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FINAL MOUND SITE PLUME DECISION DOCUMENT

RF/RMRS-97-024

Major Modification to the
Final Surface Water Interim Measures/
Interim Remedial Action Plan/
Environmental Assessment and
Decision Document for
South Walnut Creek
March 1991,
Revised October 1994

• Environmental Restoration •
Rocky Flats Environmental Technology Site

September 30 1997
Revision 0

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1.0 INTRODUCTION

This document represents a major modification to the Final Surface Water Interim Measures/ Interim Remedial Action Plan/Environmental Assessment and Decision Document for South Walnut Creek (IM/IRA) (DOE 1991). The original IM/IRA was written as a result of an agreement between Department of Energy Rocky Flats Field Office (DOE RFFO), Colorado Department of Public Health and Environment (CDPHE), and the Environmental Protection Agency (EPA) to address the issue of contaminated surface water in a portion of the South Walnut Creek Drainage at the Rocky Flats Environmental Technology Site (RFETS). This action originally consisted of collection and treatment of three surface water sources: surface water seep SW059, South Walnut Creek, and the outfall from a culvert at surface water station SW061. Water from these sources was collected and piped to the Operable Unit 2 (OU 2) Field Treatability Unit for treatment, then discharged to South Walnut Creek.

There have been many changes to this IM/IRA since it was implemented. Sampling data from several years proved that there is no unacceptable risk from two of the three sources. As a result, pursuant to a letter from EPA and CDPHE dated April 28, 1994, waters from South Walnut Creek and the culvert at SW061 are no longer collected. Pursuant to a letter from EPA and CDPHE dated September 14, 1995, use of the OU 2 Field Treatability Unit has been discontinued. The water from seep SW059 is collected, pumped to a tank near the seep, then trucked to the Consolidated Water Treatment Facility for treatment, and discharged after treatment to the South Interceptor Ditch in the Woman Creek Drainage.

The Mound Site Plume contains chlorinated organic contamination, americium and uranium in excess of Action Level and Standards Framework (ALF) Tier II level concentrations defined in Attachment 5 to the Rocky Flats Cleanup Agreement (RFCA)(DOE 1996). The proposed action will consist of constructing a subsurface groundwater collection system coupled with a passive reactive metals treatment system to treat contaminated groundwater from the Mound Site Plume and seep SW059 to the surface water action levels specified in the RFCA (DOE 1996). The project will be conducted in accordance with RFCA, DOE Orders and RFETS policies and procedures. The project will also utilize lessons learned from previous accelerated actions and will remediate one of the top ten Individual Hazardous Substance Sites (IHSSs) at RFETS. Funding for this project was provided by DOE EM50 - Subsurface Contaminant Focus Area.

2.0 PURPOSE

This Decision Document outlines the selected strategy, applicable requirements, and implementation schedule to accomplish the Mound Site Plume groundwater interception and treatment project. The Mound Site Plume is ranked seventh on the current ER Ranking (RFCA Attachment 4, DOE 1996).

This document addresses the surface water from seep SW059 that continues to be managed pursuant to the original IM/IRA. This modification proposes a new method to intercept and treat contaminated groundwater from the Mound Site Plume, including seep SW059, prior to discharge to South Walnut Creek. Collection and treatment of the hazardous substances in the Mound Site Plume will mitigate a source of surface water contamination. This action proposes using an innovative technology that effectively treats the hazardous constituents in a manner which is protective of site workers, the public, and the environment.

3.0 PROJECT DESCRIPTION AND OBJECTIVES

The Mound Site Groundwater Plume is located north of Central Avenue, and east of the protected area fence (see Figure 1). This plume of primarily volatile organic compound (VOC) contaminated groundwater is believed to originate from the Mound Site, and extend northward to where the plume discharges as seeps (including seep SW059) and subsurface flow into the South Walnut Creek Drainage. VOC-contaminated groundwater found in monitoring wells between the Mound Site and South Walnut Creek, indicates that the Mound Site was the primary source area for the plume. In addition, low levels of uranium and metals below background levels have been detected at seep SW059.

A downgradient capture system will be installed near South Walnut Creek to capture the contaminated groundwater to the extent practicable, and to minimize contaminant impacts to surface water. The groundwater will be collected and treated at a centralized treatment cell to meet surface water action levels from the ALF (DOE 1996), then discharged into surface water downgradient of the capture system. The downgradient capture system was chosen based on evaluation of other more traditional options in the Groundwater Conceptual Plan (RMRS 1996a).

The project has the following objectives:

- Intercept and treat contaminated groundwater, including seep SW059, at the distal end of the Mound Site Plume.
- Design and install a passive groundwater treatment system that, to the extent practicable, protects surface water and reduces the contaminant mass loading in surface water consistent with the ALF.
- Design the reactive metals treatment system and the barrier wall construction method to minimize the generation of low-level mixed waste and/or low-level waste.
- Design the reactive metals treatment system for easy access for operation and maintenance and for ease in media replacement or final removal.
- Develop cost and performance data for design of low cost and effective treatment systems.
- Minimize the impacts to the Prebles Meadow Jumping Mouse during construction by installing silt fences between the construction area and the creek to prevent downstream sedimentation of habitat.
- Avoid depletion of waters to South Walnut Creek.

3.1 Background

The plume of contaminated groundwater is suspected to be derived from several sources. Most of the groundwater contamination is believed to be derived from the Mound Site where approximately 1,405 intact drums were stored on the ground surface, covered with soil, between April 1954 and September 1958. The drums contained uranium and beryllium-contaminated lathe coolant (a mixture of approximately 70 percent hydraulic oil and 30 percent carbon tetrachloride). Historical information also indicates that some of the coolant contained low levels of plutonium. In 1970, all drums along with some radiologically-contaminated soil were removed from the Mound Site. Approximately 10 percent of the drums were thought to be leaking at the time of removal. However, there are no records of the volume of contaminants released to the soils at the Mound Site (DOE 1992).

An accelerated removal action was completed in Spring 1997 to excavate the soil contaminated with VOCs above Tier I action levels from the Mound Site (DOE 1997a). Low temperature thermal desorption technology will be used in the Summer of 1997 to remove the VOC contaminants of concern from the excavated soils. The treated soil below Tier II action levels will be returned to the Mound Site excavation and the area will be revegetated. If soil is present between the Tier I and Tier II action levels, disposition will be determined on a case-by-case basis in consultation with the regulators. Tier I and Tier II action levels are defined and described in RFCA (DOE 1996).

As part of the Mound Site Removal action, during March 1997, a permanent culvert was installed in the previously unlined Central Avenue Ditch in the vicinity of the Mound Site. This Ditch is immediately upgradient of the Mound Site source area, and probably contributed water to the Mound Site Plume. The culvert is expected to decrease the recharge of water to the Mound Site Plume (DOE 1997a).

Other culverts in the area also probably impact groundwater flow. A 72" storm sewer runs parallel to the western road, then turns to the east and exits to surface water at South Walnut Creek (Figure 1 and Figure 2). This culvert, or the fill material surrounding the culvert, may be acting as a preferential flow path for groundwater. The culvert forms the western edge of the plume as it intercepts groundwater and creates a preferential flow path to surface water. A 70" reinforced concrete culvert immediately north of the Mound Site Plume area diverts surface water from South Walnut Creek under the protected area fence (Figure 1 and Figure 2). This 70" culvert possibly inhibits the flow of groundwater from the west.

Another potential source of contamination contributing to the Mound Site Plume may be the fill material placed during construction of the protected area fence and the eastern road. This fill material may include the soil from IHSS 153 - Oil Burn Pit, which was excavated during construction of the south east corner of the protected area fence (Figure 1).

3.2 Previous Investigations

The Mound Site area was extensively investigated during the OU 2 Phase II Resource Conservation and Recovery Act (RCRA) Facility Investigation/Comprehensive Environmental Response, Compensation and Liability Act (CERCLA) Remedial Investigation (RFI/RI). VOCs were identified in both subsurface soil and in the groundwater contaminant plume which extends towards South Walnut Creek. Contaminated groundwater discharging at seep SW059 was also characterized (DOE 1995). Additional investigations in 1994, 1995 and 1996 confirmed and delineated the Mound Site source area (EG&G 1994, RMRS 1996b, RMRS 1996c).

An investigation, using a push-type sampler known as a geoprobe, was conducted to refine the known extent of the distal edge of the plume in late 1996 by EPA (EPA 1996). The location of these geoprobe holes is shown on Figure 1. Where available, groundwater was collected and analyzed using a portable gas chromatograph with a photoionization detector (PID). A limited number of target compounds were analyzed where possible as shown below in Table 1.

Table 1. Results of the EPA investigation.

EPA Location	Total Depth	Probable 1,1 DCE	cis, 1,2 DCE	Trichloro-ethene	Tetrachloro-ethene	Total VOCs	Comments
1	21					no sample	Dry
2	20					no sample	Moist at a depth of 17-20'
3	17.5					no sample	Moist at a depth of 14.5-17.5'
4	16.5					no sample	Moist at a depth of 13.5-16.5'
5	10.5					no sample	Moist at a depth of 7-10.5'
6	8.5	100**	5	710*	350**	1,165	
7	16.5					no sample	Dry
8	21	9**	5	220**	1,100*	1,334	
9	11.5	220**	17	1,500*	2,200*	3,937	
10	24					no sample	Dry
11	24					no sample	Dry
12	20	350**	48	3,800*	4,200*	8,398	
13	13.5					no sample	Moist at a depth of 12.5'
14	11					no sample	Dry
15	14					no sample	Dry
16	7.5	1	20	36**	26**	83	
17	11.7	nd	4	14**	19**	37	
18	6					no sample	Slightly moist
Tier I		700	7,000	500	500		
Tier II		7	70	5	5		

* Exceeds Tier I ALF Values
** Exceeds Tier II ALF Values

Many of the geoprobe holes on the eastern side of the area were dry. VOC-contaminated groundwater was found in several geoprobe holes, especially in the central portion of the area. The highest VOC concentrations were found near the center of the distal end of the plume, at location 12 where 4,200 micrograms per liter (ug/l) of tetrachloroethene and 3,800 ug/l of trichloroethene was detected. Groundwater containing low levels of VOCs (19 ug/l of tetrachloroethene and 14 ug/l of trichloroethene) was also found at location 17 on the west side of the eastern road around the protected area.

A pre-remedial investigation was conducted in March and April 1997 to determine the extent and configuration of the Mound Site Plume near South Walnut Creek (RMRS) Eighteen geoprobe holes were pushed, and temporary wells were installed in these holes. The results of this investigation are discussed in the following sections. Since the investigation was conducted during a period of rain, snow fall and snow melt, water table elevations were probably close to their maximum levels.

3.3 Hydrogeologic Setting

At the source area for the Mound Site Plume, bedrock unconformably underlies approximately 12 feet of surficial deposits and consists of weathered claystone and minor sandstones of the Cretaceous Arapahoe and Laramie Formations (DOE 1995, DOE 1997a). The Arapahoe No. 1 Sandstone subcrops under the northwest corner of the Mound Site, and is truncated to the north by the South Walnut Creek drainage. Groundwater within the Arapahoe No. 1 Sandstone exits into the colluvium, causing a higher water table, and an increase in vegetation (DOE 1995, RMRS 1996a). The Arapahoe No. 1 Sandstone is absent under the eastern portion of the Mound Site. Figure 3 illustrates the hydrogeologic setting for the plume.

Near the distal end of the plume (area of the plume closest to South Walnut Creek), clay-rich colluvium partially derived from the Rocky Flats Alluvium unconformably overlies Laramie Formation claystone (DOE 1995, EG&G 1995a, EG&G 1995b, RMRS 1996c, and RMRS 1996a). The elevation to bedrock is variable as this area has been extensively disturbed by landslides and/or slumps. Aerial photographs showed that the area was extensively regraded in 1962, probably as part of the installation of the protected area fence immediately to the west. Therefore, the bedrock surface does not closely mimic the topography. The bedrock surface forms a shallow trough plunging to the north, which probably directs groundwater flow (see Figure 4). Depth to the bedrock surface varies from 5 to 15 feet over much of the area. At the eastern extent, bedrock is 25 feet below ground surface due to fill material brought in for the eastern perimeter road.

The bedrock/colluvial contact was difficult to determine at several locations as both the colluvium and bedrock consist of fractured, weathered claystone. At location 10397, flowing sands prevented the Geoprobe from reaching the depth of the bedrock contact. In addition, there are landslide or slump features at locations 10597, 11097, and 11197 (Figure 1 and Figure 2).

The groundwater occurs in the alluvium, colluvium, in the weathered bedrock, and in the underlying Arapahoe No. 1 Sandstone. Groundwater flow is primarily to the north and follows the bedrock surface. Recharge occurs primarily through local infiltration of precipitation or local runoff. Geometric mean hydraulic conductivities are 6 x 10^{-04} cm/sec for the Rocky Flats Alluvium and 8 x 10^{-08} cm/sec for the weathered claystone (DOE 1995). Geometric mean hydraulic conductivity for the colluvium is 9 x 10^{-05} cm/sec (EG&G 1995b).

As shown on Figure 5, the water table elevation contours parallel the stream. The potentiometric surface for the Mound Site Plume follows the topography and the bedrock surface, with the major flow direction to the north. The water table elevation is very close to the elevation of the stream, necessitating care in placing the collection system to ensure that stream water is not captured.

The groundwater discharges through subsurface seeps from the bedrock into the colluvium along the hillside, seeps on the south bank of South Walnut Creek including seep SW059, and through evapotranspiration. Infiltration into the underlying unweathered claystone is limited (DOE 1995, EG&G 1995b). Depending on the season, unsaturated areas may occur within the plume (DOE 1996b, EG&G 1995b, RMRS 1996a). At seep SW059, groundwater containing low levels of VOCs with trace amounts of radionuclides discharges at a rate averaging less than 0.5 gallons per minute. The seep water is collected, stored in a tank near the seep, then transported and treated at the Building 891 Consolidated Water Treatment Facility (DOE 1995, RMRS 1996b). The approximate quantities of water collected from seep SW059 are listed in Table 2. The Spring of

1995 was exceptionally wet, including a 12-year storm event with 25+ year runoff due to saturated conditions.

Table 2. Quantity of Water Collected from Seep SW059 by Quarter

Quarter	Gallons/quarter
July-Sept. 1995	32,526
Oct.-Dec. 1995	16,930
Jan.-Mar. 1996	17,285
April-June 1996	18,775
July-Sept. 1996	13,095
Oct.-Dec. 1996	11,605
Jan.-Mar. 1997	7,268

Based on historical flow rates from seep SW059, available hydrogeologic data, and typical rates for other groundwater drains at the Site, the groundwater flow for the Mound Site Plume was calculated to be 0.1 to 2 gallon per minute for the assumed 250-foot length of groundwater interception. This flow rate assumes that water will not be depleted from South Walnut Creek, recharge to the hill side is not significantly altered from current conditions, field data is representative of the actual conditions, and that groundwater interception will occur between geoprobe holes 10297 and 11097 (Figure 1). During extended periods of below average precipitation, it is possible that the flow will effectively approach zero.

3.4 Investigation Results

The 1997 investigation determined that the distal end of the Mound Site groundwater plume extends from just west of seep SW059 to the vicinity of boring 10997 (Figure 2 and Figure 5), based on the water levels from existing wells and the recently installed, temporary wells. Photographs taken during wet periods confirm the extent of the groundwater plume. These photographs show two linear areas of heavier vegetation indicating high water tables between the Mound Site and seep SW059. These areas are limited to the western side. The upper area is probably related to the groundwater exiting the subcropping Arapahoe No. 1 Sandstone and entering the colluvium; the lower area may be related to the subcropping saturated bedrock (DOE 1995, RMRS 1996a).

Where present, groundwater was found in the colluvium and/or in the weathered bedrock just below the colluvial/bedrock contact. Water levels primarily ranged from 1 foot to 13 feet below ground surface. However, along the eastern road (Figure 2), up to 13 feet of fill material is present over the colluvium, and the water level is approximately 30 feet below ground surface.

Both the EPA investigation and the recent Site investigation discovered areas within the plume that were dry or did not produce groundwater (Figure 5) . At location 11297, the soil was dusty indicating that no groundwater was present. At the other non-producing locations, the claystone was cohesive, indicating that moisture was present. It is most likely that these areas are very low flow zones, where groundwater is present at the elevation of the surrounding water table. However, the recovery rate for the well is so low that it appears the wells are dry.

The highest groundwater levels were measured near the central portion of the plume, particularly at 10497 where the water level was one foot below ground surface. Standing water was observed in this area during the field investigation, probably due to this high water table. The water level generally declined towards the east and west edges of the plume. Location 10397 in the road bed west of seep SW059 contained significant quantities of water which supports the theory that groundwater preferentially flows through the road fill. The quantity of water present generally declines to the east and west. Location 10197, the furthest west, required several tries to collect sufficient water for a VOC analysis (120 ml).

3.5 Mound Site Plume Contamination Data Summary

Based on the results of the recent investigation in Spring 1997 (RMRS 1997), and data from the existing groundwater monitoring wells, tetrachloroethene is the predominant contaminant found in soil and groundwater at the Mound Site, with the highest historic groundwater concentration of 528,000 ug/l in Well 0174 (Figure 1). Concentrations decrease towards South Walnut Creek, which supports the Mound Site as the source area for the contaminants seen in this plume. Historical groundwater data from the Mound Site source area are summarized in Table 3, with the wells shown on Figure 1.

Table 3. Maximum Mound Site Source Area Groundwater Sampling Results Summary (from DOE 1996b).

Contaminant	Well 0174	Well 02191	Well 02291	Well 1987	Well 2087
Tetrachloroethene	528,000 ug/l	980 ug/l	3,400 ug/l	2,300 ug/l	370 ug/l
Trichloroethene	18,000 ug/l	67 ug/l	410 ug/l	110 ug/l	5 ug/l

Note: all values are maximum observed concentrations, regardless of date collected.

Figure 6 shows the wells with exceedances of Tier I and Tier II ALF values (DOE 1996) for VOCs, along with the total VOC concentrations based on the VOC contaminants of concern. The Tier I VOC exceedances are along the midline of the plume, further indicating that the Mound Site is the primary source of groundwater contamination. EPA locations 8 and 12, geoprobe location 11397, and previously existing well 02291, contain groundwater with high contaminant concentrations from the subcropping Arapahoe No. 1 Sandstone (see Figure 6).

The Arapahoe No. 1 Sandstone subcrops beneath the west side of the Mound Site Source area, and is a preferential flow pathway for contaminated groundwater to flow towards the north, towards South Walnut Creek. As shown in the cross section (Figure 3), and as verified during the recent field investigation, the Arapahoe No. 1 Sandstone subcrops beneath the colluvium in the vicinity of EPA locations 8 and 12 and geoprobe location 11397 (Figure 2). From this point, the contaminated groundwater flows northward towards South Walnut Creek in the colluvium or weathered bedrock.

From the source area to the distal end of the groundwater plume, the most commonly detected groundwater contaminants in the Mound Site Plume are tetrachloroethene and trichloroethene. Carbon tetrachloride is detected only on the western side of the plume; at seep SW059 and at location 10397 (Figure 1). This may indicate that there is a separate source of contamination in the road fill. Both dichloroethene and vinyl chloride are present in the distal portion of the plume, and are degradation products of trichloroethene and tetrachloroethene (RMRS 1996a, DOE 1995, DOE 1996b).

Table 4 provides the data for the constituents in seep SW059 above the RFCA Tier II action levels or surface water action levels during 1995 (DOE 1996) (see Section 6.0). Data for radionuclide constituents were based on 1995 and 1996 concentrations due to limited data available for 1995.

Table 4. Seep SW059 Constituents Greater than Tier II Groundwater Action Levels or Surface Water Action levels in 1995.

Chemical Name	Min. Value	Max. Value	Avg. Detect	No. De-tects	GW Tier I Action Levels	GW Tier II Action Levels	SW Action Levels	GW Back-ground	SW Back-ground	Seep Back-ground	Action Level Exceeded
Dissolved Antimony (ug/l) *	5.5	16	8.91	5	600	6	6	39.5	105,098	82.9	GW Tier II
Dissolved Manganese (ug/l) *	2.2	327	267	14	18,300	183	1,000	162.3	2,537	498.6	GW Tier II
Dissolved Thallium (ug/l)*	1.45	4.6	2.2	1	200	2	2	4.9	2,276	4.3	GW Tier II
Total Antimony (ug/l)*	5.5	11.3	6.1	1	600	6	6	36.4	13,361	264.5	GW Tier II and SW
Total Iron (ug/l)*	48.5	12,100	1,073	14	NA	NA	1,000	13,006	11,239	1.2×10^6	SW
Total Manganese (ug/l)*	258	1,440	390	14	18,300	183	1,000	296	2,020	11,852	Max value above GW Tier II and SW
Total Americium-241 (pCi/l)	0	0.25	0.08	7	15	0.15	0.15**	0.03	0.02	0.05	GW Tier II and SW
Total Gross Alpha (pCi/l) ***	4.2	31	8.59	14	NA	NA	11	232	19.5	222	Max value above SW
Total Gross Beta(pCi/l) ***	3.1	28	8.09	14	NA	NA	19	131.6	21.8	5.2	Max value above SW
Total Plutonium-239/240 (pCi/l)*	0.00	0.18	0.03	19	15.1	0.15	0.15	0.05	0.02	0.5	Max value above GW Tier II and SW
Total Uranium isotopes (pCi/l)	17.6	17.6	17.6	1	NA	NA	10	NA	1.63	2.11	SW
Total Uranium-233,-234 (pCi/l)	2.81	5.4	3.69	6	298	3	NA	85.3	1.59	3.22	U233+D only above GW Tier II
Total Uranium-238 (pCi/l)	2.25	5.03	3.16	6	77	1	NA	60.3	1.23	3.06	GW Tier II
Carbon Tetra-chloride (ug/l)	3	120	29.29	14	500	5	5	NA	NA	NA	GW Tier II and SW
Chloroform (ug/l)	5	25	8.5	14	10,000	100	6	NA	NA	NA	SW
Methylene Chloride (ug/l)	0.1	0.3	0.14	6	500	5	5	NA	NA	NA	GW Tier II and SW
Tetrachloro-ethene (ug/l)	1	21	9.29	14	500	5	5	NA	NA	NA	GW Tier II and SW
Trichloroethene (ug/l)	5	71	12.79	14	500	5	5	NA	NA	NA	GW Tier II and SW
Vinyl Chloride (ug/l)	0.7	3	0.55	4	200	2	2	NA	NA	NA	Max value above GW Tier II and SW

Note: Background values are equal to the background mean plus two standard deviations
Metal action levels are for dissolved metals only but were applied to total metals for this table.
* Metals below background concentrations
** A surface water action level of 0.05 pCi/l for Americium 241 will be met until January 1998.
*** There is no groundwater action level for gross alpha or gross beta, so the action level for Walnut Creek was used.

Soil and groundwater samples were collected near the distal end of the plume during Spring 1997 to support the design of the collection and treatment system. The analyses indicate that the highest groundwater concentrations in the distal end of the plume are trichloroethene (TCE) at 844.5 ug/l, tetrachloroethene (PCE) at 260.8 ug/l, and cis-1,2 dichloroethene at 808 ug/l seen at location 10797, directly downgradient of the Mound Site source area (Figure 1). Table 5 and Figure 6 summarizes the groundwater results of this investigation.

Table 5. Groundwater Contaminants of Concern from Recent Investigation Results (in ug/l).

	Minimum	Maximum	Average	Number of Detects	Tier I ALF	Tier II ALF
Vinyl Chloride	nd	55.0	13.0	5	200	2
1,1 Dichloroethene	nd	94.2	18.0	8	700	7
cis 1,2 Dichloroethene	nd	808.0	169.0	9	7000	70
Carbon Tetrachloride	nd	6.6	0.8	1	500	5
Chloroform	nd	177	17	6	10000	100
Trichloroethene	nd	844	195	9	500	5
Tetrachloroethene	nd	261	66	8	500	5
Methylene Chloride	nd	18	4	3	500	5
Americium 241*	0.25	0.25	0.25	1	15	0.15
Gross Beta*	3.1	28	8	14		19**
Uranium 234*	3.4	3.4	3.4	1	298	3

* Insufficient water to obtain radiological analyses, data is from seep SW059
** Surface water action level for Walnut Creek

Subsurface soil samples were collected and analyzed for VOCs, metals and radionuclides to determine whether materials excavated from the collection trench or treatment area would be required to be dispositioned as waste. An additional VOC soil sample was collected from location 10397, as field instrumentation indicated that higher levels of VOCs were present. However, only the water sample collected from this location contained elevated levels of VOCs. All soil samples were well below the RFCA action levels for subsurface soils. Analytical results by location are presented in Table 6, and the locations are shown on Figure 2.

Table 6. Subsurface Soil Radiological and VOC analytical results by location (in ug/kg except where noted)

	10197	10397	10697	10897	11697	11697-Duplicate
Carbon Tetrachloride	nd	nd	nd	nd	nd	nd
Trichloroethene	nd	nd	100	nd	nd	nd
Tetrachloroethene	160	nd	250	nd	nd	nd
Plutonium 238 (in pCi/g)	3.32×10^{-2}	ns	6.34×10^{-3}	1.26×10^{-3}	2.41×10^{-2}	1.02×10^{-1}
Plutonium 239/240 (in pCi/g)	1.05×10^{-1}	ns	1.39×10^{-2}	-2.52×10^{-3}	8.76×10^{-4}	2.99×10^{-2}
Uranium 234 (in pCi/g)	7.86×10^{-1}	ns	8.65×10^{-1}	6.0×10^{-1}	1.24	9.19×10^{-1}
Uranium 235 (in pCi/g)	3.03×10^{-2}	ns	6.17×10^{-2}	6.82×10^{-2}	9.06×10^{-2}	7.28×10^{-2}
Uranium 238 (in pCi/g)	7.2 $\times 10^{-1}$ 7.3	ns	8.33×10^{-1}	6.52×10^{-1}	1.06	9.01×10^{-1}
Americium 241 (in pCi/g)	6.34×10^{-2}	ns	5.2×10^{-2}	8.5×10^{-2}	-5.2×10^{-3}	1.08×10^{-1}

ns - not sampled

3.6 Seep SW059 Background Comparison for Metals and Radionuclides

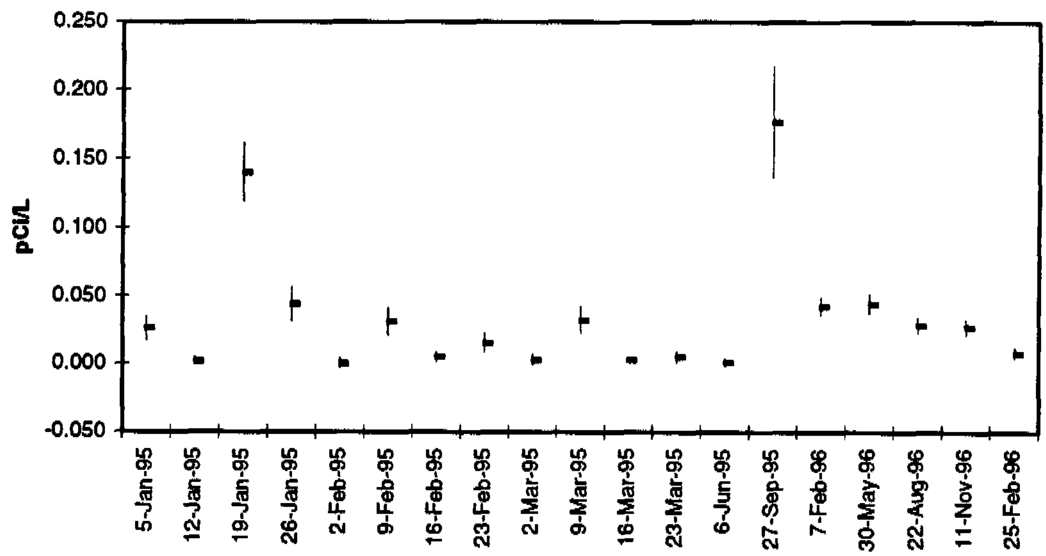
The latest readily available analytical data, for the 1995 and 1996 sampling years, were reviewed for seep SW059. A summary of the data, including minimum, maximum, average concentrations, the groundwater and surface water action level, and number of detects are reported in Table 4. For results reported as not detected at the detection limit (U-qualified results), the value assigned for calculation of the averages, was one-half the reported detection limit.

Under the RFCA, exceedances of groundwater action levels are determined by comparing each data value to the action level and then to the appropriate background concentration. A value is not considered an exceedance unless it is greater than both the action level and the background value. The maximum values for six metals and six radionuclides were above the Tier II groundwater action level or the surface water action level (where no groundwater action level was available), but were not necessarily above background levels.

For dissolved (filtered) antimony and manganese, and for total (unfiltered) antimony, iron, and manganese, the maximum detected values are below background values for both seep water and surface water, as reported in the Background Geochemical Characterization Report (DOE 1993). The seep background levels used in this Report were derived from samples from seeps outside the zone of influence of the Industrial Area (see Plate 6, DOE 1993). Dissolved thallium had one B qualified result above the seep background value of 4.3 ug/l, but this value was not above the surface water or groundwater background values. Thallium was also detected in the blank (uncontaminated) for this sample. The other 93% of the samples analyzed for thallium were nondetects. The 95% upper confidence limits of the means for all metals were below the seep and surface water background mean plus two standard deviations (M2SD). Therefore, none of these metals are considered to be chemicals of concern.

For unfiltered plutonium-239/240, two of the 19 analyses had levels at or near the groundwater or surface water action levels. No analyses were above the seep water background level (background mean plus two standard deviations) of 0.5 pCi/l. As shown in Figure 7, there is no significant temporal pattern or trend in the data. The two higher activities are not considered representative of the seep water and appear to be outliers. Therefore, plutonium is not considered a contaminant of concern.

Figure 7. SW059 Plutonium Concentrations With Error Bars



Four other radionuclides, americium-241, uranium-233/234, uranium-235, and uranium-238, were sampled several times in 1995 and 1996. Of the four radionuclides, three had values above Tier II action levels for groundwater and also above background for seep and surface water. For example, americium-241 had one value of 0.25 pCi/L; all other samples were below the surface water action level. The single analysis for total uranium also exceeded the seep water background value (Table 4).

Since there are no groundwater action levels for both gross alpha and beta, these concentrations were compared to the surface water action levels for Walnut Creek. The maximum values for both gross alpha and gross beta were above the surface water action levels. Only one of 14 analyses was above the surface water action level for gross alpha. This single value appears to be an outlier, and is well below the background values for both seep water and groundwater (Table 4). Only two of 14 gross beta values are above the surface water action levels, all other results are well below the action level and are below the surface water background value.

Neither gross alpha nor gross beta exceed the action levels on a regular basis. Therefore, neither gross alpha nor gross beta are considered a contaminant of concern.

Of the metals and radionuclides present in SW059 seep water, the maximum values for gross beta, uranium- 233/234 and uranium-238 are above background levels. Metals and radionuclides above action levels but which are not considered contaminants of concern, because these are below background levels, are asterisked in Table 4.

4.0 PROJECT APPROACH

A downgradient capture system will be installed near South Walnut Creek to intercept contaminated groundwater and to minimize impacts to surface water. A subsurface groundwater collection system will be coupled with a passive reactive metals treatment system to treat contaminated groundwater from the Mound Site Plume to the appropriate surface water action level specified in the ALF (DOE 1996). The downgradient capture system was chosen as the best remediation method following an evaluation of other more traditional options in the Groundwater Conceptual Plan (RMRS 1996a). The passive treatment system was chosen as it effectively treats VOCs and radionuclides to below action levels at a lower operations and maintenance cost than other treatment options. The treated water will then be discharged to surface water.

4.1 Proposed Action

The Mound Site Plume contains chlorinated organic contamination, americium and uranium in excess of ALF Tier II level concentrations defined in RFCA. A funnel (impermeable barrier groundwater collection system) and gate (treatment system) will be keyed into the underlying claystone for flow cut-off and treatment of the collected groundwater (Figure 3). Based on the available data, to capture the contaminant plume, a groundwater collection system will be installed that extends from the western road approximately 250 feet to the east (Figure 1 and Figure 2). An analysis of the alternatives considered prior to selection of this remedy is found in Appendix A.

The variable elevation of the bedrock surface and the similarity between the clay-rich colluvium and bedrock makes it difficult to install a collection system keyed a certain depth into bedrock.

The clay-rich colluvium and bedrock have similar properties, effective collection of the contaminated groundwater is not dependent on being keyed into bedrock. Therefore, the collection system will be installed at a variable depth of approximately 8 to 15 feet across the site, at least 6 inches, but up to several feet, into claystone, without regard to whether this is colluvium or bedrock (Figure 8). The contaminated groundwater will be treated in a series of cells containing reactive iron filings to remove VOCs and radionuclides. Under normal operations, the treated water will be discharged to groundwater using an infiltration galley located adjacent to South Walnut Creek. However, the system is designed to allow discharge directly to surface water in South Walnut Creek.

After installation of the funnel and gate system, reclamation of the collection/treatment area will be performed. The existing seep SW059 collection system will continue to operate to the extent practical, until the new system is operational. However, it is likely that installation of the funnel and gate system will require decommissioning of the existing system. During installation, collection of seep SW059 water may not be possible for a period of up to one month.

4.1.1 Installation of Funnel and Gate System

Conventional excavation/trenching techniques will be used to install the funnel and gate system. Silt fences will be installed downgradient of the excavation to control potential release of sediment to the drainages. During trench construction, the material removed from the trench will be stockpiled adjacent to the trench. A horizontal groundwater-collection line will be installed on the upgradient side of the impermeable barrier. Filter pack or pea gravel will be installed from the top of the claystone to the level of the horizontal collection line. The trench will then be backfilled and excess fill will be spread over the top of the collection system. Figure 9 shows the details of the trench construction.

During soil handling activities that result in dust generation, dust minimization techniques, such as water sprays, will be used to minimize suspension of particulates. In addition, excavation operations will not be conducted during periods of sustained high winds. The RFETS Environmental Restoration Field Operations Procedure FO.01, Air Monitoring and Dust Control, will be incorporated into the project. Air monitoring for VOCs, particulates, and radioisotopes will be performed during excavation and backfill activities.

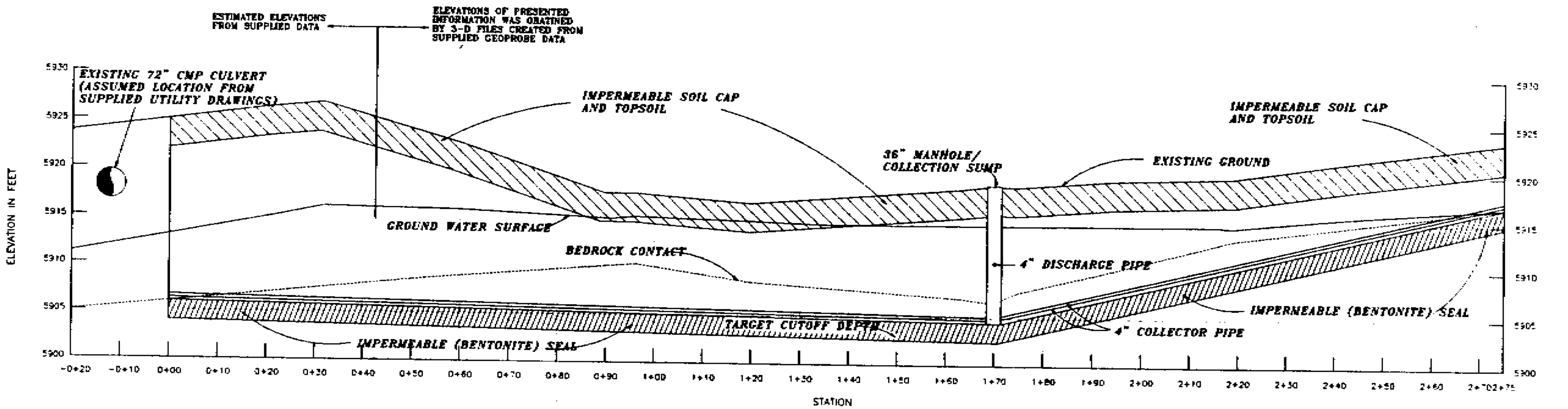
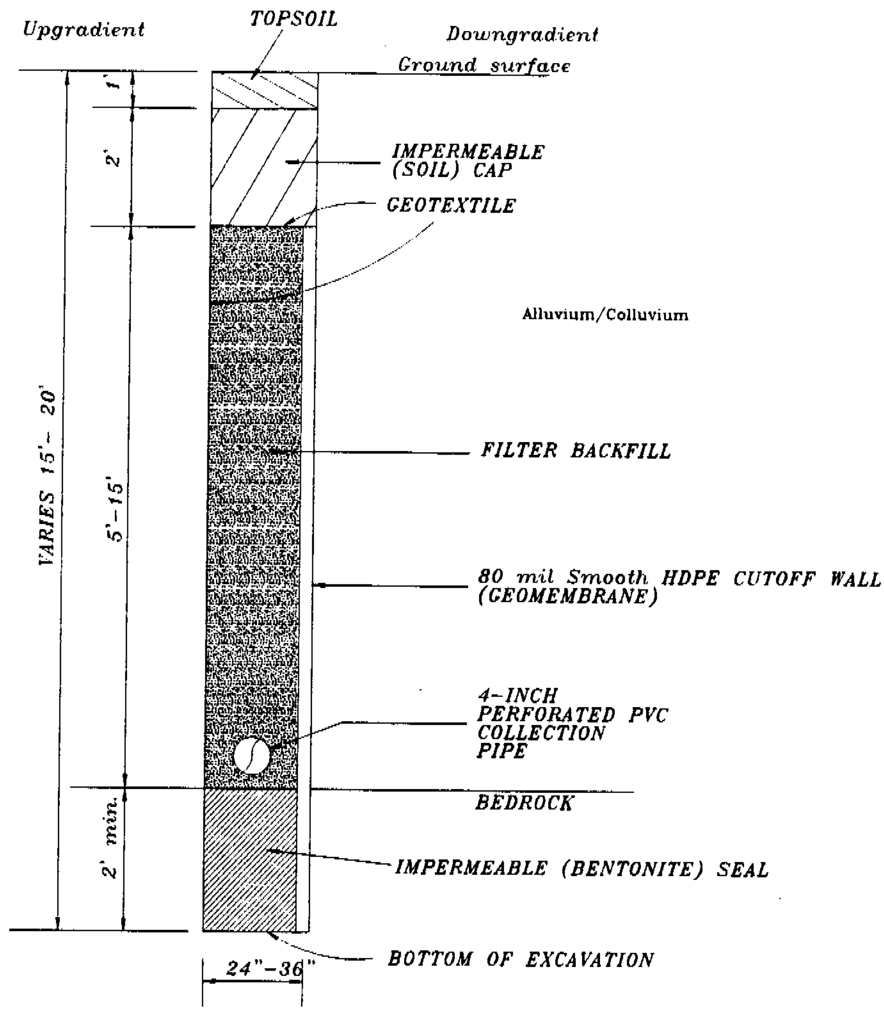


Figure 8
Cross Section along Collection Trench



TYPICAL TRENCH CROSS SECTION

NOT TO SCALE

Figure 9
Collection Trench Details

Based on the results of the soil analyses, radiological monitoring of the soils will not be performed unless required to protect workers, the public, and the environment in accordance with 10 CFR 835 and the RFETS Radiological Controls Manual (K-H, 1996). If unexpected hazards or conditions are encountered during remediation, work will be halted in order to re-evaluate the existing procedures to ensure that these are adequate to prevent spread of contamination and minimize exposure to workers.

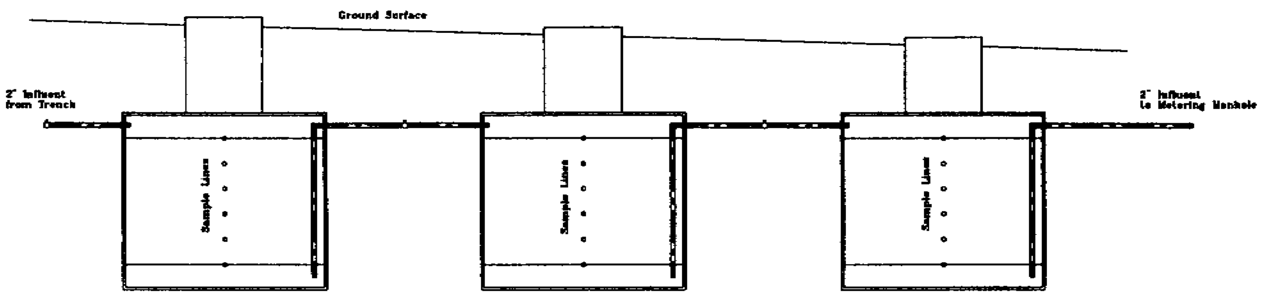
4.1.2 Treatment and Discharge

A reactive metals treatment system will be used to degrade dissolved VOCs and remove radionuclides from groundwater. The reactive metal media works by inducing conditions that cause substitution of hydrogen for chlorine in the chlorinated VOCs. The end-products of the process are completely dehalogenated hydrocarbons and non-toxic salts. Examples of end-products of chlorinated VOCs degraded by this process are ethene, ethane, and chloride ions. Radionuclides are removed by undergoing a reduction and/or absorption process.

The treatment system will be designed based on the results of laboratory treatability studies conducted by Envirometal Technologies, Inc. (ETI), the patent holder for the reactive iron filings technology, and by Sandia National Laboratories (Sandia) for radionuclide removal. ETI's and Sandia's recommendations on the volume of reactive media and retention times required to meet the surface water action levels will be incorporated into the final design of the treatment system. A schematic of the treatment system is shown on Figure 10.

Sandia tested the ability of media to remove the metals and radionuclides found in seep SW059 water by performing column test using a surrogate water sample. Their preliminary results show removal of metals and radionuclides in approximately 12 minutes.

For their laboratory treatability study, ETI used uncontaminated groundwater from RFETS and spiked it to the maximum contaminants levels expected for the Mound Site, 903 Pad/Ryan's Pit and East Trenches Plumes. Initial concentrations used in the column testing and concentrations in the treated effluent are shown in Table 7.

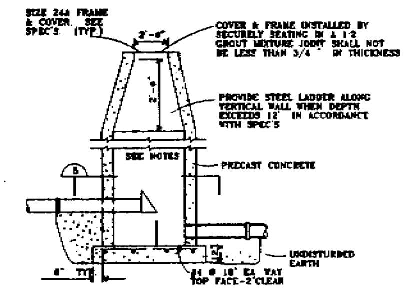


Treatment System Profile

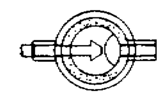
Notes:
Reactors contain a one foot flooded headspace, five feet of iron media, and a one foot drainage layer.

Sample ports originate at the center of the reactor and are spaced at one foot intervals throughout the bed depth.

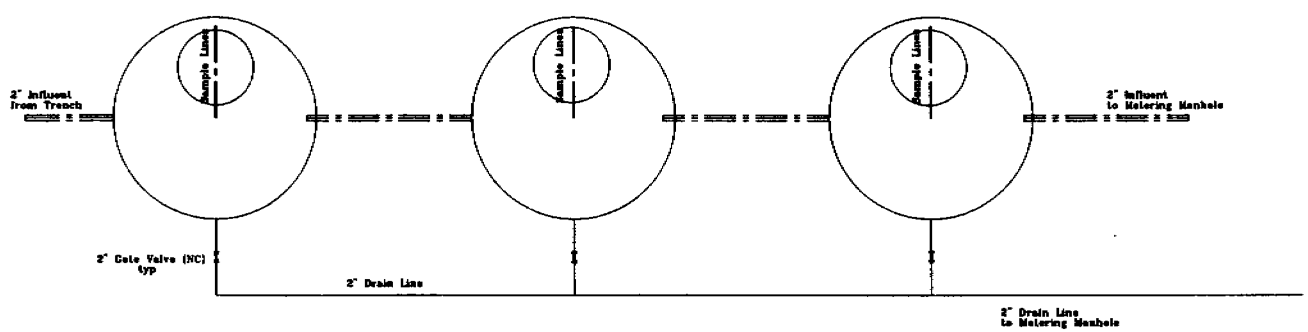
Sample lines will extend up and terminate within the access manway



Metering Manhole



SECTION
HS Type Flume
Metering Manhole Details



Treatment System Plan View

Notes:
Two inch drain lines provide a means to initially fill the reactors from teh bottom as well as allow draining of the units for media replacement

Designed by: MDW	ROCKY FLATS	COLORADO
Drawn by: MDW	MOUND SITE PLUME	
Checked by: X	Figure 10 Treatment Cell	
Reviewed by:	Plot Scale Ratio: 1/2:1; Design File: Ffield2u2e1.dgn	Date: JUNE 1997
Submitted by:	Spec. No.: DACA 45	Drawing Code: X
Chief: Section	Contract No.: DACA 45	Sheet reference number: U2.#1

All VOCs, with the exception of methylene chloride (dichloromethane) were removed to below surface water action levels. The concentrations of methylene chloride in the Mound Site Plume (Table 5) are already not detectable or low level, and surface water action levels would be met.

Table 7. Results of ETI Bench Scale Testing - Connelly Iron

Compound	Influent Conc. (ug/L)	Effluent Conc. (ug/L)	Surface Water Action Level (ug/L)
Carbon Tetrachloride	1,004	nd	5
Trichloromethane	110	nd	8
Dichloromethane	111	105	5
Tetrachloroethene	5,496	nd	5
Trichloroethene	5,250	nd	5
Cis-1,2-dichloroethene	64	nd	70
1,1-Dichloroethene	318	nd	7
Vinyl Chloride	102	nd	2
1,1,1-Trichloroethane	37	nd	200

nd = non detect

4.1.3 Performance Monitoring System

The objective of performance monitoring of the groundwater collection/treatment system is to show the effectiveness of the system in meeting the project objectives. Monitoring consists of two parts: 1) monitoring the effectiveness of the treatment system, and 2) monitoring the effectiveness of the groundwater interception system.

4.1.3.1 Treatment Monitoring

The effectiveness of the iron filings at dehalogenating chlorinated VOCs and removing radionuclides in groundwater will be evaluated by comparing VOC and radionuclide concentrations in water entering and leaving the treatment system. One access point will be installed to allow sampling inflow to the treatment system. A second access point will be installed to allow sampling of the treatment system effluent. A flow indicating device will also be installed in the treatment system discharge line. Sampling type and frequency are listed in Table 8.

4.1.3.2 Groundwater Monitoring

The effectiveness of the groundwater collection system will be assessed by monitoring the elevation of the water table in piezometers and in downgradient wells. Piezometers will be installed upgradient and downgradient of the containment wall to measure water levels. Placement of piezometers will be detailed in design drawings. The Site's Integrated Monitoring Program will be amended to select downgradient monitoring well 3586 to evaluate the effectiveness of the collection system. The sampling frequencies are listed in Table 8.

Table 8. Schedule for Water Quality Sampling and Water Table Measurements

Task	Month 1	Months 2-6	Months 7-12	Subsequent Years
Treatment System Influent	Monthly	Monthly	Monthly	Not required
Treatment System Effluent	Weekly	Monthly	Quarterly	Semi-Annually
Downgradient Water Quality	Quarterly	Quarterly	Quarterly	Semi-Annually
Hydraulic Head	Weekly	Monthly	Quarterly	Semi-Annually

Note: Water levels will be taken for each sampling event

4.1.3.3 Laboratory Methods

VOC samples will be analyzed by EPA Method 8260. Radiometric, isotopic analyses will be performed to determine the concentrations of americium, plutonium, total uranium, gross alpha and gross beta. At least 25% of the data will be validated and assessed for usability prior to use. Data will be reported to the regulators quarterly the first year, then annually thereafter.

4.1.4 Site Reclamation

At the completion of the installation of the collection and treatment system, the areas disturbed during construction will be revegetated. Radiological surveys of the equipment will be performed per the RFETS Radiological Control Manual (K-H 1996) prior to release from RFETS. Excavation equipment will be decontaminated. Typical decontamination methods include pressure washing and hand washing. Revegetation will be performed in accordance with guidance from Site ecologists using appropriate seed mixtures.

4.2 Worker Health and Safety

The nature of the contaminants present at the Mound Site cause this project to fall under the scope of the Occupational Safety and Health Administration construction standard for Hazardous Waste Operations and Emergency Response, 29 Code of Federal Regulations (CFR) 1926.65. Under this standard, a Site-Specific Health and Safety Plan (HASP) will be developed to address the safety and health hazards of each phase of site operations and to specify the requirements and procedures for employee protection. In addition, DOE Order 5480.9A, Construction Project Safety and Health Management, applies to this project. This order requires the preparation of Activity Hazard Analyses (AHAs) to identify each task, the hazards associated with each task, and the controls necessary to eliminate or mitigate the hazards. The AHAs will be included in the HASP.

This project could expose workers to physical, chemical, and potentially to low levels of radiological hazards. The physical hazards include those associated with excavation activities, use of heavy equipment, noise, heat stress, cold stress, and work on uneven surfaces. Physical hazards will be mitigated by appropriate use of personal protective equipment (PPE), engineering, and administrative controls. Chemical hazards will be mitigated by the use of PPE and administrative controls. Appropriate skin and respiratory personal protective equipment will be worn throughout the project. Routine VOC monitoring will be conducted with an organic vapor monitor for any employees who must work near the contaminated soil (i.e. soil sampling or excavation personnel). Based on employee exposure evaluations, the Site Health and Safety Officer may downgrade personal protective equipment requirements, if appropriate.

Based on the subsurface soil results (Table 6), no radiological controls will be required. However, the HASP will include project "hold points", such as encountering unexpected contaminated debris. Radiation monitoring will be included as necessary in the HASP per the RFETS Radiological Controls Manual (Kaiser-Hill, 1996).

If field conditions vary from the planned approach, an AHA will be prepared for the existing circumstances and work will proceed according to the appropriate control measures. Data and controls will be continually evaluated. Field radiological screening will be conducted using radiological instruments appropriate to detect surface contamination and airborne radioactivity. As required by 10 CFR 835, Radiation Protection of Occupational Workers, applicable implementing procedures will be followed to insure protection of the workers, co-located workers, the public, and the environment. The HASP describes the air monitoring equipment to be used to monitor for VOCs, particulates, and radiation. Finally, dust minimization techniques will be used to minimize suspension of contaminated soils.

4.3 Waste Management

Analytical data from soil sampling along the collection system alignment is expected to indicate that radionuclides are not present in soils in the area. When the impermeable barrier is excavated, soil will be stockpiled adjacent to the trench for use as backfill or to regrade or revegetate the area.

Any water that collects in the trench during trench excavation will be collected in a sump and pumped to a tank or tanker truck for treatment in the Consolidated Water Treatment Facility. Any sediment trapped in the sump, tanks, or tanker truck will be segregated, mixed with backfill material to make it more manageable for handling, and returned to the trench.

The treatment system will be designed so that there will be an initial cell containing iron filings, to remove radionuclide activity in the groundwater. The cell will be designed to have an adequate residence time to absorb the radionuclides. When the absorptive capacity of the media is exceeded, the material will be removed, stored as necessary, managed, and disposed as a low-level or low-level mixed waste. The second cell will contain iron filings to remove organics only. After this material is exhausted, it will be analyzed and then is expected to be recycled and sold as scrap metal. It is anticipated that the iron filings will require replacement every five to ten years.

Any piping or equipment from the existing seep SW059 collection system will be pressure washed to meet the debris treatment requirements (see Section 6.2.7), and disposed as nonhazardous waste.

5.0 NEPA VALUES

Incorporation of NEPA values into Site decision documents is mandated in the Rocky Flats Cleanup Agreement (RFCA) (¶95). Decision documents tied to Interim Measures/Interim Remedial Actions, such as this one, are included in that requirement by RFCA (¶118). Accordingly, this section provides a description of potential environmental impacts which may be associated with the remediation of groundwater associated with the Mound Site.

5.1 Soils and Geology

The collection system could be as long as 250 feet. Excavation for installation of the collection system may extend to claystone. Minor impacts to the claystone could occur for the full length and breadth (up to approximately four feet) of the collection system.

Soils will be disturbed for the full length and breadth of the excavation; the natural soil profile will be eliminated and replaced by a more homogeneous soil mixture when the excavated material is backfilled in the trench. The possibility that backfilling of excavated soil could affect the ability of the disturbed area to support revegetation will be mitigated by use of topsoil, imported if necessary and approved by Site ecologists in accordance with Site revegetation procedures.

It is possible that storm water could carry off excavated or in-place soil during the project. However, a silt fence will be installed downgradient of the work site to prevent transport of sediment during construction, and revegetation will provide erosion control after installation is complete.

5.2 Air

The project poses little potential for release of hazardous or radiological air emissions to the atmosphere during excavation, staging, storage, and backfilling of soil based on the low levels of contaminants expected to be present in the soil.

Kaiser-Hill Air Quality Management will evaluate the project to estimate the radionuclide and non-radionuclide air emissions generated from construction and operation of this activity. The results of this analysis will be used not only to assure compliance with applicable air quality regulations but, together with other information, to identify appropriate measures to take to protect the health of workers and public, such as wearing appropriate personal protective equipment. Such measures, if necessary, will be identified in the project's Health and Safety Plan. In addition, appropriate dust suppression measures will be implemented to minimize release of particulate air emissions. Because regulatory requirements and health-based standards will be complied with, no adverse effects are expected to air quality, and there will be no impact to colocated workers and the public from project-related air emissions. Radioactive air emissions, if any, should be very limited during either construction or operation of the project.

5.3 Water

The objective of the project is to improve water quality by removing contaminants from groundwater. Because there would be a minor change in the quantity of water discharged in the immediate area due to the addition of flow from seep SW059, and a small change in the discharge point, there are not expected to be changes in water quantity-related indicators.

The barrier will intercept groundwater flow for its length for the life of the project. Because of the small water quantities involved and the short distance between the barrier and South Walnut Creek (between 10 and 120 feet) where the water would surface normally, effects to the groundwater system are expected to be minimal.

As indicated in section 5.1, silt fencing will be installed downgradient of the work area to minimize the possibility of surface water carrying potentially-contaminated or sediment-bearing soil off the work site. Because of the silt fence and use of the pump and treatment system used to dewater the excavation, storm water runoff from the project is not expected to have adverse impacts.

Discharge of the treated water to South Walnut Creek is expected to improve water quality as water entering the stream will have significantly less contamination than at present.

5.4 Human Health

Radionuclide Air Emissions Based on the background comparison (section 3.5) radionuclides are not seen above background levels. Consequently, radionuclides are not expected to be encountered and so should not present a issue for human health.

Other Possible Effects to Human Health Other possible effects to human health include industrial accidents that can occur at any construction site where there is excavation using heavy equipment. The project's Health and Safety Plan and Field Implementation Plan will describe the steps to be taken to make the project as safe as possible for workers. (See also Section 5.13, Environmental Effects of Accidents.)

5.5 Flora and Fauna

The project will adversely effect up to about 26,000 square feet, or about six tenths of an acre, of vegetation during construction of the collection and treatment facilities. This impact will be temporary since disturbed areas will be revegetated as directed by Site ecologists. None of the area to be disturbed by the remediation activities supports or provides habitat for threatened or endangered plant or animal species, or species of concern, nor does it contain unique or unusual biological resources. The area is, however, upstream of a known population of Prebles meadow jumping mice. Use of silt fencing and Site procedures related to excavation are expected to minimize the possibility of adverse downstream effects. As a result, no impacts on downstream flora or fauna are expected.

The remedial activities will remove groundwater from the area immediately down-gradient of the barrier for the life of the project and potentially dry up a small wetland fed, at least in part, by water that daylights at seep SW059. It is also possible that construction activities could destroy the wetland. The wetland is approximately 100 sq. ft. Mitigation of this adverse effect will, if necessary, be negotiated with the Environmental Protection Agency. Mitigation, if required, could take the form of a credit against the Site's Wetland Mitigation Bank. The Site is currently working with the EPA and Army Corps of Engineers to discuss mitigation.

Due to sparse vegetative cover, its proximity to the industrial area, and its location inside the perimeter fence, the project site is used only incidentally by large mammals such as the deer and coyotes that frequent the area. Rabbits, voles, mice, and other smaller mammals as well as snakes and other reptiles would be expected to forage around or inhabit the project site. No deep-burrowing mammals (such as prairie dogs) inhabit the area. Use of the area for foraging will necessarily be interrupted during remediation, but would be expected to resume after revegetation activities are complete. It is expected that, at the conclusion of revegetation, the project site will regain its natural appearance with regard to both land contour and vegetative cover. Surveys of the area necessary for compliance with the Migratory Bird Treaty Act will be conducted by Site ecologists prior to beginning field activities.

DOE will, as required by the Endangered Species Act, confer with the U. S. Fish and Wildlife Service to confirm that the mitigation steps described above are sufficient.

5.6 Historic Resources

No buildings or other historic or potentially historic artifacts are expected to be encountered, disturbed, or affected by Mound site groundwater remediation activities. In the unlikely event that potentially historic artifacts are encountered, appropriate Site procedures will be followed.

5.7 Visual Resources

The remediation activities would result in temporary, moderate visual impacts while the project is in progress. Excavation, stockpiling of dirt and debris, and the presence of excavation equipment would change the immediate site into a construction site rather than a "natural" area. This appearance would not, however, be in sharp contrast to the industrial buildings and activities to the west. Furthermore, construction activities are expected to last less than a month, after which, as indicated above, the area would graded and revegetated to have an appearance similar to the surrounding area.

5.8 Noise

Remediation activities will result in locally-increased noise levels typically associated with other construction projects: heavy equipment operation, other machinery-related noise, *etc*. Such impacts will be minor and temporary, consistent with other noise levels at the Site, not noticeable more than a few hundred yards from the area, and confined to the Site. Appropriate hearing protection will be supplied for project personnel if called for in the project's Health and Safety Plan.

5.9 Cumulative Effects

In general, the adverse effects of Mound Site groundwater remediation activities are expected to be minimal and temporary while the beneficial effects (removal of contamination) will be long-term. Remediation of the Mound groundwater is part of the overall mission to clean up the Site and make it safe for future uses. The cumulative effects of this broader, Site-wide effort are described in the *Cumulative Impacts Document*, (DOE 1997b). That document describes the short- and long-term effects to a variety of resources from the cleanup mission, and is included in this decision document by reference.

5.10 Unavoidable Adverse Effects

Some temporary, adverse effects will necessarily occur because of the remediation activities. Some vegetation will be destroyed; soil conditions in excavated areas will be changed; noise levels will increase slightly and temporarily; some very minor quantities of air pollutants will be released to the atmosphere; fuels and other resources will be consumed; and some small mammals or reptiles may be temporarily dislocated. No long term irreversible or irretrievable commitment of resources is expected.

5.11 Short-term Uses Versus Long-term Productivity

The project area is currently vacant, *i.e.*, there is no surface use of the land. Remedial activities will improve water quality, and will open the surface area to the potential for other, possibly more productive, uses after Site closure activities are completed.

Water that is normally collected at seep SW059 and treated would not be collected during the construction period. If water collects in the excavation, it will be collected and treated. Because of the small quantity of water normally collected at seep SW059, and the very low concentrations of contaminants, environmental effects of two to four weeks of not collecting are expected to be negligible.

5.12 Irreversible and Irretrievable Commitments of Resources

Remediation will irretrievably consume fuels, small quantities of certain materials used in the treatment of water, money and labor. None of these resources will be consumed in quantities that are significant relative to their consumption elsewhere across the Site.

5.13 Environmental Effects of Accidents

The project carries only that risk of accidents that would be associated with other, similar construction projects. Radionuclides and hazardous materials are expected in quantities below those that could result in accidents and lead to adverse environmental consequences during construction or operation of the project. A project-specific Health and Safety Plan and Activity

Hazardous Analysis will be prepared to identify and control hazards that may be encountered. Implementation of the requirements of these documents will minimize the possibility, and potential consequences, of accidents.

6.0 APPLICABLE OR RELEVANT AND APPROPRIATE REQUIREMENTS

Modifications to RFETS IM/IRAs must attain, to the maximum extent practicable, federal and state applicable or relevant and appropriate requirements (ARARs). For that reason, the substantive attributes of the federal and state ARARs must be identified. In addition, RFCA recognizes section 121(e)(1) of Comprehensive Environmental Response Compensation and Liability Act (CERCLA), so that accelerated actions conducted in the buffer zone may waive the procedural requirement to obtain federal, state, or local permits. (RFCA ¶16.a.).

The groundwater treatment unit and the point source discharge will be located in the buffer zone. For each permit waived, RFCA requires identification of the substantive requirements that would have been imposed in the permit process (RFCA ¶17). Further, the method used to attain the substantive permit requirements must be explained (RFCA ¶17.c.). The following discussion is intended to compliment other descriptions provided in this IM/IRA Modification in a manner that satisfies the RFCA permit waiver requirements.

6.1 Chemical-Specific Requirements and Considerations

6.1.1 Colorado Water Quality Standards

For the VOC contaminants of concern, the site-specific Colorado Water Quality Standards for Segment 5 of Big Dry Creek are applicable to the segment of South Walnut Creek that will receive the treated discharge. These water quality standards are also relevant and appropriate to developing a design that will capture, to the maximum extent practicable, the groundwater that exceeds the surface water action levels. (See 5 CCR 1002-8, Classification and Numeric Standards South Platte River Basin, Section 3.8.0, Segment 5, Big Dry Creek). The surface water quality standards are presented in Table 9.

Table 9. Big Dry Creek Segment 5 Surface Water Quality Standards

Carbon tetrachloride	5 ug/l[1]
Chloroform (trichloromethane)	100 ug/l[2]
1,1-Dichloroethene	7 ug/l[1]
cis-1,2-Dichloroethene	70 ug/l[2]
Methylene chloride (dichloromethane)	5 ug/l[2]
Tetrachloroethene	5 ug/l[1]
1,1,1-Trichloroethane	200 ug/l[2]
Trichloroethene	5 ug/l[1]
Vinyl chloride (Chloromethane)	2 ug/l[2]

[1] Temporary Modification, effective from 3/97 to 12/09

[2] Basic Standard

6.1.2 National Emissions Standards for Hazardous Air Pollutants (NESHAP)

Title 40 of the Code of Federal Regulations (CFR) Part 61, Subparts A and H (Colorado Code of Regulations (CCR) 5 1001-3, Regulation No. 8, Part A, Subparts A and H) are the applicable NESHAPs. This regulation requires limitation of RFETS radionuclide emissions to meet an annual public dose standard (to offsite member of the public) of 10 millirem (mrem); monitoring of significant emissions points; EPA/CDPHE notification and approval (state permit) prior to construction or modification of radionuclide sources with emissions exceeding a 0.1 mrem threshold; and annual reporting of the RFETS Effective Dose Equivalent for each calendar year to demonstrate compliance with the 10 mrem standard.

Due to low concentrations of radionuclides in groundwater surface and subsurface soils, and because the proposed remediation is a CERCLA project, EPA/CDPHE notification and approval are not required. The estimated dose from the project is not expected to exceed the 0.1 mrem monitoring threshold. (See 40 CFR §61.93 (b)(4)(i)). Records will be kept, as needed, of project parameters sufficient to estimate the dose for annual compliance reporting.

6.2 Action-Specific Requirements and Considerations

The following action-specific requirements and considerations were evaluated specific to the Mound Site Plume Decision Document:

- Definition of Remediation Waste
- Identification and Listing of Hazardous Wastes
- Land Disposal Restrictions
- Construction Waters
- Soil Staging
- Temporary Unit Tank and Container Storage
- Particulate, VOC and Hazardous Air Pollution Emissions
- Debris Treatment
- Water Treatment Unit

6.2.1 Remediation Waste

In RFCA remediation waste is defined as all:

> *(1) Solid, hazardous, and mixed wastes;*
>
> *(2) All media and debris that contain hazardous substances, listed hazardous or mixed wastes or that exhibit a hazardous characteristic; and*
>
> *(3) All hazardous substances.*
>
> *generated from activities regulated under this Agreement as ... CERCLA response action.... (See RFCA ¶25.bf.).*

A parallel definition is also found in 40 CFR §260.10. As such, the definition of remediation waste is applicable to all wastes, environmental media (soil, groundwater, surface water, storm water and air) and debris generated in conjunction with this action.

6.2.2 Identification and Listing of Hazardous Wastes

Requirements governing the identification and listing of hazardous wastes are applicable to this action. (See 40 CFR Part 261). Based upon process knowledge and characterization data from the Mound Site, the contaminated groundwater and soil that will be addressed during this action also contains F001 spent solvents or still bottoms from degreasing that were released from the drums during waste storage. For that reason, the F001 hazardous waste listing is applicable to any groundwater, soil, or debris that contains solvent constituents.

6.2.3 Wastewater Treatment Unit

The Clean Water Act, NPDES governs the discharge of pollutants from any point source into the waters of the United States. (See 40 CFR §122.1(b)). The establishment of a wastewater treatment unit requires an NPDES permit waiver. Therefore, the discussion in this section is provided to satisfy ¶17 of RFCA.

As noted earlier, the Table 8 surface water quality standards (see section 6.1.1) are relevant and appropriate to the wastewater treatment unit discharge. No NPDES action-specific ARARS addressing the design or operation were identified.

6.2.4 Land Disposal Restrictions

The Land Disposal Restriction (LDR) levels for wastewater or non-wastewaters are applicable to any remediation waste that exhibits a hazardous waste characteristic or contains listed hazardous waste if it is actively managed outside of the area of contamination.

6.2.5 Construction Waters

Wastewaters generated during construction activities will be collected, then transferred to the Consolidated Water Treatment Facility for treatment. If these remediation wastewaters contain listed RCRA hazardous wastes or if the remediation wastewaters exhibit a RCRA characteristic, the RCRA hazardous waste requirements would not be applicable or relevant and appropriate during treatment because these remediation wastewaters are CERCLA wastes being treated in a CERCLA treatment unit. The Consolidated Water Treatment Facility will treat the remediation wastewater to meet applicable surface water quality standards under NPDES ARARs framework.

Any waste generated at the Consolidated Water Treatment Facility as the result of treatment of a listed remediation waste will be assigned the corresponding F001 hazardous waste code and managed in accordance with applicable RCRA ARARs. Wastes generated as a result of the treatment of remediation wastewater will also be evaluated to determine if they exhibit a hazardous characteristic.

6.2.6 Soil Staging

The movement, temporary staging and replacement of excavated soils that contain F001 listed hazardous wastes will not trigger LDRs (see 55 FR 8760) as long as these activities occur within the Mound Site Plume area of groundwater contamination.

As noted earlier, uncontaminated or marginally contaminated soils that are excavated when the system is installed will be stockpiled adjacent to or benched within the excavation. Consistent with the General Stormwater Permit for Constructions activities, Best Management Practices (BMPs) to control erosion have been considered and will be implemented. Common BMPs include silt fences or hay bales. (See 57 FR 41176). Deeper, more contaminated soils will be benched within the excavation. This will ensure that sediments and any chemical contamination are contained within the working area.

6.2.7 Temporary Unit (TU) Tank and Container Storage

Tanks and containers may be used during construction and startup to maintain groundwater that contains F001 hazardous wastes. The establishment of TUs may require a permit exemption if any of the tanks or containers are used for longer than 90 days. Therefore, the discussion in this section is provided to satisfy ¶17 of RFCA.

40 CFR §264.553 provides that temporary tanks and containers used for the storage or treatment of hazardous remediation wastes may be subject to alternative design, and operating and closure requirements as long as the requirements are protective of human health and the environment (See 40 CFR §264.553(a)). The TU must be located within the facility boundary and may only be used for treatment or storage of remediation wastes (See 40 CFR §264.553(b)).

In establishing requirements for TUs seven factors must be considered: the length of time the unit operates; the type of unit; the volumes of remediation waste; the physical and chemical characteristics of the remediation waste; the potential for releases; the conditions at the site that will influence migration; and the potential for exposure if a release occurs. (See 40 CFR §264.553(c)).

All tanks and containers will be compatible with the waste and be in good condition. Where practicable, secondary containment will be provided when liquid wastes are stored or treated in tanks or containers. For closure of the TUs, if releases have been documented, then wastes and contaminated soil must be removed, if appropriate, and structures and equipment will be decontaminated or managed as waste.

6.2.8 Particulate, VOC and Hazardous Air Pollution (HAP) Emissions

Remediation activities have the potential to generate radionuclide, fugitive dust, VOC, and HAP emissions. 5 CCR 1001-3, Regulation No. 1, governs opacity and particulate emissions. Regulation No. 1, Section II addresses opacity and requires that stack emissions from the containment structure or fuel-fired equipment must not exceed 20% opacity. Regulation No. 1, Section III addresses the control of particulate emissions. Fugitive particulate emissions will be generated from soil excavation and transport. Control methods for fugitive particulate emission should be practical, economically reasonable, and technologically feasible.

During soil handling activities, dust minimization techniques such as water sprays, will be used to minimize suspension of particulates. In addition, earth moving operations will not be conducted during periods of high wind. The substantive requirements that would otherwise be incorporated into a control plan (see Regulation No. 1, Section III.D) are embodied in the RFETS Environmental Restoration Field Operation Procedure FO.1, Air Monitoring and Particulate Control, which will be incorporated into the project. In addition, any fuel-fired equipment such as generators or compressors must comply with a particulate emission limit (See Regulation No. 1, Section III.A).

5 CCR 1001-3, Regulation No. 3, provides authority to CDPHE to inventory emissions. Regulation No. 3, Part A, Section II requires that RFETS submit an Air Pollution Emissions Notification (APEN) to CDPHE prior to initiation of the Mound Site Plume project. Pursuant to RFCA and Regulation No. 3, RFETS will prepare an APEN to facilitate the CDPHE inventory process, if necessary.

5 CCR 1001-3, Regulation No. 7, regulates VOC emissions. Regulation No. 7, Section II requires that new sources of VOC utilize Reasonably Available Control Technologies (RACT). VOCs may be emitted during soil excavation, and transport. Although significant VOC concentrations are not expected, a bounding assumption has been made that less than 1 ton of VOCs will be emitted from excavation and soil handling activities. Based on this assumption, RACT will be attained without implementing specific VOC controls for soil excavation, staging and replacement. (See Statement of Basis and Purpose, Regulation No. 3, Part D, July, 15, 1993).

Regulation No. 7, Section III governs the transfer and storage of VOCs and requires bottom or submerged fill for containers greater than 56 gallons. CDPHE has previously given guidance that any liquid containing any amount of an organic compound may be considered a VOC for purposes of this requirement. This requirement is applicable to containers and tanks larger than 56 gallons used to dewater the excavation or used to manage decontamination water. To the maximum extent practicable, storage tanks and related equipment must be maintained to prevent detectable vapor loss.

6.2.9 Debris Treatment

Decommissioning of the equipment and piping that is currently used to collect, store and transfer contaminated water to the Consolidated Water Treatment Facility for treatment may generate debris that contains F001 listed hazardous wastes.

Where appropriate, tanks, the project decontamination pad or the Main Decontamination Facility may be configured to perform low level, hazardous or mixed waste debris treatment in accordance with 40 CFR §262.34, §268.7(a)(4) and §268.45. Specifically, 40 CFR §268.45 Table 1, A.1.e. provides for treatment using high pressure steam and water sprays and 40 CFR §268.45 Table 1, A.2.a. provides for water washing and spraying. Following treatment, as long as the debris does not exhibit a hazardous waste characteristic, the debris will no longer contain a listed hazardous waste and will no longer be subject to RCRA hazardous waste requirements. Solid residues from the treatment of debris containing listed hazardous wastes will be collected and managed in accordance with RCRA hazardous waste management ARARs. Any solid residues from debris treatment that exhibit a hazardous waste characteristic will also be managed in accordance with RCRA hazardous waste management requirements.

Liquid residues from the treatment of debris containing listed hazardous wastes will be collected and transferred to the Consolidated Water Treatment Facility. Residues that result from the treatment of listed debris will carry the same listing as the listed debris from which it originated. Any Consolidated Water Treatment Facility residues that exhibit a hazardous waste characteristic will also be managed in accordance with RCRA hazardous waste management ARARs.

6.3 Location Specific Requirements and Considerations

6.3.1 Endangered Species Act

The Endangered Species Act, 50 CFR Part 17, and the Colorado Nongame, Endangered, or Threatened Species Conservation Act, CRS 33-2-101, et seq. are relevant and appropriate because the action has the potential to jeopardize critical habitat for the Prebles meadow jumping mouse. For that reason, applicable RFETS site procedures and DOE orders will be implemented to ensure attainment of these ARARs.

6.3.2 Fish and Wildlife Coordination Act

The Fish and Wildlife Coordination Act, 16 USC §661 is applicable because the modification to the wetlands and the creation of a flowing stream has the potential to impact wildlife. Coordination and consideration of the applicable ecological values will be accomplished using site procedures.

6.3.3 Wetland Assessment

Pursuant to Executive Order 11990, and 40 CFR Part 6 Appendix A, federal agencies must prevent, to the extent possible, the adverse impacts of destroying or modifying wetlands and must prevent direct or indirect support of new construction in wetlands if there is a practicable alternative. These requirements are applicable to the Mound Site Plume action and will be implemented using site procedures.

7.0 IMPLEMENTATION SCHEDULE

Installation of the collection/treatment system for the Mound Site Plume is scheduled to commence during the early Fall of 1997 and system startup is anticipated to begin within 3 weeks of start of construction. Any delays, scope, or budget changes may affect this schedule. The groundwater collection and treatment system is expected to be the long term remedy for the Mound Site Plume and to operate indefinitely.

8.0 REFERENCES

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APPENDIX A - ALTERNATIVES ANALYSIS

A1.0 DESCRIPTION OF ALTERNATIVES

The following three alternatives were evaluated for remediation of the Mound Site Plume:

- No Further Action - Continue collection of contaminated water at seep SW059 and truck the collected water to the Building 891 Consolidated Water Treatment Facility (CWTF) for treatment.
- Construct groundwater collection system and truck the collected water to the CWTF for treatment.
- Construct groundwater collection system and reactive metals treatment system and discharge treated water to South Walnut Creek.

This Appendix provides a comparison of those alternatives based on four considerations: effectiveness, implementability, cost and environmental effects. The environmental effects of Alternative 3, construction of a barrier and installation of a passive water treatment system, which is the proposed alternative, are described more fully in Section 5 of the main body of the Decision Document.

Operational requirements for the SW059 water collection and treatment system must take into account that, even though the source of contamination at the Mound Site has been removed, groundwater from the source area could take up to 30 years to reach South Walnut Creek. The actual time will depend on flow rates. Water collection and treatment will have to continue until the aquifer is producing water with contaminants below Rocky Flats Cleanup Agreement (RFCA) action levels.

A1.1 Alternative 1 - No Further Action

Since 1996, groundwater from seep SW059 has been collected in a sump, pumped to a storage tank and periodically trucked to the CWTF for treatment. In the CWTF, volatile organic compounds (VOCs) in the groundwater are removed in an ultraviolet (UV)/peroxide treatment unit, and radionuclides are removed by chemical precipitation and microfiltration. The treated water is then discharged to Woman Creek.

A1.2 Alternative 2 - Construct New Groundwater Collection System and Treat Water in the CWTF

A trench would be excavated downgradient of the Mound Site but upgradient of South Walnut Creek and an impermeable barrier placed in it to divert groundwater flowing from the Mound Site to a collection point. Groundwater would be collected in a sump at the low point of the impermeable barrier, pumped to a nearby storage tank and periodically trucked to the CWTF. VOCs in the groundwater would be removed in the CWTF UV/peroxide treatment unit and radionuclides would be removed by chemical precipitation and microfiltration. Treated water would be released to Woman Creek.

A1.3 Alternative 3 - Construct New Groundwater Collection System and Reactive Metals Treatment System

A trench would be excavated downgradient of the Mound Site but upgradient of South Walnut Creek and an impermeable barrier placed in it to divert groundwater flowing from the Mound Site to a collection point. Groundwater would be collected in a sump at the low point of the impermeable barrier and piped to a nearby reactive metals treatment system to remove VOCs and radionuclides prior to discharge to South Walnut Creek. The iron filings in the treatment unit would have to be replaced every five to 10 years and, because they would hold the radionuclides collected from the treated water, would be considered low-level waste.

A2.0 ANALYSIS OF ALTERNATIVES

A2.1 Alternative 1 - No Further Action Alternative

Effectiveness

The UV/peroxide system and the chemical oxidation/microfiltration systems have been demonstrated to consistently remove VOCs and radionuclides to levels below applicable or relevant and appropriate requirements (ARARs). Residual management is required for the sludges produced in the precipitation step.

The existing sump collects contaminated water only from seep SW059, not from other areas of the contaminated plume. The 1997 drilling program for the Mound Site Plume project showed that additional contaminated groundwater originating from the Mound Site has the potential to impact South Walnut Creek. Collecting only the contaminated groundwater from SW059 would not meet the RFCA requirement for protection of surface water.

Implementability

The CWTF is designed to treat 30 gallons of contaminated water per minute. Seep SW059 produces approximately 0.05 gallons per minute (7,000 gallons every three months). The CWTF is used to treat contaminated groundwater from the 881 Hillside French Drain, seep SW059 and water generated from environmental restoration cleanup projects. All environmental restoration projects (except for plume remediation projects) are scheduled for completion by FY2006 at which time the CWTF is scheduled for demolition. Thus, the CWTF will not be available for treatment of contaminated water after FY2006 and would have to be replaced by a smaller facility designed to treat only water generated from groundwater plume remediation projects. Other existing water treatment facilities (*i.e.*, Buildings 374, 774, and 995) do not have the capability to treat VOCs and are also scheduled to be demolished by FY2006.

Cost

The cost to truck water from seep SW059 to the CWTF and treat it is approximately $1.50/gallon. Additional costs would be incurred to replace the CWTF after FY2006. Many of the equipment components in both the UV/peroxide and the chemical precipitation/ microfiltration system require replacement every 5 to 10 years. The next replacement is scheduled for 1999, so additional costs would be incurred at that time.

Environmental Effects

The No Further Action Alternative would result in no additional disturbance to natural conditions beyond those already in existence. Minor air pollution (vehicle exhaust and other particulates) would be produced when the collected water is trucked to the CWTF. Contaminated groundwater not collected at seep SW059 would continue to flow toward South Walnut Creek and eventually discharge there. The resources (utilities, labor, equipment, supplies) necessary to operate the CWTF would continue to be consumed beyond the time that facility is scheduled to be demolished, or additional resources would be required to construct and operate a new water treatment facility specifically to treat Mound Site and other contaminated groundwater. If a new facility were constructed, substantial construction resources would be required, but its annual operating resource needs would be smaller than those of the CWTF because it would have a smaller capacity. Environmental impacts associated with a new facility would depend on its size, design, and location. The cumulative effects of the No Action Alternative, taken together with other foreseeable actions (cleaning up and closing the Site) are described in DOE's *Cumulative Impacts Document* (DOE,RFFO June 10, 1997).

No other effects, such as to flora, fauna, historic or cultural resources, or socio-economics, would be expected.

A2.2 Alternative 2 - Construct New Groundwater Collection System and Treat Water in the CWTF

Effectiveness
The UV/peroxide system and the chemical oxidation/microfiltration systems have been demonstrated to consistently remove VOCs and radionuclides to levels below ARARS. Residual management is required for the sludges produced in the precipitation step. Collecting the majority of the contaminated groundwater from the Mound Site plume, as would be done with the impermeable barrier, and treating it in the CWTF would meet the RFCA requirement for protection of surface water.

Implementability
Installation of the proposed groundwater collection system is based on use of readily available construction equipment. There are no facilities in the area of the proposed collection system that would have to be removed to construct the impermeable barrier wall. No issues have been identified that present special problems for implementation of this alternative.

The CWTF is designed to treat 30 gallons per minute of contaminated water. The Mound Site Plume collection system is estimated to produce between 0.1 and 2 gallons per minute. The CWTF is used to treat contaminated groundwater from the 881 Hillside French Drain, seep SW059 and water generated from environmental restoration cleanup projects. All environmental restoration projects (except for plume remediation projects) are scheduled for completion by FY2006 at which time the CWTF is scheduled for demolition. The CWTF will not be available for treatment of contaminated water after FY2006 and would have to be replaced by a smaller facility designed to treat only water generated from plume remediation projects. Other existing water treatment facilities (*i.e.*, Buildings 374, 774, and 995) do not have the capability to treat VOCs and are also scheduled to be demolished by FY2006.

Cost
Estimated cost to construct the impermeable barrier is $200,000. The cost to truck water from the Mound Site Plume collection system and treat the water in the CWTF is approximately $1.50/gallon. Additional costs would be incurred to replace the CWTF and to maintain the groundwater collection system. Many of the equipment components in both the UV/peroxide and the chemical precipitation/ microfiltration system require replacement every 5 to 10 years. The next replacement is scheduled for 1999, so additional costs would be incurred at that time.

Environmental Effects
Construction of the impermeable barrier would involve digging a trench approximately four feet wide to bedrock for a distance of up to 250 feet upslope of South Walnut Creek. Excavation of the trench and temporary placement of excavated materials would destroy vegetation and the natural soil gradient in the excavated area, and temporarily damage vegetation under the area where the excavated materials were deposited. Total affected area is estimated at approximately 13,500 square feet. After construction was complete, the site would be revegetated as directed by Site ecologists. It is possible that small mammals and rodents in the project area would be dislocated. A survey for nests of migratory birds would be completed within two weeks before the project's start to ensure compliance with the Migratory Bird Species Act. Construction of the trench would damage or destroy a small wetland at SW059 by drying it

up. Loss or damage of this wetland would be mitigated under the Agreement between DOE and EPA through construction of a replacement wetland at Standley Lake or other means as appropriate. Construction activities would result in a negligible increase in air emissions from the exhaust of motor vehicles during construction activities. Dust control measures would be implemented to minimize release of particulates, and a silt fence or similar device would be installed to prevent stormwater runoff from carrying sediment off the project site. The groundwater table immediately down-gradient of the barrier would be lowered substantially. This would not affect vegetation which is not dependent on water below the vadose zone. Presence of the barrier would increase the amount of water diverted from the South Walnut Creek basin to the Woman Creek basin (now approximately 0.05 gallon per minute or 7,000 gallons every three months) by a factor of between two (0.1 gallon per minute) and ten (0.5 gallon per minute).

Installation of the barrier would consume labor, equipment, and material Operation of the barrier under this alternative would require electrical energy to pump collected water from the collection point to the holding tank. Installation of the collection system would not present any hazards to workers beyond those associated with similar construction projects. Standard trench bracing techniques would be implemented to ensure worker safety and the project would have an approved health and safety plan before field work begins.

The environmental effects of transporting the water to the CWTF and treating it there or in a successor facility would be the same as those described for Alternative 1. The cumulative effects of the this alternative, taken together with other foreseeable actions (cleaning up and closing the Site) are described in DOE's *Cumulative Impacts Document*, (DOE, RFFO June 10, 1997).

No other effects, such as to historic or cultural resources, or socio-economics, would be expected.

A2.3 Alternative 3 - Construct New Groundwater Collection System and Reactive Metals Treatment System

<u>Effectiveness</u>

Bench-scale testing by Environmental Technologies, Inc. and Sandia National Laboratories has demonstrated that a reactive metals treatment system will remove site-specific VOCs and radionuclides. The reactive metal media works by inducing conditions that cause substitution of hydrogen for chlorine in the chlorinated VOCs. The end-products of the process are completely dehalogenated hydrocarbons and non-toxic salts. Examples of end-products of chlorinated VOCs degraded by this process are ethene, ethane, and chloride ions. Radionuclides are removed by undergoing a reduction and/or absorption process.

Collecting the majority of the contaminated groundwater from the Mound Site Plume, as would occur under this alliterative, would meet the RFCA requirement for protection of surface water.

<u>Implementability</u>

Installation of the proposed groundwater collection system is based on use of readily available construction equipment. There are no facilities in the area of the proposed collection system that would have to be removed to construct the impermeable barrier wall. No issues have been identified that present special problems for implementation of this alternative.

Reactive metals treatment systems similar to the proposed design have been constructed elsewhere in the United States. They require high density polyethylene (or equivalent) tanks which are readily-available, and reactive iron filings which are a byproduct of the automobile industry and available from at least three suppliers.

Cost
The cost to construct the groundwater collection system and the reactive metals treatment system is approximately $300,000.

Environmental Effects
Implementation of Alternative 3 would have the same environmental effects related to construction and operation of the impermeable barrier as Alternative 2, but would not have the environmental effects related to transporting collected water to the CWTF and treating it there or at a successor facility.

There would be an increase in affected area at the site due to construction of a pipe from the collection point in the barrier to the treatment facility, installation of the treatment facility, and installation of a pipe or other discharge facility from the treatment facility to South Walnut Creek. This additional affected area is estimated at 12,500 square feet bringing the total affected area to approximately 26,000 square feet or about 0.6 acre. Wetland damage would increase slightly from the wetland at SW059 to also include construction disturbance of a short stretch of wetlands along South Walnut Creek where the discharge pipe from the water treatment facility enters the Creek. Alternative 3 would eliminate the diversion of water from the South Walnut Creek basin to the Woman Creek basin by collecting, treating, and releasing the water all within the South Walnut Creek basin. In addition, it would eliminate the need to incur the additional environmental (and other) impacts of possibly constructing a new water treatment facility for use after FY2006. Operation of the collection system would be passive, *i.e.*, gravity would be used to transport the water from the collection system to the treatment unit, through treatment and to the discharge line to South Walnut Creek. No supplied energy would be used by the system. Periodic maintenance of the system would be required, chiefly replacing the treatment media from time to time. The cumulative effects of Alternative 3, taken together with other foreseeable actions (cleaning up and closing the Site) are described in DOE's *Cumulative Impacts Document*, (DOE, RFFO June 10, 1997).

No other effects, such as to historic or cultural resources, or socio-economics, would be expected.

A3.0 SUMMARY AND CONCLUSION

Alternative 3 was selected as the preferred alternative because the system will collect the majority of the contaminated groundwater from the Mound Site and will continue to remove VOCs and radionuclides to levels required for protection of surface water at the lowest cost and with the smallest environmental effects. The treatment system does not depend on the CWTF which is scheduled to be removed by FY2006 and is a passive, low maintenance system.

Both Alternatives 1 and 2 are based on trucking contaminated groundwater from the SW059 area for treatment in the CWTF which is scheduled for demolition in FY2006. Collection and treatment of contaminated groundwater is estimated to last for 10 to 20 years after the CWTF has been demolished. Therefore, selection of either of these alternatives would require the design and construction of a new, smaller treatment facility to replace the CWTF after 2006. Due to the need to construct a replacement facility, the costs and environmental effects of these two alternatives would be significantly greater than those of Alternative 3 with no offsetting benefits in effectiveness or implementability. In addition, Alternative 1 collects only a relatively small portion of the Mound Site plume, allowing contaminated water to reach South Walnut Creek. Therefore, this alternative does not meet the RFCA requirement for protection of surface water.

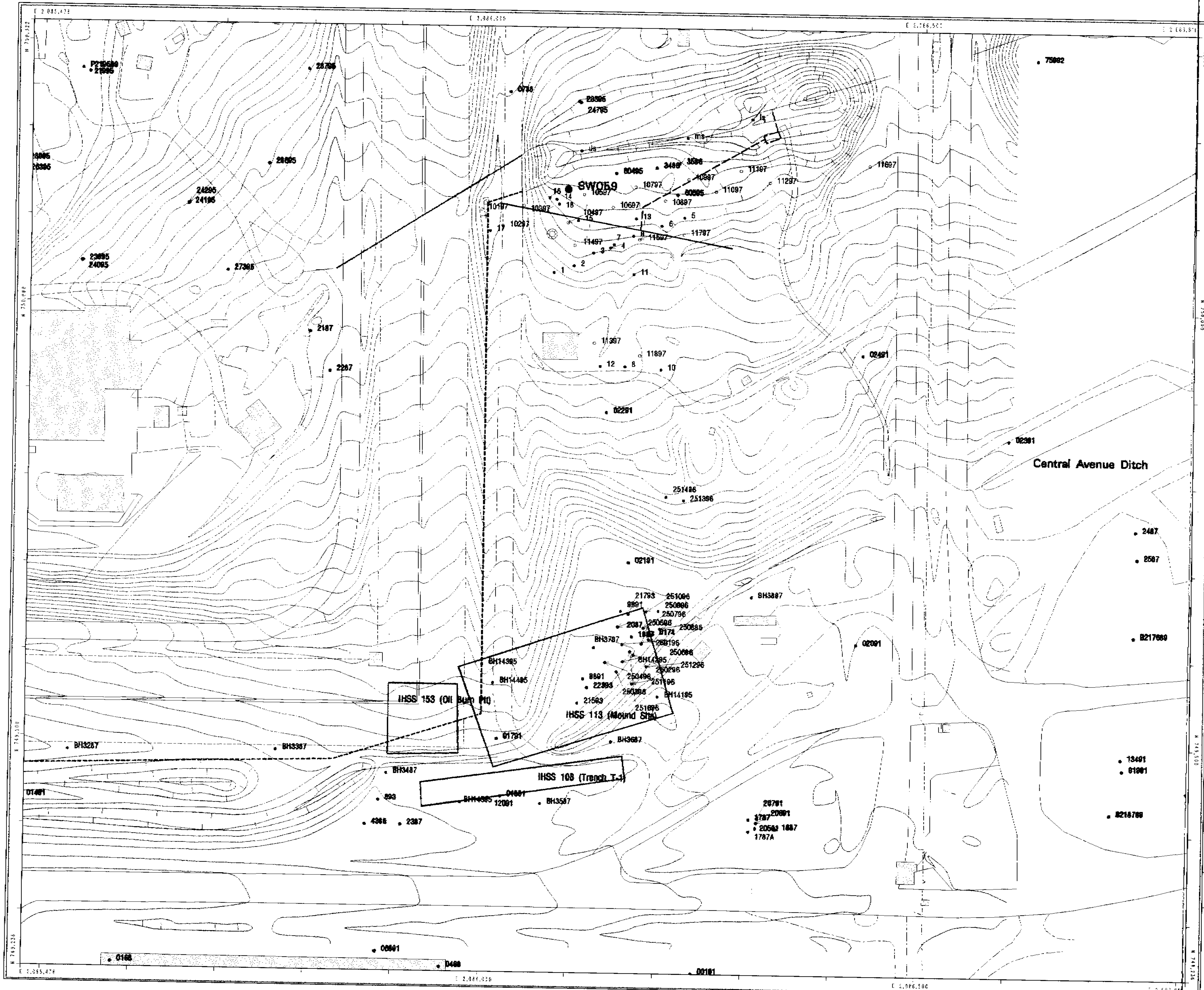

Figure 1
Mound Site Plume Area

EXPLANATION

- Selected IHSS Boundaries
- Approximate Location of Collection Trench
- Approximate Location of Piping and Treatment System
- Approximate Location of 72" Storm Sewer
- Large Diameter Culvert
- Surface Water Monitoring Locations
- Groundwater Monitoring Wells & Piezometers
- EPA Geoprobe Sampling Locations
- Boreholes
- Recent Geoprobe Sampling Locations
- SW059 Holding Tank
- 2 Foot Contours

Standard Map Features

- Buildings
- Lakes and ponds
- Streams, ditches, or other drainage features
- Fences
- Rocky Flats boundary
- Paved roads
- Dirt roads

DATA SOURCE: Buildings, roads, and fences provided by Facilities Eng., EG&G Rocky Flats, Inc. - 1991. Hydrology provided by USGS - (date unknown)

Scale = 1 : 1400
1 inch represents approximately 117 feet

45 0 90 180ft

State Plane Coordinate Projection
Colorado Central Zone
Datum: NAD27

U.S. Department of Energy
Rocky Flats Environmental Technology Site

Prepared by:

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Golden, CO 80402-0464

MAP ID: 97-0044

July 15, 1997

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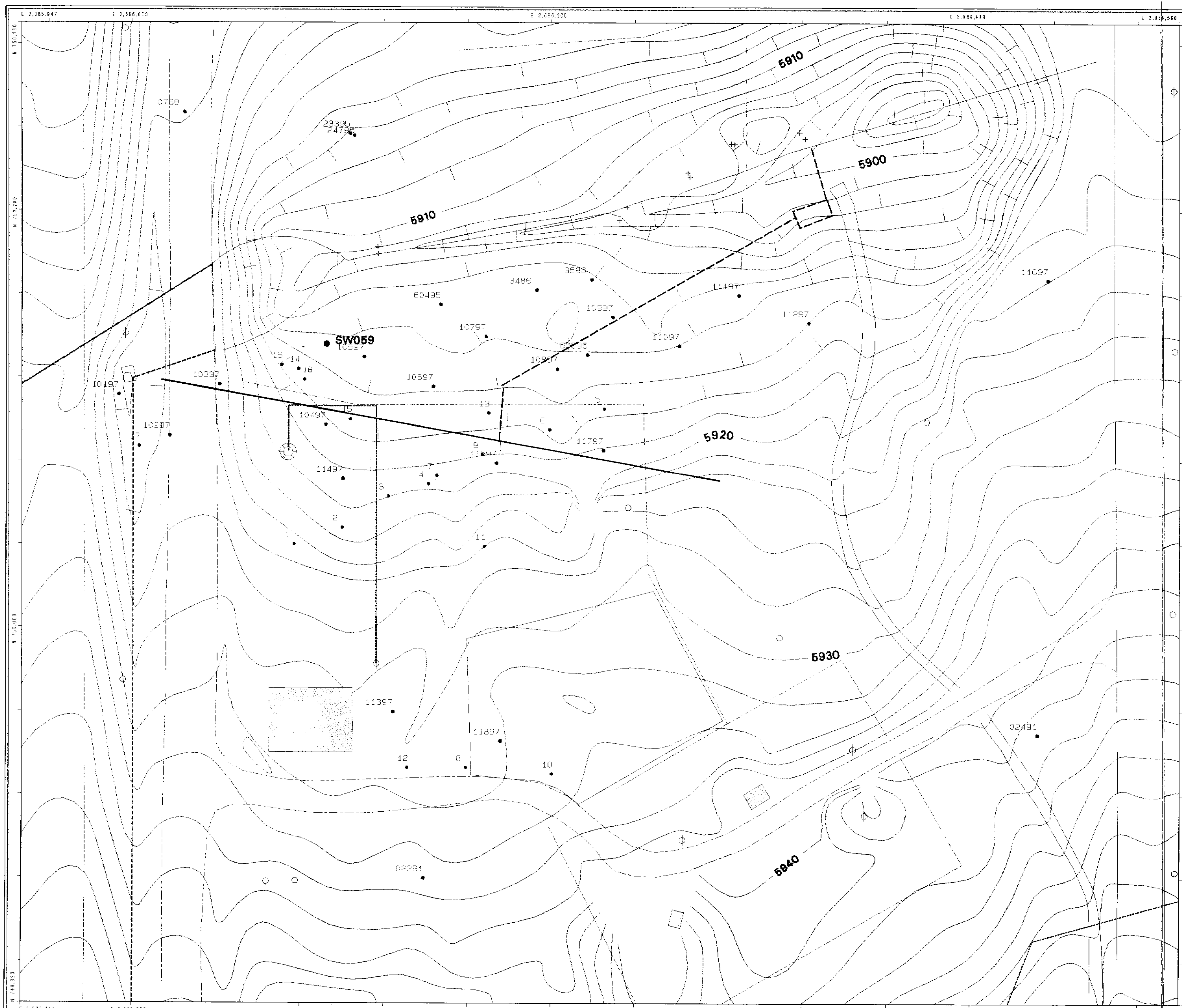

Figure 2
SW059
Site Area

EXPLANATION

- Surface Water Monitoring Locations
- Groundwater Monitoring Wells & Piezometers
- EPA Geoprobe Sampling Locations
- Stream elevation survey points
- SW059 Holding Tank
- Electric Power Pole
- Laydown Area
- Underground Utilities
- Above Ground Electrical Conduit
- Approximate Location of 72" Storm Sewer
- Large Diameter Culvert
- 2 Foot Contours

Standard Map Features

- Buildings
- Lakes and ponds
- Streams, ditches, or other drainage features
- Fences
- Rocky Flats boundary
- Paved roads
- Dirt roads

DATA SOURCE:
Buildings, roads, and fences provided
Facilities Engr.,
EG&G Rocky Flats, Inc. - 1991.
Hydrology provided by
USGS - (date unknown)

Scale = 1 : 560
1 inch represents approximately 47 feet

15 0 30 60ft

State Plane Coordinate Projection
Colorado Central Zone
Datum: NAD27

U.S. Department of Energy
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MAP ID: 97-0044

July 23, 1997

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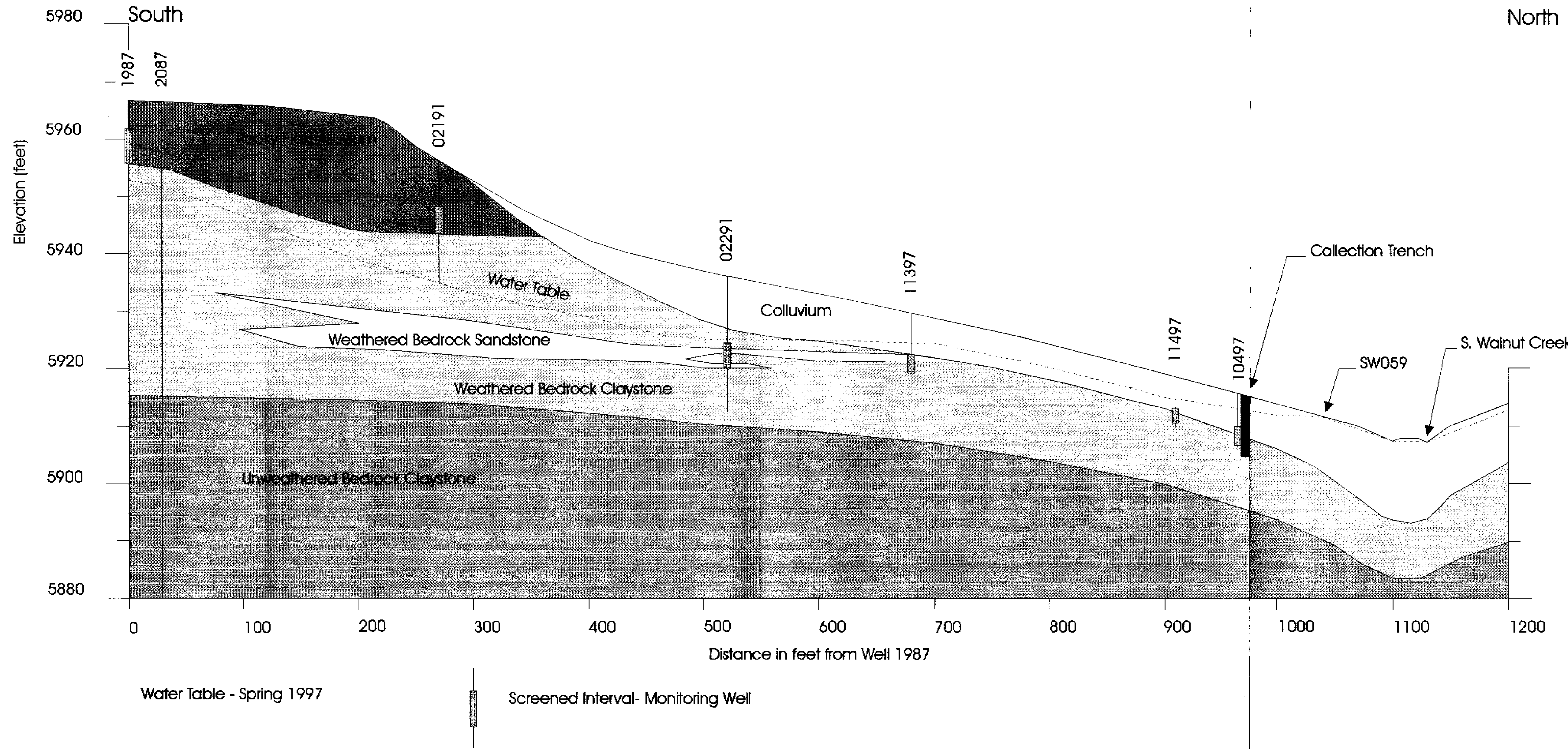
Figure 3
Mound Groundwater Plume
Hydrogeologic Cross Section



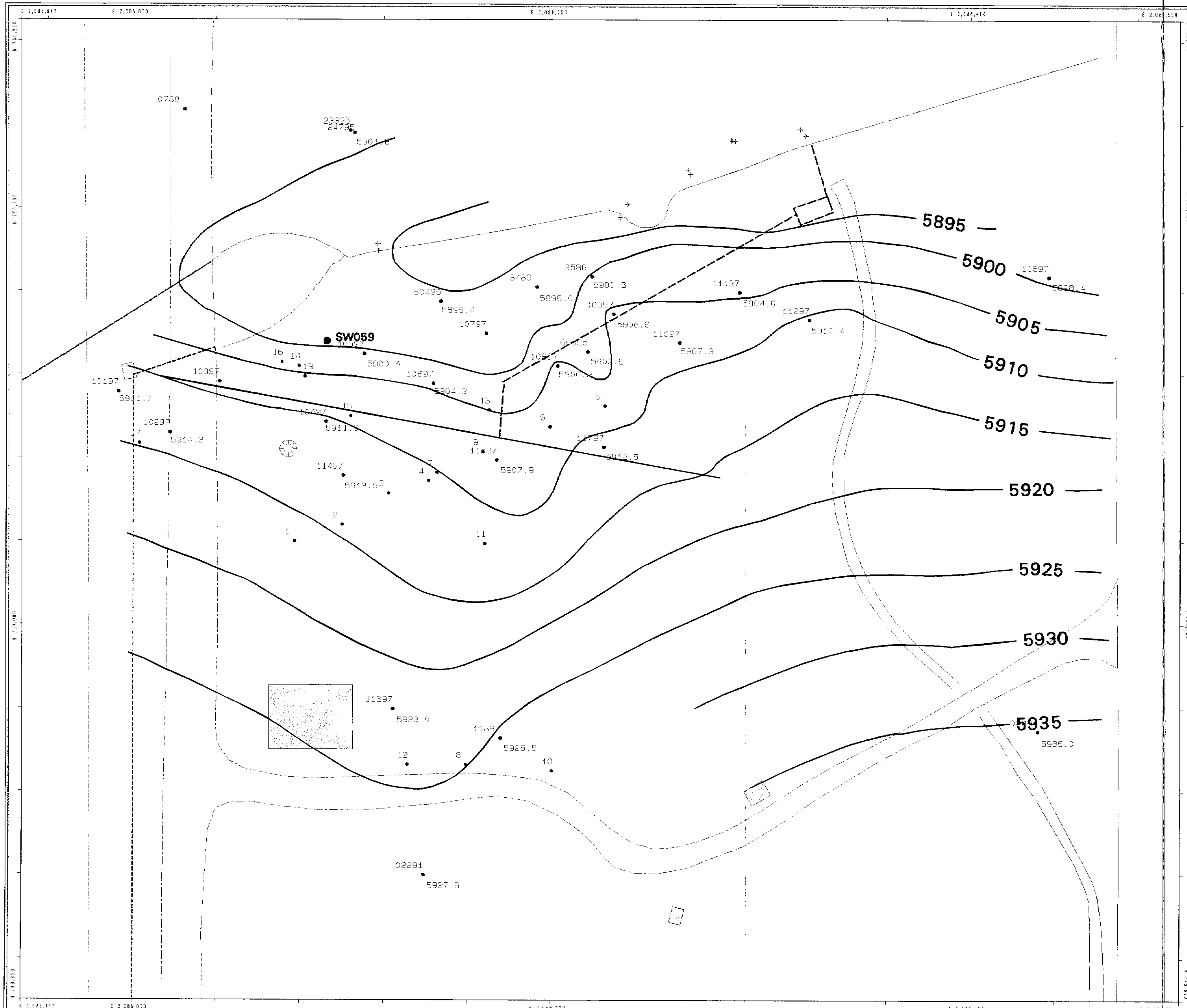


Figure 4
SW059 Site Area Bedrock Elevation Map

EXPLANATION

- Surface Water Monitoring Locations
- Groundwater Monitoring Wells & Piezometers with Posted Bedrock Elevation
- EPA Geoprobe Sampling Locations
- Stream elevation survey points
- SW059 Holding Tank
- Bedrock Elevation Contour
- Approximate Location of 72" Storm Sewer
- Large Diameter Culvert

Standard Map Features

- Buildings
- Lakes and ponds
- Streams, ditches, or other drainage features
- Fences
- Rocky Flats boundary
- Paved roads
- Dirt roads

Scale = 1 : 560
1 inch represents approximately 47 feet

15 0 30 60 ft

State Plane Coordinate Projection
Colorado Central Zone
Datum: NAD27

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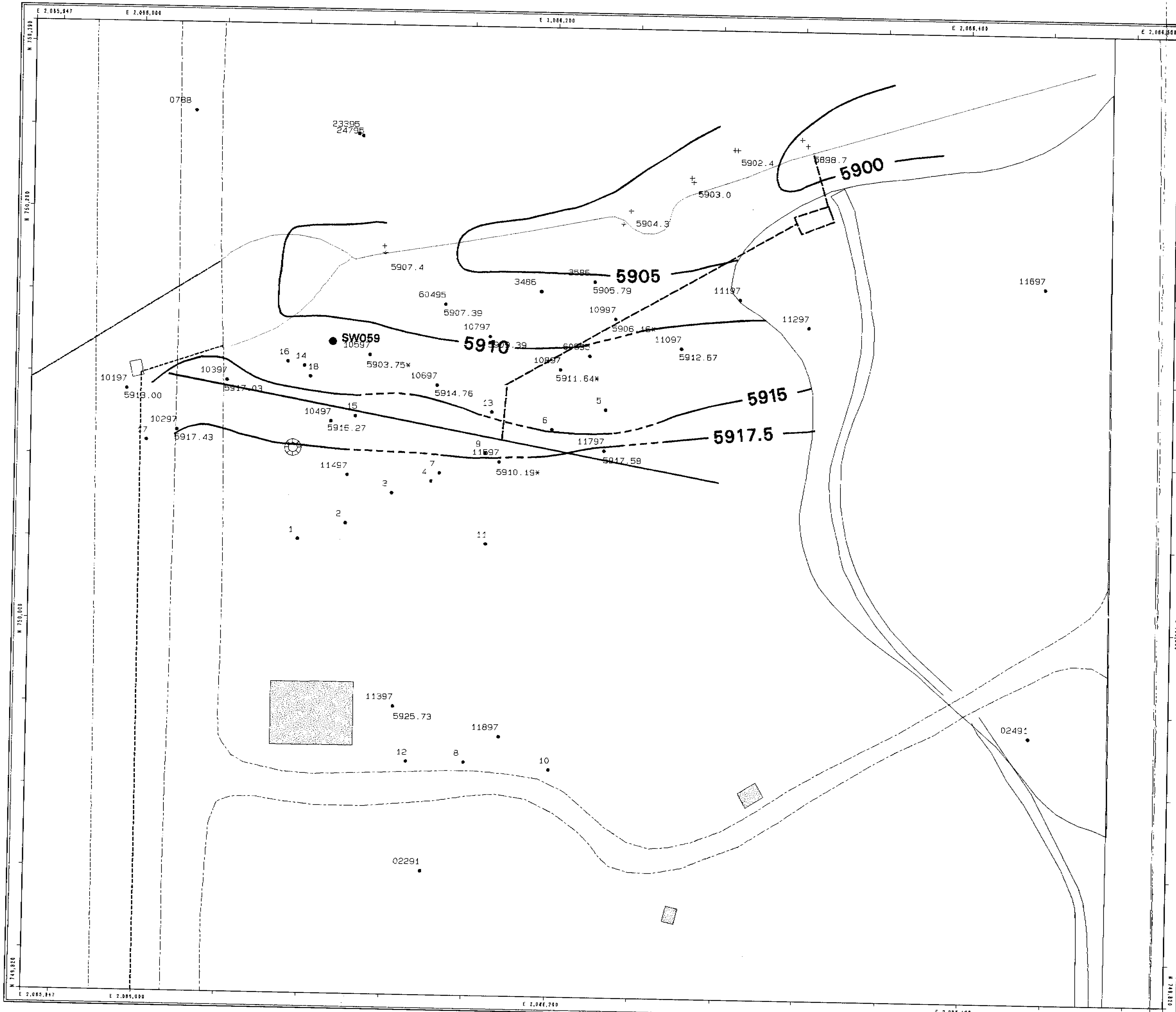

Figure 5
SW059 Site Area
Water Table Elevation
April 30, - May 8, 1997

EXPLANATION

- Surface Water Monitoring Locations
- Groundwater Monitoring Wells & Piezometers with Posted Water Table Elevation
  * not used in contouring
- EPA Geoprobe Sampling Locations
- Stream elevation survey points
- SW059 Holding Tank
- Water Table Elevation Contour Dashed Where Inferred
- Approximate Location of 72" Storm Sewer
- Large Diameter Culvert
- Unsaturated Area Boundaries Uncertain

Standard Map Features

- Buildings
- Lakes and ponds
- Streams, ditches, or other drainage features
- Fences
- Rocky Flats boundary
- Paved roads
- Dirt roads

Scale = 1 : 560
1 inch represents approximately 47 feet

15 0 30 60ft

State Plane Coordinate Projection
Colorado Central Zone
Datum: NAD27

U.S. Department of Energy
Rocky Flats Environmental Technology Site

Prepared by:

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MAP ID: 97-0044

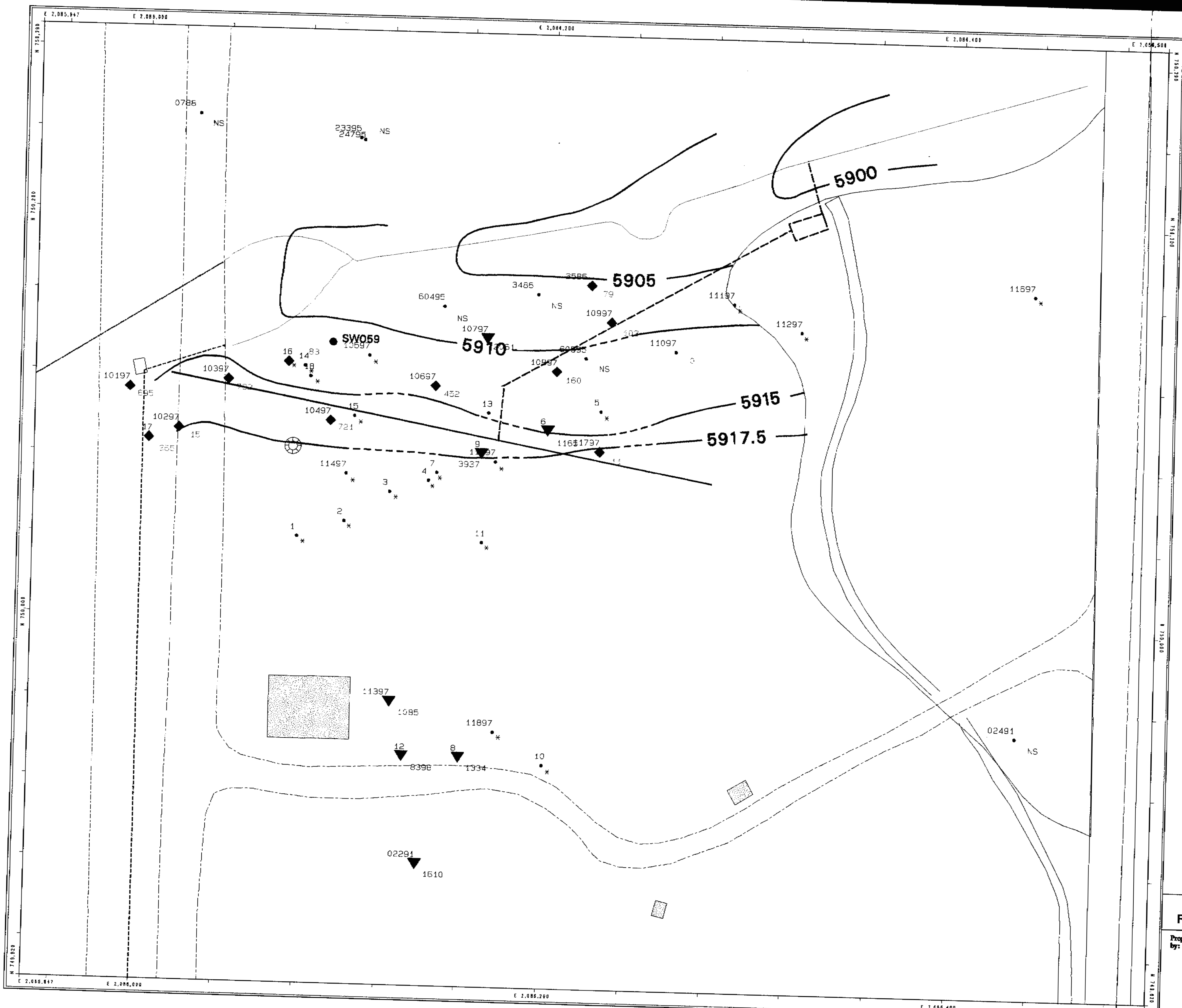

Figure 6
SW059 Site Area Water Table Elevation April 30, - May 8, 1997 with Water Quality Annotations

EXPLANATION

- ● Surface Water Monitoring Locations
- ● Groundwater Monitoring Wells Piezometers & Geoprobe Boreholes
  * = dry or insufficient water to sample
  NS = not sampled
- ▼ GW Monitoring Wells, Piezometers & Boreholes with Tier I Exceedance for VOCs
- ◆ GW Monitoring Wells, Piezometers & Boreholes with Tier II Exceedance for VOCs
- SW059 Holding Tank
- Water Table Elevation Contour Dashed Where Inferred
- Approximate Location of 72" Storm Sewer
- Large Diameter Culvert
- Unsaturated Area Boundaries Uncertain

Standard Map Features

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July 23, 1997