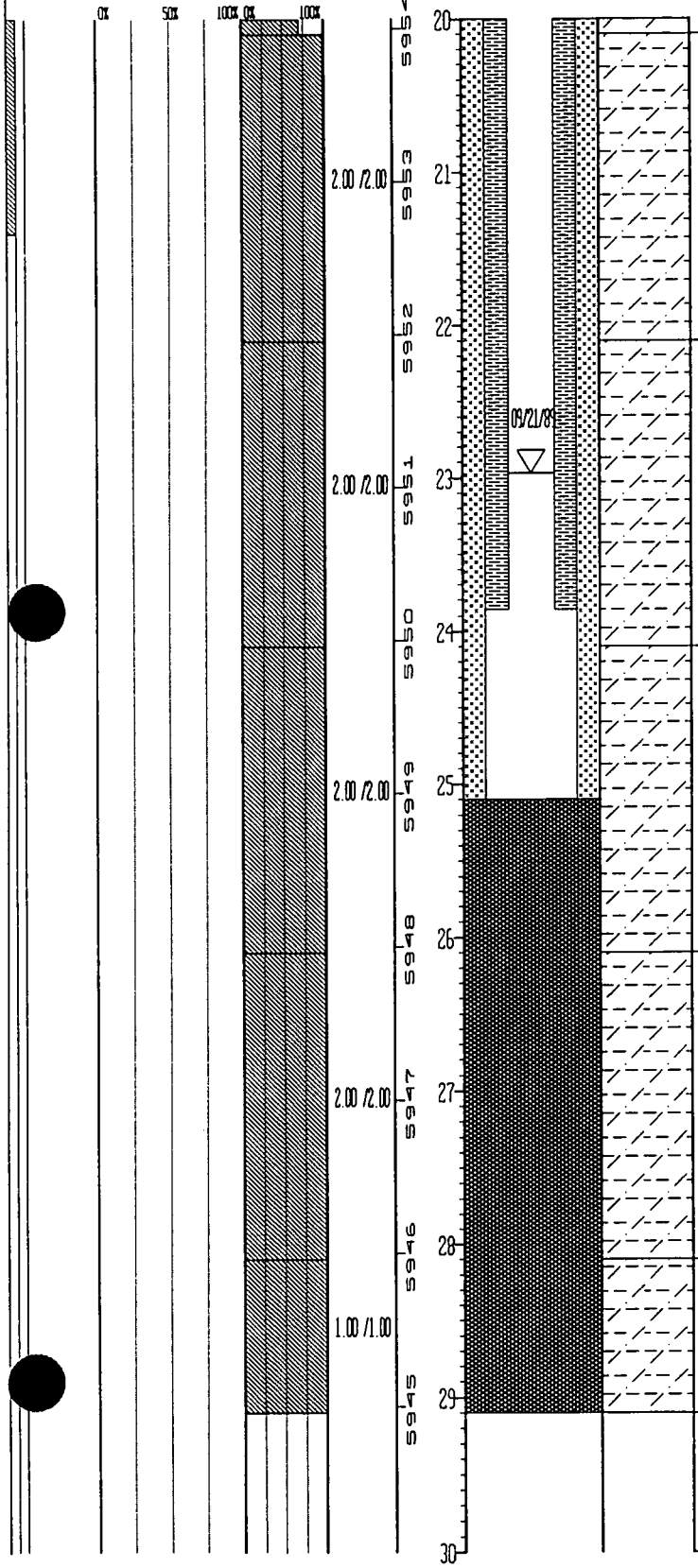
CHEMICAL SAMPLE DEPTH / GRADATIONAL SAMPLE DEPTH	SAMPLE NUMBER	SAMPLE GRAIN SIZE	PERCENT RECOVERY	RECOVERY/INTERVAL	DATUM (FT)	DEPTH (FT)	WELL OR PIEZOMETER CONSTRUCTION	LITHOLOGY	UNIFIED SOILS CLASSIFICATION OR ROCK TYPE	DESCRIPTION
		0% 50% 100%	0% 100%							
				2.00 /2.00	5963	11				SILTY CLAYSTONE: Same as above - abundt. caliche, high HCl reaction, highly weathered.
	SEP3898R0915			2.20 /2.00	5961	13				SILTY CLAYSTONE: Light olive gray (5 Y 6/1), mottled dark yellowish orange (10 YR 6/6). Highly weathered caliche, high HCl reaction. Consol., high plasticity, stiff, damp to moist.
				2.00 /2.00	5959	15				SILTY CLAYSTONE: Same as above - highly carbonaceous, black (N 1/0). More iron stains, dark yellowish orange (10 YR 6/6).
				2.00 /2.00	5957	17				SILTY CLAYSTONE: Olive gray (5 Y 3/2). Stains dusky yellow (5 Y 6/4). Small amount calcareous material, HCl reactive. Carbonaceous streaks, black (N 1/0), consol., high plasticity, stiff to hard, dry.
	SEP0389BR1521			1.40 /2.00	5955	19				SILTY CLAYSTONE: Same as above.

STATE PLANE COORDINATE:		TOTAL DEPTH (FT): 29.1	GROUND ELEVATION (FT):	5974.06	PROJECT NUMBER:	SEP03-89BR	LOG OF BORING NUMBER:
NORTH:	750395	AREA: SOLAR POND	CASING DIAMETER (IN):	4.5 O.D.	GEOLOGIST:	KEM	P207589
EAST:	2084843	LOCATOR NUMBER: L10	BOREHOLE DIAMETER (IN):	7.25	DATE DRILLED:	05/18/89	

REMARKS: Hollow Stem Auger. Weston Log.

DRAFT

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: Brownish black (5 YR 2/1). Highly carbonaceous, lignite pieces, black (N 1/0). Iron stains and fractures, dark yellowish orange (10 YR 6/6). Small amount of caliche, high HCl reaction, consol., stiff to hard, high plasticity, damp.

SILTY CLAYSTONE: Same as above - mod. yellowish brown (5 YR 5/4).

SILTY CLAYSTONE: Brownish black (5 YR 2/1), grading to med. dark gray (N 4/0). Iron stains - dark yellowish orange (10 YR 6/6). Hard to stiff, consol., high plasticity, some carbonaceous pieces, damp.

SILTY CLAYSTONE: Same as above - olive gray (5 Y 4/1).

SILTY CLAYSTONE: Same as above.

TD = 29.1'

WELL COMPLETION INFORMATION

2084843
750395 SEP 0389BR
Solar Pond
L10

QA By/Date Janell Suyman 15-19-89

Location Rocky Flats Plant: Solar Ponds Area

Well No. P207589

Coordinates N 37410.11 E 21738.72 (RFP)

Elevation: Ground Surface 5974.06'

Total Depth: Well 25.1'

Top of Casing 5975.96'

Borehole 29.1'

Formation of Completion Weathered Claystone

Casing Material Schedule 40 PVC

Casing Diameter 4 1/2" O.D.

Screen Material Schedule 40 10-slotted PVC

Surface Casing Diameter 8 5/8" O.D.

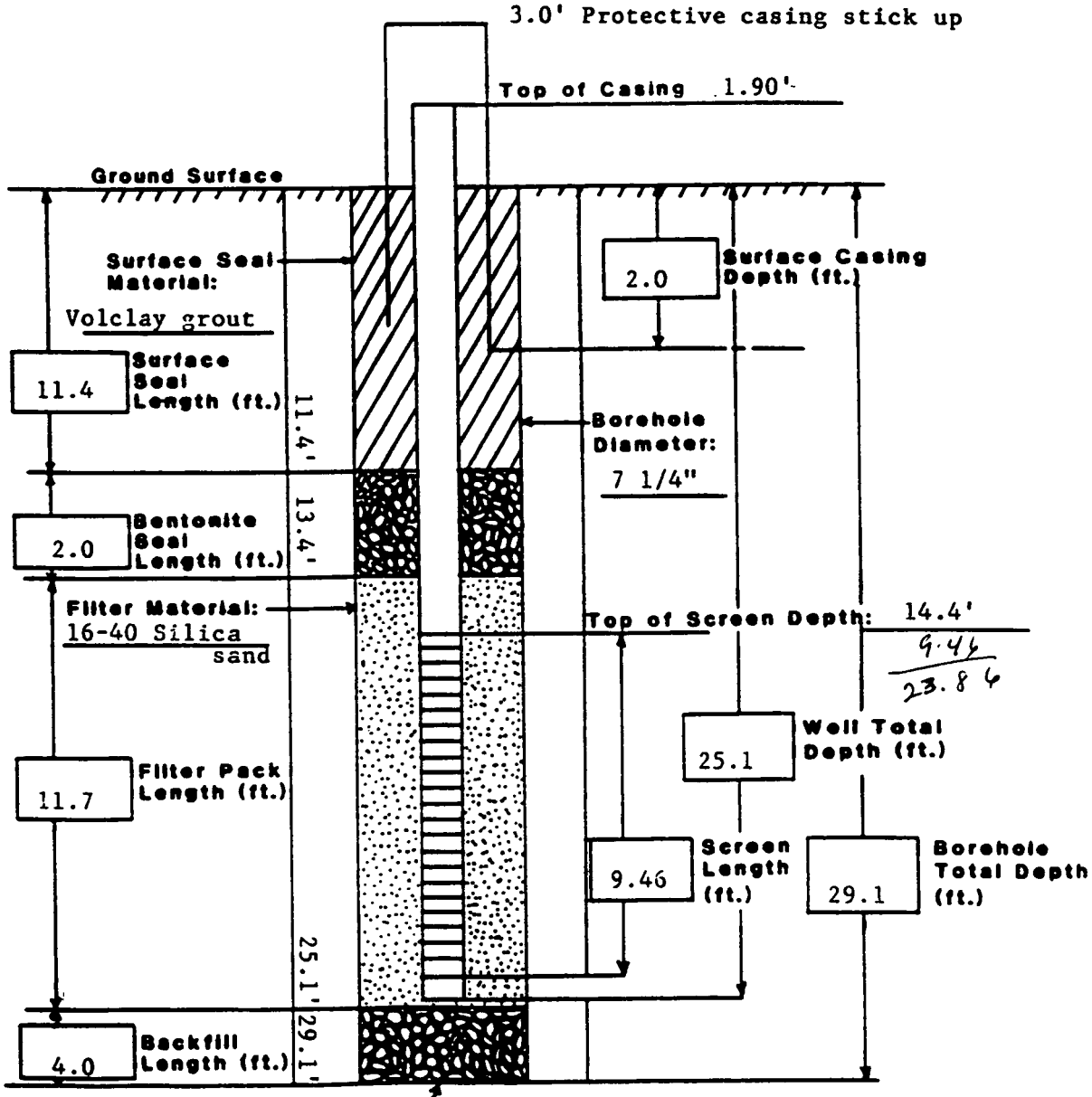
Date Installed 05/18/1989

Approved By Janell Suyman
Site Manager

Installed By K.E. Miller
Geologist

CEARP Manager

Comments Set stainless steel centralizer from 23.65' to 24.9' below ground surface.



LOG OF BOREHOLE

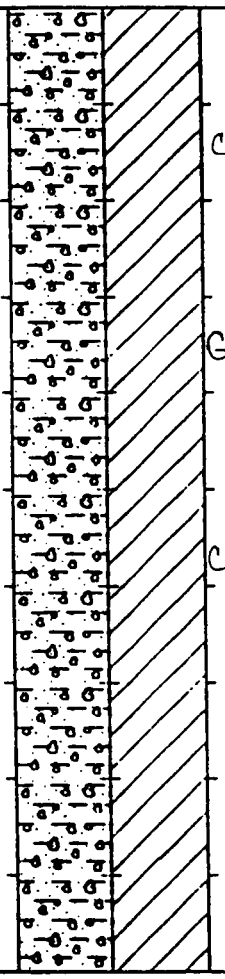
QA BY/DATE J.B. Burman / 11-28-89
LOCATION Rocky Flats Plant; Solar Ponds Area
COORDINATES N37,410.11 E21,738.72 (RFP)
TOTAL DEPTH 29.1'

DRILLING COMPANY Boyles Brothers
DATE DRILLED May 18, 1989
DRILLING METHOD Hollow Stem Auger
LOGGED BY K.E. Miller
GEOLOGIST

BOREHOLE/WELL NO. P207589
GROUND SURFACE ELEVATION 5974.06'
WATER LEVEL ENCOUNTERED 8.1'
STATIC 22.97' (09/21/89)
DRILLER R. Sharp HELPER R. Orr
DRILLING FLUID None
CHECKED BY J.B. Burman
SITE MANAGER

CEARP MANAGER

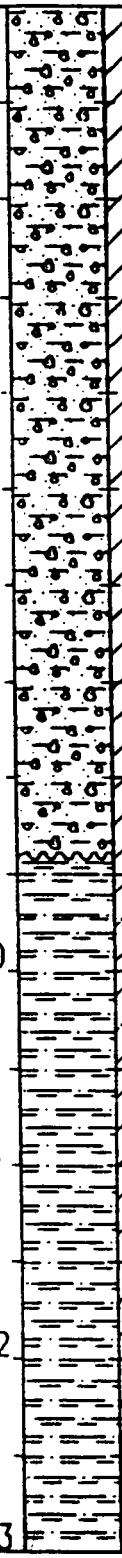
COMMENTS

DEPTH (FT)	GRAPHIC LOG	SAMPLE TYPE	LITHOLOGIC DESCRIPTION	SAMPLES COLLECTED OR OTHER TESTS PERFORMED
0 1 2 3 4 5			**ROCKY FLATS ALLUVIUM** 0.0-2.1' SAMPLE. Recovered 2.1/2.1' = 100%. CL SANDY GRAVELLY CLAY: grayish orange (10 YR 7/4) to dusky brown (5 YR 2/2); coarse to fine-grained sand; coarse to fine gravel; quartzite to 3 cm; broken; loose to firm; no to low plasticity; ~~(cl);~~ damp. 2.1-4.1' SAMPLE. Recovered 1.7/2.0' = 85%. GC SANDY CLAYEY GRAVEL: moderately yellowish brown (10 YR 5/4) to very pale orange (10 YR 8/2); coarse to fine-grained sand; coarse to fine gravel; quartzite; subrounded; some broken to 3 cm; loose; non-plastic; light HCl reaction; ~~(gc);~~ damp. (slightly calcareous) 4.1-6.1' SAMPLE. Recovered 1.3/2.0' = 65%. CL GRAVELLY SANDY CLAY: very pale orange (10 YR 8/2); coarse to fine-grained sand; quartz; some HCl reaction; coarse to fine gravel; quartzite to 3 cm; subrounded; loose to firm; no to low plasticity; ~~(cl);~~ damp. (mod. calcareous)	HNu Background: 0.0 OVA Background: 0.0 All readings on cuttings, in breathing zone, on core, and in augers; 0.0; unless otherwise noted below. TRIP BLANK SAMPLE ~~T8051889A~~ 0.0-3.0' SAMPLE SEP0389BR0003 ~~0.0~~-2.1' SAMPLE (VOAs only) ~~SEP0389BR0002~~ 0.0': Reading in Auger: ~~OVA: 9.0~~ 2.1': Reading in Auger: HNU: 0.2 3.0-9.4' SAMPLE SEP0389BR0309 4.1-5.4' SAMPLE ~~(VOAs only)~~ SEP0389BR0406 4.1': Reading in Auger: ~~OVA: 90.0~~

SEP0389A

WELL NO. P207589

LOG OF BOREHOLE

DEPTH (FT)	GRAPHIC LOG	SAMPLE TYPE	LITHOLOGIC DESCRIPTION	SAMPLES COLLECTED OR OTHER TESTS PERFORMED
5			**6.1-8.1' SAMPLE.** Recovered 1.4/2.0' = 70%. CL GRAVELLY SANDY CLAY: same as above; yellowish gray (5 Y 8/1); wet at shoe. **8.1-10.1' SAMPLE.** Recovered 1.6/2.0' = 80%. CL 8.1'-9.4': GRAVELLY SANDY CLAY: same as above; wet. **ARAPAHOE/LARAMIE FORMATION** 9.4-9.7': SILTY CLAYSTONE: light olive gray (5 Y 6/1); mottled dusky yellow (5 Y 6/4); stiff; consolidated; high plasticity; damp. **10.1-12.1' SAMPLE.** Recovered 2.0/2.0' = 100%. SILTY CLAYSTONE: same as above; abundant caliche; high HCl reaction; highly weathered. **12.1-14.1' SAMPLE.** Recovered 2.2/2.0' = 110%. SILTY CLAYSTONE: light olive gray (5 Y 6/1); mottled dark yellowish orange (10 YR 6/6); highly weathered caliche; high HCl reaction; consolidated; high plasticity; stiff; damp to moist.	**8.1-9.7' SAMPLE** ~~(VOAs only)~~ SEP03898R0810 **8.1'**: Reading in Auger: ~~OVA- 1.0~~ ▽ 8.1' **9.4-15.4' SAMPLE** SEP03898R0915 **12.1-14.1' SAMPLE** ~~(VOAs only)~~ SEP03898R1214
6				
7				
8				
9				
10				
11				
12				
13				

SEP03898

WELL NO. P207589 LOG OF BOREHOLE PAGE 3 OF 5

DEPTH (FT)	GRAPHIC LOG	SAMPLE TYPE	LITHOLOGIC DESCRIPTION	SAMPLES COLLECTED OR OTHER TESTS PERFORMED
13			14.1-16.1' SAMPLE. Recovered 2.0/2.0' = 100%. SILTY CLAYSTONE: same as above; highly carbonaceous; black (N 1/0); more iron-stains--dark yellowish orange (10 YR 6/6).	15.4-21.4' SAMPLE SEP03898R1521
14			16.1-18.1' SAMPLE. Recovered 2.0/2.0' = 100%. SILTY CLAYSTONE: olive gray (5 Y 3/2); stains--dusky yellow (5 Y 6/4); small amount calcareous material; HCl reactive; carbonaceous streaks--black (N 1/0); consolidated; high plasticity; stiff to hard; dry.	16.1-18.1' SAMPLE ~~(VOAs only)~~ SEP03898R1618
15			18.1-20.1' SAMPLE. Recovered 1.4/2.0' = 70%. SILTY CLAYSTONE: same as above.	18.1': Reading in Auger: ~~OVA: 4.~~0
16			20.1-22.1' SAMPLE. Recovered 2.0/2.0' = 100%. SILTY CLAYSTONE: brownish black (5 YR 2/1); highly carbonaceous; lignite pieces--black (N 1/0); iron-stains and fractures; dark yellowish orange (10 YR 6/6); small amount caliche; high HCl reaction; consolidated; stiff to hard; high plasticity; damp.	20.1-22.1' SAMPLE ~~(VOAs only)~~ SEP03898R2022
17				
18				
19				
20				
21				

SEP0388C

WELL NO. P207589

LOG OF BOREHOLE

DEPTH (FT)	GRAPHIC LOG	SAMPLE TYPE	LITHOLOGIC DESCRIPTION	SAMPLES COLLECTED OR OTHER TESTS PERFORMED
21			<u>22.1-24.1' SAMPLE.</u> Recovered 2.0/2.0' = 100%. SILTY CLAYSTONE: same as above; moderately yellowish brown (5 YR 5/4).	
22			<u>24.1-26.1' SAMPLE.</u> Recovered 2.0/2.0' = 100%. SILTY CLAYSTONE: brownish black (5 YR 2/1) grading to medium dark gray (N 4/0); iron-stains--dark yellowish orange (10 YR 6/6); hard to stiff; consolidated; high plasticity; some carbonaceous pieces; damp.	
23			<u>26.1-28.1' SAMPLE.</u> Recovered 2.0/2.0' = 100%. SILTY CLAYSTONE: same as above; olive gray (5 Y 4/1).	▼ 22.97'
24			<u>28.1-29.1' SAMPLE.</u> Recovered 1.0/1.0' = 100%. SILTY CLAYSTONE: same as above.	
25				
26				
27				
28				
29				

SEP0300

WELL NO. P207589

LOG OF BOREHOLE

DEPTH (FT)	GRAPHIC LOG	SAMPLE TYPE	LITHOLOGIC DESCRIPTION	SAMPLES COLLECTED OR OTHER TESTS PERFORMED
29			TOTAL DEPTH = 29.1'	
30				
31				
32				
33				
34				
35				
36				
37				

SEP0388E

STATE PLANE COORDINATE:	TOTAL DEPTH (FT): 31.5	GROUND ELEVATION (FT):	5972.16	PROJECT NUMBER:	SEP18-89BR	LOG OF BORING NUMBER:
NORTH: 750566	AREA: SOLAR POND	CASING DIAMETER (IN):	4.5 O.D.	GEOLOGIST:	KEM	P209089
EAST: 2084910	LOCATOR NUMBER: L10	BOREHOLE DIAMETER (IN):	8-5/8	DATE DRILLED:	05/17/89	

REMARKS: Hollow Stem Auger. Weston Log.

DRAFT

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%	1.50 /1.50	5972	0			CL:	Gravelly Clay - mod. yellowish brown (10 YR 5/4). Coarse to fine gravel, quartzite, sub-rounded to broken, to 3 cm. Trace c.g. to f.g. sand, firm to loose, lower portion more sandy, low plasticity, damp.
	SEP189BR0003				5971	1				
				1.70 /2.00	5970	2			SC:	Clayey Sandy Gravel - very pale orange (10 YR 8/2). Large quartzite cobbles, broken, to 3 cm. Trace c.g. to f.g. sand, loose to firm, no to low plasticity, damp to dry.
					5969	3			NO SAMPLE:	NO SAMPLE
				1.70 /2.00	5968	4			CL:	Gravelly Clay - mod. yellowish brown (10 YR 5/4). Trace c.g. to f.g. sand. Quartzite gravel to 3 cm., broken. Caliche, (HCl reactive). Iron stains, dark yellowish orange (10 YR 6/6), firm, low plasticity, damp.
					5967	5				
	SEP189BR0005			1.00 /2.00	5966	6			GC:	Sandy Clayey Gravel - very pale orange (10 YR 8/2). Poorly sorted, c.g. to f.g. sand. Coarse to fine quartzite gravel, broken, to 4 cm. Small amount caliche (HCl reactive). Loose to firm, no to low plasticity, damp.
					5965	7				
				1.10 /2.00	5964	8				
					5963	9				
						10				

STATE PLANE COORDINATE:		TOTAL DEPTH (FT): 31.5	GROUND ELEVATION (FT):	5972.16	PROJECT NUMBER:	SEP18-8988	LOG OF BORING NUMBER:
NORTH:	750566	AREA: SOLAR POND	CASING DIAMETER (IN):	4.5 O.D.	GEOLOGIST:	KEM	P209089
EAST:	2084910	LOCATOR NUMBER: L10	BOREHOLE DIAMETER (IN):	8-5/8	DATE DRILLED:	05/17/89	

REMARKS: Hollow Stem Auger. Weston Log.

DRAFT

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%	1.20 /2.00	5962 5961	10 11				
				2.00 /2.00	5960 5959	12 13			SILTY CLAYSTONE	Top of Bedrock. Yellowish gray (5 Y 7/2), mottled dark yellowish orange (10 YR 6/6). Caliche nodules (HCl reactive). Consol., stiff, high plasticity. Some carbonaceous streaks, black (N 1/0). Damp.
	SEP18898R1218			2.00 /2.00	5958 5957	14 15			SILTY CLAYSTONE	Same as above.
				2.00 /2.00	5956 5955	16 17			SILTY CLAYSTONE	Light olive gray (5 Y 5/2). Some iron stains, dark yellowish orange (10 YR 6/6). Caliche nodules, (HCl reactive), stiff to hard, med. plasticity, consol., dry.
				2.00 /2.00	5954 5953	18 19			SILTY CLAYSTONE	Same as above - grading to brownish gray (5 YR 4/1). More carbonaceous pieces, black (N 1/0), dry.
						20			SILTY CLAYSTONE	Med. gray (N 5/0) to dusky yellow (5 Y 6/4). Abundt. iron stains, dark yellowish orange (10 YR 6/6). Consol., med. to high plasticity, firm to stiff. Small amount lignite pieces, black (N 1/0). Dry.

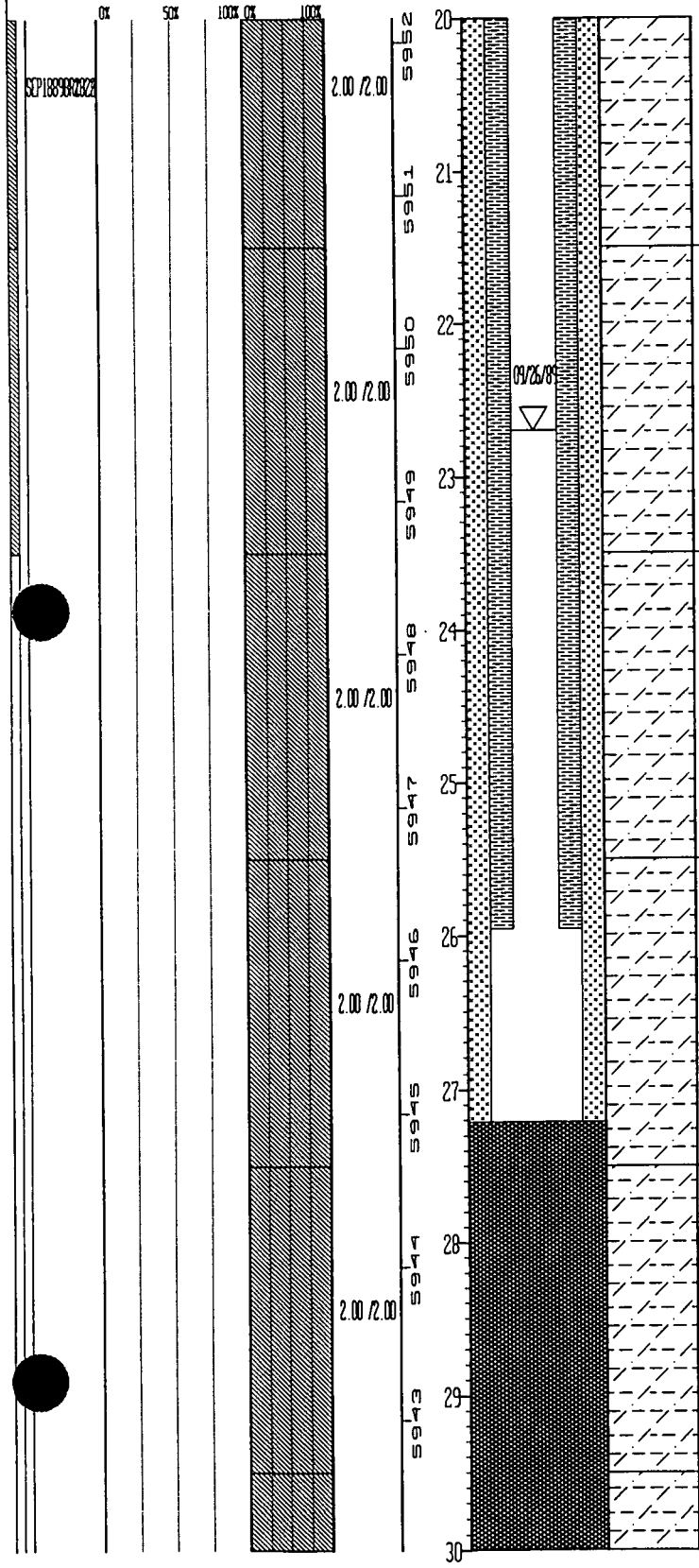
STATE PLANE COORDINATE:	TOTAL DEPTH (FT): 31.5	GROUND ELEVATION (FT):	5972.16	PROJECT NUMBER:	SEP18-89BR
NORTH: 750566	AREA: SOLAR POND	CASING DIAMETER (IN):	4.5 O.D.	GEOLOGIST:	KEM
EAST: 2084910	LOCATOR NUMBER: L10	BOREHOLE DIAMETER (IN):	8-5/8	DATE DRILLED:	05/17/89

LOG OF BORING NUMBER: P209089

REMARKS: Hollow Stem Auger. Weston Log.

DRAFT

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.

SILTY CLAYSTONE: Dusky yellow (5 Y 6/4) to med. gray (N 5/0). Mod. consol., stiff to hard. Interbedded lense (2 cm.) of v.f.g. to f.g. sand. Med. plasticity, dry.

SILTY CLAYSTONE: Same as above - trace v.f.g. to f.g. sand, interbedded, small amount carbonaceous material, streaked black (N 1/0).

SILTY CLAYSTONE: Med. gray (N 5/0) to grayish orange (10 YR 7/4). Some sand, v.f.g. to f.g., interbedded. No to low plasticity, very stiff, consol., dry.

SILTY CLAYSTONE: Same as above.

STATE PLANE COORDINATE:		TOTAL DEPTH (FT): 31.5	GROUND ELEVATION (FT):	5972.16	PROJECT NUMBER:	SEP18-89BR	LOG OF BORING NUMBER:
NORTH:	750566	AREA: SOLAR POND	CASING DIAMETER (IN):	4.5 O.D.	GEOLOGIST:	KEM	P209089
EAST:	2084910	LOCATOR NUMBER: L10	BOREHOLE DIAMETER (IN):	8-5/8	DATE DRILLED:	05/17/89	

REMARKS: Hollow Stem Auger. Weston Log.

DRAFT

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
				2.00 /2.00	5942	30				
					5941	31				
										TD = 31.5'
					5940	32				
					5939	33				
					5938	34				
					5937	35				
					5936	36				
					5935	37				
					5934	38				
					5933	39				
						40				

SEP 1889BR

WELL COMPLETION INFORMATION

QA By/Date Farrell Bynum 15-19-89

Location Rocky Flats Plant; Solar Ponds Area **Well No.** P209089

Coordinates N 37580.29 E 21806.82 (RFP) **Elevation: Ground Surface** 5972.16'

Total Depth: Well 27.21' **Top of Casing** 5974.25'

Borehole 31.5'

Formation of Completion Weathered Claystone

Casing Material Schedule 40 PVC **Casing Diameter** 4 1/2" O.D.

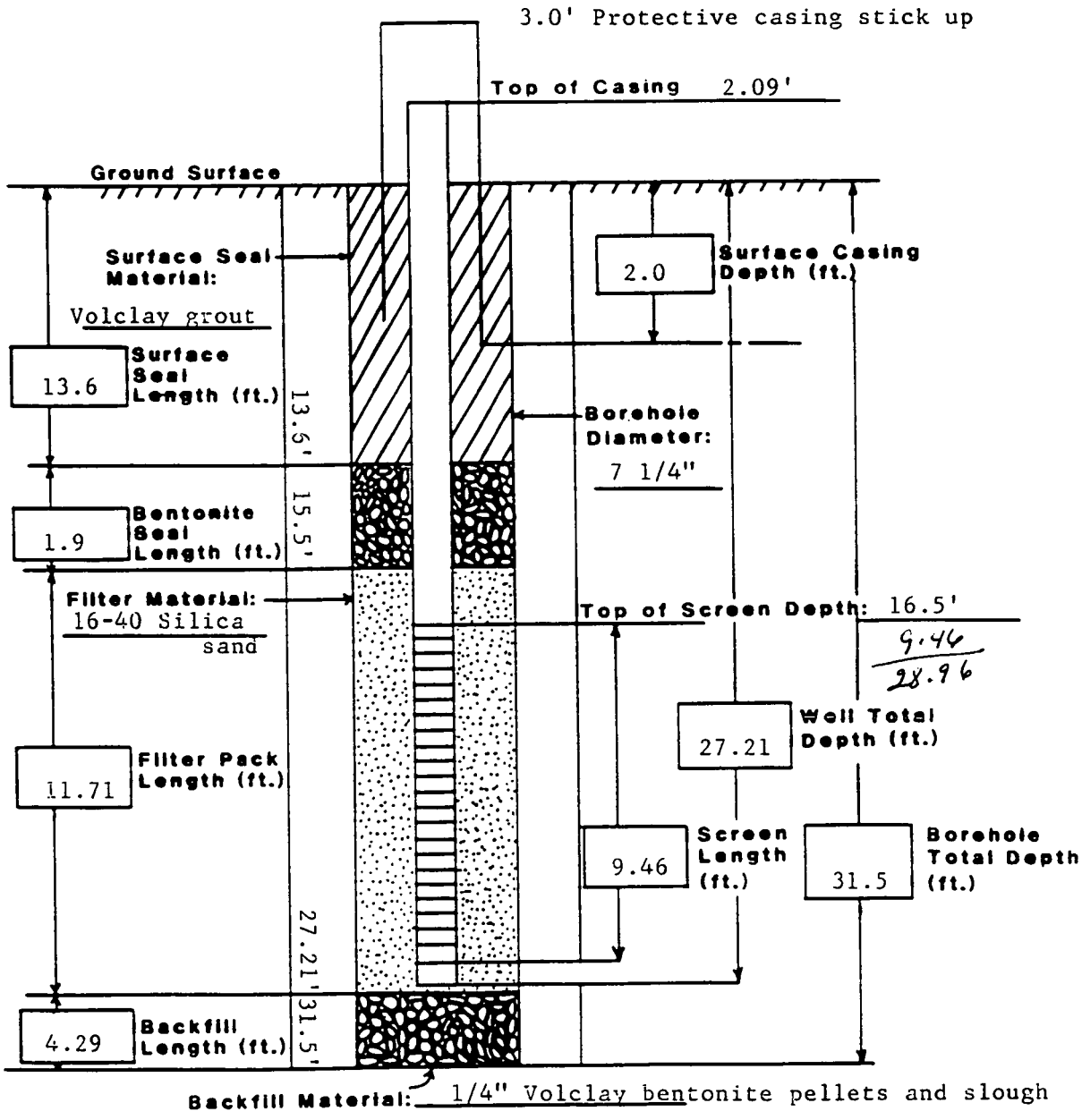
Screen Material Schedule 40 10-slotted PVC **Surface Casing Diameter** 8 5/8" O.D.

Date Installed 05/17/1989 **Approved By** Farrell Bynum
Site Manager

Installed By K.E. Miller
Geologist

CEARP Manager

Comments Set stainless steel centralizer from 25.75' to 27.0' below ground surface.



LOG OF BOREHOLE

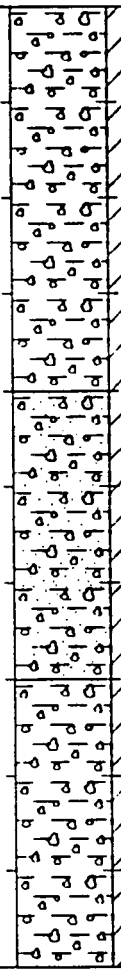
QA BY/DATE J.B. Burman 11-28-89
LOCATION Rocky Flats Plant; Solar Ponds Area
COORDINATES N37,580.29 E21,806.82 (RFP)
TOTAL DEPTH 31.5'

DRILLING COMPANY Boyles Brothers
DATE DRILLED May 17, 1989
DRILLING METHOD Hollow Stem Auger
LOGGED BY K.E. Miller
GEOLOGIST

BOREHOLE/WELL NO. P209089
GROUND SURFACE ELEVATION 5972.16'
WATER LEVEL ENCOUNTERED None
STATIC 22.70' (09/26/89)
DRILLER R. Sharp HELPER R. Orr
DRILLING FLUID None
CHECKED BY J.B. Burman
SITE MANAGER

CEARP MANAGER

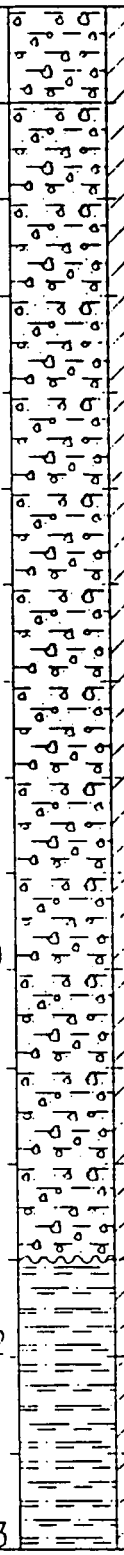
COMMENTS

DEPTH (FT)	GRAPHIC LOG	SAMPLE TYPE	LITHOLOGIC DESCRIPTION	SAMPLES COLLECTED OR OTHER TESTS PERFORMED
0 1 2 3 4 5			**ROCKY FLATS ALLUVIUM** 0.0-1.5' SAMPLE. Recovered 1.5/1.5' = 100%. CL GRAVELLY CLAY: moderate yellowish brown (10 YR 5/4); coarse to fine gravel; quartzite; subrounded to broken, to 3 cm; trace coarse to fine-grained sand; firm to loose; lower portion more sandy; low plasticity; ~~(cL)~~; damp. 1.5-3.5' SAMPLE. Recovered 1.7/2.0' = 85%. CL 1.5-2.0': GRAVELLY CLAY: same as above. SC 2.0-3.2': CLAYEY SANDY GRAVEL: very pale orange (10 YR 8/2); large quartzite cobbles; broken, to 3 cm; trace coarse to fine-grained sand; loose to firm; no to low plasticity; ~~(gc)~~; damp to dry. 3.5-5.5' SAMPLE. Recovered 1.7/2.0' = 85%. CL GRAVELLY CLAY: moderate yellowish brown (10 YR 5/4); trace coarse to fine-grained sand; quartzite gravel to 3 cm; broken; caliche; HCl reactive; iron-stains--dark yellowish orange (10 YR 6/6); firm; low plasticity; ~~(cL)~~; damp. (calcareous)	HNu Background: 0.0 OVA Background: 0.0 All readings on cuttings, in breathing zone, on core, and in augers: 0.0; unless otherwise noted below. TRIP BLANK SAMPLE TB051789A 0.0-3.2' SAMPLE SEP1889BR0003 0.0-1.5' SAMPLE (VOAs only) SEP1889BR0002 SEP1889BR0002D 0.0':Reading in Auger: OVA: 3.0 3.5-8.6' SAMPLE SEP1889BR0309 3.5-5.2' SAMPLE (VOAs only) SEP1889BR0406 3.5': Reading in Auger: OVA: 3.0

SEP1889A

WELL NO. P209089

LOG OF BOREHOLE

DEPTH (FT)	GRAPHIC LOG	SAMPLE TYPE	LITHOLOGIC DESCRIPTION	SAMPLES COLLECTED OR OTHER TESTS PERFORMED
5			5.5-7.5' SAMPLE. Recovered 1.0/2.0' = 50%. SANDY CLAYEY GRAVEL: very pale orange (10 YR 8/2); poorly sorted; coarse to fine-grained sand; coarse to fine quartzite gravel; broken, to 4 cm; small amount caliche; (HCl reactive); loose to firm; no to low plasticity; (gc); damp.	
6			7.5-9.5' SAMPLE. Recovered 1.1/2.0' = 55%. SANDY CLAYEY GRAVEL: same as above.	7.5-8.6' SAMPLE (VOAs only) SEP1889BR0810
7			9.5-11.5' SAMPLE. Recovered 1.2/2.0' = 60%. SANDY CLAYEY GRAVEL: same as above. ARAPAHOE/LARAMIE FORMATION	
8			11.5-13.5' SAMPLE. Recovered 2.0/2.0' = 100%. SILTY CLAYSTONE: yellowish gray (5 Y 7/2); mottled dark yellowish orange (10 YR 6/6); caliche nodules; (HCl reactive); consolidated; stiff; high plasticity; some carbonaceous streaks; black (N 1/0); damp.	FIELD BLANK SAMPLE SEP1889BR0018FB 11.5-17.5' SAMPLE SEP1889BR1218 SEP1889BR1218D 11.5-13.5' SAMPLE (VOAS only) SEP1889BR1214
9				
10				
11				
12				
13				

SEP1889B

WELL NO. P209089

LOG OF BOREHOLE

DEPTH (FT)	GRAPHIC LOG	SAMPLE TYPE	LITHOLOGIC DESCRIPTION	SAMPLES COLLECTED OR OTHER TESTS PERFORMED
13			13.5-15.5' SAMPLE. Recovered 2.0/2.0' = 100%. SILTY CLAYSTONE: same as above.	
14			15.5-17.5' SAMPLE. Recovered 2.0/2.0' = 100%. SILTY CLAYSTONE: light olive gray (5 Y 5/2); some iron-stains--dark yellowish orange (10 YR 6/6); caliche nodules; HCl reactive; stiff to hard; medium plasticity; consolidated; dry.	15.5-17.5' SAMPLE (VOAs only) SEP18898R1618
15			17.5-19.5' SAMPLE. Recovered 2.0/2.0' = 100%. SILTY CLAYSTONE: same as above; grading to brownish gray (5 YR 4/1); more carbonaceous pieces; black (N 1/0); dry.	17.5-23.5' SAMPLE SEP18898R1824
16			19.5-21.5' SAMPLE. Recovered 2.0/2.0' = 100%. SILTY CLAYSTONE: medium gray (N 5/0) to dusky yellow (5 Y 6/4); abundant iron-stains--dark yellowish orange (10 YR 6/6); consolidated; medium to high plasticity; firm to stiff; small amount lignite pieces; black (N 1/0); dry.	19.5-21.5' SAMPLE SEP18898R2022 19.5': Reading in Auger: OVA: 1.0
17				
18				
19				
20				
21				

SEP1889C

WELL NO. P209089

LOG OF BOREHOLE

DEPTH (FT)	GRAPHIC LOG	SAMPLE TYPE	LITHOLOGIC DESCRIPTION	SAMPLES COLLECTED OR OTHER TESTS PERFORMED
21 22 23 24 25 26 27 28 29			21.5-23.5' SAMPLE. Recovered 2.0/2.0' = 100%. SILTY CLAYSTONE: same as above. 23.5-25.5' SAMPLE. Recovered 2.0/2.0' = 100%. SILTY CLAYSTONE: dusky yellow (5 Y 6/4) to medium gray (N 5/0); moderately consolidated; stiff to hard; interbedded lense (2 cm) of very fine to fine-grained sand; medium plasticity; dry. 25.5-27.5' SAMPLE. Recovered 2.0/2.0' = 100%. SILTY CLAYSTONE: same as above; trace very fine to fine-grained sand; interbedded; small amount carbonaceous material; streaked black (N 1/0). 27.5-29.5' SAMPLE. Recovered 2.0/2.0' = 100%. SILTY CLAYSTONE: medium gray (N 5/0) to grayish orange (10 YR 7/4); some sand; very fine to fine-grained; interbedded; no to low plasticity; very stiff; consolidated; dry.	21.5': Reading in Auger: OVA: 4.0 23.5-25.5' SAMPLE (VOAS only) SEP1889BR2426 22.70'

SEP18890

WELL NO. P209089

LOG OF BOREHOLE

DEPTH (FT)	GRAPHIC LOG	SAMPLE TYPE	LITHOLOGIC DESCRIPTION	SAMPLES COLLECTED OR OTHER TESTS PERFORMED
29			29.5-31.5' SAMPLE. Recovered 2.0/2.0' = 100%. SILTY CLAYSTONE: Same as above.	
30			TOTAL DEPTH = 31.5'	
31				
32				
33				
34				
35				
36				
37				

SEP1889E

STATE PLANE COORDINATE:	TOTAL DEPTH (FT): 38.3	GROUND ELEVATION (FT):	5980.66	PROJECT NUMBER:	SEP19-89BR
NORTH: 750762	AREA: SOLAR POND	CASING DIAMETER (IN):	4.5 O.D.	GEOLOGIST:	RAC
EAST: 2084309	LOCATOR NUMBER: L10	BOREHOLE DIAMETER (IN):	7.25	DATE DRILLED:	05/25/89

REMARKS: Hollow Stem Auger. Weston Log.

LOG OF BORING NUMBER: P209189

DRAFT

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
	SEP19B9BR0003			1.30 /2.30	5980, 5979	0–2.3			SP:	Clayey Sand and Gravel - pale yellowish brown (10 YR 6/2) to dark yellowish brown (10 YR 4/2), mottled. Sand f.g. to c.g., poorly sorted, angular to sub-rounded, quartzose, loose. Gravel up to 4 cm., rounded to sub-angular, poorly sorted, quartzite. Low to med. plastic fines, unconsol., firm (gc-sp), slightly moist. 35% gravel, 40% sand, 25% fines.
				1.00 /2.00	5978, 5977	2.3–4.3			GC:	Clayey Sand and Gravel - same as above. Grayish brown (5 Y 3/2). Gravel poorly sorted, sub-angular to rounded, quartzite. F.g. to c.g. sand, poorly sorted, sub-angular to sub-rounded. Med. plastic fines, firm, moldable (gc-sp), very slightly damp. 50% gravel, 30% sand, 20% fines.
	SEP19B9BR0406			2.00 /2.00	5976, 5975	4.3–6.3			SP:	Clayey Sand and Gravel - pale yellowish brown (10 YR 6/2) to mod. yellowish brown (5 YR 4/4). F.g. to c.g. sand, poorly sorted, angular to sub-rounded, quartzose. Gravel poorly sorted, sub-angular to rounded, med. plastic, firm, calcareous, firm to stiff, moldable (sp-gp), slightly damp. 35% gravel, 60% sand, 10% fines.
	SEP19B9BR0309			1.30 /2.00	5974, 5973	6.3–8.3			SP:	Sand and Gravel - same as above. Grayish orange pink (5 Y 7/2). Less clay (5%), slightly calcareous, weakly consol., (sp-gc), dry.
	89BR0810			1.20 /2.00	5972, 5971	8.3–10	09/27/89 ▽		SP:	Sand and Gravel - grayish orange pink (5 Y 7/2). Sand f.g. to c.g., poorly sorted. Gravel rounded, quartzite (5%). Non to low plastic fines, unconsol., (sp-gp), slightly moist. 35% gravel, 60% sand, 5% fines.

STATE PLANE COORDINATE:	TOTAL DEPTH (FT): 38.3	GROUND ELEVATION (FT):	5980.66	PROJECT NUMBER:	SEP19-89BR	LOG OF BORING NUMBER:
NORTH: 750762	AREA: SOLAR POND	CASING DIAMETER (IN):	4.5 O.D.	GEOLOGIST:	RAC	P209189
EAST: 2084309	LOCATOR NUMBER: L10	BOREHOLE DIAMETER (IN):	7.25	DATE DRILLED:	05/25/89	

REMARKS: Hollow Stem Auger. Weston Log.

DRAFT

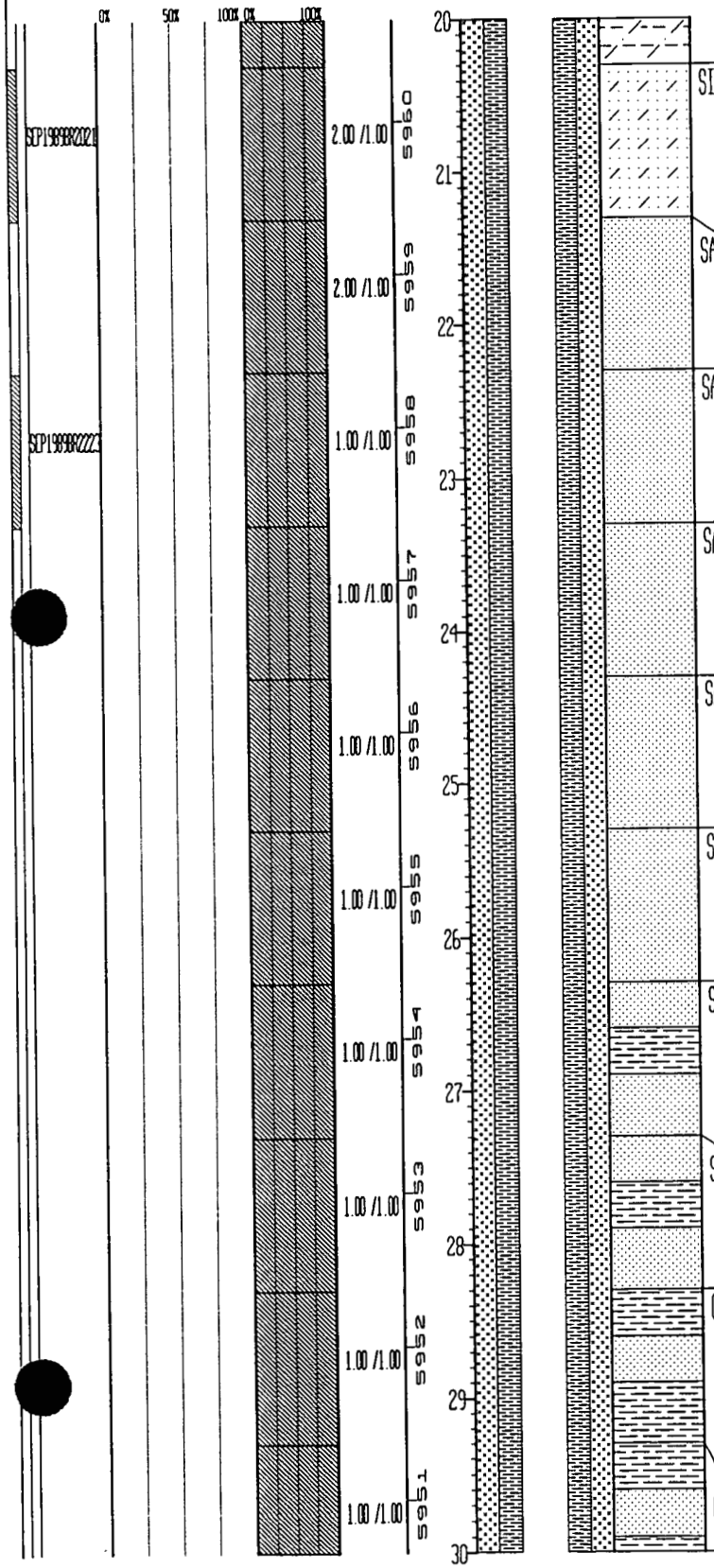
CHEMICAL SAMPLE DEPTH / GRADATIONAL SAMPLE DEPTH	SAMPLE NUMBER	SAMPLE GRAIN SIZE	PERCENT RECOVERY	RECOVERY/INTERVAL	DATUM (FT)	DEPTH (FT)	WELL OR PIEZOMETER CONSTRUCTION	LITHOLOGY	UNIFIED SOILS CLASSIFICATION OR ROCK TYPE	DESCRIPTION
		0% 50% 100%	0% 100%	2.00 /2.00	5970	10			SANDSTONE:	Top of Bedrock. Light olive gray (5 Y 5/2). F.g. sand, well sorted, sub-angular to sub-rounded, quartzose. Non to low plastic fines, weakly consol., soft, very moist. 85% sand, 15% fines.
					5969	11				
						12			SANDSTONE:	Same as above - calcareous in part, staining in layers (5 cm. thick). Light olive gray (3 Y 6/1). Sand is speckled, firm to stiff, very moist.
	SEP19BBR1816			2.00 /2.00	5968	13				
					5967	14	05/25/89		SANDSTONE:	Same as above - more sand, upper f.g. to m.g., well sorted, sub-rounded, coarsening downward, soft, iron staining in layers. Scattered lignite, black (N 1/0), wet.
				2.00 /2.00	5966	15				
					5965	16			SANDSTONE:	Same as above.
	SEP19BBR1616			2.00 /2.00	5964	17			SILTY CLAYSTONE:	Light gray (N 7/0). Non to med. plastic fines. V.f.g. sand. Occasional lignite streaks, black (N 1/0), soft to firm, wet. 20% sand, 80% fines.
					5963	18			SANDSTONE:	Sandstone and Silty Claystone - dark yellowish orange (10 YR 6/6), interbedded Sandstone. F.g. sand, well sorted, sub-angular to angular. Non to low plastic fines, non to med. plastic fines. V.f.g. sand, weakly consol., firm to stiff, moldable, wet. 5% sand, 95% fines.
				2.00 /2.00	5962	19				
					5961	20			SILTY CLAYSTONE:	Same as above - (reference interval 17.2' to 18.3').

STATE PLANE COORDINATE:		TOTAL DEPTH (FT): 38.3	GROUND ELEVATION (FT):	5980.66	PROJECT NUMBER:	SEP19-898R	LOG OF BORING NUMBER:
NORTH:	750762	AREA: SOLAR POND	CASING DIAMETER (IN):	4.5 O.D.	GEOLOGIST:	RAC	P209189
EAST:	2084309	LOCATOR NUMBER: L10	BOREHOLE DIAMETER (IN):	7.25	DATE DRILLED:	05/25/89	

REMARKS: Hollow Stem Auger. Weston Log.

DRAFT

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



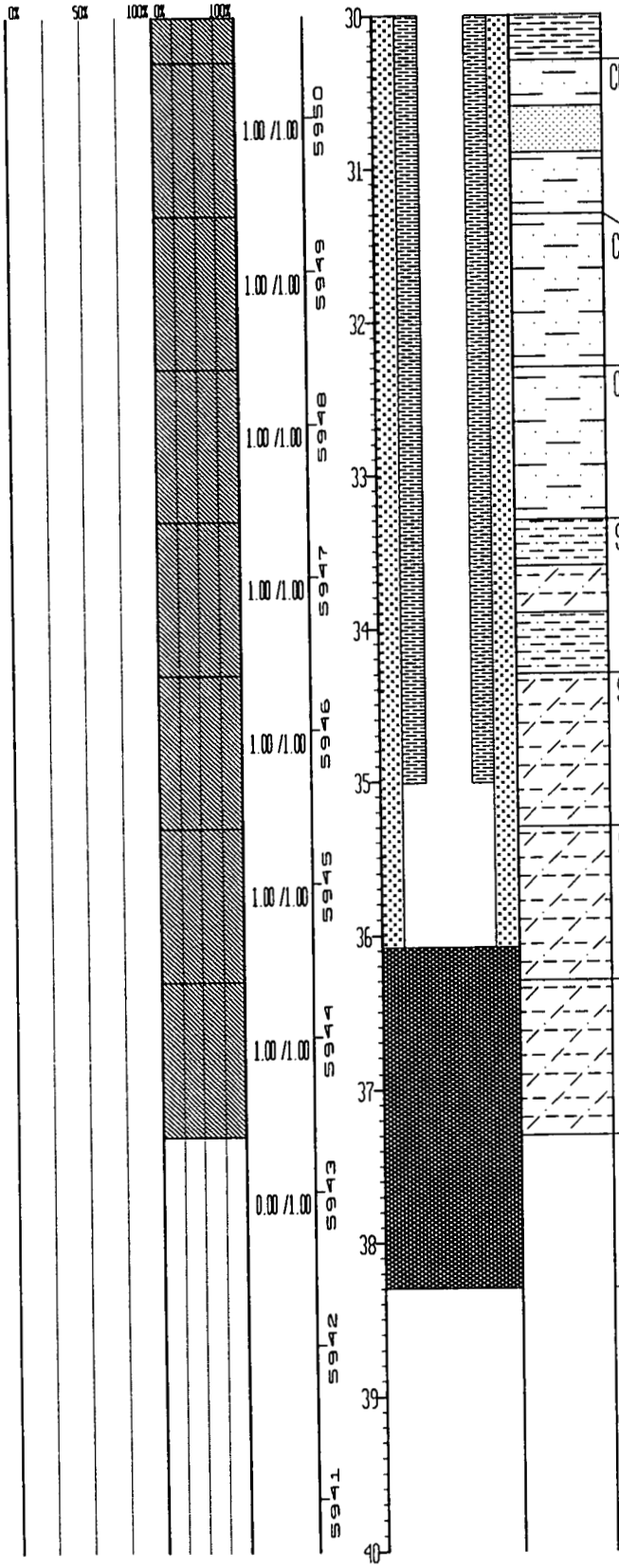
SILTY SANDSTONE:	Med. gray (N 5/0) in upper 1.0' to dark yellowish orange (10 YR 6/6) in lower foot, speckled. V.f.g. sand, well sorted, sub-angular to angular. Non to low plastic fines, poorly consol., soft to stiff, wet. 80% sand, 20% fines.
SANDSTONE:	Same as above - lenses of med. gray (N 5/0) and yellowish orange (10 YR 6/6), iron stains. More clay in yellowish orange zones, wet. 15-20% clay.
SANDSTONE:	Same as above - drier in sandier portions. More clay toward bottom, soft to firm, wet to moist.
SANDSTONE:	Same as above.
SANDSTONE:	Same as above - thin, iron-stained layers, a little drier, still very moist to wet.
SANDSTONE:	Same as above (reference interval 21.3' to 22.3'). Lower 0.5' color between light brown (5 YR 5/6) and dark yellowish orange (10 YR 6/6), wet.
SANDSTONE:	Same as above - interbedded clay lenses. F.g. Sandstone, well sorted, sub-angular. Non-plastic fines, weakly consol. Claystone - low to med. plastic fines. V.f.g. sand, wet. 80% sand, 20% fines.
SANDSTONE:	Same as above - med. gray (N 5/0) to dark yellowish orange (10 YR 6/6), interbedded. V.f.g. sand. More Claystone towards the bottom. Claystone shows increasing clay content.
CLAYSTONE:	Med. dark gray (N 4/0) to dark yellowish orange (10 YR 6/6), interbedded. More Claystone. Claystone, low to med. plastic fines. V.f.g. sand. Sandstone is same as interval 26.3' to 27.3', well sorted, sub-angular, lenses, firm, wet. 15% sand, 85% clay.
CLAYSTONE:	Same as above - interbedded Ironstone concretions. Lower

STATE PLANE COORDINATE:		TOTAL DEPTH (FT): 38.3	GROUND ELEVATION (FT):	5980.66	PROJECT NUMBER:	SEP19-89BR	LOG OF BORING NUMBER:
NORTH:	750762	AREA: SOLAR POND	CASING DIAMETER (IN):	4.5 O.D.	GEOLOGIST:	RAC	P209189
EAST:	2084309	LOCATOR NUMBER: L10	BOREHOLE DIAMETER (IN):	7.25	DATE DRILLED:	05/25/89	

REMARKS: Hollow Stem Auger. Weston Log.

DRAFT

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
	0.5' Sandstone, dark yellowish orange (10 YR 6/6), f.g., soft, wet.
CLAYEY SANDSTONE:	Clayey Sandstone and Sandstone - dark yellowish orange (10 YR 6/6). F.g. sand, well sorted, sub-angular. Non to low plastic fines, iron staining. Increasing sand with depth, firm, wet. 70% sand, 30% fines.
CLAYEY SANDSTONE:	Mod. brown (5 YR 4/4), interbedded. F.g. sand, well sorted, sub-angular. Non to med. plastic fines. Claystone lenses, weakly consol., firm to stiff, moist. 75% sand, 25% fines.
CLAYEY SANDSTONE:	Same as above - pale yellowish orange (10 YR 8/6). Claystone - mod. brown (5 YR 4/4). Interbedded sand lenses are siltier. Clay lenses have less sand.
SANDY CLAYSTONE:	Sandy Silty Claystone - interbedded. Low to med. plastic plastic fines. F.g. sand, well sorted, sub-angular, stiff, moist. 20% sand, 80% clay.
SILTY CLAYSTONE:	Med. dark gray (N 4/0). Low to med. plastic fines, stiff to very stiff, dry.
SILTY CLAYSTONE:	Same as above - less silt.
SILTY CLAYSTONE:	Same as above (reference interval 34.3' to 35.3'). Non to med. plastic fines, stiff.
NO SAMPLE:	NO SAMPLE
	TD = 38.3'

WELL COMPLETION INFORMATION

QA By/Date Farrell Bryson 10-5-89

Location Rocky Flats Plant; Solar Ponds Area

Well No. P209189

Coordinates N 37778.78 E 21206.43 (RFP)

Elevation: Ground Surface 5980.66'

Top of Casing 5982.21'

Total Depth: Well 36.08'

Borehole 38.3'

Formation of Completion Weathered Sandstone

Casing Material Schedule 40 PVC

Casing Diameter 4 1/2" O.D.

Screen Material Schedule 40 10-slotted PVC

Surface Casing Diameter 8 5/8" O.D.

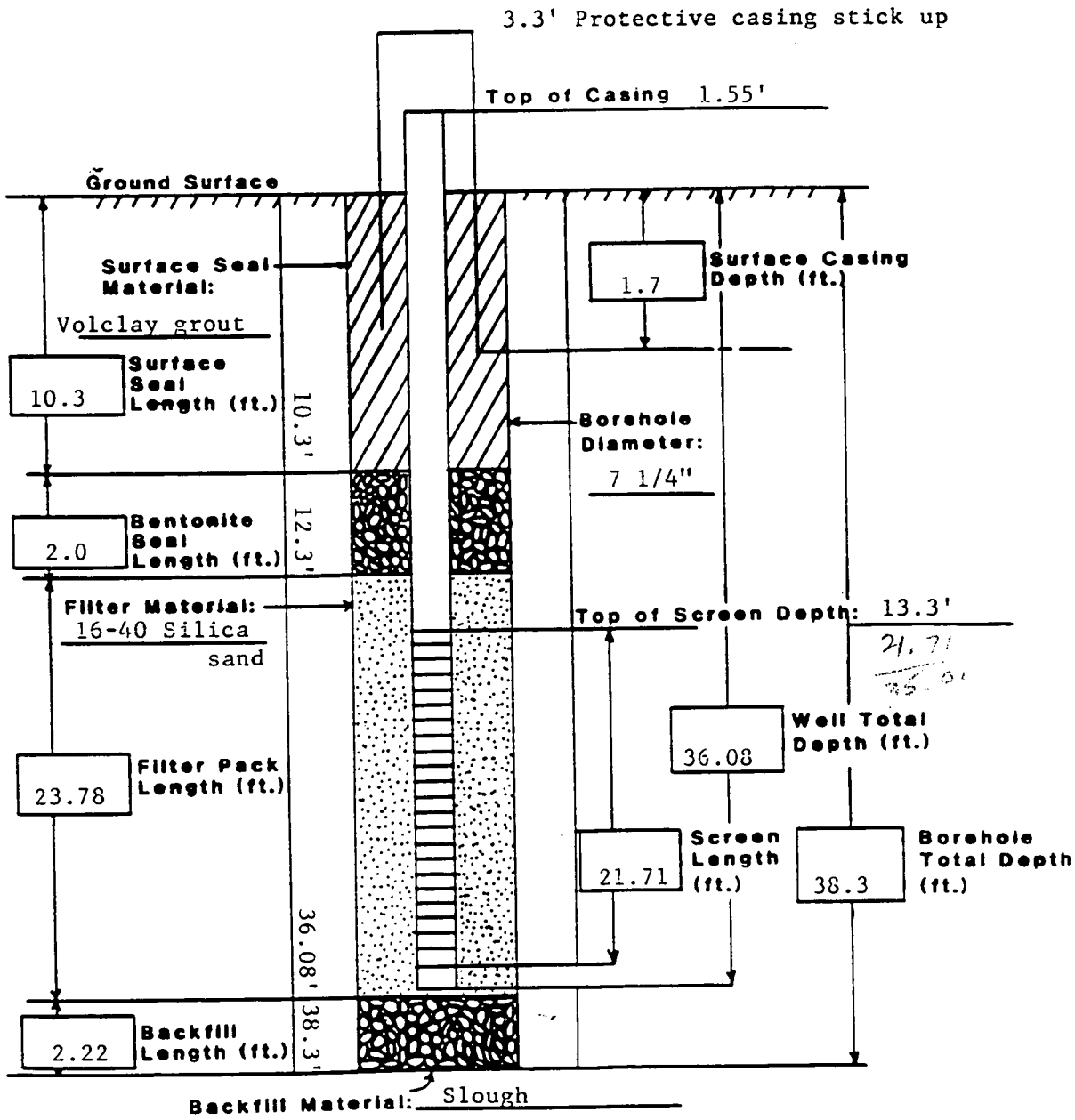
Date Installed 05/25/1989

Approved By Farrell Bryson
Site Manager

Installed By R.A. Chapuis
Geologist

CEARP Manager

Comments Set stainless steel centralizer from 35.78' to 34.58' below ground surface.



LOG OF BOREHOLE

QA BY/DATE J.B. Burman / 11-28-89
LOCATION Rocky Flats Plant: Solar Ponds Area
COORDINATES N37,778.78 E21,206.43 (RFP)
TOTAL DEPTH 38.3'

DRILLING COMPANY Boyles Brothers
DATE DRILLED May 25, 1989
DRILLING METHOD Hollow Stem Auger
LOGGED BY R.A. Chapuis
GEOLOGIST

BOREHOLE/WELL NO. P209189
GROUND SURFACE ELEVATION 5980.66'
WATER LEVEL ENCOUNTERED 14.3'
STATIC 8.95' (09/27/89)
DRILLER R. Sharp HELPER P. Mesa
DRILLING FLUID None
CHECKED BY J.B. Burman
SITE MANAGER

CEARP MANAGER

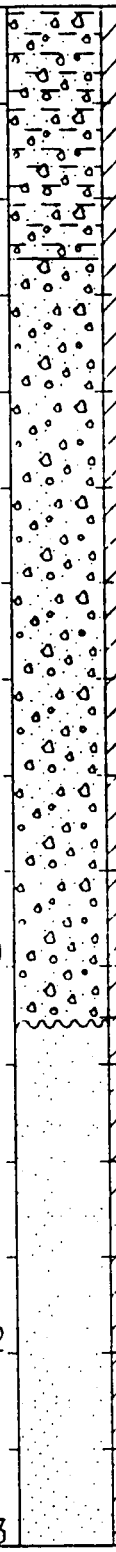
COMMENTS

DEPTH (FT)	GRAPHIC LOG	SAMPLE TYPE	LITHOLOGIC DESCRIPTION	SAMPLES COLLECTED OR OTHER TESTS PERFORMED
0			**ARTIFICIAL FILL**	
			0.0-2.3' SAMPLE. Recovered 1.3/2.3' = 57%. SP CLAYEY SAND AND GRAVEL: pale yellowish brown (10 YR 6/2) to dark yellowish brown (10 YR 4/2); mottled; ~~(40%)~~ sand; fine to coarse-grained sand; poorly sorted; angular to subrounded; quartzose; loose; ~~(35%)~~ gravel up to 4 cm; rounded to subangular; poorly sorted; quartzite; ~~(25%)~~ low to medium plastic fines; unconsolidated; firm (gc-sp); slightly moist. 40% sand, 35% gravel, 25% fines up case	HNu Background: 0.0 OVA Background: 0.0 All Readings on cuttings, in breathing zone, on core, and in augers: 0.0; unless otherwise noted below. TRIP BLANK SAMPLE TB052589A
1			**ROCKY FLATS ALLUVIUM**	
2			2.3-4.3' SAMPLE. Recovered 1.0/2.0' = 50%. GC CLAYEY SAND AND GRAVEL: same as above; grayish brown (5 Y 3/2); (50%) gravel; poorly sorted; subangular to rounded; quartzite; ~~(30%)~~ fine to coarse-grained sand; poorly sorted; subangular to subrounded; ~~(20%)~~ medium plastic fines; firm; moldable; (gc-sp); very slightly damp. up case 50% gravel, 30% sand, 20% fines	0.0-1.3' SAMPLE SEP1989BR0002 SEP1989BR0002D 0.0-3.0' SAMPLE SEP1989BR0003
3			4.3-6.3' SAMPLE. Recovered 2.0/2.0' = 100%. SP CLAYEY SAND AND GRAVEL: pale yellowish brown (10 YR 6/2) to moderate yellowish brown (5 YR 4/4); ~~(60%)~~ fine to coarse-grained sand; poorly sorted; angular to subrounded; quartzose; ~~(30%)~~ gravel; poorly sorted; subangular to rounded; (10%) medium plastic; firm; calcareous; firm to stiff; moldable; (sp-gp); slightly damp. 60% sand up case 30% gravel 10% fines	3.0-9.5' SAMPLE SEP1989BR0309 4.3-6.3' SAMPLE SEP1989BR0406 4.3-6.3': Readings on Core: OVA: 70 HNu: 25
4				
5				

SEP1989A

WELL NO. P209189

LOG OF BOREHOLE

DEPTH (FT)	GRAPHIC LOG	SAMPLE TYPE	LITHOLOGIC DESCRIPTION	SAMPLES COLLECTED OR OTHER TESTS PERFORMED
5			**6.3-8.3' SAMPLE.** Recovered 1.3/2.0' = 60%. SP SAND AND GRAVEL: same as above; grayish orange pink (5 Y 7/2); less clay (5%); slightly calcareous; weakly consolidated; (sp-gc); dry.	
6			**8.3-10.3' SAMPLE.** up case Recovered 1.2/2.0' = 60%. SP SAND AND GRAVEL: grayish orange pink (5 Y 7/2); ~~(60%)~~ sand; fine to coarse-grained; poorly sorted; ~~(35%)~~ gravel; rounded; quartzite; (5%) non to low plastic fines; unconsolidated; (sp-gp); slightly moist. 60% sand, 35% gravel, 5% fines up case	8.3-9.5' SAMPLE SEP1989BR0810
7			**ARAPAHOE/LARAMIE FORMATION** **10.3-12.3' SAMPLE.** Recovered 2.0/2.0' = 100%. SANDSTONE: light olive gray (5 Y 5/2); (85%) fine-grained sand; well sorted; subangular to subrounded; quartzose; (15%) non to low plastic fines; weakly consolidated; soft; very moist.	10.3-16.3' SAMPLE SEP1989BR1016
8			**12.3-14.3' SAMPLE.** Recovered 2.0/2.0' = 100%. SANDSTONE: same as above; calcareous in part; staining in layers (5 cm thick); light olive gray (3 Y 6/1); sand is speckled; firm to stiff; very moist.	12.3-14.3' SAMPLE SEP1989BR1214
9				8.95'
10				
11				
12				
13				

SEP1989B

WELL NO. P209189

LOG OF BOREHOLE

DEPTH (FT)	GRAPHIC LOG	SAMPLE TYPE	LITHOLOGIC DESCRIPTION	SAMPLES COLLECTED OR OTHER TESTS PERFORMED
13			**14.3-16.3' SAMPLE.** Recovered 2.0/2.0' = 100%. SANDSTONE: same as above; more sand; upper fine to medium-grained; well sorted; subrounded; coarsening downward; soft; iron-staining in layers; scattered lignite--black (N 1/0); wet.	
14			**16.3-18.3' SAMPLE.** Recovered 2.0/2.0' = 100%. 16.3-17.2': SANDSTONE: same as above. 17.2-18.3': SILTY CLAYSTONE: light gray (N 7/0); (80%) non to medium plastic fines; (20%) very fine-grained sand; occasional lignite streaks--black (N 1/0); soft to firm; wet.	▽ 14.3'
15				**16.3-18.3' SAMPLE** SEP1989BR1618 **16.3-22.3' SAMPLE** SEP1989BR1622 SEP1989BR1622D
16			**18.3-20.3' SAMPLE.** Recovered 2.0/2.0' = 100%. 18.3-19.8': SANDSTONE AND SILTY CLAYSTONE: dark yellowish orange (10 YR 6/6); interbedded sandstone; (80%); fine-grained sand; well sorted; subangular to angular; (20%) non to low plastic fines; (95%) non to medium plastic fines; (5%) very fine-grained sand; weakly consolidated; firm to stiff; moldable; wet. 19.8-20.3': SILTY CLAYSTONE: same as 17.2-18.3.'	**20.3-21.3' SAMPLE** SEP1989BR2021 **FIELD BLANKS** SEP1989BR0022FB SEP1989BR0023FB
17				
18			**20.3-21.3' SAMPLE.** Recovered 2.0/1.0' = 200%. SILTY SANDSTONE: medium gray (N 5/0) in upper 1 foot to dark yellowish orange (10 YR 6/6) in lower foot; speckled; (80%) very fine-grained sand; well sorted; subangular to angular; (20%) non to low plastic fines; poorly consolidated; soft to stiff; wet.	
19				
20				
21				

DEPTH (FT)	GRAPHIC LOG	SAMPLE TYPE	LITHOLOGIC DESCRIPTION	SAMPLES COLLECTED OR OTHER TESTS PERFORMED
21			21.3-22.3' SAMPLE. Recovered 2.0/1.0' = 200%. SANDSTONE: same as above; lenses of medium gray (N 5/0) and yellowish orange (10 YR 6/6); iron stains; more clay in yellowish orange zones (15-20%); wet.	
22			22.3-23.3' SAMPLE. Recovered 1.0/1.0' = 100%. SANDSTONE: same as above; drier in sandier portions; more clay towards bottom; soft to firm; wet to moist.	22.3-23.3' SAMPLE SEP1989BR2223
23			23.3-24.3' SAMPLE. Recovered 1.0/1.0' = 100%. SANDSTONE: same as above.	
			24.3-25.3' SAMPLE. Recovered 1.0/1.0' = 100%. SANDSTONE: same as above; thin iron-stained layers; a little drier--still very moist to wet.	
24			25.3-26.3' SAMPLE. Recovered 1.0/1.0' = 100%. SANDSTONE: same as 21.3-22.3'; lower 0.5' color between light brown (5 YR 5/6) and dark yellowish orange (10 YR 6/6); wet.	
25			26.3-27.3' SAMPLE. Recovered 1.0/1.0' = 100%. SANDSTONE: same as above; interbedded clay lenses; (80%) fine-grained sandstone; well sorted; subangular; (20%) non-plastic fines; weakly consolidated; claystone (75%)--low to medium plastic fines; (25%) very fine-grained sand; wet.	
26			27.3-28.3' SAMPLE. Recovered 1.0/1.0' = 100%. SANDSTONE AND CLAYSTONE: same as above; medium gray (N 5/0) to dark yellowish orange (10 YR 6/6); interbedded; very fine-grained sand; more claystone towards the bottom; claystone shows increasing clay content.	
27			28.3-29.3' SAMPLE. Recovered 1.0/1.0' = 100%. CLAYSTONE AND SANDSTONE: medium dark gray (N 4/0) to dark yellowish orange (10 YR 6/6); interbedded; more claystone; claystone (85%)--low to medium plastic fines; (15%) very fine-grained sand; sandstone is same as 26.3-27.3'; well sorted; subangular; lenses; firm; wet.	
28				
29				

WELL NO. P209189

LOG OF BOREHOLE

DEPTH (FT)	GRAPHIC LOG	SAMPLE TYPE	LITHOLOGIC DESCRIPTION	SAMPLES COLLECTED OR OTHER TESTS PERFORMED
29 30 31 32 33 34 35 36 37			29.3-30.3' SAMPLE. Recovered 1.0/1.0' = 100%. CLAYSTONE AND SANDSTONE: same as above; interbedded ironstone concretions; lower 0.5' sandstone; dark yellowish orange (10 YR 6/6); fine-grained; soft; wet. 30.3-31.3' SAMPLE. Recovered 1.0/1.0' = 100%. CLAYEY SANDSTONE AND SANDSTONE: dark yellowish orange (10 YR 6/6); (70%) fine-grained sand; well sorted; subangular; (30%) non to low plastic fines; iron staining; increasing sand with depth; firm; wet. 31.3-32.3' SAMPLE. Recovered 1.0/1.0' = 100%. CLAYEY SANDSTONE: moderate brown (5 YR 4/4); interbedded; (75%) fine-grained sand; well sorted; subangular; (25%) non to medium plastic fines; claystone lenses; weakly consolidated; firm to stiff; moist. 32.3-33.3' SAMPLE. Recovered 1.0/1.0' = 100%. CLAYEY SANDSTONE: same as above; pale yellowish orange (10 YR 8/6); claystone--moderate brown (5 YR 4/4); interbedded sand lenses are siltier; clay lenses have less sand. 33.3-34.3' SAMPLE. Recovered 1.0/1.0' = 100%. SANDY SILTY CLAYSTONE: interbedded; same as above; (80%) claystone; low to medium plastic fines; (30%) non to medium plastic fines; (20%) fine-grained sand; well sorted; subangular; stiff; moist. 34.3-35.3' SAMPLE. Recovered 1.0/1.0' = 100%. SILTY CLAYSTONE: medium dark gray (N 4/0); (100%) low to medium plastic fines; stiff to very stiff; dry. 35.3-36.3' SAMPLE. Recovered 1.0/1.0' = 100%. SILTY CLAYSTONE: same as above; less silt. 36.3-37.3' SAMPLE. Recovered 1.0/1.0' = 100%. SILTY CLAYSTONE: same as 34.3-35.3'; (100%) non to medium plastic fines; stiff.	

SEP1989E

WELL NO. P209189

LOG OF BOREHOLE

DEPTH (FT)	GRAPHIC LOG	SAMPLE TYPE	LITHOLOGIC DESCRIPTION	SAMPLES COLLECTED OR OTHER TESTS PERFORMED
37			Note: 37.3-38.3': Drilled with center bit. No sample recovered.	
38			TOTAL DEPTH = 38.3'	
39				
40				
41				
42				
43				
44				
45				

SEP1989F

STATE PLANE COORDINATE:	TOTAL DEPTH (FT): 34.2	GROUND ELEVATION (FT):	5981.47	PROJECT NUMBER:	SEP21-89BR
NORTH: 750864	AREA: SOLAR POND	CASING DIAMETER (IN):	4.5	GEOLOGIST:	RAC
EAST: 2084130	LOCATOR NUMBER: L10	BOREHOLE DIAMETER (IN):	7.25	DATE DRILLED:	06/07/89

REMARKS: Hollow Stem Auger. Weston Log.

LOG OF BORING NUMBER: P209389

DRAFT

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

Sample Number	Recovery/Interval	Datum (FT)	Unified Soils Classification or Rock Type	Description
SEP21B9BR0003	1.70 /2.20	5981, 5980	GC:	Sandy Clay and Gravel - mod. brown (5 YR 4/4). Gravel poorly sorted, sub-rounded to angular, max. size 6 cm. Non to med. plastic fines. F.g. to c.g. sand, poorly sorted, sub-rounded, quartzose, stiff, weakly consol., (cl-gp), damp. 60% gravel, 15% sand, 25% fines.
	1.60 /2.00	5979, 5978	GC:	Sandy Clay and Gravel - same as above.
SEP18BR0309	1.60 /2.00	5977, 5976	GP:	Clayey Sand and Gravel - mod. brown (5 YR 4/4) to grayish orange pink (5 YR 7/2). Gravel poorly sorted, sub-rounded to angular. F.g. to c.g. sand, poorly sorted, sub-angular to sub-rounded, quartzose, non to low plastic fines (gp-sd), damp. 60% gravel, 30% sand, 10% fines.
	1.30 /2.00	5975, 5974	GP:	Clayey Sand and Gravel - same as above.
	1.60 /1.80	5973, 5972	GP:	Clayey Sand and Gravel - same as above. Occasional iron stained layers. One rose quartz layer 3 cm. thick.

Depth scale: 0, 1, 2, 3, 4, 5, 6, 7, 8, 9, 10

STATE PLANE COORDINATE:	TOTAL DEPTH (FT): 34.2	GROUND ELEVATION (FT):	5981.47	PROJECT NUMBER:	SEP21-89BR
NORTH: 750864	AREA: SOLAR POND	CASING DIAMETER (IN):	4.5	GEOLOGIST:	RAC
EAST: 2084130	LOCATOR NUMBER: L10	BOREHOLE DIAMETER (IN):	7.25	DATE DRILLED:	06/07/89

REMARKS: Hollow Stem Auger. Weston Log.

LOG OF BORING NUMBER: P209389

DRAFT

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
	SEP2189BR0912			1.80 /2.20	5971, 5970	10, 11, 12			GP:	Clayey Sand and Gravel - mod. brown (5 YR 4/4) to light brown (5 YR 6/4). Gravel poorly sorted, sub-angular to sub-rounded, quartzose. F.g. to c.g. sand, poorly sorted, sub-angular, quartzose. Non to med. plastic fines, soft, moldable, normal to weakly consol. (gp-sp), damp. 40% gravel, 40% sand, 20% fines.
				0.00 /2.00	5969, 5968	13			NO SAMPLE:	NO SAMPLE
						14			NO SAMPLE:	Top of Bedrock at approx. 13.8' Note: 13.7' to 14.2': Drilled with center bit. Estimate contact alluvium and Arapahoe/Laramie Formation at 13.8' based on drilling behavior.
				2.00 /2.00	5967, 5966	15, 16	09/18/89		SANDSTONE:	Dark yellowish gray (10 YR 6/6) to yellowish gray (5 Y 7/2). F.g. sand, well sorted, sub-angular to angular, quartzose. Non to med. plastic fines. More clay in lower 1.5', soft, unconsol. to weakly consol. Interbedded sand 0.5' thick, occasional lignite towards bottom, damp. 75% sand, 25% fines.
	SEP2189BR1420			0.90 /2.00	5965, 5964	17, 18			SANDSTONE:	Same as above. Increasing clay with depth.
				2.00 /2.00	5963, 5962	19, 20			SILTY SANDSTONE:	Silty Clayey Sandstone Light brown (5 YR 5/6) to yellowish gray (5 Y 7/2). F.g. sand, well sorted, sub-angular to sub-rounded, quartzose. Non to med. plastic fines, soft, laminated iron stains, moldable, damp. 65% sand, 25% fines.

STATE PLANE COORDINATE:		TOTAL DEPTH (FT): 34.2	GROUND ELEVATION (FT):	5981.97	PROJECT NUMBER:	SEP21-89BR	LOG OF BORING NUMBER:
NORTH:	750864	AREA: SOLAR POND	CASING DIAMETER (IN):	4.5	GEOLOGIST:	RAC	P209389
EAST:	2084130	LOCATOR NUMBER: L10	BOREHOLE DIAMETER (IN):	7.25	DATE DRILLED:	06/07/89	

REMARKS: Hollow Stem Auger. Weston Log.

DRAFT

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
				2.00 /2.00	5961	20			SILTY SANDSTONE	Light brown (5 YR 5/6) to yellowish gray (5 Y 7/2). V.f.g. to m.g. sand, well sorted, sub-angular, quartzose. Normal to low plastic fines, iron stains, speckled, soft to firm, weakly consol., dry. 85% sand, 15% fines.
					5960	21				
					5959	22			SILTY SANDSTONE	Light brown (5 YR 5/6) to pale yellowish brown (10 YR 6/2). F.g. to m.g. sand, well sorted, sub-angular to sub-rounded, quartzose. Non to low plastic fines, soft to firm, iron staining, weakly consol., damp. 85% sand, 15% fines.
	SEP21BSBR2025			2.00 /2.00	5958	23				
					5957	24			SILTY SANDSTONE	Same as above - occasional lignite, black (N 1/0).
				2.00 /2.00	5956	25				
					5955	26			SILTY SANDSTONE	Same as above, slightly moist.
				2.00 /2.00	5954	27				
					5953	28			SILTY SANDSTONE	Same as above.
									CLAYSTONE	Pale brown (5 YR 3/2). Low to med. plastic, stiff to hard, crumbly in part, dry.
				1.50 /2.00	5952	29				
						30				

STATE PLANE COORDINATE:		TOTAL DEPTH (FT): 34.2	GROUND ELEVATION (FT):	5981.47	PROJECT NUMBER:	SEP21-89BR	LOG OF BORING NUMBER:
NORTH:	750864	AREA: SOLAR POND	CASING DIAMETER (IN):	4.5	GEOLOGIST:	RAC	P209389
EAST:	2084130	LOCATOR NUMBER: L10	BOREHOLE DIAMETER (IN):	7.25	DATE DRILLED:	06/07/89	

REMARKS: Hollow Stem Auger. Weston Log.

DRAFT

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
					5951	30			CLAYSTONE:	Same as above - grayish brown (5 YR 3/2) to dusky yellowish brown (10 YR 2/2), occasional lignite.
				1.60 /2.00	5950	31				
						32			CLAYSTONE:	Same as above - med. gray (N 5/6). Lignitic, siltier in part.
				1.70 /2.00	5949	33				
					5948	34				
					5947				:	TD = 34.2'
					5946	35				
					5945	36				
					5944	37				
					5943	38				
					5942	39				
						40				

SEP2189BR

WELL COMPLETION INFORMATION

QA By/Date Janice Sugman / 6-8-89

Location Rocky Flats Plant; Solar Ponds Area **Well No.** P209389

Coordinates N 37881.34 E 21026.45 (RFP) **Elevation: Ground Surface** 5981.47'

Total Depth: Well 30.05' **Top of Casing** 5983.39'

Borehole 34.2'

Formation of Completion Weathered Sandstone

Casing Material Schedule 40 PVC **Casing Diameter** 4 1/2" O.D.

Screen Material Schedule 40 10-slotted PVC **Surface Casing Diameter** 8 5/8" O.D.

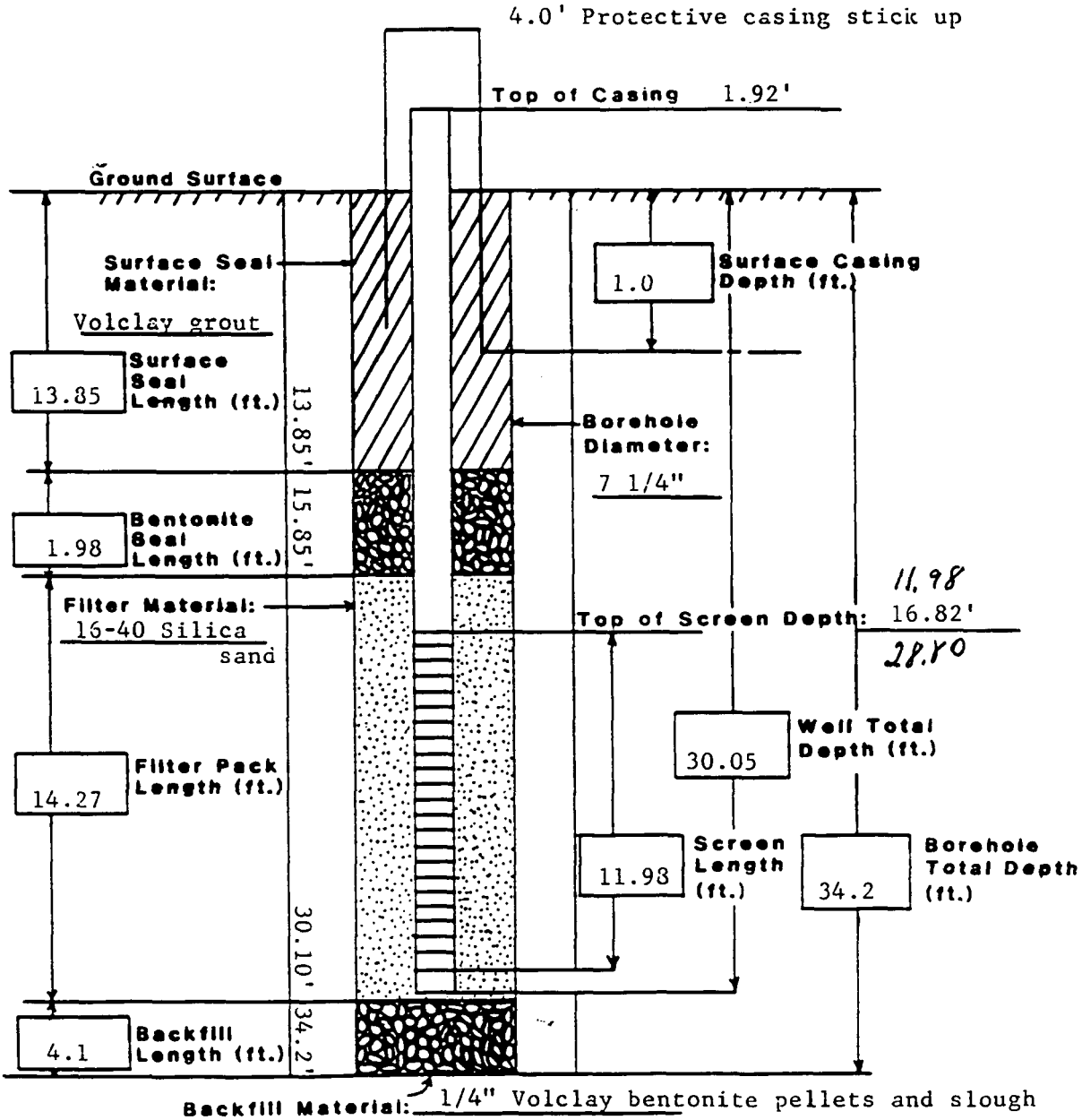
Date Installed 06/07/1989 **Approved By** Janice Sugman

Installed By R.A. Chapuis **Site Manager**

Geologist

CEARP Manager

Comments No centralizer used.



LOG OF BOREHOLE

QA BY/DATE J.B. Burman/11-29-89
LOCATION Rocky Flats Plant; Solar Ponds Area
COORDINATES N37,881.34 E21,026.45 (RFP)
TOTAL DEPTH 34.2'

DRILLING COMPANY Boyles Brothers
DATE DRILLED June 7, 1989
DRILLING METHOD Hollow Stem Auger
LOGGED BY R.A. Chapuis
GEOLOGIST

BOREHOLE/WELL NO. P209389
GROUND SURFACE ELEVATION 5981.47'
WATER LEVEL ENCOUNTERED None
STATIC 15.24' (09/18/89)
DRILLER R. Sharp HELPER P. Mesa
DRILLING FLUID None
CHECKED BY J.B. Burman
SITE MANAGER

CEARP MANAGER

COMMENTS

DEPTH (FT)	GRAPHIC LOG	SAMPLE TYPE	LITHOLOGIC DESCRIPTION	SAMPLES COLLECTED OR OTHER TESTS PERFORMED
0			**ARTIFICIAL FILL**	
			0.0-2.2': SAMPLE. Recovered 1.7/2.0' = 85%. GC SANDY CLAY AND GRAVEL: moderate brown (5 YR 4/4); ~~(60%)~~ gravel; poorly sorted; subrounded to angular; maximum size 6cm; ~~(25%)~~ non to medium plastic fines; ~~(15%)~~ fine to coarse-grained sand; poorly sorted; subrounded; quartzose; stiff; weakly consolidated; (cl-gp); damp. 60% gravel, 15% sand, 25% fines	HNU Background: 0.0 OVA Background: 0.0 All readings on cuttings, in breathing zone on core, and in augers: 0.0; unless otherwise noted below. TRIP BLANK SAMPLE TB060789A
1				
2			**ROCKY FLATS ALLUVIUM**	
			2.2-4.2' SAMPLE. Recovered 1.6/2.0' = 80%. GC SANDY CLAY AND GRAVEL: same as above.	0.0-3.0' SAMPLE SEP2189BR0003
3			4.2-6.2' SAMPLE. Recovered 1.6/2.0' = 80%. GP CLAYEY SAND AND GRAVEL: moderate brown (5 YR 4/4) to grayish orange pink (5 YR 7/2); ~~(60%)~~ gravel; poorly sorted; subrounded to angular; ~~(30%)~~ fine to coarse-grained sand; poorly sorted; subangular to subrounded; quartzose; ~~(10%)~~ non to low plastic fines; (gp-sd); damp. 60% gravel, 30% sand 10% fines.	0.0-1.7' SAMPLE (VOA's only) SEP2189BR0002 4.2-5.8' SAMPLE (VOA's only) SEP2189BR0406 3.0-9.0' SAMPLE SEP2189BR0309
4				
5				

SEP2189A

WELL NO. P209389

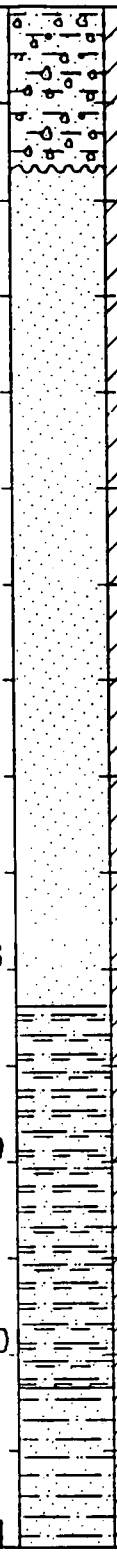
LOG OF BOREHOLE

DEPTH (FT)	GRAPHIC LOG	SAMPLE TYPE	LITHOLOGIC DESCRIPTION	SAMPLES COLLECTED OR OTHER TESTS PERFORMED
5		Gp	6.2-8.2' SAMPLE. Recovered 1.3/2.0' = 65%. CLAYEY SAND AND GRAVEL: same as above.	
6		Gp	8.2-10.0' SAMPLE. Recovered 1.6/1.8' = 89%. CLAYEY SAND AND GRAVEL: same as above; occasional iron stained layers; one rose quartz layer 3cm thick.	8.2-9.8' SAMPLE (VOA's only) SEP2189BR0810
7		Gp	10.0-12.2' SAMPLE. Recovered 1.8/2.2' = 82%. CLAYEY SAND AND GRAVEL: moderate brown (5 YR 4/4) to light brown (5 YR 6/4); ~~(40%)~~ gravel; poorly sorted; subangular to subrounded; quartzose; ~~(40%)~~ fine to coarse-grained sand; poorly sorted; subangular; quartzose; ~~(20%)~~ non to medium plastic fines; soft; moldable; normal to weakly consolidated; (gp-sp); damp. 40% gravel, 40% sand, 20% fines	9.0-11.8' SAMPLE SEP2189BR0912
8			12.2-14.2' SAMPLE. Recovered 0.0/2.0' = 0%. Note: 13.7-14.2': Drilled with center bit. Estimate contact alluvium and Arapahoe/Laramie Formation at 13.8' based on drilling behavior.	
9				
10				
11				
12				
13				

SEP2189B

WELL NO. P209389

LOG OF BOREHOLE

DEPTH (FT)	GRAPHIC LOG	SAMPLE TYPE	LITHOLOGIC DESCRIPTION	SAMPLES COLLECTED OR OTHER TESTS PERFORMED
13 14 15 16 17 18 19 20 21			**ARAPAHOE/LARAMIE FORMATION** 14.2-16.2' SAMPLE. Recovered 2.0/2.0' = 100%. SANDSTONE: dark yellowish grey (10 YR 6/6) to yellowish grey (5 Y 7/2); (75%) fine-grained sand; well sorted; subangular to angular; quartzose; (25%) non to medium plastic fines; more clay in lower 1.5'; soft; unconsolidated to weakly consolidated; interbedded sand 0.5' thick; occasional lignite towards bottom; damp. 16.2-18.2' SAMPLE. Recovered 0.9/2.0' = 45%. SANDSTONE: same as 14.2-16.2'; increasing clay with depth. 18.2-20.2' SAMPLE. Recovered 2.0/2.0' = 100%. SILTY CLAYEY SANDSTONE: light brown (5 YR 5/6) to yellowish grey (5 Y 7/2); (65%) fine-grained sand; well sorted; subangular to subrounded; quartzose; (25%) non to medium plastic fines; soft; laminated iron stains; moldable; damp. 20.2-22.2' SAMPLE. SILTY SANDSTONE: light brown (5 YR 5/6) to yellowish grey (5 Y 7/2); (85%) very fine-grained to medium grained sand; well sorted; subangular; quartzose; (15%) normal to low plastic fines; iron stains; speckled; soft to firm; weakly consolidated; dry.	14.2-16.2' SAMPLE (VOA's only) SEP2189BR1416 14.2-20.2' SAMPLE SEP2189BR1420 15.24' 18.2-20.2' SAMPLE (VOA's only) SEP2189BR1820

SEP2189C

WELL NO. P209389

LOG OF BOREHOLE

DEPTH (FT)	GRAPHIC LOG	SAMPLE TYPE	LITHOLOGIC DESCRIPTION	SAMPLES COLLECTED OR OTHER TESTS PERFORMED
21 22 23 24 25 26 27 28 29			22.2-24.2' SAMPLE. Recovered 2.0/2.0' = 100%. SILTY SANDSTONE: light brown (5 YR 5/6) to pale yellowish brown (10 YR 6/2); (85%) fine to medium-grained sand; well sorted; subangular to subrounded; quartzose; (15%) non to low plastic fines; soft to firm; iron staining; weakly consolidated; damp. 24.2-26.2' SAMPLE. Recovered 2.0/2.0' = 100%. SILTY SANDSTONE: same as above; occasional lignite; black (N 1/0). 26.2-28.2' SAMPLE. Recovered 2.0/2.0 = 100%. SILTY SANDSTONE: same as above; slightly moist. 28.2.-30.2' SAMPLE. Recovered 1.5/2.0' = 75%. 28.2-28.4': SILTY SANDSTONE: same as above. 28.4-30.2': CLAYSTONE: pale brown (5 YR 3/2); (100%) low to medium plastic; stiff to hard; crumbly in part; dry.	22.2-24.2' SAMPLE (VOA's only) SEP2189BR2224 SEP2189BR2224D 20.2-26.2' SAMPLE SEP2189BR2026 SEP2189BR2026D FIELD BLANK SAMPLE SEP2189BR0034FB

SEP21890

WELL NO. P209389

LOG OF BOREHOLE

DEPTH (FT)	GRAPHIC LOG	SAMPLE TYPE	LITHOLOGIC DESCRIPTION	SAMPLES COLLECTED OR OTHER TESTS PERFORMED
29			30.2-32.2' SAMPLE. Recovered 1.6/2.0' = 80%. CLAYSTONE: same as above; grayish brown (5 YR 3/2) to dusky yellowish brown (10 YR 2/2); occasional lignite.	
30			32.2-34.2' SAMPLE. Recovered 1.7/2.0' = 85%. CLAYSTONE: same as above; medium gray (N 5/6); lignitic; siltier in part.	
31			TOTAL DEPTH = 34.2'	
32				
33				
34				
35				
36				
37				

SEP2188E

STATE PLANE COORDINATE:		TOTAL DEPTH (FT): 48.0	GROUND ELEVATION (FT):	5977.98	PROJECT NUMBER:	SEP22-89BR	LOG OF BORING NUMBER:
NORTH:	750991	AREA: SOLAR POND	CASING DIAMETER (IN):	4.5 O.D.	GEOLOGIST:	RTT/JBB	P209489
EAST:	2084634	LOCATOR NUMBER: L10	BOREHOLE DIAMETER (IN):	8-5/8	DATE DRILLED:	05/16/89	

REMARKS: Hollow Stem Auger. Weston Log.

DRAFT

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			CL:	Clay - brownish gray (5 YR 4/1). Organic rich fragments, black (N 1/0). Granite and quartzite pebbles to 0.2 cm., angular. Some quartzose sand. Some silt, soft.
	SEP22BBR0003			1.20 /2.00	5977	1				
					5976	2			SM:	Sand and Gravel - brownish black (5 YR 2/1). Quartzite and granite gravels to 2 cm., angular. Silty clay, no plasticity, unconsol., loose, (sm-sp), damp. 15% clay.
				2.00 /2.00	5975	3				
					5974	4				
	SEP22BBR0007			1.20 /2.00	5973	5				
					5972	6				
				1.40 /2.00	5971	7			CL:	Clay - pinkish gray (5 YR 8/1). Caliche (highly effervescent with HCl). Quartzite gravels to 5 cm., sub-angular to angular. Soft, dry.
					5970	8			CL:	Silty Clay - light olive brown (5 Y 5/6). Some gravels (35 cm.), angular to sub-angular. Soft, dry.
				1.80 /2.00	5969	9			CLAYSTONE:	Top of Bedrock at 9.0'. Light gray (N 7/0). Thin Sandstone stringers (< 2 cm.). Abundt. caliche. No gravels. Sandy in shoe, quartzose, v.f.g. (3.0 phi to 3.5 phi), silty, slightly damp.
	SEP22BBR0912				5968	10			NO SAMPLE:	NO SAMPLE

STATE PLANE COORDINATE:	TOTAL DEPTH (FT): 48.0	GROUND ELEVATION (FT):	5977.98	PROJECT NUMBER:	SEP22-89BR
NORTH: 750991	AREA: SOLAR POND	CASING DIAMETER (IN):	4.5 O.D.	GEOLOGIST:	RTT/JBB
EAST: 2084634	LOCATOR NUMBER: L10	BOREHOLE DIAMETER (IN):	8-5/8	DATE DRILLED:	05/16/89

REMARKS: Hollow Stem Auger. Weston Log.

LOG OF BORING NUMBER: P209489

DRAFT

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
	SEP2289BR0912 0%	50%	100% 0% 100%			10			SANDY SILTSTONE:	Med. light gray (N 6/0) Abundt. caliche (effervesces with HCl), friable, dry.
				2.20 /2.00	5967	11			SANDY SILTSTONE:	Mod. yellowish brown (10 YR 5/4). Abundt. caliche (effervesces with HCl), friable, dry.
					5966	12			SANDSTONE:	Mod. brown (5 YR 4/4). F.g. to m.g., alternating thin beds of light gray (N 8/0) and mod. brown (5 YR 4/4). Laminae <1 cm. thick, some Ironstone nodules. Silty clay, unconsol., damp.
	SEP2289BR1213			1.30 /2.00	5965	13				
					5964	14			CLAYSTONE:	Claystone and Sandy Siltstone - light olive gray (5 Y 5/2). Claystone with mod. brown (5 YR 4/4) sandy intervals. Abundt. white caliche, reacts with HCl. Laminated (1 cm.), unconsol., damp.
	SEP2289BR1416			1.60 /2.00	5963	15				
					5962	16			SILTY SANDSTONE:	Light olive gray (5 Y 5/2) with abundt. zones of mod. brown (5 YR 4/4). Some caliche, some clay. V.f.g. to m.g. quartzose sand. Iron-stained, unconsol., damp.
				2.00 /2.00	5961	17				
					5960	18				
	SEP2289BR1621			2.00 /2.00	5959	19				
					5958	20				

STATE PLANE COORDINATE:	TOTAL DEPTH (FT): 48.0	GROUND ELEVATION (FT): 5977.98	PROJECT NUMBER: SEP22-898R	LOG OF BORING NUMBER:
NORTH: 750991	AREA: SOLAR POND	CASING DIAMETER (IN): 4.5 O.D.	GEOLOGIST: RTT/JBB	P209489
EAST: 2084634	LOCATOR NUMBER: L10	BOREHOLE DIAMETER (IN): 8-5/8	DATE DRILLED: 05/16/89	

REMARKS: Hollow Stem Auger. Weston Log.

DRAFT

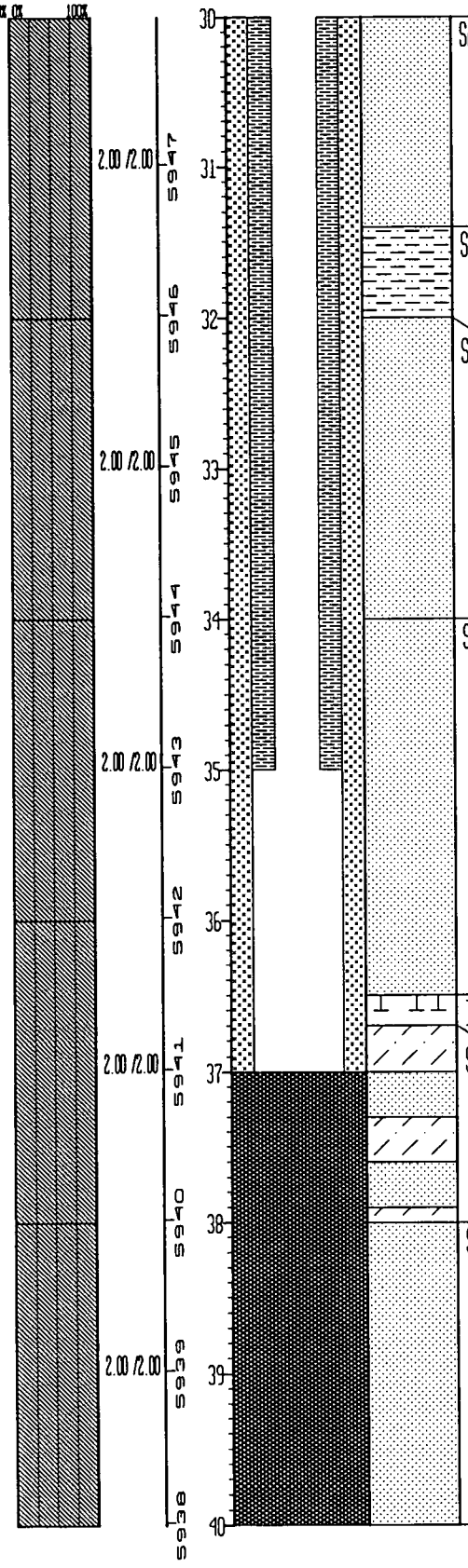
CHEMICAL SAMPLE DEPTH / GRADATIONAL SAMPLE DEPTH	SAMPLE NUMBER	SAMPLE GRAIN SIZE (0% 50% 100%)	PERCENT RECOVERY (0% 100%)	RECOVERY/INTERVAL	DATUM (FT)	DEPTH (FT)	WELL OR PIEZOMETER CONSTRUCTION	LITHOLOGY	UNIFIED SOILS CLASSIFICATION OR ROCK TYPE	DESCRIPTION
	SEP22898R0022			2.00 /2.00	5957	20–21				SILTY SANDSTONE: Same as above - decreasing sand content.
				2.00 /2.00	5956	22				SANDSTONE: Light olive gray (5 Y 5/2). F.g. to m.g. Abundt. iron staining, med. brown (5 YR 4/4). Quartzose sand. Some silt, unconsol., friable, loose, damp.
				2.00 /2.00	5955	23				
				2.00 /2.00	5954	24				SANDSTONE: Same as above - wet at 25.0'.
				2.00 /2.00	5953	25	05/16/89			
				2.00 /2.00	5952	26	09/20/89			SANDSTONE: Light olive gray (5 Y 5/2), heavily iron stained. 26.0' to 26.2', mod. brown (5 YR 4/4). Silty to m.g. quartzose sand, fining downward. Damp.
				2.00 /2.00	5951	27				
					5950	28				
				2.00 /2.00	5949	29				
					5948	30				

STATE PLANE COORDINATE:	TOTAL DEPTH (FT): 48.0	GROUND ELEVATION (FT): 5977.98	PROJECT NUMBER: SEP22-898R	LOG OF BORING NUMBER:
NORTH: 750991	AREA: SOLAR POND	CASING DIAMETER (IN): 4.5 O.D.	GEOLOGIST: RTT/JBB	P209489
EAST: 2084634	LOCATOR NUMBER: L10	BOREHOLE DIAMETER (IN): 8-5/8	DATE DRILLED: 05/16/89	

REMARKS: Hollow Stem Auger. Weston Log.

DRAFT

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



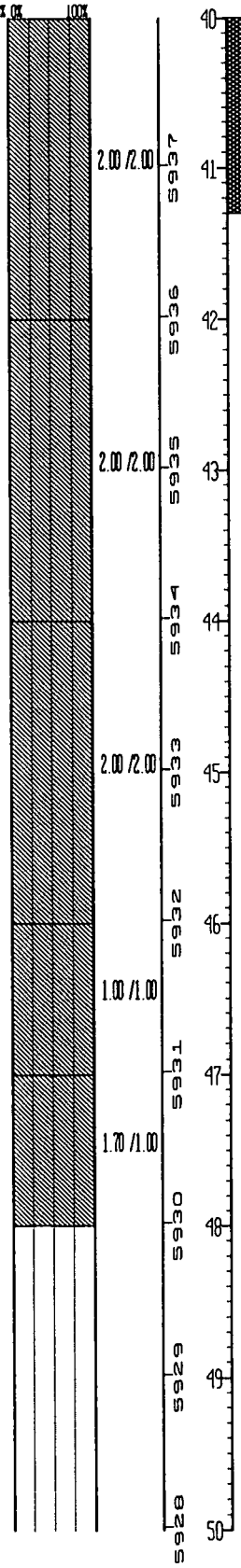
UNIFIED SOILS CLASSIFICATION OR ROCK TYPE	DESCRIPTION
SANDSTONE:	Same as above, wet.
SANDY CLAYSTONE:	Light olive gray (5 Y 5/2). V.f.g. to f.g. quartzose sand. Mod. brown (5 YR 4/4), mottled, some iron streaks, blocky Claystone texture, damp.
SANDSTONE:	Same as above (reference interval 30.0' to 31.4').
SANDSTONE:	Same as above with few layers (0.1' thick) of mod. brown (5 YR 4/4) Claystone. Blocky texture, trace organics, black (N 1/0). Friable, loose, damp to wet.
IRONSTONE:	Ironstone Nodules - mod. brown (5 YR 3/4).
SILTSTONE:	Siltstone and Sandstone - light olive gray (5 Y 5/2) with abundt. mod. brown (5 YR 4/4) mottles. Some v.f.g. sand in vertical fracture in shoe. Friable, mod. consol., weathered, wet.
SANDSTONE:	Mod. brown (5 YR 4/4) and light gray (N 7/0) Sandstone, along with alternating beds of Clayey Sandstone (2 cm. to 5 cm. thick). Heavy iron staining, mod. brown (5 YR 4/4), friable, unconsol., damp.

STATE PLANE COORDINATE:		TOTAL DEPTH (FT): 48.0	GROUND ELEVATION (FT):	5977.98	PROJECT NUMBER:	SEP22-89BR	LOG OF BORING NUMBER:
NORTH:	750991	AREA: SOLAR POND	CASING DIAMETER (IN):	4.5 O.D.	GEOLOGIST:	RTT/JBB	P209489
EAST:	2084634	LOCATOR NUMBER: L10	BOREHOLE DIAMETER (IN):	8-5/8	DATE DRILLED:	05/16/89	

REMARKS: Hollow Stem Auger. Weston Log.

DRAFT

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:	Olive gray (5 Y 4/1), blocky. Some Siltstone. Some organic fragments, black (N 1/0). Consol., dry.
CLAYSTONE:	Same as above. Trace to some sand, dry.
SILTSTONE:	Light olive gray (5 Y 6/1). Some v.f.g. sand, rounded. Some mod. brown (5 YR 4/4) stains. Abundt. black (N 1/0) organic streaks. Damp.
SANDSTONE:	Light olive gray (5 Y 6/1). V.f.g., silty, quartzose, rounded, friable, unconsol., dry.
NO SAMPLE:	NO SAMPLE.
	TD = 48.0'

SEP2289BR

LOTUS ✓
WP ✓

WELL COMPLETION INFORMATION

QA By/Date Jarell Burman 15-17-89

Location Rocky Flats Plant; Solar Ponds Area **Well No.** P209489

Coordinates N 38007.03 E 21531.26 (RFP) **Elevation: Ground Surface** 5977.98'

Total Depth: Well 36.25' **Top of Casing** 5980.10'

Borehole 48.0'

Formation of Completion Weathered Sandstone

Casing Material Schedule 40 PVC **Casing Diameter** 4 1/2" O.D.

Screen Material Schedule 40 10-slotted PVC **Surface Casing Diameter** 8 5/8" O.D.

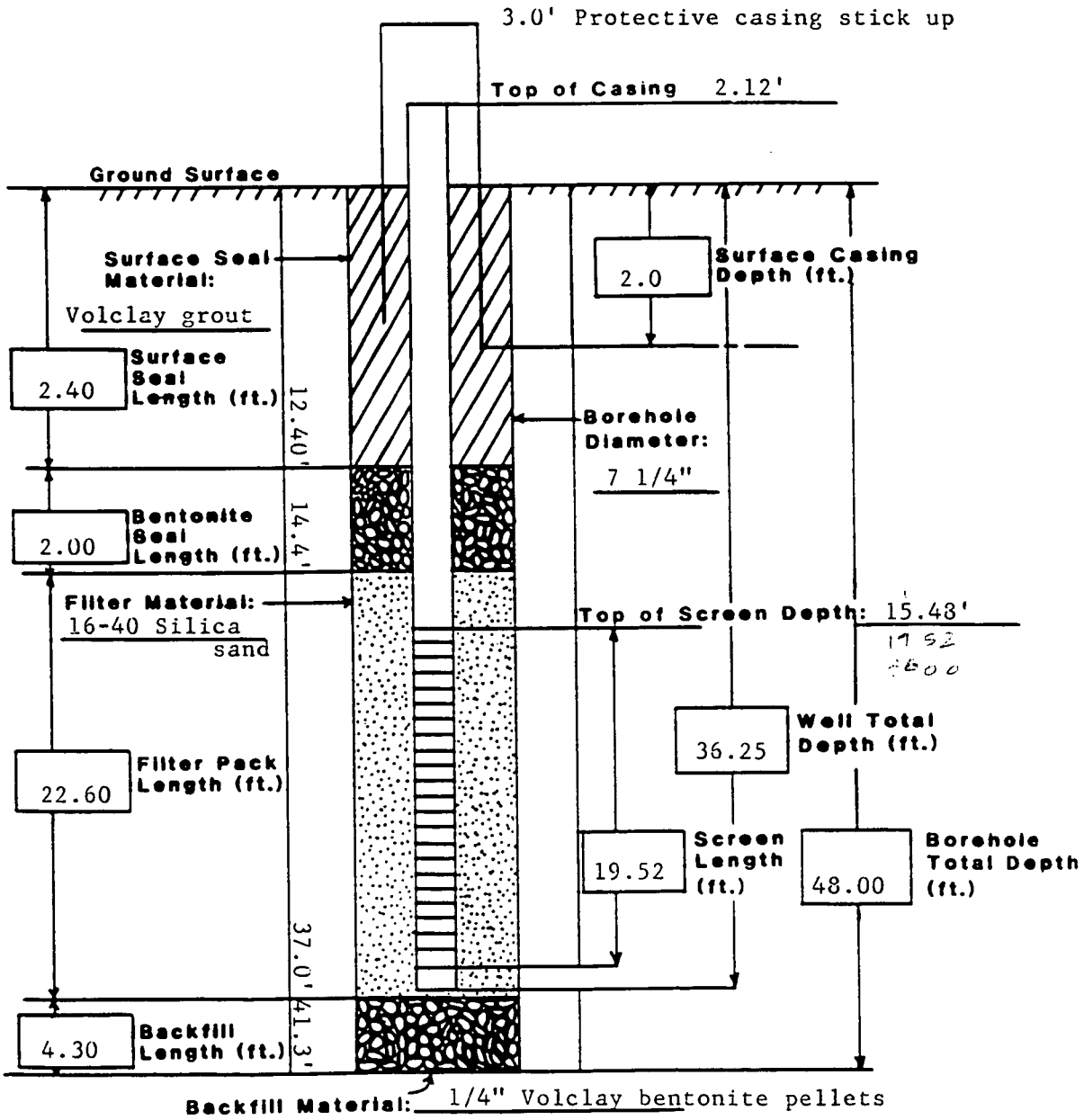
Date Installed 05/16 & 05/17/1989 **Approved By** Jarell Burman

Installed By R.T. Treat
Geologist

Site Manager

CEARP Manager

Comments Set stainless steel centralizer from 36.00' to 34.76' below ground surface.



LOG OF BOREHOLE

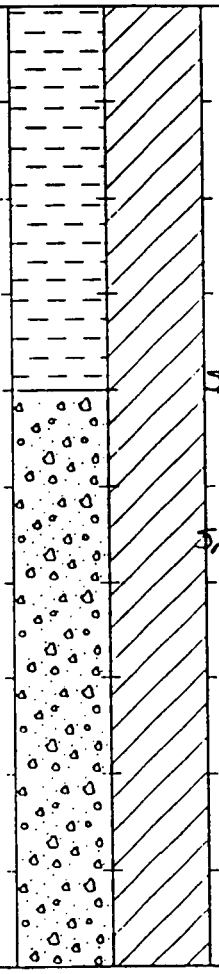
QA BY/DATE J.B. Bergman 12-4-89
LOCATION Rocky Flats Plant; Solar Ponds Area
COORDINATES N38,007.03 E21,531.26 (RFP)
TOTAL DEPTH 48.0'

DRILLING COMPANY Boyles Brothers
DATE DRILLED May 16, 1989
DRILLING METHOD Hollow Stem Auger
LOGGED BY J.B. Bergman
GEOLOGIST

BOREHOLE/WELL NO. P209489
GROUND SURFACE ELEVATION 5977.98'
WATER LEVEL ENCOUNTERED 25.0'
STATIC 26.43' (09/20/89)
DRILLER R. Sharp HELPER P. Mesa
DRILLING FLUID None
CHECKED BY J.B. Bergman
SITE MANAGER

CEARP MANAGER

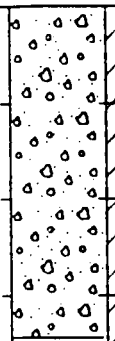
COMMENTS

DEPTH (FT)	GRAPHIC LOG	SAMPLE TYPE	LITHOLOGIC DESCRIPTION	SAMPLES COLLECTED OR OTHER TESTS PERFORMED
0 1 2 3 4 5			**TOPSOIL** 0.0-2.0' SAMPLE. Recovered 1.2/2.0' = 60%. CLAY: brownish gray (5 YR 4/1); organic rich fragments--black (N 1/0); granite and quartzite pebbles to 0.2 cm; angular; some quartzose sand; some silt; (ol); soft. **ROCKY FLATS ALLUVIUM** 2.0-4.0' SAMPLE. Recovered 2.0/2.0' = 100%. SAND AND GRAVEL: brownish black (5 YR 2/1); quartzite and granite gravels to 2 cm; angular; (15%) silty clay; no plasticity; unconsolidated; loose; (sm-sp); damp. 4.0-6.0' SAMPLE. Recovered 1.2/2.0' = 60%. SAND AND GRAVEL: same as above; (sm-sp).	HNu Background: 0.0 OVA Background: 0.0 All readings on cuttings, in breathing zone, on core, and in augers: 0.0; unless otherwise noted below. TRIP BLANK SAMPLE TB051689 0.0-2.0': Reading on Core: OVA: 0.2 0.0-1.2' SAMPLE (VOAs only) SEP2289BR0002 0.0-3.0' SAMPLE SEP2289BR0003 2.0': Reading in Auger: OVA: 2 3.0-7.4' SAMPLE SEP2289BR0307 4.0-5.2' SAMPLE (VOAs only) SEP2289BR0406 4.0': Reading in Auger: OVA: 0.2

SEP2289A

WELL NO. P209489

LOG OF BOREHOLE

DEPTH (FT)	GRAPHIC LOG	SAMPLE TYPE	LITHOLOGIC DESCRIPTION	SAMPLES COLLECTED OR OTHER TESTS PERFORMED
5			**6.0-8.0' SAMPLE.** Recovered 1.4/2.0' = 70%. 6.0-6.7': SAND AND GRAVEL: same as above; (sm-sp). 6.7-7.4': CLAY: pinkish gray (5 YR 8/1); caliche; highly effervescent with HCl; quartzite gravels to 5 cm; subangular to angular; soft; dry..	8.0': Reading in Auger: OVA: 2
6			**8.0-10.0' SAMPLE.** Recovered 1.8/2.0' = 90%. 8.0-8.9': SILTY CLAY: light olive brown (5 Y 5/6); some gravels (35 cm); angular to subangular; soft; dry.	8.0-9.8' SAMPLE (VOAs only) SEP2289BR0810 8.9-12.0' SAMPLE SEP2289BR0912
7			**ARAPAHOE/LARAMIE FORMATION** 8.9-9.8': CLAYSTONE: light gray (N 7/0); thin sandstone stringers (< 2 cm); abundant caliche; no gravels; sandy in shoe--quartzose; very fine-grained (3.0-3.5 phi); silty; slightly damp.	
8			**10.0-12.0' SAMPLE.** Recovered 2.2/2.0' = 110%. 10.0-11.2': ~~SANDY SILTSTONE:~~ medium light gray (N 6/0); abundant caliche--effervesces with HCl; friable; dry. 11.2-12.0': SANDY SILTSTONE: moderate yellowish brown (10 YR 5/4); abundant caliche; effervesces with HCl; friable; dry.	10.0': Reading in Auger: OVA: 3 12.0': Reading in Auger: OVA: 7.0
9			**12.0-14.0' SAMPLE.** Recovered 1.3/2.0' = 65%. SANDSTONE: moderate brown (5 YR 4/4); fine to medium-grained; alternating thin beds of light gray (N 8/0) and moderate brown (5 YR 4/4) laminae <1 cm thick; some ironstone nodules; (20%) silty clay; unconsolidated; damp.	12.0-13.3' SAMPLE (VOAs only) SEP2289BR1214 12.0-13.3' SAMPLE SEP2289BR1213
10				
11				
12				
13				

SEP2289B

WELL NO. P209489

LOG OF BOREHOLE

DEPTH (FT)	GRAPHIC LOG	SAMPLE TYPE	LITHOLOGIC DESCRIPTION	SAMPLES COLLECTED OR OTHER TESTS PERFORMED
13				
			14.0-16.0' SAMPLE. Recovered 1.6/2.0' = 80%. CLAYSTONE AND SANDY SILTSTONE: light olive gray (5 Y 5/2) claystone with moderate brown (5 YR 4/4) sandy intervals; abundant white caliche; reacts with HCl; laminated (1 cm); unconsolidated; damp.	14.0-15.6' SAMPLE SEP2289BR1416
14				
			16.0-18.0' SAMPLE. Recovered 2.0/2.0' = 100%. SILTY SANDSTONE: light olive gray (5 Y 5/2) with abundant zones of moderate brown (5 YR 4/4); some caliche; some clay; very fine-grained to medium-grained quartzose sand; iron-stained; unconsolidated; damp.	16.0-18.' SAMPLE (VOAs only) SEP2289BR1618 16.0-21.0' SAMPLE SEP2289BR1621
15				
			18.0-20.0' SAMPLE. Recovered 2.0/2.0' = 100%. SILTY SANDSTONE: same as above;	
			20.0-22.0' SAMPLE. Recovered 2.0/2.0' = 100%. SILTY SANDSTONE: same as above; decreasing sand content.	20.0-22.0' SAMPLE SEP2289BR2022
16				
17				
18				
19				
20				
21				

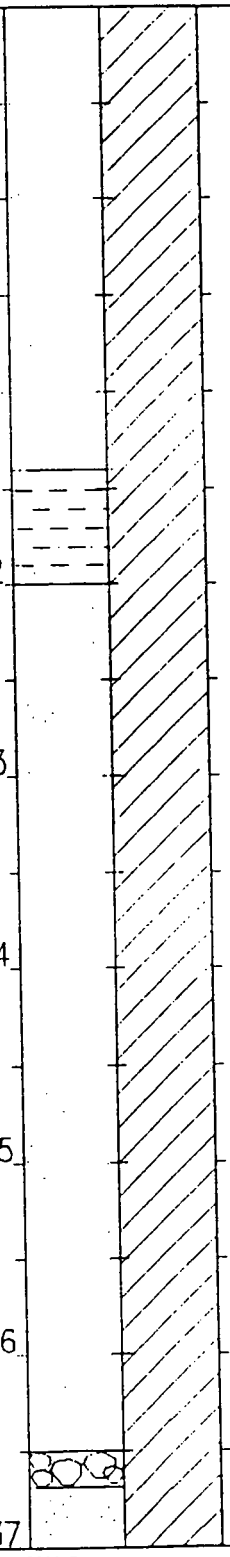
SEP2289C

WELL NO. P209489

LOG OF BOREHOLE

DEPTH (FT)	GRAPHIC LOG	SAMPLE TYPE	LITHOLOGIC DESCRIPTION	SAMPLES COLLECTED OR OTHER TESTS PERFORMED
21			**22.0-24.0' SAMPLE.** Recovered 2.0/2.0' = 100%. SANDSTONE: light olive gray (5 Y 5/2); fine to medium-grained; abundant iron staining--moderate brown (5 YR 4/4); quartzose sand; some silt; unconsolidated; friable; loose; damp.	
22			**24.0-26.0' SAMPLE.** Recovered 2.0/2.0' = 100%. SANDSTONE: same as above; wet at 25.0'	
23			**26.0-28.0' SAMPLE.** Recovered 2.0/2.0' = 100%. SANDSTONE: light olive gray (5 Y 5/2); heavily iron-stained; 26.0-26.2'--moderate brown (5 YR 4/4); silty to medium-grained quartzose sand; fining downward; damp.	
24			**28.0-30.0' SAMPLE.** Recovered 2.0/2.0' = 100%. SANDSTONE: same as above; damp.	
25				25.0'
26				26.43'
27				
28				
29				

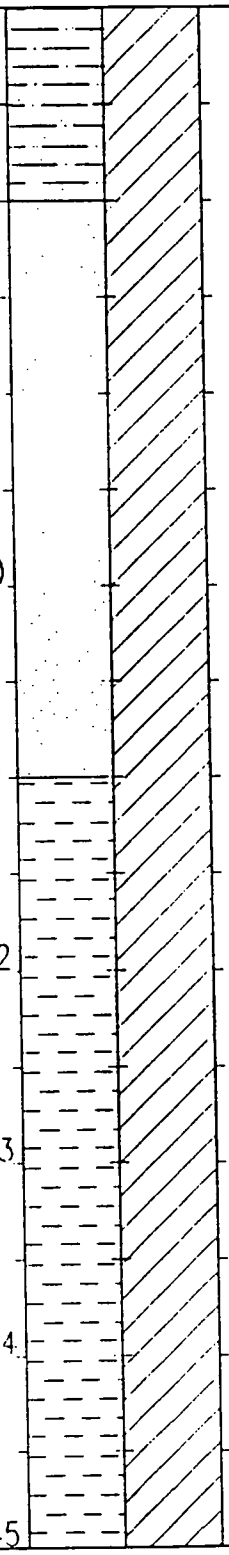
SEP22890

DEPTH (FT)	GRAPHIC LOG	SAMPLE TYPE	LITHOLOGIC DESCRIPTION	SAMPLES COLLECTED OR OTHER TESTS PERFORMED
29 30 31 32 33 34 35 36 37			<u>30.0-32.0' SAMPLE.</u> Recovered 2.0/2.0' = 100%. 30.0-31.4': SANDSTONE: same as above; wet. 31.4-32.0': SANDY CLAYSTONE: light olive gray (5 Y 5/2); very fine-grained to fine-grained quartzose sand; moderate brown (5 YR 4/4); mottled; some iron streaks; blocky claystone texture; damp. <u>32.0-34.0' SAMPLE.</u> Recovered 2.0/2.0' = 100%. SANDSTONE: same as 30.0-31.4'. <u>34.0-36.0' SAMPLE.</u> Recovered 2.0/2.0' = 100%. SANDSTONE: same as above with few layers (0.1' thick) of moderate brown (5 YR 4/4) claystone; blocky texture; trace organics--black (N 1/0); friable; loose; damp to wet. <u>36.0-38.0' SAMPLE.</u> Recovered 2.0/2.0' = 100%. 36.0-36.5': SANDSTONE: same as above. 36.5-36.7': IRONSTONE NODULES: moderate brown (5 YR 3/4). 36.7-38.0': SILTSTONE AND SANDSTONE: light olive gray (5 Y 5/2) with abundant moderate brown (5 YR 4/4) mottles; some very fine-grained sand in vertical fracture in shoe; friable; moderately consolidated; weathered; wet.	

SEP2289E

WELL NO. P209489

LOG OF BOREHOLE

DEPTH (FT)	GRAPHIC LOG	SAMPLE TYPE	LITHOLOGIC DESCRIPTION	SAMPLES COLLECTED OR OTHER TESTS PERFORMED
37 38 39 40 41 42 43 44 45			**38.0-40.0' SAMPLE.** Recovered 2.0/2.0' = 100%. SANDSTONE: moderate brown (5 YR 4/4) and light gray (N 7/0) sandstone with alternating beds of clayey sandstone (2 to 5 cm thick); heavy iron-staining--moderate brown (5 YR 4/4); friable; unconsolidated; damp. **40.0-42.0' SAMPLE.** Recovered 2.0/2.0' = 100%. 40.0-41.0': SANDSTONE: same as above. 41.0-42.0'; CLAYSTONE: olive gray (5 Y 4/1); blocky; some siltstone; some organic fragments--black (N 1/0); consolidated; dry. **42.0-44.0' SAMPLE.** Recovered: 2.0/2.0' = 100%. CLAYSTONE: same as above; trace to some sand; dry. **44.0-46.0' SAMPLE.** Recovered 2.0/2.0' = 100%. CLAYSTONE: same as above.	Pg 6

SEP2289F

WELL NO. P209489

LOG OF BOREHOLE

DEPTH (FT)	GRAPHIC LOG	SAMPLE TYPE	LITHOLOGIC DESCRIPTION	SAMPLES COLLECTED OR OTHER TESTS PERFORMED
45			**46.0-47.0' SAMPLE.** Recovered 1.0/1.0' = 100%. SILTSTONE: light olive gray (5 Y 6/1); some very fine-grained sand; rounded; some moderate brown (5 YR 4/4) stains; abundant black (N 1/0) organic streaks; damp.	
46			**47.0-48.0' SAMPLE.** Recovered 1.7/2.0' = 85%. 47.0-47.5': SILTSTONE: same as above. 47.5-47.7': SANDSTONE: light olive gray (5 Y 6/1); very fine-grained; silty; quartzose; rounded; friable; unconsolidated; dry.	
47			**TOTAL DEPTH = 48.0'**	
48				
49				
50				
51				
52				
53				

SDP2289G

STATE PLANE COORDINATE:		TOTAL DEPTH (FT): 30.2	GROUND ELEVATION (FT):	5962.63	PROJECT NUMBER:	SEP24-89BR	LOG OF BORING NUMBER:
NORTH:	750533	AREA: SOLAR POND	CASING DIAMETER (IN):	4.5 O.D.	GEOLOGIST:	KEM	P209689
EAST:	2085514	LOCATOR NUMBER: M10	BOREHOLE DIAMETER (IN):	7.25	DATE DRILLED:	05/03/89	

REMARKS: Hollow Stem Auger. Weston Log.

DRAFT

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			SM:	Silty Sand - light brown (5 YR 5/6). C.g. to f.g. quartzose sand, uncansol., well sorted. Trace gravel, sub-rounded, loose, non-plastic, damp.
				1.00 /2.20	5962	1			GC:	Clayey Gravel - mod. brown (5 YR 4/4). Gravel quartzite, sub-rounded, coarse to fine to 3 cm. Stiff, low plasticity. Trace c.g. to f.g. sand, (gc with sand), damp. 30% gravel.
					5961	2			NO SAMPLE:	NO SAMPLE
	SEP24BBR0006			0.60 /2.00	5960	3			GC:	Clayey Gravel - same as 0.4' to 1.0'. More gravel, grading to mod. brown (5 YR 3/4). Calcareous in lower portions (HCl reactive), (gc with sand).
					5959	4				
				1.40 /2.00	5958	5			GC:	Clayey Sandy Gravel - pale greenish yellow (10 Y 8/2), mottles of dark yellowish orange (10 YR 6/6). Coarse to fine gravel, broken, quartzite to 5 cm. High HCl reaction (calcareous), firm, non-plastic, damp.
					5957	6				
				1.20 /2.00	5956	7			SM:	Silty Gravelly Sand - grayish orange (10 YR 7/4). C.g. to f.g. sand, quartz, well sorted. Sub-rounded gravel, coarse to fine quartzite, sub-rounded. No effervescence (non-calcareous), (sc-sm). Wet at 8.0'.
					5955	8	05/03/89			
	SEP24BBR0612			0.70 /2.00	5954	9			SC:	Silty Clayey Sand - mod. yellow brown (10 YR 5/4). Trace gravel, coarse to fine grained, quartzose, sub-rounded. C.g. to f.g. quartzose sand, well sorted. Soft, low plasticity, (sc-sm), wet.
					5953	10				

STATE PLANE COORDINATE:		TOTAL DEPTH (FT): 30.2	GROUND ELEVATION (FT):	5962.63	PROJECT NUMBER:	SEP24-89BR	LOG OF BORING NUMBER:
NORTH:	750533	AREA: SOLAR POND	CASING DIAMETER (IN):	4.5 O.D.	GEOLOGIST:	KEM	P209689
EAST:	2085514	LOCATOR NUMBER: M10	BOREHOLE DIAMETER (IN):	7.25	DATE DRILLED:	05/03/89	

REMARKS: Hollow Stem Auger. Weston Log.

DRAFT

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
				2.20 /2.00	5952	10–11			CL:	Sandy Clay - mod. yellowish brown (10 YR 5/4), mottled light olive gray (5 Y 6/1). C.g. to f.g. quartzose sand, sub-rounded. Trace gravel. Stiff, low plasticity. Small amount carbonaceous, lignite, black (N 1/0). Calcareous nodules (HCl reactive), damp.
				2.20 /2.00	5951	11–12				
				2.20 /2.00	5950	12–13			SANDY CLAYSTONE:	Top of Bedrock. Sandy Silty Claystone - light brown (5 YR 6/4) to light olive gray (5 Y 6/1). C.g. to f.g. quartzose sand, lenses interbedded, well sorted. Highly calcareous cement, HCl reactive (calcareous), bluish white (5 B 9/1). Stiff to very stiff, low to high plastic, wet.
				2.20 /2.00	5949	13–14				
				2.00 /2.00	5948	14–15			SANDY CLAYSTONE:	Sandy Silty Claystone - same as above, wet.
	SEP24BBBR1218			2.00 /2.00	5947	15–16				
				2.00 /2.00	5946	16–17			SILTY CLAYSTONE:	Light olive gray (5 Y 6/1) to med. gray (N 5/0), mottles of dark yellowish orange (10 YR 6/6). Consol., very stiff to hard, low to high plasticity. Carbonaceous, lignite, black (N 1/0). Small amount calcareous nodules (HCl reactive). Trace c.g. to f.g. sand, quartz. Damp.
				2.20 /2.00	5945	17–18				
				2.20 /2.00	5944	18–19				
					5943	19–20				

STATE PLANE COORDINATE:		TOTAL DEPTH (FT): 30.2	GROUND ELEVATION (FT):	5962.63	PROJECT NUMBER:	SEP24-89BR	LOG OF BORING NUMBER:
NORTH:	750533	AREA: SOLAR POND	CASING DIAMETER (IN):	4.5 O.D.	GEOLOGIST:	KEM	P209689
EAST:	2085514	LOCATOR NUMBER: M10	BOREHOLE DIAMETER (IN):	7.25	DATE DRILLED:	05/03/89	

REMARKS: Hollow Stem Auger. Weston Log.

DRAFT

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
	SEP24BBR1824			2.20 /2.00	5942	20–21			SILTY CLAYSTONE	Light olive gray (5 Y 6/1) to med. gray (N 5/0). Trace c.g. to f.g. quartzose sand. Mottled, dark yellowish orange (10 YR 6/6). Very stiff to hard, low to high plasticity. Small amount of calcareous material, HCl reactive (calcareous). Damp.
				2.20 /2.00	5941	21–22				
					5940	22–23				
					5939	23–24				
				2.00 /2.00	5938	24–25	09/21/89		SILTY CLAYSTONE	Same as above - more calcareous material, hard, very reactive HCl, damp.
					5937	25–26				
				2.00 /2.00	5936	26–27			SILTY CLAYSTONE	Same as above - grading to med. dark gray (N 4/0), dry.
					5935	27–28				
				0.00 /2.00	5934	28–29			NO SAMPLE	NO SAMPLE.
					5933	29–30				

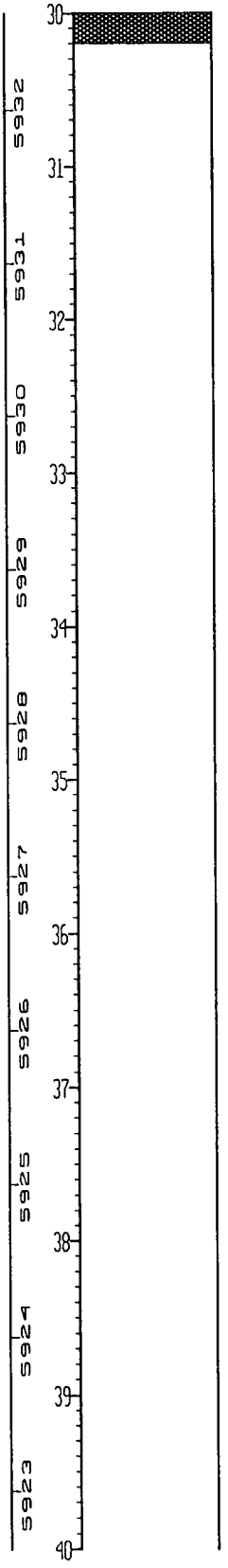
STATE PLANE COORDINATE:	TOTAL DEPTH (FT): 30.2	GROUND ELEVATION (FT):	5962.63	PROJECT NUMBER:	SEP24-89BR
NORTH: 750533	AREA: SOLAR POND	CASING DIAMETER (IN):	4.5 O.D.	GEOLOGIST:	KEM
EAST: 2085514	LOCATOR NUMBER: M10	BOREHOLE DIAMETER (IN):	7.25	DATE DRILLED:	05/03/89

REMARKS: Hollow Stem Auger. Weston Log.

LOG OF BORING NUMBER: P209689

DRAFT

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



TD = 30.2'

SEP2489BR

WELL COMPLETION INFORMATION

QA By/Date Jarell Bugman 15-8-89

Location Rocky Flats Plant; Solar Ponds Area

Well No. P209689

Coordinates N 37546.03 E 22409.68 (RFP)

Elevation: Ground Surface 5962.63'

Total Depth: Well 27.93'

Top of Casing 5964.43'

Borehole 30.2'

Formation of Completion Weathered Claystone

Casing Material Schedule 40 PVC

Casing Diameter 4 1/2" O.D.

Screen Material Schedule 40 10-slotted PVC

Surface Casing Diameter 3 5/8" O.D.

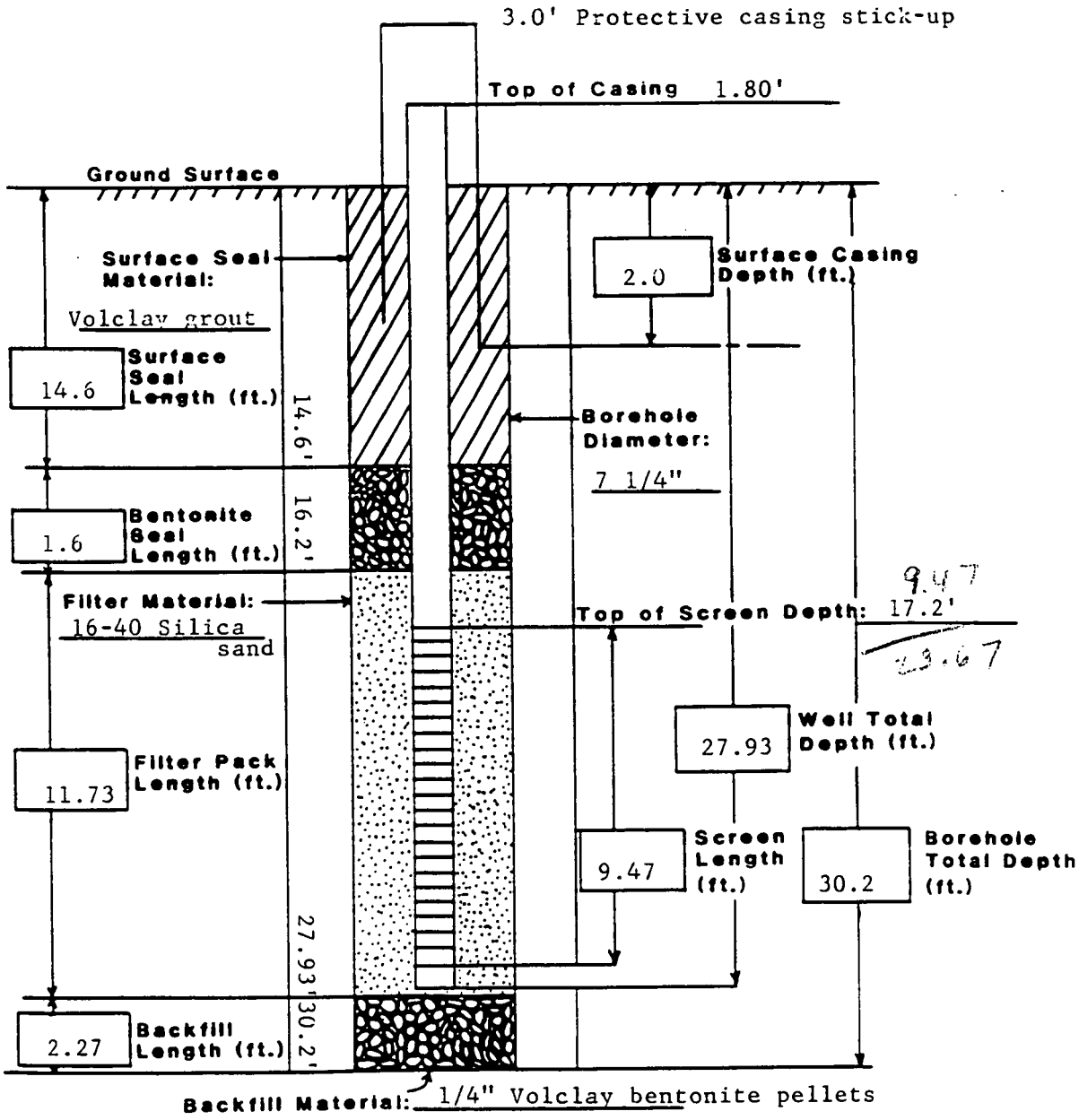
Date Installed 05/03/1989

Approved By Jarell Bugman
Site Manager

Installed By K.E. Miller
Geologist

CEARP Manager

Comments Set stainless steel centralizer from 26.33' to 27.53' below ground surface.



LOG OF BOREHOLE

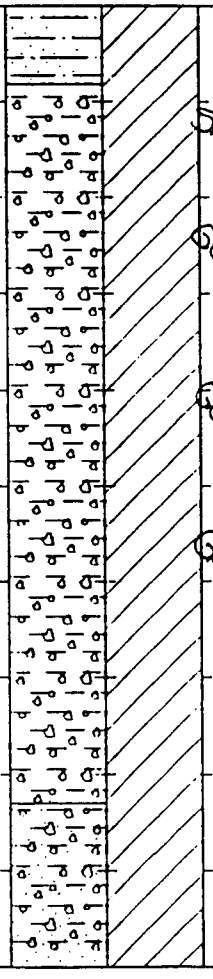
QA BY/DATE J.B. Burman 11-29-89
LOCATION Rocky Flats Plant; Solar Ponds Area
COORDINATES N37,591.03 E22,390.35 (RFP)
TOTAL DEPTH 30.2'

DRILLING COMPANY Boyles Brothers
DATE DRILLED May 3, 1989
DRILLING METHOD Hollow Stem Auger
LOGGED BY K.E. Miller
GEOLOGIST

BOREHOLE/WELL NO. P209689
GROUND SURFACE ELEVATION 5962.63'
WATER LEVEL ENCOUNTERED 8.0'
STATIC 24.67' (09/21/89)
DRILLER R. Sharp HELPER P. Mesa
DRILLING FLUID None
CHECKED BY J.B. Burman
SITE MANAGER

CEARP MANAGER

COMMENTS

DEPTH (FT)	GRAPHIC LOG	SAMPLE TYPE	LITHOLOGIC DESCRIPTION	SAMPLES COLLECTED OR OTHER TESTS PERFORMED
0 1 2 3 4 5			**ROCKY FLATS ALLUVIUM** 0.0-2.2' SAMPLE. Recovered 1.0/2.2' = 45%. 0.0-0.4': SILTY SAND: light brown (5 YR 5/6); coarse to fine-grained quartzose sand; unconsolidated; well sorted; trace gravel; subrounded; loose; non-plastic; ~~(sm)~~; damp. SM 0.4-1.0': CLAYEY GRAVEL: moderate brown (5 YR 4/4); (30%) gravel; quartzite; subrounded; coarse to fine to 3 cm; stiff; low plasticity; trace coarse to fine-grained sand; (gc with sand); damp. GC up case 2.2-4.2' SAMPLE. Recovered 0.6/2.0' = 30%. CLAYEY GRAVEL: same as 0.4 to 1.0'; more gravel; grading to moderate brown (5 YR 3/4); calcareous in lower portions (HCl reactive); (gc with sand). GC up case 4.2-6.2' SAMPLE. Recovered 1.4/2.0' = 70%. CLAYEY SANDY GRAVEL: pale greenish yellow (10 Y 8/2); mottles of dark yellowish orange (10 YR 6/6); coarse to fine-grained gravel; broken; quartzite to 5 cm; high HCl reaction (calcareous); firm; non-plastic; ~~(gc)~~; damp. GC	HNu Background: 0.0 OVA Background: 0.0 All readings on cuttings, in breathing zone, on core and in augers: 0.0; unless otherwise noted below. TRIP BLANK SAMPLE TB050389 0.0-5.6' SAMPLE SEP2489BR0006 0.0-1.0' SAMPLE (VOAs only) SEP2489BR0002 2.2': Reading in Auger: OVA: 1.0 4.2-5.6' SAMPLE (VOAs only) SEP2489BR0406 4.2': Readings in Auger: HNu: 0.2 OVA: 8.0

SEP2489A

WELL NO. P209689

LOG OF BOREHOLE

DEPTH (FT)	GRAPHIC LOG	SAMPLE TYPE	LITHOLOGIC DESCRIPTION	SAMPLES COLLECTED OR OTHER TESTS PERFORMED
5 6 7 8 9 10 11 12 13			**6.2-8.2' SAMPLE.** Recovered 1.2/2.0' = 60%. SILTY GRAVELLY SAND: grayish orange (10 YR 7/4); coarse to fine-grained sand; quartz; well sorted; subrounded gravel; coarse to fine quartzite; subrounded; no effervescence; (sc-sm); wet at 8.0'. caps non-calcareous **8.2-10.2' SAMPLE.** Recovered 0.7/2.0' = 35%. SILTY CLAYEY SAND: moderate yellow brown (10 YR 5/4); trace gravel; coarse to fine-grained; quartzose; subrounded; coarse to fine-grained quartzose sand; well sorted; soft; low plasticity; (sc-sm); wet. caps **10.2-12.2' SAMPLE.** Recovered 2.2/2.0' = 110%. SANDY CLAY: moderate yellowish brown (10 YR 5/4); mottled light olive gray (5 Y 6/1); coarse to fine-grained quartzose sand; subrounded; trace gravel; stiff; low plasticity; small amount carbonaceous--lignite black (N 1/0); calcareous nodules; HCl reactive; ~~(cl)~~; damp. **ARAPAHOE/LARAMIE FORMATION** **12.2-14.2' SAMPLE.** Recovered 2.2/2.0' = 110%. SANDY SILTY CLAYSTONE: light brown (5 YR 6/4) to light olive gray (5 Y 6/1); coarse to fine-grained quartzose sand; lenses interbedded; well sorted; highly calcareous cement; HCl reactive; bluish white (5 B 9/1); stiff to very stiff; low to high plastic; wet.	**6.2-12.2' SAMPLE** SEP2489BR0612 **8.2-8.9' SAMPLE** (VOAs only) SEP2489BR0810 8.0' **12.2-18.2' SAMPLE** SEP2489BR1218 **12.2-14.2' SAMPLE** (VOAs only) SEP2489BR1214

SEP2489B

WELL NO. P209689

LOG OF BOREHOLE

DEPTH (FT)	GRAPHIC LOG	SAMPLE TYPE	LITHOLOGIC DESCRIPTION	SAMPLES COLLECTED OR OTHER TESTS PERFORMED
13			**14.2-16.2' SAMPLE.** Recovered 2.0/2.0' = 100%. SANDY SILTY CLAYSTONE: same as above; wet.	
14			**16.2-18.2' SAMPLE.** Recovered 2.0/2.0' = 100%. SILTY CLAYSTONE: light olive gray (5 Y 6/1) to medium gray (N 5/0); mottles of dark yellowish orange (10 YR 6/6); consolidated; very stiff to hard; low to high plasticity; carbonaceous--lignite black (N 1/0); small amount calcareous nodules; HCl reactive; trace coarse to fine-grained sand; quartz; damp.	16.2-18.2' SAMPLE (VOAs only) SEP2489BR1618
15			**18.2-20.2' SAMPLE.** Recovered 2.2/2.0' = 110%. SILTY CLAYSTONE: same as above.	18.2-24.2' SAMPLE SEP2489BR1824 18.0-24.0' FIELD BLANK (VOAs only) SEP2489BR1824FB
16			**20.2-22.2' SAMPLE.** Recovered 2.2/2.0' = 110%. SILTY CLAYSTONE: light olive gray (5 Y 6/1); to medium gray (N 5/0); trace coarse to fine-grained quartzose sand; mottled; dark yellowish orange (10 YR 6/6); very stiff to hard; low to high plasticity; small amount of calcareous material; HCl reactive; damp.	20.2-22.2' SAMPLE (VOAs only) SEP2489BR2022
17				
18				
19				
20				
21				

WELL NO. P209689

LOG OF BOREHOLE

DEPTH (FT)	GRAPHIC LOG	SAMPLE TYPE	LITHOLOGIC DESCRIPTION	SAMPLES COLLECTED OR OTHER TESTS PERFORMED
21			**22.2-24.2' SAMPLE.** Recovered 2.2/2.0' = 110%. SILTY CLAYSTONE: same as above.	
22			**24.2-26.2' SAMPLE.** Recovered 2.0/2.0' = 100%. SILTY CLAYSTONE: same as above; more calcareous material; hard; very reactive HCl; damp.	24.2-26.2' SAMPLE (VOAs only) SEP2489BR2426
23			**26.2-28.2' SAMPLE.** Recovered 2.0/2.0' = 100%. SILTY CLAYSTONE: same as above; grading to medium dark gray (N 4/0); dry. **28.2-30.2' SAMPLE.** Recovered 0.0/2.0' = 0%. Note: No sample due to mislatch.	
24				
25				24.67'
26				
27				
28				
29				

SEP2489D

WELL NO. P209689

LOG OF BOREHOLE

DEPTH (FT)	GRAPHIC LOG	SAMPLE TYPE	LITHOLOGIC DESCRIPTION	SAMPLES COLLECTED OR OTHER TESTS PERFORMED
29				
			TOTAL DEPTH = 30.2'	
30				
31				
32				
33				
34				
35				
36				
37				

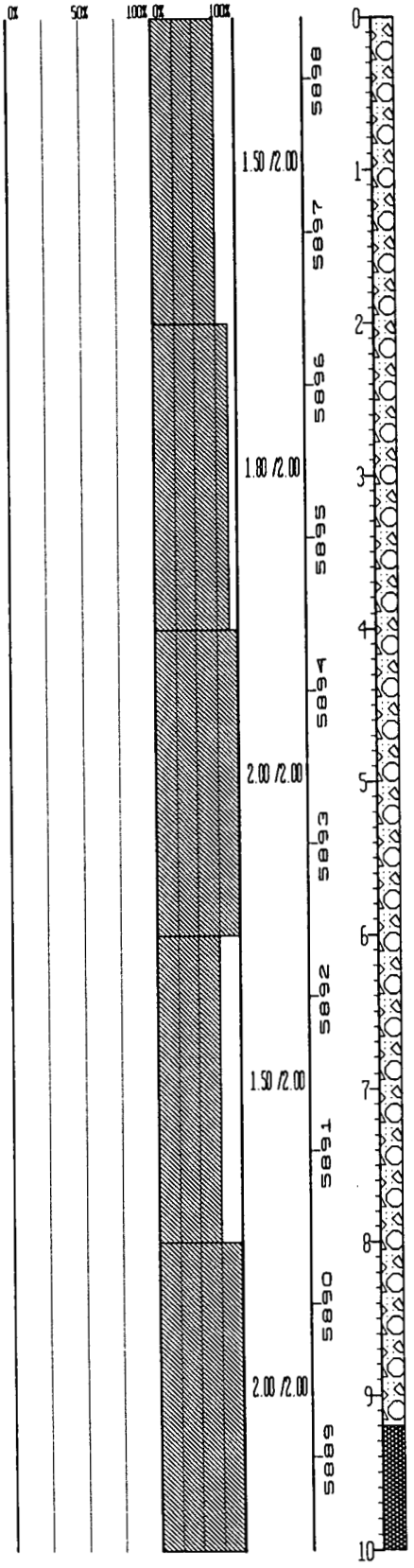
SEP2489E

STATE PLANE COORDINATE:		TOTAL DEPTH (FT): 28.0	GROUND ELEVATION (FT):	5898.40	PROJECT NUMBER:	SEP29-898R	LOG OF BORING NUMBER:
NORTH:	751564	AREA: SOLAR POND	CASING DIAMETER (IN):	4.5 O.D.	GEOLOGIST:	KEM/BJP	P210089
EAST:	2084639	LOCATOR NUMBER: L11	BOREHOLE DIAMETER (IN):	7.25	DATE DRILLED:	04/25/89	

REMARKS: Hollow Stem Auger. Surface casing set April 25, 1989 at 23.0' and cemented April 25, 1989 by K. E. Miller. Weston Log.

DRAFT

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
CL:	Silty Clay - dark yellowish brown (10 YR 4/2).
CL:	Silty Clay - mod. yellowish brown (10 YR 5/4) to mod. yellow (5 Y 7/6). Trace gravel, firm, low plasticity, damp.
CL:	Silty Clay - mod. yellowish brown (10 YR 5/4) to dark yellowish orange (10 YR 4/6). Trace gravel. C.g. to f.g. sand. Iron staining, stiff, low plasticity, damp.
CL:	Silty Clay - same as above. Some gravel, 4 cm. to 5 cm., rounded to sub-rounded. Stiff, low plasticity, damp. 20% gravel.
CL:	Silty Clay - mod. yellowish brown (5 Y 5/6). Dusky yellow (5 Y 6/4) to dark yellowish orange (10 YR 6/6). Trace gravel, rounded to sub-angular (2" cm.). Stiff, low plasticity, damp.
SILTY CLAYSTONE:	Top of Bedrock. Light olive brown (5 Y 5/6). Stiff, low plasticity, damp.
SILTY CLAYSTONE:	Light olive brown (5 Y 5/6) to dark yellowish orange (10 YR 6/6). Calcareous nodules, slight HCl reaction, stiff, low plasticity, damp.

STATE PLANE COORDINATE:		TOTAL DEPTH (FT): 28.0	GROUND ELEVATION (FT):	5898.40	PROJECT NUMBER:	SEP29-898R	LOG OF BORING NUMBER:
NORTH:	751564	AREA: SOLAR POND	CASING DIAMETER (IN):	4.5 O.D.	GEOLOGIST:	KEM/BJP	P210089
EAST:	2084639	LOCATOR NUMBER: L11	BOREHOLE DIAMETER (IN):	7.25	DATE DRILLED:	04/25/89	

REMARKS: Hollow Stem Auger. Surface casing set April 25, 1989 at 23.0' and cemented April 25, 1989 by K. E. Miller. Weston Log.

DRAFT

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
				2.00 /2.00	5888	10–11				SILTY CLAYSTONE: Light olive gray (5 Y 5/2) to dark yellowish orange (10 YR 6/6). Stiff to very stiff, low plasticity, damp.
				2.00 /2.00	5887	11–12				
				2.00 /2.00	5886	12–13				SILTY CLAYSTONE: Olive gray (5 Y 4/1) to olive black (5 Y 2/1). Fractured, calcareous nodules, iron staining. Stiff to very stiff, low plasticity, damp.
				2.00 /2.00	5885	13–14				
				2.20 /2.00	5884	14–15				SILTY CLAYSTONE: Dark yellowish brown (10 YR 4/2) to light brownish gray (5 YR 6/1). Fractured, iron staining. Stiff, low to no plasticity, damp.
				2.20 /2.00	5883	15–16				
				2.20 /2.00	5882	16–17	09/05/89			SILTY CLAYSTONE: Mod. olive brown (5 Y 4/4) to olive gray (5 Y 4/1). Fractured, iron staining. Stiff to low plasticity, damp.
				2.20 /2.00	5881	17–18				
				1.40 /2.00	5880	18–19				
					5879	19–20				CLAYEY SILTSTONE: Mod. brown (5 YR 3/4) to dark yellowish brown (10 YR 6/6). Hard, friable, no plasticity, slightly damp.
										NO SAMPLE: NO SAMPLE

STATE PLANE COORDINATE:		TOTAL DEPTH (FT): 28.0	GROUND ELEVATION (FT):	5898.40	PROJECT NUMBER:	SEP29-89BR	LOG OF BORING NUMBER:
NORTH:	751564	AREA: SOLAR POND	CASING DIAMETER (IN):	4.5 O.D.	GEOLOGIST:	KEM/BJP	P210089
EAST:	2084639	LOCATOR NUMBER: L11	BOREHOLE DIAMETER (IN):	7.25	DATE DRILLED:	04/25/89	

REMARKS: Hollow Stem Auger. Surface casing set April 25, 1989 at 23.0' and cemented April 25, 1989 by K. E. Miller. Weston Log.

DRAFT

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
				0.00 /2.00	5878	20–21				
				0.00 /0.50	5877	21–22				
				1.50 /1.50	5876	22–23				NO SAMPLE: Drilled with center bit. No sample recovery.
				2.20 /2.00	5875	23–24				SILTY CLAYSTONE: Dark yellowish brown (10 YR 4/2). Iron staining, hard, low plasticity, dry.
				2.20 /2.00	5874	24–25				SILTY CLAYSTONE: Dark yellowish brown (10 YR 4/2) to light brown (5 YR 5/6) to olive black (5 Y 2/1). Calcareous material, slight HCl reaction. Trace c.g. to f.g. sand. Very stiff, low plasticity, slightly damp.
					5873	25–26				
					5872	26–27				SILTY CLAYSTONE: Same as above - olive black (5 Y 2/1). Trace c.g. to f.g. sand. Hard, low plasticity, strong HCl reaction (calcareous), dry.
					5871	27–28				
					5870	28–29				
					5869	29–30				

SEP2989 BR

2084639 LOTUS ✓
751563 WP ✓
LH SP

WELL COMPLETION INFORMATION

QA By/Date Jarell Burman 1-4-28-89

Location Rocky Flats Plant; Solar Ponds Area **Well No.** P210089

Coordinates N 38579.31 E 21538.57 (RFP) **Elevation: Ground Surface** 5898.4'

Total Depth: Well 22.93' **Top of Casing** 5900.40'

Borehole 28.0'

Formation of Completion Weathered Claystone

Casing Material Schedule 40 PVC **Casing Diameter** 4 1/2" O.D.

Screen Material Schedule 40 10-slotted PVC **Surface Casing Diameter** 8 5/8" O.D.

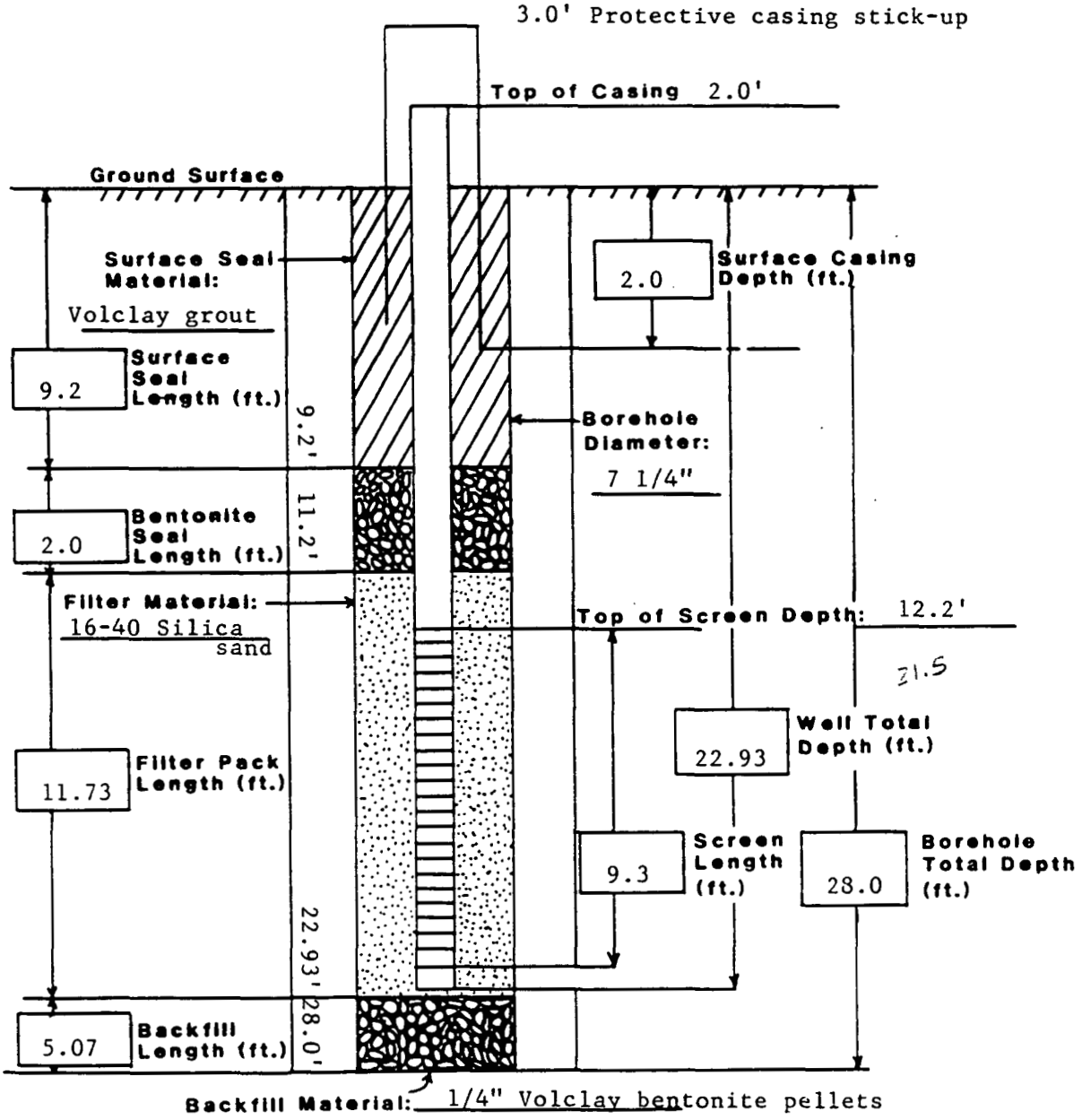
Date Installed 04/25/1989 **Approved By** Jarell Burman

Installed By K.E. Miller **Site Manager**

Geologist

CEARP Manager

Comments Set stainless steel centralizer from 21.53' to 22.78' below ground surface



LOG OF BOREHOLE

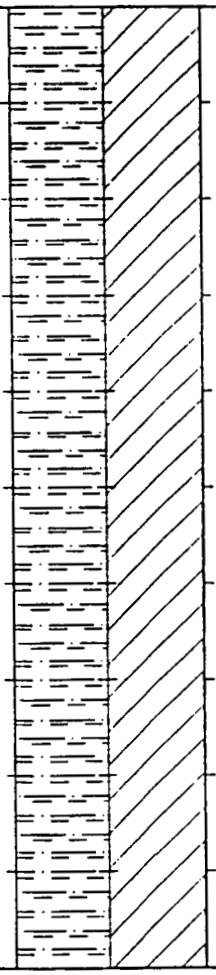
QA BY/DATE J.B. Beyman 11-29-89
LOCATION Rocky Flats Plant; Solar Ponds Area
COORDINATES N38,579.31 E21,538.57 (RFP)
TOTAL DEPTH 28.0'

DRILLING COMPANY Boyles Brothers
DATE DRILLED April 25, 1989
DRILLING METHOD Hollow Stem Auger
LOGGED BY B.J. Pribyl; K.E. Miller
GEOLOGIST

BOREHOLE/WELL NO. P210089
GROUND SURFACE ELEVATION 5898.4'
WATER LEVEL ENCOUNTERED None
STATIC 16.38' (09/05/89)
DRILLER R. Sharp HELPER P. Mesa
DRILLING FLUID None
CHECKED BY J.B. Beyman
SITE MANAGER

CEARP MANAGER

COMMENTS Surface casing set April 25, 1989 at 23.0' and cemented April 25, 1989 by K.E. Miller.

DEPTH (FT)	GRAPHIC LOG	SAMPLE TYPE	LITHOLOGIC DESCRIPTION	SAMPLES COLLECTED OR OTHER TESTS PERFORMED
0 1 2 3 4 5			**TOPSOIL** 0.0-2.0' SAMPLE. Recovered 1.5/2.0' = 75%. 0.0-0.4': SILTY CLAY: dark yellowish brown (10 YR 4/2). **COLLUVIUM** 0.4-1.5': SILTY CLAY: moderate yellowish brown (10 YR 5/4) to moderate yellow (5 Y 7/6); trace gravel; firm; low plasticity; (cl); damp. 2.0-4.0' SAMPLE. Recovered 1.8/2.0' = 90%. SILTY CLAY: moderate yellowish brown (10 YR 5/4) to dark yellowish orange (10 YR 4/6); trace gravel; coarse to fine-grained sand; iron staining; stiff; low plasticity; (cl); damp. 4.0-6.0' SAMPLE. Recovered 2.0/2.0' = 100%. SILTY CLAY: same as above; some gravel (20%); 4 to 5 cm--rounded to subrounded; stiff; low plasticity; (cl); damp.	HNu Background: 0.0 OVA Background: 0.0 All readings on cuttings, on core, in breathing zone and in augers: 0.0.

SEP2989A

WELL NO. P210089

LOG OF BOREHOLE

DEPTH (FT)	GRAPHIC LOG	SAMPLE TYPE	LITHOLOGIC DESCRIPTION	SAMPLES COLLECTED OR OTHER TESTS PERFORMED
5 6 7 8 9 10 11 12 13			**6.0-8.0' SAMPLE.** DV Recovered 1.5/2.0' = 75%. 6.0-7.2': SILTY CLAY: moderate yellowish brown (5 Y 5/6); dusky yellow (5 Y 6/4) to dark yellowish orange (10 YR 6/6); trace gravel; rounded to subangular (2 cm); stiff; low plasticity; (cl); damp. **ARAPAHOE/LARAMIE FORMATION** Top of Bedrock 7.2-8.0': SILTY CLAYSTONE: light olive brown (5 Y 5/6); stiff; low plasticity; (cl); damp. **8.0-10.0' SAMPLE.** Recovered 2.0/2.0' = 100%. SILTY CLAYSTONE: light olive brown (5 Y 5/6) to dark yellowish orange (10 YR 6/6); calcareous nodules; slight HCl reaction; stiff; low plasticity; damp. **10.0-12.0' SAMPLE.** Recovered 2.0/2.0' = 100%. SILTY CLAYSTONE: light olive gray (5 Y 5/2) to dark yellowish orange (10 YR 6/6); stiff to very stiff; low plasticity; damp. **12.0-14.0' SAMPLE.** Recovered 2.0/2.0' = 100%. SILTY CLAYSTONE: olive gray (5 Y 4/1) to olive black (5 Y 2/1); fractured; calcareous nodules; iron staining; stiff to very stiff; low plasticity; damp.	

SEP29898

WELL NO. P210089

LOG OF BOREHOLE

DEPTH (FT)	GRAPHIC LOG	SAMPLE TYPE	LITHOLOGIC DESCRIPTION	SAMPLES COLLECTED OR OTHER TESTS PERFORMED
13			14.0-16.0' SAMPLE. Recovered 2.2/2.0' = 110%. SILTY CLAYSTONE: dark yellowish brown (10 YR 4/2) to light brownish gray (5 YR 6/1); fractured; iron staining; stiff; low to no plasticity; damp.	
14			16.0-18.0' SAMPLE. Recovered 2.2/2.0' = 110%. SILTY CLAYSTONE: moderate olive brown (5 Y 4/4) to olive gray (5 Y 4/1); fractured; iron staining; stiff; low plasticity; damp.	
15			18.0-20.0' SAMPLE. Recovered 1.4/2.0' = 70%. 18.0-19.0': SILTY CLAYSTONE: same as above. 19.0-19.4': CLAYEY SILTSTONE: moderate brown (5 YR 3/4) to dark yellowish brown (10 YR 6/6); hard; friable; no plasticity; slightly damp.	
16			20.0-22.0' SAMPLE. Recovered 0.0/2.0' = 0%.	▼ 16.38'
17				
18				
19				
20				
21				

SEP2989C

WELL NO. P210089

LOG OF BOREHOLE

DEPTH (FT)	GRAPHIC LOG	SAMPLE TYPE	LITHOLOGIC DESCRIPTION	SAMPLES COLLECTED OR OTHER TESTS PERFORMED
21			Note: 22.0-22.5': Drilled with center bit. No sample recovery.	
			22.5-24.0' SAMPLE. Recovered 1.5/1.5' = 100%. SILTY CLAYSTONE: dark yellowish brown (10 YR 4/2); iron staining; hard; low plasticity; dry.	
22				
			24.0-26.0' SAMPLE. Recovered 2.2/2.0' = 110%. SILTY CLAYSTONE: dark yellowish brown (10 YR 4/2) to light brown (5 YR 5/6) to olive black (5 Y 2/1); calcareous material; slight HCl reaction; trace coarse to fine-grained sand; very stiff; low plasticity; slightly damp.	
23				
			26.0-28.0' SAMPLE. Recovered 2.2/2.0' = 110%. SILTY CLAYSTONE: same as above; olive black (5 Y 2/1); trace coarse to fine-grained sand; hard; low plasticity; strong HCl reaction; dry.	
24			TOTAL DEPTH = 28.0'	
25				
26				
27				
28				
29				

SEP29890

SEP3089BR

WELL COMPLETION INFORMATION

QA By/Date Farell Burman 15-24-89

Location Rocky Flats Plant: Solar Ponds Area **Well No.** P210189

Coordinates N 37757.66 E 21307.33 (RFP) **Elevation: Ground Surface** 5980.32'

Total Depth: Well 37.13' **Top of Casing** 5982.48'

Borehole 38.6'

Formation of Completion Weathered Sandstone

Casing Material Schedule 40 PVC **Casing Diameter** 4 1/2" O.D.

Screen Material Schedule 40 10-slotted PVC **Surface Casing Diameter** 8 5/8" O.D.

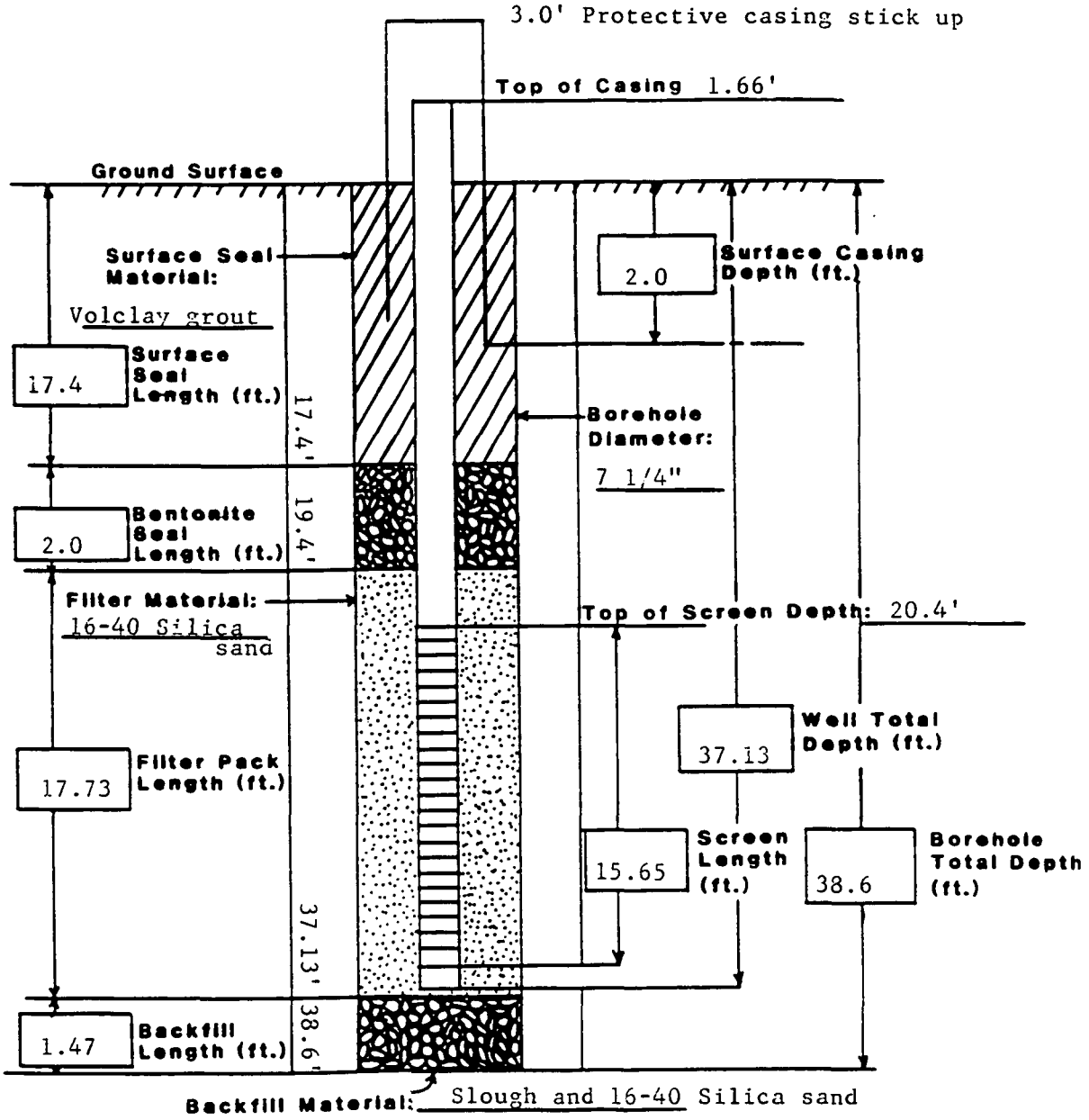
Date Installed 05/23/1989 **Approved By** Farell Burman

Installed By K.E. Miller
Geologist

Site Manager

CEARP Manager

Comments Set stainless steel centralizer from 35.49' to 36.7' below ground surface.



WELL NO. P210189

LOG OF BOREHOLE

DEPTH (FT)	GRAPHIC LOG	SAMPLE TYPE	LITHOLOGIC DESCRIPTION	SAMPLES COLLECTED OR OTHER TESTS PERFORMED
13			**ARAPAHOE/LARAMIE FORMATION** Top of Bedrock **14.6-16.6' SAMPLE.** Recovered 2.0/2.0' = 100%. CLAYEY SANDY SILTSTONE: dusky yellow (5 Y 6/4); yellowish gray (5 Y 7/2); mottled; abundant iron-stain; weathered; interbedded; very sandy and clayey in part; very fine-grained sand; well sorted; mostly quartz; consolidated yet friable; wet.	14.6-20.6' SAMPLE SEP3089BR1521
14			**16.6-18.6' SAMPLE.** Recovered 2.2/2.0' = 110%. SANDY SILTY CLAYSTONE: dark yellowish orange (10 YR 6/6); some yellowish gray (5 Y 7/2); mottled; abundant iron-stain and organic stain--black (N 1/0); very fine-grained sand; well sorted; quartzose; more sandy from 17.8-18.6'; moderate plasticity; consolidated; moderately hard; moist.	14.6'
15			**18.6-20.6' SAMPLE.** Recovered 2.2/2.0' = 110%. SANDY SILTY CLAYSTONE: same as above; more interbedded; very weathered and iron-stained; trace lignite pieces; moist.	16.6-18.6' SAMPLE (VOAs only) SEP3089BR1618
16			**20.6-22.6' SAMPLE.** Recovered 2.2/2.0' = 110%. 20.6-21.4': SILTY SANDSTONE: dark yellowish orange (10 YR 6/6) and yellowish gray (5 Y 7/2); mottled; iron-stained; weathered; very fine-grained sand; well sorted; consolidated yet friable; wet. 21.4-22.1': CLAYSTONE: pale yellowish brown (10 YR 4/2); moderate plasticity; moderately hard; wet. 22.1-22.6': SILTY SANDSTONE: same as 20.6-21.4'; interbedded throughout.	20.6-22.6' SAMPLE (VOAs only) SEP3089BR2022 20.6-26.6' SAMPLE SEP3089BR2127
17				
18				
19				
20				
21				

LOG OF BOREHOLE

QA BY/DATE J.B. Burman 11-29-89
LOCATION Rocky Flats Plant: Solar Ponds Area
COORDINATES N37,767.66 E21,307.33 (RFP)
TOTAL DEPTH 38.6'

DRILLING COMPANY Boyles Brothers
DATE DRILLED May 19, 1989
DRILLING METHOD Hollow Stem Auger
LOGGED BY J.E. Marks
GEOLOGIST

BOREHOLE/WELL NO. P210189
GROUND SURFACE ELEVATION 5980.82'
WATER LEVEL ENCOUNTERED 14.6'
STATIC 9.91' (09/28/89)
DRILLER R. Sharp HELPER R. Orr
DRILLING FLUID None
CHECKED BY J.B. Burman
SITE MANAGER

CEARP MANAGER

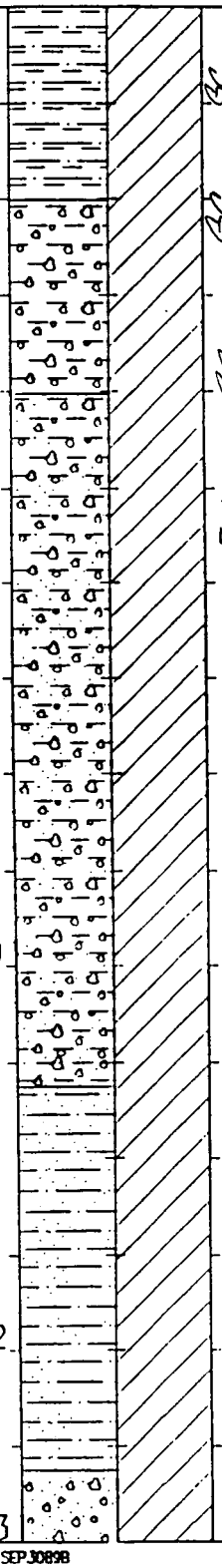
COMMENTS

DEPTH (FT)	GRAPHIC LOG	SAMPLE TYPE	LITHOLOGIC DESCRIPTION	SAMPLES COLLECTED OR OTHER TESTS PERFORMED
0			**TOPSOIL** 0.0-2.3' SAMPLE. Recovered 0.3/2.3' = 39%. SANDY CLAYEY SILT: moderate yellowish brown (10 YR 5/4); coarse to fine-grained sand; unsorted; subangular; 10% gravel--fine-grained pebble; abundant vegetation--roots; semiconsolidated; stiff; (ml); dry to slightly moist. (ML) **ROCKY FLATS ALLUVIUM** 2.3-4.6' SAMPLE. Recovered 2.3/2.3' = 100%. 2.3-4.0': SILTY CLAY: moderate yellowish brown (10 YR 5/4); 10% gravel up to 3 cm; angular; moderate plasticity; consolidated; soft; moist to dry. (CL) 4.0-4.6': SILTY CLAY: dark yellowish brown (10 YR 4/2); 15% gravel up to 4 cm; angular; granite; moderately plastic; consolidated; (cl); moist to wet. (CL) 4.6-6.6' SAMPLE. Recovered 2.0/2.0' = 100%. 4.6-6.0': SILTY CLAY: moderate reddish brown (10 R 4/6); iron-stained; 15% gravel up to 3 cm; angular; quartzite and granite; 10% sand in part; coarse-grained; unsorted; consolidated; moderately stiff; (cl); moist to dry. (CL) 6.0-6.6': CLAYEY GRAVEL: moderate yellowish brown (10 YR 5/4); gravel up to 3 cm; angular; mostly quartzite; (15%) very fine-grained sand; caliche in part; (gc); moist to dry. (GC)	All readings on cuttings, in breathing zone, on core, and in augers: 0.0; unless otherwise noted below. TRIP BLANK SAMPLE TB051989A 0.0-2.3' SAMPLE (VOAs only) SEP3089BR0002 0.0-3.0' SAMPLE SEP30890003 3.0-9.0' SAMPLE SEP3089BR0309 4.6-6.6' SAMPLE (VOAs only) SEP3089BR0406
1				
2				
3				
4				
5				

SEP3089A

WELL NO. P210189

LOG OF BOREHOLE

DEPTH (FT)	GRAPHIC LOG	SAMPLE TYPE	LITHOLOGIC DESCRIPTION	SAMPLES COLLECTED OR OTHER TESTS PERFORMED
5 6 7 8 9 10 11 12 13			**6.6-8.6' SAMPLE.** Recovered 2.0/2.0' = 100%. 6.6-7.0': CLAYEY GRAVEL: moderate brown (5 YR 4/4). 7.0-8.6': SANDY CLAYEY GRAVEL: pale yellowish brown (10 YR 6/2) to very pale orange (10 YR 8/2); mottled; some moderate olive brown (5 Y 4/4); gravel up to 4 cm; angular; mostly quartzite; coarse to fine-grained sand; unsorted; angular; caliche in part; semiconsolidated; (gc); dry to moist. **8.6-10.6' SAMPLE.** Recovered 0.8/2.0' = 40%. SANDY CLAYEY GRAVEL: same as above; gravel up to 6 cm; semiconsolidated to unconsolidated; (sm); dry. **10.6-12.6' SAMPLE.** Recovered 2.0/2.0' = 100%. SILTY SAND: dusky yellow (5 Y 6/4); coarse to fine-grained sand; unsorted; subangular; mostly quartz; 10% fine gravel; 10% clay in part; no to low plasticity; semiconsolidated to unconsolidated; loose to firm; moist to slightly wet. **12.6-14.6' SAMPLE.** Recovered 1.0/2.0' = 50%. GRAVELLY SAND: dusky yellow (5 Y 6/4); coarse to fine-grained sand; unsorted; 15% silt; unconsolidated; (sw); mostly dry.	**6.6'**: Reading in Auger: OVA: 110 **8.6-9.4'** SAMPLE (VOAs only) SEP3089BR0810 **9.0-14.6'** SAMPLE SEP3089BR0915 **12.6-13.6'** SAMPLE (VOAs only) SEP3089BR1214 ▼ 9.91'

SEP3089B

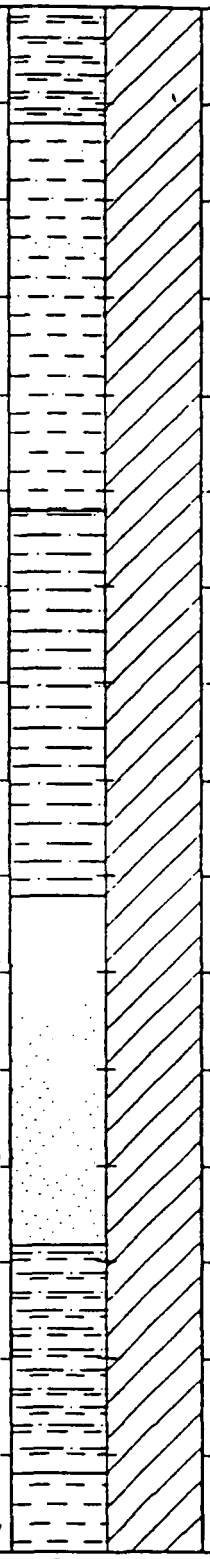
WELL NO. P210189

LOG OF BOREHOLE

DEPTH (FT)	GRAPHIC LOG	SAMPLE TYPE	LITHOLOGIC DESCRIPTION	SAMPLES COLLECTED OR OTHER TESTS PERFORMED
21			22.6-24.6' SAMPLE. Recovered 2.2/2.0' = 110%. CLAYSTONE AND SANDSTONE: light brown (5 YR 5/6) to light olive gray (5 Y 6/1); mottled; weathered; interbedded; very fine-grained sandstone (4.0-3.5 phi); well sorted; quartzose; tight; clay; moderate plasticity; trace organic staining--black (N 1/0); consolidated; moderately hard; wet.	
22			24.6-26.6' SAMPLE. Recovered 2.3/2.0' = 115%. 24.6-25.9': SILTY CLAYSTONE: dark yellowish orange (10 YR 6/6) to yellowish gray (5 Y 7/2); mottled; abundant iron-stains; vertical iron-stained fracture between 24.6-25.0'; moderate brown (5 Y 4/4); moderately hard; moist. 25.9-26.6': SILTY SANDSTONE: yellowish gray (5 Y 3/2); very fine-grained sand (4.0-3.5 phi); well sorted; quartzose; some interbedded clay; some iron-stains--dark yellowish orange (10 YR 6/6); tight; moderately hard yet friable; moist.	24.6-26.6' SAMPLE (VOAs only) SEP3089BR2426
23				
24			26.6-27.6' SAMPLE. Recovered 1.7/1.0' = 170%. Note: Abundant slough in the core barrel. CLAYEY SANDSTONE: light gray (N 7/0) to dark yellowish orange (10 YR 6/6); mottled; interbedded; very fine-grained sand (4.0-3.5 phi); well sorted; mostly quartz; very tight; some parts very clayey; moderate plasticity; consolidated; moderately soft; wet.	
25			27.6-28.6' SAMPLE. Recovered 0.9/1.0' = 90%. SILTY SANDSTONE: same as above; less clay; more sand and silt; low to no plasticity; friable.	
26			28.6-29.6' SAMPLE. Recovered 1.1/1.0' = 110%. SANDY CLAYSTONE AND SILTY SANDSTONE: dusky yellow (5 Y 6/4) to yellowish gray (5 Y 7/2); more clayey toward top; very fine-grained sand (4.0-3.5 phi); mostly quartz; tight; interbedded with silt; consolidated; moderately soft; wet to moist.	
27				
28				
29				

WELL NO. P210189

LOG OF BOREHOLE

DEPTH (FT)	GRAPHIC LOG	SAMPLE TYPE	LITHOLOGIC DESCRIPTION	SAMPLES COLLECTED OR OTHER TESTS PERFORMED
29			29.6-30.6' SAMPLE. Recovered 1.1/1.0' = 110%. SANDY CLAYSTONE: dusky yellow (5 Y 6/4) to light gray (N 7/0); very sandy in places; very fine-grained; moderate to low plasticity; consolidated; moderately soft; wet. 30.6-31.6' SAMPLE. Recovered 1.3/1.0' = 130%. SANDY CLAYSTONE: same as above; moderate plasticity; very sandy toward bottom. 31.6-32.6' SAMPLE. Recovered 0.8/1.0' = 80%. SILTY SANDSTONE: light gray (N 7/0) to dusky yellowish orange (10 YR 6/6); medium-grained sand (2.0-1.5 phi); well sorted; quartzose; subrounded; consolidated; soft; friable; wet. 32.6-33.6' SAMPLE. Recovered 1.0/1.0' = 100%. SILTY SANDSTONE: same as above. 33.6-34.6' SAMPLE. Recovered 1.1/1.0' = 110%. SANDSTONE: dark yellowish orange (10 YR 6/6); medium-grained sand (2.5-2.0 phi); well sorted; 15% silt in part; some very silty; consolidated yet friable; wet. 34.6-35.6' SAMPLE. Recovered 0.2/1.0' = 20%. SANDSTONE: dark yellowish orange (10 YR 6/6); same as above. 35.6-36.6' SAMPLE. Recovered 1.7/1.0' = 170%. 34.6-35.4': SANDSTONE: same as above. 35.4-36.6': SILTY CLAYSTONE: light olive gray (5 Y 6/1); to dark yellowish orange (10 YR 6/6); medium to high plasticity; stiff to hard; wet to moist. Note: Excess core recovery due to retrieval of lost core from previous run. 36.6-37.6' SAMPLE. Recovered 1.8/1.0' = 180%. CLAYSTONE: dusky yellow (5 Y 6/4); abundant iron stains--light brown (5 YR 5/6); weathered; moderate to high plasticity; consolidated; moderately hard; moist.	
30				
31				
32				
33				
34				
35				
36				
37				

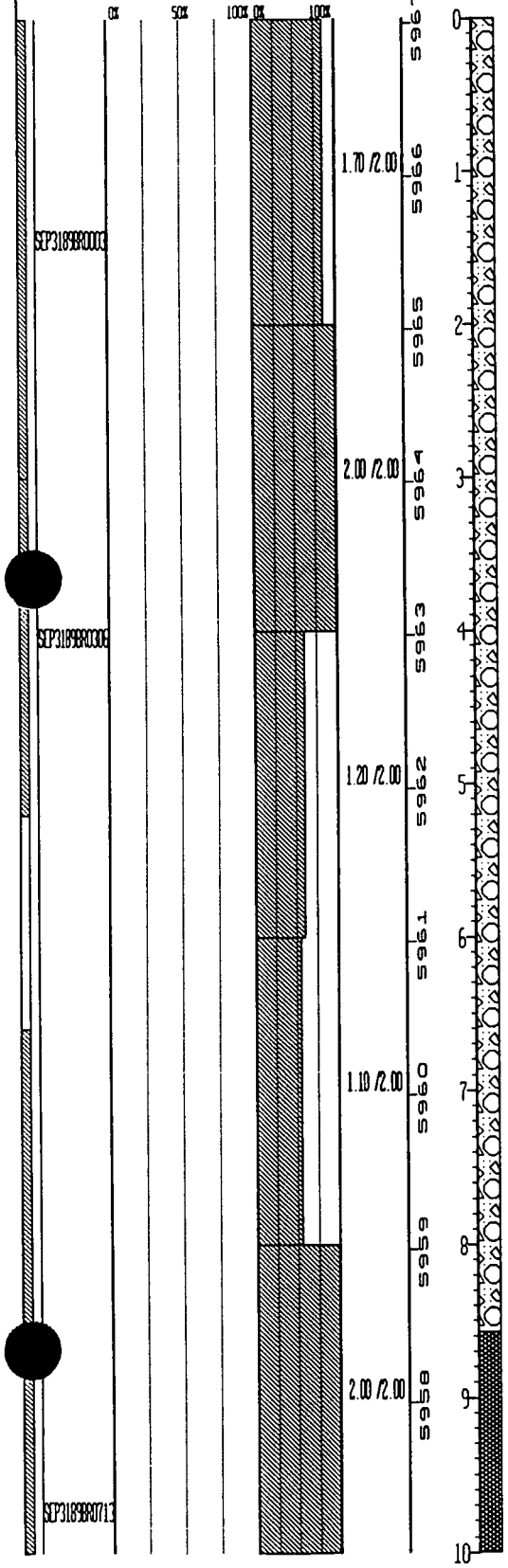
SEP30BE

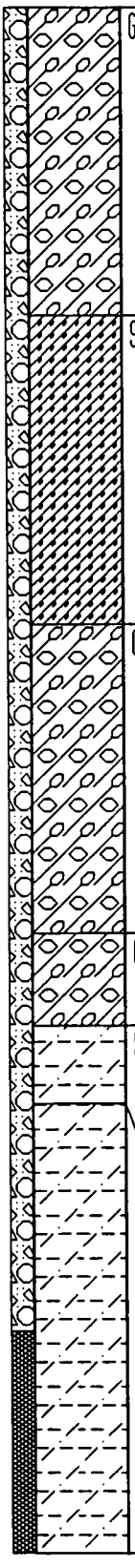
STATE PLANE COORDINATE:	TOTAL DEPTH (FT): 26.0	GROUND ELEVATION (FT):	5967.03	PROJECT NUMBER:	SEP31-89BR	LOG OF BORING NUMBER:
NORTH: 750564	AREA: SOLAR POND	CASING DIAMETER (IN):	4.5 O.D.	GEOLOGIST:	KEM	P210289
EAST: 2085223	LOCATOR NUMBER: M10	BOREHOLE DIAMETER (IN):	7.25	DATE DRILLED:	05/15/89	

REMARKS: Hollow Stem Auger. Weston Log.

DRAFT

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





GC:	Sandy Clayey Gravel - grayish orange (10 YR 7/4) to dusky brown (5 YR 2/2). C.g. to f.g. sand. Coarse to fine gravel, quartzite to 2 cm. Some organics, firm, low plasticity to no-plasticity, (gc with sand), damp.
SC:	Sandy Gravelly Clay - mod. reddish brown (10 R 4/6). Coarse gravel, quartzite to 4 cm.. Small amount of broken calcareous material, HCl reactive. C.g. to f.g. sand, quartz. Firm, med. plasticity, damp.
GC:	Sandy Clayey Gravel - grayish orange (10 YR 7/4). C.g. to f.g. sand, loose to firm, non to low plasticity, damp.
GC:	Sandy Clayey Gravel - same as above.
SILTY CLAYSTONE:	Top of Bedrock. Yellowish gray (5 Y 8/1). Consol., stiff, highly calcareous. Caliche, HCl reactive. Iron stains dusky yellow (5 Y 6/4), damp.
SILTY CLAYSTONE:	Same as above.

STATE PLANE COORDINATE:		TOTAL DEPTH (FT): 26.0	GROUND ELEVATION (FT):	5967.03	PROJECT NUMBER:	SEP31-89BR	LOG OF BORING NUMBER:
NORTH:	750564	AREA: SOLAR POND	CASING DIAMETER (IN):	4.5 O.D.	GEOLOGIST:	KEM	P210289
EAST:	2085223	LOCATOR NUMBER: M10	BOREHOLE DIAMETER (IN):	7.25	DATE DRILLED:	05/15/89	

REMARKS: Hollow Stem Auger. Weston Log.

DRAFT

CHEMICAL SAMPLE DEPTH / GRADATIONAL SAMPLE DEPTH	SAMPLE NUMBER	SAMPLE GRAIN SIZE (0% 50% 100%)	PERCENT RECOVERED (0% 100%)	RECOVERY/INTERVAL	DATUM (FT)	DEPTH (FT)	WELL OR PIEZOMETER CONSTRUCTION	LITHOLOGY	UNIFIED SOILS CLASSIFICATION OR ROCK TYPE	DESCRIPTION
				2.00 /2.00	5957	10			SILTY CLAYSTONE	Light olive gray (5 Y 6/1), mottled dark yellowish orange (10 YR 6/6). Consol., high plasticity, stiff. Caliche, high HCl reaction, some fracturing, damp.
				2.00 /2.00	5956	11				
				2.00 /2.00	5955	12			SILTY CLAYSTONE	Same as above.
	SEP31BSBR1214			2.00 /2.00	5954	13				
				2.00 /2.00	5953	14	09/15/89		SILTY CLAYSTONE	Grayish orange (10 YR 7/4) to light olive gray (5 Y 6/1). Stains dark yellowish orange (10 YR 6/6). Consol., stiff to hard. Med. plasticity. Caliche nodules, high HCl reaction, damp.
				2.00 /2.00	5952	15				
	SEP31BSBR1319			2.00 /2.00	5951	16			SILTY CLAYSTONE	Same as above, small carbonaceous pieces, black (N 1/0), damp.
				2.00 /2.00	5950	17				
				2.00 /2.00	5949	18			SILTY CLAYSTONE	Same as above (reference interval 14.0' to 16.0'). More Lignite, black (N 1/0), grading to olive gray (5 Y 4/1).
				2.00 /2.00	5948	19				
						20				

STATE PLANE COORDINATE:		TOTAL DEPTH (FT): 26.0	GROUND ELEVATION (FT):	5967.03	PROJECT NUMBER:	SEP31-898R	LOG OF BORING NUMBER:
NORTH:	750564	AREA: SOLAR POND	CASING DIAMETER (IN):	4.5 O.D.	GEOLOGIST:	KEM	P210289
EAST:	2085223	LOCATOR NUMBER: M10	BOREHOLE DIAMETER (IN):	7.25	DATE DRILLED:	05/15/89	

REMARKS: Hollow Stem Auger. Weston Log.

DRAFT

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
					5947	20			SILTY CLAYSTONE	Olive gray (5 Y 4/1) to light olive gray (5 Y 5/2). Consol., stiff to hard, med. plasticity, dry.
				2.00 /2.00	5946	21				
					5945	22			SILTY CLAYSTONE	Same as above. Large caliche nodule (2 cm.), high HCl reaction, dry.
				1.20 /2.00	5944	23				
					5943	24			SILTY CLAYSTONE	Light olive gray (5 Y 6/1). Iron stains, dark yellowish orange (10 YR 6/6). Consol., stiff to hard, low to med. plasticity. Calcareous nodules, HCl reactive, dry.
				1.30 /2.00	5942	25				
					5941	26				TD = 26.0'
					5940	27				
					5939	28				
					5938	29				
						30				

SEP3189BR

WELL COMPLETION INFORMATION

QA By/Date Jarell Burman 15-15-89

Location Rocky Flats Plant; Solar Ponds Area

Well No. P210289

Coordinates N 37577.96 E 22119.26 (RFP)

Elevation: Ground Surface 5967.03'

Total Depth: Well 22.27'

Top of Casing 5969.19'

Borehole 26.0'

Formation of Completion Weathered Claystone

Casing Material Schedule 40 PVC

Casing Diameter 4 1/2" O.D.

Screen Material Schedule 40 10-slotted PVC

Surface Casing Diameter 8 5/8" O.D.

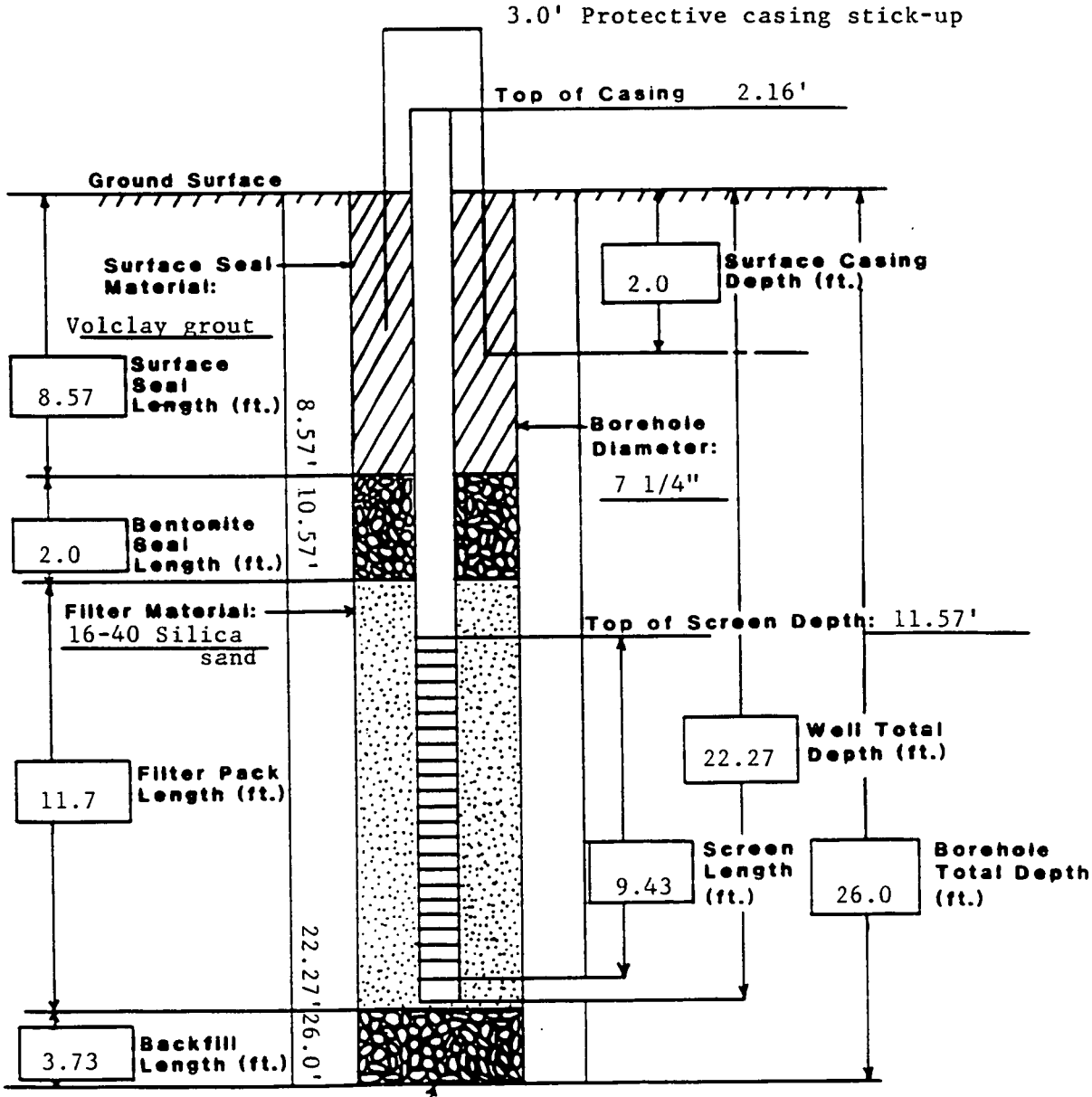
Date Installed 05/15/1989

Approved By Jarell Burman
Site Manager

Installed By K.E. Miller
Geologist

CEARP Manager

Comments Set stainless steel centralizer from 20.75' to 22.0' below ground surface.



Backfill Material: 1/4" Volclay bentonite pellets and slough

LOG OF BOREHOLE

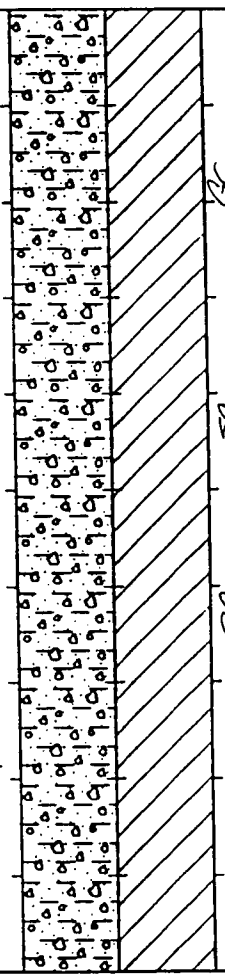
QA BY/DATE J.B. Beyman 11-29-89
LOCATION Rocky Flats Plant; Solar Ponds Area
COORDINATES N37,577.96 E22,119.26 (RFP)
TOTAL DEPTH 26.0'

DRILLING COMPANY Boyles Brothers
DATE DRILLED May 15, 1989
DRILLING METHOD Hollow Stem Auger
LOGGED BY K.E. Miller
GEOLOGIST

BOREHOLE/WELL NO. P210289
GROUND SURFACE ELEVATION 5967.03'
WATER LEVEL ENCOUNTERED None
STATIC 14.61' (19/15/89)
DRILLER R. Sharp HELPER P. Mesa
DRILLING FLUID None
CHECKED BY J.B. Beyman
SITE MANAGER

CEARP MANAGER

COMMENTS

DEPTH (FT)	GRAPHIC LOG	SAMPLE TYPE	LITHOLOGIC DESCRIPTION	SAMPLES COLLECTED OR OTHER TESTS PERFORMED
0 1 2 3 4 5		GC SC GC	**ROCKY FLATS ALLUVIUM** 0.0.2.0' SAMPLE. Recovered 1.7/2.0' = 85%. SANDY CLAYEY GRAVEL: grayish orange (10 YR 7/4) to dusky brown (5 YR 2/2); coarse to fine-grained sand; coarse to fine gravel; quartzite to 2 cm; some organics; firm; low plasticity to non plasticity; (gc with sand); damp. 2.0-4.0' SAMPLE. Recovered 2.0/2.0' = 100%. SANDY GRAVELLY CLAY: moderate reddish brown (10 R 4/6): coarse gravel; quartzite to 4 cm; small amount of broken calcareous material; HCl reactive; coarse to fine-grained sand; quartz; firm; medium plasticity; (sc); damp. 4.0-6.0' SAMPLE. Recovered 1.2/2.0' = 60%. SANDY CLAYEY GRAVEL: grayish orange (10 YR 7/4); coarse to fine gravel to 4 cm; broken; coarse to fine-grained sand; loose to firm; non to low plasticity; (gc); damp.	HNu Background: 0.0 OVA: Background: 0.0 All readings on cuttings, in breathing zone, on core and in augers: 0.0; unless otherwise noted below. TRIP BLANK SAMPLE TB051589 0.0-3.0' SAMPLE SEP3189BR0003 0.0-1.7' SAMPLE (VOAs only) SEP3189BR0002 0.0': Reading in Auger: OVA: 20.0 3.0-5.2' SAMPLE SEP318BR0306 4.0-5.2' SAMPLE (VOAs only) SEP3189BR0406

SEP31-89A

WELL NO. P210289

LOG OF BOREHOLE

DEPTH (FT)	GRAPHIC LOG	SAMPLE TYPE	LITHOLOGIC DESCRIPTION	SAMPLES COLLECTED OR OTHER TESTS PERFORMED
5			**6.0-8.0' SAMPLE.** Recovered 1.1/2.0' = 55%. 6.0-6.6': SANDY CLAYEY GRAVEL: same as above.	**6.6-13.0' SAMPLE** SEP3189BR0713
			ARAPAHOE/LARAMIE FORMATION Top of Bedrock	
6			6.6-7.1': SILTY CLAYSTONE: yellowish gray (5 Y 8/1); consolidated; stiff; highly calcareous; caliche; HCl reactive; iron-stains--dusky yellow (5 Y 6/4); damp.	
			8.0-10.0' SAMPLE. Recovered 2.0/2.0' = 100%. SILTY CLAYSTONE: same as above.	**8.0-10.0' SAMPLE** (VOAs only) SEP3189BR0810
7			**10.0-12.0' SAMPLE.** Recovered 2.0/2.0' = 100%. SILTY CLAYSTONE: light olive gray (5 Y 6/1); mottled dark yellowish orange (10 YR 6/6); consolidated; high plasticity; stiff; caliche; high HCl reaction; some fracturing; damp.	**10.0'**: Reading in Auger: OVA: 1.0
8			**12.0-14.0' SAMPLE.** Recovered 2.0/2.0' = 100%. SILTY CLAYSTONE: same as above.	**12.0-14.0' SAMPLE** SEP3189BR1214 **13.0-19.0' SAMPLE** SEP3189BR1319
9				
10				
11				
12				
13				

WELL NO. P210289

LOG OF BOREHOLE

DEPTH (FT)	GRAPHIC LOG	SAMPLE TYPE	LITHOLOGIC DESCRIPTION	SAMPLES COLLECTED OR OTHER TESTS PERFORMED
13 14 15 16 17 18 19 20 21			14.0-16.0' SAMPLE. Recovered 2.0/2.0' = 100%. SILTY CLAYSTONE: grayish orange (10 YR 7/4) to light olive gray (5 Y 6/1); stains--dark yellowish orange (10 YR 6/6); consolidated; stiff to hard; medium plasticity; caliche nodules; high HCl reaction, damp. 16.0-18.0' SAMPLE. Recovered 2.0/2.0' = 100%. SILTY CLAYSTONE: same as above; small carbonaceous pieces--black (N 1/0); damp. 18.0-20.0' SAMPLE. Recovered 2.0/2.0' = 100%. SILTY CLAYSTONE: same as 14.0-16.0'; more lignite; black (N 1/0); grading to olive gray (5 Y 4/1). 20.0-22.0' SAMPLE. Recovered 2.0/2.0' = 100%. SILTY CLAYSTONE: olive gray (5 Y 4/1) to light olive gray (5 Y 5/2); consolidated; stiff to hard; medium plasticity; dry.	14.61' 16.0-18.0' SAMPLE (VOAs only) SEP3189BR1618 18.0': Reading in Auger: OVA: 1.0

SEP3189C

WELL NO. P210289

LOG OF BOREHOLE

DEPTH (FT)	GRAPHIC LOG	SAMPLE TYPE	LITHOLOGIC DESCRIPTION	SAMPLES COLLECTED OR OTHER TESTS PERFORMED
21			**22.0-24.0' SAMPLE.** Recovered 1.2/2.0' = 60%. SILTY CLAYSTONE: same as above; large caliche nodule 2 cm.; high HCl reaction, dry.	
22			**24.0-26.0' SAMPLE.** Recovered 1.3/2.0' = 65%. SILTY CLAYSTONE: light olive gray (5 Y 6/1); iron stains--dark yellowish orange (10 YR 6/6); consolidated; stiff to hard; low to medium plasticity; calcareous nodules; HCl reactive; dry.	
23			**TOTAL DEPTH = 26.0'**	
24				
25				
26				
27				
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29				

SEP31890

STATE PLANE COORDINATE:	TOTAL DEPTH (FT): 21	GROUND ELEVATION (FT):	5994.30	PROJECT NUMBER:	EMAD
NORTH: 749460	AREA: PLANT	CASING DIAMETER (IN):	2 3/8 O.D.	GEOLOGIST:	AKS/LAH
EAST: 2083736	LOCATOR NUMBER: K9	BOREHOLE DIAMETER (IN):	7.25	DATE DRILLED:	10/16/89

REMARKS: Hollow Stem Auger. ASI Log.

LOG OF BORING NUMBER: P213689

DRAFT

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
	PZ10890003			1.10 /2.00	5994 5993	0 1			GM:	Asphalt Gravel - brownish black (5 YR 2/1). Some sand, sub-angular to sub-rounded, 2mm. to 3cm. Some silt. Probably artificial fill. 60% gravel, 35% sand, 5% silt.
				0.00 /2.00	5992 5991	2 3			NO SAMPLE:	NO SAMPLE
	PZ10890007			0.70 /2.00	5990 5989	4 5			GM:	Gravel as above. Gravel size increases to 5cm. Slightly calcareous. 60% gravel, 35% sand, 5% silt.
				0.00 /2.00	5988 5987	6 7			NO SAMPLE:	NO SAMPLE
	[illegible]890712			1.30 /2.00	5986 5985	8 9			SM:	Clayey Silty Sand - dark yellowish brown (10 YR 4/2) at bottom of interval and mottled yellowish brown at top. Mod. plasticity. High organics, some roots at bottom of interval. Some gravel, well rounded to sub-angular, 2mm to 1cm. Mod. calcareous., mod. reactive. 30% gravel, 35% sand, 15% clay, 20% silt.
						10				

STATE PLANE COORDINATE:		TOTAL DEPTH (FT): 21	GROUND ELEVATION (FT):	5994.30	PROJECT NUMBER:	EMAD	LOG OF BORING NUMBER:
NORTH:	749460	AREA: PLANT	CASING DIAMETER (IN):	2 3/8 O.D.	GEOLOGIST:	AKS/LAH	P213689
EAST:	2083736	LOCATOR NUMBER: K9	BOREHOLE DIAMETER (IN):	7.25	DATE DRILLED:	10/16/89	

REMARKS: Hollow Stem Auger. ASI Log.

DRAFT

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
				0.20 /2.00	5984	10	01/15/90		GP:	One 4cm. piece of gravel.
				0.00 /1.00	5983	11			NO SAMPLE:	NO SAMPLE
	PZ10891317			1.50 /2.00	5982	12			CLAYSTONE:	Top of Bedrock Claystone - Mottled - mod. yellowish brown (10 YR 5/4), dark yellowish orange (10 YR 6/6) and yellowish gray (5 Y 8/1). No apparent bedding. Trace silt and v.f.g. sand. >80% clay.
				0.00 /2.00	5981	13			NO SAMPLE:	NO SAMPLE
				0.50 /1.00	5980	14			CLAYSTONE:	Mottled, mod. yellowish brown (10 YR 5/4), dark yellowish orange (10 YR 6/6) and yellowish gray (5 Y 7/2). Weathered. No apparent bedding. Some v.f.g. sand. 20% sand, >80% clay.
				0.80 /1.00	5979	15			CLAYSTONE:	Same as above. 20% sand, >80% clay.
				0.90 /1.00	5978	16			CLAYEY SANDSTONE:	Color as above. V.f.g. sand, well sorted, porous, weathered. Bedding not evident.
					5977	17				
					5976	18				
					5975	19				
						20				

STATE PLANE COORDINATE:		TOTAL DEPTH (FT): 21	GROUND ELEVATION (FT):	5994.30	PROJECT NUMBER:	EMAD	LOG OF BORING NUMBER:
NORTH:	749460	AREA: PLANT	CASING DIAMETER (IN):	2 3/8 O.D.	GEOLOGIST:	AKS/LAH	P213689
EAST:	2083736	LOCATOR NUMBER: K9	BOREHOLE DIAMETER (IN):	7.25	DATE DRILLED:	10/16/89	

REMARKS: Hollow Stem Auger. ASI Log.

DRAFT

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%	2.80 /1.00	5974	20				SILTY SANDSTONE: Mod. yellowish brown (10 YR 5/4) to v. pale orange (10 YR 8/2). Sand v.f.g. to m.g., well rounded, sub-angular. No reaction to acid. Semi consol. Color change in center. Light to mod. brown due to weathering and iron staining. Bedding not evident.
					5973	21				
					5972	22				
					5971	23				
					5970	24				
					5969	25				
					5968	26				
					5967	27				
					5966	28				
					5965	29				
						30				

WELL COMPLETION INFORMATION

QA By/Date J.B. Burman 10/18-89

Location Rocky Flats Plant

Well No. P213689

Coordinates N 36478.11 E 20628.51 (RFP)

Elevation: Ground Surface 5994.3'

Total Depth: Well 14.80'

Top of Casing 5996.04'

Borehole 23.0'

Formation of Completion Rocky Flats Alluvium

Casing Material Schedule 40 PVC

Casing Diameter 2 3/8" O.D.

Screen Material Schedule 40 10-slotted PVC

Surface Casing Diameter 5 5/8" O.D.

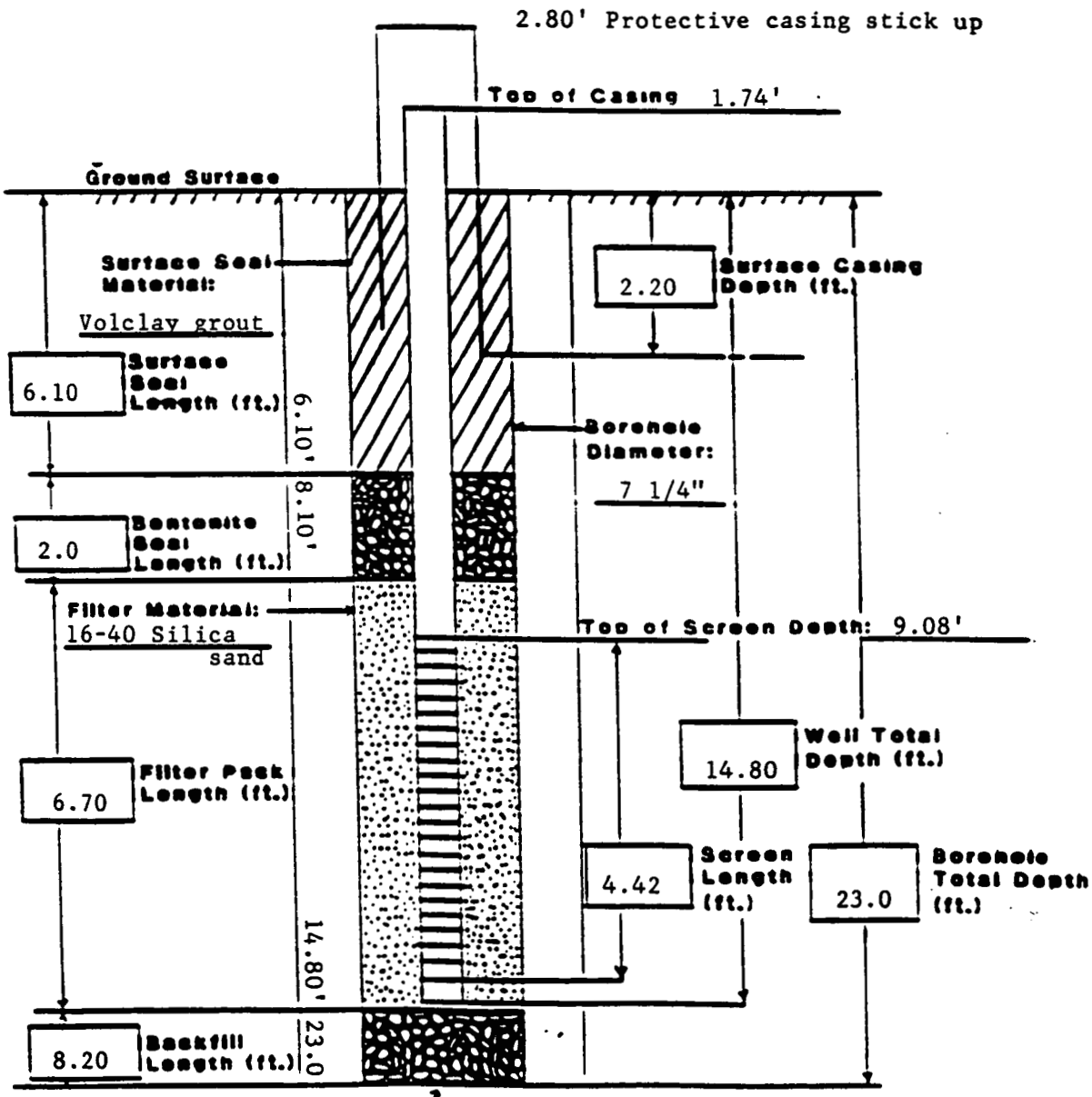
Date Installed 10/16/1989

Approved By J.B. Burman
Site Manager

Installed By C.M. Marzicola
Geologist

CEARP Manager

Comments Set stainless steel centralizer from 13.92' to 12.73' below ground surface.



Backfill Material: 1/4" Volclay bentonite pellets and slough

LOG OF BOREHOLE

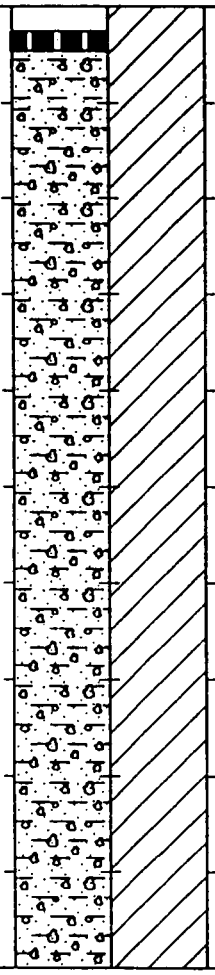
QA BY/DATE J.B. Burman 12-22-90
LOCATION Rocky Flats Plant; Original Process Waste Lines
COORDINATES N36,478.11 E20,628.51 (RFP)
TOTAL DEPTH 23.0'

DRILLING COMPANY Boyles Brothers
DATE DRILLED October 16, 1989
DRILLING METHOD Hollow Stem Auger
LOGGED BY C.M. Marzicola
GEOLOGIST

BOREHOLE/WELL NO. P213689
GROUND SURFACE ELEVATION 5994.3'
WATER LEVEL ENCOUNTERED None
STATIC 10.47' (01/15/90)
DRILLER D. Styles HELPER A. Boday
DRILLING FLUID None
CHECKED BY J.B. Burman
SITE MANAGER

CEARP MANAGER

COMMENTS

DEPTH (FT)	GRAPHIC LOG	SAMPLE TYPE	LITHOLOGIC DESCRIPTION	SAMPLES COLLECTED OR OTHER TESTS PERFORMED
0 1 2 3 4 5			**ARTIFICIAL FILL** 0.0-2.0' SAMPLE. Recovered 1.4/2.0' = 70%. 0.0-0.3': ASPHALT. 0.3-2.0': GRAVELLY SANDY CLAY: dusky yellowish brown (10 YR 2/2) to dusky brown (5 YR 2/2) to moderate brown (5 YR 3/4); broken gravel fragments to 4 cm, subangular, quartzose; medium to coarse-grained sand; poorly sorted; very low to low plasticity; unconsolidated; damp. 2.0-4.0' SAMPLE. Recovered 1.3/2.0' = 65%. GRAVELLY SANDY CLAY: same as above; with less than 1 cm clay lenses olive gray (5 Y 2/2); moist. 4.0-6.0' SAMPLE. Recovered 0.4/2.0' = 20%. GRAVELLY SANDY CLAY: same as above; with broken gravel fragments to 7 cm; quartzose.	HNu Background: 0.0 OVA Background: 0.0 All readings in augers; in cuttings; on core and in breathing zone: 0.0; unless otherwise noted below. TRIP BLANK SAMPLE TB101689A 0.0-1.4' SAMPLE (VOAs only) PZ10890002 0.0-3.0' SAMPLE PZ10890003 2.0-3.3' SAMPLE (VOAs only) PZ10890204 4.0-4.4' SAMPLE (VOAs only) PZ10890406 3.0-6.5' SAMPLE PZ10890307

PZ1089a.pj

DEPTH (FT)	GRAPHIC LOG	SAMPLE TYPE	LITHOLOGIC DESCRIPTION	SAMPLES COLLECTED OR OTHER TESTS PERFORMED
5			**ROCKY FLATS ALLUVIUM**	
			6.0-8.0' SAMPLE. Recovered 0.5/2.0' = 25%. GRAVELLY SANDY CLAY: light olive gray (5 Y 5/2) to olive gray (5 Y 3/2); 1-3 cm gravel fragments, subrounded; medium to very coarse-grained sand; poorly sorted; interbedded clay lenses, grayish olive (10 Y 4/2) throughout; medium plasticity; moist.	6.0-6.5' SAMPLE (VOAs only) PZ10890608
6			8.0-10.0' SAMPLE. Recovered 2.0/2.0' = 100%. SANDY CLAY: olive gray (5 Y 3/2) to light olive gray (5 Y 5/2); medium- to very coarse-grained sand; trace broken gravel fragments to 1 cm; subangular; poorly sorted to moderately poorly sorted; interbedded clay lenses throughout, less than 1 cm thick; calcareous; medium to moderate plasticity; organic material throughout (root hairs, etc.); very moist.	8.0-10.0' SAMPLE (VOAs only) PZ10890810 PZ10890810D
7				
8			10.0-12.0' SAMPLE. Recovered 0.5/2.0' = 25%. SANDY CLAY: olive gray (5 Y 4/1) to olive black (5 Y 2/1); trace broken gravel fragments to 3 cm; subangular; iron staining throughout; some iron cementation; trace organic material; medium plasticity; firm; moist.	10.0-10.5' SAMPLE (VOAs only) PZ10891012 7.0-10.5' SAMPLE PZ10890712 PZ10890712D
9			Note: 12.0-13.0': Drilled with center bit. No sample taken.	
10				10.47'
11				
12				
13				

WELL NO. P213689

LOG OF BOREHOLE

DEPTH (FT)	GRAPHIC LOG	SAMPLE TYPE	LITHOLOGIC DESCRIPTION	SAMPLES COLLECTED OR OTHER TESTS PERFORMED
13 14 15 16 17 18 19 20 21			**ARAPAHOE/LARAMIE FORMATION** 13.0-15.0' SAMPLE. Recovered 2.0/2.0' = 100%. CLAYSTONE: dusky yellow (5 Y 6/1) to light olive brown (5 Y 5/6) to light olive gray (5 Y 5/2) to olive gray (5 Y 3/2); weathered; iron staining throughout; firm; medium to highly plastic; inclusions of hardened claystone; some root hairs; damp to moist. 15.0-17.0' SAMPLE. Recovered 0.2/2.0' = 10%. CLAYSTONE: same as above. 17.0-18.0' SAMPLE. Recovered 0.4/1.0' = 40%. CLAYSTONE: same as above. 18.0-19.0' SAMPLE. Recovered 1.0/1.0' = 100%. CLAYSTONE: same as above; with interbedded SILTY SANDY CLAYSTONE lenses, less than 1 cm thick; moderately well sorted; fine to medium-grained sand. 19.0-20.0' SAMPLE. Recovered 0.3/1.0' = 30%. CLAYSTONE: same as above. 20.0-21.0' SAMPLE. Recovered 1.0/1.0' = 100%. SILTY SANDY CLAYSTONE: yellowish gray (5 Y 7/2) to light olive brown (5 Y 5/6) to light olive gray (5 Y 6/1); highly weathered; abundant iron staining; very fine- to fine-grained sand; low to medium plasticity; grading to sandy claystone.	13.0-15.0' SAMPLE (VOAs only) PZ10891315 15.0-15.2' SAMPLE (VOAs only) PZ10891517 13.0-15.2' SAMPLE PZ10891317 FIELD BLANK SAMPLE PZ10890012FB

WELL NO. P213689

LOG OF BOREHOLE

DEPTH (FT)	GRAPHIC LOG	SAMPLE TYPE	LITHOLOGIC DESCRIPTION	SAMPLES COLLECTED OR OTHER TESTS PERFORMED
21			21.0-23.0' SAMPLE. Recovered 2.0/2.0' = 100%. 21.0-22.0': SANDSTONE; moderate reddish brown (10 R 4/6); very fine- to fine-grained sand; iron cemented; hard. 22.0-23.0': SILTY CLAYEY SANDSTONE; very fine- to fine-grained sand; moderately well sorted; medium plasticity with claystone inclusions; firm; damp.	
22				
23			TOTAL DEPTH = 23.0'	
24				
25				
26				
27				
28				
29				

PZ1089d.pj

LOG OF BOREHOLE

P210

QA BY/DATE J.B. Burman 12-22-90
LOCATION Rocky Flats Plant; Original Process Waste Lines
COORDINATES N36,478.11 E20,628.51 (RFP)
TOTAL DEPTH 23.0'

DRILLING COMPANY Boyles Brothers
DATE DRILLED October 16, 1989
DRILLING METHOD Hollow Stem Auger
LOGGED BY C.M. Marzicola
GEOLOGIST

BOREHOLE/WELL NO. P213689
GROUND SURFACE ELEVATION 5994.3'
WATER LEVEL ENCOUNTERED None
STATIC 10.47' (01/15/90)
DRILLER D. Styles HELPER A. Boday
DRILLING FLUID None
CHECKED BY J.B. Burman
SITE MANAGER

CEARP MANAGER

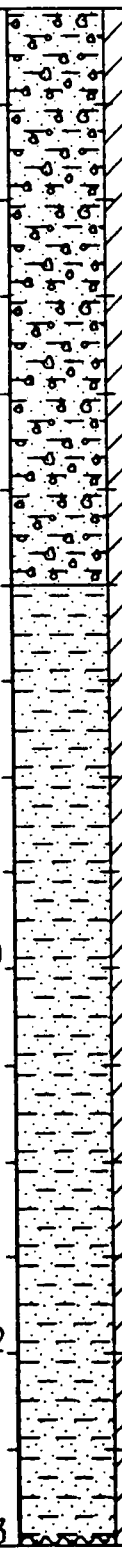
COMMENTS

DEPTH (FT)	GRAPHIC LOG	SAMPLE TYPE	LITHOLOGIC DESCRIPTION	SAMPLES COLLECTED OR OTHER TESTS PERFORMED
0 1 2 3 4 5			**ARTIFICIAL FILL** 0.0-2.0' SAMPLE. Recovered 1.4/2.0' = 70%. 0.0-0.3': ASPHALT. 0.3-2.0': GRAVELLY SANDY CLAY: dusky yellowish brown (10 YR 2/2) to dusky brown (5 YR 2/2) to moderate brown (5 YR 3/4); broken gravel fragments to 4 cm, subangular, quartzose; medium to coarse-grained sand; poorly sorted; very low to low plasticity; unconsolidated; damp. 2.0-4.0' SAMPLE. Recovered 1.3/2.0' = 65%. GRAVELLY SANDY CLAY: same as above; with less than 1 cm clay lenses olive gray (5 Y 2/2); moist. 4.0-6.0' SAMPLE. Recovered 0.4/2.0' = 20%. GRAVELLY SANDY CLAY: same as above; with broken gravel fragments to 7 cm; quartzose.	HNu Background: 0.0 OVA Background: 0.0 All readings in augers; in cuttings; on core and in breathing zone: 0.0; unless otherwise noted below. TRIP BLANK SAMPLE TB101689A 0.0-1.4' SAMPLE (VOAs only) PZ10890002 0.0-3.0' SAMPLE PZ10890003 2.0-3.3' SAMPLE (VOAs only) PZ10890204 4.0-4.4' SAMPLE (VOAs only) PZ10890406 3.0-6.5' SAMPLE PZ10890307

PZ1089a.pj

WELL NO. P213689

LOG OF BOREHOLE

DEPTH (FT)	GRAPHIC LOG	SAMPLE TYPE	LITHOLOGIC DESCRIPTION	SAMPLES COLLECTED OR OTHER TESTS PERFORMED
5 6 7 8 9 10 11 12 13			ROCKY FLATS ALLUVIUM 6.0-8.0' SAMPLE. Recovered 0.5/2.0' = 25%. GRAVELLY SANDY CLAY: light olive gray (5 Y 5/2) to olive gray (5 Y 3/2); 1-3 cm gravel fragments, subrounded; medium to very coarse-grained sand; poorly sorted; interbedded clay lenses, grayish olive (10 Y 4/2) throughout; medium plasticity; moist. 8.0-10.0' SAMPLE. Recovered 2.0/2.0' = 100%. SANDY CLAY: olive gray (5 Y 3/2) to light olive gray (5 Y 5/2); medium- to very coarse-grained sand; trace broken gravel fragments to 1 cm; subangular; poorly sorted to moderately poorly sorted; interbedded clay lenses throughout, less than 1 cm thick; calcareous; medium to moderate plasticity; organic material throughout (root hairs, etc.); very moist. 10.0-12.0' SAMPLE. Recovered 0.5/2.0' = 25%. SANDY CLAY: olive gray (5 Y 4/1) to olive black (5 Y 2/1); trace broken gravel fragments to 3 cm; subangular; iron staining throughout; some iron cementation; trace organic material; medium plasticity; firm; moist. Note: 12.0-13.0': Drilled with center bit. No sample taken.	6.0-6.5' SAMPLE (VOAs only) PZ10890608 8.0-10.0' SAMPLE (VOAs only) PZ10890810 PZ10890810D 10.0-10.5' SAMPLE (VOAs only) PZ10891012 7.0-10.5' SAMPLE PZ10890712 PZ10890712D ▼ 10.47'

PZ10835b.pj

WELL NO. P213689

LOG OF BOREHOLE

DEPTH (FT)	GRAPHIC LOG	SAMPLE TYPE	LITHOLOGIC DESCRIPTION	SAMPLES COLLECTED OR OTHER TESTS PERFORMED
13			**ARAPAHOE/LARAMIE FORMATION**	
			13.0-15.0' SAMPLE. Recovered 2.0/2.0' = 100%. CLAYSTONE: dusky yellow (5 Y 6/1) to light olive brown (5 Y 5/6) to light olive gray (5 Y 5/2) to olive gray (5 Y 3/2); weathered; iron staining throughout; firm; medium to highly plastic; inclusions of hardened claystone; some root hairs; damp to moist.	13.0-15.0' SAMPLE (VOAs only) PZ10891315
14			15.0-17.0' SAMPLE. Recovered 0.2/2.0' = 10%. CLAYSTONE: same as above.	15.0-15.2' SAMPLE (VOAs only) PZ10891517
15			17.0-18.0' SAMPLE. Recovered 0.4/1.0' = 40%. CLAYSTONE: same as above.	13.0-15.2' SAMPLE PZ10891317
			18.0-19.0' SAMPLE. Recovered 1.0/1.0' = 100%. CLAYSTONE: same as above; with interbedded SILTY SANDY CLAYSTONE lenses, less than 1 cm thick; moderately well sorted; fine to medium-grained sand.	
16			19.0-20.0' SAMPLE. Recovered 0.3/1.0' = 30%. CLAYSTONE: same as above.	
17			20.0-21.0' SAMPLE. Recovered 1.0/1.0' = 100%. SILTY SANDY CLAYSTONE: yellowish gray (5 Y 7/2) to light olive brown (5 Y 5/6) to light olive gray (5 Y 6/1); highly weathered; abundant iron staining; very fine- to fine-grained sand; low to medium plasticity; grading to sandy claystone.	
18				
19				
20				
21				

WELL NO. P213689

LOG OF BOREHOLE

DEPTH (FT)	GRAPHIC LOG	SAMPLE TYPE	LITHOLOGIC DESCRIPTION	SAMPLES COLLECTED OR OTHER TESTS PERFORMED
21			21.0-23.0' SAMPLE. Recovered 2.0/2.0' = 100%. 21.0-22.0': SANDSTONE; moderate reddish brown (10 R 4/6); very fine- to fine-grained sand; iron cemented; hard. 22.0-23.0': SILTY CLAYEY SANDSTONE; very fine- to fine-grained sand; moderately well sorted; medium plasticity with claystone inclusions; firm; damp.	
22				
23			TOTAL DEPTH = 23.0'	
24				
25				
26				
27				
28				
29				

NEW BORING NO. P213689

Relog

ROCKY FLATS PLANT BOREHOLE LOG

Borehole Number: DZ 1089
Location: North: _____ East: _____
Date: 7/26/90 - 3/26/91
Geologist: A Sieben / L. Host
Drilling Equip.: _____

Surface Elevation: _____
Area: _____
Total Depth: _____
Company: ASI
Project No.: 1667-1431
Sample Type: _____

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	SOIL/ LITHOLOGIC LOG	SAMPLE DESCRIPTION
0.0	0.0	(1) ~~0.2~~ 1.1				60% Gravel 35% Sand 5% Silt	GM	1		Asphalt. Gravel, brownish black. Some sand, subangular to subrounded, 2mm to 3cm. Some silt. Probably artificial fill
	2.0							2		
		0						3		No Sample
	4.0							4		
Box 1 of 2		(1) ~~1.5~~ 0.7				60% gravel 35% Sand 5% Silt	GM	5		Gravel, as above. Gravel size increases to 5cm. Slightly calcareous.
	6.0							6		
		0'						7		No Sample
	8.0							8		
		(1) 1.3				Sand 35% Gravel 30% Silt 20% Clay 15%	SM	9		Clayey Silty Sand. Dark yellowish brown (10yr 4/2) at btm of interval and mottled yellowish brown at top. Mod. plasticity. High organics, some roots @ btm of interval. Some gravel, well rounded to sub angular 2mm to 1cm. ~~Some CaCO3~~, mod. reactive. Mod. calcareous
	10.0									

NOTES: Materials amounts are estimated by % volume instead of % weight.
(1) Badly broken core, accurate footage measurements not possible.
(2) Core breaks cannot be matched, accurage footage measurements not possible.

LAH 10/31/91

Relog

NEW BORING NO. P213689

ROCKY FLATS PLANT BOREHOLE LOG

Borehole Number: P21089
Location - North: _____ East: _____
Date: 7/26/89 - 3/26/90
Geologist: A Sieben / L Post
Drilling Equip.: _____

Surface Elevation: _____
Area: _____
Total Depth: 1007 - 1431
Company: ASI
Project No.: _____
Sample Type: _____

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	SOIL/ LITHOLOGIC LOG	SAMPLE DESCRIPTION
										One 4 cm piece of gravel.
		0.2 (1)					GP	11		
	12.0							12		
		0								No Sample
	13.0							13		Top of Bedrock
						Clay 80%				Claystone. Mottled-mod. yellowish brown (10yr 5/4) and dk. yellowish orange (10yr 6/6) and yellowish gray (5y 8/1). No apparant bedding, trace silt and v.f.g. sand.
		1.5 (1)						14		
	15.0							15		
		0				et		16		No Sample
17.0	17.0							17		
		0.5 (1)				Clay 80% Silt 20%				Claystone. Mottled-mod. yellowish brown (10yr 5/4) and dk. yellowish orange and yellowish gray. Weathered. No apparant bedding. Some v.f.g. sand.
	18.0							18		
		0.8 (1)				Sand 70% Clay 30%				Same as above
	19.0							19		
		0.9 (2)								Clayey Sandstone. Color as above. v.f.g. sand, well sorted, porous, weathered. Bedding not evident.
	20.0									

NOTES: Materials amounts are estimated by % volume instead of % weight.
(1) Badly broken core, accurate footage measurements not possible.
(2) Core breaks cannot be matched, accurage footage measurements not possible.

Relog

NEW BORING NO. P213689

ROCKY FLATS PLANT BOREHOLE LOG

Borehole Number: PZ 1089
Location - North: _____ East: _____
Date: 7/26/90 - 3/26/90
Geologist: A Sieben/L Host
Drilling Equip.: _____

Surface Elevation: _____
Area: _____
Total Depth: _____
Company: ASI Project No.: 667-1431
Sample Type: _____

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	SOIL LITHOLOGIC LOG	SAMPLE DESCRIPTION
	20.0	2.8 (1)								Silty Sandstone. Mod. yellow brown to v. pale orange (10yr 8/2). Sand v.f.g. to m.g., well rounded, subangular. No reaction to acid. Semi consolidated. Color in center lt brown to mod brown due to weathering and iron staining. Bedding not evident.
21.0	21.0							21		Bottom of Boxes
								22		
								23		
								24		
								25		
								26		
								27		
								28		
								29		

NOTES: Materials amounts are estimated by % volume instead of % weight.
(1) Badly broken core, accurate footage measurements not possible.
(2) Core breaks cannot be matched, accurage footage measurements not possible.

STATE PLANE COORDINATE:		TOTAL DEPTH (FT): 26.0	GROUND ELEVATION (FT):	6004.00	PROJECT NUMBER:	PZ42-89	LOG OF BORING NUMBER:
NORTH:	749943	AREA: PLANT	CASING DIAMETER (IN):	2-3/8 O.D.	GEOLOGIST:	TAL	P214689
EAST:	2083044	LOCATOR NUMBER: K9	BOREHOLE DIAMETER (IN):	7.25	DATE DRILLED:	09/27/89	

REMARKS: Hollow Stem Auger. Weston Log.

DRAFT

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
					6004	0			SM:	Silty Gravelly Sand - pale yellowish brown (10 YR 6/2) to dark yellowish brown (10 YR 4/2), non-stratified, some silt. Poorly sorted, sub-angular to sub-rounded, f.g. to c.g. sand, 1 cm. to 3 cm. gravel, quartzose. Stiff, dry.
				1.50 /2.00	6003	1			CL:	Sandy Gravelly Clay - mod. brown (5 YR 3/4) to dusky brown (5 YR 2/2) - same as above. Med. to low plasticity, very stiff. Gravel 1 cm. to 8 cm. to cobbles. Slightly calcareous, moist.
	PZ42890003								NO SAMPLE:	NO SAMPLE.
					6002	2			SC:	Gravelly Clayey Sand - same as above. Low to no plasticity, dense, iron oxide staining.
				2.00 /2.00	6001	3			CL:	Sandy Clay - light olive brown (5 Y 5/6) to mod. brown (5 YR 3/4), non-stratified. M.g. to v.c.g. sand, calcareous, iron oxide staining, med. plasticity, dry.
					6000	4			GC:	Clayey Sandy Gravel - same as above (reference interval 2.0' to 3.2'), grayish orange (10 YR 7/4) to mod. yellowish brown (10 YR 5/4).
	PZ42891006			2.00 /2.00	5999	5			CL:	Gravelly Sandy Clay - mod. yellowish brown (5 YR 4/4) to light olive brown (5 YR 4/4), non-stratified. F.g. to c.g. sand. 3 cm. to 9 cm. gravels grading to cobbles. Med. plasticity, damp.
					5998	6			SC:	Gravelly Clayey Sand - pale olive (10 YR 6/2) to mod. olive brown (5 YR 4/4), non-stratified. F.g. to c.g. sand, granitic, mod. to poorly sorted, sub-angular to sub-rounded. Gravel 2 cm. to cobbles. Med. to low plasticity, poorly cemented, stiff, dry.
	PZ42890608			1.00 /2.00	5997	7				
					5996	8			SC:	Gravelly Clayey Sand - same as above, light brown (5 YR 5/6) to mod. brown (5 YR 3/4), moist.
				2.00 /2.00	5995	9				
	PZ42890812				5994	10				

STATE PLANE COORDINATE:		TOTAL DEPTH (FT): 26.0	GROUND ELEVATION (FT):	6004.00	PROJECT NUMBER:	PZ42-89	LOG OF BORING NUMBER:
NORTH:	749943	AREA: PLANT	CASING DIAMETER (IN):	2-3/8 O.D.	GEOLOGIST:	TAL	P214689
EAST:	2083044	LOCATOR NUMBER: K9	BOREHOLE DIAMETER (IN):	7.25	DATE DRILLED:	09/27/89	

REMARKS: Hollow Stem Auger. Weston Log.

DRAFT

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
	PZ42890812	0% 50%	100% 0% 100%		5993	10	01/15/90 ▽		SC:	Gravelly Clayey Sand - same as above, med. plasticity, damp.
	PZ42891012			2.00 /2.00	5993	11				
					5992	12			SC:	Gravelly Clayey Sand - same as above, with grayish yellow (5 YR 8/4).
				1.80 /2.00	5991	13				
	91216				5990	14			SC:	Gravelly Clayey Sand - same as above, with mod. orange pink (5 YR 8/9).
				2.00 /2.00	5989	15				
					5988	16			SC:	Gravelly Clayey Sand - same as above, with mod. reddish brown (10 YR 4/6).
				1.80 /2.00	5987	17				
	PZ42891620				5986	18			SC:	Gravelly Clayey Sand - same as above.
				2.00 /2.00	5985	19			CL:	Sandy Clay - pale yellowish brown (10 YR 6/2), non-stratified. Trace to some f.g. to c.g. sand, quartzose, sub-rounded to sub-angular. Med. plasticity, firm, damp.
					5984	20			SC:	Gravelly Clayey Sand - same as above.

STATE PLANE COORDINATE:		TOTAL DEPTH (FT): 26.0	GROUND ELEVATION (FT):	6004.00	PROJECT NUMBER:	P242-89	LOG OF BORING NUMBER:
NORTH:	749943	AREA: PLANT	CASING DIAMETER (IN):	2-3/8 O.D.	GEOLOGIST:	TAL	P214689
EAST:	2083044	LOCATOR NUMBER: K9	BOREHOLE DIAMETER (IN):	7.25	DATE DRILLED:	09/27/89	

REMARKS: Hollow Stem Auger. Weston Log.

DRAFT

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
					5984	20			SC:	Gravelly Clayey Sand - same as above.
	P242892022			2.00 /2.00	5983	21				
					5982	22	09/27/89		CL:	Gravelly Sandy Clay - light olive gray (5 YR 5/2), non-stratified. Trace to some f.g. to c.g. sand. Trace quartzose, 1 cm. to 2 cm. gravels, mod. to well sorted, sub-rounded to sub-angular. Med. plasticity, damp.
				2.00 /2.00	5981	23			SILTY CLAYSTONE:	Top of Bedrock. Sandy Silty Claystone - dusky yellow (5 Y 6/4). Intermittent traces f.g. quartzose sand, well sorted. Firm, plastic, moist to wet.
	2226				5980	24			SILTY CLAYSTONE:	Same as above with dusky yellow (5 Y 6/4) to light olive brown (5 Y 4/4), mottled, non-stratified.
				2.00 /2.00	5979	25				
					5978	26			:	TD = 26.0'
					5977	27				
					5976	28				
					5975	29				
					5974	30				

WELL COMPLETION INFORMATION

QA By/Date Janell Seyman 10-2-89

Location Rocky Flats Plant

Well No. P214689

Coordinates N 36964.09 E 19937.50 (RFP)

Elevation: Ground Surface 6004.0'

Total Depth: Well 23.5'

Top of Casing 6005.76'

Borehole 26.0'

Formation of Completion Rocky Flats Alluvium

Casing Material Schedule 40 PVC

Casing Diameter 2 3/8" O.D.

Screen Material Schedule 40 10-slotted PVC

Surface Casing Diameter 5 5/8" O.D.

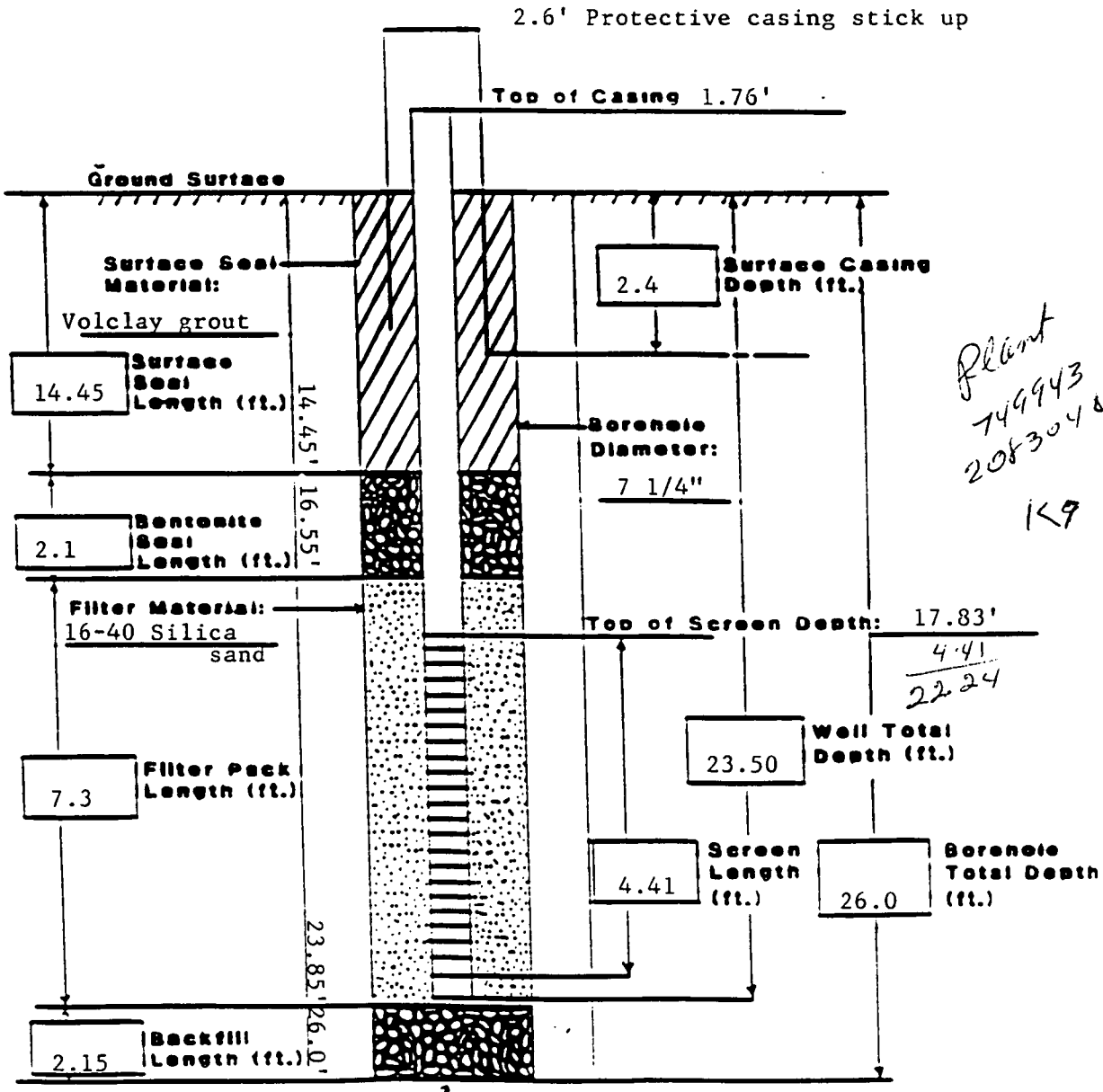
Date Installed 09/27/1989

Approved By Janell Seyman
Site Manager

Installed By T.A. Lutherer
Geologist

CEARP Manager

Comments Set stainless steel centralizer from 23.48' to 22.28' below ground surface.



Plant
749943
208304 4
K9

Backfill Material: 1/4" Volclay bentonite pellets and slough

LOG OF BOREHOLE

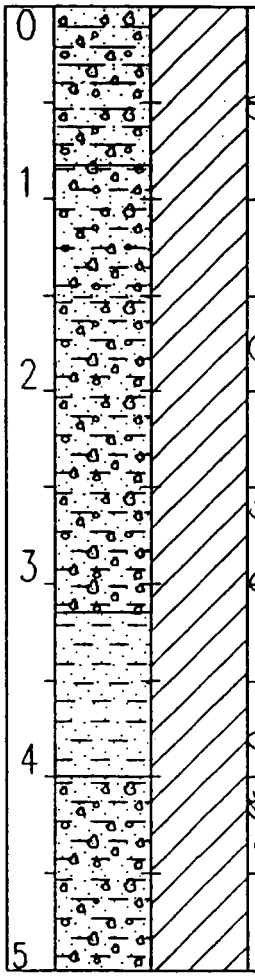
QA BY/DATE J.B. Burman 12-22-90
LOCATION Rocky Flats Plant
COORDINATES N36,964.09 E19,937.50 (RFP)
TOTAL DEPTH 26.0'

DRILLING COMPANY Boyles Brothers
DATE DRILLED September 26-27, 1989
DRILLING METHOD Hollow Stem Auger
LOGGED BY T.A. Lutherer
GEOLOGIST

BOREHOLE/WELL NO. P214689
GROUND SURFACE ELEVATION 6004.0'
WATER LEVEL ENCOUNTERED 22.0'
STATIC 10.56' (01/15/90)
DRILLER K. Parker HELPER T. Merritt
DRILLING FLUID None
CHECKED BY J.B. Burman
SITE MANAGER

CEARP MANAGER

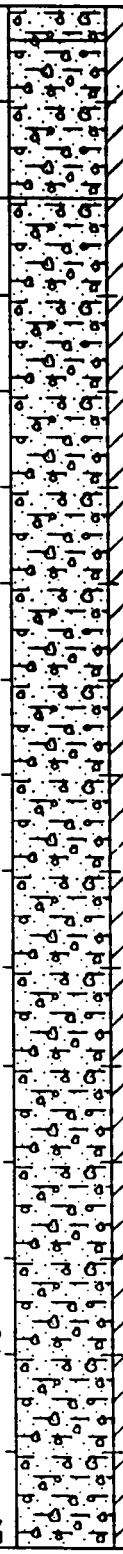
COMMENTS

DEPTH (FT)	GRAPHIC LOG	SAMPLE TYPE	LITHOLOGIC DESCRIPTION	SAMPLES COLLECTED OR OTHER TESTS PERFORMED
0 1 2 3 4 5			ARTIFICIAL FILL 0.0-2.0' SAMPLE. Recovered 1.6/2.0' = 80%. 0.0-0.7': SILTY GRAVELLY SAND: pale yellowish brown (10 YR 6/2) to dark yellowish brown (10 YR 4/2); nonstratified; some silt; poorly sorted; subangular to subrounded; fine- to coarse-grained sand; 1-3 cm gravel; quartzose; stiff; dry. ROCKY FLATS ALLUVIUM 0.7-1.6': SANDY GRAVELLY CLAY: moderate brown (5 YR 3/4) to dusky brown (5 YR 2/2); same as above; medium to low plasticity; very stiff; gravel 1-8 cm to cobbles; slight calcareous; moist. 2.0-4.0' SAMPLE. Recovered 2.0/2.0' = 100%. 2.0-3.2': GRAVELLY CLAYEY SAND: same as above; low to no plasticity; dense; iron oxide staining. 3.2-4.0': SANDY CLAY: light olive brown (5 Y 5/6) to moderate brown (5 YR 3/4); nonstratified; medium- to very coarse-grained sand; calcareous; iron oxide staining; medium plasticity; dry. 4.0-6.0' SAMPLE. Recovered 2.0/2.0' = 100%. 4.0-5.2': CLAYEY SANDY GRAVEL: same as 2.0-3.2': grayish orange (10 YR 7/4) to moderate yellowish brown (10 YR 5/4). 5.2-6.0': GRAVELLY SANDY CLAY: moderate yellowish brown (5 YR 4/4) to light olive brown (5 YR 4/4); non stratified; fine to coarse-grained sand; 3 cm to 9 cm gravels grading to cobbles; medium plasticity; damp.	HNu Background: 0.0 OVA Background: 0.0 All readings on cuttings, in breathing zone, on core and in augers: 0.0 unless otherwise noted below TRIP BLANK SAMPLE T8092689B 0.0-1.6' SAMPLE (VOAs only) PZ42890002 2.0-4.0' SAMPLE (VOAs only) PZ42890204 0.0-3.0' SAMPLE PZ42890003 3.0-6.0' SAMPLE PZ42890306

PZ4289a.pj

WELL NO. P214689

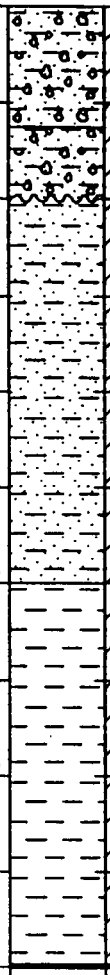
LOG OF BOREHOLE

DEPTH (FT)	GRAPHIC LOG	SAMPLE TYPE	LITHOLOGIC DESCRIPTION	SAMPLES COLLECTED OR OTHER TESTS PERFORMED
5 6 7 8 9 10 11 12 13			**6.0-8.0' SAMPLE.** Recovered 1.0/2.0 = 80%. GRAVELLY CLAYEY SAND: pale olive (10 YR 6/2) to moderate olive brown (5 YR 4/4); nonstratified; fine- to coarse-grained sand, granitic, moderately to poorly sorted, subangular to subrounded; gravels 2 cm to cobbles; medium to low plasticity; poorly cemented; stiff; dry. **8.0-10.0' SAMPLE.** Recovered 2.0/2.0' = 100%. GRAVELLY CLAYEY SAND: same as 6.0-8.0'; light brown (5 YR 5/6) to moderate brown (5 YR 3/4); moist. **10.0-12.0' SAMPLE.** Recovered 2.0/2.0' = 100%. GRAVELLY CLAYEY SAND: same as 8.0-10.0'; medium plasticity; damp. **12.0-14.0' SAMPLE.** Recovered 1.8/2.0' = 90%. GRAVELLY CLAYEY SAND: same as 10.0-12.0'; with grayish yellow (5 YR 8/4).	4.0-6.0' SAMPLE (VOAs only) PZ42890406 6.0-8.0' SAMPLE (VOAs only) PZ42890608 6.0-7.0' SAMPLE PZ42890608 8.0-10.0' SAMPLE (VOAs only) PZ42890810 8.0-12.0' SAMPLE PZ42890812 10.0-12.0' SAMPLE PZ42891012 12.0-16.0' SAMPLE PZ42891216 12.0-13.8' SAMPLE (VOAs only) PZ42891214 ▼ 10.56'

PZ42890.pl

WELL NO. P214689

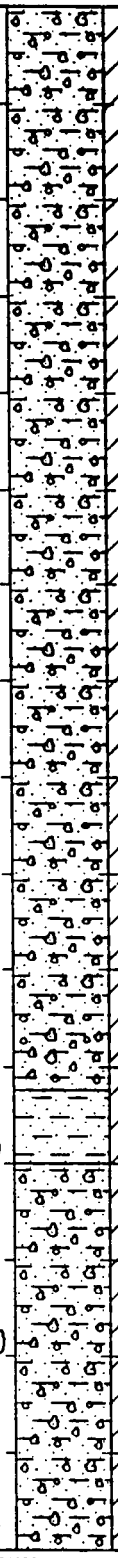
LOG OF BOREHOLE

DEPTH (FT)	GRAPHIC LOG	SAMPLE TYPE	LITHOLOGIC DESCRIPTION	SAMPLES COLLECTED OR OTHER TESTS PERFORMED
21			ARAPAHOE/LARAMIE FORMATION 22.0-24.0' SAMPLE. Recovered 2.0/2.0' = 100%. SANDY SILTY CLAYSTONE: dusky yellow (5 Y 6/4); intermittent traces fine-grained quartzose sand; well sorted; firm; plastic; moist to wet. 24.0-26.0' SAMPLE. Recovered 2.0/2.0' = 100%. SILTY CLAYSTONE: same as 22.0-24.0'; with dusky yellow (5 Y 6/4) to light olive brown (5 Y 4/4); mottled; nonstratified. TOTAL DEPTH - 26.0'	22.0-26.0' SAMPLE PZ42892226 ▽ 22.0' 22.0-24.0' SAMPLE (VOAs only) PZ42892224 24.0-26.0' SAMPLE (VOAs only) PZ42892426 FIELD BLANK SAMPLE PZ42890026FB
22				
23				
24				
25				
26				
27				
28				
29				

PZ4289dpj

WELL NO. P214689

LOG OF BOREHOLE

DEPTH (FT)	GRAPHIC LOG	SAMPLE TYPE	LITHOLOGIC DESCRIPTION	SAMPLES COLLECTED OR OTHER TESTS PERFORMED
13 14 15 16 17 18 19 20 21			**14.0-16.0' SAMPLE.** Recovered 2.0/2.0' = 100%. GRAVELLY CLAYEY SAND: same as 12.0-14.0'; with moderate orange pink (5 YR 8/9). **16.0-18.0' SAMPLE.** Recovered 1.8/2.0' = 90%. GRAVELLY CLAYEY SAND: same as 14.0-16.0'; with moderate reddish brown (10 YR 4/6). **18.0-20.0' SAMPLE.** Recovered 2.0/2.0' = 100%. 18.0-18.6': GRAVELLY CLAYEY SAND: same as 16.0-18.0'. GRAVELLY CLAYEY SAND: same as 16.0-18.0'. 18.6-19.0': SANDY CLAY: pale yellowish drown (10 YR 6/2); nonstratified; trace to some fine- to coarse-grained sand; quartzose; subrounded to subangular; medium plasticity; firm; damp. 19.0-20.0': GRAVELLY CLAYEY SAND: same as 16.0-18.0'. **20.0-22.0' SAMPLE.** Recovered 2.0/2.0' = 100%. 20.0-21.6': GRAVELLY CLAYEY SAND: same as 18.0-20.0'. 21.6-22.0: GRAVELLY SANDY CLAY: light olive gray (5 YR 5/2); nonstratified; trace to some fine- to coarse-grained sand; trace quartzose 1-2 cm gravels; moderately to well sorted, subrounded to subangular; medium plasticity; damp.	14.0-16.0' SAMPLE (VOAs only) PZ42891416 16.0-20.0' SAMPLE PZ42891620 PZ428916200 20.0-22.0' SAMPLE PZ42892022 16.0-17.8' SAMPLE (VOAs only) PZ42891618 18.0-20.0' SAMPLE (VOAs only) PZ42891820 PZ428918200 20.0-22.0' SAMPLE (VOAs only) PZ42892022

STATE PLANE COORDINATE:	TOTAL DEPTH (FT): 16.0	GROUND ELEVATION (FT):	5985.80	PROJECT NUMBER:	P218089	LOG OF BORING NUMBER:
NORTH: 749941	AREA: ORIGINAL PROCESS	CASING DIAMETER (IN):	4.5 O.D.	GEOLOGIST:	SPC	P218089
EAST: 2084020	LOCATOR NUMBER: L9	BOREHOLE DIAMETER (IN):	7.25	DATE DRILLED:	11/01/89	

REMARKS: Hollow Stem Auger. Weston Log.

DRAFT

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
	DP0389003			1.20 /2.00	5985	0–2			SC:	Gravelly Clayey Sand - mod. brown (5 YR 4/4), dark yellowish brown (10 YR 4/2), non-stratified. F.g. to v.c.g. sand, 1 cm. to 8 cm. gravels, poor sorting, sub-rounded, quartzose. Low plasticity, med. dense, moist.
	DP0389006			1.30 /2.00	5984 – 5982	2–4			CL:	Gravelly Sandy Clay - mod. brown (5 YR 4/4), mod. yellowish brown (10 YR 5/4), non-stratified. F.g. to v.c.g. sand, 1 cm. to 8 cm. gravels to cobbles, poor sorting, sub-rounded, quartzose. Low plasticity, very stiff, damp.
						4			CL:	Gravelly Sandy Clay - same as above.
				1.10 /2.00	5981 – 5980	5–6			CL:	Clay - light olive gray (5 Y 6/1), stained dark yellowish orange (10 YR 6/6), non-stratified. Some f.g. to v.c.g. sand, some gravel, trace silt, poor sorting, sub-rounded, quartzose. Low to med. plasticity, calcareous, iron staining, very stiff, moist.
									NO SAMPLE:	NO SAMPLE.
	DP0389010			2.00 /2.00	5979 – 5978	7–8			CLAYSTONE:	Top of Bedrock. Pale yellowish brown (10 YR 6/2) light olive gray (5 Y 6/1), blocky, non-stratified. Trace v.f.g. sand. Trace silt. Med. to high plastic, calcareous deposits, iron staining throughout, very weathered, firm to med. hard, moist.
				2.00 /2.00	5977 – 5976	9–10			CLAYSTONE:	Same as above - decreasing amount of calcareous material, trace dentrites.

STATE PLANE COORDINATE:	TOTAL DEPTH (FT): 16.0	GROUND ELEVATION (FT): 5985.80	PROJECT NUMBER: P218089	LOG OF BORING NUMBER:
NORTH: 749941	AREA: ORIGINAL PROCESS	CASING DIAMETER (IN): 4.5 O.D.	GEOLOGIST: SPC	P218089
EAST: 2084020	LOCATOR NUMBER: L9	BOREHOLE DIAMETER (IN): 7.25	DATE DRILLED: 11/01/89	

REMARKS: Hollow Stem Auger. Weston Log.

DRAFT

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
				2.00 /2.00	5975	10–11			SILTY CLAYSTONE:	Med. light gray (N 6/0), blocky, non-stratified. Trace to some v.f.g. sand, med. plasticity, iron staining from 10.0' to 10.6', hard, moist.
					5974	12			SILTY CLAYSTONE:	Same as above - increased iron staining.
				2.00 /2.00	5973	13			SILTY SANDSTONE:	Silty to Clayey Sandstone - light gray (N 7/0). V.f.g. sand, well sorted, rounded, quartzose, med. to non-plastic, med. hard, moist.
					5972	14			SILTY CLAYSTONE:	Same as above (reference interval 12.0' to 12.4').
				2.00 /2.00	5971	15			CLAYSTONE:	Med. light gray (N 6/0), light olive gray (5 Y 5/2), blocky, non-stratified. Trace sand. Trace silt. Med. to high plasticity, weathered, trace calcareous, iron staining, med. hard, moist.
					5970	16				TD = 16.0'
					5969	17				
					5968	18				
					5967	19				
					5966	20				

WELL COMPLETION INFORMATION

QA By/Date J B Burman / 11-17-89

Location Rocky Flats Plant; Original Process Waste Lines

Well No. P218089

Coordinates N 36958.07 E 20914.17 (RFP)

Elevation: Ground Surface 5985.8'

Total Depth: Well 8.69'

Top of Casing 5987.55'

Borehole 16.0'

Formation of Completion Rocky Flats Alluvium

Casing Material Schedule 40 PVC

Casing Diameter 4 1/2" O.D.

Screen Material Schedule 40 10-slotted PVC

Surface Casing Diameter 8 5/8" O.D.

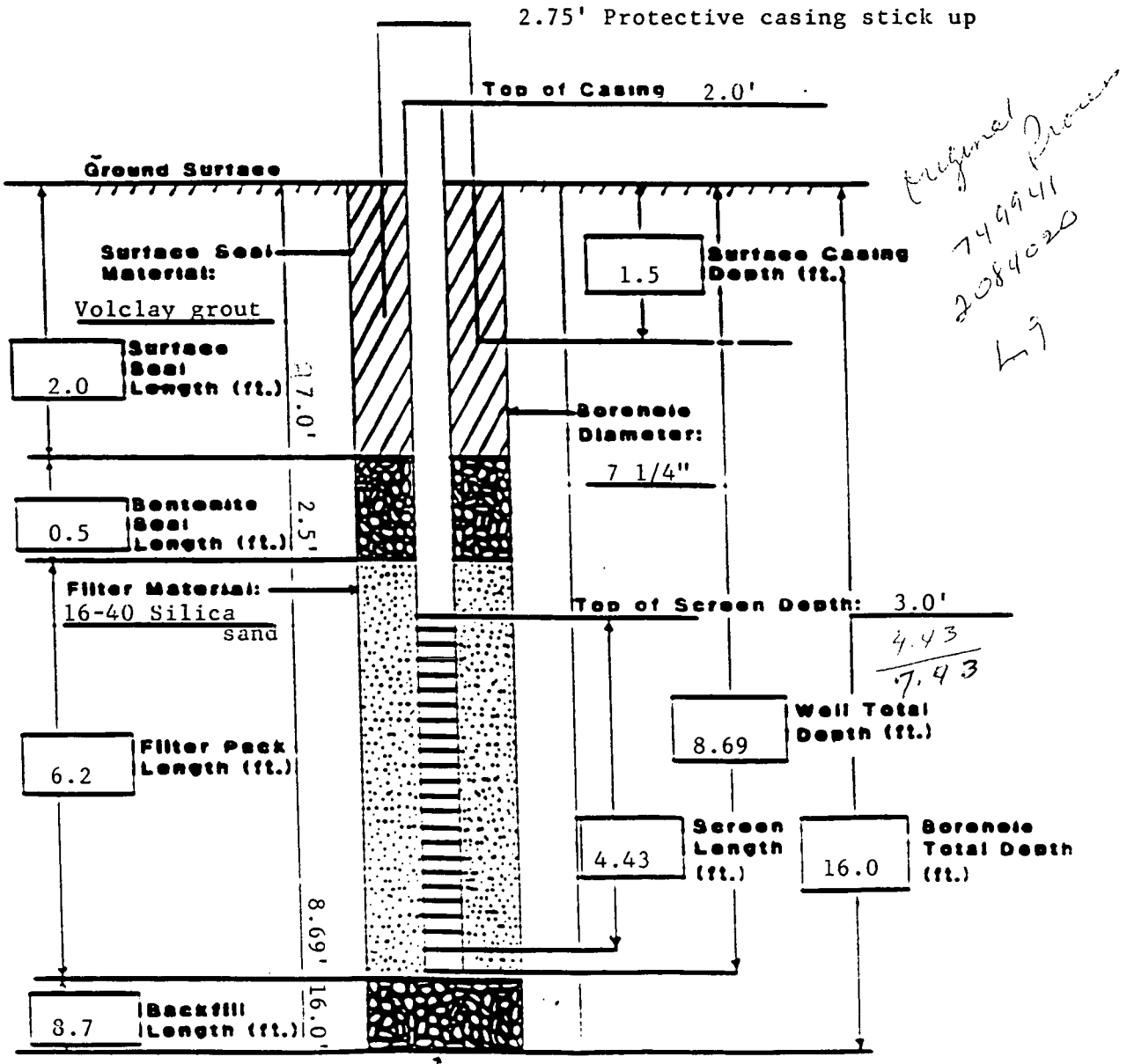
Date Installed 11/01/1989

Approved By J. B. Burman
Site Manager

Installed By S.P. Carpenter
Geologist

CEARP Manager

Comments No centralizer used



Backfill Material: 1/4" Volclay bentonite pellets and slough

LOG OF BOREHOLE

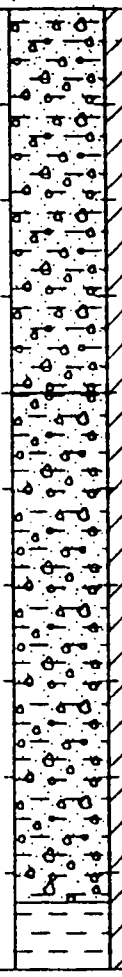
QA BY/DATE Rick Morrow 11-22-89
LOCATION Rocky Flats Plant; Original Process Waste Lines
COORDINATES
TOTAL DEPTH 16.0'

DRILLING COMPANY Boyles Brothers
DATE DRILLED November 1, 1989
DRILLING METHOD Hollow Stem Auger
LOGGED BY S. P. Carpenter
GEOLOGIST

BOREHOLE/WELL NO. P218089
GROUND SURFACE ELEVATION
WATER LEVEL ENCOUNTERED None
STATIC
DRILLER K. Parker HELPER L. Pellier
DRILLING FLUID None
CHECKED BY J.B. Burman
SITE MANAGER

CEARP MANAGER

COMMENTS

DEPTH (FT)	GRAPHIC LOG	SAMPLE TYPE	LITHOLOGIC DESCRIPTION	SAMPLES COLLECTED OR OTHER TESTS PERFORMED
0			**ROCKY FLATS ALLUVIUM** 0.0-2.0' SAMPLE. Recovered 1.2/2.0' = 60%. SC GRAVELLY CLAYEY SAND: moderate brown (5 YR 4/4) dark yellowish brown (10 YR 4/2); nonstratified; fine- to very coarse-grained sand; 1 to 8 cm gravels; poor sorting; subrounded; quartzose; low plasticity; medium dense; moist.	HNu background: 0.0. All readings in breathing zone; on core; on cuttings; and in augers; 0.0; unless otherwise noted below.
1				
2			2.0-4.0' SAMPLE. Recovered 1.3/2.0' = 65%. CL GRAVELLY SANDY CLAY: moderate brown (5 YR 4/4) moderate yellowish brown (10 YR 5/4); nonstratified; fine- to very coarse-grained sand; 1 to 8 cm gravels to cobbles; poor sorting; subrounded; quartzose; low plasticity; very stiff; damp.	TRIP BLANK SAMPLE: TB1101189B 0.0-1.2' SAMPLE (VOAs only) OP03890002
3			4.0-6.0' SAMPLE. Recovered 1.1/2.0' = 55%. CL 4.0-4.6': GRAVELLY SANDY CLAY: same as above. CL 4.6-5.1': CLAY: light olive gray (5 Y 6/1); stained dark yellowish orange (10 YR 6/6); nonstratified; some fine- to very coarse-grained sand; some gravel; trace silt; poor sorting; subrounded; quartzose; low to medium plasticity; calcareous; iron staining; very stiff; moist.	0.0-3.0' SAMPLE OP03890003 2.0-3.3' SAMPLE (VOAs only) OP03890204
4				4.0-5.1' SAMPLE (VOAs only) OP03890406 3.0-5.1' SAMPLE OP03890306
5				

18089a.cw

WELL NO. P218089

LOG OF BOREHOLE

DEPTH (FT)	GRAPHIC LOG	SAMPLE TYPE	LITHOLOGIC DESCRIPTION	SAMPLES COLLECTED OR OTHER TESTS PERFORMED
5 6 7 8 9 10 11 12 13			**ARAPAHOE/LARAMIE FORMATION** 6.0-8.0' SAMPLE. Recovered 2.0/2.0' = 100%. CLAYSTONE: pale yellowish brown (10 YR 6/2) light olive gray (5 Y 6/1); blocky; nonstratified; trace very fine-grained sand; trace silt; medium to high plastic; calcareous deposits; iron staining throughout; very weathered; firm to medium hard; moist. 8.0-10.0' SAMPLE. Recovered 2.0/2.0' = 100%. CLAYSTONE: same as above; decreasing amount of calcareous material; trace dendrites. 10.0-12.0' SAMPLE. Recovered 2.0/2.0' = 100%. SILTY CLAYSTONE: medium light gray (N 6/0); blocky; nonstratified; trace to some very fine-grained sand; medium plasticity; iron staining at 10.0-10.6': hard; moist. 12.0-14.0' SAMPLE. Recovered 2.0/2.0' = 100%. 12.0-12.4': SILTY CLAYSTONE: same as above, increased iron staining. 12.4-13.0': SILTY TO CLAYEY SANDSTONE: light gray (N 7/0); very fine-grained sand; well sorted; rounded; quartzose; medium to nonplastic; medium; hard; moist. 13.0-14.0': SILTY CLAYSTONE: same as above.	6.0-8.0' SAMPLE (VOAs only) OP03890608 8.0-10.0' SAMPLE (VOAs only) OP03890810 6.0-10.0' SAMPLE OP03890610

WELL NO. P218089

LOG OF BOREHOLE

DEPTH (FT)	GRAPHIC LOG	SAMPLE TYPE	LITHOLOGIC DESCRIPTION	SAMPLES COLLECTED OR OTHER TESTS PERFORMED
13			14.0-16.0' SAMPLE. Recovered 2.0/2.0' = 100%. CLAYSTONE: medium light gray (N 6/0) light olive gray (5 Y 5/2); blocky; nonstratified; trace sand; trace silt; medium to high plasticity; weathered; trace calcareous; iron staining; medium hard; moist.	
14				
15			TOTAL DEPTH = 16.0'	
16				
17				
18				
19				
20				
21				

18089c.cv

STATE PLANE COORDINATE:	TOTAL DEPTH (FT): 21.0	GROUND ELEVATION (FT):	5941.20	PROJECT NUMBER:	PZ18-89
NORTH: 751222	AREA: PLANT	CASING DIAMETER (IN):	2-3/8 O.D.	GEOLOGIST:	RDM
EAST: 2084010	LOCATOR NUMBER: L11	BOREHOLE DIAMETER (IN):	7.25	DATE DRILLED:	11/30/89

REMARKS: Hollow Stem Auger. Weston Log.

LOG OF BORING NUMBER: P219189

DRAFT

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
					5941	0			SW:	Gravelly Sand - dark yellowish brown (10 YR 4/2), unconsol., some silt. Angular to sub-rounded, granitic, coarse gravel to 10 cm. F.g. to c.g., poorly sorted, sub-angular, quartzose sand. 20% silt.
	P2191890003			1.00 /2.00	5940	1				
					5939	2			CL:	Silty Clay - grayish orange (10 YR 7/4), massive. Some sand, silt, trace gravel. Trace iron staining, low to high plasticity, no HCl reactions (non-calcareous), grades to dusky yellowish brown (10 YR 2/2) with depth, dry to damp. 20% sand, 25% silt.
				2.00 /2.00	5938	3				
					5937	4			CL:	Silty Clay - same as above, becoming predom. med. gray (N 5/0).
	P2191890307			1.80 /2.00	5936	5			CL:	Gravelly Clay - dark yellowish brown (10 YR 2/2). Coarse gravel, granitic. High plasticity, no HCl reaction (non-calcareous), damp.
						6			NO SAMPLE:	NO SAMPLE.
					5935				CL:	Clay - mod. yellowish brown (10 YR 5/4), homogeneous. Trace gravel. Trace silt, soft, high plasticity, no HCl reactions (non-calcareous), damp.
				0.60 /2.00	5934	7				
					5933	8			CL:	Clay - dark yellowish brown (10 YR 4/2), homogeneous. Some silt, soft, high plasticity, no HCl reactions (non-calcareous), damp. 20% silt.
	30711			0.90 /2.00	5932	9				
						10				

STATE PLANE COORDINATE:	TOTAL DEPTH (FT): 21.0	GROUND ELEVATION (FT):	5941.20	PROJECT NUMBER:	PZ18-89	LOG OF BORING NUMBER:
NORTH: 751222	AREA: PLANT	CASING DIAMETER (IN):	2-3/8 O.D.	GEOLOGIST:	RDM	P219189
EAST: 2084010	LOCATOR NUMBER: L11	BOREHOLE DIAMETER (IN):	7.25	DATE DRILLED:	11/30/89	

REMARKS: Hollow Stem Auger. Weston Log.

DRAFT

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%						CL:	Disturbed sample (clay) due to rock in sampler.
				1.00 /2.00	5931	10			CLAYSTONE:	Top of Bedrock. Med. gray (N 5/0). Some silt, trace iron staining, high plasticity, no HCl reaction (non-calcareous), damp. 20% silt.
					5930	11				
					5929	12			NO SAMPLE:	NO SAMPLE.
	P2191891116			0.00 /2.00	5928	13				
					5927	14			CLAYSTONE:	Same as above (reference interval 11.0' to 12.0').
				0.40 /2.00	5926	15				
					5925	16			NO SAMPLE:	NO SAMPLE.
				0.00 /1.00	5924	17			SILTY CLAYSTONE:	Brownish gray (5 YR 4/1), homogeneous. Some grading to Clayey Siltstone, decreasing silt with depth. Trace iron staining, mod. to high plasticity, no HCl reactions (non-calcareous), damp. 35% silt.
				2.00 /2.00	5923	18				
					5922	19			SILTY CLAYSTONE:	Light brownish gray (5 YR 6/1) to brownish gray (5 YR 4/1), mottled with light brown (5 YR 5/6). Iron staining, silt increasing with depth. Some grading to Clayey Siltstone, soft, some mod. hard, mod. to low plasticity, no HCl reactions (non-calcareous), damp. 35% silt.
				2.00 /2.00		20				

STATE PLANE COORDINATE:		TOTAL DEPTH (FT): 21.0	GROUND ELEVATION (FT):	5941.20	PROJECT NUMBER:	PZ18-89	LOG OF BORING NUMBER:
NORTH:	751222	AREA: PLANT	CASING DIAMETER (IN):	2-3/8 O.D.	GEOLOGIST:	RDM	P219189
EAST:	2084010	LOCATOR NUMBER: L11	BOREHOLE DIAMETER (IN):	7.25	DATE DRILLED:	11/30/89	

REMARKS: Hollow Stem Auger. Weston Log.

DRAFT

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
				2.00 /2.00	5921	20				
					5920	21				TD = 21.0'
					5919	22				
					5918	23				
					5917	24				
					5916	25				
					5915	26				
					5914	27				
					5913	28				
					5912	29				
						30				

WELL COMPLETION INFORMATION

L11

P219189

LOTUS ✓
WP ✓

QA By/Date J.B. Berman 12-5-89

Location Rocky Flats Plant: Bldg 774 Area

Well No. P219189

Coordinates N 38239.99 E 20907.67 (RFP)

Elevation: Ground Surface 5941.2'

Total Depth: Well 12.77'

Top of Casing 5943.15'

Borehole 21.0'

Formation of Completion Rocky Flats Alluvium

Casing Material Schedule 40 PVC

Casing Diameter 2 3/8" O.D.

Screen Material Schedule 40 10-slotted PVC

Surface Casing Diameter 5 5/8" O.D.

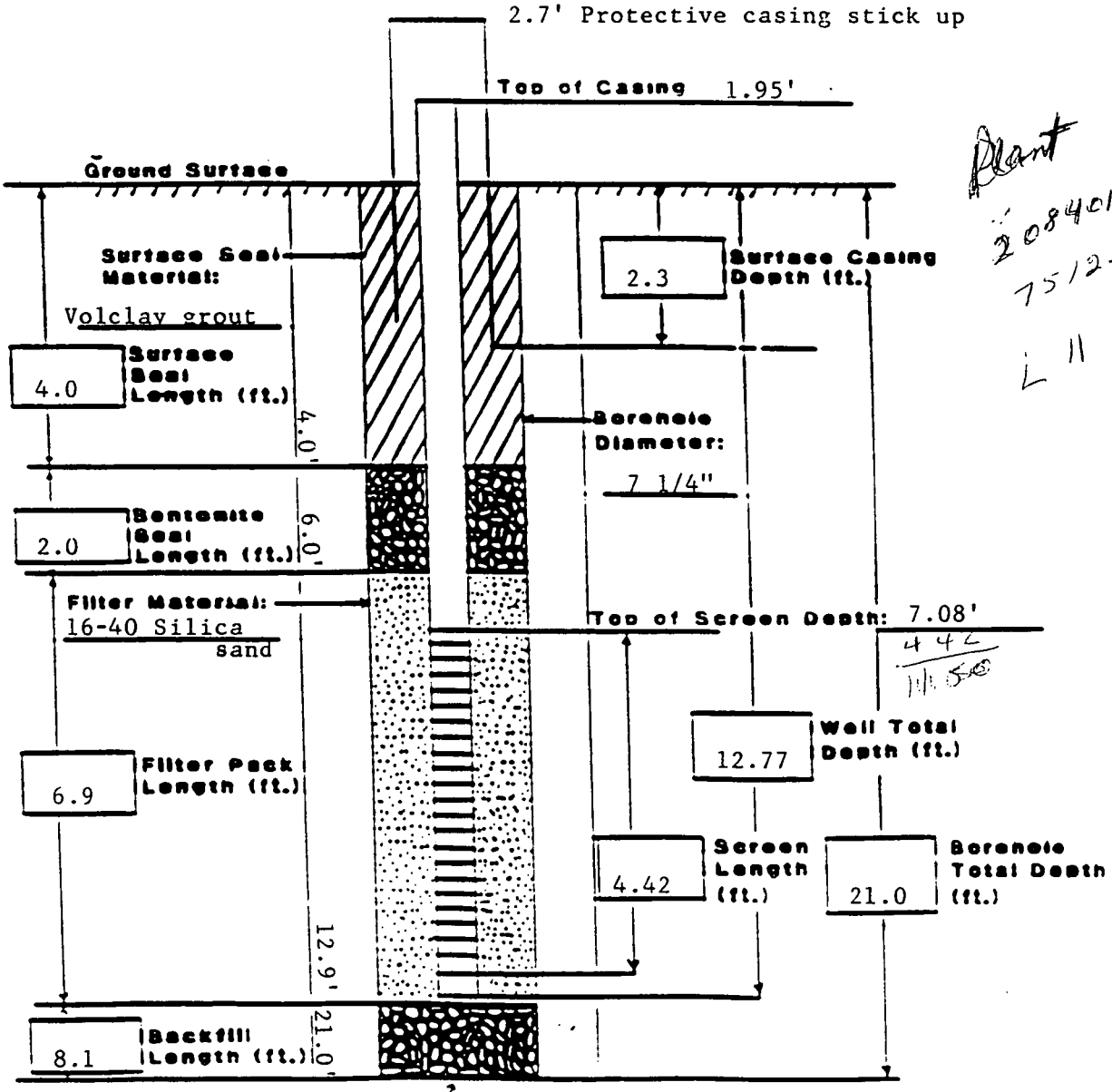
Date Installed 11/30/1989

Approved By J.B. Berman
Site Manager

Installed By R.D. Morrow
Geologist

CEARP Manager

Comments Set stainless steel centralizer from 12.75' to 11.53' below ground surface.



Plant
2084010
75122
L 11

Backfill Material: 1/4" Volclay bentonite pellets; slough

LOG OF BOREHOLE

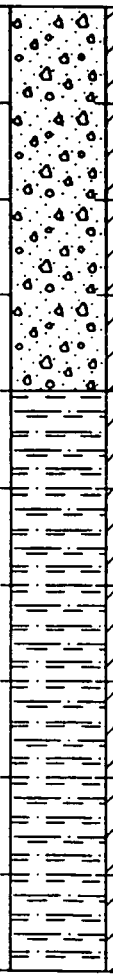
QA BY/DATE J.B. Burman 12-22-90
LOCATION Rocky Flats Plant; Original Process Waste Lines
COORDINATES N38,239.99 E20,907.67 (RFP)
TOTAL DEPTH 21.0'

DRILLING COMPANY Boyles Brothers
DATE DRILLED November 30, 1989
DRILLING METHOD Hollow Stem Auger
LOGGED BY R.D. Morrow
GEOLOGIST

BOREHOLE/WELL NO. P219189
GROUND SURFACE ELEVATION 5941.2'
WATER LEVEL ENCOUNTERED None
STATIC None (01/17/90)
DRILLER T. Merritt HELPER K. Parker
DRILLING FLUID None
CHECKED BY J.B. Burman
SITE MANAGER

CEARP MANAGER

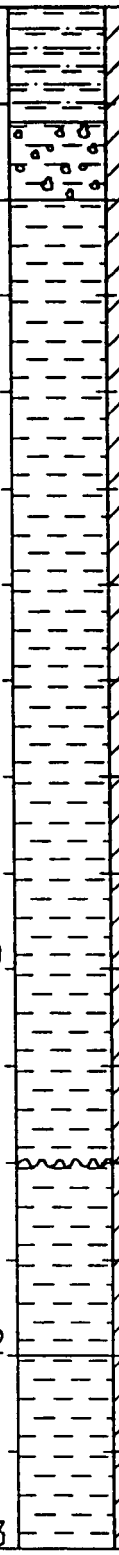
COMMENTS

DEPTH (FT)	GRAPHIC LOG	SAMPLE TYPE	LITHOLOGIC DESCRIPTION	SAMPLES COLLECTED OR OTHER TESTS PERFORMED
0 1 2 3 4 5			**ARTIFICIAL FILL** 0.0-2.0' SAMPLE. 5W Recovered 1.0/2.0' = 50%. GRAVELLY SAND: dark yellowish brown (10 YR 4/2); unconsolidated; some silt to 20%; angular to subrounded; granitic; coarse gravel to 10 cm; fine- to coarse-grained; poorly sorted; subangular; quartzose sand. 2.0-4.0' SAMPLE. CL Recovered 2.0/2.0' = 100%. SILTY CLAY: grayish orange (10 YR 7/4); massive; some sand to 20%; silt to 25%; trace gravel; trace iron staining; low to high plasticity; no HCl reactions; grades to dusky yellowish brown (10 YR 2/2) with depth; dry to damp. 4.0-6.0' SAMPLE. CL Recovered 1.8/2.0' = 90%. 4.0-5.6': SILTY CLAY: same as above; becoming predominantly medium gray (N 5/0). 5.6-5.8': GRAVELLY CLAY: dark yellowish brown (10 YR 2/2); coarse gravel; granitic; high plasticity; no HCl reactions; damp.	HNu Background: 0.0 All readings in breathing zone, on core, on cuttings, and in augers: 0.0; unless otherwise noted below. TRIP BLANK SAMPLE TB113089B 0.0-1.0' SAMPLE (VOAs only) P2191890002 0.0-3.0' SAMPLE P2191890003 2.0-4.0' SAMPLE (VOAs only) P2191890204 3.0-6.6' SAMPLE P2191890307 P2191890307D 4.0-5.8' SAMPLE (VOAs only) P2191890406 P2191890406D

19189A.cw

WELL NO. P219189

LOG OF BOREHOLE

DEPTH (FT)	GRAPHIC LOG	SAMPLE TYPE	LITHOLOGIC DESCRIPTION	SAMPLES COLLECTED OR OTHER TESTS PERFORMED
5			6.0-8.0' SAMPLE. Recovered 0.6/2.0' = 30%. CLAY: moderate yellowish brown (10 YR 5/4); homogeneous; trace gravel; trace silt; soft; high plasticity; no HCl reactions; damp. CL 8.0-10.0' SAMPLE. Recovered 0.9/2.0' = 45%. CLAY: dark yellowish brown (10 YR 4/2); homogeneous; some silt to 20%; soft; high plasticity; no HCl reactions; damp. CL 10.0-12.0' SAMPLE. Recovered 1.0/2.0' = 50%. 10.0-11.0': Disturbed sample (clay) due to rock in sampler. CL ARAPAHOE/LARAMIE FORMATION Note: Bedrock contact picked on the basis of drilling behavior and cuttings. 11.0-12.0': CLAYSTONE: medium gray (N 5/0); some silt to 20%; trace iron staining; high plasticity; no HCl reaction; damp. 12.0-14.0' SAMPLE. Recovered 0.0/2.0' = 0%. No Sample	6.0-6.6' SAMPLE (VOAs only) P2191890608 FIELD BLANK SAMPLE P2191890007FB 7.0-11.0' SAMPLE P2191890711 8.0-8.9' SAMPLE (VOAs only) P2191890810 11.0-14.4' SAMPLE P2191891116 10.0-11.0' SAMPLE (VOAs only) P2191891012
6				
7				
8				
9				
10				
11				
12				
13				

WELL NO. P219189

LOG OF BOREHOLE

DEPTH (FT)	GRAPHIC LOG	SAMPLE TYPE	LITHOLOGIC DESCRIPTION	SAMPLES COLLECTED OR OTHER TESTS PERFORMED
13 14 15 16 17 18 19 20 21			14.0-16.0' SAMPLE. Recovered 0.4/2.0' = 20%. CLAYSTONE: same as above. Note: 16.0-17.0': Drilled with center bit. No sample taken. 17.0-19.0' SAMPLE. Recovered 2.0/2.0' = 100%. SILTY CLAYSTONE: brownish gray (5 YR 4/1); homogeneous; silt to 35%; some grading to clayey siltstone; decreasing silt with depth; trace iron staining; moderate to high plasticity; no HCl reactions; damp. 19.0-21.0' SAMPLE. Recovered 2.0/2.0' = 100%. SILTY CLAYSTONE: light brownish gray (5 YR 6/1) to brownish gay (5 YR 4/1); mottled with light brown (5 YR 5/6); iron staining; silt to 35% increasing with depth; some grading to clayey siltstone; soft; some moderately hard; moderate to low plasticity; no HCl reactions; damp. TOTAL DEPTH = 21.0'	14.0-14.4' SAMPLE (VOAs only) P2191891416

19189C.cv

STATE PLANE COORDINATE:	TOTAL DEPTH (FT): 28.0	GROUND ELEVATION (FT):	6010.60	PROJECT NUMBER:	PZ24-89	LOG OF BORING NUMBER:
NORTH: 749059	AREA: PLANT	CASING DIAMETER (IN):	2 3/8 O.D.	GEOLOGIST:	TAL	P414189
EAST: 2082986	LOCATOR NUMBER: J9	BOREHOLE DIAMETER (IN):	7.25	DATE DRILLED:	10/12/89	

REMARKS: Hollow Stem Auger. Weston Log.

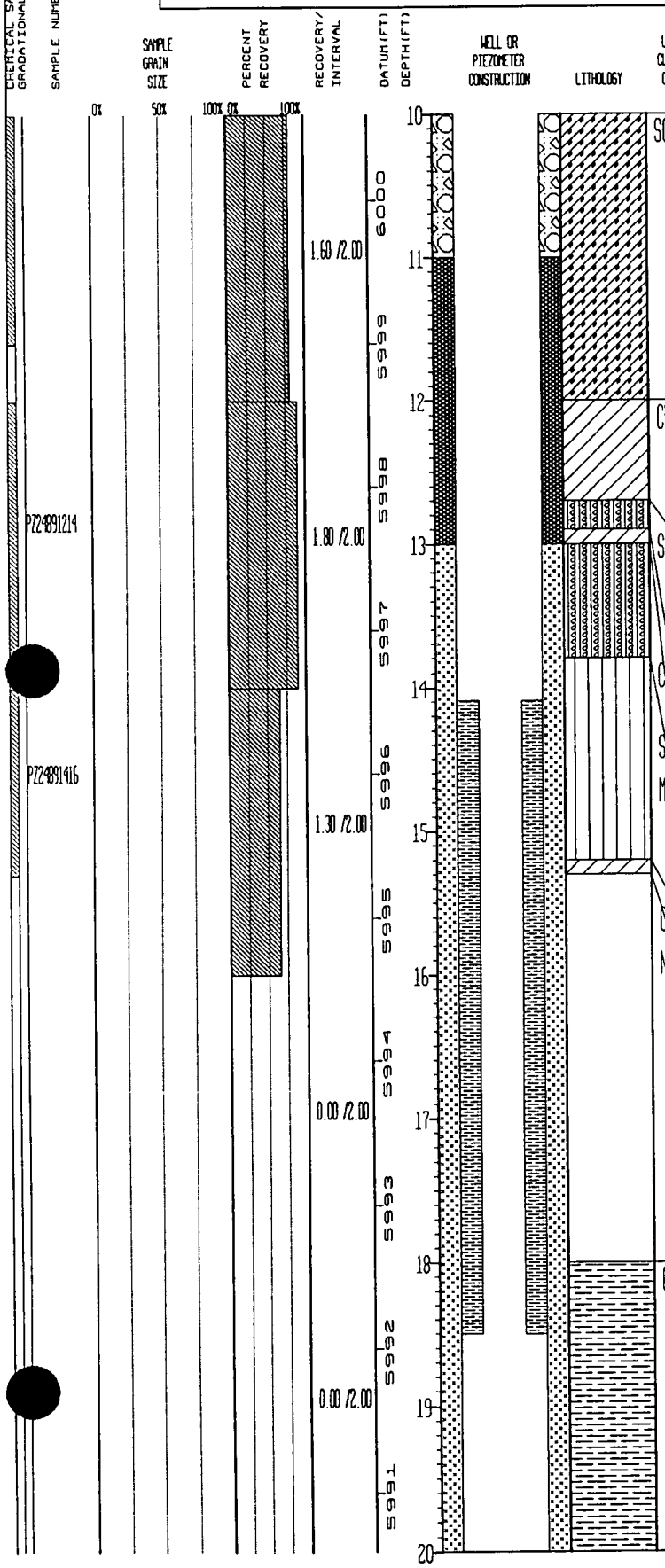
DRAFT

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
	PZ24890003			1.30 /2.00	6010	0–1			CL:	Gravelly Sandy Clay - dusky brown (5 YR 2/2). Non-stratified, f.g. to c.g. quartzose sand. Sub-angular to sub-rounded. 2 cm. to 4 cm. broken quartzose gravels. Trace to some silt. Stiff, no to low plasticity, clay.
									SC:	Gravelly Clayey Sand - same as 0.0' to 0.7' with trace silt.
					6009	1–2			NO SAMPLE:	NO SAMPLE.
						2–3			NO SAMPLE:	NO SAMPLE.
				0.00 /2.00	6008	3–4				
					6007	4–5			CL:	Gravelly Sandy Clay - light brown (5 YR 6/4) to grayish orange (10 YR 7/4), mottled. F.g. to c.g. quartzose sand. 0.5 cm. to 6.0 cm. rounded quartzose gravels, some cobbles. Caliche, slight to mod. calcareous reaction. Low to med. plasticity, damp.
				1.60 /2.00	6006	5–6				
	PZ24890408				6005	6–7			CL:	Gravelly Sandy Clay - same as 4.0' to 6.0' with mod. red (5 R 5/4). Some carbonaceous material.
				1.80 /2.00	6004	7–8				
					6003	8–9			SM:	Gravelly Silty Sand - same as 6.0' to 7.5' with some clay. Low to med. palsticity, silty, damp.
							01/18/90 ▽		SC:	Gravelly Clayey Sand - light brown (5 YR 5/6) to mod. reddish orange (10 YR 8/6) and mod. yellowish brown (10 YR 5/4), mottled. Non-stratified, f.g. to c.g. quartzose sand. Sub-rounded to sub-angular. Trace to some silt. 1 cm. to 3 cm. broken quartzose gravels. Caliche, trace to mod. calcareous reaction. Low plasticity, stiff, dry.
				1.60 /2.00	6002	9–10				
	PZ24890812				6001	10				

STATE PLANE COORDINATE:		TOTAL DEPTH (FT): 28.0	GROUND ELEVATION (FT):	6010.60	PROJECT NUMBER:	PZ24-89	LOG OF BORING NUMBER:
NORTH:	749059	AREA: PLANT	CASING DIAMETER (IN):	2 3/8 O.D.	GEOLOGIST:	TAL	P414189
EAST:	2082986	LOCATOR NUMBER: J9	BOREHOLE DIAMETER (IN):	7.25	DATE DRILLED:	10/12/89	

REMARKS: Hollow Stem Auger. Weston Log.

DRAFT



UNIFIED SOILS CLASSIFICATION OR ROCK TYPE	DESCRIPTION
SC:	Gravelly Clayey Sand - same as 8.0' to 10.0' at times grading to Gravelly Sandy Clay.
CL:	Sandy Clay - light olive gray (5 Y 6/4), non-stratified. F.g. to c.g. quartzose sand. Sub-angular to sub-rounded. Trace 2 cm. to 4 cm. gravels. Reworked Claystone. Med. to lightly plastic, stiff. Damp to dry,
SM:	Gravelly Silty Sand - mod. red (5 R 5/4) to med. orange pink (5 YR 8/4), non-stratified. V.f.g. to c.g. sand. Sub-angular to sub-rounded. 2 cm. to 4 cm. gravels. Silty, trace clay.
CL:	Sandy Clay - same as 12.0' to 12.7'.
SM:	Gravelly Silty Sand - same as 12.7' to 12.9'.
ML:	Gravelly Sandy Silt - light brown (5 YR 5/6) to light brown (5 YR 6/4), non-stratified. F.g. to c.g. quartzose sand. Sub-angular to sub-rounded. 2 cm. to 4 cm. broken quartzose gravels. Trace clay. Med. stiff, dry.
CL:	Reworked Claystone - same as 12.9' to 13.6'.
NO SAMPLE:	NO SAMPLE.
CLAYSTONE:	Top of Bedrock Logged from cuttings. Brownish gray (5 YR 4/1), non-stratified. Trace silt, blocky, stiff. Med. plasticity, dry.

STATE PLANE COORDINATE:		TOTAL DEPTH (FT): 28.0	GROUND ELEVATION (FT):	6010.60	PROJECT NUMBER:	PZ24-89	LOG OF BORING NUMBER:
NORTH:	749059	AREA: PLANT	CASING DIAMETER (IN):	2 3/8 O.D.	GEOLOGIST:	TAL	P414189
EAST:	2082986	LOCATOR NUMBER: J9	BOREHOLE DIAMETER (IN):	7.25	DATE DRILLED:	10/12/89	

REMARKS: Hollow Stem Auger. Weston Log.

DRAFT

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
				0.00 /1.00	5990	20			NO SAMPLE:	Drilled with center bit. No sample taken.
				0.50 /1.00	5989	21			CLAYSTONE:	Dark yellowish orange (10 YR 6/6), non-stratified. Trace silt. Med. plasticity, med. stiff, damp.
				0.00 /1.00	5988	22			NO SAMPLE:	NO SAMPLE
				0.00 /2.00	5987	23			NO SAMPLE:	NO SAMPLE.
	PZ24891628			0.00 /1.00	5986	24			NO SAMPLE:	NO SAMPLE.
				2.00 /2.00	5985	25			SILTY CLAYSTONE:	Same as interval 21.0' to 22.0'.
					5984	26				
					5983	27				
					5982	28			:	TD = 28.0'
					5981	29				
						30				

WELL COMPLETION INFORMATION

QA By/Date J. B. Bergman 5-18-90

Location Rocky Flats Plant

Well No. P414189

Coordinates N 36080.05 E 19876.81 (RFP)

Elevation: Ground Surface 6010.6'

Total Depth: Well 19.78'

Top of Casing 6012.18'

Borehole 28.0'

Formation of Completion Rocky Flats Alluvium

Casing Material Schedule 40 PVC

Casing Diameter 2 3/8" O.D.

Screen Material Schedule 40 10-slotted PVC

Surface Casing Diameter 5 5/8" O.D.

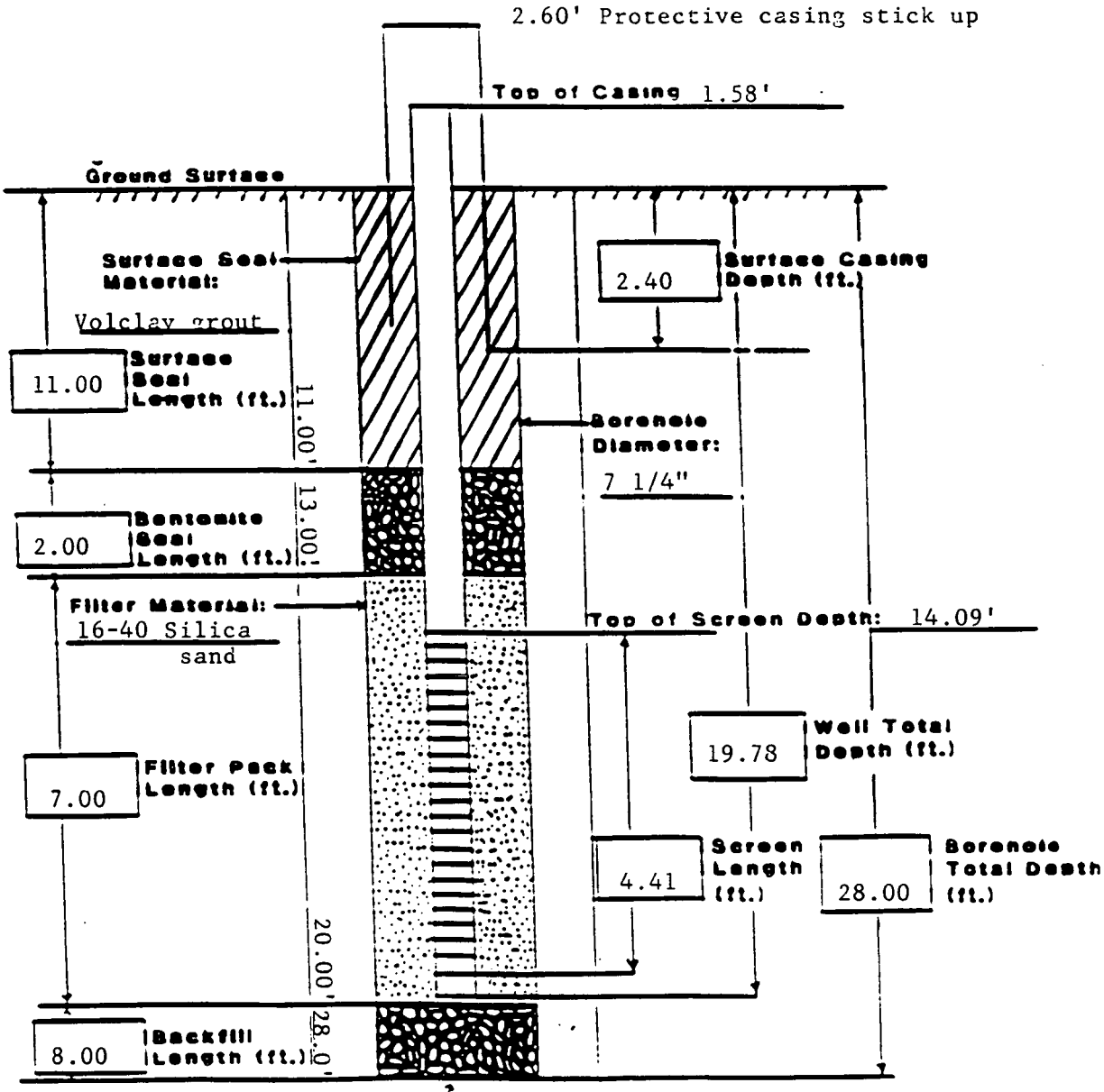
Date Installed 10/12/1989

Approved By J B Bergman
Site Manager

Installed By T.A. Lutherer
Geologist

CEARP Manager

Comments Set stainless steel centralizer from 19.76' to 18.55' below ground surface.



Backfill Material: 1/4" Volclay bentonite pellets and slough and silica sand

LOG OF BOREHOLE

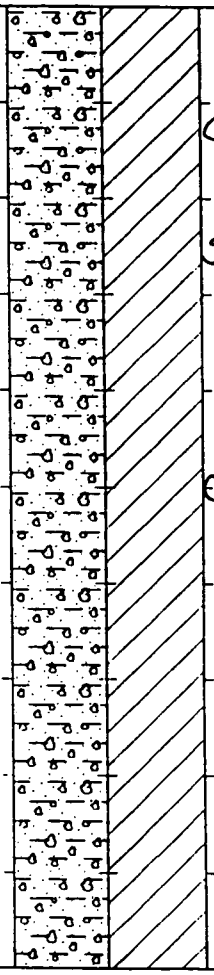
QA BY/DATE J.B. Burman 10-12-90
LOCATION Rocky Flats Plant: Original Process Waste Lines
COORDINATES N36,080.05 E19,876.81 (RFP)
TOTAL DEPTH 28.00'

DRILLING COMPANY Boyles Brothers
DATE DRILLED October 12, 1989
DRILLING METHOD Hollow Stem Auger
LOGGED BY T.A. Lutherer
GEOLOGIST

BOREHOLE/WELL NO. P414189
GROUND SURFACE ELEVATION 6010.6'
WATER LEVEL ENCOUNTERED None
STATIC 8.71' (01/18/90)
DRILLER K. Parker HELPER T. Merritt
DRILLING FLUID None
CHECKED BY J.B. Burman
SITE MANAGER

CEARP MANAGER

COMMENTS

DEPTH (FT)	GRAPHIC LOG	SAMPLE TYPE	LITHOLOGIC DESCRIPTION	SAMPLES COLLECTED OR OTHER TESTS PERFORMED
0 1 2 3 4 5			**ARTIFICIAL FILL** 0.0-2.0' SAMPLE. Recovered 1.3/2.0' = 65%. CL 0.0-0.7': GRAVELLY SANDY CLAY: dusky brown (5 YR 2/2); nonstratified; fine- to coarse-grained quartzose sand; subangular to subrounded; 2-4 cm broken quartzose gravels; trace to some silt; stiff; non-low plasticity; clay. SC 0.7-1.3': GRAVELLY CLAYEY SAND: same as 0.0-0.7' with trace silt. 2.0-4.0' SAMPLE. Recovered 0.0/2.0' = 0%. **ROCKY FLATS ALLUVIUM** 4.0-6.0' SAMPLE. Recovered 1.6/2.0' = 80%. CL GRAVELLY SANDY CLAY: light brown (5 YR 6/4) to grayish orange (10 YR 7/4); mottled; fine- to coarse-grained quartzose sand; 0.5-6.0 cm rounded quartzose gravels; some cobbles; caliche; slight to moderate calcareous reaction; low to medium plasticity; damp.	HNu Background: 0.0 OVA Background: 0.0 All readings on cuttings, in breathing zone, on core, in augers: 0.0 unless otherwise noted below. TRIP BLANK SAMPLE TB1012898 0.0-1.3' SAMPLE (VOAs only) PZ24890002 0.0-2.0' SAMPLE PZ24890003 4.0-5.6' SAMPLE (VOAs only) PZ24890406 4.0-7.8' SAMPLE PZ24890408

PZ2489a.pj

WELL NO. P414189

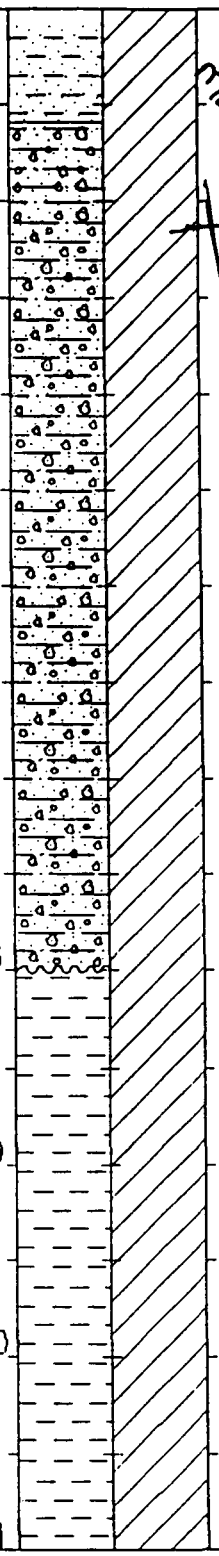
LOG OF BOREHOLE

DEPTH (FT)	GRAPHIC LOG	SAMPLE TYPE	LITHOLOGIC DESCRIPTION	SAMPLES COLLECTED OR OTHER TESTS PERFORMED
5 6 7 8 9 10 11 12 13			**6.0-8.0' SAMPLE** Recovered 1.8/2.0' = 90%. 6.0-7.5': GRAVELLY SANDY CLAY: same as 4.0-6.0' with moderate red (5 R 5/4); some carbonaceous material. 7.5-7.8': GRAVELLY SILTY SAND: same as 6.0-7.5'; with some clay; low to medium plasticity; silty; damp. **8.0-10.0' SAMPLE.** Recovered 1.6/2.0' = 80%. GRAVELLY CLAYEY SAND: light brown (5 YR 5/6) to moderate reddish orange (10 YR 8/6) and moderate yellowish brown (10 YR 5/4); mottled; nonstratified; fine- to coarse-grained quartzose sand; subrounded to subangular; trace to some silt; 1-3 cm broken quartzose gravels; caliche; trace to moderate calcareous reaction; low plasticity; stiff; dry. **10.0-12.0' SAMPLE.** Recovered 1.6/2.0' = 80%. GRAVELLY CLAYEY SAND: same as 8.0-10.0' at times grading to GRAVELLY SANDY CLAY. **12.0-14.0' SAMPLE.** Recovered 1.8/2.0' = 90%. 12.0-12.7': SANDY CLAY: light olive gray (5 Y 6/4); nonstratified; fine- to coarse-grained quartzose sand; subangular to subrounded; trace 2-4 cm gravels; reworked claystone; medium to lightly plasticity; stiff; damp to dry. 12.7-12.9': GRAVELLY SILTY SAND; moderately red (5 R 5/4) to medium orange pink (5 YR 8/4); nonstratified; very fine- to coarse-grained sand; subangular to subrounded; 2-4 cm gravels; silty; trace clay. 12.9-13.0': SANDY CLAY: same as 12.0-12.7'. 13.0-13.8': GRAVELLY SILTY SAND: same as 12.7-12.9'.	**6.0-7.8' SAMPLE** (VOAs only) PZ24890608 **8.0-11.6' SAMPLE** PZ24890812 **8.0-9.6' SAMPLE** (VOAs only) PZ24890810 **10.0-11.6' SAMPLE** (VOAs only) PZ24891012 **12.0-13.8' SAMPLE** PZ24891214 8.71'

PZ24890.pj

WELL NO. P414189

LOG OF BOREHOLE

DEPTH (FT)	GRAPHIC LOG	SAMPLE TYPE	LITHOLOGIC DESCRIPTION	SAMPLES COLLECTED OR OTHER TESTS PERFORMED
13 14 15 16 17 18 19 20 21			**14.0-16.0' SAMPLE.** Recovered 1.3/2.0' = 65%. GRAVELLY SANDY SILT: light brown (5 YR 5/6) to light brown (5 YR 6/4); nonstratified; fine- to coarse-grained quartzose sand; subangular to subrounded; 2-4 cm broken quartzose gravels; trace clay; medium stiff; dry. 15.2-15.3': REWORKED CLAYSTONE: same as 12.9-13.6'. **16.0-18.0' SAMPLE.** Recovered 0.0/2.0' = 0%. 18.0'. **ARAPAHOE/LARAMIE FORMATION** **18.0-20.0' SAMPLE.** Recovered 0.0/2.0' = 0%. CLAYSTONE: logged from cuttings: brownish gray (5 YR 4/1); nonstratified; trace silt, blocky; stiff; medium plasticity; dry. **20.0-21.0' SAMPLE.** Recovered 0.0/1.0' = 0%. Note: 20.0-21.0': Drilled with center bit. No sample taken.	12.0-13.8' SAMPLE (VOAs only) PZ24891214 14.0-15.3' SAMPLE (VOAs only) PZ24891416 14.0-15.3' SAMPLE PZ24891416 21.0-28.0' SAMPLE PZ24891628

WELL NO. P414189

LOG OF BOREHOLE

DEPTH (FT)	GRAPHIC LOG	SAMPLE TYPE	LITHOLOGIC DESCRIPTION	SAMPLES COLLECTED OR OTHER TESTS PERFORMED
21			21.0-22.0' SAMPLE. Recovered 0.5/1.0' = 50%. CLAYSTONE: dark yellowish orange (10 YR 6/6); nonstratified; trace silt; medium plasticity; medium stiff; damp.	
22			22.0-23.0' SAMPLE. Recovered 0.0/2.0' = 0%.	
			23.0-25.0' SAMPLE. Recovered 0.0/2.0' = 0%.	
			25.0-26.0' SAMPLE. Recovered 0.0/2.0' = 0%.	
23			26.0-28.0' SAMPLE. Recovered 2.0/2.0' = 100%. SILTY CLAYSTONE: same as 21.0-22.0'.	
24			TOTAL DEPTH = 28.0'	
25				
26				
27				
28				
29				

PZ2489d.pl

APPENDIX E

EVALUATION OF EXISTING DATA

E.0 EVALUATION OF EXISTING DATA

The following sections describe the approach that will be used to evaluated all existing data available from RFEDS. An example of the results of this type of evaluation for several IHSSs is also presented.

E.1 APPROACH

The first step in evaluating the existing data will be to obtain all data pertinent to OU8 that is currently stored in RFEDS. All available data will be requested for groundwater and borehole samples from the wells and boreholes identified in Figure 1-19 and for surface water and sediment samples from the monitoring locations identified in Figure 1-12. Much of the data available from RFEDS have not been validated. Efforts are ongoing at RFP to validate these data to the extent possible. All data used as a basis for refining the understanding of each IHSS and for scoping field investigations will be clearly identified as to whether the data has been validated. It is anticipated that as data validation efforts continue, that some of these data may be determined to be inaccurate or may be rejected resulting in additional rescoping of this RFI/RI.

The data obtained from RFEDS will be evaluated to determine which data may reflect contamination attributable to OU8 IHSSs. Statistical analyses such as calculation of minimum, maximum, and mean concentrations will be performed for some constituents in some media. All data will be compared to background data in an attempt to characterize the nature and extent of contamination associated with an IHSS.

The background data that will be used in this evaluation are those provided in the Background Geochemical Characterization Report (EG&G, 1990). The Background Geochemical Characterization Report identifies separate environmental media, and through statistical analyses provides background concentrations for each media, or group of media. In that report, where sufficient data were available tolerance intervals were calculated for each parameter. When there was an insufficient number of samples or an insufficient number of detectable concentrations for a given constituent for the calculation of tolerance intervals, the Background Geochemical Characterization Report provides the maximum detected value. The analytical data obtained for OU8 will be compared to the upper tolerance limit (or both upper and lower tolerance limits for pH) or the maximum detected concentration for each parameter to determine if the concentration exceeds background. In addition, when the upper tolerance limit is exceeded the concentrations will be compared to the maximum concentration detected in background samples as an additional indicator of whether the concentration detected may be evidence of a release to the environment. When the pH of a sample is greater than the upper tolerance limit or less than the lower tolerance limit it will also be compared to the range of background values.

Background data for media relevant to the evaluation of the nature and extent of contamination associated with OU8 are summarized in Tables E.1 to E.6 For the purposes of this evaluation, analytical data for surficial materials identified as artificial fill on borehole logs will be compared

to background data for Rocky Flats Alluvium. Regardless of whether borehole logs identify bedrock as being weathered or not, all bedrock data will be compared to the background data for colluvial, weathered claystone and weathered sandstone.

During the course of the preceding evaluation a list of potential contaminants at each sampling location will be developed. This list of contaminants will be compared to the contaminants known or expected to have been released from IHSS(s) that may have contributed to the impacts detected at each location. This information will serve to either refine the understanding of releases associated with each IHSS or to identify additional data that will be required to determine the source of the contamination detected. As such, this evaluation may result in a change in the type, number, and location of sampling points and the list of analytes for these samples.

The data obtained during this evaluation will also be modelled spatially and temporally if the quantity and quality of the data available is sufficient. Some examples of the types of models that may be developed include plume maps and concentrations of contaminants versus depth or time. These models may assist in defining potential sources of contamination and in identifying data gaps to be investigated during field activities.

E.2 EXAMPLE EVALUATION

The following paragraphs present a preliminary evaluation of existing data obtained from the Rocky Flats Environmental Database System (RFEDS). This evaluation is for IHSSs 118.1, 118.2, 139.1(N), 139.1(S), 139.2, and 188. The data evaluated for these IHSSs consist of data for borehole and groundwater samples from wells in the vicinity of each IHSS and for surface water and sediment samples from the monitoring stations located nearest to each IHSS. The quality and completeness of the data evaluated for these IHSSs is in question. Much of the data has not been validated, and it is possible that there is additional data for sampling points in the vicinity of these IHSSs that was not obtained for this preliminary evaluation.

E.2.1 IHSS 118.1 - Solvent Spills West End of Building 730

Documentation was not found of monitoring or sampling programs undertaken to determine the nature and extent of contamination potentially associated with this IHSS. There are no wells or boreholes in the vicinity of the IHSS in the upgradient direction. The nearest upgradient well is P114689 which is located approximately 1,150 southwest of the IHSS. This well was drilled in 1989 and completed as a piezometer in the alluvial aquifer. The nearest downgradient wells are wells P209189 and P209389, completed in bedrock, and well P209289, an alluvial well.

Groundwater measurements near this site are limited. The following discussion is based on two downgradient wells, P209389 and P209289, both of which indicate a hydraulic connection of the surficial material with the underlying Arapahoe sandstone. This hydraulic interconnection may exist at the IHSS and if so provides a pathway for contaminant transport into the bedrock aquifer. Water levels in wells P209389 and P209289 rise to within 12 feet of the ground surface. These

two wells are completed at different depths, one higher stratigraphically and open to both the surficial material and the sandstone; the other lower stratigraphically and open only to the sandstone. The second well's water levels are lower than the first indicating a vertical hydraulic gradient. Given that the surficial material underlying this IHSS is of a coarse nature and of a relatively high permeability, and the quantity and geochemical nature of the chemicals believed to have been released to the surficial materials (carbon tetrachloride and trichloroethene (TCE) both of which are dense non-aqueous phase liquids (DNAPLs)), it is likely that the groundwater was impacted.

Analytical data for well P114689 are limited to analyses of volatile organic compounds (VOCs), metals, inorganic constituents, and radionuclides in surficial material and bedrock samples taken during the drilling of this well in September 1989. Sampling and analysis of groundwater have not been performed at this well. A summary of the analytical data for samples from this well is presented in Table E.7 Several VOCs were detected in samples from various depths in this well (Figure E-1). Toluene, benzene, and carbon disulfide were detected in both alluvium and bedrock samples. The concentrations of these constituents do not display a clear trend of distribution with depth although the highest concentrations of toluene were detected in samples collected from 16 to 20 feet deep. Ethylbenzene was also detected in samples of alluvium taken at depths of 16 to 20 feet. Contamination of laboratory blanks with acetone and methylene chloride, two common laboratory contaminants, was indicated for a number of samples from this well. One sample taken from 20 to 22 feet contained 17 μg/g acetone. Laboratory blank contamination was not indicated for this sample.

Metals detected in concentrations above background in samples of alluvium include barium, cadmium, copper, iron, lead, manganese, potassium, sodium, vanadium, and zinc. Although the concentrations detected in these samples exceeded the upper tolerance limit for background alluvium (except for cadmium and sodium for which an upper tolerance limit has not been calculated), most do not exceed the maximum background concentrations for each constituent. Cadmium, copper, and sodium concentrations in a sample taken within three feet of the ground surface exceeded their respective maximum background concentrations. Copper concentrations in samples taken from several other depths also exceeded the maximum background concentration. Copper was also detected at a concentration exceeding the upper tolerance limit but less than the maximum background concentration in the one sample of bedrock taken from this well. The only inorganic constituent that exceeded background was nitrate/nitrite in a sample taken from depths of 0 to 3 feet.

Radionuclides detected at levels exceeding background in samples of alluvium were plutonium-239,240, radium-226, radium-228, strontium-89,90, tritium, uranium-233,234, uranium-235, and uranium-238. Only plutonium-239,240 and radium-226 were detected at levels greater than the maximum concentration detected in background samples. No radionuclides were detected at levels exceeding background in bedrock samples.

Borehole samples were collected from wells P209189 and P209289 during drilling. Groundwater samples have been collected quarterly from well P209189 since September 1989. Tables E.8 to

E.10 provide summaries of the analytical data available for these wells. Analyses of groundwater from well P209289 have been limited since that well is dry during most times of the year. The only analytical data for groundwater from this well are the results of the analysis of one sample of groundwater taken on May 31, 1991. No analytical data are available for well P209389.

The only VOC detected in borehole samples from well P209189 was methylene chloride. With the exception of the concentration in one sample of bedrock, methylene chloride was detected in concentrations less than the analytical detection limit. Laboratory blank contamination with methylene chloride was not indicated for any borehole samples from this well. Acetone was also detected in several samples, but contamination of laboratory blanks was indicated for those samples. Aluminum, arsenic, barium, calcium, lead, potassium, and vanadium were detected in surficial materials in concentrations exceeding their respective upper tolerance limits, but none were detected in concentrations greater than maximum background concentrations. The only metal that exceeded background in samples of bedrock was arsenic. The concentrations of arsenic, however, did not exceed the maximum background concentration for weathered bedrock. Only one sample of surficial materials was analyzed for radionuclides. The levels of gross alpha, radium-226, tritium, uranium-233,234, and uranium-238 in this sample exceeded background but only gross alpha, tritium, and uranium-238 were detected in concentrations greater than maximum background concentrations for alluvium. Plutonium-239 and tritium were detected in concentrations exceeding background in all samples of bedrock from this well.

Several VOCs were detected in samples of surficial materials and bedrock from well P209289. Benzene, chlorobenzene, methylene chloride, toluene and trichloroethene (TCE) were detected in samples of both surficial materials and bedrock. Most of these compounds were detected in concentrations less than detection limits. No trend in concentration of these compounds with depth is evident. Acetone, chloroform, and 1,1-dichloroethene (1,1-DCE) were also detected in samples of surficial materials. Metals detected in concentrations greater than background were arsenic, barium, copper, and manganese in surficial materials and arsenic, beryllium, iron, and zinc in bedrock. None of the concentrations of metals detected were greater than their respective maximum background concentrations. Americium-241, radium-226, tritium, uranium-233,234, and uranium-238 were detected in above-background concentrations in samples of surficial materials. The concentrations of americium-241 and tritium exceeded maximum background concentrations. Analysis of radionuclides was not performed for bedrock samples.

Groundwater samples from well P209189 have contained a number of VOCs including carbon tetrachloride, chloroform, 1,1-dichloroethane (1,1-DCA), 1,2-dichloroethane (1,2-DCA), 1,1-DCE, 1,2-dichloroethene (1,2-DCE), perchloroethene (tetrachloroethene, PCE), and TCE. The concentrations of theses compounds detected are generally less than analytical detection limits. Many of these compounds, 1,1-DCA, 1,2-DCA, 1,1-DCE and 1,2-DCE, are degradation products of PCE and TCE. Calcium and iron are routinely detected in concentrations exceeding background in groundwater from this well, however, the concentrations of calcium detected have all been less than the maximum background concentration. Magnesium was also detected at a concentration greater than background on one occasion. Americium-241, cesium-137, plutonium-239,240, radium-226 and tritium have been detected in groundwater samples in concentrations

exceeding background. Bromomethane and chloroform were detected in the one sample of groundwater from well P209289. This sample was not analyzed for metals or radionuclides.

The available analytical data indicate that releases from IHSS 118.1 may have impacted surficial materials, bedrock, and groundwater. This conclusion is tenuous in that it is based upon data of limited quantity and quality. Data on soil and groundwater conditions immediately upgradient from this IHSS are lacking and are needed in order to define the source of the contaminants detected in wells downgradient from the IHSS. The data available for well P114689 is of limited use at this time due to the considerable distance between this well and the IHSS and due to the lack of data for groundwater from this well. The data available for this well may be useful in future investigations when establishing upgradient conditions for this, and other, IHSSs. Upgradient, site and proximal downgradient monitoring wells are recommended. Geologic and hydrogeologic information should be recorded at these proposed groundwater monitoring well sites. Groundwater sampling should occur on a quarterly basis and water level measurements should be taken monthly.

Borehole sample and groundwater data from wells P209189 and P209289 indicate that a wide variety of VOCs have impacted soils and groundwater in the vicinity of these wells. In addition to the detection of carbon tetrachloride, the detection of PCE, TCE, and a number of degradation products of these compounds is notable. These data indicate that the possibility TCE may have been released during the documented spill cannot be ruled out at this time. In addition to gathering data specific to this IHSS, research into other possible sources of contamination in this area is needed.

This IHSS is located within the North Walnut Creek drainage basin. The surface-water runoff from this site flows northeast through a series of culverts and swales to a sump at the north edge of the PA. A 60-inch storm pipe conveys the runoff from this sump north to a 72-inch storm pipe which discharges into North Walnut Creek.

The closest surface-water monitoring site along this drainage path is SW102, which is located approximately 750 feet downstream. Sediment sampling site SED120 is located further downstream, approximately 950 feet from this IHSS. The water-quality data obtained from SW102 and SED120 cannot be used to reliably interpret the impacts from this IHSS. The surface-water from other IHSSs also drain to this monitoring site, making it difficult to isolate the source of any constituents found in the samples. Additional surface-water and sediment sampling at sites located closer to IHSS 118.1 will be required.

E.2.2 IHSS 118.2 - Solvent Spill South End of Building 776

No wells or boreholes are located in the immediate vicinity of this IHSS. The nearest upgradient well is P114689 which is located approximately 900 feet southwest of the IHSS. The analytical data available for this well are presented in Subsection E.2.1. The nearest downgradient wells are wells 2386, completed in bedrock, and 2486, completed in alluvium, which are located approximately 450 feet to the east-northeast. Groundwater samples from well 2386 have been

collected since March 1987. A summary of the analytical data for these samples is presented in Table E.11. The only analytical data available for well 2486 are the results of the analysis of VOCs in one groundwater sample collected on June 12, 1991. No VOCs were detected in this sample.

The two wells downgradient of this IHSS provide some information on the hydrogeologic conditions that may exist at the IHSS. The surficial materials are underlain by Arapahoe Formation claystones and silty claystones. There is 8.2 feet of gravel above bedrock in well 2386 and 7.2 feet of clayey gravel, caliche and clay in well 2486. The surficial material is thin in both of these wells. Well 2486, open to the surficial materials, is dry most of the time. Given the hydrogeologic conditions which may exist at the IHSS, it is not likely that a contaminant would have moved very far from the point of release. Solvents, such as DNAPLs, if they have been introduced to the groundwater would most likely be found as isolated lenses in paleotopographic lows.

Carbon tetrachloride, methylene chloride, trans-1,2-dichloroethene, and TCE have been detected in groundwater samples from well 2386. Calcium concentrations in groundwater from this well routinely exceed the upper tolerance limit but do not exceed the maximum background concentration. No radionuclides have been detected in concentrations greater than background in groundwater from this well.

Based on the limited amount of data available, it appears that groundwater in the vicinity of IHSS 118.2 may have been impacted by releases from the IHSS. As discussed in Subsection E.1 for IHSS 118.1, the data available for well P114689 are of limited use at this time for defining the nature and extent of contamination associated with this IHSS due to the separation between the well and the IHSS and the lack of groundwater data for this well. The presence of a number of VOCs in groundwater downgradient from this IHSS points to the need for further research into the types and quantities of materials that may have been released from this IHSS as well as research into other possible sources of contamination in the vicinity. Data gaps include a lack of hydrogeological and groundwater geochemical data. It is recommended that groundwater monitoring wells be installed on-site and proximally downgradient; hydrogeological and geochemical data should be collected.

This IHSS is located within the South Walnut Creek drainage basin. The surface-water runoff from this site flows southeast through an underground storm sewer system, discharging into the natural drainageway of South Walnut Creek located south of Building 980. This drainageway then discharges into another storm sewer system which carries the storm runoff around the south side of Building 991 and discharges back into South Walnut Creek east of the PA. The runoff then flows east passing under the Northeast Perimeter Road and into the B-Series ponds.

The closest surface-water monitoring site along this drainage path is SW122, which is located approximately 1800 feet downstream in the drainageway south of Building 980. Sediment sampling site SED012 is located further downstream, approximately 4400 feet along the flowpath from this IHSS, at Pond B1. The water-quality data obtained from SW122 cannot be used to

reliably interpret the impacts from this IHSS. The surface-water from other IHSSs also drain to this monitoring site, making it difficult to isolate the source of any constituents found in the samples. No data for sediment sampling site SED012 was requested from RFEDS due to the great distance between the site and the IHSSs being analyzed. Therefore, additional surface-water and sediment sampling at sites located closer to IHSS 118.2 will be required.

E.2.3 IHSS 139.1(N) AND (S) - Hydroxide Tank Area (Bldgs. 771 & 774)

There are limited data available that would assist in the definition of the nature and extent of potential contamination associated with releases from IHSSs 139.1(S) and 139.1(N). There are no wells located near or downgradient from the site of the NaOH releases (IHSS 139.1(N)). All of the tanks in this IHSS are above the high water level elevation based on water level elevations recorded for wells P119189 and P119089 since their installation in 1989. At both wells the alluvial material is thin, from 8 to 11 feet. Although these wells are upgradient of the IHSS, they are within 100 feet, and conditions similar to the well site conditions may exist at this IHSS. Relatively impermeable materials at shallow depths (Arapahoe Formation claystone at about 8.0 feet below the surface in well P119089 and clay at about 4.0 below the surface in P119189) most likely prevent a downward migration of potential contaminants and limit saturated thickness. As indicated by the high water level map for the uppermost hydrostratigraphic unit depicted in Figure 1-27, groundwater flows in a strong northerly gradient toward North Walnut Creek, essentially ridding the groundwater system of potential contaminants as seeps into the surface water system along the drainage valley walls. Standing water described as currently existing around T-107 and T-108 is most likely due to ponding of runoff which is held by low permeability surficial materials and does not reflect the level of the water table. Any contaminants which may have entered the water table aquifer due to releases at these sites are believed not to have entered bedrock and would most likely have left the groundwater system almost immediately. Therefore it is considered, that although there are no on-site or proximal downgradient wells by which contamination of the groundwater could be identified, because of the hydrogeologic conditions and the nature of the material released it is unlikely that the groundwater system has been impacted.

The nearest wells upgradient and downgradient from IHSS 139.1(S) are the same as those discussed in Subsections E.2.1 and E.2.2 for IHSSs 118.1 and 118.2. The one spill attributed to this site was believed to have been properly cleaned-up, however it was possible that some overflowing liquid infiltrated the soil beneath Building 771. Water level measurements recorded for two nearby, downgradient wells in this area, P209289 and P209389, indicate that the highest recorded water level is over 11 feet below the ground surface. The surficial materials described in these wells indicate a relatively permeable material underlies the KOH tank, however, it is unlikely that the small amount of contaminant that may have escaped cleanup efforts would have infiltrated the groundwater system. Also the groundwater data from the downgradient wells do not indicate any contaminant which may be attributable to the IHSS. The constituent that would be detected in excessive concentrations, potassium, is a naturally occurring element. Although data gaps do exist since there are no upgradient and downgradient monitoring wells in the immediate vicinity of the IHSS, elevated concentrations of this element would not necessarily

indicate contamination due to the spill. Due to the nature of the liquids released from these IHSSs, it is unlikely that any residual impact to any environmental media would be detectable except in the immediate vicinity of the releases.

These two IHSSs are located within the North Walnut Creek drainage basin. The surface-water runoff from these sites flow northeast through a series of culverts and swales to a sump at the north edge of the PA. A 60-inch storm pipe conveys the runoff from this sump north to a 72-inch storm pipe which discharges into North Walnut Creek.

The closest surface-water monitoring site to IHSS 139.1(N) is SW086, located adjacent to the north side of this IHSS and the closest monitoring site to IHSS 139.1(S) is SW102, which is located approximately 600 feet downstream to the north. Sediment sampling site SED120 is the nearest downstream monitoring site, located approximately 250 feet from IHSS 139.1(N) and approximately 800 feet from IHSS 139.1(S). The average dissolved sodium concentration based on 11 samples between January 1990 and October 1991 is 40.1 mg/l, compared to a background concentration of 35.1 mg/l. This indicates a slightly elevated concentration of sodium in the surface-water at this monitoring site.

The recorded water-quality data obtained from SW102 and SED120 cannot be used to reliably interpret the impacts from IHSS 139.1(S). The surface-water from other IHSSs also drain to these monitoring sites, making it difficult to isolate the source of any constituents found in the samples. Additional surface-water and sediment sampling at sites located closer to IHSS 139.1(S) will be required.

E.4 IHSS 139.2 - Hydrofluoric Acid Tank Area (Bldg. 714)

The nearest wells to this IHSS that may assist in evaluating the nature and extent of contamination associated with the IHSS are the same as those discussed in Subsections E.2.1 and E.2.2 for IHSSs 118.1 and 118.2. The data from these wells do not indicate any impacts that may be attributable to IHSS 139.2. Any residual impact from these releases, if detectable, would likely be confined to the immediate vicinity of the IHSS and would be unlikely to have impacted groundwater.

This IHSS is located within the North Walnut Creek drainage basin. The surface-water runoff from this site flows northeast through a series of culverts and swales to a sump at the north edge of the PA. A 60-inch storm pipe conveys the runoff from this sump north to a 72-inch storm pipe which discharges into North Walnut Creek.

The closest surface-water monitoring site along this drainage path is SW102, which is located approximately 600 feet downstream. Sediment sampling site SED120 is located approximately 750 feet further downstream. The water-quality data obtained from SW102 and SED120 cannot be used to reliably interpret the impacts from this IHSS. The surface-water from other IHSSs also drain to this monitoring site, making it difficult to isolate the source of any constituents

found in the samples. Additional surface-water and sediment sampling at sites located closer to IHSS 139.2 will be required.

E.5 IHSS 188 - Acid Leak (Southeast of Building 374)

There is a limited amount of data available that would assist in defining the nature and extent of contamination potentially associated with this IHSS. Hydrogeologic conditions in the area are expected to be similar to that found in Well P114789 over 400 feet to the south of the IHSS. In this well 26 feet of clayey sand overly Arapahoe claystone. High water levels are within six feet of the ground surface. It is likely that a small acid spill at the IHSS with similar hydrogeologic conditions, would be rapidly diluted if it reached the water table given the 20-plus feet of saturated material that exist during periods of high water levels. The nearest downgradient well, 1986, is located approximately 900 feet to the northeast. Due to the distance between this well and the IHSS, the presence of other potential sources of contamination between the well and the IHSS, and the small quantity (55 gallons maximum) of liquid released during the incident, it is improbable that any impacts attributable to this release would be detected in this well. Any residual impacts from this release, if detectable, would likely be confined to surficial materials in the immediate area of the release.

This IHSS is located within the North Walnut Creek drainage basin. The surface-water runoff flows east from this site overland to the unnamed tributary to North Walnut Creek and then northeast in a series of open drainageways and culverts to a storm sewer system which discharges into North Walnut Creek.

The closest surface-water monitoring site along this drainage path is SW018, which is located approximately 1150 feet downstream along the natural drainageway. Sediment sampling site SED010 is located near SW018 approximately 1000 feet downstream from this IHSS. The water-quality data obtained from SW018 and SED010 cannot be used to reliably interpret the impacts from this IHSS. The surface-water from other IHSSs also drain to this monitoring site, making it difficult to isolate the source of any constituents found in the samples. Additional surface-water and sediment sampling at sites located closer to IHSS 188 will be required.

TABLE E.1
BACKGROUND CONCENTRATIONS FOR ROCKY FLATS ALLUVIUM

Metals

	Aluminum	Antimony	Arsenic	Barium	Beryllium	Cadmium	Calcium[1]	Cesium	Chromium[1]	Cobalt	Copper[1]	Iron	Lead[1]	Lithium[1]
Upper Tolerance Limit (mg/kg)	13419.4947	..	4.2988	79.4928	4.7040	..	8430.1986	..	19.9897	..	11.1314	13753.5715	12.1546	..
Maximum Concentration (mg/kg)	40800.0	33.2U	41.7	209.0	19.0	3.2	157000.0	968.0U	69.6	28.1	16.6	33700.0	25.7	31.3

	Magnesium	Manganese	Mercury[1]	Molybdenum[1]	Nickel[1]	Potassium	Selenium	Silver	Sodium	Strontium[1]	Thallium[1]	Tin[1]	Vanadium[1]	Zinc[1]
Upper Tolerance Limit (mg/kg)	2484.2373	234.9950	..	..	21.4229	1557.9829	..	..	..	..	..	..	37.1857	39.7143
Maximum Concentration (mg/kg)	5570.0	656.0	0.32	41.0	54.2	4020.0	12.0U	40.9	4840.0U	226	5.4U	312.0	70.0	77.6

Inorganic Constituents

	Bicarbonate	Carbonate	Chloride	Cyanide	pH	Nitrate/ Nitrite[1]	Sulfate
Upper Tolerance Limit (mg/kg except pH)	..	..	..	..	9.5174	..	..
Lower Tolerance Limit (mg/kg except pH)	NA	NA	NA	NA	6.3858	NA	NA
Maximum Concentration (mg/kg except pH)					9.1	4.3	
Minimum Concentration (mg/kg except pH)					7.0	NA	NA

Radionuclides

	Americium-241	Cesium-137	Alpha	Beta	Plutonium-239	Radium-226	Radium-228	Strontium-90	Tritium[2]	Uranium -233,234	Uranium-235	Uranium -238
Upper Tolerance Limit (pCi/g)	0.0135	0.0669	39.3636	36.8150	0.0150	0.6513	1.9561	0.7256	0.4147	0.6558	0.0741	0.6830
Maximum Concentration (pCi/g)	0.01	0.2	42.0	44.0	0.02	0.9	2.2	1.2	0.44	3.4	0.1	3.2

NA = Not applicable .. = Value not calculated U = Concentration below detection limit [1] Value for North Rocky Flats Alluvium [2] Concentration in pCi/ml

TABLE E.2
BACKGROUND CONCENTRATIONS FOR COLLUVIUM, WEATHERED CLAYSTONE AND WEATHERED SANDSTONE

Metals

	Aluminum	Antimony	Arsenic	Barium	Beryllium	Cadmium	Calcium[1]	Cesium	Chromium[1]	Cobalt	Copper[1]	Iron	Lead[1]	Lithium[1]
Upper Tolerance Limit (mg/kg)	10427.7752	..	4.0203	121.8903	3.4013	..	7566.5613	..	10.3477	..	16.2533	14726.3649	18.6811	11.6003
Maximum Concentration (mg/kg)	22900.0	16.2	10.8	491.0	10.3	2.6U	44300.0	516.0U	21.3	29.7	26.7	38100.0	28.2	48.4U

	Magnesium	Manganese	Mercury[1]	Molybdenum[1]	Nickel[1]	Potassium	Selenium	Silver	Sodium	Strontium[1]	Thallium[1]	Tin[1]	Vanadium[1]	Zinc[1]
Upper Tolerance Limit (mg/kg)	2799.1426	203.0125	..	13.4310	20.1842	..	..	..	..	64.0675	..	..	23.7320	62.3409
Maximum Concentration (mg/kg)	5580.0	737.0	0.44	48.4U	62.4	3090.0	12.8U	33.5	3680.0	113.0	5.0U	441.0	40.9	129.0

Inorganic Constituents

	Bicarbonate	Carbonate	Chloride	Cyanide	pH	Nitrate/ Nitrite[1]	Sulfate
Upper Tolerance Limit (mg/kg except pH)	..	..	..	..	9.5161	..	..
Lower Tolerance Limit (mg/kg except pH)	NA	NA	NA	NA	7.2914	NA	NA
Maximum Concentration (mg/kg except pH)					9.7	2.5	
Minimum Concentration (mg/kg except pH)					7.2	NA	NA

Radionuclides

	Americium-241	Cesium-137	Alpha	Beta	Plutonium-239	Radium-226	Radium-228	Strontium-90	Tritium[2]	Uranium -233,234	Uranium-235	Uranium -238
Upper Tolerance Limit (pCi/g)	..	0.0745	48.4255	34.1512	0.0209	1.1379	2.0537	0.6719	0.2875	0.9830	0.1756	1.0429
Maximum Concentration (pCi/g)		0.2	48.0	34.0	0.02	1.3	2.1	0.8	0.39	2.6	0.3	2.3

NA = Not applicable .. = Value not calculated U = Concentration below detection limit [1] Value for North Rocky Flats Samples [2] Concentration in pCi/ml

TABLE E.3
BACKGROUND CONCENTRATIONS FOR UPPER MOST FLOW SYSTEM GROUNDWATER SAMPLES

Dissolved Metals

	Aluminum	Antimony	Arsenic	Barium	Beryllium	Cadmium	Calcium	Cesium	Chromium	Cobalt	Copper	Iron	Lead	Lithium
Upper Tolerance Limit (mg/l)	..	..	..	..	..	..	62.5908	..	..	..	..	..	..	..
Maximum Concentration (mg/l)	0.32	0.5U	0.01U	0.222	0.005U	0.0111	196.0	2.5U	0.02U	0.05U	0.0477	0.944	0.0396	0.4

	Magnesium	Manganese	Mercury	Molybdenum	Nickel	Potassium	Selenium	Silver	Sodium	Strontium	Thallium	Tin	Vanadium	Zinc
Upper Tolerance Limit (mg/l)	16.0851	0.2133	..	..	..	..	..	..	46.7359	..	..	..	..	..
Maximum Concentration (mg/l)	179.0	0.686	0.0008	0.5U	0.0432	11.3	0.221	0.03U	714.0	7.12	0.05U	1.0U	0.05U	0.141

Inorganic Constituents

	Bicarbonate	Carbonate	Chloride[1]	Cyanide	pH	Nitrate/ Nitrite	Sulfate
Upper Tolerance Limit (mg/l except pH)	249.3524	..	10.6716	..	8.2190	3.4338	67.0794
Lower Tolerance Limit (mg/l except pH)	NA	NA	NA	NA	6.3897	NA	NA
Maximum Concentration (mg/l except pH)	680.0	5.0U	28.0	0.01U	8.6	6.5	1800.0
Minimum Concentration (mg/l except pH)	NA	NA	NA	NA	6.3	NA	NA

Radionuclides

	Americium-241	Cesium-137	Alpha	Beta	Plutonium-239	Radium-226	Radium-228	Strontium-90	Tritium	Uranium -233,234	Uranium-235	Uranium -238
Upper Tolerance Limit (pCi/l)	0.0167	0.5061	55.0708	59.6331	0.0150	96.2939	..	0.9004	359.0676	..	2.0862	25.5702
Maximum Concentration (pCi/l)	0.034	0.5	200.0	220.0	0.03	170.0		2.13	430.0	0.1	7.74	76.9

NA = Not applicable .. = Value not calculated U = Concentration below detection limit [1] Value for North Rocky Flats Upper Most Flow System

TABLE E.4
BACKGROUND CONCENTRATIONS FOR LOWER MOST FLOW SYSTEM GROUNDWATER SAMPLES

Dissolved Metals

	Aluminum	Antimony	Arsenic	Barium	Beryllium	Cadmium	Calcium	Cesium	Chromium	Cobalt	Copper	Iron	Lead	Lithium
Upper Tolerance Limit (mg/l)	..	..	..	..	..	..	49.2824	..	..	..	..	..	..	..
Maximum Concentration (mg/l)	0.327	0.5U	0.0186	0.2U	0.005U	0.005U	167.0	2.5U	0.0177	0.05U	0.0695	0.0539	0.024	1.79

	Magnesium	Manganese	Mercury	Molybdenum	Nickel	Potassium	Selenium	Silver	Sodium	Strontium	Thallium	Tin	Vanadium	Zinc
Upper Tolerance Limit (mg/l)	..	..	..	..	..	..	..	..	231.8338	..	..	..	..	0.2234
Maximum Concentration (mg/l)	45.7	0.846	0.0003	0.5U	0.04U	21.9	0.041	0.03U	454.0	2.03	0.04U	1.0U	0.05U	0.374

Inorganic Constituents

	Bicarbonate	Carbonate	Chloride[1]	Cyanide	pH	Nitrate/ Nitrite	Sulfate
Upper Tolerance Limit (mg/l except pH)	274.7981	28.6813	..	..	10.9077	6.4068	153.7200
Lower Tolerance Limit (mg/l except pH)	NA	NA	NA	NA	6.2443	NA	NA
Maximum Concentration (mg/l except pH)	390.0	25.0	230.0	0.01U	10.4	3.6	670.0
Minimum Concentration (mg/l except pH)	NA	NA	NA	NA	7.0	NA	NA

Radionuclides

	Americium-241	Cesium-137	Alpha	Beta	Plutonium-239	Radium-226	Radium-228	Strontium-90	Tritium	Uranium -233,234	Uranium-235	Uranium -238
Upper Tolerance Limit (pCi/l)	0.0556	0.7837	25.3930	30.4997	0.0113	..	..	0.8554	420.4114	..	0.9438	6.2485
Maximum Concentration (pCi/l)	0.082	0.85	38.9	43.8	0.01	0.6		1.0	340.0		1.7	11.59

NA = Not applicable .. = Value not calculated U = Concentration below detection limit [1] Value for North Rocky Flats Lower Most Flow System

TABLE E.5
BACKGROUND CONCENTRATIONS FOR SURFACE WATER SAMPLES

Total Metals

	Aluminum	Antimony	Arsenic	Barium	Beryllium	Cadmium	Calcium[1]	Cesium	Chromium	Cobalt	Copper	Iron	Lead	Lithium[1]
Upper Tolerance Limit (mg/l)	60.4235	..	..	..	..	..	43.3634	..	..	..	..	87.1476	..	..
Maximum Concentration (mg/l)	293.0	0.5U	1.03	4.49	0.0107	0.0644	226.0	2.53	0.275	0.489	0.607	3220.0	0.516	0.1U

	Magnesium	Manganese	Mercury	Molybdenum	Nickel	Potassium	Selenium	Silver	Sodium[1]	Strontium	Thallium	Tin	Vanadium	Zinc
Upper Tolerance Limit (mg/l)	8.9377	1.9654	..	..	..	..	..	..	23.0992	..	..	..	..	0.3765
Maximum Concentration (mg/l)	28.5	27.7	0.0014	0.5U	0.646	10.2	0.025U	0.148	33.7	1.46	0.05U	0.969	1.65	2.68

Dissolved Metals

	Aluminum	Antimony	Arsenic	Barium	Beryllium	Cadmium	Calcium[1]	Cesium	Chromium	Cobalt	Copper	Iron	Lead	Lithium[1]
Upper Tolerance Limit (mg/l)	..	..	..	..	..	..	37.8275	..	..	..	..	..	..	..
Maximum Concentration (mg/l)	0.485	0.5U	0.018	0.211	0.005U	0.005U	216.0	2.5U	0.02U	0.05U	0.0278	16.7	0.0131	0.102

	Magnesium	Manganese	Mercury	Molybdenum	Nickel	Potassium	Selenium	Silver	Sodium[1]	Strontium	Thallium	Tin	Vanadium	Zinc
Upper Tolerance Limit (mg/l)	6.4118	0.5096	..	..	..	..	..	..	22.4768	..	..	..	..	..
Maximum Concentration (mg/l)	27.4	1.1	0.0013	0.5U	0.04U	2.6	0.0124	0.03U	35.2	0.967	0.05U	1.0U	0.05U	0.102

NA = Not applicable .. = Value not calculated U = Concentration below detection limit [1] Value for North Rocky Flats Surface Water

TABLE E.5 (Cont.)
BACKGROUND CONCENTRATIONS FOR SURFACE WATER SAMPLES

Inorganic Constituents

	Bicarbonate	Carbonate	Chloride	Cyanide	pH	Nitrate/ Nitrite	Sulfate
Upper Tolerance Limit (mg/l except pH)	202.1725	..	15.7253	..	9.0230	3.9883	36.9676
Lower Tolerance Limit (mg/l except pH)	NA	NA	NA	NA	5.5825	NA	NA
Maximum Concentration (mg/l except pH)	1900.0	5.0U	62.0	0.0452	9.8	11.0	560.0
Minimum Concentration (mg/l except pH)	NA	NA	NA	NA	5.0	NA	NA

Radionuclides

	Americium-241	Cesium-137	Alpha	Beta	Plutonium-239	Radium-226	Radium-228	Strontium-90	Tritium	Uranium -233,234	Uranium-235	Uranium -238
Upper Tolerance Limit (pCi/l)	0.1769	3.9312	177.4289	163.2045	1.4577	29.2468	64.2265	1.6121	2022.4548	1.1054	0.1863	0.9186
Maximum Concentration (pCi/l)	0.372	12.0	440.0	420.0	4.4	30.0	24.0	1.95	980.0	1.51	0.22	1.4

NA = Not applicable .. = Value not calculated U = Concentration below detection limit [1] Value for North Rocky Flats Surface Water

TABLE E.6
BACKGROUND CONCENTRATIONS FOR SEDIMENT SAMPLES

Metals

	Aluminum	Antimony	Arsenic	Barium	Beryllium	Cadmium	Calcium	Cesium	Chromium	Cobalt	Copper	Iron	Lead	Lithium
Upper Tolerance Limit (mg/kg)	8994.7474	..	..	..	..	..	..	..	20.8456	..	..	15664.9050	18.8158	..
Maximum Concentration (mg/kg)	21600.0	42.1U	13.0	182.0	3.5U	3.3U	52500.0	702.0U	30.4	35.1U	22.0	15000.0	49.1	70.2U

	Magnesium	Manganese	Mercury	Molybdenum	Nickel	Potassium	Selenium	Silver	Sodium	Strontium	Thallium	Tin	Vanadium	Zinc
Upper Tolerance Limit (mg/kg)	..	357.6192	..	..	..	..	..	..	..	..	..	..	24.1350	91.7952
Maximum Concentration (mg/kg)	4110.0	352.0	0.35U	70.2U	29.9	3510.0U	2.5U	6.8	3510.0U	397.0U	4.2U	70.2U	50.2	79.8

Inorganic Constituents

	Bicarbonate	Carbonate	Chloride	Cyanide	pH	Nitrate/ Nitrite	Sulfate
Upper Tolerance Limit (mg/kg except pH)	..	..	..	..	8.9280	..	..
Lower Tolerance Limit (mg/kg except pH)	NA	NA	NA	NA	5.9878	NA	NA
Maximum Concentration (mg/kg except pH)					8.7	13.0	
Minimum Concentration (mg/kg except pH)					6.1	NA	

Radionuclides

	Americium-241	Cesium-137	Alpha	Beta	Plutonium-239	Radium-226	Radium-228	Strontium-90	Tritium	Uranium -233,234	Uranium-235	Uranium -238
Upper Tolerance Limit (pCi/g)	0.0281	2.5959	57.7542	51.7571	0.0744	1.1701	1.5765	1.1015	1.1157	1.6135	0.9710	0.8462
Maximum Concentration (pCi/g)	0.02	3.2	48.0	41.9	0.08	1.1	2.3	0.99	0.97	1.48	1.34	1.3

NA = Not applicable .. = Value not calculated U = Concentration below detection limit

TABLE E.7
SUMMARY OF CONSTITUENTS DETECTED IN CONCENTRATIONS ABOVE BACKGROUND IN BOREHOLE SAMPLES FROM WELL P214689

Sample Number	Sample Depth (feet)	Acetone (µg/kg)	Benzene (µg/kg)	Carbon Disulfide (µg/kg)	Ethylbenzene (µg/kg)	Toluene (µg/kg)	Total Xylenes (µg/kg)	Barium (mg/kg)	Cadmium (mg/kg)	Copper (mg/kg)	Iron (mg/kg)	Manganese (mg/kg)	Potassium (mg/kg)
PZ42890002	0.0-1.6	ND	ND	ND	ND	ND	ND	NA	NA	NA	NA	NA	NA
PZ42890003	0.0-3.0	NA	NA	NA	NA	NA	NA		29.5	19.3			
PZ42890204	2.0-4.0	ND	ND	ND	ND	ND	ND	NA	NA	NA	NA	NA	NA
PZ42890306	3.0-6.0	NA	NA	NA	NA	NA	NA						1680
PZ42890406	4.0-6.0	ND	5V	13V	1AJ	16V	4AJ	NA	NA	NA	NA	NA	NA
PZ42890608	6.0-8.0	ND	ND	19V	2AJ	21V	6AJ						
PZ42890810	8.0-10.0	ND	ND	ND	ND	ND	ND	NA	NA	NA	NA	NA	NA
PZ42890812	8.0-12.0	NA	NA	NA	NA	NA	NA			14.6			2360
PZ42891012	10.0-12.0	ND	ND	ND	ND	ND	ND	NA	NA	NA	NA	NA	NA
PZ42891214	12.0-13.8	ND	ND	ND	ND	ND	ND	NA	NA	NA	NA	NA	NA
PZ42891216	12.0-16.0	NA	NA	NA	NA	NA	NA			26.8	15100		2190
PZ42891416	14.0-16.0	ND	ND	ND	ND	ND	ND	NA	NA	NA	NA	NA	NA
PZ42891618	16.0-17.8	ND	2AJ	ND	15V	60V	36AJ	NA	NA	NA	NA	NA	NA
PZ42891620	16.0-20.0	NA	NA	NA	NA	NA	NA			19.7	15200		
PZ42891620D	16.0-20.0(Dup.)	NA	NA	NA	NA	NA	NA						
PZ42891820	18.0-20.0	ND	2AJ	ND	14V	55V	34AJ	NA	NA	NA	NA	NA	NA
PZ42891820D	18.0-20.0(Dup.)	ND	2AJ	ND	14V	58V	37AJ	NA	NA	NA	NA	NA	NA
PZ42892022	20.0-22.0	17	5J	14	1J	17	ND	81.3		12.1		263	
PZ42892224	22.0-24.0	ND	4AJ	9V	ND	11V	3AJ	NA	NA	NA	NA	NA	NA
PZ42892226	22.0-26.0	NA	NA	NA	NA	NA	NA			19.7	16300		
PZ42892426	24.0-26.0	ND	8	22	2J	25	ND	NA	NA	NA	NA	NA	NA

V = Validated and valid A = Validated and valid with qualifiers J = Detected at concentration less than detection limit ND = Not detected
NA = Not analyzed B = Constituent detected in laboratory blank

TABLE E.7 (Cont.)
SUMMARY OF CONSTITUENTS DETECTED IN CONCENTRATIONS ABOVE BACKGROUND IN BOREHOLE SAMPLES FROM WELL P214689

Sample Number	Sample Depth (feet)	Sodium (mg/kg)	Vanadium (mg/kg)	Zinc (mg/kg)	Nitrate/ Nitrite (mg/kg)	Beta (pCi/g)	Plutonium-239,240 (Pci/g)	Radium-226 (Pci/g)	Radium-228 (pCi/g)	Strontium-89,90 (pCi/g)	Uranium-233,234 (pCi/g)	Uranium-238 (pCi/g)
PZ42890002	0.0-1.6	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
PZ42890003	0.0-3.0	7540		45.3	6.3		0.031	1.1	2		0.69	0.84
PZ42890204	2.0-4.0	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
PZ42890306	3.0-6.0						0.018	0.7				
PZ42890406	4.0-6.0	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
PZ42890608	6.0-8.0							0.8		0.83		0.83
PZ42890810	8.0-10.0	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
PZ42890812	8.0-12.0							0.9		1.33	1.04	
PZ42891012	10.0-12.0	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
PZ42891214	12.0-13.8	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
PZ42891216	12.0-16.0		37.9					0.7				
PZ42891416	14.0-16.0	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
PZ42891618	16.0-17.8	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
PZ42891620	16.0-20.0							1.3		0.95		0.86
PZ42891620D	16.0-20.0(Dup.)					37.7	0.016			0.99		0.73
PZ42891820	18.0-20.0	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
PZ42891820D	18.0-20.0(Dup.)	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
PZ42892022	20.0-22.0							0.8			0.70	0.91
PZ42892224	22.0-24.0	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
PZ42892226	22.0-26.0										0.77	0.92
PZ42892426	24.0-26.0	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA

V = Validated and valid A = Validated and valid with qualifiers J = Detected at concentration less than detection limit ND = Not detected
NA = Not analyzed B = Constituent detected in laboratory blank

TABLE E.8
SUMMARY OF CONSTITUENTS DETECTED IN CONCENTRATIONS ABOVE BACKGROUND IN GROUNDWATER SAMPLES FROM WELL P209189

Sample Number	Sample Date	Carbon Tetrachloride (µg/l)	Chloroform (µg/l)	1,1-Dichloroethane (µg/l)	1,2-Dichloroethane (µg/l)	1,1-Dichloroethene (µg/l)	1,2-Dichloroethene (µg/l)	Perchloroethene (µg/l)	Trichloroethene (µg/l)	Calcium (mg/l)
GSEP19890989001	27-SEP-89	ND	2J	2J	2J	ND	ND	3J	8	80.80
GSEP19890989001D	27-SEP-89(Dup.)	ND	3AJ	3AJ	ND	1AJ	ND	3AJ	8V	80.80
GSEP19890390001	02-MAR-90	ND	7	ND	ND	ND	7	14	28	115.00
SEP1989-0601-02-0830	01-JUN-90	ND	ND	ND	ND	ND	1J	2J	3J	67.80
GW00303IT	31-AUG-90	2J	2J	ND	ND	3J	ND	6	10	76.00
GW00617IT	08-NOV-90	1AJ	ND	2AJ	ND	2AJ	5V	4AJ	8V	75.90
GW01024IT	22-MAR-91	2AJ	ND	ND	ND	2AJ	7V	9V	15V	98.20
GW01389IT	06-JUN-91	ND	1J	ND	ND	ND	3J	4J	4J	64.60
GW01582IT	26-JUL-91	ND	ND	ND	ND	ND	ND	2J	3J	60.50
GW01814IT	10-OCT-91	ND	ND	ND	ND	ND	ND	ND	ND	70.50

Sample Number	Sample Date	Iron (mg/l)	Magnesium (mg/l)	Americium-241 (pCi/l)	Cesium-137 (pCi/l)	Plutonium-239,240 (pCi/l)	Radium-226 (pCi/l)	Tritium (pCi/l)
GSEP19890989001	27-SEP-89			0.063		0.335	NA	700
GSEP19890989001D	27-SEP-89(Dup.)			0.063		0.335	NA	700
GSEP19890390001	02-MAR-90		19.50	0.08076	1.036	0.05905	NA	NA
SEP1989-0601-02-0830	01-JUN-90	1.530				0.028	NA	
GW00303IT	31-AUG-90	0.196		NA	NA	NA	NA	NA
GW00617IT	08-NOV-90			0.5405		3.56	2.631	619
GW01024IT	22-MAR-91			NA		0.2286		782.2
GW01389IT	06-JUN-91	0.288		NA		0.1498	NA	NA
GW01582IT	26-JUL-91	0.463				0.1513	NA	
GW01814IT	10-OCT-91			0.09905		0.442	NA	

V = Validated and valid A = Validated and valid with qualifiers J = Detected at concentration less than detection limit ND = Not detected
NA = Not analyzed B = Constituent detected in laboratory blank

TABLE E.9
SUMMARY OF CONSTITUENTS DETECTED IN CONCENTRATIONS ABOVE BACKGROUND IN BOREHOLE SAMPLES FROM WELL P209189

Sample Number	Sample Depth (feet)	Methylene Chloride (µg/kg)	Aluminum (mg/kg)	Arsenic (mg/kg)	Barium (mg/kg)	Calcium (mg/kg)	Lead (mg/kg)	Potassium (mg/kg)	Vanadium (mg/kg)	Alpha (pCi/l)	Plutonium-239,240 (pCi/g)	Radium-226 (pCi/g)	Uranium-233,234 (pCi/g)	Uranium-238 (pCi/g)	Tritium (pCi/ml)
SEP1989BR0002	0.0-1.3	1AJ	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
SEP1989BR0002D	0.0-1.3(Dup.)	2AJ	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
SEP1989BR0003	0.0-3.0	NA		6	128	12400	16.9	1980	38	62	NA	0.8	1.9	1.0	0.49
SEP1989BR0309	3.0-9.5	NA	15400	13.6	48			3750		NA	NA	NA	NA	NA	NA
SEP1989BR0406	4.3-6.3	2AJ	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
SEP1989BR0810	8.3-9.5	2AJ	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
SEP1989BR1016	10.3-16.3	NA		8.7							0.07				1.1
SEP1989BR1214	12.3-14.3	3AJ	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
SEP1989BR1618	16.3-18.3	3AJ	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
SEP1989BR1622	16.3-22.3	NA		5.3							0.04				1.4
SEP1989BR1622D	16.3-22.3(Dup.)	NA								NA	NA				1.4
SEP1989BR2021	20.3-21.3	2AJ	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
SEP1989BR2223	22.3-23.3	7V	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA

V = Validated and valid A = Validated and valid with qualifiers J = Detected at concentration less than detection limit ND = Not detected
NA = Not analyzed B = Constituent detected in laboratory blank

TABLE E.10
SUMMARY OF CONSTITUENTS DETECTED IN CONCENTRATIONS ABOVE BACKGROUND IN BOREHOLE SAMPLES FROM WELL P209289

Sample Number	Sample Depth (feet)	Acetone (µg/kg)	Benzene (µg/kg)	Chlorobenzene (µg/kg)	Chloroform (µg/kg)	1,1-Dichloroethene (µg/kg)	Methylene Chloride (µg/kg)	Toluene (µg/kg)	Trichloroethene (µg/kg)	Arsenic (mg/kg)	Barium (mg/kg)	Beryllium (mg/kg)	Copper (mg/kg)
SEP20890002	0.0-1.2	ND	ND	ND	ND	ND	2J	ND	ND	NA	NA	NA	NA
SEP20890003	0.0-3.0	NA	NA	NA	NA	NA	NA	NA	NA	4.5	82		11.9
SEP20890309	3.0-9.2	NA	NA	NA	NA	NA	NA	NA	NA	5.6	91		
SEP20890406	3.0-5.8	ND	ND	ND	ND	ND	2J	ND	ND	NA	NA	NA	NA
SEP20890810	7.8-9.2	ND	ND	ND	ND	ND	6	ND	ND	NA	NA	NA	NA
SEP20890912	9.2-12.2	NA	NA	NA	NA	NA	NA	NA	NA				
SEP20891214	11.8-12.2	8J	2J	2J	8	2J	6	2J	2J	NA	NA	NA	NA
SEP20891418	13.8-17.8	NA	NA	NA	NA	NA	NA	NA	NA	6.8			
SEP20891618	15.8-17.8	ND	3J	3J	ND	ND	8	3J	3J	NA	NA	NA	NA

Sample Number	Sample Depth (feet)	Iron (mg/kg)	Manganese (mg/kg)	Zinc (mg/kg)	Americium-241 (pCi/g)	Radium-226 (pCi/g)	Tritium (pCi/ml)	Uranium-233,234 (pCi/g)	Uranium-238 (pCi/g)
SEP20890002	0.0-1.2	NA	NA	NA	NA	NA	NA	NA	NA
SEP20890003	0.0-3.0		249	41.6	0.15	0.7	1.1	0.7	
SEP20890309	3.0-9.2		456		0.03		1.0		
SEP20890406	3.0-5.8	NA	NA	NA	NA	NA	NA	NA	NA
SEP20890810	7.8-9.2	NA	NA	NA	NA	NA	NA	NA	NA
SEP20890912	9.2-12.2		238				0.42	0.9	0.8
SEP20891214	11.8-12.2	NA	NA	NA	NA	NA	NA	NA	NA
SEP20891418	13.8-17.8	28400			NA	NA	NA	NA	NA
SEP20891618	15.8-17.8	NA	NA	NA	NA	NA	NA	NA	NA

V = Validated and valid A = Validated and valid with qualifiers J = Detected at concentration less than detection limit ND = Not detected
NA = Not analyzed B = Constituent detected in laboratory blank

TABLE E.11
SUMMARY OF CONSTITUENTS DETECTED IN CONCENTRATIONS ABOVE BACKGROUND IN GROUNDWATER SAMPLES FROM WELL 2386

Sample Number	Sample Date	Carbon Tetrachloride (µg/l)	trans-1,2-Dichloroethene (µg/l)	Methylene Chloride (µg/l)	Trichloroethene (µg/l)	Calcium (mg/l)	Iron (mg/l)
23-86-03-18-87	18-MAR-87	ND	4	NA	ND	NA	NA
23-86-06-24-87	24-JUN-87	ND	ND	NA	ND	NA	NA
23-86-09-23-87	23-SEP-87	ND	5	NA	ND	NA	NA
23-86-01-15-88	15-JAN-88	7	NA	13	ND	96.4941	
23-86-03-21-88	21-MAR-88	ND	NA	16	ND	98.7690	0.1262
23-86-05-23-88	23-MAY-88	ND	NA	ND	ND	95.7839	
23-86-09-08-88	08-SEP-88	ND	NA	ND	ND	NA	NA
23-86-11-30-88	30-NOV-88	ND	NA	ND	ND	NA	NA
23-86-03-01-89	01-MAR-89	ND	ND	ND	ND	NA	NA
G23861189004	06-NOV-89	ND	NA	ND	ND		
G23860390001	22-MAR-90	ND	NA	ND	ND	94.20	
G-2386-0524-02-0910	25-MAY-90	ND	NA	5B	ND	NA	NA
GW00616IT	14-NOV-90	ND	NA	ND	6V	NA	NA
GW01199IT	24-APR-91	ND	NA	ND	ND	100.00	
GW01364IT	31-MAY-91	ND	NA	7	ND	NA	NA
GW01581IT	01-AUG-91	ND	NA	ND	ND	NA	NA
GW01815IT	07-OCT-91	ND	ND	ND	ND	NA	NA
GW02224IT	13-JAN-92	ND	NA	ND	ND	NA	NA

V = Validated and valid A = Validated and valid with qualifiers J = Detected at concentration less than detection limit ND = Not detected
NA = Not analyzed B = Constituent detected in laboratory blank

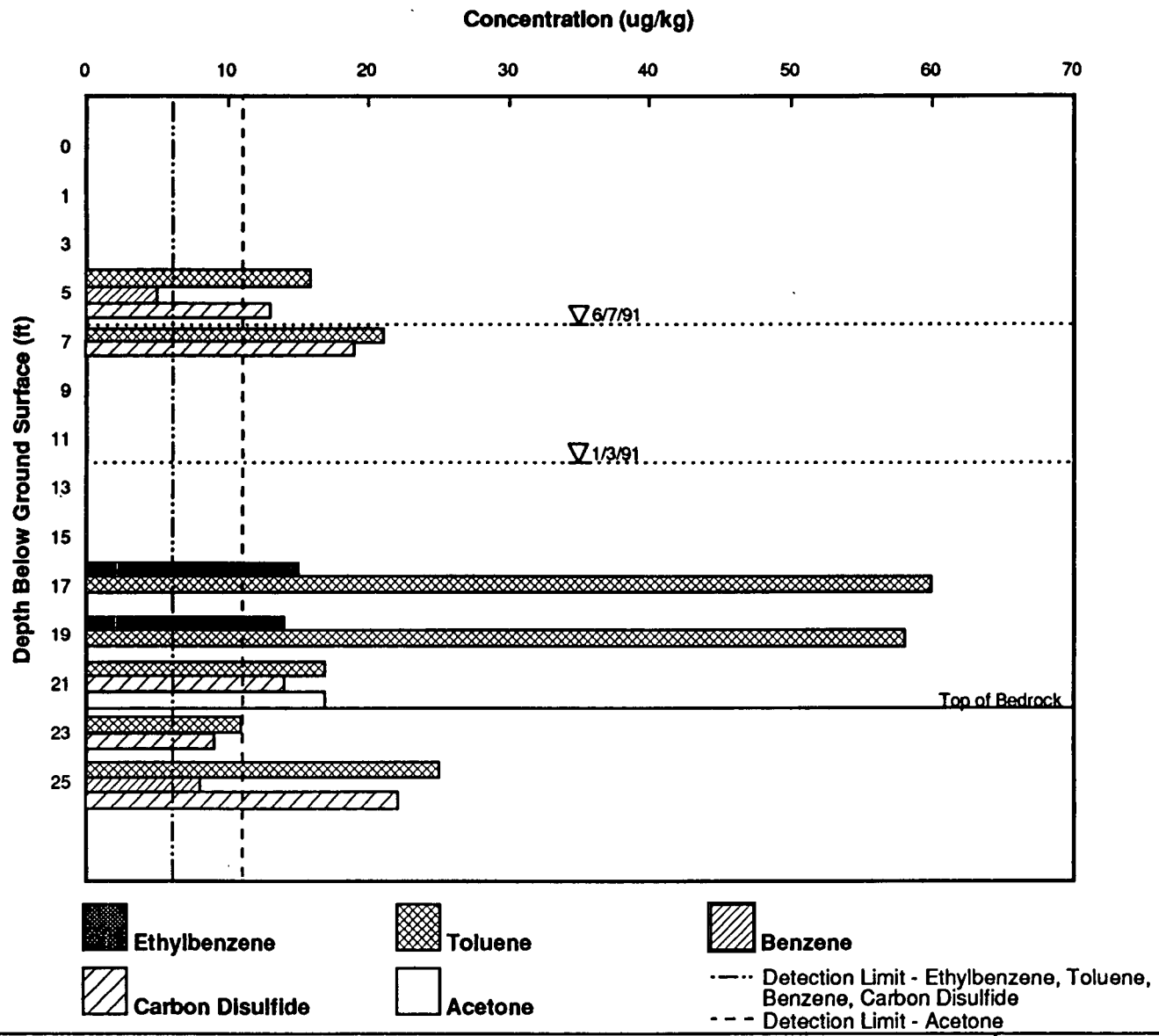
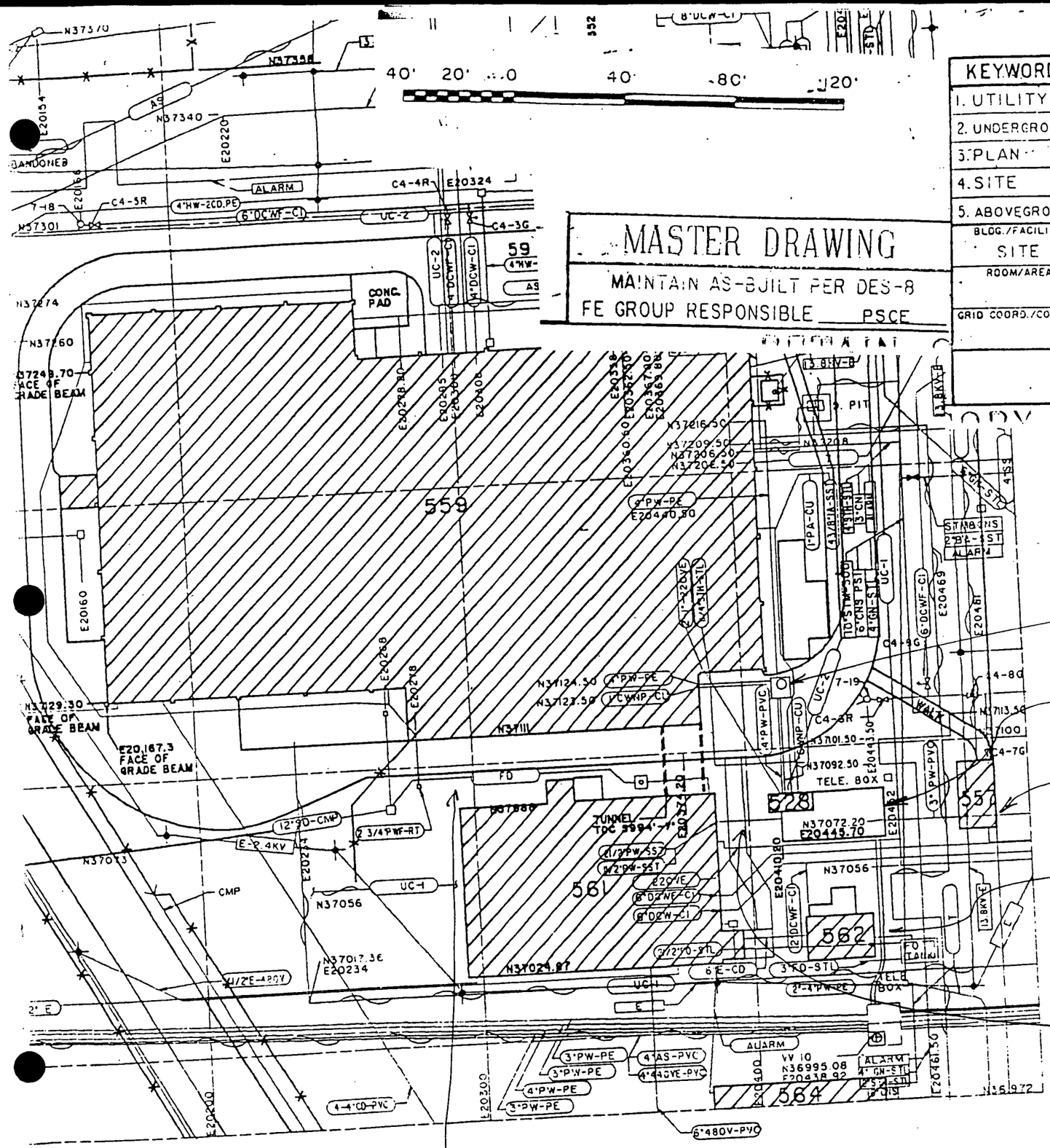


FIGURE E-1

DISTRIBUTION OF VOLATILE ORGANIC COMPOUNDS IN BOREHOLE SAMPLES FROM WELL P214689

OPERABLE UNIT NO. 8
PHASE I RFI/RI WORK PLAN
U.S. DEPARTMENT OF ENERGY
Rocky Flats Plant, Golden, Colorado



R	ADDED MASTER STAMP	7/20/90	–	LCB	QU		CB	900458
P	CONTROLLED DRAWING	1-17-87	–	WC	–	RKJ	DLG	470601
ISSUE	DESCRIPTION	DATE	RFP			DOE	CLASS	JOB NO.

KEYWORDS
1. UTILITY
2. UNDERGROUND
3. PLAN
4. SITE
5. ABOVEGROUND
BLDG./FACILITY: SITE
ROOM/AREA
GRID COORD./COL NO.

TOLERANCES: FRACT. ± ; ANGLE ± ; DEC. ± ; UNLESS NOTED OTHERWISE
REMOVE BURRS AND SHARP EDGES
NEXT ASSEMBLY
SCALE: 1" = 40'-0"

	BY	DATE
DESIGNED	—	—
DRAWN	KELLOUGH	7-20-83
CHECKED	—	—
APPROVED	TERKUN	6-17-86
SUBMITTED		
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	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.

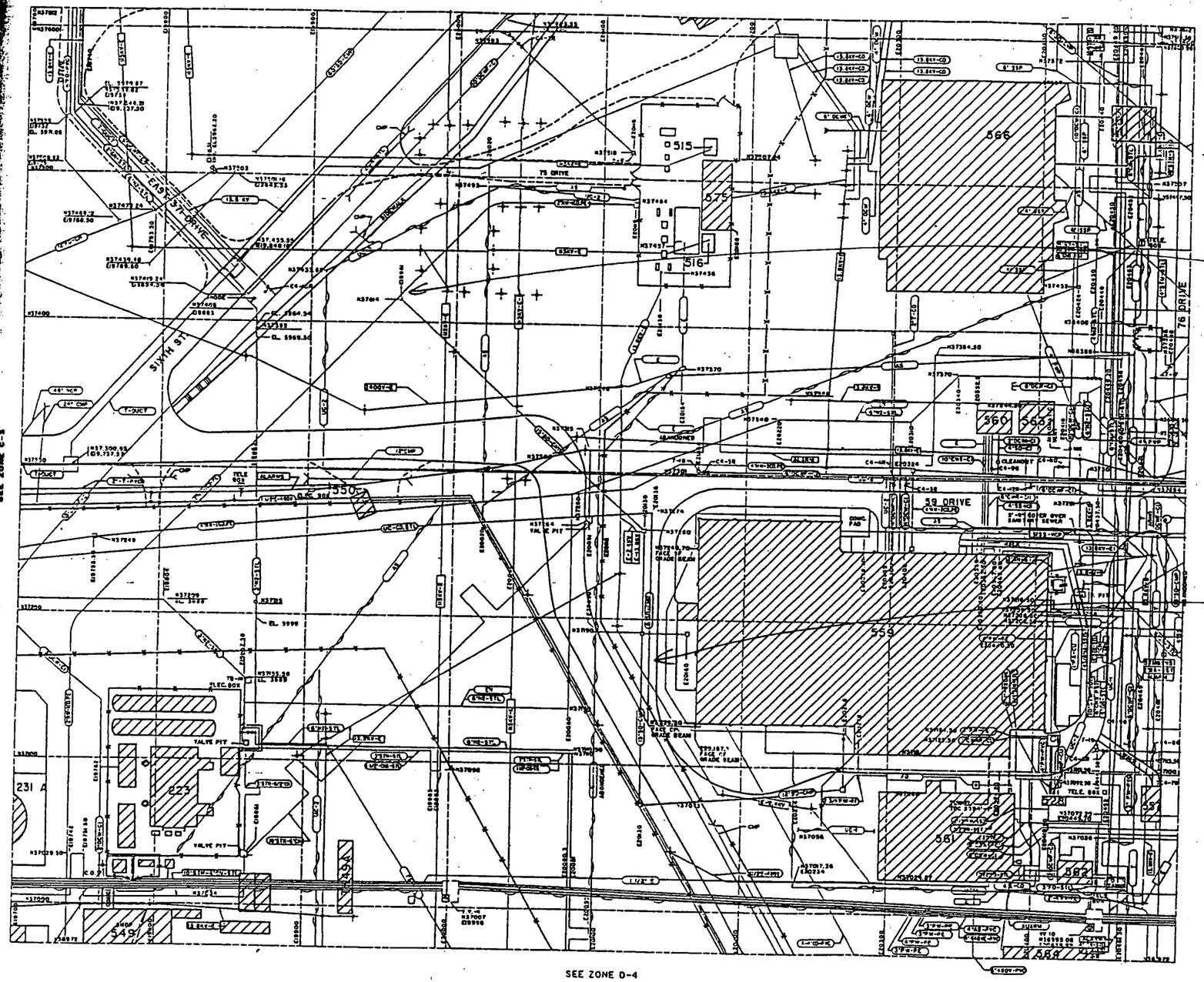
R	ADDED MASTER STAMP	7/2
P	CONTROLLED DRAWING	
ISSUE	DESCRIPTION	

KEYWORDS
1. UTILITY
2. UNDERGROUND

TOLERANCES FRACT. ± | BY | DATE

PART	CLASS	DESCRIPTION	MATERIAL

SEE ZONE B-4



SEE ZONE C-3

SEE ZONE C-5

SEE ZONE D-4

Outfall of Footing Drain/ Stormwater

Flow route of Footing Drain and Stormwater.

40' 20' 0 40' 80' 120'

KEYWORDS
1. UTILITY
2. UNDERGROUND
3. PLAN
4. SITE
5. ABOVEGROUND
SITE

REV	DESCRIPTION	DATE	RFP	DOE	CLASS	JOB NO.
R	ADDED MASTER STAMP	7/20/90	– LCB OU		CA	900458
P	CONTROLLED DRAWING	1-17-87	– WC – RKJ		DLG	470601

TOLERANCES: FRACT. ± ANGLE ± DEC. ± UNLESS NOTED OTHERWISE. REMOVE BURRS AND SHARP EDGES

	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
ROCKY FLATS OFFICE GOLDEN, COLORADO

Rocky Flats Plant
GOLDEN, COLORADO

SITE UTILITY PLANS

SIZE	DRAWING NUMBER	ISSUE	SHEET
D	15501-20-M	R	C-4

MASTER DRAWING
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FE GROUP RESPONSIBLE PSCE

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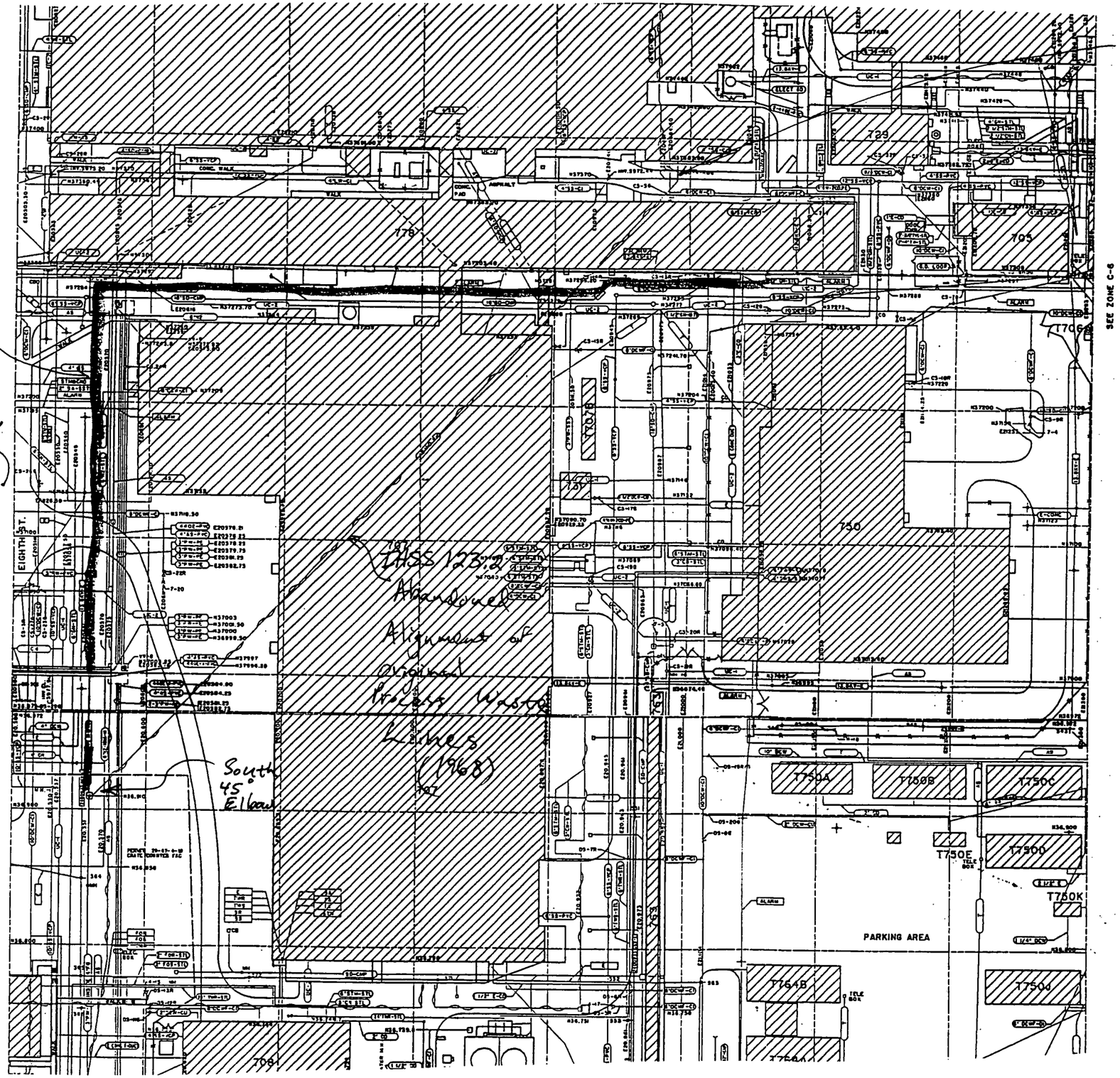
COMPUTER GENERATED
NO MANUAL CHANGES ALLOWED

R.MST104.U.KJK.C.4

"Newer" Alignment of Original Process Waste Lines (Also Currently Abandoned) (Not Part of IHSS (23.2)

North 45° Elbow



KEYWORDS	M	ADDED MASTER STAMP	5-14-90	– LCB	OU LJW		900458
1. UTILITY	L	CONTROLLED DRAWING	1-17-87	– WC	– RKJ	DLG	470601
2. UNDERGROUND		DESCRIPTION	DATE	RFP		DOE KLASS	JOB NO.
3. PLAN							
4. SITE							
5. ABOVEGROUND							
SCALE/FACILITY SITE							
ROOM/AREA							
GRID COORD./COL. NO.							

TOLERANCES: FRACT. ± ; ANGLE ± ; DEC. ± ; UNLESS NOTED OTHERWISE

REMOVE BURRS AND SHARP EDGES

PART ASSEMBLY

	BY	DATE
DESIGNED	—	—
DRAWN	KELLOUGH	7-20-83
CHECKED	—	—
APPROVED	TERKUN	6-17-86
SUBMITTED		
APPROVED RFP		
APPROVED DOE		

SCALE: 1" = 40'-0"

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GOLDEN, COLORADO

SITE UTILITY PLANS

SIZE	DRAWING NUMBER	ISSUE	SHEET
D	15501-21-M	M	C-5

COPY COMPUTER GENERATED
NO MANUAL CHANGES ALLOWED

R.MST104.U.KJK.C.5

KEYWORDS	M	ADDED MASTER STAMP	7/20/90	– BLM	OU		900458
1. SITE	L	UPDATED-OLD DWG. NO. 15501-29	7-1-86	– BSP	– VT	DLG	450031
2. UTILITIES		DESCRIPTION	DATE	RFP		DOE KLASS	JOB NO.
3. ABOVEGROUND							
4. UNDERGROUND							
5.							
SCALE/FACILITY SITE							
ROOM/AREA							
GRID COORD./COL. NO.							

TOLERANCES: FRACT. ± ; ANGLE ± ; DEC. ± ; UNLESS NOTED OTHERWISE

REMOVE BURRS AND SHARP EDGES

PART ASSEMBLY

	BY	DATE
DESIGNED	—	—
DRAWN	KELLOUGH	7-20-83
CHECKED	—	—
APPROVED	TERKUN	6-27-86
SUBMITTED		
APPROVED RFP		
APPROVED DOE		

SCALE: 1" = 40'-0"

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GOLDEN, COLORADO

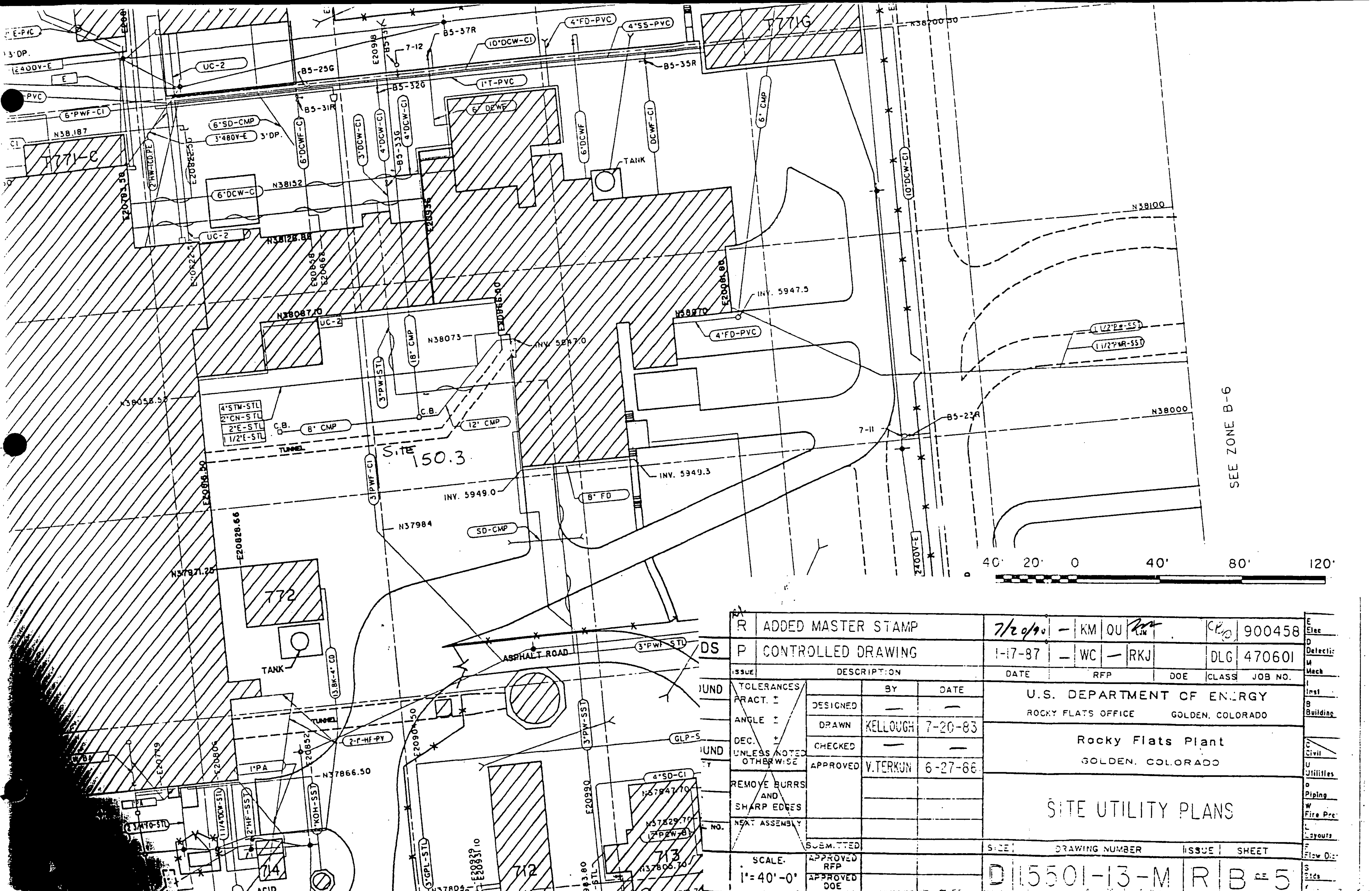
SITE UTILITY PLANS

SIZE	DRAWING NUMBER	ISSUE	SHEET
D	15501-30-M	M	D-5

COPY COMPUTER GENERATED
NO MANUAL CHANGES ALLOWED

R.MST104.U.KJK.D.5

40' 20' 0 40' 80' 120'



R	ADDED MASTER STAMP	7/20/90	—	KM	QU		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		

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ROCKY FLATS OFFICE GOLDEN, COLORADO

Rocky Flats Plant
GOLDEN, COLORADO

SITE UTILITY PLANS

SIZE	DRAWING NUMBER	ISSUE	SHEET
D	15501-13-M	R	B OF 5

E Elec
D Detection
M Mech
I Inst
B Building
C Civil
U Utilities
P Piping
W Fire Pre
L Layouts
F Flow Dia
S Stds

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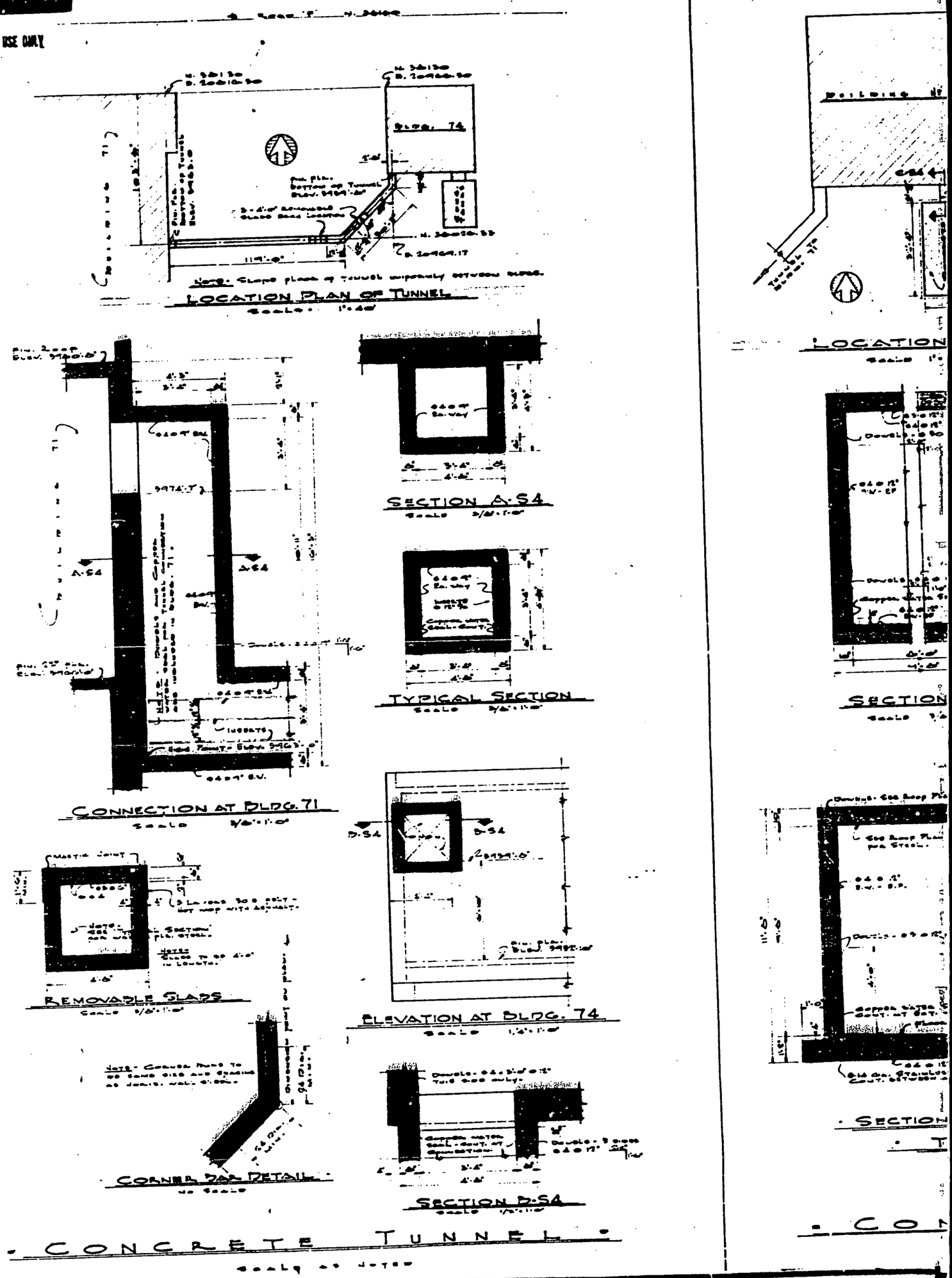


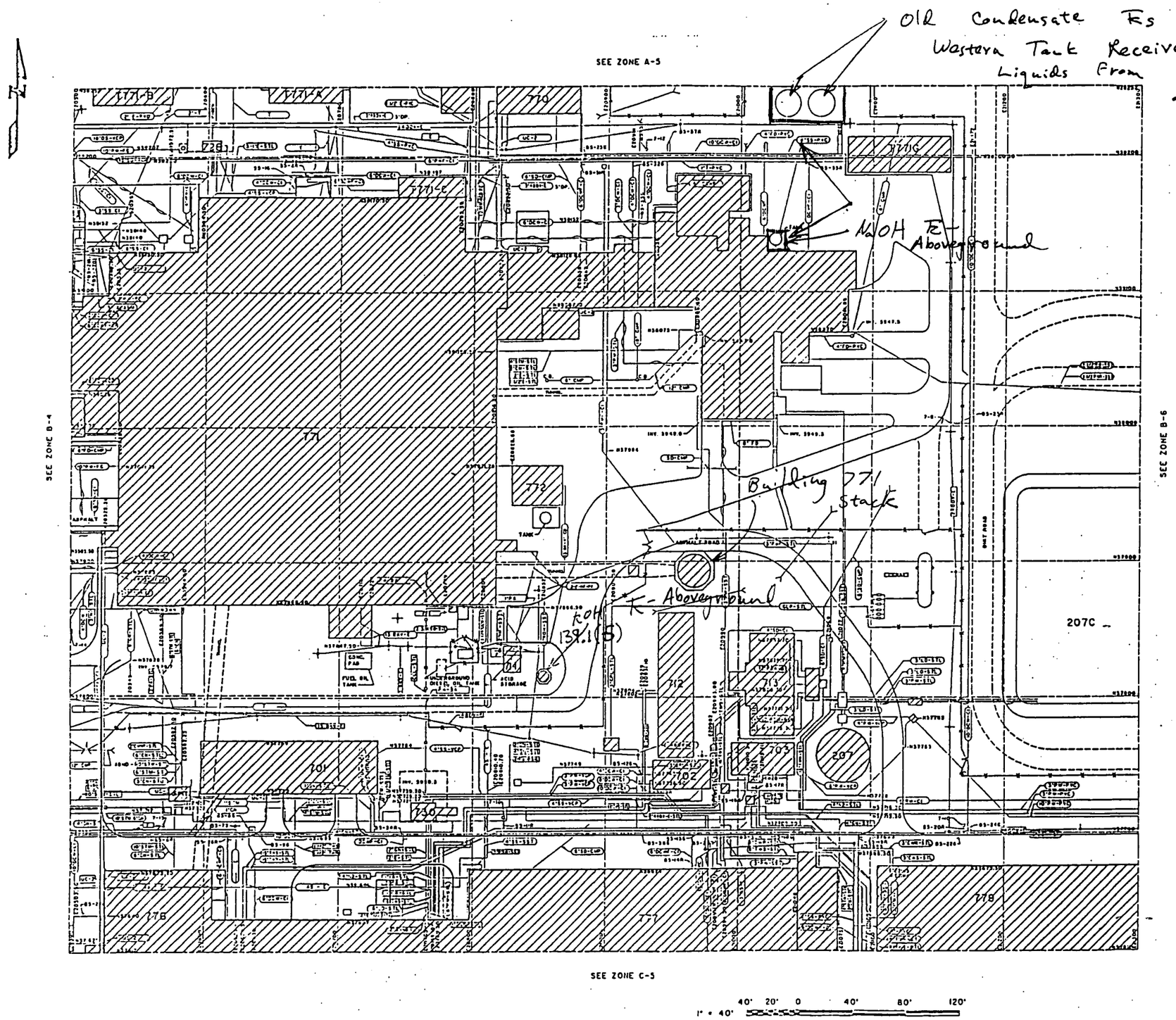
U. S. ATOMIC ENERGY COMMISSION
SANTA FE OPERATIONS OFFICE
LOS ALAMOS NEW MEXICO
ROCKY FLATS PLANT

CONCRETE TUNNEL
CONC. STORAGE TANKS

DATE 5/27/52 SCALE NOTED
DRAWN CHECKED
RF- 74-S4-B

CHANGE ORDER NO. | REVISION

FOR INFORMATION ONLY



R	ADDED MASTER STAMP	7/29/90	—	KM	QU		900456
P	CONTROLLED DRAWING	1-17-87	—	WC	—	RKJ	DLG 470601
ISSUE	DESCRIPTION	DATE		APP		DCE	CLASS JOB NO

KEYWORDS
1. UTILITY
2. UNDERGROUND
3. PLAN
4. SITE
5. ABOVEGROUND

TOLERANCES: FRACT. ± ANGLE ± DEC. ± UNLESS NOTED OTHERWISE
REMOVE BURRS AND SHARP EDGES
NEXT ASSEMBLY

	BY	DATE
DESIGNED	—	—
DRAWN	KELLOUGH	7-20-83
CHECKED	—	—
APPROVED	V. TERKUN	6-27-86

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Rocky Flats Plant
GOLDEN, COLORADO

SITE UTILITY PLANS

SIZE D | DRAWING NUMBER 15501-13-M | ISSUE R | SHEET B-5

SCALE: 1" = 40'-0"

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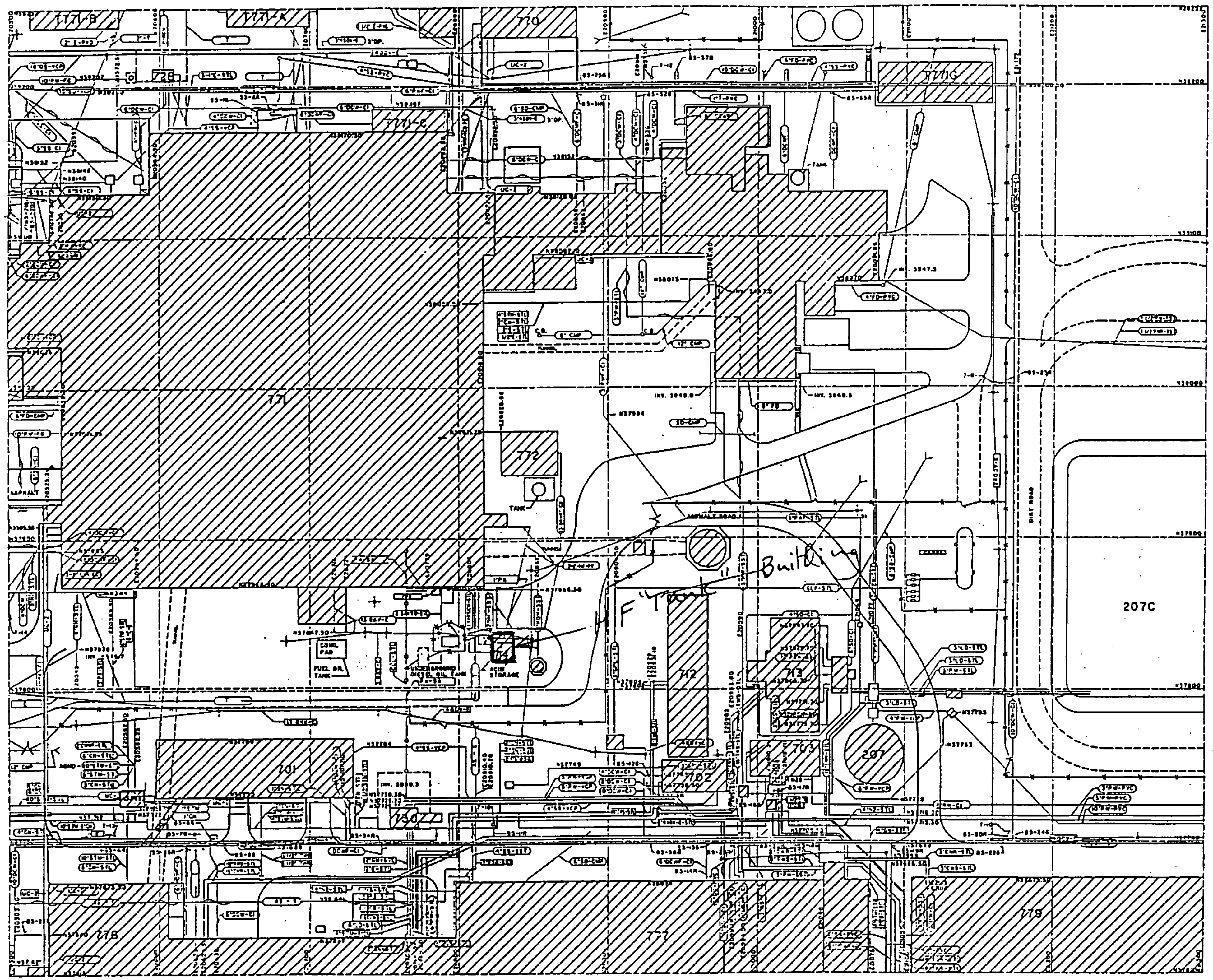
SEE ZONE A-5

SEE ZONE B-4



SEE ZONE B-6

SEE ZONE C-5

1" = 40' 40' 20' 0 40' 80' 120'

R	ADDED MASTER STAMP	7/26/90	—	KM	OU		900458
P	CONTROLLED DRAWING	1-17-87	—	WC	— RKJ	DLG	470601
ISSUE	DESCRIPTION	DATE		RFP	DOE	CLASS	JOB NO

KEYWORDS
1. UTILITY
2. UNDERGROUND
3. PLAN
4. SITE
5. ABOVEGROUND

BLDG/FACILITY: SITE

ROOM/AREA

GRID COORD/COL 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	V. TERXUN	6-27-86
SUBMITTED		
APPROVED RFP		
APPROVED DOE		

SCALE: 1"=40'-0"

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GOLDEN, COLORADO

SITE UTILITY PLANS

SIZE	DRAWING NUMBER	ISSUE	SHEET
D	15501-13-M	R	B-5

MASTER DRAWING
MAINTAIN AS-BUILT PER DES-8
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COMPUTER GENERATED
NO MANUAL CHANGES ALLOWED