Health Consultation

SCALES ROAD, ADVANCED DISPOSAL, AND BFI WASTE SYSTEM LANDFILLS

LITHONIA, DEKALB COUNTY, GEORGIA

Scales Road EPA FACILITY ID: GAD981281777
BFI Waste Systems EPA FACILITY ID: GATMP0100114
Advanced Disposal EPA FACILITY ID: GAD981237316

FEBRUARY 6, 2007

U.S. DEPARTMENT OF HEALTH AND HUMAN SERVICES
Public Health Service
Agency for Toxic Substances and Disease Registry
Division of Health Assessment and Consultation
Atlanta, Georgia 30333

Health Consultation: A Note of Explanation

An ATSDR health consultation is a verbal or written response from ATSDR to a specific request for information about health risks related to a specific site, a chemical release, or the presence of hazardous material. In order to prevent or mitigate exposures, a consultation may lead to specific actions, such as restricting use of or replacing water supplies; intensifying environmental sampling; restricting site access; or removing the contaminated material.

In addition, consultations may recommend additional public health actions, such as conducting health surveillance activities to evaluate exposure or trends in adverse health outcomes; conducting biological indicators of exposure studies to assess exposure; and providing health education for health care providers and community members. This concludes the health consultation process for this site, unless additional information is obtained by ATSDR which, in the Agency's opinion, indicates a need to revise or append the conclusions previously issued.

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Prepared By:

Georgia Department of Human Resources
Division of Public Health
under a Cooperative Agreement with the
Agency for Toxic Substances and Disease Registry

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Statement of Issues

In April 2005, the Agency for Toxic Substances and Disease Registry (ATSDR) received a petition from a citizen action group requesting a health consultation to investigate the potential for human exposure to groundwater contaminants originating from the Scales Road, Advanced Disposal, and BFI Waste Systems (BFI) construction and demolition landfills in South Dekalb County. Working in partnership with ATSDR, the Georgia Division of Public Health (GDPH) completed this health consultation.

GDPH reviewed environmental sampling data to assess whether exposure to contaminated groundwater has occurred, is occurring, or may occur at levels of health concern. The information in this health consultation is specifically designed to provide the community with information about the public health implications from exposure to hazardous substances at this site, and to identify populations for which further health actions are needed. It is not intended to address liability or other non-health issues.

Background

All three of the landfills are construction and demolition (C & D) landfills. A C & D landfill is defined by the Georgia Environmental Protection Division (GEPD) "Rules for Solid Waste Management" as a disposal site which accepts "waste building materials and rubble resulting from construction, remodeling, repair and demolition operations of pavements, houses, commercial buildings and other structures. These wastes can include but are not limited to asbestos containing waste, wood, bricks, metal, concrete, wall board, paper cardboard, inert waste landfill material, and other nonputrescible wastes which have a low potential for groundwater contamination [1].

Site Descriptions and History

All three C&D landfills are located within one-mile of each other approximately 1.75 miles northeast of the city of Lithonia, Georgia. Land use in the area is mainly industrial with scattered residences with a mile of each landfill. Advanced Disposal landfill is located on Rogers Lake Road, approximately one-mile southwest of Scales Road. BFI landfill is located on Scales Road less than an eighth-mile east of Scales Road landfill (Figure 1).

Scales Road Landfill

The Scales Road landfill was permitted in 1989 by GEPD to dispose of C&D waste [2]. The 65-acre site is bordered by Scales Road to the south, undeveloped land to the north and west, and by BFI landfill to the east (Photo 1).

The corporate owners of Scales Road landfill filed for bankruptcy in November 2000. The landfill operations ceased in August 2003 because of lack of funding needed to properly close and cap the landfill [3]. However, post-closure groundwater monitoring continued until December 2003.

During the December 2003 monitoring event, beryllium was detected in monitoring well GWC-1R-2 at a concentration of seven parts per billion (ppb) which exceeds the MCL[1] of four ppb.

1 MCL: Maximum Contaminant Level (USEPA Primary Drinking Water Standard)

Mercury was also detected during this sampling event in monitoring well GWB-1 at a concentration equal to its MCL of two ppb. The site was also under GEPD directed assessment monitoring for monitoring wells GWA-1, GWB-2, GWB-3, and GWC-3R-1 (Figure 5) [4].

PHOTO 1: Aerial View of Scales Road Landfill

No post-closure activity has been conducted at this landfill since 2003. Recently, GEPD's request for closure and post-closure care funding through the Georgia Solid Waste Trust Fund was approved by the Georgia Board of Natural Resources. Activities are expected to begin in late 2007.

Advanced Disposal Landfill

The Advanced Disposal landfill began operations in 1988. It is located west of and adjacent to Rogers Lake Road, approximately 1,200 feet north of Chapman Road in Lithonia, Georgia. Overall, the site comprises approximately 88 acres divided into two phases. The Phase I area is approximately 30 acres and currently being used for waste disposal. The approximate western half of this area has been used to obtain borrow material. The Phase II area is approximately 58 acres and borders Phase I on the north and is not currently being used [5].

PHOTO 2: Aerial view of Advanced Disposal Landfill

Surrounding Advanced Disposal landfill is a cement company west of the site; an automobile salvage yard and the proposed location for a trucking company to the south of the site. Another salvage yard, two residences, and a Dekalb County solid waste transfer station are located to the east; and undeveloped property is north of the site [5].

Groundwater flow at the site is topographically controlled. Groundwater flow follows elevation contours primarily toward existing streams and on-site ponds located on the eastern boundary of the property [5].

Groundwater monitoring indicates that concentrations of benzene and ethylbenzene in upgradient monitoring wells GWA-1B and GWA-1BR (Figure 6) are likely from the auto salvage yard south of the landfill. In 2002, there was a diesel spill in the area reported to have been cleaned up. Evidence of off-site migration of contaminants onto the landfill property include: the auto salvage yard located upgradient of the landfill property, and associated gasoline constituents, such as benzene, toluene, ethylbenzene, and xylenes detected in a sample collected from a culvert emanating from the auto salvage yard [6].

PHOTO 3: Auto Salvage Yard located south of Advanced Disposal Landfill

Historical and current concentrations of chloroethane and cis-1, 2-dichloroethene in monitoring wells GWC-3A and GWC-4 (Figure 6) are believed to be from the residual effects of historical landfill gas migration on the southern portion of the landfill property [6].

BFI Waste System Landfill

BFI Waste System landfill (BFI) began operations in December 1995 [7]. The site encompasses approximately 100 acres and is located on the southeastern side of Scales Road, approximately 1.75 miles northeast of the city of Lithonia. [1]. The BFI site is bounded by Swift Creek, a natural drainage divide to the east, and an unnamed tributary to the south.

PHOTO 4: Aerial view of BFI Waste System Landfill

Topographically, the site is dominated by a large knoll which crests in the central portion of the site at an elevation of approximately 900 feet. The site is flanked by four linear ridges which generally trend north, south, and east and decrease in elevation toward Swift Creek on the northern and eastern portions of the site. Three intermittent streams flow across the site, in a north and northeast direction. Two of the hillside streams appear to originate from depression type springs onsite. All three streams flow into Swift Creek just off the northeastern boundary of the site. The lowest site elevation is approximately 800 feet, and is located in the stream bed near the northeastern site corner. Two other drainage formations flow southward and join an easterly flowing tributary which also discharges into Swift Creek [1].

Groundwater monitoring at the site identified the presence of metals and volatile organic compounds (VOCs) that required submittal of an Assessment of Corrective Measures (ACM) to GEPD. Site groundwater sampling data indicate low level VOCs along the northern boundary near monitoring wells GWC-1, GWC-2, and GWC-3 (Figure 7). The impacts do not extend past the property boundary. Downgradient monitoring wells were sampled for VOCs and none were detected. Low-level VOC constituents detected in on-site groundwater monitoring wells equaled or exceeded the MCLs [8].

On January 16, 2001 an ACM report addressed VOCs in the groundwater. Corrective actions were evaluated to identify the most appropriate, effective and economical alternative capable of achieving the corrective action goals. The report recommended control measures for leachate to include implementation of an intermediate cover consistent with the facility design and operation plan and final cover as required. The report also recommended monitored natural attenuation as the groundwater remedy. Natural attenuation is the reduction in mass or concentration of a compound in an environmental medium over time or distance from the sources of constituents of concern because of naturally occurring physical, chemical, and biological processes, such as biodegradation, dispersion, dilution, adsorption, and volatilization [9]. A revised ACM report was submitted in November 2002 that recommended using oxygen release compounds (ORC) to

accelerate biodegradation in limited areas and monitored natural attenuation (MNA) to meet corrective action goals [8].

Site Visits

GDPH staff members visited the area in June, July, and October of 2006. The following observations were made:

1. Access to the Advanced Disposal landfill and BFI Waste Systems sites is controlled by the scale house attendants during working hours and by a security fence surrounding the landfills. On-site physical hazards include: vehicles, machinery, and equipment. Because Scales Road landfill is closed, there is no security patrolling this site, but the perimeter of the property is fenced.

2. Activity at Advanced Disposal landfill and BFI landfill appeared routine. Vehicles and several structures were present on site.

PHOTO 5: View of Advanced Disposal Landfill Looking Southeast

3. No odors or leachate were evident. Odor was evident from the nearby asphalt plant.
4. Trees and other vegetation separated the sites from nearby residential areas.

Natural Resources Use

The nearest municipal water supply is a Gwinnett County pumping station at Norris Lake, approximately three miles east/northeast of the sites. However, Dekalb County drinking water supply is drawn from the Chattahoochee River from approximately 40 miles northeast of the landfills. Groundwater is not used to supplement this source [10].

A windshield reconnaissance was performed within a 0.5 mile radius of the sites and water meters and fire hydrants were observed to be located along Rogers Lake Road. The sites are served by the Dekalb County Water System [5]. With the exception of four private wells located

within a 0.5-mile of the sites, all residences within two miles of the landfills are connected to Dekalb County municipal water supply [5].

Private Wells

Potentiometric (water flowing from higher levels of potential to lower levels of potential) maps of the sites show that groundwater flows in an easterly direction away from the sites. A physical inspection of the area around the landfills, and Dekalb County Health Department and GEPD records, were checked for private wells within 0.5-mile of the sites boundaries and:

PrivateWell Location	Distance to Site Boundary
Coffee Road	1500 ft. west of Scales Road property line
Coffee Road	1700 ft. west of Scales Road property line
Rogers Lake Road	1750 ft. west of Scales Road property line

All three private wells are on the upgradient side of the landfills [2].

A fourth private well was identified downgradient of Scales Road landfill on Scales Road. During the October 2006 site visit, it appeared that this residence was abandoned. GDPH staff confirmed (from a former resident) that the private well on the property had not been used since the Scales Road landfill began operations in 1989.

Area Hydrogeology

Shallow unconfined water table conditions are present throughout the Piedmont Geologic Province. There are no significant groundwater recharge areas within two miles of the sites, as defined by Georgia Geologic Survey Hydrologic Atlas number 18 [2]. Recharge to groundwater occurs from precipitation that averages approximately 49 inches per year within the Atlanta area [11]. Average annual recharge to the unconfined aquifer is between 4.7 to 8.8 inches per year [5]. Soils within the area consist predominantly of sandy silts and silty sands which allow rapid percolation of the rainfall. Typically, the infiltration of precipitation through the soil to the groundwater occurs within a few days after rainfall. Groundwater also occurs in the fractures and joints of the underlying weathered bedrock. The movement of groundwater through these fractures is dependent upon their size, spacing, and interconnection [11]. To view a conceptual model of the sites' geology/hydrogeology, see Figure 8, drawn conceptually from the BFI site.

At Scales Road landfill, groundwater was encountered in each of the test borings accomplished at depths which ranged from 8.5 to 25 feet below ground surface. Since no extensive joints or fractures were observed during a subsurface investigation or during a visual inspection of adjacent quarries, groundwater associated with the landfills consists mostly of an unconfined aquifer [11].

Site investigations show that the water table lies entirely within fractured rock in the highest portions of the sites and rises into the soil overburden in the lower parts of the site. The degree of metamorphic activity experienced in the area has apparently altered the hydrogeologic characteristics of the rock aquifer to such an extent that the aquifer assumed the more homogeneous characteristics of a typical water table aquifer that has no pronounced pathways. In addition, there is no apparent confining zone, which would separate the groundwater present in

the bedrock with that in the overlying soil. Therefore, groundwater encountered in all locations is considered to be part of a single unconfined system [8].

Demographics

The population within one mile of the sites is approximately 2,000 people. Using 2000 U.S. Census data, the Agency for Toxic Substances and Disease Registry (ATSDR) calculated population information for individuals living within a 1-mile radius of the sites (Figures 2-4).

Community Health Concerns

Residences near the landfills include several homes along the southern boundary of Advanced Disposal landfill and along the western borders of the Scales Road landfill and BFI landfill. During the July 2006 site visit, GDPH staff visited communities near the three landfills. Most residents reported living in the area for more than ten years. Three residents living west of the landfills that have private wells were mailed water well quality brochures.

Several residents were asked if they have any concerns about the landfills. If residents were not home, business cards were left at their doors. GDPH received two follow-up telephone calls from residents who were left business cards. Common concerns were odors/air quality from the landfills and speeding trucks in the area. Some residents expressed concern about respiratory illness.

Discussion

Evaluation Process

For each environmental medium, in this case, groundwater; GDPH examines the types and concentrations of contaminants of concern. In preparing this document, GDPH used the ATSDR comparison values, and other agencies' reference values, to screen contaminants that may warrant further evaluation. Comparison values (CVs) are concentrations of contaminants that can reasonably (and conservatively) be regarded as harmless, assuming default conditions of exposure. The CVs generally include ample safety factors to ensure protection of sensitive populations. Because CVs do not represent thresholds of toxicity, exposure to contaminant concentrations above CVs will not necessarily lead to adverse health effects. CVs and the evaluation process used in this document are described in more detail in Appendix B. GDPH then considers how people may come into contact with the contaminants. Because the level of exposure depends on the route and frequency of exposure and the concentration of the contaminants, this exposure information is essential to determine if a public health hazard exists.

Environmental Sampling Data

Either the highest levels of contaminants detected, or their ranges, in on-site groundwater at each of the sites above a health-based comparison value (CV), are listed in the Tables 2, 3, and 4, along with their applicable comparison values CVs. On-site monitoring wells were installed for monitoring purposes only, and none of the monitoring wells have been or will be used as a drinking water supply.

Scales Road Landfill

Groundwater monitoring was conducted at the site on a semi-annual basis from December 1997 until its closure in December 2003. VOCs were detected in samples from monitoring wells GWB-1 and GWB-3 (Figure 5). Of the VOCs detected, vinyl chloride and benzene have

exceeded their respective CVs. In addition, the metal beryllium has exceeded its respective CV [4].

An alternative source demonstration for metals was submitted May, 2001 and approved by GEPD. This demonstration showed that metals detections in monitoring wells GWC-2R and GWC-4R are likely from naturally occurring sources and not the landfill. Therefore, assessment monitoring was not required for these monitoring wells [4].

TABLE 2: Contaminants in On-Site Monitoring Wells at Scales Road Landfill

Contaminant	Highest Level or Range of Concentrations (ppb)	Health-Based Comparison Value (ppb)	Type of CV
Beryllium	7.0	4.0	MCL
Benzene	3.0	5.0 0.6	MCL CREG
Vinyl Chloride	2.0 to 6.0	2.0 0.03	MCL CREG

ppb: parts per billion
MCL: Maximum Contamination Level
CREG: Cancer Risk Evaluation Guide
Source: ATSDR Drinking Water Comparison Values

Advanced Disposal Landfill

Advanced Disposal landfill has fourteen groundwater monitoring wells consisting of six up-gradient and eight down-gradient monitoring wells. During the most recent sampling event in October 2005 (for which data is available), only benzene was detected above a comparison value [6].

TABLE 3: Contaminants in On-Site Monitoring Wells at Advanced Disposal Landfill

Contaminant	Range of Concentrations (ppb)	Health-Based Comparison Value (ppb)	Type of CV
Benzene	ND to 3.0	5.0 0.6	MCL CREG[2]

ppb: parts per billion
ND: non-detect
MCL: Maximum Contamination Level
CREG: Cancer Risk Evaluation Guide
Source: ATSDR Drinking Water Comparison Values

BFI Waste Systems Landfill

Benzene was initially detected at GWC-1 in April 1999, peaked in September 2001 (12 ppb) and has been decreasing over time to the most recent concentration of seven ppb. Benzene, initially detected at GWC-2 in September 1999 (2 ppb) and detected in the ten subsequent sampling events, was reported below the detection limit in February 2005 and again in August 2005 above its MCL [8].

[2] CREG: Cancer risk evaluation guide is a media-specific comparison value used to identify concentrations of cancer causing substances that are unlikely to result in an increase of cancer rates in an exposed population. Source: ATSDR Public Health Assessment Guidance Manual.

TABLE 4: Contaminants in On-Site Monitoring Wells at BFI Waste Systems Landfill

Contaminant	Range of Concentrations (ppb)	Health-Based Comparison Value (ppb)	Type of CV
Benzene	ND to 18.0	5.0 0.6	MCL CREG

ppb: parts per billion
MCL: Maximum Contamination Level
CREG: Cancer Risk Evaluation Guide
Source: ATSDR Drinking Water Comparison Values

Benzene has been detected in GWC-2 along the northern portion of the landfill at concentrations ranging from non-detect to 18 ppb. Benzene concentrations in GWC-2 are increasing, and based on current trends, would be expected to continue to exceed MCLs, requiring proactive corrective action. However, these impacts do not extend beyond the property boundary [7].

Pathway Analysis

GDPH identifies pathways of human exposure by identifying environmental and human components that might lead to contact with contaminants in environmental media (e.g., air, soil, groundwater, and surface water). A pathways analysis considers five principle elements: a source of contamination, transport through an environmental medium, a point of exposure, a route of human exposure, and a receptor population. Completed exposure pathways are those in which all five elements are present, and indicate that exposure to a contaminant has occurred in the past, is presently occurring, or will occur in the future. GDPH regards people who come into contact with contamination as exposed. For example, people who reside in an area with contaminants in air, or who drink water known to be contaminated, or who work or play in contaminated soil are considered to be exposed to contamination. Potential exposure pathways are those for which exposure seems possible, but one or more of the elements is not clearly defined. Potential pathways indicate that exposure to a contaminant could have occurred in the past, could be occurring now, or could occur in the future. However, key information regarding a potential pathway may not be available. A potential exposure pathway identified for each site is presented in Table 5. It should be noted that the identification of an exposure pathway does not imply that health effects will occur. Exposures may, or may not be substantive. Thus, even if exposure has occurred, human health effects may not necessarily result [12].

Potential Exposure Pathways

TABLE 5: Potential Exposure Pathways

Pathway	Exposure Pathway Elements					Time
Drinking water	Movement of contaminants from various sources	Groundwater	Residential private wells	Ingestion, Inhalation, Dermal	Residents using private well water as water supply source	Past, Current, and Future

GDPH reviewed each of the sites' history and available environmental sampling data. Based on this review, GDPH did not identify a completed exposure pathway because all five principal elements of a completed exposure pathway are not present; namely, a receptor population for on-site contaminated groundwater at the landfills does not exist.

Child Health Considerations

To protect the health of the nation's children, ATSDR has implemented an initiative to guard children from exposure to hazardous substances. In communities faced with contamination of the water, soil, air, or food, ATSDR and GDPH recognize that the unique vulnerabilities of infants and children demand special emphasis. Due to their immature and developing organs, infants and children are usually more susceptible to toxic substances than are adults. Children are more likely to be exposed because they play outdoors and they often bring food into contaminated areas. They are also more likely to encounter dust, soil, and contaminated vapors close to the ground. Children are generally smaller than adults, which results in higher doses of chemical exposure because of their lower body weights relative to adults. In addition, the developing body systems of children can sustain permanent damage if toxic exposures occur during critical growth stages.

At these sites, it is not likely that children may have been exposed to contaminants in groundwater because, with the exception of the three private wells located nearly 0.5 miles west of the sites, and the private well which has not been in use since 1989 east of the Scales Road landfill, all residences within two miles of the landfills are connected to the Dekalb County municipal water supply, and onsite groundwater contamination present at these landfills have not migrated outside the boundaries of the landfills.

Conclusions

GDPH developed the following conclusions and assigned a public health hazard category to the site. A description of public health hazard categories is provided in Appendix C.

Based on the data evaluated, GDPH considers this site to pose **no past or current public health hazard**. Specifically:

1. Exposure to contaminated groundwater originating from these landfills above health guidelines has not occurred for Lithonia residents consuming private well water west of the landfills because private wells are located upgradient and opposite the direction of groundwater flow. Also, the private well located east of Scales Road landfill has not been used since 1989 and the home located on this site is abandoned.

2. Aside from the four upgradient private wells located near the landfills, all residents living near the landfills are connected to municipal water.

3. Current and future exposure to potable water from municipal wells having contamination is unlikely because Dekalb County drinking water supply is drawn from the Chattahoochee River which located approximately 42 miles from the landfills. In addition, the water supply is tested as often as hourly, 24 hours a day at the water treatment facility and five days a week throughout the distribution system.

Recommendations

There are no recommendations at this time.

Public Health Action Plan

Actions Completed

- In July 2006, the GDPH provided households with health education materials on how to conduct water well maintenance and disinfection.

Actions Planned

- If additional data become available, the information will be reviewed by GDPH and appropriate actions will be taken at that time.
- GDPH will respond to all requests for information regarding health issues associated with these sites.

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CERTIFICATION

This Scales Road, Advanced Disposal, and BFI Waste Systems landfills health consultation was prepared by the Georgia Division of Public Health under a cooperative agreement with the federal Agency for Toxic Substances and Disease Registry (ATSDR). It was completed in accordance with approved methodologies and procedures existing at the time the health consultation was initiated. Editorial Review was completed by the Georgia Division of Public Health.

Technical Project Officer, CAT, SPAB, DHAC

The Division of Health Assessment and Consultation (DHAC), ATSDR, has reviewed this health consultation and concurs with its findings.

Team Lead, CAT, SPAB, DHAC, ATSDR

FIGURES

FIGURE 1: Site Area in Lithonia, GA

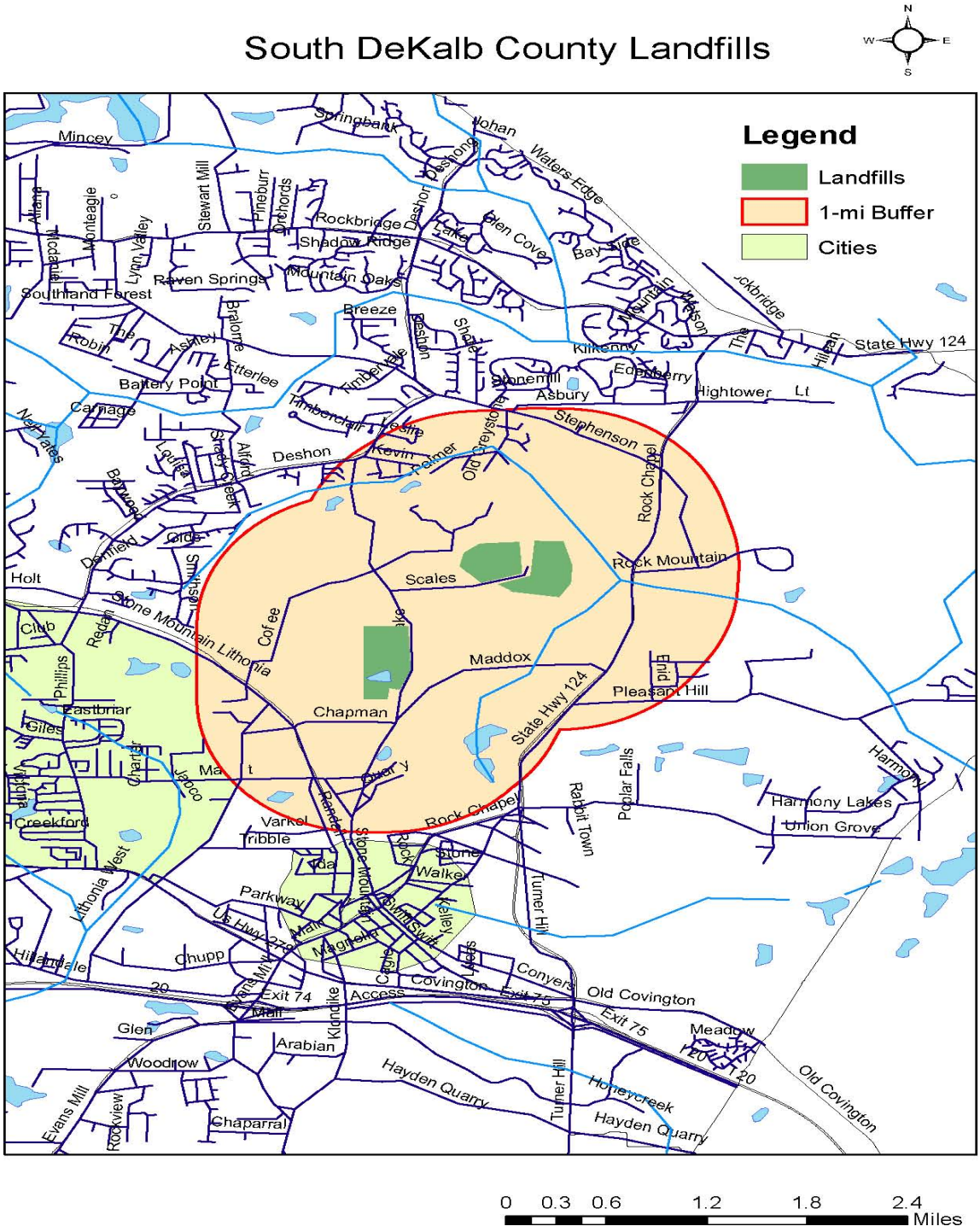


FIGURE 2: Scales Road Area Demographics

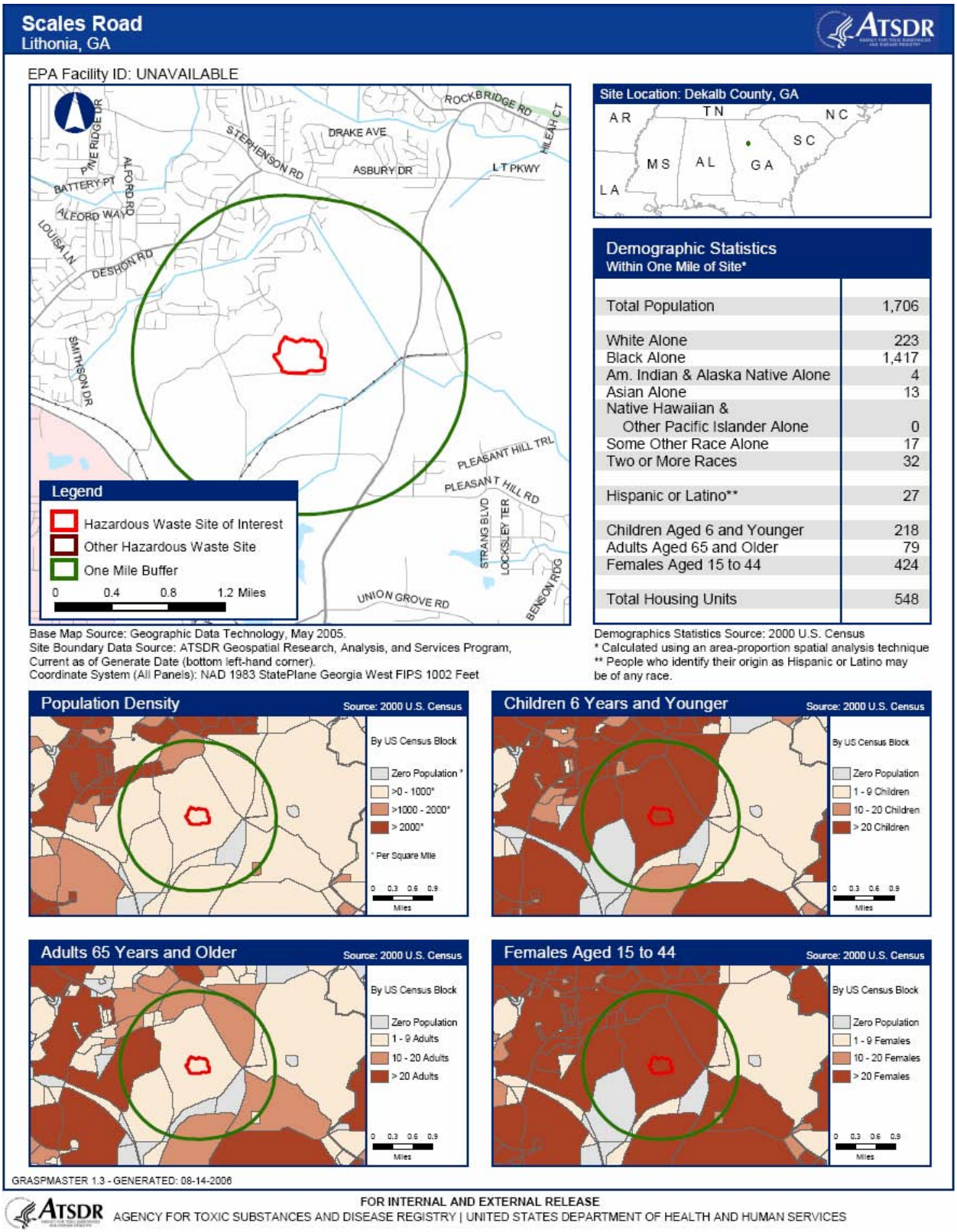


FIGURE 3: Advanced Disposal Area Demographics

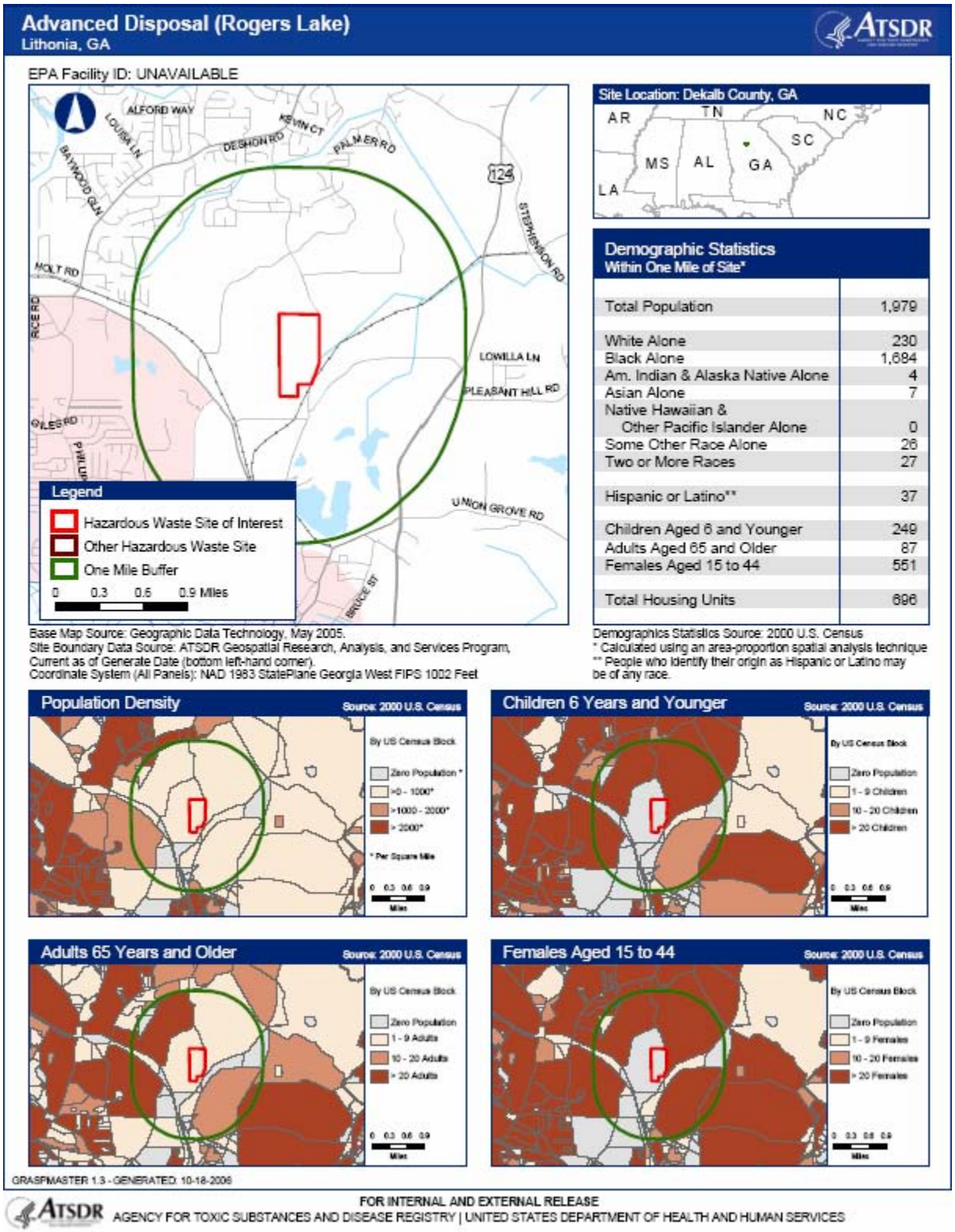


FIGURE 4: BFI Area Demographics

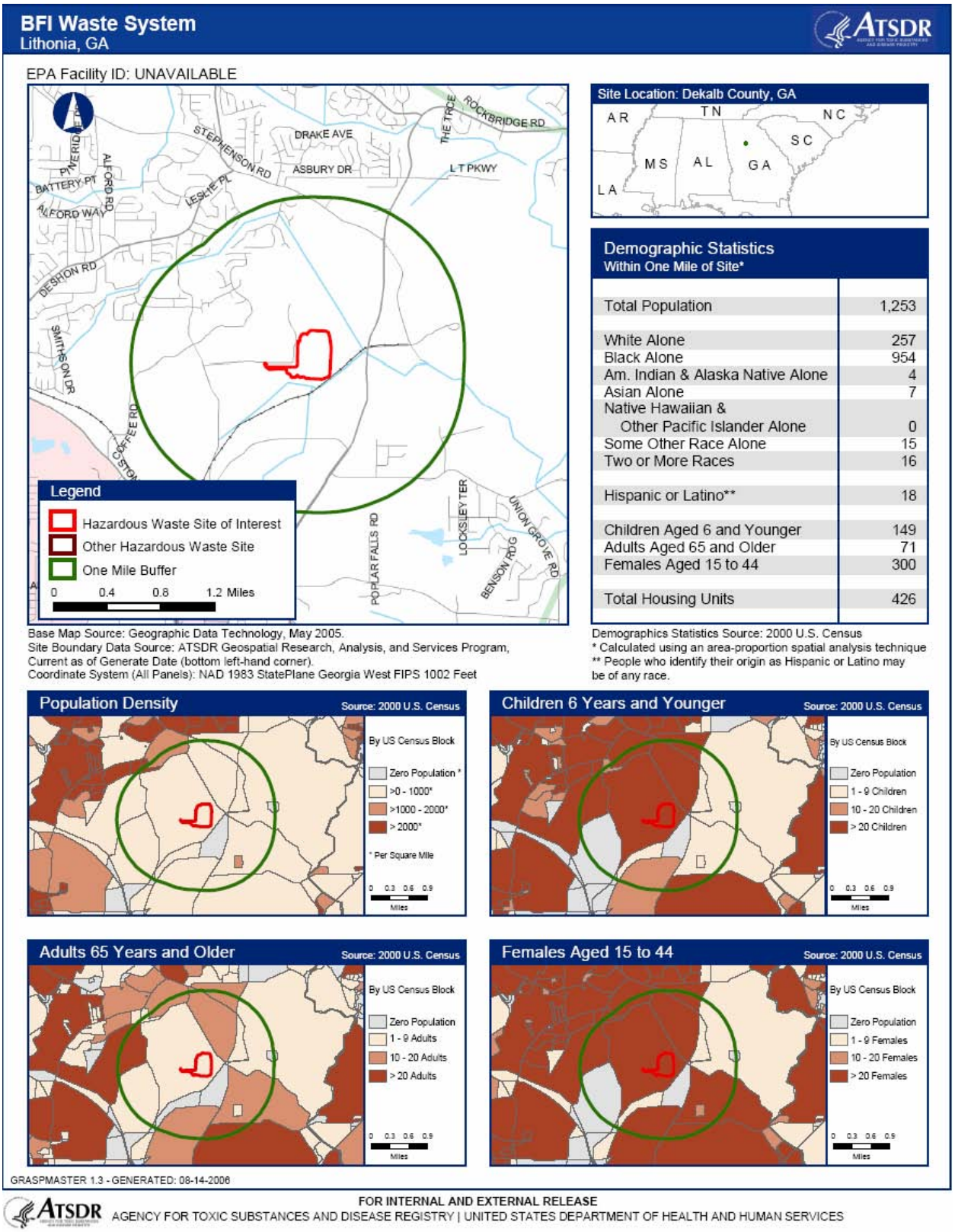


FIGURE 5: Scales Road Potentiometric Surface Map

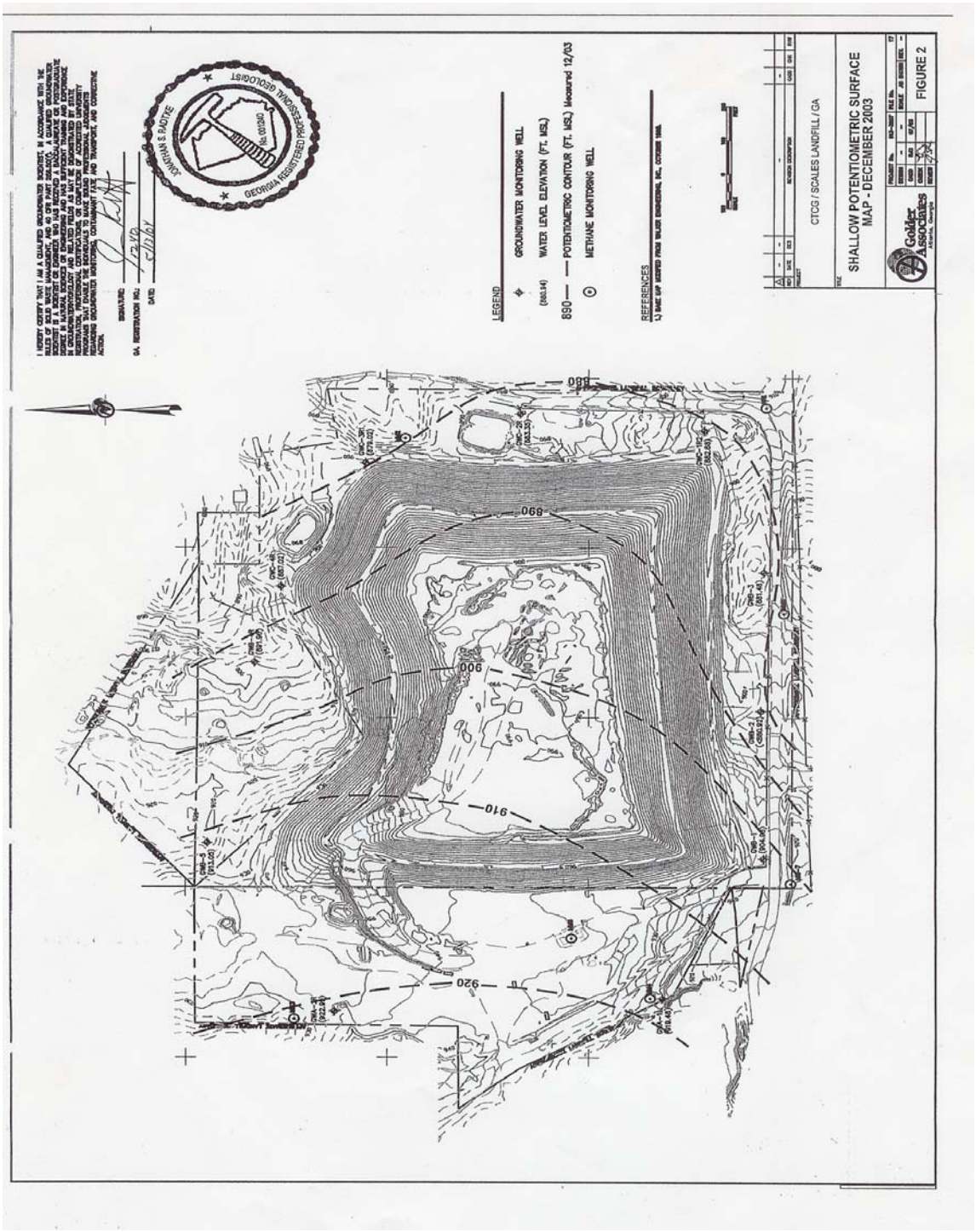


FIGURE 6: Advanced Disposal Groundwater Elevation Contour Map

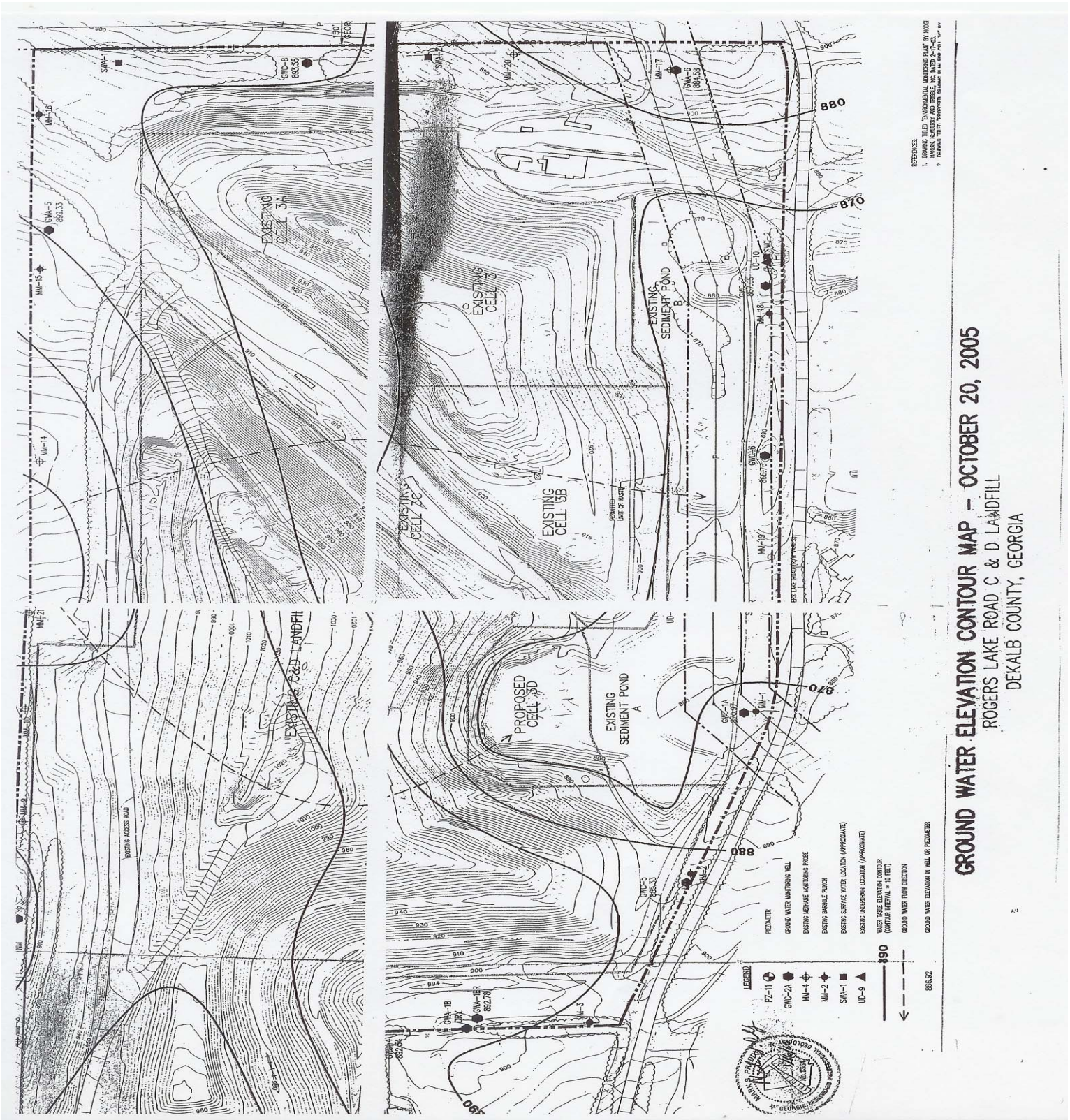
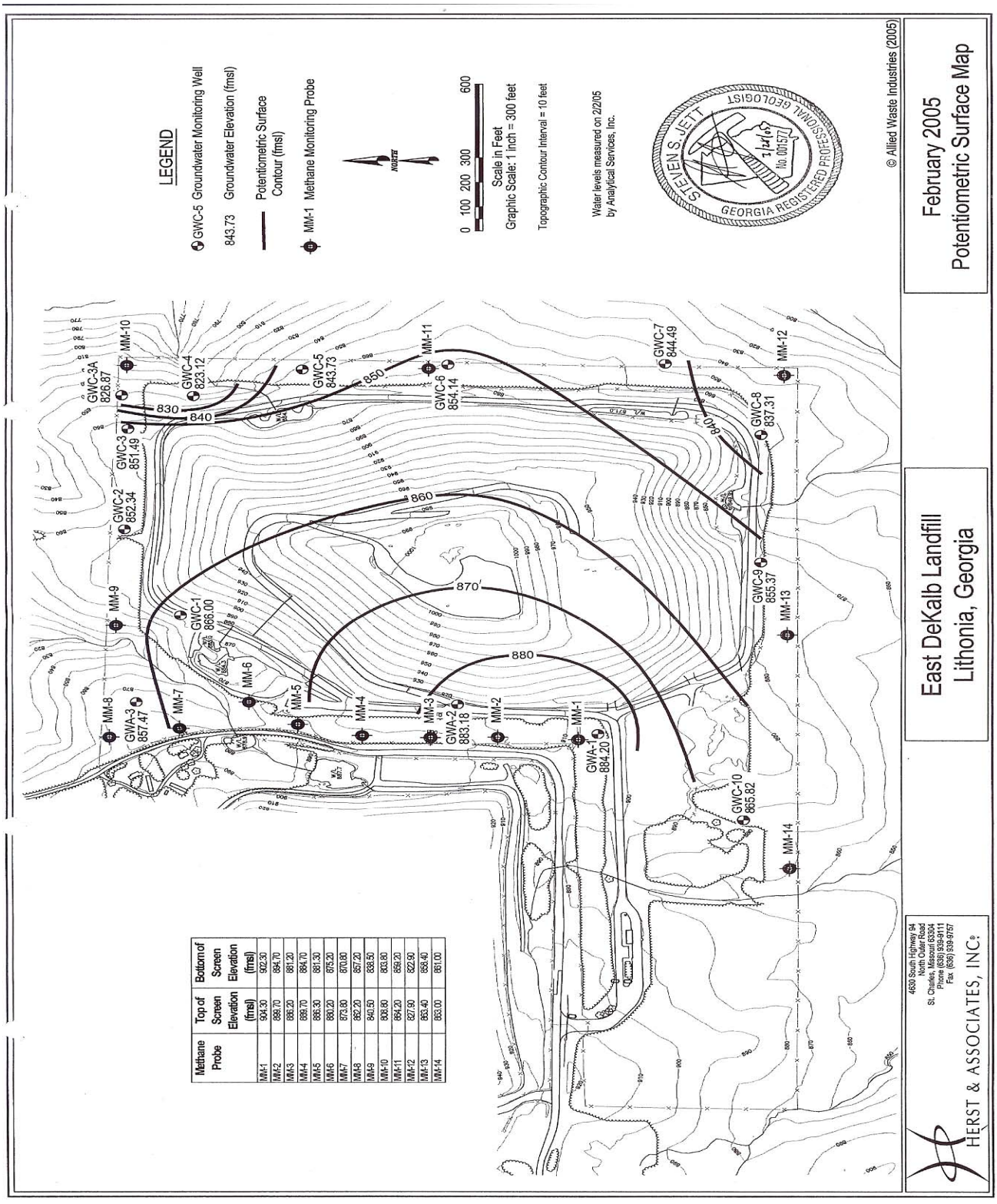
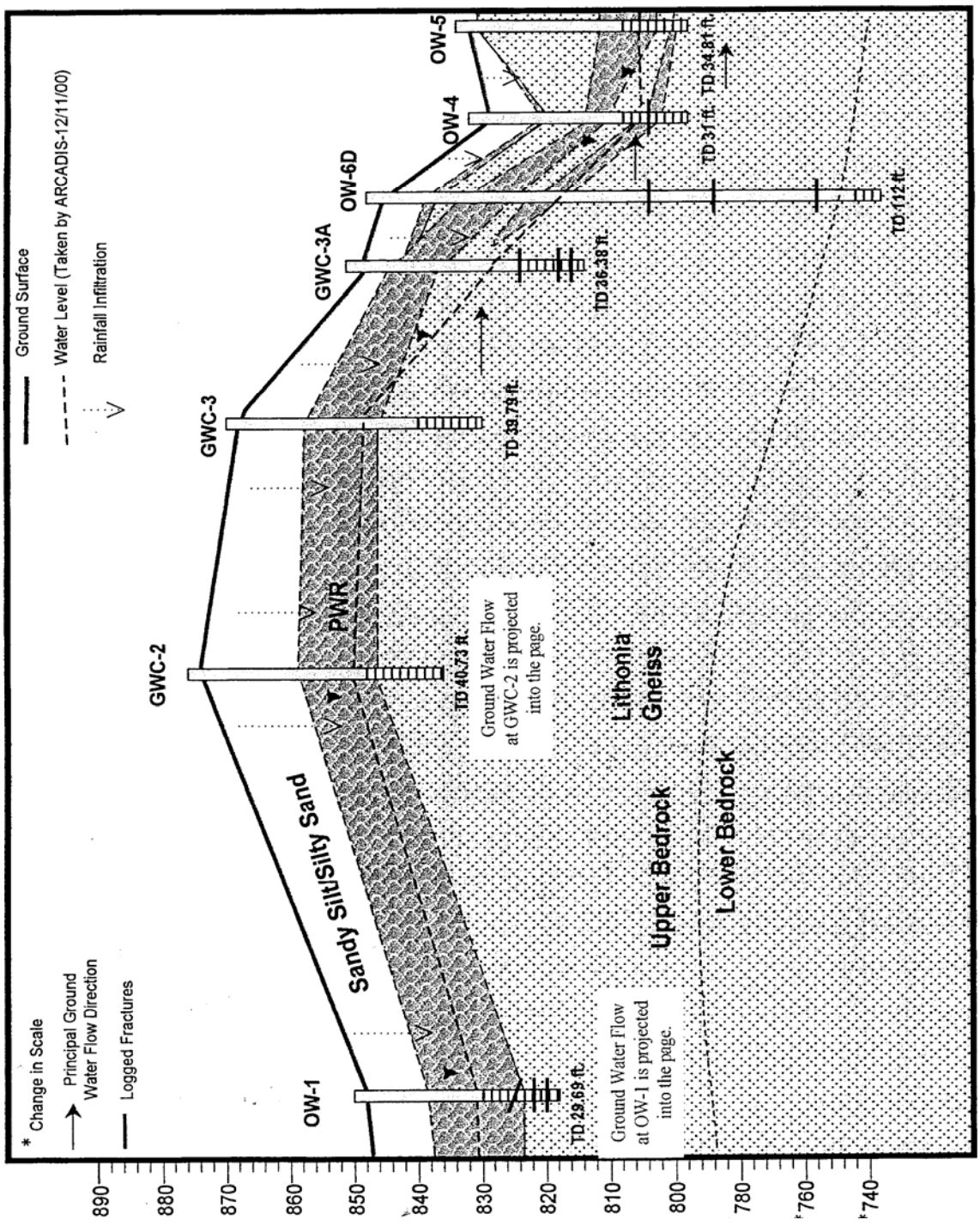


FIGURE 7: BFI Potentiometric Surface Map



Methane Probe	Top of Screen Elevation (fmsl)	Bottom of Screen Elevation (fmsl)
MM-1	904.30	902.30
MM-2	898.70	894.70
MM-3	886.20	881.20
MM-4	899.70	894.70
MM-5	886.30	881.30
MM-6	880.20	875.20
MM-7	873.80	870.80
MM-8	862.20	857.20
MM-9	840.50	838.50
MM-10	808.80	803.80
MM-11	864.20	859.20
MM-12	827.90	822.90
MM-13	863.40	858.40
MM-14	863.00	861.00

FIGURE 8: Conceptual Site Model of Geology and Hydrogeology



APPENDICES

APPENDIX A: Explanation of Evaluation Process

Step 1--The Screening Process

In order to evaluate the available data, GDPH used comparison values (CVs) to determine which chemicals to examine more closely. CVs are contaminant concentrations found in a specific environmental media (for example: air, soil, or water) and are used to select contaminants for further evaluation. CVs incorporate assumptions of daily exposure to the chemical and a standard amount of air, soil, or water that someone may inhale or ingest each day. CVs are generated to be conservative and non-site specific. The CV is used as a screening level during the health consultation process where substances found in amounts greater than their CVs might be selected for further evaluation. CVs are not intended to be environmental clean-up levels or to indicate that health effects occur at concentrations that exceed these values.

CVs can be based on either carcinogenic (cancer-causing) or non-carcinogenic effects. Cancer-based CVs are calculated from the U.S. Environmental Protection Agency's (EPA) oral cancer slope factors for ingestion exposure, or inhalation risk units for inhalation exposure. Non-cancer CVs are calculated from ATSDR's minimal risk levels, EPA's reference doses, or EPA's reference concentrations for ingestion and inhalation exposure. When a cancer and non-cancer CV exist for the same chemical, the lower of these values is used as a conservative measure. The chemical and media-specific CVs used in the preparation of this health consultation are listed below:

An **Environmental Media Evaluation Guide (EMEG)** is an estimated comparison concentration for exposure that is unlikely to cause adverse health effects, as determined by ATSDR from its toxicological profiles for a specific chemical.

A **Reference Dose Media Evaluation Guide (RMEG)** is an estimated comparison concentration that is based on EPA's estimate of daily exposure to a contaminant that is unlikely to cause adverse health effects.

A **Cancer Risk Evaluation Guide (CREG)** is an estimated comparison concentration that is based on an excess cancer rate of one in a million persons exposed over a lifetime (70 years), and is calculated using EPA's cancer slope factor.

Step 2--Evaluation of Public Health Implications

The next step in the evaluation process is to take those contaminants that are above their respective CVs and further identify which chemicals and exposure situations are likely to be a health hazard. Separate child and adult exposure doses (or the amount of a contaminant that gets into a person's body) are calculated for site-specific scenarios, using assumptions regarding an individual's likelihood of accessing the site and contacting contamination. A brief explanation of the calculation of estimated exposure doses used in this health consultation are presented below. Calculated doses are reported in units of milligrams per kilogram per day (mg/kg/day).

Ingestion of contaminants present in drinking water

Exposure doses for ingestion of contaminants present in groundwater were calculated using the average detected concentrations of contaminants in milligrams per liter (mg/kg [mg/kg = ppm]). The following equation is used to estimate the exposure doses resulting from ingestion of contaminated groundwater:

$$ED_w = \frac{C \times IR \times EF}{BW} * 2$$

where;

ED_w = exposure dose water (mg/kg/day)
C = contaminant concentration (mg/kg)
IR = intake rate of contaminated medium (based on default values of 2 liters/day for adults, 1 liter/day for children)

EF = exposure factor (based on frequency of exposure, exposure duration, and time of exposure).
BW = body weight (based on average rates: for adults, 70 kg; children, 25 kg).
* 2 = dose was multiplied by 2 to account for inhalation and dermal absorption during bathing avtivities.

Non-cancer Health Risks

The doses calculated for exposure to individual chemicals are then compared to an established health guideline, such as an ATSDR minimal risk level (MRL) or an EPA reference dose (RfD), in order to assess whether adverse health impacts from exposure are expected. Health guidelines are chemical-specific values that are based on available scientific literature and are considered protective of human health. Non-carcinogenic effects, unlike carcinogenic effects, are believed to have a threshold, that is, a dose below which adverse health effects will not occur. As a result, the current practice to derive health guidelines is to identify, usually from animal toxicology experiments, a no observed adverse effect level (NOAEL), which indicates that no effects are observed at a particular exposure level. This is the experimental exposure level in animals (and sometimes humans) at which no adverse toxic effect is observed. The known toxicological values are doses derived from human and animal studies that are summarized in ATSDR's *Toxicological Profiles (www.atsdr.cdc.gov/toxpro2.html).* The NOAEL is modified with an uncertainty (or safety) factor, which reflects the degree of uncertainty that exists when experimental animal data are extrapolated to the human population. The magnitude of the uncertainty factor considers various factors such as sensitive subpopulations (e.g., children, pregnant women, the elderly), extrapolation from animals to humans, and the completeness of the available data. Thus, exposure doses at or below the established health guideline are not expected to cause adverse health effects because these values are much lower (and more human health protective) than doses, which do not cause adverse health effects in laboratory animal studies.

For non-cancer health effects, the following health guidelines were used in this health consultation:

Minimal Risk Levels (MRLs) are developed by ATSDR for contaminants commonly found at hazardous waste sites. The MRL is developed for ingestion and inhalation exposure, and for lengths of exposures: acute (less than 14 days); intermediate (between 15-364 days), and chronic (365 days or greater). ATSDR has not developed MRLs for dermal exposure (absorption through skin).

Reference Doses (RfDs) EPA developed chronic RfDs for ingestion and RfCs for inhalation as estimates of daily exposures to a substance that are likely to be without a discernable risk of deleterious effects to the general human population (including sensitive subgroups) during a lifetime of exposure.

If the estimated exposure dose to an individual is less than the health guideline value, the exposure is unlikely to result in non-cancer health effects. If the calculated exposure dose is greater than the health guideline, the exposure dose is compared to known toxicological values for the particular chemical and is discussed in more detail in the text of the health consultation. A direct comparison of site-specific exposures and doses to study-derived exposures and doses found to cause adverse health effects is the basis for deciding whether health effects are likely to occur.

It is important to consider that the methodology used to develop health guidelines does not provide any information on the presence, absence, or level of cancer risk. Therefore, a separate cancer risk evaluation is necessary for potentially cancer-causing contaminants detected at this site.

Cancer Risks

Exposure to a cancer-causing chemical, even at low concentrations, is assumed to be associated with some increased risk for evaluation purposes. The estimated risk for developing cancer from exposure to contaminants associated with the site was calculated by multiplying the site-specific doses by EPA's chemical-specific cancer slope factors (CSFs) available at *www.epa.gov/iris*. This calculation estimates a theoretical excess cancer risk expressed as a proportion of the population that may be affected by a carcinogen during a lifetime of exposure. For example, an estimated risk of 1×10^{-6} predicts the probability of one additional cancer over background in a population of 1 million. An increased lifetime

cancer risk is not a specified estimate of expected cancers. Rather, it is an estimate of the increase in the probability that a person may develop cancer sometime in his or her lifetime following exposure to a particular contaminant under specific exposure scenarios. For children, the theoretical excess cancer risk is not calculated for a lifetime of exposure, but from a fraction of lifetime; based on known or suspected length of exposure, or years of childhood.

Because of conservative models used to derive CSFs, using this approach provides a theoretical estimate of risk; the true or actual risk is unknown and could be as low as zero. Numerical risk estimates are generated using mathematical models applied to epidemiologic or experimental data for carcinogenic effects. The mathematical models extrapolate from higher experimental doses to lower experimental doses. Often, the experimental data represent exposures to chemicals at concentrations orders of magnitude higher than concentrations found in the environment. In addition, these models often assume that there are no thresholds to carcinogenic effects--a single molecule of a carcinogen is assumed to be able to cause cancer. The doses associated with these estimated hypothetical risks might be orders of magnitude lower that doses reported in toxicology literature to cause carcinogenic effects. As such, a low cancer risk estimate of 1×10^{-6} and below may indicate that the toxicology literature supports a finding that no excess cancer risk is likely. A cancer risk estimate greater than 1×10^{-6}, however, indicates that a careful review of toxicology literature before making conclusions about cancer risks is in order.

APPENDIX B: ATSDR Public Health Hazard Conclusion Categories

ATSDR Public Health Hazard Categories

Depending on the specific properties of the contaminant, the exposure situations, and the health status of individuals, a public health hazard may occur. Using data from public health assessments and consultations, sites are classified using one of the following public health hazard categories:

Category 1: Urgent Public Health Hazard

Sites that pose a serious risk to public health as the result of short-term exposures to hazardous substances.

Category 2: Public Health Hazard

Sites that pose a public health hazard as the result of long-term exposures to hazardous substances.

Category 3: Potential/Indeterminate Public Health Hazard

Sites for which no conclusions about public health hazard can be made because data are lacking.

Category 4: No Apparent Public Health Hazard

Sites where human exposure to contaminated media is occurring or has occurred in the past, but the exposure is below a level of health hazard.

Category 5: No Public Health Hazard

Sites for which data indicate no current or past exposure or no potential for exposure and therefore no health hazard.