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RECORD OF DECISION

ROD DECISION SUMMARY

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File # DE011
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SUMMARY OF REMEDIAL ALTERNATIVE SELECTION

WILDCAT LANDFILL SITE

KENT COUNTY, DELAWARE

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
REGION III
PHILADELPHIA, PA

and

DELAWARE DEPARTMENT OF NATURAL RESOURCES AND ENVIRONMENTAL CONTROL
DOVER, DE

Record of Decision Operable Unit #1

Wildcat

TABLE OF CONTENTS

		Page
I.	Introduction	1
II.	Site Location and Description	1
III.	Site History	4
IV.	Current Site Status	5
	A. Geology	5
	B. Hydrology	8
	C. Extent of Contamination	13
	1. Inorganic	13
	2. Organic	14
V.	Biological Assessment	15
VI.	Risk Assessment	15
	A. Groundwater--Current Offsite Residents	19
	B. Groundwater--Future Offsite Residents	19
	C. Groundwater--Future Onsite residents	19
	D. Soil and Leachate--Occasional Site Users	19
	E. Surface Water--Occasional Site Users	20
	F. Fish Intake--Occasional Site Users	20
VII.	Remedial Action Objectives	20
VIII.	Remedial Alternatives Evaluation	21
	A. Description of Alternatives	21
	B. Evaluation of Alternatives	23
IX.	Community Relations	33
X.	Documentation of Significant Changes	34
XI.	Selected Remedial Alternative	34
	A. Description and Performance Goals	34
	B. Statutory Determinations	36

ATTACHMENTS

A - Administrative Record Index
B - Responsiveness Summary

FIGURES

	Page
Figure 1. Site Location Map	2
Figure 2. Site Map	3
Figure 3. Borehole and Monitor Well Locations	6
Figure 4. Trench Locations	7
Figure 5. Groundwater-level Elevations in Columbia Formation	10
Figure 6. Groundwater-level Elevations in Waste and Meander Channel	11
Figure 7. Schematic Hydrodynamic Cross Section	12
Figure 8. Organic Compounds in Groundwater Samples	16
Figure 9. Domestic Well Sample Locations	28
Figure 10. Offsite Groundwater Restricted Areas in Columbia Formation	29

TABLES

Table 1. Summary of Risk Assessment	18
Table 2. Recommended Alternatives: Summary of Detailed Analysis	24

SUMMARY OF REMEDIAL ALTERNATIVE SELECTION
Wildcat Landfill Site
Kent County, Delaware

I. Introduction

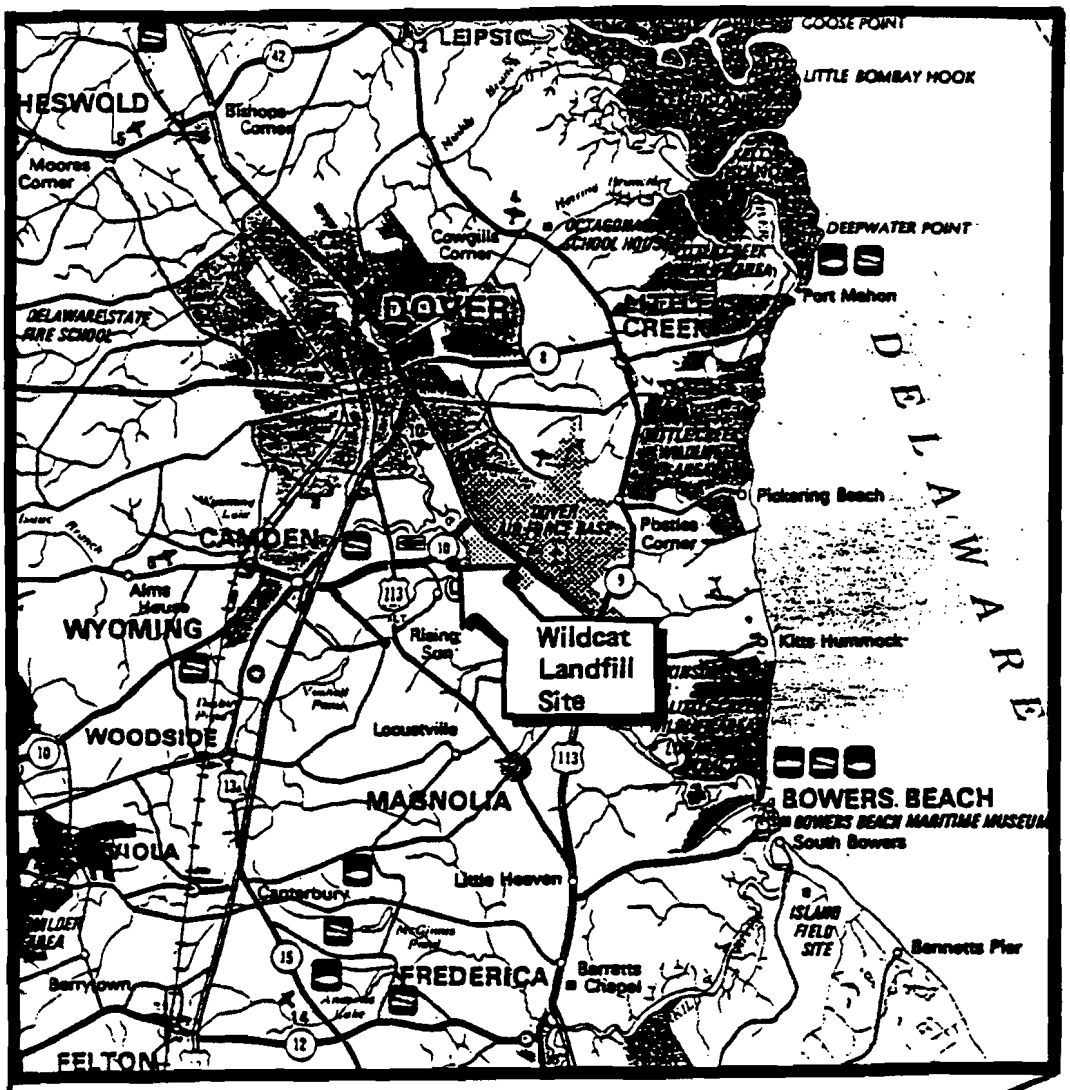
This Record of Decision addresses the first of two operable units for the Wildcat Landfill site and is made up of the landfill proper and the adjacent areas. The second operable unit consists only of the pond that is located along the northwestern border of the landfill. This ROD involves selection of a remedial alternative which addresses the contamination source by preventing existing and future direct contact where a direct contact threat is posed by the site, by reducing the potential for future direct contact risks off the site, and by prohibiting well installations in areas of known or suspected contamination. The remedial investigation/feasibility study (RI/FS) will be continued in order to address the impacts the landfill on the adjacent pond and the wildlife found there.

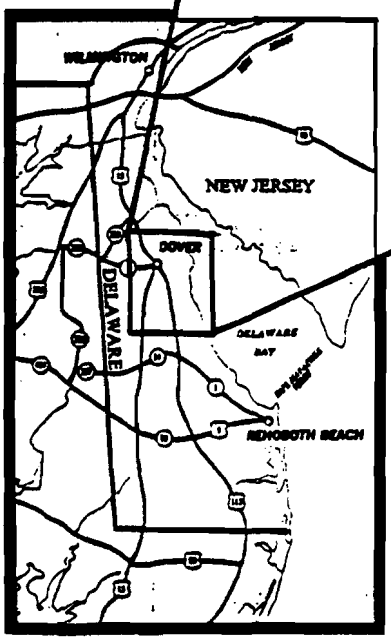
A remedial investigation was conducted to determine the extent of contamination resulting from the site and to determine the potential risks posed to human health and the environment on and adjacent to the site. The remedial investigation report addresses the onsite risks posed by the site, the offsite ground water contamination risks, and the stream and wetland systems on and adjacent to the site. The accompanying feasibility study report screened various response actions which could be used to mitigate effects of the site and to compare a number of alternatives which address the problems posed by the site. The alternatives have been evaluated using the following criteria from the Superfund Amendments and Reauthorization Act (SARA) Section 121: protection of human health and the environment, compliance with other environmental requirements, implementability, short-term effectiveness, long-term effectiveness and permanence, reduction in toxicity, mobility and volume, cost effectiveness, and community acceptance. The public was given an opportunity to comment upon the Proposed Remedial Action Plan and the Administrative Record which includes the RI/FS. The comments and concerns made by the public are considered in the alternative evaluation and are specifically addressed in the attached responsiveness summary (Appendix B).

Finally, this Record of Decision documents the selection of the final remedy by DNREC and EPA and is based upon the contents of the Administrative Record.

II. Site Location and Description

The Wildcat Landfill site is approximately 44 acres in area located in Kent County, Delaware, 2 1/2 miles southeast of Dover (See Figure 1). The site lies along the west bank of the St. Jones River and is bordered to the north and east by the river and associated marshlands, and to the south and west by residential and commercial establishments (See Figure 2). A pond which was created by construction of the landfill is located directly adjacent to the site along the northwestern edge. Portions of the site lie within the 100-year floodplain of the St. Jones River.





Approximate Map Scale: 1" = 3 miles.

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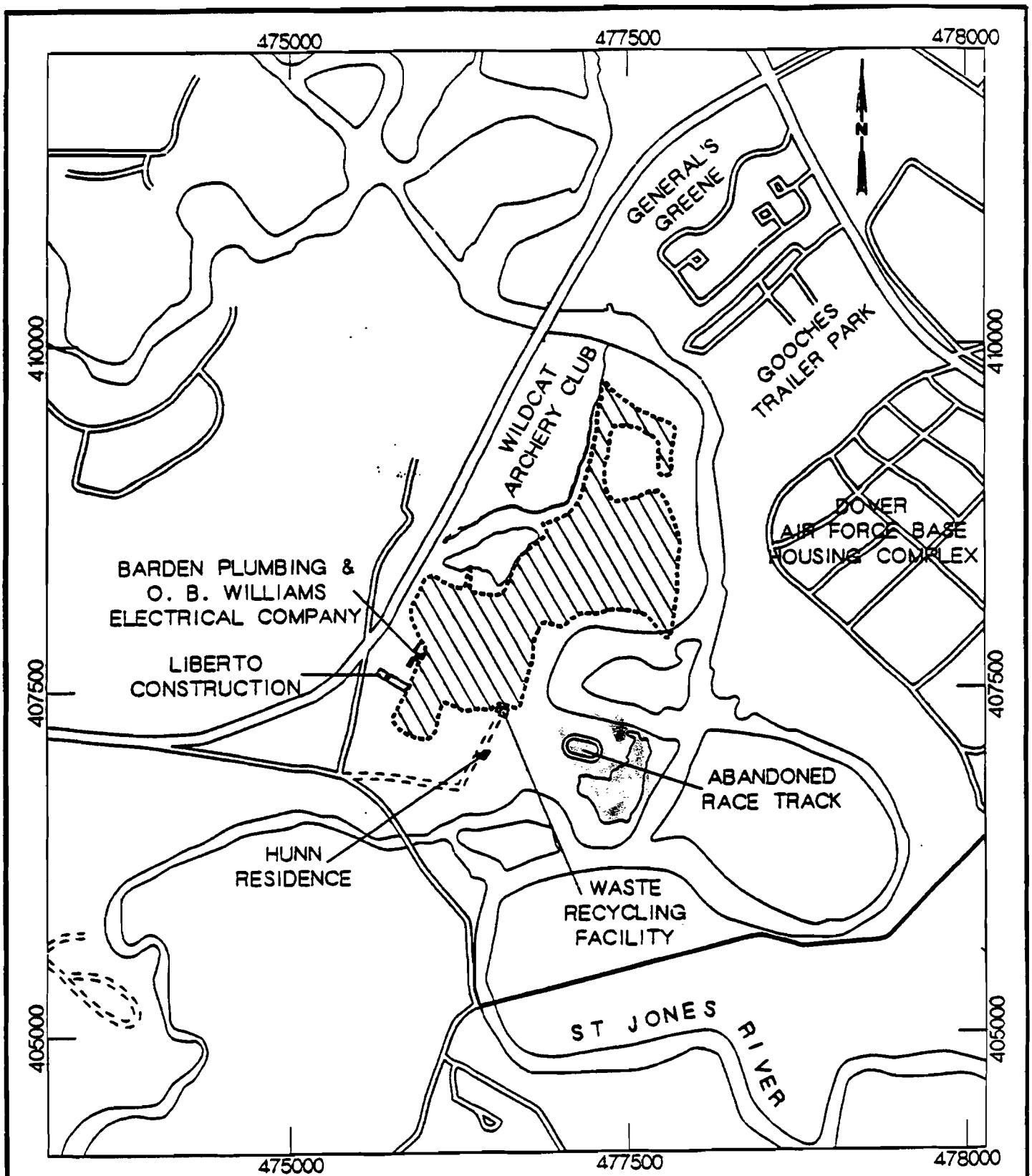
Figure 1
GENERAL SITE
LOCATION MAP
Wildcat Landfill, Dover, Delaware

CH2M HILL



APPROXIMATE LANDFILL BOUNDARY

0 500 1000 1500 2000
SCALE 1" = 1000'

Figure 2

FEATURES ADJOINING LANDFILL SITE

Wildcat Landfill
Dover, Delaware

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CH2MHILL

Much of the site is situated upon low-lying wetland sediments. However, the area to the southwest was backfilled with wastes following excavation of soil and sand material; consequently, in that area of the landfill, wastes are in direct contact with the surficial sand aquifer. The entire site was covered with sands excavated from this area and from a second excavation area nearby although this second area was not used for landfilling. Much of the site is presently well vegetated with a number of plant communities established. Leachate seeps are present in a few areas of the site, particularly in the area of the adjacent pond. Exposed trash is evident in isolated areas across the entire area of the site and includes empty or partially empty drums, tires, solid latex, and assorted municipal trash.

The St. Jones River and its associated marshlands provide natural barriers to human access along the north, east, and part of the southeast boundaries of the site. Access along the northwest area of the site is not restricted but is made somewhat difficult by the adjacent pond and associated marshy areas. The site is easily accessed along the southwest perimeter both by vehicle and on foot in the area of the Hunn house and behind the businesses located adjacent to the site. As shown in Figure 2, the only residential property located directly adjacent to the site is the Hunn residence who are the property owners.

The Wildcat Landfill site is situated in the Atlantic Coastal Plain Physiographic Province. Most of the site is below about 20 feet mean sea level (MSL), within the natural meander channel of the St. Jones River. This low-lying part of the landfill was created by dumping and spreading waste directly into the wetlands of the river. The southwestern corner of the landfill lies at elevations of 20 to 30 feet MSL and is apparently beyond the meander channel. Wastes in this upland portion were disposed within a man-made excavation.

The predominant surface hydrologic feature of the area is the St. Jones River and its tributary, Tidbury Creek. Both are tidal with a normal tide range of 2 feet in the vicinity of the site. Much of the site lies within the 100-year floodplain. Two other surface hydrologic features of the area are the pond and a small drainageway (which conveys water from Route 10 to the St. Jones River along the northwestern border of the site). The drainageway appears to have been man-made and is separated from the landfill by a low but continuous ridge extending along the pond and landfill.

The geohydrologic units of major importance in the area are the surficial Columbia Formation and two major sand beds within the Calvert Formation of the Chesapeake Group, namely, the Frederica Aquifer and the underlying Cheswold Aquifer. All residents of the study area draw their water from wells within one of these three units.

III. Site History

The site was operated as a permitted sanitary landfill between 1962 and 1973, accepting both municipal and industrial wastes. Liquid and solid wastes were reportedly mixed together, compacted, and covered; drums of waste were reportedly emptied onsite and the empty drums recycled. Industrial wastes suspected to have been disposed include latex waste and paint sludges.

However, there are no known existing records of the actual quantity of wastes which were disposed in the landfill.

The facility was permitted as a solid waste landfill by the Delaware State Board of Health in 1962. The site was later permitted by the Delaware Water and Air Resources Commission (WARC) and then by DNREC. However, throughout its eleven years of operation, the facility appears to have routinely violated operating and other permits issued by the regulating agencies. In August of 1973 the facility was ordered by DNREC to cease operations for failing to comply with permit conditions. The site operators were ordered to cover with soil and revegetate the site. The entire regulatory history is discussed in the EPA Remedial Action Master Plan (RAMP) which is available in the Administrative Record.

The site was investigated by the EPA in June 1982 for possible inclusion on the National Priority List (NPL) of hazardous waste sites. The site was subsequently listed in December 1983 and the RAMP published that same month. The Delaware DNREC requested and the EPA agreed to allow the state to perform a remedial investigation and feasibility study. DNREC began the investigation in September 1985 and the feasibility study in November 1987. The RI/FS report was drafted and released for public comment in May 1988.

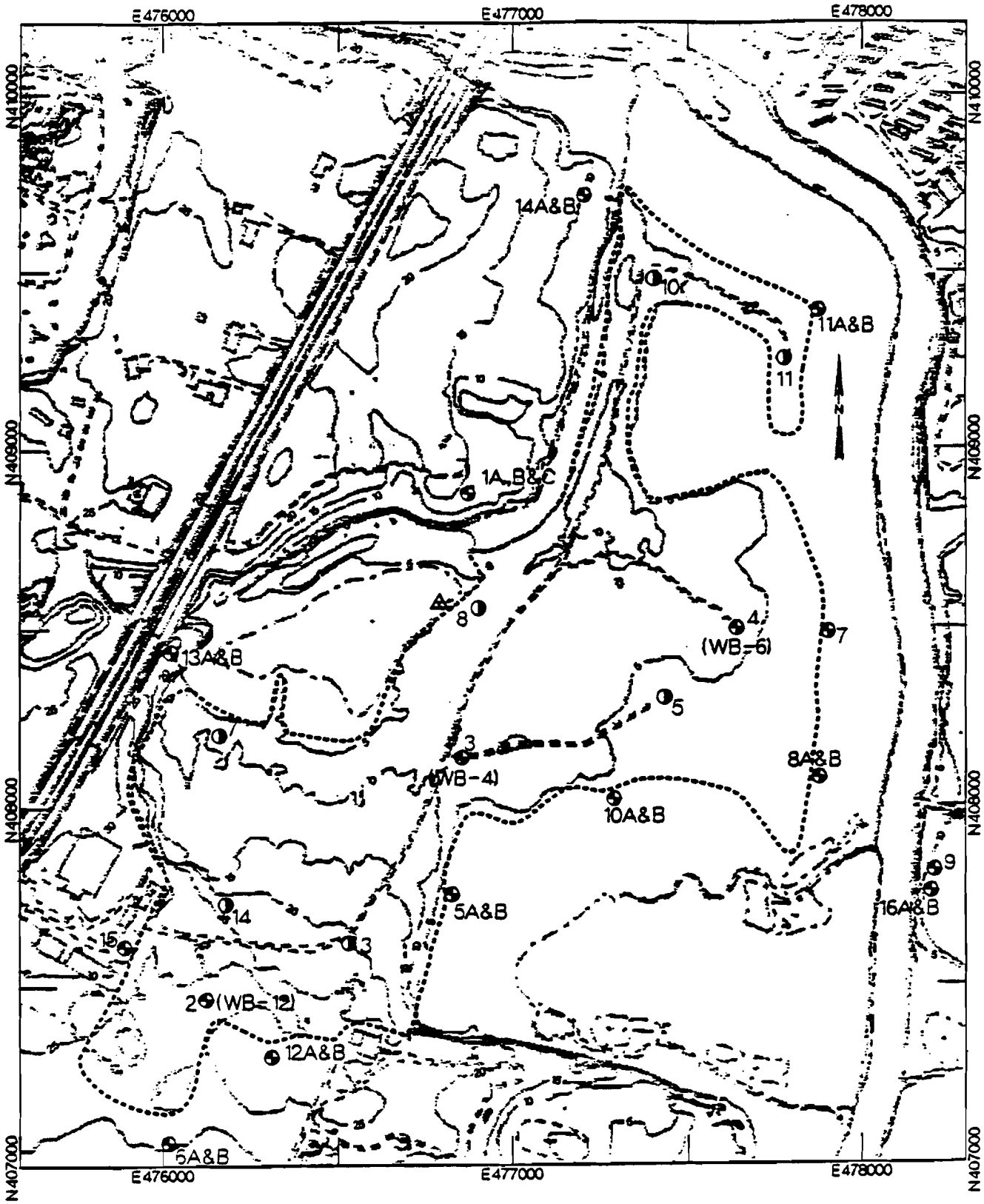
IV. Current Site Status

Through a Cooperative Agreement with the EPA, the Delaware DNREC completed the RI/FS for the Wildcat Landfill site through its contractor, CH2M Hill Southeast, Inc. The RI report describes the geology and hydrogeology, onsite and offsite chemical characteristics, onsite and offsite biological assessment, wetlands assessment, and suspected risks within the study area. The geology, hydrology, and types and concentrations of contaminants found onsite and offsite will be described in this section. The biological assessment and the risk assessment will be described in the next two sections, respectively. A summary of all chemical data generated during the remedial investigation is included in Remedial Investigation Report.

A. Geology

The geology of the study area was interpreted from monitor well borings drilled onsite and offsite. The monitor well locations are found on Figure 3. Trenches were dug onsite both for sample collection and for interpreting the geology and hydrology of the study area (See Figure 4). Other information sources were cuttings from nearby residential wells, logs of nearby wells from the Delaware Geological Survey, logs of borings from the Delaware Department of Transportation at the Route 10 bridge, historical areal photographs, United States Geological Survey (USGS) topographical maps, Delaware Geological Survey geologic and hydrogeologic reports, and reconnaissance of the area.

There are three kinds of surficial deposits in the study area. The two naturally occurring deposits are sands interpreted to be of the Columbia Formation and the meander channel organic silts and sands of the St. Jones River. The third surficial material are the landfill wastes associated with the landfill and a small area on the eastern side of the river which appears to be construction material.



◑ 3 WASTE BOREHOLE

⊕ 15 MONITORING WELL

△ POND WATER LEVEL MONUMENT

APPROXIMATE LANDFILL BOUNDARY

0 200 400 600 800

SCALE 1" = 400'

Figure 3 000009

BOREHOLE AND MONITORING WELL SAMPLING LOCATIONS

Wildcat Landfill, Dover, Delaware

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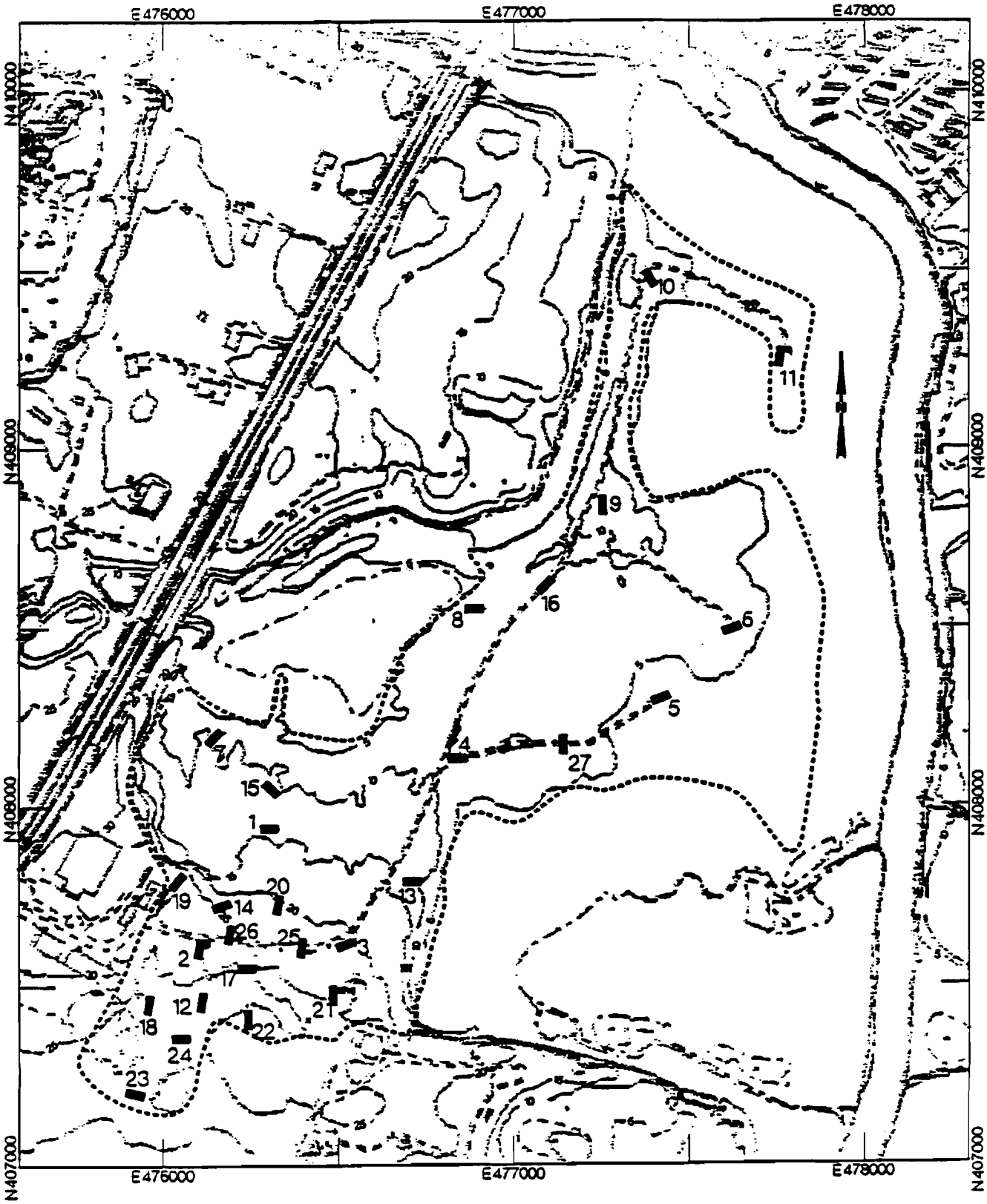


14 TRENCH LOCATION

APPROXIMATE LANDFILL BOUNDARY

NOTE: TRENCHES 1-14 EXCAVATED 12/9-13/85;
TRENCHES 15-25 EXCAVATED 11/2-6/87

0 200 400 600 800

SCALE 1" = 400'

GRID TIED TO DELAWARE STATE PLANE COORDINATE SYSTEM

MAP SOURCE: AERIAL PHOTOGRAPHY FLOWN ON 1/8/86

000010

Figure 4

LOCATIONS OF TRENCHES EXCAVATED FOR THE REMEDIAL INVESTIGATION

WILDCAT LANDFILL, DOVER, DELAWARE

CH2M HILL

The general stratigraphy of the study area is detailed in the RI report and is described here in ascending order:

(1) The Cheswold aquifer is a sandy zone within the Chesapeake Group consisting of medium to coarse sand and shells. The top of the Cheswold aquifer in the study area is at approximatley 200 feet below ground surface. These sands underlie the entire study and are separated from the overlying Frederica sands by confining silts and clays. The Cheswold sands were not evaluated in the remedial investigation but will be used in the remedial action;

(2) The Frederica sands are interpreted as members of the upper Chesapeake Group. These sands underlie the entire study area and generally grade from fine silty sand in the southern part of the study area to coarse sand with gravel in the central and eastern portions of the study area;

(3) The clay semi-confining layer found above the Frederica sands extends throughout the study area although its extent and integrity beneath the meander channel was not defined. These clays are generally plastic and in some places contain a trace of silt and fine sand;

(4) The Columbia Formation directly overlies the clay semi-confining layer in all locations outside of the meander channel of the St. Jones River. This formation is composed primarily of fine to coarse sands with a trace of medium gravel. Sands of the Columbia underlie portions of the landfill outside of the meander channel. Within the meander channel, however, distribution of Columbia sands is uncertain although sand deposits were found there. These could either be extensions of the Columbia or channel deposits;

(5) The meander channel deposits of the St. Jones River are exposed along the north, east, and southeast of the boundaries of the landfill. Similiar deposits are found exposed in and around the pond on the west side of the landfill. The uppermost unit of these deposits is composed of organic silts and some clay, root fibers, and wood fragments. These deposits were also found beneath the landfill in the meander channel. Beneath these organic deposits are sands which may either be undisturbed Columbia sands or reworked channel deposits;

(6) The landfill materials are in direct contact with sands of the Columbia Formation in the southeast corner of the landfill. This is referred to as Area 1 in the risk assessment. Wastes within the meander channel are in direct contact with meander channel organic silts. The typical wastes encountered during the remedial investigation included municipal refuse (glass bottles, waste paper, trash, and decomposed garbage), latex in strips and sheets, scattered crushed, empty, and some intact drums, and manufactured plastic items. Wastes ranged to 20 feet deep across the site with the thickest and highest area outside the meander channel. Within the meander channel the wastes have compressed and otherwise displaced the meander channel silts.

B. Hydrology

The hydrology of the study area is strongly influenced by the St. Jones River and the tidal action of the river. The hydrogeology was determined with the 27 monitor wells installed at 15 locations on and near the landfill. Wells were

screened within the Columbia Formation, Frederica sands, landfill materials, meander channel silts, and meander channel sands.

The hydraulic properties of natural materials in the study area were determined through variable-head (slug) tests at individual wells, and by an aquifer test conducted for 48 hours in the Frederica sands at MW-16A. Single water-level measurements were taken in all the monitor wells and in the pond adjacent to the site in April and June 1986. Continuous water-level measurements were taken between September 1986 and January 1987 at various monitor wells and from the St. Jones River. Figure 5 and Figure 6 represent the offsite and onsite surface water table configuration, respectively. The hydraulic conductivity of the Columbia wells ranged from 2.5×10^{-3} to 3.3×10^{-2} cm/sec which is typical of sands and silty sands. The hydraulic conductivity of the meander channel organic silts were 9.9×10^{-4} and 1.9×10^{-5}. Many of the tests conducted in the meander channel silts and sands were abnormal which may indicate a limited areal extent of those sands. The hydraulic properties of the Frederica sands were 412 to 330 ft^2/day for transmissivity, 3×10^{-3} and 1.3×10^{-2} cm/sec for hydraulic conductivity, and 9.6×10^{-4} and 2.7×10^{-3} for storativity. These values are typical of semiconfined sands and silty sands.

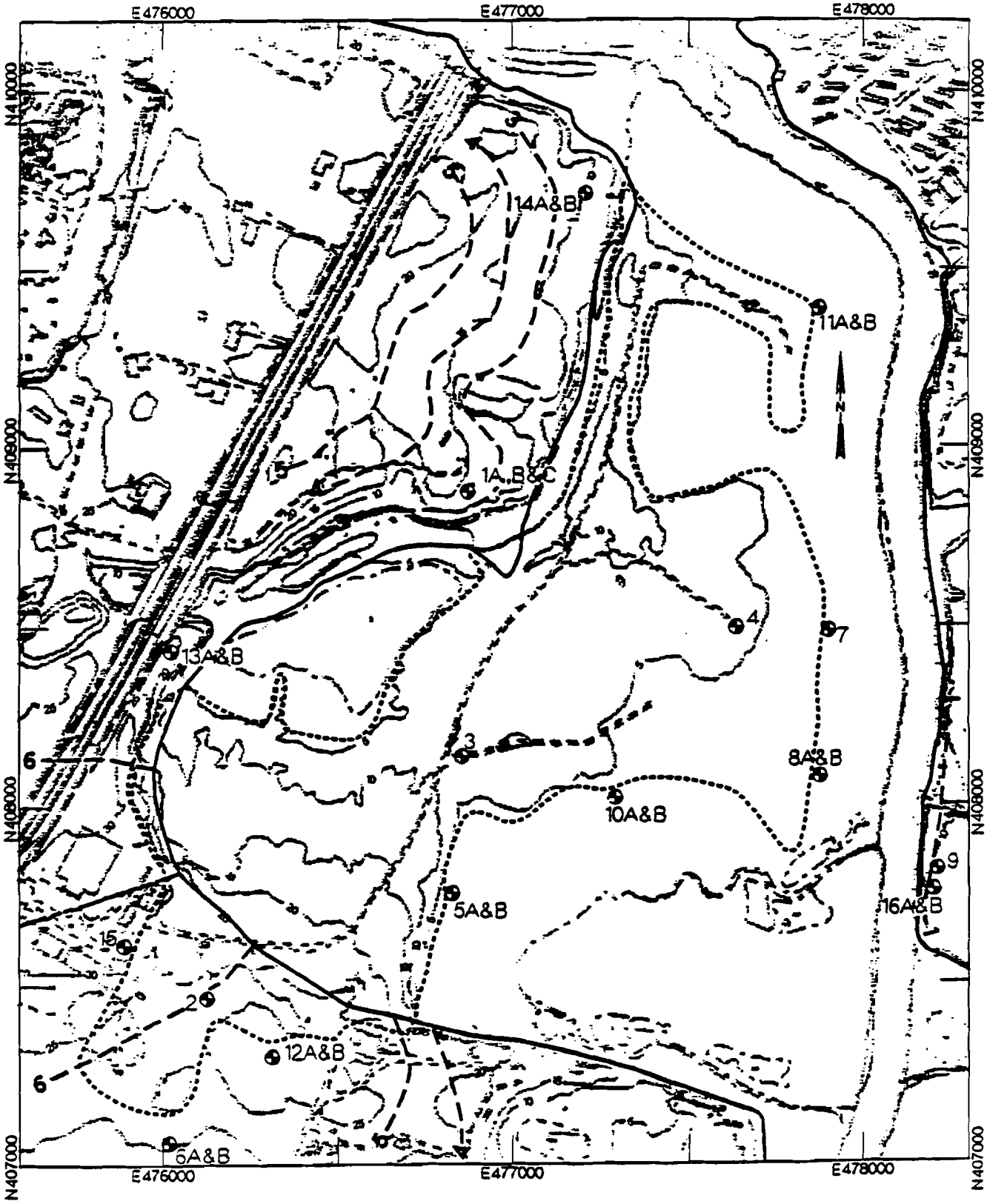
Patterns of groundwater flow are generally toward the St. Jones River although very localized flow directions are more varied because of local topographic features and tidal fluctuations of the river. Measurements from wells which are tidally influenced are difficult to interpret because the tidal influence varies both spatially and temporally depending on the location of the monitor well with respect to the river.

The hydrodynamic setting is depicted in Figure 7 and as follows:

(1) The Columbia Formation is unconfined and the water table mimics the topography. Flow is from topographic highs to topographic lows. Groundwater from the Columbia discharges into the various surface features found within the meander channel. Discharge from the area of the Wildcat Archery Range is either into the St. Jones River directly or into the drainageway that exists northwest of both the pond and the site. Discharge from the Columbia in the area directly west of the site is toward the pond, the landfill, and Tidbury Creek. Discharge may also occur into the meander channel sands if they are directly connected to the Columbia sands. The southwestern corner of the landfill rests directly upon Columbia sands and horizontal flow continues from this area of the landfill toward both the St. Jones River and Tidbury Creek;

(2) The semiconfining clays found atop the Frederica sands allow vertical flow. Within the meander channel this flow is vertically upward while outside of the meander channel the flow is downward;

(3) The Frederica sands are semiconfined with the overlying confining clays relatively thin beneath parts of the meander channel. Horizontal flow is generally from west to east. Vertical flow is controlled by recharge occurring from the Columbia Formation through the confining clays and into the Frederica sands outside of the meander channel, and upward discharge from the Frederica sands into the meander channel and the St. Jones River occurring



5 INTERPRETED WATER-LEVEL CONTOUR (FT MSL)

COLUMBIA/MEANDER CHANNEL CONTACT LINE

GROUNDWATER DIVIDE

6.36 15 MONITOR WELL AND WATER LEVEL READING (FT MSL)

APPROXIMATE LANDFILL BOUNDARY

0 200 400 600 800

SCALE 1" = 400'

Figure 5

INTERPRETIVE MAP OF WATER-LEVEL ELEVATIONS IN COLUMBIA FORMATION, APRIL 10-11, 1986

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Wildcat Landfill, Dover, Delaware

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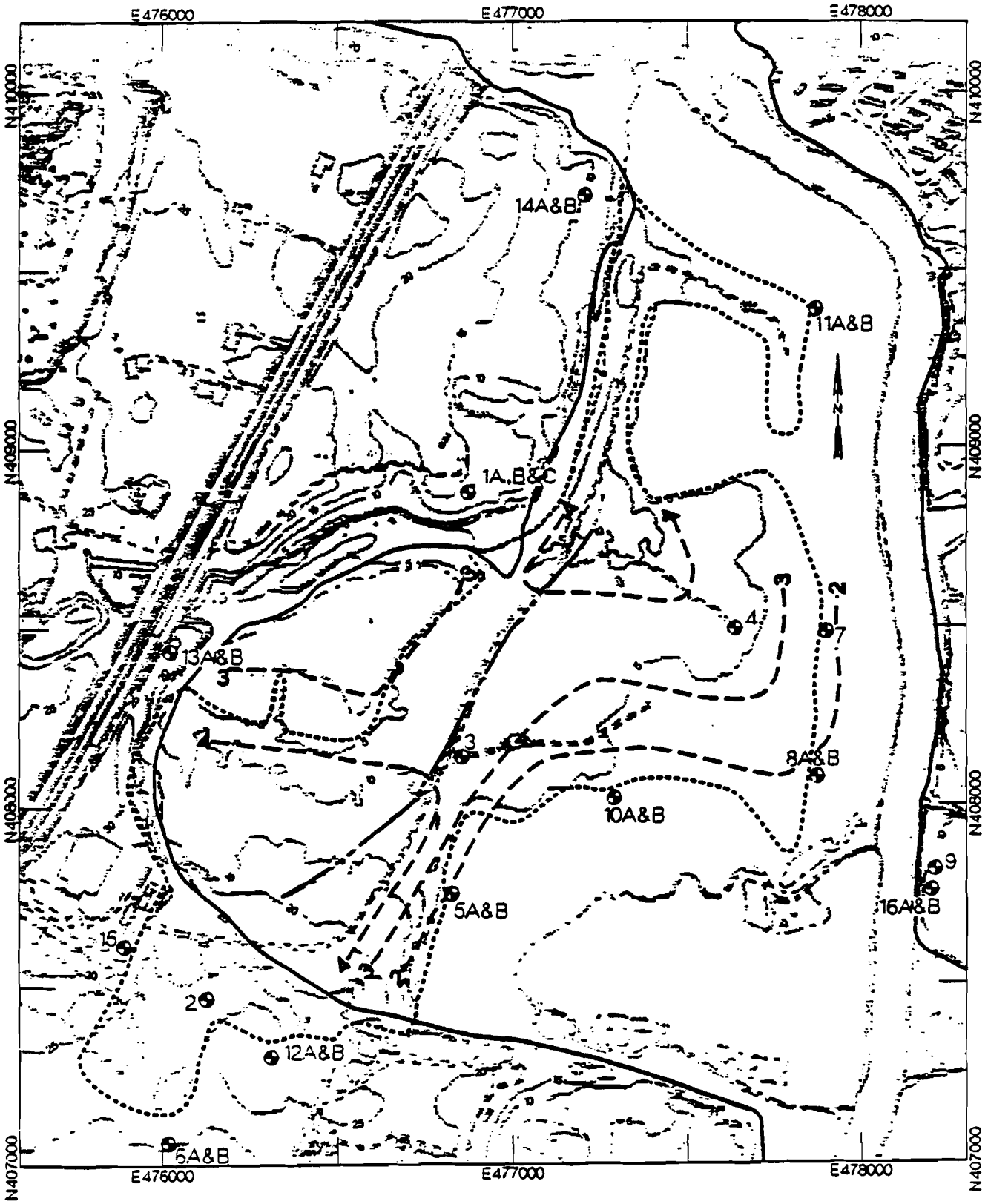

5 INTERPRETED WATER-LEVEL CONTOUR (FT MSL)

COLUMBIA/MEANDER CHANNEL CONTACT LINE

GROUNDWATER DIVIDE

6.36 15 MONITOR WELL AND WATER LEVEL READING (FT MSL)

APPROXIMATE LANDFILL BOUNDARY

0 200 400 600 800

SCALE 1" = 400'

Figure 6

INTERPRETIVE MAP OF WATER-LEVEL ELEVATIONS IN WASTE AND IN MEANDER CHANNEL ORGANIC SOILS, APRIL 10-11, 1986

Wildcat Landfill, Dover, Delaware

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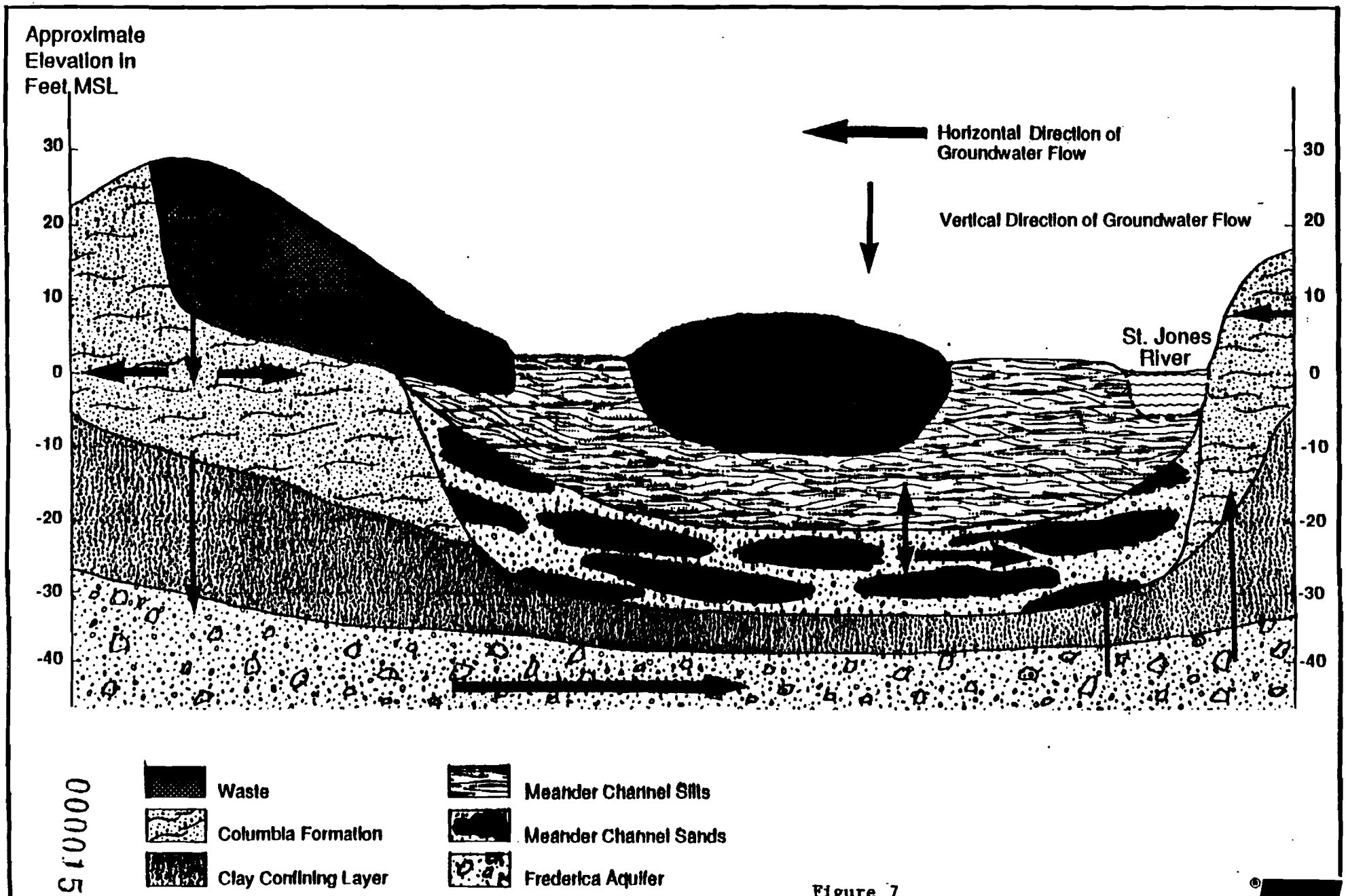

Figure 7
SCHEMATIC HYDROGEOLOGIC CROSS SECTION
Wildcat Landfill

CH2M HILL

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within the meander channel. All wells within the Frederica were influenced by tidal action from the river;

(4) Horizontal flow direction within the meander channel sands is poorly defined although flow directions are undoubtedly toward the St. Jones River. All wells were influenced by the tidal action of the river. These sands are being recharged by overlying deposits near the center of the landfill and away from the center of the meander channel, and discharging upward into overlying deposits within the meander channel;

(5) Horizontal flow directions within the landfill wastes is poorly defined within the meander channel. However, flow is expected to follow topography and be consistent with flow from Columbia sands outside of the landfill. Generally, horizontal flow will be radial from topographic highs within the landfill with discharge occurring into the adjacent pond and meander channel deposits. Within Area 1, horizontal flow will continue offsite into Columbia sands with subsequent discharge into the St. Jones River and Tidbury Creek.

(6) The mean tidal variation in the St. Jones River is approximately 2 feet. The mean elevation was 1 foot mean sea level (MSL) with a total range of -1 to 3 feet MSL. Water levels in many wells showed similiar fluctuations in level. Generally, the water levels were higher in April and lower in June and October. The average linear velocity of flow in the Columbia Formation was calculated at 49 to 91 feet per year. The average linear velocity of groundwater flow in the Frederica sands is between 5.6 and 26 feet per year.

C. Extent of Contamination

Two rounds of sampling and chemical analyses were performed in the remedial investigation and the table summaries are found in the RI Report. Samples of soil, water, and landfill contents were collected throughout the study area. This includes samples collected by the EPA Emergency Response Team from wetlands and stream channel locations.

1. Inorganic Characterization and Contamination

The major ion and bulk chemistry interpretations were used to classify the various waters in the study area and to interpret the likelihood of inorganic metal concentrations and distribution. Based upon the total dissolved solids concentration, the waters of the study area are of three types:

-less than 200 parts per million (ppm)--Columbia Formation, all domestic wells, and Frederica sands;
-500 to 2000 ppm--meander channel silts, landfill leachate; and
-greater than 2000 ppm--surface water from St. Jones River and its tributaries.

The ion chemistry (namely the cations:calcium, magnesium, potassium, sodium; and anions:carbonate, chloride, sulfate) suggest that the pond and MW-12 waters have been affected by the landfill, that the meander channel silt water has been affected by the St. Jones River, and that the meander channel sand waters are affected by the Frederica aquifer waters. There appears to be no affect of either the St. Jones River nor the landfill on the meander channel sands. This data supports the hydrogeologic understanding that there exists an upward gradient from the Frederica aquifer into the meander channel, or that the

meander channel organic silts have been an effective buffer for contaminants leaving the landfill and entering those organic deposits, or both. Both MW-15 and MW-16B are similiar to the Frederica aquifer water. MW6B may be affected by the landfill but the results are anomalous.

The trace element chemistry (aluminum, antimony, arsenic, barium, cadmium, chromium, cobalt, copper, iron, lead, manganese, mercury, nickel, selenium, silver, tin, vanadium, zinc) of waste trenches were similiar to the bottom sediments of the St. Jones River and generally within the range of naturally-occurring concentrations. The concentrations from soils taken from borings, primarily of Columbia Formation sands outside the landfill, were slightly below the river and landfill sediments.

The extraction procedure analyses performed on landfill wastes were almost all below the detection limits although barium at 2400 ppb occurred in Trench 6; lead at 10.5 ppb in trench 1, 20.5 ppb in Trench 3, 19.5 ppb in Trench 7, and 1940 ppb in Trench 17; mercury at 0.3 ppb in Trench 16, 1.4 ppb in Trench 18, and 0.2 ppb in Trench 24; and selenium at 10 ppb in Trench 10.

The mean concentration of trace elements in water samples were primarily reflective of the St. Jones River, as most were taken from the river. Station 6 in wetlands adjacent to the southeast of the landfill had relatively high concentrations of aluminum, arsenic, barium, chromium, iron, lead, manganese, vanadium, and zinc. Station 16 in the pond and the leachate seep near the south end of the pond also had higher concentrations of these elements as compared to the St. Jones River. Groundwater and leachate samples taken within the landfill contained elevated levels all trace elements except arsenic and manganese when compared with groundwater samples taken outside the landfill. In addition, cadmium, cobalt, nickel, and vanadium were consistently present in the landfill waters but rare or absent in other groundwater samples including both domestic and commercial, and monitor wells.

2. Organic Characterization and Contamination

With few exceptions, samples taken from the study area contained concentrations of organic constituents in the low ppb range. Further, there was no discernible pattern to their distribution.

The highest concentrations up to a total of 70 ppm were found in drums excavated during the second trenching operation. Most of this is accounted for with styrene at 69 ppm. Other common constituents were ethylbenzene (from a few to 900 ppb), methylene chloride (similiar range), and phthalates (generally 10 to 40 ppb).

Trench samples typically contained totals of a few hundred ppb of organic constituents. Of the 43 organic compounds detected in Round 2 sampling, only acetone (6 to 43 ppb), benzene (4 to 15 ppb), chlorobenzene (16 to 110 ppb), ethylbenzene (1 to 300 ppb), methylene chloride (1 to 5 ppb), xylenes (7 to 150 ppb), and naphthalene (5 to 32 ppb) were common. The highest single concentration for phthalate was 8500 ppb in Trench 24.

The water and sediment samples collected from the wetlands and surface water by the EPA Emergency Response Team were generally free of organic constituents. Phthalates were found from some sediments in the study area in the low ppb

range.

Both groundwater and surface water samples generally contained low levels of organic contamination. But as seen in Figure 8, benzene compounds, toluene, and xylenes (BTX) were common contaminants in the low ppb range. Certain of these contaminants also occurred in wells upgradient of the landfill, such as MW 13A, 1B and C, and 14A. In fact, the highest concentration of BTX compounds occurred in MW-16B which is screened across the river in the Columbia Formation.

V. Biological Assessment

The biological assessment documented a productive and diverse ecosystem within the Wildcat Landfill site boundary. Five species of plants were identified which are listed on the Delaware Natural Heritage Inventory draft list of rare or seldom seen plants. Histopathology on white-footed mice and bioaccumulation studies of small mammals did not indicate adverse effects to terrestrial wildlife.

Comprehensive sediment toxicity testing did not indicate any adverse effects on the St. Jones River and the marshlands adjacent to the site. However, of the fish that were collected from the river, two fish contained PCB levels in excess of the Food and Drug Administration action level of 2 ppm. The available monitor well water data, surface water data, and sediment data do not indicate that the landfill is a source of the PCBs.

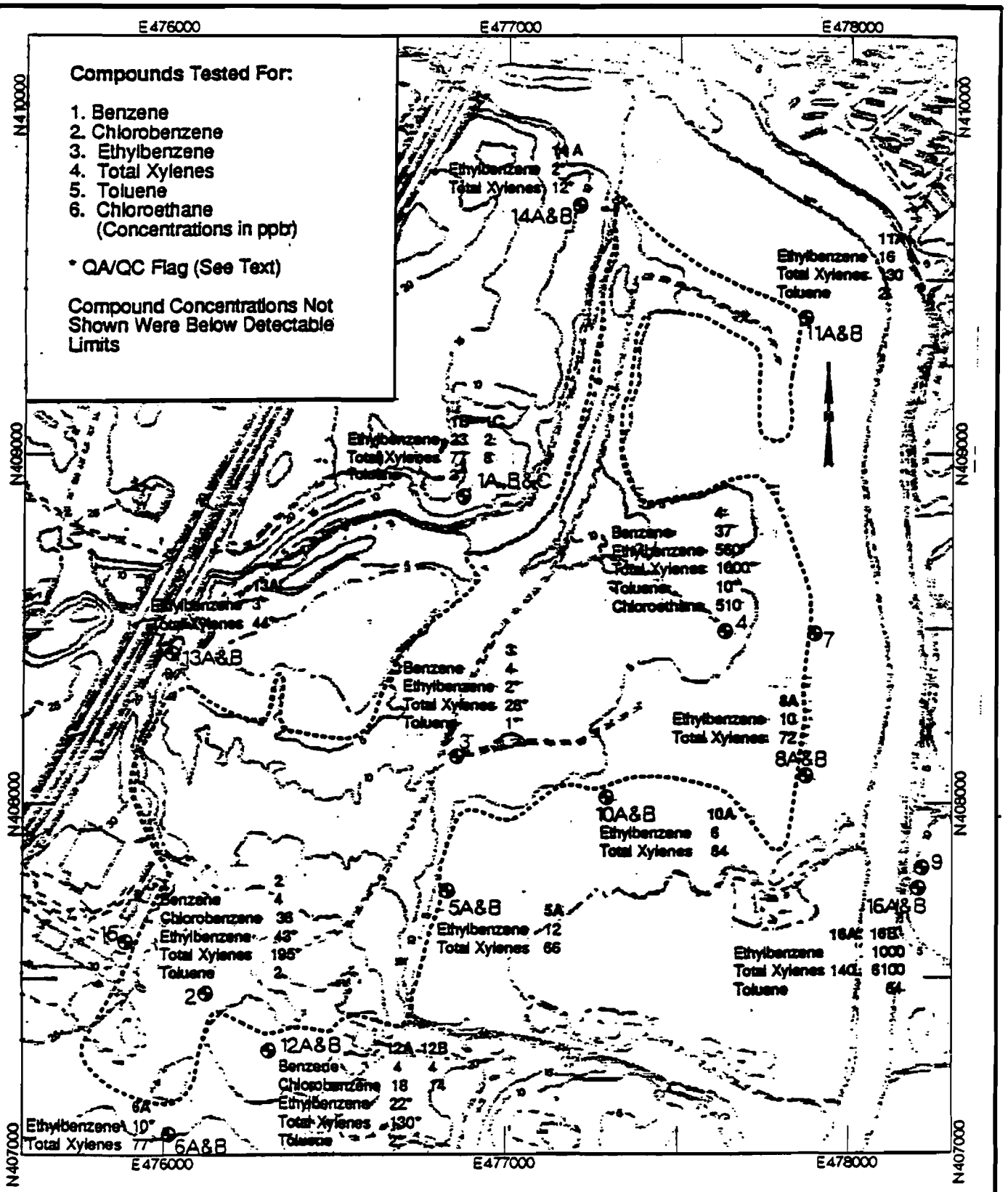
Several impacts from the landfill were found in the pond adjacent to the site. These impacts included levels of acute toxicity in the southwest portion of the pond, leachate entering the pond from the site having concentrations of certain metals above water quality criteria, and bioaccumulation of several metals within turtles and mummichog fishes collected from the pond.

In order to fully assess the impact of bioaccumulation in the fish upon migratory birds which may be feeding on these fish, the pond has been made a separate operable unit and will be addressed in a continuation of the remedial investigation and feasibility study. Remediation of the pond is not addressed in this record of decision.

VI. Risk Assessment

The purpose of the risk assessment is to provide a mechanism for documenting the hazards or potential hazards posed by the site for the support of remedial actions under Section 106 of CERCLA. The general elements of the risk assessment include a toxicity assessment of chemicals identified at the site, exposure assessment for identifying the major potential routes of human exposure, and the risk characterization which combines the potential exposure pathways and information on the toxicity assessment to estimate the potential effects of the site on human health.

The current and future exposure pathways examined for this site in the risk assessment are (1) exposure in groundwater for residents downgradient of the site who use groundwater as a source of drinking water, (2) exposure to



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Source: USGS 7.5 Minute Quadrangle Maps for Dover, Little Creek Wyoming and Frederica, Delaware, and Aerial Photography Flown 1/8/88. Grid tied to Delaware State plane coordinate system.

Figure 8
SIGNIFICANT ORGANIC COMPOUNDS IN GROUNDWATER SAMPLES, ROUND 2
Wildcat Landfill

CH2M HILL

contaminants in groundwater for future onsite residents who use groundwater as a source of drinking water, (3) exposure of contaminants in the St. Jones River from incidental ingestion of surface water by occasional site users, (4) exposure through ingestion of fish from the St. Jones River by occasional site users, (5) exposure to contaminants in soil and leachate through direct contact by occasional site users, and (6) exposure to contaminants in the soil and leachate through direct contact by future onsite residents.

The ingestion of fish in the St. Jones River is reported here but is not a subject for this decision. The information has been given to the federal and state agencies responsible for this public health concern. This pathway is not considered here because of the following: (1) the landfill could not be identified as a source of the PCBs although PCBs were found in certain waste materials, (2) PCBs were not found offsite in either sediments or water samples, and (3) the fish sampled in the St. Jones River travel well beyond the length of river near the site, including possibly beyond the St. Jones River watershed.

The risk characterization includes comparisons between estimated intakes and reference doses (RfDs) for noncarcinogenic chemicals and estimates of excess lifetime cancer risk for exposure to carcinogens. These comparisons and risk estimates must be interpreted carefully because, for each exposure setting, assumptions as to chemical concentrations, exposure durations, and characteristics of the potentially exposed population are made. Further, quantitative assessment is possible only for those chemicals for which EPA has developed numerical criteria. Chemicals which have no criteria are excluded from the risk analysis. Table 1 summarizes the risk assessment with summaries of existing or future exposed populations, routes of exposure, excess lifetime cancer risks, comparisons to reference doses for noncarcinogens, and chemicals of concern.

Over 80 chemicals were detected in samples analyzed for the RI and over 60 were considered in the risk assessment. These chemicals can be separated into two categories according to their health effects, namely, carcinogens and other chronic toxicants that are noncarcinogenic. The carcinogenic effects are expressed as the excess lifetime cancer risk from exposure to individual chemicals.

The excess lifetime cancer risk is the incremental increase in the probability of developing a cancer from exposure to contaminants at the site. For example, a 1×10^{-6} excess lifetime cancer risk is an increase in the risk of cancer incidence of one case per million people exposed. The acceptable risk range adopted by EPA is 10^{-4} to 10^{-7}.

The exposure to noncarcinogens is assessed by comparing estimated daily intakes of contaminants to reference doses (RfDs). RfDs are established below the threshold dose, that is, below the dose at which effects are expected to occur. A simple additive risk model is used to assess the overall potential for noncarcinogenic effects from a mixture of chemicals. The estimated daily intake for each chemical is divided by the RfD for that chemical and the resulting quotients for each chemical of the mixture is added resulting in the hazard index (HI). If the HI exceeds 1.0, the potential hazard is unacceptable and the chemicals are further evaluated.

Table 1
SUMMARY OF RISK ASSESSMENT
WILDCAT LANDFILL SITE

Exposure Population	Route of Exposure	Excess Lifetime Cancer Risk	Comparison of Reference Dose	Chemicals of Concern	Comments
Current Offsite Residents	Groundwater ingestion	1×10^{-6}	No chemical exceeds RfD; HI = 1.0	None	Carcinogenic contaminants include benzene and methylene chloride. Both were detected at low concentrations, hence leading to cancer risk estimates in the acceptable risk range.
Future Onsite Residents	Groundwater ingestion	4×10^{-3}	HI = 104	Arsenic PCBs Chrysene Antimony Cadmium Lead Mercury (if alkyl) Barium Chromium (if hexavalent) Nickel	Arsenic was present at levels below the MCL. Chrysene was detected in one sample. Levels of noncarcinogens exceeding RfDs were detected in leachate only.
Future Offsite Residents	Groundwater ingestion	6×10^{-6}	HI = 2.9	Manganese	Carcinogenic contaminants include benzene only. It was detected in one sample at 4 ppb and hence does not appear to be of concern. Two of eleven samples would lead to exposures of manganese exceeding the RfD. Manganese causes taste problems.
Occasional Site Users	Direct contact with soil	1×10^{-3}	HI = negligible for children and adults	Arsenic PCBs Chrysene	Chrysene was detected in one sample.
	Direct contact with leachate	Not applicable	Not applicable	Mercury	Comparison of children's intake to adjusted 10-day health advisories.
Occasional Site Users	Incidental ingestion of surface water	8×10^{-5}	All daily intakes are negligible	None	Assumes exposure every day for a lifetime. Carcinogenic contaminants include arsenic and chlordane. Arsenic was detected at levels below the MCL. Chlordane was detected in one sample.
Occasional Site Users	Fish ingestion	3×10^{-4}	All daily intakes are negligible	PCBs	Three fish fillet samples exceed the FDA action level. PCBs in these fish are probably not due to the site.

WDR356/048

000021

A. Groundwater - Current Offsite Residents

There is no evidence of contamination from the landfill in any of the domestic wells sampled near the site. All wells within the immediate vicinity of the landfill were sampled in the RI. The domestic wells DW-8 and DW-10 exist in close proximity to the landfill and could potentially be affected by landfill contaminants should they be overpumped or if groundwater flow directions change near these wells. A risk assessment was performed on these wells because of their close proximity to the site. No RfDs were exceeded and the HI equals 1.0. The chemicals which contributed to the HI were barium, cadmium, copper, and lead. These are natural trace elements. The potential excess lifetime cancer risk was determined from maximum concentrations reported in residential and commercial wells and is 1×10^{-6} because of the presence of benzene and methylene chloride.

B. Groundwater--Future Offsite Residents

There are no existing users of water downgradient of the site where offsite migration of contaminants has been documented. The risk assessment is based upon data from MW-12A and B, and MW-6B. The estimated daily intake for manganese was exceeded in MW-12, and the HI equals 2.9. However, manganese is an essential nutrient and the RfD is based upon inhalation exposures rather than ingestion. The potential excess lifetime cancer risk through ingestion of offsite groundwater is 6×10^{-6} due to the presence of benzene at 4 ug/l in MW-12. No other carcinogens were detected in these wells.

C. Groundwater--Future Onsite Residents

The toxicity effects of onsite chemicals were used in the risk assessment to evaluate their effects on future onsite residents. Data from MW-2 and aqueous trench samples from Area 1 were used in the evaluation. The RfDs were substantially exceeded for antimony, cadmium, lead, mercury, barium, and chromium, and the HI was 104. The potential excess lifetime cancer risk was 4×10^{-3}. Arsenic, PCBs, and chrysene contributed most to this value. Concentrations of arsenic, however, are below the maximum contaminant level (MCL). Of the eleven samples used in this assessment, six contained arsenic, four contained PCBs, and one contained chrysene.

D. Soil and Leachate--Occasional Site Users

Both current and future occasional site users such as recreational users and workers could be exposed to contaminants in soil and leachate. The values for soils are extrapolated from chemical concentrations found in buried landfill wastes and from leachate from the trenches. Values from a leachate seep sampled near the pond were also used. Only ingestion is quantitatively assessed and is compared to acute (10-day) exposure to chemicals in the leachate. The RfDs for adults and children were not exceeded and the HI values were negligible. The excess lifetime cancer risk from the ingestion of soils is 1×10^{-3} with arsenic, PCBs, and chrysene contributing most to that risk level. This level is very conservative with a number of important assumptions. The chemical concentration levels in the surficial leachate seeps is assumed to be the same as the levels found in leachate from the trenches even though the concentrations for the leachate seep near the pond were considerably lower than the trench samples, and with no PCBs found at the surface seep.

E. Surface Water--Occasional Site Users

The RfDs for surface water were not exceeded and are negligible. The excess lifetime cancer risk of 8×10^{-5} is based on arsenic (which was below the MCL) and chlordane (detected in one sample).

F. Fish Intake--Occasional Site Users

Three fish collected from the St. Jones River were found to contain PCB levels in excess of the Food and Drug Administration (FDA) action level of 2.0 ppb. The excess lifetime cancer risk is 3×10^{-4}. The remedial investigation was unable to detect any PCBs beyond the landfill wastes in either sediments, groundwater, or surface water samples. The fish that were analyzed are able to move considerably within the St. Jones River and its tributaries and are bottom feeders. For these reasons, the information on the PCB levels in the fish samples has been given to the appropriate state and federal agencies and is not addressed as a site-specific issue in this decision.

VII. Remedial Alternative Objectives

The remedial action objectives were developed to respond to the site hazards (summarized previously in this document) which are discussed in the Remedial Investigation Report. Remedial action objectives address the media of concern, which, for the Wildcat Landfill site are the offsite biota and the landfill contents.

The remedial investigation found that the major areas of contamination are the leachate within the landfill contents, leachate seeps near the pond, and groundwater contamination of the shallow surface aquifer in a limited area. The risk assessment performed for the Wildcat Landfill indicates that contaminants leaving the landfill do not currently pose a threat to human health. However, people coming onto the landfill may be exposed to contaminants at levels of concern in leachate seeps or from exposed landfill contents. The potential risks associated with future releases of contaminants from the landfill into the groundwater and, subsequently, into surface water are also considered.

As stated previously in the Biological Assessment (Section V of this document), biota on the landfill have not been adversely affected. However, onsite biota could become contaminated in the future. Therefore, the objective is to minimize the ingestion of contaminated biota by humans by limiting the exposure of biota to landfill contents. The impact of the landfill contaminants on small fish and turtles in the adjacent pond is not a human health concern since neither the turtles nor the small fish are consumed by humans. However, the fish may be a concern for migratory birds which use the pond for feeding. This will be addressed as a separate operable unit with an extended RI/FS report.

There are a number of concerns regarding the landfill contents: (1) the St. Jones River could cause some erosion of the landfill contents through either flooding of the river or through migration of the river channel;

(2) there are leachate seeps at isolated areas along the periphery of the landfill, particularly notable in the area of the pond; and (3) protection of the pond and wetlands adjacent to the site from runoff during any remedial action activities.

Future direct contact with wastes is also a concern should residential or commercial development occur upon the landfill. Therefore, the future risks associated with onsite water wells was evaluated.

There is a future risk associated with future releases to the groundwater of contaminants originating from the landfill. These groundwaters, however, occur only as the water table aquifer, are of very limited area, contain no existing users, contain little available groundwater, have naturally high iron content, and discharge to the St. Jones River and Tidbury Creek, a few hundred yards away from the landfill.

In conclusion, the remedial action objectives for the Wildcat Landfill Feasibility Study are:

1. Minimize the ingestion of potentially contaminated biota taken from the site.
2. Prevent direct public contact with landfill wastes.
3. Limit the erosion of the landfill contents by the St. Jones River.
4. Minimize the environmental impacts of the landfill contents on biota.
5. Identify future impacts of releases of landfill contents to groundwater and, subsequently, to surface water. Any releases must be addressed.

VIII. Remedial Alternatives Evaluation

A. Description of Alternatives

The alternative development process combines technologies and corresponding process options for each medium which form the remedial actions for the site as a whole. The resulting alternatives include a range of remedies and level of effort which satisfy all or some of the remedial action objectives. In accordance with recent EPA guidance, none of the alternatives in the detailed analysis include treatment due to the size of the landfill (approximately 44 acres) and the absence of hot spots on the site. These site specific factors make treatment impracticable. The purpose of the alternative analysis is to provide the lead agency with a list of potential alternatives which provide the best balance among the evaluation criteria and meets the statutory finding of protection of human health and the environment, attains ARARs, is cost effective, and utilizes alternate treatment technologies to the maximum extent practicable. The no action alternative is included as the baseline and should only be used when the risk assessment indicates there are no present or future threats to public health or the environment.

Alternative 1: No Action

The no action alternative requires no remedial action, therefore, the existing site conditions would remain unchanged. The existing vegetative cover provides for a large degree of erosion control, maintains the existing hydrologic system, provides wildlife habitat, and limits direct contact by

humans and biota over much of the site. The five rare plants identified onsite that are on the Delaware Natural Heritage Inventory would remain undisturbed. There would be no institutional or monitoring requirements onsite or offsite.

Alternative 2: Institutional Control and Monitoring

This alternative addresses the remedial action objectives by controlling the receptors rather than the contaminants. The alternative consists of fencing and signposting to limit access to the site, monitoring offsite groundwater to reveal any migration of contaminants, and preventing development upon the landfill and water well drilling onsite or in the surface aquifer in areas of concern adjacent to the site. The site conditions would remain unchanged in this alternative.

Alternative 3: Institutional and Surface Control

The purpose of the surface controls is to decrease erosion and ponding of water on the surface of the site. This alternative includes institutional control, monitoring and surface control, and removal and treatment of drums and their contents found on the surface of the landfill or uncovered during grading. Surface control is achieved by grading and revegetating the site and includes a temporary drainage ditch to protect the adjacent pond and wetlands during remediation activities. Even though this would provide only minimal cover, it would limit direct contact with the landfill contents. The institutional and monitoring requirements would be the same as described in Alternative 2.

Empty drums found during this operation would be crushed and disposed within the landfill during the grading operation. Drums containing materials would be sampled and secured on the site and, if the material is a RCRA hazardous waste, transported and incinerated offsite. Drums containing non-RCRA waste or product will need to be evaluated as to proper disposal. The state and EPA will make this determination.

Alternative 4A: Containment With Soil Cap

This alternative adds a soil cap thicker than the cover material from the previous alternative. In addition, the institutional, monitoring, and surface controls of the previous alternatives are included. The purpose of the soil cap is to provide extra protection against the direct contact risk in order to meet the direct contact objective.

Alternative 4B: Containment With Soil/Clay Cap

Instead of the soil cap listed in Alternative 4A, this alternative includes installation of a clay cap with soil cover plus all the technologies listed in the previous alternatives. The clay would be effective in increasing runoff and minimizing infiltration and would also be less susceptible to cracking from settlement. The soil/clay cap should be able to survive deformation caused by settling better than the soil cap alone.

B. Evaluation of Alternatives

The five alternatives assembled above are evaluated to develop a more complete analysis of their relative advantages and disadvantages. The evaluation is based upon the following eight criteria developed in accordance with Section 121 of SARA (See Table 2):

- short-term effectiveness;
- long-term effectiveness and permanence;
- reduction of toxicity, mobility, and volume;
- implementability;
- compliance with ARARs;
- overall protection of human health and the environment;
- cost; and
- community acceptance.

State acceptance is also a criteria developed by EPA for the analysis of alternatives but since the state is a co-selector of the remedy along with EPA, that criteria is not pertinent since the state acceptance is reflected in selection of the final remedy.

The short-term effectiveness pertains to the potential impacts on the community and to workers during the remedial action activities, the potential environmental impacts of the remedial action, and the effectiveness and reliability of mitigative and protective measures. The protection of the community and workers during implementation of the remedial action refers to the onsite risks and offsite risks of implementing the alternative. At this site, three of the four alternatives have transportation of drums to a RCRA incinerator as the only offsite component. There would also be increases in dust levels during construction activities. Therefore, there is little risk to the community from implementation of any of the alternatives. There may be risk to workers onsite; therefore, worker protection would be needed to prevent direct contact with the landfill contents and inhalation of dust and volatile emissions.

The landfill is currently affecting only the shallow groundwater aquifer and the offsite pond adjacent to the site. As was mentioned previously, the effects on the pond will be addressed in an extended RI/FS report. There are, however, several other environmental impacts resulting from the implementation of alternatives.

The fence in Alternative 2 would deter large terrestrial animals from feeding on the landfill and would deter transient populations from coming in contact with exposed waste and leachate on the site. The grading and capping activities in Alternatives 3, 4A, and 4B would prevent any potential risk to terrestrial animals from direct contact with landfill contents. However, it would also involve the removal of trees and shrubs used as nesting habitat by birds. In addition, these alternatives would also eliminate 7.9 acres of wetland within the landfill and 1.8 acres of wetland around the perimeter of the landfill as a result of cap overlap. However, the cap overlap in the vicinity of the pond could minimize the impact of the leachate seeps on the pond. There are also five plants found on the site listed on the Delaware Natural Heritage Inventory that would be eliminated from the landfill by Alternatives 3, 4A, and 4B.

Table 2
SUMMARY OF DETAILED ANALYSIS OF ALTERNATIVES
WILDCAT LANDFILL FS

Criteria	Alternative 1 No Action	Alternative 2 Institutional Control and Monitoring	Alternative 3 Surface Control	Alternative 4A Containment with a Soil Cap	Alternative 4B Containment with a Soil/Clay Cap	DNREC And EPA's
	Site remains unchanged.	Fence site and post signs. Monitor groundwater.	Fence site and post signs. Monitor groundwater. Grade landfill.	Fence site and post signs. Monitor groundwater. Grade and cap landfill with soil.	Fence site and post signs. Monitor groundwater. Grade and cap landfill with soil/clay.	Post signs, monitor groundwater, grade, and partially cap landfill with soil.
Short-Term Effectiveness	No present threat to community. Impact off-site pond.	Slight increase in dust during construction which is estimated to take one construction season.	Increase in dust during construction which is estimated to take 2 years.	Increase in dust during construction which is estimated to take 2-3 years.	See Alternative 4A.	See Alternative 4A.
Long-Term Effectiveness	Not protective or effective. Has potential for future risk.	Significant risk of direct contact with landfill contents. Sole reliance on fence for prevention of direct contact. Groundwater monitoring would report any future releases to the groundwater.	Potential exists for direct contact with landfill contents. Groundwater monitoring would report any future releases to the groundwater.	Low potential for direct contact. Groundwater monitoring would reveal any future releases to the groundwater.	See Alternative 4A.	See Alternative 4A.
Reduction of Toxicity, Mobility, and Volume	No reduction of toxicity mobility and volume.	See Alternative 1.	Reduction of mobility by erosion control. Minimal decrease in volume and toxicity through drum removal and incineration.	See Alternative 3.	See Alternative 3.	See Alternative 3.
Implementability	Easy to implement.	Easy to construct and operate.	Easy to construct. Potential for some settling.	See Alternative 3.	See Alternative 3.	Easy to construct however, settling could be a problem with the 2 ft. cap.

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Table 2
(Continued)
SUMMARY OF DETAILED ANALYSIS OF ALTERNATIVES
WILDCAT LANDFILL FS

Criteria	Alternative 1 No Action	Alternative 2 Institutional Control and Monitoring	Alternative 3 Surface Control	Alternative 4A Containment with a Soil Cap	Alternative 4B Containment with a Soil/Clay Cap	DNREC and EPA's
Complaince with ARARs	Does not satisfy 40 CFR 264.310 or Delaware State Solid Waste Disposal Regulations since no final cover is provided.	See Alternative 1.	Construction must be approved by DRBC and DNREC. Relevant and appropriate state solid waste regulations requiring a final cover of 2 feet is not met. The relevant and appropriate federal requirements of long-term minimization of infiltration and the placement of a cap with a permeability less than or equal to the permeability of the natural subsoil are not satisfied, however, this is a proposed rule [265.310(c)] under Alternate Closure which when passed would eliminate this requirement. NPDES permit required for discharge of runoff diverted by temporary dike. Satisfies 40 CFR 264.18(b), and Executive Orders 11988 and 11990 for the protection of Floodplains and Wetlands.	See Alternative 3.	Construction must be approved by DRBC and DNREC. Relevant and appropriate state solid waste regulations requiring a final cover of 2 feet is not met. The relevant and appropriate federal requirements of long-term minimization of infiltration is not met, but the placement of a cap with a permeability less than or equal to the permeability of the natural subsoil is satisfied. Better long-term minimization of infiltration. NPDES permit required for discharge of runoff diverted by temporary dike. Satisfies 40 CFR 264.18(b), and Executive Orders 11988 and 11990 for the protection of Floodplains and Wetlands.	Construction must be approved by DRBC and DNREC. Relevant and appropriate state solid waste regulations requiring a final cover of 2 feet is met. The relevant and appropriate federal requirements of long-term minimization of infiltration is not met but the placement of a cap with a permeability less than or equal to the permeability of the natural subsoil is satisfied. NPDES permit required for discharge of runoff diverted by temporary dike. Satisfies 40 CFR 264.18(b), and Executive Orders 11988 and 11990 for the protection of Floodplains and Wetlands.

000098

Table 2
(continued)

Criteria	Alternative 1 No Action	Alternative 2 Institutional Control and Monitoring	Alternative 3 Surface Control	Alternative 4A Containment with a Soil Cap	Alternative 4B Containment with a Soil/Clay Cap	DNREC and EPA's
Overall Protection of Public Health and the Environment.	Is the least protective of public health and the environment.	Risk of direct contact controlled only by fence. Risk of future releases monitored. Risk of groundwater ingestion controlled by administrative restrictions.	Risk of direct contact, erosion, and ponding controlled by grading and revegetation. Risk of future releases monitored. Risk of groundwater ingestion controlled by administrative restrictions.	See Alternative 3.	See Alternative 3.	See Alternative 3.
Present-Worth Cost	$ 0	$ 350,000	$6,300,000	$7,500,000	$8,530,000	$5,340,000

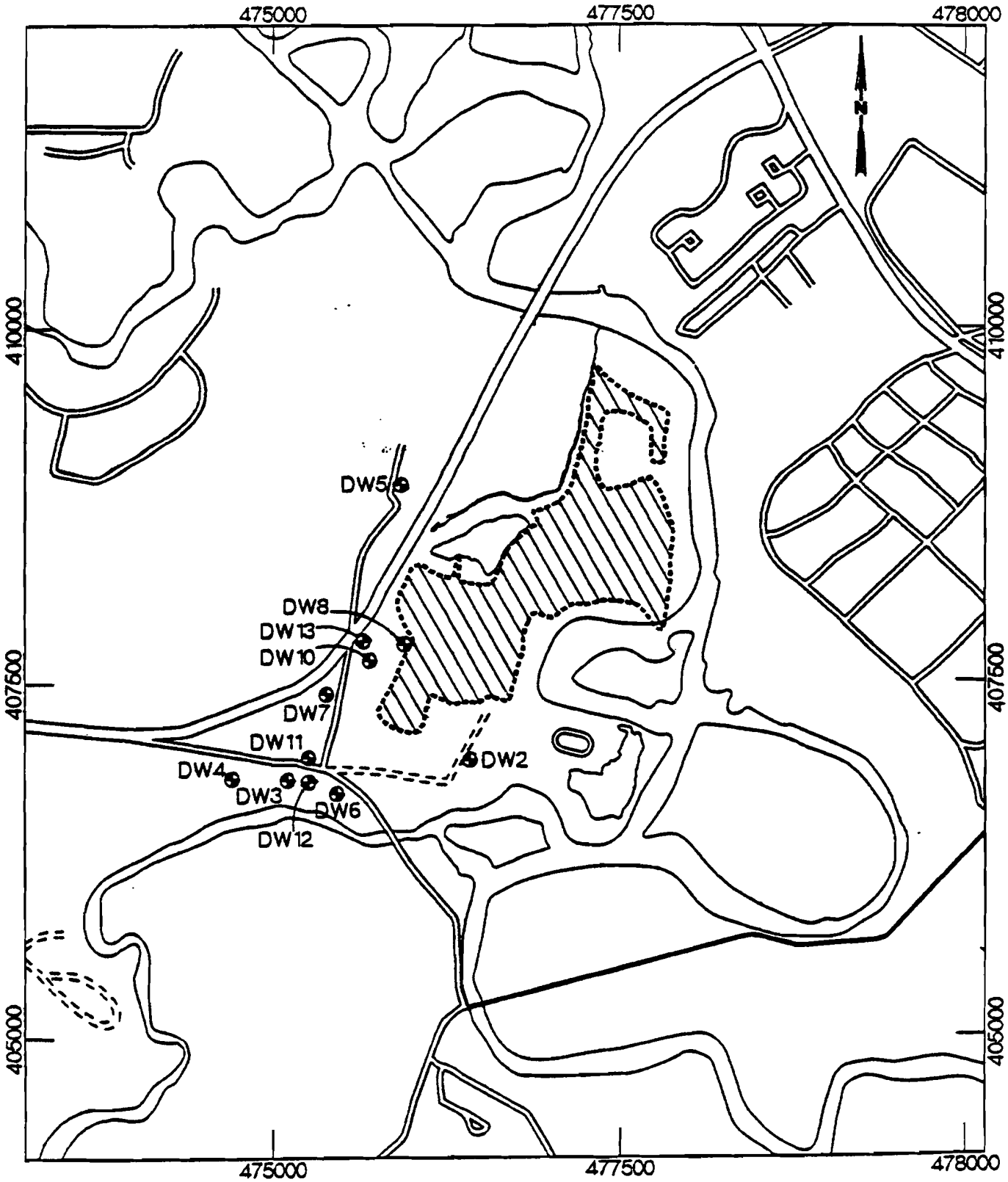
WDR339/054

000029

The long-term effectiveness and permanence refers to the magnitude of total residual risk in terms of untreated waste, the adequacy and suitability of controls used to manage untreated waste, and the reliability of these controls over time. In terms of total risk of the residual waste, only Alternatives 3, 4A, and 4B constitute any waste reduction, namely, the removal of any drums found on the surface or through grading operations. The fact that landfill waste will remain onsite for all the alternatives means that there is a potential for future contaminant releases from known and unknown waste in the landfill, although the potential and rate of release is small. This applies to all the alternatives, including the No Action Alternative. Because the potential for direct contact exists on the site, the No Action alternative (which included no controls) is not reliable. Groundwater monitoring is included in all alternatives except the No Action and should prove reliable in reporting any future releases to the groundwater, and hence, potential releases to surface waters. Alternative 2 would rely entirely on the fence as the control against direct contact. The grading and capping options would provide additional protection against direct contact and thus supply the best direct contact protection. The grading and capping options would require the most maintenance. All of the alternatives except Alternative 1 contain institutional controls to prohibit all well drilling onsite and in the shallow aquifer to the southeast of the site and along the extreme southwest edge, as delineated in Figure 10. Since these restrictions are to be administered by the state, it is considered a long-term remedial action. Finally, since waste will remain onsite, a review of the effectiveness of the final remedial action will be done in five years.

Reduction of toxicity, mobility, and volume refers to the amount of material to be treated, the amount of hazardous materials that will be destroyed or reduced, and the degree of expected reduction. Also, this evaluation addresses the statutory preference for selecting a remedial action that employs treatment to significantly reduce the toxicity, mobility, and volume of hazardous substances. Volume would be reduced depending on the number of drums encountered during the remedial action and disposed of offsite. Other than the potential for treatment of drum contents, none of the alternatives completely treat all of the waste found onsite.

The analysis of implementability addresses the technical and administrative feasibility of implementing the alternatives as well as the availability of services and materials associated with each alternative. The alternatives do not require unusual equipment or materials although the volumes of soil and clay are considerable. However, sources of soil and clay exist within the State of Delaware. With the exception of the offsite drum disposal, only onsite technologies are included. Monitoring of groundwater is essential for detecting any future releases of contaminants. The only significant implementability issue will be construction requirements for the grading and capping in Alternatives 3, 4A, and 4B. Since the landfill is located in wetland areas, settlement of the cap would need to be investigated before construction. Also, a more detailed analysis of the potential flood velocities in the event of the 100-year storm of 24-hour duration should be done targeting some of the assumptions made in the preliminary analysis included in the Feasibility Study. This should be done for the grading and capping options of Alternatives 3, 4A, and 4B. Implementation of state imposed restrictions on well development both onsite and in the previously described shallow aquifer area is not considered a problem because Delaware



DW10 DOMESTIC WELL LOCATION (ROUNDS 1 & 2)

DW13 DOMESTIC WELL LOCATION (ROUND 2 ONLY)

APPROXIMATE LANDFILL BOUNDARY

0 500 1000 1500 2000

SCALE 1" = 1000'

Figure 9

DOMESTIC WELLS SAMPLED BY DNREC

000031

Wildcat Landfill, Dover, Delaware

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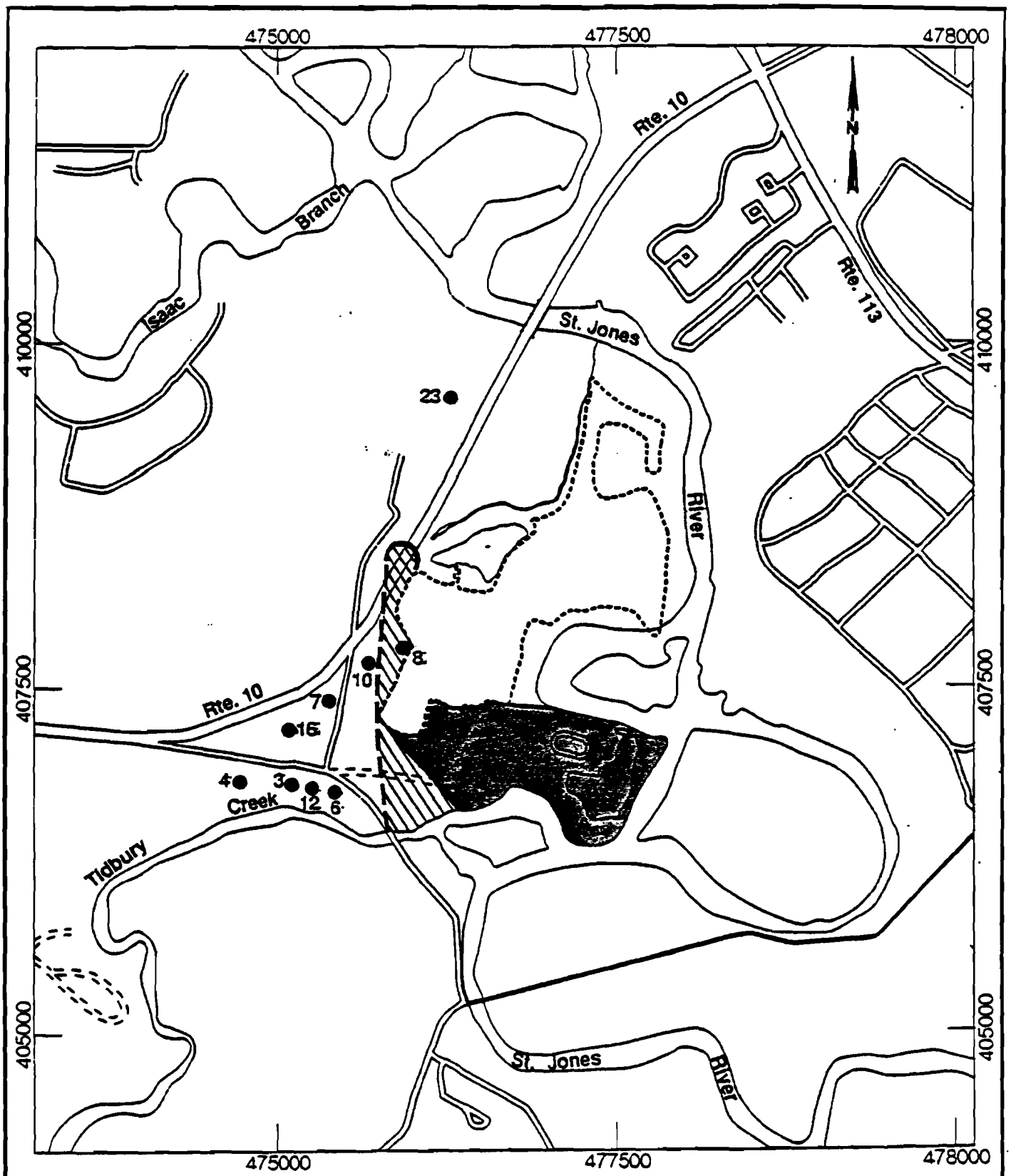

Approximate Landfill Boundary

Area of Known or Probable Groundwater Contamination

Area Potentially Susceptible to Groundwater Contamination (Location of Western Boundary is Uncertain)

3 Domestic or Commercial Wells in Columbia Formation

0 1000 2000ft.
Scale

000032

Figure 10
OFFSITE GROUNDWATER CONTAMINATION
IN THE COLUMBIA FORMATION
Wildcat Landfill

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presently has this authority under the state well permitting program. Further, this shallow aquifer has very low water yielding capacity and contains naturally high levels of iron.

The evaluation of ARAR compliance by alternatives includes a review of the state and federal applicable or relevant and appropriate chemical-specific, action-specific, and location-specific requirements, and other concerns identified as to-be-considered (TBC). The TBCs do not meet the regulatory prerequisites of ARARs. These are nonpromulgated advisories or guidance issued by state or federal agencies. In this section, the alternatives will be evaluated as to how each meets the major ARARs for the site. A complete list of the ARARs is found in the Feasibility Study report and Technical Memorandum Number 1, found in the Administrative Record. The ARARs used in this analysis include the action-specific requirements of the Delaware River Basin Commission (DRBC), the Executive Orders pertaining to wetlands and floodplains, 40 CFR 264.310, and the effluent limitations of the National Pollution and Discharge Elimination System (NPDES) pursuant to Section 402 of the Clean Water Act (CWA). Any construction activities affecting greater than 2.5 acres of wetland must be approved by the DRBC. This is applicable to the grading and capping alternatives. A statement of findings regarding the wetlands is included in this record of decision under statutory determinations. Discharge into the offsite stream from the temporary diversion ditches in Alternatives 3, 4A, and 4B would require an NPDES permit. A CWA Section 404 permit issued by the US Army Corps of Engineers is also required for the placement of fill material within the offsite navigable waters, including the wetlands.

The DNREC Wetland Regulations and Wetlands Act are state ARARs. Permits for any construction activity within offsite wetlands is required regardless of the area affected. Wetlands over the surface of the landfill and around the perimeter of the landfill would be lost during the construction activities for Alternatives 3, 4A, and 4B. Permits are not required for any remedial action activities on the site in accordance with SARA.

The Delaware Regulations Governing the Construction of Water Wells would apply to the installation of monitor wells or other wells associated with the remedial actions.

The location-specific rules governing floodplains applies to remedial actions at this site. All portions of the remedial activity must be designed, constructed, and maintained to avoid washout by the 100-year flood. Also, remedial activity should avoid adverse effects, and restore and preserve natural and beneficial values. Since the landfill is partially within the 100-year floodplain, this would apply to all alternatives except the no-action alternative.

The State of Delaware Solid Waste Disposal Regulations of 1974 and federal RCRA closure and capping requirements (40 CFR 264.310) are relevant and appropriate. The state solid waste disposal regulations require a cap with a minimum 2-feet of compacted soil with a minimum 2 per cent slope on the final grade. Alternatives 3, 4A, and 4B satisfy the slope requirement but none of them satisfy the 2 feet of compacted soil requirement. However, the soil and soil/clay caps are both 1.5 feet thick with an added thickness provided by the grading fill that ranges from 0 to 4 feet.

The soil requirements of the Delaware solid waste regulations may not practicable at the Wildcat Landfill site for three reasons: (1) the weight of such a cap would likely alter the existing site dynamics by causing subsidence of the landfill materials deeper into the underlying wetland sediments, (2) the intent of the two feet of compacted cover material is to reduce infiltration into the waste materials but at the Wildcat Landfill site this is not a concern since the landfill is already located within a wetlands area and decreasing infiltrating water will not alter that hydrologic feature, and (3) the onsite risks associated with the site are from direct contact with exposed wastes and this risk would be more cost-effectively reduced by a soil cap.

The relevant and practicable intents of the capping option at the Wildcat Landfill site would be better accomplished by a soil cap containing 1.5 feet of compacted soil and 0.5 feet of topsoil. The essential 2 foot cover requirement is, thus, met.

Closure of the landfill will be accomplished in accordance with the relevant portions of Subtitle C of RCRA. The RCRA requirements are not applicable to this situation because there are no site records indicating that RCRA waste was disposed of at the site and because no RCRA characteristic waste was identified in the study. However, in order to address the contamination encountered at the Wildcat Landfill, the requirements of RCRA are considered relevant.

Since the intent of RCRA closure is generally not appropriate for large municipal landfills where waste is generally of low toxicity, EPA has proposed requirements for alternate closure options under RCRA (52 Fed. Reg. 8712, March 19, 1987) which may only be used where closure is not applicable, but is relevant and appropriate. The alternate closure options combine the elements of clean closure and the closure in place options.

The alternate closure is considered the correct closure method for the Wildcat Landfill site because the pathways of potential exposure of contaminants is limited and the contamination remaining onsite has both low mobility and low toxicity. The alternate landfill closure consists of the partial removal of wastes (in this case, the removal of drums containing wastes encountered either on the landfill surface or during the grading operation), stabilization and containment with a soil cap (that will be permeable) to address the direct contact threat, and long-term management controls. The long-term management controls consist of maintenance of the site and the cap, onsite land use restrictions, and ground water monitoring. Although the alternate landfill closure should be used when there is not significant threat to ground water, the implementation of the state imposed institutional controls on well development in the very limited area of concern is considered sufficient for this situation.

Alternatives 1, 2, and 3 do not meet the alternate landfill closure requirements because none contain a landfill cover. Alternatives 4A satisfies this ARAR because it consists of a soil cover over the entire site. Alternative 4B exceeds the alternate landfill closure requirements because it consists of an impermeable clay cap with a soil cover.

The Delaware Natural Heritage Inventory draft list of rare or seldom seen plants is a TBC since five plants from that list have been identified on the site. Impacts of any remedial action affecting these plants are to be minimized, however, this does not preclude implementation of the remedial action. Since Alternatives 3, 4A, and 4B involve earthwork on the site, this TBC would apply to all three of these alternatives.

Section IV of this ROD summarized the contamination in the groundwater near the site. This section showed that certain chemical-specific criteria (MCLs) are presently exceeded in the ground water. The point of human exposure to the contaminated ground water should normally be set at the facility boundary unless specific criteria set forth in Section 121 (d)(2)(B)(ii) of SARA are met. Maximum contaminant levels are not considered relevant and appropriate at the Wildcat Landfill site since the site conditions meet the exceptions outlined in Section 121 (d)(2)(B)(ii). For the Wildcat Landfill site it has been determined water quality criteria in the St. Jones River are the appropriate levels to achieve because the ground water discharges directly into the river and there is no statistical increase in the levels above water quality criteria. In addition, institutional controls are a part of the selected remedy in the limited distance between the site and the points of ground water discharge. Finally, current and projected risk levels and reference doses (RfD's) for offsite ground water ingestion is within the risk range considered acceptable by EPA.

Alternative 1 does not meet this ARAR because it is a no action without institutional controls and monitoring. However, Alternatives 2, 3, 4A, and 4B meet this requirement since they all contain institutional and monitoring controls in the distance between the site and the points of ground water discharge to the St. Jones River.

The <u>overall protection of human health and the environment</u> criterion refers to how each alternative eliminates, reduces, or controls existing and potential risks to human health and the environment through treatment, engineering controls, and/or institutional controls. All alternatives, except Alternative 1, control the ingestion of contaminated groundwater by administrative restrictions and monitoring for future releases. Alternative 2 reduces only the risk of direct contact. Alternatives 3, 4A, and 4B reduce the risk of direct contact and erosion of the landfill contents and could reduce the impact of the leachate seeps into the offsite pond.

All of the final alternatives are also evaluated on a <u>cost</u> basis. The cost estimates are within +50% to -30% cost range in accordance with EPA policy. They represent the best estimation of the capital, operation and maintenance, and total present worth costs. Costs will only be updated at the pre-design and final design stage. Since the capital costs are the highest for the soil/clay cap alternative, that alternative has the highest present worth of approximately $8.5 million. The costs for the alternatives from the detailed analysis is as follows: Alternative 1- $0.00; Alternative 2- $350,000; Alternative 3- $6.3 M; Alternative 4A- $7.5 M; Alternative 4B- $8.53 M. The cost for the preferred alternative is $5.4 M.

There are uncertainties involved with the cost estimates that are important to note. The level of personal protection required during the grading and capping alternatives is uncertain. Landfill gas and vapors could be emitted

with disturbance of the landfill contents. Since the composition of the landfill gases has not been characterized, Level B protection would be required. However, future monitoring and sampling may prove that the landfill gases do not present any danger which would lower the degree of personal protection for workers. Should this be the case only Level D protection would be necessary. In order to provide a conservative cost estimate it was assumed that Level B and Level D personal protection would be used 50% of the time during grading and cap construction. Another uncertainty involves the sampling, removal, excavation, and treatment of the drums in an offsite RCRA incinerator. The number and contents of drums on and in the landfill is unknown. Based on estimates made from visual inspection of the landfill and the excavated trenches, a number of 160 drums was used for the drum count as the number of drums containing hazardous waste requiring offsite incineration, that are currently on or could be uncovered, during the grading operation.

The community acceptance criterion indicates those features of the alternatives the community supports, those for which they have reservations, and those for which they strongly oppose. This evaluation is based upon comments submitted to either the state or EPA as well as those made at the public meeting.

IX. Community Relations

The Wildcat Landfill site is located in a moderately populated area 2 1/2 miles southeast of Dover in Kent County, Delaware. Private residences are found along Route 10 to the north and west of the site. The site owner's residence is located directly adjacent to the site to the south. A number of small businesses are located directly adjacent to the site to the southwest. An archery range is situated on property presently owned by the landfill owner and is situated between Route 10 and the northwestern edge of the landfill. Dover Air Force Base housing is located directly across the St. Jones River from the landfill.

Local officials were briefed by DNREC prior to initiation of the remedial investigation in 1985 and again following completion of the Proposed Plan in June 1988. A fact sheet was prepared and distributed to the local residences and businesses prior to the remedial investigation which described the RI/FS process and discussed the site-specific problems. Press conferences were held at the site prior to the initiation of field activities during both the first and second rounds of sample collection. Press releases were also issued by DNREC to the news media during the investigation and when the proposed plan was issued.

A public meeting was held on June 16, 1988 to discuss the proposed plan and to obtain public comment on that plan. Letters were sent to the businesses and residences located very near to the site inviting them to the public meeting. A 30-day public comment period was held by DNREC and EPA from May 26, 1988 to June 24, 1988. The administrative record was made available for public review both near the site and at EPA Region III offices.

DNREC and EPA have attempted to respond to all public comments in the attached responsiveness summary (Appendix B).

X. Documentation of Significant Changes

No significant changes to the preferred alternative presented in the proposed plan have occurred.

XI. Recommended Alternative

The selected remedy chosen by the lead agency must a cost-effective remedy which effectively mitigates and minimizes threats to and provides adequate protection of human health and the environment. Both CERCLA and SARA require selection of a remedy which provides protection of human health and the environment which is cost-effective and utilizes permanent solutions and alternative treatment technologies or resource recovery options to the maximum extent practicible, and that attains federal and state ARARs unless otherwise waived. In addition, treatment of the principal threat at the site to reduce the mobility, toxicity, and volume of the hazardous substance is preferred. The remedy selected for the Wildcat Landfill site, excluding final decision on addressing the adjacent pond, is discussed below.

A. Description of the Selected Remedial Alternative and Performance Goals

A modified version of Alternative 4A, Containment With a Soil Cap, has been chosen to mitigate the existing and future risks posed by the site and which meet the goals and objectives, and federal and state ARARs. This alternative includes the institutional controls and monitoring requirements detailed in Alternative 2 and included in Alternative 4A. The major difference between the chosen modified alternative and Alternative 4A is that only those areas on the site which pose a direct contact risk will be capped and that the cap will meet the intent of the Delaware solid waste regulations. As was mentioned previously, the two-foot compacted soil requirement may not be practicable for the reasons previously detailed. Chapter 6 of the Feasibility Study describes the chosen alternative and estimates the total cost for that alternative.

This preferred alternative would require all the institutional controls described in Alternative 2 onsite and in offsite areas identified as potential problem areas. The purpose of these restrictions is to prevent direct contact (primarily through ingestion) with landfill contents or contaminants originating from the landfill. Fencing is not chosen for inclusion in this alternative for the following reasons: (1) the limited soil cap was chosen as the more long-term remedy for reducing the future onsite risks, (2) difficulty in constructing a fence because of the number of property owners who would be effected, and (3) access to the site is limited by the surrounding land-use and terraine features. A very limited soil cap (both areally and physically) similiar in design to that described in Alternative 4A will be placed on areas of the landfill where wastes are exposed or where leachate seeps or pools are found. These areas will be graded, covered with soil and seeded. Further, any drums exposed on the landfill surface or from the graded areas will be disposed of offsite in either a solid waste landfill, or in a RCRA incinerator if the contents are determined to be hazardous. Hazardous wastes will not be disposed of at RCRA landfills in deference to the land ban on disposal of hazardous waste. However, no RCRA characteristic hazardous wastes were encountered during the remedial investigation.

The general features of the preferred alternative is as follows:

1. Institutional controls will be implemented by the state in areas adjacent to the site to prevent the installation of water wells in the surface aquifer that is downgradient of the southwestern edge of the site. These controls will be implemented by the state using the existing water well permitting program. This area discharges into the St. Jones River and Tidbury Creek. The ARAR associated with this aspect of the chosen alternative is the Delaware Regulations Governing the Construction of Water Wells.

2. Institutional controls will be implemented by the state which preclude onsite installation of water wells for domestic or commercial purposes. Construction activities which would disturb the integrity of the soil cap on the site will be discouraged. The existing state well permit program will preclude onsite water well construction under the Regulations Governing the Construction of Water Wells. The Delaware Solid Waste Regulations will be the ARAR used to discourage onsite development which would disturb the integrity of the site. Also, the state will work toward including language in the deeds of site owners, or other legal means, at least describing the landfill location on the property.

3. Two commercial wells, DW-8 and DW-10, located adjacent to the site in an area of concern will be replaced. The shallow wells presently existing would be replaced by single-cased wells to approximately 200 feet below ground surface. The installation of these wells would be according to the Delaware Regulations Governing the Construction of Water Wells.

4. Exposed landfill wastes, barren areas, and leachate pools or seeps will be covered according to the intent of the Delaware Solid Waste Regulations of 1974 which includes 1.5 feet of uncompacted and 0.5 feet of topsoil cover, minimum 2 per cent slope, and revegetation. Consideration will be given to the other TBC's identified such as the DNHI draft list and to the existing natural uses of the site such as areas of important wildlife habitat value. The RCRA alternate landfill closure policy will also be used to meet the RCRA relevant and appropriate requirements. Also, should the volume of cover required to meet the ARAR's be impracticable because of site-specific concerns, such as subsidence because of excessive weight, DNREC and EPA will decide on the actual cover requirements to be met.

5. Offsite disposal of drums containing wastes to either a solid waste landfill or a RCRA incinerator depending on whether the waste is hazardous or not. The RCRA requirements will be the appropriate ARARs for offsite transportation and disposal of hazardous wastes. Disposal of non-hazardous wastes will done in accordance with the Delaware Solid Waste Regulations.

6. Signposting to discourage disruption of the soil cap.

7. Monitoring of groundwater downgradient of the site will be done in compliance to RCRA, Subpart F to identify changes in the release of contaminants from the site. This is particularly important in the southeastern area near the owner's residence.

8. Shallow monitor wells will be installed in the groundwater discharge area of the southwestern corner of the landfill along Tidbury Creek to insure that

the Federal Water Quality Criteria are not exceeded above background levels at the discharge point. Monitor well construction will be done in accordence with the Delaware Regulations Governing the Construction of Water Wells. Sampling will be done along with the other monitoring activities at the site. The Clean Water Act is the appropriate federal ARAR.

Since much of the site is well vegetated with limited cover material in place, the existing direct contact risk is only associated with those areas where waste materials are exposed or where leachate seeps or pools are found. Institutional controls taken by the state will be imposed to prevent the future direct contact risks identified in the risk assessment.

The performance goals are met where the intent of the Delaware Solid Waste Regulations and the RCRA alternate landfill closure requirements are achieved on the site. The Federal Water Quality Criteria standards will be monitored offsite at surface water discharge points and within the groundwater monitoring wells between the landfill and the surface water discharge area. The institutional restrictions will be placed by the state to insure that the onsite and offsite restrictions are placed upon the property. This will include water well installation restrictions and declarations in property deeds that landfilling has occurred within the property boundary.

The following statement of findings regarding the wetlands is also considered as a TBC. (1) The RI/FS for the Wildcat Landfill site has determined that wetlands onsite and adjacent to the site may be graded and covered in order to eliminate the existing leachate seeps and provide cover to exposed wastes in areas that constitute an unacceptable risk to public health and the environment. All remedial alternatives except the No Action Alternative will require grading and covering of certain of these areas. (2) The grading and filling activities shall be conducted in a manner consistant with provisions of Appendix A of 40 CFR Part 6. The subject regulations have been entitled "Statement of Procedures on Floodplain Management and Wetland Protection." These procedures constitute policy and guidance for carrying out provisions of Executive Order 11990 which addresses Protection of Wetlands. (3) The remedial design of the remedial action shall be developed in a manner consistant with Appendix A of 40 CFR Part 6 to assure that potential harm and adverse effects to the wetlands is minimized. The remedial design has not been initiated at this time. Therefore, specific steps to minimize impacts have not yet been identified. In addition, the effect of the remedial action on the wetlands cannot be accurately assessed at this time. (4) While all remedial measures shall be designed to minimize harm to the wetlands, it is possible that some adverse effects may be unavoidable. Should remedial activity be expected to create such effects, restorative or mitigative measures shall be developed during the remedial design and reviewed by DNREC and EPA. If anticipated adverse effects occur, restorative or mitigative measures may be implemented as part of the remedial action.

B. Statutory Determinations

The purpose of this section is to describe the ability of the selected remedy to be consistant with the statutory requirements of Section 121 of CERCLA and will describe the adequacy of the remedy to be protective of human health and the environment, attain ARARs, be cost-effective, utilize permanent solutions

and alternative technologies or resource recovery technologies to the maximum extent practicable, and address the preference for reduction in toxicity, mobility, or volume.

Protection of Human Health and the Environment

The selected remedy is adequately protective of human health and the environment through the alternate closure engineering of the landfill surface, removal and treatment of drums containing wastes, and the onsite and offsite institutional controls to be imposed by the state. The existing direct contact risks from exposed waste, leachate seeps and pools found onsite will be eliminated by the alternate closure soil capping to be placed in areas of the site where direct contact exists. Stabilization of the surface eliminates the human exposure to the wastes and also reduces the exposure of the biological community to waste materials. The future direct contact risks to humans will be minimized by the institutional controls to be placed on the site for water well drilling and construction activities. Signposting will also discourage onsite exposure.

The selected alternative will not pose unacceptable short-term risks although the grading and the offsite disposal of drums have low short-term risks associated with them. There should be no cross-media impacts from the selected media since all waste materials will remain in place except the drums which are to be disposed of offsiste.

Attainment of the Applicable or Relevant and Appropriate Requirements

The selected remedy for addressing the problems posed by the Wildcat Landfill site meets the intent of the applicable or relevant and appropriate requirements of both Federal and any more stringent State environmental and public health requirements. A number of Federal and State to be considered (TBC's) have also been identified and are included in this discussion. The MCL requirement in ground water at the facility boundary has been waived because of the special conditions present at the site. These special conditions include the very limited aquifer area, lack of receptors, close proximity to the surface discharge, and low yield and quality of the section of aquifer in question. The intent of the Delaware Solid Waste Disposal Regulations will be met by meeting the state closure requirements found in the Delaware Sanitary Code, Part 38, under which the site was originally to be closed.

The complete listing of State and Federal ARAR's and TBC's are found in the Feasibility Study report and Technical Memorandun #1, both found in the Administrative Record.

The chemical-specific requirements are:

1. 40 CFR 122 (Clean Water Act) - This is a relevant and appropriate requirement which includes the acute and chronic ambient water quality criteria (WQC) for protection of freshwater aquatic life. At the Wildcat Landfill site these requirements are to be met at the ground water discharge point along Tidbury Creek.

2. 40 CFR 122 (Clean Water Act) - The Federal Pollution Discharge Elimination Standards are applicable for the discharge from the landfill during landfill capping activities.

3. The State of Delaware Regulations Governing the Control of Water Pollution - The applicable requirements involve the discharge of waters to surface water and this applies to the onsite landfill capping action during construction. A permit would be required since water would be discharged offsite.

4. The State of Delaware Water Quality Standards for Streams - This is an applicable state requirement for discharges to surface waters from point sources. These requirements are enforced under the Delaware Regulations Governing the Control of Water Pollution.

The location-specific requirements are:

1. State of Delaware Regulations Governing the Construction of Water Wells- This is an action-specific requirement concerning the construction and siting of water wells. These requirements are applicable to remedial actions for both monitor well construction and replacement of domestic wells.

2. State of Delaware Wetland Regulations and the Wetlands Act (Chapter 66) - These location-specific requirements are applicable to all remedial actions which impact the existing tidal wetlands. The capping actions at the Wildcat Landfill site will impact both onsite and offsite wetlands and measures must be taken to minimize these impacts. A permit is required.

3. Delaware River Basin Commission (DRBC) Rules of Practice and Procedure - This applicable requirement applies to actions where 2.5 or more acres of wetlands are drained, filled, or otherwise altered. An environmental impact analysis is required.

4. 40 CFR 264.18(b) - Actions within the 100-year floodplain must be designed, constructed, operated, and maintained to avoid washout.

5. Executive Order 11988, Protection of Floodplains (40 CFR 6, Appendix A) - This applicable requirement requires actions to avoid adverse effects, minimize potential harm, and restore and preserve natural and beneficial values.

6. Executive Order 11990, Protection of Wetlands (40 CFR 6, Appendix A) - Measures must be taken to minimize the destruction, loss, or degradation of wetlands.

7. Clean Water Act, Section 404 (40 CFR Parts 230, 231) - Action must be taken to prohibit discharge of dredged or fill material into wetlands without a permit.

The action-specific requirements are:

1. State of Delaware Solid Waste Disposal Regulations (1974) and the State Sanitary Code Part 38 - Section 6.03(g)(1) of the solid waste

regulations requires a final slope of at least 2 per cent which precludes erosion. A minimum of two feet of compacted cover is also required in Section 6.03(g)(4)(b). The actual cover requirements will be a two foot soil cover but the compaction requirements will be modified as described previously with 1.5 feet of compacted and 0.5 feet of uncompacted topsoil.

2. 40 CFR 264.310 - The RCRA closure requirements will be met under the EPA alternate landfill closure policy allowing the site to be suitably covered. This is a relevant and appropriate requirement.

3. 40 CFR 264 - The RCRA hazardous waste requirements will also be applicable to the transportation and disposal of any hazardous wastes found in drums either on the landfill surface or during the grading actions.

The <u>to be considered</u> (TBC's) are:

1. Delaware Natural Heritage Inventory - This is a draft list of rare or seldom seen plants which have been found on the site. These plants will be considered during the onsite grading and capping activities.

2. Integrated Risk Information System data base - This information is used in determining the concentration of carcinogenic compounds at the 10^{-6} risk level and the concentration of non-carcinogens for the reference dose level.

3. 45 FR 79318-79379 (November 28, 1980) - These are levels for contaminants in water for the protection of human health.

<u>Cost-Effectiveness</u>

The selected remedy attains ARARs and mitigates the onsite and offsite risks to human health and the environment while the cost is less than the other remedies (3, 4A, and 4B) that include the onsite soil capping option. The selected remedy is also much more sensitive to the other to-be-considered requirements such as the rare plants than the other remedies.

The selected remedy is considerably more costly than the no action alternative and Alternative 2. However, these alternatives are not effective in addressing the identified risks over the long-term nor do they meet the federal and state ARAR's.

<u>Utilization of Permanent Solutions and Alternative Treatment Technologies</u>

The final feasibility study report describes the modified alternative chosen to remedy problems posed by the site. This selected remedy differs from the detailed alternatives 3, 4A, and 4B by reducing the area of the landfill to be covered with a soil cap. This was done for two reasons: (1) certain areas of the site are already covered and very well vegetated with adequate slopes and (2) sensitive wetland and open water environments are directly adjacent to the site with certain areas of the site having reverted to wetland-like conditions. Any grading, capping and revegetation would not improve over the existing site conditions.

The selected remedy is as protective of human health as Alternatives 3, 4A, and 4B because the same existing and future direct contact risks are mitigated but at a lower cost. Further, the selected remedy is more protective of the environment since the areas of the site which are stable and already provide value to the biological community are left intact and because encrouchment of the cap near the wetlands and the pond is reduced considerably. Both the short-term and long-term effectiveness of the selected remedy both for the soil capping and the institutional controls are as good as the other alternatives where capping is detailed. Further, the replacement of certain wells adjacent to the site is very effective and precludes the need for monitoring in that area and is thus more cost-effective. The implementability of the institutional controls, particularly for restricting water well development, will be straightforward as the state well permitting program is in place with the state authority to approve or deny water well development. The placement of deed restrictions is less straightforward but would be accomplished by the state through mechanisms recently developed by the DNREC Solid Waste Branch for active landfill facilities. Although authority does not exist at the state level to specifically preclude all activities on the landfill, language either placed in deeds or as declarations to the deed which state the presence of the landfill will preclude activities on the landfill. These institutional controls would be permanent controls as would the onsite capping and offsite water well replacement. The toxicity of contaminants within the landfill will not be reduced as no treatment of landfill contents will occur (except for drum wastes found to be hazardous). The mobility of contaminants offsite is presently reduced considerably by the presence of the organic silts beneath much of the landfill and the hydrologic groundwater regime existing in the vicinity of the river. The short-term effectiveness of the cap in reducing infiltration and altering the existing evapotransporation regime will not be as good as the existing site conditions since areas to be graded, covered with soil, and revegetated are presently vegetated with a wide variety of flora. However, this will likely not increase the mobility of the onsite contaminants since surface drainage controls will be in place during the grading activities.

Summarily, the selected remedy is found to be the more cost-effective while at the same time addressing the onsite and offsite risks identified in the remedial investigation. Further, the remedy is as effective both in the short-term and the long-term as the other alternatives which include soil capping.

Preference for Treatment as a Principal Element

The selected remedy will be using incineration as the only permanent treatment and this will apply only to the contents of drums found either on the surface of during the grading of certain areas of the landfill where these contents are determined to be hazardous wastes. The remedial investigation did not identify areas of the landfill which would require special treatment except where drums are found nor did the risk assessment identify existing unacceptable offsite risks to human health which would be associated with the landfill. Finally, the very large area and volume of the landfill precluded any practicable treatment of all the landfill wastes.