6. GROUNDWATER PROGRAMS

6.1 SUMMARY

Groundwater monitoring at DOE PORTS is required by a combination of state and federal regulations, legal agreements with Ohio EPA and U.S. EPA, and DOE Orders. More than 400 monitoring wells are used to track the flow of groundwater and to identify and measure groundwater contaminants. Groundwater programs also include on-site surface water monitoring and water supply monitoring.

The contaminated groundwater plumes present at PORTS did not change significantly in 2004. There have been no detections of trichloroethene in groundwater beyond the DOE property boundary that exceed the drinking water standard (called the Maximum Contaminant Level [MCL]) of 5 μg/L. In the southern portion of the X-749/X-120 groundwater plume near the DOE property boundary, injection of hydrogen release compounds caused decreases in the concentrations of trichloroethene in two wells. Trichloroethene and two other volatile organics were detected in the X-749/X-120 plume at estimated concentrations less than 1 μg/L (1 part per billion) in an off-site well approximately 45 feet south of the DOE property line.

6.2 INTRODUCTION

The PORTS reservation is the largest industrial user of water in the vicinity and obtains its water from three water supply well fields that are next to the Scioto River south of Piketon. The wells tap the Scioto River Valley buried aquifer. In 2004, total groundwater production from the water supply well fields averaged approximately 5 million gallons per day for the entire site (including USEC activities). Groundwater directly beneath PORTS is not used as a domestic, municipal, or industrial water supply, and contaminants in the groundwater beneath PORTS do not affect the quality of the water in the Scioto River Valley buried aquifer. In addition, DOE has filed a deed notification at the Pike County Auditor's Office that restricts the use of groundwater beneath the PORTS site.

Groundwater monitoring at PORTS includes several activities. Monitoring wells are used to obtain information about groundwater. When the level of water, or groundwater elevation, is measured in a number of wells over a short period of time, the groundwater elevations, combined with information about the subsurface soil, can be used to estimate the rate and direction of groundwater flow. The rate and direction of groundwater flow can be used to predict the movement of contaminants in the groundwater and to develop ways to control or remediate groundwater contamination. Samples of water are also collected from groundwater monitoring wells and analyzed to obtain information about contaminants and naturally-occurring compounds in the groundwater.

6.3 GROUNDWATER MONITORING AT DOE PORTS

Groundwater monitoring at PORTS was initiated in the 1980s. Groundwater monitoring has been conducted in response to state and/or federal regulations, regulatory documents prepared by DOE PORTS, agreements between DOE and Ohio EPA or U.S. EPA, and DOE Orders.

Because of the numerous regulatory programs applicable to groundwater monitoring at PORTS, an *Integrated Groundwater Monitoring Plan* was developed to address all groundwater monitoring requirements for PORTS. The initial plan, dated November 1998, was reviewed and approved by Ohio EPA and implemented at PORTS starting on April 1, 1999. The *Integrated Groundwater Monitoring Plan* is periodically revised and approved by Ohio EPA. In 2004, groundwater monitoring at PORTS was performed under the *Integrated Groundwater Monitoring Plan* dated October 2003, which was effective throughout 2004.

Groundwater monitoring is also conducted to meet DOE Order requirements. Exit pathway monitoring assesses the effect of PORTS on off-site groundwater quality. DOE Orders are the basis for radiological monitoring of groundwater at PORTS.

Two water-bearing zones are present beneath PORTS: the Gallia and Berea formations. The Gallia is the uppermost water-bearing zone and contains most of the groundwater contamination at PORTS. The Berea is deeper than the Gallia and is usually separated from the Gallia by the Sunbury shale, which acts as a barrier to impede groundwater flow between the Gallia and Berea formations. Additional information about site hydrogeology is available in the PORTS Environmental Information Center. Chapter 3, Sect. 3.7, discusses the Environmental Information Center in more detail.

Several areas of groundwater contamination have been identified at PORTS. Groundwater contamination consists of volatile organic compounds (primarily trichloroethene) and radionuclides such as uranium and technetium-99.

In recent years, concentrations of volatile organic compounds have increased at the southern edge of the X-749/X-120 groundwater plume, which is near the southern PORTS boundary. A barrier wall is installed at the southern edge of the plume, but volatile organics, including trichloroethene, have moved beyond the wall. In 2004, four wells installed off site, south of the plume and the barrier wall, were sampled for volatile organic compounds, radionuclides, and other parameters. Trichloroethene and two other volatile organics were detected at estimated concentrations less than 1 μg/L in one of the wells located approximately 45 feet south of the property line.

In April 2004, a project was implemented to remediate volatile organics at the southern edge of the X-749/X-120 groundwater plume, near the barrier wall. Hydrogen release compounds were injected into the groundwater to accelerate the process of breaking down trichloroethene into nontoxic compounds. Section 6.4.1.3 provides additional information about groundwater monitoring results for this area in 2004.

In other areas of groundwater contamination at PORTS, the concentration of contaminants and the lateral extent of plume boundaries did not significantly increase in 2004. The *2004 Groundwater Monitoring Report for the Portsmouth Gaseous Diffusion Plant* provides further details on the groundwater plumes at PORTS, specific monitoring well identifications, and analytical results for monitoring wells. This document and other documents referenced in this chapter are available in the PORTS Environmental Information Center.

This chapter also includes information on the groundwater treatment facilities at PORTS. These facilities receive contaminated groundwater from the groundwater monitoring areas and treat the water prior to discharge through the DOE PORTS permitted NPDES outfalls.

6.4 GROUNDWATER MONITORING AREAS

The *Integrated Groundwater Monitoring Plan* requires groundwater monitoring of 11 areas within the quadrants of the site designated by the RCRA Corrective Action Program. These areas (see Fig. 6.1) are:

- X-749/X-120/PK Landfill,
- Quadrant I Groundwater Investigative Area/X-749A Classified Materials Disposal Facility,
- Quadrant II Groundwater Investigative Area,
- X-701B Holding Pond,
- X-633 Pumphouse/Cooling Towers Area,
- X-616 Chromium Sludge Surface Impoundments,
- X-740 Waste Oil Handling Facility,
- X-611A Former Lime Sludge Lagoons,
- X-735 Landfills,
- X-734 Landfills, and
- X-533 Switchyard Area.

The *Integrated Groundwater Monitoring Plan* also contains requirements for (1) surface water monitoring in creeks and drainage ditches at PORTS that receive groundwater discharge, and (2) water supply monitoring.

In general, samples are collected from wells (or surface water locations) at each area listed above and are analyzed for metals, volatile organic compounds, and radiological constituents. Table 6.1 lists the analytical requirements for each groundwater monitoring area and other monitoring programs described in this chapter. DOE PORTS then compares constituents detected in the groundwater to standards called preliminary remediation goals to assess the potential for each constituent to affect human health and the environment.

6.4.1 X-749 Contaminated Materials Disposal Facility/X-120 Old Training Facility/PK Landfill

In the southernmost portion of PORTS, groundwater concerns focus on three contaminant sources: X-749 Contaminated Materials Disposal Facility, X-120 Old Training Facility, and PK Landfill.

6.4.1.1 X-749 Contaminated Materials Disposal Facility/X-120 Old Training Facility

The X-749 Contaminated Materials Disposal Facility is a landfill located in the south-central section of the facility. The landfill covers approximately 7.5 acres and was built in an area of highest elevation within the southern half of PORTS. The landfill operated from 1955 to 1990, during which time buried wastes were generally contained in metal drums or other containers compatible with the waste.

The northern portion contains waste contaminated with industrial solvents, waste oils from plant compressors and pumps, sludges classified as hazardous, and low-level radioactive materials. The southern portion contains non-hazardous, low-level radioactive scrap materials.

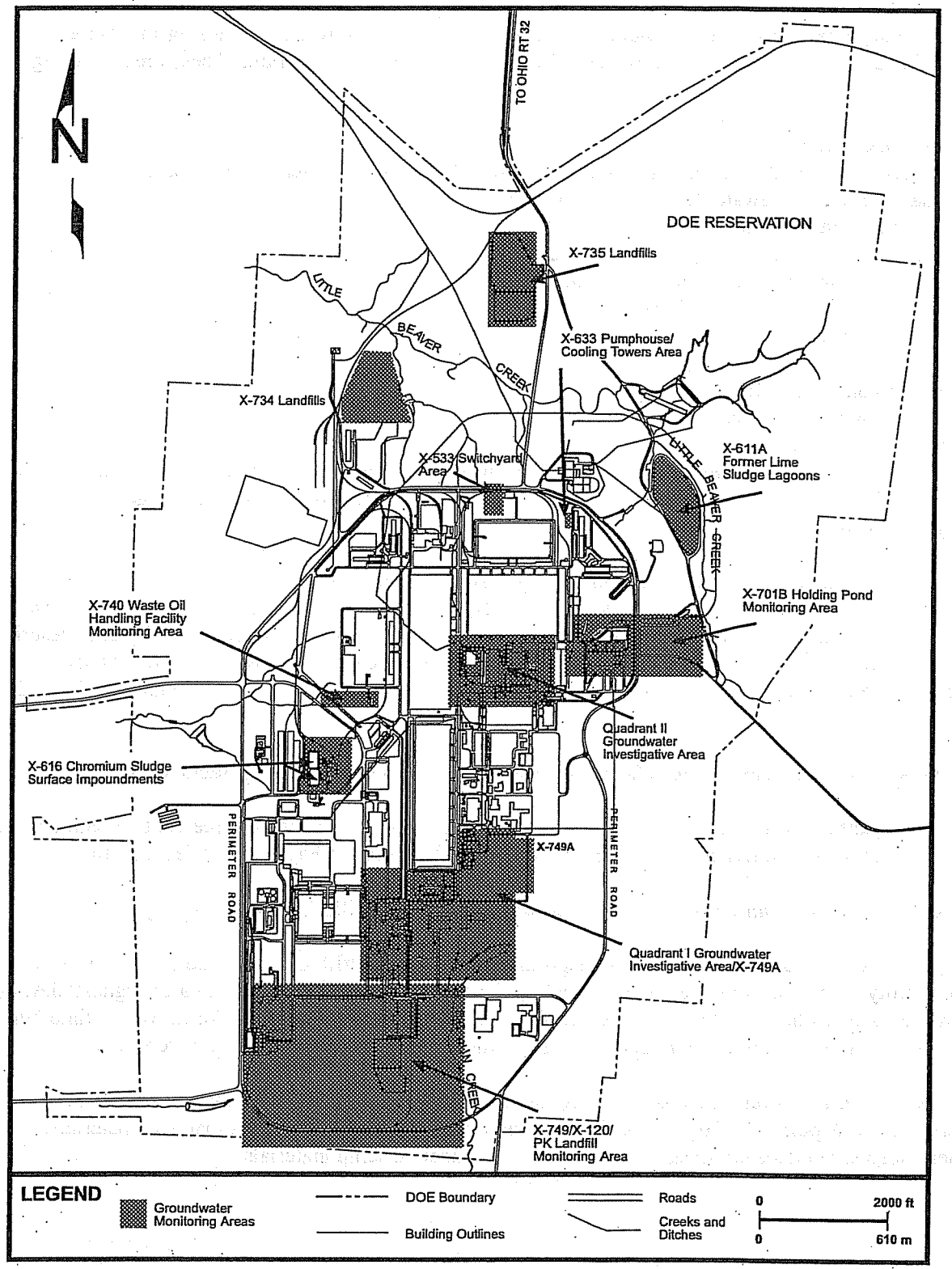


Fig. 6.1. Groundwater monitoring areas at PORTS.

Table 6.1. Analytical parameters for monitoring areas and programs at PORTS

Monitoring Area or Program	Analytes	
X-749/X-120/PK Landfill[a]		
X-749/X-120 plume	volatile organic compounds[b] technetium-99 total U, $^{233/234}U$, ^{235}U, ^{236}U, ^{238}U[c] alkalinity	chloride sulfate total metals[c]: Ca, Fe, Mg, K, Na transuranics[c]: ^{241}Am, ^{237}Np, ^{238}Pu, $^{239/240}Pu$
PK Landfill	volatile organic compounds[b] technetium-99 total U, $^{233/234}U$, ^{235}U, ^{236}U, ^{238}U[c] alkalinity chloride sulfate fluoride	total metals[c]: As, Cd, Ca, Cr, Co, Cu, Fe, Pb, Mg, Ni, K, Se, Na, V, Zn mercury transuranics[c]: ^{241}Am, ^{237}Np, ^{238}Pu, $^{239/240}Pu$ Arochlor-1260
Quadrant I Groundwater Investigative Area[a]		
X-231B plume	volatile organic compounds[b, d] technetium-99 total U, $^{233/234}U$, ^{235}U, ^{236}U, ^{238}U[c] alkalinity chloride	sulfate total metals[c, d]: Ca, Fe, Mg, Mn, K, Na transuranics[c]: ^{241}Am, ^{237}Np, ^{238}Pu, $^{239/240}Pu$
X-749A Classified Materials Disposal Facility	volatile organic compounds[e] technetium-99 total U, $^{233/234}U$, ^{235}U, ^{236}U, ^{238}U[c] alkalinity chloride sulfate nitrite nitrate ammonia	total metals[c]: Sb, As, Ba, Be, Cd, Ca, Cr, Co, Cu, Fe, Pb, Mg, Mn, Ni, K, Se, Ag, Na, Tl, V, Zn transuranics[c]: ^{241}Am, ^{237}Np, ^{238}Pu, $^{239/240}Pu$ chemical oxygen demand total dissolved solids
Quadrant II Groundwater Investigative Area[a]	volatile organic compounds[b] technetium-99 total U, $^{233/234}U$, ^{235}U, ^{236}U, ^{238}U[c] alkalinity	chloride sulfate total metals[c]: Ca, Fe, Mg, K, Na transuranics[c]: ^{241}Am, ^{237}Np, ^{238}Pu, $^{239/240}Pu$
X-701B Holding Pond[a]	volatile organic compounds[b, d] technetium-99 total U, $^{233/234}U$, ^{235}U, ^{236}U, ^{238}U[c] alkalinity chloride	sulfate total metals[c, d]: Ca, Cd, Co, Cr, Fe, Mg, Mn, K, Pb, Na, Ni, Tl transuranics[c]: ^{241}Am, ^{237}Np, ^{238}Pu, $^{239/240}Pu$
X-633 Pumphouse/Cooling Towers Area	total metals[c]: Cr	

Table 6.1. Analytical parameters for monitoring areas and programs at PORTS (continued)

Monitoring Area or Program	Analytes	
X-616 Chromium Sludge Surface Impoundments	volatile organic compounds[b] technetium-99 total U, $^{233/234}U$, ^{235}U, ^{236}U, ^{238}U[c] alkalinity	chloride sulfate total metals[c]: Ca, Fe, Mg, K, Na, Ba, Cd, Cr, Pb, Mn, Ni, Sb, Tl
X-740 Waste Oil Handling Facility[a]	volatile organic compounds[b] technetium-99 total U, $^{233/234}U$, ^{235}U, ^{236}U, ^{238}U[c] alkalinity	chloride sulfate total metals[c]: Ca, Fe, Mg, K, Na transuranics[c]: ^{241}Am, ^{237}Np, ^{238}Pu, $^{239/240}Pu$
X-611A Former Lime Sludge Lagoons	total metals[c]: Be, Cr	
X-735 Landfills	volatile organic compounds[e] technetium-99 total U, $^{233/234}U$, ^{235}U, ^{236}U, ^{238}U[c] alkalinity chloride sulfate nitrite nitrate ammonia	total metals[c]: Sb, As, Ba, Be, Cd, Ca, Cr, Co, Cu, Fe, Pb, Mg, Mn, Ni, K, Se, Ag, Na, Tl, V, Zn transuranics[c]: ^{241}Am, ^{237}Np, ^{238}Pu, $^{239/240}Pu$ chemical oxygen demand total dissolved solids
X-734 Landfills	volatile organic compounds[e] technetium-99 total U, $^{233/234}U$, ^{235}U, ^{236}U, ^{238}U[c] alkalinity chloride sulfate nitrite nitrate ammonia	total metals[c]: Sb, As, Ba, Be, Cd, Ca, Cr, Co, Cu, Fe, Pb, Mg, Mn, Ni, K, Se, Ag, Na, Tl, V, Zn transuranics[c]: ^{241}Am, ^{237}Np, ^{238}Pu, $^{239/240}Pu$ chemical oxygen demand total dissolved solids
X-533 Switchyard Area	total metals[c]: Cd, Co, Ni	
Surface Water	volatile organic compounds[b] technetium-99 total U, $^{233/234}U$, ^{235}U, ^{236}U, ^{238}U[c] alkalinity	chloride sulfate total metals[c]: Ca, Fe, Mg, K, Na transuranics[c]: ^{241}Am, ^{237}Np, ^{238}Pu, $^{239/240}Pu$
Water Supply	volatile organic compounds[b] technetium-99 total U, $^{233/234}U$, ^{235}U, ^{236}U, ^{238}U[c] alkalinity	chloride sulfate total metals[c]: Ca, Fe, Mg, K, Na transuranics[c]: ^{241}Am, ^{237}Np, ^{238}Pu, $^{239/240}Pu$

Table 6.1. Analytical parameters for monitoring areas and programs at PORTS (continued)

Monitoring Area or Program	Analytes		
Exit Pathway	volatile organic compounds[b]	chloride	
	technetium-99	sulfate	
	total U, $^{233/234}U$, ^{235}U, ^{236}U, ^{238}U[c]	total metals[c]:	Ca, Fe, Mg, K, Na
	alkalinity	transuranics[c]:	^{241}Am, ^{237}Np, ^{238}Pu, $^{239/240}Pu$

[a]Selected well(s) in this area are sampled once every two years for a comprehensive list of over 200 potential contaminants (Title 40, Code of Federal Regulations, Part 264 Appendix IX – Appendix to Ohio Administrative Code Rule 3745-54-98).

[b]Acetone, benzene, bromodichloromethane, bromoform, carbon disulfide, carbon tetrachloride, chlorobenzene, chloroethane, chloroform, dibromochloromethane, 1,2-dichlorobenzene, 1,4-dichlorobenzene, 1,1-dichloroethane, 1,2-dichloroethane, 1,1-dichloroethene, cis-1,2-dichloroethene, trans-1,2-dichloroethene, ethylbenzene, bromomethane, chloromethane, methylene chloride, 2-butanone (methyl ethyl ketone), 4-methyl-2-pentanone (methyl isobutyl ketone), 1,1,2,2-tetrachloroethane, tetrachloroethene, toluene, 1,1,1-trichloroethane, 1,1,2-trichloroethane, trichloroethene, trichlorofluoromethane (CFC-11), vinyl chloride, xylenes (M+P xylenes).

[c]Appendix C lists the symbols for metals and transuranic radionuclides.

[d]Not all wells at this area are analyzed for all metals listed or for volatile organic compounds.

[e]Volatile organic compounds listed in footnote b plus: acrylonitrile, bromochloromethane, 1,2-dibromo-3-chloropropane, 1,2-dibromoethane, trans-1,4-dichloro-2-butene, 1,2-dichloropropane, cis-1,3-dichloropropene, trans-1,3-dichloropropene, 2-hexanone (methyl butyl ketone), dibromomethane, iodomethane, styrene, 1,1,1,2-tetrachloroethane, 1,2,3-trichloropropane, and vinyl acetate.

The initial closure of the X-749 landfill included installation of (1) a multimedia cap, (2) a barrier wall along the north side and northwest corner of X-749, and (3) subsurface groundwater drains on the northern half of the east side and the southwest corner, including one sump within each of the groundwater drains. The barrier wall and subsurface drains extend down to bedrock. An additional barrier wall on the south and east sides of the X-749 landfill was constructed in 2002. The groundwater drain and sump on the east side of the landfill were removed for construction of this barrier wall. Groundwater from the remaining subsurface drain is treated at the X-622 Groundwater Treatment Facility and discharged through DOE NPDES Outfall 608, which flows to the USEC Sewage Treatment Plant.

The leading edge of the contaminated groundwater plume emanating from the X-749 landfill has been approaching the southern boundary of the PORTS reservation. In 1994, a subsurface barrier wall was completed across a portion of this southern boundary. The X-749 South Barrier Wall was designed to inhibit migration of the plume off plant property prior to the implementation of a final remedial measure; however, volatile organics have moved beyond the wall. A project was begun in 2004 to remediate volatile organics in this area. Hydrogen release compounds, which act as an accelerant to the natural microbial process that breaks down volatile organics into nontoxic compounds, were injected into the soil in over 150 locations during April 2004. Additional monitoring took place after the injections to monitor the concentrations of volatile organics, gases, and other breakdown products in the groundwater.

The X-120 Old Training Facility covered an area of approximately 11.5 acres near the present-day XT-847 building. The X-120 facility, which no longer exists, included a machine shop, metal shop, paint shop, and several warehouses used during the construction of PORTS in the 1950s. Groundwater in the vicinity of this facility contains primarily trichloroethene. In 1996, a horizontal well was installed along the approximate axis of the X-120 plume. Contaminated groundwater flows from this well to the X-625 Groundwater Treatment Facility. On July 9, 2003, operation of the X-625 Groundwater Treatment Facility and horizontal well was placed on stand-by with approval from Ohio EPA. The horizontal well and treatment facility did not operate during 2004.

The *Comprehensive Monitoring Program for the X-749 and Peter Kiewit Landfill Areas for the Portsmouth Gaseous Diffusion Plant* was developed in 2003 to monitor the effect of the new X-749 barrier wall on groundwater quality and migration in the northern area of the X-749 plume and at the PK Landfill. Groundwater quality monitoring required by the program began in the fourth quarter of 2003 and continued through 2004.

Twenty-nine wells, 20 of which are part of the *Comprehensive Monitoring Program*, are sampled quarterly, 15 wells (14 monitoring wells and 1 sump) are sampled semiannually, 10 wells are sampled annually, and 9 wells are sampled biennially to monitor the X-749/X-120 plume. Four new off-site monitoring wells were also sampled in 2004. Table 6.1 lists the analytical parameters for the wells in this area.

6.4.1.2 PK Landfill

The PK Landfill is located west of Big Run Creek just south of the X-230K Holding Pond. The landfill, which began operations in 1952, was used as a salvage yard, burn pit, and trash area during the construction of PORTS. After the initial construction, the disposal site was operated as a sanitary landfill until 1968, when soil was graded over the site and the area was seeded with native grasses.

During site investigations, intermittent seeps were observed emanating from the PK Landfill into Big Run Creek. In 1994, a portion of Big Run Creek was relocated approximately 50 ft to the east. A groundwater collection system was installed in the old creek channel to capture the seeps emanating from the landfill. A second collection system was constructed in 1997 on the southeastern landfill boundary to

contain the groundwater plume migrating toward Big Run Creek from the southern portion of the PK landfill. A cap was constructed over the landfill in 1998.

In 2002, a 5-year review was completed for the PK Landfill to evaluate the effectiveness of the corrective measures implemented at this area (see the report entitled *X-611A Prairie and the X-749B Peter Kiewit Landfill Five-Year Evaluation Report for the Portsmouth Gaseous Diffusion Plant, Piketon, Ohio*). In response to the findings of the 5-year review, the *Comprehensive Monitoring Program for the X-749 and Peter Kiewit Landfill Areas for the Portsmouth Gaseous Diffusion Plant* was developed to provide additional data to evaluate the effectiveness of the landfill cap and groundwater collection systems, to determine whether a barrier wall is needed on the north and west sides of the PK Landfill, and to monitor the effect of the new X-749 barrier wall as previously described.

Eight wells are sampled quarterly, as required by the *Comprehensive Monitoring Program*, and two wells are sampled semiannually to monitor the landfill. Two sumps that accumulate groundwater within the groundwater collection systems and two manholes in the PK Landfill groundwater collection systems are sampled quarterly. Table 6.1 lists the analytical parameters for the wells and sumps in this area.

6.4.1.3 Monitoring results for the X-749/X-120/PK Landfill in 2004

A contaminated groundwater plume is associated with the X-749/X-120/PK Landfill groundwater monitoring area (see Fig. 6.2). The most extensive and most concentrated constituents associated with the X-749/X-120 plume are volatile organic compounds, particularly trichloroethene. The plume perimeter (defined as 5 μg/L of trichloroethene) did not change substantially in 2004. In the southern portion of the plume, injection of hydrogen release compounds (see Sect. 6.4.1.1) caused decreases in the concentrations of trichloroethene in two wells, X749-PZ04G and X749-97G. Trichloroethene was detected above 5 μg/L in both samples collected from well X749-97G in 2003. The concentration of trichloroethene detected in this well decreased to 2.4 μg/L in the sample collected from the well during October 2004. Trichloroethene and two other volatile organics were detected at estimated concentrations less than 1 μg/L (1 part per billion) in one of the off-site wells installed in 2004 (WP-03, which is approximately 45 feet south of the property line). These concentrations are significantly below the MCL for trichloroethene of 5 μg/L.

In addition to volatile organic compounds, inorganics (metals) and radionuclides have also been detected in the groundwater beneath the X-749 area. Remediation of groundwater is being accomplished in accordance with the RCRA Corrective Action Program.

Some of the wells associated with the PK Landfill also appear to be contaminated with low levels of volatile organic compounds, but usually at concentrations below preliminary remediation goals. Vinyl chloride, however, was detected in samples collected from wells PK-17B and PK-21B at concentrations ranging from 7 to 30 μg/L, which is above the preliminary remediation goal of 2 μg/L. Vinyl chloride is generally detected in these wells.

Cobalt is of special interest in the PK Landfill monitoring area and was detected in three wells in 2004 at concentrations at or above the preliminary remediation goal. Remediation of groundwater is being accomplished in accordance with the RCRA Corrective Action Program.

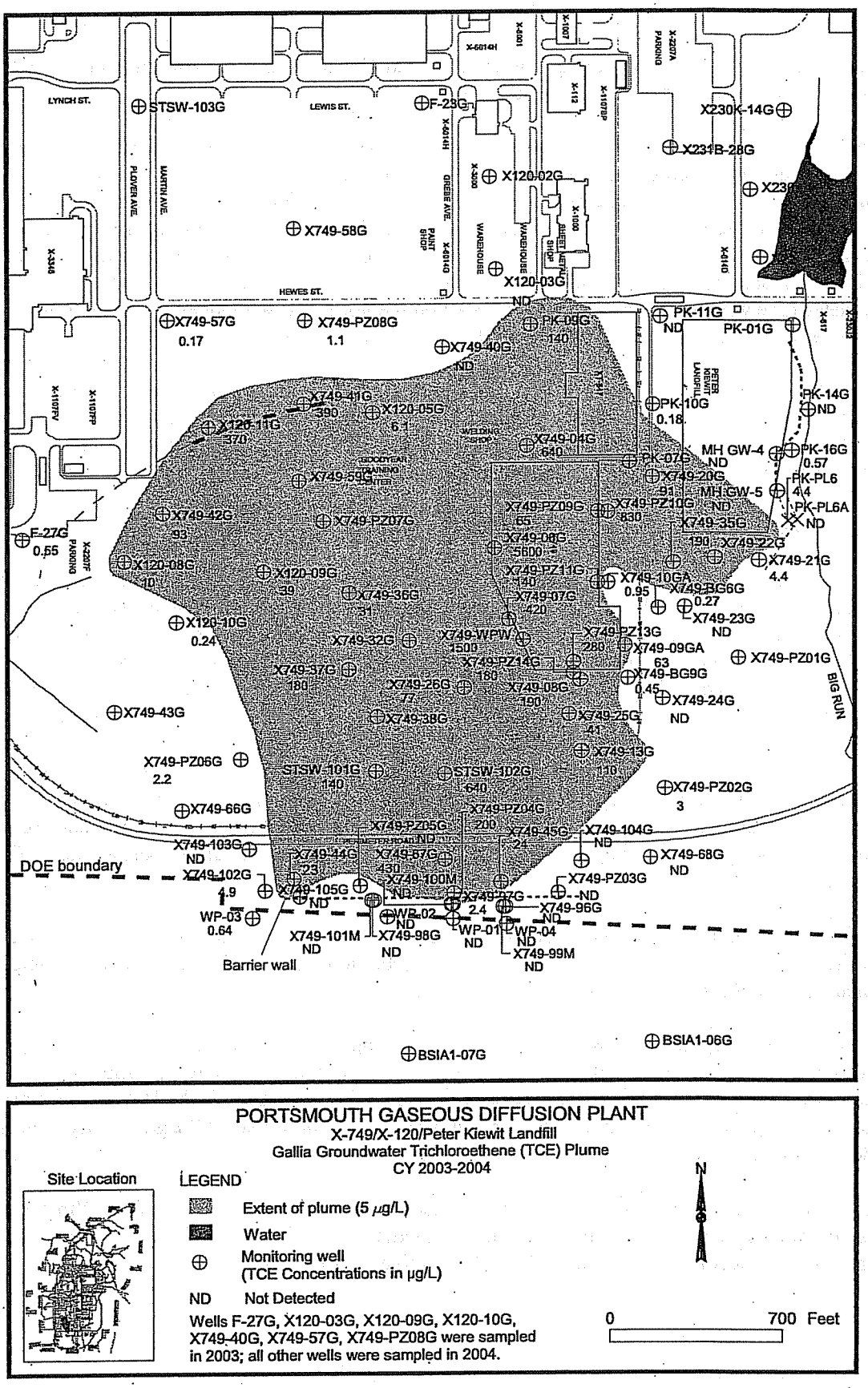


Fig. 6.2. Trichloroethene-contaminated Gallia groundwater plume at the X-749/X-120/PK Landfill.

6.4.2 Quadrant I Groundwater Investigative Area/X-749A Classified Materials Disposal Facility

In the northern portion of Quadrant I, groundwater concerns are focused on two areas, the Quadrant I Groundwater Investigative Area and the X-749A Classified Materials Disposal Facility. The X-231B Southwest Oil Biodegradation Plot is a part of the Quadrant I Groundwater Investigative Area and was monitored prior to implementation of the *Integrated Groundwater Monitoring Plan*. The X-749A was also monitored prior to implementation of the *Integrated Groundwater Monitoring Plan* under requirements for solid waste landfills.

6.4.2.1 X-231B Southwest Oil Biodegradation Plot

The X-231B Southwest Oil Biodegradation Plot was used from 1976 to 1983 for land application of contaminated oil/solvent mixtures generated from the enrichment process and maintenance activities. The X-231B area, located west of the X-600 Steam Plant, consisted of two disposal plots, each surrounded by an elevated soil berm, that were periodically fertilized and plowed to enhance aeration and promote biological degradation of waste oil.

Three groundwater extraction wells were installed in the Gallia in 1991 as part of the X-231B interim remedial measure. Eleven additional groundwater extraction wells were installed in 2001-2002 and began operation in 2002. The extracted groundwater is treated at the X-622 Groundwater Treatment Facility and discharged through DOE NPDES Outfall 608, which flows into the USEC Sewage Treatment Plant. A multimedia landfill cap was installed over this area in 2000 to minimize water infiltration and control the spread of contamination.

Twenty-two wells are sampled semiannually as part of the monitoring program for the Quadrant I Groundwater Investigative Area. An additional 16 wells are sampled annually or biennially. Table 6.1 lists the analytical parameters for the wells in this area.

6.4.2.2 X-749A Classified Materials Disposal Facility

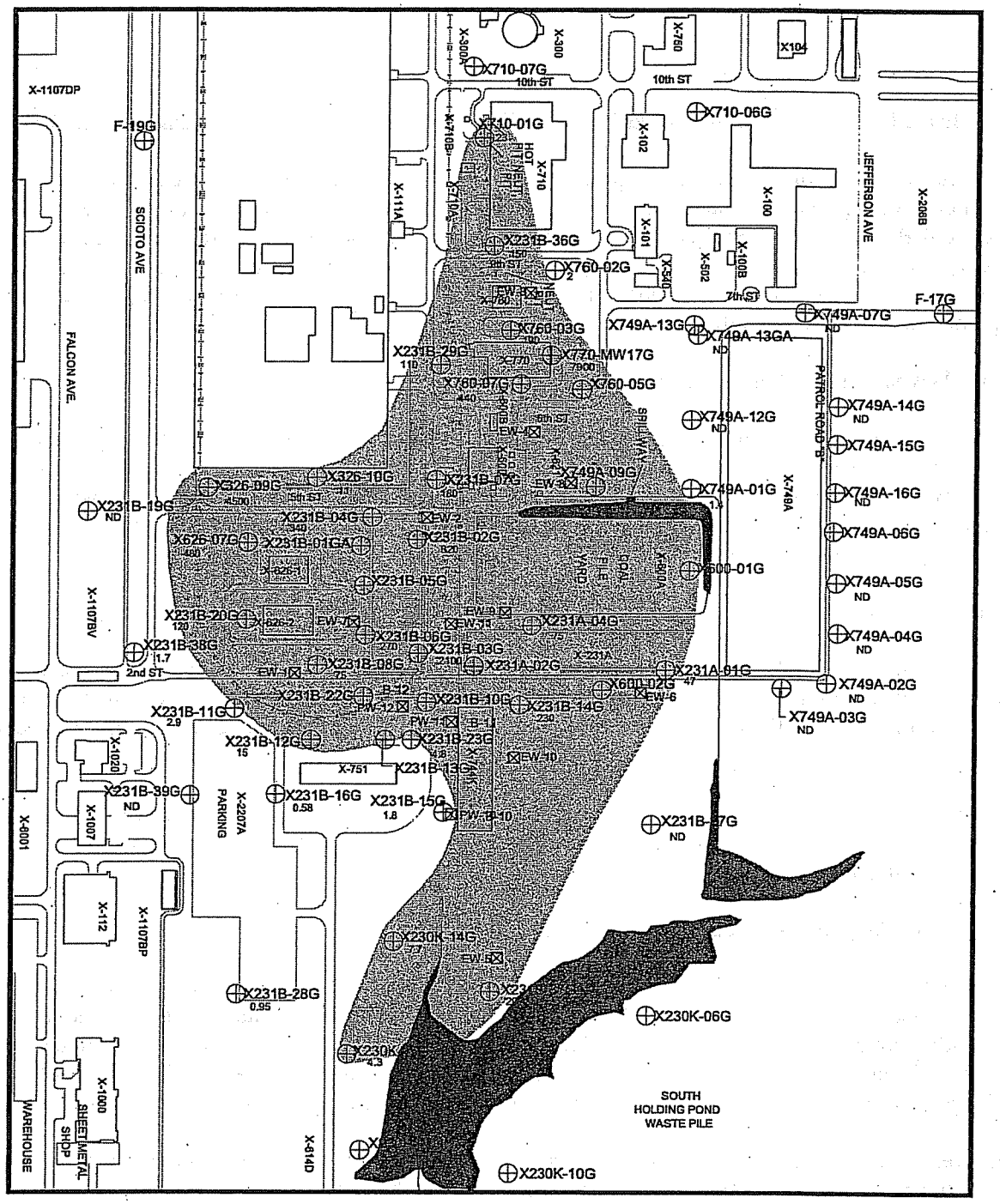
The 6-acre X-749A Classified Materials Disposal Facility operated from 1953 through 1988 for the disposal of wastes classified under the Atomic Energy Act. Potential contaminants include PCBs, asbestos, radionuclides, and industrial waste. Closure of the landfill, completed in 1994, included the construction of a multilayer cap and the installation of a drainage system to collect surface water runoff. The drainage system discharges via a USEC NPDES-permitted outfall.

Ten wells are sampled semiannually as part of the routine monitoring program for the X-749A landfill. Table 6.1 lists the analytical parameters for the wells in this area.

6.4.2.3 Monitoring results for the Quadrant I Groundwater Investigative Area/X-749A in 2004

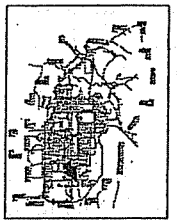
A contaminated groundwater plume consisting primarily of trichloroethene is associated with the Quadrant I Groundwater Investigative Area (see Fig. 6.3). Other volatile organic compounds are also present in the plume. The plume perimeter did not change significantly from 2003 to 2004.

Concentrations of trichloroethene detected in several wells within the plume have decreased when compared to data collected prior to 2002 because of the 11 new extraction wells in the Quadrant I Groundwater Investigative Area, which began operation in April 2002. For example, trichloroethene was detected at 17 and 15 μg/L in samples collected during 2004 from well X231B-12G, which is in the middle western edge of the plume. Concentrations of trichloroethene detected in samples from this well in 1999-2001 ranged from 96 to 260 μg/L.



PORTSMOUTH GASEOUS DIFFUSION PLANT
Quadrant I Groundwater Investigative Area Gallia
Groundwater Trichloroethene (TCE) Plume CY 2003-2004

Site Location



LEGEND

- Extent of plume (5 μg/L)
- Water
- Monitoring well (TCE concentrations in μg/L)
- Extraction wells
- ND Not detected

Wells X230K-14G, X231B-07G, X231B-11G, X231B-19G, X231B-29G, X231B-36G, X231B-38G, X231B-39G, X710-01G, X760-02G, X760-03G and X760-07G were sampled in 2003; all other wells were sampled in 2004.

N

0 400 Feet

Fig. 6.3. Trichloroethene-contaminated Gallia groundwater plume at the Quadrant I Groundwater Investigative Area.

Inorganics (metals) and radionuclides have also been detected in the groundwater beneath the area. Remediation of groundwater is being accomplished in accordance with the RCRA Corrective Action Program.

Statistical evaluations of data collected from wells at the X-749A landfill are also completed to monitor the landfill for releases. In 2004, none of the control limits for the statistical monitoring parameters were exceeded.

6.4.3 Quadrant II Groundwater Investigative Area

The Quadrant II Groundwater Investigative Area consists of an area of groundwater contamination with several potential sources. One of these sources, the X-701C Neutralization Pit, was monitored prior to implementation of the *Integrated Groundwater Monitoring Plan*. The X-701C Neutralization Pit was an open-topped neutralization pit that received process effluents and basement sump wastewater such as acid and alkali solutions and rinse water contaminated with trichloroethene and/or trichloroethane from metal cleaning operations. The X-701C Neutralization Pit was located within a trichloroethene plume centered around the X-700 and X-705 buildings. The pit was removed in 2001.

The natural groundwater flow direction in this area is to the east toward Little Beaver Creek. The groundwater flow pattern has been changed in this area by use of sump pumps in the basements of the X-700 and X-705 buildings. Thus, the groundwater plume in this area does not spread but instead flows toward the sumps where it is collected and then treated at the X-627 Groundwater Treatment Facility, which replaced the X-622T Groundwater Treatment Facility in September 2004. This facility discharges through DOE NPDES Outfall 611, which flows to the USEC Sewage Treatment Plant. Ten wells are sampled annually as part of the monitoring program for this area. An additional 15 wells are sampled biennially. Table 6.1 lists the analytical parameters for the wells in this area.

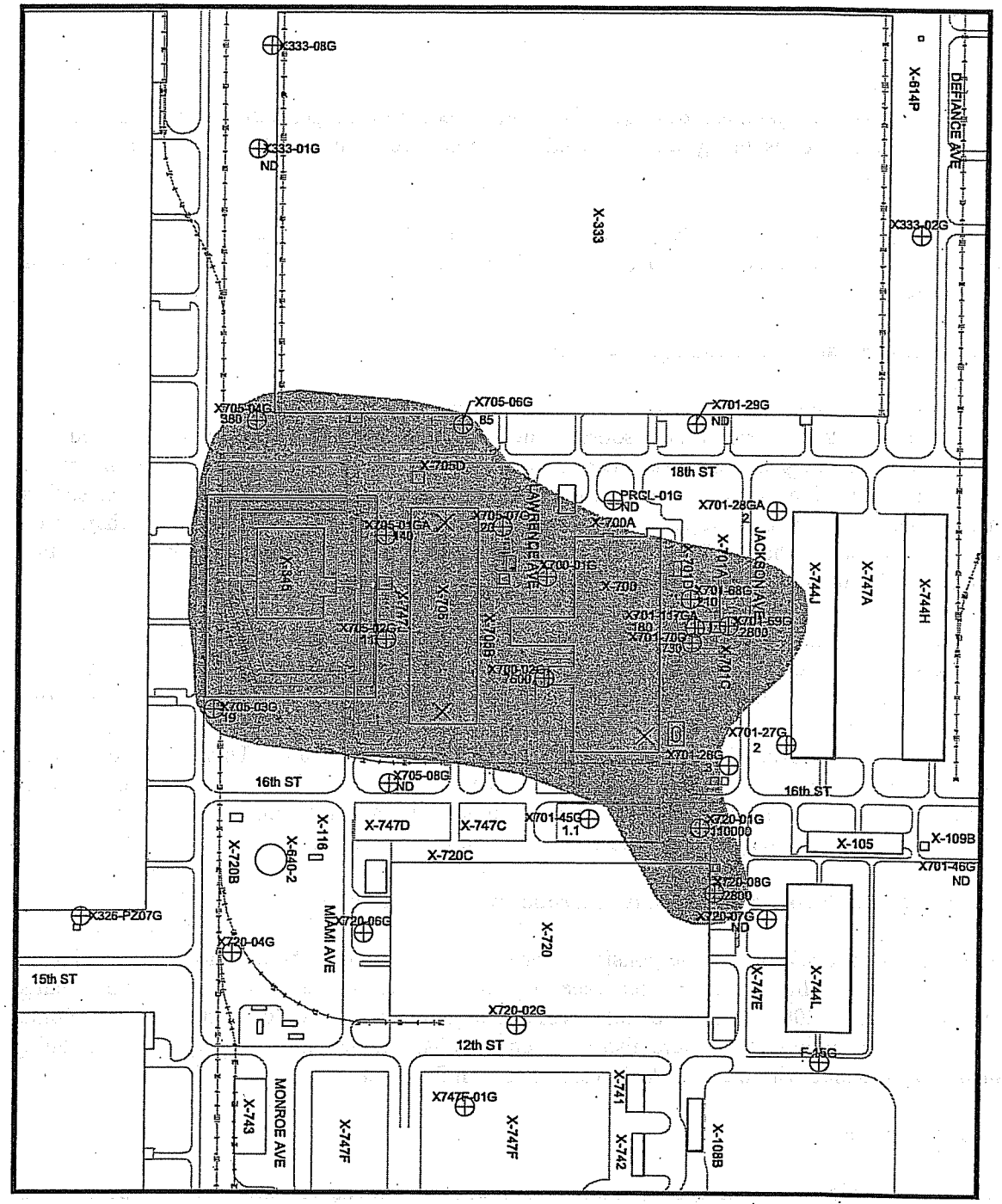
6.4.3.1 Monitoring results for the Quadrant II Groundwater Investigative Area in 2004

A contaminated groundwater plume consisting primarily of trichloroethene is associated with the Quadrant II Groundwater Investigative Area (see Fig. 6.4). The plume perimeter did not change significantly from 2003 to 2004. Numerous other volatile organics were also detected within the plume. Inorganics (metals) and radionuclides were also detected in 2004. Remediation of groundwater is being accomplished in accordance with the RCRA Corrective Action Program.

6.4.4 X-701B Holding Pond

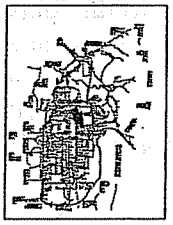
In the eastern portion of Quadrant II, groundwater concerns focus on three areas: the X-701B Holding Pond, the X-230J7 Holding Pond, and the X-744Y Waste Storage Yard.

The X-701B Holding Pond was used from the beginning of plant operations in 1954 until November 1988. The pond was designed for neutralization and settlement of acid waste from several sources. Trichloroethane and trichloroethene were also discharged to the pond. Two surface impoundments (sludge retention basins) were located west of the holding pond. The X-230J7 Holding Pond received wastewater from the X-701B Holding Pond. The X-744Y Waste Storage Yard is south of the X-701B Holding Pond. The yard is approximately 15 acres and surrounds the X-744G Bulk Storage Building. RCRA hazardous waste was managed in this area.



PORTSMOUTH GASEOUS DIFFUSION PLANT
Quadrant II Groundwater Investigative Area Gallia
Groundwater Trichloroethene (TCE) Plume CY 2003-2004

Site Location



LEGEND

- Extent of plume (5 μg/L)
- Water
- ⊕ Monitoring well (TCE concentrations in μg/L)
- ND Not detected
- × Sump

Wells PRCL-01G, X701-26G, X701-27G, X701-28GA, X701-29G, X705-02G, X705-03G, X705-06G, X705-08G, and X720-07G were sampled in 2003; all other wells were sampled in 2004.

N

0 400 Feet

Fig. 6.4. Trichloroethene-contaminated Gallia groundwater plume at the Quadrant II Groundwater Investigative Area.

A contaminated groundwater plume extends from the X-701B Holding Pond to Little Beaver Creek. Three groundwater extraction wells were installed southeast of the X-701B Holding Pond as part of the ongoing RCRA closure of the unit. These wells were designed to intercept contaminated groundwater emanating from the holding pond area before it could join the existing groundwater contaminant plume. Extracted groundwater is processed at the X-623 Groundwater Treatment Facility and discharged through DOE NPDES Outfall 610, which flows to the USEC Sewage Treatment Plant. This facility also processes water recovered from a shallow sump in the bottom of the X-701B Holding Pond.

Two groundwater interceptor trenches (French drains) are used to intercept trichloroethene-contaminated groundwater emanating from X-701B. These interceptor trenches, called the X-237 Groundwater Collection System, have significantly reduced trichloroethene migration into Little Beaver Creek. The 660-foot-long primary trench has two sumps in the backfill, and a 440-foot-long secondary trench intersects the primary trench. The extracted groundwater is treated at the X-624 Groundwater Treatment Facility and discharges through DOE NPDES Outfall 015, which flows to Little Beaver Creek.

Thirty-four wells are sampled semiannually as part of the monitoring program for this area. An additional 11 wells are sampled annually or biennially. Table 6.1 lists the analytical parameters for the wells in this area.

6.4.4.1 Monitoring results for the X-701B Holding Pond in 2004

The trichloroethene plume at this groundwater monitoring area contains the highest concentrations of trichloroethene measured in groundwater at PORTS. Numerous other volatile organics are also detected in samples collected from the monitoring wells in this area. The plume perimeter did not change significantly from 2003 to 2004 (see Fig. 6.5). Additionally, the second trichloroethene plume in the X-701B monitoring area (the plume southwest of the X-744G Bulk Storage Building) did not change significantly in 2004.

Samples from five wells in the western portion of the monitoring area were analyzed for selected metals (cadmium, chromium, cobalt, lead, manganese, nickel, and thallium). Chromium was the only metal detected above the respective preliminary remediation goal and was detected in only one well. Samples from five wells in or near the X-744Y Storage Yard and X-744G Bulk Storage Building were analyzed for cadmium and nickel, which were detected above preliminary remediation goals in three of the five wells.

Radionuclides were also detected in the groundwater in this area. Remediation of groundwater is being accomplished in accordance with the RCRA Corrective Action Program.

6.4.5 X-633 Pumphouse/Cooling Towers Area

The X-633 Pumphouse/Cooling Towers Area consists of a recirculating water pumphouse and four cooling towers with associated basins. Chromium-based corrosion inhibitors were added to the cooling water until the early 1990s, when the system was converted to a phosphate-based inhibitor.

The X-633 Pumphouse/Cooling Towers Area was identified as an area of concern for potential metals contamination in 1996 based on historical analytical data for groundwater wells in this area. Samples from wells in this area were collected to assess the area for metals contamination. Based on the results of this study, this area was added to the PORTS groundwater monitoring program. Two wells (see Fig. 6.6) are sampled semiannually for chromium as part of the monitoring program for this area.

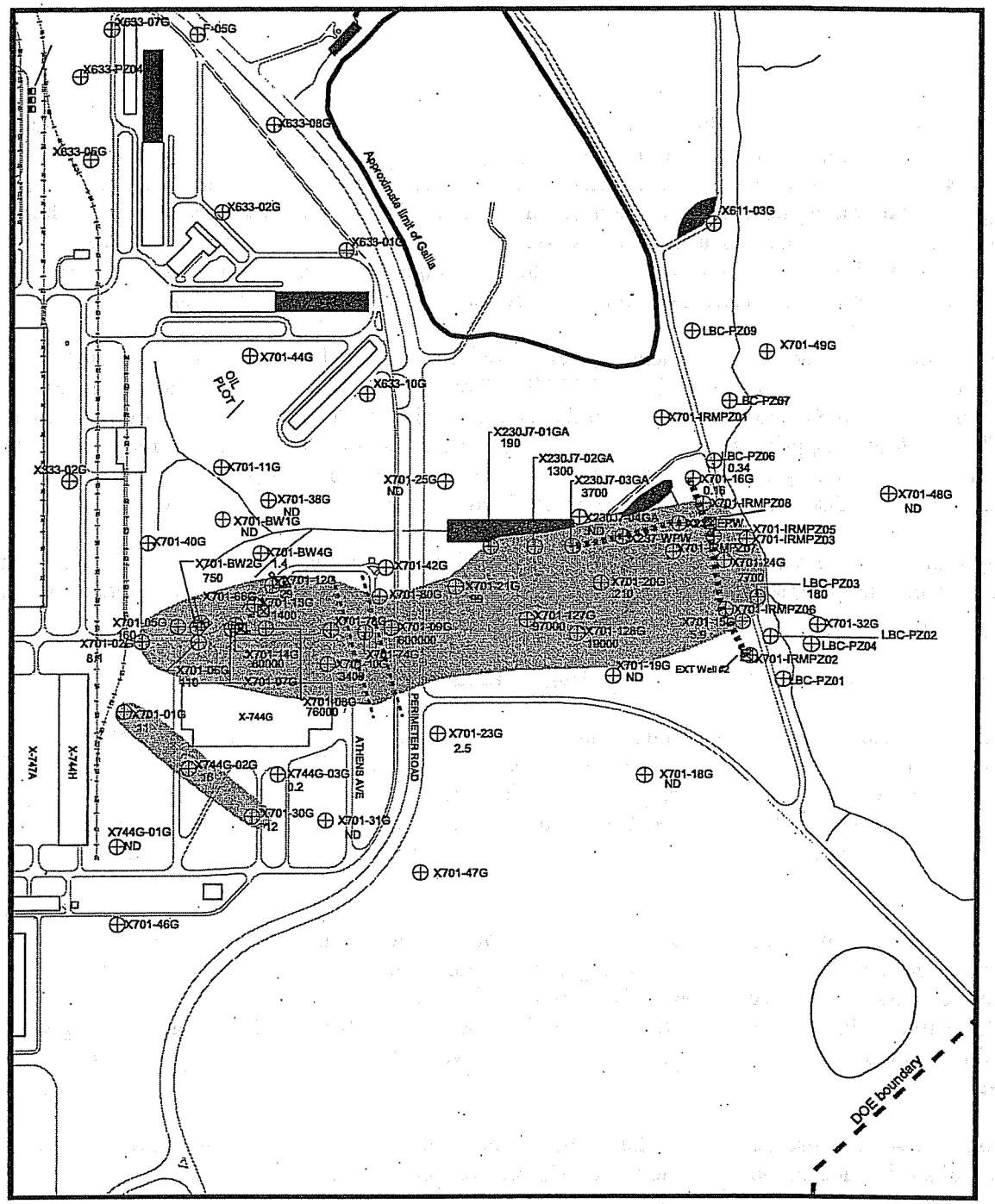


Fig. 6.5. Trichloroethene-contaminated Gallia groundwater plume at the X-701B Holding Pond.

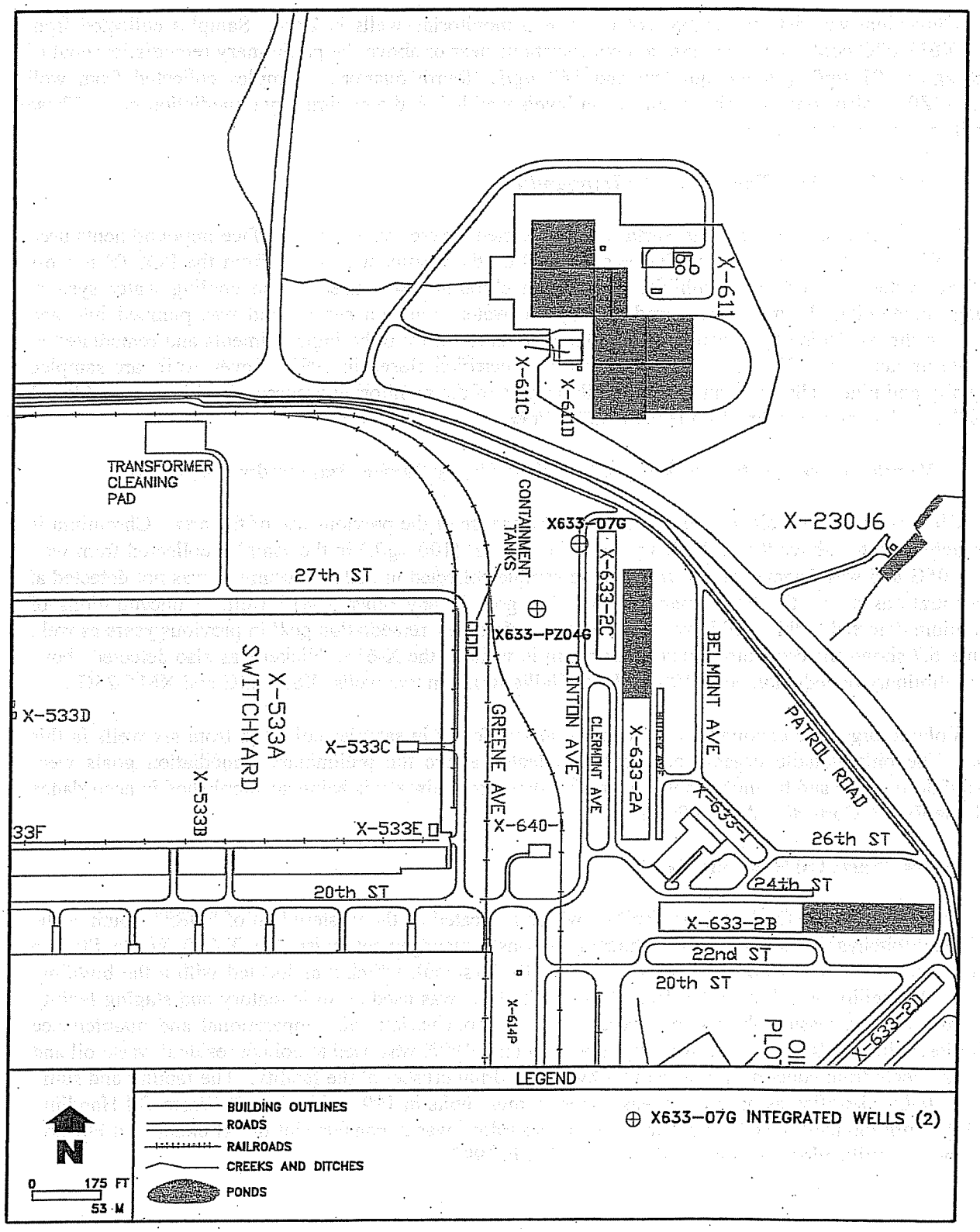


Fig. 6.6. Groundwater monitoring wells at the X-633 Pumphouse/Cooling Towers Area.

6.4.5.1 Monitoring results for the X-633 Pumphouse/Cooling Towers Area in 2004

Chromium was detected in both of the X-633 monitoring wells in 2004. Samples collected from well X633-07G contained chromium at concentrations near or above the preliminary remediation goal of 100 μg/L: 91 μg/L (second quarter) and 140 μg/L (fourth quarter). Samples collected from well X633-PZ04G also contained chromium but at levels well below the preliminary remediation goal. These results are typical for these wells.

6.4.6 X-616 Chromium Sludge Surface Impoundments

The X-616 Chromium Sludge Surface Impoundments were two unlined surface impoundments used from 1976 to 1985 for storage of sludge generated by the treatment of water from the PORTS process cooling system. A corrosion inhibitor containing chromium was used in the cooling water system. Sludge containing chromium was produced by the water treatment system and was pumped into and stored in the X-616 impoundments. The sludge was removed from the impoundments and remediated as an interim action in 1990 and 1991. The unit was certified closed in 1993. Seven wells are sampled annually and nine wells are sampled biennially as part of the monitoring program for this area. Table 6.1 lists the analytical parameters for the wells in this area.

6.4.6.1 Monitoring results for the X-616 Chromium Sludge Surface Impoundments in 2004

Chromium is of special concern at the X-616 because of the previous use of the area. Chromium is routinely detected above the preliminary remediation goal (100 μg/L) in the samples collected from well X616-05G and was detected at 150 μg/L in the sample collected in 2004. Chromium was not detected at concentrations above the preliminary remediation goal in any other X-616 well. Concentrations of chromium detected in this well have exceeded the preliminary remediation goal in previous years as well. Figure 6.7 shows the concentrations of chromium in wells at the X-616. Nickel was also detected above the preliminary remediation goal (100 μg/L for Gallia wells) in two wells (X616-05G and X616-25G).

Volatile organic compounds were detected at low levels in samples collected from six wells in this area. The only volatile organic compounds detected above the preliminary remediation goals were 1,1-dichloroethene and trichloroethene. Remediation of groundwater is being accomplished in accordance with the RCRA Corrective Action Program.

6.4.7 X-740 Waste Oil Handling Facility

The X-740 Waste Oil Handling Facility, which is located on the western half of PORTS south of the X-530A Switchyard, consists of two hazardous waste management units, the X-740 Waste Storage Facility and the X-740 Hazardous Waste Storage Tank (sump), which was located within the building. The X-740 facility, which operated from 1983 until 1991, was used as an inventory and staging facility for waste oil and waste solvents that were generated from various plant operational and maintenance activities. The tank/sump, which was only operated until 1990, was used to collect residual waste oil and waste solvents from containers crushed in a hydraulic drum crusher at the facility. The facility and sump were initially identified as hazardous waste management units in 1991. The X-740 Waste Oil Handling Facility (both the facility and sump identified as hazardous waste management units) underwent closure, and closure certification was approved by Ohio EPA in 1998.

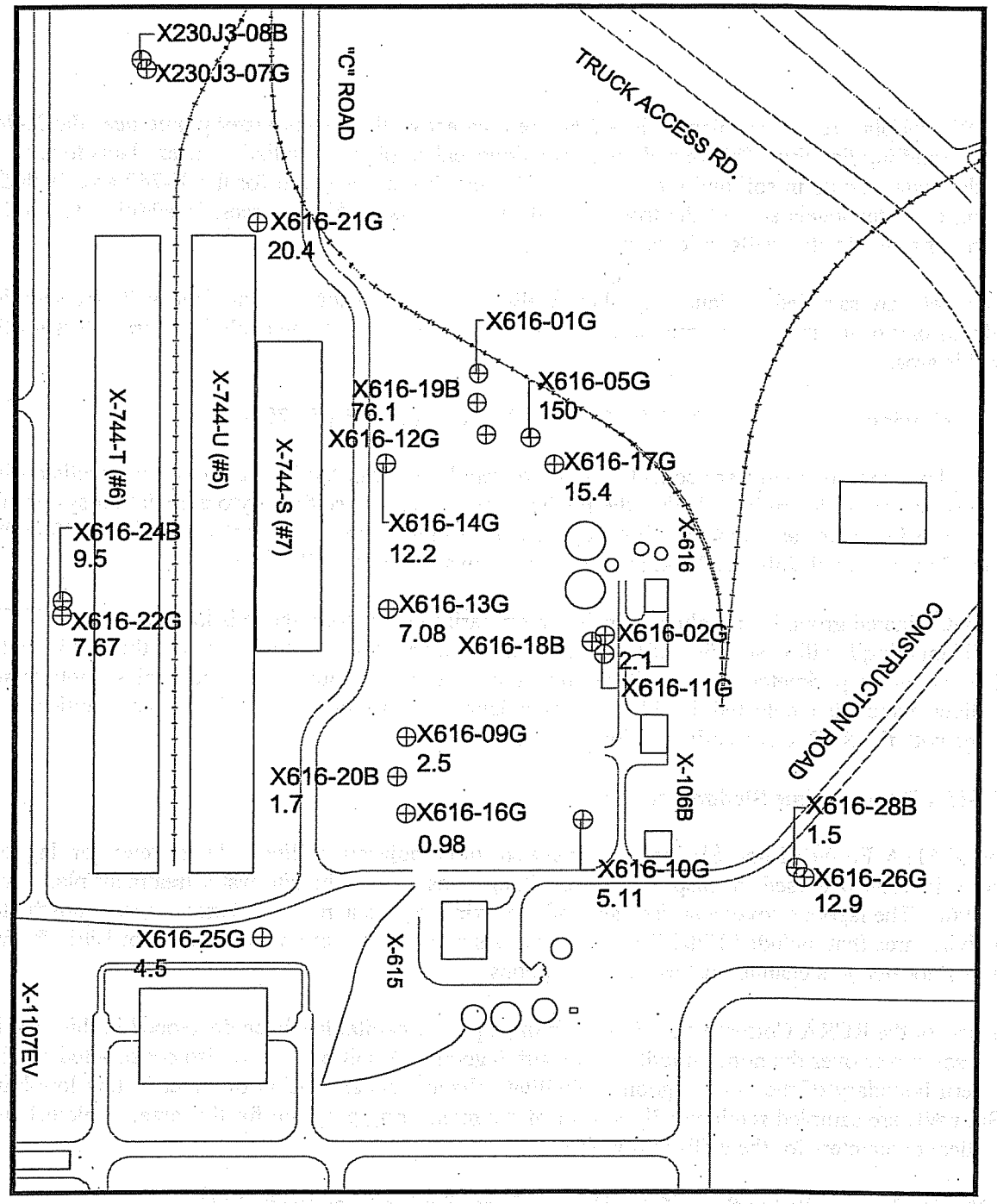


Fig. 6.7. Chromium concentrations in groundwater at the X-616 Chromium Sludge Surface Impoundments.

In 1999, poplar trees were planted in a 2.6-acre area above the groundwater plume near the X-740 Waste Oil Handling Facility. This remediation technique, called phytoremediation, uses plants to remove or degrade contaminants in soil and groundwater. The monitoring program for the X-740 area includes monitoring of water levels around the trees to evaluate water usage by the trees, in addition to routine monitoring of groundwater wells for contaminants.

Nine wells are sampled semiannually, three wells are sampled annually, and four wells are sampled biennially as part of the monitoring program for this area. Table 6.1 lists the analytical parameters for the wells in this area.

6.4.7.1 Monitoring results for the X-740 Waste Oil Handling Facility in 2004

Water level measurements are collected on a frequent basis from the X-740 monitoring wells during the growing season to determine whether the poplar trees that comprise the phytoremediation system for this area are using water as intended. Hourly water level measurements collected at two X-740 Gallia wells from July 1 through July 31, 2004, indicated groundwater usage by the trees.

A contaminated groundwater plume consisting primarily of trichloroethene is located near the X-740 Waste Oil Handling Facility (see Fig. 6.8). Concentrations of trichloroethene detected in the X-740 wells, as well as the plume perimeter, were similar to data collected in previous years. Inorganics (metals) and radionuclides were also detected in 2004. Remediation of groundwater is being accomplished in accordance with the RCRA Corrective Action Program.

6.4.8 X-611A Former Lime Sludge Lagoons

The X-611A Former Lime Sludge Lagoons were three adjacent unlined sludge retention lagoons constructed in 1954 and used for disposal of lime sludge waste from the site water treatment plant from 1954 to 1960. The lagoons cover a surface area of approximately 18 acres. The lagoons were constructed in a low-lying area that included Little Beaver Creek. As a result, approximately 1500 ft of Little Beaver Creek was relocated to a channel just east of the lagoons.

As part of the RCRA Corrective Action Program, a prairie habitat has been developed in this area by placing a soil cover over the north, middle, and south lagoons. A soil berm was also constructed outside the northern boundary of the north lagoon to facilitate shallow accumulation of water in this low-lying area. Six wells are sampled semiannually as part of the monitoring program for this area. Table 6.1 lists the analytical parameters for the wells in this area.

6.4.8.1 Monitoring results for the X-611A Former Lime Sludge Lagoons in 2004

The six monitoring wells at X-611A (see Fig. 6.9) are sampled and analyzed for beryllium and chromium. In 2004, chromium was detected in two of the six wells at concentrations less than the preliminary remediation goal.

Beryllium was detected in each of the X-611A wells. Each of these detections was below the preliminary remediation goal with the exception of the third quarter sample collected from well F-07G. The concentration of beryllium detected in this sample (7.2 μg/L) was just above the preliminary remediation goal (6.5 μg/L). Samples collected from well F-07G routinely contain beryllium at concentrations just below or just above the preliminary remediation goal.

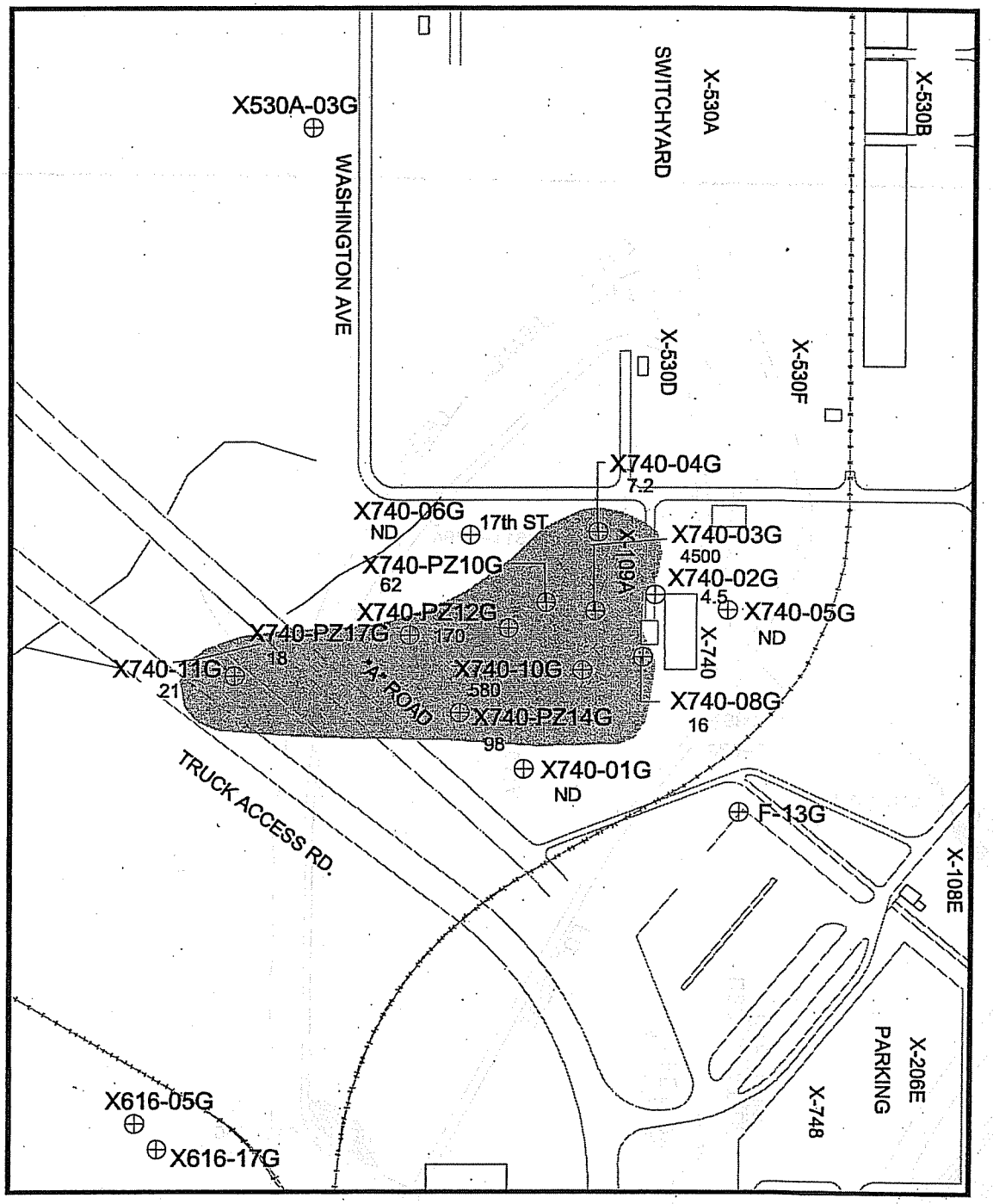


Fig. 6.8. Trichloroethene-contaminated Gallia groundwater plume near the X-740 Waste Oil Handling Facility.

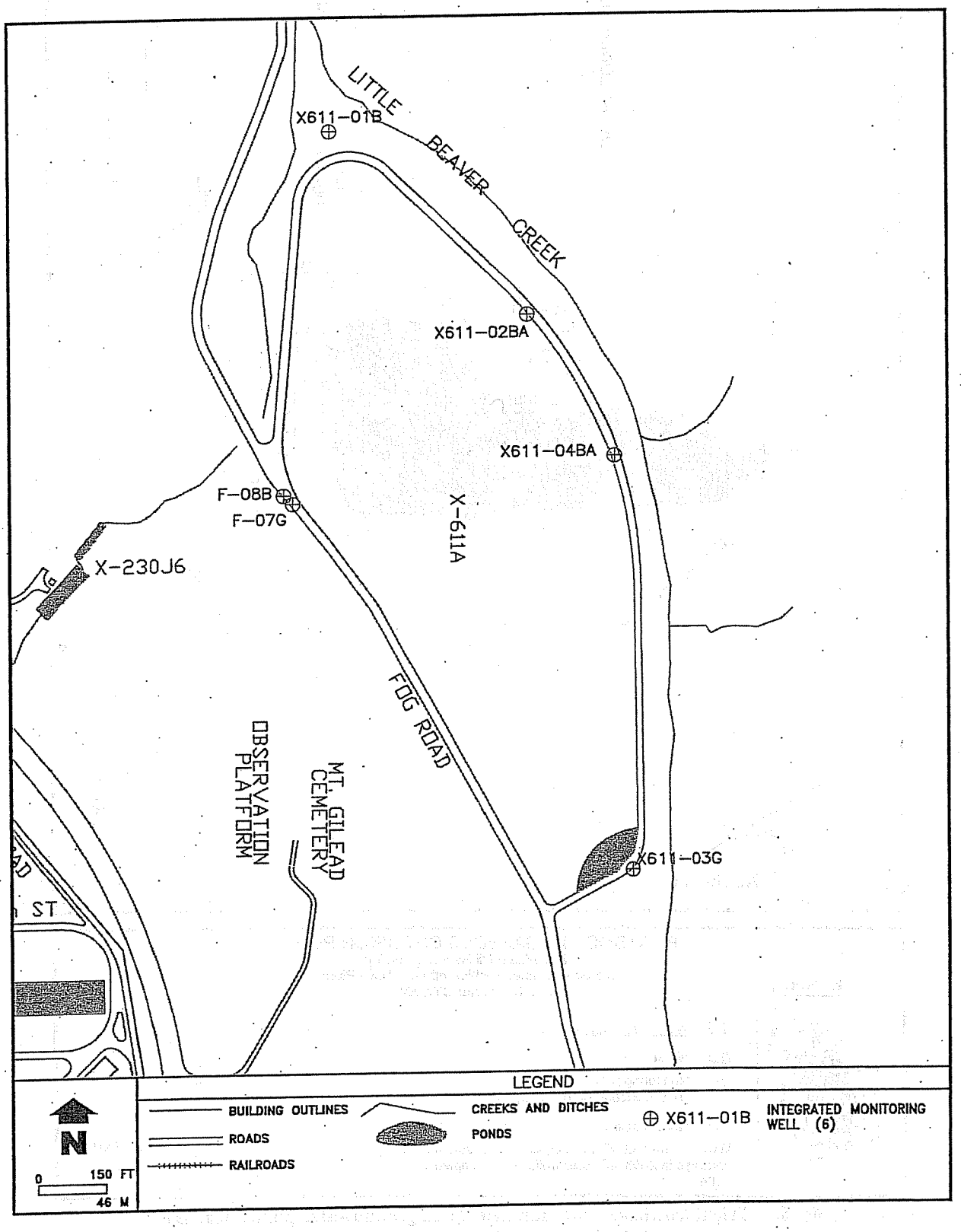


Fig. 6.9. Monitoring wells at the X-611A Former Lime Sludge Lagoons.

6.4.9 X-735 Landfills

Several distinct waste management units are contained within the X-735 Landfills area. The main units consist of the hazardous waste landfill, referred to as the X-735 Landfill (Northern Portion), and the X-735 Industrial Solid Waste Landfill. The X-735 Industrial Solid Waste Landfill includes the industrial solid waste cells, asbestos disposal cells, and the closed chromium sludge monocells A and B. The chromium sludge monocells contain a portion of the chromium sludge generated during the closure of the X-616 Chromium Sludge Surface Impoundments.

Initially, a total of 17.9 acres was approved by the Ohio EPA and Pike County Department of Health for landfill disposal of conventional solid wastes. The landfill began operation in 1981. During operation of the landfill, PORTS investigations indicated that wipe rags contaminated with solvents had inadvertently been disposed in the northern portion of the landfill. The contaminated rags were considered a hazardous waste. Waste disposal in the northern area ended in December 1991, and Ohio EPA determined that the area required closure as a RCRA hazardous waste landfill. Consequently, this unit of the sanitary landfill was identified as the X-735 Landfill (Northern Portion).

A buffer zone was left unexcavated to provide space for groundwater monitoring wells and a space between the RCRA landfill unit and the remaining southern portion, the X-735 Industrial Solid Waste Landfill. Routine groundwater monitoring has been conducted at the X-735 Landfills since 1991.

The industrial solid waste portion of the X-735 Landfills included a solid waste section and an asbestos waste section. The X-735 Industrial Solid Waste Landfill, not including the chromium sludge monocells, encompasses a total area of approximately 4.1 acres. Operation of the X-735 Industrial Solid Waste Landfill ceased in 1997, and this portion of the landfill was capped in 1998.

The *Integrated Groundwater Monitoring Plan* incorporates monitoring requirements for the hazardous and solid waste portions of the X-735 Landfills. Eighteen wells are sampled semiannually under the routine monitoring program for this area. Table 6.1 lists the analytical parameters and Fig. 6.10 shows the monitoring wells in this area.

6.4.9.1 Monitoring results for the X-735 Landfills in 2004

No volatile organic compounds other than acetone and methylene chloride (common sample contaminants) were detected in any of the X-735 wells in 2004.

Statistical evaluations of data collected from wells at the X-735 Landfills are also completed to monitor the landfill for releases. In general, analytical results from previous sampling events are used to calculate control limits for selected monitoring parameters at designated X-735 monitoring wells. For example, analytical results for alkalinity from eight sampling events at well X735-05GA between 1998 and 2001 are used to calculate two control limits for alkalinity at this well (these data are considered the baseline data). Results for samples analyzed for alkalinity from this well in 2004 are evaluated against these limits. If the limits are exceeded, it is possible that a release from the landfill has occurred, although exceedences can also happen due to variations in groundwater quality and other reasons.

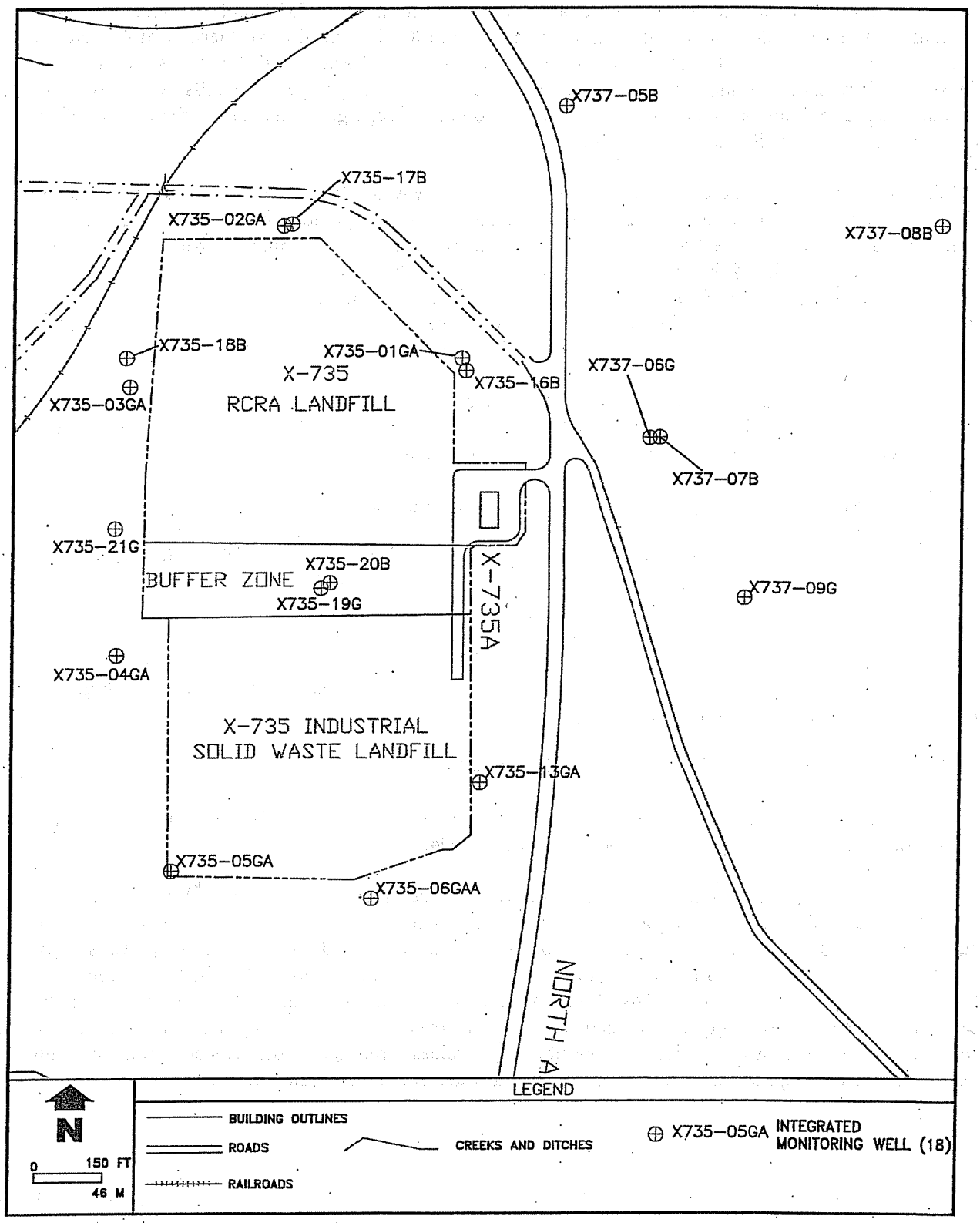


Fig. 6.10. Monitoring wells at the X-735 Landfills.

Control limits for total dissolved solids and alkalinity in well X735-21G were exceeded during the second and fourth quarters of 2004. Control limits for other constituents at this well and two other wells were also exceeded only in the fourth quarter. DOE worked with Ohio EPA throughout 2004 to evaluate and determine the actions necessary to address these exceedences. The reports entitled *Assessment Report for Statistically Significant Increases in Total Dissolved Solids at the X-735 Landfill at the Portsmouth Gaseous Diffusion Plant, Piketon, Ohio* and *Addendum to Assessment Report for Statistically Significant Increases in Total Dissolved Solids at the X-735 Landfill at the Portsmouth Gaseous Diffusion Plant, Piketon, Ohio* provide additional information for this area.

6.4.10 X-734 Landfills

The X-734 Landfills consisted of three landfill units that were used until 1985. Detailed records of materials disposed of in the landfills were not kept. However, wastes known to be disposed at the landfills include trash and garbage, construction spoils, wood and other waste from clearing and grubbing, and empty drums. Other materials reportedly disposed of in the landfills may have included waste contaminated with metals, empty paint cans, and uranium-contaminated soil from the X-342 area.

The X-734 Sanitary Landfill was closed in accordance with the solid waste regulations in effect at that time, and no groundwater monitoring of the unit was required. The X-734 Landfills were capped in 1999-2000 as part of the remedial actions required for Quadrant IV.

Fifteen wells (see Fig. 6.11) are sampled semiannually as part of the monitoring program for this area. Table 6.1 lists the monitoring parameters for the wells in this area.

6.4.10.1 Monitoring results for the X-734 Landfills in 2004

Volatile organic compounds were detected in samples collected from four wells in the X-734 monitoring area in 2004; however, trichloroethene is the only compound that exceeded the preliminary remediation goal (5 μg/L). In the second quarter and fourth quarter samples collected from well X734-21B, trichloroethene was detected at 150 μg/L and 120 μg/L, respectively.

Cobalt is also monitored in the X-734 Landfills area. Cobalt was detected in five wells in 2004 (X734-01G, X734-03G, X734-06G, X734-15G, and X734-16G) at concentrations equal to or exceeding the preliminary remediation goal of 13 μg/L for Gallia wells. These detections ranged from 13 to 33 μg/L. Additional inorganics (metals) and radionuclides were also detected in 2004. Control and monitoring of groundwater is being accomplished in accordance with the RCRA Corrective Action Program.

6.4.11 X-533 Switchyard Area

The X-533 Switchyard Area consists of a switchyard containing electrical transformers and circuit breakers, associated support buildings, and a transformer cleaning pad. The groundwater area of concern is located north of the switchyard and associated support buildings near the transformer cleaning pad.

The X-533 Switchyard Area was identified as an area of concern for potential metals contamination in 1996 based on historical analytical data for groundwater wells in this area. Samples from wells in this area were collected to assess the area for metals contamination. The area was added to the PORTS groundwater monitoring program because the study identified three metals (cadmium, cobalt, and nickel) that may have contaminated groundwater in this area. Three wells are sampled semiannually for cadmium, cobalt, and nickel.

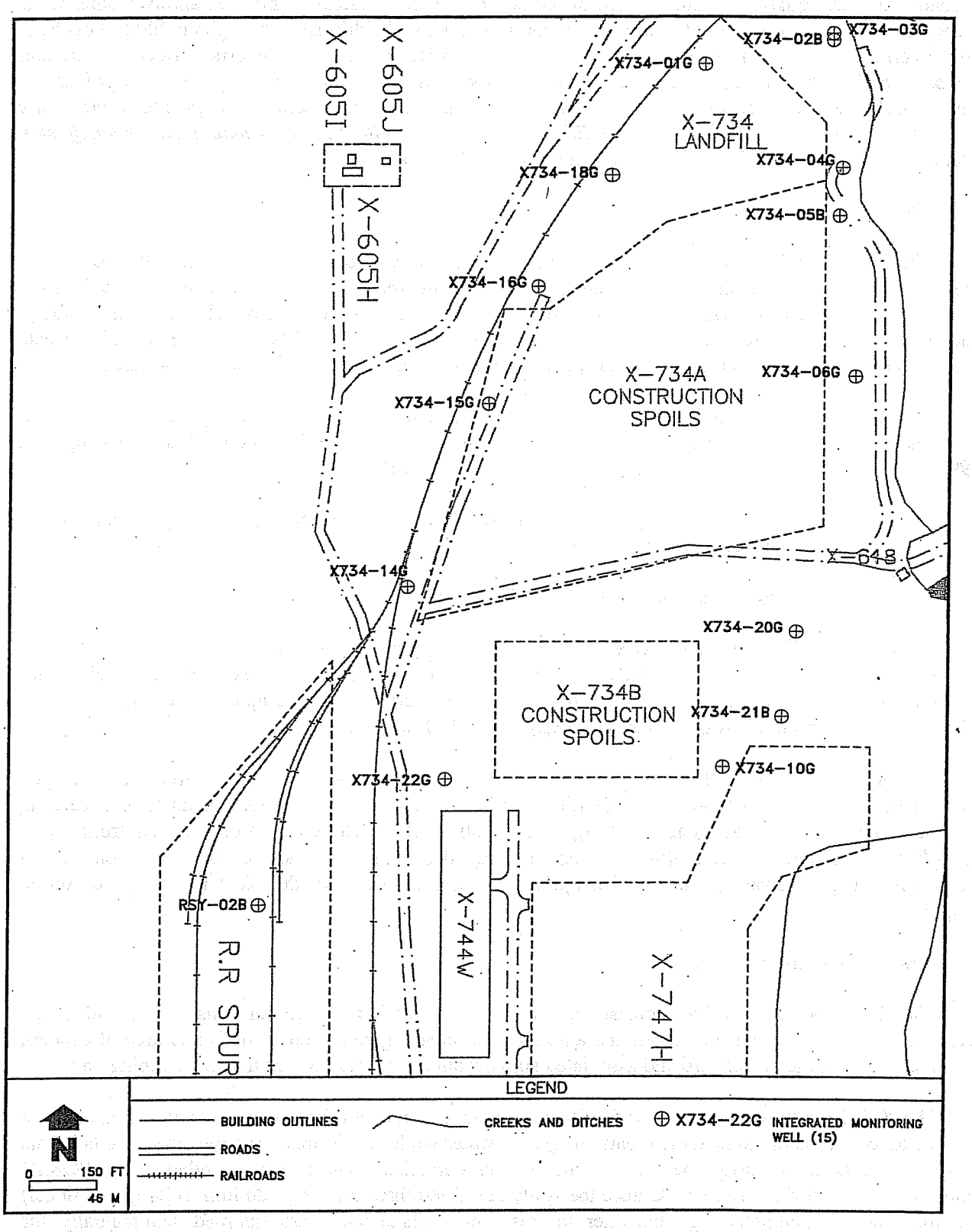


Fig. 6.11. Monitoring wells at the X-734 Landfills.

6.4.11.1 Monitoring results for the X-533 Switchyard Area in 2004

Two Gallia wells that monitor the X-533 Switchyard Area (see Fig. 6.12) were sampled in the second and fourth quarters of 2004 and analyzed for cadmium, cobalt, and nickel. Each of the well samples contained these metals at concentrations above the preliminary remediation goals (6.5 μg/L for cadmium, 13 μg/L for cobalt, and 100 μg/L for nickel). Concentrations of cadmium detected in the wells ranged from 7 to 28 μg/L, concentrations of cobalt detected in the wells ranged from 21 to 61 μg/L, and concentrations of nickel detected in the wells ranged from 120 to 290 μg/L. These results are typical for these wells.

6.4.12 Surface Water Monitoring

Surface water monitoring is conducted in conjunction with groundwater assessment monitoring to determine if contaminants present in groundwater are detected in surface water samples. Surface water is collected quarterly from 15 locations (see Fig. 6.13). Surface water samples are analyzed for the parameters listed in Table 6.1. The purpose for each surface water monitoring location is listed below:

- Little Beaver Creek and East Drainage Ditch sample locations LBC-SW01, LBC-SW02, and EDD-SW01 assess possible X-701B area plume groundwater discharges.

- Little Beaver Creek sample location LBC-SW03 assesses potential contamination from the Former X-611A Lime Sludge Lagoons.

- Big Run Creek sample locations BRC-SW01 and BRC-SW02 monitor for potential groundwater discharges related to the X-231B Southwest Oil Biodegradation Plot, the Quadrant I Groundwater Investigative Area plume, and the X-749/X-120/PK Landfill area plume, all of which discharge into the X-230K Holding Pond and Big Run Creek.

- As required by the *Comprehensive Monitoring Program*, Big Run Creek sample locations BRC-SW03 and BRC-SW04 monitor for potential groundwater discharges from the X-749/X-120/PK Landfill area into Big Run Creek.

- Southwestern Drainage Ditch sample locations UND-SW01 and UND-SW02 assess potential groundwater releases to this creek and the X-2230M Holding Pond from the western portion of the X-749/X-120 groundwater plume.

- North Holding Pond sample location NHP-SW01 and Little Beaver Creek sample location LBC-SW04 assess potential groundwater discharges from the X-734 Landfill and other Quadrant IV sources.

- Western Drainage Ditch sample locations WDD-SW01, WDD-SW02, and WDD-SW03 assess potential groundwater discharges from the X-616 and X-740 areas to the Western Drainage Ditch and the X-2230N Holding Pond.

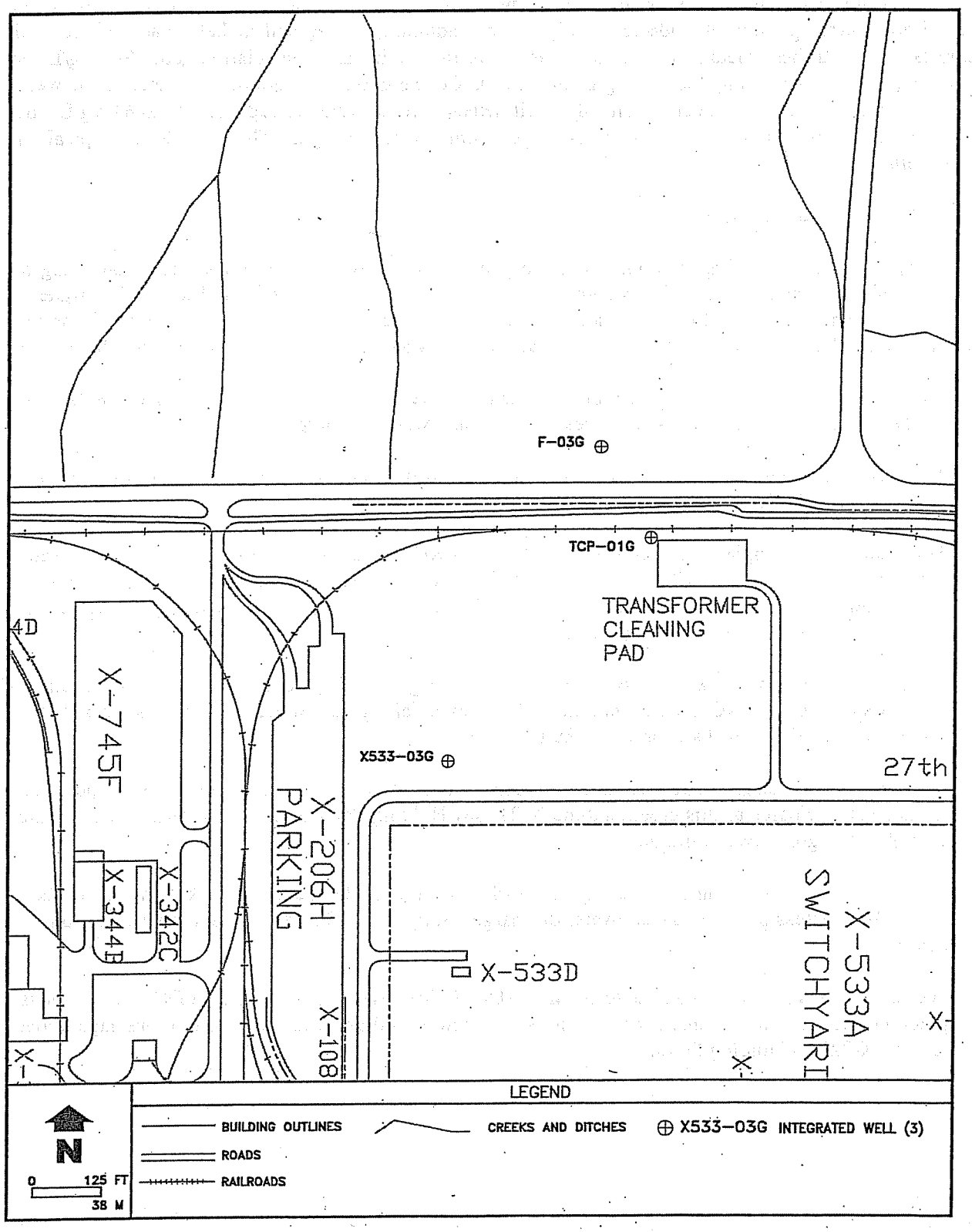


Fig. 6.12. Monitoring wells at the X-533 Switchyard Area.

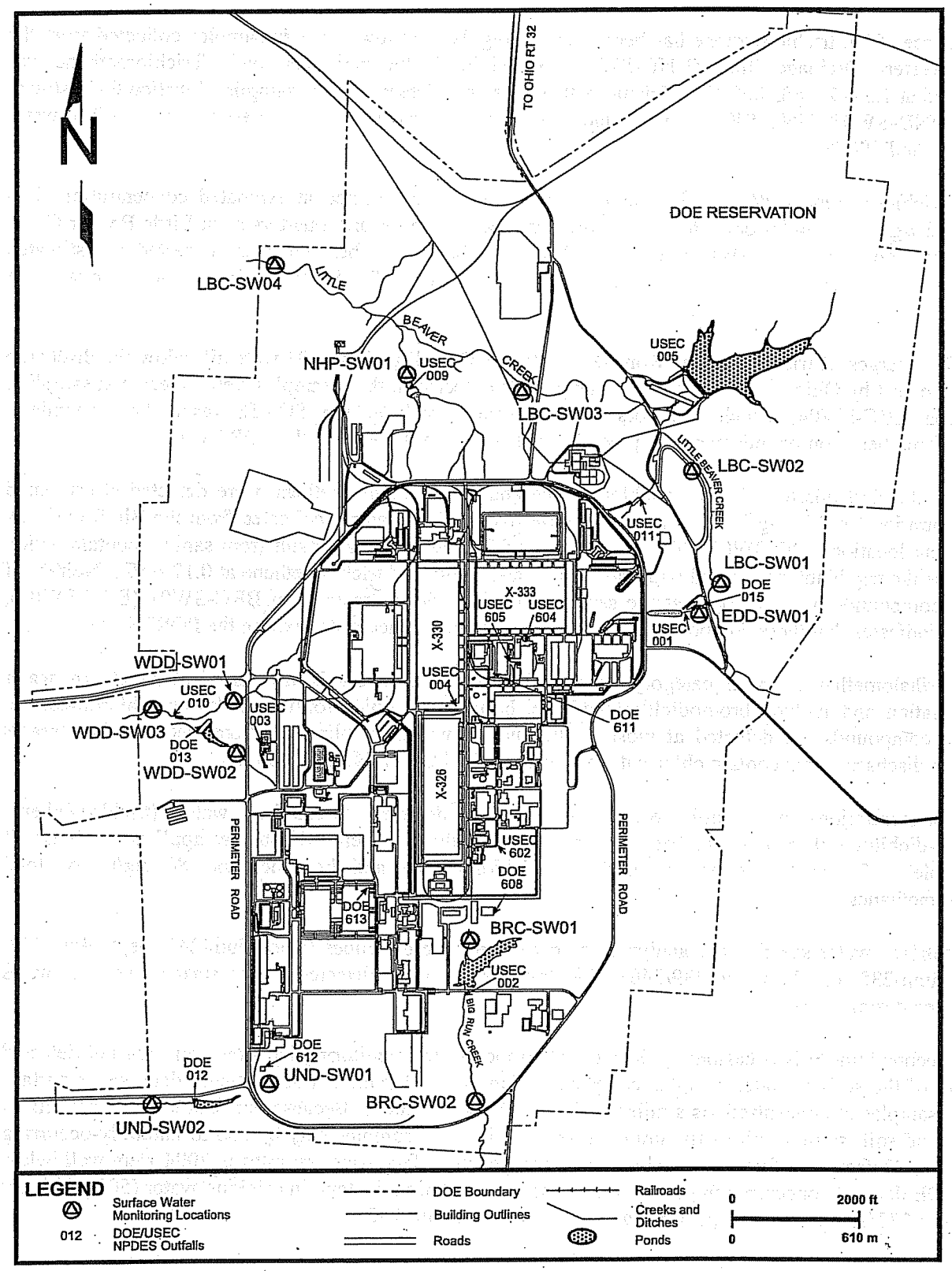


Fig. 6.13. Surface water monitoring locations.

6.4.12.1 Monitoring results for surface water in 2004

Since 1990, trichloroethene has been detected regularly at low levels in samples collected from the Southwestern Drainage Ditch (UND-SW01, located inside the perimeter road). Trichloroethene was detected at 1.3 – 2 μg/L in 2004. Trichloroethene was not detected at the sampling location downstream from UND-SW01 (UND-SW02), which indicates that trichloroethene is not present in the surface water exiting the PORTS site.

Trichloroethene and/or *cis*-1,2-dichloroethene were also detected at estimated concentrations less than 0.5 μg/L in samples collected during the first, second, and fourth quarters from Little Beaver Creek sampling locations LBC-SW01 and LBC-SW02. Toluene and benzene were detected at estimated concentrations less than 1 μg/L in the sample collected from LBC-SW04 during the fourth quarter of 2004.

Discharges of trichloroethene from DOE NPDES Outfall 015 in 2004 were all below the discharge limitation set by Ohio EPA. None of the compounds detected in these samples were detected at sampling location LBC-SW04, which monitors Little Beaver Creek at the PORTS reservation boundary. Therefore, these compounds were not present in the surface water exiting the PORTS site.

In the first quarter of 2004, trichloroethene and *cis*-1,2-dichloroethene were detected at estimated concentrations of 0.27 μg/L and 0.14 μg/L, respectively, in the sample collected from the Big Run Creek sampling location BRC-SW01. The detection of trichloroethene may result from sample contamination because the trip blank associated with this sample also contained trichloroethene at 0.17 μg/L. Neither of these compounds were detected at the sampling location downstream from BRC-SW01 (BRC-SW02), which indicates that these compounds are not present in the surface water exiting the PORTS site.

Trihalomethanes are a category of volatile organic compounds that are byproducts of water chlorination and include bromodichloromethane, bromoform, chloroform, and dibromochloromethane. These compounds are detected at most of the surface water sampling locations because the streams receive discharges that contain chlorinated water from the PORTS NPDES outfalls.

Concentrations of volatile organic compounds detected in surface water (trichloroethene, *cis*-1,2-dichloroethene, toluene, benzene, and trihalomethanes) were well below applicable MCLs (if available). These MCLs are 5 μg/L for trichloroethene and benzene, and 80 μg/L for total trihalomethanes.

Surface water samples are analyzed for transuranic radionuclides (americium-241, neptunium-237, plutonium-238, or plutonium-239/240). No transuranics were detected in the surface water samples collected during 2004.

Technetium-99 is occasionally detected at surface water monitoring locations, but was not detected in any of the surface water samples collected during 2004. Uranium was routinely detected in surface water samples at concentrations similar to those detected in 2003. Because uranium occurs naturally in rocks and soil, some or all of the uranium detected in these samples may be due to naturally-occurring uranium. Detections of uranium and uranium isotopes in surface water samples in 2004 were well below the DOE derived concentration guide for the respective uranium isotope in drinking water (500 pCi/L for uranium-233/234 and 600 pCi/L for uranium-235 and uranium-238).

6.4.13 Water Supply Monitoring

Routine monitoring of residential drinking water sources is completed at PORTS in accordance with the requirements of Section VIII of the September 1989 Consent Decree between the State of Ohio and DOE and the Residential Groundwater Monitoring Requirements contained in the *Integrated Groundwater Monitoring Plan.*

The purpose of the program is to determine whether residential drinking water sources have been adversely affected by plant operations. Although this program may provide an indication of contaminant transport off site, it should not be interpreted as an extension of the on-site groundwater monitoring program, which bears the responsibility for detection of contaminants and determining the rate and extent of contaminant movement. Data from this program will not be used in environmental investigations due to the lack of knowledge of how residential wells were constructed and due to the presence of various types of pumps (which may not be ideal equipment for sampling).

Seven residential drinking water sources participated in the program in 2004 (see Fig. 6.14). Wells are sampled semiannually with two samples collected from each well: a regular sample and a duplicate sample. Each sample is analyzed for the parameters listed in Table 6.1. The PORTS water supply (RES-012 on Fig. 6.14) is also sampled as part of this program. Sampling locations may be added or deleted if requested by a resident and as program requirements dictate. Typically, sampling locations are deleted when a resident obtains a public water supply.

In the first quarter of 2004, trichloroethene was detected in both the regular and duplicate samples collected at location RES-004 at 0.18 μg/L and 0.21 μg/L, respectively. This residence is south of the PORTS reservation and east of Big Run Creek. Because the trichloroethene plume at PORTS is west of Big Run Creek, it is unlikely that groundwater migration from PORTS caused these detections. No trichloroethene was detected in any of the water supplies sampled during the third quarter. Acetone was detected at estimated concentrations less than 5 μg/L in two water supply samples and the trip blank associated with the samples collected during the third quarter. A trip blank is a quality control sample of water that accompanies the environmental samples throughout the sampling process. Acetone is a common sample contaminant. Therefore, acetone was most likely present in the samples as a result of sample contamination.

No transuranics or technetium-99 were detected in the water supply samples collected during 2004.

Metals detected in the water supply samples were within naturally-occurring concentrations found in the area. Low levels of uranium and uranium isotopes detected in some of the wells are consistent with naturally-occurring concentrations found in common geologic materials.

6.5 DOE ORDER MONITORING PROGRAMS

The surveillance monitoring program at DOE PORTS consists of exit pathway monitoring. Exit pathway monitoring assesses the effect of the facility on off-site groundwater quality.

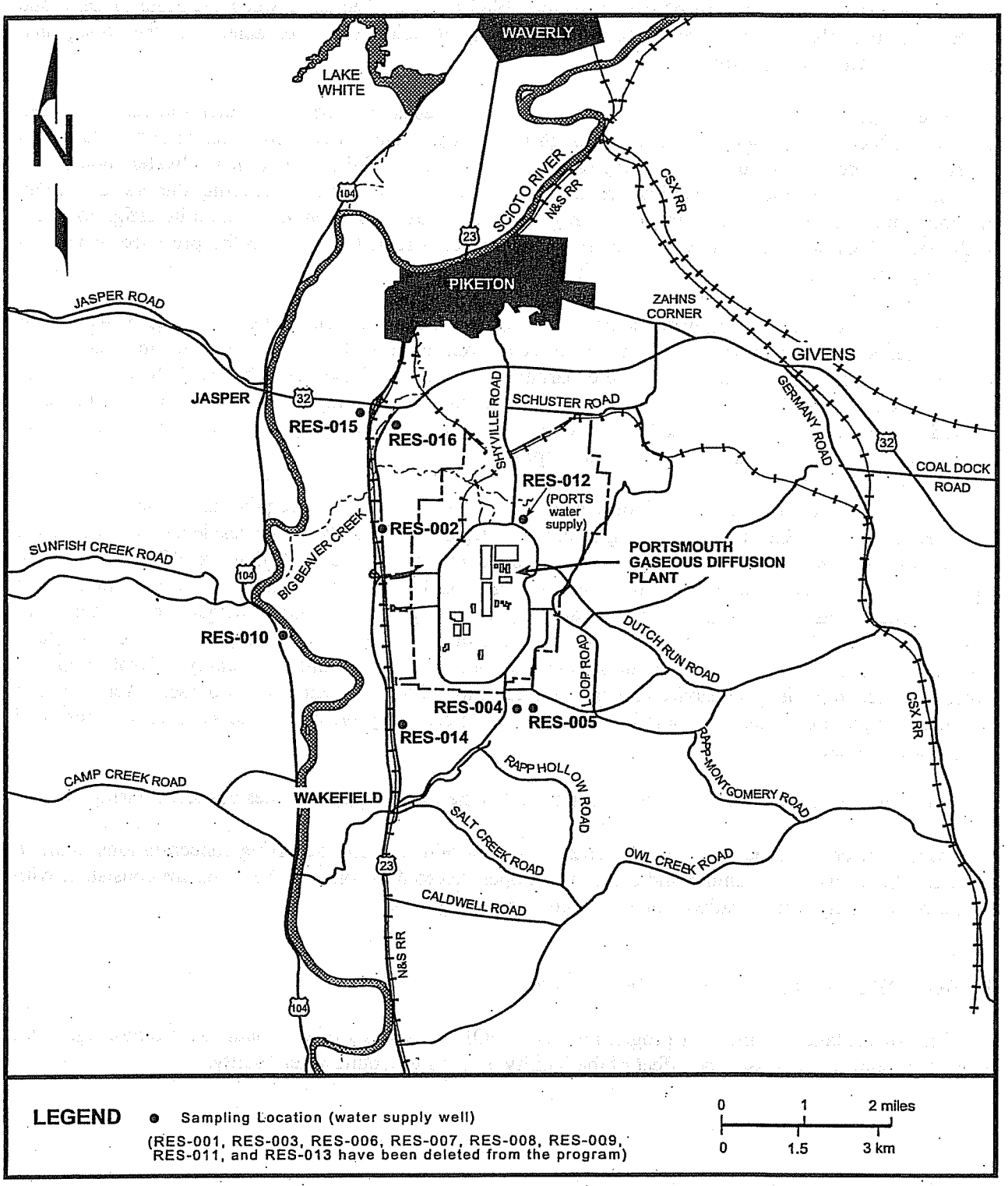


Fig. 6.14. Water supply monitoring locations.

6.5.1 Exit Pathway Monitoring

Selected locations on local streams and drainage channels near the reservation boundary are sampling points of the exit pathway monitoring program because groundwater discharges to these surface waters. Monitoring wells near the reservation boundary are also used in the exit pathway monitoring program. Figure 6.15 shows the sampling locations for exit pathway monitoring and Table 6.1 lists the analytical parameters.

Surface water sampling points on Big Run Creek (BRC-SW02), Little Beaver Creek (LBC-SW04), Southwestern Drainage Ditch (UND-SW02), and Western Drainage Ditch (WDD-SW03) are part of the exit pathway monitoring program. Sample contaminants acetone, methyl ethyl ketone (2-butanone), and methylene chloride were detected in a few of the samples collected from these locations in 2004. Toluene and benzene were detected at estimated concentrations less than 1 μg/L in the sample collected from LBC-SW04 during the fourth quarter of 2004. Trihalomethanes, which are common residuals in chlorinated drinking water, were detected in samples collected from Big Run Creek and the Western Drainage Ditch at concentrations well below drinking water standards. Metals, including uranium, were detected at concentrations consistent with background concentrations for these parameters. Section 6.4.12.1 provides additional information for these monitoring results.

In 2004, volatile organic compounds, including trichloroethene, were detected in three of the exit pathway groundwater monitoring wells (X749-44G, X749-45G, and X749-97G) that monitor the X-749 South Barrier Wall and are part of the monitoring program for the X-749/X-120/PK Landfill monitoring area (see Fig. 6.2 and Sect. 6.4.1.3). Concentrations of trichloroethene detected in the samples from these wells were 20 to 23 g/L in well X749-44G, 9.9 to 24 μg/L in well X749-45G, and 2.4 to 8.8 μg/L in well X749-97G. These detections exceed the MCL for trichloroethene (5 μg/L); however, these monitoring wells are located within the PORTS boundary. Remediation of groundwater is being accomplished in accordance with the RCRA Corrective Action Program.

Technetium-99 was detected at concentrations less than 20 pCi/L in both samples collected from well X749-44G. These detections are significantly less than the preliminary remediation goal for technetium-99 (3790 pCi/L).

6.6 GROUNDWATER TREATMENT FACILITIES

In 2004, a combined total of approximately 34.4 million gallons of water were treated at the X-622, X-622T, X-623, X-624, and X-627 Groundwater Treatment Facilities (the X-627 Groundwater Treatment Facility replaced the X-622T in September 2004). Approximately 277 gallons of trichloroethene were removed from the water. All processed water is discharged through NPDES outfalls before exiting PORTS. Facility information is summarized in Table 6.2.

Table 6.2. Summary of trichloroethene removed by DOE PORTS groundwater treatment facilities in 2004

Facility	Gallons of water treated	Gallons of TCE removed
X-622	16,273,260	3
X-622T	8,060,360	16
X-623	4,135,720	229
X-624	3,033,624	22
X-627	2,908,580	7

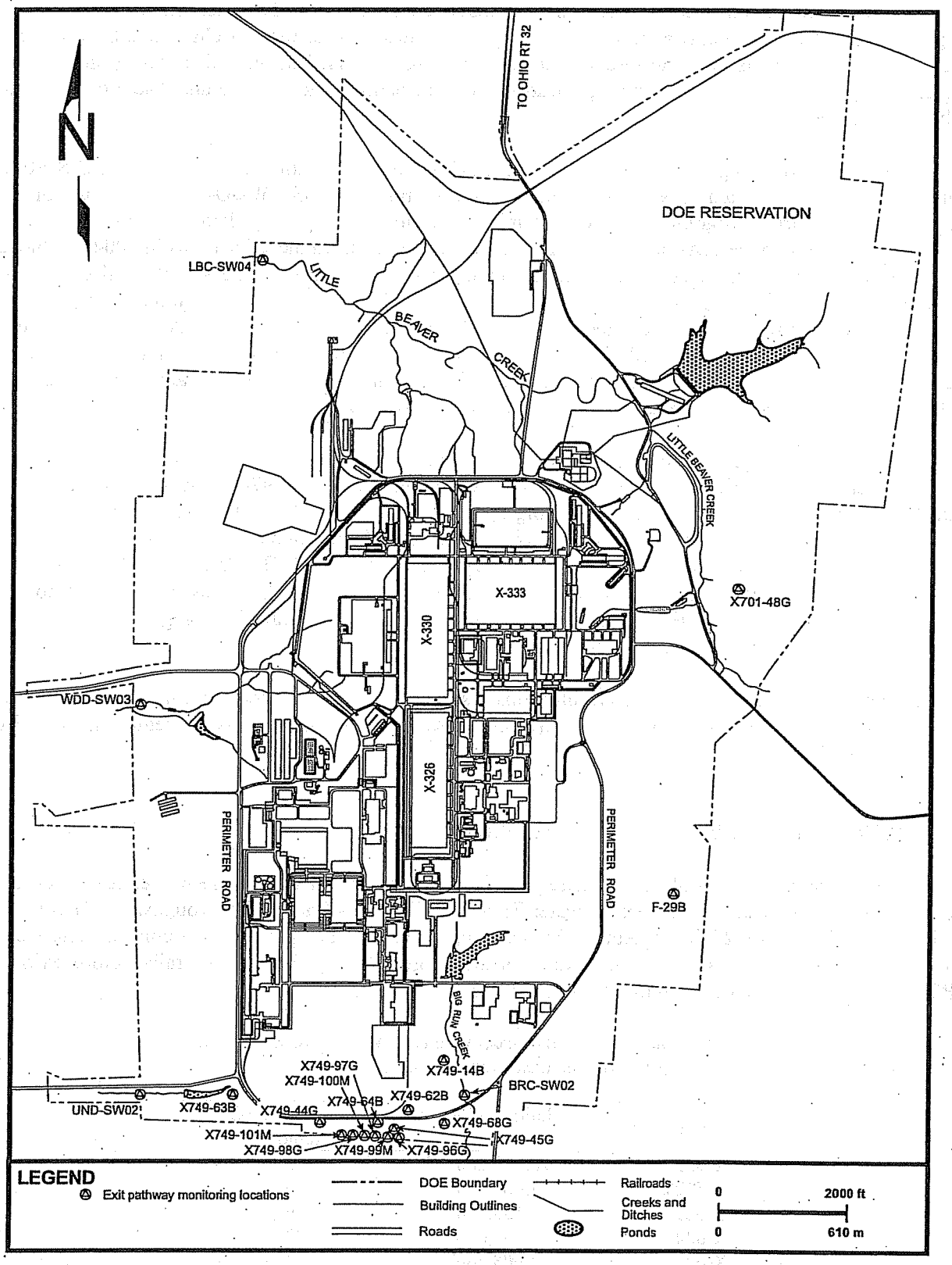


Fig. 6.15. Exit pathway monitoring locations.

6.6.1 X-622 Groundwater Treatment Facility

The X-622 Groundwater Treatment Facility consists of an air stripper with a de-mister and aqueous-phase activated carbon filtration. This facility processes groundwater from the following systems in Quadrant I:

- Groundwater collection system and associated sump (X749-WPW) on the southwest boundary of the X-749 Landfill;
- Groundwater collection system and associated sumps (PK-PL6 and PK-PL6A) on the eastern boundary of the PK Landfill; and
- Fourteen extraction wells located in the Quadrant I Groundwater Investigative Area.

The X-749 and PK Landfill groundwater collection systems and the extraction wells in the Quadrant I Groundwater Investigative Area operated throughout 2004. The facility processed approximately 16 million gallons of groundwater, thereby removing approximately 3 gallons of trichloroethene from the water. Treated water from the facility discharges through DOE NPDES Outfall 608, which flows to the USEC Sewage Treatment Plant. No NPDES permit limitations were exceeded at Outfall 608 in 2004.

6.6.2 X-622T/X-627 Groundwater Treatment Facilities

At the X-622T Groundwater Treatment Facility, activated carbon was used to treat contaminated groundwater from the X-700 Chemical Cleaning Facility and the X-705 Decontamination Building. In September 2004, the X-622T was replaced by the X-627 Groundwater Treatment Facility. The X-627 Groundwater Treatment Facility consists of an air stripper with offgas activated carbon filtration and aqueous phase activated carbon filtration. The X-700 and X-705 buildings are located above the Quadrant II Groundwater Investigative Area plume, and contaminated groundwater is extracted from sumps located in the basement of each building.

The X-700 and X-705 sumps operated throughout 2004. Approximately 11 million gallons of groundwater were processed during 2004 by either the X-622T or X-627 facilities, thereby removing 23 gallons of trichloroethene from the water. Treated water from the facility discharges through DOE NPDES Outfall 611, which flows to the USEC Sewage Treatment Plant. No NPDES permit limitations were exceeded at Outfall 611 in 2004.

6.6.3 X-623 Groundwater Treatment Facility

The X-623 Groundwater Treatment Facility consists of an air stripper with offgas activated carbon filtration and aqueous-phase activated carbon filtration. The X-623 Groundwater Treatment Facility treats trichloroethene-contaminated groundwater from a sump in the bottom of the X-701B Holding Pond and three groundwater extraction wells (#1, #2, and #3) east of the holding pond. The sump located in the bottom of the X-701B Holding Pond and the two of three extraction wells east of the pond operated throughout 2004. Extraction well #2 was out of service from August through November.

The facility treated approximately 4 million gallons of water during 2004, thereby removing approximately 229 gallons of trichloroethene from the water. Treated water from the facility discharges through DOE NPDES Outfall 610, which flows to the USEC Sewage Treatment Plant. No NPDES permit limitations were exceeded at Outfall 610 in 2004.

6.6.4 X-624 Groundwater Treatment Facility

At the X-624 Groundwater Treatment Facility, groundwater is treated via an air stripper with offgas activated carbon filtration and aqueous-phase activated carbon filtration. This facility processes trichloroethene-contaminated groundwater from the X-701B groundwater plume, specifically the X-237 Groundwater Collection System, which consists of north-south and east-west collection trenches and sumps #1 and #2.

The X-237 Groundwater Collection System operated throughout 2004. The X-624 Groundwater Treatment Facility treated approximately 3 million gallons of water in 2004, thereby removing approximately 22 gallons of trichloroethene from the water. Treated water from the facility discharges through DOE NPDES Outfall 015, which discharges to Little Beaver Creek. No NPDES permit limitations were exceeded at Outfall 015 in 2004.

6.6.5 X-625 Groundwater Treatment Facility

On July 9, 2003, the X-625 Groundwater Treatment Facility was placed on stand-by with approval from Ohio EPA. The X-625 Groundwater Treatment Facility did not operate in 2004.