FINAL

PHASE I RFI/RI WORK PLAN

ROCKY FLATS PLANT

WALNUT CREEK PRIORITY DRAINAGE
(Operable Unit No. 6)

Volume I

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

ENVIRONMENTAL RESTORATION PROGRAM

September 1991

REVIEWED FOR CLASSIFICATION/UCNI
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LIST OF ACRONYMS

The following is a list of acronyms used throughout this work plan.

ACL	Alternative Concentration Limit
AEC	Atomic Energy Commission
ARAR	Applicable or Relevant and Appropriate Requirements
AWQC	Ambient Water Quality Criteria
BCF	Bioconcentration Factor
BNA	Base-neutral acid extractable organics
BRAP	Baseline Risk Assessment Plan
CAD	Corrective Action Decision
CCR	Colorado Code of Regulations
CDH	Colorado Department of Health
CEARP	Comprehensive Environmental Assessment and Response Program
CERCLA	Comprehensive Environmental Response, Compensation and Liability Act
CFR	Code of Federal Regulations
CLP	Contract Laboratory Program
CMP	corrugated metal pipe
CMS	corrective measures study
CRDL	contract-required detection limit
CRQL	contract-required quantitation limit
CRP	community relations plan
CSU	Colorado State University
CWA	Clean Water Act
DOE	Department of Energy
DQO	data quality objective
EEP	Environmental Evaluation Plan
EIS	Environmental Impact Statement
EPA	Environmental Protection Agency
ER	environmental restoration
ERDA	Energy Research and Development Administration
FIDLER	Field Instrument for Detection of Low Energy Radiation
FS	feasibility study
FSP	field sampling plan
GAC	granular activated carbon
GC	gas chromatograph
GPR	ground penetrating radar
GRRASP	General Radiochemistry and Routine Analytical Services Protocol
HSP	Health and Safety Plan
HSU	Hydrostratigraphic unit
IAG	Interagency Agreement
IHSS	Individual Hazardous Substance Site
IRIS	Integrated Risk Information System
MATC	Maximum Allowable Tissue Concentration
MCL	maximum contaminant level
MCLG	maximum contaminant level goal

MDA	minimum detectable activity
MSL	mean sea level
NCP	National Contingency Plan
NPDES	National Pollutant Discharge Elimination System
OU	Operable Unit
PARCC	precision, accuracy representativeness, completeness, and comparability
PCB	polychlorinated biphenyl
PCE	tetrachloroethylene
PID	photoionization detector
QAA	Quality Assurance Addendum
QA/QC	Quality Assurance/Quality Control
QAPjP	Quality Assurance Project Plan
RCRA	Resource Conservation and Recovery Act
RFEDS	Rocky Flats Environmental Database System
RFI	RCRA facility investigation
RFP	Rocky Flats Plant
RI	remedial investigation (CERCLA)
ROD	Record of Decision
SAS	Special Analytical Services
SAP	sampling and analysis plan
SARA	Superfund Amendments and Reauthorization Act of 1986
SID	South Interceptor Ditch
SIR	subsurface interface radar
SDWA	Safe Drinking Water Act
SOP	Standard Operating Procedure
SOPA	Standard Operating Procedure Addendum
TAL	target analyte list
TBC	to be considered
TCA	trichloroethane
TCE	trichloroethylene
TCL	target compound list
TDS	total dissolved solids
TIC	tentatively identified compounds
TOC	total organic carbon
UV	ultraviolet
VOA	volatile organic analysis
VOC	volatile organic compounds
WQC	Water Quality Criteria
WQCC	Water Quality Control Commission

This document presents the work plan for the Phase I RCRA Facility Investigation (RFI)/Remedial Investigation (RI) of the North and South Walnut Creek drainages (Operable Unit Number 6) at the Rocky Flats Plant, Jefferson County, Colorado. This work plan includes a field sampling plan (FSP) that presents the investigation planned to evaluate the presence or absence of contamination at Individual Hazardous Substance Sites (IHSSs) within the North and South Walnut Creek drainages. The FSP developed in this work plan is based on the requirements of the Interagency Agreement (IAG) amongst the Department of Energy, Environmental Protection Agency, and the State of Colorado Department of Health and additional work as needed to initially assess each IHSS. Twenty IHSSs, as identified in the IAG, are located in Operable Unit Number 6 (OU6). They are the A-series Detention Ponds, Ponds A-1 through A-4 (IHSSs 142.1 through 142.4) and IHSS 142.12; the B-series Detection Ponds, Ponds B-1 through B-5 (IHSSs 142.5 through 142.9); the North, Pond, and South Area spray fields (IHSSs 167.1, 167.2 and 167.3), the East Area Spray Field (IHSS 216.1), Trenches A, B and C (IHSSs 166.1 166.,2 and 166.3), the Sludge Dispersal Area (IHSS 141), the Triangle Area (IHSS 165), and the Old Outfall (IHSS 143). A Soil Dump Area (IHSS 156.2) has also been added to this work plan because of its location along the Walnut Creek drainage, making a total of twenty-one IHSSs in OU6.

The schedule and the sequence of work for completing the OU6 investigation is specified in the IAG and is outlined below to provide some background on the requirements for the OU6 RFI/RI. The IAG states that each operable unit (OU), including OU6, may proceed through several phases of investigation dependent on the information gathered to characterize the OU (Section I.B.9, IAG Statement of Work). For OU6, the IAG requires that DOE submit a draft Phase I RFI/RI Workplan, in accordance with the requirements for RFI/RI Workplans, to EPA and the State for review and comment (this document was submitted in April 1991). DOE has subsequently revised this draft RFI/RI Workplan to address all comments submitted by EPA and the State, and is resubmitting this RFI/RI Workplan to EPA and the State for review and joint written approval.

Following completion of the Phase I work plan, the IAG requires that the results of the Phase I RFI/RI for OU6 be documented within a draft Phase I RFI/RI report. This draft RFI/RI report will include a Preliminary Site Characterization and will also recommend work to be performed for the Phase II investigation if needed. The IAG specifies that this draft Phase I report be submitted to the EPA and the State for review with DOE to address their comments and resubmit a Final Phase I RFI/RI report for EPA and/or the State review and approval. DOE is not to commence the next investigatory phase prior to receiving approval of the Final Phase I Report for OU6 and approval of Phase II RFI/RI Workplans.

The IAG specifies that the priority and schedule for the Phase II RFI/RI investigations for OUs 3, 5, 6, 8, 12, 13, 14, 15, and 16 will be determined after evaluating the Final Phase I RFI/RI Reports for the

operable units. If EPA and/or the State determine that no further investigatory work is required for OU6 after the Phase I investigation is complete, EPA and/or the State shall approve the Final Phase I RFI/RI Report as a Final RFI/RI Report. The field investigations for OU6 will be considered complete after approval of a Final RFI/RI Report.

This work plan presents the activities that will be carried out to complete the Phase I investigation. Section 1.0 of this Work Plan presents introductory information and a general characterization of the region and plant site. In addition, the regional geology and hydrology at Rocky Flats are discussed. Section 2.0 presents descriptions of the site physical characteristics, histories and previous investigations, available information concerning the nature and extent of contamination, and conceptual models for the IHSSs. This initial characterization forms the basis for establishing data needs, data quality objectives (DQOs), and developing an FSP for each IHSS. Section 3.0 presents applicable or relevant and appropriate requirements (ARARs) developed for OU6. Section 4.0 establishes data needs and DQOs considering site characteristics and conceptual models of each IHSS in OU6. Section 5.0 outlines RFI/RI tasks to be performed, while Section 6.0 presents the schedule for these tasks. A Field Sampling Plan, based on the requirements of the IAG, is presented in Section 7.0 to satisfy the data needs and DQOs identified in Section 4.0. The Baseline Risk Assessment Plan and Environmental Evaluation Plan are presented in Sections 8.0 and 9.0, respectively. A Quality Assurance Addendum and Standard Operating Procedure Addenda are presented in Sections 10.0 and 11.0, respectively. A list of references is presented in Section 12.0.

The initial step in the development of the OU6 RFI/RI work plan was a review of existing information. Available historical and background data for each IHSS were collected through a literature search and a review of the Rocky Flats Environmental Database System (RFEDS). Only a few limited investigations have been conducted at OU6 in the past. These investigations include sediment sampling in the A- and B-series ponds, ongoing surface water, groundwater, and sediment sampling programs along Walnut Creek, and the plant-wide Ambient Air Monitoring Program.

Data quality objectives have been developed for this Phase I investigation. DQOs are qualitative and quantitative statements that describe the quality and quantity of data required by the RFI/RI. The DQO process is divided into three stages. Through application of the DQO process, site-specific RFI/RI goals are established and data needs are identified for achieving these goals.

After assessing the existing information for OU6, the following objectives for the Phase I RFI/RI have been identified:

- Characterize the physical and hydrogeologic setting of the IHSSs
- Assess the presence or absence of contamination at the sites
- Characterize the nature and extent of contamination at the sites, if present
- Support the Phase I Baseline Risk Assessment and Environmental Evaluation

Within these broad objectives, site-specific data needs have been identified based on preliminary identification of contaminants potentially present at each IHSS and the data needs for the Phase I Baseline Risk Assessment and Environmental Evaluation. The FSP developed in this work plan is based on the data needs and the requirements of the IAG. The FSP for each IHSS requires a combination of screening activities, sampling of soils, sediment and surface water, and well installation and sampling. Site-specific FSPs are briefly summarized below.

IHSS 141 - Sludge Dispersal Area The screening activity at the sludge dispersal area will be a radiological survey. Sampling activities will be limited to surface soil sampling. One monitoring well will be installed downgradient of the unit and sampled.

IHSS 142.1-9, 12 - Detention Ponds - A-Series and B-Series Surface water and sediment samples will be collected in several locations in each pond. Sediment samples will also be collected from Walnut Creek upgradient and downgradient of the ponds. A total of four monitoring wells will be installed and sampled in the alluvium downgradient of the dams at Ponds A-4 and B-5.

IHSS 143 - Old Outfall The screening activity at the Old Outfall site will be a radiological survey. Sampling will include surface soil sample collection at the existing surface and at the original surface below the fill, collection of soil samples to a depth of two feet below the original ground surface, and collection of composite fill samples. In addition, soil samples will be collected upslope from the Old Outfall where the surface runoff was channeled to this area.

IHSS 156.2 - Soil Dump Area A germanium radiation survey will be performed at this IHSS followed by surface and subsurface soil sampling. One well will be installed within the unit and sampled.

IHSS 165 - Triangle Area A radiological survey and a soil gas survey will be the screening activities conducted at the Triangle Area. Surface soil samples will be collected from plume areas delineated during the screening. Subsurface samples will be collected from the same locations as the surface samples. Two alluvial groundwater monitoring wells will be installed within the IHSS and sampled.

IHSS 166.1-3 - Trenches A, B and C The screening activity will consist of an electromagnetic geophysical survey that will be used to delineate the locations and extent of the trenches. Subsurface samples will be collected from borings drilled along the long axis of the trenches. One groundwater well will be installed east of this IHSS and sampled.

IHSS 167.1-3 - North Area, Pond Area and South Area Spray Fields Based on the findings of the aerial photograph review, surface and subsurface soil samples will be collected in each spray field area using a grid location system. Two alluvial groundwater monitoring wells will be installed and sampled, one downgradient of the North Area Spray Field and one downgradient of the South Area Spray Field.

IHSS 216.1 - East Area Spray Field Although the IAG does not specify field sampling at this site, limited surface and subsurface soil samples will be collected within this unit.

Data collected during the Phase I Walnut Creek drainage RFI/RI, as well as data from other ongoing and planned investigations, will be incorporated into the existing RFEDS database. These data will be used to (1) better define site characteristics, source characteristics, and the nature and extent of contamination; (2) to support the baseline risk assessment and environmental evaluation; and (3) to evaluate potential remedial alternatives. An RFI/RI Report will be prepared summarizing the data obtained during the Phase I program and containing the Phase I Risk Assessment and Environmental Evaluation.

1.0
INTRODUCTION

This document presents the work plan for the Phase I RCRA Facility Investigation (RFI)/Remedial Investigation (RI) of the Walnut Creek Drainage (Operable Unit Number 6) at the Rocky Flats Plant, Jefferson County, Colorado. In this work plan, the existing information is initially summarized to characterize Operable Unit Number 6 (OU6) and a field sampling program is presented to assess the nature and extent of contamination in the twenty-one Individual Hazardous Substance Sites (IHSSs) along or within the North and South Walnut Creek drainages. These IHSSs are the Sludge Dispersal Area (IHSS 141); the ten detention ponds along North and South Walnut creeks (IHSS 142.1 through 142.9) and IHSS 142.12; the Old Outfall (IHSS 143); the Triangle Area (IHSS 165); Trenches A, B, and C (IHSSs 166.1, 166.2, and 166.3); the North Area, Pond Area, and South Area Spray fields (IHSS 167.1, 166.2, and 166.7) and the East Area Spray Field (IHSS 216.1). A Soil Dump Area (IHSS 156.2) has also been added to OU6 and is included in this work plan. The Phase I RFI/RI will be conducted in accordance with the Guidance for Conducting Remedial Investigations and Feasibility Studies under CERCLA (U.S.EPA 1988a) and Interim Final RCRA Facility Investigation (RFI) Guidance (U.S. EPA 1989a). The data generated will be used to begin developing and screening remedial alternatives and to evaluate the need for further studies for the 21 IHSSs. The data will be used to estimate risks to human health and the environment posed by each hazardous substance site.

This investigation is part of a comprehensive, phased program of site characterization, remedial investigations, feasibility studies, and remedial/corrective actions currently in progress at the Rocky Flats Plant. These investigations are pursuant to the U.S. Department of Energy (U.S. DOE) Environmental Restoration (ER) Program [formerly known as the Comprehensive Environmental Assessment and Response Program (CEARP)], a Compliance Agreement between DOE, the U.S. Environmental Protection Agency (U.S. EPA), and the State of Colorado Department of Health (CDH) dated July 31, 1986, and an Inter-Agency Agreement (IAG) among DOE, EPA, and CDH dated January 22, 1991. The IAG addresses RCRA and CERCLA issues and has been integrated with the ER program. In accordance with the IAG, the CERCLA terms "Remedial Investigation" and "Feasibility Study" in this document are considered equivalent to the RCRA terms "RCRA Facility Investigation" and "Corrective Measures Study" (CMS).

1.1 ENVIRONMENTAL RESTORATION PROGRAM

The ER Program is designed to investigate and clean up contaminated sites at DOE facilities. The ER Program being implemented is organized into five major activities. Activity 1 has already been completed at Rocky Flats Plant (U.S. DOE 1986a). This work plan is part of the Activity 2 program currently in progress for OU6 (North/and South Walnut Creek drainages).

- Activity 1 - Installation Assessment includes preliminary assessments and site inspections to assess potential environmental concerns.

- Activity 2 - Remedial Investigations include planning and implementation of sampling programs to delineate the magnitude and extent of contamination at specific sites, evaluate potential contaminant migration pathways, and perform baseline risk assessments.

- Activity 3 - Feasibility Studies to evaluate remedial alternatives and develop remedial action plans to mitigate environmental problems identified as needing correction in Activity 2.
- Activity 4 - Remedial Design/Remedial Action includes design and implementation of site-specific remedial actions selected on the basis of Activity 3 Feasibility Studies.

- Activity 5 - Compliance and Verification implements monitoring and performance assessments of remedial actions and then verifies and documents the adequacy of remedial actions carried out under Activity 4.

The schedule and the sequence of work for completing the OU6 investigation is specified in the IAG and is outlined below to provide background on the requirements for the OU6 RFI/RI. The IAG states that each OU, including OU6, shall proceed through several phases of investigation dependent on the information gathered to characterize the OU (Section I.B.9, IAG Statement of Work). Pursuant to the final IAG dated January 22, 1991, OUs 3-16 have not undergone Phase I field investigations.

For OU-s 3-16, DOE shall submit draft Phase I RFI/RI Workplans, in accordance with the requirements for RFI/RI Workplans, to EPA and the State for review and comment. DOE shall revise the draft RFI/RI Workplans to address all comments submitted by EPA and the State, and resubmit the RFI/RI workplans to EPA and the State for review and joint written approval.

The results of the Phase I RFI/RI, for OUs 3-16, shall be documented within draft Phase I RFI/RI reports. The draft RFI/RI reports shall include a Preliminary Site Characterization. The draft Phase I RFI/RI reports for OUs 3-16 shall also recommend work to be performed for each Phase II investigation. EPA and the state shall review these draft Phase I RFI/RI reports. DOE will address the comments and resubmit a Final Phase I RFI/RI report for EPA and/or the state review and approval. DOE shall not commence the next investigatory phase prior to receiving approval of the Final Phase I Reports for OUs 3-16 and approval of Phase II RFI/RI Workplans.

The Phase II RFI/RI investigations for OUs 3, 5, 6, 8, 12, 13, 14, 15, and 16 shall be prioritized, scheduled and conducted after evaluation of the Final Phase I RFI/RI Reports. If EPA and/or the state

determine that no further investigatory work is required within an OU after the Phase I investigation is complete, EPA and/or the state shall approve the Final Phase I RFI/RI Report as a Final RFI/RI Report for that specific OU. The investigatory phase for each OU within OUs 3-16 shall be considered complete after approval of a Final RFI/RI Report.

1.2 WORK PLAN SCOPE

Existing information on OU6 has been obtained from numerous sources for use in work plan preparation. Section 1.0 of this work plan presents introductory information and a general characterization of the region and plant site. In addition, the regional geology and hydrology at Rocky Flats are discussed. Section 2.0 presents descriptions of the site physical characteristics, histories and previous investigations, available information concerning the nature and extent of contamination, and conceptual models for the IHSSs. This initial characterization forms the basis for establishing data needs, data quality objectives (DQOs), and developing an FSP for each IHSS. Section 3.0 presents applicable or relevant and appropriate requirements (ARARs) developed for OU6. Section 4.0 establishes data needs and DQOs considering site characteristics and conceptual models of each IHSS in OU6. Section 5.0 outlines RFI/RI tasks to be performed. Section 6.0 presents the schedule for these tasks. A Field Sampling Plan, based on the requirements of the IAG, is presented in Section 7.0 to satisfy the data needs and DQOs identified in Section 4.0. The Baseline Risk Assessment Plan (BRAP) and Environmental Evaluation Plan (EEP) are presented in Sections 8.0 and 9.0, respectively. A Quality Assurance Addendum (QAA) and Standard Operating Procedure Addenda (SOPA) are presented in Sections 10.0 and 11.0, respectively. A list of references is presented in Section 12.0.

1.3 REGIONAL AND PLANT SITE BACKGROUND INFORMATION

1.3.1 Site Background and Plant Operations

The Rocky Flats Plant is a government-owned and contractor-operated facility that is part of the nationwide nuclear weapons production complex. The Plant was operated for the U.S. Atomic Energy Commission (AEC) from the Plant's inception in 1951 until the AEC was dissolved in January 1975. At that time, responsibility for the Plant was assigned to the Energy Research and Development Administration (ERDA), which was succeeded by the DOE in 1977. Dow Chemical USA, an operating unit of the Dow Chemical Company, was the prime operating contractor of the facility from 1951 until June 30, 1975. Rockwell International succeeded Dow Chemical USA from July 1, 1975 to January 1, 1990, when EG&G Rocky Flats, Inc. succeeded Rockwell International.

The Rocky Flats Plant's primary mission is to produce metal components for nuclear weapons. These components are fabricated from plutonium, uranium and nonradioactive metals, principally beryllium and stainless steel. Parts made at the plant are shipped elsewhere for final assembly. When a nuclear

weapon is determined to be obsolete, components of these weapons fabricated at the Plant are returned for special processing to recover plutonium and americium. Other activities at the Rocky Flats Plant include research and development in metallurgy, machining, nondestructive testing, coatings, remote engineering, chemistry, and physics. Both radioactive and nonradioactive wastes are generated in these research and production processes. Current waste handling practices involve on-site and off-site recycling of hazardous materials, on-site storage of hazardous and radioactive mixed wastes, and disposal of solid radioactive materials at another DOE facility. However, historically, Rocky Flats Plant operating procedures included both on-site storage and disposal of hazardous and radioactive wastes. Preliminary assessments under the ER Program identified some of the past on-site storage and disposal locations as potential sources of environmental contamination.

1.3.2 Previous Investigations

Various studies have been conducted at the Rocky Flats Plant to characterize environmental media and to assess the extent of radiological and chemical contaminant releases to the environment. The investigations are referenced in numerous reports including the Final Phase II RFI/RI Work Plan for Operable Unit No. 2 (EG&G 1991a).

In 1986, two major investigations were completed at the Plant. The first was the ER Program Installation Assessment (U.S. DOE 1986a), which included analyses and identification of current operational activities, active and inactive waste sites, current and past waste management practices, and potential environmental pathways through which contaminants could be transported. A number of sites were identified that could potentially have adverse impacts on the environment. These sites were designated as Solid Waste Management Units (SWMUs) (renamed Individual Hazardous Substance Sites (IHSSs) in the January 22, 1991 IAG) by Rockwell International (1987a) and were divided into three categories:

1. Hazardous waste management units that will continue to operate and need a RCRA operating permit.

2. Hazardous waste management units that will be closed under RCRA interim status.

3. Inactive waste management units that will be investigated and cleaned up under Section 3004(u) of RCRA or under CERCLA. No RCRA or CERCLA regulatory distinction in the use of the terms "site," "unit," "SWMU," or "IHSS" is intended in this document.

The second major investigation completed at the Plant in 1986 involved a hydrogeologic and hydrochemical characterization of the entire Plant site. Plans for this study were presented in Rockwell International publications 1986b and 1986c, and study results were reported in Rockwell International

publication 1986d. These investigations identified the twenty-one IHSSs that are included in OU6 based on their location adjacent to Walnut Creek.

1.3.3 Physical Setting

The Rocky Flats Plant is located in northern Jefferson County, Colorado, approximately 16 miles northwest of Denver (Figure 1-1). Other surrounding cities include Boulder, Westminster, and Arvada, which are located less than 10 miles to the northwest, east and southeast, respectively. The Plant consists of approximately 6,550 acres of federal land and occupies Sections 1 through 4 and 9 through 15 of T2S, R70W, 6th principal meridian. Major plant buildings are located within a Plant security area of approximately 400 acres. The security area is surrounded by a buffer zone of approximately 6,150 acres.

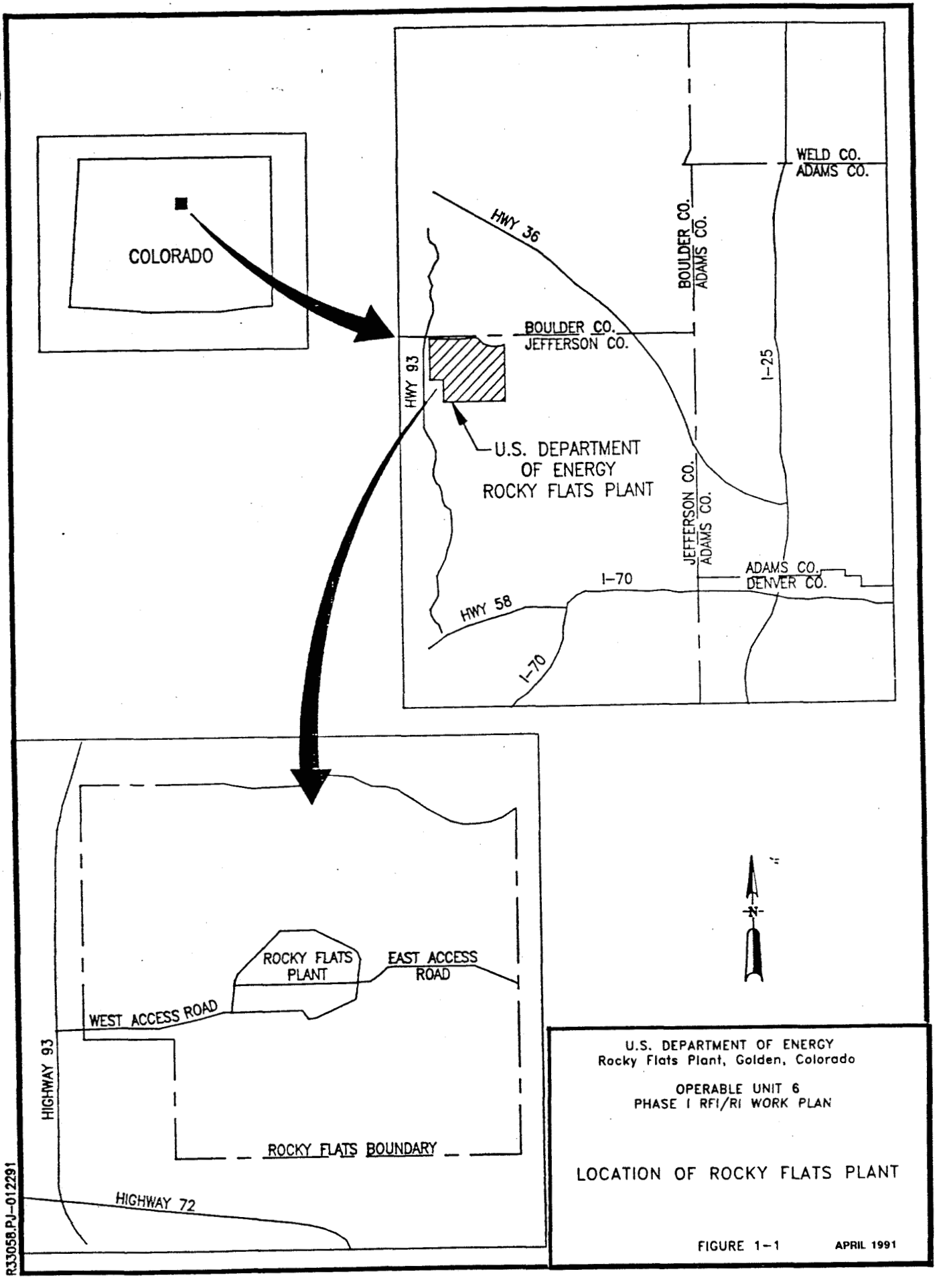
The Plant is bounded on the north by State Highway 128. To the east is Jefferson County Highway 17, also known as Indiana Street; to the south are agricultural and industrial properties, and Highway 72; and to the west is State Highway 93 (Figure 1-2).

1.3.3.1 Topography and Drainage

The natural environment of the Plant and vicinity is influenced primarily by its proximity to the Front Range of the Rocky Mountains. The Plant site is located directly east of the north-south-trending Front Range, located about 16 miles east of the Continental Divide. The Rocky Flats Plant is located on a broad, eastward-sloping system of coalescing alluvial fans. These fans, created by the erosion of the Front Range, extend approximately 5 miles to the east, where they terminate in low, rolling hills. The Plant is at an elevation of approximately 6,000 feet above mean sea level (msl). The Plant security area is located near the eastern edge of the fans on a pediment between stream cut gullies or arroyos (North Walnut Creek and Woman Creek) (Figure 1-2).

1.3.3.2 Surface Water Hydrology

Three streams drain the Rocky Flats Plant with flow generally from west to east. These drainages are Rock Creek, Walnut Creek, and Woman Creek (Figure 1-2). Rock Creek drains the northwestern corner of the Plant and flows northeast through the buffer zone to its off-site confluence with Coal Creek. North and South Walnut creeks, and an unnamed tributary of North Walnut Creek drain the northern portion of the Plant security area. These three forks of Walnut Creek join in the buffer zone and flow to Great Western Reservoir, approximately 1 mile east of their confluence. The flow is diverted around Great Western Reservoir into Big Dry Creek by the Broomfield Diversion Ditch. Rock Creek, North and South Walnut creeks and the unnamed tributary are intermittent streams, with continuous flow occurring only after precipitation events and spring snowmelt. An east-west trending interfluve separates Walnut Creek



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

OPERABLE UNIT 6
PHASE I RFI/RI WORK PLAN

LOCATION OF ROCKY FLATS PLANT

FIGURE 1-1 APRIL 1991

R33058.PJ-012291

from Woman Creek on the south. Woman Creek, a perennial stream, drains the southern Rocky Flats Plant buffer zone and flows eastward into Standley Lake Reservoir and Mower Reservoir. The South Interceptor Ditch is a ditch that flows intermittently and lies between the Plant and Woman Creek. The South Interceptor Ditch collects runoff from the southern Plant security area and diverts it to Pond C-2, where it is monitored in accordance with the Plant's National Pollutant Discharge Elimination System (NPDES) permit.

1.3.3.3 Climate

The climate in the area of the Rocky Flats Plant is semi-arid, characterized by warm summers and dry, cool winters, as is typical of much of the central Rocky Mountain Region. However, the elevation of the Plant (6,000 feet) and the nearby slopes and canyons of the Front Range modify the regional climate. Winds, although variable, are predominantly from the west-northwest, with stronger winds occurring during the winter. The canyons along the Front Range tend to channel the flow during both upslope and downslope conditions, especially when there is strong atmospheric stability. The area occasionally experiences Chinook winds with gusts up to 100 miles per hour.

Rocky Flats meteorology is strongly influenced by the diurnal cycle of mountain and valley breezes. Two dominant flow patterns exist, one during daytime conditions, and one at night. During daytime hours as the earth heats, the mountains receive more direct sunlight than the plains and valleys. The result is a general trend for the air flow to travel toward the higher elevations (upslope). The general air flow pattern during upslope conditions for the Denver area is typically north to south with the flow moving up the South Platte River Valley and then entering the canyons into the Front Range. After sunset the air against the mountain side is cooled and begins to flow toward the lower elevations (downslope). The pattern for the Denver area during downslope is flow moving down the canyons of the Front Range onto the plains. This flow converges with the South Platte River Valley flow moving toward the north-northeast.

Temperatures at Rocky Flats are moderate. On the average, daily summer maximum temperatures range from 55 to 85 degrees Fahrenheit (°F) and winter maximum temperatures range from 20 to 45°F. Extremely warm or cold weather is usually of short duration. Based on precipitation averages collected between 1953 and 1976, the mean annual precipitation at the Plant is approximately 15 inches. Approximately 40 percent of the precipitation falls during the spring, predominantly as wet snow. Autumn and winter are drier seasons, accounting for 19 and 11 percent of the annual precipitation, respectively. Thunderstorms from June to August account for about 30 percent of the total precipitation. Snowfall, generally occurring between October and May, averages 85 inches per year.

1.3.4 Surrounding Land Use and Population Density

The Rocky Flats Plant is located in a rural area. Approximately 50 percent of the area within 10 miles of the Rocky Flats Plant is in Jefferson County. The remainder is located in Boulder County (40 percent) and Adams County (10 percent). According to the 1973 Colorado Land Use Map, 75 percent of this land in 1973 was used for agriculture or was undeveloped. Since 1973, portions of this land have been converted to residential use, with several new housing subdivisions being constructed within a few miles of the buffer zone. One subdivision is located south of Jefferson County Airport, to the northeast, and several are located southeast of the Plant (EG&G 1991a).

A recent demographic study shows that approximately 2.2 million people lived within 50 miles of the Rocky Flats Plant in 1989 (U.S. DOE 1990a). Approximately 9,100 people lived within 5 miles of the Plant in 1989. The most populous sector lies to the southeast, toward Denver. Recent population estimates, registered by the Denver Regional Council of Governments (DRCOG) for the eight-county Denver metro region, have shown distinct patterns of growth during the first and second halves of the 1980s. Between 1980 and 1985, the population of the eight-county region increased by 197,890 -- a 2.4 percent annual growth rate. Between 1985 and 1989, a population gain of 71,575 was recorded, representing a 1.0 percent annual increase (the national average). The 1989 population showed an increase of 2,225 (or 0.1 percent) over 1988 (DRCOG 1989).

There are 8 public schools within 6 miles of the Rocky Flats Plant. The nearest educational facility is the Witt Elementary School, approximately 2.7 miles east of the plant buffer zone. The closest hospital is Centennial Peaks Hospital, located approximately 7 miles to the northeast.

The closest park and recreational area is Standley Lake Reservoir, approximately 5 miles southeast of the Plant. Boating, picnicking, and limited overnight camping are permitted. Several other small parks exist in communities within 10 miles. The closest major park, Golden Gate Canyon State Park, located approximately 15 miles to the southwest, provides 8,400 acres of general camping and outdoor recreation. Other national and state parks are located in the mountains west of the Rocky Flats Plant, but all are more than 15 miles away.

Some of the land adjacent to the Plant's buffer zone is zoned for industrial development. Industrial facilities within 5 miles include the TOSCO laboratory (a 40-acre site located 2 miles south), the Great Western Inorganics Plant (2 miles south), the Frontier Forest Products yard (2 miles north), the Idealite Lightweight Aggregate Plant (2.4 miles northwest), and the Jefferson County Airport and Industrial Park (a 990-acre site located 4.8 miles northeast). Several ranches are located within 10 miles of the plant, primarily in Jefferson and Boulder counties. They are operated to produce crops, raise beef cattle, supply milk, and breed and train horses. According to the 1987 Colorado Agricultural Statistics, 20,758 acres of crops were planted in Jefferson County (total land area of approximately 475,000 acres)

and 68,760 acres of crops were planted in Boulder County (total land area of 405,760 acres). Crops consisted of winter wheat, corn, barley, dry beans, sugar beets, hay, and oats. Livestock consisted of 5,314 head of cattle, 113 hogs, and 346 sheep in Jefferson County, and 19,578 head of cattle, 2,216 hogs, and 12,133 sheep in Boulder County (Post 1989).

1.3.5 Ecology

A variety of plant life is found within the Plant boundary. Species are representative of lower mountainous and foothill ravine regions and include species of tall and short grass prairie. Riparian vegetation exists along the site's drainages and wetlands. None of these vegetative species present on the Rocky Flats facility have been reported to be on the endangered species list (EG&G 1991a). Disturbed areas of the Plant have revegetated since establishment of Rocky Flats Plant, as evidenced by the presence of disturbance-sensitive grasses like big bluestem (*Andropogon gerardii*) and sideoats grama (*Bouteloua curtipendula)*.

The fauna inhabiting the Rocky Flats Plant and its buffer zone consists of species associated with western prairie regions. The most common large mammal is the mule deer (*Odocoileus hemionus*), with an estimated 100 to 125 permanent residents. There are a number of small carnivores, such as coyote (*Canis latrans*), red fox (*Vulpes fulva*), striped skunk (*Mephitis mephitis*), and long-tailed weasel (*Mustela frenata*). A profusion of small herbivores can be found throughout the Plant and buffer zone, consisting of species such as the pocket gopher (*Thomomys talpoides*), white-tailed jackrabbit (*Lepus townsendii*), and the meadow vole (*Microtus pennsylvanicus*) (U.S. DOE 1980).

Commonly observed birds include western meadowlarks (*Sturnella neglecta*), horned larks (*Eremophila alpestris*), mourning doves (*Zenaidura macroura*), and vesper sparrows (*Pooecetes gramineus*). A variety of ducks (*Anas sp.*), killdeer (*Charadrius vociferus*), and red-winged blackbirds (*Agelaius phoeniceus*) are seen near pond areas. Mallards (*Anas platyrhynochos*) and other ducks frequently nest and rear young on several of the ponds. Common birds of prey in the area include marsh hawks (*Circus cyaneus*), red-tailed hawks (*Buteo jamaicensis*), ferruginous hawks (*Buteo regalis*), rough-legged hawks (*Buteo lagopus*), and great horned owls (*Bubo virginianus*) (U.S. DOE 1980).

Bull snakes (*Pituophis melanoleucus*) and rattlesnakes (*Crotalus sp.*) are the most frequently observed reptiles. Eastern yellow-bellied racers (*Coluber constrictor flaviventris*) have also been seen. The eastern short-horned lizard (*Phrynosoma douglassi brevirostre*) has been reported on the site, but these and other lizards are not commonly observed. The western painted turtle (*Chrysemys picta*) and the western plains garter snake (*Thamnophis radix*) are found in and around many of the ponds (U.S. DOE 1980).

1.3.6 Regional and Local Geology and Hydrogeology

The Rocky Flats Plant is located on a broad, eastward-sloping plain of overlapping alluvial fans along the Front Range of the Rocky Mountains. Figure 1-3 presents a generalized stratigraphic section of the Denver Basin bedrock and Figure 1-4 shows a local stratigraphic section of the Rocky Flats Plant. The stratigraphic section that pertains to the Rocky Flats Plant includes, in descending order, unconsolidated surficial units (Rocky Flats Alluvium, various other alluvial deposits, valley fill alluvium and colluvium), the Arapahoe Formation, the Laramie Formation, and Fox Hills Sandstone. The surficial geology of the OU6 area is presented in Figure 1-5. Groundwater occurs under unconfined conditions in both the surficial units and the shallow bedrock units. In addition, confined groundwater flow occurs in deeper bedrock sandstones (e.g., Laramie/Fox Hills Sandstone). Geologic interpretations are based on information from Hurr (Hurr 1976) and from the ongoing geologic characterization studies. These interpretations are subject to change or modification based upon information gathered during the Phase II Geologic Characterization. A description of each of the geologic units is discussed in the following subsections.

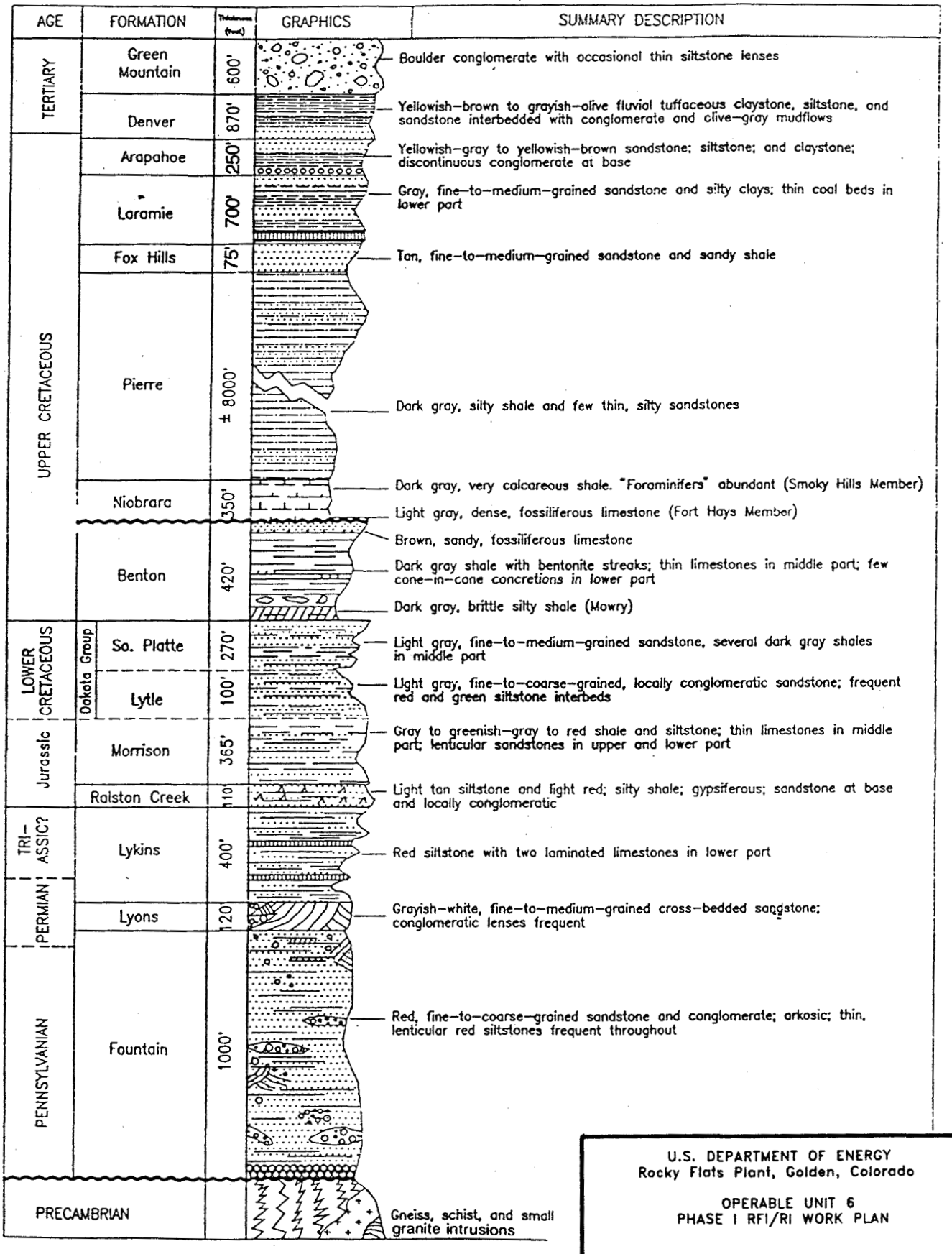
1.3.6.1 Rocky Flats Alluvium

The Rocky Flats Alluvium is the oldest and topographically highest alluvial deposit in the Rocky Flats Plant area (Figure 1-6). The Rocky Flats Alluvium was deposited by braided streams that produced a series of coalescing alluvial fans. The alluvium is a broad deposit consisting of a topsoil layer underlain by up to 100 feet of varying amounts of silt, clay,and gravel. Unconfined groundwater flow occurs in the Rocky Flats Alluvium, which is relatively permeable. Recharge to the alluvium is from precipitation, snowmelt, and water losses from ditches, streams, and ponds that are cut into the alluvium. General water movement in the Rocky Flats Alluvium is from west to east and toward the drainages. Groundwater flow is also controlled by pediment drainages in the top of the bedrock. Groundwater levels in the Rocky Flats Alluvium rise in response to recharge in the spring and decline in the summer, fall, and winter. Fluctuations in the groundwater level vary approximately 2 to 25 feet within the Plant site vicinity (Hurr 1976). Discharge from the alluvium occurs at seeps in the colluvium that covers the contact between alluvium and underlying bedrock along the edges of the valleys. Most seeps flow intermittently. The Rocky Flats Alluvium thins and becomes discontinuous east of the Plant boundary and, therefore, does not directly supply water to wells located downgradient of the Rocky Flats Plant.

1.3.6.2 Other Alluvial and Colluvial Deposits

Various other alluvial deposits occur topographically below and east of the Rocky Flats Alluvium in the drainages of the Rocky Flats Plant. Colluvium (slope wash) mantles the valley side slopes between the Rocky Flats Alluvium and the valley bottoms. The colluvium is a product of mass wasting that collects

136236



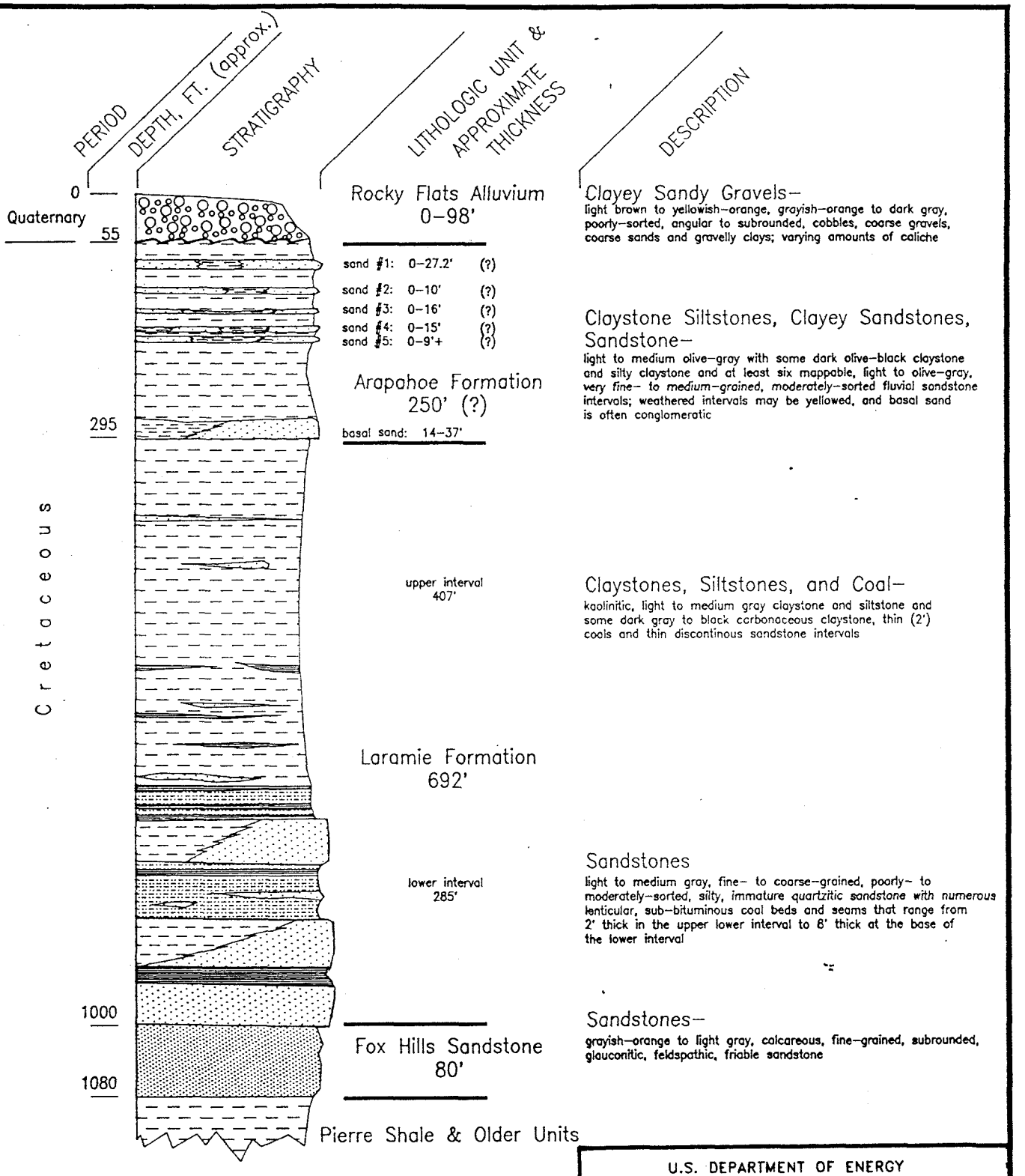
(modified from: Weimer, 1973)

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

OPERABLE UNIT 6
PHASE I RFI/RI WORK PLAN

GENERALIZED STRATIGRAPHIC SECTION OF THE DENVER BASIN BEDROCK

FIGURE 1-3 APRIL 1991



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

OPERABLE UNIT 6
PHASE I RFI/RI WORK PLAN

LOCAL STRATIGRAPHIC SECTION OF THE ROCKY FLATS PLANT

FIGURE 1–4

REV. AUGUST 1991
APRIL 1991

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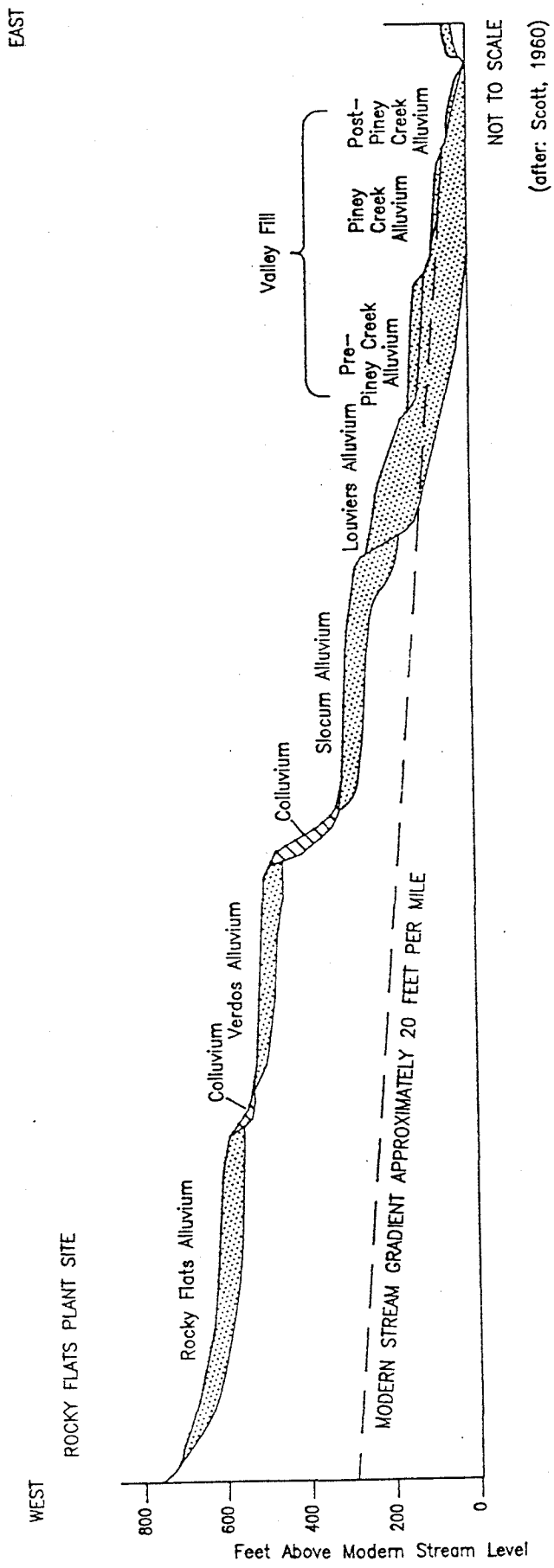


U.S. DEPARTMENT OF ENERGY
Rocky Flats Plant, Golden, Colorado

OPERABLE UNIT 6
PHASE I RFI/RI WORK PLAN

EROSIONAL SURFACES AND ALLUVIAL DEPOSITS EAST OF THE FRONT RANGE, COLORADO

FIGURE 1-6 APRIL 1991

on the sides and at the base of hills and slopes. These deposits tend to be poorly sorted mixtures of soil debris from bedrock clay and sand, mixed with gravel and cobbles derived from the older alluvium which caps the hills and ridges (Hurr 1976). The colluvium varies from a few inches to several feet in thickness and rests on bedrock and other alluvial material. In addition to the colluvium, remnants of younger terrace deposits including the Slocum and Louviers alluvial deposits occur occasionally along the valley sides slopes. Recent valley fill alluvium occurs in the active stream channels.

Unconfined groundwater flow occurs in these surficial deposits. Recharge occurs through precipitation, infiltration from streams during periods of surface water runoff, and by seeps discharging from the Rocky Flats Alluvium. Discharge occurs through evapotranspiration and by seepage into other geologic formations, subcrops, and streams. The direction of groundwater flow is generally to the east and downslope through colluvial materials, and then along the course of the stream in valley fill materials. During periods of high surface water flow, some of the water is lost to bank storage in the valley fill alluvium and then returns to the stream after the runoff subsides.

1.3.6.3 Arapahoe Formation

Underlying most of the surficial units at the Rocky Flats Plant is the Cretaceous Arapahoe Formation. The Arapahoe Formation is a fluvial deposit consisting primarily of siltstone and claystone over bank deposits with some silty sandstone channel deposits beneath the Plant. Geologic characterization of the Arapahoe Formation beneath Rocky Flats indicates that fluvial channel sequences containing sandstones in stream channel-shaped structures occur in this area. Formation thickness varies but maximum thickness is approximately 270 feet, and the unit is nearly horizontal beneath the Plant (less than 2° dip) (EG&G 1990g and 1990e). The sandstone units in the Arapahoe Formation are composed predominately of fine-grained sands and silts, and their hydraulic conductivity is equivalent to or less than that of the overlying Rocky Flats Alluvium. The Arapahoe Formation beneath Rocky Flats Plant, described by earlier RFI/RI studies, contains more clay and silt than typically described for other areas within the Denver Basin. There is a similarity of the siltstones and claystones beneath Rocky Flats to those of the Laramie Formation.

The Arapahoe Formation is recharged by groundwater from overlying surficial deposits and infiltration from streams. The main recharge areas are under the Rocky Flats Alluvium although limited recharge from the colluvium and valley fill alluvium likely occurs along the stream valleys (U.S. DOE 1990a). Recharge is greatest during the spring and early summer, when rainfall and stream flow are at a maximum and water levels in the Rocky Flats Alluvium are high. Groundwater movement on a regional basis is from west to east, in the Arapahoe Formation, although the groundwater flow regime in the bedrock has generally not yet been characterized. Regionally, groundwater flow in the Arapahoe Formation is toward the South Platte River in the center of the Denver Basin (Robson et al. 1981a).

1.3.6.4 Laramie Formation and Fox Hills Sandstone

The Laramie Formation, approximately 700 feet thick, underlies the Arapahoe Formation. This unit is composed of a thick upper claystone unit and lower sandstone unit that contains coal beds up to 10 feet thick. The upper claystone interval is approximately 400 feet thick and is of very low hydraulic conductivity; therefore, the U.S. Geological Survey concluded that Plant operations will not impact any units below the upper claystone unit of the Laramie Formation (Hurr 1976).

The lower sandstone unit of the Laramie Formation and the underlying Fox Hills Sandstone form a regionally important aquifer in the Denver Basin known as the Laramie-Fox Hills Aquifer. Near the center of the basin, the aquifer thickness ranges from 200 to 300 feet. West of the Plant, the Laramie-Fox Hills Aquifer can be seen in clay pits excavated through the Rocky Flats Alluvium. The steeply dipping beds of these units west of the Plant (approximately a 50° dip) quickly flatten to the east (less than 2° dip) (EG&G 1990g and 1990e). Recharge to this aquifer occurs along the rather limited outcrop area exposed to surface water flow and infiltration along the Front Range (Robson et al. 1981b).

1.4 RECENT GEOLOGIC CHARACTERIZATION

EG&G has identified inconsistencies in the methods that had been used for logging geologic materials and interpreting geologic data at Rocky Flats. As a result, a project was initiated to further define the geologic characteristics of the Rocky Flats Plant by conducting a literature review, reclassifying previously obtained samples using standardized procedures, conducting further laboratory testing on previously obtained samples, processing seismic data, and then reinterpreting the geology based on all available data.

Interim results of this ongoing study are presented in a draft report (EG&G 1990e). However, that report is a working draft which has not been prepared for distribution. That report presents summaries of stratigraphy and structural geology of the area and regions, the current working model of Plant geology, conclusions based on the working model, and recommendations for further work required to continue the ongoing characterization. Data and summaries of the data pertinent to OU6 are presented in this Work Plan.

2.0
SITE CHARACTERIZATION

Twenty Individual Hazardous Substances Sites (IHSSs) geographically located along or within the drainage areas of North and South Walnut creeks (Figure 2-1) have been designated as Operable Unit 6 (OU6) in the Environmental Restoration Interagency Agreement (IAG), dated January 22, 1991 (U.S. DOE 1991). Ten of these IHSSs are detention ponds and include the A-series and B-series Ponds. The A-series Ponds, located on North Walnut Creek, are Ponds A-1, A-2, A-3, and A-4 (IHSSs 142.1 through 142.4), and the pond identified as Pond A-5, which will be referred to as the pond east of the confluence of North and South Walnut creeks and/or as IHSS 142.12 in this work plan. The B-series Ponds, located on South Walnut Creek, are Ponds B-1, B-2, B-3, B-4, and B-5 (IHSSs 142.5 through 142.9). The remaining ten IHSSs in OU6 are located on the banks and/or plateau areas which ultimately drain into North or South Walnut creeks or the unnamed tributary of North Walnut Creek (Figure 2-1). Four of these IHSSs are spray fields and are the North, Pond, South, and the East Area Spray Fields (IHSSs 167.1, 167.2, 167.3, and 216.1). Three are trenches and are Trenches A, B, and C (IHSSs 166.1, 166.2, and 166.3). The remaining three IHSSs are the Sludge Dispersal Area (IHSS 141), the Triangle Area (IHSS 165), and the Old Outfall (IHSS 143). In addition to these twenty IHSSs, IHSS 156.2, the Soil Dump Area has also been added to the Phase I OU6 investigation because of its location along the Walnut Creek drainage.

The initial step in the development of the OU6 work plan was a review of existing information. Available historical and background data for each IHSS were collected through a literature search, which included references at the Rocky Flats Public Reading Room, various libraries within the Rocky Flats Plant, and a review of the Rocky Flats Environmental Database (RFEDS). Information concerning existing alluvial and bedrock groundwater wells within and near the North and South Walnut creek drainages has been collected for this study (Table 2-1). Personal communications with Plant personnel were also used as a source of information during the background data review so that each IHSS could be better described.

The twenty-one IHSSs in OU6 are discussed in detail in the following subsections. The location and description of each IHSS, the history of use, surface drainage, nature of contamination, previous investigations conducted at or near the individual IHSSs, geology, and hydrology are discussed. The A-series Ponds are discussed together in the following sections, as are the B-series Ponds, since these IHSSs have interrelated and similar histories. Also grouped together based on their similar operations and use are the North, Pond, and South Area spray fields, as well as Trenches A, B, and C. The areal extent and boundary of each IHSS is based on a preliminary review of historical aerial photographs (U.S. EPA 1988b), and the historical operations of the unit. The boundaries for each IHSS in this work plan are the same as those established in the IAG except for the Old Outfall (Figure 2-1). The boundary for the Old Outfall has been enlarged based on historical maps of this IHSS. Several investigations are

TABLE 2-1

ALLUVIAL AND BEDROCK GROUNDWATER WELLS IN THE VICINITY OF OPERABLE UNIT 6

Well Number	Status	Ground Surface Elevation	Total Depth	Formation Completed In	Depth to Bedrock	Screen Interval
B206189	1, 4	5,984.5	36.61	Kcl	20.90	25.90-35.36
B206289	1	5,977.59	43.05	Kcl	14.80	32.37-41.82
B206489	1	5,969.14	11.35	Qrf/Kss(w)	7.50	3.25-10.0
7287	1	5,969.11	7.0	Qrf	6.50	3.50-8.76
B206389	1, 4	5,969.70	14.74	Qrf/Qaf	13.30	4.0-13.50
B206589	1	5,967.80	36.24	Kss(w)	9.50	23.50-35.14
7087	1	5,966.30	16.50	Qrf/Kss	13.50	3.50-16.26
B206689	1	5,959.31	19.41	Kcl	3.70	8.70-18.17
B206889	1	5,917.09	18.20	Kcl	3.0	8.0-17.45
B207189	1	5,884.80	77.76	Kss(u)	7.10	70.98-75.43
B207089	1	5,883.07	54.0	Kss(w)	6.0	31.32-53.0
B206989	1	5,882.42	22.5	Kcl	6.0	11.80-21.30
B206789	1, 4	5,927.90	20.52	Kcl	4.80	9.80-19.28
B207289	1	5,948.27	15.89	Kcl	0.20	5.20-14.65
0886	1	5,925.03	63.80	Kss(w)	5.0	59.08-63.79
0786	1	5,924.46	5.74	Qvf	6.0	3.0-5.74
4287	1	5,854.05	6.60	Qvf	6.10	3.0-6.36
0686	1	5,806.10	8.88	Qvf	8.0	3.28-8.88
B208789	1	5,909.03	12.29	Qvf	10.40	2.88-10.93
B210389	1	5,873.20	24.35	Kcl	8.60	13.61-23.07
B208689	1	5,867.60	23.07	Kcl	7.30	12.32-21.80
1786	1	5,865.26	13.98	Qvf/Kcl	12.50	3.73-13.98
1686	1	5,864.74	45.06	Kss(u)	7.0	39.06-45.06
B208589	1	5,856.50	5.07	Qvf	3.60	3.23-3.99
B210489	1	5,856.40	8.67	Qc	7.0	2.98-7.41
B208389	1	5,876.80	9.03	Qc	7.30	3.37-7.30
B208489	1	5,876.30	30.49	Kcl	15.10	19.76-29.22
1886	1	5,882.82	7.50	Qaf	7.0	3.74-7.50
1486	1	5,844.71	55.36	Kss(w)	11.0	39.42-55.36

TABLE 2-1
ALLUVIAL AND BEDROCK GROUNDWATER WELLS
IN THE VICINITY OF OPERABLE UNIT 6
(Continued)

Well Number	Status	Ground Surface Elevation	Total Depth	Formation Completed In	Depth to Bedrock	Screen Interval
1386	1	5,837.22	9.50	Qvf	9.0	3.09-9.50
1586	1	5,845.61	14.69	Qvf/Kcl	12.50	4.09-14.69
B208289	1	5,850.70	16.16	Kcl	0.90	5.95-15.42
1286	1	5,780.56	11.30	Qvf	11.0	2.04-11.30
1186	1	5,712.19	10.25	Qvf	9.50	3.94-10.25
B208089	1	5,935.40	14.16	Qc	12.40	3.40-12.90
B208189	1	5,935.40	27.58	Kcl	11.90	16.90-26.34
B213789	4, 5	5,917.80	8.25	Qc	6.40	2.46-6.90
3686	1	5,881.94	6.50	Qvf	5.50	3.50-6.49
P213889	4, 5	5,954.10	22.03	Kss(w)	8.30	11.30-20.83
3486	1	5,910.44	56.25	Kss(w)	16.10	44.24-56.25
3586	1	5,909.20	11.60	Qvf/Kcl	10.30	4.86-11.60
P213989	4, 5	5,954.30	7.20	Qrf	6.70	3.29-6.93
P219489	4, 5	5,959.50	22.90	Qrf	22.45	18.48-22.90
P219589	4, 5	5,963.80	26.99	Qrf	25.20	21.27-25.70
P207789	1, 4	5,965.88	28.63	Kcl	12.90	17.90-27.34
P209689	1, 4	5,962.63	27.93	Kcl	12.20	17.20-26.67
2986	1	5,958.26	8.77	Qrf	8.70	2.83-8.77
P218389	4, 5	5,956.20	13.77	Qrf	12.0	8.06-12.56
0460	1	5,962.0	17.78	--	--	--
P207889	1, 4	5,962.82	8.95	Qrf	7.20	3.26-7.70
P209789	1, 4	5,962.82	13.75	Qrf	12.0	3.0-12.50
2886	1	5,961.23	8.60	Qaf	8.40	4.03-8.60
2786	1	5,961.86	133.0	Kss(u)	9.20	128.50-133.0
P209589	1, 4	5,948.17	19.77	Kcl	4.10	9.07-18.52
P208889	1, 4	5,947.30	99.16	Kss(u)	3.50	87.76-96.94
P207989	1, 4	5,963.09	21.73	Kcl	6.0	11.0-20.48
P210289	1, 4	5,967.03	22.27	Kcl	6.60	11.57-21.0
P207689	1, 4	5,966.32	14.36	Qrf	12.60	3.64-13.10

TABLE 2-1
ALLUVIAL AND BEDROCK GROUNDWATER WELLS
IN THE VICINITY OF OPERABLE UNIT 6
(Concluded)

Well Number	Status	Ground Surface Elevation	Total Depth	Formation Completed In	Depth to Bedrock	Screen Interval
3886	1	5,728.13	8.50	Qvf	10.0	2.91-8.50
0181	3	5,718.90	22.05	--	--	--
0586	1	5,720.07	9.76	Qvf	8.0	4.40-9.76
0486	1	5,636.60	14.92	Qvf	15.0	3.52-14.92
4087	1	5,882.69	6.70	Qvf	6.20	3.50-6.46
P219089	3	5,949.10	15.70	Qaf	10.40	5.0-14.44
P219189	4, 5	5,941.20	12.77	Qrf	11.0	7.08-11.50
3887	1	5,971.79	9.50	Qrf	7.50	3.50-9.27
P209689	1, 4	5,962.63	27.93	Kcl	12.20	17.20-26.67
P210089	1	5,898.40	22.93	Kcl	7.20	12.20-21.50
P209989	1	5,898.10	9.58	Qc	7.70	3.81-8.18

In Appendix D, this existing data is summarized for each sample location by analyte, total samples analyzed, hits above the CRQL level, maximum hits and average hit concentration values.

Key to Status:
1 - Active Well
2 - Abandoned Borehole
3 - Inactive Well
4 - Borehole Sampled
5 - Observation Well

Key to Geologic Strata:
Qrf - Rocky Flats Alluvium
Qc - Colluvium
Qvf - Valley Fill Alluvium
Kcl - Bedrock Weathered Claystone
Kss(u) - Bedrock Unweathered Sandstone
Kss(w) - Bedrock Weathered Sandstone
Qaf - Artificial Fill
Kss - Undifferentiated Bedrock Sandstone

Source: EG&G 1990c

ongoing near the North and South Walnut Creek drainages, including ongoing surfacewater, groundwater, and sediment sampling programs and investigations at OUs 4, 7, and 10. Where previous or ongoing investigations have been conducted at or near an IHSS, some of the analytical data are included for reference in the following sections. The inclusion of these data is for informational purposes only. The geology underlying each IHSS has been characterized by the ongoing geologic characterization program in progress by EG&G at Rocky Flats (EG&G 1990e). This program includes conducting a comprehensive literature search, reprocessing and describing previously obtained core samples, and collecting and analyzing selected samples for grain size analyses. The geologic characterization program will incorporate all geologic information Plant-wide for continued refinement of the working geologic model. The above referenced report is a draft internal working document. Data and results of this characterization that are pertinent to Operable Unit 6 are presented in this work plan. In addition to the review of each IHSS, a generic conceptual model for the IHSSs of OU6 has been developed. The generic model will be refined and modified appropriate to each IHSS in the RFI/RI Report.

Also discussed in the following section are North and South Walnut Creek drainage systems adjacent to the Rocky Flats Plant. North and South Walnut creeks and the unnamed tributary of North Walnut Creek constitute the drainage systems which provides a common physical setting for all the IHSSs in OU6.

2.1 NORTH AND SOUTH WALNUT CREEKS

The Rocky Flats Plant is located on a plateau which is bounded on the north by North Walnut Creek. North and South Walnut creeks are intermittent streams that receive surface runoff from the northern and eastern portion of the Plant facility and adjoining buffer zone. An unnamed tributary (located ½ mile north of the facility and north of North Walnut Creek) receives surface runoff from the northern buffer zone. All three of these creeks merge into Walnut Creek within the buffer zone about 1 mile northeast of the Perimeter Security Zone (PSZ) (Figure 2-1). Walnut Creek flows toward Great Western Reservoir, located approximately ⅓ mile east of the eastern boundary (Indiana Street) of the Rocky Flats Plant. The water from Walnut Creek is diverted around Great Western Reservoir by the Broomfield Diversion Ditch, and is carried to Big Dry Creek.

The headwaters of North Walnut Creek originate within the Upper Church Ditch, approximately 1½ miles west of Highway 93, near Coal Creek (Figure 1-2). This ditch splits within the western buffer zone forming McKay Ditch and Church Ditch. North Walnut Creek continues for approximately 3 miles before converging with South Walnut Creek to form Walnut Creek.

South Walnut Creek originates near the center of the Rocky Flats Plant security area and bisects the eastern half of the security area. South Walnut Creek converges with North Walnut Creek approximately one mile east of the eastern boundary of the main security area (Figure 2-1). The original headwaters of South Walnut Creek were backfilled during construction of the Plant's facilities; therefore, flow begins near a buried culvert west of Building 991.

The natural drainage of both North and South Walnut creeks have been modified in the OU6 area by the construction of several detention ponds. These detention ponds serve to temporarily detain surface runoff draining from the Plant facilities and buffer zone in order for the water to be sampled and analyzed prior to release downstream. These detention ponds are also used for spill control management. Four detention ponds (the A-series Ponds) were built in North Walnut Creek and five detention ponds were built in South Walnut Creek (the B-series Ponds). Following is a brief discussion of the drainage system near these detention ponds.

The four A-series detention ponds (Ponds A-1 through A-4) have been built in North Walnut Creek, northeast of the main security area of the Plant facility (Figure 2-1). Surface water in North Walnut Creek flows eastward in its original channel to just west of Pond A-1. The A-1 Bypass diverts this runoff around Ponds A-1 and A-2 and channels it into Pond A-3, where the water is temporarily detained. Currently ponds A-1 and A-2 receive no upstream runoff from North Walnut Creek. These ponds are used primarily for spill control management and to detain runoff from the area immediately adjacent to these ponds. The water collected in Ponds A-1 and A-2 is not released downstream but is disposed of through spray and pond evaporation. Pond A-3 receives surface water from North Walnut Creek and runoff from the northern production facilities via the A-1 Bypass. Periodically, water in Pond A-3 flows into Pond A-4. The water in Pond A-4 is treated by a granular activated-carbon (GAC) system before being discharged into North Walnut Creek. Downstream of Pond A-4 and west of Indiana Street, water from Walnut Creek is temporarily detained in a pond, IHSS 142.12, until it reaches a high enough level to flow out and downstream into Walnut Creek toward Great Western Reservoir. The effluent from this pond is sampled daily when discharging downstream. The water in Walnut Creek is diverted around Great Western Reservoir by the Broomfield Diversion Ditch, which carries water to Big Dry Creek.

The B-series detention ponds (Ponds B-1 through B-5) have been built in South Walnut Creek east of the main security area of the Plant facility (Figure 2-1). Ponds B-1 and B-2, are primarily used for spill control management and to detain surface runoff from the upstream portion (eastern part) of the facility. The water collected in these ponds is not discharged downstream but disposed of through spray field evaporation similar to Ponds A-1 and A-2. Pond B-3 receives effluent from the Sewage Treatment Plant (STP) (Building 995) and local surface runoff. Water in Pond B-3 is continuously discharged to Pond B-4 under a National Pollutant Discharge Elimination System (NPDES) agreement (Permit Number CO-0001333). The purpose of the NPDES agreement is to achieve and maintain compliance with water pollution control standards of the Clean Water Act. Discharge limitations and parameters monitored

under this NPDES permit are summarized in the Surface Water Management Plan at Rocky Flats (U.S. DOE 1991b). The water in Pond B-4 is sampled and analyzed three days a week. Water in Pond B-4 is continuously released to Pond B-5. Pond B-5 receives water not only from Pond B-4 but from surface runoff from the Central Avenue Ditch located south of the B-series Ponds (Figure 2-1). This ditch receives surface runoff that originates near the eastern production facilities. The water in Pond B-5 is not discharged to South Walnut Creek but periodically pumped to Pond A-4, where the water is treated through a GAC system before being discharged downstream into Walnut Creek.

In addition to the physical characteristics described above, there is also analytical data on Walnut Creek drainage itself from the sediment, surface water and groundwater samples collected along this drainage and its tributaries (Figures 2-1 and 2-2). In the following three sections the existing data from this sampling program are reviewed and summarized.

2.1.1 Existing Sediment Sampling Program

Sediment samples are being collected quarterly at 16 locations along North and South Walnut Creek, the unnamed tributary to the north of North Walnut Creek and from drainages along the north slope of the plant site (Figure 2-2). Almost all of these sediment samples have been collected over the last few years. This existing sediment sampling program consists of five sediment sampling locations along South Walnut Creek, three along North Walnut Creek, four along the unnamed tributary north of North Walnut creek, three locations from drainages located on the north slope of the plant site, and one in Walnut Creek just west of Indiana Street. Sediment samples are collected from each of these locations according to Rocky Flats SOP SW.6, with the samples generally analyzed for TAL metals, TCL-volatiles, TCL semi-volatiles, TCL pesticides/PCBs, and radionuclides. These above existing data will also be used in Section 7.0 to focus the additional sediment data collection effort in areas where there is data lacking.

Most of the sediment sampling locations have analytical results available from one to four sampling events, with these data summarized in Appendix A. A list of sediment locations that have analytical data included in this Work Plan can be found on page one of Appendix A. In Appendix A, this existing data is summarized for each sample location by analyte, total samples analyzed, hits above the CRQL levels, maximum hits, and average hit concentration values. The Contract Required Quantitation Limit (CRQL) used as a subtitle in Appendix A, refers to the CRQL, the CRDL (Contract Required Detection Limit), and MDA (minimum detectable activity) for Contract Laboratory Program (CLP) organics, CLP inorganics and radionuclides, respectively. MDA is the required detection limit for radionuclides (EG&G 1990d). A review of these data for organics from Appendix A (except for the common lab contaminants including acetone, methylene chloride, toluene and 2-butanone) reveals that all but two of the locations had very few organic/pesticide hits above the CRQL level. Sediment locations SED-124 and SED-6 were the only locations which had more than three reported organic/pesticide concentrations above

the CRQL levels. Figure 2-2 lists all of the organic hits above the CRQLs level for each sediment location except for acetone and methylene chloride compounds (common lab contaminants). For the other common laboratory contaminants (2-butanone and toluene) their concentrations are listed on Figure 2-2 if they had reported concentrations above five times the CRQL. This is consistent with EPA guidance for the contract laboratory program which recommends that, unless their concentrations are greater than five times the CRQL, they should not be considered significant values (USEPA 1988h). The limited number of organics detected above the CRQL levels in almost all of the OU6 sediment locations probably indicates that these compounds will not be a significant concern for this area. For the two locations (SED-6 and SED-124) that detected several organics these concentrations may be due to local factors. SED-124 is located downslope from the north part of Rocky Flats which may have impacted this location. Location SED-6 which detected 12 base neutral compounds during one of its two sampling events may be anomalous or due to the Landfill Pond and/or the new Landfill, which are upslope of this location.

In addition to the organic compounds, most sediment locations had reported concentrations above the MDA and CRDL levels for radionuclides and metals, respectively (Appendix A). However, the reported metal and radionuclide concentrations that are above the CRDL and MDA levels may be representative of background concentrations. In addition, there are certain measurement errors associated with the radionuclide concentrations contained in Appendix A. Subsequently, some of the detected radionuclides may not actually be above the MDA levels when considering this measurement error. These metal and radionuclide results will be further evaluated when background has been more fully established during the remedial investigation.

2.1.2 Existing Surface Water Sampling Program

Surface water samples are currently collected monthly to monitor the water quality of the detention ponds and in the Walnut Creek drainage. A surface water monitoring program was established several years ago at Rocky Flats facility and is presently being supervised by EG&G personnel. Numerous established surface sampling locations along the drainage area of Walnut Creek and within the A- and B-series Ponds (Figure 2-2) are sampled on a monthly basis providing there is water present and the water is not frozen. Analytical results from these surface water samples along the Walnut Creek drainage (Figure 2-2) were reviewed for this Work Plan. A majority of available surface water data is from 1989 and 1990, with a few samples collected prior to 1989. Surface water samples collected as part of the existing program are collected according to Standard Operating Procedure (SOP) SW.3 for surface water.

Many of the surface water sampling locations from the existing sampling program have been compiled and summarized and these data are contained in Appendix B. In Appendix B, this existing data is summarized for each sample location by analyte, total samples analyzed, hits above the CRQL levels, maximum hits, and average hit concentration values. The subtitle Contract Required Quantitation Limit (CRQL) in Appendix C, refers to the CRQL, the CRDL (Contract Required Detection Limit), and MDA (minimum detectable activity) for CLP organics, CLP inorganics and radionuclides, respectively. MDA is the required detection limit for radionuclides (EG&G 1990d). A list of the surface water stations that have analytical data included in this Work Plan can be found on the first page of Appendix B. Many of the organic compounds which are listed in Appendix B are common laboratory contaminants (acetone, methylene chloride, toluene, and 2-butanone) (USEPA 1988h). According to the Statement of Work in USEPA Contract Laboratory guidance, these compounds should not be considered significant unless they have concentrations greater than five times the CRQL (USEPA 1988h). A review of the organic results from the existing stations (excluding the laboratory contaminants listed above) reveals that most reported concentrations above the CRQLs were volatile organics from stations located immediately downslope of the PSZ either at seep locations or at the headwaters of South Walnut Creek. Almost all of the other sampling stations had organic concentrations below the CRQLs levels with only a few analytes having higher concentrations (Appendix B).

A review of the database indicates that most of the surface water sampling locations have detectable concentrations of radionuclides and metal concentrations above the MDA and CRDL levels. However, detectable concentrations of radionuclides and metals are also found in upstream areas from this OU and thus these concentrations may represent background for these areas. These concentrations will be further evaluated during the remedial investigation to identify potential sources and to determine if they are within the background range for this area. In addition, there is certain measurement error associated with the radionuclide concentrations contained in this Appendix. Subsequently, some of the detected radionuclides may not actually be above the MDA when considering this measurement error.

2.1.3 Existing Groundwater Sampling Program

Groundwater samples from existing wells at Rocky Flats in the OU6 area are currently collected on a quarterly basis to monitor the groundwater quality beneath the Plant site (Figure 2-1). Chemical analytical results from many of the groundwater wells located near North and South Walnut creeks have been compiled , summarized, and reviewed and these data are contained in Appendix C. In Appendix C, this existing data is summarized for each sample location by analyte, total samples analyzed, hits above the CRQL levels, maximum hits and average hit concentration values. The Contract Required Quantitation Limit (CRQL) used as a subtitle in the Appendix, refers to the CRQL, the CRDL (Contract Required Detection Limit), and MDA (minimum detectable activity) for CLP organics, CLP inorganics and radionuclides, respectively. MDA is the required detection limit for radionuclides (EG&G 1990d). A list of the groundwater wells with analytical data included in this Work Plan can be found on the first page

of Appendix C. Many of the organic compounds detected in the groundwater are common laboratory contaminants (acetone, methylene chloride, toluene, and 2-butanone) (USEPA 1988h). According to the Statement of Work in USEPA Contract Laboratory guidance, these compounds should not be considered significant unless they have concentrations greater than 5 times the CRQL (USEPA 1988h). Groundwater samples are collected according to Rocky Flats SOP GW.6, with the samples generally analyzed for TAL metals, TCL-volatiles, TCL semi-volatiles, TCL pesticides/PCBs and radionuclides. Following in Section 2.1, analytical results from several groundwater wells near and downgradient to specific IHSSs of OU6 have been tabulated to show all analytes above the CRQLs, CRDLs and MDAs. Generally in each of the subsequent sections, the groundwater monitoring wells near each IHSS with organics above the CRQLs (excluding the common laboratory contaminants) are discussed. The metals and radionuclides are also discussed but for many of these analytes their concentrations may be representative of background. Subsequently, concentrations above the CRDLs and MDAs will be further evaluated in the RI report when there is more information available on the local background for each of the IHSSs. There is certain measurement error associated with the radionuclide concentrations contained in Appendix C. Subsequently, some of the detected radionuclides may not actually be above the MDA when considering this measurement error.

2.2 A-SERIES PONDS A-1, A-2, A-3, A-4 (IHSSs 142.1, 142.2, 142.3, 142.4), and IHSS 142.12

2.2.1 Location and Description

Ponds A-1, A-2, A-3, and A-4 (IHSSs 142.1 through 142.4) in North Walnut Creek, northeast of the main security area of the Rocky Flats Plant (Figure 2-3). IHSS 142.12, the pond located approximately 2,500 feet east of the confluence of North and South Walnut creeks and immediately west (upstream) of Indiana Street will be discussed with the A-series Ponds. The size of these ponds vary seasonally but are usually maintained at 10 percent capacity. The estimated storage capacity for Ponds A-1, A-2, A-3, and A-4 are 1,660,000; 6,700,000; 14,110,000; and 3,090,000 gallons, respectively. These ponds were generally constructed by the placement of an earthen embankment across the North Walnut Creek drainage. Outlets and spillways were constructed in some of the ponds. Outlets are used to regulate downstream flow from the ponds with spillways used to channel excess water around the embankment when the ponds are near their full capacity. As-built drawings for ponds A-2, A-3, and A-4 are contained in Appendix D (EG&G 1991c). A description of surface water flows through these ponds is contained in subsection 2.1.

2.2.2 History

The A-series Ponds are used primarily to capture and control surface water runoff from the northern part of the Rocky Flats production facilities and from North Walnut Creek. Historically, the A-series Ponds

have received discharges from several different sources. Between 1952 and 1979, Pond A-1 was used to hold laundry wastewater that contained nitrates and radioactive substances, including plutonium and uranium, that was discharged into North Walnut Creek from the northern production facilities. Pond A-1 also received process liquid waste, cooling tower blowdown and steam condensate discharges, which contained chromates and algicides. After the construction and completion of Pond A-2 (prior to 1978) the water of Pond A-1 was allowed to flow into Pond A-2 where the water was disposed of by natural and spray evaporation (Hurley 1979).

These discharges, although long since discontinued, produced significant amounts of plutonium in the stream sediments of North Walnut Creek and in the sediments of Pond A-1 (U.S. DOE 1980). Pond A-1 is presently used for spill control management and receives only local surface runoff and seepage that may occur in the area. The water collected in this pond is currently disposed of through spray evaporation. Pond A-2 received process wastewater and laundry wastewater from Ponds A-1 and B-2 (IHSS 142.6). The water from Pond B-2 was pumped to Pond A-2. The water from Pond A-2 has always been disposed of by natural and spray evaporation. Pond A-2 is presently used for spill control management, like Pond A-1, and receives only local surface runoff and seepage that may occur near this area.

Pond A-3, constructed in 1971, was used to impound surface water runoff from the northern Plant facilities and North Walnut Creek prior to being discharged downstream. Presently, Pond A-3 collects surface runoff from the northern production facilities and North Walnut Creek as waters originating upstream in North Walnut Creek are diverted around Ponds A-1 and A-2 by the A-1 Bypass and channelled into Pond A-3. The water is temporarily detained in Pond A-3 before being released into Pond A-4.

Pond A-4, constructed in 1980, historically received water from Pond A-3. Presently, Pond A-4 receives water from Ponds A-3 and B-5 (the water from Pond B-5 is pumped into Pond A-4). The water in Pond A-4 is treated by a GAC system before being discharged downstream into Walnut Creek.

IHSS 142.12, or the pond east of the confluence of North and South Walnut creeks is used to take flow measurements of Walnut Creek. This is accomplished using two Parshall Flumes (6-inch throat and 36-inch throat). Sediments transported by North and South Walnut creeks may settle out in IHSS 142.12 due to the quiescent conditions of this pond (Blaha 1990). The effluent from this pond is sampled on a daily basis when discharging. Discharging occurs when the capacity of the pond reaches a high enough capacity to flow out and downstream into Walnut Creek.

2.2.3 Surface Drainage

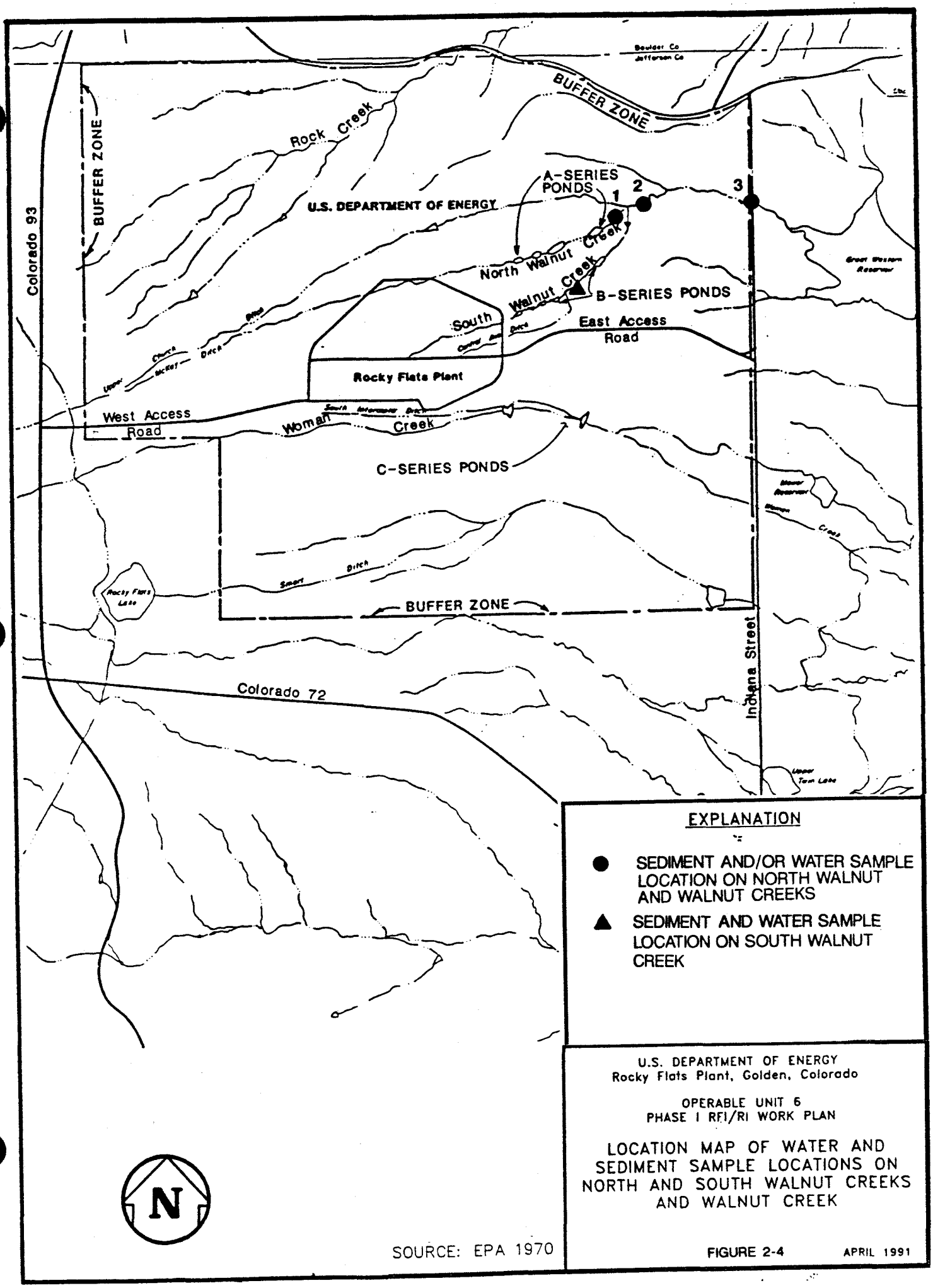
The surface drainage system near Detention Ponds A-1 through A-4 and IHSS 142.12 is discussed in subsection 2.1. Ponds A-1 and A-2 receive local runoff and seepage which may occur near these ponds. Pond A-3 receives surface runoff from the northern Plant facilities and North Walnut Creek. Pond A-4 receives water from Pond A-3, Pond B-5 and any local runoff or seepage which may occur in this area. IHSS 142.12 receives treated water that is discharged downstream of Pond A-4 and runoff that may occur in the immediate area.

2.2.4 Nature of Contamination and Previous Investigations

The A-series detention ponds have received considerable attention over the last several years, and numerous investigations have been conducted on the water and sediment quality of the ponds and stream sediments of North Walnut Creek. Included in these studies was a 1970 study conducted by the EPA (U.S. EPA 1970), a 1979 study on radioactivity levels associated with the pond sediments (Hurley 1979), a 1980 study by D. Paine on plutonium in freshwater systems at Rocky Flats (Paine 1980), and a 1986 study conducted as a requirement for a RCRA Part B permit application (Rockwell 1988). In addition to the above studies, chemical analytical results from groundwater samples collected near these IHSSs were reviewed during preparation of this Work Plan.

The study conducted in February 1970 by EPA involved the analysis of two water samples and three bottom sediment samples from Walnut Creek (U.S. EPA 1970). The bottom sediment samples were collected by scraping the bottom area below the water line with a hand trowel. Grab samples of water were collected in 1-gallon plastic containers with 2 to 5 gallons collected per sample. A water and a bottom sediment sample were collected at Location 1 (Figure 2-4) approximately 50 feet upstream of the confluence of North and South Walnut creeks. The second sample, in which only a bottom sediment sample was collected (Location 2), was about 50 feet downstream of the confluence (Figure 2-4). The third sample (Location 3) was collected from Walnut Creek at Indiana Street. The water sample at this location was collected on the east side of Indiana Street and the bottom sediment sample was collected on the west side (Figure 2-4). Analyses of these water and sediment samples are tabulated in Table 2-2.

The 1979 study concerning radioactivity associated with the pond sediments concluded that most of the plutonium was in the pond sediments and that the amount of plutonium in the water depended to a great extent on the amount of suspended material in the sample. Sediments showed an extremely high affinity for plutonium; the adsorption and fixation of plutonium by sediments was rapid and essentially irreversible. The highest plutonium concentrations found within the pond sediments were found at subsurface depths rather than on the sediment surface (Hurley 1979).



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LOCATION MAP OF WATER AND SEDIMENT SAMPLE LOCATIONS ON NORTH AND SOUTH WALNUT CREEKS AND WALNUT CREEK

FIGURE 2-4 APRIL 1991

TABLE 2-2

WATER AND SEDIMENT ANALYTICAL DATA ALONG WALNUT CREEK

Dissolved Radioactivity in Water Samples (pCi/l)

Station	Gross Alpha	Tritium	Sr-89	Sr-90	Total Alpha Radiation	Uranium[1]	Pu-239
Location 1	0.9	N.D.	0.1	0.7	<0.1	2.7	0.02
Location 3	0.6	N.D.	0.1	0.6	<0.1	4.8	0.05

Radioactivity in Bottom Sediment Samples (pCi/g)

Station	Gross Alpha	Sr-90	Total Alpha Radiation	Uranium[1]	Pu-239
Location 1	10	0.1	5.4	2.3	0.50
Location 2	17	0	2.8	1.0	3.41
Location 3	14	0.1	4.1	2.1	0.92

Source: EPA 1970

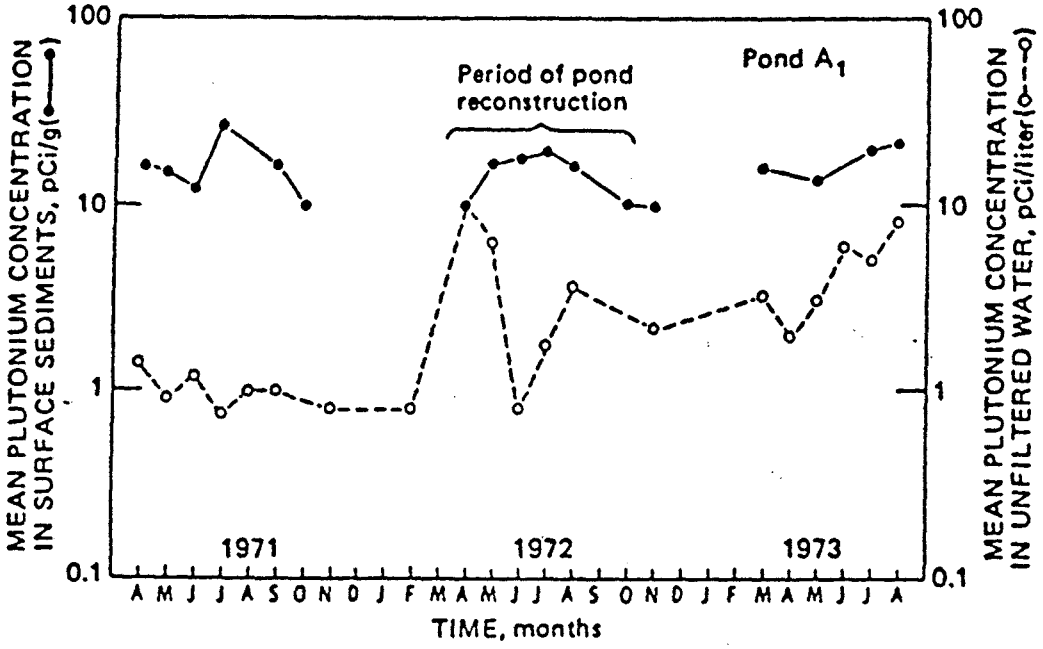
Note: [1] Concentration in μg/l
N.D. - Not Determined
(See Figure 2-4 for station locations)

The 1980 study by D. Paine, was conducted to determine the behavior of plutonium in the freshwater systems at Rocky Flats Plant (Paine 1980). In this study, sediment cores were taken at 5 cm intervals on a monthly basis from Pond A-1 during the study period (spring of 1971 through the summer of 1973). These core samples were taken to determine the vertical distribution of plutonium in the pond sediments. Surface water samples and water samples were collected at 0.5 meter increments from the pond surface to the sediment/water interface.

The average or mean plutonium concentrations (Pu-239 and Pu-240) in unfiltered water and surface sediments taken from Pond A-1 during this study period are illustrated in Figure 2-5. Reconstruction activities of Pond A-1 resulted in an increase in plutonium concentrations in the surface water samples as observed in Figure 2-5, but not in the ponds sediments. The sediment samples collected at depth showed no significant vertical variation in plutonium concentrations with depth, probably because of the shallow nature of Pond A-1. In addition, the plutonium concentrations detected in the pond sediments of Pond A-1 are relatively low in comparison to the B-series Ponds (see subsection 2.3.4). This may be due to the relatively low percentage of plutonium in the filterable fraction of the water samples (Table 2-3). In this 1980 study, Paine concluded that sediments (especially clays) appear to be the major reservoir for ultimate plutonium deposition and that relatively insignificant transport of plutonium through biotic systems to man exists.

The 1986 study "Trends in the Rocky Flats Surface Water Monitoring" summarized analytical data collected between 1980 and 1985. During this 5-year period, water samples collected from Pond A-1 had maximum plutonium concentrations of 0.24 pCi/l. Water quality in Pond A-2 was reported to be similar to the water in Pond A-1 with maximum plutonium concentrations of 0.17 pCi/l. Higher concentrations of uranium-233/234 (6.4 pCi/l) and uranium-238 (5.8 pCi/l) were measured from Pond A-2, as compared to samples from Pond A-1. Pond A-3's water was reported to contain elevated uranium-233/234 and uranium-238 concentrations like Pond A-2. Water quality of Pond A-4 was similar to background concentrations (Rockwell 1988).

To provide some background data for the groundwater quality in this area, chemical analytical results from two alluvial groundwater wells (1286 and 1386), located adjacent to Pond A-3 and upstream from Pond A-1, respectively, were reviewed (Figure 2-3)(Appendix C). Analytical results from both these alluvial monitoring wells indicated that several metals and radionuclides above the CRDLs and MDAs are present (Tables 2-4 and 2-5) but these concentrations could represent background and will be further evaluated during the RI (see Subsection 2.1.3). No organics or pesticide/PCBs (excluding the common laboratory contaminants) were detected above the CRQLs in well 1286 and only three organics were detected above the CRQLs in well 1386. Chemical analytical results from surface water locations within the A-series Ponds and in North Walnut Creek have also been included for reference in Appendix B of this Work Plan. Surface water sampling locations in the OU6 area are illustrated on Figure 2-2.



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MEAN PLUTONIUM CONCENTRATIONS IN SURFACE SEDIMENTS (pCi/g) AND MEAN PLUTONIUM CONCENTRATIONS IN UNFILTERED WATER (pCi/l) FOR POND A-1

SOURCE: PAINE, 1980

FIGURE 2-5

APRIL 1991

TABLE 2-3

PERCENT OF PLUTONIUM ISOTOPES ASSOCIATED WITH FILTERABLE FRACTION OF WATER SAMPLES FROM ROCKY FLATS PONDS

Pond	Filterable fraction*
B-1	90 ± 6
B-2	80 ± 12
B-3	80 ± 8
B-4	70 ± 12
C-1	30 ± 30
A-1	35 ± 20

Source: Paine 1980

* Mean ± standard error

TABLE 2-4

MAXIMUM HITS ABOVE CRDLs/MDAs IN GROUNDWATER SAMPLES COLLECTED FROM WELL 1286

Analyte	Total Samples	Total Hits	CRDL/MDA[1]	Maximum Hit		
Dissolved Metals (μg/l)						
Antimony	6	1	60.0	118.0		
Calcium	6	6	5000.0	252042.0		
Chromium	6	2	10.0	16.0		
Lithium	1	1	100.0	123.0		
Magnesium	6	6	5000.0	264000.0		
Manganese	6	6	15.0	336.0		
Mercury	6	1	0.2	0.3		
Potassium	6	1	5000.0	8100.0		
Silver	6	1	10.0	10.0		
Sodium	6	6	5000.0	241685.0		
Strontium	6	6	200.0	2038.0		
Zinc	6	3	20.0	25.0		
Total RADs (pCi/l)						
Americium-241	3	1	0.01	0.4	±	1.5
Gross alpha	3	3	2.0	91.0	±	20.0
Gross beta	3	3	2.0	86.0	±	12.0
Plutonium-239	3	1	0.01	0.5	±	1.1
Strontium-90	2	2	1.0	5.0		
Uranium, Total	3	3	0.0	48.4		
Uranium-233, -234	3	3	0.6	25.0		
Uranium-235	2	1	0.6	3.5	±	2.0
Uranium-238	3	3	0.6	20.0	±	5.0

TABLE 2-4
(Concluded)

Analyte	Total Samples	Total Hits	CRDL/MDA[1]	Maximum Hit		
Dissolved RADs (pCi/l)						
Americium-241	2	1	0.01	0.05	±	0.10
Gross alpha	2	2	2.0	125.0	±	62.0
Gross beta	2	2	2.0	87.0	±	51.0
Plutonium-239	2	1	0.01	0.2	±	1.5
Strontium-90	1	1	1.0	3.0		
Uranium, Total	2	2	0.0	35.0		
Uranium-233, -234	2	2	0.6	19.0	±	2.0
Uranium-235	2	1	0.6	2.5	±	1.2
Uranium-238	2	2	0.6	15.0	±	3.3

Source: EG&G 1991h

Note:

[1] CRDL (Contract required detection limit for CLP inorganics)
MDA (Required detection limits for radionuclides (EG&G 1990d))

TABLE 2-5

MAXIMUM HITS ABOVE CRQLs/CRDLs/MDAs IN GROUNDWATER SAMPLES COLLECTED FROM WELL 1386

Analyte	Total Samples	Total Hits	CRDL/MDA	Maximum Hit		
VOA (µg/l)						
1,1,2-Trichloroethane	17	1	5.0	6.0		
Chloroform	17	2	5.0	125.0		
Trichloroethene	17	1	5.0	55.0		
Dissolved Metals (µg/l)						
Calcium	5	5	5000.0	105000.0		
Chromium	5	2	10.0	13.0		
Copper	5	1	25.0	62.0		
Magnesium	5	5	5000.0	34700.0		
Manganese	5	1	15.0	48.0		
Mercury	5	1	0.2	0.3		
Sodium	5	5	5000.0	122000.0		
Strontium	5	4	200.0	883.0		
Zinc	5	1	20.0	28.0		
Total RADs (pCi/l)						
Gross alpha - suspended	1	1	2.0	2.5	±	6.5
Dissolved RADs (pCi/l)				29.0	±	11.0
Gross alpha - dissolved	1	1	2.0	29.0	±	2.5
Gross alpha	1	1	2.0	8.0	±	3.0
Gross beta - dissolved	1	1	2.0	11.0	±	4.1
Gross beta	1	1	2.0	15.5	±	.5
Strontium-89, -90	1	1	1.0	1.1	±	--
Uranium, total	1	1	0.0	15.00	±	--
Uranium-233, -234	2	2	0.6	10.0	±	2.0
Uranium-238	2	2	0.6	8.0	±	2.0

Source: EG&G 1991h
Note:
(1) CRQL (Contract required quantitation limit for CLP organics)
CRDL (Contract required detection limit for CLP inorganics)
MDA (Minimum detectable activity for radionuclides (EG&G, 1990d))

The effluent, if any, from the pond east of the confluence of North and South Walnut creeks (IHSS 142.12) is sampled daily when discharging downstream into Walnut Creek. On-site analytical results from the effluent of IHSS 142.12 during August, September, and October of 1990 have been reviewed for this report. Maximum concentrations for radionuclides include plutonium-239/240 (0.022 ± 0.017 pCi/l), americium-241 (0.035 ± 0.039 pCi/l), uranium-233/234 (1.11 ± 0.40 pCi/l), and uranium-238 (1.09 ± 0.26 pCi/l). These data results are recorded in the monthly Environmental Monthly Reports prepared by EG&G which are distributed to the regulatory agencies (EG&G 1990f).

Discharges from Ponds A-3 and A-4 are presently monitored to comply with NPDES permit requirements with limitations placed on Pond A-3 for nitrate concentrations and pH values. Pond A-4 has limitations on the amount of sediment it can release. Plutonium-239/240, americium-241, uranium-234 and -238, and tritium are also monitored in the discharges from these ponds (Rockwell 1987a). Pond A-3 is discharged to Pond A-4 when necessary and the water in Pond A-4 is treated by a granular activated carbon (GAC) system before being discharged into North Walnut Creek. Flow measurements and water quality samples are collected from Pond A-4 during discharge. The analytical data results are presented in the monthly environmental monitoring report prepared by EG&G (EG&G 1990f).

Local runoff and groundwater seepage that naturally collect in detention ponds A-1 and A-2 are disposed of through evaporation. High-pressure spraying of water from Ponds A-1 and A-2 over the ponds' surface facilitates the evaporation process (Rockwell 1988). These ponds are not normally sampled since there are no surface water releases.

2.2.5 Geology and Hydrology

The geology near and beneath the A-series Ponds has been characterized through lithologic information obtained from monitoring wells upgradient of the A-series Ponds, within the North Walnut Creek drainage, and adjacent to Ponds A-1 and A-3. Monitoring well 1286 adjacent to Pond A-3, encountered approximately 11 feet of valley fill alluvium, overlying the Arapahoe Formation (Figure 2-3). Monitoring well B208289 adjacent to Pond A-1 encountered the Arapahoe Formation one foot below ground surface with one foot of soil on top (Figure 2-3). Colluvium is found on the slopes adjacent to the drainage areas of North Walnut Creek. This is illustrated by well B208489, located upstream from Pond A-1, as this well encountered approximately 12 feet of colluvium overlying the Arapahoe Formation (Figure 2-1). The Arapahoe Formation, specifically the Arapahoe No. 4 sandstone, is potentially the bedrock unit beneath the valley fill alluvium and colluvium in the immediate area. A schematic cross section through North and South Walnut creeks, upgradient of the A-series Ponds and also the B-series Ponds, is illustrated in Figure 2-6 to show the general geology of the area. Figure 2-7 is a cross section illustrating a more detailed section beneath Ponds A-3 and A-4 (EG&G 1991a).

Descriptions of the geologic units found beneath and near the A-series Ponds, including the valley fill alluvium, colluvium, and the Arapahoe No. 4 sandstone interval, are discussed below. A discussion on the hydrogeology of the area is also presented.

Valley Fill Alluvium and Colluvium - The valley fill alluvium and colluvium are described together as their lithologies are similar. These units are yellowish-brown, silty gravelly clays to gravelly sandy clays with fine to coarse sands and quartzite gravels. The colluvium is deposited by slope wash and downslope creep of the Rocky Flats Alluvium and the Arapahoe Formation. The valley fill alluvium is stream-deposited materials from the erosion of the Rocky Flats Alluvium, Arapahoe Formation, and colluvium in this area.

Arapahoe Formation (No. 4 Sandstone Interval) - The Number 4 sandstone interval of the Arapahoe Formation is a stratigraphic unit comprised of fluvial overbank and channel sediments that underlie the valley fill alluvium, pond sediments, and colluvium. This sandstone unit, which is approximately 10 to 15 feet thick, is present in monitoring well 1186 indicating a sandstone channel may be present immediately beneath Ponds A-3 and A-4 (Figure 2-7). Based on the lithology encountered in other nearby monitoring wells (wells 1286 and 1386), this unit is comprised of a silty clay (Figure 2-3). This silty clay unit is believed to be a fluvial overbank deposit time-stratigraphically equivalent to the No. 4 channel sandstone.

The uppermost aquifer near the A-series Ponds is the valley fill alluvium. The saturated portion of the valley fill alluvium is generally less than 5 feet in thickness with groundwater encountered from 2½ to 5½ feet below the ground surface. Based on the lithology of the valley fill alluvium in monitoring wells 1286 and 1386, this unit probably has moderate permeability. Groundwater flow within the unit is downstream primarily to the east. Flow direction is probably modified, however, near each surface impoundment by recharge from each pond and by the removal of the alluvial sediments in this area during pond construction.

Beneath the valley fill alluvium, the Arapahoe Formation contains a high percentage of siltstone and claystone and is likely to have a lower permeability than the overlying alluvium. However, if the Arapahoe No. 4 sandstone is present, it would be expected to have a moderate permeability.

2.3 B-SERIES PONDS B-1, B-2, B-3, B-4, AND B-5 (IHSSs 142.5, 142.6, 142.7, 142.8, and 142.9)

2.3.1 Location and Description

Ponds B-1, B-2, B-3, B-4, and B-5 (IHSSs 142.5 through 142.9) are built in South Walnut Creek, east of the eastern perimeter of the security area of the Plant (Figure 2-8). The estimated capacity for Ponds B-1 through B-5 are 795,000; 1,930,000; 620,000; 600,000 and 23,140,000 gallons, respectively.

The B-series Ponds were generally constructed by the placement of an earthen embankment across South Walnut Creek. Outlet structures and spillways were built in some of the ponds to regulate flow out of these detention ponds and to channel excess water around the embankments when the ponds are near their full capacity. As-built drawings were obtained for Pond B-5 and are contained in Appendix E (EG&G 1991c). A description of how these ponds interact with South Walnut Creek's surface water flow is contained in subsection 2.1.

2.3.2 History

The B-series Ponds are used primarily to capture and control surface water runoff from the eastern and central portions of the Rocky Flats production facilities. Historically, several waste disposal activities have been associated with the B-series Ponds since the beginning of the Plant operations in 1952. Between 1952 and 1973, decontaminated process water and laundry wastewater were released into South Walnut Creek and subsequently into the B-series Ponds (Ponds B-1 through B-4). Nitrate, plutonium, and uranium were contained in these wastes; however, the volume of wastes released into South Walnut Creek is unknown (Rockwell 1988). Ponds B-1 and B-4 also received sanitary effluent from the sewage treatment plant (U.S. DOE 1980).

Pond reconstruction activities between 1971 and 1973 resulted in disturbances of the bottom sediment. This construction caused much of the upstream sediment to migrate to the B-1 pond, which subsequently increased the total plutonium inventory in the entire B-series Ponds (U.S. DOE 1980). As a result of this activity, there are probably several additional curies of plutonium presently trapped in the sediment within the waste discharge pipe and the inlet of Pond B-1 (Rockwell 1988). Presently, Ponds B-1 and B-2 are used for spill control management and to detain local surface runoff and seepage which may occur from nearby areas. Pond B-3 receives effluent from the Sewage Treatment Plant (STP) (Building 995), and local surface runoff. Pond B-4 receives discharges from Pond B-3. The water in Pond B-4 is continuously released into Pond B-5.

Pond B-5 was constructed after 1979 and was used as an overflow pond for Pond B-4. In 1991, a diversion pipeline structure was built from Pond C-2 to Pond B-5 and periodically water is pumped from Pond C-2 into Pond B-5. Presently, Pond B-5 receives water from Pond B-4, surface runoff from the Central Avenue Ditch and water from Pond C-2. The water is detained in Pond B-5 and then pumped to Pond A-4, where it is treated by a granular activated carbon (GAC) system prior to being discharged downstream into Walnut Creek.

2.3.3 Surface Drainage

The surface drainage into and downstream from the B-series detention ponds (Ponds B-1 through B-5) is discussed in subsection 2.1. Ponds B-1 and B-2 receive local surface runoff and seepage which may occur near these ponds. Pond B-3 receives effluent from the STP and local surface runoff. Pond B-4 receives water from Pond B-3. The water in Pond B-4 is continuously released into Pond B-5. Pond B-5, in addition to receiving discharges from Pond B-4, receives surface runoff from the Central Avenue Ditch located south of the B-series Ponds.

2.3.4 Nature of Contamination and Previous Investigations

Various investigations of the water and sediment quality within the B-series Ponds and in South Walnut Creek drainage have been conducted. Included in these studies are a study conducted by EPA (U.S. EPA 1970), a 1980 study on plutonium in freshwater systems at Rocky Flats (Paine 1980), and a 1986 study conducted as a requirement for a RCRA Part B Permit Application (Rockwell 1988). In addition, chemical analytical results from groundwater samples near these IHSSs were reviewed during preparation of this Work Plan.

In the 1970 study conducted by EPA, a water sample and a bottom sediment sample were collected downstream from the B-series Ponds in South Walnut Creek (Figure 2-4). Grab samples of water were collected in 1-gallon plastic containers with 2 to 5 gallons collected per sample. Bottom sediment samples were collected by scraping the bottom area below the water line with a hand trowel. Analysis of this water and bottom sediment sample is presented in Table 2-6.

The 1980 study by D. Paine, was conducted in order to determine the behavior of plutonium in the freshwater systems at Rocky Flats (Paine 1980). In this study, sediment cores were taken at 5 cm intervals on a monthly basis from Ponds B-1, B-2, B-3 and B-4 between the spring of 1971 through the summer of 1973. These core samples were taken to determine vertical distribution of plutonium in the pond sediments. Surface water samples and water samples collected at depth (0.5 meter increments from the pond surface to the sediment water interface) were also collected.

The average or mean plutonium concentrations (Pu-239 and Pu-240) in unfiltered water samples and surface sediment samples from Ponds B-1 through B-4 for this study are illustrated in Figure 2-9. An accidental release of water containing low concentrations of Pu-239, -240 was released into the sanitary waste system in March 1971. This release is apparent in Figure 2-9. In addition, reconstruction activities of each of the ponds between 1971 and 1973 also resulted in a significant increase in plutonium concentrations in the mean surface (top 5 cm) sediments of the ponds (Figure 2-9) (Table 2-7). Plutonium concentrations also increased in the sediment sample and unfiltered water sample collected at the sampling location at Walnut Creek and Indiana Street during this reconstruction period

TABLE 2-6

DISSOLVED RADIOACTIVITY IN A WATER SAMPLE AND RADIOACTIVITY IN A BOTTOM SEDIMENT SAMPLE ALONG SOUTH WALNUT CREEK

	Strontium-90	Total Alpha Radiation	Total Uranium	Plutonium 239	Gross Alpha	Gross Beta
Water Sample [1]	0.6	0.1	7.9	0.04	N.D.	N.D.
Sediment Sample[2]	0.1	3.4	1.1	3.51	18.0	N.D.

Source: EPA 1970

Notes: [1] All units in pCi/l except for uranium (μg/l)
[2] All units in pCi/gram dry weight except for uranium (μg/gram)

N.D. - Not determined

TABLE 2-7

MEAN-SURFACE (TOP 5 CM)-SEDIMENT PLUTONIUM 239/240 CONCENTRATIONS DURING PRECONSTRUCTION AND POSTCONSTRUCTION PERIODS

	Preconstruction		Postconstruction	
Pond	n*	pCi/g†	n*	pCi/g†
B-1	13	200 ± 70	11	1300 ± 350
B-2	12	80 ± 30	11	200 ± 60
B-3	13	30 ± 10	11	200 ± 200
B-4	14	20 ± 10	10	55 ± 15

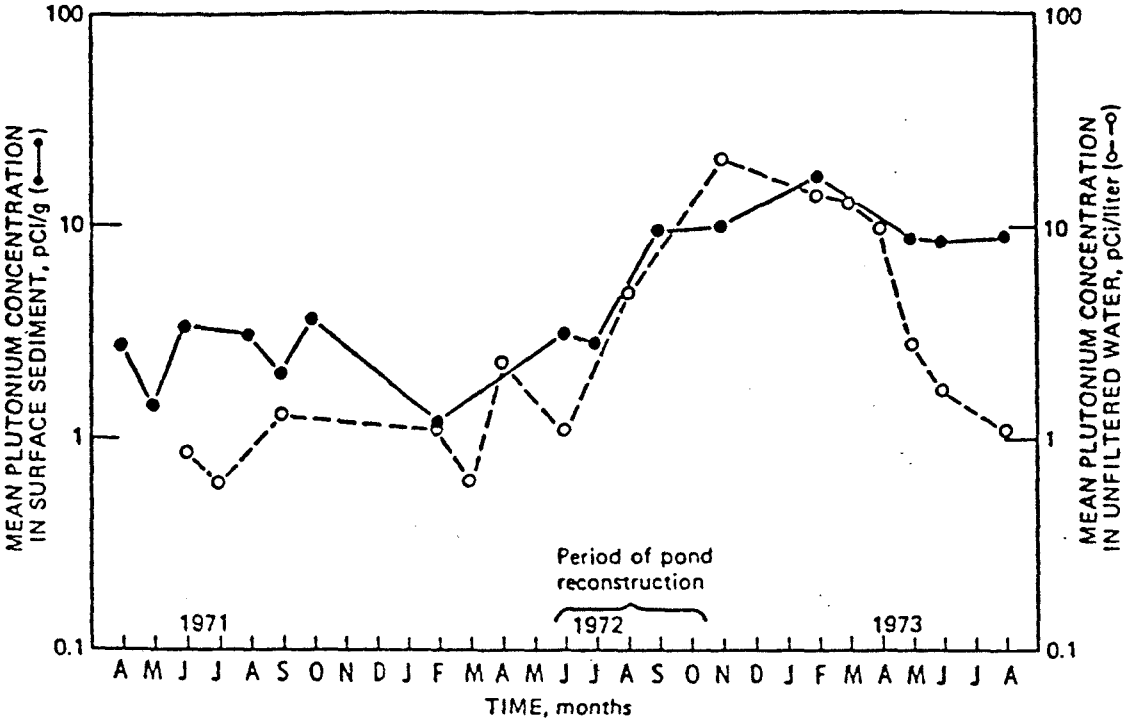
*n = number of sampling periods
† = Mean ± standard error

Source: Paine 1989

(Figure 2-10). This increase suggests that reconstruction played a role in redistributing plutonium in Walnut Creek. Also during this study, core samples of the sediments were collected from Ponds B-1 through B-4 and analyzed for plutonium at 5 cm intervals. The results from this sampling program indicated that the highest plutonium concentrations occurred in Pond B-1. These plutonium concentrations in ponds B-1, B-2, B-3 and B-4 as a function of sediment depth, are illustrated in Table 2-8 (Paine 1980).

The 1986 study "Trends in the Rocky Flats Surface Water Monitoring", summarized analytical data collected between 1980 and 1985. The water quality of Pond B-1 was characterized by low major ion concentrations and moderately elevated uranium-233/234 (6.4 pCi/l) and uranium-238 (9.6 pCi/l) concentrations. Plutonium concentrations were recorded at 4.2 pCi/l. In 1973, the plutonium inventory of the sediments in Pond B-1 was 2.9 curies. Hazardous Substance List (HSL) organics were detected in these samples, but were reported to be less than the detection limits (Rockwell 1988). Water in Pond B-2, unlike the water in Pond B-1, contained background levels for the various radionuclides, with the exception of plutonium (0.37 pCi/l). Pond B-3 was characterized by relatively low major ion concentrations and background levels for the radionuclides with the exception of plutonium, at a concentration of 0.08 pCi/l. Zinc was moderately elevated (0.58 mg/l) and nitrate was present at 13.4 mg/l (Rockwell 1988). Water in Pond B-4, which receives surface water runoff and occasional flow from Pond B-3, had levels of uranium-233/234 at 1.5 pCi/l and uranium-238 at 2.1 pCi/l. Major ions were at relatively low concentrations and nitrates were undetected. Strontium and zinc occurred at 0.31 mg/l and 0.36 mg/l, respectively. Radionuclide data available from Pond B-5 showed slightly elevated concentrations of uranium-233/234 (2.6 pCi/l) and uranium-238 (2.1 pCi/l). All other radionuclides were at background levels (Rockwell 1988).

To provide some groundwater quality data for this area, chemical analytical results from two alluvial groundwater monitoring wells (3686 and 3786), installed near the B-series Ponds in 1986, were reviewed. (Appendix C). Well 3686 is located upgradient from Pond B-1 and well 3786 is located between Ponds B-4 and B-5 (Figure 2-8). Several metals were detected above the CRDLs in both wells with several radionuclides reported above the MDAs in well 3786. These concentrations may be representative of background concentrations and will be evaluated in the RI report when there is more information about background for each of these IHSSs (see Subsection 2.1.3). No radionuclide data was available from well 3686 during preparation of this Work Plan (Tables 2-9 through 2-10). Only three organics with concentrations slightly above the CRQLs, were detected in both wells. Two of the organics were reported in well 3686 with the third reported in well 3786 (Tables 2-9 and 2-10). The organics in well 3686 may be anomalous as low concentrations were reported and they were only detected in one of the analyses (Table 2-9). Chemical analytical results from surface water locations within the B-series Ponds and South Walnut Creek have been included for reference in Appendix B of this Work Plan. Surface water locations in the OU6 area are illustrated on Figure 2-2.



SOURCE: PAINE, 1980

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

OPERABLE UNIT 6
PHASE I RFI/RI WORK PLAN

MEAN PLUTONIUM CONCENTRATIONS IN SURFACE SEDIMENTS (pCi/g) AND MEAN PLUTONIUM CONCENTRATIONS IN UNFILTERED WATER (pCi/l) FOR THE SAMPLING STATION LOCATION WHERE WALNUT CREEK CROSSES UNDER INDIANA STREET

FIGURE 2-10 APRIL 1991

TABLE 2-8

DISTRIBUTION OF PLUTONIUM CONCENTRATIONS IN DEPTH PROFILES OF PONDS B-1 THROUGH B-4

	Plutonium concentration, $(d/min)g^{-1}$			
Depth, cm	Pond B-1	Pond B-2	Pond B-3	Pond B-4
0 - 5	2,000	260	40	430
5 - 10	2,200	80	170	190
10 - 15	10,900	40	370	20
15 - 20	32,100	60	330	4
20 - 25	8,800	230	20	7
25 - 30	1,100	190	3	7
30 - 35	880	390	3	<1
35 - 40	900	340	380	
40 - 45	190	100	6	
45 - 50	30	20	6	
50 - 55	100	10	3	
55 - 60	70	9	2	
60 - 65	5	4	2	
70 - 75	7	3		
75 - 80		2		
80 - 85		12		
85 - 90		50		
90 - 95		30		
95 - 100		3		
100 - 105		7		
105 - 110		40		
110 - 115		12		

Source: Paine 1980

TABLE 2-9

MAXIMUM HITS ABOVE CRQLs/CRDLs IN GROUNDWATER SAMPLES COLLECTED FROM WELL 3686

Analyte	Total Samples	Total Hits	CRQL/CRDL[1]	Maximum Hit
VOA (μg/l)				
Trichloroethene	9	1	5.0	6.0
Vinyl chloride	6	1	10.0	13.0
Dissolved Metals (μg/l)				
Antimony	1	1	60.0	65.8
Calcium	1	1	5000.0	215000.0
Chromium	1	1	10.0	21.9
Lithium	1	1	100.0	123.0
Magnesium	1	1	5000.0	74000.0
Manganese	1	1	15.0	77.3
Nickel	1	1	40.0	287.0
Sodium	1	1	5000.0	288000.0
Strontium	1	1	200.0	2020.0
Zinc	1	1	20.0	22.1

Source: EG&G 1991h

Note:
[1] CRDL (Contract required quantitation limit for CLP inorganics)
MDA (Required detection limits for radionuclides (EG&G 1990d))

TABLE 2-10

MAXIMUM HITS ABOVE CRQLs/CRDLs/MDAs IN GROUNDWATER SAMPLES COLLECTED FROM WELL 3786

Analyte	Total Samples	Total Hits	CRQL/CRDL /MDA[1]	Maximum Hit/Qualifier[2]
VOA (µg/l)				
Tetrachloroethene	12	4	5.0	30.0
Dissolved Metals (µg/l)				
Calcium	1	1	5000.0	256000.0
Chromium	1	1	10.0	36.1
Lithium	1	1	100.0	139.0
Magnesium	1	1	5000.0	98800.0
Sodium	1	1	5000.0	289000.0
Strontium	1	1	200.0	2930.0
Zinc	1	1	20.0	259.0
Dissolved RADs (pCi/l)				
Gross alpha	2	2	2.0	59.0 ± 23.5 x
Gross Beta	2	2	2.0	23.0 ± 6.5 x
Uranium-233, -234	2	2	0.6	36.5 ± 5.5
Uranium-235	2	2	0.6	1.5 ± .6
Uranium-238	2	2	0.6	26.0 ± 3.0 x

Source: EG&G 1991h

Note:
[1] CRQL (Contract required quantitation limit for CLP organics)
CRDL (Contract required detection limit for CLP inorganics)
MDA (Minimum detectable activity for radionuclides (EG&G, 1990d)

[2] X = Comments noted about analysis results on original data sheets

Discharges from Ponds B-3 and B-5 are regularly monitored to comply with NPDES permit requirements. Sanitary effluent limitations have been placed on Pond B-3 and sediment limitations have been placed on Pond B-5. All discharges are monitored for plutonium, americium, uranium, and tritium (Rockwell 1987a). Pond B-5 has a downstream 24-hour time-composite sampler and Parshall flume to monitor discharge. The data on water quality results from the discharge of this pond are recorded and presented in the Environmental Monitoring Report prepared by EG&G (EG&G 1990f). Continuous flow measurements and daily water quality samples are collected at Pond B-5.

2.3.5 Geology and Hydrology

The geologic units near and beneath the B-series Ponds and within the drainage area of South Walnut Creek include valley fill alluvium, colluvium, and the Arapahoe Formation. Two monitoring wells (wells 3686 and 3786), drilled adjacent to Ponds B-1 and B-5 in South Walnut Creek encountered approximately 5½ to 7 feet of valley fill alluvium (Figure 2-8). The valley fill alluvium is a yellowish-brown to light-gray sandy clay to clayey gravel unit. Beneath the valley fill alluvium is the Arapahoe Formation which is described as a yellowish-gray to light-olive gray claystone in the above wells. A schematic cross section across South Walnut Creek upgradient from the B-series Ponds is presented in Figure 2-6. The uppermost aquifer near the B-series Ponds is the valley fill alluvium. Groundwater is encountered a few feet below the ground surface in this area, and groundwater flow is generally to the east. The flow through the valley fill alluvium probably has been modified near each surface impoundment by recharge from the pond and the possible removal of the alluvium during pond construction. The valley fill alluvium likely has moderate permeability, in comparison to the Arapahoe Formation which is primarily a claystone with a low permeability. Therefore, groundwater flow probably does not migrate through the Arapahoe Formation.

2.4 NORTH, SOUTH, AND POND AREA SPRAY FIELDS (IHSSs 167.1, 167.2, and 167.3)

2.4.1 Location and Description

IHSSs 167.1, 167.2, and 167.3 are located north of the security area of the Plant and north of North Walnut Creek (Figure 2-11). The North and South Area Spray Fields (IHSSs 167.1 and 167.3), which occupy approximately 172,500 and 40,000 square feet (3.96 and 0.92 acres), respectively, are partially located on the plateau areas that bound the unnamed tributary on North Walnut Creek. The Pond Area Spray Field (IHSS 167.2) occupies approximately 31,250 square feet (0.72 acres) and is located on a north-facing slope leading into the present-day Landfill Pond (Figure 2-11). These spray fields are presently covered by grasses common to the Rocky Flats Area.

2.4.2 History

The periods during which these IHSSs were operational are not precisely known; however, the spray fields were used shortly after the present landfill became active in 1968. These fields were used solely for the purpose of spraying water over the ground surface to enhance evaporation of the water. The water sprayed over these spray fields was obtained from two ponds located east of the Present Landfill (IHSS 114) (Figure 2-1). These two ponds, referred to as the East Landfill Pond (the existing landfill pond) and the West Landfill Pond (no longer present), were used to intercept groundwater that may have been contaminated by leachate generated at the landfill, and to impound leachate generated by the landfill, respectively (Figure 2-1). In addition, the East Pond was used for spill control management. In May 1981, with the expansion of the landfill (U.S. DOE 1990a), the West Pond was covered over.

Spray evaporation was selected as the method to dispose of water from these ponds. The first area used as a spray field was the South Area Spray Field (IHSS 167.3). During operation of this spray field, surface runoff was found to be draining toward North Walnut Creek. The use of this field was subsequently discontinued and the spray irrigation was moved to the North Area Spray Field (IHSS 167.1). During operation of this spray field, the water sprayed onto this unit was found to be draining into the unnamed tributary of North Walnut Creek and, subsequently, into Walnut Creek. The spraying was again discontinued and moved to the Pond Area Spray Field (IHSS 167.2). During operation of this spray field, the drainage from this unit flowed back into the existing landfill pond and thus water was continuously contained within this pond.

2.4.3 Surface Drainage

Surface runoff across the North Area Spray Field (IHSS 167.1) and the South Area Spray Field (IHSS 167.3) flows toward the unnamed tributary of North Walnut Creek (Figure 2-7). Surface runoff across IHSS 167.2 flows to the north, where it enters into the present landfill pond.

2.4.4 Nature of Contamination and Previous Investigations

No previous studies have been conducted at these spray fields. However, there are some chemical analytical results from surface water samples collected from the West and East Landfill Ponds. These data are significant, since the water from the ponds was sprayed onto the spray fields.

In September 1973, tritium and strontium were detected in the drainage of the Rocky Flats Sanitary Landfill. Due to this discovery and since the two landfill ponds collected water and leachate generated from the landfill, samples from the two ponds were analyzed for these two analytes. Strontium concentrations for both landfill ponds were reported from 1973 until 1984 and are contained in

Table 2-11 (Blaha 1987). In addition, between 1973 and 1980, monthly tritium concentrations were reported for the West Pond (no longer present) with the results tabulated in Table 2-12.

To provide some background data on the surface water and groundwater quality in this area, analytical results from surface water samples collected from location SW-100 and groundwater samples collected from monitoring well B206789 have been reviewed (Figure 2-11). Surface water location SW-100 is located downgradient from IHSS 167.3, and is located in the unnamed tributary north of North Walnut Creek (Figure 2-11). Only two organics, 4-methylphenol and Phenol (excluding the common laboratory contaminants) have been detected above the CRQLs in water samples collected from this location (Appendix B). Both these organics were only detected during one sampling event. No pesticides/PCB compounds were detected. Several metals and radionuclides were reported above the CRDL and MDA levels and will be further evaluated during the RI (see subsection 2.1.3). Chemical analytical results from a bedrock groundwater monitoring well (B206789), installed in 1989, was reviewed also to provide groundwater quality data for this area (Appendix C). This well is located downgradient from the Pond Area Spray Field (IHSS 167.2) (Figure 2-11). No organics or pesticides/PCBs were reported above the CRQLs in this well but several metals and radionuclides were reported above the CRDLs and MDAs (Table 2-13). The metals and radionuclides in both the surface water and groundwater may be representative of background conditions. Further evaluation of this data will be conducted and presented in the RI report when more data is available for the background concentrations in this area (see Subsection 2.1.3).

2.4.5 Geology and Hydrology

The geology near and beneath these spray fields has been characterized from lithologic information obtained from the limited nearby monitoring wells and by the general knowledge of the geology of the area. The Rocky Flats Alluvium, colluvium and the Arapahoe Formation are the geologic units which underlie these IHSSs.

The Rocky Flats Alluvium is the surficial geologic unit underlying IHSS 167.3 and the western half of IHSS 167.1 (Figure 1-5). The Rocky Flats Alluvium is described as a poorly sorted, gravelly sandy clay to gravelly clayey sand, with subangular grains and scattered cobbles.

Colluvium is likely to be present beneath the eastern half of IHSSs 167.1 and 167.3 based on the lithology of monitoring well B206689 located slightly downslope from IHSS 167.3 (Figure 2-11). The colluvium is approximately 3 feet thick and is described as a silty sandy gravel to gravel containing cobbles and clay.

TABLE 2-11

STRONTIUM CONCENTRATIONS IN LANDFILL PONDS

Month	1984	1983	1982	1981	1980	1979	1978	1977	1976	1975	1974	1973
January	N.A.	0.5	<3	3.5 E 7.5 W	3.6 E <3 W	N.A.	N.A.	N.A.	N.A.	--	--	N.A.
February	N.A.	<3	<3	<3 E <3 W	3.0 E 3.0 W	N.A. N.A.	N.A.	<3	N.A.	--	--	N.A.
March	2.3	<3	N.A.	3.2 E 3.2 W	4.6 E <3 W	N.A.	7.2	<3	<3	--	--	N.A.
April	N.A.	2.4	N.A.	N.A.	<3 E <3 W	N.A.	5.7	<3	<3	--	--	N.A.
May	N.A.	N.A.	<3	<3	3.5 E <3 W	N.A.	N.A.	<3	3.5	--	--	N.A.
June		N.A.	<3	4.2	4.3 E <3 W	N.A.	<3	<3	3.3	--	--	N.A.
July		N.A.	<3	<3	4.3 E <3 W	N.A.	3.3	<3	4	--	--	N.A.
August		N.A.	<3	<3	3.5 E 2.1 W	3.2 E	<3	<3	4.5	--	--	N.A.
September		N.A.	<3	<3	4.1 E 5.0 W	<3 E	N.A.	N.A.	3	--	--	N.A.
October		7.9	<3 3.4 W	<3 3.4 W	4.4 E <3 W	4.3 E <3 W	<3	N.A.	3	--	--	16
November		N.A.	<3	<3	3.6 E <3 W	5.8 E <3 W	3.6	N.A.	<10	--	--	16
December		N.A.	0.6	<3	3.7 E <3 W	45 E <3 W	N.A.	N.A.	NS	3	--	N.A.

Source: Blaha 1987

NOTES: Results prior to April 1983 were Sr^{89} + Sr^{90} in most cases, except for 1973.
N.A. - Not Analyzed
E = East Landfill Pond
W = West Landfill Pond
EPA Drinking Water Standard: Sr^{89} = 80 pCi/l, Sr^{90} = 8pCi/l
All concentrations in pCi/l

TABLE 2-12

TRITIUM CONCENTRATIONS IN WESTERN LANDFILL POND

Month	1980	1979	1978	1977	1976	1975	1974	1973
January	738	1316	1136	1365	1740	1143	N.A.	
February	709	780	1368	922	1733	1429	N.A.	
March	520	844	775	1303	1323	1837	7922	
April	886	886	944	1113	1431	924	N.A.	
May	639	805	956	818	1121	1445	N.A.	
June	530	816	720	740	1172	984	5875	
July	546	694	953	856	1378	1520	4797	
August	508	976	1022	983	1305	1258	3724	
September	576	564	768	863	1143	1777	5056	34,000 39,000 57,000
October	495	938	818	806	869	1762	3304	N.A.
November	490	575	1033	812	1005	1553	1800	N.A.
December	530	436	863	880	1067	1542	N.A.	N.A.

Source: Blaha 1987

NOTES: Concentrations in pCi/l
N.A. - Not Analyzed

TABLE 2-13

MAXIMUM HITS ABOVE CRDLs/MDAs IN GROUNDWATER SAMPLES COLLECTED FROM WELL B206789

Analytes	Total Samples	Total Hits	CRDL/MDA[1]	Maximum Hit/Qualifier[2]
Disolved Metals (µg/l)				
Calcium	4	4	5000.0	165,000.0
Chromium	4	1	10.0	14.0
Iron	4	1	100.0	115.0
Lithium	4	4	100.0	212.0
Magnesium	4	4	5000.0	43,200.0
Mercury	4	1	0.2	0.21
Selenium	4	4	5.0	821.0
Silicon	1	1	100.0	5470.0
Sodium	4	4	5000.0	150,000.0
Strontium	4	4	200.0	1470.0
Zinc	4	1	20.0	43.0*
Total RADS (pCi/l)				
Americium - 241	1	1	0.01	.5 ± .5J
Gross Alpha	1	1	2.0	33.0 ± 9.0
Gross Beta	1	1	2.0	10.0 ± 4.0
Uranium - 233, -234	1	1	0.60	6.0 ± 1.5
Dissolved RADS (pCi/l)				
Gamma Alpha	2	2	2.0	4.0
Gamma Beta	2	2	2.0	7.0
Gamma Beta Particle Radioactive	1	1	2.0	3.0
Plutonium - 239	1	1	0.01	0.011
Uranium, total	1	1	0.0	7.0

TABLE 2-13
(Concluded)

Analytes	Total Samples	Total Hits	CRDL/MDA[1]	Maximum Hit/Qualifier[2]
Uranium - 233/234	3	3	0.60	5.0 ± 2.0
Uranium - 238	3	3	0.60	3.0 ± 1.0

Source: EG&G 1991h

Notes:
[1] CRDL (Contract required detection limit for CLP inorganics)
MDA (Minimum detectable activity for radionuclides (EG&G, 1990d))

[2] * Duplicate Analysis outside control limits
J - Present below detection limit

Fill and possibly colluvial deposits underlie the Pond Area Spray Field (IHSS 167.2). This is based on the lithologic units encountered in well B206789 located 10 feet downslope from this IHSS (Figure 2-11).

Approximately 5 feet of fill was encountered overlying the Arapahoe Formation. The fill in this area is described as a consolidated, poorly sorted, brownish-gray sandy clay unit with angular to subangular sand.

The Arapahoe Formation underlies the Rocky Flats Alluvium, colluvium and fill in this area. This formation is described in nearby monitoring wells as a silty claystone to claystone, mottled, with very fine- to fine-grained sand. The Arapahoe Formation is found at a depth of approximately 4 to 6 feet below ground surface, and is highly weathered near the top of the unit.

Groundwater flow is toward the surrounding drainages and is discharged from the Rocky Flats Alluvium at the contact with claystones of the Arapahoe. The depth to groundwater under the spray fields is, however, unknown.

2.5 EAST AREA SPRAY FIELD (IHSS 216.1)

2.5.1 Location and Description

The East Area Spray Field (IHSS 216.1) is located within the buffer zone, northeast of the northeastern boundary of the security area of the Plant facility. It is geographically on an east-west trending interfluve that separates North and South Walnut creeks in the vicinity of the A-series and B-series Detention Ponds (Figure 2-8). This IHSS covers an area of approximately 150,000 square feet (3.4 acres).

2.5.2 History

This spray field became operational in 1989 to provide an additional area to accommodate the spray evaporation of water in Pond B-3. The water in Pond B-3 is from the effluent of the Sewage Treatment Plant (STP) (Building 995) and local surface runoff. The use of this area as a spray field stopped shortly after it became operational in the latter part of 1989 due to excessive runoff problems.

2.5.3 Surface Drainage

Surface runoff across IHSS 216.1 is primarily to the south, where water flows toward South Walnut Creek. South Walnut Creek is about 80 feet lower in elevation than the East Area Spray Field and is approximately 500 feet away.

2.5.4 Nature of Contamination and Previous Investigation

No previous investigations have been conducted on this IHSS, however, maximum concentrations from many analytes detected in the water from Pond B-3 during 1989, when this water was being sprayed upon this IHSS, have been tabulated and are presented in Table 2-14. These data provide some information on the quality of the water sprayed on the East Area Spray Field.

2.5.5 Geology and Hydrology

The geology beneath this IHSS is somewhat unknown as no monitoring wells have been drilled on this IHSS. Therefore, the geology beneath the East Area Spray Field has been characterized by the geographic location of this IHSS and from the surficial geologic map of the OU6 area (Figure 1-5). The Rocky Flats Alluvium, typical to plateau areas at Rocky Flats Plant, is the surficial geologic unit beneath this IHSS. The Rocky Flats Alluvium is estimated to be 5 to 10 feet in thickness based on outcrops that surround this IHSS. In this area, the Rocky Flats Alluvium is a poorly sorted, unconsolidated, gravelly silty sand unit with fine- to very coarse-grained sand. Beneath the alluvium is the Arapahoe Formation. This unit is weathered near the top and consists of claystone with some interbedded sandstone units. Further characterization of the lithologic nature and thickness of these formations is needed.

Groundwater flow beneath this site is unknown because no wells are present near this IHSS. If groundwater is present, however, it probably flows to the northeast where it enters into either the North or South Walnut creek drainages.

2.6 TRENCHES A, B, AND C (IHSS 166.1, 166.2, and 166.3)

2.6.1 Location and Description

IHSSs 166.1, 166.2, and 166.3 are located north of the Rocky Flats security area on a plateau that separates North Walnut Creek and the unnamed tributary to the north (Figure 2-11). IHSS 166.1 (Trench A) is estimated to have dimensions of approximately 40 feet by 190 feet and is located about 100 feet southeast of the present landfill. IHSS 166.2 (Trench B) is also estimated to be a 40-foot by 190-foot trench that is approximately 125 feet south of IHSS 166.1. IHSS 166.3 (Trench C) consists of two separate trenches (Figure 2-11). The first trench is located between IHSS 166.1 and IHSS 166.2 and is approximately 30 feet by 200 feet. The second trench is located about 300 feet east of IHSS 166.1 and is estimated to have dimensions of 20 feet by 100 feet.

TABLE 2-14

MAXIMUM CONCENTRATIONS DETECTED IN SURFACE WATER SAMPLES COLLECTED IN POND B-3 IN 1989

Analyte	Pond B-3 (SW-B3)		
Radionuclides	Concentration[2] (pCi/l)		
Americium-241	0.05	±	0.01
Cesium-137	0.1	±	0.6
Gross Alpha	3.0	±	2.0
Gross Beta	13.0	±	3.0
Plutonium-239	0.15	±	0.03
Radium 226	--		
Radium 228	--		
Strontium 90	0.4	±	0.4
Tritium	370.0	±	220.0
Uranium Total[1]	0.2		
U-233/234	0.2	±	0.2
U-235	0.0	±	0.1
U-238	0.0	±	0.2
Metals	Concentration[2] (mg/l)		
Iron	0.232		
Magnesium	7.01		
Manganese	0.0318		
Mercury	0.0008		
Selenium	N.A.		
Strontium	N.A.		
Zinc	0.123		
Lead	N.A.		
Beryllium	N.A.		
Cadmium	N.A.		
Organics	Concentration[2] (µg/l)		
Phenol	2.0		

Source: EG&G 1991h
Note:
[1] No units are available
[2] Potential applicable or relevant and appropriate requirements for OU6 are presented in Section 3.0.
N.A. - Not Analyzed

2.6.2 History

The history of these IHSSs and the dates they were active are based primarily on aerial photographs (U.S. EPA 1988b), since little documentation is available concerning their operational histories. IHSS 166.1 (Trench A) appeared to be active from 1964 until about 1974 (Rockwell 1988). IHSS 166.2 (Trench B) was active in 1959, though the closure date of this trench is unknown. Evidence of this trench was still visible in the 1988 aerial photograph, after which time this area began to revegetate. IHSS 166.3 (Trench C) was active between 1964 until possibly 1974 (U.S. DOE 1986b). In 1978, a road had been built across a portion of IHSSs 166.1 and 166.3.

IHSSs 166.1 and 166.2 received uranium- and/or plutonium-contaminated sludge from the Sewage Treatment Plant (Building 995) (Rockwell 1988). No other materials or wastes are known to have been placed in these trenches. Materials placed in IHSS 166.3 are unknown, but it is probable that sewage sludge was also placed within this trench.

2.6.3 Surface Drainage

Surface runoff across these IHSSs is minimal as these surface trenches are located on a relatively flat area. However, surface runoff is toward the north, where it enters into either the existing landfill pond or the unnamed tributary of North Walnut Creek (Figure 2-11).

2.6.4 Nature of Contamination and Previous Investigations

Only one previous investigation of this site has been performed. In this investigation, soil samples were collected (date unknown) from IHSS 166.1 (Rockwell 1988). Laboratory results from these samples reported relatively low concentrations of uranium-233/234 (0.87 ± 0.16 pCi/l) and uranium-238 (0.79 ± 0.16 pCi/l). Volatile organics (2-butanol, 1,1,1-TCA, TCE, and toluene) were also detected, but concentrations are unavailable (Rockwell 1988).

To provide some surface water quality data downstream from these IHSSs (IHSS 166.1, 166.2, and 166.3) surface water location SW-100 (Figure 2-11) was reviewed. A discussion on the water quality at this location is presented in subsection 2.4.4 and the analytical results can be found in Appendix B. Chemical analytical results from an alluvial groundwater monitoring well (B206489) installed in 1989 was also reviewed to provide some background data on the groundwater for this area (Appendix C). Well B206489 is located in Trench A (IHSS 166.1), downslope from Trench B (IHSS 166.2) and the western part of Trench C (IHSS 166.3) (Figure 2-11). Several metals and radionuclides were detected above the CRDL and MDA levels in this well with only one volatile organic, Trichloroethene, detected above the CRQL (Table 2-15). Metals and radionuclide concentrations may be representative of background

TABLE 2-15

MAXIMUM HITS ABOVE CRQLs/CRDLs/MDAs IN GROUNDWATER SAMPLES COLLECTED FROM WELL B206489

Analyte	Total Samples	Total Hits	CRQL/CRDL/ MDA[1]	Maximum Hit/Qualifier		
VOA (μg/l)						
Trichloroethene	5	5	5.0	62.0		
Dissolved Metals (μg/l)						
Calcium	4	4	5000.0	77000.0		
Magnesium	4	4	5000.0	15500.0		
Manganese	4	1	15.0	32.0		
Silicon	1	1	100.0	6540.0		
Sodium	4	4	5000.0	58200.0		
Strontium	4	4	200.0	476.0		
Zinc	4	1	20.0	73.0*		
Dissolved RADs (pCi/l)						
Gross alpha	2	2	2.0	10.0	±	4.0
Gross beta	2	2	2.0	3.25	±	1.2
Uranium-233, -234	2	2	0.6	7.5	±	1.5
Uranium-238	2	2	0.6	5.0	±	1.0

Source: EG&G 1991h

Notes:

[1] CRQL (Contract required quantitation limit for CLP organics)
CRDL (Contract required detection limit for CLP inorganics)
MDA (Minimum detectable activity for radionuclides (EG&G, 1990d))

[2] * Duplicate analysis outside control limits
J = present below detection limit

conditions for this area and will be further reviewed during the RI Report when more specific information is available on this area.

2.6.5 Geology and Hydrology

The geology beneath these trenches has been based primarily on the lithology encountered in monitoring well B206489, drilled near IHSS 166.1 (Trench A) (Figure 2-11). Approximately 1.5 feet of topsoil has developed on the Rocky Flats Alluvium at IHSS 166.1 and may be present in the vicinity of Trenches B and C. Rocky Flats Alluvium is found beneath the topsoil and has a thickness of about 6 feet in this area. The Rocky Flats Alluvium is described as a poorly sorted, moderately cemented, sand and gravel unit, with angular to subangular grains and very fine- to very coarse-grained sands. The Arapahoe Formation underlies the Rocky Flats Alluvium, and is principally a claystone in this area. The thickness of this formation in this area is not known as no wells have penetrated through this formation.

The aquifer in the area of the trenches is Rocky Flats Alluvium. Groundwater is approximately 5½ feet below ground surface and flow is primarily to the east. The permeability of the Rocky Flats Alluvium is likely to be high when compared to that of the Arapahoe Formation, which is primarily a claystone in this area, however, further characterization of these two formations is needed.

2.7 SLUDGE DISPERSAL AREA (IHSS 141)

2.7.1 Location and Description

The Sludge Dispersal Area (IHSS 141) is located along the eastern perimeter of the security zone of the Rocky Flats Plant facility. The western half of this IHSS is located within the security area of the Plant and the eastern half is located within the buffer zone (Figure 2-12). Located on the western half of this IHSS are two corrugated metal buildings which cover the present day drying beds of the Sewage Treatment Plant. The eastern half of this IHSS gently slopes eastward toward South Walnut Creek and the B-series Ponds. Two paved roads cross this IHSS in a north-south direction. One of the roads is within the security area while the other is located in the buffer zone. A drainage ditch separates these two roads, with the ditch being located on the outside of the security fence. The water which collects in this drainage ditch flows out and into the B-series Detention Ponds.

2.7.2 History

Prior to 1983, the Sludge Dispersal Area was an area that received airborne radioactive particles from dried sludge packaging operations (Rockwell 1988). The sludge was generated by the sewage treatment facility (Building 995) located near the western perimeter of this IHSS. In addition, this area

may have received spillage of dried or drying sludge from drying beds visible in a 1964 aerial photograph (U.S. EPA 1988c), located to the west of this IHSS.

Radioactive laundry effluent was the only known radioactive effluent entering the drying beds between 1969 and 1972. By the latter half of 1972, however, plumbing changes were made and all Plant wastes were channeled through the Sewage Treatment Plant and then into the drying beds. This resulted in increased radioactivity levels in the sludges (Owen 1973). An overflow incident in June 1972 from Building 701 contributed elevated levels of plutonium to the effluent entering the Sewage Treatment Plant, and subsequently to the drying beds (Owen 1973).

2.7.3 Surface Drainage

Surface runoff across this IHSS drains into South Walnut Creek and subsequently into Detention Pond B-1. Pond B-1 is located about 300 feet to the east and is approximately 60 feet lower in elevation than the Sludge Dispersal Area.

2.7.4 Nature of Contamination and Previous Investigations

Prior to 1983, all Plant wastes were processed at the Sewage Treatment Plant; therefore, a potential for contamination within the drying beds by a variety of chemicals, particularly plutonium, is possible. However, no previous investigations have been conducted on this IHSS.

An alluvial groundwater well (Well 3686), located near this IHSS (Figure 2-12), has been reviewed to provide some groundwater quality near this IHSS. Analytical results from this well are described under subsection 2.2.4 and analytes detected in the water samples collected from this well that were above the CRQL and CRDL levels are presented in Table 2-9. To provide for surface water quality data for this area, analytical results from surface water location SW-23 has been reviewed. This surface water location is located downslope from this IHSS in the headwaters of South Walnut Creek (Figure 2-11). No organics or pesticides/PCBs were detected above the CRQLs at this location (Appendix B). Several metals and radionuclides were detected above the CRDLs and MDAs, however, further investigations need to be conducted as these concentrations may represent background conditions (see Subsection 2.1.3).

2.7.5 Geology and Hydrology

The geology beneath this IHSS has been characterized by the lithology encountered in a nearby monitoring well, P213889, located approximately 300 feet west of this IHSS (Figure 2-12). The Rocky Flats Alluvium is the surficial geologic unit underlying this IHSS. This alluvium is approximately 5 feet thick. The Rocky Flats Alluvium is described as a poorly sorted, unconsolidated, gravelly silty sand with

subangular grains. Fine- to very coarse-grained sands and quartzites are also present with the lithology of the unit becoming more clayey near its base. Beneath the Rocky Flats Alluvium is the Arapahoe Formation, and potentially the Arapahoe No. 1 sandstone unit. The No. 1 Arapahoe sandstone unit as encountered in well P213889, is described as a poorly sorted, nonstratified , light-gray unit that is stained dark yellowish-orange and has very fine- to trace medium-grained subangular sand grains. This unit is approximately 2½ feet thick and is about 8.5 feet below the ground surface. Below this sandstone unit, the lithology of the Arapahoe Formation is a clayey sandstone unit. The uppermost section of the Arapahoe Formation is highly weathered and moist. The lithologic nature of the Arapahoe Formation beneath the Sludge Dispersal Area, however, is not fully known as no wells have been drilled on this IHSS to determine if the No. 1 Arapahoe sandstone encountered in the nearby monitoring well (P213889) is also present beneath the Sludge Dispersal Area.

The upper aquifer near and beneath the Sludge Dispersal Area is the Rocky Flats Alluvium. The Rocky Flats Alluvium beneath this site is moderately permeable based on the Alluvium's lithologic characteristics. Groundwater flow is to the east and the depth to groundwater is approximately 3 feet in this area. Downward migration of groundwater from the Rocky Flats Alluvium into the Arapahoe Formation in the vicinity of the Sludge Dispersal Area may occur if the lithology of the Arapahoe Formation is a sandstone. However, further characterization of the subsurface formations beneath this IHSS is needed.

2.8 TRIANGLE AREA (IHSS 165)

2.8.1 Location and Description

The Triangle Area is located within the security area of the Rocky Flats Plant facility between the NE Perimeter Road on the north and Spruce Avenue on the south (Figure 2-12). This IHSS covers approximately 250,000 square feet (5.7 acres). The western two-thirds of this unit are within the PSZ. The PSZ fencing crosses through the eastern one-third of this IHSS in a north-south direction (Figure 2-12). The Triangle Area is not paved, is sparsely vegetated, and has been partially covered with gravel fill, thickness unknown. The Triangle Area is presently used as a storage yard for various types of equipment and pipes. The southwestern corner of this IHSS overlaps slightly with IHSS 176 of Operable Unit No. 10.

2.8.2 History

The Triangle Area was used as a storage site for miscellaneous wastes between 1966 and 1975. During the latter half of 1966 the Triangle Area was first used as a drum storage area when it became necessary to remove a large number of drums to the Triangle Area from a field north of Building 883. This was due to construction activities of a new decontamination facility in that area. The drums were directly

placed on the ground through the winter of 1966. In the spring of 1967, the Chemical Operations Department at Rocky Flats categorized all drums based on their contents and placed them on wooden pallets (DOW 1974a). Various scrap materials stored in the drums included graphite molds, crucibles, incinerator ash heels, crucible heels, Raschig Rings and combustible wastes (DOW 1974b). These scrap materials were stored until they could be processed for plutonium in Building 771. Drums containing graphite and washables were also found stored in the Triangle Area in March 1967. Surfaces of surplus equipment stored in the area during this time had detectable concentrations of alpha contamination, apparently blown from the nitrate ponds or solar evaporation ponds to the west (DOW 1974a). By December 1968, about 5,000 drums had been placed on the Triangle Area. High winds during December 1968 were responsible for damaging many drums located on the Triangle Area. One incident that was reported indicated that as many as 150 drums had blown over at one time (DOW 1974a). The type of drums and liners used for the storage of wastes in the Triangle Area varied. Until 1969, the 55 gallon drums used for containment of wastes were made of an inexpensive material, had a liner made of double polyethylene bags, and had previously been used to contain miscellaneous wastes. During 1969, the Chemical Operations group started cutting lids from peroxide container liners, and these were used as inside liners for the drums. By 1971, the use of used drums was discontinued due to several spills and leaks which had resulted from drum deterioration. Better quality drums were purchased and used only once (DOW 1974a).

In May 1969, a fire occurred in Building 776. Following cleanup operations, the accumulated fire waste and residues from the fire were drummed and moved into the Triangle Area for temporary storage until they could be sent to the drum counter in Building 771. The amount of plutonium contained in the wastes was estimated to determine whether the wastes would be shipped to the Idaho facility or held in the Triangle Area until the waste could be processed for the recovery of plutonium (DOW 1974a).

On five separate occasions, once in 1969, once in 1971, and three times in 1973, leaking drums were discovered on the site. A historical summation of each incident is provided below.

In January 1969, approximately 29 drums were found leaking on the Triangle Area. This leakage affected an area of about 200 square feet (Owen 1973). The soil was subsequently removed and shipped as hot waste to an off-site facility (DOW 1974a). Following this 1969 spill, all the drums in the Triangle Area were transferred to rail/truck cargo containers to help minimize future leakage that might occur. This transfer was completed by 1971 (DOW 1974a).

Leaking drums were again discovered on site in 1971, in spite of the efforts to contain all wastes in better quality drums and in the cargo containers. Contaminated soil was removed from approximately 1,000 square feet of the Triangle Area as a result of this incident. Wastes contained in the leaking drums within the cargo containers apparently included incinerator ash heels and Fulflo filters (Owen 1973). Insufficient drying of the incinerator ash heels and Fulflo filters may have contributed to the deterioration

of the drums. This may have resulted in the accumulation of dilute nitric acid, which eventually penetrated the bottom of the drums. Condensation of moisture during periods of cold weather may also have contributed to liquid accumulation within the drums and eventually penetration of the wastes through the bottom of the drums (DOW 1974c). After the 1971 incident, the bottom of the cargo containers were routinely fiberglassed on the inside with fiberglass running up approximately one inch on each of the four inner walls. This addition was to enhance and improve containment of the waste and any moisture buildup within the cargo containers (DOW 1974a).

In June 1973, a spill from a leaking drum containing nitric acid was found. This spill affected an area of approximately 500 square feet. Approximately 40 drums of soil were removed for off-site disposal (Rockwell 1988). A second incident in the summer of 1973 occurred when leakage from the contents of two drums in a cargo container was discovered. Holes, about one and one-half inch in diameter, were found at the bottom of the drums. These drums contained incinerator ash heels (DOW 1974a). The two soil contaminated areas were treated with a strippable coating (latex in one case and plastic foam in the second) to prevent resuspension of the waste in air. This strippable coating, along with the contaminated soil, were subsequently removed and shipped to an Idaho facility as non-retrievable hot waste (DOW 1974b). In late 1973, a third area found to be contaminated was temporarily covered with latex to protect the area from high winds during the winter of 1973. In August 1974, eight drums of both soil and latex were removed from this area (DOW 1974b).

In September/October 1974, an initial radiometric survey of the Triangle Area identified 26 spots above background. Three soil survey instruments were used in this investigation and were a Spark V, FIDLER, and Ludlum 12 instrument. A description of each of these instruments along with the original draft report from these surveys are contained in Appendix F of this work plan.

Following this initial survey, several additional radiometric surveys were conducted on portions of the Triangle Area during the first half of 1975. These surveys were conducted with a Spark V instrument. Included in these surveys were surveys conducted over an area of 1,000 square feet in January (DOW 1975a), 2,000 square feet in February (DOW 1975b), 1,337 square feet in March (DOW 1975c), 3,000 square feet in April (DOW 1975d), and 3,500 square feet in May (DOW 1975e). In all cases, no additional hot spots were discovered on the Triangle Area. Locations where the surveys were conducted on the Triangle Area are not known.

By June 1975, all cargo containers were removed from the Triangle Area and shipped to an approved facility in Idaho. This area has not been used since for radioactive storage (Rockwell 1988). Following the removal of the cargo containers, a radiometric soil survey was conducted over an area of approximately 4,000 square feet on the Triangle Area. No hot spots were identified from the survey; however, six drums of soil from previously discovered hot spots were removed and sent to the drum counter at Building 771 (DOW 1975f). A second radiometric survey was conducted on the Triangle Area

in July 1975 in an area of approximately 2,000 square feet. Two very small hot spots were detected, but no soil was removed from these areas at this time (Rockwell 1975).

In a letter dated July 13, 1979, from Rockwell International to DOE, the results from a radiometric soil survey conducted within the PSZ and specifically the Triangle Area were presented. Four areas within the Triangle Area were recorded to have above-background readings at this time (Rockwell 1979). By January 1980, the soil in these designated areas had been removed (Rockwell 1980). The locations of these excavated areas are shown in Figure 2-12. The amount of soil removed from these areas is unknown.

A preliminary review of aerial photographs for this work plan revealed that in addition to the 55-gallon drums stored on this IHSS, miscellaneous equipment was also present on the west and northwest part of this IHSS between 1971 and 1983. Stained soils were visible in the northwest corner of this unit in the 1971 aerial photograph (U.S. EPA 1988b). In the 1986 aerial photograph, the Triangle Area had a minimal amount of material, such as pipes and scrap metal, stored on its premises.

2.8.3 Surface Drainage

Surface runoff across this IHSS is minimal as this unit is located on a relatively flat area. However, runoff from the Triangle Area flows towards the north and south, draining into North and South Walnut creeks via culverts.

2.8.4 Nature of Contamination and Previous Investigations

As described above in the history of the Triangle Area (Section 2.8.2), several soil investigations took place between 1969 and 1980 and soil was removed on several occasions from the area. In January 1969, due to the discovery of 29 leaking drums on the Triangle Area, radiation levels were detected as high as 200,000 dpm/100 cm^2 in adjacent soils (Rockwell 1988). In 1971, leaking drums containing incinerator ash heels, Fulflo filters and other miscellaneous waste resulted in levels ranging between 2,000 to 200,000 dpm/100 cm^2 in nearby soils (Rockwell 1988). In June 1973, an incident from a leaking drum containing nitric acid resulted in radiation levels of approximately 2,500 dpm/100 cm^2 in nearby and adjacent soils (Rockwell 1988). After soil removal had been completed from this nitric acid spill, a soil sample was collected from the base of the excavation to confirm that the cleanup had been adequately performed. This sample had a concentration of 24 dpm/g (Rockwell 1988).

In June 1975, following the removal of all cargo containers on the Triangle Area, six drums of soil from previously discovered areas of anomalous radiation readings were removed. Measurements indicated that the contents of five of the drums contained less than 1 gram of plutonium each while the sixth drum contained approximately two grams of plutonium (DOW 1975f).

Radiological surveys conducted in 1975 and 1979/1980 within the Triangle Area resulted in soil being removed and drummed for disposal. Soil was removed when surface counts were detected at 1,000 cpm or greater (Rockwell 1988). All areas reported at or above this level were cleaned up to a level of 250 cpm, as determined by a FIDLER probe (Rockwell 1988).

In additional to the above soil investigations, analytical results from groundwater samples collected from two bedrock groundwater monitoring wells P209689 and P207989, installed in 1989, were reviewed. Well P209689 is located in the western half of the Triangle Area and P207989 is located just upgradient from the IHSS (Figure 2-12). Several metals and volatile organics were detected in well P209689, but only one radionuclide was reported above the CRQLs in this well (Table 2-16). Several metals and radionuclides were detected above the CRQLs in the upgradient well P207989, however, no volatile organics were detected above the CRQLs in this well (Table 2-17). The metals and radionuclide concentrations may be representative of background conditions and will be evaluated in the RI report (see subsection 2.1.3).

2.8.5 Geology and Hydrology

The geology beneath the Triangle Area has been characterized by several alluvial and bedrock monitoring wells drilled in and adjacent to this IHSS (Figure 2-12). Well data for these wells can be found in Table 2-1. Beneath and adjacent to the Triangle Area, the Rocky Flats Alluvium is the surficial geologic unit. The thickness of the alluvium beneath this site ranges from approximately 8½ feet, as encountered in well 2986, to approximately 12 feet as encountered in wells P209689, P209789 and P218389 (Figure 2-12). The Rocky Flats Alluvium is described as a yellowish-gray to reddish-brown, poorly sorted, silty clayey sand to sandy gravelly clay unit containing subrounded, coarse- to very-fine-grained sands and gravels. The Rocky Flats Alluvium thins to about 4 feet, approximately 200 feet northwest of the Triangle Area. This is based on the thickness of the Rocky Flats Alluvium in monitoring wells P208889 and P209589. South of this IHSS, the Rocky Flats Alluvium thickens to 22.5 and 25 feet as encountered in wells P219489 and P219589, respectively (Figure 2-12).

The Arapahoe Formation underlies the Rocky Flats Alluvium. The lithologic nature of the Arapahoe Formation beneath the western boundary of the Triangle Area is described as a yellowish-gray to light olive gray consolidated silty claystone based on surrounding monitoring wells. In addition, this unit is highly calcareous and is weathered near its top. In alluvial monitoring well 2986 (Figure 2-12) a sandstone unit approximately 10 feet thick was encountered in the Arapahoe Formation. This sandstone has been correlated and mapped as the Arapahoe Number 1 Sandstone. The extent of this sandstone unit beneath the Triangle Area, however, is unknown and further characterization of this formation is needed.

TABLE 2-16

MAXIMUM HITS ABOVE CRQLs/CRDLs/MDAs IN GROUNDWATER SAMPLES COLLECTED FROM WELL P209689

Analyte	Total Samples	Total Hits	CRQL/CRDL/ MDA[1]	Maximum Hit/Qualifier
VOA (μg/l)				
1,2-Dichloroethene	3	1	5.0	11.0
Carbon Tetrachloride	3	1	5.0	82.0
Chloroform	3	2	5.0	20.0
Tetrachloroethene	3	1	5.0	6.0
Trichloroethene	3	1	5.0	83.0
Dissolved Metals (μg/l)				
Calcium	1	1	5000.0	183000.0
Magnesium	1	1	5000.0	30200.0
Manganese	1	1	15.0	16.8
Potassium	1	1	5000.0	56200.0
Sodium	1	1	5000.0	291000.0
Strontium	1	1	200.0	852.0
Total RADs (pCi/l)				
Gross alpha - suspended	1	1	2.0	3.5 ± 8.0

Source: EG&G 1991h

Note:
[1] CRQL (Contract required quantitation limit for CLP organics)
CRDL (Contract required detection limit for CLP inorganics)
MDA (Minimum detectable activity for radionuclides (EG&G, 1990d))

TABLE 2-17

MAXIMUM HITS ABOVE CRDLs/MDAs IN GROUNDWATER SAMPLES COLLECTED FROM WELL P207989

Analyte	Total Samples	Total Hits	CRDL/MDA[1]	Maximum Hit		
Dissolved Metals (μg/l)						
Calcium	1	1	5000.0	63700.0		
Magnesium	1	1	5000.0	49200.0		
Manganese	1	1	15.0	64.0		
Mercury	1	1	0.2	0.25		
Selenium	1	1	5.0	17.0		
Sodium	1	1	5000.0	241000.0		
Strontium	1	1	200.0	1060.0		
Dissolved RADs (pCi/l)						
Gross alpha	2	2	2.0	71.0	±	25.0
Gross beta	2	2	2.0	25.0	±	5.0
Uranium-233, -234	2	2	0.6	28.0	±	4.0
Uranium-235	2	2	0.6	1.0	±	.5
Uranium-238	2	2	0.6	21.0	±	3.5

Source: EG&G 1991h

Note:
[1] CRDL (Contract required detection limit for CLP inorganics)
MDA (Minimum detectable activity for radionuclides (EG&G, 1990d))

The upper aquifer near and beneath the Triangle Area is the Rocky Flats Alluvium. Groundwater is approximately 3 feet below ground surface in this area. Beneath the northern part of the Triangle Area, groundwater probably flows toward the north into North Walnut Creek. Based on the topography in the southeast part of the Triangle Area, it is estimated that groundwater flows to the east toward South Walnut Creek.

2.9 OLD OUTFALL (IHSS 143)

2.9.1 Location and Description

The Old Outfall (IHSS 143) was located to the northwest of Building 773 (Guard Station) and Building 771 within the PSZ (Figure 2-13). This unit is approximately 30,000 square feet, and has been covered with fill (amount unknown). Temporary trailers are currently situated on and near this IHSS. Because of the construction activities in this area, the existing drainage system is different from the drainage system that existed during the operation of the outfall (Figure 2-14).

2.9.2 History

The Old Outfall acted as a catchment basin that received liquids from various sources, the main one being the laundry holding tanks in Building 771 (DOW 1971a). Liquid waste from these holding tanks, which contained plutonium, were discharged onto the outfall area if plutonium concentrations were found to be below 3,300 d/m/l. Between the middle of 1953 until mid-1957, 4.5 million gallons of liquid were released onto the Old Outfall. Approximately 2.23 mCi of plutonium were released with these liquids (DOW 1971a). At no time did concentrations from the discharge exceed 1,000 d/m/l (DOW 1971a). In 1957, a waste line was completed to allow liquid from these holding tanks to flow to Building 774. However, periodic releases from these holding tanks occurred between 1957 and 1965 onto the Old Outfall area and subsequently into North Walnut Creek due to occasional equipment problems. During this period, 434,000 gallons of liquid containing 0.25 mCi of plutonium were released to the outfall area (DOW 1971a).

Other sources of discharge to the Old Outfall area from building 771 included the analytical laboratory and radiography sinks, the personnel decontamination room (showers), and runoff from the roof and adjacent ground areas around the building. No documentation of the quantities of liquid or radioactivity content of these liquids was recorded (DOW 1971a).

The plutonium contamination contained in these discharges resulted in soil contamination at the point of discharge at the Old Outfall (DOW 1973). The first occurrence of soil contamination at the Old Outfall was reported in May 1956. Two years later, in May 1958, soil contamination was again found (DOW 1971a). It is not known if these contaminated soils were removed from this area.

In May 1968, a sewer line broke at Building 771. This incident caused the sewage lift station tank (located to the west of Building 771) to overflow onto the Outfall Area (Figure 2-14). Low concentrations of radioactive materials (including plutonium) and various chemicals were detected in the soils near the outfall following this spill (Rockwell 1988). In April 1970, hot spots were detected in the soils at the Outfall and subsequently soil samples were collected and analyzed. In June 1970, the area between building 771, the Old Outfall and North Walnut Creek was surveyed and in September contaminated soil was removed from an area of approximately 75 square feet in size (location unknown) (DOW 1971b).

In early 1971, an alpha survey along with soil sampling at the Old Outfall Area disclosed that an area of approximately 800 square feet was contaminated with plutonium. One small area showed contamination at a depth of 3½ feet (DOW 1971c). Removal of soils from an 800 square foot area at the Old Outfall began in February 1971 and was completed in early August (Figure 2-14). Soil was initially removed from an area 2½ feet deep, 3 feet wide and 15 feet long. The depth of this excavation became shallower (to a depth of about 1 foot) in the area farthest from the discharge point. East of this excavation, a second area, approximately 25 x 30 feet, was excavated to a depth of approximately 1 foot (DOW 1971a). Digging was performed only when the soils were relatively dry to reduce the potential for liquid to collect in the waste drums. Cement was added to each drum before and after the placement of the soil into the drums to absorb any liquid that may have been contained within the soil. The excavated area and the soil sample results from this area is illustrated in Figure 2-14 (DOW 1971c). Following these soil removal activities, the area was considered to be free of significant plutonium concentrations (DOW 1971c).

2.9.3 Surface Drainage

The surface drainage near the Old Outfall (IHSS 143) has been modified since this IHSS was active. The Old Outfall, during the time in which it was active, received surface runoff from the south via a culvert, and liquid discharge from the effluent of Building 771 to the southeast. The water entered into a small stream channel and flowed northward into North Walnut Creek (Figure 2-14).

The Old Outfall Area is presently a flat area, as it has been covered with fill. The surface drainage system near this unit now consists of a small ditch, which diverts runoff across a portion of this IHSS and subsequently into North Walnut Creek via a culvert beneath the PSZ. In addition, an intermittent stream flows from the southwest across the Old Outfall Area to the northeast through a culvert buried beneath this IHSS. Water flowing within this channel originates in the buffer zone west of the PSZ.

2.9.4 Nature of Contamination and Previous Investigations

Soil investigations took place on several occasions near the Old Outfall. The first report of soil contamination in the area was in May 1956, and a maximum concentration of 130 d/m/g gross alpha was recorded. Soil samples were analyzed at the Outfall Area again in May 1958 and concentrations were reported as high as 2,000 d/m/g gross alpha (DOW 1971a).

In April 1970, hot spots detected at the Old Outfall reported concentrations greater than 190,000 d/m/g. In June 1971, soil samples collected between Building 771, the Old Outfall, and North Walnut Creek showed plutonium activities ranging between 60,000 d/m/g and 200,000 d/m/g (DOW 1971b).

Discharges from the Old Outfall and leaching of these discharges through the Old Outfall Area may have contributed to contamination in North Walnut Creek. This is supported by plutonium analyses of the creek's water. The average plutonium concentration in North Walnut Creek's water in December 1970 was 0.4 pCi/l. The 3-month plutonium moving average in Walnut Creek was 1.1 pCi/l in December (DOW 1971b). Sediment samples collected from North Walnut Creek during the beginning of 1970 were also found to contain plutonium, ranging in concentration from 4 to 36 d/m/g (DOW 1973).

A soil investigation also took place in 1970 following a May 1968 incident when a broken sewer line caused the sewage lift station to overflow onto the Old Outfall Area. Radioactivity levels at the Old Outfall were recorded to be as high as 100,000 d/m/g in this investigation. Based on these results, removal of the contaminated soil began in February 1971 (Figure 2-14) (Rockwell 1988). During initial soil removal activities, the soil showed levels ranging between 120 and 1,300 d/m/g. Rocks, after being completely dried, recorded levels as high as 10,000 c/m by direct instrument measurements (DOW 1971a). The area east of the initial excavation (an area of approximately 25 x 30 feet), after removal of approximately 1 foot of soil, still had soil contamination present at depth (Figure 2-14). The underlying soil was measured to have levels between 2,000 and 3,000 d/m/g (DOW 1971a). The depth of penetration of plutonium into the soil was believed to be due to the soap and detergents discharged from the laundry holding tanks of Building 771 (DOW 1971a). Soil removal activities were completed in early August 1971. The highest soil contamination level recorded during soil removal activities was 29,000 d/m/g (DOW 1971c). Final surveys of the area following remediation showed no direct alpha count greater than 250 c/m and results averaged 34 d/m/g with a maximum of 150 d/m/g (DOW 1971c).

To provide some surface water data downslope from this IHSS, surface water location SW-17 was reviewed. This location is on North Walnut Creek approximately 100 feet downstream from where surface water drains from the Old Outfall Area through a culvert and into the small tributary leading into North Walnut Creek (Figure 2-2). No organics were detected above the CRQLs at this sampling location, however, several metals and radionuclides were reported above the CRQLs (Appendix B). The

reported concentrations for metals and radionuclides may be representative of background and will be evaluated further during the RI. The data from nearby existing groundwater wells are not summarized in this section since they are located too far away to provide useful data.

2.9.5 Geology and Hydrology

The geology beneath and near the Old Outfall has been characterized by its geographic location and from lithologic data obtained from monitoring well P219189, located 450 feet to the east (Figure 2-13).

The two surficial geologic units likely to be beneath the Old Outfall are valley fill alluvium and colluvium. An intermittent stream once flowed across this IHSS, contributing minor deposits of valley fill alluvium. On the slopes of this drainage system and to the south of this IHSS, colluvium has been deposited across this area by slope wash and downslope creep of the Rocky Flats Alluvium and/or Arapahoe Formation.

The rock units encountered in well P219189 located 450 feet to the east were fill (approximately 10 feet) overlying the Arapahoe Formation. The fill in this area is described as a dark yellowish-brown, poorly sorted, unconsolidated gravelly sand unit, with angular to subrounded fine- to coarse grains. Fill is known to have been placed in the area of the Old Outfall; however, the thickness of fill is unknown. The Arapahoe Formation is described as a claystone to silty claystone in this area.

2.10 SOIL DUMP AREA (IHSS 156.2)

2.10.1 Location and Description

The Soil Dump Area (IHSS 156.2) is located within the buffer zone, approximately 10 feet northeast of the northeastern boundary of the security area of the Plant facility, and northeast of the Triangle Area (Figure 2-12). Geographically, this IHSS is on an east-west trending interfluve that separates North and South Walnut creeks in the vicinity of the A-series and B-series Detention Ponds. A dirt road crosses through this unit in a northeast, southwest direction. The Soil Dump Area covers an area of approximately 255,000 square feet (5.9 acres).

2.10.2 History

The Soil Dump Area was an area that received between 50 to 75 dump truck loads of soil containing low levels of plutonium. These soils were excavated during the construction of Parking Area No. 334 located in the middle of the western half of the Plant production area. However, the excavated soils removed from the Parking Area originally had been excavated around and near Building 774.

Building 774 is located approximately 100 feet east of Building 771 near the Old Outfall Area (Figure 2-13). Asphalt debris and concrete remains were also found within the Soil Dump Area.

2.10.3 Surface Drainage

Surface runoff across this IHSS is minimal as this unit is situated on a flat area that is sparsely vegetated (Figure 2-12). However, runoff near the northern boundary flows toward North Walnut Creek and the A-series Ponds and runoff near the southern boundary flows toward South Walnut Creek and the B-series Ponds. Surface runoff that may flow toward the northeast boundary may cross the East Area Spray Field (IHSS 216.1) before draining into North and/or South Walnut Creeks.

2.10.4 Nature of Contamination and Previous Investigations

Soils placed onto the Soil Dump Area contained low levels of plutonium (Rockwell 1988). The volume of plutonium within these soils and concentrations are not known (Rockwell 1988). A piezometer (TH-14) was installed in the northwest corner of this IHSS (exact location unknown), however, no records or completion details of this well are available (Rockwell 1988). No other data from previous investigations on nearby monitoring stations were identified for this IHSS.

2.10.5 Geology and Hydrology

The geology beneath this IHSS has not fully been characterized as no monitoring wells have been drilled through this unit. Based on the geographic location of this IHSS, the surficial geologic map of the OU6 area (Figure 1-5), and the surficial lithologic unit encountered in a nearby monitoring well (B213789) the Rocky Flats Alluvium is the formation beneath this IHSS. The Rocky Flats Alluvium is about 6 feet thick in this area based on well B213789. The Rocky Flats Alluvium is described as a poorly sorted, unconsolidated sandy clay, yellowish-brown to brown, and calcareous. The Arapahoe Formation underlies the Rocky Flats Alluvium and in this area the Arapahoe Formation is described as a poorly sorted, unconsolidated, calcareous weathered clayey sandstone to claystone with oxide staining. Outcrops of the Arapahoe Formation are found at three small locations in a road cut near the western boundary of this IHSS. The lithology found at two of these bedrock outcrops are sandstones while the other is a claystone unit (Figure 1-5).

Hydrologic studies beneath and near this IHSS have described the Rocky Flats Alluvium in this area to be unsaturated (Rockwell 1988). An alluvium monitoring well (B213789) located approximately 100 feet south of the southern most boundary of this IHSS is dry during most of the year (Figure 2-12). Only about ½ foot of water was reported in this well in August 1990.

2.11 CONCEPTUAL MODELS

Conceptual models describe a site and its environs and present hypotheses regarding the contaminants, their routes of migration, and their potential impact on receptors. Since little is known concerning the contaminants and their routes of migration in OU6, the conceptual models must be very general. The hypotheses of the models are tested, refined and modified throughout the RFI/RI process.

A generic Phase I conceptual model has been developed for IHSSs in OU6 and is presented in the following sections. The model will be refined and modified as appropriate to each IHSS in the RFI/RI Report.

2.11.1 IHSS Locations and Sources

The A-series Ponds (Ponds A-1, A-2, A-3, and A-4) (IHSSs 142.1, 142.2, 142.3, and 142.4) are located in North Walnut Creek, northeast of the main security area of the Rocky Flats Plant. These detention ponds are used to capture and control surface runoff from the northern part of the Rocky Flats production facilities. Various discharges that contained nitrates and radioactive substances, including plutonium and uranium, along with laundry wastes containing plutonium, flowed into North Walnut Creek upstream of the A-series detention ponds. This contributed significant amounts of plutonium to the stream sediments of North Walnut Creek and in the sediments of the A-series Ponds. Numerous investigations have taken place at the A-series ponds. The results are discussed in subsection 2.2.4. Potential sources of contamination in the A-series ponds are water and sediments in the ponds.

The B-series ponds (B-1, B-2, B-3, B-4, and B-5) (IHSSs 142.5, 142.6, 142.7, 142.8, and 142.9) are located in South Walnut Creek, east of the eastern perimeter of the main security area of the Rocky Flats Plant. These ponds are used to capture and control surface water runoff from the eastern and central portions of the Rocky Flats production facilities. Decontamination process water, laundry wastewater, and sewage treatment plant effluent containing nitrates, plutonium, and uranium have been discharged to the B-series ponds over various periods. Investigations have been conducted in South Walnut Creek and the B-series ponds. The results are discussed in subsection 2.3.4. Potential sources of contamination in the B-series ponds are water and sediments in the ponds.

The North, South, and Pond Area Spray Fields (IHSSs 167.1, 167.2 and 167.3) are located north of the security area of the plant within the buffer zone. These fields were used to spray and evaporate the water that collected in the East and West Landfill Ponds. Excessive runoff caused spraying to be stopped at the North and South Spray Fields. Limited chemical data are available and are described in subsection 2.4.4. Contaminated spray water may have contaminated the surface soils on the spray field areas, and these soils would be a source.

The East Area Spray field (IHSS 166.1) is located on an interfluve separating North and South Walnut creeks within the buffer zone. For a few months in 1989, this area was used to accommodate the spray evaporation from the water in Pond B-3. Surface water analyses conducted during 1989 for the water in Pond B-3 are presented in subsection 2.5.4. Contaminated spray water may have contaminated the surface soils on the East Area Spray Field and these soils could be a source.

Trenches A, B, and C (IHSSs 166.1, 166.2 and 166.3) are located on a plateau separating North Walnut Creek from the unnamed tributary to the north. Trenches A and B received sewage sludge which contained uranium and/or plutonium. Trench C is also suspected to have received sewage sludge. Soil covers were placed over the trenches (date unknown). The source of contamination at the trenches, if present, is the material in the trenches.

The Sludge Dispersal Area (IHSS 141) is located along the eastern perimeter of the main security zone of the Rocky Flats Plant. Prior to 1983, the Sludge Dispersal Area was an area that may have received airborne radioactive particles from dried sludge packaging operations. Elevated levels of plutonium occurred in the sludge. Surface soils in the area may have been contaminated by the airborne particles.

The Triangle Area (IHSS 165) is located primarily in the northeastern corner of the PSZ. The area was used as a storage site for miscellaneous wastes, including 55-gallon drums containing plutonium-contaminated wastes, between 1966 and 1975. Cleanup activities have been conducted in the Triangle Area on several occasions, and fill has been placed in the area.

The Old Outfall (IHSS 143) is located within the PSZ near Buildings 773 and 771. The area received process and/or laundry wastes between the 1950s and the 1970s. The area was remediated in 1971 and has since been covered with fill. The presence or absence of hazardous substances will be investigated during the Phase I Investigation.

The Soil Dump Area (IHSS 156.2) is located within the buffer zone, northeast of the northeastern boundary of the security area of the Plant. This IHSS received contaminated soils containing low levels of plutonium, asphalt debris and concrete remains. The source of contamination at this IHSS would be from the soils dumped at this site.

2.11.2 Potential Pathways of Exposure

Air Pathway. Sources of contamination exposed at the surface of any IHSS have the potential to become airborne. The air pathway includes both airborne particulates and gaseous emissions.

Surface Water Pathway. Sources of contamination exposed to surface water have the potential to enter the surface water pathway. In addition, surface water in North and South Walnut Creeks or the A and B-series Ponds is considered a source for those units. The primary surface water pathway is North and South Walnut Creeks and it's tributaries and diversions.

Groundwater Pathway. Migration of contaminants by infiltration and percolation of water through a source into groundwater is another potential pathway of exposure. Migration will occur into the underlying groundwater system and then in the direction of movement of the particular aquifer encountered. The primary flow path of the aquifers is expected to be to the east.

Direct Contact. A fourth pathway exists through direct contact with sources, or contaminated soil, sediment or water.

2.11.3 Receptors

Potential receptors of contaminants are humans on-site and off-site, primarily downgradient, and on-site and off-site biota. Biota and on-site humans are more likely to have the potential for direct contact.

3.0
APPLICABLE OR RELEVANT AND APPROPRIATE REQUIREMENTS

This section provides a preliminary identification of chemical-specific Applicable or Relevant and Appropriate Requirements (ARARs) for groundwater, surface water, and soils at Operable Unit 6 so that appropriate analytical detection limits are used during the RCRA Facility Investigation/Remedial Investigation. Use of appropriate detection limits is necessary to allow evaluation of compliance with ARARs in the Corrective Measures Study/Feasibility Study (CMS/FS) report. As described in subsection 3.2, evaluation and establishment of location-specific ARARs are a part of the RI process and will be addressed in the RFI/RI Report. Chemical-specific ARARs will be established in the RFI/RI Report. Identification of action-specific ARARs and remediation goals is a part of the feasibility study process and will be addressed in the CMS/FS Report.

3.1 THE ARAR BASIS

The basis for ARARs is cited in Section 121(d) of Comprehensive Environmental Response, Compensation and Liability Act (CERCLA), as amended by the Superfund Amendments and Reauthorization Act (SARA), which requires that Fund-financed, enforcement, and federal facility remedial actions comply with all applicable or relevant and appropriate promulgated federal and state environmental or facility siting laws. For the purposes of identification and notification of promulgated state standards, the term "promulgated" means that the standards are of general applicability and are legally enforceable (National Contingency Plan (NCP), 40 Code of Federal Regulations (CFR) 300.400(g)(4)).

Health-based, chemical-specific ARARs pertinent to groundwater, surface water, and soils (environmental media addressed by this work plan) have been identified for the Environmental Protection Agency's (EPA) Contract Laboratory Program (CLP) target compound list (TCL) for organic compounds and target analyte list (TAL) for inorganic compounds, as well as radionuclides and conventional pollutants. The chemical-specific ARARs are primarily derived from federal and state health and environmental statutes and regulations. As discussed below, in some instances, these standards are classified as terms "to be considered" (TBC). A summary of potential chemical-specific ARARs/TBCs for possible contaminants in OU6 groundwater is presented in Table 3-1. Similarly, potential ARARs/TBCs for OU6 surface water are summarized in Tables 3-2 and 3-3.

One medium for which chemical-specific ARARs do not currently exist is soils. As the remedial investigation proceeds, information will become available from the baseline risk assessment that will allow a determination of acceptable contaminant concentrations in soils to ensure environmental "protectiveness." This is discussed further in subsection 3.5.

TABLE 3-1 POTENTIAL CHEMICAL-SPECIFIC ARARs/TBCs (August 1, 1991)
GROUNDWATER QUALITY STANDARDS (ug/l)

				FEDERAL STANDARDS					STATE STANDARDS (TBCs)							
									CDH WQCC Groundwater Quality Standards (d)							
									Statewide	Site-Specific (g)						
Parameter	Type (5)	PQL MDL	Method (6)	SDWA Maximum Contaminant Level (a)	SDWA Maximum Contaminant Level TBCs (b)	SDWA Maximum Contaminant Level Goal (a)	SDWA Maximum Contaminant Level Goal TBCs (b)	RCRA Subpart F Concentration Limit (40CFR264.94) (c)	Tables A & B (d)	Table 1 Human Health	Table 2 Secondary Drinking	Table 3 Agriculture	Table 4 TDS	Table 5 Chronic	Table 6 Radionuclides Woman Creek	Table 6 Radionuclides Walnut Creek
Bicarbonate	A	10	E310.1													
Carbonate	A	10	E310.1													
Chloride	A	5	E325	250,000 *							250,000					
Chlorine	A	1000	E4500													
Fluoride	A	5	E340	4,000; 2,000*		4,000				4,000		2,000				
N as Nitrate	A	5	E353.1	10,000			10,000			10,000						
N as Nitrate+Nitrite	A	5	E353.1		10,000		10,000					100,000				
N as Nitrite	A	5	E354.1		1,000		1,000			1,000		10,000				
Sulfate	A	5	E375.4	250,000*							250,000					
Sulfide	A															
Coliform (total)	B	1	SM9221C	1/100 ml						1/100 ml						
Ammonia as N	C	5	E350													
Dioxin	D		d						0.00000022 (7)					0.000000013		
Sulfur	E	100,000	E600													
Dissolved Oxygen	FP	0.5	SM4500													
pH	FP	0.1	E150.1	6.5-8.5 *							6.5-8.5	6.5-8.5				
Specific Conductance	FP	1	E120.1													
Temperature	FP															
Boron	I	5	E6010									750				
Total Dissolved Solids	I	10	E160.1	500,000*									400,000 (1)			
Aluminum	M	200	CT		50 to 200*							5,000				
Antimony	M	60	CT													
Arsenic	M	10	CT	50				50		50		100				
Arsenic III	M															
Arsenic V	M															
Barium	M	200	CT	1,000	2,000 (c)		2,000 (c)	1,000		1,000						

TABLE 3-1 POTENTIAL CHEMICAL-SPECIFIC ARARs/TBCs (August 1, 1991)
GROUNDWATER QUALITY STANDARDS (ug/l)

				FEDERAL STANDARDS					STATE STANDARDS (TBCs)							
									CDH WQCC Groundwater Quality Standards (d)							
									Statewide	Site-Specific (g)						
Parameter	Type (5)	PQL MDL	Method (6)	SDWA Maximum Contaminant Level (a)	SDWA Maximum Contaminant Level TBCs (b)	SDWA Maximum Contaminant Level Goal (a)	SDWA Maximum Contaminant Level Goal TBCs (b)	RCRA Subpart F Concentration Limit (40CFR264.94) (c)	Tables A & B (d)	Table 1 Human Health	Table 2 Secondary Drinking	Table 3 Agriculture	Table 4 TDS	Table 5 Chronic	Table 6 Radionuclides Woman Creek	Table 6 Radionuclides Walnut Creek
Beryllium	M	5	CT									100				
Cadmium	M	5	CT	10	5		5	10		10		10				
Calcium	M	5,000	CT													
Cesium	M	1,000	NC													
Chromium	M	10	CT	50	100		100	50		50		100				
Chromium III	M	5	SW8467196													
Chromium VI	M	10	E218.5													
Cobalt	M	50	CT									50				
Copper	M	25	CT	1,000 *			1300 (f)				1,000	200				
Cyanide	M	10	CT							200						
Iron	M	100	CT	300 *							300	5,000				
Lead	M	5	CT	50			0 (f)	50		50		100				
Lithium	M	100	NC									2,500				
Magnesium	M	5000	CT													
Manganese	M	15	CT	50 *							50	200				
Mercury	M	0.2	CT	2	2		2	2		2		10				
Molybdenum	M	200	NC													
Nickel	M	40	CT									200				
Potassium	M	5000	CT													
Selenium	M	5	CT	10	50		50	10		10		20				
Silver	M	10	CT	50	100 *			50		50						
Sodium	M	5000	CT													
Strontium	M	200	NC													
Thallium	M	10	CT													
Tin	M	200	NC													
Titanium	M	10	E6010													
Tungsten	M	10	E6010													
Vanadium	M	50	CT									100				
Zinc	M	20	CT	5,000 *							5,000	2,000				

TABLE 3-1 POTENTIAL CHEMICAL-SPECIFIC ARARs/TBCs (August 1, 1991)
GROUNDWATER QUALITY STANDARDS (ug/l)

				FEDERAL STANDARDS					STATE STANDARDS (TBCs)							
									CDH WQCC Groundwater Quality Standards (d)							
									Statewide	Site-Specific (g)						
Parameter	Type (5)	PQL MDL	Method (6)	SDWA Maximum Contaminant Level (a)	SDWA Maximum Contaminant Level TBCs (b)	SDWA Maximum Contaminant Level Goal (a)	SDWA Maximum Contaminant Level Goal TBCs (b)	RCRA Subpart F Concentration Limit (40CFR264.94) (c)	Tables A & B (d)	Table 1 Human Health	Table 2 Secondary Drinking	Table 3 Agriculture	Table 4 TDS	Table 5 Chronic	Table 6 Radionuclides Woman Creek	Table 6 Radionuclides Walnut Creek
2,4,5-TP Silvex	P		d	10	50		50	10	10							
2,4-Dichlorophenoxyacetic Acid	P		d	100	70		70	100	100							
(2,4-D)	P															
Aldicarb	P				3 (e)		1 (e)		10							
Aldrin	P	0.05	CP						0.002 (7)					0.0000784		
Bromacil	P															
Carbofuran	P		d		40		40		36							
Chloranil	P															
Chlordane (Alpha)	P	0.5	CP		2		0		0.03 (7)					0.00046		
Chlordane (Gamma)	P	0.5	CP		2		0		0.03 (7)					0.00046		
Chlorpyrifos	P		E619													
DDT	P	0.1	CP						0.1 (7)					0.000024		
DDT Metabolite (DDD)	P	0.1	CP													
DDT Metabolite (DDE)	P	0.1	CP													
Demeton	P															
Diazinon	P															
Dieldrin	P	0.1	CP						0.002 (7)					0.000071		
Endosulfan I	P	0.05	CP													
Endosulfan II	P	0.1	CP													
Endosulfan sulfate	P	0.1	CP													
Endrin	P	0.1	CP	0.2				0.2	0.2							
Endrin Ketone	P	0.1	CP													
Guthion	P															
Heptachlor	P	0.05	CP		0.4		0		0.008 (7)					0.00028		
Heptachlor Epoxide	P	0.05	CP		0.2		0		0.004 (7)							
Hexachlorocyclohexane, Alpha	P	0.05	CP											0.0092		
Hexachlorocyclohexane, Beta	P	0.05	CP											0.0163		
Hexachlorocyclohexane, Delta	P	0.05	CP													

TABLE 3-1 POTENTIAL CHEMICAL-SPECIFIC ARARs/TBCs (August 1, 1991)
GROUNDWATER QUALITY STANDARDS (ug/l)

				FEDERAL STANDARDS					STATE STANDARDS (TBCs)							
									CDH WQCC Groundwater Quality Standards (d)							
									Statewide	Site-Specific (g)						
Parameter	Type (5)	PQL MDL	Method (6)	SDWA Maximum Contaminant Level (a)	SDWA Maximum Contaminant Level TBCs (b)	SDWA Maximum Contaminant Level Goal (a)	SDWA Maximum Contaminant Level Goal TBCs (b)	RCRA Subpart F Concentration Limit (40CFR264.94) (c)	Tables A & B (d)	Table 1 Human Health	Table 2 Secondary Drinking	Table 3 Agriculture	Table 4 TDS	Table 5 Chronic	Table 6 Radionuclides Woman Creek	Table 6 Radionuclides Walnut Creek
Hexachlorocyclohexane, Technical	P		f											0.0123		
Hexachlorocyclohexane, Lindane	P	0.05	CP	4	0.2		0.2	4.0	4					0.0186		
Malathion	P															
Methoxychlor	P	0.5	CP	100	40		40	100	100	100						
Mirex	P															
Parathion	P															
PCBs	P	0.5	CP		0.5		0		0.005 (7)					0.000079		
Simazine	P		e											4.0		
Toxaphene	P	1	CP		3		0	5.0	5	5						
Vaponite 2	P															
Aroclor 1016	PP	0.5	CP													
Aroclor 1221	PP	0.5	CP													
Aroclor 1232	PP	0.5	CP													
Aroclor 1242	PP	0.5	CP													
Aroclor 1248	PP	0.5	CP													
Aroclor 1254	PP	1	CP													
Aroclor 1260	PP	1	CP													
Atrazine	PP		e		3		3							3.0		
Americium (pCi/l)	R														0.05	0.05
Americium 241 (pCi/l)	R	0.01														
Cesium 134 (pCi/l)	R	1							80 (2)						80	80
Cesium 137 (pCi/l)	R	1														
Gross Alpha (pCi/l)	R	2		15 (8)						15					7	11
Gross Beta (pCi/l)	R	4		50 (4 mrem/yr)						4 mrem/yr					5	19
Plutonium 238+239+240 (pCi/l)	R	0.01							15 (2)							
Plutonium (pCi/l)	R														0.05	0.05
Radium 226+228 (pCi/l)	R	0.5/1.0 (4)		5					5 (2)							
Strontium 89+90 (pCi/l)	R	1														

TABLE 3-1 POTENTIAL CHEMICAL-SPECIFIC ARARs/TBCs (August 1, 1991)
GROUNDWATER QUALITY STANDARDS (ug/l)

				FEDERAL STANDARDS					STATE STANDARDS (TBCs)							
									CDH WQCC Groundwater Quality Standards (d)							
									Statewide	Site-Specific (g)						
Parameter	Type (5)	PQL MDL	Method (6)	SDWA Maximum Contaminant Level (a)	SDWA Maximum Contaminant Level TBCs (b)	SDWA Maximum Contaminant Level Goal (a)	SDWA Maximum Contaminant Level Goal TBCs (b)	RCRA Subpart F Concentration Limit (40CFR264.94) (c)	Tables A & B (d)	Table 1 Human Health	Table 2 Secondary Drinking	Table 3 Agriculture	Table 4 TDS	Table 5 Chronic	Table 6 Radionuclides Woman Creek	Table 6 Radionuclides Walnut Creek
Strontium 90 (pCi/l)	R			8 (3)					8 (2)						8	8
Thorium 230+232 (pCi/l)	R								60 (2)							
Tritium (pCi/l)	R			20,000 (3)					20,000 (2)						500	500
Uranium 233+234 (pCi/l)	R															
Uranium 235 (pCi/l)	R	0.6														
Uranium 238 (pCi/l)	R	0.6														
Uranium (Total) (pCi/l)	R														5	10
1,2,4,5-Tetrachlorobenzene	SV		b						2 (7)							
1,2,4-Trichlorobenzene	SV	10	CS													
1,2-Dichlorobenzene (Ortho)	SV	10	CS		600		600		620							
1,2-Diphenylhydrazine	SV		b						0.05 (7)							
1,3-Dichlorobenzene (Meta)	SV	10	CS						620							
1,4-Dichlorobenzene (Para)	SV	10	CS	75		75			75							
2,4,5-Trichlorophenol	SV	50	CS						700							
2,4,6-Trichlorophenol	SV	10	CS						2 (7)					1.2		
2,4-Dichlorophenol	SV	10	CS						21							
2,4-Dimethylphenol	SV	10	CS													
2,4-Dinitrophenol	SV	50	CS													
2,4-Dinitrotoluene	SV	10	CS													
2-Chloronaphthalene	SV	10	CS													
2-Chlorophenol	SV	10	CS													
2-Methylnaphthalene	SV	10	CS													
2-Methylphenol	SV	10	CS													
2-Nitroaniline	SV	50	CS													
2-Nitrophenol	SV	10	CS													
3,3-Dichlorobenzidine	SV	20	CS													
3-Nitroaniline	SV	50	CS													
4,6-Dinitro-2-methylphenol	SV	50	CS													

TABLE 3-1 POTENTIAL CHEMICAL-SPECIFIC ARARs/TBCs (August 1, 1991)
GROUNDWATER QUALITY STANDARDS (ug/l)

				FEDERAL STANDARDS					STATE STANDARDS (TBCs)							
									CDH WQCC Groundwater Quality Standards (d)							
									Statewide	Site-Specific (g)						
Parameter	Type (5)	PQL MDL	Method (6)	SDWA Maximum Contaminant Level (a)	SDWA Maximum Contaminant Level TBCs (b)	SDWA Maximum Contaminant Level Goal (a)	SDWA Maximum Contaminant Level Goal TBCs (b)	RCRA Subpart F Concentration Limit (40CFR264.94) (c)	Tables A & B (d)	Table 1 Human Health	Table 2 Secondary Drinking	Table 3 Agriculture	Table 4 TDS	Table 5 Chronic	Table 6 Radionuclides Woman Creek	Table 6 Radionuclides Walnut Creek
4-Bromophenyl Phenylether	SV	10	CS													
4-Chloroaniline	SV	10	CS													
4-Chlorophenyl Phenyl Ether	SV	10	CS													
4-Chloro-3-methylphenol	SV	10	CS													
4-Methylphenol	SV	10	CS													
4-Nitroaniline	SV	50	CS													
4-Nitrophenol	SV	50	CS													
Acenaphthene	SV	10	CS													
Anthracene	SV	10	CS													
Benzidine	SV		d						0.0002 (7)	0.1				0.00012		
Benzoic Acid	SV	50	CS													
Benzo(a)anthracene	SV	10	CS													
Benzo(a)pyrene	SV	10	CS													
Benzo(b)fluoranthene	SV	10	CS													
Benzo(g,h,i)perylene	SV	10	CS													
Benzo(k)fluoranthene	SV	10	CS													
Benzyl Alcohol	SV	10	CS													
bis(2-Chloroethoxy)methane	SV	10	CS													
bis(2-Chloroethyl)ether	SV	10	CS						0.03 (7)					0.0000037		
bis(2-Chloroisopropyl)ether	SV	10	CS													
bis(2-Ethylhexyl)phthalate	SV	10	CS													
Butadiene	SV															
Butylbenzylphthalate	SV	10	CS													
Chlorinated Ethers	SV															
Chlorinated Napthalenes	SV															
Chloroalkylethers	SV	10	CS													
Chlorophenol	SV									1						
Chrysene	SV	10	CS													
Dibenzofuran	SV	10	CS													

TABLE 3-1 POTENTIAL CHEMICAL-SPECIFIC ARARs/TBCs (August 1, 1991)
GROUNDWATER QUALITY STANDARDS (ug/l)

				FEDERAL STANDARDS					STATE STANDARDS (TBCs)							
									CDH WQCC Groundwater Quality Standards (d)							
									Statewide	Site-Specific (g)						
Parameter	Type (5)	PQL MDL	Method (6)	SDWA Maximum Contaminant Level (a)	SDWA Maximum Contaminant Level TBCs (b)	SDWA Maximum Contaminant Level Goal (a)	SDWA Maximum Contaminant Level Goal TBCs (b)	RCRA Subpart F Concentration Limit (40CFR264.94) (c)	Tables A & B (d)	Table 1 Human Health	Table 2 Secondary Drinking	Table 3 Agriculture	Table 4 TDS	Table 5 Chronic	Table 6 Radionuclides Woman Creek	Table 6 Radionuclides Walnut Creek
Dibenz(a,h)anthracene	SV	10	CS													
Dichlorobenzenes	SV															
Dichlorobenzidine	SV	20	CS											0.01		
Diethylphthalate	SV	10	CS													
Dimethylphthalate	SV	10	CS													
Dinitrotoluene	SV	10	CS													
Di-n-butylphthalate	SV	10	CS													
Di-n-octylphthalate	SV	10	CS													
Ethylene Glycol	SV		d						7,000							
Fluoranthene	SV	10	CS													
Fluorene	SV	10	CS													
Formaldehyde	SV															
Haloethers	SV															
Hexachlorobenzene	SV	10	CS						0.02 (7)					0.00072		
Hexachlorobutadiene	SV	10	CS						14					0.45		
Hexachlorocyclopentadiene	SV	10	CS						49							
Hexachloroethane	SV	10	CS											1.9		
Hydrazine	SV															
Indeno(1,2,3-cd)pyrene	SV	10	CS													
Isophorone	SV	10	CS						1,050							
Naphthalene	SV	10	CS													
Nitrobenzene	SV	10	CS						3.5 (7)							
Nitrophenols	SV															
Nitrosamines	SV															
Nitrosodibutylamine	SV		b											0.0064		
Nitrosodiethylamine	SV		b											0.0008		
Nitrosodimethylamine	SV		b											0.0014		
Nitrosopyrrolidine	SV		b											0.016		
N-Nitrosodiphenylamine	SV	10	CSb											4.9		

TABLE 3-1 POTENTIAL CHEMICAL-SPECIFIC ARARs/TBCs (August 1, 1991)
GROUNDWATER QUALITY STANDARDS (ug/l)

				FEDERAL STANDARDS					STATE STANDARDS (TBCs)							
									CDH WQCC Groundwater Quality Standards (d)							
									Statewide	Site-Specific (g)						
Parameter	Type (5)	PQL MDL	Method (6)	SDWA Maximum Contaminant Level (a)	SDWA Maximum Contaminant Level TBCs (b)	SDWA Maximum Contaminant Level Goal (a)	SDWA Maximum Contaminant Level Goal TBCs (b)	RCRA Subpart F Concentration Limit (40CFR264.94) (c)	Tables A & B (d)	Table 1 Human Health	Table 2 Secondary Drinking	Table 3 Agriculture	Table 4 TDS	Table 5 Chronic	Table 6 Radionuclides Woman Creek	Table 6 Radionuclides Walnut Creek
N-Nitroso-di-n-dipropylamine	SV	10	CSb													
Pentachlorinated Ethanes	SV		b													
Pentachlorobenzene	SV		b						6 (7)							
Pentachlorophenol	SV	50	CS		1 (e)		0 (e)		200							
Phenanthrene	SV	10	CS													
Phenol	SV	10	CS							1						
Phthalate Esters	SV															
Polynuclear Aromatic Hydrocarbons	SV		b											0.0028		
Vinyl Chloride	SV	10	CV	2		0			2							
1,1,1-Trichloroethane	V	5	CV	200		200			200							
1,1,2,2-Tetrachloroethane	V	5	CV											0.17		
1,1,2-Trichloroethane	V	5	CV						28							
1,1-Dichloroethane	V	5	CV											0.6		
1,1-Dichloroethene	V	5	CV	7		7			7							
1,2-Dichloroethane	V	5	CV	5		0			5							
1,2-Dichloroethene (cis)	V		a		70		70		70							
1,2-Dichloroethene (total)	V	5	CV													
1,2-Dichloroethene (trans)	V		a		100		100		70							
1,2-Dichloropropane	V	5	CV		5		0		0.56 (7)							
1,3-Dichloropropene (cis)	V	5	CV													
1,3-Dichloropropene (trans)	V	5	CV													
2-Butanone	V	10	CV													
2-Hexanone	V	10	CV													
4-Methyl-2-pentanone	V	10	CV													
Acetone	V	10	CV													
Acrylonitrile	V		c											0.058		
Benzene	V	5	CV	5		0			5							
Bromodichloromethane	V	5	CV													

TABLE 3-1 POTENTIAL CHEMICAL-SPECIFIC ARARs/TBCs (August 1, 1991)
GROUNDWATER QUALITY STANDARDS (ug/l)

				FEDERAL STANDARDS					STATE STANDARDS (TBCs)							
									CDH WQCC Groundwater Quality Standards (d)							
									Statewide	Site-Specific (g)						
Parameter	Type (5)	PQL MDL	Method (6)	SDWA Maximum Contaminant Level (a)	SDWA Maximum Contaminant Level TBCs (b)	SDWA Maximum Contaminant Level Goal (a)	SDWA Maximum Contaminant Level Goal TBCs (b)	RCRA Subpart F Concentration Limit (40CFR264.94) (c)	Tables A & B (d)	Table 1 Human Health	Table 2 Secondary Drinking	Table 3 Agriculture	Table 4 TDS	Table 5 Chronic	Table 6 Radionuclides Woman Creek	Table 6 Radionuclides Walnut Creek
Bromoform	V	5	CV													
Bromomethane	V	10	CV													
Carbon Disulfide	V	5	CV													
Carbon Tetrachloride	V	5	CV	5		0			5							
Chlorinated Benzenes	V	10	CV/CS													
Chlorobenzene	V	5	CV/CS		100		100		300							
Chloroethane	V	10	CV													
Chloroform	V	5	CV	Tot THM <100**					Tot THM <100**					0.19		
Chloromethane	V	10	CV													
Dibromochloromethane	V	5	CV													
Dichloroethenes	V															
Ethyl Benzene	V	5	CV		700		700		680							
Ethylene Dibromide	V		d		0.05		0		0.0004							
Ethylene Oxide	V															
Halomethanes	V			100					100					0.19		
Methylene Chloride	V	5	CV													
Pyrene	V	10	CS													
Styrene	V	5	CV		100		100									
Tetrachloroethanes	V	5	CV													
Tetrachloroethene	V	5	CV		5		0		10					0.8		
Toluene	V	5	CV		1,000		1,000		2,420							
Trichloroethanes	V	5	CV													
Trichloroethene	V	5	CV	5		0			5							
Vinyl Acetate	V	10	CV													
Xylenes (total)	V	5	CV		10,000		10,000									

EXPLANATION OF TABLE

* = secondary maximum contaminant level; TBCs
** = total trihalomethanes: chloroform, bromoform, bromodichloromethane, dibromochloromethane

CDH = Colorado Department of Health
CLP = Contract Laboratory Program
EPA = Environmental Protection Agency
pCi/l = picocuries per liter
PCB = polychlorinated biphenyl
PQL = Practical Quantitation Limit
RCRA = Resource Conservation and Recovery Act
SDWA = Safe Drinking Water Act
TAL = Target Analyte List
THM = Total Trihalomethanes
TIC = Tentatively Identified Compound
MDL = Minimum Detection Limit for radionuclides (pCi/l)
ug/l = micrograms per liter
VOA = Volatile Organic Analysis
WQCC = Water Quality Control Commission

(1) TDS standard - see Table 4 in (d); standard is 400 mg/l or 1.25 times the background level, whichever is least restrictive
(2) radionuclide standards - see sec. 3.11.5(c)2 in (d)
(3) If both strontium-90 and tritium are present, the sum of their annual dose equivalents to bone marrow shall not exceed 4 mrem/yr.
(4) MDL for Radium 226 is 0.5; MDL for radium 228 is 1
(5) type abbreviations are: A=anion; B=bacteria; C=cation; D=dioxin; E=element; FP=field parameter; I=indicator; M=metal; P=pesticide; PP=pesticide/PCB; R=radionuclide; SV=semi-volatile; V=volatile
(6) method abbreviations are: CT=CLP-TAL; NC=non-CLP; CV=CLP-VOA; CS=CLP-SEMI; EP=EPA-PEST; CP=CLP-PEST; E=EPA; a = detected as total in CV; b = detected as TICs in CS; c = detected as TIC in CV; d = not routinely monitored; e = monitored in discharge ponds; f = mixture-individual isomers detected.
(7) Standard is below (more stringent than) PQL, therefore PQL is standard.

(a) EPA National Primary and Secondary Drinking Water Regulations, 40 CFR 141 and 40 CFR 143 (as of 5/1990)
(b) EPA National Primary and Secondary Drinking Water Regulations, 40 CFR Parts 141, 142, 143, Final Rule, Effective July 30, 1992 (56 Federal Register 3526; 1/30/1991)
(c) NCP, 40 CFR 300; NCP Preamble 55 FR 8764; CERCLA Compliance with Other Laws Manual, EPA/540/G-89/006, August 1988
(d) CDH/Water Quality Control Commission, The Basic Standards for Ground Water, 3.11.0 (5 CCR 1002-8) 1/5/1987 amended 9/11/1990
(e) EPA National Primary and Secondary Drinking Water Regulations, 40 CFR Parts 141, 142, 143, Final Rule, Effective January 1, 1993 (56 FR 30266; 7/1/1991)
(f) EPA Maximum Contaminant Level Goals and National Primary Drinking Water Regulations for Lead and Copper, 40 CFR 141 and 142 (56 FR 26460; 6/7/91) effective 11/6/91.
(g) CDH/Water Quality Control Commission, Classifications and Water Quality Standards for Ground Water, 3.12.0 (3/5/1991).

TABLE 3-2 POTENTIAL CHEMICAL-SPECIFIC ARARs/TBCs (August 1, 1991)
FEDERAL SURFACE WATER QUALITY STANDARDS (ug/l)

Parameter	Type (7)	PQL MDL	Method (8)	SDWA Maximum Contaminant Level (a)	SDWA Maximum Contaminant Level TBCs (b)	SDWA Maximum Contaminant Level Goal (a)	SDWA Maximum Contaminant Level Goal TBCs (b)	CWA AWQC for Protection of Aquatic Life/TBCs (c)		CWA AWQC for Protection of Human Health/TBCs (c)	
								Acute Value	Chronic Value	Water and Fish Ingestion	Fish Consumption Only
Bicarbonate	A	10	E310.1								
Carbonate	A	10	E310.1								
Chloride	A	5	E325	250,000*				860,000(e)	230,000(e)		
Chlorine	A	1000	E4500					19	11		
Flouride	A	5	E340	4,000; 2,000*		4,000					4,000
N as Nitrate	A	5	E353.1	10,000			10,000			10,000	
N as Nitrate+Nitrite	A	5	E353.1		10,000		10,000				
N as Nitrite	A	5	E354.1		1,000		1,000				
Sulfate	A	5	E375.4	250,000*							
Sulfide	A										
Coliform (Fecal)	B	1	SM9221C	1/100 ml							
Ammonia as N	C	5	E350					Criteria are pH	and temperature	dependent - see	criteria document
Dioxin	D		d					0.01	0.00001	0.000000013	0.000000014
Sulfur	E	100,000	E600								
Dissolved Oxygen	FP	0.5	SM4500					5,000			
pH	FP	0.1	E150.1	6.5-8.5 *					6.5-9		
Specific Conductance	FP	1	E120.1								
Temperature	FP							SS	SS		
Boron	I	5	E6010								
Total Dissolved Solids	I	10	E160.1	500,000*				SS	SS	250,000	
Aluminum	M	200	CT		50 to 200*			750	87		
Antimony	M	60	CT					9,000	1,600	146	45,000
Arsenic	M	10	CT	50						.0022	.0175
Arsenic III	M							360	190		
Arsenic V	M							850	48		
Barium	M	200	CT	1,000	2,000 (f)		2,000 (f)			1,000	
Beryllium	M	5	CT					130	5.3	.0068**	.117**
Cadmium	M	5	CT	10	5		5	3.9 (3)	1.1 (3)	10	

TABLE 3-2 POTENTIAL CHEMICAL-SPECIFIC ARARs/TBCs (August 1, 1991)
FEDERAL SURFACE WATER QUALITY STANDARDS (ug/l)

Parameter	Type (7)	PQL MDL	Method (8)	SDWA Maximum Contaminant Level (a)	SDWA Maximum Contaminant Level TBCs (b)	SDWA Maximum Contaminant Level Goal (a)	SDWA Maximum Contaminant Level Goal TBCs (b)	CWA AWQC for Protection of Aquatic Life/TBCs (c)		CWA AWQC for Protection of Human Health/TBCs (c)	
								Acute Value	Chronic Value	Water and Fish Ingestion	Fish Consumption Only
Calcium	M	5,000	CT								
Cesium	M	1,000	NC								
Chromium	M	10	CT	50	100		100				
Chromium III	M	5	SW8467196					1,700	210	170,000	3,433,000
Chromium VI	M	10	E218.5					16	11	50	
Cobalt	M	50	CT								
Copper	M	25	CT	1,000*			1,300 (f)	18 (3)	12 (3)		
Cyanide	M	10	CT					22	5.2	200	
Iron	M	100	CT	300 *					1,000	300	
Lead	M	5	CT	50			0 (g)	82 (3)	3.2 (3)	50	
Lithium	M	100	NC								
Magnesium	M	5000	CT								
Manganese	M	15	CT	50 *						50	100
Mercury	M	0.2	CT	2	2		2	2.4	0.012	0.144	0.146
Molybdenum	M	200	NC								
Nickel	M	40	CT					1,400 (3)	160 (3)	13.4	100
Potassium	M	5000	CT								
Selenium	M	5	CT	10	50		50	20 (d)	5 (d)	10	
Silver	M	10	CT	50	100 *			4.1 (3)	0.12	50	
Sodium	M	5000	CT								
Strontium	M	200	NC								
Thallium	M	10	CT					1,400 (1)	40 (1)	13	48
Tin	M	200	NC								
Titanium	M	10	E6010								
Tungsten	M	10	E6010								
Vanadium	M	50	CT								
Zinc	M	20	CT	5,000 *				120 (3)	110 (3)		
2,4,5-TP Silvex	P		d	10	50		50				
2,4-Dichlorophenoxyacetic Acid (2,4-D)	P		d	100	70		70				

TABLE 3-2 POTENTIAL CHEMICAL-SPECIFIC ARARs/TBCs (August 1, 1991)
FEDERAL SURFACE WATER QUALITY STANDARDS (ug/l)

Parameter	Type (7)	PQL MDL	Method (8)	SDWA Maximum Contaminant Level (a)	SDWA Maximum Contaminant Level TBCs (b)	SDWA Maximum Contaminant Level Goal (a)	SDWA Maximum Contaminant Level Goal TBCs (b)	CWA AWQC for Protection of Aquatic Life/TBCs (c)		CWA AWQC for Protection of Human Health/TBCs (c)	
								Acute Value	Chronic Value	Water and Fish Ingestion	Fish Consumption Only
Aldicarb	P				3 (f)		1 (f)				
Aldrin	P	0.05	CP					3.0		0.000074	0.000079
Bromacil	P										
Carbofuran	P		d		40		40				
Chloranil											
Chlordane (Alpha)	P	0.5	CP		2		0	2.4	0.0043	0.00046	0.00048
Chlordane (Gamma)	P	0.5	CP		2		0	2.4	0.0043	0.00046	0.00048
Chlorpyrifos	P		E619					0.063	0.041		
DDT	P	0.1	CP					1.1	0.0011	0.000024	0.000024
DDT metabolite (DDD)	P	0.1	CP					0.06			
DDT metabolite (DDE)	P	0.1	CP					1,050			
Demeton	P								0.1		
Diazinon	P										
Dieldrin	P	0.1	CP					2.5	0.0019	0.00007	0.000076
Endosulfan I	P	0.05	CP					0.22	0.056	74	159
Endosulfan II	P	0.1	CP								
Endosulfan Sulfate	P	0.1	CP								
Endrin	P	0.1	CP	0.2				0.18	0.0023	1	
Endrin Ketone	P	0.1	CP								
Guthion	P								0.01		
Heptachlor	P	0.05	CP		0.4		0	0.52	0.0038	0.00028	0.00029
Heptachlor Epoxide	P	0.05	CP		0.2		0				
Hexachlorocyclohexane, Alpha	P	0.05	CP							0.0092	0.031
Hexachlorocyclohexane, Beta	P	0.05	CP							0.0163	0.0547
Hexachlorocyclohexane, Delta	P	0.05	CP								
Hexachlorocyclohexane, Technical	P		f							0.0123	0.0414
Hexachlorocyclohexane, (Lindane) Gama	P	0.05	CP	4	0.2		0.2	2.0	0.08		
Malathion	P								0.01		
Methoxychlor	P	0.5	CP	100	40		40		0.03	100	
Mirex	P								0.001		

TABLE 3-2 POTENTIAL CHEMICAL-SPECIFIC ARARs/TBCs (August 1, 1991)
FEDERAL SURFACE WATER QUALITY STANDARDS (ug/l)

Parameter	Type (7)	PQL MDL	Method (8)	SDWA Maximum Contaminant Level (a)	SDWA Maximum Contaminant Level TBCs (b)	SDWA Maximum Contaminant Level Goal (a)	SDWA Maximum Contaminant Level Goal TBCs (b)	CWA AWQC for Protection of Aquatic Life/TBCs (c)		CWA AWQC for Protection of Human Health/TBCs (c)	
								Acute Value	Chronic Value	Water and Fish Ingestion	Fish Consumption Only
Parathion	P							0.065	0.013		
PCBs	P	0.5	CP		0.5		0	2.0	0.014	0.000079	0.000079
Simazine	P		c								
Toxaphene	P	1	CP		3		0	0.73	0.0002	0.0071	0.00073
Vaponite 2	P										
Aroclor 1016	PP	0.5	CP								
Aroclor 1221	PP	0.5	CP								
Aroclor 1232	PP	0.5	CP								
Aroclor 1242	PP	0.5	CP								
Aroclor 1248	PP	0.5	CP								
Aroclor 1254	PP	1	CP								
Aroclor 1260	PP	1	CP								
Atrazine	PP		e		3		3				
Americium (pCi/l)	R										
Americium 241 (pCi/l)	R	0.01									
Cesium 134 (pCi/l)	R	1									
Cesium 137 (pCi/l)	R	1									
Gross Alpha (pCi/l)	R	2		15							15
Gross Beta (pCi/l)	R	4		50 (4 mrem/yr)							
Plutonium (pCi/l)	R										
Plutonium 238+239+240 (pCi/l)	R	0.01									
Radium 226+228 (pCi/l)	R	0.5/0.1 (9)		5							5
Strontium 89+90 (pCi/l)	R	1									
Strontium 90 (pCi/l)	R			8 (6)							8
Thorium 230+232 (pCi/l)	R										
Tritium (pCi/l)	R			20,000 (6)							
Uranium 233+234 (pCi/l)	R										
Uranium 235 (pCi/l)	R	0.6									
Uranium 238 (pCi/l)	R	0.6									

TABLE 3-2 POTENTIAL CHEMICAL-SPECIFIC ARARs/TBCs (August 1, 1991)
FEDERAL SURFACE WATER QUALITY STANDARDS (ug/l)

Parameter	Type (7)	PQL MDL	Method (8)	SDWA Maximum Contaminant Level (a)	SDWA Maximum Contaminant Level TBCs (b)	SDWA Maximum Contaminant Level Goal (a)	SDWA Maximum Contaminant Level Goal TBCs (b)	CWA AWQC for Protection of Aquatic Life/TBCs (c)		CWA AWQC for Protection of Human Health/TBCs (c)	
								Acute Value	Chronic Value	Water and Fish Ingestion	Fish Consumption Only
Uranium (total) (pCi/l)	R										
1,2,4,5-Tetrachlorobenzene	SV		b							38	48
1,2,4-Trichlorobenzene	SV	10	CS								
1,2-Dichlorobenzene (Ortho)	SV	10	CS		600		600				
1,2-Diphenylhydrazine	SV		b					270 (1)			
1,3-Dichlorobenzene (Meta)	SV	10	CS								
1,4-Dichlorobenzene (Para)	SV	10	CS	75		75					
2,4,5-Trichlorophenol	SV	50	CS							2,800	
2,4,6-Trichlorophenol	SV	10	CS						970 (1)	1.2 **	3.6 **
2,4-Dichlorophenol	SV	10	CS					2,020 (1)	365 (1)	3,090	
2,4-Dimethylphenol	SV	10	CS					2,120 (1)			
2,4-Dinitrophenol	SV	50	CS								
2,4-Dinitrotoluene	SV	10	CS							0.11 **	9.1 **
2-Chloronaphthalene	SV	10	CS								
2-Chlorophenol	SV	10	CS					4,360 (1)	2,000 (1)		
2-Methylnaphthalene	SV	10	CS								
2-Methylphenol	SV	10	CS								
2-Nitroaniline	SV	50	CS								
2-Nitrophenol	SV	10	CS								
3,3-Dichlorobenzidine	SV	20	CS							0.01	0.02
3-Nitroaniline	SV	50	CS								
4,6-Dinitro-2-methylphenol	SV	50	CS								
4-Bromophenyl Phenylether	SV	10	CS								
4-Chloroaniline	SV	10	CS								
4-Chlorophenyl Phenyl Ether	SV	10	CS								
4-Chloro-3-methylphenol	SV	10	CS					30 (1)			
4-Methylphenol	SV	10	CS								
4-Nitroaniline	SV	50	CS								
4-Nitrophenol	SV	50	CS					230 (1)	150 (1)		

TABLE 3-2 POTENTIAL CHEMICAL-SPECIFIC ARARs/TBCs (August 1, 1991)
FEDERAL SURFACE WATER QUALITY STANDARDS (ug/l)

Parameter	Type (7)	PQL MDL	Method (8)	SDWA Maximum Contaminant Level (a)	SDWA Maximum Contaminant Level TBCs (b)	SDWA Maximum Contaminant Level Goal (a)	SDWA Maximum Contaminant Level Goal TBCs (b)	CWA AWQC for Protection of Aquatic Life/TBCs (c)		CWA AWQC for Protection of Human Health/TBCs (c)	
								Acute Value	Chronic Value	Water and Fish Ingestion	Fish Consumption Only
Acenaphthene	SV	10	CS					1,700 (1)	520 (1)		
Anthracene	SV	10	CS								
Benzidine	SV		d					2,500		0.00012	0.00053
Benzoic Acid	SV	50	CS								
Benzo(a)anthracene	SV	10	CS								
Benzo(a)pyrene	SV	10	CS								
Benzo(b)fluoranthene	SV	10	CS								
Benzo(g,h,i)perylene	SV	10	CS								
Benzo(k)fluoranthene	SV	10	CS								
Benzyl Alcohol	SV	10	CS								
bis(2-Chloroethoxy)methane	SV	10	CS								
bis(2-Chloroethyl)ether	SV	10	CS							0.03**	1.36 **
bis(2-Chloroisopropyl)ether	SV	10	CS							34.7	4,360
bis(2-Ethylhexyl)phthalate	SV	10	CS							15,000	50,000
Butadiene	SV										
Butylbenzylphthalate	SV	10	CS								
Chlorinated Ethers	SV										
Chlorinated Napthalenes	SV							1,600 (1)			
Chloroalkylethers	SV	10	CS					238,000 (1)			
Chlorophenol	SV										
Chrysene	SV	10	CS								
Dibenzofuran	SV	10	CS								
Dibenz(a,h)anthracene	SV	10	CS								
Dichlorobenzenes	SV							1,120 (1)	763 (1)	400	2,600
Dichlorobenzidine	SV	20	CS							0.01	0.02
Diethylphthalate	SV	10	CS							350,000	1,800,000
Dimethylphthalate	SV	10	CS							313,000	2,900,000
Dinitrotoluene	SV	10	CS					330 (1)	230 (1)	70	14,300
Di-n-butylphthalate	SV	10	CS								
Di-n-octylphthalate	SV	10	CS								

TABLE 3-2 POTENTIAL CHEMICAL-SPECIFIC ARARs/TBCs (August 1, 1991)
FEDERAL SURFACE WATER QUALITY STANDARDS (ug/l)

Parameter	Type (7)	PQL MDL	Method (8)	SDWA Maximum Contaminant Level (a)	SDWA Maximum Contaminant Level TBCs (b)	SDWA Maximum Contaminant Level Goal (a)	SDWA Maximum Contaminant Level Goal TBCs (b)	CWA AWQC for Protection of Aquatic Life/TBCs (c)		CWA AWQC for Protection of Human Health/TBCs (c)	
								Acute Value	Chronic Value	Water and Fish Ingestion	Fish Consumption Only
Ethylene Glycol	SV		d								
Fluoranthene	SV	10	CS					3,980 (1)		42	54
Fluorene	SV	10	CS								
Formaldehyde	SV										
Haloethers	SV							380 (1)	122 (1)		
Hexachlorobenzene	SV	10	CS							0.00072**	0.00074**
Hexachlorobutadiene	SV	10	CS					90 (1)	9.3 (1)	0.45**	50 **
Hexachlorocyclopentadiene	SV	10	CS					7 (1)	5.2 (1)	206	
Hexachloroethane	SV	10	CS					980 (1)	540 (1)	1.9	8.74
Hydrazine	SV										
Indeno(1,2,3-cd)pyrene	SV	10	CS								
Isophorone	SV	10	CS					117,000 (1)		5,200	520,000
Naphthalene	SV	10	CS					2,300 (1)	620 (1)		
Nitrobenzene	SV	10	CS					27,000 (1)		19,800	
Nitrophenols	SV							230 (1)	150 (1)		
Nitrosamines	SV							5,850 (1)			
Nitrosodibutylamine	SV		b							0.0064	0.587
Nitrosodiethylamine	SV		b							0.0008	1.24
Nitrosodimethylamine	SV		b							0.0014	16
Nitrosopyrrolidine	SV		b							0.016	91.9
N-Nitrosodiphenylamine	SV	10	b							4.9 **	16.1 **
N-Nitroso-di-n-dipropylamine	SV	10	b								
Pentachlorinated Ethanes	SV		b					7,240 (1)	1,100 (1)		
Pentachlorobenzene	SV		b							74	85
Pentachlorophenol	SV	50	CS		1 (f)		0 (f)	20 (4)	13 (4)	1,010	
Phenanthrene	SV	10	CS								
Phenol	SV	10	CS					10,200 (1)	2,560 (1)	3,500	
Phthalate Esters	SV		e					940 (1)	3 (1)		
Polynuclear Aromatic Hydrocarbons	SV		b							0.0028**	0.0311**
Vinyl Chloride	SV	10	CV	2		0				2 **	525 **

TABLE 3-2 POTENTIAL CHEMICAL-SPECIFIC ARARs/TBCs (August 1, 1991)
FEDERAL SURFACE WATER QUALITY STANDARDS (ug/l)

Parameter	Type (7)	PQL MDL	Method (8)	SDWA Maximum Contaminant Level (a)	SDWA Maximum Contaminant Level TBCs (b)	SDWA Maximum Contaminant Level Goal (a)	SDWA Maximum Contaminant Level Goal TBCs (b)	CWA AWQC for Protection of Aquatic Life/TBCs (c)		CWA AWQC for Protection of Human Health/TBCs (c)	
								Acute Value	Chronic Value	Water and Fish Ingestion	Fish Consumption Only
1,1,1-Trichloroethane	V	5	CV	200		200				18,400	1,030,000
1,1,2,2-Tetrachloroethane	V	5	CV						2,400	0.17**	10.7 **
1,1,2-Trichloroethane	V	5	CV						9,400	0.6**	41.8 **
1,1-Dichloroethane	V	5	CV								
1,1-Dichloroethene	V	5	CV	7		7					
1,2-Dichloroethane	V	5	CV	5		0		118,000	20,000	0.94**	243 **
1,2-Dichloroethene (cis)	V		a		70		70				
1,2-Dichloroethene (total)	V	5	CV								
1,2-Dichloroethene (trans)	V		a		100		100				
1,2-Dichloropropane	V	5	CV		5		0	23,000	5,700		
1,3-Dichloropropene (cis)	V	5	CV					6,060	244 (1)	87	14,100
1,3-Dichloropropene (trans)	V	5	CV					6,060	244 (1)	87	14,100
2-Butanone	V	10	CV								
2-Hexanone	V	10	CV								
4-Methyl-2-pentanone	V	10	CV								
Acetone	V	10	CV								
Acrylonitrile	V		c					7,500	2,600	0.058	0.65
Benzene	V	5	CV	5		0		5,300		0.66**	40 **
Bromodichloromethane	V	5	CV								
Bromoform	V	5	CV								
Bromomethane	V	10	CV								
Carbon Disulfide	V	5	CV								
Carbon Tetrachloride	V	5	CV	5		0		35,200 (1)		0.4**	6.94 **
Chlorinated Benzenes	V	10	CV/CS					250 (1)	50 (1)		
Chlorobenzene	V	5	CV/CS		100		100				
Chloroethane	V	10	CV								
Chloroform	V	5	CV	Tot THM<100 (2)				28,900 (1)	1,240 (4)	0.19 **	15.7 **
Chloromethane	V	10	CV								
Dibromochloromethane	V	5	CV								

TABLE 3-2 POTENTIAL CHEMICAL-SPECIFIC ARARs/TBCs (August 1, 1991)
FEDERAL SURFACE WATER QUALITY STANDARDS (ug/l)

Parameter	Type (7)	PQL MDL	Method (8)	SDWA Maximum Contaminant Level (a)	SDWA Maximum Contaminant Level TBCs (b)	SDWA Maximum Contaminant Level Goal (a)	SDWA Maximum Contaminant Level Goal TBCs (b)	CWA AWQC for Protection of Aquatic Life/TBCs (c)		CWA AWQC for Protection of Human Health/TBCs (c)	
								Acute Value	Chronic Value	Water and Fish Ingestion	Fish Consumption Only
Dichloroethenes	V							11,600 (1)		0.033**	1.85 **
Ethyl Benzene	V	5	CV		700		700	32,000 (1)		1,400	3,280
Ethylene Dibromide	V		d		0.05		0				
Ethylene Oxide	V										
Halomethanes	V			100				11,000 (1)		0.19**	15.7 **
Methylene Chloride	V	5	CV								
Pyrene	V	10	CS								
Styrene	V	5	CV		100		100				
Tetrachloroethanes	V	5	CV					9,320 (1)			
Tetrachloroethene	V	5	CV		5		0	5,280 (1)	840 (1)	0.80**	8.85 **
Toluene	V	5	CV		1,000		1,000	17,500 (1)		14,300	424,000
Trichloroethanes	V	5	CV					18,000 (1)			
Trichloroethene	V	5	CV	5		0		45,000 (1)	21,900 (1)	2.7 **	80.7 **
Vinyl Acetate	V	10	CV								
Xylenes (total)	V	5	CV		10,000		10,000				

EXPLANATION OF TABLE

* = secondary maximum contaminant level, TBCs
** = Human health criteria for carcinogens reported for three risk levels. Value presented is the 10-5 risk level.

AWQC = Ambient Water Quality Criteria
CLP = Contract Laboratory Program
CWA = Clean Water Act
EPA = Environmental Protection Agency
pCi/l = picocuries per liter
PCB = polychlorinated biphenyl
PQL = Practical Quantitation Level
SDWA = Safe Drinking Water Act
SS = Species Specific

TAL = Target Analyte List
THM = Total Trihalomethanes
TIC = Tentatively Identified Compound
MDL = Minimum Detection Limit for radionuclides (pCi/l)
ug/l = *micrograms per liter*
VOA = Volatile Organic Analysis

(1) criteria not developed; value presented is lowest observed effects level (LOEL)
(2) total trihalomethanes: chloroform, bromoform, bromodichloromethane, dibromochloromethane
(3) hardness dependent criteria
(4) pH dependent criteria (7.8 pH used)
(5) standard is not adequately protective when chloride is associated with potassium, calcium, or magnesium, rather than sodium.
(6) if both strontium-90 and tritium are present, the sum of their annual dose equivalents to bone marrow shall not exceed 4 mrem/yr.
(7) type abbreviations are: A=anion; B=bacteria; C=cation; D=dioxin; E=element; I=indicator; FP=field parameter; M=metal; P=pesticide; PP=pesticide/PCB; R=radionuclide; SV=semi-volatile; V=volatile
(8) method abbreviations are: CT=CLP-TAL; NC=non-CLP; CV=CLP-VOA; CS=CLP-SEMI; EP=EPA-PEST; CP=CLP-PEST; E=EPA; a = detected as total in CV; b = detected as TIC in CS; c = detected as TIC in CV; d = not routinely monitored; e = monitored in discharge ponds; f = mixture-individual isomers detected.
(9) MDL for radium 226 is 0.5; MDL for radium 228 is 1.0
(10) Value for gross alpha excludes uranium

(a) EPA National Primary and Secondary Drinking Water Regulations, 40 CFR 141 and 40 CFR 143 (as of May 1990)
(b) EPA National Primary and Secondary Drinking Water Regulations, 40 CFR Parts 141, 142 and 143, Final Rule, effective July 30, 1992
(c) EPA, Quality Criteria for Protection of Aquatic Life, 1986
(d) EPA, National Ambient Water Quality Criteria for Selenium - 1987
(e) EPA, National Ambient Water Quality Criteria for Chloride - 1988
(f) EPA National Primary and Secondary Drinking Water Regulations, 40 CFR Parts 141, 142, and 143, Final Rule (56 FR 30266; 7/1/1991) effective 1/1/1993.
(g) EPA Maximum Contaminant Level Goals and National Primary Drinking Water Regulations for Lead and Copper, 40 CFR 141 and 142 (56 FR 26460; 6/7/1991) effective 11/6/1991.

TABLE 3-3 POTENTIAL CHEMICAL-SPECIFIC ARARs/TBCs (August 1, 1991)
STATE (CDH/WQCC) SURFACE WATER QUALITY STANDARDS (ug/l)

				Statewide Standards (a)							Basin Standards (b)		Segment 4 & 5 Stream Classification and Water Quality Standards (b)(7)						
				Tables A,B Carcinogens/ Noncarcin-ogens (2)	Table C Aquatic Life		Tables I,II,III (1) Aquatic Life				Organics (12)		Tables A,B (2)	Table C Fish & Water Ingestion	Table D Radio-nuclide	Stream Segment Table (8)		Table 2 Radionuclides	
Parameter	Type (10)	PQL MDL	Method (11)		Acute Value	Chronic Value	Acute Value (2)	Chronic Value (2)	Agricul-tural Standard (3)	Domestic Water Supply (6)	Aquatic Life	Water Supply				Acute Value	Chronic Value	Woman Creek	Walnut Creek
Bicarbonate	A	10	E310.1																
Carbonate	A	10	E310.1																
Chloride	A	5	E325							250,000						3	3		
Chlorine	A				3	3										3	3		
Fluoride	A	5	E340							2,000									
N as Nitrate	A	5	E353.1						100,000	10,000						10,000	10,000		
N as Nitrate+Nitrite	A	5	E353.1						100,000	10,000									
N as Nitrite	A	5	E354.1				SS	SS	10,000	1,000						1,000	1,000		
Sulfate	A	5	E375.4							250,000						250,000	250,000		
Sulfide	A							2		50									
Coliform (Fecal)	B	1	SM9221C							2000/100 ml									
Ammonia as N	C	5	E350				620	60		5,000						620	60		
Dioxin	D		d	0.00000022 (13)	0.01	0.00001							0.00000022 (13)	0.000000013			0.000000013		
Sulfur	E	100,000	E600													2.0	2.0		
Dissolved Oxygen	FP	0.5	SM4500				5,000	5,000	3,000	3,000						5,000	5,000		
pH	FP	0.1	E150.1				6.5-9.0	6.5-9.0		5.0-9.0						6.5-9	6.5-9		
Specific Conductance	FP	1	E120.1																
Temperature	FP						30 degrees	30 degrees											
Boron	I	5	E6010						750							750	750		
Total Dissolved Solids	I	10	E160.1																
Aluminum	M	200	CT				950	150											
Antimony	M	60	CT																
Arsenic	M	10	CT				360	150	100	50						50			
Arsenic III	M																		
Arsenic V	M																		
Barium	M	200	CT							1,000									
Beryllium	M	5	CT						100										

TABLE 3-3 POTENTIAL CHEMICAL-SPECIFIC ARARs/TBCs (August 1, 1991)
STATE (CDH/WQCC) SURFACE WATER QUALITY STANDARDS (ug/l)

				Statewide Standards (a)							Basin Standards (b)		Segment 4 & 5 Stream Classification and Water Quality Standards (b)(7)						
				Tables A,B Carcinogens/ Noncarcin-ogens (2)	Table C Aquatic Life		Tables I,II,III (1) Aquatic Life				Organics (12)		Tables A,B (2)	Table C Fish & Water Ingestion	Table D Radio-nuclide	Stream Segment Table (8)		Table 2 Radionuclides	
Parameter	Type (10)	PQL MDL	Method (11)		Acute Value	Chronic Value	Acute Value (2)	Chronic Value (2)	Agricul-tural Standard (3)	Domestic Water Supply (6)	Aquatic Life	Water Supply				Acute Value	Chronic Value	Woman Creek	Walnut Creek
Cadmium	M	5	CT				TVS	TVS	10	10						TVS	TVS		
Calcium	M	5,000	CT																
Cesium	M	1,000	NC																
Chromium	M	10	CT																
Chromium III	M	5	SW8467196				TVS	TVS	100	50						50			
Chromium VI	M	10	E218.5				16	11	100	50						TVS	TVS		
Cobalt	M	50	CT																
Copper	M	25	CT				TVS	TVS	200							TVS	TVS		
Cyanide	M	10	CT				5	5	200	1,000						5	5		
Iron	M	100	CT					1,000		300 (dis)							300 (5)		
Lead	M	5	CT				TVS	TVS	100	50						TVS	TVS		
Lithium	M	100	NC																
Magnesium	M	5000	CT																
Manganese	M	15	CT					1,000	200	50 (dis)							50 (5)		
Mercury	M	0.2	CT				2.4	0.1		2.0							0.01		
Molybdenum	M	200	NC																
Nickel	M	40	CT				TVS	TVS	200							TVS	TVS		
Potassium	M	5000	CT																
Selenium	M	5	CT				135	17	20	10						10			
Silver	M	10	CT				TVS	TVS		50						TVS	TVS		
Sodium	M	5000	CT																
Strontium	M	200	NC																
Thallium	M	10	CT					15											
Tin	M	200	NC																
Titanium	M	10	E6010																
Tungsten	M	10	E6010																
Vanadium	M	50	CT																
Zinc	M	20	CT				TVS	TVS	2,000	5,000						TVS	TVS		
2,4,5-TP Silvex	P		d	10									10						

TABLE 3-3 POTENTIAL CHEMICAL-SPECIFIC ARARs/TBCs (August 1, 1991)
STATE (CDH/WQCC) SURFACE WATER QUALITY STANDARDS (ug/l)

				Statewide Standards (a)							Basin Standards (b)		Segment 4 & 5 Stream Classification and Water Quality Standards (b)(7)						
				Tables A,B Carcinogens/ Noncarcin-ogens (2)	Table C Aquatic Life		Tables I,II,III (1) Aquatic Life				Organics (12)		Tables A,B (2)	Table C Fish & Water Ingestion	Table D Radio-nuclide	Stream Segment Table (8)		Table 2 Radionuclides	
Parameter	Type (10)	PQL MDL	Method (11)		Acute Value	Chronic Value	Acute Value (2)	Chronic Value (2)	Agricul-tural Standard (3)	Domestic Water Supply (6)	Aquatic Life	Water Supply				Acute Value	Chronic Value	Woman Creek	Walnut Creek
2,4-D	P		d	100								100	100						
Aldicarb	P			10									10						
Aldrin	P	0.05	CP	0.002 (13)	3						0.003		0.002 (13)	0.000074			0.000074		
Bromacil	P																		
Carbofuran	P		d	36									36						
Chloranil	P																		
Chlordane (alpha)	P	0.5	CP	0.03 (13)	2.4	0.0043							0.03 (13)	0.00046			0.00046		
Chlordane (gamma)	P	0.5	CP	0.03 (13)	2.4	0.0043							0.03 (13)	0.00046			0.00046		
Chlorpyrifos	P				0.083	0.041													
DDT	P	0.1	CP	0.1 (13)	1.1	0.001					0.001		0.1 (13)	0.000024			0.000024		
DDT metabolite (DDD)	P	0.1	CP		0.6						0.001								
DDT metabolite (DDE)	P	0.1	CP		1,050						0.001								
Demeton	P					0.1					0.1								
Diazinon	P																		
Dieldrin	P	0.1	CP	0.002 (13)	2.5	0.0019					0.003		0.002 (13)	0.000071			0.000071		
Endosulfan I	P	0.05	CP		0.22	0.056					0.003								
Endosulfan II	P	0.1	CP																
Endosulfan Sulfate	P	0.1	CP																
Endrin	P	0.1	CP	0.2	0.18	0.0023					0.004		0.2						
Endrin Ketone	P	0.1	CP																
Guthion	P					0.01					0.01								
Heptachlor	P	0.05	CP	0.008 (13)	0.52	0.0038					0.001	0.2	0.008 (13)	0.00028			0.00028		
Heptachlor epoxide	P	0.05	CP	0.004 (13)									0.004 (13)						
Hexachlorocyclohexane, Alpha	P	0.05	CP											0.0092			0.0092		
Hexachlorocyclohexane, Beta	P	0.05	CP											0.0163			0.0163		
Hexachlorocyclohexane, Delta	P	0.05	CP																
Hexachlorocyclohexane, Tech.	P		f											0.0123			0.0123		
Hexachlorocyclohexane, Lindane	P	0.05	CP	4	2.0	0.08					0.01	4.0	4	0.0186			0.0186		
Malathion	P					0.1					0.1								
Methoxychlor	P	0.5	CP	100		0.03					0.03	100	100						

TABLE 3-3 POTENTIAL CHEMICAL-SPECIFIC ARARs/TBCs (August 1, 1991)
STATE (CDH/WQCC) SURFACE WATER QUALITY STANDARDS (ug/l)

				Statewide Standards (a)							Basin Standards (b)		Segment 4 & 5 Stream Classification and Water Quality Standards (b)(7)						
				Tables A,B Carcinogens/ Noncarcin-ogens (2)	Table C Aquatic Life		Tables I,II,III (1) Aquatic Life				Organics (12)		Tables A,B (2)	Table C Fish & Water Ingestion	Table D Radio-nuclide	Stream Segment Table (8)		Table 2 Radionuclides	
Parameter	Type (10)	PQL MDL	Method (11)		Acute Value	Chronic Value	Acute Value (2)	Chronic Value (2)	Agricul-tural Standard (3)	Domestic Water Supply (6)	Aquatic Life	Water Supply				Acute Value	Chronic Value	Woman Creek	Walnut Creek
Mirex	P					620					0.001								
Parathion	P					0.013					0.04								
PCBs	P	0.5	CP	0.005 (13)	2.0	0.014					0.001		0.005 (13)	0.000079			0.000079		
Simazine	P		e											4			4		
Toxaphene	P	1	CP	5	0.73	0.0002					0.005	5.0	5						
Vaponite 2	P																		
Aroclor 1016	PP	0.5	CP																
Aroclor 1221	PP	0.5	CP																
Aroclor 1232	PP	0.5	CP																
Aroclor 1242	PP	0.5	CP																
Aroclor 1248	PP	0.5	CP																
Aroclor 1254	PP	1	CP																
Aroclor 1260	PP	1	CP																
Atrazine	PP		e											3			3		
Americium (pCi/l)	R																	0.05	0.05
Americium 241 (pCi/l)	R	0.01													30				
Cesium 134 (pCi/l)	R	1		80 (6)									80		80			80	80
Cesium 137 (pCi/l)	R	1																	
Gross Alpha (pCi/l)	R	2																7	11
Gross Beta (pCi/l)	R	4																5	19
Plutonium (pCi/l)	R																	0.05	0.05
Plutonium 238+239+240 (pCi/l)	R	0.01		15 (6)											15				
Radium 226+228 (pCi/l)	R	0.5/1.0 (14)		5 (6)											5				
Strontium 89+90 (pCi/l)	R	1																	
Strontium 90 (pCi/l)	R			8 (6)											8			8	8
Thorium 230+232 (pCi/l)	R			60 (6)											60				
Tritium (pCi/l)	R			20,000 (6)											20,000			500	500
Uranium 233+234 (pCi/l)	R																		
Uranium 235 (pCi/l)	R	0.6																	

TABLE 3-3 POTENTIAL CHEMICAL-SPECIFIC ARARs/TBCs (August 1, 1991)
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				Statewide Standards (a)							Basin Standards (b)		Segment 4 & 5 Stream Classification and Water Quality Standards (b)(7)						
				Tables A,B Carcinogens/ Noncarcin-ogens (2)	Table C Aquatic Life		Tables I,II,III (1) Aquatic Life				Organics (12)		Tables A,B (2)	Table C Fish & Water Ingestion	Table D Radio-nuclide	Stream Segment Table (8)		Table 2 Radionuclides	
Parameter	Type (10)	PQL MDL	Method (11)		Acute Value	Chronic Value	Acute Value (2)	Chronic Value (2)	Agricul-tural Standard (3)	Domestic Water Supply (6)	Aquatic Life	Water Supply				Acute Value	Chronic Value	Woman Creek	Walnut Creek
Uranium 238 (pCi/l)	R	0.6																	
Uranium (total) (pCi/l)	R						TVS	TVS							40			5	10
1,2,4,5-Tetrachlorobenzene	SV		b	2 (13)									2						
1,2,4-Trichlorobenzene	SV	10	CS																
1,2-Dichlorobenzene (ortho)	SV	10	CS	620									620						
1,2-Diphenylhydrazine	SV		b	0.05 (13)									0.05 (13)						
1,3-Dichlorobenzene (meta)	SV	10	CS	620									620						
1,4-Dichlorobenzene (para)	SV	10	CS	75									75						
2,4,5-Trichlorophenol	SV	50	CS	700									700						
2,4,6-Trichlorophenol	SV	10	CS	2.0 (13)		970							2.0 (13)	1.2			1.2		
2,4-Dichlorophenol	SV	10	CS	21	2,020	365							21						
2,4-Dimethylphenol	SV	10	CS		2,120														
2,4-Dinitrophenol	SV	50	CS																
2,4-Dinitrotoluene	SV	10	CS																
2-Chloronaphthalene	SV	10	CS																
2-Chlorophenol	SV	10	CS		4,380	2,000													
2-Methylnaphthalene	SV	10	CS																
2-Methylphenol	SV	10	CS																
2-Nitroaniline	SV	50	CS																
2-Nitrophenol	SV	10	CS																
3,3-Dichlorobenzidine	SV	20	CS											0.01			0.01		
3-Nitroaniline	SV	50	CS																
4,6-Dinitro-2-methylphenol	SV	50	CS																
4-Bromophenyl Phenylether	SV	10	CS																
4-Chloroaniline	SV	10	CS																
4-Chlorophenyl Phenyl Ether	SV	10	CS																
4-Chloro-3-methylphenol	SV	10	CS		30														
4-Methylphenol	SV	10	CS																
4-Nitroaniline	SV	50	CS																

TABLE 3-3 POTENTIAL CHEMICAL-SPECIFIC ARARs/TBCs (August 1, 1991)
STATE (CDH/WQCC) SURFACE WATER QUALITY STANDARDS (ug/l)

				Statewide Standards (a)							Basin Standards (b)		Segment 4 & 5 Stream Classification and Water Quality Standards (b)(7)						
				Tables A,B	Table C Aquatic Life		Tables I,II,III (1) Aquatic Life				Organics (12)		Tables A,B	Table C	Table D	Stream Segment Table (8)		Table 2 Radionuclides	
Parameter	Type (10)	PQL MDL	Method (11)	Carcinogens/ Noncarcin-ogens (2)	Acute Value	Chronic Value	Acute Value (2)	Chronic Value (2)	Agricul-tural Standard (3)	Domestic Water Supply (6)	Aquatic Life	Water Supply	(2)	Fish & Water Ingestion	Radio-nuclide	Acute Value	Chronic Value	Woman Creek	Walnut Creek
4-Nitrophenol	SV	50	CS																
Acenaphthene	SV	10	CS		1,700	520													
Anthracene	SV	10	CS																
Benzidine	SV		d	0.0002 (13)	2,500						0.1	0.01	0.0002 (13)	0.00012			0.00012		
Benzoic Acid	SV	50	CS																
Benzo(a)anthracene	SV	10	CS																
Benzo(a)pyrene	SV	10	CS																
Benzo(b)fluoranthene	SV	10	CS																
Benzo(g,h,i)perylene	SV	10	CS																
Benzo(k)fluoranthene	SV	10	CS																
Benzyl Alcohol	SV	10	CS																
bis(2-Chloroethoxy)methane	SV	10	CS																
bis(2-Chloroethyl)ether	SV	10	CS	0.03 (13)									0.03 (13)	0.0000037			0.0000037		
bis(2-Chloroisopropyl)ether	SV	10	CS																
bis(2-Ethylhexyl)phthalate	SV	10	CS																
Butadiene	SV																		
Butyl Benzylphthalate	SV	10	CS																
Chlorinated Ethers	SV																		
Chlorinated Napthalenes	SV																		
Chloroalkylethers	SV	10	CS																
Chlorophenol	SV										1.0	1.0							
Chrysene	SV	10	CS																
Dibenzofuran	SV	10	CS																
Dibenz(a,h)anthracene	SV	10	CS																
Dichlorobenzenes	SV																		
Dichlorobenzidine	SV	20	CS											0.01			0.01		
Diethylphthalate	SV	10	CS																
Dimethylphthalate	SV	10	CS																
Dinitrotoluene	SV	10	CS		330	230													
Di-n-butylphthalate	SV	10	CS																

TABLE 3-3 POTENTIAL CHEMICAL-SPECIFIC ARARs/TBCs (August 1, 1991)
STATE (CDH/WQCC) SURFACE WATER QUALITY STANDARDS (ug/l)

				Statewide Standards (a)							Basin Standards (b)		Segment 4 & 5 Stream Classification and Water Quality Standards (b)(7)						
				Tables A,B Carcinogens/ Noncarcin-ogens (2)	Table C Aquatic Life		Tables I,II,III (1) Aquatic Life				Organics (12)		Tables A,B (2)	Table C Fish & Water Ingestion	Table D Radio-nuclide	Stream Segment Table (8)		Table 2 Radionuclides	
Parameter	Type (10)	PQL MDL	Method (11)		Acute Value	Chronic Value	Acute Value (2)	Chronic Value (2)	Agricul-tural Standard (3)	Domestic Water Supply (6)	Aquatic Life	Water Supply				Acute Value	Chronic Value	Woman Creek	Walnut Creek
Di-n-octylphthalate	SV	10	CS																
Ethylene glycol	SV		d																
Fluoranthene	SV	10	CS		3,980														
Fluorene	SV	10	CS																
Formaldehyde	SV																		
Haloethers	SV																		
Hexachlorobenzene	SV	10	CS	0.02 (13)									0.02 (13)	0.00072			0.00072		
Hexachlorobutadiene	SV	10	CS	14	90	9.3							14	0.45			0.45		
Hexachlorocyclopentadiene	SV	10	CS	49	7	5.2							49						
Hexachloroethane	SV	10	CS		980	540								1.9			1.9		
Hydrazine	SV																		
Indeno(1,2,3-cd)pyrene	SV	10	CS																
Isophorone	SV	10	CS	1,050	117,000								1,050						
Naphthalene	SV	10	CS		2,300	620													
Nitrobenzene	SV	10	CS	3.5 (13)	27,000								3.5 (13)						
Nitrophenols	SV																		
Nitrosamines	SV																		
Nitrosodibutylamine	SV		b											0.0064			0.0064		
Nitrosodiethylamine	SV		b											0.0008			0.0008		
Nitrosodimethylamine	SV		b											0.0014			0.0014		
Nitrosopyrrolidine	SV		b											0.016			0.016		
N-Nitrosodiphenylamine	SV	10	CSb											4.9			4.9		
N-Nitroso-di-n-dipropylamine	SV	10	CSb																
Pentachlorinated Ethanes	SV		b																
Pentachlorobenzene	SV		b	6 (13)									6 (13)						
Pentachlorophenol	SV	50	CS	200	9	5.7							200						
Phenanthrene	SV	10	CS																
Phenol	SV	10	CS		10,200	2,560					500	1.0							
Phthalate Esters	SV		c																
Polynuclear Aromatic Hydrocarbons	SV		b											0.0028			0.0028		

TABLE 3-3 POTENTIAL CHEMICAL-SPECIFIC ARARs/TBCs (August 1, 1991)
STATE (CDH/WQCC) SURFACE WATER QUALITY STANDARDS (ug/l)

				Statewide Standards (a)							Basin Standards (b)		Segment 4 & 5 Stream Classification and Water Quality Standards (b)(7)						
				Tables A,B Carcinogens/ Noncarcin-ogens (2)	Table C Aquatic Life		Tables I,II,III (1) Aquatic Life				Organics (12)		Tables A,B (2)	Table C Fish & Water Ingestion	Table D Radio-nuclide	Stream Segment Table (8)		Table 2 Radionuclides	
Parameter	Type (10)	PQL MDL	Method (11)		Acute Value	Chronic Value	Acute Value (2)	Chronic Value (2)	Agricul-tural Standard (3)	Domestic Water Supply (6)	Aquatic Life	Water Supply				Acute Value	Chronic Value	Woman Creek	Walnut Creek
Vinyl Chloride	SV	10	CV	2									2						
1,1,1-Trichloroethane	V	5	CV	200									200						
1,1,2,2-Tetrachloroethane	V	5	CV			2,400								0.17			0.17		
1,1,2-Trichloroethane	V	5	CV	28		9,400							28	0.60			0.60		
1,1-Dichloroethane	V	5	CV																
1,1-Dichloroethene	V	5	CV	7									7						
1,2-Dichloroethane	V	5	CV	5	118,000	20,000							5						
1,2-Dichloroethene (cis)	V		a	70									70						
1,2-Dichloroethene (total)	V	5	CV																
1,2-Dichloroethene (trans)	V		a	70									70						
1,2-Dichloropropane	V	5	CV	0.56 (13)	23,000	5,700							0.56 (13)						
1,3-Dichloropropene (cis)	V	5	CV		6,060	244													
1,3-Dichloropropene (trans)	V	5	CV		6,060	244													
2-Butanone	V	10	CV																
2-Hexanone	V	10	CV																
4-Methyl-2-pentanone	V	10	CV																
Acetone	V	10	CV																
Acrylonitrile	V		c		7,550	2,600								0.058			0.058		
Benzene	V	5	CV	5	5,300								5						
Bromodichloromethane	V	5	CV																
Bromoform	V	5	CV																
Bromomethane	V	10	CV																
Carbon Disulfide	V	5	CV																
Carbon Tetrachloride	V	5	CV	5	35,200								5						
Chlorinated Benzenes	V	10	CV/CS																
Chlorobenzene	V	5	CV/CVS	300									300						
Chloroethane	V	10	CV																
Chloroform	V	5	CV	Tot THM <100 (4)	28,900	1,240							Tot THM <100 (4)	0.19			0.19		

TABLE 3-3 POTENTIAL CHEMICAL-SPECIFIC ARARs/TBCs (August 1, 1991)
STATE (CDH/WQCC) SURFACE WATER QUALITY STANDARDS (ug/l)

				Statewide Standards (a)							Basin Standards (b)		Segment 4 & 5 Stream Classification and Water Quality Standards (b)(7)						
				Tables A,B Carcinogens/ Noncarcin-ogens (2)	Table C Aquatic Life		Tables I,II,III (1) Aquatic Life				Organics (12)		Tables A,B (2)	Table C Fish & Water Ingestion	Table D Radio-nuclide	Stream Segment Table (8)		Table 2 Radionuclides	
Parameter	Type (10)	PQL MDL	Method (11)		Acute Value	Chronic Value	Acute Value (2)	Chronic Value (2)	Agricul-tural Standard (3)	Domestic Water Supply (6)	Aquatic Life	Water Supply				Acute Value	Chronic Value	Woman Creek	Walnut Creek
Chloromethane	V	10	CV																
Dibromochloromethane	V	5	CV																
Dichloroethenes	V																		
Ethyl benzene	V	5	CV	680	32,000								680						
Ethylene dibromide	V		d																
Ethylene oxide	V																		
Halomethanes	V			100									100	0.19			0.19		
Methylene Chloride	V	5	CV																
Pyrene	V	10	CS																
Styrene	V	5	CV																
Tetrachloroethanes	V	5	CV											0.8			0.8		
Tetrachloroethene	V	5	CV	10	5,280	840							10						
Toluene	V	5	CV	2,420	17,500								2,420						
Trichloroethanes	V	5	CV																
Trichloroethene	V	5	CV	5	45,000	21,900							5						
Vinyl Acetate	V	10	CV																
Xylenes (Total)	V	5	CV																

EXPLANATION OF TABLE

CLP = Contract Laboratory Program
CDH = Colorado Department of Health
dis = dissolved
EPA = Environmental Protection Agency
pCi/l = picocuries per liter
PCB = polychlorinated biphenyl
PQL = Practical Quantitation Level
SS = species specific
TAL = Target Analyte List
THM = Total Trihalomethanes

TIC = Tentatively Identified Compound
TVS = Table Value Standard (hardness dependent), see Table III in (a)
MDL = Minimum Detection Limit for radionuclides (pCi/l)
ug/l = micrograms per liter
VOA = Volatile Organic Analysis
WQCC = Water Quality Control Commission

(1) Table I = physical and biological parameters
Table II = inorganic parameters
Table III = metal parameters
Values in Tables I, II, and III for recreational uses, cold water biota and domestic water supply are not included.
(2) In the absence of specific, numeric standards for non-naturally occurring organics, the narrative standard is interpreted as zero with enforcement based on practical quantification levels (PQLs) as defined by CDH/WQCC or EPA
(3) All are 30-day standards except for nitrate+nitrite
(4) Total trihalomethanes: chloroform, bromoform, bromodichloromethane, dibromochloromethane
(5) Lowest value given: dissolved or total recoverable
(6) Ammonia, sulfide, chloride, sulfate, copper, iron, manganese, and zinc are 30-day standards, all others are 1-day standards
(7) Segment 4 standards for inorganics, metals, organics, and radionuclides are TBC and Segment 5 standards are goals (TBCs)
(8) Includes Table 1: Additional Organic Chemical Standards (chronic only)
(9) See section 3.1.11 (f)(2) in (a)
(10) type abbreviations are: A=anion; B=bacteria; C=cation; D=dioxin; E=element; FP=field parameter; I=indicator; M=metal; P= pesticide; PP=pesticide/PCB; R=radionuclide; SV=semi-volatile; V=volatile
(11) method abbreviations are: CT=CLP-TAL; NC=non-CLP; CV=CLP-VOA; CS=CLP-SEMI; EP=EPA-PEST; CP=CLP-PEST; E=EPA; a = detected as total in CV; b = detected as TICs in CS; c = detected as TIC in CV; d = not routinely monitored; e = monitored in discharge ponds; f = mixture-individual isomers detected.
(12) See Section 3.8.5 (2)(a) in (b)
(13) Standard is below (more stringent than) PQL, therefore PQL is standard.
(14) MDL for Radium 226 is 0.5; MDL for Radium 228 is 1.0

(a) CDH/WQCC, Colorado Water Quality Standards 3.1.0 (5 CCR 1002-8) 1/15/1974; amended 9/30/1989 (Envrionmental Reportef 726:1001-1020:6/1990)
(b) CDH/WQCC, Classifications and Numeric Standards for S. Platte River Basin, Laramie River Basin, Republican River Basin, Smoky Hill River Basin 3.8.0 (5 CCR 1002-8) 4/6/1981; amended 2/15/1990

ARARs addressing contaminants in air will be included in the CMS/FS Report. In general, federal and state standards for air exist only as source- or activity-specific requirements and, accordingly, will be addressed in detail in the FS process.

3.2 THE ARAR PROCESS

3.2.1 ARARs

"Applicable requirements," as defined in 40 CFR 300.5, are "those clean-up standards, standards of control, and other substantive requirements, criteria, or limitations promulgated under federal environmental or state environmental or facility siting laws that specifically address a hazardous substance, pollutant, contaminant, remedial action, location, or other circumstance found at a CERCLA site. Only those state standards that are identified by a state in a timely manner and that are more stringent than federal requirements may be 'applicable.'" "Relevant and appropriate requirements," also defined in 40 CFR 300.5, are "those clean-up standards, standards of control, and other substantive requirements, criteria, or limitations promulgated under federal environmental or state environmental or facility siting laws, that, while not 'applicable' to a hazardous substance, pollutant, contaminant, remedial action, location, or other circumstance at a CERCLA site, address problems or situations sufficiently similar to those encountered at the CERCLA site that their use is well suited to the particular site. Only those state standards that are identified in a timely manner and are more stringent than federal requirements may be relevant and appropriate." The most stringent promulgated standards are applied as ARAR (Preamble to NCP, 55 FR 8741).

3.2.2 TBCs

In addition to ARARs, advisories, criteria, or guidance may be identified as TBC for a particular release. As defined in 40 CFR 300.400(g)(3), the TBC category consists of advisories, criteria, or guidance developed by EPA, other federal agencies, or states that may be useful in developing remedies. Use of TBCs is discretionary rather than mandatory, as opposed to the use of ARARs, which is mandatory.

3.2.3 ARAR Categories

In general, there are three categories of ARARs. These categories are:

1. Ambient or chemical-specific requirements
2. Location-specific requirements
3. Performance, design, or other action-specific requirements

ARARs are generally considered to be dynamic in nature in that they evolve during the CERCLA site clean-up process. Initially, during the RI work plan stage, probable chemical-specific ARARs may be identified, usually based on a limited amount of data. Chemical-specific ARARs at this point have meaning only in that they may be used to establish appropriate detection limits so that data collected in the RI will be amenable for comparison to ARAR standards. Identified potential chemical-specific ARARs may be modified if they are found to be inappropriate any time in the RFI/RI process. For example, chemical-specific ARARs could be deleted based on the absence of a constituent in analytical data obtained during the investigation.

It is also appropriate to identify location-specific ARARs early in the RI process so that information may be gathered to determine if restrictions have been placed on the concentration of hazardous substances or on the conduct of an activity solely because it occurs in a specific location. As discussed in the introductory paragraph to this section, detailed location-specific ARARs will be proposed in the RFI/RI Report.

Identification of action-specific ARARs and remediation goals is part of the FS process and will be addressed in the CMS/FS report. For the proper management of investigation-derived wastes, as required in the Interagency Agreement (IAG), Attachment 2, Statement of Work, Section IV, the Department of Energy (DOE) has developed Standard Operating Procedures (SOPs) for field investigation activities. All waste generated by the various investigations conducted at Rocky Flats Plant will be managed in accordance with the SOPs. The SOPs satisfy the IAG requirement to comply with ARARs as they relate to investigation activities. Development of an overall site-wide approach to managing investigation-derived wastes is consistent with EPA policy.

3.2.4 FS ARAR Requirements

Development of a preliminary list of potential chemical-specific ARARs in the RI process also allows the establishment of a list of preliminary remediation goals in the early FS process, which is essentially a tentative listing of contaminants together with initially anticipated clean-up concentrations or risk levels for each medium. Preliminary remediation goals serve to focus the development of alternatives to be considered in the detailed remedial alternative analysis, conducted later in the FS process. As more information becomes available during the RI stage, chemical-specific ARARs may become more refined as constituents are added or deleted. Once data collection is complete, revised chemical-specific ARARs may be proposed.

When the data collection is complete, it is also appropriate to refine location-specific ARARs that may affect the development of remedial alternatives. In addition, during development of remedial action alternatives at the beginning of the FS process, a preliminary consideration of action-specific ARARs will be conducted. As remedial alternatives are screened during the FS, action-specific ARARs will be

identified. When a detailed analysis of the remedial alternatives is conducted, all action-specific ARARs are refined and finalized with respect to each alternative before a comparison of alternatives begins. At this point, a discussion is provided in the FS report for each remedial alternative regarding the rationale for all ARAR determinations.

3.3 REMEDIAL ACTION AND REMEDIATION GOALS

CERCLA §121 requires attainment of all ARARs. As explained in the preamble to the NCP (55 FR 8741), a remedial action must comply with the most stringent ARAR requirements, which then should ensure attainment of all other ARARs. In addition, CERCLA requires that the remedies selected meet ARARs and be protective of human health and the environment. Consequently, preliminary remediation goals based on ARARs will require modification as new information and data are collected in the RI, including the baseline risk assessment (to be conducted), when ARARs are not available or are determined to be inadequate for protection of human health and the environment. In this way, remediation goals that define contaminant clean-up objectives for remedial actions at Rocky Flats Plant will comply with CERCLA ARARs and protectiveness requirements, as well as other EPA and Colorado protectiveness performance requirements which may be ARAR, such as the RCRA corrective action requirements of 40 CFR 264.101 (6 CCR 264.101) or the RCRA Closure Performance Standard of 40 CFR 264.111 (6 CCR 264.111).

Development of remediation goals is actually a portion of the overall development of remedial action objectives, which ultimately will define the required endpoint of the selected remedial action. As stated in the preamble to the NCP (55 FR 8713), "remedial action objectives are the more general description of what the remedial action will accomplish. Remediation goals are a subset of remedial action objectives and consist of medium-specific or operable unit-specific chemical concentrations that are protective of human health and the environment and serve as goals for the remedial action. The remedial action objectives...should specify: (1) the contaminants of concern, (2) exposure routes and receptors, and (3) an acceptable contaminant level or range of levels for each exposure medium (i.e., a preliminary remediation goal)." According to 40 CFR 300.430(e)(2)(i), "Remediation goals shall establish acceptable exposure levels that are protective of human health and the environment and shall be developed by considering the following:

- ARARs (chemical-specific)
    - Acceptable exposure levels for systemic toxicants
    - Acceptable exposure levels for known or suspected carcinogens

- Technical limitations (e.g., detection limits)
- Uncertainty factors
- Other pertinent information

- Maximum Contaminant Level Goals (MCLGs) (or MCLs where MCLGs are zero) where relevant and appropriate.

- For potential carcinogens, acceptable exposure levels where multiple contaminants or multiple exposure pathways will cause exposure at ARAR levels not exceeding cumulative risk of 10^{-4}.

- Clean Water Act (CWA) Ambient Water Quality Criteria (AWQC) where relevant and appropriate.

- A CERCLA Alternative Concentration Limit (ACL) established pursuant to CERCLA §121(d)(2)(B)(ii).

- Environmental evaluations, performed to assess specific threats to the environment."

Once a preferred remedial action alternative is formally selected, all chemical-, location-, and action-specific ARARs have also been defined in final form. If it is found that the most suitable alternative does not meet an ARAR, the NCP at 40 CFR 300.430(f)(1)(ii)(C) provides for waivers of ARARs under certain circumstances, such as technical impracticability, risk, or inconsistent application of state requirements. From this point, the alternative will become the final remedy as it is incorporated into the Record of Decision (ROD). Once the final ROD has been signed, requirements may be modified only when they are determined to be applicable or relevant and appropriate <u>and</u> necessary to ensure that the remedy is protective of human health and the environment [40 CFR 300.430(f)(1)(ii)].

3.4 OU6 ALLUVIAL GROUNDWATER ARARs

The potential ARARs/TBCs for groundwater listed in Table 3-1 were developed using the ARARs rationale described above and were identified by examining the following standards and criteria:

- Safe Drinking Water Act (SDWA) MCLs
- Resource Conservation and Recovery Act (RCRA) 40 CFR Part 264 Subpart F concentration limits
- Colorado Water Quality Control Commission (WQCC) Standards for Ground Water
- CWA AWQC

3.4.1 SDWA MCLs

SDWA MCLs represent the maximum permissible level of a contaminant in water that is delivered to the freeflowing outlet of the ultimate user of a public water system [40 CFR 141.2(c)]. Because groundwater at OU6 is a potential source of drinking water, MCLs are identified as ARAR. Furthermore, the NCP [40 CFR 300.430(e)] requires that, in development of remediation goals for evaluating alternatives for final remediation, the following be considered for current or potential sources of drinking water: attainment of MCLGs or MCLs, if MCLGs are zero, and attainment of CWA AWQC, where relevant and appropriate.

Because groundwater at OU6 is a potential source of drinking water, the MCLGs (or MCLs) are relevant and appropriate for remediation goals and should be attained (note: the MCLGs are currently zero or equal to the MCLs). CWA AWQC are discussed in subsection 3.4.4. It should be noted that on January 30, 1991 and June 7, 1991 (56 FR 3526 and 56 FR 26460, respectively), EPA published final rules amending MCLs and MCLGs for a number of the constituents identified in Table 3-1. These standards are effective July 30, 1992 and November 6, 1991, respectively, and will be regarded as relevant and appropriate at that time. The new MCLs (new MCLGs are zero or equal to the MCLs, except in the case of copper), are identified as potential TBCs in Table 3-1.

3.4.2 RCRA 40 CFR Part 264 Subpart F Concentration Limits

Owners or operators of facilities that treat, store, or dispose of hazardous waste must ensure that hazardous constituents listed in 6 CCR (Colorado Code of Regulations) 1007-3 and 40 CFR 261 Appendix VIII entering the groundwater from a regulated unit do not exceed concentration limits (6 CCR 1007-3 and 40 CFR 264.94) at the point of compliance in the uppermost aquifer. The concentration limits include standards for 14 compounds (these standards are equivalent to and a subset of SDWA MCLs and are identified at 40 CFR 264.94, Table 1), with background or ACLs used as the standards for the other RCRA 40 CFR Part 261 Appendix VIII constituents or 40 CFR Part 264 Appendix IX constituents. These concentration limits apply to RCRA "regulated units" subject to permitting (defined at 40 CFR 264.90 to include landfills, surface impoundments, waste piles, and land treatment units) that received RCRA hazardous waste after July 26, 1982. Although OU6 does not contain RCRA-regulated hazardous waste management units, it does contain Individual Hazardous Substance Sites (IHSS's). As a result, these RCRA 40 CFR Part 264 Subpart F regulations are considered relevant and appropriate for groundwater.

As discussed above, an ACL may be established for a hazardous constituent if it is determined that attainment of a Subpart F (Table 1) constituent standard or background standard is not necessary to ensure adequate protection of human health and the environment. Furthermore, EPA has stated that for potential drinking water sources, the Agency's preference is to set remediation levels that are the

equivalent of exposure- or health-based ACLs under RCRA (EPA 1988c). It is appropriate to establish background as ARAR until it is determined through risk assessment whether attainment of background is necessary for adequate protection of human health and the environment. Accordingly, hazardous constituent background values will be applied as ARAR until such time as risk assessment information indicates some other alternative standard is necessary to ensure "protectiveness." The 40 CFR 264.94 (Table 1) standards are considered to be relevant and appropriate. Table 3-1, however, will identify SDWA MCLs rather than RCRA 40 CFR 264.94 (Table 1) standards because the RCRA standards are currently equivalent and a subset of the SDWA MCLs. ARAR background groundwater values for Subpart F will be applied from background groundwater in both the alluvial and bedrock lithologies at Rocky Flats Plant.

3.4.3 Colorado WQCC Standards for Groundwater

The Colorado WQCC has established both state-wide and classification-specific standards for the protection of state groundwaters. State-wide standards currently exist for certain radioactive materials and organic pollutants (see Section 3.11.0, 5 CCR 1002-0). These standards are not currently independently enforceable. The standards may be enforced by application under other Colorado environmental regulatory programs, though it remains questionable whether enforcement under other Colorado regulatory programs could satisfy the requirements of the NCP, 40 CFR 300.400(g)(4). Therefore, WQCC state-wide groundwater standards have been applied as TBC in Table 3-1.

The WQCC classification-specific groundwater standards do not appear to meet the NCP criteria for state ARARs. On March 15, 1991, the Colorado WQCC issued groundwater classifications and standards for groundwaters at the Rocky Flats Plant, effective April 30, 1991 (see 3.12.0, 5 CCR 1002-8). The standards assigned to alluvial groundwater address human health, secondary drinking water considerations, agriculture, dissolved solids, and surface water protection standards which include additional organics and radionuclide standards. The classifications and standards for groundwater at Rocky Flats Plant may be enforceable in the future through the State Discharge Permit System regulations anticipated to become effective in July 1992 (see 6.1.0, 5 CCR 1002-2). However, the Rocky Flats Plant site-specific standards do not meet the general applicability requirement of the NCP since no other state groundwaters have been similarly classified. Accordingly, the Rocky Flats site-specific standards have also been applied as TBC in Table 3-1.

3.4.4 CWA AWQC

The CWA AWQC are non-enforceable guidance developed under CWA Section 304, and are used by states in conjunction with designated stream segment usages to establish water quality standards for the protection of aquatic life and for the protection of human health. Criteria include levels established for drinking water and fish consumption, fish consumption only, as well as standards for the protection

of aquatic life. As guidance, CWA AWQC cannot be ARAR; however, CERCLA Section 121(d) requires that CWA AWQC be considered in the development of remediation goals in the FS process, where relevant and appropriate. Relative to this work plan, AWQC in the form of drinking water and fish consumption may be considered relevant and appropriate for the groundwater medium being investigated. These AWQC will require consideration in the development of remediation goals for OU6 and, accordingly, have been identified as TBCs for alluvial groundwater.

It is important to note, however, as discussed in subsection 3.4.3, that the Colorado WQCC has issued standards determined by the state to be appropriate and necessary for the protection of groundwater at the Rocky Flats Plant. Although not yet ARAR because they are not yet of general applicability, the existence of WQCC site-specific standards that reflect the specific conditions of site groundwaters may result in a determination that other standards of a broader nature are not relevant and appropriate. Consequently, it is unlikely that CWA AWQC will be considered relevant and appropriate for OU6 groundwater when remediation goals are established.

3.5 OU6 BEDROCK GROUNDWATER ARARs

OU6 bedrock groundwater ARARs were established in the same manner as those identified for alluvial groundwater. The only exceptions are the site-specific groundwater standards, as discussed in Section 3.4.3, applied as TBC to alluvial groundwater. The standards for surface water protection, namely those standards addressing additional organics and radionuclides, were not determined by the Colorado WQCC to be necessary for the bedrock aquifers at Rocky Flats Plant. Accordingly, these standards are not applied to OU6 bedrock groundwater. Table 3-1 summarizes potential ARARs/TBCs from Federal and colorado standards and criteria.

3.6 OU6 SURFACE WATER ARARs

The potential ARARs/TBCs for surface water are listed in Tables 3-2 and 3-3 and were identified by examining the following standards and criteria:

- SDWA MCLs
- Colorado WQCC Standards for Surface Water
- CWA Ambient Water Quality Criteria (AWQC)

Table 3-2 presents a summary of potential surface water ARARs/TBCs derived from Federal standards and criteria while Table 3-3 summarizes potential ARARs/TBCs from Colorado-adopted standards and criteria.

3.6.1 Safe Drinking Water Act MCLs

As discussed earlier in Section 3.4.1, the NCP requires that SDWA MCLGs be considered in the development of remediation goals, where relevant and appropriate. Moreover, in cases where groundwater or surface water is an actual or potential source of drinking water, MCLs will be ARAR. Accordingly, since OU6 surface water may ultimately contribute to sources of drinking water, SDWA MCLs and MCLGs have been identified in Table 3-2.

3.6.2 Colorado WQCC Standards for Surface Water

The Colorado WQCC has adopted both state-wide and stream segment-specific standards for the protection of state surface waters. State-wide standards exist for certain radioactive materials as well as organic standards adopted for all state sources of drinking water and areas requiring protection for aquatic life (see Section 3.1.11, 5 CCR 1002-8). These standards are consequently of general applicability. The state-wide standards are enforceable through the state's National Pollutant Discharge Elimination System (NPDES) permitting process. Having apparently met the NCP state ARAR requirements of enforceability and general applicability [40 CFR 300.400(g)(4)], the state-wide surface water standards have been applied as ARAR in Table 3-3.

Site-specific surface water standards also exist for certain metal, inorganic, organic, and radioactive constituents. Unlike the WQCC state-wide standards discussed above, these site-specific standards do not appear to satisfy the NCP requirements for state ARARs. While these standards are enforceable through the NPDES permitting process, they have been adopted only for surface waters at Rocky Flats Plant and so are not of general applicability. Also, the site-specific organic standards are based almost entirely on CWA AWQC for water and fish ingestion. These standards have not been generally applied to the surface waters of Colorado and, in fact, have only been applied to Rocky Flats Plant. Furthermore, the site-specific standards for radioactive constituents are significantly more stringent than any standards applied to other Colorado surface water bodies. Consequently, the site-specific organic chemical and radionuclide surface water standards cannot be ARAR. These standards have been applied as TBC in Table 3-3 because they reflect the degree of protectiveness determined to be necessary for Rocky Flats Plant surface waters by the Colorado WQCC.

3.6.3 CWA AWQC

As was described in Section 3.4.4, CWA AWQC are required to be considered in the development of remediation goals, where relevant and appropriate. These criteria appear to be relevant but are not appropriate because of the existence of site-specific WQCC standards that more accurately reflect the surface water protection needs of the site. CWA AWQC have been identified as TBCs in Table 3-2.

3.7 OU6 SOIL ARARs

As discussed in Section 3.1, one medium for which chemical-specific ARARs do not currently exist is soils; however, some chemical-related, action-specific requirements do exist, such as Colorado's construction standard for plutonium in soil. Action-specific requirements will be addressed in the CMS/FS process. Relative to chemical-specific ARARs, a risk assessment will be performed to determine acceptable contaminant concentrations in soils to ensure environmental "protectiveness." At this time, with respect to establishing analytical detection limits for soils, use of the method detection limits provided in the General Radiochemistry and Routine Analytical Services Protocol (GRRASP) (EG&G 1990d), which are CLP contract required quantitation limits, should enable meaningful interpretation of soil sample results.

3.8 OU6 PARAMETERS LACKING ARARs/TBCs

For any parameters to be analyzed in groundwater, surface water, or soils for which no ARARs or TBCs were found, use of the analytical methods that achieve the detection limits provided in the GRRASP (EG&G 1990d), which are CLP contract required quantitation limits, should enable meaningful interpretation of sample results. In addition, whenever a potential standard is below the GRRASP-derived detection limit, the detection limit has been used as the standard. Risk-based concentrations taken from the baseline risk assessment will be used in establishing the remediation goals for the parameters for which no potential ARARs could be identified, thus ensuring environmental "protectiveness."

4.0
DATA NEEDS AND DATA QUALITY OBJECTIVES

The primary objective of a RCRA Facility Investigation (RFI)/Remedial Investigation (RI) is to collect the data necessary to determine the nature, distribution, and migration pathways of contaminants. This information will be used to support a baseline risk assessment and environmental assessment. These assessments determine the need for remediation and are used to evaluate remedial alternatives. Five general goals of a RFI/RI (EPA 1988a) are to

- Characterize site physical features
- Define contaminant sources
- Determine the nature and extent of contamination
- Describe contaminant fate and transport
- Provide a baseline risk assessment

Data quality objectives (DQOs) are qualitative and quantitative statements that describe the quality and quantity of data required by the RFI/RI (U.S. EPA 1987a). The DQO process is divided into three stages:

- Stage 1 - Identify decision types
- Stage 2 - Identify data uses/needs
- Stage 3 - Design data collection program

Through application of the DQO process, site-specific RFI/RI goals are established and data needs are identified for achieving those goals. This section of the RFI/RI Work Plan proceeds through the DQO process.

4.1 STAGE 1 - IDENTIFY DECISION TYPES

4.1.1 Identify and Involve Data Users

Data users are the decision makers and the primary and secondary data users. The decision makers for OU6 are the management and regulatory personnel of EG&G, the Department of Energy (DOE), the Environmental Protection Agency (EPA), and the Colorado Department of Health (CDH). EG&G's contractor will provide day-to-day management of the RI in accordance with this work plan. The decision makers have been and are involved in the OU6 DQO process through the Interagency Agreement (IAG), which specifies the minimum level of effort for the Phase I RI. The decision makers remain involved through the review and approval process specified in the IAG.

Primary data users are those individuals involved in ongoing RI activities. These are EG&G and EG&G's subcontractor technical staffs. They will be involved in the collection and analysis of the data and in the preparation of the RI Report, including the Baseline Risk Assessment and the Environmental Assessment.

Secondary data users are those users that rely on RI outputs to support their activities. Secondary data users may include EG&G and EG&G subcontractor personnel working on other operable units or sitewide projects, EPA and CDH.

4.1.2 Evaluate Available Data

The historical and current conditions of each site are described in Section 2.0 of this work plan.

The following is a summary of the existing information based on the data presented in Section 2.0.

- The data from the existing sediment, surface water, and ground water sampling programs (summarized in Section 2.0) is from RFEDS and these data may need to be evaluated further.
- Contamination by radioactive materials is known or suspected to exist at all of the IHSSs in OU6. Contamination also occurs in Walnut Creek.
- Little information is available, excluding Walnut Creek and the detention ponds, concerning metals contamination, if any, in these IHSSs.
- Contamination, if any, due to other substances is unknown at this time for most of the IHSSs.
- The extent of contamination, if any, at the IHSSs in OU6 is unknown at this time.
- The presence of contamination is uncertain in the Old Outfall area (IHSS 143). Investigations should focus on confirming the presence or absence of contamination.
- There appears to be a potential for contamination from topographically or hydraulically upgradient or upwind sources (i.e., other operable units) to be present at the IHSSs.

4.1.3 Develop Conceptual Models

A generic conceptual model has been developed for the IHSSs in subsection 2.11. This model includes a description of potential sources, pathways and receptors. Since very few previous studies have been

conducted at OU6, the model is basic. It is not known if the sources or pathways actually exist at the IHSSs.

4.1.4 Specify Phase I RFI/RI Objectives and Data Needs

Based on existing data and the IHSS conceptual models, site-specific Phase I RFI/RI objectives/data needs associated with identifying contaminant sources and the nature and extent of contamination are shown in Table 4-1. Identification of contaminant plumes will be used at several sites to assist in identification and characterization of contaminant sources.

The objectives of the Phase I RFI/RI are:

- To characterize the physical and hydrogeologic setting of the IHSSs
- To assess the presence or absence of contamination at each site
- To characterize the nature and extent of contamination at the sites, if present
- To support the Phase I Baseline Risk Assessment and Environmental Evaluation

It is important to recognize that additional phases of investigation and risk assessment may be required at some IHSSs.

4.2 STAGE 2 - IDENTIFY DATA USES/NEEDS

Stage 2 of the DQO process defines data uses and specifies the types of data needed to meet the project objectives. The summary of Stage 2 of the DQO process is presented as Table 4-1.

4.2.1 Identify Data Uses

RI/FS data uses can be described in the following general purpose categories:

- Site characterization
- Health and safety
- Risk Assessment
- Evaluation of alternatives
- Engineering design of alternatives

TABLE 4-1

DATA QUALITY OBJECTIVES

Data Need	Sample/Analysis Activity	Analytical Level	Data Use
CHARACTERIZE PHYSICAL FEATURES			
• Identify extent of the spray fields, trenches, Old Outfall, Soil Dump Area, and Triangle Area.	• Review aerial photographs • Visual inspection • Logging of boreholes	I & II	• Site Characterization • Alternatives Evaluation
• Characterize surface water and sediments in the ponds	• Logging of sediment samples • Measurement of field parameters in water in the ponds	I & II	• Site Characterization • Alternatives Evaluation
• Locate and delineate extent of the trenches	• Geophysical survey	I & II	• Site Characterization • Alternatives Evaluation
CHARACTERIZE AND DELINEATE CONTAMINANT SOURCES			
• Identify plumes (if present) at the Triangle Area that may lead to sources	• Soil gas survey • Boreholes and wells with analytical testing on samples, if plumes are identified	II (field GC) IV (analytical)	• Site Characterization • Alternatives Evaluation • Risk Assessment
• Characterize sources (if present) at the Trenches and Old Outfall	• Boreholes and surface samples in areas of trenches and outfall with analytical testing of samples	I & II (field) IV (analytical)	• Site Characterization • Alternatives Evaluation • Risk Assessment
CHARACTERIZE NATURE AND EXTENT OF CONTAMINATION			
• Characterize plumes or areas of anomalous radiation readings identified at the Triangle Area	• Boreholes and wells with analytical testing of samples, if plumes are identified	IV and V (radiological analyses)	• Site Characterization • Alternatives Evaluation • Risk Assessment
• Characterize horizontal and vertical extent and nature of contamination at the spray fields, trenches, Triangle Area, Soil Dump Area, and Old Outfall	• Boreholes and wells with analytical testing of samples	IV V (radiological analyses)	• Site Characterization • Alternatives Evaluation • Risk Assessment

TABLE 4-1

DATA QUALITY OBJECTIVES
(Concluded)

Data Need	Sample/Analysis Activity	Analytical Level	Data Use
• Characterize extent of radioactive materials at the Triangle Area, Old Outfall, Sludge Dispersal Area, and Soil Dump Area	• Radiation surveys	I & II	• Site Characterization • Health and Safety
• Characterize nature and extent of contamination in surface water and sediments in Walnut Creek and the ponds	• Sediment and surface water sampling with analytical testing of the samples	II (field) IV V (radiological analyses)	• Site Characterization • Alternatives Evaluation • Risk Assessment
• Characterize nature and extent of contamination in alluvial groundwater	• Install and sample wells	IV V (radiological analyses)	• Site Characterization • Alternatives Evaluation • Risk Assessment
• Characterize the lateral extent of Sludge Dispersal Area	• Surface soil samples with analytical testing	IV V (radiological analyses)	• Site Characterization • Alternatives Evaluation • Risk Assessment

- Monitoring during remedial action
- PRP determination

Since this work plan describes a Phase I RI, data uses such as engineering design and monitoring during remediation (both remedial action activities) will not be considered. The data use for PRP determination is also not appropriate to this work plan. The remaining four data uses will be important in meeting the objectives identified in subsection 4.1.4.

4.2.2 Identify Data Types

Data types can be specified in broad groups initially and then divided into more specific components. For the Phase I investigation, soil, sediment, groundwater and surface water samples will be collected. In addition, radiation surveys will be conducted over some of the units. These data types will provide broad Phase I information regarding the presence or absence of contamination at the units. Selection of chemical analyses and physical testing will be based on the objectives of the Phase I program and on the past activities at the units. Data types are listed on Table 4-1 as sample/analysis methods.

4.2.3 Identify Data Quality Needs

EPA defines five levels of analytical data as follows (U.S. EPA 1987a):

- Level I - field screening or analysis using portable instruments. Results are often not compound specific and not quantitative but results are available in real-time. It is the least costly of the analytical options.

- Level II - field analyses using more sophisticated portable analytical instruments: in some cases, the instruments may be set up in a mobile laboratory on site. There is a wide range in the quality of data that can be generated. The quality depends on the use of suitable calibration standards, reference materials, and sample preparation equipment; and the training of the operator. Results are available in real-time or several hours.

- Level III - all analyses performed in an off-site analytical laboratory. Level III analyses may or may not use Contract Laboratory Program (CLP) procedures, but do not usually utilize the validation or documentation procedures required of CLP Level IV analysis. The laboratory may or may not be a CLP laboratory.

- Level IV - CLP routine analytical services (RAS). All analyses are performed in an off-site CLP analytical laboratory following CLP protocols. Level IV is characterized by rigorous QA/QC protocols and documentation.

- Level V - analysis by non-standard methods. All analyses are performed in an off-site analytical laboratory which may or may not be a CLP laboratory. Method development or method modification may be required for specific constituents or detection limits. CLP special analytical services (SAS) are Level V.

The levels appropriate to the data need and data use have been specified on Table 4-1 for each data need. The levels as they apply to this work plan and specific analyses are presented in Table 4-2.

4.2.4 Identify Data Quantity Needs

Data quantity needs are based primarily on the quantities specified in the IAG. The Phase I data will be evaluated to determine the appropriate number of samples to be obtained in subsequent phases of the RI.

4.2.5 Evaluate Sampling/Analysis Options

The sampling/analysis approach for this Phase I work plan is based on a stepped, or phased approach. Screening level sampling and analysis is followed by sampling of areas of anomalous radiation readings or other areas identified during screening. Where no data are available, a grid system will be used.

4.2.6 Review PARCC Parameter Information

PARCC (precision, accuracy representativeness, completeness and comparability) parameters are indicators of data quality. Precision, accuracy and completeness goals are established for this work plan based on the analyses being performed and the analytical levels. PARCC goals are specified in the Quality Assurance Addendum (QAA) in Section 10.0 of this work plan.

4.3 STAGE 3 - DESIGN DATA COLLECTION PROGRAM

The purpose of Stage 3 of the DQO process is to design the specific data program for the Phase I Walnut Creek drainage RI. To accomplish this, the elements identified in Stages 1 and 2 and the IAG were assembled, and the Sampling and Analysis Plan (SAP) was prepared. The SAP consists of a Field Sampling Plan (FSP) and Quality Assurance Project Plan (QAPjP). These two components are presented in Sections 7.0 and 10.0 of this work plan.

TABLE 4-2

LEVEL OF ANALYSIS

Required Analytical Level	Task
Level I (Field Screens)	• Water level measurement • pH measurement • Screening for organics (OVA/HNu) • Screening for radionuclides (beta-gamma) • Temperature • Specific conductance • Geophysical surveys
Level II (Field Analyses)	• Screening for organics (GC) • Screening for radionuclides (gross beta/gross alpha, gamma spec) • Analysis of engineering properties
Level III (Laboratory Analyses using EPA Standard Methods)	• Major ion analysis • Organics analysis • Inorganics analysis
Level IV (Laboratory Analyses using EPA CLP Methods)	• Analysis of Target Compound List (TCL) and Target Analyte List (TAL)
Level V (Nonstandard Analyses)	• Radiological analyses • Chemical analyses requiring modification of standard methods • Special Analytical Services (SAS)

Source: U.S. EPA (1987a)

5.0
PHASE I RCRA FACILITY INVESTIGATION/ REMEDIAL INVESTIGATION TASKS

5.1 TASK 1 - PROJECT PLANNING

Project planning will consist of the activities necessary to initiate the Phase I RCRA Facility Investigation (RFI)/Remedial Investigation (RI) of the Individual Hazardous Substance Sites (IHSSs) in the Walnut Creek drainage. Activities undertaken for this project have included a review of previous investigation results, historical aerial photographs, and other historical information. Results of this review are presented in Section 2.0 of this work plan. Prior to field investigations, it is necessary to complete the review of the existing data, including plant records and plans, available aerial photographs, and new data which becomes available after preparation of this work plan. The Interagency Agreement (IAG) also requires the submittal of several existing reports to the regulatory agencies. These reports will be assembled and reviewed during the project planning task.

Available aerial photographs will be reviewed again to assess the types and extent of activities at several of the IHSSs. A discussion of the aerial photograph review for each unit is included as the Step 1 work for each unit in Section 7.0 of this document. Available reports and Plant plans will also be reviewed. The findings of the aerial photo review and the records review will be used to finalize the field investigation program.

There are ongoing site studies at Rocky Flats of surface water and sediments, groundwater, geology background geochemistry (EG&G 1990b), and ambient air that may provide data that have bearing on investigations in Walnut Creek. These data will be compiled and evaluated during Task 1. Data from investigations at overlapping and nearby OUs will also be reviewed. If available data from ongoing investigations meet the requirements of the Phase I sampling and analysis plan, the samples proposed in Section 7.0 need not be collected again.

Other project-related documents are currently being prepared. The Sampling and Analysis Plan (SAP), which includes the site-wide Quality Assurance Project Plan (QAPjP) and Standard Operating Procedures (SOP) for field activities, is being completed by EG&G. The Health and Safety Plan (HSP) is also being completed by EG&G. The Field Sampling Plan (FSP) for the Phase I investigation is included as Section 7.0 of this document. The FSP will be revised as necessary based on the findings of the photo and historical records review.

5.2 TASK 2 - COMMUNITY RELATIONS

The information contained in this section is summarized from DOE (1990b). In accordance with the IAG dated January 22, 1991, the Communications Department at Rocky Flats is developing a Plant-wide Community Relations Plan (CRP) to develop an interactive relationship with the public relating to environmental restoration activities. A Draft Community Relations Survey Plan has been completed and forwarded to the Environmental Protection Agency (EPA), the Colorado Department of Health (CDH), and the public for review. This plan specifies activities planned to complete the Environmental Restoration (ER) Program CRP, including plans for community interviews. The draft CRP was completed in September and the final CRP in November 1990, in accordance with the IAG schedules. Accordingly, a site-specific CRP is not required for Operable Unit Number 6 (OU6). The ER Program community relations activities include participation by Plant representatives in informational workshops, meetings of the Rocky Flats Environmental Monitoring Council, briefings for the public on proposed remedial action plans, and meetings to solicit public comment on various ER Program plans and actions.

The Communications Department is continuing other public information efforts to keep the public informed of ER activities and other issues related to Plant operations. A Speakers Bureau program sends speakers to civic groups and educational organizations, while a public tour program allows the public to visit Rocky Flats. An Outreach Program is also in place in which Plant officials visit elected officials, the news media, and business and civic organizations to further discuss issues related to Rocky Flats and ER activities. The Communications Department receives numerous public inquiries, which are answered through telephone conversations or by sending written informational materials to the requestor.

5.3 TASK 3 - FIELD INVESTIGATION

Phase I field investigations will be conducted at all of the IHSSs in Walnut Creek to collect samples and data concerning the nature and extent of contamination, if any, at each unit. The data and sample results will be used to support the Phase I Environmental Evaluation and Phase I Baseline Risk Assessment, as well as meet the objectives and data needs described in Section 4.0 of this Work Plan. It is important to recognize that additional Phases of investigation and risk assessment may be required at some IHSSs prior to Feasibility Studies.

Three types of activities will be performed during the Phase I field investigation: screening activities, sampling activities, and monitoring well installation. Screening activities include visual inspections, radiological surveys, geophysical surveys, and soil gas surveys. Sampling activities include surface soil sampling, subsurface sampling using test borings, surface water sampling and sediment sampling. Wells will be installed at specified locations and in some test borings.

Twenty-one individual IHSSs have been included in OU6 in the Walnut Creek drainage. These IHSSs have been grouped into eight groups based on the historical use of the units and the physical similarities of the units. The group numbers are used in the maps, figures and tables to describe each of the units. Because of the diverse nature of the IHSS groups, the Phase I field investigations of each group will be different. The general discussion of field activities for each IHSS group, based on the IAG, is given below. Specific field activities are described in the Phase I FSP in Section 7.0 of this work plan.

5.3.1 IHSS 141 - Sludge Dispersal Area

The screening activity at the sludge dispersal area will be a radiological survey. Sampling activities will be limited to surface soil sampling. One monitoring well will be installed downgradient of the unit and sampled.

5.3.2 IHSS 142.1-9, 12 - Detention Ponds - A-Series and B-Series

There will not be any screening activities at the four A-series or five B-series ponds. Surface water and sediment samples will be collected in several locations in each pond. Sediment samples will also be collected from Walnut Creek upgradient and downgradient of the ponds and between the ponds. A total of four monitoring wells will be installed below detention ponds A-4 and B-5 and sampled.

5.3.3 IHSS 143 - Old Outfall

The screening activity that will be conducted at the Old Outfall site will be a radiological survey. Sampling will include surface soil sample collection and collection of soil samples to a depth of two feet below the original surface below the fill. In addition, soil samples will be collected upslope from the Old Outfall where the surface runoff was channeled to this area.

5.3.4 IHSS 156.2 - Soil Dump Area

A germanium radiation survey will be performed at this IHSS followed by surface and subsurface soil samples. One well will be installed within the unit and sampled.

5.3.5 IHSS 165 - Triangle Area

A radiological survey and a soil gas survey will be the screening activities conducted at the Triangle Area. Surface soil samples will be collected from plume areas delineated during the screening. Subsurface samples will be collected from the same locations as the surface samples. Two alluvial ground water monitoring wells will be installed within the IHSS and sampled.

5.3.6 IHSS 166.1-3 - Trenches A, B, and C

The screening activity will consist of an electromagnetic geophysical survey which will be used to delineate the locations and extent of the trenches. Subsurface samples will be collected from borings drilled along the long axis of the trenches. One groundwater well will be installed east of IHSS 166.2 and sampled.

5.3.7 IHSS 167.1-3 - North, South, and Pond Area Spray Fields

There will not be any screening activities conducted at the Spray Fields. Based on the findings of the aerial photograph review, surface and subsurface soil samples will be collected in each spray field area using a grid location system. Two alluvial ground water monitoring wells will be installed and sampled, one downgradient of the North Area Spray Field and one downgradient of the South Area Spray Field.

5.3.8 IHSS 216.1 - East Area Spray Field

Although the IAG does not specify field sampling at this site, limited surface and subsurface soil samples will be collected within this unit.

5.4 TASK 4 - SAMPLE ANALYSIS AND DATA VALIDATION

Samples collected during the Phase I field investigation will be analyzed for the parameters specified in the IAG, as a minimum, as described in subsection 7.3. Analytical procedures will be completed in accordance with the ER Program QAPjP. Project-specific QA requirements are included in the Quality Assurance Addendum (QAA), Section 10.0 of this work plan. Subsection 7.3 of this work plan specifies analytical requirements, as well as sample containers, preservation and holding times, and field quality control (QC) requirements. Samples collected for this work plan will be analyzed by a Rocky Flats Plant (RFP) contract laboratory.

Phase I data will be reviewed and validated according to the data validation guidelines in the QAPjP and the Data Validation Functional Guidelines (EG&G 1990a). These documents state that the results of data review and validation activities will be documented in data validation reports.

5.5 TASK 5 - DATA EVALUATION

Data collected during the Phase I Walnut Creek drainage RI will be incorporated into the existing database with data from ongoing investigations at other OUs. The data will be used to better define site characteristics, source characteristics, the nature and extent of contamination, to evaluate proposed remedial alternatives, and to support the baseline risk assessment and environmental evaluation.

5.5.1 Site Characterization

Geologic and hydrogeologic data will be used to develop site maps and cross-sections. Geologic data will be used to further characterize the stratigraphy of the alluvium and colluvium at each site and to better define the depth to bedrock and the bedrock type. Geologic data from boreholes will provide information on the size and depths of the trenches and Old Outfall.

Hydrogeologic data will be used to characterize the unconfined aquifer at the sites. These data will include information about the following:

- Hydrostratigraphic characteristics of units present
- Aquifer hydraulic parameters
- Hydraulic gradients
- Water table depth and configuration

Data collected during surface water and sediment sampling will be used to characterize Walnut Creek and the A- and B-series ponds.

To characterize the general groundwater flow regime within and adjacent to the IHSSs, groundwater flow modeling at an appropriate scale will be conducted. This flow modeling will initially consist of a single modeling project designed to include the IHSSs within OU6 and integrate consistently with sitewide groundwater flow modeling. The initial flow modeling will be used to construct flow paths from the IHSSs and to determine requirements for more detailed flow and transport modeling. Detailed flow and transport modeling will be done at the IHSS level as necessary.

To characterize the general surface water system of OU6, a regional scale surface water flow and transport model will be developed. This model will include the Walnut Creek segments that exist on Rocky Flats Plant. The model will be integrated with pond models to simulate the Walnut Creek system. The regional model may be expanded to include off-site segments as necessary. Where required, IHSS-specific flow and transport models will be developed and integrated to the regional scale model.

5.5.2 Source Characterization

The data collected during the Phase I RFI/RI will be evaluated to identify potential sources of contamination at the IHSSs. Potential sources include wastes disposed at the IHSSs and off-site sources located topographically and/or hydraulically upgradient or upwind of the sites. Analytical data from soil and sediment sampling at the sites will be used to characterize the nature, lateral and vertical extent, and volume of source materials, if present.

5.5.3 Nature and Extent of Contamination

Graphical and, where appropriate, statistical methods will be used to identify chemical and radioactive contaminants present in the soil, sediment, surface water, and groundwater and to estimate the concentrations and distributions of the contaminants in these media. Results of sampling will be compared with results of the ongoing background geochemical characterization to assess if chemical concentrations are above background levels. Products of these analyses may include isopleth maps, cross-sections and profiles, chemical tables, and statistical results.

5.6 TASK 6 - PHASE I BASELINE RISK ASSESSMENT

Using existing data and data collected during the tasks described above, a Phase I baseline risk assessment will be prepared for OU6 to evaluate the potential risks to public health and the environment in the absence of remedial action. The Phase I baseline risk assessment will provide the basis for determining whether remedial actions are necessary.

The risk assessment process will be accomplished in five general steps:

- Identification of chemicals of concern
- Exposure assessment
- Toxicity assessment
- Qualitative and quantitative uncertainty analysis
- Risk characterization

The Phase I risk assessment will address the potential public health and environmental impacts associated with the site under the no-action alternative (no remedial action taken) based on the data available. This assessment will aid in the preliminary screening site remedies based on the contaminants of concern and the environmental media associated with potential risks to public health and the environment.

The objectives and description of work for each risk assessment step are described in detail in the Baseline Risk Assessment Plan for OU6, Section 8.0 of this work plan. The Environmental Evaluation work plan is presented in Section 9.0 of this work plan.

5.7 TASK 7 - DEVELOPMENT AND SCREENING OF REMEDIAL ALTERNATIVES

Remedial Alternatives Development/Screening

This section identifies potential technologies applicable to the remediation of contaminated soils, wastes, and groundwater at OU6. The identified technologies are based on the preliminary site characterization developed in Section 2.0. Identification and screening of technologies, assembling an initial screening of alternatives and identification of potential interim remedial actions will be conducted while the RFI/RI investigation is being conducted. However, the investigation of this operable unit is in its early stages and thus remedial alternatives are only briefly reviewed in this section. A more detailed evaluation of the remedial alternatives of each IHSS will be performed as more data are collected. It is important to recognize that additional phases of investigation may be required at some IHSSs prior to final screening of alternatives.

The process that will be employed to develop and evaluate alternatives for Operable Unit Number 6 is similar to the EPA Superfund process for selecting remedial alternatives. The Superfund Comprehensive Environmental Recovery, Compensation and Liability Act of 1980 (CERCLA) process is described in detail in Guidance for Conducting Remedial Investigations and Feasibility Studies Under CERCLA (U.S. EPA 1988a). The CERCLA process was adopted because it specifies in the greatest detail the steps that should be followed for selection of remedial alternatives. In addition, the IAG requires general compliance with both Resource Conservation and Recovery Act (RCRA) and CERCLA guidance.

The steps followed to develop remediation alternatives for the IHSSs in OU6 are:

- Develop site remedial action objectives based on: chemical- and radionuclide-specific standards (when available); site-specific, risk-related factors; and other criteria, as appropriate.

- Develop preliminary risk-based remedial action goals for affected media. Preliminary remedial action goals will be applied as performance objectives (along with chemical-specific Applicable or Relevant and Appropriate Requirements [ARARs]) for evaluating the effectiveness of specific technology processes identified as candidate components of viable remedial action alternatives. Consistent with the National Contingency Plan (NCP), preliminary remediation goals will be established at a 1×10^{-6} excess cancer risk point of departure and at other intervals within the 1×10^{-4} to 1×10^{-6} decision range. As the Feasibility Study evolves, preliminary remediation goals may be revised to a different risk level based on consideration of appropriate factors including, but not limited to: exposure, uncertainty, and technical issues.

- Develop a list of general types of actions appropriate for the IHSS areas constituting OU6 (such as containment, treatment, and/or removal) that may be taken to satisfy the objectives defined in the previous step. These general types or classes of action are generally referred to as "general response actions" in EPA guidance.

- Identify and screen technology groups for each general response action. For example, the general response action for containment can be further defined to include the in situ stabilization of contaminants in a form that is less mobile or immobile in the environment. Other containment alternatives could consist of groundwater barriers, such as slurry walls. Screening will eliminate those groups that are not technically feasible at the site.

- Identify and evaluate process options for each technology group to select a representative process for each group under consideration. Although specific process options are selected for alternative development and evaluation, these processes are intended to represent the broader range of options within a general technology group. For example, a soil bentonite slurry wall may be selected as representative of vertical barriers and would be used for technical and cost comparisons.

- Assemble the selected representative technologies into potential interim response actions for each IHSS, if appropriate.

- Assemble the selected representative technologies into site closure and corrective action alternatives for the IHSS areas comprising OU6 that represent a range of treatment and containment combinations, as appropriate.

- Screen the assembled alternatives against the short- and long-term aspects of three broad criteria: effectiveness, implementability, and cost. Because the purpose of the screening evaluation is to reduce the number of alternatives that will undergo a thorough and extensive analysis, alternatives will be evaluated in less detail than subsequent evaluations.

"Effectiveness" is an evaluation of the protectiveness of human health and the environment achieved by a remedial alternative action during construction and implementation and after the response objectives have been met. Evaluation of effectiveness in the short term is based on protection of the community and workers, impacts to the environment, and the time required to meet remedial response objectives. Long-term evaluation of effectiveness addresses the risk remaining to human health and the environment and is based on the permanent destruction of, the decreased mobility of, or the reduction in volume of toxic compounds achieved after response objectives have been met.

"Implementability" is a measure of both the technical and administrative feasibility of constructing and operating and maintaining a remedial action alternative. It is used during screening to evaluate the combinations of process options with respect to site-specific conditions. "Technical feasibility" refers to the ability to construct, reliably operate, and comply with action-specific (technology-specific) requirements in order to complete the remedial action. "Administrative feasibility" refers to the ability to obtain required permits and approvals; to obtain the necessary services and capacity for treatment, storage, and disposal of hazardous wastes; and to obtain essential equipment and technical expertise.

Cost estimates for screening will be derived from cost curves, generic unit costs, vendor information, conventional cost estimating guides, and prior estimates made for Rocky Flats and similar sites, with modifications made for Rocky Flats Plant conditions. Absolute cost accuracy is not necessary, but cost estimates should have the same relative accuracy for comparison and screening. The cost estimating procedures used during screening are similar to those that will be used during the later, detailed alternatives analysis. The later, detailed analysis, however, will receive more in-depth and detailed cost estimates for the components of each alternative. The screening cost estimates will include capital, operating, and maintenance costs. The operating and maintenance costs will be calculated for the lifetime of the treatment unit operation at the site. Present-worth cost analysis will be used for alternatives to make the costs for the various alternatives comparable.

Alternatives with the most favorable results from the composite evaluation will be retained for further scrutiny during the detailed analysis. Not more than 10 alternatives will be retained for detailed analysis (including containment and no-action alternatives). At that time, it may be determined that additional site-specific information or technology-specific treatability studies are necessary for an objective detailed analysis. Also, it will be necessary to identify and verify the action-specific ARARs that each respective alternative will be required to meet.

For the Phase I RFI/RI work plan, the appropriate level of alternatives analysis is the listing of general response actions most applicable to the type of site under investigation. General response actions are defined as those broad classes of actions that may satisfy the objectives for remediation defined for OU6. Table 5-1 provides a list and description of general response actions and typical technologies associated with remediating soils, groundwater, sediments, and surface water. Table 5-1 also includes a general statement regarding the applicability of the general response action to potential exposure pathways. Not all of the alternative response actions and typical technologies listed may be appropriate for the IHSSs comprising OU6. Some will be discarded during the screening of alternatives.

The response actions outlined in Table 5-1 must be applied to the potential exposure pathways that will be identified for OU6. The response actions can be capable of providing control over all or some of the potential pathways. Partially effective response actions can be combined to form complementary sets of response actions that provide control over all pathways.

TABLE 5-1

GENERAL RESPONSE ACTIONS, TYPICAL ASSOCIATED REMEDIAL TECHNOLOGIES, AND EVALUATION

General Response Action	Description	Applicability of General Response Typical Technologies	Action to Potential Pathways
No Action	No remedial action taken at site.	Some monitoring and analyses may be performed.	National Contingency Plan requires consideration of no action as an alternative. Would not address potential pathways, although existing access restriction would continue to control onsite contact.
Access and use restrictions	Permanent prevention of entry into contaminated area of site. Control of land use.	Site security; fencing; deed use restrictions; warning signs.	Could control onsite exposure and reduce potential for offsite exposure. Site security fence and some signs are in place. Additional short-term or long-term access restriction would likely be part of most remedial actions.
Containment	In-place actions taken to prevent migration of contaminants.	Capping; groundwater containment barriers; soil stabilization; enhanced vegetation.	If applied to source, could be used to control all pathways. If applied to transport media, could be used to mitigate past releases (except air).
Pumping	Transfer of accumulated subsurface or surface contaminated water, usually to treatment and disposal.	Groundwater pumping; leachate collection; liquid removal from surface impoundments.	Applicable to leachate removal prior to in situ treatment or waste removal. Applicable to removal of contaminated groundwater and bulk liquids (for example, from buried drums).
Removal	Excavation and transport of primarily nonaqueous contaminated material from area of concern to treatment or disposal area.	Excavation and transfer of drums, soils, sediments, wastes, contaminated structures.	If applied to source, could be used to control all pathways. If applied to transport media, will control corresponding pathway. Must be used with treatment or disposal response actions to be effective.

TABLE 5-1
GENERAL RESPONSE ACTIONS, TYPICAL ASSOCIATED REMEDIAL TECHNOLOGIES, AND EVALUATION
(Concluded)

General Response Action	Description	Applicability of General Response Typical Technologies	Action to Potential Pathways
Treatment	Application of technology to change the physical or chemical characteristics of the contaminated material. Applied to material that has been removed.	Solidification; biological, chemical, and physical treatment.	Applied to removed source material; could be used to control all pathways. Applied to removed transport media, could control air, surface water, groundwater, and sediment pathways.
In Situ Treatment	Application of technologies in situ to change the in-place physical or chemical characteristics of contaminated material.	In situ vitrification; bioremediation.	Applied to source, could be used to control all pathways. Applied to transport media, could be used to control corresponding pathways.
Storage	Temporary stockpiling of removed material in a storage area or facility prior to treatment or disposal.	Temporary storage structures.	May be useful as a means to implement removal actions, but definition would not be considered a final action for pathways.
Disposal	Final placement of removed contaminated material or treatment residue in a permanent storage facility.	Permitted landfill; repositories.	With source removal, could be used to control all pathways. With removal of contaminated transport media, could be used to control corresponding pathway (except air).
Monitoring	Short- and/or long-term monitoring is implemented to assess site conditions and contamination levels.	Sediment, soil, surface water, and groundwater sampling and analysis.	RCRA requires post-closure monitoring to assess performance of closure and corrective action implementation.

In general terms, potential human exposure may be avoided by prevention of contaminant release, transport and/or contact. Thus, application of the response actions may be considered at three different points in each potential exposure pathway: (1) at the point where the contaminant could be released from the source, (2) in the transport medium, and (3) at the point where the contact could occur with the released contaminant.

The existing data regarding the site hydrogeologic characteristics and potential soil and groundwater contamination are not sufficient for implementing the screening process. The IAG and this work plan indicate that the following information will be collected during the Phase I RFI/RI for the characterization of the source and groundwater contaminants and for the preliminary screening of alternatives:

- Describe contaminant fate and transport
  - Collect and analyze soil and groundwater samples below and hydraulically downgradient of potential release areas to evaluate contaminant spread
  - Collect groundwater samples at selected locations to evaluate contaminant distribution
  - Collect and analyze surface water and sediment samples at the Detention Ponds
  - Collect sediment/surface soil samples in the creek/stream and beds
  - Collect surface soil samples at the North, Pond, and South Area Spray Fields, East Area Spray Field, Sludge Dispersal Area, Triangle Area, and Soil Dump Area
  - Describe and characterize hydrogeology beneath all IHSS areas

- Site physical characterization
  - Groundwater flow regime within the unconfined aquifer
  - Soil types and general engineering properties
  - Surface water flow regime
  - Depth to groundwater and saturated thickness of aquifers of concern

These data will provide for a thorough comparative evaluation of the technologies with respect to implementability, effectiveness, and cost, and will allow for informed decisions to be made with respect to the selection of preferred technologies. The FSP (Section 7.0) describes the methodology that will be followed to obtain the required information.

Detailed Analysis of Remedial Alternatives

It is unlikely that sufficient data will be generated during the Phase I investigation to allow a detailed analyses of remedial alternatives. The detailed analysis of each alternative will be performed when

sufficient data is generated during the remedial selection process. The detailed analysis is not a decision-making process, but it is the process of analyzing and comparing relevant information in order to select a remedial action. Each alternative will be assessed against nine evaluation criteria, and the assessments will be compared to identify the key tradeoffs among the alternatives. Assessment against the nine evaluation criteria is necessary for the Feasibility Study (FS) and the subsequent Record of Decision (ROD)/Corrective Action Decision (CAD) to comply with the CERCLA/RCRA ARARs. The nine specific evaluation criteria are:

- Overall protection of human health and the environment
- Compliance with ARARs
- Long-term effectiveness and permanence
- Reduction of toxicity, mobility, or volume
- Short-term effectiveness
- Implementability
- Cost
- State acceptance
- Community acceptance

These criteria are described in the CERCLA EPA guidance document (U.S. EPA 1988a). The initial two criteria are considered threshold criteria because these alternatives must be satisfied before further consideration of the remaining criteria. The next five criteria are considered the primary criteria on which the analysis is based. The final two criteria, state and community acceptance, are addressed during the final decision-making process after completion of the Corrective Measure/Feasibility Study (CMS/FS).

5.8 TASK 8 - TREATABILITY STUDIES

This task includes efforts to provide technical support in the form of bench-scale treatability tests to the Rocky Flats Plant ER Program in the event that treatability studies are necessary or appropriate to support the OU6 RFI/RI. EG&G has prepared a site-wide Treatability Studies Plan (EG&G 1991f) which addresses this task. The site-wide studies will be utilized as appropriate for OU6.

Treatability studies are conducted primarily to: (1) provide sufficient data to allow treatment alternatives to be fully developed and evaluated during the detailed analysis, and to support the design of a selected remedial alternative; and (2) reduce cost and performance uncertainties for treatment alternatives to acceptable levels so that a remedy can be selected. Treatability study requirements are developed during the development and screening of remedial alternatives (Section 5.7) and include all available data from the current study as well as prior studies.

Numerous technologies that appear to be potentially applicable for treating OU6 will be screened for treatability testing. The technologies selected for screening will be limited to those already commercially established or which have demonstrated potential for processing spent solvents, radionuclides, oils, and similar contaminants. Additionally, the technologies considered will be required to be readily implementable (i.e., standard design package units available) within a short time frame. Innovative and alternative technologies not meeting the above requirements will not be considered.

Depending on the hydraulic properties of the unconfined aquifer considered for remediation, it may be feasible to collect groundwater for treatment above ground. In that case, the following technologies have been identified for potential testing:

- Chemical Oxidation of Organics - Chemical oxidation is used to degrade hazardous organic materials to less toxic compounds. Oxidation systems, particularly those using ultraviolet (UV) light, ozone, and hydrogen peroxide, are powerful tools for treating a wide variety of common organic environmental contaminants. Disadvantages are similar to those for inorganic oxidation reduction: potential nontarget organics and inorganics can produce undesirable side products and increase oxidant requirements.

- Granular Activated Carbon (GAC) Adsorption of Organics - GAC adsorption is the most fully developed and widely used technology for treating groundwater contaminated with organics. It is effective for the removal of a wide range of organics from aqueous waste streams. Bench- scale testing consists of running a series of descriptive tests to determine isotherms for the groundwater contaminants. GAC is typically regenerated with a thermal process and the regeneration process can be performed at either off-site or on-site facilities.

- Reverse Osmosis - Reverse osmosis processes involve the use of semipermeable membranes. By applying water pressure greater than the osmotic pressure to one side of the membrane, water is passed through the membrane while particulate, salts, and high molecular weight organics are retained. However, the retained, highly concentrated solution (retentate) contains dissolved salts as well as the target contaminants, and requires further treatment or disposal.

- Air Stripping - Air stripping is a proven technology for removal of volatile and semivolatile contaminants from water. This process involves the transfer of contaminants from a contaminated liquid phase to a vapor phase by passing the two countercurrent streams through a packed tower. Air emission treatment is generally required, with vapor phase activated carbon systems being the most commonly used

process for this purpose, though other alternatives, such as oxidation and incineration, exist. The vapor phase treatment unit is generally costly.

- Distillation - Distillation is a process that involves separating compounds by means of their boiling point characteristics. The primary use of distillation is for reclaiming spent solvents from industrial processes, and it is generally applicable only to rather concentrated solutions. The process can be used to separate various volatile compounds or to separate mixtures of organics into light and heavy fractions. The light fraction can usually be recycled or used as a boiler feed, while the heavy fraction requires further treatment.

- Biological Reactors - Biological reactors utilize microorganisms to remove organic contaminants from the water. Most organic contaminants can be biologically degraded by introducing the appropriate microorganisms. High concentrations of some organics and the presence of metals may prove toxic to the organisms, however, and pretreatment may be required. Several types of aerobic reactors exist, including activated sludge systems, trickling filters, rotating biological contactors, and immobilized cell reactors. In general, these methods generate large amounts of sludge, requiring disposal.

- Sorption of Radionuclides - Sorption of inorganics, metals, and radionuclides is a standard technique for removal and concentration of these contaminants from wastewater. Common and proven sorption processes include ion exchange and GAC, while less-proven techniques involve the use of activated alumina, bone char, and proprietary sorption media. The sorption media are generally chemically regenerated, which results in a concentrated side stream requiring further treatment or disposal. Ion exchange and GAC sorbants are addressed separately, elsewhere in this subsection, while the use of activated alumina and bone char are discussed below.

  Activated alumina is a porous form of aluminum oxide with a large surface area. For removal of aqueous contaminants, activated alumina is typically used in a column similar to that for ion exchange. It has been proven successful in the removal of arsenic and fluoride from groundwater (Rubel 1980). More recently, activated alumina has shown promise in absorbing plutonium from a low-level wastewater effluent at the Hanford Site (Barney et al. 1989). In the same study, plutonium adsorption on bone char was the most rapid and gave the highest decontamination factors. Waste-stream-specific laboratory testing would provide valuable information on the suitability of these sorbents for low-level radionuclide removal.

- Ion Exchange of Radionuclides - Ion exchange processes are used for a wide range of water treatment application, including commonly recognized systems such as demineralizers and water softeners. The goal of an ion exchange system is to remove undesirable ions of a certain type(s) from a solution and replace them with more acceptable ions. Radionuclides are commonly removed from waste streams at nuclear facilities using ion exchange.

  Ion exchange resins, particularly anion exchange resins, have been used to recover uranium from mine run-off water for many years. Extensive studies on the laboratory scale report removal of uranium from natural waters as high as 99 percent (Sorg 1988). A small full-scale ion exchange system was capable of removing uranium from drinking water supplies to as low as 1 μg/l (Jelinek 1988). Ion exchange resins are typically rechargeable; however, the resins used in radioactive applications are generally only used once and are then disposed of as solid waste. Although published information in the removal of plutonium from natural waters by ion exchange has not been found, there is indication that ionized plutonium is removable using this technology (Marston 1990).

In cases where collection of groundwater is not feasible or practical, the following technologies have been identified for potential testing:

- In Situ Biological Treatment - Depending on the effective porosity of the soils, in situ biological treatment may be feasible. In situ biological treatment of groundwater involves the stimulation of biological growth in the contaminated zone in order to reduce the contaminant concentrations. Microorganisms that can use some or all of the contaminants as substrates will normally exist in a contaminated environment. The microorganisms are stimulated to increase their biological growth and consumption of contaminants through addition of essential nutrients. Aerobic treatment systems also require the introduction of oxygen. In situ treatment is dependent on geological and hydrological conditions. The process is relatively inexpensive.

- Vacuum Extraction - Volatile contaminants can be removed from soil using vacuum extraction, which is an in situ treatment technology that involves the air stripping of contaminants by inducing a vapor flow through the soil. Since this technology involves the transfer of contaminants to the vapor, air emission treatment is generally required. The efficiency of the process is highly dependent on geologic conditions, and would tend to be ineffective in low-permeability materials.

In cases where contaminants are entrained in soils, the soil (such as surface soil) is accessible, and the contamination is of limited areal extent, the following technologies have been identified for potential testing:

- Solidification/Stabilization - Solidification is a process in which contaminants are mechanically bound to solidification agents, reducing their mobility. This produces a solid matrix of waste with high structural integrity. Stabilization usually involves the addition of a chemical reagent to react with the contaminant, producing a less mobile or less toxic compound. Solidification and stabilization are frequently used together and are a well-established method for reducing the mobility and toxicity of hazardous wastes. This process generates large volumes of solidified materials requiring disposal.

- Vitrification - The vitrification process involves heating the waste matrix to a very high temperature and either combining the matrix with molten glass or heating the matrix until it melts. Once cooled, the molten mass solidifies into a stable, noncrystalline solid resistant to leaching of inorganic, metal, and radionuclide contaminants. Organic components are destroyed by pyrolysis. The process can be conducted either in situ or off site; however, the process is generally expensive.

- Physical Separation - Soil contaminants are often found to be associated with particular size fractions of soils, most often fine particles. In these cases, fractionation of the soil based on particle size can be effective means of reducing the volume of the material that requires further treatment. The processes used for soil fractionation include screening, classification, flotation, and gravity concentration.

- Soil Washing - Soil washing is based on the principle of contaminant removal from soil by washing with two liquid solutions. Washing agents include water, acids, solvents, surfactants, and chelators. With the selection of appropriate washing solutions, soil washing technology can potentially be used to remove organic, inorganics, metals, and radionuclides. The wash solution containing the contaminants will require treatment and/or disposal.

5.9 TASK 9 - REMEDIAL INVESTIGATION REPORT

An RFI/RI report will be prepared summarizing the data obtained during the Phase I field work and data collected from previous and ongoing investigations. This report will:

- Describe in detail of the field activities that serve as the basis for the RFI/RI report. This will include any deviations from the work plan that occurred during implementation of the field investigation.

- Discuss site physical conditions. This discussion will include surface features, meteorology, surface water hydrology, surficial and subsurface geology, groundwater hydrology, demography and land use, and ecology.

- Present a Preliminary Site Characterization based on all RFI/RI activities at OU6 to characterize the nature and extent of contamination. The media to be addressed will include contaminant sources, soils, sediments, groundwater, surface water, air, and biota.

- Discuss contaminant fate and transport. This discussion will include potential contaminant migration routes, contaminant persistence, chemical attenuation processes and potential receptors.

- Present a baseline risk assessment. The risk assessment will include human health and environmental evaluations.

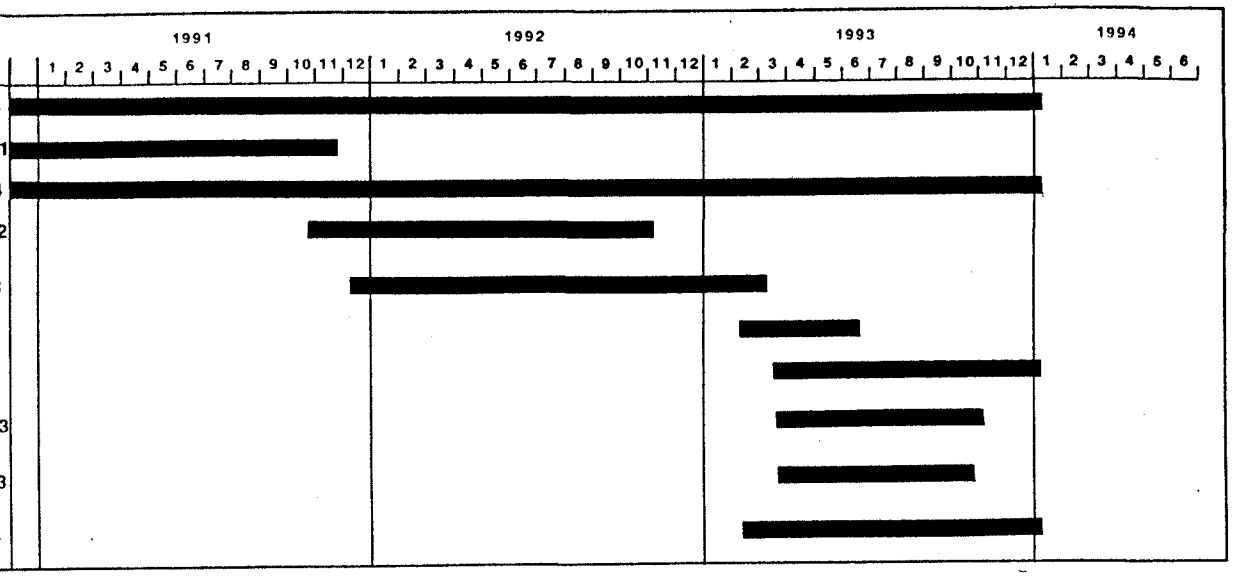
- Present a summary of the findings and conclusions.

- Identify data gaps and work to be performed for the Phase II investigation.

6.0
SCHEDULE

The schedule for conducting the Phase I Remedial Investigation is summarized in Figure 6-1. Dates shown are from the Interagency Agreement (IAG), dated January 22, 1991. According to the schedule, approximately 3 years will elapse from the time this work plan is finalized until the Phase I Remedial Investigation Report is issued.

ACTIVITY	DATES START	DATES FINISH
PROJECT MANAGEMENT	18 Sep,90	7 Jan,94
TASK 1 - PROJECT PLANNING	18 Sep,90	20 Nov,91
TASK 2 - COMMUNITY RELATIONS	18 Sep,90	7 Jan,94
TASK 3 - FIELD INVESTIGATION	16 Oct,91	17 Nov,92
TASK 4 - SAMPLE ANALYSIS & DATA VALIDATION	2 Dec,91	8 Mar,93
TASK 5 - DATA EVALUATION	9 Feb,93	4 Jun,93
TASK 6 - BASELINE RISK ASSESSMENT	2 Mar,93	7 Jan,94
TASK 7 - DEVELOPMENT AND SCREENING OF REMEDIAL ALTERNATIVES	2 Mar,93	28 Oct,93
TASK 8 - TREATABILITY STUDIES	2 Mar,93	22 Oct,93
TASK 9 - PHASE I REMEDIAL INVESTIGATION REPORT	9 Feb,93	7 Jan,94



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

OPERABLE UNIT 6
PHASE I RFI/RI WORK PLAN

PHASE I RFI/RI SCHEDULE

FIGURE 6-1

APRIL 1991

7.1 BACKGROUND AND SAMPLING RATIONALE

7.1.1 Background

The objectives of the Phase I RCRA Facility Investigation (RFI)/Remedial Investigation (RI) are:

- To characterize the physical and hydrogeologic setting of the Individual Hazardous Substance Sites (IHSSs)
- To assess the presence or absence of contamination at each site
- To characterize the nature and extent of contamination at the sites, if present
- To support the Phase I Baseline Risk Assessment and Environmental Evaluation

Within these broad objectives, site-specific data needs have been identified in Section 4.0. The purpose of this section of the work plan is to provide a Field Sampling Plan (FSP) that will address the data needs and data quality objectives. The FSP developed in this section is based on the requirements of the IAG Statement of Work for Operable Unit 6 (OU6), and the data needs developed in Section 4.0. It is important to recognize that additional phases of investigation and risk assessment may be required at some IHSSs prior to the feasibility studies.

Generally, only limited information is available concerning the IHSSs in OU6 since there have been few previous investigations. Available information includes aerial photographs, site histories, and some analytical data for samples collected near the IHSSs. Little or no information exists specific to the physical characteristics of the sites, except for some of the A- and B-series ponds, or the nature and extent of the contamination, if present.

One of the objectives of the RFI/RI is to assess the presence or absence of contamination in the groundwater, surface water, and soils at the sites. A stepped approach as outlined in the IAG will be used in Phase I to achieve this objective. This approach requires an iterative process involving continuing reassessment of the site condition as the data are obtained. Based on this process, the subsequent field sampling program may be modified to collect more representative data for each IHSS. This FSP describes this stepped process.

Based on the previous investigations and historical data presented in Section 2.0 of this report, the primary potential contaminants of concern are radioactive materials. Insufficient data exists to confirm or deny the presence of metals or organic compounds in IHSSs within OU6.

7.1.2 Sampling Rationale

As discussed above, a stepped approach will be used for the sampling program. There are a total of four steps which may be completed at any site.

- Step 1 consists of a review of existing data, including aerial photographs and site records. Data from ongoing or other operable unit investigations that have become available since preparation of this Phase I work plan will also be compiled and evaluated. These data will be validated as appropriate for incorporation into the OU6 site characterization. This review of existing information has already been partially performed during preparation of this Phase I work plan.

- Step 2 involves screening activities, including radiation surveys, a soil gas survey in the Triangle Area, and an electromagnetic geophysical survey at the Trenches. The radiation and soil gas surveys are designed to provide Phase I screening-level data concerning the presence or absence of contaminants at these sites. The geophysical survey will provide data on the depth and lateral extent of the Trenches.

- Step 3 consists of Phase I sampling activities for soil, sediment and surface water. Soil borings will be completed at some IHSSs to collect samples at depth and to characterize the IHSS. Some of the sampling locations may be selected to investigate anomalies identified in the Step 2 soil gas and radiation surveys. This step will provide confirmation of the Phase I screening data as well as aid in Phase I geologic and hydrogeologic characterization of the sites.

- Step 4 is monitoring well installation and sampling, which will follow the Step 3 characterization and sampling. Groundwater monitoring wells will be installed to characterize the hydrogeologic setting of each site and to monitor alluvial groundwater conditions within or downgradient of several sites. These wells will be sampled after completion and development, and the results will be included in the Phase I RFI/RI Report.

7.1.3 Modifications to the IAG Plan

Several sampling and analytical activities described in the IAG have been modified in this FSP. These modifications, listed below, have been made so that each IHSS can be better evaluated during the Phase I investigation. Modifications to the Phase I sampling program are presented first followed by the modification to the Phase I analytical program.

Sampling Program Modifications

1) Both the Triangle Area (IHSS 165) and the Old Outfall (IHSS 143) appear to have been modified since waste disposal activities ceased at these locations. Fill has been added (origin of the fill unknown) and buildings have been constructed on the Old Outfall after waste disposal activities were discontinued. As much as 8 to 10 feet of fill may exist over the original surface. In addition, about 6 inches of surface fill has also been placed over parts of the Triangle Area. The Field Sampling Plan has been modified so that the surface soil sampling specified in the IAG can be taken from the original surfaces of these units. This will entail using borings to drill down to the original land surface so that samples can be collected at and below this surface. Composite samples of the fill will also be collected to determine if any contamination is present. The modifications to this sampling program are described in subsections 7.2.3 and 7.2.5.

2) Two-foot composite samples will not be used for volatile organics analysis at the Triangle Area (IHSS 165) or Trenches (IHSS 166). Instead, discrete samples will be collected at two-foot increments for analysis. Composite samples are not appropriate for analysis of volatile organic compounds, since a significant portion of the volatiles present in a sample can be volatilized during compositing of a sample.

3) The soil gas survey at the Triangle Area (IHSS 165) will be conducted on a 100-foot offset grid instead of the 50-foot grid specified in the IAG. If areas of anomalous radiation readings are detected, the size of the grid will be reduced in that area to locate the organics source.

4) One of the wells proposed in the Triangle Area (IHSS 165) will be drilled 20 feet into bedrock. The well within the PSZ will be screened in the first sandstone zone in the bedrock, if encountered. If there is not a sandstone zone in the boring, the well will be completed in the saturated alluvium. The purpose of the bedrock well is to confirm bedrock geology in this area and identify contamination, if present.

5) One well will be installed to monitor the saturated alluvium downgradient (east-southeast) of IHSS 166.2 (Trench B). It is suspected, based on the local topography, that Trench B may be near a groundwater drainage divide. Groundwater flow to the north from the trenches is

monitored by several wells while no monitoring wells exist to the east. The purpose of this additional well will be to provide data on possible groundwater contamination adjacent to this trench and in the eastward flow direction.

6) Five sediment samples are to be collected in each A-series and B-series pond as proposed in the IAG. However, three of the five locations have been changed so that more representative samples of the pond sediment can be obtained. The five locations proposed in this Phase I FSP are:

- In the deepest portion of the pond,
- In the pond, five feet from the inlet, and
- At three randomly selected locations within the pond.

The samples to be collected at the three random locations are the locations which have been changed from those specified in the IAG. These random samples will provide pond sediment data that can be statistically averaged, while the sediment samples collected from the deepest part of the ponds are likely to provide worst case concentrations. These average and worst case concentrations can then be used to better characterize the extent and nature of any contamination in the ponds and provide more useful data for the Phase I baseline risk assessment. The three original sampling locations specified in the IAG would provide non-random data that cannot be used in statistical analyses.

7) Surface and subsurface samples will be collected in the North, Pond and South Area Spray Fields (IHSSs 167.1, 167.2 and 167.3) on 100-foot grids. Since homogeneous liquids were sprayed across the spray fields, the 100-foot grid should adequately characterize the nature and extent of contamination, if present. In addition, one sediment samples will be collected in the drainage immediately east of the North Spray Field and a second sample will be collected immediately downgradient of the South Spray Field so as to characterize potential downstream contamination from these units.

8) Surface and subsurface soil samples will be collected on a 200-foot grid from the East Area Spray Field (IHSS 216.1). The purpose of these additional samples is to evaluate the presence or absence of contamination in that area. The rationale for this sampling is that if contamination is not found, then this IHSS may be removed from further phases of the RFI/RI process.

9) IHSS 156.2, the Soil Dump Area, has been moved from Operable Unit No. 14 into OU6. The field sampling plan for this unit will consist of a germanium surface radiation survey over the entire site instead of the proposed FIDLER survey specified in the IAG as the germanium survey should be a superior radiation detection technique. Surface and subsurface samples will be

taken on a 150-foot grid across this IHSS instead of the 50-foot grid around the perimeter as proposed in the IAG. The rationale for this is that it is better to sample the waste pile present within this IHSS than the perimeter of the unit. This sampling along with the surface germanium radiation survey should more adequately characterize the nature and extent of contamination, if present in this area. In addition, one well will be drilled 20 feet into bedrock within this IHSS and will be completed in bedrock if a sandstone zone is encountered.

10) Sediment samples will be collected from the drainages in OU6 to characterize areas where existing data is currently lacking. Proposed sediment samples have been located along each stream segment of North and South Walnut creeks where additional characterization is needed. Based on a review of the data collected at the 17 existing locations along the OU6 drainages, there exists a significant amount of information about the sediments in many parts of OU6 (see Section 2.0). Subsequently, the sampling locations specified in the IAG have been reduced where data already exist with proposed sampling locations placed in areas that need further characterization. Based on this approach, the following sediment sample locations have been identified for OU6: (1) three additional samples have been added to South Walnut Creek to augment the five existing stations and 25 pond sediment samples that are collected in this area; (2) three sediment stations have been added to North Walnut Creek to supplement the six existing and 20 pond sediment locations; (3) two sediment locations have been added to Walnut Creek downgradient of the junction of North and South Walnut Creek to supplement the one existing and five pond sediment samples that are collected in this area; and (4) two locations have been added to the unnamed tributaries north of North Walnut Creek just downstream of IHSSs 167.1 and 167.2 to supplement the existing three sediment samples along this drainage. These proposed sampling locations in combination with the 17 existing sediment stations in this area and the 50 sediment samples to be collected from the detention ponds should be sufficient to characterize the drainages in OU6. In addition to the above, two more sediment locations have been located south of the Triangle Area to determine if the drainage from this IHSS has affected the area downslope of this unit.

11) Five bedrock wells will be installed in the vicinity of North Walnut Creek during the OU6 investigation. The purpose of these wells is to characterize the bedrock in the vicinity of the A-series ponds.

Analytical Program Modifications

1) Soil samples from the preexisting surface (below the fill) of the Triangle Area (IHSS 165) will be analyzed for metals as well as for radioactive elements. This should provide more specific data on the potential for metals contamination at this site. Metal analyses have been added to this site because the wastes that were placed in this area may have contained metals, and for

consistency, since the groundwater monitoring program calls for analysis of metals in wells near this IHSS.

2) A gamma radiation scan will be conducted by EG&G or its contractor on each of the sediment samples collected from the location at the deepest portion of the A- and B-series ponds. Sediment samples at these locations will be collected from the sediment core at five-centimeter intervals. The rationale behind this analysis is to evaluate whether contamination may exist in thinly stratified layers and to provide additional data to characterize pond sediment.

3) The IAG specifies that water and sediment samples be analyzed for soluble and insoluble radionuclides and metals. For the purposes of this Phase I investigation, each of the water samples will be filtered, with both the filtered and unfiltered aliquots analyzed for the specified metals and radionuclides. The filtered samples will provide data on the dissolved constituents and the unfiltered samples will provide data on the total constituent concentrations. Also, water samples (both filtered and unfiltered) and sediments will be analyzed for both plutonium isotopes (239/240). This is consistent with the existing Rocky Flats analytical methods.

4) Several analyses have been added to the Phase I analytical program to assess chemicals of interest in the Environmental Evaluation. Groundwater from wells at the Triangle Area (IHSS 165), Trenches A, B and C (IHSS 166), the North and South Area Spray Fields (IHSSs 167.1 and 167.3) and all the sediment samples collected in Walnut Creek (excluding the pond samples) will be analyzed for TCL pesticides/PCBs. For the pond sediment samples, the sample from the deepest part of the pond and from the inlet area will be analyzed for TCL pesticides/PCBs. All surface (0-2 inches) soil samples taken in OU6 and sediment samples collected in Walnut Creek and the Ponds will be analyzed for total organic carbon (TOC).

7.2 INVESTIGATION PROGRAM

This section describes the Phase I investigation program for the IHSSs within OU6. For each IHSS, the tasks listed are generally divided into office activities prior to field sampling (Step 1), field screening activities prior to sampling (Step 2), field sampling activities (Step 3), and groundwater monitoring well installation and sampling (Step 4). As part of the field sampling program, data from the site-wide monitoring program and investigations at other OUs will be used as appropriate to add to, or substitute for, the data collected during the Phase I investigation. The sites in OU6 are IHSS 141 - Sludge Dispersal Area, IHSS 142.1-9, 12 - A and B Series Detention Ponds, IHSS 143 - Old Outfall, IHSS 156.2 - Soil Dump Area, IHSS 165 -Triangle Area, IHSS 166 - Trenches A, B and C, IHSS 167 - North, Pond, and South Area Spray Fields, and IHSS 216.1 - East Spray Fields - North Area. For reference, the Phase I investigation programs for each IHSS are summarized below. A number of standard operating

procedures (SOPs) will be used during the investigation. The SOPs are cited in this section and discussed further in Section 11.0 of this Phase I work plan.

7.2.1 IHSS 141 - Sludge Dispersal Area

Step 1 - Radiation Survey

A radiation survey will be performed over the areas affected by IHSS 141 (see Table 7-1). The radiation readings will be taken on a 25 ft. grid according to the procedure described in SOP FO.16 (Field Radiological Measurements) (Figure 7-1). If areas of anomalous radiation readings are detected, the size of the grid will be reduced in that area to locate the radiation source. The results will be plotted and contoured on a map. The Phase I survey will be conducted using a side-shielded field instrument for detection of low energy radiation (FIDLER) and a shielded Geiger-Mueller (G-M) pancake-type detector.

Step 2 - Surface Soil Sampling

Surface soil samples will be collected to a depth of 2 in. on a 25 ft. grid over IHSS 141 (Figure 7-1) according to the procedures in GT.8, Surface Soil Sampling. Surface soil samples will also be collected from areas of anomalous radiation readings located during the radiation survey. Grid points located in paved areas (road) or under buildings within this IHSS will not be collected. A discussion of the analytical program for these samples is contained in subsection 7.3.

Step 3 - Monitoring Well

One monitoring well will be installed downgradient of IHSS 141 (a preliminary location is shown on Figure 7-1). The location of the well will be selected after completion of the Step 2 activities and after a review of the geologic conditions at the site. The proposed well location will be submitted to EPA and CDH for review and approval prior to its installation. This well will be screened to monitor the saturated alluvium. If a water bearing sandstone unit is found to be the first bedrock unit underlying the alluvium, the well will be completed in the sandstone unit at that location. The well will be drilled according to SOP GT.2, installed according to SOP GT.6 and developed according to SOP GW.2. Following development, the well will be sampled according to SOPs GW.5 and GW.6. The Phase I analytical program for samples collected from this well is contained in Section 7.3. The results of the first round of sampling will be reported in the Phase I Report. The well will be sampled and quarterly basis for a minimum of one year.

TABLE 7-1

PHASE I INVESTIGATION
IHSS 141 - SLUDGE DISPERSAL AREA

Activity	Purpose	Location	Number of Samples or Locations
Radiation survey	Locate areas of anomalous radiation readings	Entire site - 25 ft grid	NA
Surface soil sampling	Characterize surface contamination and areas of anomalous radiation readings	Entire site - 25 ft grid and areas of anomalous radiation readings except under buildings and roads	60
Install well	Monitor alluvial groundwater downgradient of the unit	See Figure 7-1	1

NA - Not Applicable

7.2.2 IHSS 142.1-9, 12 - A and B Series Detention Ponds

Step 1 - Review Existing Data

Surface water and sediment samples are currently being collected at locations in the Walnut Creek drainage as part of ongoing monitoring activities at the Rocky Flats Plant. The sampling locations, methodology, analytical parameters, and results from this monitoring will be reviewed prior to Phase I activities to assess potential overlap between programs. Data collected during these ongoing monitoring activities may satisfy the requirements of this OU6 program and will be utilized, if appropriate (Table 7-2). Also, as specified in the IAG, the 1986 Rockwell International report entitled "Trends in the Rocky Flats Surface Water Monitoring" (U.S. DOE 1986a) and other data pertaining to these ponds will be submitted to the EPA and CDH.

Step 2 - Surface Water and Sediment Samples

Five surface water samples will be collected from each of the four A-Series Detention Ponds and the five B-Series Detention Ponds and IHSS 142.12. At least one of the five water samples from each pond will be taken from the deepest part of the pond. As specified in the IAG, stratification of the water column at this location will be identified through temperature and/or dissolved oxygen measurements taken according to SOP SW.8. If stratification of the pond is identified, grab water samples will be taken from each vertically stratified zone. The second water sample from each pond will be collected from within 5 feet of the inlet of the pond. The third water sample from each pond will be taken within 5 feet of the pond spillway. The other two sampling locations will be randomly selected based on the size of the pond at the time of sampling. The surface water sample collected at each location will consist of a composite sample from the entire vertical water column, except for the grab samples at the deepest sampling location (described above). Samples will be collected according to SOPs SW.1, SW.2, and SW.8 as they apply to pond water sampling.

Five sediment samples will be collected from each of four A-Series Detention Ponds the five B-Series Detention Ponds and IHSS 142.12 (Figures 7-2 and 7-3). One of the five sediment samples will be collected from within 5 feet of the pond inlet. The second sediment sample will be taken from the deepest parts of each pond. The other three samples will be taken at random locations within the area of the pond as it exists at the time of sampling. All sediment samples will represent the entire vertical column of sediment present at each location. If sediment depth is greater than 2 feet, 2-foot composite samples will be collected. Sediment samples will be geologically logged according to SOP GT.1.

TABLE 7-2

PHASE I INVESTIGATION
IHSS 142.1-9 and 142.12 - A and B SERIES PONDS

Activity	Purpose	Location	Number of Samples or Locations
Collect surface water samples	Characterize surface water contamination	5 locations in each pond and from each vertically stratified zone at the deepest point in the pond	72
Collect sediment samples in ponds	Characterize sediments in ponds and contamination	5 locations in each pond. Samples will also be taken from each 5 centimeter interval of sediment from the deepest part of each pond.	50
Collect sediment samples in other locations on Walnut Creek	Characterize Walnut Creek sediments and contamination	See Figure 7-4 and text.	13
Install wells	Monitor alluvial groundwater downgradient of the Ponds A-4 and B-5	Below ponds A-4 and B-5 dams (2 each)	4

In addition to the above samples, grab sediment samples will be collected from discrete vertical intervals in the sediment core taken from the deepest part of the pond. These sediment samples will consist of composite samples collected at 5-centimeter intervals in this core. Each of these samples will be analyzed by a gamma radiation scan.

Sediment samples will also be collected along Walnut Creek from adjacent to Parking Area No. 71 to Indiana Street (Figure 7-4). There already exist data on the sediments in the OU6 area (see Section 2.0). These existing data were used to focus the Phase I sediment data collection effort in areas where there are data gaps. In addition, the sediment samples that are collected from the individual detention ponds should also provide a significant amount of information on the sediments in this area. This pond sediment data is considered particularly important for characterizing the contamination present in this drainage because the contaminants should be preferentially present in the finer-grained sediments that exist in these ponds.

Based on the existing sediment sampling locations within the detention ponds and near the IHSSs along this drainage, the Phase I sediment sampling locations for this work plan were selected (Figure 7-4). Table 7-3 contains the Phase I sediment sampling program (both existing and proposed) which has been developed for OU6. Generally, additional sampling locations have been placed downstream of each IHSS and along each stream segment where existing data is lacking to characterize this drainage. This proposed sampling program along with the existing sediment program should be able to adequately characterize the drainages within OU6 and to determine if there has been any impact from the IHSSs located along it. If contaminants are detected, additional sediment samples will be collected as needed to characterize these areas.

In addition to the above sediment samples, two samples will be collected south of the triangle area to determine if this area has been affected by runoff from this IHSS (Figure 7-4). One of these locations along the south boundary of this IHSS will sample the sediment at the upstream end of a culvert that runs underneath the PSZ. The second sediment location, southwest of the Triangle Area, will be used to characterize the sediment that are present in this area.

These stream sediment samples will be collected within the stream at points that are conducive to the collection of sediment. The sample at each location will consist of 2-foot composite samples taken to the depth of the first gravel layer below the sediment. If the sediment is thicker than two feet, then two-foot composite samples will be collected. All sediment samples listed above will be collected according to SOP SW.1, SW.2, SW.3, SW.6 and the SOP Addendum (SOPA) to SOP SW.6 in Section 11.0 of this document. The chemical analyses that will be performed on these samples are presented in subsection 7.3.

TABLE 7-3

PROPOSED SEDIMENT SAMPLING PROGRAM

Stream Segment of Location	Proposed Locations	Existing Locations	IHSSs Upslope of Segment	Length of Stream Segment
South Walnut Creek				
Upstream of IHSS 141	3	SED-11	IHSS 165	600 ft.
Between IHSS 141 and Pond B-1	None	SED-12	IHSS 141	400 ft.
Between Ponds B-1 and B-4	20*	None	IHSSs 216.1, 156.2, 142.5, 142.6, 142.7, and 142.8	1,000 ft.
Between Ponds B-4 and B-5	1	SED-32	IHSS 216.1	900 ft.
Between Pond B-4 and junction with North Walnut Creek	1	SED-13 SED-33	None	1,650 ft.
North Walnut Creek				
Between IHSS 113 and Pond A-1	2	SED-118 SED-9	IHSSs 113, 166.2, 166.3, and 165	3,000 ft.
Between Ponds A-1 and A-3	15*	None	IHSSs 156.2, 216.1, 142.1, 142.2, and 142.3	2,400 ft.
Between Ponds A-3 and A-4	6*	None	None	1,400 ft.
Between Pond A-4 and junction with South Walnut Creek	1	SED-8	None	600 ft.
Walnut Creek between junction of North and South Walnut Creek and Indiana	2	SED-3	IHSS 142.12	360 ft.

*Pond sediment sampling locations - five samples per pond.

TABLE 7-3
(Concluded)

Stream Segment of Location	Proposed Locations	Existing Locations	IHSSs Upslope of Segment	Length of Stream Segment
Downgradient of IHSS 167.1 on unnamed tributary	1	None	167.1	900 ft.
Downgradient of IHSS 167.3 on unnamed tributary	1	SED-6	167.3	900 ft.

*Pond sediment sampling locations - five samples per pond.

Step 3 - Monitoring Wells

Two monitoring wells will be installed immediately downgradient of each dam at Pond A-4 and at Pond B-5 for a total of 4 wells (Figure 7-2 and Figure 7-3). The wells will be constructed within the original stream channel according to SOP GT.6 and will monitor the saturated alluvium. If a water-bearing sandstone unit is found to be the first bedrock unit underlying the alluvium, the well will be completed in the sandstone unit at that location. Following development of the wells according to SOP GW.2, the wells will be sampled according to SOPs GW.5 and GW.6. Results of the first round of sampling will be reported in the Phase I RI Report. The wells will be sampled quarterly for a minimum of one year. The analytical program for samples from these wells is discussed in subsection 7.3.

Five bedrock monitoring wells will be installed in the North Walnut Creek area to further characterize the bedrock and to determine if the Arapahoe No. 4 sand is present in this area. These bedrock wells will be cored only in the interval in which they will be completed. The five wells will be installed in the approximate locations shown on Figure 7-4 to depths ranging from 80 to 120 feet. Drilling fluids and cuttings from these wells will be handled according to SOP FO.8 and the wells will be completed in accordance with SOP GT.6. Following development of the wells (SOP GW.2), the wells will be sampled on a quarterly basis for a minimum of one year. The analytical program for samples from these wells is discussed in subsection 7.3.

7.2.3 IHS143 - Old Outfall

Step 1 - Radiation Survey

A radiation survey will be performed over the area affected by IHSS 143 according to SOP FO.16. The radiation readings will be taken on a 10-foot grid (Table 7-4). If areas of anomalous radiation readings are detected, the size of the grid will be reduced in that area to pinpoint the radiation source. The results will be plotted and contoured on a map. The survey will be conducted using a side-shielded field instrument for detection of low energy radiation (FIDLER) and a shielded Geiger-Mueller (G-M) pancake-type detector.

Step 2 - Surface and Subsurface Soil Sampling

Surface soil samples will be collected to a depth of 2 inches below the existing ground surface at the central location of all areas identified by the radiation survey as having above-background radiation levels. These samples will be collected according to SOP GT.8.

TABLE 7-4

PHASE I INVESTIGATION
IHSS 143 - OLD OUTFALL AREA

Activity	Purpose	Location	Number of Samples or Locations
Radiation survey	Locate areas of anomalous radiation readings	Entire site - 10 ft grid	NA
Surface soil sampling	Characterize surface contamination and areas of anomalous radiation readings	Entire site - 20 ft grid and areas of anomalous radiation readings, and along drainage	11
Subsurface soil sampling	Characterize top two feet of soil and areas of anomalous radiation readings	Same as surface locations. Sampling will extend to 2 feet below the fill layer	11
Fill sampling	Determine if contamination is present to fill	Composite sample of fill from every fourth soil boring	3

NA - Not Applicable

The Old Outfall is an area where fill has been placed since waste discharge activities ceased at this site. Fill thicknesses may vary from 0 to 10 feet. Since the area of interest is the pre-fill ground surface, it will be necessary to drill through the fill to collect samples from the original ground surface. Soil borings in IHSS 143 will be drilled on a 20-foot grid, except under buildings, to a depth of 2 feet below the original pre-fill surface (see Figure 7-5). One sample will be collected from the top of the prefill surface to 2 inches below the pre-fill surface. The second sample will be collected from 2 inches to 24 inches below the prefill surface. Composite samples will be collected from the entire vertical section of the fill section in every fourth boring. The borings will be drilled according to SOP GT.2. In addition to the above borings, one boring will be drilled just east of the east culvert and sampled similar to the above borings (see Figure 7-5).

7.2.4 IHSS 156.2 - Soil Dump Area

Step 1 - Review Aerial Photographs

Aerial photographs will be evaluated to identify the extent of the Soil Dump Area (Table 7-5).

Step 2 - Radiation Survey

A ground-based radiation survey employing a high-purity germanium gamma-ray sensor will be performed over the Soil Dump Area. The area to be surveyed for IHSS 156.2 is the boundary outline for this IHSS (Figure 7-1). The sodium iodide sensors employed for this survey will be spaced such that there is overlapping coverage between stations, so that essentially 100% coverage can be obtained. The gamma-emitting radionuclides that are detected will be analyzed to identify the isotopes that may be present. Prior to implementation, an SOP will be developed for performing this survey. If areas of anomalous radiation readings are detected, they will be surveyed sufficiently to define their lateral extent. The results will be plotted and contoured on a map and will also be presented in tabular form.

Step 3 - Surface Soil Samples and Soil Borings

Surface soil samples will be collected to a depth of 2 inches on a 150-foot grid over the Soil Dump Area (Figure 7-1). Surface soil samples will be collected according to SOP GT.8. Soil borings will be drilled 3-feet into the undisturbed soil beneath the soil piles on the same 150-foot grid according to SOP GT.2. Samples will be taken continuously in these borings and will be composited from each 2-foot interval. These samples will be analyzed for radioactive elements (see subsection 7.3).

During sampling a soil classification survey will be completed in the Soil Dump Area for use in the Environmental Evaluation. Several samples may also be collected from 0 to 2 feet for grain size analysis.

TABLE 7-5

PHASE I INVESTIGATION
IHSS 156.2 - SOIL DUMP AREA

Activity	Purpose	Location	Number of Samples or Locations
Review aerial photographs and radiation surveys	Identify extent	Entire site	NA
Radiation Survey	Locate areas of anomalous radiation readings	Entire site	NA
Surface soil samples	Characterize surface materials and contamination and areas of anomalous radiation readings	Entire site - 150-ft grid	14
Soil borings	Characterize subsurface conditions and materials	Entire site - 150-ft grid. Borings will be drilled 3 ft into the undisturbed soils beneath the soil piles	14
Install wells	Monitor groundwater in bedrock sand zone, if encountered	In western part of unit	1

NA - Not Applicable

Step 4 - Monitoring Well

One monitoring well will be installed in this IHSS to monitor groundwater underlying the Soil Dump Area. The well will be located in the western part of the unit (Figure 7-1). The well will be drilled 20 feet into bedrock. If a sandstone zone is present in the boring, then the well will be completed to monitor the sandstone layers. The purpose of this well is to confirm bedrock geology and to characterize the presence of contamination in this area, if present. The well will be drilled according to SOP GT.2, installed according to SOP GT.6, and developed and tested according to SOP GW.2. During slug testing of this well, special attention will be directed towards characterizing this stratigraphic sandstone lenses in the bedrock, if present. Following development, the well will be sampled according to SOPs GW.5 and GW.6. The proposed analytical program for samples from these wells is contained in subsection 7.3. The results of the first round of sampling will be reported in the Phase I RI Report. This well will be sampled on a quarterly basis for a minimum of one year.

7.2.5 IHSS 165 - Triangle Area

Step 1 - Review Aerial Photographs

Aerial photographs from 1953, 1964, 1969 and 1971 will be re-evaluated to identify the extent of the disposal area (Table 7-6). The aerial photographs suggest that the site extends farther to the north, east and west than is presently mapped. Additional studies conducted on or near the Triangle Area after preparation of this work plan will also be evaluated. These include investigations currently planned for Operable Unit 2 and the investigation planned for IHSS 176 (S & W Contractor Storage Yard), which partially overlaps this area. Also during Step 1 any reports or documents concerning the radiometric surveys conducted from 1975 to 1983 and any cleanup activities at this site will be submitted to the EPA and CDH.

Step 2 - Radiation and Soil Gas Surveys

A radiation survey will be performed over the Triangle Area on a 25-foot grid, excluding the PSZ fence area, (Figure 7-1) according to the procedures specified in SOP FO.16. If areas of anomalous radiation readings are detected, the size of the grid will be reduced in that area to locate the radiation source. The results will be plotted on a map and contoured. The survey will be conducted using a side-shielded FIDLER and a shielded G-M pancake-type detector.

TABLE 7-6

PHASE I INVESTIGATON
IHSS 165 - TRIANGLE AREA

Activity	Purpose	Location	Number of Samples or Locations
Review aerial photographs	Identify extent	Entire site	NA
Radiation survey	Locate areas of anomalous radiation readings	Entire site - excluding PSZ fence - 25 ft grid	NA
Soil gas survey	Locate plumes of volatiles	Entire site - excluding PSZ fence - 100 ft grid	56
Surface soil samples	Verify presence or non-presence of volatiles identified during soil gas survey and characterize areas of anomalous radiation readings	VOC and areas of anomalous radiation readings	6-15
Soil cores	Verify presence or non-presence of volatiles identified during soil gas survey	Random basis, 1 sample, every 15 soil gas samples, at the depth of the soil gas probe.	4
Soil borings (if plumes are identified)	Transect plumes identified by soil gas or radiation survey, if identified	Three borings transecting three highest soil gas locations. Borings will be drilled 3 ft. into weathered bedrock.	Maximum of 9
Install wells	Monitor groundwater under the unit	One well east of PSZ and one in north part of unit within PSZ	2

NA - Not Applicable

A real-time soil gas survey will be conducted over the Triangle Area, excluding the PSZ fence area (Figure 7-1) to evaluate the presence of organic volatile compounds. Soil gas samples will be taken on a 100-foot offset grid according to the procedures described in SOP GT.9. If organics are detected, the size of the grid will be reduced in that area to locate the organics source. The probe will be driven two to four feet into the soil, below the fill, if possible, to collect the sample. The soil gas samples will be analyzed for carbon tetrachloride, trichloroethene (TCE), dichloromethane, acetone, 2-butanone, tetrachloroethene (PCE), 1,2-dichloroethane (DCA), chloroform and toluene. Analytical peaks of compounds for which the gas chromatograph (GC) is not calibrated will be noted. The soil gas survey will be conducted using a portable GC. The analytical program for this soil gas survey is further discussed in subsection 7.3.2.

Step 3 - Soil Cores, Surface Soil Samples, and Soil Borings

Soil cores will be collected on a random basis to confirm the results of this survey. One soil core will be collected for every 15 soil gas samples at the same depth as the soil gas samples. In addition, surface soil samples will be collected at the locations of volatile organic or radiation plumes, if detected. The surface soil samples will be taken at the surface of the fill material and at the original ground surface according to the procedures described in SOP GT.8.

During sampling, a soil classification survey will be completed at the Triangle Area for use in the Environmental Evaluation. Several samples may also be collected from 0 to 2 feet for grain size analysis.

If plumes are identified by the soil gas survey, soil borings will be utilized to transect the plumes. At each plume area one soil boring will be placed at the location of the highest soil gas reading and two borings will be drilled downgradient of that point. Three borings will be placed at up to three areas where plumes have been identified by the soil gas survey at the Triangle Area, resulting in a maximum of 9 borings for this area. The soil borings will be drilled 3 feet into weathered bedrock according to the procedures described in SOP GT.2. Samples will be taken continuously in these borings. Discrete samples will be collected from every 2-foot increment and analyzed for volatile organic compounds as described in subsection 7.3. Samples will be composited from every 6-foot interval and analyzed for semivolatile organic compounds and radionuclides as described in subsection 7.3.

Step 4 - Monitoring Wells

Two monitoring wells will be installed within this IHSS to monitor the groundwater in the Triangle Area. Two locations have been tentatively selected on the north side of the triangle area where there are currently no wells present (preliminary locations are shown on Figure 7-1). One of these wells will be located east of the PSZ fence, and the other well will be located within the PSZ. Final locations for the

Phase I wells will be selected following a review of the existing well locations at the time of the investigation. The wells will be drilled according to SOP GT.2 and installed according to SOP GT.6. The well west of the PSZ fence will be drilled 20 feet into bedrock. If a sandstone zone is present in this boring, then the well will be completed in the sandstone. If the sand is not present, the well will be completed in the saturated alluvium. The well east of the PSZ fence will be completed in the saturated alluvium. The wells will be developed according to SOP GW.2. Following development, the wells will be sampled according to SOPs GW.5 and GW.6. The proposed analytical program for samples from these wells is contained in subsection 7.3. The results of the first round of sampling will be reported in the Phase I RI Report. These wells will be sampled on a quarterly basis for a minimum of one year.

7.2.6 IHSS 166 - Trenches A, B, and C

Step 1 - Review Aerial Photographs

Aerial photographs from 1964 and 1969 will be re-evaluated to identify the extent of the trenches (Table 7-7). The dimensions and locations of the trenches will be measured from the aerial photographs and used for preliminary locations for the geophysical surveys.

Step 2 - Geophysical Survey

Surface geophysical techniques will be utilized to estimate the location and lateral extent of Trenches A, B, and C. Electromagnetics (EM) methods will be employed. Electrical conductivity variations are expected between the undisturbed soils and rock and those areas disturbed by trenching and sludge deposits. EM methods provide a rapid means of measuring the electrical conductivity of subsurface soil, rock, and groundwater. Analysis of conductivity variations should allow the trenches to be mapped.

The EM method involves induction of electrical current into the earth. A time-varying magnetic field is generated by a transmitter coil inducting a current into the ground. This primary field induces a secondary field that is measured by a receiver coil. Changes in magnitude and phase of the individual currents are converted to voltages and output in ground conductivity values. These values are then analyzed for variations across the site.

The EM survey will be conducted over the suspected trench locations. Sufficient data will be collected to obtain "background level" conductivities. General EM line locations are shown in Figure 7-6. Approximately 4,500 feet of EM data will be collected utilizing a 10-foot station spacing. This spacing will allow good resolution of trench lateral extent.

TABLE 7-7

PHASE I INVESTIGATION
IHSS 166 - TRENCHES A, B, AND C

Activity	Purpose	Location	Number of Samples or Locations
Review aerial photographs	Identify location and extent of the trenches	Entire site	NA
Geophysical survey	Locate and delineate extent of the trenches	Each trench area	NA
Soil classification survey	For Environmental Evaluation	Entire site	NA
Soil borings	Characterize materials and contamination in trenches and size of trench	Transecting the trenches longitudinally every 25 ft. Borings will be drilled to 5 ft below the bottom of the trench.	26
Install well	Monitor alluvial groundwater downgradient of Trench B (166.2)	In most eastward boring at IHSS 166.2, immediately east of the trench	1

NA - Not Applicable

A geonics EM-31 ground conductivity meter will be used for the EM data collection. Data will be collected in the horizontal dipole mode, which provides depth penetration to nine feet, and the vertical dipole mode, which provides depth penetration to 18 feet. Given the shallow depth of the Arapahoe/Laramie Formation in this area (8-15 feet), these penetration depths will be sufficient. However, preliminary analysis will allow a determination if increased penetration is required. If so, a geonics EM-34 will also be used allowing penetration depths of 25-30 feet.

After completion of the survey, conductivity values will be plotted and contoured over each grid area. A non-disturbed area and the trench locations will be evaluated in this interpretation. If the E-M method is unsuccessful, ground penetrating radar (GPR) will be used to aid trench detection and delineation, GPR is an electromagnetic sounding technique, and operates on the principle that electromagnetic waves emitted from a transmitter antenna are reflected from buried objects and detected at a receiver antenna. Reflections are observed for subsurface materials that have different dielectric permittivities than the host material. Subsurface metal, refuse, or trench edges often possess substantial dielectric permittivity contrasts allowing these subsurface features to be mapped. Under favorable conditions, subsurface features can be detected to 20 or 30 feet.

In practice, the success of a GPR survey is highly site dependent. The depth of GPR penetration is a function of the near-surface soil conductivity. In areas where clay or conductive soil is near the surface, penetration can be reduced to a couple of feet or less. For this reason, a test line will be conducted at each survey site to ensure penetration is sufficient to detect subsurface trenches. The test line will also test various antennas for an optimum choice, as well as determine data recording parameters.

Upon confirmation that the method is producing sufficient penetration, a series of profiles will be conducted at each survey site over suspected trench areas. A Subsurface Interface Radar (SIR)-3 or SIR-8 system will be used to collect the radar data. Profile radar results will be correlated to all other data, both geophysical and geological, to interpret trench locations.

Step 3 - Soil Borings

As specified in the IAG, soil borings will be drilled on 25-foot centers along the long axis of each of the trenches (Figure 7-6). The borings will be drilled and sampled according to SOP GT.2 and will be terminated 5 feet below the bottom of each trench. Samples will be taken continuously in these borings. Discrete samples will be collected from every 2-foot interval and analyzed for TCL volatiles. Samples will be composited from every 6-foot interval and analyzed for TAL metals, and radioactive elements (see subsection 7.3). Since it is possible that groundwater may be encountered in these borings, the borings should be completed during the period of low water table in the fall to limit the potential of encountering groundwater in the borings.

During sampling a soil classification survey will be completed at the Trenches for use in the Environmental Evaluation. Several samples may also be collected from 0 to 2 feet for grain size analysis.

Step 4 - Monitoring Well

One monitoring well will be installed to monitor the saturated alluvium downgradient of trench B (Figure 7-6). This well will be installed in the most eastward boring at trench B, immediately east of the trench, according to the procedures described in SOP GT.6. If the alluvium is dry, and the bedrock consists of sandstone, then this well will be installed in the saturated portion of the sandstone. The well will be developed according to SOP GW.2 and sampled according to SOPs GW.5 and GW.6 following development. Results of the first round of sampling will be reported in the Phase I RI Report. This well will be sampled on a quarterly basis for a minimum of one year.

7.2.7 IHSS 167 - North, Pond, and South Area Spray Fields

Step 1 - Review Aerial Photographs

Aerial photographs from 1988 will be reviewed to evaluate the location and extent of the north, south, and pond area spray fields (Table 7-8). The sampling program proposed in Step 2 may be modified if the sizes of these IHSSs are modified.

Step 2 - Surface Soil Samples, Soil Borings, and Sediment Sampling

Surface soil samples will be collected to a depth of 2 inches on a 100-foot grid over the areas of the spray fields as estimated from the air photo review conducted in Step 1 (Figure 7-6). Surface soil samples will be collected according to SOP GT.8. Soil borings will be drilled to a depth of 4 feet on the same 100-foot grid according to SOP GT.2. Samples will be taken continuously and will be composited from each 2-foot interval. The analytical program for these samples is described in subsection 7.3.

During sampling a soil classification survey will be completed at the Spray Fields for use in the Environmental Evaluation. Several samples may also be collected from 0 to 2 feet for grain size analysis.

Two stream sediment samples will be collected in the drainage just downslope of the North and South Area Spray Fields (IHSSs 167.1 and 167.3). These samples will be collected within the stream at points that are conducive to the collection of sediment (Figure 7-4). The sample at each location will consist of 2-foot composite samples taken to the depth of the first gravel layer below the sediment. The samples will be collected according to SOP SW.6 and the SOPA to SOP SW.6.

TABLE 7-8

PHASE I INVESTIGATION
IHSS 167 - NORTH, POND, AND SOUTH AREA SPRAY FIELDS

Activity	Purpose	Location	Number of Samples or Locations
Review aerial photographs	Identify location and extent of the units	Entire site	NA
Soil classification survey	For Environmental Evaluation	Entire site	NA
Surface soil sampling	Characterize surface contamination	Entire site - 100 ft grid	57
Soil borings	Characterize subsurface conditions and contamination to 4 ft.	Entire site - 100 ft grid	57
Collect sediment samples	Characterize sediments and contamination downstream of the unit	Within the drainage downstream of the unit	2
Install wells	Monitor alluvial ground water downgradient of the spray fields	Within the drainages downgradient of units 167.1 and 167.3	2

NA - Not Applicable

Step 3 - Monitoring Wells

Two monitoring wells will be installed immediately downgradient of the North Area and South Area spray fields to monitor the saturated alluvium (Figure 7-6). These wells will be located within the surface drainages that flow toward North Walnut Creek. The wells will be drilled according to SOP GT.2 and installed according to SOP GT.6 with the screen located in the alluvium just above the weathered bedrock. If a water bearing sandstone unit is found to be the first bedrock unit underlying the alluvium, the well will be completed in the sandstone unit at that location. The wells will be developed according to SOP GW.2 and sampled according to SOPs GW.5 and GW.6 following development. The results of the first round of sampling will be reported in the Phase I RI Report. The wells will be sampled on a quarterly basis for a minimum of one year.

7.2.8 IHSS 216.1 - East Area Spray Field

Step 1 - Historical Data

As specified in the IAG, historical information regarding the use of the East Spray Field (IHSS 216.1) will be obtained and submitted to the EPA and CDH. The review of this IHSS that was performed for this work plan indicated that this spray field only operated during 1989 and received water from Pond B-3 (see Section 2.0). Analyses of the Pond B-3 surface water from 1989 indicates that fairly low concentrations of radionuclides, metals, and organics were present.

Step 2 - Surface Soil Samples and Soil Borings

Surface soil samples will be collected to a depth of 2 inches on a 200-foot grid over the entire site (Table 7-9 and Figure 7-3). Samples will be collected according to SOP 3.8. In addition, soil borings will be located on the same 200-foot grid as the surface soil samples. The borings will be drilled to a depth of 4 feet according to SOP GT.8. Samples will be taken continuously and will be composited from each 2-foot interval. The analytical program for these soil samples is described below.

7.2.9 Ambient Air Monitoring Program

Three Hi-Vol air sampling devices will be installed near the North and South Walnut Creek drainages to monitor the air pathway from this Operable Unit (Figure 7-4). One will be located approximately 1,000 feet south of Pond B-4 (IHSS 142.8). The second air monitoring station will be placed approximately 1,000 feet south of Pond B-5 (IHSS 142.9) and the third will be located about 300 feet east of Pond B-5.

TABLE 7-9

PHASE I INVESTIGATION
IHSS 216.1 - EAST AREA SPRAY FIELD

Activity	Purpose	Location	Number of Samples or Locations
Surface soil sampling	Characterize surface contamination	Entire site - 200 ft. grid	6
Soil borings	Characterize subsurface conditions and contamination to 4 ft.	Entire site - 200 ft. grid	6

The data obtained from these stations, as well as the existing nearby air stations, will be used to evaluate the air emissions from this area. There are currently seven air monitoring stations (S-3, S-4, S-6, S-21, S-22, S-24, and S-36) near North and South Walnut creek drainages (Figure 7-4). The three proposed monitoring stations will be sampled in accordance with the Site-Wide Ambient Air Monitoring Program currently being conducted by EG&G at the Rocky Flats Plant. The operation and sampling procedures are briefly described below.

Air coming in contact with the Hi-Vol Ambient Air samples is forced through a filter material, trapping radioactive particulates and other airborne matter for subsequent analysis. Performance data from these RAAMP air samplers are collected by Environmental Monitoring and Assessment Technologists (EMAT) on a weekly basis, and air filters are replaced every 2 weeks. Once a month, the two filters collected from each air monitoring station are composited, and one sample from each air monitoring station is sent to Radiological Health Labs (Building 123) at the Plant for analysis. Detailed procedures describing the air sampler operations, filter exchange, filter preparation for analysis, RAAMP documentation, and reporting requirements are contained in SOP AP.13. These air samples will be analyzed according to the procedures outlined in the GRRASP. The samples will be analyzed for the same analytes as are analyzed in the site-wide program (which is currently plutonium). The analytical program for the site-wide Ambient Air Program is expected to be expanded in the near future to include other radionuclides, at which time the analytical program for the three proposed OU6 air stations will also be increased.

7.3 SAMPLE ANALYSIS

This section describes the sample handling procedures and analytical program for samples collected during the Phase I investigation. This section discusses sample designations, analytical requirements, sample containers and preservation, and sample handling and documentation.

7.3.1 Sample Designations

All sample designations generated for this RFI/RI will conform to the input requirements of the Rocky Flats Environmental Database System (RFEDS). Each sample designation will contain a nine-character sample number consisting of a two-letter prefix identifying the media sampled (e.g., "SB" for soil borings, "SS" for stream sediments), a unique five-digit number, and a two-letter suffix identifying the contractor (e.g., "WC" for Woodward-Clyde). One sample number will be required for each sample generated, including QA/QC samples. In this manner, 99,999 unique sample numbers are available for each contractor that contributes sample data to the database. A block of numbers will be reserved for the Phase I RFI/RI sampling of OU6. Boring numbers will be developed independently of the sample number for a given boring. Specific sample location numbers are not assigned at this time, pending the results of the aerial photograph analysis and review of existing data.

7.3.2 Analytical Requirements

Generally, samples from the Phase I RI will be analyzed for some or all of the following chemical and radionuclide parameters:

- Nitrate
- Target Analyte List (TAL) metals
- Uranium 233/234, 235 and 238
- Transuranic elements (plutonium and americium)
- Cesium 137 and strontium 89/90
- Gross alpha and gross beta
- Tritium
- Total Dissolved Chromium (water only)
- Total organic carbon (TOC)
- TCL volatile organics
- TCL semivolatile organics
- TCL pesticides/PCBs
- CO_3, HCO_3, Cl, SO_4, NO_3 (water only)

The specific analytes in the groups listed above and their detection/quantitation limits are contained in Table 7-10. The specific Phase I analytical programs for each IHSS are contained in Table 7-11. Both filtered and unfiltered samples, surface water and groundwater samples will be analyzed at each location.

The analytical program for each media at every IHSS is summarized in Table 7-11. This analytical program for each IHSS was developed in the IAG based on the type of waste suspected to be present at each site. The specific analytes and detection/quantitation limit are specified in the IAG by reference to CLP (Contract Laboratory Program) analyses. The General Radiochemistry and Routine Analytical Services Protocol (GRRASP) (EG&G 1990d) provides a listing of CLP analytes and limits that will be used for this Phase I RFI/RI. These analytes and limits are presented in Table 7-10. The program shown in Table 7-11 should address the bulk of chemicals and compounds that were handled or suspected to be present at OU6 and enable detection of soil, sediment, surface water, and groundwater contamination, if present. Nitrates are included because low-level radioactive wastes with high nitrate concentrations may be present in Walnut Creek. Metals were handled at OU6; however, details are not well known. Therefore, all of the TAL metals plus other metals known to have been found on site have been selected for Phase I analysis.

TABLE 7-10

PHASE I
SOIL, SEDIMENT, AND WATER SAMPLING PARAMETERS AND DETECTION LIMITS

	DETECTION LIMITS*	
TARGET ANALYTE LIST - METALS	Water (µg/l)	Soil/Sediment (mg/kg)
Aluminum	200	40
Antimony	60	12
Arsenic	10	2
Barium	200	40
Beryllium	5	1.0
Cadmium	5	1.0
Calcium	5000	2000
Cesium	1000	200
Chromium	10	2.0
Cobalt	50	10
Copper	25	5.0
Cyanide	10	10
Iron	100	20
Lead	5	1.0
Lithium	100	20
Magnesium	5000	2000
Manganese	15	3.0
Mercury	0.2	0.2
Molybdenum	200	40
Nickel	40	8.0
Potassium	5000	2000
Selenium	5	1.0
Silver	10	2.0
Sodium	5000	2000
Strontium	200	40
Thallium	10	2.0
Tin	200	40
Vanadium	50	10.0
Zinc	20	4.0
TOTAL ORGANIC CARBON	1	1
	QUANTITATION LIMITS*	
TARGET COMPOUNDS LIST - VOLATILES	Water (µg/l)	Soil/Sediment (µg/kg)
Chloromethane	10	10
Bromomethane	10	10
Vinyl Chloride	10	10
Chloroethane	10	10
Methylene Chloride	5	5
Acetone	10	10
Carbon Disulfide	5	5
1,1-Dichloroethene	5	5
1,1-Dichloroethane	5	5

TABLE 7-10
(Continued)

PHASE I
SOIL, SEDIMENT, AND WATER SAMPLING PARAMETERS
AND DETECTION LIMITS

	QUANTITATION LIMITS*	
TARGET COMPOUNDS LIST - VOLATILES (Continued)	Water (µg/l)	Soil/Sediment (µg/kg)
total 1,2-Dichloroethene	5	5
Chloroform	5	5
1,2-Dichloroethane	5	5
2-Butanone	10	10
1,1,1-Trichloroethane	5	5
Carbon Tetrachloride	5	5
Vinyl Acetate	10	10
Bromodichloromethane	5	5
1,1,2,2-Tetrachloroethane	5	5
1,2-Dichloropropane	5	5
trans-1,3-Dichloropropene	5	5
Trichloroethene	5	5
Dibromochloromethane	5	5
1,1,2-Trichloroethane	5	5
Benzene	5	5
cis-1,3-Dichloropropene	5	5
Bromoform	5	5
2-Hexanone	10	10
4-Methyl-2-pentanone	10	10
Tetrachloroethene	5	5
Toluene	5	5
Chlorobenzene	5	5
Ethyl Benzene	5	5
Styrene	5	5
Total Xylenes		

	QUANTITATION LIMITS*	
TARGET COMPOUNDS LIST - SEMIVOLATILES	Water (µg/l)	Soil/Sediment (µg/kg)
Phenol	10	330
bis(2-Chloroethyl)ether	10	330
2-Chlorophenol	10	330
1,3-Dichlorobenzene	10	330
1,4-Dichlorobenzene	10	330
Benzyl Alcohol	10	330
1,2-Dichlorobenzene	10	330
2-Methylphenol	10	330
bis(2-Chloroisopropyl)ether	10	330
4-Methylphenol	10	330
N-Nitroso-di-n-dipropylamine	10	330
Hexachloroethane	10	330

TABLE 7-10
(Continued)

PHASE I
SOIL, SEDIMENT, AND WATER SAMPLING PARAMETERS
AND DETECTION LIMITS

	QUANTITATION LIMITS*	
TARGET COMPOUND LIST - SEMIVOLATILES (Continued)	Water (µg/l)	Soil/Sediment (µg/kg)
Nitrobenzene	10	330
Isophorone	10	330
2-Nitrophenol	10	330
2,4-Dimethylphenol	10	330
Benzoic Acid	50	1600
bis(2-Chloroethoxy)methane	10	330
2,4-Dichlorophenol	10	330
1,2,4-Trichlorobenzene	10	330
Naphthalene	10	330
4-Chloroaniline	10	330
Hexachlorobutadiene	10	330
4-Chloro-3-methylphenol(para-chloro-meta-cresol)	10	330
2-Methylnaphthalene	10	330
Hexachlorocyclopentadiene	10	330
2,4,6-Trichlorophenol	10	330
2,4,5-Trichlorophenol	50	1600
2-Chloronaphthalene	10	330
2-Nitroaniline	50	1600
Dimethylphthalate	10	330
Acenaphthylene	10	330
2,6-Dinitrotoluene	10	330
3-Nitroaniline	50	1600
Acenaphthene	10	330
2,4-Dinitrophenol	50	1600
4-Nitrophenol	50	1600
Dibenzofuran	10	330
2,4-Dinitrotoluene	10	330
Diethylphthalate	10	330
4-Chlorophenyl Phenyl ether	10	330
Fluorene	10	330
4-Nitroaniline	50	1600
4,6-Dinitro-2-methylphenol	50	1600
N-nitrosodiphenylamine	10	330
4-Bromophenyl Phenylether	10	330
Hexachlorobenzene	10	330
Pentachlorophenol	50	1600
Phenanthrene	10	330
Anthracene	10	330
Di-n-butylphthalate	10	330
Fluoranthene	10	330
Pyrene	10	330
Butylbenzylphthalate	10	330

TABLE 7-10
(Continued)

PHASE I
SOIL, SEDIMENT, AND WATER SAMPLING PARAMETERS AND DETECTION LIMITS

TARGET COMPOUND LIST - SEMIVOLATILES (Continued)	Water (µg/l)	Soil/Sediment (µg/kg)
3,3'-Dichlorobenzidine	20	660
Benzo(a)anthracene	10	330
Chrysene	10	330
bis(2-Ethylhexyl)phthalate	10	330
Di-n-octylphthalate	10	330
Benzo(b)fluoranthene	10	330
Benzo(k)fluoranthene	10	330
Benzo(a)pyrene	10	330
Indeno(1,2,3-cd)pyrene	10	330
Dibenz(a,h)anthracene	10	330
Benzo(g,h,i)perylene	10	330

TARGET COMPOUND LIST - PESTICIDES/PCBS	QUANTITATION LIMITS*	
	Water µg/l	Soil/Sediment µg/kg
alpha-BHC	0.05	8.0
beta-BHC	0.05	8.0
delta-BHC	0.05	8.0
gamma-BHC (Lindane)	0.05	8.0
Heptachlor	0.05	8.0
Aldrin	0.05	8.0
Heptachlor epoxide	0.05	8.0
Endosulfan I	0.05	8.0
Dieldrin	0.10	16.0
4,4'-DDD	0.10	16.0
Endrin	0.10	16.0
Endosulfan II	0.10	16.0
4,4'-DDD	0.10	16.0
Endosulfan sulfate	0.10	16.0
4,4'-DDT	0.10	16.0
Methoxychlor	0.5	80.0
Endrin ketone	0.10	16.0
alpha-Chlordane	0.5	80.0
gamma-Chlordane	0.5	80.0
Toxaphene	1.0	160.0
Aroclor-1016	0.5	80.0
Aroclor-1221	0.5	80.0
Aroclor-1232	0.5	80.0
Aroclor-1242	0.5	80.0
Aroclor-1248	0.5	80.0
Aroclor-1254	1.0	160.0
Aroclor-1260	1.0	160.0

TABLE 7-10
(Concluded)

PHASE I
SOIL, SEDIMENT, AND WATER SAMPLING PARAMETERS
AND DETECTION LIMITS

	REQUIRED DETECTION LIMITS*	
RADIONUCLIDES	Water (pCi/ℓ)	Soil/Sediment (pCi/g)
Gross Alpha	2	4 dry
Gross Beta	4	10 dry
Uranium 233+234, 235, and 238 (each species)	0.6	0.3 dry
Americium 241	0.01	0.02 dry
Plutonium 239+240	0.01	0.03 dry
Tritium	400	400 (pCi/ml)
Cesium 137	1	0.1 dry
Strontium 89+90	1	1 dry

	DETECTION LIMITS*
Parameters Exclusively for Groundwater Samples	Water (mg/ℓ)
ANIONS	
Carbonate	10
Bicarbonate	10
Chloride	5
Sulfate	5
Nitrate as N	5
FIELD PARAMETERS	
pH	0.1 pH unit
Specific Conductance	1
Temperature	
Dissolved Oxygen	0.5
Barometric Pressure	
INDICATORS	
Total Dissolved Solids	5

* Detection and quantitation limits are highly matrix dependent. The limits listed here are the minimum achievable under ideal conditions. Actual limits may be higher.

TABLE 7-11
PHASE I ANALYTICAL PROGRAM

IHSS	Location	Media	Total U	Total Cr	Be	H3	Nitrate	Gross α	Gross β	U 233/234	U 235	U 238	Pu 239/240	Am 241	Cs 137	Sr 89/90
141	Surface samples on 25' grid	Soil		X	X		X	X	X	X	X	X	X	X		
	Well downgradient of unit	Water	X					X	X							
142	Sediment samples	Seds.		X	X	X	X	X	X	X	X	X	X	X	X	X
	Water samples	Water		X	X	X	X	X	X	X	X	X	X	X	X	X
	Wells downgradient of A-4 and B-5 including the four Bedrock Wells in North Walnut Creek	Water		X	X	X	X	X	X	X	X	X	X	X	X	X
143	Surface and core samples on 20' grid	Soil		X	X	X	X	X	X	X	X	X	X	X		
156	Surface samples	Soil						X	X	X	X	X	X	X		
	Borings	Soil						X	X	X	X	X	X	X		
	Well within unit	Water						X	X	X	X	X	X	X		
165	Surface samples from transect locations	Soil	X		X			X	X	X	X	X	X	X		
	Borings to confirm soil gas	Soil														
	Borings transecting plumes grabs from 2' intervals 6' composites	Soil			X			X	X	X	X	X	X	X		
	Wells within the site	Water						X	X							
166	Borings along each trench grabs from 2' intervals 6' composites	Soil						X	X	X	X	X	X	X		
	Well downgradient of the trenches and the Bedrock Well located in unnamed tributary of North Walnut Creek	Water						X	X							
167	Surface and core samples on 100' grid	Soil						X	X	X	X	X	X	X		
	Wells downgradient of units	Water				X	X						X	X		
216	Surface and core samples	Soil				X		X	X	X	X	X	X	X		

TABLE 7-11
PHASE I ANALYTICAL PROGRAM
(Concluded)

								Filtered						
IHSS	Location	Media	TAL Metals	TOC	TCL Vols	TCL Semi	TCL Pests	U	Pu 239/240	Cs 239/240	Sr 89/90	Am 241	TAL Met	Anions TDS
141	Surface samples on 25' grid	Soil	X											
	Well downgradient of unit	Water	X		X	X								
142	Sediment samples	Seds.	X	X	X	X	X							
	Water samples	Water	X		X	X		X	X	X	X	X	X	X
	Wells downgradient of A-4 and B-5	Water	X		X	X		X	X	X	X	X	X	X
143	Surface and core samples on 20' grid	Soil	X	X										
156	Surface samples	Soil		X										
	Borings	Soil												X
	Well within unit	Water	X					X	X			X	X	
165	Surface samples from transect locations	Soil		X										
	Borings to confirm soil gas	Soil			X	X								
	Borings transecting plumes	Soil												
	grabs from 2' intervals				X	X								
	6' composites		X											
	Wells within the site	Water	X		X	X	X							
166	Borings along each trench	Soil										X		
	grabs from 2' intervals				X									
	6' composites		X											
	Well downgradient of trench	Water	X		X	X	X							
167	Surface and core samples on 100' grid	Soil	X	X										
	Wells downgradient of units	Water	X		X		X	X	X					
216	Surface and core samples	Soil	X	X										

Uranium is likely to have been a constituent of the wastes at OU6. The isotopes U-233, U-234, U-235 and U-238 have been selected for analysis in Phase I. Plutonium is the only transuranic element that is used on the site. However, americium is a daughter product of plutonium and is found at the Rocky Flats Plant. Therefore, plutonium and americium have been selected as Phase I radionuclide parameters. Gross alpha and gross beta are included as screening parameters because they are useful indicators of radionuclides. Tritium, strontium, and cesium are also included in the analytical program.

Volatile and semivolatile organics may have been handled at OU6 in small quantities. The specific compounds used are unknown; therefore, all of the TCL volatile and semivolatile organics will be included in the Phase I analyses. TCL pesticides/PCBs and TOC have been included to provide data for the environmental evaluation.

The analytical parameters for the soil gas survey at IHSS 165 are carbon tetrachloride, trichloroethene (TCE), dichloromethane, acetone, 2-butanone, tetrachloroethene (PCE), 1,2-dichloroethane (DCA), chloroform and toluene. Detection limits proposed for these parameters during the soil gas survey are listed in Table 7-12.

7.3.3 Sample Containers and Preservation

Sample volume requirements, preservation techniques, holding times, and container material requirements are dictated by the media being sampled and by the analyses to be performed. The soil matrices to be analyzed will include soils and sediments. The water matrices for analysis will include surface water and groundwater. Tables 7-13 and 7-14 list analytical parameters of interest in OU6 for water and soil matrices, along with the associated container size, preservatives (chemical and/or temperature), and holding times. Additional specific guidance on the appropriate use of containers and preservatives is provided in SOP FO.13, Containerizing, Preserving, Handling, and Shipping of Soil and Water Samples.

7.3.4 Sample Handling and Documentation

Sample control and documentation is necessary to ensure the defensibility of data and to verify the quality and quantity of work performed in the field. Accountable documents include logbooks, data collection forms, sample labels or tags, chain-of-custody forms, photographs, and analytical records and reports. Specific guidance defining the necessary sample control, identification, and chain-of-custody documentation is discussed in SOP FO.14.

TABLE 7-12

PHASE I INVESTIGATION SOIL GAS PARAMETERS AND PROPOSED DETECTION LIMITS

IHSS-165 Triangle Area

Volatiles	Detection Limit
methylene cloride	1 μg/l
acetone	1 μg/l
2-butanone	1 μg/l
chloroform	1 μg/l
carbon tetrachloride	1 μg/l
toluene	1 μg/l
PCE	1 μg/l
TCE	1 μg/l
1,2 DCA	1 μg/l

NOTE: Detection limits are a function of the detector type and injection volume. Thus, the detection limit may vary.

TABLE 7-13

SAMPLE CONTAINERS, SAMPLE PRESERVATION, AND SAMPLE HOLDING TIMES FOR WATER SAMPLES

Parameter	Container	Preservative	Holding Time
Liquid - Low to Medium Concentration Samples			
Organic Compounds:			
Purgeable Organics (VOCs)	2 x 40-mL VOA vials with teflon lined septum lids	Cool, 4°C[a] with HCl to pH<2	7 days 14 days
Extractable Organics (BNAs), Pesticides and PCBs	1 x 4-L amber[b] glass bottle	Cool, 4°C[a]	7 days until extraction, 40 days after extraction
Inorganic Compounds:			
Metals (TAL)	1 x 1-L polyethylene bottle	Nitric acid pH<2; Cool, 4°C	180 days[c]
Cyanide	1 x 1-L polyethylene bottle	Sodium hydroxide[d] pH>12; Cool, 4°C	14 days
Anions	1 x 1-L polyethylene bottles	Cool, 4°C	14 days
Sulfide	1 x 1-L polyethylene bottle	1 mL-zinc acetate sodium hydroxide to pH>9; Cool, 4°C	7 days
Liquid - Low to Medium Concentration Samples			
Nitrate	1 x 1-L polyethylene bottle	Cool, 4°C	48 hours
Total Dissolved Solids (TDS)	1 x 1-L polyethylene bottle	Cool, 4°C	48 hours
Radionuclides (Full Suite)	12 x 1-L polyethylene bottle	Nitric acid pH<2	180 days

[a] Add 0.008% sodium thiosulfate ($Na_2S_2O_3$) in the presence of residual chlorine

[b] Container requirement is for any or all of the parameters given.

[c] Holding time for mercury is 28 days.

[d] Use ascorbic acid only if the sample contains residual chlorine. Test a drop of sample with potassium iodine-starch test paper; a blue color indicates need for treatment. Add ascorbic acid, a few crystals at a time, until a drop of sample produces no color on the indicator paper. Then add an additional 0.6g of ascorbic acid for each L of sample volume.

TABLE 7-14

SAMPLE CONTAINERS, SAMPLE PRESERVATION, AND SAMPLE HOLDING TIMES FOR SOIL SAMPLES

Parameter	Container	Preservative	Holding Time
Soil or Sediment Samples - Low to Medium Concentration			
Organic Compounds:			
Purgeable Organics (VOCs)	1 x 4-oz wide-mouth teflon lined glass vials	Cool, 4°C	14 days
Extractable Organics (BNAs), Pesticides and PCBs	1 x 8-oz wide-mouth teflon lined glass vials	Cool, 4°C	7 days until extraction, 40 days after extraction
Inorganic Compounds:			
Metals (TAL)	1 x 8-oz wide-mouth glass jar	Cool, 4°C	180 days[1]
Cyanide	1 x 8-oz wide-mouth glass jar	Cool, 4°C	14 days
Sulfide	1 x 8-oz wide-mouth glass jar	Cool, 4°C	28 days
Nitrate	1 x 8-oz wide-mouth glass jar	Cool, 4°C	48 hours
Radionuclides	1 x 1-L wide-mouth glass jar	None	45 days

[1]Holding time for mercury is 28 days.

7.3.5 Data Reporting Requirements

Field data will be input into the RFEDS environmental database using a remote data entry module supplied by EG&G. Data will be entered on a timely basis and a 3.5-inch diskette will be delivered to EG&G. A hard copy report will be generated from the module for contractor use. The data will be put through a prescribed QC process based on SOP FO.14 to be generated by EG&G.

A sample tracking spreadsheet will be maintained by the contractor for use in tracking sample collection and shipment. EG&G will supply the spreadsheet format and will stipulate the timely reporting of the information. This data will also be delivered to EG&G on 3.5-inch diskettes. Computer hardware and software requirements for contractors using government supplied equipment will be supplied by EG&G. Computer and data security will also follow acceptable procedures outlined by EG&G.

7.4 FIELD QC PROCEDURES

Sample duplicates, field preservation blanks, and equipment rinsate blanks will be prepared. Trip blanks will be obtained from the laboratory. The analytical results obtained for these samples will be used by the ER Project Manager to assess the quality of the field sampling effort. The types of field QC samples to be collected and their applications are discussed below. The frequency for QC samples to be collected and analyzed is provided in Table 7-15.

Duplicate samples will be collected by the sampling team and will be used as a relaeasure of the precision of the sample collection process. These samples will be collected at the same time, using the same procedures, the same equipment, and in the same types of containers as required for the samples. They will also be preserved in the same manner and submitted for the same analyses as required for the samples.

Field preservation blanks of distilled water, preserved according to the preservation requirements (subsection 7.3.3), will be prepared by the sampling team and will be used to provide an indication of any contamination introduced during field sample preparation technique. As indicated by Table 7-15, these QC samples are applicable only to samples requiring chemical preservation.

Equipment (rinsate) blanks will be collected from final decontamination rinsate to evaluate the success of the field sampling team's decontamination efforts on nondedicated sampling equipment. Equipment blanks are obtained by rinsing cleaned equipment with distilled water prior to sample collection. The rinsate is collected and placed in the appropriate sample containers. Equipment rinsate blanks are applicable to all analyses for water and soil samples as indicated in Table 7-15.

TABLE 7-15

FIELD QC SAMPLE FREQUENCY

Sample Type	Type of Analysis	Media	
		Solids	Liquids
Duplicates	Organics	1/10	1/10
	Inorganics	1/10	1/10
	Radionuclides	1/10	1/10
Field Preservation Blanks	Organics	NA	NA
	Inorganics	NA	1/20
	Radionuclides	NA	1/20
Equipment Blanks	Organics	1/20	1/20
	Inorganics	1/20	1/20
	Radionuclides	1/20	1/20
Trip Blanks	Organics (Volatiles)	NR	1/20
	Inorganics	NR	NR
	Radionuclides	NR	NR

NA = Not Applicable
NR = Not Required

Trip blanks consisting of deionized water will be prepared by the laboratory technician and will accompany each shipment of water samples for volatile organic analysis. Trip blanks will be stored with the group of samples with which they are associated. Analysis of the trip blank will indicate migration of volatile organics or any problems associated with the shipment, handling, or storage of the samples.

Procedures for monitoring field QC are given in the site-wide Quality Assurance Project Plan (QAPjP).

8.1 OVERVIEW

A baseline health risk assessment will be prepared for Operable Unit Number 6 (OU6) as part of the Phase I RCRA Facility Investigation (RFI)/Remedial Investigation (RI) report. Both a human health evaluation and an environmental evaluation will be performed. This section describes the human health risk assessment. The environmental risk assessment is described in Section 9.0 of this Work Plan.

The purpose of the Phase I baseline risk assessment is to provide an estimate of potential health risks that may result from releases of hazardous substances from OU6 in the absence of any remedial action. Risks will be calculated for both on-site and off-site exposures to contaminants released and/or transported from the Individual Hazardous Substance Sites (IHSSs), using available data as well as data collected during the Phase I investigation of the unit.

The purpose of the baseline risk assessment is to provide information useful in determining the following, as described in the National Contingency Plan:

- A determination of whether the contaminants of concern identified at the site pose a current or potential risk to human health in the absence of any remedial action
- A determination of whether remedial action is necessary at IHSSs within the unit, and an identification of the media needing remediation
- A justification for performing remedial actions

This assessment will follow the guidance provided by the Environmental Protection Agency. It will also make use of additional information and methods that will facilitate interpretation of the results of the risk assessment. EPA publications that will be consulted when performing the health risk assessment include the following:

- Risk Assessment Guidance for Superfund, Volume I, Human Health Evaluation Manual (Part A). Interim Final. 1989. EPA/540/1-89/002.
- Guidance for Conducting Remedial Investigations and Feasibility Studies Under CERCLA. Interim Final. 1988.
- Superfund Exposure Assessment Manual. 1988. EPA/540/1-88/001.
- Exposure Factors Handbook. 1989. EPA/600/8-89/043.
- Guidance for Data Useability in Risk Assessment. Interim Final. 1990. EPA/540/G-90/008.

These documents constitute the most recent and appropriate EPA guidance on public health risk assessment. It must be emphasized that EPA manuals are guidelines only and that EPA states that considerable professional judgment must be used in their application. This risk assessment will focus on producing a realistic analysis of exposure and health risk.

The risk assessment will be accomplished in five general tasks: Task 1 - Identification of Contaminants of Concern, Task 2 - Exposure Assessment, Task 3 - Toxicity Assessment, Task 4 - Uncertainty Analysis, and Task 5 - Risk Characterization. Each of these tasks are described below.

A separate risk assessment will be performed on each IHSS to the extent appropriate for the IHSS. Due to the separated locations, varied historical practices, and different contamination profiles, the IHSSs should receive individualized treatment. This IHSS-specific analysis will allow the identification of the most important contributors to the risk from the operable unit, and it will permit sufficient attention to be paid to contaminants that may be important at one IHSS but not at another. IHSSs that do not contribute significant risks can then be identified so that efforts may be aimed at further analysis of the significant sources of risk.

Four technical memoranda submitted to the agencies will also be part of the risk assessment program for OU6. These technical memoranda will deal with: (1) selection of indicator chemicals, (2) fate and transport model selection, (3) selection of exposure scenarios and associated assumptions and (4) identification of toxicology information to be used in the risk assessment. EPA and CDH review and approval of this series of technical memoranda should result in the agencies participation in the risk assessment process.

8.2 TASK 1 - IDENTIFICATION OF CONTAMINANTS OF CONCERN

Contaminants of concern includes chemicals and other constituents, such as metals or radionuclides, that are identified at the unit. They are the contaminants that are evaluated in the baseline risk assessment. A two-step process will be used to identify contaminants of concern. First, an initial list of contaminants of potential concern are selected on the basis of the following criteria:

- They are identified in one or more samples at the IHSS.
- They are related to activities at the IHSS; they are potentially released from an identified source in the IHSS.
- They are recognized or suspected toxicants or carcinogens.
- They are present in significant concentrations (above background).

Contaminants of potential concern will be selected following evaluation of available historical and background sampling results and the results of the Phase I field sampling proposed for OU6. Existing

background data will be used to help identify contaminants that are background constituents in the environment and that are therefore not IHSS-related. Background information is expected to be available from ongoing studies including the "Background Geochemical Characterization Report, Rocky Flats Plant." (EG&G 1990c).

Available historical data on chemical and radionuclide concentrations in groundwater, surface water, sediments, soils and air near OU6 will be used in conjunction with the results of the Phase I field sampling program to identify IHSS-related chemicals of concern.

Existing analytical results taken from other sources will be accepted as suitable for risk assessment purposes. The sampling and analytical program for the Phase I investigation of OU6 is described in Section 7.0 of this Work Plan. The sampling program is designed to address all potential exposure pathways (groundwater, surface water, sediments, and soils) to the extent that they can be anticipated. Samples and analytical results obtained as part of the Phase I investigation will be collected and validated according to the Quality Assurance (QA)/Quality Control (QC) procedures described in that section. Only data validated as suitable for risk assessment purposes will be used in the risk assessment.

Tentatively Identified Compounds (TICs) will be evaluated to determine if they should be included in the risk assessment. If there are few of them in comparison to the Target Analyte List (TAL), they are normally omitted in accordance with EPA guidance.

The second step in the identification process will be followed if the number of chemicals of potential concern is high. In that case, the list may be further reduced to focus on the chemicals that pose the greatest risks at the site. Carrying a very large number of chemicals through a quantitative risk assessment can be unwieldy, time-consuming, and may obscure the dominant risks at the site. The rationale for selecting a final list of chemicals of concern will be presented in the text and will be based on the following criteria:

- historical information
- concentration, toxicity, and known synergistic effects
- mobility, persistence, and bioaccumulation
- special exposure routes
- treatability
- Applicable or Relevant and Appropriate Requirements (ARARs)
- chemical class
- frequency of detection (hits/samples)
- evaluation of essential nutrients

- concentration relative to background levels (natural or anthropogenic)
- potential for being a laboratory contaminant

The results of data collection and evaluation and selection of chemicals of concern will be summarized in the text and appropriate tables.

8.3 TASK 2 - EXPOSURE ASSESSMENT

The objective of the exposure assessment is to identify human populations (receptors) that might be exposed to chemical releases from the IHSSs and to estimate the temporal variation and magnitude of their exposure. The exposure assessment involves identifying potential receptors, identifying all potential pathways of exposure, estimating exposure point concentrations of chemicals of concern based on monitoring data and modeling results, and estimating the intake of each chemical for each pathway. The results of the exposure assessment are pathway-specific chemical intakes, expressed as mg chemical/kg body weight/day, by potentially exposed receptor populations. Exposure to radioisotopes will be expressed as activity of intake for internal exposure or as activity in environmental media for external exposure.

Conceptual models of the IHSSs will be formulated and refined based on data collected to integrate the components of the exposure assessment and clarify the pathways to be considered.

8.3.1 Potential Receptors

The exposure scenarios that will be developed in the baseline risk assessment may include exposure of potential future receptors to contaminated media within OU6 as well as exposure of off-site receptors to potentially contaminated groundwater, surface water, and airborne soil particulates. The exact exposure scenarios to be considered will be selected according to policy decisions regarding future use (e.g., residential, recreational, restricted access) of the site that may be made prior to the completion of the risk assessment. An assessment of potentially exposed populations will be conducted to assess the likelihood of a complete pathway, population characteristics and to estimate the number of humans potentially exposed. Current and proposed population dynamics will be identified and evaluated in the exposure assessment. This information will be integrated into the risk characterization.

8.3.2 Exposure Pathways

Identification of exposure pathways involves linking the source of chemical release, an environmental transport mechanism, a point of human exposure, and a mechanism of human uptake. Sources of chemical release will be sites within OU6 that contain contaminants of concern. Mechanisms of release can include leaching of chemicals from soils into groundwater or surface runoff, airborne transport of

contaminated soil particulates, volatilization of organic compounds, or release of radioactive particles. Points of human exposure will be identified during the site characterization. These may include sites within the operating unit as well as off-site locations where contaminants may be transported. Examples of mechanisms of human uptake are dermal contact with contaminated media, inhalation of volatile organics or particulates, and ingestion of soils or water.

Only complete exposure pathways will be evaluated in the risk assessment. If any one of the elements of an exposure pathway (chemical source and release, environmental transport mechanism, exposure point, or uptake) is missing, the exposure pathway is considered incomplete and will not be addressed in the assessment.

8.3.3 Exposure Point Concentrations

Exposure point concentrations of contaminants of concern will be estimated using analytical results of the sample program described elsewhere in this Work Plan and available relevant historical data. Release and transport of chemicals in environmental media may be modeled using basic analytical models recommended by EPA or the best model available, as determined by a model performance evaluation. The models will be calibrated to improve performance using site-specific parameters when possible.

Model outputs will be characterized by estimating variance through an uncertainty analysis to the extent required by the overall risk uncertainty analysis. Effort will be made to reduce the variance of model output: the optimal target for model variance is that it be similar to other sources of variability in the risk assessment, including exposure factors and toxicity values.

Concentrations will also be estimated for "average" and "reasonable maximum" exposure conditions at a minimum. When feasible, a goodness-of-fit analysis will be conducted to correctly identify the distribution of the data and the most appropriate measure of central tendency. The reasonable maximum concentration will be the upper 95 percent confidence limit on the appropriate mean or maximum likelihood estimate. In calculating the media concentrations, censored data (data sets with missing values, nondetects, etc.) will be treated by appropriate methods such as those described in Gilbert, 1987 (Statistical methods for environmental pollution monitoring, Van Nostrand Reinhold).

8.3.4 Estimation of Intake

Human intakes of contaminants of concern will be estimated using reasonable estimates of exposure parameters. EPA guidance, site-specific factors, and professional judgment will be applied in establishing exposure assumptions. Using reasonable values permits estimating risks associated with the assumed exposure conditions that do not underestimate actual risk. The estimate of intake is the

"intake factor," which may then be mathematically combined with the exposure point concentrations and the critical toxicity values to determine cancer risks and hazard indices.

8.4 TASK 3 - TOXICITY ASSESSMENT

The toxicity assessment is conducted to characterize the evidence regarding the potential for a contaminants of concern to cause adverse effects in exposed populations and, where possible, to estimate the relationship between the extent of exposure and the extent of adverse effects (i.e., dose-response relationship). The toxicity assessment evaluates:

- The evidence for toxic effects of the chemical
- The nature of the dose-response relationship
- The level of uncertainty in the dose-response relationship
- The primary target organs or mechanism of action for each compound of concern
- The applicability of the toxicologic data to the identified exposure scenarios

Sources of toxicity factors (cancer slope factors and reference doses) used in assessing health risks due to exposure to organic compounds, metals, and radionuclides include EPA's Integrated Risk Information System (IRIS) and the most current volume of EPA's Health Effects Assessment Summary Tables. Other sources in the public domain, such as the National Research Council's reports on the Biological Effects of Ionizing Radiation, reports IV and V, and EPA's Background Information Document, Draft E/S for Proposed National Emission Standards for Hazardous Air Pollutants (NESHAPS) for Radionuclides, will be consulted as appropriate. New toxicity data and analyses of the health risks of contaminants of concern will be considered as they become available in the literature. No new experimental toxicological data will be developed.

The toxicity assessment will include a discussion of the uncertainties inherent in the development and application of toxicity factors. The text will include a discussion of the EPA weight-of-evidence classification for carcinogens, the conservatism inherent in applying upper 95th percentile cancer slope factors, the uncertainty factors used in deriving reference doses, and other uncertainties involved in predicting human responses.

In addition, those contaminants that present the greatest risk at the site will receive additional toxicological analysis to more fully describe the potential range of appropriate critical toxicity values based on such considerations as mechanism of carcinogenesis, the validity of toxicity endpoints used to derive the RfD, or pharmakokinetic information that may provide insight on extrapolation from one species to another.

8.5 TASK 4 - QUALITATIVE AND QUANTITATIVE UNCERTAINTY ANALYSIS

Presentation of uncertainties and limitations of the risk analysis is an integral part of the risk assessment process. Usually, uncertainty is discussed after the risk characterization has been completed. However, in this risk assessment, the uncertainty analysis will provide substantial input into the risk characterization process.

Uncertainties exist primarily in the estimation and modeling of exposure point concentrations, the estimation of human exposures, and the use of toxicology data based on animal studies. These uncertainties will be described qualitatively to provide an understanding of the issues. In addition, a detailed quantitative analysis of the uncertainty will be presented to the extent practicable.

Several methods are available for quantitative analysis. The uncertainty analysis will be performed to quantify, to the extent practicable, the sources and magnitude of uncertainty in the baseline risk assessment. Quantitative techniques may include: sensitivity analysis, first-order analysis, or numerical methods such as stratified Monte Carlo sampling. The outputs will be described and interpreted in the text. This will inform the risk manager of the sufficiency of the baseline risk assessment given the level of site characterization at the conclusion of Phase I, the degree of confidence that is appropriate for the risk estimates, and a basis for further remedial activities at the site.

8.6 TASK 5 - RISK CHARACTERIZATION

Risk characterization integrates the toxicity factors for the contaminants of concern with the estimated chemical intakes and radiation exposures under the assumed exposure conditions to yield protective estimates of carcinogenic and noncarcinogenic health risks. The IHSS conceptual models will be consulted again at this point to determine realistic combinations of exposure pathways as well as maximum likelihood/reasonable maximum estimates for those pathways. Risks to receptors associated with different chemicals and exposure routes will be summed across exposure pathways that are likely to occur simultaneously in order to estimate total noncarcinogenic and carcinogenic risk from chemicals and radioisotopes. When toxicants with known mechanism of action or target organ specificity in humans can be identified, their hazards will be segregated and considered separately.

The results of the risk characterization for average, reasonable maximum, and reasonable minimum exposure conditions as determined by the uncertainty analysis will be summarized in tables and discussed in the text. The risk characterization will therefore be an unbiased estimate of risks upon which risk management decisions may be based. Populations that may be affected by the real or potential risks will be identified to the extent that is possible. These results will be discussed in the context of the output from the uncertainty analysis described above. This information will allow the risk manager to make a more informed decision on a final deterministic cleanup value.

9.1 INTRODUCTION

The objective of this Environmental Evaluation Plan is to provide a framework for addressing and quantifying the ecological effects to the biotic environment (plants, animals, microorganisms) from exposure to contaminants resulting from IHSSs within the Walnut Creek Drainage, Operable Unit (OU) 6. An ecosystem approach will be used as the basis for this environmental evaluation to ensure that ecological effects or endpoints (e.g. structural diversity, biomass, phenology, nutrient cycling, trophic structure) are addressed as well as populations and individuals that are more traditionally evaluated in a risk assessment approach (U.S. EPA 1989e). The ecosystem approach is comprehensive in that it initially addresses all ecosystem components, then progressively focuses on those aspects of the system potentially affected by contamination. The result of this process will be an evaluation of the nature and extent of contamination in biota, its relationship to abiotic sources, and the type and extent of adverse effects at the ecosystem, population, and individual levels of organization, as appropriate.

This plan is prepared in conformance with the requirements of current applicable legislation, including the Comprehensive Environmental Response, Compensation and Liability Act (CERCLA), as amended by the Superfund Amendments and Reauthorization Act (SARA), and follows the guidance for such studies as provided in the National Oil and Hazardous Substances Pollution Contingency Plan (NCP) and Environmental Protection Agency (EPA) documents for the conduct of Resource Conservation and Recovery Act (RCRA) Facility Investigation/Remedial Investigation (RFI/RI) activities. Specifically, the EPA guidance provided in Risk Assessment Guidance for Superfund, Vol. II, Environmental Evaluation Manual (U.S. EPA 1989e) is followed. Although a formal Natural Resource Damage Assessment (NRDA) process has not been initiated at Rocky Flats as of this time, this work plan was also designed to be consistent with the NRDA process to the maximum extent possible.

Determination of the effects on biota will be performed in conjunction with the human health risk assessment for OU6. Where appropriate, criteria necessary for performing the environmental evaluation will be developed in conjunction with human health risk assessments and environmental evaluations for all Rocky Flats Plant OUs. Information from the environmental evaluation will assist in determining the form, feasibility, and extent of remediation necessary for Walnut Creek Drainage in accordance with CERCLA.

During preparation of this work plan, several documents were reviewed as part of an assessment of available information. These included the Final Environmental Impact Statement (EIS), Rocky Flats Plant (U.S. DOE 1980); Wetlands Assessment (EG&G 1990h); and the Draft Environmental Evaluation Work

Plan for OU2 (in RFI/RI Alluvial Work Plan, EG&G 1991b) among others. Literature reviews will continue throughout the environmental evaluation. Review of this Draft Phase I RFI/RI Work Plan for OU6 and the Environmental Evaluation Work Plan for OU2 (EG&G 1991b) formed the basis for the establishment of the initial sampling locations presented in the OU6 Environmental Evaluation Field Sampling Plan (subsection 9.3).

9.1.1 Approach

This plan presents a comprehensive approach to conducting the environmental evaluation at Walnut Creek Drainage. This comprehensive approach is designed to ensure that all procedures to be performed are appropriate, necessary, and sufficient to adequately characterize the nature and extent of environmental effects to biota under the "no action" scenario. The approach presented in this plan is adapted from the toxicity-based approach to the assessment of ecosystem effects (U.S. EPA 1989d, 1989e). The approach is based on standard risk assessment concepts whereby uncertainties concerning potential ecosystem effects are explicitly recognized and, where possible, quantified. The planned approach is also based, to the greatest extent possible, on providing objective estimates of ecological damage and the establishing a firm, causal relationship between contamination and ecological effects. To establish this relationship, the Work Plan focuses on the obtainment of three types of information:

- Chemical - Chemical analyses of appropriate media to establish the presence, concentrations, and variabilities of specific toxic compounds. This effort will be conducted under the RFI/RI abiotic sampling program.

- Ecological - Ecological surveys to characterize the condition of existing communities and establish whether any adverse effects have occurred.

- Toxicological - Toxicological and ecotoxicological testing to establish the link between adverse ecological effects and known contamination.

Without these three types of data, other potential causes of the observed effects on ecosystems unrelated to the presence of contamination, such as habitat alterations and natural variability, cannot be eliminated.

The ecological assessment scheme adopted for this project blends standard environmental and risk assessment methods with ecological and toxicological modeling to produce an integrated procedure for selecting contaminants of concern and indicator species, and for conducting an investigation of ecosystem effects resulting from contamination. As is recommended by EPA, this environmental

evaluation is not intended to be or to develop into a research-oriented project. The plan presented herein is designed to provide a focused investigation of potential contaminant effects on biota.

Each task of the environmental evaluation will be coordinated with RFI/RI activities at nearby OUs in order to avoid unnecessary duplication of effort and resources. Environmental evaluation planning is currently underway at six OUs in close proximity to OU6; i.e., OU2 (903 Pad, Mound, and East Trenches Area); OU4 (Solar Ponds); OU7 (Present Landfill); OU10 (Other Outside Closures); OU11 (West Spray Field); and OU13 (100 Area). A coordinated approach with these OUs is necessary in order to account for contaminant migration into OU6.

The environmental evaluation process has been divided into ten tasks. These tasks and their interrelationships are shown on Figure 9-1. The following is a brief description of each of these tasks. More detailed descriptions of each task are presented in subsection 9.2.

Task 1: Preliminary Planning

Task 1 will focus on planning and coordination of the OU6 environmental evaluation with nearby OU activities. Task 1 will include a determination of the scope of work and a definition of the study area. The Data Quality Objectives (DQO) process will be initiated in Task 1 according to EPA guidance (U.S. EPA 1989d, 1989e), and procedures for monitoring and controlling data quality will be specified. Task 1 activities will also include development of criteria for selection of contaminants of concern, key receptor species, and reference areas.

Task 2: Data Collection/Evaluation and Preliminary Risk Assessment

Task 2 will include a review, evaluation, and summary of available chemical and ecological data and identification of data gaps. Based on these data, contaminants of concern will be identified based on their documented effects on key receptor species and/or other ecological endpoints. As part of the conceptual biota model development, a food web model will be constructed and preliminary exposure pathways will be identified. Results of this task will be used to refine the ecological (Task 3) and ecotoxicological (Task 9) field investigation sampling designs.

Task 3: Ecological Field Investigation

Task 3 will include the preliminary field surveys, and an ecological field inventory to characterize OU6 biota and their trophic relationships and to note locations of obvious zones of chemical contamination. Brief field surveys will be conducted in the spring, summer, fall, and winter to obtain information on the occurrence, distribution, variability, and general abundance of key plant and animal species. Field inventories will be conducted in late spring and summer to obtain quantitative data on community

composition in terrestrial and aquatic habitats. Samples collected as part of the activity will be saved for tissue analyses where contaminants of concern have been identified and sampling protocol are in place. Task 3 will also include aquatic toxicity tests using *Ceriodaphnia spp.* and fathead minnows (*Pimephales promelas*). As part of these activities, all collected field data will be reduced, evaluated, compared with, and integrated into the existing database to update knowledge of site conditions.

Task 4: Toxicity Assessment

Task 4 will entail compilation of toxicity literature and the toxicological assessment of potential adverse effects from contaminants of concern on key receptor species. This task will be performed in conjunction with the following Task 5.

Task 5: Exposure Assessment and Pathways Model

Task 5 will entail development of a site-specific pathways model based on the ecological field survey. This exposure-receptor pathways model will be used to evaluate the transport of contaminants at OU6 to biological receptors. The pathways model is based on a conceptual pathways approach (Fordham and Reagan 1991) and will provide an initial determination of the movement and distribution of contaminants, likely interactions among ecosystem components, and expected ecological effects. It is anticipated that this approach will be coordinated with the efforts of investigators working in other OUs to avoid duplication of effort, to collect comparable data, and to provide a consistent assessment of contaminant effects.

Task 6: Preliminary Contamination Characterization

Task 6 will provide a characterization of the threat or risk of OU6 contaminants to receptor populations and habitats. Determinations will be made as to the magnitude of the effects of contamination on OU6 biota. The actual or potential effects of contamination on ecological endpoints (e.g., species diversity, food web structure, productivity) will also be addressed. Depending on DQOs and the quality of data collected, the contamination characterization will be expressed qualitatively, quantitatively, or a combination of the two. Task 6 may include the preliminary derivation of remediation criteria. Development of these criteria will entail consideration of federal and Colorado laws and regulations pertaining to preservation and protection of natural resources that are Applicable or Relevant and Appropriate Requirements (ARARs) (see Section 3.0). Information from ARARs, toxicological assessments, and the pathways model will be used to develop criteria that address biological resource protection.

Task 7: Uncertainty Analysis

Task 7 includes the identification of assumptions and the evaluation of uncertainty in the environmental risk assessment analysis. Task 7 will include the identification of data needs to calibrate/validate the pathways model developed in Task 5.

Task 8: Planning

Task 8 will entail the development of additional DQOs with respect to the conduct of the Task 9, Ecotoxicological Field Investigation. DQOs to be achieved by such sampling will be defined according to EPA guidance (U.S. EPA 1989d). Scoping and design of the Task 9 field studies will be based initially on the outcome of Tasks 1 through 3. Field sampling for assessment of injury will only be performed where acceptance criteria for demonstrating injury to a biological resource will be satisfied in accordance with regulations under the Natural Resource Damage Assessment Rule [43 CFR Subtitle A Section 11.62 (f)] and the accompanying Type B Technical Information Document (U.S. DOI 1987).

Task 9: Ecotoxicological Field Investigation

Task 9 will include tissue analysis studies and any additional ecotoxicological field investigations. Samples collected in Task 3 field studies will be used wherever possible (e.g., when contaminants of concern have been identified and sampling protocols are in place); new samples will be collected if necessary. The need for measuring additional population endpoints through reproductive success, enzyme inhibition, microbial respiration, or other ecotoxicological studies will be evaluated based on the Task 3 preliminary ecological risk assessment. Selection of target analytes, species, and tissues will be based on the determination of which contaminants are likely to be present in sufficient concentrations, quantities, and locations as to be detected in biota. Selection of these specific criteria will be developed in consultation with EPA and the State. All necessary federal and state permits will be obtained prior to any destructive sampling or collecting.

Task 10: Environmental Evaluation Report

Task 10 will provide a final characterization of contamination in biota at OU6. Results from the Task 9 ecotoxicological field investigations will be used to evaluate ecosystem effects. Information on site environmental characteristics and contaminants, characterization of effects, remediation criteria, conclusions, uncertainty analysis, and limitations of the assessment will be summarized into the Environmental Evaluation Report.

Each of the preceding tasks is described in further detailin Subsecton 9.2. A suggested outline for the Environmental Evaluation Report is presented in subsection 9.2.11. The field sampling plan presented

in subsection 9.3 addresses both the Task 3 ecological investigation and the Task 9 ecotoxicological field investigations. A tentative schedule for performing the environmental evaluation is presented in subsection 9.4.

9.1.2 OU6 Contamination

A number of chemicals are suspected to be present in OU6 soils and surface water at levels above background, as described in Section 2.0 of the Phase I RFI/RI Work Plan. Preliminary reviews of available data show some chemicals (organics, metals, and radionuclides) in surface water to be above detection levels and various federal and state surface water quality standards (Tables 9-1 and 9-2). Which of these levels are above background is currently being evaluated as part of the RFI/RI effort. Most of the contaminants are likely to impact biota if present at sufficient concentrations. The following subsections present a discussion of which of these chemicals are likely to be of paramount concern at OU6 given their toxic nature and their concentrations at OU6. Actual selection of contaminants of concern to biota will take place in Task 2 after a more detailed analysis of potential adverse effects and review of available toxicological literature. Further comparisons of site data to the recent Background Geochemical Characterization Report (EG&G 1990b) to determine above background levels will also be made as part of the RFI/RI investigation.

9.1.2.1 Metals

Terrestrial Ecosystems

Heavy metals are the most commonly evaluated environmental contaminants in biomonitoring studies of terrestrial ecosystems. Studies on heavy metals are of several types: (1) reports of metal concentrations in animals from only one location, (2) correlations of tissue concentrations with environmental concentrations, (3) monitoring a site through time, (4) concentrations in animals collected along a gradient of pollution, and (5) comparisons of concentrations in animals from reference and contaminated sites or sites where contamination is suspected. These studies generally provide information on background concentrations of contaminants and correlations of tissue concentrations with environmental concentrations. Data from the Talmage and Walton (1990) study are available for most heavy metals for a variety of mammal species and lower trophic levels. Data from Talmage and Walton (1990) and other available studies on heavy metals effects on biota will be reviewed as part of the Task 2 effort and compared to OU6 data as appropriate.

Several of the heavy metals detected in aquatic ecosystems at OU6 are phytotoxic and are also known to bioaccumulate and biomagnify in terrestrial ecosystems. Bioaccumulation, the process by which chemicals are taken up by organisms directly or through consumption of food containing the chemicals, is documented for arsenic, cadmium, chromium, cobalt, copper, lead, mercury, nickel, and selenium.

TABLE 9-1 COMPARISON OF MAXIMUM SURFACE WATER VALUES TO STATE (CDH/WQCC) SURFACE WATER QUALITY STANDARDS (ug/l)

				Statewide Standards (a)							Basin Standards (b)		Segment 4 & 5 Stream Classification and Water Quality Standards (b)(7)						
		Maximum Surface Water Value (11)		Tables A,B Carcinogens/ Noncarcin-ogens (2)	Table C Aquatic Life		Tables I,II,III (1)				Organics (12)		Tables A,B (2)	Table C Fish & Water Ingestion	Table D Radio-nuclide	Stream Segment Table (8)		Table 2 Radionuclides	
							Aquatic Life												
Parameter	Type (10)				Acute Value	Chronic Value	Acute Value (2)	Chronic Value (2)	Agricul-tural Standard (3)	Domestic Water Supply (6)	Aquatic Life	Water Supply				Acute Value	Chronic Value	Woman Creek	Walnut Creek
Bicarbonate	A																		
Carbonate	A																		
Chloride	A									250,000						3	3		
Chlorine	A				3	3										3	3		
Fluoride	A									2,000									
N as Nitrate	A								100,000	10,000						10,000	10,000		
N as Nitrate+Nitrite	A								100,000	10,000									
N as Nitrite	A						SS	SS	10,000	1,000						1,000	1,000		
Sulfate	A									250,000						250,000	250,000		
Sulfide	A							2		50									
Coliform (Fecal)	B									2000/100 ml									
Ammonia as N	C						620	60		5,000						620	60		
Dioxin	D			0.00000022 (13)	0.01	0.00001							0.00000022 (13)	0.000000013			0.000000013		
Sulfur	E															2.0	2.0		
Dissolved Oxygen	FP						5,000	5,000	3,000	3,000						5,000	5,000		
pH	FP						6.5-9.0	6.5-9.0		5.0-9.0						6.5-9	6.5-9		
Specific Conductance	FP																		
Temperature	FP						30 degrees	30 degrees											
Boron	I								750							750	750		
Total Dissolved Solids	I																		
		Dissolved	Total																
Aluminum	M	4,520	111,000				950	150											
Antimony	M	160	142																
Arsenic	M		157				360	150	100	50						50			
Arsenic III	M																		
Arsenic V	M																		
Barium	M	817	2,320							1,000									
Beryllium	M	170	8.3						100										

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							Aquatic Life												
Parameter	Type (10)				Acute Value	Chronic Value	Acute Value (2)	Chronic Value (2)	Agricul-tural Standard (3)	Domestic Water Supply (6)	Aquatic Life	Water Supply				Acute Value	Chronic Value	Woman Creek	Walnut Creek
Cadmium	M	171	47.7				TVS	TVS	10	10						TVS	TVS		
Calcium	M	1,490,000	972,000																
Cesium	M																		
Chromium	M	108	298																
Chromium III	M						TVS	TVS	100	50						50			
Chromium VI	M						16	11	100	50						TVS	TVS		
Cobalt	M	219	75.5																
Copper	M	184	216				TVS	TVS	200							TVS	TVS		
Cyanide	M		211				5	5	200	1,000						5	5		
Iron	M	607,000	499,000					1,000		300 (dis)							300 (5)		
Lead	M	20.9	189				TVS	TVS	100	50						TVS	TVS		
Lithium	M	85,200	80,500																
Magnesium	M	266,000	270,000																
Manganese	M	2,920	4,250					1,000	200	50 (dis)							50 (5)		
Mercury	M	6.6	1.0				2.4	0.1		2.0							0.01		
Molybdenum	M	500																	
Nickel	M	338	171				TVS	TVS	200							TVS	TVS		
Potassium	M	3,330,000	4,260,000																
Selenium	M	550	450				135	17	20	10						10			
Silver	M	57.9	70.3				TVS	TVS		50						TVS	TVS		
Sodium	M	7,560,000	9,080,000																
Strontium	M	7,350	8,040																
Thallium	M	29						15											
Tin	M	451	443																
Titanium	M																		
Tungsten	M																		
Vanadium	M	121	273																
Zinc	M	4,210	6,050				TVS	TVS	2,000	5,000						TVS	TVS		
2,4,5-TP Silvex	P			10									10						

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			Statewide Standards (a)							Basin Standards (b)		Segment 4 & 5 Stream Classification and Water Quality Standards (b)(7)						
		Maximum Surface Water Value (11)	Tables A,B Carcinogens/ Noncarcin-ogens (2)	Table C Aquatic Life		Tables I,II,III (1)				Organics (12)		Tables A,B (2)	Table C Fish & Water Ingestion	Table D Radio-nuclide	Stream Segment Table (8)		Table 2 Radionuclides	
						Aquatic Life												
Parameter	Type (10)			Acute Value	Chronic Value	Acute Value (2)	Chronic Value (2)	Agricul-tural Standard (3)	Domestic Water Supply (6)	Aquatic Life	Water Supply				Acute Value	Chronic Value	Woman Creek	Walnut Creek
2,4-D	P		100								100	100						
Aldicarb	P		10									10						
Aldrin	P	60	0.002 (13)	3						0.003		0.002 (13)	0.000074			0.000074		
Bromacil	P																	
Carbofuran	P		36									36						
Chloranil	P																	
Chlordane (Alpha)	P	255uj	0.03 (13)	2.4	0.0043							0.03 (13)	0.00046			0.00046		
Chlordane (Gamma)	P	255uj	0.03 (13)	2.4	0.0043							0.03 (13)	0.00046			0.00046		
Chlorpyrifos	P			0.083	0.041													
DDT	P	50uj	0.1 (13)	1.1	0.001					0.001		0.1 (13)	0.000024			0.000024		
DDT Metabolite (DDD)	P	50uj		0.6						0.001								
DDT Metabolite (DDE)	P	50uj		1,050						0.001								
Demeton	P				0.1					0.1								
Diazinon	P																	
Dieldrin	P	50uj	0.002 (13)	2.5	0.0019					0.003		0.002 (13)	0.000071			0.000071		
Endosulfan I	P	25.5uj		0.22	0.056					0.003								
Endosulfan II	P	50uj																
Endosulfan Sulfate	P	50uj																
Endrin	P	50uj	0.2	0.18	0.0023					0.004		0.2						
Endrin Ketone	P	50uj																
Guthion	P				0.01					0.01								
Heptachlor	P	25.5uj	0.008 (13)	0.52	0.0038					0.001	0.2	0.008 (13)	0.00028			0.00028		
Heptachlor Epoxide	P	25.5uj	0.004 (13)									0.004 (13)						
Hexachlorocyclohexane, Alpha	P	25.5uj											0.0092			0.0092		
Hexachlorocyclohexane, Beta	P	100											0.0163			0.0163		
Hexachlorocyclohexane, Delta	P	25.5uj																
Hexachlorocyclohexane, Tech.	P												0.0123			0.0123		
Hexachlorocyclohexane, Lindane	P	25.5uj	4	2.0	0.08					0.01	4.0	4	0.0186			0.0186		
Malathion	P				0.1					0.1								
Methoxychlor	P	255uj	100		0.03					0.03	100	100						

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				Statewide Standards (a)							Basin Standards (b)		Segment 4 & 5 Stream Classification and Water Quality Standards (b)(7)						
		Maximum Surface Water Value (11)		Tables A,B Carcinogens/ Noncarcin-ogens (2)	Table C Aquatic Life		Tables I,II,III (1) Aquatic Life				Organics (12)		Tables A,B (2)	Table C Fish & Water Ingestion	Table D Radio-nuclide	Stream Segment Table (8)		Table 2 Radionuclides	
Parameter	Type (10)				Acute Value	Chronic Value	Acute Value (2)	Chronic Value (2)	Agricul-tural Standard (3)	Domestic Water Supply (6)	Aquatic Life	Water Supply				Acute Value	Chronic Value	Woman Creek	Walnut Creek
Mirex	P					620					0.001								
Parathion	P					0.013					0.04								
PCBs	P			0.005 (13)	2.0	0.014					0.001		0.005 (13)	0.000079			0.000079		
Simazine	P	6,000												4			4		
Toxaphene	P	500uj		5	0.73	0.0002					0.005	5.0	5						
Vaponite 2	P																		
Aroclor 1016	PP	255uj																	
Aroclor 1221	PP	255uj																	
Aroclor 1232	PP	255uj																	
Aroclor 1242	PP	255uj																	
Aroclor 1248	PP	255uj																	
Aroclor 1254	PP	500uj																	
Aroclor 1260	PP	500uj																	
Atrazine	PP	10,000												3			3		
		Dissolved	Total																
Americium (pCi/l)	R																	0.05	0.05
Americium 241 (pCi/l)	R	0.1	2.2												30				
Cesium 134 (pCi/l)	R			80 (6)									80		80			80	80
Cesium 137 (pCi/l)	R		4.1																
Gross Alpha (pCi/l)	R	1,900	1,400															7	11
Gross Beta (pCi/l)	R	3,800	2,500															5	19
Plutonium 239 (pCi/l)	R	0.77	10															0.05	0.05
Plutonium 238+239+240 (pCi/l)	R			15 (6)											15				
Radium 226+228 (pCi/l)	R	1.6 (228)	0.13	5 (6)											5				
Strontium 89+90 (pCi/l)	R	1.885x																	
Strontium 90 (pCi/l)	R	1.3	3.2	8 (6)											8			8	8
Thorium 230+232 (pCi/l)	R			60 (6)											60				
Tritium (pCi/l)	R	265.8j		20,000 (6)											20,000			500	500
Uranium 233+234 (pCi/l)	R	300	861																
Uranium 235 (pCi/l)	R	21	65.5																

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				Statewide Standards (a)							Basin Standards (b)		Segment 4 & 5 Stream Classification and Water Quality Standards (b)(7)						
		Maximum Surface Water Value (11)		Tables A,B Carcinogens/ Noncarcin-ogens (2)	Table C Aquatic Life		Tables I,II,III (1) Aquatic Life				Organics (12)		Tables A,B (2)	Table C Fish & Water Ingestion	Table D Radio-nuclide	Stream Segment Table (8)		Table 2 Radionuclides	
Parameter	Type (10)				Acute Value	Chronic Value	Acute Value (2)	Chronic Value (2)	Agricul-tural Standard (3)	Domestic Water Supply (6)	Aquatic Life	Water Supply				Acute Value	Chronic Value	Woman Creek	Walnut Creek
Uranium 238 (pCi/l)	R	290	336																
Uranium (Total) (pCi/l)	R	442	1,023				TVS	TVS							40			5	10
1,2,4,5-Tetrachlorobenzene	SV			2 (13)									2						
1,2,4-Trichlorobenzene	SV																		
1,2-Dichlorobenzene (Ortho)	SV			620									620						
1,2-Diphenylhydrazine	SV			0.05 (13)									0.05 (13)						
1,3-Dichlorobenzene (Meta)	SV			620									620						
1,4-Dichlorobenzene (Para)	SV			75									75						
2,4,5-Trichlorophenol	SV			700									700						
2,4,6-Trichlorophenol	SV			2.0 (13)		970							2.0 (13)	1.2			1.2		
2,4-Dichlorophenol	SV			21	2,020	365							21						
2,4-Dimethylphenol	SV	6j			2,120														
2,4-Dinitrophenol	SV																		
2,4-Dinitrotoluene	SV																		
2-Chloronaphthalene	SV																		
2-Chlorophenol	SV				4,380	2,000													
2-Methylnaphthalene	SV	21																	
2-Methylphenol	SV	5j																	
2-Nitroaniline	SV																		
2-Nitrophenol	SV																		
3,3-Dichlorobenzidine	SV													0.01			0.01		
3-Nitroaniline	SV																		
4,6-Dinitro-2-methylphenol	SV																		
4-Bromophenyl Phenylether	SV																		
4-Chloroaniline	SV																		
4-Chlorophenyl Phenyl Ether	SV																		
4-Chloro-3-methylphenol	SV				30														
4-Methylphenol	SV	160																	
4-Nitroaniline	SV																		

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			Statewide Standards (a)							Basin Standards (b)		Segment 4 & 5 Stream Classification and Water Quality Standards (b)(7)						
			Tables A,B	Table C Aquatic Life		Tables I,II,III (1) Aquatic Life				Organics (12)		Tables A,B	Table C	Table D	Stream Segment Table (8)		Table 2 Radionuclides	
Parameter	Type (10)	Maximum Surface Water Value (11)	Carcinogens/ Noncarcin-ogens (2)	Acute Value	Chronic Value	Acute Value (2)	Chronic Value (2)	Agricul-tural Standard (3)	Domestic Water Supply (6)	Aquatic Life	Water Supply	(2)	Fish & Water Ingestion	Radio-nuclide	Acute Value	Chronic Value	Woman Creek	Walnut Creek
4-Nitrophenol	SV																	
Acenaphthene	SV	4j		1,700	520													
Anthracene	SV																	
Benzidine	SV		0.0002 (13)	2,500						0.1	0.01	0.0002 (13)	0.00012			0.00012		
Benzoic Acid	SV	6j																
Benzo(a)anthracene	SV																	
Benzo(a)pyrene	SV																	
Benzo(b)fluoranthene	SV																	
Benzo(g,h,i)perylene	SV																	
Benzo(k)fluoranthene	SV																	
Benzyl Alcohol	SV	2j																
bis(2-Chloroethoxy)methane	SV																	
bis(2-Chloroethyl)ether	SV		0.03 (13)									0.03 (13)	0.0000037			0.0000037		
bis(2-Chloroisopropyl)ether	SV																	
bis(2-Ethylhexyl)phthalate	SV	650e																
Butadiene	SV																	
Butyl Benzylphthalate	SV	3j																
Chlorinated Ethers	SV																	
Chlorinated Napthalenes	SV																	
Chloroalkylethers	SV																	
Chlorophenol	SV									1.0	1.0							
Chrysene	SV	1.5j																
Dibenzofuran	SV																	
Dibenz(a,h)anthracene	SV																	
Dichlorobenzenes	SV																	
Dichlorobenzidine	SV												0.01			0.01		
Diethylphthalate	SV	6j																
Dimethylphthalate	SV																	
Dinitrotoluene	SV			330	230													
Di-n-butylphthalate	SV	20b																

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			Tables A,B	Table C Aquatic Life		Tables I,II,III (1)				Organics (12)		Tables A,B	Table C	Table D	Stream Segment Table (8)		Table 2 Radionuclides	
						Aquatic Life							Fish &	Radio-				
Parameter	Type (10)	Maximum Surface Water Value (11)	Carcinogens/ Noncarcin-ogens (2)	Acute Value	Chronic Value	Acute Value (2)	Chronic Value (2)	Agricul-tural Standard (3)	Domestic Water Supply (6)	Aquatic Life	Water Supply	(2)	Water Ingestion	nuclide	Acute Value	Chronic Value	Woman Creek	Walnut Creek
Di-n-octylphthalate	SV	24b																
Ethylene Glycol	SV																	
Fluoranthene	SV			3,980														
Fluorene	SV	3j																
Formaldehyde	SV																	
Haloethers	SV																	
Hexachlorobenzene	SV		0.02 (13)									0.02 (13)	0.00072			0.00072		
Hexachlorobutadiene	SV		14	90	9.3							14	0.45			0.45		
Hexachlorocyclopentadiene	SV		49	7	5.2							49						
Hexachloroethane	SV			980	540								1.9			1.9		
Hydrazine	SV																	
Indeno(1,2,3-cd)pyrene	SV																	
Isophorone	SV		1,050	117,000								1,050						
Naphthalene	SV	25		2,300	620													
Nitrobenzene	SV		3.5 (13)	27,000								3.5 (13)						
Nitrophenols	SV																	
Nitrosamines	SV																	
Nitrosodibutylamine	SV												0.0064			0.0064		
Nitrosodiethylamine	SV												0.0008			0.0008		
Nitrosodimethylamine	SV												0.0014			0.0014		
Nitrosopyrrolidine	SV												0.016			0.016		
N-Nitrosodiphenylamine	SV	300											4.9			4.9		
N-Nitroso-di-n-dipropylamine	SV																	
Pentachlorinated Ethanes	SV																	
Pentachlorobenzene	SV		6 (13)									6 (13)						
Pentachlorophenol	SV	20j	200	9	5.7							200						
Phenanthrene	SV	6j																
Phenol	SV	39		10,200	2,560					500	1.0							
Phthalate Esters	SV																	
Polynuclear Aromatic Hydrocarbons	SV												0.0028			0.0028		

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		Maximum Surface Water Value (11)	Tables A,B Carcinogens/ Noncarcin-ogens (2)	Table C Aquatic Life		Tables I,II,III (1)				Organics (12)		Tables A,B (2)	Table C Fish & Water Ingestion	Table D Radio-nuclide	Stream Segment Table (8)		Table 2 Radionuclides	
						Aquatic Life												
Parameter	Type (10)			Acute Value	Chronic Value	Acute Value (2)	Chronic Value (2)	Agricul-tural Standard (3)	Domestic Water Supply (6)	Aquatic Life	Water Supply				Acute Value	Chronic Value	Woman Creek	Walnut Creek
Vinyl Chloride	SV	16	2									2						
1,1,1-Trichloroethane	V	42	200									200						
1,1,2,2-Tetrachloroethane	V	240			2,400								0.17			0.17		
1,1,2-Trichloroethane	V	2j	28		9,400							28	0.60			0.60		
1,1-Dichloroethane	V	8																
1,1-Dichloroethene	V	133	7									7						
1,2-Dichloroethane	V	4j	5	118,000	20,000							5						
1,2-Dichloroethene (cis)	V		70									70						
1,2-Dichloroethene (total)	V	150																
1,2-Dichloroethene (trans)	V	9	70									70						
1,2-Dichloropropane	V		0.56 (13)	23,000	5,700							0.56 (13)						
1,3-Dichloropropene (cis)	V			6,060	244													
1,3-Dichloropropene (trans)	V	3j		6,060	244													
2-Butanone	V	76																
2-Hexanone	V	87																
4-Methyl-2-pentanone	V	24b																
Acetone	V	220																
Acrylonitrile	V			7,550	2,600								0.058			0.058		
Benzene	V	4j	5	5,300								5						
Bromodichloromethane	V																	
Bromoform	V	2j																
Bromomethane	V																	
Carbon Disulfide	V	19																
Carbon Tetrachloride	V	605	5	35,200								5						
Chlorinated Benzenes	V																	
Chlorobenzene	V	7	300									300						
Chloroethane	V	24																
Chloroform	V	82	Tot THM <100 (4)	28,900	1,240							Tot THM <100 (4)	0.19			0.19		

TABLE 9-1 COMPARISON OF MAXIMUM SURFACE WATER VALUES TO STATE (CDH/WQCC) SURFACE WATER QUALITY STANDARDS (ug/l)

			Statewide Standards (a)							Basin Standards (b)		Segment 4 & 5 Stream Classification and Water Quality Standards (b)(7)						
			Tables A,B	Table C Aquatic Life		Tables I,II,III (1) Aquatic Life				Organics (12)		Tables A,B	Table C	Table D	Stream Segment Table (8)		Table 2 Radionuclides	
Parameter	Type (10)	Maximum Surface Water Value (11)	Carcinogens/ Noncarcin-ogens (2)	Acute Value	Chronic Value	Acute Value (2)	Chronic Value (2)	Agricul-tural Standard (3)	Domestic Water Supply (6)	Aquatic Life	Water Supply	(2)	Fish & Water Ingestion	Radio-nuclide	Acute Value	Chronic Value	Woman Creek	Walnut Creek
Chloromethane	V	38																
Dibromochloromethane	V																	
Dichloroethenes	V																	
Ethyl Benzene	V	18	680	32,000								680						
Ethylene Dibromide	V																	
Ethylene Oxide	V																	
Halomethanes	V		100									100	0.19			0.19		
Methylene Chloride	V	340																
Pyrene	V																	
Styrene	V																	
Tetrachloroethanes	V												0.8			0.8		
Tetrachloroethene	V	270	10	5,280	840							10						
Toluene	V	94	2,420	17,500								2,420						
Trichloroethanes	V																	
Trichloroethene	V	260	5	45,000	21,900							5						
Vinyl Acetate	V	3j																
Xylenes (Total)	V	21																

EXPLANATION OF TABLE

CLP = Contract Laboratory Program
CDH = Colorado Department of Health
dis = dissolved
EPA = Environmental Protection Agency
pCi/l = picocuries per liter
PCB = polychlorinated biphenyl
PQL = Practical Quantitation Level
SS = species specific
TAL = Target Analyte List
THM = Total Trihalomethanes

TIC = Tentatively Identified Compound
TVS = Table Value Standard (hardness dependent), see Table III in (a)
MDL = Minimum Detection Limit for radionuclides (pCi/l)
ug/l = micrograms per liter
VOA = Volatile Organic Analysis
WQCC = Water Quality Control Commission

(1) Table I = physical and biological parameters
Table II = inorganic parameters
Table III = metal parameters
Values in Tables I, II, and III for recreational uses, cold water biota and domestic water supply are not included.
(2) In the absence of specific, numeric standards for non-naturally occurring organics, the narrative standard is interpreted as zero with enforcement based on practical quantification levels (PQLs) as defined by CDH/WQCC or EPA
(3) All are 30-day standards except for nitrate+nitrite
(4) Total trihalomethanes: chloroform, bromoform, bromodichloromethane, dibromochloromethane
(5) Lowest value given: dissolved or total recoverable
(6) Ammonia, sulfide, chloride, sulfate, copper, iron, manganese, and zinc are 30-day standards, all others are 1-day standards
(7) Segment 4 standards for inorganics, metals, organics, and radionuclides are TBC and Segment 5 standards are goals (TBCs)
(8) Includes Table 1: Additional Organic Chemical Standards (chronic only)
(9) See section 3.1.11 (f)(2) in (a)
(10) type abbreviations are: A=anion; B=bacteria; C=cation; D=dioxin; E=element; FP=field parameter; I=indicator; M=metal; P=pesticide; PP=pesticide/PCB; R=radionuclide; SV=semi-volatile; V=volatile
(11) Data are from Appendix B for surface water samples. Data qualifiers are as follows: u=compound analyzed but not detected (number=detection limit); j=compound not detected (detection limit estimated due to dilution); b=value greater than instrument detection limit, but less than contract required quantitation limit; e=reported value is estimated because of the presence of interference; x=analysis done by special procedure
(12) See Section 3.8.5 (2)(a) in (b)
(13) Standard is below (more stringent than) PQL, therefore PQL is standard.
(14) MDL for Radium 226 is 0.5; MDL for Radium 228 is 1.0

(a) CDH/WQCC, Colorado Water Quality Standards 3.1.0 (5 CCR 1002-8) 1/15/1974; amended 9/30/1989 (Envrionmental Reporter 726:1001-1020:6/1990)
(b) CDH/WQCC, Classifications and Numeric Standards for S. Platte River Basin, Laramie River Basin, Republican River Basin, Smoky Hill River Basin 3.8.0 (5 CCR 1002-8) 4/6/1981; amended 2/15/1990

TABLE 9-2 COMPARISON OF MAXIMUM SURFACE WATER VALUES TO FEDERAL SURFACE WATER QUALITY STANDARDS (ug/l)

Parameter	Type (7)	Maximum Surface Water Values (8)		SDWA Maximum Contaminant Level (a)	SDWA Maximum Contaminant Level TBCs (b)	SDWA Maximum Contaminant Level Goal (a)	SDWA Maximum Contaminant Level Goal TBCs (b)	CWA AWQC for Protection of Aquatic Life/TBCs (c)		CWA AWQC for Protection of Human Health/TBCs (c)	
								Acute Value	Chronic Value	Water and Fish Ingestion	Fish Consumption Only
Bicarbonate	A										
Carbonate	A										
Chloride	A			250,000*				860,000(e)	230,000(e)		
Chlorine	A							19	11		
Flouride	A			4,000; 2,000*		4,000					4,000
N as Nitrate	A			10,000			10,000			10,000	
N as Nitrate+Nitrite	A				10,000		10,000				
N as Nitrite	A				1,000		1,000				
Sulfate	A			250,000*							
Sulfide	A										
Coliform (Fecal)	B			1/100 ml							
Ammonia as N	C							Criteria are pH	and temperature	dependent – see	criteria document
Dioxin	D							0.01	0.00001	0.000000013	0.000000014
Sulfur	E										
Dissolved Oxygen	FP							5,000			
pH	FP			6.5–8.5 *					6.5–9		
Specific Conductance	FP										
Temperature	FP							SS	SS		
Boron	I										
Total Dissolved Solids	I			500,000*				SS	SS	250,000	
		Dissolved	Total								
Aluminum	M	4,520	111,000		50 to 200*			750	87		
Antimony	M	160	142					9,000	1,600	146	45,000
Arsenic	M		157	50						.0022	.0175
Arsenic III	M							360	190		
Arsenic V	M							850	48		
Barium	M	817	2,320	1,000	2,000 (f)		2,000 (f)			1,000	
Beryllium	M	170	8.3					130	5.3	.0068**	.117**
Cadmium	M	171	47.7	10	5		5	3.9 (3)	1.1 (3)	10	

TABLE 9-2 COMPARISON OF MAXIMUM SURFACE WATER VALUES TO FEDERAL SURFACE WATER QUALITY STANDARDS (ug/l)

Parameter	Type (7)	Maximum Surface Water Values (8)		SDWA Maximum Contaminant Level (a)	SDWA Maximum Contaminant Level TBCs (b)	SDWA Maximum Contaminant Level Goal (a)	SDWA Maximum Contaminant Level Goal TBCs (b)	CWA AWQC for Protection of Aquatic Life/TBCs (c)		CWA AWQC for Protection of Human Health/TBCs (c)	
								Acute Value	Chronic Value	Water and Fish Ingestion	Fish Consumption Only
Calcium	M	1,490,000	972,000								
Cesium	M										
Chromium	M	108	298	50	100		100				
Chromium III	M							1,700	210	170,000	3,433,000
Chromium VI	M							16	11	50	
Cobalt	M	219	75.5								
Copper	M	184	216	1,000*			1,300 (f)	18 (3)	12 (3)		
Cyanide	M		211					22	5.2	200	
Iron	M	607,000	499,000	300 *					1,000	300	
Lead	M	20.9	189	50			0 (g)	82 (3)	3.2 (3)	50	
Lithium	M	85,200	80,500								
Magnesium	M	266,000	270,000								
Manganese	M	2,920	4,250	50 *						50	100
Mercury	M	6.6	1.0	2	2		2	2.4	0.012	0.144	0.146
Molybdenum	M	500									
Nickel	M	338	171					1,400 (3)	160 (3)	13.4	100
Potassium	M	3,330,000	4,260,000								
Selenium	M	550	450	10	50		50	20 (d)	5 (d)	10	
Silver	M	57.9	70.3	50	100 *			4.1 (3)	0.12	50	
Sodium	M	7,560,000	9,080,000								
Strontium	M	7,350	8,040								
Thallium	M	29						1,400 (1)	40 (1)	13	48
Tin	M	451	443								
Titanium	M										
Tungsten	M										
Vanadium	M	121	273								
Zinc	M	4,210	6,050	5,000 *				120 (3)	110 (3)		
2,4,5-TP Silvex	P			10	50		50				
2,4-Dichlorophenoxyacetic Acid (2,4-D)	P			100	70		70				

TABLE 9-2 COMPARISON OF MAXIMUM SURFACE WATER VALUES TO FEDERAL SURFACE WATER QUALITY STANDARDS (ug/l)

Parameter	Type (7)	Maximum Surface Water Values (8)	SDWA Maximum Contaminant Level (a)	SDWA Maximum Contaminant Level TBCs (b)	SDWA Maximum Contaminant Level Goal (a)	SDWA Maximum Contaminant Level Goal TBCs (b)	CWA AWQC for Protection of Aquatic Life/TBCs (c)		CWA AWQC for Protection of Human Health/TBCs (c)	
							Acute Value	Chronic Value	Water and Fish Ingestion	Fish Consumption Only
Aldicarb	P			3 (f)		1 (f)				
Aldrin	P	60					3.0		0.000074	0.000079
Bromacil	P									
Carbofuran	P			40		40				
Chloranil	P									
Chlordane (Alpha)	P	255uj		2		0	2.4	0.0043	0.00046	0.00048
Chlordane (Gamma)	P	255uj		2		0	2.4	0.0043	0.00046	0.00048
Chlorpyrifos	P						0.063	0.041		
DDT	P	50uj					1.1	0.0011	0.000024	0.000024
DDT Metabolite (DDD)	P	50uj					0.06			
DDT Metabolite (DDE)	P	50uj					1,050			
Demeton	P							0.1		
Diazinon	P									
Dieldrin	P	50uj					2.5	0.0019	0.00007	0.000076
Endosulfan I	P	25.5uj					0.22	0.056	74	159
Endosulfan II	P	50uj								
Endosulfan Sulfate	P	50uj								
Endrin	P	50uj	0.2				0.18	0.0023	1	
Endrin Ketone	P	50uj								
Guthion	P							0.01		
Heptachlor	P	25.5uj		0.4		0	0.52	0.0038	0.00028	0.00029
Heptachlor Epoxide	P	25.5uj		0.2		0				
Hexachlorocyclohexane, Alpha	P	25.5uj							0.0092	0.031
Hexachlorocyclohexane, Beta	P	100							0.0163	0.0547
Hexachlorocyclohexane, Delta	P	25.5uj								
Hexachlorocyclohexane, Technical	P								0.0123	0.0414
Hexachlorocyclohexane, (Lindane) Gama	P	25.5uj	4	0.2		0.2	2.0	0.08		
Malathion	P							0.01		
Methoxychlor	P	255uj	100	40		40		0.03	100	
Mirex	P							0.001		

TABLE 9-2 COMPARISON OF MAXIMUM SURFACE WATER VALUES TO FEDERAL SURFACE WATER QUALITY STANDARDS (ug/l)

Parameter	Type (7)	Maximum Surface Water Values (8)		SDWA Maximum Contaminant Level (a)	SDWA Maximum Contaminant Level TBCs (b)	SDWA Maximum Contaminant Level Goal (a)	SDWA Maximum Contaminant Level Goal TBCs (b)	CWA AWQC for Protection of Aquatic Life/TBCs (c)		CWA AWQC for Protection of Human Health/TBCs (c)	
								Acute Value	Chronic Value	Water and Fish Ingestion	Fish Consumption Only
Parathion	P							0.065	0.013		
PCBs	P				0.5		0	2.0	0.014	0.000079	0.000079
Simazine	P	6,000									
Toxaphene	P	500uj			3		0	0.73	0.0002	0.0071	0.00073
Vaponite 2	P										
Aroclor 1016	PP	255uj									
Aroclor 1221	PP	255uj									
Aroclor 1232	PP	255uj									
Aroclor 1242	PP	255uj									
Aroclor 1248	PP	255uj									
Aroclor 1254	PP	500uj									
Aroclor 1260	PP	500uj									
Atrazine	PP	10,000			3		3				
		Dissolved	Total								
Americium (pCi/l)	R										
Americium 241 (pCi/l)	R	0.1	2.2								
Cesium 134 (pCi/l)	R										
Cesium 137 (pCi/l)	R		4.1								
Gross Alpha (pCi/l)	R	1,900	1,400	15 (10)							15
Gross Beta (pCi/l)	R	3,800	2,500	50 (4 mrem/yr)							
Plutonium 239 (pCi/l)	R	0.77 (239)	10 (239)								
Plutonium 238+239+240 (pCi/l)	R										
Radium 226+228 (pCi/l)	R	1.6 (228)	0.13	5							5
Strontium 89+90 (pCi/l)	R	1.885x									
Strontium 90 (pCi/l)	R	1.3	3.2	8 (6)							8
Thorium 230+232 (pCi/l)	R										
Tritium (pCi/l)	R	265.8j		20,000 (6)							
Uranium 233+234 (pCi/l)	R	300	861								
Uranium 235 (pCi/l)	R	21	65.5								
Uranium 238 (pCi/l)	R	290	336								

TABLE 9-2 COMPARISON OF MAXIMUM SURFACE WATER VALUES TO FEDERAL SURFACE WATER QUALITY STANDARDS (ug/l)

Parameter	Type (7)	Maximum Surface Water Values (8)		SDWA Maximum Contaminant Level (a)	SDWA Maximum Contaminant Level TBCs (b)	SDWA Maximum Contaminant Level Goal (a)	SDWA Maximum Contaminant Level Goal TBCs (b)	CWA AWQC for Protection of Aquatic Life/TBCs (c)		CWA AWQC for Protection of Human Health/TBCs (c)	
								Acute Value	Chronic Value	Water and Fish Ingestion	Fish Consumption Only
Uranium (Total) (pCi/l)	R	442	1,023								
1,2,4,5-Tetrachlorobenzene	SV									38	48
1,2,4-Trichlorobenzene	SV										
1,2-Dichlorobenzene (Ortho)	SV				600		600				
1,2-Diphenylhydrazine	SV							270 (1)			
1,3-Dichlorobenzene (Meta)	SV										
1,4-Dichlorobenzene (Para)	SV			75		75					
2,4,5-Trichlorophenol	SV									2,800	
2,4,6-Trichlorophenol	SV								970 (1)	1.2 **	3.6 **
2,4-Dichlorophenol	SV							2,020 (1)	365 (1)	3,090	
2,4-Dimethylphenol	SV	6j						2,120 (1)			
2,4-Dinitrophenol	SV										
2,4-Dinitrotoluene	SV									0.11 **	9.1 **
2-Chloronaphthalene	SV										
2-Chlorophenol	SV							4,360 (1)	2,000 (1)		
2-Methylnaphthalene	SV	21									
2-Methylphenol	SV	5j									
2-Nitroaniline	SV										
2-Nitrophenol	SV										
3,3-Dichlorobenzidine	SV									0.01	0.02
3-Nitroaniline	SV										
4,6-Dinitro-2-methylphenol	SV										
4-Bromophenyl Phenylether	SV										
4-Chloroaniline	SV										
4-Chlorophenyl Phenyl Ether	SV										
4-Chloro-3-methylphenol	SV							30 (1)			
4-Methylphenol	SV	160									
4-Nitroaniline	SV										
4-Nitrophenol	SV							230 (1)	150 (1)		

TABLE 9-2 COMPARISON OF MAXIMUM SURFACE WATER VALUES TO FEDERAL SURFACE WATER QUALITY STANDARDS (ug/l)

Parameter	Type (7)	Maximum Surface Water Values (8)	SDWA Maximum Contaminant Level (a)	SDWA Maximum Contaminant Level TBCs (b)	SDWA Maximum Contaminant Level Goal (a)	SDWA Maximum Contaminant Level Goal TBCs (b)	CWA AWQC for Protection of Aquatic Life/TBCs (c)		CWA AWQC for Protection of Human Health/TBCs (c)	
							Acute Value	Chronic Value	Water and Fish Ingestion	Fish Consumption Only
Acenaphthene	SV	4j					1,700 (1)	520 (1)		
Anthracene	SV									
Benzidine	SV						2,500		0.00012	0.00053
Benzoic Acid	SV	6j								
Benzo(a)anthracene	SV									
Benzo(a)pyrene	SV									
Benzo(b)fluoranthene	SV									
Benzo(g,h,i)perylene	SV									
Benzo(k)fluoranthene	SV									
Benzyl Alcohol	SV	2j								
bis(2-Chloroethoxy)methane	SV									
bis(2-Chloroethyl)ether	SV								0.03**	1.36 **
bis(2-Chloroisopropyl)ether	SV								34.7	4,360
bis(2-Ethylhexyl)phthalate	SV	650e							15,000	50,000
Butadiene	SV									
Butylbenzylphthalate	SV	3j								
Chlorinated Ethers	SV									
Chlorinated Napthalenes	SV						1,600 (1)			
Chloroalkylethers	SV						238,000 (1)			
Chlorophenol	SV									
Chrysene	SV	1.5j								
Dibenzofuran	SV									
Dibenz(a,h)anthracene	SV									
Dichlorobenzenes	SV						1,120 (1)	763 (1)	400	2,600
Dichlorobenzidine	SV								0.01	0.02
Diethylphthalate	SV	6j							350,000	1,800,000
Dimethylphthalate	SV								313,000	2,900,000
Dinitrotoluene	SV						330 (1)	230 (1)	70	14,300
Di-n-butylphthalate	SV	20b								
Di-n-octylphthalate	SV	24b								

TABLE 9-2 COMPARISON OF MAXIMUM SURFACE WATER VALUES TO FEDERAL SURFACE WATER QUALITY STANDARDS (ug/l)

Parameter	Type (7)	Maximum Surface Water Values (8)	SDWA Maximum Contaminant Level (a)	SDWA Maximum Contaminant Level TBCs (b)	SDWA Maximum Contaminant Level Goal (a)	SDWA Maximum Contaminant Level Goal TBCs (b)	CWA AWQC for Protection of Aquatic Life/TBCs (c)		CWA AWQC for Protection of Human Health/TBCs (c)	
							Acute Value	Chronic Value	Water and Fish Ingestion	Fish Consumption Only
Ethylene glycol	SV									
Fluoranthene	SV						3,980 (1)		42	54
Fluorene	SV	3j								
Formaldehyde	SV									
Haloethers	SV						380 (1)	122 (1)		
Hexachlorobenzene	SV								0.00072**	0.00074**
Hexachlorobutadiene	SV						90 (1)	9.3 (1)	0.45**	50 **
Hexachlorocyclopentadiene	SV						7 (1)	5.2 (1)	206	
Hexachloroethane	SV						980 (1)	540 (1)	1.9	8.74
Hydrazine	SV									
Indeno(1,2,3-cd)pyrene	SV									
Isophorone	SV						117,000 (1)		5,200	520,000
Naphthalene	SV	25					2,300 (1)	620 (1)		
Nitrobenzene	SV						27,000 (1)		19,800	
Nitrophenols	SV						230 (1)	150 (1)		
Nitrosamines	SV						5,850 (1)			
Nitrosodibutylamine	SV								0.0064	0.587
Nitrosodiethylamine	SV								0.0008	1.24
Nitrosodimethylamine	SV								0.0014	16
Nitrosopyrrolidine	SV								0.016	91.9
N-Nitrosodiphenylamine	SV	300							4.9 **	16.1 **
N-Nitroso-di-n-dipropylamine	SV									
Pentachlorinated Ethanes	SV						7,240 (1)	1,100 (1)		
Pentachlorobenzene	SV								74	85
Pentachlorophenol	SV	20j		1 (f)		0 (f)	20 (4)	13 (4)	1,010	
Phenanthrene	SV	6j								
Phenol	SV	39					10,200 (1)	2,560 (1)	3,500	
Phthalate Esters	SV						940 (1)	3 (1)		
Polynuclear Aromatic Hydrocarbons	SV								0.0028**	0.0311**
Vinyl Chloride	SV	16	2		0				2 **	525 **

TABLE 9-2 COMPARISON OF MAXIMUM SURFACE WATER VALUES TO FEDERAL SURFACE WATER QUALITY STANDARDS (ug/l)

Parameter	Type (7)	Maximum Surface Water Values (8)	SDWA Maximum Contaminant Level (a)	SDWA Maximum Contaminant Level TBCs (b)	SDWA Maximum Contaminant Level Goal (a)	SDWA Maximum Contaminant Level Goal TBCs (b)	CWA AWQC for Protection of Aquatic Life/TBCs (c)		CWA AWQC for Protection of Human Health/TBCs (c)	
							Acute Value	Chronic Value	Water and Fish Ingestion	Fish Consumption Only
1,1,1-Trichloroethane	V	42	200		200				18,400	1,030,000
1,1,2,2-Tetrachloroethane	V	240						2,400	0.17**	10.7 **
1,1,2-Trichloroethane	V	2j						9,400	0.6**	41.8 **
1,1-Dichloroethane	V	8								
1,1-Dichloroethene	V	133	7		7					
1,2-Dichloroethane	V	4j	5		0		118,000	20,000	0.94**	243 **
1,2-Dichloroethene (cis)	V			70		70				
1,2-Dichloroethene (total)	V	150								
1,2-Dichloroethene (trans)	V	9		100		100				
1,2-Dichloropropane	V			5		0	23,000	5,700		
1,3-Dichloropropene (cis)	V						6,060	244 (1)	87	14,100
1,3-Dichloropropene (trans)	V	3j					6,060	244 (1)	87	14,100
2-Butanone	V	76								
2-Hexanone	V	87								
4-Methyl-2-pentanone	V	24b								
Acetone	V	220								
Acrylonitrile	V						7,500	6,000	0.058	0.65
Benzene	V	4j	5		0		5,300		0.66**	40 **
Bromodichloromethane	V									
Bromoform	V	2j								
Bromomethane	V									
Carbon Disulfide	V	19								
Carbon Tetrachloride	V	605	5		0		35,200 (1)		0.4**	6.94 **
Chlorinated Benzenes	V						250 (1)	50 (1)		
Chlorobenzene	V	7		100		100				
Chloroethane	V	24								
Chloroform	V	82	Tot THM<100 (2)				28,900 (1)	1,240 (4)	0.19 **	15.7 **
Chloromethane	V	38								
Dibromochloromethane	V									

TABLE 9-2 COMPARISON OF MAXIMUM SURFACE WATER VALUES TO FEDERAL SURFACE WATER QUALITY STANDARDS (ug/l)

Parameter	Type (7)	Maximum Surface Water Values (8)	SDWA Maximum Contaminant Level (a)	SDWA Maximum Contaminant Level TBCs (b)	SDWA Maximum Contaminant Level Goal (a)	SDWA Maximum Contaminant Level Goal TBCs (b)	CWA AWQC for Protection of Aquatic Life/TBCs (c)		CWA AWQC for Protection of Human Health/TBCs (c)	
							Acute Value	Chronic Value	Water and Fish Ingestion	Fish Consumption Only
Dichloroethenes	V						11,600 (1)		0.033**	1.85 **
Ethyl Benzene	V	18		700		700	32,000 (1)		1,400	3,280
Ethylene Dibromide	V			0.05		0				
Ethylene Oxide	V									
Halomethanes	V		100				11,000 (1)		0.19**	15.7 **
Methylene Chloride	V	340								
Pyrene	V									
Styrene	V			100		100				
Tetrachloroethanes	V						9,320 (1)			
Tetrachloroethene	V	270		5		0	5,280 (1)	840 (1)	0.80**	8.85 **
Toluene	V	94		1,000		1,000	17,500 (1)		14,300	424,000
Trichloroethanes	V						18,000 (1)			
Trichloroethene	V	260	5		0		45,000 (1)	21,900 (1)	2.7 **	80.7 **
Vinyl Acetate	V	3j								
Xylenes (total)	V	21		10,000		10,000				

EXPLANATION OF TABLE

* = secondary maximum contaminant level, TBCs
** = Human health criteria for carcinogens reported for three risk levels. Value presented is the 10-5 risk level.

AWQC = Ambient Water Quality Criteria
CLP = Contract Laboratory Program
CWA = Clean Water Act
EPA = Environmental Protection Agency
pCi/l = picocuries per liter
PCB = polychlorinated biphenyl
PQL = Practical Quantitation Level
SDWA = Safe Drinking Water Act
SS = Species Specific

TAL = Target Analyte List
THM = Total Trihalomethanes
TIC = Tentatively Identified Compound
MDL = Minimum Detection Limit for radionuclides (pCi/l)
ug/l = micrograms per liter
VOA = Volatile Organic Analysis

(1) criteria not developed; value presented is lowest observed effects level (LOEL)
(2) total trihalomethanes: chloroform, bromoform, bromodichloromethane, dibromochloromethane
(3) hardness dependent criteria
(4) pH dependent criteria (7.8 pH used)
(5) standard is not adequately protective when chloride is associated with potassium, calcium, or magnesium, rather than sodium.
(6) if both strontium-90 and tritium are present, the sum of their annual dose equivalents to bone marrow shall not exceed 4 mrem/yr.
(7) type abbreviations are: A=anion; B=bacteria; C=cation; D=dioxin; E=element; FP=field parameter; I=indicator; M=metal; P=pesticide; PP=pesticide/PCB; R=radionuclide; SV=semi-volatile; V=volatile
(8) Data are from Appendix B for surface water samples. Data qualifiers are as follows: u=compound analyzed but not detected (number=detection limit); j=compound not detected (detection limit estimated due to dilution); b=value greater than instrument detection limit, but less than contract required quantitation limit; e=reported value is estimated because of the presence of interference; x=analysis done by special procedure
(9) MDL for radium 226 is 0.5; MDL for radium 228 is 1.0
(10) Value for gross alpha excludes uranium

(a) EPA National Primary and Secondary Drinking Water Regulations, 40 CFR 141 and 40 CFR 143 (as of May 1990)
(b) EPA National Primary and Secondary Drinking Water Regulations, 40 CFR Parts 141, 142 and 143, Final Rule, effective July 30, 1992
(c) EPA, Quality Criteria for Protection of Aquatic Life, 1986
(d) EPA, National Ambient Water Quality Criteria for Selenium - 1987
(e) EPA, National Ambient Water Quality Criteria for Chloride - 1988
(f) EPA National Primary and Secondary Drinking Water Regulations, 40 CFR Parts 141, 142, and 143, Final Rule (56 FR 30266; 7/1/1991) effective 1/1/1993.
(g) EPA Maximum Contaminant Level Goals and National Primary Drinking Water Regulations for Lead and Copper, 40 CFR 141 and 142 (56 FR 26460; 6/7/1991) effective 11/6/1991.

Biomagnification, or the process by which tissue concentrations of chemicals increase as the chemical passes up through two or more trophic levels, is documented from soil to plants for beryllium, cadmium, chromium, copper, lead, mercury, and selenium. In herbivores, biomagnification occurs for antimony, arsenic, cadmium, chromium, copper, lead, mercury, and selenium. In terrestrial carnivores, mercury and cadmium are known to biomagnify. Any, if not all, of these metals are likely to become contaminants of concern in the OU6 environmental evaluation depending on historical usage, concentrations detected in soils, and potential uptake by biological receptors at OU6.

Aquatic Ecosystems

EPA (U.S. EPA 1986b, 1987c, 1988f, 1988g) and the State have established ambient water quality criteria (AWQC) to be protective of the environment (See Section 3.0 and Tables 3-2 and 3-3). Specifically, these criteria represent the maximum allowable water concentrations consistent with the protection of aquatic wildlife. One rationale for establishing criteria protective of aquatic life is that aquatic organisms and plants are important in food chains to higher life forms. In addition, their direct dependence on the aquatic environment results in constant contact with the water and the organisms are therefore likely to assimilate any contaminants. One EPA objective in establishing AWQC was to determine chemical concentrations that would not be directly harmful to aquatic organisms and plants and would not present a hazard to higher life forms due to any biomagnification of individual chemical substances.

Of the metals and analytes, such as cyanide, detected in surface water at OU6, a number are of immediate interest in the evaluation of aquatic ecosystems given their presence at levels above Federal surface water quality standards (Tables 9-1 and 9-2). Those with maximum values exceeding Federal AWQC for protection of aquatic life include aluminum, beryllium, cadmium, copper, cyanide, iron, lead, mercury, nickel, selenium, silver, and zinc. Chromium may also be of concern depending on the fraction of chromium VI present. Metals or analytes with values exceeding Federal MCLs or SMCLs include arsenic, barium, cadmium, chromium, iron, lead, manganese, mercury, selenium, silver, and zinc. Metals or analytes with maximum values exceeding Federal AWQC for protection of human health include antimony, arsenic, barium, beryllium, cadmium, chromium, cyanide, iron, lead, manganese, mercury, nickel, selenium, silver, and thallium. Metals or analytes with no federal standards include calcium, cobalt, lithium, magnesium, molybdenum, potassium, sodium, strontium, tin, and vanadium.

Metals or analytes with maximum values exceeding Colorado aquatic life standards include aluminum, arsenic, chromium, cyanide, iron, manganese, mercury, selenium, and thallium. Metals or analytes with maximum values exceeding Colorado statewide agricultural standards include arsenic, beryllium, cadmium, chromium, copper, cyanide, lead, manganese, nickel, selenium, and zinc. Cadmium, chromium, copper, lead, nickel, silver, and zinc may be of additional concern at OU6 depending on the site-specific table value standard. Metals or analytes with maximum values which do not exceed state AWQC, or which have no AWQC but exceed other state criteria include barium, beryllium, cadmium,

chromium, copper, lead, nickel, and silver. Metals or analytes which were detected at OU6, for which there are no state standards include antimony, calcium, cobalt, lithium, magnesium, molybdenum, potassium, sodium, strontium, tin, and vanadium.

Brief summaries of AWQC toxicity information (U.S. EPA 1986b, 1987c, 1988f) and other available toxicological literature on the metals and analytes of likely concern at OU6 are presented in the following text. Similar toxicity profiles will be evaluated against site-specific concentrations data in the selection of contaminants of concern and key receptor species by the Risk Assessment Technical Working Group.

In addition to metals, adverse effects to biota from nutrient loading of organic nitrogen and phosphate species, as well as ammonia, will be evaluated. The occurrence of metals and analytes at elevated levels in surface water does not necessarily imply that they are available for assimilation in all organisms or that they transfer to successive trophic levels. The potential for adverse effects to occur is dependent of a number of physicochemical factors including: (1) physiological and ecological characteristics of the organism; (2) forms of dissolved trace metals; (3) forms of trace metals in ingested solids; and (4) chemical and physical characteristics of water (Jenne and Luoma 1977). Each of these factors will be considered in the evaluation of potential adverse environmental effects at OU6.

Aluminum

The toxicity of aluminum to freshwater aquatic organisms appears to be due primarily to the simple hydroxide forms of aluminum and is dependent upon the pH. Acute toxicity values for aluminum are available for several freshwater animal species; these values range from 1,900 μg/l for a cladoceran to 79,900 μg/l for a midge (*Dipterai spp.*). The range of concentrations of aluminum that are acutely toxic to freshwater invertebrates is about the same as the range of concentrations that are toxic to fish. These species include a wide variety of animals that perform a wide spectrum of ecological functions.

The chronic values for aluminum have been determined with three freshwater species. Chronic tests using *Ceriodaphnia dubia* showed reduced survival and reproduction at concentrations of 2,600 μg/l. Tests using *Daphnia magna* showed reduced survival at concentrations of 1,020 μg/l. Tests using fathead minnows showed reduced weight by 11.4% at concentrations of 4,700 μg/l and by 7.1% at concentrations of 2,300 μg/l. However, survival at both concentrations was as good or better than in the control treatment. These chronic tests indicate that, of the three species tested, the invertebrates are more sensitive to aluminum than the vertebrates. Other data have shown that concentrations of 169 μg/l cause a 24% reduction in the weight of young brook trout (*Salvelinus fontinalis*), and concentrations of 88 μg/l cause a 4% reduction in weight. In a 7-day test, concentrations of 174.4 μg/l killed 58% of the exposed striped bass (*Micropterus spp.*). Bioconcentration factors for aluminum range from 50 to 231.

Cadmium

Freshwater acute toxicity values for cadmium are available for species in 44 genera and range from 1.0 μg/l for rainbow trout (*Salmo gairdnesi*) to 28,000 μg/l for a mayfly (*Ephemeroptera spp.*). The antagonistic effect of hardness on acute toxicity has been demonstrated with five species. Chronic tests have been conducted on 12 freshwater fish species and 4 invertebrate species; chronic values range from 0.15 μg/l for *Daphnia magna* to 156 μg/l for the Atlantic salmon (*Salmo salar*). Freshwater aquatic plants are affected by cadmium at concentrations ranging from 2 to 7,400 μg/l. These values are in the same range as the acute toxicity values for fish and invertebrate species, and are considerably above the chronic values. Bioconcentration factors (BCFs) for cadmium in fresh water range from 164 to 4,190 for invertebrates and from 3 to 2,213 for fishes.

Chromium(VI)

The toxicity of chromium is largely due to its oxidizing action in its hexavalent state (as chromic oxide, chromate, or dichromate) and its easy permeation of biologic membranes (NRC 1974). Acute toxicity values for chromium(VI) are available for freshwater animal species in 27 genera; these values range from 23.07 μg/l for a cladoceran to 1,870,000 μg/l for a stonefly (*Acroneuria spp.*). These species include a wide variety of animals that perform a wide spectrum of ecological functions. Daphnids are especially sensitive. The few data that are available indicate that the acute toxicity of chromium(VI) decreases as hardness and pH increase.

The chronic value for both rainbow trout and brook trout is 264.6 μg/l; while the chronic value for fathead minnow is 1,987 μg/l. Chronic tests using chinook salmon (*Oncorhynchus tshawytscha*) show a reduction in growth at low concentrations of 16 μg/l. Chronic values in soft water for daphnids range from <2.5 to 40 μg/l and acute-chronic ratios range from 1.130 to >9.680. Green algae are quite sensitive to chromium(VI). The bioconcentration factor (BCF) for rainbow trout is less than 3.

Copper

The toxicity of copper to aquatic organisms is due primarily to the cupric (Cu^{2+}) ion and possibly to some of the hydroxy complexes. Concentrations of copper ranging from 1 to 8,000 μg/l inhibit growth of various aquatic plant species. Sensitivities for aquatic invertebrates and fish are similar to those for plants. Acute toxicity data are available for species in 41 genera of freshwater animals. At a hardness of 50 mg/ℓ, the genera range in sensitivity from 16.74 μg/l for squawfish (*Ptychocheilus*) to 10,240 μg/l for a stonefly. Acute toxicity generally decreases as water hardness increases. Additional data for several species indicate that toxicity also decreases with increases in alkalinity and total organic carbon. Chronic values are available for 15 freshwater fish species and range from 3.87 μg/l for brook trout to

60.36 μg/l for northern pike (*Esoxlucius*). Fish and invertebrate species seem to be equally sensitive to the chronic toxicity of copper.

Protection of animal species appears to offer adequate protection of plants. Copper does not appear to bioconcentrate very much in the edible portion of freshwater aquatic species. Many animals have some ability to cope with excess copper through excretion (Rand and Petrocelli 1985). In animals where copper is not excreted, copper will accumulate in tissues, especially in the liver.

Lead

The acute toxicity of lead to several species of freshwater animals has been shown to decrease as the hardness of water increases. At a hardness of 50 mg/l, the acute sensitivities range from 142.5 μg/l for an amphipod (*Amphipoda*) to 235,900 μg/l for a midge. Data on the chronic effects of lead on freshwater animals are available for two fish and two invertebrate species. The lowest and highest available chronic values (12.26 and 128.1 μg/l) are both for a cladoceran, but in soft and hard water respectively. Freshwater algae are affected by concentrations of lead above 500 μg/l, based on data for four species. BCFs are available for four invertebrate and two fish species and range from 42 to 1,700.

Several enzymes are sensitive to lead at very low concentrations. Lead strongly inhibits several ATPases, lipoamide dehydrogenase, and aminolevulinic acid dehydratase, which is involved in the synthesis of heme (Rand and Petrocelli 1985). In vertebrate animals, lead poisoning is characterized by neurological defects, kidney dysfunction, and anemia.

Mercury

Mercury is toxic to all forms of biota in aquatic ecosystems, although many factors (e.g., alkalinity, pH, and temperature) influence toxicity. The toxic action of mercury in plants and animals appears to involve cell membranes and their permeability. In mammals, early subacute poisoning generally has a neurological manifestation (Rand and Petrocelli 1985). Data are available on the acute toxicity of mercury(II) to 28 genera of freshwater animals. Acute values for invertebrate species range from 2.2 μg/l for *Daphnia pulex* to 2,000 μg/l for three insects. Acute values for fish range from 30 μg/l for the guppy to 1,000 μg/l for tilapia (*Mozambique tilapia*). Few data are available for various organomercury compounds and mercurous nitrate, which are 4 to 31 times more acutely toxic than mercury(II).

Available chronic data indicate that methylmercury is the most chronically toxic of the tested mercury compounds. Tests on methylmercury with *Daphnia magna* and brook trout show chronic values less than 0.07 μg/l. For mercury(II), the chronic value for *Daphnia magna* is about 1.1 μg/l and the acute-

chronic ratio is 4.5. In both a life-cycle test and an early life-stage test on mercuric chloride with the fathead minnow, the chronic value was less than 0.26 μg/l and the acute-chronic ratio was over 600.

Freshwater plants show a wide range of sensitivities to mercury, but the most sensitive plants appear to be less sensitive than the most sensitive freshwater animals to both mercury(II) and methylmercury. A BCF of 4,994 is available for mercury(II); BCFs for methylmercury range from 4,000 to 85,000.

Selenium

Although selenium can be quite toxic, it has been shown to be an essential trace nutrient for many aquatic and terrestrial species and it has been shown to ameliorate the effects of a variety of pollutants (e.g., arsenic, cadmium, copper, and mercury). Invertebrates have been shown to be both the most sensitive and the most resistant freshwater species to selenium(IV). Acute values for *Daphnia spp.* range from 6 μg/l to 3,870 μg/l for selenium(IV). Acute values in fish for selenium(IV) range from 620 μg/l for fathead minnow to 35,000 μg/l for carp (*Cyprinus carpio*). The final chronic value for selenium(IV) of 27 μg/l is based on sensitivities of rainbow trout. Based on data for three species, selenium(IV) was shown to be 5 to 32 times more toxic than selenium(VI). Although selenium(IV) appears to be more acutely and chronically toxic than selenium(VI) to most aquatic animals, this does not seem to be true for aquatic plants. Growth of several species of green algae were affected by concentrations ranging from 10 to 300 μg/l. BCFs that have been obtained for selenium (IV) with freshwater species range from 2 for the muscle of rainbow trout to 452 for the bluegill (*Lepomis macrochirus*). Highest concentrations of selenium(IV) have been found in fish viscera, due to the uptake of selenium adhering to food.

Zinc

The levels of dietary zinc at which toxic effects are evident depend markedly on the concentration ratio of zinc to copper (Rand and Petrocelli 1985). Zinc is also a metabolic antagonist of cadmium, so that high zinc intakes in animals afford some protection against cadmium exposure. Acute toxicity values are available for 43 species of freshwater animals. Data indicate that acute toxicity generally decreases as hardness increases. When adjusted to a hardness of 50 mg/l, sensitivities range from 50.70 μg/l for *Ceriodaphnia reticulate* to 88,960 μg/l for a damselfly. Additional data indicate that toxicity increases as temperature increases. Chronic toxicity data are available for nine freshwater species. Chronic values for two invertebrates range from 46.73 μg/l for *Daphnia magna* to >5,243 μg/l for the caddisfly (*Clistoronia magnificia*). Chronic values for seven fish species range from 36.41 μg/l for flagfish (*Jordanella floridae*) to 854.7 μg/l for the brook trout. The sensitivity range of freshwater plants is greater than that for animals. Growth of the alga, *Selenastrum capriocornutum,* is inhibited by 30 μg/l; however, 4-day EC50s for several other species of green algae, exceed 200,000 μg/l. Zinc bioaccumulates in freshwater animal tissues at 51 to 1,130 times the water concentration.

9.1.2.2 Radionuclides

Basic ecological research on radionuclides in the environment has a 40-year history resulting in sophisticated models for identification and prediction of the movement and concentration of specific radionuclides. The same is true for effects resulting from exposure to both external and internal sources of radiation. Most of the scientific literature concerning radioecology has resulted from interaction between DOE operated facilities and nearby universities.

The following discussion is a brief summary of the radionuclide data and literature reviewed. In general, transuranics tend to bind in the soils and sediments and have limited availability to biota. Bioaccumulation or concentration factors routinely are low between trophic levels. Data from Little et al. (1980) from the Rocky Flats Plant site indicate that radionuclide inventories (and thus radiation doses) in vertebrate populations are well below levels know to elicit effects.

Elevated levels of some radionuclides were found in surface water and sediments at various locations in OU6 (see Appendixes A and B). Maximum surface water values for gross alpha and gross beta exceed both state and federal surface water standards at a number of surface water sampling locations. Maximum particle values exceed state stream segment standards for gross alpha (11 pCi/l) and gross beta (19 pCi/l) at 19 and 18 out of 35 sampling locations, respectively. The highest values detected for gross alpha (particle, 1400 pCi/l) and gross beta (particle, 2500 pCi/l) were found at SW90, which is within the perimeter security zone.

Maximum values for americium 241, plutonium 239, and uranium (total) also exceed state stream segment standards at a number of locations. Both americium 241 and plutonium 239 values exceed the stream segment standards at 15 of 35 sampling locations. The highest values for both americium 241 (2.2 pCi/l) and plutonium 239 (10 pCi/l) were found at SW95, which is approximately 600 feet north-northeast of the solar ponds, outside the perimeter security zone. Elevated levels of both these radionuclides were also found in several of the A- and B-series ponds.

Maximum values for total uranium exceed the state stream segment standard (10 pCi/l) at 11 of 35 sampling locations. The highest value (1023 pCi/l) was detected at SW90. Even though the reported radionuclide levels in surface water and sediment exceed state or federal standards at a number of locations, it is not known whether sufficient sensitive methods exist to distinguish injury to biota due to radionuclides from background "noise" (chance fluctuations due to climate, weather, human disturbance, etc. or injury from other contaminants) at the Rocky Flats Plant Site. The following sections provide a summary of general information regarding the effects of radionuclide contamination on terrestrial and aquatic ecosystems.

Terrestrial Ecosystems

Historically, the principal reason for determining BCFs for terrestrial biota was to calculate the internal radiation dose to higher trophic levels at an equilibrium body burden from radionuclides assimilated from foodstuffs. For the most part, BCFs for mammals have been collected from fallout studies under widely varied habitat conditions (arctic, desert, temperature zone, and laboratory) and, consequently, there are few consistent generalizations. Concentration factors for ^{137}cesium typically show an increase from plant to mammalian herbivores as well as increases at the higher trophic levels. Ninefold increases in ^{137}cesium through the plant → mule deer (*Odocoileus hemionus*) → cougar (*Felis concolor*) food-chain were demonstrated in the work done by Pendleton et al. (1965). Also an increase of approximately 2 to 5 fold at each link in the lichen → caribou (*Rangifer spp.*) → wolf (*Canis lupis*) food-chain has been reported by Hanson et al. (1967).

Less comprehensive data are available for the other radionuclides, but it is evident that not all radionuclides are concentrated in food-chains and that different food-chains may exhibit markedly different concentration patterns for the same nuclide. ^{90}Strontium accumulation for the plant → herbivore chain ranges from 0.02 to 8.4; while the BCF's for tritium, ^{60}cobalt and ^{131}iodine are less than 1.0 with the exception of 2.4 for seed → water → quail for ^{60}cobalt movement (Auerbach 1973).

There have been few field studies on the comparative uptake of actinides (transuranics) by biota from contaminated soils. Uranium, thorium, and plutonium transfer in terrestrial food-chains has not been well studied because of the difficulty and expense of analyzing these elements at low levels in biota and the frequent high degree of variation in field data that complicates statistical comparisons between different actinides. Field studies that have been conducted on soil-plant-animal transfer suggest that bioaccumulation of these elements does not occur. Hakonson (1975) indicates that at the Trinity Site, residual plutonium levels in soils, plants, and animals were approximately 10 times lower in small rodents than in the corresponding grass samples. This same trend has been noted in other studies as well (Garten and Daklman 1978, Garten et al. 1981). Bly and Whicker (1978) found that the mean ratio of ^{239}plutonium in arthropods to ^{239}plutonium in 0 to 3 cm soil at Rocky Flats Plant was 9×10^{-3}.

Little et al. (1980) conducted a comprehensive study in the grassland ecosystem around Rocky Flats. The overall conclusions mirror the previously mentioned works in that plutonium was not accumulated up through the food-chain. Additionally, the body burdens of biota were significantly lower than required to elicit a biological or ecological effect.

Most studies of radiosensitivities of soil fungal populations have been performed in the laboratory. Studies on the effects of irradiation of natural populations in the field have been rare and have suffered from inadequate controls (Stotsky and Mortenson 1959; Stanovick, Giddens, and McCreery 1961).

A study by Edwards (1969), revealed distinct differences in radiosensitivities of various microarthropod groups, but all were killed at levels much lower than those lethal to microflora. Orbatid mites, the most radiation-resistant microarthropods, were killed by 200 kilorads. Auerbach et al. (1957) found that with lower radiation doses, a lag effect exists in growth rates in certain microarthropods, such as *Collembola*. Cawse (1969) noted that bacteria are the most tolerant to radiation up to about 2.5 megarads. Fungi are resistant up to about 1 megarad (Johnson and Osborne 1964).

Fraley and Whicker (1973) found native shortgrass plains vegetation to be very resistant to chronic gamma radiation at exposure rates varying from 0.01 to 650 rads/hr. One of the most resistant species was *Lepidium densiflorum* which became dominant at exposure rates of 12 to 28 rads/hr and was able to germinate, develop, and complete seed set at exposure rates greater than 28 rads/hr. The level of radiation exposure in their study is many orders of magnitude greater than any encountered in the environment around Rocky Flats.

A long-term project was initiated in 1968 at Oak Ridge National Laboratory (Styron et al. 1975) to assess effects of mixed beta and gamma radiation from simulated fallout on a grassland ecosystem. Extensive statistical analyses of data on numbers of individuals collected for each of 76 arthropod and 2 molluscan taxa have identified no lasting significant changes in similarity or species diversity of experimental versus control communities as the result of the long-term irradiation at low doses rates. Natural fluctuations in community dynamics obscured any possible radiation effects.

Mammal species and populations exhibit a similar resistance to chronic low-level exposures and even acute exposures required in excess of 100 rads to elicit reproductive, hemopoietic, or survivorship responses (Kitchings 1978).

Aquatic Ecosystems

Aquatic food-chain dynamics are similar to those previously described for terrestrial ones. On the whole, the actinides have no known biological function and do not show an affinity for muscle in higher trophic level organisms (Poston and Klopfer 1988). In a study conducted at the Savannah River Plant by Whicker et al. (1990), aquatic macrophytes were found to have the highest concentration ratio, primarily, the authors suggest, due to adsorption of sediment particulates to surfaces. All other trophic levels were found to have very low concentration ratios. In nearly all cases, concentrations of transuranics in vertebrate tissues were very low. One would expect very low concentrations of transuranics in vertebrate tissues because of the low concentrations in water, sediments, macrophytes, and invertebrates, and because of the generally low food-chain transfer factors of most transuranics (Bair and Thompson 1974, Eyman and Trabalka 1980).

Only 5 to 10 percent of the plutonium and americium in sediments in a process waste pond on the Hanford Reservation were found to be available for foodweb transfer (Emery et al. 1975). The remaining fraction appeared to be tightly bound to particles and would be transported ecologically in particulate form. Watercress (*Barbarea orthoceras*) had a plutonium concentration about equal to the sediments while dragonfly larvae and snails (*Mollusca spp.*) had americium levels approximating the sediments. All remaining biota had plutonium and americium concentrations which were generally well below those of the sediments. Goldfish (*Carassius auratus*) in the pond concentrated small amounts of both isotopes.

With respect to the distribution of several long-lived radionuclides within aquatic ecosystems, the work of Whicker et al. (1990) tends to confirm and strengthen the concept that many radionuclides tend to reside entirely in the sediments. It appears that this is true for ^{137}cesium and the transuranium elements. The rule also seems to hold for different types of systems with widely varying limnological properties. As a consequence, only a very small fraction of the total system inventory can reside in the biotic components. For radionuclides that tend to sorb strongly to sediments, this distribution can probably be extended to most freshwater ecosystems.

9.1.2.3 Organic Compounds

Most of the organic compounds detected in OU6 surface water and sediments (Appendixes A and B) are on the RCRA Appendix VIII and IX Lists, the Superfund Target Compound List, and the EPA Clean Water Act Priority Pollutants Compounds List. Each is known to cause adverse acute and chronic effects on aquatic life depending on concentration. Values for a number of pesticides and organic compounds detected in surface water at OU6 exceed the potential chemical-specific ARARs/TBCs reported in Table 3-1, 3-2 and 3-3 (see Tables 9-1 and 9-2). Most of the reported maximum values for pesticides (see Appendix B), however, have the qualifiers "u" or "uj" [see footnote (11) in Table 9-1] and are therefore non-detections. Only four pesticide/PCB values were reported without qualifiers and thus could be meaningfully compared to state and federal standards. These pesticides are aldrin, hexachlorocyclohexane (beta), simazine, and atrazine. Maximum values for each of these compounds exceed various state standards. Maximum values for aldrin and hexachlorocyclohexane also exceed various federal standards; there are no federal standards for atrazine and simazine.

Of the 48 maximum values for semi-volatile and volatile organic compounds reported in Appendix B, 10 compounds were reported without qualifiers at values exceeding state standards. These chemicals include phenol, n-nitrosodiphenylamine, vinyl chloride, 1,1,2,2-tetrachloroethane, carbon tetrachloride, chloroform, tetrachloroethane, and trichloroethene. Maximum values for n-nitrosodiphenylamine, vinyl chloride, 1,1,2,2-tetrachloroethane, carbon tetrachloride, tetrachloroethane, and trichloroethene also exceed various federal standards. Of the 27 semi-volatile or volatile chemicals detected (without qualifiers) at OU6, 12 have no state and 11 have no federal standards. Such chemicals will be evaluated

further for their potential to cause adverse effects in aquatic or terrestrial ecosystems as part of the Environmental Evaluation Task 4 Toxicity Assessment.

While there is no history of their disposal, detection of pesticides such as aldrin, PCBs, or dioxins in the Phase I analytical program for abiotic media will warrant close consideration due to the high biomagnification potential of these contaminants. Locations of elevated levels of organic chemicals detected in groundwater may also warrant further evaluation due to the potential interaction with surface water and subsequent potential for exposure to receptor organisms.

9.1.3 Protected Wildlife, Vegetation and Habitats

9.1.3.1 Wildlife

The U.S. Fish & Wildlife Service has identified several listed endangered or threatened wildlife species which could possibly occur in the Rocky Flats Plant area. However, none is expected to occur because of lack of habitat. These species include the endangered bald eagle *(Haliaeetus leucocephalus),* the two threatened subspecies of peregrine falcon *(Falco peregrinus tundris* and *F. p. anatum*), the endangered whooping crane *(Grus americana)* and the endangered black-footed ferret *(Mustela nigripes).*

The bald eagle is primarily a winter resident around rivers and lakes, and the closest known nesting pairs are found at Barr Lake, 25 miles to the east of Rocky Flats. Although the Rocky Flats Plant Site lacks suitable bald eagle nesting habitat, bald eagles have been observed over the plant site, and one pair has been observed feeding regularly at Great Western Reservoir, located approximately 0.4 miles east of the site.

The whooping crane passes through Colorado during its spring and fall migrations. Whooping cranes blown off their migration course could use the Rocky Flats area as a night roost. These birds prefer large marshes and wetlands in broad open river bottoms and prairies. Such habitat is not present at Rocky Flats.

The two subspecies of peregrine falcon may occasionally occur in the Rocky Flats area as they hunt for prey. Nesting preferences are high cliff sides and river gorges, both of which are absent at Rocky Flats. However, nesting sites have been recorded to the west about 4 to 5 miles from the site.

The historical geographic range of the black-footed ferret coincides with that of prairie dogs, a principal prey species. Although black-footed ferret populations are thought by many to be extinct in the wild, large prairie dog towns sufficient to support a black-footed ferret population (>80 acres for black-tailed

prairie dogs) if found at Rocky Flats would be surveyed by approved methods (U.S. Fish and Wildlife 1986).

Several additional species are of special interest to the State of Colorado because they are endangered in the state, are game species, have small and/or declining populations, or are pest/nuisance species (Colorado Division of Wildlife 1981, 1982a, 1982b, and 1985). These species will be identified and investigated during Task 2 and will be considered in the development of on-site food webs.

9.1.3.2 Vegetation

Thirteen federally-listed or proposed plant species occur in Colorado, most of which are western slope species. One proposed endangered species, Ute ladies-tresses (*Spiranthes diluvialis*) is known to occur near Golden and Boulder and could potentially occur at Rocky Flats, although it has not been found in previous botanical inventories. A number of candidate species for federal listing are known to occur in Jefferson and Boulder Counties, but have not been identified at Rocky Flats.

9.1.3.3 Wetlands

Numerous regulations and acts have been promulgated to protect water-related resources, including wetlands. Wetlands play an important role in ecosystem processing and in providing habitat to a variety of plant and animal species. An assessment of Rocky Flats wetlands was completed in 1989 (EG&G 1990h). Wetlands occur along North and South Walnut Creek, the Unnamed Tributary, and around the A- and B-series Ponds. DOE activities with a potential to impact wetlands will follow regulations designed for their protection. Should filling of any wetlands occur, the U.S. Army Corps of Engineers would have jurisdiction.

9.2 ENVIRONMENTAL EVALUATION TASKS

An environmental evaluation at OU6 is necessary for Rocky Flats Plant to meet the requirements of Sections 121(b)(1) and (d) of CERCLA and Section 300.430(d) of the NCP (55 FR 8666, 3/8/90). An environmental evaluation, in conjunction with the human health risk assessment, is required to ensure that remedial actions are protective of human health and the environment. Guidelines for conducting this evaluation, which is also called an ecological assessment, are provided by EPA in Risk Assessment Guidance for Superfund, Volume II, Environmental Evaluation Manual (U.S. EPA 1989e). Additional guidance is derived from EPA's Ecological Assessments of Hazardous Waste Sites: A Field and Laboratory Reference Document (U.S. EPA 1989d) and other guidance documents (Table 9-3).

TABLE 9-3

EXAMPLES OF EPA AND DOE GUIDANCE DOCUMENTS AND REFERENCES FOR CONDUCTING ENVIRONMENTAL EVALUATIONS

Barnthouse, L.W., G.W. Suter, S.M. Bartell, J.J. Beauchamp, R.H. Gardener, E. Linder, R.V. O'Neill and A.E. Rosen. 1986. User's Manual for Ecological Risk Assessment. Environmental Sciences Division. Publication No. 2679, ORNL-6251.

U.S. DOE. 1988a. Comprehensive Environmental Response, Compensation, and Liability Act Requirements. DOE Order 5400.YY. Draft, September 1988.

U.S. DOE. 1988b. Radiation Effluent Monitoring and Environmental Surveillance. DOE Order 5400.XY, Draft, September 1988.

U.S. DOE. 1990b. Radiation Protection of the Public and the Environment. DOE Order 5400.5

U.S. EPA. 1988a. Guidance for Conducting Remedial Investigations and Feasibility Studies under CERCLA. Interim Final. Office of Emergency and Remedial Response, Washington D.C., EPA/540/g-89/004.

U.S. EPA. 1988c. Guidance on Remedial Actions for Contaminated Groundwater at Superfund Sites. Office of Emergency and Remedial Response. Washington, D.C. EPA/540/2-88/003.

U.S. EPA. 1988e. Superfund Exposure Assessment Manual. Office of Emergency and Remedial Response. Washington, D.C. EPA/540/1-88/001.

U.S. EPA. 1989c. Exposure Factors Handbook. Office of Health and Environmental Assessment. Washington, D.C. EPA/600/8-89/043.

U.S. EPA. 1989d. Ecological Assessments of Hazardous Waste Sites: A Field and Laboratory Reference Document. Office of Research and Development. EPA/600/3-89/013.

U.S. EPA. 1989e. Risk Assessment Guidance for Superfund, Volume II, Environmental Evaluation Manual. Interim Final. Office of Emergency and Remedial Response. Washington, D.C. EPA/540/1-89/001.

U.S. EPA. 1990. Guidance for Data Useability in Risk Assessment. Office of Emergency and Remedial Response. Washington, D.C. EPA/540/G-90/008.9.2.1 Task 1: Preliminary Planning

The environmental evaluation is both a qualitative and quantitative appraisal of the actual or potential injury to biota other than humans and domesticated species due to contamination at OU6. The environmental evaluation is intended to reduce the inevitable uncertainty associated with understanding the environmental effects of contaminants present in OU6 and to give more definitive boundaries to that uncertainty during remediation.

The following plan for OU6 provides a framework for the review of existing data, the conduct of subsequent field investigations, and the preparation of the contamination assessment. Methodologies for the ecological and ecotoxicological field investigations (Tasks 3 and 9) are described in the Field Sampling Plan presented in subsection 9.3.

Several of the tasks presented in the following plan will require coordination between the various OUs. In order to assure an integrated effort and to provide a means for obtaining input from regulatory agencies throughout the preliminary planning and implementation tasks, a Risk Assessment Technical Working Group has been established. As participants in this group, representatives from EG&G, DOE, and each of the regulatory review agencies will be involved in activities such as the determination of selection criteria for contaminants of concern, key receptor species, and reference areas, and decisions regarding the use of existing data.

9.2.1 Task 1: Preliminary Planning

This task includes a definition of the study area, a determination of the scope of the environmental evaluation, identification of DQOs, and development of a plan for obtaining consensus on selection criteria for contaminants of concern, key receptor species, reference areas, and the field sampling approach/design. The scope of the environmental evaluation will describe the kind and amount of information that will be collected in the study. The biological parameters that are to be measured, estimated, and calculated will be described. The time period and boundaries of the evaluation will be designated. Depending on the available pathways for exposure and the habitats potentially exposed to contamination, the study area for this ecological assessment may extend beyond the boundaries of each IHSS and Walnut Creek.

9.2.1.1 Selection Criteria for Contaminants of Concern

Because not all chemicals found at OU6 will have adverse effects on biota, the list of chemicals to be evaluated can be narrowed. Chemical and species-specific criteria (e.g., likelihood of exposure) will be used for selecting those contaminants that are of particular concern from an ecological perspective at OU6. Chemical, physical, and toxicological criteria will be used in selecting contaminants of concern. Selection of these specific criteria will be developed in consultation with EPA and the State. Examples of the potential criteria to be evaluated in selecting contaminants of concern are shown in Table 9-4.

TABLE 9-4

POTENTIAL SELECTION CRITERIA FOR CONTAMINANTS OF CONCERN

Concentrations detected on site
Frequency of detection
Historical disposal information
- Type
- Quantity

Mobility in environmental media
Chemical fate (transport)
- Adsorption coefficient
- Partition coefficient (water-octanol)
- Water solubility
- Vapor pressure

Persistence
- Biodegradation
- Chemical degradation

Bioaccumulation potential
Bioavailability
Biotransformation potential
Background concentrations
Biochemistry
- Essential nutrient
- Enzyme inhibitor

Toxicity
Treatability

Although the selection process for contaminants of concern parallels that for the Human Health Risk Assessment, the lists may differ somewhat based on contaminant fate and transport characteristics and species-specific toxicities. The process for selecting contaminants of concern is currently being developed by the Risk Assessment Technical Working Group. Selection of the contaminants of concern will be evaluated in accordance with EPA guidance (U.S. EPA 1989e). An appropriate scoring system may be used to quantify the selection as much as possible. The selection process for these criteria will take into account the limited data that are available to quantify some of these factors (e.g., concentrations detected on site; frequency of detection). In these cases, a weighing factor may be used to assign such criteria a low reliance. The screening values for each of the criteria will be used as tools to help select chemicals that need further assessment. They will not be used as limits which indicate absolute "no adverse effects" levels. Actual site-specific conditions will determine the potential for adverse effects in receptor species at OU6.

9.2.1.2 Identification of Key Receptors

Key receptors are those species or taxon which are or may be sensitive to the particular contaminants of concern. Organisms at each trophic level within a food web differ in their sensitivity and the ways they take in, accumulate, metabolize, distribute, and expel contaminants. The susceptibility of a particular organism also varies with the mechanism through which contaminants are taken up from the environment. In general, the following criteria determine the susceptibility of the receptor to a particular contaminant (U.S. EPA 1989e):

- The rapidity with which the contaminant is absorbed from the environment
- Sensitivity of the receptor's tissues to the dosage incurred
- Relationship between tissue sensitivity and the expression of symptoms of toxic injury
- The rapidity of repair or accommodation to the toxic injury

Selection of key receptors will depend on the ability to detect toxic injury in the organism or subsequent adverse effects to the population. National standards on the definitions of injury to biological receptors are found in the Natural Resource Damage Assessment Rule [43 CFR Subtitle A Section 11.62 (f)]. These include death, disease, behavioral abnormalities, cancer, physiological malfunctions, and physical deformation. Additional methods for detecting injury to biological resources are provided in the Type B Technical Information Document: Injury to Fish and Wildlife Species (U.S. DOI 1987). The procedures described in these documents provide a framework for determining what categories of effects might be

observed in the field during the site visit and subsequent surveys and for selecting appropriate study methods to establish relationships between contaminant distribution and concentration in the physical environment and biological consequences in the receptor species and populations (Reagan and Fordham 1991). By using this approach to focus efforts on examining specific effects in key receptor species, costs and sampling efforts will be reduced.

The selection of key receptor species is in part a subjective decision based on species dominance or judged importance in the food chain. Selection criteria for key receptors will include consideration of the following:

- Sensitivity to contaminants
- Listing as rare, threatened, or endangered by a governmental organization
- Game species
- A key component of ecosystem structure and function (e.g., abundant prey for other important species)

Additional criteria used in the selection of key receptors include habitat preferences, food preferences and other behavioral characteristics which can determine population size and distribution in an area or significantly affect the potential for exposure. Key receptors may include game species such as mule deer which is mobile and has a large home range; or an organism that is sedentary or has a more restricted movement, such as plants, some invertebrates, and some small vertebrates. For contaminants that bioaccumulate, the effects are usually most severe for organisms at the top of the food chain (e.g., top predators). Examination of contaminant effects on these more mobile species may necessitate the integration of data from different OUs.

A checklist of OU6 biota will be developed in conjunction with the ecological field inventory. The initial list of key receptors will be chosen from the checklist based on the selection criteria and will include organisms from each trophic level. The documented selection analysis will include an evaluation of the receptor's relation to potential contaminant exposure through both direct contaminant accumulation from the abiotic environment and bioaccumulation through the food chain. Examples of key receptors species (or taxon) likely to be on this list are presented in Table 9-5. This list will be refined as information is evaluated on known contaminant effects on these species (or similar species) and the documented levels of contamination present at the site.

TABLE 9-5

POTENTIAL KEY BIOLOGICAL RECEPTORS FOR ASSESSMENT OF ECOLOGICAL IMPACTS AT OU6

Community	Taxon
Periphyton	Green algae Blue-green algae
Benthic Macroinvertebrates	Mayflies (larvae) Caddis flies (larvae) Chironomids (larvae) Crayfish
Fish	Fathead minnow Bluegill
Reptiles	Garter snake Bull snake Rattlesnake
Mammals	Deer mouse Northern pocket gopher Microtines Rabbit Coyote
Birds	Mourning dove Mallard Killdeer Red-winged blackbird Ring-necked pheasant Cormorant Blue heron Great-horned owl
Terrestrial Invertebrates	Earthworms Grasshoppers
Grasses	Western wheatgrass Blue grama Cheatgrass
Shrubs/Forbs	Snowberry Willows Bindweed Sunflower Cattails Pondweed
Microbial Populations	Entire population

Key receptors will be selected from this list for subsequent detailed food web analyses, and possible tissue sampling or other ecotoxicological analyses. Selection of key receptor species for tissue analyses will depend on the receptor's suitability for sampling, sample size requirements, results of the preliminary exposure assessment, and expectation for finding contaminants in the tissues sampled (see subsections 9.2.9 and 9.2.10). Final selection of contaminants of concern and key receptors will provide the basis for the contamination assessment (Tasks 4 through 7). In the contamination assessment, food webs and contaminant exposure pathways will be developed for OU6. Information on these food webs will be used to relate quantitative data on contaminants in the abiotic environment to adverse effects in biota and to evaluate potential impacts to biota due to contaminant exposure.

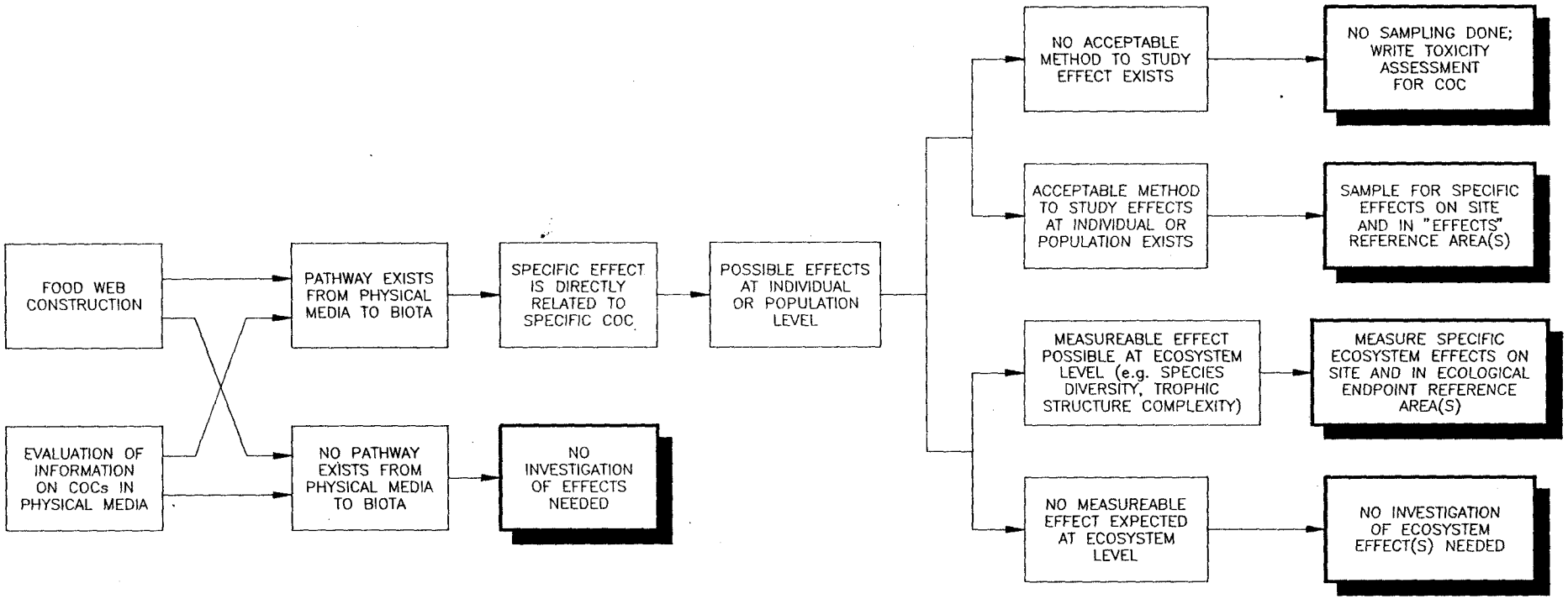
9.2.1.3. Reference Areas

Determination of criteria for selection and sampling of reference areas will be coordinated between OUs and will be addressed by the Risk Assessment Technical Working Group. Reference areas will be identified as needed for terrestrial, wetland, and aquatic species and will be selected based on measurement endpoints. Reference areas are likely to be selected in the northwestern portion of Rocky Flats Plant, away from potential effects associated with release from either Rocky Flats or OU6. Additional off-site areas may also be selected, as appropriate.

Reference areas need not be selected where current and historical data are available to assess impacts from OU6 contaminants. Where such data are not available, one or more reference areas may be selected based upon their similarity to OU6, their lack of exposure to contamination from Rocky Flats or other sources, and the selected measurement endpoint. If more than one habitat or ecosystem type (e.g., terrestrial and aquatic) is to be assessed at OU6, comparable reference areas may be established for each, or a reference area may be selected containing those habitats or ecosystem types in a comparable distribution. For OU6, at least one reference area may be located upstream of the assessment area unless conditions indicate the area is unsuitable as a reference area. Data collected at the reference area will be compared where possible to values reported in the scientific literature to demonstrate that the data represent a normal range of conditions. Methods used to collect data at the reference area will be comparable to those used at OU6.

The decision process for using reference areas in the investigation of adverse effects from contamination at Rocky Flats is presented in Figure 9-2. As shown in this figure, a number of activities will take place prior to the selection of reference areas. These activities include the determination that:

- A pathway (inhalation, ingestion, etc.) exists for the movement of a contaminant of concern from the physical abiota media to biota.



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

OPERABLE UNIT 6
PHASE I RFI/RI WORK PLAN

DECISION PROCESS FOR THE INVESTIGATION OF INDIVIDUAL, POPULATION, AND ECOSYSTEM LEVEL EFFECTS AND FOR THE USE OF REFERENCE AREAS FOR COC EFFECTS

FIGURE 9-2 SEPTEMBER 1991

2506E003

- Acceptable methods are available to study the resultant effects of contamination at the individual, population, or ecosystem level (e.g., species diversity, trophic structure complexity).

Selection of a reference area(s) will ultimately depend on the specific effect or ecological endpoint that is to be measured. More than one reference area may be used depending on the effects to be studied.

The selection of reference areas would be made to meet DQOs (U.S. EPA 1989e) and the selected assessment and measurement endpoints. Two basic criteria would be employed in the selection and establishment of reference areas:

1. The reference areas will be similar to OU6 in terms of soil series, topography, aspect, vegetation, habitat types, and plant and animal assemblages.

2. The reference areas, including vegetation and wildlife, have not been impacted by releases from OU6 or other Rocky Flats Plant OUs.

9.2.1.4 Data Quality Objectives

The DQO development process will follow the three steps recommended by EPA (1989d). Step I of the DQO process involves preparing definitions and concise DQOs. Examples of Step I program DQOs for this environmental evaluation include the following:

- Identify appropriate site-specific receptor species, contaminants of concern, and exposure pathways to determine if there is a potential for adverse effects to occur as a result of contamination. This step includes determination of relevant contaminant concentrations in biological tissues.

- Evaluate the potential for impacts to occur to biological resources outside the boundaries of OU6 or the Rocky Flats Plant.

- Evaluate the need for remediation to protect the environment.

Steps II and III of the DQO process include identification of data uses and needs and design of the data collection program. Products of Step II include proposed statements of the type and quality of environmental data required to support the DQOs, along with other technical constraints on the data collection program. The objective of Step III is to develop data collection plans that will meet the criteria and constraints established in Steps I and II. Step III results in the specification of methods by which data of acceptable quality and quantity will be obtained. The DQO development process will continue

as scoping of the environmental evaluation becomes more refined. Additional Step I decision-type DQOs may be needed or data collection-type DQOs may be modified based on Task 1 and Task 2 results and subsequent refinement of the field sampling plan.

9.2.1.5 Field Sampling Approach/Design

The Field Sampling Plan presented in subsection 9.3 is designed to be flexible so that it can be revised as additional data are collected. Flexibility in the Field Sampling Plan will ensure that field data collection activities will be comparable to and compatible with previous data collection activities performed at the site while providing a mechanism for planning and approving new field activities. The Field Sampling Plan, in conjunction with the SOPs for Ecology (EG&G 1991g, Volume V), will provide guidance for all field work by defining the sampling and data-gathering methods to be used on the project.

9.2.2 Task 2: Data Collection/Evaluation and Conceptual Model Development

As an integral part of the RFI/RI process, Task 2 of the environmental evaluation will focus on accumulating and analyzing pertinent information on three major areas:

- Species, populations, and food web interrelationships
- Types, distribution, and concentrations of contaminants in the abiotic environment (e.g., soil, surface water, groundwater, and air)
- Preliminary determination of potential exposure pathways and potential contaminant effects on OU6 biota based on literature review

The principal subtasks in Task 2 include Literature Review and Site Characterization. These subtasks will be performed in conjunction with the Task 3, Ecological Field Investigation. Information that will be developed from these tasks includes the following:

- Chemical inventory/Contaminants of Concern - Existing information including that obtained on chemical contaminants from other investigations at Rocky Flats and other DOE facilities will be used in the development of a preliminary list of contaminants of concern.
- Initial toxicity test data - Preliminary data on the toxicity of potentially complex chemical mixtures in OU6 surface waters.

- Descriptive field surveys - Inventory of OU6 biota and locations of obvious zones of chemical contamination, ecological effects, and human disturbance.

- Species inventory - Plant and animal species known to occur within OU6 or to potentially contact contaminants at OU6 and their trophic relationships.

- Population characteristics - General information on the abundance of key species (see SOPs).

- Food habit studies - Available information from literature sources to supplement field observations and possible gut content analysis on key species.

9.2.2.1 Literature Review

As an essential part of Task 2, a review of available documents, aerial photographs, and data relevant to the site will be completed. This will allow compilation of a database from which to determine data gaps and to provide evidence for a defensible field sampling program. Prior studies by DOE and the Rocky Flats Plant operating contractors will be reviewed and evaluated. Information to be reviewed will include the following:

- Project files maintained by Rockwell International and EG&G

- Project reports and documents on file at Front Range Community College Library, at the Colorado Department of Health, and at the Colorado Division of Wildlife

- DOE documents and DOE orders

- The Phase I database

- The Rocky Flats EIS database

- Data from ongoing environmental monitoring and National Pollution Discharge Elimination System (NPDES) programs

- Studies conducted at Rocky Flats on radionuclide uptake, retention, and effects on plant and animal populations

- Scientific literature, including ecological and risk assessment reports, from other DOE facilities (Oak Ridge National Laboratory, Los Alamos, Hanford, Savannah River, Fernald)

If available and applicable, historical data will be used. Where the same methods are not used in the collection of new data, use of historical data will depend on the demonstrated comparability of the data collection methods. Where possible, analytical files will be made available in an electronic file format.

9.2.2.2 Site Characterization

Environmental resources at the site will be characterized based on reviews of existing literature and reports, including results from the Phase I RFI/RI investigation, other OU RFI/RI investigations, and the Task 3 ecological field investigation. The description of the site will be presented in terms of the following distinct resource areas:

- Meteorology/air quality
- Soils
- Sediments
- Geology
- Surface and groundwater hydrology
- Terrestrial ecology
- Aquatic ecology
- Protected/important species and habitats

The purpose of the site characterization is to describe resource conditions as they exist without remediation. The narrative with supporting data will include descriptions of each resource, with attendant tables and figures, as appropriate, to depict, in a concise and clear fashion, site conditions, particularly as they influence contaminant fate and transport.

Included in this task is the development of a community food web model (Reagan and Fordham 1991) to describe the feeding relationships of organisms at Rocky Flats Plant. Food web construction begins with gathering information to evaluate the food habits of species or species groups (e.g., grasshoppers) found or potentially occurring on site. Standard computer searches will be augmented with searches of local university libraries to locate any regionally pertinent studies on food habits. The preliminary list of important species, compiled from background information, will be completed based on observations of presence and abundance made during the ecological site surveys and on trophic level data obtained from the food web model. Based on the model, a modified list of species will be made using toxicological information (toxicity assessment) to determine which species or species groups might be most affected or most sensitive to the chemical(s) of interest.

Data from past studies and preliminary data from current environmental studies will be used to better define the present distribution of contaminants in the abiotic environment and to develop an initial food web model. The food web model in conjunction with a preliminary pathways analysis will identify likely or presumed exposure pathways or combinations of pathways and receptor species at risk. Based on this preliminary information, the Task 3 and Task 9 field investigation sampling approach/designs may be revised.

9.2.3 Task 3: Ecological Field Investigation

The Phase I field investigation for OU6 consists of the following separate programs: (1) the air quality program which will entail emissions estimation and modeling; (2) the soils, surface water, and groundwater sampling programs, which will be conducted as part of the Phase I RFI/RI activities; and (3) the terrestrial and aquatic biota sampling program, which will be conducted as part of this environmental evaluation.

9.2.3.1 Air Quality

A site-wide air quality monitoring program is currently being conducted at Rocky Flats. Specific air monitoring is also proposed for OU6 (see subsection 7.2.9). These data can be used to model airborne deposition and transport of contaminants through the food web to potential receptors. Such modeling could be performed where data in abiotic media are inadequate. Where the inhalation pathway is considered to be significant in the case of OU6 biota, a detailed pathways analysis and assessment of potential adverse effects using these transport model data will be performed.

9.2.3.2 Soils

Few data exist on contaminants present in surficial materials at OU6. Groundwater monitoring wells have been installed at several locations within the drainages and in several IHSSs. Soil samples from various depths in these wells were analyzed. These data have not been validated, and there is some uncertainty in the unvalidated data.

The purpose of the Phase I RFI/RI sampling and analysis program is to provide data for characterizing the IHSSs and for confirming the presence or absence of contamination. The Phase I RFI/RI Work Plan proposes to collect soil samples from each of the IHSSs at OU6. Soil samples will be collected from the surface (< 2 inches deep) in the Sludge Dispersal, Old Outfall, Triangle, Spray Field, and Soil Dump areas. Surface soils samples will be analyzed for radionuclides and metals at the Sludge Dispersal, Old Outfall and Spray Field areas and for radionuclides only at the Triangle and Soil Dump areas. Soil samples will also be collected from borings at the Old Outfall, Trenches, Soil Dump and Spray Field areas and only where there are areas of anomalous radiation or high soil gas readings in the Triangle.

The list of soil analysis parameters is presented in Table 7-10 and the planned analytical program is presented in Table 7-11 In addition to these analyses, soil analyses will be conducted in the field and laboratory to confirm and clarify Soil Conservation Service descriptions and classifications. This information will be used to evaluate suitability of the soils for plant growth and to assist in the selection of suitable reference areas.

Surficial soil samples will be of prime importance for determining source contaminants for biota. This uppermost layer provides the major source of nutrients and contaminant uptake for the vegetation under study and is also a source of potential contaminant ingestion to wildlife. Soil samples from all depths are related to surface water and groundwater regimes. Fluids moving through the soils can leach contaminants, transport them through available flow paths, and deposit them in downgradient environments. Contamination in soil and groundwater at a depth of greater than 20 feet (maximum depth of burrowing animals and plant root penetration) will not be considered to affect biota.

The sampling and analysis programs under the Phase I RFI/RI field investigations have been reviewed and modified as necessary to ensure that sampling intervals, methods, and analytical programs are appropriate and meet the DQOs of the environmental evaluation. Data from nearby OU programs will also be evaluated for use in characterizing the nature and areal extent of surface soil contamination in the vicinity of OU6. This information will be used to help identify exposure pathways for the environmental assessment.

9.2.3.3 Surface Water and Sediments

Surface water and sediment samples are collected on a regular basis as part of ongoing investigations at OU6 as well as nearby OUs. These investigations will continue. This Phase I RFI/RI Work Plan proposes extensive sampling along Walnut Creek, the Unnamed Tributary, and in the A- and B-Series Ponds. Samples will be analyzed for metals, radionuclides, inorganics, and organics. Total organic carbon in soils and sediments and sediment grain size will also be determined as part of the analytical program.

Surface water sampling and analytical results presented in existing nearby OU work plans and reports will be evaluated with respect to the planned abiotic sampling programs planned in other nearby OUs to assure the data needs for the environmental evaluations at each of these OUs are addressed. Sampling locations presented in each of these work plans will be integrated. Chemical results from nearby surface sampling locations will be reviewed and incorporated into the OU6 environmental evaluation as needed.

9.2.3.4 Groundwater

Groundwater monitoring wells upgradient and downgradient of some of the IHSSs provide limited information on groundwater conditions in Walnut Creek Drainage. This Phase I RFI/RI proposes to install additional monitoring wells downgradient of the Sludge Dispersal, Trenches, Spray Field areas, and Ponds A-4 and B-5, and within the Triangle Area. The laboratory analytical results will be used to assess the presence or absence of groundwater contamination and to assess the exposure pathway, if present.

Data from other OU programs will aid in characterizing the nature and areal extent of groundwater contamination in the vicinity of the site. The hydrogeologic information and laboratory analytical results from other planned boring and well installation programs will be incorporated in this environmental evaluation where applicable. The information will be used to assist in determining the nature and extent of contamination in shallow groundwater and help identify exposure pathways for the OU6 environmental assessment.

9.2.3.5 Terrestrial and Aquatic Biota

Terrestrial and aquatic species in the Rocky Flats Plant area have been described by several researchers (Weber et al. 1974; Clark 1977; Clark et al. 1980; Quick 1964; Winsor 1975; CDOW 1981; CDOW 1982a, 1982b); most of these reports are summarized in the Final EIS (U.S. DOE 1980). In addition, terrestrial and aquatic radioecology studies conducted by Colorado State University (CSU) and DOE (Rockwell International 1986e; Paine 1980; Johnson et al. 1974; Little 1976; Hiatt 1977) along with annual monitoring programs at Rocky Flats Plant, have provided information on the plants and animals in the area and their relative distribution.

Limited field surveys will be conducted in Task 3 to characterize current biological site conditions in terms of species presence, habitat characteristics and/or community organization. The emphasis will be to describe the structure of the biological communities at OU6 in order to identify potential contaminant pathways, biotic receptors, and key species.

Initial aquatic toxicity tests using *Ceriodaphnia spp.* and fathead minnows will be conducted at OU6 under Task 3. The technical objective of the toxicity tests is to provide a screening mechanism to aid in the determination of the nature and extent of contamination, particularly since there is the potential for exposure to mixtures of contaminants. EPA recognizes the usefulness of such toxicity testing as a means for integrating the effects of all toxic pollutants, which cannot be measured by chemical analysis. Standardized EPA acute and chronic test methods will be followed in accordance with NPDES toxicity testing procedures currently being used at Rocky Flats.

Vegetation

The objectives of the vegetation sampling program are to provide data for: (1) the description of site vegetation characteristics; (2) identification of potential exposure pathways from contaminant releases to higher trophic-level receptors; (3) selection of key species for contaminant analysis to determine background conditions for OU6; and (4) identification of any protected vegetation species or habitats.

A number of habitat types are expected to be found in the Walnut Creek Drainage (Clark et al. 1980). Grasses characteristic of the short grass plains are expected to be abundant. Representative species include blue grama (*Bouteloua gracilis*), Junegrass (*Koeleria cristata*), dropseed (Sporobolus spp.), slender wheatgrass (*Agropyron trachycaulum*), and green needlegrass (*Stipa viridula*), which are interspersed with other grasses, shrubs, and a variety of annual flowering plants. Transects will be established at each of the IHSSs, along the Unnamed Tributary, and along North and South Walnut Creek to collect phytosociological data on biomass and cover, shrub/tree density and frequency, and species presence.

Wetland Vegetation

Wetlands have been identified along the Unnamed Tributary and North and South Walnut Creek (EG&G 1990h). These occur as linear wetlands that support hydrophytic vegetation species including sandbar willow (*Salix exigua*), american watercress (*Barbarea orthoceras*), and plains cottonwood (*Populus sargentii*). Other species associated with these wetlands include broad-leaf cattail (*Typha latifolia*), baltic rush (*Juncus articus*), cordgrass (*Spartina pectinata*), silver sedge (*Carex praegracilis*), and various bulrushes (*Scirpus spp.*). Transects will be established in wetland vegetation habitats at the designated aquatic sampling locations along North and South Walnut Creek, the Unnamed Tributary, and at the A- and B-Series Ponds to collect phytosociological data on biomass and cover, shrub/tree density and frequency, and species presence.

Periphyton

The periphyton community is a closely-adhering group of organisms that form mat-like communities on rocks, other solid objects, or the stream bottom. The community is composed of algae, bacteria, fungi, detritus, and other macroscopic heterotrophic organisms. Because of the large surface-to-volume ratio of its constituents, periphyton have been found to be an excellent indicator community for accumulation of contaminants. Periphyton samples will be collected at designated locations in OU6 (see subsection 9.3.2.2) along North and South Walnut Creek, the Unnamed Tributary, and in the A- and B-Series Ponds.

Periphyton communities provide a sensitive mechanism to detect changes in aquatic environments that result from the introduction of contaminants. Taxonomic composition and relative abundance of

periphyton can be measured on natural substrates as well as standardized artificial substrates. On hard artificial substrates, data on algal abundance, biomass, and species composition will be obtained by removing the substrate and by scraping or brushing the organisms from a measured area into a container.

Benthic Macroinvertebrates

Benthic macroinvertebrates may exist in rocky/gravelly substrates or as soft bottom communities along portions of the Unnamed Tributary, North and South Walnut Creek, and the A- and B-Series Ponds. The soft-bottom benthos are those macroscopic invertebrates inhabiting mud or silt substrates, whereas the immature stages of insects inhabit rock surfaces, rooted stems, and leaves or gravelly substrates. Because these communities are essentially stationary, they are good indicators of past and present habitat contamination. Additionally, their feeding methods (filtering microscopic organisms and fine materials, preying on smaller invertebrates, and grazing periphyton), suggest that benthic species are ingesting other organisms that are potentially concentrating contaminants. Designated locations in the Walnut Creek Drainage will be sampled for benthic organisms.

Fish

Fish can be important components of ecological assessments because they are relatively long-lived, occupy upper trophic levels of aquatic ecosystems, and they may spend their entire lives in relatively small areas. Fish species representing both herbivores and carnivores are likely present in OU6 aquatic habitats and may demonstrate biomagnification of contaminants within the creek or pond ecosystem. Designated aquatic sampling locations (see subsection 9.3.2.2) will be sampled for fish where the habitat is appropriate.

Terrestrial Wildlife

A field survey will be conducted to gather data on animal communities in the Walnut Creek Drainage. The objective of the animal life survey is to: (1) describe the existing animal community in Walnut Creek Drainage; (2) identify potential contaminant pathways through trophic levels; (3) develop food web models including contribution from vegetation; (4) identify key species for potential collection and tissue analysis; and (5) identify any protected species.

The field survey as presented in the Field Sampling Plan (see subsection 9.3) will document the presence of terrestrial species and allow for a general description of the community. Some species (e.g., songbirds, larger mammals, reptiles, and raptors) may use the area daily, seasonally or sporadically, or wander through as vagrants. Survey timing and techniques will consider these uses.

9.2.4 Contamination Assessment (Tasks 4 through 7)

The contamination assessment includes Tasks 4 through 7. The two major objectives of the contamination assessment are to:

- Obtain quantitative information on the types, concentrations, and distribution of contaminants in selected species, and

- Evaluate the effects of contamination in the abiotic environment on ecological systems.

Conducting a contamination assessment requires an evaluation of chemical and radiological exposures and the subsequent toxicological effects on key species. Of specific importance in the contamination assessment is the identification of exposure points, the measurement of contaminant concentrations at those points, and the determination of potential impacts or injury. Impacts may result from movement of contaminants through ecological systems or from direct exposure (inhalation, ingestion, or deposition).

The Contamination Assessment for OU6 will be based on existing environmental criteria, published toxicological literature, and existing, site-specific environmental evaluations. The program design will be integrated with other ongoing RFI/RI studies so that concentrations of contaminants in abiotic media can be related to contaminant levels and effects in biota. A preliminary contamination assessment will be made in Task 2 based on the site characterization and contaminant identification activities. The preliminary Task 2 assessment will be used to revise the Task 9 ecotoxicological field investigation sampling design. The contamination assessment process described in the following tasks will include the development of a site-specific pathways model to quantify the potential for contaminant exposure and adverse effects in biota.

The objectives and description of work for each of the contamination assessment tasks is described below.

9.2.5 Task 4: Toxicity Assessment

This assessment will include a summary of the types of adverse effects on biota associated with exposure to site-related chemicals, relationships between magnitude of exposures and adverse effects, and related uncertainties for contaminant toxicity, particularly with respect to wildlife. Ecological receptor health effects will be characterized using EPA-derived critical toxicity values when available in addition to selected literature pertaining to site- and receptor-specific parameters.

The toxicity assessment will provide brief toxicological profiles centered on health effects information on wildlife populations. The profiles will cover the major health effects information available for each contaminant of concern. Data pertaining to wildlife species will be emphasized, and information on domestic or laboratory animals will be used when wildlife data are unavailable. Adequacy of the existing database will be evaluated as part of this task.

9.2.6 Task 5: Exposure Assessment and Pathways Model

This task will identify the exposure or migration pathways of the contaminants, taking into account environmental fate and transport through both physical and biological means. Each pathway will be described in terms of the chemical(s) and media involved and the potential ecological receptors. The exposure assessment process will include the following three subtasks:

- Identify exposure pathways
- Determine exposure points and concentrations
- Estimate chemical intake for receptors

Each of these subtasks is described below.

9.2.6.1 Exposure Pathways

The purpose of this subtask is to qualitatively identify the actual or potential pathways by which various biological receptors at or near OU6 might be exposed to site-related chemicals or radionuclides. The exposure pathway analysis will address the following four elements:

- A chemical/ radionuclide source and mechanism of release to the environment
- An environmental transport medium (e.g., soil, water, air) for the released chemical/ radionuclide
- A point of potential biological contact with the contaminated medium
- A biological uptake mechanism at the point of exposure

All four elements must be present for an exposure pathway to be complete and for exposure to occur. Exposure pathways will be evaluated and modeled, where possible, using the pathways approach (Reagon and Fordham 1991; Thomann 1981).

The pathways approach uses a bioaccumulation model of contaminant transfer through a food web. The model links contamination in soil and water to contamination in biota. The pathways model approach blends standard environmental assessment methods with ecological and toxicological modeling to produce an integrated procedure to selecting indicator species and conducting an investigation of ecosystem effects resulting from contamination in soil and water. Where possible, uncertainty in the model is reduced by direct sampling (i.e., tissue analysis).

Toxicity tests, such as those proposed for Task 3, can also be used to conduct a direct effects-related investigation. Additional toxicity tests may be designed based on the pathways model results.

9.2.6.2 Determination of Exposure Points and Concentrations

The identified exposure points are those locations where key ecological receptor species may contact the contaminants of concern. Potential for exposure depends on characteristics of the contaminant, the organism, and the environment. Determination of exposure points entails an analysis of key receptor species, locations, and food habits in relation to potential contaminant exposure both through direct contaminant accumulation or deposition from the abiotic environment and through indirect bioaccumulation. The exposure assessment for OU6 will provide information on the following:

- What organisms are actually or potentially exposed to contaminants from OU6
- What the significant routes of exposure are
- What amounts of each contaminant organisms are actually or potentially exposed to
- Duration of exposure
- Frequency of exposure
- Seasonal and climatic variations in conditions which are likely to affect exposure
- Site-specific geophysical, physical, and chemical conditions affecting exposure

A determination of the nature and extent of contamination in the abiotic media (air, soils, surface water, and groundwater) is presented in this Phase I RFI/RI Work Plan for Walnut Creek Drainage. Phase I data, when available and validated, will be summarized and used to characterize source areas and release characteristics at the site. The exact exposure points can be expected to vary depending on both the contaminant and the key receptor species under consideration.

Concentrations of chemicals that are likely to have the greatest impact (based on concentration in the environment, toxicity values, and biological uptake) will be determined by actual environmental media sampling for each exposure point or by environmental fate and transport modeling. Fate, transport, and endpoint contamination levels in abiotic media may be modeled, where necessary, using environmental multi-media risk assessment models. Such models can provide the potential maximum concentrations of chemicals at the exposure points by which to evaluate the "worst-case" scenario.

9.2.6.3 Estimation of Chemical Intake by Key Receptor Species

This step includes an evaluation of key receptor species' contaminant uptake by direct routes (i.e., inhalation, ingestion, dermal contact) and indirect routes (bioconcentration, bioaccumulation, biomagnification). The amounts of chemical and radiological uptake will be estimated using appropriate conservative assumptions, site-specific analytical data on contaminant concentrations in abiotic and biotic media, and forthcoming guidance from EPA's Wildlife Exposure Factors Handbook (to be published in 1991). A pathways analysis model (Reagan and Fordham 1991; Thomann 1981) will be used to establish relationships between concentrations of a chemical in different media with concentrations known to cause adverse effects.

Direct measurement of contaminant uptake through tissue analyses will be conducted during Task 9 of the environmental evaluation. Such site-specific data and field observations will be used to reduce uncertainty in the pathways model and strengthen interpretation of the overall study.

9.2.7 Task 6: Contamination Characterization

Contamination characterization entails the integration of abiotic exposure concentrations and reasonable worst-case assumptions with the information developed during the exposure and toxicity assessments to characterize current and potential adverse biological effects (e.g., death, diminished reproductive success, reduced population levels, etc.) posed by OU6 contamination. The potential impacts from all exposure routes (inhalation, ingestion, and dermal contact) and all media (air, soil, groundwater, and surface water/ sediment) will be included in this evaluation as appropriate according to EPA guidance (U.S. EPA 1989d, 1989e).

Characterization of adverse effects on receptor species and their populations is generally more qualitative in nature than characterizing human risks. This is because the toxicological effects of most chemicals have not been well documented for most species. Criteria or toxicological benchmarks that are usable and applicable for the evaluation of ecological effects are generally limited. EPA AWQC and Maximum Allowable Tissue Concentrations (MATC) are the most readily available criteria. Criteria found in federal and Colorado state laws and regulations pertaining to the preservation and protection of natural resources can also be used. Criteria may also be derived from information developed for use under other environmental statutes, such as the Toxic Substances Control Act or the Federal Insecticide, Fungicide and Rodenticide Act. An attempt will be made to consider the adverse effects of chemicals on populations and habitats rather than on individual members of a species according to EPA guidance (U.S. EPA 1989d, 1989e). Where specific information is available in the published literature, a more quantitative evaluation of effects will be made using the site-specific pathways model. This approach is in agreement with EPA guidance (U.S. EPA 1989e).

9.2.8 Task 7: Uncertainty Analysis

The process of assessing ecological effects is one of estimation under conditions of uncertainty. Understanding the effects of environmental stresses resulting from contamination on real populations depends on complex abiotic and biotic processes that cannot be reproduced in the laboratory. To address uncertainties, the OU6 environmental evaluation will present each conclusion, along with the issues that support and fail to support the conclusion, and the uncertainty accompanying the conclusion. Factors that limit or prevent development of definitive conclusions will also be discussed. In summarizing the assessment data, the following sources of uncertainty and limitations will be specified:

- Variance estimates for all statistics
- Assumptions and the range of conditions underlying use of statistics and models
- Narrative explanations of other sources of potential error

Validation and calibration of the pathways model will also be used where practicable.

9.2.9 Task 8: Planning

Task 8 will include planning for tissue analysis studies and any additional ecotoxicological studies (e.g. reproductive success, enzyme analyses, microbial respiration) needed to assess adverse effects from the contaminants of concern on key receptors. Initial designing for the Task 9 ecotoxicological field investigations will begin after contaminants of concern and key receptors have been selected in Task 2. Species to be sampled for tissue analyses will be designated to the earliest extent possible in order to avoid a duplication of the Task 3 sampling effort.

The need for measuring additional ecotoxicological endpoints in Task 9 will be evaluated based on the pathways analyses and published information on direct toxic effects. Selection of field methodologies will be based on a review of available scientific literature providing quantitative data for the species of concern or similar test species. Analysis of population, habitat, or ecosystem changes will be based on species or habitats that represent broad components of the ecosystem or are especially sensitive to the contaminants. In order to select methodologies for the ecotoxicological field sampling program, the biological response under consideration and the proposed methodology should satisfy program DQOs as well as the following more specific criteria:

- The biological response is a well-defined, easily identifiable, and documented response to the designated contaminant(s) of concern (i.e., methodology and measurement endpoint are appropriate to the exposure pathway).

- Exposure to the contaminant is known to cause the biological response in laboratory experiments or experiments with free-ranging organisms.

- Methodology is capable of demonstrating a measurable biological response distinguishable from other environmental factors such as weather or physical site disturbance.

- The biological response can be measured using a published standardized laboratory or field testing methodology.

- The biological response measurement is practical to perform and produces scientifically valid results (e.g., sample size is large enough to have useful power and small Type II error).

Tissue studies to document site-specific contamination will be conducted in Task 9 for both aquatic and terrestrial systems. Tissue analyses will be conducted on selected species from OU6 and reference areas (if necessary) to document current levels of specific target analytes. Information from the Task 2 data evaluation and Task 3 field survey will determine the species and contaminants to be tested and the methods to be used. Selection of the target analytes, species, and tissues will depend on an initial determination as to which contaminants are likely to adversely impact biota and which contaminants are likely to be present in concentrations sufficient for detection.

Acute and chronic aquatic toxicity tests using fathead minnows and *Ceriodaphnia spp.* are proposed for Task 3 (see subsection 9.3.5). These simple screening tests will provide an initial determination of the toxicity of potentially complex chemical mixtures in OU6 aquatic ecosystems. If toxicity is observed in either the acute or chronic tests at any one station, then a supplemental toxicity testing program in conjunction with physical and chemical analyses of the water and sediment may be designed for that location to determine the potential extent of the toxicant(s).

Toxicity testing methods are available for terrestrial ecosystems using microbes, earthworms, crickets, and grasshoppers (U.S. EPA 1989e). The need for such tests will be evaluated based on the above criteria as part of this planning process.

Prior to conducting Task 9 studies, the field sampling plan will be refined to address the proposed methodologies. More specific DQOs will be formulated based on the proposed methodologies and will address the following:

- The number and types of analyses to be run
- The species, locations, and tissues to be sampled
- The number of samples to be taken
- The detection limits for contaminants
- The acceptable margin of error in analyzing results

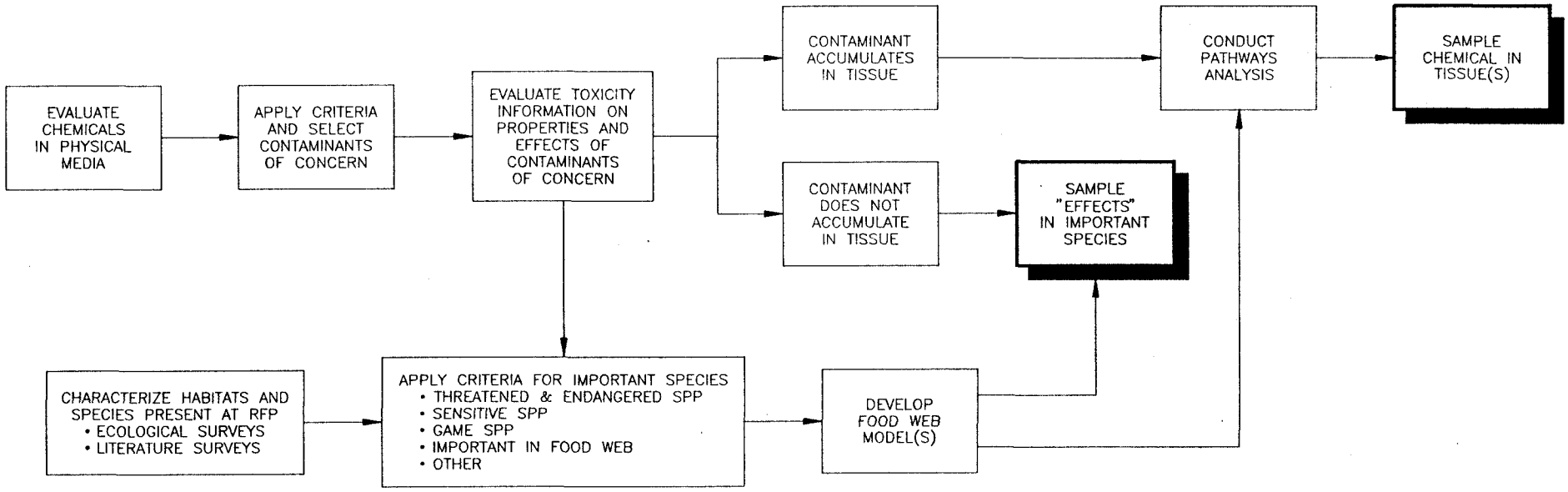
9.2.10 Task 9: Ecotoxicological Field Investigations

Tissue analyses will comprise most of the Task 9 ecotoxicological field investigation. Because individuals and species accumulate contaminants differentially in their tissues depending on the exposure route and form of the contaminants, environmental concentrations and general uptake rates will not necessarily predict biotic concentrations or adverse effects. Tissue analyses will be conducted to measure the total concentration of specific chemical compounds in key receptor species. By comparing tissue analysis results to toxicological benchmark concentrations (e.g., LC50 or MATC values), the potential for adverse effects in a population can be characterized. Analysis of tissue contaminant concentrations will provide data to confirm the predicted relationship, if any, between environmental concentrations and the amount of contaminants accumulated in receptor species.

Selection of the species and specific tissues for analysis will be based on a preliminary evaluation of site-specific food webs, potential contaminant transport pathways, and the potential for bioaccumulation, bioconcentration, and biomagnification. The decision process for conducting tissue analyses is presented in Figure 9-3. Tissue sampling will only be conducted for those contaminants of concern which bioaccumulate in tissue. Whole bodies or specific tissues will be analyzed depending on which portion is consumed by higher trophic level organisms. Suitability of the species for sampling and sampling size requirements will largely determine the species to be selected for tissue analysis.

To the extent possible, tissue samples will be collected simultaneously with environmental media samples (see Section 7.0). This will allow for a determination of site-specific BCFs. These BCFs will be incorporated into the final exposure assessment and will be used to calibrate/validate the pathways model. Where BCFs cannot be determined, published or predicted BCF values will be used in the pathways model to assess potential impacts.

For contaminants of concern which bioaccumulate, the acceptable concentration (i.e., ARAR/TBC) in the physical environment (e.g., water) may be below reliable detection limits measurable by direct methods. For example, the chronic AWQC for protection of aquatic life for DDT is 0.001 μg/l while the detection level using gas chromatography is 0.1 μg/l. In these instances, indicator species would be sampled as indirect indicators of contaminant concentrations in the physical media that bioaccumulate.



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DECISION PROCESS FOR CHEMICAL SAMPLING OF TISSUES

FIGURE 9-3 SEPTEMBER 1991

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Where ARARs/TBCs (i.e., acceptable levels in receptor species or next lowest prey species) are established, tissue sampling need only be conducted on site and not in the reference areas. Where no applicable criteria exist, sampling for contaminants of concern would be conducted both on site and in appropriate reference area(s). The decision process on the use of reference areas for sampling contaminants in tissues is shown in Figure 9-4.

Statistical tests will be used in the measurement of the contaminant-specific biological response in samples from OU6 and the reference areas. Use of statistical tests will be consistent with DQOs and quality assurance provisions of the Quality Assurance Project Plan (QAPjP).

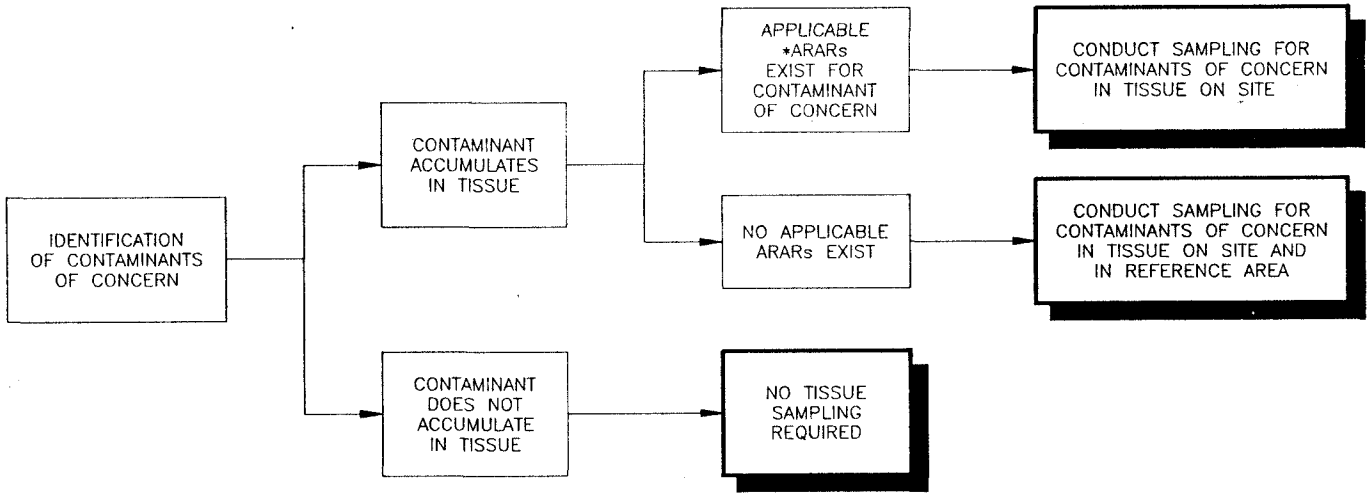
Additional ecotoxicological studies or toxicity tests may include in-situ (in-field) and/or laboratory toxicity tests. In-situ methods usually involve exposing animals in the field to existing aquatic or soil conditions. Laboratory toxicity tests can be used to evaluate the lethal or sublethal effects of chemicals as they occur in environmental media. Both approaches can be used to test for toxicity of mixtures as they actually occur in the environment. Selection of a particular methodology is generally based on the capability of the method to demonstrate a measurable biological response to the selected contaminant(s) of concern in addition to those specific criteria presented in subsection 9.2.9.

9.2.11 Task 10: Environmental Evaluation Report

Task 10 will include the summary of information and production of an Environmental Evaluation Report as part of the RFI/RI Report. The Environmental Evaluation Report will be prepared in a clear and concise manner to present study results and interpretation. Relevant data from the environmental evaluation, in addition to relevant Phase I RFI/RI data, will be integrated and evaluated in the characterization of potential environmental impacts. The following topics will be covered in the report:

- Objectives
- Scope of Investigation
- Site Description
- Contaminants of Concern and Key Receptor Species
- Contaminant Sources and Releases
- Exposure Characterization
- Contaminant (Impact) Characterization
- Remediation Criteria
- Conclusions and Limitations

A proposed, detailed outline of the report is shown in following Table 9-6.



* ARARs MAY NOT BE APPLICABLE IF THEY ARE BASED ON SPECIES THAT DO NOT EXIST ON SITE (e.g., TROUT) OR IF THEY ARE BASED ON BIOTA PATHWAYS TO HUMANS.

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DECISION PROCESS ON USE OF REFERENCE AREAS FOR CONTAMINANTS IN TISSUES

FIGURE 9-4 SEPTEMBER 1991

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TABLE 9-6
PROPOSED ENVIRONMENTAL EVALUATION REPORT OUTLINE
WALNUT CREEK DRAINAGE

EXECUTIVE SUMMARY

1.0 INTRODUCTION

- 1.1 OBJECTIVES
- 1.2 SITE HISTORY
- 1.3 SCOPE OF EVALUATION

2.0 SITE DESCRIPTION

- 2.1 PHYSICAL ENVIRONMENT
  - 2.1.1 Air Quality/Meteorology
  - 2.1.2 Soils
  - 2.1.3 Surface Water
  - 2.1.4 Groundwater
- 2.2 BIOTIC COMMUNITY
  - 2.2.1 Freshwater Community
  - 2.2.2 Terrestrial Community
  - 2.2.3 Protected/Important Species and Habitats

3.0 CONTAMINANT SOURCES AND RELEASES

- 3.1 SOURCES
- 3.2 RELEASES

4.0 CONTAMINANTS OF CONCERN

- 4.1 CRITERIA DEVELOPMENT FOR SELECTION OF CONTAMINANTS OF CONCERN
- 4.2 DEFINITION OF CONTAMINANTS

5.0 TOXICITY ASSESSMENT

- 5.1 TOXICITY ASSESSMENTS OF CONTAMINANTS OF CONCERN
- 5.2 CONTAMINANT EFFECTS
  - 5.2.1 Terrestrial Ecosystems
  - 5.2.2 Aquatic Ecosystems

6.0 EXPOSURE ASSESSMENT

- 6.1 CONTAMINANT PATHWAYS AND ACCEPTABLE CRITERIA DEVELOPMENT
  - 6.1.1 General Methodology for Pathway Analysis
  - 6.1.2 Selection of Key Receptor Species

TABLE 9-6
(Concluded)

6.2 EXPOSURE POINT IDENTIFICATION

6.2.1 Air
6.2.2 Soil
6.2.3 Sediment
6.2.4 Water
6.2.5 Vegetation

6.3 CHEMICAL FATE AND TRANSPORT
6.4 EXPOSURE POINT CONCENTRATIONS

6.4.1 Soil and Sediment Concentrations
6.4.2 Surface Water Concentrations
6.4.3 Groundwater Concentrations
6.4.4 Vegetation Concentrations

6.5 EXPOSURE PATHWAYS

6.5.1 Terrestrial Pathway
6.5.2 Freshwater Pathway

7.0 CONTAMINATION CHARACTERIZATION

7.1 DEVELOPMENT OF ECOLOGICAL EFFECTS CRITERIA

7.1.1 Air Criteria
7.1.2 Soil and Sediment Criteria
7.1.3 Freshwater Criteria
7.1.4 Vegetation Criteria

7.2 EFFECTS CHARACTERIZATION

7.2.1 Terrestrial Pathway

7.2.1.1 Air
7.2.1.2 Soil
7.2.1.3 Vegetation

7.2.2 Freshwater Pathway

7.2.2.1 Air
7.2.2.2 Surface Runoff
7.2.2.3 Seeps, Springs, Streams, and Ponds

8.0 ASSUMPTIONS AND UNCERTAINTIES

9.0 RECOMMENDATIONS AND CONCLUSIONS

10.0 REFERENCES

Remediation Criteria

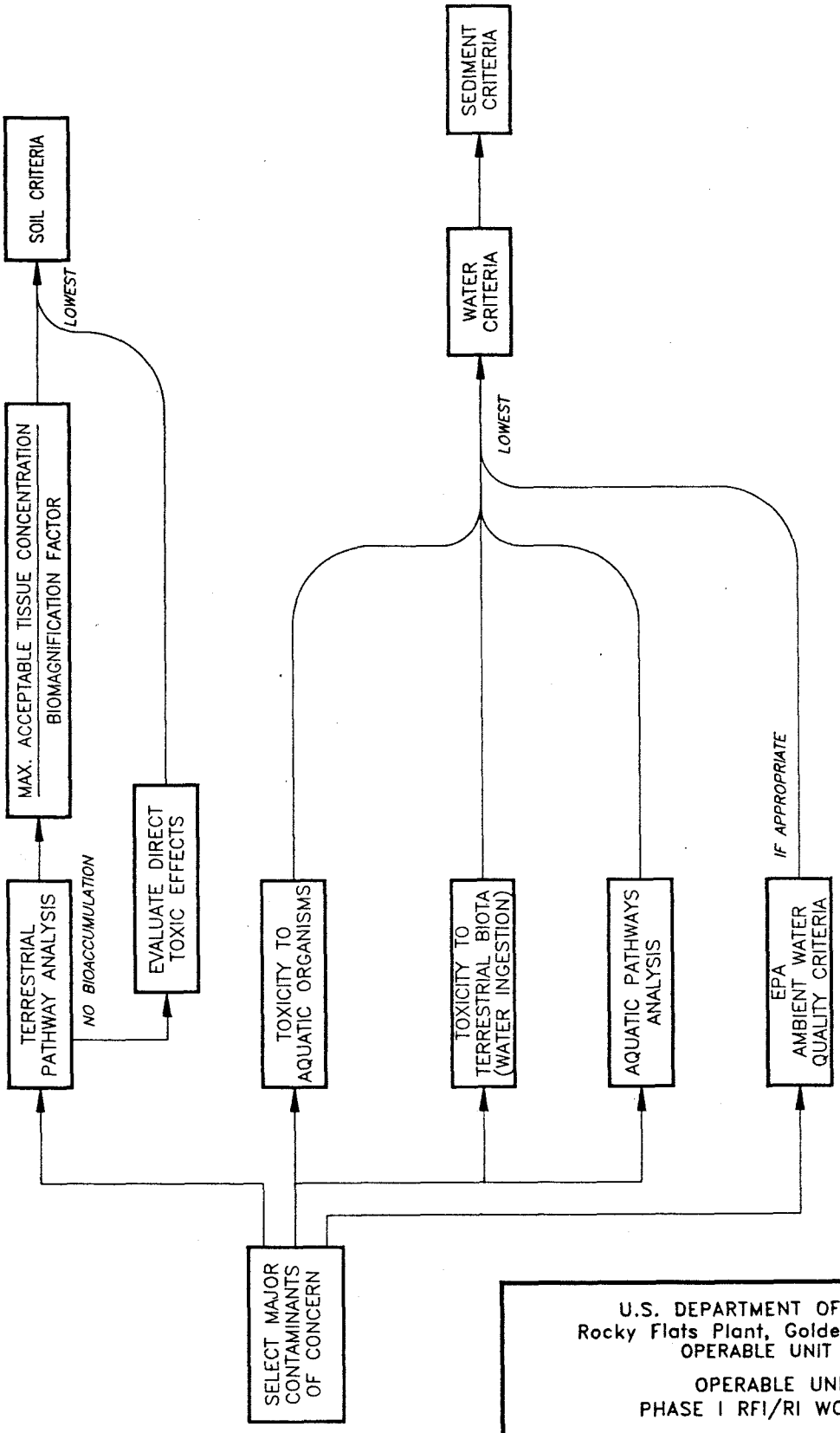
The primary element used in the assessment of environmental effects or risk is a set of environmental criteria to which measured and or predicted concentrations of hazardous constituents in abiotic media are compared. Where these criteria are exceeded, adverse effects are likely to occur. Where water quality or other available federal or state criteria are available for comparison to concentrations of contaminants, they are generally used (see subsection 9.2.7) (U.S. EPA 1989e). Remediation criteria can also be developed from other environmental statutes, such as the Toxic Substances Control Act or the Federal Insecticide, Fungicide and Rodenticide Act, or through the conduct of an environmental risk assessment such as outlined in this work plan.

Remediation criteria protective of biota are not available for contaminants in soils, or for many of the contaminants that occur in aquatic ecosystems at hazardous waste sites. Remediation criteria protective of site-specific plants and animals for the contaminants of concern can be developed in this environmental evaluation based on ecological effects criteria and detailed food-web analyses using a calibrated/validated pathways model. Ecological effects criteria are determined by tracing the biomagnification of contaminant residues from organisms at the top of the food web back through intermediate trophic levels to the abiotic environment. The "no effects" criteria levels for abiotic media are then derived from contaminant concentrations known to produce sublethal effects in the most sensitive (usually highest trophic level) organisms. Development of ecological effects criteria for OU6 will be based on results of the pathways model as well as available data which document potential adverse effects from contaminants of concern on key biological receptors. The process for establishing ecological criteria is shown in Figure 9-5. Determination of these criteria for OU6 will be coordinated with other RFI/RI studies and environmental evaluations.

The acceptable (no-effects) criteria levels will be used in conjunction with ARARs to evaluate potential adverse effects on biota as appropriate for the environmental evaluation portion of the Phase I RFI/RI. This approach will be integrated with the Human Health Risk Assessment process and will assist in the development of potential remediation criteria.

9.3 FIELD SAMPLING PLAN

The OU6 Environmental Evaluation is planned in 10 tasks as described in subsection 9.2. Field sampling activities will be conducted in Task 3 and Task 9 of the environmental evaluation. Task 3 will include brief field surveys, an ecological inventory of biota present at OU6, and initial aquatic toxicity testing. The field surveys and inventory will be conducted to obtain information on the occurrence, distribution, and general abundance of biota in OU6. Data obtained in the field inventory will be used to identify key receptor species, to develop a site-specific food web model and to provide input to the pathways analysis and contamination assessment. Planning for the Task 9 tissue analysis program will



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OUTLINE OF THE METHODOLOGY FOR DETERMINING CRITERIA FOR MAJOR CONTAMINANTS OF CONCERN

SOURCE: REAGAN AND FORDHAM, 1991

FIGURE 9-5 SEPTEMBER 1991

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begin in Task 2 so that samples collected in the Task 3 field inventory may be used wherever possible (i.e., where contaminants of concern have been defined and field sampling protocol have been developed). Final determination of the need for further ecotoxicological studies in Task 9 will be made in Task 8, Planning, after completion of the contamination assessment.

The following field sampling plan is provisional and will be periodically revised as appropriate. The Task 3 sampling plan is largely complete but may be altered in order to better coordinate with the surface water and soil sampling programs for OU6 or other OUs. The Task 9 field sampling plan will be designed in greater detail after contaminants of concern and key receptor species have been identified and a preliminary determination of food webs and contaminant source-receptor pathways has been developed. This information will allow determination as to which contaminants of concern are likely to be present in sufficient concentrations to be detected in biota and which biota are most practical and suitable for sampling.

SOPs for sampling biota have been published (EG&G, 1991g) as part of the Environmental Evaluation process at Rocky Flats. The SOPs include discussion of purpose and scope, responsibilities and qualifications, references, equipment, and execution of protocols. Sampling procedures for the following organisms are included in the Ecology SOPs (Volume V):

- Periphyton
- Benthic macroinvertebrates
- Plankton
- Fish
- Large mammals
- Small mammals
- Birds
- Reptiles and amphibians
- Terrestrial arthropods
- Terrestrial vegetation
- Soil microbes

SOPs that are currently being developed in addition to the above include the following:

- Design of Field Sampling Plans
- Recording and Managing Data
- Preserving and Handling Samples
- Conducting Laboratory Studies
- Incorporating QA/QC

The preceding SOPS are referenced in the following OU6 Field Sampling Plan where appropriate.

9.3.1 Sampling Objectives

The Task 3 Ecological Field Investigation for OU6 has four broad objectives:

1. Conduct brief field surveys and an ecological inventory to describe the existing ecological setting in terms of habitats, vegetation, wildlife and aquatic species. Conduct initial aquatic toxicity testing using *Ceriodaphnia spp.* and fathead minnows. Observe OU6 for obvious signs or zones of contamination or injury to biota and their habitats. Accomplish an ecological field inventory through the use of established ecological field methodologies (e.g., Mueller-Dombois and Ellenberg 1974; Southwood 1978; Krebs 1989).

2. From the above data, identify key food web species which represent the major flow of energy and nutrients and thus the major pathways for contaminant transfer from physical environmental media to higher trophic-level ecological receptors.

3. Identify the presence or absence of protected or other important species and habitats.

4. Provide site-specific information for determining objectives, measurement endpoints and methodologies for Task 9 field/laboratory contamination studies.

Data from the field survey, inventory, and aquatic toxicity tests will be summarized, tabulated and accompanied with a narrative description of the following data types:

- Species Present (Diversity)
- Habitat Descriptions/Mapping Units (Clark et al. 1980)
- Soil Descriptions/Classifications (part of RFI effort)
- Critical/Protected Habitats
- Protected Species
- Terrestrial and Aquatic Food Webs
- Potential Exposure Pathways
- Abundance of Key Species
- Vegetation Cover
- Vegetation Frequency and Density (shrubs/trees)
- Vegetation Importance (community dominance) Values
- Aquatic Toxicity Test Results

Appropriate statistical tests will be used to analyze the data so that precision and accuracy of the results can be presented at a stated level of confidence. Depending on the data types being analyzed, within-and-between station differences, within-and-between season differences, and within-and-between species differences will be presented. Means, variances, standard errors, analyses of variance, regression, and correlation coefficients will be computed as appropriate. Where sample sizes are insufficient to detect differences, only descriptive statistics will be prepared.

9.3.2 Sample Location and Frequency

Both Task 3 and Task 9 field sampling activities for OU6 will be located and timed to the extent possible to coincide with collection of other media samples (soils, surface water, and groundwater) as well as sampling activities at other OUs (Figure 9-6). This integrated sampling approach is consistent with EPA guidance and will provide a synoptic view of potential contaminants in all relevant media at one time.

The field sampling plan for Task 3 is based on the assumption that brief field surveys will be conducted in the spring, summer, fall, and winter and that the ecological field sampling program will take place within the May-June and July-August timeframes. Aquatic toxicity testing will take place in May-June (high flow) and September-October (low flow). Information from the initial surveys and field inventory may be used to modify sampling parameters for later field investigations.

Sampling locations are largely located at or downgradient from areas of known or suspected contamination. Sampling locations were selected to coincide with sampling efforts in abiotic media and to characterize the biotic communities that are present. The intent of the selected locations was not to test specific hypotheses regarding the effects of contamination, but to characterize the ecological communities that are present and provide site-specific input to the pathways model.

9.3.2.1 Locations for Vegetative Sampling

Vegetation sampling for phytosociological data will be performed at OU6 IHSSs, along the Unnamed Tributary, and along North and South Walnut Creek. A systematic walk-through of these areas will be conducted in the spring, summer, and fall to observe species composition.

A stratified randomization procedure will be utilized to identify sampling locations for the quantitative vegetative description portion of the field inventory. The basis for selecting a random procedure of vegetation transect/plot location is to obtain as unbiased an estimator as possible of true population parameters for herbaceous cover and shrub/tree density and frequency. Stratification is required because several distinct vegetation types appear to be present in the study area, including prairie grassland, marsh, streambank vegetation, well-vegetated disturbed areas, and sparsely vegetated disturbed areas.

The basis for stratification will be a vegetation type map, to be prepared based on the 1975 University of Colorado vegetation map of Rocky Flats and the Clark et al. (1980) report, updated by visual observations during the field surveys. This map will cover the Walnut Creek drainage.

Transects for the quantitative community surveys will be located near soil sampling sites (see subsection 7.2) wherever possible. From each soil sampling point, the centerpoint of a vegetation transect will be selected based on a random distance (to 10 m) and random direction, using random numbers tables. Transect locations will be selected until an adequate number have been selected for each major vegetation type at each IHSS. Locations will be discarded under several conditions: where the selected location is in a vegetation type for which an adequate number of transects has already been selected (for each IHSS); where the vegetation is not homogeneous (i.e., located in more than one type or across an ecotone); and where the transect would be located in buildings or paved areas. A similar process will be used for transects along the Unnamed Tributary, and North and South Walnut Creek, where sample locations will be located in the general area of surface-water/sediment sampling points. Since vegetation types associated with these features tend to be linear, the randomization process may require limits on direction. Multiple transects will be located near (within 50 meters of) each surface water/sediment sampling point to provide an adequate sample size.

9.3.2.2 Locations for Periphyton, Macrobenthos and Fish Sampling

Periphyton, macrobenthos, and fish samples will be collected at the following surface water sampling locations: SW-96, SW-100, SW-110, SW-111, SW-16, SW-24, SW-25, SW-03, and the four A-Series and five B-Series Ponds (Figure 9-6). Should the organisms or proper habitat be absent at a particular location, then the nearest location downstream with suitable habitat will be sampled and located on a map. Sampling at OU6 will be coordinated with OU6 surface water and sediment sampling activities as well as with nearby OU sampling programs. Although duplicate sampling locations may be designated in various work plans, such locations will only be sampled once. The resultant data will then be distributed for use in each of the appropriate reports.

Both sediment and surface water quality data will be collected at the same locations and time as the aquatic biota sampling. Sampling locations may be altered to ensure these efforts are coordinated. Sampling locations for aquatic biota may also be altered depending on DQOs or required sample size.

9.3.2.3 Locations for Wildlife Sampling

A terrestrial wildlife inventory will be conducted within OU6, along North and South Walnut Creek, and along the Unnamed Tributary. Small mammal sampling will be conducted, to the extent possible, at the vegetative sampling locations. Searches for reptiles will be conducted in the appropriate habitats within OU6.

9.3.2.4 Locations for Initial Toxicity Testing

Locations for initial aquatic toxicity testing will be mostly the same as those for periphyton, macrobenthos, and fish sampling: SW-96, SW-100, SW-110, SW-111, SW-16, SW-24, SW-25, SW-03 and the four A-Series and five B-Series Ponds (Figure 9-6). Toxicity testing activities for OU6 will be coordinated with toxicity testing activities proposed for nearby OUs.

9.3.2.5 Tissue Sampling Locations

Locations for the collection of tissue samples (terrestrial vegetation, periphyton, benthos, macrobenthos, fish) will be the same as those for terrestrial and aquatic sampling. An initial identification of species for tissue sampling will be made in Task 2. Additional sampling requirements will be determined during the contamination assessment (Tasks 4 through 7) and contaminant data from surface water, soil and sediment sampling. The intent is to collect tissue samples where existing abiotic media sampling has indicated significant contamination to occur. Development of the OU6 tissue sampling program will be coordinated with other OU programs.

9.3.2.6 Sample Frequency

Brief field surveys will be conducted during 1-week periods in the spring, summer, fall, and winter. Special note of transitory species, migratory species, and seasonal breeding habits will be made during these multi-season surveys.

Field inventory sampling will occur during the May-June and July-August timeframes. Samples collected during the inventory will be saved and used in the tissue analysis studies where sampling and analysis protocol have been established.

Initial toxicity tests will also be conducted during May-June (high flow) and September-October (low flow). Two acute and two chronic tests will be conducted within 1 to 2 weeks of each other during each season. If toxicity is observed in either acute or chronic tests at any one station, then a supplemental program will be designed for that location to determine if the toxicity is consistent and to determine the potential extent of the toxicant.

9.3.3 Reference Areas

Tissue analysis studies may require the sampling of contaminated and control areas in order to establish a relationship between contaminated conditions and background conditions in areas not exposed to Rocky Flats Plant contamination. Selection of reference areas may be based on criteria developed in the Task 1 preliminary planning process and may be coordinated with similar efforts at other OUs.

Potential selection criteria include species to be sampled or similarity to OU6 in terms of topography, aspect, soils, vegetation, range type, and land use history. Reference areas should be upstream from drainage off Rocky Flats Plant and where windblown contaminants are of concern, upwind from prevailing air flow patterns through Rocky Flats Plant.

Additional aquatic reference areas ideally should be located in Rock Creek depending on the selected measurement endpoints. A site visit will be made of the proposed aquatic sampling locations for OU6 and nearby OUs. Habitat characteristics will be noted if not previously recorded in ongoing Rocky Flats Plant studies (depth, flow, substrate type, pool/riffle, aquatic/streamside vegetation, etc.). This process will be repeated at potential reference sites.

Reference areas will be selected only after criteria, data quality objectives, and measurement endpoints are identified. The process for selecting reference areas will be developed in discussions and working sessions of the Risk Assessment Technical Working Group.

9.3.4 Field Survey and Inventory Sampling Methods

Sampling methods for periphyton, benthic macroinvertebrates, fish, mammals, birds, reptiles and amphibians, terrestrial arthropods, and terrestrial vegetation are detailed in the Ecology SOPs. The SOPs include several standardized forms to be used when sampling biota. Site Description Form 5.0D will be used for sampling terrestrial biota; stream and pond habitat description forms (Forms 5.0A and 5.0B) will be completed at each of the aquatic sampling locations. Chain-of-custody field sample forms will be completed where samples are collected for laboratory analysis or voucher specimens. Additional forms to be completed are specified in the following subsections.

9.3.4.1 Vegetation

Both qualitative and quantitative methods will be used to characterize the terrestrial and wetland vegetation at OU6. Qualitative surveys using a relevé analysis (see Ecology SOP) will be conducted in the spring, summer, and fall to record the floristic composition of the plant communities present. These qualitative surveys will include a systematic walk-through of OU6. Voucher specimens will be collected as necessary for the taxononic identification. The following data will be recorded on all vegetation species encountered:

- Scientific name
- Common name
- Life form
- Vegetative stage at the time
- Qualitative statement on condition

- Qualitative statement on abundance (relevé analysis - see Ecology SOPs, EG&G, 1991g)

Quantitative procedures will be used to collect structural and compositional data. Point-intercept transects will be used to collect data on species cover. Data will be recorded on Form 5.10B, Point-Intercept Data Form. Belt transects will be used in conjunction with the point-intercept transects to collect data on shrub cover and density. Trunk diameter, height, canopy diameter, and species will be recorded for any trees within the belt transect or within any IHSS. Shrub and tree data will be recorded on Form 5.10C, Belt Transect Data Form. Production data (standing biomass) will be collected from 1/4- to 1-m^2 quadrants at the same locations as the transects. Different quadrant sizes may be used depending on vegetation type (e.g., a 1/4-m^2 quadrant may be used on dense streambank vegetation). Production data will be recorded on Form 5.10D.

Each plot or transect will be considered as an observation in calculating the mean and variance. Sample adequacy will be determined for total herbaceous cover/total fresh weight biomass using Cochran's formula (1977):

$$N = \frac{(t^2)(s^2)}{[(x)(d)]^2}$$

where: N = the minimum number of samples needed
t = t distribution value for a given level of confidence
s^2 = the variance estimate
x = the mean of the sample
d = the level of accuracy desired

Sample adequacy will be obtained for each vegetation/habitat type within OU6. Where OUs overlap, habitats within the overlap area will only be sampled once and data will be applied to each OU. An 80% level of accuracy will be used to characterize total cover and total fresh weight in the vegetation communities. Where the vegetation community is disturbed or otherwise highly variable, a lower standard of accuracy may be used (e.g., 60%) to avoid excessive sampling.

9.3.4.2 Terrestrial Wildlife and Invertebrates

The Task 3 survey is planned to note the presence or absence of terrestrial/wetland species and to make note of their food habits. The survey procedure will include a systematic walk-through of the Walnut Creek Drainage to record ecological features. Field data will be recorded on the standardized Qualitative Survey/Relative Abundance Data Form 5.0C for large mammals, small mammals, birds, reptiles and amphibians, and terrestrial arthropods. Opportunistic observations of bird and raptor nests, large mammal pellets and mammal burrow/dens will be recorded on the appropriate forms.

Vocalization surveys for birds and anurans will also use the appropriate forms. Data to be recorded include:

- Species encountered/ observed
- Scientific name
- Common name
- Qualitative statement on:

  - Condition
  - Abundance
  - Habitat requirements
  - Predator/prey species/food habits
  - Regulatory status (to be determined prior to field sampling)

- Species presence will be determined by:

  - Visual observation
  - Vocalization
  - Burrow/den
  - Nest
  - Droppings/scat

Quantitative information on wildlife populations will be obtained in the Task 3 field inventory. Inventory sampling will include the following procedures, which are detailed in the SOPs:

- Live trapping of small mammals at each IHSS and along the drainages. Data to be recorded include:

  - Scientific name/common name
  - Sex
  - Reproductive condition
  - Weight
  - Life history stage

- Reptile occurrence will be recorded along the same transects used for small mammal trapping in addition to habitat searches. Data to be recorded include:

  - Species encountered
  - Activity

- Habitat
- Qualitative statement on abundance

- Medium- and larger-sized mammals will be counted by recording all species along a systematic walk-through of OU6. The counting will occur during the small mammal transect trapping. Species encountered and activity will be recorded.

- Foliage invertebrates will be collected by sweep net and beating. Where conditions permit, foliage invertebrate and arthropod sampling may be conducted using a D-vac suction sampler in place of sweep netting (see Ecology SOPs). Data to be recorded will include:

  - Host plant
  - Herbivore
  - Position in food web

9.3.4.3 Periphyton

Sampling to characterize periphyton communities will occur at the selected locations along the Unnamed Tributary, North and South Walnut Creek, and the A- and B-Series Ponds (See SOPs). Triplicate samples will be taken on a transect upstream and within 10 meters of the designated sampling locations. Data to be collected include:

- Scientific name
- Algal density (cell counts of each taxon)
- Biomass (chlorophyll-a and phaeophytin-a concentrations)

Field data will be recorded on the Periphyton Field Sample Form 5.1A (see SOP). Data from quantitative sampling will be used to determine species diversity and standing crop (biomass). Voucher samples will be retained. All analyses will be completed within five days of the collection of the slides from the field (U.S. EPA 1987b).

9.3.4.4 Macrobenthos

Benthic invertebrates are the most common fauna used in ecological assessments of contaminant releases and are defined as the invertebrates retained by screens of mesh size greater than 0.2 mm. Macrobenthos will be sampled at the aquatic sampling locations shown on Figure 9-6 using the procedures described in the SOPs. Triplicate samples will be taken on a transect upstream and within 10 meters of the designated sampling locations. Data to be collected include:

- Scientific name (generally to genus)
- Number of individuals in each taxon

Field data will be recorded on the Benthic Macroinvertebrate Field Sample Form 5.2A. Data from quantitative samples will be used to determine macroinvertebrate density (standing crop), taxa richness, and taxa diversity. Voucher specimens will be retained.

9.3.4.5 Fish

Fish will be collected in 10- to 25-meter-long collection areas using a backpack shocker or by seining blocked-off creek sections. In the A- and B-series Ponds, fish will be sampled from a flat-bottom boat using an electroshocker. Data to be collected include:

- Scientific name
- Number of individuals in each taxon
- Length
- Weight

Scales will be collected to obtain data on age classes versus size, population structure and survivorship. Field data will be recorded on the Fish Field Inventory Form 5.4B (see SOP). Samples will be taken for laboratory identification/confirmation. Analyses will consist of compiling and summarizing the number, size, and weight of each species of fish captured at each sampling site. Graphic presentations may include fish length-frequency histograms and plots of catch-per-effort for each sampling area.

9.3.5 Initial Toxicity Tests

The initial toxicity testing program will be limited to aquatic organisms and will include standardized EPA acute and chronic tests with fathead minnows and *Ceriodaphnia spp.*. Water samples will be cooled to 4°C and shipped to the laboratory conducting the toxicity tests within 12 to 24 hours. The toxicity tests will be initiated within 36 hours of the field collection time. The duration of the static renewal acute tests will be 48 hours for *Ceriodaphnia* and 96 hours for fathead minnows. The test water will be renewed daily using dilution water from the sampling station. The static renewal chronic tests will last for 7 days for fathead minnows and until 60 percent of the *Ceriodaphnia spp.* in the control vessels have three broods. Quality control procedures will conform to the EPA requirements for NPDES toxicity testing currently being used at Rocky Flats and to the QAPjP.

9.3.6 Tissue Analysis Sampling Methods

The methodologies selected for tissue analysis studies will depend on the contaminants of concern and their anticipated effects on the selected key receptor species. Contaminants of concern and key receptor species will be determined as early as possible in Task 2. It is anticipated that some biota samples collected in the Task 3 field inventory can be used for tissue analysis. Standardized site protocol for preserving samples for tissue analyses will be followed in those instances where it is anticipated that tissue analyses will be conducted.

Analyses for metals and radionuclides in biota may call for a greater biomass of tissue than is available through standard collection methods. At least 80 grams of material (wet weight) is needed per sample for metals analysis, and 100 grams of material (dried and ashed) is needed for radionuclides. Obtaining this amount of sample may be impractical for some species of vegetation, periphyton, benthos, and macrobenthos. It is also not the intent of the sampling program to cause unnecessary disturbance or damage to the biota communities in order to collect sufficient samples. Sampling design will be adequate to ensure statistically valid results. DQOs for the tissue sampling program will be evaluated with respect to this determination prior to field collection activities.

Based on the literature reviewed and the information presented in this report, it is anticipated that most tissue samples will be analyzed for metals and very few samples, if any, may be analyzed for radionuclides. Tissue samples collected for contaminant analysis will be sent to a laboratory for specific metals and radionuclide analyses as determined in the preliminary Task 1/Task 2 environmental evaluation. Analytical methods will follow SOPs.

Holding times, preservation methods, sample containers, and field and laboratory quality control sample numbers are contained in the Quality Assurance Project Plan (QAPjP) and shown in Table 9-7. Tissue sampling protocol for biota are not necessarily standardized and may vary depending upon the laboratory conducting the analyses. Specific sample preparation requirements will be reported in SOPs which are currently in development.

9.3.7 Sampling Equipment

Equipment for field sampling of biota are identified in the Volume V Ecology SOPs (EG&G, 1991g).

TABLE 9-7

HOLDING TIMES, PRESERVATION METHODS, AND SAMPLE CONTAINERS FOR BIOTA SAMPLES

	Holding Time From Date Collected	Preservation Method	Container	Approximate Sample Size++
SAMPLES FOR METALS ANALYSES				
TERRESTRIAL VEGETATION				
- Metals Determined by ICP*	6 mos	Freeze & ship w/dry ice	Paper bag inserted into plastic bag and sealed	25 g
- Metals Determined by GFAA+	6 mos.	Freeze & ship w/dry ice	Paper bag inserted into plastic bag and sealed	25 g
- Hexavalent Chromium	24 hours	Freeze & ship w/dry ice	Paper bag inserted into plastic bag and sealed	25 g
- Mercury	28 days	Freeze & ship w/dry ice	Paper bag inserted into plastic bag and sealed	5 g
Periphyton, Benthic Macroinvertebrates, Fish				
- Metals Determined by ICP*	6 mos.	Freeze & ship w/dry ice	Plastic	25 g
- Metals Determined by GFAA+	6 mos	Freeze & ship w/dry ice	Plastic	25 g
- Hexavalent Chromium	24 hours	Freeze & ship w/dry ice	Plastic	25 g
- Mercury	28 days	Freeze & ship w/dry ice	Plastic	5 g

TABLE 9-7
(Concluded)

	Holding Time From Date Collected	Preservation Method	Container	Approximate Sample Size++
SAMPLES FOR RADIONUCLIDE ANALYSES				
Terrestrial Vegetation				
- Uranium-233, 234, 235, 238 Americium-241 Plutonium-239/240	6 mos	Freeze & ship w/dry ice	Paper bag inserted into plastic bag and sealed	100 g
Periphyton, Benthic Macroinvertebrates, Fish				
- Uranium-233, 234, 245, 238 Americium-241 Plutonium-239/240	6 mos	Freeze & ship w/dry ice	Plastic	100 g

*ICP = Inductively Coupled Argon Plasma Emission Spectroscopy. Metals to be determined include Ba, Cr, Cu, and Fe.

+GFAA = Graphite Furnace Atomic Absorption Spectroscopy. Metals to be determined include As, Cd, Li, Pg, Se, and Sr.

++ Sample size may vary with specific laboratory requirements.

9.4 SCHEDULE

The following Figure 9-7 presents a proposed schedule for implementation of the OU6 environmental evaluation. The schedule follows the task approach presented in this environmental evaluation. While many of the tasks are sequential, most tasks will overlap in time. The months indicated in the table reflect the timeframe in which the activity will occur and not necessarily the amount of time necessary to complete the task. The schedule is provisional and likely to change depending on the Phase I OU6 RFI/RI activity schedule as well as schedules from other OUs.

10.0
QUALITY ASSURANCE ADDENDUM

The following document is the Quality Assurance Addendum which establishes the specific quality assurance controls applicable to the field investigation activities described in this RFI/RI Work Plan for OU6. This document was developed separately from the other sections of this report; therefore, this section is formatted differently. This section includes a separate table of contents, and the pages are numbered sequentially instead of sectionally.

The following Rocky Flats Plant (RFP) program-wide Standard Operating Procedures (SOPs) will be utilized during the specific field investigations for Operable Unit Number 6 (OU6).

- FO.8 Handling of Drilling Fluids and Cuttings
- FO.13 Containerizing, Preserving, Handling and Shipping Soil and Water Samples
- FO.14 Data Base Management
- FO.16 Field Radiological Measurements
- GW.1 Water Level Measurements in Wells and Piezometers
- GW.2 Well Development
- GW.5 Measurement for Groundwater Field Parameters
- GW.6 Groundwater Sampling
- GT.1 Logging Alluvial and Bedrock Material
- GT.2 Drilling and Sampling Using Hollow-Stem Auger Techniques
- GT.6 Monitoring Well and Piezometer Installation
- GT.8 Surface Soil Sampling
- GT.9 Soil Gas Sampling and Field Analysis
- SW.1 Surface Water Data Collection Activities
- SW.2 Field Measurement of Surface Water Field Parameters
- SW.3 Surface Water Sampling
- SW.6 Sediment Sampling
- SW.8 Pond Sampling
- AP.13 Radioactive Ambient Air Monitoring Program

In addition, Field Operations, Volume I, SOPs will also be used as appropriate during field operations.

Specific information concerning sampling activities is provided in the Field Sampling Plan (FSP) (Section 7.0) for most of the sampling activities. Project-specific details for this work plan will be included in the Standard Operating Procedures addenda (SOPA). These SOPA will be attached to the SOP for use during field activities.

11.1 SOP ADDENDUM TO SOP SW.6, SEDIMENT SAMPLING

Sediment samples will be collected from five locations each in the A- and B-series Ponds and in IHSS 142.12. In addition, sediment samples will be collected from numerous locations within North and South Walnut Creek. The sediment samples from the ponds will be collected from the following locations:

- The deepest part of the pond
- Within the pond, 5 feet from the pond inlet
- Three locations selected at random within the area of the pond at the time of sampling

Sediment samples in North Walnut Creek and South Walnut Creek will be collected within the channels in locations conducive to the collection of sediments.

The sediment samples at each location will be collected such that they represent the entire vertical column of sediment at the sampling location. Currently the depth of sediment in the detection ponds is unknown. Samples will be collected at 2-foot intervals. All of the sediment samples, except the one from the deepest part of each pond, will be vertical composite samples that represent the entire sediment thickness, up to 2 feet. If the sediment depth is greater than 2 feet, 2-foot composite samples will be collected. The samples from the deepest part of each pond will be composited at 5-centimeter intervals, instead of 2-foot intervals.

Samples from North and South Walnut Creek will be collected according to SOP SW.6, Sediment Sampling. These samples will be collected with a core sampling device capable of obtaining a loggable sample of the entire thickness of sediment at a given location. Samples for analysis of volatile organic compounds (VOCs) will be collected as grab samples and not composited.

Sediment samples from the Detention Ponds will be collected with a King tube sampler with a diameter of not more than 2 inches. Several soil cores may be needed to obtain enough samples for analyses. One of the samples will be maintained in the vertical position and frozen for subsequent geologic logging. This frozen core will be logged according to SOP GT.1, with the thickness and character of any thin stratifications in the sediment column noted. The sediment samples collected for chemical analysis will then be composited at 5-centimeter intervals. Sample handling and decontamination procedures will be followed as described in SOP SW.6, Sediment Sampling.

11.2 SOP ADDENDUM TO SOP NO. SW.8, POND SAMPLING

Water samples will be collected from five locations each in the A- and B-series Ponds and IHSS 142.12. The specific locations are as follows:

- The deepest part of the pond
- Within 5 feet of the pond inlet
- Within 5 feet of the pond spillway
- Two locations selected at random within the pond

Prior to sampling at each sampling point, profiles of water temperature and dissolved oxygen in the water column will be collected at the sampling location. The Hydrolab Multi-Parameter Measuring Instrument will be used to collect the profiles across the entire water column.

All of the samples except the one from the deepest part of the pond will be vertical composite samples representing the entire depth of the water column at the sampling point. The sampling from the deepest part of the pond will consist of taking grab samples from each of the zones of stratification identified in the water column at that point.

11.2.1 Composited Samples

Following the measurement of temperature and dissolved oxygen at the sampling point, a sample will be collected. The sample may be collected using a regulated flow sampler (described in SOP SW.3, Surface Water Sampling), which is pulled through the entire column of water. Samples may also be collected using a peristaltic pump with the intake tubing pulled through the entire water column. VOC samples will be collected as described in SOP SW.8, Pond Sampling.

Field parameters such as pH and specific conductance will be measured in the composited sample in accordance with SOP GW.5.

11.2.2 Grab Samples

Temperature and dissolved oxygen at the sampling point in the deepest part of the pond will be measured to determine the location of stratified layers at this point. The grab samples will then be collected using a peristaltic pump in each stratified zone for all samples except VOC samples. The uppermost stratified zone will be sampled first, followed by the next lower zone, and so on. The zone at the bottom of the pond will be sampled last. VOC samples will be collected as described in SOP SW.8, Pond Sampling.

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APPENDIX A
SEDIMENT ANALYTICAL DATA

INDEX LIST OF SEDIMENT LOCATIONS

SED-009
SED-003
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SED-007
SED-008
SED-010
SED-011
SED-012
SED-013
SED-032
SED-033
SED-035
SED-036
SED-118
SED-120
SED-124

SEDIMENT VOA SAMPLING EVENTS

---------- LOCATION=SED003 ----------

	LOCATION	NEWDATE	SMPLNO	TOTANAL
1	SED003		SED0308860	35
2	SED003	89-08-10	SED003001	34

---------- LOCATION=SED006 ----------

OBS	LOCATION	NEWDATE	SMPLNO	TOTANAL
3	SED006		SED0608860	35
4	SED006	90-11-28	SS00137WC	34

---------- LOCATION=SED007 ----------

OBS	LOCATION	NEWDATE	SMPLNO	TOTANAL
5	SED007		SED0708860	35

---------- LOCATION=SED008 ----------

OBS	LOCATION	NEWDATE	SMPLNO	TOTANAL
	SED008		SED0808860	35
	SED008	90-08-30	SS00105WC	34
8	SED008	90-11-07	SS00138WC	34
9	SED008	91-03-05	SS00172WC	34

---------- LOCATION=SED009 ----------

OBS	LOCATION	NEWDATE	SMPLNO	TOTANAL
10	SED009		SED0908860	35
11	SED009	90-08-30	SS00107WC	34

---------- LOCATION=SED010 ----------

OBS	LOCATION	NEWDATE	SMPLNO	TOTANAL
12	SED010		SED1008860	35

---------- LOCATION=SED011 ----------

OBS	LOCATION	NEWDATE	SMPLNO	TOTANAL
13	SED011		SED1108860	35
	SED011	90-09-05	SS00106WC	34
15	SED011	90-12-03	SS00140WC	34

SEDIMENT VOA SAMPLING EVENTS

---------- LOCATION=SED012 ----------

	LOCATION	NEWDATE	SMPLNO	TOTANAL
16	SED012		SED1208860	35

---------- LOCATION=SED013 ----------

OBS	LOCATION	NEWDATE	SMPLNO	TOTANAL
17	SED013		SED1308860	35

---------- LOCATION=SED032 ----------

OBS	LOCATION	NEWDATE	SMPLNO	TOTANAL
18	SED032	89-08-11	SED032001	34

---------- LOCATION=SED035 ----------

OBS	LOCATION	NEWDATE	SMPLNO	TOTANAL
19	SED035	89-08-10	SED035001	34
20	SED035	90-08-29	SS00123WC	34
	SED035	90-12-03	SS00157WC	34

---------- LOCATION=SED036 ----------

OBS	LOCATION	NEWDATE	SMPLNO	TOTANAL
22	SED036	89-08-10	SED036001	34
23	SED036	90-12-03	SS00158WC	34

---------- LOCATION=SED118 ----------

OBS	LOCATION	NEWDATE	SMPLNO	TOTANAL
24	SED118	90-09-18	SS00127WC	34
25	SED118	90-11-28	SS00161WC	34

---------- LOCATION=SED120 ----------

OBS	LOCATION	NEWDATE	SMPLNO	TOTANAL
26	SED120	90-09-19	SS00128WC	34
27	SED120	90-12-17	SS00162WC	34

SEDIMENT VOA SAMPLING EVENTS

---------- LOCATION=SED124 ----------

	LOCATION	NEWDATE	SMPLNO	TOTANAL
28	SED124	90-09-19	SS00129WC	34
29	SED124	90-12-17	SS00163WC	34

SEDIMENT BASE NEUTRAL EXTRACTABLE SAMPLING EVENTS

---------- LOCATION=SED003 ----------

	LOCATION	NEWDATE	SMPLNO	TOTANAL
1	SED003		SED0308860	49
2	SED003	89-08-10	SED003001	49

---------- LOCATION=SED006 ----------

OBS	LOCATION	NEWDATE	SMPLNO	TOTANAL
3	SED006		SED0608860	49
4	SED006	90-11-28	SS00137WC	49

---------- LOCATION=SED007 ----------

OBS	LOCATION	NEWDATE	SMPLNO	TOTANAL
5	SED007		SED0708860	49

---------- LOCATION=SED008 ----------

OBS	LOCATION	NEWDATE	SMPLNO	TOTANAL
	SED008		SED0808860	49
	SED008	90-08-30	SS00105WC	49
8	SED008	90-11-07	SS00138WC	49
9	SED008	91-03-05	SS00172WC	49

---------- LOCATION=SED009 ----------

OBS	LOCATION	NEWDATE	SMPLNO	TOTANAL
10	SED009		SED0908860	49
11	SED009	90-08-30	SS00107WC	49
12	SED009	90-11-28	SS00139WC	49

---------- LOCATION=SED010 ----------

OBS	LOCATION	NEWDATE	SMPLNO	TOTANAL
13	SED010		SED1008860	49

---------- LOCATION=SED011 ----------

OBS	LOCATION	NEWDATE	SMPLNO	TOTANAL
	SED011		SED1108860	49
15	SED011	90-09-05	SS00106WC	49
16	SED011	90-12-03	SS00140WC	49

SEDIMENT BASE NEUTRAL EXTRACTABLE SAMPLING EVENTS

---------- LOCATION=SED012 ----------

	LOCATION	NEWDATE	SMPLNO	TOTANAL
17	SED012		SED1208860	49

---------- LOCATION=SED013 ----------

OBS	LOCATION	NEWDATE	SMPLNO	TOTANAL
18	SED013		SED1308860	49

---------- LOCATION=SED032 ----------

OBS	LOCATION	NEWDATE	SMPLNO	TOTANAL
19	SED032	89-08-11	SED032001	49

---------- LOCATION=SED033 ----------

OBS	LOCATION	NEWDATE	SMPLNO	TOTANAL
20	SED033	89-08-10	SED033001	49

---------- LOCATION=SED035 ----------

OBS	LOCATION	NEWDATE	SMPLNO	TOTANAL
21	SED035	90-08-29	SS00123WC	40
22	SED035	90-12-03	SS00157WC	49

---------- LOCATION=SED036 ----------

OBS	LOCATION	NEWDATE	SMPLNO	TOTANAL
23	SED036	89-08-10	SED036001	49
24	SED036	90-12-03	SS00158WC	49

---------- LOCATION=SED118 ----------

OBS	LOCATION	NEWDATE	SMPLNO	TOTANAL
25	SED118	90-09-18	SS00127WC	49
26	SED118	90-11-28	SS00161WC	49

SEDIMENT BASE NEUTRAL EXTRACTABLE SAMPLING EVENTS

---------- LOCATION=SED120 ----------

	LOCATION	NEWDATE	SMPLNO	TOTANAL
27	SED120	90-09-19	SS00128WC	49
28	SED120	90-12-17	SS00162WC	49

---------- LOCATION=SED124 ----------

OBS	LOCATION	NEWDATE	SMPLNO	TOTANAL
29	SED124	90-09-19	SS00129WC	49
30	SED124	90-12-17	SS00163WC	49

SEDIMENT ACID EXTRACTABLE SAMPLING EVENTS

---------- LOCATION=SED003 ----------

	LOCATION	NEWDATE	SMPLNO	TOTANAL
1	SED003		SED0308860	16
2	SED003	89-08-10	SED003001	16

---------- LOCATION=SED006 ----------

OBS	LOCATION	NEWDATE	SMPLNO	TOTANAL
3	SED006		SED0608860	16
4	SED006	90-11-28	SS00137WC	16

---------- LOCATION=SED007 ----------

OBS	LOCATION	NEWDATE	SMPLNO	TOTANAL
5	SED007		SED0708860	16

---------- LOCATION=SED008 ----------

OBS	LOCATION	NEWDATE	SMPLNO	TOTANAL
	SED008		SED0808860	16
	SED008	90-08-30	SS00105WC	16
8	SED008	90-11-07	SS00138WC	16
9	SED008	91-03-05	SS00172WC	16

---------- LOCATION=SED009 ----------

OBS	LOCATION	NEWDATE	SMPLNO	TOTANAL
10	SED009		SED0908860	16
11	SED009	90-08-30	SS00107WC	16
12	SED009	90-11-28	SS00139WC	16

---------- LOCATION=SED010 ----------

OBS	LOCATION	NEWDATE	SMPLNO	TOTANAL
13	SED010		SED1008860	16

---------- LOCATION=SED011 ----------

OBS	LOCATION	NEWDATE	SMPLNO	TOTANAL
	SED011		SED1108860	16
15	SED011	90-09-05	SS00106WC	16
16	SED011	90-12-03	SS00140WC	16

SEDIMENT ACID EXTRACTABLE SAMPLING EVENTS

---------- LOCATION=SED012 ----------

	LOCATION	NEWDATE	SMPLNO	TOTANAL
17	SED012		SED1208860	16

---------- LOCATION=SED013 ----------

OBS	LOCATION	NEWDATE	SMPLNO	TOTANAL
18	SED013		SED1308860	16

---------- LOCATION=SED032 ----------

OBS	LOCATION	NEWDATE	SMPLNO	TOTANAL
19	SED032	89-08-11	SED032001	16

---------- LOCATION=SED033 ----------

OBS	LOCATION	NEWDATE	SMPLNO	TOTANAL
20	SED033	89-08-10	SED033001	16

---------- LOCATION=SED035 ----------

OBS	LOCATION	NEWDATE	SMPLNO	TOTANAL
21	SED035	90-08-29	SS00123WC	16
22	SED035	90-12-03	SS00157WC	16

---------- LOCATION=SED036 ----------

OBS	LOCATION	NEWDATE	SMPLNO	TOTANAL
23	SED036	89-08-10	SED036001	16
24	SED036	90-12-03	SS00158WC	16

---------- LOCATION=SED118 ----------

OBS	LOCATION	NEWDATE	SMPLNO	TOTANAL
25	SED118	90-09-18	SS00127WC	16
26	SED118	90-11-28	SS00161WC	16

SEDIMENT ACID EXTRACTABLE SAMPLING EVENTS

---------- LOCATION=SED120 ----------

	LOCATION	NEWDATE	SMPLNO	TOTANAL
27	SED120	90-09-19	SS00128WC	16
28	SED120	90-12-17	SS00162WC	16

---------- LOCATION=SED124 ----------

OBS	LOCATION	NEWDATE	SMPLNO	TOTANAL
29	SED124	90-09-19	SS00129WC	16
30	SED124	90-12-17	SS00163WC	16

SEDIMENT PESTICIDE/PCB SAMPLING EVENTS

LOCATION=SED003

OBS	LOCATION	NEWDATE	SMPLNO	TOTANAL
1	SED003		SED0308860	26

LOCATION=SED006

OBS	LOCATION	NEWDATE	SMPLNO	TOTANAL
2	SED006		SED0608860	26
3	SED006	90-11-28	SS00137WC	27

LOCATION=SED007

OBS	LOCATION	NEWDATE	SMPLNO	TOTANAL
4	SED007		SED0708860	26

LOCATION=SED008

OBS	LOCATION	NEWDATE	SMPLNO	TOTANAL
5	SED008		SED0808860	26
[illegible]	SED008	90-08-30	SS00105WC	27
[illegible]	SED008	90-11-07	SS00138WC	27
8	SED008	91-03-05	SS00172WC	27

LOCATION=SED009

OBS	LOCATION	NEWDATE	SMPLNO	TOTANAL
9	SED009		SED0908860	26
10	SED009	90-08-30	SS00107WC	27
11	SED009	90-11-28	SS00139WC	27

LOCATION=SED010

OBS	LOCATION	NEWDATE	SMPLNO	TOTANAL
12	SED010		SED1008860	26

LOCATION=SED011

OBS	LOCATION	NEWDATE	SMPLNO	TOTANAL
[illegible]	SED011		SED1108860	26
[illegible]	SED011	90-09-05	SS00106WC	27
15	SED011	90-12-03	SS00140WC	27

SEDIMENT PESTICIDE/PCB SAMPLING EVENTS

---------- LOCATION=SED012 ----------

OBS	LOCATION	NEWDATE	SMPLNO	TOTANAL
16	SED012		SED1208860	26

---------- LOCATION=SED013 ----------

OBS	LOCATION	NEWDATE	SMPLNO	TOTANAL
17	SED013		SED1308860	26

---------- LOCATION=SED035 ----------

OBS	LOCATION	NEWDATE	SMPLNO	TOTANAL
18	SED035	90-08-29	SS00123WC	27
19	SED035	90-12-03	SS00157WC	27

---------- LOCATION=SED036 ----------

OBS	LOCATION	NEWDATE	SMPLNO	TOTANAL
20	SED036	90-12-03	SS00158WC	27

---------- LOCATION=SED118 ----------

OBS	LOCATION	NEWDATE	SMPLNO	TOTANAL
21	SED118	90-09-18	SS00127WC	54
22	SED118	90-11-28	SS00161WC	27

---------- LOCATION=SED120 ----------

OBS	LOCATION	NEWDATE	SMPLNO	TOTANAL
23	SED120	90-09-19	SS00128WC	27
24	SED120	90-12-17	SS00162WC	27

---------- LOCATION=SED124 ----------

OBS	LOCATION	NEWDATE	SMPLNO	TOTANAL
25	SED124	90-09-19	SS00129WC	54
26	SED124	90-12-17	SS00163WC	27

SEDIMENT TOTAL METAL SAMPLING EVENTS

LOCATION=SED003

	LOCATION	NEWDATE	SMPLNO	TOTANAL
1	SED003		SED0308860	26
2	SED003	89-08-10	SED003001	28

LOCATION=SED006

OBS	LOCATION	NEWDATE	SMPLNO	TOTANAL
3	SED006		SED0608860	26
4	SED006	90-11-28	SS00137WC	29

LOCATION=SED007

OBS	LOCATION	NEWDATE	SMPLNO	TOTANAL
5	SED007		SED0708860	26

LOCATION=SED008

OBS	LOCATION	NEWDATE	SMPLNO	TOTANAL
	SED008		SED0808860	26
	SED008	90-08-30	SS00105WC	28
8	SED008	90-11-07	SS00138WC	28
9	SED008	91-03-05	SS00172WC	28

LOCATION=SED009

OBS	LOCATION	NEWDATE	SMPLNO	TOTANAL
10	SED009		SED0908860	26
11	SED009	90-08-30	SS00107WC	28
12	SED009	90-11-28	SS00139WC	29

LOCATION=SED010

OBS	LOCATION	NEWDATE	SMPLNO	TOTANAL
13	SED010		SED1008860	26

SEDIMENT TOTAL METAL SAMPLING EVENTS

---------- LOCATION=SED011 ----------

	LOCATION	NEWDATE	SMPLNO	TOTANAL
14	SED011		SED1108860	26
15	SED011	89-03-13	SED011001	28
16	SED011	90-09-05	SS00106WC	28
17	SED011	90-12-03	SS00140WC	27

---------- LOCATION=SED012 ----------

OBS	LOCATION	NEWDATE	SMPLNO	TOTANAL
18	SED012		SED1208860	26

---------- LOCATION=SED013 ----------

OBS	LOCATION	NEWDATE	SMPLNO	TOTANAL
19	SED013		SED1308860	26

---------- LOCATION=SED035 ----------

OBS	LOCATION	NEWDATE	SMPLNO	TOTANAL
	SED035	89-08-10	SED035001	28
21	SED035	90-08-29	SS00123WC	27
22	SED035	90-12-03	SS00157WC	28

---------- LOCATION=SED036 ----------

OBS	LOCATION	NEWDATE	SMPLNO	TOTANAL
23	SED036	89-08-10	SED036001	28
24	SED036	90-12-03	SS00158WC	27

---------- LOCATION=SED118 ----------

OBS	LOCATION	NEWDATE	SMPLNO	TOTANAL
25	SED118	90-09-18	SS00127WC	29
26	SED118	90-11-28	SS00161WC	29

---------- LOCATION=SED120 ----------

OBS	LOCATION	NEWDATE	SMPLNO	TOTANAL
	SED120	90-09-19	SS00128WC	29

SEDIMENT TOTAL METAL SAMPLING EVENTS

---------- LOCATION=SED124 ----------

	LOCATION	NEWDATE	SMPLNO	TOTANAL
28	SED124	90-09-19	SS00129WC	29

SEDIMENT TOTAL RAD SAMPLING EVENTS

---------- LOCATION=SED003 ----------

	LOCATION	NEWDATE	SMPLNO	TOTANAL
1	SED003		SED0308860	8
2	SED003	89-08-10	SED003001	1

---------- LOCATION=SED006 ----------

OBS	LOCATION	NEWDATE	SMPLNO	TOTANAL
3	SED006		SED0608860	8
4	SED006	90-09-17	SS00104WC	13

---------- LOCATION=SED007 ----------

OBS	LOCATION	NEWDATE	SMPLNO	TOTANAL
5	SED007		SED0708860	8

---------- LOCATION=SED008 ----------

OBS	LOCATION	NEWDATE	SMPLNO	TOTANAL
	SED008		SED0808860	8

---------- LOCATION=SED009 ----------

OBS	LOCATION	NEWDATE	SMPLNO	TOTANAL
7	SED009		SED0908860	8
8	SED009	90-08-30	SS00107WC	12
9	SED009	90-11-28	SS00139WC	12

---------- LOCATION=SED010 ----------

OBS	LOCATION	NEWDATE	SMPLNO	TOTANAL
10	SED010		SED1008860	8

---------- LOCATION=SED011 ----------

OBS	LOCATION	NEWDATE	SMPLNO	TOTANAL
11	SED011		SED1108860	8
12	SED011	89-03-13	SED011001	12

SEDIMENT TOTAL RAD SAMPLING EVENTS

LOCATION=SED012

OBS	LOCATION	NEWDATE	SMPLNO	TOTANAL
13	SED012		SED1208860	8

LOCATION=SED013

OBS	LOCATION	NEWDATE	SMPLNO	TOTANAL
14	SED013		SED1308860	8

LOCATION=SED032

OBS	LOCATION	NEWDATE	SMPLNO	TOTANAL
15	SED032	89-08-11	SED032001	1

LOCATION=SED033

OBS	LOCATION	NEWDATE	SMPLNO	TOTANAL
16	SED033	89-08-10	SED033001	1

LOCATION=SED035

OBS	LOCATION	NEWDATE	SMPLNO	TOTANAL
17	SED035	89-08-10	SED035001	1

LOCATION=SED036

OBS	LOCATION	NEWDATE	SMPLNO	TOTANAL
18	SED036	89-08-10	SED036001	1
19	SED036	90-09-17	SS00124WC	13

Location=SED009 SEDIMENT VOA SUMMARY All UNITS UG/KG

OBS	ANALYTE	Total Samples	Total CRQL Hits	CRQL	Maximum Hit	MAXHUNIT	Average Hit	MAXIMUM	MAXUNIT	Total Average
1	1,1,1-TRICHLOROETHANE	2	0	5	.		.	7 U	UG/KG	3.00
2	1,1,2,2-TETRACHLOROETHANE	2	0	5	.		.	7 U	UG/KG	3.00
3	1,1,2-TRICHLOROETHANE	2	0	5	.		.	7 U	UG/KG	3.00
4	1,1-DICHLOROETHANE	2	0	5	.		.	7 U	UG/KG	3.00
5	1,1-DICHLOROETHENE	2	0	5	.		.	7 U	UG/KG	3.00
6	1,2-DICHLOROETHANE	2	0	5	.		.	7 U	UG/KG	3.00
7	1,2-DICHLOROETHENE	1	0	5	.		.	7 U	UG/KG	3.50
8	1,2-DICHLOROPROPANE	2	0	5	.		.	7 U	UG/KG	3.00
9	2-BUTANONE	2	0	10	.		.	13 U	UG/KG	5.75
10	2-CHLOROETHYL VINYL ETHER	1	0	0	.		.	10 U	UG/KG	5.00
11	2-HEXANONE	2	0	10	.		.	13 U	UG/KG	5.75
12	4-METHYL-2-PENTANONE	2	0	10	.		.	13 U	UG/KG	5.75
13	ACETONE	2	2	10	140	UG/KG	77.5	140	UG/KG	77.50
14	BENZENE	2	0	5	.		.	7 U	UG/KG	3.00
15	BROMODICHLOROMETHANE	2	0	5	.		.	7 U	UG/KG	3.00
16	BROMOFORM	2	0	5	.		.	7 U	UG/KG	3.00
17	BROMOMETHANE	2	0	10	.		.	13 U	UG/KG	5.75
18	CARBON DISULFIDE	2	0	5	.		.	7 U	UG/KG	3.00
19	CARBON TETRACHLORIDE	2	0	5	.		.	7 U	UG/KG	3.00
20	CHLOROBENZENE	2	0	5	.		.	7 U	UG/KG	3.00
21	CHLOROETHANE	2	0	10	.		.	13 U	UG/KG	5.75
22	CHLOROFORM	2	0	5	.		.	7 U	UG/KG	3.00
23	CHLOROMETHANE	2	0	10	.		.	13 U	UG/KG	5.75
24	DIBROMOCHLOROMETHANE	2	0	5	.		.	7 U	UG/KG	3.00
25	ETHYLBENZENE	2	0	5	.		.	7 U	UG/KG	3.00
26	METHYLENE CHLORIDE	2	2	5	6 BJ	UG/KG	3.5	6 BJ	UG/KG	3.50
27	STYRENE	2	0	5	.		.	7 U	UG/KG	3.00
28	TETRACHLOROETHENE	2	0	5	.		.	7 U	UG/KG	3.00
29	TOLUENE	2	0	5	.		.	7 U	UG/KG	3.00
30	TOTAL XYLENES	2	0	5	.		.	7 U	UG/KG	3.00
31	TRICHLOROETHENE	2	0	5	.		.	7 U	UG/KG	3.00
32	VINYL ACETATE	2	0	10	.		.	13 U	UG/KG	5.75
33	VINYL CHLORIDE	2	0	10	.		.	13 U	UG/KG	5.75
34	cis-1,3-DICHLOROPROPENE	2	0	5	.		.	7 U	UG/KG	3.00
35	trans-1,2-DICHLOROETHENE	1	0	5	.		.	5 U	UG/KG	2.50
36	trans-1,3-DICHLOROPROPENE	2	0	5	.		.	7 U	UG/KG	3.00
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		69	4							

Location=SED009

SEDIMENT BASE NEUTRAL EXTRACTABLE SUMMARY ALL UNITS UG/KG

OBS	ANALYTE	Total Samples	Total CRQL Hits	CRQL	Maximum Hit	MAXHUNIT	Average Hit	MAXIMUM	MAXUNIT	Total Average
1	1,2,4-TRICHLOROBENZENE	3	0	330	.		.	960 U	UG/KG	336.67
2	1,2-DICHLOROBENZENE	3	0	330	.		.	960 U	UG/KG	336.67
3	1,3-DICHLOROBENZENE	3	0	330	.		.	960 U	UG/KG	336.67
4	1,4-DICHLOROBENZENE	3	0	330	.		.	960 U	UG/KG	336.67
5	2,4-DINITROTOLUENE	3	0	330	.		.	960 U	UG/KG	336.67
6	2,6-DINITROTOLUENE	3	0	330	.		.	960 U	UG/KG	336.67
7	2-CHLORONAPHTHALENE	3	0	330	.		.	960 U	UG/KG	336.67
8	2-METHYLNAPHTHALENE	3	0	330	.		.	960 U	UG/KG	336.67
9	2-NITROANILINE	3	0	1600	.		.	4600 U	UG/KG	1616.67
10	3,3'-DICHLOROBENZIDINE	3	0	660	.		.	1900 U	UG/KG	670.00
11	3-NITROANILINE	3	0	1600	.		.	4600 U	UG/KG	1616.67
12	4-BROMOPHENYL PHENYL ETHER	3	0	330	.		.	960 U	UG/KG	336.67
13	4-CHLOROANILINE	3	0	330	.		.	960 U	UG/KG	336.67
14	4-CHLOROPHENYL PHENYL ETHER	3	0	330	.		.	960 U	UG/KG	336.67
15	4-NITROANILINE	3	0	1600	.		.	4600 U	UG/KG	1616.67
16	ACENAPHTHENE	3	0	330	.		.	960 U	UG/KG	336.67
17	ACENAPHTHYLENE	3	0	330	.		.	960 U	UG/KG	336.67
18	ANTHRACENE	3	0	330	.		.	960 U	UG/KG	336.67
19	BENZO(a)ANTHRACENE	3	0	330	.		.	960 U	UG/KG	336.67
20	BENZO(a)PYRENE	3	0	330	.		.	960 U	UG/KG	336.67
21	BENZO(b)FLUORANTHENE	3	0	330	.		.	960 U	UG/KG	336.67
22	BENZO(ghi)PERYLENE	3	0	330	.		.	960 U	UG/KG	336.67
23	BENZO(k)FLUORANTHENE	3	0	330	.		.	960 U	UG/KG	336.67
24	BIS(2-CHLOROETHOXY)METHANE	3	0	330	.		.	960 U	UG/KG	336.67
	BIS(2-CHLOROETHYL)ETHER	3	0	330	.		.	960 U	UG/KG	336.67
	BIS(2-CHLOROISOPROPYL)ETHER	3	0	330	.		.	960 U	UG/KG	336.67
27	BIS(2-ETHYLHEXYL)PHTHALATE	3	3	330	590 BJ	UG/KG	323.33	590 BJ	UG/KG	323.33
28	BUTYL BENZYL PHTHALATE	3	0	330	.		.	960 U	UG/KG	336.67
29	CHRYSENE	3	1	330	200 J	UG/KG	200.00	960 U	UG/KG	261.67
30	DI-n-BUTYL PHTHALATE	3	2	330	190 J	UG/KG	125.00	850 U	UG/KG	225.00
31	DI-n-OCTYL PHTHALATE	3	0	330	.		.	960 U	UG/KG	336.67
32	DIBENZO(a,h)ANTHRACENE	3	0	330	.		.	960 U	UG/KG	336.67
33	DIBENZOFURAN	3	0	330	.		.	960 U	UG/KG	336.67
34	DIETHYL PHTHALATE	3	0	330	.		.	960 U	UG/KG	336.67
35	DIMETHYL PHTHALATE	3	0	330	.		.	960 U	UG/KG	336.67
36	FLUORANTHENE	3	2	330	300 J	UG/KG	220.00	300 J	UG/KG	181.67
37	FLUORENE	3	0	330	.		.	960 U	UG/KG	336.67
38	HEXACHLOROBENZENE	3	0	330	.		.	960 U	UG/KG	336.67
39	HEXACHLOROBUTADIENE	3	0	330	.		.	960 U	UG/KG	336.67
40	HEXACHLOROCYCLOPENTADIENE	3	0	330	.		.	960 U	UG/KG	336.67
41	HEXACHLOROETHANE	3	0	330	.		.	960 U	UG/KG	336.67
42	INDENO(1,2,3-cd)PYRENE	3	0	330	.		.	960 U	UG/KG	336.67
43	ISOPHORONE	3	0	330	.		.	960 U	UG/KG	336.67
44	N-NITROSO-DI-n-PROPYLAMINE	3	0	330	.		.	960 U	UG/KG	336.67
45	N-NITROSODIPHENYLAMINE	3	1	330	2000 B	UG/KG	2000.00	2000 B	UG/KG	968.33
46	NAPHTHALENE	3	0	330	.		.	960 U	UG/KG	336.67
47	NITROBENZENE	3	0	330	.		.	960 U	UG/KG	336.67
48	PHENANTHRENE	3	1	330	140 J	UG/KG	140.00	960 U	UG/KG	241.67
49	PYRENE	3	2	330	280 J	UG/KG	195.00	280 J	UG/KG	165.00
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		147	12							

Location=SED009 SEDIMENT ACID EXTRACTABLE SUMMARY ALL UNITS UG/KG

ORD	ANALYTE	Total Samples	Total CRQL Hits	CRQL	Maximum Hit	MAXHUNIT	Average Hit	MAXIMUM	MAXUNIT	Total Average
1	2,4,5-TRICHLOROPHENOL	3	0	1600	.		.	4600 U	UG/KG	1616.67
2	2,4,6-TRICHLOROPHENOL	3	0	330	.		.	960 U	UG/KG	336.67
3	2,4-DICHLOROPHENOL	3	0	330	.		.	960 U	UG/KG	336.67
4	2,4-DIMETHYLPHENOL	3	0	330	.		.	960 U	UG/KG	336.67
5	2,4-DINITROPHENOL	3	0	1600	.		.	4600 U	UG/KG	1616.67
6	2-CHLOROPHENOL	3	0	330	.		.	960 U	UG/KG	336.67
7	2-METHYLPHENOL	3	0	330	.		.	960 U	UG/KG	336.67
8	2-NITROPHENOL	3	0	330	.		.	960 U	UG/KG	336.67
9	4,6-DINITRO-2-METHYLPHENOL	3	0	1600	.		.	4600 U	UG/KG	1616.67
10	4-CHLORO-3-METHYLPHENOL	3	0	330	.		.	960 U	UG/KG	336.67
11	4-METHYLPHENOL	3	0	330	.		.	960 U	UG/KG	336.67
12	4-NITROPHENOL	3	0	1600	.		.	4600 U	UG/KG	1616.67
13	BENZOIC ACID	3	0	1600	.		.	4600 U	UG/KG	1616.67
14	BENZYL ALCOHOL	3	0	330	.		.	960 U	UG/KG	336.67
15	PENTACHLOROPHENOL	3	0	1600	.		.	4600 U	UG/KG	1616.67
16	PHENOL	3	0	330	.		.	960 U	UG/KG	336.67
		=======	=========							
		48	0							

Location=SED009

SEDIMENT PESTICIDE/PCB SUMMARY ALL UNITS UG/KG

OBS	ANALYTE	Total Samples	Total CRQL Hits	CRQL	Maximum Hit	MAXHUNIT	Average Hit	MAXIMUM	MAXUNIT	Total Average
1	4,4'-DDD	3	0	16	.		.	46 U	UG/KG	15.167
2	4,4'-DDE	3	0	16	.		.	46 U	UG/KG	15.167
3	4,4'-DDT	3	0	16	.		.	46 U	UG/KG	15.167
4	ALDRIN	3	0	8	.		.	23 U	UG/KG	7.583
5	AROCLOR-1016	3	0	80	.		.	230 U	UG/KG	75.833
6	AROCLOR-1221	3	0	80	.		.	230 U	UG/KG	75.833
7	AROCLOR-1232	3	0	80	.		.	230 U	UG/KG	75.833
8	AROCLOR-1242	3	0	80	.		.	230 U	UG/KG	75.833
9	AROCLOR-1248	3	0	80	.		.	230 U	UG/KG	75.833
10	AROCLOR-1254	3	0	80	.		.	460 U	UG/KG	151.667
11	AROCLOR-1260	3	0	80	.		.	460 U	UG/KG	151.667
12	CHLORDANE	1	0	80	.		.	15 U	UG/KG	7.500
13	DIELDRIN	3	0	16	.		.	46 U	UG/KG	15.167
14	ENDOSULFAN I	3	0	8	.		.	23 U	UG/KG	7.583
15	ENDOSULFAN II	3	0	16	.		.	46 U	UG/KG	15.167
16	ENDOSULFAN SULFATE	3	0	16	.		.	46 U	UG/KG	15.167
17	ENDRIN	3	0	16	.		.	46 U	UG/KG	15.167
18	ENDRIN KETONE	3	0	16	.		.	46 U	UG/KG	15.167
19	HEPTACHLOR	3	0	8	.		.	23 U	UG/KG	7.583
20	HEPTACHLOR EPOXIDE	3	0	8	.		.	23 U	UG/KG	7.583
21	METHOXYCHLOR	3	0	80	.		.	230 U	UG/KG	75.833
22	TOXAPHENE	3	0	160	.		.	460 U	UG/KG	151.667
23	alpha-BHC	3	0	8	.		.	23 U	UG/KG	7.583
24	alpha-CHLORDANE	2	0	80	.		.	230 U	UG/KG	110.000
	beta-BHC	3	0	8	.		.	23 U	UG/KG	7.583
	delta-BHC	3	0	8	.		.	23 U	UG/KG	7.583
27	gamma-BHC (LINDANE)	3	0	8	.		.	23 U	UG/KG	7.583
28	gamma-CHLORDANE	2	0	80	.		.	230 U	UG/KG	110.000
		=======	=========							
		80	0							

Location=SED009 SEDIMENT TOTAL METAL SUMMARY ALL UNITS UG/KG

CRL	ANALYTE	Total Samples	Total CRQL Hits	CRQL	Maximum Hit	MAXHUNIT	Average Hit	MAXIMUM	MAXUNIT	Total Average
1	ALUMINUM	3	0	40000	.		.	7850	MG/KG	5490.00
2	ANTIMONY	3	0	12000	.		.	5.9 BN	MG/KG	2.70
3	ARSENIC	3	0	2000	.		.	5.1	MG/KG	3.33
4	BARIUM	3	0	40000	.		.	83.6	MG/KG	63.23
5	BERYLLIUM	3	0	1000	.		.	0.48 B	MG/KG	0.35
6	CADMIUM	3	0	1000	.		.	0.97 B	MG/KG	0.64
7	CALCIUM	3	0	2000000	.		.	12900 E	MG/KG	8523.33
8	CESIUM	3	0	200000	.		.	83.1 B	MG/KG	32.35
9	CHROMIUM	3	0	2000	.		.	11.8	MG/KG	7.37
10	COBALT	3	0	10000	.		.	7.4 B	MG/KG	6.00
11	COPPER	3	0	5000	.		.	15.6 *	MG/KG	10.77
12	IRON	3	0	20000	.		.	11600	MG/KG	9726.67
13	LEAD	3	0	1000	.		.	16.2	MG/KG	11.18
14	LITHIUM	2	0	20000	.		.	6.9 B	MG/KG	5.80
15	MAGNESIUM	3	0	2000000	.		.	2060	MG/KG	1564.33
16	MANGANESE	3	0	3000	.		.	669	MG/KG	509.33
17	MERCURY	4	0	200	.		.	0.27	MG/KG	0.13
18	MOLYBDENUM	3	0	40000	.		.	7.9 U	MG/KG	3.18
19	NICKEL	3	0	8000	.		.	11.1	MG/KG	7.70
20	POTASSIUM	3	0	2000000	.		.	1210	MG/KG	1108.33
21	SELENIUM	3	0	1000	.		.	0.27 B	MG/KG	0.19
22	SILVER	3	0	2000	.		.	0.8 B	MG/KG	0.49
23	SODIUM	3	0	2000000	.		.	228 B	MG/KG	194.00
24	STRONTIUM	3	0	40000	.		.	40 B	MG/KG	30.57
	THALLIUM	3	0	2000	.		.	13	MG/KG	4.55
	TIN	2	0	40000	.		.	10.7 B	MG/KG	8.55
27	VANADIUM	3	0	10000	.		.	24.2	MG/KG	18.87
28	ZINC	3	0	4000	.		.	98.3 E*	MG/KG	74.23
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		83	0							

Location=SED009

SEDIMENT TOTAL RAD SUMMARY ALL UNITS PCI/KG

OBS	ANALYTE	Total Samples	Total CRQL Hits	CRQL	Maximum Hit	MAXHUNIT	Average Hit	MAXIMUM	MAXUNIT	Total Average
1	AMERICIUM-241	3	3	20	255	PCI/KG	206.70	255	PCI/KG	206.70
2	CESIUM-137	2	2	100	137.7	PCI/KG	78.42	137.7	PCI/KG	78.42
3	GROSS ALPHA - DISSOLVED	2	2	4000	15870	PCI/KG	10035.00	15870	PCI/KG	10035.00
4	GROSS ALPHA PARTICLE RADIOAC	1	1	4000	15000	PCI/KG	15000.00	15000	PCI/KG	15000.00
5	GROSS BETA - DISSOLVED	2	2	10000	26700	PCI/KG	24865.00	26700	PCI/KG	24865.00
6	GROSS BETA PARTICLE RADIOACT	1	1	10000	24000	PCI/KG	24000.00	24000	PCI/KG	24000.00
7	PLUTONIUM-238	1	1	0	3.882 J	PCI/KG	3.88	3.882 J	PCI/KG	3.88
8	PLUTONIUM-239	1	1	30	90	PCI/KG	90.00	90	PCI/KG	90.00
9	PLUTONIUM-239/240	2	2	30	951.2	PCI/KG	577.25	951.2	PCI/KG	577.25
10	RADIUM-226	2	2	500	1010	PCI/KG	752.30	1010	PCI/KG	752.30
11	RADIUM-228	2	2	500	1995	PCI/KG	1542.50	1995	PCI/KG	1542.50
12	STRONTIUM-89,90	2	2	1000	173.7 J	PCI/KG	155.10	173.7 J	PCI/KG	155.10
13	TRITIUM	2	1	400000	261.4 J	PCI/L	261.40	261.4 J	PCI/L	185.70
14	URANIUM, TOTAL	1	1	0	1.76		1.76	1.76		1.76
15	URANIUM-233,-234	3	3	300	1355	PCI/KG	1023.87	1355	PCI/KG	1023.87
16	URANIUM-235	2	2	300	98.33 J	PCI/KG	85.26	98.33 J	PCI/KG	85.26
17	URANIUM-238	3	3	300	1524	PCI/KG	1089.87	1524	PCI/KG	1089.87
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		32	31							

Location=SED007

SEDIMENT ACID EXTRACTABLE SUMMARY ALL UNITS UG/KG

OBS	ANALYTE	Total Samples	Total CRQL Hits	CRQL	Maximum Hit	MAXHUNIT	Average Hit	MAXIMUM	MAXUNIT	Total Average
1	2,4,5-TRICHLOROPHENOL	1	0	1600	.		.	2000 U	UG/KG	1000
2	2,4,6-TRICHLOROPHENOL	1	0	330	.		.	400 U	UG/KG	200
3	2,4-DICHLOROPHENOL	1	0	330	.		.	400 U	UG/KG	200
4	2,4-DIMETHYLPHENOL	1	0	330	.		.	400 U	UG/KG	200
5	2,4-DINITROPHENOL	1	0	1600	.		.	2000 U	UG/KG	1000
6	2-CHLOROPHENOL	1	0	330	.		.	400 U	UG/KG	200
7	2-METHYLPHENOL	1	0	330	.		.	400 U	UG/KG	200
8	2-NITROPHENOL	1	0	330	.		.	400 U	UG/KG	200
9	4,6-DINITRO-2-METHYLPHENOL	1	0	1600	.		.	2000 U	UG/KG	1000
10	4-CHLORO-3-METHYLPHENOL	1	0	330	.		.	400 U	UG/KG	200
11	4-METHYLPHENOL	1	0	330	.		.	400 U	UG/KG	200
12	4-NITROPHENOL	1	0	1600	.		.	2000 U	UG/KG	1000
13	BENZOIC ACID	1	0	1600	.		.	2000 U	UG/KG	1000
14	BENZYL ALCOHOL	1	0	330	.		.	400 U	UG/KG	200
15	PENTACHLOROPHENOL	1	1	1600	320 J	UG/KG	320	320 J	UG/KG	320
16	PHENOL	1	0	330	.		.	400 U	UG/KG	200
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		16	1							

Location=SED007

SEDIMENT VOA SUMMARY All UNITS UG/KG

S	ANALYTE	Total Samples	Total CRQL Hits	CRQL	Maximum Hit	MAXHUNIT	Average Hit	MAXIMUM	MAXUNIT	Total Average
1	1,1,1-TRICHLOROETHANE	1	0	5	.		.	5 U	UG/KG	2.5
2	1,1,2,2-TETRACHLOROETHANE	1	0	5	.		.	5 U	UG/KG	2.5
3	1,1,2-TRICHLOROETHANE	1	0	5	.		.	5 U	UG/KG	2.5
4	1,1-DICHLOROETHANE	1	0	5	.		.	5 U	UG/KG	2.5
5	1,1-DICHLOROETHENE	1	0	5	.		.	5 U	UG/KG	2.5
6	1,2-DICHLOROETHANE	1	0	5	.		.	5 U	UG/KG	2.5
7	1,2-DICHLOROPROPANE	1	0	5	.		.	5 U	UG/KG	2.5
8	2-BUTANONE	1	0	10	.		.	10 U	UG/KG	5.0
9	2-CHLOROETHYL VINYL ETHER	1	0	0	.		.	10 U	UG/KG	5.0
10	2-HEXANONE	1	0	10	.		.	10 U	UG/KG	5.0
11	4-METHYL-2-PENTANONE	1	0	10	.		.	10 U	UG/KG	5.0
12	ACETONE	1	1	10	173	UG/KG	173	173	UG/KG	173.0
13	BENZENE	1	0	5	.		.	5 U	UG/KG	2.5
14	BROMODICHLOROMETHANE	1	0	5	.		.	5 U	UG/KG	2.5
15	BROMOFORM	1	0	5	.		.	5 U	UG/KG	2.5
16	BROMOMETHANE	1	0	10	.		.	10 U	UG/KG	5.0
17	CARBON DISULFIDE	1	1	5	2 J	UG/KG	2	2 J	UG/KG	2.0
18	CARBON TETRACHLORIDE	1	0	5	.		.	5 U	UG/KG	2.5
19	CHLOROBENZENE	1	0	5	.		.	5 U	UG/KG	2.5
20	CHLOROETHANE	1	0	10	.		.	10 U	UG/KG	5.0
21	CHLOROFORM	1	0	5	.		.	5 U	UG/KG	2.5
22	CHLOROMETHANE	1	0	10	.		.	10 U	UG/KG	5.0
23	DIBROMOCHLOROMETHANE	1	0	5	.		.	5 U	UG/KG	2.5
24	ETHYLBENZENE	1	0	5	.		.	5 U	UG/KG	2.5
25	METHYLENE CHLORIDE	1	1	5	2 J	UG/KG	2	2 J	UG/KG	2.0
[illegible]	STYRENE	1	0	5	.		.	5 U	UG/KG	2.5
[illegible]	TETRACHLOROETHENE	1	0	5	.		.	5 U	UG/KG	2.5
28	TOLUENE	1	0	5	.		.	5 U	UG/KG	2.5
29	TOTAL XYLENES	1	0	5	.		.	5 U	UG/KG	2.5
30	TRICHLOROETHENE	1	0	5	.		.	5 U	UG/KG	2.5
31	VINYL ACETATE	1	0	10	.		.	10 U	UG/KG	5.0
32	VINYL CHLORIDE	1	0	10	.		.	10 U	UG/KG	5.0
33	cis-1,3-DICHLOROPROPENE	1	0	5	.		.	5 U	UG/KG	2.5
34	trans-1,2-DICHLOROETHENE	1	0	5	.		.	5 U	UG/KG	2.5
35	trans-1,3-DICHLOROPROPENE	1	0	5	.		.	5 U	UG/KG	2.5
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		35	3							

Location=SED006

SEDIMENT TOTAL RAD SUMMARY ALL UNITS PCI/KG

OBS	ANALYTE	Total Samples	Total CRQL Hits	CRQL	Maximum Hit	MAXHUNIT	Average Hit	MAXIMUM	MAXUNIT	Total Average
1	AMERICIUM-241	2	2	20	490	PCI/KG	251.22	490	PCI/KG	251.22
2	CESIUM-137	1	1	100	877.5	PCI/KG	877.50	877.5	PCI/KG	877.50
3	GROSS ALPHA - DISSOLVED	1	1	4000	13270	PCI/KG	13270.00	13270	PCI/KG	13270.00
4	GROSS ALPHA PARTICLE RADIOAC	1	1	4000	16000	PCI/KG	16000.00	16000	PCI/KG	16000.00
5	GROSS BETA - DISSOLVED	1	1	10000	25880	PCI/KG	25880.00	25880	PCI/KG	25880.00
6	GROSS BETA PARTICLE RADIOACT	1	1	10000	17000	PCI/KG	17000.00	17000	PCI/KG	17000.00
7	PLUTONIUM-238	1	1	0	1.623 J	PCI/KG	1.62	1.623 J	PCI/KG	1.62
8	PLUTONIUM-239	1	0	30	.		.	10	PCI/KG	10.00
9	PLUTONIUM-239/240	1	1	30	27.52 J	PCI/KG	27.52	27.52 J	PCI/KG	27.52
10	RADIUM-226	1	1	500	1082	PCI/KG	1082.00	1082	PCI/KG	1082.00
11	RADIUM-228	1	1	500	1976	PCI/KG	1976.00	1976	PCI/KG	1976.00
12	STRONTIUM-89,90	1	1	1000	712.7 J	PCI/KG	712.70	712.7 J	PCI/KG	712.70
13	TRITIUM	2	0	400000	.		.	2322	PCI/L	1246.00
14	URANIUM, TOTAL	1	1	0	0.9		0.90	0.9		0.90
15	URANIUM-233,-234	2	2	300	788	PCI/KG	679.00	788	PCI/KG	679.00
16	URANIUM-235	1	1	300	25.09 J	PCI/KG	25.09	25.09 J	PCI/KG	25.09
17	URANIUM-238	2	2	300	991.2	PCI/KG	660.60	991.2	PCI/KG	660.60
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		21	18							

Location=SED006

SEDIMENT TOTAL METAL SUMMARY ALL UNITS UG/KG

OBS	ANALYTE	Total Samples	Total CRQL Hits	CRQL	Maximum Hit	MAXHUNIT	Average Hit	MAXIMUM	MAXUNIT	Total Average
1	ALUMINUM	2	0	40000	.		.	14800	MG/KG	12650.00
2	ANTIMONY	2	0	12000	.		.	7.7 BN	MG/KG	4.42
3	ARSENIC	2	0	2000	.		.	4.5	MG/KG	2.80
4	BARIUM	2	0	40000	.		.	200	MG/KG	176.00
5	BERYLLIUM	2	0	1000	.		.	1.2	MG/KG	1.15
6	CADMIUM	2	0	1000	.		.	1.1 B	MG/KG	0.70
7	CALCIUM	2	0	2000000	.		.	6810 E	MG/KG	5400.00
8	CESIUM	2	0	200000	.		.	20.2 U	MG/KG	7.55
9	CHROMIUM	2	0	2000	.		.	10	MG/KG	9.00
10	COBALT	2	0	10000	.		.	10.5 B	MG/KG	8.70
11	COPPER	2	0	5000	.		.	30.5 *	MG/KG	22.75
12	IRON	2	1	20000	27700	MG/KG	27700	27700	MG/KG	22300.00
13	LEAD	2	0	1000	.		.	20.4	MG/KG	14.15
14	LITHIUM	1	0	20000	.		.	10.4 B	MG/KG	10.40
15	MAGNESIUM	2	0	2000000	.		.	2820 E	MG/KG	2425.00
16	MANGANESE	2	0	3000	.		.	360	MG/KG	304.50
17	MERCURY	3	0	200	.		.	0.5	MG/KG	0.26
18	MOLYBDENUM	2	0	40000	.		.	12 U	MG/KG	5.10
19	NICKEL	2	0	8000	.		.	15	MG/KG	14.50
20	POTASSIUM	2	0	2000000	.		.	3640	MG/KG	2730.00
21	SELENIUM	2	0	1000	.		.	0.53 B	MG/KG	0.29
22	SILVER	2	0	2000	.		.	1.2 U	MG/KG	0.50
23	SODIUM	2	0	2000000	.		.	170	MG/KG	132.25
24	STRONTIUM	2	0	40000	.		.	56	MG/KG	52.50
25	THALLIUM	2	0	2000	.		.	44	MG/KG	22.13
26	TIN	1	0	40000	.		.	17.6 B	MG/KG	17.60
27	VANADIUM	2	0	10000	.		.	44.4	MG/KG	42.20
28	ZINC	2	0	4000	.		.	71	MG/KG	68.80
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		55	1							

Location=SED006

SEDIMENT PESTICIDE/PCB SUMMARY ALL UNITS UG/KG

OBS	ANALYTE	Total Samples	Total CRQL Hits	CRQL	Maximum Hit	MAXHUNIT	Average Hit	MAXIMUM	MAXUNIT	Total Average
1	4,4'-DDD	2	0	16	.		.	43 U	UG/KG	11.500
2	4,4'-DDE	2	0	16	.		.	43 U	UG/KG	11.500
3	4,4'-DDT	2	0	16	.		.	43 U	UG/KG	11.500
4	ALDRIN	2	0	8	.		.	22 U	UG/KG	5.875
5	AROCLOR-1016	2	0	80	.		.	220 U	UG/KG	58.750
6	AROCLOR-1221	2	0	80	.		.	220 U	UG/KG	58.750
7	AROCLOR-1232	2	0	80	.		.	220 U	UG/KG	58.750
8	AROCLOR-1242	2	0	80	.		.	220 U	UG/KG	58.750
9	AROCLOR-1248	2	0	80	.		.	220 U	UG/KG	58.750
10	AROCLOR-1254	2	0	80	.		.	430 U	UG/KG	115.000
11	AROCLOR-1260	2	0	80	.		.	430 U	UG/KG	115.000
12	CHLORDANE	1	0	80	.		.	15 U	UG/KG	7.500
13	DIELDRIN	2	0	16	.		.	43 U	UG/KG	11.500
14	ENDOSULFAN I	2	0	8	.		.	22 U	UG/KG	5.875
15	ENDOSULFAN II	2	0	16	.		.	43 U	UG/KG	11.500
16	ENDOSULFAN SULFATE	2	0	16	.		.	43 U	UG/KG	11.500
17	ENDRIN	2	0	16	.		.	43 U	UG/KG	11.500
18	ENDRIN KETONE	2	0	16	.		.	43 U	UG/KG	11.500
19	HEPTACHLOR	2	0	8	.		.	22 U	UG/KG	5.875
20	HEPTACHLOR EPOXIDE	2	0	8	.		.	22 U	UG/KG	5.875
21	METHOXYCHLOR	2	0	80	.		.	220 U	UG/KG	58.750
22	TOXAPHENE	2	0	160	.		.	430 U	UG/KG	115.000
23	alpha-BHC	2	0	8	.		.	22 U	UG/KG	5.875
24	alpha-CHLORDANE	1	0	80	.		.	220 U	UG/KG	110.000
25	beta-BHC	2	0	8	.		.	22 U	UG/KG	5.875
26	delta-BHC	2	0	8	.		.	22 U	UG/KG	5.875
27	gamma-BHC (LINDANE)	2	0	8	.		.	22 U	UG/KG	5.875
28	gamma-CHLORDANE	1	0	80	.		.	220 U	UG/KG	110.000
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		53	0							

Location=SED006

SEDIMENT BASE NEUTRAL EXTRACTABLE SUMMARY ALL UNITS UG/KG

BS	ANALYTE	Total Samples	Total CRQL Hits	CRQL	Maximum Hit	MAXHUNIT	Average Hit	MAXIMUM	MAXUNIT	Total Average
1	1,2,4-TRICHLOROBENZENE	2	0	330	.		.	890 U	UG/KG	322.5
2	1,2-DICHLOROBENZENE	2	0	330	.		.	890 U	UG/KG	322.5
3	1,3-DICHLOROBENZENE	2	0	330	.		.	890 U	UG/KG	322.5
4	1,4-DICHLOROBENZENE	2	0	330	.		.	890 U	UG/KG	322.5
5	2,4-DINITROTOLUENE	2	0	330	.		.	890 U	UG/KG	322.5
6	2,6-DINITROTOLUENE	2	0	330	.		.	890 U	UG/KG	322.5
7	2-CHLORONAPHTHALENE	2	0	330	.		.	890 U	UG/KG	322.5
8	2-METHYLNAPHTHALENE	2	1	330	20 J	UG/KG	20	890 U	UG/KG	232.5
9	2-NITROANILINE	2	0	1600	.		.	4300 U	UG/KG	1575.0
10	3,3'-DICHLOROBENZIDINE	2	0	660	.		.	1800 U	UG/KG	650.0
11	3-NITROANILINE	2	0	1600	.		.	4300 U	UG/KG	1575.0
12	4-BROMOPHENYL PHENYL ETHER	2	0	330	.		.	890 U	UG/KG	322.5
13	4-CHLOROANILINE	2	0	330	.		.	890 U	UG/KG	322.5
14	4-CHLOROPHENYL PHENYL ETHER	2	0	330	.		.	890 U	UG/KG	322.5
15	4-NITROANILINE	2	0	1600	.		.	4300 U	UG/KG	1575.0
16	ACENAPHTHENE	2	1	330	240 J	UG/KG	240	890 U	UG/KG	342.5
17	ACENAPHTHYLENE	2	0	330	.		.	890 U	UG/KG	322.5
18	ANTHRACENE	2	1	330	400	UG/KG	400	890 U	UG/KG	422.5
19	BENZO(a)ANTHRACENE	2	1	330	520	UG/KG	520	890 U	UG/KG	482.5
20	BENZO(a)PYRENE	2	1	330	560	UG/KG	560	890 U	UG/KG	502.5
21	BENZO(b)FLUORANTHENE	2	1	330	880	UG/KG	880	890 U	UG/KG	662.5
22	BENZO(ghi)PERYLENE	2	1	330	680	UG/KG	680	890 U	UG/KG	562.5
23	BENZO(k)FLUORANTHENE	2	1	330	880	UG/KG	880	890 U	UG/KG	662.5
24	BIS(2-CHLOROETHOXY)METHANE	2	0	330	.		.	890 U	UG/KG	322.5
25	BIS(2-CHLOROETHYL)ETHER	2	0	330	.		.	890 U	UG/KG	322.5
26	BIS(2-CHLOROISOPROPYL)ETHER	2	0	330	.		.	890 U	UG/KG	322.5
27	BIS(2-ETHYLHEXYL)PHTHALATE	2	1	330	120 J	UG/KG	120	890 U	UG/KG	282.5
28	BUTYL BENZYL PHTHALATE	2	0	330	.		.	890 U	UG/KG	322.5
29	CHRYSENE	2	1	330	530	UG/KG	530	890 U	UG/KG	487.5
30	DI-n-BUTYL PHTHALATE	2	1	330	80 J	UG/KG	80	890 U	UG/KG	262.5
31	DI-n-OCTYL PHTHALATE	2	0	330	.		.	890 U	UG/KG	322.5
32	DIBENZO(a,h)ANTHRACENE	2	0	330	.		.	890 U	UG/KG	322.5
33	DIBENZOFURAN	2	1	330	160 J	UG/KG	160	890 U	UG/KG	302.5
34	DIETHYL PHTHALATE	2	0	330	.		.	890 U	UG/KG	322.5
35	DIMETHYL PHTHALATE	2	0	330	.		.	890 U	UG/KG	322.5
36	FLUORANTHENE	2	1	330	1600	UG/KG	1600	1600	UG/KG	1022.5
37	FLUORENE	2	1	330	160 J	UG/KG	160	890 U	UG/KG	302.5
38	HEXACHLOROBENZENE	2	0	330	.		.	890 U	UG/KG	322.5
39	HEXACHLOROBUTADIENE	2	0	330	.		.	890 U	UG/KG	322.5
40	HEXACHLOROCYCLOPENTADIENE	2	0	330	.		.	890 U	UG/KG	322.5
41	HEXACHLOROETHANE	2	0	330	.		.	890 U	UG/KG	322.5
42	INDENO(1,2,3-cd)PYRENE	2	1	330	560	UG/KG	560	890 U	UG/KG	502.5
43	ISOPHORONE	2	0	330	.		.	890 U	UG/KG	322.5
44	N-NITROSO-DI-n-PROPYLAMINE	2	0	330	.		.	890 U	UG/KG	322.5
45	N-NITROSODIPHENYLAMINE	2	1	330	360 JB	UG/KG	360	890 U	UG/KG	402.5
46	NAPHTHALENE	2	0	330	.		.	890 U	UG/KG	322.5
47	NITROBENZENE	2	0	330	.		.	890 U	UG/KG	322.5
48	PHENANTHRENE	2	1	330	1400	UG/KG	1400	1400	UG/KG	922.5
49	PYRENE	2	1	330	1300	UG/KG	1300	1300	UG/KG	872.5
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		98	18							

Location=SED006

SEDIMENT ACID EXTRACTABLE SUMMARY ALL UNITS UG/KG

OBS	ANALYTE	Total Samples	Total CRQL Hits	CRQL	Maximum Hit	MAXHUNIT	Average Hit	MAXIMUM	MAXUNIT	Total Average
1	2,4,5-TRICHLOROPHENOL	2	0	1600	.		.	4300 U	UG/KG	1575.0
2	2,4,6-TRICHLOROPHENOL	2	0	330	.		.	890 U	UG/KG	322.5
3	2,4-DICHLOROPHENOL	2	0	330	.		.	890 U	UG/KG	322.5
4	2,4-DIMETHYLPHENOL	2	0	330	.		.	890 U	UG/KG	322.5
5	2,4-DINITROPHENOL	2	0	1600	.		.	4300 U	UG/KG	1575.0
6	2-CHLOROPHENOL	2	0	330	.		.	890 U	UG/KG	322.5
7	2-METHYLPHENOL	2	0	330	.		.	890 U	UG/KG	322.5
8	2-NITROPHENOL	2	0	330	.		.	890 U	UG/KG	322.5
9	4,6-DINITRO-2-METHYLPHENOL	2	0	1600	.		.	4300 U	UG/KG	1575.0
10	4-CHLORO-3-METHYLPHENOL	2	0	330	.		.	890 U	UG/KG	322.5
11	4-METHYLPHENOL	2	0	330	.		.	890 U	UG/KG	322.5
12	4-NITROPHENOL	2	0	1600	.		.	4300 U	UG/KG	1575.0
13	BENZOIC ACID	2	0	1600	.		.	4300 U	UG/KG	1575.0
14	BENZYL ALCOHOL	2	0	330	.		.	890 U	UG/KG	322.5
15	PENTACHLOROPHENOL	2	0	1600	.		.	4300 U	UG/KG	1575.0
16	PHENOL	2	0	330	.		.	890 U	UG/KG	322.5
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		32	0							

Location=SED006

SEDIMENT VOA SUMMARY All UNITS UG/KG

BS	ANALYTE	Total Samples	Total CRQL Hits	CRQL	Maximum Hit	MAXHUNIT	Average Hit	MAXIMUM	MAXUNIT	Total Average
1	1,1,1-TRICHLOROETHANE	2	0	5	.		.	7 U	UG/KG	3.00
2	1,1,2,2-TETRACHLOROETHANE	2	0	5	.		.	7 U	UG/KG	3.00
3	1,1,2-TRICHLOROETHANE	2	0	5	.		.	7 U	UG/KG	3.00
4	1,1-DICHLOROETHANE	2	0	5	.		.	7 U	UG/KG	3.00
5	1,1-DICHLOROETHENE	2	0	5	.		.	7 U	UG/KG	3.00
6	1,2-DICHLOROETHANE	2	0	5	.		.	7 U	UG/KG	3.00
7	1,2-DICHLOROETHENE	1	0	5	.		.	7 U	UG/KG	3.50
8	1,2-DICHLOROPROPANE	2	0	5	.		.	7 U	UG/KG	3.00
9	2-BUTANONE	2	2	10	30 B	UG/KG	24.5	30 B	UG/KG	24.50
10	2-CHLOROETHYL VINYL ETHER	1	0	0	.		.	10 U	UG/KG	5.00
11	2-HEXANONE	2	0	10	.		.	14 U	UG/KG	6.00
12	4-METHYL-2-PENTANONE	2	0	10	.		.	14 U	UG/KG	6.00
13	ACETONE	2	2	10	106	UG/KG	77.0	106	UG/KG	77.00
14	BENZENE	2	0	5	.		.	7 U	UG/KG	3.00
15	BROMODICHLOROMETHANE	2	0	5	.		.	7 U	UG/KG	3.00
16	BROMOFORM	2	0	5	.		.	7 U	UG/KG	3.00
17	BROMOMETHANE	2	0	10	.		.	14 U	UG/KG	6.00
18	CARBON DISULFIDE	2	1	5	1 J	UG/KG	1.0	7 U	UG/KG	2.25
19	CARBON TETRACHLORIDE	2	0	5	.		.	7 U	UG/KG	3.00
20	CHLOROBENZENE	2	0	5	.		.	7 U	UG/KG	3.00
21	CHLOROETHANE	2	0	10	.		.	14 U	UG/KG	6.00
22	CHLOROFORM	2	0	5	.		.	7 U	UG/KG	3.00
23	CHLOROMETHANE	2	0	10	.		.	14 U	UG/KG	6.00
24	DIBROMOCHLOROMETHANE	2	0	5	.		.	7 U	UG/KG	3.00
25	ETHYLBENZENE	2	0	5	.		.	7 U	UG/KG	3.00
[illegible]	METHYLENE CHLORIDE	2	2	5	2 BJ	UG/KG	1.5	2 BJ	UG/KG	1.50
27	STYRENE	2	0	5	.		.	7 U	UG/KG	3.00
28	TETRACHLOROETHENE	2	0	5	.		.	7 U	UG/KG	3.00
29	TOLUENE	2	0	5	.		.	7 U	UG/KG	3.00
30	TOTAL XYLENES	2	0	5	.		.	7 U	UG/KG	3.00
31	TRICHLOROETHENE	2	0	5	.		.	7 U	UG/KG	3.00
32	VINYL ACETATE	2	0	10	.		.	14 U	UG/KG	6.00
33	VINYL CHLORIDE	2	0	10	.		.	14 U	UG/KG	6.00
34	cis-1,3-DICHLOROPROPENE	2	0	5	.		.	7 U	UG/KG	3.00
35	trans-1,2-DICHLOROETHENE	1	0	5	.		.	5 U	UG/KG	2.50
36	trans-1,3-DICHLOROPROPENE	2	0	5	.		.	7 U	UG/KG	3.00
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		69	7							

Location=SED003

SEDIMENT TOTAL RAD SUMMARY ALL UNITS PCI/KG

OBS	ANALYTE	Total Samples	Total CRQL Hits	CRQL	Maximum Hit	MAXHUNIT	Average Hit	MAXIMUM	MAXUNIT	Total Average
1	AMERICIUM-241	1	1	20	420	PCI/KG	420.00	420	PCI/KG	420.00
2	CESIUM-137	1	1	100	900	PCI/KG	900.00	900	PCI/KG	900.00
3	GROSS ALPHA PARTICLE RADIOAC	1	1	4000	24000	PCI/KG	24000.00	24000	PCI/KG	24000.00
4	GROSS BETA PARTICLE RADIOACT	1	1	10000	32000	PCI/KG	32000.00	32000	PCI/KG	32000.00
5	PLUTONIUM-239	1	1	30	1900	PCI/KG	1900.00	1900	PCI/KG	1900.00
6	TRITIUM	1	0	400000	.		.	-30	PCI/L	-30.00
7	URANIUM, TOTAL	1	1	0	1.95		1.95	1.95		1.95
8	URANIUM-233,-234	1	1	300	950	PCI/KG	950.00	950	PCI/KG	950.00
9	URANIUM-238	1	1	300	1000	PCI/KG	1000.00	1000	PCI/KG	1000.00
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		9	8							

Location=SED003

SEDIMENT TOTAL METAL SUMMARY ALL UNITS UG/KG

	ANALYTE	Total Samples	Total CRQL Hits	CRQL	Maximum Hit	MAXHUNIT	Average Hit	MAXIMUM	MAXUNIT	Total Average
1	ALUMINUM	2	1	40000	10000000	UG/KG	10000000	10000000	UG/KG	5000004.85
2	ANTIMONY	2	0	12000	.		.	15000 U	UG/KG	3751.43
3	ARSENIC	2	1	2000	4200	UG/KG	4200	4200	UG/KG	2100.05
4	BARIUM	2	1	40000	154000	UG/KG	154000	154000	UG/KG	77028.50
5	BERYLLIUM	2	0	1000	.		.	1300 U	UG/KG	326.15
6	CADMIUM	2	1	1000	1800	UG/KG	1800	1800	UG/KG	900.15
7	CALCIUM	2	1	2000000	4940000	UG/KG	4940000	4940000	UG/KG	2470355.00
8	CESIUM	2	0	200000	.		.	251000 U	UG/KG	62752.75
9	CHROMIUM	2	1	2000	14700	UG/KG	14700	14700	UG/KG	7358.00
10	COBALT	2	0	10000	.		.	12500 U	UG/KG	3129.00
11	COPPER	2	1	5000	16300	UG/KG	16300	16300	UG/KG	8159.50
12	IRON	2	1	20000	16000000	UG/KG	16000000	16000000	UG/KG	8006250.00
13	LEAD	2	1	1000	26100	UG/KG	26100	26100	UG/KG	13057.00
14	LITHIUM	1	0	20000	.		.	25100 U	UG/KG	12550.00
15	MAGNESIUM	2	1	2000000	2580000	UG/KG	2580000	2580000	UG/KG	1290125.00
16	MANGANESE	2	1	3000	152000	UG/KG	152000	152000	UG/KG	76100.00
17	MERCURY	2	0	200	.		.	130 U	UG/KG	32.63
18	MOLYBDENUM	2	0	40000	.		.	25100 U	UG/KG	6280.50
19	NICKEL	2	1	8000	16500	UG/KG	16500	16500	UG/KG	8257.00
20	POTASSIUM	2	0	2000000	.		.	1290000	UG/KG	646305.00
21	SELENIUM	2	0	1000	.		.	1300 U	UG/KG	325.06
22	SILVER	2	1	2000	21200	UG/KG	21200	21200	UG/KG	10601.10
23	SODIUM	2	0	2000000	.		.	1250000 U	UG/KG	312557.50
24	STRONTIUM	2	0	40000	.		.	251000 U	UG/KG	62757.00
25	THALLIUM	2	0	2000	.		.	2500 U	UG/KG	625.27
26	TIN	1	0	40000	.		.	25100 U	UG/KG	12550.00
27	VANADIUM	2	1	10000	39600	UG/KG	39600	39600	UG/KG	19816.00
28	ZINC	2	1	4000	74200	UG/KG	74200	74200	UG/KG	37135.50
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		54	15							

Location=SED003

SEDIMENT PESTICIDE/PCB SUMMARY ALL UNITS UG/KG

OBS	ANALYTE	Total Samples	Total CRQL Hits	CRQL	Maximum Hit	MAXHUNIT	Average Hit	MAXIMUM	MAXUNIT	Total Average
1	4,4'-DDD	1	0	16	.		.	4 U	UG/KG	2
2	4,4'-DDE	1	0	16	.		.	4 U	UG/KG	2
3	4,4'-DDT	1	0	16	.		.	4 U	UG/KG	2
4	ALDRIN	1	0	8	.		.	2 U	UG/KG	1
5	AROCLOR-1016	1	0	80	.		.	20 U	UG/KG	10
6	AROCLOR-1221	1	0	80	.		.	20 U	UG/KG	10
7	AROCLOR-1232	1	0	80	.		.	20 U	UG/KG	10
8	AROCLOR-1242	1	0	80	.		.	20 U	UG/KG	10
9	AROCLOR-1248	1	0	80	.		.	20 U	UG/KG	10
10	AROCLOR-1254	1	0	80	.		.	40 U	UG/KG	20
11	AROCLOR-1260	1	0	80	.		.	40 U	UG/KG	20
12	CHLORDANE	1	0	80	.		.	20 U	UG/KG	10
13	DIELDRIN	1	0	16	.		.	4 U	UG/KG	2
14	ENDOSULFAN I	1	0	8	.		.	2 U	UG/KG	1
15	ENDOSULFAN II	1	0	16	.		.	4 U	UG/KG	2
16	ENDOSULFAN SULFATE	1	0	16	.		.	4 U	UG/KG	2
17	ENDRIN	1	0	16	.		.	4 U	UG/KG	2
18	ENDRIN KETONE	1	0	16	.		.	4 U	UG/KG	2
19	HEPTACHLOR	1	0	8	.		.	2 U	UG/KG	1
20	HEPTACHLOR EPOXIDE	1	0	8	.		.	2 U	UG/KG	1
21	METHOXYCHLOR	1	0	80	.		.	20 U	UG/KG	10
22	TOXAPHENE	1	0	160	.		.	40 U	UG/KG	20
23	alpha-BHC	1	0	8	.		.	2 U	UG/KG	1
24	beta-BHC	1	0	8	.		.	2 U	UG/KG	1
25	delta-BHC	1	0	8	.		.	2 U	UG/KG	1
26	gamma-BHC (LINDANE)	1	0	8	.		.	2 U	UG/KG	1
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		26	0							

Location=SED003

SEDIMENT BASE NEUTRAL EXTRACTABLE SUMMARY ALL UNITS UG/KG

OBS	ANALYTE	Total Samples	Total CRQL Hits	CRQL	Maximum Hit	MAXHUNIT	Average Hit	MAXIMUM	MAXUNIT	Total Average
1	1,2,4-TRICHLOROBENZENE	2	0	330	.		.	430 U	UG/KG	205.0
2	1,2-DICHLOROBENZENE	2	0	330	.		.	430 U	UG/KG	205.0
3	1,3-DICHLOROBENZENE	2	0	330	.		.	430 U	UG/KG	205.0
4	1,4-DICHLOROBENZENE	2	0	330	.		.	430 U	UG/KG	205.0
5	2,4-DINITROTOLUENE	2	0	330	.		.	430 U	UG/KG	205.0
6	2,6-DINITROTOLUENE	2	0	330	.		.	430 U	UG/KG	205.0
7	2-CHLORONAPHTHALENE	2	0	330	.		.	430 U	UG/KG	205.0
8	2-METHYLNAPHTHALENE	2	0	330	.		.	430 U	UG/KG	205.0
9	2-NITROANILINE	2	0	1600	.		.	2200 U	UG/KG	1050.0
10	3,3'-DICHLOROBENZIDINE	2	0	660	.		.	870 U	UG/KG	412.5
11	3-NITROANILINE	2	0	1600	.		.	2200 U	UG/KG	1050.0
12	4-BROMOPHENYL PHENYL ETHER	2	0	330	.		.	430 U	UG/KG	205.0
13	4-CHLOROANILINE	2	0	330	.		.	430 U	UG/KG	205.0
14	4-CHLOROPHENYL PHENYL ETHER	2	0	330	.		.	430 U	UG/KG	205.0
15	4-NITROANILINE	2	0	1600	.		.	2200 U	UG/KG	1050.0
16	ACENAPHTHENE	2	0	330	.		.	430 U	UG/KG	205.0
17	ACENAPHTHYLENE	2	0	330	.		.	430 U	UG/KG	205.0
18	ANTHRACENE	2	0	330	.		.	430 U	UG/KG	205.0
19	BENZO(a)ANTHRACENE	2	0	330	.		.	430 U	UG/KG	205.0
20	BENZO(a)PYRENE	2	0	330	.		.	430 U	UG/KG	205.0
21	BENZO(b)FLUORANTHENE	2	0	330	.		.	430 U	UG/KG	205.0
22	BENZO(ghi)PERYLENE	2	0	330	.		.	430 U	UG/KG	205.0
23	BENZO(k)FLUORANTHENE	2	0	330	.		.	430 U	UG/KG	205.0
24	BIS(2-CHLOROETHOXY)METHANE	2	0	330	.		.	430 U	UG/KG	205.0
25	BIS(2-CHLOROETHYL)ETHER	2	0	330	.		.	430 U	UG/KG	205.0
26	BIS(2-CHLOROISOPROPYL)ETHER	2	0	330	.		.	430 U	UG/KG	205.0
27	BIS(2-ETHYLHEXYL)PHTHALATE	2	1	330	190 JB	UG/KG	190	430 U	UG/KG	202.5
28	BUTYL BENZYL PHTHALATE	2	0	330	.		.	430 U	UG/KG	205.0
29	CHRYSENE	2	0	330	.		.	430 U	UG/KG	205.0
30	DI-n-BUTYL PHTHALATE	2	2	330	390 B	UG/KG	244	390 B	UG/KG	244.0
31	DI-n-OCTYL PHTHALATE	2	0	330	.		.	430 U	UG/KG	205.0
32	DIBENZO(a,h)ANTHRACENE	2	0	330	.		.	430 U	UG/KG	205.0
33	DIBENZOFURAN	2	0	330	.		.	430 U	UG/KG	205.0
34	DIETHYL PHTHALATE	2	0	330	.		.	430 U	UG/KG	205.0
35	DIMETHYL PHTHALATE	2	0	330	.		.	430 U	UG/KG	205.0
36	FLUORANTHENE	2	0	330	.		.	430 U	UG/KG	205.0
37	FLUORENE	2	0	330	.		.	430 U	UG/KG	205.0
38	HEXACHLOROBENZENE	2	0	330	.		.	430 U	UG/KG	205.0
39	HEXACHLOROBUTADIENE	2	0	330	.		.	430 U	UG/KG	205.0
40	HEXACHLOROCYCLOPENTADIENE	2	0	330	.		.	430 U	UG/KG	205.0
41	HEXACHLOROETHANE	2	0	330	.		.	430 U	UG/KG	205.0
42	INDENO(1,2,3-cd)PYRENE	2	0	330	.		.	430 U	UG/KG	205.0
43	ISOPHORONE	2	0	330	.		.	430 U	UG/KG	205.0
44	N-NITROSO-DI-n-PROPYLAMINE	2	0	330	.		.	430 U	UG/KG	205.0
45	N-NITROSODIPHENYLAMINE	2	1	330	1100 B	UG/KG	1100	1100 B	UG/KG	657.5
46	NAPHTHALENE	2	0	330	.		.	430 U	UG/KG	205.0
47	NITROBENZENE	2	0	330	.		.	430 U	UG/KG	205.0
48	PHENANTHRENE	2	0	330	.		.	430 U	UG/KG	205.0
49	PYRENE	2	0	330	.		.	430 U	UG/KG	205.0
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		98	4							

Location=SED003

SEDIMENT ACID EXTRACTABLE SUMMARY ALL UNITS UG/KG

NUMS	ANALYTE	Total Samples	Total CRQL Hits	CRQL	Maximum Hit	MAXHUNIT	Average Hit	MAXIMUM	MAXUNIT	Total Average
1	2,4,5-TRICHLOROPHENOL	2	0	1600	.		.	2200 U	UG/KG	1050
2	2,4,6-TRICHLOROPHENOL	2	0	330	.		.	430 U	UG/KG	205
3	2,4-DICHLOROPHENOL	2	0	330	.		.	430 U	UG/KG	205
4	2,4-DIMETHYLPHENOL	2	0	330	.		.	430 U	UG/KG	205
5	2,4-DINITROPHENOL	2	0	1600	.		.	2200 U	UG/KG	1050
6	2-CHLOROPHENOL	2	0	330	.		.	430 U	UG/KG	205
7	2-METHYLPHENOL	2	0	330	.		.	430 U	UG/KG	205
8	2-NITROPHENOL	2	0	330	.		.	430 U	UG/KG	205
9	4,6-DINITRO-2-METHYLPHENOL	2	0	1600	.		.	2200 U	UG/KG	1050
10	4-CHLORO-3-METHYLPHENOL	2	0	330	.		.	430 U	UG/KG	205
11	4-METHYLPHENOL	2	0	330	.		.	430 U	UG/KG	205
12	4-NITROPHENOL	2	0	1600	.		.	2200 U	UG/KG	1050
13	BENZOIC ACID	2	0	1600	.		.	2200 U	UG/KG	1050
14	BENZYL ALCOHOL	2	0	330	.		.	430 U	UG/KG	205
15	PENTACHLOROPHENOL	2	0	1600	.		.	2200 U	UG/KG	1050
16	PHENOL	2	0	330	.		.	430 U	UG/KG	205
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		32	0							

Location=SED003

SEDIMENT VOA SUMMARY All UNITS UG/KG

S	ANALYTE	Total Samples	Total CRQL Hits	CRQL	Maximum Hit	MAXHUNIT	Average Hit	MAXIMUM	MAXUNIT	Total Average
1	1,1,1-TRICHLOROETHANE	2	0	5	.		.	6 U	UG/KG	2.75
2	1,1,2,2-TETRACHLOROETHANE	2	0	5	.		.	6 U	UG/KG	2.75
3	1,1,2-TRICHLOROETHANE	2	0	5	.		.	6 U	UG/KG	2.75
4	1,1-DICHLOROETHANE	2	0	5	.		.	6 U	UG/KG	2.75
5	1,1-DICHLOROETHENE	2	0	5	.		.	6 U	UG/KG	2.75
6	1,2-DICHLOROETHANE	2	0	5	.		.	6 U	UG/KG	2.75
7	1,2-DICHLOROETHENE	1	0	5	.		.	6 U	UG/KG	3.00
8	1,2-DICHLOROPROPANE	2	0	5	.		.	6 U	UG/KG	2.75
9	2-BUTANONE	2	1	10	2 JB	UG/KG	2.0	10 U	UG/KG	3.50
10	2-CHLOROETHYL VINYL ETHER	1	0	0	.		.	10 U	UG/KG	5.00
11	2-HEXANONE	2	0	10	.		.	13 U	UG/KG	5.75
12	4-METHYL-2-PENTANONE	2	0	10	.		.	13 U	UG/KG	5.75
13	ACETONE	2	1	10	240	UG/KG	240.0	240	UG/KG	123.25
14	BENZENE	2	0	5	.		.	6 U	UG/KG	2.75
15	BROMODICHLOROMETHANE	2	0	5	.		.	6 U	UG/KG	2.75
16	BROMOFORM	2	0	5	.		.	6 U	UG/KG	2.75
17	BROMOMETHANE	2	0	10	.		.	13 U	UG/KG	5.75
18	CARBON DISULFIDE	2	0	5	.		.	6 U	UG/KG	2.75
19	CARBON TETRACHLORIDE	2	0	5	.		.	6 U	UG/KG	2.75
20	CHLOROBENZENE	2	0	5	.		.	6 U	UG/KG	2.75
21	CHLOROETHANE	2	0	10	.		.	13 U	UG/KG	5.75
22	CHLOROFORM	2	0	5	.		.	6 U	UG/KG	2.75
23	CHLOROMETHANE	2	0	10	.		.	13 U	UG/KG	5.75
24	DIBROMOCHLOROMETHANE	2	0	5	.		.	6 U	UG/KG	2.75
25	ETHYLBENZENE	2	0	5	.		.	6 U	UG/KG	2.75
[illegible]	METHYLENE CHLORIDE	2	2	5	90	UG/KG	48.5	90	UG/KG	48.50
27	STYRENE	2	0	5	.		.	6 U	UG/KG	2.75
28	TETRACHLOROETHENE	2	0	5	.		.	6 U	UG/KG	2.75
29	TOLUENE	2	0	5	.		.	6 U	UG/KG	2.75
30	TOTAL XYLENES	2	0	5	.		.	6 U	UG/KG	2.75
31	TRICHLOROETHENE	2	0	5	.		.	6 U	UG/KG	2.75
32	VINYL ACETATE	2	0	10	.		.	13 U	UG/KG	5.75
33	VINYL CHLORIDE	2	0	10	.		.	13 U	UG/KG	5.75
34	cis-1,3-DICHLOROPROPENE	2	0	5	.		.	6 U	UG/KG	2.75
35	trans-1,2-DICHLORDETHENE	1	0	5	.		.	5 U	UG/KG	2.50
36	trans-1,3-DICHLOROPROPENE	2	0	5	.		.	6 U	UG/KG	2.75
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		69	4							

Location=SED007

SEDIMENT BASE NEUTRAL EXTRACTABLE SUMMARY ALL UNITS UG/KG

BS	ANALYTE	Total Samples	Total CRQL Hits	CRQL	Maximum Hit	MAXHUNIT	Average Hit	MAXIMUM	MAXUNIT	Total Average
1	1,2,4-TRICHLOROBENZENE	1	0	330	.		.	400 U	UG/KG	200
2	1,2-DICHLOROBENZENE	1	0	330	.		.	400 U	UG/KG	200
3	1,3-DICHLOROBENZENE	1	0	330	.		.	400 U	UG/KG	200
4	1,4-DICHLOROBENZENE	1	0	330	.		.	400 U	UG/KG	200
5	2,4-DINITROTOLUENE	1	0	330	.		.	400 U	UG/KG	200
6	2,6-DINITROTOLUENE	1	0	330	.		.	400 U	UG/KG	200
7	2-CHLORONAPHTHALENE	1	0	330	.		.	400 U	UG/KG	200
8	2-METHYLNAPHTHALENE	1	0	330	.		.	400 U	UG/KG	200
9	2-NITROANILINE	1	0	1600	.		.	2000 U	UG/KG	1000
10	3,3'-DICHLOROBENZIDINE	1	0	660	.		.	800 U	UG/KG	400
11	3-NITROANILINE	1	0	1600	.		.	2000 U	UG/KG	1000
12	4-BROMOPHENYL PHENYL ETHER	1	0	330	.		.	400 U	UG/KG	200
13	4-CHLOROANILINE	1	0	330	.		.	400 U	UG/KG	200
14	4-CHLOROPHENYL PHENYL ETHER	1	0	330	.		.	400 U	UG/KG	200
15	4-NITROANILINE	1	0	1600	.		.	2000 U	UG/KG	1000
16	ACENAPHTHENE	1	0	330	.		.	400 U	UG/KG	200
17	ACENAPHTHYLENE	1	0	330	.		.	400 U	UG/KG	200
18	ANTHRACENE	1	0	330	.		.	400 U	UG/KG	200
19	BENZO(a)ANTHRACENE	1	0	330	.		.	400 U	UG/KG	200
20	BENZO(a)PYRENE	1	0	330	.		.	400 U	UG/KG	200
21	BENZO(b)FLUORANTHENE	1	0	330	.		.	400 U	UG/KG	200
22	BENZO(ghi)PERYLENE	1	0	330	.		.	400 U	UG/KG	200
23	BENZO(k)FLUORANTHENE	1	0	330	.		.	400 U	UG/KG	200
24	BIS(2-CHLOROETHOXY)METHANE	1	0	330	.		.	400 U	UG/KG	200
25	BIS(2-CHLOROETHYL)ETHER	1	0	330	.		.	400 U	UG/KG	200
26	BIS(2-CHLOROISOPROPYL)ETHER	1	0	330	.		.	400 U	UG/KG	200
27	BIS(2-ETHYLHEXYL)PHTHALATE	1	1	330	200 J	UG/KG	200	200 J	UG/KG	200
28	BUTYL BENZYL PHTHALATE	1	0	330	.		.	400 U	UG/KG	200
29	CHRYSENE	1	0	330	.		.	400 U	UG/KG	200
30	DI-n-BUTYL PHTHALATE	1	0	330	.		.	400 U	UG/KG	200
31	DI-n-OCTYL PHTHALATE	1	0	330	.		.	400 U	UG/KG	200
32	DIBENZO(a,h)ANTHRACENE	1	0	330	.		.	400 U	UG/KG	200
33	DIBENZOFURAN	1	0	330	.		.	400 U	UG/KG	200
34	DIETHYL PHTHALATE	1	0	330	.		.	400 U	UG/KG	200
35	DIMETHYL PHTHALATE	1	0	330	.		.	400 U	UG/KG	200
36	FLUORANTHENE	1	0	330	.		.	400 U	UG/KG	200
37	FLUORENE	1	0	330	.		.	400 U	UG/KG	200
38	HEXACHLOROBENZENE	1	0	330	.		.	400 U	UG/KG	200
39	HEXACHLOROBUTADIENE	1	0	330	.		.	400 U	UG/KG	200
40	HEXACHLOROCYCLOPENTADIENE	1	0	330	.		.	400 U	UG/KG	200
41	HEXACHLOROETHANE	1	0	330	.		.	400 U	UG/KG	200
42	INDENO(1,2,3-cd)PYRENE	1	0	330	.		.	400 U	UG/KG	200
43	ISOPHORONE	1	0	330	.		.	400 U	UG/KG	200
44	N-NITROSO-DI-n-PROPYLAMINE	1	0	330	.		.	400 U	UG/KG	200
45	N-NITROSODIPHENYLAMINE	1	1	330	240 JB	UG/KG	240	240 JB	UG/KG	240
46	NAPHTHALENE	1	0	330	.		.	400 U	UG/KG	200
47	NITROBENZENE	1	0	330	.		.	400 U	UG/KG	200
48	PHENANTHRENE	1	0	330	.		.	400 U	UG/KG	200
49	PYRENE	1	0	330	.		.	400 U	UG/KG	200
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		49	2							

Location=SED007

SEDIMENT PESTICIDE/PCB SUMMARY ALL UNITS UG/KG

OBS	ANALYTE	Total Samples	Total CRQL Hits	CRQL	Maximum Hit	MAXHUNIT	Average Hit	MAXIMUM	MAXUNIT	Total Average
1	4,4'-DDD	1	0	16	.		.	3 U	UG/KG	1.50
2	4,4'-DDE	1	0	16	.		.	3 U	UG/KG	1.50
3	4,4'-DDT	1	0	16	.		.	3 U	UG/KG	1.50
4	ALDRIN	1	0	8	.		.	1.5 U	UG/KG	0.75
5	AROCLOR-1016	1	0	80	.		.	15 U	UG/KG	7.50
6	AROCLOR-1221	1	0	80	.		.	15 U	UG/KG	7.50
7	AROCLOR-1232	1	0	80	.		.	15 U	UG/KG	7.50
8	AROCLOR-1242	1	0	80	.		.	15 U	UG/KG	7.50
9	AROCLOR-1248	1	0	80	.		.	15 U	UG/KG	7.50
10	AROCLOR-1254	1	0	80	.		.	30 U	UG/KG	15.00
11	AROCLOR-1260	1	0	80	.		.	30 U	UG/KG	15.00
12	CHLORDANE	1	0	80	.		.	15 U	UG/KG	7.50
13	DIELDRIN	1	0	16	.		.	3 U	UG/KG	1.50
14	ENDOSULFAN I	1	0	8	.		.	1.5 U	UG/KG	0.75
15	ENDOSULFAN II	1	0	16	.		.	3 U	UG/KG	1.50
16	ENDOSULFAN SULFATE	1	0	16	.		.	3 U	UG/KG	1.50
17	ENDRIN	1	0	16	.		.	3 U	UG/KG	1.50
18	ENDRIN KETONE	1	0	16	.		.	3 U	UG/KG	1.50
19	HEPTACHLOR	1	0	8	.		.	1.5 U	UG/KG	0.75
20	HEPTACHLOR EPOXIDE	1	0	8	.		.	1.5 U	UG/KG	0.75
21	METHOXYCHLOR	1	0	80	.		.	15 U	UG/KG	7.50
22	TOXAPHENE	1	0	160	.		.	30 U	UG/KG	15.00
23	alpha-BHC	1	0	8	.		.	1.5 U	UG/KG	0.75
24	beta-BHC	1	0	8	.		.	1.7 U	UG/KG	0.85
25	delta-BHC	1	0	8	.		.	1.5 U	UG/KG	0.75
26	gamma-BHC (LINDANE)	1	0	8	.		.	1.5 U	UG/KG	0.75
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		26	0							

Location=SED007

SEDIMENT TOTAL RAD SUMMARY ALL UNITS PCI/KG

OBS	ANALYTE	Total Samples	Total CRQL Hits	CRQL	Maximum Hit	MAXHUNIT	Average Hit	MAXIMUM	MAXUNIT	Total Average
1	AMERICIUM-241	1	0	20	.		.	10	PCI/KG	10.00
2	GROSS ALPHA PARTICLE RADIOAC	1	1	4000	26000	PCI/KG	26000.00	26000	PCI/KG	26000.00
3	GROSS BETA PARTICLE RADIOACT	1	1	10000	22000	PCI/KG	22000.00	22000	PCI/KG	22000.00
4	PLUTONIUM-239	1	0	30	.		.	0	PCI/KG	0.00
5	TRITIUM	1	0	400000	.		.	120	PCI/L	120.00
6	URANIUM, TOTAL	1	1	0	1.39		1.39	1.39		1.39
7	URANIUM-233,-234	1	1	300	760	PCI/KG	760.00	760	PCI/KG	760.00
8	URANIUM-238	1	1	300	630	PCI/KG	630.00	630	PCI/KG	630.00
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		8	5							

Location=SED008

SEDIMENT VOA SUMMARY All UNITS UG/KG

BS	ANALYTE	Total Samples	Total CRQL Hits	CRQL	Maximum Hit	MAXHUNIT	Average Hit	MAXIMUM	MAXUNIT	Total Average
1	1,1,1-TRICHLOROETHANE	4	0	5	.		.	9 U	UG/KG	3.500
2	1,1,2,2-TETRACHLOROETHANE	4	0	5	.		.	9 U	UG/KG	3.500
3	1,1,2-TRICHLOROETHANE	4	0	5	.		.	9 U	UG/KG	3.500
4	1,1-DICHLOROETHANE	4	0	5	.		.	9 U	UG/KG	3.500
5	1,1-DICHLOROETHENE	4	0	5	.		.	9 U	UG/KG	3.500
6	1,2-DICHLOROETHANE	4	0	5	.		.	9 U	UG/KG	3.500
7	1,2-DICHLOROETHENE	3	0	5	.		.	9 U	UG/KG	3.833
8	1,2-DICHLOROPROPANE	4	0	5	.		.	9 U	UG/KG	3.500
9	2-BUTANONE	4	1	10	18 B	UG/KG	18.000	18 U	UG/KG	9.875
10	2-CHLOROETHYL VINYL ETHER	1	0	0	.		.	10 U	UG/KG	5.000
11	2-HEXANONE	4	0	10	.		.	18 U	UG/KG	6.875
12	4-METHYL-2-PENTANONE	4	0	10	.		.	18 U	UG/KG	6.875
13	ACETONE	4	4	10	114	UG/KG	42.750	114	UG/KG	42.750
14	BENZENE	4	0	5	.		.	9 U	UG/KG	3.500
15	BROMODICHLOROMETHANE	4	0	5	.		.	9 U	UG/KG	3.500
16	BROMOFORM	4	0	5	.		.	9 U	UG/KG	3.500
17	BROMOMETHANE	4	0	10	.		.	18 U	UG/KG	6.875
18	CARBON DISULFIDE	4	0	5	.		.	9 U	UG/KG	3.500
19	CARBON TETRACHLORIDE	4	0	5	.		.	9 U	UG/KG	3.500
20	CHLOROBENZENE	4	0	5	.		.	9 U	UG/KG	3.500
21	CHLOROETHANE	4	0	10	.		.	18 U	UG/KG	6.875
22	CHLOROFORM	4	1	5	5 J	UG/KG	5.000	9 U	UG/KG	3.750
23	CHLOROMETHANE	4	0	10	.		.	18 U	UG/KG	6.875
24	DIBROMOCHLOROMETHANE	4	0	5	.		.	9 U	UG/KG	3.500
25	ETHYLBENZENE	4	0	5	.		.	9 U	UG/KG	3.500
26	METHYLENE CHLORIDE	4	3	5	25 B	UG/KG	13.667	25 B	UG/KG	11.000
27	STYRENE	4	0	5	.		.	9 U	UG/KG	3.500
28	TETRACHLOROETHENE	4	0	5	.		.	9 U	UG/KG	3.500
29	TOLUENE	4	0	5	.		.	9 U	UG/KG	3.500
30	TOTAL XYLENES	4	0	5	.		.	9 U	UG/KG	3.500
31	TRICHLOROETHENE	4	0	5	.		.	9 U	UG/KG	3.500
32	VINYL ACETATE	4	0	10	.		.	18 U	UG/KG	6.875
33	VINYL CHLORIDE	4	0	10	.		.	18 U	UG/KG	6.875
34	cis-1,3-DICHLOROPROPENE	4	0	5	.		.	9 U	UG/KG	3.500
35	trans-1,2-DICHLOROETHENE	1	0	5	.		.	5 U	UG/KG	2.500
36	trans-1,3-DICHLOROPROPENE	4	0	5	.		.	9 U	UG/KG	3.500
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		137	9							

Location=SED008

SEDIMENT ACID EXTRACTABLE SUMMARY ALL UNITS UG/KG

OBS	ANALYTE	Total Samples	Total CRQL Hits	CRQL	Maximum Hit	MAXHUNIT	Average Hit	MAXIMUM	MAXUNIT	Total Average
1	2,4,5-TRICHLOROPHENOL	4	0	1600	.		.	6400 U	UG/KG	2087.5
2	2,4,6-TRICHLOROPHENOL	4	0	330	.		.	1300 U	UG/KG	420.0
3	2,4-DICHLOROPHENOL	4	0	330	.		.	1300 U	UG/KG	420.0
4	2,4-DIMETHYLPHENOL	4	0	330	.		.	1300 U	UG/KG	420.0
5	2,4-DINITROPHENOL	4	0	1600	.		.	6400 U	UG/KG	2087.5
6	2-CHLOROPHENOL	4	0	330	.		.	1300 U	UG/KG	420.0
7	2-METHYLPHENOL	4	0	330	.		.	1300 U	UG/KG	420.0
8	2-NITROPHENOL	4	0	330	.		.	1300 U	UG/KG	420.0
9	4,6-DINITRO-2-METHYLPHENOL	4	0	1600	.		.	6400 U	UG/KG	2087.5
10	4-CHLORO-3-METHYLPHENOL	4	0	330	.		.	1300 U	UG/KG	420.0
11	4-METHYLPHENOL	4	0	330	.		.	1300 U	UG/KG	420.0
12	4-NITROPHENOL	4	0	1600	.		.	6400 U	UG/KG	2087.5
13	BENZOIC ACID	4	0	1600	.		.	6400 U	UG/KG	2087.5
14	BENZYL ALCOHOL	4	0	330	.		.	1300 U	UG/KG	420.0
15	PENTACHLOROPHENOL	4	0	1600	.		.	6400 U	UG/KG	2087.5
16	PHENOL	4	0	330	.		.	1300 U	UG/KG	420.0
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		64	0							

Location=SED008

SEDIMENT BASE NEUTRAL EXTRACTABLE SUMMARY ALL UNITS UG/KG

OBS	ANALYTE	Total Samples	Total CRQL Hits	CRQL	Maximum Hit	MAXHUNIT	Average Hit	MAXIMUM	MAXUNIT	Total Average
1	1,2,4-TRICHLOROBENZENE	4	0	330	.		.	1300 U	UG/KG	420.00
2	1,2-DICHLOROBENZENE	4	0	330	.		.	1300 U	UG/KG	420.00
3	1,3-DICHLOROBENZENE	4	0	330	.		.	1300 U	UG/KG	420.00
4	1,4-DICHLOROBENZENE	4	0	330	.		.	1300 U	UG/KG	420.00
5	2,4-DINITROTOLUENE	4	0	330	.		.	1300 U	UG/KG	420.00
6	2,6-DINITROTOLUENE	4	0	330	.		.	1300 U	UG/KG	420.00
7	2-CHLORONAPHTHALENE	4	0	330	.		.	1300 U	UG/KG	420.00
8	2-METHYLNAPHTHALENE	4	0	330	.		.	1300 U	UG/KG	420.00
9	2-NITROANILINE	4	0	1600	.		.	6400 U	UG/KG	2087.50
10	3,3'-DICHLOROBENZIDINE	4	0	660	.		.	2600 U	UG/KG	857.50
11	3-NITROANILINE	4	0	1600	.		.	6400 U	UG/KG	2087.50
12	4-BROMOPHENYL PHENYL ETHER	4	0	330	.		.	1300 U	UG/KG	420.00
13	4-CHLOROANILINE	4	0	330	.		.	1300 U	UG/KG	420.00
14	4-CHLOROPHENYL PHENYL ETHER	4	0	330	.		.	1300 U	UG/KG	420.00
15	4-NITROANILINE	4	0	1600	.		.	6400 U	UG/KG	2087.50
16	ACENAPHTHENE	4	0	330	.		.	1300 U	UG/KG	420.00
17	ACENAPHTHYLENE	4	0	330	.		.	1300 U	UG/KG	420.00
18	ANTHRACENE	4	1	330	80 J	UG/KG	80.00	1300 U	UG/KG	392.50
19	BENZO(a)ANTHRACENE	4	0	330	.		.	1300 U	UG/KG	420.00
20	BENZO(a)PYRENE	4	0	330	.		.	1300 U	UG/KG	420.00
21	BENZO(b)FLUORANTHENE	4	0	330	.		.	1300 U	UG/KG	420.00
22	BENZO(ghi)PERYLENE	4	0	330	.		.	1300 U	UG/KG	420.00
23	BENZO(k)FLUORANTHENE	4	0	330	.		.	1300 U	UG/KG	420.00
24	BIS(2-CHLOROETHOXY)METHANE	4	0	330	.		.	1300 U	UG/KG	420.00
25	BIS(2-CHLOROETHYL)ETHER	4	0	330	.		.	1300 U	UG/KG	420.00
26	BIS(2-CHLOROISOPROPYL)ETHER	4	0	330	.		.	1300 U	UG/KG	420.00
27	BIS(2-ETHYLHEXYL)PHTHALATE	4	3	330	230 BJ	UG/KG	158.33	1100 U	UG/KG	256.25
28	BUTYL BENZYL PHTHALATE	4	0	330	.		.	1300 U	UG/KG	420.00
29	CHRYSENE	4	0	330	.		.	1300 U	UG/KG	420.00
30	DI-n-BUTYL PHTHALATE	4	2	330	3100	UG/KG	1680.00	3100	UG/KG	1025.00
31	DI-n-OCTYL PHTHALATE	4	0	330	.		.	1300 U	UG/KG	420.00
32	DIBENZO(a,h)ANTHRACENE	4	0	330	.		.	1300 U	UG/KG	420.00
33	DIBENZOFURAN	4	0	330	.		.	1300 U	UG/KG	420.00
34	DIETHYL PHTHALATE	4	0	330	.		.	1300 U	UG/KG	420.00
35	DIMETHYL PHTHALATE	4	0	330	.		.	1300 U	UG/KG	420.00
36	FLUORANTHENE	4	0	330	.		.	1300 U	UG/KG	420.00
37	FLUORENE	4	0	330	.		.	1300 U	UG/KG	420.00
38	HEXACHLOROBENZENE	4	0	330	.		.	1300 U	UG/KG	420.00
39	HEXACHLOROBUTADIENE	4	0	330	.		.	1300 U	UG/KG	420.00
40	HEXACHLOROCYCLOPENTADIENE	4	0	330	.		.	1300 U	UG/KG	420.00
41	HEXACHLOROETHANE	4	0	330	.		.	1300 U	UG/KG	420.00
42	INDENO(1,2,3-cd)PYRENE	4	0	330	.		.	1300 U	UG/KG	420.00
43	ISOPHORONE	4	0	330	.		.	1300 U	UG/KG	420.00
44	N-NITROSO-DI-n-PROPYLAMINE	4	0	330	.		.	1300 U	UG/KG	420.00
45	N-NITROSODIPHENYLAMINE	4	1	330	300 JB	UG/KG	300.00	1300 U	UG/KG	447.50
46	NAPHTHALENE	4	0	330	.		.	1300 U	UG/KG	420.00
47	NITROBENZENE	4	0	330	.		.	1300 U	UG/KG	420.00
48	PHENANTHRENE	4	0	330	.		.	1300 U	UG/KG	420.00
49	PYRENE	4	0	330	.		.	1300 U	UG/KG	420.00
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		196	7							

Location=SED008

SEDIMENT PESTICIDE/PCB SUMMARY ALL UNITS UG/KG

CS	ANALYTE	Total Samples	Total CRQL Hits	CRQL	Maximum Hit	MAXHUNIT	Average Hit	MAXIMUM	MAXUNIT	Total Average
1	4,4'-DDD	4	0	16	.		.	64 U	UG/KG	18.750
2	4,4'-DDE	4	0	16	.		.	64 U	UG/KG	18.750
3	4,4'-DDT	4	0	16	.		.	64 U	UG/KG	18.750
4	ALDRIN	4	0	8	.		.	32 U	UG/KG	9.438
5	AROCLOR-1016	4	0	80	.		.	320 U	UG/KG	94.375
6	AROCLOR-1221	4	0	80	.		.	320 U	UG/KG	94.375
7	AROCLOR-1232	4	0	80	.		.	320 U	UG/KG	94.375
8	AROCLOR-1242	4	0	80	.		.	320 U	UG/KG	94.375
9	AROCLOR-1248	4	0	80	.		.	320 U	UG/KG	94.375
10	AROCLOR-1254	4	0	80	.		.	640 U	UG/KG	187.500
11	AROCLOR-1260	4	0	80	.		.	640 U	UG/KG	187.500
12	CHLORDANE	1	0	80	.		.	15 U	UG/KG	7.500
13	DIELDRIN	4	0	16	.		.	64 U	UG/KG	18.750
14	ENDOSULFAN I	4	0	8	.		.	32 U	UG/KG	9.438
15	ENDOSULFAN II	4	0	16	.		.	64 U	UG/KG	18.750
16	ENDOSULFAN SULFATE	4	0	16	.		.	64 U	UG/KG	18.750
17	ENDRIN	4	0	16	.		.	64 U	UG/KG	18.750
18	ENDRIN KETONE	4	0	16	.		.	64 U	UG/KG	18.750
19	HEPTACHLOR	4	0	8	.		.	32 U	UG/KG	9.438
20	HEPTACHLOR EPOXIDE	4	0	8	.		.	32 U	UG/KG	9.438
21	METHOXYCHLOR	4	0	80	.		.	320 U	UG/KG	94.375
22	TOXAPHENE	4	0	160	.		.	640 U	UG/KG	187.500
23	alpha-BHC	4	0	8	.		.	32 U	UG/KG	9.438
24	alpha-CHLORDANE	3	0	80	.		.	320 U	UG/KG	123.333
25	beta-BHC	4	0	8	.		.	32 U	UG/KG	9.438
26	delta-BHC	4	0	8	.		.	32 U	UG/KG	9.438
27	gamma-BHC (LINDANE)	4	0	8	.		.	32 U	UG/KG	9.438
28	gamma-CHLORDANE	3	0	80	.		.	320 U	UG/KG	123.333
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		107	0							

Location=SED008

SEDIMENT TOTAL METAL SUMMARY ALL UNITS UG/KG

Obs	ANALYTE	Total Samples	Total CRQL Hits	CRQL	Maximum Hit	MAXHUNIT	Average Hit	MAXIMUM	MAXUNIT	Total Average
1	ALUMINUM	4	0	40000	.		.	18700	MG/KG	16900.00
2	ANTIMONY	4	0	12000	.		.	10 BN	MG/KG	3.55
3	ARSENIC	4	0	2000	.		.	6	MG/KG	4.50
4	BARIUM	4	0	40000	.		.	165	MG/KG	153.00
5	BERYLLIUM	4	0	1000	.		.	1.1	MG/KG	0.95
6	CADMIUM	4	0	1000	.		.	1.7 B	MG/KG	0.88
7	CALCIUM	4	0	2000000	.		.	9040	MG/KG	6897.50
8	CESIUM	4	0	200000	.		.	168 U	MG/KG	61.05
9	CHROMIUM	4	0	2000	.		.	19	MG/KG	16.60
10	COBALT	4	0	10000	.		.	12.7 B	MG/KG	10.55
11	COPPER	4	0	5000	.		.	24.6	MG/KG	21.00
12	IRON	4	1	20000	21300	MG/KG	21300	21300	MG/KG	19000.00
13	LEAD	4	0	1000	.		.	25.9	MG/KG	18.85
14	LITHIUM	3	0	20000	.		.	13.7	MG/KG	12.33
15	MAGNESIUM	4	0	2000000	.		.	3900	MG/KG	3670.00
16	MANGANESE	4	0	3000	.		.	430	MG/KG	421.00
17	MERCURY	4	0	200	.		.	0.23	MG/KG	0.12
18	MOLYBDENUM	4	0	40000	.		.	10 U	MG/KG	4.58
19	NICKEL	4	0	8000	.		.	20.2	MG/KG	17.85
20	POTASSIUM	4	0	2000000	.		.	6610	MG/KG	3422.50
21	SELENIUM	4	0	1000	.		.	0.77 B	MG/KG	0.36
22	SILVER	4	0	2000	.		.	1.3 B	MG/KG	0.67
23	SODIUM	4	0	2000000	.		.	249	MG/KG	198.25
24	STRONTIUM	4	0	40000	.		.	78	MG/KG	66.28
	THALLIUM	4	0	2000	.		.	12	MG/KG	3.34
	TIN	3	0	40000	.		.	15.7 B	MG/KG	10.70
27	VANADIUM	4	0	10000	.		.	45.6	MG/KG	44.15
28	ZINC	4	0	4000	.		.	101 E	MG/KG	90.07
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		110	1							

Location=SED008

SEDIMENT TOTAL RAD SUMMARY ALL UNITS PCI/KG

OBS	ANALYTE	Total Samples	Total CRQL Hits	CRQL	Maximum Hit	MAXHUNIT	Average Hit	MAXIMUM	MAXUNIT	Total Average
1	AMERICIUM-241	1	1	20	90	PCI/KG	90.00	90	PCI/KG	90.00
2	GROSS ALPHA PARTICLE RADIOAC	1	1	4000	19000	PCI/KG	19000.00	19000	PCI/KG	19000.00
3	GROSS BETA PARTICLE RADIOACT	1	1	10000	22000	PCI/KG	22000.00	22000	PCI/KG	22000.00
4	PLUTONIUM-239	1	1	30	130	PCI/KG	130.00	130	PCI/KG	130.00
5	TRITIUM	1	0	400000	.		.	320	PCI/L	320.00
6	URANIUM, TOTAL	1	1	0	1.31		1.31	1.31		1.31
7	URANIUM-233,-234	1	1	300	740	PCI/KG	740.00	740	PCI/KG	740.00
8	URANIUM-238	1	1	300	570	PCI/KG	570.00	570	PCI/KG	570.00
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		8	7							

Location=SED009

SEDIMENT VOA SUMMARY All UNITS UG/KG

OBS	ANALYTE	Total Samples	Total CRQL Hits	CRQL	Maximum Hit	MAXHUNIT	Average Hit	MAXIMUM	MAXUNIT	Total Average
1	1,1,1-TRICHLOROETHANE	2	0	5	.		.	7 U	UG/KG	3.00
2	1,1,2,2-TETRACHLOROETHANE	2	0	5	.		.	7 U	UG/KG	3.00
3	1,1,2-TRICHLOROETHANE	2	0	5	.		.	7 U	UG/KG	3.00
4	1,1-DICHLOROETHANE	2	0	5	.		.	7 U	UG/KG	3.00
5	1,1-DICHLOROETHENE	2	0	5	.		.	7 U	UG/KG	3.00
6	1,2-DICHLOROETHANE	2	0	5	.		.	7 U	UG/KG	3.00
7	1,2-DICHLOROETHENE	1	0	5	.		.	7 U	UG/KG	3.50
8	1,2-DICHLOROPROPANE	2	0	5	.		.	7 U	UG/KG	3.00
9	2-BUTANONE	2	0	10	.		.	13 U	UG/KG	5.75
10	2-CHLOROETHYL VINYL ETHER	1	0	0	.		.	10 U	UG/KG	5.00
11	2-HEXANONE	2	0	10	.		.	13 U	UG/KG	5.75
12	4-METHYL-2-PENTANONE	2	0	10	.		.	13 U	UG/KG	5.75
13	ACETONE	2	2	10	140	UG/KG	77.5	140	UG/KG	77.50
14	BENZENE	2	0	5	.		.	7 U	UG/KG	3.00
15	BROMODICHLOROMETHANE	2	0	5	.		.	7 U	UG/KG	3.00
16	BROMOFORM	2	0	5	.		.	7 U	UG/KG	3.00
17	BROMOMETHANE	2	0	10	.		.	13 U	UG/KG	5.75
18	CARBON DISULFIDE	2	0	5	.		.	7 U	UG/KG	3.00
19	CARBON TETRACHLORIDE	2	0	5	.		.	7 U	UG/KG	3.00
20	CHLOROBENZENE	2	0	5	.		.	7 U	UG/KG	3.00
21	CHLOROETHANE	2	0	10	.		.	13 U	UG/KG	5.75
22	CHLOROFORM	2	0	5	.		.	7 U	UG/KG	3.00
23	CHLOROMETHANE	2	0	10	.		.	13 U	UG/KG	5.75
24	DIBROMOCHLOROMETHANE	2	0	5	.		.	7 U	UG/KG	3.00
25	ETHYLBENZENE	2	0	5	.		.	7 U	UG/KG	3.00
26	METHYLENE CHLORIDE	2	2	5	6 BJ	UG/KG	3.5	6 BJ	UG/KG	3.50
27	STYRENE	2	0	5	.		.	7 U	UG/KG	3.00
28	TETRACHLOROETHENE	2	0	5	.		.	7 U	UG/KG	3.00
29	TOLUENE	2	0	5	.		.	7 U	UG/KG	3.00
30	TOTAL XYLENES	2	0	5	.		.	7 U	UG/KG	3.00
31	TRICHLOROETHENE	2	0	5	.		.	7 U	UG/KG	3.00
32	VINYL ACETATE	2	0	10	.		.	13 U	UG/KG	5.75
33	VINYL CHLORIDE	2	0	10	.		.	13 U	UG/KG	5.75
34	cis-1,3-DICHLOROPROPENE	2	0	5	.		.	7 U	UG/KG	3.00
35	trans-1,2-DICHLOROETHENE	1	0	5	.		.	5 U	UG/KG	2.50
36	trans-1,3-DICHLOROPROPENE	2	0	5	.		.	7 U	UG/KG	3.00
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		69	4							

Location=SED009

SEDIMENT BASE NEUTRAL EXTRACTABLE SUMMARY ALL UNITS UG/KG

OBS	ANALYTE	Total Samples	Total CRQL Hits	CRQL	Maximum Hit	MAXHUNIT	Average Hit	MAXIMUM	MAXUNIT	Total Average
1	1,2,4-TRICHLOROBENZENE	3	0	330	.		.	960 U	UG/KG	336.67
2	1,2-DICHLOROBENZENE	3	0	330	.		.	960 U	UG/KG	336.67
3	1,3-DICHLOROBENZENE	3	0	330	.		.	960 U	UG/KG	336.67
4	1,4-DICHLOROBENZENE	3	0	330	.		.	960 U	UG/KG	336.67
5	2,4-DINITROTOLUENE	3	0	330	.		.	960 U	UG/KG	336.67
6	2,6-DINITROTOLUENE	3	0	330	.		.	960 U	UG/KG	336.67
7	2-CHLORONAPHTHALENE	3	0	330	.		.	960 U	UG/KG	336.67
8	2-METHYLNAPHTHALENE	3	0	330	.		.	960 U	UG/KG	336.67
9	2-NITROANILINE	3	0	1600	.		.	4600 U	UG/KG	1616.67
10	3,3'-DICHLOROBENZIDINE	3	0	660	.		.	1900 U	UG/KG	670.00
11	3-NITROANILINE	3	0	1600	.		.	4600 U	UG/KG	1616.67
12	4-BROMOPHENYL PHENYL ETHER	3	0	330	.		.	960 U	UG/KG	336.67
13	4-CHLOROANILINE	3	0	330	.		.	960 U	UG/KG	336.67
14	4-CHLOROPHENYL PHENYL ETHER	3	0	330	.		.	960 U	UG/KG	336.67
15	4-NITROANILINE	3	0	1600	.		.	4600 U	UG/KG	1616.67
16	ACENAPHTHENE	3	0	330	.		.	960 U	UG/KG	336.67
17	ACENAPHTHYLENE	3	0	330	.		.	960 U	UG/KG	336.67
18	ANTHRACENE	3	0	330	.		.	960 U	UG/KG	336.67
19	BENZO(a)ANTHRACENE	3	0	330	.		.	960 U	UG/KG	336.67
20	BENZO(a)PYRENE	3	0	330	.		.	960 U	UG/KG	336.67
21	BENZO(b)FLUORANTHENE	3	0	330	.		.	960 U	UG/KG	336.67
22	BENZO(ghi)PERYLENE	3	0	330	.		.	960 U	UG/KG	336.67
23	BENZO(k)FLUORANTHENE	3	0	330	.		.	960 U	UG/KG	336.67
24	BIS(2-CHLOROETHOXY)METHANE	3	0	330	.		.	960 U	UG/KG	336.67
[illegible]	BIS(2-CHLOROETHYL)ETHER	3	0	330	.		.	960 U	UG/KG	336.67
26	BIS(2-CHLOROISOPROPYL)ETHER	3	0	330	.		.	960 U	UG/KG	336.67
27	BIS(2-ETHYLHEXYL)PHTHALATE	3	3	330	590 BJ	UG/KG	323.33	590 BJ	UG/KG	323.33
28	BUTYL BENZYL PHTHALATE	3	0	330	.		.	960 U	UG/KG	336.67
29	CHRYSENE	3	1	330	200 J	UG/KG	200.00	960 U	UG/KG	261.67
30	DI-n-BUTYL PHTHALATE	3	2	330	190 J	UG/KG	125.00	850 U	UG/KG	225.00
31	DI-n-OCTYL PHTHALATE	3	0	330	.		.	960 U	UG/KG	336.67
32	DIBENZO(a,h)ANTHRACENE	3	0	330	.		.	960 U	UG/KG	336.67
33	DIBENZOFURAN	3	0	330	.		.	960 U	UG/KG	336.67
34	DIETHYL PHTHALATE	3	0	330	.		.	960 U	UG/KG	336.67
35	DIMETHYL PHTHALATE	3	0	330	.		.	960 U	UG/KG	336.67
36	FLUORANTHENE	3	2	330	300 J	UG/KG	220.00	300 J	UG/KG	181.67
37	FLUORENE	3	0	330	.		.	960 U	UG/KG	336.67
38	HEXACHLOROBENZENE	3	0	330	.		.	960 U	UG/KG	336.67
39	HEXACHLOROBUTADIENE	3	0	330	.		.	960 U	UG/KG	336.67
40	HEXACHLOROCYCLOPENTADIENE	3	0	330	.		.	960 U	UG/KG	336.67
41	HEXACHLOROETHANE	3	0	330	.		.	960 U	UG/KG	336.67
42	INDENO(1,2,3-cd)PYRENE	3	0	330	.		.	960 U	UG/KG	336.67
43	ISOPHORONE	3	0	330	.		.	960 U	UG/KG	336.67
44	N-NITROSO-DI-n-PROPYLAMINE	3	0	330	.		.	960 U	UG/KG	336.67
45	N-NITROSODIPHENYLAMINE	3	1	330	2000 B	UG/KG	2000.00	2000 B	UG/KG	968.33
46	NAPHTHALENE	3	0	330	.		.	960 U	UG/KG	336.67
47	NITROBENZENE	3	0	330	.		.	960 U	UG/KG	336.67
48	PHENANTHRENE	3	1	330	140 J	UG/KG	140.00	960 U	UG/KG	241.67
49	PYRENE	3	2	330	280 J	UG/KG	195.00	280 J	UG/KG	165.00
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		147	12							

Location=SED009

SEDIMENT ACID EXTRACTABLE SUMMARY ALL UNITS UG/KG

OBS	ANALYTE	Total Samples	Total CRQL Hits	CRQL	Maximum Hit	MAXHUNIT	Average Hit	MAXIMUM	MAXUNIT	Total Average
1	2,4,5-TRICHLOROPHENOL	3	0	1600	.		.	4600 U	UG/KG	1616.67
2	2,4,6-TRICHLOROPHENOL	3	0	330	.		.	960 U	UG/KG	336.67
3	2,4-DICHLOROPHENOL	3	0	330	.		.	960 U	UG/KG	336.67
4	2,4-DIMETHYLPHENOL	3	0	330	.		.	960 U	UG/KG	336.67
5	2,4-DINITROPHENOL	3	0	1600	.		.	4600 U	UG/KG	1616.67
6	2-CHLOROPHENOL	3	0	330	.		.	960 U	UG/KG	336.67
7	2-METHYLPHENOL	3	0	330	.		.	960 U	UG/KG	336.67
8	2-NITROPHENOL	3	0	330	.		.	960 U	UG/KG	336.67
9	4,6-DINITRO-2-METHYLPHENOL	3	0	1600	.		.	4600 U	UG/KG	1616.67
10	4-CHLORO-3-METHYLPHENOL	3	0	330	.		.	960 U	UG/KG	336.67
11	4-METHYLPHENOL	3	0	330	.		.	960 U	UG/KG	336.67
12	4-NITROPHENOL	3	0	1600	.		.	4600 U	UG/KG	1616.67
13	BENZOIC ACID	3	0	1600	.		.	4600 U	UG/KG	1616.67
14	BENZYL ALCOHOL	3	0	330	.		.	960 U	UG/KG	336.67
15	PENTACHLOROPHENOL	3	0	1600	.		.	4600 U	UG/KG	1616.67
16	PHENOL	3	0	330	.		.	960 U	UG/KG	336.67
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		48	0							

Location=SED009

SEDIMENT PESTICIDE/PCB SUMMARY ALL UNITS UG/KG

OBS	ANALYTE	Total Samples	Total CRQL Hits	CRQL	Maximum Hit	MAXHUNIT	Average Hit	MAXIMUM	MAXUNIT	Total Average
1	4,4'-DDD	3	0	16	.		.	46 U	UG/KG	15.167
2	4,4'-DDE	3	0	16	.		.	46 U	UG/KG	15.167
3	4,4'-DDT	3	0	16	.		.	46 U	UG/KG	15.167
4	ALDRIN	3	0	8	.		.	23 U	UG/KG	7.583
5	AROCLOR-1016	3	0	80	.		.	230 U	UG/KG	75.833
6	AROCLOR-1221	3	0	80	.		.	230 U	UG/KG	75.833
7	AROCLOR-1232	3	0	80	.		.	230 U	UG/KG	75.833
8	AROCLOR-1242	3	0	80	.		.	230 U	UG/KG	75.833
9	AROCLOR-1248	3	0	80	.		.	230 U	UG/KG	75.833
10	AROCLOR-1254	3	0	80	.		.	460 U	UG/KG	151.667
11	AROCLOR-1260	3	0	80	.		.	460 U	UG/KG	151.667
12	CHLORDANE	1	0	80	.		.	15 U	UG/KG	7.500
13	DIELDRIN	3	0	16	.		.	46 U	UG/KG	15.167
14	ENDOSULFAN I	3	0	8	.		.	23 U	UG/KG	7.583
15	ENDOSULFAN II	3	0	16	.		.	46 U	UG/KG	15.167
16	ENDOSULFAN SULFATE	3	0	16	.		.	46 U	UG/KG	15.167
17	ENDRIN	3	0	16	.		.	46 U	UG/KG	15.167
18	ENDRIN KETONE	3	0	16	.		.	46 U	UG/KG	15.167
19	HEPTACHLOR	3	0	8	.		.	23 U	UG/KG	7.583
20	HEPTACHLOR EPOXIDE	3	0	8	.		.	23 U	UG/KG	7.583
21	METHOXYCHLOR	3	0	80	.		.	230 U	UG/KG	75.833
22	TOXAPHENE	3	0	160	.		.	460 U	UG/KG	151.667
23	alpha-BHC	3	0	8	.		.	23 U	UG/KG	7.583
24	alpha-CHLORDANE	2	0	80	.		.	230 U	UG/KG	110.000
25	beta-BHC	3	0	8	.		.	23 U	UG/KG	7.583
26	delta-BHC	3	0	8	.		.	23 U	UG/KG	7.583
27	gamma-BHC (LINDANE)	3	0	8	.		.	23 U	UG/KG	7.583
28	gamma-CHLORDANE	2	0	80	.		.	230 U	UG/KG	110.000
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		80	0							

Location=SED009

SEDIMENT TOTAL METAL SUMMARY ALL UNITS UG/KG

OBS	ANALYTE	Total Samples	Total CRQL Hits	CRQL	Maximum Hit	MAXHUNIT	Average Hit	MAXIMUM	MAXUNIT	Total Average
1	ALUMINUM	3	0	40000	.		.	7850	MG/KG	5490.00
2	ANTIMONY	3	0	12000	.		.	5.9 BN	MG/KG	2.70
3	ARSENIC	3	0	2000	.		.	5.1	MG/KG	3.33
4	BARIUM	3	0	40000	.		.	83.6	MG/KG	63.23
5	BERYLLIUM	3	0	1000	.		.	0.48 B	MG/KG	0.35
6	CADMIUM	3	0	1000	.		.	0.97 B	MG/KG	0.64
7	CALCIUM	3	0	2000000	.		.	12900 E	MG/KG	8523.33
8	CESIUM	3	0	200000	.		.	83.1 B	MG/KG	32.35
9	CHROMIUM	3	0	2000	.		.	11.8	MG/KG	7.37
10	COBALT	3	0	10000	.		.	7.4 B	MG/KG	6.00
11	COPPER	3	0	5000	.		.	15.6 *	MG/KG	10.77
12	IRON	3	0	20000	.		.	11600	MG/KG	9726.67
13	LEAD	3	0	1000	.		.	16.2	MG/KG	11.18
14	LITHIUM	2	0	20000	.		.	6.9 B	MG/KG	5.80
15	MAGNESIUM	3	0	2000000	.		.	2060	MG/KG	1564.33
16	MANGANESE	3	0	3000	.		.	669	MG/KG	509.33
17	MERCURY	4	0	200	.		.	0.27	MG/KG	0.13
18	MOLYBDENUM	3	0	40000	.		.	7.9 U	MG/KG	3.18
19	NICKEL	3	0	8000	.		.	11.1	MG/KG	7.70
20	POTASSIUM	3	0	2000000	.		.	1210	MG/KG	1108.33
21	SELENIUM	3	0	1000	.		.	0.27 B	MG/KG	0.19
22	SILVER	3	0	2000	.		.	0.8 B	MG/KG	0.49
23	SODIUM	3	0	2000000	.		.	228 B	MG/KG	194.00
24	STRONTIUM	3	0	40000	.		.	40 B	MG/KG	30.57
25	THALLIUM	3	0	2000	.		.	13	MG/KG	4.55
26	TIN	2	0	40000	.		.	10.7 B	MG/KG	8.55
27	VANADIUM	3	0	10000	.		.	24.2	MG/KG	18.87
28	ZINC	3	0	4000	.		.	98.3 E*	MG/KG	74.23
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		83	0							

Location=SED009

SEDIMENT TOTAL RAD SUMMARY ALL UNITS PCI/KG

OBS	ANALYTE	Total Samples	Total CRQL Hits	CRQL	Maximum Hit	MAXHUNIT	Average Hit	MAXIMUM	MAXUNIT	Total Average
1	AMERICIUM-241	3	3	20	255	PCI/KG	206.70	255	PCI/KG	206.70
2	CESIUM-137	2	2	100	137.7	PCI/KG	78.42	137.7	PCI/KG	78.42
3	GROSS ALPHA - DISSOLVED	2	2	4000	15870	PCI/KG	10035.00	15870	PCI/KG	10035.00
4	GROSS ALPHA PARTICLE RADIOAC	1	1	4000	15000	PCI/KG	15000.00	15000	PCI/KG	15000.00
5	GROSS BETA - DISSOLVED	2	2	10000	26700	PCI/KG	24865.00	26700	PCI/KG	24865.00
6	GROSS BETA PARTICLE RADIOACT	1	1	10000	24000	PCI/KG	24000.00	24000	PCI/KG	24000.00
7	PLUTONIUM-238	1	1	0	3.882 J	PCI/KG	3.88	3.882 J	PCI/KG	3.88
8	PLUTONIUM-239	1	1	30	90	PCI/KG	90.00	90	PCI/KG	90.00
9	PLUTONIUM-239/240	2	2	30	951.2	PCI/KG	577.25	951.2	PCI/KG	577.25
10	RADIUM-226	2	2	500	1010	PCI/KG	752.30	1010	PCI/KG	752.30
11	RADIUM-228	2	2	500	1995	PCI/KG	1542.50	1995	PCI/KG	1542.50
12	STRONTIUM-89,90	2	2	1000	173.7 J	PCI/KG	155.10	173.7 J	PCI/KG	155.10
13	TRITIUM	2	1	400000	261.4 J	PCI/L	261.40	261.4 J	PCI/L	185.70
14	URANIUM, TOTAL	1	1	0	1.76		1.76	1.76		1.76
15	URANIUM-233,-234	3	3	300	1355	PCI/KG	1023.87	1355	PCI/KG	1023.87
16	URANIUM-235	2	2	300	98.33 J	PCI/KG	85.26	98.33 J	PCI/KG	85.26
17	URANIUM-238	3	3	300	1524	PCI/KG	1089.87	1524	PCI/KG	1089.87
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		32	31							

Location=SED010

SEDIMENT VOA SUMMARY All UNITS UG/KG

BS	ANALYTE	Total Samples	Total CRQL Hits	CRQL	Maximum Hit	MAXHUNIT	Average Hit	MAXIMUM	MAXUNIT	Total Average
1	1,1,1-TRICHLOROETHANE	1	0	5	.		.	5 U	UG/KG	2.5
2	1,1,2,2-TETRACHLOROETHANE	1	0	5	.		.	5 U	UG/KG	2.5
3	1,1,2-TRICHLOROETHANE	1	0	5	.		.	5 U	UG/KG	2.5
4	1,1-DICHLOROETHANE	1	0	5	.		.	5 U	UG/KG	2.5
5	1,1-DICHLOROETHENE	1	0	5	.		.	5 U	UG/KG	2.5
6	1,2-DICHLOROETHANE	1	0	5	.		.	5 U	UG/KG	2.5
7	1,2-DICHLOROPROPANE	1	0	5	.		.	5 U	UG/KG	2.5
8	2-BUTANONE	1	0	10	.		.	11 U	UG/KG	5.5
9	2-CHLOROETHYL VINYL ETHER	1	0	0	.		.	11 U	UG/KG	5.5
10	2-HEXANONE	1	0	10	.		.	11 U	UG/KG	5.5
11	4-METHYL-2-PENTANONE	1	0	10	.		.	11 U	UG/KG	5.5
12	ACETONE	1	1	10	55 B	UG/KG	55	55 B	UG/KG	55.0
13	BENZENE	1	0	5	.		.	5 U	UG/KG	2.5
14	BROMODICHLOROMETHANE	1	0	5	.		.	5 U	UG/KG	2.5
15	BROMOFORM	1	0	5	.		.	5 U	UG/KG	2.5
16	BROMOMETHANE	1	0	10	.		.	11 U	UG/KG	5.5
17	CARBON DISULFIDE	1	0	5	.		.	5 U	UG/KG	2.5
18	CARBON TETRACHLORIDE	1	0	5	.		.	5 U	UG/KG	2.5
19	CHLOROBENZENE	1	0	5	.		.	5 U	UG/KG	2.5
20	CHLOROETHANE	1	0	10	.		.	11 U	UG/KG	5.5
21	CHLOROFORM	1	0	5	.		.	5 U	UG/KG	2.5
22	CHLOROMETHANE	1	0	10	.		.	11 U	UG/KG	5.5
23	DIBROMOCHLOROMETHANE	1	0	5	.		.	5 U	UG/KG	2.5
24	ETHYLBENZENE	1	0	5	.		.	5 U	UG/KG	2.5
25	METHYLENE CHLORIDE	1	1	5	31	UG/KG	31	31	UG/KG	31.0
[illegible]	STYRENE	1	0	5	.		.	5 U	UG/KG	2.5
[illegible]	TETRACHLOROETHENE	1	0	5	.		.	5 U	UG/KG	2.5
28	TOLUENE	1	1	5	1 BJ	UG/KG	1	1 BJ	UG/KG	1.0
29	TOTAL XYLENES	1	0	5	.		.	5 U	UG/KG	2.5
30	TRICHLOROETHENE	1	1	5	1 J	UG/KG	1	1 J	UG/KG	1.0
31	VINYL ACETATE	1	0	10	.		.	11 U	UG/KG	5.5
32	VINYL CHLORIDE	1	0	10	.		.	11 U	UG/KG	5.5
33	cis-1,3-DICHLOROPROPENE	1	0	5	.		.	5 U	UG/KG	2.5
34	trans-1,2-DICHLOROETHENE	1	0	5	.		.	5 U	UG/KG	2.5
35	trans-1,3-DICHLOROPROPENE	1	0	5	.		.	5 U	UG/KG	2.5
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		35	4							

Location=SED010

SEDIMENT ACID EXTRACTABLE SUMMARY ALL UNITS UG/KG

OBS	ANALYTE	Total Samples	Total CRQL Hits	CRQL	Maximum Hit	MAXHUNIT	Average Hit	MAXIMUM	MAXUNIT	Total Average
1	2,4,5-TRICHLOROPHENOL	1	0	1600	.		.	2000 U	UG/KG	1000
2	2,4,6-TRICHLOROPHENOL	1	0	330	.		.	400 U	UG/KG	200
3	2,4-DICHLOROPHENOL	1	0	330	.		.	400 U	UG/KG	200
4	2,4-DIMETHYLPHENOL	1	0	330	.		.	400 U	UG/KG	200
5	2,4-DINITROPHENOL	1	0	1600	.		.	2000 U	UG/KG	1000
6	2-CHLOROPHENOL	1	0	330	.		.	400 U	UG/KG	200
7	2-METHYLPHENOL	1	0	330	.		.	400 U	UG/KG	200
8	2-NITROPHENOL	1	0	330	.		.	400 U	UG/KG	200
9	4,6-DINITRO-2-METHYLPHENOL	1	0	1600	.		.	2000 U	UG/KG	1000
10	4-CHLORO-3-METHYLPHENOL	1	0	330	.		.	400 U	UG/KG	200
11	4-METHYLPHENOL	1	0	330	.		.	400 U	UG/KG	200
12	4-NITROPHENOL	1	0	1600	.		.	2000 U	UG/KG	1000
13	BENZOIC ACID	1	0	1600	.		.	2000 U	UG/KG	1000
14	BENZYL ALCOHOL	1	0	330	.		.	400 U	UG/KG	200
15	PENTACHLOROPHENOL	1	0	1600	.		.	2000 U	UG/KG	1000
16	PHENOL	1	0	330	.		.	400 U	UG/KG	200
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		16	0							

Location=SED010

SEDIMENT BASE NEUTRAL EXTRACTABLE SUMMARY ALL UNITS UG/KG

BS	ANALYTE	Total Samples	Total CRQL Hits	CRQL	Maximum Hit	MAXHUNIT	Average Hit	MAXIMUM	MAXUNIT	Total Average
1	1,2,4-TRICHLOROBENZENE	1	0	330	.		.	400 U	UG/KG	200
2	1,2-DICHLOROBENZENE	1	0	330	.		.	400 U	UG/KG	200
3	1,3-DICHLOROBENZENE	1	0	330	.		.	400 U	UG/KG	200
4	1,4-DICHLOROBENZENE	1	0	330	.		.	400 U	UG/KG	200
5	2,4-DINITROTOLUENE	1	0	330	.		.	400 U	UG/KG	200
6	2,6-DINITROTOLUENE	1	0	330	.		.	400 U	UG/KG	200
7	2-CHLORONAPHTHALENE	1	0	330	.		.	400 U	UG/KG	200
8	2-METHYLNAPHTHALENE	1	0	330	.		.	400 U	UG/KG	200
9	2-NITROANILINE	1	0	1600	.		.	2000 U	UG/KG	1000
10	3,3'-DICHLOROBENZIDINE	1	0	660	.		.	800 U	UG/KG	400
11	3-NITROANILINE	1	0	1600	.		.	2000 U	UG/KG	1000
12	4-BROMOPHENYL PHENYL ETHER	1	0	330	.		.	400 U	UG/KG	200
13	4-CHLOROANILINE	1	0	330	.		.	400 U	UG/KG	200
14	4-CHLOROPHENYL PHENYL ETHER	1	0	330	.		.	400 U	UG/KG	200
15	4-NITROANILINE	1	0	1600	.		.	2000 U	UG/KG	1000
16	ACENAPHTHENE	1	0	330	.		.	400 U	UG/KG	200
17	ACENAPHTHYLENE	1	0	330	.		.	400 U	UG/KG	200
18	ANTHRACENE	1	0	330	.		.	400 U	UG/KG	200
19	BENZO(a)ANTHRACENE	1	0	330	.		.	400 U	UG/KG	200
20	BENZO(a)PYRENE	1	0	330	.		.	400 U	UG/KG	200
21	BENZO(b)FLUORANTHENE	1	0	330	.		.	400 U	UG/KG	200
22	BENZO(ghi)PERYLENE	1	0	330	.		.	400 U	UG/KG	200
23	BENZO(k)FLUORANTHENE	1	0	330	.		.	400 U	UG/KG	200
24	BIS(2-CHLOROETHOXY)METHANE	1	0	330	.		.	400 U	UG/KG	200
25	BIS(2-CHLOROETHYL)ETHER	1	0	330	.		.	400 U	UG/KG	200
[illegible]	BIS(2-CHLOROISOPROPYL)ETHER	1	0	330	.		.	400 U	UG/KG	200
27	BIS(2-ETHYLHEXYL)PHTHALATE	1	0	330	.		.	400 U	UG/KG	200
28	BUTYL BENZYL PHTHALATE	1	0	330	.		.	400 U	UG/KG	200
29	CHRYSENE	1	0	330	.		.	400 U	UG/KG	200
30	DI-n-BUTYL PHTHALATE	1	1	330	240 JB	UG/KG	240	240 JB	UG/KG	240
31	DI-n-OCTYL PHTHALATE	1	0	330	.		.	400 U	UG/KG	200
32	DIBENZO(a,h)ANTHRACENE	1	0	330	.		.	400 U	UG/KG	200
33	DIBENZOFURAN	1	0	330	.		.	400 U	UG/KG	200
34	DIETHYL PHTHALATE	1	0	330	.		.	400 U	UG/KG	200
35	DIMETHYL PHTHALATE	1	0	330	.		.	400 U	UG/KG	200
36	FLUORANTHENE	1	0	330	.		.	400 U	UG/KG	200
37	FLUORENE	1	0	330	.		.	400 U	UG/KG	200
38	HEXACHLOROBENZENE	1	0	330	.		.	400 U	UG/KG	200
39	HEXACHLOROBUTADIENE	1	0	330	.		.	400 U	UG/KG	200
40	HEXACHLOROCYCLOPENTADIENE	1	0	330	.		.	400 U	UG/KG	200
41	HEXACHLOROETHANE	1	0	330	.		.	400 U	UG/KG	200
42	INDENO(1,2,3-cd)PYRENE	1	0	330	.		.	400 U	UG/KG	200
43	ISOPHORONE	1	0	330	.		.	400 U	UG/KG	200
44	N-NITROSO-DI-n-PROPYLAMINE	1	0	330	.		.	400 U	UG/KG	200
45	N-NITROSODIPHENYLAMINE	1	1	330	440 B	UG/KG	440	440 B	UG/KG	440
46	NAPHTHALENE	1	0	330	.		.	400 U	UG/KG	200
47	NITROBENZENE	1	0	330	.		.	400 U	UG/KG	200
48	PHENANTHRENE	1	0	330	.		.	400 U	UG/KG	200
49	PYRENE	1	0	330	.		.	400 U	UG/KG	200
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		49	2							

Location=SED010 SEDIMENT PESTICIDE/PCB SUMMARY ALL UNITS UG/KG

S	ANALYTE	Total Samples	Total CRQL Hits	CRQL	Maximum Hit	MAXHUNIT	Average Hit	MAXIMUM	MAXUNIT	Total Average
1	4,4'-DDD	1	0	16	.		.	4 U	UG/KG	2
2	4,4'-DDE	1	0	16	.		.	4 U	UG/KG	2
3	4,4'-DDT	1	0	16	.		.	4 U	UG/KG	2
4	ALDRIN	1	0	8	.		.	2 U	UG/KG	1
5	AROCLOR-1016	1	0	80	.		.	20 U	UG/KG	10
6	AROCLOR-1221	1	0	80	.		.	20 U	UG/KG	10
7	AROCLOR-1232	1	0	80	.		.	20 U	UG/KG	10
8	AROCLOR-1242	1	0	80	.		.	20 U	UG/KG	10
9	AROCLOR-1248	1	0	80	.		.	20 U	UG/KG	10
10	AROCLOR-1254	1	0	80	.		.	40 U	UG/KG	20
11	AROCLOR-1260	1	0	80	.		.	40 U	UG/KG	20
12	CHLORDANE	1	0	80	.		.	20 U	UG/KG	10
13	DIELDRIN	1	0	16	.		.	4 U	UG/KG	2
14	ENDOSULFAN I	1	0	8	.		.	2 U	UG/KG	1
15	ENDOSULFAN II	1	0	16	.		.	4 U	UG/KG	2
16	ENDOSULFAN SULFATE	1	0	16	.		.	4 U	UG/KG	2
17	ENDRIN	1	0	16	.		.	4 U	UG/KG	2
18	ENDRIN KETONE	1	0	16	.		.	4 U	UG/KG	2
19	HEPTACHLOR	1	0	8	.		.	2 U	UG/KG	1
20	HEPTACHLOR EPOXIDE	1	0	8	.		.	2 U	UG/KG	1
21	METHOXYCHLOR	1	0	80	.		.	20 U	UG/KG	10
22	TOXAPHENE	1	0	160	.		.	40 U	UG/KG	20
23	alpha-BHC	1	0	8	.		.	2 U	UG/KG	1
24	beta-BHC	1	0	8	.		.	2 U	UG/KG	1
25	delta-BHC	1	0	8	.		.	2 U	UG/KG	1
26	gamma-BHC (LINDANE)	1	0	8	.		.	2 U	UG/KG	1
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		26	0							

Location=SED010

SEDIMENT TOTAL METAL SUMMARY ALL UNITS UG/KG

BS	ANALYTE	Total Samples	Total CRQL Hits	CRQL	Maximum Hit	MAXHUNIT	Average Hit	MAXIMUM	MAXUNIT	Total Average
1	ALUMINUM	1	0	40000	.		.	2950	MG/KG	2950.00
2	ANTIMONY	1	0	12000	.		.	0.5 U	MG/KG	0.25
3	ARSENIC	1	0	2000	.		.	0.5	MG/KG	0.50
4	BARIUM	1	0	40000	.		.	11	MG/KG	11.00
5	BERYLLIUM	1	0	1000	.		.	0.5 U	MG/KG	0.25
6	CADMIUM	1	0	1000	.		.	0.5 U	MG/KG	0.25
7	CALCIUM	1	0	2000000	.		.	3990	MG/KG	3990.00
8	CESIUM	1	0	200000	.		.	27 U	MG/KG	13.50
9	CHROMIUM	1	0	2000	.		.	4.7	MG/KG	4.70
10	COBALT	1	0	10000	.		.	5.4 U	MG/KG	2.70
11	COPPER	1	0	5000	.		.	0.42	MG/KG	0.42
12	IRON	1	0	20000	.		.	5280	MG/KG	5280.00
13	LEAD	1	0	1000	.		.	7.6	MG/KG	7.60
14	MAGNESIUM	1	0	2000000	.		.	2480	MG/KG	2480.00
15	MANGANESE	1	0	3000	.		.	340	MG/KG	340.00
16	MERCURY	1	0	200	.		.	0.11 U	MG/KG	0.05
17	MOLYBDENUM	1	0	40000	.		.	11 U	MG/KG	5.50
18	NICKEL	1	0	8000	.		.	4.3 U	MG/KG	2.15
19	POTASSIUM	1	0	2000000	.		.	550	MG/KG	550.00
20	SELENIUM	1	0	1000	.		.	0.04 U	MG/KG	0.02
21	SILVER	1	0	2000	.		.	1.1 U	MG/KG	0.55
22	SODIUM	1	0	2000000	.		.	54 U	MG/KG	27.00
23	STRONTIUM	1	0	40000	.		.	15	MG/KG	15.00
24	THALLIUM	1	0	2000	.		.	0.11 U	MG/KG	0.05
25	VANADIUM	1	0	10000	.		.	13	MG/KG	13.00
26	ZINC	1	0	4000	.		.	23	MG/KG	23.00
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		26	0							

Location=SED010

SEDIMENT TOTAL RAD SUMMARY ALL UNITS PCI/KG

	ANALYTE	Total Samples	Total CRQL Hits	CRQL	Maximum Hit	MAXHUNIT	Average Hit	MAXIMUM	MAXUNIT	Total Average
1	AMERICIUM-241	1	0	20	.		.	0	PCI/KG	0.0
2	GROSS ALPHA PARTICLE RADIOAC	1	1	4000	10000	PCI/KG	10000.0	10000	PCI/KG	10000.0
3	GROSS BETA PARTICLE RADIOACT	1	1	10000	28000	PCI/KG	28000.0	28000	PCI/KG	28000.0
4	PLUTONIUM-239	1	0	30	.		.	10	PCI/KG	10.0
5	TRITIUM	1	0	400000	.		.	160	PCI/L	160.0
6	URANIUM, TOTAL	1	1	0	1.8		1.8	1.8		1.8
7	URANIUM-233,-234	1	1	300	890	PCI/KG	890.0	890	PCI/KG	890.0
8	URANIUM-238	1	1	300	910	PCI/KG	910.0	910	PCI/KG	910.0
		8	5							

Location=SED011

SEDIMENT VOA SUMMARY All UNITS UG/KG

OBS	ANALYTE	Total Samples	Total CRQL Hits	CRQL	Maximum Hit	MAXHUNIT	Average Hit	MAXIMUM	MAXUNIT	Total Average
1	1,1,1-TRICHLOROETHANE	3	0	5	.		.	9 U	UG/KG	3.333
2	1,1,2,2-TETRACHLOROETHANE	3	0	5	.		.	9 U	UG/KG	3.333
3	1,1,2-TRICHLOROETHANE	3	0	5	.		.	9 U	UG/KG	3.333
4	1,1-DICHLOROETHANE	3	0	5	.		.	9 U	UG/KG	3.333
5	1,1-DICHLOROETHENE	3	0	5	.		.	9 U	UG/KG	3.333
6	1,2-DICHLOROETHANE	3	0	5	.		.	9 U	UG/KG	3.333
7	1,2-DICHLOROETHENE	1	0	5	.		.	9 U	UG/KG	4.500
8	1,2-DICHLOROPROPANE	3	0	5	.		.	9 U	UG/KG	3.333
9	2-BUTANONE	3	1	10	12	UG/KG	12.0	130 U	UG/KG	28.667
10	2-CHLOROETHYL VINYL ETHER	1	0	0	.		.	10 U	UG/KG	5.000
11	2-HEXANONE	3	0	10	.		.	64 U	UG/KG	15.333
12	4-METHYL-2-PENTANONE	3	0	10	.		.	64 U	UG/KG	15.333
13	ACETONE	3	1	10	167	UG/KG	167.0	167	UG/KG	80.333
14	BENZENE	3	0	5	.		.	9 U	UG/KG	3.333
15	BROMODICHLOROMETHANE	3	0	5	.		.	9 U	UG/KG	3.333
16	BROMOFORM	3	0	5	.		.	9 U	UG/KG	3.333
17	BROMOMETHANE	3	0	10	.		.	18 U	UG/KG	6.833
18	CARBON DISULFIDE	3	0	5	.		.	9 U	UG/KG	3.333
19	CARBON TETRACHLORIDE	3	0	5	.		.	9 U	UG/KG	3.333
20	CHLOROBENZENE	3	0	5	.		.	9 U	UG/KG	3.333
21	CHLOROETHANE	3	0	10	.		.	18 U	UG/KG	6.833
22	CHLOROFORM	3	0	5	.		.	9 U	UG/KG	3.333
23	CHLOROMETHANE	3	0	10	.		.	18 U	UG/KG	6.833
24	DIBROMOCHLOROMETHANE	3	0	5	.		.	9 U	UG/KG	3.333
25	ETHYLBENZENE	3	1	5	1 J	UG/KG	1.0	9 U	UG/KG	2.833
26	METHYLENE CHLORIDE	3	2	5	6 J	UG/KG	4.0	6 J	UG/KG	3.667
27	STYRENE	3	0	5	.		.	9 U	UG/KG	3.333
28	TETRACHLOROETHENE	3	0	5	.		.	9 U	UG/KG	3.333
29	TOLUENE	3	2	5	2 J	UG/KG	1.5	6 U	UG/KG	2.000
30	TOTAL XYLENES	3	1	5	7 J	UG/KG	7.0	9 U	UG/KG	4.833
31	TRICHLOROETHENE	3	0	5	.		.	9 U	UG/KG	3.333
32	VINYL ACETATE	3	0	10	.		.	64 U	UG/KG	15.333
33	VINYL CHLORIDE	3	0	10	.		.	18 U	UG/KG	6.833
34	cis-1,3-DICHLOROPROPENE	3	0	5	.		.	9 U	UG/KG	3.333
35	trans-1,2-DICHLOROETHENE	2	0	5	.		.	6 U	UG/KG	2.750
36	trans-1,3-DICHLOROPROPENE	3	0	5	.		.	9 U	UG/KG	3.333
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		103	8							

Location=SED011 SEDIMENT ACID EXTRACTABLE SUMMARY ALL UNITS UG/KG

SBS	ANALYTE	Total Samples	Total CRQL Hits	CRQL	Maximum Hit	MAXHUNIT	Average Hit	MAXIMUM	MAXUNIT	Total Average
1	2,4,5-TRICHLOROPHENOL	3	0	1600	.		.	11000 U	UG/KG	2143.33
2	2,4,6-TRICHLOROPHENOL	3	0	330	.		.	2300 U	UG/KG	561.67
3	2,4-DICHLOROPHENOL	3	0	330	.		.	2300 U	UG/KG	561.67
4	2,4-DIMETHYLPHENOL	3	0	330	.		.	2300 U	UG/KG	561.67
5	2,4-DINITROPHENOL	3	0	1600	.		.	11000 U	UG/KG	2700.00
6	2-CHLOROPHENOL	3	0	330	.		.	2300 U	UG/KG	561.67
7	2-METHYLPHENOL	3	0	330	.		.	2300 U	UG/KG	561.67
8	2-NITROPHENOL	3	0	330	.		.	2300 U	UG/KG	561.67
9	4,6-DINITRO-2-METHYLPHENOL	3	0	1600	.		.	11000 U	UG/KG	2716.67
10	4-CHLORO-3-METHYLPHENOL	3	0	330	.		.	2300 U	UG/KG	701.67
11	4-METHYLPHENOL	3	0	330	.		.	2300 U	UG/KG	561.67
12	4-NITROPHENOL	3	0	1600	.		.	11000 U	UG/KG	2700.00
13	BENZOIC ACID	3	0	1600	.		.	11000 U	UG/KG	2716.67
14	BENZYL ALCOHOL	3	0	330	.		.	2300 U	UG/KG	701.67
15	PENTACHLOROPHENOL	3	0	1600	.		.	11000 U	UG/KG	2716.67
16	PHENOL	3	0	330	.		.	2300 U	UG/KG	561.67
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		48	0							

Location=SED011

SEDIMENT BASE NEUTRAL EXTRACTABLE SUMMARY ALL UNITS UG/KG

OBS	ANALYTE	Total Samples	Total CRQL Hits	CRQL	Maximum Hit	MAXHUNIT	Average Hit	MAXIMUM	MAXUNIT	Total Average
1	1,2,4-TRICHLOROBENZENE	3	0	330	.		.	2300 U	UG/KG	561.67
2	1,2-DICHLOROBENZENE	3	0	330	.		.	2300 U	UG/KG	561.67
3	1,3-DICHLOROBENZENE	3	0	330	.		.	2300 U	UG/KG	561.67
4	1,4-DICHLOROBENZENE	3	0	330	.		.	2300 U	UG/KG	561.67
5	2,4-DINITROTOLUENE	3	0	330	.		.	2300 U	UG/KG	561.67
6	2,6-DINITROTOLUENE	3	0	330	.		.	2300 U	UG/KG	561.67
7	2-CHLORONAPHTHALENE	3	0	330	.		.	2300 U	UG/KG	561.67
8	2-METHYLNAPHTHALENE	3	0	330	.		.	2300 U	UG/KG	561.67
9	2-NITROANILINE	3	0	1600	.		.	11000 U	UG/KG	2716.67
10	3,3'-DICHLOROBENZIDINE	3	0	660	.		.	4700 U	UG/KG	1136.67
11	3-NITROANILINE	3	0	1600	.		.	11000 U	UG/KG	2716.67
12	4-BROMOPHENYL PHENYL ETHER	3	0	330	.		.	2300 U	UG/KG	561.67
13	4-CHLOROANILINE	3	0	330	.		.	2300 U	UG/KG	701.67
14	4-CHLOROPHENYL PHENYL ETHER	3	0	330	.		.	2300 U	UG/KG	561.67
15	4-NITROANILINE	3	0	1600	.		.	11000 U	UG/KG	2716.67
16	ACENAPHTHENE	3	0	330	.		.	2300 U	UG/KG	561.67
17	ACENAPHTHYLENE	3	0	330	.		.	2300 U	UG/KG	561.67
18	ANTHRACENE	3	0	330	.		.	2300 U	UG/KG	561.67
19	BENZO(a)ANTHRACENE	3	0	330	.		.	2300 U	UG/KG	561.67
20	BENZO(a)PYRENE	3	0	330	.		.	2300 U	UG/KG	561.67
21	BENZO(b)FLUORANTHENE	3	0	330	.		.	2300 U	UG/KG	561.67
22	BENZO(ghi)PERYLENE	3	0	330	.		.	2300 U	UG/KG	561.67
23	BENZO(k)FLUORANTHENE	3	0	330	.		.	2300 U	UG/KG	561.67
24	BIS(2-CHLOROETHOXY)METHANE	3	0	330	.		.	2300 U	UG/KG	561.67
25	BIS(2-CHLOROETHYL)ETHER	3	0	330	.		.	2300 U	UG/KG	561.67
26	BIS(2-CHLOROISOPROPYL)ETHER	3	0	330	.		.	2300 U	UG/KG	561.67
27	BIS(2-ETHYLHEXYL)PHTHALATE	3	3	330	290 J	UG/KG	156.667	290 J	UG/KG	156.67
28	BUTYL BENZYL PHTHALATE	3	0	330	.		.	2300 U	UG/KG	561.67
29	CHRYSENE	3	0	330	.		.	2300 U	UG/KG	561.67
30	DI-n-BUTYL PHTHALATE	3	1	330	40 J	UG/KG	40.000	2300 U	UG/KG	540.00
31	DI-n-OCTYL PHTHALATE	3	0	330	.		.	2300 U	UG/KG	561.67
32	DIBENZO(a,h)ANTHRACENE	3	0	330	.		.	2300 U	UG/KG	561.67
33	DIBENZOFURAN	3	0	330	.		.	2300 U	UG/KG	561.67
34	DIETHYL PHTHALATE	3	0	330	.		.	2300 U	UG/KG	561.67
35	DIMETHYL PHTHALATE	3	0	330	.		.	2300 U	UG/KG	561.67
36	FLUORANTHENE	3	0	330	.		.	2300 U	UG/KG	561.67
37	FLUORENE	3	0	330	.		.	2300 U	UG/KG	561.67
38	HEXACHLOROBENZENE	3	0	330	.		.	2300 U	UG/KG	561.67
39	HEXACHLOROBUTADIENE	3	0	330	.		.	2300 U	UG/KG	561.67
40	HEXACHLOROCYCLOPENTADIENE	3	0	330	.		.	2300 U	UG/KG	561.67
41	HEXACHLOROETHANE	3	0	330	.		.	2300 U	UG/KG	561.67
42	INDENO(1,2,3-cd)PYRENE	3	0	330	.		.	2300 U	UG/KG	561.67
43	ISOPHORONE	3	0	330	.		.	2300 U	UG/KG	561.67
44	N-NITROSO-DI-n-PROPYLAMINE	3	0	330	.		.	2300 U	UG/KG	561.67
45	N-NITROSODIPHENYLAMINE	3	1	330	170 JB	UG/KG	170.000	2300 U	UG/KG	583.33
46	NAPHTHALENE	3	0	330	.		.	2300 U	UG/KG	561.67
47	NITROBENZENE	3	0	330	.		.	2300 U	UG/KG	561.67
48	PHENANTHRENE	3	0	330	.		.	2300 U	UG/KG	561.67
49	PYRENE	3	0	330	.		.	2300 U	UG/KG	561.67
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		147	5							

Location=SED011

SEDIMENT PESTICIDE/PCB SUMMARY ALL UNITS UG/KG

S	ANALYTE	Total Samples	Total CRQL Hits	CRQL	Maximum Hit	MAXHUNIT	Average Hit	MAXIMUM	MAXUNIT	Total Average
1	4,4'-DDD	3	0	16	.		.	42 U	UG/KG	12.167
2	4,4'-DDE	3	0	16	.		.	42 U	UG/KG	12.167
3	4,4'-DDT	3	1	16	95 XZ	UG/KG	95	95 XZ	UG/KG	39.167
4	ALDRIN	3	0	8	.		.	21 U	UG/KG	6.083
5	AROCLOR-1016	3	0	80	.		.	210 U	UG/KG	60.833
6	AROCLOR-1221	3	0	80	.		.	210 U	UG/KG	60.833
7	AROCLOR-1232	3	0	80	.		.	210 U	UG/KG	60.833
8	AROCLOR-1242	3	0	80	.		.	210 U	UG/KG	60.833
9	AROCLOR-1248	3	0	80	.		.	210 U	UG/KG	60.833
10	AROCLOR-1254	3	1	80	540 X	UG/KG	540	540 X	UG/KG	255.000
11	AROCLOR-1260	3	0	80	.		.	420 U	UG/KG	121.667
12	CHLORDANE	1	0	80	.		.	15 U	UG/KG	7.500
13	DIELDRIN	3	0	16	.		.	42 U	UG/KG	12.167
14	ENDOSULFAN I	3	0	8	.		.	21 U	UG/KG	6.083
15	ENDOSULFAN II	3	0	16	.		.	42 U	UG/KG	12.167
16	ENDOSULFAN SULFATE	3	0	16	.		.	42 U	UG/KG	12.167
17	ENDRIN	3	0	16	.		.	42 U	UG/KG	12.167
18	ENDRIN KETONE	3	0	16	.		.	42 U	UG/KG	12.167
19	HEPTACHLOR	3	0	8	.		.	21 U	UG/KG	6.083
20	HEPTACHLOR EPOXIDE	3	0	8	.		.	21 U	UG/KG	6.083
21	METHOXYCHLOR	3	0	80	.		.	210 U	UG/KG	60.833
22	TOXAPHENE	3	0	160	.		.	420 U	UG/KG	121.667
23	alpha-BHC	3	0	8	.		.	21 U	UG/KG	6.083
24	alpha-CHLORDANE	2	0	80	.		.	210 U	UG/KG	87.500
25	beta-BHC	3	0	8	.		.	21 U	UG/KG	6.083
26	delta-BHC	3	0	8	.		.	21 U	UG/KG	6.083
27	gamma-BHC (LINDANE)	3	0	8	.		.	21 U	UG/KG	6.083
28	gamma-CHLORDANE	2	0	80	.		.	210 U	UG/KG	87.500
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		80	2							

Location=SED011

SEDIMENT TOTAL METAL SUMMARY ALL UNITS UG/KG

BS	ANALYTE	Total Samples	Total CRQL Hits	CRQL	Maximum Hit	MAXHUNIT	Average Hit	MAXIMUM	MAXUNIT	Total Average
1	ALUMINUM	4	1	40000	6920000	UG/KG	6920000	6920000	UG/KG	1737057.50
2	ANTIMONY	4	0	12000	.		.	17800 U	UG/KG	2226.04
3	ARSENIC	4	1	2000	4500	UG/KG	4500	4500	UG/KG	1126.73
4	BARIUM	4	1	40000	95300	UG/KG	95300	95300	UG/KG	23864.08
5	BERYLLIUM	4	1	1000	2500	UG/KG	2500	2500	UG/KG	625.31
6	CADMIUM	4	0	1000	.		.	1500 U	UG/KG	188.25
7	CALCIUM	4	1	2000000	27400000	UG/KG	27400000	27400000	UG/KG	6892925.00
8	CESIUM	3	0	200000	.		.	296000 U	UG/KG	49352.00
9	CHROMIUM	4	1	2000	7900	UG/KG	7900	7900	UG/KG	1981.15
10	COBALT	4	0	10000	.		.	14800 U	UG/KG	1854.88
11	COPPER	4	1	5000	13200	UG/KG	13200	13200	UG/KG	3311.60
12	IRON	4	1	20000	8980000	UG/KG	8980000	8980000	UG/KG	2250825.00
13	LEAD	4	1	1000	12200	UG/KG	12200	12200	UG/KG	3059.78
14	LITHIUM	3	0	20000	.		.	7200	UG/KG	2403.57
15	MAGNESIUM	4	0	2000000	.		.	1980000	UG/KG	496030.50
16	MANGANESE	4	1	3000	152000	UG/KG	152000	152000	UG/KG	38089.50
17	MERCURY	4	0	200	.		.	140 U	UG/KG	17.70
18	MOLYBDENUM	4	0	40000	.		.	3000 U	UG/KG	376.34
19	NICKEL	4	0	8000	.		.	11800 U	UG/KG	1487.40
20	POTASSIUM	4	0	2000000	.		.	1480000 U	UG/KG	186711.75
21	SELENIUM	4	0	1000	.		.	1500 U	UG/KG	187.67
22	SILVER	4	1	2000	15000	UG/KG	15000	15000	UG/KG	3751.15
23	SODIUM	4	0	2000000	.		.	1480000 U	UG/KG	185257.00
24	STRONTIUM	4	1	40000	62400	UG/KG	62400	62400	UG/KG	15624.02
25	THALLIUM	4	0	2000	.		.	2900 U	UG/KG	363.66
26	TIN	3	1	40000	404000	UG/KG	404000	404000	UG/KG	134677.90
27	VANADIUM	4	1	10000	22300	UG/KG	22300	22300	UG/KG	5588.48
28	ZINC	4	1	4000	735000	UG/KG	735000	735000	UG/KG	184066.70
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		109	15							

Location=SED011

SEDIMENT TOTAL RAD SUMMARY ALL UNITS PCI/KG

	ANALYTE	Total Samples	Total CRQL Hits	CRQL	Maximum Hit	MAXHUNIT	Average Hit	MAXIMUM	MAXUNIT	Total Average
1	AMERICIUM-241	1	0	20	.		.	20	PCI/KG	20.00
2	CESIUM-137	1	0	100	.		.	0	PCI/KG	0.00
3	GROSS ALPHA PARTICLE RADIOAC	2	2	4000	19000	PCI/KG	16000.00	19000	PCI/KG	16000.00
4	GROSS BETA PARTICLE RADIOACT	2	2	10000	24000	PCI/KG	18500.00	24000	PCI/KG	18500.00
5	PLUTONIUM-239	2	1	30	100	PCI/KG	100.00	100	PCI/KG	60.00
6	RADIUM-226	1	1	500	700	PCI/KG	700.00	700	PCI/KG	700.00
7	RADIUM-228	1	1	500	1400	PCI/KG	1400.00	1400	PCI/KG	1400.00
8	STRONTIUM-90	1	0	1000	.		.	-99		-100.00
9	TRITIUM	2	0	400000	.		.	180	PCI/L	180.00
10	URANIUM, TOTAL	2	2	0	2.6		1.59	2.6		1.59
11	URANIUM-233,-234	2	1	300	1200	PCI/KG	1200.00	1200	PCI/KG	745.00
12	URANIUM-235	1	0	300	.		.	200	PCI/KG	200.00
13	URANIUM-238	2	1	300	1200	PCI/KG	1200.00	1200	PCI/KG	745.00
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		20	11							

Location=SED012

SEDIMENT VOA SUMMARY All UNITS UG/KG

CS	ANALYTE	Total Samples	Total CRQL Hits	CRQL	Maximum Hit	MAXHUNIT	Average Hit	MAXIMUM	MAXUNIT	Total Average
1	1,1,1-TRICHLOROETHANE	1	0	5	.		.	5 U	UG/KG	2.5
2	1,1,2,2-TETRACHLOROETHANE	1	0	5	.		.	5 U	UG/KG	2.5
3	1,1,2-TRICHLOROETHANE	1	0	5	.		.	5 U	UG/KG	2.5
4	1,1-DICHLOROETHANE	1	0	5	.		.	5 U	UG/KG	2.5
5	1,1-DICHLOROETHENE	1	1	5	5 J	UG/KG	5	5 J	UG/KG	5.0
6	1,2-DICHLOROETHANE	1	0	5	.		.	5 U	UG/KG	2.5
7	1,2-DICHLOROPROPANE	1	0	5	.		.	5 U	UG/KG	2.5
8	2-BUTANONE	1	0	10	.		.	10 U	UG/KG	5.0
9	2-CHLOROETHYL VINYL ETHER	1	0	0	.		.	10 U	UG/KG	5.0
10	2-HEXANONE	1	0	10	.		.	10 U	UG/KG	5.0
11	4-METHYL-2-PENTANONE	1	0	10	.		.	10 U	UG/KG	5.0
12	ACETONE	1	1	10	39	UG/KG	39	39	UG/KG	39.0
13	BENZENE	1	1	5	3 J	UG/KG	3	3 J	UG/KG	3.0
14	BROMODICHLOROMETHANE	1	0	5	.		.	5 U	UG/KG	2.5
15	BROMOFORM	1	0	5	.		.	5 U	UG/KG	2.5
16	BROMOMETHANE	1	0	10	.		.	10 U	UG/KG	5.0
17	CARBON DISULFIDE	1	0	5	.		.	5 U	UG/KG	2.5
18	CARBON TETRACHLORIDE	1	0	5	.		.	5 U	UG/KG	2.5
19	CHLOROBENZENE	1	1	5	4 J	UG/KG	4	4 J	UG/KG	4.0
20	CHLOROETHANE	1	0	10	.		.	10 U	UG/KG	5.0
21	CHLOROFORM	1	0	5	.		.	5 U	UG/KG	2.5
22	CHLOROMETHANE	1	0	10	.		.	10 U	UG/KG	5.0
23	DIBROMOCHLOROMETHANE	1	0	5	.		.	5 U	UG/KG	2.5
24	ETHYLBENZENE	1	0	5	.		.	5 U	UG/KG	2.5
25	METHYLENE CHLORIDE	1	0	5	.		.	5 U	UG/KG	2.5
[illegible]	STYRENE	1	0	5	.		.	5 U	UG/KG	2.5
[illegible]7	TETRACHLOROETHENE	1	0	5	.		.	5 U	UG/KG	2.5
28	TOLUENE	1	0	5	.		.	5	UG/KG	5.0
29	TOTAL XYLENES	1	0	5	.		.	5 U	UG/KG	2.5
30	TRICHLOROETHENE	1	1	5	4 J	UG/KG	4	4 J	UG/KG	4.0
31	VINYL ACETATE	1	0	10	.		.	10 U	UG/KG	5.0
32	VINYL CHLORIDE	1	0	10	.		.	10 U	UG/KG	5.0
33	cis-1,3-DICHLOROPROPENE	1	0	5	.		.	5 U	UG/KG	2.5
34	trans-1,2-DICHLOROETHENE	1	0	5	.		.	5 U	UG/KG	2.5
35	trans-1,3-DICHLOROPROPENE	1	0	5	.		.	5 U	UG/KG	2.5
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		35	5							

Location=SED012

SEDIMENT ACID EXTRACTABLE SUMMARY ALL UNITS UG/KG

[illegible]S	ANALYTE	Total Samples	Total CRQL Hits	CRQL	Maximum Hit	MAXHUNIT	Average Hit	MAXIMUM	MAXUNIT	Total Average
1	2,4,5-TRICHLOROPHENOL	1	0	1600	.		.	1400 U	UG/KG	700
2	2,4,6-TRICHLOROPHENOL	1	0	330	.		.	270 U	UG/KG	135
3	2,4-DICHLOROPHENOL	1	0	330	.		.	270 U	UG/KG	135
4	2,4-DIMETHYLPHENOL	1	0	330	.		.	270 U	UG/KG	135
5	2,4-DINITROPHENOL	1	0	1600	.		.	1400 U	UG/KG	700
6	2-CHLOROPHENOL	1	0	330	.		.	270 U	UG/KG	135
7	2-METHYLPHENOL	1	0	330	.		.	270 U	UG/KG	135
8	2-NITROPHENOL	1	0	330	.		.	270 U	UG/KG	135
9	4,6-DINITRO-2-METHYLPHENOL	1	0	1600	.		.	1400 U	UG/KG	700
10	4-CHLORO-3-METHYLPHENOL	1	0	330	.		.	270 U	UG/KG	135
11	4-METHYLPHENOL	1	0	330	.		.	270 U	UG/KG	135
12	4-NITROPHENOL	1	0	1600	.		.	1400 U	UG/KG	700
13	BENZOIC ACID	1	0	1600	.		.	1400 U	UG/KG	700
14	BENZYL ALCOHOL	1	0	330	.		.	270 U	UG/KG	135
15	PENTACHLOROPHENOL	1	0	1600	.		.	1400 U	UG/KG	700
16	PHENOL	1	0	330	.		.	270 U	UG/KG	135
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		16	0							

Location=SEDD12

SEDIMENT BASE NEUTRAL EXTRACTABLE SUMMARY ALL UNITS UG/KG

OBS	ANALYTE	Total Samples	Total CRQL Hits	CRQL	Maximum Hit	MAXHUNIT	Average Hit	MAXIMUM	MAXUNIT	Total Average
1	1,2,4-TRICHLOROBENZENE	1	0	330	.		.	270 U	UG/KG	135
2	1,2-DICHLOROBENZENE	1	0	330	.		.	270 U	UG/KG	135
3	1,3-DICHLOROBENZENE	1	0	330	.		.	270 U	UG/KG	135
4	1,4-DICHLOROBENZENE	1	0	330	.		.	270 U	UG/KG	135
5	2,4-DINITROTOLUENE	1	0	330	.		.	270 U	UG/KG	135
6	2,6-DINITROTOLUENE	1	0	330	.		.	270 U	UG/KG	135
7	2-CHLORONAPHTHALENE	1	0	330	.		.	270 U	UG/KG	135
8	2-METHYLNAPHTHALENE	1	0	330	.		.	270 U	UG/KG	135
9	2-NITROANILINE	1	0	1600	.		.	1400 U	UG/KG	700
10	3,3'-DICHLOROBENZIDINE	1	0	660	.		.	540 U	UG/KG	270
11	3-NITROANILINE	1	0	1600	.		.	1400 U	UG/KG	700
12	4-BROMOPHENYL PHENYL ETHER	1	0	330	.		.	270 U	UG/KG	135
13	4-CHLOROANILINE	1	0	330	.		.	270 U	UG/KG	135
14	4-CHLOROPHENYL PHENYL ETHER	1	0	330	.		.	270 U	UG/KG	135
15	4-NITROANILINE	1	0	1600	.		.	1400 U	UG/KG	700
16	ACENAPHTHENE	1	0	330	.		.	270 U	UG/KG	135
17	ACENAPHTHYLENE	1	0	330	.		.	270 U	UG/KG	135
18	ANTHRACENE	1	0	330	.		.	270 U	UG/KG	135
19	BENZO(a)ANTHRACENE	1	0	330	.		.	270 U	UG/KG	135
20	BENZO(a)PYRENE	1	0	330	.		.	270 U	UG/KG	135
21	BENZO(b)FLUORANTHENE	1	0	330	.		.	270 U	UG/KG	135
22	BENZO(ghi)PERYLENE	1	0	330	.		.	270 U	UG/KG	135
23	BENZO(k)FLUORANTHENE	1	0	330	.		.	270 U	UG/KG	135
24	BIS(2-CHLOROETHOXY)METHANE	1	0	330	.		.	270 U	UG/KG	135
25	BIS(2-CHLOROETHYL)ETHER	1	0	330	.		.	270 U	UG/KG	135
26	BIS(2-CHLOROISOPROPYL)ETHER	1	0	330	.		.	270 U	UG/KG	135
27	BIS(2-ETHYLHEXYL)PHTHALATE	1	1	330	160 J	UG/KG	160	160 J	UG/KG	160
28	BUTYL BENZYL PHTHALATE	1	0	330	.		.	270 U	UG/KG	135
29	CHRYSENE	1	0	330	.		.	270 U	UG/KG	135
30	DI-n-BUTYL PHTHALATE	1	1	330	50 J	UG/KG	50	50 J	UG/KG	50
31	DI-n-OCTYL PHTHALATE	1	0	330	.		.	270 U	UG/KG	135
32	DIBENZO(a,h)ANTHRACENE	1	0	330	.		.	270 U	UG/KG	135
33	DIBENZOFURAN	1	0	330	.		.	270 U	UG/KG	135
34	DIETHYL PHTHALATE	1	0	330	.		.	270 U	UG/KG	135
35	DIMETHYL PHTHALATE	1	0	330	.		.	270 U	UG/KG	135
36	FLUORANTHENE	1	1	330	50 J	UG/KG	50	50 J	UG/KG	50
37	FLUORENE	1	0	330	.		.	270 U	UG/KG	135
38	HEXACHLOROBENZENE	1	0	330	.		.	270 U	UG/KG	135
39	HEXACHLOROBUTADIENE	1	0	330	.		.	270 U	UG/KG	135
40	HEXACHLOROCYCLOPENTADIENE	1	0	330	.		.	270 U	UG/KG	135
41	HEXACHLOROETHANE	1	0	330	.		.	270 U	UG/KG	135
42	INDENO(1,2,3-cd)PYRENE	1	0	330	.		.	270 U	UG/KG	135
43	ISOPHORONE	1	0	330	.		.	270 U	UG/KG	135
44	N-NITROSO-DI-n-PROPYLAMINE	1	0	330	.		.	270 U	UG/KG	135
45	N-NITROSODIPHENYLAMINE	1	1	330	240 JB	UG/KG	240	240 JB	UG/KG	240
46	NAPHTHALENE	1	0	330	.		.	270 U	UG/KG	135
47	NITROBENZENE	1	0	330	.		.	270 U	UG/KG	135
48	PHENANTHRENE	1	0	330	.		.	270 U	UG/KG	135
49	PYRENE	1	1	330	50 J	UG/KG	50	50 J	UG/KG	50
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		49	5							

Location=SED012

SEDIMENT PESTICIDE/PCB SUMMARY ALL UNITS UG/KG

S	ANALYTE	Total Samples	Total CRQL Hits	CRQL	Maximum Hit	MAXHUNIT	Average Hit	MAXIMUM	MAXUNIT	Total Average
1	4,4'-DDD	1	0	16	.		.	3 U	UG/KG	1.50
2	4,4'-DDE	1	0	16	.		.	3 U	UG/KG	1.50
3	4,4'-DDT	1	0	16	.		.	3 U	UG/KG	1.50
4	ALDRIN	1	0	8	.		.	1.5 U	UG/KG	0.75
5	AROCLOR-1016	1	0	80	.		.	15 U	UG/KG	7.50
6	AROCLOR-1221	1	0	80	.		.	15 U	UG/KG	7.50
7	AROCLOR-1232	1	0	80	.		.	15 U	UG/KG	7.50
8	AROCLOR-1242	1	0	80	.		.	15 U	UG/KG	7.50
9	AROCLOR-1248	1	0	80	.		.	15 U	UG/KG	7.50
10	AROCLOR-1254	1	0	80	.		.	30 U	UG/KG	15.00
11	AROCLOR-1260	1	0	80	.		.	30 U	UG/KG	15.00
12	CHLORDANE	1	0	80	.		.	15 U	UG/KG	7.50
13	DIELDRIN	1	0	16	.		.	3 U	UG/KG	1.50
14	ENDOSULFAN I	1	0	8	.		.	1.5 U	UG/KG	0.75
15	ENDOSULFAN II	1	0	16	.		.	3 U	UG/KG	1.50
16	ENDOSULFAN SULFATE	1	0	16	.		.	3 U	UG/KG	1.50
17	ENDRIN	1	0	16	.		.	3 U	UG/KG	1.50
18	ENDRIN KETONE	1	0	16	.		.	3 U	UG/KG	1.50
19	HEPTACHLOR	1	0	8	.		.	1.5 U	UG/KG	0.75
20	HEPTACHLOR EPOXIDE	1	0	8	.		.	1.5 U	UG/KG	0.75
21	METHOXYCHLOR	1	0	80	.		.	15 U	UG/KG	7.50
22	TOXAPHENE	1	0	160	.		.	30 U	UG/KG	15.00
23	alpha-BHC	1	0	8	.		.	1.5 U	UG/KG	0.75
24	beta-BHC	1	0	8	.		.	1.5 U	UG/KG	0.75
25	delta-BHC	1	0	8	.		.	1.5 U	UG/KG	0.75
26	gamma-BHC (LINDANE)	1	0	8	.		.	1.5 U	UG/KG	0.75
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		26	0							

Location=SED012

SEDIMENT TOTAL METAL SUMMARY ALL UNITS UG/KG

OBS	ANALYTE	Total Samples	Total CRQL Hits	CRQL	Maximum Hit	MAXHUNIT	Average Hit	MAXIMUM	MAXUNIT	Total Average
1	ALUMINUM	1	0	40000	.		.	9660	MG/KG	9660.00
2	ANTIMONY	1	0	12000	.		.	2.3 U	MG/KG	1.15
3	ARSENIC	1	0	2000	.		.	0.27 U	MG/KG	0.14
4	BARIUM	1	0	40000	.		.	119	MG/KG	119.00
5	BERYLLIUM	1	0	1000	.		.	0.57 U	MG/KG	0.29
6	CADMIUM	1	0	1000	.		.	0.57 U	MG/KG	0.29
7	CALCIUM	1	0	2000000	.		.	12000	MG/KG	12000.00
8	CESIUM	1	0	200000	.		.	14 U	MG/KG	7.00
9	CHROMIUM	1	0	2000	.		.	9.1	MG/KG	9.10
10	COBALT	1	0	10000	.		.	8	MG/KG	8.00
11	COPPER	1	0	5000	.		.	17	MG/KG	17.00
12	IRON	1	0	20000	.		.	12800	MG/KG	12800.00
13	LEAD	1	0	1000	.		.	17	MG/KG	17.00
14	MAGNESIUM	1	0	2000000	.		.	2600	MG/KG	2600.00
15	MANGANESE	1	0	3000	.		.	189	MG/KG	189.00
16	MERCURY	1	0	200	.		.	0.2	MG/KG	0.20
17	MOLYBDENUM	1	0	40000	.		.	11 U	MG/KG	5.50
18	NICKEL	1	0	8000	.		.	17	MG/KG	17.00
19	POTASSIUM	1	0	2000000	.		.	42700	MG/KG	42700.00
20	SELENIUM	1	0	1000	.		.	0.27 U	MG/KG	0.14
21	SILVER	1	0	2000	.		.	1.1 U	MG/KG	0.55
22	SODIUM	1	0	2000000	.		.	659	MG/KG	659.00
23	STRONTIUM	1	0	40000	.		.	86	MG/KG	86.00
24	THALLIUM	1	0	2000	.		.	8.4	MG/KG	8.40
25	VANADIUM	1	0	10000	.		.	28	MG/KG	28.00
26	ZINC	1	0	4000	.		.	258	MG/KG	258.00
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		26	0							

Location=SED012

SEDIMENT TOTAL RAD SUMMARY ALL UNITS PCI/KG

CN	ANALYTE	Total Samples	Total CRQL Hits	CRQL	Maximum Hit	MAXHUNIT	Average Hit	MAXIMUM	MAXUNIT	Total Average
1	AMERICIUM-241	1	1	20	190	PCI/KG	190.00	190	PCI/KG	190.00
2	GROSS ALPHA PARTICLE RADIOAC	1	1	4000	24000	PCI/KG	24000.00	24000	PCI/KG	24000.00
3	GROSS BETA PARTICLE RADIOACT	1	1	10000	22000	PCI/KG	22000.00	22000	PCI/KG	22000.00
4	PLUTONIUM-239	1	1	30	350	PCI/KG	350.00	350	PCI/KG	350.00
5	TRITIUM	1	0	400000	.		.	240	PCI/L	240.00
6	URANIUM, TOTAL	1	1	0	1.23		1.23	1.23		1.23
7	URANIUM-233,-234	1	1	300	610	PCI/KG	610.00	610	PCI/KG	610.00
8	URANIUM-238	1	1	300	620	PCI/KG	620.00	620	PCI/KG	620.00
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		8	7							

Location=SED013

SEDIMENT VOA SUMMARY All UNITS UG/KG

BS	ANALYTE	Total Samples	Total CRQL Hits	CRQL	Maximum Hit	MAXHUNIT	Average Hit	MAXIMUM	MAXUNIT	Total Average
1	1,1,1-TRICHLOROETHANE	1	0	5	.		.	5 U	UG/L	2.5
2	1,1,2,2-TETRACHLOROETHANE	1	0	5	.		.	5 U	UG/L	2.5
3	1,1,2-TRICHLOROETHANE	1	0	5	.		.	5 U	UG/L	2.5
4	1,1-DICHLOROETHANE	1	0	5	.		.	5 U	UG/L	2.5
5	1,1-DICHLOROETHENE	1	0	5	.		.	5 U	UG/L	2.5
6	1,2-DICHLOROETHANE	1	0	5	.		.	5 U	UG/L	2.5
7	1,2-DICHLOROPROPANE	1	0	5	.		.	5 U	UG/L	2.5
8	2-BUTANONE	1	0	10	.		.	10 U	UG/L	5.0
9	2-CHLOROETHYL VINYL ETHER	1	0	0	.		.	10 U	UG/L	5.0
10	2-HEXANONE	1	0	10	.		.	10 U	UG/L	5.0
11	4-METHYL-2-PENTANONE	1	0	10	.		.	10 U	UG/L	5.0
12	ACETONE	1	1	10	47 B	UG/L	47	47 B	UG/L	47.0
13	BENZENE	1	0	5	.		.	5 U	UG/L	2.5
14	BROMODICHLOROMETHANE	1	0	5	.		.	5 U	UG/L	2.5
15	BROMOFORM	1	0	5	.		.	5 U	UG/L	2.5
16	BROMOMETHANE	1	0	10	.		.	10 U	UG/L	5.0
17	CARBON DISULFIDE	1	0	5	.		.	5 U	UG/L	2.5
18	CARBON TETRACHLORIDE	1	0	5	.		.	5 U	UG/L	2.5
19	CHLOROBENZENE	1	0	5	.		.	5 U	UG/L	2.5
20	CHLOROETHANE	1	0	10	.		.	10 U	UG/L	5.0
21	CHLOROFORM	1	0	5	.		.	5 U	UG/L	2.5
22	CHLOROMETHANE	1	0	10	.		.	10 U	UG/L	5.0
23	DIBROMOCHLOROMETHANE	1	0	5	.		.	5 U	UG/L	2.5
24	ETHYLBENZENE	1	0	5	.		.	5 U	UG/L	2.5
25	METHYLENE CHLORIDE	1	0	5	.		.	5 U	UG/L	2.5
26	STYRENE	1	0	5	.		.	5 U	UG/L	2.5
27	TETRACHLOROETHENE	1	0	5	.		.	5 U	UG/L	2.5
28	TOLUENE	1	0	5	.		.	5 U	UG/L	2.5
29	TOTAL XYLENES	1	0	5	.		.	5 U	UG/L	2.5
30	TRICHLOROETHENE	1	0	5	.		.	5 U	UG/L	2.5
31	VINYL ACETATE	1	0	10	.		.	10 U	UG/L	5.0
32	VINYL CHLORIDE	1	0	10	.		.	10 U	UG/L	5.0
33	cis-1,3-DICHLOROPROPENE	1	0	5	.		.	5 U	UG/L	2.5
34	trans-1,2-DICHLOROETHENE	1	0	5	.		.	5 U	UG/L	2.5
35	trans-1,3-DICHLOROPROPENE	1	0	5	.		.	5 U	UG/L	2.5
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		35	1							

Location=SED013

SEDIMENT ACID EXTRACTABLE SUMMARY ALL UNITS UG/KG

S	ANALYTE	Total Samples	Total CRQL Hits	CRQL	Maximum Hit	MAXHUNIT	Average Hit	MAXIMUM	MAXUNIT	Total Average
1	2,4,5-TRICHLOROPHENOL	1	0	1600	.		.	2300 U	UG/KG	1150
2	2,4,6-TRICHLOROPHENOL	1	0	330	.		.	460 U	UG/KG	230
3	2,4-DICHLOROPHENOL	1	0	330	.		.	460 U	UG/KG	230
4	2,4-DIMETHYLPHENOL	1	0	330	.		.	460 U	UG/KG	230
5	2,4-DINITROPHENOL	1	0	1600	.		.	2300 U	UG/KG	1150
6	2-CHLOROPHENOL	1	0	330	.		.	460 U	UG/KG	230
7	2-METHYLPHENOL	1	0	330	.		.	460 U	UG/KG	230
8	2-NITROPHENOL	1	0	330	.		.	460 U	UG/KG	230
9	4,6-DINITRO-2-METHYLPHENOL	1	0	1600	.		.	2300 U	UG/KG	1150
10	4-CHLORO-3-METHYLPHENOL	1	0	330	.		.	460 U	UG/KG	230
11	4-METHYLPHENOL	1	0	330	.		.	460 U	UG/KG	230
12	4-NITROPHENOL	1	0	1600	.		.	2300 U	UG/KG	1150
13	BENZOIC ACID	1	0	1600	.		.	2300 U	UG/KG	1150
14	BENZYL ALCOHOL	1	0	330	.		.	460 U	UG/KG	230
15	PENTACHLOROPHENOL	1	0	1600	.		.	2300 U	UG/KG	1150
16	PHENOL	1	0	330	.		.	460 U	UG/KG	230
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		16	0							

Location=SED013

SEDIMENT BASE NEUTRAL EXTRACTABLE SUMMARY ALL UNITS UG/KG

OBS	ANALYTE	Total Samples	Total CRQL Hits	CRQL	Maximum Hit	MAXHUNIT	Average Hit	MAXIMUM	MAXUNIT	Total Average
1	1,2,4-TRICHLOROBENZENE	1	0	330	.		.	460 U	UG/KG	230
2	1,2-DICHLOROBENZENE	1	0	330	.		.	460 U	UG/KG	230
3	1,3-DICHLOROBENZENE	1	0	330	.		.	460 U	UG/KG	230
4	1,4-DICHLOROBENZENE	1	0	330	.		.	460 U	UG/KG	230
5	2,4-DINITROTOLUENE	1	0	330	.		.	460 U	UG/KG	230
6	2,6-DINITROTOLUENE	1	0	330	.		.	460 U	UG/KG	230
7	2-CHLORONAPHTHALENE	1	0	330	.		.	460 U	UG/KG	230
8	2-METHYLNAPHTHALENE	1	0	330	.		.	460 U	UG/KG	230
9	2-NITROANILINE	1	0	1600	.		.	2300 U	UG/KG	1150
10	3,3'-DICHLOROBENZIDINE	1	0	660	.		.	920 U	UG/KG	460
11	3-NITROANILINE	1	0	1600	.		.	2300 U	UG/KG	1150
12	4-BROMOPHENYL PHENYL ETHER	1	0	330	.		.	460 U	UG/KG	230
13	4-CHLOROANILINE	1	0	330	.		.	460 U	UG/KG	230
14	4-CHLOROPHENYL PHENYL ETHER	1	0	330	.		.	460 U	UG/KG	230
15	4-NITROANILINE	1	0	1600	.		.	2300 U	UG/KG	1150
16	ACENAPHTHENE	1	0	330	.		.	460 U	UG/KG	230
17	ACENAPHTHYLENE	1	0	330	.		.	460 U	UG/KG	230
18	ANTHRACENE	1	0	330	.		.	460 U	UG/KG	230
19	BENZO(a)ANTHRACENE	1	0	330	.		.	460 U	UG/KG	230
20	BENZO(a)PYRENE	1	0	330	.		.	460 U	UG/KG	230
21	BENZO(b)FLUORANTHENE	1	0	330	.		.	460 U	UG/KG	230
22	BENZO(ghi)PERYLENE	1	0	330	.		.	460 U	UG/KG	230
23	BENZO(k)FLUORANTHENE	1	0	330	.		.	460 U	UG/KG	230
24	BIS(2-CHLOROETHOXY)METHANE	1	0	330	.		.	460 U	UG/KG	230
25	BIS(2-CHLOROETHYL)ETHER	1	0	330	.		.	460 U	UG/KG	230
26	BIS(2-CHLOROISOPROPYL)ETHER	1	0	330	.		.	460 U	UG/KG	230
27	BIS(2-ETHYLHEXYL)PHTHALATE	1	1	330	180 J	UG/KG	180	180 J	UG/KG	180
28	BUTYL BENZYL PHTHALATE	1	0	330	.		.	460 U	UG/KG	230
29	CHRYSENE	1	0	330	.		.	460 U	UG/KG	230
30	DI-n-BUTYL PHTHALATE	1	1	330	90 J	UG/KG	90	90 J	UG/KG	90
31	DI-n-OCTYL PHTHALATE	1	0	330	.		.	460 U	UG/KG	230
32	DIBENZO(a,h)ANTHRACENE	1	0	330	.		.	460 U	UG/KG	230
33	DIBENZOFURAN	1	0	330	.		.	460 U	UG/KG	230
34	DIETHYL PHTHALATE	1	0	330	.		.	460 U	UG/KG	230
35	DIMETHYL PHTHALATE	1	0	330	.		.	460 U	UG/KG	230
36	FLUORANTHENE	1	0	330	.		.	460 U	UG/KG	230
37	FLUORENE	1	0	330	.		.	460 U	UG/KG	230
38	HEXACHLOROBENZENE	1	0	330	.		.	460 U	UG/KG	230
39	HEXACHLOROBUTADIENE	1	0	330	.		.	460 U	UG/KG	230
40	HEXACHLOROCYCLOPENTADIENE	1	0	330	.		.	460 U	UG/KG	230
41	HEXACHLOROETHANE	1	0	330	.		.	460 U	UG/KG	230
42	INDENO(1,2,3-cd)PYRENE	1	0	330	.		.	460 U	UG/KG	230
43	ISOPHORONE	1	0	330	.		.	460 U	UG/KG	230
44	N-NITROSO-DI-n-PROPYLAMINE	1	0	330	.		.	460 U	UG/KG	230
45	N-NITROSODIPHENYLAMINE	1	1	330	370 JB	UG/KG	370	370 JB	UG/KG	370
46	NAPHTHALENE	1	0	330	.		.	460 U	UG/KG	230
47	NITROBENZENE	1	0	330	.		.	460 U	UG/KG	230
48	PHENANTHRENE	1	0	330	.		.	460 U	UG/KG	230
49	PYRENE	1	0	330	.		.	460 U	UG/KG	230
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		49	3							

Location=SED013

SEDIMENT PESTICIDE/PCB SUMMARY ALL UNITS UG/KG

OBS	ANALYTE	Total Samples	Total CRQL Hits	CRQL	Maximum Hit	MAXHUNIT	Average Hit	MAXIMUM	MAXUNIT	Total Average
1	4,4'-DDD	1	0	16	.		.	3 U	UG/KG	1.50
2	4,4'-DDE	1	0	16	.		.	3 U	UG/KG	1.50
3	4,4'-DDT	1	0	16	.		.	3 U	UG/KG	1.50
4	ALDRIN	1	0	8	.		.	1.5 U	UG/KG	0.75
5	AROCLOR-1016	1	0	80	.		.	15 U	UG/KG	7.50
6	AROCLOR-1221	1	0	80	.		.	15 U	UG/KG	7.50
7	AROCLOR-1232	1	0	80	.		.	15 U	UG/KG	7.50
8	AROCLOR-1242	1	0	80	.		.	15 U	UG/KG	7.50
9	AROCLOR-1248	1	0	80	.		.	15 U	UG/KG	7.50
10	AROCLOR-1254	1	0	80	.		.	30 U	UG/KG	15.00
11	AROCLOR-1260	1	0	80	.		.	30 U	UG/KG	15.00
12	CHLORDANE	1	0	80	.		.	15 U	UG/KG	7.50
13	DIELDRIN	1	0	16	.		.	3 U	UG/KG	1.50
14	ENDOSULFAN I	1	0	8	.		.	1.5 U	UG/KG	0.75
15	ENDOSULFAN II	1	0	16	.		.	3 U	UG/KG	1.50
16	ENDOSULFAN SULFATE	1	0	16	.		.	3 U	UG/KG	1.50
17	ENDRIN	1	0	16	.		.	3 U	UG/KG	1.50
18	ENDRIN KETONE	1	0	16	.		.	3 U	UG/KG	1.50
19	HEPTACHLOR	1	0	8	.		.	1.5 U	UG/KG	0.75
20	HEPTACHLOR EPOXIDE	1	0	8	.		.	1.5 U	UG/KG	0.75
21	METHOXYCHLOR	1	0	80	.		.	15 U	UG/KG	7.50
22	TOXAPHENE	1	0	160	.		.	30 U	UG/KG	15.00
23	alpha-BHC	1	0	8	.		.	1.5 U	UG/KG	0.75
24	beta-BHC	1	0	8	.		.	6.4 U	UG/KG	3.20
25	delta-BHC	1	0	8	.		.	1.5 U	UG/KG	0.75
26	gamma-BHC (LINDANE)	1	0	8	.		.	1.5 U	UG/KG	0.75
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		26	0							

Location=SED013

SEDIMENT TOTAL METAL SUMMARY ALL UNITS UG/KG

OB	ANALYTE	Total Samples	Total CRQL Hits	CRQL	Maximum Hit	MAXHUNIT	Average Hit	MAXIMUM	MAXUNIT	Total Average
1	ALUMINUM	1	0	40000	.		.	8520	MG/KG	8520.00
2	ANTIMONY	1	0	12000	.		.	1.6	MG/KG	1.60
3	ARSENIC	1	0	2000	.		.	0.23	MG/KG	0.23
4	BARIUM	1	0	40000	.		.	91	MG/KG	91.00
5	BERYLLIUM	1	0	1000	.		.	0.39 U	MG/KG	0.20
6	CADMIUM	1	0	1000	.		.	0.39 U	MG/KG	0.20
7	CALCIUM	1	0	2000000	.		.	6930	MG/KG	6930.00
8	CESIUM	1	0	200000	.		.	6.6 U	MG/KG	3.30
9	CHROMIUM	1	0	2000	.		.	7.8	MG/KG	7.80
10	COBALT	1	0	10000	.		.	4.6	MG/KG	4.60
11	COPPER	1	0	5000	.		.	10	MG/KG	10.00
12	IRON	1	0	20000	.		.	14300	MG/KG	14300.00
13	LEAD	1	0	1000	.		.	11	MG/KG	11.00
14	MAGNESIUM	1	0	2000000	.		.	1800	MG/KG	1800.00
15	MANGANESE	1	0	3000	.		.	325	MG/KG	325.00
16	MERCURY	1	0	200	.		.	0.02 U	MG/KG	0.01
17	MOLYBDENUM	1	0	40000	.		.	7.8 U	MG/KG	3.90
18	NICKEL	1	0	8000	.		.	9.3	MG/KG	9.30
19	POTASSIUM	1	0	2000000	.		.	34100	MG/KG	34100.00
20	SELENIUM	1	0	1000	.		.	0.22 U	MG/KG	0.11
21	SILVER	1	0	2000	.		.	1.6	MG/KG	1.60
22	SODIUM	1	0	2000000	.		.	324	MG/KG	324.00
23	STRONTIUM	1	0	40000	.		.	48	MG/KG	48.00
24	THALLIUM	1	0	2000	.		.	8.5	MG/KG	8.50
	VANADIUM	1	0	10000	.		.	26	MG/KG	26.00
	ZINC	1	0	4000	.		.	99	MG/KG	99.00
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		26	0							

Location=SED013

SEDIMENT TOTAL RAD SUMMARY ALL UNITS PCI/KG

Obs	ANALYTE	Total Samples	Total CRQL Hits	CRQL	Maximum Hit	MAXHUNIT	Average Hit	MAXIMUM	MAXUNIT	Total Average
1	AMERICIUM-241	1	1	20	30	PCI/KG	30.00	30	PCI/KG	30.00
2	GROSS ALPHA PARTICLE RADIOAC	1	1	4000	34000	PCI/KG	34000.00	34000	PCI/KG	34000.00
3	GROSS BETA PARTICLE RADIOACT	1	1	10000	22000	PCI/KG	22000.00	22000	PCI/KG	22000.00
4	PLUTONIUM-239	1	1	30	70	PCI/KG	70.00	70	PCI/KG	70.00
5	TRITIUM	1	0	400000	.		.	-10	PCI/L	-10.00
6	URANIUM, TOTAL	1	1	0	1.56		1.56	1.56		1.56
7	URANIUM-233,-234	1	1	300	930	PCI/KG	930.00	930	PCI/KG	930.00
8	URANIUM-238	1	1	300	630	PCI/KG	630.00	630	PCI/KG	630.00
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		8	7							

Location=SED032

SEDIMENT VOA SUMMARY ALL UNITS UG/KG

OBS	ANALYTE	Total Samples	Total CRQL Hits	CRQL	Maximum Hit	MAXHUNIT	Average Hit	MAXIMUM	MAXUNIT	Total Average
1	1,1,1-TRICHLOROETHANE	1	0	5	.		.	7 U	UG/KG	3.5
2	1,1,2,2-TETRACHLOROETHANE	1	0	5	.		.	7 U	UG/KG	3.5
3	1,1,2-TRICHLOROETHANE	1	0	5	.		.	7 U	UG/KG	3.5
4	1,1-DICHLOROETHANE	1	0	5	.		.	7 U	UG/KG	3.5
5	1,1-DICHLOROETHENE	1	0	5	.		.	7 U	UG/KG	3.5
6	1,2-DICHLOROETHANE	1	0	5	.		.	7 U	UG/KG	3.5
7	1,2-DICHLOROETHENE	1	0	5	.		.	7 U	UG/KG	3.5
8	1,2-DICHLOROPROPANE	1	0	5	.		.	7 U	UG/KG	3.5
9	2-BUTANONE	1	1	10	2 J	UG/KG	2	2 J	UG/KG	2.0
10	2-HEXANONE	1	0	10	.		.	14 U	UG/KG	7.0
11	4-METHYL-2-PENTANONE	1	0	10	.		.	14 U	UG/KG	7.0
12	ACETONE	1	0	10	.		.	14 U	UG/KG	7.0
13	BENZENE	1	0	5	.		.	7 U	UG/KG	3.5
14	BROMODICHLOROMETHANE	1	0	5	.		.	7 U	UG/KG	3.5
15	BROMOFORM	1	0	5	.		.	7 U	UG/KG	3.5
16	BROMOMETHANE	1	0	10	.		.	14 U	UG/KG	7.0
17	CARBON DISULFIDE	1	0	5	.		.	7 U	UG/KG	3.5
18	CARBON TETRACHLORIDE	1	0	5	.		.	7 U	UG/KG	3.5
19	CHLOROBENZENE	1	0	5	.		.	7 U	UG/KG	3.5
20	CHLOROETHANE	1	0	10	.		.	14 U	UG/KG	7.0
21	CHLOROFORM	1	0	5	.		.	7 U	UG/KG	3.5
22	CHLOROMETHANE	1	0	10	.		.	14 U	UG/KG	7.0
23	DIBROMOCHLOROMETHANE	1	0	5	.		.	7 U	UG/KG	3.5
24	ETHYLBENZENE	1	0	5	.		.	7 U	UG/KG	3.5
25	METHYLENE CHLORIDE	1	1	5	5 J	UG/KG	5	5 J	UG/KG	5.0
26	STYRENE	1	0	5	.		.	7 U	UG/KG	3.5
27	TETRACHLOROETHENE	1	0	5	.		.	7 U	UG/KG	3.5
28	TOLUENE	1	1	5	1 J	UG/KG	1	1 J	UG/KG	1.0
29	TOTAL XYLENES	1	0	5	.		.	7 U	UG/KG	3.5
30	TRICHLOROETHENE	1	0	5	.		.	7 U	UG/KG	3.5
31	VINYL ACETATE	1	0	10	.		.	14 U	UG/KG	7.0
32	VINYL CHLORIDE	1	0	10	.		.	14 U	UG/KG	7.0
33	cis-1,3-DICHLOROPROPENE	1	0	5	.		.	7 U	UG/KG	3.5
34	trans-1,3-DICHLOROPROPENE	1	0	5	.		.	7 U	UG/KG	3.5
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		34	3							

Location=SED032

SEDIMENT ACID EXTRACTABLE SUMMARY ALL UNITS UG/KG

SS	ANALYTE	Total Samples	Total CRQL Hits	CRQL	Maximum Hit	MAXHUNIT	Average Hit	MAXIMUN	MAXUNIT	Total Average
1	2,4,5-TRICHLOROPHENOL	1	0	1600	.		.	2300 U	UG/KG	1150
2	2,4,6-TRICHLOROPHENOL	1	0	330	.		.	470 U	UG/KG	235
3	2,4-DICHLOROPHENOL	1	0	330	.		.	470 U	UG/KG	235
4	2,4-DIMETHYLPHENOL	1	0	330	.		.	470 U	UG/KG	235
5	2,4-DINITROPHENOL	1	0	1600	.		.	2300 U	UG/KG	1150
6	2-CHLOROPHENOL	1	0	330	.		.	470 U	UG/KG	235
7	2-METHYLPHENOL	1	0	330	.		.	470 U	UG/KG	235
8	2-NITROPHENOL	1	0	330	.		.	470 U	UG/KG	235
9	4,6-DINITRO-2-METHYLPHENOL	1	0	1600	.		.	2300 U	UG/KG	1150
10	4-CHLORO-3-METHYLPHENOL	1	0	330	.		.	470 U	UG/KG	235
11	4-METHYLPHENOL	1	0	330	.		.	470 U	UG/KG	235
12	4-NITROPHENOL	1	0	1600	.		.	2300 U	UG/KG	1150
13	BENZOIC ACID	1	0	1600	.		.	2300 U	UG/KG	1150
14	BENZYL ALCOHOL	1	0	330	.		.	470 U	UG/KG	235
15	PENTACHLOROPHENOL	1	0	1600	.		.	2300 U	UG/KG	1150
16	PHENOL	1	0	330	.		.	470 U	UG/KG	235
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		16	0							

Location=SED032

SEDIMENT BASE NEUTRAL EXTRACTABLE SUMMARY ALL UNITS UG/KG

OBS	ANALYTE	Total Samples	Total CRQL Hits	CRQL	Maximum Hit	MAXHUNIT	Average Hit	MAXIMUM	MAXUNIT	Total Average
1	1,2,4-TRICHLOROBENZENE	1	0	330	.		.	470 U	UG/KG	235
2	1,2-DICHLOROBENZENE	1	0	330	.		.	470 U	UG/KG	235
3	1,3-DICHLOROBENZENE	1	0	330	.		.	470 U	UG/KG	235
4	1,4-DICHLOROBENZENE	1	0	330	.		.	470 U	UG/KG	235
5	2,4-DINITROTOLUENE	1	0	330	.		.	470 U	UG/KG	235
6	2,6-DINITROTOLUENE	1	0	330	.		.	470 U	UG/KG	235
7	2-CHLORONAPHTHALENE	1	0	330	.		.	470 U	UG/KG	235
8	2-METHYLNAPHTHALENE	1	0	330	.		.	470 U	UG/KG	235
9	2-NITROANILINE	1	0	1600	.		.	2300 U	UG/KG	1150
10	3,3'-DICHLOROBENZIDINE	1	0	660	.		.	930 U	UG/KG	465
11	3-NITROANILINE	1	0	1600	.		.	2300 U	UG/KG	1150
12	4-BROMOPHENYL PHENYL ETHER	1	0	330	.		.	470 U	UG/KG	235
13	4-CHLOROANILINE	1	0	330	.		.	470 U	UG/KG	235
14	4-CHLOROPHENYL PHENYL ETHER	1	0	330	.		.	470 U	UG/KG	235
15	4-NITROANILINE	1	0	1600	.		.	2300 U	UG/KG	1150
16	ACENAPHTHENE	1	0	330	.		.	470 U	UG/KG	235
17	ACENAPHTHYLENE	1	0	330	.		.	470 U	UG/KG	235
18	ANTHRACENE	1	0	330	.		.	470 U	UG/KG	235
19	BENZO(a)ANTHRACENE	1	0	330	.		.	470 U	UG/KG	235
20	BENZO(a)PYRENE	1	0	330	.		.	470 U	UG/KG	235
21	BENZO(b)FLUORANTHENE	1	0	330	.		.	470 U	UG/KG	235
22	BENZO(ghi)PERYLENE	1	0	330	.		.	470 U	UG/KG	235
23	BENZO(k)FLUORANTHENE	1	0	330	.		.	470 U	UG/KG	235
24	BIS(2-CHLOROETHOXY)METHANE	1	0	330	.		.	470 U	UG/KG	235
25	BIS(2-CHLOROETHYL)ETHER	1	0	330	.		.	470 U	UG/KG	235
26	BIS(2-CHLOROISOPROPYL)ETHER	1	0	330	.		.	470 U	UG/KG	235
27	BIS(2-ETHYLHEXYL)PHTHALATE	1	1	330	130 J	UG/KG	130	130 J	UG/KG	130
28	BUTYL BENZYL PHTHALATE	1	0	330	.		.	470 U	UG/KG	235
29	CHRYSENE	1	0	330	.		.	470 U	UG/KG	235
30	DI-n-BUTYL PHTHALATE	1	1	330	100 JB	UG/KG	100	100 JB	UG/KG	100
31	DI-n-OCTYL PHTHALATE	1	0	330	.		.	470 U	UG/KG	235
32	DIBENZO(a,h)ANTHRACENE	1	0	330	.		.	470 U	UG/KG	235
33	DIBENZOFURAN	1	0	330	.		.	470 U	UG/KG	235
34	DIETHYL PHTHALATE	1	0	330	.		.	470 U	UG/KG	235
35	DIMETHYL PHTHALATE	1	0	330	.		.	470 U	UG/KG	235
36	FLUORANTHENE	1	0	330	.		.	470 U	UG/KG	235
37	FLUORENE	1	0	330	.		.	470 U	UG/KG	235
38	HEXACHLOROBENZENE	1	0	330	.		.	470 U	UG/KG	235
39	HEXACHLOROBUTADIENE	1	0	330	.		.	470 U	UG/KG	235
40	HEXACHLOROCYCLOPENTADIENE	1	0	330	.		.	470 U	UG/KG	235
41	HEXACHLOROETHANE	1	0	330	.		.	470 U	UG/KG	235
42	INDENO(1,2,3-cd)PYRENE	1	0	330	.		.	470 U	UG/KG	235
43	ISOPHORONE	1	0	330	.		.	470 U	UG/KG	235
44	N-NITROSO-DI-n-PROPYLAMINE	1	0	330	.		.	470 U	UG/KG	235
45	N-NITROSODIPHENYLAMINE	1	0	330	.		.	470 U	UG/KG	235
46	NAPHTHALENE	1	0	330	.		.	470 U	UG/KG	235
47	NITROBENZENE	1	0	330	.		.	470 U	UG/KG	235
48	PHENANTHRENE	1	0	330	.		.	470 U	UG/KG	235
49	PYRENE	1	0	330	.		.	470 U	UG/KG	235
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		49	2							

Location=SED032

SEDIMENT TOTAL RAD SUMMARY ALL UNITS PCI/KG

	ANALYTE	Total Samples	Total CRQL Hits	CRQL	Maximum Hit	MAXHUNIT	Average Hit	MAXIMUM	MAXUNIT	Total Average
1	CESIUM-137	1	0	100	.		.	0	PCI/KG	0
		1	0							

Location=SED033

SEDIMENT ACID EXTRACTABLE SUMMARY ALL UNITS UG/KG

S	ANALYTE	Total Samples	Total CRQL Hits	CRQL	Maximum Hit	MAXHUNIT	Average Hit	MAXIMUM	MAXUNIT	Total Average
1	2,4,5-TRICHLOROPHENOL	1	0	1600	.		.	2900 U	UG/KG	1450
2	2,4,6-TRICHLOROPHENOL	1	0	330	.		.	590 U	UG/KG	295
3	2,4-DICHLOROPHENOL	1	0	330	.		.	590 U	UG/KG	295
4	2,4-DIMETHYLPHENOL	1	0	330	.		.	590 U	UG/KG	295
5	2,4-DINITROPHENOL	1	0	1600	.		.	2900 U	UG/KG	1450
6	2-CHLOROPHENOL	1	0	330	.		.	590 U	UG/KG	295
7	2-METHYLPHENOL	1	0	330	.		.	590 U	UG/KG	295
8	2-NITROPHENOL	1	0	330	.		.	590 U	UG/KG	295
9	4,6-DINITRO-2-METHYLPHENOL	1	0	1600	.		.	2900 U	UG/KG	1450
10	4-CHLORO-3-METHYLPHENOL	1	0	330	.		.	590 U	UG/KG	295
11	4-METHYLPHENOL	1	0	330	.		.	590 U	UG/KG	295
12	4-NITROPHENOL	1	0	1600	.		.	2900 U	UG/KG	1450
13	BENZOIC ACID	1	0	1600	.		.	2900 U	UG/KG	1450
14	BENZYL ALCOHOL	1	0	330	.		.	590 U	UG/KG	295
15	PENTACHLOROPHENOL	1	0	1600	.		.	2900 U	UG/KG	1450
16	PHENOL	1	0	330	.		.	590 U	UG/KG	295
		16	0							

Location=SED033

SEDIMENT BASE NEUTRAL EXTRACTABLE SUMMARY ALL UNITS UG/KG

BS	ANALYTE	Total Samples	Total CRQL Hits	CRQL	Maximum Hit	MAXHUNIT	Average Hit	MAXIMUM	MAXUNIT	Total Average
1	1,2,4-TRICHLOROBENZENE	1	0	330	.		.	590 U	UG/KG	295
2	1,2-DICHLOROBENZENE	1	0	330	.		.	590 U	UG/KG	295
3	1,3-DICHLOROBENZENE	1	0	330	.		.	590 U	UG/KG	295
4	1,4-DICHLOROBENZENE	1	0	330	.		.	590 U	UG/KG	295
5	2,4-DINITROTOLUENE	1	0	330	.		.	590 U	UG/KG	295
6	2,6-DINITROTOLUENE	1	0	330	.		.	590 U	UG/KG	295
7	2-CHLORONAPHTHALENE	1	0	330	.		.	590 U	UG/KG	295
8	2-METHYLNAPHTHALENE	1	0	330	.		.	590 U	UG/KG	295
9	2-NITROANILINE	1	0	1600	.		.	2900 U	UG/KG	1450
10	3,3'-DICHLOROBENZIDINE	1	0	660	.		.	1200 U	UG/KG	600
11	3-NITROANILINE	1	0	1600	.		.	2900 U	UG/KG	1450
12	4-BROMOPHENYL PHENYL ETHER	1	0	330	.		.	590 U	UG/KG	295
13	4-CHLOROANILINE	1	0	330	.		.	590 U	UG/KG	295
14	4-CHLOROPHENYL PHENYL ETHER	1	0	330	.		.	590 U	UG/KG	295
15	4-NITROANILINE	1	0	1600	.		.	2900 U	UG/KG	1450
16	ACENAPHTHENE	1	0	330	.		.	590 U	UG/KG	295
17	ACENAPHTHYLENE	1	0	330	.		.	590 U	UG/KG	295
18	ANTHRACENE	1	0	330	.		.	590 U	UG/KG	295
19	BENZO(a)ANTHRACENE	1	0	330	.		.	590 U	UG/KG	295
20	BENZO(a)PYRENE	1	0	330	.		.	590 U	UG/KG	295
21	BENZO(b)FLUORANTHENE	1	0	330	.		.	590 U	UG/KG	295
22	BENZO(ghi)PERYLENE	1	0	330	.		.	590 U	UG/KG	295
23	BENZO(k)FLUORANTHENE	1	0	330	.		.	590 U	UG/KG	295
24	BIS(2-CHLOROETHOXY)METHANE	1	0	330	.		.	590 U	UG/KG	295
25	BIS(2-CHLOROETHYL)ETHER	1	0	330	.		.	590 U	UG/KG	295
26	BIS(2-CHLOROISOPROPYL)ETHER	1	0	330	.		.	590 U	UG/KG	295
27	BIS(2-ETHYLHEXYL)PHTHALATE	1	1	330	87 J	UG/KG	87	87 J	UG/KG	87
28	BUTYL BENZYL PHTHALATE	1	0	330	.		.	590 U	UG/KG	295
29	CHRYSENE	1	0	330	.		.	590 U	UG/KG	295
30	DI-n-BUTYL PHTHALATE	1	1	330	250 JB	UG/KG	250	250 JB	UG/KG	250
31	DI-n-OCTYL PHTHALATE	1	0	330	.		.	590 U	UG/KG	295
32	DIBENZO(a,h)ANTHRACENE	1	0	330	.		.	590 U	UG/KG	295
33	DIBENZOFURAN	1	0	330	.		.	590 U	UG/KG	295
34	DIETHYL PHTHALATE	1	0	330	.		.	590 U	UG/KG	295
35	DIMETHYL PHTHALATE	1	0	330	.		.	590 U	UG/KG	295
36	FLUORANTHENE	1	0	330	.		.	590 U	UG/KG	295
37	FLUORENE	1	0	330	.		.	590 U	UG/KG	295
38	HEXACHLOROBENZENE	1	0	330	.		.	590 U	UG/KG	295
39	HEXACHLOROBUTADIENE	1	0	330	.		.	590 U	UG/KG	295
40	HEXACHLOROCYCLOPENTADIENE	1	0	330	.		.	590 U	UG/KG	295
41	HEXACHLOROETHANE	1	0	330	.		.	590 U	UG/KG	295
42	INDENO(1,2,3-cd)PYRENE	1	0	330	.		.	590 U	UG/KG	295
43	ISOPHORONE	1	0	330	.		.	590 U	UG/KG	295
44	N-NITROSO-DI-n-PROPYLAMINE	1	0	330	.		.	590 U	UG/KG	295
45	N-NITROSODIPHENYLAMINE	1	0	330	.		.	590 U	UG/KG	295
46	NAPHTHALENE	1	0	330	.		.	590 U	UG/KG	295
47	NITROBENZENE	1	0	330	.		.	590 U	UG/KG	295
48	PHENANTHRENE	1	0	330	.		.	590 U	UG/KG	295
49	PYRENE	1	0	330	.		.	590 U	UG/KG	295
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		49	2							

Location=SED033

SEDIMENT TOTAL RAD SUMMARY ALL UNITS PCI/KG

	ANALYTE	Total Samples	Total CRQL Hits	CRQL	Maximum Hit	MAXHUNIT	Average Hit	MAXIMUM	MAXUNIT	Total Average
1	CESIUM-137	1	0	100	.		.	0	PCI/KG	0
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		1	0							

Location=SED035

SEDIMENT VOA SUMMARY All UNITS UG/KG

S	ANALYTE	Total Samples	Total CRQL Hits	CRQL	Maximum Hit	MAXHUNIT	Average Hit	MAXIMUM	MAXUNIT	Total Average
1	1,1,1-TRICHLOROETHANE	3	0	5	.		.	6 U	UG/KG	2.833
2	1,1,2,2-TETRACHLOROETHANE	3	0	5	.		.	6 U	UG/KG	2.833
3	1,1,2-TRICHLOROETHANE	3	0	5	.		.	6 U	UG/KG	2.833
4	1,1-DICHLOROETHANE	3	0	5	.		.	6 U	UG/KG	2.833
5	1,1-DICHLOROETHENE	3	0	5	.		.	6 U	UG/KG	2.833
6	1,2-DICHLOROETHANE	3	0	5	.		.	6 U	UG/KG	2.833
7	1,2-DICHLOROETHENE	3	0	5	.		.	6 U	UG/KG	2.833
8	1,2-DICHLOROPROPANE	3	0	5	.		.	6 U	UG/KG	2.833
9	2-BUTANONE	3	1	10	1 JB	UG/KG	1.000	12 U	UG/KG	4.167
10	2-HEXANONE	3	0	10	.		.	12 U	UG/KG	5.667
11	4-METHYL-2-PENTANONE	3	0	10	.		.	12 U	UG/KG	5.667
12	ACETONE	3	1	10	3 BJ	UG/KG	3.000	11 U	UG/KG	4.667
13	BENZENE	3	0	5	.		.	6 U	UG/KG	2.833
14	BROMODICHLOROMETHANE	3	0	5	.		.	6 U	UG/KG	2.833
15	BROMOFORM	3	0	5	.		.	6 U	UG/KG	2.833
16	BROMOMETHANE	3	0	10	.		.	12 U	UG/KG	5.667
17	CARBON DISULFIDE	3	1	5	1 J	UG/KG	1.000	6 U	UG/KG	2.167
18	CARBON TETRACHLORIDE	3	0	5	.		.	6 U	UG/KG	2.833
19	CHLOROBENZENE	3	0	5	.		.	6 U	UG/KG	2.833
20	CHLOROETHANE	3	0	10	.		.	12 U	UG/KG	5.667
21	CHLOROFORM	3	0	5	.		.	6 U	UG/KG	2.833
22	CHLOROMETHANE	3	0	10	.		.	12 U	UG/KG	5.667
23	DIBROMOCHLOROMETHANE	3	0	5	.		.	6 U	UG/KG	2.833
24	ETHYLBENZENE	3	0	5	.		.	6 U	UG/KG	2.833
25	METHYLENE CHLORIDE	3	3	5	7 B	UG/KG	5.667	7 B	UG/KG	5.667
[illegible]	STYRENE	3	0	5	.		.	6 U	UG/KG	2.833
[illegible]	TETRACHLOROETHENE	3	0	5	.		.	6 U	UG/KG	2.833
28	TOLUENE	3	0	5	.		.	6 U	UG/KG	2.833
29	TOTAL XYLENES	3	0	5	.		.	6 U	UG/KG	2.833
30	TRICHLOROETHENE	3	0	5	.		.	6 U	UG/KG	2.833
31	VINYL ACETATE	3	0	10	.		.	12 U	UG/KG	5.667
32	VINYL CHLORIDE	3	0	10	.		.	12 U	UG/KG	5.667
33	cis-1,3-DICHLOROPROPENE	3	0	5	.		.	6 U	UG/KG	2.833
34	trans-1,3-DICHLOROPROPENE	3	0	5	.		.	6 U	UG/KG	2.833
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		102	6							

Location=SED035

SEDIMENT ACID EXTRACTABLE SUMMARY ALL UNITS UG/KG

NS	ANALYTE	Total Samples	Total CRQL Hits	CRQL	Maximum Hit	MAXHUNIT	Average Hit	MAXIMUM	MAXUNIT	Total Average
1	2,4,5-TRICHLOROPHENOL	2	0	1600	.		.	3400 U	UG/KG	1350.0
2	2,4,6-TRICHLOROPHENOL	2	0	330	.		.	710 U	UG/KG	277.5
3	2,4-DICHLOROPHENOL	2	0	330	.		.	710 U	UG/KG	277.5
4	2,4-DIMETHYLPHENOL	2	0	330	.		.	710 U	UG/KG	277.5
5	2,4-DINITROPHENOL	2	0	1600	.		.	3400 U	UG/KG	1350.0
6	2-CHLOROPHENOL	2	0	330	.		.	710 U	UG/KG	277.5
7	2-METHYLPHENOL	2	0	330	.		.	710 U	UG/KG	277.5
8	2-NITROPHENOL	2	0	330	.		.	710 U	UG/KG	277.5
9	4,6-DINITRO-2-METHYLPHENOL	2	0	1600	.		.	3400 U	UG/KG	1350.0
10	4-CHLORO-3-METHYLPHENOL	2	0	330	.		.	710 U	UG/KG	277.5
11	4-METHYLPHENOL	2	0	330	.		.	710 U	UG/KG	277.5
12	4-NITROPHENOL	2	0	1600	.		.	3400 U	UG/KG	1350.0
13	BENZOIC ACID	2	0	1600	.		.	3400 U	UG/KG	1350.0
14	BENZYL ALCOHOL	2	0	330	.		.	710 U	UG/KG	277.5
15	PENTACHLOROPHENOL	2	0	1600	.		.	3400 U	UG/KG	1350.0
16	PHENOL	2	0	330	.		.	710 U	UG/KG	277.5
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		32	0							

Location=SED035

SEDIMENT BASE NEUTRAL EXTRACTABLE SUMMARY ALL UNITS UG/KG

BS	ANALYTE	Total Samples	Total CRQL Hits	CRQL	Maximum Hit	MAXHUNIT	Average Hit	MAXIMUM	MAXUNIT	Total Average
1	1,2,4-TRICHLOROBENZENE	2	0	330	.		.	710 U	UG/KG	277.5
2	1,2-DICHLOROBENZENE	2	0	330	.		.	710 U	UG/KG	277.5
3	1,3-DICHLOROBENZENE	2	0	330	.		.	710 U	UG/KG	277.5
4	1,4-DICHLOROBENZENE	2	0	330	.		.	710 U	UG/KG	277.5
5	2,4-DINITROTOLUENE	2	0	330	.		.	710 U	UG/KG	277.5
6	2,6-DINITROTOLUENE	2	0	330	.		.	710 U	UG/KG	277.5
7	2-CHLORONAPHTHALENE	2	0	330	.		.	710 U	UG/KG	277.5
8	2-METHYLNAPHTHALENE	2	0	330	.		.	710 U	UG/KG	277.5
9	2-NITROANILINE	2	0	1600	.		.	3400 U	UG/KG	1350.0
10	3,3'-DICHLOROBENZIDINE	2	0	660	.		.	1400 U	UG/KG	552.5
11	3-NITROANILINE	2	0	1600	.		.	3400 U	UG/KG	1350.0
12	4-BROMOPHENYL PHENYL ETHER	2	0	330	.		.	710 U	UG/KG	277.5
13	4-CHLOROANILINE	2	0	330	.		.	710 U	UG/KG	277.5
14	4-CHLOROPHENYL PHENYL ETHER	2	0	330	.		.	710 U	UG/KG	277.5
15	4-NITROANILINE	2	0	1600	.		.	3400 U	UG/KG	1350.0
16	ACENAPHTHENE	2	0	330	.		.	710 U	UG/KG	277.5
17	ACENAPHTHYLENE	2	0	330	.		.	710 U	UG/KG	277.5
18	ANTHRACENE	2	0	330	.		.	710 U	UG/KG	277.5
19	BENZO(a)ANTHRACENE	2	0	330	.		.	710 U	UG/KG	277.5
20	BENZO(a)PYRENE	1	0	330	.		.	400 U	UG/KG	200.0
21	BENZO(b)FLUORANTHENE	1	0	330	.		.	400 U	UG/KG	200.0
22	BENZO(ghi)PERYLENE	1	0	330	.		.	400 U	UG/KG	200.0
23	BENZO(k)FLUORANTHENE	1	0	330	.		.	400 U	UG/KG	200.0
24	BIS(2-CHLOROETHOXY)METHANE	2	0	330	.		.	710 U	UG/KG	277.5
25	BIS(2-CHLOROETHYL)ETHER	2	0	330	.		.	710 U	UG/KG	277.5
26	BIS(2-CHLOROISOPROPYL)ETHER	2	0	330	.		.	710 U	UG/KG	277.5
27	BIS(2-ETHYLHEXYL)PHTHALATE	1	1	330	47 J	UG/KG	47	47 J	UG/KG	47.0
28	BUTYL BENZYL PHTHALATE	2	0	330	.		.	710 U	UG/KG	277.5
29	CHRYSENE	1	0	330	.		.	400 U	UG/KG	200.0
30	DI-n-BUTYL PHTHALATE	2	1	330	79 J	UG/KG	79	400 U	UG/KG	139.5
31	DI-n-OCTYL PHTHALATE	1	0	330	.		.	400 U	UG/KG	200.0
32	DIBENZO(a,h)ANTHRACENE	1	0	330	.		.	400 U	UG/KG	200.0
33	DIBENZOFURAN	2	0	330	.		.	710 U	UG/KG	277.5
34	DIETHYL PHTHALATE	2	0	330	.		.	710 U	UG/KG	277.5
35	DIMETHYL PHTHALATE	2	0	330	.		.	710 U	UG/KG	277.5
36	FLUORANTHENE	2	0	330	.		.	710 U	UG/KG	277.5
37	FLUORENE	2	0	330	.		.	710 U	UG/KG	277.5
38	HEXACHLOROBENZENE	2	0	330	.		.	710 U	UG/KG	277.5
39	HEXACHLOROBUTADIENE	2	0	330	.		.	710 U	UG/KG	277.5
40	HEXACHLOROCYCLOPENTADIENE	2	0	330	.		.	710 U	UG/KG	277.5
41	HEXACHLOROETHANE	2	0	330	.		.	710 U	UG/KG	277.5
42	INDENO(1,2,3-cd)PYRENE	1	0	330	.		.	400 U	UG/KG	200.0
43	ISOPHORONE	2	0	330	.		.	710 U	UG/KG	277.5
44	N-NITROSO-DI-n-PROPYLAMINE	2	0	330	.		.	710 U	UG/KG	277.5
45	N-NITROSODIPHENYLAMINE	2	0	330	.		.	710 U	UG/KG	277.5
46	NAPHTHALENE	2	0	330	.		.	710 U	UG/KG	277.5
47	NITROBENZENE	2	0	330	.		.	710 U	UG/KG	277.5
48	PHENANTHRENE	2	0	330	.		.	710 U	UG/KG	277.5
49	PYRENE	2	0	330	.		.	710 U	UG/KG	277.5
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		89	2							

Location=SED035

SEDIMENT PESTICIDE/PCB SUMMARY ALL UNITS UG/KG

S	ANALYTE	Total Samples	Total CRQL Hits	CRQL	Maximum Hit	MAXHUNIT	Average Hit	MAXIMUM	MAXUNIT	Total Average
1	4,4'-DDD	2	0	16	.		.	34 U	UG/KG	13.5
2	4,4'-DDE	2	0	16	.		.	34 U	UG/KG	13.5
3	4,4'-DDT	2	0	16	.		.	34 U	UG/KG	13.5
4	ALDRIN	2	0	8	.		.	17 U	UG/KG	6.7
5	AROCLOR-1016	2	0	80	.		.	170 U	UG/KG	67.0
6	AROCLOR-1221	2	0	80	.		.	170 U	UG/KG	67.0
7	AROCLOR-1232	2	0	80	.		.	170 U	UG/KG	67.0
8	AROCLOR-1242	2	0	80	.		.	170 U	UG/KG	67.0
9	AROCLOR-1248	2	0	80	.		.	170 U	UG/KG	67.0
10	AROCLOR-1254	2	0	80	.		.	340 U	UG/KG	135.0
11	AROCLOR-1260	2	0	80	.		.	340 U	UG/KG	135.0
12	DIELDRIN	2	0	16	.		.	34 U	UG/KG	13.5
13	ENDOSULFAN I	2	0	8	.		.	17 U	UG/KG	6.7
14	ENDOSULFAN II	2	0	16	.		.	34 U	UG/KG	13.5
15	ENDOSULFAN SULFATE	2	0	16	.		.	34 U	UG/KG	13.5
16	ENDRIN	2	0	16	.		.	34 U	UG/KG	13.5
17	ENDRIN KETONE	2	0	16	.		.	34 U	UG/KG	13.5
18	HEPTACHLOR	2	0	8	.		.	17 U	UG/KG	6.7
19	HEPTACHLOR EPOXIDE	2	0	8	.		.	17 U	UG/KG	6.7
20	METHOXYCHLOR	2	0	80	.		.	170 U	UG/KG	67.0
21	TOXAPHENE	2	0	160	.		.	340 U	UG/KG	135.0
22	alpha-BHC	2	0	8	.		.	17 U	UG/KG	6.7
23	alpha-CHLORDANE	2	0	80	.		.	170 U	UG/KG	67.0
24	beta-BHC	2	0	8	.		.	17 U	UG/KG	6.7
25	delta-BHC	2	0	8	.		.	17 U	UG/KG	6.7
26	gamma-BHC (LINDANE)	2	0	8	.		.	17 U	UG/KG	6.7
27	gamma-CHLORDANE	2	0	80	.		.	170 U	UG/KG	67.0
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		54	0							

Location=SED035

SEDIMENT TOTAL METAL SUMMARY ALL UNITS UG/KG

OBS	ANALYTE	Total Samples	Total CRQL Hits	CRQL	Maximum Hit	MAXHUNIT	Average Hit	MAXIMUM	MAXUNIT	Total Average
1	ALUMINUM	3	1	40000	6600000	UG/KG	6600000	6600000	UG/KG	2207646.67
2	ANTIMONY	3	0	12000	.		.	12200 U	UG/KG	2037.70
3	ARSENIC	3	1	2000	6200	UG/KG	6200	6200	UG/KG	2069.33
4	BARIUM	3	1	40000	86900	UG/KG	86900	86900	UG/KG	29050.00
5	BERYLLIUM	3	0	1000	.		.	1000 U	UG/KG	167.22
6	CADMIUM	3	0	1000	.		.	1000 U	UG/KG	167.93
7	CALCIUM	3	1	2000000	3450000	UG/KG	3450000	3450000	UG/KG	1155913.33
8	CESIUM	2	0	200000	.		.	203000 U	UG/KG	50751.20
9	CHROMIUM	3	1	2000	6100	UG/KG	6100	6100	UG/KG	2042.13
10	COBALT	3	1	10000	10900	UG/KG	10900	10900	UG/KG	3641.07
11	COPPER	3	1	5000	14100	UG/KG	14100	14100	UG/KG	4715.47
12	IRON	3	1	20000	33300000	UG/KG	33300000	33300000	UG/KG	11111000.00
13	LEAD	3	1	1000	18900	UG/KG	18900	18900	UG/KG	6314.07
14	LITHIUM	3	0	20000	.		.	20300 U	UG/KG	3388.92
15	MAGNESIUM	3	0	2000000	.		.	1600000	UG/KG	535223.33
16	MANGANESE	3	1	3000	465000	UG/KG	465000	465000	UG/KG	155154.67
17	MERCURY	3	0	200	.		.	91 U	UG/KG	15.20
18	MOLYBDENUM	3	0	40000	.		.	20300 U	UG/KG	3385.18
19	NICKEL	3	1	8000	14700	UG/KG	14700	14700	UG/KG	4911.37
20	POTASSIUM	3	0	2000000	.		.	1020000 U	UG/KG	171100.00
21	SELENIUM	3	0	1000	.		.	1000 U	UG/KG	166.88
22	SILVER	3	0	2000	.		.	2000 U	UG/KG	334.48
23	SODIUM	3	0	2000000	.		.	1020000 U	UG/KG	170082.67
24	STRONTIUM	3	0	40000	.		.	203000 U	UG/KG	33866.93
25	THALLIUM	3	0	2000	.		.	2100 U	UG/KG	350.18
26	TIN	3	0	40000	.		.	20300 U	UG/KG	3394.28
27	VANADIUM	3	1	10000	45100	UG/KG	45100	45100	UG/KG	15054.00
28	ZINC	3	1	4000	59500	UG/KG	59500	59500	UG/KG	19875.80
		83	13							

Location=SED035

SEDIMENT TOTAL RAD SUMMARY ALL UNITS PCI/KG

	ANALYTE	Total Samples	Total CRQL Hits	CRQL	Maximum Hit	MAXHUNIT	Average Hit	MAXIMUM	MAXUNIT	Total Average
1	CESIUM-137	1	1	100	200	PCI/KG	200	200	PCI/KG	200
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		1	1							

Location=SED036

SEDIMENT VOA SUMMARY All UNITS UG/KG

BS	ANALYTE	Total Samples	Total CRQL Hits	CRQL	Maximum Hit	MAXHUNIT	Average Hit	MAXIMUM	MAXUNIT	Total Average
1	1,1,1-TRICHLOROETHANE	2	0	5	.		.	6 U	UG/KG	2.75
2	1,1,2,2-TETRACHLOROETHANE	2	0	5	.		.	6 U	UG/KG	2.75
3	1,1,2-TRICHLOROETHANE	2	0	5	.		.	6 U	UG/KG	2.75
4	1,1-DICHLOROETHANE	2	0	5	.		.	6 U	UG/KG	2.75
5	1,1-DICHLOROETHENE	2	0	5	.		.	6 U	UG/KG	2.75
6	1,2-DICHLOROETHANE	2	0	5	.		.	6 U	UG/KG	2.75
7	1,2-DICHLOROETHENE	2	0	5	.		.	6 U	UG/KG	2.75
8	1,2-DICHLOROPROPANE	2	0	5	.		.	6 U	UG/KG	2.75
9	2-BUTANONE	2	0	10	.		.	12 U	UG/KG	5.75
10	2-HEXANONE	2	0	10	.		.	12 U	UG/KG	5.75
11	4-METHYL-2-PENTANONE	2	0	10	.		.	12 U	UG/KG	5.75
12	ACETONE	2	1	10	7 J	UG/KG	7.0	11 U	UG/KG	6.25
13	BENZENE	2	0	5	.		.	6 U	UG/KG	2.75
14	BROMODICHLOROMETHANE	2	0	5	.		.	6 U	UG/KG	2.75
15	BROMOFORM	2	0	5	.		.	6 U	UG/KG	2.75
16	BROMOMETHANE	2	0	10	.		.	12 U	UG/KG	5.75
17	CARBON DISULFIDE	2	0	5	.		.	6 U	UG/KG	2.75
18	CARBON TETRACHLORIDE	2	0	5	.		.	6 U	UG/KG	2.75
19	CHLOROBENZENE	2	0	5	.		.	6 U	UG/KG	2.75
20	CHLOROETHANE	2	0	10	.		.	12 U	UG/KG	5.75
21	CHLOROFORM	2	0	5	.		.	6 U	UG/KG	2.75
22	CHLOROMETHANE	2	0	10	.		.	12 U	UG/KG	5.75
23	DIBROMOCHLOROMETHANE	2	0	5	.		.	6 U	UG/KG	2.75
24	ETHYLBENZENE	2	0	5	.		.	6 U	UG/KG	2.75
25	METHYLENE CHLORIDE	2	2	5	4 J	UG/KG	3.5	4 J	UG/KG	3.50
26	STYRENE	2	0	5	.		.	6 U	UG/KG	2.75
27	TETRACHLOROETHENE	2	0	5	.		.	6 U	UG/KG	2.75
28	TOLUENE	2	0	5	.		.	6 U	UG/KG	2.75
29	TOTAL XYLENES	2	0	5	.		.	6 U	UG/KG	2.75
30	TRICHLOROETHENE	2	0	5	.		.	6 U	UG/KG	2.75
31	VINYL ACETATE	2	0	10	.		.	12 U	UG/KG	5.75
32	VINYL CHLORIDE	2	0	10	.		.	12 U	UG/KG	5.75
33	cis-1,3-DICHLOROPROPENE	2	0	5	.		.	6 U	UG/KG	2.75
34	trans-1,3-DICHLOROPROPENE	2	0	5	.		.	6 U	UG/KG	2.75
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		68	3							

Location=SED036

SEDIMENT ACID EXTRACTABLE SUMMARY ALL UNITS UG/KG

OBS	ANALYTE	Total Samples	Total CRQL Hits	CRQL	Maximum Hit	MAXHUNIT	Average Hit	MAXIMUM	MAXUNIT	Total Average
1	2,4,5-TRICHLOROPHENOL	2	0	1600	.		.	1900 U	UG/KG	925
2	2,4,6-TRICHLOROPHENOL	2	0	330	.		.	380 U	UG/KG	185
3	2,4-DICHLOROPHENOL	2	0	330	.		.	380 U	UG/KG	185
4	2,4-DIMETHYLPHENOL	2	0	330	.		.	380 U	UG/KG	185
5	2,4-DINITROPHENOL	2	0	1600	.		.	1900 U	UG/KG	925
6	2-CHLOROPHENOL	2	0	330	.		.	380 U	UG/KG	185
7	2-METHYLPHENOL	2	0	330	.		.	380 U	UG/KG	185
8	2-NITROPHENOL	2	0	330	.		.	380 U	UG/KG	185
9	4,6-DINITRO-2-METHYLPHENOL	2	0	1600	.		.	1900 U	UG/KG	925
10	4-CHLORO-3-METHYLPHENOL	2	0	330	.		.	380 U	UG/KG	185
11	4-METHYLPHENOL	2	0	330	.		.	380 U	UG/KG	185
12	4-NITROPHENOL	2	0	1600	.		.	1900 U	UG/KG	925
13	BENZOIC ACID	2	1	1600	44 J	UG/KG	44	1800 U	UG/KG	472
14	BENZYL ALCOHOL	2	0	330	.		.	380 U	UG/KG	185
15	PENTACHLOROPHENOL	2	0	1600	.		.	1900 U	UG/KG	925
16	PHENOL	2	0	330	.		.	380 U	UG/KG	185
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		32	1							

Location=SED036

SEDIMENT BASE NEUTRAL EXTRACTABLE SUMMARY ALL UNITS UG/KG

OBS	ANALYTE	Total Samples	Total CRQL Hits	CRQL	Maximum Hit	MAXHUNIT	Average Hit	MAXIMUM	MAXUNIT	Total Average
1	1,2,4-TRICHLOROBENZENE	2	0	330	.		.	380 U	UG/KG	185.0
2	1,2-DICHLOROBENZENE	2	0	330	.		.	380 U	UG/KG	185.0
3	1,3-DICHLOROBENZENE	2	0	330	.		.	380 U	UG/KG	185.0
4	1,4-DICHLOROBENZENE	2	0	330	.		.	380 U	UG/KG	185.0
5	2,4-DINITROTOLUENE	2	0	330	.		.	380 U	UG/KG	185.0
6	2,6-DINITROTOLUENE	2	0	330	.		.	380 U	UG/KG	185.0
7	2-CHLORONAPHTHALENE	2	0	330	.		.	380 U	UG/KG	185.0
8	2-METHYLNAPHTHALENE	2	0	330	.		.	380 U	UG/KG	185.0
9	2-NITROANILINE	2	0	1600	.		.	1900 U	UG/KG	925.0
10	3,3'-DICHLOROBENZIDINE	2	0	660	.		.	760 U	UG/KG	367.5
11	3-NITROANILINE	2	0	1600	.		.	1900 U	UG/KG	925.0
12	4-BROMOPHENYL PHENYL ETHER	2	0	330	.		.	380 U	UG/KG	185.0
13	4-CHLOROANILINE	2	0	330	.		.	380 U	UG/KG	185.0
14	4-CHLOROPHENYL PHENYL ETHER	2	0	330	.		.	380 U	UG/KG	185.0
15	4-NITROANILINE	2	0	1600	.		.	1900 U	UG/KG	925.0
16	ACENAPHTHENE	2	0	330	.		.	380 U	UG/KG	185.0
17	ACENAPHTHYLENE	2	0	330	.		.	380 U	UG/KG	185.0
18	ANTHRACENE	2	0	330	.		.	380 U	UG/KG	185.0
19	BENZO(a)ANTHRACENE	2	0	330	.		.	380 U	UG/KG	185.0
20	BENZO(a)PYRENE	2	0	330	.		.	380 U	UG/KG	185.0
21	BENZO(b)FLUORANTHENE	2	0	330	.		.	380 U	UG/KG	185.0
22	BENZO(ghi)PERYLENE	2	0	330	.		.	380 U	UG/KG	185.0
23	BENZO(k)FLUORANTHENE	2	0	330	.		.	380 U	UG/KG	185.0
24	BIS(2-CHLOROETHOXY)METHANE	2	0	330	.		.	380 U	UG/KG	185.0
25	BIS(2-CHLOROETHYL)ETHER	2	0	330	.		.	380 U	UG/KG	185.0
26	BIS(2-CHLOROISOPROPYL)ETHER	2	0	330	.		.	380 U	UG/KG	185.0
27	BIS(2-ETHYLHEXYL)PHTHALATE	2	2	330	64 J	UG/KG	51	64 J	UG/KG	51.0
28	BUTYL BENZYL PHTHALATE	2	0	330	.		.	380 U	UG/KG	185.0
29	CHRYSENE	2	0	330	.		.	380 U	UG/KG	185.0
30	DI-n-BUTYL PHTHALATE	2	1	330	79 JB	UG/KG	79	380 U	UG/KG	134.5
31	DI-n-OCTYL PHTHALATE	2	0	330	.		.	380 U	UG/KG	185.0
32	DIBENZO(a,h)ANTHRACENE	2	0	330	.		.	380 U	UG/KG	185.0
33	DIBENZOFURAN	2	0	330	.		.	380 U	UG/KG	185.0
34	DIETHYL PHTHALATE	2	0	330	.		.	380 U	UG/KG	185.0
35	DIMETHYL PHTHALATE	2	0	330	.		.	380 U	UG/KG	185.0
36	FLUORANTHENE	2	0	330	.		.	380 U	UG/KG	185.0
37	FLUORENE	2	0	330	.		.	380 U	UG/KG	185.0
38	HEXACHLOROBENZENE	2	0	330	.		.	380 U	UG/KG	185.0
39	HEXACHLOROBUTADIENE	2	0	330	.		.	380 U	UG/KG	185.0
40	HEXACHLOROCYCLOPENTADIENE	2	0	330	.		.	380 U	UG/KG	185.0
41	HEXACHLOROETHANE	2	0	330	.		.	380 U	UG/KG	185.0
42	INDENO(1,2,3-cd)PYRENE	2	0	330	.		.	380 U	UG/KG	185.0
43	ISOPHORONE	2	0	330	.		.	380 U	UG/KG	185.0
44	N-NITROSO-DI-n-PROPYLAMINE	2	0	330	.		.	380 U	UG/KG	185.0
45	N-NITROSODIPHENYLAMINE	2	0	330	.		.	380 U	UG/KG	185.0
46	NAPHTHALENE	2	0	330	.		.	380 U	UG/KG	185.0
47	NITROBENZENE	2	0	330	.		.	380 U	UG/KG	185.0
48	PHENANTHRENE	2	0	330	.		.	380 U	UG/KG	185.0
49	PYRENE	2	0	330	.		.	380 U	UG/KG	185.0
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		98	3							

Location=SED036

SEDIMENT PESTICIDE/PCB SUMMARY ALL UNITS UG/KG

	ANALYTE	Total Samples	Total CRQL Hits	CRQL	Maximum Hit	MAXHUNIT	Average Hit	MAXIMUM	MAXUNIT	Total Average
1	4,4'-DDD	1	0	16	.		.	19 U	UG/KG	9.50
2	4,4'-DDE	1	0	16	.		.	19 U	UG/KG	9.50
3	4,4'-DDT	1	0	16	.		.	19 U	UG/KG	9.50
4	ALDRIN	1	0	8	.		.	9.3 U	UG/KG	4.65
5	AROCLOR-1016	1	0	80	.		.	93 U	UG/KG	46.50
6	AROCLOR-1221	1	0	80	.		.	93 U	UG/KG	46.50
7	AROCLOR-1232	1	0	80	.		.	93 U	UG/KG	46.50
8	AROCLOR-1242	1	0	80	.		.	93 U	UG/KG	46.50
9	AROCLOR-1248	1	0	80	.		.	93 U	UG/KG	46.50
10	AROCLOR-1254	1	0	80	.		.	190 U	UG/KG	95.00
11	AROCLOR-1260	1	0	80	.		.	190 U	UG/KG	95.00
12	DIELDRIN	1	0	16	.		.	19 U	UG/KG	9.50
13	ENDOSULFAN I	1	0	8	.		.	9.3 U	UG/KG	4.65
14	ENDOSULFAN II	1	0	16	.		.	19 U	UG/KG	9.50
15	ENDOSULFAN SULFATE	1	0	16	.		.	19 U	UG/KG	9.50
16	ENDRIN	1	0	16	.		.	19 U	UG/KG	9.50
17	ENDRIN KETONE	1	0	16	.		.	19 U	UG/KG	9.50
18	HEPTACHLOR	1	0	8	.		.	9.3 U	UG/KG	4.65
19	HEPTACHLOR EPOXIDE	1	0	8	.		.	9.3 U	UG/KG	4.65
20	METHOXYCHLOR	1	0	80	.		.	93 U	UG/KG	46.50
21	TOXAPHENE	1	0	160	.		.	190 U	UG/KG	95.00
22	alpha-BHC	1	0	8	.		.	9.3 U	UG/KG	4.65
23	alpha-CHLORDANE	1	0	80	.		.	93 U	UG/KG	46.50
24	beta-BHC	1	1	8	11 XZ	UG/KG	11	11 XZ	UG/KG	11.00
25	delta-BHC	1	0	8	.		.	9.3 U	UG/KG	4.65
26	gamma-BHC (LINDANE)	1	0	8	.		.	9.3 U	UG/KG	4.65
27	gamma-CHLORDANE	1	0	80	.		.	93 U	UG/KG	46.50
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		27	1							

Location=SED036

SEDIMENT TOTAL METAL SUMMARY ALL UNITS UG/KG

OBS	ANALYTE	Total Samples	Total CRQL Hits	CRQL	Maximum Hit	MAXHUNIT	Average Hit	MAXIMUM	MAXUNIT	Total Average
1	ALUMINUM	2	1	40000	5510000	UG/KG	5510000	5510000	UG/KG	2759270.00
2	ANTIMONY	2	0	12000	.		.	12800 U	UG/KG	3200.88
3	ARSENIC	2	1	2000	3700	UG/KG	3700	3700	UG/KG	1852.70
4	BARIUM	2	1	40000	90400	UG/KG	90400	90400	UG/KG	45262.50
5	BERYLLIUM	2	0	1000	.		.	1100 U	UG/KG	275.25
6	CADMIUM	2	0	1000	.		.	1100 U	UG/KG	275.37
7	CALCIUM	2	1	2000000	4240000	UG/KG	4240000	4240000	UG/KG	2121830.00
8	CESIUM	1	0	200000	.		.	213000 U	UG/KG	106500.00
9	CHROMIUM	2	1	2000	4500	UG/KG	4500	4500	UG/KG	2255.10
10	COBALT	2	0	10000	.		.	10700 U	UG/KG	2678.05
11	COPPER	2	1	5000	8200	UG/KG	8200	8200	UG/KG	4111.80
12	IRON	2	1	20000	11000000	UG/KG	11000000	11000000	UG/KG	5506250.00
13	LEAD	2	1	1000	13500	UG/KG	13500	13500	UG/KG	6762.40
14	LITHIUM	2	0	20000	.		.	21300 U	UG/KG	5329.05
15	MAGNESIUM	2	0	2000000	.		.	1300000	UG/KG	650915.00
16	MANGANESE	2	1	3000	294000	UG/KG	294000	294000	UG/KG	147105.00
17	MERCURY	2	0	200	.		.	93 U	UG/KG	23.27
18	MOLYBDENUM	2	0	40000	.		.	21300 U	UG/KG	5325.30
19	NICKEL	2	1	8000	9400	UG/KG	9400	9400	UG/KG	4706.00
20	POTASSIUM	2	0	2000000	.		.	1070000 U	UG/KG	268410.00
21	SELENIUM	2	0	1000	.		.	1000 U	UG/KG	250.15
22	SILVER	2	0	2000	.		.	2100 U	UG/KG	525.14
23	SODIUM	2	0	2000000	.		.	1070000 U	UG/KG	267542.80
24	STRONTIUM	2	0	40000	.		.	213000 U	UG/KG	53269.35
25	THALLIUM	2	0	2000	.		.	2100 U	UG/KG	525.06
26	TIN	2	0	40000	.		.	21300 U	UG/KG	5329.80
27	VANADIUM	2	1	10000	24400	UG/KG	24400	24400	UG/KG	12210.35
28	ZINC	2	1	4000	36200	UG/KG	36200	36200	UG/KG	18133.05
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		55	12							

Location=SED036

SEDIMENT TOTAL RAD SUMMARY ALL UNITS PCI/KG

	ANALYTE	Total Samples	Total CRQL Hits	CRQL	Maximum Hit	MAXHUNIT	Average Hit	MAXIMUM	MAXUNIT	Total Average
1	AMERICIUM-241	1	1	20	4.187 J	PCI/KG	4.19	4.187 J	PCI/KG	4.19
2	CESIUM-137	2	1	100	239.7	PCI/KG	239.70	239.7	PCI/KG	169.85
3	GROSS ALPHA - DISSOLVED	1	1	4000	6786	PCI/KG	6786.00	6786	PCI/KG	6786.00
4	GROSS BETA - DISSOLVED	1	1	10000	21890	PCI/KG	21890.00	21890	PCI/KG	21890.00
5	PLUTONIUM-238	1	1	0	0 J	PCI/KG	0.00	0 J	PCI/KG	0.00
6	PLUTONIUM-239/240	1	1	30	12.99 J	PCI/KG	12.99	12.99 J	PCI/KG	12.99
7	RADIUM-226	1	1	500	1042	PCI/KG	1042.00	1042	PCI/KG	1042.00
8	RADIUM-228	1	1	500	1512	PCI/KG	1512.00	1512	PCI/KG	1512.00
9	STRONTIUM-89,90	1	1	1000	329.7 J	PCI/KG	329.70	329.7 J	PCI/KG	329.70
10	TRITIUM	1	0	400000	.		.	1208	PCI/L	1208.00
11	URANIUM-233,-234	1	1	300	1139	PCI/KG	1139.00	1139	PCI/KG	1139.00
12	URANIUM-235	1	1	300	10.37 J	PCI/KG	10.37	10.37 J	PCI/KG	10.37
13	URANIUM-238	1	1	300	1108	PCI/KG	1108.00	1108	PCI/KG	1108.00
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		14	12							

Location=SED118

SEDIMENT VOA SUMMARY All UNITS UG/KG

OBS	ANALYTE	Total Samples	Total CRQL Hits	CRQL	Maximum Hit	MAXHUNIT	Average Hit	MAXIMUM	MAXUNIT	Total Average
1	1,1,1-TRICHLOROETHANE	2	0	5	.		.	18 U	UG/KG	6.00
2	1,1,2,2-TETRACHLOROETHANE	2	0	5	.		.	18 U	UG/KG	6.00
3	1,1,2-TRICHLOROETHANE	2	0	5	.		.	18 U	UG/KG	6.00
4	1,1-DICHLOROETHANE	2	0	5	.		.	18 U	UG/KG	6.00
5	1,1-DICHLOROETHENE	2	0	5	.		.	18 U	UG/KG	6.00
6	1,2-DICHLOROETHANE	2	0	5	.		.	18 U	UG/KG	6.00
7	1,2-DICHLOROETHENE	2	0	5	.		.	18 U	UG/KG	6.00
8	1,2-DICHLOROPROPANE	2	0	5	.		.	18 U	UG/KG	6.00
9	2-BUTANONE	2	2	10	59 B	UG/KG	31.5	59 B	UG/KG	31.50
10	2-HEXANONE	2	0	10	.		.	36 U	UG/KG	11.75
11	4-METHYL-2-PENTANONE	2	1	10	1 BJ	UG/KG	1.0	36 U	UG/KG	9.50
12	ACETONE	2	1	10	2 BJ	UG/KG	2.0	36 U	UG/KG	10.00
13	BENZENE	2	0	5	.		.	18 U	UG/KG	6.00
14	BROMODICHLOROMETHANE	2	0	5	.		.	18 U	UG/KG	6.00
15	BROMOFORM	2	0	5	.		.	18 U	UG/KG	6.00
16	BROMOMETHANE	2	0	10	.		.	36 U	UG/KG	11.75
17	CARBON DISULFIDE	2	1	5	2 J	UG/KG	2.0	18 U	UG/KG	5.50
18	CARBON TETRACHLORIDE	2	0	5	.		.	18 U	UG/KG	6.00
19	CHLOROBENZENE	2	0	5	.		.	18 U	UG/KG	6.00
20	CHLOROETHANE	2	0	10	.		.	36 U	UG/KG	11.75
21	CHLOROFORM	2	0	5	.		.	18 U	UG/KG	6.00
22	CHLOROMETHANE	2	0	10	.		.	36 U	UG/KG	11.75
23	DIBROMOCHLOROMETHANE	2	0	5	.		.	18 U	UG/KG	6.00
24	ETHYLBENZENE	2	0	5	.		.	18 U	UG/KG	6.00
25	METHYLENE CHLORIDE	2	2	5	10 B	UG/KG	9.5	10 B	UG/KG	9.50
26	STYRENE	2	0	5	.		.	18 U	UG/KG	6.00
27	TETRACHLOROETHENE	2	0	5	.		.	18 U	UG/KG	6.00
28	TOLUENE	2	1	5	2 BJ	UG/KG	2.0	18 U	UG/KG	5.50
29	TOTAL XYLENES	2	0	5	.		.	18 U	UG/KG	6.00
30	TRICHLOROETHENE	2	0	5	.		.	18 U	UG/KG	6.00
31	VINYL ACETATE	2	0	10	.		.	36 U	UG/KG	11.75
32	VINYL CHLORIDE	2	0	10	.		.	36 U	UG/KG	11.75
33	cis-1,3-DICHLOROPROPENE	2	0	5	.		.	18 U	UG/KG	6.00
34	trans-1,3-DICHLOROPROPENE	2	0	5	.		.	18 U	UG/KG	6.00
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		68	8							

Location=SED11B

SEDIMENT ACID EXTRACTABLE SUMMARY ALL UNITS UG/KG

OBS	ANALYTE	Total Samples	Total CRQL Hits	CRQL	Maximum Hit	MAXHUNIT	Average Hit	MAXIMUM	MAXUNIT	Total Average
1	2,4,5-TRICHLOROPHENOL	2	0	1600	.		.	11000 U	UG/KG	3225.0
2	2,4,6-TRICHLOROPHENOL	2	0	330	.		.	2400 U	UG/KG	697.5
3	2,4-DICHLOROPHENOL	2	0	330	.		.	2400 U	UG/KG	697.5
4	2,4-DIMETHYLPHENOL	2	0	330	.		.	2400 U	UG/KG	697.5
5	2,4-DINITROPHENOL	2	0	1600	.		.	11000 U	UG/KG	3225.0
6	2-CHLOROPHENOL	2	0	330	.		.	2400 U	UG/KG	697.5
7	2-METHYLPHENOL	2	0	330	.		.	2400 U	UG/KG	697.5
8	2-NITROPHENOL	2	0	330	.		.	2400 U	UG/KG	697.5
9	4,6-DINITRO-2-METHYLPHENOL	2	0	1600	.		.	11000 U	UG/KG	3225.0
10	4-CHLORO-3-METHYLPHENOL	2	0	330	.		.	2400 U	UG/KG	697.5
11	4-METHYLPHENOL	2	0	330	.		.	2400 U	UG/KG	697.5
12	4-NITROPHENOL	2	0	1600	.		.	11000 U	UG/KG	3225.0
13	BENZOIC ACID	2	0	1600	.		.	11000 U	UG/KG	3225.0
14	BENZYL ALCOHOL	2	0	330	.		.	2400 U	UG/KG	697.5
15	PENTACHLOROPHENOL	2	0	1600	.		.	11000 U	UG/KG	3225.0
16	PHENOL	2	0	330	.		.	2400 U	UG/KG	697.5
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		32	0							

Location=SED118

SEDIMENT BASE NEUTRAL EXTRACTABLE SUMMARY ALL UNITS UG/KG

OBS	ANALYTE	Total Samples	Total CRQL Hits	CRQL	Maximum Hit	MAXHUNIT	Average Hit	MAXIMUM	MAXUNIT	Total Average
1	1,2,4-TRICHLOROBENZENE	2	0	330	.		.	2400 U	UG/KG	697.5
2	1,2-DICHLOROBENZENE	2	0	330	.		.	2400 U	UG/KG	697.5
3	1,3-DICHLOROBENZENE	2	0	330	.		.	2400 U	UG/KG	697.5
4	1,4-DICHLOROBENZENE	2	0	330	.		.	2400 U	UG/KG	697.5
5	2,4-DINITROTOLUENE	2	0	330	.		.	2400 U	UG/KG	697.5
6	2,6-DINITROTOLUENE	2	0	330	.		.	2400 U	UG/KG	697.5
7	2-CHLORONAPHTHALENE	2	0	330	.		.	2400 U	UG/KG	697.5
8	2-METHYLNAPHTHALENE	2	0	330	.		.	2400 U	UG/KG	697.5
9	2-NITROANILINE	2	0	1600	.		.	11000 U	UG/KG	3225.0
10	3,3'-DICHLOROBENZIDINE	2	0	660	.		.	4700 U	UG/KG	1367.5
11	3-NITROANILINE	2	0	1600	.		.	11000 U	UG/KG	3225.0
12	4-BROMOPHENYL PHENYL ETHER	2	0	330	.		.	2400 U	UG/KG	697.5
13	4-CHLOROANILINE	2	0	330	.		.	2400 U	UG/KG	697.5
14	4-CHLOROPHENYL PHENYL ETHER	2	0	330	.		.	2400 U	UG/KG	697.5
15	4-NITROANILINE	2	0	1600	.		.	11000 U	UG/KG	3225.0
16	ACENAPHTHENE	2	0	330	.		.	2400 U	UG/KG	697.5
17	ACENAPHTHYLENE	2	0	330	.		.	2400 U	UG/KG	697.5
18	ANTHRACENE	2	0	330	.		.	2400 U	UG/KG	697.5
19	BENZO(a)ANTHRACENE	2	0	330	.		.	2400 U	UG/KG	697.5
20	BENZO(a)PYRENE	2	0	330	.		.	2400 U	UG/KG	697.5
21	BENZO(b)FLUORANTHENE	2	0	330	.		.	2400 U	UG/KG	697.5
22	BENZO(ghi)PERYLENE	2	0	330	.		.	2400 U	UG/KG	697.5
23	BENZO(k)FLUORANTHENE	2	0	330	.		.	2400 U	UG/KG	697.5
24	BIS(2-CHLOROETHOXY)METHANE	2	0	330	.		.	2400 U	UG/KG	697.5
25	BIS(2-CHLOROETHYL)ETHER	2	0	330	.		.	2400 U	UG/KG	697.5
26	BIS(2-CHLOROISOPROPYL)ETHER	2	0	330	.		.	2400 U	UG/KG	697.5
27	BIS(2-ETHYLHEXYL)PHTHALATE	2	0	330	.		.	2400 U	UG/KG	697.5
28	BUTYL BENZYL PHTHALATE	2	0	330	.		.	2400 U	UG/KG	697.5
29	CHRYSENE	2	0	330	.		.	2400 U	UG/KG	697.5
30	DI-n-BUTYL PHTHALATE	2	0	330	.		.	2400 U	UG/KG	697.5
31	DI-n-OCTYL PHTHALATE	2	0	330	.		.	2400 U	UG/KG	697.5
32	DIBENZO(a,h)ANTHRACENE	2	0	330	.		.	2400 U	UG/KG	697.5
33	DIBENZOFURAN	2	0	330	.		.	2400 U	UG/KG	697.5
34	DIETHYL PHTHALATE	2	0	330	.		.	2400 U	UG/KG	697.5
35	DIMETHYL PHTHALATE	2	0	330	.		.	2400 U	UG/KG	697.5
36	FLUORANTHENE	2	1	330	45 J	UG/KG	45	2400 U	UG/KG	622.5
37	FLUORENE	2	0	330	.		.	2400 U	UG/KG	697.5
38	HEXACHLOROBENZENE	2	0	330	.		.	2400 U	UG/KG	697.5
39	HEXACHLOROBUTADIENE	2	0	330	.		.	2400 U	UG/KG	697.5
40	HEXACHLOROCYCLOPENTADIENE	2	0	330	.		.	2400 U	UG/KG	697.5
41	HEXACHLOROETHANE	2	0	330	.		.	2400 U	UG/KG	697.5
42	INDENO(1,2,3-cd)PYRENE	2	0	330	.		.	2400 U	UG/KG	697.5
43	ISOPHORONE	2	0	330	.		.	2400 U	UG/KG	697.5
44	N-NITROSO-DI-n-PROPYLAMINE	2	0	330	.		.	2400 U	UG/KG	697.5
45	N-NITROSODIPHENYLAMINE	2	0	330	.		.	2400 U	UG/KG	697.5
46	NAPHTHALENE	2	0	330	.		.	2400 U	UG/KG	697.5
47	NITROBENZENE	2	0	330	.		.	2400 U	UG/KG	697.5
48	PHENANTHRENE	2	0	330	.		.	2400 U	UG/KG	697.5
49	PYRENE	2	1	330	70 J	UG/KG	70	2400 U	UG/KG	635.0
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		98	2							

Location=SED118

SEDIMENT PESTICIDE/PCB SUMMARY ALL UNITS UG/KG

S	ANALYTE	Total Samples	Total CRQL Hits	CRQL	Maximum Hit	MAXHUNIT	Average Hit	MAXIMUM	MAXUNIT	Total Average
1	4,4'-DDD	2	0	16	.		.	110 U	UG/KG	32.250
2	4,4'-DDE	2	0	16	.		.	110 U	UG/KG	32.250
3	4,4'-DDT	2	0	16	.		.	110 U	UG/KG	32.250
4	ALDRIN	2	0	8	.		.	57 U	UG/KG	16.625
5	AROCLOR-1016	2	0	80	.		.	570 U	UG/KG	166.250
6	AROCLOR-1221	2	0	80	.		.	570 U	UG/KG	166.250
7	AROCLOR-1232	2	0	80	.		.	570 U	UG/KG	166.250
8	AROCLOR-1242	2	0	80	.		.	570 U	UG/KG	166.250
9	AROCLOR-1248	2	0	80	.		.	570 U	UG/KG	166.250
10	AROCLOR-1254	2	0	80	.		.	1100 U	UG/KG	322.500
11	AROCLOR-1260	2	0	80	.		.	1100 U	UG/KG	322.500
12	DIELDRIN	2	0	16	.		.	110 U	UG/KG	32.250
13	ENDOSULFAN I	2	0	8	.		.	57 U	UG/KG	16.625
14	ENDOSULFAN II	2	0	16	.		.	110 U	UG/KG	32.250
15	ENDOSULFAN SULFATE	2	0	16	.		.	110 U	UG/KG	32.250
16	ENDRIN	2	0	16	.		.	110 U	UG/KG	32.250
17	ENDRIN KETONE	2	0	16	.		.	110 U	UG/KG	32.250
18	HEPTACHLOR	2	0	8	.		.	57 U	UG/KG	16.625
19	HEPTACHLOR EPOXIDE	2	0	8	.		.	57 U	UG/KG	16.625
20	METHOXYCHLOR	2	0	80	.		.	570 U	UG/KG	166.250
21	TOXAPHENE	2	0	160	.		.	1100 U	UG/KG	322.500
22	alpha-BHC	2	0	8	.		.	57 U	UG/KG	16.625
23	alpha-CHLORDANE	2	0	80	.		.	570 U	UG/KG	166.250
24	beta-BHC	2	0	8	.		.	57 U	UG/KG	16.625
25	delta-BHC	2	0	8	.		.	57 U	UG/KG	16.625
26	gamma-BHC (LINDANE)	2	0	8	.		.	57 U	UG/KG	16.625
27	gamma-CHLORDANE	2	0	80	.		.	570 U	UG/KG	166.250
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		54	0							

Location=SED118

SEDIMENT TOTAL METAL SUMMARY ALL UNITS UG/KG

BS	ANALYTE	Total Samples	Total CRQL Hits	CRQL	Maximum Hit	MAXHUNIT	Average Hit	MAXIMUM	MAXUNIT	Total Average
1	ALUMINUM	2	0	40000	.		.	14300	MG/KG	10275.00
2	ANTIMONY	2	0	12000	.		.	13.3 BN	MG/KG	8.35
3	ARSENIC	2	0	2000	.		.	10.2	MG/KG	7.60
4	BARIUM	2	0	40000	.		.	188	MG/KG	146.50
5	BERYLLIUM	2	0	1000	.		.	1.2 B	MG/KG	1.10
6	CADMIUM	2	0	1000	.		.	1.5 B	MG/KG	1.30
7	CALCIUM	2	0	2000000	.		.	12000 E	MG/KG	9985.00
8	CESIUM	2	0	200000	.		.	52 U	MG/KG	14.30
9	CHROMIUM	2	0	2000	.		.	11.3	MG/KG	9.65
10	COBALT	2	0	10000	.		.	15 B	MG/KG	11.55
11	COPPER	2	0	5000	.		.	35.9 *	MG/KG	24.85
12	IRON	2	1	20000	21700	MG/KG	21700	21700	MG/KG	16250.00
13	LEAD	2	0	1000	.		.	21.6	MG/KG	18.25
14	LITHIUM	2	0	20000	.		.	11.2 U	MG/KG	7.85
15	MAGNESIUM	2	0	2000000	.		.	4270 E	MG/KG	3345.00
16	MANGANESE	2	0	3000	.		.	457	MG/KG	350.50
17	MERCURY	3	0	200	.		.	0.5	MG/KG	0.24
18	MOLYBDENUM	2	0	40000	.		.	7.2 B	MG/KG	4.85
19	NICKEL	2	0	8000	.		.	24.3 B	MG/KG	19.50
20	POTASSIUM	2	0	2000000	.		.	2130 BE	MG/KG	1590.00
21	SELENIUM	2	0	1000	.		.	0.68 B	MG/KG	0.46
22	SILICON	1	1	0	1040 *	MG/KG	1040	1040 *	MG/KG	1040.00
23	SILVER	2	0	2000	.		.	2.3 U	MG/KG	1.62
24	SODIUM	2	0	2000000	.		.	402 BE	MG/KG	372.50
25	STRONTIUM	2	0	40000	.		.	74.8 B	MG/KG	58.50
26	THALLIUM	2	0	2000	.		.	1.4 UW	MG/KG	0.47
27	TIN	2	0	40000	.		.	24.9 B	MG/KG	15.25
28	VANADIUM	2	0	10000	.		.	42.4	MG/KG	31.80
29	ZINC	2	0	4000	.		.	111 E	MG/KG	91.05
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		58	2							

Location=SED120

SEDIMENT VOA SUMMARY All UNITS UG/KG

BS	ANALYTE	Total Samples	Total CRQL Hits	CRQL	Maximum Hit	MAXHUNIT	Average Hit	MAXIMUM	MAXUNIT	Total Average
1	1,1,1-TRICHLOROETHANE	2	0	5	.		.	8 U	UG/KG	3.25
2	1,1,2,2-TETRACHLOROETHANE	2	0	5	.		.	8 U	UG/KG	3.25
3	1,1,2-TRICHLOROETHANE	2	0	5	.		.	8 U	UG/KG	3.25
4	1,1-DICHLOROETHANE	2	0	5	.		.	8 U	UG/KG	3.25
5	1,1-DICHLOROETHENE	2	0	5	.		.	8 U	UG/KG	3.25
6	1,2-DICHLOROETHANE	2	0	5	.		.	8 U	UG/KG	3.25
7	1,2-DICHLOROETHENE	2	0	5	.		.	8 U	UG/KG	3.25
8	1,2-DICHLOROPROPANE	2	0	5	.		.	8 U	UG/KG	3.25
9	2-BUTANONE	2	1	10	3 BJ	UG/KG	3.0	11 U	UG/KG	4.25
10	2-HEXANONE	2	0	10	.		.	16 U	UG/KG	6.75
11	4-METHYL-2-PENTANONE	2	0	10	.		.	16 U	UG/KG	6.75
12	ACETONE	2	2	10	5 BJ	UG/KG	3.5	5 BJ	UG/KG	3.50
13	BENZENE	2	0	5	.		.	8 U	UG/KG	3.25
14	BROMODICHLOROMETHANE	2	0	5	.		.	8 U	UG/KG	3.25
15	BROMOFORM	2	0	5	.		.	8 U	UG/KG	3.25
16	BROMOMETHANE	2	0	10	.		.	16 U	UG/KG	6.75
17	CARBON DISULFIDE	2	1	5	2 J	UG/KG	2.0	5 U	UG/KG	2.25
18	CARBON TETRACHLORIDE	2	0	5	.		.	8 U	UG/KG	3.25
19	CHLOROBENZENE	2	0	5	.		.	8 U	UG/KG	3.25
20	CHLOROETHANE	2	0	10	.		.	16 U	UG/KG	6.75
21	CHLOROFORM	2	0	5	.		.	8 U	UG/KG	3.25
22	CHLOROMETHANE	2	0	10	.		.	16 U	UG/KG	6.75
23	DIBROMOCHLOROMETHANE	2	0	5	.		.	8 U	UG/KG	3.25
24	ETHYLBENZENE	2	0	5	.		.	8 U	UG/KG	3.25
25	METHYLENE CHLORIDE	2	2	5	8 B	UG/KG	6.5	8 B	UG/KG	6.50
[illegible]	STYRENE	2	0	5	.		.	8 U	UG/KG	3.25
[illegible]	TETRACHLOROETHENE	2	0	5	.		.	8 U	UG/KG	3.25
28	TOLUENE	2	0	5	.		.	8 U	UG/KG	3.25
29	TOTAL XYLENES	2	0	5	.		.	8 U	UG/KG	3.25
30	TRICHLOROETHENE	2	0	5	.		.	8 U	UG/KG	3.25
31	VINYL ACETATE	2	0	10	.		.	16 U	UG/KG	5.25
32	VINYL CHLORIDE	2	0	10	.		.	16 U	UG/KG	6.75
33	cis-1,3-DICHLOROPROPENE	2	0	5	.		.	8 U	UG/KG	3.25
34	trans-1,3-DICHLOROPROPENE	2	0	5	.		.	8 U	UG/KG	3.25
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		68	6							

Location=SED120

SEDIMENT ACID EXTRACTABLE SUMMARY ALL UNITS UG/KG

OBS	ANALYTE	Total Samples	Total CRQL Hits	CRQL	Maximum Hit	MAXHUNIT	Average Hit	MAXIMUM	MAXUNIT	Total Average
1	2,4,5-TRICHLOROPHENOL	2	0	1600	.		.	5200 U	UG/KG	1725.0
2	2,4,6-TRICHLOROPHENOL	2	0	330	.		.	1100 U	UG/KG	362.5
3	2,4-DICHLOROPHENOL	2	0	330	.		.	1100 U	UG/KG	362.5
4	2,4-DIMETHYLPHENOL	2	0	330	.		.	1100 U	UG/KG	362.5
5	2,4-DINITROPHENOL	2	0	1600	.		.	5200 U	UG/KG	1725.0
6	2-CHLOROPHENOL	2	0	330	.		.	1100 U	UG/KG	362.5
7	2-METHYLPHENOL	2	0	330	.		.	1100 U	UG/KG	362.5
8	2-NITROPHENOL	2	0	330	.		.	1100 U	UG/KG	362.5
9	4,6-DINITRO-2-METHYLPHENOL	2	0	1600	.		.	5200 U	UG/KG	1725.0
10	4-CHLORO-3-METHYLPHENOL	2	0	330	.		.	1100 U	UG/KG	362.5
11	4-METHYLPHENOL	2	0	330	.		.	1100 U	UG/KG	362.5
12	4-NITROPHENOL	2	0	1600	.		.	5200 U	UG/KG	1725.0
13	BENZOIC ACID	2	0	1600	.		.	5200 U	UG/KG	1725.0
14	BENZYL ALCOHOL	2	0	330	.		.	1100 U	UG/KG	362.5
15	PENTACHLOROPHENOL	2	0	1600	.		.	5200 U	UG/KG	1725.0
16	PHENOL	2	0	330	.		.	1100 U	UG/KG	362.5
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		32	0							

Location=SED120

SEDIMENT BASE NEUTRAL EXTRACTABLE SUMMARY ALL UNITS UG/KG

OBS	ANALYTE	Total Samples	Total CRQL Hits	CRQL	Maximum Hit	MAXHUNIT	Average Hit	MAXIMUM	MAXUNIT	Total Average
1	1,2,4-TRICHLOROBENZENE	2	0	330	.		.	1100 U	UG/KG	362.5
2	1,2-DICHLOROBENZENE	2	0	330	.		.	1100 U	UG/KG	362.5
3	1,3-DICHLOROBENZENE	2	0	330	.		.	1100 U	UG/KG	362.5
4	1,4-DICHLOROBENZENE	2	0	330	.		.	1100 U	UG/KG	362.5
5	2,4-DINITROTOLUENE	2	0	330	.		.	1100 U	UG/KG	362.5
6	2,6-DINITROTOLUENE	2	0	330	.		.	1100 U	UG/KG	362.5
7	2-CHLORONAPHTHALENE	2	0	330	.		.	1100 U	UG/KG	362.5
8	2-METHYLNAPHTHALENE	2	0	330	.		.	1100 U	UG/KG	362.5
9	2-NITROANILINE	2	0	1600	.		.	5200 U	UG/KG	1725.0
10	3,3'-DICHLOROBENZIDINE	2	0	660	.		.	2100 U	UG/KG	700.0
11	3-NITROANILINE	2	0	1600	.		.	5200 U	UG/KG	1725.0
12	4-BROMOPHENYL PHENYL ETHER	2	0	330	.		.	1100 U	UG/KG	362.5
13	4-CHLOROANILINE	2	0	330	.		.	1100 U	UG/KG	362.5
14	4-CHLOROPHENYL PHENYL ETHER	2	0	330	.		.	1100 U	UG/KG	362.5
15	4-NITROANILINE	2	0	1600	.		.	5200 U	UG/KG	1725.0
16	ACENAPHTHENE	2	0	330	.		.	1100 U	UG/KG	362.5
17	ACENAPHTHYLENE	2	0	330	.		.	1100 U	UG/KG	362.5
18	ANTHRACENE	2	0	330	.		.	1100 U	UG/KG	362.5
19	BENZO(a)ANTHRACENE	2	2	330	200 J	UG/KG	145.5	200 J	UG/KG	145.5
20	BENZO(a)PYRENE	2	1	330	100 J	UG/KG	100.0	1100 U	UG/KG	325.0
21	BENZO(b)FLUORANTHENE	2	1	330	90 J	UG/KG	90.0	1100 U	UG/KG	320.0
22	BENZO(ghi)PERYLENE	2	0	330	.		.	1100 U	UG/KG	362.5
23	BENZO(k)FLUORANTHENE	2	1	330	74 J	UG/KG	74.0	1100 U	UG/KG	312.0
24	BIS(2-CHLOROETHOXY)METHANE	2	0	330	.		.	1100 U	UG/KG	362.5
25	BIS(2-CHLOROETHYL)ETHER	2	0	330	.		.	1100 U	UG/KG	362.5
26	BIS(2-CHLOROISOPROPYL)ETHER	2	0	330	.		.	1100 U	UG/KG	362.5
[illegible]	BIS(2-ETHYLHEXYL)PHTHALATE	2	2	330	160 J	UG/KG	116.0	160 J	UG/KG	116.0
28	BUTYL BENZYL PHTHALATE	2	0	330	.		.	1100 U	UG/KG	362.5
29	CHRYSENE	2	1	330	110 J	UG/KG	110.0	1100 U	UG/KG	330.0
30	DI-n-BUTYL PHTHALATE	2	0	330	.		.	1100 U	UG/KG	362.5
31	DI-n-OCTYL PHTHALATE	2	0	330	.		.	1100 U	UG/KG	362.5
32	DIBENZO(a,h)ANTHRACENE	2	0	330	.		.	1100 U	UG/KG	362.5
33	DIBENZOFURAN	2	0	330	.		.	1100 U	UG/KG	362.5
34	DIETHYL PHTHALATE	2	0	330	.		.	1100 U	UG/KG	362.5
35	DIMETHYL PHTHALATE	2	0	330	.		.	1100 U	UG/KG	362.5
36	FLUORANTHENE	2	2	330	300 J	UG/KG	255.0	300 J	UG/KG	255.0
37	FLUORENE	2	0	330	.		.	1100 U	UG/KG	362.5
38	HEXACHLOROBENZENE	2	0	330	.		.	1100 U	UG/KG	362.5
39	HEXACHLOROBUTADIENE	2	0	330	.		.	1100 U	UG/KG	362.5
40	HEXACHLOROCYCLOPENTADIENE	2	0	330	.		.	1100 U	UG/KG	362.5
41	HEXACHLOROETHANE	2	0	330	.		.	1100 U	UG/KG	362.5
42	INDENO(1,2,3-cd)PYRENE	2	0	330	.		.	1100 U	UG/KG	362.5
43	ISOPHORONE	2	0	330	.		.	1100 U	UG/KG	362.5
44	N-NITROSO-DI-n-PROPYLAMINE	2	0	330	.		.	1100 U	UG/KG	362.5
45	N-NITROSODIPHENYLAMINE	2	0	330	.		.	1100 U	UG/KG	362.5
46	NAPHTHALENE	2	0	330	.		.	1100 U	UG/KG	362.5
47	NITROBENZENE	2	0	330	.		.	1100 U	UG/KG	362.5
48	PHENANTHRENE	2	2	330	310 J	UG/KG	240.0	310 J	UG/KG	240.0
49	PYRENE	2	2	330	440 J	UG/KG	315.0	440 J	UG/KG	315.0
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		98	14							

Location=SED120

SEDIMENT PESTICIDE/PCB SUMMARY ALL UNITS UG/KG

S	ANALYTE	Total Samples	Total CRQL Hits	CRQL	Maximum Hit	MAXHUNIT	Average Hit	MAXIMUM	MAXUNIT	Total Average
1	4,4'-DDD	2	0	16	.		.	260 U	UG/KG	69.250
2	4,4'-DDE	2	0	16	.		.	260 U	UG/KG	69.250
3	4,4'-DDT	2	0	16	.		.	260 U	UG/KG	69.250
4	ALDRIN	2	0	8	.		.	130 U	UG/KG	34.625
5	AROCLOR-1016	2	0	80	.		.	1300 U	UG/KG	346.250
6	AROCLOR-1221	2	0	80	.		.	1300 U	UG/KG	346.250
7	AROCLOR-1232	2	0	80	.		.	1300 U	UG/KG	346.250
8	AROCLOR-1242	2	0	80	.		.	1300 U	UG/KG	346.250
9	AROCLOR-1248	2	0	80	.		.	1300 U	UG/KG	346.250
10	AROCLOR-1254	2	1	80	120 J	UG/KG	120	2600 U	UG/KG	710.000
11	AROCLOR-1260	2	0	80	.		.	2600 U	UG/KG	692.500
12	DIELDRIN	2	0	16	.		.	260 U	UG/KG	69.250
13	ENDOSULFAN I	2	0	8	.		.	130 U	UG/KG	34.625
14	ENDOSULFAN II	2	0	16	.		.	260 U	UG/KG	69.250
15	ENDOSULFAN SULFATE	2	0	16	.		.	260 U	UG/KG	69.250
16	ENDRIN	2	0	16	.		.	260 U	UG/KG	69.250
17	ENDRIN KETONE	2	0	16	.		.	260 U	UG/KG	69.250
18	HEPTACHLOR	2	0	8	.		.	130 U	UG/KG	34.625
19	HEPTACHLOR EPOXIDE	2	0	8	.		.	130 U	UG/KG	34.625
20	METHOXYCHLOR	2	0	80	.		.	1300 U	UG/KG	346.250
21	TOXAPHENE	2	0	160	.		.	2600 U	UG/KG	692.500
22	alpha-BHC	2	0	8	.		.	130 U	UG/KG	34.625
23	alpha-CHLORDANE	2	0	80	.		.	1300 U	UG/KG	346.250
24	beta-BHC	2	0	8	.		.	130 U	UG/KG	34.625
25	delta-BHC	2	0	8	.		.	130 U	UG/KG	34.625
26	gamma-BHC (LINDANE)	2	0	8	.		.	130 U	UG/KG	34.625
27	gamma-CHLORDANE	2	0	80	.		.	1300 U	UG/KG	346.250
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		54	1							

Location=SED120

SEDIMENT TOTAL METAL SUMMARY ALL UNITS UG/KG

BS	ANALYTE	Total Samples	Total CRQL Hits	CRQL	Maximum Hit	MAXHUNIT	Average Hit	MAXIMUM	MAXUNIT	Total Average
1	ALUMINUM	1	0	40000	.		.	10800 *	MG/KG	10800.00
2	ANTIMONY	1	0	12000	.		.	9.4 UN	MG/KG	4.70
3	ARSENIC	1	0	2000	.		.	5.1 N	MG/KG	5.10
4	BARIUM	1	0	40000	.		.	124	MG/KG	124.00
5	BERYLLIUM	1	0	1000	.		.	1 B	MG/KG	1.00
6	CADMIUM	1	0	1000	.		.	1.9	MG/KG	1.90
7	CALCIUM	1	0	2000000	.		.	5260	MG/KG	5260.00
8	CESIUM	1	0	200000	.		.	3.1 WN*	MG/KG	3.10
9	CHROMIUM	1	0	2000	.		.	15.2	MG/KG	15.20
10	COBALT	1	0	10000	.		.	9.6 B	MG/KG	9.60
11	COPPER	1	0	5000	.		.	18.5	MG/KG	18.50
12	IRON	1	0	20000	.		.	16200 *	MG/KG	16200.00
13	LEAD	1	0	1000	.		.	59.4 N	MG/KG	59.40
14	LITHIUM	1	0	20000	.		.	15.7 U	MG/KG	7.85
15	MAGNESIUM	1	0	2000000	.		.	2920	MG/KG	2920.00
16	MANGANESE	1	0	3000	.		.	339	MG/KG	339.00
17	MERCURY	1	0	200	.		.	0.11 U	MG/KG	0.05
18	MOLYBDENUM	1	0	40000	.		.	3.1 U	MG/KG	1.55
19	NICKEL	1	0	8000	.		.	19.7	MG/KG	19.70
20	POTASSIUM	1	0	2000000	.		.	1600	MG/KG	1600.00
21	SELENIUM	1	0	1000	.		.	0.61 UWN	MG/KG	0.30
22	SILICON	1	1	0	815 *	MG/KG	815	815 *	MG/KG	815.00
23	SILVER	1	0	2000	.		.	3.1 U	MG/KG	1.55
24	SODIUM	1	0	2000000	.		.	113 B	MG/KG	113.00
25	STRONTIUM	1	0	40000	.		.	37.2	MG/KG	37.20
26	THALLIUM	1	0	2000	.		.	0.61 U	MG/KG	0.30
27	TIN	1	0	40000	.		.	0.08 U	MG/KG	0.04
28	VANADIUM	1	0	10000	.		.	29.1	MG/KG	29.10
29	ZINC	1	0	4000	.		.	102 E	MG/KG	102.00
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		29	1							

Location=SED124

SEDIMENT VOA SUMMARY All UNITS UG/KG

BS	ANALYTE	Total Samples	Total CRQL Hits	CRQL	Maximum Hit	MAXHUNIT	Average Hit	MAXIMUM	MAXUNIT	Total Average
1	1,1,1-TRICHLOROETHANE	2	0	5	.		.	8 U	UG/KG	3.75
2	1,1,2,2-TETRACHLOROETHANE	2	0	5	.		.	8 U	UG/KG	3.75
3	1,1,2-TRICHLOROETHANE	2	0	5	.		.	8 U	UG/KG	3.75
4	1,1-DICHLOROETHANE	2	0	5	.		.	8 U	UG/KG	3.75
5	1,1-DICHLOROETHENE	2	0	5	.		.	8 U	UG/KG	3.75
6	1,2-DICHLOROETHANE	2	0	5	.		.	8 U	UG/KG	3.75
7	1,2-DICHLOROETHENE	2	0	5	.		.	8 U	UG/KG	3.75
8	1,2-DICHLOROPROPANE	2	0	5	.		.	8 U	UG/KG	3.75
9	2-BUTANONE	2	1	10	3 BJ	UG/KG	3.0	15 U	UG/KG	5.25
10	2-HEXANONE	2	0	10	.		.	15 U	UG/KG	7.50
11	4-METHYL-2-PENTANONE	2	0	10	.		.	15 U	UG/KG	7.50
12	ACETONE	2	2	10	28 B	UG/KG	17.5	28 B	UG/KG	17.50
13	BENZENE	2	0	5	.		.	8 U	UG/KG	3.75
14	BROMODICHLOROMETHANE	2	0	5	.		.	8 U	UG/KG	3.75
15	BROMOFORM	2	0	5	.		.	8 U	UG/KG	3.75
16	BROMOMETHANE	2	0	10	.		.	15 U	UG/KG	7.50
17	CARBON DISULFIDE	2	0	5	.		.	8 U	UG/KG	3.75
18	CARBON TETRACHLORIDE	2	0	5	.		.	8 U	UG/KG	3.75
19	CHLOROBENZENE	2	0	5	.		.	8 U	UG/KG	3.75
20	CHLOROETHANE	2	0	10	.		.	15 U	UG/KG	7.50
21	CHLOROFORM	2	0	5	.		.	8 U	UG/KG	3.75
22	CHLOROMETHANE	2	0	10	.		.	15 U	UG/KG	7.50
23	DIBROMOCHLOROMETHANE	2	0	5	.		.	8 U	UG/KG	3.75
24	ETHYLBENZENE	2	0	5	.		.	8 U	UG/KG	3.75
25	METHYLENE CHLORIDE	2	2	5	17 B	UG/KG	16.0	17 B	UG/KG	16.00
[illegible]	STYRENE	2	0	5	.		.	8 U	UG/KG	3.75
[illegible]	TETRACHLOROETHENE	2	0	5	.		.	8 U	UG/KG	3.75
28	TOLUENE	2	0	5	.		.	8 U	UG/KG	3.75
29	TOTAL XYLENES	2	0	5	.		.	8 U	UG/KG	3.75
30	TRICHLOROETHENE	2	0	5	.		.	8 U	UG/KG	3.75
31	VINYL ACETATE	2	0	10	.		.	15 U	UG/KG	7.50
32	VINYL CHLORIDE	2	0	10	.		.	15 U	UG/KG	7.50
33	cis-1,3-DICHLOROPROPENE	2	0	5	.		.	8 U	UG/KG	3.75
34	trans-1,3-DICHLOROPROPENE	2	0	5	.		.	8 U	UG/KG	3.75
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		68	5							

Location=SED124

SEDIMENT ACID EXTRACTABLE SUMMARY ALL UNITS UG/KG

OBS	ANALYTE	Total Samples	Total CRQL Hits	CRQL	Maximum Hit	MAXHUNIT	Average Hit	MAXIMUM	MAXUNIT	Total Average
1	2,4,5-TRICHLOROPHENOL	2	0	1600	.		.	4800 U	UG/KG	1825.0
2	2,4,6-TRICHLOROPHENOL	2	0	330	.		.	1000 U	UG/KG	377.5
3	2,4-DICHLOROPHENOL	2	0	330	.		.	1000 U	UG/KG	377.5
4	2,4-DIMETHYLPHENOL	2	0	330	.		.	1000 U	UG/KG	377.5
5	2,4-DINITROPHENOL	2	0	1600	.		.	4800 U	UG/KG	1825.0
6	2-CHLOROPHENOL	2	0	330	.		.	1000 U	UG/KG	377.5
7	2-METHYLPHENOL	2	0	330	.		.	1000 U	UG/KG	377.5
8	2-NITROPHENOL	2	0	330	.		.	1000 U	UG/KG	377.5
9	4,6-DINITRO-2-METHYLPHENOL	2	0	1600	.		.	4800 U	UG/KG	1825.0
10	4-CHLORO-3-METHYLPHENOL	2	0	330	.		.	1000 U	UG/KG	377.5
11	4-METHYLPHENOL	2	0	330	.		.	1000 U	UG/KG	377.5
12	4-NITROPHENOL	2	0	1600	.		.	4800 U	UG/KG	1825.0
13	BENZOIC ACID	2	0	1600	.		.	4800 U	UG/KG	1825.0
14	BENZYL ALCOHOL	2	0	330	.		.	1000 U	UG/KG	377.5
15	PENTACHLOROPHENOL	2	0	1600	.		.	4800 U	UG/KG	1825.0
16	PHENOL	2	0	330	.		.	1000 U	UG/KG	377.5
		32	0							

Location=SED124

SEDIMENT BASE NEUTRAL EXTRACTABLE SUMMARY ALL UNITS UG/KG

S	ANALYTE	Total Samples	Total CRQL Hits	CRQL	Maximum Hit	MAXHUNIT	Average Hit	MAXIMUM	MAXUNIT	Total Average
1	1,2,4-TRICHLOROBENZENE	2	0	330	.		.	1000 U	UG/KG	377.5
2	1,2-DICHLOROBENZENE	2	0	330	.		.	1000 U	UG/KG	377.5
3	1,3-DICHLOROBENZENE	2	0	330	.		.	1000 U	UG/KG	377.5
4	1,4-DICHLOROBENZENE	2	0	330	.		.	1000 U	UG/KG	377.5
5	2,4-DINITROTOLUENE	2	0	330	.		.	1000 U	UG/KG	377.5
6	2,6-DINITROTOLUENE	2	0	330	.		.	1000 U	UG/KG	377.5
7	2-CHLORONAPHTHALENE	2	0	330	.		.	1000 U	UG/KG	377.5
8	2-METHYLNAPHTHALENE	2	2	330	110 J	UG/KG	110	110 J	UG/KG	110.0
9	2-NITROANILINE	2	0	1600	.		.	4800 U	UG/KG	1825.0
10	3,3'-DICHLOROBENZIDINE	2	0	660	.		.	2000 U	UG/KG	750.0
11	3-NITROANILINE	2	0	1600	.		.	4800 U	UG/KG	1825.0
12	4-BROMOPHENYL PHENYL ETHER	2	0	330	.		.	1000 U	UG/KG	377.5
13	4-CHLOROANILINE	2	0	330	.		.	1000 U	UG/KG	377.5
14	4-CHLOROPHENYL PHENYL ETHER	2	0	330	.		.	1000 U	UG/KG	377.5
15	4-NITROANILINE	2	0	1600	.		.	4800 U	UG/KG	1825.0
16	ACENAPHTHENE	2	2	330	600 J	UG/KG	520	600 J	UG/KG	520.0
17	ACENAPHTHYLENE	2	0	330	.		.	1000 U	UG/KG	377.5
18	ANTHRACENE	2	2	330	1100	UG/KG	835	1100	UG/KG	835.0
19	BENZO(a)ANTHRACENE	2	2	330	4200	UG/KG	2520	4200	UG/KG	2520.0
20	BENZO(a)PYRENE	2	2	330	3400	UG/KG	2040	3400	UG/KG	2040.0
21	BENZO(b)FLUORANTHENE	2	1	330	4000	UG/KG	4000	4000	UG/KG	2127.5
22	BENZO(ghi)PERYLENE	2	2	330	2400	UG/KG	1435	2400	UG/KG	1435.0
23	BENZO(k)FLUORANTHENE	2	2	330	2200	UG/KG	1650	2200	UG/KG	1650.0
24	BIS(2-CHLOROETHOXY)METHANE	2	0	330	.		.	1000 U	UG/KG	377.5
25	BIS(2-CHLOROETHYL)ETHER	2	0	330	.		.	1000 U	UG/KG	377.5
[illegible]	BIS(2-CHLOROISOPROPYL)ETHER	2	0	330	.		.	1000 U	UG/KG	377.5
[illegible]	BIS(2-ETHYLHEXYL)PHTHALATE	2	1	330	2000	UG/KG	2000	2000	UG/KG	1127.5
28	BUTYL BENZYL PHTHALATE	2	0	330	.		.	1000 U	UG/KG	377.5
29	CHRYSENE	2	2	330	4800	UG/KG	2810	4800	UG/KG	2810.0
30	DI-n-BUTYL PHTHALATE	2	0	330	.		.	1000 U	UG/KG	377.5
31	DI-n-OCTYL PHTHALATE	2	0	330	.		.	1000 U	UG/KG	377.5
32	DIBENZO(a,h)ANTHRACENE	2	1	330	1200	UG/KG	1200	1200	UG/KG	727.5
33	DIBENZOFURAN	2	2	330	240 J	UG/KG	215	240 J	UG/KG	215.0
34	DIETHYL PHTHALATE	2	0	330	.		.	1000 U	UG/KG	377.5
35	DIMETHYL PHTHALATE	2	0	330	.		.	1000 U	UG/KG	377.5
36	FLUORANTHENE	2	2	330	7200	UG/KG	4750	7200	UG/KG	4750.0
37	FLUORENE	2	2	330	520 J	UG/KG	445	520 J	UG/KG	445.0
38	HEXACHLOROBENZENE	2	0	330	.		.	1000 U	UG/KG	377.5
39	HEXACHLOROBUTADIENE	2	0	330	.		.	1000 U	UG/KG	377.5
40	HEXACHLOROCYCLOPENTADIENE	2	0	330	.		.	1000 U	UG/KG	377.5
41	HEXACHLOROETHANE	2	0	330	.		.	1000 U	UG/KG	377.5
42	INDENO(1,2,3-cd)PYRENE	2	2	330	2300	UG/KG	1395	2300	UG/KG	1395.0
43	ISOPHORONE	2	0	330	.		.	1000 U	UG/KG	377.5
44	N-NITROSO-DI-n-PROPYLAMINE	2	0	330	.		.	1000 U	UG/KG	377.5
45	N-NITROSODIPHENYLAMINE	2	0	330	.		.	1000 U	UG/KG	377.5
46	NAPHTHALENE	2	2	330	340 J	UG/KG	265	340 J	UG/KG	265.0
47	NITROBENZENE	2	0	330	.		.	1000 U	UG/KG	377.5
48	PHENANTHRENE	2	2	330	6100	UG/KG	4200	6100	UG/KG	4200.0
49	PYRENE	2	2	330	10000	UG/KG	5950	10000	UG/KG	5950.0
		=======	==========							
		98	33							

Location=SED124

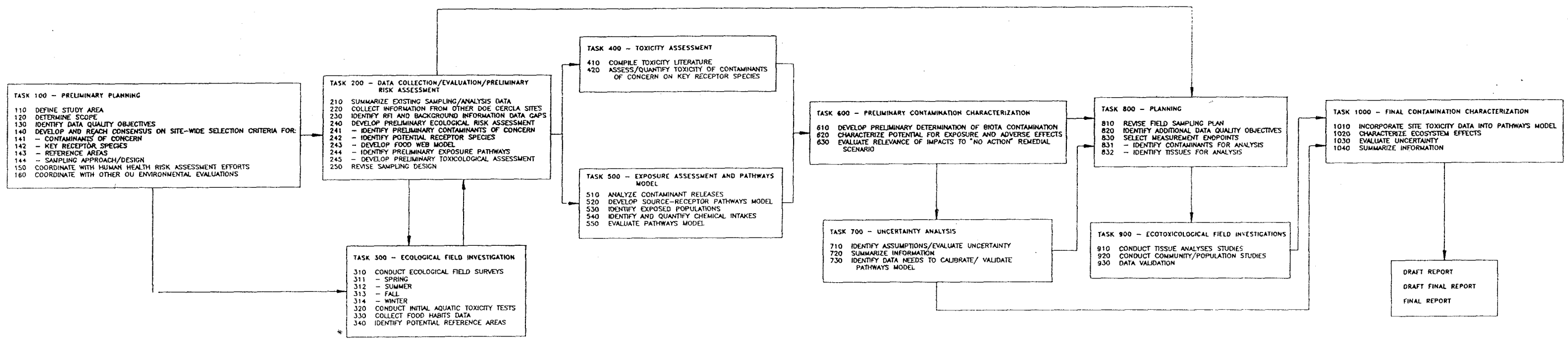
SEDIMENT PESTICIDE/PCB SUMMARY ALL UNITS UG/KG

BS	ANALYTE	Total Samples	Total CRQL Hits	CRQL	Maximum Hit	MAXHUNIT	Average Hit	MAXIMUM	MAXUNIT	Total Average
1	4,4'-DDD	2	0	16	.		.	1800 U	UG/KG	512.5
2	4,4'-DDE	2	0	16	.		.	1800 U	UG/KG	512.5
3	4,4'-DDT	2	0	16	.		.	1800 U	UG/KG	512.5
4	ALDRIN	2	0	8	.		.	920 U	UG/KG	260.0
5	AROCLOR-1016	2	0	80	.		.	9200 U	UG/KG	2600.0
6	AROCLOR-1221	2	0	80	.		.	9200 U	UG/KG	2600.0
7	AROCLOR-1232	2	0	80	.		.	9200 U	UG/KG	2600.0
8	AROCLOR-1242	2	0	80	.		.	9200 U	UG/KG	2600.0
9	AROCLOR-1248	2	0	80	.		.	9200 U	UG/KG	2600.0
10	AROCLOR-1254	2	2	80	66000	UG/KG	35000	66000	UG/KG	35000.0
11	AROCLOR-1260	2	0	80	.		.	2500 U	UG/KG	1075.0
12	DIELDRIN	2	0	16	.		.	1800 U	UG/KG	512.5
13	ENDOSULFAN I	2	0	8	.		.	920 U	UG/KG	260.0
14	ENDOSULFAN II	2	0	16	.		.	1800 U	UG/KG	512.5
15	ENDOSULFAN SULFATE	2	0	16	.		.	1800 U	UG/KG	512.5
16	ENDRIN	2	0	16	.		.	1800 U	UG/KG	512.5
17	ENDRIN KETONE	2	0	16	.		.	1800 U	UG/KG	512.5
18	HEPTACHLOR	2	0	8	.		.	920 U	UG/KG	260.0
19	HEPTACHLOR EPOXIDE	2	0	8	.		.	920 U	UG/KG	260.0
20	METHOXYCHLOR	2	0	80	.		.	9200 U	UG/KG	2600.0
21	TOXAPHENE	2	0	160	.		.	2500 U	UG/KG	1075.0
22	alpha-BHC	2	0	8	.		.	920 U	UG/KG	260.0
23	alpha-CHLORDANE	2	0	80	.		.	9200 U	UG/KG	2600.0
24	beta-BHC	2	0	8	.		.	920 U	UG/KG	260.0
25	delta-BHC	2	0	8	.		.	920 U	UG/KG	260.0
26	gamma-BHC (LINDANE)	2	0	8	.		.	920 U	UG/KG	260.0
27	gamma-CHLORDANE	2	0	80	.		.	9200 U	UG/KG	2600.0
		=======	=========							
		54	2							

Location=SED124

SEDIMENT TOTAL METAL SUMMARY ALL UNITS UG/KG

SS	ANALYTE	Total Samples	Total CRQL Hits	CRQL	Maximum Hit	MAXHUNIT	Average Hit	MAXIMUM	MAXUNIT	Total Average
1	ALUMINUM	1	0	40000	.		.	6940 *	MG/KG	6940.00
2	ANTIMONY	1	0	12000	.		.	9 UN	MG/KG	4.50
3	ARSENIC	1	0	2000	.		.	4.2 N	MG/KG	4.20
4	BARIUM	1	0	40000	.		.	111	MG/KG	111.00
5	BERYLLIUM	1	0	1000	.		.	0.82 B	MG/KG	0.82
6	CADMIUM	1	0	1000	.		.	2.2	MG/KG	2.20
7	CALCIUM	1	0	2000000	.		.	12000	MG/KG	12000.00
8	CESIUM	1	0	200000	.		.	1.9 WN*	MG/KG	1.90
9	CHROMIUM	1	0	2000	.		.	44.7	MG/KG	44.70
10	COBALT	1	0	10000	.		.	7.6 B	MG/KG	7.60
11	COPPER	1	0	5000	.		.	31.8	MG/KG	31.80
12	IRON	1	0	20000	.		.	11300 *	MG/KG	11300.00
13	LEAD	1	0	1000	.		.	37.8 N	MG/KG	37.80
14	LITHIUM	1	0	20000	.		.	15 U	MG/KG	7.50
15	MAGNESIUM	1	0	2000000	.		.	1960	MG/KG	1960.00
16	MANGANESE	1	0	3000	.		.	182	MG/KG	182.00
17	MERCURY	1	0	200	.		.	0.15 U	MG/KG	0.08
18	MOLYBDENUM	1	0	40000	.		.	3.1	MG/KG	3.10
19	NICKEL	1	0	8000	.		.	32.1	MG/KG	32.10
20	POTASSIUM	1	0	2000000	.		.	1160 B	MG/KG	1160.00
21	SELENIUM	1	0	1000	.		.	0.57 UWN	MG/KG	0.29
22	SILICON	1	1	0	1210 *	MG/KG	1210	1210 *	MG/KG	1210.00
23	SILVER	1	0	2000	.		.	3 U	MG/KG	1.50
24	SODIUM	1	0	2000000	.		.	156 B	MG/KG	156.00
25	STRONTIUM	1	0	40000	.		.	39.6	MG/KG	39.60
26	THALLIUM	1	0	2000	.		.	0.57 U	MG/KG	0.29
27	TIN	1	0	40000	.		.	0.08 U	MG/KG	0.04
28	VANADIUM	1	0	10000	.		.	22.3	MG/KG	22.30
29	ZINC	1	0	4000	.		.	693 E	MG/KG	693.00
		=======	=========							
		29	1							



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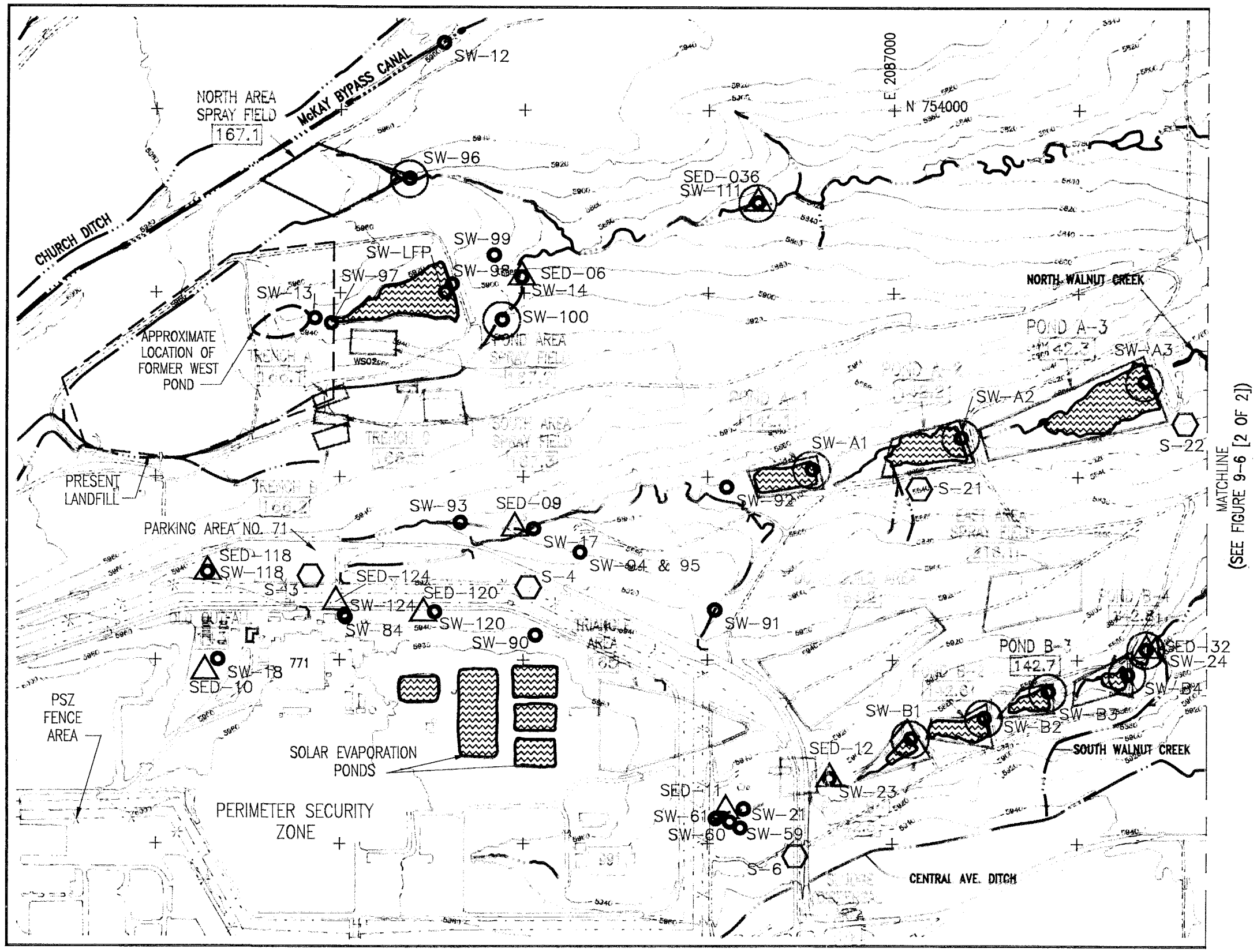
OPERABLE UNIT 6
PHASE I RFI/RI WORK PLAN

FLOW DIAGRAM:
INTERRELATIONSHIPS BETWEEN TASKS

FIGURE 9–1 APRIL 1991



N

0 300 600

SCALE: 1" = 600'

EXPLANATION

- INDIVIDUAL HAZARDOUS SUBSTANCE SITE (IHSS) IN OPERABLE UNIT 6
- IHSS REFERENCE NUMBER
- SW-1 — EXISTING SURFACE WATER SAMPLING LOCATION
- SED-10 — EXISTING SEDIMENT SAMPLE LOCATION
- S-22 — EXISTING RADIOACTIVE AMBIENT AIR MONITORING PROGRAM LOCATION
- PERIMETER SECURITY ZONE
- DIRT ROAD
- INTERMITTENT STREAM
- SAMPLING LOCATION FOR AQUATIC BIOTA [1]

[1] ALL PROPOSED LOCATIONS ARE APPROXIMATE

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

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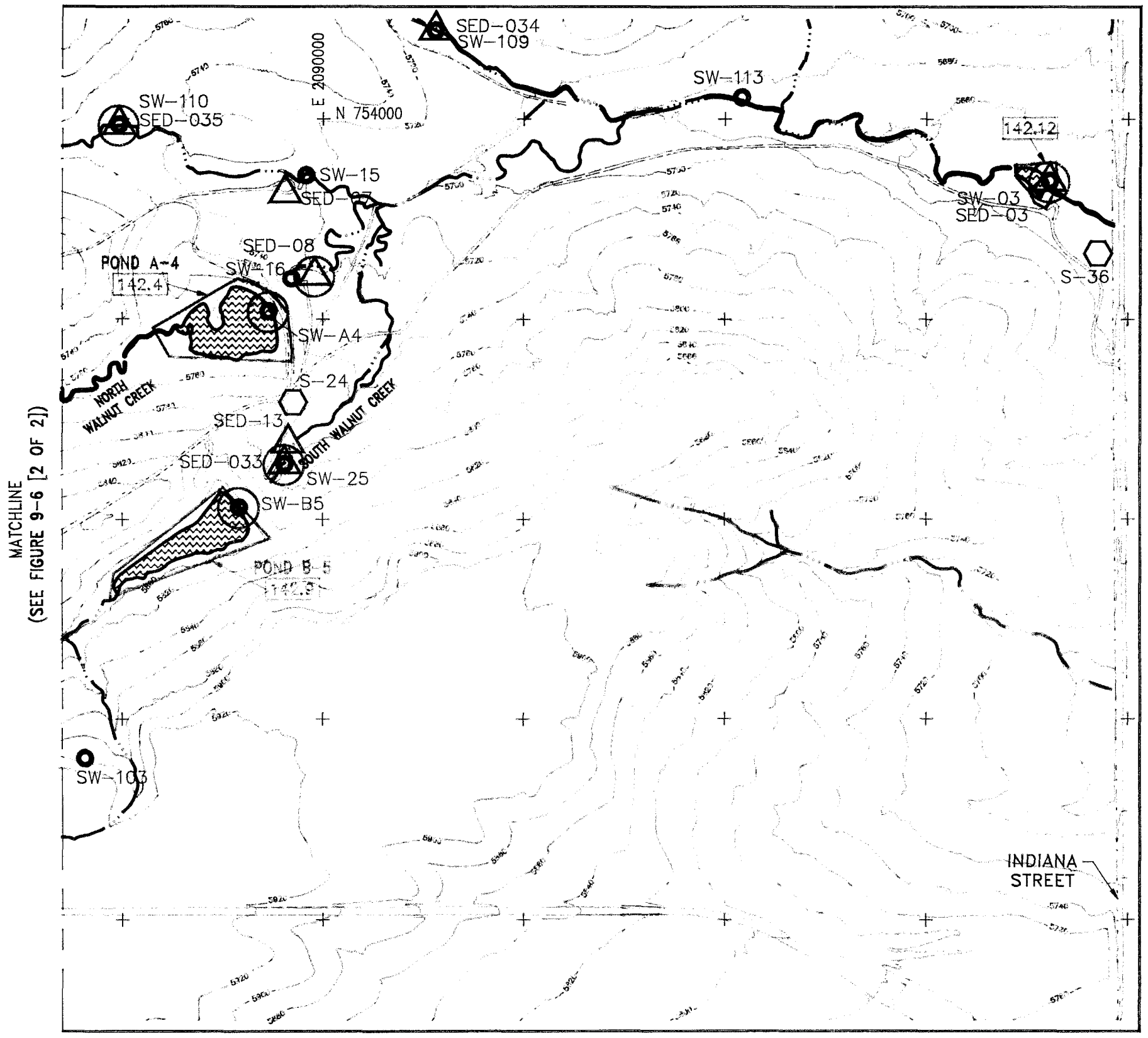
LOCATION MAP OF INDIVIDUAL HAZARDOUS SUBSTANCE SITES, EXISTING SEDIMENT & SURFACE LOCATIONS, AIR MONITORING STATIONS, & AQUATIC SAMPLING LOCATIONS

FIGURE 9-6 (1 OF 2) REV. SEPTEMBER 1991 APRIL 1991

2506037A



N

0 300 600

SCALE: 1" = 600'

EXPLANATION

- INDIVIDUAL HAZARDOUS SUBSTANCE SITE (IHSS) IN OPERABLE UNIT 6
- IHSS REFERENCE NUMBER
- SW-1 — EXISTING SURFACE WATER SAMPLING LOCATION
- SED-10 — EXISTING SEDIMENT SAMPLE LOCATION
- S-22 — EXISTING RADIOACTIVE AMBIENT AIR MONITORING PROGRAM LOCATION
- PERIMETER SECURITY ZONE
- DIRT ROAD
- INTERMITTENT STREAM
- SAMPLING LOCATION FOR AQUATIC BIOTA [1]

[1] ALL PROPOSED LOCATIONS ARE APPROXIMATE

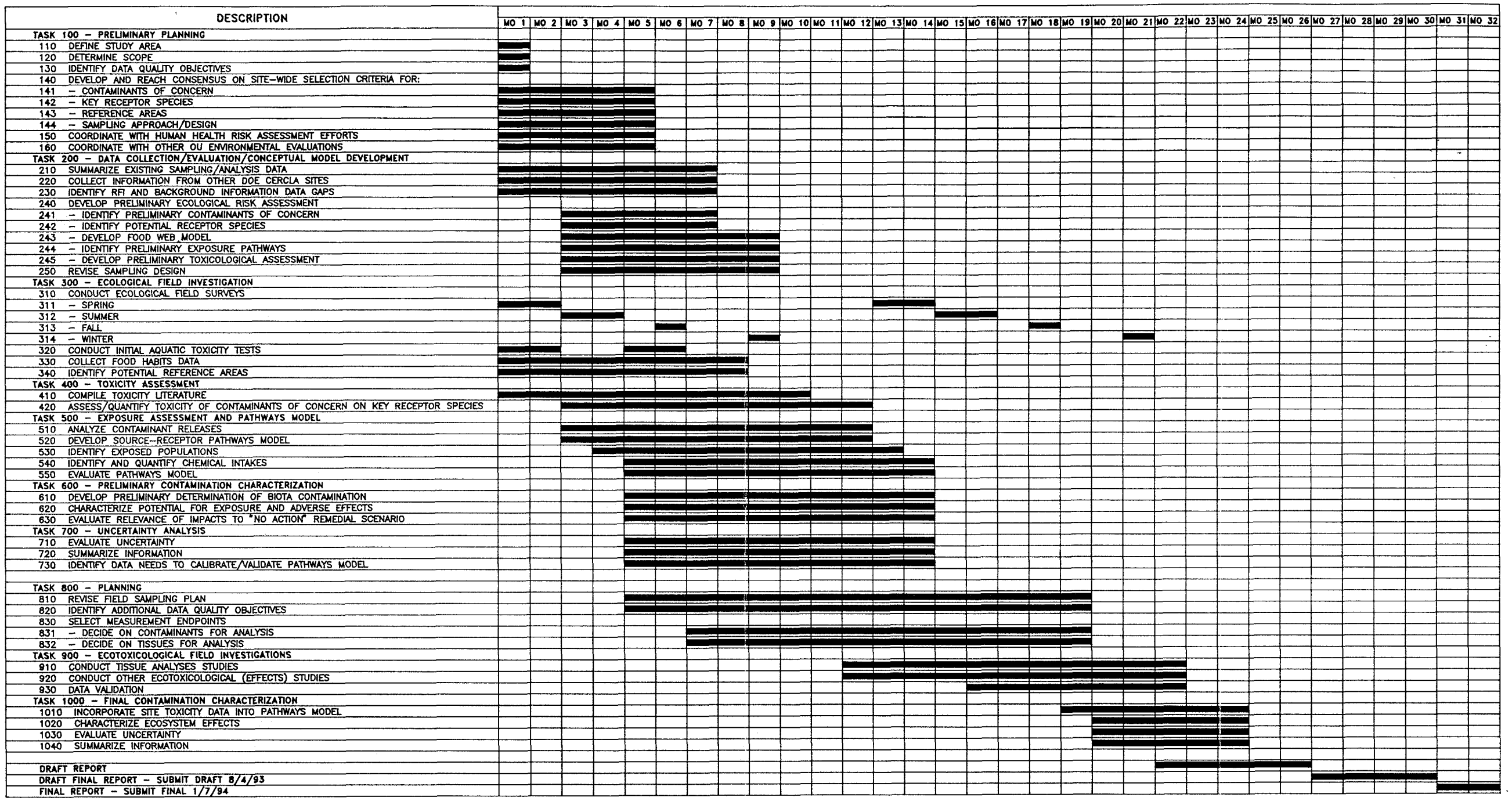
U.S. DEPARTMENT OF ENERGY
Rocky Flats Plant, Golden, Colorado

OPERABLE UNIT 6
PHASE I RFI/RI WORK PLAN

LOCATION MAP OF INDIVIDUAL HAZARDOUS SUBSTANCE SITES, EXISTING SEDIMENT & SURFACE LOCATIONS, AIR MONITORING STATIONS, & AQUATIC SAMPLING LOCATIONS

FIGURE 9-6 (2 OF 2) REV. SEPTEMBER 1991 APRIL 1991

2506037B



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Rocky Flats Plant, Golden, Colorado

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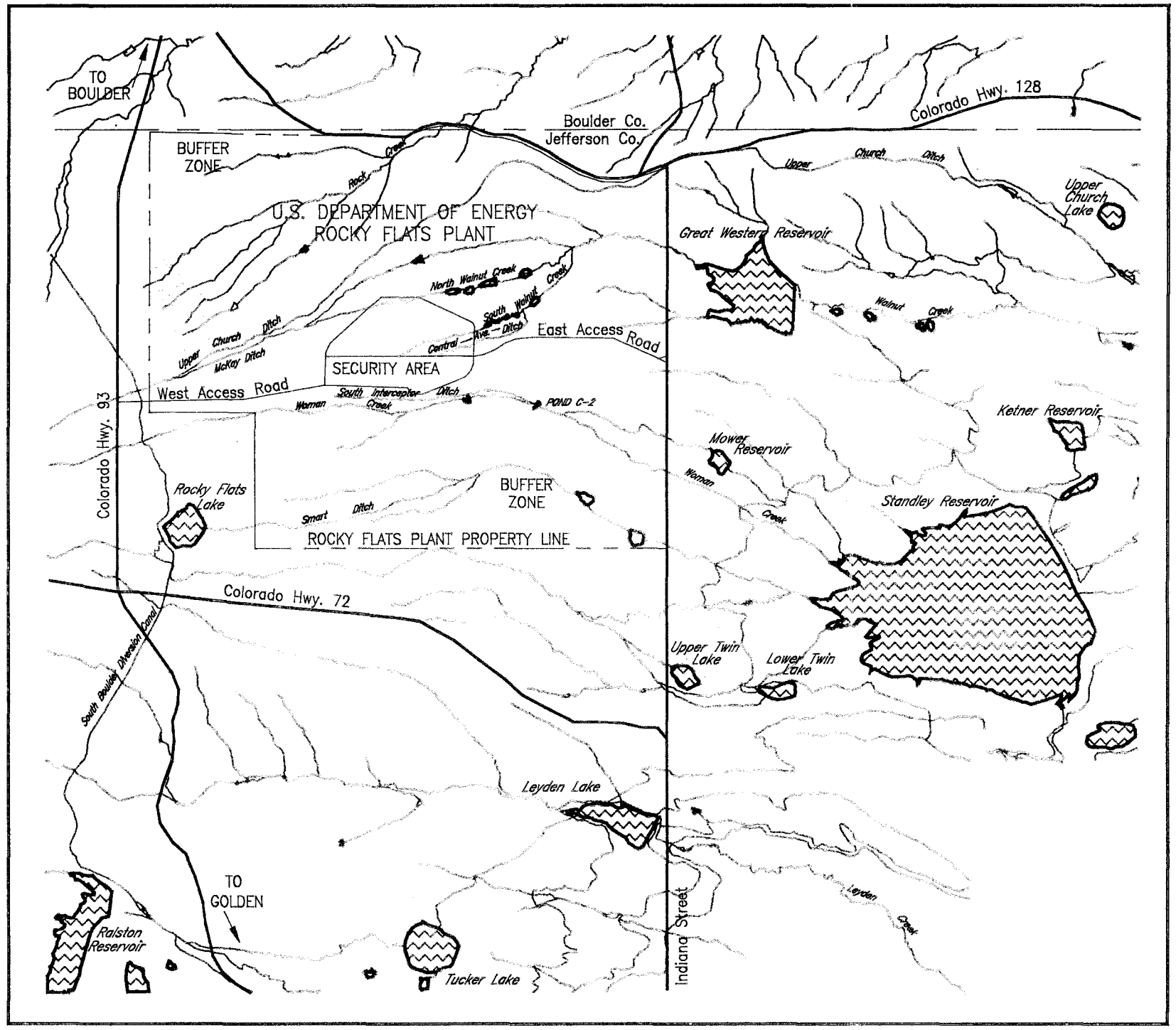
WALNUT CREEK
ENVIRONMENTAL EVALUATION
ACTIVITY SCHEDULE

FIGURE 9–7 SEPTEMBER 1991

2506D9–7



SOURCE: EG&G 1991b

N

0 1/2 1 MILE

SCALE: 1" = 1 MILE

EXPLANATION

BROOMFIELD DIVERSION CANAL

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Rocky Flats Plant, Golden, Colorado

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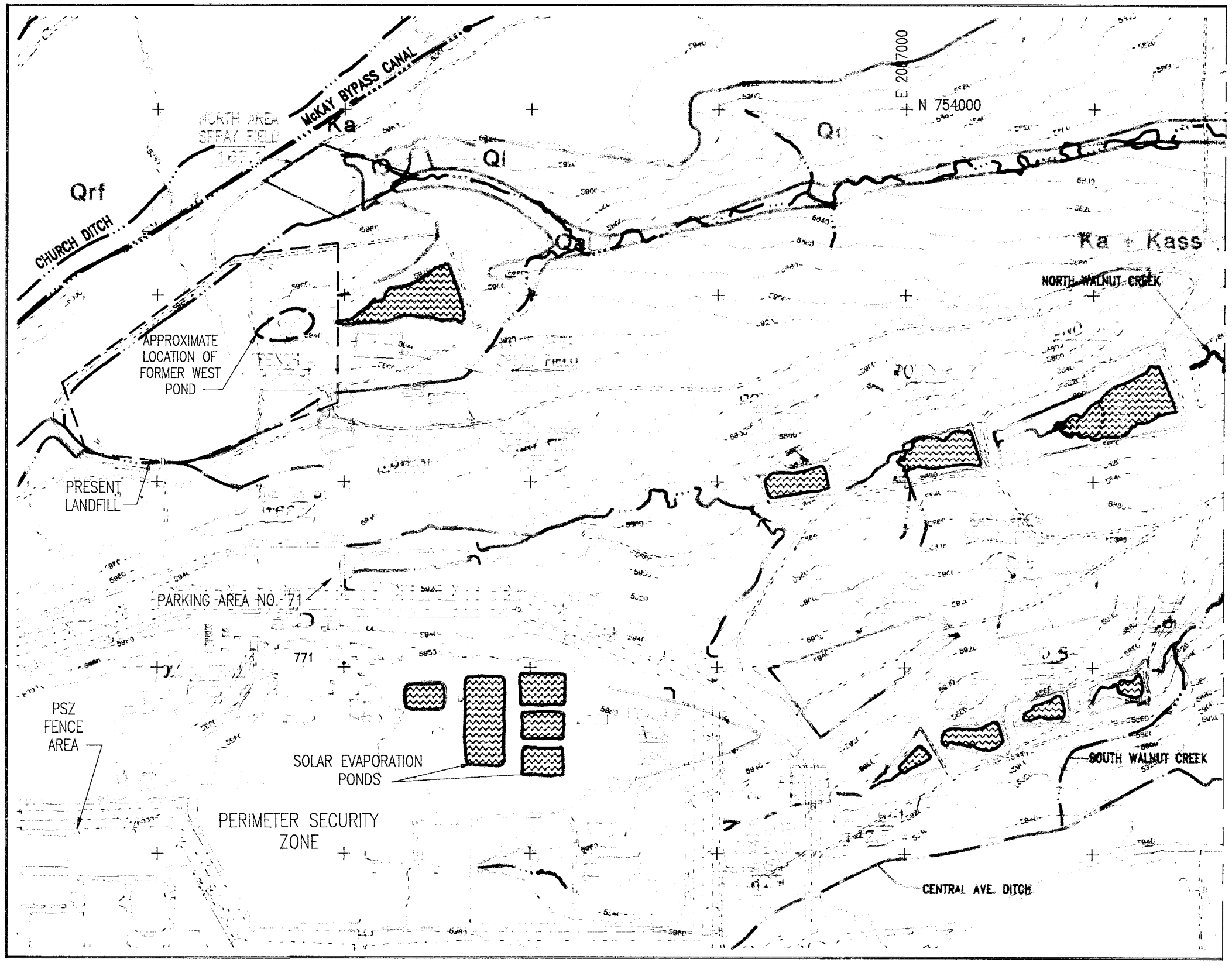
ROCKY FLATS PLANT
BOUNDARIES AND BUFFER ZONE

FIGURE 1–2

REV. AUGUST 1991
APRIL 1991

25060200



N

0 300 600

SCALE: 1" = 600'

EXPLANATION

INDIVIDUAL HAZARDOUS SUBSTANCE SITE (IHSS) IN OPERABLE UNIT 6

IHSS REFERENCE NUMBER

PERIMETER SECURITY ZONE

DIRT ROAD

CONTACT

DASHED WHERE APPROXIMATELY LOCATED, QUERIED WHERE INFERRED.

B208189 QUATERNARY

RECENT VALLEY FILL
LANDSLIDE
COLLUVIUM
LOUVIERS ALLUVIUM
SLOCUM ALLUVIUM
ROCKY FLATS ALLUVIUM

CRETACEOUS

Kass ARAPAHOE FORMATION, SANDSTONE
ARAPAHOE FORMATION, CLAYSTONE

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

OPERABLE UNIT 6
PHASE I RFI/RI WORK PLAN

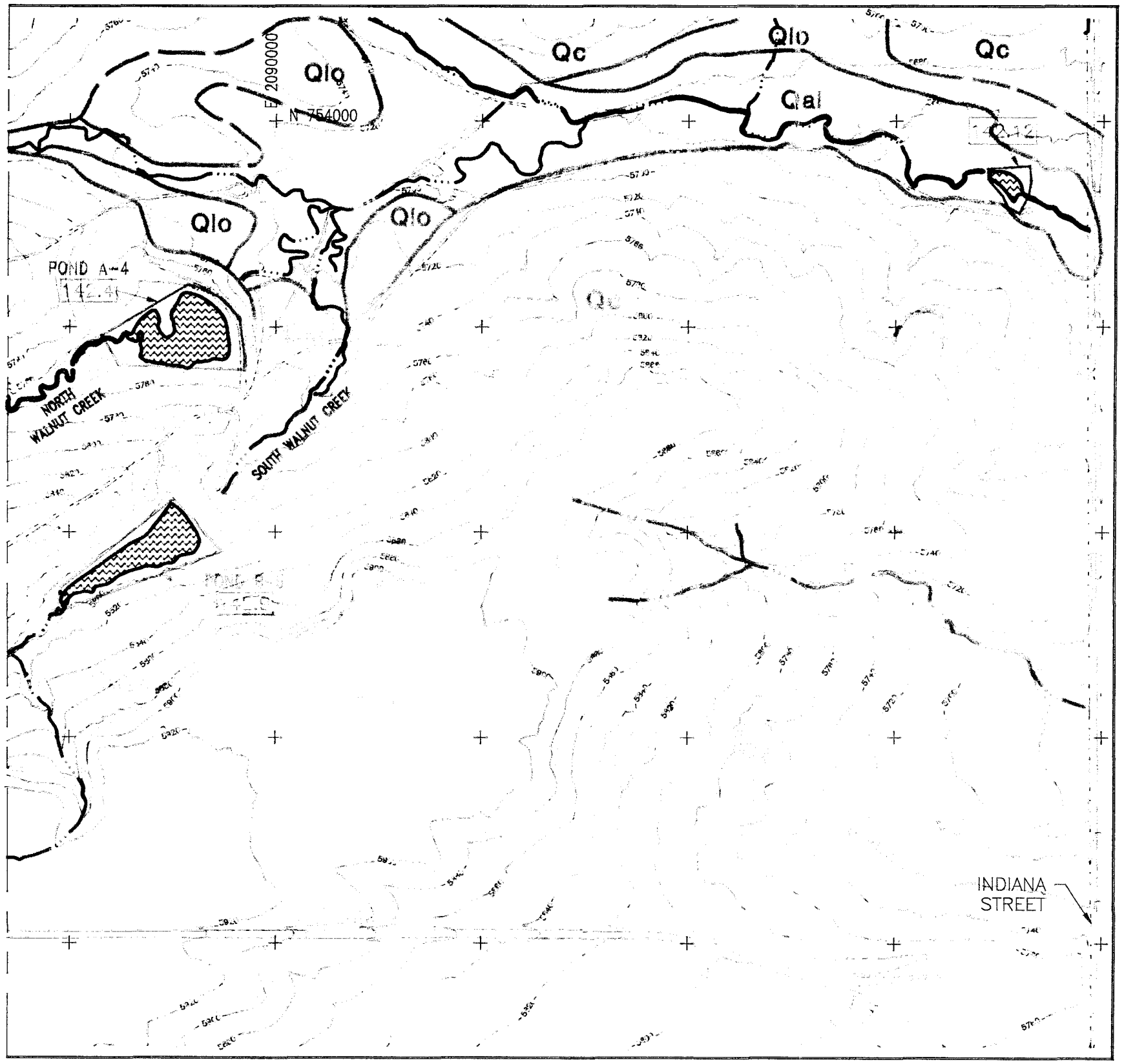
SURFICIAL GEOLOGY MAP

FIGURE 1-5 (1 OF 2)

REV. AUGUST 1991
APRIL 1991

SOURCE: EG&G 1990b

2506022A



MATCHLINE (SEE FIGURE 1-5 [1 OF 2])

N

0 300 600

SCALE: 1" = 600'

EXPLANATION

INDIVIDUAL HAZARDOUS SUBSTANCE SITE (IHSS) IN OPERABLE UNIT 6

IHSS REFERENCE NUMBER

INTERMITTENT STREAM

DIRT ROAD

CONTACT

DASHED WHERE APPROXIMATELY LOCATED, QUERIED WHERE INFERRED.

QUATERNARY

RECENT VALLEY FILL
LANDSLIDE
COLLUVIUM
LOUVIERS ALLUVIUM
SLOCUM ALLUVIUM
ROCKY FLATS ALLUVIUM

CRETACEOUS

ARAPAHOE FORMATION, SANDSTONE
ARAPAHOE FORMATION, CLAYSTONE

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

OPERABLE UNIT 6
PHASE I RFI/RI WORK PLAN

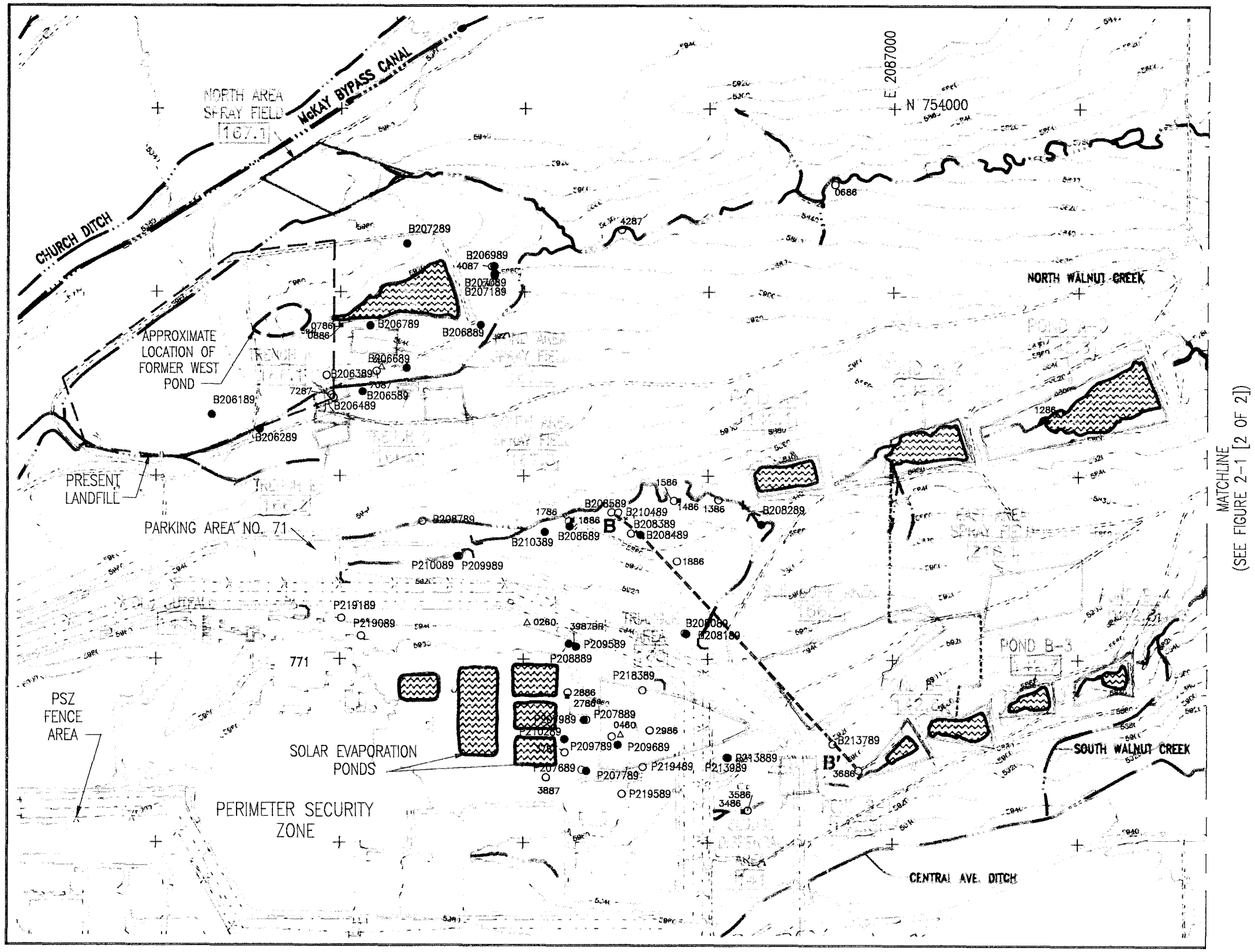
SURFICIAL GEOLOGY MAP

SOURCE: EG&G 1990b

FIGURE 1-5 (2 OF 2)

REV. AUGUST 1991
APRIL 1991

2506022B



N

0 300 600

SCALE: 1" = 600'

EXPLANATION

- INDIVIDUAL HAZARDOUS SUBSTANCE SITE (IHSS) IN OPERABLE UNIT 6
- IHSS REFERENCE NUMBER
- PERIMETER SECURITY ZONE
- DIRT ROAD
- EXISTING RADIOACTIVE AMBIENT AIR MONITORING PROGRAM LOCATION
- 5786 ○ EXISTING ALLUVIAL GROUNDWATER MONITORING WELL
- B208189 ● EXISTING BEDROCK GROUNDWATER MONITORING WELL
- 0181 △ EXISTING PRE-1986 GROUNDWATER MONITORING WELL
- 1486 ■ EXISTING PRE-1988 BEDROCK GROUNDWATER MONITORING WELL
- INTERMITTENT STREAM
- B — B' CROSS-SECTION B-B', SEE FIGURE 2-6
- A-1 BYPASS (UNDERGROUND PIPELINE)
- UNDERGROUND PIPELINE FROM POND B-2 TO POND A-2

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

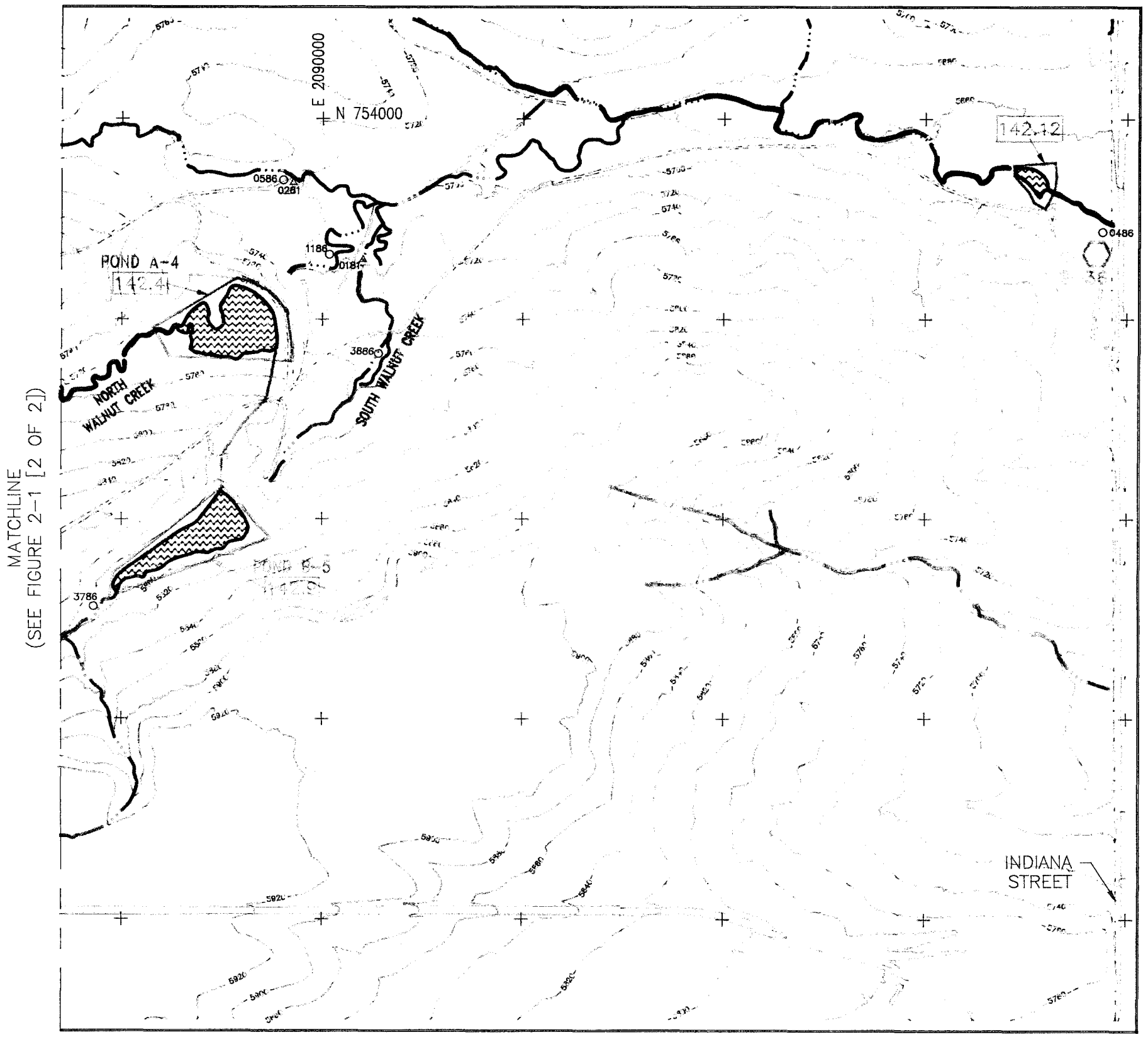
OPERABLE UNIT 6
PHASE I RFI/RI WORK PLAN

LOCATION MAP OF INDIVIDUAL HAZARDOUS SUBSTANCE SITES, MONITORING WELLS, AIR MONITORING STATIONS, & DIVERSION STRUCTURES ALONG NORTH & SOUTH WALNUT CREEKS

FIGURE 2-1 (1 OF 2)

REV. AUGUST 1991
APRIL 1991

2506023A



N

0 300 600

SCALE: 1" = 600'

EXPLANATION

- INDIVIDUAL HAZARDOUS SUBSTANCE SITE (IHSS) IN OPERABLE UNIT 6
- IHSS REFERENCE NUMBER
- PERIMETER SECURITY ZONE
- DIRT ROAD
- EXISTING RADIOACTIVE AMBIENT AIR MONITORING PROGRAM LOCATION
- 5786 ○ EXISTING ALLUVIAL GROUNDWATER MONITORING WELL
- B208189 ● EXISTING BEDROCK GROUNDWATER MONITORING WELL
- 0181 △ EXISTING PRE-1986 GROUNDWATER MONITORING WELL
- 1486 ■ EXISTING PRE-1988 BEDROCK GROUNDWATER MONITORING WELL
- INTERMITTENT STREAM
- TRANSFER LINE FROM POND B-5 TO POND A-4

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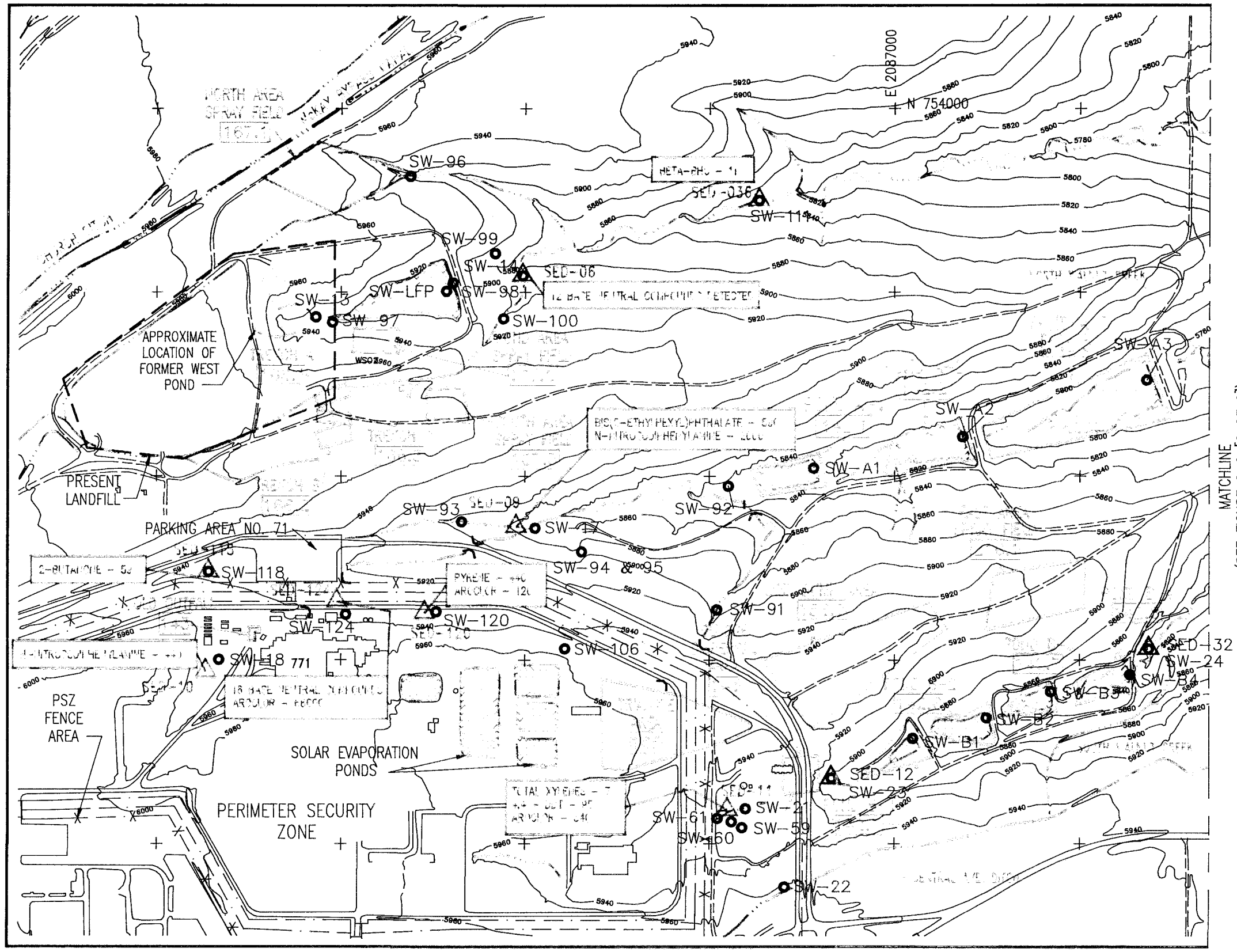
OPERABLE UNIT 6
PHASE I RFI/RI WORK PLAN

LOCATION MAP OF INDIVIDUAL HAZARDOUS SUBSTANCE SITES, MONITORING WELLS, AIR MONITORING STATIONS, & DIVERSION STRUCTURES ALONG NORTH AND SOUTH WALNUT CREEKS

FIGURE 2-1 (2 OF 2)

REV. AUGUST 1991
APRIL 1991

2506023B



N

0 300 600

SCALE: 1" = 600'

EXPLANATION

INDIVIDUAL HAZARDOUS SUBSTANCE SITE (IHSS) IN OPERABLE UNIT 6

IHSS REFERENCE NUMBER

PERIMETER SECURITY ZONE

DIRT ROAD

INTERMITTENT STREAM

SW-1 EXISTING SURFACE WATER SAMPLING LOCATION

SED-17 EXISTING SEDIMENT SAMPLING LOCATION

771 ROCKY FLATS BLDG. NO.

PYRENE - 440 PARAMETER, REPORTED mg/kg CONCENTRATION

NOTE: ALL ORGANIC CONCENTRATIONS ABOVE CRQL LEVELS, EXCEPT FOR ACETONE AND METHYLENE CHLORIDE, ARE NOT PLOTTED, AND REPORTED CONCENTRATIONS FOR TOLUENE AND 2-BUTANONE ARE ONLY LISTED IF THEIR CONCENTRATIONS ARE ABOVE FIVE TIMES THE CRQL.

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

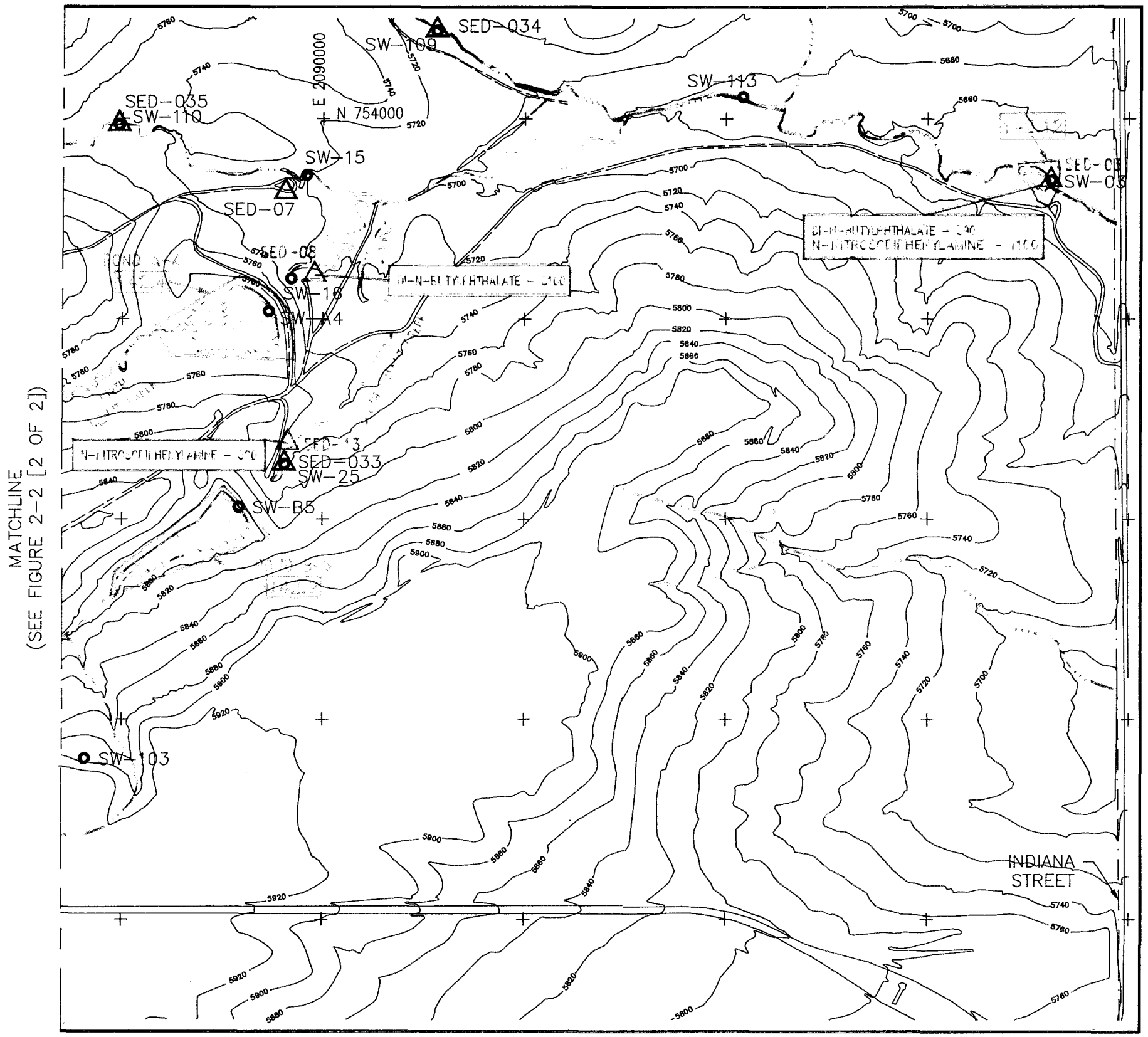
OPERABLE UNIT 6
PHASE I RFI/RI WORK PLAN

EXISTING SURFACE AND SEDIMENT LOCATIONS AND DETECTED ORGANIC AND PESTICIDE CONCENTRATIONS IN EXISTING SEDIMENT SAMPLES ALONG NORTH & SOUTH WALNUT CREEKS

FIGURE 2-2 (1 OF 2)

REV. AUGUST 1991
APRIL 1991

2506024A



N

0 300 600

SCALE: 1" = 600'

EXPLANATION

INDIVIDUAL HAZARDOUS SUBSTANCE SITE (IHSS) IN OPERABLE UNIT 6

IHSS REFERENCE NUMBER

PERIMETER SECURITY ZONE

DIRT ROAD

INTERMITTENT STREAM

SW-1 EXISTING SURFACE WATER SAMPLING LOCATION

SED-17 EXISTING SEDIMENT SAMPLING LOCATION

771 ROCKY FLATS BLDG. NO.

PARAMETER, REPORTED mg/kg CONCENTRATION

NOTE: ALL ORGANIC CONCENTRATIONS ABOVE CRQL LEVELS, EXCEPT FOR ACETONE AND METHYLENE CHLORIDE, ARE NOT PLOTTED, AND REPORTED CONCENTRATIONS FOR TOLUENE AND 2-BUTANONE ARE ONLY LISTED IF THEIR CONCENTRATIONS ARE ABOVE FIVE TIMES THE CRQL.

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

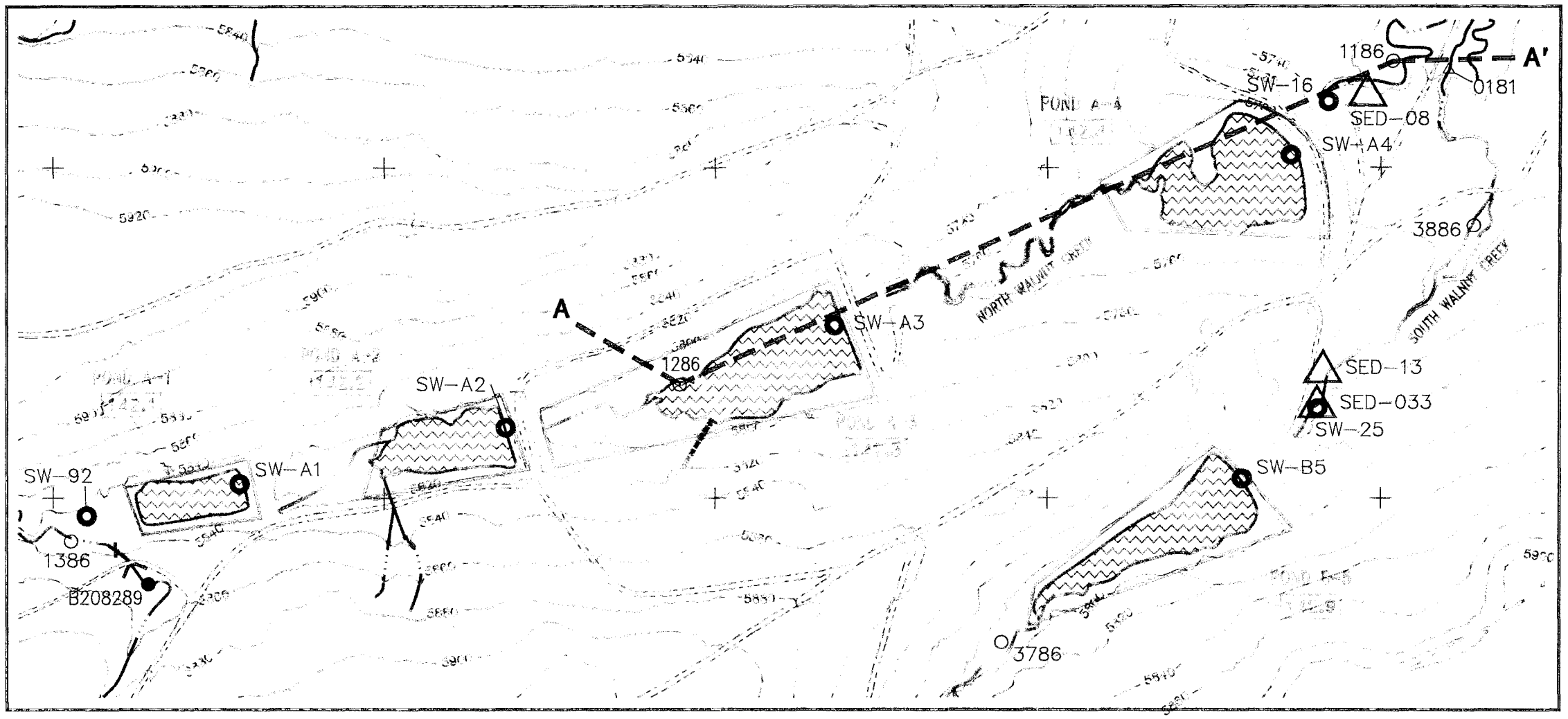
OPERABLE UNIT 6
PHASE I RFI/RI WORK PLAN

EXISTING SURFACE AND SEDIMENT LOCATIONS AND DETECTED ORGANIC AND PESTICIDE CONCENTRATIONS IN EXISTING SEDIMENT SAMPLES ALONG NORTH & SOUTH WALNUT CREEKS

FIGURE 2-2 (2 OF 2)

REV. AUGUST 1991
APRIL 1991

2506024B



N

0 200 400

SCALE: 1" = 400'

EXPLANATION

- INDIVIDUAL HAZARDOUS SUBSTANCE SITE
- SW-1 — EXISTING SURFACE WATER SAMPLING LOCATION
- 5786 — EXISTING ALLUVIAL GROUNDWATER MONITORING WELL
- SED-17 — EXISTING SEDIMENT SAMPLING LOCATION
- 3087 — EXISTING BEDROCK GROUNDWATER MONITORING WELL
- 0181 — EXISTING PRE-1986 WELL
- INTERMITTENT STREAM
- DIRT ROAD
- A — A' CROSS-SECTION A-A', SEE FIGURE 2-7
- A-1 BYPASS (UNDERGROUND PIPE)

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Rocky Flats Plant, Golden, Colorado

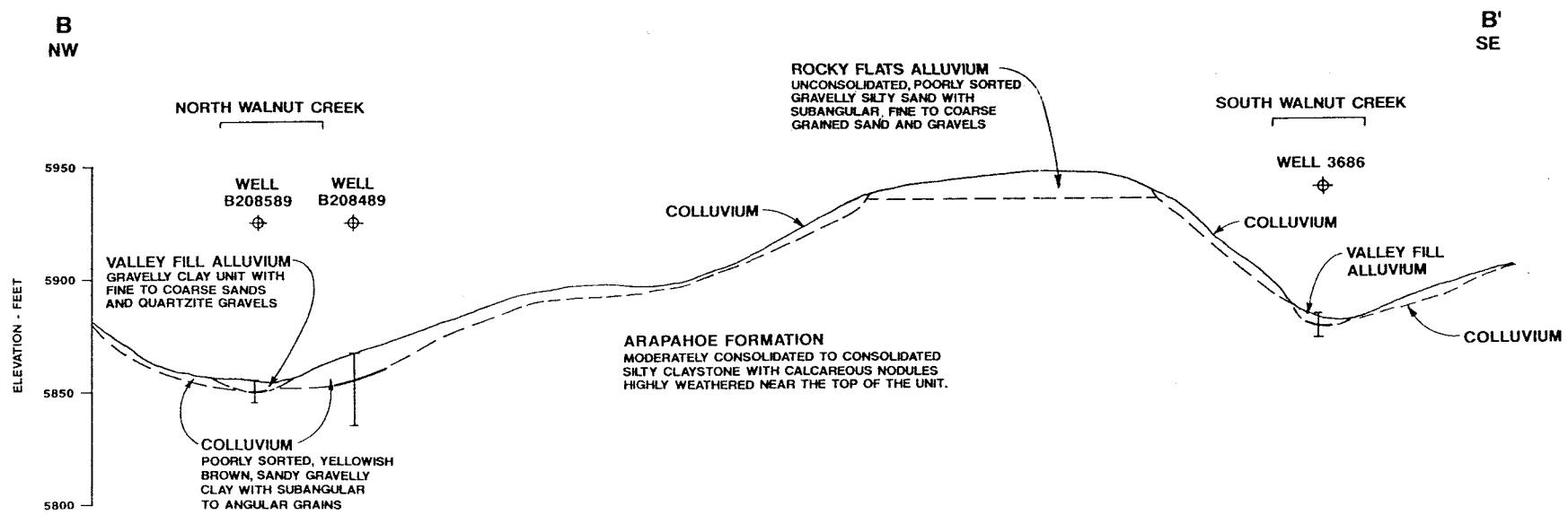
OPERABLE UNIT 6
PHASE I RFI/RI WORK PLAN

IHSSs 142.1-4
A-SERIES DETENTION PONDS
(A-1, A-2, A-3, AND A-4)
ALONG NORTH WALNUT CREEK

FIGURE 2-3

REV. AUGUST 1991
APRIL 1991

25060250



0 150 300

HORIZONTAL SCALE: 1" = 300'

EXPLANATION

ALLUVIAL MONITORING WELL

INFERRED BOUNDARY OF ROCK LIMITS

4X VERTICAL EXAGGERATION

CROSS-SECTIONAL LINE ON FIGURE 2-1

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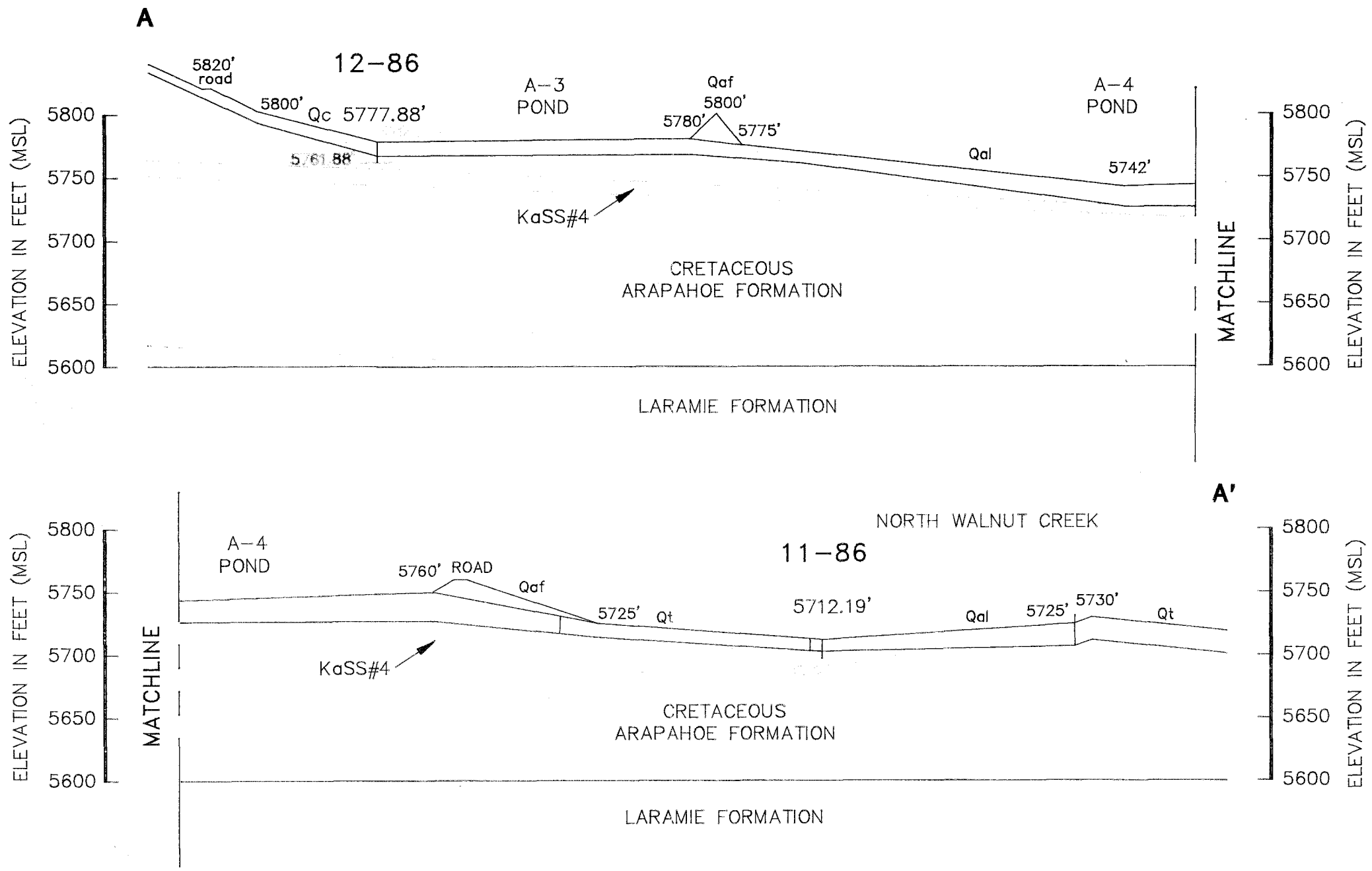
OPERABLE UNIT 6
PHASE I RFI/RI WORK PLAN

GEOLOGIC CROSS-SECTION ACROSS NORTH AND SOUTH WALNUT CREEKS

FIGURE 2-6 APRIL 1991



VERTICAL SCALE: 1" = 100'
HORIZONTAL SCALE: 1" = 200'

Source: EG&G 1990e

EXPLANATION

QUATERNARY

Qal = Recent Valley Fill
Qc = Colluvium
Qaf = Artificial Fill
Qt = Terrace Alluvium

CRETACEOUS

Kass#4 = Arapahoe Sandstone No.4

5968'= Ground Surface Elevation

CROSS SECTIONAL LINE ON FIGURE 2-3

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

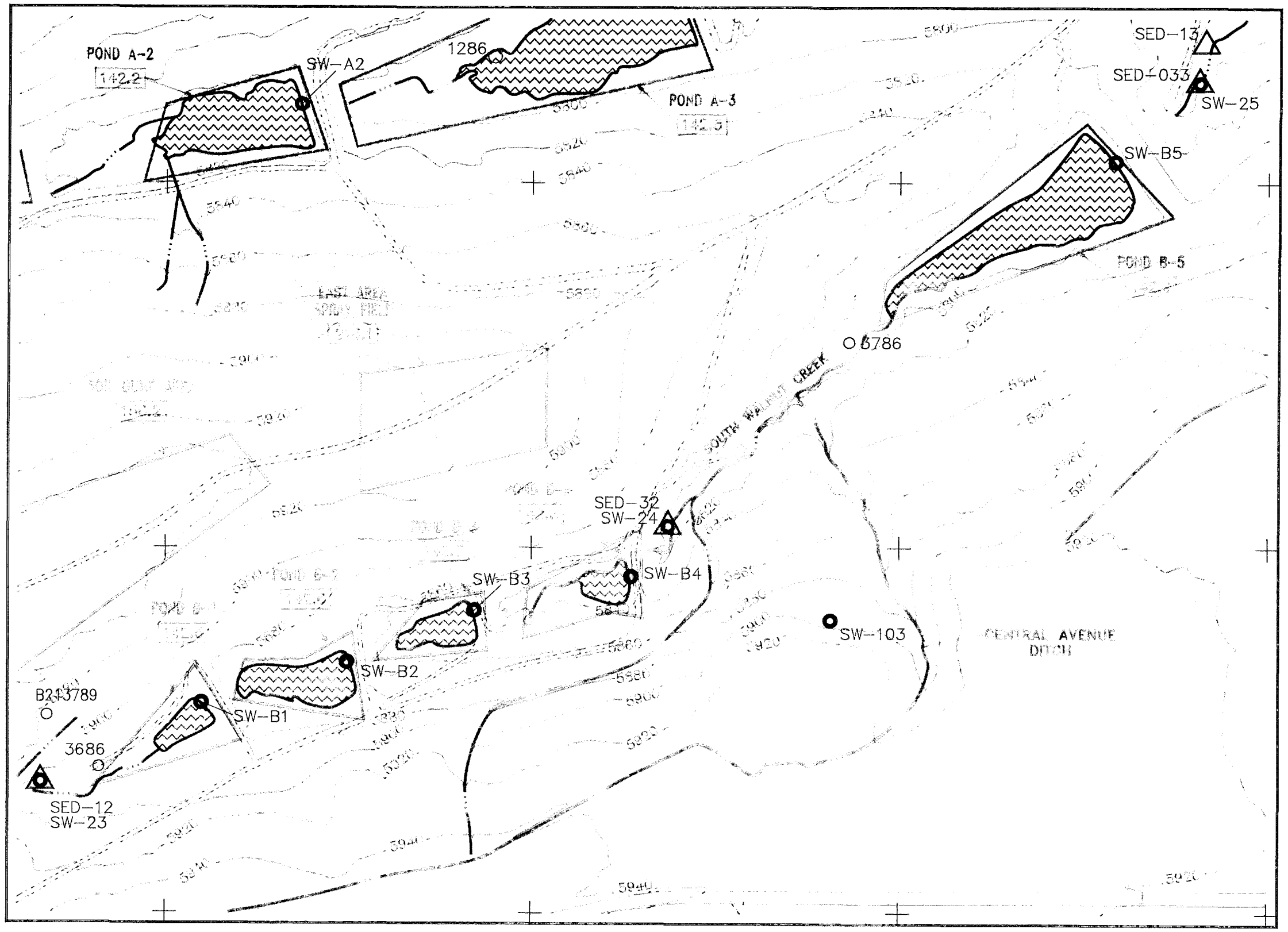
OPERABLE UNIT 6
PHASE I RFI/RI WORK PLAN

GEOLOGIC CROSS-SECTION A-A'

FIGURE 2-7

REV. AUGUST 1991
APRIL 1991

25060260



N

0 150 300

SCALE: 1" = 300'

EXPLANATION

- INDIVIDUAL HAZARDOUS SUBSTANCE SITE
- SW-1 — EXISTING SURFACE WATER SAMPLING LOCATION
- 5786 — EXISTING ALLUVIAL GROUNDWATER MONITORING WELL
- SED-17 — EXISTING SEDIMENT SAMPLING LOCATION
- INTERMITTENT STREAM
- DIRT ROAD

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

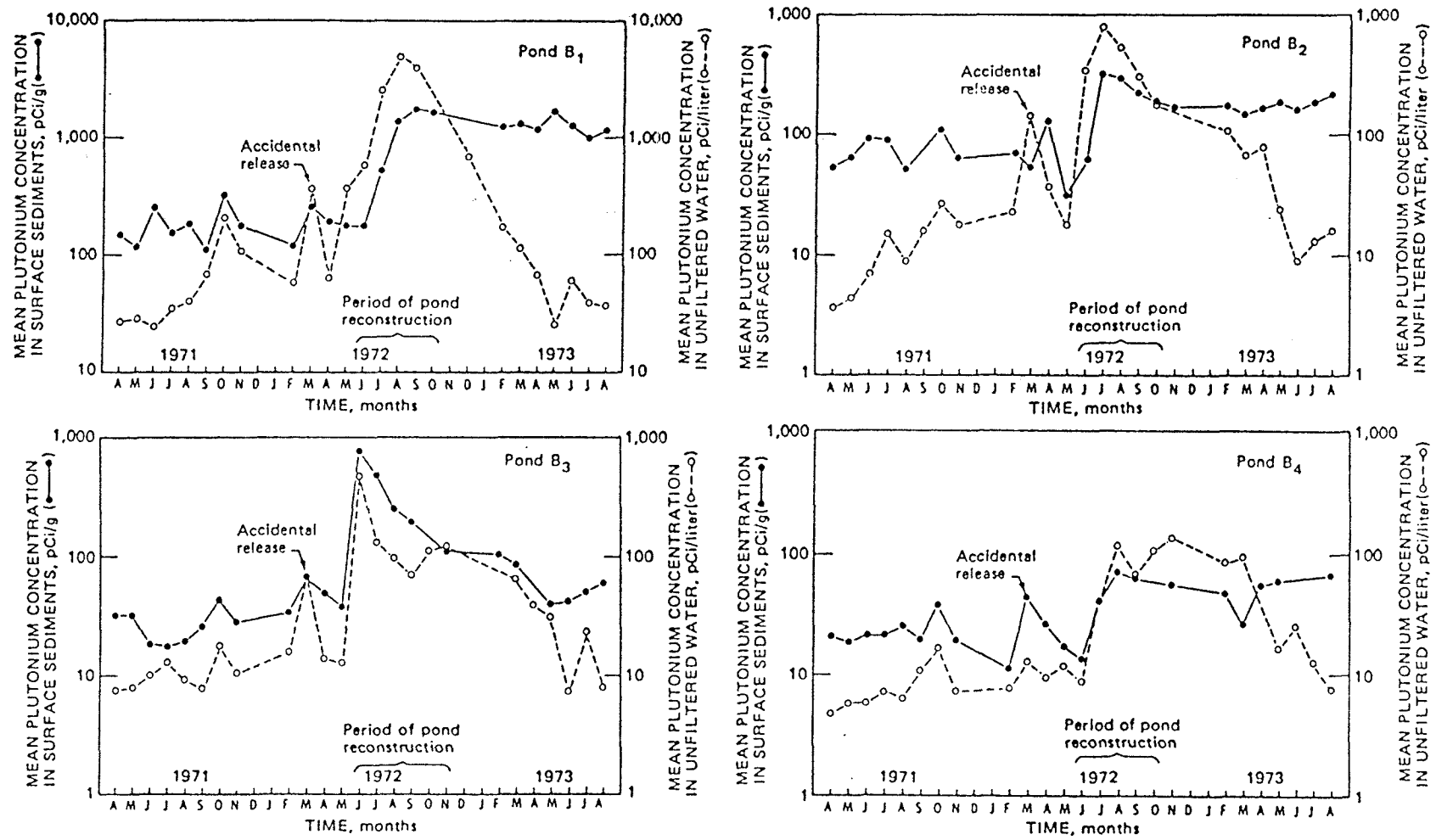
OPERABLE UNIT 6
PHASE I RFI/RI WORK PLAN

IHSSs 142.5-9,
B-SERIES DETENTION PONDS
ALONG SOUTH WALNUT CREEK,
IHSS 216.1 EAST AREA SPRAY FIELD

FIGURE 2-8

REV. AUGUST 1991
APRIL 1991

25060270



SOURCE: PAINE, 1980

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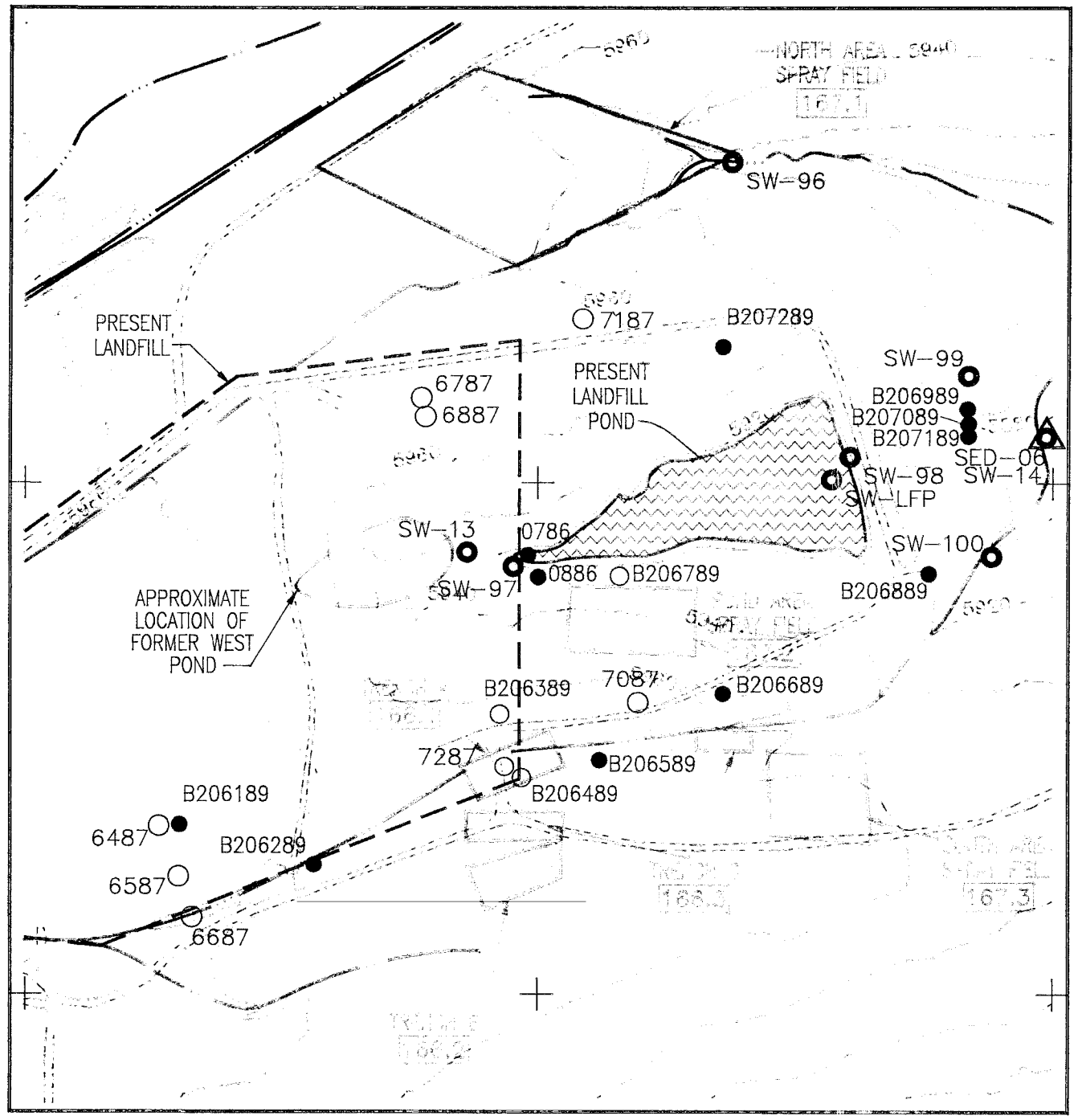
Rocky Flats Plant, Golden, Colorado

OPERABLE UNIT 6
PHASE I RFI/RI WORK PLAN

MEAN PLUTONIUM CONCENTRATIONS IN SURFACE SEDIMENTS (pCi/g) AND MEAN PLUTONIUM CONCENTRATIONS IN UNFILTERED WATER (pCi/l) FOR PONDS B-1, B-2, B-3, AND B-4

FIGURE 2-9

APRIL 1991



N

0 150 300

SCALE: 1" = 300'

EXPLANATION

- INDIVIDUAL HAZARDOUS SUBSTANCE SITE
- SW-1 — EXISTING SURFACE WATER SAMPLING LOCATION
- 5786 — EXISTING ALLUVIAL GROUNDWATER MONITORING WELL
- SED-17 — EXISTING SEDIMENT SAMPLING LOCATION
- 3087 — EXISTING BEDROCK GROUNDWATER MONITORING WELL
- INTERMITTENT STREAM
- DIRT ROAD

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

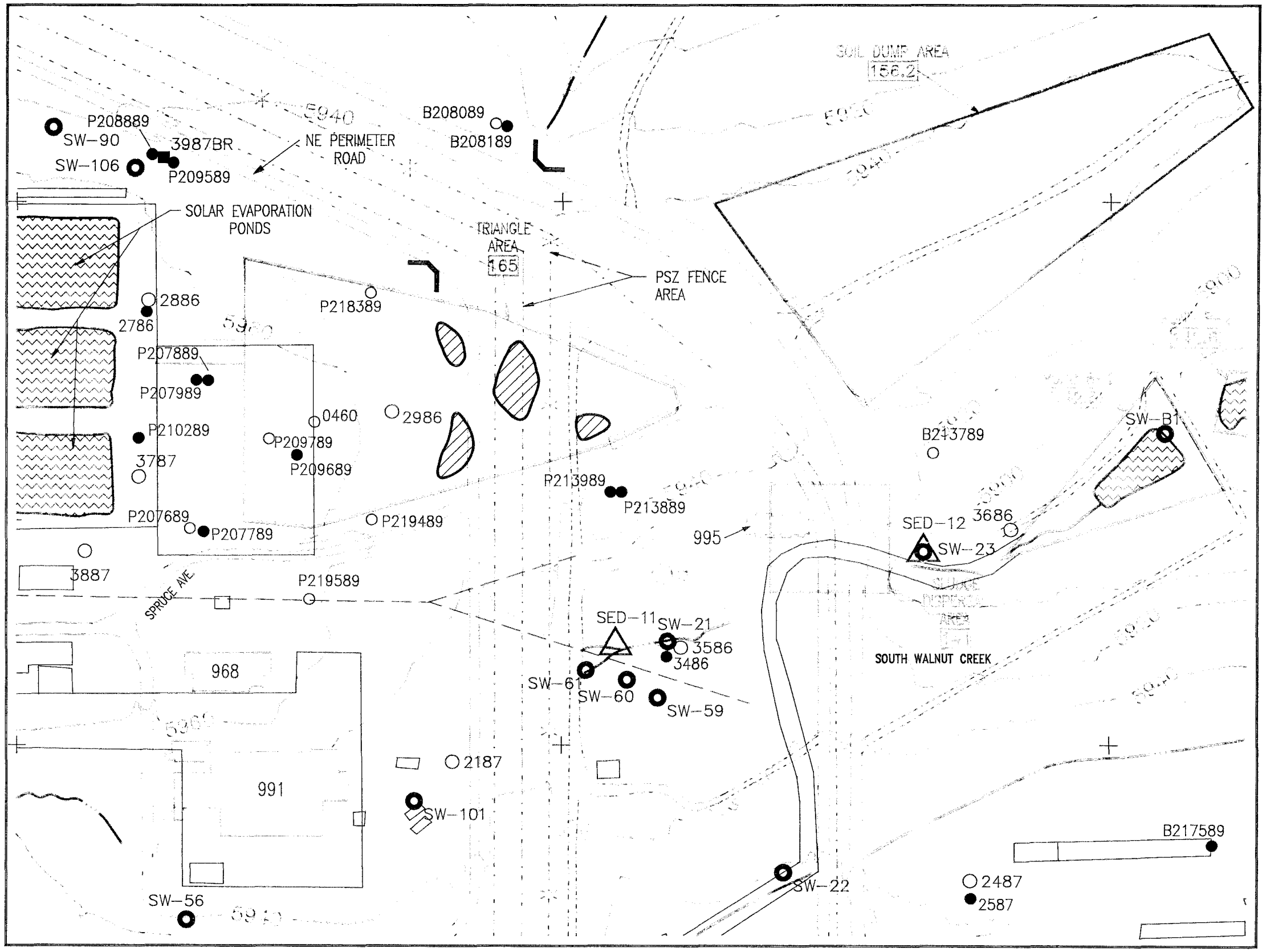
OPERABLE UNIT 6
PHASE I RFI/RI WORK PLAN

IHSSs 166.1-3, TRENCHES A, B, & C
IHSSs 167.1-3 NORTH AREA,
POND AREA AND SOUTH AREA
SPRAY FIELDS

FIGURE 2-11

REV. AUGUST 1991
APRIL 1991

25060280



N

0 100 200
SCALE: 1" = 200'

EXPLANATION

- INDIVIDUAL HAZARDOUS SUBSTANCE SITE
- SW-1 — EXISTING SURFACE WATER SAMPLING LOCATION
- 5786 — EXISTING ALLUVIAL GROUNDWATER MONITORING WELL
- SED-17 — EXISTING SEDIMENT SAMPLING LOCATION
- 3087 — EXISTING BEDROCK GROUNDWATER MONITORING WELL
- DIRT ROAD
- INTERMITTENT STREAM
- 968 — ROCKY FLATS BLDG. NO.
- SOIL EXCAVATIONS IN 1979 (SOIL CONCENTRATIONS ABOVE BACKGROUND LEVELS)

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

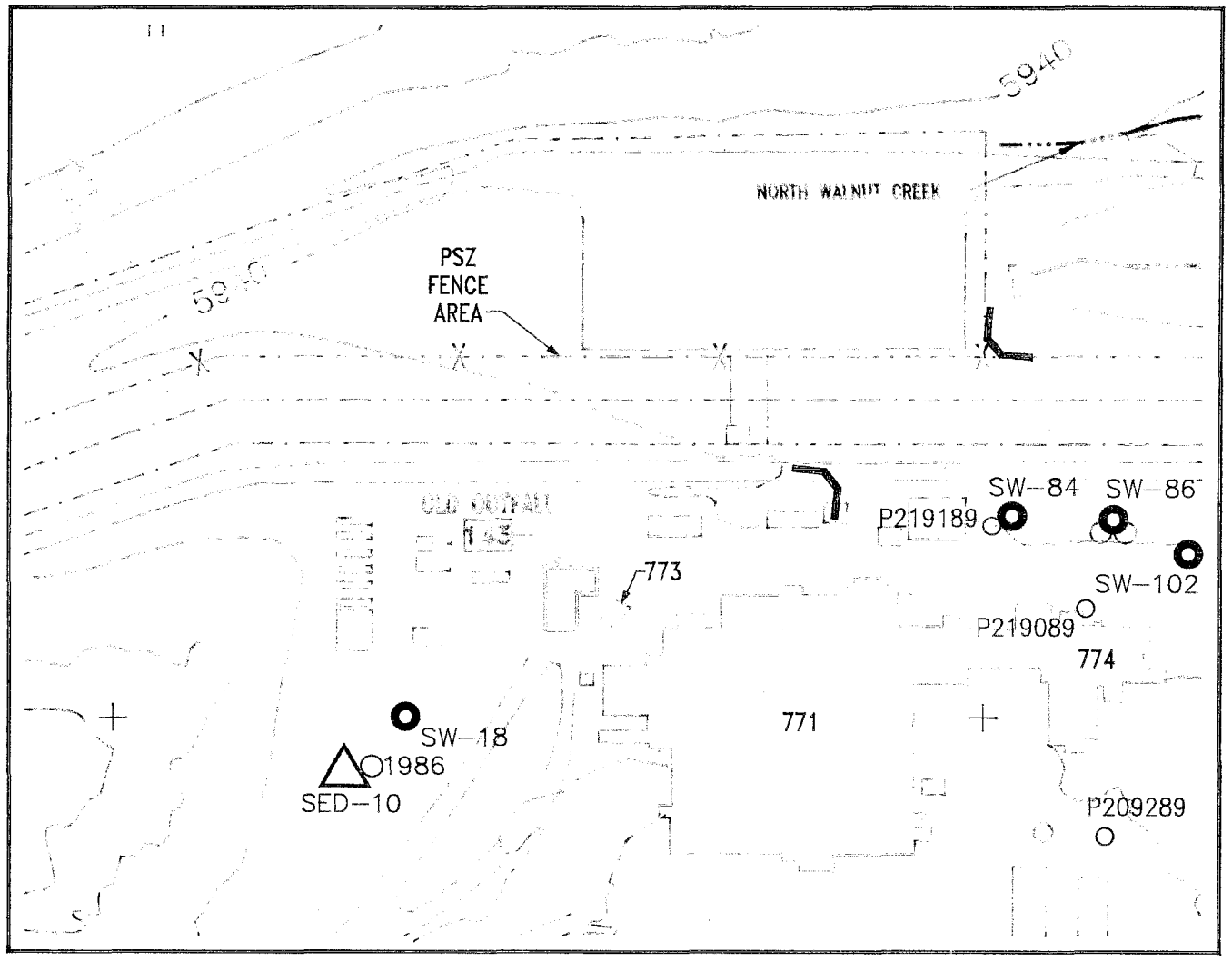
OPERABLE UNIT 6
PHASE I RFI/RI WORK PLAN

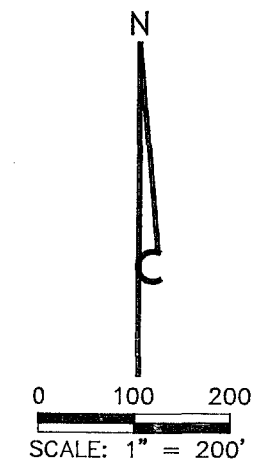
IHSS 141 SLUDGE DISPERSAL,
IHSS 165 TRIANGLE AREA,
IHSS 156.2 SOIL DUMP AREA

FIGURE 2-12

REV. AUGUST 1991
APRIL 1991

25060290





EXPLANATION

- INDIVIDUAL HAZARDOUS SUBSTANCE SITE
- SW-1 — EXISTING SURFACE WATER SAMPLING LOCATION
- 5786 — EXISTING ALLUVIAL GROUNDWATER MONITORING WELL
- SED-17 — EXISTING SEDIMENT SAMPLING LOCATION
- INTERMITTENT STREAM
- DIRT ROAD
- 968 — ROCKY FLATS BLDG. NO.

U.S. DEPARTMENT OF ENERGY
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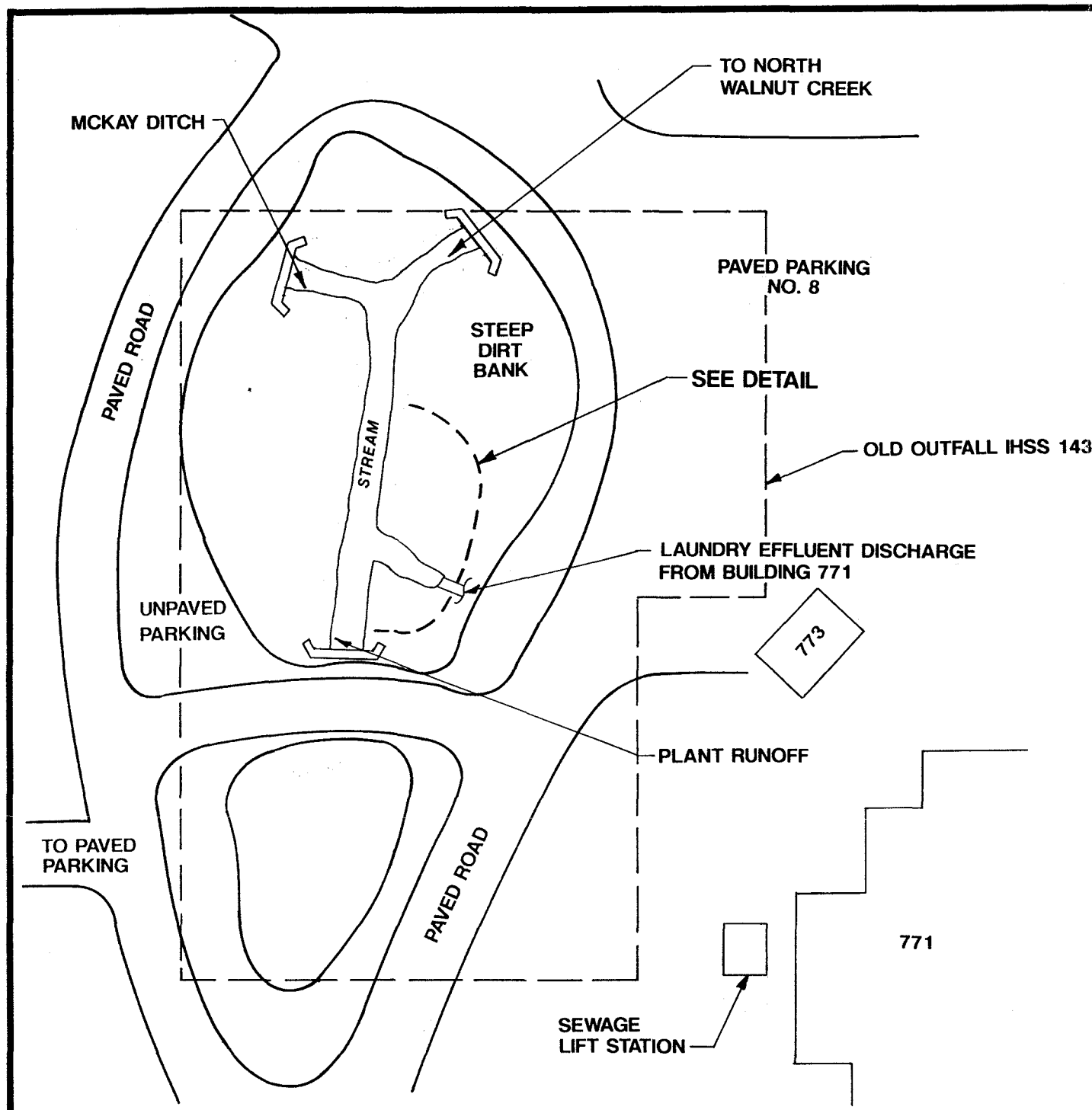
OPERABLE UNIT 6
PHASE I RFI/RI WORK PLAN

IHSS 143 OLD OUTFALL AREA

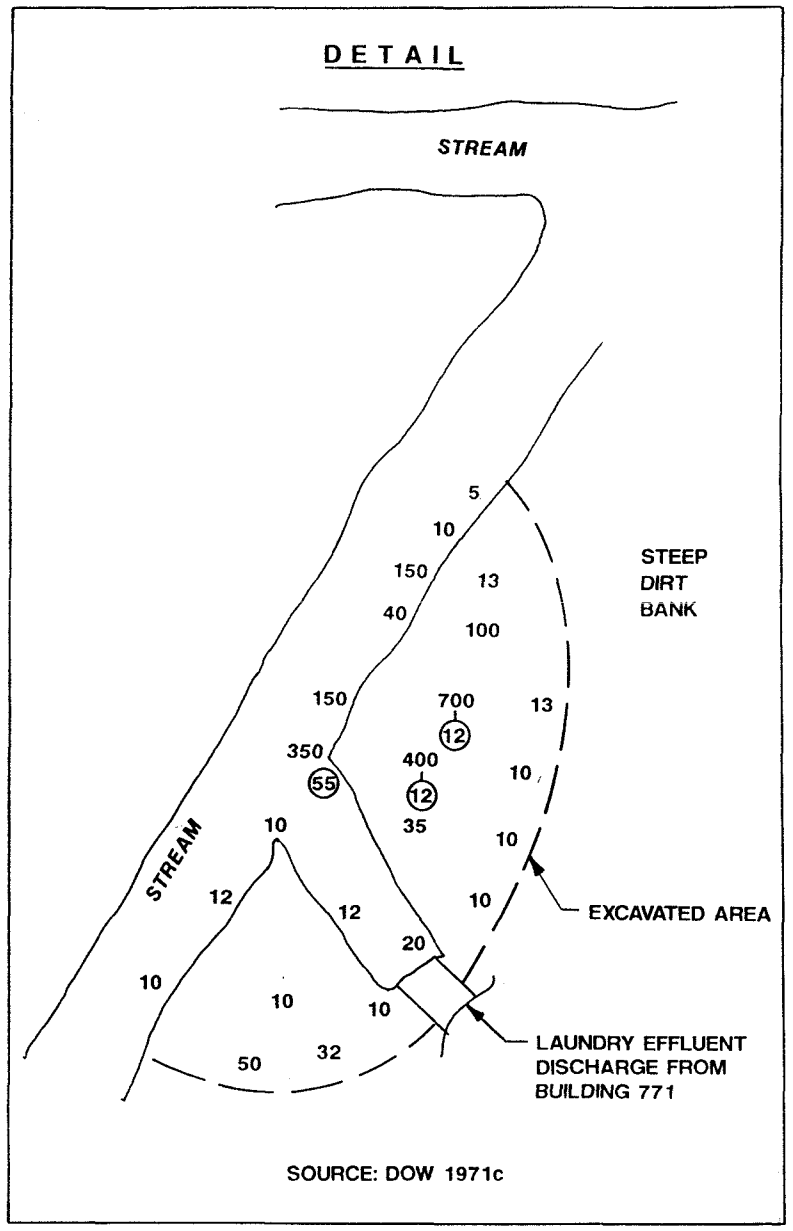
FIGURE 2-13

REV. AUGUST 1991
APRIL 1991

25060300



SOURCE: DOW 1971a



SOURCE: DOW 1971c

SCALE: NOT TO SCALE

EXPLANATION

12 PLUTONIUM CONCENTRATIONS OF SOIL SAMPLE IN d/m/gm

(12) CONCENTRATION OF RESAMPLED SOIL SAMPLE IN d/m/gm AFTER FURTHER DIGGING

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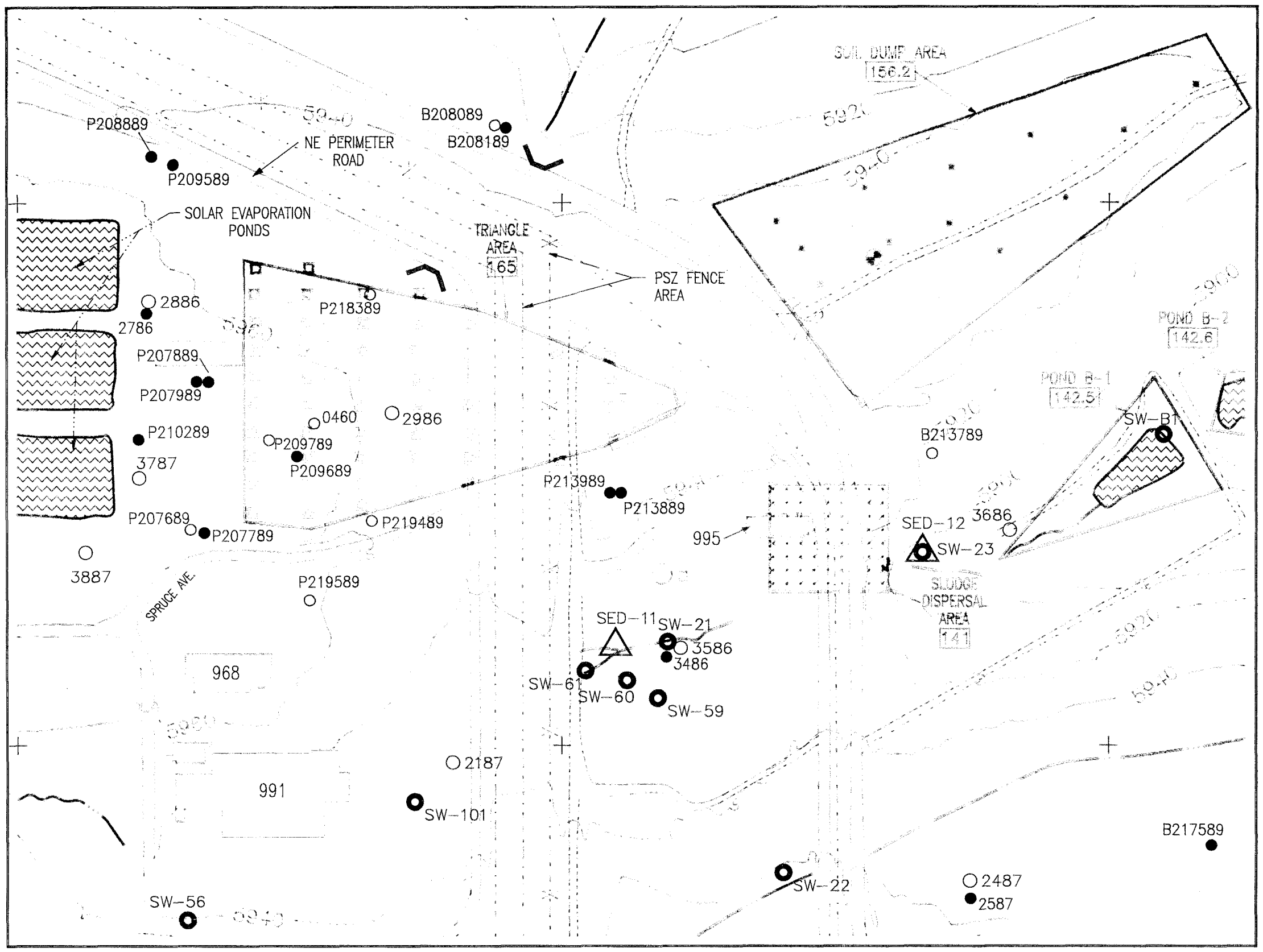
Rocky Flats Plant, Golden, Colorado

OPERABLE UNIT 6
PHASE I RFI/RI WORK PLAN

IHSS 143 OLD OUTFALL AREA
LOCATION OF CULVERTS AND OUTFALL
CATCHMENT BASIN IN FEBRUARY 1971 AND
SOIL SAMPLE RESULTS DURING SOIL
REMOVAL ACTIVITIES BETWEEN FEBRUARY
AND AUGUST 1971

FIGURE 2-14 APRIL 1991



N

0 100 200

SCALE: 1" = 200'

EXPLANATION

- INDIVIDUAL HAZARDOUS SUBSTANCE SITE
- SW-1 EXISTING SURFACE WATER SAMPLING LOCATION
- 5786 EXISTING ALLUVIAL GROUNDWATER MONITORING WELL
- SED-17 EXISTING SEDIMENT SAMPLING LOCATION
- 3087 EXISTING BEDROCK GROUNDWATER MONITORING WELL
- DIRT ROAD
- INTERMITTENT STREAM
- 968 ROCKY FLATS BLDG. NO.
- PROPOSED SOIL GAS SURVEY LOCATION [1]
- PROPOSED WELL LOCATION [1]
- PROPOSED SURFACE SAMPLING AND RADIATION SURVEY LOCATION [1]
- PROPOSED BORING AND SURFACE SAMPLING LOCATION [1]

[1] ALL PROPOSED LOCATIONS ARE APPROXIMATE

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Rocky Flats Plant, Golden, Colorado

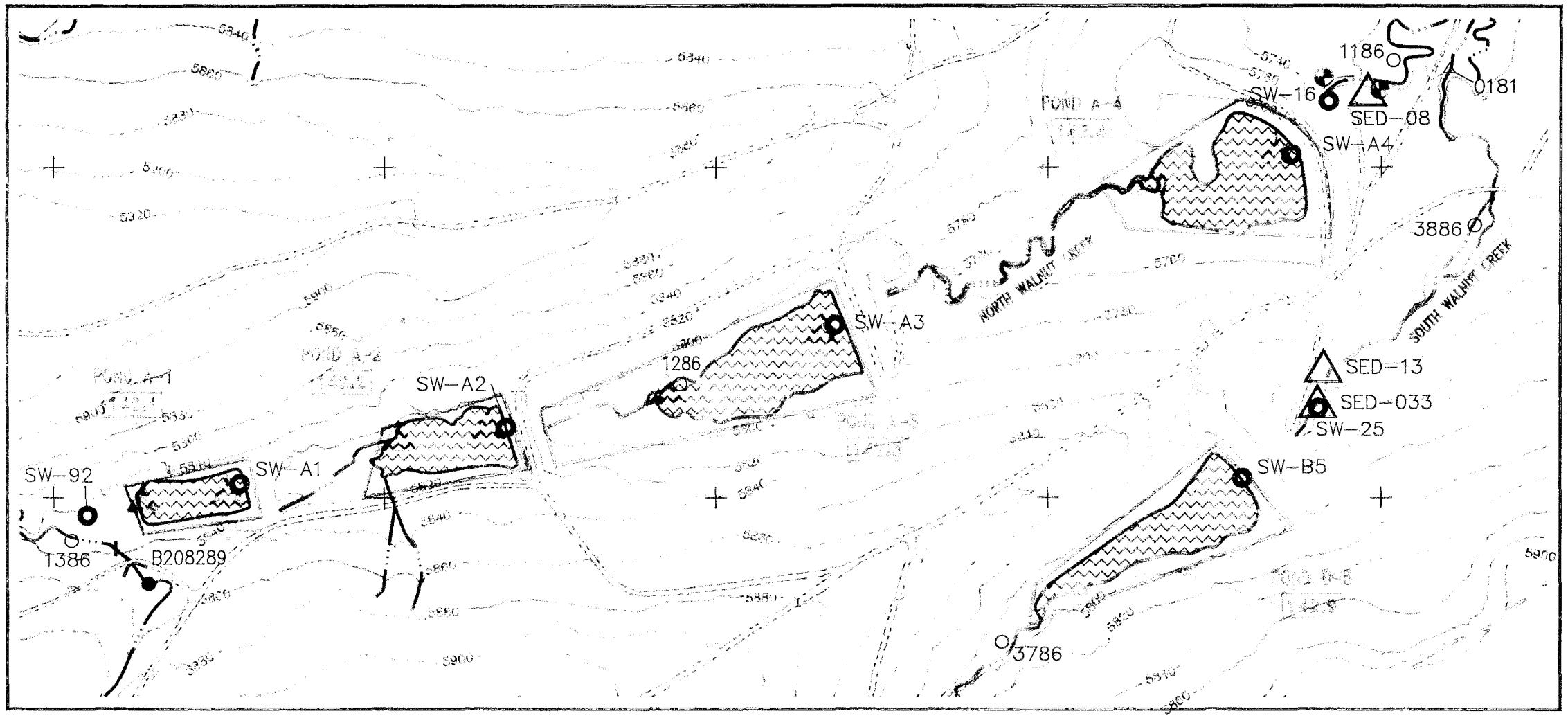
OPERABLE UNIT 6
PHASE I RFI/RI WORK PLAN

PROPOSED SAMPLING AND WELL LOCATIONS IHSS 141 SLUDGE DISPERSAL IHSS 165 TRIANGLE AREA IHSS 156.2 SOIL DUMP AREA

FIGURE 7-1

REV. AUGUST 1991
APRIL 1991

25060310



N

0 200 400

SCALE: 1" = 400'

EXPLANATION

- INDIVIDUAL HAZARDOUS SUBSTANCE SITE
- SW-1 EXISTING SURFACE WATER SAMPLING LOCATION
- 5786 EXISTING ALLUVIAL GROUNDWATER MONITORING WELL
- SED-17 EXISTING SEDIMENT SAMPLING LOCATION
- 3087 EXISTING BEDROCK GROUNDWATER MONITORING WELL
- 0181 EXISTING PRE-1986 WELL
- INTERMITTENT STREAM
- DIRT ROAD
- PROPOSED WELL LOCATION[1]
- PROPOSED SEDIMENT SAMPLE LOCATION[1]
- PROPOSED BEDROCK WELL LOCATION[1]

[1] ALL PROPOSED LOCATIONS ARE APPROXIMATE

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

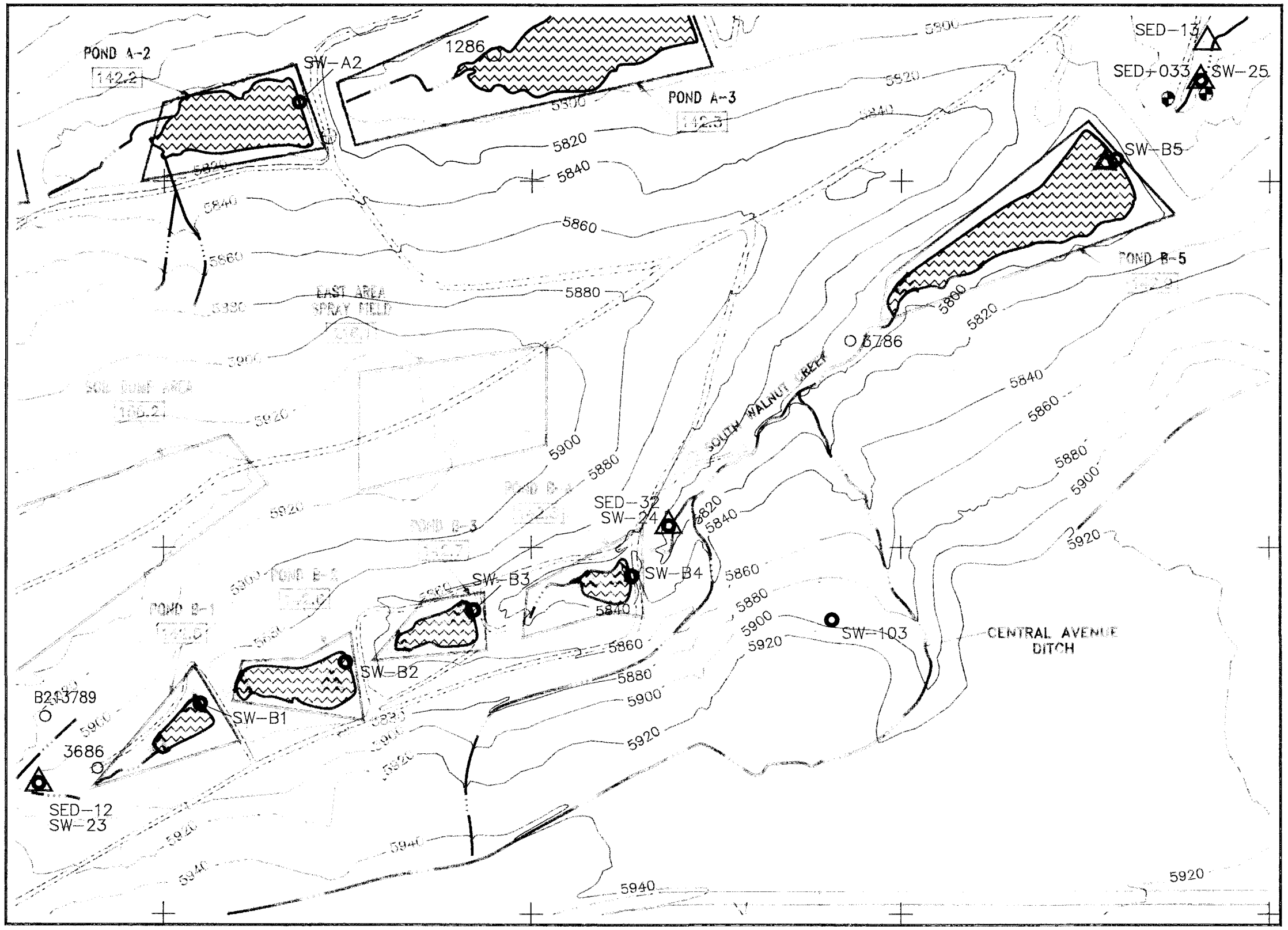
OPERABLE UNIT 6
PHASE I RFI/RI WORK PLAN

PROPOSED SAMPLING & WELL LOCATIONS
IHSSs 142.1-4
A-SERIES DETENTION PONDS
ALONG NORTH WALNUT CREEK

FIGURE 7-2

REV. AUGUST 1991
APRIL 1991

25060320



N

0 150 300

SCALE: 1" = 300'

EXPLANATION

- INDIVIDUAL HAZARDOUS SUBSTANCE SITE
- SW-1 — EXISTING SURFACE WATER SAMPLING LOCATION
- 5786 — EXISTING ALLUVIAL GROUNDWATER MONITORING WELL
- SED-17 — EXISTING SEDIMENT SAMPLING LOCATION
- INTERMITTENT STREAM
- DIRT ROAD
- 968 — ROCKY FLATS BLDG. NO.
- PROPOSED WELL LOCATION [1]
- PROPOSED BORING AND SURFACE SAMPLE [1] LOCATION
- PROPOSED SEDIMENT SAMPLE LOCATION [1,2]
- PROPOSED BEDROCK WELL LOCATION [1]

[1] ALL PROPOSED LOCATIONS ARE APPROXIMATE

[2] THREE OTHER LOCATIONS IN EACH POND WILL BE SELECTED AT RANDOM

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

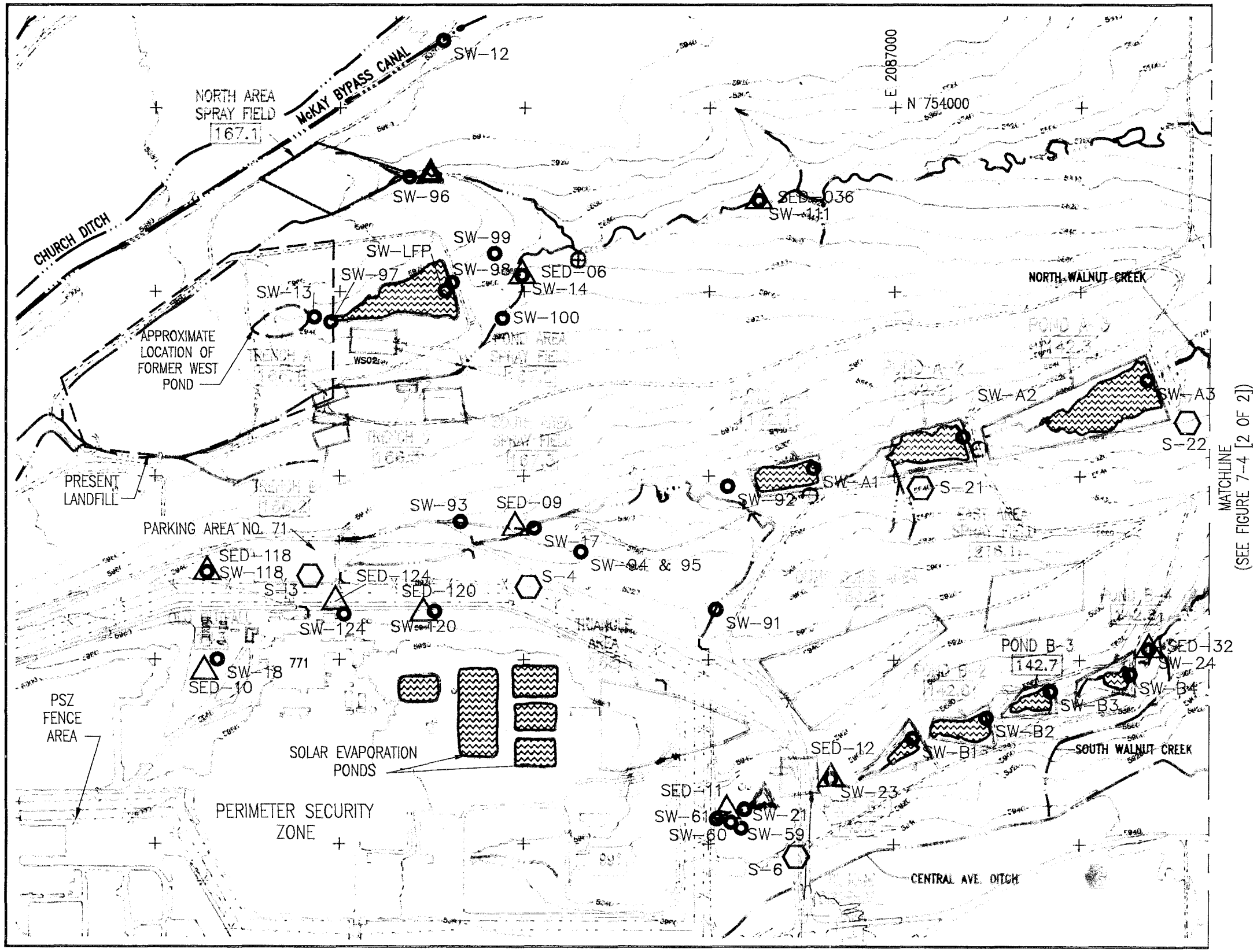
OPERABLE UNIT 6
PHASE I RFI/RI WORK PLAN

PROPOSED SAMPLING & WELL LOCATIONS
IHSSs 142.5-9,
B-SERIES DETENTION PONDS
ALONG SOUTH WALNUT CREEK
IHSS 216.1 EAST AREA SPRAY FIELD

FIGURE 7-3

REV. AUGUST 1991
APRIL 1991

25060330



N

0 300 600

SCALE: 1" = 600'

EXPLANATION

- INDIVIDUAL HAZARDOUS SUBSTANCE SITE (IHSS) IN OPERABLE UNIT 6
- IHSS REFERENCE NUMBER
- SW-1 EXISTING SURFACE WATER SAMPLING LOCATION
- SED-17 EXISTING SEDIMENT SAMPLE LOCATION
- S-22 EXISTING RADIOACTIVE AMBIENT AIR MONITORING PROGRAM LOCATION
- PERIMETER SECURITY ZONE
- DIRT ROAD
- PROPOSED SEDIMENT SAMPLE LOCATION [1]
- PROPOSED BEDROCK WELL LOCATION [1]
- PROPOSED RADIOACTIVE AMBIENT AIR MONITORING PROGRAM LOCATION [1]

[1] ALL PROPOSED LOCATIONS ARE APPROXIMATE

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

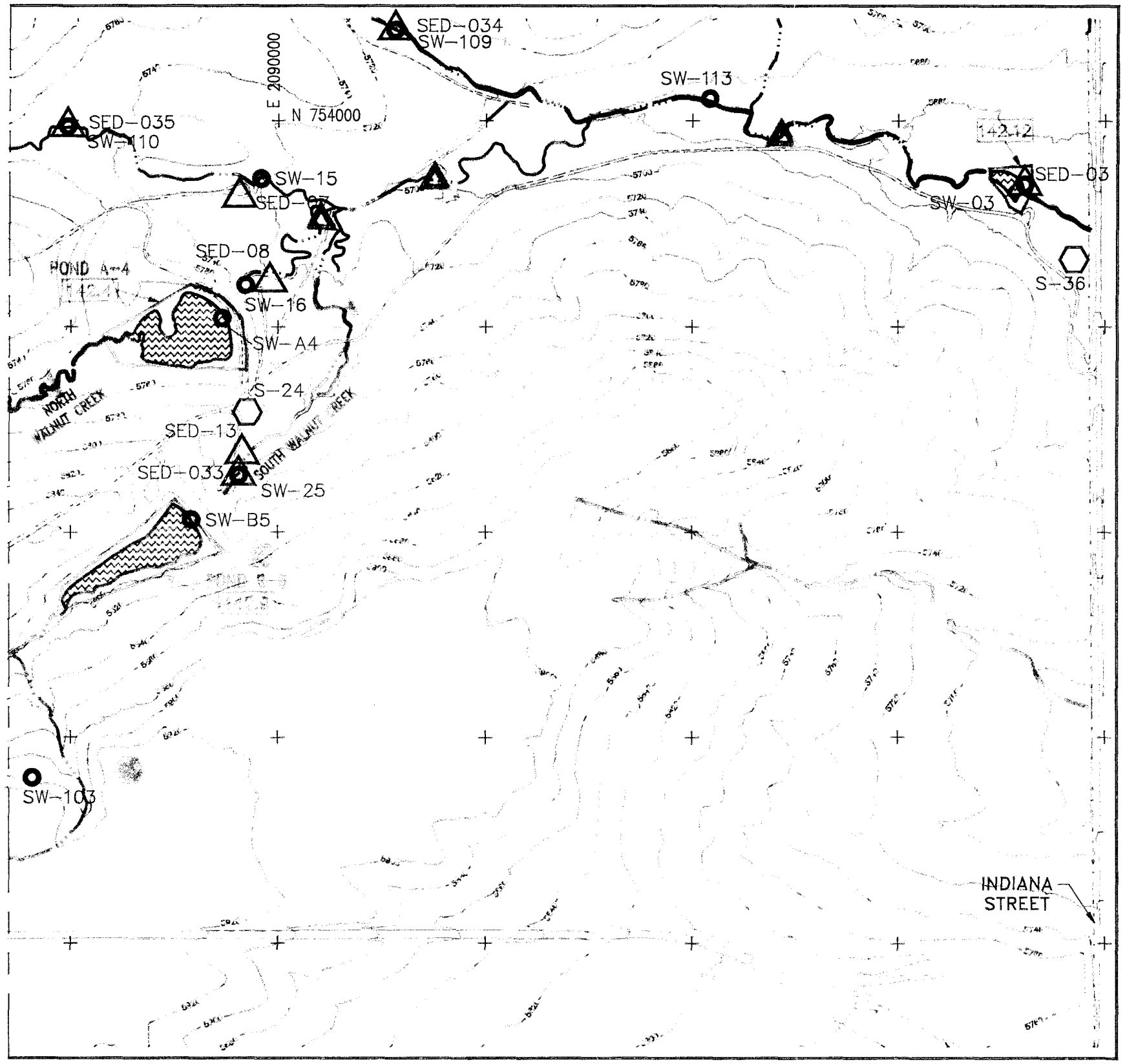
OPERABLE UNIT 6
PHASE I RFI/RI WORK PLAN

PROPOSED SEDIMENT SAMPLING SITES, AIR MONITORING STATIONS, AND BEDROCK WELLS ON NORTH & SOUTH WALNUT CREEKS

FIGURE 7-4 (1 OF 2)

REV. AUGUST 1991
APRIL 1991

2506034A



N

0 300 600

SCALE: 1" = 600'

EXPLANATION

- INDIVIDUAL HAZARDOUS SUBSTANCE SITE (IHSS) IN OPERABLE UNIT 6
- 115 — IHSS REFERENCE NUMBER
- SW-1 — EXISTING SURFACE WATER SAMPLING LOCATION
- SED-17 — EXISTING SEDIMENT SAMPLE LOCATION
- S-22 — EXISTING RADIOACTIVE AMBIENT AIR MONITORING PROGRAM LOCATION
- PERIMETER SECURITY ZONE
- DIRT ROAD
- PROPOSED SEDIMENT SAMPLE LOCATION [1]
- PROPOSED BEDROCK WELL LOCATION [1]
- PROPOSED RADIOACTIVE AMBIENT AIR MONITORING PROGRAM LOCATION [1]

[1] ALL PROPOSED LOCATIONS ARE APPROXIMATE

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

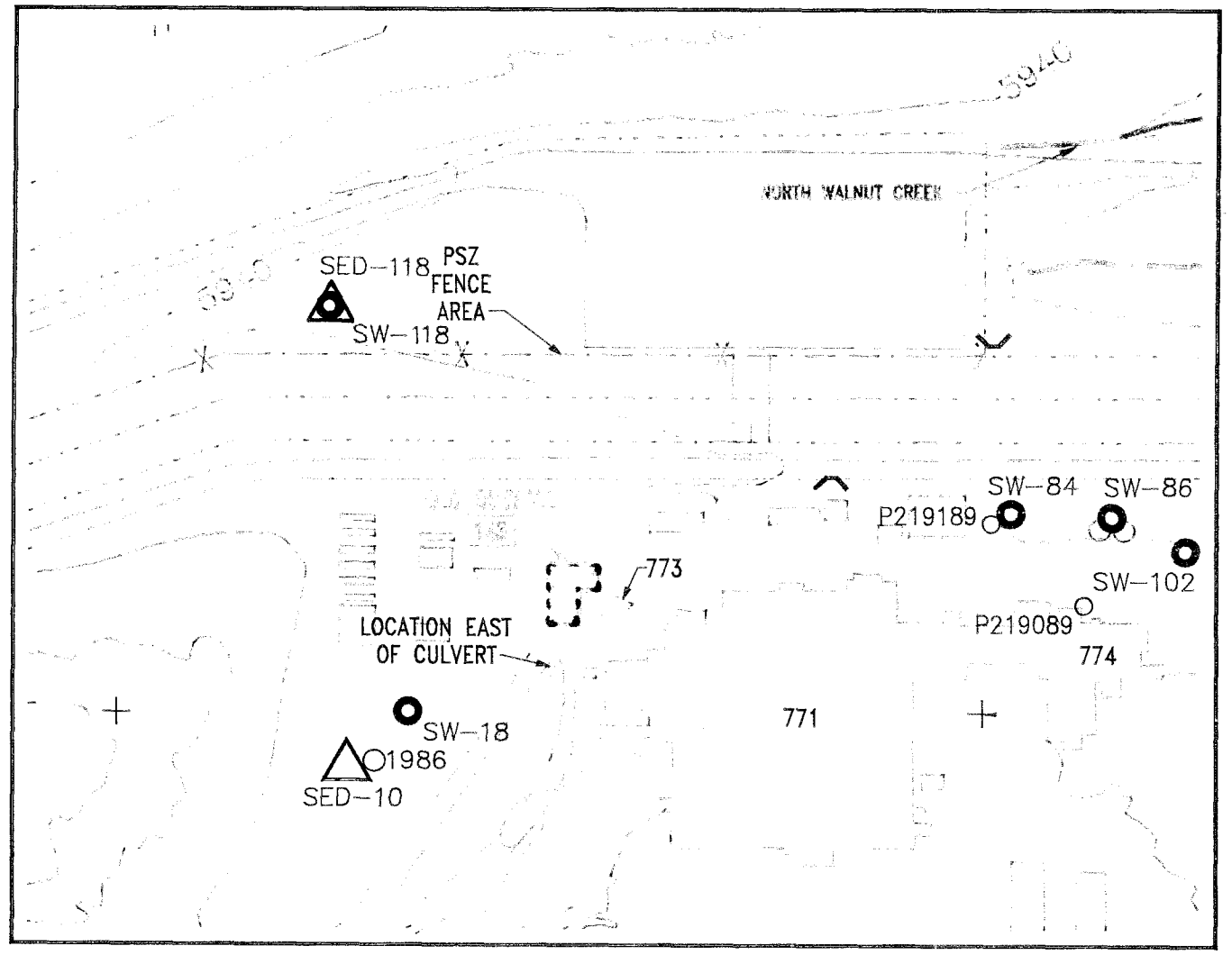
OPERABLE UNIT 6
PHASE I RFI/RI WORK PLAN

PROPOSED SEDIMENT SAMPLING SITES, AIR MONITORING STATIONS, AND BEDROCK WELLS ON NORTH & SOUTH WALNUT CREEKS

FIGURE 7-4 (2 OF 2)

REV. AUGUST 1991
APRIL 1991

2506034B



N

0 100 200

SCALE: 1" = 200'

EXPLANATION

- INDIVIDUAL HAZARDOUS SUBSTANCE SITE
- SW-1 — EXISTING SURFACE WATER SAMPLING LOCATION
- 5786 — EXISTING ALLUVIAL GROUNDWATER MONITORING WELL
- SED-17 — EXISTING SEDIMENT SAMPLING LOCATION
- INTERMITTENT STREAM
- DIRT ROAD
- 968 — ROCKY FLATS BLDG. NO.
- PROPOSED SOIL BORING LOCATION[1]

[1] ALL PROPOSED LOCATIONS ARE APPROXIMATE

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

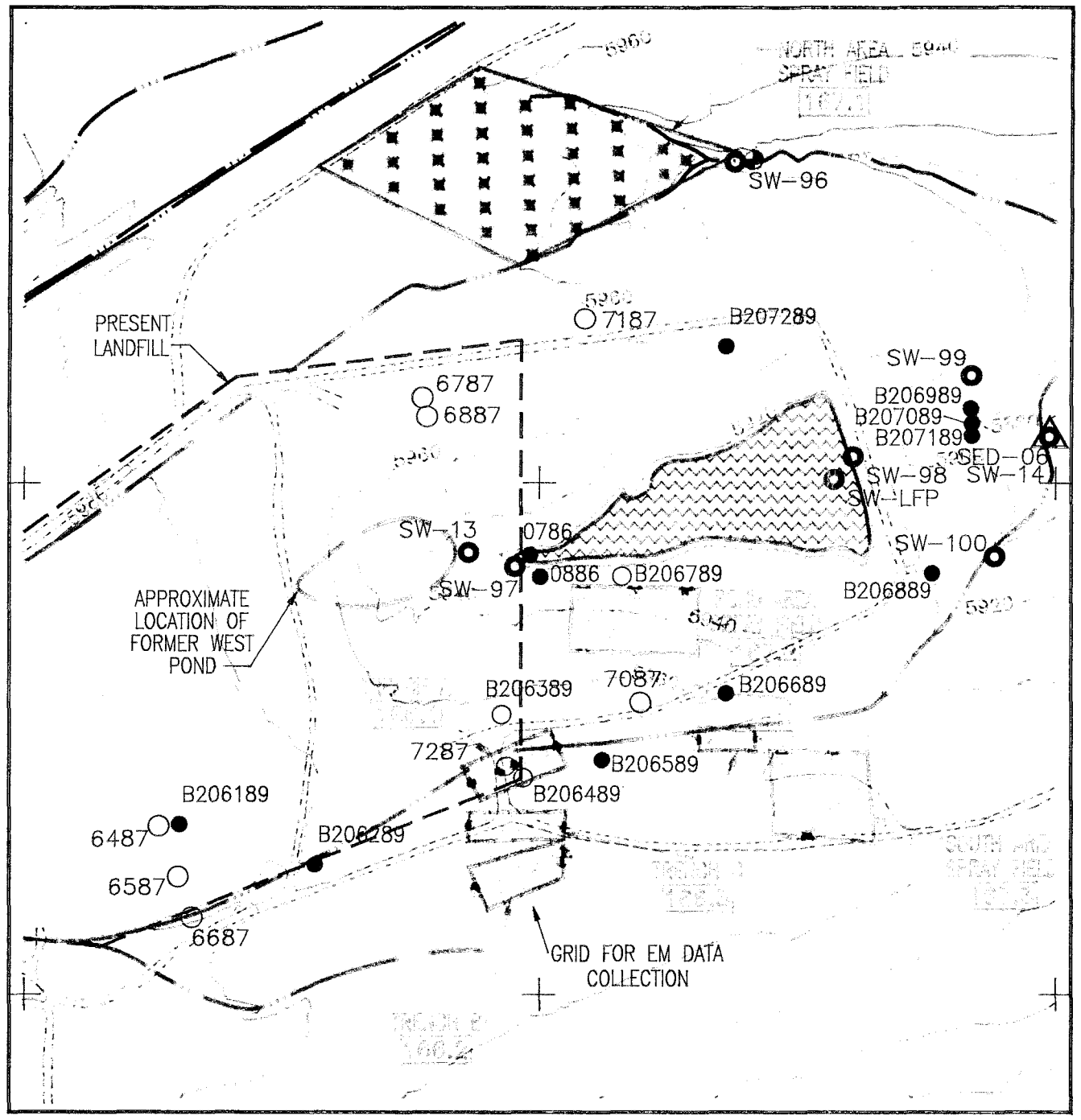
OPERABLE UNIT 6
PHASE I RFI/RI WORK PLAN

PROPOSED SAMPLING LOCATIONS
IHSS 143 OLD OUTFALL AREA

FIGURE 7-5

REV. AUGUST 1991
APRIL 1991

25060350



N

0 150 300

SCALE: 1" = 300'

EXPLANATION

- INDIVIDUAL HAZARDOUS SUBSTANCE SITE
- SW-1 — EXISTING SURFACE WATER SAMPLING LOCATION
- 5786 — EXISTING ALLUVIAL GROUNDWATER MONITORING WELL
- SED-17 — EXISTING SEDIMENT SAMPLING LOCATION
- 3087 — EXISTING BEDROCK GROUNDWATER MONITORING WELL
- INTERMITTENT STREAM
- DIRT ROAD
- PROPOSED SOIL BORING LOCATION [1]
- PROPOSED WELL LOCATION [1]
- PROPOSED BORING AND SURFACE SAMPLE LOCATION [1]
- PROPOSED ELECTROMAGNETIC SURVEY LINE LOCATION [1]

[1] ALL PROPOSED LOCATIONS ARE APPROXIMATE

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

OPERABLE UNIT 6
PHASE I RFI/RI WORK PLAN

PROPOSED SAMPLING & WELL LOCATIONS
IHSSs 166.1–3, TRENCHES A, B, & C
IHSSs 167.1–3 NORTH AREA,
POND AREA AND SOUTH AREA

FIGURE 7–6

REV. AUGUST 1991
APRIL 1991

25060360