Closure Strategy for the Rocky Flats Environmental Technology Site

Sanitary Sewer System

Draft

March 30, 2004

1/30

Table of Contents

Appendices

Figures

Tables

2

Acronyms and Abbreviations

ALF	Action Level Framework
ALs	Action Levels
ASI	Advanced Sciences, Inc
CAD	Corrective Action Decision
CBOD5	carbonaceous biochemical oxygen demand
D&D	Decontamination and Decommissioning
d/m/l	Disintegrations/minute/liter
DOE	Department of Energy
DOP	Dioctyl phthalate
EPA	Environmental Protection Agency
ER	Environmental Restoration
FFCA	Federal Facilities Compliance Agreement
IASAP	Industrial Area Sampling and Analysis Plan
IHSS	Individual Hazardous Substance Site
ISCORS	Interagency Steering Committee on Radiation Standards
KH	Kaiser-Hill Company, LLC
MEK	Methyl ethyl ketone
MGD	million gallons per day
mg/kg	milligram per kilogram
nCi/g	nanoCuries/gram
NPDES	National Pollutant Discharge Elimination System
NRC	Nuclear Regulatory Commission
NTS	Nevada Test Site
OU 1	Operable Unit 1
PAC	Potential Area of Concern
PA	Protected Area
PAH	polyaromatic hydrocarbons
pCi/g	picoCuries per gram
pCi/l	picoCuries per liter
PPE	personal protective equipment
PPM	parts per million
PVC	polyvinyl chloride
RCT	Radiological Control Technician
RFCA	Rocky Flats Cleanup Agreement
RFETS	Rocky Flats Environmental Technology Site
ROD	Record of Decision
RSOP	RFCA Standard Operating Protocol

3

TCLP	Toxicity Characteristic Leaching Procedure
VCP	vitrified clay pipe
ug/kg	microgram per kilogram
WRW	Wildlife Refuge Worker
WWTF	Wastewater Treatment Facility

1 0 Introduction

This document provides the closure strategy for the entire Rocky Flats Environmental Technology Site (RFETS) sanitary sewer system The sanitary sewer system is part of Individual Hazardous Substance Site (IHSS) Group 000-3 that consists of Potential Area of Concern (PAC) 000-500 – Sanitary Sewer System, PAC 000-505 – Storm Drains, IHSS 143 – Old Outfall at Building 771, and IHSS 190 – Central Avenue Ditch Caustic Leak

There are three main components to the sanitary sewer system other than those addressed by Wastewater Treatment Facility (WWTF) closure main sewer lines not associated with buildings, smaller sanitary sewer lines associated with buildings, and abandoned lines Major components of the sanitary sewer system are addressed based on available data and process knowledge

Sanitary sewer lines associated with buildings are removed by the facility if within three feet of final grade Associated potential contamination is addressed through an Environmental Remediation (ER) Rocky Flats Cleanup Agreement (RFCA) Standard Operating Protocol (RSOP) notification for the appropriate IHSS Group, if applicable The main sanitary sewer system and the storm drains are addressed as part of IHSS Group 000-3 The WWTF will be closed following closure of the sanitary sewer lines as a separate project However, this document addresses the project approach for dispositioning all of the sanitary sewer system defined as PAC 000-500

1 1 Project Approach

This document presents the data that justifies proposing the PAC 000-500 - Sanitary Sewer System as a no further accelerated action based on process knowledge and available analytical data This document also describes the additional Best Management Practices that ensure protection of the environment

The following data were utilized to develop the approach and are discussed in more detail in later sections

- Historic information such as discharges to the sewer, reported leaks, studies and line evaluations to identify potential contaminant types, and condition of the system,
- Biosolid and influent data to provide information on current and historical average contaminant levels within the sanitary sewer system, and
- Previously removed sanitary sewer lines at Building 442 and Building 441 provide information on potential contaminant levels in the piping and surrounding soils

Using these data, a closure strategy for the sanitary sewer system was developed that is a coordinated effort between WWTF operations, decommissioning projects and environmental restoration

After the routine maintenance and operations of the WWTF is complete (expected October 2004), the following approach will be implemented

- Demolition of the WWTF,
- Removal and closure of building-related sanitary sewer lines and components with the associated buildings, and
- Closure of remaining known abandoned sanitary sewer lines
  - Obtain no further accelerated action for sewer lines based on process knowledge
  - Remove lines within three feet of the surface
  - Implement additional Best Management Practices

Table 1 shows the closure status for the Sanitary Sewer System

Table 1 Closure Status of Sanitary Sewer System PAC 000-500

Sanitary Sewer Component	Closure Status	Documentation
Building 995 Wastewater Treatment Plant	Closure And Removal	Facility Disposition RSOP (DOE, 2000)
Sewer lines beneath and near Buildings	Remove within 3 feet of surface as Buildings are closed – plug and survey pipe ends	Closure Strategy For Sanitary Sewer System - Best Management Practice
Operating Lines and Manholes	Operate until closure of Treatment Facility – remove manholes to 3 feet below final grade, plug and survey pipe ends	Closure Strategy For Sanitary Sewer System - Best Management Practice
Abandoned Lines	Where known, remove to within 3 feet of final ground surface – plug and survey pipe ends	Closure Strategy For Sanitary Sewer System - Best Management Practice
Sanitary Sewer Components in other IHSS Groups		
PAC 700-144 Sewer Line Break	Will be closed under IHSS Group 700-3	ER RSOP notification letter
PAC 800-145 Sanitary Waste Line	Closed through the Operable Unit 1 (OU 1) Corrective Action Decision/Record of Decision (CAD/ROD)	OU 1 Corrective Action CAD/ROD (DOE, 1997)
PAC 800-106	Closed through the OU 1 Record of Decision	OU 1 Corrective Action Record of Decision (DOE, 1997)
PAC 900-141 Sludge Dispersal	No Further Action Approval	1999 Annual Update to Historical Release Report (DOE, 1999)
PAC 100-604 T130 Complex Sewer Line Breaks	No Further Action Approval	2002 Annual Update to Historical Release Report (DOE, 2002a)

The Inner East and West Guard Shacks (Buildings 100 and 900) had independent septic leach fields and did not connect to the sanitary sewer system On average, only 4 or 5 people were assigned to each guard post and potentially used these facilities The structures associated with these leach fields will be removed to three feet below grade and are not part of this strategy

1 2 Interface with WWTF Cluster Closure

The Site's WWTF also known as B995 cluster, contains buildings 971, 972, 973, 974, T974A, 975, 976, 977, 988, 988A, and 990 as well as the influent and effluent storage tanks and the discharge line along the B-Series Ponds This cluster is anticipated to close in 2004 As part of Site Closure, all buildings, tanks and other related structures will be removed to a depth of three feet below final grade The sanitary sewer lines and manholes within the cluster will be removed to a minimum depth of three feet below the final grade and associated pipe bedding material will be disrupted to eliminate or minimize potential pathways to surface water Any remaining sewer lines in this cluster will be plugged and capped

1 3 Interface with Other Building D&D Activities

As discussed in the Facility Disposition Rocky Flats Cleanup Agreement (RFCA) Standard Operating Protocol (RSOP) (Department of Energy [DOE], 2000) and the ER RSOP for Routine Soil Remediation (DOE, 2003a), prior to building demolition, sanitary sewer lines within the building are flushed with domestic water Flushing consists of high volume, short duration clean water flows of at least five times the total volume of the sewer line being flushed

6

There is probably little benefit from this action However since the lines are available and still accessible, this is an appropriate action as a best management practice for closure to remove solids and trapped debris within the line Flushing is coordinated with WWTF to ensure the high volumes of water and/or sediment associated with flushing can be accommodated

After the flushing is completed, all openings to the sanitary sewer within the building are plugged with a watertight seal to keep the pipe closed during decontamination and decommissioning (D&D) The sanitary sewer lines are then cut and the open ends plugged with a watertight permanent seal such as a cement plug outside the building footprint at a convenient location close to the building but away from ongoing building activities Sanitary sewer lines less than three feet below grade are removed and open ends plugged as above At closure, a map with the location of the plugged ends will be documented in the Administrative Record as part of Site closure conditions

2 0 Background Information

Installation of the sanitary sewer system and associated treatment plant began around 1952 (DOE, 1992) The estimated total length of the sanitary sewer lines is approximately 67,000 feet including active and abandoned lines The diameter of the lines ranges from 3 to 12 inches with about 30,000 feet of 6-inch and larger lines and about 11,500 feet of 4-inch lines (DOE, 2002b) The lines include vitrified clay pipe (VCP), polyvinyl chloride pipe (PVC), cast iron and ductile iron pipe PVC lines were installed in 1984 or later In 1985, some of the system was rehabilitated to reduce infiltration and leakage (Advanced Sciences, Inc [ASI], 1991) The sanitary sewer system is shown in Figure 1

The sanitary sewer collection system flows by gravity from west to east across the industrial area However, some facilities also have lift stations to pump sewage where gravity flow is not possible, such as for the Building 881 and Building 771 clusters There are two sections of the sanitary sewer system the north section collects flow from the plant area formerly located within the Protected Area (PA), the south section collects flow from the rest of the plant exterior to the PA The two sections join at Building 990

From Building 990, wastewater flows into one of three 110,000 gallon influent storage tanks at WWTF allowing inflow to be collected while another tank holding the previous day's flow is processed (DOE, 2001) The Site's wastewater treatment plant is an activated sludge treatment facility with a design capacity of 0 5 million gallons per day (MGD) In 2003, normal flows were approximately 0 16 MGD The flow rate continues to decline as the Site closes

The lengths of various main sewer lines types were calculated based on Figure 1 and are presented in Table 2 The lengths presented are only for the main lines Numerous smaller lines and laterals are associated with the buildings and were not included in this estimate

As shown on Table 2, about half of the active lines are already flushed and significant portions of the sanitary sewer lines are already abandoned (43%) including 17% of the total that were flushed prior to abandonment These numbers may be low because many of these abandoned lines are believed to be flushed, plugged, or removed In addition, an effluent line that runs from the wastewater treatment plant was included in the calculations even though this line was exposed only to treated water and does not need to be flushed

THIS TARGET SHEET REPRESENTS AN
OVER-SIZED MAP / PLATE FOR THIS DOCUMENT·
(Ref: 04-RF-00390, JLB-032-04)

Draft Closure Strategy for the Rocky Flats Environmental Technology Site Sanitary Sewer System

March 30, 2004

Figure 1:

Sanitary Sewer System Location Map

February 11, 2004

CERCLA Administrative Record Document, IA-A-002054

U S DEPARTEMENT OF ENERGY
ROCKY FLATS ENVIRONMENTAL TECHNOLOGY SITE

GOLDEN, COLORADO

Table 2 Sanitary Sewer Line Summary

Active Sanitary Sewer Lines	Length (feet)	Length (miles)	Percentage of Active Lines	Percentage of Total Lines
Active Sanitary Sewer, Not Flushed	18,317	3 47	49 5%	28 2%
Active Sanitary Sewer, Flushed	18,722	3 55	50 5%	28 8%
Total Active Lines	**37,039**	**7 01**	**100 0%**	**57 0%**
Abandoned Lines	**Length (feet)**	**Length (miles)**	**Percentage of Abandoned Lines**	**Percentage of Total Lines**
Abandoned Lines, Flushed and Plugged	7,009	1 33	25 0%	10 8%
Abandoned Lines, Flushed	3,800	0 72	13 6%	5 8%
Older Abandoned Lines	15,520	2 94	55 4%	23 9%
Abandoned Lines, Not Located	1,072	0 20	3 8%	1 6%
Lines Removed through D&D	597	0 11	2 1%	0 9%
Total Abandoned Lines	**27,998**	**5 30**	**100 0%**	**43 0%**
Total Lines	**65,037**	**12 32**		**100 0%**

Manhole inspections and photographs indicate that sanitary sewer lines are generally greater than three feet below grade with the exception of the lines in the 130 trailer complex on the west side of the Site Lines associated with buildings are generally less than three feet below grade because the system relies on gravity flow and shallower lines are required for flow from the buildings into the main lines

2 1 Influent to the Sanitary Sewer System

Within Site buildings, various drains, sinks, sumps, and toilets discharge to collection lines and then to the main lines that transport the wastewater to WWTF Process wastes are managed in a separate system from sanitary wastes In every Site building, waste discharge points (drains, sinks, sumps, etc) are designated as either "sanitary drain" or "process drain" Process waste drains are plumbed separately into the Process Waste System In some plant facilities, wastes are, or have historically been, collected and temporarily stored in tanks piped into both systems, and transferred to the appropriate system based on analytical results (DOE, 1992)

Historically, some storm water sources, such as roof drains, were connected to the sanitary sewer system These were disconnected and there are no known cross connections between the storm drain and the sanitary sewer system (ASI, 1991) In addition, cooling tower sumps were generally pumped into the sanitary sewer system to dispose of cooling tower blowdown water These are disconnected as the cooling towers are decommissioned

2 2 Non-Sanitary Discharges to the Sanitary Sewer System

In the past, some non-domestic wastes were discharged into the sanitary sewer system These discharges changed over time in response to internal guidelines and to State and Federal regulations Much of the potential contaminants discharged to the sanitary sewer system were derived from laundry waste A 1967 survey indicated that of the average daily flow of 250,000 gallons, 21,000 gallons was laundry waste However, a 1973 investigation of plutonium releases to the sanitary sewer system indicated that 88% of the plutonium in the sanitary sewer system at that time originated from the numerous laundries on Site (DOE, 1992) This primary source of contaminated discharges was eliminated when potentially contaminated laundry began being laundered offsite in 1996 There is potential for liquids to be dumped into the sanitary sewer by employees but this is not expected to be significant

Table 3 summarizes information compiled on known non-sanitary waste streams discharged into the sanitary sewer system through 1991 In 1991, EPA and DOE entered into the National Pollutant Discharge Elimination System (NPDES) Federal Facilities Compliance Agreement (FFCA) that implemented more controls over non-sanitary releases to the sanitary sewer system

Excluded from Table 3 are discharges of compounds not anticipated to be contaminants of concern such as acids, dyes, unneutralized demineralization waste from the steam plant, ethylene glycol, and oil A complete listing is found in the Historical Release Report (DOE, 1992)

Table 3 Non-Sanitary Discharges to the Sanitary Sewer System

Waste Type	Description
Lab Wastes	8/1953 & 4/1965 – Building 123 laboratory waste with high nitrates and unspecified radioactivity from unnalysis specimens Unknown – Building 331 Old Lab Area had unspecified radioactive contamination around footing drains plumbed into sanitary sewer
Laundry waste	1953 – Unknown Building 442 Laundry waste water discharged with varying radioactivity levels 9/55 - 2,700 gallons of laundry waste discharged with alpha radioactivity exceeding 8,500 disintegrations/minute/liter (d/m/l) discharged while leaks in Building 881 process waste line were repaired 1986 – Building 444 Elevator shaft sump and employee wash facilities are plumbed into sewer, small amounts of uranium oxide and beryllium potentially entered sanitary sewer 1953 – Unknown Building 771 Laundry waste exceeding the radioactivity limit for direct discharge to Walnut Creek is diluted with sanitary sewer system effluent to meet discharge limits Building 881 Process waste and laundry waste discharged to sanitary sewer 1952-53 discharge limit is 10,000 d/m/l 1954 discharge limit is 8,500 d/m/l 1956 discharge limit suspended for indefinite period 1986 – Document states that 2 restrooms in Building 883 are in use where workers do not have to cleanup prior to use
Hexavalent chromium	Mid-1962 -Several discharges of oil and hexavalent chromium waste 6/26/63 - Unknown amount of hexavalent chromium solution discharged 5 parts per millions (ppm) hexavalent chromium at WWTF settling tank, 0 6 ppm at effluent 12/12/63 - Unknown quantity of hexavalent chromium solution discharged to the sanitary sewer 20 ppm was detected at settling tank, 0 18 at effluent 2/1989 - Chromic acid stored in Building 444 overflowed tanks and a containment berm and entered the building's foundation drains The spill collected in a sump that automatically transferred to the sanitary sewer system with an estimated 30 pounds of chromium released to the sanitary sewer system After the chromic acid release, Building 444 foundation drains were plumbed to process waste system
Process waste	11/1964 – Releases to sanitary sewer because of leaks in process waste lines from Buildings 441, 444, 881 and 883 1974 - A document states that radioactive waste from Building 779 was pumped to sanitary sewer if it does not exceed unspecified discharge limits 1978- A document states that all drains in the Building 705 research facility drained to the sanitary sewer system Uranium, beryllium, chromium and acids were used at this location 1978 –A building 881 process waste sink was found to be plumbed into sanitary sewer 1979 – A document states that unspecified chemicals from Building 559 disposed into sanitary drain 1966 – Documents allows up to 500 milliliters of unspecified acids, bases and solvents can be discharged into sanitary sewer in Building 991
Paint	9/11/70 – Silver paint used in Building 444 poured down unspecified drain and cleaned up 1980 – Unspecified type and amount of paint released from Building 374 into sanitary sewer Spill was controlled without reportedly causing environmental impact 1990 – Building 374 discharged paint containing volatile organic compounds to the sanitary sewer
Radioactive iodine	7/24/79 – Unknown amount of iodine-131 was released to the sanitary system as a result of an employee medical treatment 8/09/79 - Unknown amount of iodine-131 was released to the sanitary system as a result of an employee medical treatment.
Tritium	4/73 – 5/73 - An estimated 50 - 100 curies of tritium were inadvertently released from Building 779 to the sanitary sewer system One release contained an estimated six curies of tritium in 7,800 gallons of waste, and a second release contained an estimated 44 curies in 8,000 gallons of waste 8/17/79 – 2,000 picoCuries per liter (pCi/l) was detected in effluent Source was the steam condensate from Buildings 771 776 and 779 that originated as Solar Evaporation Pond water 1,000 gallons per hour were discharged until October 1979
Scrubber solution	10/25/89 – Scrubber system in Building 444 overflowed Effluent showed higher alpha and beta radioactivity than normal

10

Based on a review of spill records compiled since 1991, only a few spills may have introduced potential contaminants of concern into the sanitary sewer system Most of the recent spills into the system were small, less than 100-gallon quantities of ethylene glycol or oils In addition, the following discharges were noted since 1991

- 1994 – 7 gallons of photographic developer/fixer solution released into the sanitary drain in B111 Floor area investigated in 2001 and determined to require no action
- 1995 – approximately one pound of mercury was spilled onto the floor in Building 443 Most of the mercury was believed to be caught in the floor drain P-trap and was retrieved
- 1997 – approximately 50 gallons of water with NALCO inhibitor, a possible chromium source, was discharged into the sanitary sewer from the B460 cooling tower

2 3 Potential for Residual Contamination in Sanitary Sewer System

The potential for contamination in the sanitary sewer system is based on the historical use of the system, the history of contaminant releases, and characteristics of the sludge from the system

Historically, there are two potential sources of contamination that could impact the sanitary sewer

1) Accidental discharges of liquids with higher levels of contamination than routine waste streams, and,
2) Discharges of laundry waste

Contaminated liquids discharged to the sanitary sewer system were more common in the past Potential contamination incidents mostly occurred in the 1950s and 1960s, along with discharge from laundries that had higher contaminant loading (see Section 2 2) Older abandoned lines or lines that have seen little use since they carried more contaminated sewage might still have residual contaminated solids such as the lines found at Building 442

The current sewage influent is not a source of contamination because of better spill control, and the lack of contaminated sources discharging into the sewer Because of the controls currently in place over what can be discharged to the sanitary sewer system, the current discharge to the sanitary sewer is not a source of contamination, and tends to flush the system of contaminants

2 3.1 Potential for Contaminated Solids in Sanitary Sewer System

There is potential for contaminated solids within the sanitary sewer system Potential residual contamination in the system is based on the chemical and physical processes that could cause the solids or contaminants in the line

Physical processes include the build up of material at joints and other places that would not be scoured by flow In areas at the top of lines that are not constantly exposed to flow, there could be residual solids caked on the inside of the line Also, since much of the sewer system is gravity-flow, there could be low spots where heavier materials build up This is probably not as much of a problem since sanitary sewers are periodically cleaned as part of normal operations

Chemical processes consist primarily of precipitation processes, which could form a scale on the walls of the pipe However, because of the continual flow, chemical contamination will tend to flow through the pipe rather than remain in the system

If there is residual contamination in the lines from past releases, it is most likely in joints and other low spots within the system The length of time since contaminant releases, the large quantity of sewage that has flowed through the lines since the releases, and the fact that many of the lines have been cleaned as part of routine operations, indicate that little contaminated solids are present with the lines Therefore, most if not all of the solids currently within the sanitary sewer system are similar to the biosolids discussed in Section 3 2 of this document

While no direct data have been obtained, scale material resulting from precipitation of contaminants is most likely inorganic, consisting of both metals and radionuclides mixed with organic material Precipitation is controlled by pH, oxidation-reduction potential, and the concentration of dissolved species Precipitation will often occur when a liquid system is not in equilibrium or when there are changes in these parameters Unlike a process waste line where there can be frequent changes in pH and oxidation-reduction potential, a sanitary sewer line is expected to be a much more neutral solution

Concentrations of materials that could precipitate are expected to be low considering the dilution caused by multiple sources running into the same line To form precipitates, the liquids in the line have to maintain a certain concentration of ions So although precipitates could form, the concentrations are not expected to be high enough for sufficient time to form precipitates In addition, precipitates that did form could go back into solution

Therefore, it appears that significant amounts of precipitates with leachable contaminants are not present in the sanitary sewer system The large quantities of sewage that moved through the sanitary sewer system likely leached out these materials already, if previously present Even if present, it not likely that much leaching will occur when exposed to natural waters since the sewage is chemically similar So although precipitation cannot be ruled out, it does not appear that this is a viable source of contamination

For these reasons, it is believed that the contaminants found in the influent to the sewage treatment plant represent what is being discharged to the sewer system and are not derived from the lines themselves Furthermore, the organic solids in the sewer line are probably more similar to the biosolids recovered at the sewage treatment plant than to materials released in historical short-term releases It is anticipated that the mechanism for precipitate build up is probably from the day-to-day exposure to metals and other ions in sewage Finally, even if precipitates should be present they would probably not be in a leachable form since they have been exposed to substantial quantities of sewage that would probably have either similar or greater leaching capability as natural waters

It appears that the sanitary sewer system is an unlikely source for significant quantities of contamination However, additional sampling is proposed to confirm this conclusion This is discussed in Section 4 2 1

2 4 Sanitary Sewer Lines – Existing Conditions

In 1999 and 2000, RFETS personnel conducted extensive field inspections of the collection system, including sanitary sewer line inspections using video equipment In 2000, video inspection of about 20% of the 6 inch and larger main lines of the collection system was completed The initial inspections showed that many of the lines were partially obstructed with sediment, solids and debris High-pressure water jetting and vacuum equipment was used to clean the collection system during July 2000 (DOE, 2001) Most, but not all, of the main feeder lines were cleaned at this time (DOE, 2002b) The manholes were jetted at the same time as the jetting equipment passed through the manholes However, no special effort was made to clean more than the manhole floor (personal communication, Michael Vess, 2003)

Based on these recent inspections, the system is in good condition overall One older manhole constructed of brick was repaired to reduce inflow through leaks in the walls In addition, plastic manhole inserts were installed throughout the system to significantly reduce the amount of inflow

12

(DOE, 2002b) Some VCP lines were found to have been slip-lined and in good condition Some sections of VCP that were not slip-lined were found to be in good condition, although a few joints were noted with some deterioration, cracking, and leakage An approximately 1,100 foot-long section of VCP was in questionable condition and has since been slip-lined (DOE, 2002b)

No samples of the material from the cleaning were obtained However, Radiological Control Technician (RCT) coverage was required for these operations, and no elevated readings were found on any of the equipment, indicating that the main lines of the sanitary sewer system are not radioactively contaminated

2 5 System Assessments

Several assessments of the sanitary sewer system were conducted including Task 1 of the Zero-Offsite Water-Discharge Study (ASI, 1991) and the more recent Infiltration and Inflow Evaluations (DOE, 2002b, 2003b) These investigations are summarized below and assess the potential for the following pathways

- **Infiltration** - caused by shallow groundwater entering the sanitary sewer system primarily through leaky sewer lines and joints
- **Inflow** – caused by precipitation or surface water entering the sanitary sewer system primarily through direct connections such as manhole lids and catch basins
- **Exfiltration** – loss of water under the same conditions as infiltration where the water table is below the sewer line invert elevations or possibly where the line is pressurized

2 5.1 Zero Discharge Study

This report was prepared in 1991 as Task 1 of the Zero-Offsite Water-Discharge Study for the Site (ASI, 1991), and assessed the infiltration and inflow for the period May 1990 through May 1991 Exfiltration, or loss of water into the ground, was estimated to be about 5% of the annual WWTF discharge and within the measurement error for this study The results of this short-term evaluation also estimated infiltration and inflow to contribute as much as 30% of the flow to the sanitary collection system

2.5 2 Infiltration and Inflow Evaluations

As part of the renewal of the Site's NPDES permit, a new requirement was instituted in 2001 for an annual evaluation of impacts of infiltration and inflow on the Site's WWTF In 2001, there was an estimated maximum of 20% to 40% infiltration and inflow into the Site's sanitary sewer collection system, within the range expected for small utilities As described earlier, several steps were taken at the Site to reduce this amount including lining portions of the collection system, installing manhole inserts, and making repairs as necessary (DOE, 2002b, 2003b)

If the 2001 and 2002 monthly averages are compared to the annual average plus one standard deviation, the peak month in 2001 had a 30% increase in flow, which coincided with the heaviest precipitation event of the year In 2002, the comparison of monthly flows to the annual average plus one standard deviation showed a 6% increase in flow in June, shortly after the peak precipitation event This suggests that the repairs implemented in 2001 have had an impact in reducing infiltration and inflow (DOE, 2002b, 2003b), although it is not known how much effect drought conditions also had in that same time period

These data suggest that infiltration and inflow influence the sanitary sewer collection system with the greatest influence from inflow It is likely that infiltration at Rocky Flats contributes little to

13

increased flows during wet weather (DOE, 2003b) As the Site closes, the size of the collection system will be reduced and, with that, the potential for infiltration and inflow will also decrease

2 6 Releases from the Sanitary Sewer System

The following releases are known from the sanitary sewer system to the environment PAC 700-144 (Sewer Line Break) and PAC 800-145 (Sanitary Waste Line) target releases from sanitary sewer lines, which historically have handled laundry water containing low concentrations of radionuclides PAC 800-106 was an outfall for an overflow line from a sanitary sewer sump in Building 887 that released untreated sewage PAC 900-141 (Sludge Dispersal) addresses wind dispersion of radioactively contaminated sanitary system sludges from drying beds near Building 995 PAC 100-604 (T130 Complex Sewer Line Breaks) targets sanitary sewer line leaks in 1990 at the T130 office trailer complex on the west side of the Site (DOE, 1992) These PACs are addressed under the appropriate IHSS Group As shown in Table 1, all but PAC 700-144 have been dispositioned as No Further Accelerated Action required

3 0 Potential Contamination Associated with the Sanitary Sewer System

Contamination within the sanitary sewer system is primarily from historic laundering of potentially contaminated laundry, and from contaminated releases or spills into the system As described above, the influence of infiltration has been greatly minimized by recent system improvements, and contamination from outside the lines, such as from other adjacent IHSSs or from contaminated groundwater plumes, is not significant (Section 2 5) Contaminant releases into the sanitary sewer system have decreased over the years and generally stopped by the early 1990s when laundry services were consolidated and building specific laundries were no longer used Onsite laundry of potentially contaminated laundry stopped entirely in 1996

While Site Closure has the potential for releasing contaminants into the sanitary sewer system, precautions are in place to prevent this type of release Building stripout is the most likely source of potential contamination, however, the Facility Disposition RSOP requires that the buildings flush and plug openings to the sanitary sewer prior to decommissioning the building The cold and dark process also requires isolating the sanitary sewer as well as other utilities prior to decommissioning activities No other new sources for potential contaminant releases have been identified

Analytical results for the residual solids in the lines and the biosolids collected at the sewage treatment plant were compared to wildlife refuge worker (WRW) action levels as described in Section 3 2 While it is not appropriate to compare these data to WRW action levels (ALs) to determine whether an action is needed, this was done to provide a relative assessment of whether the solids in the sanitary sewer system could cause potential impacts to the environment if released Please note that this is unlikely to occur since the sewer system will be isolated whereas soil is more or less continuously exposed to groundwater or surface water through percolation, run-off and/or groundwater saturation

3 1 Contaminated Sewer Lines

Three contaminated sanitary sewer lines were encountered during recent Environmental Restoration (ER) accelerated actions These are uranium in the sanitary sewer at Building 442, mercury in the sewer line at Building 441 and plutonium and americium in a sanitary drain at Building 779

3.1.1 Building 442 – IHSS Group 400-7

Building 442 was used as a laundry from 1953 to approximately 1972 The clothing laundered came from the garage, general maintenance and also from Building 444 where beryllium and depleted uranium components were manufactured An accelerated action for most of IHSS Group 400-7, including the building and associated IHSSs, was completed in 2002 Information will be summarized in a closeout report when all the remaining actions are completed

During the accelerated action, the sanitary sewer lines underneath the Building 442 slab were removed A 6-inch cast iron sanitary sewer line ran from east to west and served as the main discharge from Building 442 to a manhole on 5th Street Approximately five feet of the sewer line was removed outside of the building to more than 6' below grade to the point where cast iron pipe was joined to a 6" PVC pipe Even though the cast iron was joined to PVC pipe with a dilapidated rubber boot, no soil contamination was present The joint was most likely in poor condition when in use These type of joints are susceptible to leaking and are generally no longer used in newer construction

When the sewer line was cut in 2002, a sample was retrieved from inside the sewer line (Table 4) The solids contained elevated uranium at 4 nanoCuries/gram (nCi/g) and elevated semi-volatile compounds

Table 4 Building 442 Sanitary Sewer Line Solids Analytical Results

Analyte	Concentration (Totals)	Units	Concentration (TCLP)	Units	Wildlife Worker AL (DOE 2003a)
Uranium 238	3,920	PCi/g	-		351 pCi/g
Uranium 235	114	PCi/g	-		8 pCi/g
Beryllium	52 4	Mg/kg	-		921 mg/kg
Cadmium	200	Mg/kg	246	ug/l	962 mg/kg
Chromium VI	1300	Mg/kg	3	ug/l	268 mg/kg
Copper	2870	Mg/kg	-		40900 mg/kg
Lead	2400	Mg/kg	846	ug/l	1000 mg/kg
Nickel	1710	Mg/kg	-		20400 mg/kg
Silver	408	Mg/kg	0 54	ug/l	5110 mg/kg
Thallium	19 4	Mg/kg	-		NA
Benzo (a) anthracene	5500	Ug/kg	-		34900 ug/kg
Benzo (b) flouranthene	7900	Ug/kg	-		34900 ug/kg
Benzo (k) flouranthene	7100	Ug/kg	-		349000 ug/kg
Benzo (g,h,I) perylene	9300	Ug/kg	-		NA
Benzo (a) pyrene	8200	Ug/kg	-		3490 ug/kg
Bis (2-ethylhexyl) phthalate	3600	Ug/kg	-		1970000 ug/kg
Chrysene	7400	Ug/kg	-		3490000 ug/kg
Flouranthene	3700	Ug/kg	-		27200000 ug/kg
Indeno (1,2,3-cd) pyrene	8500	Ug/kg	-		34900 ug/kg
Phenanthrene	910	Ug/kg	-		NA
Pyrene	4500	Ug/kg	-		22100000 ug/kg
Acetone	380	Ug/kg	-		102000000 ug/kg
2-butanone (MEK)	32	Ug/kg	-		192000000 ug/kg

- = analysis not performed
pCi/g = picocuries per gram
mg/kg = milligram per kilogram
ug/kg = microgram per kilogram
MEK = methyl ethyl ketone

As shown above, uranium, lead and benzo(a)pyrene were above WRW ALs The uranium is most likely a result of the laundry operations Lead is possibly derived from the older plumbing in this building The benzo(a)pyrene and other semi-volatile compounds detected are primarily polyaromatic hydrocarbons (PAHs) that are common in this area and are associated with asphalt,

15

foundation sealant and cleaning supplies Bis (2-ethylhexl) phthalate, while not above action levels, is also known as dioctyl phthalate (DOP), and is most likely a result of spills during the filter testing at this facility

The east (building) end of the PVC pipe was sealed with foam The west end of the sewer line where it connects to the main line was previously plugged with cement grout at the manhole on 5th Street prior to building D&D at a depth to the sewer line of approximately 9 feet About 30 feet of 6-inch sanitary sewer line that connected Building 442 to the main sewer line was sealed at both ends and left in place

Another sanitary sewer line exited the warehouse section of the Building 442 slab, however, no contamination was detected within this segment Most of the line was more than three feet below grade and, therefore, left in place The remaining sections and clean-outs within the line were removed to below three feet and disposed of as sanitary waste The main sewer lines on 5th Street and Central Avenue connecting to the Building 442 area were jetted as part of the 2000-2001 activities

The Building 442 laundry was one of the first laundries at the site and was known to have discharged wastewater into the sanitary sewer with potentially radioactive contamination (see Table 3) Because it was active early in plant history, the discharge levels were most likely the highest that occurred As described earlier, better practices were implemented over time that reduce the contaminant load to the sanitary sewer system The remaining line is greater than 6 feet below grade and also plugged at both ends For these reasons, the solids within this sewer line, if any, will not impact surface water or groundwater quality

Because some contaminated material is left in place, the subsurface soil screen was performed for the solids as described in Attachment 5, Section 5 3 to RFCA (DOE, 2003a)

- **Screen 1** – Are the contaminant of concern (COC) concentrations below RFCA Table 3 Soil ALs for the WRW? Yes - uranium and benzo (a) pyrene are above WRW ALs

- **Screen 2** – Is there a potential for subsurface soil to become surface soil (landslides and erosion areas identified on Figure 1 of the RFCA Modification)? No, the contaminants have no potential to become surface soil because these are contained within a pipe, 6 feet or greater below grade and the pipe is grouted at both ends

- **Screen 3** – Does subsurface soil contamination for radionuclides exceed criteria defined in RFCA Section 5 3 and Attachment 14? No, subsurface soil radiological contamination does not exceed the criteria in RFCA Attachment 5, Section 5 3

- **Screen 4** – Is there an environmental pathway and sufficient quantity of COCs that would cause an exceedance of surface water standards? No, there is neither an environmental pathway nor sufficient quantity of contaminants to cause an exceedance of the surface water standards

- **Screen 5** – Are COC concentrations below RFCA Table 3 Soil ALs for ecological receptors? No, because of the depth, while uranium exceeds the Ecological Receptor AL, there is no pathway for exposure to an ecological receptor because of the depth and the location inside a pipe

Based on the results of the screen, no accelerated action is necessary because there is neither an environmental pathway nor sufficient quantity of contaminants to cause an exposure

16

3 1 2 Building 441 – IHSS Group 400-8

During the accelerated action for IHSS Group 400-8, that included Building 441 slab removal, mercury was noted within the sanitary sewer and process waste lines Building 441 was originally a laboratory but was converted to an office building in 1966 The mercury in the sanitary sewer and process waste lines was most likely derived from the laboratory operations, possibly because of a broken lab instrument such as a pressure gauge

The mercury was primarily found in the pipe joints on both lines The joints are slightly lower than the adjacent piping and tend to trap heavy liquids The mercury was removed during pipe removal and dispositioned appropriately

3.1 3 Building 779 – IHSS Group 700-7

During the accelerated action for IHSS Group 700-7, that includes Building 779 slab removal, a contaminated sanitary sewer drain was found in the annex area Building 779 was placed into service in 1965 and was primarily a research and development facility with minor production and plutonium recovery operations The research and development activities included pyrochemical technology, coatings, plutonium and non-plutonium metallurgy, chemical plutonium recovery, and product physical chemistry As noted in Table 3, there were several radioactive discharges to the sanitary sewer at this building

As the slab was removed, the sanitary sewer line at this location was found to have broken in the past, with the soil stained immediately adjacent to the break Radiological surveys of the pipe indicated that radiological contamination was present on the outside of the pipe in the area of the break Therefore, soil samples were collected from two depths at this location to characterize the potential contamination The results were

- Six inch interval underneath the slab Americium-241 at 117 6 pCi/g
- Next lower six inch interval Americium-241 at 26 25 pCi/g

Calculated plutonium 239/240 activities are 670 pCi/g and 150 pCi/g respectively based on a plutonium to americium ratio of 5 7

Lateral extent of the contaminated soil is limited to the area adjacent to the drain, based on field screening samples that showed zero detectable activity 2 feet away from the drain in all directions and the limited lateral extent of the staining This soil will be remediated as part of the accelerated action at this location

3 2 Biosolids Data

In addition to treated effluent, WWTF generates a solid waste stream, the biosolids (dewatered sludge from the filter press) Biosolids information is relevant since it is likely to be similar to residual solids that might be left in the lines Biosolids are dispositioned as low-level waste at the Nevada Test Site (NTS) Analytical data for the biosolids are available from three sources

- Data collected in support of the Site's NPDES permit and provisions of the biosolids regulations at 40 CFR 503,
- Data collected to support disposal of biosolids at the Nevada Test Site, and
- Data collected to support Department of Energy (DOE) Order 5400 5 to prove that the Site is not releasing radionuclides to the environment

These data are available only for the past decade and show that the average contaminant concentrations are well below regulated levels The combined data show that since the early 1990s, only low levels of metals and radionuclides have been detected, and virtually no volatile

17

organic compounds (KH, 2002) This compares favorably with data compiled by the Sewage Subcommittee of the Interagency Steering Committee on Radiation Standards (ISCORS) showing that radionuclide concentrations in sewage sludge and ash nationwide are relatively low (Nuclear Regulatory Commission [NRC], EPA, 1999)

3.2.1 NPDES Data

Biosolid management is regulated by the Site's current NPDES permit and by provisions of the biosolids regulations at 40 CFR 503, including monitoring of metal concentrations Information gathered in the past 10 to 12 years from this monitoring was compared to the current WRW action levels in the RFCA Action Level Framework (ALF) (DOE, et al, 2003) None of the results exceed the 40 CFR 503 limits and, with the exception of arsenic, the RFCA action levels Table A-1 in Appendix A summarizes these results While Environmental Protection Agency (EPA) regulations require one sample per year, several samples may be collected in a given year with the average provided in Table A-1 Where only one sample was taken, the drying bed sampled is indicated The notable zinc increase in 2002 is due to zinc orthophosphate now added to drinking water to prevent copper and lead corrosion It is anticipated that residual materials in the sewer will be below these levels and likely far below action levels since the main lines will continue to be flushed (KH, 2002)

3 2.2 NTS Data

Between 1990 and 1994, extensive analysis of the RFETS sewage sludge was undertaken to satisfy the waste acceptance criteria at Nevada Test Site (NTS) The results showed that the sewage sludge did not contain hazardous constituents and demonstrated that the waste was acceptable to NTS Both SW846 methodology and Toxicity Characteristic Leaching Procedure (TCLP) analyses were reported These data are shown in Tables A-2 and A-3 in Appendix A While not appropriate for determining the need for a remedial action, these data were compared to soil action levels and were found to be significantly lower even though the sludge is more concentrated than solids found in the sanitary sewer system

3.2 3 DOE Order 5400.5 Sample Results

DOE Order 5400 5 requires occasional sampling of the biosolids for plutonium, americium and uranium to ensure that the site is not releasing radionuclides to the environment EPA has not established radionuclide limitations for biosolids, so no standards are available for comparison However, activities were compared to the current WRW action levels in RFCA (DOE, et al, 2003) and none of the results exceed RFCA action levels The most recent results are presented in Table A-4 in Appendix A

3 2 4 Summary of Biosolid Sample Data

Biosolid sample results are all well below the RFCA WRW action levels and indicate that materials transmitted through the RFETS sanitary sewer system within the last 12 years did not contain contaminants above the action levels Because of the constant flow of essentially clean sewage for several years tends to flush the sewer system, this information supports a no further accelerated action determination

3.3 Influent Data

The influent to Building 995 is monitored routinely for total suspended solids and carbonaceous biochemical oxygen demand (CBOD5) required by the current NPDES permit In addition, during the period 1993 to 2000, the influent was monitored for a variety of constituents These data indicate that there are low levels of metals and radionuclides in the WWTF influent However, with the exception of copper and zinc, all are well below surface water ALs Various organic

18

compounds have been analyzed for during this period, with only one detected compound, acetone Table B-1 in Appendix B presents the influent radionuclide concentrations Metals concentrations within the influent are very low and are reported in Table B-2 of Appendix B The results for organic parameters are presented in Table B-3 of Appendix B

Influent samples were collected recently at Building 990, the former equalization basin facility upstream of WWTF Sanitary sewage flows from the north and south sides of RFETS, generally the former PA and the non-Protected Area, combine at Building 990 prior to flowing into the treatment plant The results from four sampling events in 2002 and 2003 indicate that concentrations are generally consistent with the values shown in the tables cited above One notable exception is that the recent introduction of zinc orthophosphate to control corrosion in the water distribution system has resulted in elevated levels of zinc above action levels in the influent flows The analyses at Building 990 on both the north and south side show zinc as high as 916 ug/l Use of zinc orthophosphate will be discontinued when the water supply system closes

The average concentration of copper and acetone are above the standards, however, it is unlikely that these would remain a problem after closure of the sanitary sewer Acetone is unlikely to remain in the system because it is highly volatile It is not clear whether copper was discharged to the system or whether it is from copper piping in the domestic water lines However, if it is being discharged to the system, this will be discontinued as the system is closed and it is unlikely that residual copper will remain in the lines, based on the discussion in section 2 3 1 about precipitates Copper piping will be isolated from the sanitary sewer system prior to its closure

Current influent data supports a no further accelerated action approach

4 0 Proposed Approach

Based on the information presented, the PAC 000-500 sanitary sewer system is proposed as a no further accelerated action based on process knowledge and existing analytical data In addition, Best Management Practices, described below, will be implemented to disrupt potential pathway to surface water

4 1 No Further Accelerated Action Justification

As discussed previously, the sanitary sewer lines including smaller lines, main lines and abandoned lines are not significant contaminant sources for the following reasons

- Sanitary sewer lines and components associated with buildings will be removed to a depth of 3 feet below the final grade as stated in the Facility Disposition RSOP (DOE, 2000) These are predominately smaller lines and represent a large percent of the total length due to the number of lines beneath and around facilities It should be noted that some sewer lines were connected to administrative buildings or other non-process buildings and were never associated with processes that could contaminate the lines
- The main contaminant source to the sanitary sewer system was laundry waste that is no longer generated at the Site Recent spills do not warrant accelerated actions A number of historic spills have already been closed under the OU 1 CAD/ROD (DOE, 1997) or as No Further Accelerated Action sites In many lines, residuals from laundry waste have been flushed through continued use of the lines
- All of the major contaminant discharges to the sewer system happened prior to 1990 (see Table 3) There has not been a major incident since the February 1989 chromic acid spill Significant quantities of sewage have likely been discharged through these lines since these incidents occurred Much tighter controls over hazardous wastes, radionuclides and other potential contaminants were implemented in the 1980s and 1990s at RFETS greatly reducing the number of spills that could have impacted the

19

sewer system as documented in the few incidents occurring in the 1990s (Section 2 2) Other measures were also taken including an intensive effort to label all drains and an evaluation of lines to ensure that they were separated from hazardous and radiological sources

- Recent accelerated actions at Buildings 442 and 441 indicate that, when found, elevated contaminant concentrations within the sanitary sewer lines do not coincide with contamination in the adjacent soils, even when couplings and joints were significantly deteriorated High concentrations are expected closest to their source, where the lines are most likely to be removed Contaminants are often associated with traps, bends and joints that are within three feet of final grade and will be removed

- Jetting of the main lines eliminated significant solids within the main lines While no data were collected from the removed solids, the jetting equipment was not radiologically contaminated during the operations, indicating that significant levels of radioactivity are not present in the main system

- Infiltration and inflow studies indicate that water leaks into the sanitary sewer system, and that exfiltration is minimal Therefore, contamination in the soil along the sanitary sewer system is unlikely This is due in part to most of the system being gravity flow rather than pressurized Additionally, it is anticipated that even if the overall site water table rises after Site Closure, the grouting at manholes will further isolate the residual sanitary sewer lines, eliminating these as a pathway

- In recent years, a number of modifications have been made to prevent infiltration and, coincidentally, exfiltration of the sewer lines Lines have been slip-lined to seal joints and other areas that could potentially leak

- Biosolids are similar to residual solids that may remain in the sanitary sewer lines Since the largest lines will be or have been flushed, there may only be negligible amounts in these lines In lines that might not have been flushed, the amount could vary However, the current biosolids data indicate that this material is not a risk to the environment

- Current influent to the WWTF is well below surface water action levels except for acetone, copper and zinc levels (see Section 3 3) As noted, the likely sources of these materials will be discontinued or removed prior to closure of the sanitary sewer lines These influent concentrations indicate similar contaminant concentrations currently exist within the sanitary sewer lines If higher contaminant concentrations are present but being diluted by the flow, isolation of the system as described above will prevent these from entering surface water

- Large volumes of relatively clean water will continue to flush the system until the sanitary sewer system is closed This has the effect of further reducing or eliminating contaminated solids within the system

4 2 Proposed Path Forward

While the sanitary sewer system is not a contaminant sources requiring an accelerated action, these lines could still be a significant pathway for groundwater flow to surface water through pipes and pipe bedding due to the large diameter of the pipes, wide extent across Site, and the proximity of downgradient segments to surface water For these reasons, the Best Management Practices described below will be used to disrupt potential pathways to surface water

The closure of the sanitary collection system is associated with the closure of Building 995 For this reason, a table will be included in the D&D Closeout Report for Building 995 showing the disposition of the collection system components including manholes and lift stations Waste generated as part of the sanitary sewer system closure will be tracked according to waste type and volume and also reported in this closeout report

20

Proposed Grab Sampling

In consultation with the Colorado Department of Public Health and Environment, it is proposed that one-time grab samples of solids be collected from the lines at locations shown on Figure 1 These samples would be analyzed for the radionuclides listed in Table 5 All samples will be grab samples and will be obtained from the material (solids) from inside the pipe

Although efforts will be made to sample solids, samples could consist predominantly of material currently carried by the system Therefore the contaminant levels might be more representative of materials currently being added to the line rather than solids due to scaling or other types of deposits on the pipe wall Because this material is not environmental media, no Industrial Area Sampling and Analysis Plan (IASAP) Addendum is required

Table 5 List of Analytes for Proposed Grab Samples from Sanitary Sewer System

Analytes
Americium 241
Plutonium 239, 240
Uranium 233, 234
Uranium 235
Uranium 238

Based on the analytical results, additional best management practices may be proposed for a given line segment

4 2 1 Best Management Practices Proposed at Manholes

Manholes are located approximately every 200 feet along the main sanitary sewer lines The proposed approach is to

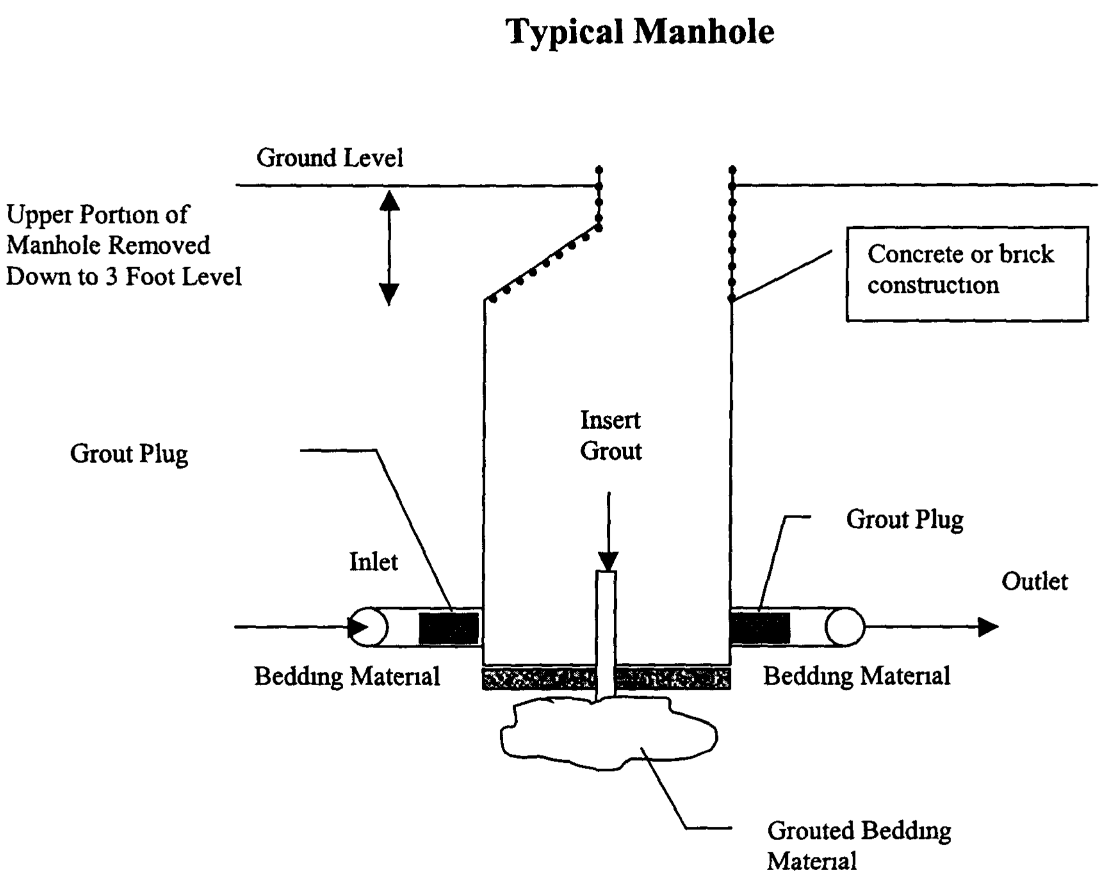
1 Remove the portions of the manhole within 3 feet of final grade,
2 Plug the lines going through the manhole, and
3 Plug the bedding material surrounding the lines at intersections of major utility corridors that the pathways for transport are blocked

Prior to removal, the influent and effluent lines into the manholes will be plugged with a grout plug to prevent continued flow through the pipe In certain areas, additional grout or similar materials may be injected beneath the manhole to minimize flow in the bedding materials These actions will result in isolating 200 foot-long segments of the sanitary sewer lines and will effectively eliminate the potential for a pathway to exist to surface water Figure 2 illustrates the process proposed at the manholes to eliminate the pathway to surface water

While the specific details will be included in the appropriate work control document, it is expected that after plugging the openings to the inlet and outlet pipes with grout or similar materials, the manhole structure will be removed to a depth of at least 3 feet below final grade The removed materials will be placed back into the manhole and bentonite grout, concrete or similar materials will be poured into the manhole to a height above the inlet and outlet piping The remainder of the structure will be backfilled with soil, grout or similar materials to final grade

For the manholes at intersections of major utility corridors, a hole will be drilled through the base of the manhole, and a fluid grout will be introduced into the bedding materials The grout may be injected if this can be safely accomplished within the restrictions of the confined space entry

Figure 2 Best Management Practices at Manholes



4 2 2 Best Management Practices at Lift Stations

Sewer lift stations at Buildings 881, 771 and other deep buildings are anticipated to be removed during building decommissioning If not removed at this time, these will be removed to a depth of at least 3 feet below grade as a Best Management Practice The sewer lines entering the lift stations will be removed as required and the ends grouted Bedding materials under the piping will be disrupted with grout or by removing the permeable material and replacing it with fill or native materials The lift station excavation, if present, will be backfilled with low permeability material to eliminate the pathway to surface water

4 2 3 Best Management Practices at WWTF

The WWTF Decommissioning Project will remove all WWTF structures to a depth of three feet below final grade The pathway to surface water in this area is eliminated using similar methods as described above In accordance with the Facility Disposition RSOP, all lines within three feet of the final grade will be removed and the ends plugged

At this location, a Best Management Practice will be implemented to disrupt the bedding material for removed sanitary sewer lines Disruption will be either by physically removing the bedding

22

material and replacing this with fill dirt or native materials, or by adding bentonite, grout or other impermeable materials

4 2 4 Potentially Abandoned Sanitary Sewer Lines

Abandoned lines are no longer part of the active sanitary sewer system Recently abandoned lines were flushed and plugged with grout, either at the manhole or where the line was cut Older lines were isolated from the system

The expected abandoned lines are shown on Figure 1 However, the number of abandoned sanitary sewer lines cannot be quantified Some of the lines believed to be abandoned were either previously removed or never existed Some reportedly abandoned lines are based on design drawings that were never implemented, erroneous reports, maps showing an existing line in the wrong location, etc

Recently, what was thought to be an abandoned sanitary sewer line running to Building 991 was determined not to exist based on interviews with Site personnel And as the active sanitary sewer lines were being disconnected at Buildings 551 and 334 where abandoned lines were expected to exist, evidence of utility trenches were found along with some broken tile, but the sanitary sewer pipe was no longer present

Because of the uncertainty, the following approach will be followed

- Known abandoned lines will be removed to a depth of three feet below final grade and the remaining ends plugged Any remaining manhole on an abandoned line will be dispositioned as described in Section 4 2 1
- Abandoned lines associated with Building 980 and other 900 area buildings are not well located, however, these tie into a manhole on the main sewer line These lines will be dispositioned as described in Section 4 2 1 along with the associated manhole
- Sanitary sewer lines discovered during demolition or an accelerated action will be removed to a depth of 3 feet below final grade with the remaining ends plugged

5 0 Conclusions and Recommendations

Based on existing information from the previously no further accelerated action determinations for sanitary sewer waste spills, no additional characterization or accelerated action is required for the soils associated with the sanitary sewer lines Additional characterization or remediation might be performed in accordance with the ER RSOP for Routine Soil Remediation for sanitary sewer segments associated with the individual IHSS Groups

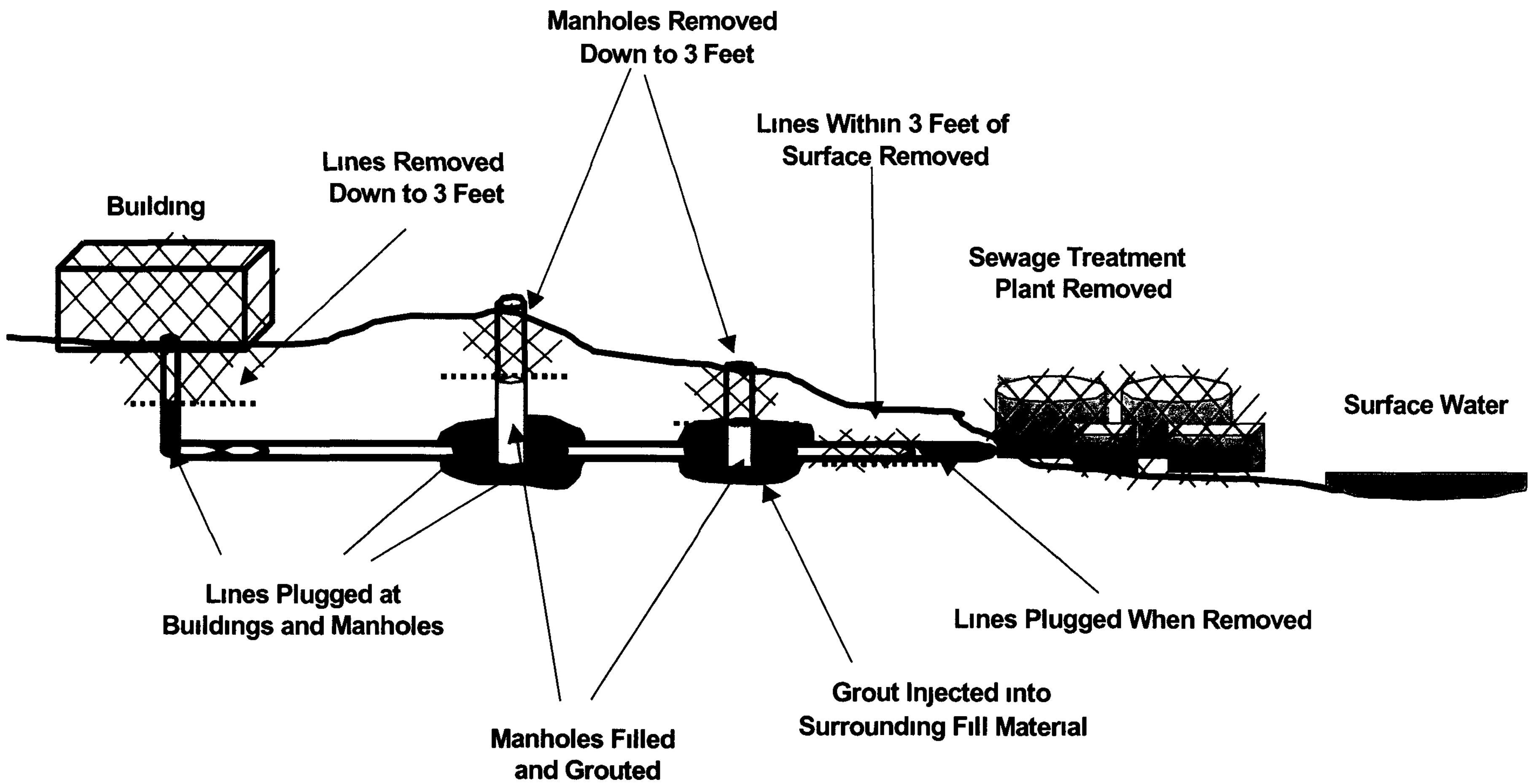
A no further accelerated action document will be generated documenting this information in the appropriate format in accordance to RFCA requirements and submitted for regulatory agency approval

Samples will be collected from within the sanitary sewer system at locations agreed upon through the consultative process with the regulatory agencies These sample results will be used to determine if additional best management practices will be performed at given line segments

A Sanitary Sewer Best Management Practice Field Implementation Plan Addendum or other work control document will be generated as needed to document the actions to eliminate the potential pathway to surface water Because no decision document is required to implement these Best Management Practices, the scope can be performed where and when access is available

23

Figure 3 Impediments to Flow in Sanitary Sewer System



Work is expected to be initiated in the south and west sides of the Site first, most likely first in the area where the 893 trailers were previously located In consultation with CDPHE, a contact record was generated that details the salient points of this strategy as it applies to this area so that work can be initiated prior to completion of this strategy

At Site closure, the main sewer lines will be a series of pipe segments that are below three feet and plugged at both ends further interrupted by grouted manholes Figure 3 shows the impediments to flow to surface water once best management practices have been implemented

6 0 References

Advanced Sciences, Inc (ASI) 1991, Zero-Offsite Water-Discharge Study Task 1 Sanitary Sewer Infiltration/Inflow and Exfiltration Study, Rocky Flats, Golden, Colorado

DOE, 1992, Historical Release Report for the Rocky Flats Plant, Rocky Flats Plant, Golden, Colorado

DOE, 1997, OU 1 Corrective Action Decision /Record of Decision, Rocky Flats Environmental Technology Site, Golden, Colorado, February

DOE, 1999, Annual Update, Historical Release Report, Rocky Flats Environmental Technology Site, Golden, Colorado, September

DOE, 2000, Facility Disposition RFCA Standard Operating Protocol, Rocky Flats Environmental Technology Site, Golden, Colorado

DOE, 2001, 1999/2000 Sanitary Sewer Manhole Inventory, Pipe Cleaning, and Video Inspection, Rocky Flats Environmental Technology Site, August 6

DOE, 2002a, Annual Update, Historical Release Report, Rocky Flats Environmental Technology Site, Golden, Colorado, August

DOE, 2002b, Evaluation Of Infiltration And Inflow At The Rocky Flats Environmental Technology Site Wastewater Treatment Plant, Building 995, Rocky Flats Environmental Technology Site, Golden, Colorado

DOE, 2003a, Environmental Restoration RFCA Standard Operating Protocol for Routine Soil Remediation, Modification 1, Rocky Flats Environmental Technology Site, Golden, Colorado, September

DOE, 2003b, Evaluation Of Infiltration And Inflow At The Rocky Flats Environmental Technology Site Wastewater Treatment Plant For Calendar Year 2002, Rocky Flats Environmental Technology Site, Golden, Colorado

DOE, CDPHE, and EPA, 2003, Modifications to the Rocky Flats Cleanup Agreement, Rocky Flats Environmental Technology Site, Golden, Colorado, April

KH, 2002, Rocky Flats Annual Sewage Sludge Report, Rocky Flats Environmental Technology Site, Golden, Colorado

NRC, EPA, 1999, Joint NRC/EPA Sewage Sludge Radiological Survey Survey Design and Test Site Results, EPA 832-R-99-900, May

Michael Vess, 2003, Personal Communication

25

Appendix A - Biosolids Data

A 1 NPDES Data

This data was collected as part of biosolids management under the Site NPDES Permit

Table A-1 Summary of Metals Results for Site Biosolids – 1993 to 2002 (in mg/kg)

	Arsenic	Cadmium	Chromium VI	Copper	Lead	Mercury	Molybdenum	Nickel	Selenium	Zinc
1993 (avg)	11	12 7	68	N/A	74 3	2 02	N/A	N/A	7	N/A
1994 (avg)	8 3	17 8	74 3	559	78 9	N/A	N/A	25 3	4 1	1404
1995 (avg)	23 21	10 26	63 1	543	69 66	26 5	20 85	30 48	11 34	1474 13
1996 (avg	29 93	10 87	44 8	337 33	72 73	7 73	9 1	16 53	10 63	840
1997 (avg)	6	13 7	51 6	683 7	91 3	8 2	17 6	25 9	6 6	1688
1998 (Bed 7)	16 1	28 6	125	775	109	5 4	17 8	30 8	8 2	1870
1999 (avg)	7 85	9 9	37 5	896	66 95	7 25	24 55	24 05	9 65	2170
2000 (avg)	4 76	3 75	48 8	470	59 7	4 715	15 15	52 95	2 986	855
2001 (Bed 1)	5 9	8 2	107	571	101	10 5	13 6	45 9	6 7	3610
2002 (Bed 3)	6 8	12	62	770	87	10	14	67	7 1	6300
2003	2 9	5 3	27	380	31	12	8 6	14	5 9	5400
Average (11 year)	11 2	12 1	64 5	598 5	76 5	9 4	15 7	33 3	7 3	2561 1
40 CFR 503 Monthly Avg Limit	41	39	-	1500	300	17	N/A	420	100	2800
WRW AL	22 2	962	268	40900	1000	25200	5110	20400	5110	30700

N/A=Not applicable

A 2 NTS Data

This data was collected to demonstrate that biosolids met the waste acceptance criteria at the NTS

Table A-2 Biosolid NTS Waste Acceptance Criteria Results – Radionuclides

Radionuclides	Activity (pCi/g)	WRW AL
Gross alpha	29 516	N/A
Gross beta	25 194	N/A
Uranium 233/234	11 864	300
Uranium 235	0 422	8
Uranium 238	5 029	351
Plutonium 239/240	2 824	50
Americium 241	0 731	76

N/A=Not applicable

Table A-3 Biosolid NTS Waste Acceptance Criteria Results – Metals and Organics

Analyte	Total (mg/kg)	TCLP (mg/l)	WRW AL For Soil (mg/kg)
Arsenic	11 00	ND	22 2
Barium	404 00	0 217	26400
Cadmium	12 69	0 009	962
Chromium VI	67 97	0 007	268
Lead	74 34	0 036	1000
Mercury	2 02	ND	25,200
Selenium	7 02	ND	5,110
Silver	130 44	0 004	5,110
1,1,1-Trichloroethane	0 0102	ND	79,700
1,1,2-Trichloroethane	ND	ND	236
1,1-Dichloroethene	ND	ND	17
1,2-Dichlorobenzene	ND	ND	31,200
1,2-Dichloroethane	ND	ND	106
1,4-Dichlorobenzene	ND	ND	840
2,4,6-Trichlorophenol	ND	ND	3,470
2,4-Dinitrotoluene	ND	ND	56,300
2-Butanone	0 126	0 029	192,000
2-Methylphenol [o-Cresol]	ND	ND	N/A
3-Methylphenol [M-Cresol]	ND	ND	N/A
4-Methylphenol [P-Cresol]	0 848	ND	N/A
Total Cresols	ND	ND	N/A
4-Methyl-2-pentanone	0 02	ND	16,400
Acetone	ND	0 41	102,000
Benzene	ND	ND	205
Carbon disulfide	0 015	0 011	15,100
Carbon tetrachloride	ND	ND	81 5
Chlorobenzene	ND	ND	6,090
Chloroform [Trichloromethane]	ND	0 011	19 2
Ethylbenzene	0 0107	ND	4,250
Ethyl Ether	ND	ND	N/A
Hexachlorobenzene	ND	ND	17 2
Hexachlorobutadiene	ND	ND	147
Hexachloroethane	ND	ND	737
Methylene chloride [Dichloromethane]	ND	ND	2,530
Nitrobenzene	ND	ND	332
Pentachlorophenol	ND	ND	162
Tetrachloroethene	ND	ND	615
Toluene	0 014	0 011	31,300
Trichloroethene	ND	ND	196
Vinyl chloride	ND	ND	412
Xylene (total)	0 01	ND	1,000,000

ND = Not Detected

A 3 DOE Order 5400 5 Data

This data was collected to meet the requirements of DOE Order 5400 5, which requires that the biosolids be occasionally sampled for plutonium, americium, and uranium

Table A-4 Summary of Radionuclides Results and Comparison to RFCA Levels

Analyte	2001	2002	RFCA WRW AL	Units
Americium 241	0 5	0 6	76	pCi/g
Plutonium 239	0 7	0 9	50	pCi/g
Uranium 234	12 0	8 3	300	pCi/g
Uranium 235	0 4	0 9	8	pCi/g
Uranium 238	14 2	10 7	351	pCi/g

28

Appendix B – Building 995, Sewage Treatment Plant Influent Data

The influent to Building 995 is the incoming untreated sewage so it consists of everything that flows through the sanitary sewer system The data presented below was collected between 1993 and 2000

Table B-1 Summarized Radionuclide Results for WWTF Influent

Analyte	Average Activity (pCi/l)	Number of Samples	Surface Water Standard (pCi/l)
Uranium 235	0 041	38	10*
Uranium 238	1 097	38	10*
Plutonium	0 032	38	0 15
Americium	0 016	38	0 15
Gross Alpha	1 496	702	11
Gross Beta	10 008	721	19

* Total uranium value

Table B-2 Summarized Metal Results for WWTF Influent

Analyte	Average Conc ug/L	Number of Samples	Surface Water Standard (ug/L)
Arsenic	3 65	27	50
Cadmium	0 62	27	1 5
Chromium	3 41	28	50
Copper	39 92	30	16
Lead	4 74	27	6 5
Mercury	0 15	22	0 01
Molybdenum	17 90	26	N/A
Nickel	5 01	27	123
Selenium	2 00	27	5
Zinc	152 58	26	141

29

Table B-3 Summarized Organic Results for WWTF Influent

Analyte	Average Conc ug/L	Number of Samples	Surface Water Standard (ug/l)
1,1,1-Trichloroethane	ND	35	200
1,1,2,2-Tetrachloroethane	ND	35	2 1
1,1,2-Trichloroethane	ND	35	3
1,1-Dichloroethane	ND	35	3,650
1,2-Dichloroethene	ND	35	70
1,2-Dichloropropane	ND	35	0 52
2-Butanone	ND	35	21,900
2-Hexanone	ND	35	-
Acetone	157 06	36	3,650
Benzene	ND	35	1 2
Bromodichloromethane	ND	35	0 56
Bromoform	ND	35	4 3
Bromomethane	ND	35	48
Carbon Disulfide	ND	35	3,650
Carbon Tetrachloride	ND	35	0 25
Chloroethane	ND	35	29 4
Chloroform	ND	35	5 7
Chloromethane	ND	35	5 7
Dibromochloromethane	ND	35	80
Methylene Chloride	ND	35	4 7
Tetrachloroethene	ND	35	0 8
Total Xylenes	ND	35	10,000
Trichloroethene	ND	35	2 7
Vinyl Chloride	ND	35	2 00

ND = Not Detected

30/30

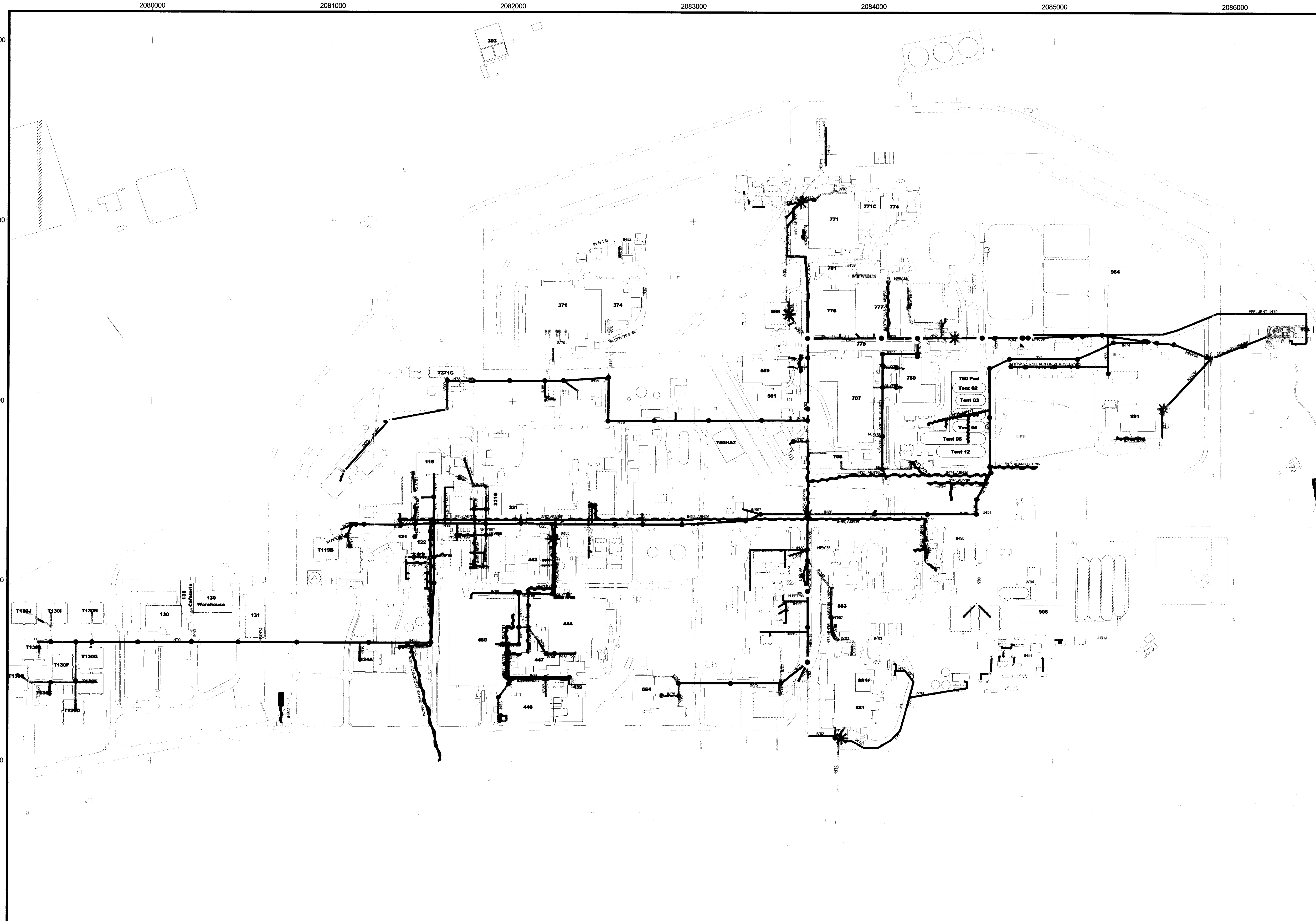


Figure 1
Sanitary Sewer System Location Map

Explanation

- Manhole Sampling Location
- Sanitary Sewer
- Sanitary Sewer, Flushed
- Abandoned, Flushed and Plugged
- Abandoned, Flushed
- Abandoned Previously
- Sewer on Drawing but not Located
- Sanitary Sewer, Removed D&D
- Outfall Sanitary Sewer
- 1952 Infrastructure

Standard Map Features

Buildings and Other Structures

- Demolished
- Standing
- Dirt Roads
- Paved Roads

NOTES:

Manholes (point features) follow the same color categorizations as the sewer lines. (Sampled Manholes have Cross Hairs)

Abandoned Lines with a squiggly line were abandoned before 1990.

Abandoned lines without a squiggly line were abandoned after 1990.

N / E / S / W

300 0 300 600 Feet

Scale 1:3600
1 Inch = 300 Feet
State Plane Coordinate Projection
Colorado Central Zone
Datum: NAD 27

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

Prepared by: CH2MHILL

Prepared for: KAISER•HILL COMPANY

Date: February 11, 2004

File: W:\Projects\Fy2004\000-3\sanitary-sewer-sampled--manholes-bb.apr Layout: Sewer Site Layout