US Army Corps
of Engineers
Buffalo District

Record of Decision
Groundwater Operable Unit

Authorized under FUSRAP

Luckey Site
Luckey, Ohio

Prepared by:
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February 2008

I.

DECLARATION FOR THE RECORD OF DECISION

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SITE NAME AND LOCATION

Luckey Site
Luckey, Ohio

STATEMENT OF BASIS AND PURPOSE

This Record of Decision (ROD) presents the final remedy for the groundwater unit investigated by the United States Army Corps of Engineers (USACE) under the Formerly Utilized Sites Remedial Action Program (FUSRAP) at the Luckey site. This is the second of two RODs specific to the Luckey site; the soil operable unit ROD is finalized and found under separate cover (USACE 2006). This groundwater ROD addresses impacts from hazardous substance releases derived from Atomic Energy Commission (AEC)-related activities, which are eligible for response under FUSRAP.

The process to reach the final decisions and identify the selected remedial action was performed in accordance with the Comprehensive Environmental Response, Compensation, and Liability Act, 42 United States code 9601 et seq., as amended (CERCLA), and the National Oil and Hazardous Substances Pollution Contingency Plan (NCP), as directed by Congress in the Energy and Water Appropriation Act for Fiscal Year (FY) 2000, PL 106-60, 10 U.S.C. 2701. Information supporting all USACE decisions as the lead agency is contained in the Administrative Record file located at the USACE Public Information Center, 1776 Niagara Street, Buffalo, NY 14207 and the Luckey Public Library, 228 Main Street, Luckey, Ohio 43443.

Comments on the Proposed Plan (USACE 2003a) provided by the Ohio Environmental Protection Agency (Ohio EPA) were evaluated and considered in selecting the final remedy. Appendix A provides public comments on the Proposed Plan (PP) and corresponding USACE responses that address the comments; groundwater-related concerns are addressed in this groundwater operable unit ROD. The State of Ohio EPA has stated that it supports the recommended preferred alternative contained in the Proposed Plan (PP) to remedy the site (See Attachment 5 to Appendix A).

ASSESSMENT OF THE SITE

Actual or threatened releases of hazardous substances from this site, if not addressed by implementing the response action selected in the soil ROD (USACE 2006) and this ROD pertaining to groundwater, may present an endangerment to public health, welfare, or the environment in the future.

DESCRIPTION OF THE SELECTED REMEDY

Background on Remedy Selection

The Luckey site is comprised of a large production building and warehouse, two abandoned railroad spurs, and several smaller process and support buildings. The area surrounding the site to the west, north, and east is primarily residential farmland. From 1949 to the early 1960s, the Brush Beryllium Company (BBC), as a contractor to the AEC, used the Luckey site for beryllium processing to support the national defense program (Powers 1983 and Smith 1950). Beryllium production activities brought different types of source media or potential contaminants to the site. Primary materials delivered to the BBC at the Luckey site for processing or re-processing include beryl ore from Africa and South America, scrap beryllium, and radiologically contaminated scrap steel.

Under FUSRAP authority, USACE conducted a CERCLA remedial investigation (RI) of the Luckey site to characterize site conditions and to determine nature and extent of contamination (USACE 2000). The scope was limited to addressing radioactivity, beryllium, and other constituents related to the production of beryllium at the Luckey site in support of the nation's early atomic energy program. The RI report for the Luckey site also includes a baseline risk assessment evaluating risks to human health and the environment posed by site contaminants. The USACE CERCLA feasibility study (FS) (USACE 2003) identifies cleanup goals and evaluates remedial action alternatives for the Luckey site. The USACE Proposed Plan identifies the remedial action alternatives (soil and groundwater) preferred by USACE (USACE 2003a) for the Luckey site.

The groundwater-specific, AEC-related constituents of concern (COCs) that exist in select groundwater wells at concentrations which pose an unacceptable risk if consumed as a drinking water source include beryllium, lead, and total uranium (mass-based). These elements are COCs since drinking water in the vicinity of the site is obtained from groundwater. As previously identified, USACE does not have authority to address other constituents not related to AEC activities at the Luckey site and therefore they are not addressed in this decision document. Information on the presence of other non-AEC related contaminants may be used by USACE for worker protection and the proper disposal management of any AEC-related materials.

The three groundwater COCs are a subset of six soil COCs that pose unacceptable risks under a subsistence farmer scenario (i.e., a human health receptor who resides on the site and is self-sufficient from food grown or produced on the site), which has been identified as the reasonable future use scenario (i.e., the critical group) for the Luckey site (USACE 2003).

Beryllium production for commercial use also occurred during the timeframe beryllium was being produced for AEC at the Luckey site. Releases resulting from commercial production of beryllium at the site are co-mingled and thus indistinguishable from releases relating to the production of beryllium in support of the nation's early atomic energy program. Lead was identified as a COC since lead oxide was used as an additive in the beryllium production process. In order to fully assess impacts related to AEC-contracted activities at the Luckey site, the USACE will address beryllium, lead, and uranium contamination in groundwater at the site.

Selected Remedy

USACE determined CERCLA action is necessary for groundwater based on the results of the RI completed by USACE (USACE 2000), extensive groundwater flow and contaminant transport modeling (Groundwater Modeling Report, USACE 2001) performed for the FS (USACE 2003), and subsequent annual groundwater sampling at on- and off-site wells. The USACE will remediate AEC-impacted soils under the remedy selected in the Luckey-site soils ROD (USACE 2006); this removal action will preclude potential for further contamination of the groundwater system and promote the natural attenuation of contaminants within the site hydrogeologic system.

The monitored natural attenuation (MNA) remedy will confirm that maximum contaminant levels (MCLs) promulgated pursuant to the Safe Drinking Water Act (SDWA) will be attained over time to protect human health from identified adverse effects from beryllium, lead and uranium in site groundwater. The Federal MCL of 30 µg/L for uranium is found at 40 CFR § 141.66(e) as published in 65 Federal Register (FR) 76708-76748, December 7, 2000. The MCL of 4 µg/L for beryllium is found at 40 CFR § 141.62(b), as well as the Ohio Administrative Code (OAC) at 3745-81-11(B) (i.e., the State of Ohio drinking water standard). The SWDA action level, 40 CFR § 141.80(c), and Ohio standard, OAC 3745-8180(C)(1), for lead both are 15 µg/L (as a promulgated treatment action level).

Consequently, the remedial goals for COCs in groundwater at the Luckey site are:

- Beryllium = 4 µg/L
- Lead = 15 µg/L
- Total Uranium = 30 µg/L

The estimated present cost of the MNA remedy is approximately $890,000, which includes performance monitoring and five-year reviews to declare the effectiveness of the remedy, which may require between 40 and 150 years of monitoring.

STATUTORY DETERMINATIONS

The selected remedy for on- and off-site groundwater is cost effective, utilizes permanent solutions, and optimizes alternative treatment to the maximum extent practicable to protect human health and the environment.

The groundwater remedy in this Operable Unit (OU) does not satisfy the statutory preference for treatment as a principal element for the remedy for the following reasons: 1) remedial alternatives involving treatment were identified and not selected (USACE 2003a), 2) the soils remedy (USACE 2006) includes source removal that will require short-term groundwater extraction and control associated with excavations, 3) COCs in groundwater above MCLs will reduce in concentration throughout time via dispersion, diffusion, and adsorption to soil. These components will ensure the remedy is protective of human health and the environment. The end state of the Luckey site after both the soil and groundwater RODs are completed is an unlimited use and unrestricted exposure scenario. A MNA performance monitoring and five-year review program will ensure the MNA remedy is protective of human health and the environment.

_______________/S/___________________ ______2/27/08______

BRUCE A. BERWICK
Brigadier General, Corps of Engineers
Commander
Great Lakes and Ohio River Division

Date

II.

DECISION SUMMARY
FOR THE RECORD OF DECISION

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ACRONYMS, ABBREVIATIONS, & SYMBOLS

AEC	Atomic Energy Commission
AL	U.S. EPA Action Level (treatment based)
amsl	Above mean sea level
ARAR	Applicable or Relevant and Appropriate Requirement
BBC	Brush Beryllium Company
bgs	Below ground surface
BRA	Baseline risk assessment
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CFR	Code of Federal Regulations
COC	Constituent of concern
COPC	Constituent of potential concern
DPC	Defense Plant Corporation
DOD	Department of Defense
DOE	Department of Energy
Eh	Redox potential (milliVolts - mV)
EPA	United States Environmental Protection Agency
EPC	Exposure point concentration
ERA	Ecological risk assessment
EU	Exposure unit
FS	Feasibility Study
ft	Feet
ft/day	Feet per day
FUSRAP	Formerly Utilized Sites Remedial Action Program
FY	Fiscal Year
HHRA	Human Health Risk Assessment
HI	hazard index
HQ	hazard quotient
IEUBK	Integrated Exposure Uptake Biokinetic Model
ILCR	Incremental Lifetime Cancer Risk
in/y	Inches per year
K	Hydraulic Conductivity
K_d	Distribution Coefficient
L/kg	Liters per kilogram
lb/ft3	Pounds per cubic foot
MARSSIM	Multi-Agency Radiation Survey and Site Investigation Manual
MCL	Maximum contaminant level
MDL	Minimum detection limit
MED	Manhattan Engineer District
mg/kg	Milligrams per kilogram
mg/m^3	Milligrams per cubic meter
mL/g	Milliliters per gram
MNA	Monitored natural attenuation
NCP	National Contingency Plan
NPDES	National Pollutant Discharge Elimination System
NRC	Nuclear Regulatory Commission
OAC	Ohio Administrative Code
ODH	Ohio Department of Health
ODNR	Ohio Department of Natural Resources
Ohio EPA	Ohio Environmental Protection Agency
O&M	Operation and Maintenance

ACRONYMS, ABBREVIATIONS, & SYMBOLS (continued)

ORNL	Oak Ridge National Laboratory
OU	Operable Unit
pCi/g	Picocuries per gram
PRG	Preliminary remediation goal
RAGS	Risk Assessment Guidance for Superfund
RAO	Remedial Action Objective
RBC	risk-based concentration
RCRA	Resource Conservation and Recovery Act
RESRAD	Residual Radioactivity Computer Code
RI	Remedial Investigation
RME	Reasonable Maximum Exposure
ROD	Record of Decision
SDWA	Safe Drinking Water Act
SESOIL	A Seasonal Soil Compartment Model
SOR	Sum of Ratios
TBC	To be considered
TOSC	Technical Outreach Services for Communities
TOC	Total Organic Carbon
TSCA	Toxic Substances Control Act
USACE	United States Army Corps of Engineers
µg/L	Microgram per liter
$\mu g/m^3$	Micrograms per cubic meter

1.0 SITE NAME, LOCATION AND DESCRIPTION

The 40-acre Luckey site is located at 21200 Luckey Road in Luckey, Ohio, which is a village of approximately 1,500 people located 22 miles southeast of Toledo (Figure 1). The site lies just north of the village, an inactive France Stone Quarry, and the current Troy Township Dump. Figure 2 displays an aerial view of the site, which is surrounded by predominantly agricultural fields to the north, east, and west. Patches of forests and old fields of varying ages are present throughout the area.

1.1 Luckey Site Investigation Overview

The Groundwater Record of Decision (ROD) for the Luckey site was prepared by the United States Army Corps of Engineers (USACE) as part of the Formerly Utilized Sites Remedial Action Program (FUSRAP). The USACE is issuing this ROD to comply with a public participation responsibility under the requirements of the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) 42 United States Code (USC) 9617(a) and the National Oil and Hazardous Substances Pollution Contingency Plan (NCP) 40 CFR § 300.430(f) (2). This ROD addresses only the constituents associated with the beryllium production efforts performed for the Atomic Energy Commission (AEC), which includes beryllium, materials associated with the beryllium production process, and radioactive residuals found at the Luckey site in Ohio. This document presents the USACE decision and supporting rationale regarding the remedy selected to address groundwater contamination at the Luckey site. All other areas of investigation were addressed in a previous soils ROD (USACE 2006) and are not addressed here.

Four key documents associated with this ROD are the Remedial Investigation (RI) report (USACE 2000), which describes the nature and extent of contaminants, the Groundwater Modeling Report (USACE 2001), which simulated site hydrogeology for remedial design evaluations, the Feasibility Study (FS) (USACE 2003), which describes the development and evaluation of the remedial alternatives, and the Proposed Plan (PP) (USACE 2003a), which details the alternative selection process. Information also is taken from the Baseline Risk Assessment (BRA) contained in the RI and the FS Reports, which assessed risks to public health and the environment posed by contaminants in the environmental media at the site.

The series of CERCLA documents regarding the Luckey site are found within the Administrative Record File located at the Public Information Center, USACE Buffalo District Office and at the Luckey Public Library. USACE encourages the public to review all available material about the Luckey site in order to gain a more comprehensive understanding of the CERCLA activities performed at the site.

Groundwater alternatives evaluated within the FS (USACE 2003) were screened for effectiveness using a groundwater flow model. Groundwater flow path analyses evaluated current and historical conditions at the site, and then predicted groundwater flow paths in the event of continued or discontinued operation of either the East or West Production Wells (or both). The parameters used in the modeling and associated calibration are documented in the

Groundwater Modeling Report (USACE 2001). Data collected and reported as part of the remedial investigation (RI) form the primary data set used to develop input to the model. The Groundwater Modeling report is a stand-alone document that contains or cites, where possible, information presented in the RI report.

2.0 SITE HISTORY

From 1949 to the early 1960s, the Brush Beryllium Company (BBC) used the Luckey site for beryllium processing in support of the national defense program under an AEC contract. Contaminant source media at the Luckey site include the following materials brought to the site for processing or reprocessing:

- Beryl ore from Africa and South America, shipped in bags and barrels via rail
- Some scrap beryllium sent for reprocessing, shipped by truck
- Radiologically contaminated scrap iron sent for possible reprocessing, shipped by rail car.

Beryllium processing primarily occurred in the Annex on the south side of the Production Building, where beryllium ore was converted to beryllium oxides and metal. Process wastes were discharged to three lagoons south of the Annex in liquid or slurry form, which was allowed to either evaporate or discharge to Toussaint Creek via site ditches. From 1950 through 1958, sludge from the lagoons was dredged, transported, and discharged to disposal pits and trenches located in the northeast corner of the property.

The AEC contracted with BBC in 1959 to close the Luckey plant, at which time an on-site disposal area was designated in the northeastern corner of the property. Following closure, the lagoons were reportedly covered with 3 to 5 ft of clean soil and later capped with up to 2 feet of clay (Cline 1990 and Knutsen 1988). Sampling conducted by ORNL in 1988 indicated that residual sludge may still exist in all three lagoons (ORNL 1990).

These processing and closure activities resulted in the occurrence of elevated levels of beryllium, lead, and uranium in groundwater under portions of the property.

FUSRAP was established to remediate sites impacted by activities of the Manhattan Engineering District (MED), or the AEC, in the early years of the nation's atomic energy program. The Luckey site was designated as eligible for inclusion in FUSRAP in 1991, when it was owned by Hayes Lemmerz International, Inc., who leased approximately 23 acres of the site to Uretech International, Inc., a manufacturer of urethane parts for the automotive, sporting goods, and health care industries.

The entire property currently is undergoing transference to Abdoo Wrecking of Fremont, Ohio, who has not operated the production wells in 2007, although they still are available for use if required. A detailed site history is available in the FS (USACE 2003).

2.1 Previous Investigations

Multiple investigations were performed at the Luckey site, both prior to and during FUSRAP actions; the following summary is derived from the CERCLA administrative record (RI Report in 2000, Groundwater Modeling in 2001, Feasibility Study in 2003, and the Proposed Plan in 2003):

- 1949 - 1954: The Ohio Department of Health approved the use of the lagoons and required groundwater and surface-water monitoring, although no early records have been found. Later analyses indicate that some connectivity exists between the lagoons and groundwater.
- 1985 - 1990: Potable water supply tests on the site production wells showed beryllium at levels below the Safe Drinking Water Act (SDWA) maximum contaminant level (MCL) of 4 micrograms per liter (µg/L), with one exception of 8.8 µg/L in late 1985 and early 1986. Oak Ridge National Laboratory (ORNL 1988) collected water samples to support U.S. Department of Energy (DOE) FUSRAP designation process.
- 1992 - 2000: DOE designated the Luckey site eligible for inclusion into FUSRAP. Phase I sampling led to the development of data quality objectives for further sampling actions. A remedial investigation (RI) was initiated and resulted in a multiphase characterization report. Wetland delineations occurred in an area immediately north of the abandoned railroad bed and Lagoon C was delineated as a federal wetland; a waterway east of the pump house is indicative of a shallow emergent wetland (USACE, 1998). All these data were combined into a comprehensive RI report (USACE 2000).
- 2001 - 2002: The USACE and Wood County Health Department tested groundwater from residential wells near the Luckey site for beryllium, manganese, and total uranium. Beryllium was not detected in any of the residential groundwater samples; average concentrations were 6.1 µg/L for manganese and 3.39 µg/L for total uranium, indicating neither was above their respective MCLs of 50 µg/L and 30 µg/L. Subsequent groundwater modeling efforts and CERCLA decision documents were compiled by the USACE and provide the basis for this groundwater ROD. The resulting analyses showed that site COCs in groundwater are beryllium, lead, and total uranium (USACE 2003).
- 2002 – 2006: After the FS Report (USACE 2003), annual sampling commenced for site COCs at select wells exhibiting detectable to elevated COC concentrations. Several wells that initially showed contamination have declined over time, as detailed in Section 5.3 of this ROD. Table 1 list all Luckey site wells, Table 2 presents summary data, and Table 3 presents the annually sampled groundwater data that appear stable (steady-state) or show reducing trends; several wells still produce results above respective COC MCLs.
- 2006- 2007: A ROD for the contaminated soils, waste, and debris at the Luckey site was completed to institute cleanup goals based on residential farmer risk/land-use scenarios (USACE 2006). The Proposed Plan (USACE 2003a) listed and screened both soil and groundwater alternatives. Soil remedial alternative #5 was the chosen remedy and is scheduled for implementation in Fiscal Year 2011, subject to available funding. This separate groundwater ROD summarizes the groundwater-specific alternatives and selected remedy that will commence concurrently with the soils ROD. Interim annual monitoring will be maintained to protect resources and build a comparative groundwater database for future decision making.

3.0 COMMUNITY PARTCIPATION

Public input was encouraged during the Proposed Plan period to ensure the remedy selected for the Luckey site met the needs of the local community in addition to being an effective solution. The administrative record contains all of the documentation used to support the selected remedy and is available at the following locations:

U.S. Army Corps of Engineers
FUSRAP Public Information Center
1776 Niagara Street
Buffalo, NY 14207-3199

Luckey Public Library
228 Main Street
Luckey, OH 43443
(copy of original)

Prior to the release of the Proposed Plan, USACE had established in 1999 the Luckey Partnering Team to facilitate the open exchange of information with the community. The members of the Partnering Team include representatives from regulatory agencies, local government entities, and property owners. The Partnering Team held periodic meetings to receive input on the remediation process and to provide comments on draft technical documents.

In addition to formulating the Partnering Team, USACE contacted the Technical Outreach Services for Communities (TOSC), who worked directly with the local community on site pollution issues. After a number of public meetings, TOSC concluded the community was satisfied with USACE's efforts, which concluded TOSC involvement.

On June 6, 2003, a letter announcing the release of the Proposed Plan (USACE 2003a) for the Luckey site was sent to 308 individuals including elected officials, all of whom previously submitted post cards to be placed on the Luckey site mailing list.

Additional public participation was encouraged during the Proposed Plan period via legal advertisements announcing the June 19, 2003 public meeting on the Luckey site Proposed Plan in the following newspapers:

- The Blade (Toledo) – June 12 & 15, 2003
- Sentinel-Tribune (Bowling Green) – June 12 & 17, 2003
- West Toledo Herald – June 18, 2003
- Sylvania Herald (Toledo) – June 18, 2003.

The public meeting was held June 19, 2003, from 6:30 p.m. to 8:30 p.m. in the Troy Fire Hall, 313 Krotzer Avenue, Luckey, Ohio, where USACE explained the site history, studies and investigations in areas of contamination, the CERCLA evaluation criteria, the remedial action alternatives, and the project schedule. A court reporter was available at the meeting to record comments. Four members of the public requested the opportunity to speak at the meeting. Comments received at the public meeting and written comments are addressed in the Responsiveness Summary for Luckey Groundwater ROD (Appendix A). All comments received from the public and the State and any other entities have been considered as part of the remedy selection process for this remedial action.

USACE will continue to keep the public informed of the site status and progress through periodic news releases, information meetings, fact sheets, and the public information website. Members of the public may also contact USACE by e-mail addressed to fusrap@usace.army.mil or by calling the Public Information Line (1-800-833-6390).

4.0 SCOPE AND ROLE OF THE RESPONSE ACTION

The Luckey site consisted of the following units that were investigated for necessary response actions:

- Soils (on-site and off-site contiguous soils);
- Site-wide and Off-site Groundwater;
- On-site Buildings;
- Toussaint Creek (including on-site and off-site drainage ditches);
- France Stone Quarry; and
- Troy Township Dump (landfill).

Only site soils and groundwater posed CERCLA-based human and environmental risk and thus were the focus of FUSRAP remedial activities. As indicated earlier, the selected remedy for the soil unit was addressed under a separate Record of Decision released in June, 2006 (USACE 2006).

Based on the results of the Remedial Investigation, the baseline risk assessment (USACE 2000), groundwater modeling (USACE 2001 and 2003), site FS (USACE 2003), the Proposed Plan (USACE 2003a), and recent annual groundwater sampling (Table 2), active groundwater remediation is not necessary. The chosen response action is therefore monitored natural attenuation (MNA) of groundwater upon soils remediation, both of which will ensure the protection of human health and the environment. This remedy is discussed in subsequent sections of this ROD.

This MNA action for groundwater, in concert with soils remedy, is limited to addressing beryllium, total uranium and lead, which are related to the production of beryllium at the Luckey site in support of the nation’s early atomic energy program. Lead was identified as a COC since lead oxide was used as an additive in the beryllium production process. Other constituents not related to AEC activities do not fall under the USACE authority at the Luckey site and are not addressed in this decision document.

5.0 SITE CHARACTERISTICS

The 40-acre Luckey site is located at 21200 Luckey Road in Luckey, Ohio, which is a village of approximately 1,500 people located 22 miles southeast of Toledo (Figure 1). The site lies just north of the village, the inactive France Stone Quarry, and the current Troy Township Dump. Figure 2 displays an aerial view of the site, which is surrounded by predominantly agricultural fields to the north, east, and west. Patches of forests and old fields of varying ages are present throughout the area.

The Luckey site is located in the Eastern Lake Plains section of the Central Lowlands Province, where gentle topography slopes northward toward Lake Erie at approximately 3 to 4 feet per mile (Glaze, 1972). Sand (paleo-beach) and dolomite ridges rise up to 10 ft over the low-lying lake plain. Surface elevations range from 580 ft above mean sea level (amsl) in northern Wood County to 705 ft amsl in southern Wood County (Bush, 1966). At the FUSRAP site, surface elevations range from 647 to 664 ft amsl; anthropogenic activity has created a generally higher topographic feature in the northeast corner of the site.

Other nearby features include the Village of Luckey to the south at ~680 ft amsl; the inactive 70-foot deep France Stone Quarry adjacent to the site; and the easterly flowing Toussaint Creek about 300 meters to the north at ~634 ft amsl at the Lemoyne Road underpass. Figure 3 shows topographic contours of the site, along with the edge of the quarry just south of the site and Toussaint Creek north of the site.

Climate records from Bowling Green (1961 to 1990) and Toledo (1955 to 1986) show that Wood County has a continental temperate climate; average annual precipitation at Bowling Green is 32.77 inches per year and 32.52 inches per year at Toledo. Estimates of evapotranspiration range from 22 inches per year (Harstine, 1991) to 24 inches per year (Lyford and Cohen, 1988) for Wood County (or 67% to 74% of precipitation). These data indicate that 9 to 11 inches of surplus precipitation is available for runoff and infiltration.

Figure 4 shows the Luckey site consists of a large production building and warehouse, two abandoned railroad spurs, and several smaller process and ancillary buildings. The current site owner, Abdoo Wrecking, has removed or demolished several ancillary site structures and now is awaiting full property title transfer before proceeding with further demolition actions unknown to the USACE.

The northeastern corner of the site was a disposal area for lagoon sludges, scrap metal, and other waste materials (Figure 4); spoil piles located in this area consist of excavated soil, process materials, building rubble, and AEC-related ore residuals.

Three former process waste lagoons, designated Lagoons A, B, and C are located in the southeastern corner of the site. In 1949, under Ohio Department of Health (ODH) approval, Lagoons A and B were used simultaneously and contained various sludges generated at different stages of the beryllium processing. Lagoon C likely received waste similar to Lagoons A and B. A fourth lagoon, Lagoon D, was excavated northeast of Lagoons A, B, and C but never used.

Surface water drainage features at the FUSRAP site include several National Pollutant Discharge Elimination System (NPDES) outfalls, storm sewers, drainage ditches, and low-lying wet areas (Figure 5). Site drainage flows to either the main drainage ditch or the western drainage ditch. The main drainage ditch originates on site and flows northerly through the adjacent farm field. The western drainage ditch flows northerly along Luckey Road between the road and the property fenceline; this ditch originates as a road-side ditch that receives some outflow from the

Frances Stone Quarry property. These two primary ditches and other minor drainage flow to Toussaint Creek.

During beryllium production operations, Lagoons B and C discharged to the main drainage ditch; current runoff from roof drains and truck bays at the Production Building, Annex, and several other buildings discharge to the main ditch, as does the on-site sanitary sewage treatment facility (STP) at an NPDES outfall just east of the filter beds.

The western drainage ditch historically received runoff from Lagoon A and currently from NPDES Outfalls 004 and 006, which receive storm water from multiple roof drains (former Laboratory Building, part of the Annex, and other structures), asphalt driveways, and runoff from near the former lime pit.

The 70-ft deep former France Stone Company quarry located directly south of the Luckey site produced lime and crushed stone aggregate for highway work, ship ballast, and flux stone for the steel industry. The standing water in the quarry is not contaminated (USACE 2000). During operation, neither groundwater inflow nor dewatering rates were recorded, although reports indicate it easily was dewatered. The currently inactive quarry has a water level near the ground surface (~646 feet in elevation) and drains to the western drainage ditch along Luckey Road.

5.1 Geology And Hydrogeology

5.1.1 Water Use

National water-use data from 1995, as maintained by the U.S. Geological Survey (USGS), indicate the population of Wood County was 116, 930 people (USGS, 1995); 67,820 were on public water supply systems, 59,680 of which received water from surface water sources and 8,140 received water from groundwater sources. The remaining 49,110 received their water from private domestic supply wells or springs, primarily from the carbonate aquifer. Breen and Dumouchelle (1991) noted that 10 villages in Lucas, Wood, and Sandusky counties used the carbonate aquifer to obtain their public water supply. The 1995 data estimated the daily per capita use of groundwater was about 5 gal per day for residents with private wells. Residents in Luckey, OH generally depend on wells drilled 50 to 80 feet into the carbonate aquifer that starts ~30 feet below the ground surface (bgs). The year-2000 census tabulated a Wood County population of 121,065 persons (or 3.5% growth), which if assumed uniformly distributed would not abnormally stress local groundwater resources.

Most of the glacial deposits in Wood County are poor water-bearing units due to high clay and silt contents (Smith and Sabol, 1994). Paulson (1981) reported water yields up to 20 gal per minute in glacial outwash deposits along the preglacial Napoleon River valley. The glacial sediments at the Luckey site consist of both a shallow silty clay and a deeper discontinuous sand and gravel deposit that either directly overlies bedrock or is found within the till (intra-till layer). The till and underlying sand & gravel zone are considered the shallow groundwater zone, whereas the intermediate zone is the upper 10- to 15-foot thick weathered bedrock zone typically found above more competent bedrock. This intermediate water-bearing zone can sustain domestic well production (Breen and Dumouchelle 1991, after Forsyth, 1968), especially when overlain by the sand and gravel deposits.

The balance of the approximately 300-foot thick Lockport Dolomite contains a regional aquifer that typically yields 10 to 20 gallons per minute (gpm) and maximums of 100 to 500 gpm from secondary porosity features such as solution-widened joints and bedding planes (Smith and Sabol, 1994). Paulson (1981) indicates a highly productive zone occurs from 50 to 80 ft below the surface of the unit (i.e., top of bedrock). Local domestic wells and site production wells (East and West) obtain groundwater primarily from this 30-foot thick zone in the Lockport Dolostone. Other highly productive groundwater zones are associated with northeast-southwest trending vertical fracture sets (Breen and Dumouchelle (1991) after Van Wagner, 1988; Glaze, 1972; Rowland and Kunkle, 1970).

The West Production and East Production Wells previously used for site-worker consumption and operational water are capable of yielding up to 186 gal per minute and 246 gal per minute, respectively. Both wells are installed to a depth of 320 ft or fully penetrating the Lockport Dolomite.

The France Stone Quarry south of the Luckey site acts as a recharge source to the bedrock aquifer, where groundwater flows northerly under the Luckey site towards Lake Erie. A conceptual model depicting the location of the supply wells and groundwater is provided in Figure 6.

5.1.2 Principal Hydrogeologic Units

The hydrostratigraphic units used to evaluate site conditions and develop the numerical model layering is detailed in the Groundwater Modeling Report (USACE 2001). Each hydrostratigraphic unit has similar hydrogeologic properties, groundwater flow, and contaminant transport characteristics. RI-related drilling and sampling provided spatial trends in the upper till, the sand and gravel layers, and the lower till layers, which were interpolated into offsite areas using well information on file at the Ohio Department of Natural Resources (ODNR). Figure 7 shows the overall thickness of the glacial sediments in the Luckey site area (i.e., regional isopach map) and Figure 8 shows a differentiated cross-section along a localized south-north transect through the Luckey site (from Frances Quarry to Toussaint Creek), which illustrates the local hydrostratigraphy listed below:

- Layer 1 - Upper Silty Clay: A glacial diamict (or till) that varies from 5 to 50 feet in thickness, with thinning in the southeast corner of the conceptual model area.

- Layer 2 - Sand and Gravel: A coarse-grained sand and gravel layer commonly coincident with a trough in the bedrock roughly beneath Toussaint Creek north of the site; the unit varies up to 10 feet in thickness. However, site-specific data indicates the unit exists under and south of the site as well. Spatial uncertainty associated with its off-site extent allowed USACE to assign hydrogeologic properties to the unit that are between silty clay (till) and sand and gravel for modeling purposes.

- Layer 3 - Lower Silty Clay: A silty clay that underlies the sand and gravel layer in the northeastern portion of the Luckey site and is similar to the upper silty clay. This lower unit varies up to 29 ft in thickness in the southeast corner of the conceptual model area, and may be non-existent in other areas (i.e., the sand and gravel directly contacts the bedrock). The hydraulic properties of the lower silty clay are similar to the upper silty clay and thus treated similarly for modeling purposes. The extent of this unit is uncertain and extrapolated trends are supported by the lithologies recorded on local water-well logs.

- Layers 4, 5, 6, and 7 - Lockport Dolomite: The Lockport Dolomite was subdivided into four layers to provide a detailed simulation of groundwater flow within the 300-foot thick formation; the upper boundary (or topographic surface) of the bedrock is shown in Figure 9. Model Layer 4 represents the upper 20 ft of dolomite and permits evaluation of groundwater flow conditions characterized by intermediate depth wells completed in the upper 10 to 15 feet of the dolomite. Layer 5 is the 30-foot thick zone extending from 20 to 50 feet below the top of bedrock, which simulates flow conditions represented by deep bedrock wells. Layer 6 is a 50-foot zone between 50 and 100 ft below the top of bedrock and Layer 7 represents the lower 200 ft of the dolomite occurring immediately above the Rochester Shale. Layers 6 and 7 are hydrogeologically similar and present flow conditions near the production wells during the numerical modeling efforts.

- Basal Rochester Shale. Very little site-specific information exists pertaining to the Rochester Shale; although oil-well logs from the area indicate that it occurs about 300 ft below the top of bedrock near Luckey. Breen and Dumouchelle (1991) indicate this low-yielding 20-ft thick unit provides an impermeable basal layer below the carbonate aquifer.

5.1.3 Aquifer Types

Groundwater at the Luckey site is unconfined in the surficial unconsolidated glacial till and semi-confined in the localized sand and gravel units within the till.

Groundwater in the Lockport Dolomite aquifer occurs as both water-table and semi-confined (or leaky-confined) conditions. Unconfined conditions occur in areas where the overlying till is thin (generally less than 20 ft thick) or absent and semi-confined conditions where the overlying till is thicker (generally greater than 20 ft thick). The till allows leakage between local coarse-grained glacial deposits and the underlying carbonate aquifer.

5.1.4 Groundwater Flow

Groundwater in Wood County flows from recharge areas in the south toward discharge zones at Lake Erie and the Maumee River. A potentiometric surface map in Breen and Dumouchelle (1991) shows a groundwater mound beneath the town of Luckey, where shallow bedrock receives greater recharge rates. Groundwater flows radially from the mound, with the exception of no flow toward the southwest.

Groundwater in the vicinity of the Luckey site flows northerly under shallow gradients of roughly 5 ft/mi. Forty-three monitoring wells and piezometers installed at the Luckey site at various depths are listed in Table 1 and shown in Figure 10; well identification numbers designate either (S) for the unconsolidated overburden, (I) for the intermediate zone within the top 10 to 15 feet of bedrock, or (B) for the deep zone greater than 20 ft below the top of bedrock.

Regional bedrock flow (generally in the deep zone) was refined through a survey of on-site and 41 residential wells in November 1999 (Figure 11); a hydraulic depression derived from the operation of site pumping wells at ~70 gallons per minute (gpm) extends beneath the northern half of the Luckey site towards Toussaint Creek and beyond the east and west site boundaries. The pumping rate of ~70 gpm is considered the average rate used by the plant at the time of measurement. These head distributions are exemplified in Figures 11 through 14, which show potentiometry for the various hydrostratigraphic units. Figure 11 shows regional data from residential wells commonly screened between 30 and 50 feet below the top of the bedrock (deep zone); this figure exemplifies the local influence from the site pumping well and overall regional north-northeast to northeast gradients that would govern flow during non-pumping periods. Groundwater flow directions and gradients within the shallow, intermediate, and deep zones (Figures 12, 13, and 14, respectively) are similar.

Groundwater elevations near Toussaint Creek indicate a weak losing condition occurs while the production wells are operating, with little potential for bedrock groundwater to move off site toward Toussaint Creek. The creek appears to weakly gain groundwater from the glacial sediments when the production wells are turned off, thus indicating the creek is potential receptor of contaminated site groundwater (USACE 2001). Figures 15 and 16 show the predicted potentiometry for a non-pumping condition in the glacial sediments and bedrock.

The cone of influence from the operational production wells indicates little potential for groundwater in the bedrock to migrate to Toussaint Creek or downgradient residential wells. However, shallow well data indicate that groundwater in the unconsolidated sediments beneath the northeast portion of the site property may move off site to the north. In addition, the potentiometry also shows that a slight upward gradient (from bedrock to glacial sediments) exists in the northeastern portion of the site, thereby reducing the downward migration from soil contamination in this area.

Groundwater levels distal from the site (e.g., west and east of the Luckey site in Figure 11) show an overall northerly to northwesterly flow, which would be expected at the site when the Production Well(s) are not operating. The waste storage and eastern lagoon areas both exhibit standing water that creates a groundwater mound (see Figure 12) that could disperse contaminants upon pumping cessation.

When the production wells are not operating (as estimated in Figures 15 &16), the semi-confining glacial sediments (till and sand & gravel) may exhibit lower heads than the bedrock zones. The unstressed head differentials and apparent vertical gradients between the shallow, intermediate, and deep zones indicate that the potential for shallow-zone contamination to migrate into the intermediate or deep zones is much less during non-pumping periods. The current site condition (non-pumping) is amenable to the effectiveness of the selected remedy.

5.1.5 Groundwater Levels

Hydrographs indicate seasonal water level variations in all three zones (shallow, intermediate, and deep) vary significantly on an annual basis. Seasonal groundwater levels show recharge occurring during the mid summer (July and August) and lower levels (discharge) during November.

The periodic water-level measurement variations listed in the RI (USACE 2000) range between 0.45 feet (ft) at MW-26(S) and 17.22 ft at MW-39(B) with an average variation of 3.22 ft; continuous recorder data ranged from 1.24 ft at MW-13(S) to 21.22 ft at MW-39(B) with an average of 4.15 ft. If deep wells MW-34(B) and MW-39(B) are omitted from the dataset, the average fluctuations are 2.68 ft and 3.25 ft, respectively. The heads in wells MW-34(B) and MW-39(B) were influenced by the East Production Well and a nearby residential well. Wells completed at different depths within the carbonate bedrock were observed to have similar water levels, suggesting that the water-bearing zones are weakly interconnected (Paulson, 1981).

Since seasonal variations are generally similar in site monitoring wells (i.e., track the same recharge and discharge periods and recharge responses), it is assumed that flow directions are similar throughout the year and thus short-term, small-scale vector variations are ignored.

5.1.6 Hydraulic and Hydrogeologic Parameters

Physical parameters used to assess groundwater flow and contaminant transport include recharge and discharge characteristics, hydraulic conductivity, porosity, bulk density, and organic carbon content (USACE 2003).

Recharge to the carbonate aquifer (depicted in Figure 6) occurs through leakage through the glacial till, direct infiltration of precipitation in areas where the glacial till is thin or absent, direct infiltration of surface water into the carbonate bedrock at the France Stone Quarry, and infiltration of surface water through streambeds. Breen and Dumouchelle (1991) estimated higher recharge to the carbonate aquifer occurs where the till is less than 20 ft thick or absent and much less in areas of thicker till (>20 ft thick).

Site-specific water-balance estimates indicate 9 to 11 inches of precipitation is available for recharge and runoff. Paulson (1981) noted that recharge to the carbonate aquifer began during November and peaked in May, with about a four-week lag between precipitation events and infiltration response in wells. Precipitation during late spring and summer periods normally is consumed by evapotranspiration and soil moisture deficits in the surficial till. Groundwater recharge values vary between 4.1 inches per year (in/y) where the till is thin (<20 ft thick) to 0.14 in/y where the till thickens to over 20 ft.

Groundwater discharges from the unconsolidated sediments to local ditches and streams (mainly Toussaint Creek) and vertical leakage down into the carbonate aquifer. The carbonate aquifer then discharges to local and regional rivers, streams, lakes and quarries (via evaporation or dewatering); domestic and municipal supply wells, artesian springs, and flowing wells also are discharge features for the aquifer. Breen and Dumouchelle (1991) stated that the Maumee and Portage River networks are regional discharge features for these groundwater systems.

Hydraulic conductivity values determined using slug test data from six wells varied between 0.028 ft/day and 126.3 ft/day in the unconsolidated sediments, and between 0.027 ft/day and 18.160 ft/day in bedrock (USACE 2003). This heterogeneity is due to differences between the silty clay till and the sand and gravel deposits, as well as the degree of weathering and fracturing of the carbonate bedrock. For both the overburden and carbonate units, the measured hydraulic conductivities are within the range of published literature values for the respective lithologies.

Geotechnical data collected during the RI and from the literature include porosity and specific yield (USACE 2000, Domenico and Schwartz 1990, Kruseman and de Ridder 1992); total porosity for the glacial deposits ranged from 19.1% (silty sand and gravel deposit) to 37.3% (silty clay till). Specific yield (or effective porosity) data input to the transport model was 6% for the silty clay till, 16% for sandy deposits, and 14% for weathered limestone.

Dry bulk density for 13 samples collected from the glacial deposits ranged from 1.77 grams per cubic centimeter (g/cm3) to 2.19 g/cm3 (or 110.2 to 136.5 pounds per cubic foot [lb/ft3]) with an average dry bulk density of 1.92 g/cm3 (120 lb/ft3). Bulk density values for the Lockport Dolomite were not determined during the RI but literature-based density values (USACE 2001) range between 2.68 to 2.84 g/cm3 (167 to 177 lb/ft3).

The total organic carbon content (TOC) in the soils, glacial sediments, and dolomite bedrock was not quantified during the RI fieldwork, although TOC of the local Hoytville Clay ranges from 4.2 to 6.5% (usually more than 5%) as reported in the soil survey for Wood County. The mean organic carbon content dissolved in the carbonate aquifer was calculated at 2.1 ± 1.2 milligrams per liter (mg/L) based on the results from 143 groundwater samples (Breen and Dumouchelle, 1991).

5.2 Constituents Of Concern

The RI, FS, and Proposed Plan (PP) (USACE 2000, 2003, and 2003a) identified site features, defined the nature and extent of constituents, evaluated risks to human health and the environment, and developed remedial alternatives to address constituents associated with site COCs. The potential for soil-based COCs to migrate to groundwater was evaluated through a multi-step process, where site soil data were compared to background and risk-screening values. This process is detailed in USACE (2001 and 2003) and employed statistical data distribution analyses, weight of evidence criteria, risk-based exposure point limits, and promulgated limits.

Soil-based contaminants of potential concern (predecessors to site COCs) listed in the RI (USACE 2000) that are not evident in groundwater or exhibited less than 2 feet of vertical migration in soil cores were considered immobile contaminants and removed from consideration. This multi-step vetting process indicated that soil contaminants which may leach to groundwater in excess of regulatory limits (MCLs) include beryllium, lead, radium-226, thorium-230, uranium-234, and uranium-238 (short-lived daughter radionuclides such as actinium-228, thorium-227, and thorium-234 are assumed in equilibrium with parents).

The baseline risk assessment (BRA) and inclusive human health risk assessment (HHRA), as well as modeling analyses (USACE 2000 and 2003), evaluated these contaminants against their respective ARARs and determined that groundwater COCs are a risk to human health and the environment. These COCs include beryllium, lead, and total uranium (mass), which have the EPA MCLs of 4 µg/L, 15 µg/L (as an action level or AL), and 30 µg/L, respectively.

5.3 Impacted Groundwater

Knowledge of both historical operations and recent site conditions form the basis for this groundwater ROD and Performance Assessment Program. Site features depicted in Figure 4 include potential sources for groundwater contamination: disposal trenches 1 through 7, lagoons, above-ground storage areas, filter-bed areas, drainage-ditch dredge spoils, and wind-blown deposition. The on-site soils, waste, and debris impacted by AEC-related activities that exceed unrestricted land-use cleanup goals are estimated in Figure 17, which shows approximately 60,000 cubic yards of material may be removed (Argonne National Lab, May 2007 estimate).

Groundwater samples collected from on-site wells do not indicate a contiguous plume of COC-contaminated groundwater, although beryllium levels has been evident historically above the MCL of 4µg/L in five wells, including the West Production Well; MW-26(S) showed the maximum detected value of 170 µg/L in June 2001. Lead historically existed above the drinking water action level (AL) of 15 µg/L in three wells, with a maximum detected value of 48.5 µg/L at MW-21(I) in June 2001. Uranium was detected historically above the MCL of 30 µg/L in two wells, with a maximum detected concentration of 390 µg/L in MW-24(S) in June 2001. Figure 10 depicts the locations where beryllium, lead, and uranium have been detected historically or recently in groundwater above cleanup goals (USACE 2006).

Sampling data from the RI/FS-based efforts (USACE 2000 and 2003) and annual groundwater sampling from 2004 to 2007 confirms the continued presence of COCs in site groundwater, albeit at different levels (see Table 3 and Figures 18, 19, and 20). These datasets show COC concentrations at the site offer no long-term increasing trends indicative of gross transport from soil contamination areas.

- Beryllium has declined in wells MW-02(S), and -19(I), and remained relatively steady in MW-01(I), and PW(W). Recent data (2005, 2006 & 2007) show only wells MW-01(I) and -02(S) still exceed the MCL of 4 µg/L. The exceedance at shallow well MW-26(S) in 2002 has not been reconfirmed recently due to commonly dry conditions (i.e., the well is 15 feet deep, where the balance are normally 20 feet or more). The ROD performance monitoring program includes MW-26(S) to assess Beryllium source areas; recharge season (spring) sampling will be the preferred timeframe to ensure site well production.
- Lead appears to fluctuate in MW-21(I), -24(S), and MW-26(S), although positive trends do not appear prevalent. Despite these positive detections, only well MW-21(I) currently exceeds the AL of 15 µg/L.
- Total Uranium in MW-24(S) has declined from early sampling results and still exceeds the MCL of 30 µg/L; 2006 and 2007 sample results show a progressive 50 µg/L increase since the 2005 low value of 165 µg/L. However, the recent 2007 value of 215 µg/L is still below the population average of 243 µg/L for all uranium results. MW-21(I)

exceeded the MCL once in June 2001 and has maintained below-MCL values since, although the 2007 calculated value of 27.5 µg/L shows a slight rise from previous values.

Currently, only four site wells exceed MCLs or ALs: MW-01(I), -02(S), -21(I), and -24(S). The recent increases of uranium at MW-21(I) and -24(S), and beryllium slightly in MW-01(I), may be indicative site disturbances in 2006 and 2007 (e.g., building demolition) and flow pattern changes from cessation of the pumping well(s). All groundwater sampling results from the deep bedrock zone, some of which have been sampled up to eight times throughout the CERCLA process, show non-detects for site COCs (i.e., J- and/or U-flagged data at or near COC-specific minimum detection limits or MDLs). Both the RI and pre-ROD annual groundwater sampling will continue to provide baseline data prior to the soils remedy; the performance monitoring period will begin concurrently with the soils remedy to best monitor groundwater conditions during and after soil remediation.

The fluctuating to reducing (but not rising) trends indicate natural attenuation will advance once remedial measures remove contaminated soil, waste, and debris from the site, which will preclude their further leaching to groundwater. In other words, the data trends generally reflect a transport system in equilibrium with the current contaminant leaching source (non-rising trends), so the source removal will facilitate lower trends towards MCL values.

In general, groundwater COCs are found in the upper unconsolidated silty clay till and to a lesser extent in the intermediate sand and gravel zones; deeper groundwater in the bedrock is not impacted (with the exception of the West Production Well that also draws groundwater from upper layers). The groundwater COCs are found in noncontiguous wells and thus connected plumes exceeding cleanup goals are not presented. Consequently, groundwater transport scenarios of each remedial alternative (USACE 2003) were designed to evaluate remedial effectiveness from point-specific or small areas to assess cleanup goals for groundwater (USACE 2001).

Water-level fluctuations and COC concentrations appear to be interdependent. Beryllium in shallow wells MW-02(S) and MW-26(S) produced total (unfiltered) beryllium results of 70.8 µg/L and 137 µg/L, respectively, during a June 2001 high-water event. Beryllium concentrations subsequently dropped as water levels declined through November 2001: MW-02(S) to 35.1 µg/L and MW-26(S) to 38.6 µg/L. Beryllium also was detected slightly above cleanup goals in MW-19(I) during wet-season periods, although June 2005 sampling shows a decline to 3.1 µg/L from 6.0 µg/L in 2004. This positive correlation indicates the soil remedy (removal) will promote natural attenuation since high groundwater periods will not have a soil source term to seasonally enrich the groundwater with site COCs (i.e., recontaminate groundwater where the COCs already were attenuated to equilibrium).

Lead was detected consistently above cleanup goals in unfiltered samples from MW-21(I), with a maximum detected value of 47 µg/L that lowered to 25.5 µg/L in 2005; MW-24(S) had a filtered result of 15.9 µg/L in 2001, which has declined to 4.2 µg/L in 2005. Unfiltered groundwater samples were normally slightly higher in lead due to sorption to soil particles possibly in the samples. The overall dataset indicates that 10% of lead is removed by field filtering samples.

Uranium was consistently detected above cleanup goals in MW-24(S), with a maximum detected value of 390 µg/L (as converted from U-238 results in pCi/L according to USACE 2003, see Table 3 notes). Uranium declined through 2006 to a value of 174 µg/L, although elevated in 2007 to a calculated value of 215 µg/L. No other detections above the uranium MCL were reported.

Sampling results in Figures 18, 19, and 20 show reducing to steady-state (with fluctuation) trends in contaminated wells; these data trends show unfiltered (conservative) sampling results. A comparison of the filtered and unfiltered data from 2002 to 2007 (using Table 3 values) shows that the average dissolved (filtered) beryllium and lead results are 90-95% of their unfiltered (total) values (i.e., only 5-10% of these species are retained on a 0.45 micron field filter). Uranium (isotopic or mass) was sampled only for unfiltered species to ensure conservative values are used in site decision making processes; USACE expects that a corresponding dissolved/total uranium value would be similar to the other COCs (e.g., 90% or higher). These data show that groundwater COCs exist predominantly in a dissolved state at the Luckey site.

Section 12.9 discusses future monitoring programs that may include both filtered and/or unfiltered sampling techniques; for conservation, the total sampling results (or calculated equivalents) will be used to assess future groundwater quality and COC attenuation. Groundwater COC sampling data collected since 2000 using low-flow techniques are summarized on Table 2 and annual sampling data on Table 3.

The non-pumping condition (i.e., no production wells in operation) now maintained by Abdoo Wrecking will affect contaminant migration by promoting hydraulic gradients that may lessen the migration of shallow contamination towards bedrock zones. This is supported in USACE (2001), which showed a slow northerly to north-northeasterly transport in the shallow and intermediate zones, versus a more vertical vector derived from pumping related drawdown in the deeper zone.

Modeling (USACE 2006) has estimated that the groundwater COCs at Luckey likely originate from the following sources (see Figures 4 and 17 for mentioned entities):

- Wells MW-01(I), MW-02(S), and MW-21(I) are near the disposal areas, lagoons, trench 5, and the bare-earth spot, where elevated concentrations of beryllium are found in soil

- Well MW-26(S) is near trenches 5 and 4 and exhibited total beryllium concentrations ranging from 170 µg/L in June 2001, to 57.7 µg/L in November 2001, to 119 µg/L in June 2002. The high values may be derived from high water levels contacting beryllium-contaminated trench bottoms.

- The West Production Well may be partially contaminated by Lagoon A overflow towards the Luckey Road ditch, which contaminated soil just west of the well.

- Wells MW-21(I) and MW-24(S) near trenches 2 and 4, the bare-earth spot, the Lagoon B area, and trench 6, which show lead contamination in soil and groundwater.

- Well MW-24(S) consistently shows uranium above cleanup goals; one elevated result was detected at MW-21(I). The uranium contamination may be derived from discharges to Lagoon B, which was 5 to 6 feet deep during its operation or about 1 to 2 feet above the water table.

The FS (USACE 2003) and the Groundwater Modeling Report (USACE 2001) provide the following conclusions regarding site soil contamination relationships to groundwater:

- Water levels from June 2001 are proximate to or contact Trench 4 bottoms and fall within several feet of Trenches 2 and 5 bottoms, which may intersect sand and gravel layers below the trenches. This preferential transport pathway has been exemplified through borings and groundwater monitoring results from wells MW-26(S), MW-01(I), and MW-02(S) installed near the trenches, most specifically trench 5.

- The proximity and depth of Lagoon B in relation to water levels and contamination in well MW-24(S) indicates dispersion from old Lagoon B is entering the underlying clay-rich till near MW-24(S).

6.0 CURRENT AND POTENTIAL FUTURE LAND AND RESOURCE USES

Current land use at the Luckey site is industrial and is expected to remain industrial for the near future. The property is currently zoned light industrial. Wood County has a comprehensive plan (Wood County 1998) for Troy Township that acts as a guide for zoning and future use. It states the property is an expansion area for the Village of Luckey, indicating the village is slated to grow into the area. Given the current zoning designation, the most likely future expansion use for the property is industrial or commercial use. However, it is possible the future use could be residential or agricultural for several reasons; the surrounding land use on three sides of the Luckey site is agricultural and residential, which are the dominant land uses throughout Troy Township.

In addition, there is no other industry in the immediate area and industrial facilities at the site are aging. The most recent deed to the property (a quitclaim deed from Goodyear on April 1, 1987) lists no specific restrictions or easements that would preclude residential or agricultural land use. Therefore, the reasonable future site use identified for the Luckey Site is subsistence farming and is considered to be the critical exposure group for further evaluation and protection.

7.0 SUMMARY OF SITE RISKS

The Baseline Risk Assessment (BRA) detailed in USACE (2000 and 2003) provides a quantitative estimate of potential risks to human health and the environment from chemical (elemental) and radiological constituents at the Luckey site. In accordance with United States Environmental Protection Agency (EPA) guidance, the primary health risks investigated were cancer and other chemical-related illnesses (non-cancer), as well as ecological risks. In addition, radiological dose rates were determined for exposure to radionuclides. The purpose of the risk assessment was to determine the need for cleanup and provide a baseline to compare remedial alternatives. A brief summary of the radiological and chemical health risks, as related to the groundwater pathway, is provided herein.

The overall objectives of the Luckey site risk assessment were to:

- Identify areas that do not pose unacceptable risks to human health or the environment, and thus require no further action.
- Develop a list of COCs that contribute unacceptable risks to human health or the environment for each exposure unit.
- Estimate potential risks to human health and the environment associated with the Luckey site if no remedial action or administrative controls exists.
- Develop risk-based concentrations (RBCs) and/or action levels for the identified COCs in order to focus remedial resources on significant contributors to risk.

An exposure assessment performed in the BRA identified current and future populations that may be exposed to constituents of potential concern (COPCs) in the groundwater exposure unit (EU), which includes both on- and off-site groundwater listed as EU 7 in USACE (2000).

Environmental media that may transport contaminants to receptors were identified (e.g., soil and groundwater), as well as the route of uptake for the receptor (e.g., ingestion, inhalation, or absorption). An exposure point concentration (EPC) for each COPC for each receptor was then estimated. The toxicity of the various COPCs was estimated using current data from sources approved by the USEPA. The EPC, exposure assessment, and toxicity data all utilized conservative assumptions that build in additional safety factors for the public.

USACE considered both non-cancer risks and cancer risks. For non-cancer health effects, the Risk Based Concentrations (RBC) are based on a total hazard index (HI) for each pathway, which is based upon the tabulation of chemical-specific hazard quotients (HQs) for all preliminary COCs for each pathway. For non-carcinogens, acceptable exposure levels are concentrations that do not exceed a HI of 1.

For cancer risks, the acceptable risk-based range established by CERCLA exposure levels represent an upper bound life-time cancer risk to an individual of 10E-4 (1:10,000) to 10E-6 (1:1,000,000), using information on the relationship between dose and response. An incremental lifetime cancer risk (ILCR) of 10E-6 corresponds to the conservative end of the acceptable risk range (EPA 1990).

7.1 Human Health Risk Assessment (HHRA)

The HHRA evaluated risks from soil and groundwater to industrial workers (on-site), resident farmers (off-site), and adolescent trespassers (off-site). Future land use receptors include those identified as current receptors and subsistence farmers (on-site). Because groundwater is the source of drinking water to previous site occupants and current residents in the vicinity, site groundwater was considered a drinking water source in the HHRA.

The risk assessment followed EPA's Risk Assessment Guidance for Superfund (RAGS) (EPA 1992), which requires that the modeling include a Reasonable Maximum Exposure (RME) scenario, where an individual would be exposed to the constituents on the properties for prolonged periods of time. Lead was evaluated using EPA's Integrated Exposure Uptake Biokinetic Model (IEUBK) for Lead in Children (EPA 2001). For current and future land uses, the residual radioactivity model software, Residual Radiation Computer Code (RESRAD, Version 6.1), was used for radiological contaminants in soil (Yu 1993).

Chemical and radiological constituents are identified as preliminary COCs if they contribute significantly to total risk (i.e., the concentration or activity must be reduced in order to reduce total ILCR below target levels).

Risks due to exposures to contaminated soil are summarized in the soils ROD (USACE 2006).

The site-wide EPC for groundwater did not indicate that beryllium or uranium would pose an unacceptable risk to hypothetical residents who might drink site groundwater. However, there are localized areas of contamination in the groundwater that could pose an unacceptable risk to human health if that groundwater was consumed. In addition, there is no established safe level for lead in drinking water, and areas of the site groundwater contain lead concentrations above the action level (AL) found in 40 CFR 141. Therefore, a remedial action must be taken in order to mitigate these potential risks.

The potential for COCs to leach from soils to groundwater was evaluated using the SESOIL model, which indicated COCs detected in soils at concentrations equal to those established as cleanup goals in the 2006 soils ROD would not leach through the clay-rich tills to the bedrock groundwater at concentrations which would pose an unacceptable risk via drinking the groundwater (USACE 2003).

Thus, the cleanup goals developed for soil (USACE 2006) are assumed to be protective of groundwater and support the delineation of soil sources that must be removed to allow the groundwater remedy to be protective and effective.

Furthermore, soil cleanup objectives for beryllium, uranium, and lead, in conjunction with use of MCLs as cleanup targets for groundwater, are protective of all exposure pathways. The RESRAD model calculated that uranium leaching from soil remediated to the uranium soil cleanup goal would not impact groundwater and thus preclude consumptive uses. For beryllium, the groundwater cleanup goal is the ARAR-based MCL of 4 µg/L, which equates to a child HQ of approximately 0.2. Consequently, drinking water containing beryllium at the MCL would not contribute significantly to risks above and beyond risks due to exposure to soils alone. The AL for treatment technology of 15 µg/L will be used as groundwater cleanup objective (see 40 CFR 141). Section 8.1 details the promulgated regulations that institute these objectives.

7.2 Groundwater Modeling Summary

Site soil, groundwater, and hydrogeologic sampling data derived from the FUSRAP efforts (USACE 2000, 2001, 2003), previous investigations, and a literature review were input to several different models to predict contaminant leaching from soil and wastes and resulting contaminant transport (fate) in groundwater. The models then were used to support the evaluation of remedial alternatives in the FS report (USACE 2003). The following models were used in the decision-making processes leading to this groundwater ROD:

- The PHREEQC code (Version 2), Speciation, Batch-Reaction, One-Dimensional Transport, and Inverse Geochemical Calculations by the USGS (Parkhurst and Appelo 1999) was used to geochemically model COC solubility, ion exchange, and speciation.
- The SESOIL code (Seasonal Soil Compartment Model) was used to simulate transport of constituents from contaminated soil zones to the groundwater (see SESOIL v.3 by General Sciences Corporation, 1998).
- A calibrated groundwater flow model of the Luckey site was used to predict contaminant flow paths within site groundwater; see "Luckey Site, Luckey, Ohio, Final Groundwater Model Report" prepared for U.S. Army Corps of Engineers, Buffalo District, by SAIC, February 2001. The U.S. Geological Survey (USGS) MODFLOW code (McDonald and Harbaugh 1988) was used in conjunction with the MODPATH particle tracking code (Pollock 1994).
- The MT3DMS code (Zhang 2000) was used in conjunction with MODFLOW to simulate contaminant transport within the groundwater flow field, as detailed in USACE (2003).

7.2.1 Model Data Development

These modeling efforts assumed several site conditions to simplify the groundwater flow system and transport processes. All assumptions are detailed in USACE (2001), although the most significant are listed below:

- The secondary porosity features in the Lockport Dolomite (i.e., solution-widened fractures, joints, bedding planes) are simulated as an equivalent porous medium.
- Site Production Well operations reflect historic use and have a steady-state effect.
- A single steady-state flow condition was field calibrated and ignores minor seasonality.
- Potentiometry from the regional residential well survey provided boundary conditions.
- Site-specific hydrogeologic parameters are representative of regional hydrostratigraphy.
- The Frances Stone quarry is a recharge source to the local groundwater flow system.
- Higher recharge rates occur where overlying till is thin (<20 ft thick) or absent.
- RI-based groundwater sampling results represent source concentrations for site COCs.
- The simulated groundwater flownet developed for pumping and non-pumping conditions remain unchanged throughout the simulation.
- Literature-based soil-groundwater partition coefficients (Kd values) are acceptable for predictive transport simulations.
- Current site conditions are the "starting point" for all transport simulations.

7.2.2 Geochemical Modeling Using PHREEQC

Modeling of the chemical speciation and solubility of beryllium and uranium was done to support site-specific transport modeling of these constituents. Site hydrogeochemical modeling using the USGS PHREEQC geochemical model (Parkhurst and Appelo 1999) estimated the solubility, ion exchange behavior, and speciation of beryllium and uranium in groundwater at the site. Lead was not assessed since only limited exceedences were evident at well MW-21(I) (Figure 19). The beryllium and uranium results then were used as input to the SESOIL and MT3DMS models; literature values were used for lead input to these two subsequent models.

Luckey site groundwater is characterized as a calcium-magnesium-sodium water with lesser amounts of potassium and iron. The primary anions include bicarbonate (HCO3-1), carbonate (CO3-2), chloride (Cl-1) and sulfate (SO4-2). Groundwater temperatures average 13 ^{o}C, Eh varies from –100 to +100 mV, and pH varies between 7 and 8. The solubility of site species is dependent on the ionic distribution of calcium and sodium together with alkalinity (bicarbonate plus carbonate) and sulfate. Groundwater chemistry from wells MW-24 and GW-004 (small site production well) represented site conditions (USACE 2003).

Beryllium, a positive divalent ion, speciated with bicarbonate (aqueous-phase or dissolved species) and bromellite (BeO), which is the controlling phase for precipitation. When the concentration of calcium is high, the concentration of beryllium is low due to carbonate competition and bromellite speciation that lessen leaching to and transport in groundwater.

The solubility of uranium at 13 ^{o}C and in a mildly reducing Eh of -100 mV (as seen in the shallow groundwater zone) was controlled by uranium hydroxide ion [U(OH)5 -1] as the aqueous phase specie and uraninite (UO2) was the controlling solid phase, both of which have low mobility and moderate to low solubility. For oxidizing Eh values of +100 mV, uranium formed more mobile (soluble) uranyl carbonates that offset soil Kd values (i.e., the carbonate specie does not partition to soil like the hydroxide or oxide species and thus is more mobile).

7.2.3 SESOIL Modeling Results

The SESOIL model of site conditions estimated the migration (or leaching) of AEC-related constituents from the impacted soils to groundwater, which was then input as a contamination load to the groundwater flow model. The SESOIL infiltration (groundwater recharge) was calibrated to 2 in/y and a sensitivity analysis was completed to evaluate the uncertainty of model input parameters. It should be noted that the MODFLOW model discussed in Section 7.2.4 was calibrated to 0.4 in/y of recharge, thereby indicating the higher-flow SESOIL results are a conservative estimation of the leaching site conditions.

Simulations were developed to predict the migration of beryllium, lead, and uranium (i.e., the groundwater COCs) through the soil at the Luckey FUSRAP site. Initial concentrations were assumed to be one foot above the water table to reflect lagoon bottoms and trench fill. Both baseline (contaminated) conditions and remediated soil conditions were modeled to ensure that soil cleanup goals were protective of groundwater; results were positive. The input parameters for the SESOIL simulations are detailed in Appendix 6A of the FS (USACE 2003); Table 6A.2 of FS Appendix 6A provides references for final input values used in this model.

Results for each groundwater COC are summarized below; note the cleanup goals are from the soils ROD (USACE 2006):

Beryllium
The simulation using the beryllium cleanup goal of 131 µg/g for site soil and a Kd value of 8,000 mL/g indicates that beryllium remediation to concentrations established in the soils ROD (USACE 2006) will not adversely impact groundwater and are protective.

A simulation using the highest observed concentration for beryllium (757 µg/g) indicated that beryllium failed to migrate through 1 ft of silty clay soil into the groundwater at concentrations exceeding the beryllium MCL after a 1,000 year simulation period.

Lead
Two lead simulations assessed the soil cleanup goals and observed conditions. The lead soil cleanup goal of 400 µg/g and a Kd value of 1,830 mL/g failed to leach lead to groundwater at concentrations exceeding the AL of 15 µg/L. The second simulation of observed lead at 228 µg/g also failed to impact groundwater at concentrations exceeding the AL after the 1,000-year simulation.

Uranium
Two uranium simulations were compiled. The first with soil assigned the U-238 cleanup goal of 26 pCi/g (or the mass-equivalent total U concentration of 77.2 µg/g) and a Kd of 500 mL/g, which did not impact groundwater at concentrations exceeding the MCL of 30 µg/L. The second simulation with U-238 at 6.27 pCi/g (or a mass equivalent of 18.63 µg/g) also showed minimal uranium migration in 1,000 years. Two similar simulations with uranium Kd values lowered to 250 mL/g also did not impact groundwater within the 1000 year period. These simulations indicate the soil cleanup goal for U-238 of 26 pCi/g is protective of groundwater at the Luckey site.

Since the SESOIL calculated minimal transport of COCs through the clay-rich tills and not the observed groundwater concentrations, sensitivity simulations were run for beryllium and uranium. These tests included higher recharge variables (up to 5.4 in/y), very low Kd values (as low as 0.79 mL/g for beryllium and 10 mL/g for uranium), and very high solubility (as a non-limiting variable). The tests indicate that observed trends in groundwater require very low Kd values and thus further support the likelihood of preferential pathways are transporting COCs to groundwater via the sand and gravel layers in contact with the waste trenches and lagoons (USACE 2003). These coarse lenses would have lower distribution coefficients and higher hydraulic conductivities (K) than the ambient till and create preferential pathways for contaminant migration. Simulations were not run for lead since it is a relatively minor COC.

A Kd value of 15 mL/g for uranium was used in the RESRAD model to determine soil cleanup goals, which produced a conservative goal for uranium in all glacial soils; this Kd is indicative of sandy material and attempts to account for the sand lenses in contact with the trench/lagoon inverts and resulting preferred groundwater transport pathway (USACE 2003).

The synergistic transport mechanisms of coarse-grained deposits contacting the bottom of the trenches (and possibly lagoons) and high groundwater levels during recharge periods promote a groundwater contamination scenario that should promote dispersion and migration, as discussed in Section5.3.

7.2.4 Groundwater Flow Model Results

The groundwater flow model is detailed in the Groundwater Modeling Report (USACE 2001) and provided a deterministic tool to understand local groundwater flow, identify data uncertainties, predict the behavior of groundwater remediation scenarios, and support risk-assessment scenarios developed for the FS (USACE 2003).

The geologic units of interest at the Luckey site are summarized in Section 5.1.2 and were digitally interpolated to a level of accuracy acceptable to simulate site-related groundwater flow. Simplifying assumptions used in the numerical model were discussed in Section 7.2.1.

Water-level data measured in November 1999 were used as calibration targets for the groundwater flow model because the dataset includes residential- and site-well potentiometry.

The modeled water budget (inflows and outflows) of the groundwater flow system included inflows from precipitation recharge, vertical leakage across layers, recharge from surface water bodies, and lateral flux of groundwater into the flow system. Outflows consisted of removal through pumping, vertical leakage across layers, discharge to surface water bodies, and lateral flux of groundwater out of the flow system. Evapotranspiration was included in the recharge estimates.

The conceptual water budget included estimates for recharge and lateral groundwater fluxes into and out of the model; groundwater entered along the southern model boundary eventually exits across the northeast and northwestern boundaries, with internal boundaries and sinks being included. These conceptual assumptions and resulting analytical estimates provided a range of values to assess numerical model accuracy. The calibration of the groundwater flow model was performed using an iterative process that achieved a good match to the observed potentiometry (November 1999). Model residuals (observed minus simulated heads) all fell within acceptable limits with respect to overall groundwater flow (USACE 2001), indicating good calibration. The volumetric water budget had a -0.01-percent discrepancy and both Production Well pumping and non-pumping scenarios were compiled to assess pumping effects on groundwater and contaminant flow.

7.2.5 Groundwater Pathway Analysis

The calibrated groundwater flow model was used to assess flowpaths during pumping and non-pumping periods, which supported remedial alternative analyses for the site. Particle tracking techniques using the USGS particle tracking code, MODPATH, estimated the movement of hypothetical water particles in the groundwater flownet beneath suspected sources of contamination, from areas feeding proposed extraction and current site production wells, from areas contributing groundwater to discharge features, and from recharge areas when production well pumping was ceased. These scenarios are detailed in USACE 2001 and 2003.

The East Production Well normally discharges at 75 gpm and draws groundwater from below the entire site, the former France Stone Quarry, as well as the northern property (Figure 21). Water particles travel over 1000 years to the East Production Well from distal areas in the north. A simulation with the East Production Well at 15 gpm and West Production Well at 60 gpm produced similar conditions, with more water being drawn from under the Town of Luckey. These simulations indicated that the Production Well(s) would eventually capture all COCs in groundwater at the Luckey site.

A transient-state simulation without Production Wells in operation produced groundwater level increases of up to 13.1 ft in the upper and intermediate zones (Layers 1 and 4) that then simulated a predominantly northern (to northwestern) flow from the quarry towards Toussaint Creek. A corresponding particle tracking analysis indicates that contaminants in the shallow zone under the lagoons, the disposal trench area, and along the northern site border would migrate into the silty clay till layer (Layer 1), with minor migration through the sand and gravel (Layer 2). Flow in the sand and gravel is north-northwesterly towards Toussaint Creek and will require over 50 years to discharge to the creek. Water particles placed in Layer 4 (weathered bedrock) under the lagoons flow north-northwesterly toward Toussaint Creek, where they discharged, on average, in approximately 41 years (the earliest particles reach the creek in 16 years).

To assess impacts from a potential reopening of the former France Stone Quarry, a sump collection system was simulated in the northeast corner of the quarry in Layer 6 while the East Production Well was operating. The resulting stresses dewatered the glacial sediments in the southeast quarter of the model, drew water from the bedrock throughout the entire model domain, dried the intermediate bedrock zone, and caused Toussaint Creek to become a fully losing stream. Particles from contaminant areas on the Luckey site were drawn into the production well between six years and 10 years and into the quarry sump between seven and 17 years. The reopening of the quarry is unlikely and a greater potential to be used for recreation or irrigation water, which would not be affected by site contamination (USACE 2003).

These timeframes are only for advective transport of water and would be significantly longer for site COC transport due to partitioning properties of site soils.

7.2.6 Groundwater Transport With MT3DMS

The fate and transport of groundwater COCs were simulated the USGS contaminant-transport model, MT3DMS (Zhang and Wang, 1999), which was coupled to the MODFLOW groundwater flow model. COCs within the simulated flow field were defined using observed concentrations (RI data) and leaching rates predicted with SESOIL.

The results from the transport simulations provide information on the time frames required for attainment of ARARs, the likeliest migration pathways, and regions where groundwater impacts above ARARs may occur in the future. Flow and transport conditions for each FS-based alternative were simulated to predict the spatial and temporal fate of each groundwater COC.

MT3DMS input parameters were consistent with SESOIL input; distribution coefficient (Kd) values for each constituent in each major model layer are listed below:

- Beryllium: 8000 L/kg in the Till, 62 L/kg in Sand & Gravel, 0 for Bedrock
- Lead: 1830 L/kg in the Till, 234 L/kg in Sand & Gravel, 0 for Bedrock
- Uranium: 10 L/kg in the Till, 0.06 L/kg in Sand & Gravel, 0 for Bedrock

The alternative leaching mechanism(s) for transporting COCs into groundwater, as discussed in Section 7.2.3, were considered in this model by conservatively lowering the Kd values for uranium (the COC with highest concentrations) to better reflect the observed contamination and allow transport to occur for predictive risk analyses. Contaminant distributions input to the model were derived from a June 2001 sampling event, which provided higher (conservative) concentration values due to coincident recharge events, as discussed in Section 7.2.3.

Other modeling input, as detailed in the Groundwater Modeling Report (USACE 2001), were based on either available literature or optimized to match observed concentrations.

MT3DMS simulations using the SESOIL-based contaminant loading to groundwater indicate the following sources of impacts to site wells:

- Disposal pits and trenches caused historically elevated uranium and beryllium in MW-19(I) and MW-13(S), which attenuated before reaching down-gradient wells, such as MW-22(I);
- Trench 5 likely impacted wells MW-01(I), MW-02(S), and MW-26(S);
- Trench 6 impacted well MW-21(I), irrespective of the East or West Production Well pumping; and,
- Lagoon B and associated process lines impacted MW-24(S).

The final transport simulations were completed using conservative literature-based advection, dispersion, and adsorption (Kd) variables to ensure potential transport pathways were accounted for in predictive analyses. Section 12.9 discusses the performance monitoring program for the selected remedy; the current site wells chosen and proposed new installations are based spatially upon the MT3DMS modeling results of COC transport and potential plume movement and fate.

7.3 Basis For Action

The response action selected in this Record of Decision is necessary to protect the public health or welfare or the environment from actual or threatened releases of hazardous substances into the environment. Groundwater COCs for the Subsistence Farmer Receptor using site groundwater are beryllium, lead, and total uranium.

8.0 REMEDIAL ACTION OBJECTIVES

Remedial Action Objectives (RAOs) guide the choice of remedial alternatives that must be assessed to protect human health and the environment from COCs in groundwater. The RAOs for the Luckey site should provide long-term protection of human health and the environment by identifying exposure routes and receptors and an acceptable maximum contaminant level for these receptors.

The RAOs for groundwater at the Luckey site are as follows:

- Monitor, control, or actively reduce COCs in groundwater to ensure that, within a limited period of time, concentrations of these constituents are reduced to or below the ARAR-based cleanup goals at an established point of compliance to achieve compliance with federal and state law.
- Restore the site to a condition consistent with its current and anticipated future uses.
- Prevent releases and other impacts that could adversely affect human or ecological receptors during implementation of the remedial alternative(s).
- Comply with ARARs.

RAOs for site-wide groundwater (EU 7) are based on promulgated ARARs.

8.1 Applicable Or Relevant And Appropriate Requirements (ARARs)

Agencies responsible for remedial actions under CERCLA must ensure that selected remedies meet ARARs adopted for groundwater cleanup of the Luckey site.

Applicable requirements are those cleanup standards, standards of control, and other substantive environmental protection requirements, criteria, or limitations promulgated under the federal environmental or state environmental or facility citing laws that specifically address a hazardous substance, pollutant, contaminant, remedial action, location, or other circumstance at a CERCLA site. An applicable requirement directly and fully addresses an element of the remedial action.

Relevant and appropriate requirements are those cleanup or control standards, and other substantive environmental protection requirements, criteria or limitations promulgated under federal environmental or state environmental or facility citing laws that, while not applicable to a hazardous substance, pollutant, contaminant, remedial action, location, or other circumstance at a CERCLA site, nonetheless address problems or situations sufficiently similar to those encountered at the CERCLA site that their use is suited to the particular site. In addition, only those state standards that are promulgated (specifically stated in laws or regulations adopted pursuant to laws), are identified by the state in a timely manner, and are more stringent than federal requirements may be applicable or relevant and appropriate.

USACE has determined that the groundwater cleanup ARARs for remedial activities at the Luckey site are the Safe Drinking Water Act (SDWA) MCLs for beryllium and uranium and action level for lead.

The MCLs promulgated pursuant to the SDWA are enforceable standards developed to protect human health from identified adverse effects from drinking water contaminants. The MCL for uranium is found at 40 CFR § 141.66(e) as published in 65 Federal Register (FR) 76708-76748, December 7, 2000 and the MCL for beryllium is found at 40 CFR § 141.62(b) and the OAC at 3745-81-11(B). The Federal MCL for uranium has been established at 30 μg/L. The Federal

MCL for beryllium is the same as the State of Ohio drinking water standard of 4 parts per billion (ppb) or µg/L. The SWDA action level and Ohio standard for lead is 15 µg/L.

An action level under the SDWA is the regulatory equivalent of an MCL for a drinking water contaminant. In requiring that National Pollution Drinking Water Regulations (NPDWRs) be established for drinking water contaminants, the SDWA provides that standards can be promulgated as MCLs or as treatment techniques. The lead NPDWR health standard found at 40 CFR § 141.80(c) and OAC 3745-8180(C)(1) is promulgated as a treatment technique, with a trigger action level of 0.015 mg/L (or 15 µg/L).

Since MCLs apply to community water systems that directly serve 25 or more people or supply 15 or more service connections, the potential use and distribution of groundwater for potable sources at the Luckey site is considered a community water system. However, MCLs apply when water comes out at the tap, whereas at the Luckey site, the MCLs are being used as a cleanup goal for groundwater still within the subsurface and will be measured in the groundwater rather than at the tap. Therefore, the MCLs are not applicable to groundwater at the Luckey site but are relevant and appropriate for a groundwater cleanup goal at the Luckey site, as is the lead action level in groundwater (applied as the target media-specific clean-up goal).

As stated in Section 7.1, the soil cleanup objectives for beryllium, uranium, and lead, in conjunction with use of MCLs & ALs as cleanup targets for groundwater, are protective of all exposure pathways at a point of compliance coincident with the East Production Well and a local downgradient residential well: (PW(E) and GW0002 on Figure 10.

At the Luckey site, the MCL values are being cited as the target media-specific cleanup goals, as relevant and appropriate. Other provisions of 40 CFR § 141.66, such as monitoring and reporting requirements, are not included. The monitoring and reporting requirements set forth in 40 CFR § 141.66 and § 141.80 (Monitoring and reporting CFR) apply to community water systems that provide drinking water to consumers.

USACE expects the selected remedy for groundwater will satisfy the following statutory requirements of CERCLA §121(b): 1) be protective of human health and the environment; 2) comply with ARARs; 3) be cost-effective; and (4) utilize permanent solutions that will preclude any future environmental impact to the groundwater system. Implementation of the selected remedy will allow eventual release of the site for unrestricted use, with groundwater in the glacial sediments governing the timeframe for unrestricted release. These restrictions are not applicable to the underlying deep bedrock aquifer since COCs have not impacted this domestically utilized groundwater unit.

Contaminants not associated with AEC-related beryllium production activities are not addressed under the CERCLA remedial actions described herein and may preclude specific areas from being released for unrestricted use. The determination of the need for and performance of response actions related to other releases of hazardous substances at this site is not within the authority of USACE under FUSRAP.

The remedy confirmation methodology includes a performance monitoring program that will allow the USACE to optimally manage the MNA remedy and meet ARARs for the eventual closure of the this ROD. This program is detailed in Section 12.9.

8.2 Selected Cleanup Goals

The cleanup goals selected for impacted soils were evaluated with the SESOIL and RESRAD models to assess their protectiveness of groundwater. Both models indicate that soil COCs remediated to cleanup goals do not leach readily through the clay-rich tills at concentrations exceeding their respective risk- or ARAR-based groundwater cleanup goals or drinking water standards, and thus are protective of groundwater.

The following soil remedial goals support the groundwater remedial strategy (USACE 2006):

- Beryllium = 131 µg/g as net Beryllium soil concentrations
- Lead = 400 µg/g as net Beryllium soil concentrations
- Radium-226 = 2.0 pCi/g as net Radium-226 soil concentrations
- Thorium-230= 5.8 pCi/g as net Thorium-230 soil concentrations
- Uranium-234 = 26.0 pCi/g as net Uranium-234 soil concentrations
- Uranium-238 = 26.0 pCi/g as net Uranium-238 soil concentrations
  Net soil concentrations exclude background.

The Future Subsistence Farmer scenario (most conservative) for groundwater exposure will need to meet the following ARAR standards for site groundwater:

- Beryllium at 4 µg/L
- Lead at 15 µg/L
- Total Uranium (mass) at 30 µg/L.

9.0 REMEDIAL ACTION ALTERNATIVES

The remedial alternatives were constructed by combining general response actions, technology types, and process options. They were developed to assure adequate protection of human health and the environment, achieve RAOs, meet ARARs, and permanently and significantly reduce the volume, toxicity, and/or mobility of site-related contaminants.

Several remedial alternatives presented in the FS (USACE 2003) address groundwater contamination at the Luckey site. The alternatives encompass a range of potential actions:

- Alternative 1: No Action (Soils and Groundwater)
- Alternative 2: Limited Action (Soils and Groundwater) ~ Restricted Land Use
- Alternative 7: Monitored Natural Attenuation (Groundwater) ~ Unrestricted Land Use
- Alternative 8: Active Groundwater Treatment, Ex Situ (Groundwater) ~ Unrestricted Land Use
- Alternative 9: Electrokinetics (Groundwater) ~ Unrestricted Land Use

Alternative 2 includes soil and relies on passive MNA for groundwater contamination in conjunction with limited site improvements and land use controls. No source control or removal actions would be implemented under Alternative 2. Since land use at the Luckey site has the potential to revert to residential or agricultural (thus conforming to surrounding landuse) in accordance to the deed (i.e., the property lists no specific restrictions or easements that would preclude residential or agricultural land use), then the restricted use Alternative 2 was not considered further in the Proposed Plan (USACE 2003a), and thus not evaluated further as a viable remedy in this ROD.

The four remaining alternatives underwent evaluations in the Modeling Report (USACE 2001), the FS (USACE 2003), the PP (USACE 2003a). The screening of the alternatives followed CERCLA guidance, which narrowed them to an acceptable set of three to address groundwater (Alternatives #7, #8, and #9).

Groundwater alternatives 7, 8, and 9 include monitored natural attenuation (MNA), active remediation (pump and treat), and electrokinetics, which are coupled with a long-term monitoring component and five-year reviews. These subsequent measures ensure COC concentrations in groundwater achieve the exposure scenario for the property. Time periods for environmental monitoring are specific to each alternative and depend upon the relevant ARARs coupled with the specific technologies employed under each alternative. The retained groundwater alternatives are briefly discussed below and detailed in the FS and PP; the MT3DMS model assessed these alternatives for applicability and preference.

9.1 Alternative 1: No Action (Soils and Groundwater)

This alternative would provide no further remedial action at the Luckey site and is included as a baseline against which other alternatives were compared. Although land use controls are in place at the site, these would be left in place, but not necessarily maintained under this alternative. However, the site is assumed to operate in compliance with existing regulations that impose limitations on occupational exposures. No five-year reviews would be conducted under this Alternative.

9.2 Alternative 7: Monitored Natural Attenuation of Groundwater

This alternative would be implemented in conjunction with the soil remedy and includes the natural attenuation of COCs in groundwater verified through monitoring concentrations over time. Groundwater remedial action would require zero years to complete with a 40- to 150-year monitoring period, as estimated from the model predictions. Groundwater monitoring would be conducted in accordance with a performance monitoring program detailed in Section 12.9, which will confirm the efficacy of MNA alternative. Land-use controls during the monitoring period would include the following restrictions to ensure no new groundwater development occurs on site beyond the two available pumping wells: maintaining fencing and signs; restrictions to prohibit changes in groundwater use from the current industrial and plant-potable water condition; and periodic inspection of the site to determine any changes in land use. Five-year reviews would be conducted in accordance with CERCLA 121(c).

A conceptualization of this alternative is shown in Figure 22.

9.3 Alternative 8: Active Ex-situ Groundwater Treatment

This alternative would be implemented in conjunction with the soil remedy and consists of active groundwater contaminant removal via pump and treat technology that would use cation-exchange media to remove COCs from influent groundwater. This groundwater remedial action would achieve the beryllium MCL in 80 years and the uranium MCL in 10 years, as estimated from contaminant transport modeling. Lead remediation time was not estimated with the model but would be addressed by the alternative (assumed similar to beryllium). Treatment-system discharge would be monitored routinely and groundwater would be monitored annually to confirm the efficacy of this treatment alternative. Land-use controls during the monitoring period would include the following restrictions: maintaining fencing and signs; restrictions to prohibit changes in groundwater use; and periodic inspection of the site to determine any changes in land use. Five-year reviews would be conducted in accordance with CERCLA 121(c).

A conceptualization of the alternative is similar to Alternative 7, as shown in Figure 22.

9.4 Alternative 9: In-situ Electrokinetic Treatment of Groundwater

Alternative 9 involves installing a rectilinear grid of wells through the shallow groundwater zone to the fractured bedrock; each well would contain an electrode encased in a permeable membrane filled with an electrolyte. The electrodes (as cathode-anode pairs) would electrically drive metal contaminants in groundwater to the anodes for removal via the electrolyte solution, which then would be disposed. This alternative would be implemented in conjunction with the soil remedy to effectively remove the sources contributing to groundwater contamination. Groundwater monitoring in and near the treatment area would be performed annually for the first 5 years after soil source removal and for up to 15 years during electrokinetic treatment. Groundwater monitoring of constituents in bedrock would continue up to an additional 25 years, as estimated from modeling scenarios. Land-use controls during the monitoring period would include the following restrictions: maintaining fencing and signs; restrictions to prohibit changes in groundwater uses; and periodic inspection of the site to determine any changes in land use. Five-year reviews would be conducted in accordance with CERCLA 121(c).

A conceptualization of this alternative is shown in Figure 23.

9.5 Summary of Modeling Results For Alternative Evaluation

The modeling approach to assess FS alternatives consisted of simulating contaminant leaching from soils (via SESOIL) followed by modeling contaminant migration through the groundwater (via MODFLOW, MODPATH, and MT3DMS). Geochemical modeling (via PHEEQC) was used to identify speciation, solubility, and mobility characteristics for beryllium and uranium in support of the groundwater transport calculations; literature values were used for lead assessments due to its limited extent and concentrations (i.e., values maximally twice the MCL).

Results of the SESOIL simulations indicate the planned soil cleanup goals for the soil remedy are protective of groundwater. The soil remediation remedy will reduce the flux of all COCs to groundwater and thus predictive modeling used current groundwater COCs distributions to predict fate.

Initial contaminant conditions input to the transport model were based on June 2001 sampling data (a conservative wet-season distribution described in USACE 2001); USACE (2003) shows the area, concentration, and total mass of each COC initially loaded into the transport model. Contaminant transport modeling of pumping (East Production Well operation) and non-pumping (no Production Well operation) conditions shows differing results.

The pumping condition simulations predicted that COCs would not impact the East Production Well at concentrations exceeding cleanup goals due to the dilution from a large capture zone relative to the site-specific contaminant flux to groundwater. Neither lead nor uranium is predicted to ever move off site at concentrations exceeding their cleanup goals. Only beryllium, which occurs above its cleanup goal at the northern property boundary, may migrate off site and then decline below cleanup goals within 250 to 300 feet downgradient. The simulated pumping also reduced the saturation of the overlying unconsolidated silty clay (due to a low hydraulic conductivity of 0.05 ft/d) and thus would leave residual contaminants in the till. Even at very low pumping rates the till did not remediate well, thus reducing remedial efficiencies by up to 15%, as derived from Table 4 data.

The new property owner (2006 transaction with Abdoo Wrecking) has discontinued the use of the on-site production wells, which will produce a site condition reflective of the non-pumping simulations that produced northerly to north-northwesterly contaminant transport vectors. The non-pumping conditions are more conservative, since contaminants can migrate off site. Lead and uranium are not predicted to migrate off site above cleanup goals, whereas beryllium detected at the northern boundary of the site will migrate off site and attenuate to below cleanup goals within 300 feet of the site.

Table 4 shows that the transport results under non-pumping conditions, with no active treatment, support the evaluation of Alternative 7, Monitored Natural Attenuation. The table also presents results for Alternative 8, Active Treatment under Production Well pumping and non-pumping conditions. In the active treatment scenarios, up to two extraction wells were installed near areas of elevated groundwater concentrations, with withdrawal rates varying between 0.5 and 5 gpm to ensure the contaminated zones remain saturated to augment removal. The table shows the associated time periods required for the beryllium, lead, and uranium to meet their respective cleanup goals in both the overburden and bedrock.

Table 4 summarizes groundwater transport simulations that show the time frames necessary to attain ARARs under Alternatives 7 and 8 (USACE 2003). The retention of COCs in the silty clay till may persist between 600 years for lead and over 1000 years for uranium; these residual COCs would slowly desorb from the soil at rates that would not cause exceedences of their respective MCLs in the bedrock aquifer. However, the planned removal of soil near the shallow wells outlined in Table 4 will address most of this recalcitrant condition and likely reduce these MNA timeframes to manageable periods.

Under Production Well pumping conditions, natural attenuation timeframes for beryllium in the shallow sand & gravel and upper bedrock are up to 175 and 40 years, respectively; lead is less than 2 years and uranium was not simulated in the intermediate zone under pumping conditions due to dewatering of the area (i.e., loss of transport media). Active treatment of groundwater would reduce the respective beryllium time frames to 90 years and 26 years at the site boundary, whereas lead will take roughly 1 year; again, uranium was not simulated in the intermediate zone under active treatment due to dewatering of the area.

Under non-pumping conditions, natural attenuation timeframes for beryllium in the shallow sand & gravel and upper bedrock are up to 150 and 40 years, respectively; lead is less than 5 years and uranium 30 years. Active treatment of groundwater would reduce the respective beryllium time frames to 80 years and 25 years at the site boundary, whereas lead will take roughly 1 year and uranium about 10 years.

During these estimated attenuation or treatment periods, the protection of the sand & gravel and bedrock zones, as the primary aquifers in the area, will be verified through performance monitoring of the complimentary soil and groundwater remedies.

These model-based predictions have inherent uncertainties, such as the actual time for the attainment of ARARs, which will occur over a range of times rather an exact point in time. Variations in site-specific input parameters (e.g. hydraulic conductivity) and historical activities that affect groundwater flow will add temporal uncertainty, as do future land uses of the site and their potential impacts on contaminant migration rates.

These uncertainties generally mean that estimated timeframes to attain ARARs may have 10% to 20% temporal variability (e.g., a 20-year period to attain ARARs may vary between 16 and 24 years). This is an acceptable range of results for long-term planning and evaluation of future performance monitoring metrics. Consequently, the groundwater monitoring for Alternatives 7, 8, and 9 may vary from the predicted 40 to 150 years, which will be assessed during the five-year reviews occurring after soil remediation. The modeling supports the implementation of preferred Alternative 7 (MNA) and associated positive cost impacts (USACE 2003a).

9.6 Evaluation Criteria for Remedial Alternatives

The three retained remedial alternatives for groundwater at the Luckey site were evaluated in detail in the Proposed Plan (USACE 2005).

The alternative analysis provided information of sufficient quality and quantity to justify the selection of a remedy and understand the requirements of the remedy selection process. This process is driven by the requirements set forth in CERCLA Section 121 (EPA 1988), where the preferred remedial action(s) must:

- Be protective of human health and the environment
- Attain ARARs or provide grounds for justifying a waiver
- Be cost effective

- Use permanent solutions and alternative treatment technologies to the maximum extent practicable
- Satisfy the preference for treatment that, as a principle element, reduces volume, toxicity, or mobility.

The CERCLA criteria emphasize long-term effectiveness and related considerations for each remedial alternative. These statutory considerations include:

- Long-term uncertainties associated with land disposal (soil specific)
- The goals, objectives, and requirements of the Solid Waste Disposal Act (soil and groundwater treatment specific)
- The persistence, toxicity, and mobility of hazardous substances, and their propensity to bioaccumulate (related to groundwater consumption)
- Short-and long-term potential for adverse health effects from human exposure (related to groundwater consumption)
- Long-term maintenance costs (monitoring and treatment specific)
- The potential for future remedial action costs if the remedial alternative in question were to fail (treatment specific)
- The potential threat to human health and the environment associated with extraction (groundwater), transportation, and re-disposal or containment (treatment-media specific).

These statutory requirements are implemented through the use of nine evaluation criteria that are grouped into threshold criteria, balancing criteria, and modifying criteria; these are applied in accordance with Section 300.430 (e) of the NCP. Each groundwater alternative was evaluated against the following criteria to determine whether it will perform according to the NCP criteria:

Overall Protection of Human Health and the Environment (Threshold Criteria) addresses whether or not a remedy provides adequate protection and describes how exposure to the hazardous substances released at the site is eliminated, reduced, or controlled through treatment, engineering controls, or land-use controls. An alternative is considered to be protective of human health and the environment if it complies with media-specific cleanup goals.

Compliance with Applicable or Relevant and Appropriate Requirements (Threshold Criteria) addresses whether or not a remedy will meet all of the applicable or relevant and appropriate requirements of Federal and State environmental statutes and/or provide grounds for invoking a waiver.

Long-term Effectiveness and Permanence (Balancing Criteria) refers to the magnitude of residual risk and the ability of a remedy to maintain reliable protection of human health and the environment over time once the cleanup goals have been met. Alternatives that provide the highest degree of long-term effectiveness and permanence leave little or no untreated waste at the site (reduce residual risk), make long-term maintenance and monitoring unnecessary, and minimize the need for land-use controls.

Reduction of Toxicity, Mobility, or Volume through Treatment (Balancing Criteria) is the anticipated performance of the treatment technologies that may be employed in a remedy (e.g., the irreversibility of the treatment process and quantity of residuals remaining after treatment).

Short-term Effectiveness (Balancing Criteria) refers to the speed with which the remedy achieves protection, as well as its potential to create adverse impacts on human health and the environment during the construction and implementation period.

Implementability (Balancing Criteria) is the technical and administrative feasibility of a remedy, including the availability of materials and services needed to implement the chosen solution.

Cost (Balancing Criteria) includes capital, operation, and maintenance costs, as estimated according to EPA guidance (EPA 2000).

State Acceptance (Modifying Criteria) indicates whether, based on its review of the Remedial Investigation/Feasibility Study and Proposed Plan, the State concurs with, opposes, or has no comment on the preferred alternative.

Community Acceptance (Modifying Criteria) is assessed following a review of the public comments received on the Proposed Plan.

10.0 COMPARATIVE ANALYSIS OF REMEDIAL ALTERNATIVES USING NCP CRITERIA

The three retained groundwater alternatives (and comparative Alternative 1 – No Action) are compared for the purpose of identifying relative advantages and disadvantages of each alternative. Overall protection of human health and the environment and compliance with ARARs are threshold criteria that must be met by any alternative for it to be eligible for selection. The other criteria, consisting of short-and long-term effectiveness; reduction of contaminant toxicity, mobility, or volume through treatment; ease of implementation; and cost are the primary balancing criteria used to select a preferred remedy among alternatives satisfying the threshold criteria. Tables 5 and 6 illustrate the comparative analysis of all Alternatives. In addition, the community and state acceptance criteria assessed in the Proposed Plan and soils ROD (USACE 2003a and 2006) are addressed in this groundwater ROD (Appendix A).

Additional information pertaining to the advantages and disadvantages of each groundwater alternative also are included in Table 7. Remedial timeframes estimated for non-pumping and pumping conditions (i.e., while the East Production is simulated as off and on) generally show that East Production Well operation lengthens the timeframes required to achieve cleanup goals in groundwater. It is important to note, the predicted time frames from the groundwater model (Table 4) assisted in the comparison of alternatives. As with any modeling effort, uncertainty associated with input parameters, historical site operations, and contaminant distributions exist. Therefore, the estimated time frames for the selected remedies to meet the MCLs or AL are likely to occur within a period of time similar to the time frame predicted by the groundwater model but not necessarily at the exact year (i.e., +/- 5 years or a 10% to 20% temporal variation).

10.1 Overall Protection of Human Health and the Environment

Each of the alternatives, except Alternative 1, is protective of human health and the environment; consequently Alternative 1 is omitted from further discussion. Alternative 7 is less protective than 8 and 9 in the short term, although in the long term, all Alternatives will have similar outcomes.

10.2 Compliance With ARARs

A summary of the ARARs is presented Section 8.1. Alternatives 7, 8, and 9 satisfy all ARAR-based groundwater cleanup goals when implemented in conjunction with the selected response action for soils. Alternative 7 is expected to achieve ARARs within 40 to 150 years, Alternative 8 within 80 years, and Alternative 9 within 40 years after implementation. The major differences are the time frame in which land-use controls are no longer necessary.

10.3 Long-Term Effectiveness and Permanence

Human health risks due to exposure to contaminated groundwater will be reduced from the existing levels of risk by varying degrees when the groundwater alternatives are combined with the soil remedy. All of the groundwater alternatives provide long-term effectiveness when coupled with the soil remedy.

All three remedial alternatives (7, 8, & 9) will have long-term effectiveness by reducing risk and permanence by attaining MCLs/action levels for groundwater COCs. Little residual risk from groundwater will remain after the completion of each alternative, which will be ensured through a performance monitoring program. Alternative 7 provides a medium level of long-term effectiveness and permanence since monitoring may last up to 150 years, which will require property access and extended land-use controls. Alternatives 8 and 9 provide the highest degree of long-term effectiveness and permanence since little or no untreated waste will remain at the site, monitoring periods will be lessened, and land-use controls lifted earlier than Alternative 7.

Pursuant to CERCLA, site remedy reviews would be conducted every five years for groundwater Alternatives 7, 8, and 9 until the contaminants have attenuated or are remediated to a concentration allowing unlimited groundwater use and unrestricted exposure.

10.4 Reduction in Contaminant Volume, Toxicity, and Mobility Through Treatment

Alternative 7 has a medium level of efficiency at reducing the toxicity and mobility of COCs through the MNA process (i.e., dispersion, diffusion, and soil adsorption); MNA will reduce the volume through adsorption. Alternatives 8 and 9 have a high level of efficiency at reducing the volume, toxicity and mobility of the contaminated groundwater by using extraction and/or treatment. All Alternatives have a likelihood of reducing long-term mobility through adsorption, which assumes adsorptive sites are available in site soils; this is exemplified by the RI-based comparison of seasonal heads and concentrations in Section 5.3.

In addition, the complicit soils remedy currently estimates excavation depths of 10 to 20 feet below grade in areas of greatest groundwater contamination (Figure 17). This effort will require the control, removal, and possibly treatment of large volumes of soil drainage and groundwater entering the excavation. These groundwater sinks (excavations) may remove significant amount of contaminated groundwater from the shallow zone, thereby reducing the volume of potentially contaminated groundwater available for transport from the shallow and into intermediate zones towards downgradient receptors and monitoring points. Therefore, the selected groundwater remedy may not require the explicit removal contaminated groundwater to be effective, since significant volume removal is expected during the implementation of the soils remedy.

10.5 Short-Term Effectiveness

Alternatives 7, 8, and 9 involve increasing risk to workers due to activities necessary to the alternative. These increased risks are due to well drilling, installation of system piping and filtration system, installation of power systems (including a 480 volt ground level system for Alternative 9), and handling of filter media and electrolytes. Among the groundwater alternatives, short-term risks are greatest for Alternative 9 and least for Alternative 7. Short-term negative impacts to the environment are likely to occur with all groundwater alternatives due to the drilling of monitoring and extraction wells (Alternatives 7 & 8) and the construction of treatment facilities (Alternatives 8 & 9). Alternatives 8 and 9 will produce remedial wastes (i.e., ion-exchange or treatment material and electrolyte media, respectively), which will require waste-management programs.

10.6 Implementability

USACE can technically accomplish the groundwater remedies, obtain approvals and coordinate with other authorities (i.e., administrative feasibility), and acquire the materials and services needed for the groundwater alternatives. The degree of difficulty in implementing alternatives increases with the amount and type of remediation desired, its accordance with regulations, and the time of coordination involved in completing the alternative.

Commercial sources are available to efficiently implement all groundwater treatment technologies considered under Alternatives 7, 8, and 9. Groundwater Alternatives 7 and 8 would be difficult to implement administratively due to the long time frames involved. Alternative 9 requires treatment units that are commercially available and only demonstrated under controlled conditions; this Alternative is considered moderately technically feasible. All the groundwater alternatives rely, to some extent, on land use controls, the implementability of which is proportional to the duration, where long durations are more difficult to implement.

10.7 Cost

The estimated present (2007) cost to complete each of the groundwater-related Alternatives are listed below; these originated from fiscal year 2002 dollars under a seven percent discount factor:

- Alternative 1: $ 0.0 million ($0.0 million in 2002 dollars)
- Alternative 7: $ 0.89 million ($0.83 million in 2002 dollars)
- Alternative 8: $ 4.0 million ($3.7 million in 2002 dollars)

- Alternative 9: $ 10.1 million ($9.4 million in 2002 dollars)

10.8 State Acceptance

The Ohio EPA supported the various groundwater alternatives, including the chosen groundwater remedy, Alternative 7, Monitored Natural Attenuation. Both the soil and groundwater remedies will achieve the media-specific cleanup goals developed and selected by the USACE to protect a residential/subsistence farmer receptor. A letter from the Ohio Environmental Protection Agency concerning the *Proposed Plan for the Luckey Site* is included in Appendix A, Responsiveness Summary for Luckey Groundwater ROD, as is the USACE response.

10.9 Community Acceptance

At the public meeting conducted on June 19, 2003, support for the selected soil and groundwater remedies was voiced by the public; see the soils ROD (USACE 2006), Alternative 5, Excavation and Off-Site Disposal (Soils) – Unrestricted Land Use and this groundwater remedy, Alternative 7, Monitored Natural Attenuation (Groundwater). The details of comments at the public meeting for the project, written comments and the USACE responses to comments, are included in Appendix A, Responsiveness Summary for Luckey Groundwater ROD. This ROD considered these comments when choosing the remedy.

11.0 SELECTED REMEDY

The Proposed Plan (USACE 2003a) provides a detailed evaluation of retained groundwater alternatives against the criteria outlined in Section 9.6; Tables 5 and 6 summarize this evaluation. The complimentary remedy chosen in the soils ROD (USACE 2006) also will be protective of human health, be permanent, and comply with soil-exposure ARARs for the Luckey site.

Considerations common to all groundwater alternatives include the following:

- The groundwater remedy will be implemented in conjunction with the soils remedy to preclude further groundwater impacts.
- The clay-rich tills have the potential to retain beryllium, lead, and uranium through adsorption for long periods of time, which if reversible, could desorb COCs back into groundwater over long periods of time (hundreds of years). This minor contaminant source term may affect the shallow and intermediate zones by simply increasing attenuative time frames for compliance with ARARs at performance monitoring wells.
- Groundwater sampling results indicate decreasing to steady-state trends in COCs derived from soil leaching and seasonally high groundwater directly contacting contaminant sources (e.g., base of trenches and Lagoon B) (USACE 2003). These data also show when groundwater elevations fall below the COC sources COC, concentrations reduce through attenuative processes.
- The groundwater in the primary domestic use aquifer (deep zone) is not impacted and modeling predicts local to regional hydrogeologic conditions will maintain this state.

These conditions all indicate the soil remedy is protective of all groundwater sources (zones) and MNA is a viable groundwater remedy.

Tables 4 5, 6 and 7 together provide comparative data and summarize the advantages and disadvantages of the groundwater alternatives, when combined with COC trends on Figures 18, 19, and 20, all indicate that Alternative 7, Monitored Natural Attenuation (Groundwater) ~ Unrestricted Land Use is the optimal remedy for groundwater after the remediation of contaminated soil, waste, and debris (i.e., soils ROD implementation).

This chosen remedy consists of monitored natural attenuation of beryllium, lead, and uranium after source control, as recommended in EPA (1999) guidance. Source control, or soils remediation, will eliminate further addition of COC to groundwater at concentrations above the MCLs. Natural attenuation processes at the Luckey site will reduce contaminant concentrations through the processes of dispersion, diffusion, and sorption onto the soil (dispersion and diffusion in the bedrock), which will reduce contaminant mobility and bioavailability.

The beryllium concentrations in the shallow zone sands and gravels are expected to drop significantly after contaminant-source removal, which is based upon modeling results and observed beryllium trends coordinated with groundwater fluctuations. The actual decline in beryllium concentrations after source removal is uncertain, although conservative source-term estimates predict beryllium concentrations to achieve cleanup goals within 150 years. Should significant contamination remain within the clay-rich till, natural attenuation periods may be much longer due to the low dispersion and desorption from the silty clay till. Modeling results indicate beryllium-contaminated groundwater in the upper 20 feet of bedrock attenuates within 40 years.

This MNA period is less for uranium and lead in the intermediate zone aquifer (maximums of 30 and 3.5 years, respectively), although residual lead and uranium concentrations will persist in the overlying silty clay till for up to 1000 years at levels unlikely to impact domestic groundwater resources in the deep aquifer. Current trends (Figures 18, 19, and 20) indicate that these timeframes are very conservative and that lesser monitoring periods are likely to attain beryllium and uranium MCLs and the lead AL.

Installation of monitoring wells to optimize the current configuration for MNA, and the replacement of existing wells removed due to soils excavation, would require less than three months to complete, although may require up to 150 years of monitoring (Tables 4 and 5). As indicated earlier, the beryllium concentrations in the sands and gravels are expected to drop significantly after the source is removed. Timeframes may be shorter if distribution coefficients are higher than expected, which would produce a greater potential for contaminants to sorb to soils, or if increased recharge results in more rapid contaminant dispersion. Following completion of monitoring well installation and implementation of land use controls, variably timed monitoring events and five-year reviews would be conducted.

The industrial land use at the Luckey site is expected to continue according to current zoning as light industrial, although an expansion of the Village of Luckey may promote changes to commercial, residential, or agricultural since the surrounding land use is agricultural and residential. However, the combined remedies in the soils and groundwater RODs will institute cleanup goals protective of subsistence farmer land-use scenarios.

12.0 STATUTORY DETERMINATIONS

USACE expects the selected remedy (Alternative 7) for groundwater in conjunction with the selected soil remediation response action (USACE 2006) will satisfy the following statutory requirements of CERCLA §121(b): 1) be protective of human health and the environment; 2) comply with ARARs; 3) be cost-effective; and 4) utilize permanent solutions and alternative treatment technologies to the maximum extent practicable. The following sections assess the MNA remedy against all the NCP criteria for completeness, including the required four CERCLA requirements listed above.

12.1 Protection of Human Health and the Environment

Alternative 7 includes the use of monitoring wells to monitor natural attenuation of beryllium, lead, and uranium in groundwater after the elimination of contaminated soil sources.

Currently there is no unacceptable exposure to COCs in groundwater (i.e., local residential wells currently test negatively for groundwater COCs, as does the East Production Well). Modeling results predict that MCLs will not be exceeded (or quantitatively approached) in deeper bedrock aquifer that supplies local domestic wells. Only beryllium, which occurs in groundwater at the northern fence line, is predicted to move off site for a period of about 40 years in the upper bedrock and up to approximately 150 years in the sand and gravel, although this movement is expected to occur over a distance of less than 300 feet (i.e., attenuation will occur within that flow distance). The closest downgradient domestic well, which is screened in the deep bedrock unit, is approximately 1100 feet downgradient of the site and consequently will not be impacted.

Land-use controls would restrict the use of site groundwater and be protective of human health until impacted groundwater is returned to a condition of compliance according to performance metrics outlined in Section 12.9.

12.2 Attainment of ARARs

ARAR-based cleanup goals (the contaminant-specific MCLs and AL) selected for the Luckey site were detailed in Section 8.1. Under Alternative 7, all MCLs/AL in groundwater would be satisfied with passage of time and enhanced by the implementation of a soil alternative.

Since the cleanup goals are applicable to community drinking water sources at the tap, the attainment of MCLs in the subsurface is a conservative approach ensured through monitoring and land-use controls.

12.3 Long-Term Effectiveness and Permanence

The long-term effectiveness and permanence of Alternative 7, in conjunction with the removal of impacted materials, would result in a permanent reduction in the risk of recontamination to the groundwater. Natural attenuation would ensure groundwater remediation would be permanent and will eventually reduce concentrations of contaminants below MCLs. For purposes of this evaluation, it is assumed an environmental monitoring program would assess natural attenuation until the attainment of groundwater MCLs/AL is exemplified via five-year reviews.

12.4 Reduction of Toxicity, Mobility, or Volume through Treatment

Alternative 7 would not mechanically reduce the toxicity, mobility, or volume of contaminants in groundwater, although naturally occurring adsorption to site soils would reduce concentration (toxicity) and mobility. Sorption within the bedrock is assumed to be negligible, although concentrations are reduced through the dispersion, diffusion, and adsorption as contaminants move through the overburden (shallow zone) and the upper bedrock zone (intermediate zone). The deep bedrock zone that supplies local domestic wells is not impacted, although will be monitored under the performance monitoring program to ensure the soils remedy coupled with dispersion, diffusion, and adsorption in the shallow and intermediate groundwater zones are protective of local primary groundwater sources.

As discussed in Section 10.4, the soils remedy is expected to remove some groundwater contamination through groundwater inflow controls during deep excavation. Although the USACE has not estimated this inflow volume, the capture and treatment during excavation is expected to reduce the volume and limit mobility of the groundwater near the excavations since they will act as local sink. Therefore, the MNA remedy will not explicitly remove contaminated groundwater volumes but the implementation of the soils remedy will perform some volume reduction that will positively impact the MNA performance monitoring program. In addition, the backfilling of the soil-remedy excavations will introduce soils without site COCs present and possibly add to the adsorptive capacity of MNA remedy.

12.5 Short-Term Effectiveness

The short-term effectiveness of Alternative 7 is good for groundwater within the bedrock aquifer and could be poor for groundwater within the overburden due to the persistence of COCs residuals in the clay-rich till. Monitoring, in accordance with EPA (1999) will be used to evaluate the short-term effectiveness of MNA with respect to shallow and intermediate zones. Land use controls would restrict the use of site groundwater until monitoring has shown the process to be complete, as detailed in Section 12.9. The soil cleanup goals that will be implemented by the soils ROD will be protective of groundwater.

Other short-term artifacts of the MNA remedy include worker exposure to drill (auger) cuttings during well installation and potential public exposure to fugitive dust during well installations.

12.6 Implementability

This alternative is considered to be technically implementable. Modeling indicates the groundwater contaminants will naturally attenuate within the glacial sediments and uppermost bedrock over a time frame considered reasonable for bedrock groundwater use. In addition, soil cleanup goals will be protective of groundwater in the long term. Land use controls restricting groundwater use are considered technically implementable.

Drilling and monitoring of groundwater wells is an established activity and generally does not pose implementation problems. Monitoring locations are proximate to or at selected down-gradient locations from probable source areas to demonstrate MNA effectiveness according to the long-term performance monitoring plan proposed in Section 12.9. All of these factors add to the administrative difficulty of implementing this remedy, although their contribution is minor.

12.7 Community and State Acceptance

The acceptability of Alternative 7 would be affected by the administrative requirements for monitoring and the requirement to restrict groundwater use in the overburden for a lengthy period of time. Imposition of these controls would depend on the cooperation of the current (2007) owner and the State of Ohio regulatory agencies. Many durable land use controls can be placed on the property only by the owner of the property. Other durable land use controls require the involvement of local government to implement, monitor, and maintain the controls on a voluntary basis.

Public support of the selected soil and groundwater remedies was evidenced at a public meeting conducted on June 19, 2003; the soils ROD (USACE 2006), Alternative 5, Excavation and Off-Site Disposal (Soils) – Unrestricted Land Use and this groundwater remedy, Alternative 7, Monitored Natural Attenuation (Groundwater) were supported. The comment-response summary of the public meeting and other written comments are included in Appendix A, Responsiveness Summary for Luckey Groundwater ROD. This ROD considered these comments when choosing the MNA remedy and performance monitoring program.

12.8 Cost Effectiveness

The present value cost to complete Alternative 7 (derived from 2002 dollars) is approximately $0.89 million ($890K). Costs are based on installation and replacement of monitoring wells, long-term monitoring and well maintenance costs, and land use controls, which are estimated for a period up to 150 years.

The assessments of unselected Alternatives 8 and 9 are presented in the Proposed Plan (USACE 2003a) and summarized, along with Alternative 7, in Tables 5, 6, and 7. These alternatives have higher capital costs and also require long-term performance monitoring. In addition, the pump and treat alternative (# 8) may not fully capture site contamination in the overburden since it is predicted to dewater the overburden and leave residual contamination in the sediments; the pumping of fine-grained sediments also usually produce limited zones of capture. Similarly, Alternative 9 is somewhat experimental and would likely leave residual contamination that can remobilize upon system cessation, which adds uncertainty to its effectiveness. The MNA alternative (# 7) is based on equilibrated soil and groundwater partitioning that would not increase COCs once the MCLs/AL are reached because no latent dissolution or desorption would occur from site soils, as opposed to this potential with Alternatives 8 & 9. The ranking and selection process is summarized throughout Section 8.0 (USACE 2003 and 2003a).

The contaminated material removal action for the Luckey site is scheduled for fiscal year 2010 (October 2009 through September 2010), or possibly 2011. This groundwater remedy initiates with the soil remedy to assess potential groundwater impacts derived from soil excavation (i.e., concentration changes form annual baseline ranges due to significant site disturbances); the groundwater-remedy performance monitoring program will be fully implemented once the soils remedy is completed. During the interim period (2008 through soil-ROD initiation), the USACE will continue to annually sample groundwater COCs for MNA trends and/or possible plume advancement if site conditions change due actions of the site owner, Abdoo Wrecking.

12.9 Performance Monitoring Plan and Five-Year Reviews

A Performance Monitoring Program will be conducted at the Luckey site to evaluate the effectiveness of the soil remedy at protecting groundwater resources and the MNA remedy for currently contaminated groundwater. This MNA performance program will demonstrate the pace of natural attenuation, ensure the protection of down-gradient receptors, detect potential releases due to changes in site conditions, and to verify attainment of beryllium and uranium MCLs, as well as the lead AL. The combined remedies will protect human health and the environment in and around the Luckey site.

The initiation of this groundwater performance monitoring program occurs with the soil remedy; during the interim, annual sampling for all COCs at existing wells highlighted on Figure 24 will monitor groundwater conditions at the site. Four new "ROD wells" (ROD-MW-50(I), -51(I), -52(I), and -53(I)) will be installed either before or after the soil remedy, depending on whether a planned excavation is collocated with a well location. New wells will be installed only after their intended location is released during the soils remedy (i.e., the final status survey is completed and any excavation is backfilled). Existing wells that are removed during the soils remedy will be replaced once the final status survey for the area is completed and the excavation backfilled.

Figure 25 shows groundwater-level data from June, 12 2007, which reflect a non-pumping condition developed under Abdoo Wrecking management. The predicted (Figures 15 & 16) and actual potentiometry generally agree, thereby confirming that model predictions from the RI & FS provide good indications of future conditions (see Groundwater Model Report, USACE 2001 and FS, USACE 2003). The non-pumping condition shows that the bedrock zones (both intermediate and deep) apply upward gradients to the glacial sediments (shallow zone) in and near the Luckey site. This condition significantly promotes the effectiveness of the MNA remedy, although does not reduce its long-term effectiveness if pumping occurs. Groundwater levels will be recorded synchronously from all on- and off-site wells during each sampling effort to ensure transport pathways do not significantly change.

In addition to assessing MNA processes at the site, the MNA performance program will provide data to determine if subsequent remedial actions are necessary due to MNA failure, which will be assessed through five-year review cycles. The full MNA remedy may require between 40 and 150 years to achieve all COC cleanup objectives, so the performance monitoring period will show COC concentration fluctuations (as evident in Figures 18, 19, and 20) that shall not be mistaken as failure in the short term. Five-year review cycles and groundwater data trends must account for site activities performed by both the USACE and site owners, which may impact groundwater (e.g., building demolition, soil remediation, general ground disturbance, allowable land-use changes, and rights of entry – this list is not inclusive of all potential impact drivers).

The Performance Monitoring Program will use the existing site monitoring wells and four new "ROD" wells listed on Figure 24, to monitor MNA processes, irrespective of the use of site Production Well(s). If the operation of either the East or West Production Wells continues, the MNA well network is designed to ensure the MNA remedy can still determine ARAR compliance. The balance of the site wells on Figure 24 (besides those listed and highlighted) will be used to collect potentiometric data for groundwater flow analyses, as well as to provide flexibility in the Performance Monitoring Program if site operations affect groundwater quality (i.e., building demolition and/or changes in stormwater management impact contaminated soil areas before remediation occurs).

Figure 24 shows that the performance monitoring programs includes COC monitoring in the till and sand & gravel unit (shallow zone), the upper bedrock zone (the intermediate zone), and the deeper bedrock (deep zone). The shallow wells monitor conditions derived by the soil remedy and source MNA, the intermediate wells monitor the first transportive unit where COCs indicate MNA effectiveness, and the deep well provides data reflecting the local drinking water zone at a downgradient location (indicating MNA protectiveness). The deep bedrock zone also will be evaluated by sampling the fully penetrating production wells, PW(E) and PW(W), at the depth coincident with the deep bedrock water-bearing zone.

Initial monitoring for all COCs will occur semi-annually during both the soils remedy period and subsequent three years (post soils remedy); the periodicity reduces to annual monitoring during the next two years of the first five-year cycle. This initial semi-annual periodicity (spring and late fall) will provide data to assess seasonal concentration trends, which will allow the USACE to optimize the annual sampling to capture conservative MNA processes. The initial five-year performance report will include COC concentration trends in impacted site monitoring wells and the levels of site COCs in downgradient wells to ensure the protectiveness of the soil and groundwater remedies.

Data from the first five-year ROD cycle will undergo trend and statistical analyses (EPA 1999a) to support possible program reductions as MNA progresses (or expansions if MNA fails). These data evaluations will include descriptive statistics, trend-line regression, outlier analyses, and qualitative descriptions regarding site operations that may affect the groundwater data.

The following bullets summarized the monitoring reduction objectives of the MNA performance plan; these criteria may change as future guidance and innovative techniques that evaluate MNA performance are added to the literature, which will be researched for the five-year reviews. In addition, these assessments are specific to wells currently showing COCs above MCLs/AL (see Figures 10 and 24) and not to their supporting downgradient wells that already show below-MCL/AL results. The COC-wells and supporting wells are addressed accordingly below:

- All wells showing above-MCL/AL sampling results will be assessed for MNA progress and those showing continued violation of the MCLs/AL will be included into the next five-year cycle, as will their supporting downgradient wells. Groundwater level data collected during sampling events will support gradient-dependent sampling decisions.
- When an above-MCL/AL COC trend at a specific well achieves three or more consecutive values below the COC-specific MCL/AL (irrespective of sampling periodicity) within a five-year cycle, then the COC will not be sampled at that well and proximal downgradient well(s) during subsequent five-year review cycles. However, downgradient wells will be evaluated conservatively for COC trends to ensure the MNA program properly accounts for transport potential before recommending program reductions. Groundwater level data collected during sampling events will support gradient-dependent decisions to reduce the number of wells sampled.
- When a COC in a well shows three or more consecutive below-MCL/AL values but then violates a MCL/AL in a subsequent sample within a five-year cycle, the USACE will statistically evaluate the multi-year data to determine whether the higher result is an outlier, indicative of normal fluctuation of a COC in the well, or fluctuation within a well defined MNA (reducing) trend (i.e., not a recurrence of a rising trend). Such evaluations will include, and not be limited to, descriptive statistics, rolling average and exponential smoothing trends, rolling confidence limit analyses, annual Mann-Kendall or seasonal Mann trend analyses, and the potential use of long-term monitoring optimization software (EPA 2005). Pending these analyses and/or according to appropriate regulatory guidance (e.g., EPA 1999), the well may continue into the next five-year cycle or be omitted from further COC-specific sampling. Groundwater level data collected during sampling events will support gradient-dependent decisions to reduce well sampling The five-year review report will present sound technical support to defend the disposition or retention of each well.

The USACE will use groundwater data from every sampling event (both inter- and intra-five-year cycles) when evaluating for MCL/AL compliance within a five-year cycle. This will allow both historic and recent data trends to support the aforementioned decision-making process. However, once a well is scheduled for sampling within a five-year cycle, it will be sampled throughout the cycle even if the MCL/AL criteria are met during the cycle. This intra-cycle continuance will to prove the effectiveness of the MNA remedy for the five-year review.

Basically, MNA performance program under this ROD will continue at each performance monitoring well listed on Figure 24 until each COC-impacted well shows a progressive MNA trend that indicates the respective cleanup goals (MCLs or AL) are defensibly reached. Currently contaminated wells and downgradient support wells will be omitted from the program over time as MNA achieves below-MCL/AL concentrations for unrestricted site release.

All five-year reviews will document COC reductions and, if appropriate, redefine the number of wells sampled, and the well-specific COCs. The performance monitoring program will sunset as both the number of sampled wells and the COCs sampled at each well systematically drop from the program, especially for single wells with multiple COCs, such as MW-21(I) or -24(S). Once the final well(s) achieves the MCL criteria, then the final five-year review will propose a programmatic close-out, ROD conclusion, and unrestricted site-release.

This program falls within the monitoring cost estimates presented in the FS (USACE 2003) and will indicate the effectiveness of the soil-removal alternative with respect to impacts to groundwater.

13.0 EXPLANATION OF SIGNIFICANT CHANGES

There were no significant changes to the Proposed Plan (USACE 2003a) based on comments received in the responsiveness summary in Appendix A..

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Table 1. Luckey Site Monitoring Wells and Piezometers

Well ID	Easting (ft) #	Northing (ft) #	Ground Surface (ft)	Well Bottom (ft)
MW-01(I)	1697509.4386	654799.7349	647.88	617.88
MW-02(S)	1697495.7800	654793.7296	647.85	628.85
MW-03(I)	1697057.4343	653858.9710	649.33	622.33
MW-04(S)	1697041.9934	653859.7723	649.16	631.96
MW-05(I)	1698188.0426	654307.2644	650.68	620.68
MW-06(S)	1698187.1600	654322.9701	650.46	632.46
MW-07(I)	1698132.0026	654675.6136	648.6	617.6
MW-08(S)	1698138.8486	654662.4507	648.66	628.36
MW-13(S)	1697939.3016	654811.0356	648.75	630.75
MW-14(S)	1697028.6385	654000.3239	649.51	632.01
MW-17(S)	1698018.1442	654341.8833	649.82	629.79
MW-18(I)	1696732.2910	654599.6176	647.88	614.88
MW-19(I)	1697954.1195	654806.6200	648.62	618.62
MW-20(S)	1697853.9878	654097.6144	650.54	636.54
MW-21(I)	1697394.4970	654513.6371	649.25	621.25
MW-22(I)	1697743.3728	654798.8183	647.82	620.32
MW-23(S)	1697755.7772	653841.1278	650.06	634.51
MW-24(S)	1697302.7405	654031.9662	650.91	627.91
MW-25(I)	1697030.1492	654797.3753	647.25	616.75
MW-26(S)	1697694.9323	654802.2052	647.78	620.28
OMW-27(I)	1697272.7700	654832.8454	647.7	592.7
OMW-28(B)	1697264.1500	654832.8824	647.67	592.67
OMW-29(I)	1696546.9202	655130.6620	646.85	612.85
OMW-30(B)	1696547.0502	655139.7640	646.73	589.73
OMW-31(I)	1697191.3503	655223.1144	646.47	615.47
OMW-32(B)	1697200.0603	655222.8654	646.52	590.52
OMW-33(I)	1696857.1905	655512.8327	646.29	591.29
OMW-34(B)	1696865.5605	655512.4257	646.38	550.38
OMW-35(I)	1697852.2105	655497.0959	646.38	614.98
OMW-36(B)	1697852.1905	655506.3229	646.42	591.22
OMW-37(I)	1696779.3508	655884.6858	641.34	606.24
OMW-38(B)	1696786.3308	655886.9478	641.37	586.37
MW-39(B)	1697509.2499	654812.2982	647.87	553.87
MW-40(B)	1697500.4799	654812.5412	647.85	591.65
MW-41(B)	1697371.8800	653846.6120	650.33	594.33
TW-42(S)	1697071.0300	653859.6880	649.3	634.3
TW-43(S)	1696694.7500	653848.8410	649.35	634.35
PZ01	1696809.8572	654485.2251	647.68	629.11
PZ02	1697294.1739	654783.8674	647.29	630.39
PZ03	1697650.9977	654306.1664	648.7	632.7
PZ04	1696695.6358	653841.8728	648.9	630.99
PZ05	1698263.3528	653836.5070	650.06	637.56
PZ06	1697110.7569	654632.3612	647.41	629.25

Ohio State Plane – North, 1983, Feet
Parenthetic value after well identification signifies monitored zone:
(S) = Shallow till and minor sand & gravel
(I) = Intermediate in deeper sand & gravel and upper bedrock zone
(D) = Deeper bedrock zone (residential aquifer zone)

Table 2. Summary Statistics for COCs in Groundwater at the Luckey Site

Parameter	Detection Frequency	Minimum Value	Minimum Location #	Maximum Value	Maximum Location #	Average Value	Background	Background Exceed	MCL ***	MCL Exceed	MCL Exceed / Total Samples (%)	Units
Beryllium	73/291	0.15 B	MW-25(I)	170	MW-26(S)	4.72	0.79	51/73	4	39/73	13.4	µg/L
Beryllium (Filtered)	46/257	0.17 B	MW-24(S)	137	MW-26(S)	3.53	--	46/46	4	21/42	8.2	µg/L
Lead	123/282	1.4 B	MW-19(I)	48.5	MW-21(I)	4.53	7.2	33/123	15	15/123	5.3	µg/L
Lead (Filtered)	86/257	1.5 B	MW-14(S)	46.2	MW-21(I)	3.67	1.8	74/86	15	10/86	3.9	µg/L
Uranium, total *	245/291	0.11	MW-39(B)	389.86	MW-24(S)	11.48	4.23 **	71/245	30	13/245	4.5	µg/L

NOTES:

* Where total uranium values were absent, total uranium values were calculated by using the equation (U-238 value x 2.046/0.677) resulting in a total uranium value in µg/L.

** The total uranium background value was calculated by converting the U-238 background value (1.4 pCi/l) using the equation above.

*** MCL = USEPA Maximum Contamnant Level (ARAR-based cleanup goal) and includes the lead Action Level for treatment.

\# Well designators: S = Shaloow Zone, I = Intermediate Zone, B = Deep Bedrock Zone

-- Non-Detect

Table 3. Annual Groundwater Monitoring Program Results

Well	Sample Year	Beryllium	Beryllium (Filtered)	Lead	Lead (Filtered)	Uranium, Total
Units		µg/L	µg/L	µg/L	µg/L	µg/L
Cleanup Standards		*4*	*4*	*15*	*15*	*30*
IA09-GW0001	2002	ND	ND	ND	ND	0.48
	2004	ND	NA	1.7 J	NA	0.561
IA09-GW0002	2002	ND	ND	ND	ND	0.18
	2004	ND	NA	ND	NA	0.371
	2005	ND	ND	0.8 J	1 J	ND
	2006	ND	ND	0.6 J	ND	0.85 J
	2007	ND	ND	ND	ND	0.2 J
IA09-MW-01(I)	2002	34	11	ND	3	0.52
	2004	31.1	NA	ND	NA	3.16
	2005	41.2	33.8	ND	ND	3.32
	2006	31.8	33.2	ND	0.62 J	2.85
	2007	32.5	30.9	ND	ND	2.39
IA09-MW-02(S)	2002	60	60	4	ND	6.46
	2004	77.8	NA	1.7 J	NA	6.24
	2005	44.2	43	1.5 J	2.3 J	5.23
	2006	14.8	13.7	1.8	1.4	4.13
	2007	14.2	13.2	ND	ND	4.56
IA09-MW-05(I)	2002	ND	ND	4	4	3.58
	2004	ND	NA	ND	NA	2.79
	2005	ND	ND	2.6 J	3.4	3.23
	2006	ND	ND	1.5	1.2	3.82
	2007	ND	ND	ND	ND	2.69
IA09-MW-07(I)	2002	ND	ND	ND	ND	2.48
	2004	ND	NA	ND	NA	2.47
	2005	ND	ND	ND	ND	2.53
	2006	ND	ND	ND	ND	2.73
	2007	ND	ND	ND	ND	3.23
IA09-MW-19(I)	2002	ND	ND	ND	ND	0.43
	2004	2.8 J	NA	ND	NA	0.554
	2005	3.1 J	2.9 J	ND	ND	0.492 J
	2006	2.8	3.5	ND	ND	ND
	2007	2.2 J	2.1 J	ND	ND	2.06
IA09-MW-21(I)	2002	ND	ND	34	29	27.6
	2004	ND	NA	32.5	NA	13.57
	2005	ND	ND	25.5	25.7	14.9
	2006	ND	ND	32.7	31.7	35
	2007	ND	ND	27.1	25.7	27.5
IA09-MW-24(S)	2002	ND	ND	12	12	333
	2004	ND	NA	9.4	NA	273
	2005	ND	ND	ND	4.2 J	161
	2006	0.38 J	0.17 J	6.8	6.1	184
	2007	ND	ND	6.1 J	7.1 J	215
IA09-MW-26(S)	2002	119	103	10	ND	13.8
IA09-MW-40(B)	2002	ND	ND	4	3	1.03
	2004	ND	NA	ND	NA	1.1
	2005	ND	ND	ND	ND	0.484 J
	2006	ND	ND	ND	0.49 J	ND
	2007	ND	ND	ND	ND	0.46
IA09-OMW-29(I)	2002	ND	ND	ND	ND	0.21
	2004	ND	NA	ND	NA	0.299
	2005	ND	ND	ND	ND	4.45
	2006	ND	ND	ND	0.89 J	2.5
	2007	ND	ND	ND	ND	1.72
IA09-OMW-31(I)	2002	ND	ND	ND	ND	0.67
	2004	ND	NA	ND	NA	0.982
	2005	ND	ND	ND	ND	1.42
	2006	ND	ND	ND	ND	1.81 J
	2007	ND	ND	ND	ND	0.64
IA09-OMW-35(I)	2002	ND	ND	ND	ND	0.72
	2004	ND	NA	ND	NA	0.763
	2005	ND	ND	ND	ND	0.528 J
	2006	ND	ND	1.6	1.5	1.91 J
	2007	ND	ND	ND	ND	3.17
IA09-PW(E)	2002	ND	ND	ND	ND	0.18
	2004	ND	NA	ND	NA	0.502
IA09-PW(W)	2004	4.1 J	NA	ND	NA	8.04

NA - Not Analyzed
ND - Not Detected
NU - Result was not used because of quality issues
J - Estimated
2007 Total Uranium Based On U-238 Values Using (U-238*(2.046/0.677); See USACE 2003.

Table 4. Remedial Periods in Years for Alternative 7 -MNA and Alternative 8 -Active Pump and Treat at Luckey Under Non-Pumping and Pumping Conditions

Constituent	Location	Alternative 7 Monitored Natural Attenuation			Alternative 8 Active Groundwater Treatment		
		Clay-Rich Till	Sand & Gravel	Bedrock	Clay-Rich Till	Sand & Gravel	Bedrock
NON-PUMPING CONDITIONS							
Beryllium	MW-01(I)		60	12		14	2
	MW-26(S)		150	40		50-80	25
	PW(W) 1		0	3.5		0	1
Lead	MW-21(I) 2		0	3.5		0	0.5
	MW-24(S) 3	400-600		3.5	200-400		1
Uranium	MW-24(S)	>1,000		30	200-500		10
PUMPING CONDITIONS							
Beryllium	MW-01(I)		1.5	4.5		3.5	3
	MW-26(S)		175	40		90	26
	PW(W) 1		0	1		0	1
Lead	MW-21(I) 2		0	1.2		0	0.5
	MW-24(S) 3,4	400-600		NA	200-400		NA
Uranium	MW-24(S) 4	>1000		NA	200-500		NA

Notes:

1 Simulations for beryllium at PW(W) were initiated with beryllium in the bedrock only, and concentrations never exceed ARAR-based cleanup goals in the sand and gravel.

2 Simulations for lead at MW-21(I) were initiated with lead in the upper weathered bedrock only, and concentration never exceed ARAR-based cleanup goals in the overlying sand and gravel.

3 Sand and gravel does not occur at MW-24(S) and therefore, no time frames are reported for both uranium and lead at this location.

4 Simulations for lead and uranium under pumping conditions were completed with the source term (starting concentrations) released in the overburden. No simulations were run with the source term released only in the upper bedrock, and therefore, time frames are not reported for the bedrock for lead and uranium at MW-24(S).

The time frames (years) are based upon predictive modeling results. Modeling was not performed for electrokinetics. Estimated total time for the completion of groundwater remediation using electrokinetics is 15 years for the clay-rich tills and the sands and gravels. Remediation of groundwater in the carbonate bedrock is assumed to be similar in duration to MNA (Alt 7) for achievement of ARARs since electrokinetics may not be effective (< 40 years). Long time frames for achievement of ARARs are possible (as predicted from modeling) for groundwater in the clay-rich till. In particular, the area around MW-24(S) results in significant time frames for both MNA and pump and treat evaluations, if constituents remain in the clay-rich till above the weathered bedrock. MW-24(S) is completed across the interface between the clay-rich till and the upper weathered bedrock. Based upon the lithologic log for MW-24(S), clay-rich till occurs immediately above the bedrock (there is no significant sand and gravel identified in the log for MW-24(S)). Therefore, no time frames are reported for sand and gravel at MW-24(S) for either lead or uranium.

Table 5. Summary of Detailed Analysis of Remedial Alternatives

NCP Evaluation Criteria	**Alternative 1 No Action**	**Alternative 7 Monitored Natural Attenuation (Unrestricted Land Use)**	**Alternative 8 Active Groundwater Treatment (Unrestricted Land Use)**	**Alternative 9 Electrokinetics (Unrestricted Land Use)**
Human Health Protection	Not protective due to risk from exposure.	Protective due to natural attenuation and mitigation of exposure pathways due to land use controls.	Protective due to treatment of groundwater and land use controls.	See Alternative 8.
Environmental Protection	Continued potential for adverse impacts from existing conditions; however, habitat and receptors are limited.	Groundwater is not an ecological concern until it becomes surface water.	See Alternative 7.	See Alternative 7.
ARARs	Not compliant.	Compliant in approximately 40 to 150 years.	Compliant in approximately 80 years.	Compliant in approximately 40 years.
Magnitude of Residual Risk	Residual risk exceeds EPA risk range due to waste remaining in current configurations, thereby allowing for potential future exposure.	Meets risk range without restrictions. Would require a longer time frame to achieve than Alts 8 or 9.	Meets risk range without restrictions on future land use.	See Alternative 8.
Adequacy and Reliability of Controls	No land use controls.	Land use controls required and considered adequate while MNA works.	Land use controls required and considered adequate for duration of treatment.	Land use controls required and considered adequate for duration of treatment.
Long-Term Management	No long-term management.	Required for up to 150 years or duration of treatment.	Required for 80 years.	Required for 40 years.
Reduction through Treatment.	None (no treatment).	None.	Volume and mobility reduction.	See Alternative 8.
Community	Risk to community not increased, but potential contaminant migration and increased exposure over time.	Slight potential for an increase in risk during well installation activities. Site risks would be controlled by mitigation measures.	Slight potential for an increase in risk during well installation activities. Site risks would be controlled by mitigation measures.	Potential for an increase in risk from construction and implementation activities. Site risks would be controlled by mitigation measures.
Workers	No significant increase of risks or hazards to workers	Slight potential of radiological and non-radiological hazards reduced by mitigation measures.	Radiological risks and non-radiological hazards reduced by mitigation measures; site safety measures would be implemented. Potential for additional risks due to materials handling during treatment.	See Alternative 8. Potential for additional risks due to electrical system needed for electrodes.
Ecological Resources	Continued potential for impacts from existing conditions.	Slight impact.	See Alternative 7.	Potential short-term environmental impacts minimized by Engineering controls.
Engineering Controls	None.	Potential releases controlled with management and engineering practice.	See Alternative 7.	See Alternative 7.
Time to Complete (1)	0 years	0 years	0.5 years	1 year
O & M Period	0 years	40 to 150 years	80 years	40 years
Technical Feasibility	Not applicable.	Relatively easy; readily available technology.	Relatively easy; readily available technology.	Moderate as treatment units available commercially but effectiveness must be demonstrated.
Administrative Feasibility	Not applicable.	Relatively easy.	See Alternative 7.	See Alternative 7.
Estimated Cost (2)	$0.0 million ($0.0 million)	$0.83 million (0.89 million)	$3.7 million ($4.0 million)	$9.4 million ($10.1 million)

Notes:
1 Time to complete remedial action after completion of remedial design, assuming timely project funding; does not include monitoring period.
2 Estimated costs in FY 02 dollars (FY 2007 dollars using a seven percent discount factor on FY 2002 cost).

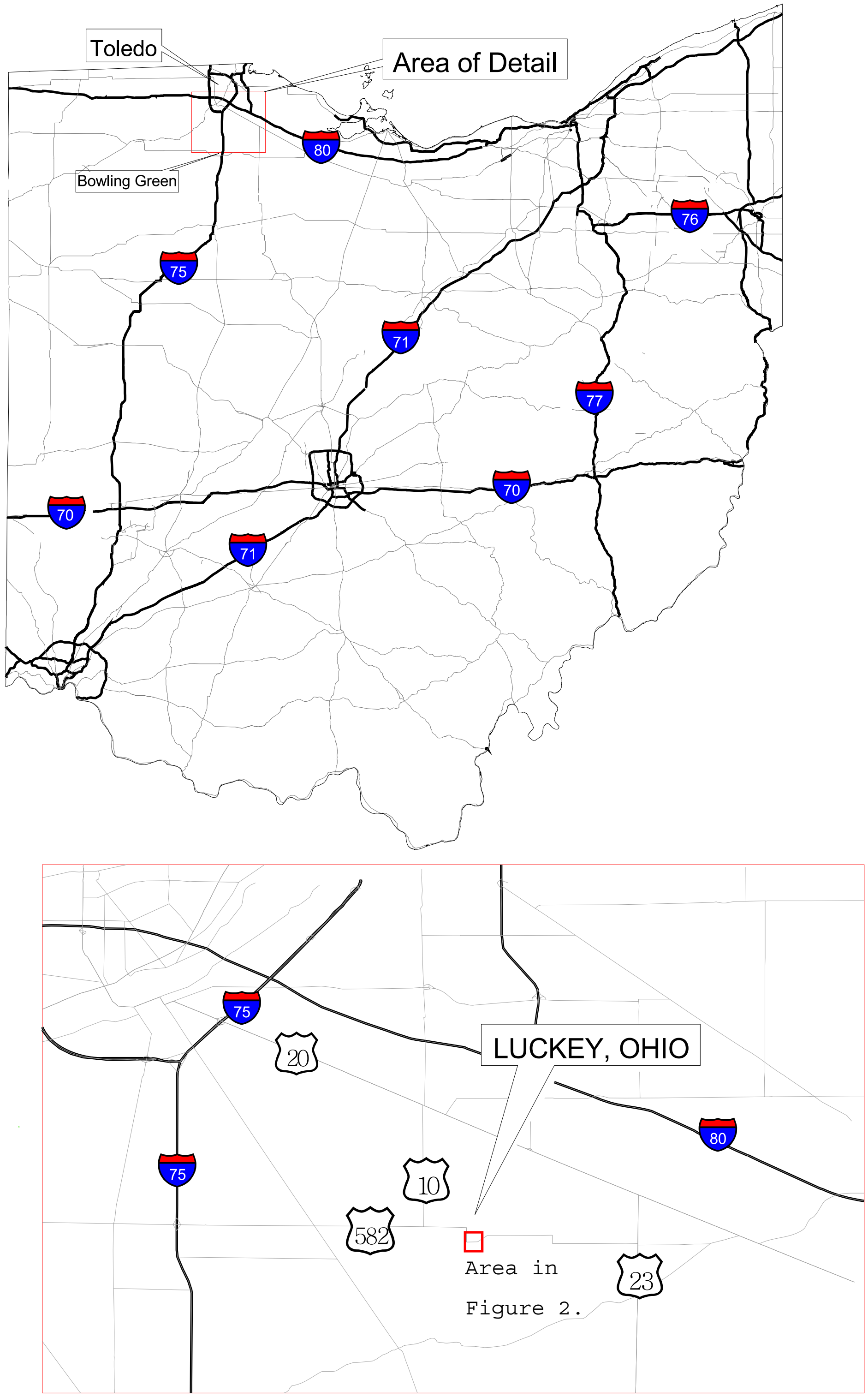
Table 6. Summary of Comparative Analysis of Remedial Alternatives

NCP Evaluation Criteria	Alternative 1 No Action	Alternative 7 Monitored Natural Attenuation (Unrestricted Land Use)	Alternative 8 Active Groundwater Treatment (Unrestricted Land Use)	Alternative 9 Electrokinetics (Unrestricted Land Use)
(1) Overall Protection of Human Health and the Environment	Low	Low / Medium	High	High
(2) Compliance with ARARs	Low	Low / Medium	High	High
(3) Long-Term Effectiveness and Permanence	Low	Medium	High	High
(4) Reduction of Toxicity, Mobility, or Volume through Treatment	Low	Medium	High	High
(5) Short-Term Effectiveness (includes potential for environmental impacts) Time to complete (1) O&M Period.	Low 0 years 0 years	High 0 years 40 to 150 years	Medium 0.5 years 80 years	Low 1 year 40 years
(6) Implementability	High	High	Medium	Medium
(7) Cost (2)	$0	$0.83 million	$3.7 million	$9.4 million
(8) State / Agency Acceptance	Low	Low	Medium	High
(9) Community Acceptance	Low	Low	Medium	High

Notes:
1 Time to complete remedial action after remedial design, is dependent upon timely project funding. Does not include monitoring.
2 Estimated costs calculated as net present value in FY 02 dollars using a seven percent discount factor (~$0.89 million in FY07).

Table 7. Advantages and Disadvantages of Groundwater Alternatives for Comparative Analysis

Alternative	Advantages	Disadvantages
Alternative 7 Monitored Natural Attenuation	• Observed data for uranium and to lesser extent lead suggest decreasing trends suggesting already effective • Predicted times: lead < 5 yrs; uranium < 30 yrs; beryllium < 40 for bedrock, <150 for sand & gravel • Applies to all areas of the site • Small or negligible volume of Investigative Derived Waste (IDW) • Lower overall costs	• Contamination in clay-rich tills could increase time frame for effectiveness • Requires extensive performance monitoring program • Potential for contaminant migration • Relatively long time period for beryllium in sand and gravel (long- term monitoring) • Public perception as "no action" alternative for groundwater • Land use controls required until attainment of beneficial reuse status (until all ARARs are met)
Alternative 8 Active Groundwater Treatment – Ex situ	• Effective for remediation of groundwater in sand and gravel and carbonate bedrock aquifer • Time to achieve ARARs is predicted to be maximum of 50 to 80 years • Predicted times: lead < 1 year; uranium < 10 years; beryllium <25 years for bedrock < 80 years for sand & gravel • Controls/eliminates potential for contaminant migration to receptors • Reduces contaminant mass/concentration in groundwater	• Ineffective for contamination in clay-rich tills • Flow field variability from operation or shut down of the East Production Well impacts extraction well placement • Relatively small cone of influence due to shallow contamination (thin zone for pump and treat) may require closer well spacing • System installation and maintenance costs are relatively high • Construction and operation of treatment facility that may require maintenance beyond typical design life • Time period for completion up to 80 years • Generates large volumes of water to be treated and disposed • Possible recontamination after system shutdown • Land use controls required until attainment of beneficial reuse status (until all ARARs are met)
Alternative 9 Electrokinetics	• Addresses impacted groundwater within the clay-rich till and sand and gravels • Controls or eliminates potential future migration of contaminants • Predicted times: completion ~ 15 years for clay-rich tills; <40 years for bedrock	• Does not address impacted groundwater in carbonate bedrock • Significant system installation and operation costs (including a pilot study to determine effectiveness) • Construction and operation of treatment system that may require maintenance beyond typical design life • IDW generated during installation (approximately 15 drums each of liquid waste for beryllium and uranium -30 total drums) • Land use controls required until attainment of beneficial reuse status (until all ARARs are met)



Primary road with limited access
Primary road

Inset Scale
60 0 60 Miles

N
W E
S

U.S. Army Corps of Engineers
Buffalo District

LUCKEY SITE

Site Location

USACE - Buffalo District
Luckey Site Groundwater ROD
Figure 1. Site Location

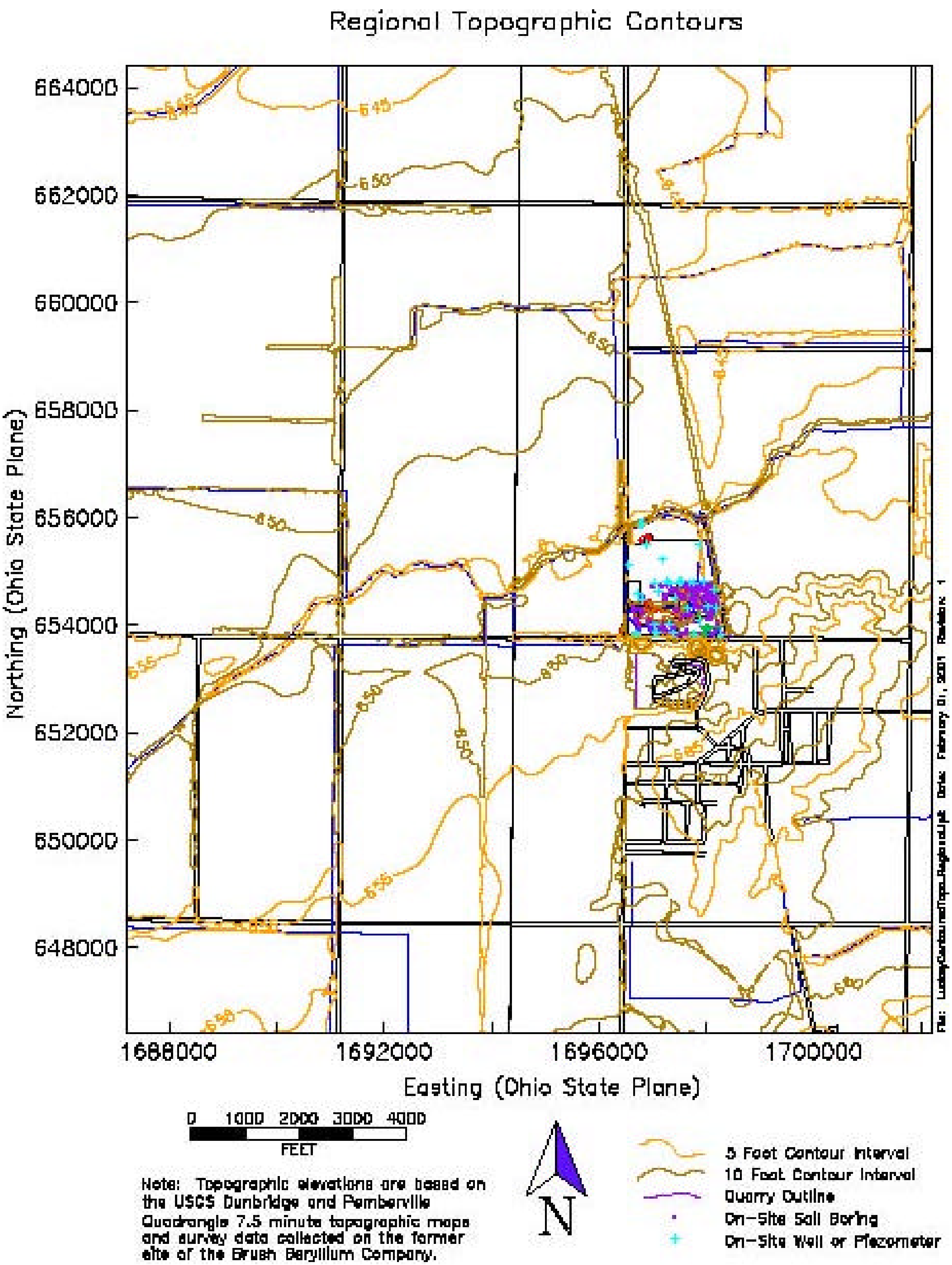
S:ARCVIEW LUCKEY/C01748/801/SITE LOCATION FS Report Fig No. 2.1

S:ARCVIEW LUCKEY/GIS/PROJECT3.APR LAYOUT AERIAL PHOTO

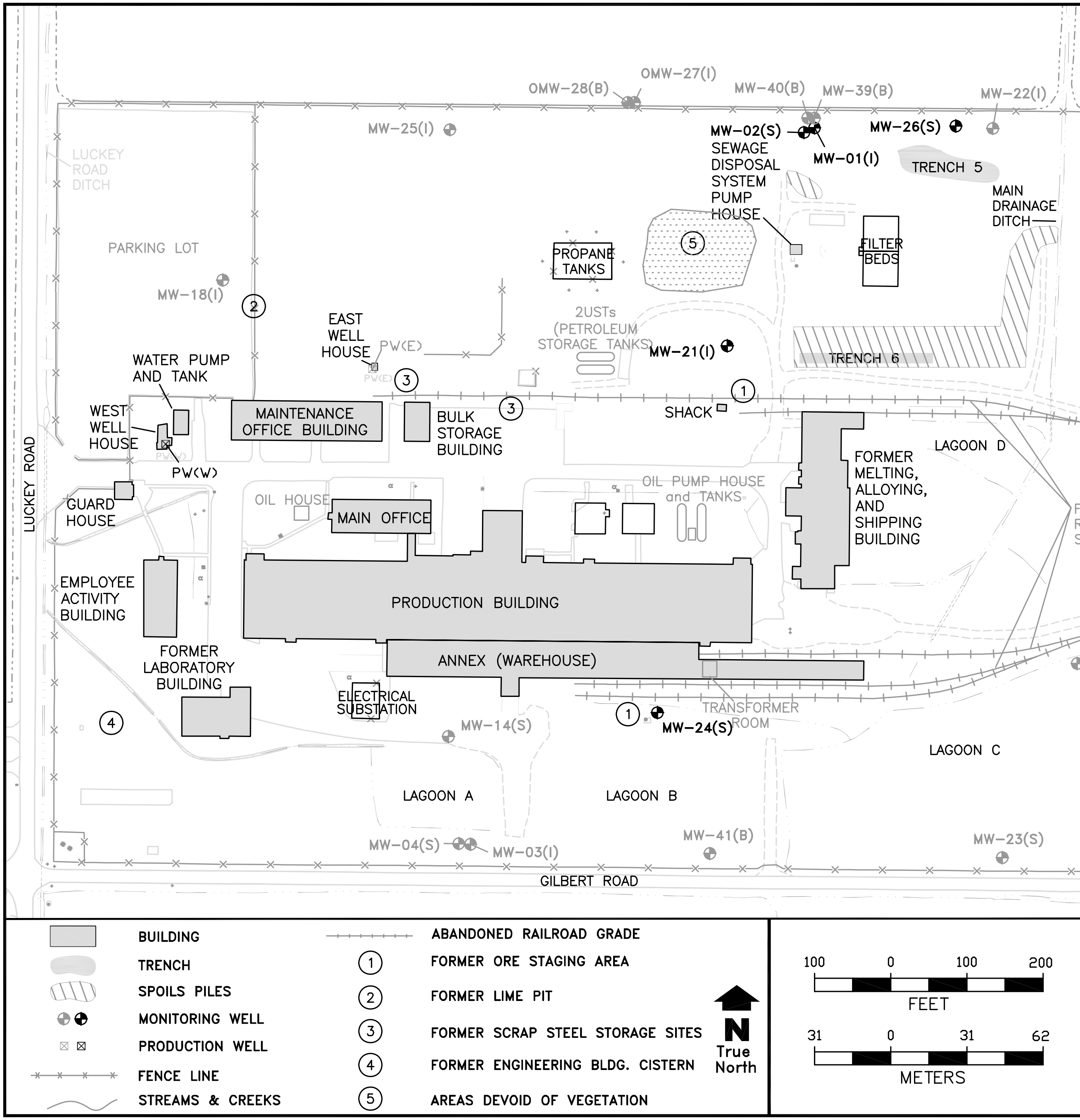
U.S. ARMY CORPS OF ENGINEERS
BUFFALO DISTRICT
LUCKEY SITE

Luckey Site near Luckey, Ohio

USACE - Buffalo District
Luckey Site Groundwater ROD
Figure 2. Luckey Site Overview



USACE - Buffalo District
Luckey Site Groundwater ROD
Figure 3. Regional Topographic Contours (5 foot contour intervals)



U.S. Army Corps of Engineers
Buffalo District

Features at the Luckey Site

USACE - Buffalo District
Luckey Site Groundwater ROD
Figure 4. Features at the Luckey Site

XREF Files: LUCKFEET DRIVES FENCE FIELDS IABOUNDS IAINFO MISC ROADS RR-RAIL STRUCT TOPO TREES UTILSTRC WATER IMAGE Files: Armylogoblk.bmp feet.tif 2
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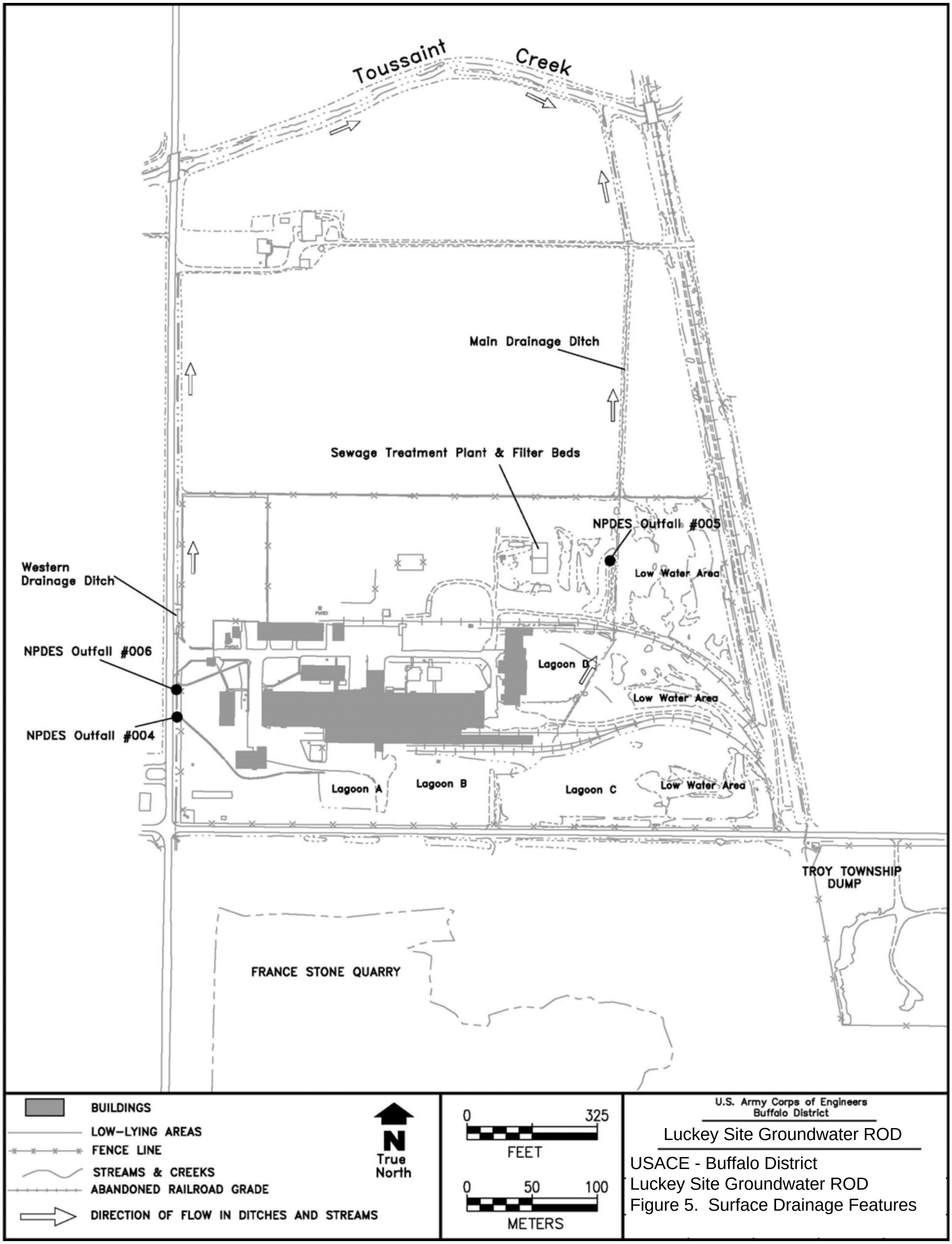

Figure 5. Surface Drainage Features

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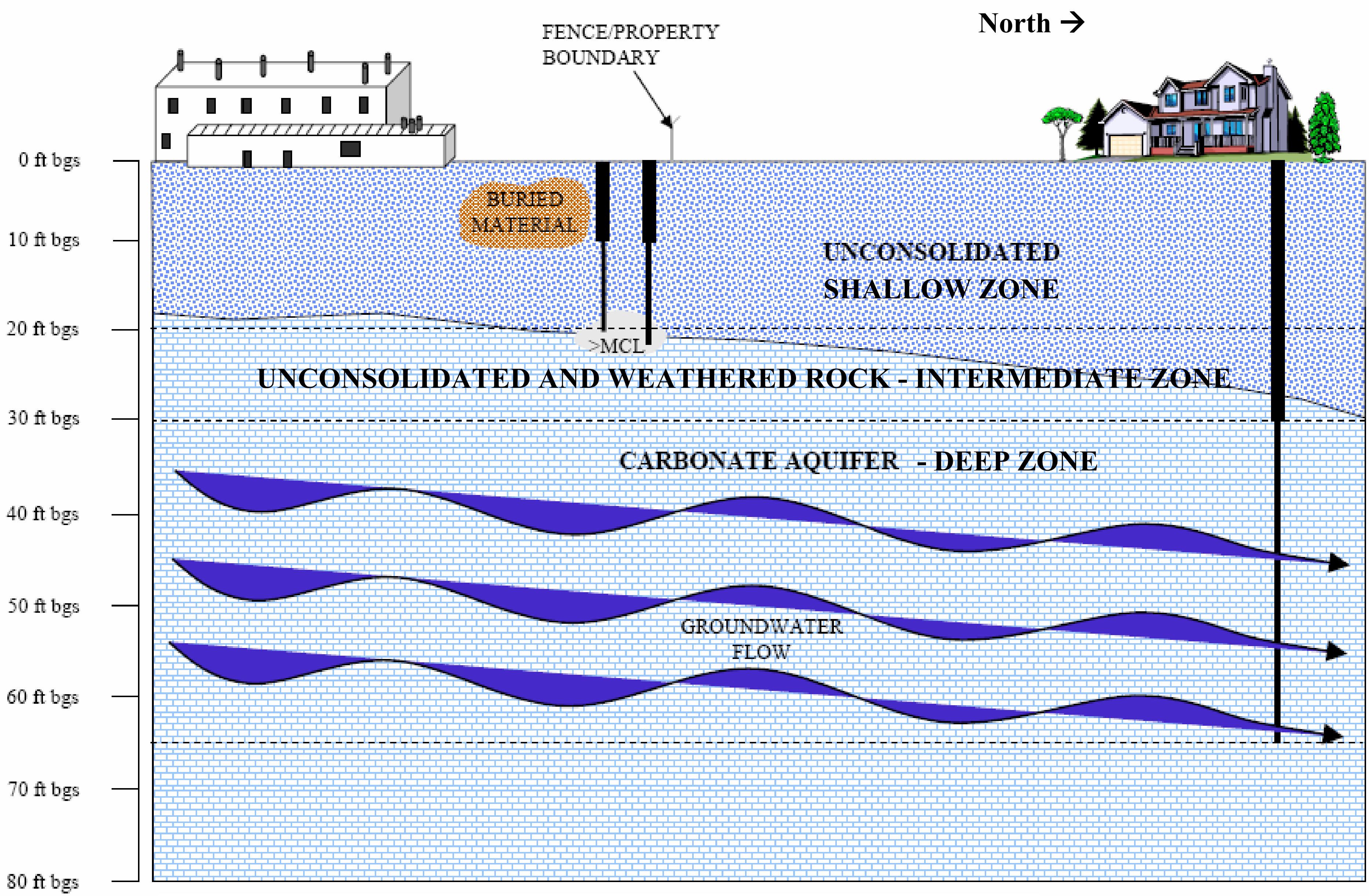
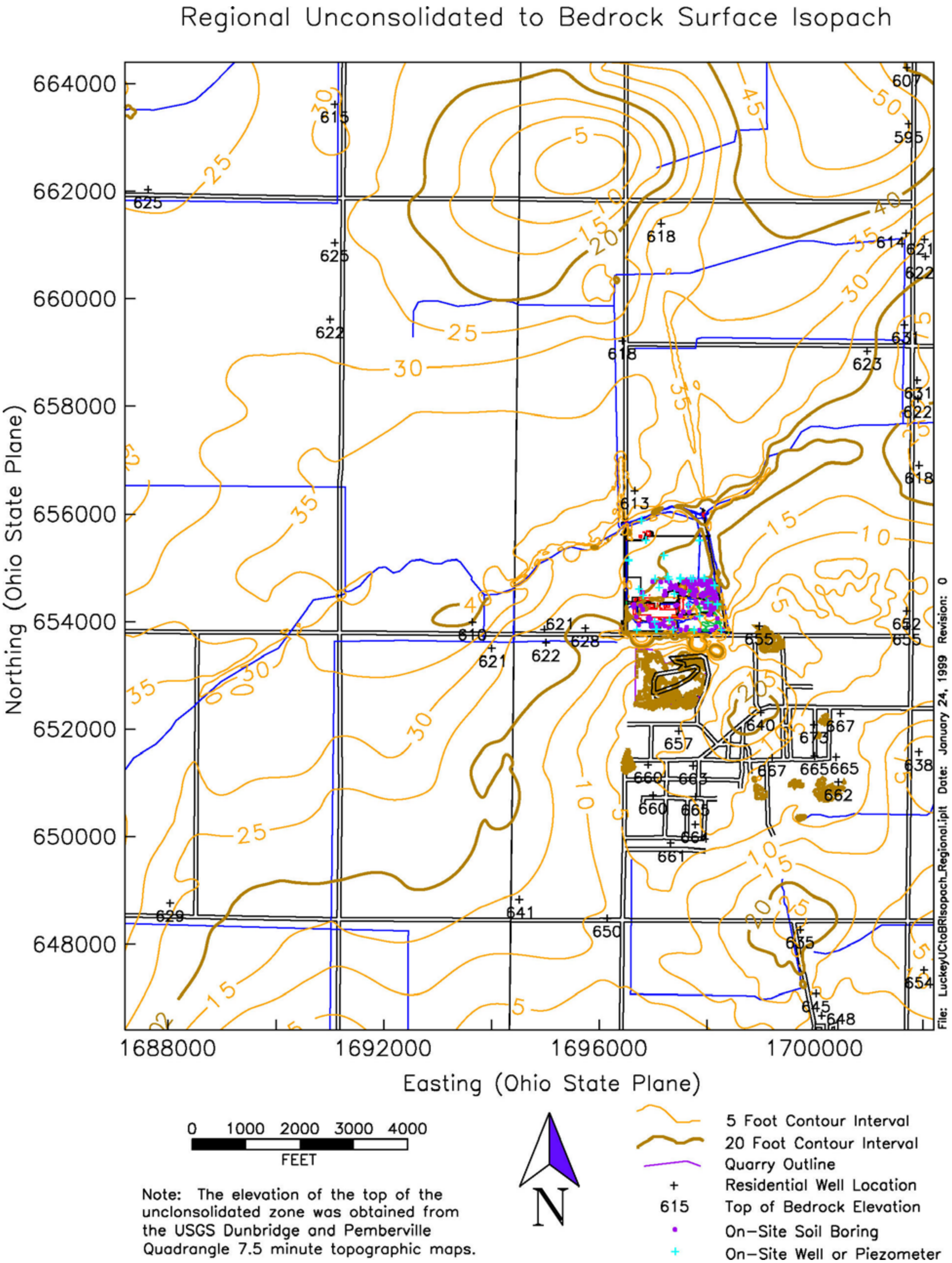


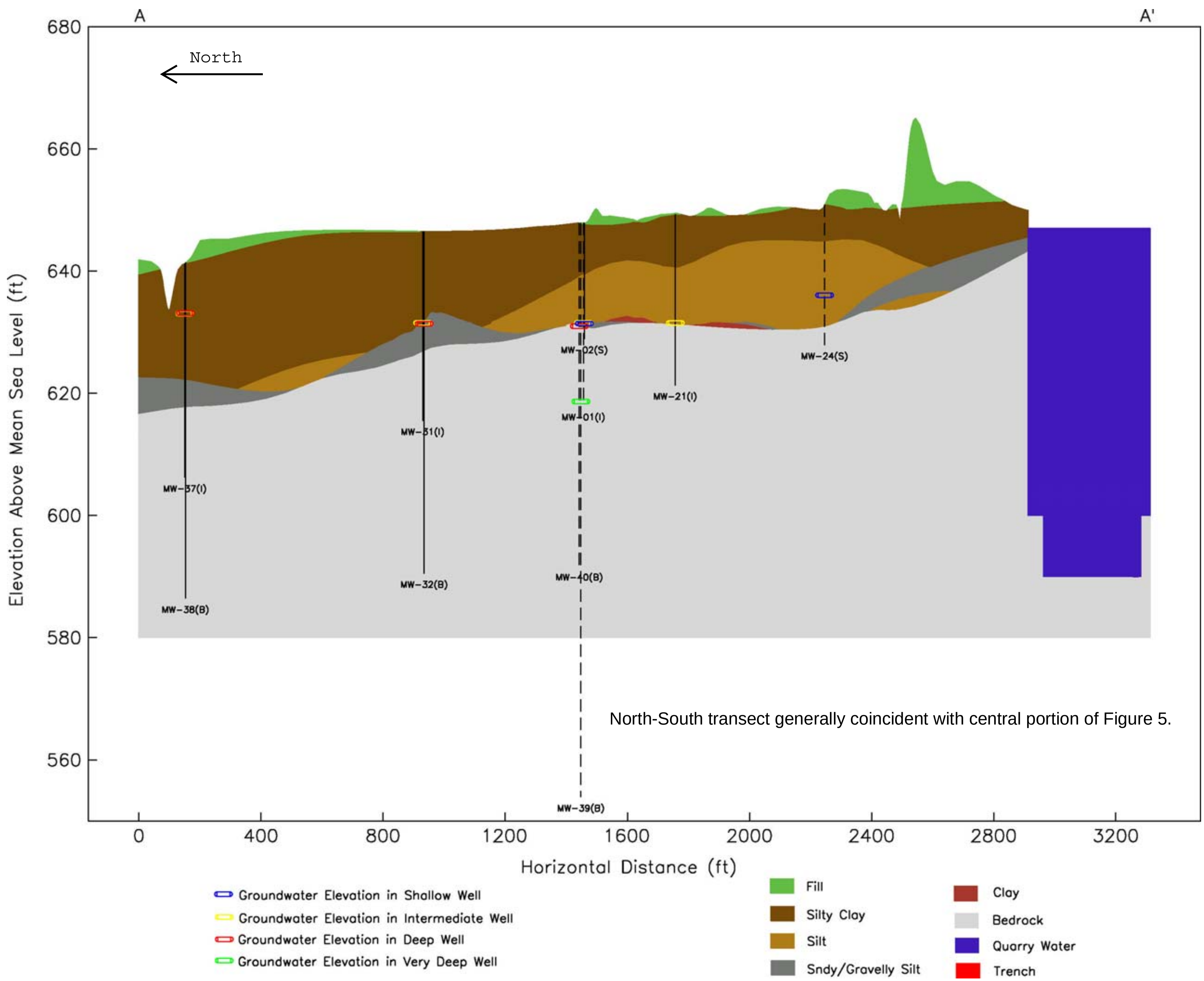
USACE - Buffalo District
Luckey Site Groundwater ROD
Figure 6. Conceptual Groundwater Model

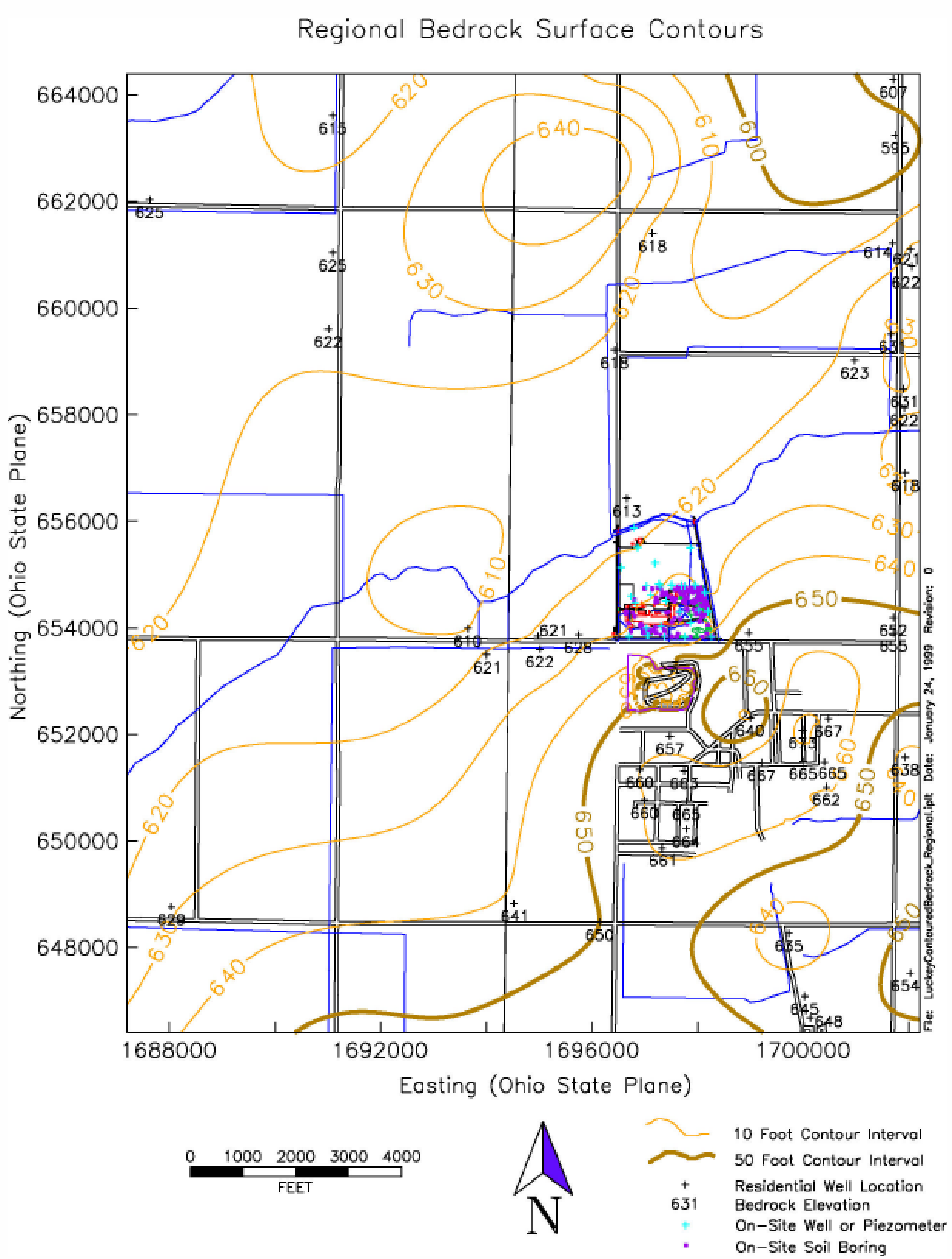


USACE - Buffalo District
Luckey Site Groundwater ROD
Figure 7. Regional Unconsolidated Sediment Isopach Map

(5-foot thickness contours)

USACE - Buffalo District
Luckey Site Groundwater ROD
Figure 8. Local Hydrostratigraphic Cross Section





USACE - Buffalo District
Luckey Site Groundwater ROD
Figure 9. Lockport Dolomite Surface Topography (10-foot contour interval)

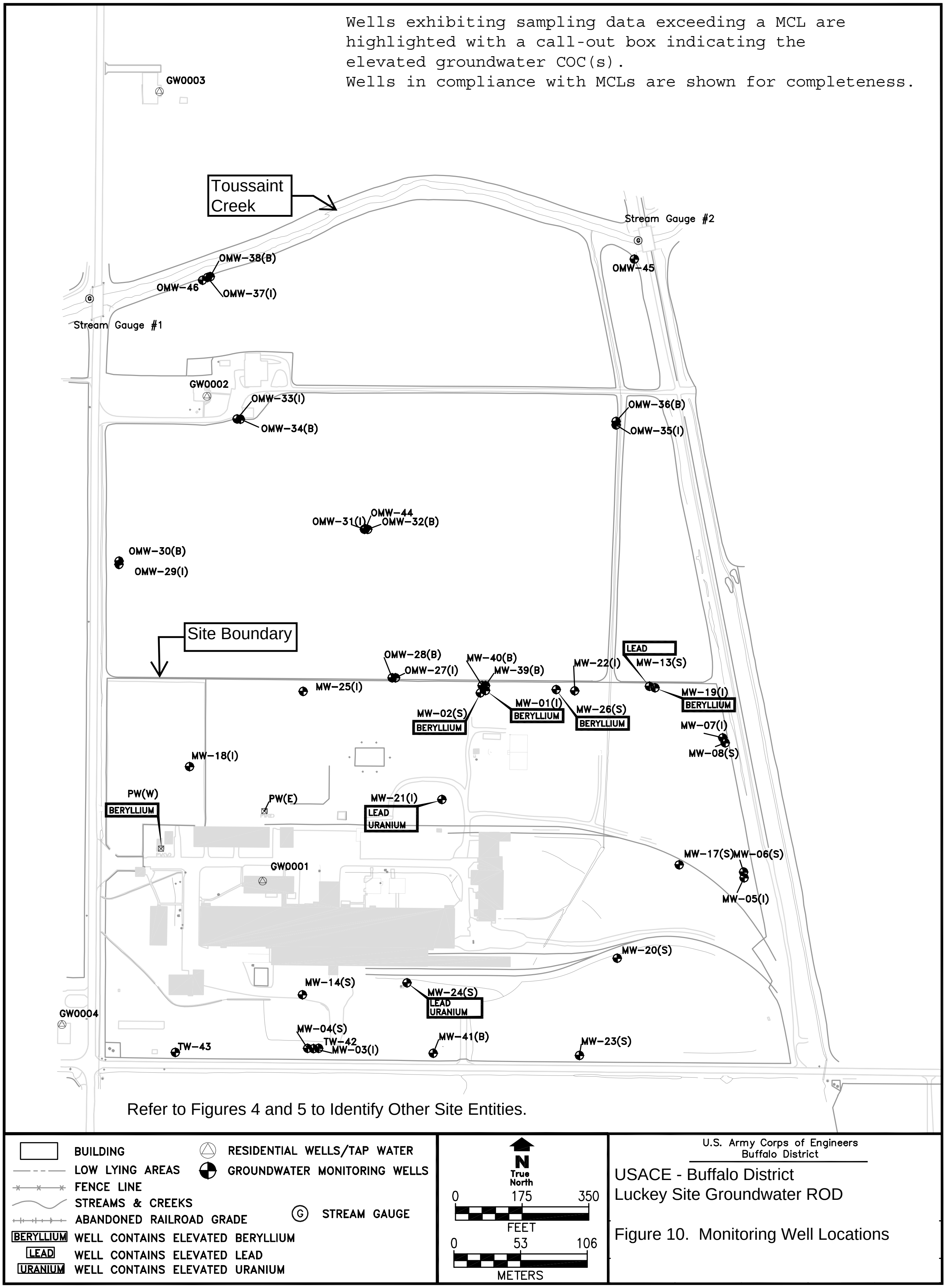
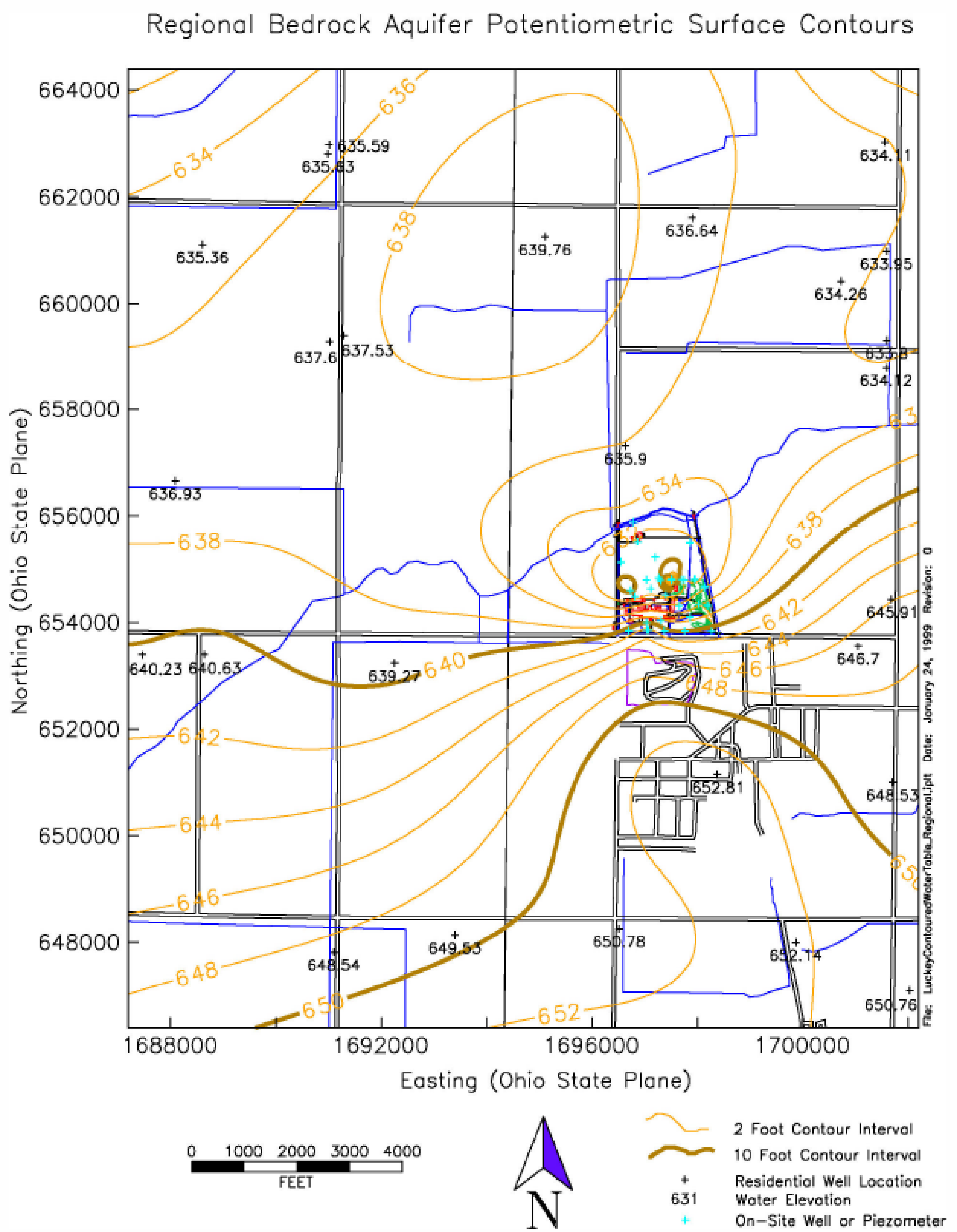


Figure 10. Monitoring Well Locations

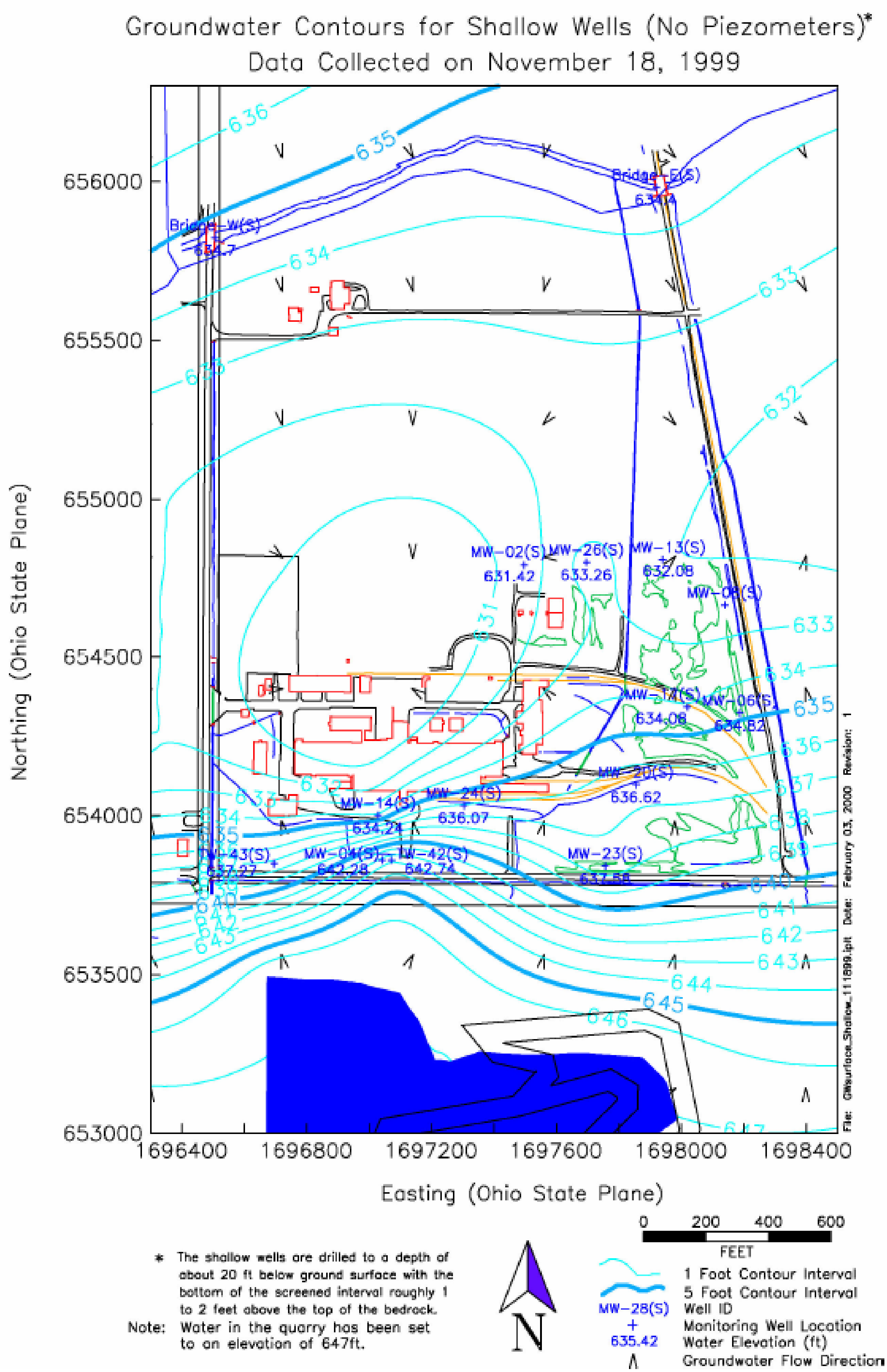
XREF Files: luckfeet DRIVES FENCE FIELDS IABOUNDS IAINFO MISC ROADS RR-RAIL STRUCT TOPO TREES UTILSTRC WATER IMAGE Files: Armylogoblk.bmp feet.tif feet.tif 2_foot.tif
File: W:\CAD Gov\Luckey\tw041612\533-FS_rev4\Fig3-3 Fs_PhaseII&IVgw rev1 cap.dwg Layout: Layout2 User: evansstev Jun 02, 2003 - 11:00am



USACE - Buffalo District
Luckey Site Groundwater ROD
Figure 11. Regional Bedrock Potentiometry

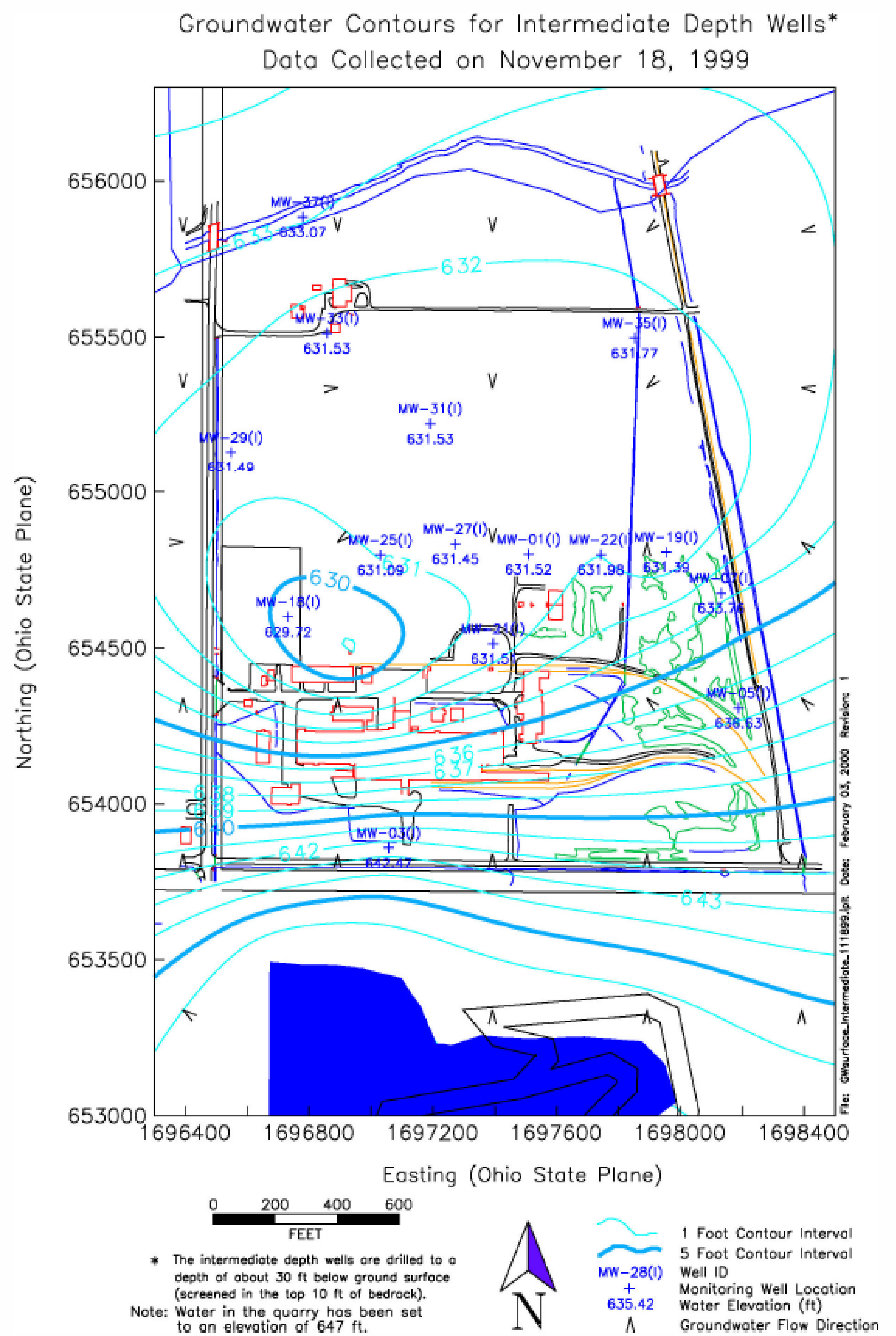
Water levels recorded during early November, 1999.

East Production Well (PW[E]) operating at ~70 gallons per minute.



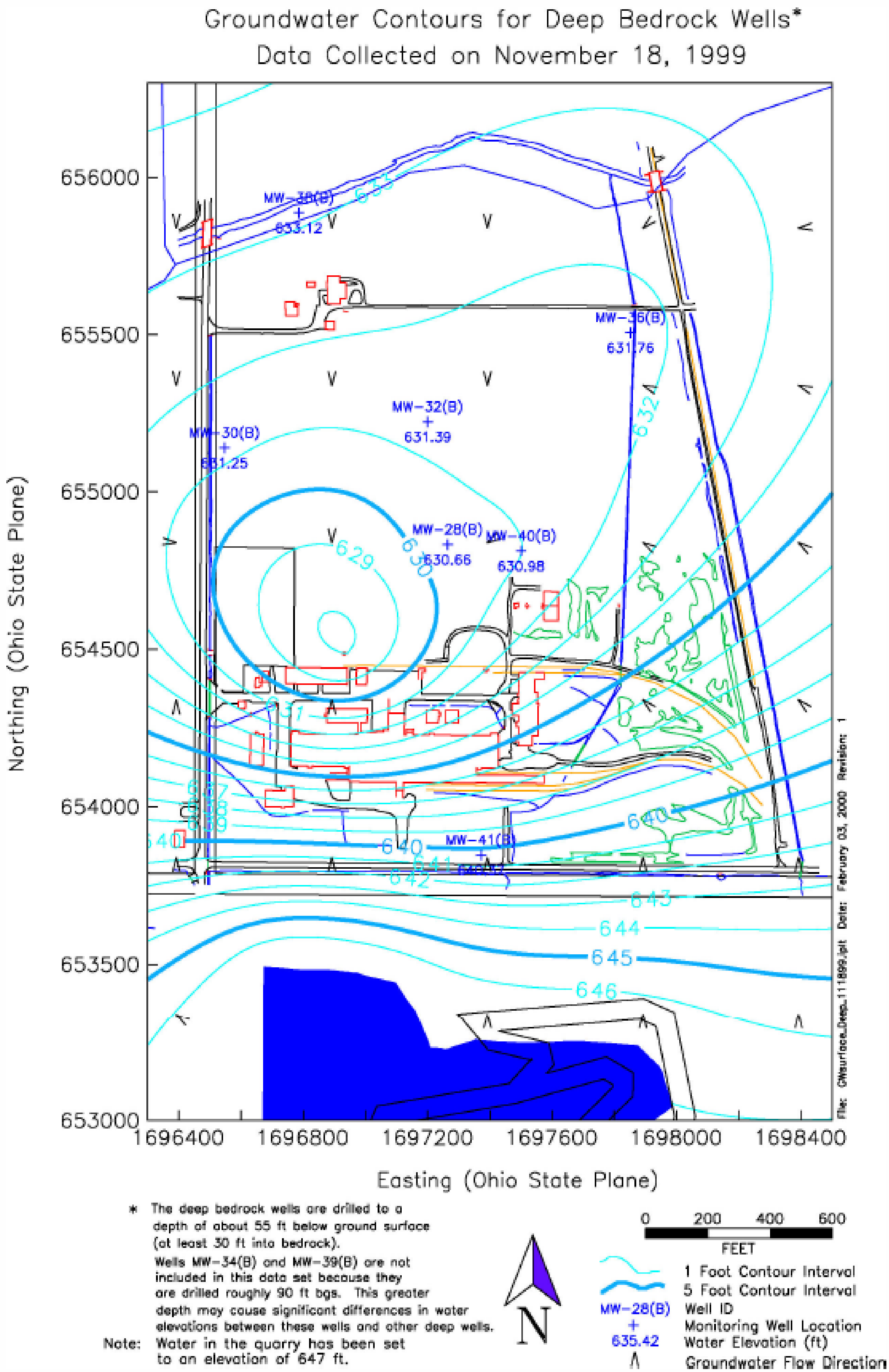
East Production Well (PW[E]) operating at ~70 gallons per minute.

USACE - Buffalo District
Luckey Site Groundwater ROD
Figure 12. Shallow-Zone (S-Wells) Potentiometry



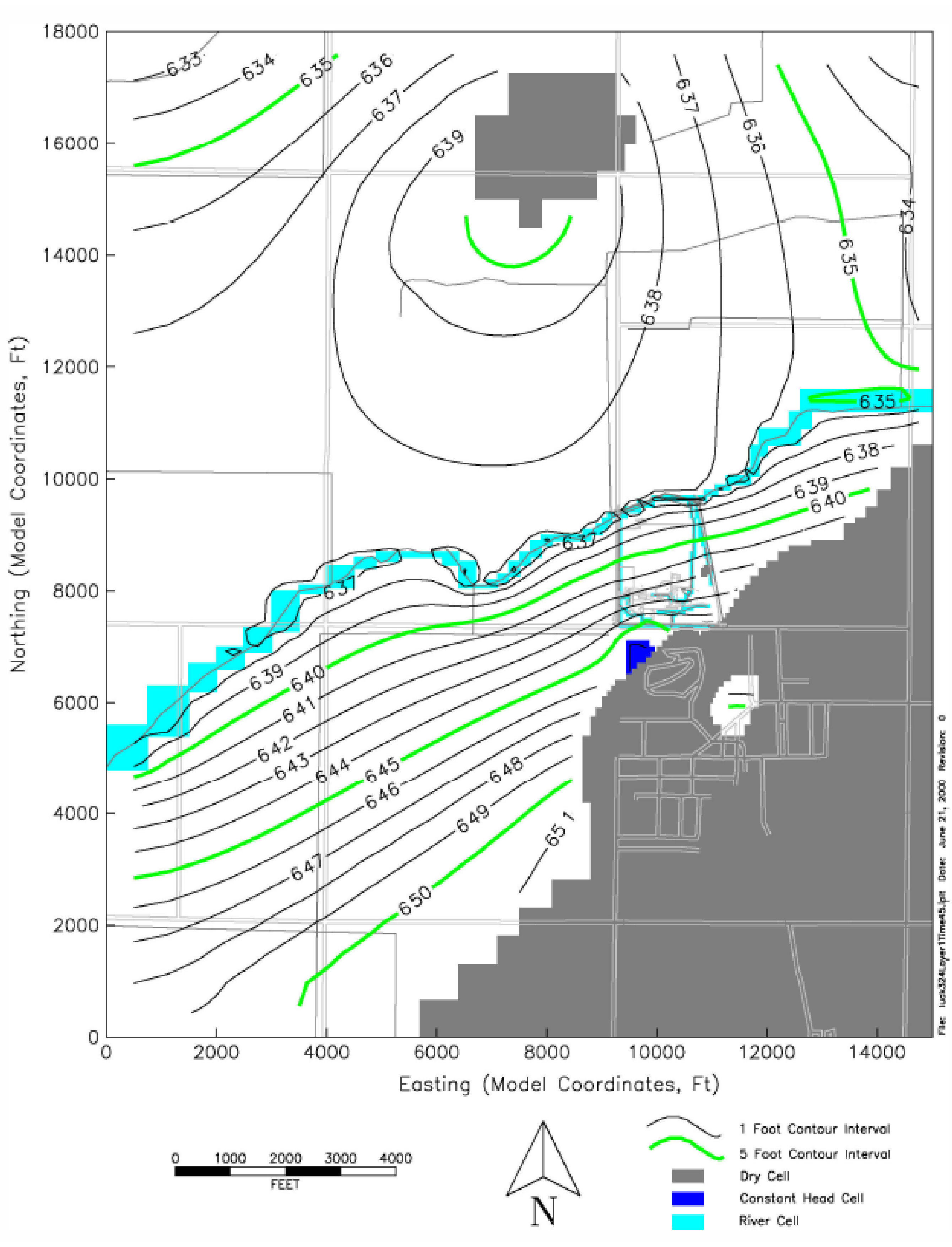
USACE - Buffalo District
Luckey Site Groundwater ROD
Figure 13. Intermediate-Zone (I-Wells) Potentiometry

East Production Well (PW[E]) operating at ~70 gallons per minute.

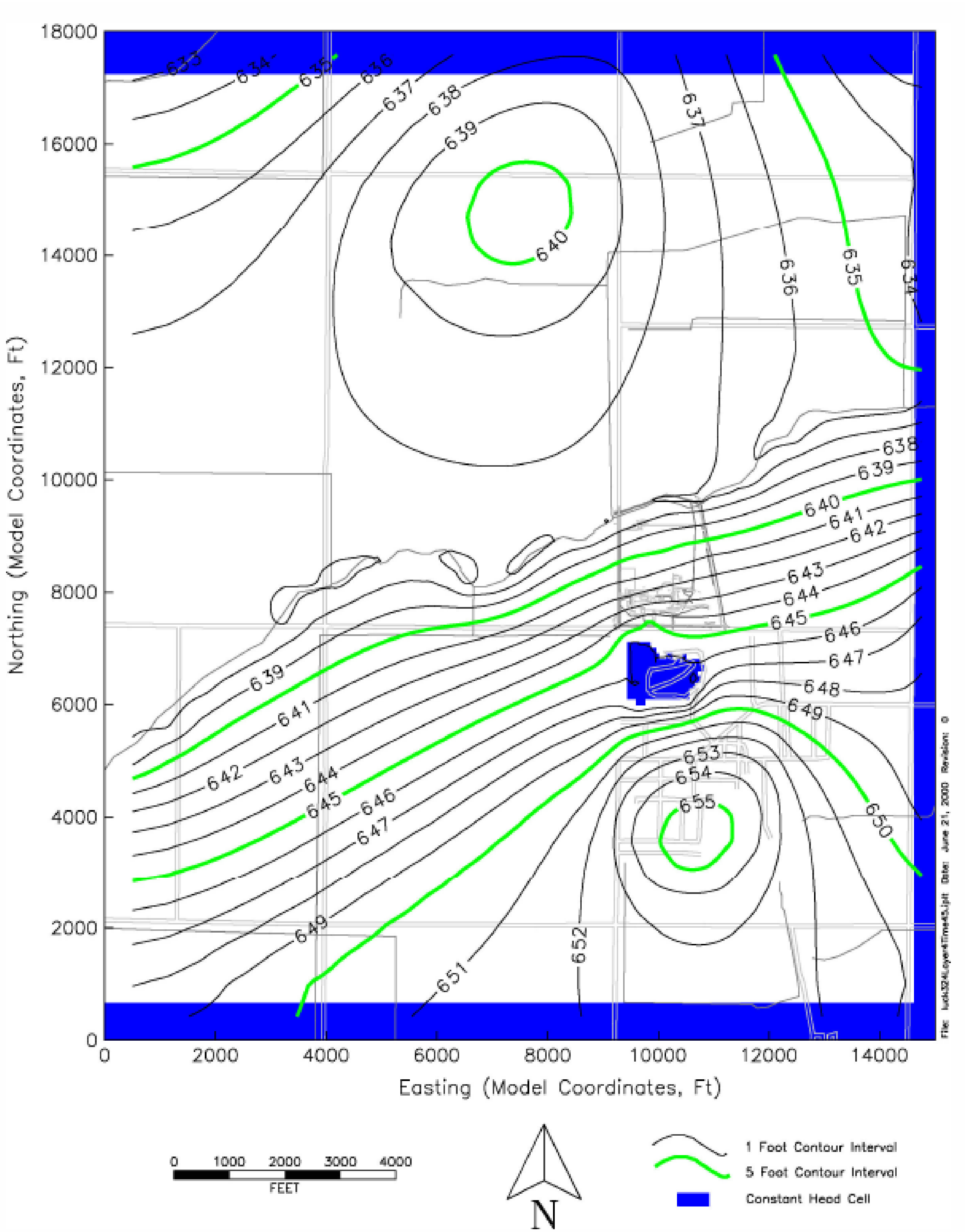


East Production Well (PW[E]) operating at ~70 gallons per minute.

USACE - Buffalo District
Luckey Site Groundwater ROD
Figure 14. Deep Bedrock Zone (B-wells) Potentiometry



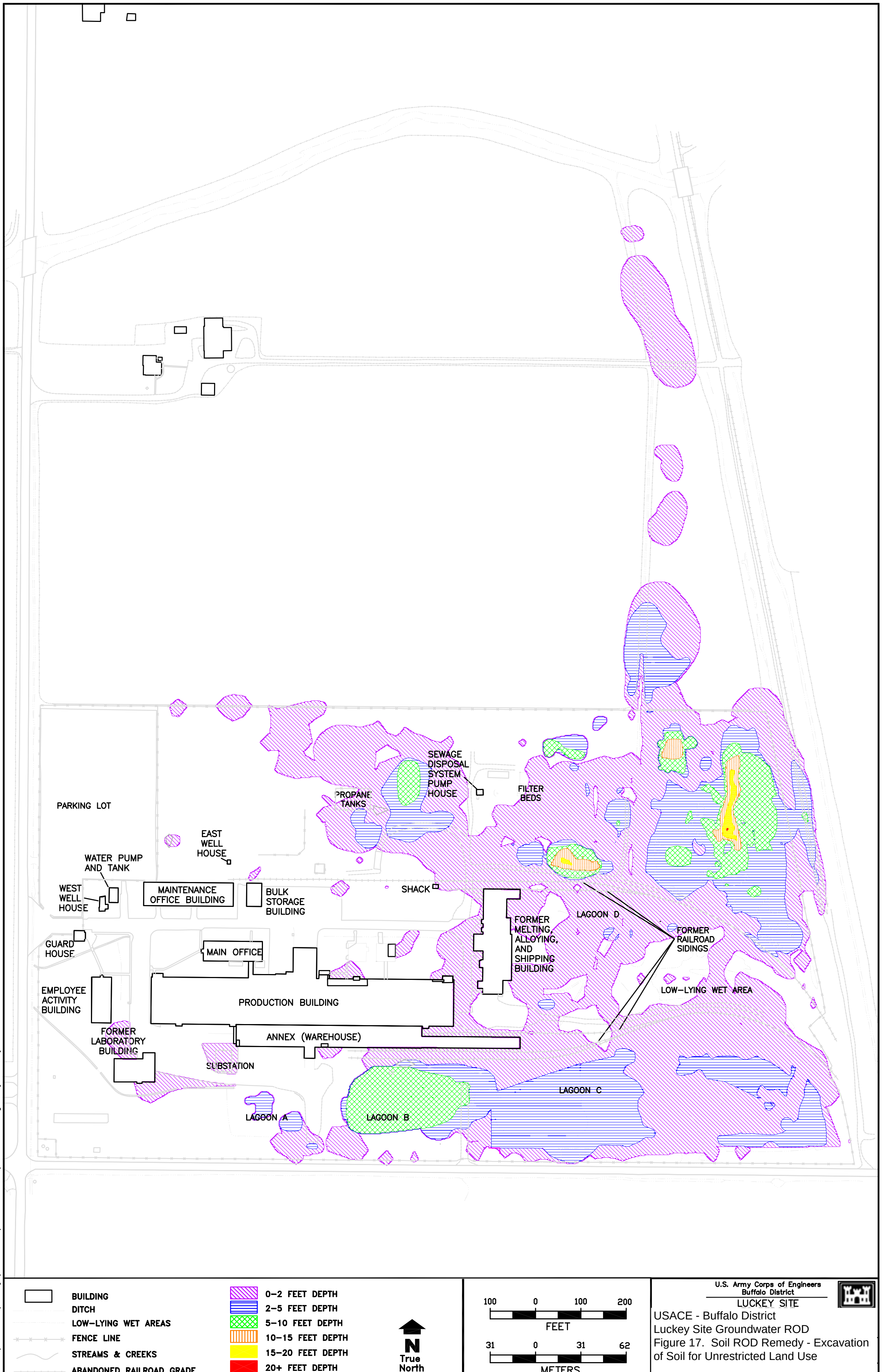
USACE - Buffalo District
Luckey Site Groundwater ROD
Figure 15. Simulated Heads in Shallow-Zone Sediments After Production Well Cessation



USACE - Buffalo District

Luckey Site Groundwater ROD

Figure 16. Simulated Heads in Regional Bedrock Aquifer (Deep Zone) After Production Well Cessation



USACE - Buffalo District
Luckey Site Groundwater ROD
Figure 17. Soil ROD Remedy - Excavation of Soil for Unrestricted Land Use

XREF Files: luckfeet DRIVES FENCE FIELDS IABOUNDS IAINFO MISC ROADS RR-RAIL STRUCT TOPO TREES UTILSTRC WATER IMAGE Files: Armylogoblk.bmp feet.tif 2_foot.tif
File: W:\CAD Gov\Luckey\tw041612\533-FS_rev2\excavation.dwg Layout: Layout1 User: evansstev Jun 02, 2003 -CTB: PLOTTING\FULLCOLR.CTB

Figure 18. Beryllium Trends in Luckey Site Groundwater

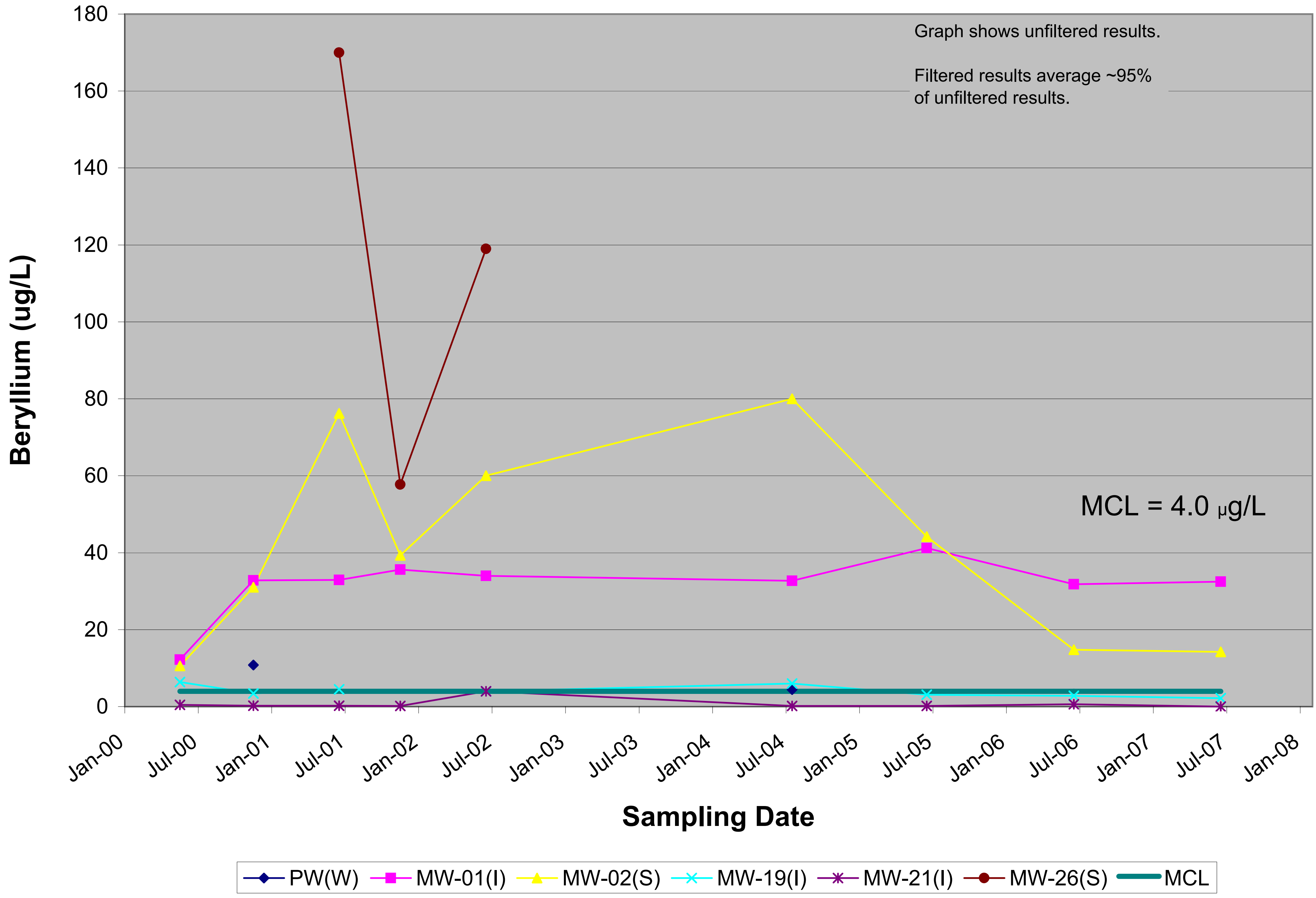


Figure 19. Lead Trends in Luckey Site Groundwater

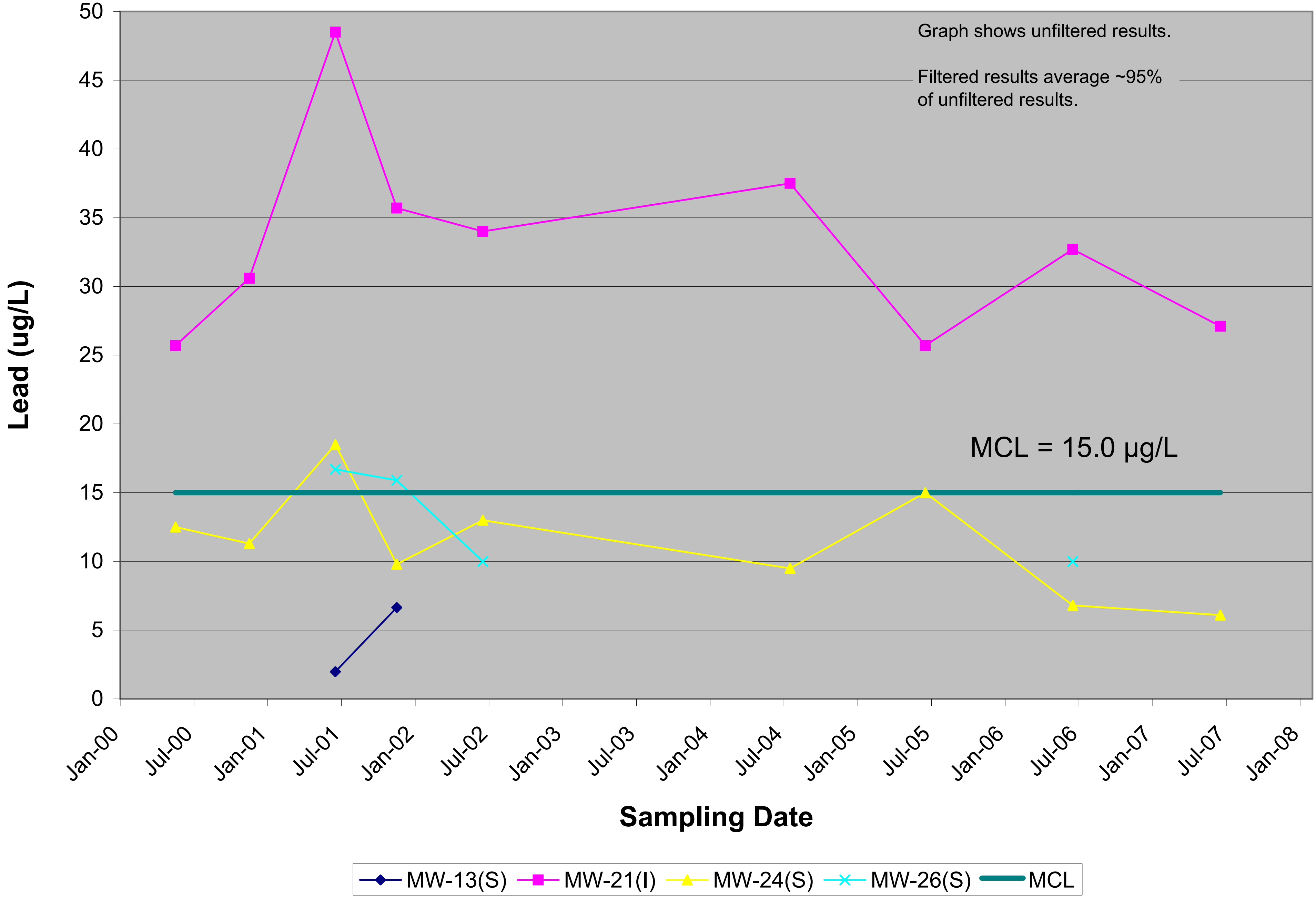
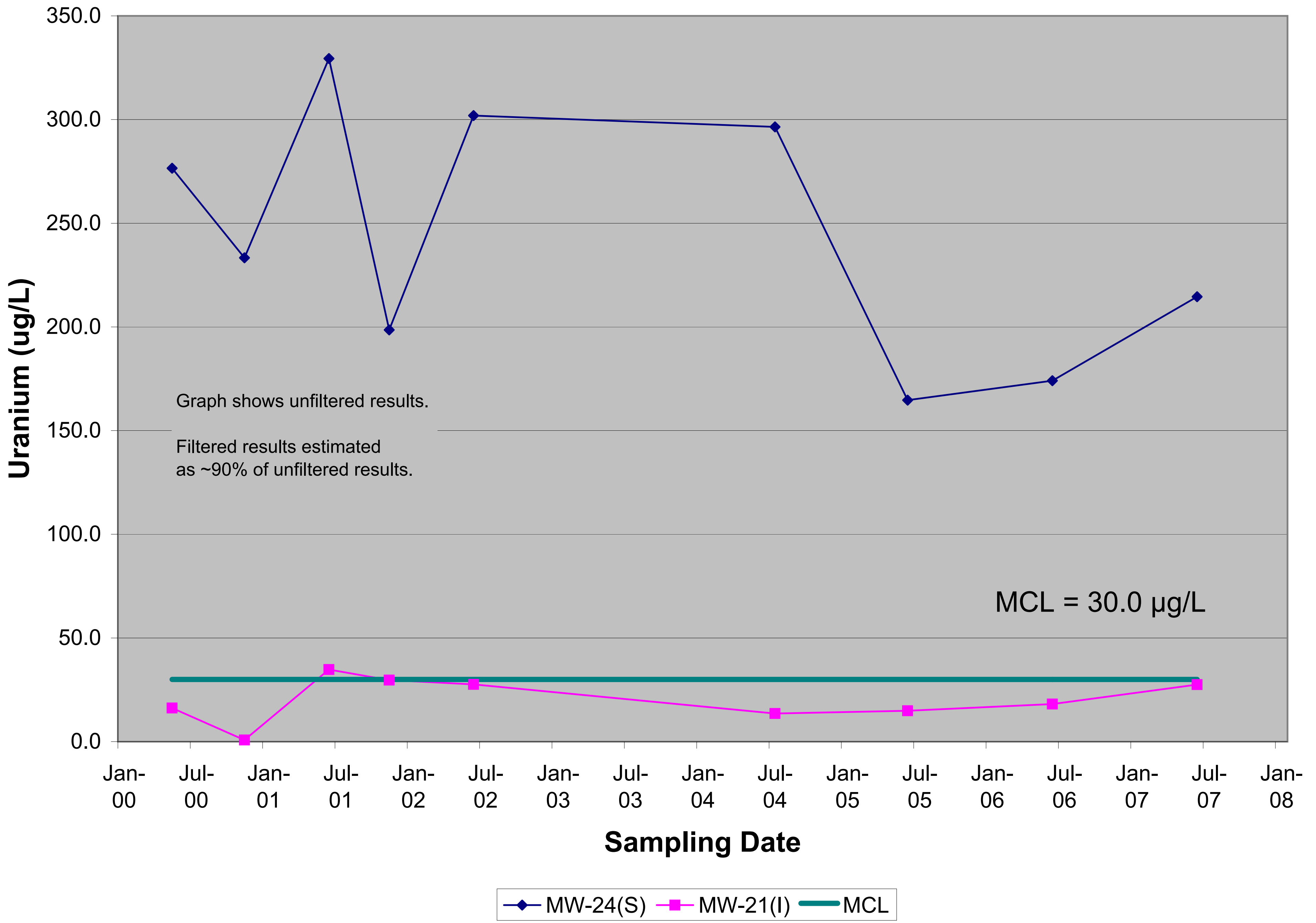
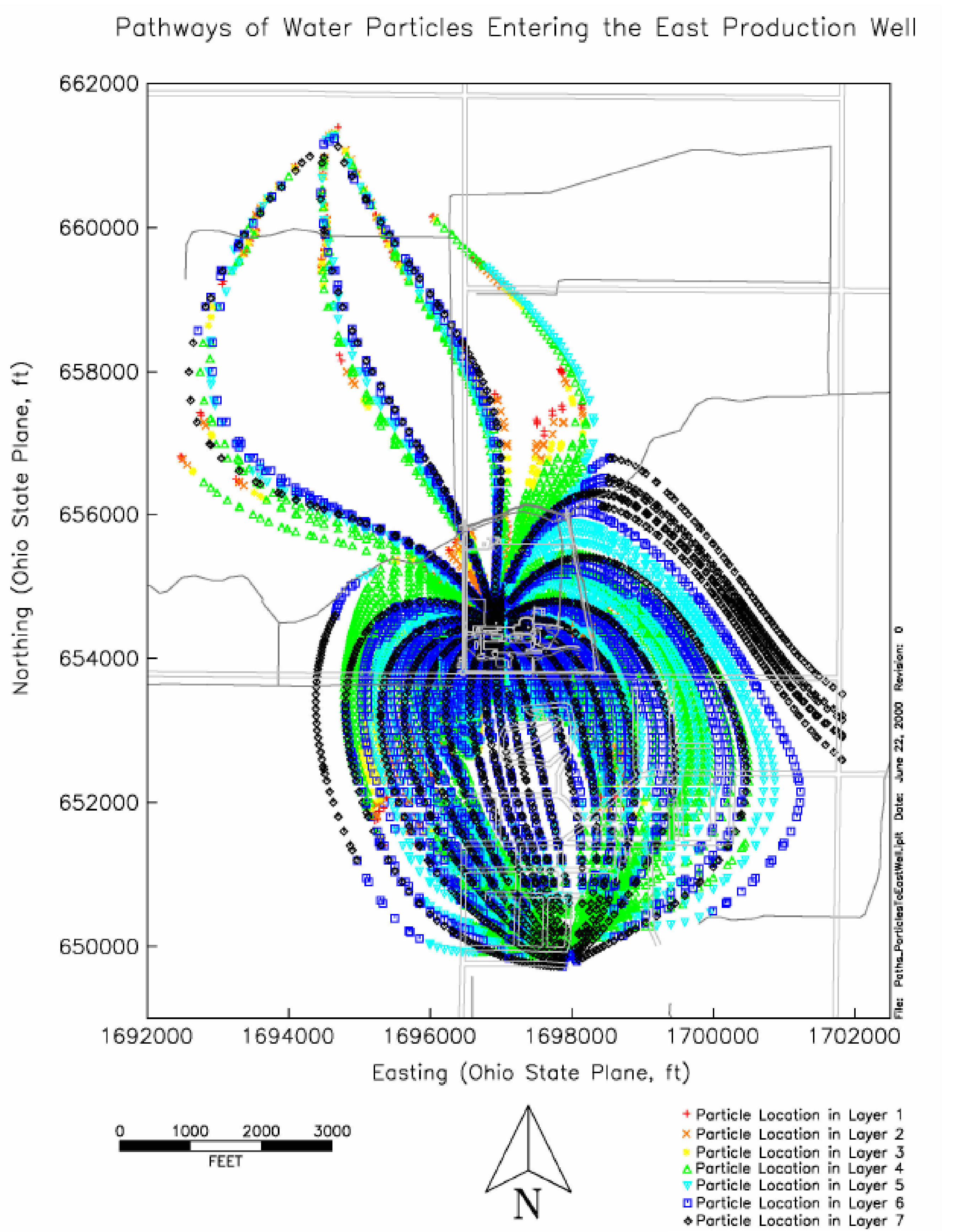


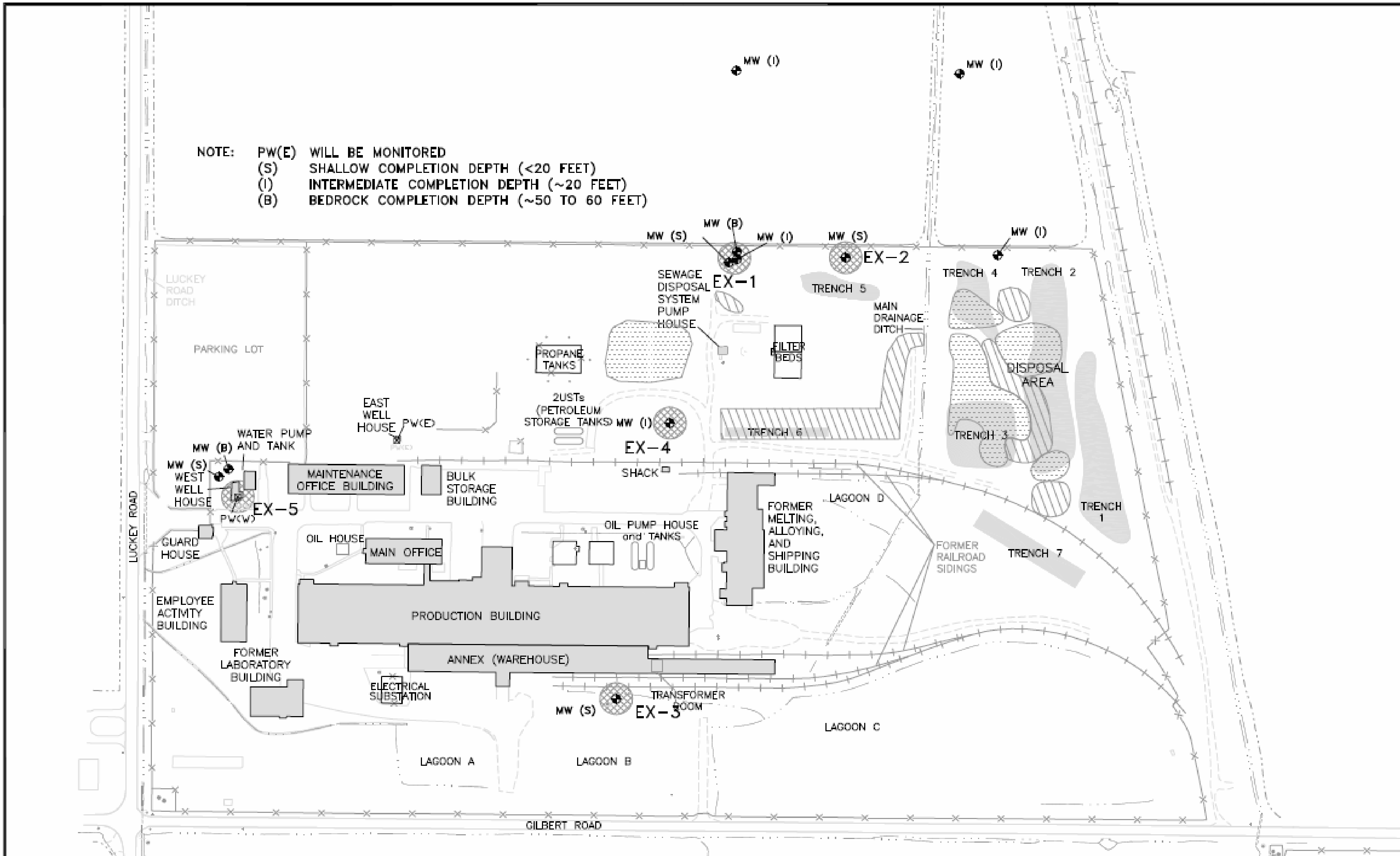
Figure 20. Total Uranium Trends in Luckey Site Groundwater





East Production Well Discharge Simulated at 70 gallons per minute

USACE - Buffalo District
Luckey Site Groundwater ROD
Figure 21. Particle Tracks to East Production Well



BUILDING

TRENCH

SPOILS PILES

MONITORING WELL

PRODUCTION WELL

FENCE LINE

STREAMS & CREEKS

ABANDONED RAILROAD GRADE

AREAS DEVOID OF VEGETATION

EX−3 DENOTES AREA FOR PLACEMENT OF EXTRACTION WELLS

N True North

125 0 125 250
FEET

38 0 38 76
METERS

U.S. Army Corps of Engineers
Buffalo District

Luckey Site
Groundwater ROD

Conceptualization of Alternatives 7 & 8:
MNA & Active Groundwater Treatment

Figure 22.

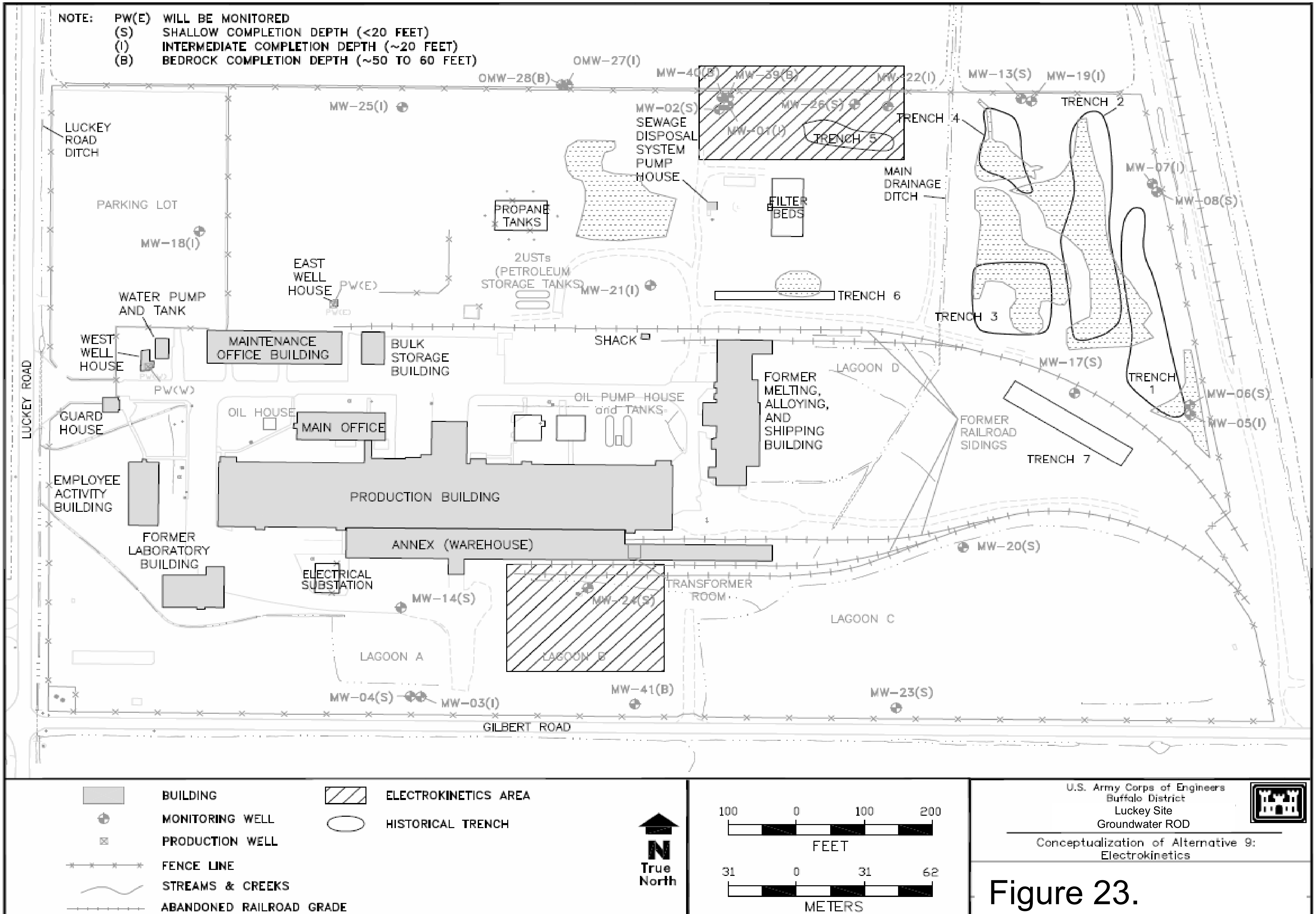
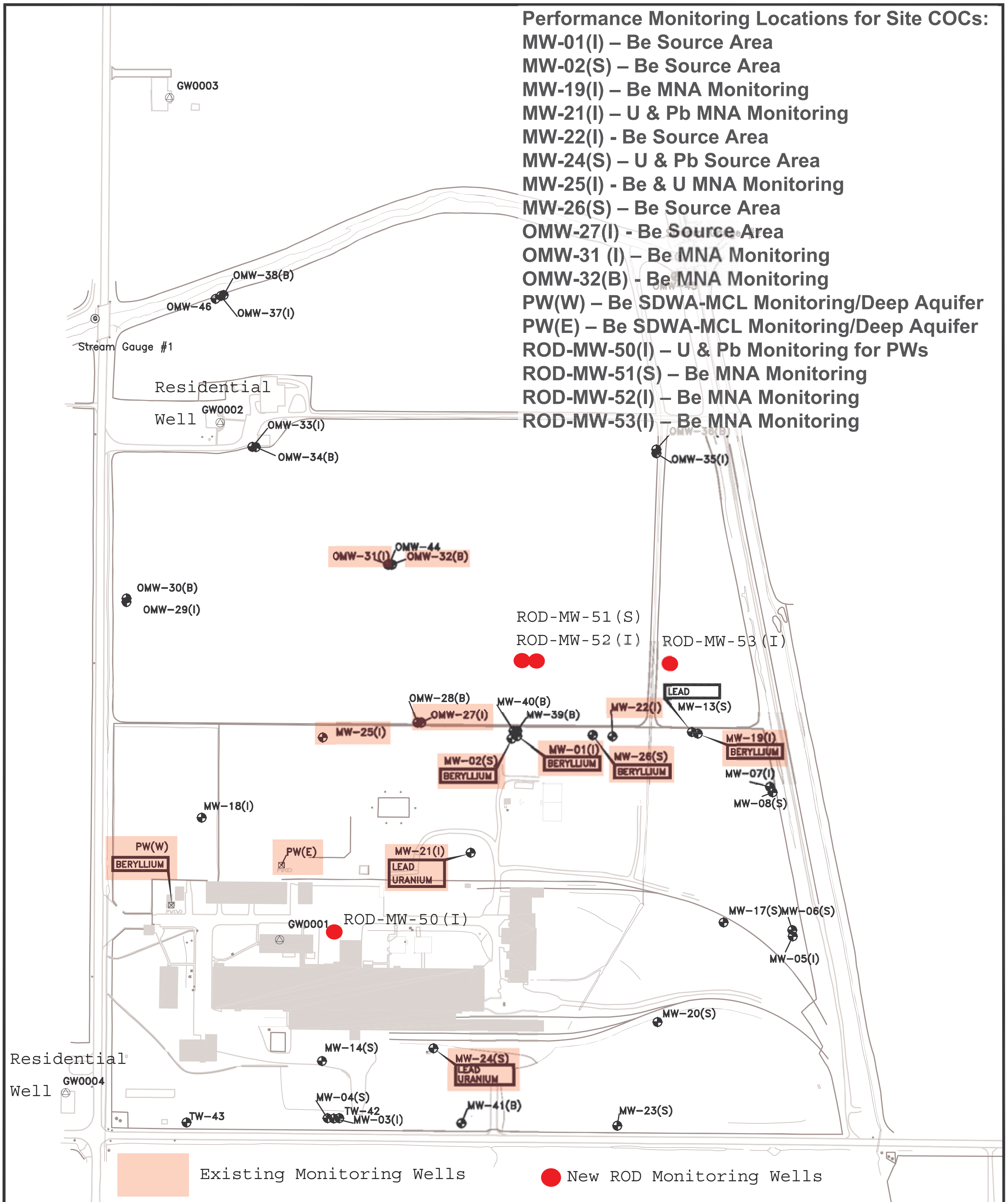

NOTE: PW(E) WILL BE MONITORED
(S) SHALLOW COMPLETION DEPTH (<20 FEET)
(I) INTERMEDIATE COMPLETION DEPTH (~20 FEET)
(B) BEDROCK COMPLETION DEPTH (~50 TO 60 FEET)
OMW-27(I)
OMW-28(B)
MW-40(B)
MW-39(B)
MW-22(I)
MW-13(S)
MW-19(I)
MW-25(I)
MW-02(S)
MW-26(S)
MW-01(I)
TRENCH 2
TRENCH 4
TRENCH 5
LUCKEY ROAD DITCH
SEWAGE DISPOSAL SYSTEM PUMP HOUSE
MAIN DRAINAGE DITCH
MW-07(I)
MW-08(S)
PARKING LOT
PROPANE TANKS
FILTER BEDS
MW-18(I)
2USTs (PETROLEUM STORAGE TANKS)
EAST WELL HOUSE
PW(E)
MW-21(I)
TRENCH 6
WATER PUMP AND TANK
TRENCH 3
WEST WELL HOUSE
MAINTENANCE OFFICE BUILDING
BULK STORAGE BUILDING
SHACK
LAGOON D
MW-17(S)
PW(W)
FORMER MELTING, ALLOYING, AND SHIPPING BUILDING
TRENCH 1
MW-06(S)
MW-05(I)
LUCKEY ROAD
GUARD HOUSE
OIL HOUSE
MAIN OFFICE
OIL PUMP HOUSE and TANKS
FORMER RAILROAD SIDINGS
TRENCH 7
EMPLOYEE ACTIVITY BUILDING
PRODUCTION BUILDING
FORMER LABORATORY BUILDING
ANNEX (WAREHOUSE)
MW-20(S)
ELECTRICAL SUBSTATION
MW-14(S)
MW-24(S)
TRANSFORMER ROOM
LAGOON C
LAGOON A
LAGOON B
MW-04(S)
MW-03(I)
MW-41(B)
MW-23(S)
GILBERT ROAD
BUILDING
MONITORING WELL
PRODUCTION WELL
FENCE LINE
STREAMS & CREEKS
ABANDONED RAILROAD GRADE
ELECTROKINETICS AREA
HISTORICAL TRENCH
N
True North
100 0 100 200
FEET
31 0 31 62
METERS
U.S. Army Corps of Engineers
Buffalo District
Luckey Site
Groundwater ROD
Conceptualization of Alternative 9: Electrokinetics

Figure 23.



BUILDING
LOW LYING AREAS
FENCE LINE
STREAMS & CREEKS
ABANDONED RAILROAD GRADE
BERYLLIUM WELL CONTAINS ELEVATED BERYLLIUM
LEAD WELL CONTAINS ELEVATED LEAD
URANIUM WELL CONTAINS ELEVATED URANIUM
RESIDENTIAL WELLS/TAP WATER
GROUNDWATER MONITORING WELLS
STREAM GAUGE

N True North

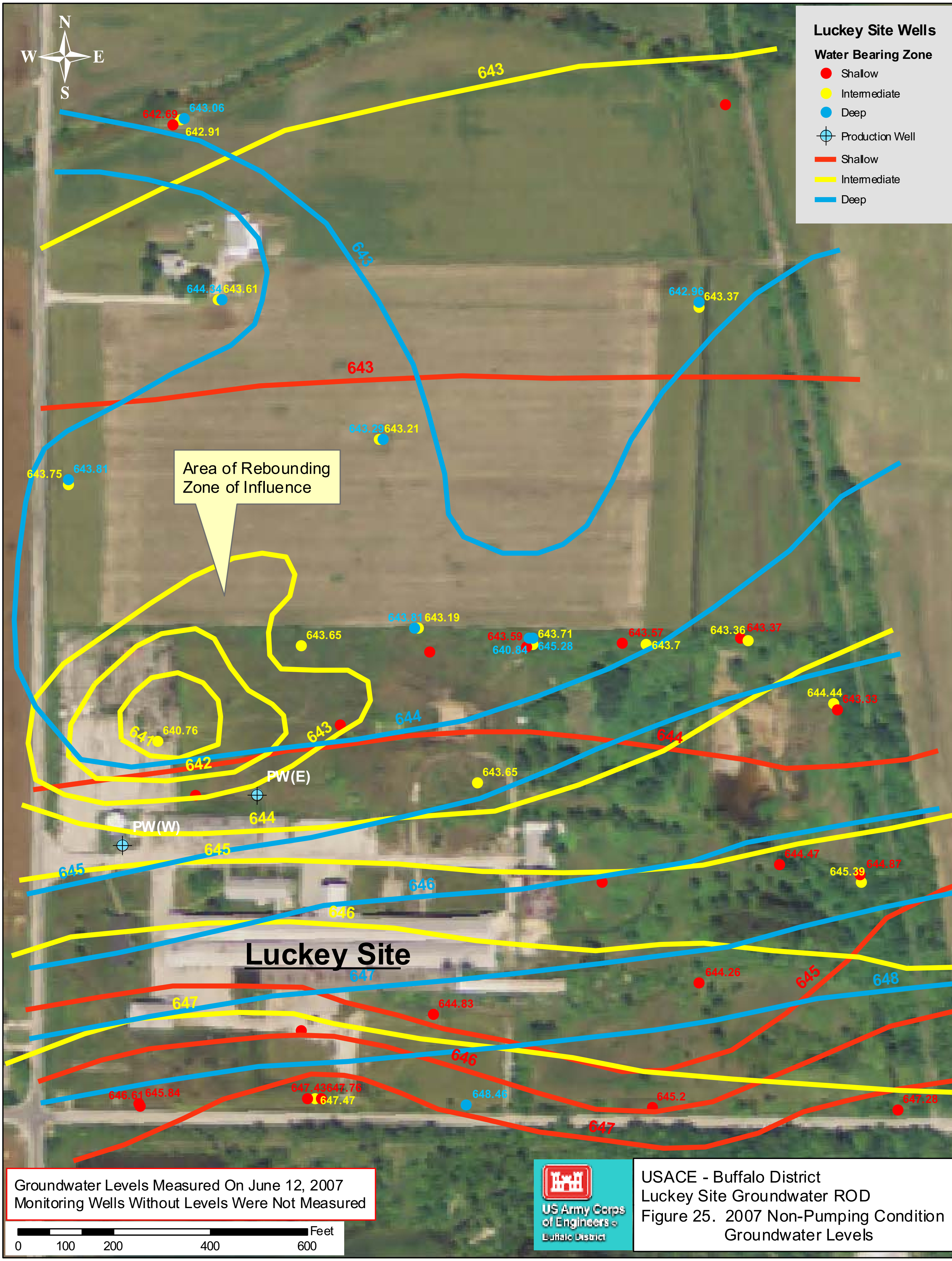
0 175 350 FEET

0 53 106 METERS

U.S. Army Corps of Engineers
Buffalo District
LUCKEY SITE

USACE - Buffalo District
Luckey Site Groundwater ROD
Figure 24. MNA Performance Monitoring Program Wells

XREF Files: luckfeet DRIVES FENCE FIELDS IABOUNDS IAINFO MISC ROADS RR-RAIL STRUCT TOPO TREES UTILSTRC WATER IMAGE Files: Armylogoblk.bmp feet.tif feet.tif 2_foot.tif
File: W:\CAD Gov\Luckey\tw041612\533-FS_rev4\Fig3-3 Fs_Phasell&IVgw rev1 cap.dwg Layout: Layout2 User: evansstev Jun 02, 2003 - 11:00am



USACE - Buffalo District
Luckey Site Groundwater ROD
Figure 25. 2007 Non-Pumping Condition Groundwater Levels

APPENDIX A

Responsiveness Summary for the Luckey Groundwater ROD

APPENDIX A - TABLE OF CONTENTS

LIST OF ATTACHMENTS

1.0 INTRODUCTION

On June 7, 2003, the Buffalo District, United States Army Corps of Engineers (USACE) issued a Proposed Plan for the Luckey Site in Luckey, Ohio. A public meeting was held on June 19, 2003 for the USACE to present background information and its recommended strategy for the site. During the meeting, the public was invited to submit comments; the comments were accepted through September 9, 2003. This Responsiveness Summary addresses the comments received from the public during both the public meeting and the comment period

The preferred remedy for the Luckey Site to address soils and groundwater impacted by AEC-related activities and associated constituents of concern (COCs) consists of Soil Excavation (Alternative 5) and Groundwater Monitored Natural Attenuation (Alternative 7). Impacted soils would be excavated to achieve the soil cleanup goals. The removal of impacted soils eliminates the potential for further impacts to the groundwater system thus allowing for the natural cleaning of the groundwater at the site. These alternatives are considered to be most protective, and are permanent because impacted soils associated with the beryllium production process would be removed from the site and groundwater would be monitored until clean-up goals are achieved.

2.0 OVERVIEW OF PUBLIC INVOLVEMENT

On June 6 2003, a letter announcing the release of the Proposed Plan for the Luckey Site was sent to 308 individuals including elected officials. Post cards were sent to individuals on the Site mailing list. Individuals wishing to receive the letter announcing the release of the Proposed Plan were instructed to return the post cards.

Legal advertisements announcing the June 19, 2003 public meeting on the Luckey site Proposed Plan were placed in the following local newspapers:

- The Blade (Toledo) – June 12 & 15,2003
- Sentinel-Tribune (Bowling Green) – June 12 & 17, 2003
- West Toledo Herald – June 18, 2003
- Sylvania Herald (Toledo) – June 18, 2003.

The public meeting was held June 19, 2003, from 6:30 p.m. to 8:30 p.m. in the Troy Fire Hall, 313 Krotzer Avenue, Luckey, Ohio. At the meeting USACE explained the history of the Site, studies and investigations completed areas of contamination, CERCLA evaluation criteria, the remedial action alternatives and the schedule. A court reporter was available at the meeting to record comments. Four members of the public requested the opportunity to speak at the public meeting and written comments are addressed in Section 3 of this Appendix. The meeting transcript is attached after this Comment/Response section.

3.0 RESPONSES TO COMMENTS

At the public meeting held June 19, 2003, four individuals provided comments on the Proposed Plan. Comments provided by individuals at the public meeting and USACE's responses to comments are addressed in Section 3.1. The transcript of the public meeting is provided afterwards for reference.

Written comments received during the public comment period are also included as Attachment 1 of this Appendix. USACE's responses to the written comments are addressed in Section 3.2 of this Appendix.

USACE encourages those interested in learning more about the Luckey Site or other FUSRAP projects to review the Administrative Record (which contains reports and other information), or call USACE's toll free number (1-800-833-6390) to ask questions or to be added to the mailing list for future mailings. The Administrative Record for the Luckey Site is available for public review at the following locations:

USACE FUSRAP Public Information Center
1776 Niagara Street
Buffalo, New York 14207-3199
(716) 879-4197
(800) 833-6390 (press "5" at the recorded message)

Luckey Public Library
228 Main Street
Luckey, Ohio 43443
(419) 833-6090

3.1 RESPONSES TO COMMENTS, PUBLIC MEETING

The following are comments made during the public meeting held on June 19, 2003. A copy of the meeting transcript is included as Attachment 1.

3.1.1 Mr. Gary Brown (meeting transcript, page 43)

Comment: "My name is Gary Brown. I've been a maintenance man out at the plant for about 30 years. I've been out there for about 30 years. I understand a lot of what you're talking about, but I don't understand when you say 88,000 cubic yards you're going to pull out. Is that just in one general area or is that going to be all around the plant? There is, if I remember ---- I've seen the print, the plot out there. There was two on the south side, one in the northeast corner, two on the north side. But also, back in the early '80s, when I was in the union as the vice president --- Boarder Wheel, it was Boarder Wheel at that time, Corporation got a letter from the DOE, the Department of Energy. They said they may have very contaminated steel out there.

There wasn't anything after that. But I asked some people that used to work out there and they said, yes, there was truckload after truckload of contaminated steel that was brought in there and they were suited up and buried in the northeast corner. That went beyond, according to the brush print, beyond the fence, in the northeast corner.

That's the kind of stuff I want answered on. I've heard nothing about this. I'd like to know how much you're digging up and where you're digging up at. Because there's a lot of pits out there . . . a lot of pits."

Response: Available historical information and interviews indicate contaminated scrap steel was shipped to the site in the early 1950s. Approximately 1,000 tons of steel were sent when there was a possibility the Magnesium plant operations might be restarted. The steel was stored along the northern rail spur north of the maintenance building and current parking lot. That material may have been buried in the northeast corner although workers from that time, who were interviewed, were not certain what happened to it.

USACE reviewed historical plans for expanding the burial area in the northeast corner beyond the current fence. During reviews of available historical information and the Remedial Investigation, USACE found no indication these plans were ever completed although parts of the intended construction may have been started in the area within the current fence. Using historical documents and geophysical tools, USACE located seven "pits" or "trenches" where materials were disposed. The materials found within these trenches include metals, building debris, and sludge.

The extent of planned soil excavation is presented in Figure 7.1 of the Proposed Plan. A large quantity of material will be removed in the location of the disposal areas in the northeast corner of the facility as well as the former lagoons located in the southern portion of the facility.

3.1.2 Mr. Eric Jacobs (meeting transcript, page 46)

Comment No. 1: "Yes, I have one. I have a lot of questions. I'm Eric Jacobs from the village of Luckey. Most of the comments I have with the --- how are they going to be transported, by our local road, by rails? How are they going to transport or what roads will they be on, township roads? That's the questions I have."

Response No. 1: In developing the Feasibility Study, USACE evaluated several modes of transportation including truck and rail, and potential routes. The rail spur at the site has been abandoned and the closest rail spur is several miles away. Currently excavated materials will be transported via truck to a nearby rail facility or disposal facility. In general the most direct route will be used to minimize disruption to public roads. In addition, routes will be planned to avoid residential areas. Transportation routes will be coordinated with Wood County and the Ohio Public Utilities Commission. For more details, please reference Appendix 4B of the Feasibility Study.

Comment No. 2: “The biggest question I have concerning it is will there be a danger of the trucks going past your house, an accident, or something?”

Response No. 2: Every effort will be made to minimize the likelihood of accidents, and transportation routes will be planned to avoid residential areas as much as is possible. Accident rates are one of the factors that will be considered in the final selection of the transportation route.

3.1.3 Mr. Rick Brogin (meeting transcript, page 47)

Comment No. 1: “I'm Rick Brogin. My questions would be the TSD site. You mentioned those 88,000 yards, $36 and a half million I think it was. That's quite a chunk of change. So there must be something they're doing with it when it leaves here. That would also indicate to me that there's something seriously wrong with the material that's in there.”

Response No. 1: Impacted soils would be excavated to achieve cleanup goals, which are based on exposure to a conservative receptor, the subsistence farmer, and shipped off site for disposal. The material will be disposed, like most industrial waste, in a secure landfill permitted to accept the types of material removed from this site. Roughly two thirds of the cost of the excavation alternative is in the transportation and disposal of these materials. Disposal costs are high to ensure the landfill is properly constructed and maintained. Estimated costs are approximately $400/cubic yard for remediation. A large portion of that ensures the public is protected during and after construction activities. USACE procedures require that all TSDFs that have permits or licenses, which allow acceptance of this waste, be contacted. It is also important to note that USACE takes the additional precaution of contacting the disposal facility’s regulator (or governing agency) for approval before any material is shipped offsite.

Comment No. 2: “I'd also like to know what the flow direction of the groundwater is, in the area. I'd like to know around the wells that we have checked in area, what kind of contamination we have now, including all of the metals.”

Response No. 2: In general, groundwater in this region flows north and east towards Toussaint Creek and ultimately Lake Erie. Under current operating conditions, groundwater at the Luckey site is influenced by the operation of the production wells and flows towards the center of the site where the production wells are located.

Groundwater monitoring wells were installed at the Luckey site and north of the site during the Remedial Investigation and have been sampled regularly. Beryllium, lead, and uranium have been detected above drinking water standards in a few of these site wells, but these detections appear to be localized (Section 3.4 and Figure 3.4 of the Proposed

Plan). In January 2001, groundwater samples also were collected from several residential wells located in the vicinity of the Luckey site – both up-gradient and down-gradient of the site. Beryllium was not detected in any of these samples.

Comment No. 3: "I'd like to know who the third party firm is that's going to ensure that you're doing this as your plan is put forth."

Response No. 3: The USACE Buffalo District will prepare a remediation plan based on the Record of Decision (ROD). This plan will be reviewed by Ohio EPA, the Ohio Department of Health, and site stakeholders. The state regulatory agency, Ohio EPA for the Luckey Site, also will be following the remediation efforts to ensure cleanup is performed and completed in accordance with the ROD as has been done at other FUSRAP Sites remediated by USACE Buffalo District. USACE Buffalo District is internally held accountable to the division and headquarters offices of USACE for completion of the remediation in accordance with the ROD. USACE also is held accountable to Congress for completing the remediations in accordance with the ROD.

3.1.4 Mr. Wayne Plagley (meeting transcript, page 48)

Comment: "My name is Wayne Plagley. My question has to do with the two wells out there, the east well and the west well. I understand that the west well is contaminated with beryllium.

Generally, I use the east well for all our processing and drinking needs. Occasionally, the pump has gone bad and we've had to use the west well, which is contaminated with beryllium. When that happens, we switch over and we do not allow drinking of that water, but we use it for process water and still discharge.

I understand that discharge eventually makes its way up the creek. I don't see in your presentation anything about that well out there, if that would still be allowed to continue to be used or if someone will provide another well.

As people in town know, we have a fire system out there that the township comes out and fills their trucks up occasionally. That has been filled up with beryllium water while the east well was out. I think you should be aware of that. Thank you."

Response: In general, groundwater in this region flows north and east towards Toussaint Creek and ultimately to Lake Erie. Under current operating conditions, groundwater at the Luckey site is influenced by the operation of the production wells and flows towards the center of the site where the production wells are located. Groundwater monitoring wells were installed at the Luckey site as well as north of the site during the Remedial Investigation and have been sampled regularly. Beryllium, lead, and uranium have been detected above drinking water standards in a few of these site wells, but detections appear to be localized (Section 3.4 and Figure 3.4 of the Proposed Plan).

Beryllium has been consistently detected in the West Production Well at concentrations ranging from 9.3 to 13.2 µg/L which is above the drinking water standard of 4 µg/L. The preferred alternative for groundwater includes source removal, attenuation, land use controls, and monitoring. The information presented in the Remedial Investigation Report and in the Feasibility Study indicates that when remediation is complete for the soils, the source of beryllium contamination to the groundwater system will have been removed. Groundwater modeling indicates that, once remediation is complete, even if pumping of the east well is discontinued, the beryllium will not migrate off-site at concentrations that present a risk above (USEPA and CERCLA) guidelines to current receptors. In addition, modeling indicates concentrations in the West Production Well will decline below drinking water standards in less than five years. Use and discharge of groundwater obtained from the West Production Well, when necessary, is also administered by the Ohio EPA and the Wood County Health Department. Use of the water from the West Production Well as process water does not pose an unacceptable threat to human health or the environment. Remedial investigation sampling results for the local creek indicate no evidence of ecological impacts from discharges of AEC-related constituents to the creek and anticipate no further impacts.

A source of safe drinking water for the Luckey Site is currently available and being used.

3.1.5 Mr. Rick Brogin (meeting transcript, page 50)

Comment No. 1: “I'm Rick Brogin. At this point, I didn't realize there was contamination to the west of that. I'd like to know what it's contaminated with and the results that we've had on that since the testing period began.”

Response No. 1: The groundwater analytical data associated with the recent sampling results are presented in the Feasibility Study in Appendix 2A as well as in the Remedial Investigation Report, Appendix 4A. Beryllium has been consistently detected in the West Production Well at concentrations ranging from 9.3 to 13.2 µg/L which is above the drinking water standard of 4 µg/L. The preferred alternative for groundwater includes source removal, attenuation, land use controls, and monitoring. The information presented in the Remedial Investigation Report and in the Feasibility Study indicates that when remediation is complete for the soils, the source of beryllium contamination to the groundwater system will have been removed. Groundwater modeling indicates that, once remediation is complete, even if pumping of the east well is discontinued the beryllium will not migrate off site at concentrations that exceed the drinking water MCL under the Safe Drinking Water Act. In addition, modeling indicates concentrations in the West Production Well will decline below drinking water standards in less than five years. Use and discharge of groundwater obtained from the West Production Well, when necessary, is also administered by the Ohio EPA and the Wood County Health Department.

A source of safe drinking water for the Luckey Site is currently available and being used.

Comment No. 2: "I also would like to know what the --- another gentleman mentioned where it was -- how it was going to be shipped from Luckey to wherever. I'd like to know the method of shipment. Is it going to be something in a bulk form or is it going to be containerized as in drums? I guess that would be it for now."

Response No. 2: In developing the Feasibility Study, USACE evaluated several modes of transportation including truck and rail as well as potential routes. The rail spur at the site has been abandoned and the closest rail spur is several miles away. Currently excavated materials will be transported in bulk via truck for non-radiologically contaminated materials and via truck using intermodal containers for radiologically contaminated materials to a nearby rail facility or disposal facility. In general the most direct route will be used to minimize disruption to public roads. In addition, routes will be planned to avoid residential areas. Transportation routes will be coordinated with Wood County and the Ohio Public Utilities Commission. For more details, please reference Appendix 4B of the Feasibility Study.

3.2 RESPONSES TO WRITTEN COMMENTS

The following are responses to comments received outside of the public meeting comments recorded in the transcript and addressed above.

3.2.1 Response to L. Sherman (Environmental Technologies Inc) Comments

Mr. Sherman submitted comments in a letter to USACE dated June 16, 2003. A copy of that letter is included in Attachment 2 to this Appendix.

Summary of Comments: USACE should reconsider the selection of monitored natural attenuation for remediation of the groundwater based on findings of a report included with the letter.

Response: The comments provided by Mr. Sherman, of International Environmental Technologies Inc., are directed at the Groundwater Alternative 7: Monitored Natural Attenuation. Mr. Sherman's letter references the treatment of TCE and its daughter products at the Ashtabula Site and presents their firms experience at treating similar contaminants at similar sites in Ohio. At the Luckey site, the constituents detected in groundwater above their respective cleanup goals are beryllium, lead, and uranium. These constituents are metals and are characteristically different from TCE, which is an organic contaminant. The treatment of metals in groundwater using bioremediation was evaluated by USACE during the screening of technologies and determined not to be applicable to inorganic contaminants (i.e. beryllium, lead, and uranium). Bioremediation technologies involve destruction or transformation techniques in which a favorable environment is created for microorganisms to grow and use the contaminants as a food or energy source. Biological treatment is generally most effective for treating organic contaminants.

Therefore, this option was eliminated from further consideration. If any additional viable information on demonstrated technologies for in situ treatment of beryllium, lead, and uranium in groundwater is made available, USACE would evaluate these technologies for application at the Luckey site.

Contamination will not be left in place as indicated in the comment. The Groundwater Alternative 7: Monitored Natural Attenuation includes the removal or treatment of the source contamination in the soils. Removal of the source will allow contaminants in groundwater to naturally attenuate over time. For more details on the extensive groundwater modeling performed at the Luckey Site, please refer to Appendix 6A of the Feasibility Study.

3.2.2 Response to R. Emans Comments

Mr. Emans submitted comments on a sheet handed to USACE on June 16, 2003. A copy of his comment regarding taking down the buildings is included in Attachment 3 to this Appendix.

Summary of Comments: Why not take all buildings down now?

Response: As stated in 40 CFR Part 300.3(a)(2), the NCP applies to and is in effect for: "Releases into the environment of hazardous substances, and pollutants or contaminants which may present an imminent and substantial danger to public health or welfare of the United States." After evaluating the results of the Remedial Investigation for the on-site buildings, USACE has concluded there is no evidence of a release from the buildings, as defined by CERCLA, nor evidence of a substantial threat of a release of hazardous substances into the environment from the buildings that would present an imminent and substantial danger to the public health thus warranting a CERCLA response action. CERCLA defines the term "release" to mean "any spilling, leaking, pumping, pouring, emitting, emptying, discharging, injecting, escaping, leaching, dumping, or disposing into the environment," and specifically excludes " . . . any release which results in exposure to persons solely within a workplace, . . . ". Therefore, based on the results of the remedial investigation, USACE has concluded that the buildings would not qualify to be addressed under CERCLA and are no longer within the scope of the CERCLA efforts being undertaken by USACE at the Luckey site.

3.2.3 Response to J. Goldin (Metals Treatment Technologies, LLC) Comments

Mr. Goldin provided comments to USACE electronically via the Web in the form of an electronic e-mail on June 23, 2003. A copy of his comment regarding waste disposal options and treatment is included in Attachment 4 to this Appendix.

Summary of Comments: The comments focused on whether USACE had considered stabilizing heavy metals in excavated soils and disposing of them in a radiological disposal facility instead of a mixed waste disposal facility.

Response: The waste disposal options considered by USACE for the soil material at the Luckey Site are based on the contaminant constituents. The waste streams will consist of the following:

- Solid waste - beryllium contaminated soils (64% of total waste stream),
- Radiological waste (29% of the total waste stream),
- Hazardous waste (<3% of the water stream), and
- Radiological waste commingled with RCRA hazardous waste (<5% of the total waste stream).

The majority of the waste (93%) will be disposed as a solid or low level radioactive waste. Mixed waste that is characteristically hazardous or a listed hazardous would have to be treated per the requirements of 40 CFR Part 268, Land Disposal Restrictions (LDRs). As indicated in Section 3, page 310, of the Feasibility Study, mixed waste is defined as RCRA hazardous waste with radioactive residuals that are not NRC regulated. After the mixed waste has been treated, it will be disposed at a Subtitle C facility licensed to accept radiological contaminated soils. For more details, please refer to Appendix 3B and Appendix 4A of the Feasibility Study.

3.2.4 Response to Ohio EPA Comments

Ohio EPA submitted comments in a letter to USACE dated July 2, 2003. A copy of their comments is included in Attachment 5 to this Appendix. USACE acknowledges the cooperative interaction between Ohio EPA and USACE and the Ohio EPA agreement with the recommended preferred alternative for the Luckey Site. Some specific comments also were included in the letter. These comments and USACE's responses are addressed below.

Comment No. 1: The on-site buildings in their present condition have been determined by USACE to require no further action. However, should conditions change whereby the buildings are substantially modified or even razed, further evaluation will be necessary to ascertain whether these modification activities, the resulting debris and the soils contained beneath the foundation footprint exceed the established cleanup goals for the site, Ohio EPA recommends that a deed restriction be negotiated with the current property owners and other responsible parties to ensure that further characterization activities are implemented under such circumstances that may result in a future release to the environment. It is our goal to make certain the property continues to meet unrestricted use criteria in the event future modifications or demolition of these structures occurs.

Response No. 1: As stated in 40 CFR Part 300.3(a) (2), the NCP applies to and is in effect for: "Releases into the environment of hazardous substances, and pollutants or contaminants which may present an imminent and substantial danger to public health or welfare of the United States." After evaluating the results of the Remedial Investigation for the on-site buildings, USACE has concluded there is no evidence of a release from the buildings, as defined by CERCLA, nor evidence of a substantial threat of a release of hazardous substances into the environment from the buildings that would present an imminent and substantial danger to the public health thus warranting a CERCLA response action. CERCLA defines the term "release" to mean "any spilling, leaking, pumping, pouring, emitting, emptying, discharging, injecting, escaping, leaching, dumping, or disposing into the environment," and specifically excludes " . . . any release which results in exposure to persons solely within a workplace. . .". Therefore, based on the results of the remedial investigation, USACE has concluded that the buildings would not qualify to be addressed under CERCLA and are no longer within the scope of the CERCLA efforts being undertaken by USACE at the Luckey site. Based on this conclusion, USACE believes that placement of deed restrictions on the buildings or taking any action associated with the buildings would be outside the scope of the CERCLA efforts being undertaken by USACE.

Comment No. 2: An off-site noncontiguous residential property was investigated during this project for AEC related contaminants and it was found to contain concentrations of beryllium from the Luckey FUSRAP site that exceed the established cleanup goal. Ohio EPA encourages USACE to limit future exposure to AEC chemicals of concern at this property by taking appropriate actions while implementing the selected remedy at the Luckey FUSRAP site.

Response No. 2: With respect to USACE addressing any contaminants found in Troy Township and neighboring boundaries, USACE, under FUSRAP, is only authorized to address those sites that have been added to the program with the understanding that contamination on properties adjacent to the site can be addressed should the AEC-related contamination have migrated to those areas. For locations away from the site where AEC-related material may have been placed by separate actions or activities other than those associated with the AEC-related activities conducted by or for the AEC, the program requires the location be evaluated and a determination made as to whether it should be added to FUSRAP as a designated vicinity property. Until such locations are added to FUSRAP, USACE does not have the programmatic authority to address them. Should any such locations be added to the program before or during the remediation of the Luckey Site, USACE will evaluate whether these locations can be integrated into the Luckey Site remediation efforts and if so, issue a modification to the Record of Decision to include those locations. To date, no evidence of Federal Government responsibility has been found for any contamination on the off-site noncontiguous residential property that was investigated. Thus, it does not meet the criteria for inclusion in FUSRAP, as defined in Engineering Regulation 200-14, "Formerly Utilized Sites Remedial Action Program (FUSRAP) – Site Designation, Remediation Scope, and Recovering Costs", dated 30 August 2003.

Comment No. 3: The west production well is contaminated with beryllium at levels exceeding the maximum contaminant level (MCL) for this compound of 4.0 µg/1. The beryllium now exists in the deep bedrock aquifer at the site, which also serves as the regional potable drinking water aquifer, due to the depth of pumping of the west production well. Currently, it is believed that the contamination is being retained on-site by the pumping of the east production well. However, if this pumping should cease or if capture is not being provided by the east production well's cone of influence, then the contamination could migrate down-gradient and off-site and eventually arrive at a potable drinking water well. The renovation of the west production well or the plugging and abandonment of this well and the drilling of a new well would constitute a primary form of addressing the contamination since the probable entry point of the contamination is the west production well itself. This would potentially remedy the problem and remove the possibility of the contamination migrating off-site in the future.

Response No. 3: The preferred alternative for groundwater includes source removal, attenuation, land use controls, and monitoring. The information presented in the Remedial Investigation Report and in the Feasibility Study indicates that when remediation is complete for the soils, the source of beryllium contamination to the groundwater system will have been removed. Groundwater modeling indicates that, once remediation is complete, even if pumping of the east well is discontinued, the beryllium will not migrate off site at concentrations that present a risk above (USEPA and CERCLA) guidelines to current receptors. In addition, modeling indicates concentrations in the West Production Well will decline below drinking water standards in less than five years. Use and discharge of groundwater obtained from the West Production Well, when necessary, is also administered by the Ohio EPA and the Wood County Health Department.

A source of safe drinking water for the Luckey Site is currently available and being used.

Comment No. 4: The performance monitoring program will be designed to determine the effectiveness of the Monitored Natural Attenuation (MNA) remedy. The effectiveness review of the MNA remedy based on the results of the performance monitoring program should occur at five years from completion of the source removal.

Response No. 4: Because of the length of time necessary for MNA to work, the decision of when to transition to five year reviews or to re-evaluate may be delayed because of natural fluctuations in groundwater flow. These fluctuations may mask real reductions over shorter periods. After annual monitoring has ceased, the groundwater will be monitored in five year intervals until the groundwater has returned to a fully usable state.

3.2.5 Response to J. Greiner (Northwestern Water & Sewer District) Comments

Mr. Greiner submitted comments in a letter to USACE dated July 3, 2003. A copy of Mr. Greiner’s letter identifying an alternative water source is included in Attachment 6 to this Appendix.

Summary of Comments: The letter offered their assistance to USACE in providing an alternative drinking water source for the site.

Response: USACE acknowledges the willingness of the Northwestern Water & Sewer District to provide an alternative drinking water source for the Luckey community. However, USACE has not identified any problems with the drinking water that would warrant alternate drinking water sources for the community. With the exception of the West Production Well, the exceedances occurred in groundwater encountered immediately above bedrock or in the shallow bedrock. Beryllium was the only constituent detected above drinking water standards in the West Production Well, which is used on a limited basis. Beryllium, lead, and uranium were not detected above drinking water standards in samples collected from the residential wells/tap water.

3.2.6 Response to Troy Township Trustees Comments

The Troy Township Trustees submitted comments in a letter to USACE dated July 5, 2003. A copy of that letter expressing concerns about the buildings and vicinity properties is included in Attachment 7 to this Appendix.

Summary of Comments: The Trustees would like to see the site completely cleaned including the buildings and any contaminants in Troy Township and neighboring boundaries.

Response: As stated in 40 CFR Part 300.3(a) (2), the NCP applies to and is in effect for: "Releases into the environment of hazardous substances, and pollutants or contaminants which may present an imminent and substantial danger to public health or welfare of the United States." After evaluating the results of the Remedial Investigation for the on-site buildings, USACE has concluded there is no evidence of a release from the buildings, as defined by CERCLA, nor evidence of a substantial threat of a release of hazardous substances into the environment from the buildings that would present an imminent and substantial danger to the public health thus warranting a CERCLA response action. CERCLA defines the term "release" to mean "any spilling, leaking, pumping, pouring, emitting, emptying, discharging, injecting, escaping, leaching, dumping, or disposing into the environment," and specifically excludes " . . . any release which results in exposure to persons solely within a workplace. . . ". Therefore, based on the results of the remedial investigation, USACE has concluded that the buildings would not qualify to be addressed under CERCLA and are no longer within the scope of the CERCLA efforts being undertaken by USACE at the Luckey site.

With respect to USACE addressing any contaminants found in Troy Township and neighboring boundaries, USACE, under FUSRAP, is only authorized to address those sites that have been added to the program with the understanding that contamination on properties adjacent to the site can be addressed should the AEC-related contamination have migrated to those areas. For locations away from the site where AEC-related material may have been placed by separate actions or activities other than those associated with the AEC-related activities conducted by or for the AEC, the program requires that the location be evaluated and a determination made as to whether it should be added to FUSRAP as a designated vicinity property. Until such locations are added to FUSRAP, USACE does not have the programmatic authority to address them. Should any such locations be added to the program before or during the remediation of the Luckey Site, USACE will evaluate whether these locations can be integrated into the Luckey Site remediation efforts and if so, issue a modification to the Record of Decision to include those locations.

3.2.7 Response to S. Brown (S.J. Brown & Associates, LLC) Comments

Mr. Brown submitted comments on a form delivered to USACE on July 9, 2003. A copy of that form with his comment regarding the selected alternative is included in Attachment 8 to this Appendix.

Summary of Comments: The comments focused on concerns that Alternative 5 would result in another contaminated site and that Alternative 6 would provide for treatment and hence no further contamination.

Response: Alternative 5, Excavation of Soils and Off-site Disposal, would involve the removal and transportation for off-site disposal impacted soils excavated to achieve the cleanup goals for unrestricted land use by the critical group which has been identified as the subsistence farmer for the Luckey site. Impacted soils would be transported to an off-site disposal facility licensed or permitted to accept these wastes. The disposal facility would remain a contaminated site regardless of whether the materials from the Luckey Site were shipped there or not, however the waste would be placed inside an engineered enclosure isolating it from contact with the surrounding environment.

Alternative 6, Excavation of Soils, Treatment, and Off-site Disposal also is an attractive alternative for the reason you indicated in the comment. It is, however, more costly and may not be as protective as Alternative 5 in the short term due to the potential for worker exposures and releases during the treatment operations. Although treatment in Alternative 6 reduces the disposal volume, Alternative 6 is more costly, may be more difficult to implement, and may result in additional waste streams that will need to be managed.

3.2.8 Response to D. Bates (Uretech International, Inc.) Comments

Mr. Bates submitted comments electronically via e-mail to USACE on July 9, 2003 and September 9, 2003. A copy of his comments regarding the buildings and continued use of the West End well is included in Attachment 9 to this Appendix.

Summary of Comments: The comments focused on the need to fix the contamination problems at the West well and the need to address all of the buildings.

Response: As stated in 40 CFR Part 300.3(a) (2), the NCP applies to and is in effect for: “Releases into the environment of hazardous substances, and pollutants or contaminants which may present an imminent and substantial danger to public health or welfare of the United States.” After evaluating the results of the Remedial Investigation for the on-site buildings, USACE has concluded there is no evidence of a release from the buildings, as defined by CERCLA, nor evidence of a substantial threat of a release of hazardous substances into the environment from the buildings that would present an imminent and substantial danger to the public health thus warranting a CERCLA response action. CERCLA defines the term “release” to mean “any spilling, leaking, pumping, pouring, emitting, emptying, discharging, injecting, escaping, leaching, dumping, or disposing into the environment”, and specifically excludes “. . . any release which results in exposure to persons solely within a workplace. . .”. Therefore, based on the results of the remedial investigation, USACE has concluded that the buildings would not qualify to be addressed under CERCLA and are no longer within the scope of the CERCLA efforts being undertaken by USACE at the Luckey site.

With respect to the concerns regarding the West Production Well and its continued use, information presented in the Remedial Investigation Report and in the Feasibility Study indicates that when remediation is complete for the soils, the source of beryllium contamination to the groundwater system will have been removed. Groundwater modeling indicates that, once remediation is complete, even if pumping of the east well is discontinued the beryllium will not migrate off site at concentrations that present a risk above (USEPA and CERCLA) guidelines to current receptors. In addition, modeling indicates concentrations in the West Production Well will decline below drinking water standards in less than five years. Use and discharge of groundwater obtained from the West Production Well, when necessary, is also administered by the Ohio EPA and the Wood County Health Department.

A source of safe drinking water for the Luckey Site is currently available and being used.

3.2.9 Response to S. Shaffer Comments

Mr. Shaffer submitted comments in a letter to USACE on July 20, 2003. A copy of his letter with his comments regarding the groundwater and the preferred alternative is included in Attachment 10 to this Appendix.

Summary of Comments: The comments focused on concerns with the long-term impacts to the groundwater system and that the residents in the area rely on the groundwater for their drinking water supply. The past disposal activities at the site has placed the contaminated materials closer to the groundwater system. The “right thing to do” would be for USACE to clean the entire site by implementing alternative 5 or 6 and return the site to its original natural state.

Response: USACE agrees that the preferred alternative should be the complete removal of the AEC-related contaminants from the soils thus minimizing any future exposure potential and further impacts to the groundwater system. This is why the preferred alternative for the soils is Alternative 5 and is coupled with Alternative 7: Monitored Natural Attenuation for the groundwater. The determination of the need for and performance of response actions related to other releases of hazardous substances at this site that are not AEC-related is not within the authority of USACE under FUSRAP. It is the responsibility of other agencies and parties to undertake any other necessary response actions at this site.

The information presented in the Remedial Investigation Report and the Feasibility Study indicate that when remediation is complete for the soils, which will remove all five AEC-related COCs noted in the comment, the source of any beryllium contamination, as well as the other AEC-related COCs, in the groundwater system will have been removed. Modeling indicates that, once remediation is complete, even if pumping of the east well is discontinued the beryllium and the other two groundwater COCs will not migrate off site at concentrations that present an unacceptable risk to current receptors.

3.2.10 Response to R. Emans (Troy Township Trustee) Comments

Mr. Emans submitted comments on a form delivered to USACE on July 24, 2003. A copy of that form with the comment regarding the buildings is included in Attachment 11 to this Appendix.

Summary of Comments: The comments stated the need for all of the buildings to come down if USACE is going to clean up the site for any future use.

Response: As stated in 40 CFR Part 300.3(a)(2), the NCP applies to and is in effect for: "Releases into the environment of hazardous substances, and pollutants or contaminants which may present an imminent and substantial danger to public health or welfare of the United States." After evaluating the results of the Remedial Investigation for the on-site buildings, USACE has concluded there is no evidence of a release from the buildings, as defined by CERCLA, nor evidence of a substantial threat of a release of hazardous substances into the environment from the buildings that would present an imminent and substantial danger to the public health thus warranting a CERCLA response action. CERCLA defines the term "release" to mean "any spilling, leaking, pumping, pouring, emitting, emptying, discharging, injecting, escaping, leaching, dumping, or disposing into the environment", and specifically excludes ". . . any release which results in exposure to persons solely within a workplace. . .". Therefore, based on the results of the remedial investigation, USACE has concluded that the buildings would not qualify to be addressed under CERCLA and are no longer within the scope of the CERCLA efforts being undertaken by USACE at the Luckey site.

3.2.11 Response to M. Kolanz (Brush Wellman Inc.) Comments

Mr. Kolanz submitted comments in a letter to USACE on September 9, 2003. A copy of Mr. Kolanz's letter is included in Attachment 12 to this Appendix.

USACE acknowledges the efforts by Brush Wellman Inc. in the continued support in research concerning the environmental and health effects of beryllium and their desire to do a more complete and comprehensive review of all of the documentation associated with the Proposed Plan. However, the period for the public review was extended twice, thus giving the public over 90 days to review the Proposed Plan. USACE believes that the scope of the effort is clearly stated in Section 4 of the Proposed Plan and is clearly stated in the Record of Decision. A detailed discussion regarding non-AEC elated contaminants, including PAHs, found at the site is contained in Section 2.3.5 and 2.4 of the Feasibility Study. In Section 2.4.1 of the Feasibility Study, the scope of the USACE CERCLA actions are reiterated to state that non-AEC related materials, including PAHs, are not within the scope of the USACE actions unless they are co-mingled with AEC-related materials.

The following are responses to specific comments made regarding the following six areas:

1. The remedial action objective should be based on an industrial use scenario in light of the site's long-standing current and potential future use.
2. The baseline ingestive risk calculations should recognize the safety and uncertainty factors contained in the MCL and RfD for beryllium and should not add unnecessary or duplicative safety factors.
3. The baseline risk calculations should recognize the high degree of conservatism in the MCL and RfD for beryllium and the absence of any adverse health effects demonstrated to have resulted from the ingestion of beryllium by humans.
4. The baseline inhalation risk values used to calculate the overall risk based concentration should use the most appropriate scientific study and recognize the safety factors underlying the current USEPA ambient air standard for beryllium.
5. The estimated volume of soil to be removed and the associated costs are unreasonably high. Through careful project management the amount of soil needed to be removed can be substantially reduced under any remediation scenario.
6. The potential for drag-out from inside the buildings to the outside and the potential releases from below the footprint of the existing building may not have been adequately assessed.

The complete text associated with the comments for these general areas is contained in Attachment 12 to this Appendix.

Comment No. I: An Industrial Use Scenario Should Be Selected As The Remedial Action Objective And Should Be Used In the Baseline Risk Assessment.

Response No. I: The Luckey Baseline Risk Assessment (BRA) evaluated potential risks for several human receptors, including an industrial worker and a future resident scenario. Although risks were presented for several types of potential human receptors, ultimately, Alternative 5 (Excavation of Soils and Off-site Disposal ~ Unrestricted Land Use) was selected as the preferred alternative based on what USACE believes to be a reasonable future use for the site.

As noted in the Proposed Plan, OAC 3701:1-38-22 establishes an unrestricted property release level for radiologically contaminated sites of 25 millirem/year total effective dose equivalent (TEDE) to an average member of the "critical group." OAC 3701:1-38-22 defines "critical group" as the group of individuals reasonably expected to receive the greatest exposure to residual radioactivity for any applicable set of circumstances. The subsistence farmer scenario was selected for the preferred alternative based, not on ODH's preference for this exposure scenario, but rather on prevailing land use patterns in the Luckey vicinity and for the sake of consistency between the assessment of risks for chemical and radiological contaminants. Based on an evaluation of the site and land use in the surrounding area, subsistence farmer is believed to a reasonable future use receptor and "critical group" for the Luckey site. Revised RBCs for the subsistence farmer scenario are presented in Appendix 3A of the FS Report.

For clarification, the entire northern boundary of the Luckey Site is adjacent to farmland. Farmland also is present to the west across Luckey Road and to the east across the old railroad bed. The area to be remediated includes primarily the northern and eastern portions of the property. If this area were to be released for unrestricted use, the fence could simply be moved southward and the area could be farmed just like the adjacent farmland. No buildings would need to be removed and the existing buildings do not impede access to most of this area. USACE does not agree that this scenario is an unlikely or unreasonable future use of the property.

Comment No. II: The Baseline Risk Assessment Calculation for Ingestion Risks Fails To Recognize The MCL And RfD For Beryllium Reflect A High Degree Of Conservatism And Contain Several Safety And Uncertainty Factors.

Response No. II: The human health risks documented in the BRA were used in conjunction with ARARs and other regulations that are necessary "to be considered" (TBC) in order to determine the need for remedial action at the Luckey site. As documented in the Proposed Plan, the risk assessment, along with ARARs and TBCs, provide a basis for determining the concentrations of radiological and non-radiological constituents that can remain on site and still be adequately protective of human health and the environment. Two ARAR-based remedial goals were considered in the Luckey Remedial Investigation Report: National Primary Drinking Water MCLs and EPA and DOE standards for radiological contamination. MCLs are constituent-specific maximum concentration limits established as enforceable drinking water regulations. MCLs are promulgated numbers which are considered relevant and appropriated for CERCLA cleanups, such as one planned for the Luckey site. The legal precedence for using ARARs like MCLs is well established. If the commenter feels the toxicological basis for the MCLs is overly conservative this issue should be raised with the EPA's Office of Water.

A similar situation exists with use of the beryllium RfD. Although toxicological reference values are not promulgated standards, the Luckey BRA was conducted according to the methodology presented by the EPA in the Risk Assessment Guidance for Superfund (RAGS) and other guidance documents, including the Integrated Risk Information System (IRIS). IRIS was initially developed by EPA in response to a growing demand for consistent information on chemical substances for use in risk assessments, decision-making and regulatory activities. Combined with site-specific exposure information, the data in IRIS are intended to be used for characterization of the public health risks of a given chemical in a given situation, that can then lead to a risk management decision designed to protect public health. To use a toxicological reference value different from the one provided in IRIS is inconsistent with EPA's risk assessment guidance.

The methods used in the BRA were initially proposed in the Technical Memorandum (TM) for the BRA (SAIC 1999) and formally adopted in the Remedial Investigation Report (SAIC 2000). Both the TM and BRA included a hierarchy of information sources for toxicological information to be used in the BRA. The risk assessment methods outlined in the TM are widely accepted. If the commenter feels that the beryllium RfD is overly conservative this issue should be raised with EPA Risk Assessment Forum.

Numerous uncertainties are involved in the establishment of toxicological reference values, including those associated with extrapolations from animal data to humans and from high experimental doses to lower environmental exposures. The organs affected and the type of adverse effect resulting from chemical exposure may differ between study animals and humans. In addition, many factors besides exposure to a chemical influence the occurrence and extent of human disease. Uncertainties related to toxicity information used in the BRA are documented in Section 6.6.3 of the BRA. The Uncertainty Assessment (Section 6.6 of the BRA) acknowledges the high degree of conservatism factored into numerous step of the risk assessment process, however, any alteration to an RfD, RfC, slope factor or unit risk as they appear in IRIS (for example, the use of more or fewer uncertainty factors than were applied to arrive at an RfD) invalidates and distorts their application in estimating the potential health risk posed by chemical exposure.

Each reference dose/concentration and carcinogenicity assessment has been reviewed by a group of EPA health scientists using consistent chemical hazard identification and dose-response assessment methods. These methods are discussed or referenced in the IRIS Background Documents. It is important to note that the information in IRIS may be revised by EPA, as appropriate, when additional health effects data become available and new developments in assessment methods are adopted. In the meantime, it is USACE's position that both the beryllium MCL and the beryllium RfD were used in a manner consistent with current EPA guidance.

Comment No. III: The Baseline Risk Assessment Should Be Revised For Beryllium.

Response No. III: The commenter noted "the chief failure of the risk assessment is the development of a risk-based concentration for beryllium in soil ingested by the resident farmer's child and the use of a safety factor of 10 to compute the RBC". In computing the RfD for beryllium EPA used the following uncertainty factors: 10 for extrapolation for interspecies differences, 10 for consideration of intra-species variation, and 3 for database deficiencies. A partial uncertainty factor for database deficiencies was applied because while there are several chronic oral animal studies, human toxicity data by the oral route are lacking and reproductive/developmental and immunotoxicologic endpoints have not been adequately assessed in animals. Database gaps include lack of adequate studies for evaluation of reproductive and developmental toxicity (including multigenerational studies, studies on male reproductive toxicity, teratology, and postnatal development) owing to the possible crossing of the placenta and greater absorption of beryllium in young animals. In addition, oral studies examining immunologic endpoints, the most sensitive endpoint by the inhalation route, are lacking. The uncertainty factors listed above account for these multiple deficiencies. This is not an instance of duplicative computing since the uncertainty factors account for different things.

It is USACE's opinion that Brush Wellman is not correct in stating that applying the uncertainty factor of 10 is protective of children and thus negates the need to develop an RBC for children exposed to beryllium. The intent of RfD uncertainty factors is to encompass the range of responses possible in a population but they do not account for differences in exposure, as is done in the exposure assessment portion of the risk assessment.

In developing site-specific RBCs for the Luckey site the RfD uncertainty factors recommended by IRIS were adopted and the same RfDs were used for both adult and child receptors. However, risks and RBCs for these receptors differ due to variability in the exposure assumptions used. Consistent with RAGS, the exposure assumptions for body weights, ingestion rates, inhalation rates, and exposure frequency and duration were all adjusted to more accurately reflect exposure conditions for adult and child receptors.

If Brush Wellman Inc. feels the method EPA used to compute the RfD is overly-conservative they may raise this matter with EPA's Risk Assessment Forum. The Risk Assessment Forum is a standing committee of senior EPA scientists which was established to promote Agency-wide consensus on difficult and controversial risk assessment issues and to ensure that this consensus is incorporated into appropriate Agency risk assessment guidance. The Risk Assessment Forum can be reached at:

Phone: (202) 564-3361
Fax: (202) 565-0062
E-mail: risk.forum@epa.gov

The basic intent of IRIS is to provide consistent information on the toxicity of chemical substances for use in risk assessments and the BRA utilized IRIS as its principle source for toxicity values. To use or develop a toxicity value when one exists in IRIS would not be consistent with EPA guidance. If the value were a provisional value or an outdated Health Effects Assessment Summary Tables (HEAST) value, USACE may be more open to considering other options, but this is not the case for beryllium. It is therefore, USACE's position that both the beryllium MCL and the beryllium RfD were used in a manner consistent with current EPA guidance and revision to the BRA is not needed.

Comment No. IV: The Baseline Inhalation Risk Values Used To Calculate The Overall Risk Based Concentration Should Use The Most Appropriate Science And Recognize The Underlying Safety Factors.

Response No. IV: The inhalation RfCs for beryllium was derived according to the Interim Methods for Development of Inhalation Reference Doses (EPA 1994) based on beryllium sensitization and progression to chronic beryllium disease (CBD) identified in the co-principal studies by Kreiss et al. (1996) and Eisenbud et al. (1949). The Kreiss et al. (1996) occupational exposure study identified a LOAEL for beryllium sensitization in workers exposed to 0.55 µg/m3 (median of average concentrations).

CBD is a chronic inflammatory lung lesion that can result from inhalation exposure to beryllium characterized by the formation of granulomas (pathologic clusters of immune cells) and involves a beryllium-specific immune response. The observation of beryllium-specific proliferation indicates beryllium sensitization which is a necessary precursor to CBD. It is important to note that the critical effect noted in the IRIS profile for "beryllium and compounds" is sensitization and progression to CBD, not sensitization alone.

The inhalation RfC for beryllium has been reviewed by a group of EPA health scientists using consistent chemical hazard identification and dose-response assessment methods. These methods are discussed or referenced in the IRIS Background Documents. The RfC may ultimately be revised by EPA but in the meantime, it is USACE's position that the beryllium RfC was used in a manner consistent with current guidance and needs no further revision.

Comment No. V: The Estimated Volume Of Soil Should Be Reduced.

Response No. V: The volume estimate presents two different volumes which may be the source of some confusion. The initial volume cited of 42,200 cubic yards is an in situ volume not accounting for conservative over excavation nor does it account for the increased volume (swell) due to excavation. Based on limited information, an additional 13,200 cubic yards of material that has not been characterized as contaminated but might be, has been included in the volume in order to be conservative. This results in an initial estimate of 55,400 cubic yards of in situ volume. It is standard practice to over excavate by roughly 20% and engineering judgment indicates that roughly a 10% increase in the in situ volume is likely in order to maintain the stability of the excavation. This places the in situ volume to be excavated at 73,128 cubic yards. When excavating it is normal to experience a 20% volume increase from in situ volume to the volume transported and this accounts for the 87,754 cubic yards. Over excavation and constructability are not unusual factors and 'swell' is a standard factor applied to excavated materials. This is explained in detail in Appendix 3B of the Feasibility Study.

The volume estimate is considered to be adequately documented and usable for the Feasibility Study.

With respect to the concern that the cost estimates appear to be excessive, the Feasibility Study cost estimates are, according to EPA, designed to be comparative costs not construction bids. The primary concern is that the costs be developed in a consistent manner so that the relative costs can be compared. When finished the estimates are not intended to do better than +50/-30% of the actual construction costs. All the estimates have been prepared in the same manner and therefore are comparable in a relative manner. The fine details, of whether there is a uniform distribution of costs over a five-year period or whether they are allocated preferentially, will not affect the decisions made based on the costs presented.

The Cost Estimates are considered adequate for the intended purpose and no change is intended for the cost estimates or the Feasibility Study.

The USACE will, after the design phase of the remediation, seek bids for the remedial action. At that time a real cost number will be available. Until then, a Proposed Plan and a Record of Decision must be presented. The costs developed in the Feasibility Study are intended not as budgetary items but as tools to evaluate the relative cost efficiencies of the alternatives. They do not contain the detail necessary to develop a full remedial design. Even at the stage of the Proposed Plan changes in the plan can occur so no "Final" design would be available until after the Record of Decision is issued and a Design Phase is complete. Only after the Design Phase will a detailed enough design be available on which to base a "bid" cost.

Comment No. VI: The Buildings And The Area Beneath The Buildings Should Be Included In The Remediation.

Response No. VI: As stated in 40 CFR Part 300.3(a) (2), the NCP applies to and is in effect for: "Releases into the environment of hazardous substances, and pollutants or contaminants which may present an imminent and substantial danger to public health or welfare of the United States." After evaluating the results of the Remedial Investigation for the on-site buildings, USACE has concluded there is no evidence of a release from the buildings, as defined by CERCLA, nor evidence of a substantial threat of a release of hazardous substances into the environment from the buildings that would present an imminent and substantial danger to the public health thus warranting a CERCLA response action. CERCLA defines the term "release" to mean "any spilling, leaking, pumping, pouring, emitting, emptying, discharging, injecting, escaping, leaching, dumping, or disposing into the environment", and specifically excludes ". . . any release which results in exposure to persons solely within a workplace. . .". Therefore, based on the results of the remedial investigation, USACE has concluded that the buildings would not qualify to be addressed under CERCLA and are no longer within the scope of the CERCLA efforts being undertaken by USACE at the Luckey site. Since the buildings and their foundations are from the original site operations and therefore were constructed before any AEC-related materials were brought to the site, contamination is not expected to be underneath them (i.e., material was not disposed of or moved under the buildings). However, should the situation arise during remediation where contaminated soil appears to be located beneath a building structure, the CERCLA process would have to be followed to determine the necessary and appropriate action.

USACE does not have the authority nor the responsibility to evaluate the health and safety program of an employer to ascertain its effectiveness. The Ohio Department of Health has that authority and responsibility to review the programs and procedures that the current employer has for their worker protection. The findings of the remedial investigation did not find any eminent threats to the health and safety of the people working in the buildings. As stated in Section 6.7.4 of the Remedial Investigation Report (USACE 2000a), the radiological dose results were relatively low (<1.6 mrem/yr) and most likely due to the fact that only small (less than 1 m2) and sparsely distributed areas of elevated activity were identified in the site buildings. Also, as stated in Section 8.1.5 of the Remedial Investigation Report (USACE 2000a), beryllium was found to be clearly present in the building dust and in building materials from the Old Lab, Maintenance Building, Production Building, Annex, and the Bulk Storage Building. The largest concentrations found in the buildings are in areas not normally used under current operations. As stated in the Remedial Investigation Report, the potential exists for this material to be re-suspended during disruptive maintenance activities and may, at that time, pose the potential to exceed the proposed ACGIH TWA beryllium guideline for airborne beryllium of 0.2 µg/m3 . The current employer has the responsibility for worker protection during any potential disruptive maintenance activities.

Additional comments beyond those associated with the above six areas also were provided and are addressed below. The complete text of the comment is contained in Attachment 12.

Comment No. A-I: The Proposed Plan incorrectly states that the Brush Beryllium Company "leased" the Luckey site (p. 2-2).

Response No. A-I: The text description of Site History that is in the Proposed Plan reflects the wording as stated in Section 2.2.1 of the Feasibility Study. USACE acknowledges that BBC was under a contract with the AEC and that the AEC owned the beryllium production facilities and were operated by BBC from 1949 to 1958. However, historic documents indicate that BBC leased the property for private commercial use during periods when the total production capacity of the plant was not needed for government work. The text in the Site History section of the Record of Decision reflects that BBC was under contract with the AEC, that the AEC owned the site, and that BBC did lease the property as well.

Comment No. A-II: The Protectiveness, Implementability and Acceptability of Alternative 4 Are Ranked Too Low.

Response No. A-II: Alternative 4 proposes that an excavation be done to a level protective of an industrial worker. There are a number of reasons why this alternative is not ranked as high as Alternative 5:

- Since not all material will be removed, there is a possibility that exposure could occur, this reduces its protectiveness evaluations.
- Because limited land use requires the imposition and maintenance of long term controls, it would be difficult to implement administratively. Some durable land use controls require the involvement of local government to implement, monitor, and maintain the controls. The long term stability of those arrangements is uncertain.

- The alternative does not get high acceptability scores because the current land owner has indicated a preference for "free release" of the property and the State has indicated it will not approve limited land use without the consent of the owner.

Comment No. A-III: The Protectiveness And Acceptability Of Alternative 7 Are Ranked Too Low.

Response No. A-III: Alternative 7 has been rated as low/medium in its protectiveness because it may take 150 years to be complete. Therefore a chance exists that during that time some exposures may occur. The other groundwater alternatives are completed in a shorter time and so the probability of exposure is considerably reduced. The other alternatives also are "active" alternatives in that it will be obvious that an operation is taking place and that will tend to inhibit the unauthorized use of groundwater. MNA however is passive and despite signs and public information campaigns, it may not be obvious to the casual observer that groundwater should not be used.

Comment No. A-IV: There is conflicting information provided in the reports.

Response No. A-IV: USACE does not believe there is conflicting information as presented in the comment. The purpose of the remedial investigation was to gather data through various sources, such as field investigations, document reviews, interviews, etc. The Remedial Investigation Report stated the buildings were decontaminated using various means and that was based on the information at that time. Subsequent to the Remedial Investigation, USACE continued its investigation to determine if the details of the AEC decontamination plan, as written, were actually performed in accordance with that specific plan. USACE could not find any documentation to the fact that the buildings were decontaminated in accordance with the plan prepared by the AEC. This does not mean that the buildings were not decontaminated. It means that USACE could not find documentation that decontamination efforts, as detailed in the AEC decontamination plan, were actually performed in that manner. Without that documentation, one cannot determine if there where any deviations from that plan, and if so, what were they.

Comment No. A-V: Beryllium Exposure via Inhalation and Potential Cancer Risks.

Response No. A-V: The cancer dose-response assessment for beryllium presented on IRIS is based on the occupational study of Wagoner et al. (1980), was derived by EPA in 1987, and was verified and loaded on IRIS in 1988. Newer studies, particularly the occupational study of Ward et al. (1992), have been considered as the basis for a dose-response assessment, but share a limitation with the Wagoner et al. (1980) study--lack of individual exposure monitoring or job history data that would support a more definitive exposure assessment. The National Institute of Occupational Safety and Health (NIOSH) has recently completed a lung cancer case-control study nested within a cohort mortality study of beryllium manufacturing workers at the Reading beryllium processing facility. The study developed an exposure matrix and calculated airborne beryllium exposure concentrations and thus may provide the best available basis for a quantitative cancer estimate. The study is currently in peer review. Rather than calculate an interim quantitative estimate based on the

Ward et al. (1992) data and poorly defined exposure estimates, EPA recommended that the existing unit risk based on the Wagoner et al. (1980) study be retained until the NIOSH assessment can be evaluated as the basis for a quantitative estimate.

Comment No. A-VI: Beryllium Exposure via Ingestion and Potential Cancer Risks.

Response No. A-VI: Agreed. The oral database is considered inadequate for the assessment of carcinogenicity.

Chronic oral studies of the potential carcinogenicity of beryllium in animals were conducted at dose levels below the maximum tolerated dose, and therefore are inadequate for the assessment of carcinogenicity. However, since no carcinogenic slope factors for beryllium are available on IRIS, the Luckey Remedial Investigation Report and Feasibility Study do not include estimates for potential cancer risk due to oral exposures to beryllium. Therefore, there are no such calculations to remove. Please note that the beryllium RBC is based on non-cancer effects utilizing the RfD (see Appendix 3A of the Feasibility Study).

Comment No. A-VII: The USACE assumption that beryllium uptake via food poses a health risk is ill founded.

Response No. A-VII: Subsequent to release of the Luckey BRA site planners and stakeholders requested the addition of a subsistence farmer scenario, a more conservative receptor group, based on the requirements of 10 Code of Federal Regulations Part 20 Subpart E and Ohio Administrative Code 3701:1-38-22 to evaluate the “critical group” for radionuclides. For consistency, chemical constituents also were evaluated using the subsistence farmer scenario.

Since the plant pathway is an oral exposure route, oral toxicity criteria from IRIS were used to estimate non-cancer risks. The low gastrointestinal absorption potential of beryllium is noted in Appendix 3A, Section 3A.2.1.2 of the Feasibility Study along with other uncertainties surrounding the toxicity of beryllium following oral exposure. The uncertainties are discussed; however the pathway is included because the ingestion of home-grown produce by a subsistence farm child was determined to be a reasonable potential future land use for the Luckey site.

The fact that beryllium may be naturally occurring in food stuff in no way affects the potential toxicity that may result from ingesting it. Arsenic, cyanide and numerous other potentially toxic agents also are naturally occurring in food.

Comment No. A-VIII: USACE’s use of a Bulk Dust Preliminary Remediation Goal (PRG) is scientifically unsupportable.

Response No. A-VIII: The Bulk Dust PRG computation presented in Section 3.5.3.5 of the Luckey Remedial Investigation Report is based on the American Conference of Government and Industrial Hygienists (ACGIH) nuisance dust guideline of 10 mg/m3 and the ACGIH proposed guideline for a maximum eight-hour, time-weighted average (TWA) concentration for airborne beryllium in an occupational setting is 0.0002 mg Be/m3. This calculation shows that if the concentration of total beryllium in settled dust does not exceed 20 mg/kg and if the ACGIH nuisance dust guideline of 10 mg/m3 is not exceeded, then the proposed ACGIH TWA will not be exceeded. Although the calculations for bulk dust PRGs are somewhat unsubstantiated, these calculations were not part of either the Feasibility Study or the Proposed Plan and so, have effectively been dropped from the decision making process. It is important to note that the Luckey Site Remedial Investigation Report was issued as final in September 2000 and is no longer subject to revision.

ATTACHMENT 1

PUBLIC MEETING TRANSCRIPT
Public Meeting June 19, 2003

Please note the following corrections of misspelled names contained in the attached transcript:

Transcript Spelling:	Correct Spelling:
Jim Burns	Tim Byrnes
Jim Carston	Jim Karsten
Steve Dekey	Steve Buechi
Michelle Marzak	Michelle Barczak
Karen Kyle	Karen Keil

BEFORE THE CITY OF LUCKEY
IN RE: PUBLIC COMMENT PERIOD
BEFORE: Lieutenant Jeff Hall
Pat Jones, Chief of Public Affairs
Joe Baker, Public Affairs
Jim Burns, Product Manager
Jim Carston, Program Manager
Tony Capella, Industrial Hygienist
Steve Dekey - Project Organizer
Michelle Marzak, Counsel
Karen Kyle, Risk Assessor
HEARING: Thursday, June 19, 2003
6:30 p.m.
LOCATION: Troy Fire Hall
1313 Krutzer Avenue
Luckey, OH
WITNESSES: Rick Brogin, Eric Jacobs, Gary Brown
Reporter: Stephanie L. Pregi

I N D E X

P R O C E E D I N G S

MR. HALL:

Good evening and welcome. My name is Lieutenant Jeff Hall and I'm the commander. Thank you for coming out tonight to listen to our presentation on the proposed plant for the Luckey site. Your participation in the decision making process is welcomed and appreciated.

The purpose of this meeting is to present to you the proposed plan, but most importantly, is to get your input.

Here's the agenda that we will follow tonight. Before I move ahead into the introductory remarks, I would like to lay out a few ground rules we have established to make this meeting organized and fair to everyone that has come out tonight.

First, when you came in, you should have received a sign in card. If anyone needs a card, please raise your hand and we will get you one.

On the card is a box to mark, if you wish to mark --- excuse me. On the card is a box to mark, if you wish to make a statement or ask a question.

Anyone who wishes to speak should indicate that on their sign in card and pass them to our assistants.

Second, I ask that everyone be courteous and allow us to make our presentation before asking any questions. We will provide everyone an opportunity to first make their comments on a proposed plan for the record. We'll limit your time to no more than five minutes per individual. After all comments have been received about the proposed plan, we will conclude the formal meeting.

My staff and I will remain to answer any questions that you may have and we will be here until we've answered them all. Your cooperation is deeply appreciated.

Third, please keep in mind we will continue to accept written comments up to the close of business on July the 9th, 2003.

Back to the agenda. After some additional introductory remarks and a brief look at the proposed plan, there will be a technical presentation and then we will address questions and comments. We will review how the comments will be accepted following the technical presentation.

This is our mission. I want everyone to know what that mission is. The U.S. Army Corp of Engineers is committed to protecting you and the environment, while executing our program in the most safe, effective and efficient manner and in compliance with the Comprehensive Environmental Response, Compensation and Liability Act, otherwise known as CERCLA.

CERCLA is the law that gives us the authority to clean at the site and it establishes the process we will follow.

This slide shows where the proposed plan is in the CERCLA process. We reviewed from the assessment of alternatives in the feasibility study to the preferred remedy and its formal review in the proposed plan. Following the formal review, we will be issuing the record a decision on the remedial action, which is otherwise known as the cleanup.

To do all of this, the Corp of Engineers, the lead federal agency, brings together its multi-disciplinary team of Corp Employees from here in the Toledo area, from Buffalo and across the nation, along with its contractors. This team has a wealth of experience addressing FUSRAP sites throughout the nation.

The Corp team is really a subset of a much larger team, as shown here on the slide. We call that the Luckey team. You are part of that team. We do not operate alone and we depend upon the input from others. We have and will continue to solicit input from the Luckey team or work with all the parties to come to a synergistic solution for addressing the Luckey site's needs.

Much of the broad team I just showed to you have participated along the way in the development of the proposed plan. We have conducted extensive internal reviews. Now is the time to get formal comments from you. The primary purpose of this meeting is to listen to and record comments from the public on this plan. Your input is very important to us.

I'd like to highlight no decision has been made. The final remedy will not be selected until the Corp has received and considered all public and regulatory comments obtained during the 30 day comment period. Again, that ends on the 9th of July, 2003.

This is the preferred plan from the proposed plan, which includes a combination of excavation and disposal of impacted soils and monitored, natural attenuation of impacted groundwater.

The process we follow to get to this point, in a more descriptive explanation, will follow. At this point, I will turn the presentation over to Jim Burns, who is our project manager, and he will lead us through the technical presentation of tonight's proposed plan. Jim.

MR. BURNS:

Thank you, sir. Welcome. First of all, I'd like to introduce the rest of the Corp of Engineers team. I have people in --- contractors. First of all, I'd like to point out Jim Carson, our program manager for FUSRAP. Tony Capella, industrial hygienist.

Steve Dekey, in the back here, is going to stick his head out the door there a minute. He's the project engineer. Michelle Marzak right up front here, our counsel. Karen Kyle, our risk assessor. Joe Baker, in the back, is with our public affairs and Pat Jones, our chief of public affairs in the back.

We also have our prior contracts Doug Bach with Montgomery, Watson, Harza (phonetic) and we have Laura Oakloy (phonetic) with Scientific Applications International.

Again, I'd like to welcome you. We're going to take you through some of these items. Briefly, take you through this history. Many of you may have much more history than I do. We'll go through a little history for those of you who haven't been here before. Go through the problem identification of the nature and extent. Go through the processing criteria, cover the alternatives and then move into the preferred plan or preferred alternative.

I'd like to first of all, for those who may not be as familiar with this, I'd like to point out some things here. Here is essentially the Luckey site. Running north and south right here is Luckey Road. Gilbert Road here. The industrial part of the site, shown here in a older picture.

Also, we have Toussaint Creek to the north. The old railroad back here to the east. And as you can see, the site is industrial for the most part here. Agricultural land to the north.

With the history, a Formerly Utilized site Sites Remediation Action Program was developed to address the legacy left by the early Atomic Energy Program that was authorized in 1974. At the Luckey site, the Atomic Energy Commission began beryllium processing back in 1949 and finished with that and ceased sometime in the early '60s.

Part of that beryllium process also is that at one time in the '50s, contaminated scrap steel was brought to the site, which may be the reason why the radio-nuclides are out on this particular site.

The Luckey site entered the program in 1992 under the designation by the Department of Energy. The FUSRAP program itself was turned over to the Department of --- the Corp of Engineers, rather, in 1997. We have been running with the program since that time.

In more recent history, we completed the Remedial Investigation or most of the study work back in September 2000. At that time, we had a public workshop with you and we presented primarily a focus on the groundwater modeling that we were doing at the time.

In March of 2001, we completed tap water sampling, which was a request of yours at the September 2000 meeting that we look at and evaluate the water relative --- surrounding the site. We did so and completed that without Wood County Health Department and Brad Esten (phonetic). We thank him for that assistance.

The next item along the lines of our investigation, we completed the groundwater model in May of 2002, along with the Toussaint Creek investigation. The groundwater model was thoroughly coordinated with the state regulators as was the Toussaint Creek investigation.

Toussaint Creek investigation indicated that there was no need for further action. As we had pointed out to you the last time we met you back in December of 2001, it may be some time before we get back with you, as we were taking and assessing the information for the feasibility study.

That feasibility study was completed in May of this year, May 2003, and is now in the administrative record in your Luckey public library and at our offices should you care to examine that.

Right now, where we are is the Luckey proposed plan, which was released this June and we are now in the public comment period as the Commander said.

That's essentially the history of the Luckey site. The next slide will take you into the first activities we had --- basically examining the site for the nature and extent of the problem relative in four primary areas; the soil, groundwater, sediments and buildings.

The soils, contaminated

with --- such concern that we looked at were the radio-nuclides, mainly radium, thorium and uranium, and also the chemicals beryllium and lead.

For the groundwater, the contaminants of concern were one radiological, that is uranium --- one radio-nuclide rather, it's uranium and two chemicals; beryllium and lead.

It's key to point out here that of the four examined, only the first two soils and groundwater had impacts that exceeded guidelines. And the proposed plan that we are talking to tonight addresses these with alternatives.

The other two, namely Toussaint Creek sediments, where the beryllium and lead was found, pose no threat to human health or the environment. The beryllium and radio-nuclides were found to pose no unacceptable risk to human health and the environment. Those are without the examined --- alternatives presented here tonight.

Regarding the nature and extent of contamination, this slide here shows --- is meant to show the extent of contamination. And primarily the outline that you see here, is showing you the beryllium contamination at the surface. The other coloring, which can be better shown on this graph, where --- if you have an opportunity later to examine, shows you the different depths of contamination, which basically run from surface to 20 feet.

The beryllium contamination, the soils here

--- this was meant to cover soils. Again, it is the primary contaminant, essentially 60 percent of the volume is beryllium alone contamination. There may be, as we mentioned, chemicals of lead --- chemical lead and beryllium as that contamination is commingled, for the most part, by the lead and uranium, the radio-nuclides.

Regarding groundwater, groundwater impacts are limited. Here are the locations of seven wells. Primarily, you can see them to the northeast quadrant of the industrial portion of the site. Based upon our analysis, impacts are limited, very limited areas around these wells.

Lead and uranium are not predicted to migrate off the site in the near future. I will address these northern wells here conceptually in the next slide.

Here's a conceptual drawing of the site, the industrial part of the site, the northern fence or boundary of the site and the properties to the north or the agricultural area.

Basically, a breakdown here of two types of strata; the unconsolidated strata here, which provides some groundwater, but generally not usable in any significant quantity. And here, where generally speaking, at some greater level, serves as the groundwater source or drinking water source to may in the area.

Where we found the contamination is narrowing in this unconsolidated area here, from two to 20 feet. When we found contamination in the groundwater in the sustained area, which is generally not sufficient to supply continuous water for drinking water.

The deeper bedrock here, where most --- the groundwater is drawn from, is not impacted by our modeling predictions. The contamination is unlikely to reach this deep aquifer or natural attenuation will take place, as the groundwater moves through the system and the concentrations of contaminants decrease from physical --- from natural, physical and chemical processes.

So there, we've covered is through the --- given you a conceptual model of what's going on with groundwater.

As we move from

identification of the problem, we're up to the nature and extent that's been identified that leads us to development of the cleanup guide criteria. Regulations were examined for constituents of concerns in soils as I mentioned namely, radio-nuclides beryllium and lead. The radio-nuclide --- these two regulations, one federal, one Ohio, cited here, establish the dose criteria for the critical group of receptors for unrestricted land-use. That group is the subsistence farmer. Subsistence farmer is a possible future. That means if this land became vacant, the site --- industrial site, it essentially means someone would live off produce, vegen sources that would come right off of this site.

So those two regulations

provided us that information developed as the cleanup guidelines for the radio- nuclides in the soils.

Now, for the beryllium and lead, there's a different situation. There are not regulations to address this. So risk based guidelines were developed.

Moving to the cleanup criteria, next slide, for groundwater, regulations were examined for the constituents of concern. Namely, the uranium, beryllium and lead.

The maximum contamination levels, shown here, are essentially standards developed to protect you and I or human health from identified adverse effects to drinking water.

The first federal regulation or cite here addresses uranium. The second two, both the federal and Ohio, address beryllium. Again, addressing these establish the cleanup criteria for beryllium and uranium in groundwater. The next, relative to lead, the national primary drinking water regulations again address drinking water contaminants. In this case, lead. You can see the code cites here, federal regulation and another Ohio regulation. These are the cleanup guidelines.

Based upon the use of those, we came up with some cleanup guidelines. Mainly here, as you see down this column, contaminants of concern from beryllium down to uranium. Actually, I'll go through that. Beryllium, lead, radium, thorium and the two uraniums. In the groundwater; beryllium, lead and uranium.

These numbers --- it's not so important that you get relative these numbers, but subsistence farmer, that's what we have to cleanup. That's our cleanup guidelines. These are the maximum detects that we've shown in the field. In our next slides, I'll try to show you a comparison of what we have to reach to be protective of human health and the environment versus the maximum. Now, this is not the average, but the maximum that we've had.

In comparison in soils, as you can see, you have a condition for a subsistence farmer and then for the different --- beryllium and lead. As you can see, the comparison is just a number down to where we need to see where the units are. You can see there's considerable reductions as opposed to some of what the maximum levels were that we've encountered in the field. That's soils.

For groundwater, a similar situation. For a subsistence farmer condition, we have these levels. For maximum detects, we have considerably different levels.

Having taken that into account --- the next slide, please. We've taken you from examination of the problem into looking at the regulations, getting to what the cleanup goals will be and then taking those cleanup goals, we developed them into a series of alternatives or a number of alternatives.

Here, we have six alternatives. Nine alternatives were examined as part of the feasibility investigation. However, alternatives two, three and four, if you notice, are missing. They did not achieve our unrestricted land-use. Therefore, they are not evaluated in the proposed plan.

I'm going to go through a brief of each one of these. Primarily, on this slide, I'd like to address, this is a no action plan. A no action plan is essentially a plan that remains --- things remain as they are. As you can see --- point out in this, things remain as they are two criteria that are investigated under CERCLA, namely protectiveness and do they meet the regulations, you see nos there.

This plan is carried forward as a part of --- solely as a part of --- for comparison purposes. It's not anything that we would propose.

Going through the alternatives. First we have those dealing with soils. We're going to have two. Both of them, which in this case, alternative five is focused on an excavation. Excavation of soils and off-site disposal. Here, we address the soils by removal of the impact soils and the potential source for any groundwater contamination, along with off-site disposal and backfill.

Essentially 88,000 cubic yards of material will be shipped off-site at a total cost of about $36 and a half million.

Alternative six, again, excavation of soils. The essential difference here from the previous alternative regarding excavation regarding --- this alternative addresses treatment of radio-nuclides in the soils, which are only a small portion of the expected waste stream. That treatment adds over $6,000,000 to the cost.

Alternative seven, here is the first of three groundwater alternatives. Now, any groundwater alternative includes source removal or must be combined with one of these soils alternatives that I just mentioned.

This alternative, mainly monitoring natural attenuation, relies on natural, physical and chemical processes, reaching cleanup goals. Until they are achieved, land-use controls will be in place to prevent use of contaminated groundwater.

The time to achieve the

cleanup from 40 to 150 years is based upon achievement of the goals in the unconsolidated, overburden or areas that I previously mentioned as generally not used as a drinking water supply.

Land-use controls, if I may, are measures to warn and/or legal means that would be used to protect the groundwater while the remediation is underway or the cleanup is underway.

Alternative eight, again, active groundwater treatment, we're addressing groundwater. This alternative relies on putting in wells and extracting the groundwater. Treatment of contamination and discharging the water until cleanup goals are reached or achieved, land-use controls will be in place to prevent use of contaminated groundwater. The time to achieve cleanup here is 40 to 80 years based again on achievement of goals in shallow overburden or unconsolidated material. Land-use controls, cost $3,600,000.

This alternative --- again, electrokinetic treatment of groundwater, relies on putting in an electronic field with wells and extracting groundwater, treating the contamination and discharging the water. Again, until cleanup goals are achieved, land-use controls will be in place to prevent use of contaminated groundwater. The time to achieve the ground cleanup will be 40 years. It's based upon again, achievement of --- in the shallow or unconsolidated material, which is not currently used for drinking water.

Having taken all those alternatives and developing all the alternatives, the process, in the next slide please, under CERCLA, into the nine criteria to evaluate alternatives.

In the one slide I've shown you relative to no action, we talked about these two professional criteria which must be met. That means, there must be protection. There must be protection for you and I and that of the environment, in compliance with regulations.

As I had pointed out before, the no action plan did not meet those conditions. All the other alternatives carried into the proposed plan did. What I'd like to do now, is lead you into the next criteria, the next five in blue. The evaluation criteria, mainly their effectiveness, both long and short term; their impacts in reduction in toxicity, mobility or volume; their implimentablity in the cost.

The two reasons why we're here right now, that we talked about and the commander mentioned is we're seeking your comments. These are the last two criteria; community acceptance and state acceptance. Although I say last, not least in importance. Those criteria is what we're here to get your comments on tonight and through the comment period.

I'd like to now move on to the five criteria and go through the different balancing criteria or comparative analysis of all alternatives.

Here, we have a focus on

soils. Down this column here, we have the five criteria; long term effectiveness, reduction in toxicity, short-term effectiveness. We have another item, time to complete, to show you something there. Implimentability and cost.

Remember the no action plan is not protected, so this is showing here the different data on here. Ranking is shown for comparison purposes. The two other plans include excavation. In other words, material leaves the site.

Alternative five here, excavation and off-site disposal, implementability is more certain than treatability or alternative six. Because of that, a pilot study would be needed regarding treatability. However, if the treatability did work or would work, it would result in reduced volume shipped off the site.

This is a comparative analysis of the alternatives regarding groundwater. Again, for groundwater, alternatives must consider a soil removal or a source removal.

The difference showing here is in long term effectiveness between the plans. Because of a potential longer time to obtain cleanup of the groundwater and the overburden or alternative seven, monitored natural attenuation versus the high ranking.

Again though, that is in the strata that has --- is not productive or is less productive and likely to be used for drinking water.

Monitored natural attenuation of it has a greater short term effectiveness. There are less risks due to the alternative and potential exposure.

Also, there is uncertainty with the treatment and electrokinetics, whether they will work. Pilot studies are called for. If they would work, they would reduce the mobility and volume of the materials shipped off-site.

After going through the comparison of alternatives, both for the soils and for the groundwater, we arrive at the preferred alternative. It's upon a comparison of the alternatives, alternative five, excavation and off-site disposal and followed by site restoration addressing the soils as --- doesn't address the source for groundwater.

Furthermore, alternative

seven, monitored natural attenuation of the impacted groundwater, along with land-use controls as we mentioned, which would have --- be in place, either warnings or legal means to prevent --- while that gets underway from people using groundwater.

That plan that could cost roughly $37 and a half million is the preferred alternative. This plan, again, would result in essentially 88,000 cubic yards of material removed from the site.

Some of the benefits regarding the preferred alternative. One, most important, it's fully protective of you and I or human health and the environment. It also meets the requirements of relevant regulations and guidelines.

It's permanent in that once the groundwater portion of it is done, there should be no further and unrestricted use of the land made available.

It can be initiated in a timely manner. We believe it's responsive to community concerns, which we are eliciting from you.

Project schedule. Here is where we are at, 30 day public review. We will consider each and every comment received during the 30 day public review. We will prepare a formal response to each comment. Responses will be issued in a responsiveness summary that will become a part of the administrative record.

The comments will be considered, where applicable, in the development of the record of decision. As you can see here, it's scheduled for December of this year.

Then we will have a decision regarding the remedy. However, we will have to await funding before proceeding with any remedy. Currently, there are a number of ongoing cleanups at other FUSRAP sites that are utilizing a substantial portion of the program funds.

Given those ongoing cleanups, it appears program funds will not become available until fiscal year 2006 for this project site.

The comments portion. Again, I'm taking you through the presentation. If there's anyone who desires to make any oral comment, if they would fill out one of those yellow sheets. After the comments, we will dispense with the formal meeting procedures and adjourn and the staff, myself, the commander, all of the staff here will answer any questions until we're done.

I'd like you to remember also that you may still write or submit your comments in the mail to us until July 9th. You'll still have time to send us comments.

We'll respond to your comments. We'll consider each comment received during the 30 day public review comment period and prepare a formal response to each comment. Again, the responses will be issued in the responsiveness summary. They will be put into the evident record. It will be placed in the Luckey public library and it's also back in our office at Buffalo.

When the record of

decision is issued, we will post it on our website and also place a copy of it in the official record. We will send out a postcard to everyone on our mailing list. I understand on the card, you have an opportunity to give or, if you sign it on the back, identify for us if you'd like to be on the mailing list, if you're not already on it.

We will let you know the record of decision or when it has been issued.

I'd like to review for you the ground rules. A restatement of that. One person speaks at a time. Again, we'd like you to come up here, please and if you would, come up here for the --- we have a microphone here. If you come up so our recorder can hear your comments, state your affiliation, if that is so required.

We'd also like to limit you to five minutes. I want everyone to be given an opportunity to speak. If you have comments a lot --- if you feel it will last longer than five minutes, please give us written comments. You can hand those to us. You can write comments, I understand, on the sheets that have been passed out and hand it to them.

You do not have to come up here and speak. That's not a requirement. You can give us written comments. Again, remember that we will be recording this and we'd like you to come up here, if you can. Speak clearly so the audience may hear you and we may get your comments recorded here.

This is my last thing. If you don't want to speak tonight, you still have opportunity to mail them in. This is the address up here. I'll leave this up here in case anyone wants to copy that down, that information.

We have cards in the back with the information, our website and information. If you would like to present any comments during the comment period.

With that, I'd like to move us right into comments. Joe, if you would, he'll take from the list, establish order and call you up if you mention --- marked on your card that you'd like to talk. We'll go from there. Anyone? If you can get people --- I'm not going to make anybody sweat it out, so to speak here, but I guess I want to make sure that everyone has an opportunity.

We'll give you a minute to think about if they have any comments or questions. Again, if you have any comments or questions, we'll put them on the record. You will receive a formal response.

Well, if they're not any questions, I guess I will close the formal portion of the --- yes, sir.

MR. BROWN:

I have a question. The 88,000 cubic yards ---.

MR. BURNS:

Excuse me, could you come up. We need to have your comments recorded, dually recorded. You will have a formal response to it. We need your name and ---.

MR. BROWN:

My name is Gary Brown.

I've been a maintenance man out at the plant for about 30 years. I've been out there for about 30 years. I understand a lot of what you're talking about, but I don't understand when you say 88,000 cubic yards you're going to pull out. Is that just in one general area or is that going to be all around the plant?

There is, if I remember --- I've seen the print, the plot out there. There was two on the south side, one in the northeast corner, two on the north side. But also, back in the early '80s, when I was in the union as the vice president --- Boarder Wheel, it was Boarder Wheel at that time, Corporation got a letter from the DOE, the Department of Energy. They said they may have very contaminated steel out there.

There wasn't anything after that. But I asked some people that used to work out there and they said, yes, there was truckload after truckload of contaminated steel that was brought in there and they were suited up and buried in the northeast corner. That went beyond, according to the brush print, beyond the fence, in the northeast corner.

That's the kind of stuff I want answered on. I've heard nothing about this. I'd like to know how much you're digging up and where you're digging up at. Because there's a lot of pits out there. A lot of pits.

MR. HALL:

As I was going to point out, we'll take your questions and your comments. I'm not going to respond to them right here. Thank you for you comment. We will give you a written and formal response. Is there anyone else that would like to raise a question, make a comment?

MR. JACOBS:

Yes, I have one. I have a lot of questions. I'm Eric Jacobs from the village of Luckey. Most of the comments I have with the --- how are they going to be transported, by our local road, by rails? How are they going to transport or what roads will they be on, township roads? That's the questions I have.

The biggest question I have concerning it is will there be a danger of the trucks going past your house, an accident or something.

MR. HALL:

Thank you.

MR. BROGIN:

I'm Rick Brogin. My questions would be the TSD site. You mentioned those 88,000 yards, $36 and a half million I think it was. That's quite a chunk of change. So there must be something they're doing with it when it leaves here. That would also indicate to me that there's something seriously wrong with the material that's in there.

I'd also like to know what the flow, direction of the groundwater is, in the area. I'd like to know around the wells that we have checked in area, what kind of contamination we have now, including all of the metals.

I'd like to know who the third party firm is that's going to ensure that you're doing this as your plan is put forth.

MR. HALL:

Thank you. Are there any others who would like to comment, question? I want to point out again, we're going to give you every opportunity to make a comment or raise a question. Yes, sir.

MR. PLAGLEY:

My name is Wayne Plagley. My question has to do with the two wells out there, the east well and the west well. I understand that the west well is contaminated with beryllium.

Generally, I use the east well for all our processing and drinking needs. Occasionally, the pump has gone bad and we've had to use the west well, which is contaminated with beryllium. When that happens, we switch over and we do not allow drinking of that water, but we use it for process water and still discharge.

I understand that discharge eventually makes its way up the creek. I don't see in your presentation anything about that well out there, if that would still be allowed to continue to be used or if someone will provide another well.

As people in town know, we have a fire system out there that the township comes out and fills their trucks up occasionally. That has been filled up with beryllium water while the east well was out. I think you should be aware of that. Thank you.

MR. BROGIN:

I have another question. I guess at this point, I didn't realize there was contamination in the well west of the property.

MR. HALL:

Excuse me, can you restate your name?

MR. BROGIN:

I'm sorry. I'm Rick Brogin. At this point, I didn't realize there was contamination to the west of that. I'd like to know what it's contaminated with and the results that we've had on that since the testing period began.

I also would like to know what the --- another gentleman mentioned where it was --- how it was going to be shipped from Luckey to wherever. I'd like to know the method of shipment. Is it going to be something in a bulk form or is it going to be containerized as in drums. I guess that would be it for now.

MR. HALL:

Anyone else? I'll give you a couple more minutes. I'm now trying to make you at ease --- but I want to give you every opportunity in case something comes to your mind so you can state it on the record.

Anyone? Without any additional comments, I'd like to close the formal portion of this meeting, I guess, and let you know that we will stay around here to answer your questions. We have a number of sources here in the back that you can look at.

I wanted to point out again that if you're computer savvy, we have out a website where you can get the various documents and data that we summarized in today's presentation. If you have any additional comments, please submit them to our offices. The address --- put it back up there again. Please submit them to us by the close of business on the 9th of July.

Otherwise, I thank you for coming. We appreciate your input. Thank you very much.

* * * * * * * * *

MEETING CONCLUDED AT 7:30 P.M.

* * * * * * * * *

ATTACHMENT 2

L. D. SHERMAN COMMENTS
June 16, 2003

International Environmental Technologies Inc

P.O. Box 797 Perrysburg, Ohio 43551 419-466-2276

6/16/03

U.S. Army Corps of Engineers, Buffalo District
FUSRAP Information Center-Luckey
1776 Niagara Street
Buffalo, New York 14207-3199

Sirs,

After reviewing your public notice, we at IET would like to be placed on record stating that you should seriously reconsider the selection of "natural attenuation of groundwater" for the Luckey site. In similar settings in Ohio at the DOE remediation of the Ashtabula site, it has been found to be a failure. At Ashtabula the remediation goal was 22 mg/kg for TCE and its daughter products. At the Ashtabula site DOE selected accelerated natural attenuation with the injection of HRC compound a co-metabolite.

Attached is the April 2003 sampling results and the evaluation that the system will not meet the remediation goals. Natural Attenuation will leave a significant number of monitoring point at concentrations 2 to 4 times the EPA standard. This is not success.

Please read the following information that should be available within DOE and considered during your selection process.

In-situ remediation is still a viable and cost effective tool when conducted properly. Your plan to leave the contamination in place and then in sum unknown manner attenuate the contaminants is little more than wishful thinking. If over the past 30 to 40 years the site has not "Naturally Attenuated" itself how will things differ now. This type of thinking is not logical.

IET has successfully remediated 10 sites in Fostoria, Ohio (clay similar to Luckey), Youngstown, Ohio (clay similar to Ashtabula) and at 8 other sites in mixed geology. Why do we succeed when others fail, we hold the patent for in-situ treatment in soils. We have experience in all types of monitoring and remediation in clay were others only have failures and do not understand contaminant/water flow in tight formations. Attached is a White paper on our work in Youngstown. We are the only group in the US that has remediated to background levels in clay to a depth of 40 feet, in 22 months, for $87,000. We know what we are doing.

Respectfully,

L. D. Sherman, VP Technical Services

mg/kg, additional samples taken from this location should be watched closely to determine if this increasing trend continues.

Soil samples are beginning to show increases of DCE concentrations, the step-wise degradation product of TCE. These increases in TCE daughter products tend to confirm that the dechlorination of TCE is occurring in the subsurface. SEC has not modeled the predicted increases in DCE or VC concentrations as a function of time or TCE dechlorination, because the production of these byproducts is anticipated to be transient as TCE is dechlorinated. SEC would anticipate an increase in DCE concentrations that corresponds directly with the decrease in TCE concentrations and then an increase in VC concentration that corresponds directly with the subsequent decrease in DCE concentrations. However, sampling data do not confirm these increases in transient daughter products. Several explanations for this discrepancy may be relevant and are presented below:

- The high levels of TCE in many of the samples cause the laboratory to perform significant sample dilution. These high dilutions may be masking the presence of detectable levels of daughter products.

- The step-wise dechlorination of TCE results in DCE, VC, and finally ethane gas, respectively. The laboratory has had difficulty in the analyses of dissolved gases. The complete degradation of TCE into ethane gas could be occurring, resulting in non-detectable concentrations of the transient daughter products. Dissolved gas analyses would enable this hypothesis to be confirmed.

The current site information indicates that the three zones of the original six need substantial additional remediation. The primary purpose of using HRC was to accelerate natural attenuation via reductive dechlorination. The current groundwater chemistry indicates that the core of the contamination is extremely aerobic which will inhibit dechlorination. Despite this condition, annual and confirmation sampling events have shown decreases in the sorbed phase contamination of 17 to 78 percent. If this phenomenon continues with renewed injections (as currently planned), it cannot be expected that an improvement beyond another 25 to 50 percent is possible. The mass of HRC currently slated for injection is not stoichiometrically sufficient to satisfy the competing electron acceptor demand and to reductively dechlorinate the contaminants.

Although the current strategy could bring a number of soil horizons to the target level, there are a significant number of sampling areas where the current sampling shows concentrations much greater than the average 200 mg/kg. The overall effect of a dose(s) that cannot negate the extreme concentration of competing electron acceptors may only reduce the average soil concentration to two to four times the planned target of 22.6 mg/kg.

SEC has developed revised injection designs aimed at overcoming these high-than-anticipated conditions. The new injection designs were developed to meet the following goals:

- Remediation of the site by May 2005
- Remediation of the site by May 2004

The new designs were provided under separate cover. As discussed above, the current bioremediation model used to predict contaminant concentrations over time is no longer valid. Because competing electron acceptor demand, dissolved-phase TCE concentrations, and sorbed-phase TCE concentrations were higher than anticipated, the initial design and model did not include enough HRC to satisfy these demands and stimulate remediation. Additionally, the model did not include the retarding effect that overcoming these factors would have on remediation progress. The Q3 Groundwater Monitoring Report provides a more detailed description and bases of the assumptions used in the model, the model itself, and the reasons the model is no longer valid.

Correction factor?

SEC has developed revised soil and groundwater models based on actual site conditions and sampling data. The results of this model (including predictions of TCE concentrations as a function of time) are attached to this report. Because site data collected during the baseline, Q1, Q2, and Q3 sampling events were used to develop the model, the revised groundwater model is applicable for future monitoring events.

As assessment of the initial model and revised model predictions for the A1 sampling versus actual A1 sampling results is presented below in Table 3. Data from the baseline and A1 soil sampling indicate significantly higher levels of contamination than predicted in the initial remediation model, as shown below. As discussed above, site data collected during recent sampling events make the initial model obsolete because of the large differences between predicted and actual site conditions (as discussed in the Q3 report).

Table 3. Actual sampling results compared to predicted results (from the performance models).

	Initial Model (Predicted)*		Revised Model (Predicted)*		Actual*	
	Baseline (mg/kg)	A1 (mg/kg)	Baseline (mg/kg)	A1 (mg/kg)	Baseline (mg/kg)	A1 (mg/kg)
A1	62	17	203	132	203	110
A2	37	10	91	59	91	206
A3	262	74	151	98	151	125
A4	19	7	2.16	1.4	2.16	9.68
A5	96	29	305.18	198	305.18	248.8
A6	346	111	1669.2	1085	1669.2	272
C4	NA	NA	739.2	480	739.2	164
C6	NA	NA	320.2	208	320.2	138
Site Average	137	41	435	283	435	159

*Soil TCE levels represent average concentration in the 1-6 meter bgs range.

The extreme heterogeneity of the data collected during the sampling events makes it very difficult to generalize and to predict remediation progress. Data from the A1 soil sampling event show remediation is occurring quicker than anticipated by the revised model in several sample locations, including the A1 (B-1 zone), A6 (M-1 zone), C4 (R-1 zone), and C6 (M-1 zone). Again these areas are those zones where the highest mass of HRC was injected. In some areas, remediation is occurring more slowly than predicted,

ATTACHMENT 3

ROBERT EMANS COMMENTS
June 19, 2003

US Army Corps of Engineers

Former Luckey Site Public Comment Meeting June 19, 2003

Do you wish to make a public comment? Yes ✓ No ___

Name: ROBERT EMANS - TRUSTEE

Address: 112 MAIN ST. LUCKEY OHIO 43443

~~Question:~~ why not TAKE DOWN ALL BUILDINGS now?

ATTACHMENT 4

JEFF GOLDIN COMMENTS
June 23, 2003

Sent: Monday, June 23, 2003 4:03 PM
To: Fusrap
Subject: Luckey FUSRAP Site Inquiry

Dear USACE:

Regarding the subject site, I assume from advertised material that the impacted soil will be disposed of as a mixed-waste. Was there any consideration given to stabilizing the heavy metals in the impacted soil and sending the treated soils to a rad landfill? I believe the savings to the government could be substantial in disposing of the impacted soils as a rad waste versus a mixed waste. Please let me know.

Regards,

Jeff

Jeff Goldin
Vice President, Sales & Marketing
Metals Treatment Technologies, LLC.

Phone: 303-456-6977 Ext: 28

ATTACHMENT 5

GRAHAM MITCHELL COMMENTS
July 2, 2003

OhioEPA

State of Ohio Environmental Protection Agency
Southwest District

401 East Fifth Street
Dayton, Ohio 45402-2911

TELE: (937) 285-6357
FAX: (937) 285-6249

July 2, 2003

U.S. Army Corps of Engineers ~ Buffalo District
FUSRAP Information Center ~ Luckey
1776 Niagara Street
Buffalo, NY 14207-3199

To whom it may concern:

Ohio EPA has been actively involved in the Luckey FUSRAP Site since designation into the program in the mid 1990s. Through cooperative interaction during implementation of the CERCLA process with both DOE and USACE , Ohio EPA has assisted in the development of the Remedial Investigation, Feasibility Study and Proposed Plan for this site. Because of this extensive participation, Ohio EPA is comfortable with the supporting documents to the Proposed Plan and agrees with the recommended preferred alternative contained therein to remedy the site. The following comments are being submitted for the public record to memorialize extant issues related to this project:

1. The on-site buildings in their present condition have been determined by USACE to require no further action. However, should conditions change whereby the buildings are substantially modified or even razed, further evaluation will be necessary to ascertain whether these modification activities, the resulting debris and the soils contained beneath the foundation footprint exceed the established cleanup goals for the site. Ohio EPA recommends that a deed restriction be negotiated with the current property owners and other responsible parties to ensure that further characterization activities are implemented under such circumstances that may result in a future release to the environment. It is our goal to make certain the property continues to meet unrestricted use criteria in the event future modifications or demolition of these structures occurs.

2. An off-site noncontiguous residential property was investigated during this project for AEC related contaminants and it was found to contain concentrations of beryllium from the Luckey FUSRAP site that exceed the established cleanup goal. Ohio EPA encourages USACE to limit future exposure to AEC chemicals of concern at this property by taking appropriate actions while implementing the selected remedy at the Luckey FUSRAP site.

3. The west production well is contaminated with beryllium at levels exceeding the maximum contaminant level (MCL) for this compound of 4.0 micrograms per liter (ug/l). The beryllium now exists in the deep bedrock aquifer at the site, which also serves as the regional potable drinking water aquifer, due to the depth of pumping of the west production well. Currently, it is believed that the contamination is being retained on site by the pumping of the east production well. However, if this pumping should cease or if capture is not being provided by the east production well's cone of influence, then the contamination could migrate downgradient and offsite and eventually arrive at a potable drinking water well. The renovation of the west production well or the plugging and abandonment of this well and the drilling of a new well would constitute a primary form of addressing the contamination since the probable entry point of the contamination is the west production well itself. This potentially would remedy the problem and remove the possibility of the contamination migrating offsite in the future.

4. The performance monitoring program will be designed to determine the effectiveness of the Monitored Natural Attenuation (MNA) remedy. The effectiveness review of the MNA remedy based on the results of the performance monitoring program should occur at five years from completion of the source removal.

Ohio EPA appreciates the opportunity to provide comments on this project during the public comment period. We look forward to finalizing this portion of the CERCLA process through issuance of the Record of Decision for the site and moving forward with the actual cleanup.

Sincerely,

Graham Mitchell
Chief, Office of Federal Facilities Oversight

cc: Steve Snyder, DERR, NWDO
Geoff Leking, DDAGW, NWDO
Joe Crombie, ODH
File

GM/sdj

ATTACHMENT 6

JERRY GREINER COMMENTS
July 3, 2003

NORTHWESTERN
WATER & SEWER
DISTRICT

July 3, 2003

U.S. Army Corps of Engineers
Buffalo District
FUSRAP Information Center – Luckey
1776 Niagara Street
Buffalo, NY 14207-3199

RE: Luckey, Ohio Proposed Plan and FUSRAP Site

Gentlemen:

Let me introduce our organization – the Northwestern Water and Sewer District. We provide potable water and sanitary services to approximately 17,000 users in Wood County.

We have followed the Army Corps' efforts in Luckey, Ohio for the last several years. As recently as 2002 we completed an extension to our water system which brings Toledo water from Lake Erie to within 1-1/2 miles of Luckey's corporate limits.

We are prepared to extend our system to Luckey if the environmental need and financial support is there to do so. We propose a meeting to discuss this further if it could mitigate any concerns for that area in regard to their drinking water.

Please call us to discuss further.

Sincerely,

Jerry Greiner
Executive Director

JG/cj

12560 Middleton Pike • P.O. Box 348 • Bowling Green, Ohio 43402
FAX: (419) 354-9344 • (877) 354-9090 • (419) 354-9090 • www.nwwsd.org • E-mail: district@nwwsd.org

ATTACHMENT 7

LINDA BINIKER COMMENTS
July 5, 2003

TROY TOWNSHIP TRUSTEES

LUCKEY, OHIO 43443

July 5, 2003

Timothy E. Byrnes
Luckey Project Manager
Department of the Army
Buffalo District
1776 Niagara Street
Buffalo, NY 14207-3199

Dear Mr. Byrnes:

Subject: Luckey Formerly Utilized Sites Remedial Action Program (FUSRAP) Site

The Troy Township Trustees reviewed your correspondence dated June 6, 2003 at their last regular meeting. The correspondence discussed proposed plan of Excavation and Off-site Disposal for soils and Monitored Natural Attenuation for groundwater for the Luckey Site.

The Trustees are concerned with the safety of the citizens which includes their health and welfare. The Trustees would like the site completely cleaned including the buildings and any contaminates in Troy Township and neighboring boundaries.

The Trustees invite you or your designate to attend a Township meeting to discuss the issues. Our meetings are the 2nd and last Wednesday of each month. Please contact me at 419-833-3401 to confirm when you would be able to attend.

Sincerely,

Linda F. Biniker

Linda F. Biniker
Clerk

Robert S. Emans, Trustee
Michael R. Hoelter, Trustee
James R. Jacobs, Trustee

ATTACHMENT 8

STANLEY BROWN COMMENTS
July 9, 2003

U.S. ARMY CORPS OF ENGINEERS
PROPOSED PLAN FOR THE LUCKEY SITE ~ LUCKEY, OHIO

Your input to the PROPOSED PLAN for the Luckey Site is important to USACE. You may use the following space to write your comments, then fold, and mail. Comments must be postmarked by July 7, 2003. If you have any questions about the comment period, please contact USACE at 1-716-879-4410 or 1-800-833-6390.

Please write your comments below.

Although Alternative(5) for soils would allow release of the site for unrestricted use in a reasonable period of time; ~~the~~ this Alternative would create another contaminated site. Alternative (6) would provide a treatment for these soils, hence, no further contamination.

Moreover, this present Case Preparation Monitoring, together with Ambient Trend Monitoring, should provide for successive generations of new instruments or monitoring devices.

Stanley Brown
S.J. Brown & Associates, LLC
649 Bruns Drive
Rossford, Ohio 43460
Tel: 419-661-0941
Fax: 419-662-9832

ATTACHMENT 9

DON BATES COMMENTS
July 9 and September 9, 2003

From: Don Bates [mailto:dbates@uretech.com]
Sent: Wednesday, July 09, 2003 4:41 PM
To: Byrnes, Timothy E LRB
Subject: Luckey FUSRAP issues

Tim, I just want to reiterate again on our position of the west well. This well is still in use on a regular basis(in fact it is the one running right now) by the plant. It is contaminated with Be and should be "fixed". We believe that this well is clearly a FUSRAP responsibility and should be addressed by the Corp of Engineers ASAP, as it is a "release" whenever it is used.
Don Bates

From: Don Bates [mailto:dbates@uretech.com]
Sent: Tuesday, September 09, 2003 4:58 PM
To: Byrnes, Timothy E LRB
Subject: Luckey FUSRAP site

Tim, as I discussed with Jim Karsten and Bruce Smith a week ago, they recommended that I ask you to add my un-resolved issues(West Well & Buildings) to the public record for comments.
Thanks, Don Bates

ATTACHMENT 10

STEVE SHAFFER COMMENTS
July 20, 2003

Dept. of the Army - Buffalo District
1776 Niagrara St.
Buffalo, NY
14207-3199

July 20, 2003

Dear Dept. of the Army - Buffalo District,

As a resident living within a ¼ of a mile of the Luckey Site, I have many concerns with the health and safety of my family and others in the area. We have lived here for 15 years and only recently found out the magnitude of the hazards that exist down the road from our home, which we built. Drinking the water and raising fruits and vegetables from of which we feed our family on.

I am concerned with the long-term impact to the aquifer and possible contamination to the drinking water from this site. I believe in time, these contaminants will eventually appear at some diluted level but none the less will appear. Yes, the beryllium is an airborne hazard, but the remaining other 5 COC's appearing in the ground water will pose a health hazard.

A close friend worked for this facility at the time it was operated by Brush Wellman and explained the activities that went on there in the sixties. One that I was most concerned with was the burial of "Hot" contaminated items such as barrels and tools within the ground. Bull dozing a pit down to the bedrock and dumping these items in the pit to be covered up achieved this. As you know, the bedrock is very close to the surface in this area, thus putting the aquifer closer to this material. In addition to the bedrock is the close proximity of a deep quarry within a few hundred feet of the site.

The "Right thing to do" would be for the US Army Corps of Engineers to step up and clean up this site. The town of Luckey, area farmers and homeowners rely on the clean, safe ground water for survival. What will these people do if this hazard is left to remain and eventually poisoning the water in the future? It would be even more costly to the government in the future not to mention the lives ruined by the actions of others in the past. My opinion is to implement alternative #5 or #6 and return the land to its original natural state prior to Brush Wellman's tainting and protecting the generations of residents to come.

Sincerely,

Steve Shaffer
5315 Middelton Pk.
Luckey, Ohio 43443

ATTACHMENT 11

ROBERT EMANS COMMENTS
July 24, 2003

U.S. ARMY CORPS OF ENGINEERS
PROPOSED PLAN FOR THE LUCKEY SITE ~ LUCKEY, OHIO

Your input to the PROPOSED PLAN for the Luckey Site is important to USACE. You may use the following space to write your comments, then fold, and mail. Comments must be postmarked by July 7, 2003. If you have any questions about the comment period, please contact USACE at 1-716-879-4410 or 1-800-833-6390.

Please write your comments below.

7-24-03

In the proposed Plan for remediation the buildings are not included.
If you are going to reclame the property for any future use the buildings will have to come down.
The building were built in the early 40s and are inefficient with the cost of utilities today.
The building will soon be abandoned and left to rot and fall in. In fact the large building to the northeast is contaminated has been abandoned and is roting and will fall in.
I suggest you negotiate with the owner and lease to discontinue use of the site and clean it up right the first time.
The buildings eventually will have to come down.

Thank you

Robert Emans
Troy Township Trustee
112 main St
Luckey Ohio
43443

ATTACHMENT 12

MARC KOLANZ COMMENTS
September 9, 2003

September 9, 2003

Mr. James W. Karsten
U.S. Army Corps of Engineers, Buffalo District
FUSRAP Information Center - Luckey
1776 Niagara Street
Buffalo, NY 14207-3199

Reference: Brush Wellman comments on the FUSRAP Luckey Ohio site proposed cleanup plan.

Dear Mr. Karsten:

Brush Wellman Inc. (Brush Wellman) appreciates this opportunity to submit comments on the documents associated with the remedial investigation report, proposed plan and feasibility study report for the Luckey, Ohio FUSRAP site. Brush Wellman is the leading international supplier of high performance engineered materials containing beryllium and is headquartered in Cleveland, Ohio, USA. It is the only fully integrated supplier of beryllium, beryllium-containing alloys and beryllia ceramic in the world.

Since its founding in 1931, Brush Wellman has concentrated its operations and skills on advancing the unique performance capabilities and applications of beryllium-based materials. As a world leader in beryllium production and technology, Brush Wellman strives to remain a leader in medical knowledge of beryllium and in the environmental, health and safety aspects of the material as well. Brush Wellman has sponsored basic research concerning the environmental and health effects of beryllium and has assisted government agency studies. Brush Wellman supports continuing efforts to prevent chronic beryllium disease (CBD). Brush Wellman's current model to prevent CBD is based on our knowledge and understanding of the potential health risks posed by different types of exposure to beryllium such aschemical form, processing method, and particle size.

Brush Wellman appreciates the effort made by the USACE to extend the comment date for the Luckey Site Proposed Plan to September 9, 2003. However, despite this extension of time, the volume of information and the complexity of the project did not allow Brush sufficient time to completely and thoroughly review all the documents, cross-check the regulatory references and double check the calculations related to risk assessment and cost.
We are submitting the following comments based on a limted review of the Remedial Investigation, Feasibility Study and Proposed Plan reports and attachments made available to Brush by USACE. The Remedial Investigation report appears to be well written with good documentation of the sampling plan and results. However, the Feasibility Study and Proposed Plan reports read as if they contained conflicting arguments and conclusions. Brush Wellman often found it difficult and sometimes impossible to sort out the logic used because the

discussion tended to jump between legal requirements and best practice justifications. Brush Wellman found the Proposed Plan particularly confusing.

Most of the information presented in the Proposed Plan is available in the Remedial Investigation and Feasibility Study. To improve understanding by the reader the proposed plan could have been a short section of the Feasibility Study. Though our comments about the structure of the reports may appear to be grousing, Brush Wellman's primary concern is that the report is likely unintelligible to the residents of Luckey, Ohio. Brush Wellman does not believe the report is written in a fashion suitable for understanding by the community residents. For example, Brush Wellman believes that the community take away message from the public meeting was that the USACE is going to clean-up the Luckey site to a level safe to be farmed by a resident subsistence farmer. This belief is based on the fact that USACE's proposed plan to address only AEC materials was not covered in the PowerPoint presentation during the public meeting. Brush Wellman does not believe the community understands that considerable contamination will remain from non-AEC constituents of concern such as poly-aromatic hydrocarbons (PAH's). The existence of these remaining non-AEC constituents of concern leaves open an on-going National Contingency Plan requirement to further evaluate and remediate the site. In addition, the existence of on-going manufacturing at the site and in buildings which contain both AEC and non-AEC constituents of concern, may result in drag-out from the buildings. The fact that the areas beneath the footprint of the buildings were not sampled for constituents of concern raise questions as to the completeness of the remediation.

Brush Wellman believes the USACE should evaluate the effectiveness of their communications to municipal leaders and the public to ensure their understanding of the proposed plan.

The attached document summarizes Brush Wellman's comments based on its review of the three reports. If you have any questions, please feel free to contact me at 216-383-6848.

Respectfully submitted,

Marc Kolanz, CIH
Vice President,
Environmental Health & Safety

MEK/elm

COMMENTS OF BRUSH WELLMAN INC.
ON THE JUNE 2003 PROPOSED PLAN
AND
MAY 2003 FINAL FEASIBILITY STUDY REPORT
FOR THE LUCKEY SITE

Submitted to U.S. Army Corps of Engineers
Buffalo District

September 9, 2003

Brush Wellman Inc.
17876 St. Clair Avenue
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Brush Wellman Inc. supports the remediation of the Luckey site through the Corps of Engineers' preferred approaches: excavation and off-site disposal of impacted soils and monitored natural attenuation of groundwater (Alternative 7).

For reasons more fully explained below, Brush Wellman believes the site should be remediated to an industrial land use rather than unrestricted land use. Additionally, contamination from the past, current and future non-AEC operations that is not included in the AEC cleanup renders the site non-suitable for agricultural, residential, or subsistence farmer use. Although the reports clearly state that the scope and extent of the studies together with cleanup goals are pertinent only to AEC-materials, the public may not fully understand the implications of these constraints and limited goals. As a result, the public could assume (with potential adverse health consequences) that the site is clean because USACE has declared it clean (within the scope of the proposed clean-up plan).

The following observations demonstrate that contaminants may still be present on the site and may not be suitable for unrestricted land use after the AEC cleanup is concluded:

1. Section 2.1.1.5 (Post AEC Operations), page 2-5 of the Remedial Investigation report shows that post-AEC owners/operators include Aluminum and Magnesium (a subsidiary of Vulcan Materials), Luckey Industries, Goodyear Tire and Rubber Co., Motor Wheel and Uretech. These facilities generated hazardous wastes not subject to AEC investigation and cleanup.

2. At one point, the facility was a treatment, storage and disposal facility (TSDF) which was later changed to a large quantity generator. However, the report did not indicate if the change from a TSDF was accomplished with the appropriate investigation and cleanup.

3. Section 2.1.2.3 (Other Contaminants) states that Motor Wheel submitted a RCRA closure plan for waste streams that include toluene diisocyanate (U223) and methylene chloride (F002). However, the report did not actually state if the closure was implemented. The report further states that USACE has authority only for the wastes other than AEC-materials when they are intermingled with AEC materials. The report also states that indicators (contaminants) from the Motor Wheel wastes are assumed to be site-wide. The report went on to say that *"Characterization of the non-AEC indicator compounds was limited to areas where beryllium or radionuclides were thought to be above acceptable limits."* Furthermore, the report states that Uretech currently manages operations similar to its predecessor.

All these imply that after the site is cleaned up to unrestricted land use from AEC materials, hazardous materials from "other contaminants" will still be on site and unaddressed.

Current and future operations could re-contaminate the remediated areas after USACE has concluded its cleanup.

Under section ES.1 (Scope), page ES-1 of the Feasibility Report, USACE has limited the scope to *"addressing radioactivity, beryllium, and other constituents related to the production of beryllium at the Luckey site…"*. However, no evidence was presented in the reports to show that the "other constituents" have been thoroughly identified. USACE appears to have not identified or evaluated the potential impact of support and maintenance materials that were used during the

AEC operations. The Feasibility Study report states on page 2-18, second full paragraph, that *"the highest cancer risk from soil is from exposure to PAHs."* USACE does not appear to have investigated if AEC could have contributed to these PAHs through the use of production support materials or maintenance materials known to contain PAHs such as asphalt and roofing tars. Degreasers, solvents and lubricants are still utilized extensively in the metals industry and were typically used with minimum controls prior to the advent of USEPA regulations. It is likely that the AEC operations contributed to the PAH contaminants. Also, the impurities that were inherent in the raw materials and other materials brought to the site should have been considered in the investigation.

For the reasons stated above and following, Brush Wellman believes with respect to the excavation and off-site disposal of impacted soils, Alternative 4 should have been selected and that Alternatives 4 and 5 should be modified in the following ways in order to produce a more precise and cost-effective remediation:

(1) The remedial action objective should be based on an industrial use scenario in light of the site's long-standing current and potential future use.

(2) The baseline ingestive risk calculations should recognize the safety and uncertainty factors contained in the MCL and RfD for beryllium and should not add unnecessary or duplicative safety factors.

(3) The baseline risk calculations should recognize the high degree of conservatism in the MCL and RfD for beryllium and the absence of any adverse health effects demonstrated to have resulted from the ingestion of beryllium by humans.

(4) The baseline inhalation risk values used to calculate the overall risk based concentration should use the most appropriate scientific study and recognize the safety factors underlying the current USEPA ambient air standard for beryllium.

(5) The estimated volume of soil to be removed and the associated cost are unreasonably high.Through careful project management the amount of soil that has to be removed can be substantially reduced under any remediation scenario.

(6) . The potential for drag-out from inside the buildings to the outside and the potential releases from below the footprint of the existing building may not have been adequately assessed.

Selection of Alternative 4 still would require a relatively substantial soil excavation and off-site disposal; however, the costs would be substantially less because the depth of soil excavation and the total amount of soil excavated would be less. Selection of Alternative 4 would have no significant impact on Alternative 7.

The following comments are specific to, and supportive of, the above six points.

I. An Industrial Use Scenario Should Be Selected As The Remedial Action Objective And Should Be Used In the Baseline Risk Assessment.

The Proposed Plan is based on a post-remediation land use scenario of subsistence farming. Accordingly, baseline risk assessment has been based on protecting the child of a subsistence farmer who lives on the site. The reasoning used to select this hypothetical scenario is flawed. Proper consideration of the relevant factors, including the Wood County Comprehensive Plan, demonstrates that an industrial land use scenario should be employed.

The Proposed Plan recognizes: "Current land use at the Luckey site is industrial and is expected to remain industrial for the near future" (p. 6-1). The Proposed Plan also notes that the property is zoned for light industry (p. 4-1). The Proposed Plan could have stated, as does the Feasibility Study, that the site has been used for industrial purposes for over 60 years (FS 2-5). The Feasibility Study presents these points more strongly than does the Proposed Plan:

> *"The Luckey site is zoned light industrial and is expected to remain industrial for the near future. Given the current zoning designation and published expansion plans for the Village of Luckey (Wood County 1998), the most likely future use for the property is industrial or commercial use."*

FS 2-17.

However, instead of developing a remediation plan based on this long-standing current and expected future use, the Proposed Plan selects a hypothetical future use of subsistence farming for its remedial objectives. In justifying the selection of this hypothetical future use, the Proposed Plan overlooks key facts relating to future land use and unfairly diminishes the value of the site as industrial or commercial property and its anticipated future use for such purposes.

The Proposed Plan states that there are several reasons why *"it is possible that the future land use could be residential or agricultural."* These reasons are:

(1) *"Surrounding land use on three sides of the site is agricultural and residential*";

(2) *"Agricultural and residential are the dominant land uses throughout Troy Township*"; and

(3) *"There is no other industry in the immediate area and industrial facilities at the site are aging"* (p. 6-1).

The Proposed Plan's analysis omits several important facts which show that the site is almost certainly the least likely 40-acre parcel in Troy Township to be converted to residential or agricultural use. The chief omitted fact is that the proposed remediation will affect less than half of the surface area of the site, and remaining on the site will be a large manufacturing facility. There will continue to be a complex of large buildings used for manufacturing, with over 100,000 square feet under roof. Also remaining will be the web of above-ground and underground utilities lines and pipes that serve this complex, as well as paved roadways and a parking lot for hundreds of cars. It would take a very rich and foolish subsistence farmer to demolish these massive buildings, remove all the pavement and unneeded utility lines and pipes and remediate, as may be necessary, the soil under these areas, which are not being excavated under the Proposed Plan.

Even if one were to focus on the future use of just the eastern third of the property, most of which is to be remediated under the Proposed Plan, it is unreasonable to predict that someone would elect to build a house there and engage in subsistence farming. It would probably be the most undesirable 10-12-acre location for such a farm in Troy Township. The existing manufacturing complex would be along the entire west boundary of this hypothetical farm and during the late afternoon much of the land would literally be in the shade of the tall manufacturing buildings (not conducive to crop growth). To the south and southeast, across the road, would be the France Stone Quarry and the Troy Township Dump. Along the entire eastern side of the hypothetical farm would be the railroad tracks. Only on one side of the hypothetical farm, the north, would it be bordered by agricultural land.

In contrast to the unlikelihood of the subsistence farm scenario, continued use of the site for industrial purposes is likely, as the Proposed Plan states. While it is true that some of the manufacturing facilities are old, the site remains in use and has shown a remarkable adaptability for different industrial uses over its 61-year history. The site has many characteristics, which are not noted by the Proposed Plan, that encourage its future industrial use:

- A variety of buildings (office, production, warehouse, maintenance),
- Zoning for industrial use,
- Utilities needed for industrial use,
- Adjacent railroad with potential rail access, and
- Highway access (State Route 582) and proximity to a number of major highways (U.S. 20/23 and Interstate 75, 80 and 90) which run north, south, east and west.

Increasingly, factories are being located in rural areas because of cheaper land prices and the ability to recruit loyal employees with a good work ethic who appreciate the ability to continue to live in their community without having to move away to find employment.

The absence of the land zoned and used for industrial purposes in Troy Township (and neighboring Webster township) makes the future industrial use of the site more likely, not less likely as indicated in the Proposed Plan.

There is also a strong and growing land use ethic and public economic planning policy that industrial properties (a.k.a. "Brownfields") should be maintained in productive industrial or commercial use rather than disturbing "greenfields" for new factories and stores. This ethical policy is reflected in the Wood County Comprehensive Plan which names as one of its four goals: *"preserve prime land for agricultural purposes"* (Wood Plan, p. 13). Indeed, the Wood County Plan states that its land use goal is *"to utilize a land use plan that maximizes the* *efficiency of existing and future infrastructure, agricultural resources, community facilities, and services throughout Wood County."* Accordingly, with respect to industrial developments, the Wood County Plan recognizes the need for industrial development to occur or as extensions to *"pre-existing land use pattern"* (Wood Plan, p. 169).

Also recognizing the value of the industrial development in terms of meeting a community's employment needs, the Wood County Plan encourages local communities to identify locations suitable for industrial development. (*Id.*) Hence, identifying the site as having a future use as subsistence farming is inconsistent with the site's future value and with sound community planning, like the Wood County Plan, which recognizes the need to preserve prime farmland, avoid urban sprawl and utilize existing industrial land for continued industrial use.

In light of the facts that indicate the future use of the site will be industrial or commercial, the absence of an existing deed restriction precluding the site from being used as residential or agricultural property, which the Proposed Plan asserts, does virtually nothing to increase the possibility that the site will be used for residential or agricultural purposes. With extremely rare exceptions, no land in Ohio is prevented from future residential or agricultural use by deed restrictions. However, if it were important to the Corps of Engineers in its remedy selection that the remediated portion of the site be deed-restricted against residential or agricultural use, obtaining such a restriction should be pursued and can in all probability be obtained.[1]

The Proposed Plan seems to have backed into selection of the subsistence farm future land use scenario, which was not analyzed in the Remedial Investigation Report, via the consideration of Ohio Administrative Code 3701:1-3822 (FS p. 3A-1). This Ohio rule does not dictate the selection of the future land use scenario. With respect to the subsistence farmer risk assessment, the Ohio rule is improperly identified as an Applicable or Relevant and Appropriate Requirement (ARAR); and even if it were an ARAR for this particular purpose, it would not dictate the selection of future land use scenario. At most, the Ohio rule is a chemical-specific goal for remediation of radionuclides.

As noted in the Proposed Plan, OAC: 3701:1-38-22(B) establishes as an unrestricted property release level *"a total effective dose equivalent to an average member of the critical group that does not exceed twenty-five million per year"* plus As Low as Reasonably Achievable (ALARA). OAC 3701:1-38-01(A)(35) defines "critical group" as the group of individuals reasonably expected to receive the greatest exposure to residual radioactivity for any applicable set of circumstances.

[1] If the Corps intends to pursue such an investigation, it should consider whether there are any land use restrictions or easements in the chain of title prior to the April 1, 1987 Goodyear quitclaim deed, as the Proposed Plan implies that this deed was the only document examined. *See* p. 4-1. If any land use restrictions or easements were filed before April 1, 1987, these documents would bind future use of the property according to their terms.

Without citation to authority or explanation of reasoning, the Proposed Plan states: *"In Ohio, the critical group has been consistently defined as the subsistence farmers"* (p. 6-3).[2] Clearly, what the Proposed Plan is referring to is not a state "requirement" within the meaning of 40 CFR § 300.430(e)(2)(i)(A) but a state interpretation which does not have the force of law as to what a "critical group" is. Hence, Ohio's interpretation of "critical group" meaning "subsistence farmers," consistent or otherwise, is not an ARAR. CERCLA Section 121(d)(2)(A) requires compliance with "promulgated" state standards. State guidance is not a "promulgated" standard. 52 Federal Register 32496, 32498 (August 27, 1987).

Turning to what is the Ohio requirement—the definition of "critical group"—it is clear from the foregoing analysis of the future land use that the "group of individuals <u>reasonably expected</u> to receive the greatest exposure to radioactivity for any applicable set of circumstances" is industrial workers.[3] In other words, in order to apply to Ohio rule, one has to determine what the reasonable future use is, as that use is not predetermined by the rule, as incorrectly suggested by the Proposed Plan. Furthermore, regardless as to whether the critical group is deemed to be industrial workers or anyone else, the Ohio rule is an ARAR only with respect to radioactivity and not as to other chemicals of concern.

II. The Baseline Risk Assessment Calculation for Ingestion Risks Fails To Recognize The MCL And RfD For Beryllium Reflect A High Degree Of Conservatism And Contain Several Safety And Uncertainty Factors.

The baseline risk assessment employs ARAR drinking water standard (maximum contaminant level or MCL) for beryllium and the IRIS Reference Dose (RfD) for beryllium. The MCL is based on a lifetime oral ingestion study of rats conducted by Schroeder, Mitchner, *Life - term Effects of Mercury, Methyl Mercury, and Nine Other Trace Metals on Mice*, <u>Journal of Nutrition</u> 421-427, 452-458 (1975). The IRIS RfD for beryllium is based on a long-term oral ingestion study of dogs by Morgareidge, Gallo, and Cox, *Chronic Feeding Studies with Beryllium in Dogs* (1976 There are no known studies regarding human ingestion of beryllium. <u>ATSDR Toxicological Profile for Beryllium</u> 7 (Sept. 2002) *("Swallowing beryllium has not been reported to cause effects in humans because very little beryllium can move from the stomach or intestines into the blood stream.").* There is no reported association between ingestion of beryllium and chronic or acute beryllium disease, which are risks associated with inhalation of beryllium. *Id.* at 74.

Both the MCL and RfD for beryllium are highly conservative, as can be demonstrated in several ways. First, the media-specific cleanup goals adopted by the Proposed Plan are more restrictive for beryllium in soils and groundwater than for lead, despite the fact that well-documented adverse human health effects exist for ingestion of lead but not for beryllium. Second, the beryllium MCL is so low that it overlaps with the range of naturally occurring levels

[2] It may be that Ohio law "consistently" interpreted "critical group" to be subsistence farmers; however, the question has to be raised whether Ohio has in the past considered all possible circumstances or even the particular circumstances of this site. If the Ohio rule were to be applied to a Lake Erie beach, Maumee River sediment remediation project, or City of Toledo property, clearly a subsistence farmer could not possibly be the critical group.

[3] It should be noted that OAC 3701:1-38-22 requires that the total effective dose be calculated to be protective of the "average member" of the critical group, not the most vulnerable member.

of beryllium in water. *See* ATSDR Toxicological Profile for Beryllium 6.4.2 (September 2002). Third, the RfD-derived soil-specific cleanup goal in the Proposed Plan overlaps with the range of naturally occurring levels of beryllium in the earth's crust. *Id.* at 6.4.3. Fourth, both the MCL and RfD are calculated by the safety and uncertainty factors applied to NOAEL and LOAEL studies.

In the case of the drinking water standards, over conservatism resulted chiefly from the use of the Schroeder and Mitchner study and the application of the largest possible safety factor *"for possible carcinogenic potential of this contaminant via ingestion"* despite the fact that a Morgareidge rat study reported a substantially higher NOAEL and <u>all</u> animal ingestion carcinogenicity studies were negative. *Id.* at 3.2.2:1 through .7.[4] In the RfD excessive conservatism is due chiefly to the selection and multiplier effect of a series of safety or uncertainty factors. In computing the drinking water standard, EPA used an uncertainty factor of 100. In computing the RfD, EPA has increased the uncertainty factor to 300. This increase is unwarranted as will be demonstrated by the following comments.

A. Database Adequacy—Reference Dose

In computing a reference dose for beryllium, EPA inappropriately applied an uncertainty factor of 3 for the completeness of the database. Using beryllium sulfate (a water soluble beryllium compound), the Morgareidge chronic rat study showed no toxic effects at up to 500 ppm (25 mg/kg/day) for 2 years and the dog study resulted in no systemic toxicity at up to 50 ppm for 3.5 years. Site of contact irritation/corrosion resulted in termination of the dogs exposed to 500 ppm after 33 weeks, and the study director and pathologist concluded that even in these dogs, the minor systemic effects observed were the result of systemic bacterial infection because of the damaged gastrointestinal tract. The systemic effects were <u>not</u> attributed to absorbed beryllium. This should be of no surprise since the commercial form of beryllium sulfate has a pH of 1, meaning it is highly corrosive. As a sulfated compound, the corrosive nature alone can account for the gastrointestinal lesions. It is illogical to implicate beryllium as the source of toxicity under such circumstances.

Although no "developmental toxicity studies" meeting the EPA guidelines have been reported, no abnormal pups or increased neonatal deaths were reported in the Morgareidge et al. dog study. In that study, there was no effect of long-term beryllium exposure of both males and females on reproduction. In the epidemiological study, no effect on reproduction as a result of maternal or paternal occupational exposure was reported (Savitz et al., 1989, cited in TERIS). In a single generation study of rats, a single intratracheal administration of beryllium oxide (0.6 mg/kg prior to mating) had no effect on pregnancy outcome (Clary et al., 1975, cited in ATSDR Toxicology Profile for Beryllium). In addition, no effect on reproductive organs was seen in either dogs exposed to beryllium for 50 ppm for 3.5 years or in rats exposed to 500 ppm for 2 years.

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[4] Schroeder and Mitchener concluded that beryllium was "virtually innocuous" by ingestion and is not tumorogenic. Indeed "beryllium was noted for its lack of toxicity," and the authors concurred with previous studies indicating "that beryllium is poorly absorbed through the gut, and that ingestion is not a hazard."

Uncertainty does not exist with respect to immunological effects from oral exposure. There are no specific immunologic assays of beryllium or its salts by oral administration; however, such testing is not necessary. Chronic studies of beryllium sulfate in rats and dogs did not reveal any evidence of immunologic effects. There was no difference in spleen or thymus, and no hematologic differences suggestive of immunologic effects. Intestinal absorption of orally administrated beryllium is very low; and there is no evidence that orally administered beryllium would reach sensitive cells in the lung where sensitization could occur. Therefore, immunologic testing by the oral route would be wasteful of animals and would not add to the understanding of beryllium toxicity.

In sum, the database for oral administration of beryllium is adequate to assess the reference dose; there is little uncertainty that could be reduced by additional studies. Therefore, the uncertainty factor for the completeness of the database should be 1 not 3, which is used by IRIS.

B. Interspecies Extrapolation—Reference Dose

In computing the RfD, IRIS uses the highest possible uncertainty factor (10) for inter-species variation. This is unreasonable because the Morgareidge dog study was long-term (3+ years); because the rat data obtained by both Morgareidge and Schroeder and Mitchner were negative despite exposure at higher doses, and because dog studies are considered more representative of metal toxicity to humans than are rodent studies.

The nature of the feeding study and critical effect observed also warrant a lower uncertainty factor. The absorption of beryllium salts administered to the intestinal tract is very low. It is very unlikely that the intestinal effects in the Morgareidge et al. dog study occurred from systemic toxicity of beryllium. Instead, this appears to be a site of contact irritation/corrosive response to the beryllium salt. The gastrointestinal effects of minerals are normally due to corrosive properties of the salts. Indeed, the veterinary pathologist who reviewed the study for EPA concluded that one cannot discern if lesions are due to a local toxic or irritant effect of beryllium (sulfate). For site of contact effects, humans are not more sensitive than dogs. Thus, there should not be an uncertainty factor of 10 for extrapolation from dogs to humans. A factor of 1 is more appropriate.

C. Intraspecies Extrapolation—Reference Dose

The highest possible uncertainty factor of 10 was also applied by IRIS for intra-species variation. This is unreasonable because it appears that the one dog in the Morgareidge study considered to be affected at 50 ppm dose already represents a sensitive population. Thus, there is no reason to assume the greatest uncertainty and apply the maximum uncertainty factor for intraspecies extrapolation, when the data shows that the administered dose did not affect 90 percent of the test species. In addition, the database uncertainty is reduced because the Morgareidge dog study is supported by a chronic rat study at three dose levels approaching the practical limit for dietary administration.

D. Conclusion

The stringency of both the drinking water standards and the reference dose for beryllium is startling in light of absence of human information on oral toxicity. There is, of course, an abundant amount of data on human oral exposure to beryllium, as beryllium is commonly found in foods and water supplies. *See e.g.*, ATSDR Toxicological Profile for Beryllium pp. 97-93 (beryllium concentrations in water, soil and food). Indeed, such exposure has occurred since the origin of the human species. Against this exposure data, the lack of oral toxicity evidence in humans speaks volumes, yet this point is ignored in computing both the IRIS RfD and the drinking water standards for beryllium. This approach is not only scientifically near-sighted but perverse, as the resulting drinking water standards dictate that trivial reductions be achieved in water supplies or soils of all types at significant costs. These standards are lower than necessary to protect the public from beryllium toxicity and can result in clean-up standards that are lower than the naturally occurring level of beryllium in many water sources and soils. Hence, they result in increased costs with no benefit to humans.

III. The Baseline Risk Assessment Should Be Revised For Beryllium.

The Proposed Plan and Feasibility Study fail to communicate the degree of conservatism of the beryllium drinking water standards and reference dose and they fail to take this into effect in computing the baseline risk assessment.

The chief failure of the risk assessment is the development of a risk-based concentration (RBC) for beryllium in soil ingested by resident farmer's child and the use of a safety factor of 10 to compute that RBC. As discussed above, EPA in computing the RfD for beryllium has employed a series of safety factors so that the use of an additional safety factor in computing the RBC is unnecessary and duplicative. The long-term Morgareidge study included reproduction by the subjects and a safety factor of 3 was added for uncertainty as to completeness of the database, which would take into account exposure to children. In addition, EPA computed the RfD by adding on an additional uncertainty factor of 10 to account for possible intra-species variation. This uncertainty factor addresses the possibility of a more susceptible population, such as children. Hence, it was unnecessary for the Proposed Plan to compute an RBC for children, because the RfD was designated to protect them, and using an additional safety factor to do so duplicated the safety factors employed by the RfD.[5]

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[5] Brush Wellman participated in that rulemaking and ultimately filed for judicial review of the drinking water standards. Brush Wellman contended that research conducted by Morgareidge and his colleagues in the 1970s provided a more appropriate scientific basis for developing drinking water standards for beryllium. Judicial review of the 1992 standards has been stayed while Brush Wellman pursued further discussions with EPA. These discussions led to the selection of beryllium as one of the candidates for IRIS Pilot Study for revising IRIS health assessments. 64 Federal Register 14570 (April 12, 1996). In the revised IRIS health assessment for beryllium issued on April 3, 1998, an oral reference dose or RfD was established for beryllium using a 1976 chronic feeding study of dogs conducted by Morgareidge et al.

Brush Wellman's interest in the drinking water standards and reference dose for beryllium is not surprising. Brush Wellman is the only fully integrated supplier of beryllium, beryllium alloys and beryllia ceramic in the world. Since its founding in 1931, Brush Wellman has concentrated its operations on advancing the unique performance capabilities and applications of beryllium-based materials. Beryllium is a unique material exhibiting physical and mechanical properties unmatched by any other metal. It is one of the lightest structural materials known, yet has specific stiffness six times greater than steel. It possesses high heat absorbing capability and has dimensional

IV. The Baseline Inhalation Risk Values Used To Calculate The Overall Risk Based Concentration Should Use The Most Appropriate Science And Recognize The Underlying Safety Factors.

The use of the Integrated Risk Information System (IRIS) value for calculating non-cancer inhalation risks is ill founded. First, the IRIS value is higher than the current USEPA NESHAPS ambient air standard. Second, IRIS inappropriately uses the Kreiss[6] occupational exposure study and discounts the Eisenbud study on which the USEPA standard is based. The Eisenbud study[7] is a study of actual community exposure to beryllium using the most appropriate health end-point and is the basis for the current standard.

Not only is the IRIS value higher than the current USEPAS ambient air standard, it inappropriately considers sensitization to beryllium as a health effect. Sensitization is an inappropriate end point because in and of itself, sensitization is not a health effect or a health risk[8]. Sensitization is not simply or accurately determined and has a low positive predictive value for CBD[9]. Sensitization has been shown to reverse and has been measured in a non-occupationally exposed group at levels of 1-2%[10]. The non-cancer inhalation health effect end-point that should be used is clinical CBD (symptomatic)[9].

(continued…)

stability over a wide range of temperatures. Equipment used in fields such as medicine, aerospace, national defense, computers and telecommunications all rely on beryllium-containing materials.

Brush Wellman has sponsored basic research concerning the environmental and health effects of beryllium, including the impact of beryllium exposure on animals and freshwater organisms. Brush Wellman's current research work is focused on understanding and preventing chronic beryllium-disease—an obstructive lung disease caused by inhalation of beryllium. Much of this cutting-edge research is being conducted in close collaboration with NIOSH. Two Brush Wellman employees along with a colleague from NIOSH were awarded the 2002 Alice Hamilton Award from NIOSH for their efforts to identify an appropriate measure for assessing potential risk of chronic beryllium disease in workers. Their award-winning paper is published in the May 2001 edition of *Applied Occupational and Environmental Hygiene*.

Brush Wellman's research efforts are a testament to its belief that standards for exposure to beryllium should be protective of human health and environment. However, being heavily engaged in such research, Brush Wellman is sensitive to the adverse consequences of risk-based standards that are set well below levels necessary for such protection. Brush Wellman believes that the current drinking water standards and reference dose for beryllium fall into this category.

[6] Kreiss K., Mroz M.M., Newman L.S., et al. Machining Risk of Beryllium Disease and Sensitization with Median Exposures Below 2 $\mu g/m^3$. Am J Ind Med 30: 16–25 (1996).

[7] Eisenbud M., Berghout C.F., Steadman L.T. Non-Occupational Berylliosis. J Ind Hyg Toxicol 31:282–294 (1949).

[8] American Conference of Governmental Industrial Hygienists. Biological Exposure Index Feasibility Assessment for Beryllium and Inorganic Compounds (2002).

[9] Deubner D., Goodman M, Iannuzzi J. Variability, Predictive Value, and Uses of the Beryllium Blood Lymphocyte Proliferation Test (BLPT): Preliminary Analysis of the Ongoing Workforce Survey. Appl Occup Environ Hyg 16(5): 521-526 (2001).

[10] Kolanz, M. Introduction to Beryllium: Uses, Regulatory History, and Disease. Appl Occup Environ Hyg 16(5) 559-567 (2001).

The USACE should use in its calculations the established community exposure limit that has been shown to be effective over several decades in preventing chronic beryllium disease in the general population (the current exposure limit is lower than the IRIS value). The United States ambient air standard for beryllium was originally recommended by Eisenbud of the Atomic Energy Commission in 1949 and it has been a federally enforceable United States Environmental Protection Agency (USEPA) regulation since 1973. Brush Wellman is aware of no cases of clinical CBD due to air pollution attributable to exposures after about 1960. The current ambient air standard for beryllium is 0.01 $\mu g/m^3$ as a 30-day average and incorporates a 20-fold safety factor[11].

The Eisenbud study also noted that the Lorain study population was exposed to levels of beryllium well above the current standard which had been set using safety factors. For example, in 1948 the levels of airborne beryllium within one-quarter mile of the Lorain plant averaged about 1 $\mu g/m^3$ and in some instances exceeded 2 $\mu g/m^3$. Eisenbud estimated that ambient air levels of beryllium during the 10 years preceding 1948 were determined to likely be no more than 8 times higher than the 1948 levels.

It is also important to note that the 0.01 $\mu g/m^3$ ambient air standard incorporated data which accounted for child health risks. A x-ray health survey was conducted in 1948 in the neighborhood surrounding a beryllium manufacturing facility in Lorain, Ohio. Approximately 10,000 persons were surveyed (20% of the population in the survey area). Nine thousand satisfactory films were obtained. Of those films, 2000 were of children. The report of this study was designed to detect clinical CBD, the appropriate health end-point. The study did not identify any cases of clinical CBD among the children x-rayed in the survey.

In Appendix 3A section 3A.2.1.3 and elsewhere the USACE chooses to use a conservative Risk Based Concentration based on the child receptor (as representing the sensitive subgroup) and the *"uncertainties surrounding the beryllium sensitization process"*. The USACE claim that the *"uncertainties surrounding the beryllium sensitization process"* as justification for a more conservative Risk Based Concentration is unfounded based on the above comments that sensitization is not a health effect.

The USACE should reevaluate the beryllium inhalation non-cancer risk factors based on the scientific facts that:

1. children were accounted for in actual studies of community health risk due to beryllium exposure.

2. sensitization is not a health effect and can occur normally in occupationally unexposed persons.

[11] Eisenbud,M.: The Standard for Control of Chronic Beryllium Disease. Appl Occup Environ Hyg 13(1):25–31 (1998).

V. The Estimated Volume Of Soil Should Be Reduced.

The volume and costs for remediating the soil, Alternative 5, appear excessive as demonstrated by the following:

1. There appears to be too much factoring in the volume estimation. The volume of soil that needs to be excavated increased dramatically when estimated for disposal. Table 3.4 (Estimated Volume of Impacted Soils - Unrestricted Land Use) of the Feasibility Study shows a modeled volume of 42,200 cu.yd. After adding several factors, the ex-situ volume amounted to 87,754 cu.yd. Table 3.5 (Estimated Volume of Impacted Soils – Industrial Land Use) shows a modeled volume of 8,540 cu.yd. and an ex-situ volume of about six times to 47,599 cu.yd. Since modeling is typically conservative to start with, the safety factors that caused the volume to dramatically increase, appear to have been overly utilized.

2. The remediation cost appears to be excessive. This is demonstrated in the appendix to the Feasibility Study, Alternative 5 (Excavation and Offsite Disposal-Unrestricted Land Use), pages 3 and 4 of 14. The two pages show escalation costs for overhead, design and technical support, project management, construction management and owner costs. According to the report, the owner cost (presumably USACE's) includes program management, project management, construction management, etc., with a cost of $1 million per year for 5 years. Table 6.1 (Estimated Completion Time Frames for Alternatives) of the Feasibility Study report breaks down the activities for the "owner cost" over the 5-year period as follows: Remedial design for 1 year, Remedial Action for 2.9 years and Post Remedial Action for 1 year. Realistically, there cannot be a construction management during the design period. Likewise, ownership costs from the Remedial Action should be different than for Post Remediation Action. Furthermore, the USACE people assigned to this project cannot be 100% tied to the project due to the natural slack in the activities (and should be working on other FUSRAP projects). Thus, uniformly distributing a $1 million expense each year for 5 years appears excessive in light of the above factors and Brush Wellman's remediation experience.

3. While it may be necessary to calculate "budget" estimates for the various remedial scenarios presented, the cost for the actual proposed method should be based on bid proposals to make it realistic.

VI. The Buildings And The Area Beneath The Buildings Should Be Included In The Remediation.

The USACE decision to exclude the existing buildings based on the CERCLA guidance which excludes *"…any release which results in exposure to persons solely within a workplace"* does not appear to be a decision which supports the protection of the current building occupants from potential health risk to the current building occupants.

In addition, the exclusion of the existing buildings from remediation does not appear consistent with the proposed clean-up level to a subsistence farmer, nor does it support the prevention of recontamination of the remediated areas from AEC materials of concern currently inside the existing buildings. The presence of AEC materials of concern in and beneath existing buildings as it relates to the future use by a subsistence farmer should be more thoroughly addressed by the USACE proposed plan.

Brush Wellman offers the following in support of its above comments.

The Proposed Plan states on page 1-2, that *"After evaluating the results of the Remedial Investigation for the on-site buildings, USACE has concluded there is no evidence of a release from the buildings, as defined by CERCLA, nor evidence of a substantial threat of a release of hazardous substances into the environment from the buildings."* The following appear to contradict this statement.

1. On page 4-32 of the Remedial Investigation report, Section 4.3.7 (Summary Discussion), the first bullet states that *"The direct radiation reading data clearly shows that there are several areas within the Annex and two isolated locations in the Production Building that have activity above NRC guidelines for release to the public."*

2. The second bullet states that "Beryllium swipes show significant contamination in the Annex, Production Building, Former Laboratory, and Maintenance Building."

3. The fourth bullet states that "The building materials samples indicate that there is significant concentrations of beryllium in the paint, brick, concrete and other materials in the structure of the buildings."

> Note: Brush Wellman agrees that the wipe or bulk settled dust samples from inside the buildings may contain residual beryllium from the AEC activities, and that there is no health based standard upon which to compare the beryllium surface sample results or settled dust results obtained by USACE .

USACE should investigate whether current occupants of the buildings have programs and procedures in place to deal with the potential health hazards of the AEC-materials currently in the buildings. It is not prudent to leave these materials unremediated just because the CERCLA requirement excludes them. The CERCLA requirement should be used as guidance and the government's responsibility to the people should be paramount.

If the buildings will be left "as is," then the site should certainly be remediated to an industrial land use clean-up level. If the site is to be remediated to unrestricted land use, then the current operations should be terminated, the buildings razed and all past and current waste management units (WMUs) remediated to unrestricted land use in conjunction with the USACE cleanup to prevent worker exposure and further site contamination. However, remediating to unrestricted land use really does not make sense in light of the long-term current zoning of this property and zoning and use of surrounding properties.

In addition, the CERCLA exclusion guidance seems to infer that once the buildings are abandoned, USACE will be coming back to remediate the buildings. It would appear less costly to address the building issues in conjunction with the soil issues.

Additional Comments

Following are additional comments indirectly related to the selection of the appropriate remediation plan.

I. The Proposed Plan incorrectly states that the Brush Beryllium Company "leased" the Luckey site (p. 2-2).

Brush Beryllium was at the Luckey site as a contractor to the United States Atomic Energy Commission (AEC) and not as a lessee, as noted in the contract between these two entities. As a contractor, Brush Beryllium operated and maintained the plant and later prepared the plant for closing, all at the direction of the AEC pursuant to the contract.

II. The Protectiveness, Implementability and Acceptability of Alternative Are Ranked Too Low.

Alternative 4 requires excavation of soils to industrial land use and off-site disposal. Under Alternative 4, an estimated 30.050 cubic yards of in-situ soil would be removed from the site at a cost of $29.3 million. Alternative 4 is most comparable to Alternative 5, which would remove 55,400 cubic yards of in-situ soil at a cost of $36.5 million. The main differences in the soil to be removed in these two alternatives are that (1) no off-site soil would be removed under Alternative 4 and (2) soil would be removed to a greater depth in the Lagoon C and disposal areas under Alternative 5 than under Alternative 4. Despite their comparability in terms of soil remvoval, the Acceptability of Alternative 4 is ranked as "Low/Medium," whereas the Acceptablity of Alternative 5 is ranked as "High." Perhaps this difference is because Alternative 4 does not contemplate soil excavation in the off site area. In any event, removal of off-site soils to a level protective of farming use would be an appropriate modification for Alternative 4, as the off-site area is not an industrial area. If this modification were made there would be very little difference between Alternatives 4 and 5 with respect to their Protectiveness, Implementability and Acceptabilty. Even without this modification, Alternative 4 should be ranked more closely to Alternative 5 in terms of Acceptablity than to the No Action Alternative, as was done in the Feasibilty Study. See FS Table 6.3. In contrast, the Feasibility Study ranks Alternative 4 as virtually the same as Alternative 3, an excavate and cap remedy with no soil removal.

III. The Protectiveness And Acceptability Of Alternative 7 Are Ranked Too Low.

The Proposed Plan has inaccurately categorized the protectiveness of Alternative 7 as Low/Medium and consequently has unfairly concluded that the acceptability of this alternative is low. There is no significant difference between the protectiveness of Alternative 7 and that of Alternatives 8 and 9, whose protectiveness is ranked as "High." The principal way of addressing groundwater contamination will be via soil excavation, which is common to Alternatives 7, 8 and 9. The time required to complete these three remedial alternatives are somewhat rough estimates, and there is substantial overlap in these estimates:

Alternative 7 — 40 to 150 years
Alternative 8 — 80 years
Alternative 9 — 40 years

Furthermore, time is not a critical element in the remedy selection because as noted by the Proposed Plan: *"Currently there is not unacceptable exposure to groundwater."* (p. 8-13). All three alternatives reduce groundwater concentration below the MCL (which as noted above is highly conservative). Hence, there are no differences in the protectiveness of these alternatives that would justify labeling Alternative 7 as "Low/Medium" and Alternatives 8 and 9 as "High." Properly described and understood, there would be no significant difference in the acceptability of these alternatives. Hence, the Proposed Plan is erroneous in placing acceptability of these alternatives at opposite ends of the spectrum.

IV. There is conflicting information provided in the reports:

For example, page 2-10, first full paragraph of the Feasibility Study report states that *"Although building decontamination plans are documented, no subsequent documentation was found to indicate AEC actually implemented decontamination."* However, page 2-5 of the Remedial Investigation report states that *"Buildings were decontaminated by dismantling equipment, disposing of equipment as surplus, and steam-cleaning the building interiors."* While documents may no longer exist containing sampling data as to the level of decontamination achieved, there is no question that "AEC actually implemented decontamination."

Also, the existence of numerous conflicting statements in the reports would indicate a lack of peer review (outside of USACE and SAIC) prior to finalizing the reports and making them available to the public.

V. Beryllium Exposure via Inhalation and Potential Cancer Risks

The USACE did not find significant inhalation cancer risk as part of its Remedial Investigation. However, in any future assessment, the USACE should reconsider its calculations to evaluate cancer risk from beryllium exposure via inhalation.

The American Conference of Governmental Industrial Hygienists (ACGIH) and the International Agency for Research on Cancer (IARC) currently classify beryllium as a human carcinogen. However, these organizations were unable to consider the evidence presented in the scientific paper written by Paul S. Levy and his colleagues entitled, "Beryllium and Lung Cancer: A Reanalysis of the NIOSH Cohort Mortality Study"[12]. The paper, which was officially released in the November 2002 edition of Inhalation Toxicology, reanalyzes the data and conclusions of the 1992 study by Ward[13] and her colleagues which was used to substantiate a causal relationship between beryllium exposure and lung cancer. The 1992 Ward study itself was not definitive in its conclusion regarding beryllium exposure stating only that:

"occupational exposure to beryllium compounds is the most plausible explanation for the increased risk of lung cancer observed in the study."

Levy reevaluated the Ward data using more sophisticated methods to adjust for smoking, calculate appropriate expected lung cancer rates, and perform meta-analysis on the data. Levy concludes that

"there is no statistical association between beryllium exposure in these workers and lung cancer when using the most appropriate population cancer rates."

Notwithstanding the new findings of Levy, both IARC and the ACGIH had both recognized that any association which may exist between beryllium and cancer exists only at the extremely high levels of exposure which existed in the 1940s. IARC states:

"the greater excess was in workers hired before 1950 when exposures to beryllium in the work place were relatively uncontrolled and much higher than in subsequent decades," and "the highest risk for lung cancer being observed among individuals diagnosed with acute beryllium-induced pneumonitis, who represent a group that had the most intense exposure to beryllium."

IARC further noted that:

"Prior to 1950, exposure to beryllium in working environments was usually very high, and concentrations exceeding 1 mg/m^3 [1000 micrograms per cubic meter] were not unusual."

The ACGIH has made a similar statement.

There is no scientific basis to conclude that very low concentrations can result in cancer. In fact, both the Ward and the Levy study found no cancer risk in the five "modern plants" which first started operations after 1950. Inhalation exposures in these "modern plants" were typically 10 to 100 times lower than that experienced in the two oldest

[12] Levy P., Roth H., Hwang P., Powers T. Beryllium and Lung Cancer: A Reanalysis of a NIOSH Cohort Mortality Study. Inhalation Toxicology 14: 1003-1015 (2002).

[13] Ward, E., et al. A Mortality Study of Workers at Seven Beryllium Processing Plants. Am J Ind Med 22: 885-904 (1992).

plants. However, beryllium concentration in air exposures were still experienced above the current Occupational Exposure Limit of 2 micrograms per cubic meter in these “modern plants”, especially in the 1950s and 1960s.

In summary, the most recent analysis of the available beryllium data finds an absence of an association between beryllium and cancer. Also, all agencies reviewing the carcinogenicity of beryllium had previously found that any link to cancer exists only at the very high occupational exposures which typically have not been seen for over 50 years. The extensive reviews of beryllium carcinogenicity over the years make it very evident that the high beryllium exposures which could be linked to cancer have not and do not occur to the general public.

Based on these scientific findings, the USACE should revisit the basis for it calculations involving cancer inhalation risks.

VI. Beryllium Exposure via Ingestion and Potential Cancer Risks

There have been several oral feeding studies using beryllium compounds. None of the studies have resulted in the formation of cancerous tumors beyond those found in the control populations. There are no scientific studies implicating beryllium as an oral cancer hazard. There is no scientific basis for the USACE to estimate beryllium cancer risks as a result of ingestion. All such calculations used in the estimates for potential cancer risks are unfounded and should be removed.

VII. The USACE assumption that beryllium uptake via food poses a health risk is ill founded.

The USACE’s assumption that beryllium uptake through growing of food is founded on the supposition that the mere presence of beryllium in food poses a health risk. The USACE itself identified the fact that beryllium present in soils is expected to chemically bind to soils. The chemical binding of the beryllium would seek a neutral state (i.e. less corrosive). Based on the previous discussion of the potential health risk of beryllium in soil, the chemical form of the beryllium in a plant could not pose the corrosive characteristics evident in the dog feeding studies. On this basis alone, the USACE should remove its estimated risk of beryllium exposure via foods due to the absence of scientific evidence that beryllium in food poses a health risk. In fact, the below table demonstrates that beryllium is naturally found in food stuffs throughout the world.

FOODSTUFF (dry weight)	MICROGRAMS PER KILOGRAM (ppb)
CABBAGE	0.24
MUSHROOMS	1.58
CRABS	15.4 - 26.2
OYSTER FLESH	2.00
POLISHED RICE	80
POTATOES	170
TOMATOES	240
HEAD LETTUCE	330
EGGPLANT	370
GREEN PEPPER	400
KIDNEY BEANS	2,500
RAW CARROTS	25
FIELD CORN	25

Source: ATSDR, Toxicological Profile for Beryllium 2002

VIII. USACE's use of a Bulk Dust Preliminary Remediation Goal (PRG) is scientifically unsupportable.

The USACE creation of a Bulk Dust PRG on page 3-44 of the Remedial Investigation is scientifically unsupportable. The USACE's attempt at deriving a concentration of beryllium in settled dust which equates to a inhalation risk is unscientific. Though the calculation invented by USACE for this purpose shows some real imagination, there is no science that supports the estimation of airborne beryllium concentrations from settled dust concentrations. In addition, the calculation used is so erroneous that the units used do not even cancel properly as a mathematical computation.

The idea of inventing such a correlation has been explored for years, however, no one has been successful at developing an approach which is scientifically viable. This is the reason the USACE did not find a formal standard for bulk dust. The primary variables which make such a computation impossible include particle size, shape and density along with air currents (or absence thereof). These variables affect particle settling rates thereby affecting concentration. In addition, the amount of dust which becomes airborne along with room volume are critical factors to possibly estimating an airborne concentration even if settling rate was not a consideration. For example, the USACE's "safe concentration" for beryllium is 20 mg/kg or 20 ppm. Assume one could disperse and hold in the air for eight hours one kilogram of beryllium-containing dust containing 20 mg Be/kg of dust in a room 10x10x3 meters. If this is possible, the airborne concentration of beryllium would be 66.7 micrograms beryllium per cubic meter or 33 times the current OSHA standard (330 times the proposed ACGIH limit). Therefore, whether 20 mg/kg is a "safe concentration" is highly dependent on the uncontrolled variables of room volume and dust quantity.

The USACE needs to abandon its use of a Bulk Dust PRG as scientifically unsupportable.