EPA

On this day, May 23, 2008,

the U.S. Environmental Protection Agency (U.S. EPA)

Determines that

Midvale Slag Superfund Site Is Ready for Mixed Reuse

Carol L. Campbell

U.S. Environmental Protection Agency

This Ready for Reuse (RfR) Determination is for the Midvale Slag Superfund Site ("Site"), excluding the Jordan River riparian zone. This RfR Determination is based on limitations and requirements established in U.S. Environment Protection Agency (EPA) decision documents for the Site, including the 1995 OU1 and 2002 OU2 Records of Decision (ROD), the 1998 and 2006 Explanation of Significant Differences (ESD) for OU1, and the 2003 Five-Year Review. EPA have made a technical determination that these parcels of land at the Site, located in the City of Midvale, Salt Lake County, Utah, are ready for mixed use, including residential, recreational, commercial and light industrial uses and that the Site's remedy will remain protective of human health and the environment, subject to operation and maintenance of the remedy and the limitations as specified in the RODs, ESDs, Five-Year Review, and the City of Midvale's ordinance entitled *Institutional Controls Ordinance for Bingham Junction, Jordan Bluffs and Designated Rights-of-Ways*, which have been summarized in the attached report, Ready for Reuse Determination, Midvale Slag Superfund Site, May 16, 2008. This RfR Determination remains valid only as long as the requirements and use limitations specified in the RODs, ESD, Five-Year Review, and Institutional Control Ordinance enacted by the City of Midvale, Utah, are met.

Limitations on Site uses include the following: Additional requirements for the management of surface water apply to portions of Bingham Junction South as laid out in the City of Midvale Ordinance. The Ordinance also designates the areas of Bingham Junction South subject to vapor mitigation. The Midvale Ordinance and the 2004 *Technical Memorandum for Preliminary Remediation Goals and Decision-making Process at Midvale Slag OU1*, "Technical Memorandum" includes a protocol for determining if a parcel of land in OU1 is suitable for development for residential or recreational land use without any restrictions or institutional controls. If this protocol is met, only ICs addressing groundwater will apply. If not, the additional ICs addressing soils and residential use outlined in the Ordinance will apply. Ground water ICs prohibit all new water wells, as well as the disturbance of existing wells, without EPA and UDEQ approval. Soil ICs specify requirements for the disposal of excess excavated soils, the excavation and handling of visible slag, and the notification of the potential presence of contaminants to contractors working on the Site. Residential use ICs require building permit applicants to submit grading plans, to file conditions with the Subdivision Plat, and to retain an inspector to oversee IC implementation.

This Ready for Reuse Determination is an environmental status report and does not have any legally binding effect, nor does it expressly or implicitly create, expand, or limit any legal rights, obligations, responsibilities, expectations, or benefits of any party. U.S. EPA assumes no responsibility for reuse activities or for any possible or potential harm that might result from reuse activities. U.S. EPA retains any and all rights and authorities it has, including but not limited to legal, equitable, or administrative rights. U.S. EPA specifically retains any and all rights and authorities it has to conduct, direct, oversee, and/or require environmental response actions in connection with the Site, including instances when new or additional information has been discovered regarding the contamination or conditions at the Site that indicate that the remedy and/or the conditions at the Site are no longer protective of human health or the environment for the uses identified in the Ready for Reuse Determination. The City of Midvale is responsible for ensuring that any limitations specified in the RODs, ESD, Five-Year Review, or Institutional Control Ordinance enacted by the City of Midvale that might be affected by a particular use are complied with during the activity

The types of uses identified as protective in this RfR Determination remain subject to (i) applicable federal, state, and local regulation, and to (ii) title documents, including but not limited to easements, restrictions, and institutional controls.

Ready for Reuse Determination
Midvale Slag Superfund Site

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List of Exhibits

I. Executive Summary

This Ready for Reuse (RfR) Determination is for the Midvale Slag Superfund Site ("Site"), excluding the Jordan River riparian zone. The Site is 446 acres, has two operable units and is mostly located in the City of Midvale with a portion extending into the City of Murray, Utah. Operable Unit 1 (OU1) is 266 acres and includes the portion of the Site now called Bingham Junction North, the Winchester Estates Mobile Home Park on the northern portion of the site, the abandoned Midvale Wastewater Treatment Plant, a former lagoon area, and jurisdictional wetlands (wetlands protected by the Clean Water Act). Operable Unit 2 (OU2) contains 180 acres on the southern part of the site, now known as Bingham Junction South. Included within OU2 are the former Silver Refinery Area, located in the southeast portion of OU2, and the Butterfield Lumber property, which lies in the northeast portion of OU2. The excluded Jordan River Riparian Zone contains approximately 6 acres. This RfR Determination, therefore, encompasses approximately 440 acres.

This RfR Determination is based on limitations and requirements established in United States Environment Protection Agency (EPA) decision documents for the Site, including the 1995 OU1 and 2002 OU2 Records of Decision (ROD), the 1998 and 2006 Explanation of Significant Differences (ESD) for OU1, and the 2003 Five-Year Review. EPA has made a technical determination that these parcels of land at the Site, located in the City of Midvale and the City of Murray, Salt Lake County, Utah, are ready for mixed use, including residential, recreational, commercial and light industrial uses and that the Site's remedy will remain protective of human health and the environment, subject to operation and maintenance of the remedy and the limitations as specified in the RODs, ESDs, Five-Year Review, and the City of Midvale's ordinance entitled *Institutional Controls Ordinance for Bingham Junction, Jordan Bluffs and Designated Rights-of-Ways*, as summarized in the text of this RfR Determination.

According to the 2003 Five Year Review, the northern parcels of OU1 (WENW and WESE parcels – see Exhibit 2) located in the City of Murray, Utah were cleaned up to residential levels (650 mg/kg lead and 73 mg/kg arsenic) and no institutional controls (ICs) were needed except for those addressing ground water. At the time of the 1999 Remedial Action Report for OU1, the remaining portion of OU1 (LF, LG, LR, LR-East – see Exhibit 2) was ready for commercial and industrial use with additional requirements for residential/recreational use. The developer of OU1 conducted further remediation on a portion of OU1 to remove the need for soil ICs.

Bingham Junction South, or OU2, includes a surface cover underlain by a demarcation layer consisting either of slag material (minimum 24 inches) or a geotextile material. The material below the demarcation layer is presumed to exceed the remediation goals established by EPA for the property, but that presumption may be rebutted. Bingham Junction South is ready for mixed reuse, including residential, subject to institutional controls relating to the management of materials removed from below the demarcation layer, cover maintenance and ground water use. Additional requirements for the management of surface water apply to portions of Bingham Junction South as laid out in the City of Midvale Ordinance. The Ordinance also designates the areas of Bingham Junction South subject to vapor mitigation.

EPA and UDEQ established institutional controls for OU1 and OU2. According to the 2004 Consent Decree, which the City of Midvale signed, responsibility for ensuring implementation of institutional controls falls to City of Midvale Department of Community and Economic Development, landowners, and property owner's associations (POAs). EPA and Utah Department of Environmental Quality (UDEQ) will continue overseeing operation and maintenance activities and will coordinate future five-year reviews at the Site. The City of Midvale adopted its Institutional Control Ordinance on June 26, 2007. The Ordinance uses the City of Midvale's development review, excavation permit, and construction specifications processes to oversee activities.

The Midvale Ordinance and the 2004 *Technical Memorandum for Preliminary Remediation Goals and Decision-making Process at Midvale Slag OU1*, (Technical Memorandum) include a decision flowchart, or protocol, for determining if a parcel of land in OU1 is suitable for development for residential or recreational land use without any restrictions or institutional controls. If this protocol is met, only ICs addressing groundwater will apply. If not, the additional ICs addressing soils and residential use outlined in the Ordinance will apply. Ground water ICs prohibit all new water wells, as well as the disturbance of existing wells, without EPA and UDEQ approval. Soil ICs specify requirements for the disposal of excess excavated soils, the excavation and handling of visible slag, and the notification of the potential presence of contaminants to contractors working on the Site. Residential use ICs require building permit applicants to submit grading plans, to file conditions with the Subdivision Plat, and to retain an inspector to oversee IC implementation.

EPA has assessed the risk to human health and the environment resulting from contamination at the Site. EPA and UDEQ conducted risk assessments of the human and environmental risks associated with residential uses at the Site (1992 baseline risk assessment and 2004 Technical Memorandum). Unacceptable risks identified for the Site included human exposure to arsenic and lead through dust and soils, and arsenic through ground water. In its 1995 OU1 ROD and the 2002 OU2 ROD, EPA selected response actions to manage and eliminate these risks. In 1998 and 2006, EPA issued two ESDs modifying the remedy established in the original OU1 ROD. Changes included altering soil remediation and changing land use requirements for portions of OU1; regulating riparian zone remediation; and selecting a comprehensive ground water monitoring plan consistent with the OU2 ROD. With the completion of the response actions required by the RODs and ESDs, the Midvale Slag Site has attained the CERCLA cleanup goals and remedial action objectives for the majority of the Site, excluding the Jordan River Riparian Zone and the groundwater.

Based upon information available as of this date, EPA has determined that the unacceptable levels of risk to current and future users of the Midvale Slag Superfund Site have been mitigated for mixed users. The Site is ready for mixed use and the Site's remedy will remain protective of human health and the environment, subject to operation and maintenance of the remedy and limitations as specified in the ROD, ESDs, Five-Year Review, and the Institutional Control Ordinance enacted by the City of Midvale, Utah.

EPA Region 8 issued this Ready for Reuse Determination, effective May 23, 2008

By: Carol L. Campbell

Carol L. Campbell
Acting Assistant Regional Administrator
Office of Ecosystems Protection and Remediation
Environmental Protection Agency, Region 8

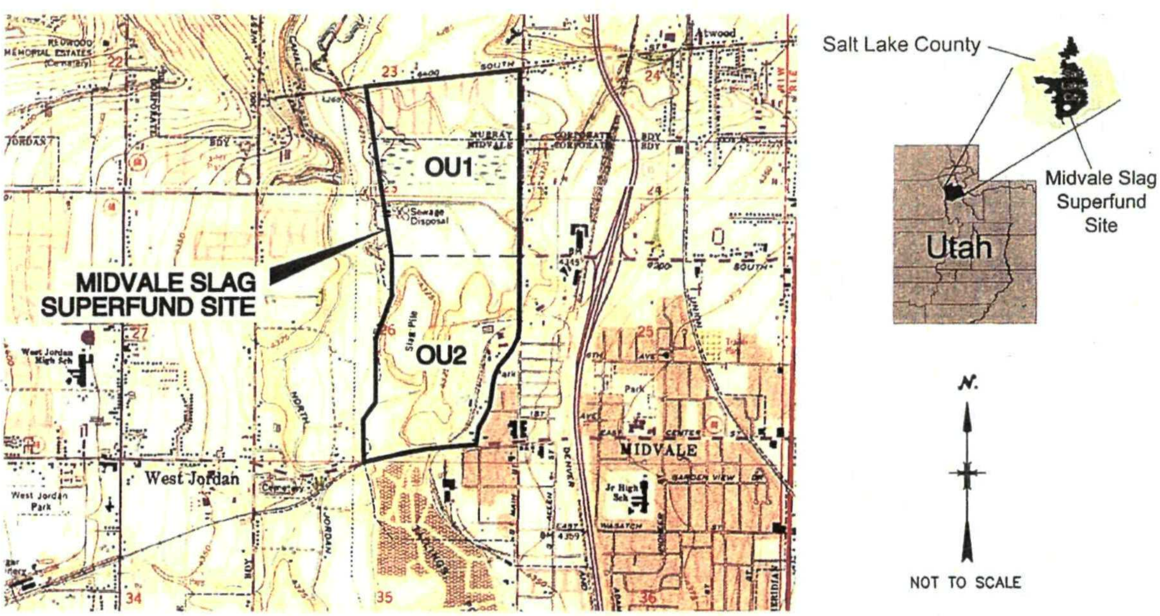
Documents pertaining to the Site and the RfR Determination are part of the Administrative Record for the Site, which is available for review at the Ruth Vine Tyler Library, 8041 South Wood Street (55 West) Midvale, Utah 84047 or the EPA Superfund Records Center, 1595 Wynkoop Street, Denver, Colorado 80202. Additional information can be obtained from Erna Waterman, the Site's Remedial Project Manager (RPM) for EPA, who can be reached at 303.312.6762 or waterman.erna@epa.gov .

II. Site and Parcel Location

The Site is located 12 miles south of Salt Lake City, Utah, with the majority of the Site within the city limits of Midvale. Exhibit 1 provides a location map of the Midvale Slag site. The northern portion of the site extends into the City of Murray. The Site is bounded by 7800 South Street on the south, the Jordan River on the west, 6400 South Street on the north, 700 West Street on the northeast and east, and Holden Street on the southeast. The Site includes tax parcels # 21-23-476-002-4001, # 21-23-476-002-4002, # 21-26-200-014-4001, # 21-26-200-014-4002, # 21-26-401-003, # 21-23-402-001, #21-23-426-004, # 21-23-426-007, # 21-23-426-009 and # 21-23-426-011.

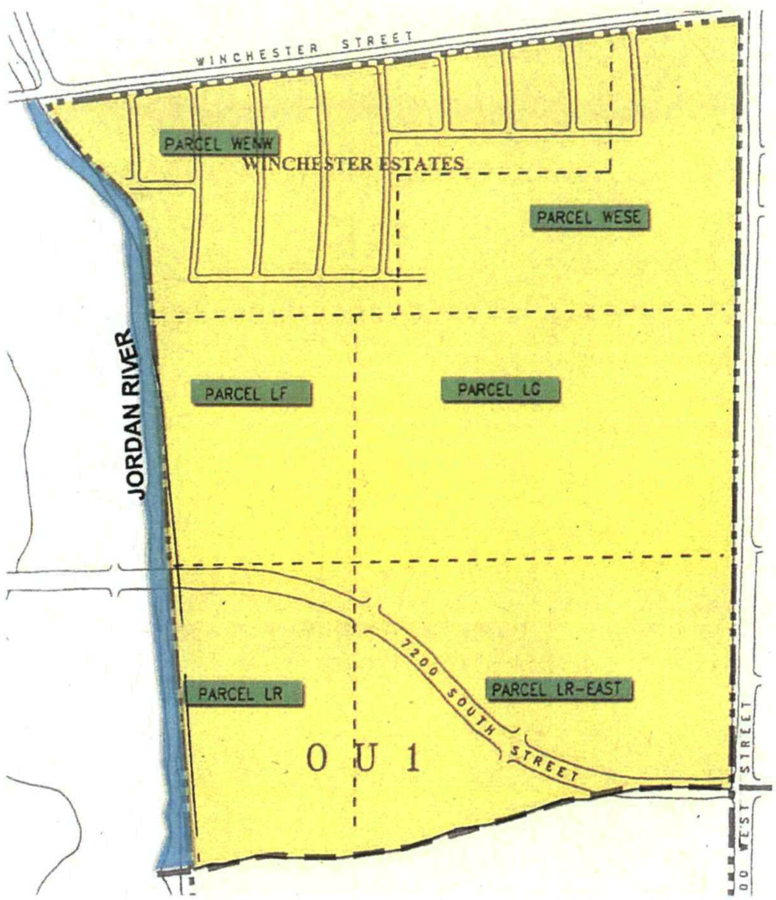
The Site is located in the Salt Lake Valley, bounded on the west by the Oquirrh Mountains and on the east by the Wasatch Range. The land south and west of Midvale were historically used primarily for agricultural and commercial activities, now are evolving into suburban residential areas; the land north and east of Midvale is mostly urban. The entire area drains into the Jordan River, which provides coldwater habitat for fish, but has historically been used for agricultural irrigation. Adjacent to the Jordan River are wetlands, which provide wildlife habitat to different species of birds and other animals. The Site is adjacent to Sharon Steel, another Superfund site, which contained ore-processing facilities, some of which were related to those at the Midvale Slag site. Remediation of the Sharon Steel Site has been completed and a ready for reuse determination was issued for Sharon Steel in September 2004.

Exhibit 1: Midvale Slag Location Map



The Site is approximately 446 acres and is divided into two operable units (OUs), OU1, which is approximately 266 acres and OU2, which is approximately 180 acres. OU1 includes the northern portion of the Site and OU2 includes the southern portion of the Site. OU1 also includes the Winchester Estates Mobile Home Park, the abandoned Midvale Wastewater Treatment Plant, a former lagoon area, and jurisdictional wetlands. Included within OU2 are the former Silver Refinery Area, located in the southeast portion of OU2, and the Butterfield Lumber property, which lies in the northeast portion of OU2. This RfR Determination is for both OU1 and OU2, excluding the Jordan River riparian zone, encompassing an approximately 50 feet strip of land along the length of the Site and on both sides of the Jordan River. Exhibit 2 shows the OU1 parcel map and Exhibit 3 shows the OU2 parcel map.

Exhibit 2: Midvale Slag OU1 Parcel Map



III. Site Summary

Site and Contaminant History

Smelting operations began in the vicinity of the Midvale Slag and Sharon Steel Sites in 1871 and continued through 1958. Five separate smelters have been located on these

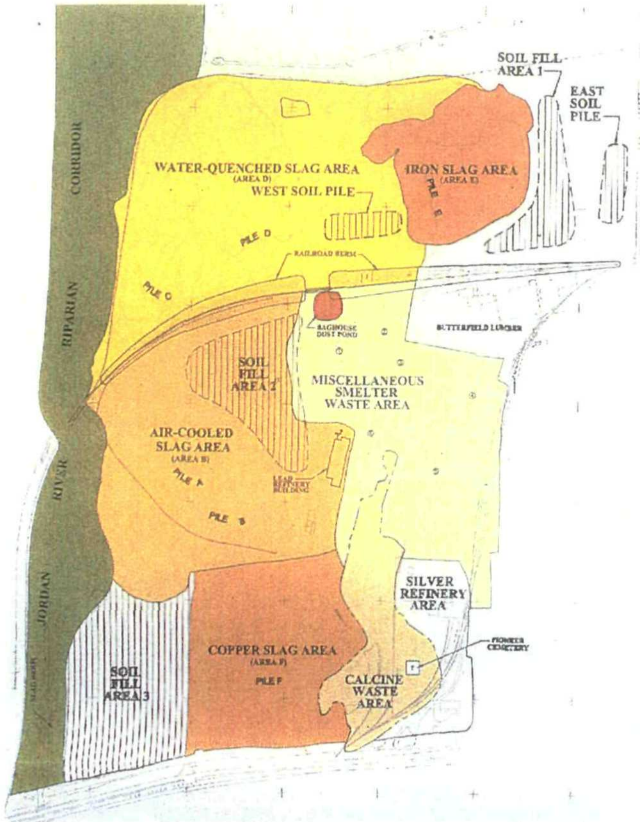
Sites, which were once joined. The earliest smelter was built on what is now Jordan Bluffs (Sharon Steel Site). This parcel was later acquired by the United States Mining Company (USMC). In 1900 and 1901, the Bingham Consolidated Mining and Smelting Company constructed a 250 tons per day semi-pyritic copper smelter at the Sharon Steel/Midvale Slag site. In 1902, USMC started operation of its 1,000 tons per day capacity copper smelter south of and contiguous to the Bingham Consolidated Smelter. The USMC smelter was located on the site of the Old Jordan Smelter Works, which is now OU2 of Midvale Slag. USMC was acquired by United States Smelting, Refining, and Mining Company (USSRM) in 1906. The smelters treated ores from Bingham Canyon and other mines.

In 1907 the Bingham Consolidated Smelter shut down and the USSRM shifted from copper to lead smelting to reduce the sulfur content of its smelting fumes. The USSRM lead smelter operated for the next 50 years, and was expanded and modified periodically. A lead refinery was added in 1933. Arsenic, zinc, copper, silver, and cadmium were also recovered from the complex ores and concentrates obtained from across the western United States. During World War II, substantial tonnages of arsenic trioxide were produced for the US government to be used as herbicides. In 1958, the Midvale lead smelter closed. The contaminants of concern found at the Site likely originated on OU2 and Sharon Steel. They include lead and arsenic.

Smelting activities at the site left a variety of smelter waste products throughout OU2. EPA categorized the various types of wastes and evaluated remedies in accordance with the threat posed by the various wastes. The Mixed Smelter Waste (MSW) Area includes contaminated demolition debris, tailings, calcine and possibly baghouse dust. MSW was distributed across the east-central portion of the Site in areas formerly occupied by smelter buildings and structures. The Baghouse Dust Pond Area contained particulates that had settled out of the washwater for the baghouse filters and formed a sediment layer on the pond bottom. The Calcine Waste Area contained the waste product from the arsenic trioxide recovery process during World War II.

Exhibit 3 shows the various waste areas present on OU2 prior to the cleanup. Slag within each area was present in piles distributed across the ground surfaces. The material in each pile differed somewhat based upon the process from which they originated. The slags included air-cooled slag, water quenched slag, iron slag and copper slag. There were also five areas of fill or stockpiled soil within or adjacent to the slag areas.

Exhibit 3, OU2 Area Designations



Little information is available describing historical activities on OU1 prior to the 1940s. Before then, it is generally believed that the land was used as pasture with no industrial activities, except for a small landfill and associated unpaved road. Domestic trash and household goods were disposed on the southwest corner of the LF Parcel from the 1940s until the county established a landfill in the 1960s. The South Valley Water Reclamation District operated the Midvale Wastewater Treatment Plant on OU1 from 1959 until 1986, when the lagoons were closed according to an approved closure plan. Smelting activities on land south of OU1 from 1871 until 1958 are presumed to account for the contaminants detected at OU1.

Contamination of OU1 soils are thought to have occurred in the following ways:

- Wind transport of slag dust and possibly larger particles onto OU1 from slag piles on OU2;
- Surface water transport of slag dust and possibly larger particles onto OU1 from slag piles on OU2;
- Fallout of smelter fumes onto OU1 from smelter chimneys on OU2 and/or the south chimney on OU1 of the former Sharon Steel Superfund Site, which is adjacent to the southern portion of OU2; and
- Deliberate placement of slag and possibly other smelter waste onto OU1 to fill

wetlands or other low areas and to sand roads in the Winchester Estates development during snow or ice events

Description of Risks

Risk assessments were prepared for the Midvale Slag Superfund Site as part of the remedial investigation. The risk assessment looked at risks before any remedial activities were completed at the Site. The risks that EPA identified included exposure to arsenic and lead through ingestion of surface and subsurface soils and ground water. The 1992 baseline risk assessment (BRA) for OU1 indicated that cancer risks exceeded EPA's acceptable risk range of one in ten thousand to one in one million (1×10^{-4} to 1×10^{-6}) for cancer-causing contaminants. The cancer risk at OU1 from ingestion of soil exceeded the acceptable risk range in two areas: 1) hypothetical future residents on the undeveloped southeast portion of Winchester Estates (WESE Parcel); and 2) current residents on 11 residential yards in the Winchester Estates development (WENW Parcel). These cancer risks were due to arsenic. Non-cancer risks for future residents on WESE Parcel exceeded acceptable levels. Ten residential yards in WENW Parcel also showed non-cancer risks that exceeded acceptable levels. Lead concentrations in 13 residential yards in WENW Parcel were also determined to exceed acceptable levels. EPA originally included cadmium as a contaminant of concern (COC) for OU1 but later excluded in it the based upon analysis in the *Technical Memorandum for Preliminary Remediation Goals and Decision-making Process at Midvale Slag OU1* (Technical Memorandum). Appendix A.

For OU2, the BRA originally evaluated exposure for several populations of concern but reevaluated these potential receptors based on site observations and information presented in the Bingham Junction Reuse Assessment and Master Plan. Preliminary Remediation Goals were calculated for medium specific COCs based on the human populations of concern. Results of the BRA indicate that COCs in site surface and subsurface soil in OU2 posed a risk of excess cancer and adverse health effects to current and future populations.

In 2005, the BRA was reviewed and updated in the Technical Memorandum. This document laid out a decision-making process to allow the land use requirements for the undeveloped portion of OU1 to be changed to accommodate multiple land uses as allowed under the new zoning for this area. This process was formally adopted in the 2006 ESD. Subsequently, under EPA and UDEQ oversight, a developer used the decision-making process to conduct further remediation on the LF and LC parcels in OU1. These parcels are now suitable for residential development and no ICs are required, except for ICs relating to ground water.

Summary of Cleanup Activities

Exhibit 4 summarizes the relevant events and important dates in the Midvale Slag Superfund Site's chronology.

Exhibit 4: Chronology of Site Events

Date	Event
1871-1971	Ore processing conducted at the Site
1982	Salt Lake County Health Department and the Utah Department of Health (UDOH) conduct environmental investigations at the site.
March 1983	UDOH and EPA conduct a preliminary assessment of the Site.
April 1984	State of Utah Bureau of Solid and Hazardous Waste (BSHW) conducts a site inspection of the Site.
June 1985	EPA conducts a field investigation at the Site.
August 1985	Investigation conducted of surface water and sediment in the Jordan River.
1986	A preliminary characterization of the Site is performed.
June 1986	EPA proposes listing the Site on the National Priorities List (NPL).
1988	A site investigation is conducted by EPA Region 8.
March 1990	EPA performs a removal action that installs a fence around both OUs.
December 1990	Removal action is carried out to dispose of chemicals and explosives remaining onsite.
February 1991	The Site is added to the NPL.
February 1992	The *LR Parcel Data Summary Report for Operable Unit No. 1* is completed.
June 1992	The *Site Characterization Report for Operable Unit No. 1* is completed.
1994	The *Final Feasibility Study Report of Operable Unit No. 1* is completed.
April 1995	EPA issues a Record of Decision (ROD) for OU1 with concurrence from UDEQ.
July 1995	EPA begins a series of non-time critical removal actions on OU2.
May 1996	RA construction begins for the remediation of contaminated soil on the WENW Parcel of OU1.
August 1996	The U.S. Bureau of Reclamation (USBR) and UDEQ confirm that construction on the WENW Parcel on OU1 is complete.
September 1996	A risk evaluation report is prepared for the undeveloped residential portion of WESE.
1997	USBR prepares the design and specifications for the remediation of the contaminated soil on the WESE Parcel of OU1.
1998	RA construction performed on the WESE Parcel of OU1. EPA finalizes the supplemental remedial investigation report for ground water for OU2.
May 1998	UDEQ issues an ESD documenting two changes to the OU1 ROD.
November 1998	USBR and UDEQ confirm construction on the WESE Parcel of OU1 is complete.
January 1999	Final inspection conducted by EPA, UDEQ, and USBR for the RAs completed on OU1.
March 1999	Final RA report for OU1 remedy completed.
July 1999	The Site is selected as EPA Region 8's pilot program for the Superfund Redevelopment Initiative.
May-June 2001	An additional field investigation (Phase 1) is performed at the Site.
October 2001	A removal action is completed on OU1.
January 2002	An additional field investigation (Phase 2) is performed at the Site.
October 2002	EPA issues the ROD for OU2.
October 2003	EPA conducts the Five-Year Review.
September 2004	EPA signs the RD/RA Consent Decree (Civil No. 2:04 CV-843), which includes the Institutional Control Process Plans for OU1 and OU2.
December 2004	Mixed Smelter Waste (MSW) and Slag RA begins on OU2

Date	Event
March 2005	Technical Memorandum for Preliminary Remediation Goals and Decision-Making Process at Midvale Slag OU1 is finalized
March 2006	EPA issues a second ESD for OU1.
July 2006	Final inspection of MSW and Slag RA for OU2
September 2006	Completion of additional work by Developer on OU1
May 2007	Final inspection for one year warranty period
June 2007	City of Midvale passes ordanance adopting land use restrictions as ICs
August 2007	Final RA report for OU2 MSW and Slag remedy completed
August 2007	Certification of Completion of MSW and Slag RA for OU2

Removal Actions

In March 1990, EPA performed a removal action that installed a fence around both OU1 and OU2.

In December 1990, an interim removal action disposed of lab chemicals and explosives remaining onsite from an abandoned lab facility.

In June and July 1996, a removal action was conducted to properly close five water supply wells on-site to prevent contamination from reaching the Deep Principal Aquifer. Ten ground water monitoring wells were also abandoned at this time.

In August 1996, an archeological evaluation was performed on a small contaminated area on OU2 that contained one or two grave markers. This archeological work was coordinated with the Utah State Historic Preservation Office. Approximately 40 gravesites of early settlers were uncovered and this area became known as the Midvale Pioneer Cemetery. In October 1996 EPA signed an Action Memorandum authorizing a time critical removal action on the Pioneer Cemetery. EPA fenced the cemetery, excavated contaminated surface soils and backfilled the area with clean soils.

In September and October 1996, EPA signed Action Memorandums to perform a time critical removal action at the Butterfield Lumber property. High values of lead and arsenic were discovered on this active lumber yard, which sits in the location of the former arsenic plant. The removal action involved excavation of contaminated soils and backfilling with clean soils.

In October 2001, EPA completed a removal action on OU1 to dispose of approximately 84 deteriorated drums. This included one drum of oily liquid, apparently dumped on the Site illegally.

Remedial Activities for OU1

EPA selected a remedy in OU1's 1995 ROD. All of the potential remedies considered for the Site assumed that the likely future reuse of the Site would be for commercial/industrial use on the southern parcels of OU1 (LF, LG, LR, LR-EAST) and for residential use on the northern parcels of OU1 (WESE and WENW); however, alternatives were also evaluated that would permit flexibility in future land use.

The remedy selected in the 1995 ROD includes:

- Excavation of the upper 18 inches of native soils at 14 residential yards in Parcel WENW. Import clean fill to restore the excavated residential yards as closely as possible to its original grade and condition. Dispose of excavated material in a Resource Conservation and Recovery Act (RCRA) Subtitle D landfill or store excavated material at OU2 pending remedy selection for OU2;

- Placement of a 2-foot thick monolayer soil cover on Parcel WESE, and implementation of deed restrictions or other institutional controls on Parcel WESE precluding most future excavation that would breach the soil cover. Any native soils from permitted excavations must be properly controlled onsite or disposed of in RCRA Subtitle D landfill;

- Implement deed restrictions or other institutional controls on Parcels LF, LG, LR, and LR-EAST that would prohibit future residential land use without additional property remediation to residential soil cleanup levels; and

- Monitor groundwater semi-annually in the upper sand and gravel aquifer at the hydraulically down gradient site boundary (west and north) for a minimum of 5 years.

The OU1 remedy was implemented in two phases. The first phase, remediation of the 14 residential yards located on the WENW Parcel was conducted in 1996. The second phase, excavation of contaminated soil on the WESE Parcel and disposal on OU2 was conducted in 1998.

Phase I

In May 1996, UDEQ oversaw cleanup on the WENW parcel. Cleanup activities included site preparation (cleaning and concrete removal) and excavation of contaminated soil. UDEQ's contractor hauled the excavated contaminated soils to the Sharon Steel Superfund Site, where it placed the soil under a clay and geomembrane cap. After all zones on a property were completely excavated, confirmatory soil sampling was conducted to verify that the zones were clean. Once confirmatory sampling determined that the entire property was clean, UDEQ backfilled the property with clean fill and restored it, as closely as possible, to its original condition. UDEQ completed the remedial action on the WENW Parcel in 1996.

In 1998, EPA issued an ESD addressing two changes to the OU1 ROD. The OU1 ROD required a cover consisting of 18 inches of fill material overlain with 6 inches of organic topsoil over contaminated soils in Parcel WESE. EPA eliminated this requirement once all contaminated soil was removed. It also eliminated all ICs other than groundwater controls for the WENW and WESE Parcels after UDEQ cleanup up all residential areas to 650 mg/kg lead and 73 mg/kg arsenic.

Phase II

UDEQ began the Phase 2 work in July 1998 on the WESE Parcel. Site activities included resurfacing a haul road, establishing a temporary repository for the contaminated materials from OU1 on OU2, and excavation of contaminated soil. The excavated contaminated soil was hauled to OU2 and placed in the temporary repository. UDEQ completed Phase 2 in November 1998.

EPA and UDEQ conducted a final inspection in January 1999. The final inspection confirmed that remedial actions had been successfully executed and that the remedies were operational and functional.

In 2006, EPA issued a second ESD addressing three changes to the OU1 remedy:

- The land use requirements for the southern parcels of OU1 (LF, LG, LR, LR-EAST) may be changed to accommodate multiple land uses as allowed under the new zoning for this area with the incorporation of the Technical Memo into the decision-making process. The Midvale Ordinance shall control the process of implementing institutional controls, when needed.

- The Technical Memorandum and later the Midvale Ordinance outlined the requirements of the RODs and ESDs for maintaining protectiveness with recreational uses. Those requirements should also be used for the riparian zone. In addition, the riparian zone remedy and other related requirements specified in OU1 ESD and OU2 ROD should apply to OU1 riparian zone.[1]

- The OU1 ROD required semi-annual monitoring of the ground water in OU1 for a period of 5 years after the implementation of the remedy. However, additional ground water sampling indicated that a comprehensive ground water plan for the plume that underlies both OU1 and OU2 would be more effective. The OU2 ROD selected a comprehensive ground water monitoring plan that could apply to both OU1 and OU2, which the 2006 ESD adopted.

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Remedial Activities for OU2

[1] The OU2 ROD sets out general requirements for the riparian zone. The riparian zone remedy will include some bank stabilization and/or possible revegetation to minimize site contaminated material from sloughing into the Jordan River. In addition, the applicable or relevant and appropriate federal and state requirements (ARARs) specific to the riparian zone, are written in the OU2 ROD and added to the OU1 ESD.

Ground Water – This limited action remedy does not actively attempt to restore the Upper Sand and Gravel (US&G) Aquifer, but provides points for monitoring and assessing as well as institutional controls. This approach relies on ground water and surface water monitoring to assess whether the alternate concentration limits are being met for the selected COCs (antimony, arsenic, cadmium, and selenium). Regulatory agencies use points of assessment to provide an early indication if the arsenic plume spreads laterally and/or vertically with the boundaries of the Site.

The Deep Principal Aquifer is not impacted by site contamination and requires no remediation. The Deep Principal Aquifer is separated from the US&G Aquifer by a confining layer. Assessment sampling and trend analysis will be conducted to provide early indications if contaminated ground water flow patterns change in a manner that might affect the Deep Principal Aquifer.

The Utah State Engineer has placed institutional controls on the Site restricting ground water use and the placement of new wells within the affected areas. In addition, Midvale's ordinance places restrictions upon surface water management and irrigation practices to limit infiltration in the plume area.

PCE Plume – During site investigations in 2001 and 2002, a plume primarily containing PCE was detected passing through the site from the upgradient Dahl Ball Field to the Jordan River. The source of this plume appears to originate off site and up gradient. Identification and investigation of the source of this PCE plume has been referred to the site assessment section at UDEQ. Source remediation for the PCE plume is not included as part of the Midvale Slag remedy.

The principal Site concern with PCE in groundwater is the possibility that volatile organic compounds may accumulate in indoor spaces if buildings are constructed over the PCE plume, leading to unacceptable levels of human health risks in the affected buildings. There are currently no buildings located above the PCE plume. The most effective way to provide protection for future residents is to require basement/crawl space venting in any buildings constructed above the plume. The Midvale City ordinance included institutional controls with respect to vapor mitigation for residential property constructed over the PCE plume.

MSW – MSW encompasses nine former waste areas on site. They were the Miscellaneous Smelter Waste Area, the Baghouse Dust Pond Area, the Calcine Waste Area, the Silver Refinery Area, Soil Fill Area 3, the Lead Refinery, the East and West Soil piles, Soil Fill Area 1, and the Riparian Zone. For the purposes of organizing the various site materials in the above areas and their associated environmental effects, the materials were put into one of four relative categories that reflect the toxicity and mobility of the wastes. Most of the MSW waste is Category II and III waste although there is a small amount of Category I waste and some slag (Category IV) mixed in. Category I wastes are considered principal threat wastes (highly mobile, highly toxic). Category II materials are wastes, demolition debris, foundations, and soils with high

COC concentrations. Category III wastes contain elevated concentrations of COCs, but pass TCLP tests and SPLP tests indicate that the material is not leachable in sufficient concentrations to impact ground water quality. Category IV material is slag.

Category I waste (crude arsenic trioxide) was located based upon survey data. The waste and the surrounding soil directly in contact with the waste was excavated and disposed of off site at a Subtitle C facility. Investigations did not uncover significant quantities of this waste.

Category II and III wastes require a cover under most land use scenarios. EPA developed a matrix of equivalent cover requirements for different land use scenarios. (See Table 9-11 of the OU2 ROD) Appropriate cover consists of a vegetative soil cover or its equivalent under the redevelopment alternative. Under commercial/light industrial land use scenarios, Category II waste must be covered, but Category III waste may not require a cover. A layer of slag was spread over the existing wastes left in place prior to construction of the cover. The slag layer provides a visual notice when any future excavation approaches the more contaminated Category II or III wastes. In some instances a brightly colored geotextile was placed between the waste and the cover to mark the waste. The City of Midvale enacted ICs that require permits and a special inspector for work performed in these areas. These ICs include health and safety precautions in the event a property owner accesses or removes any Category II or III waste in the future. These controls also provide for the maintenance and repair of the cover to ensure protectiveness into the future.

Slag- The contractor regraded and covered the slag with an appropriate soil or redevelopment cover. EPA allowed for the beneficial reuse of slag as an engineered fill on site or off site, as well as an aggregate in concrete. Institutional controls in the form of Midvale's ordinance places restrictions on future excavations into the slag and provides for the review of any proposal to change the type of land use at the site.

Redevelopment/Reuse History

In April 2000, the Midvale City Council adopted a reuse plan for the Site titled "Bingham Junction Reuse Assessment and Master Plan." This plan is the city's official vision of possible future uses of the site. In November 2001, the Midvale City Council approved an additional section to its land use ordinance that establishes the Bingham Junction Zone. This new zone provides the standards for land development on the Site in a way that is supportive of the remediation, and acknowledges and accommodates the contamination that will remain on site. The zone recognizes the Site's Superfund status and allows a mix of uses generally consistent with the Bingham Junction plan. Midvale City envisions multiple future uses for the Site, including residential, office space, commercial, light industrial, recreational, and transit areas. The property owners or future developers are required to submit for approval a master plan for the areas, which must meet the city's goals and responds to development and market needs prior to any redevelopment on the Site.

When EPA signed the OU1 ROD, the City of Midvale also rezoned the area to I-2, which included residential, light/heavy industrial, and commercial designations. The city of Midvale has since revised its zoning for the OU1 based upon the Bingham Junction ordinance. The current zoning continues to allow mixed uses, including residential, recreational, commercial and light industrial, but disallows heavy industrial use. The landowner has proposed a mixed use scenario in recent redevelopment plans; this reuse scenario includes residential and recreational uses and appears to be supported by the community.

In June 2007, the City of Midvale adopted a new ordinance adopting land use restrictions for the Site and rescinded the original ordinance adopted for OU1. The new ordinance implements a more comprehensive approach to land use and redevelopment at both OUs of the Midvale Slag site and at the Sharon Steel site, redesignating them as Bingham Junction and Jordan Bluffs, respectively.

IV. U.S. EPA's Basis for the Ready for Reuse (RfR) Determination

EPA has based the Midvale Slag Superfund Site RfR Determination on documents produced during the course of remedial activities at the Site. These documents provide evidence that the Site is ready for mixed use and that the Site's remedy will remain protective of human health and the environment, subject to operation and maintenance of the remedy and limitations as specified in the RODs, ESDs, Five-Year Review, Consent Decree and the City of Midvale Ordinance.

The RfR Determination is based primarily on the Site's risk assessments, completed in 1992, and the Technical Memorandum, completed in 2005. The 2003 Five-Year Review states that the remedy at OU1 as implemented in the Winchester Estate Mobile Home Park, the portion of the Site currently inhabited, is functioning as intended and remains protective for mixed use. However, the 1995 ROD did not fully address the potential for residential or recreational use of the undeveloped portion of OU1.

As a result, the parties developed the 2005 Technical Memorandum to provide updated human health risk based concentrations (RBCs) for the residential and recreational land use scenarios. The 2006 ESD requires a decision-making process as specified in the Technical Memorandum for determining if a parcel of land within OU1 becomes suitable for residential or recreational land use, and whether institutional controls are still needed.

The OU2 ROD fully envisioned the prospects for redeveloping the site as a mixed use project that included residential development. The ROD allowed for the cleanup of OU2 with an eye towards future redevelopment.

Additional information about the risks present at the Site can be found in the site decision and technical documents, which are available as part of the Administrative Record for the Site. The Administrative Record is available for review at the Ruth Vine Tyler Library, 8041 South Wood Street (55 West) Midvale, Utah 84047 or EPA Superfund Records Center, 1595 Wynkoop St., Denver, Colorado 80202-1129.

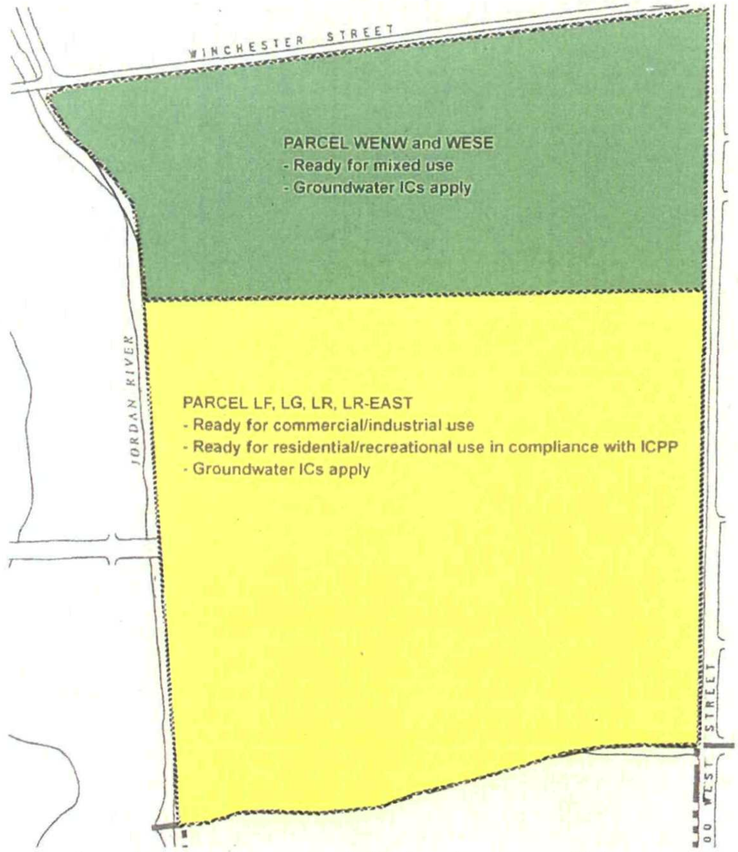
V. Ongoing Limitations and Responsibilities Previously Established by U.S. EPA

Institutional and Engineering Controls

The ROD identified ICs that were further developed during the Remedial Design into the Institutional Control Process Plans (ICPPs). The ICPPs were incorporated into the Consent Decree and used as the basis for the Midvale Ordinance governing ICs. The ordinance is attached as Appendix B of this RfR Determination. The ICPPs established legal requirements to maintain protectiveness during and after completion of redevelopment. The Midvale ordinance, as currently written, accurately reflects the requirements of the ICPP. EPA and UDEQ reviewed the ordinance and determined that it complied with the requirements of the ROD and ICPPs in the Consent Decree. Any changes that Midvale may make to the ordinance will need to be in compliance with the Consent Decree and be coordinated with EPA and UDEQ. The ordinance covers both the Sharon Steel site and the portion of the Midvale Slag site that lies in Midvale, Utah. The far northern portions of OU1 of the Midvale Slag site lie in Murray, Utah. Those parcels (WENW and WESE Parcels) are ready for residential use with no institutional controls required other than those addressing ground water. The Utah State Engineer implemented groundwater controls for the entire plume.

The southern portion of OU1 (LF, LG, LR, LR-EAST) requires ground water ICs and in some instances, soil ICs. The Technical Memorandum sets out a process whereby the developer may sample and remove contaminated material so as to eliminate the need for soil ICs. (Exhibit 5). Areas for which this work is completed to the satisfaction of the EPA, UDEQ and the City of Midvale will be designated on an attachment to the Midvale Ordinance.

Exhibit 5: Land Use Areas and Institutional Controls at Midvale Slag Site (OU1)



The following institutional control responsibilities for three different entities were included in the Midvale Ordinance.

<u>City of Midvale Responsibilities</u>:

1. Periodic inspection of covers and final barriers on the Site.
2. Prohibition of water wells.
3. Repair of covers and final barriers, if the POA or landowner is unresponsive. The City will enforce repair and collection of costs.
4. Review of site plan applications and issuance of final site plan approval.
5. Review of road-cut permit applications and issuance of permits.
6. Review of intrusive activity plans and issuance of final approval.
7. Periodic inspections during initial site development and post-development construction to ensure compliance with construction permits including air quality monitoring plans.
8. Oversight of landscaping activities of POA (or similar entity).
9. Verification that private covenants and deed restrictions for developments include the requirements of the ordinance relating to landscaping and excavation.
10. Review irrigation plans for non-residential development with Source Areas

and issue approval for such plans.

11. Review request for Certificate of Occupancy to determine whether the final depth of surface cover meets or exceeds the approved depth.

U.S. EPA and UDEQ Responsibilities:

1. Review of procedures and protocols for testing excavated materials and issuance of final approvals.

Landowner/POA Responsibilities:

1. Maintenance and repair of covers on their property.
2. Review, approve and oversee the implementation of irrigation plans in residential areas.
3. Establish conditions, covenants and restrictions which include the creation of a POAs to oversee compliance with applicable excavation and grading restrictions.
4. Prepare and submit all plans and request for approvals as required by the Midvale Ordinance.
5. Hire a Special Inspector to oversee residential development projects.

The Midvale City Department of Community and Economic Development will be the primary enforcement and oversight agency for the ordinances at the Site.

Operation and Maintenance Requirements

Operation and maintenance (O&M) activities at the Site include semi-annual groundwater monitoring, which will be conducted by UDEQ. O&M also requires the maintenance of the soil cover and compliance with ICs. EPA and UDEQ will conduct reviews at the Site every five years to ensure that the remedy remains protective of human health and the environment.

VI. Provisos

This RfR Determination is an environmental status report and does not have any legally binding effect and does not expressly or implicitly create, expand, or limit any legal rights, obligations, responsibilities, expectations, or benefits of any party. EPA assumes no responsibility for reuse activities and/or for any potential harm that might result from reuse activities. EPA retains any and all rights and authorities it has, including, but not limited to legal, equitable, or administrative rights. EPA specifically retains any and all rights and authorities it has to conduct, direct, oversee, and/or require environmental response actions in connection with the Site, including but not limited to instances when new or additional information has been discovered regarding the contamination or conditions at the Site that indicate that the response and/or the conditions at the Site are no longer protective of human health or the environment for the types of uses identified in the Ready for Reuse Determination.

The types of uses as identified as protective in this RfR Determination remain subject to (i) applicable federal, state, and local regulation and to (ii) title documents, including, but not limited to, easements, restrictions, and institutional controls.

This RfR Determination remains valid only as long as the requirements specified in the RODs, ESDs, Consent Decree and the Midvale Ordinance are met.

APPENDIX A

TECHNICAL MEMORANDUM FOR PRELIMINARY REMEDIATION GOALS AND DECISION-MAKING PROCESS AT MIDVALE SLAG OU1

Response Action Contract
for Remedial, Enforcement Oversight, and Non-time
Critical Removal Activities at Sites of Release or
Threatened Release of Hazardous Substances
in EPA Region VIII

U.S. EPA Contract No. 68-W5-0022

Technical Memorandum
For
Preliminary Remediation Goals and Decision-Making Process
At Midvale Slag OU1

Midvale Slag Superfund Site
Midvale, Utah

Work Assignment No.: 986-RICO-0871
Document Control No.: 3282-986-RT-OTHR-23843

March 2005

Prepared for:

U.S. Environmental Protection Agency
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Technical Memorandum

Preliminary Remediation Goals and Decision-Making Process at Midvale Slag OU1

Section 1 Derivation of PRGs

1.1 Introduction

Human health risks from site-related contaminants at Midvale Slag Operable Unit 1 (site) were first evaluated in a baseline human health risk assessment prepared in 1992 (Life Systems 1992). The risk calculations presented in the baseline risk assessment were updated in the feasibility study (FS) for the site (Weston 1994), and a series of preliminary remediation goals (PRGs) for chemicals of concern (arsenic, cadmium and lead) were calculated for residential and commercial land uses. The PRGs selected for application at the site presented in the ROD (USEPA 1995) were as follows:

Chemical of Concern	PRG (ppm)	
	Residential Land Use	Commercial Land Use
Arsenic	73	960
Cadmium	49	2980
Lead	650	--

At that time, it was expected that only the northern portion of OU1 (Winchester Estates) would be used for residential purposes, and that the central and southern portions of OU1 would be used for commercial/industrial purposes. Based on a review of the data, it was concluded that the central and southern parts of OU1 could be developed for commercial/industrial uses without restriction, but that residential or other land uses would not be acceptable without further evaluation. Since that time, land use plans have been revised, and the central and southern portions of OU1 are now being considered for residential and recreational uses as well as some commercial uses.

The purpose of Section 1 of this technical memorandum is to revisit the derivation of PRGs for OU1. This is necessary because PRGs were not previously developed for recreational land use in OU1, and PRGs for residential and commercial land uses need to be updated to account for changes in EPA-recommended toxicity and exposure parameters that have occurred since the original PRG calculations reported in the FS.

1.2 Conceptual Model for Exposure

Figure 1 is a conceptual site model that identifies the human populations that may be exposed at the site and the exposure pathways that could be of potential concern. As seen, each population (residents, workers, recreational visitors) may be exposed to site-related contaminants by several different pathways. However, not all of these pathways are of equal concern. Pathways that are judged to be the most important are shown by boxes filled with an "X", and pathways that are judged to be minor are shown by an "O." Pathways that are not complete are shown as empty boxes. The basis for these judgments is summarized below.

Residential -The main pathway of exposure of residents to site related contaminants is through incidental ingestion of soil and of indoor dust that has become contaminated with soil. Ingestion of contaminants taken up from soil into garden vegetables was evaluated in the original risk assessment (Life Systems 1992), but this pathway is generally minor (USEPA 1995), especially when the anticipated land use is medium- to high-density residential housing, which will not accommodate vegetable gardening on a scale that would contribute significantly to overall vegetable intake. Thus, the garden vegetable pathway is not included in the PRG calculations. Likewise, residents could be exposed to particulate matter in air, but screening level calculations show this pathway is very minor compared to ingestion of soil and dust, so this pathway is not included in the PRG calculations.

Worker - Some parts of OU1 may be developed for shops and stores, and workers in these buildings may be exposed to contaminants in outdoor soil and indoor dust at the workplace. These pathways are the main exposure routes for workers and are included in the PRG calculations. Like with residents, inhalation exposure to dust in air could occur, but this is minor and is not included. Note that this type of worker is not expected to have extensive contact with outdoor soil, and PRGs based on the commercial land use scenario are not intended to apply to construction workers who may have high direct contact with soils.

Recreational - Current development plans for OU1 and OU2 include a possible ecological park along the Jordan River where visitors (especially children) can be exposed to surface soils in the park, and may also be exposed to surface water and sediments while playing along the bank of the Jordan River. Some visitors (mainly adults) may also catch and ingest fish from the river. Fish ingestion has been evaluated for OU2 (CDM 2002, FFS, Appendix A, Attachment 3), and has been found to be below a level of concern.

1.3 Chemicals of Concern

Although a number of different chemicals are detectable in soil, surface water, and sediment at OU1, not all occur at a level of potential human health concern, and hence PRGs are not needed for all chemicals in all media. Attachment 1 describes the method used to evaluate the level of potential concern for each chemical detected, and to decide if PRG values are needed. In brief, a conservative risk-based concentration (RBC) was calculated for each chemical in each medium for each land use, and the maximum detected value in that medium was compared to the lowest land-use specific RBC. If the maximum value did not exceed the lowest relevant RBC, the chemical was not considered further. As discussed in Attachment 1, this screening procedure indicates that PRGs are needed only for arsenic and lead in soil. Other chemicals and other media do not appear to pose a potential for unacceptable risks to humans. This includes cadmium, which was previously included as a chemical of concern. However, this was mainly because of the theoretical exposure that might occur for residents with large home vegetable gardens. As noted above, it is considered unlikely that vegetable gardens will be large enough to contribute significant exposure, and risks from cadmium are below a level of concern when this pathway is excluded.

1.4 PRGs for Arsenic

PRGs are calculated for a medium by reversing the normal process used in risk assessment. That is, rather than calculating the risk associated with a specified concentration level in the medium, the concentration associated with a specified risk is derived. For chemicals such as arsenic that cause both noncancer and cancer effects PRGs are calculated for both types of effects and the final PRG is the more stringent (lower) of the two. In most cases, the most stringent PRG will be based on cancer risk. However, in exposure scenarios that have relatively low exposure durations, PRGs based on non-cancer risk may be the most stringent.

1.4.1 Equations and Input Parameters

The basic equations for calculating the noncancer (NC) and cancer (C) PRGs for ingestion of arsenic in soil and dust are as follows:

$$PRG(NC) = \frac{THQ \cdot oRfD - D_0 \cdot HIF_d \cdot RBA}{HIF_s \cdot RBA + ksd \cdot HIF_d \cdot RBA}$$

$$PRG(C) = \frac{TR / oSF - D_0 \cdot HIF_d \cdot RBA}{HIF_s \cdot RBA + ksd \cdot HIF_d \cdot RBA}$$

where:

THQ =Target HQ
TR =Target cancer risk
oRfD = Oral Reference Dose (mg/kg-day)
oSF = Oral slope factor $(mg/kg\text{-}day)^{-1}$
HIF = Human intake factor for soil (HIF_s) or dust (HIF_d). The values of HIF (kg/kg-day) are calculated as follows:

HIF = (IR/BW) ·(EF ·ED/AT)

where:

IR = intake rate (kg/day)
BW = body weight (kg)
EF = Exposure frequency (days/yr)
ED = Exposure duration (days)
AT = Averaging Time (days)

RBA = Relative bioavailability
D0 = Concentration of contaminant in dust due to sources other than soil (mg/kg)
ksd = Fraction of indoor dust contributed by outdoor soil

Table 1 lists input parameters for each of these terms. In most cases, there is a single value recommended by EPA for use in the equations. However, in some cases, there are two or more alternative choices that are plausible. These alternatives are discussed below.

Target Risk

The target noncancer risk is 1E+00 and the range of target cancer risks is 1E-04, 1E-05 and 1E-06. Note that, in accord with EPA guidance, these values are expressed to only one significant figure. Using noncancer risk as an example, this means that all soil concentrations that yield an HQ that rounds to 1E+00 are potentially acceptable as PRGs. For this reason, two types of PRGs are calculated: "exact" (this is the concentration that yields an HQ of 1.00), and "upper limit" (this is a concentration that yields an HQ of 1.499, which is the highest concentration that rounds to 1E+00 when expressed to one significant figure). The same principle applies to cancer risks.

Relationship Between Soil and Dust

In most cases, the default assumption used by EPA for the relationship between the concentration of a contaminant in soil and in indoor dust is Cdust = Csoil. However, for lead, the default assumption is Cdust = 0.7*Csoil. This is based on a number of studies which suggest that the concentration of lead in indoor dust is usually not as high as in outdoor soil unless there is an alternative indoor source (e.g., leaded paint). Similar data are also available for arsenic, and these studies also suggest that arsenic in indoor dust is usually less concentrated than outdoor soil. Thus, one option in calculating the PRG is to assume a ksd value of 0.7 for arsenic, similar to that used for lead. Another option is to use the empiric relationship that has been established for arsenic in soil and dust based on data collected at Winchester Estates (Weston 1994)), as follows:

$$C(dust) = 20 + 0.2\ C(soil)$$

When using the site-specific regression equation, there are also two alternative strategies in deriving the PRG: the intercept term (D0) that represents arsenic in dust that is not attributable to soil can be included (i.e., set to 20 ppm), or it can be set to zero. The former approach decreases the PRG for soil to account for the non-soil sources, while the latter approach does not.

Soil Intake Rates by Children

The EPA has established default soil intake rates of 100 mg/day (CTE) and 200 mg/day (RME) for children, and these values are normally used in PRG calculations for residential soils. These defaults are based on soil intake studies performed by Calabrese et al. (1989) in Amherst, Massachusetts. More recently, Stanek and Calabrese (2000) performed another soil intake study in Anaconda, Montana, using improved analytical and data reduction procedures. Although EPA does not recommend the data from this study as national defaults, exposure conditions in Anaconda may be somewhat more representative of mining sites in the west than the data from Amherst. For this reason, PRG calculations using the data from Anaconda are used to illustrate the uncertainty that exists in the PRG as a function of uncertainty in the soil intake term for children.

1.4.2 Results: Range of Alternative PRGs for Arsenic in Soil

Table 2 lists the range of alternative PRGs calculated for arsenic in soil. As seen, for each land use, a wide range of values is plausible, depending on the target risk selected and on the input parameters selected. In cases where D0 (the concentration of arsenic in dust that is not related to soil) is assumed to be 20 mg/kg, it is not possible to achieve a risk level of 1E-05 or lower for residents even if soil is reduced to zero.

1.4.3 Risk Management Decision: Selection of the PRGs for Arsenic in Soil

EPA and the State of Utah have reviewed the range of alternative PRGs derived as described above. In accord with EPA guidance for Superfund sites (USEPA 1991b), a risk level of 1E-04 is identified as the appropriate target risk for cancer. Based on this, the range of plausible PRGs for each land use are as follows. For convenience, the previous PRGs specified in the ROD (USEPA 1995) are also shown.

Land Use	Range of PRGs (ppm)	PRG from ROD (ppm) (USEPA 1995)
Residential	49-143	73
Commercial	480-1280	960
Recreational	61-103	--

As seen, for residential and commercial land uses, the range of arsenic PRGs calculated in this technical memo span the PRG value previously selected. Based on this, it is concluded that the existing PRGs are still protective and appropriate for these land uses, and these PRGs are retained for use without revision. For recreational land use, the range of PRGs is similar to the range for residential land use, so the PRG for residential land use is also applied to recreational lands.

In summary, the PRGs for arsenic in soil at Midvale Slag OU1 are:

Land Use	Arsenic PRG (ppm)
Residential	73
Commercial	960
Recreational	73

1.5 PRGs for Lead

Risks from lead are evaluated using a somewhat different approach than for arsenic. First, because lead is wide-spread in the environment, exposure can occur by many different pathways. Thus, lead risks are usually based on consideration of total exposure (all pathways) rather than just to site-related exposures. Second, because studies of lead exposures and resultant health effects in humans have traditionally been described in terms of blood lead level (PbB, expressed in units of ug/dL), lead exposures and risks are typically assessed using an uptake-biokinetic model rather than an RfD/HQ approach. Therefore, calculating the level of exposure and risk from lead in soil also requires assumptions about the level of lead in other media, and also requires use of pharmacokinetic parameters and assumptions that are not needed in traditional methods.

1.5.1 Lead PRG for Residential Land Use

Basic Approach

For residential land use, the sub-population of chief concern is young children. The USEPA has identified 10 ug/dL as the blood lead level at which effects that warrant avoidance begin to occur, and has set as a goal that there should be no more than a 5% chance that any child will have a blood lead value above 10 ug/dL (EPA 1994a, 1994b). For convenience, the probability of exceeding a blood lead concentration of 10 ug/dL is referred to as P10.

The USEPA has developed an Integrated Exposure Uptake Biokinetic (IEUBK) model for predicting the likely range of blood lead levels in a population of residential children exposed to a specified set of environmental lead levels (USEPA 1994b). The electronic version of the model used for these calculations is IEUBKwin32 Version 1.0 (build 261). This model requires as input data on the levels of lead in soil, dust, water, air, and diet at a particular location, and on the amount of these media ingested or inhaled by a child living at that location. These data are used to calculate an estimate of the central tendency of the distribution of blood lead values that might occur in a population of children exposed to the specified conditions. Assuming the distribution is lognormal, and given (as input) an estimate of the variability between different children (this is specified by the geometric standard deviation or GSD), the model calculates the expected distribution of blood lead values, and estimates the probability that any random child might have a blood lead value over 10 ug/dL. (i.e., the P10 value). The PRG for lead in residential soil is usually derived by calculating the P10 value for a range of soil values, and finding the soil concentration that yields a P10 value of 5%.

Inputs

All inputs to the calculations were USEPA default values provided in IEUBKwin32 Version 1.0 (build 261) except as discussed below.

Dietary Intake

Dietary intake of lead has been decreasing in recent years, and EPA has updated the recommended dietary intake values for use in the IEUBK model. These values are available at http://www.epa.gov/superfund/programs/lead/ieubkfaq.htm

Relationship Between Soil and Dust

As noted above, the default assumption for lead is Cdust = 0.7*Csoil. Another alternative is to use site-specific data collected at Winchester Estates (Weston 1994) to estimate the relationship, as follows:

C(dust) = 290 + 0.2 C(soil)

When using the site-specific regression equation, there are also two alternative strategies in deriving the PRG: the intercept term (D0) that represents lead in dust that is not attributable to soil (i.e., most likely due to leaded paint) can be included (i.e., set to 290 ppm), or it can be set to zero. The former approach decreases the PRG for soil to account for paint-related exposures, while the latter approach does not.

Soil Intake Rates by Children

As noted above, the default soil intake rates for children are based on a study in Amherst, Massachussetts. In this study, the average intake was estimated to be about 100 mg/day, and in the IEUBK model, this average is adjusted to account for age-specific differences in intake. A more recent study in Anaconda Montana estimates that the mean intake may be about 35 mg/day, and calculations based on this estimate illustrate the uncertainty in the predictions attributable to uncertainty in the soil intake assumptions.

Geometric Standard Deviation

The value of P10 is strongly dependent on the assumed value of GSD. The EPA default value is 1.6. Studies at other sites in Utah suggest that values of 1.3-1.5 may be appropriate in some cases (Griffin et al. 1999). For this reason, model calculations based on a GSD of 1.4 are provided to illustrate how the PRG depends on this variable.

Interpretation of the Point Estimate

The point estimate generated by the IEUBK model is usually interpreted as the geometric mean of the blood lead distribution. However, *if all of the model inputs are* arithmetic means, the output of the model will be the arithmetic mean, not the geometric mean. (Note: if the inputs are geometric means, the output is not the geometric mean, but some unknown percentile). Thus, risk estimates are likely to be improved by converting the point estimate (assumed to be approximately equal to the arithmetic mean) to the corresponding geometric mean as follows:

$$GM = \exp[\ln(\text{point estimate}) - 0.5 \cdot \ln(GSD)^2]$$

Results: Range of Lead PRGs for Residents

Table 3 summarizes the range of alternative soil lead PRGs for residential land use that may be generated using different inputs to the IEUBK model. As seen, the range is quite wide (min = 310, max = 3100), depending on which set of input parameters is used.

Risk-Management Decision: Selection of the Residential PRG for Lead

EPA and the State of Utah have reviewed the range of alternative PRGs for lead in residential soil derived as described above. As seen, the PRG derived previously (650 ppm) is included within and lies in the low end of the range of credible values. Based on this, it is concluded that the existing PRG of 650 ppm is still protective and appropriate for residential land uses, and this PRG is retained for use without revision.

1.5.2 Lead PRG for Commercial Land Use

For commercial land use, the population of chief concern is pregnant women or women of child-bearing age. A lead PRG was not previously derived for commercial land use at OU1 because, at the time of the ROD, EPA had not developed a standard method for evaluating risks to adults for lead. Since that time, the USEPA has developed an adult lead model for use in estimating blood lead levels in the fetus of a pregnant woman (USEPA 1996). This method is used to derive a lead PRG for commercial land use, as described below.

Basic Approach

The adult lead model requires as input data on the levels of lead in blood expected in the absence of site-related exposures and the level of intake from site media. Based on these inputs, the model calculates the expected geometric mean of the distribution of blood lead values in the exposed population. The degree of variability in blood lead levels among different members of the population is characterized by a GSD, and this allows calculation of the P10 value. The PRG for lead in commercial soil is found by calculating the P10 value for women exposed to a range of soil values, and finding the soil concentration that yields a P10 value of 5%.

Inputs

Table 4 lists the input parameters used to estimate lead risks to female workers at this site. As above, there is only one value considered for some variables, while two or more values are considered plausible for other variables. These alternatives are discussed below.

Relationship Between Soil and Dust

The same soil-dust relations discussed above for residents are also considered relevant to workers.

Geometric Standard Deviation

The default GSD recommended by EPA for a homogeneous population of women is 1.8. However, studies at other sites (e.g., Bingham Creek) suggest a value of about 1.5 may be more appropriate

Results: Range of Lead PRGs for Workers

Table 5 summarizes the PRG values for lead in soil for commercial land use that may be derived using the inputs described above. As seen, the values are substantially higher than the PRGs for residential land use. This is because adults ingest less soil and dust than children, and they absorb less of the ingested lead.

Risk-Management Decision: Selection of the Commercial Land Use PRG for Lead

EPA and the State of Utah have reviewed the range of alternative PRGs for lead in soil at commercial land use areas derived as described above. A value of 2,000 ppm is selected for application at this site. This PRG is near the low end of the range of credible PRGs, is judged to provide protection of public health with an adequate level of confidence, and is consistent with the PRG for commercial land use in OU2.

1.5.3 Lead PRG for Recreational Land Use

A PRG for recreational land use of 1066 ppm has been developed for use at Midvale Slag OU2. For OU1, it is expected that some homes may be built very near the recreational area and some children may play in the recreational area nearly as frequently as in their own yards. Based on this, in order to ensure that children playing in the park and near the proposed lake will not be exposed to excessive levels of lead, the residential PRG (650 ppm) is selected for application in recreational/open space areas as well.

1.5.4 Summary of Lead PRGs

In summary, the PRGs for lead in soil at Midvale Slag OU1 are:

Land Use	Lead PRG (ppm)
Residential	650
Commercial	2,000
Recreational	650

Section 2
Decision Framework

Section 2 of this technical memo presents a decision flowchart for determining if a parcel of land in OU1 is suitable for development for residential or recreational land use without any restrictions or institutional controls. Because PRG values for arsenic and lead in OU1 are not changed from the values used in the ROD, the risk management decision that OU1 is suitable for commercial/industrial use without restrictions is also unchanged. That is, the process below is required only if the proposed land use is residential or recreational.

2.1 Conceptual Model for Soil Contamination

The historic surface of OU1 was impacted mainly by airborne releases of stack emissions and blowing particulate matter originating mainly in OU2 and the Sharon Steel smelter site. These impacts tended to be fairly uniform in degree and mainly surficial in extent (i.e., restricted to the native soil surface). Because most metals have relatively low mobility in soils, subsequent migration of contaminants into the underlying native soil appears to have been restricted to a relatively shallow depth interval (usually less than 2-3 feet in most cases), with a decreasing concentration gradient (highest in the surface, decreasing with depth). This conceptual model is important because it implies that substantial "hot spots" are not expected in the native soil surface (except as noted below), and the data evaluation strategy is based on that assumption.

A potential exception to the conceptual model of generally uniform contamination occurs at locations where solid wastes (e.g., slag) were placed on the original soil surface. This is known to have occurred in some locations. As these wastes become crushed and mixed into the soil, they may also contribute to increased levels of site-related contaminants (metals) in soil, and concentration values in these areas may be higher than in surrounding areas.

After the time that the airborne and solid wastes were deposited on the native soil surface at OU1, clean fill was imported and used to cover about the eastern 2/3 of the OU. The depth of fill ranges from more than 15 feet at some locations on the east to 0 feet about 2/3 of the way to the western edge. Beyond the capped area, native soil still remains at the surface.

2.2 Basic Decision Rules

Figure 2 presents a flow chart for deciding if a parcel of land will be considered suitable for residential or recreational development without the need for remediation and/or institutional controls (ICs). As seen, the procedure consists of the following basic steps:

1) Determine the depth from the current surface to the top of the historic ("native") soil surface (i.e., before fill was added). If the depth cannot be reasonably estimated based on current data, additional data must be collected before proceeding.
2) If the native soil surface is located 0-2 feet below the current surface, evaluate the area based on the flow chart shown in the left side of Figure 2.
3) If the native soil surface is located deeper than 2 feet and less than the maximum excavation depth (usually < 12 feet), evaluate the area using the flow chart shown in the center of Figure 2.
4) If the native soil surface is deeper than 12 feet or the maximum excavation depth (whichever is greater), no evaluation is needed (Figure 2, right side).

The following text outlines the requirements and the rationale for this approach.

2.2.1 Evaluation if the Native Surface is 0-2 Feet Deep

Rules:

- The size of a parcel to be evaluated shall not be larger than 10 acres or smaller than the size of a residential lot (assumed to be about ¼ acre).

- Calculate the Exposure Point Concentration (EPC) for lead and arsenic in the native soil surface and compare each EPC to the corresponding PRG. For arsenic, the EPC is the 95% UCL of the mean or the maximum value (whichever is lower). For lead, the EPC is the arithmetic mean. The UCL of the mean shall be calculated using EPA's ProUCL software. If the EPC does not exceed the applicable land-use-specific and COPC-specific PRG, AND if the maximum individual concentration value observed within that interval does not exceed 2-times the PRG, the area is considered acceptable. The minimum number of native soil samples required for this calculation is 10 for parcels of 1 acre or less, 15 for parcels of 1-5 acres, and 30 for parcels of 5-10 acres.

Rationale

Human exposure to soil is mainly restricted to soil which is at the surface (0-2 inches). However, human exposure to soil in the shallow subsurface (e.g., 2 inches to 2 feet) may also occur due to routine activities such as gardening, home maintenance, landscaping, etc. These activities can result in intermittent direct exposures of residents, and could also result in shallow subsurface soil being spread on the surface where repeated direct exposure of residents or recreational visitors could occur. Therefore, the surface soil down to a depth of 2 feet must meet PRGs in order to ensure that routine activities by property owners or landscapers will not result in contamination of surface soil above applicable PRGs.

Within an exposure unit, exposure to surface soil is assumed to be random. Therefore, the most appropriate metric of exposure is the arithmetic mean concentration. However, because the true mean cannot be calculated with certainty from a limited set of measurements, the 95% UCL of the mean or the maximum detected value (whichever is lower) is used as a conservative estimate of the mean.

The method used to calculate the 95% UCL for an exposure area depends on the distribution of data values from the area. If the data are well described by a continuous parametric distribution (e.g., normal, lognormal, gamma, etc), then the 95% UCL can be computed using the appropriate equation for the best-fit distribution. If the data are not well characterized by a continuous parametric distribution, then non-parametric methods may be used. The USEPA has developed guidance and software (ProUCL) that evaluates a given data set, calculates a series of alternative estimates of the UCL, and recommends which value is most appropriate. This software shall be used for all calculations of all 95% UCL values.

While the 95% UCL of the mean is expected to be conservative (i.e., greater than the true mean) 95% of the time regardless of the number of samples used in the calculation, use of an EPC based on the maximum detected value may not be conservative in cases where the number of samples is small. For example, assuming a lognormal distribution, if the true mean is the pth percentile of the distribution, the probability that the maximum value in a set of n samples will be greater than the true mean is:

$$\text{Prob}(\text{Cmax}>\text{Mean}) = 1 - p^n$$

The following table gives the probability for a series of different sample sizes (n) for a series of lognormal distributions with differing variability (GSD).

n	P(Cmax > Mean)			
	GSD = 2	GSD = 2.5	GSD = 3	GSD = 3.5
1	0.36	0.32	0.29	0.27
2	0.60	0.54	0.50	0.46
3	0.74	0.69	0.64	0.60
4	0.84	0.79	0.75	0.71
6	0.93	0.90	0.87	0.84
8	0.97	0.96	0.94	0.92
10	0.99	0.98	0.97	0.95

As seen, at least 8 to10 samples are needed to ensure approximately 95% confidence that the maximum value exceeds the true mean in cases where the data set has moderate variability (GSD = 3-3.5). For this reason, all EPC values shall be based on a minimum of 10 data points. In addition, requiring a minimum number of samples helps decrease the possibility of missing a significant "hot spot" (if one is present), and also helps minimize the possibility of Type II errors.

If exposure to soil across an exposure unit were always entirely random, no other requirements would be needed. However, in some cases, preferential exposure to a sub-area within the larger exposure area may occur. It is for this reason that it is prudent to impose a limit on the maximum value detected, since this ensures that, if preferential exposure does occur in some sub-area, and if that sub-area happens to have a concentration higher than the average for the exposure unit as a whole, the maximum possible risk that could occur will be no more than 2-times the target (well within the margin of safety provided by EPA's risk assessment methodologies).

2.2.2 Evaluation if the Native Surface is >2 Feet But <Maximum Excavation Depth

Rules:

- This evaluation may be performed for a parcel of any size.

- If the native surface soil is covered by a depth of clean fill that is greater than the maximum depth of excavation expected during or after development, the area is considered acceptable and no sampling or calculations are required. For locations where single family dwellings are planned, this depth is not expected to exceed 12 feet. In locations where multi-family dwellings are planned, the depth shall be determined from the proposed building design.

- If the native soil surface exists at a depth of greater than 2 feet and less than the *maximum expected excavation depth, if the simple average concentration in the* native surface soil layer (0-1 foot in thickness) does not exceed the appropriate land-use-specific surface soil PRG for any COPC, AND if the maximum individual concentration value observed does not exceed 3-times the PRG, the area is considered acceptable. The minimum sampling density required for this evaluation is approximately 1 per 5 acres (an average of 0.2 samples per acre). For example, a parcel of 5 acres would require at least 1 sample, a parcel of 25 acres would require at least 5 samples, and so on.

Rationale

Humans are not expected to be exposed to subsurface soil unless it is excavated and brought to the surface. This could occur either during original land development or as a result of subsequent major remodeling or construction activities. Consequently, it is necessary to ensure that potentially contaminated subsurface soils (i.e., the native soil surface) within the likely excavation zone satisfy surface soil PRGS, or else ICs are needed. Most single family residences that have basements are expected to involve excavation to a depth of about 8-10 feet, although some homes may involve excavations to 10-12 feet. Thus, a depth of 12 feet is expected to be adequate in essentially all cases, except possibly for large multi-unit dwellings (e.g., apartment buildings, large condominiums, etc.). Contamination that exists at depths beyond that which would likely occur during or after construction is not of concern for the direct contact scenario.

Focusing on the 0-1 foot native soil surface is appropriate because highest concentrations of contaminants are expected to occur in this interval. If the 0-1 foot native soil surface layer is acceptable, it is very likely that deeper depths will also be acceptable.

Use of the simple mean rather than the UCL of the mean for judging risk from subsurface soil is acceptable because, if subsurface excavation occurs during or after construction of a building, it is expected that any subsurface soil that is brought to the surface would become mixed with soils from the surface and other depths. Although the magnitude of the dilution due to mixing will vary from place to place depending on how the soil is handled, it is likely that the concentration would be reduced at least several-fold, if not more. For example, if an excavation to 8 feet occurred, and if complete mixing across depth occurred, the contaminated native soil (occurring in a layer 1 foot thick) would be diluted about 8-fold. This mixing provides a margin of safety that serves the same purpose as the use of the 95% UCL. In locations where a layer of subsurface contamination is encountered that is substantially thicker than 1 foot (as determined by visual observation of solid waste), the degree of reduction due to mixing could be less, and appropriate steps to prevent spreading the waste on the surface should be taken as described in Section III.A of the Institutional Control Process Plan for the site (Littleson 2004).

The requirement for a minimum of 10 samples per 50 acres is needed to ensure that the estimate of the mean is reasonably accurate and to increase the probability that any large hot spots (if any) in the native surface soil are included in the evaluation.

Section 3
References

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Figures

Figures

FIGURE 2. DECISION FRAMEWORK

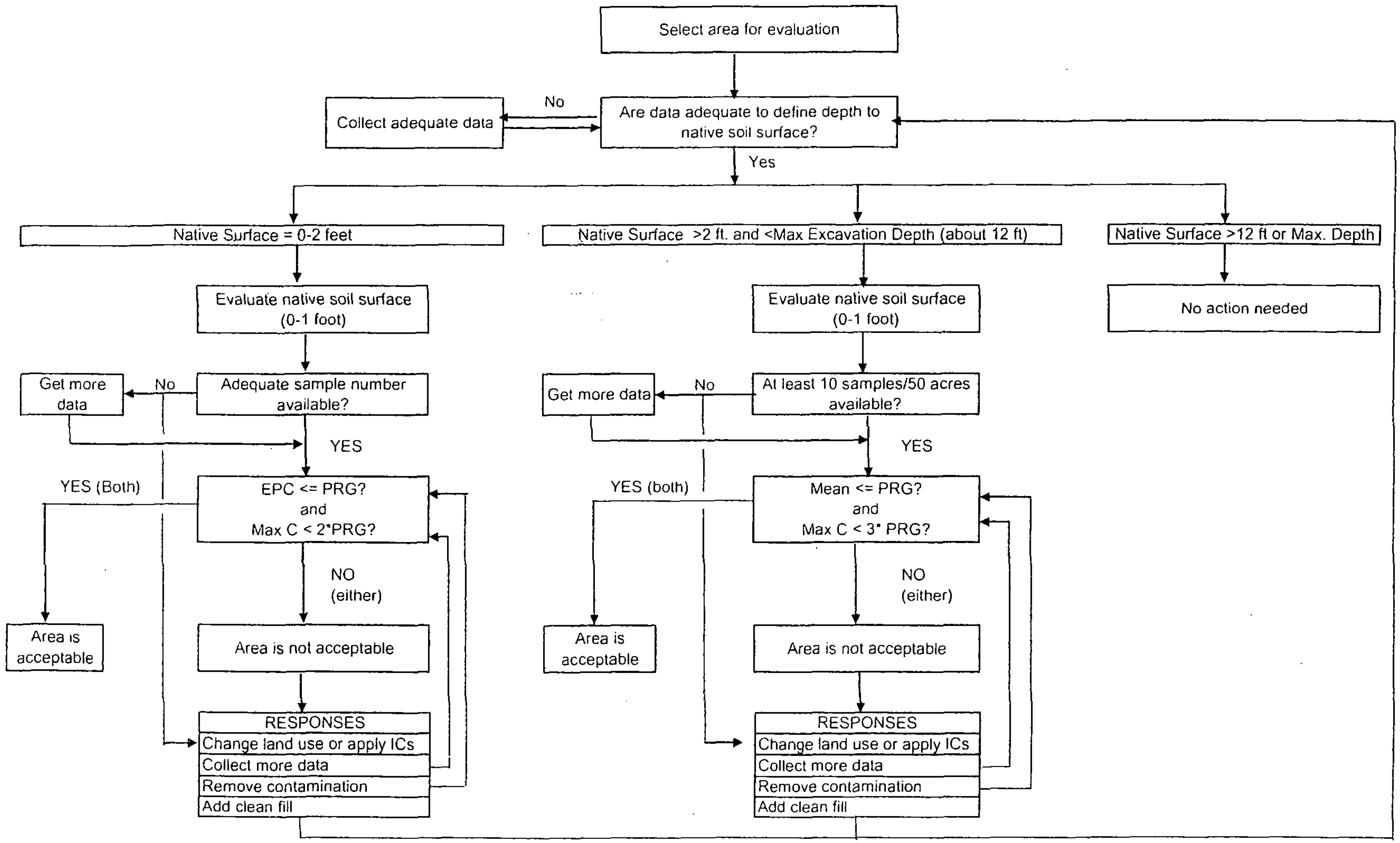
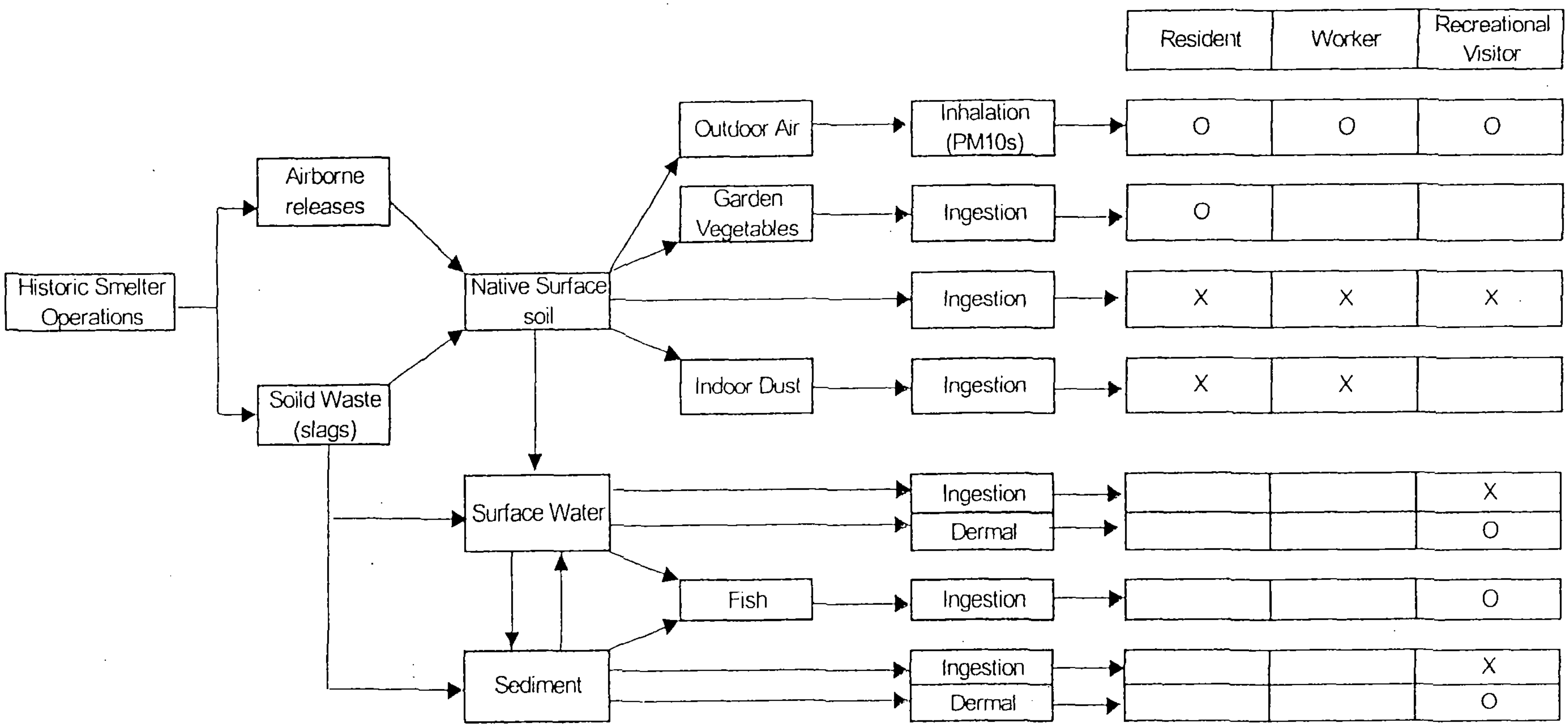


FIGURE 1. CONCEPTUAL SITE MODEL



X = pathway is or may be complete; include in PRG

O = pathway is minor; not included in PRG

Tables

Table 2 Alternative PRGS for Arsenic in Soil

RESIDENTIAL LAND USE

Scenario	ksd	D0	Soil Intake	HQ = 1 Exact	HQ = 1 Upper	1E-04 Exact	1E-04 Upper	1E-05 Exact	1E-05 Upper	1E-06 Exact	1E-06 Upper
1	1.0	0	Default	102.7	154.0	53.2	79.8	5.3	8.0	0.5	0.8
2	0.7	0	Default	122.9	184.4	63.7	95.6	6.4	9.6	0.6	1.0
3	0.2	20	Default	163.7	255.3	75.4	122.9	<0 (a)	<0 (a)	<0 (a)	<0 (a)
4	0.2	0	Default	183.3	275.0	95.1	142.6	9.5	14.3	1.0	1.4
5	1.0	0	Anaconda	94.4	141.6	48.9	73.4	4.9	7.3	0.5	0.7
6	0.7	0	Anaconda	113.0	169.6	58.6	87.9	5.9	8.8	0.6	0.9
7	0.2	20	Anaconda	148.9	233.2	67.8	111.5	<0 (a)	<0 (a)	<0 (a)	<0 (a)
8	0.2	0	Anaconda	168.6	252.8	87.4	131.1	8.7	13.1	0.9	1.3

COMMERCIAL LAND USE

Scenario	ksd	D0	Soil Intake	HQ = 1 Exact	HQ = 1 Upper	1E-04 Exact	1E-04 Upper	1E-05 Exact	1E-05 Upper	1E-06 Exact	1E-06 Upper
1	1.0	0	Default	766.5	1149.8	477	715	47.7	71.5	4.8	7.2
2	0.7	0	Default	918.0	1376.9	571	857	57.1	85.7	5.7	8.6
3	0.2	20	Default	1349.1	2033.5	832	1258	65.5	108.1	<0 (a)	<0 (a)
4	0.2	0	Default	1368.8	2053.1	852	1278	85.2	127.8	8.5	12.8

RECREATIONAL LAND USE (Based on Child)

Scenario	ksd	D0	Soil	HQ = 1 Exact	HQ = 1 Upper	1E-04 Exact	1E-04 Upper	1E-05 Exact	1E-05 Upper	1E-06 Exact	1E-06 Upper
1	na	na	Default	68.4	102.7	124	186	12.4	18.6	1.2	1.9
2	na	na	Anaconda	60.8	91.3	114	171	11.4	17.1	1.1	1.7

(a) Risk attributable by "background" concentration of arsenic in dust (20 ppm) contributes risk greater than the target.

Table 3 Range of Alternative PRGS for Lead in Residential Soil

Run	Model Variable					PRG
	ksd	D0	GSD	Soil Intake	AM->GM (a)	(ppm)
1	0.7	0	1.6	Default	No	400
2	0.2	290	1.6	Default	No	310
3	0.2	0	1.6	Default	No	600
4	0.7	0	1.4	Default	No	550
5	0.2	290	1.4	Default	No	520
6	0.2	0	1.4	Default	No	810
7	0.7	0	1.6	Anaconda	No	1450
8	0.2	290	1.6	Anaconda	No	1870
9	0.2	0	1.6	Anaconda	No	2140
10	0.7	0	1.4	Anaconda	No	1900
11	0.2	290	1.4	Anaconda	No	2550
12	0.2	0	1.4	Anaconda	No	2880
13	0.7	0	1.6	Default	Yes	480
14	0.2	290	1.6	Default	Yes	410
15	0.2	0	1.6	Default	Yes	700
16	0.7	0	1.4	Default	Yes	620
17	0.2	290	1.4	Default	Yes	650
18	0.2	0	1.4	Default	Yes	940
19	0.7	0	1.6	Anaconda	Yes	1680
20	0.2	290	1.6	Anaconda	Yes	2160
21	0.2	0	1.6	Anaconda	Yes	2480
22	0.7	0	1.4	Anaconda	Yes	2300
23	0.2	290	1.4	Anaconda	Yes	2800
24	0.2	0	1.4	Anaconda	Yes	3100

(a) Point estimate output of IEUBK model assumed to be arithmetic mean (AM), converted to geometric mean (GM) as discussed in text.

Table 4 Inputs for Adult Lead Model

Input	Units	Value	Source
PbB0	ug/dL	1.7	1
BKSF	ug/dL per ug/day	0.4	1
Soil+Dust IR	mg/day	50	1
Fraction soil		0.45	1
EF	days/yr	250	1
AF	--	0.12	1
Fetal/maternal ratio		0.9	1
GSD		1.8 1.5	1 2
Soil dust relationship		Cdust = 0.7*Csoil Cdust = 0.2*Csoil + 290 ppm Cdust = 0.2*Csoil	1 3 3

Sources
1. USEPA default
2. Based on data from Bingham Creek
3. Site-specific data

Table 5 Alternative Lead PRGS for Commercial Land Use

GSD	ksd	D0	PRG
1.5	0.7	0	2916
1.5	0.2	290	4063
1.5	0.2	0	4348
1.8	0.7	0	1840
1.8	0.2	290	2458
1.8	0.2	0	2743

Attachment 1

Screening of OU1 Data Against Risk-Based Concentrations for Residential and Recreational Scenarios

Attachment 1

Section 1 Introduction

The five-year review of the 1995 Operable Unit 1 (OU1) Record of Decision (ROD) identified several issues requiring evaluation and follow-up action. Land use for the undeveloped parcels south of Winchester Estates currently allows for multiple uses, including residential, recreational, commercial, and light industrial. The ROD did not fully address the potential for residential or recreational use of this portion of OU1.

The OU1 Baseline Risk Assessment (BRA) - Human Health Evaluation (Life Systems, Inc. [LSI] 1992) evaluated potential health risks to future residents in the middle (LF and LG) and southern (LR) parcels of OU1, assuming exposure occurred to the native surface soil. Cancer risk estimates for future residents in those parcels were above 1E-04 (one in ten thousand) and noncancer hazard indices were above 1E+00. Therefore, contamination is present at concentrations above levels appropriate for residential land use. While residential Preliminary Remediation Goals (PRGs) were provided in the OU1 ROD for arsenic, cadmium, and lead in Winchester Estates soil, they were developed using older risk assessment guidance. Toxicity values, exposure assumptions, and the model to estimate blood lead levels have changed.

The OU1 BRA did not evaluate potential risks associated with recreational exposures. Results from soil sampling in 2001 indicate that contamination present on the western edge of OU1, along the Jordan River, is above acceptable exposure levels for the commercial/industrial worker and is likely to be above levels appropriate for the anticipated land use of ecological park/recreational area. While recreational PRGs were developed for OU2, they were not developed for the same list of chemicals detected in OU1.

These changes warrant updating of residential PRGs for consistency with current guidance and for consistency of PRGs across OUs. The first step in the process is identification of the chemicals of concern (COCs) for which PRGs are needed. Because of updates to exposure assumptions and toxicity values, the COC list may now differ from arsenic, cadmium, and lead.

This technical memorandum was developed to provide current human health risk-based concentrations (RBCs) for the residential and recreational land use scenarios, against which to screen chemicals detected in OU1 media. Chemicals exceeding the RBCs will be considered COCs.

Section 2
Calculation of Risk-Based Concentrations for OU1 Residential and Recreational Scenarios

2.1 Land Use Assumptions

The scenarios evaluated in these calculations are future residential development of OU1 and future recreational use of OU1.

- Residential - This receptor is described in the OU1 BRA (Life Systems 1992). The scenario from the OU1 BRA has been modified here to represent the anticipated land use of medium- to high-density residential, which will not accommodate vegetable gardening on a scale that would contribute significantly to overall vegetable intake. Exclusion of vegetable intake is consistent with assumptions used for OU2.

- Recreational - current plans include a possible ecological park along the Jordan River. This is a hypothetical future scenario that has been evaluated for OU2 (CDM 2002, FFS, Appendix A, Attachment 3). Future recreational scenarios include a child park visitor and a recreational angler.

2.2 Receptors of Interest

Based on the land uses identified above, the following receptors have been identified:

- Adult/child resident - surface soil, groundwater used for drinking water

- Child park visitor - soil, sediment, surface water

- Recreational angler - fish

Exposures to groundwater and to fish have been evaluated previously for the OU2 *focused feasibility study* (FFS). The PRGs for groundwater apply to both OU1 and OU2 and will not be reevaluated in this assessment. The OU2 FFS determined that potential risks through ingestion of fish from the Jordan River were not significant and that the exposure pathway did not warrant further evaluation. While the additional residential and park visitor exposure pathways have also been considered for OU2, some of the chemicals detected in OU1 soil, sediment, and surface water differ from OU2. Detected chemicals are summarized in Table 1.

2.3 Equations and Input Parameters

This section discusses the equations and exposure parameters for each receptor and medium that were used in this assessment to develop RBCs. The human intake factor equations (HIF) provided in the 1992 OU1 BRA and the 1994 OU2 BRA (LSI 1994) were the basis for the screening level equations. Reasonable maximum exposure (RME) values were applied. The acceptable noncancer hazard quotient was set at 1, and acceptable cancer risk level was set at 10^{-4}.

2.3.1 Adult/Child Resident (Soil)

The residential equations combining child and adult exposure were adapted from Page 3-30 of the OU1 BRA, and the parameters were taken from Table 3-4 on Page 3-34 of the OU1 BRA. In addition, assumptions regarding the contribution of soil to indoor dust were incorporated. These assumptions were part of the basis for the original PRGs developed in the OU1 FS and presented in the OU1 ROD. Equations and parameter values are provided in Table 2 for soil.

Table 5 shows relevant chemical-specific information. Consistent with the bioavailability values used to develop OU2 PRGs (CDM 2002), default relative bioavailability (RBA) values of 0.6 for lead and 0.8 for arsenic are used here to calculate OU1 RBCs. The chemical-specific soil-dust relationship values are also provided in Table 5.

2.3.2 Child Park Visitor (Soil, Sediment, Surface Water)

The child park visitor is a young child (0 to 6 years) future resident of OU1 whose parents take him/her to the hypothetical future ecological park. In addition to exposures to soil, the child may be exposed to sediment and surface water along the Jordan River while wading. This scenario was not evaluated in the 1992 OU1 BRA, but was included in the OU2 FFS report (CDM 2002). Equations and parameter values were taken from Appendix A, Attachment 3, of the FFS and are presented in Tables 2 to 4.

Table 5 shows relevant chemical/physical parameters. Consistent with the bioavailability values used to develop OU2 PRGs (CDM 2002), default relative bioavailability (RBA) values of 0.6 for lead and 0.8 for arsenic are used here to calculate OU1 RBCs. Dermal permeability coefficients and absorption fractions were taken from EPA's dermal risk assessment guidance (EPA 2001).

2.4 Toxicity Values

Toxicity values (cancer slope factors [SFs] and reference doses [RfDs]) were taken from EPA's Integrated Risk Information System (IRIS) website (EPA 2004). If values were not available from IRIS, toxicity values were taken from the EPA Region III risk-based concentration tables (October 2003). Toxicity values are provided in Tables 6 and 7.

2.5 Site-Specific RBCs

2.5.1 Site-Specific RBCs for COPCs except Lead

Potential site-specific RBCs for soil, sediment, and surface water based on land use/receptor are provided in Tables 8 through 11, and are summarized in Table 12.

2.5.2 Site-Specific RBCs for Lead

EPA has not published toxicity criteria for lead. This is because available data suggest no threshold for adverse effects, even at exposure levels that might be considered background. Any significant increase above such background exposures could represent a cause for concern. In lieu of evaluating risk using typical intake calculations and toxicity criteria, EPA has developed other methodologies for evaluating lead exposures. One such methodology is the Integrated Exposure Uptake biokinetic (IEUBK) model, a biokinetic computer model used for prediction of blood-lead levels in children exposed to lead from a variety of sources, including soil, dust groundwater air, diet, lead-based paint, and maternal blood. Estimated blood-lead levels are compared to target blood-lead concentrations to assess possible risks. The IEUBK model is intended for use only for children up to the age of seven, as these are the most sensitive receptors to lead exposure and protection for this age group is assumed to protect older individuals. The model assumes daily exposure in a residential setting. Since child residents are the receptors of concern for residential lead exposure, the target risk for lead is based on child blood lead level. The criterion is a blood lead level of 10 micrograms of lead per deciliter of blood (ug/dL) for the 95^{th} percentile blood lead concentration among children having exposures to the specified site soil concentration. This means the likelihood of a child blood lead concentration greater than 10 ug/dL would be 5 percent of less.

Residential Scenario

The IEUBK model (Version 1.0 Build 260, April 2004) was used to estimate a RBC for soil for a 0- to 6-year-old child resident. Default EPA assumptions were used in the model for all inputs other than the soil and associated dust lead concentrations. The default assumptions include the current TRW recommendations for dietary input to the model, which are based on a 2001 Food and Drug Administration total diet study. The soil and dust lead concentrations were adjusted upwards from the default of 200 ug Pb/g until the probability of a child blood lead concentration greater than 10 ug/dL was approximately 5 percent. The ratio of concentration in dust to concentration in soil was maintained at 0.2, based on measured concentrations in soil and dust from Winchester Estates as reported in the OU1 FS. The RBC estimated for lead in soil is 600 ug Pb/g (600 mg/kg) for the residential child. The model predicts this lead concentration in soil would result in approximately 5 percent of the exposed children with blood lead levels greater than 10 ug/dL.

Recreational Scenario

The IEUBK model (Version 1.0 Build 260, April 2004) results for a residential child are used to estimate RBCs for recreational exposures for a 0- to 6-year-old child. The application to the evaluation of recreational scenarios is nonstandard, and there have been no attempts made to validate the model for use in such scenarios. It is possible that the model overestimates exposures in a recreational scenario. Exposure to generally low lead concentrations with intermittent exposure to high concentrations may result in lower "equilibrium" concentrations since time between exposures would allow single higher doses to be either excreted or distributed to liver and/or bone before the next dose was received. The application of the IEUBK model to the recreational scenario can be viewed as a screening level only and not the sole support for any remedial action taken at the site.

A RBC for the child park visitor exposed to lead contaminated soil is calculated using a ratio of residential exposure frequency (365 days per year) to recreational exposure frequency (150 days per year). The RBC for a child park visitor also assumes that there is no relationship between the lead in soil at the park and lead in indoor dust at the child's home (i.e., the default lead concentration in dust from the IEUBK model is used). The resulting RBC for soil based on a recreational exposure is 1,240 ug Pb/g (1,240 mg/kg).

The exposure frequency for the child park visitor exposed to sediments while wading on the banks of the Jordan River is 60 days per year. As discussed previously, this exposure frequency may result in non quasi-steady state blood lead concentrations. The RBC calculated by prorating exposure frequencies is 3,100 ug Pb/g (3,100 mg/kg).

A RBC for the child park visitor exposed to lead contaminated surface water while wading in the Jordan River is calculated using a ratio of residential exposure frequency (365 days per year) to recreational exposure frequency (60 days per year). The RBC for a child park visitor also assumes an incidental ingestion rate of 0.03 liters of surface water per event. The resulting RBC for surface water is 1,034 ug Pb/L (1.03 mg/L).

Section 3
Comparison of RBCs to Maximum Detected Concentrations

Maximum concentrations detected in OU1 soil, sediment, and surface water are screened against the RBCs in Table 13. The data for all media are based on sample results reported in the OU1 BRA. In addition, the reported concentrations for sediment and surface water include more recent data collected in June 2001 from the Jordan River where it borders OU1.

No chemicals in sediment or surface water exceeded their RBCs for recreational scenarios.

Four chemicals detected in surface soil exceeded their RBCs: arsenic, lead, antimony, and vanadium. In the case of antimony and vanadium in soil, only one detected concentration in one parcel (LR-SE) was higher than the RBC. All other detected concentrations throughout OU1 were well below the RBC. For both chemicals, the 95 percent upper confidence limit (UCL) of the mean concentration in LR-SE was also well below the RBC. Therefore, antimony and vanadium are not selected as chemicals of concern.

In the case of arsenic and lead in soil, all four of the middle and southern parcels in OU1 have maximum detected concentrations that exceed the identified RBCs for residential and recreational use. These chemicals had been identified previously in the ROD as being of concern for OU1 and are retained for further analysis (i.e., calculation of PRGs).

The OU1 ROD had also included cadmium as a chemical of concern. However, the detected concentrations do not exceed the RBCs estimated here based on updated residential and recreational exposure assumptions, which do not include homegrown vegetable ingestion.

In summary, as a result of screening OU1 soil, sediment, and surface water data against residential and recreational RBCs, only two chemicals in soil are retained as chemicals of concern for OU1: arsenic and lead. Soil PRGs will be identified for these two chemicals.

Section 4
References

CDM. 2002. Midvale Slag Superfund Site Operable Unit 2, Midvale, Utah, Final Focused Feasibility Study for Groundwater in Operable Unit 2. May.

Life Systems, Inc. 1992. Baseline Risk Assessment - Human Health Evaluation. Midvale Slag Superfund Site, Operable Unit 1, Midvale, Utah. November.

EPA. 1989. Risk Assessment Guidance for Superfund, Volume I: Human Health Evaluation Manual (Part A). EPA/540/1-89/002. December.

____. 1991. Human Health Evaluation Manual, Supplemental Guidance: Standard Default Exposure Factors. OSWER Directive 9285.6-03. March.

____. 2001. Risk Assessment Guidance for Superfund, Volume I: Human Health Evaluation Manual (Part E, Supplemental Guidance for Dermal Risk Assessment) Interim. EPA/540/R/99/005. September.

____. 2004. Integrated Risk Information System (IRIS). http://www.epa.gov/iris/.

List of Tables
Midvale Slag - RBCs for ESD following First 5-Yr Review

TABLE 1

SUMMARY OF OU1 CHEMICALS OF POTENTIAL CONCERN

Midvale Slag Superfund Site - Operable Unit 1 - Midvale, UT

Chemicals	Soil	Sediment	Surface Water
SVOCs			
bis(2-Ethylhexyl)phthalate	Yes	--	--
Butylbenzylphthalate	Yes	--	--
Di-n-butylphthalate	Yes	--	--
Diethylphthalate	Yes	--	--
P/PCBs			
4,4'-DDE	Yes	--	--
4,4'-DDT	Yes	--	--
Heptachlor epoxide	Yes	--	--
INORGs			
Aluminum	Yes	Yes	Yes
Antimony	Yes	Yes	--
Arsenic	Yes	Yes	Yes
Barium	Yes	Yes	Yes
Beryllium	Yes	Yes	Yes
Cadmium	Yes	Yes	Yes
Cobalt	Yes	Yes	--
Cyanide	Yes	Yes	--
Lead	Yes	Yes	Yes
Manganese	Yes	Yes	Yes
Mercury	Yes	Yes	--
Nickel	Yes	Yes	Yes
Silver	Yes	Yes	--
Thallium	Yes	Yes	--
Vanadium	Yes	Yes	Yes

Notes:

COPC = Chemical of Potential Concern.

-- = Not detected in OU1 samples

YES = Detected and selected as COPC

Table 2

VALUES USED FOR INTAKE AND RBC CALCULATIONS - SOIL

Scenario Timeframe:	Future
Medium	Soil
Exposure Medium:	Soil

Exposure Route	Receptor Population	Receptor Age	Exposure Point	Parameter Code	Parameter Definition	RME Value	Units	RME Rationale/ Reference	Equations
Ingestion	Resident	Combined	OU1 Soil	IRa	Ingestion Rate of Soil/Dust - Ages 6-30	100	mg/day	BRA 1992, EPA 1991	Age-adjusted Ingestion Factor (IF)
		child and adult		IRc	Ingestion Rate of Soil/Dust - Ages 0-6	200	mg/day	BRA 1992, EPA 1991	(mg-yr/kg-day) =
		(0-30 yr)		EDa	Exposure Duration - Ages 6-30	24	years	BRA 1992, EPA 1991	(IRc*EDc)/BWc + (IRa*EDa)/BWa
				EDc	Exposure Duration - Ages 0-6	6	years	BRA 1992, EPA 1991	
				BWa	Body Weight - Ages 6-30	70	kg	BRA 1992, EPA 1991	
				BWc	Body Weight - Ages 0-6	15	kg	BRA 1992, EPA 1991	
				IF	Age-adjusted Ingestion Factor	114	mg*yr/kg*day		Intake Factor (kg soil/kg-bw*day) =
				Fs	Fraction of intake that is soil	0.45	unitless	IEUBK default	IF x (Fs + B*Fd) x CF1 x EF x RBA x 1/AT
				Fd	Fraction of intake that is dust	0.55	unitless	IEUBK default	
				B	Fraction of dust that is from soil	See Table 5			
				CF1	Conversion Factor 1	1E-06	kg/mg	--	RBC, cancer (mg/kg) =
				EF	Exposure Frequency	350	days/year	BRA 1992, EPA 1991	Target risk x 1/CSF x 1/Intake factor
				RBA	Relative Bioavailability	See Table 5	unitless	See Table 5	
				AT-C	Averaging Time (Cancer)	25,550	days	BRA 1992, EPA 1989	RBC, noncancer (mg/kg) =
				AT-N	Averaging Time (Noncancer)	10,950	days	BRA 1992, EPA 1989	Target hazard index x RfD x 1/Intake factor
				CSF	Cancer Slope Factor	See Table 7	(mg/kg/day)-1	See Table 7	
				RFD	Reference Dose	See Table 6	mg/kg/day	See Table 6	
					Intake factor, cancer	1.6E-06	kg-soil/kg bw*d		
					Intake factor, noncancer	3.7E-06	kg-soil/kg-bw*d		
	Recreational	Child (0-6 yr)	OU1 Soil - Ecological Park	CF1	Conversion Factor 1	1E-06	kg/mg	--	Intake Factor (kg-soil/kg-bw*day) =
	- Ecological Park			IR-S	Ingestion Rate of Soil	200	mg/day	FFS 2002, EPA 1991	CF1 x IR-S x EF x ED x RBA x 1/BW x 1/AT
	Visitor			EF	Exposure Frequency	150	days/year	FFS 2002	RBC, cancer (mg/kg) =
				ED	Exposure Duration	6	years	FFS 2002, EPA 1991	Target risk x 1/CSF x 1/Intake factor
				RBA	Relative Bioavailability	See Table 5	unitless	See Table 5	RBC, noncancer (mg/kg) =
				BW	Body Weight	15	kg	FFS 2002, EPA 1991	Target hazard index x RfD x 1/Intake factor
				AT-C	Averaging Time (Cancer)	25,550	days	FFS 2002, EPA 1991	
				AT-N	Averaging Time (Noncancer)	2,190	days	FFS 2002, EPA 1991	
				CSF	Cancer Slope Factor	See Table 7	(mg/kg/day)-1	See Table 7	
				RFD	Reference Dose	See Table 6	mg/kg/day	See Table 6	
					Intake factor, cancer	4.7E-07	kg-soil/kg-bw*d		
					Intake factor, noncancer	5.5E-06	kg-soil/kg bw*d		

Sources:

EPA 1989. Risk Assessment Guidance for Superfund. Vol. 1. Human Health Evaluation Manual, Part A. OERR. EPA/540/1-89/002.

EPA 1991. Risk Assessment Guidance for Superfund. Vol. 1. Human Health Evaluation Manual. Supplemental Guidance. Standard Default Exposure Factors. Interim Final. OSWER Directive 9285.6-03.

BRA 1992. Baseline Risk Assessment for the Midvale Slag Superfund Site Operable Unit 1, Midvale, Utah

FFS 2002. Focused Feasibility Study for Groundwater in Operable Unit 2. Midvale Slag Superfund Site, Operable Unit 2, Midvalue, Utah. Appendix A. Attachment 3.

Table 3
VALUES USED FOR INTAKE AND RBC CALCULATIONS - SURFACE WATER

Scenario Timeframe:	Future
Medium:	Surface Water
Exposure Medium:	Surface Water

Exposure Route	Receptor Population	Receptor Age	Exposure Point	Parameter Code	Parameter Definition	RME Value	Units	RME Rationale/ Reference	Equations
	Recreational - Wading	Child (0-6)	River	IR-W	Ingestion Rate of Water	0.03	L/day	FFS 2002	Ingestion Intake Factor (mg*L/(ug*kg*day)) = IF-I =
				EF	Exposure Frequency	60	days/year	FFS 2002	CF1 x IR-W x EF x ED x 1/BW x 1/AT
				ED	Exposure Duration	6	years	FFS 2002	
				BW	Body Weight	15	kg	FFS 2002	
				AT-C	Averaging Time (Cancer)	25,550	days	FFS 2002	
				AT-N	Averaging Time (Noncancer)	2,190	days	FFS 2002	
				CSF	Cancer Slope Factor	See Table 7	(mg/kg/day)-1	See Table 7	
				RFD	Reference Dose	See Table 6	mg/kg/day	See Table 6	
				IFi	Intake factor, cancer	2.82E-05	L/(kg*day)		
				IFi	Intake factor, noncancer	3.29E-04	L/(kg*day)		
Dermal	Recreational - Wading	Child (0-6)	River	SA	Skin Surface Area Available for Contact	8,000	cm^2	FFS 2002 (2)	Dermal Intake Factor (L/(kg*day)) = IF-D =
				PC	Permeability Coefficient	See Table 5	cm/hr	See Table 5	CF1 x SA x PC x CF2 x ET x EF x ED x 1/BW x 1/AT
				CF2	Conversion Factor 2	0.001	L/cm^3	--	
				ET	Exposure Time	1	hr/day	FFS 2002	
				EF	Exposure Frequency	60	days/year	FFS 2002	
				ED	Exposure Duration	6	years	FFS 2002 (1)	
				BW	Body Weight	15	kg	FFS 2002	
				AT-C	Averaging Time (Cancer)	25,550	days	FFS 2002	RBC, cancer (mg/L) =
				AT-N	Averaging Time (Noncancer)	2,190	days	FFS 2002	Target risk x 1/CSF x 1/(IFi+IFd)
				CSF	Cancer Slope Factor	See Table 7	(mg/kg/day)-1	See Table 7	RBC, noncancer (mg/L) =
				RFD	Reference Dose	See Table 6	mg/kg/day	See Table 6	Target hazard index x RfD x 1/(IFi+IFd)
				IFd	Intake factor, cancer	7.51E-03	L/(kg*day)		
				IFd	Intake factor, noncancer	8.77E-02	L/(kg*day)		

RME = Reasonable Maximum Exposure.

Sources:

FFS 2002 Focused Feasibility Study for Groundwater in Operable Unit 2 Midvale Slag Superfund Site, Operable Unit 2, Midvalue, Utah, Appendix A, Attachment 3

Table 4
VALUES USED FOR INTAKE AND RBC CALCULATIONS - SEDIMENT

Scenario Timeframe:	Future
Medium:	Sediment
Exposure Medium:	Sediment

Exposure Route	Receptor Population	Receptor Age	Exposure Point	Parameter Code	Parameter Definition	RME Value	Units	RME Rationale/ Reference	Equations
Ingestion	Recreational - Wading	Child (0-6 yr)	Ecological Park	CF1	Conversion Factor 1	1E-06	kg/mg	--	Ingestion Intake Factor (kg-sed/kg-bw*day) = IFi = CF1 x IR-S x EF x ED x RBA x 1/BW x 1/AT
				IR-S	Ingestion Rate of Sediment	100	mg/day	FFS 2002	
				EF	Exposure Frequency	60	days/year	FFS 2002	
				ED	Exposure Duration	6	years	FFS 2002	
				RBA	Relative Bioavailability	See Table 5	unitless	See Table 5	
				BW	Body Weight	15	kg	FFS 2002, EPA 1991	
				AT-C	Averaging Time (Cancer)	25,550	days	FFS 2002, EPA 1991	
				AT-N	Averaging Time (Noncancer)	2,190	days	FFS 2002, EPA 1991	
				CSF	Cancer Slope Factor	See Table 7	(mg/kg/day)-1	See Table 7	
				RFD	Reference Dose	See Table 6	mg/kg/day	See Table 6	
				IFi	Intake factor, cancer	9.4E-08	kg-sed/kg-bw*d		
				IFi	Intake factor, noncancer	1.1E-06	kg-sed/kg-bw*d		
Dermal	Recreational - Wading	Child (0-6 yr)	Ecological Park	CF1	Conversion Factor 1	1E-06	kg/mg	--	Dermal Intake Factor (kg-sed/kg-bw*day) = IFd = CF1 x SA x AF x ABS x EF x ED x RBA x 1/BW x 1/AT
				SA	Skin Surface Area Available for Contact	3,023	cm^2	FFS 2002	
				AF	Adherence Factor	0.2	mg/cm^2	FFS 2002	
				ABS	Absorption Factor	See Table 5	unitless	See Table 5	
				EF	Exposure Frequency	60	days/year	FFS 2002	
				ED	Exposure Duration	6	years	FFS 2002	
				RBA	Relative Bioavailability	See Table 5	unitless	See Table 5	
				BW	Body Weight	15	kg	FFS 2002, EPA 1991	
				AT-C	Averaging Time (Cancer)	25,550	days	FFS 2002, EPA 1991	RBC, cancer (mg/L) = Target risk x 1/CSF x 1/(IFi+IFd)
				AT-N	Averaging Time (Noncancer)	2,190	days	FFS 2002, EPA 1991	
				CSF	Cancer Slope Factor	See Table 7	(mg/kg/day)-1	See Table 7	RBC, noncancer (mg/L) = Target hazard index x RfD x 1/(IFi+IFd)
				RFD	Reference Dose	See Table 6	mg/kg/day	See Table 6	
				IFd	Intake factor, cancer	5.7E-07	kg-sed/kg-bw*d		
				IFd	Intake factor, noncancer	6.6E-06	kg-sed/kg-bw*d		

Sources:

EPA 1989: Risk Assessment Guidance for Superfund. Vol. 1. Human Health Evaluation Manual, Part A. OERR. EPA/540/1-89/002.
EPA 1991: Risk Assessment Guidance for Superfund. Vol. 1. Human Health Evaluation Manual, Supplemental Guidance. Standard Default Exposure Factors. Interim Final. OSWER Directive 9285.6-03
BRA 1992. Baseline Risk Assessment for the Midvale Slag Superfund Site Operable Unit 1, Midvale, Utah.
FFS 2002. Focused Feasibility Study for Groundwater in Operable Unit 2. Midvale Slag Superfund Site, Operable Unit 2, Midvalue, Utah. Appendix A, Attachment 3

TABLE 5
CHEMICAL-SPECIFIC INFORMATION USED FOR INTAKE AND RBC CALCULATIONS

Chemical of Potential Concern	Relative Bioavailability (1)	Permeability Coefficient (2) (cm/hr) (water)	Dermal Absorption Fraction (2) (sediment)	Fraction of Dust that is from soil (B) (unitless)	Fs + B*Fd
SVOCs					
bis(2-Ethylhexyl)phthalate	1	2.5E-02	0.1	1	1.0E+00
Butylbenzylphthalate	1	NA	0.1	1	1.0E+00
Di-n-butylphthalate	1	2.4E-02	0.1	1	1.0E+00
Diethylphthalate	1	3.9E-03	0.1	1	1.0E+00
P/PCBs					
4,4'-DDD	1	1.8E-01	0.03	1	1.0E+00
4,4'-DDE	1	1.6E-01	0.03	1	1.0E+00
4,4'-DDT	1	2.7E-01	0.03	1	1.0E+00
Heptachlor epoxide	1	NA	NA	1	1.0E+00
INORGs					
Aluminum	1	1E-03	NA	1	1.0E+00
Antimony	1	1E-03	NA	1	1.0E+00
Arsenic	0.8	1E-03	0.03	1	1.0E+00
Barium	1	1E-03	NA	1	1.0E+00
Beryllium	1	1E-03	NA	1	1.0E+00
Cadmium	1	1E-03	0.001	1	1.0E+00
Cobalt	1	4E-04	NA	1	1.0E+00
Cyanide	1	1E-03	NA	1	1.0E+00
Lead	0.6	1E-04	NA	1	1.0E+00
Manganese	1	1E-03	NA	1	1.0E+00
Mercury	1	1E-03	NA	1	1.0E+00
Nickel	1	2E-04	NA	1	1.0E+00
Silver	1	6E-04	NA	1	1.0E+00
Thallium	1	1E-03	NA	1	1.0E+00
Vanadium	1	1E-03	NA	1	1.0E+00

NA = Not available.

(1) Consistent with the PRG calculations for OU2 (FFS 2002), the default bioavailability values of 0.6 for lead and 0.8 for arsenic are used.

(2) Source: EPA. 2001c. Risk Assessment Guidance for Superfund. Part E. Exhibit 3-4 for Dermal Absorption Fraction. Exhibits 3-1 and B-2 for Permeability Coefficients.

TABLE 6
NON-CANCER TOXICITY DATA -- ORAL/DERMAL

Chemical of Potential Concern	*Chronic/* Subchronic	*Oral RfD*		Oral Absorption Efficiency for Dermal (1)	*Absorbed RfD for Dermal (1)*		*Primary* Target Organ(s)	*Combined* Uncertainty/Modifying Factors	*RfD Target Organ(s)*	
		Value	Units		Value	Units			Source(s)	Date(s) (2) (MM/DD/YYYY)
SVOCs										
bis(2 Ethylhexyl)phthalate	Chronic	2.0E-02	mg/kg/day	--	2.0E-02	mg/kg/day	Liver	1000	IRIS	02/17/2004
Butylbenzylphthalate	Chronic	2.0E-01	mg/kg/day	--	2.0E-01	mg/kg/day	Liver	1000	IRIS	02/17/2004
Di-n-butylphthalate	Chronic	1 0E-01	mg/kg/day	--	1.0E-01	mg/kg/day	Whole Body	1000	IRIS	02/17/2004
Diethylphthalate	Chronic	8 0E-01	mg/kg/day	--	8 0E-01	mg/kg/day	Whole Body	1000	IRIS	02/17/2004
P/PCBs										
4,4'-DDD	Chronic	NA	NA	--	NA	NA	NA	NA	EPA Region 3	10/15/2003
4,4'-DDE	NA	NA	NA	--	NA	NA	NA	NA	EPA Region 3	10/15/2003
4,4'-DDT	Chronic	5.0E-04	mg/kg/day	--	5 0E-04	mg/kg-day	Liver	100	IRIS	2/17/2004
Heptachlor epoxide	Chronic	1.3E-05	mg/kg/day	--	1.3E-05	mg/kg-day	Liver	1000	IRIS	2/17/2004
INORGs										
Aluminum	Chronic	1 0E+00	mg/kg/day	--	1 0E+00	mg/kg/day	NA	NA	EPA Region 3	10/15/2003
Antimony	Chronic	4 0E-04	mg/kg/day	15 0%	6.0E-05	mg/kg/day	Whole Body/Blood	1000	IRIS	2/17/2004
Arsenic	Chronic	3 0E-04	mg/kg/day	--	3.0E-04	mg/kg/day	Skin	3	IRIS	2/17/2004
Barium	Chronic	7.0E-02	mg/kg/day	7.0%	4.9E-03	mg/kg/day	Kidney	3	IRIS	2/17/2004
Beryllium	Chronic	2 0E-03	mg/kg/day	0.7%	1.4E-05	mg/kg/day	GI tract	300	IRIS	2/17/2004
(3) Cadmium	Chronic	1.0E-03	mg/kg/day	2 5%	2.5E-05	mg/kg/day	Kidney	10	IRIS	2/17/2004
Cobalt	Chronic	2.0E-02	mg/kg/day	--	2.0E-02	mg/kg/day	NA	NA	EPA Region 3	10/15/2003
Cyanide	Chronic	2.0E-02	mg/kg/day	--	2.0E-02	mg/kg day	Whole Body/Thyroid/CNS	500	IRIS	2/17/2004
Lead	NA	NA	NA	--	NA	NA	NA	NA	IRIS	2/17/2004
(4) Manganese	Chronic	2 0E-02	mg/kg/day	4 0%	8.0E-04	mg/kg/day	CNS	1	IRIS	2/17/2004
(5) Mercury	Chronic	1.0E-04	mg/kg/day	--	1.0E-04	mg/kg/day	NA	NA	IRIS	2/17/2004
(6) Nickel	Chronic	2.0E-02	mg/kg/day	4.0%	8.0E-04	mg/kg/day	Whole Body	300	IRIS	2/17/2004
Silver	Chronic	5.0E-03	mg/kg/day	4.0%	2.0E-04	mg/kg-day	Skin	3	IRIS	2/13/2004
Thallium	Chronic	7.0E-05	mg/kg/day	--	7.0E-05	mg/kg/day	NA	NA	EPA Region 3	10/15/2003
Vanadium	Chronic	3 0E-04	mg/kg/day	2 6%	7.8E-06	mg/kg/day	NA	NA	EPA Region 3	10/15/2003

EPA Region 3 = EPA Region 3 Risk Based Concentration Table, October 2003

IRIS = Integrated Risk Information System

RfD = Reference dose

NA = Not Available

(1) The dermal RfD was assumed to equal the oral RfD, unless an adjustment factor was found in Exhibit 4-1 of EPA 2001b

(2) IRIS values were confirmed against the EPA's online database, February 2004.

(3) IRIS provides two RfDs for cadmium: 5e-4 mg/kg/day for cadmium in drinking water and 1e-3 mg/kg/day for cadmium in food

(4) The RfD of 2e-2 mg/kg/day applies to nondietary exposures, and was calculated from the IRIS RfD of 1 4e-1 mg/kg/day as recommended in IRIS. Dietary exposure (5 mg/day) was subtracted and a modifying factor of 3 was applied.

(5) RfDo value for methyl mercury was used as a surrogate

(6) Based on the IRIS entry for nickel soluble salts

TABLE 7
CANCER TOXICITY DATA -- ORAL/DERMAL

Chemical of Potential Concern	Oral Cancer Slope Factor		Oral Absorption Efficiency for Dermal (1)	Absorbed Cancer Slope Factor for Dermal (1)		Weight of Evidence/ Cancer Guideline Description	Oral CSF	
	Value	Units		Value	Units		Source(s)	Date(s) (2) (MM/DD/YYYY)
SVOCs								
bis(2-Ethylhexyl)phthalate	1.4E-02	(mg/kg/day)-1	--	1.4E-02	(mg/kg/day)-1	B2	IRIS	02/17/2004
Butylbenzylphthalate	NA	NA	--	NA	NA	C	IRIS	02/17/2004
Di-n-butylphthalate	NA	NA	--	NA	NA	D	IRIS	02/17/2004
Diethylphthalate	NA	NA	--	NA	NA	D	IRIS	02/17/2004
P/PCBs								
4,4'-DDD	2.4E-01	(mg/kg/day)-1	--	2.4E-01	(mg/kg/day)-1	B2	IRIS	02/17/2004
4,4'-DDE	3.4E-01	(mg/kg/day)-1	--	3.4E-01	(mg/kg/day)-1	B2	IRIS	02/17/2004
4,4'-DDT	3.4E-01	(mg/kg/day)-1	--	3.4E-01	(mg/kg/day)-1	B2	IRIS	02/17/2004
Heptachlor epoxide	9.1E+00	(mg/kg/day)-1	--	9.1E+00	(mg/kg/day)-1	B2	IRIS	02/17/2004
INORGs								
Aluminum	NA	NA	--	NA	NA	NA	EPA Region 3	10/15/2003
Antimony	NA	NA	--	NA	NA	NA	EPA Region 3	10/15/2003
Arsenic	1.5E+00	(mg/kg/day)-1	--	1.5E+00	(mg/kg/day)-1	A	IRIS	02/17/2004
Barium	NA	NA	--	NA	NA	D	IRIS	02/17/2004
Beryllium	NA	NA	--	NA	NA	B1	IRIS	02/17/2004
(3) Cadmium	NA	NA	--	NA	NA	D	IRIS	02/17/2004
Cobalt	NA	NA	--	NA	NA	NA	EPA Region 3	10/15/2003
Cyanide	NA	NA	--	NA	NA	D	IRIS	02/17/2004
Lead	NA	NA	--	NA	NA	B2	IRIS	02/17/2004
Manganese	NA	NA	--	NA	NA	D	IRIS	02/17/2004
Mercury	NA	NA	--	NA	NA	D	IRIS	02/17/2004
Nickel	NA	NA	--	NA	NA	NA	IRIS	02/17/2004
Silver	NA	NA	--	NA	NA	D	IRIS	02/17/2004
Thallium	NA	NA	--	NA	NA	NA	IRIS	02/17/2004
Vanadium	NA	NA	--	NA	NA	NA	IRIS	02/17/2004

EPA Region 3 = EPA Region 3 Risk Based Concentration Table, October 2003
IRIS = Integrated Risk Information System
CSF = Cancer slope factor
NA = Not Available

(1) The dermal Cancer Slope Factor was assumed to equal the oral Cancer Slope Factor
No adjustment factor was applied
(2) IRIS values were confirmed against the EPA's online database, February 2004
(3) Cadmium is a B1 carcinogen by the inhalation route, but a D carcinogen by the oral route.

EPA Weight of Evidence.
A - Human Carcinogen
B1 - Probable human carcinogen - indicates that limited human data are available.
B2 - Probable human carcinogen - indicates sufficient evidence in animals and inadequate or no evidence in humans.
C - Possible human carcinogen
D - Not classifiable as human carcinogen
E - Evidence of noncarcinogenicity

TABLE 8

RBC FOR SOIL - RESIDENTIAL - ADULT & CHILD (COMBINED)

Midvale Slag Superfund Site - Midvale UT

		RBC Calculations - Cancer					RBC Calculations - Non-Cancer Hazard		
				Target Risk = 1E-4			Target HI = 1		
Exposure Route	Chemical of Potential Concern	Cancer RME Unit Intake Ingestion (mg/kg/day)	Cancer SF (mg/kg/day)-1	Minimum Cancer RBC (mg/kg) 4.5E-05	Exact Cancer RBC (mg/kg) 1.0E-04	Maximum Cancer RBC (mg/kg) 1.5E-04	Noncancer RME Unit Intake (mg/kg/day)	Noncancer RfD (mg/kg/day)	Noncancer RBC (mg/kg)
Incidental Ingestion									
	SVOCs								
	bis(2-Ethylhexyl)phthalate	1.6E-06	1.4E-02	4.3E+03	4.6E+03	6.8E+03	3.7E-06	2.0E-02	5.5E+03
	Butylbenzylphthalate	1.6E-06	NA	--	--	--	3.7E-06	2.0E-01	5.5E+04
	Di-n butylphthalate	1.6E-06	NA	--	--	--	3.7E-06	1.0E-01	2.7E+04
	Diethylphthalate	1.6E-06	NA	--	--	--	3.7E-06	8.0E-01	2.2E+05
	P/PCBs								
	4,4'-DDE	1.6E-06	3.4E-01	1.8E+02	1.9E+02	2.8E+02	3.7E-06	NA	--
	4,4'-DDT	1.6E-06	3.4E-01	1.8E+02	1.9E+02	2.8E+02	3.7E-06	5.0E-04	1.4E+02
	Heptachlor epoxide	1.6E-06	9.1E+00	6.7E+00	7.0E+00	1.1E+01	3.7E-06	1.3E-05	3.6E+00
	INORGs								
	Aluminum	1.6E-06	NA	--	--	--	3.7E-06	1.0E+00	2.7E+05
	Antimony	1.6E-06	NA	--	--	--	3.7E-06	4.0E-04	1.1E+02
	Arsenic	1.3E-06	1.5E+00	5.1E+01	5.3E+01	8.0E+01	2.9E-06	3.0E-04	1.0E+02
	Barium	1.6E-06	NA	--	--	--	3.7E-06	7.0E-02	1.9E+04
	Beryllium	1.6E-06	NA	--	--	--	3.7E-06	2.0E-03	5.5E+02
	Cadmium	1.6E-06	NA	--	--	--	3.7E-06	1.0E-03	2.7E+02
	Cobalt	1.6E-06	NA	--	--	--	3.7E-06	2.0E-02	5.5E+03
	Cyanide	1.6E-06	NA	--	--	--	3.7E-06	2.0E-02	5.5E+03
	Lead	9.4E-07	NA	--	--	--	2.2E-06	NA	--
	Manganese	1.6E-06	NA	--	--	--	3.7E-06	2.0E-02	5.5E+03
	Mercury	1.6E-06	NA	--	--	--	3.7E-06	1.0E-04	2.7E+01
	Nickel	1.6E-06	NA	--	--	--	3.7E-06	2.0E-02	5.5E+03
	Silver	1.6E-06	NA	--	--	--	3.7E-06	5.0E-03	1.4E+03
	Thallium	1.6E-06	NA	--	--	--	3.7E-06	7.0E-05	1.9E+01
	Vanadium	1.6E-06	NA	--	--	--	3.7E-06	3.0E-04	8.2E+01

TABLE 9

RBC FOR SOIL - ECOLOGICAL PARK - CHILD

Midvale Slag Superfund Site - Midvale, UT

Exposure Route	Chemical of Potential Concern	Cancer RME Intake (mg/kg/day)	Cancer SF (mg/kg/day)-1	Minimum Cancer RBC (mg/kg)	Exact Cancer RBC (mg/kg)	Maximum Cancer RBC (mg/kg)	Noncancer RME Intake (mg/kg/day)	Noncancer RfD (mg/kg/day)	Noncancer RBC (mg/kg)
		RBC Calculations - Cancer					RBC Calculations - Non-Cancer Hazard		
				Target Risk = 1E-4			Target HI = 1		
				9.5E-05	1.0E-04	1.5E-04			
Incidental Ingestion	**SVOCs**								
	bis(2-Ethylhexyl)phthalat	4.7E-07	1.4E-02	1.4E+04	1.5E+04	2.3E+04	5.5E-06	2.0E-02	3.7E+03
	Butylbenzylphthalate	4.7E-07	NA	--	--	--	5.5E-06	2.0E-01	3.7E+04
	Di-n-butylphthalate	4.7E-07	NA	--	--	--	5.5E-06	1.0E-01	1.8E+04
	Diethylphthalate	4.7E-07	NA	--	--	--	5.5E-06	8.0E-01	1.5E+05
	P/PCBs								
	4,4'-DDE	4.7E-07	3.4E-01	5.9E+02	6.3E+02	9.4E+02	5.5E-06	NA	--
	4,4'-DDT	4.7E-07	3.4E-01	5.9E+02	6.3E+02	9.4E+02	5.5E-06	5.0E-04	9.1E+01
	Heptachlor epoxide	4.7E-07	9.1E+00	2.2E+01	2.3E+01	3.5E+01	5.5E-06	1.3E-05	2.4E+00
	INORGs								
	Aluminum	4.7E-07	NA	--	--	--	5.5E-06	1.0E+00	1.8E+05
	Antimony	4.7E-07	NA	--	--	--	5.5E-06	4.0E-04	7.3E+01
	Arsenic	3.8E-07	1.5E+00	1.7E+02	1.8E+02	2.7E+02	4.4E-06	3.0E-04	6.8E+01
	Barium	4.7E-07	NA	--	--	--	5.5E-06	7.0E-02	1.3E+04
	Beryllium	4.7E-07	NA	--	--	--	5.5E-06	2.0E-03	3.7E+02
	Cadmium	4.7E-07	NA	--	--	--	5.5E-06	1.0E-03	1.8E+02
	Cobalt	4.7E-07	NA	--	--	--	5.5E-06	2.0E-02	3.7E+03
	Cyanide	4.7E-07	NA	--	--	--	5.5E-06	2.0E-02	3.7E+03
	Lead	2.8E-07	NA	--	--	--	3.3E-06	NA	--
	Manganese	4.7E-07	NA	--	--	--	5.5E-06	2.0E-02	3.7E+03
	Mercury	4.7E-07	NA	--	--	--	5.5E-06	1.0E-04	1.8E+01
	Nickel	4.7E-07	NA	--	--	--	5.5E-06	2.0E-02	3.7E+03
	Silver	4.7E-07	NA	--	--	--	5.5E-06	5.0E-03	9.1E+02
	Thallium	4.7E-07	NA	--	--	--	5.5E-06	7.0E-05	1.3E+01
	Vanadium	4.7E-07	NA	--	--	--	5.5E-06	3.0E-04	5.5E+01

TABLE 10

RBCS FOR SEDIMENT - RECREATIONAL SCENARIO CHILD WADER

Midvale Slag Superfund Site - Midvale, UT

Exposure Route	Chemical of Potential Concern	RBC Calculations - Cancer, Target Risk = 1E-4					RBC Calculations - Non-Cancer Hazard, Target HI = 1		
		Cancer RME Intake (mg/kg/day)	Cancer SF (mg/kg/day)-1	Minimum Cancer RBC (mg/kg)	Exact Cancer RBC (mg/kg)	Maximum Cancer RBC (mg/kg)	Noncancer RME Intake (mg/kg/day)	Noncancer RfD (mg/kg/day)	Noncancer RBC (mg/kg)
	INORGs								
	Aluminum	9.4E-08	NA	--	--	--	1.1E-06	1.0E+00	9.1E+05
	Antimony	9.4E-08	NA	--	--	--	1.1E-06	4.0E-04	3.7E+02
	Arsenic	8.9E-08	1.5E+00	7.1E+02	7.5E+02	1.1E+03	1.0E-06	3.0E-04	2.9E+02
	Barium	9.4E-08	NA	--	--	--	1.1E-06	7.0E-02	6.4E+04
	Beryllium	9.4E-08	NA	--	--	--	1.1E-06	2.0E-03	1.8E+03
	Cadmium	9.5E-08	NA	--	--	--	1.1E-06	1.0E-03	9.1E+02
	Cobalt	9.4E-08	NA	--	--	--	1.1E-06	2.0E-02	1.8E+04
	Cyanide	9.4E-08	NA	--	--	--	1.1E-06	2.0E-02	1.8E+04
	Lead	5.6E-08	NA	--	--	--	6.6E-07	NA	--
	Manganese	9.4E-08	NA	--	--	--	1.1E-06	2.0E-02	1.8E+04
	Mercury	9.4E-08	NA	--	--	--	1.1E-06	1.0E-04	9.1E+01
	Nickel	9.4E-08	NA	--	--	--	1.1E-06	2.0E-02	1.8E+04
	Silver	9.4E-08	NA	--	--	--	1.1E-06	5.0E-03	4.6E+03
	Thallium	9.4E-08	NA	--	--	--	1.1E-06	7.0E-05	6.4E+01
	Vanadium	9.4E-08	NA	--	--	--	1.1E-06	3.0E-04	2.7E+02

TABLE 11
RBCS FOR SURFACE WATER - RECREATIONAL SCENARIO CHILD WADER
Midvale Slag Superfund Site - Midvale, UT

		RBC Calculations - Cancer					RBC Calculations - Non Cancer Hazard		
				Target Risk = 1E-4			Target HI = 1		
Exposure Route	Chemical of Potential Concern	Cancer RME Intake (mg/kg/day)	Cancer SF (mg/kg/day)-1	Minimum Cancer RBC (mg/kg) 9.5E-05	Exact Cancer RBC (mg/kg) 1.0E-04	Maximum Cancer RBC (mg/kg) 1.5E-04	Noncancer RME Intake (mg/kg/day)	Noncancer RfD (mg/kg/day)	Noncancer RBC (mg/kg)
Ing + Dermal	**INORGs**								
	Aluminum	3 6E-05	NA	--	--	--	4 2E-04	1.0E+00	2.4E+03
	Arsenic	3.6E-05	1.5E+00	1.8E+00	1.9E+00	2.8E+00	4 2E-04	3.0E-04	7 2E-01
	Barium	3.6E-05	NA	--	--	--	4 2E-04	7 0E-02	1.7E+02
	Beryllium	3 6E-05	NA	--	--	--	4 2E-04	2 0E-03	4.8E+00
	Cadmium	3.6E-05	NA	--	--	--	4.2E-04	1 0E-03	2.4E+00
	Lead	2.9E-05	NA	--	--	--	3.4E-04	NA	--
	Manganese	3 6E-05	NA	--	--	--	4.2E-04	2.0E-02	4.8E+01
	Nickel	3.0E-05	NA	--	--	--	3.5E-04	2.0E-02	5.8E+01
	Vanadium	3.6E-05	NA	--	--	--	4 2E-04	3.0E-04	7.2E-01

TABLE 12

SUMMARY OF RESIDENTIAL AND RECREATIONAL RBCS FOR OU1

Midvale Slag Superfund Site - Operable Unit 1 - Midvale, UT

Chemicals	Soil (mg/kg)		Sediment (mg/kg)	Surface Water (mg/L)
	Resident	Child Park Visitor	Child Park Visitor - Wading	Child Park Visitor - Wading
SVOCs				
bis(2-Ethylhexyl)phthalate	5475	3650		
Butylbenzylphthalate	54750	36500		
Di-n-butylphthalate	27375	18250		
Diethylphthalate	219000	146000		
P/PCBs				
4,4'-DDE	282	939		
4,4'-DDT	137	91		
Heptachlor epoxide	3.6	2.4		
INORGs				
Aluminum	273750	182500	912500	2401
Antimony	110	73	365	
Arsenic	80	68	290	0.72
Barium	19163	12775	63875	168
Beryllium	548	365	1825	4.8
Cadmium	274	183	907	2.4
Cobalt	5475	3650	18250	
Cyanide	5475	3650	18250	
Lead	600	1240	3100	1.03
Manganese	5475	3650	18250	48
Mercury	27	18	91	
Nickel	5475	3650	18250	58
Silver	1369	913	4563	
Thallium	19	13	64	
Vanadium	82	55	274	0.72

Note: RBCs shown are the minimum of the RBCs for HI = 1 and for cancer risk = 1E-4

TABLE 13

COMPARISON OF MAXIMUM DETECTED CONCENTRATIONS IN OU1 TO RBCS

Midvale Slag Superfund Site - Operable Unit 1 - Midvale, UT

Chemicals	Soil (mg/kg)					Sediment (mg/kg)		Surface Water (mg/L)	
	Lowest Soil RBC (mg/kg)	Maximum Detected in LF Parcel	Maximum Detected in LG Parcel	Maximum Detected in LR - West Parcel	Maximum Detected in LR - SE Parcel	Sediment RBC (mg/kg)	Maximum Detected in Sediment	Lowest Surface Water RBC (mg/L)	Maximum Detected in Surface Water
SVOCs									
bis(2-Ethylhexyl)phthalate	3,650		45						
Butylbenzylphthalate	36,500		0.06						
Di-n-butylphthalate	18,250		0.27						
Diethylphthalate	146,000		0.18						
P/PCBs									
4,4'-DDD	399		ND						
4,4'-DDE	282		0.0058						
4,4'-DDT	91		0.003						
Heptachlor epoxide	2.4		0.003						
INORGs									
Aluminum	182,500	22000	19000	15000	20000	912,500	17000	2401	0.95
Antimony (1)	73	9	38	9.9	1310	365	14		
Arsenic	68	240	860	210	2000	290	180	0.72	0.172
Barium	12,775	300	380	280	710	63,875	340	168	0.093
Beryllium	365	0.96	1.3	0.98	1.7	1,825	1.5	4.8	0.0016
Cadmium	183	18	48	28	120	907	11	2.4	0.0013
Cobalt	3,650	12	7.9	7.3	16	18,250	11		
Cyanide	3,650	ND	0.42	8.2	ND	18,250	3.4		
Lead	600	1000	2600	1300	32000	3,100	1600	1.03	0.18
Manganese	3,650	430	410	530	900	18,250	540	48	0.29
Mercury	18	0.84	2.1	0.66	6.6	91	1.3		
Nickel	3,650	23	23	17	37	18,250	20	58	0.0035
Silver	913	4.6	11	6.5	32	4,563	3.4		
Thallium	13	1.8	2.9	0.61	3.4	64	1.4		
Vanadium (2)	55	36	34	26	85	274	37	0.72	0.014

RBC = Risk-Based Concentration.

Shaded cell = maximum detected concentration exceeds the minimum RBC for that medium.

Blank cell = chemical was not detected in this medium.

(1) For antimony in LR-SE soil, one sample had a concentration of 1,310 mg/kg and may have been misreported. The next highest detected concentration was 31.8 mg/kg and the 95% upper confidence limit (UCL) on the mean for the LR-SE area was 29 mg/kg, both of which are below the RBC of 73 mg/kg.

(2) For vanadium in LR-SE soil, one sample had a concentration of 85 mg/kg. The next highest detected concentration was 46 mg/kg, and the 95% UCL was 30 mg/kg, both of which are below the RBC of 55 mg/kg.

APPENDIX B

MIDVALE CITY ORDINANCE ADOPTED JUNE 19, 2007

Midvale Municipal Code

Chapter 8.10

Institutional Controls Ordinance for Bingham Junction, Jordan Bluffs and Designated Rights-of-Way

8.10.010 Purpose

The Institutional Control Ordinance for Bingham Junction, Jordan Bluffs and designated rights-of-way (the "IC Ordinance" or "Ordinance") sets forth the requirements and procedures for the public Institutional Controls ("ICs") for the redevelopment and reuse of the Bingham Junction and Jordan Bluffs properties, both of which have been or will be fully remediated under the federal Superfund program, also known as CERCLA. Generally speaking, the purpose of the ICs adopted in this Ordinance is to prevent unacceptable human exposure to contaminants that remain onsite by ensuring the protection, maintenance, and improvement of physical barriers that have been or will be placed on the various properties. This Ordinance also addresses contaminated groundwater issues in certain areas.

This Ordinance has been prepared as a mechanism to assure that consistent and effective inspection and maintenance and enforcement activities are occurring and will occur in the future throughout the Bingham Junction and Jordan Bluffs properties.

The ICs in this Ordinance applicable to Bingham Junction are based upon the Institutional Control Process Plans for Operable Unit No. 1 and Operable Unit No. 2 of the Midvale Slag Site and the ICs for Jordan Bluffs are based upon the Institutional Control Process Plan for the Sharon Steel Site.

8.10.020 Scope

Unless otherwise expressly provided, this Ordinance extends to all parts of the Bingham Junction and Jordan Bluffs properties, as depicted in Figure A and Figure B, respectively, of this Ordinance. All development and other construction activities within the boundaries of the Bingham Junction and Jordan Bluffs properties must be performed in accordance with this Ordinance.

8.10.030 Definitions

In the construction of this Chapter, the following words and phrases shall be as defined in this section unless a different meaning is specifically defined elsewhere in this title and clearly applies:

A. "Bingham Junction North" means that portion of the Bingham Junction Property as depicted in Figure C of this Ordinance. Bingham Junction North was originally designated by EPA as "Operable Unit 1" or "OU1."

"Zone A" means that portion of Bingham Junction North for which only groundwater and monitoring well controls are needed, as depicted in Figure D of this Ordinance.

"Zone B" means that portion of Bingham Junction North that has additional soil management requirements, as depicted in Figure E of this Ordinance.

B. "Bingham Junction South" means that portion of the Bingham Junction Property as depicted in Figure F of this Ordinance. Bingham Junction South was originally designated by EPA as "Operable Unit 2" or "OU2."

C. "Calcine Area" means that portion of the Bingham Junction South property as depicted in Figure G of this Ordinance.

D. "Calcine Material" consists of dense, fine-grained, purple-colored material and is located beneath demarcation materials within the Calcine Area. Calcine Material contains relatively high levels of metals and has the potential to generate acidic conditions.

E. "Cap" means that portion of the Jordan Bluffs property where an engineered Cap has been installed over mine wastes.

F. "Cap Area" means that portion of the Jordan Bluffs property where the Cap has been installed over tailings materials and other mine wastes, as depicted in Figure H of this Ordinance.

G. "City" means City of Midvale, Utah.

H. "Clean Fill" means a mixture of uncontaminated nonwater-soluble, nondecomposable, inert solid such as rock, soil or gravel, concrete, glass and/or clay or ceramic products. Clean fill shall not mean processed or unprocessed mixed construction and demolition debris. Material derived from a known source of contamination will not be considered clean fill unless sampled and approved by the City. Parties using clean fill will maintain a record of the source of the fill brought into the area and any sampling conducted on the fill material. This information will be provided to the City, UDEQ or EPA upon request.

H. "Consent Decree" means the Remedial Design/Remedial Action Consent Decree entered in the matter of _United States v. Littleson, Inc.,_ Civ. No. 2:99CV0757 ST (U.S. District Court, Utah, 2004).

I. "CUP" means Conditional Use Permit.

J. "EPA" means the U.S. Environmental Protection Agency.

K. "EPA Action Level" means the level of lead, arsenic or cadmium that can remain safely in the soils. This level varies depending on the use of the property. The allowable levels of lead, arsenic and cadmium for Bingham Junction North and South for residential use are: Arsenic 73 ppm, Cadmium 49 ppm, and lead 650 ppm. The allowable levels of lead and arsenic for Jordan Bluffs East are: Lead 500 ppm and Arsenic 70 ppm.

L. "ICs" or "Institutional Controls" means the land use requirements and restrictions contained in this Ordinance for the safe management of contaminants that may be found in the air, water or soils of Bingham Junction North, Bingham Junction South, and Jordan Bluffs.

M. "Jordan Bluffs West" means the portion of the property formerly known as the Sharon Steel Site that is overlain with an impermeable cap that requires special care, as depicted in Figure H of this Ordinance.

"Jordan Bluffs East" means the former mill area of the property formerly known as the Sharon Steel Site, that does not have an impermeable cap, as depicted in Figure I of this Ordinance.

N. "Materials Management Plan" means a plan submitted to Midvale City with respect to any construction activities at the Site involving potentially contaminated materials and demonstrating that such construction activities will be in compliance with the ICs contained in this Ordinance.

O. "Multi-Family Use" means residential uses that do not include access to a yard that is owned and controlled by the resident, such as apartment complexes, condominiums, and multi-story buildings.

P. "National Ambient Air Quality Standards" means the air quality standards codified at 40 CFR Part 50 and promulgated by EPA pursuant to section 109 of the federal Clean Air Act, 42 U.S.C. 7401 *et seq.*

Q. "Plume Area" means that area within the Bingham Junction South and Bingham Junction North properties as depicted in Figure J of this Ordinance.

R. "POA" means Property Owners Association.

S. "RCRA Subtitle D" means Subchapter IV of the Resource Conservation and Recovery Act, 42 U.S.C. §§ 6941 to 6949a.

T. "RCRA Subtitle D landfill" means a landfill permitted and operated in compliance with RCRA Subchapter IV, including but not limited to landfills permitted and operated in compliance with *Utah Administrative Code* R315-301 to 311.

U. "Rights-of-Way" means the public rights-of-way depicted in Figure K and the portion of 7800 South that runs between Jordan Bluffs and Bingham Junction South.

V. "Riparian Zone" means the area next to the Jordan River that is included in the park property owned by the City of Midvale.

W. "Single Family Use" means residential land uses that include access to a yard that is owned and controlled by the resident, such as traditional single, detached housing units.

X. "Site" means the entire Jordan Bluffs, Bingham Junction North, and Bingham Junction South, and land areas.

Y. "SMP" means the Site Modification Plan relating to the Jordan Bluffs property, dated February 2, 2004.

Z. "Source Area" means that area within the Bingham Junction South property as depicted in Figure L of this Ordinance.

AA. "Special Inspector" means a registered professional engineer with the appropriate experience and knowledge to oversee implementation of applicable sections of this Code. The Special Inspector will certify to the City that the applicable Institutional Controls set for the in this Code have been followed in connection with such construction activities.

BB. "Surface Cover" means clean soil or fill used as a final cover and barrier over slag, smelter wastes and native soils at Bingham Junction South and over native soils and slag at Bingham Junction North.

CC. "UDEQ" means the Utah Department of Environmental Quality.

DD. "Union Pacific Property" means the real property located within the Bingham Junction South property that is owned by Union Pacific Railroad and used only for transportation purposes.

EE. "UTA" means the Utah Transit Authority.

FF. "UTA Property" means the real property located within the Bingham Junction South property that is owned or controlled by UTA and used only for transportation purposes.

GG. "Vapor Mitigation Area" means that area within the Bingham Junction property as depicted in Figure M of this Ordinance.

HH. "Waste Materials" means hazardous substances under Section 101(14) of CERCLA, 42 USC § 9601(14); pollutants or contaminants under Section 101(33) of CERCLA; and solid waste under Section 1004(27) of RCRA, 42 U.S.C. § 6903(27).

8.10.040 Groundwater and Monitoring Wells

A. New groundwater wells are prohibited within the Bingham Junction North (Zone A and Zone B), Bingham Junction South, Jordan Bluffs West, and Jordan Bluffs East properties without the prior consent of EPA, the UDEQ, and the State Engineer.

B. No person shall disturb an existing monitoring well without the prior approval of EPA and UDEQ. New monitoring wells shall be approved by EPA and UDEQ. *A rehabilitation or well replacement plan must accompany any request to* disturb a monitoring well.

8.10.050 Jordan Bluffs West

Sections 8.10.050 through 8.10.080 apply only to the Jordan Bluffs West property unless otherwise specifically provided. The Jordan Bluffs West property includes an engineered Cap covering tailings materials. The purpose of the Cap is to prevent unacceptable exposures to the underlying mine wastes as well as to protect groundwater and surface water. It is important that the integrity of the Cap be maintained through redevelopment and reuse of the property.

8.10.060 Jordan Bluffs West- Covers and Materials Management

A. Site plan approval as required by chapter 17-7-3 and regulated by 17-7-10 of the Midvale City Zoning Ordinance and Title 16, Subdivisions, shall be obtained before initial Site development, future redevelopment or change in land use. Applications shall be made available through the City Community and Economic Development Department. In conjunction with the submittal of the preliminary site plan application, the applicant shall submit documentation that shall include an attestation that the applicant is aware of the current Site condition and will comply with all Institutional Controls. All applicants must retain, at their sole cost, a Special Inspector as defined in Paragraph AA of this Ordinance. Applicant submittals and requirements under the site plan approval process are summarized in this section, which are in addition to and in conjunction with the requirements identified in 17-7-3 and 17-7-10 of the Midvale City Zoning Ordinance.

(1) Applicant shall submit a plan illustrating the proposed construction and development. Preliminary and final site plans for development shall be submitted for review and approval. Preliminary and final development plans shall specify the amount of existing and proposed soil cover over the Cap as well as any proposed penetrations or alterations of the Cap. Any proposal which includes penetrations or alterations of the Cap must include detailed plans for repairing the Cap in accordance with the SMP.

(2) Grading and drainage plans are required and shall specifically assure the protection of soil covers from erosion over the Cap membranes and provide adequate drainage to prevent accumulation of water on the Cap.

(3) Alterations to the existing Operations and Maintenance plan may be proposed by the applicant, the City or other party. EPA and UDEQ shall consider alterations to assure the proposed development site will be maintained in a manner which shall preserve the effectiveness of the Cap.

(4) An air quality monitoring and dust suppression plan shall be provided. The plan must ensure that National Ambient Air Quality Standards and state and local air quality requirements are met for site contaminants at the boundary between the construction area and the developed areas. Applicant may request a waiver of the air monitoring requirements by submitting relevant data demonstrating compliance with all air quality standards under similar circumstances (similar weather conditions, construction operations, site materials, etc.).

B. If any intrusive exploratory activities (such as excavations, borings, CPT soundings) or foundations (including piles or drilled shafts) are proposed for the Cap Area at depths that penetrate the Cap, approval must first be obtained from the City. The request for approval must include a detailed description of the proposed exploration or construction activity as well as the mechanism(s) that will be used to prevent contamination of the aquifer and release of contaminated material. In addition, the plan shall be in conformance with the accepted SMP. The request must be approved by the City of Midvale prior to implementation of the work.

C. A road cut permit shall be required for any work in the public right-of-way, per ordinance 12.12 of the Midvale City Municipal Code.

D. All property within the Jordan Bluffs West property will be included within one or more Property Owner's Association(s) ("POA"). The POA will be established by the owner or authorized representative prior to subdivision plat approval for the Jordan Bluffs property. Membership in any and all POAs is a condition of development on the Jordan Bluffs property. The POA shall be responsible for maintenance and repair of the Cap (including soil covers) beneath property within its boundaries. The City shall make necessary repairs to covers and barriers if the landowner or POA fails to do so in a timely or appropriate manner. In that event, the City shall have the right to recover its costs from the landowner or POA. The City shall also have the right, in its sole discretion, to charge the landowner a surcharge for the costs of the City's work related to the property, in an amount established by ordinance.

E. Reasonable efforts must be used to minimize penetration of the Cap. Excess soil or tailings generated from underneath the Cap either during development or after development will be managed in accordance with the accepted SMP.

8.10.070 Jordan Bluffs West - Water Management

A. In order to reduce the risk of future groundwater contamination, the integrity of the Cap will be maintained as provided in Section 1-01-160, no utilities will be located beneath the Cap, and all surface water management (including storm water management during construction) will be in compliance with the SMP.

8.10.080 Jordan Bluffs West- Construction, Development, and Excavations After Initial Development

Development within the Jordan Bluffs West property may require the placement of additional soils above the existing Cap as outlined in the SMP. With respect to any and all developed areas within the Cap Area after initial development, the POA shall oversee the landscaping and maintenance of all landscaped areas. A range of controls may be included within the responsibilities of the POA. At a minimum the controls shall include: For areas with less than three (3) feet of cover soil over the cap, the POA shall take responsibility for any and all landscape installation and maintenance. For areas with greater than three (3) feet thickness of soil covers, the POA may allow individual property owners to install and maintain landscaping insofar as regrading of the property does not occur. All landscape plans on individual properties shall be reviewed and approved by the POA to ensure adequate soil covers, appropriate irrigation, and approved planting plans. All plants must be on the approved list contained in the SMP.

8.10.090 Bingham Junction South

Sections 8.10.090 through 8.10.130 apply only to the Bingham Junction South property unless otherwise specifically provided. The Bingham Junction South property includes a Surface Cover underlain by a demarcation layer consisting either of slag material (minimum 24 inches) or a brightly-colored geotextile material. It is presumed that materials located beneath the demarcation layer exceed the remediation goals established by EPA for the property; however, this presumption may be rebutted as provided herein.

8.10.100 Bingham Junction South - Covers and Materials Management

A. <u>Surface Cover Maintenance.</u> The individual landowners are responsible for maintenance and repair of Surface Covers on their property. The City shall have the right to make necessary repairs to Surface Covers if the landowner fails to do so in a timely or appropriate manner. In that event, the City shall have the right to recover its costs from the landowner. The City shall also have the right, in its sole discretion, to charge the landowner for the costs of the City's work related to the property, in an amount established by ordinance. This right to impose these costs does not apply to the Union Pacific Property or UTA Property.

B. <u>Storage of Surface Covers, Slag Materials.</u> Subject to Subsection I of this section, materials excavated from beneath final Surface Covers must be segregated in a reasonable fashion from such Surface Cover materials. Where present, slag materials must also be segregated from materials underlying the slag. Storage of slag materials must also limit or prevent human and environmental exposure (*e.g.* limited access, dust suppression, etc.). Storage and management of excavated materials must be described in reasonable detail and performed in accordance with the Materials Management Plan discussed in subsection G.

C. <u>Storage of Materials from Below Demarcation Layer.</u> Subject to Subsection I, materials excavated from below the demarcation layer may be stored on plastic and covered with plastic or cloth tarp for a single 8-hour work shift. Storage for up to 24 hours adjacent to the work area is permitted if the storage area is secured by temporary fencing. Storage beyond 24 hours must be in roll- off bins with secured tops or equivalent. In lieu of the foregoing specific management requirements for materials excavated from beneath the demarcation layer, it will be sufficient for a contractor to comply with applicable OSHA worker health and safety laws, rules, and regulations pertaining to such materials. Storage and management of excavated materials must be described in reasonable detail and performed in accordance with the Materials Management Plan discussed in subsection G.

D. Replacement of Excavated Materials. Subject to Subsection I, reasonable efforts should be used to return excavated materials to the original excavation. If excavated materials are returned to the excavation, any materials beneath the demarcation layer must be placed first, with the demarcation layer being replaced to the excavation and compacted as appropriate, followed by restoration of an appropriate Surface Cover. To the extent practicable, any new demarcation layers must tie into existing demarcation layers prior to the placement of Surface Covers. If the demarcation layer consists of slag, the minimum thickness must be 24-inches; otherwise a brightly-colored geotextile fabric must be used. Worn or damaged geotextile demarcation material in an excavated area must be replaced with new material. Any left over waste material must be managed in accordance with this Section (8.10.100).

E. Relocation of Excavated Materials. Reasonable efforts should be used to appropriately re-distribute excess materials excavated from beneath final Surface Covers within the area of excavation, in accordance with the requirements of this Section. However, except for Calcine Material, excess excavation materials may also be relocated to any area within the Bingham Junction South property. Calcine Materials may be relocated only in areas that are within the Calcine Area, without further approval from EPA and UDEQ. In connection with the relocation of such excess excavation materials, a demarcation layer consisting of a minimum 24-inch layer of slag or other appropriate demarcation material shall be placed on top of any relocated materials, followed by an appropriate Surface Cover. Worn or damaged geotextile demarcation material must be replaced with new material. Any new demarcation layers shall, to the extent practicable, tie into existing demarcation layers prior to placement of Surface Covers. Compaction requirements from the City of Midvale must be satisfied. If the Surface Cover consists of a vegetated soil cover, the minimum depth must be 18-inches (24-inches for residential use) and the area must be re-seeded and vegetation re-established. Relocation of materials to undeveloped areas of Bingham Junction South must not result in slopes exceeding the maximum slope established in the Remedial Design for Bingham Junction South or otherwise adversely affect storm water management systems.

F. Off-Site Disposal. Subject to Subsection I, any soils or other materials from beneath the demarcation layer, that must be disposed off-site must be disposed in a permitted landfill. Wastes must be characterized in accordance with the requirements of the permitted disposal facility and disposed of in accordance with applicable federal and state hazardous and solid waste laws. Off-site disposal of Waste Material in excess of 10 cubic yards must also comply with Paragraph 13 of the Consent Decree.

Excess slag materials may also be beneficially re-used off-site as engineered fill as well as aggregate in concrete. Any beneficial reuse shall be explained in the Materials Management Plan.

G. Environmental Plans and Approvals. Site plan approval as defined and required by chapter 17-7-3 and regulated by 17-7-9 of the Midvale City Zoning Ordinance shall be obtained before initial site development, future redevelopment or change in land use. Environmental Plan applications shall be made available through the City Community and Economic Development Department. In the application, the applicant shall disclose the presence of hazardous substances on the Site and identify the type and location of reports pertaining to the location and type of hazardous substances on the Site. In conjunction with the submittal of the preliminary site plan application, the applicant shall submit, to the City Community and Economic Development Department, documentation that shall include an attestation that the applicant is aware of the current Site condition and will comply with all Institutional Controls. Applicant submittals and requirements under this section are summarized in this section, which are in addition to and in conjunction with the requirements identified in 17-7-3 and 17-7-9 of the Midvale City Zoning Ordinance:

(1) Development and Final Cover Plans. Applicant shall submit a plan illustrating the proposed construction and development. Final cover plans for the development shall be submitted for review and approval. Preliminary and final cover plans must designate the type and location of final covers.

(2) Materials Management Plan. A materials management plan must be provided with respect to any construction activities that involve the management of potentially contaminated materials (*e.g.*, slag or underlying materials). The materials management plan must demonstrate that all such construction activities will be in compliance with this Ordinance. All applicants must retain, at their sole cost, a Special Inspector as defined in Paragraph AA of this Ordinance.

(3) Dust Suppression and Monitoring Plan. An air quality monitoring and dust suppression plan shall be provided with respect to any construction activities that involve the management of potentially contaminated materials (*e.g.*, slag or underlying materials). The plan will ensure that National Ambient Air Quality Standards are met for site contaminants at the boundary between the construction area and the developed areas in addition to State or local air quality requirements. Applicant may request a waiver of the air monitoring requirements by submitting relevant data demonstrating compliance with all air quality standards under similar circumstances (similar weather conditions, construction operations, site materials).

(4) Surface Cover Drainage Plans. Surface Cover drainage plans will be required and shall specifically demonstrate the protection of Surface Covers from erosion and ensure that drainage patterns are appropriate and consistent with the ICs for the groundwater remedy adopted by EPA.

(5) Monitoring and Maintenance. A proposed monitoring and maintenance plan must be provided by applicant to ensure that all Surface Covers on the proposed development site will be maintained in accordance with this Code.

(6) Road Cut Permit. A road cut permit shall be required for any work in the public right-of-way that breaches final site covers, per ordinance 12.12 of the Midvale City Municipal Code.

H. Intrusive Activity Plan. If any intrusive exploratory activities (such as excavations, borings, CPT soundings) or foundations (such as piles or drilled shafts) are proposed for the Source or Plume Areas (as depicted in Figures L and J) at depths greater than 20 feet, plan approval must first be obtained from the City of Midvale. The plan must include a detailed description of the proposed exploration or construction activity as well as the mechanism(s) that will be used to prevent cross contamination between the two aquifers. The plan must be approved by the City of Midvale prior to implementation of the work.

I. Procedures for Testing Materials. Excavated materials, soils, slag, and other materials excavated from beneath the final covers, barriers, and demarcation layers shall not be subject to the materials management provisions of 1-01-200.B., C., and E. of this Ordinance, for use within the Bingham Junction or Jordan Bluffs areas, if the results of voluntary testing of a representative sample of such materials are at or below the EPA Action Level applicable to Bingham Junction South. Material testing below EPA's Action Level for Bingham Junction South, but above EPA's 400 ppm screening level for lead, shall not be considered clean fill for uses outside the Bingham Junction or Jordan Bluffs area from which it was excavated, without prior approval of the City, UDEQ and EPA. Procedures and protocols for testing of such excavated materials shall be approved in advance by the City, UDEQ, and EPA on a case-by-case basis.

J. Notice to Contractors. Contractors performing earthwork within the Bingham Junction South property will be informed of the presence of contamination and informed of applicable EPA documents. Contractors will be required to comply with applicable environmental laws and regulations, including OSHA.

8.10.110 Bingham Junction South - Water Management

The shallow aquifer beneath a portion of the Bingham Junction property is contaminated, primarily with arsenic, as well as other substances. The Source Area as depicted in Figure L contains significant amounts of arsenic that impacts groundwater. Water management on portions of the Bingham Junction property will also focus on preventing new sources of water from affecting the extent, direction, and flow of the arsenic plume within the Source and Plume Areas.

A. Source and Plume Area Definition - Subdivision. The Source and Plume Areas depicted in Figures L and J are merely illustrative. At the time that Subdivision (as defined by the Midvale City Code) occurs on any property within a Source or Plume Area, the boundaries of these areas will be specifically noted by the developer on the small scale master plan, subdivision plat, and/or other permanent record maintained by Midvale City for purposes of compliance.

B. Unlined Storm Water Detention Basins. Unlined storm water detention basins are prohibited within the boundaries of or within 100 feet of a Source or Plume Area. Liners of detention basins must be impervious as determined and approved by the City (detention basins will be shown on construction plans relative to source area boundaries and will be included in site plan applications).

C. Wet Utilities and Irrigated Areas.

(1) Slag Bedding Prohibited. Wet utilities may not be bedded in slag material. However, slag material may be used as backfill for wet utilities, above the pipe zone, as per APWA standards.

(2) Flowfill or Equivalent Bedding. All wet utilities traversing a Source or Plume Area must be bedded with flowable concrete (flowfill), "welded" HDPE pipe, or equivalent engineering solution acceptable to the City. (Wet utility locations must be shown on construction plans relative to source area boundaries and will be included in site plan applications.)

(3) Collars or Equivalent. Low-permeability collars (or equivalent engineering controls acceptable to the City) will be required for all wet utilities within 100-feet of the Source Area or Plume Area and that traverse a Source Area or Plume Area somewhere along the utility alignment. If used, collars will be installed at 50-foot intervals. Collar designs or other equivalent engineering control design will be submitted with the construction permit and site plan application.

(4) Surface Irrigation Restrictions. Within Source Areas, developers must provide a mechanism to limit infiltration of irrigation water. Minimum measures for Source Areas may include installing a buried impermeable barrier with drain system conveying excess water to the storm drain system beneath irrigated areas (or alternative with equivalent performance as accepted by the City). Large shrubs or trees may be placed in sealed planter boxes *(the location of irrigated areas and piping will be shown on construction plans relative to source areas and will be included in site plan applications).*

(5) Irrigation Plans. For non-residential development within Source Areas, all building permit applicants will be required to submit to the City an irrigation plan in order to implement the requirements in 8.10.110.C(4) above. The City will have the responsibility of approving and overseeing the implementation of the irrigation plan.

(6) POAs. For residential development within Source Areas, Property Owners' Associations will have the responsibility of reviewing, approving, and overseeing the implementation of irrigation plans.

D. Concrete Rubble. Concrete rubble may not be used as fill material below the historic high water table within 100-feet of a Source or Plume Area.

E. Construction De-watering. Disposal of contaminated construction wastewater must be done in accordance with applicable environmental regulations *(to be included in site plan application).*

8.10.120 Vapor Mitigation at Bingham Junction North and South

Unless risks posed by vapors from chlorinated organic contaminants (i.e. PCE) are demonstrated to be below a level of concern to the satisfaction of Region 8 EPA, for residential buildings within the area depicted in the Vapor Mitigation Area, appropriate vapor mitigation measures will be implemented. Appropriate measures may include passive mitigation installed in connection with initial building construction or other periodic vapor monitoring and mitigation if required in the future.

8.10.130 Bingham Junction South - Single Family Use Development

A. Scope. The following controls have been developed to permit Single Family Use development on the Bingham Junction South property. The clean fill barrier portion of the materials must be at least 24 inches for Single Family Use. Additional cover material may also be installed. This Section does not apply to the Union Pacific or UTA Property or to Multi-Family Use property.

B. New Single Family Use Developments. As part of the City's Small Area Master Plan process, developments including Single Family Use will be subject to the following additional requirements:

(1) CUP Approved Depth. At the time that the CUP for the Small Scale Master Plan is granted for areas designated for Single Family Use, the City will identify the depth of clean fill for the specific Single Family Use development area ("CUP Approved Depth"). The CUP Approved Depth will be a uniform depth of fill number equal to the most shallow fill area located within the relevant development area.

(2) Grading Plans. Grading plans must demonstrate that the depth of clean fill for Single Family Use development will be equal to or greater than the CUP Approved Depth upon completion of initial home construction.

(3) Irrigation Plans - Source Areas. For any Single Family Use development within a Source Area, an Irrigation Plan must be submitted to the City that demonstrates that all surface irrigation activities will be in compliance with the requirements of Section 8.10.110(C)(4).

(4) POAs. Conditions, Covenants and Restrictions to be filed with the Subdivision Plat which include the creation of a Property Owners Association in order to oversee compliance with applicable excavation and grading restrictions as identified in Section 1-01-200. For residential development within Source Areas, Property Owners' Associations will have the responsibility of reviewing, approving, and overseeing the implementation of irrigation plans for residential areas as required by section 8.10.110.

(5) Materials and Water Management. In Single Family Use developments, the requirements set forth in Sections 8.10.100 and 8.10.110 of this Code will apply to all activities leading up to and including initial home construction, including placement of clean fill, lot grading, and landscaping to the extent completed prior to the issuance of a Certificate of Occupancy.

(6) Certificate of Occupancy. In order to receive a Certificate of Occupancy for a Single Family Use dwelling, the developer or owner must demonstrate to the City that the final depth of Surface Cover meets or exceeds the CUP Approved Depth.

C. Activities Subject to Building Permit After Initial Home Construction.

(1) For all activities after initial home construction that require a building permit which involve excavations exceeding the CUP Approved Depth, a materials management plan will be required as part of the Midvale City Building Permit and Inspection process. The City will oversee implementation of the materials management plan. All building permit applicants requiring a materials management plan must retain, at their sole cost, a Special Inspector as defined in Paragraph AA of this Ordinance. Prior to issuance of a Certificate of Occupancy by the Midvale City Building Official, the owner or developer will submit a certification that final depth of Surface Cover meets or exceeds the CUP Approved Depth.

(2) Subject to Section 8.10.100(I), all materials from excavations deeper than the demarcation layer (including slag materials) will be segregated to prevent mixing with the Surface Cover soils and will be managed, and demarcation materials and Surface Covers replaced, in accordance with Section 8.10.100.

D. Activities Not Subject to Building Permits After Initial Home Construction

(1) In Single Family Use areas where the CUP Approved Depth is equal to or greater than four feet it is not expected that individual homeowners will engage in non-permitted excavation activities that will exceed the depth of the Surface Cover material. However, homeowners will be required to manage materials excavated from beneath demarcation layers, including slag materials, as provided in section 8.10.100. However, no additional institutional controls will apply to excavation activities not otherwise subject to building permits in these areas.

(2) In residential areas subject to institutional controls where the CUP Approved Depth is less than four feet, the following institutional controls will apply to certain activities that do not otherwise require a building permit:

(a) All property owners must submit a landscape and, if applicable, grading plan to the POA prior to beginning any landscaping or grading activities. The POA shall ensure that the CUP Approved Depth is maintained and preserved through the landscaping process.

(b) All grading activities which result in a final area with less than the CUP Approved Depth are prohibited. Importation of clean fill will be required to achieve desired landscaping elevations.

8.10.140 Bingham Junction North Zone B and Jordan Bluffs East

This Section applies only to the Bingham Junction North Zone B and Jordan Bluffs East property unless otherwise specifically provided. The Bingham Junction North Zone B and Jordan Bluffs East properties include a native surface layer that may contain some contaminants above EPA Action Levels for Single Family Use, overlain by varying thicknesses of Surface Cover. Unlike the Bingham Junction South property, there is no readily-identifiable demarcation layer between the Surface Cover and the native soil surface. Limited amounts of slag may also be encountered within the Bingham Junction North Zone B property.

8.10.150 Bingham Junction North Zone B, Jordan Bluffs East, Riparian Zone and Rights-of-Way Areas - Materials Management

A. Off-Site Disposal. All excess excavated soils in excess of five cubic yards, not otherwise relocated within the Bingham Junction North property, that the landowner or developer elects to haul off-Site for disposal, must be disposed of in a RCRA Subtitle D landfill unless the excavated soils are demonstrated to satisfy applicable EPA Action Levels. Wastes must be characterized in accordance with the requirements of the permitted disposal facility and disposed of in accordance with applicable federal and state hazardous and solid waste laws. Excavated soils of five cubic yards or less require no additional precautions.

B. Slag Materials. Slag visible at the surface either prior to or after site grading will be excavated and handled by one of the following methods: (i) placed under roadways constructed in City rights-of-way, in parking lots, or in similar areas; (ii) covered with a minimum of 2-feet of Surface Cover; or (iii) disposed in a RCRA Subtitle D landfill.

C. Procedures for Testing Materials. Excess excavated materials, soils, slag, and other materials shall not be subject to this materials management provision if the results of voluntary testing of a representative sample of such materials are at or below the applicable EPA Action Levels.

D. Notice to Contractors. Contractors performing earthwork within the Bingham Junction North property will be informed of the presence of contamination and informed of applicable EPA documents. Contractors will be required to comply with applicable environmental laws and regulations, including OSHA.

8.10.160 Bingham Junction North Zone B and Jordan Bluffs East - Single Family Use Development

A. Scope. The following controls have been developed to permit Single Family Use development on the Bingham Junction North Zone B and Jordan Bluffs East property in areas where EPA has determined that the original native soil layer may contain contaminants at levels exceeding EPA Action Levels. These areas are depicted in the document included here as Figure E. In such areas, a Surface Cover of at least 24 inches must be in place for Single Family Use and the following Institutional Controls will apply. Additional Surface Cover may also be installed, or unrestricted future use may be achieved by performing a sampling a removal process similar to that approved by EPA and UDEQ previously in Bingham Junction North. Any plan to achieve unrestricted future use must be approved and overseen by UDEQ and EPA.

B. New Single Family Use Developments. As part of the City's Small Area Master Plan process, developments including Single Family Use will be subject to the following additional requirements:

(1) CUP Approved Depth. At the time that the CUP for the Small Scale Master Plan is granted, the City will identify the depth of Surface Cover for the specific development ("CUP Approved Depth"). The CUP Approved Depth will be a uniform depth of Surface Cover equal to the most shallow Surface Cover area located within the relevant development area. Grading plans will indicate the depth of Surface Cover on residential and recreational lots.

(2) CC&Rs. Conditions, Covenants and Restrictions to be filed with the Subdivision Plat which include the creation of a Property Owners Association and non-building permit excavation and grading restrictions (applicable to periods after initial home construction) as identified in section 8.10.150 and subsection 4 of this section.

(3) New Home Construction. The following additional Institutional Controls will apply to all Single Family Use construction in areas of the Bingham Junction North Zone B and Jordan Bluffs East property where EPA has determined that the native soils may contain contaminants exceeding applicable EPA cleanup levels:

(a) Special Inspector. All building permit applicants for construction of a Single Family Use residential unit must retain, at their sole cost, a special inspector as defined in Paragraph AA of this Ordinance. Prior to issuance of a Certificate of Occupancy by the Midvale City Building Official, the Special Inspector will submit a certification that final Surface Cover depth meets or exceeds the CUP Approved Depth.

(b) Materials Management. All materials from excavations deeper than the CUP Approved Depth ("Restricted Materials") shall be subject to a Materials Management Plan. All materials will be segregated to prevent mixing with the Surface Cover; except that any excavated materials that the special inspector certifies do not contain contaminants at levels above EPA Action Levels will not be considered "Restricted Materials." All Restricted Materials will be (i) placed back in the excavation (where feasible) at or below the applicable depth, compacted as appropriate, and the Surface Cover replaced at an elevation not less than the original CUP Approved Depth;

(ii) relocated to areas within the Bingham Junction North Property intended for uses other than residential; or (iii) disposed of in a RCRA Subtitle D landfill.

(4) Excavation Activities Requiring Building Permit After Initial Home Construction. For all activities after initial home construction that require a building permit and involve excavations below the CUP Approved Depth, a materials management plan and a Special Inspector will be required as part of the Midvale City Building Permit and Inspection process. The Special Inspector will oversee implementation of the materials management plan.

(a) Special Inspector. All building permit applicants for construction work within residential areas will be required to retain, at their sole cost, a special inspector as defined in Paragraph AA of this Ordinance. The special inspector will certify to the City that the applicable Institutional Controls set forth in this Code (as then applicable to such property and activity) have been followed in connection with such construction activities.

(b) Materials Management. All materials from excavations deeper than the CUP Approved Depth ("Restricted Materials") will be segregated to prevent mixing with the Surface Cover; except that any excavated materials that the special inspector certifies do not contain contaminants at levels above EPA Action Levels will not be considered "Restricted Materials." All Restricted Materials will be (i) placed back in the excavation (where feasible) at or below the applicable depth, compacted as appropriate, and the Surface Cover replaced at an elevation not less than the original CUP Approved Depth; (ii) relocated to areas within the Bingham Junction North Property intended for uses other than residential; or (iii) disposed of in a RCRA Subtitle D landfill.

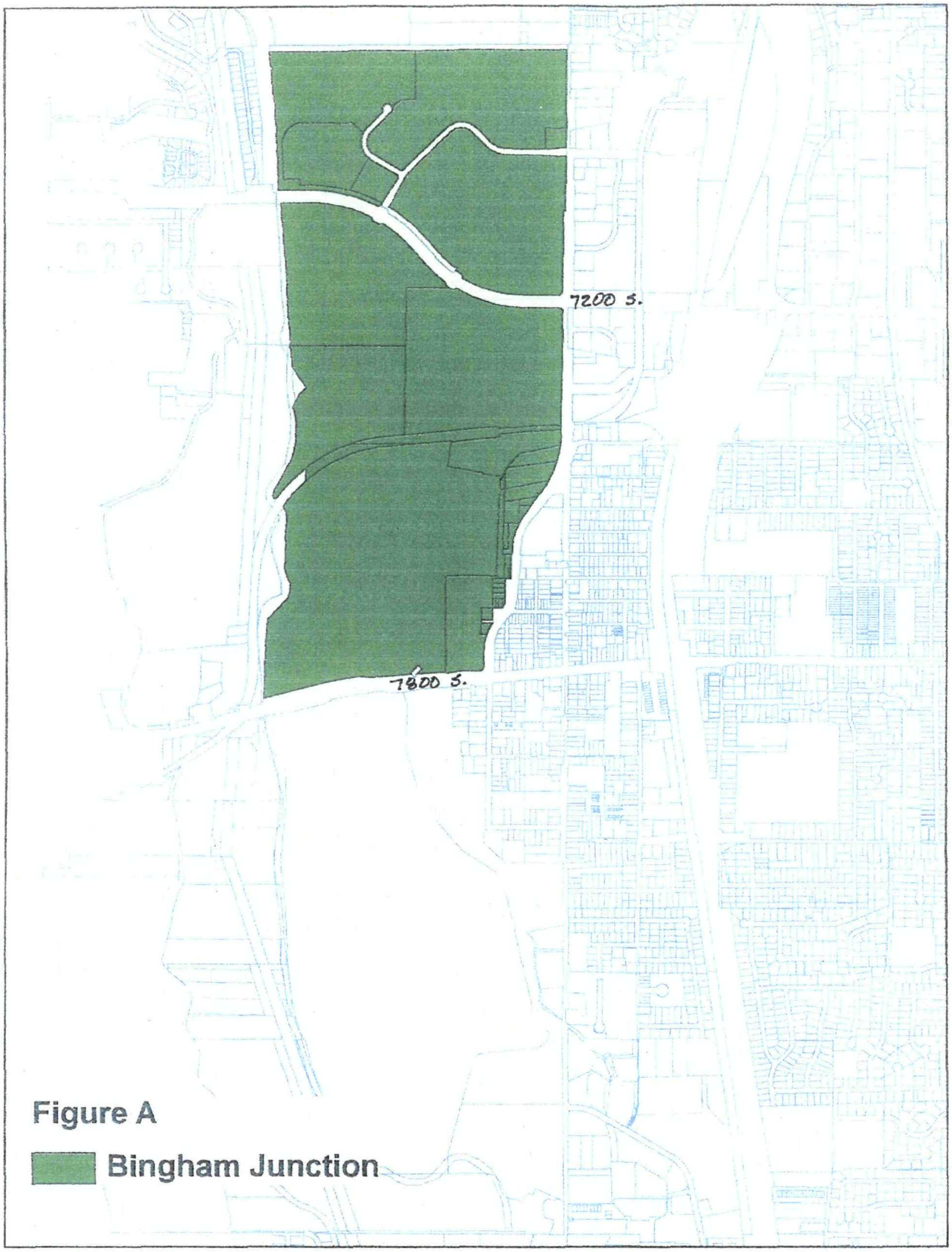
(5) Activities Not Subject to Building Permit Requirement.

(a) In Single Family Use areas subject to this section, where the CUP Approved Depth is equal to or greater than four feet, no additional institutional controls will apply with respect to excavations not otherwise subject to building permits.

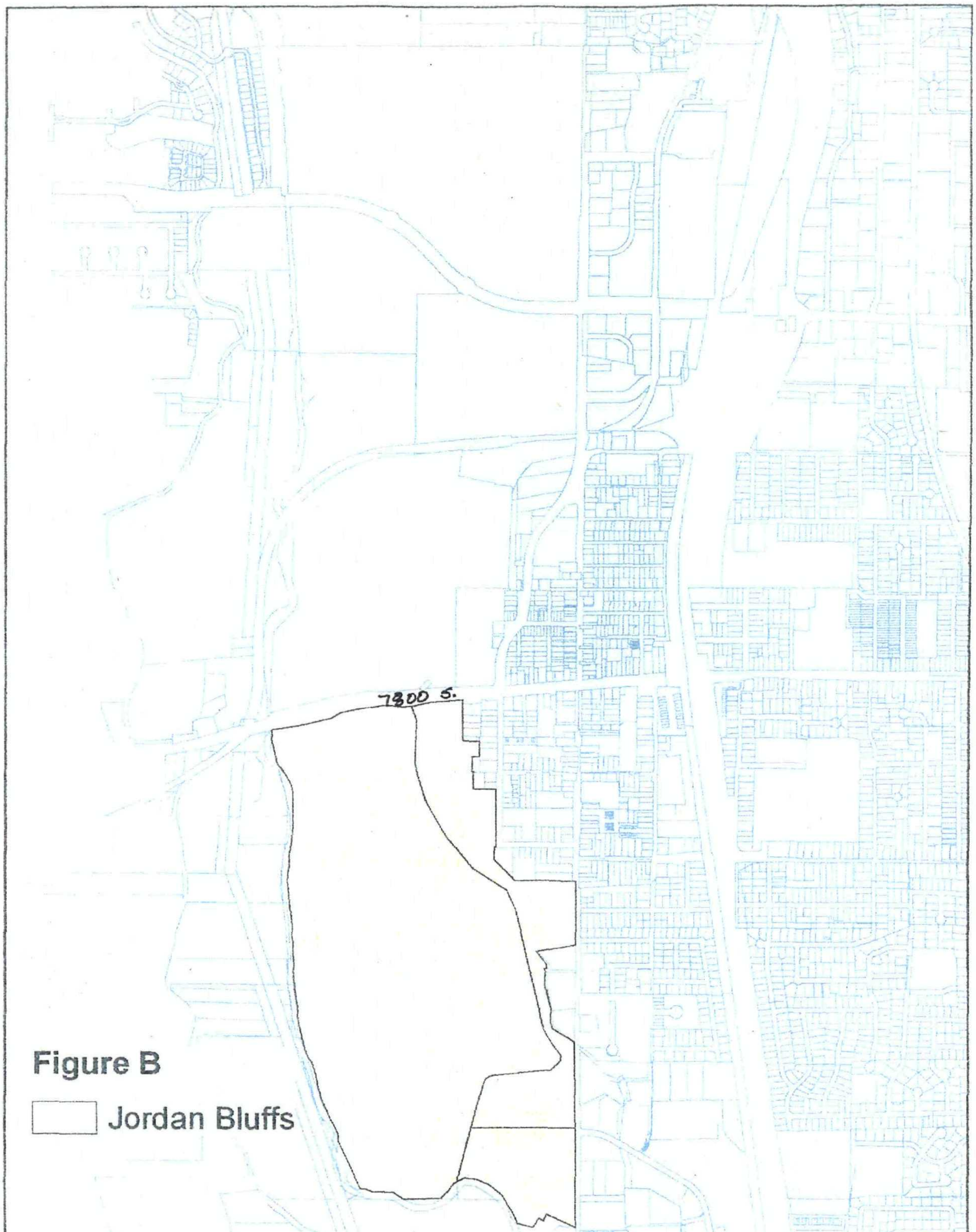
(b) In Single Family Use areas subject to this section, where the CUP Approved Depth is less than four feet, the following additional controls will apply to excavations exceeding the CUP Approved Depth where no building permit is otherwise required:

(i) All property owners must submit a landscape and, if applicable, grading plan to the POA prior to beginning any landscaping or grading activities. The POA shall ensure that the CUP Approved Depth is maintained and preserved through the landscaping process.

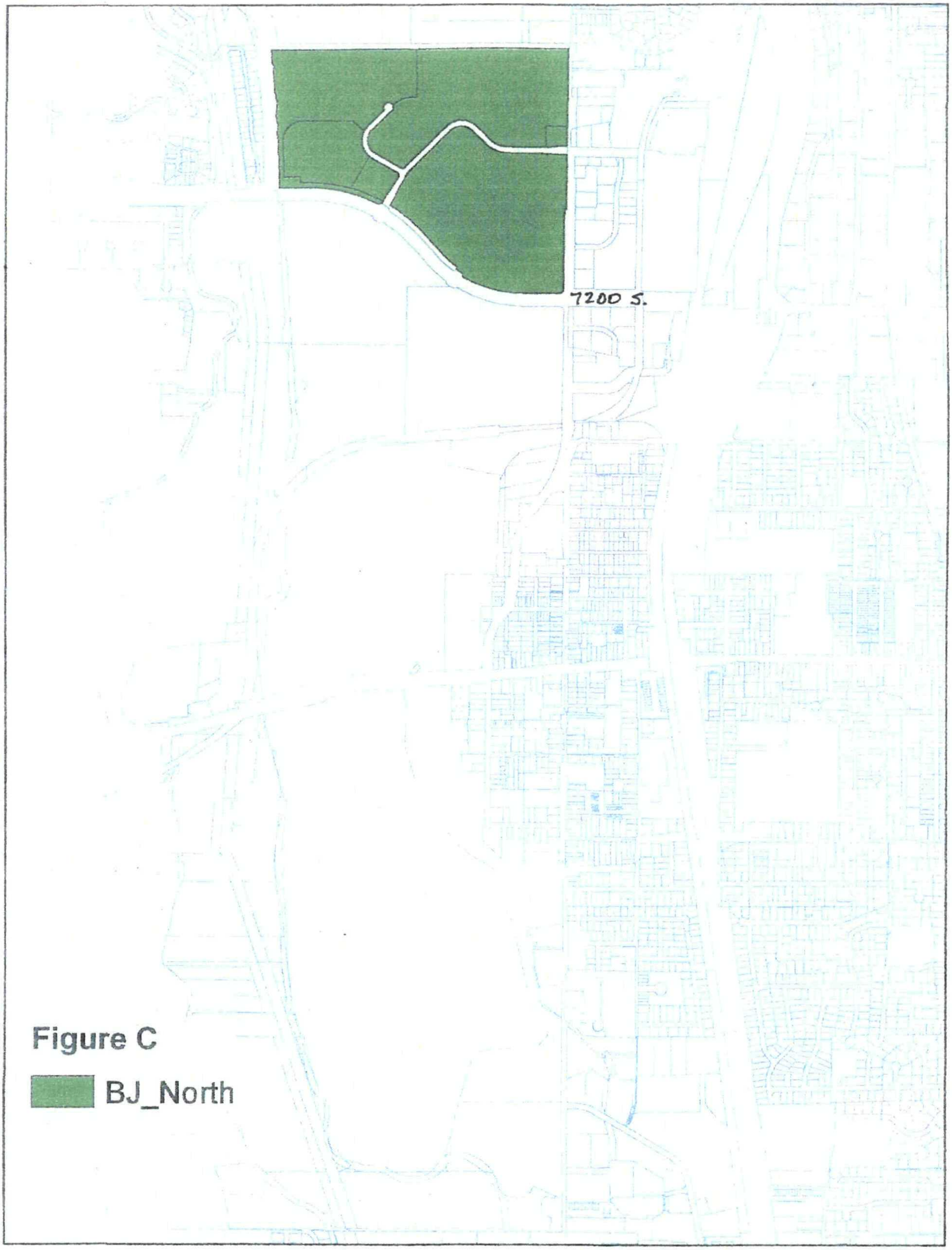
(ii) All grading activities which result in a final area with less than the CUP Approved Depth are prohibited. Importation of Surface Cover will be required to achieve desired landscaping elevations.



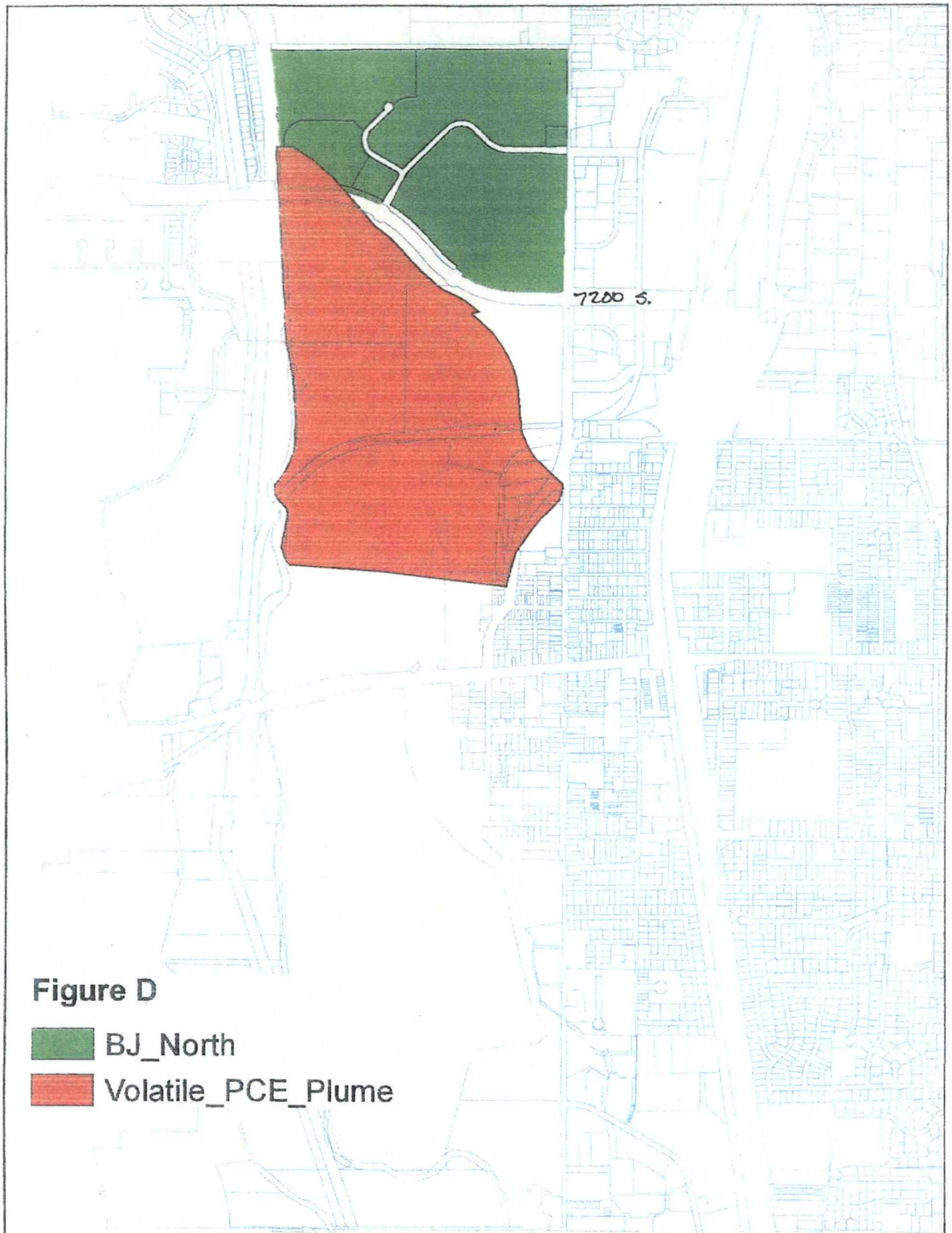
7200 S.
7800 S.
Figure A
Bingham Junction

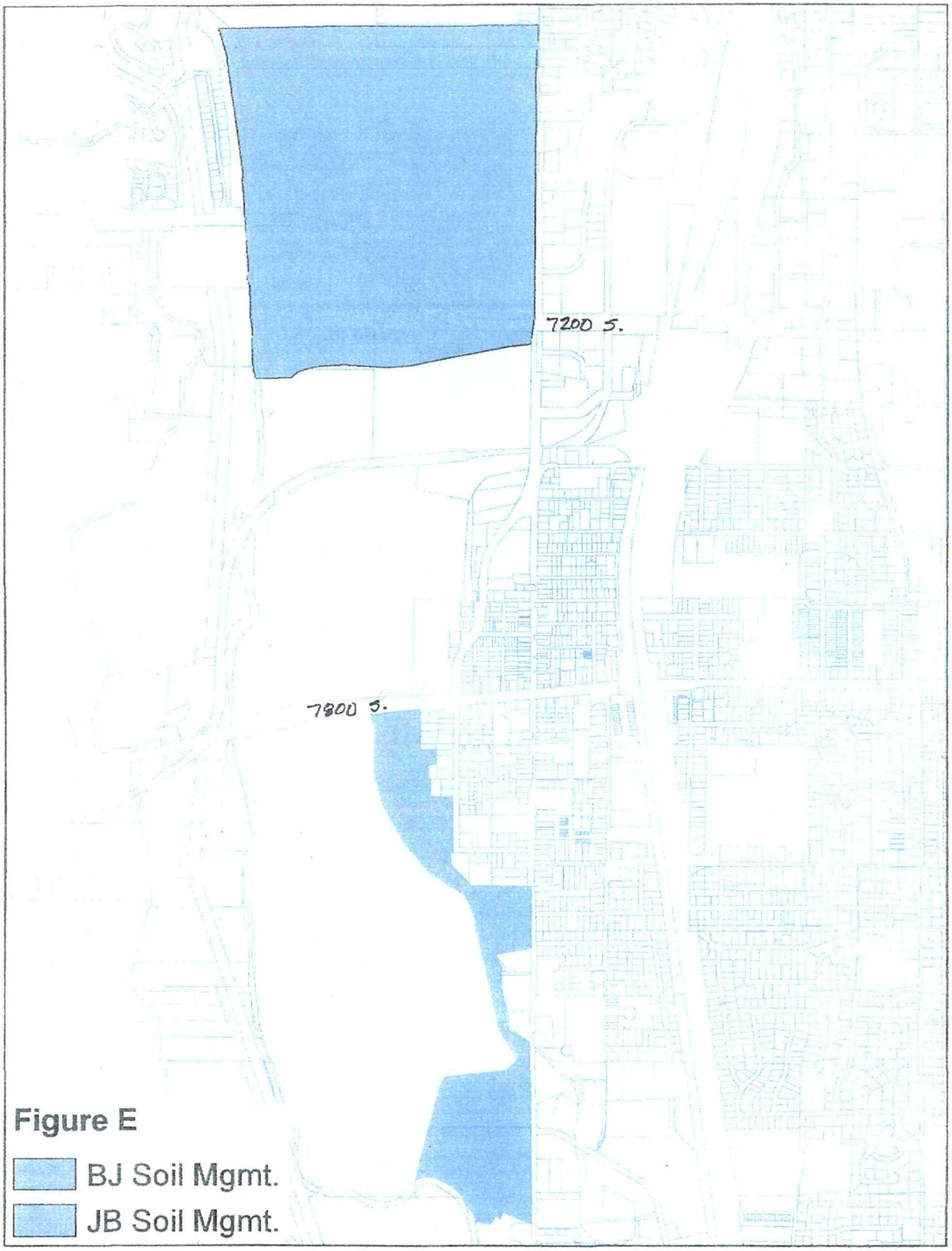


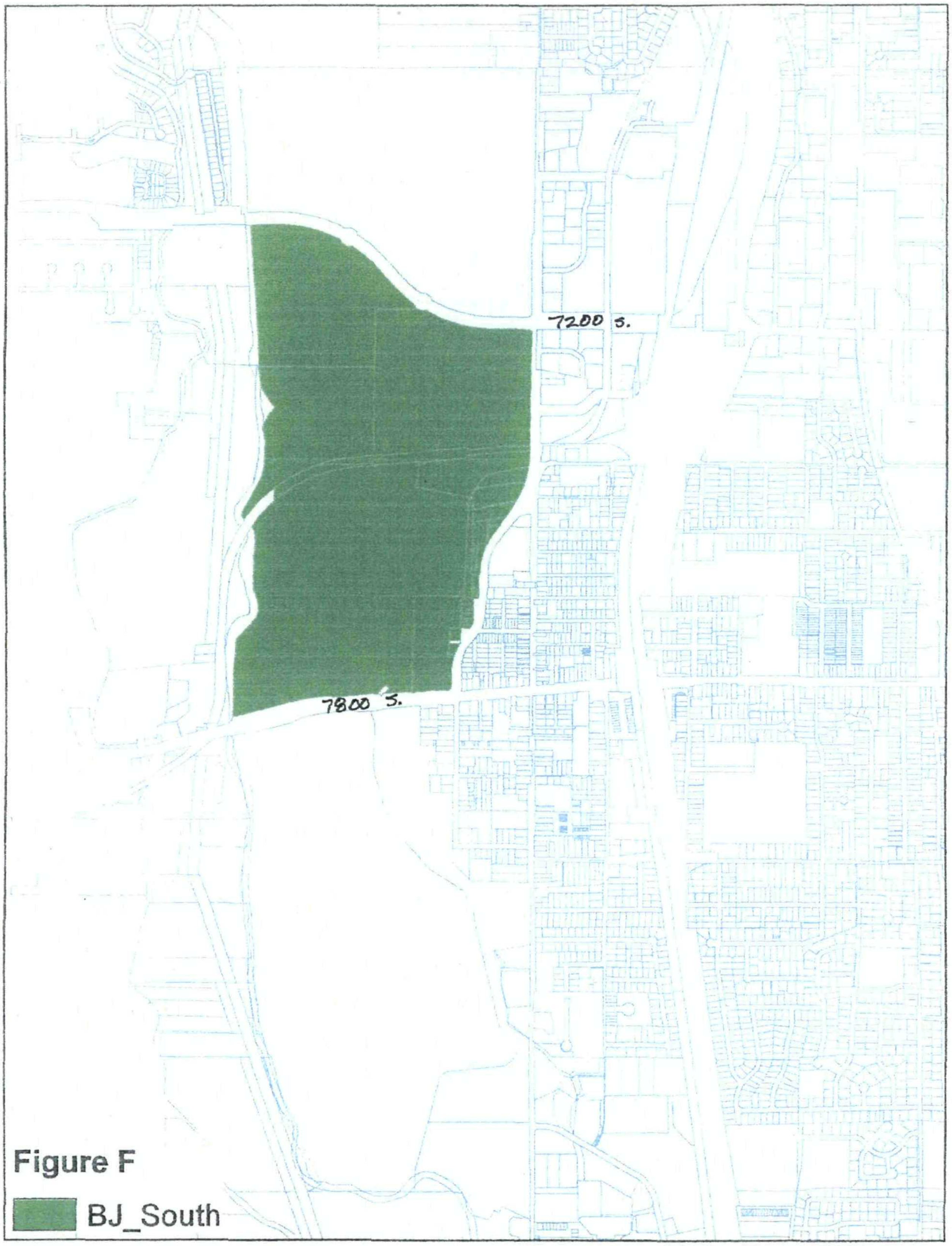
7800 S.
Figure B
Jordan Bluffs

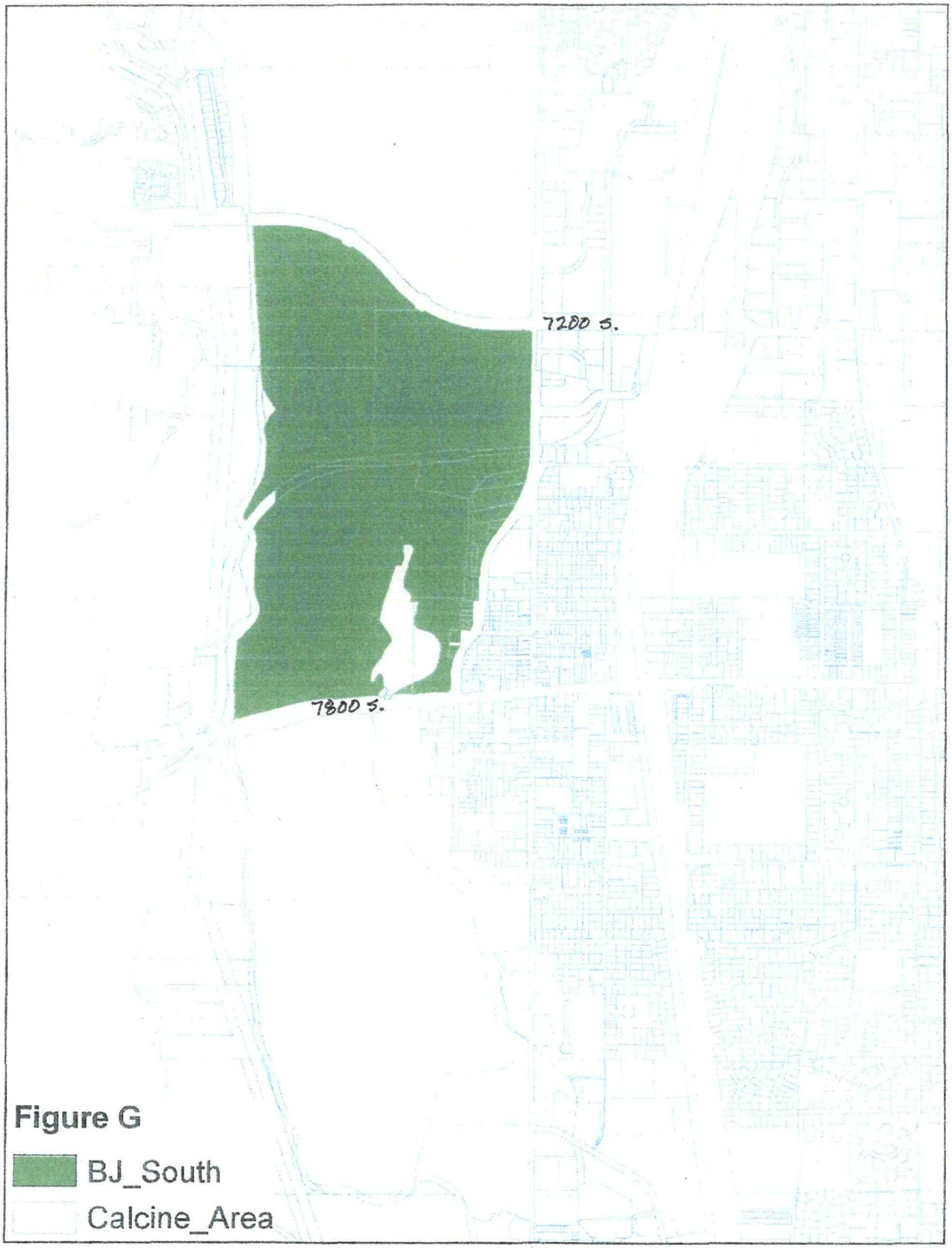


7200 S.
Figure C
BJ_North


7200 S.
Figure D
BJ_North
Volatile_PCE_Plume


7200 S.
7800 S.
Figure E
BJ Soil Mgmt.
JB Soil Mgmt.


7200 S.
7800 S.
Figure F
BJ_South


7200 S.
7800 S.
Figure G
BJ_South
Calcine_Area

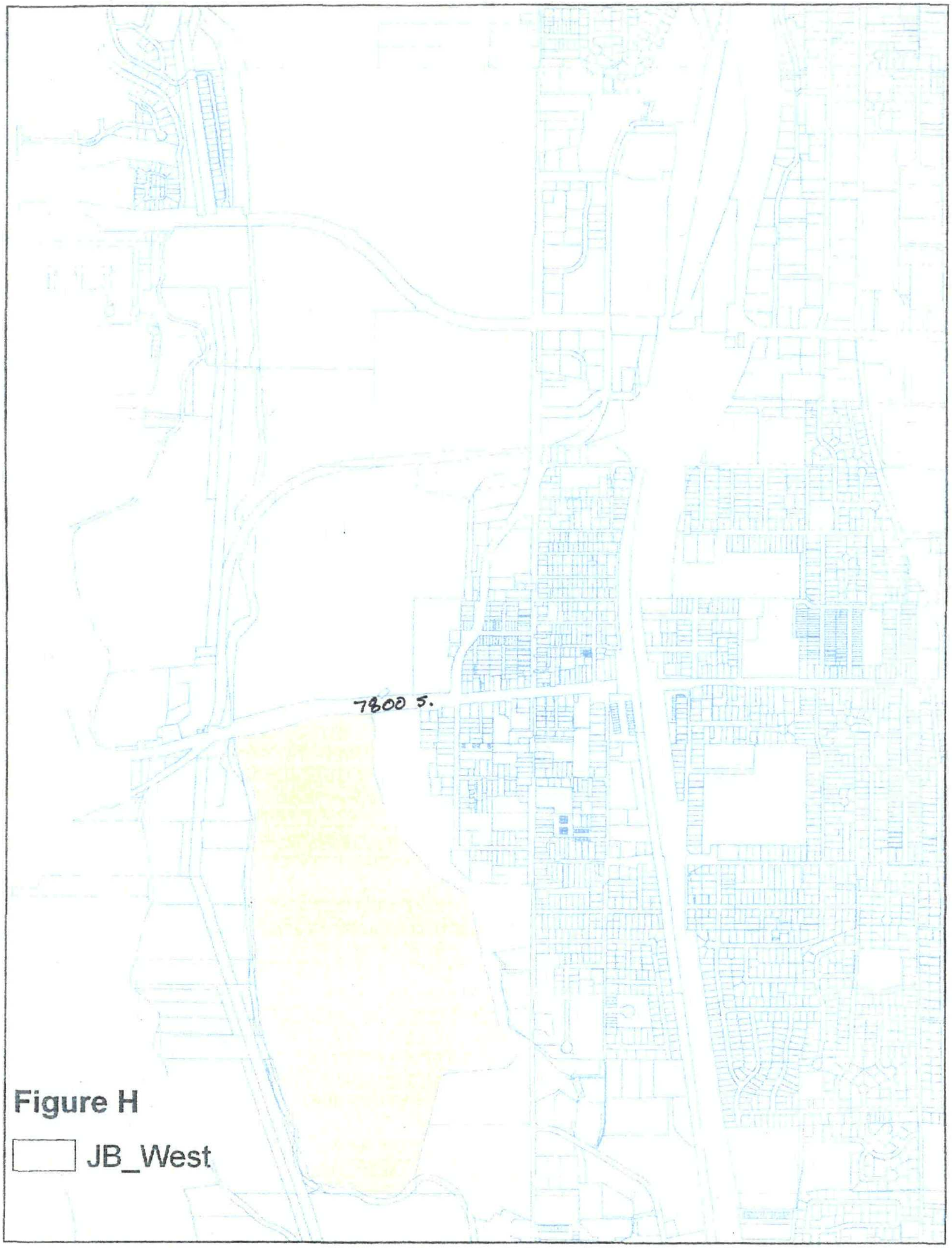


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Figure H
JB_West

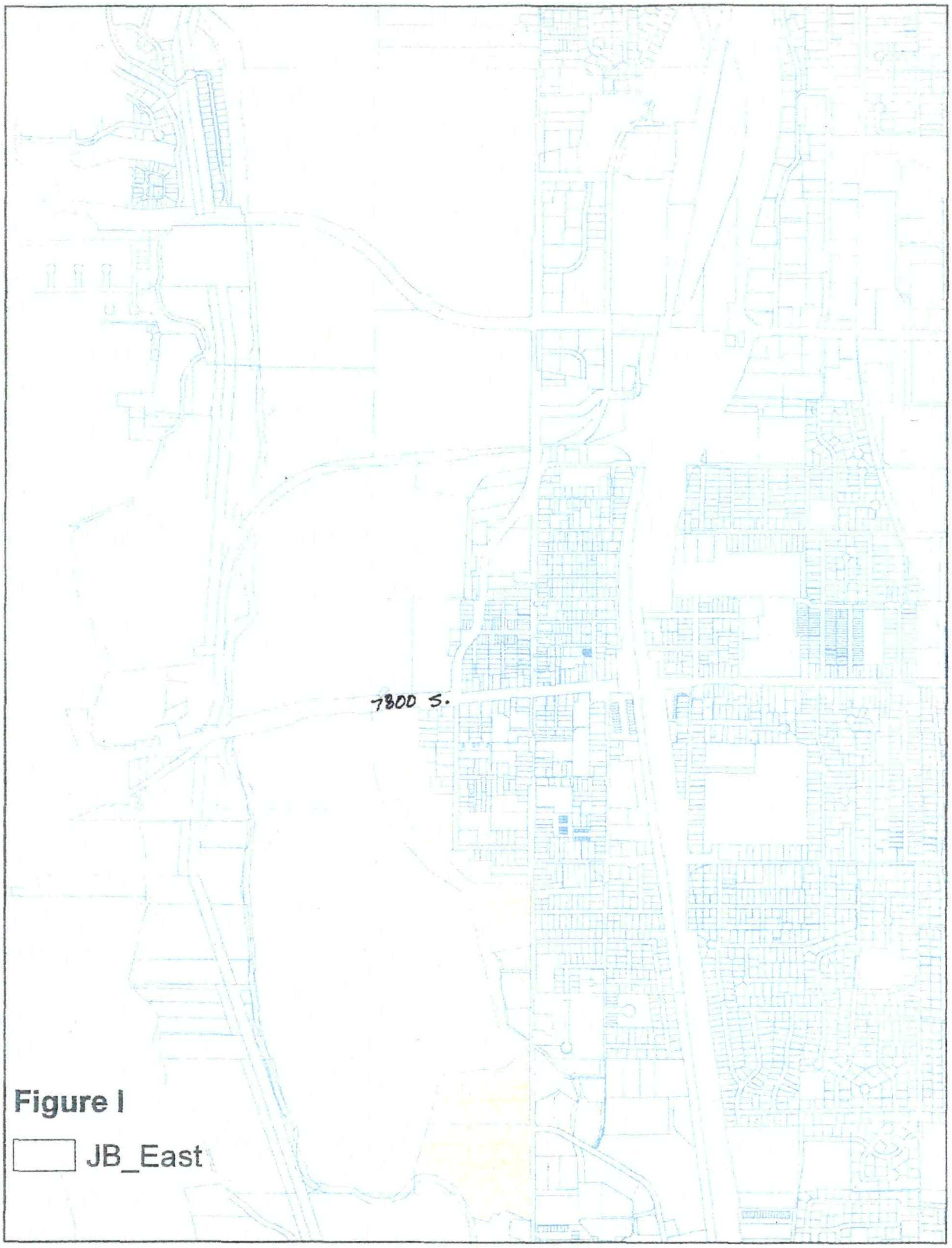
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Figure I
JB_East

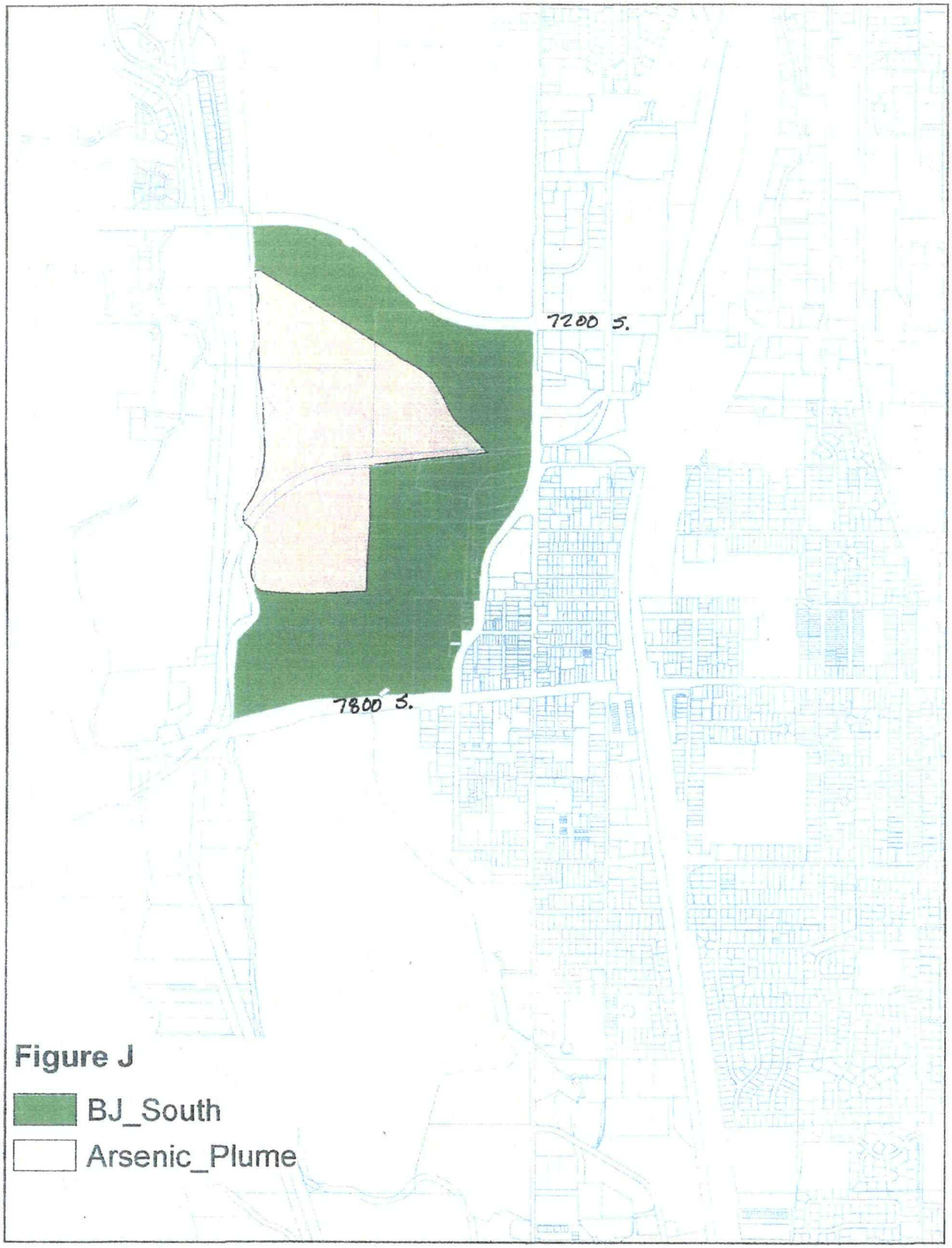
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Figure J
BJ_South
Arsenic_Plume

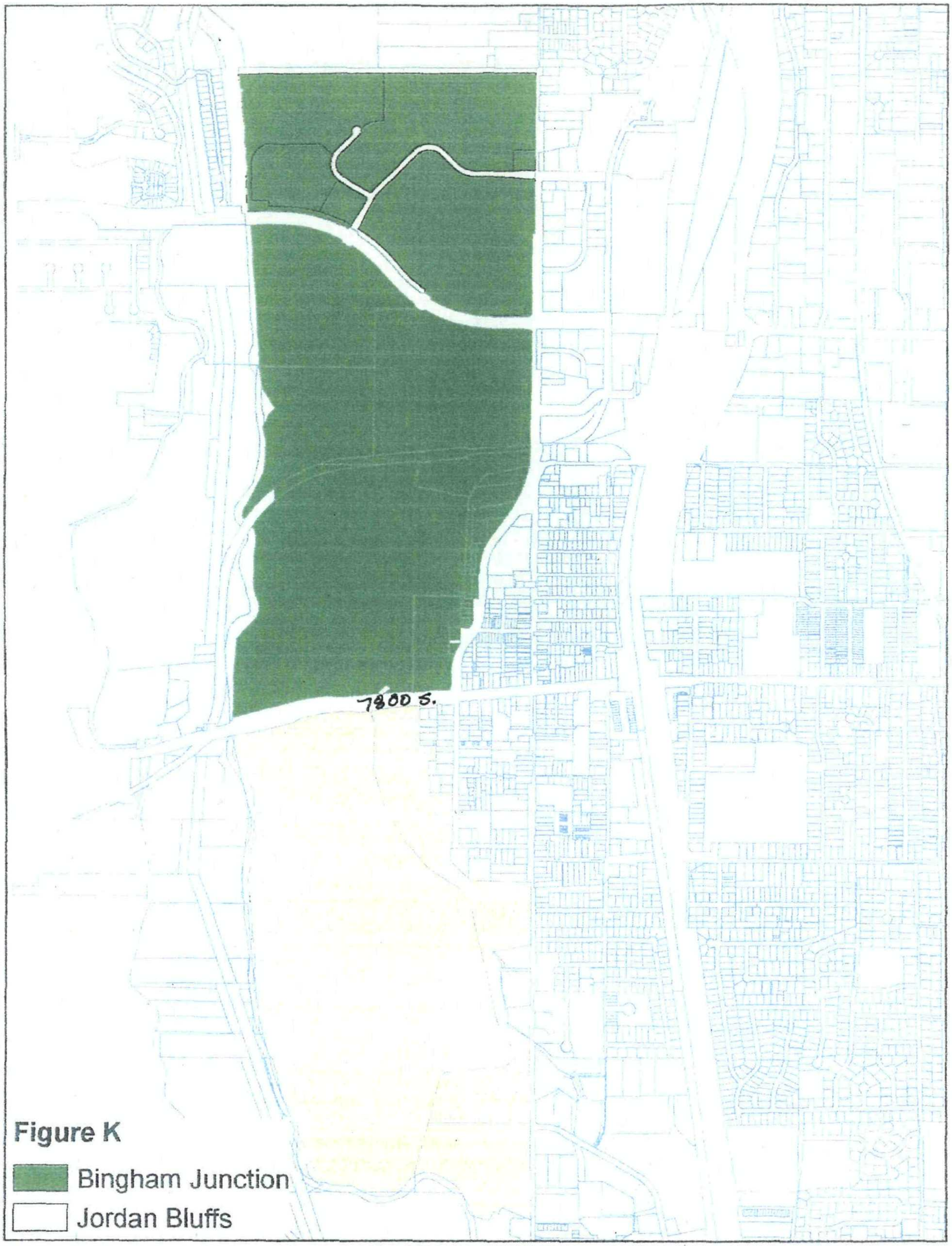
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Figure K
Bingham Junction
Jordan Bluffs

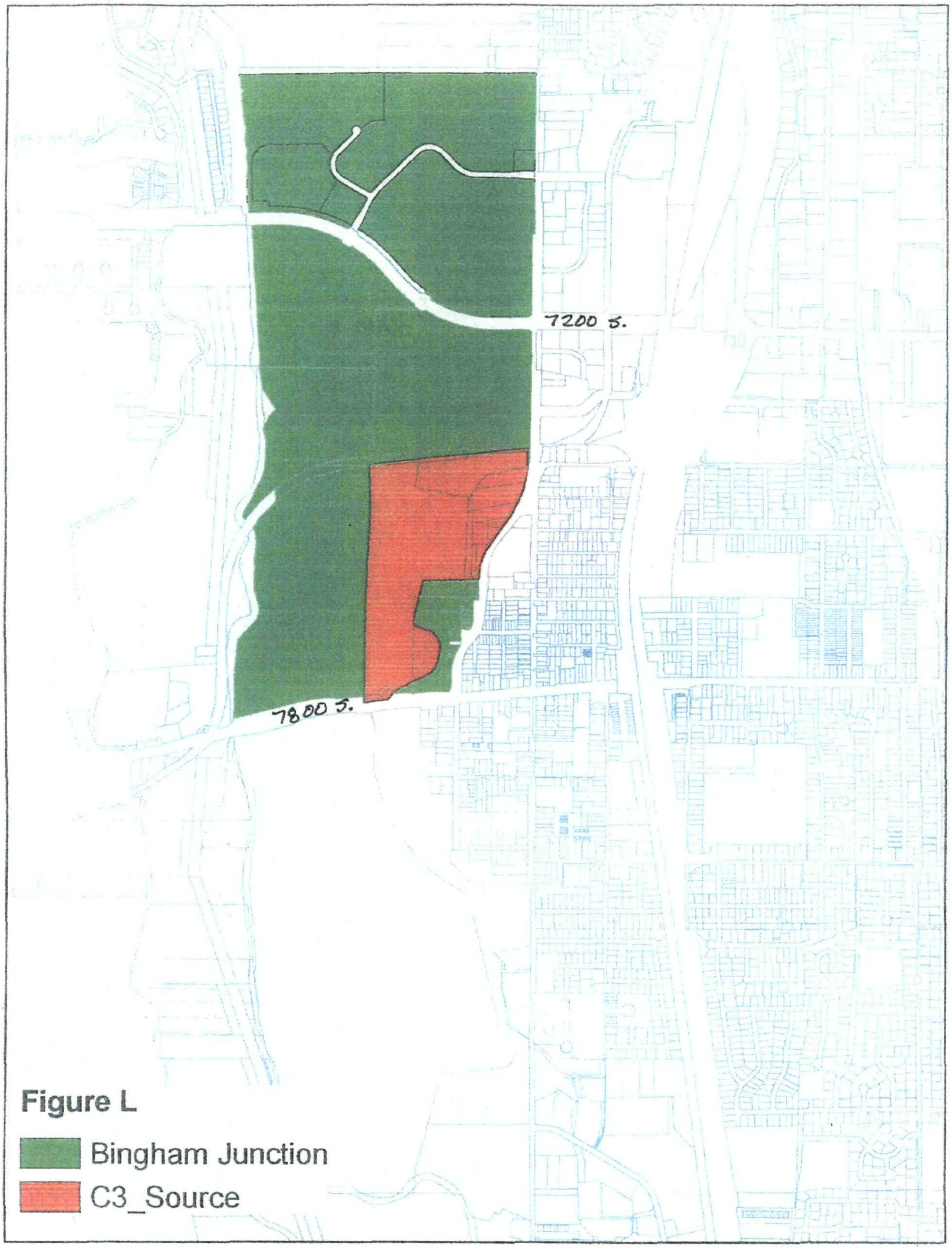
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Figure L
Bingham Junction
C3_Source

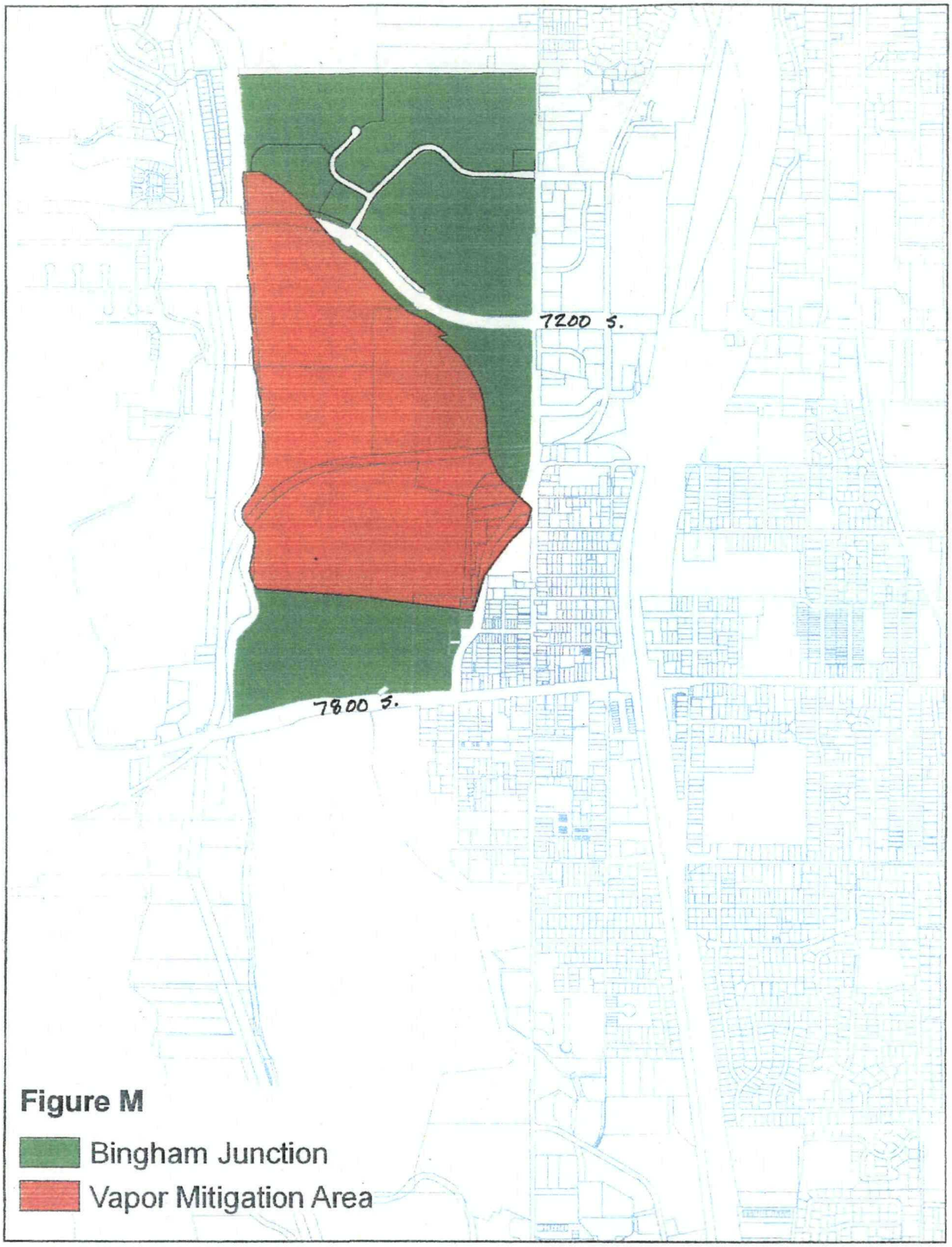

Figure M

APPENDIX C

ABBREVIATIONS AND ACRONYMS

AR - Administrative Record
ARARs - Applicable or Relevant and Appropriate Federal and State Requirements
B(L)RA - Baseline Risk Assessment
BSHW - State of Utah Bureau of Solid and Hazardous Waste
CERCLA - Comprehensive Environmental Response, Compensation, and Liability Act of 1980 (Superfund)
EE/CA - Engineering Evaluation/Cost Analysis
ESD - Explanation of Significant Differences
ICs - Institutional Controls
ICPP - Institutional Control Process Plan
NPL - (N)ational (P)riorities (L)ist of Superfund Hazardous Waste Sites
O&M - Operations and Maintenance
OU - Operable Unit
OSHA - Occupational Safety and Health Administration
POAs - Property Owners Associations
PRGs - Preliminary Remediation Goals
PRP - Potentially Responsible Party
RA - Remedial Action
RBCs - Human Health Risk Based Concentrations
RCRA - Resource Conservation and Recovery Act
RD - Remedial Design
RfR Determination - Ready for Reuse Determination
RI/FS - Remedial Investigation/Feasibility Study
ROD - Record of Decision
RPM - Remedial Project Manager
UDEQ - Utah Department of Environmental Quality
UDOH - Utah Department of Health
U.S. EPA - United States Environmental Protection Agency

APPENDIX D

GLOSSARY

Baseline Risk Assessment (BRA): A qualitative and quantitative evaluation of the risk posed to human health and/or the environment by the actual or potential presence and/or use of specific pollutants. A risk assessment characterizes the current or potential threat to public health and the environment that may be posed by chemicals originating at or migrating from a contaminated site.

Cap: A layer of clay or other impermeable material installed over the top of a closed landfill to prevent entry of rainwater and minimize leachate.

Construction Completion List (CCL): The CCL is a compilation of sites presently or formerly on the NPL. Sites qualify for the CCL when: any necessary physical construction is complete; U.S. EPA has determined that the response action should be limited to measures that do not involve construction; or the site qualifies for deletion from the NPL.

Consent Decree: A legal document, approved by a judge, that formalizes an agreement reached between EPA and potentially responsible parties (PRPs) through which PRPs will conduct all or part of a cleanup action at a Superfund site; cease or correct actions or processes that are polluting the environment; or otherwise comply with EPA initiated regulatory enforcement actions to resolve the contamination at the Superfund site involved. The consent decree describes the actions PRPs will take and may be subject to a public comment period.

Engineering controls: Engineering controls eliminate or reduce exposure to a chemical or physical hazard through the use or substitution of engineered machinery or equipment. An example of an engineering control is a protective cover over waste left on site.

Explanation of Significant Differences (ESD): A significant change to a Record of Decision (ROD) that does not fundamentally alter the remedy. An ESD may be initiated by U.S. EPA.

Exposure pathways: Exposure pathways are means by which contaminants can reach populations of people, plants, or animals. Exposure pathways include groundwater, surface water, soil, and air.

Feasibility Study (FS): A study of a hazardous waste site intended to (1) evaluate alternative remedial actions from technical, environmental, and cost-effectiveness perspectives; (2) recommend the cost-effective remedial action; and (3) prepare a conceptual design, a cost estimate for budgetary purposes, and a preliminary construction schedule.

Geomembrane Cap: A cap that is composed of a prefabricated continuous sheet of flexible polymeric or geosynthetic material.

Institutional controls: Institutional controls (ICs) are non-engineered instruments, such as administrative and/or legal controls, that help minimize the potential for human exposure to contamination and/or protect the integrity of a remedy by limiting land or resource use.

Jurisdictional wetland: A wetland identified and delineated by the U.S. Army Corps of Engineers and protected by the Clean Water Act.

National Priorities List (NPL): Sites are listed on the National Priorities List (NPL) upon completion of Hazard Ranking System (HRS) screening, public solicitation of comments about the proposed site, and consideration of all comments. The NPL primarily serves as an information and management tool. The identification of a site for the NPL is intended primarily to guide U.S. EPA in: determining which sites warrant further investigation to assess the nature and extent of the human health and environmental risks associated with a site; identifying what CERCLA-financed remedial actions may be appropriate; notifying the public of sites U.S. EPA believes warrant further investigation; and serving notice to potentially responsible parties that U.S. EPA may initiate CERCLA-financed remedial action.

NPL site listing process: The NPL is a list of the most serious sites identified for possible long-term remediation. A proposed NPL site is listed when U.S. EPA issues a final rule in the *Federal Register*, which enables U.S. EPA to use federal monies to pay for long-term remedial actions. U.S. EPA issues a proposed rule in the *Federal Register* to solicit comments on proposed NPL sites. U.S. EPA responds to comments and adds sites to the NPL that continue to meet requirements for listing.

Operation and Maintenance (O&M): O&M activities are conducted after remedial actions are complete in order to ensure that remedies are operational and effective.

Potentially Responsible Parties (PRPs): The Superfund law (CERCLA) allows U.S. EPA to respond to releases or threatened releases of hazardous substances into the environment. Under CERCLA, potentially responsible parties (PRPs) are expected to conduct or pay for the cleanup. The Superfund enforcement program identifies the PRPs at the site; negotiates with PRPs to do the cleanup; and recovers from PRPs the costs spent by U.S. EPA at Superfund cleanups.

Preliminary Assessment (PA): Preliminary assessments are investigations of site conditions to ascertain the source, nature, extent, and magnitude of the contamination.

Remedial Action (RA): The implementation of a permanent resolution to address a release or potential release of a hazardous substance from a site.

Remedial Design (RD): The process of fully detailing and specifying the selected remedy identified in the Record of Decision.

Remedial Investigation (RI): An investigation intended to gather the data necessary to: (1) determine the nature and extent of problems at the site; (2) establish cleanup criteria for the site; (3) identify preliminary alternative remedial actions; and (4) support the technical and cost analyses of the alternatives.

Record of Decision (ROD): The ROD documents the cleanup decision for the site or a portion of a NPL site and the supporting analyses.

Restrictive covenants: Restrictive covenants are deed restrictions that apply to a specific real estate parcel.

Riparian zones: Areas adjacent to rivers and streams with a differing density, diversity, and productivity of plant and animal species relative to nearby uplands.

Site Inspection (SI): The process of collecting site data and samples to characterize the severity of the hazard for the hazard ranking score and/or enforcement support.