4. HAZARD-SPECIFIC CONTEXT RBES DESCRIPTION

This chapter presents potential actions to address hazards that could be used to reach the RBES. These presentations are not meant to be pre-decisional but are meant to introduce examples of actions that may be completed to reach the RBES. The selection of specific actions will be made in accordance with applicable law and agreements.

This chapter presents the hazard-specific context RBES description. This description provides the greatest detail for the key hazard areas of concern at PGDP. The information presented is that necessary to qualify or quantify the nature of the hazard present, the potential of the hazard to have an impact (and degree of impact) on human health and the environment, and any mitigation of the hazard identified. Hazard-specific maps and CSMs are presented for both current and RBES land use. Note that hazard-specific maps for the current planned end state are presented in Chap. 5. Both the RBES maps and CSMs in this chapter and the current planned end state maps and CSMs in Chap. 5 are used to support the forthcoming variance discussion.

The CSMs presented are intended to communicate risk information to DOE managers, the regulatory community, and the general public. They provide summary level information regarding the hazard, pathways, receptors, and barriers (if applicable) between hazards and the receptors. The five major elements of the CSMs are as follows:

1) A description of the hazard area of concern being depicted in the map;

2) Identification of the primary and secondary sources of contamination;

3) Identification of the current and potential future release, transport, and exposure mechanisms;

4) Identification of the current and potential future receptors believed to be at risk; and

5) Identification of current and planned barriers or mechanisms that will prevent or limit potential exposure to at-risk receptors.

The CSMs were developed following guidance presented in American Society for Testing and Materials (ASTM) Standard E 1689-95, *Standard Guide for Developing Conceptual Site Models for Contaminated Sites*, as extended by the DOE guidance material concerning development of RBES (DOE 2003a) and its associated clarification memorandum (DOE 2003c).

As noted earlier, the CSMs are presented for both the current state and RBES for each hazard area. The goal of this presentation is to highlight the current protective mechanisms in place at each hazard site (if any) and the additional mechanisms that are anticipated to be included when the RBES is attained. The purpose of the CSMs, therefore, is to clarify what already has been done at each hazard site and what DOE intends to do to manage potential and actual risks to attain the RBES.

The narrative that accompanies the CSMs includes a description of the mechanisms envisioned to be in place when the RBES is attained. Discussion of potential specific mechanisms is necessary to provide an analytical framework and is not meant to be pre-decisional As noted in Chap. 1, the selection of specific actions will be made in the appropriate decision documents after receipt of stakeholder and public inputs as required in accordance with applicable law and agreements.

Nine hazard areas are considered in this chapter. These hazard areas are depicted under the current state and RBES in Figs. 4.0a1 and 4.0b1, respectively. These areas were developed to be consistent with the PGDP site mission and cleanup strategy presented in Chap. 1 and are as follows.

- Hazard Area 1: This hazard area is composed of the GWOU. It encompasses both the sources of contamination to groundwater and the three dissolved phase plumes. Sources considered are those below the C-400 Cleaning Building located in the center of the industrialized area of PGDP, two burial grounds located in the west central portion of the industrialized area of PGDP, the C-720 Building located in the southern part of PGDP, and an oil landfarm.

- Hazard Area 2: This hazard area is composed of the SWOU. It encompasses the sources of surface water contamination found within the industrialized portion of PGDP, the plant ditches and outfalls found inside the industrialized portion of PGDP; the NSDD, a portion of which is located outside the industrialized portion of PGDP; and Bayou and Little Bayou Creeks, which are found outside the industrialized area and run both on and off DOE property.

- Hazard Area 3: This hazard area is composed of three areas included in the burial grounds OU that contain buried waste and/or soil that are not believed to serve as a source of groundwater contamination, but for which the current planned end state and RBES differ. These burial grounds are located in the northwestern part of the industrialized area of PGDP.

- Hazard Area 4: This hazard area is composed of units that make up the SSOU. It encompasses all areas containing contamination that does not impact the GWOU or SWOU. As depicted later in this chapter, this hazard area includes all areas inside the industrialized portion of PGDP that are not part of other hazard areas, including those that are part of Hazard Area 9.

- Hazard Area 5: This hazard area is composed of two permitted, closed landfills, the currently operating permitted landfill, and, under future conditions, a potential “CERCLA Cell” that would be used to dispose of debris and other materials generated during GDP D&D. The two closed landfills and the operating landfills are located in the north-central portion of PGDP, outside the industrialized area. The site of the potential CERCLA Cell has not been determined at this time.

- Hazard Area 6: This hazard area is composed of four areas included in the BGOU that contain buried waste and/or soil that are not believed to serve as a source of groundwater contamination, but for which the current planned end state and RBES do not differ. These include a landfill located to the southwest of the industrialized portion of PGDP, adjacent to Bayou Creek, and three burial grounds located in the northwestern part of the industrialized area of PGDP.

- Hazard Area 7: This hazard area is composed of legacy waste found at storage locations at PGDP and potentially contaminated debris, surfaces, and soil found in DMSAs located throughout PGDP.

- Hazard Area 8: This hazard area is composed of the cylinder yards that contain DUF_6 and a facility currently being planned to convert the DUF_6 to more stable uranium oxides before off-site shipment. The cylinder yards are located throughout the site, and the largest yard is in the southeast corner of the industrialized area of PGDP. The planned conversion facility will be located adjacent to this yard.

- Hazard Area 9: This hazard area is composed of the GDP facilities and infrastructure that will undergo D&D as part of either the D&D OU strategic initiative (see Chap. 1) or the final GDP D&D. This hazard area also encompasses any sources to groundwater and surface water not addressed in other hazard areas.

4.1 HAZARD AREA 1 – GWOU

This hazard area is composed of the facilities and SWMUs listed below. This hazard area is depicted in Fig. 4.1a1. A description of each facility and SWMU is provided in the following section.

- C-720 Maintenance and Storage Building
- C-400 Cleaning Facility
- SWMU 1: C-747-C Oil Land Farm
- SWMU 2: C-749 Uranium Burial Ground
- SWMU 4: C-747 Contaminated Burial Ground
- SWMU 201: Northwest Groundwater Plume
- SWMU 202: Northeast Groundwater Plume
- SWMU 210: Southwest Groundwater Plume
- Little Bayou Creek Groundwater Plume Seeps

4.1.1 Current State

Sources

The *C-720 Maintenance and Storage Building* was built in 1950 and is located in the southern part of the industrialized area of PGDP. The building is composed of structural steel and corrugated transite siding. It occupies 281,200 ft^2 and contains several repair and machine shops as well as other support operations. From the early 1950s to present, the C-720 Building has been used for the fabrication, assembling, cleaning, and repairing of process equipment. Various shops housed within the C-720 Building include the compressor shop, machine shop, paint shop, instrument shop, vacuum pump shop, welding shop, and valve shop. Based on past and current activities in these shops, the potential contaminants associated with the C-720 Building include volatile organic compounds, semi-volatile organic compounds, metals, PCBs, and radionuclides.

During RIs (DOE 1999b), three areas were identified as potential sources of contamination at the C-720 Building. These were SWMU 209 (the Compressor Shop Pit Sump), AOC 211 (the spill site located to the northeast of the building), and the floor drain system in the C-720 Building. Subsequently, TCE and its breakdown products were identified at elevated concentrations in subsurface soil around the building. The highest concentrations (i.e., 68, 450, and 0.4 ppm of TCE, *trans*-1,2-dichloroethene [*trans*-1,2-DCE], and vinyl chloride [VC], respectively) were found in shallow (<35 ft bgs) subsurface soil near the southeast corner of the building and suggest the presence of DNAPLs in this area.

What is DNAPL?

DNAPLs are liquid chemicals that do not readily dissolve in water and are denser than water. Once in the ground, DNAPLs can migrate downward through the subsurface, with a portion being trapped in the pore spaces in the soil and the remaining portion continuing to migrate downward.

In the subsurface, DNAPL serves as a continuing source of groundwater contamination as it slowly goes into solution with water. Because DNAPL is difficult to locate in the subsurface and oftentimes exists in the pore spaces in the soil, achieving cleanup has been shown to be very difficult.

The *C-400 Cleaning Building* was built in the early 1950s and is located near the center of the industrialized section of PGDP. Primary activities taking place in the C-400 Building are cleaning machinery parts, disassembling and testing of cascade components, and laundering plant clothes.

Suspected sources of leaks and spills at the C-400 Building include degreaser and cleaning tank pits, drains and

sewers, the east side plenum/fan room basement, tanks and sumps outside the building, and various other processes. These sources have resulted in contamination of soil and groundwater by volatile organic compounds (primarily TCE and its breakdown products), semi-volatile organic compounds, and various metals and radionuclides.

According to the RI (DOE 1999a), the most significant source of leaks and spills of TCE that have been identified at the C-400 Building is located at the southeast corner of the building. This location, identified as SWMU 11, is where a drain line from the degreaser sump was connected to a storm sewer and where transfer pumps and piping moved solvents to and from a storage area associated with the building.

The highest concentrations of solvents in the soil and groundwater were found southeast and southwest of the C-400 Building. As noted above, the area to the southeast contains SWMU 11 and the transfer pumps and piping. The area of soil contamination to the southwest of the building has not been linked to a particular C-400 process. In the SWMU 11 area, TCE was detected at 11,055 ppm, *trans*-1,2-DCE was detected at 102 ppm; and VC was detected at 29 ppm. Both *cis*-1,2-DCE and 1,1,1-trichloroethane (1,1,1-TCA) were found at 2 ppm. The area of soil contamination to the southwest of the building contains TCE at 168 ppm; *trans*-1,2-DCE at 15 ppm; and *cis*-1,2-DCE at 1 ppm in the subsurface soils. The elevated concentrations of TCE and its breakdown products in subsurface soils suggest that DNAPL source areas exist within the subsurface soils to the southeast and southwest of the C-400 Building. The maximum TCE concentration detected in the underlying aquifer (i.e., the Regional Groundwater Aquifer or RGA) at the C-400 Building was 701 ppm. (64% of the maximum solubility of TCE in water), suggesting that the DNAPL has penetrated the RGA and is acting as a secondary source of groundwater contamination.

The *C-747-C Oil Landfarm* (SWMU 1) is located in the western part of the industrialized portion of PGDP. It was used for landfarming of waste oils contaminated with TCE, uranium, PCBs and 1,1,1-TCA. These waste oils are believed to have been derived from a variety of plant processes. When in operation, the landfarm consisted of two 1,125 sq ft plots that were plowed to a 1 to 2 ft depth. Waste oils were spread on the surface every 3 to 4 months, then the surface was limed and fertilized. Several investigations have collected data on SWMU 1, with the most recent being the RI (DOE 1999a). These investigations have identified solvents (TCE and its breakdown products), PCBs, dioxins, semi-volatile organic compounds, heavy metals, and radionuclides as potential contaminants.

After use of the landfarm was discontinued in 1979, a cover (<12 inches) of soil was placed over the two disposal plots. As part of a subsequent removal action, approximately 23 yd^3 of dioxin-contaminated soil was excavated from SWMU 1.

The *C-749 Uranium Burial Ground* (SWMU 2) was used for the disposal of containerized and uncontainerized uranium and uranium-contaminated wastes. It is located in the west-central portion of the industrialized portion of PGDP. The wastes were buried in 16- to 17-ft deep pits and then covered with 2 to 4 ft of soil. These wastes included uranium shavings in oils and solvents (i.e., TCE). Three major investigations have been conducted at SWMU 2, with the most recent being a post-ROD site investigation (DOE 1997b). The main contaminants at SWMU 2 are pyrophoric uranium and other radionuclides, heavy metals, solvents, and PCBs.

Pyrophoric Uranium

Pyrophoric uranium consists of small pieces of uranium metal. When exposed to air, the small pieces of metal spontaneously combust creating uranium oxides, that become air-borne. Because combustion occurs spontaneously, the cleanup of pyrophoric uranium is difficult.

In 1982, a 6-inch clay cap was installed over the burial pits. In 1984, a pit was excavated, resulting in the recovery of 40 drums. The liquids found in four of the drums were transferred to new drums. All the drums were placed in overpack drums, reburied, and recapped with 6 inches of clay and 18 inches of soil.

The *C-747 Contaminated Burial Yard* (SWMU 4) operated from 1951 through 1958 and is located in the west-central portion of the industrialized area of PGDP, south of SWMU 2. It was used for disposal of contaminated and uncontaminated trash, some of which was burned. The site consists of several pits excavated to about 15 ft. The waste was placed in the pits and covered with 2 to 3 ft of soil. This waste consists of scrap equipment with surface contamination and other materials. A 6-inch clay cap was installed in 1982, and, in 2000, a fence was placed around the SWMU, preventing access by the general plant population. The most recent investigation occurred in 1999 (DOE 2000b). The contaminants found included radionuclides, heavy metals, solvents, semi-volatile organics, and PCBs. A follow-up investigation that will focus on identifying the sources of the Southwest Plume includes additional sampling near the C-747 Burial Yard.

The *Northwest Dissolved Phase Plume* originates at the C-400 Building and extends to near the TVA Shawnee Steam Plant, which is off DOE-owned property. Near the steam plant, some discharges to the surface occur at seeps along Little Bayou Creek (see text below for additional discussion concerning the seeps). The principal contaminant in the plume is TCE. Other contaminants found near source areas are TCE breakdown products and ^{99}Tc. SWMU 2 is another potential source of TCE that is found in the Northwest Dissolved Phase Plume.

Concentrations of TCE in the plume range from 701 ppm near the C-400 Building to less than 5 ppb near the steam plant. The maximum concentrations seen in an area off DOE property to the north of PGDP is over 1,000 ppb, or 200 times TCE's maximum contaminant level (MCL).

The *Northeast Dissolved Phase Plume* also originates at the C-400 Building and extends toward the Ohio River into areas off DOE-owned property. No surface discharges are known to occur within the Northeast Dissolved Phase Plume. The principal plume contaminant is TCE. Other contaminants found near source areas are TCE breakdown products.

Groundwater Contamination at the PGDP

The primary aquifer affected by contamination at PGDP is called the Regional Gravel Aquifer or RGA. This aquifer consists primarily of course sand and gravel and extends from 45 to 100 ft bgs. Regionally, the RGA is a very productive aquifer and is a major source of drinking water.

Primary contaminants from PGDP found in off-site locations in this aquifer are TCE and its breakdown products and ^{99}Tc. Contaminants found below the industrialized portion of PGDP and not in off-site locations include several metals, volatile organic compounds (e.g., carbon tetrachloride and tetrachloroethene), and radionuclides (primarily uranium isotopes) (DOE 2001a).

Concentrations of TCE in the plume range from 701 ppm near the C-400 Building to less than 5 ppb at the plumes leading edge. The maximum concentrations seen in an area off DOE property to the northeast of PGDP is over 1,000 ppb, or over 200 times TCE's MCL.

The *Southwest Plume* potentially originates at the vicinity of the C-720 Building, SWMU 1 and SWMU 4, and extends west toward the DOE property line. The Southwest Plume does not currently extend to areas off DOE-owned property. The primary source of the plume has not been identified, and an investigation currently is underway. The primary contaminants associated with the Southwest Plume are solvents (primarily TCE and its breakdown products) and radionuclides (^{99}Tc).

The *Little Bayou Creek Groundwater Plume Seeps* are located near the TVA Shawnee Steam Plant to the north of PGDP. These seeps lie approximately 6,700 to 11,500 ft from the industrialized portion of PGDP. As noted above, these seeps contain TCE and other solvents thought to be discharged from the Northwest Dissolved Phase Groundwater Plume. The concentrations of TCE in samples of surface water collected at the seeps range from 12 to 440 ppb.

Pathways

In the current CSM for the GWOU (see Fig. 4.1a2), solvents existing as DNAPLs in subsurface soil and in groundwater are identified as the current sources of contamination. These liquids can go into solution with groundwater and be transported to areas off DOE property. In addition, groundwater could be discharged to surface water. Once in surface water contaminants could affect ecological receptors or enter the food chain. (^{99}Tc is not discussed in the CSM because it is not found at concentrations greater than its MCL in areas off DOE property [see Fig. 1.2].)

Using this model, the media of concern are subsurface soil, groundwater, and surface water. Receptors potentially exposed to subsurface soil are workers. Receptors potentially exposed to groundwater are workers and residents. Receptors potentially exposed to surface water are workers, visitors, and ecological receptors. In addition, the resident, visitor, and ecological receptor potentially are exposed through the food chain. (Please see the CSM for a definition of all receptors.)

Under current conditions, the barriers to exposure are access controls to prevent exposure to subsurface soil ① and the PGDP Water Policy, which provides an alternative source of water for residential use (DOE 1994) ②. The impacts of discharges to surface water are minimized through natural attenuation ④. Finally, a "hot spot" pump-and-treat ③, which consists of extraction wells within the high TCE concentration areas of the Northwest and Northeast Dissolved Phase Plumes, presently is used to control the spread of high TCE concentration areas.

Barriers to Exposure

On the CSMs, barriers to exposure are numbered consecutively starting with those present under current conditions and continuing through the potential barriers under the RBES and current planned end state. In the narrative discussing the CSMs, the numbers attached to the barriers (e.g., ①, ②, ③) are included for illustration.

Risk Levels

As shown in Fig. 4.1a2, no exposure pathways currently are complete for the GWOU due to the presence of barriers to exposure; however, baseline or unmitigated risks that could be present if the barriers did not exist have been assessed. Tables 4.1 and 4.2 summarize these results for a resident potentially exposed to groundwater in off-site areas near the PGDP property boundary, both under current conditions and assuming continued migration of contaminants from source areas to the point of exposure. Additionally, the unmitigated risk potentially posed to a recreational user exposed to groundwater discharged to the surface along Little Bayou Creek is presented. Note that these results show that the primary contaminants posing risks at off-site locations are solvents, with TCE and its breakdown products being most prominent.

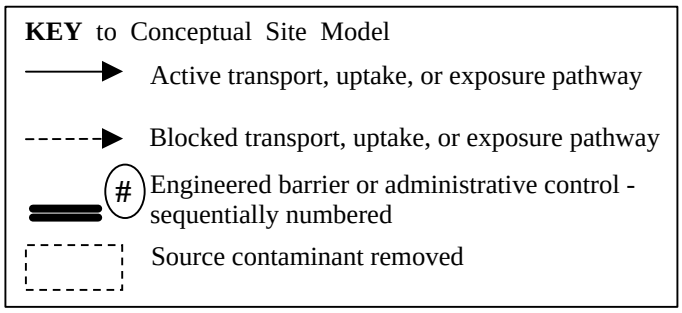


Table 4.1 Risk assessment summary[a] for residential exposure to groundwater drawn from the RGA at a point within the off-site Northwest and Northeast Plumes and for recreational exposure to groundwater discharged to the surface at seeps along Little Bayou Creek

Location[b]	Land Use	Risk[c]	Risk Scenario[d]	Contaminant Description	Representative Concentration	Baseline Risk Level[e]	PRG[f]	Basis for PRG[g]	Actual or Expected Post Cleanup Concentration[h]
NW Plume Offsite	Residential	Y	Residential	TCE	1.39 mg/L	ELCR = 1E-03 HI=120	0.005 mg/L	MCL	NA
				Cadmium	0.0161 mg/L	ELCR = 6E-04 HI = 2	0.005 mg/L	MCL	NA
NE Plume Offsite	Residential	Y	Residential	TCE	0.754 mg/L	ECLR = 5E-04 HI = 64	0.005 mg/L	MCL	NA
				1,1-DCE	0.006 mg/L	ELCR = 6E-04 HI = NA	0.007 mg/L	MCL	NA
Seeps (1997 data)	Recreational	N	Recreational	TCE	0.051 mg/L (maximum)	18 of 88 results (1 location) exceeded no action level	0.0218 mg/L	Risk-Based	NA
				Cadmium	0.026 mg/L (maximum)	1 of 39 results exceeded no action level	0.00457 mg/L	Risk-Based	NA
Seeps (2000 data)	Recreational	N	Recreational	TCE	0.44 mg/L (maximum)	49 of 71 results (12 locations) exceeded no action level	0.0127	Risk-Based	NA
				Antimony	0.0035 mg/L (maximum)	1 of 15 results exceeded no action level	0.00312	Risk-Based	NA

[a] Results for Northwest and Northeast Plumes are taken from DOE 2001a. Results for seeps are from an unnumbered information sheet entitled, *Seeps Along Little Bayou Creek, Northwest Groundwater Plume*, dated July 2001. Risks presented are "unmitigated" or baseline risks, which assume exposure with no barriers.

[b] Contaminant concentrations used for the assessment were the upper 95% confidence limit on the average concentrations of all groundwater results collected from wells in the off-site areas of the Northwest and Northeast Plumes.

[c] "Y" indicates the result came from a baseline risk assessment. "N" indicates the result came from a screening level risk assessment.

[d] Residential scenario considered lifetime (40 year) exposure by a resident to groundwater used in the home as drinking water, while showering, and for general household uses. Recreational scenario considered direct exposure to water while wading.

[e] "ELCR" is the excess lifetime cancer risk level. Values from E-06 to E-04 are within EPA's acceptable risk range for site related exposures. "HI" is the hazard index, a measure for potential systemic toxicity. Values greater than 1 indicate that a deleterious health effect is possible.

[f] "PRG" is the preliminary remediation goal used when considering potential response actions.

[g] "MCL" = maximum contaminant level. "Risk-Based" = value derived using a scenario appropriate to the land use and a target risk of either 1E-06 (cancer) or 1 (hazard).

[h] Under RBES, the potential action is monitored natural attenuation; therefore, no values are available at this time.

Table 4.2 Risk assessment summary[a] for residential exposure to groundwater at off-site location impacted by sources at the C-400 Building (Northwest and Northeast Dissolved Phase Plume) or at the C-720 Building, SWMU 1, and SWMU 4 (Southwest Plume)

Contaminant	Max modeled concentration over 1000 years (mg/L or pCi/l)[b]	Cancer Risk[c]	Hazard[d]	Dose (mrem/yr)[e]
Results for the Northwest and Northeast Dissolved Phase Plumes				
Copper	1.19E+01	NA	2E+01	NA
Benzene	6.16E-03	2E-05	1E+00	NA
Chloroform	1.37E-03	6E-06	4E+00	NA
Dichloroethene, 1,1-	2.36E-01	5E-03	2E+00	NA
Dichloroethene. cis-1,2-	1.98E+01	NA	7E+02	NA
Naphthalene	3.96E-01	NA	1E+02	NA
Trichloroethene	8.08E+00	5E-03	5E+02	NA
Vinyl chloride	6.29E-02	2E-03	2E+00	NA
Technetium-99	1.70E+04	1E-03	NA	1.7E+01
Results for the Southwest Plume				
Carbon tetrachloride	2.21E+01	1E-01	1E+04	NA
Chloroform	4.90E+02	>Unity	2E+06	NA
Dichloroethene (mixed),1,2-	6.34E+01	NA	3E+03	NA
Dichloroethene, 1,1-	1.87E+01	4E-01	1E+02	NA
Dichloroethene. cis-1,2-	2.15E+04	NA	8E+05	NA
Dichloroethene. trans-1,2-	9.28E+02	NA	2E+04	NA
Naphthalene	4.65E-03	NA	2E+00	NA
Trichloroethene	4.13E+01	2E-02	3E+03	NA
Vinyl chloride	5.11E-01	1E-02	2E+01	NA
Technetium-99	2.10E+03	2E-04	NA	2.2E+00

NA – not applicable to this pathway Max - maximum

[a] Values in this table were derived from an ongoing risk assessment at PGDP. The risks reported are baseline or unmitigated risks that assume no barriers to exposure. The points of exposure considered are within the Northwest and Northeast Plume at the DOE property boundary. The point of exposure for the Southwest Plume is a location on the DOE property boundary where the plume is projected to leave DOE property at some time in the future. A projected point of exposure was used because the Southwest Plume does not currently extend to an off-site location.

[b] Contaminant concentrations reported are the maximum expected over the next 1,000 years at the point of exposure, if no source actions are implemented at the C-400 Building source areas.

[c] Cancer risk to a resident that uses groundwater in the home as drinking water, while showering, and for other purposes. A lifetime exposure (40 years) is assumed.

[d] Hazard index for a child resident exposed as discussed above. Hazard index for an adult would be less.

[e] Dose to an adult resident exposure as discussed above. The dose to a child would be less.

4.1.2 RBES

Sources

This hazard area is composed of the facilities and SWMUs listed below. Please see Sect. 4.1.1 for a description of these facilities and SWMUs and their contaminant levels.

- C-720 Maintenance and Storage Building
- C-400 Cleaning Facility
- SWMU 1: C-747-C Oil Land Farm
- SWMU 2: C-749 Uranium Burial Ground
- SWMU 4: C-747 Contaminated Burial Ground
- SWMU 201: Northwest Groundwater Plume
- SWMU 202: Northeast Groundwater Plume
- SWMU 210: Southwest Groundwater Plume
- Little Bayou Creek Groundwater Plume Seeps

Pathways

As discussed above, the current CSM for the GWOU (see Fig. 4.1a2) identified solvents existing as DNAPLs in subsurface soil and in groundwater as current sources of contamination. These liquids can go into solution with groundwater and be transported to areas off DOE property. In addition, groundwater could be discharged to surface water. Once in surface water, contaminants could affect ecological receptors or enter the food chain.

Using this model, the media of concern are subsurface soil, groundwater, and surface water. Receptors potentially exposed to subsurface soil are workers. Receptors potentially exposed to groundwater are workers and residents. Receptors potentially exposed to surface water are workers, visitors, and ecological receptors. In addition, the resident, visitor, and ecological receptor potentially are exposed through the food chain.

Barriers to exposure at the RBES (see Figs. 4.1b1 and 4.1b2) are continued access controls to prevent exposure to subsurface soil ① and implementation of enhanced institutional controls to limit access to and use of contaminated groundwater ⑤. (Enhanced institutional controls under the RBES would be implemented on both DOE- and non-DOE-owned property. These controls could range from implementation of legal agreements with surrounding landowners to place enforceable restrictions on groundwater use to DOE's acquiring rights from surrounding property owners and directly implementing restrictions on groundwater and property use.) Discharges to surface water are addressed under the RBES through natural attenuation ④. Contaminants in source zones and in the plumes are addressed through monitored natural attenuation ⑥. (Source actions are not planned under the RBES because analyses have shown that these actions would not reduce contaminant concentration to MCLs and long-term monitoring would be required with or without source actions.) Finally, the burial grounds are capped ⑦ to mitigate any potential contaminant migration.

Under the RBES, the only receptors affected during implementation of the response actions (see Fig. 4.1b3) are the environmental sampler, remediation worker, and maintenance worker. The environmental sampler could be exposed during sampling activities. The maintenance worker could be exposed while maintaining access controls. The remediation worker could be exposed while constructing the cap.

Projected Risk Levels

At the RBES, risks to all potential receptors would be at *de minimis* levels using barriers to prevent exposure. Because contamination would continue to exist at levels above MCLs, monitored natural attenuation, which may require approval of an alternative concentration limit (ACL) petition and/or a technical impractability waiver, would be required until MCLs are met.

4.2 HAZARD AREA 2 – SURFACE WATER OPERABLE UNIT

This hazard area is composed of the facilities and SWMUs listed below. This hazard area is depicted in Fig. 4.2a1. A description of each facility and SWMU is presented in the following section.

- SWMUs 60, 61, 62, 63, 66, 67, 68, 69, 168, and 526: Internal plant ditches and outfalls
- SWMUs 58 and 59: NSDD
- SWMU 64: Little Bayou Creek
- SWMU 65: Bayou Creek
- SWMU 179: Storm sewer systems
- SWMUs 13, 14, 15, 16, and 520: Scrapyards

4.2.1 Current State

Sources

The *Internal Plant Ditches and Outfalls* are part of the original construction of PGDP. These originally were designed to convey plant effluents to one of the surrounding creeks. Currently, the water quality of each effluent ditch is regulated by a KPDES permit. Each ditch has an established monitoring station where water quality is tested regularly, in accordance with the conditions of the facility permit. The SWMUs making up the internal plant ditches and outfalls are as follows.

- SWMU 60: Outfall 002 ditch located on the east side of PGDP
- SWMU 61: Outfall 013 ditch located on the east side of PGDP
- SWMU 62: Outfall 009 ditch located on the southwest side of PGDP
- SWMU 63: Outfall 008 ditch located on the west side of PGDP
- SWMU 66: Outfall 010 ditch located on the east side of PGDP
- SWMU 67: Outfall 011 ditch located on the east side of PGDP
- SWMU 68: Outfall 015 ditch located on the west of PGDP
- SWMU 69: Outfall 001 ditch located near the northwest corner of PGDP
- SWMU 168: Outfall 012 ditch located on the east side of PGDP

In addition, the internal plant drainage system is SWMU 526.

The primary contaminants in the internal plant ditches and outfalls are PCBs, metals, and radionuclides. (In the past, dioxins and furans potentially were identified at very low concentrations in some areas. However, it is uncertain if these analytes are still present in ditch sediments.) The internal ditch system and outfalls are the subject of a site investigation.

The *NSDD* (SWMUs 58 and 59) is located in the north-central portion of PGDP and was part of the original plant construction. At one time, this ditch served as Outfall 003 and conveyed plant effluent from

sources in the central portion of PGDP, including the C-400 Building, to the north with ultimate discharge to Little Bayou Creek. However, this ditch no longer conveys effluents, and the portion located within the industrialized portion of PGDP (SWMU 59) is undergoing remediation (i.e., excavation). Currently, the portion of the ditch located outside the industrialized portion of PGDP (SWMU 58) is the subject of a planned site investigation. The principal contaminants associated with the sediments and soils of the NSDD are radionuclides, metals, and PCBs.

Little Bayou Creek (SWMU 64) is a perennial stream that begins approximately 0.4 miles south of PGDP (off DOE property) and flows along the east side of PGDP (within the DOE property but outside of the industrialized portion of PGDP) to a confluence with Bayou Creek that is off DOE property. The ultimate discharge point of Little Bayou and Bayou Creeks is the Ohio River.

Little Bayou Creek has received effluent from the process facilities located on the east side of PGDP since operation of the plant began. The east side of the plant contains the most heavily industrialized area of the plant, including the main uranium processing buildings.

Previous investigations of Little Bayou Creek have been limited to site investigations. No remedial investigations of Little Bayou Creek have been completed. The primary contaminants found within Little Bayou Creek sediments are metals, PCBs, and radionuclides.

Bayou Creek (SWMU 65) is a perennial stream that flows generally northward along the western boundary of PGDP from approximately 2.5 miles south of the plant to the Ohio River. Both upstream and downstream reaches extend beyond the DOE property boundaries. The ultimate discharge point of Bayou Creek is the Ohio River.

Bayou Creek has received effluent from the process facilities located on the west and south sides of PGDP since operation of the plant began. Additional contaminant sources include facilities located outside the main industrial area but adjacent to Bayou Creek. These include the C-746-K Landfill (SWMU 8) and the C-611 Water Treatment Plant.

Previous investigations of Bayou Creek have been limited to site investigations. No RIs of Bayou Creek have been completed. The primary contaminants found in Bayou Creek are metals, PCBs, and radionuclides.

The *Storm Sewer Systems* (SWMU 179) carry precipitation runoff from building roof drains and ground surfaces within the industrialized portion of PGDP to various regulated outfalls around the plant. Materials from spills and leaks also may have been transported by the storm sewer system. Portions of the storm sewer system have been qualitatively evaluated during the various site and remedial investigations performed for source areas. These evaluations have determined that the storm sewer system is a potential transport pathway to the SWOU. Limited investigations of contaminant levels within the storm sewer system and within the bedding materials surrounding the sewers have been performed, and areas of the storm sewer system will be sampled as part of investigations supporting cleanup activities for the GWOU and SWOU (completion 2005). Potential contaminants thought to have a source at the storm sewer systems are solvents, semi-volatile organic compounds, PCBs, metals, and radionuclides.

The *Scrapyards* consist of several SWMUs located in the industrialized portion of PGDP. These contain both clean and contaminated scrap derived from plant processes. The majority of these are located on the north side of the industrialized portion of PGDP. These SWMUs are as follows:

- SWMU 13: C-746-P Clean Scrapyard
- SWMU 14: C-746-E Contaminated Scrapyard

- SWMU 15: C-746-C Scrapyard
- SWMU 16: C-746-D Classified Scrapyard
- SWMU 520: Scrap Material West of C-746-A

Each of these scrapyards currently is the subject of a removal action that will result in on- and off-site disposal of the scrap. Contaminants for the scrapyards are semi-volatile organic compounds, PCBs, metals, and radionuclides.

Pathways

In the current CSM for the SWOU (see Fig. 4.2a2), sediment and waste from past enrichment operations (i.e., scrap) are identified as current sources of contamination. Contaminants found in either media are available for direct contact on-site or for transport to areas outside the industrialized area of PGDP. Once in the environment, contaminants could directly affect ecological receptors or enter the food chain.

Using this model, the scrap, sediments, and surface water are of concern. Receptors potentially exposed to scrap are workers, visitors, and ecological receptors. Receptors potentially exposed to sediment and surface water are also workers, visitors, and ecological receptors. The resident, visitor, and ecological receptor potentially are exposed through the food chain.

Under current conditions, the only barrier to exposure is access controls to prevent exposure to scrap and contaminated sediments ①. In addition, monitoring of effluents is ongoing to ensure that any future releases are identified quickly ②. (As noted above, the scrapyards currently are undergoing a removal action that will result in on- and off-site disposal of the scrap. After this removal action is complete, this scrap no longer will be a source of contamination.)

Risk Levels

As shown in Fig. 4.2a2, no exposure pathways are currently complete for the SWOU due to presence of barriers to exposure; however, the baseline or unmitigated risks that could be present if the barriers did not exist have been assessed. Table 4.3 summarizes these results for a recreational user potentially exposed to contaminated sediment found in four outfall ditches and to the portion of the NSDD located outside the industrialized area of PGDP. Table 4.4 summarizes the potential risks to a recreational user and worker potentially exposed to surface water contaminated by migration of contaminants from scrap and sediments found in the industrialized portion of PGDP. The points of exposure considered in Table 4.4 are where Bayou and Little Bayou Creek leave DOE-owned property and at the confluence of Bayou and Little Bayou Creek near the Ohio River.

The contaminants included in Table 4.4 are PCBs, PAHs, and ^{238}U. Only results for these contaminants are shown because only these contaminants were determined to migrate from the industrialized portions of PGDP and result in potentially measurable concentrations in surface water.

Table 4.3 Risk assessment summary[a] for recreational user exposure to contaminated sediments found in outfall ditches and portions of NSDD located outside of the industrialized portion of the PGDP

Location[b]	Land Use	Risk[c]	Risk Scenario[d]	Contaminant Description	Representative Concentration (mg/kg or pCi/g)	Baseline Risk Level[e]	PRG [f] (mg/kg or pCi/g)	Basis for PRG[g]	Actual or Expected Post Cleanup Conc or Risk Level[h]
Outfall 8 ditch sediment/soils (discharges to Bayou Creek)	Industrial	N	Recreational user	Antimony	2	HI = 1	2	Risk-Based	Average concentration to achieve ELCR = 1E-4 and HI = 1.
				Iron	17,341	HI = 2	8,830	Risk-Based	Average concentration to achieve ELCR = 1E-4 and HI = 1.
				Manganese	818	HI = 4	193	Risk-Based	Average concentration to achieve ELCR = 1E-4 and HI = 1.
				Vanadium	26	HI = 2	14	Risk-Based	Average concentration to achieve ELCR = 1E-4 and HI = 1.

Table 4.3 (continued)

Location[b]	Land Use	Risk[c]	Risk Scenario[d]	Contaminant Description	Representative Concentration (mg/kg or pCi/g)	Baseline Risk Level[e]	PRG [f] (mg/kg or pCi/g)	Basis for PRG[g]	Actual or Expected Post Cleanup Conc or Risk Level[h]
Outfall 10 ditch sediment/soils (discharges to Little Bayou Creek)	Industrial	N	Recreational user	Antimony	2	HI = 1	2	Risk-Based	Average concentration to achieve ELCR = 1E-4 and HI = 1.
				Iron	19,765	HI = 2	8,830	Risk-Based	Average concentration to achieve ELCR = 1E-4 and HI = 1.
				Vanadium	35	HI = 3	14	Risk-Based	Average concentration to achieve ELCR = 1E-4 and HI = 1.
Outfall 11 ditch sediment/soils (discharges to Little Bayou Creek)	Industrial	N	Recreational user	Uranium	391	HI = 5	87	Risk-Based	Average concentration to achieve ELCR = 1E-4 and HI = 1.
				Vanadium	43	HI = 3	14	Risk-Based	Average concentration to achieve ELCR = 1E-4 and HI = 1.
				Total PAHs	8	ELCR = 6E-4	0.0133	Risk-Based	Average concentration to achieve ELCR = 1E-4 and HI = 1.

Table 4.3 (continued)

Location[b]	Land Use	Risk[c]	Risk Scenario[d]	Contaminant Description	Representative Concentration (mg/kg or pCi/g)	Baseline Risk Level[e]	PRG [f] (mg/kg or pCi/g)	Basis for PRG[g]	Actual or Expected Post Cleanup Conc or Risk Level[h]
				Total PCBs	21	ELCR = 2E-4	0.127	TSCA	25 mg/kg
				U-238	52	ELCR = 1E-4	4	Risk-Based	Average concentration to achieve ELCR = 1E-4 and HI = 1.
Outfall 15 ditch sediment/soils (discharges to Little Bayou Creek)	Industrial	N	Recreational user	Antimony	2	HI = 1	2	Risk-Based	Average concentration to achieve ELCR = 1E-4 and HI = 1.
				Cs-137	52	ELCR = 3E-4	0.18	Risk-Based	Average concentration to achieve ELCR = 1E-4 and HI = 1.
NSDD – Section 3	Industrial	N	Recreational user	Vanadium	26	HI = 1	21	Risk-Based	Average concentration to achieve ELCR = 1E-4 and HI = 1.
				Total PCBs	20	ELCR = 2E-4	0.127	TSCA	1 mg/kg
NSDD – Section 4	Industrial	N	Recreational user	Vanadium	39	HI = 2	21	Risk-Based	Average concentration to achieve ELCR = 1E-4 and HI = 1.

Table 4.3 (continued)

Location[b]	Land Use	Risk[c]	Risk Scenario[d]	Contaminant Description	Representative Concentration (mg/kg or pCi/g)	Baseline Risk Level[e]	PRG [f] (mg/kg or pCi/g)	Basis for PRG[g]	Actual or Expected Post Cleanup Conc or Risk Level[h]
				Arsenic	9	ELCR = 3E-5	60	Risk-Based	Average concentration to achieve ELCR = 1E-4 and HI = 1.
				Iron	21,376	HI = 2	13,500	Risk-Based	Average concentration to achieve ELCR = 1E-4 and HI = 1.
				Manganese	651	HI = 2	290	Risk-Based	Average concentration to achieve ELCR = 1E-4 and HI = 1.
NSDD – Section 5	Industrial	N	Recreational user	Vanadium	75	HI = 4	21	Risk-Based	Average concentration to achieve ELCR = 1E-4 and HI = 1.
				Iron	50,900	HI = 4	13,500	Risk-Based	Average concentration to achieve ELCR = 1E-4 and HI = 1.

Table 4.3 (continued)

Location[b]	Land Use	Risk[c]	Risk Scenario[d]	Contaminant Description	Representative Concentration (mg/kg or pCi/g)	Baseline Risk Level[e]	PRG [f] (mg/kg or pCi/g)	Basis for PRG[g]	Actual or Expected Post Cleanup Conc or Risk Level[h]
				Manganese	1,780	HI = 6	290	Risk-Based	Average concentration to achieve ELCR = 1E-4 and HI = 1.
				Arsenic	33	ELCR = 9E-5	60	Risk-Based	Average concentration to achieve ELCR = 1E-4 and HI = 1.

[a] Results for outfall ditches taken from BJC 2003a. Results for NSDD Sections 3, 4, and 5 taken from BJC 2003b. Risks presented are "unmitigated" or baseline risks, which assume exposure with no barriers.

[b] Contaminant concentrations used for the assessment were the upper 95% confidence limit on the average concentrations of all sediment samples collected along the outfall ditch or NSDD. For the NSDD, Section 3 of the ditch is that portion closest to the industrialized area, and Section 5 of the ditch is that portion farthest from the industrialized area. Section 4 of the ditch lies between Sections 3 and 5 and is that portion of the ditch located near the landfills found outside of the industrialized area (see Sect. 5).

[c] "Y" indicates the result came from a baseline risk assessment. "N" indicates the result came from a screening level risk assessment.

[d] Recreational user exposure includes child/teen (140 d/yr, 6 yr) and adult (104 d/yr, 34 yr).

[e] "ELCR" is the excess lifetime cancer risk level. Values from E-06 to E-04 are within EPA's acceptable risk range for site related exposures. "HI" is the hazard index, a measure for potential systemic toxicity. Values greater than 1 indicate that a deleterious health effect is possible.

[f] "PRG" is the preliminary remediation goal used when considering potential response actions.

[g] "Risk-Based" = value derived using a scenario appropriate to the land use and a target risk of either 1E-06 (cancer) or 1 (hazard). For this table, value reported is that for the default recreational user at risk level 1E-6 and hazard of 1.

[h] Value for the site-specific recreational user at risk level 1E-6 and hazard of 0.1 from BJC 2003b.

Table 4.4 Risk assessment summary[a] for exposure to maximum modeled concentrations in surface water from sources at the PGDP

Receptor	Big Bayou	Little Bayou	Confluence
	Risks[b]		
Recreational Swimmer	1.94E-05	6.49E-07	3.93E-06
Recreational Wader	2.23E-05	3.14E-07	4.33E-06
Industrial Worker	1.30E-05	1.84E-07	2.53E-06
Residential Fish Ingestion*	3.74E-03	1.39E-04	1.87E-03
	Hazards[c]		
Recreational Swimmer	6.04E-02	8.92E-03	1.77E-02
Recreational Wader	6.46E-02	1.06E-02	1.88E-02
Industrial Worker	2.75E-02	4.51E-03	8.01E-03
Residential Fish Ingestion*	3.67E-03	1.13E-03	1.98E-03
	Doses[d] *(mrem/yr)*		
Recreational Swimmer	7.79E-04	2.42E-02	8.73E-03
Recreational Wader	NA	NA	NA
Industrial Worker	NA	NA	NA
Residential Fish Ingestion*	1.82E-02	1.98E+00	2.74E-01

NA – not applicable.

[a] Values in this table were derived from an ongoing risk assessment at PGDP. The risks reported are baseline or unmitigated risks that assume no barriers to exposure. The points of exposure considered where Bayou and Little Bayou Creek leave DOE-owned property and at the confluence of these creeks near the Ohio River. Contaminant concentrations used in this assessment are the maximum expected over 30 years from present assuming no source actions. Contaminants in derivation of risk, hazard, and dose values are PCBs, PAHs, and ^{238}U.

[b] Cancer risk to a recreational user assumes lifetime exposure at the point of exposure (i.e., over 40 years).

[c] Hazard index is for a child recreational user. Hazard index for an adult would be less.

[d] Dose is not age dependent under the scenario assessed; therefore, the values presented are relevant to all age cohorts.

* Fish ingestion results based on average modeled concentrations.

4.2.2 RBES

Sources

This hazard area is composed of the facilities and SWMUs listed below. Please see Sect. 4.2.1 for a description of these facilities and SWMUs and their contaminant levels.

- SWMUs 60, 61, 62, 63, 66, 67, 68, 69, 168, and 526: Internal plant ditches and outfalls
- SWMUs 58 and 59: NSDD
- SWMU 64: Little Bayou Creek
- SWMU 65: Bayou Creek
- SWMU 179: Storm sewer systems
- SWMUs 13, 14, 15, 16, and 520: Scrapyards

Pathways

As discussed above, the current CSM for the SWOU (see Fig. 4.2a2) identified sediment and waste from past enrichment operations (includes scrap) as current sources of contamination. Contaminants found in these sources of contamination are available for direct contact on-site or for transport to areas outside the industrialized area of PGDP. Once in the environment, contaminants could directly affect ecological receptors or enter the food chain.

Using this model, scrap, sediments, and surface water are of concern. Receptors potentially exposed to scrap are workers, visitors, and ecological receptors. Receptors potentially exposed to sediment and surface water are also workers, visitors, and ecological receptors. The resident, visitor, and ecological receptor are potentially exposed through the food chain.

The barriers to exposure at the RBES (see Figs. 4.2b1 and 4.2b2) are continued access controls to prevent exposure to scrap ①. Source actions are planned under the RBES to remove the sources of surface water contamination (i.e., scrap and sediments) ③. Finally, monitoring of effluents would continue to ensure any future releases are identified quickly ②.

Under the RBES, potential receptors during implementation of the response actions (see Fig. 4.2b3) are the environmental sampler, maintenance worker, remediation worker, general site worker, disposal worker, transportation worker, the public, and ecological receptors. The environmental sampler could be exposed during sampling activities. The maintenance worker could be exposed while performing maintenance activities. The remediation worker and ecological receptors could be exposed during completion of source actions (anticipated to be characterization and disposal of scrap and excavation of sediments). The general site worker could also be exposed during implementation of the source actions. The disposal worker could be exposed while accepting waste from the scrap disposal and excavation activities. The transportation worker, public, and ecological receptor could be exposed during transportation of waste to an off-site disposal location.

Projected Risk Levels

At the RBES, risks to all potential receptors would be at *de minimis* levels due either to the presence of barriers that prevent exposure or to the removal of scrap and contaminated sediments. The risk target for cleanup levels for sediments under the RBES in locations inside the industrialized area is an industrial risk of 1E-04. The PCB concentration target for sediments in industrial areas is 25 ppm. The risk target for cleanup levels for sediments under the RBES in locations outside the industrialized area is a recreational risk of 1E-04. The PCB concentration target for sediments in recreational use areas is 1 ppm. For both the industrial worker and the recreational user, these target risks will be determined using the average contaminant concentration (defined as the 95% upper confidence limit of the mean concentration) within the exposure unit appropriate for the area's land use. Similarly, the PCB concentration target will be the average concentration within the exposure unit.

4.3 HAZARD AREA 3 – BURIAL GROUND OPERABLE UNIT (GROUP 1)

This hazard area is composed of the two burial grounds located in the northwestern corner of the industrialized portion of PGDP and one landfill to the north of the industrialized portion of the plant. This hazard area is depicted in Fig. 4.3a1. A description of each facility and SWMU is presented in the following section. **Note:** none of these burial grounds currently is accepting waste, and waste in each currently is covered with soil. The burial grounds included are as follows:

- SWMU 3: C-404 Low-level Radioactive Waste Burial Ground
- SWMU 6: C-747-B Burial Ground
- SWMU 145: Residential/Inert Landfill Borrow Area (and old NSDD Channel)

4.3.1 Current State

Sources

The *C-404 Low-level Radioactive Waste Burial Ground* (SWMU 3) is located in the west-central portion of the industrialized portion of PGDP. It originally was constructed as an aboveground holding pond with a tamped floor and clay dike walls. Liquid uranium-bearing wastes were treated in the pond in the 1950s. This activity was discontinued in 1957, when all free liquids were removed from the unit. From 1957 to 1977, solid contaminated scrap was placed in the site. At that time, burial of containerized and bulk wastes on top of the filled-in pond area was begun. The unit was closed as a RCRA-hazardous waste landfill in 1987. This closure included construction of a multi-layer cap consisting of 2 ft of compacted clay, a 36-mil Hypalon liner, 1 ft of granular fill, geotextile fabric, and 2 ft of vegetative cover.

In the holding pond area, the waste consists of uranium precipitated from aqueous solutions, UF_4, uranium metal, uranium oxides, and contaminated trash. The upper tier of waste contains the same type of wastes as well as smelter furnace liners and approximately 450 drums of EP toxic hazardous wastes. The main contaminants at SWMU 3 consist of radionuclides, metals, solvents, and PCBs.

The *C-747-B Burial Area* (SWMU 6) is located in the northwest portion of the industrialized portion of PGDP and covers 36,245 ft^2. It accepted waste from 1960 to 1976. It consists of five burial pits of various sizes containing contaminated equipment and drums of metal scrap. Each pit contains a specific type of waste. After placement of the waste, each pit was covered with 3 to 5 ft of soil. The southern half of the area is a storage yard for contaminated vehicles that no longer are functional. An RI for the burial ground was completed in 1999 (DOE 2000c). Contaminants determined to be associated with this burial ground are metals, radionuclides, and PCBs.

The *Residential/Inert Landfill Borrow Area (and old NSDD Channel)* (SWMU 145) is located outside the industrialized portion of PGDP, but on DOE-owned property, immediately north of Ogden Landing Road. This area lies adjacent to permitted landfills and consists of a section of the NSDD that was filled with debris when a new channel was constructed for the ditch. (Note that SWMU 145 actually covers a much larger area; however, only the portion of SWMU 145 associated with the ditch is in the GWOU.) An investigation of this area was performed in 1999 to determine the types of materials that may have been placed in this area. Two test pits were excavated, and only construction debris was found. Contaminants believed to be associated with SWMU 145 are radionuclides and metals.

Pathways

In the current CSM for the BGOU (Group 1) (see Fig. 4.3a2), waste materials from plant operations and surface and subsurface soil are identified as current sources of contamination. Contaminants found in waste and soil are available for direct contact on-site. Migration of contamination from these burial grounds is not expected due to the nature of the wastes. Ecological receptors potentially could contact contaminants at the burial grounds resulting in contamination entering the food chain, but impacts from this pathway would be limited because the burial grounds are located in industrialized areas.

Using this model, the waste materials, surface soil, and subsurface soil are of concern. Receptors potentially exposed to waste material and soil are workers, visitors, and ecological receptors. In addition, the ecological receptor is potentially exposed through the food chain.

Under current conditions, the only barrier to exposure that prevents exposure to waste and soil at SWMUs 6 and 145 is access controls ①. However, at SWMU 3 both access controls ① and a cap prevent exposure ②. (Note that although waste is covered with soil at SWMUs 6, contaminants were found in the soil cover during the RI of SWMU 6, indicating exposure to contamination is possible at SWMU 6 if access controls are violated. A similar condition may exist at SWMU 145.)

Risk Levels

As shown in Fig. 4.3a2, no pathways currently are considered complete for the Burial Grounds OU (Group 1); however, the baseline or unmitigated risks that could be present if the barriers did not exist has been assessed for SWMU 6. Table 4.5 summarizes these results for an industrial worker exposed to surface soil at this burial ground. (Results are not shown for SWMU 3 and SWMU 145 because assessments using representative data are not available for these areas.)

Table 4.5 Risk assessment summary[a] for industrial worker exposure to contaminated surface soil found at SWMU 6: C-747-B Burial Ground

Location[b]	Land Use	Risk[c]	Risk Scenario[d]	Contaminant Description	Representative Concentration (mg/kg or pCi/g)	Baseline Risk Level[e]	PRG (mg/kg or pCi/g)[f]	Basis for PRG[g]	Actual or Expected Post Cleanup Conc or Risk Level
C-747-B Burial Ground	Industrial	N	Industrial	Arsenic	3.22	ELCR = 6E-6	0.523	Risk-Based	*De minimis* – due to cap
				Manganese	472	HI = 1	452	Risk-Based	*De minimis* – due to cap
				Uranium	114	HI = 0.5	202	Risk-Based	*De minimis* – due to cap
				Vanadium	21	HI = 0.6	33.2	Risk-Based	*De minimis* – due to cap
				Total PAHs	0.34	ELCR = 2E-5	0.021	Risk-Based	*De minimis* – due to cap
				Th-228	0.406	ELCR = 2E-5	0.028	Risk-Based	*De minimis* – due to cap

[a] Values in this table were derived from an ongoing risk assessment at PGDP (DOE 2003i). Risks presented are "unmitigated" or baseline risks, which assume exposure with no barriers.

[b] Contaminant concentrations used for the assessment were the upper 95% confidence limit on the average concentrations of all soil samples collected at the burial ground.

[c] "Y" indicates the result came from a baseline risk assessment. "N" indicates the result came from a screening level risk assessment.

[d] Industrial worker exposure (250 d/yr for 25 yr).

[e] "ELCR" is the excess lifetime cancer risk level. Values from E-06 to E-04 are within EPA's acceptable risk range for site related exposures. "HI" is the hazard index, a measure for potential systemic toxicity. Values greater than 1 indicate that a deleterious health effect is possible.

[f] "PRG" is the preliminary remediation goal used when considering potential response actions.

[g] "Risk-Based" = value derived using a scenario appropriate to the land use and a target risk of either 1E-06 (cancer) or 1 (hazard). For this table, value reported is that for the default industrial worker at risk level 1E-6 and hazard of 1.

4.3.2 RBES

Sources

This hazard area is composed of the SWMUs listed below. Please see Sect. 4.3.1 for a description of these SWMUs and their contaminant levels.

- SWMU 3: C-404 Low-level Radioactive Waste Burial Ground
- SWMU 6: C-747-B Burial Ground
- SWMU 145: Residential/Inert Landfill Borrow Area (and old NSDD Channel)

Pathways

The current CSM for the BGOU (Group 1) (see Fig. 4.3a2) identified waste materials from plant operations and surface and subsurface soil as current sources of contamination. Contaminants found in waste and soil are available for direct contact on-site. Migration of contamination from these burial grounds is not expected due to the nature of the wastes. Ecological receptors potentially could contact contaminants at the burial grounds resulting in contamination entering the food chain, but impacts from this pathway would be limited because the burial grounds are located in industrialized areas..

Using this model, the waste materials, surface soil, and subsurface soil are of concern. Receptors potentially exposed to waste material and soil are workers, visitors, and ecological receptors. In addition, the ecological receptor is potentially exposed through the food chain.

The barriers to exposure at the RBES (see Figs. 4.3b1 and 4.3b2) are continued access controls ① and capping ② to prevent exposure to waste and soil.

Under the RBES, potential receptors during implementation of the response actions (see Fig. 4.3b3) are the maintenance worker and remediation worker. The maintenance worker could be exposed during site maintenance activities performed as part of access controls. The remediation worker could be exposed while capping the burial grounds.

Projected Risk Levels

At the RBES, risks to all potential receptors would be at *de minimis* levels due to the barriers that prevent exposure.

4.4 HAZARD AREA 4 – SOILS OPERABLE UNIT

This hazard area is composed of surface soils found within the industrialized areas of PGDP that are not included in other hazard areas. This hazard area is depicted in Fig. 4.4a1.

4.4.1 Current State

Sources

This hazard area is composed of units that make up the SSOU. It encompasses all areas inside the industrialized portion of PGDP that contain potential contamination that is not suspected of impacting the GWOU or SWOU. An RI of these areas has not been completed to date. However, samples collected as

part of other projects indicate that contaminants associated with the SSOU are metals, PAHs, PCBs, and radionuclides.

Pathways

In the current CSM for the SSOU (see Fig. 4.4a2), past spills and releases from operations are identified as the primary source of contamination, and surface soil is identified as the current source of contamination. Contaminants found in soil are available for direct contact on-site. Migration of contamination from the SSOU areas is not expected (i.e., uncertain pathway); however, it is possible that ecological receptors could contact contaminants within source areas resulting in contamination entering the food chain.

Using this model, the media of concern is surface soil. Receptors potentially exposed to soil are workers, visitors, and ecological receptors. In addition, the ecological receptor is potentially exposed through the food chain. Under current conditions, the only barrier to exposure is access controls to prevent exposure to soil①.

Risk Levels

As shown in Fig. 4.4a2, no pathways currently are considered complete for the SSOU; however, the baseline or unmitigated risks that could be present if the barriers did not exist have been assessed for some areas included in the SSOU. Table 4.6 summarizes the results for an industrial worker exposed to surface soil at some of the areas included in the SSOU. A summary for ecological risks is not available.

4.4.2 RBES

Sources

This hazard area is composed of surface soils found within the industrialized areas of PGDP. Please see Sect. 4.4.1 for a description of this hazard area.

Pathways

The current CSM for the SSOU (see Fig. 4.4a2) identified past spills and releases from operations as the primary source of contamination and surface soil as the current source of contamination. Contaminants found in soil are available for direct contact on-site. Migration of contamination from the SSOU areas is not expected (i.e., uncertain pathway); however, it is possible that ecological receptors could contact contaminants within source areas resulting in contamination entering the food chain.

Using this model, the media of concern is surface soil. Receptors potentially exposed to soil are workers, visitors, and ecological receptors. In addition, the ecological receptor is potentially exposed through the food chain.

The barriers to exposure at the RBES (see Figs. 4.4b1 and 4.4b2) are continued access controls to prevent exposure to soil ①. In addition, source actions to remove the “hot spot” soil ② also are planned under the RBES.

Table 4.6 Risk assessment summary[a] for industrial worker exposure to contaminated surface soil found at selected areas in the SSOU

Location[b]	Land Use	Risk[c]	Risk Scenario[d]	Contaminant Description	Representative Concentration (mg/kg or pCi/g)	Baseline Risk Level[e]	PRG (mg/kg or pCi/g)[f]	Basis for PRG[g]	Actual or Expected Post Cleanup Conc or Risk Level
C-728 Clean Waste Oil Tank	Industrial	N	Industrial	Manganese	415	HI = 1	452	Risk-Based	Average concentration to achieve ELCR = 1E-4 and HI=1
				Vanadium	19.8	HI = 0.6	33.2	Risk-Based	Average concentration to achieve ELCR = 1E-4 and HI=1
				Total PCBs	104	ELCR = 5E-4	PCB at 25	TSCA	25 mg/kg
C-615 Sewage Treatment Plant	Industrial	N	Industrial	Manganese	511	HI = 1	452	Risk-Based	Average concentration to achieve ELCR = 1E-4 and HI=1
				Uranium	1,850	HI = 9	202	Risk-based	Average concentration to achieve ELCR = 1E-4 and HI=1
				Total PCBs	46.4	ELCR = 2E-4	PCB at 25	TSCA	25 mg/kg

Table 4.6 (continued)

Location[b]	Land Use	Risk[c]	Risk Scenario[d]	Contaminant Description	Representative Concentration (mg/kg or pCi/g)	Baseline Risk Level[e]	PRG (mg/kg or pCi/g)[f]	Basis for PRG[g]	Actual or Expected Post Cleanup Conc or Risk Level
				Cs-137	3.05	ELCR = 4E-5	0.0858	Risk-based	Average concentration to achieve ELCR = 1E-4 and HI=1
				Th-228	1.21	ELCR = 4E-5	0.0280	Risk-based	Average concentration to achieve ELCR = 1E-4 and HI=1
C-540-A PCB Staging Area	Industrial	N	Industrial	Manganese	232	HI = 1	452	Risk-based	Average concentration to achieve ELCR = 1E-4 and HI=1
				Vanadium	27.8	HI = 1	33.2	Risk-based	Average concentration to achieve ELCR = 1E-4 and HI=1
				Total PCBs	93.4	ELCR = 5E-4	PCB at 25	TSCA	25 mg/kg
C-541-A PCB Waste Staging Area	Industrial	N	Industrial	Arsenic	13.4	ELCR = 3E-5	0.523	Risk-based	Average concentration to achieve ELCR = 1E-4 and HI=1
				Manganese	704	HI = 2	452	Risk-based	Average concentration to achieve ELCR = 1E-4 and HI=1

Table 4.6 (continued)

Location[b]	Land Use	Risk[c]	Risk Scenario[d]	Contaminant Description	Representative Concentration (mg/kg or pCi/g)	Baseline Risk Level[e]	PRG (mg/kg or pCi/g)[f]	Basis for PRG[g]	Actual or Expected Post Cleanup Conc or Risk Level
				Uranium	4,140	HI = 20	202	Risk-based	Average concentration to achieve ELCR = 1E-4 and HI=1
				Total PAHs	0.15	ELCR = 7E-6	0.0212	Risk-based	Average concentration to achieve ELCR = 1E-4 and HI=1
				Total PCBs	7.11	ELCR = 4E-5	PCB at 25	TSCA	25 mg/kg

[a] Values in this table were derived from an ongoing risk assessment at PGDP (DOE 2003i). Risks presented are "unmitigated" or baseline risks, which assume exposure with no barriers.

[b] Contaminant concentrations used for the assessment were the upper 95% confidence limit on the average concentrations of all soil samples collected within that area mentioned.

[c] "Y" indicates the result came from a baseline risk assessment. "N" indicates the result came from a screening level risk assessment.

[d] Industrial worker exposure (250 d/yr for 25 yr).

[e] "ELCR" is the excess lifetime cancer risk level. Values from E-06 to E-04 are within EPA's acceptable risk range for site related exposures. "HI" is the hazard index, a measure for potential systemic toxicity. Values greater than 1 indicate that a deleterious health effect is possible.

[f] "PRG" is the preliminary remediation goal used when considering potential response actions.

[g] "Risk-Based" = value derived using a scenario appropriate to the land use and a target risk of either 1E-06 (cancer) or 1 (hazard). For this table, value reported is that for the default industrial worker at risk level 1E-6 and hazard of 1. "TSCA" = based upon Toxic Substances Control Act.

Under the RBES, potential receptors during implementation of the response actions (see Fig. 4.4b3) are the maintenance worker, remediation worker, general site worker, disposal worker, transportation worker, the public, and ecological receptors. The maintenance worker potentially could be exposed during site maintenance activities performed as part of access controls. The remediation worker, general site worker, and ecological receptors potentially could be exposed during the excavation of contaminated soil "hot spots." The disposal worker potentially could be exposed while accepting waste, and the transportation worker, public, and ecological receptors potentially could be exposed during transportation of waste to an off-site disposal location.

Projected Risk Levels

At the RBES, risks to all potential receptors would be at *de minimis* levels due to the barriers that prevent exposure and removal of contaminated soil. The risk target for cleanup levels under the RBES is a worker risk of 1E-04. The PCB concentration target is 25 ppm. Attainment of the target risk will be determined using the average contaminant concentration (defined as the 95% upper confidence limit of the mean concentration) within the exposure unit appropriate for the area's land use. Similarly, the PCB concentration target will be the average concentration within the exposure unit.

4.5 HAZARD AREA 5 – PERMITTED LANDFILLS

This hazard area is composed of the permitted landfills found at PGDP. This hazard area is depicted in Fig. 4.5a1. A description of each landfill is presented in the following section. The permitted landfills included currently are as follows:

- SWMU 9: C-746-S Residential Landfill
- SWMU 10: C-746-T Inert Landfill
- SWMU 208: C-746-U Landfill

(Note that a potential CERCLA Cell is another permitted landfill that may exist at PGDP when the RBES is attained. This potential facility is discussed in Sect. 4.5.2.)

4.5.1 Current State

Sources

The *C-746-S Residential Landfill* (SWMU 9) is located to the north of the industrialized portion of PGDP. This unit was the PGDP sanitary landfill from 1981 to 1995. Before the construction and permitting of the C-746-S Landfill, the area was used for the disposal of scrap and waste. C-746-S consists of 6 cells, each of which was lined with 12 inches of clay. The landfill permit allowed the disposal of industrial operations refuse, debris, and combustible and noncombustible garbage. Trash was compacted daily and covered with 6 inches of soil.

The Kentucky Division of Waste Management (KDWM) issued a permit for the construction of the C-746-S Residential Landfill in April of 1981. DOE complied with required modifications to landfill operations in July 1993, designed to promote groundwater and surface water protection, and completed a certified closure of the last landfill cell in June of 1995. A continuing groundwater and surface water monitoring program is in place to trigger corrective action requirements, should actions be needed.

An RI for the C-746-S Landfill has not been completed. The landfill is a potential source of solvents, metals, and radionuclides.

The *C-746-T Inert Landfill* (SWMU 10) is located adjacent to the C-746-S Landfill (SWMU 9). It was used for the disposal of industrial trash from 1985 through 1992. Common buried debris includes concrete, wood, and rock, with steam plant fly ash used as filler material. The C-746-T operating permit required that the waste be covered with clay and a vegetative cover for closure.

The KDWM issued a permit for the construction of the C-746-T Inert Landfill in February of 1985. DOE completed a certified closure of the landfill in November of 1992. A continuing groundwater and surface water monitoring program is in place to trigger corrective action requirements, should actions be needed.

An RI for the C-746-S Landfill has not been completed. The landfill is a potential source of solvents, metals, radionuclides, and asbestos.

The *C-746-U Landfill* (SWMU 208) is an operating Subtitle D solid waste landfill located directly north of the C-746-S and T Landfills. It covers 59.7 acres and includes a liner and leachate collection system. This landfill started receiving waste in 1997. Waste accepted includes construction debris, industrial waste, asbestos material, incinerator ash, tires, paper, dead animals, cardboard, and plastics. Leachate from the C-746-U Landfill is treated at PGDP before being released to KPDES permitted outfalls.

Pathways

In the current CSM for the Permitted Landfills (see Fig. 4.5a2), buried waste and soil are identified as current sources of contamination. Contaminants from these sources may migrate to both the groundwater and surface water; however, these are uncertain pathways due to the presence of leachate collection systems. Once in surface water, contaminants could affect ecological receptors or enter the food chain; however, this pathway is uncertain as well.

Using this model, buried waste, subsurface soil, groundwater, and surface water are of concern. Receptors potentially exposed to waste and soil are workers, visitors, and ecological receptors. Receptors potentially exposed to groundwater are workers and residents. Receptors potentially exposed to surface water are workers, visitors, and ecological receptors. In addition, the visitor, resident, and ecological receptor potentially are exposed through the food chain.

Under current conditions, barriers to exposure are the current land cover ① and access controls ②, which prevent exposure to waste and soil; continuation of the PGDP Water Policy ④, which provides an alternate water supply to any residences affected by contaminated groundwater (DOE 1994); and the landfill cap and leachate collection system ③, which minimizes contaminant migration. In addition, the landfills are monitored to ensure that these systems are working properly.

Risk Levels

Risk assessment results using adequate data are not available for the permitted landfills; therefore, it is not possible to report unmitigated or baseline risks. However, because all pathways are incomplete, all unmitigated risks can be assumed to be at *de minimis* levels.

4.5.2 RBES

Sources

This hazard area is composed of the following three SWMUs and a planned facility. Please see Sect. 4.5.1 for a description of the SWMUs and their contaminant levels. A short description of the planned facility, a potential CERCLA Cell, is provided here.

- SWMU 9: C-746-S Residential Landfill
- SWMU 10: C-746-T Inert Landfill
- SWMU 208: C-746-U Landfill
- Potential CERCLA Cell

The *CERCLA Cell* for PGDP is a potential facility that has not yet been sited. Fig. 4.5b1 shows the locations investigated as part of a siting study. This unit would provide PGDP with waste disposal alternatives for CERCLA-derived waste, such as low-level, TSCA, mixed, and hazard wastes. The waste would be generated from environmental restoration and D&D activities and, potentially, legacy and DMSA waste disposal.

Pathways

The current CSM for the Permitted Landfills (see Fig. 4.5a2) identified buried waste and soil as current sources of contamination. Contaminants from these sources may migrate to both the groundwater and surface water; however, these are uncertain pathways. Once in surface water, contaminants could affect ecological receptors or enter the food chain; however, this pathway is uncertain as well.

Using this model, buried waste, subsurface soil, groundwater, and surface water are of concern. Receptors potentially exposed to waste and soil are workers, visitors, and ecological receptors. Receptors potentially exposed to groundwater are workers and residents. Receptors potentially exposed to surface water are workers, visitors, and ecological receptors. In addition, the visitor, resident, and ecological receptor potentially could be exposed through the food chain.

Barriers to exposure at the RBES are similar to those currently in place. (See Figs. 4.5b1 and 4.5b2.) These barriers are the current land cover ① and access controls ②, which prevent exposure to waste and soil; implementation of enhanced institutional controls, which will limit access to and use of groundwater ⑤, and the landfill cap, leachate collection system, and monitoring ③, which minimizes contaminant migration. (Enhanced institutional controls under the RBES would be implemented on both DOE- and non-DOE-owned property. These controls could range from implementation of legal agreements with surrounding landowners to place enforceable restrictions on groundwater use to DOE's acquiring rights from surrounding property owners and directly implementing restrictions on groundwater and property use.)

Under the RBES, potential receptors in the treatment train (see Fig. 4.5b3) are the maintenance worker and environmental sampler. The maintenance worker could be exposed while maintaining the access controls and landfill containment systems. The environmental sampler could be exposed during routine sampling activities.

Projected Risk Levels

At the RBES, risks to all potential receptors would be at *de minimis* levels because barriers would prevent exposure.

4.6 HAZARD AREA 6 – C-746-K LANDFILL

This hazard area is composed of the facilities and SWMUs listed below. This hazard area is depicted in Fig. 4.6a1. A description of each facility and SWMU is presented in the following section.

- SWMU 5: C-746-F Burial Ground
- SWMU 7: C-747-A Burial Ground
- SWMU 8: C-746-K Landfill
- SWMU 30: C-747-A Burn Area

4.6.1 Current State

Sources

The *C-746-F Burial Ground* (SWMU 5) is located in the northwest part of the industrialized portion of PGDP and covers 272,986 ft^2. This burial ground was used for the disposal of radionuclide-contaminated and uncontaminated classified scrap beginning in 1965. An RI for the burial ground was completed in 1999 (DOE 2000c). Contaminants determined to be associated with this burial ground are uranium, ^{99}Tc, tritium, ^{60}Co, and metals.

The *C-747-A Burial Ground* (SWMU 7) is located in the extreme northwest corner of the industrialized portion of PGDP and covers 127,077 ft^2. This burial ground was used for disposal of miscellaneous debris from 1957 to 1979. Within the boundaries of the burial ground are three burial pits that cover approximately 23,100 ft^2 and contain noncombustible, contaminated and uncontaminated trash and equipment; one burial pit that covers approximately 2,100 ft^2 and contains contaminated concrete; and another burial pit that covers 9,000 ft^2 and contains uranium-contaminated scrap metal and equipment. An RI for the burial ground was completed in 1997 (DOE 1998a). Contaminants found include metals, VC, semi-volatile organic compounds, PCBs, and radionuclides.

The *C-746-K Landfill* (SWMU 8) is located to the southwest of the industrialized portion of PGDP. This unit was used as a sanitary landfill from the early 1950s through the early 1980s. The landfill is known to contain sanitary trash (burned and unburned) and fly ash from coal-burning operations. Before 1967, trenches were cut in the ash to form burn pits. After 1967, the trash was buried in the ash without burning. Sludge from the C-615 Sewage Treatment Plant was reported to have been used as fill material. C-746-K possibly contains some slightly radionuclide-contaminated trash.

DOE closed the landfill in 1982 by covering the landfill with a 6-inch clay cap and a 18-inch vegetative cover. Seepage points were identified in a ditch adjacent to the unit in January of 1992. This landfill subsequently underwent an RI. A ROD has been signed for this landfill. Corrective actions taken (1992) include installation of rip-rap along creek bank to prevent direct contact with the seeps, recontouring of the landfill cap to promote rainfall runoff, implementation of institutional controls, and long-term monitoring. The DOE placed deed restrictions on the landfill in 1997. Possible contaminants associated with the landfill are solvents and metals.

The *C-747-A Burn Area* (SWMU 30) is located to the west of the C-747-A Burial Ground and covers 125,540 ft^2. The C-747-A Burn Area was operated from 1951 to 1970 for burning and disposal of combustible trash, some of which may have been contaminated with uranium. Burning was done at an incinerator, which subsequently has been demolished and portions of it are buried within this SWMU's boundary. During operation of the C-747-A Burn Area, a waste burial pit was used for disposal of contaminated and uncontaminated trash, ash, and debris. An RI for the SWMU was completed in 1997 (DOE 1998a). Contaminants found include solvents, radionuclides, metals, semi-volatile organic compounds, and PCBs.

Pathways

In the current CSM for the BGOU (Group 2) (see Fig. 4.6a2), waste materials from plant operations and surface and subsurface soil are identified as current sources of contamination. Contaminants found in waste and soil are available for direct contact on site. For all but the C-746-K Landfill (SWMU 8), migration of contamination from these burial grounds to surface water or groundwater is not expected due to the nature of the wastes. Similarly, for all but the C-746-K Landfill, ecological receptors potentially could contact contaminants at the burial grounds resulting in contamination entering the food chain, but impacts from this pathway would be limited because the burial grounds are located in industrialized areas. For the C-746-K Landfill, releases to surface water are known to have occurred in the past and these releases may impact ecological receptors in Bayou Creek in an area outside the industrialized portion of PGDP.

Using this model, the waste materials (soil, groundwater, and surface water) are of concern. Receptors potentially exposed to waste and soil are workers, visitors, and ecological receptors. Receptors potentially exposed to groundwater are workers and residents. Receptors potentially exposed to surface water are workers, visitors, and ecological receptors. In addition, the visitor, resident, and ecological receptor potentially could be exposed through the food chain.

Under current conditions, the barriers to exposure are the current land cover ① and access controls ②, which prevent exposure to waste and subsurface soil (and surface water at the C-746-K Landfill), and continuation of the PGDP Water Policy ③, which provides an alternate water supply to any residences affected by contaminated groundwater (DOE 1994).

Risk Levels

As shown in Fig. 4.6a2, only the biota pathway though surface water currently is considered complete for the Burial Ground OU (Group 2); and, as discussed previously, this pathway is complete only for the C-746-K Landfill. Representative ecological and human health risk assessments for this surface water pathway are not available; however, baseline (i.e., unmitigated) risk results for exposure by ecological receptors and humans to soils at the landfill are available and are presented in Table 4.7. Additionally, unmitigated risk results that could be present if barriers did not exist at the C-747-A Burial Ground (SWMU 7) are available at this time. These results are presented in Table 4.8.

Table 4.7. Risk assessment summary[a] for industrial worker and ecological receptor exposure to contaminated surface soil found at SWMU 8: C-747-K Landfill

Location[b]	Land Use	Risk[c]	Risk Scenario[d]	Contaminant Description	Representative Concentration (mg/kg or pCi/g)	Baseline Risk Level[e]	PRG (mg/kg or pCi/g)[f]	Basis for PRG[g]	Actual or Expected Post Cleanup Conc or Risk Level
C-746-K Landfill	Industrial	N	Industrial	Arsenic	11.5	ELCR = 2E-5	0.52	Risk-Based	*De minimis* – due to cap
				Antimony	3.7	HI = 1	3.8	Risk-Based	De minimis – due to cap
				Manganese	2,110	HI = 5	452	Risk-Based	De minimis – due to cap
				Vanadium	45	HI = 1	33.2	Risk-Based	*De minimis* – due to cap
				Total PAHs	0.35	ELCR = 2E-5	0.02	Risk-Based	*De minimis* – due to cap
				Th-228	1.12	ELCR = 4E-5	0.03	Risk-Based	*De minimis* – due to cap
C-746-K Landfill	Industrial	N	Ecological – Terrestrial Plants	Aluminum	7,000	HQ = 159	NA	NA	NA
				Chromium	11.6	HQ = 15	NA	NA	NA
				Manganese	1,140	HQ = 6	NA	NA	NA
				Vanadium	17.8	HQ = 11	NA	NA	NA
C-746-K Landfill	Industrial	N	Ecological – Earthworms	Chromium	11.6	HQ = 39	NA	NA	NA
				Mercury	0.15	HQ = 2	NA	NA	NA
C-746-K Landfill	Industrial	N	Ecological – Microflora	Aluminum	7,000	HQ = 13	NA	NA	NA
				Chromium	11.6	HQ = 2	NA	NA	NA
				Iron	12,700	HQ = 93	NA	NA	NA
				Manganese	1,140	HQ = 28	NA	NA	NA

Table 4.7 (continued)

Location[b]	Land Use	Risk[c]	Risk Scenario[d]	Contaminant Description	Representative Concentration (mg/kg or pCi/g)	Baseline Risk Level[e]	PRG (mg/kg or pCi/g)[f]	Basis for PRG[g]	Actual or Expected Post Cleanup Conc or Risk Level
C-746-K Landfill	Industrial	N	Ecological – Herbivorous Wildlife (meadow vole)	Aluminum	7,000	HQ = 12	NA	NA	NA
C-746-K Landfill	Industrial	N	Ecological – Omnivorous Wildlife (white-footed mouse)	Aluminum	7,000	HQ = 19	NA	NA	NA
C-746-K Landfill	Industrial	N	Ecological – Vermivorous Wildlife (short-tailed shrew)	Aluminum	7,000	HQ = 307	NA	NA	NA
				Arsenic	3.78	HQ = 4	NA	NA	NA
				Mercury	0.15	HQ = 1	NA	NA	NA
				Vanadium	17.8	HQ = 3	NA	NA	NA

NA = value is not available at this time.

[a] Values in this table for the worker were derived from an ongoing risk assessment at PGDP (DOE 2003i). Risks for ecological receptors are from 1996a. In all cases, risks presented are "unmitigated" or baseline risks, which assume exposure with no barriers.

[b] Contaminant concentrations used for the assessment were the upper 95% confidence limit on the average concentrations of all sediment samples collected from soil and/and or sediment at the C-746K Landfill.

[c] "Y" indicates the result came from a baseline risk assessment. "N" indicates the result came from a screening level risk assessment.

[d] Industrial worker exposure (250 d/yr for 25 yr). All ecological exposures are assumed to be lifetime exposures.

[e] "ELCR" is the excess lifetime cancer risk level. Values from E-06 to E-04 are within EPA's acceptable risk range for site related exposures. "HI" is the hazard index, a measure for potential systemic toxicity. Values greater than 1 indicate that a deleterious health effect is possible. "HQ" is a hazard quotient for ecological receptors. A value greater than 1 indicates that a deleterious effect on the ecological receptor is possible.

[f] "PRG" is the preliminary remediation goal used when considering potential response actions.

[g] "Risk-Based" = value derived using a scenario appropriate to the land use and a target risk of either 1E-06 (cancer) or 1 (hazard). For this table, value reported is that for the default industrial worker at risk level 1E-6 and hazard of 1.

Table 4.8 Risk assessment summary[a] for industrial worker exposure to contaminated surface soil found at SWMU 7: C-747-A Burial Ground

Location[b]	Land Use	Risk[c]	Risk Scenario[d]	Contaminant Description	Representative Concentration (mg/kg or pCi/g)	Baseline Risk Level[e]	PRG (mg/kg or pCi/g)[f]	Basis for PRG[g]	Actual or Expected Post Cleanup Conc or Risk Level
C-747-A Burial Ground	Industrial	N	Industrial	Beryllium	24.4	HI = 3	9.5	Risk-Based	*De minimis* – due to cap
				Manganese	341	HI = 1	452	Risk-Based	*De minimis* – due to cap
				Uranium	361	HI = 2	202	Risk-Based	*De minimis* – due to cap
				Vanadium	30.9	HI = 1	33.2	Risk-Based	*De minimis* – due to cap
				Total PAHs	0.94	ELCR = 5E-5	0.021	Risk-Based	*De minimis* – due to cap
				U-238	530	ELCR = 3E-4	1.71	Risk-Based	*De minimis* – due to cap

[a] Values in this table were derived from an ongoing risk assessment at PGDP (DOE 2003i). Risks presented are "unmitigated" or baseline risks, which assume exposure with no barriers.

[b] Contaminant concentrations used for the assessment were the upper 95% confidence limit on the average concentrations of all soil samples collected at the burial ground.

[c] "Y" indicates the result came from a baseline risk assessment. "N" indicates the result came from a screening level risk assessment.

[d] Industrial worker exposure (250 d/yr for 25 yr).

[e] "ELCR" is the excess lifetime cancer risk level. Values from E-06 to E-04 are within EPA's acceptable risk range for site related exposures. "HI" is the hazard index, a measure for potential systemic toxicity. Values greater than 1 indicate that a deleterious health effect is possible.

[f] "PRG" is the preliminary remediation goal used when considering potential response actions.

[g] "Risk-Based" = value derived using a scenario appropriate to the land use and a target risk of either 1E-06 (cancer) or 1 (hazard). For this table, value reported is that for the default industrial worker at risk level 1E-6 and hazard of 1.

4.6.2 RBES

Sources

This hazard area is composed of the SWMUs listed below. Please see Sect. 4.6.1 for a description of these SWMUs and their contaminant levels.

- SWMU 5: C-746-F Burial Ground
- SWMU 7: C-747-A Burial Ground
- SWMU 8: C-746-K Landfill
- SWMU 30: C-747-A Burn Area

Pathways

In the current CSM for the BGOU (Group 2) (see Fig. 4.6a2), waste materials from plant operations and surface and subsurface soil are identified as current sources of contamination. Contaminants found in waste and soil are available for direct contact onsite. For all but the C-746-K Landfill (SWMU 8), migration of contamination from these burial grounds to surface water or groundwater is not expected due to the nature of the wastes. Similarly, for all but the C-746-K Landfill, ecological receptors potentially could contact contaminants at the burial grounds resulting in contamination entering the food chain, but impacts from this pathway would be limited because the burial grounds are located in industrialized areas. For the C-746-K Landfill, releases to surface water are known to have occurred in the past, and these releases may impact ecological receptors in Bayou Creek in an area outside the industrialized portion of PGDP.

Using this model, the waste materials (soil, groundwater, and surface water) are of concern. Receptors potentially exposed to waste and soil are workers, visitors, and ecological receptors. Receptors potentially exposed to groundwater are workers and residents. Receptors potentially exposed to surface water are workers, visitors, and ecological receptors. In addition, the visitor, resident, and ecological receptor potentially could be exposed through the food chain.

Barriers to exposure at the RBES are depicted Fig. 4.6b1 and 4.6b2. These are the current land cover ① and access controls ②, which prevent exposure to waste and subsurface soil; enhanced institutional controls, which will limit use of and access to groundwater ⑤; and the landfill cap ④, which mitigates contaminant migration. (The enhanced institutional controls discussed above replace the current PGDP Water Policy. Enhanced institutional controls under the RBES would be implemented on both DOE- and non-DOE-owned property. These controls could range from implementation of legal agreements with surrounding landowners to place enforceable restrictions on groundwater use to DOE's acquiring rights from surrounding property owners and directly implementing restrictions on groundwater and property use.)

Under the RBES, potential receptors in the treatment train (see Fig. 4.6b3) are the maintenance worker, remediation worker, environmental sampler, and ecological receptor. The maintenance worker could be exposed while maintaining the access controls and current cover. The remediation worker and ecological receptor could be exposed while the landfill caps are installed. The environmental sampler could be exposed during routine sampling activities.

Projected Risk Levels

At the RBES, risks to all potential receptors would be at *de minimis* levels because barriers limit exposure or mitigate contaminant migration.

4.7 HAZARD AREA 7 – LEGACY WASTE AND DMSAS

This area consists of the legacy waste found at storage locations at PGDP and potentially contaminated debris, surfaces, and soil found in DMSAs located throughout PGDP. This hazard area is depicted in Fig. 4.7a1. The following facilities hold containerized legacy waste in storage:

C-746-A	C-746-V	C-310	C-337
C-746-B	C-746-M	C-331	C-752-A
C-746-H3	C-752-C	C-333	C753-A
C-746-Q	C-733	C-335	

Facilities containing DMSAs, including 18 outside locations, are as follows:

Outside – Locations 1-18	C-333 – Locations 1-43	C-409 – Locations 1-2
C-310 – Locations 1-5	C-337 – Locations 1-45	C-720 – Locations 1-4
C-331 – Locations 1-24	C-400 – Locations 1-8	

4.7.1 Current State

Sources

Legacy Waste areas contain investigation-derived waste (IDW) classified as low-level waste (LLW), PCBs, nonhazardous, and hazardous waste streams. The process buildings (C-331, C-C-333, and C-337) contain DMSAs that contain some legacy waste. The C-746-A and C-746-B Warehouses are 72,000 ft^2 and contain 55-gal drums of material contaminated with hazardous substances and radionuclides. Most of the containers in these facilities are labeled as PCB and/or radiologically contaminated and may contain soils or liquid wastes. C-746-A is a permitted hazard waste storage area. The C-746-H3 Pad is a waste storage area that is approximately 56,150 ft^2. It contains nonhazardous IDW. C-746-M is a nonhazardous waste storage facility used to store PCB contaminated wastes. C-746-Q is a 100,00 ft^2 building used to store low-level and hazardous waste containers. This facility is included in the RCRA Part B Permit. C-746-V and C-753-A are storage areas that contain LLW and PCB containers. C-752-A is a hazardous waste permitted storage facility that stores LLW, PCB, and hazardous waste containers. Both liquids and solids are stored in this facility.

DOE Material Storage Areas are comprised of 160 areas located throughout PGDP. These areas contain many types of materials, such as process equipment, tanks, scrap metal, miscellaneous equipment, pallets, motors, trash, PPE/plastic containers, piping, empty transformers, PCB and LLW containers, rail cars, vehicles, fire extinguishers, and fork lifts. The material has been stored in these areas for many years and characterization is an ongoing activity.

Pathways

Under the current CSM for Legacy Waste and DMSAs (see Fig. 4.7a2), stored waste and surface soil are identified as current sources of contamination. Contaminants found in either location are available for direct contact on site. Additionally, contaminants in surface soil potentially could migrate to surface water and sediment, but this is an uncertain pathway. Once in the environment, contaminants could directly affect ecological receptors or enter the food chain.

Using this model, waste, soil, sediments, and surface water are of concern. Receptors potentially exposed to stored waste are workers and ecological receptors. Receptors potentially exposed to soil are workers and ecological receptors. Receptors potentially exposed to sediment and surface water are workers, visitors, and ecological receptors; however, this is an uncertain pathway. In addition, the resident, visitor, and ecological receptor are potentially exposed through the food chain, another uncertain pathway.

Under current conditions, the only barrier to exposure is access restrictions ① to prevent access to the waste and soil.

Projected Risk Levels

A risk assessment has not been performed for any Legacy Waste or DMSA sites. However, because access to all areas is controlled, risks are at *de minimis* levels.

Unmitigated risks to legacy wastes may exceed *de minimis* levels because contaminant levels could be high in some of this waste; however, the unmitigated risks associated with the DMSAs are uncertain. For DMSAs characterized to date, data indicate that uncontrolled exposure to materials may result in levels of risk that are *de minimis*, but this result may differ as more characterization is performed.

4.7.2 RBES

Sources

This area consists of the legacy waste found at storage locations at PGDP and potentially contaminated debris, surfaces, and soil found in DMSAs located throughout PGDP. The following facilities hold containerized legacy waste in storage:

C-746-A	C-746-V	C-310	C-337
C-746-B	C-746-M	C-331	C-752-A
C-746-H3	C-752-C	C-333	C753-A
C-746-Q	C-733	C-335	

The following facilities containing DMSAs include 18 outside locations.

Outside – Locations 1-18	C-333 – Locations 1-43	C-409 – Locations 1-2
C-310 – Locations 1-5	C-337 – Locations 1-45	C-720 – Locations 1-4
C-331 – Locations 1-24	C-400 – Locations 1-8	

Please see Sect. 4.7.1 for a description of these areas and their contaminant levels.

Pathways

The current CSM for Legacy Waste and DMSAs (see Fig. 4.7a2) identified stored waste and surface soil as current sources of contamination. Contaminants found in either location are available for direct contact onsite. Additionally, contaminants in surface soil potentially could migrate to surface water and sediment, but this is an uncertain pathway. Once in the environment, contaminants could directly affect ecological receptors or enter the food chain.

Using this model, the stored waste, soil, sediments, and surface water are of concern. Receptors potentially exposed to stored waste are workers and ecological receptors. Receptors potentially exposed to soil are workers and ecological receptors. Receptors potentially exposed to sediment and surface water are workers, visitors, and ecological receptors. In addition, the resident, visitor, and ecological receptor potentially could be exposed through the food chain.

No barriers to exposure are required at the RBES (see Figs. 4.7b1 and 4.7b2) because all legacy waste and materials in the DMSAs are characterized and disposed of in an off-site location or in a permitted landfill at PGDP ②. Additionally, any contaminated surfaces are decontaminated ③ and contaminated soil is excavated and disposed of in an off-site location ④ or in a permitted landfill at PGDP. (Please see Sect. 5 for a discussion of risks at permitted landfills at PGDP.)

Under the RBES, potential receptors during implementation of the response actions (see Fig. 4.7b3) are the remediation worker, general site worker, disposal worker, transportation worker, the public, and ecological receptors. The remediation worker, general site worker, and ecological receptor could be exposed during the characterization and disposal of waste, decontamination of surfaces, and excavation of soil. The landfill worker and disposal worker could be exposed while accepting waste, including excavated soil. The transportation worker, public, and ecological receptor could be exposed during transportation of waste and soil to an off-site disposal location.

Projected Risk Levels

At the RBES, risks to all potential receptors would be at *de minimis* levels due to characterization and disposal of waste and soil. The risk target for cleanup levels for soil and surfaces under the RBES is an industrial worker risk of 1E-04. The PCB concentration target is 25 ppm. Attainment of the target risk will be determined using the average contaminant concentration (defined as the 95% upper confidence limit of the mean concentration) within the exposure unit appropriate for the area's land use. Similarly, the PCB concentration target will be the average concentration within the exposure unit.

4.8 HAZARD AREA 8 – CYLINDER YARDS AND CONVERSION FACILITY SITE

This hazard area is composed of 20 cylinder yards and the DUF_6 Conversion Facility that will be built, operated, and undergo D&D as part of the EM mission at PGDP. This hazard area is depicted in Fig. 4.8a1. Please see the following section for a description of these areas.

4.8.1 Current State

Sources

The cylinder yards are located throughout the site and are used to store cylinders containing depleted uranium hexafluoride (UF_6). The yards are primarily gravel or concrete covered and contain cylinders held in place with creosote wood and concrete saddles. Most of the cylinders are 12 ft long and 4 ft in diameter, with a nominal wall thickness of 5/16 inch The largest storage area at PGDP is in the southeast corner of the site. There are about 40,351 cylinders of depleted UF_6 stacked two layers high at Paducah; 28,351 of them were generated by DOE and about 12,000 were generated by USEC. The cylinders generated by USEC are not the responsibility of DOE and currently fall outside the PGDP mission.

DOE will be building a facility to convert its UF_6 to a more stable form for long-term storage, use, or permanent disposal. (Disposal will be at an off-site location.) The planned site of the DUF_6 Conversion Facility is located west of the south cylinder yards and south of the main plant entrance. Conversion to

oxide for use or long-term storage would begin as soon as possible, with conversion to metal only if uses for the metal are identified.

Pathways

The current CSM for the Cylinder Yards and DUF_6 Conversion Facility (see Fig. 4.8a2) identified the facility infrastructure, cylinders, and associated soils as current sources of contamination. Contaminants found associated with the facility infrastructure, cylinders, and soil are available for direct contact onsite. Additionally, contaminants in surface soil potentially could migrate to surface water and sediment, but this is an uncertain pathway. Once in the environment, contaminants could directly affect ecological receptors or enter the food chain.

Using this model, the contaminants from the facility infrastructure and cylinders and in soil, sediments, and surface water are of concern. Receptors potentially exposed to facility infrastructure, cylinders, and associated soil are workers and ecological receptors. Receptors potentially exposed to sediment and surface water are workers, visitors, and ecological receptors. In addition, the resident, visitor, and ecological receptor are potentially exposed through the food chain.

At the RBES, (see Figs. 4.8b1 and 4.8b2) all sources of contamination are removed. The completion of the conversion mission ③ includes offsite disposal of converted uranium; D&D of infrastructure, followed by on-site disposal ④, and excavation of any contaminated soil ⑤. In addition, any contamination in runoff is attenuated before it reaches surface water naturally.

Under the RBES, potential receptors during implementation of the response actions (see Fig. 4.8b3) are the industrial worker, remediation worker, landfill worker, general site worker, and ecological receptor. The industrial worker would be exposed while working in the conversion facility. The remediation worker, general site worker, and ecological receptor could be exposed during the D&D of the facility infrastructure and excavation of soil. The landfill worker and general site worker could be exposed while waste is transported to, and accepted at, the potential on-site CERCLA Cell.

Risk Levels

No risk information is available for the Cylinder Yards and DUF_6 Conversion Facility. Risks, however, are at *de minimis* levels because of the access restrictions. Unmitigated risks could be higher, if under unmitigated conditions, receptors are exposed to contamination for longer periods.

4.8.2 RBES

Sources

This hazard area is composed of 20 cylinder yards and the DUF_6 Conversion Facility that will be built, operated, and undergo D&D as part of the EM mission at PGDP. Please see Sect. 4.8.1 for a description of these areas and their contaminant levels.

Pathways

The current CSM for the Cylinder Yards and DUF_6 Conversion Facility (see Fig. 4.8a2) identified the facility infrastructure, cylinders, and associated soils as current sources of contamination. Contaminants found associated with the facility infrastructure, cylinders, and soil are available for direct contact onsite. Additionally, contaminants in surface soil potentially could migrate to surface water and sediment, but

this is an uncertain pathway. Once in the environment, contaminants directly could affect ecological receptors or enter the food chain.

Using this model, contaminants from the facility infrastructure and cylinders and in soil, sediments, and surface water are of concern. Receptors potentially exposed to facility infrastructure, cylinders, and associated soil are workers and ecological receptors. Receptors potentially exposed to sediment and surface water are workers, visitors, and ecological receptors. In addition, the resident, visitor, and ecological receptor potentially could be exposed through the food chain.

At the RBES, (see Figs. 4.8b1 and 4.8b2) all sources of contamination are removed. The completion of the conversion mission ③ includes off-site disposal of converted uranium; D&D of infrastructure, followed by on-site disposal ④, and excavation of any contaminated soil ⑤.

Under the RBES, potential receptors during implementation of the response actions (see Fig. 4.8b3) are the industrial worker, remediation worker, landfill worker, general site worker, and ecological receptor. The industrial worker would be exposed while working in the conversion facility. The remediation worker, general site worker, and ecological receptor could be exposed during the D&D of the facility infrastructure and excavation of soil. The landfill worker and general site worker could be exposed while waste is transported to, and accepted at, the potential on-site CERCLA Cell.

Projected Risk Levels

At the RBES, risks to all potential receptors would be at *de minimis* levels due to D&D of facility infrastructure, completion of the conversion mission, and excavation of any contaminated soils. The risk target for cleanup levels for soil under the RBES is an industrial worker risk of 1E-04. The PCB concentration target is 25 ppm. Attainment of the target risk will be determined using the average contaminant concentration (defined as the 95% upper confidence limit of the mean concentration) within the exposure unit appropriate for the area's land use. Similarly, the PCB concentration target will be the average concentration within the exposure unit.

4.9 HAZARD AREA 9 – GDP FACILITIES

This hazard area is composed primarily of the buildings and infrastructure currently leased to USEC for the enrichment of uranium. Please see Fig. 4.9a1 for a depiction of the location of these buildings. The buildings and infrastructure include:

- C-331, C-333, C-335, and C-337 process buildings and associated switchyards and cooling towers
- C-710 Technical Service Building
- C-720 Building
- C-724/725 Paint Shop
- Sewage Treatment Plant
- Water Treatment Plants
- C-400 Cleaning Building.

This hazard area also includes two large buildings and 15 smaller facilities that are currently slated for D&D as part of the D&D Operable Unit (see Chap. 1). These two large buildings are the C-410/420 Feed Plant and the C-340 Metals Plant. Please see the following section for additional information about these buildings and their associated contamination.

4.9.1 Current State

Sources

Process Buildings C-331, C-333, C-335, and C-337 are located along the east side of PGDP. Each is estimated to cover over 1,000,000 ft^2. These buildings house equipment and facilities for the processing of uranium. These facilities could have multiple environmental impacts, including releases of Freon™ to the atmosphere, lubrication oil leaks, radionuclide contamination, PCB contamination, lead-based paint usage, TCE, ^{99}Tc and chromate water releases, and asbestos containing materials. Associated cooling towers are used to cool and recirculate process water used in the process buildings. The cooling tower system consists of recirculating pumps, evaporative cooling towers, catch basins, and associated piping and equipment. Heavy metals are the primary potential contaminants associated with the cooling tower system; however, PCBs and chlorinated solvents also are potential contaminants for the cooling tower systems.

The *C-710 Technical Services Building* is located in the central portion of the plant security area and occupies approximately 88,997 ft^2. The building and area consists of a gas cylinder storage area and office space for laboratories, a shop, and storage. Environmental impacts include UF_6, fluorine, mercury, arsenic acetone, is-octane, hexane, methylene chloride, TCE, CIF_3, PCBs, uranium, concentrated acids, chromated water, lead, and asbestos containing materials.

The *C-724/7245 Shops* house the primary facility maintenance-related paint shops at PGDP. Potential environmental contamination sources include paint-related contaminants such as TCA, xylene, chromium VI, barium, TSP, titanium dioxide, and volatile organic compounds.

The *C-611 Water Treatment Plant* is a 15-acre area that consists of a treatment building and a series of lagoons. It is located on the west side of PGDP. Historical contamination consists of PCBs, mercury, chlorine trifluoride, nitric acid spills, radiological contamination, TCE releases from degreaser usage, and oil and grease.

The *C-615 Sewage Disposal Plant* is located in the southwest corner of the plant area. This facility receives effluent discharges from within PGDP and treats those effluents before discharge to KPDES Outfall 004. The Sewage Disposal Plant has several sources of potential environmental impact including PCBs, uranium, chlorine, lead, and asbestos contaminated material.

The *C-410/C-420 Feed Plant* complex is located in the central portion of the industrialized area of PGDP. The C-410/C-420 complex was constructed to produce UF_6 from UO_3 through a series of chemical reactions. Groundwater and soils in the vicinity of the C-410/C-420 complex were investigated as part of a remedial investigation (DOE 1999a). Contaminants found include solvents, PCBs, metals, and radionuclides. This facility currently is the subject of a removal action.

The *C-340 Metals Plant* is located in the east-central portion of the industrialized portion of PGDP. The facility was erected in 1957 with operations in the metals plant continuing until 1975. Final lockdown of the facility occurred in 1991. D&D activities began in 1992. Site investigations for the area of the C-340 Metals Plant identified solvents, PCBs, metals, and radionuclides as contaminants. This facility currently is the subject of a removal action.

Pathways

Under the current CSM for the GDP Facilities (see Fig. 4.9a2), contaminated infrastructure and soils were identified as current sources of contamination. Contaminants associated with infrastructure and soil

may migrate to groundwater and be transported to areas off DOE property. Additionally, contaminants may migrate to surface water and sediment and be transported to locations off DOE property. Finally, groundwater could be discharged to surface water. Once in surface water, contaminants could affect ecological receptors or enter the food chain.

Using this model, the contaminated infrastructure, soil, groundwater, surface water, and sediments, are of concern. Receptors potentially exposed to contaminated infrastructure and soil are workers, visitors, and ecological receptors. Receptors potentially exposed to groundwater are workers and residents. Receptors potentially exposed to surface water are workers, visitors, and ecological receptors. In addition, the resident, visitor, and ecological receptor are potentially exposed through the food chain.

Barriers to exposure under the current state (see Figs. 4.9a1 and 4.9a2) are access and excavation restrictions, which prevent exposure to contaminants in soil ①, and continuation of the PGDP Water Policy ②, which provides an alternate water supply to affected residences (DOE 1994). Discharges to surface water are addressed under the RBES through natural attenuation ④. Finally, a "hot spot" pump-and-treat ③, which consists of extraction wells within the high TCE concentration areas of the Northwest and Northeast Dissolved Phase Plumes, presently is used to control the spread of high TCE concentration areas.

Risk Levels

Risk information is not available; however, risks are at *de minimis* levels because there are no complete pathways. Unmitigated risks could exceed *de minimis* levels under current conditions in many areas because the GDP is operating industrial facility.

4.9.2 RBES

Sources

This hazard area is composed of the buildings and infrastructure leased to USEC for the enrichment of uranium. The buildings are listed below. Please see Sect. 4.9.1 for descriptions of these buildings.

- C-331, C-333, C-335, and C-337 process buildings and associated switchyards and cooling towers
- C-710 Technical Service Building
- C-720 Building
- C-724/725 Paint Shop
- Sewage Treatment Plant
- Water Treatment Plants
- C-400 Cleaning Building.

This hazard area also includes two large buildings and 15 smaller facilities that are currently slated for D&D as part of the D&D OU (see Chap. 1). These two large buildings are the C-410/420 Feed Plant and the C-340 Metals Plant. Please see Sect. 4.9.1 for additional information about these buildings and their associated contamination.

Pathways

The current CSM for the GDP Facilities (see Fig. 4.9a2) identified contaminated infrastructure and soils as current sources of contamination. Contaminants associated with infrastructure and soil may migrate to groundwater and be transported to areas off DOE property. Additionally, contaminants may

migrate to surface water and sediment and be transported to locations off DOE property. Finally, groundwater could be discharged to surface water. Once in surface water, contaminants could affect ecological receptors or enter the food chain.

Using this model, the contaminated infrastructure, soil, groundwater, surface water, and sediments are of concern Receptors potentially exposed to contaminated infrastructure and soil are workers, visitors, and ecological receptors. Receptors potentially exposed to groundwater are workers and residents. Receptors potentially exposed to surface water are workers, visitors, and ecological receptors. In addition, the resident, visitor, and ecological receptor are potentially exposed through the food chain.

Barriers to exposure at the RBES (see Figs. 4.9b1 and 4.9b2) are continued access and excavation restrictions, which prevents exposure to contaminants in soil ①, and implementation of enhanced institutional controls ⑤, which will limit access to and prevent use of groundwater. (Enhanced institutional controls under the RBES would be implemented on both DOE- and non-DOE-owned property. These controls could range from implementation of legal agreements with surrounding landowners to place enforceable restrictions on groundwater use to DOE's acquiring rights from surrounding property owners and directly implementing restrictions on groundwater and property use.) Source actions are planned to meet the RBES. These source actions include D&D of infrastructure with disposal in a potential on-site CERCLA Cell ⑥ and excavation of soil with disposal in the potential CERCLA Cell ⑦. Discharges to surface water currently are planned to be addressed through natural attenuation ④, and monitored natural attenuation will be used to address contamination in source zones and groundwater ⑧.

Under the RBES, receptors potentially exposed during implementation of the response actions (see Fig. 4.9b3) are the general site worker, environmental sampler, remediation worker, landfill worker, and, if off-site disposal is required, the transportation worker, disposal worker, and the public. (Off-site disposal of wastes derived from D&D of the C-340 and C-410/420 Buildings is possible if the D&D occurs before the potential CERCLA Cell is constructed and operating.) The general site worker and ecological receptors could be exposed during infrastructure D&D, excavation of soil, and disposal of waste. The environmental sampler could be exposed during sampling activities. The remediation worker could be exposed during completion of infrastructure D&D and soil excavation. The landfill and disposal workers could be exposed while accepting D&D waste and soil. Finally, the transportation worker, public, and ecological receptors could be exposed during transportation of waste to an off-site disposal location.

Projected Risk Levels

At the RBES, risks to all potential receptors would be at *de minimis* levels using barriers to prevent exposure and through removal of infrastructure and contaminated soil. The soil cleanup risk targets would be for an industrial worker risk of 1E-04. The PCB target would be 25 ppm. For soils, attainment of the target risk will be determined using the average contaminant concentration (defined as the 95% upper confidence limit of the mean concentration) within the exposure unit appropriate for the area's land use. Similarly, the PCB concentration target in soil will be the average concentration within the exposure unit. Because contamination in groundwater would continue to exist at levels above MCLs, monitored natural attenuation would be required for groundwater until MCLs are met.

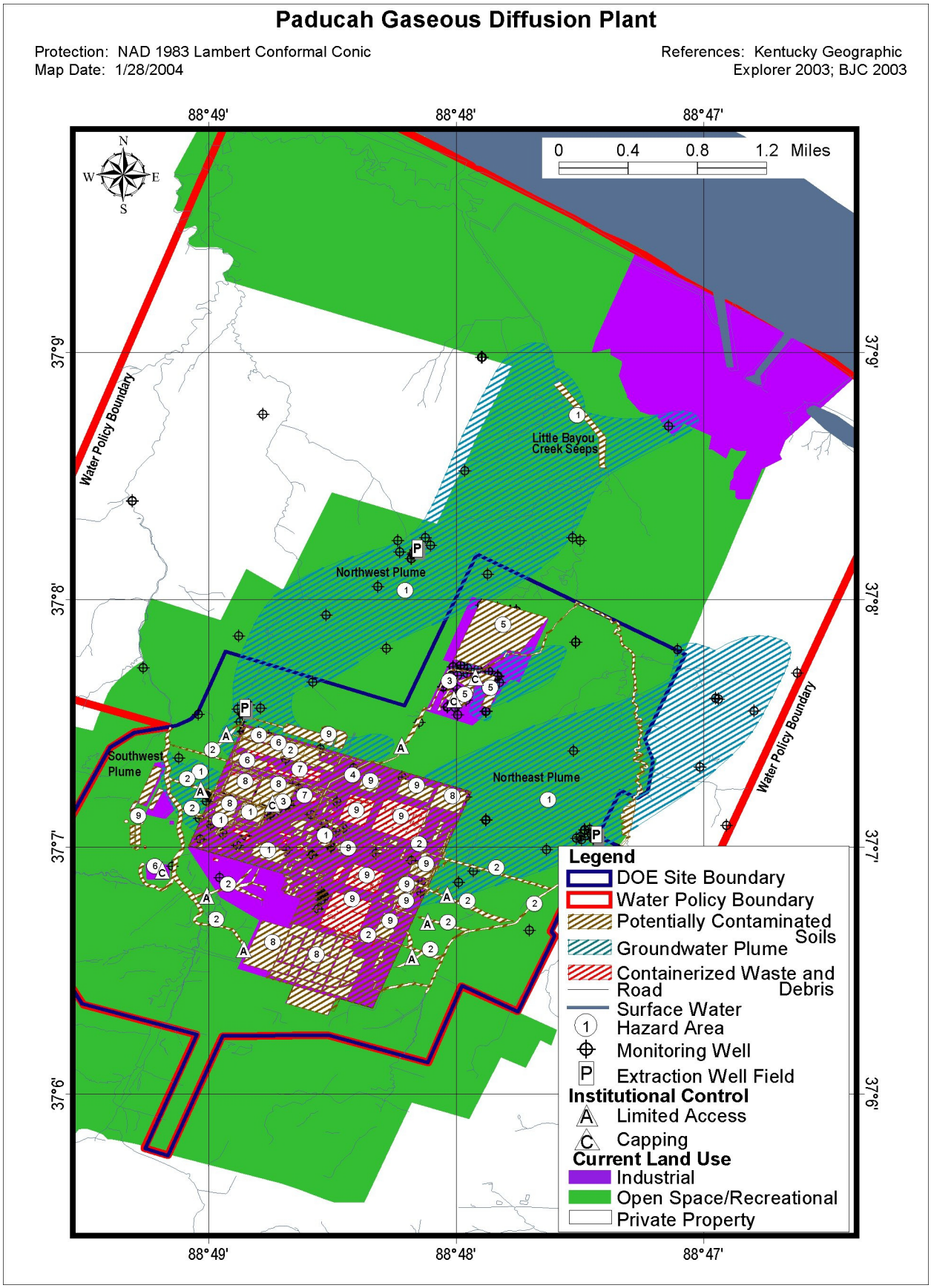


Fig. 4.0a1. Hazard areas – current state.

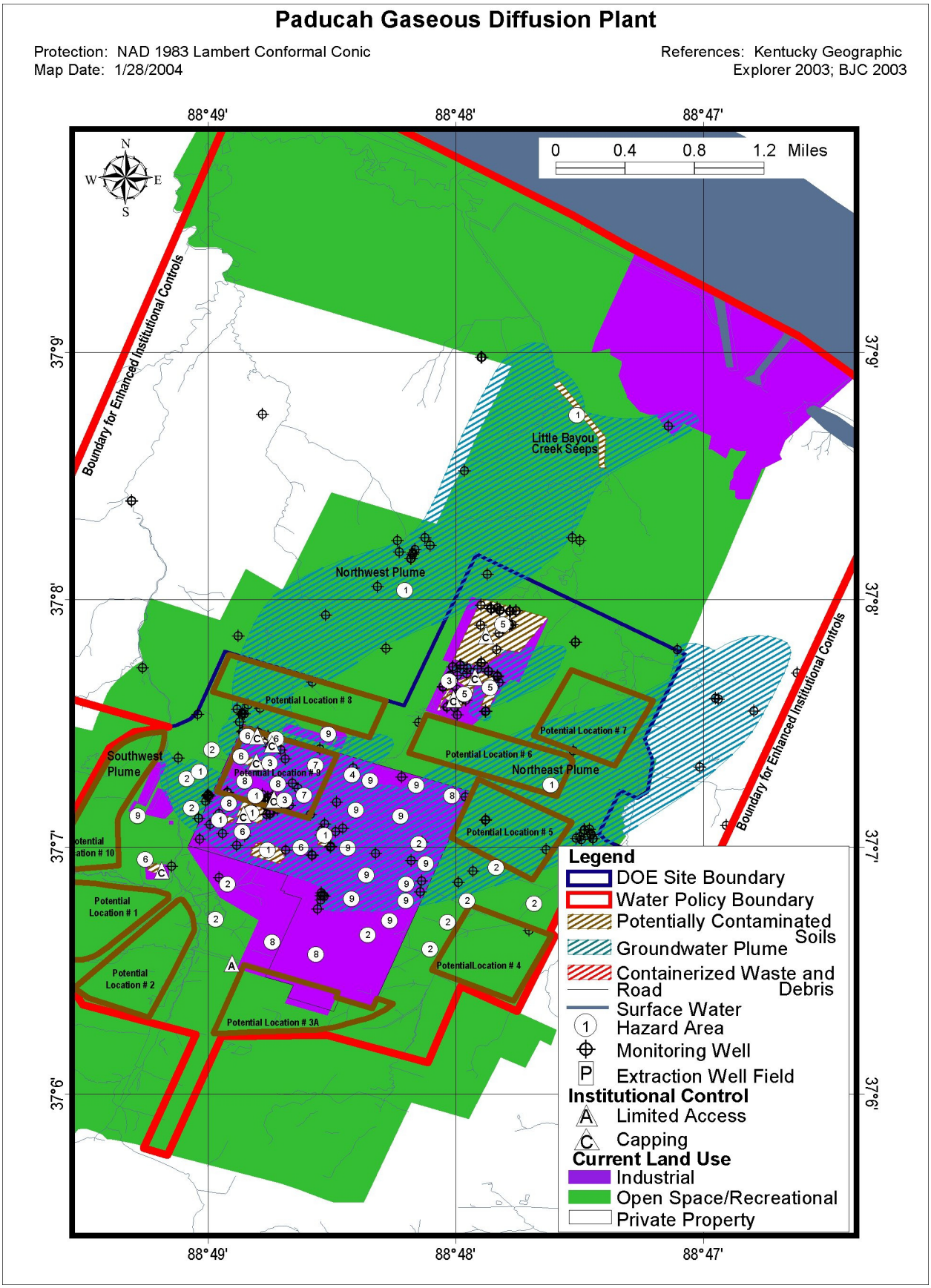


Fig. 4.0b1. Hazard areas – RBES.

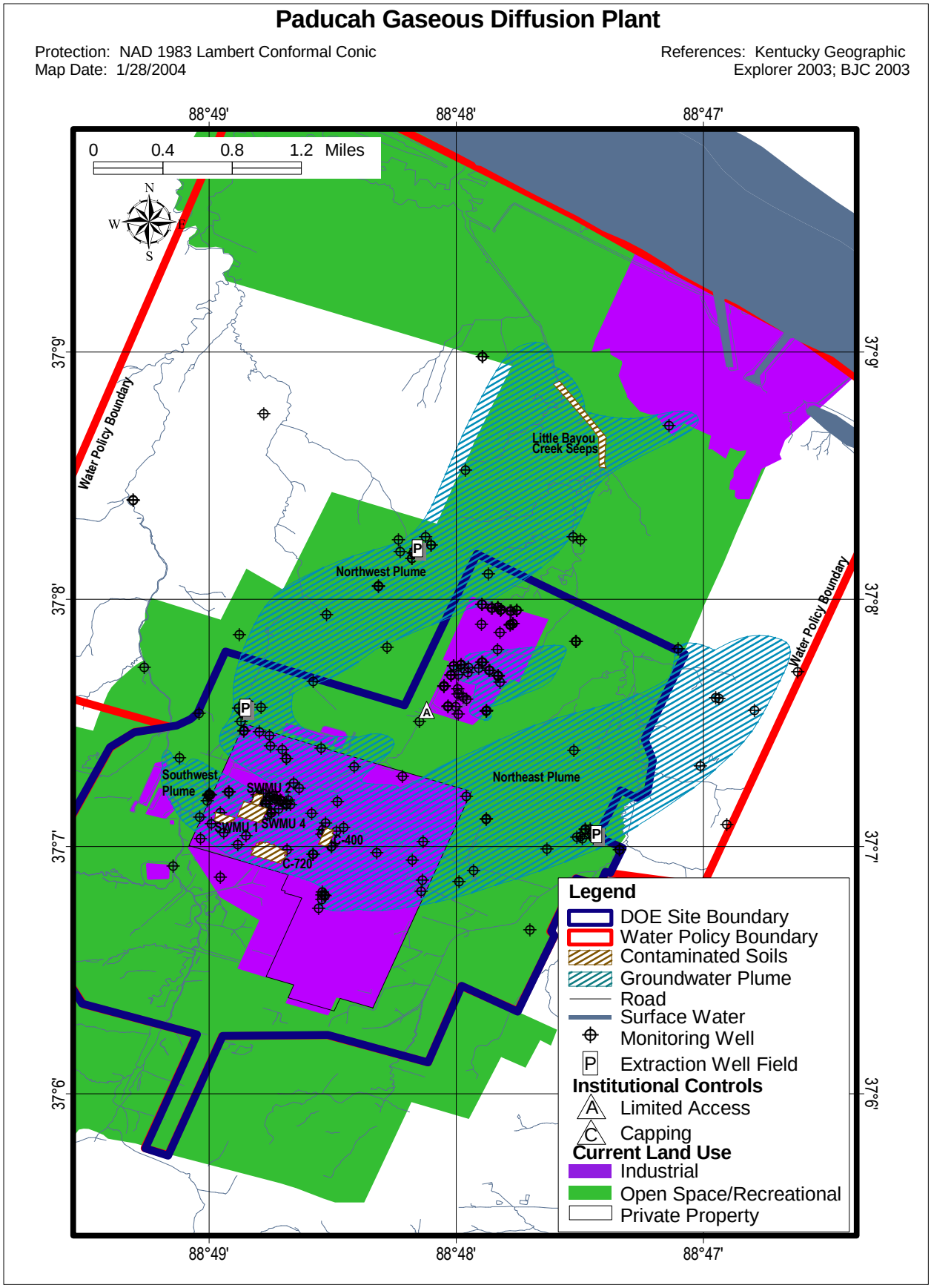
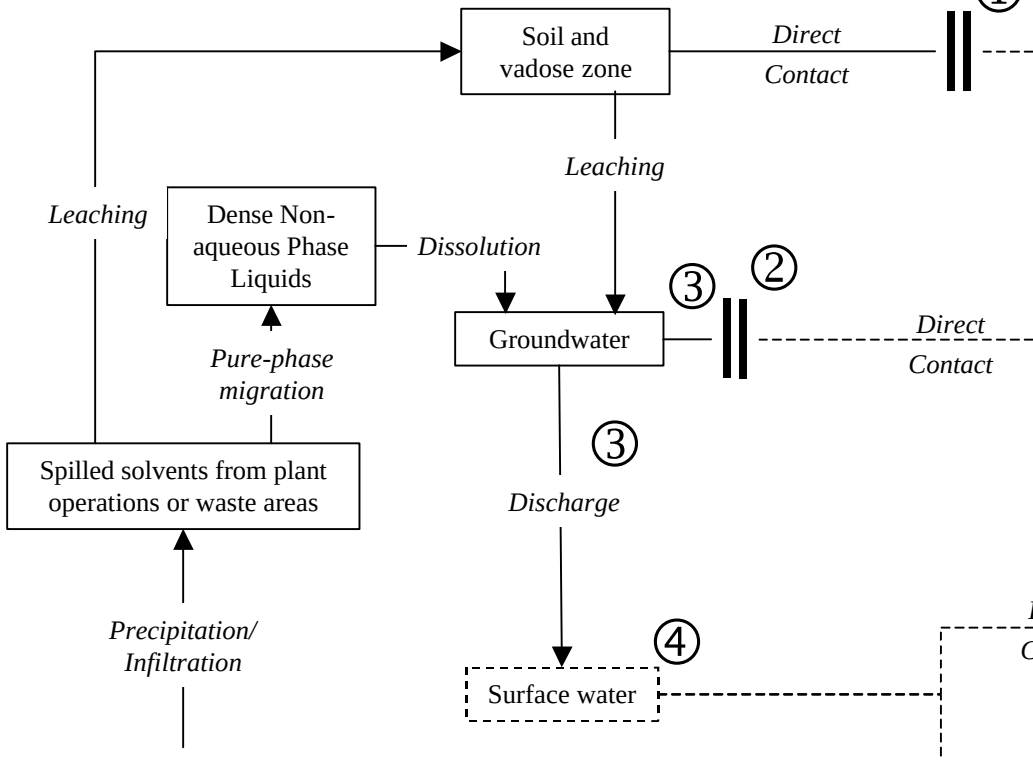


Fig. 4.1a1. Hazard Area 1: Groundwater OU – current state.

Hazard Area 1: Groundwater Operable Unit – Current State



Potential Receptor Exposed			
Worker	Resident	Visitor	Ecological
R/F/D/I			
R/F/D/I	F/D/I		
F/D/I		F/D/I	F/D/I
	F	F	F

Current Controls or Actions
① Access and excavation restrictions.
② PGDP Water Policy.
③ "Hot spot" pump and treat.
④ Attenuation

Receptor Key
Worker – includes workers exposed during inside and outside activities, including the remediation worker.
Resident – includes residents engaged in all but recreation activities.
Visitor – includes recreational users, intruders, and trespassers.
Ecological – includes on- and offsite aquatic and terrestrial ecological receptors.

Exposure Route Key
R = External Exposure
F = Ingestion
D = Dermal
I = Inhalation

Fig. 4.1a2. Hazard Area 1: Groundwater OU CSM – current state.

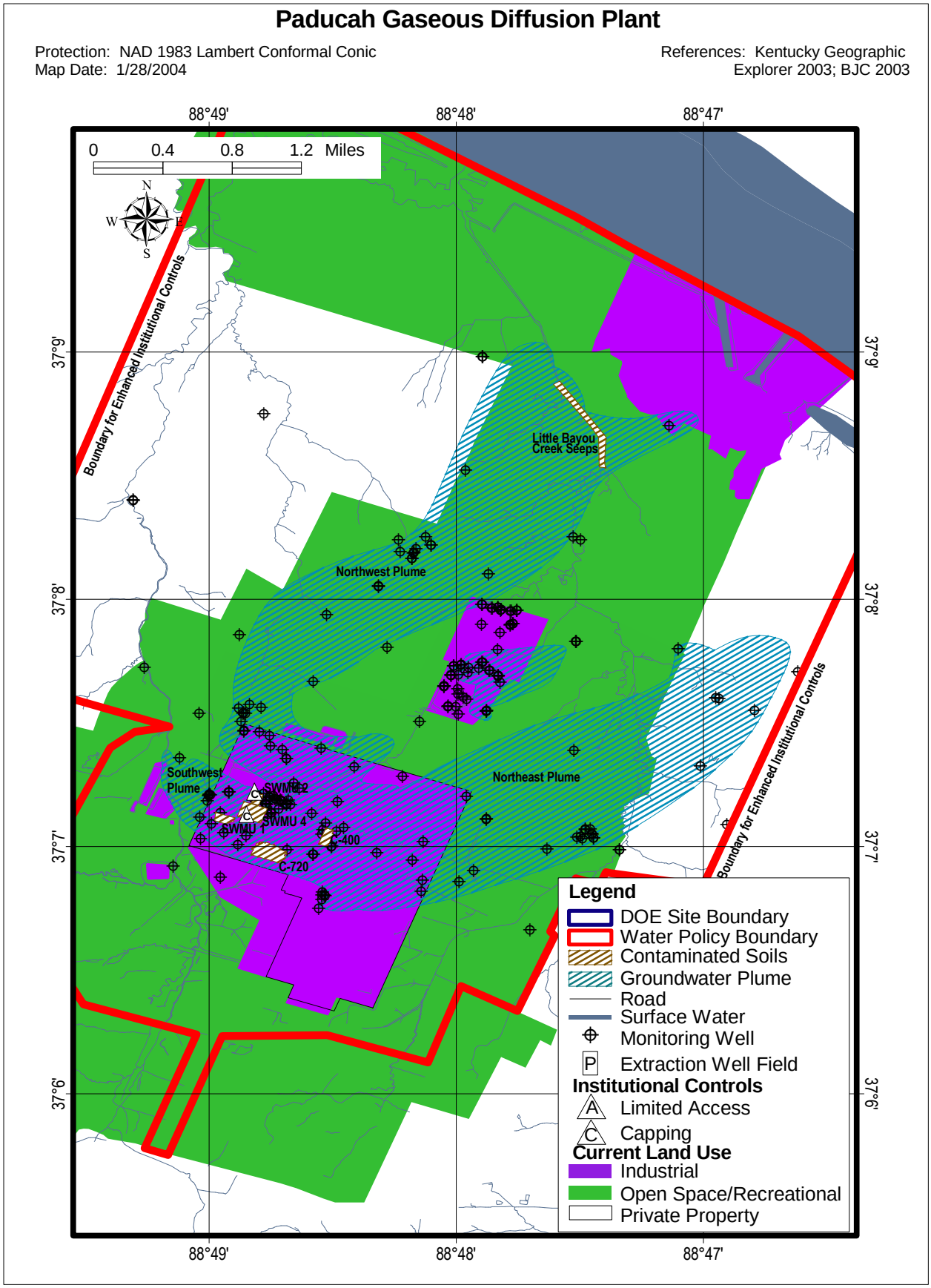
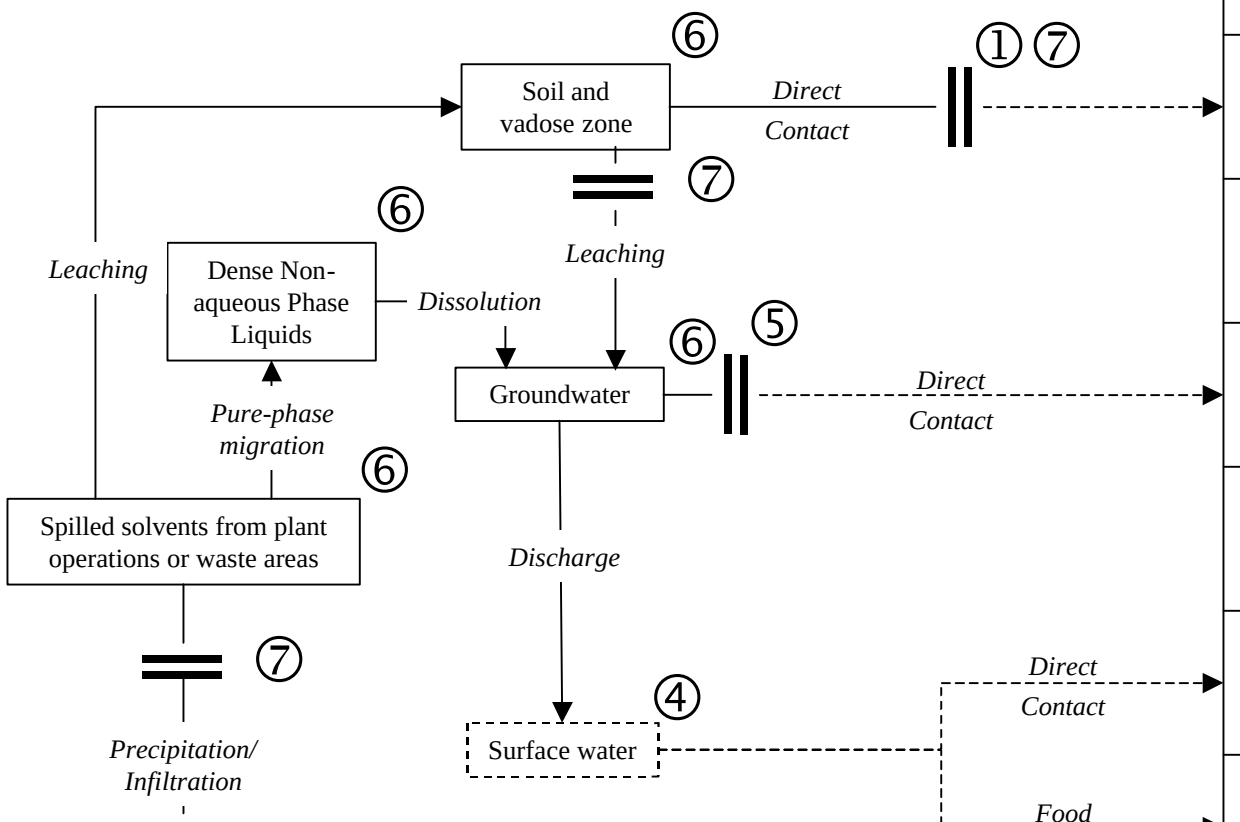


Fig. 4.1b1. Hazard Area 1: Groundwater OU – RBES.

Hazard Area 1: Groundwater Operable Unit – RBES



Potential Receptor Exposed			
Worker	Resident	Visitor	Ecological
R/F/D/I			
R/F/D/I	F/D/I		
F/D/I		F/D/I	F/D/I
	F	F	F

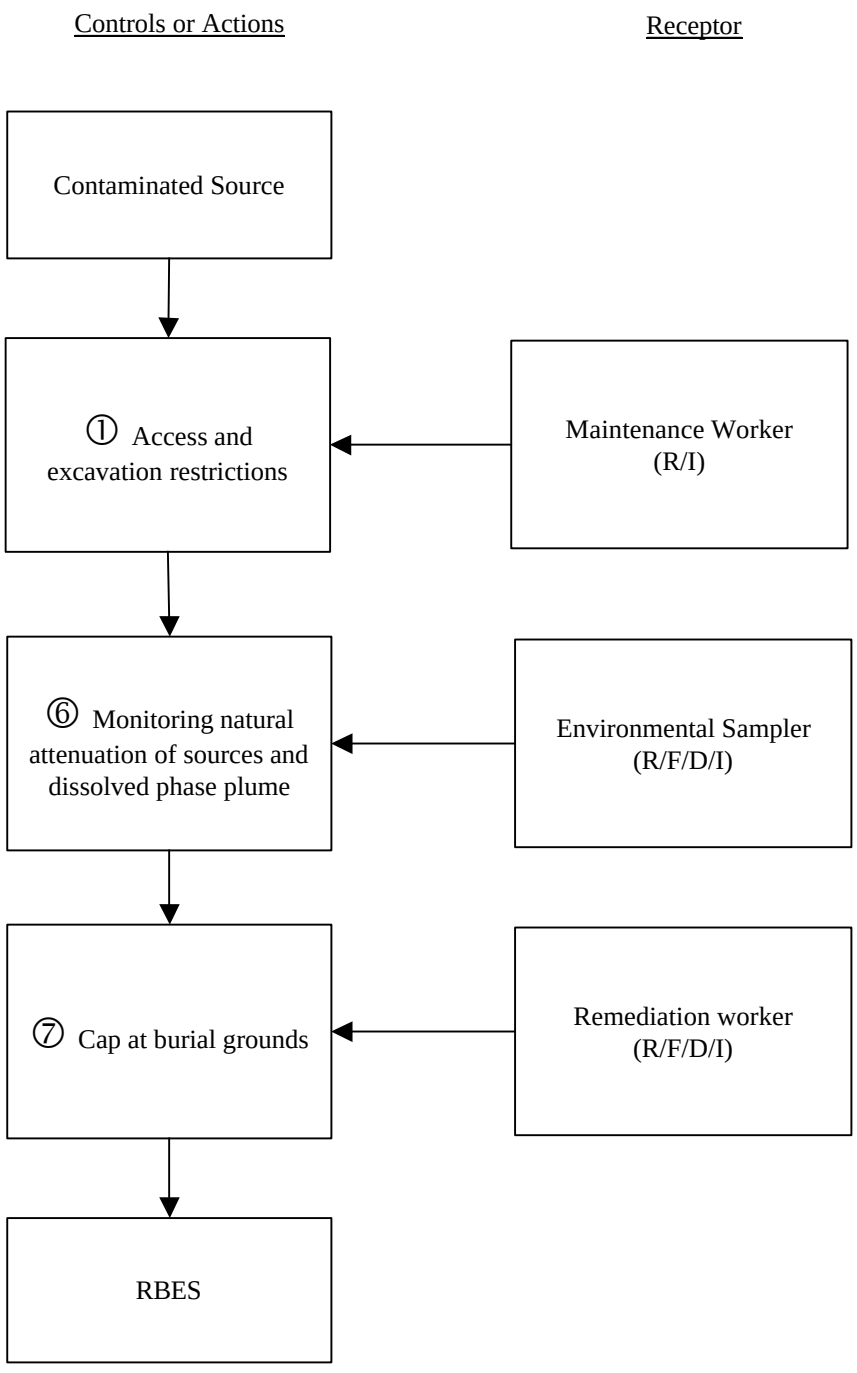
RBES Controls or Actions
① Access and excavation restrictions.
④ Attenuation.
⑤ Enhanced institutional controls to limit access and use of groundwater.
⑥ Monitored natural attenuation of sources and dissolved phase plume.
⑦ Cap at burial grounds.

Receptor Key
Worker – includes workers exposed during inside and outside activities, including the remediation worker.
Resident – includes residents engaged in all but recreation activities.
Visitor – includes recreational users, intruders, and trespassers.
Ecological – includes on- and offsite aquatic and terrestrial ecological receptors.

Exposure Route Key
R = External Exposure
F = Ingestion
D = Dermal
I = Inhalation

Fig. 4.1b2. Hazard Area 1: Groundwater OU CSM – RBES.

Hazard Area 1: Groundwater OU treatment train - RBES



Exposure Route Key: R=External Exposure, F=Ingestion, D=Dermal, I=Inhalation

Fig. 4.1b3. Hazard Area 1: Groundwater OU treatment train – RBES.

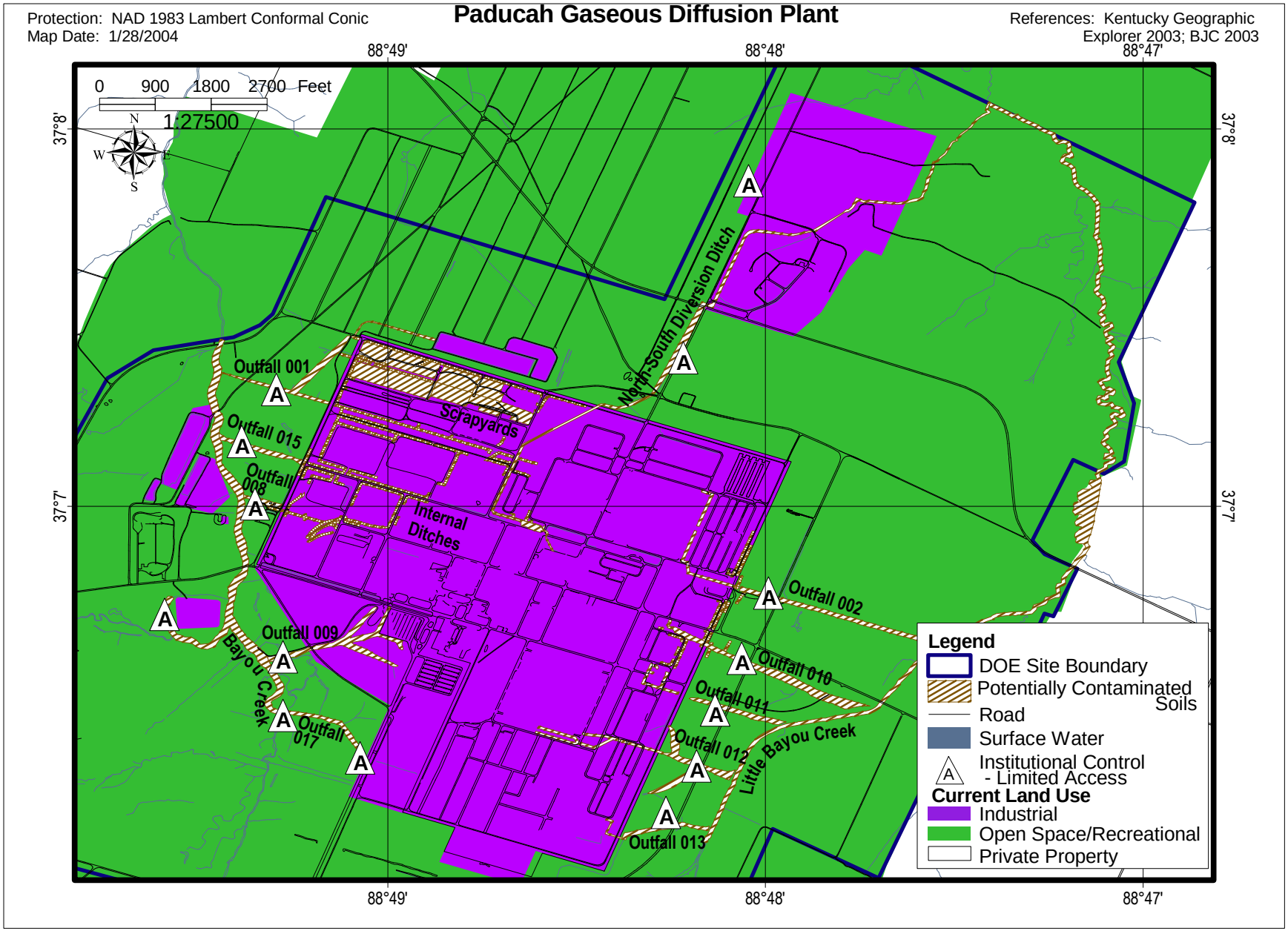
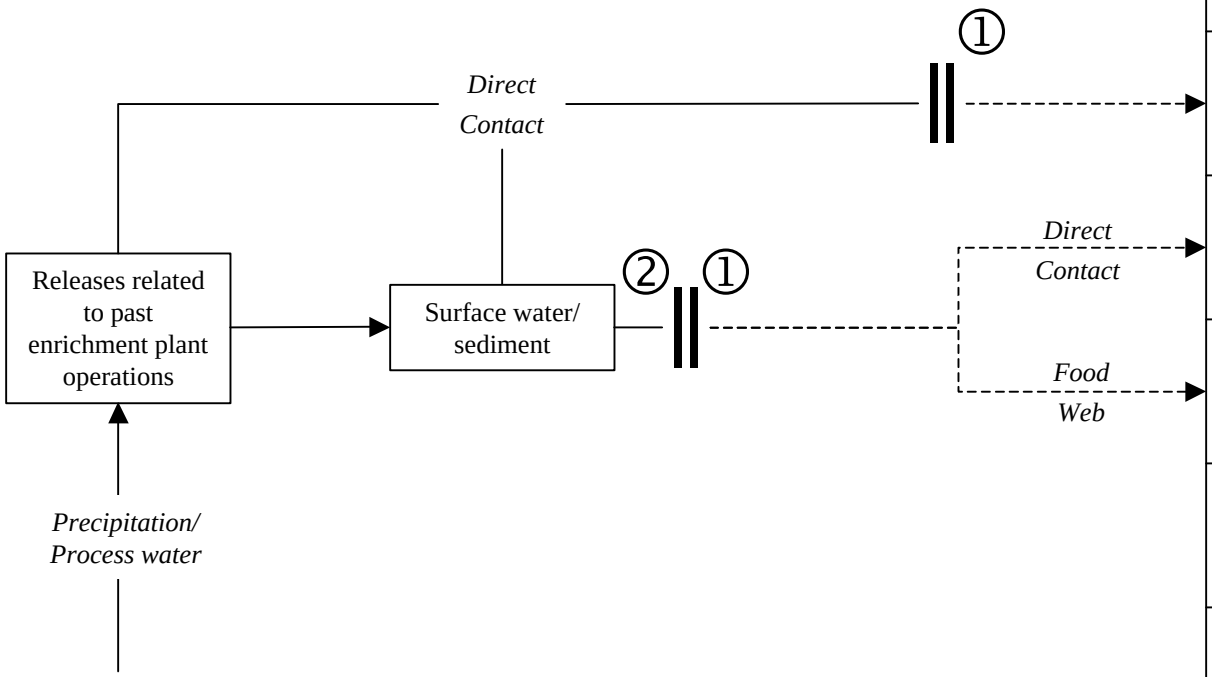


Fig. 4.2a1. Hazard Area 2: Surface water OU – current state.

Hazard Area 2: Surface Water Operable Unit – Current State



Potential Receptor Exposed			
Worker	Resident	Visitor	Ecological
R/F/D/I		R/F/D/I	R/F/D/I
F/D/I		F/D/I	F/D/I
	F	F	F

Current Controls and Action
① Access and use restrictions/posted warnings.
② Environmental monitoring.

Receptor Key
Worker – includes workers exposed during inside and outside activities, including the remediation worker.
Resident – includes residents engaged in all but recreation activities.
Visitor – includes recreational users, intruders, and trespassers.
Ecological – includes on- and offsite aquatic and terrestrial ecological receptors.

Exposure Route Key
R = External Exposure
F = Ingestion
D = Dermal
I = Inhalation

Fig. 4.2a2. Hazard Area 2: Surface water OU CSM – current state.

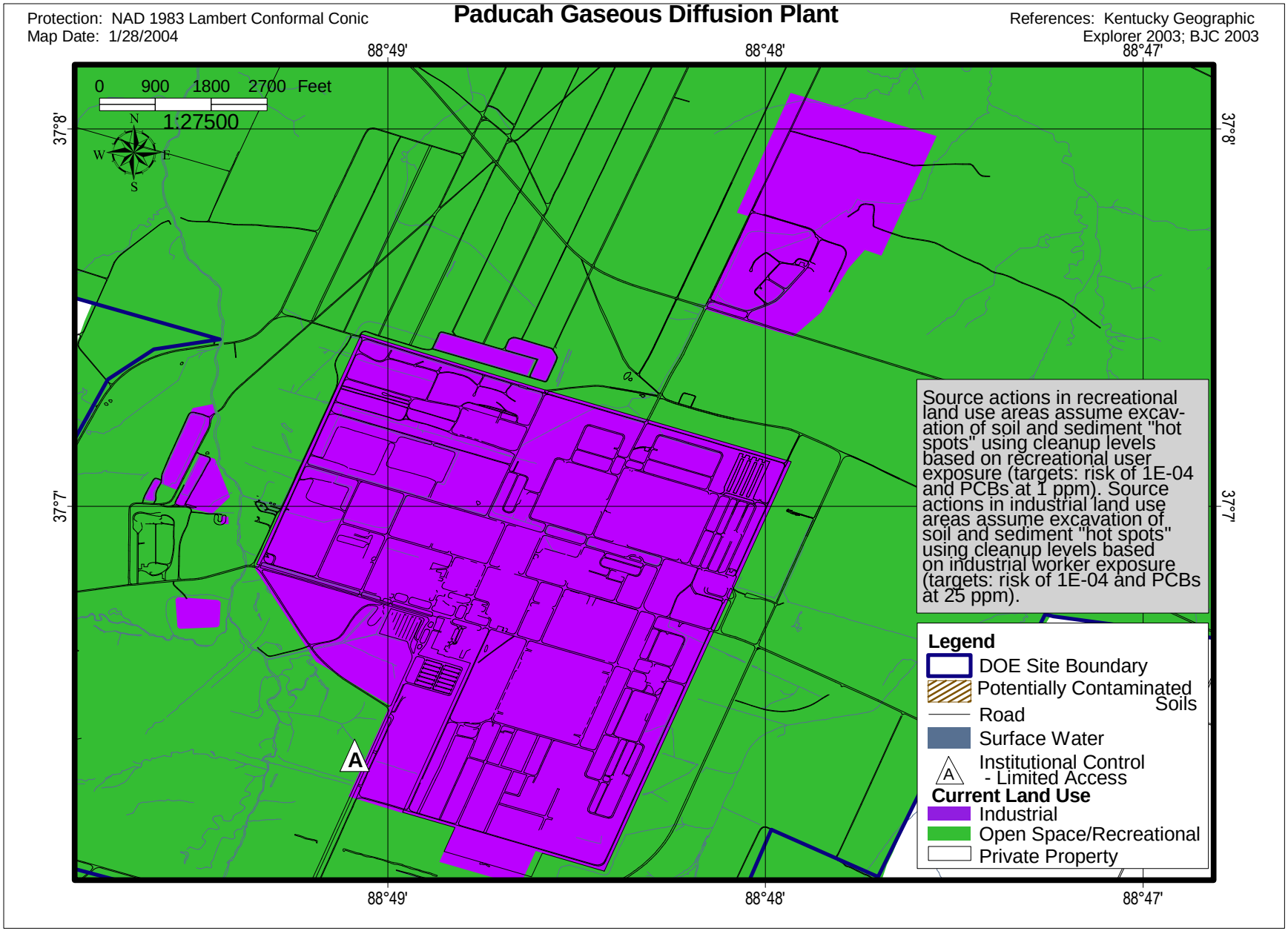
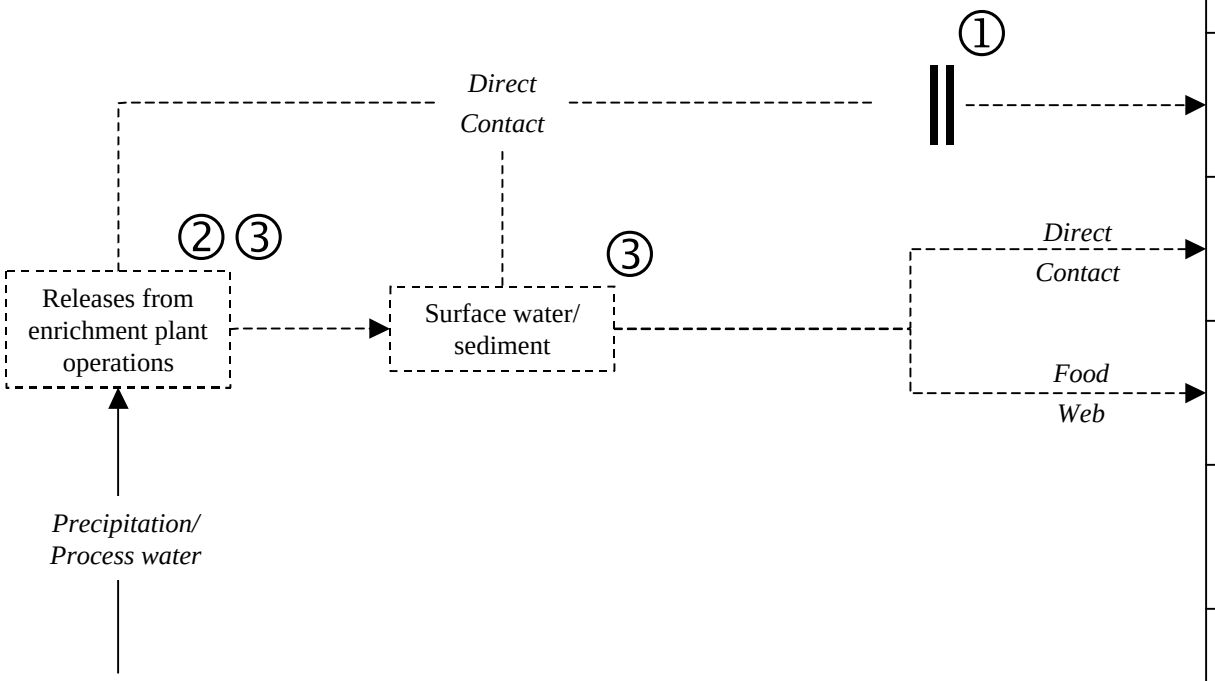


Fig. 4.2b1. Hazard Area 2: Surface water OU – RBES

Hazard Area 2: Surface Water Operable Unit – RBES



Potential Receptor Exposed			
Worker	Resident	Visitor	Ecological
R/F/D/I		R/F/D/I	R/F/D/I
F/D/I		F/D/I	F/D/I
	F	F	F

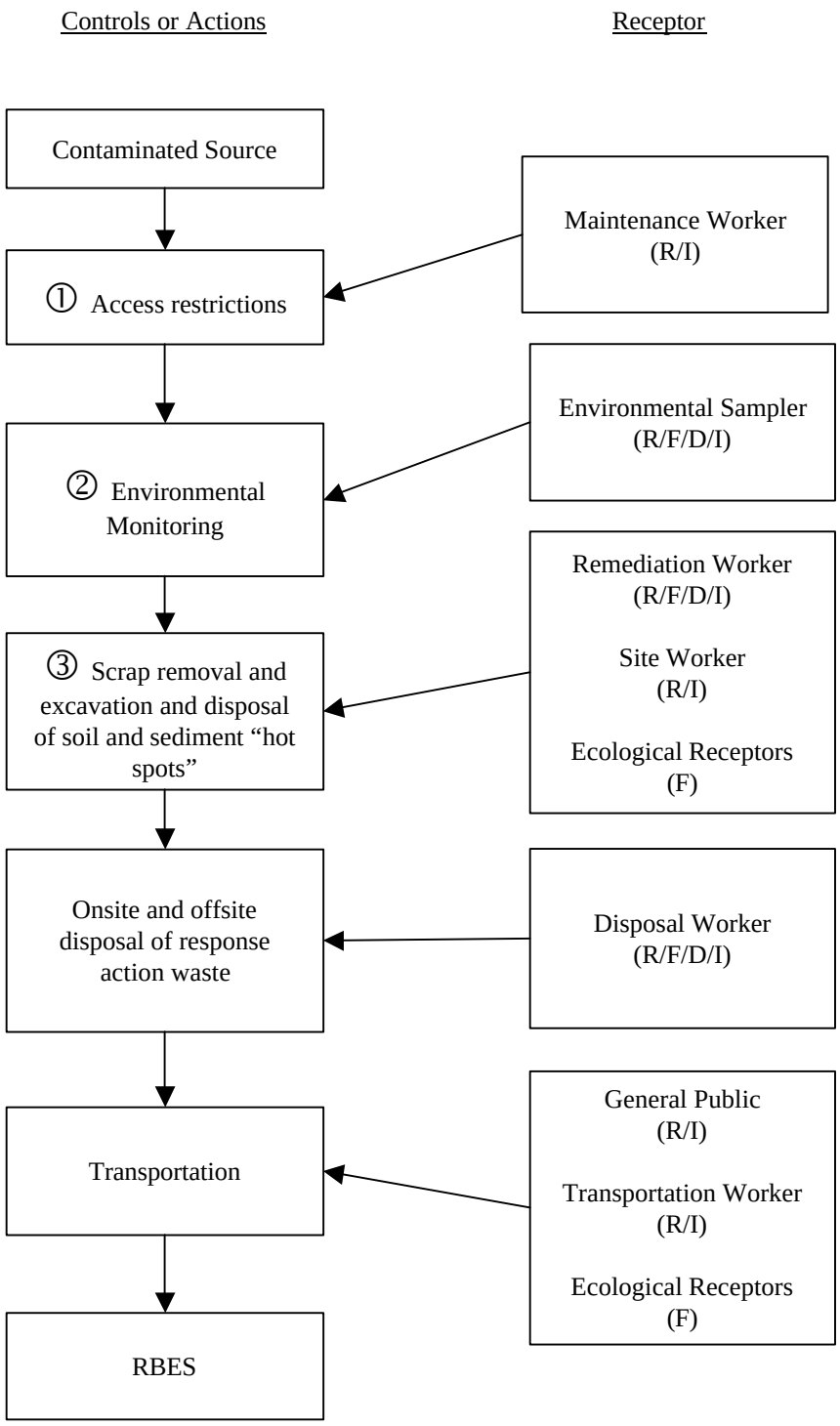
RBES Controls and Action
① Access restrictions.
② Environmental monitoring.
③ Scrap removal and excavation of "hot spots" (target in industrial areas based on average exposure over entire unit: worker risk of 1E-04, PCBs at 25 ppm; target in recreational areas: recreational user risk of 1E-04, PCBs at 1ppm).

Receptor Key
Worker – includes workers exposed during inside and outside activities, including the remediation worker.
Resident – includes residents engaged in all but recreation activities.
Visitor – includes recreational users, intruders, and trespassers.
Ecological – includes on- and offsite aquatic and terrestrial ecological receptors.

Exposure Route Key
R = External Exposure
F = Ingestion
D = Dermal
I = Inhalation

Fig. 4.2b2. Hazard Area 2: Surface water OU CSM – RBES.

Hazard Area 2: Surface water OU treatment train – RBES



Exposure Route Key: R=External Exposure, F=Ingestion, D=Dermal, I=Inhalation

Fig. 4.2b3. Hazard Area 2: Surface water OU treatment train – RBES.

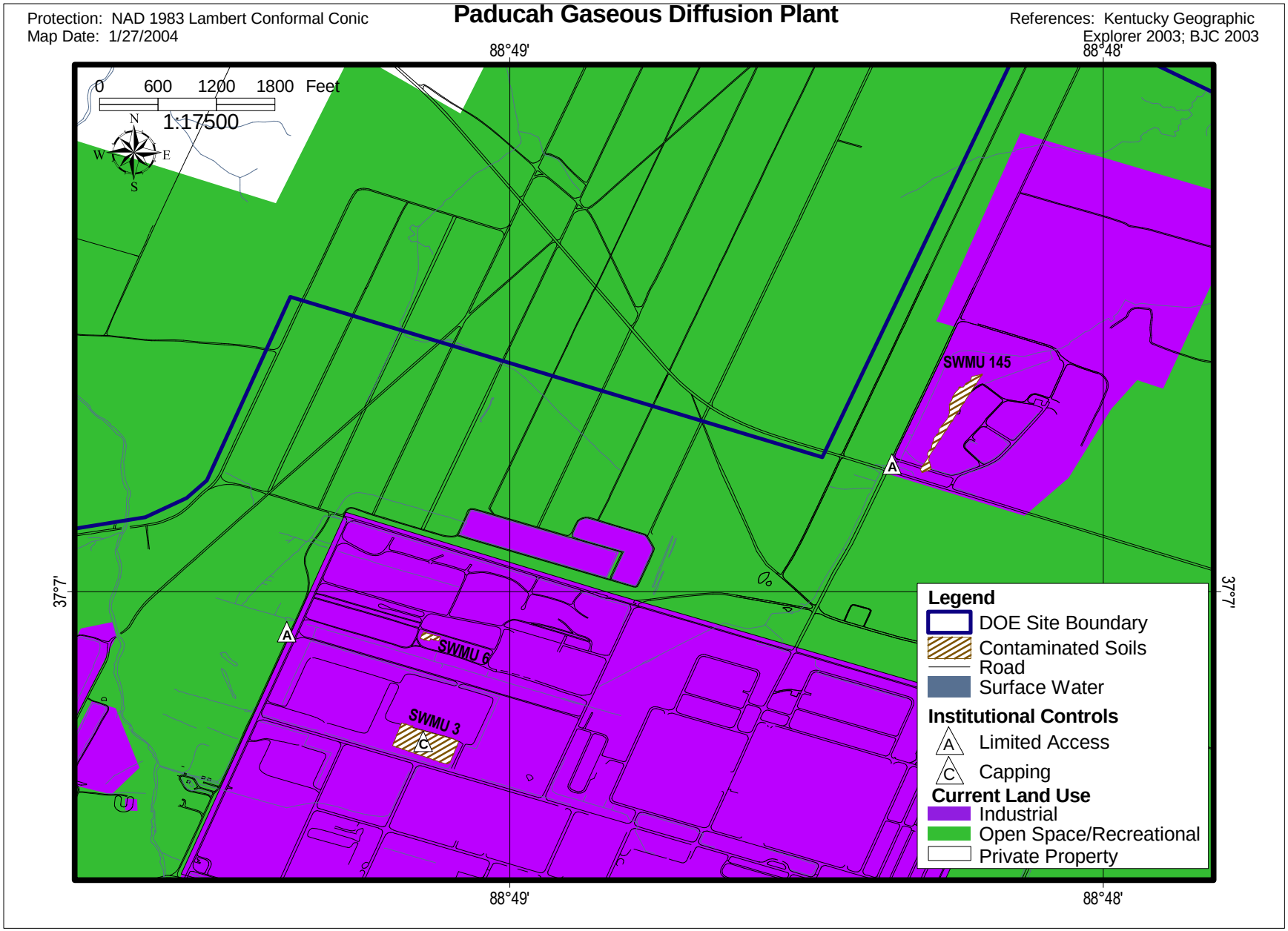
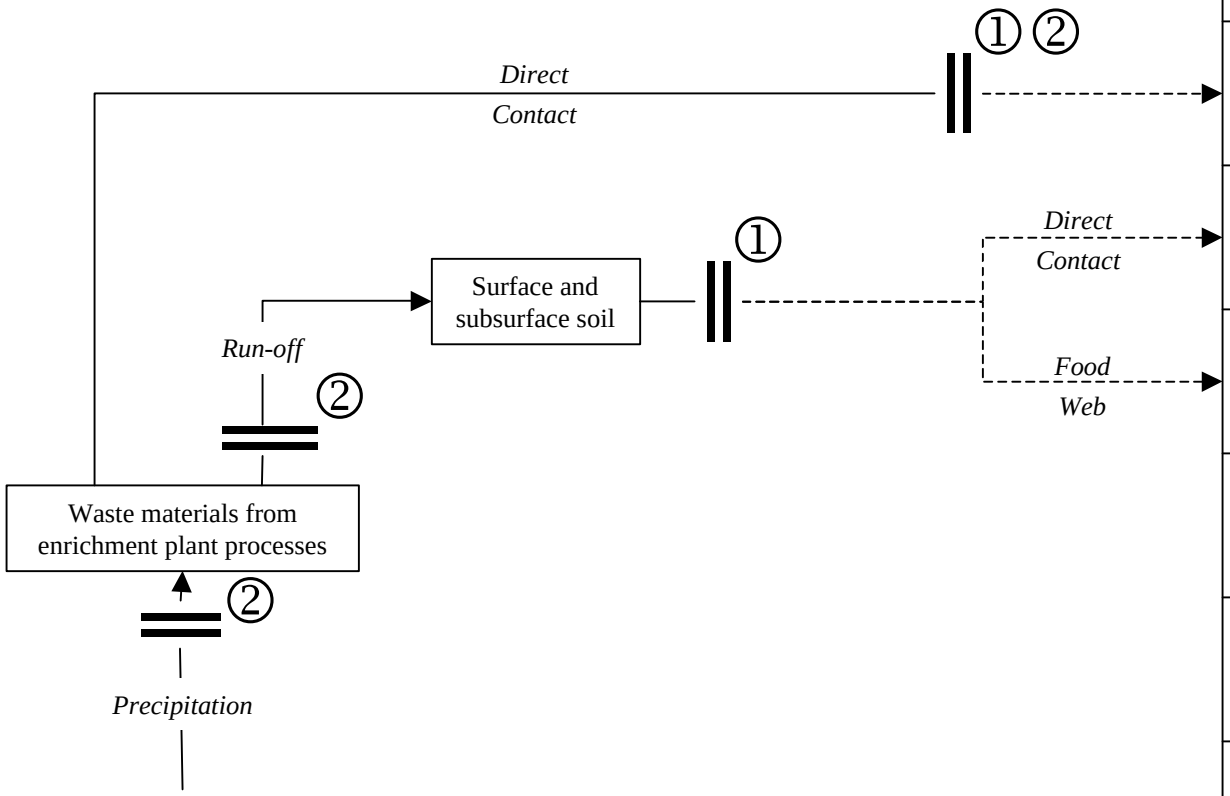


Fig. 4.3a1. Hazard Area 3: Burial grounds OU (Group 1) – current state.

Hazard Area 3: Burial Grounds Operable Unit (Group 1) – Current State



Potential Receptor Exposed			
Worker	Resident	Visitor	Ecological
R/F/D/I		R/F/D/I	R/F/D/I
R/F/D/I		R/F/D/I	R/F/D/I
			F

Current Controls and Actions
① Access and excavation restrictions.
② Cap at SWMU 3, only.

Receptor Key
Worker – includes workers exposed during inside and outside activities, including the remediation worker.
Resident – includes residents engaged in all but recreation activities.
Visitor – includes recreational users, intruders, and trespassers.
Ecological – includes on- and offsite aquatic and terrestrial ecological receptors.

Exposure Route Key
R = External Exposure
F = Ingestion
D = Dermal
I = Inhalation

Fig. 4.3a2. Hazard Area 3: Burial grounds OU (Group 1) CSM – current state.

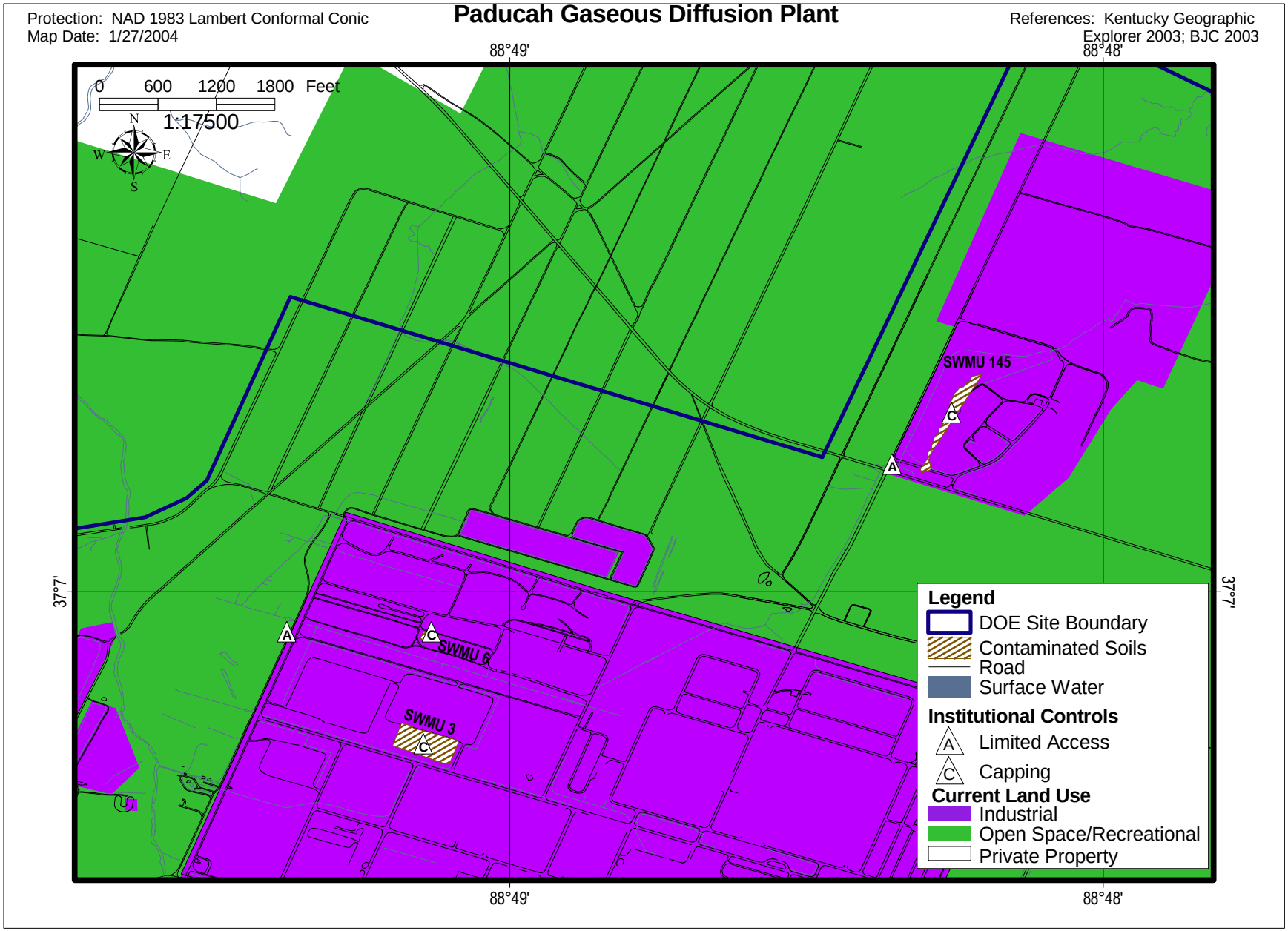
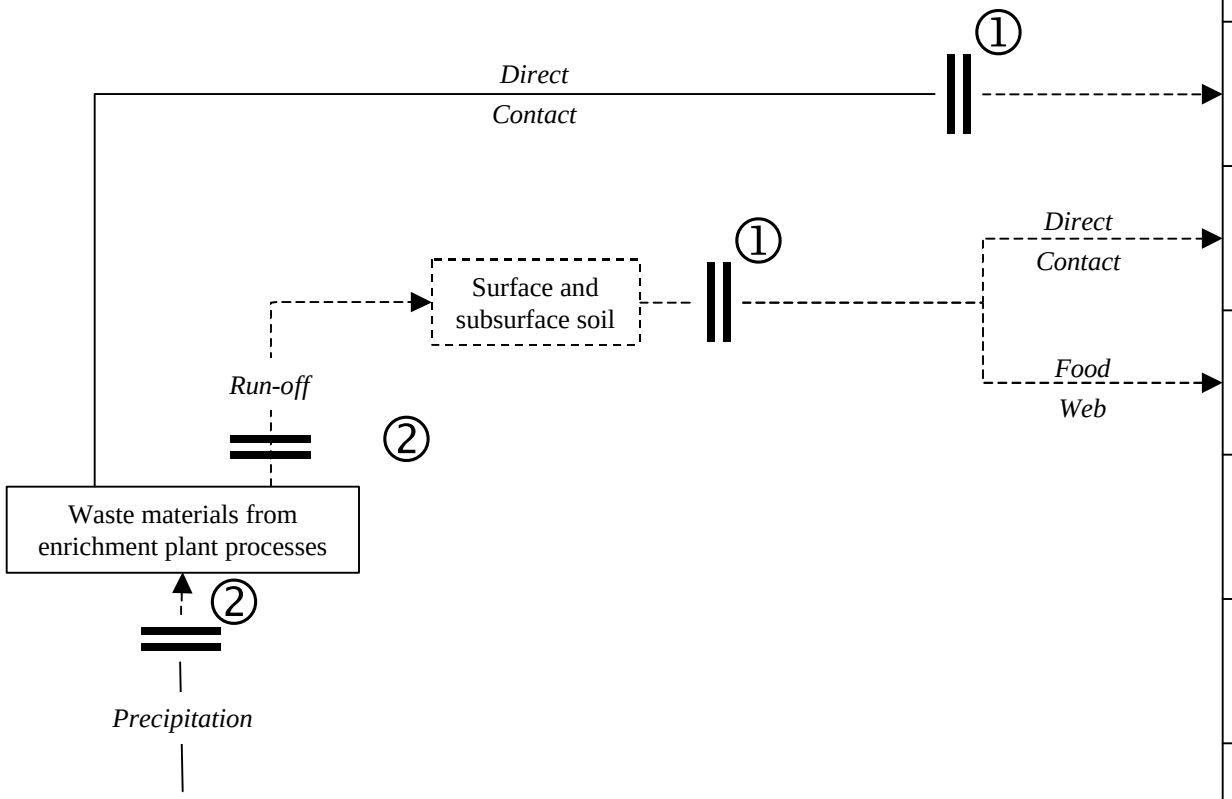


Fig. 4.3b1. Hazard Area 3: Burial grounds OU (Group 1) – RBES.

Hazard Area 3: Burial Grounds Operable Unit – RBES



Potential Receptor Exposed			
Worker	Resident	Visitor	Ecological
R/F/D/I		R/F/D/I	R/F/D/I
R/F/D/I		R/F/D/I	R/F/D/I
			F

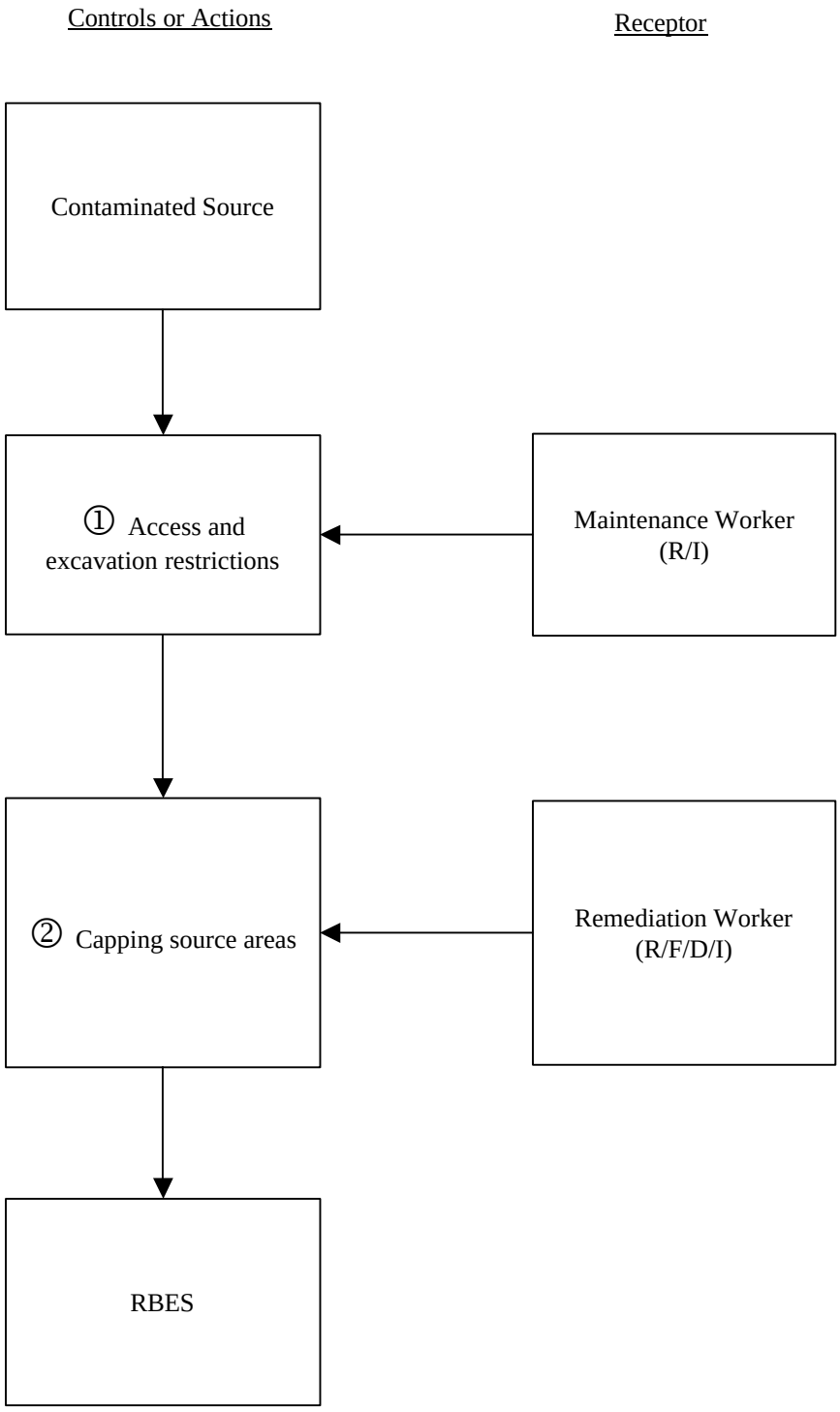
RBES Controls and Actions
① Access and excavation restrictions.
② Capping.

Receptor Key
Worker – includes workers exposed during inside and outside activities, including the remediation worker.
Resident – includes residents engaged in all but recreation activities.
Visitor – includes recreational users, intruders, and trespassers.
Ecological – includes on- and offsite aquatic and terrestrial ecological receptors.

Exposure Route Key
R = External Exposure
F = Ingestion
D = Dermal
I = Inhalation

Fig. 4.3b2. Hazard Area 3: Burial grounds OU (Group 1) CSM – RBES.

Hazard Area 3: Burial grounds OU treatment train – RBES



Exposure Route Key: R=External Exposure, F=Ingestion, D=Dermal, I=Inhalation

Fig. 4.3b3. Hazard Area 3: Burial grounds OU (Group 1) treatment train – RBES.

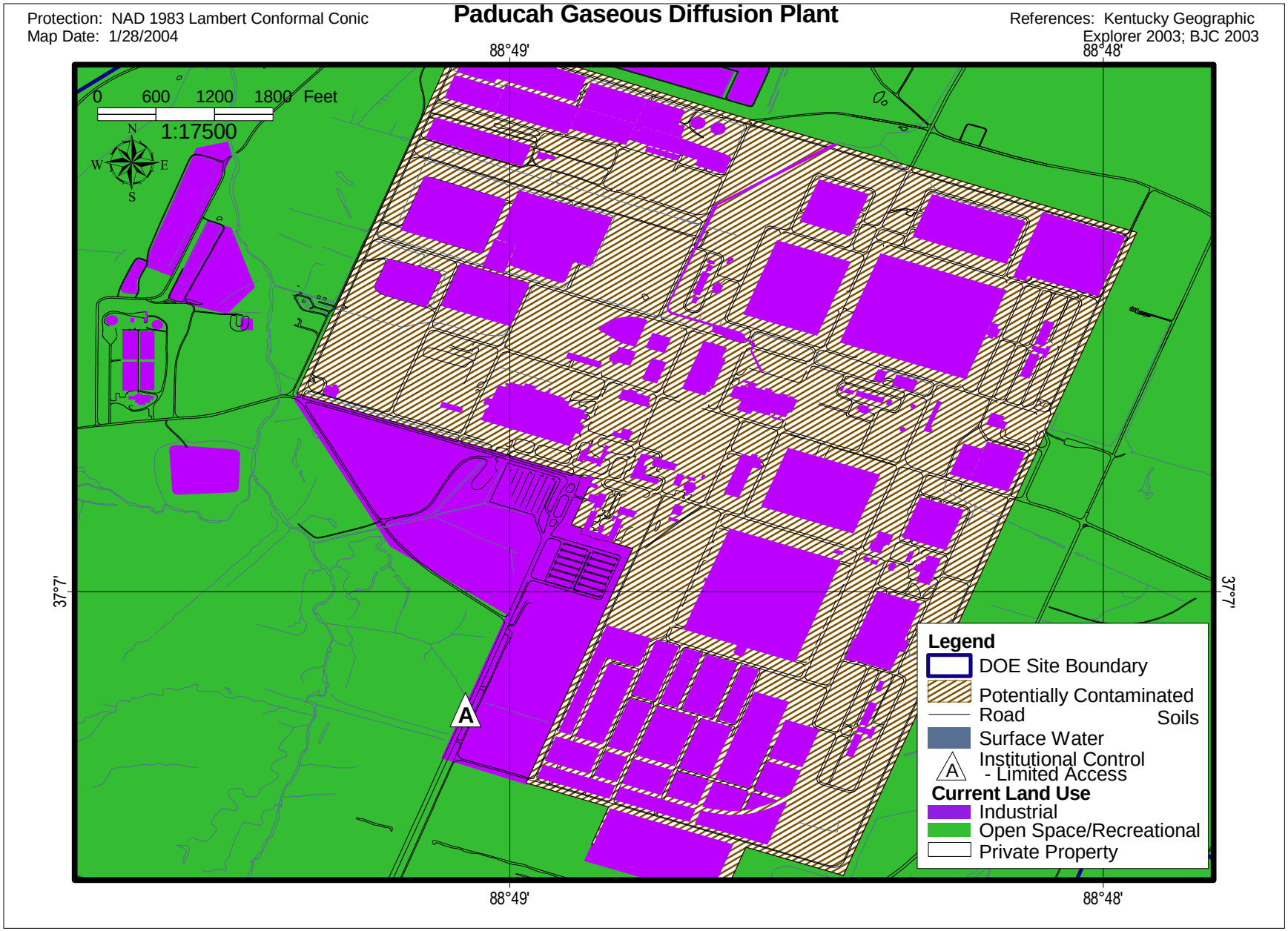
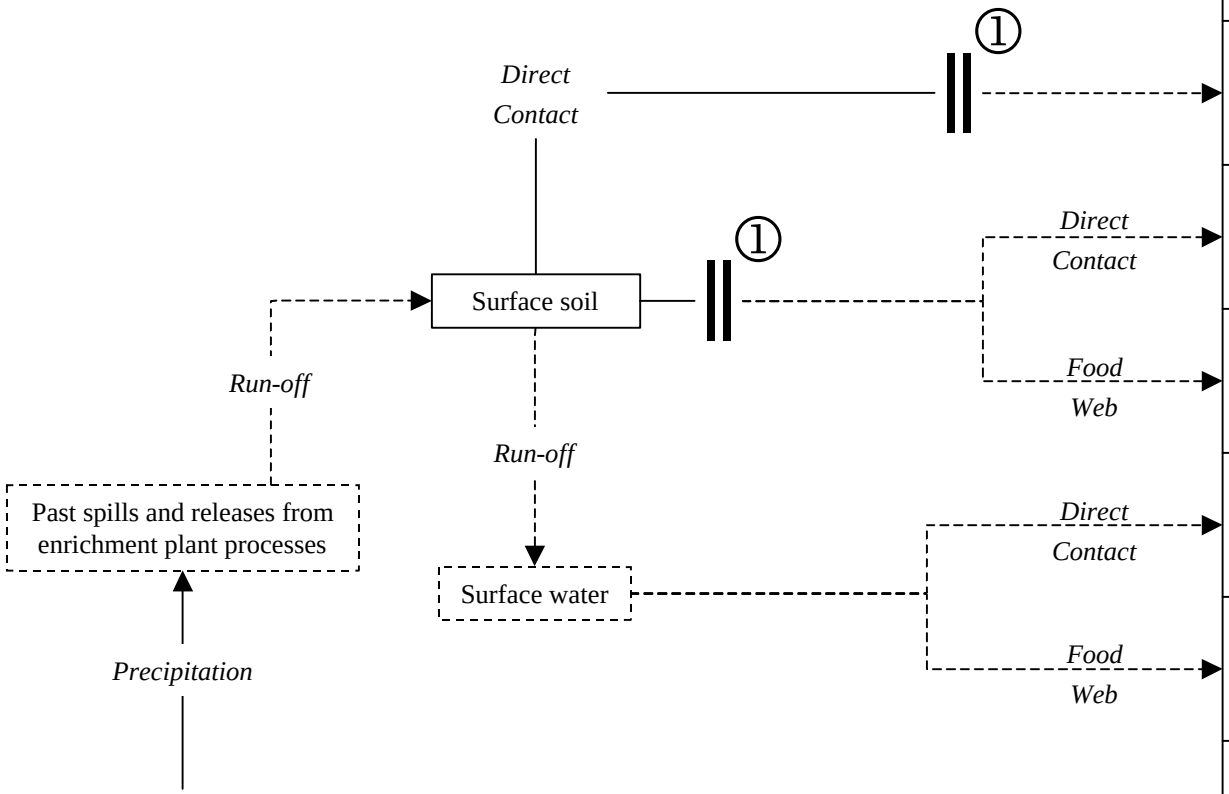


Fig. 4.4a1. Hazard Area 4: Surface soils OU – current state.

Hazard Area 4: Surface Soils Operable Unit – Current State



Potential Receptor Exposed			
Worker	Resident	Visitor	Ecological
R/F/D/I		R/F/D/I	R/F/D/I
R/F/D/I		R/F/D/I	R/F/D/I
	F	F	F
F/D/I		F/D/I	F/D/I
	F	F	F

Direct Contact

Food Web

Direct Contact

Food Web

Current Controls and Actions
① Access and excavation restrictions.

Receptor Key
Worker – includes workers exposed during inside and outside activities, including the remediation worker.
Resident – includes residents engaged in all but recreation activities.
Visitor – includes recreational users, intruders, and trespassers.
Ecological – includes on- and offsite aquatic and terrestrial ecological receptors.

Exposure Route Key
R = External Exposure
F = Ingestion
D = Dermal
I = Inhalation

Fig. 4.4a2. Hazard Area 4: Surface soils OU CSM – current state.

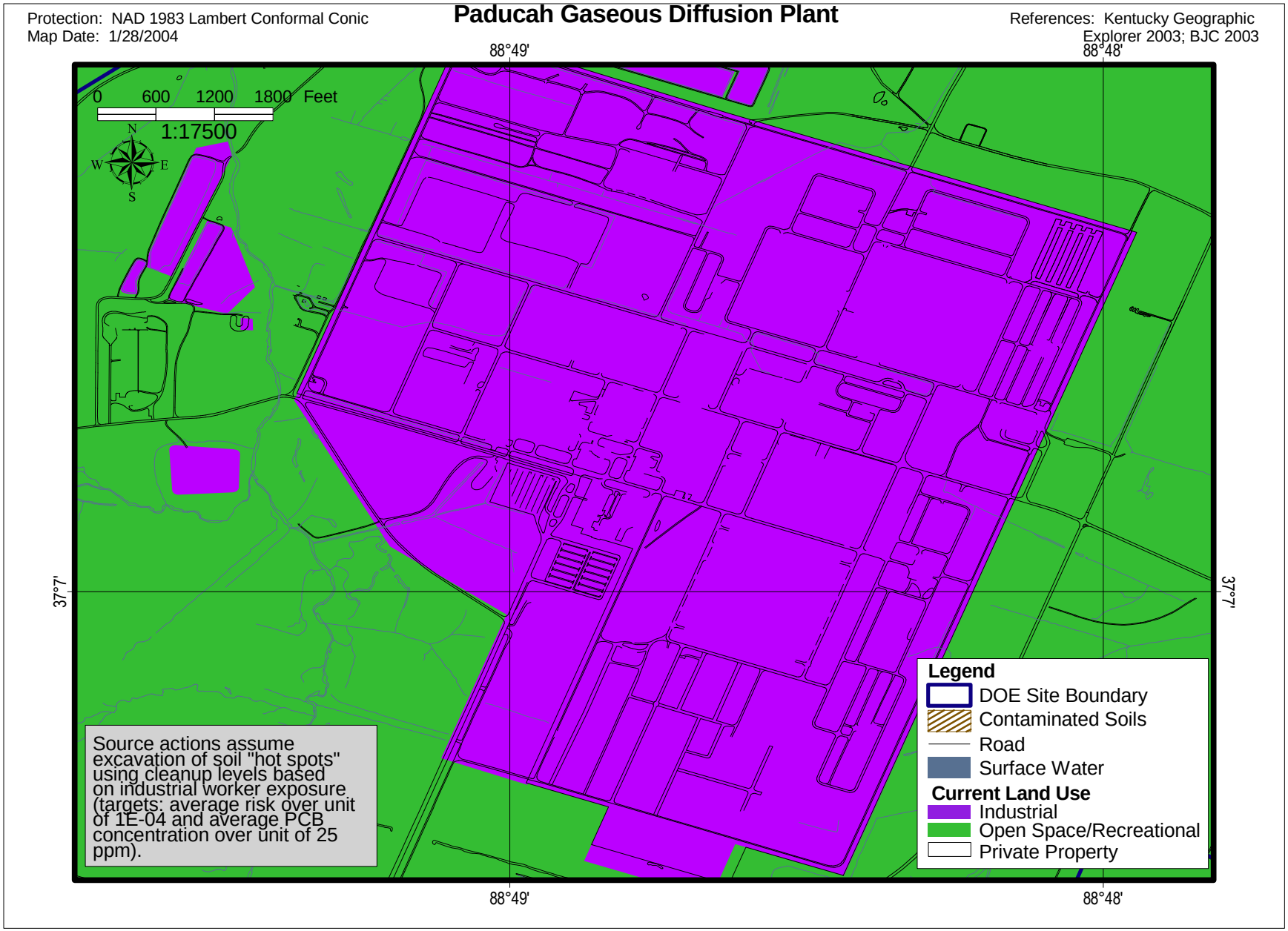
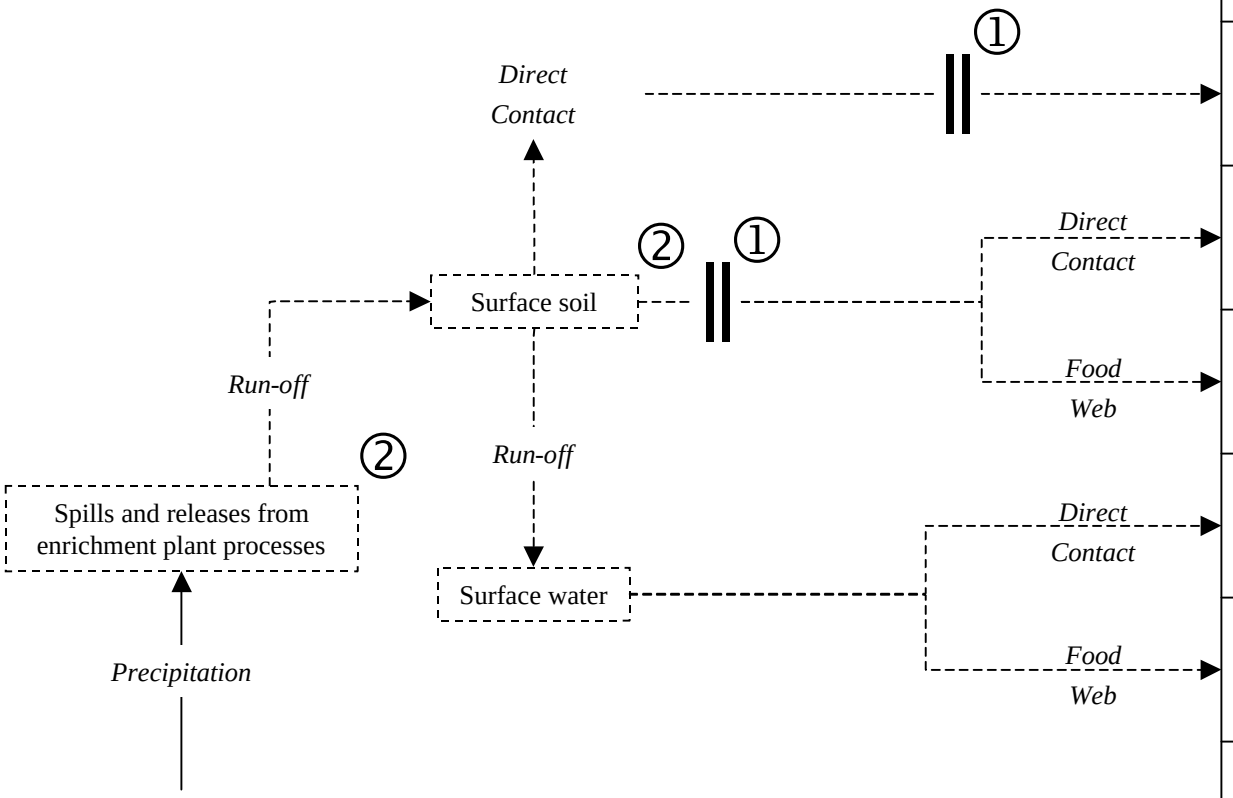


Fig. 4.4b1. Hazard Area 4: Surface soils OU – RBES.

Hazard Area 4: Surface Soils Operable Unit – RBES



Potential Receptor Exposed			
Worker	Resident	Visitor	Ecological
R/F/D/I		R/F/D/I	R/F/D/I
R/F/D/I		R/F/D/I	R/F/D/I
	F	F	F
F/D/I		F/D/I	F/D/I
	F	F	F

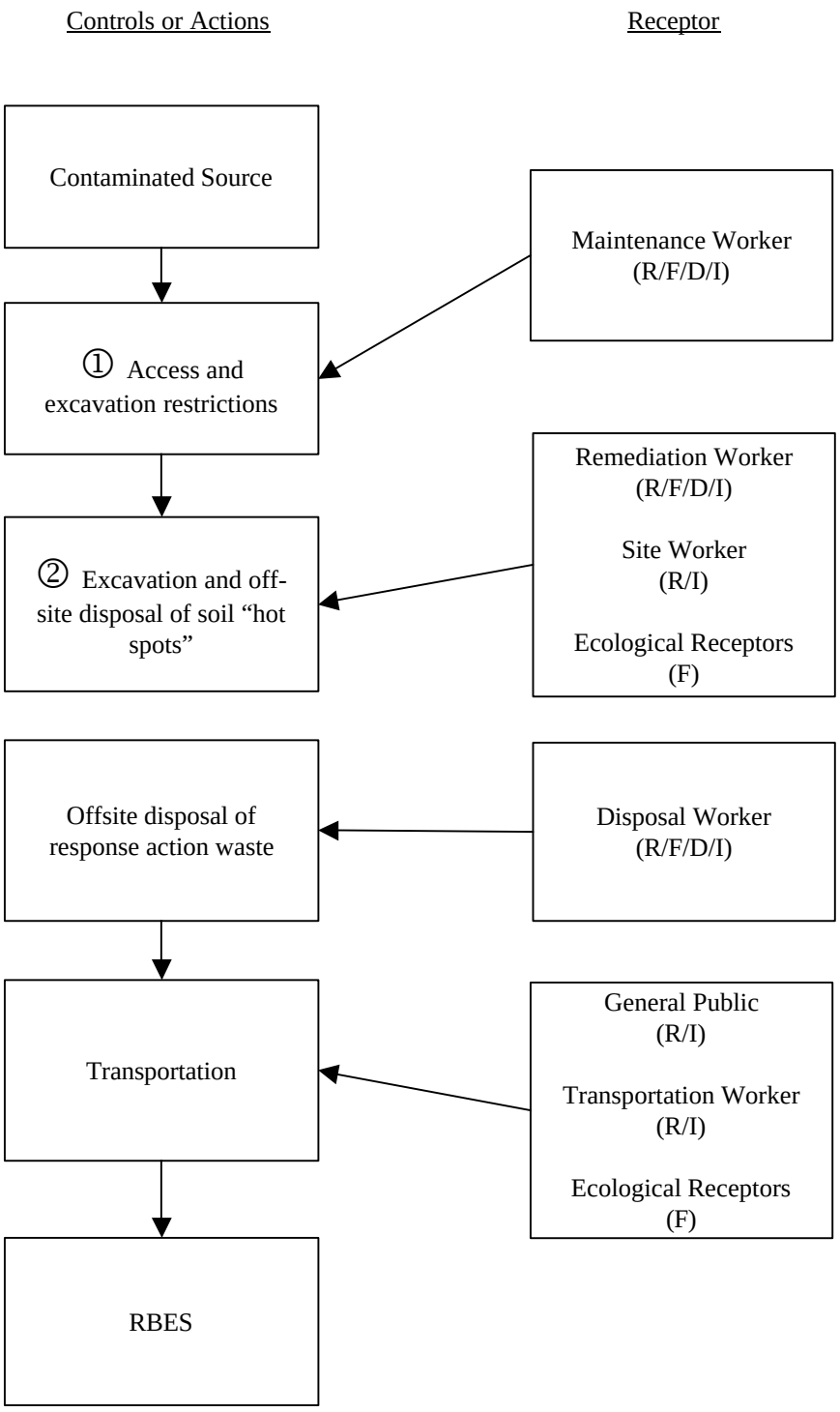
RBES Controls and Actions
① Access and excavation restrictions.
② Excavation of "hot spots" (target based on average exposure over entire unit: worker risk of 1E-04, PCBs at 25 ppm).

Receptor Key
Worker – includes workers exposed during inside and outside activities, including the remediation worker.
Resident – includes residents engaged in all but recreation activities.
Visitor – includes recreational users, intruders, and trespassers.
Ecological – includes on- and offsite aquatic and terrestrial ecological receptors.

Exposure Route Key
R = External Exposure
F = Ingestion
D = Dermal
I = Inhalation

Fig. 4.4b2. Hazard Area 4: Surface soils OU CSM – RBES.

Hazard Area 4: Surface soils OU treatment train – RBES



Exposure Route Key: R=External Exposure, F=Ingestion, D=Dermal, I=Inhalation

Fig. 4.4b3. Hazard Area 4: Surface soils OU treatment train – RBES.

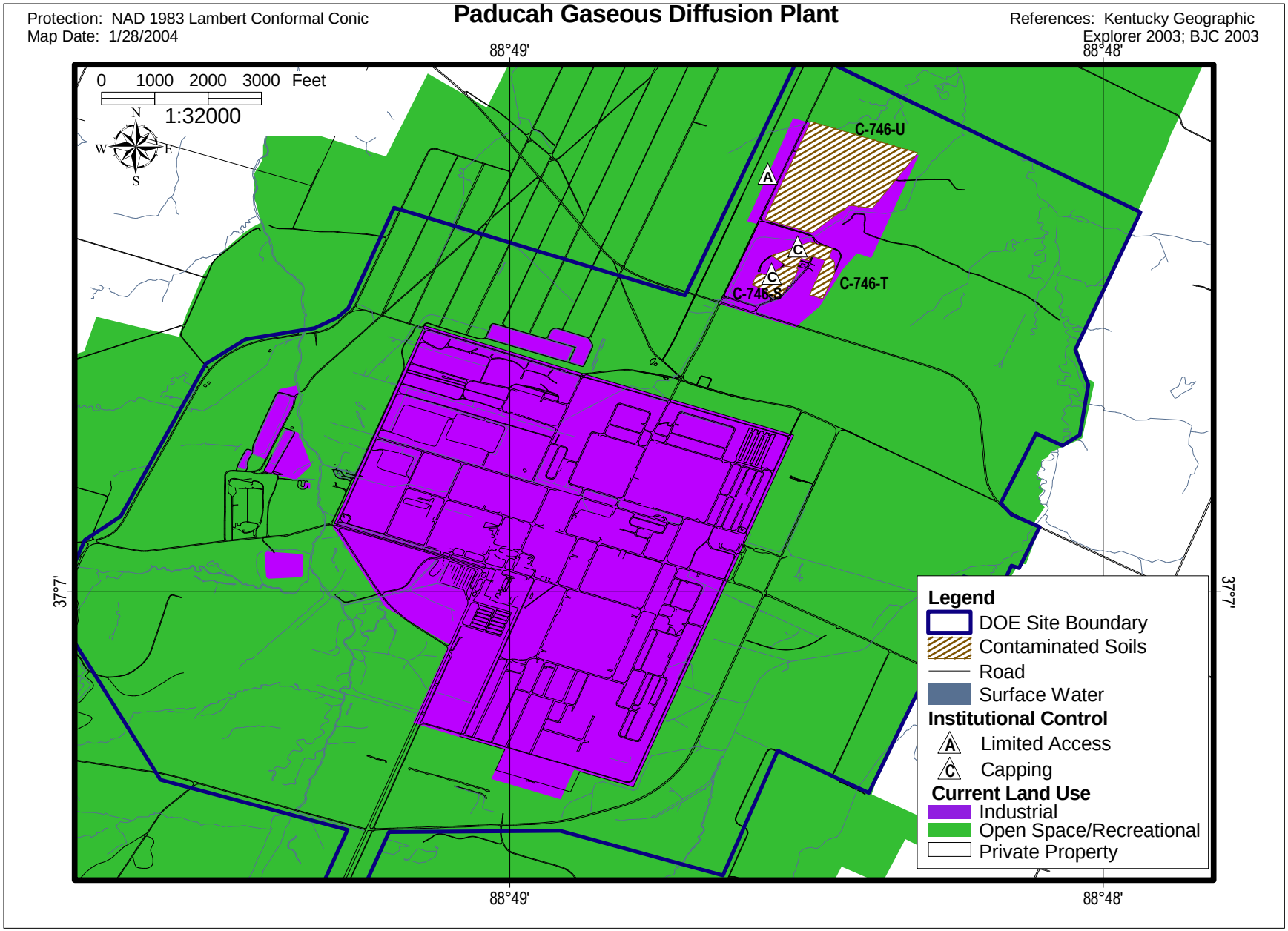
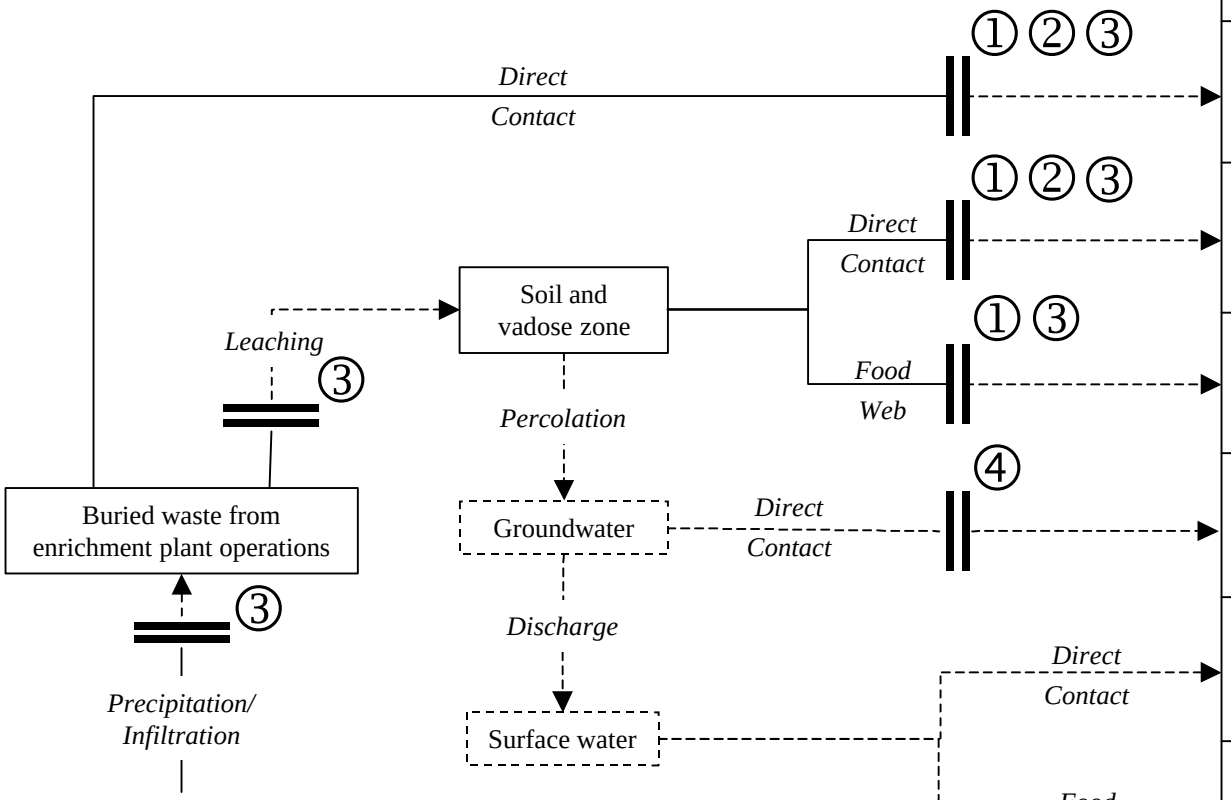


Fig. 4.5a1. Hazard Area 5: Permitted Landfills – current state.

Hazard Area 5 Permitted Landfills – Current State



Potential Receptor Exposed			
Worker	Resident	Visitor	Ecological
R/F/D/I		R/F/D/I	R/F/D/I
R/F/D/I		R/F/D/I	R/F/D/I
		F	F
R/F/D/I	R/F/D/I		
F/D/I		F/D/I	F/D/I
	F	F	F

Current Controls and Actions
① Current land cover.
② Access and excavation restrictions
③ Landfill cap, leachate collection system, and monitoring.
④ PGDP Water Policy.

Receptor Key
Worker – includes workers exposed during inside and outside activities, including the remediation worker.
Resident – includes residents engaged in all but recreation activities.
Visitor – includes recreational users, intruders, and trespassers.
Ecological – includes on- and offsite aquatic and terrestrial ecological receptors.

Exposure Route Key
R = External Exposure
F = Ingestion
D = Dermal
I = Inhalation

Fig. 4.5a2. Hazard Area 5: Permitted Landfills CSM – current state.

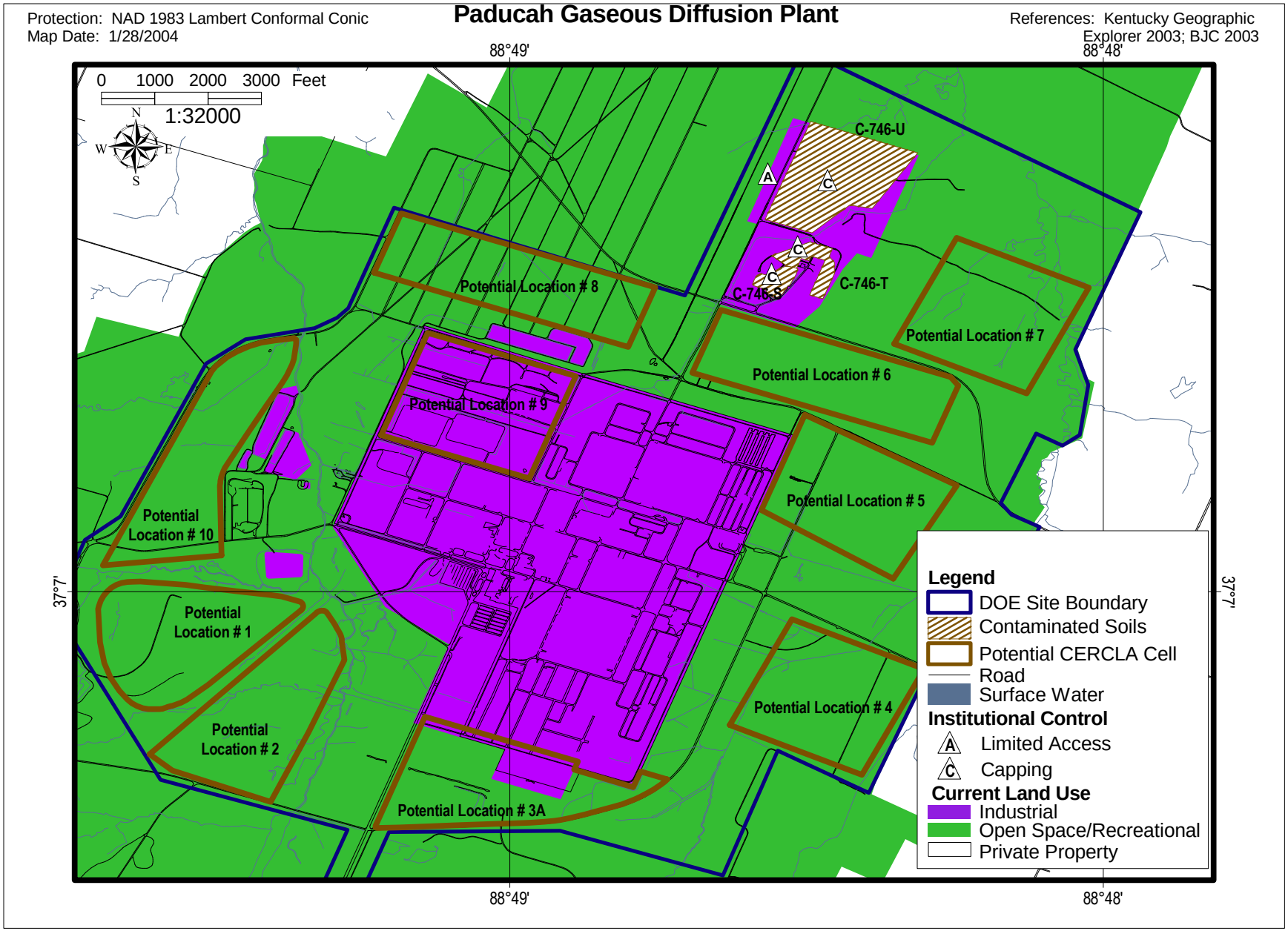
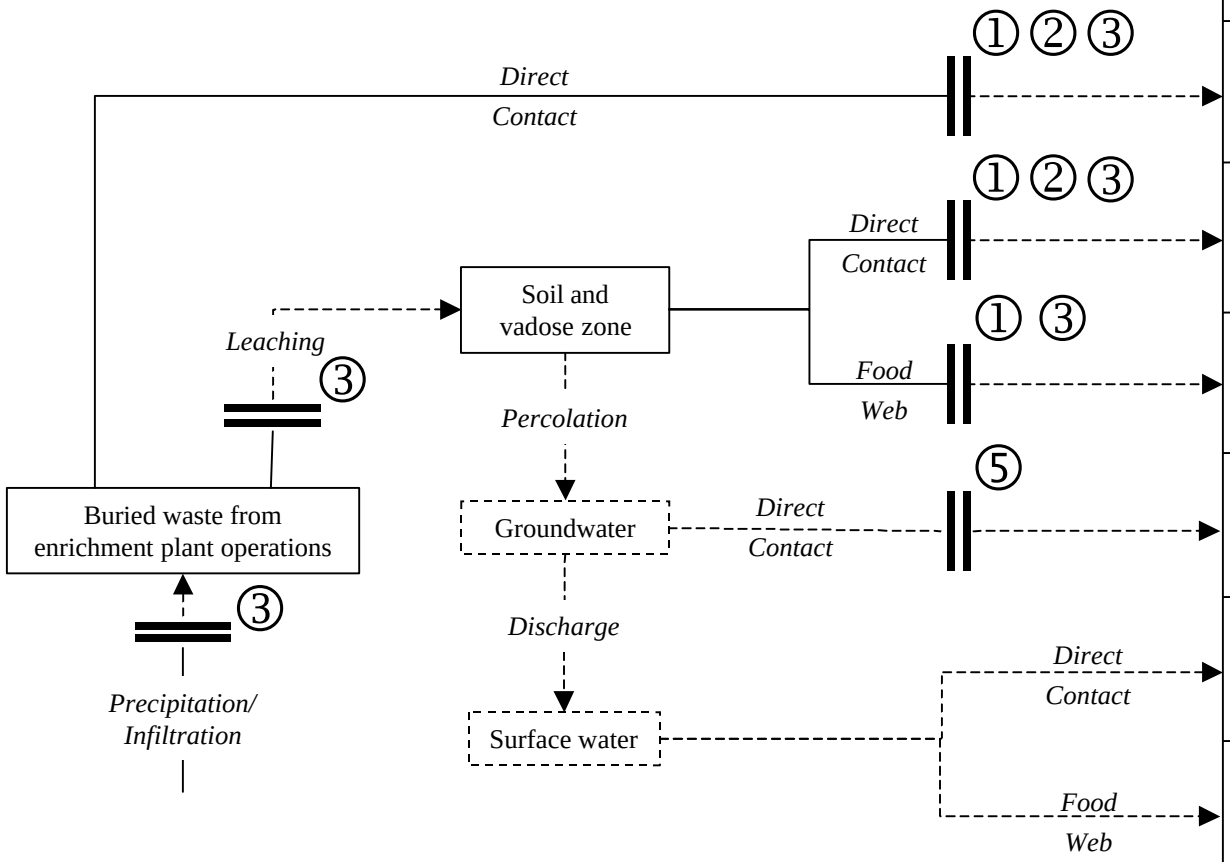


Fig. 4.5b1. Hazard Area 5: Permitted Landfills – RBES.

Hazard Area 5 Permitted Landfills – RBES



Potential Receptor Exposed			
Worker	Resident	Visitor	Ecological
R/F/D/I		R/F/D/I	R/F/D/I
R/F/D/I		R/F/D/I	R/F/D/I
		F	F
R/F/D/I	R/F/D/I		
F/D/I		F/D/I	F/D/I
	F	F	F

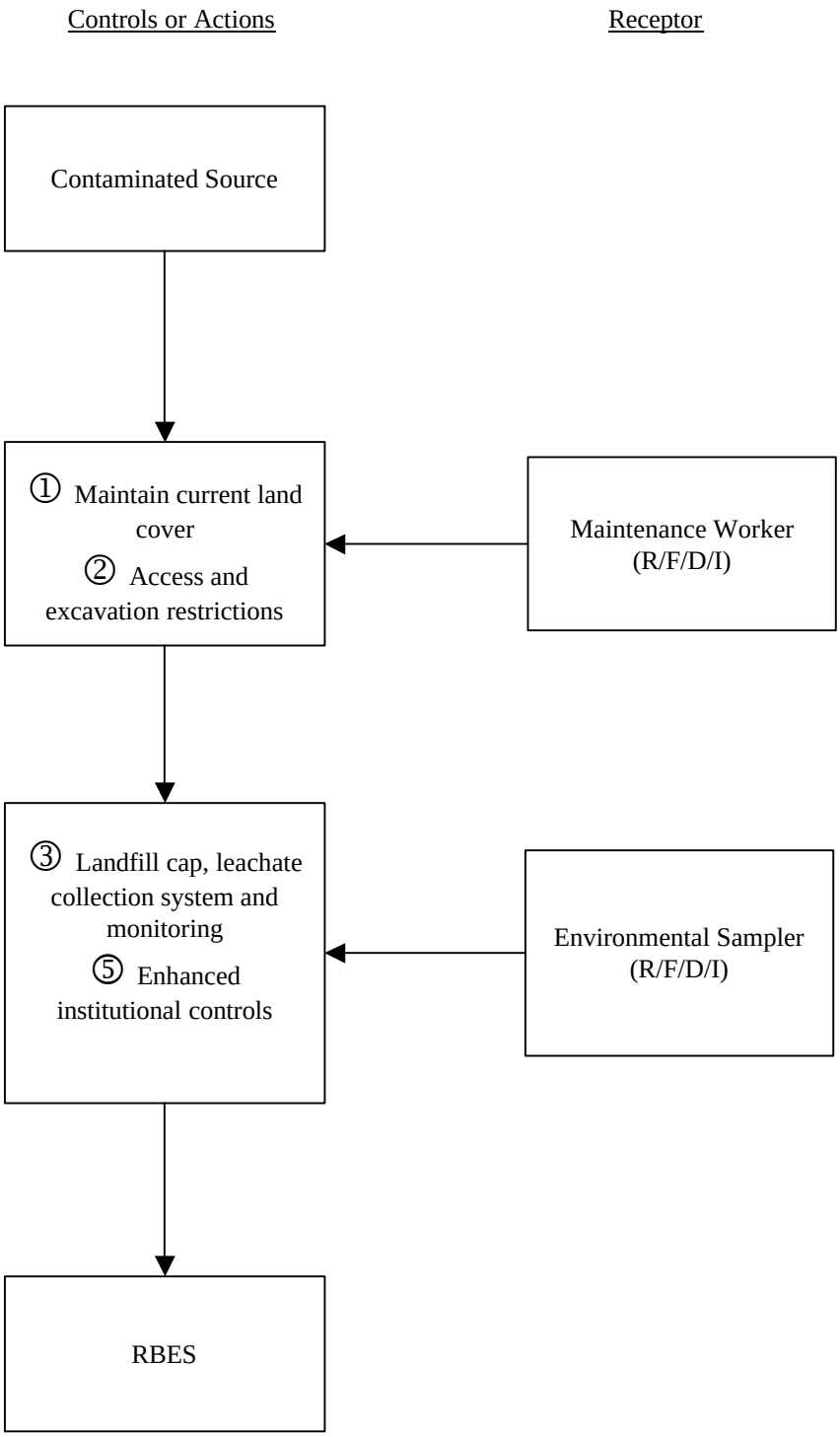
RBES Controls and Actions
① Current land cover.
② Access and excavation restrictions
③ Landfill cap, leachate collection system, and monitoring.
⑤ Enhanced institutional controls to limit access and use of groundwater.

Receptor Key
Worker – includes workers exposed during inside and outside activities, including the remediation worker.
Resident – includes residents engaged in all but recreation activities.
Visitor – includes recreational users, intruders, and trespassers.
Ecological – includes on- and offsite aquatic and terrestrial ecological receptors.

Exposure Route Key
R = External Exposure
F = Ingestion
D = Dermal
I = Inhalation

Fig. 4.5b2. Hazard Area 5: Permitted Landfills CSM – RBES.

Hazard Area 5: Permitted Landfills treatment train – RBES



Exposure Route Key: R=External Exposure, F=Ingestion, D=Dermal, I=Inhalation

Fig. 4.5b3. Hazard Area 5: Permitted Landfills treatment train – RBES.

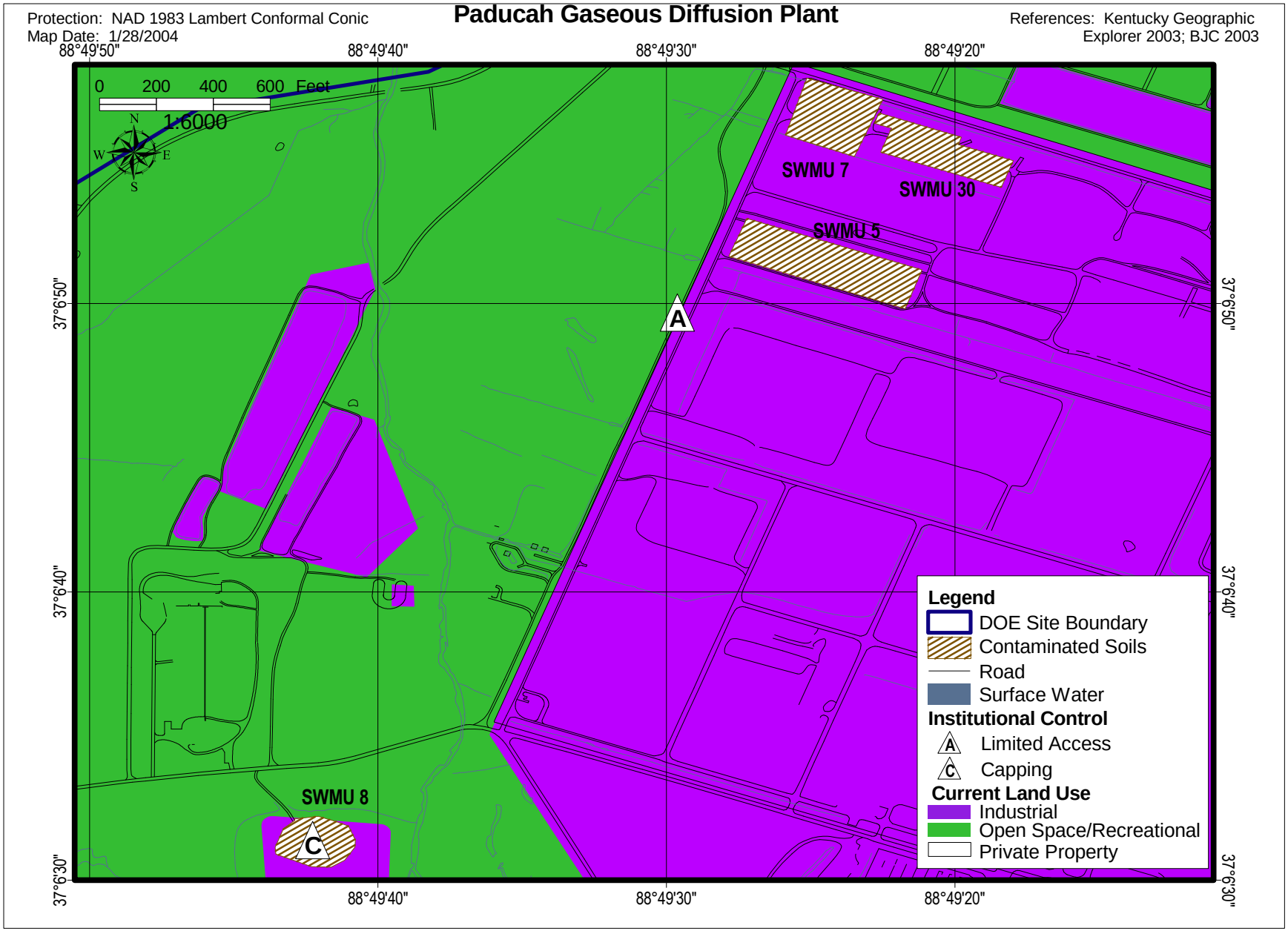
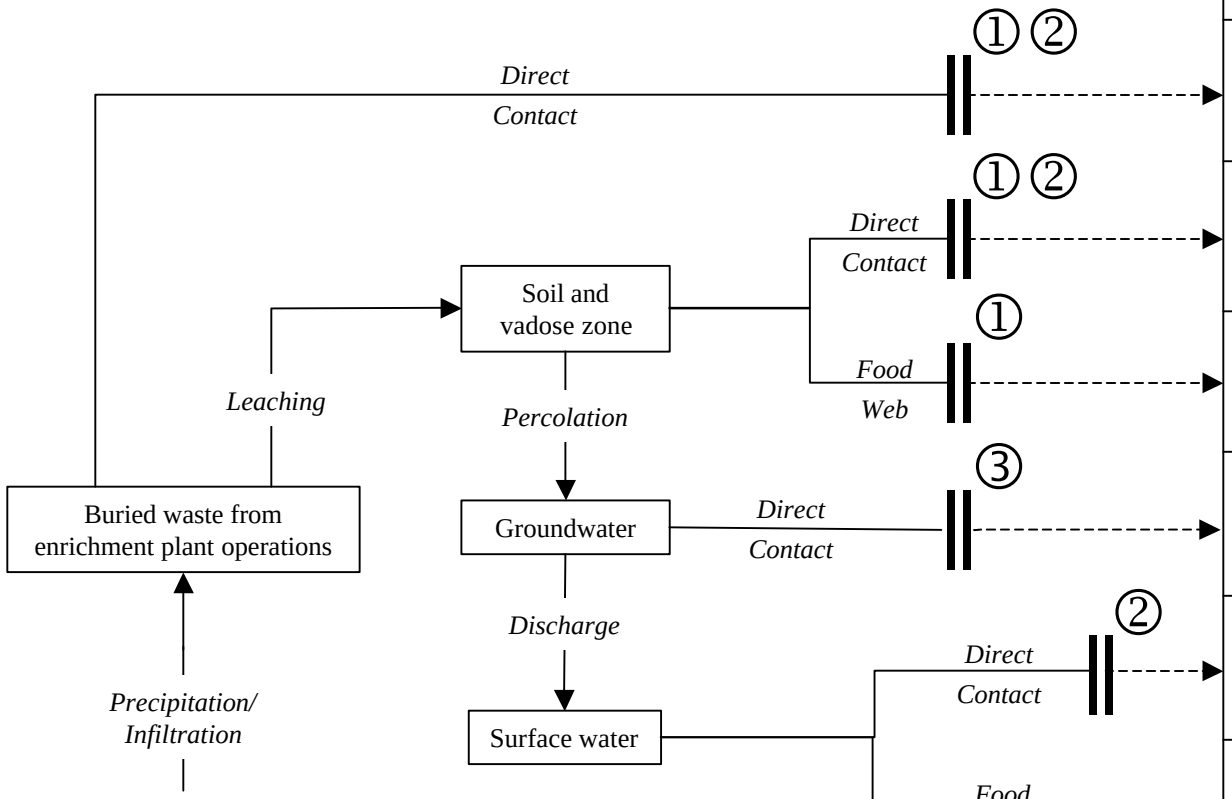


Fig. 4.6a1. Hazard Area 6: Burial Grounds OU (Group 2) – current state.

Hazard Area 6 Burial Grounds (Group 2) – Current State



Potential Receptor Exposed			
Worker	Resident	Visitor	Ecological
R/F/D/I		R/F/D/I	R/F/D/I
R/F/D/I		R/F/D/I	R/F/D/I
		F	F
R/F/D/I	R/F/D/I		
F/D/I		F/D/I	F/D/I
	F	F	F

Current Controls and Actions
① Current land cover.
② Access and excavation restrictions.
③ PGDP Water Policy.

Receptor Key
Worker – includes workers exposed during inside and outside activities, including the remediation worker.
Resident – includes residents engaged in all but recreation activities.
Visitor – includes recreational users, intruders, and trespassers.
Ecological – includes on- and offsite aquatic and terrestrial ecological receptors.

Exposure Route Key
R = External Exposure
F = Ingestion
D = Dermal
I = Inhalation

Fig. 4.6a2. Hazard Area 6: Burial Grounds OU (Group 2) CSM – current state.

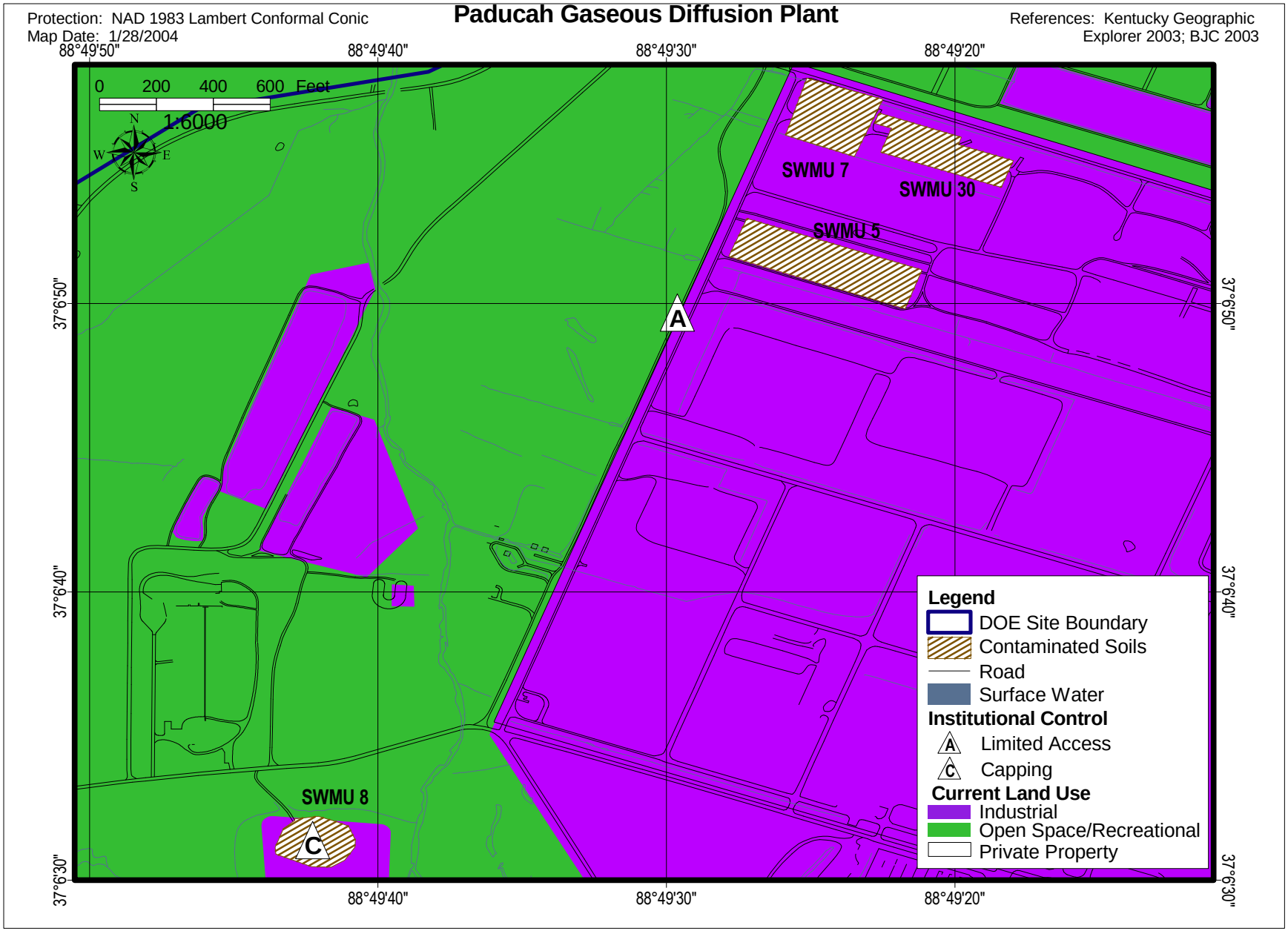
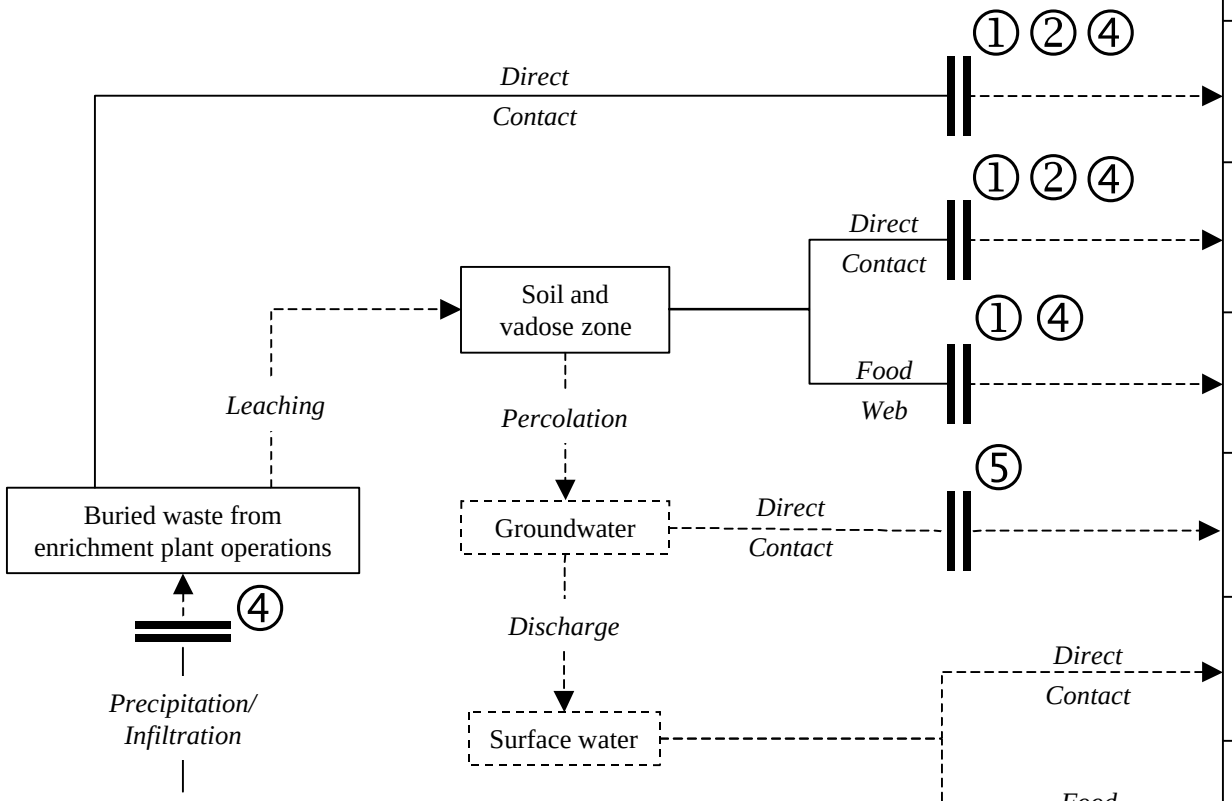


Fig. 4.6a1. Hazard Area 6: Burial grounds OU (Group 2)- current state.

Hazard Area 6 Burial Grounds (Group 2) – RBES



Potential Receptor Exposed			
Worker	Resident	Visitor	Ecological
R/F/D/I		R/F/D/I	R/F/D/I
R/F/D/I		R/F/D/I	R/F/D/I
		F	F
R/F/D/I	R/F/D/I		
F/D/I		F/D/I	F/D/I
	F	F	F

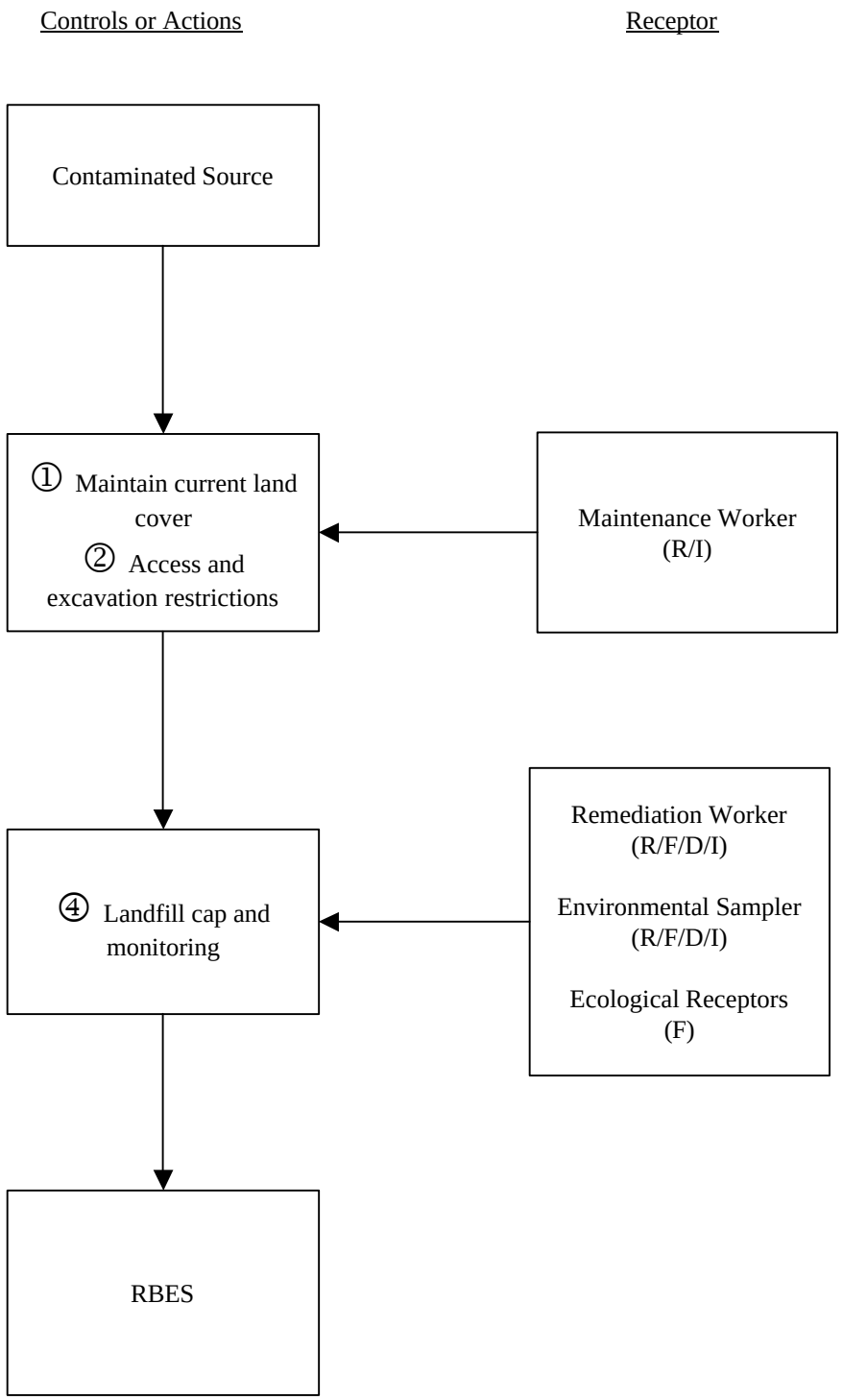
RBES Controls and Actions
① Current land cover.
② Access and excavation restrictions
④ Landfill cap and monitoring.
⑤ Enhanced institutional controls to limit access and use of groundwater.

Receptor Key
Worker – includes workers exposed during inside and outside activities, including the remediation worker.
Resident – includes residents engaged in all but recreation activities.
Visitor – includes recreational users, intruders, and trespassers.
Ecological – includes on- and offsite aquatic and terrestrial ecological receptors.

Exposure Route Key
R = External Exposure
F = Ingestion
D = Dermal
I = Inhalation

Fig. 4.6b2. Hazard Area 6: Burial Grounds OU (Group 2) CSM – RBES.

Hazard Area 6: C-746-K Landfill treatment train – RBES



Exposure Route Key: R=External Exposure, F=Ingestion, D=Dermal, I=Inhalation

Fig. 4.6b3. Hazard Area 6: Burial Grounds OU (Group 2) treatment train – RBES.

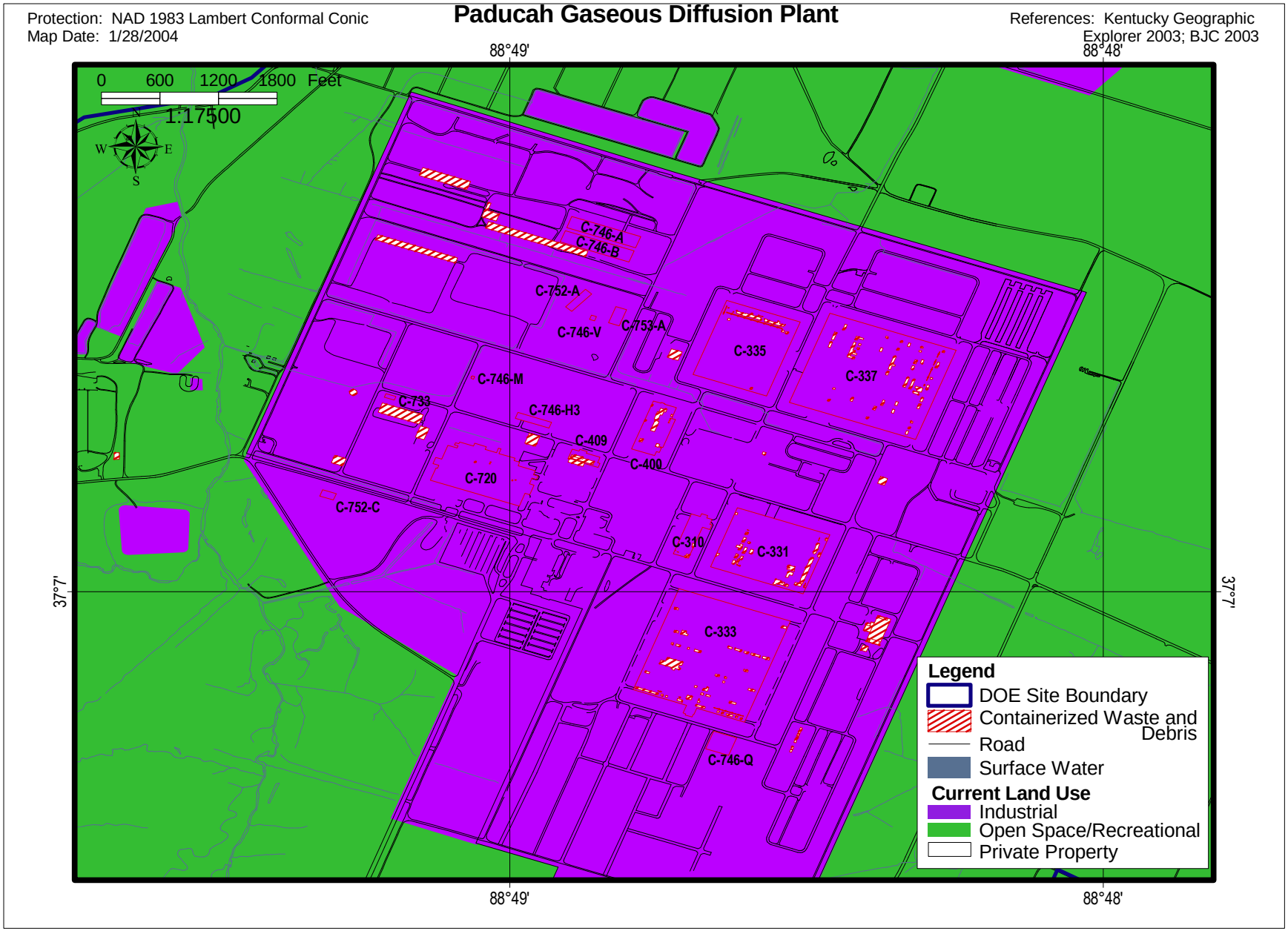
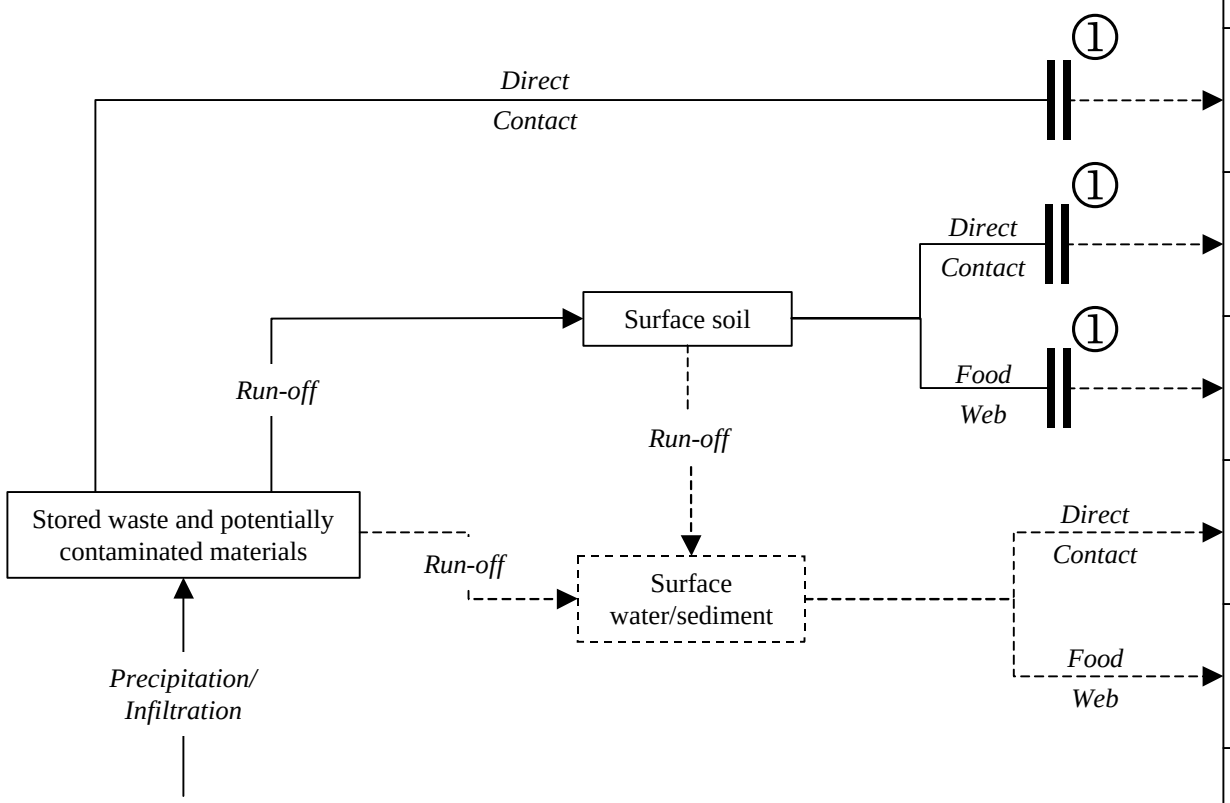


Fig. 4.7a1. Hazard Area 7: Legacy Waste and DOE Material Storage Areas - current state.

Hazard Area 7 Legacy Waste and DOE Material Storage Areas – Current State



Potential Receptor Exposed			
Worker	Resident	Visitor	Ecological
R/F/D/I			R/F/D/I
R/F/D/I			R/F/D/I
			F
F/D/I		F/D/I	F/D/I
	F	F	F

Current Controls and Actions
① Access restrictions.

Receptor Key
Worker – includes workers exposed during inside and outside activities, including the remediation worker.
Resident – includes residents engaged in all but recreation activities.
Visitor – includes recreational users, intruders, and trespassers.
Ecological – includes on- and offsite aquatic and terrestrial ecological receptors.

Exposure Route Key
R = External Exposure
F = Ingestion
D = Dermal
I = Inhalation

Fig. 4.7a2. Hazard Area 7: Legacy waste and DOE material storage areas CSM – current state.

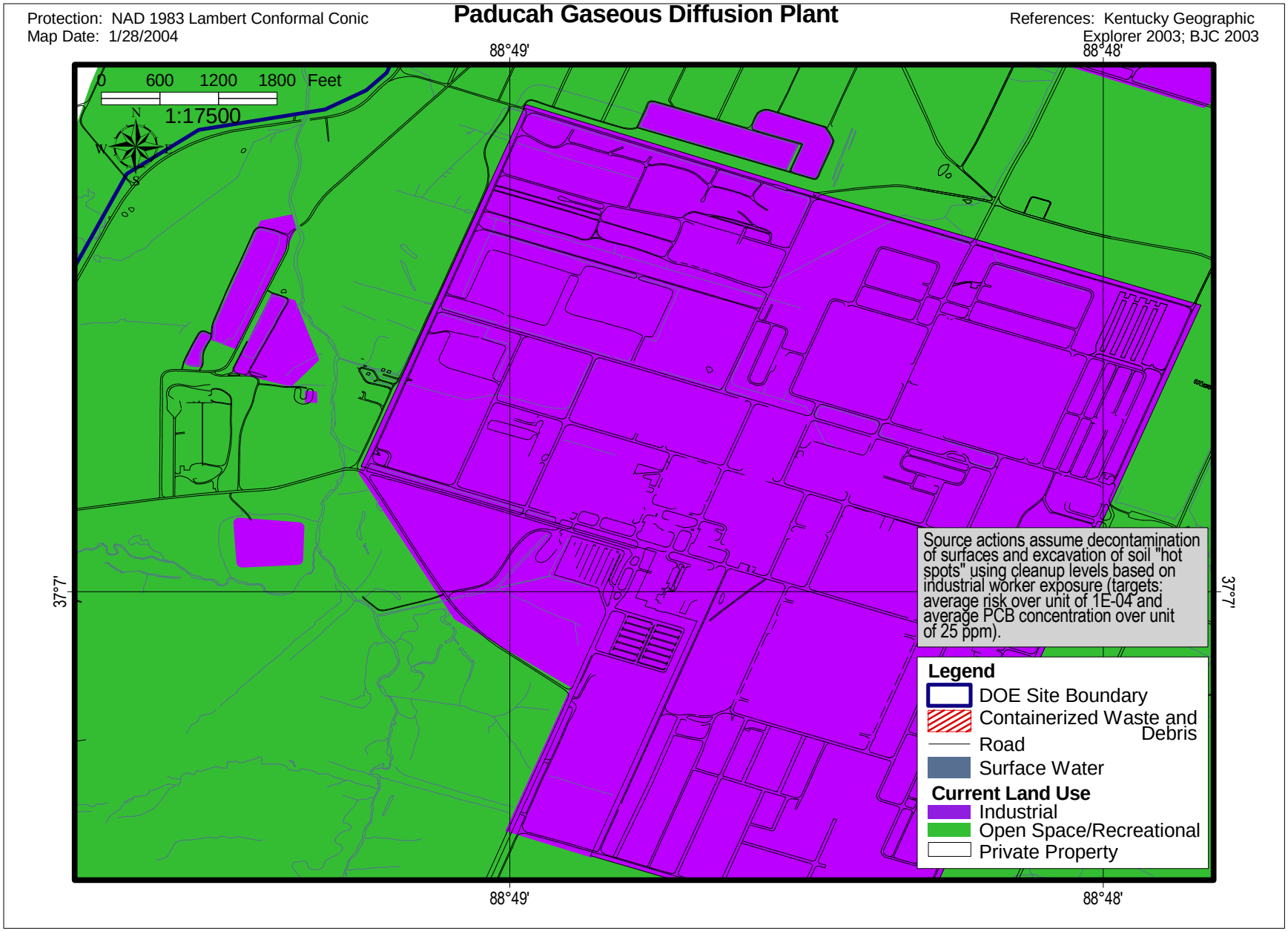
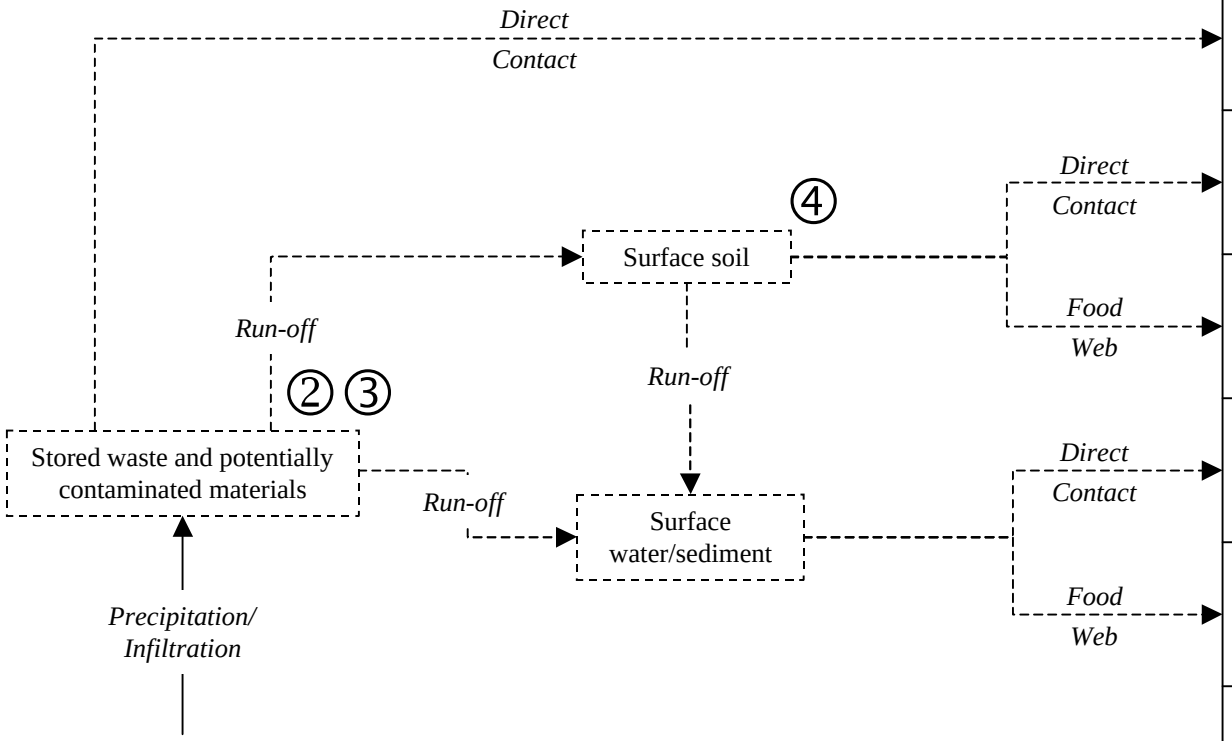


Fig. 4.7b1. Hazard Area 7: Legacy Waste and DOE Material Storage Areas - RBES.

Hazard Area 7 Legacy Waste and DOE Material Storage Areas – RBES



Potential Receptor Exposed			
Worker	Resident	Visitor	Ecological
R/F/D/I			R/F/D/I
R/F/D/I			R/F/D/I
			F
F/D/I		F/D/I	F/D/I
	F	F	F

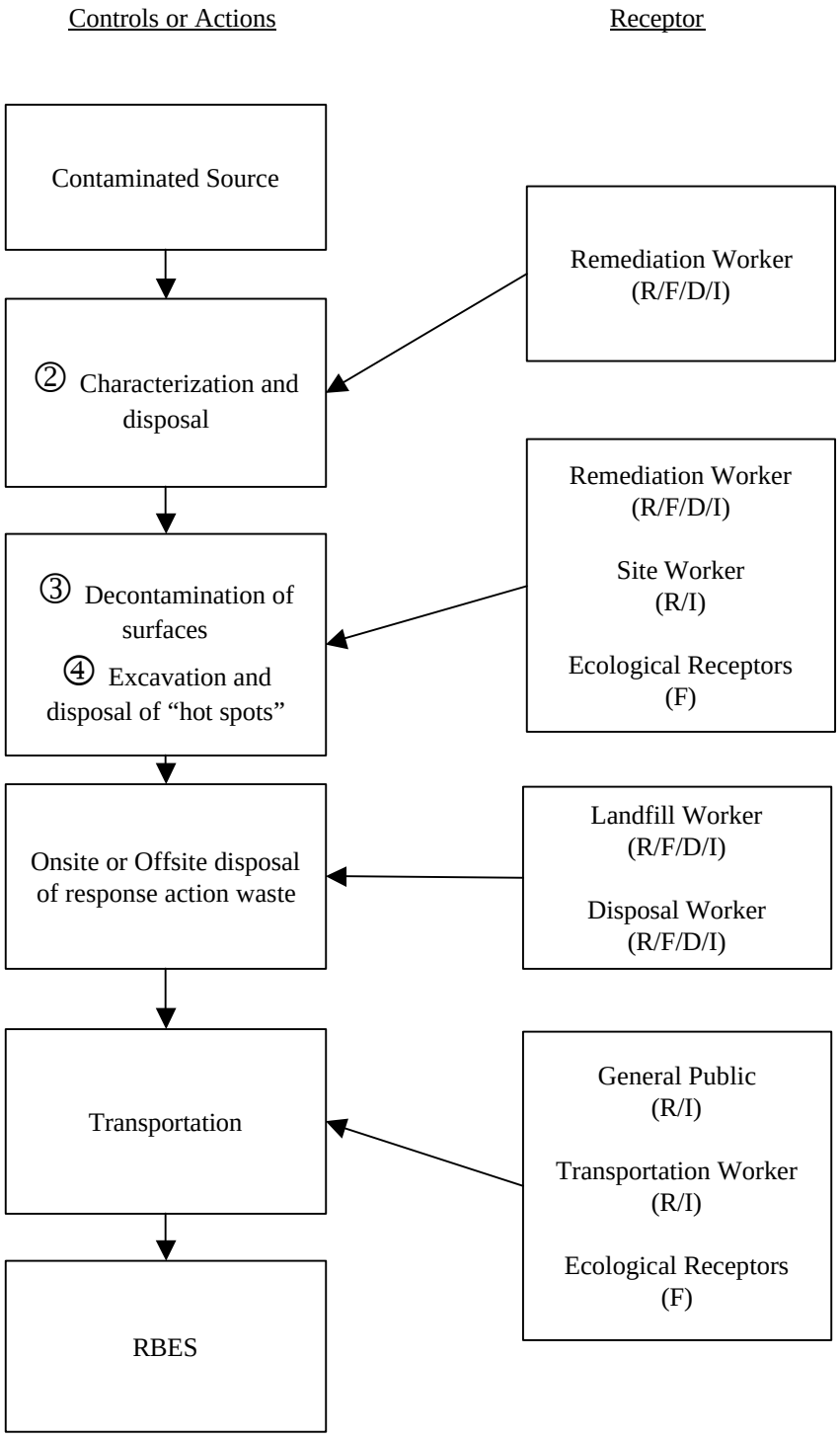
RBES Controls and Actions
② Characterization and disposal.
③ Decontamination of surfaces (target based on average exposure over entire unit: worker risk of 1E-04, PCBs at 25 ppm).
④ Excavation of "hot spots" (target based on average exposure over entire unit: worker risk of 1E-04, PCBs at 25 ppm).

Receptor Key
Worker – includes workers exposed during inside and outside activities, including the remediation worker.
Resident – includes residents engaged in all but recreation activities.
Visitor – includes recreational users, intruders, and trespassers.
Ecological – includes on- and offsite aquatic and terrestrial ecological receptors.

Exposure Route Key
R = External Exposure
F = Ingestion
D = Dermal
I = Inhalation

Fig. 4.7b2. Hazard Area 7: Legacy waste and DOE material storage areas CSM – RBES.

Hazard Area 7: Legacy waste and DOE material storage areas treatment train – RBES



Exposure Route Key: R=External Exposure, F=Ingestion, D=Dermal, I=Inhalation

Fig. 4.7b3. Hazard Area 7: Legacy waste and DOE material storage areas treatment train – RBES.

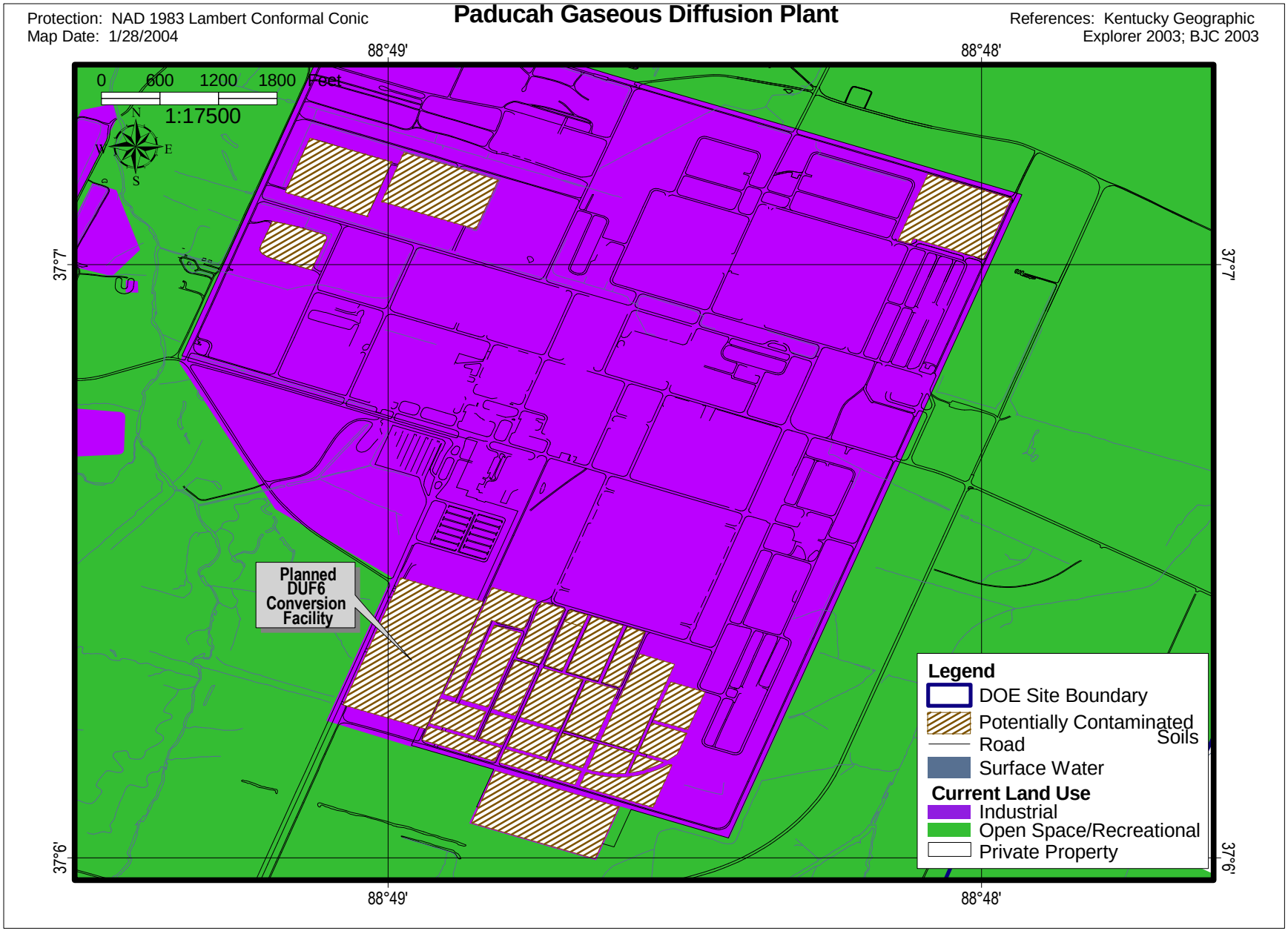
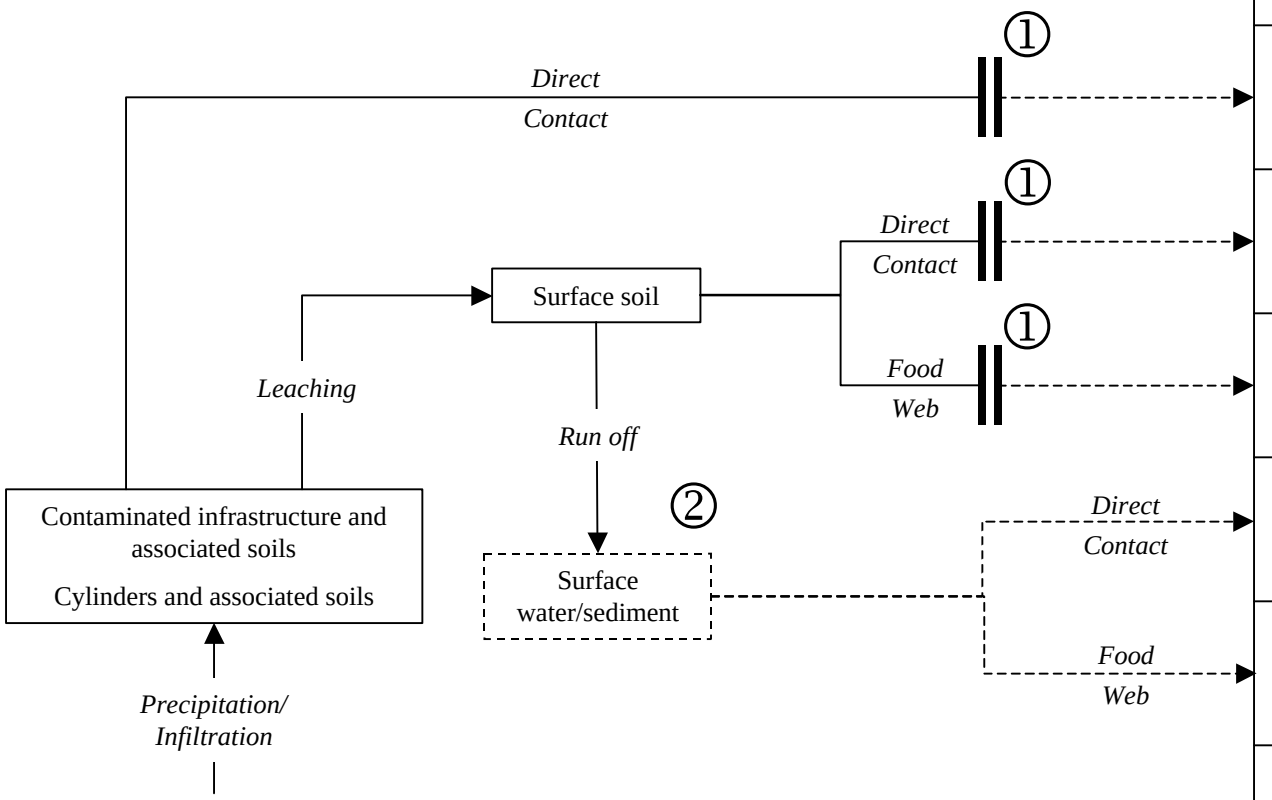


Fig. 4.8a1. Hazard Area 8: Cylinder yards and DUF_6 conversion facility – current state.

Hazard Area 8 Cylinder Yards and DUF_6 Conversion Facility – Current State



Potential Receptor Exposed			
Worker	Resident	Visitor	Ecological
R/F/D/I			R/F/D/I
R/F/D/I			R/F/D/I
		F	F
R/F/D/I		R/F/D/I	R/F/D/I
	F	F	F

Current Controls and Actions
① Access restrictions.
② Attenuation

Receptor Key
Worker – includes workers exposed during inside and outside activities, including the remediation worker.
Resident – includes residents engaged in all but recreation activities.
Visitor – includes recreational users, intruders, and trespassers.
Ecological – includes on- and offsite aquatic and terrestrial ecological receptors.

Exposure Route Key
R = External Exposure
F = Ingestion
D = Dermal
I = Inhalation

Fig. 4.8a2. Hazard Area 8: Cylinder yards and DUF_6 conversion facility CSM – current state.

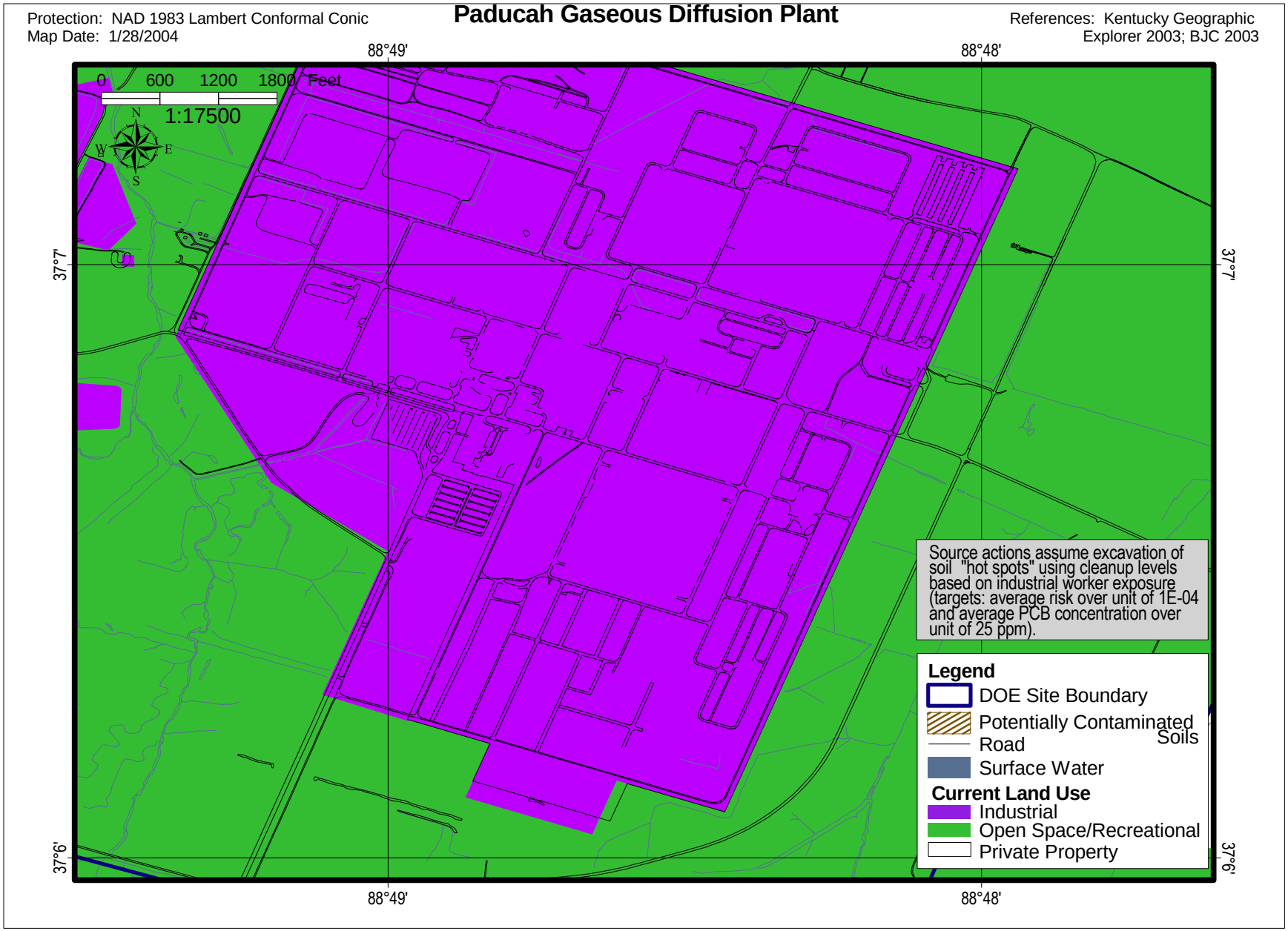
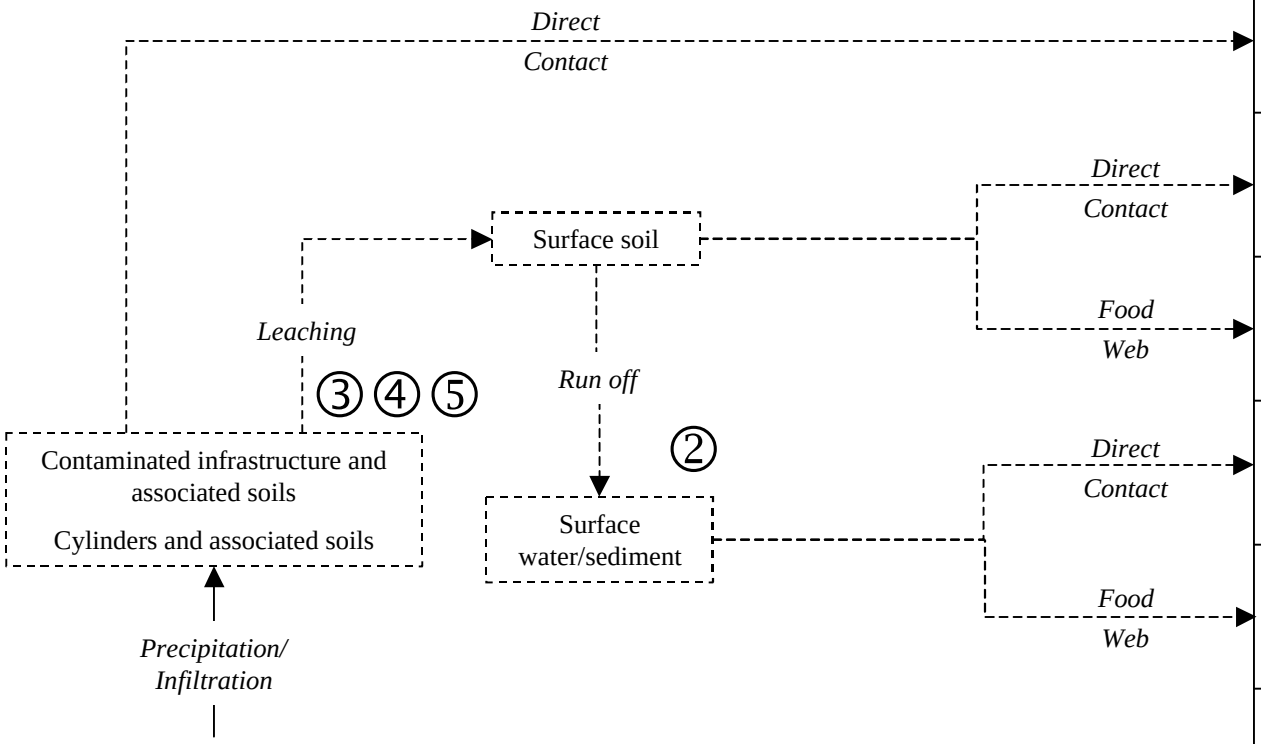


Fig. 4.8b1. Hazard Area 8: Cylinder yards and DUF_6 conversion facility – RBES.

Hazard Area 8 Cylinder Yards and DUF_6 Conversion Facility – RBES



Potential Receptor Exposed			
Worker	Resident	Visitor	Ecological
R/F/D/I			R/F/D/I
R/F/D/I			R/F/D/I
		F	F
R/F/D/I		R/F/D/I	R/F/D/I
	F	F	F

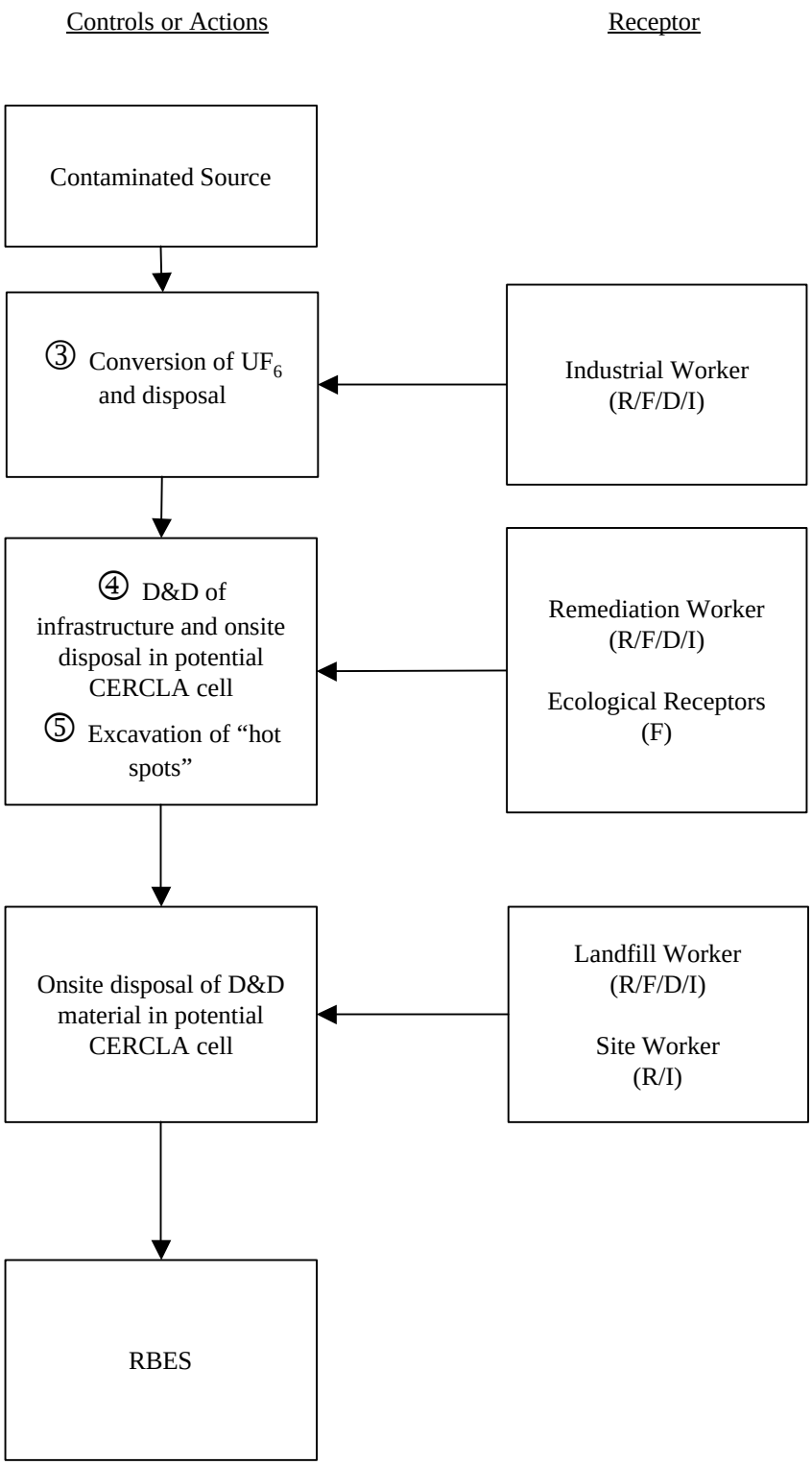
RBES Controls and Actions
② Attenuation
③ Conversion of depleted UF_6 and disposal.
④ D&D of infrastructure.
⑤ Excavation of "hot spots" in surface soil (target based on average exposure over entire unit: worker risk of 1E-04, PCBs at 25 ppm).

Receptor Key
Worker – includes workers exposed during inside and outside activities, including the remediation worker.
Resident – includes residents engaged in all but recreation activities.
Visitor – includes recreational users, intruders, and trespassers.
Ecological – includes on- and offsite aquatic and terrestrial ecological receptors.

Exposure Route Key
R = External Exposure
F = Ingestion
D = Dermal
I = Inhalation

Fig. 4.8b2. Hazard Area 8: Cylinder yards and DUF_6 conversion facility CSM – RBES.

Hazard Area 8: Cylinder yards and DUF_6 conversion facility treatment train – RBES



Exposure Route Key: R=External Exposure, F=Ingestion, D=Dermal, I=Inhalation

Fig. 4.8b3. Hazard Area 8: Cylinder yards and DUF_6 conversion facility treatment train – RBES.

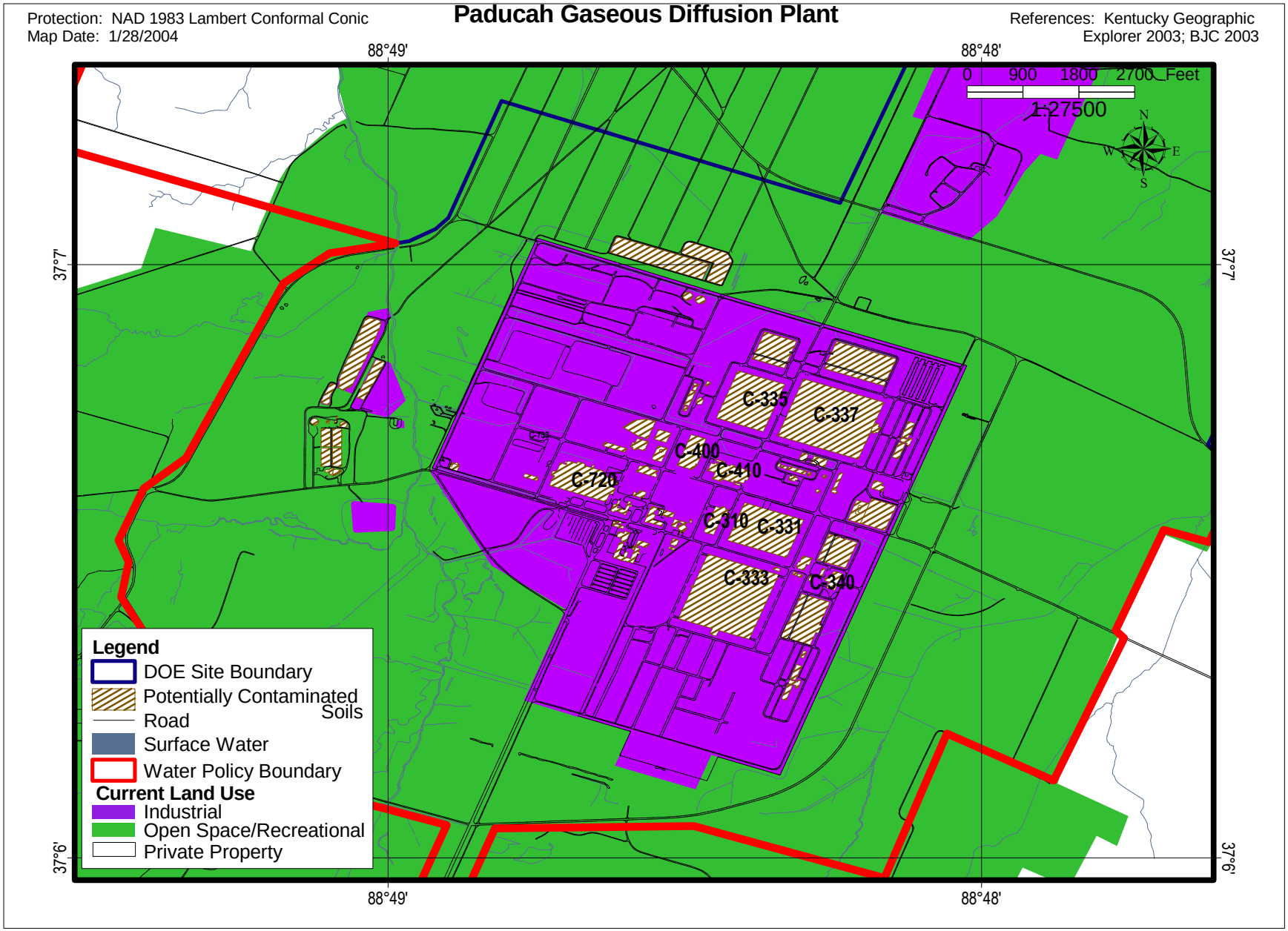
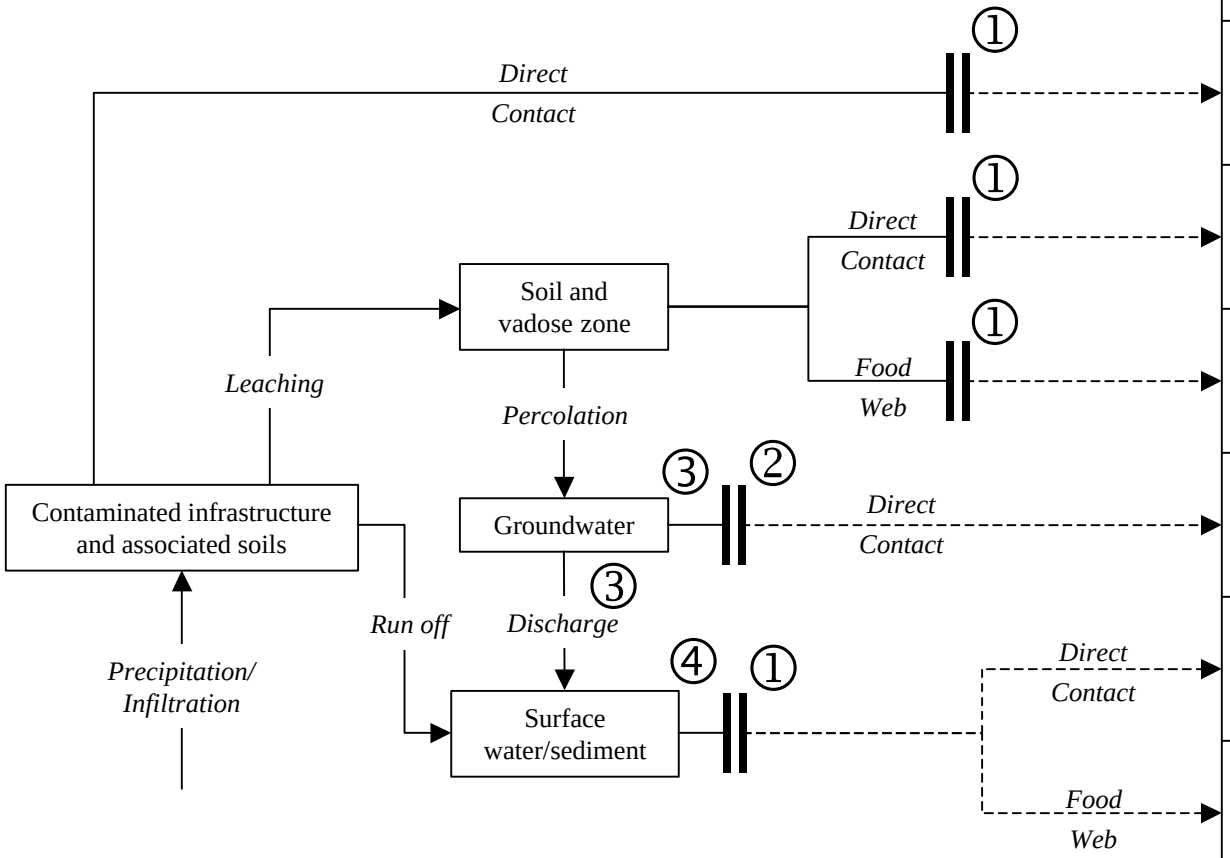


Fig. 4.9a1. Hazard Area 9: GDP facilities – current state.

Hazard Area 9 GDP Facilities – Current State



Potential Receptor Exposed			
Worker	Resident	Visitor	Ecological
R/F/D/I		R/F/D/I	R/F/D/I
R/F/D/I		R/F/D/I	R/F/D/I
	F	F	F
	R/F/D/I		
R/F/D/I		R/F/D/I	R/F/D/I
	F	F	F

Current Controls and Actions
① Access and excavation restrictions.
② PGDP Water Policy.
③ "Hot spot" pump and treat.
④ Natural attenuation.

Receptor Key
Worker – includes workers exposed during inside and outside activities, including the remediation worker.
Resident – includes residents engaged in all but recreation activities.
Visitor – includes recreational users, intruders, and trespassers.
Ecological – includes on- and offsite aquatic and terrestrial ecological receptors.

Exposure Route Key
R = External Exposure
F = Ingestion
D = Dermal
I = Inhalation

Fig. 4.9a2. Hazard Area 9: GDP facilities CSM – current state

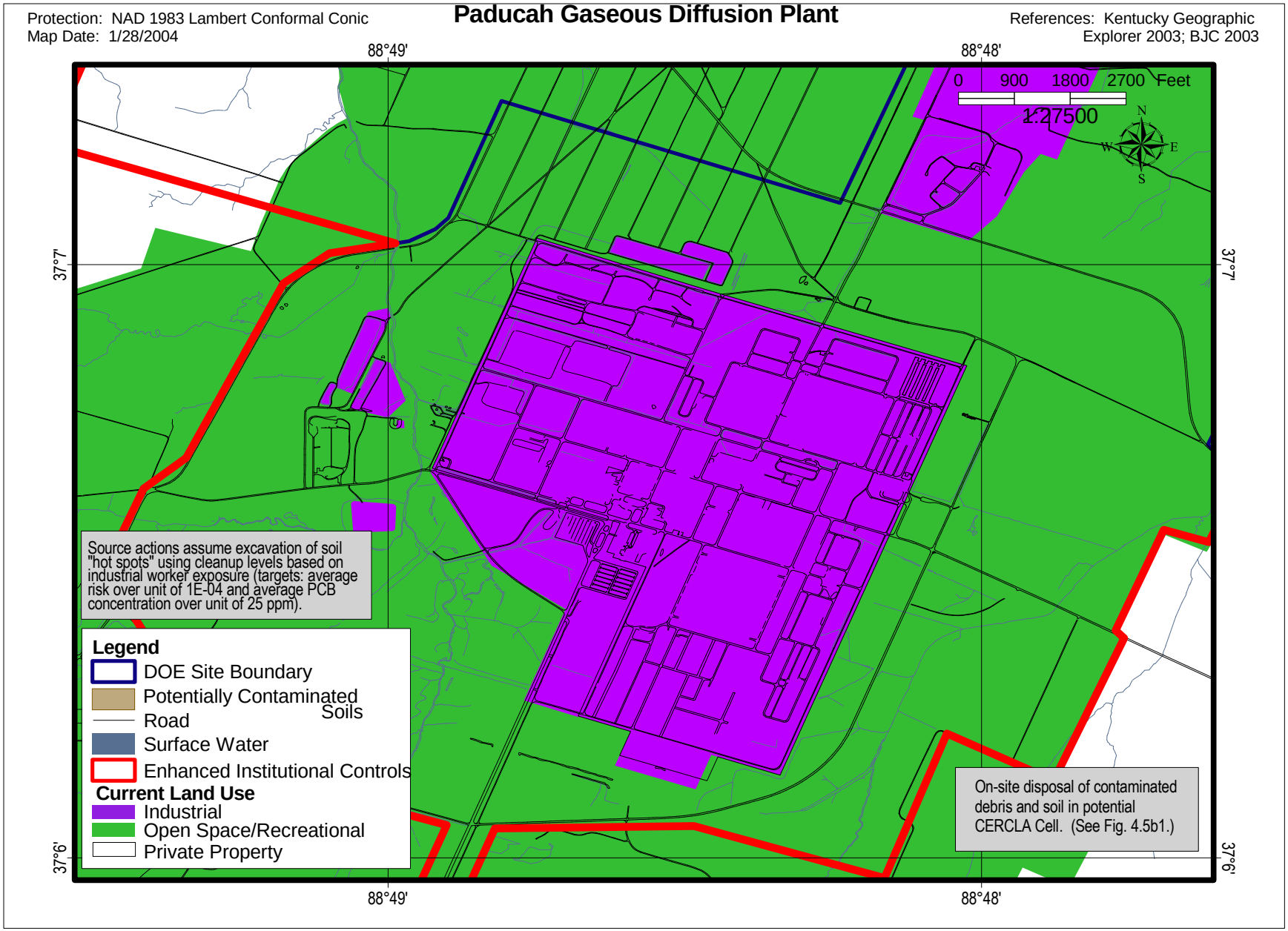
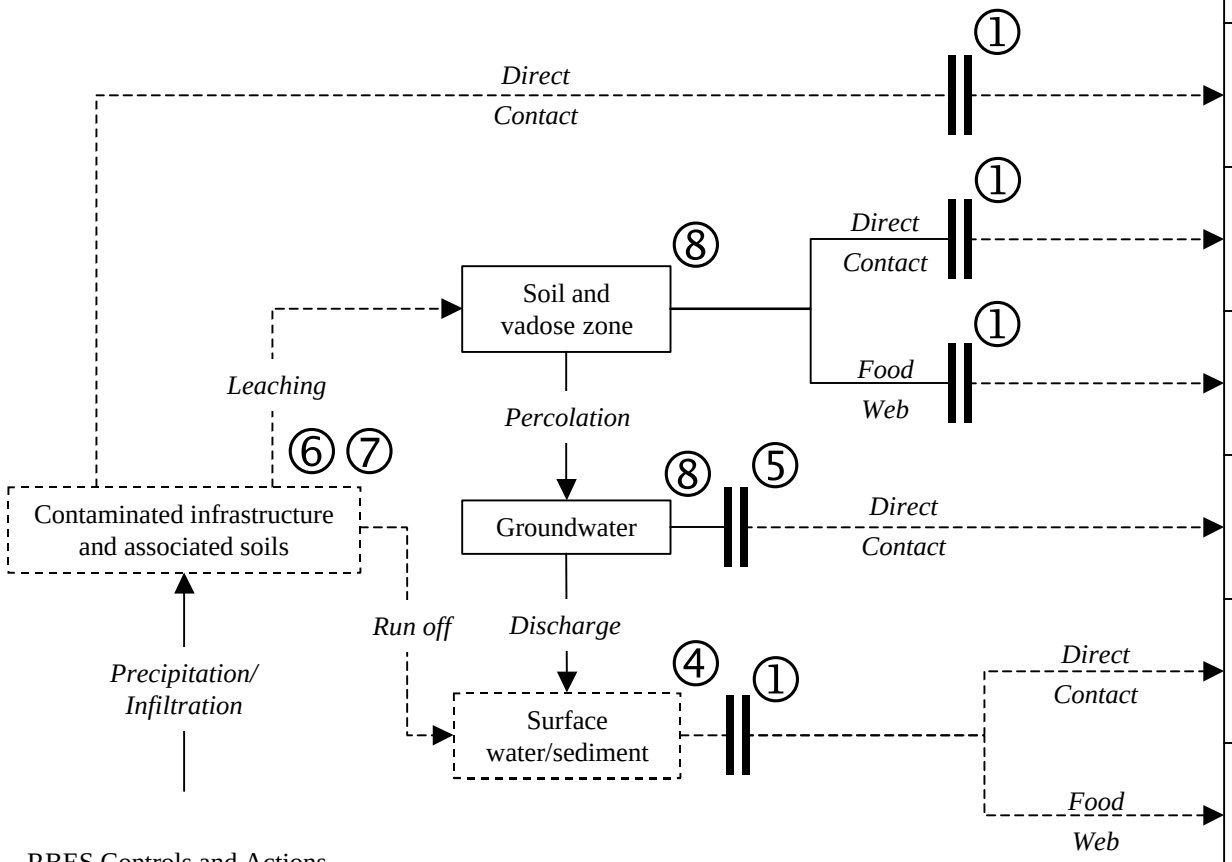


Fig. 4.9b1. Hazard Area 9: GDP facilities – RBES.

Hazard Area 9 GDP Facilities – RBES



Potential Receptor Exposed			
Worker	Resident	Visitor	Ecological
R/F/D/I		R/F/D/I	R/F/D/I
R/F/D/I		R/F/D/I	R/F/D/I
	F	F	F
	R/F/D/I		
R/F/D/I		R/F/D/I	R/F/D/I
	F	F	F

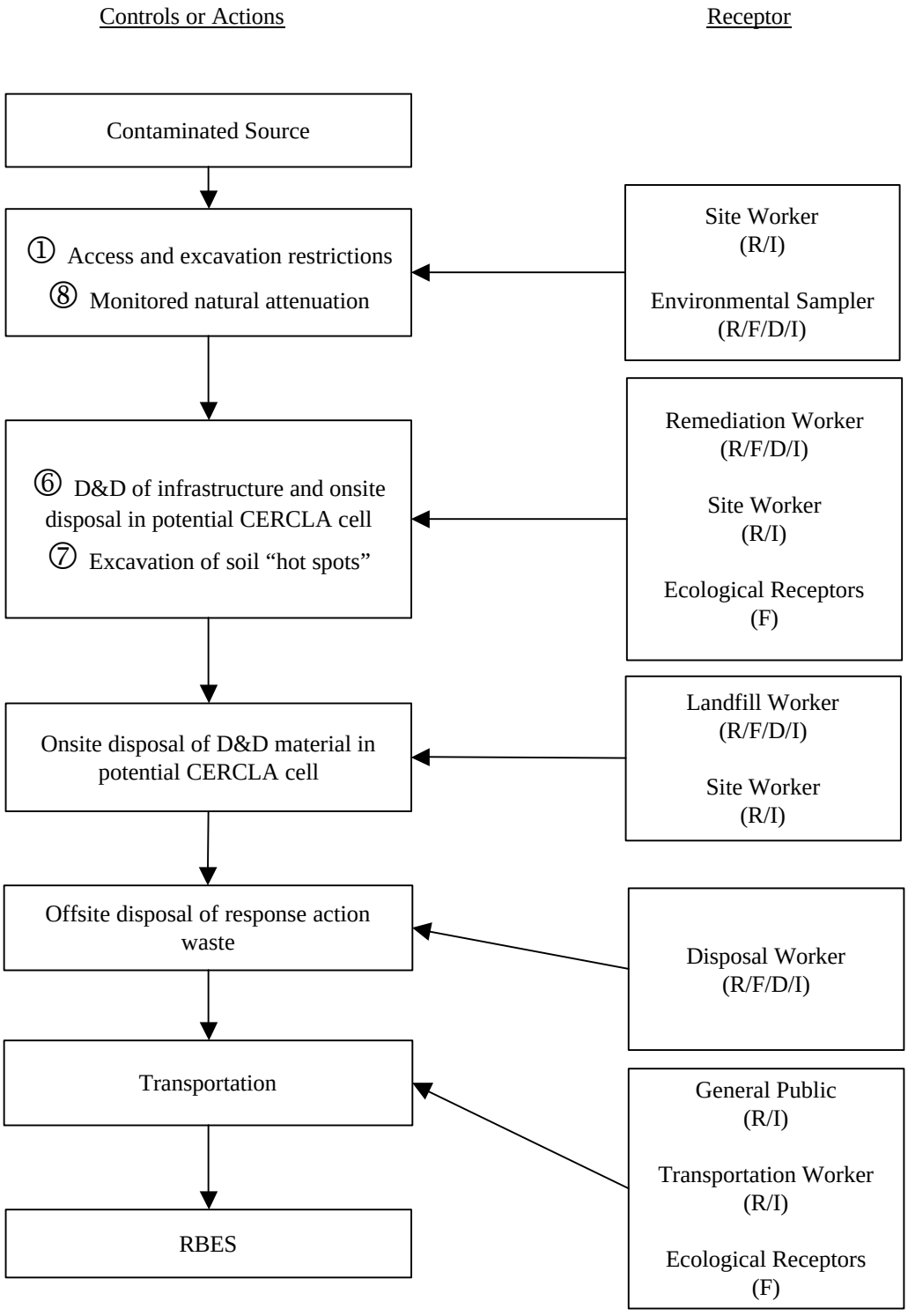
RBES Controls and Actions
① Access and excavation restrictions.
④ Attenuation.
⑤ Enhanced institutional controls to limit access to and use of groundwater.
⑥ D&D of infrastructure and disposal in potential CERCLA Cell.
⑦ Excavation of soil "hot spots" (target based on average exposure over entire unit: worker risk of 1E-04, PCBs at 25 ppm).
⑧ Monitored natural attenuation of sources and plume.

Receptor Key
Worker – includes workers exposed during inside and outside activities, including the remediation worker.
Resident – includes residents engaged in all but recreation activities.
Visitor – includes recreational users, intruders, and trespassers.
Ecological – includes on- and offsite aquatic and terrestrial ecological receptors.

Exposure Route Key
R = External Exposure
F = Ingestion
D = Dermal
I = Inhalation

Fig. 4.9b2. Hazard Area 9: GDP facilities CSM – RBES.

Hazard Area 9: GDP facilities treatment train – RBES



Exposure Route Key: R=External Exposure, F=Ingestion, D=Dermal, I=Inhalation

Fig. 4.9b3. Hazard Area 9: GDP facilities treatment train – RBES.