

PUBLIC HEALTH CONSULTATION

**Ventron Velsicol (AKA Berry's Creek)
Wood-Ridge/Carlstadt, Bergen County, New Jersey**

January 24, 1995

BACKGROUND AND STATEMENT OF ISSUES

The Ventron Velsicol/Berry's Creek (VVBC) site is located in a heavily industrialized section of Wood-Ridge Borough and Carlstadt Township, Bergen County, New Jersey. The VVBC site occupies approximately 40 acres and is situated in a tidal wetlands area through which runs Berry's Creek (Figures 1,2,& 3). The VVBC site was the location of a mercury processing/reclamation facility which operated from 1929 to 1974. Mercury wastes were landfilled on site in the tidal wetlands and mercury contaminated liquid wastes were discharged directly to Berry's Creek. Metallic mercury is reported in on-site soils at levels as high as 195,000 parts per million (ppm), and it is estimated that approximately 160 tons of metallic mercury may be present (buried) at the site ⁽¹⁾. In addition, mercury contamination has spread throughout the Berry's Creek tidal ecosystem in the Hackensack Meadowlands over a distance of several thousand feet downstream of the site. A municipal repair yard and publicly owned treatment works (POTW) plant is located proximal to the site boundary. Two warehouses were constructed upon the seven acre parcel which was the location of the mercury processing facility, the remaining area of the site is tidal wetlands.

The site was placed on the National Priorities List (NPL) in September 1984. To date, remedial activities at the VVBC site (facilitated by the New Jersey Department of Environmental Protection and Energy [NJDEPE]) include investigation by the Army Corps of Engineers of mercury methylation and bioaccumulation in the tidal ecosystem ^(2,3), and remediation of off-site mercury contaminated soil in a residential area located approximately 600 feet northwest of the site (Figure 4). The NJDEPE is currently negotiating an amended judicial consent order with the responsible parties (Ventron and Velsicol) to initiate the remedial investigation and feasibility study.

ATSDR conducted a preliminary health assessment in April 1989 which categorized the site as a "public health concern" based upon the possibility of human exposure pathways associated with exposure to contaminated soils, inhalation of metallic mercury vapor, and ingestion of contaminated biota from Berry's Creek ⁽⁴⁾. ATSDR performed a consultation in July 1991 which identified a potential human exposure pathway associated with volatilized mercury vapor in ambient air ⁽⁵⁾. The consultation recommended on-site/off-site time weighted air monitoring for mercury vapor, but such sampling has not yet occurred. A Site Review And Update (SRU) for the VVBC site was prepared by the New Jersey Department of Health (NJDOH) on April 20, 1993 ⁽⁶⁾. This SRU recommended a health consultation be performed to address three specific issues:

- 1) To evaluate the degree of exposure to contaminated soils in the residential areas affected by the VVBC site prior to the remediation performed by the NJDEPE in 1990;

- 2) To evaluate the possible exposure of municipal workers at the adjacent repair yard and POTW through the pathways of ingestion of contaminated soils (dusts) and inhalation of metallic mercury vapor;
- 3) To evaluate the public health significance of the ingestion of edible aquatic species from Berry's Creek.

Representatives of the NJDOH (James Pasqualo) and the ATSDR Regional Office (Steve Jones) performed a site visit of the VVBC site on August 3, 1993. Conditions at the VVBC site have remained constant, with no notable changes from conditions described during previous investigations.

DISCUSSION

Residential Soils

In 1989, the NJDEPE identified a residential area approximately 600 feet to the north of the VVBC site as potentially contaminated with mercury. These areas were constructed on reclaimed wetlands after the mercury recovery facility began operations in 1927, and are thought to have become contaminated by tidal flooding, airborne transport, or use of contaminated soils for fill.

Twenty four properties were sampled by the NJDEPE in 1989. Sample results (0-12 inches) of residential soils indicated that 9 properties were contaminated at levels exceeding the 14 ppm action level utilized by the NJDEPE for this site. The average concentration of mercury detected during this sampling event was 10 ppm with a maximum concentration of 60 ppm (total mercury) (see Figure 4). In 1990, the NJDEPE remediated these properties by removing all soils exhibiting mercury concentrations exceeding the action level of 14 ppm.

The human exposure pathway of concern identified in the 1993 SRU was the ingestion of contaminated soils (and dusts) by residents. Other pathways such as the ingestion of vegetables or inhalation of metallic mercury vapor have been discounted as incomplete or indeterminate after review of available data. The available data describe total mercury in soils, and made no distinction between metallic and inorganic forms. For the purposes of this consultation it will be assumed (as a worst case scenario) that the reported concentrations are for inorganic mercury as this is the form most toxicologically significant with respect to the exposure pathway of soil/dust ingestion. For the purposes of calculating a potential exposure dose, it will also be assumed that a 70 kg adult will ingest 50 mg/day of soil⁽⁷⁾. The calculated exposure dose for the maximum (60 ppm) concentration present in residential soils at the site was approximately 4.29×10^{-5} mg/kg/day (7.14×10^{-6} for 10 ppm average concentration). This estimated exposure dose is approximately five orders of magnitude smaller than the lowest

observed adverse effect level (LOAEL) for non-cancer effects resulting from chronic oral exposure to inorganic mercury cited in the ATSDR Toxicological Profile for Mercury ⁽⁸⁾. At such concentrations, it is not likely that adverse health effects would occur.

An exposure dose for children may be calculated (based upon the maximum concentration of mercury (inorganic) detected in residential soils) with the assumption that a 10 kg child will ingest 200 mg of soil per day. The exposure dose for a pica child of intermediate tendency weighing 10 kg (1.5 - 3.5 years) was approximately 1.2×10^{-3} mg/kg/day. For a child with a body weight of 16 kg, the estimated exposure dose decreased to 7.5×10^{-4} . These levels are approximately a minimum of one order of magnitude below the NOAEL for adverse renal health effects.

An exposure dose for children exhibiting high pica tendency (5,000 mg/day) may be calculated based upon the maximum and average concentration of mercury (inorganic) detected in residential soils. This exposure dose estimate assumes a body weight of 16 kg (1.5 - 6 years; 50th percentile) and an exposure duration of 14 consecutive days. The calculated exposure dose based upon the maximum concentration of mercury present in residential soils exceeds the ATSDR acute oral MRL for inorganic mercury. The calculated exposure dose based upon the average concentration of mercury present in residential soils approximately equals the ATSDR acute oral MRL for inorganic mercury. In both cases the calculated exposure dose is approximately at the level where adverse renal health effects may be possible, as cited in the ATSDR Toxicological Profile for Mercury.

Municipal Repair Yard/POTW

The SRU identified two potential exposure pathways with regard to the municipal repair yard and the POTW plant: the inhalation of metallic mercury vapor, and ingestion of mercury (inorganic) contaminated soils by municipal workers.

Inhalation Pathway

Data describing potential site related air contamination is limited. During a visit to the VVBC site on June 17, 1991, metallic mercury vapor was detected with portable equipment (*Jerome* monitor) at a maximum of 0.04 mg/m^3 at the border of the municipal repair yard/POTW facility and the site. Since comprehensive air sampling has not yet been conducted, this value will be used for the purposes of this consultation.

In evaluating the toxicological significance of potential exposure to mercury vapor among the municipal workers at the repair yard/POTW facility, the following assumptions were made: 1) workers were present for a standard 8 hour workday, five days per week; 2) a worker will inhale 9,600 liters/day (9.6 m^3) of air; 3) an individual body weight of 70 kilograms. Using these assumptions an exposure dose of 3.89×10^{-3} mg/kg/day may be calculated. This dose is an order of magnitude lower than the NOAEL for chronic exposure in animals and is less than the minimal risk level for effects other than cancer cited in the ATSDR Toxicological Profile

for Mercury. At such an exposure dose, it is not likely that adverse health effects would occur. However, because of the limitations and potential variability of available air data, it is advisable to reevaluate the exposure dose to municipal workers when comprehensive air sampling has been completed.

Soil (Dust) Ingestion Pathway

The NJDEPE reports that mercury contamination in the repair yard/POTW facility has been detected at a maximum of 44.2 ppm while the ATSDR SRU of April 13 1993 reports a maximum value of 600 ppm. For the purposes of this consultation, the toxicological significance of both values were evaluated. As was the case with residential soils, these values will be assumed to be concentrations of inorganic mercury since form-specific data were unavailable, and the inorganic form is most pertinent to the pathway of ingestion.

In evaluating the toxicological significance of potential exposure to inorganic mercury among the municipal workers at the repair yard/POTW facility, the following assumptions were made: 1) workers were present for a standard 8 hour workday 5 days per week; 2) an adult will ingest 50 mg/day of soil; 3) an individual body weight of 70 kilograms.

Using these assumptions, an exposure dose of 3.04×10^{-4} mg/kg/day (for 600 ppm) may be calculated. Similarly an exposure dose of 2.24×10^{-5} may be calculated based upon the concentration reported by NJDEPE of 44.2 ppm. These doses are at least four orders of magnitude lower than the LOAEL for chronic exposure in animals and the minimal risk level for effects other than cancer cited in the ATSDR Toxicological Profile for mercury. At such exposure doses, it is not likely that adverse health effects would occur.

Berry's Creek Biota

Mercury contamination of the Berry's Creek estuary has been historically documented since the late 1920's, and the subject of investigation by the NJDEPE, Hackensack Meadowlands Development Commission, and the U.S. Army Corps of Engineers^(9,10,11). Sediments in Berry's Creek near the site have been reported to contain mercury at 89,000 ppm maximum and average concentrations from 100 - 10,000 ppm. Biota from Berry's Creek have been found to contain significant mercury contamination; Killifish (*Fundulus* species) have exhibited whole body burdens of up to 2 ppm (59 ppm in heart muscle), and invertebrates have been found with whole tissue burdens of up to 150 ppm (NJDEPE).

The ATSDR SRU of April 1993 recommended an evaluation of the public health significance of the ingestion of biota from Berry's Creek. Data are available describing mercury contamination in four edible species (carp, white perch, blue claw crab, brown bullhead catfish) which may be taken from the creek by recreational fisherman; these are presented in Table 1. Mean daily ingestion rates by recreational fisherman for these species are available from the United States Environmental Protection Agency⁽¹²⁾. Potential exposure doses for each species

were calculated and are presented in Table 2. Concentrations presented refer to organic mercury as this was the form most likely to be bioaccumulated by Berry's Creek fauna. All calculated exposure doses for ingestion of biota from the creek were a minimum of four orders of magnitude below the NOAEL for chronic oral exposure to organic mercury, and below the minimal risk level for effects other than cancer cited in the ATSDR Toxicological Profile for Mercury. At such concentrations, adverse health effects are not likely.

However fishing patterns and ingestion rates of fish may vary widely with each individual, with a consequent wide variation in possible mercury exposure. Table 3 presents estimated exposure doses for a hypothetical subsistence fishermen. These estimates assume consumption of 1/2 pound (227 grams) of biota for three consecutive days. Estimated exposure doses for subsistence fishermen may equal and exceed the acute exposure LOAEL for serious effects in animals. At such concentrations, adverse developmental health effects are possible.

CONCLUSIONS

Residential Soils

Maximum concentrations of mercury detected by the NJDEPE in residential areas adjacent to the VVBC site presented potential exposure doses for adults that were below levels where adverse health effects would be likely. Calculated exposure doses for children of intermediate pica tendency (200 mg/day ingestion) were more significant but still below levels where adverse health effects would be likely. Calculated exposure doses for children of high pica tendency (5,000 mg/day ingestion) approached and equaled levels where adverse renal effects may be possible. It should be noted that exposure dose calculations were based upon the maximum concentration of mercury detected in residential soils, and thus represent a worst case exposure scenario. Additionally, there is no evidence or information indicating that children who could exhibit pica behavior inhabited any of the residences with documented contamination. The remedial measures performed in 1990 by the NJDEPE, specifically the removal of soil exhibiting mercury concentrations exceeding 14 ppm, have served to minimize any potential human exposure by the ingestion of contaminated soil in residential areas.

Municipal Repair Yard/POTW Facility

Maximum concentrations of mercury detected by the NJDEPE in the municipal repair yard and POTW facility adjacent to the VVBC site present potential exposure doses that were below levels where adverse health effects would be likely.

Limited air sampling data suggest that volatilization of metallic mercury is occurring at the VVBC site. Maximum concentrations detected with portable monitoring equipment present

potential exposure doses that were below levels where adverse health effects would be likely. However, comprehensive time weighted air monitoring (as recommended in the July 29, 1991 consultation) has not been conducted at the site and may yield data which would necessitate reevaluation of potential exposure doses for mercury vapor.

Berry's Creek Biota

Mercury originating at the VVBC site has/is contaminating the Berry's creek estuary and biota at significant concentrations as far downstream as the Hackensack River. Biota have exhibited mercury concentrations in excess of the 1 ppm USEPA advisory level. Estimated exposure doses for "average" recreational fishermen are below levels where adverse health effects would be likely.

Estimated exposure doses for subsistence fishermen equal and exceed the NOAEL for adverse health effects (developmental disorders). While individual consumption practices may lead to significant variability in mercury ingestion, frequent ingestion of Berry's Creek biota would likely result in exposure to organic mercury at levels of public health concern.

RECOMMENDATIONS

The remedial actions effected by the NJDEPE with regard to the contamination of residential soils have effectively neutralized this exposure pathway. No further activity by the NJDEPE or ATSDR is recommended based upon available data and information.

Comprehensive time weighted air sampling for mercury vapor should be considered for the VVBC site, possibly as part of the impending remedial investigation/feasibility study. Should significant concentrations of metallic mercury vapor be detected in air (greater than 0.04 mg/m³) potential human exposure to this media should be reevaluated by the ATSDR and the NJDOH.

There is sufficient evidence of mercury contamination in Berry's Creek estuary to prohibit ingestion of biota. Consideration should be given towards the institution of a fishing restriction for Berry's Creek, and posting the waters as contaminated with advisories against the consumption of finfish and crustacea.

HEALTH ACTIVITIES RECOMMENDATION PANEL DETERMINATIONS

The data and information developed in the Public Health Consultation for the Ventron Velsicol site, Bergen County, New Jersey, has been evaluated by ATSDR's Health Activities Recommendation Panel (HARP) for appropriate follow-up with respect to health activities. The panel determined that no followup health actions are indicated at this time. However, the panel agreed with the NJDOH recommendation that warning signs need to be posted warning the public of the hazards associated with consuming fish from Berry's Creek.

PUBLIC HEALTH ACTIONS

The Public Health Action Plan (PHAP) for the Ventron Velsicol site contains a description of the actions that have been or will be taken by ATSDR and/or NJDOH at or in the vicinity of the site subsequent to the completion of this Public Health Consultation. The purpose of the PHAP is to ensure that this public health consultation not only identifies public health hazards, but provides a plan of action designed to mitigate and prevent adverse human health effects resulting from exposure to hazardous substances in the environment. Included, is a commitment on the part of ATSDR/NJDOH to follow up on this plan to ensure that it is implemented.

Actions Planned

1. ATSDR and the NJDOH will coordinate with the appropriate environmental agencies to develop plans to implement the recommendations contained in this public health consultation.
2. ATSDR will provide an annual follow up to this PHAP, outlining the actions completed and those in progress. This report will be placed in repositories that contain copies of this public health consultation, and will be provided to persons who request it.

ATSDR will reevaluate and expand the Public Health Action Plan (PHAP) when needed. New environmental, toxicological, health outcome data, or the results of implementing the above proposed actions may determine the need for additional actions at this site.

CERTIFICATION

The Public Health Consultation for the Ventron Velsicol site was prepared by the New Jersey Department of Health under a cooperative agreement with the Agency for Toxic Substances and Disease Registry (ATSDR). It is in accordance with approved methodology and procedures existing at the time the public health consultation was initiated.



Technical Project Officer, SPS, SSAB, DHAC

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



Director, DHAC, ATSDR

Table 1 - Mercury (Organic) Concentrations in Aquatic Fauna From Berry's Creek Estuary; Ventron/Velsicol Site, Wood-Ridge, New Jersey.

Species	Conc. Hg. ppm		Sample Size
	Mean	Range	
Kilifish	0.35	0.2 - 0.79	10
Carp	0.29	0.13 - 0.53	6
White Perch	0.71	0.3 - 1.9	8
Blue Claw Crab	0.23	0.1 - 0.76	8
Bullhead Catfish	NA	0.05 - 0.16	NA

NA = Data Not Available

Levels Cited Are For Whole Fish Composite Samples

Source = Hackensack Meadowlands Development Commission Report; October 1978.

Table 2 - Species Specific Exposure Dose Estimates For Recreational Fishermen, Berry's Creek Biota.

Species	Ingestion Rate grams/day*	Estimated Exposure Dose Organic Mercury mg/kg/day	
		Average	Maximum
Carp	0.016	6.62×10^{-8}	1.00×10^{-7}
White Perch	0.062	6.00×10^{-7}	1.70×10^{-7}
Blue Claw Crab	0.254	8.30×10^{-7}	2.80×10^{-6}
Bullhead Catfish	0.292	NA	7.00×10^{-7}

* = Source: United States Environmental Protection Agency; Exposure Factors Handbook. March 1989.

NA = Not Available

Table 3 - Species Specific Exposure Dose Estimates For Subsistence Fisherman, Berry's Creek Biota.

Species	Ingestion Rate; grams/day*	Estimated Exposure Dose (70 kg Adult) Organic Mercury mg/kg/day	
		Average	Maximum
Carp	681	2.82×10^{-3}	5.15×10^{-3}
White Perch	681	6.90×10^{-3}	1.80×10^{-2}
Blue Claw Crab	681	2.23×10^{-3}	7.30×10^{-3}
Bullhead Catfish	681	NA	1.50×10^{-3}

* = Assumes a subsistence fisherman would consume approximately 227 grams/day for 3 days.

NA = Not Available

Appendices

Tables

1. Mercury (organic) concentrations in aquatic fauna from Berry's Creek Estuary; Ventron/Velsicol site, Woodridge, New Jersey.
2. Species specific exposure dose estimates for recreational fishermen, Berry's Creek biota.
3. Species specific exposure dose estimates for subsistence fishermen, Berry's Creek biota.

Figures

1. Schematic map of the Berry's Creek area.
2. Large scale map of the Ventron/Velsicol Berry's Creek area.
3. Small scale map of the Ventron/Velsicol Berry's Creek Area.
4. Residential Area soil sampling locations.

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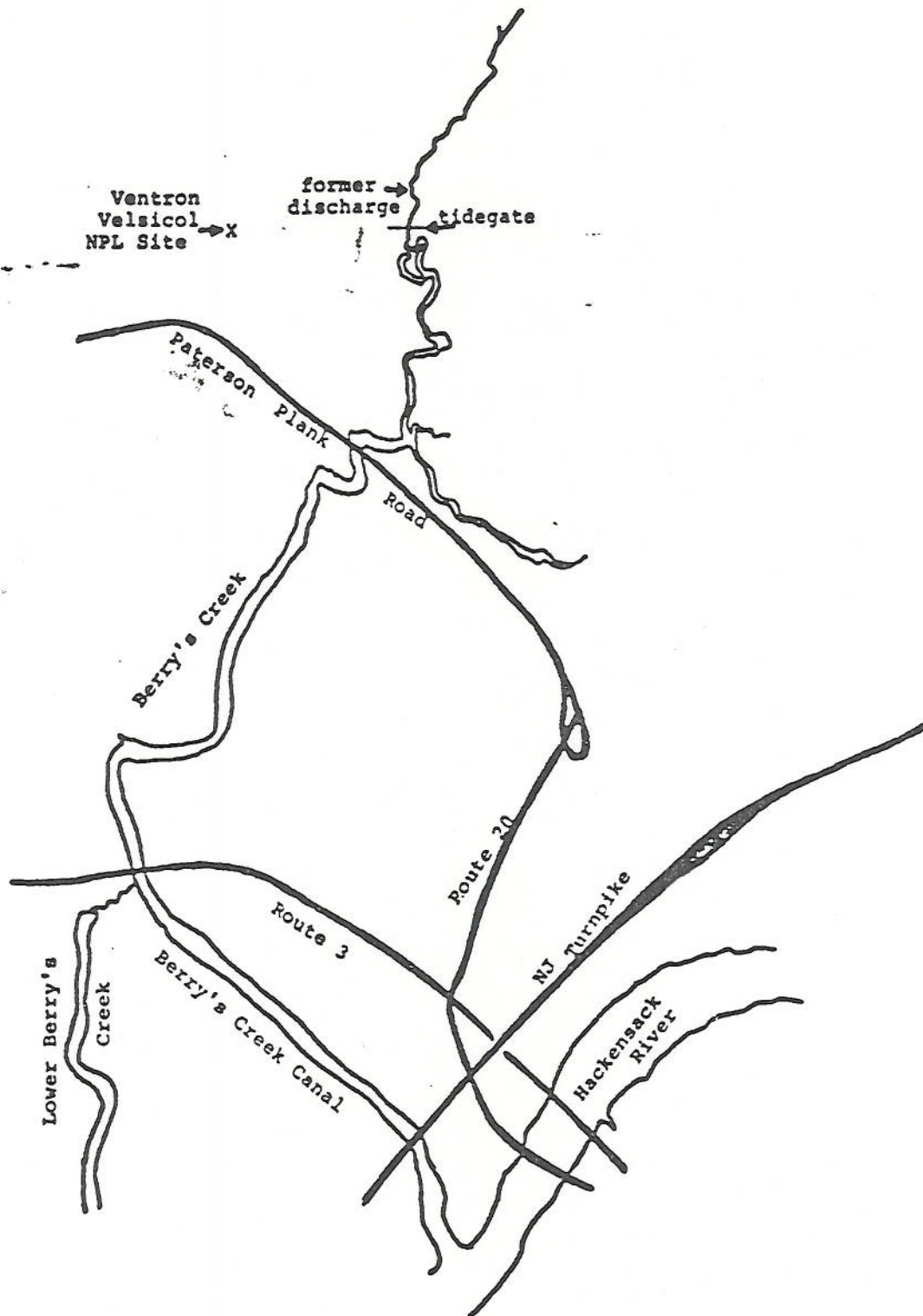
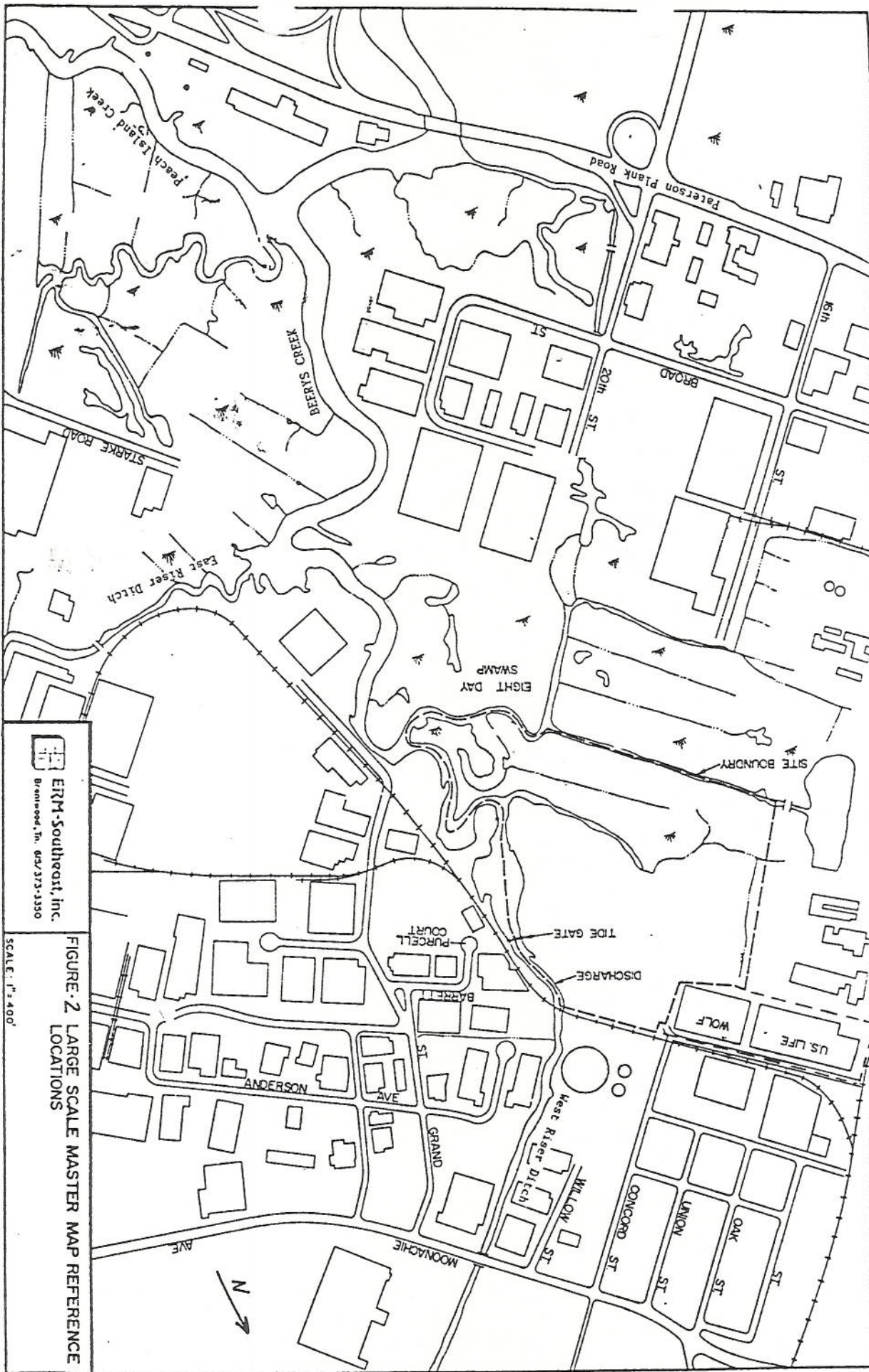


Figure 1. Schematic Map of Berry's Creek Area



ERM-Southeast, Inc.
Brenwood, In. 63/373-330

FIGURE 2. LARGE SCALE MASTER MAP REFERENCE LOCATIONS

SCALE: 1"=400'

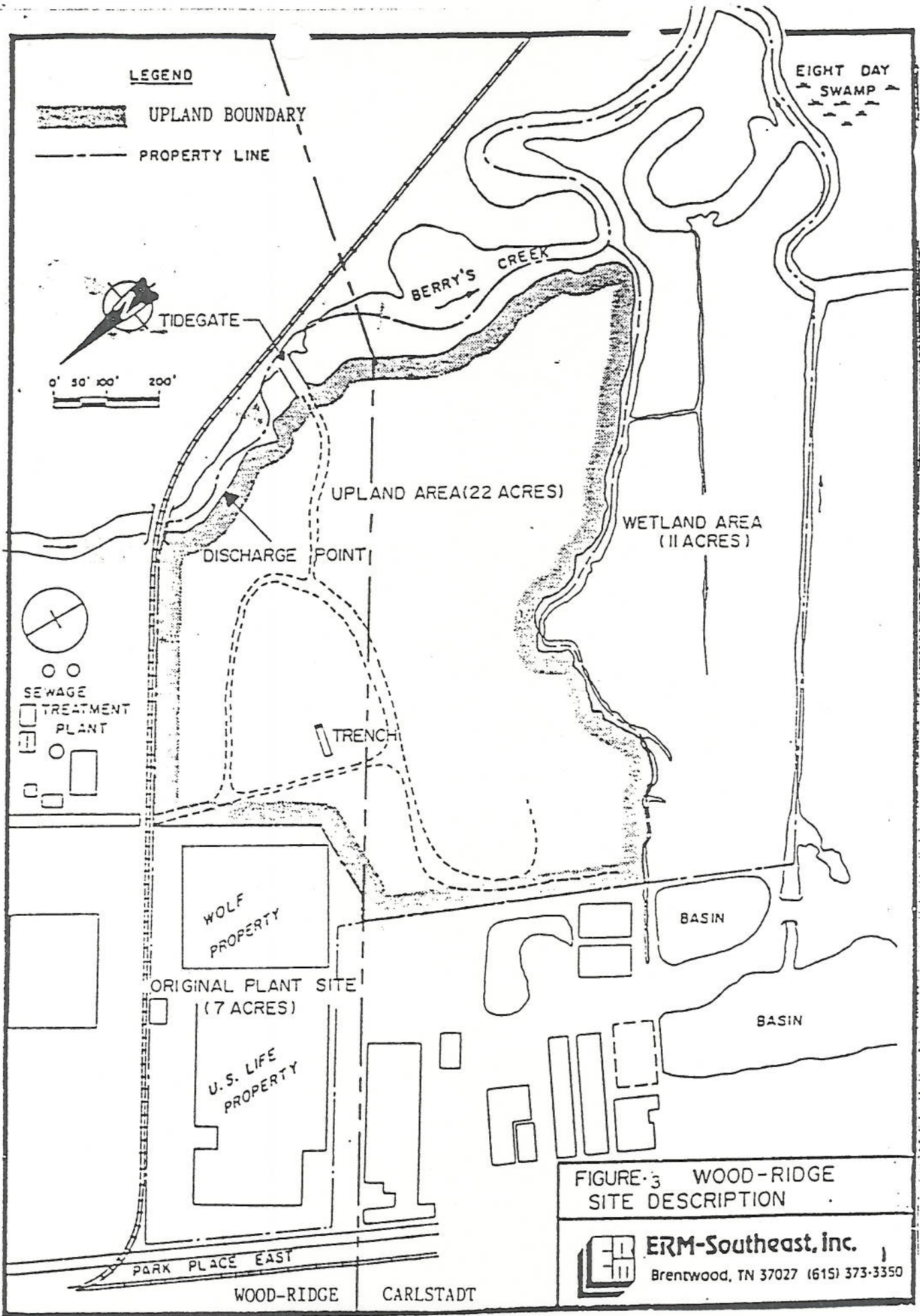


FIGURE 3 WOOD-RIDGE SITE DESCRIPTION

ERM-Southeast, Inc.
 Brentwood, TN 37027 (615) 373-3350

